LAND TENURE CENTER

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LAND USE POLICY AND ADMINISTRATION PROJECT (LUPAP)

REPORT ON THE INFORMATION STRUCTURE, NEEDS, GIS EXPERIENCES AND POLICY IMPLICATIONS OF STATE AGENCIES TO THE DEVELOPMENT OF A NATIONAL LIS/GIS

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EXECUTIVE SUMMARY

The Land Use Policy Administration Project (LUPAP) under the Agricultural Sector Reform Project (ASRP) of the Government of Trinidad and Tobago is responsible for providing technical assistance to land management agencies within the Ministry of Housing and Settlements.

The responsibilities of the core state land management, land administration and other participating agencies need to be described, their information linkages identified and a record of GIS experiences of agencies in Trinidad and Tobago documented. This will assist land administrators to formulate policies for:

- Integration of land information and management functions among institutions;
- Making land market more transparent and functional;
- Support of consistent land use planning.

This study focuses on the experiences of institutions that have either an operational GIS or information structures in place that serve the needs of state land management. The scope of the work includes compiling information about the data structures, contents and procedures used by selected agencies to achieve their goals. The GIS experiences of the agencies will then be reviewed. Information compiled about the agencies, their GIS experiences and data policies will be evaluated to assess how they can contribute to and affect the formulation of a national land and geographic information system.

Spatial data is available in all the state agencies. These data are often in paper format. Many maps originated in the colonial era, and these have been inconsistently maintained and updated. The currency of the printed maps date to the 1980's. However, state agencies update maps on a daily basis, but these revisions are not available in printed format.

The state land administration agencies are involved in the collection of spatial data for the entire country. State land management agencies are interested in lands vested in their authority and state lands that are suitable for development and can be vested in their authority.

Plans are indexed through various methods and include subdivision of the country into regions/county/wards/settlement/enclosures/parcels, indexing through register books in alphabetical order according to the names of estates, names of persons in whom the land is vested, chronological order that are associated with book/folio/plan numbers and physical constraints such as the size of filing cabinets.

The need for a unique parcel referencing number (UPRN) is evident. Many state agencies have adopted various systems to suit their present needs. Some of the agencies have included a field for such a UPRN in their databases in the event that a digital parcel index system will become available in the future. The UPRN system adopted by the different state agencies are discussed and a UPRN suited to all their needs have been recommended. Various methods for the development of the digital cadastre within a reasonable time have been put forward. The update of all spatial data products have been very slow in the past, mainly because paper products had to be manually updated on a daily basis or were targeted for complete revision only after a number of years. Digital spatial coverages (road, river networks, utilities, services, land use etc.) are easier to maintain and with the cooperation of all state agencies, it is expected that such a database can be kept current.

Attribute data is being automated at all the state land administration agencies. However progress is varied amongst these agencies. Generally there is a coherent manner of collecting and maintaining files pertaining to land information. Files are accessed through various registers that are indexed in most instances by the name of persons with interest in the land rather than unique references to the land. All the agencies have field officers who visit sites and update these files. Classifications and codes relating to information collected need to be standardized so data can be easily shared and understood. Most of the agencies require legal documents relating to land and/or information from these documents. A report containing the necessary data from legal documents can be generated by the Registrar General's Department that will have at least 70% of its records automated by May 31, 2000. Such reports can be made available to other state agencies on a regular basis. Depending on the contents of the report it may take as little as a day to generate these reports.

In addition, data fields in the RGD database that are incomplete such as the parcel address and the UPRN should be updated as the digital cadastre is created. This should be simple since survey plans are cross-referenced to deeds through deed numbers. This cross-reference will be a primary key that will link the spatial database to the attribute database of many agencies. Other links include addresses and names of persons with legal interests in the land. Presently, due to the inconsistencies in writing addresses and referring to places this field does not serve to uniquely locate places identified on applications, legal or other documents.

A structured approach to GIS development has been adopted with functional and user requirement analyses undertaken in most agencies. This resulted in the production of data dictionaries before the development of the GIS systems. Most of the agencies have some staff with GIS experience or training and this will aid in implementation of a LIS/GIS at a national level. No data sharing policies have been formulated but agencies price data based on cost recovery or on inherited pricing schemes. Cost recovery and data protection is under review for the GIS that the Lands and Surveys Division are expected to have available by 2001.

CHAPTER 1

INTRODUCTION

The term "land administration" refers to the processes of recording and disseminating information about ownership, use and value of land. In this context the land administration agencies identified were:

- Lands and Surveys Division (LSD)
- Town and Country Planning Division (TCPD)
- Valuation Division (VD)
- Registrar General Department (RGD)
- Chief State Solicitor Office (CSSO)

State Land Management refers to those activities that result in sustainable development of state lands. Their activities will require identification of state lands, evaluation of its best use, dissemination of lands for development, monitoring of activities/developments on land, managing land tenure and prevention of illegal activities on land. State land management agencies included in this study are:

- Lands and Surveys Division (Land Section)
- Ministry of Agriculture, Lands and Marine Resources (MALMR)
- National Housing Authority (NHA) and Caroni 1975 Ltd.
- Petrotrin
- Property and Industrial Development Company of Trinidad and Tobago (PIDCOTT)

1.1 Terms of Reference

The LUPAP team recognizes that the application of GIS has been scattered among various institutions, therefore the study focuses on the experiences of institutions that have either an operational GIS or have attempted an institutional arrangement to serve the needs of state land management. The review will collect specific information on the data structure, content and procedures utilized in select agencies which have accumulated experiences with GIS, evaluate the applicability of their experiences and outline how

these experiences can contribute to the formulation of a national land and geographic information system policy.

1.2 Approach

Questionnaires, interviews and documents review were employed to collate information about the data structures of the previously listed agencies. The questionnaire required the candidates to provide information on:
- Type, medium, format, and currency of data collected and the accuracy required for spatial data products
- Linkages between files, legal documents and map products
- Activity flow in the capture, processing and production of land records
- Processes which improve the utility of the data.

Information was also collected about GIS experiences, with respect to:
- Hardware and software
- Staff composition and training
- Analyses undertaken of organizational needs
- Automation of records
- Data sharing policies.

The first objective of the investigation of the various state agencies is to obtain an insight into the manner in which the land databases are structured, the information contained in these databases, linkages if any between spatial and attribute data collected and the maintenance and use of these databases. The second aspect of the investigation was to gather information relating to the experiences of the various agencies in the automation of their databases. It sought to identify the strengths and weaknesses in the development of digital databases and the direction of the agencies with respect to future plans in digital information. The final part of the report identifies the major land information capture the essence of the land information of the state agencies in formulating a plan to develop a comprehensive land information system to cater to these needs.

CHAPTER 2
INFORMATION STRUCTURES

2.1 Function of State Agencies

The information structure within the different state agencies will be detailed in this section. It is based on answers to questionnaires and interviews conducted at the various agencies. The collection and processing of data within the state agencies are geared to achieve the mandate of the agency. The functions of the agencies are given in Table 2.1.

TABLE 2.1 FUNCTIONS PERFORMED BY STATE AGENCIES

Agency	Functions
Lands and Surveys Division	Management of State Lands
	Maintains and updates cadastral, geodetic and topographic databases
	Quality control of cadastral surveys
	Surveys of State Lands
	Map and chart production
Town and Country Planning Division	Administer the town and country planning system through the:
	Production of physical development plans
	Control of development
Valuation Division	Valuation
	Land Economy
	Estate Management
Registrar General's Department	Maintain records of all dealings and interest in land
Chief State Solicitor Office	Prepares legal documents for transactions in state lands
	Determine interest in state lands
	Provide other legal advice

Agency	Functions
Ministry of Agriculture, Lands and Marine Resources	Distribution and management of agricultural state lands through lease regulation, development and maintenance of the State Agriculture Land Information System (SALIS). Process applications for land and transfers and monitors use of land
National Housing Authority	Construction of houses for rent and for sale Mortgage financing for low and middle income citizens Acquisition of property Land development and property management Provide incentives to developers to enter housing sector of the economy Research and planning in housing demand, design and construction
Property and Industrial Company of Trinidad and Tobago	Management of property assets of the Tourism and Industrial Company of Trinidad and Tobago (TIDCO) Physical planning and development of estates Project management Collection of rents and administration of outgoings Asset Valuation, auction sales and arbitration
Caroni 1975 Ltd.	Estate Management of Caroni's Lands
PETROTRIN	Increasing the productivity and viability of the company's resources
Central Statistics Office	Compile statistics on the following: Population, agriculture, economy, social statistics for servicing the need of government, business, the social community and international organizations

Effective performance of the listed functions requires the collection of data and the organization of the records for easy management and access. The spatial and attribute data capture and organization is discussed in the following sections.

2.2 Spatial Data Structure

Trinidad and Tobago has a history of land area classification based on various administrative boundaries. These range from classification into counties, regional cooperation, wards, districts and enumeration districts. The administrative boundaries are prepared on paper maps at a scale of 1:150,000 by the Lands and Surveys Division (LSD) and are used by other agencies to divide the country into broad regions that are further subdivided to the level of parcels which are the smallest unit of land. Some agencies have these administrative boundaries in digital form. Table 2.2 shows the different administrative boundaries used by the various agencies.

TABLE 2.2 STATE AGENCY SUBDIVISION OF LAND BY ADMINISTRATIVE BOUNDARIES

Boundary State Agency	Regional Coop.	County	Ward	District	ED	Settlement	Enclosure	Block	Parcel
LSD		X				X	X		X
TCPD		X				X			
VD		X				X	X		X
RGD									X
CSSO									
MALMR	X	X	X	X				X	X
PIDCOTT								Estate	X
NHA								Estate	X
CSO			X		X				

LSD – Lands and Surveys Division; TCPD – Town and Country Planning Division

VD – Valuations Division; RGD – Registrar General Department; ED – Enumeration District

CSSO – Chief State Solicitor Office; MALMR – Ministry of Agriculture, Lands and Marine Resources

PIDCOTT – Property and Industrial Development Company of Trinidad and Tobago

NHA – National Housing Authority; CSO – Central Statistical Office

POS CORP – Port of Spain Cooperation

From Table 2.2 it should be noted that the Valuation Division and LSD have adopted the same subdivision scheme down to the parcel level. TCPD also uses this

system, but only to the settlement level (see Appendix A for details). The State Agricultural Land Information System (SALIS) under the MALMR bases its division on regions, wards and districts since files are maintained at the district offices and are used to update the database. The ease of locating sites by field officers is the basis of the classification used by Valuation Division and CSO. Once these broad divisions are identified by the various agencies the cadastral index sheets at scales of 1:10,000, 1:2500 and 1:1250 are used to reference large scaled plans and other land related documents.

The cadastral index sheets were prepared from aerial photography as early as 1967 and are updated daily by the drawing office staff at the LSD. The last printed copy however dates to 1980. Other state agencies may have even older versions of these sheets, which they update as plans filter into their offices through various applications and requests. These index sheets are appropriately named because they contain information to retrieve other records. Accuracy checks carried out on these sheets (Balkaransingh, 1994) have shown that in some areas shifts are required while in other places orientation is a problem. The information on the cadastral index sheets at the parcel level is incomplete, since references are made to large scale plans which gives details about individual parcels. The greatest complaint about these sheets is the lack of up to date and complete information concerning the location of parcels, roads and rivers and the names of roads and rivers. This information is required by other agencies that update these sheets with sketches of parcels from survey plans that are collected at their offices. The information contained on these sheets is shown in Table 2.3. The RGD and the CSSO do not use these cadastral index maps. Other state agencies use the information supplied on the maps to extract information to meet their needs.

The index to the general reference plans (layouts) is the next level of spatial data collected by most agencies. The indexes of these plans vary according to the subdivision used by the state agency. TCPD sorts layouts by alphanumeric indices (T1 – region 1and settlement T), VD sorts according to a numeric system (82312 – region 8, settlement 23 and enclosure 12) while LSD indexes plans based on the paper size for filing in different size cabinets (see Table 2.4).

TABLE 2.3 CADASTRAL INDEX MAP (CIM) INFORMATION OF VARIOUS AGENCIES

Agency / CIM Information	LSD	TCPD	VD	MALMR
County	X	X	X	X
Ward	X	X	X	X
Owner's Name	X			X
Area	X			X
Road	X	X		X
River	X	X		X
Book No.	X			X
Folio No.	X			X
Plan No.	X			X
App'n No.		X		X
UPRN			X	X

UPRN – Unique Parcel Identifier

The referencing system used by the agencies in Table 2.3 are:

LSD - book/ folio/plan number based on chronological order;

TCPD - region/settlement is used as its main identifier to the cadastral index sheets and a sequential number/year are added onto application forms to locate specific parcels of land;

VD - region/settlement/enclosure/parcel;

MALMR - region/county/ward/district/locality/block/plot number.

TABLE 2.4 INDEXING SYSTEM TO GENERAL REFERENCE PLANS

Agency / Indexed By	LSD	TCPD	NHA	PIDCOTT
Paper Size	AN		A	
Region		N		
County				
Ward				
ED				
District				
Settlement		A		
Estate			A	A

A – Alpha   N – Numeric   AN – Alphanumeric

The filing sequence for the general reference plans of agencies include:

LSD assigns a letter of the alphabet to its filing cabinet and plans that are filed in the cabinet are numbered sequentially as they are received;

TCPD assigns a letter to the plans based on its settlement location and a number based on the region;

NHA keeps a book register of the name of its estates in alphabetical order. These estates are then referenced to filing cabinets that are in alphabetic order based on the size of the cabinet.

PIDCOTT has a similar book register to locate its estate plans.

The general reference plans are also sketched in on 1:2500 and 1:1250 topographic sheets at the TCPD. These sheets were prepared from 1967 aerial photography and are incomplete, uncoordinated in some instances, adjacent sheets do not match and the information is out dated making it difficult to update with new information. Contours clutter the maps that are needed only for index purposes. PIDCOTT and NHA maintain registers of estates in an alphabetic listing of estate names. These plans are then stored in cabinets according to their paper sizes.

The information contained on these plans show road reserves, lot numbers and the general name of roads that may be in the vicinity e.g., Southern Main Road Couva. The lack of unique identifiers and addresses for blocks of land and/or parcels are two of the greatest problems faced by agencies in their day to day activities regarding managing their land records.

Survey plans of individual parcels of land are referenced through the cadastral index maps or general reference plans. Survey plans give the description of boundaries, measurements (distances, bearings and area), the owner's name, ward, district and references to other legal documents which include reference numbers to survey orders, deeds, certificate of title, real property ordinance documents. Survey plans may or may not be linked to the national coordinate system. The scale of these plans and units of measurements also vary. The lack of unique addressing of parcels is also associated with these plans. The survey plans are not found in any one place in a cohesive manner. TCPD stores these plans with applications in their respective jackets, RGD have some attached to deeds and certificates of titles indexed according to books, folios and date registered, LSD maintains books with the plans as they are submitted to the division. The information relating to individual parcels will be most complete in the LSD however not all survey plans attached to deeds are submitted to the division. Unfortunately survey plans are not indexed according to locality, therefore plans for any settlement will be scattered across any number of books. TCPD maintains jackets according to regions and settlements thus survey plans for settlements will be in close (physical) proximity. Table 2.5 shows the coverage required by state agencies relating to individual parcels.

TABLE 2.5 PARCEL COVERAGE REQUIRED BY STATE AGENCIES

Agency Coverage	Entire country	State Lands Vested in the Authority	Privately owned Land
LSD	X		
TCPD	X		
RGD	X		
VD	X		
MALMR		X	
PETROTRIN		X	
PIDCOTT		X	
NHA		X	X
CARONI		X	

Other themes of map data that are created, collected, maintained and used by the state agencies are shown in Table 2.6. From this table it is obvious that the LSD is the major producer of map products. A catalogue of these products is given in Appendix B. Topographic maps are in paper form and have been produced from aerial photographs taken in 1967. Some of the sheets were updated from the 1988 aerial photography. Road maps for urban areas and boroughs have been updated in the 1990's and work is ongoing. Although planimetric data concerning buildings and public utilities are not generally a part of the mapping information collected by agencies, it is important to note that attribute information relating to these features are collected by most agencies. This shall be discussed later.

Land use maps created by TCPD are also in paper form and are updated on an ongoing basis. Soil maps and geological maps are available in both paper and digital form. Soil and land capability maps are stored at LSD but were created by MALMR in collaboration with UWI. The maps were produced in 1972. The land capability maps are only available on paper format. The geological maps are created by the consortium of oil based companies of which PETROTRIN is a part. These are revised in the 1990's and update is on a regular basis. Agencies collecting these products have them in paper rather than digital form. These map boundaries are transitional in nature, therefore the accuracy is dependent on sampling techniques and other indicators used in their production.

Social services such as police station, health centers, schools and fire services are shown on the topographic maps. These are also available in digital form at CSO, who also maintain a database. CSO last updated this database in the 1990's. The mapping section of the LSD produces thematic maps for other private and state agencies.

Examples are the update of shopping centers by topographers with census information supplied by Home Construction Ltd. to show consumer catchment areas; maps for the fire services and forestry (watershed) are currently underway (see Appendix B).

The Water and Sewage Authority (WASA) maintains maps of its water mains for the urban and suburban regions of the country in digital format. The sewer main only exists in five areas and these are also available in digital format. The spatial data accuracy required by state agencies is 1m for location of planimetric data and sub-decimeter accuracy is needed for utilities and cadastral surveys.

TABLE 2.6 MANAGEMENT OF MAP DATA OF THE VARIOUS AGENCIES

Map Data	Produce	Collect	Maintain	Use
Boundary				
Region				
County				
Ward				
Settlement				
ED				
Estate				
Parcel				
Topography				
Roads				
Rivers				
Contour				
Social Services				
Shopping Centers				
Community "				
Police Station				
Health Office				
Fire Services				
Land Use				
Existing				
Proposed				
Other Features				
Buildings				
Wells				
Other				
Public Utilities				
Water Lines				
Soil Disposal				
Overhead Line				
Underground Line				
Soil				
Land Capability				
Geology				
Geodetic				

Legend (agencies, per column): CSO, YD, TCPD, LSD, MALMR, PETROTRIN, PIDCOTT, NHA

2.3 Attribute Data Structure

Land information other than map products is also collected by state agencies on a daily basis. Collection of data takes the form of questionnaires, forms, informal site visits and data extracted from documents submitted to the various agencies. Table 2.7 gives a list of information collected through these methods, Table 2.8 gives the land use classification and codes used by the state agencies and Table 2.9 shows the means used by the different agencies for data collection and the primary purposes served by the information collected.

TABLE 2.7 LAND RELATED DATA COLLECTED BY STATE AGENCIES

Land Related Data Collected	Agency Collecting Data
Property: Property Address Land owner name & address County, ward & survey plan no. Ward sheet no. Area	LSD, TCPD, VD, RGD, CSSO, MALMR, NHA, PIDCOTT, CARONI, CSO and Petrotrin.
Building: Access Use Drainage Facilities: water, electricity, telephone, transport, soil disposal No. of floors Height of building	TCPD, VD, PIDCOTT, NHA, CSO
Details of structure: Foundation, beams, ceiling, windows, doors Accommodations: bedrooms, bathroom, kitchen etc. Sundries: no of wc's, taps, etc.	Valuation Division TCPD, VD and CSO
Existing land use: Land use of site and surroundings	TCPD, VD, MALMR, and CSO
Development on land	TCPD
Amenities and Disabilities: Social services: Schools, health centers, police stations, etc.	LSD, TCPD, VD, Petrotrin and CSO

Flooding, pollution, landslip etc.	VD, CSO and PIDCOTT
Land Related Data Collected	**Agency Collecting Data**
Tenancy: Vendor/purchaser name & address Interest conveyed, consideration, L&B assessment no. Terms of lease, dates of issue, renewal, transfer, surrender etc. Rent ,	LSD, VD, RGD, CSSO, MALMAR, PIDCOTT, NHA, Petrotrin, CARONI LSD, RGD, CSSO, MALMAR, PIDCOTT, NHA, Petrotrin, CARONI
Reference Numbers: Deed, lease, certificate of title, bills of sale	LSD, VD, RGD, CSSO, MALMAR, PIDCOTT, NHA, Petrotrin, CARONI
Decisions: Approvals, reasons for refusal Breaches, notices Complaints, action taken	LSD, TCPD, MALMR, PIDCOTT and NHA
Census: Population structure: age, sex, ethnicity, name, address, education Income Employment Business, tenancy, dwelling	CSO
Collector's Information: Name & position of data collector Name & position of verifier Dates of collection & verification	VD, TCPD, MALMR and CSO

There is a general overlap in the information collected by the state agencies and it would be an asset to a national land information system if these data could be of a standard form. Also, various land use classifications are used by the state agencies and this is shown in Table 2.8. Again standardization of classes and codes is needed for a national information system.

TABLE 2.8 LAND USE CLASSIFICATION AND CODES USED BY STATE AGENCIES

Land Use Classification	Agency
Land use policy: Residential (very low density to very high density) – R1 to R6 Commercial (low to high density) – C1 to C5 Agriculture (based on acerage) – A1 to A5 Industry (cottage/light/heavy/agro) – M1 to M4 Community Facilities – CM; Entertainment Facilities – EM Conservation (Parks, Buildings) – P1/P2; Quarrying – QR Open Space – OS; Ribbon Development, Special use district and Utilities	Town and Country Planning Division
Existing/Proposed Land Use Class and Code: Agriculture – 01; Residential – 02; Offices – 03; Trade – 04; Industrial - 05; Institutional - 06; Protective/Health/Welfare – 07; Public Utilities – 08; Transport/Communication/Warehousing – 09; Recreation/Open Space – 10; Vacant – 11; Special – 12	TCPD and MALMR
Land use codes Rain forest – 1 to 2; Uncultivated – 3 to 5; Swamp – 6 to 8; Plantation – 9 to 17; Orchard – 19 to 23; Sugar cane – 24 to 26; Tobacco – 27; Food crops – 28 to 37; Horticulture – 38 to 41; Livestock – 42 to 43; grazing – 44 to 53; Service Areas – 54; Urban (residential/commercial/industrial) – 55 to 58	Valuation Division
Agricultural Land Use Codes Forest – 01; Derelict – 02; Livestock – 03; Crop – 04; Aquaculture – 05; Apiculture – 06; Horticulture – 07; Processing – 08; Other – 09	MALMR

| | |
| | |

Other Classification Codes		
Structures on Land		
Residence – 1;	Comb Dwg/Dryer – 2;	
Workmen's quarters – 3;	Drying house –4;	Valuation Division
Processing shed – 5;	General shed –6;	
Poultry house – 7;	Pen – 8;	
Other Sundry – 9	Other – 10	
Residential – 01;	Commercial – 02;	
Pens (cattle/pig/calf) – 03 to 05;		MALMR
Poultry (house/hatchery) – 06 to 07;		
Garage – 08;		
Other – 09		
Separate house – 01;	Flat/apartment – 02;	CSO
Town house – 03;	Condominium – 04;	
Wafda – 05;	Duplex – 06;	
Part commercial/industrial – 07;	Barracks – 08;	
Out room – 09;	Other - 10	
Water Supply:		
Main (WASA) – 1;	Stand pipe – 2;	Valuation Division
Truck borne – 3;	Stream (perennial/seasonal) – 4 & 5;	
Private storage – 6;	Well – 7	
Public piped into dwelling (WASA) – 1		
Public piped into yard – 2;		
Private piped into dwelling – 3;		CSO
Private catchment – 4;	Public standpipe – 5;	
Truck borne – 6;	Other – 7	
River – 00,	Pond – 01,	MALMR
Spring – 02;	Well – 03;	
Main (WASA) - 04		

TABLE 2.9 METHOD OF DATA COLLECTION AND USE OF DATA BY STATE AGENCIES

Agency	Method of Data Collection	Use of Data
LSD (Survey Section)	Topographers perform field visits (No standard format for collecting data) Surveyors perform cadastral surveys	Update topographic and other thematic maps. Determine boundaries and update cadastral index maps.
(Land Section)	Field officers visit site to determine rents, taxes, use/condition of land and breaches in the terms of the lease.	Managing lease information Enforcement action in cases of breach in contract
TCPD	Applications submitted Site visits by development control inspector with standard forms	Approval of development Control of development Existing land use maps Environmental impact assessment
VD	Valuers visit site and fill out valuation survey sheets Search clerks records transactions in land on standard cards	Market analysis Produce tax rolls Provide estate management advice
MALAMR	County officers and enumerators visit site with data collection form (done once every 3 yr. at present)	Manage agricultural leases Monitors use of land Administer notices of breach in contract Update SALIS database
CSO	Enumerators visit households with census questionnaire	Provide statistical data to state and private agencies on an enumeration district basis.
PETROTRIN		
PIDCOTT	Informal site visits Ledgers used for maintenance of accounts	Estate management of 19 industrial estates Monitor developments
NHA	Foreman visits property to determine maintenance required. Complaint forms for repairs needed. Accounts maintained by cashier on receipt of payments.	Property Maintenance
RGD	Registers all land-related documents submitted to office.	Determine interests in land and consideration
Chief State Solicitor Office	Title search	Determine legal interest in land

2.4 Summary

Spatial data collected by the 11 state agencies discussed show 9 agencies are concerned with data at the individual parcel level. Of these 4 require coverage over the entire country while the other 5 are interested in lands vested in their authority. One requires spatial data at the enumeration district level and the other is mainly concerned with legal documentation rather than spatial data creation or collection.

Road and river networks are necessary to all agencies, but at present the major problem is the currency of these maps. Especially in the context of road networks many new developments in the country have not been mapped.

With the exception of the RGD and the Chief State Solicitor Office, all other state agencies collect data on the use of land at either a parcel or dwelling level. The currency of the planimetric data with respect to structures is questionable (1970's or 1980's); in either, case it is very much outdated since it has not been maintained by any agency. Six of these agencies relate information pertaining to structures to the individual parcel while one aggregates information to the enumeration district level. The relation adopted by the other two agencies was not ascertained. Land use classification and codes are used by 4 of the state agencies but are not standardized.

Information relating to social services is collected and maintained by five of the state agencies but the spatial data is again out dated but a digital coverage is updated by CSO. Eight of the agencies keep records pertaining to land tenure. Seven of these agencies require detailed information while the other agency need only a few items about transaction in land.

Nine of the eleven agencies store legal documents relating to land. All these agencies use the reference number assigned by the RGD to access these documents. Usually these numbers will be used to cross-reference the documents to other records (plans, accounts).

There is an overlap in the collection of data by the state agencies. The data collected by the different agencies are categorized and coded e.g., land use but there is a need to classify and code these items so uniformity can exist throughout agencies in the description of land and its associated structures and use.

2.5 Relationship amongst State Agencies

The information and services provided by a particular state agency are oftentimes required by another agency. Some of these interactions amongst agencies are as follows:

1. Survey orders issued by the LSD for the acquisition of lands involves:
   (a) Field surveys (LSD or private surveyor)
   (b) Computation checks (LSD)
   (c) Title searches (Chief State Solicitor Office and Registrar General Office)
   (d) Valuation of property (Valuation Division)
   (e) Preparation of legal document (Chief State Solicitor Office)

2. Issue for the Valuation of Properties
   (a) Obtaining survey plans (LSD, developers, private surveyors, other organizations)
   (b) Determine interest held in land and consideration of land (RGD)
   (c) Site visit to assess details of land, property and surroundings
   (d) Request TCPD approvals for use of land (existing and/or proposed)

3. Application for development of land by TCPD involves:
   (a) Submission of location plan, site survey plans and engineering drawings
   (b) Plotter updates maps (cadastral index maps and/or layouts)
   (c) Site visits by the development control inspector

4. Distribution of lands by MALMR
   (a) Identify block of land (MALMR)
   (b) Establish tenure (RGD)
   (c) Survey of land (LSD)
   (d) TCPD approval (TCPD)
   (e) Determine rental values (VD)
   (f) Prepare lease documents (Chief State Solicitors Office)
   (g) Register and execution of lease (LSD - Land Section and MALMR)

5. Development and distribution of housing by NHA
   These follow similar procedures to (4) but leases for state lands vested in the authority are prepared by the legal department of the authority.

6. PIDCOTT's development of its estates involves:
   (a) Site visits to determine condition of site (PIDCOTT)
   (b) Surveys (private surveyors)

(c) Valuation of land and building (PIDCOTT)

(d) Obtain approvals from various authorities (TCPD, WASA Health Authority etc.)

(e) Prepares legal documents (PIDCOTT)

(f) Register deeds (RGD)

(g) Administer lease and payments (PIDCOTT)

(h) Project management of constructions

The above interactions amongst state agencies demonstrate the importance of the state administration agencies in the overall creation and capture of data. These offices are key to providing unique references to records and classification of data that other agencies will later require.

2.6 Needs of the State Agencies

Most of the state agencies are interested in a complete cadastre either for the entire country, state lands and/or land vested in their authority. In addition, unique addresses of legal parcels of land are necessary for use as references to index applications and legal documents. At present the location of land is referenced through addresses which may be as vague as ward and district or in general terms such as a street names e.g. Eastern Main Road, Arima or LP #55 Beetham Estate. The state management agencies (TCPD, VD, CSO, RGD) have a structured way in which information is collected and processed to manage their records within these constraints. With the creation of a digital cadastre with unique parcel identifiers (UPRN) the drafting of legal documents and the production of cadastral plans should be detailed enough include these UPRN'S and also unique addresses of parcels. There is also the need to define terms in relation to boundaries such as regions, settlements, blocks etc. so agencies will not be referring to different entities by the same name.

2.6.1 Creation of a digital cadastre

(TCPD, VD, Caroni 1975 Ltd. and MALMR, NHA) have identified the creation of a digital cadastre as important to the production of map products, analysis of land data collected and estate management functions. The accuracy of cadastral surveys are to sub-decimeter level and with proper automation procedures this accuracy can be maintained and reflected by the digital cadastre. Of greater importance is the completeness, currency

and relative accuracy of adjacent parcels. A number of alternative methods for the production of such a cadastre have been proposed and they include:

1. Scanning and vectorisation of existing cadastral index maps and improving the accuracy through rubber sheeting techniques.

2. The coordination of cadastral plans using GPS and the digitization of these plans.

3. Coordination of blocks of cadastral plans through GPS, adjustment of the measurements from these plans and then plotting the adjusted coordinates of boundaries.

4. Use of the planimetric data as it is provided from the digital mapping production facility (DMPF) to identify boundaries in built up areas, cross check the data with cadastral plan information and use this to build up parts of the digital cadastre.

5. Various rapid appraisal methods based on combinations of orthophotography and field GPS techniques.

6. Combination of the above methods.

Once the boundaries are identified then the parcels must be uniquely identified. Ramlal, 1999 gives a detailed discussion on the UPRN used by different agencies and recommendations are made concerning the appropriate system to use. Briefly, Valuation Division divides the country into 9 regions, which are subdivided into settlements, enclosures and parcels; TCPD divides the country into regions and settlements; CSO uses county, ward, enumeration district; MALMR and WASA use their regional offices wards and settlements districts for building a UPRN. The LSD has adopted the VD UPRN system. It has been identified as simple to use, easy to remember, easily automated, flexible, able to reflect changes in boundaries, accurate and able to serve several purposes making it the best choice out of the existing framework. The main weakness in the system is the definition of boundaries by population size. It is necessary to use familiar boundaries whether administrative or defined by road networks or settlements but this should be within a measurement system also to keep subdivisions units as uniform as possible. The categories identified by Dr. Ramlal have been modified to account for parcels with a minimum size of 5000 square feet:

1. Size of the island = 1,980 square miles = 1,267,200 acres
2. Size of region ~ 105,600 acres (number of regions 1….12)
3. Size of an estate ~ 7,500 acres (number of estates 1….15)
4. Size of settlement area ~ 300 acres (number of Settlements 1….25)
5. Size of enclosures ~ 12 acres (number of Enclosures 1….25)
6. Size of parcels ~ 5000 square feet (number of parcels 1….99)

The system must cater to subdivision and conglomeration of lands. The parent UPRN will have to be recorded and new numbers assigned to subdivided parcels, while in the case of consolidation of lands the old reference numbers have to be included as cross reference and a single UPRN assigned.

In order to implement any UPRN the reorganization of the cadastral records at the vault of the Red House is imperative. As areas are identified for digital work the plans should be extracted from their books and placed in jackets to be inserted in loose-leaf binders. This will allow plans to be updated with a UPRN and inserted (in a numeric order) into the appropriate binder that will serve as a register based on settlements or enclosures.

The LSD have undertook pilot projects in the creation of such a digital cadastre and the structure for the tables associated with the cadastre (indexing, area of parcel, names etc.) have already been developed.

2.6.2 Creation of Other Spatial Digital Data

An accurate and current road network is needed to facilitate field officers who perform site visits from the various agencies. Currently regional officers must be familiar with the region or have a good relationship with developers operating in the region to locate sites. Trinidad and Tobago Water Services undertook a mapping exercise in which all the roads in Trinidad were mapped and are collated in books according to wards. These were recently acquired by TTPOST who is in the process of updating these maps. They are updated through information gathered from postal officers, developers that supply development plans and site visits with a walk wheel to measure the distances along roads. A map wheel is then used to scale this information onto the existing maps. These maps are scaled but not coordinated and the names of roads are correctly recorded on these maps. Once a digital coverage of the road network is available TTPOST is

capable and willing to assist in maintaining this database since their officers are "on the road" everyday and are aware of any new developments within the country. The assignment of unique addresses to households that are in "out of post" and newly developed areas is being undertaken by TTPOST. However this does not address the problem of lands without dwelling units or those areas already serviced by postal officers.

One of the major concerns of agencies is the lack of current map data and the unavailability of this data even when it exists. For example the cadastral index maps are updated daily but the printed copies available are from 1980. The state administration agencies (TCPD, VD, CSO and the RGD) all have a structured collection of land information (through forms and questionnaires) therefore these records will be/are easily automated. Those management agencies that collect information on an informal basis should develop a comprehensive system to capture the information they use through functional and user requirement analysis. This will later aid in automation and updating of records.

CHAPTER 3
THE GIS EXPERIENCES OF STATE AGENCIES
AND OUTLINE OF POLICY IMPLICATIONS

3.1 GIS Experiences

The GIS experiences across agencies vary from full GIS databases to GIS databases that were developed only as pilot projects. However, digital databases of register books are found in most agencies and the information in these databases link to files that relate to maps, thus the structure for a GIS is indirectly present although not formally conceptualized in these agencies.

Table 3.1 gives a summary of the GIS experiences of the state agencies. All of the state agencies are equipped with personal computers. TCPD has two workstations for GIS related work. Most of the computers were only recently acquired within the last two years. Of these agencies LSD, VD and the RGD are satisfied with vendor support that comes mainly from a single source. MALMR, CSO and TCPD obtained hardware from a variety of sources and are not satisfied with vendor support.

The two main types of GIS software are ArcInfo/ArcView and GeoMedia Pro. The latter is used by LSD and was used by the Land Bank at NHA; both users have been satisfied with the vendor support provided. The majority of agencies use ArcInfo/ArcView. MALMR is satisfied with the support provided by the vendors while TCPD and CSO have not been satisfied.

Other database software includes Microsoft Access, Oracle, FoxPro, Dbase IV, SQL Server and other custom designed property management software. There has been general satisfaction of vendor support of these products. Many of the agencies have custom designed graphic user interfaces for data entry purposes. It has been their experience that vendors supply assistance and training in the development and use of these software packages.

With the exception of the VD, all other agencies that have undertaken GIS pilot projects or have developed GIS systems have personnel with some level of experience obtained through vendor training, certificate courses and/or degrees (B.Sc. or MSc.) in GIS. Additionally, consultants have been engaged in GIS development or pilot studies for

Table 3.1 A SUMMARY OF THE GIS EXPERIENCES OF STATE AGENCIES

	LSD	TCPD	VD	RGD	MALMR	PETROTRIN	PIDCOTT	WASA	NHA	CSO
Hardware										
Workstation		X						X		
Personal Computer	X	X	X	X	X	X				X
Digitizing Tables	X	X				X		X		X
Plotters	X	X				X		X		X
Printers	X	X	X	X	X	X		X		X
Scanner	X	X	X	X		X				
Software										
GIS	GeoMedia Pro	ArcInfo/View	ArcView		ArcInfo/View	ArcInfo/View		ArcInfo/View		ArcInfo/View
Database	Oracle	SQL Server	FoxPro, Access SIBIS	PIMS (Oracle)		Access, Oracle	Property management	Access	Property Management	Access Dbase IV
Mapping						ACAD		ACAD		
Network								X		
Personnel										
GIS Project Manager	X	X			X			X		
Dbase Administrator		X		X		X		X		X
GIS Project Leader					X	X		X		X
Technical Staff	X	X			X	X		X		X
Other			X		X					
Analysis										
Functional	X	X			X	X				X
User Requirement	X	X		X	X	X		X		X
Data Dictionary	X	X		X	X	X		X		X
Progress Report		X		X	X			X		X
Financial Report		X		X	X			X		X

Table 3.1 A SUMMARY OF THE GIS EXPERIENCES OF STATE AGENCIES (Continued)

	LSD	TCPD	VD	RGD	MALMR	PETROTRIN	PIDCOTT	WASA	NHA	CSO
GIS Development								X		
Operational GIS					X					X
GIS for Projects	X	X								
Pilot Project Only			X			X				
Spatial dbase Only										
Attribute dbase Only		X		X			X	X		
Automation										
In-house	X	X				X		X		X
External contracts			X	X	X			X		
Updating										
In-house	X	X		X	X			X		X
External contracts								X		
Data Policies										
Is there a data sharing policy?	N	N		N	N	N		N		N
Are data sold?	N	N		Y	N	N		Y		Y
Pricing Technique	NA	NA			NA	NA		File Size		Level of detail
Data Protection		N		Password				Contract		Contract
Do you source data externally?	N	N		N	N	Y		Y		Y

State agencies. Functional and user requirement analyses as well as data dictionaries and reports have also been done for these agencies. Analyses and reports for MALMR and the RGD were done through consultants. Staff at the other state agencies (LSD, TCPD, PETROTRIN, CSO and WASA) performed these tasks.

MALMR and CSO have full GIS capabilities of their major records. Detailed functional analysis and user requirement analyses were performed and questionnaires were prepared to capture data. Data dictionaries were developed and progress and financial reports written. MALMR contracted these tasks to a consultant while CSO did all these task in-house. Data collection forms were collated by staff at MALMR's county offices and data entry as well as spatial data automation was done externally. The RGD automation of its records also follows a similar trend with staff at the RGD stripping and organizing records for scanning and data entry by external operators. Records such as judgements, lis pendens and bills of sale are entered from files dated back to 1996, information from the deed documents are automated to 1970 and should be completed at the end of May 2000, Real Property Ordinance documents are scattered in a number of different books and registers therefore automation has not yet begun, but the data capture is progressing and the targeted date of completion is at the end of the year 2000. CSO collects data on a daily basis and has staff dedicated to editing, coding and data entry. However, in the case of a national census temporary staff is hired and trained to do these tasks. Work is carried out on a twenty-four hour basis in these instances. TCPD had an automated attribute database (Dbase) therefore once its data dictionaries and tables were formalized the data were converted to SQL Server database and new information is added by staff trained in the data entry using a custom designed GUI. The GIS staff of the LSD has undertaken all the necessary analysis and development of data dictionaries and tables for collecting attribute data. The attribute data is in paper form and with the limited human and technical resources progress has been very slow in the compilation of the records and data entry. The attribute and spatial data automation is being done in parallel by the same staff and this may also be one of the factors slowing progress. WASA's GIS started out as a mapping activity with the sole purpose of producing maps in a digital form for reproduction. It was only later expanded to encompass the concepts of GIS. User requirement analyses were performed later in the development

Data collection forms and questionnaires are reviewed as work progresses to improve the efficiency and accuracy of field surveys and to ensure completeness of data capture. WASA has identified problems in its database through quality checks performed on its data. Permanent staff at the state agencies maintains these database designs and collection forms. LSD, TCPD, RGD and MALMR use pilot projects to identify problems in their databases and make amendments as work progress. Also, MALMR have redesigned its data collection forms to include given conditions of land that is associated with particular actions/decisions. This type of information also forms part of the TCPD database design. Since the Land and Record Management Section of the LSD is involved in automating records pertaining to all state lands it is apparent that there will be a duplication in effort since state agricultural lands falls under its purview. This information is already available from the State Agricultural Land Information System (SALIS) at the MALMR. Unfortunately, the details required by LSD is much greater than that provided by SALIS however, data from the tables can be imported where possible and used to quickly access records pertaining to agricultural parcels since reference numbers of records (deed and lease nos.) are contained in this database. NHA also has its register books automated and this will assist LSD in accessing legal records relating to housing.

Spatial data automation of MALMR was done externally using cadastral index maps, survey plans where available and sketches of parcels provided by field officers. Accuracy was not of the prime considerations but relative position of parcels and completeness of spatial data were important. The attribute data was then linked to this data through the UPRN discussed previously. CSO aggregates the data collected at a household level to enumeration districts. Population size is used to determine the extent of these boundaries. CSO bought digital coverages of roads and rivers from the Water and Sewage Authority (WASA) to include in its spatial database. The Land Record Management Section of the LSD is responsible for the automation of its cadastral records. This has been done by coordination of survey plans and digitization of these plans. UPRN's are assigned to parcels as discussed and the attribute database linked to these records. The accuracy of spatial data is very important to maintain spatial integrity as data is continually added to eventually provide a digital cadastre for the entire country.

Only selected areas have been targeted this far and the pace of work is very slow. The Digital Mapping Production Facility (DMPF) at the LSD is also involved in creating a GIS of its topographic data. The spatial data automation is externally contracted and expected completion is at the end of 2001. Tiles of planimetric data supplied by consultants will be supplemented with attribute data that will be collected by topographers and data entry done in-house. A very important aspect of this database will be its maintenance since it will already be six years old on completion (base information is from the 1994 aerial photography). TCPD has completed seventy percent of the digitization of road and rivers from existing topographic maps. In order to integrate the attribute database (application for development and complaints) with spatial information TCPD require a complete digital cadastre of the country but do not have the capacity for such an exercise. The attribute database contains two fields for the coordinates of a centroid of each parcel but can easily be modified to include a UPRN field.

WASA digitized its road, river and planimetric coverages from stereoplotted images of aerial photographs of 1989. The road and river networks for the entire country forms part of its GIS database and the coverages are updated on a weekly basis as the need arises. GPS surveys were undertaken to coordinate the water mains and lines connecting these mains represent the water network. The water main coverage as well as the building coverage extends over the urban and suburban areas of the country. The System Investigator (more acquainted with the water main details) checks the accuracy of this coverage. A point coverage is used to indicate the location of buildings (for linkage to the customer database) this also covers the major populated areas. The UPRN used for this point coverage is based on ward, Ed and a sequential number. The Ed coverage was bought from CSO. Although the spatial data is updated on a regular basis the GIS is still in its data verification stages. Analyses and reports are performed on the customer and other databases rather than with the use of the GIS facilities.

TCPD employs the full capacity of GIS only on project basis to support its analysis on land use, suitability analysis and environmental impact assessment of proposed developments. In these instances maps contained in their offices, obtained from developers and other sources are digitized. Field visits by town and country planning

assistants are then used to update these maps and develop an attribute database. Census data is also obtained from CSO and used in these analyses.

A pilot GIS project was developed for VD by foreign consultants in order to implement a land tax based on capital rather than the existing rental value system. The project was completed in its entirety but was never implemented nor training provided in its use and maintenance. The attribute database for property analysis was DOS-based and data has to be extracted and brought into a compatible format for use with ArcView. This system is non-functional at present. Petrotrin undertook a pilot project around 1996 to investigate the usefulness of GIS in managing its estates to increase its productivity and viability. Reports were written on the user requirements of such a system. The spatial data was imported from AutoCad files and digitized from existing maps. The coverages included cadastre, pipelines, facilities (tanks batteries, steam generators etc.), land use (broad division), settlements, landmarks (include social services), seismic lines, hydrology, soil, geology, contours, roads, rivers and wells. The spatial data was linked to the oracle databases through unique identifiers assigned sequentially to features. The primary focus of the agency is increasing its productivity and viability therefore map making has not been given major importance. The project was disbanded. Presently, the idea of a GIS is still being explored but if coverages can be bought then the prospect of an operational GIS will be more attractive. Ten percent of attribute and spatial data are in digital form.

GIS experiences show that at least two years (CSO) is required to implement an operational GIS. MALMR took five years to create a parcel-based system for all state agricultural lands and this was with the help of consultants and external data automation. Other agencies are at various stages of development with automation taking anywhere from two to ten years.

3.2 Policy Implications

None of the state agencies have data sharing policies. The consortium of oil company pool resources together for creating and maintaining the digital geological map of Trinidad and the data is shared amongst these agencies. Other state agencies have expressed willingness to share their data with other agencies once the data is not

confidential. Valuation Division, TCPD, CSO and the RGD all collect land records that they assert are confidential, whereas LSD and MALMR records are public. It is necessary for the state agencies to identify confidential data items and these data will have to be protected when a national LIS/GIS becomes a reality.

Data is sold by three of the agencies and the criteria for pricing include:

- Inherited from previous practices (RGD)
- Level of detail (CSO)
- Cost recovery (WASA)

At present the DMPF at the LSD is investigating means of pricing digital topographic data to facilitate cost recovery and to prevent piracy of data they include:

- Royalties for mass production of maps by private companies
- Signed contracts for use of data
- Copyrights

Many organizations have abandoned the idea of developing a GIS because of the prohibitive cost of acquiring existing digital spatial data and the lack of confidence in its currency, usefulness and completeness. Also many of the agencies manage their land tenure through property management software and do not see the need for a GIS if spatial data automation has to be done in-house. Although cost recovery is desirable it will be unrealistic if the pricing strategy does not cater to the budget of users of the data. Accuracy, currency and completeness of digital data are necessary to convince users of the integrity of the product. When a national LIS/GIS is created continual checks on these three data components should be performed. All data collected should be dated to facilitate checks on the currency of data (both spatial and attribute). In this regard there should be formal sheets prepared for users to submit if they should encounter errors in the database. Users who paid for such data should be reimbursed through supply of additional information at a reduced rate or payments for their contribution to the database.

It must be realized that weakness that are a part of state agencies such as the unclear definition of functions of agencies, overlapping of functions, compromising situations in the administration of the duties of the agencies due to conflicting legislation cannot be resolved by any type of database development. State agencies must have a

forum to gather and resolve these issues. During the surveys conducted it was found that these issues have resulted in insecurity amongst workers and frustration because the proper execution of duties are rendered defunct.

The full potential of a GIS has not been explored by the state agencies. It is important to inform other authorities of the capabilities of such a system as it becomes operational (health authority, police service, fire service, traffic division etc.).

3.3 Recommendations

After reviewing the type information within agencies, their needs, GIS experiences and automation of records in Trinidad it becomes clear that there is a need for coordination of efforts amongst agencies if a national LIS/GIS is to be created and maintained in an efficient manner. One of the most important spatial coverage identified is the cadastre but most of the state agencies are unable or do not give priority to the creation of a digital cadastre although they acknowledge that its existence will definitely be an asset to their activities. The agencies are willing to be contributors to the maintenance of a national LIS/GIS when it becomes a reality.

Lands and Surveys Division must be acknowledged as the major custodian of spatial data. The mandate of this agency also requires that it must maintain these data. This agency will play a key role in the development of a digital cadastre and will be required to maintain it once it is created. However a major re-organization of the cadastral records is required and must be done by staff at the Red House Vault and temporary employees must be hired to facilitate the permanent staff since the staff is also engaged in assisting the public and other duties. Once the cadastral records of enclosures and settlements are collated then UPRN's must be assigned to individual parcels. The automation of the boundary information has to be done either in-house or contracted. Parallel to this activity database tables designed by the Land Record Management Section should be related updated with relevant information related to each parcel. It is necessary for some formal mechanism to be put in place for the assignment of unique addresses for each parcel. This will facilitate maintenance of the database later on and facilitate officers in the state agencies who perform site visits. All contributors to the database should adopt this referencing system. State agencies (such as District Revenue

Office, NHA, WASA, PIDCOTT etc.) that maintain records based on name and addresses of persons should adjust their registers to reflect these new fields (UPRN and unique addresses).

Another aspect of the database is the maintenance of the road networks. This can be done through the DMPF in conjunction with TTPOST. Also developers of land should be required to supply site plans with planimetric detail of construction to the DMPF so other topographic databases can be updated. Non-conformance of developers should also be associated with penalties.

Classification of data and associated classification codes need to be standardized and look-up tables created and used by all agencies. In addition, land-related data on legal documents need to be clearly defined and adhered to by legal practitioners to facilitate data entry of pertinent data especially where the data is used to access the documents.

Only WASA has data quality check procedures in place, however the positional check on features is by overlay of digitized coverages onto maps from which they were digitized therefore there is lack of proper understanding of the data quality checks. Data quality checks are very important to ensure a reliable GIS therefore procedures must be set for data quality checks and GIS personnel and database administrators should appreciate the methods of checking data quality in the state agencies.

Maintenance of other aspects of the database (landuse, structures on land, tenancy, physical conditions of land etc.) can be ascertained through field officers of the various state agencies. In this regard, data collection forms should be designed to facilitate maintenance of the LIS/GIS database, as it becomes operational. All field officers in the different agencies should be identified and targeted for data collection and each agency will be responsible for maintaining these records.

Important to the development of a national LIS/GIS is the ability of this system to monitor illegal or spontaneous developments on land. State agencies will then be able to better control lands that are under their jurisdiction. At present the Ministry of Agriculture looses land to housing (squatter developments), lands ear-marked for extensive cultivation are encroached on by people who practice intensive agriculture and watershed areas are destroyed by squatting. These are only a few of the areas of mapping

that is required by a national LIS/GIS. It was already stated that identifying problems and addressing them are two separate issues.

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APPENDIX A

THE INDEXING SYSTEM FOR IDENTIFYING LAND

THE INDEXING SYSTEM FOR IDENTIFYING LAND

Valuation Division (adopted by LSD):

Regions: Region 1 – St. George West (including the City of Port of Spain)

Region 2 – St. George East

Region 3 – St. George East (including the Borough of Arima)

Region 4 – St. Andrew-St. David

Region 5 – Caroni

Region 6 – Nariva-Mayaro

Region 7 – Victoria (including the Borough of San Fernando)

Region 8 – St. Patrick (including the Borough of Point Fortin)

Region 9 – Tobago

Settlement Areas

These have been designed by the TCPD and divide the country into neighbourhood units of population for planning purposes. There are 116 settlement areas in Trinidad and 21 in Tobago.

Enclosures

Areas are further subdivided into enclosures which each contain between 30 to 50 parcels of land. In urban and built-up areas these enclosures are usually bounded by streets and in rural areas by streams, rivers, roads, traces etc.

Example: A parcel of land could be identified as follows:

7 – Region 7

22 – Settlement Area 22

009 – Enclosure 9

023 – Parcel number 23

The unique parcel identifier will be 7/22/009/023.

Town and Country Planning Division

Regions are the same as Valuation Division but letters of the alphabet are used to identify settlements. No further subdivision occurs.

Example:T9 refers to Region 9, Settlement area T.

Added to these map references are the application number for development which is sequential beginning at 1 every new year and the last two digits of the year is added to this number.

Example: M148098 refers to the 480th application that was submitted in 1998 and can be found in region 1 Settlement M.

Ministry of Agricultural Land and Marine Resources

The country is divided into two regions: North – NR and South – SR

These are then subdivided into County, Ward, District, Settlement/block and Parcel.

The settlement in this instance is the physical town or village.

MALMR also includes the Valuation Division, TCPD, CSO and WASA reference numbers in its database.

Central Statistical Office

CSO classification is based on the administrative regions, wards and enumeration districts. The latter is the based on a fixed number of households per enumeration district. Some Ed's may be very small in densely populated areas or very large in rural or sparsely populated areas.

National Housing Authority and PIDCOTT

These agencies have their lands divided into estates (names are assigned to each estate). These estates are then subdivided into blocks, which are then subdivided into parcels.

APPENDIX B

Catalogue of Maps of the Lands and Surveys Division

Maps Produced by the Mapping Facility at Lands and Surveys Division

Lands and Surveys Maps

      (a) 1:10,000 Port of Spain

      (b) 1:1,000 San Fernando

      (c) 1:50,000 Tobago

      (d) 1:150,000 Road Map of Trinidad and Tobago

      (e) 1:150,000 Road Map of Trinidad

      (f) 1:75,000 Map of Trinidad (4 parts)

      (g) 1:150,000 Map of Point Fortin

      (h) 1:1,250, 1:25,000, 1:10,000 Cadastral Sheets

      (i) 1:5,000 Map of Mt Hope

      (j) 1:25,000 Aerial Photos (938 Prints) Full Set

      (k) 1:12,500 Aerial Photos (2098 Prints) Full

      (l) Maps showing approaches to the Harbour (Hydrographic)

Maps requested by Other Agencies and Produced by this Section

1. Forestry Division

      (a) Forest Reserve Maps

      (b) Watershed Maps

      (c) Rainfall Maps

      (d) Time cards

      (e) File jackets

2. NEMA

      (a) Disaster response maps for

      Port of Spain

      San Fernando

      Arima

      Tobago

      Point Fortin

      All counties

3. **Town and Country Planning**

    (a) Population Maps

    (b) Development Maps

    (c) Aerial Photos

4. **Ministry of Health**

    (a) Maps showing health centers

    (b) Charts, forms, booklets, posters and pamphlets

5. **Ministry of Agriculture**

    (a) Maps

    (b) Posters (mealy bug), file jackets, pamphlets and forms

6. **Home Construction Ltd.**

    (a) Maps showing malls, banks, police and fire stations and other relevant information

Miscellaneous Jobs

Surveyors Progress Reports

File Movement Cards

File Jackets

Index to Proceedings

State Grant Movement Cards

Award of Contracts

Schedule of Accounts

Data Capture Forms

Survey Field Books

Survey Record Card

Survey Consent Form

Survey Order Form

Hydrographic Tide Tables