

Belize National
Spatial Data Infrastructure
*Supporting Sustainable and Resilient
National Development*

DATA INVENTORY AND ASSESSMENT

Discussion Draft v2

2 May 2016



Belize National Spatial Data Infrastructure

DATA INVENTORY AND ASSESSMENT

DISCUSSION DRAFT

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**Government of Belize
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EXECUTIVE SUMMARY

This Data Inventory and Assessment report is a compilation and synthesis of over 530 data sources identified in the Stakeholder Situation Update Survey. Basic information about each source was cataloged to an inventory database and categorized to a Class/Theme/Topic hierarchical classification scheme which includes 6 data Classes, approximately 50 data Themes and over 225 data Topics. This database was then correlated against a list of more than 1700 instances where it was identified that GIS can support stakeholder functions in the Stakeholder Survey report. This information was then filtered to provide a listing of business functions to be supported by each data Theme/Topic thus providing insights to the business requirements for each.

For each Theme and its associated list of topics, the following information has been provided:

- **General definition** – What does the topic refer to and how is this information typically used;
- **Currently available information in Belize** – What data sources currently exist or are planned for the near future;
- **Business activities** – as described previously, a comprehensive listing of the business activities that require such information, providing “use case” intelligence that can be translated to data requirements;
- **Fundamental Geospatial Data Sets (FGDS)** – fundamental data layers within each Theme that will provide the foundation for the BNSDI;
- **Compilation strategy and suggested custodianship** – One important target of the BNSDI is to consolidate and standardize geospatial data to the extent practical and to ensure there is one single data custodian who has the overall responsibility for the development and maintenance of this information.

This report provides analysis and input that is further summarized within the BNSDI Requirements Analysis Report under separate cover.

Note: Most of the information presented in this document was collected and recorded in 2014. In late 2015 there was an election and administrative re-structuring of the government that changed the configuration of several Ministries. While some administrative structures have changed, the basic functions carried out by government remain largely the same. Since the purpose of this exercise is to reflect the aggregate requirements of representative stakeholders, the information in this report has not been reconfigured to reflect government restructuring.

1 INTRODUCTION

This Data Inventory and Assessment (DIA) report provides a compilation of information gathered about the future requirements and current data holdings of organizations that were identified as potentially important participants in the next stage of development of the Belize National Spatial Data Infrastructure (BNSDI) program. The objective of the current effort is to assist the Government of Belize (GoB) to review existing BNSDI policy and provide a roadmap for successful and sustainable implementation and governance of BNSDI with respect to investment programs identified under the Climate Resilient Infrastructure Project (CRIP). The BNSDI is to provide an enabling environment for the CRIP Project Preparation Facility, providing critical information infrastructure to support more effective formulation, design, development, monitoring and evaluation of targeted retrofitting, rehabilitation and reconstruction activities that are needed to strengthen the resilience of critical infrastructure to natural hazards and the anticipated impacts of climate variability. Beyond the immediate CRIP program requirements the study is also addressing a broader range of development concerns across all major sectors in Belize.

This Data Inventory and Assessment report is one component of a structured work program for the planning, design, and implementation of the BNSDI. The position of this report relative to the entire work program is illustrated in the Figure below.

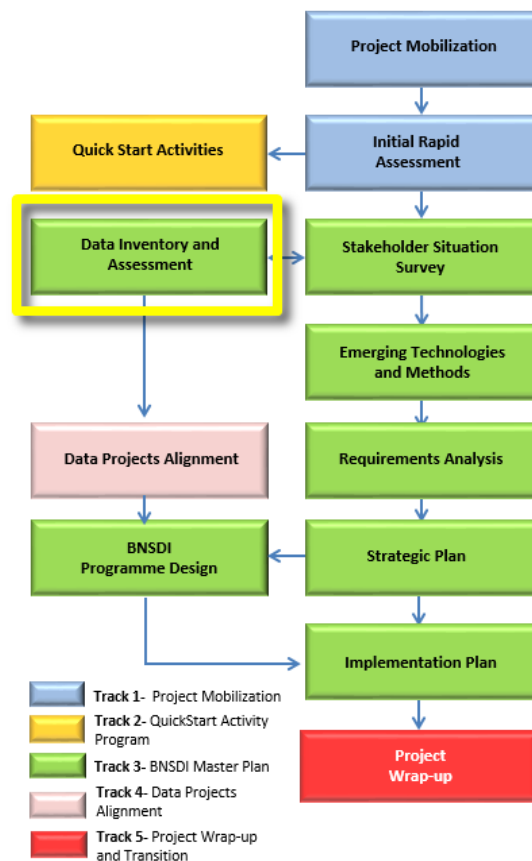


Figure 1 – Work Program Illustration

In a previous Stakeholder Situation Survey activity, a basic inventory of geospatial data used or generated by each stakeholder was identified and documented at a summary level according to information made available by each organization. The data inventory was documented according to a standard template that is consistent with international metadata standards, but that also includes fields of information that are necessary for conducting the assessment portion of this task. That information has provided the primary input to the current DIA report.

1.1 Purpose of this document

The BNSDI Data Inventory and Assessment (DIA) serves to compile, describe and assess the spatial data sources that were referenced in the BNSDI Stakeholder Situation Survey and how these data fit into the BNSDI data framework of Fundamental Geospatial Data Sets (FGDS). Data sources include digital GIS files as well as any other type or form of data used or generated that relates to location directly or indirectly. This information is then sorted according to a Class/Theme/Topic classification system to group those datasets that are most related according to the underlying geospatial “primitives” that are being referenced, topical and system interrelationships. This report is organized according to the classification system and each section provides a summary of the existing information sources that exist for each Theme, a summary of the business use cases within the BNSDI stakeholder community that need that information, an assessment of any gaps between what exists and what is needed, and a summary of the approach that will be required to fill those gaps. The most likely data custodians for each theme are also suggested, based on mandate and business processes, as explained in sections following.

The data requirements and issues identified in this document, combined with those business requirements identified in the BNSDI Requirements Analysis report, will provide important input to the BNSDI Strategic Plan, Program Design, and Implementation Approach in subsequent stages of the project.

The development of a comprehensive BNSDI database covering all the required data themes will take time to develop and can be expected to continue to evolve once it is in place. It will be important that the procedures are in place for the BNSDI coordinating function in the government to continue to facilitate coordination and standardization across the community. It is expected therefore that this report will become a “living document” that will be updated as a common reference for the stakeholder community that can be referenced to determine the current status of any theme or topic of geospatial and related information in Belize.

Some data themes have been included in this document that are the responsibility of several organizations that were not included in the current study due to time and resource constraints. Experience with other NSDI initiatives around the world suggests that these themes are usually important to address in an NSDI, and where substantiated through consideration of these themes in the Belize context have been included as placeholders. These are useful to

acknowledge the level of need for these themes and to help identify those stakeholders that should be added in the next cycle of BNSDI expansion and refinement.

1.2 Organization of this document

This document is organized to the following major sections:

Section 1 – Introduction: Provides the background and purpose of the BNSDI initiative, the structure of the overall program, and the purpose, process and results of this document specifically.

Section 2 – Fundamental Geospatial Data Sets (FGDS). The concept of Fundamental Geospatial Data Sets (FGDS) represents a classification system of data classes, themes and topics that provides the organizational framework around which this report and these considerations are structured.

Section 3 – Basemap. Information in the Basemap category provides the essential spatial frame of reference for all other geographic data at all scales.

Section 4 – Areas. The Areas data class refers to subdivisions of land (or water) according to some intended purpose. Areas delineate administrative boundaries, jurisdictional areas, socioeconomic and management zones and are used for a variety of planning, administrative and special management purposes.

Section 5 – Environmental. Environmental data typically include features of the natural environment such as land cover, soils, geology, archaeological sites, sensitive flora or fauna locations, and other information.

Section 6 – Utilities. The Utilities theme includes all those major infrastructure utility networks and associated structures and appurtenances

Section 7 – Transportation. Transportation data include roadways, highways, rail lines, bridges, airports and any other information related to transportation networks and facilities.

The current document should be considered a “discussion draft” that will undergo further refinement with the involvement and advice of the BNSDI stakeholder community. There are a number of remaining questions that remain to be answered by some organizations. These questions and missing information have been noted and highlighted in the present document so that they can be responded to by the relevant organizations in due time, without holding up the distribution and review of the rest of the content. Corrections and additions will be compiled and incorporated into a final version of the report according to the project schedule.

Much of the data produced as part of the BNSDI FGDS framework will be produced at a large scale (1:1,000 – 1:5,000+) to support urban area applications. Large scale maps generally provide the greatest amount of precision covering smaller areas where more intense human development activity is present thus requiring a higher level of detail. Of particular importance at this scale is the mapping of urban environments and infrastructure where the information derived can then be used for other FGDS themes. Data produced at this scale can then be generalized to smaller scales for those areas covered, and added to the larger coverage areas of smaller scale mapping.

This scale is required primarily for engineering level works including facility mapping and management, streetscape design, urban and architectural design and small area environmental inventory and assessment works. This scale is suitable for all aspects of engineering planning and general design, but does not preclude the need for site-specific engineering work, including site surveys and the locating of underground utilities, that is needed for most construction works.

This scale includes a variety of urban topographic basemapping at the most detailed level including street centerlines, structures, land ownership plots and block boundaries, pavement edge and other sorts of planimetric features. This scale may also include planned as well as existing features such as planned buildings and community facilities that may need to be referenced at this scale for urban design, utility maintenance, call-before-you-dig clearances and other applications.

Large scale base mapping requires the high level of accuracy that is needed to support a wide variety of applications. This level of accuracy requires a highly accurate network of survey control points and/or other means for assuring accurate horizontal and vertical control for photogrammetric engineering and field surveys.

2.0 FUNDAMENTAL GEOSPATIAL DATA SETS

This section provides a summary of the considerations involved in the development and assessment of a comprehensive inventory of geospatial data for the BNSDI. At present there are many related, redundant and/or interdependent information sources that are being used or generated across the BNSDI stakeholder community. A key target of the BNSDI is to ensure the effective collection, management and utilization of commonly needed geospatial information across the community. This requires that the specific data themes needed in common are identified, the full range of business requirements that each theme is intended to fulfill are assessed, the existing sources that may contribute to building each theme are evaluated, and that the most appropriate custodian for each theme or topic is logically and systematically defined. The concept of Fundamental Geospatial Data Sets (FGDS) represents a classification system of data classes, themes and topics that provides the organizational framework around which this report and these considerations are structured.

In today's technological world, the management and use of most geospatial and related data is more efficiently and effectively handled in a digital form. The BNSDI is being developed so that this information can be created once and used many times across the community. It is important therefore to distinguish between the detailed "Enterprise" information that is needed and created by a specific agency for carrying out its own work, and the typically more limited version of that same data topic that may be needed by most of the rest of the stakeholder community. For example, an electrical utility may maintain an extensive, detailed and complex electrical database that allows them to integrate their facility mapping, maintenance management system, financial mapping and electrical system modeling needs, while the rest of the community may only need to know the location, material and KVA rating of the cable. This latter version of the electrical network data would be identified as an FGDS layer for the purposes of the BNSDI.

The Return On Investment (ROI) in GIS and related computing and information infrastructure is defined first at the "Enterprise" level of individual organizations, and secondly enhanced through the BNSDI by eliminating redundancy and making more information accessible for use that might not otherwise be available or is prohibitively costly to develop independently from others. The development of the full BNSDI FGDS framework will not happen overnight and its development will need to be prioritized, both according to the priorities and capabilities of individual organizations as well as the collective needs of the larger community. The DIA the range of issues that may affect prioritization that will be considered in the development of the implementation plan in later stages.

2.1 Defining FGDS

Fundamental geospatial data sets (FGDS) are those data types that are most commonly needed by multiple entities within the BNSDI community. These often include, among other issues, topographic information, cadastral information, ortho-rectified aerial photography, elevation data, transportation, hydrography, governmental administrative units, land use/land cover, demographics, soils, climatology, air and water quality, community facilities and service areas. International experience has revealed a range of information types that are often needed in common within an NSDI, and this list has been used as a starting point for further refinement and extension to a form that is specific to Belize.

For the purposes of this data inventory and assessment, FGDS are defined around “geospatial primitives” that represent the most basic geospatial feature that is being represented or referenced. For example, a building footprint represents the location of the external walls of a habitable structure, and that building footprint may fall within a plot of land which is a unique cadastral area that has been administratively and legally defined. Both of these features may also relate to but are distinct from a street address point that actually represents the location of the primary entrance to an addressable structure. Other information may only be spatial by a reference to one of the geospatial primitives, for example a business license in a tabular file that can be tied to a location on the ground through a street address or building identifier.

FGDS definition helps to identify sets of related data and a variety of interdependencies that need to be reflected in the modeling of that information to a standardized content and form that can support the widest range of community needs practical, while recognizing that this information is to be maintained independently by officially recognized data custodians.

2.2 Framework Data and Fundamental Registries

Some FGDS are also considered “Framework” data, in that they represent geospatial “primitives” that can be used as an essential framework for georeferencing other information. For example, building footprints can be used as a framework and common spatial reference for building permits, household surveys, commercial licenses, residence location, student records, utility customer accounts, and many other purposes. It is important both for the efficiency and reliability of the BNSDI that there be a single official custodian for each layer of FGDS who is authorized and accountable for maintaining and managing that information for their own purposes and in support of the rest of the community. The custodianship for each FGDS is established based on who is best suited to capture information as a part of their normal business transactions. This usually refers to which organization has the existing mandate, authority and accountability for recording a specific topic of information and is first to do so chronologically, and at the most detailed level according to standard business practices. This logic is applied as a general rule, but of course exceptions can occur. For example an organization may, according to its mandate and business processes, be the logical custodian but not have the existing capacity to do so reliably in a digital form. In such cases these organizations will need to either develop the capacity (and be given the resources needed to do so) in a timeframe that is suitable to the rest of the community, or that

responsibility can be assigned to another organization or outsourced to an external service provider temporarily until the required capacity can be developed.

Similar in principle to FGDS are “Fundamental Registries” (FR’s). FR’s are centrally maintained tabular databases that provide a single source of authoritative identification information for certain entities such as people, vehicles, buildings, plots of land, public sector investment projects, businesses and many others. Establishing such registries under a single, authorized custodianship and enabling this information to be referenced to verify accuracy before accepting an entry to any government database helps to ensure that correct information is captured, thus providing latent interoperability and the ability to link and integrate information across sectors and units of government. Many of these registries refer to geographically “fixed” entities that have spatial relevance either directly or indirectly and thus are directly relevant to the BNSDI. Others are “movable” (such as people and vehicles) and their movements and current location may be tracked in GIS. In both cases such registries are also important generally to eGovernment and other aspects of societal information infrastructure.

2.3 FGDS Classification Scheme

FGDS data are grouped according to certain classes and themes of data to help identify those that are related from a data modeling perspective. The FGDS framework is organized as a taxonomic description of the fundamental classes, related data themes, and the principal topics that make up a data theme. Classes, themes, and topics are outlined below and the taxonomic categories utilized in BNSDI currently are listed in Appendix B:

Class. A data class is a grouping of related data issues that have topical and structural commonalities. Relationships between objects in a class can be both spatial and topical (i.e. domain specific). A class contains data themes.

Theme. Data themes are sub-types of a data class. These usually have geospatial properties but may not always have physical representation on the ground. Data themes usually relate to an area of knowledge, a phenomenon, or a data product. A data theme is made up of one or more related data topics.

Topic. Data topics are sub-types of a data theme. They have geospatial properties and generally speaking, strong spatial relationships at the data theme level. Data topics may describe multiple types of a single geographic phenomenon or data products. Also, one FGDS may related to several data topics. Representation of data topics will vary by spatial scale. Requirements for data collection and management will also vary within a single data topic. Additionally some topics are not inherently spatial, but can be related to a specific spatial primitive feature for geocoding purposes.

A set of data classes and themes based on international NSDI experience has been adapted to fit the needs of the BNSDI. The five (5) basic classes of geospatial information are Basemap, Areas, Environmental, Utilities and Transportation. These comprise nearly 40 themes, representing over 200 data topics. In consideration of the business requirements, these are then consolidated to approximately 100 FGDS that represent clusters of related topics to be addressed programmatically in the BNSDI program design and implementation plan.

No categorization fits all purposes, and this one is no exception. What is provided by the BNSDI is an initial organizational framework that provides a starting point for initial program design that can be periodically updated and refined over time.

Each class identified in this study is described below, along with a listing of its related themes. Themes may vary somewhat at each scale, as certain data themes may not be applicable or available at certain scales. This study addresses each them at the most detailed scale needed to support stakeholder requirements, and where appropriate to support uses at larger scales the implications of generalization are summarized.

Basemap. Information in this class provides the spatial frame of reference for all other geographic data. These include horizontal and vertical geodetic control, topographic and bathymetric contours, spot elevations, planimetric features (such as landmarks), remote sensing imagery, coordinate grids, and similar information. The Basemap class includes the following data themes:

- Survey Control
- Places
- Elevation
- Imagery
- Remotely Sensed Data
- Planimetric Features
- Structures
- Scanned Basemaps
- Grids and Indexes

Areas. This class refers to subdivisions of land (or water) according to some intended purpose. Areas, such as political units, can follow topographic features, or be used to delineate socioeconomic or management zones. Areas delineate jurisdictional areas, socioeconomic and management zones and are used for a variety of planning, administrative and adjudication purposes. The Areas class includes the following data themes:

- Activity Areas
- Cadastral
- Planning Areas
- Political/Administrative Areas
- Service Areas

- Special Management Areas
- Statistical Areas
- Social Areas

Environmental. Environmental data typically include features of the natural environment such as land use, soils, geology, archaeological sites, sensitive flora or fauna locations, and other information concerning the natural and cultural environment. There is a great deal of interest within certain organizations involved with rational physical planning, resource management and environmental protection, to enhance the development of more extensive environmental databases. The classification of flora, fauna, and biological habitat data, for both terrestrial and marine environments, has been brought together under Biodiversity. This theme recognizes the interrelatedness and complexity of plant and animal species within habitat zones. Terrestrial and marine plants, animals, and habitats are then addressed under specific data topics. The Environmental class includes the following data themes:

- Air and Climate
- Waste
- Cultural Resources
- Land and Aquatic Use/Land Cover
- Biodiversity
- Surficial Hydrology
- Subsurface Hydrology
- Soils
- Geology
- Seismology
- Geomorphology
- Marine Abiotic

Utilities. The definition of utilities in the present context addresses the various types of asset-intensive and capital-intensive infrastructure services such as electricity, water, sewage, gas, and to a certain extent telecommunication. Utilities around the world may have undergone several stages of unbundling and/or restructuring of their services following the wave of deregulation and/or privatization that have swept the globe during the previous two decades with an attempt to improve market competitiveness and to provide a better offering to the public i.e. improved service quality at lower prices. The Utilities class includes the following data themes:

- Electrical Facilities
- Potable Water Facilities
- Sanitary Sewer Facilities
- Stormwater Facilities
- Telecommunication Facilities
- Waste Management Facilities

Transportation. This class include roadways, highways, rail lines, bridges, airports and any other information related to transportation networks and facilities. This information can be used in a variety of spatial analyses and for general reference. For example, the street network can be used to route delivery trucks, school buses, public transport vehicles, emergency medical or police response, and other routing applications. It can also be used for allocation applications, by correlating the street network with other information, such as population adjacent to the streets to be served by public transportation, and other factors. The Transportation class includes the following data themes:

- Land Transportation
- Water Transportation
- Air Transportation

There are many different data themes that may be tied to the geospatial primitives listed above. For example, average household income may be tied to statistical reporting areas, or a restaurant may be tied to the building it is in. In addition there may be information tied to transient locations, for example animal or vehicle tracking information, social media reporting points, or location based citizen complaints. Where these “incidents” are of common interest to the community, this information would be classified with its most closely related theme.

The following table provides a consolidated listing of all the Class/Theme/Topic information that was identified through the BNSDI Stakeholder Survey. Also included are some themes and topics not encountered perhaps because the likely responsible organization may not have been included in the current study but which international experience suggests could be important in the future.

Table 1 – BNSDI FGDS Classification

CLASS	THEME	TOPIC	FGDS
Basemap	Survey Control	Geodetic Control Network	Geodetic and Survey Control Network
Basemap	Survey Control	CORS/RTK Station Locations	CORS/RTK station locations
Basemap	Survey Control	Ground Control Points	Ground Control Points
Basemap	Places	Gazeteer	Gazeteer
Basemap	Places	Points of Interest	Points of Interest
Basemap	Elevation	LiDAR Elevation Data	LiDAR Elevation Data
Basemap	Elevation	Topographic/Bathymetric Contours	Topographic/Bathymetric Contours
Basemap	Elevation	Digital Terrain Model (DTM)	Digital Terrain Model (DTM)
Basemap	Elevation	Digital Elevation Model (DEM)	Digital Elevation Model (DEM)
Basemap	Elevation	Triangular Irregular Network (TIN)	Triangular Irregular Network (TIN)
Basemap	Elevation	Coastline	Coastline
Basemap	Imagery	High Resolution Satellite Imagery	High Resolution Satellite

			Imagery
Basemap	Imagery	Aerial Photography	Aerial Photography
Basemap	Imagery	Orthophotography	Orthophotography
Basemap	Remote Sensing Data	MSS, SAR, Other	High/Medium Resolution Satellite Data
Basemap	Remote Sensing Data	MSS, SAR, Other	Low Resolution Satellite Data
Basemap	Planimetric Features	Utility Structure, Fences, Walls, Landscape Vegetation, Pavement Edge, Landscape Structures, Parking	Planimetric Features
Basemap	Structures	Building Footprint, Building Points, Street Address, 3D Buildings, Facilities, Accommodation, Eating and Drinking, Attractions, Commercial Services, Education and Health, Public Infrastructure, Retail, Sports and Entertainment, Manufacturing and Production, Accommodations, Restaurants and Bars, Botanical and Zoological, Museums and Art galleries, Recreational Landscapes, Tourism Facilities, Financial Services, Health Practitioners and Establishments, Animal Health, Primary, Second and Tertiary, Education, Recreational and Vocational, Education, Burial Sites and Cemeteries, Government Agencies and Offices, Organizations, Places of Worship, Postal Services, Public Safety, Recycling Facilities, Utilities Companies, Fuel Stations, Parking Lots and Structures, Food, Drink and Multi-Item Retail, Outdoor Pursuits, Venues, Stage, and Screen, Farming Products Facility, Forestry Products Facility, Industrial Products Facility	Building Footprints Building Points
Basemap	Scanned Basemaps	Scanned Topographic Basemaps	Scanned Topographic Basemaps
Basemap	Scanned Basemaps	Scanned Historical Maps	Scanned Historical Maps
Basemap	Grids and Indexes	Coordinate Grids	Coordinate Grids
Basemap	Grids and Indexes	Non-Coordinate Indexes	Non-Coordinate Indexes
Areas	Activity Areas	PSIP, Research Plots, Other	Activity Areas
Areas	Cadastral	Plot Boundaries	Plot Boundaries
Areas	Cadastral	Block Boundaries	Block Boundaries
Areas	Cadastral	Easements	Easements
Areas	Cadastral	Right of Way	Right of Way
Areas	Planning Areas	National Spatial Plan, Area Plans, Regional Plans, Urban Design Areas, Special Development Areas, Natural Resource Management Plans	Planning Areas
Areas	Political/Administrative Areas	National and Sub-National Boundaries	National and Sub-National Boundaries
Areas	Political/Administrative Areas	Electoral Divisions	Electoral Divisions
Areas	Political/Administrative Areas	Municipal Boundaries	Municipal Boundaries
Areas	Political/Administrative Areas	Exclusive Economic Zone	Exclusive Economic Zone
Areas	Service Areas	Utility Service Areas,	Utility Service Areas,

Areas	Service Areas	Government Service Areas	Government Service Areas
Areas	Special Management Areas	Marine Protected Areas, Protected Areas	Protected Areas
Areas	Special Management Areas	Designated Cultural Heritage, Designated Natural Heritage, Private Protected Areas, Designated Sensitive Habitat	Designated Heritage Areas
Areas	Special Management Areas	Mineral Concession, Petroleum Concession	Concession Areas
Areas	Statistical Areas	Population Census Demographics, Housing and Population Trade Gross Domestic Product (GDP) Consumer Price Index (CPI) Labor Force	(See <i>Political/Administrative Areas</i>) District Boundaries Municipal Boundaries Town or Village Boundaries
Environmental	Air & Climate	Meteorological Station Locations	Meteorological Station Locations
Environmental	Air & Climate	Air temperature, wind speed and direction, relative humidity, pressure, precipitation, evaporation, and sunshine duration	Climate Summary Data
Environmental	Air & Climate	Air temperature, wind speed and direction, relative humidity, pressure, precipitation, evaporation, and sunshine duration	Derived Climate Isohyets
Environmental	Air & Climate	Green House Gas Emissions	Green House Gas (GHG) Emissions
Environmental	Waste	Municipal Solid Waste, Construction and Demolition Waste Sources, Landscape Waste Sources, Hazardous Waste, Medical Waste, Industrial Emissions	Waste and Emissions
Environmental	Cultural Resources	Historical Sites	Historical Sites
Environmental	Cultural Resources	Archeological Sites	Archeological Sites
Environmental	Cultural Resources	Paleontological Sites	Paleontological Sites
Environmental	Land & Aquatic Use/Cover	Land Use, Land Cover, Vegetation, Benthic Type,	Land and Aquatic Use/Cover
Environmental	Land & Aquatic Use/Cover	Urban Land Use	Urban Land Use
Environmental	Land & Aquatic Use/Cover	Agriculture Land Use	Agriculture Land Use
Environmental	Biodiversity	Habitat Type	Habitat Type
Environmental	Biodiversity	Biological Survey Boundaries, Species Observation Points, Biological Plot Surveys, Animal Tracking Data, Species Range Data, Population Assessments;	Biodiversity Study Data
Environmental	Biodiversity	Biodiversity value, Habitat of species of special concern	Biodiversity Value
Environmental	Biodiversity	Protection status and gap analysis	Biodiversity Protection Gap Analysis
Environmental	Surficial Hydrology	Rivers and Streams	Rivers and Streams
Environmental	Surficial Hydrology	Waterbodies	Waterbodies
Environmental	Surficial Hydrology	Watersheds	Watersheds
Environmental	Surficial Hydrology	Flood Zones	Flood Zones
Environmental	Surficial Hydrology	Coastal Storm Surge	Coastal Storm Surge
Environmental	Subsurface Hydrology	Groundwater Monitoring Locations	Groundwater Monitoring Locations

Environmental	Subsurface Hydrology	Groundwater Basins	Groundwater Basins
Environmental	Subsurface Hydrology	Groundwater Model Outputs, depth to groundwater, salinity, ph, other	Groundwater Model Outputs
Environmental	Soils	Soils boundaries, soil sample points and data	Soil Type Areas
Environmental	Soils	Geotechnical study locations and data	Geotechnical Studies
Environmental	Geology	Geologic Sample Sites, Surficial Geology, Subsurface Geology, Mineral Resource Areas	Geology
Environmental	Seismology	Seismic Faults	Seismic Faults
Environmental	Seismology	Seismic Risk Zones	Seismic Risk Zones
Environmental	Seismology	Seismic Events	Seismic Events
Environmental	Geomorphology	Geomorphology	Geomorphology
Environmental	Geomorphology	Topographic Slope	Topographic Slope
Environmental	Geomorphology	Elevation Regimes	Elevation Regimes
Environmental	Geomorphology	Solar Aspect, Hillshade	Solar Aspect
Environmental	Geomorphology	Landform	Landform
Environmental	Marine Abiotic	Marine Monitoring Station Locations	Marine Monitoring Stations
Environmental	Marine Abiotic	Temperature, Pressure, Light intensity, Light wavelengths, Tides, Current strength and direction, Waves, Storm surge, Tsunami runup zones, Density of the water medium (dependent on temperature and dissolved materials), Salinity, Concentration of other dissolved salts, Concentration of dissolved minerals such as iron, phosphorus, calcium, magnesium, Concentration of fixed nitrogen, pH, Concentration of dissolved carbon dioxide, Concentration of dissolved oxygen, Concentration of other dissolved solutes and nutrients, Marine sediment type and distribution, Magnetic field strength and direction	Marine Monitoring Data
Utilities	Electric Facilities	Electrical Generation Facilities	Electrical Generation Facilities
Utilities	Electric Facilities	Electrical Transmission Facilities	Electrical Transmission Facilities
Utilities	Electric Facilities	Electrical Distribution Facilities	Electrical Distribution Facilities
Utilities	Electric Facilities	Electrical Utility Communications Facilities	Electrical Utility Communications Facilities
Utilities	Potable Water Facilities	Water Production Facilities	Water Production Facilities
Utilities	Potable Water Facilities	Water Distribution Facilities	Water Distribution Facilities
Utilities	Sanitary Sewer Facilities	Sewer Collection Facilities	Sewer Collection Facilities
Utilities	Sanitary Sewer Facilities	Sewer Treatment Facilities	Sewer Treatment Facilities
Utilities	Stormwater Sewer Facilities	Stormwater Sewer Collection Facilities	Stormwater Sewer Collection Facilities
Utilities	Stormwater Sewer Facilities	Stormwater Sewer Cachment Areas	Stormwater Sewer Cachment Areas
Utilities	Telecommunications Facilities	Telephone Cable Network Facilities	Telephone Cable Network Facilities

Utilities	Telecommunications Facilities	Wireless Towers	Wireless Towers
Utilities	Waste Management Facilities	Landfill Facilities	Landfill Facilities
Utilities	Waste Management Facilities	Solid Waste Management Facilities	Solid Waste Management Facilities
Utilities	Waste Management Facilities	Solid Waste Collection Routes	Solid Waste Collection Routes
Transportation	Land Transportation	Highways, roads, tracks, trails	Road Network
Transportation	Land Transportation	Roads Linear Referencing Scheme	Roads Linear Referencing Scheme
Transportation	Land Transportation	Transit Routes, Bus Routes	Transit Routes
Transportation	Water Transportation	Water Transport Facilities	Water Transport Facilities
Transportation	Water Transportation	Water Transport Routes, Water Taxi Routes, Ferry Routes	Water Transport Routes
Transportation	Water Transportation	Water Transport Aids to Navigation	Water Transport Aids to Navigation
Transportation	Air Transportation	Air Transportation Facility Locations, Airports, Airstrips, Helipads	Air Transportation Facility Locations
Transportation	Air Transportation	Air Transportation Routes,	Air Transportation Routes

2.4 Data Structure and Format

The physical structure and format of data will impact how effectively the same information can be used by multiple organizations to support different applications. Ideally, FGDS should be structured in a manner that can support the greatest number of identified applications, and that models the form, characteristics and behavioral nature of the feature or system being depicted, in a manner that can be transformed or restructured to meet other needs without losing essential information. The data model requirements are at the core of the data development lifecycle, starting with the operational requirements of custodian agencies, and then adapted as needed to support the broader needs of the BNSDI stakeholder community.

Internationally there is a growing body of data structure and format standards that provide a basis for interoperability and format exchange among different systems and applications. These can ensure that data developed in one format can be technically imported or exported among systems. The usability of the resulting data when migrated among data structures or formats is still highly dependent on the content standards applied.

There is currently no systematic treatment of geospatial data standards in Belize, other than those associated with specific existing systems such as LandFolio or those that are inherent to data provided by external organizations.

2.5 Scale and Accuracy

Different applications of geospatial data have different requirements for geographic scale and levels of spatial detail and accuracy. The geographic scale at which information is compiled can be indicative of the level of detail and accuracy that can be reliably achieved.

The BNSDI geospatial data can be grouped into three scale ranges:

Large scale. 1:1,000 to 1:5,000 – typical scales for an urban neighborhood or for detailed engineering works, or to view a whole village.

Medium scale. 1:10,000 to 1:25,000 – more suitable at the city level, or for a large area of relatively distributed human development;

Small scale. 1:50,000 and above – used to visualize large parts of the country. Much smaller scales may be used to depict data at the national and international scales, but these are too general as FGDS for most applications, and are therefore not specifically addressed here;

Positional (horizontal and vertical) accuracy can be of crucial importance, and there is a relationship between this and scale, whereby the level of accuracy generally increases at larger scales.

Attribute accuracy is also important to the overall accuracy of a geospatial dataset. This refers to the consistency and accuracy of the information that has been entered into tabular database fields.

2.6 Data Completeness

Data completeness includes both geographic coverage as well as the presence and population of tabular attribute data fields.

Spatial completeness refers to whether or not a data set covers the entire territory that is needed to support the BNSDI community's needs. Descriptive or attribute completeness refers to whether or not the fields of tabular descriptive data that are needed in common to support end-user applications are present, and the extent to which these are populated accurately and consistently.

2.7 Temporal Scale and Currency

How often a piece of information must be updated depends in part on the nature of the data theme, and the business needs of the user community. The boundaries of new buildings may need to be updated on a daily or weekly basis as building permits are processed, whereas the boundaries of a soil or geology map may not need to be changed for many years. As such, the dimension of time becomes a very important consideration for how data is developed,

managed, and used. Information may be tied to a particular increment of time (start, stop, and duration), as well as periodicity (every month, quarter, year, etc.).

What underlies the actual temporal dimension are typically the business requirements that the FGDS is intended to support, and the means by which this information is captured. The data update frequency will depend also to a great extent on the level of readiness and automation of the individual stakeholder agencies that will be contributing to the BNSDI FGDS.

2.8 Tabular and Spatial Relationships

The interrelationships among geographic datasets and tabular or other information media that can be related to geographic data depends upon either tabular relational keys (e.g. a common building address), or a specific geographic equivalency (e.g. a block boundary is composed of the outside edges of all the individual parcels within it). Similarly, features like roads and buildings captured at larger scales can be generalized for use at smaller scales and the attributes of geographic features compiled at smaller scales may be “conflated” to populate the attribute features of more accurate feature geometry captured at larger scales. This raises the aspect of interoperability of spatial data sets through the provision of the following:

- Solutions to ensure unambiguous identification of spatial objects (place code), to which unique identifiers under existing sub-national systems can be mapped in order to ensure interoperability between them;
- The relationship between spatial objects; for example, consistency of information shall be maintained for the spatial data sets between items of information which refer to the same location or between items of information which refer to the same object represented at different scales.

2.9 Data Capture

How data is captured and processed to a form that is usable to the BNSDI community is an important consideration. Ideally, data is collected as a part of a normal business transaction (e.g. the issuance of a building permit, a land subdivision application, or a utility extension project planning and implementation process). This is far more effective and efficient than periodic compilation as a separate process, though clearly certain data topics (e.g. soil types) are best collected as a one-time effort. In addition, the SDI should provide mechanisms for integrating business processes where data relationships and dependencies are concerned.

Where data is updated with a certain frequency – as opposed to being a one-time creation – it will be necessary to integrate it into the existing business processes, at two levels:

- One level that is managed inside the stakeholder agencies whereby the data transactions are rolled up from distributed operational environments to centralized spatial databases that maintain the entire information assets of the individual organizations. This may also include data that is monitored on a continuous or periodic basis that may be statistically summarized (e.g. air quality) for FGDS usage;

- One level that is handled within the BNSDI network i.e. between the individual nodes or agencies and the BNSDI central node/ data clearinghouse whereby the data is shared by the BNSDI Community.

2.10 Metadata

Metadata is “data about data”, basically a standardized catalog that describes existing data holding. A common geospatial metadata catalog is important in that it allows stakeholders to identify information that may be of interest, and to qualify its appropriateness for a particular use. The international GIS community has developed common geospatial metadata standards that have now been formalized within the International Standards Organization (ISO), the U.S. Federal Geographic Data Committee (FGDC) and the Open Geospatial Consortium (OGC). In addition, there are related metadata standards that either extend the geospatial metadata standards to accommodate specialized areas of use, as well as metadata standards in related fields such as library documents and multi-media. SDI metadata should provide summary information on the data including, but not limited to, the following:

- Data inventory or catalogue
- Geospatial coverage
- Conditions applying to access to, and use of spatial data sets and, where applicable, corresponding fees;
- The quality of spatial data, including whether they are validated and the quality measures, specifications and procedures that were adopted for data validation;
- The custodian agencies i.e. responsible for establishment, management, maintenance and distribution of spatial data sets and services including contact information;
- Limitations on public access and the reasons for such limitations in accordance with government laws.
- The BNSDI community has adopted the ISO metadata standard, however, in most organizations today this information has not been developed and/or is not maintained. Two notable examples of organizations that have developed extensive metadata records include CZMAI and BERDS.

2.11 Data Custodianship

Data custodianship considerations are addressed where appropriate in the Data Inventory & Assessment report. Several characteristics are considered in relation to identifying a data custodian:

- Relies on the business and business processes as the main driver, e.g. the owner of the business process that first records a change on the ground should also be the first choice in being the custodian of that information;
- Is required to capture the information at a level of accuracy that is suitable or better than required by a majority of the stakeholders;
- Has authority, mandate and responsibility;
- Has capacity to be a reliable custodian on behalf of the rest of the community;
- Can be a temporary custodian due to non-readiness of the prime custodian.

Data custodian responsibility, once approved by the concerned agencies and the BNSDI community, will need to become binding. Other organizations will come to rely on this information thus the assigned custodian agency should be committed and responsible for provisioning the data based on the content, format, standards, update frequencies, procedures and quality that will be agreed upon with other concerned stakeholders. This service oriented mindset will be the driver behind the value propositions offered by the various players in the BNSDI community. Once those agreements and procedures have been established, it will be important to monitor compliance and when not met, to work with the involved agencies to ensure corrective measures are taken.

2.12 Data Security

It is important for the sake of privacy, security, confidentiality, intellectual property rights, and government transparency and public information access rights to know that the overall security implications of each geospatial dataset be carefully considered. This information can then be used to determine such things as who should be able to access and view certain data, data download, data dissemination, limitations on use, and other issues.

2.13 Data Backup and System Recovery

Any proper IT system and database backup and recovery should be started by preparing a back and recovery plan that can satisfy the business needs as appropriate. A backup and recovery plan defines a business's data backup and recovery needs and specifies the workflow that meets those needs. A disaster recovery plan defines how the business will get back up and running after any kind of catastrophic event. Data backup and recovery is part of a disaster recovery plan—not a substitute for one.

3.0 BASEMAP

Basemap is often used to refer to a cartographic product presenting a variety of general context information that is used as a base or reference upon which additional data of specialized nature are compiled, overlaid or overprinted for correlation. A more strict and limited definition is used here for the purpose of this DIA. For the purposes of the technical discussion presented in this report, basemap refers specifically to the horizontal and vertical control, structures, planimetric features and orthographically corrected imagery that is used specifically as the primary geographic reference for most other thematic data. Although cadastral and administrative boundaries are often considered part of a basemap, these are organized under the Areas class to consolidate the various types of boundaries that often do not form part of a basemap, except for specialized groups.

Topographic basemapping in most countries is carried out at multiple scales to support a variety of purposes. Large scale basemapping may be carried out for urbanized areas at compilation ratio scales ranging from 1:1,000 in dense areas to 1:5,000 in suburban or rural settlement areas. Medium scale mapping at 1:10,000 to 1:50,000+ is used for general land use and regional planning and most natural resource management activities. Small scale basemapping at 1:100,000 and above provide a more generalized picture covering large areas and are useful for depicting whole systems over large areas, such as regional networks of roads or rivers.

At present there is no officially adopted standards for topographic basemapping in Belize. The UK Ordnance Survey map series at scales ranging from 1:50,000 to 1:250,000 are used as a de facto standard, and many of the comprehensive country-wide datasets that have been developed have been digitized from those map series.

Medium to small scale topographic basemapping in most countries is carried out by officially appointed National Mapping Organizations (NMO's). NMO's are usually responsible for maintaining the geodetic survey control network and the development and maintenance of general purpose topographic basemaps for medium to small scale mapping. Larger scale mapping for urbanized areas is usually the responsibility of a municipal or county level government department, however this level of mapping is less consistent around the world, and often an accurate cadastral map and high resolution aerial orthophotography may be used to fulfill the need for a spatially accurate frame of reference.

In Belize the Ministry of Natural Resources and Agriculture, Land Information Center (MNRA/LIC) has partially fulfilled the role of an NMO, but this has been limited to deriving digital data from the UK Ordnance Survey map series. The Survey Department within the MNRA has been responsible for the management of the national geodetic network for survey

control, and many others are involved in developing and maintaining basemap relevant information as outlined in the sections following.

3.1 Survey Control

General Considerations: A National Geodetic Framework has in the past provided the most reliable basis for establishing the horizontal and vertical survey control networks that tie coordinate systems and mapped features to specific locations on the face of the earth. A highly accurate geodetic framework is needed to:

- Provide the common horizontal and vertical reference for all photogrammetric engineering and basemapping works;
- Provide the common horizontal and vertical reference needed to support field surveys and the use of location-aware devices by field crews;
- Provide a common reference for location based services and the spatially-aware mobile devices to utilize them.

A common geodetic framework is the foundation for the establishment of the common survey control network and topographic base map development at all levels that is needed to ensure the spatial integration of any other thematic data that will use basemaps or orthoimagery as the basis for establishing location. It is also important as a common reference for all field surveys or the accurate spatial enabling of field devices that might be used by utility crews, census takers, environmental observations, geotechnical samples and other activities that will utilize GPS as the spatial reference. The same geodetic framework then further provides for the accurate integration of field-collected data with any thematic data mapped off of the base map.

For the purposes of the BNSDI and the establishment of a common survey and mapping reference, a Geodetic Framework can be thought of as consisting of three basic components, including:

- *Geoid:* A geoid is essentially a calculated figure of the Earth abstracted from its topographic features. It is an idealized equilibrium surface of sea water, the mean sea level surface in the absence of currents, air pressure variations etc. The geoid, unlike the ellipsoid, is irregular and too complicated to serve as the computational surface on which to solve geometrical problems like point positioning.
- *Ellipsoid:* A reference ellipsoid is calculated to be the same basic volume as the geoid but describes a more regular surface that is based on its equatorial radius and a flattening parameter.
- *Survey monument network:* Traditionally, a hierarchy of networks has been built to allow point positioning within a country. Highest in the hierarchy were triangulation networks. These were densified into networks of traverses (polygons), into which local mapping surveying measurements, usually with modern land

survey instrumentation, are tied. Local survey networks have fixed monuments with known coordinates that can then be referenced to support local surveys using traditional equipment and techniques.

- *CORS/RTK*: Continuously Operating Reference Station (CORS) and Real-Time Kinematic (RTK) technology provides centimeter-level accuracy without the need for permanent monumentation,

Based on February 2015 UN resolution, the suggestion is to convert to WGS84, the accepted Global Geodetic Framework. The one currently used in Belize is an adapted NAD27.

Business Requirements: An accurate geodetic network for an entire country has traditionally been required to support all geospatially accurate mapping works. However, with the advent of highly accurate geo-positioning satellites (GPS) technology the need for such networks and permanent physical monuments is becoming less. Today's CORS/RTK technology is providing centimeter-level accuracy without the need for permanent monuments, however this requires investment in a substantial national infrastructure, the technical capacity to manage and maintain it, and the capacity of the surveyor community to use it effectively.

The full range of BNSDI stakeholder activities that have some direct dependency on the establishment of geographic coordinate locations in the field are depicted in Appendix B. According to this information, over 60% of the activities carried out by BNSDI stakeholders require the verification of coordinate locations, at various levels of accuracy that can be summarized as follows:

Very high accuracy. Centimeter level horizontal and vertical accuracy is required for establishing land property boundaries, site level engineering works and vertical control on certain utilities that rely on precise control such as gravity flow for sanitary sewers. Such surveys must rely on very accurate survey control or access to CORS/RTK facilities or Total Station survey equipment with differential correction.

Moderately high accuracy. Accuracy in the range .5m to 2m is adequate for conducting many field survey activities. Those that require the more accurate end of this range include the establishment of ground control points for high accuracy orthophoto mapping, site mapping and others. Less accuracy within this range is suitable for street furniture inventories, address point establishment, utility as-built mapping, and field mapping of facilities in urban areas.

Lower accuracy. Lower accuracy in the range of 5m to 10m is usually suitable for such things as vehicle navigation and tracking, utilization of most location based services, locating oneself generally, biological species sitings and incident mapping in remote areas where more accuracy is not warranted.

Each of the above classes of accuracy has implications for the time and cost of information capture, thus choosing the right level and the appropriate equipment to achieve that level of accuracy is important. There are hybrid options that can be used to achieve higher accuracy results with lower accuracy GPS, for example the use of a field device with lower accuracy GPS that can be used to situate oneself generally, then utilizing high accuracy orthophotography to interactively capture the actual point of interest (e.g. a building or address point) according to visible features in the imagery.

Current Situation: At present the MNRA Department of Lands and Surveys, Survey Unit has two staff that systematically maintain existing control points and occasionally add new points for network densification. They are also replacing lost geodetic control network monuments where these are known, but it was indicated that many have been permanently lost. With the advent of highly accurate GPS technology the need for such monuments is becoming less. In addition, today's Continuously Operating Reference Station (CORS) and Real-Time Kinematic (RTK) technology provides centimeter-level accuracy. While Belize has not yet established its own CORS/RTK system, some private surveyors are utilizing those available in surrounding countries. In addition, the Geology Unit now within the Ministry of Energy, Science & Technology and Public Utilities (MoESTPU) has installed a differential GPS station on the roof of the MNRA headquarters building in Belmopan and utilizes its own base station for differential correction of GPS coordinates it is collecting.

Most survey work in Belize has traditionally been carried out in NAD27 datum, although most GIS mapping today is being carried out in WGS84. The entire geodetic network was resurveyed in 1996. There is a requirement now for information submitted to the government be captured in WGS84, however most of the licensed surveyors are still more accustomed to working in NAD27.

The law currently requires every cadastral survey to be tied to a major or minor geodetic control point. With the advent of new survey and location finding technologies it may become necessary to update the law to reflect new realities.

Several organizations have been involved in collecting ground control points (GCP's) that are then used to control aerial photography or satellite imagery. Others collect ground-truthing points to provide input to remote sensing data processing. GCP's and ground truth points have not been generally maintained as an information source for future reference by the organizations that collected them.

Current Data Sources. The following data sources were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 2 – Data Sources Related to Survey Control Data Theme

Lands and Surveys	Land Information	DOS/MCP Survey Control Stations	This point feature depicts the location of major control points in the country, these
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Department	Centre		are control points with a high degree of accuracy that support surveying activities in Belize, it is a network of monumented control points that provide a unified or standardized coordinate system for surveying.
Lands and Surveys Department	Survey and Mapping Section	National Geodetic Control Network (digital)	The MNRA Lands Department, Survey and Mapping Section maintains a GIS point file indicating the location, identification number and other basic information concerning each point.
Land and Surveys Department	Land Information Center	Survey/Cadastral: DOS/MCP Survey Control Stations	Surveys & Mapping
Coastal Zone Management Authority & Institute		Satellite Training Data / Ground Control Points	date of publication: 2005. Originator: Emch et al.. Preferential Scale: 1:250,000. Notes: digitized from visual inspection of LandSat MSS imagery.
Coastal Zone Management Authority & Institute		Satellite Training Data / Ground Control Points	date of publication: 1998. Originator: White et al. ("Remote Sensing Analysis of Land Use and Land Cover, Central Belize" study). Preferential Scale: unknown. Notes: GPS points (uncorrected) of various land features and vegetation types.
Coastal Zone Management Authority & Institute		Satellite Training Data / Ground Control Points	date of publication: 2005. Originator: Emch et al.. Preferential Scale: 1:100,000. Notes: digitized from visual inspection of LandSat ETM imagery.
Coastal Zone Management Authority & Institute		Satellite Training Data / Ground Control Points	date of publication: 2002. Originator: DiFiore (Master's thesis, Columbia University). Preferential Scale: unknown. Notes: GPS points (uncorrected) of various land features and vegetation types.

Topics: The typical topics that describe this Theme include:

- CORS/RTK Station Locations
- Geodetic Control Network
- Ground Control Points

FGDS: Specific FGDS that relate to this thematic area include the following:

FGDS Name	Geodetic and Survey Control Network
Description	National database of geodetic and survey control points
Current Status	Mostly complete and being maintained periodically. It is not expected that all surveying work requiring high accuracy will be carried out with high precision GPS in the near term, so it will still be necessary to

	maintain a suitable local survey control network to support local survey work with other instruments in the meantime. Steps may need to be taken to ensure that the existing survey control database is complete and accurate nationally, and that it includes linkage to locations and characteristics of all official monuments, with site location photos that can aid in locating and identifying each. This effort should also ensure that the appropriate resources and procedures are in place to maintain this information into the near future. The database control monuments layer should be available for the entire Country indicating the locations and characteristics of all official monuments, with site location photos that can aid in locating and identifying each monument.
Future Program Considerations	To be maintained until replaced by other technologies render the classical approach unnecessary and until the local surveyor community is prepared to adapt to the new approach.
Custodianship Considerations	Maintenance of this information would logically continue to be the responsibility of the Survey Unit.
Security Considerations	There is no special security or other issue that would constrain the distribution of this information.

FGDS Name	CORS/RTK station locations
Description	Continuously Operating Reference Station (CORS) and Real-Time Kinematic (RTK) station locations. This FGDS will also need to include meta-information about each station, and be accessible to surveyors and location based service providers through an arrangement with the government.
Current Status	No system in place in Belize at this time, but some surveyors are tying into systems in adjacent countries. One differential GPS station has been established by the MoESTPU.
Future Program Considerations	It will likely be beneficial for Belize in the near future to establish a CORS/RTK framework to support survey and mapping efforts across the country. Once established, the location and basic characteristics of each station across the network can be captured as a GIS layer for common reference through the BNSDI. There is no special security or other issue that would constrain the distribution of this information, and the use of the output of the network should be carefully controlled by the MNRA. While initially it is likely that this system would be used principally by surveyors, this capability will also be useful to support other field survey data collection activities, location based and navigation purposes and others.
Custodianship Considerations	A CORS/RTK system for Belize civilian use would logically be established and maintained by the MNRA Department of Lands and Surveys.
Security	The CORS/RTK system could be considered critical national

Considerations	infrastructure that may require special security consideration.
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FGDS Name	Ground Control Points
Description	Retaining the ground control points that have been used to control particular aerial surveys or high resolution satellite imagery could be stored in a repository for future reference. The meta-information associated with each control point should include reference to the imagery it relates to. Ideally a central physical or virtual repository of all the information available for Belize would be made generally available to the community.
Current Status	Most imagery work in Belize has been carried out for specific projects and the ground control points that were used to georectify those imagery have typically not been retained.
Future Program Considerations	A collection of verified ground control points could be maintained as one important facet of a future comprehensive imagery database for Belize.
Custodianship Considerations	Georectified imagery provides a viable alternative to vector photogrammetric basemapping for many applications. This repository and its accompanying information such as ground control points would logically be maintained by the MNRA Land Information Center (LIC). Given that many organizations would be relying on effective and reliable access to this information it would be critical that the human and technical infrastructure capacity of the LIC be structured to accommodate this, either as a physical or virtual repository.
Security Considerations	There would be no special security considerations relative to ground control points.

3.2 Places

General Considerations: Places are features of common reference and their associated names (geonames). These include those regional features that have traditionally been associated with a map gazetteer as well as points of interest that are prevalent in urban mapping and car navigation systems. They may provide the user with general orientation information, or in the case of a gazetteer, comprise a comprehensive inventory of places of common reference, both natural and man-made. A classical gazetteer or place names dataset may include villages, towns, historic locations, landmarks, mountain peaks, valleys, and any other type of common locational reference.

The official names applied to places, otherwise referred to as “Geonames”, help to strengthen the identity of a place or street, orient people to locations, and reinforce historical and cultural values. The power of naming is especially evident on the cultural landscape. Place names use

a single word or series of words to distinguish and identify one place from another. A key application of Geonames is facilitating physical navigation; geonames can evoke powerful images contributing to the development of a sense of place. Geonames permeate the daily vocabulary, both verbal and visual, appearing on road signs, addresses and maps. Geonames meld history with geography and conflate place identity. A primary application for Geonames is the naming of streets.

For the most part, traditional gazetteer datasets have been created at smaller scales and depict geographic places, features and points of reference as cartographically represented locations or annotations on a map. However, the same principle applied to urban scale mapping can also provide a useful reference and a basis for quickly moving to an area of interest by querying for a common landmark in a digital GIS environment. In an urban context places of this type are generally referred to as “points of interest” to align with how points are referred to in urban wayfinding and navigation devices. Features such as building footprints, well known landmarks and points of reference are already addressed as spatial primitive features elsewhere in this framework to which other information regarding community facilities and points of interest can be connected.

Volunteered geographic information (VGI) and the collection of common place reference names via social media can also be a rich source of place names. This may be used as an adjunct to “official” gazetteer information.

In a fully developed point of interest database, the majority of community facilities that people are interested in would be represented, including but not limited to those listed in the following Table:

Table 3 – Community Facility Points of Interest

<ul style="list-style-type: none"> ▪ Accomodation, Eating and Drinking ▪ Attractions ▪ Commercial Services ▪ Education and Health ▪ Public Infrastructure ▪ Retail ▪ Sports and Entertainment ▪ Manufacturing and Production ▪ Accommodations ▪ Restaurants and Bars ▪ Botanical and Zoological ▪ Museums and Art galleries ▪ Recreational Landscapes 	<ul style="list-style-type: none"> ▪ Recreational and Vocational Education ▪ Burial Sites and Cemeteries ▪ Government Agencies and Offices ▪ Organizations ▪ Places of Worship ▪ Postal Services ▪ Public Safety ▪ Recycling Facilities ▪ Utilities Companies ▪ Fuel Stations ▪ Parking, Lots and Structures ▪ Food, Drink and Multi-Item
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<ul style="list-style-type: none"> ▪ Tourism Facilities ▪ Financial Services ▪ Health Practitioners and Establishments ▪ Animal Health ▪ Primary, Second and Tertiary Education 	<p>Retail</p> <ul style="list-style-type: none"> ▪ Outdoor Pursuits ▪ Sports and Amusement Complexes ▪ Venues, Stage, and Screen ▪ Farming Products Facility ▪ Forestry Products Facility ▪ Industrial Products Facility
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In developing these data, it is important that any formal names, alternative names, aliases, and common language transliterations are accurately captured. It is also important that a variety of formal and common alias names be used, especially where many such aliases and common references can exist for places, streets, and buildings. Until a consistent and reliable street naming and building addressing system is developed in Belize, the ability to reference landmarks, known building names, area names and other common references will continue to be of vital importance.

The administration and recording of official names is normally the responsibility of an assigned government agency, most usually the National Mapping Organization (NMO) or other such entity. In Belize there is no central authority responsible for facilitating the process of official names adoption, nor the management of that information centrally as an official record.

Business Requirements: A comprehensive compiled database of recognized place names is very valuable as a tool for navigating both a digital database as well as supporting wayfinding on the ground. Given the lack of a comprehensive street addressing system thus far in Belize, the second best method for referencing locations is by well-known place names and landmarks. This database can play an important part in making the BNSDI easy to use and navigate, and provide a sound basis for direction giving and wayfinding.

The full range of BNSDI stakeholder activities that have some direct need for place names and locations are depicted in Appendix B. According to this information, over 87% of the activities carried out by BNSDI stakeholders will use this information in some manner. The majority of these will use the information as a “locator” in a GIS application to navigate quickly to an area of interest, while others will use it for wayfinding purposes.

For general purpose and topographic basemapping at medium to small scale it is especially important that names are officially recognized and administered through a systematic process. These do not require a high level of spatial accuracy, but it is important that they be clearly associated with the features that they represent. In addition to the location and name of the entry, it is also desirable to indicate the type of feature referenced and where available the

“etymology” that describes the story behind the name that can be of both general interest as well as historical and educational value.

Urban scale points of interest will usually come from a variety of organizations, but in such case it is important that one entity is responsible for facilitating and managing a compiled database that provides all these references in a single, integrated database.

Current Situation: At present there is no official body in Belize that is responsible for administering official gazetteer names, nor the compilation of an integrated points of interest database for urban areas. Most of the gazetteer type place names data that exists has been originally derived from medium to small scale Ordnance Survey topographic sheets, with added information that has been entered over time through project work and new information sources. There are several instances of place name information today, some of which are based on original information from the MNRA LIC, but it is not clear whether project-based additions carried out outside the LIC by other organizations have ever been returned for incorporation to LIC repository. There is no official standard adopted for this information, and no etymology describing the origins and meanings of the names has been recorded in a compiled digital form.

At the urban level, the establishment of custodianship and standard operating procedures for the development and maintenance of a common points of interest database that is then made available across the community and the public as a standard will increase the utility of the information and catalyze multiple channels of review and input that can help to refine the database over time if properly managed.

Current Data Sources. The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 4 – Data Sources Related to Places Data Theme

Lands and Surveys Department	Land Information Centre	Villages/Settlements	The Villages/Settlements layer depicts the centerpoint for towns, villages and settlements across Belize. Each point includes the name of the place, the type of place, and the district name. District name is included to differentiate between the same community name in different districts.
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Belize City Council		Street Use Fee File	No additional information provided
Department of Environment		Environmental Complaint Log	The Department of Environment (DOE) maintains an Environmental Complaint Log in paper form. Complaints will often be submitted over the phone and each is recorded on paper and an entry is made to the complaint log. If the complaint is related to a specific project, then the notes will be cross-filed to the two different paper file locations. Complaint locations most often refer to an address or community name.
Department of Environment		Environmental Complaint Log	The Department of Environment (DOE) maintains an Environmental Complaint Log in paper form. Complaints will often be submitted over the phone and each is recorded on paper and an entry is made to the complaint log. If the complaint is related to a specific project, then the notes will be cross-filed to the two different paper file locations. Complaint locations most often refer to an address or community name.
Coastal Zone Management Authority & Institute		Settlements	date of publication: 1992. Originator: University of Edinburgh. Preferential Scale: 1:250,000. Notes: this dataset was probably digitized from the points on the 1:250,000 topographic sheets; it contains 289 settlements.

Coastal Zone Management Authority & Institute		Settlements	date of publication: 2004. Originator: Meerman. Preferential Scale: 1:350,000. Notes: according to the metadata, this dataset was created from three main sources: (i) the 1:350,000 International Travelers Map of Belize, (ii) data from CSO, and (iii) Meerman's own point data; the points in this dataset, for the most part, constitute the "centers" of the communities listed; data from CSO (2000 census) was integrated to give estimates of population size for each settlement; this dataset contains 263 entries, compared to the 289 settlements in the earlier U. Edinburgh dataset.
Coastal Zone Management Authority & Institute		Settlements	date of publication: 1994. Originator: Fairweather & Gray (FAO-funded "the Land Use of Belize 1989-92" study). Preferential Scale: 1:50,000. Notes: extracted from the Fairweather & Gray land use dataset; see notes above.
Coastal Zone Management Authority & Institute		Settlements	date of publication: 2001. Originator: Meerman & Sabido (Central America Ecosystems Mapping Project). Preferential Scale: 1:250,000. Notes: extracted from the Meerman & Sabido ecosystem map (for which at least two versions exist).
Coastal Zone Management Authority & Institute		Settlements	date of publication: 2004. Originator: Meerman. Preferential Scale: 1:100,000. Notes: digitized from LandSat ETM imagery.
Coastal Zone Management Authority & Institute		Settlements	date of publication: 2005. Originator: Meerman (National Protected Areas Policy & System Plan Project - NPAPSP). Preferential Scale: 1:100,000. Notes: extracted from the Meerman ecosystem dataset; see notes above.
Coastal Zone Management Authority & Institute		Settlements	date of publication: 2010. Originator: Jan Meerman. Preferential Scale: 1:100,000. Notes: Point dataset of Belize Towns, Cities, villages and communities. Point locations are

			<p>approximate centres of densest infrastructure patterns and do not indicate any legal center of a community.</p> <p>Principal Source of information is the National Association of Village Councils of Belize (NAVCO): http://navco.org.bz/village_council.html</p> <p>These data have been augmented with a village dataset distributed by CCAD: http://www.ccad.ws/mapas/mapoteca.htm and further strengthened with actual fieldwork recording settlements with the use of a GPS. Population data are based on the 2010 Population Census and have been provided by the Statistical Institute of Belize (SIB).</p>
Coastal Zone Management Authority & Institute		Settlements	<p>date of publication: 2010. Originator: Jan Meerman (Biodiversity and Environmental Resource Data System of Belize - Belize Tropical Forest Studies). Preferential Scale: 1:100,000 . Notes: Polygon dataset of settlements in Belize based on 2010 Landsat 30 resolution data Derived from 2010 Land use map.</p>
Coastal Zone Management Authority & Institute		Settlements	<p>date of publication: 2011. Originator: Jan Meerman (Biodiversity and Environmental Resource Data System of Belize - Belize Tropical Forest Studies). Preferential Scale: 1:100,000. Notes: Polygon dataset of settlements in Belize based on 2010 Landsat 30 resolution data Derived from 2010 Land use map.</p>
Coastal Zone Management Authority & Institute		Sites of Interest	<p>date of production: 2004. Originator: Meerman. Preferential Scale: 1:50,000. Notes: this is a dataset of various sites of interest (caves, archaeological sites, peaks, quarries, cliffs and other similar points), digitized from the 1:50,000 survey sheets.</p>

Total Business Solution Ltd.			TBSL has invested significant time and resources to mapping various Point of Interest countrywide. These include Schools, Gas Stations, Hotels, Stores, Supermarkets, Bars, Restaurants, Government Offices, etc. Specific relevance of this activity area to GIS in Belize and the BNSDI includes but is not limited to: Commercial Layer – includes stores, restaurants, and other points of interest. Intention is to develop a geocoding service for Belize.
Belize Tropical Forest Studies		Spatial Layer: Settlements	Spatial Layer: Settlements Source: Int'l Travel Map of Belize (1:350,000), 2000 GOB Census, 2001 CSO Abstract of Statistics

Topics: Data topics to be covered under this theme include, but are not limited to the following:

- Points of Interest
- Gazetteer Place Names

FGDS: The following dataset is expected to be of common interest as FGDS across the BNSDI community at the large scale:

FGDS Name	Place Names Gazetteer
Description	Centralized national registry of all official place names across Belize.
Current Status	Most existing place name data has been derived from small and medium scale Ordnance Survey topographic basemaps. There are several versions of place name databases existing in multiple organizations and many of these were originally derived from LIC data but updates have not been systematically coordinated, nor is there any official body responsible in government for place name adoption.
Future Program Considerations	The development of an official process for the administration and management of an official place names gazetteer will be important for establishing a common, authoritative place names database.
Custodianship Considerations	Oversight of the process for adoption and management of a single authoritative place names gazetteer for Belize would most logically be carried out by the MNRA LIC. The establishment of a Parliament level executive committee is needed to assure executive review and approval of all official place names.
Security	There would be no special security considerations relative to place

Considerations	names.
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FGDS Name	Points of Interest
Description	Centralize national database of points of interest (POI) within urbanized areas across Belize
Current Status	Points of interest are mapped by multiple agencies at present, with no standardization or central coordination.
Future Program Considerations	Points of interest refer to a broad range of topics and generated through a variety of processes. In all cases, development of a locally relevant points of interest database requires intimate local knowledge, communication and coordination among entities that are generating such information. A data content standard for POI's should be adopted for use across the BNSDI community. A policy and procedures are also needed to assign responsibility for managing local point of interest compilation to the most appropriate local authority, with that entity then passing that information to the BNSDI coordinating unit for consolidation to the national database.
Custodianship Considerations	Where local municipal or village authorities exist, these can be used to coordinate, review and approve locally relevant POI information. Outside of local government jurisdiction this role could be assumed by the District offices of the Ministry of Labour, Local Government, Rural Development, NEMO and Immigration and Nationality. In both cases this information could be regularly transmitted to the BNSDI coordinating unit for compilation and publishing of a common, nationwide POI database.
Security Considerations	There would be no special security considerations relative to points of interest.

3.3 Elevation

General Considerations: Elevation is a vertical measurement value above or below some reference such as sea level. It is most often depicted as topographic (terrestrial) or bathymetric (underwater) as contours (lines connecting points of identical vertical height according to some pre-set interval), spot elevations (indicating height for a specific location), break lines (lines representing a “hard break” such as a retaining wall or engineered road edge with multiple elevation values along its course), digital elevation models (regular grid of elevation points), digital terrain model (combination of irregular spot elevations and break lines configured to best represent a topographic or other surface), triangular irregular network (TIN) surface model, LiDAR elevation point clouds, and other forms. Elevations may be given for ground surface as well as the tops of buildings, structures or tree masses.

Elevation information may be field surveyed, derived through photogrammetric analysis of stereo aerial photography, calculated from remote sensing satellites, or airborne LiDAR surveys, among other techniques. Bathymetric elevation underwater may be compiled using satellite or aerial techniques in relatively shallow areas, or soundings utilizing sonar and other similar hydrographic survey techniques for deeper or turbid waters.

Business Requirements. Elevation data are used in the context of all scales of mapping to understand the topographic form and aspect of the land and other surfaces, and at larger scales to support many detailed engineering, planning and environmental applications. It is also necessary for constructing 3D views of land and the built environment.

Analysis of the Stakeholder activities identified previously suggests that more than 62% of these are in need of elevation data. It should be especially noted that elevation information is critical for a wide variety of applications that are of critical importance to the Belize economy, climate resiliency planning and community safety.

Common uses of elevation data at large scale include, but are not limited to:

- Assess urban flooding and coastal storm surge threats;
- Reference for defining urban storm drainage catchments and storm flows;
- Vertical reference for the design of sanitary sewer gravity flow networks;
- Vertical control for all manner of architectural and engineering works;
- Derive elevation surfaces for various 3D urban planning, modeling and visualization;
- Detailed bathymetry for areas of high environmental importance or engineering works;

Of particular interest at the medium scale are elevation derivatives that generally describe land characteristics over a larger area that can be used for cartographic presentation and many aspects of environmental and more general engineering analysis and modeling. Common uses of elevation data at medium scale include, but are not limited to:

- Urban and regional land use planning, opportunity and constraint modeling;
- Climate change impact analysis and mitigation planning;
- Watershed and hydrologic analysis;
- Flood modeling;
- Slope constraint mapping and erosion potential;
- Localized drainage analysis;
- Transportation planning and design;
- Civil infrastructure planning and design;
- Agriculture planning;
- Protected area planning and management;
- Renewable energy planning and management;

- Sensitive and degraded lands assessment;
- Environmental impact assessment;
- Building permit review and approval process;
- Development of bathymetric layers for marine navigation, undersea engineering and port planning, design and management;
- Solar exposure analysis;
- 3D visualization;
- Viewshed analysis;
- Environmental habitat modeling,
- Assess topographic effects on weather;
- Topographic contours and hillshade to support medium scale cartographic mapping.

Elevation at the small scale depicts the general landform and elevations over larger areas. This type of information is useful for many applications including regional planning and generalized environmental modeling. Elevation surfaces may be generated at coarser scales while the elevation increments between contours will be larger. Common uses of elevation data at small scale include, but are not limited to:

- Topographic contours and hillshade for cartographic production at regional and national levels;
- National hydrologic mapping and modeling;
- Geomorphological analysis;

Current Situation: There are currently a variety of elevation data available in Belize, but most of these are either highly generalized, or have been specially derived from multiple sources for specific projects that are not necessarily usable for general purpose use.

Generalized topographic contours were digitized by the MNRA LIC from Ordnance Survey topographic basemaps at 1:250,000 scale at 20m intervals. These are useful for depicting the general topographic landforms across the country at medium to small scales but are too generalized for most analytical purposes. This database has been distributed to many of the GIS users in Belize and is being used primarily for cartographic presentation purposes.

Various types and levels of DEM's have been acquired for use in Belize. The Global Digital Elevation Model (GDEM), a joint operation between NASA and Japan's Ministry of Economy, Trade and Industry (METI), was originally released to the public in 2009. Version 2 of the GDEM with improved horizontal and vertical accuracy was released in 2011. The previous most comprehensive map, NASA's Shuttle Radar Topography Mission conducted in 2000, covered approximately 80% of the Earth's surface, with a global resolution of 90 meters, and a resolution of 30 meters over the USA. The GDEM covers the planet from 83 degrees North to 83 degrees South (surpassing SRTM's coverage of 56 °S to 60 °N), becoming the first earth mapping system that provides comprehensive coverage of the polar-

regions. It was created by compiling 1.3 million VNIR images taken by ASTER using single-pass stereoscopic correlation techniques, with terrain elevation measurements taken globally at 30 meter (98 ft) intervals.

The 30m SRTM DEM's originally only released for the U.S., have recently been approved by the U.S. government for general global distribution and are being made available online. In both cases, GDEM and SRTM data depict the elevation of the observed surface, which in Belize will often be the forest canopy rather than land surface which puts some limitations on how this information can be used.

The SRTM and GDEM data were acquired some years ago by the MNRA LIC and have been used to create a variety of derived data products such as hillshade and slope maps. The 30 meter SRTM DEM for Belize had not yet been acquired and processed at the time of this writing.

CATHALAC supported NEMO in the development of a hybrid elevation dataset based on a combination of SRTM and GDEM data that was used to identify areas that may be subject to flooding in Belize. This study also utilized Intermap Star3i higher resolution (10 meter horizontal, vertical accuracy not reported). Intermap Star3i elevation data was acquired through an overflight in 1999 by Intermap. Like the SRTM data this is a digital surface model which captures canopy, and not a digital terrain model; the spatial resolution of this dataset is 10m; the data source is not satellite-borne radar but aerial radar; this data was acquired through the MBC project and has limited circulation.

More detailed topographic surveys have been developed for specific development and infrastructure projects, however this information covers only project sites and immediately surrounding areas and has not been compiled in digital form by the agencies.

Royal Admiralty Charts were used as the basis for digitizing of bathymetric contours and spot elevations. The CZMAI is in possession of this information but have indicated that they are not aware of the source information scale and are assuming that the information was digitized from hard copies by The Nature Conservancy's Marine Country Program maps.

CZMAI is also in possession of 1:250,000 scale bathymetric contours that were produced by a CZMP staff while visiting WCMC in Cambridge, England. These contours were manually digitized from hardcopy 1:250,000 map sheets with values in fathoms. Focus of this effort was on the inner barrier reef lagoon and atolls.

There are various sources available that depict the coastline of the mainland and cayes. Most of these have been digitized from hardcopy topographic maps at medium to small scale for specific projects.

LiDAR survey data has been produced for selected for specific project works in Belize, most recently for the El Pilar archeological area in support of archeological investigations.

Current Data Sources. The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 5 – Data Sources Related to Elevation Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Hypsometric Layers	This layer depicts elevation regimes derived from the 1:250K topographic basemaps, according to the elevation breaks shown in those maps.
MNRA	Lands and Surveys Department	Land Information Centre	Contours (20 Meter Interval)	This layer shows the 20 M contour intervals derived from 30m Aster digital elevation model data. Each line is unbroken and includes the elevation value in meters.
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: Offshore Cayes	Belize Map (DOS)
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: Hyposemetric Layers	SRTM Digital Elevation Model (NASA)
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: Contours (20 Meter Interval)	SRTM Digital Elevation Model (NASA)
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: Slopes	SRTM Digital Elevation Model (NASA)
MNRA	Lands and Surveys Department	Land Information Center	Topography/ Baseline: SRTM Digital Elevation Model (.img/.tiff)	NASA/USGS/CATHALAC
MNRA	Lands and Surveys Department	Land Information Center	Topography/ Baseline: ASTER Digital Elevation Model (.img/.tiff)	NASA/USGS/CATHALAC
MNRA	Lands and Surveys Department	Land Information Center	Topography/ Baseline: Slopes	ASTER DEM - NASA/USGS/CATHALAC

			(.img/.tiff)	
MNRA	Lands and Surveys Department	Land Information Center	Topography/ Baseline: Hill Shading (.img/.tiff)	ASTER DEM - NASA/USGS/CATHALAC
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Ordnance Survey E755 Topographic Maps	(See Writeup for MNRA/LIC)
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		SRTM30	SRTM30 is a near-global digital elevation model (DEM) comprising a combination of data from the Shuttle Radar Topography Mission, flown in February, 2000 and the U.S. Geological Survey's GTOPO30 data set. It can be considered to be either an SRTM data set enhanced with GTOPO30, or as an upgrade to GTOPO30.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		ASTER Global Digital Elevation Model	On 29 June 2009, the Global Digital Elevation Model (GDEM) was released to the public. A joint operation between NASA and Japan's Ministry of Economy, Trade and Industry (METI), the Global Digital Elevation Model is the most complete mapping of the earth ever made, covering 99% of its surface. The GDEM covers the planet from 83 degrees North to 83 degrees South (surpassing SRTM's coverage of 56 °S to 60 °N), becoming the first earth mapping system that provides comprehensive coverage of the polar-regions.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Cayes	date of publication: unknown. Originator: University of Edinburgh. Preferential Scale: 1:250,000. Notes: this dataset may be a subset of the larger polygon dataset of Belize's landmass (i.e. country boundaries); it is apparent that this dataset has been digitized, however, from the 1:250,000 map sheets (while it is alleged the other was digitized from the 1:50,000 map sheets); this dataset is considerably incomplete,

				and the boundaries of the cayes (changeable in themselves) should not be considered precise; it may be that better comprehensive cayes datasets exist in private collections.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Elevation (contours)	date of publication: unknown. Originator: University of Edinburgh. Preferential Scale: 1:50,000. Notes: 100m intervals, digitized from 1:50,000 Ordnance Survey E755 sheets (the sheets themselves contain contours in 20m intervals).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Elevation (contours)	date of publication: 2004. Originator: Shuttle Radar Topography Mission (SRTM). Preferential Scale: 1:350,000. Notes: 100m intervals generated from 90m digital surface model data.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Elevation (digital elevation model)	Originator: Intermap Star3i. Preferential Scale: 1:40,000. Notes: this elevation data was acquired through an overflight in 1999 by Intermap; like the SRTM data described below, this is a digital surface model which captures canopy, and NOT a digital terrain model; the spatial resolution of this dataset is 10m; the data source is not satellite-borne radar but aerial radar; this data was acquired through the MBC project and has LIMITED circulation.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Elevation (digital elevation model)	date of publication: 2001. Originator: Global 30-arc Second Topographic Data (GTOPO30). Preferential Scale: 1:4,000,000. Notes: this is a 1km resolution dataset developed by the US Geologic Survey from interpolating contour data collected for the countries of the world.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Elevation (digital elevation model)	date of publication: 2004. Originator: Shuttle Radar Topography Mission (SRTM). Preferential Scale: 1:350,000. Notes: this elevation data was acquired through NASA's February 2000 Shuttle Radar Topography Mission; the spatial resolution of the available data is 90m (there is also a 30m dataset which is NOT available); this dataset has been acknowledged as a digital SURFACE model and not necessarily a digital terrain model (i.e. a 'first-surface' DEM which captures canopy); this 2004 version has filled gaps which were

				present in the earlier published version.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Slope	date of publication: 1992. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:100,000. Notes: see notes on the King et al. soil data.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Bathymetry / Depth	date of publication: unknown. Originator: Royal Admiralty Charts. Preferential Scale: unknown. Notes: the Royal Admiralty's bathymetric data were apparently digitized from the hard copies at some point by The Nature Conservancy's marine country program; the spacing between the points is variable.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Bathymetry / Depth	date of publication: 1993. Originator: Coastal Zone Management Project - World Conservation Monitoring Centre. Preferential Scale: 1:250,000. Notes: this dataset is one of a series that were digitized by Janet Gibson of the CZMP while visiting the WCMC (now UNEP-WCMC) in Cambridge; these were digitized on the 1:250,000 sheets; bathymetric data from this dataset are contoured, in fathoms; data is mainly for the inner barrier reef lagoon, and also for the atolls.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Bathymetry / Depth	date of publication: 2001 (?). Originator: WRISCS project. Preferential Scale: unknown. Notes: these were apparently acquired using the RoxAnn sounder; bathymetric data for other areas was apparently also collected by WRISCS.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Bathymetry / Depth	date of publication: 2002. Originator: WWF (MACR database v 1.1). Preferential Scale: unknown. Notes: this dataset exists as bathymetric contours; due to the lack of accompanying metadata / attribute data, it is unknown how this dataset was generated.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Bathymetry / Depth	date of publication: 2004. Originator: WRI (Reefs-at-Risk in the Caribbean project). Preferential Scale: 1:4,000,000. Notes: this data exists as a raster (1km grid); it was developed by WRI's Loretta Burke using satellite imagery data from NOAA, NASA, and the Danish Hydrologic Institute.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Bathymetry / Depth	date of publication: 2004. Originator: Programme for Belize (TNC Freshwater Initiative). Preferential Scale: unknown. Notes: according to E. Ariola (personal communication), a sounder was used to capture this data.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Bathymetry / Depth	date of publication: 2005. Originator: Wildlife Conservation Society (Glover's Reef Living SeaScape project). Preferential Scale: unknown. Notes: Wildlife Conservation Society (Glover's Reef Living SeaScape project).
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Elevation (200m intervals)	ELEVATION (200m intervals) Source: 1980 DOS 1:50,000 Topographic Maps
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Elevation (100m intervals + Bathymetry)	Spatial Layer: Elevation (100m intervals + Bathymetry) Source: 1980 DOS 1:50,000 Topographic Maps

Topics: The typical topics that describe this Theme include the following topics, each of which may be represented at each of the three scale regimes discussed previously:

- LiDAR Elevation Data
- Topographic/Bathymetric Contours
- Digital Terrain Model (DTM)
- Digital Elevation Model (DEM)
- Triangular Irregular Network (TIN)
- Coastline

Note: Topographic slope, solar aspect, hillshade and other such data typically derived from elevation information are classified under Environmental/Geomorphology for the purposes of this study.

FGDS: The specific FGDS elevation related data layers that are expected to be included in the BNSDI are listed below.

FGDS Name	LiDAR Elevation Data
Description	This FGDS would include nationwide, processed LiDAR elevations collected with sufficient accuracy and resolution to support analysis applications at both large and medium scales for urban/agriculture and natural areas of the country respectively. This information would need to be analyzed to differentiate between ground level and tree canopy, tops of buildings and other such features situated on the ground.

	Maintaining this processed original data will provide the greatest flexibility for the various types of topographic analysis that is needed to support different applications.
Current Status	LiDAR data has only been collected for very limited areas of Belize.
Future Program Considerations	The development of a complete, accurate and reliable LiDAR database for Belize would require a complete national survey that will need to be preceded with the development of a well-considered specification. The specification will need to address a variety of key requirements, including different density and accuracy levels for urban, agricultural and natural areas of the Country. It will also need to address whether LiDAR can be used to map the relative shallow coastal and marine areas inside and around the Mesoamerican Reef, or whether other data collection techniques will be needed to properly record the bathymetric information. Also, it may be desirable to combine the collection of LiDAR data with the additional equipment to simultaneously acquire new higher resolution digital orthophotography and/or airborne multispectral information that could be used to support land use and land cover mapping, agricultural inventories, urban image basemapping and other applications.
Custodianship Considerations	Oversight of the process for adoption and management of a single authoritative LiDAR database for Belize would most logically be managed by the MNRA LIC. Ideally this would be carried out on behalf of the government as a whole, as one component of a coordinated imagery and remote sensing FGDS program, with oversight by an Imagery and Remote Sensing Data Special Interest Group composed of representatives from the stakeholder entities that are most interested in this area.
Security Considerations	LiDAR data may have security issues that would need to be further assessed, e.g. where military camps or other sensitive facilities are concerned. In addition, LiDAR can reveal patterns in the landscape that can be interpreted to discover archeological sites that could expose them to abuse.

FGDS Name	Topographic/ Bathymetric Contours
Description	This FGDS would include a national database of topographic and bathymetric contours and spot heights covering the mainland, cayes, coastal and marine environments out to the limits of the Country's Exclusive Economic Zone (EEZ). <i>Note: It may be desirable to extend this area of interest out to the continental shelf or 350 nautical miles limits as specified in the United Nations Convention on the Law of the Sea (UNCLOS) for potential assertion of the associated territorial rights that may have economic and environmental advantages for Belize.</i>

Current Status	Topographic and bathymetric contours and spot heights for all of Belize are only available at small scale and are mostly too generalized to support most analytical uses. Medium scale contours have been derived by CATHALAC based on available ASTER and SRTM data, but the actual accuracy of this information may not be suitable for many applications.
Future Program Considerations	This information would ideally be derived from a combination of the LiDAR Elevation Data mentioned previously, with deeper marine areas to be collected through a new hydrographic survey or captured from existing admiralty maps. The development of this layer of information would require the development of specifications for at least three scales of delineation, including 1' to 2' intervals at large scale for urban and agriculture areas and shallow coastal areas, and variable intervals for medium scale natural areas ranging from lower values (e.g. 5' interval) low relief natural areas and higher values (e.g. 10' – 20' intervals) for high topographic relief mountainous areas and deeper marine bathymetry.
Custodianship Considerations	Oversight of the process for adoption and management of a single authoritative LiDAR database for Belize would most logically be managed by the MNRA LIC. Ideally this would be carried out on behalf of the government as a whole, as one component of a coordinated imagery and remote sensing FGDS program, with oversight by an Imagery and Remote Sensing Data Special Interest Group composed of representatives from the stakeholder entities that are most interested in this information.
Security Considerations	LiDAR data may have security issues that would need to be further assessed, e.g. where military camps or other sensitive facilities are concerned. In addition, LiDAR can reveal patterns in the landscape that can be interpreted to discover archeological sites that could expose them to abuse.

FGDS Name	Digital Terrain Model
Description	This FGDS would include a national Digital Terrain Model (DTM) providing an elevation dataset that has been optimized to decrease the amount of data involved while preserving the delineation of essential topographic features for terrestrial urban/agriculture and natural areas as well as coastal and marine environments.
Current Status	There is currently no national DTM available for Belize. Digital surface model data has been developed by CATHALAC in support of NEMO, however this does not distinguish elevations that represent the top of the forest canopy versus actual ground surface.
Future Program	This information would ideally be derived from a combination of the Elevation Data described previously. The development of this layer of

Considerations	information would require spatial analytical processing to reduce the number of elevation data points involved to preserve essential features while minimizing the size of the database. This is needed because some end users may wish to conduct their own topographic analysis but lack the software and processing power needed to effectively manipulate the LiDAR database.
Custodianship Considerations	Oversight of the process for adoption and management of a single authoritative DTM database for Belize would most logically be managed by the MNRA LIC. Ideally this would be carried out on behalf of the government as a whole, as one component of a coordinated topographic/bathymetric mapping FGDS program, with oversight by an Topographic Mapping Data Working Group composed of representatives from the stakeholder entities that are most interested in this information.
Security Considerations	There are no security issues expected with this FGDS topic.

FGDS Name	Digital Elevation Model
Description	This FGDS would include a national Digital Elevation Model (DEM) providing an elevation dataset that has been optimized to support raster topographic analysis.
Current Status	DEM information for Belize has been compiled from ASTER and SRTM information. The existing information is appropriate for a more generalized level of medium scale mapping. The recently released 30 meter resolution SRTM data can provide additional detail, but this does not distinguish between forest canopy and ground elevations and will not be suitable for ensuring accuracy of important analysis applications such as flood potential mapping.
Future Program Considerations	This information would ideally be derived from a combination of the Elevation Data described previously. The development of this layer of information would require spatial analytical processing to derive DEM's from the original data. This is needed because some end users may wish to conduct their own topographic analysis in a raster form and may lack the software or knowledge to derive that data from the original source information on their own.
Custodianship Considerations	Oversight of the process for adoption and management of a single authoritative DEM database for Belize would most logically be managed by the MNRA LIC. Ideally this would be carried out on behalf of the government as a whole, as one component of a coordinated topographic/bathymetric mapping FGDS program, with oversight by an Topographic Mapping Data Working Group composed of representatives from the stakeholder entities that are most interested in this information.

Security Considerations	There are no security issues expected with this FGDS topic.
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3.4 Imagery

General Considerations: For the purposes of the BNSDI discussions, the data theme Imagery includes aerial photographs, orthophotographs, and satellite imagery. It is distinguished from remotely sensed data in that it is primarily limited to depiction of spatial phenomena in the visible bands of the electromagnetic spectrum captured through either digital or analog means and converted to a georegistered raster digital image. Imagery may be derived (interpreted) from data collected with a scanner, captured via timed exposure of photographic film or captured using a digital recording device. At the large scale, high resolution imagery provides a photographic depiction of the ground surface and built environment as seen from above, and in most cases orthographically corrected as an accurate geographic reference. The “image maps” can be used as an alternate to vector basemap information thus providing visual reference to visible features like buildings, trees and other elements of the urban landscape.

In addition to orthographically compiled and corrected imagery, the original uncorrected aerial photography can also be valuable for many purposes, especially where stereoscopic viewing is needed to view depth, or in providing more oblique angle views of buildings and other features at the outer edges of such imagery.

Imagery provides a snapshot of an area in time. In areas undergoing rapid development it is necessary to periodically refresh such imagery to ensure a current and accurate view. Maintaining a historical imagery archive over time also provides an effective means to track and analyze urban development and landscape change for a variety of land use planning and other purposes.

Business Requirements. Accurate and up to date high resolution imagery provides a very valuable geospatial reference framework that is simple to use and understand by non-technical users. The full range of BNSDI stakeholder activities that have some direct need for imagery data are depicted in Appendix B. According to this information, over 74% of the activities carried out by BNSDI stakeholders will use this information in some manner. Common existing or potential uses for imagery in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Image basemap alternative to vector basemap;
- Online image data services as a general purpose background;
- Land use planning and urban design;
- Disaster contingency planning and response support;
- Health, safety and environmental impact assessments;
- Urban change monitoring and analysis;

- Permit reviews;
- Extraction of basemap features in vector format (heads-up digitizing);
- Rectification of other raster data with respect to the imagery (e.g. scanned drawings)
- Extraction of elevation information;
- Extraction of building façade texture maps for building 3D models;
- Image draping for 3D viewing.

Current Situation: At the large scale, high resolution (18 cm) orthophotography has been compiled by the MNRA LIC in 2012 for several towns in support of the GOB Land Management Programme III. The purpose was to conduct cadastral survey rectification in these towns that would later be declared as compulsory registration section. The original digital aerial photography that was used to compile the orthophoto coverage are also maintained. This imagery is available for Belize City, Orange Walk, San Ignacio/Santa Elena, Dangriga,

In 2004 high resolution (18cm) aerial photography for several towns was acquired by the MNRA LIC through the GOB Land Management Programme. Communities involved included Placencia, San Pedro Town, Corozal Town, Benque Viejo Town, and Punta Gorda Town. The purpose was to conduct cadastral survey rectification in these towns that would later be declared as compulsory registration section.

In lieu of other options, many organizations are utilizing imagery available through Google Maps, which at the most detailed level are usually 60cm imagery from Digital Globe. The date and level of ground control applied to the Digital Globe data that is accessed through Google Maps is variable, according to the needs of the entity that originally ordered that information. Thus the spatial accuracy of the information is inconsistent and not suitable for certain applications that require higher accuracy and certainty of consistency, such as urban utility or building footprint mapping where that information is to be used for more than general reference purposes.

Current Data Sources. The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 6 – Data Sources Related to Imagery Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Aerial Photographs 2004 monochrome (Belize City, Dangriga Town, Orange Wlak town,	These Aerial photos were aquired through the GOB Land Mangement Programme in April 2004. The purpose was to conduct cadastral survey rectification in these towns that would later be declared as
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			San Ignacio/ Santa Elena Town)	compulsory registration section. These images have a resolution of 18 cm.
MNRA	Lands and Surveys Department	Land Information Centre	Aerial Photographs 2012 color (Placencia, San Pedro Town, Corozal town, Benque Viejo Town, Punta Gorda Town)	These Aerial photos were aquired through the GOB Land Mangement Programme III in march 2012. The purpose was to conduct cadastral survey rectification in these towns that would later be declared as compulsory registration section. These images have a resolution of 18 cm.
MNRA	Lands and Surveys Department	Land Information Center	Aerial/Ortho Photos: Belize City (.img/.sid)	Lands & Survey Department/LIC
MNRA	Lands and Surveys Department	Land Information Center	Aerial/Ortho Photos: Orange Walk Town (.img/.sid)	Lands & Survey Department/LIC
MNRA	Lands and Surveys Department	Land Information Center	Aerial/Ortho Photos: San Ignacio/Santa Elena (.img/.sid)	Lands & Survey Department/LIC
MNRA	Lands and Surveys Department	Land Information Center	Aerial/Ortho Photos: Dangriga (.img/.sid)	Lands & Survey Department/LIC
MNRA	Lands and Surveys Department	Land Information Center	Aerial/Ortho Photos: San Ignacio Town (.bmp)	Orbis Technical Services

Topics: Data topics relevant to the BNSDI at a large scale include:

- Satellite Imagery
- Aerial Photography
- Orthophotography

FGDS: Within this data theme, the BNSDI will need to address the following FGDS:

FGDS Name	Orthophotography
Description	This FGDS category includes high resolution (10cm-20cm) orthophotography for urban areas and major settlements.
Current Status	At the large scale, high resolution (18 cm) orthophotography has been compiled by the MNRA LIC in 2012 for several towns in support of the GOB Land Mangement Programme III.
Future Program Considerations	It will be desirable to develop and apply a common standard for orthophotography to be used for all communities across Belize. It may also be desirable to conduct this work as a coordinated program such that the imagery for all settlements is flown and compiled at one time, with periodic updates every 3-4 years. The detailed requirements for this program would need to be developed in consultation with an

	Interest Group composed of stakeholder representatives from those organizations with an interest in this topic.
Custodianship Considerations	This imagery will be used primarily to support the planning and management of urban and settled areas, and therefore logically falls primarily under the administrative jurisdiction of the Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality. However, this Ministry may not wish to develop and provide the technical and human capacity to manage this specialized service on behalf of the rest of the community, in which case this function might best be served by the MNRA LIC.
Security Considerations	Since this imagery would be developed for communities there would not be any special security considerations.

FGDS Name	Aerial Photography
Description	This FGDS category includes high resolution (10cm-20cm) aerial photo stereopair imagery for urban areas and major settlements.
Current Status	At the large scale, high resolution (18 cm) aerial photography has been compiled by the MNRA LIC in 2004 and 2012 for several towns in support of a land management program.
Future Program Considerations	It will be desirable to develop and apply a common standard for aerial photography to be used for all communities across Belize. The aerial photography is required to support orthophoto development, therefore should be operationally integrated with that program.
Custodianship Considerations	The aerial photography is required to support orthophoto development, therefore should be operationally integrated with that program.
Security Considerations	Since this imagery would be developed for communities there would not be any special security considerations.

FGDS Name	Satellite Imagery – High Resolution
Description	This FGDS category includes high resolution (60cm – 1m) satellite imagery for all land areas in Belize, inclusive of the mainland, cayes and atolls at a minimum. This may also include shallow coastal marine areas within the barrier reef and vicinity of atolls, depending on the detailed requirements that will need to be deliberated through a working group process.
Current Status	Government agencies often default to using high resolution satellite imagery that is available for free through sources such as Google Maps, Bing Maps and ArcGIS Online. These are sufficient for general reconnaissance but the inherent variability of the underlying imagery used by these services is not reliable for some applications.
Future	It will be desirable to develop and apply a common standard for high

Program Considerations	resolution satellite imagery to be used across Belize. Depending on the product selected, the original satellite data that is used to derive the imagery may also be used to support land use and land cover mapping, change detection and other analytical products that utilize the multispectral information. The detailed requirements for this program would need to be developed in consultation with an Imagery Working Group composed of stakeholder representatives from those organizations with an interest in this topic. Whether or not it will be desirable and cost effective to include shallow coastal marine areas within the barrier reef will require further deliberation with the Working Group. This imagery should be updated every 3-5 years.
Custodianship Considerations	The acquisition, management and publishing of this information would logically be carried out by the MNRA LIC on behalf of the BNSDI stakeholder community.
Security Considerations	Versions of this information is available from public sources and therefore does not present any additional security considerations.

3.5 Remote Sensing Data

For the purposes of the BNSDI discussions, Remotely Sensed Data refers to a variety of sensor information collected via a satellite platform. This can include multispectral information that can both be used to derive false color images that approximate what the eye would observe (See section on Imagery), but more importantly provides the spectral measurements that can be interpreted for land use and land cover mapping and other purposes. There is today a wide range of earth observing satellite networks that are equipped with different types of sensors depending on the phenomenon being monitored.

General Considerations: Satellite-based remote sensing provides an effective means of collecting information about conditions on the ground for broad geographic areas at the medium scale. These data are usually collected as reflectance values on the electro-magnetic spectrum. Weather data is monitored and analyzed at smaller scales. Remotely-sensed data can be captured using scanners mounted on platforms such as satellites, aircraft or seacraft and use a passive (i.e. radiated light, microwaves) or active (i.e. radar signal sent from sensor) signal.

There are four dimensions of “resolution” that are important to note for remote sensing data, including the following:

- Spatial resolution. This addresses the size of the pixel, or grid cell that is recorded;
- Spectral resolution. The wavelength width of the different frequency bands recorded;
- Radiometric resolution. The number of different intensities of radiation the sensor is able to distinguish;

- Temporal resolution. The frequency of flyovers by the satellite or plane.

The resolution of all dimensions of collected imagery from satellite platforms has been improving with each new emerging technology and satellite system; many are now capturing levels of information that are suitable for medium scale mapping and spatial analysis applications. The U.S. government has recently relaxed restrictions on the resolution of imagery that can be distributed for civilian purposes, and vendors are announcing data down to 25cm, and this trend toward more accurate and detailed satellite information can be expected to continue.

Multispectral Scanner (MSS) remote sensing technology has the most immediate relevance for the BNSDI community, as these are commercially available from various sources. Other technologies, such as synthetic aperture radar (SAR) and light detection and ranging (LiDAR) are also becoming more available at less cost than has been the case in the past.

In general, remotely sensed MSS data are provided in raster format where the value of each grid cell represents its reflectance value. Each satellite provides data with a number of bands associated, which is equivalent to the number of sensors on the satellite. As the number of bands increase, the possible spectral detail that can be captured also increases. For many purposes, composites can be generated by grouping various bands into one image which, in turn, highlights different characteristics of the land or water. The spectral responses can be interpreted by developing “signatures” that identify classes of land cover such as vegetation, pavement, beaches, etc. These data are usually recorded continuously and can be ordered or downloaded through various organizations and companies.

Remotely sensed data can be a complex type of data to use due to the various classification techniques and digital imagery processing needed to make the data useful for various purposes. How the data will be applied greatly influences the scale and accuracy required. For example, LiDAR data (< 1 m resolution) is much more useful for urban planning and establishing land elevations than Landsat data (30 m resolution), which is better applied to regional analyses of land use and land cover where multi-band spectral signature analysis is required.

It is important that the type of remotely sensed data selected is appropriate for the intended applications. Landsat data are freely available and is useful for regional analyses and monitoring change. SPOT data provides similar capabilities, but at a finer resolution (15 m). The Indian Remote Sensing IRS-1C and 1D satellites supply the highest resolution optical satellite imagery that is commercially available today. Both the 1C and 1D satellites carry three sensors. The Panchromatic sensor collects a single band of imagery with 5.8 meter resolution. The LISS-3 multispectral sensor has a resolution of 23.5 meters and collects 4 bands of image data in the visible, near infrared and shortwave infrared portions of the electromagnetic spectrum. Data such as LiDAR and SAR are useful for urban applications and supplementing elevation derivatives and uses.

Within the remotely sensed data sources, there are different licensing schemes that must be carefully analyzed before purchase to ensure that a) the information that is being acquired is appropriate for the intended applications (in terms of when the data were captured, resolution, bands captured, etc.), and b) that the terms and conditions of use including restrictions on viewing and distribution, rights to derivative products, and other issues) will allow the intended use and distribution of this information across the BNSDI stakeholder community. This is particularly important when the data are to be purchased once on behalf of the BNSDI community for common use.

Business Requirements. Accurate and up to date remote sensing data provides a very powerful basis for analyzing and monitoring land use, land cover, geomorphology, marine environments and other issues. Most organizations that indicated they are using remote sensing data are primarily only using it as background imagery. Few have been involved in actually processing and analyzing the underlying multi-spectral information for the creation of analytical outputs. This may be largely due to the lack of general awareness about what can be done with remote sensing data, as well as a lack of the technical and human resources to do so. Remote sensing analysis is critical for planning, policy making and a broad range of other applications. The full range of BNSDI stakeholder activities that have some direct need for remote sensing data are depicted in Appendix B. According to this information, over 37% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for remote sensing data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Derive various interpreted imagery for base map reference purposes;
- Land use and land cover mapping;
- Change detection;
- Identifying potential habitat for various species;
- Oil exploration;
- Disaster contingency planning and response;
- Detect illegal forest logging;
- Detect illegal fishing;
- Evaluation of overall urban development and rate of expansion;
- Monitoring of near shore and shallow water sedimentation;
- Mapping of shallow water habitats;
- Survey design for environmental studies;
- Hydrologic modeling;
- Delineation of soils and geology formations;
- Provide various interpretive background base maps to provide reference for viewing other thematic data;
- Transportation planning.

Current Situation: At present there are several organizations that have been collecting and using various sorts of remote sensing data within Belize. In general, there has been little coordination of these acquisitions, thus there have been some redundant purchases, and

missed opportunities to re-use these data to support multiple applications. Also it should be noted that awareness regarding the range of potential products that can be derived from satellite data and the technical and human infrastructure to create these products is generally low, which has limited demand for these outputs.

High to medium resolution satellite data has been purchased by various organizations in recent years:

- In 2012 the Belize Electric Ltd (BEL) purchased GeoEye High Resolution Satellite Imagery for all the urban areas in Belize. The GeoEye-1 satellite sensor provides a resolution of 0.46 meters. This was purchased under a single user license and cannot therefore be distributed outside of BEL;
- The Department of Forestry received RapidEye high resolution satellite imagery that was acquired under the Regional REDD Program in Central America and the Dominican Republic. The Program functions under the direction of the Central American Commission on Environment and Development (CCAD) - the environmental branch of the Central American Integration System (SICA). The programme receives support from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) funded by the Federal Republic of Germany through the Federal Ministry for Economic Cooperation and Development (BMZ).
- IKONOS data acquired by CZMAI/NEMO for San Pedro and Caye Caulker, and this information is also being used by the MNRA LIC.
- ASTER data acquired by CATHALAC has been used to support flooding potential mapping for Belize in support of NEMO. ASTER is a Japanese sensor which is one of five remote sensory devices on board the Terra satellite launched into Earth orbit by NASA in 1999. ASTER provides high-resolution images of the planet Earth in 14 different bands of the electromagnetic spectrum, ranging from visible to thermal infrared light. The resolution of images ranges between 15 to 90 meters. ASTER data are used to create detailed maps of surface temperature of land, emissivity, reflectance, and elevation.

Several organizations are utilizing Landsat satellite data that can be downloaded for free. Some of these indicated that others had downloaded and processed this information on their behalf since they did not have the technical capability or software to do so.

The Belize National Meteorological Office uses weather related outputs that are derived from GOES and other weather related satellite data. Most of these are sourced at NOAA. The Office has indicated a desire in the future to augment the weather models with local weather monitoring and topographic information as a basis for generating more accurate and detailed weather monitoring and forecast products.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 7 – Data Sources Related to Remote Sensing Data Theme

MNRA	Lands and Surveys Department	Land Information Center	IKONOS: San Pedro (.img/.tiff)	CZMAI/NEMO
MNRA	Lands and Surveys Department	Land Information Center	IKONOS: Caye Caulker (.img/.tiff)	CZMAI/NEMO
MNRA	Lands and Surveys Department	Land Information Center	ASTER: Belize & Cayes (.img/.tiff)	NASA/USGS/CATHALAC
MNRA	Lands and Surveys Department	Land Information Center	LANDSAT TM: Belize & Cayes (.img/.tiff)	NASA/USGS/CATHALAC
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer).	ASTER is a Japanese sensor which is one of five remote sensory devices on board the Terra satellite launched into Earth orbit by NASA in 1999. The instrument has been collecting superficial data since February 2000. ASTER provides high-resolution images of the planet Earth in 14 different bands of the electromagnetic spectrum, ranging from visible to thermal infrared light. The resolution of images ranges between 15 to 90 meters. ASTER data are used to create detailed maps of surface temperature of land, emissivity, reflectance, and elevation.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Geostationary Satellite System (GOES) Remotely Sensed Data	The Geostationary Satellite system (GOES), operated by the United States National Environmental Satellite, Data, and Information Office (NESDIS), supports weather forecasting, severe storm tracking, and meteorology research. Spacecraft and ground-based elements of the system work together to provide a continuous stream of environmental data. The National Weather Office (NWS) uses the GOES system for its United States weather monitoring and forecasting operations, and scientific researchers use the data to better understand land, atmosphere, ocean, and climate interactions.

Ministry of Forestry, Fisheries and Sustainable Development	Department of Forestry		RapidEye Satellite Imagery	RapidEye is a 5 meter Satellite Imagery product from Blackbridge LLC. With a constellation of five Earth Observation satellites, the RapidEye constellation images over 4 Million square kilometers of Earth every day, and has amassed nearly 3.0 Billion square kilometers in its archive in just two years of commercial operation. The collections occur at 11:00 am local time (daily off-nadir, every 5.5 days at-nadir).
Regional Organizations	CATHALAC		ASTER Satellite Data	The Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) is an imaging instrument onboard Terra, the flagship satellite of NASA's Earth Observing System (EOS) launched in December 1999. ASTER is a cooperative effort between NASA, Japan's Ministry of Economy, Trade and Industry (METI), and Japan Space Systems (J-spacesystems). ASTER data is used to create detailed maps of land surface temperature, reflectance, and elevation.
Regional Organizations	CATHALAC		EO-1 Satellite Data	The Earth Observing-1 Mission (EO-1) satellite is part of NASA's New Millennium Program (NMP), to develop and validate a number of instrument and spacecraft bus breakthrough technologies designed to enable the development of future earth imaging observatories that will have a significant increase in performance while also having reduced cost and mass. Its Advanced Land Imager (ALI) measures nine different wavelengths simultaneously, instead of the seven measured by the imager in Landsat 7.
Utilities	Belize Electric Limited		GeoEye High Resolution Satellite Imagery	In 2012 the Belize Electric Ltd (BEL) purchased GeoEye High Resolution Satellite Imagery for all the urban areas in Belize. The GeoEye-1 satellite sensor provides a resolution of 0.46 meters.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: 1990 Landsat Images	Spatial Layer: 1990 Landsat Images Source: J. Meerman. - Dataset combines a total of 8 variables to assess the potential for land degradation in Belize. These variables include; Soil pH, Shallow depth, Soil Fertility, Fire Risk, Slope, Geology and Rainfall. Within these, the soil pH and slope weigh heaviest. In general, those areas with a high combined land degradation value should be considered unsuitable for development, particularly agricultural development.

Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: 2004 Landsat Images	Spatial Layer: 2004 Landsat Images Source: 2004 Orthorectified Landsat Thematic Mapper Mosaic (bands 453). 8-bit 256 colour and b&W GeoTIFF images with WorldFiles; created from composite 32-bit MrSID image. Emil Cherrington and Jan Meerman. 2005.
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Topics: Remotely Sensed data topics refer to the different techniques and associated types of information collected:

- Synthetic Aperture Radar (SAR)
- Multispectral Scanner

FGDS: The remotely sensed data that are expected to be of common interest to the BNSDI community as FGDS include the following. For the purposes of this report, the FGDS associated with the Remote Sensing Data theme have been classified to high/medium and low resolution. This does not do complete justice to the full range of requirements and variables that need to be considered to fulfill those requirements and that will need a much deeper assessment of community needs and priorities as part of an Imagery and Remote Sensing Special Interest Group during BNSDI implementation.

Also, it should be recognized that new satellites and remote sensing products are becoming available every year, and this list is likely to change significantly over time.

FGDS Name	High/Medium Resolution Satellite Data
Description	This FGDS category includes lower resolution (60cm – 10m) satellite nationally.
Current Status	Acquisition of raw satellite data in Belize has only carried out for specific projects and limited geographic areas.
Future Program Considerations	It will be desirable to develop and apply a common standard for high resolution satellite data to be used across Belize and a centralized program for data acquisition and publishing to the community. The detailed requirements for this program would need to be developed in consultation with an Interest Group composed of stakeholder representatives from those organizations with an interest in this topic. The Group will need to consider the range of applications that can utilize remote sensing data, the detailed requirements including data resolution, spectral bands, periodicity and other factors. Analysis of these factors can be matched against the available government and private satellite data products available, as part of the development of a government-wide imagery and remote sensing data program supporting the entire community.

Custodianship Considerations	The acquisition, management and publishing of this information would logically be carried out by the MNRA LIC on behalf of the BNSDI stakeholder community.
Security Considerations	It is note expected that this data presents any security considerations, beyond the legal responsibility for complying with data licensing terms and conditions.

FGDS Name	Low Resolution Satellite Data
Description	This FGDS category includes lower resolution (90m – 1km) satellite nationally.
Current Status	Acquisition of raw satellite data in Belize has only carried out for specific projects and limited geographic areas.
Future Program Considerations	It will be desirable to develop and apply a common standard for high resolution satellite data to be used across Belize and a centralized program for data acquisition and publishing to the community. The detailed requirements for this program would need to be developed in consultation with an Interest Group composed of stakeholder representatives from those organizations with an interest in this topic. The Group will need to consider the range of applications that can utilize remote sensing data, the detailed requirements including data resolution, spectral bands, periodicity and other factors. Analysis of these factors can be matched against the available government and private satellite data products available, as part of the development of a government-wide imagery and remote sensing data program supporting the entire community.
Custodianship Considerations	The acquisition, management and publishing of this information would logically be carried out by the MNRA LIC on behalf of the BNSDI stakeholder community.
Security Considerations	It is note expected that this data presents any security considerations, beyond the legal responsibility for complying with data licensing terms and conditions.

3.6 Planimetric Features

General Considerations: Planimetric features refer to vector basemap information that is used only for cartographic reference, and not generally for any inventory or analytical purposes. This might include for example sidewalk and path edges, shrubbery and tree masses, driveway aprons and other general reference features, but would not include buildings and street centerlines that are special data themes unto themselves that other data sets will need to be linked to and modeled accordingly. In the past, it was impossible or impractical to utilize imagery in a digital GIS environment, thus vector basemaps had to include the

delineation of many planimetric features needed to provide a sufficient amount of general reference information on maps. Today, orthophoto image maps have routinely replaced the need for much of this vector feature information; however, the amount of detail contained in high resolution imagery may be distracting for some applications, requires more bandwidth for communication over a network, and places more demands on plotting resources for hardcopy outputs. It is therefore often desirable to capture selected vector planimetric features to support general vector mapping purposes.

Business Requirements: Vector planimetric data provides cartographic features that may be needed to support base mapping. The full range of BNSDI stakeholder activities that have some direct need for remote sensing data are depicted in Appendix B. According to this information, about 21% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. However, it should be mentioned that modern capacity to effectively utilize high resolution aerial photography has greatly reduced the need for vector planimetric features which are typically used only for contextual reference. The range of existing or potential uses for planimetric feature data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Support cartographic production of city map guides, tourist maps and other general mapping purposes;
- Provide an uncluttered basemap for utility map series production, work order sketches for field crews and other map output situations for which orthophotos are not appropriate;
- Support online viewing of various data when orthophotos are not appropriate.

Planimetric features are depicted as points (vegetation points or trees, utility structures), lines (fences and walls, pavement edges, landscape structures), or polygons (vegetation areas, utility structures, landscape structures). They may be attributed according to types and classes as the basis for cartographic representation. Often these features need to be represented at a large scale such as 1:1,000 due to the high accuracy requirement for engineering purposes, such as a pavement edge which might be used as a reference for underground utility location measurements. Accuracy requirements for vegetation features and landscape structures are typically less stringent. Planimetric maps can be developed from either ground surveys or aerial photography. Most new planimetric maps are now based on, or replaced by, aerial photography, but may be updated incrementally with as-built information from new construction projects.

Current Situation: Where they occur, the use of planimetric information as features in various cartographic products has been based on the specific map product being produced. There is no standardization of this information in the Country.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 8 – Data Sources Related to Planimetric Features Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	NEW LIC DATA	Contains new data created or produce by LIC, such as the building foot prints, build up areas and other data created by interns.
MNRA	Lands and Surveys Department	Land Information Centre	Belize River valley buildings and flood hazard areas	No additional information provided
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Driver's License Database	The MoWT maintains a database of all the driver's licenses issued by the Ministry. This includes basic information about the driver including home address or location descriptive information. The MoWT is only responsible for carrying out this function outside of the municipalities. Each municipality is responsible for issuing drivers licenses to persons residing within their jurisdiction, and there is no coordination or integrated repository of this information nationally.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Vehicle Registration Database	The MoWT maintains a database of all the vehicle registrations issued by the Ministry. This includes basic information about the vehicle owner including home address or location descriptive information. The MoWT is only responsible for carrying out this function outside of the municipalities. Each municipality is responsible for issuing vehicle registrations to persons residing within their jurisdiction, and there is no coordination or integrated repository of this information nationally.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Traffic Tickets	The MoWT Transport Department is responsible for carrying out traffic law enforcement outside of the municipalities. There are a total of 28 enforcement officers who patrol the country's highways. They are responsible for issuing traffic, equipment and other safety violation tickets and identifying drivers who may be driving under the influence of alcohol or drugs. In addition, the enforcement officers also inspect buses at terminals. The officers issue approximately 250 tickets each month. Each ticket includes the home address or community name of the offender and the approximate location of the offense, by

				address, street or intersection name, and highway milepost or landmark reference. The Department would like to upgrade the approach in the future to include automating the ticket system and establishing a more precise way to record geographic locations
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	Traffic Department	Driver's License Database	Belize City Council Traffic Department maintains a database of all driver's licenses issued by the Department within the jurisdiction of Belize City. This includes all relevant information about each driver, including home address. This information is not linked with other jurisdictions, therefore there is no complete, centralized recording of driver's licenses nationally.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	Traffic Department	Vehicle Registration Database	Belize City Council Traffic Department maintains a database of all vehicle licenses issued by the Department. This includes all relevant information about each vehicle and its owner, including home address. This information is not linked with other jurisdictions, therefore there is no complete, centralized recording of vehicle licenses nationally.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	TBD	Trade License Files	No additional information provided
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	TBD	Liquor License Files	No additional information provided
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	TBD	Auctioneer License Fee Files	No additional information provided

Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council		Building Permit Fee Files	No additional information provided
Ministry of Housing and Urban Development	Central Building Authority		Building Permit Plan Log Register	Building permit applications that have been approved for submission are recorded to the Building Permit Plan Log Register. A Central Building Authority sequence number is assigned for common reference during the permit approval and construction inspection process. The Parcel # is used as the primary location reference
Ministry of Housing and Urban Development	Central Building Authority		Building Footprint Database	A GIS Consultant was hired by the Central Building Authority to develop a building footprint/building stop order database which joins all the attributes within the building permit plan log to each footprint. The consultant used ArcGIS Software to develop this database.
Utilities	Belize Electric Limited		BEL Customer Care Database	The Belize Electric Ltd. (BEL) maintains a digital database that includes information about each of its over 82,000 customers including the location of the metered account by street address or location description, the mailing address of the property owner, current and past electricity consumption and billing information and a record of any significant complaints or other communications.
Private Sector	AREBB Member Database			This is a listing of the business name, owner name, address, website URL, telephone and other basic information about AREBB members.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Hurricane Iris Damage	Spatial Layer: Hurricane Iris Damage Source: Meerman, J. C. 2001.

Topics: Topics that can be expected within this data theme include the following:

Utility structures: Usually polygon features representing the footprint of various structures such as towers, pumping stations, manholes and other such utility-related visible features derived from aerial photography or very high resolution satellite imagery. Depending on arrangement with the utilities, such visible features as power

poles, street lights and telephone poles may also be mapped as planimetric features to be used to register utility information to known accurate locations.

Fences and walls: These are usually delineated as linear features, derived from aerial photography or very high resolution satellite imagery during the large scale basemap projects.

Vegetation points and areas: This information may be depicted as individual trees in the form of points, or vegetation areas such as natural or cultivated lands, or specific relief forms.

Pavement edges: Pavement edges may either be represented as linear or area polygon features, captured from aerial photography, or very high resolution satellite imagery, or from as built drawings. Future incremental updates may be carried out based on as-built information from construction projects, and/or periodic basemap updates carried out through photogrammetric techniques.

Landscape structures: These may include statuary, shade structures, play areas or other features that will for the most part be derived from aerial photography. Future incremental updates may be carried out based on as-built information from construction projects, and/or periodic basemap updates carried out through photogrammetric techniques.

FGDS: Based on the current assessment, the following FGDS data are of particular interest to the BNSDI community. The final list of these features will need to be addressed by an Urban Topographic Basemap Working Group:

FGDS Name	Planimetric Feature
Description	This FGDS category includes the representation of a variety of permanent features on the ground that are useful for basemap reference but that are not included in other datasets. This may include utility structures, fences and walls, pavement, sidewalks and landscape structures.
Current Status	There is no systematic or standardized mapping of planimetric features in Belize today.
Future Program Considerations	Provision for the standardized capture of planimetric features will need to be included within and systematic topographic basemapping program that may be developed. The detailed requirements for such a program should be clearly articulated through a Topographic Basemap Working Group.
Custodianship Considerations	The development of standards and implementation oversight support for this information would logically be carried out by the MNRA LIC on behalf of the BNSDI stakeholder community. However it should also be the responsibility of the local city or town council to provide

	oversight and management support for base map projects within their jurisdiction.
Security Considerations	It is not expected that this data presents any security considerations.

3.7 Structures

General Considerations: Buildings and man-made structures that will be used for inventory purposes, those to which other information should be tied to, or those that will be used for 3D visualization will need to be modeled as discrete geographic objects accordingly.

Buildings may require referencing for both cadastral as well as street addressing purposes. From the cadastral perspective, buildings on the same plot but having different ownership must be referenced as cadastral objects to which legal property title deeds can be tied. Likewise, units within buildings (e.g. condominiums) that are separately owned must also have unique cadastral identification, but it is usually not necessary to indicate these boundaries spatially in a GIS. This issue is addressed further in the section of this report dealing with cadastral boundary information. In addition, buildings need to be individually identified in a manner that makes sense to the driver or pedestrian on the street according to expected rules, e.g. increasing numbers by block with consistent odd and even numbers on opposing sides of the street. These two systems represent significantly different frames of reference, one a hierarchical, area-based approach that is most appropriate for cadastral identification, the other a linear based reference relative to the full length of a street.

Business Requirements: Structures data provides the spatial framework object that other databases can be linked to for geospatial referencing. The full range of BNSDI stakeholder activities that have some direct need for remote sensing data are depicted in Appendix B. According to this information, nearly 82% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for structures data in Belize as identified through the Stakeholder Situation Survey and international practice include:

Ways that large scale structure data will be useful at the large scale include, but are not limited to the following:

- Support cadastral mapping down to the building level where appropriate;
- Support effective street address mapping by providing a geographic object to which addresses can be attached;
- Provide a geographic object to which land use information can be attached for planning purposes;
- Administer regulated facility and activity permits including chemicals and hazardous materials permitting - critical for both inspectors and emergency first-responders;

- Provide building, populated areas, and government building information to support disaster contingency planning and response;
- Plan community services, such as health and education, based on land use and gap analysis
- Link utility customer service information to customer location;
- 3D building massing and architectural visualization;
- Link commercial licenses to geographic location;
- Link personal identification information to geographic location;
- Post and mail delivery;
- Design, plan and maintain civic facilities;
- Building permit management;
- Transport natural gas to consumers

With advancing technologies and improved base map content up to the building footprint, information within the building footprint is now becoming more readily available and increasingly important in urban land management. A large percentage of the world's activities in populated areas take place inside the building footprint. These activities involve strategic and tactical planning for business functions such as space management, leasing and sales, asset management, move management, security, environmental quality, and emergency response. The same kinds of analysis that are applied on landscapes with simple features (geometry calculations, proximity analysis, nearest neighbor analysis, surface interpolations from point samples, visibility analysis, routing and logistics, etc) can also be applied inside a building and across the landscape using in-building attributes with more complex geometric features such as multi-floored buildings. Further, technologies such as the local GRS network allow for high-resolution situational awareness, enabling information to be collected quickly and accurately in this large-scale, multi-dimensional manner.

GIS software is quickly adapting the tools necessary to manage coincident features with an appropriate data model for 3-D analysis beyond that of the “sugar-cube” used for visualization and planning activities today. In-building spatial analysis will warrant further attention from the BNSDI in the future.

Current Situation: Previously several different organizations in Belize had started to develop their own mapping for building location information. The MNRA LIC helped to facilitate an informal process to bring all the key stakeholders together to carry out systematic mapping of building footprint information nationally as a collaborative effort. The effort was initiated by several organizations involved in working together through the National Emergency Management Organization (NEMO) in consideration of disaster risk reduction and damage assessment requirements. Participants have included:

- Central Building Authority (CBA);
- Sustainable Tourism Program;
- Statistics Institute Belize (SIB);

- Belize Electric Ltd. (BEL);
- Belize Natural Energy Ltd. (BNE);
- San Ignacio and Santa Elena Town Council (SISE);
- Land Information Centre, Ministry of Natural Resources and Agriculture (LIC/MNRA);
- Biodiversity and Environmental Resource Data System of Belize (BERDS);
- National Emergency Management Organization (NEMO);
- Ministry of Local Government and Rural Development (MLGRD);
- Ministry of Health (MoH);
- National Association of Village Councils Organization (NAVCO);
- Coastal Zone Management Authority and Institute (CZMAI).

This effort includes both the delineation of built-up area boundaries for towns, villages and settlements as well as building footprint boundaries for every significant structure nationwide. The requirements for the development of this database were defined by the participants. Built-up area and building footprint information is being developed based on the best available imagery and supporting collateral information for each area which ranges from detailed orthophotography for Belize City conducted in 2012 (18cm resolution) to QuickBird (Digital Globe) high resolution satellite data (~60cm resolution) for much of the remainder of the Country that was accessible through Bing Maps and Google Earth. It was recognized that utilizing multiple sources would result in a database of variable accuracy. It was seen as preferable to develop this database to support current requirements and activities. In the future when more accurate boundaries are required, procedures can be applied to “conflate” attribute information to a more precise geometry.

Field work is then conducted to confirm the boundaries on the ground and to add information regarding each building, including a photo and selected attributes including:

- Type of walls
- # of floors
- Roof type
- Land Use
- Name of building/establishment
- Description

As the date of original Stakeholder Situation Survey, over 23,000 buildings had been digitized in Corozal Town, Orange Walk, Benque, Punta Gorda, and Dangriga. However as of November, 2014 there were administrative changes at the LIC that have constrained the resources available to continue this facilitation, and at the time of this writing in April 2016 the collaborative effort was not active. Methods by which this information will be kept up to date in the future were under discussion previously but will need to be re-visited in future implementation planning. The subject was brought up in the inaugural BNSDI Technical Committee meeting and there was an intention expressed to explore a collaborative effort

between MNRI (previously MNRA) and the Statistics Institute Belize (SIB) in advance of the next population census.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 9 – Data Sources Related to Structures Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	NEW LIC DATA	Contains new data created or produce by LIC, such as the building foot prints, build up areas and other data created by interns.
MNRA	Lands and Surveys Department	Land Information Centre	Belize River valley buildings and flood hazard areas	Additional information not provided
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Driver's License Database	The MoWT maintains a database of all the driver's licenses issued by the Ministry. This includes basic information about the driver including home address or location descriptive information. The MoWT is only responsible for carrying out this function outside of the municipalities. Each municipality is responsible for issuing drivers licenses to persons residing within their jurisdiction, and there is no coordination or integrated repository of this information nationally.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Vehicle Registration Database	The MoWT maintains a database of all the vehicle registrations issued by the Ministry. This includes basic information about the vehicle owner including home address or location descriptive information. The MoWT is only responsible for carrying out this function outside of the municipalities. Each municipality is responsible for issuing vehicle registrations to persons residing within their jurisdiction, and there is no coordination or integrated repository of this information nationally.

Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Traffic Tickets	The MoWT Transport Department is responsible for carrying out traffic law enforcement outside of the municipalities. There are a total of 28 enforcement officers who patrol the country's highways. They are responsible for issuing traffic, equipment and other safety violation tickets and identifying drivers who may be driving under the influence of alcohol or drugs. In addition, the enforcement officers also inspect buses at terminals. The officers issue approximately 250 tickets each month. Each ticket includes the home address or community name of the offender and the approximate location of the offense, by address, street or intersection name, and highway milepost or landmark reference. The Department would like to upgrade the approach in the future to include automating the ticket system and establishing a more precise way to record geographic locations
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	Traffic Department	Driver's License Database	Belize City Council Traffic Department maintains a database of all driver's licenses issued by the Department within the jurisdiction of Belize City. This includes all relevant information about each driver, including home address. This information is not linked with other jurisdictions, therefore there is no complete, centralized recording of driver's licenses nationally.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	Traffic Department	Vehicle Registration Database	Belize City Council Traffic Department maintains a database of all vehicle licenses issued by the Department. This includes all relevant information about each vehicle and its owner, including home address. This information is not linked with other jurisdictions, therefore there is no complete, centralized recording of vehicle licenses nationally.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	TBD	Trade License Files	No additional information provided

Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	TBD	Liquor License Files	No additional information provided
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	TBD	Auctioneer License Fee Files	No additional information provided
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council		Building Permit Fee Files	No additional information provided
Ministry of Housing and Urban Development	Central Building Authority		Building Permit Plan Log Register	Building permit applications that have been approved for submission are recorded to the Building Permit Plan Log Register. A Central Building Authority sequence number is assigned for common reference during the permit approval and construction inspection process. The Parcel # is used as the primary location reference
Ministry of Housing and Urban Development	Central Building Authority		Building Footprint Database	A GIS Consultant was hired by the Central Building Authority to develop a building footprint/building stop order database which joins all the attributes within the building permit plan log to each footprint. The consultant used ArcGIS Software to develop this database.
Utilities	Belize Electric Limited		BEL Customer Care Database	The Belize Electric Ltd. (BEL) maintains a digital database that includes information about each of its over 82,000 customers including the location of the metered account by street address or location description, the mailing address of the property owner, current and past electricity consumption and billing information and a record of any significant complaints or other communications.

Private Sector	AREBB Member Database			This is a listing of the business name, owner name, address, website URL, telephone and other basic information about AREBB members.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Hurricane Iris Damage	Spatial Layer: Hurricane Iris Damage Source: Meerman, J. C. 2001.

Topics: The topic under this Theme includes:

- Buildings Footprints
- Building Points
- Street Address
- 3D Buildings
- Facilities

FGDS: FGDS that are considered to be of high interest to the BNSDI community include the following:

FGDS Name	Building Footprints
Description	This FGDS includes the building footprint of all habitable structures in Belize.
Current Status	The MNRA LIC helped to facilitate an informal process to bring all the key stakeholders together to carry out systematic mapping of building footprint information nationally as a collaborative effort. The effort was initiated by several organizations involved in working together through the National Emergency Management Organization (NEMO) in consideration of disaster risk reduction and damage assessment requirements. This effort is utilizing a variety of imagery sources as a reference from which to digitize the rooflines as visible in the imagery. It should be noted that while these boundaries will be of sufficient accuracy to support many important applications, it could be up to 5m – 10m offset which will not be sufficient to support detailed utility mapping, engineering works and other applications that require 1:1000 or better level of accuracy.
Future Program Considerations	The basic building footprint representation that will be most important to the majority of the BNSDI community is the base of buildings (as opposed to the roofline), as this is the boundary that will affect most activities at the ground level. Building outlines photogrammetrically digitized as vector polygons from imagery represent the visible extent of the structure base and any discernable parts of structures. When uniquely referenced in a GIS, building polygons become a ‘spatial primitive’ to which a wide variety of related textual data can be associated; therefore, this information is considered to be “framework”

	<p>information. Capture of building boundary data is best carried out at a large scale because it allows representation of buildings footprints within the high accuracy tolerances required for utility and other engineering purposes such as building permits, utility clearance services and others. Frequent updates will be required, preferably on a transaction basis. This might also include early posting of information undergoing early development review by the BPA. Capturing of this information might best be carried out by providing project owners and their consultants with practical specifications for submittal of this information during the project review process in a form that can be immediately added to the GIS. As the date of Stakeholder Situation Survey, over 23,000 buildings had been digitized in Corozal Town, Orange Walk, Benque, Punta Gorda, and Dangriga. However as of November, 2014 there were administrative changes at the LIC that have constrained the resources available to continue this facilitation, and at the time of this writing in January 2015 the collaborative effort had essentially halted.</p> <p>The association of related structures within facilities should also be accommodated in the data model. Facilities are a complex group of structures that function together operationally, such as ports and harbors, hospitals, airports, stadiums and the like.</p> <p>Although not an initial priority, there will be the potential to further enhance this data with 3D information to support more advanced visualization in the future. The development of 3D models and texture mapping for major buildings in major urban areas could provide an effective mechanism for visualizing the existing and proposed urban environments.</p>
Custodianship Considerations	<p>The development of the initial, medium scale accuracy building footprints information has been a joint effort. Management of the fully compiled version of this database on behalf of the community should be officially delegated to the MNRA LIC initially. At some point it will be important to transition from the initial building footprint database which is known to have variable accuracy, to one that is consistently mapped using photogrammetric techniques that will be suitable to support utility and engineering works at large scale. Once that is completed, the ongoing updating of building footprints should be captured through the building permit process. At that time, the acquisition, management and publishing of this information would logically be carried out by the Central Building Authority as part of the building permit process. This may need to be augmented every 2-3 years to account for any habitable structures built outside of the building permit process.</p>

Security Considerations	There are no special security consideration with the building footprint information per se. There may be issues with certain other data that may be linked to the building permits, including personal information, population census, security usage, etc. but the implications of each of these linked data should be considered on their own merit without impacting the general utilization of building footprint data on its own.
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FGDS Name	Building Points
Description	This FGDS includes points representing the centroid of all habitable structures in Belize.
Current Status	At this time the inventory of habitable structures in Belize is incomplete and there is no committed schedule or resources for its completion.
Future Program Considerations	Given the level of effort required to capture building outlines and the fact that this data derived from inconsistent data sources per the previously used method will result in variable spatial accuracy that will need to be redone in the future to accommodate a greater and more consistent accuracy, it may be desirable to represent the building locations with a simple x,y geographic coordinate point location for now that can be digitized much more quickly. Ideally, large scale topographic basemapping would be carried out for all towns and villages using photogrammetric techniques. Once this baseline database is established, transactional updating could be carried out through the building permit process as described elsewhere.
Custodianship Considerations	Given the level of effort required to capture building outlines and the fact that this data derived from inconsistent data sources will result in variable spatial accuracy that will need to be redone in the future, it may be desirable to represent the building locations with a simple x,y geographic coordinate point location that can be digitized much more quickly thus saving time and effort.
Security Considerations	There are no special security consideration with the building footprint information per se. There may be issues with certain other data that may be linked to the building permits, including personal information, population census, security usage, etc. but the implications of each of these linked data should be considered on their own merit without impacting the general utilization of building footprint data on its own.

3.8 Scanned Basemaps

General Considerations: Scanned basemaps are topographic and/or historical survey basemaps that have been scanned to a digital image form and then georectified to real world coordinates for use with other information in a GIS. Raster basemaps of this sort are useful as

a general reference backdrop for other GIS information, especially for historical reference or where other basemap information is not available in digital form.

Example common uses for large scale scanned basemaps include:

- Provide geographic reference where no other basemap data are available;
- Provide a geo-rectified data source that can be used as the basis for heads-up digitizing of selected features;
- Provide an efficient way to access and reference historical hardcopy basemap or other historical thematic maps.
- Provide historical reference to roads, building footprints, structures and appurtenances, environmental conditions such as vegetation, coastline, and marine conditions, etc.

Business Requirements: Scanned basemaps are by default best used at a scale close to that of the original basemap compilation scale. Scanned basemaps, by their very nature, will not be updated but instead simply archived for historical purposes when a newer basemap is scanned. Basemaps should be scanned such that the lines and dots are still sharp when viewed or printed at the original scale. Once scanned, images should be georeferenced. If the original basemaps were in a stable media, georeferencing can be from graticules or other features with known coordinates. If the original basemap was in a media that has suffered distortions and/or has been folded, then more complex georeferencing methods should be used.

Current Situation: Multiple organizations have scanned and digitized the UK Ordnance topographic basemap sheets at 1:50,000 scale. These are used by several organizations as a standard backdrop for the presentation of other information, and as a basis for heads-up digitizing. Over 40 sheets cover all of Belize but it has been stated that not all of these are from the same timeframe and map series.

CZMAI has acquired scanned topographic basemap sheets for other series beyond the Ordnance Survey maps. These include map sheets at 1:100,000 scale created as part of the 2005 NRI Land Resource Assessments and the 1999 U.S. National Imagery & Mapping Agency Digital Atlas of Central America project at 1:250,000 scale.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 10 – Data Sources Related to Scanned Basemap Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	DOS Topographic Sheets (.jpeg)	This is a georeferenced scan images (Directorate of Overseas Surveys/UK military) showing the topography of Belize, it consist of a total of 44 sheets that cover the entire country at a scale of 1:50,000. Most if LIC's baseline data were digitized from these
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				images.
MNRA	Lands and Surveys Department	Land Information Center	Topography/Baseline: DOS Topographic Sheets (.jpeg)	Ordnance Survey International (Britain)
MNRA	Natural Resources Department	Mining Unit	1:50K Topographic Basemap Images	The MNRA Department of Natural Resources Mining Unit maintains scanned and georectified versions of the Ordnance Survey topographic map series. These include the 1:50,000 E755 topographic sheets UK Ordnance Survey, sheets 1-44 (sheets 22 & 43 are missing from the collection).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Map Sheets / Topographic Sheets	date of publication: variable. Originator: U.K. Ordnance Survey / Directorate of Overseas Surveys (E755 sheets). Preferential Scale: 1:50,000. Notes: all of the sheets for mainland Belize were scanned by the University of Mississippi's Geomatics Centre (UMGC); unfortunately, these cover varying periods, which can only be deduced from inspection of the particular land use shading schemes utilized by sheets for different periods; it seems that sheets from both edition 6 and edition 5 were used
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Map Sheets / Topographic Sheets	date of publication: 1993. Originator: U.K. Ordnance Survey / Directorate of Overseas Surveys (E755 sheets). Preferential Scale: 1:50,000. Notes: these are listed separately as this set was scanned by the University of Florida, but has not been georeferenced or corrected for warping; unlike the sheets scanned by the University of Mississippi, these possess their legends
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Map Sheets / Topographic Sheets	date of publication: 1986. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:100,000. Notes: the source data for this is aerial photography; the printed map sheets were scanned and corrected by Emch et al. (2005).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Map Sheets / Topographic Sheets	date of publication: 1986. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:100,000. Notes: the source data for this is aerial photography; the printed map sheets were scanned and corrected by Emch et al. (2005).

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Map Sheets / Topographic Sheets	date of publication: 1999. Originator: U.S. National Imagery & Mapping Agency (Digital Atlas of Central America project). Preferential Scale: 1:250,000. Notes: the U.S. National Imagery & Mapping Agency has produced 1:250,000 topographic maps of Central America which may have been generated from the individual countries' 1:250,000 sheets; it is unknown what period these sheets correspond to, but were published on the Hurricane Mitch-related Digital Atlas of Central America
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Topics: Data topics expected to be covered under this theme and of FGDS interest to the BNSDI community include the following.

- Reference basemaps
- Historical reference maps

FGDS: Based on the current assessment, the following FGDS data are of particular interest to the BNSDI community.

FGDS Name	Scanned Topographic Basemaps
Description	This FGDS category includes scanned versions of topographic basemap series originally mapped by U.K. Ordnance Survey and U.S. NIMA (now NGA).
Current Status	Existing scanned basemaps represent different map series and timeframes.
Future Program Considerations	Development of a standard set of historical topographic basemaps available to the whole community would be of value. This would require a more thorough and systematic assessment of requirements and the identification of what sources, map series and timeframes are most needed in common by the community.
Custodianship Considerations	If a standard set of topographic basemaps is to be produced for use in common by the community, the MNRA LIC would be the logical custodian for this information.
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Scanned Historical Maps
Description	This FGDS category includes scanned versions of various historical maps that provide useful reference
Current Status	No scanned versions of historical maps in Belize were identified during the current study. However international experience suggests that such information could provide valuable reference and may be desirable in

	the future
Future Program Considerations	The definition of a program to identify and produce an archive of historical maps of Belize could be undertaken by a Working Group or Special Interest Group.
Custodianship Considerations	If a standard set of historical scanned maps is to be produced for use in common by the community, the MNRA LIC would be the logical custodian for this information.
Security Considerations	It is not expected that this data presents any security considerations.

3.9 Grids and Indexes

General Considerations: Coordinate grids are often generated in advance or on-the-fly as a cartographic reference depicting geographic x,y coordinates on a digital display or on hardcopy maps. Index grids, or indexes, depict the boundaries of map sheets, primarily for hardcopy map series printing purposes. Coordinate grids may be generated at various levels of resolution. For example for large scale mapping in UTM coordinates, the grids may represent 1000 meter increments. Indexes for large scale map series production match the boundaries of traditional map sheets at various scales. These indexes may be based on real world coordinates, or may be generated on an independent grid basis that has nothing to do with geographic coordinates but rather has been positioned to accommodate “best fit” for producing hard copy maps. Map indices indicate the boundaries of available paper maps, the physically separate files of a digital mapping system, or pre-defined viewing or plotting limits within a GIS environment.

Since modern digital geographic datasets are produced on a continuous basis rather than on map sheets, map indexes have no other major significance beyond map series production. However, in some cases the user community may have become accustomed to referencing areas by map grid index, and in these cases a legacy map number can be useful as the basis for area of interest locating purposes.

Coordinate grids provide an accurate frame of reference in a projected world space, allowing accurate location and area georeferencing capabilities on produced maps often used for field surveys. Although GPS provides real-time georeferencing capabilities, the coordinate grid is still valuable when field GPS is unavailable or when sharing location references between manual and GPS-enabled systems. Coordinate grids are also used for registering published maps to digital features for georeferencing historical maps.

Business Requirements. In Belize, grids and indexes are primarily needed for referencing the boundaries of map sheets, either for scanned basemaps or thematic maps, or for map sheet production.

Current Situation: At present, those organizations that have scanned and georegistered basemaps or historical maps will usually maintain a grid indicating the location and sheet identifier for each panel.

The MNRA LIC maintains an archive of UK Ordnance Survey scanned maps at 1:250K and 1:50K scales. CZMAI also maintains scanned versions of these same maps, as well as 1:250K maps from NIMA and a 1:100K map series created by King et al for the 1986 NRI Land Resource Assessments.

Topics: Topics for this theme include as described above:

- Coordinate Grids
- Map Indexes

FGDS: The FGDS data sets within this Theme can be summarized as follows:

FGDS Name	Coordinate Grids
Description	Coordinate grids are used to delineate geographic coordinate reference across geography at some regular interval. These may be lines of latitude/longitude or UTM feet or meters. Grids may be delineated either as “tic” marks along the neat line of a map, or as a physical line work grid. While these data may exist as physical digital files, they can also be automatically generated “on-the-fly” in the GIS to meet specific mapping needs at various levels and under different coordinate systems.
Current Status	Coordinate grids in Belize have primarily been generated as a geographic reference for image files of hardcopy maps that have been scanned and georegistered.
Future Program Considerations	The development and maintenance of coordinate grids are needed as a reference for any archive of scanned basemap or historical maps.
Custodianship Considerations	For commonly needed historical basemap information such as the scanned UK Ordnance Survey maps at 1:250K and 1:50K to be used in common by the BNSDI stakeholder community, the MNRA LIC would be the logical custodian for this information. Indices for more specialized historical information or map sheet production would be maintained by the organization that most needs the information.
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Non-Coordinate Index
Description	Non-Coordinate Indexes are used to delineate geographic reference across geography at some irregular interval. These may be by

	administrative area, cadastral block or other
Current Status	There are a variety of map series being used in Belize that have map sheet boundaries that are not coordinate bound.
Future Program Considerations	The development and maintenance of con-coordinate indexes may be needed as a reference for any archive of scanned basemap or historical maps, the boundaries of which are not based on geographic coordinates.
Custodianship Considerations	Indices for more specialized historical information or map sheet production would be maintained by the organization that most needs the information.
Security Considerations	It is not expected that this data presents any security considerations.

4.0 AREAS

The Areas data class refers to subdivisions of land (or water) according to some intended purpose. Areas delineate administrative boundaries, jurisdictional areas, socioeconomic and management zones and are used for a variety of planning, administrative and special management purposes. Areas are often delineated in reference to topographic or man-made features such as rivers and streams, ridge lines, watersheds, roads and urban boundaries. In some cases, such as planning and statistical boundaries, areas are delineated according to both physical features and the underlying characteristics of those areas, such as population and land use.

4.1 Activity Areas

General Considerations: Activity Areas may be used to delineate the extent of where a government or other entity is carrying out specific activities on the ground that other organizations need to be aware of. These can include a development project area, a utility renovation project area, an environmental study area, a vector-control treatment area, and many others. Activity areas may be temporary and short-lived or may be persistent for years. In addition to a boundary delineating the extent of an activity area, each should be accompanied by essential information about the activity, including the activity type, time period of the activity, contact information, etc.

The primary purpose of this FGDS topical area is to establish a common basis upon which entities can record their current and proposed activities so that others with projects in the same area can be aware of one another. This can also provide valuable historical information, and a spatial reference to project documents that can be used as one basis for searching for and retrieving such information through a spatial query.

Expressing an activity area for projects and studies requires the delineation of a boundary according to some criteria. These may range from adopting a country boundary as the basis

for indicating the development of a Country-wide soils map, to a segment of street where a new water pipeline is to be installed, down to a specific environmental study plot that is being used for long term scientific monitoring and research. In some cases there may be studies referring to the same project but having differing boundaries, for example the delineation of the affected area involved in a roadway design project may be different from the extent of the environmental impact assessment (EIA) that may accompany it.

Business Requirements. Activity areas by their nature tend to be transitory, and exist for the duration of a project or study. Activity areas may overlap where multiple organizations are working in a community, even if those organizations are providing the same types of community services. The notion of activity areas can extend to program areas that are, by contrast, more permanent. They define a general zone of influence within which one or more permanent activities may occur. The full range of BNSDI stakeholder activities that most relevant to this data theme are depicted in Appendix B. According to this information, over 49% of the activities carried out by BNSDI stakeholders could use this information in some manner. Common existing or potential uses for activity area data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Planning and tracking of utility projects and associated utility coordination;
- Development project tracking;
- Tracking and analysis of public sector investment project areas;
- Identify potential conflicts among activities that are planned for the same location in the same timeframe;
- Identify location of area studies, e.g. for land tenure, land use planning, mining and minerals, oil and gas exploration, etc.;
- Tracking of environmental impact studies (EIA's);
- Support coordination and data sharing among engineering and scientific studies (e.g. site specific geotechnical studies or information gathered by different consultants in the development of EIA's).

At a large scale, activity areas are depicted as polygons. Given their nature, these features do not have high accuracy requirements. Activity areas are captured in many different ways depending on their nature, and may or may not require updating other to change status or other descriptive information. Basic metadata about each activity should also be recorded, including but not limited to an indication of the responsible entity, activity description, timeframe, and current status. Custodianship of this theme would cut across all the agencies recording their activities.

The FGDS for this topical area is expected to comprise one primary dataset defining an activity area boundary and associated unique, chronologically assigned activity identification number. This number can be linked to any number of government entity databases, each of which should share common fields and standards for indicating the activity type, description, timeframe, and contact information. Beyond this, those linked databases may have other information that is specific to each activity, and there will need to be further discussion among

the BNSDI Technical Committee to determine how much of that information is needed and useful in common.

Current Situation: At present there is no standard for delineating activity areas in use in Belize. The Ministry of Finance and Economic Development maintains a listing and essential characteristics for all Public Sector Investment Projects (PSIP's) from all sectors of government. However, most projects are only referenced to a community name or general milepost along a highway in a form that could be used in a GIS if the "footprint" boundary of each project were digitized.

Topics: Topics include:

- Activity Areas
- Development Project Areas
- Study Areas

FGDS: FGDS within this theme that would support the requirements of the BNSDI include the following:

FGDS Name	Activity Areas
Description	This FGDS would include the location, extent and basic characteristics of a variety of government related activities, including but not limited to land use planning and development projects, utility projects and studies.
Current Status	The locations of activities at present are only described in textual form by District, community, milepost or other general reference to geographic location that cannot be effectively used in a mapping system.
Future Program Considerations	The recording of the location and basic characteristics of public sector investment projects and other significant activities is important both for coordination purposes and to understand where resources are being invested. Each class of activity will require its own set of accompanying information structured in a form that can support thematic and statistical mapping and reporting geographically. By making this information generally available it will be possible for agencies to be aware of each other's activities in an area and thereby increase coordination and avoid potentially costly conflicts in work schedules (e.g. digging up road pavement to replace a utility line when the road had been newly surfaced). The establishment of a standard operating procedure and simple tool to record the boundary and basic data for each planned activity as a routine activity in project planning and financing could help to ensure that this information is captured effectively and consistently.
Custodianship	Each entity that is responsible for defining projects and major activities

Considerations	would be responsible for recording their location and basic characteristics. The MoFED could adopt a standard to ensure that this information would be included for the proposal of any public sector investment project. The basic software tool to facilitate that entry and to manage the centralized database and ensure access by others could be managed by the MNRA LIC.
Security Considerations	It is not expected that this data presents any security considerations where civilian activities are concerned. The police, national security and defense forces may require similar functionality to support better coordination across the involved organizations, but that potential is not being addressed in the current study.

4.2 Cadastral

General Considerations: A cadastre is a registry of land ownership that often describes the details of ownership, precise location, land parcel dimensions, land area, certain area-specific constraints such as easements and rights-of-way, and improvements. Land ownership is often documented in the form of a recorded deed that provides all this information in a manner that is prescribed in a country's law, and officially recorded within a public body, such as a Court or other office within a Ministry of Justice or equivalent organization. Likewise, any claims against a property, such as a mortgage loan, promissory note, or lien, must be recorded in the same registry to ensure legal standing and notice of encumbrance. The establishment and maintenance of a well-structured cadastral system is critical to land tenure and all the rights and privileges that go along with property ownership. In some economies and cultures it is also a critical source of capital whereby land is used as collateral for loans that infuse money into the economy for financing businesses, property improvements, and other purposes.

Business Requirements. Cadastral surveys are used to document land ownership by the production of various documents, diagrams, sketches, plot plans, and other means of describing and verifying the property itself and its ownership. Often the boundary information from the deeds that has been surveyed through coordinate geometry in the field is used as a basis to compile a highly accurate digital map of land ownership in a GIS as a cadastral boundary dataset. This dataset usually includes an assigned unique parcel identification number for each legal plot, and this ID can be used as a relational key to tie the boundaries to any other textual databases that contain the same number. These parcel ID's often consist of a number or hierarchically "nested" numbers such as District, Sector, Block, Parcel, and below to Building and Flat. The concatenation of these area designations provides a unique identification number for each plot. In this way, plots can be linked to legal records and associated ownership and improvements information, building permits, site inspections, and any other information that needs to be linked to specific property.

As described previously under the “Structures” FGDS category, the land cadastre may also extend below the plot level to delineate distinct ownership at the sub-plot level, such as buildings and units within buildings. For the purpose of delineating property boundaries in a GIS, the building may be treated as the smallest unit of boundary delineation, with separate flat identification numbers that may be linked to a building location. However some have also chosen to extend the GIS data to the specific floor plan level of detail within a building.

The full range of BNSDI stakeholder activities that most relevant to this data theme are depicted in Appendix B. According to this information, over 63% of the activities carried out by BNSDI stakeholders could use this information in some manner. Common existing or potential uses for cadastral data in Belize as identified through the Stakeholder Situation Survey and international practice include, but are not limited to:

- Management of a cadastral registry;
- Link between property boundary and associated case files;
- Support the real estate market;
- Property acquisition for public purpose (eminent domain);
- Maintain inventory of government owned properties;
- Building and other site specific permitting;
- Property valuation and taxation;
- Land use planning;
- Existing land use mapping;
- Land use zoning and associated building regulations;
- Leasing and allocation of National Estate lands;
- Construction permitting and certification;
- Demolition licensing;
- Utility facility mapping;
- Utility connections;
- Utility operations;
- Utility Capital Improvement Planning;
- Conduct censuses and surveys;
- Conduct natural hazard assessments;
- Emergency planning and response;
- Issue and administer commercial licenses.

Cadastral features are most often depicted as polygons (plots, blocks, building footprints and floorplans where appropriate, easements and rights-of-way), and points indicating the locations of property corner stakes (sometimes a permanent metal pipe or other permanent monument that is inserted into the ground). Cadastral boundaries are most accurately collected through closed traverse survey that is tied to a physical survey monument that is itself tied into the geodetic framework. This field-confirmed coordinate geometry of the plot may be entered as the “legal description” in the property deed. In some cases the coordinate

geometry information may be used to compile the GIS cadastral map, or tied as attributes to aerial photo interpretation of the boundaries to where a more diagrammatic representation is compiled, or a combination of both. The techniques used for both the legal description on individual deeds, and the representation of compiled boundaries in a seamless GIS data base will depend on the legal cadastral system used, with then the adoption of associated technical survey techniques required to meet the needs of the legal system and how this information is to be used in a GIS. Custodianship of the different information parts of the cadastre (survey control, property corner stakes, deeds and associated legal boundary description, recorded encumbrances, and GIS boundaries) may involve different government entities depending on the system of government.

Cadastral plot boundaries are often used as a “framework” for linking other information to geographic location. For example, existing or planned land use might be described as tabular information that is tied to the plot boundaries. Other transactional information such as Building Permits may also be tied to cadastral plots.

Current Situation: The MNRA Department of Lands and Surveys is responsible for administering all aspects of the national cadaster in Belize. Belize encompasses a total land area of 22,960 km² of which 5% is distributed over more than 1,060 islands. Privately held lands represent 54% (approximately 12,400 km²) of the total national territory with over 10,000 km² distributed in rural parcels greater than 0.4 km² (40 ha). While small private urban parcels represent less than 0.1% of the total national territory they account for most of the land transactions. Public lands account for 46% (approximately 10,560 km²) of the total land surface of Belize. These public lands are further divided into: (i) protected areas and forest reserves which represent over 30% of the total national territory; and (ii) other ‘national lands’ (16% of the total national territory) which are either already allocated under a government lease or unleased public land. It is estimated that there exists between 90,000 and 105,000 land parcels that can eventually form part of the national cadastre and contribute to a dynamic investment market¹.

The MNRA in 2006 initiated the development of the Landfolio system, a comprehensive enterprise system for the management of cadastral information. Landfolio is an application software suite originally developed by Stewart Global Systems that automates the core elements of land records management providing a complete land information management solution. The software has been built on top of the ESRI GIS platform and MS SQL Server database. This was implemented initially in 2006 and then extended through the third phase of the IDB funded Belize National Land Management Program (LMP), intended to develop a national land policy framework focusing on both private and public sector development through secure land tenure. Land Management Program III involved the expansion of the Land Information System including the expansion of the Landfolio solution to the departments of Planning, National Estates, Valuation and Inland Revenue/Cashiering. The system is maintained and supported internally at present by the MNRA IT Department.

¹ BELIZE Project Profile (PP), IDB Land Management Program III, Prj# BL-L1008

The Landfolio system is now includes the complete database for parcels in registered land areas and this information is being routinely updated as subdivisions, lot splits and lot join transactions are processed. Much of the unregistered lands however remain undocumented or partially documented, and only a portion of this information has been entered to the Landfolio systems thus far. Applications for the lease or purchase of government owned land requires a recommendation from the appropriate elected representative and/or land caretaker. These applications are submitted to the National Estate Section and a case file is created for each in both hardcopy and entered to the Landfolio system. Among other information, the application requires a sketch map and location description of the proposed property. The Section staff reviews the application and if all in order for undeclared areas they will request a field survey from the MNRA Survey and Mapping Section, and may also conduct their own field investigation. Field investigation includes the capture of at least three gps coordinates to establish the location of the site. All information and correspondence associated with the case are kept in the case file as well as scanned and entered to Landfolio.

The Landfolio system is currently not fully interoperable with other GIS layers maintained by the MNRA. GIS plot boundaries and ownership information are made available to others upon request, but a significant fee is charged for providing such information (average of \$1 per plot). Some stakeholders have indicated that this has limited their ability to make full use of this information in their operations.

Topics: Geospatial data topics to be covered under this theme include:

- Plots;
- Blocks;
- Easements;
- Rights of Way, and
- Other Encumbrances.

FGDS: The DMA is the de facto custodian agency for these FGDS listed below under the current system.

FGDS Name	Plot Boundaries
Description	This FGDS would ideally include the boundaries for all plots in Belize, with status as declared, undeclared or other differentiated in the tabular information accompanying each plot. This will include all privately and publicly owned lands that are registered with full title information. Whether or not these can be managed in one database that also includes the boundaries of National Estate lands that are either leased and/or undergoing full title development will depend on how this information is modeled in the Landfolio system
Current Status	The MNRA Landfolio system is being used to develop, process and manage all the land cadastre information. The system is complete for declared lands and under process for undeclared National Estate leases

	and land allocations or sales.
Future Program Considerations	There is a need to complete the registration of undeclared National Estate lands to fully titled and registered plots. At present this is being conducted incrementally as issues arise. There will continue to be issues and significant time expended until the registration process can be completed. Once completed this could greatly simplify the cadastral management issue in Belize, strengthen the real estate market, and provide the greater certainty and clarity that is needed to attract private investment. Accelerating this process would require additional investment in the near term, but likely would yield significant return on investment in the near future.
Custodianship Considerations	Custodianship for the plot data will logically remain with the MNRA Department of Lands and Surveys. However, this information should be made more interoperable with other geospatial services and other agencies. The issue of charging for the use of this information, especially by other government agencies, should be carefully evaluated.
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Block Boundaries
Description	The Block Boundaries FGDS is derived from the Plots data, representing an amalgamation of an urban neighborhood unit usually surrounded by streets. Block boundaries are useful both for presenting more generalized version of an urban area landbase and may also be suitable as a basis for census or other statistical reporting.
Current Status	There is currently no comprehensive cover of block boundaries for Belize.
Future Program Considerations	Block Boundaries can be derived from the Plots data. This would need to be updated on a periodic basis, in alignment with updating of the plots data.
Custodianship Considerations	Custodianship for the Block Boundary data will logically remain with the MNRA Department of Lands and Surveys and made available to the BNSDI community for their use.
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Easements
Description	This FGDS would delineate easements as a property interest which one person has in land owned by another entitling the holder of the interest to limited use or enjoyment of the other's land (Ardary, 2005). Typically easements have a geographical extension and can be modeled

	as spatial features. Easements which are not localized (do not have a distinct legal description/boundaries), are considered as an attribute to a property parcel. When easements are represented spatially, they should have the same accuracy as the parcels themselves, which is typically found at the engineering scale. The compilation of easements is part of the parcel compilation process.
Current Status	NOT CLEAR IF EASEMENTS ARE ACCOMMODATED IN THE EXISTING PROPERTY LAWS IN BELIZE – NEED TO REVIEW WITH MNRA.
Future Program Considerations	DEPENDENT UPON ABOVE INVESTIGATION
Custodianship Considerations	Custodianship for the Easement data will logically remain with the MNRA Department of Lands and Surveys.
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Right of Way
Description	These represent the right or privilege to pass over a designated portion of the property of another (Ardary, 2005). Rights of way (ROW) are most often used to indicate the allocation of land for public or utility passage, e.g. a street ROW or an ROW for an electrical transmission facility. Rights of way have a geographical extension and can be modeled as spatial features, and the accuracy requirement may be the same as a parcel or easement. Rights of way which are not sufficiently localized (do not have a distinct legal description/boundaries), are considered as an attribute to a property parcel or may be described in their general locational terms. The compilation of rights of way is part of the parcel compilation process.
Current Status	No additional information provided
Future Program Considerations	To be determined
Custodianship Considerations	Custodianship for the Right of Way data will logically remain with the MNRA Department of Lands and Surveys.
Security Considerations	It is not expected that this data presents any security considerations.

4.3 Planning Areas

General Considerations: Planning Areas include any areas that have been designated for some special land use, preservation or other management treatment or controls. Generally

speaking, the designation of planning areas is usually the result of some spatial planning process that may be codified in law, in the case of boundaries that have legal regulatory standing, or in practice where these are related to land use and development capital improvement areas or corridors.

Business Requirements. Spatial planning may be carried out at many levels from national down to individual neighborhoods, depending on the purpose and topic involved. For example, land use planning can include regional delineation of target development areas and the major infrastructure components needed to support them, versus neighborhood level zoning that will indicate the specific allowed land uses, building setbacks and height limitations, floor area ratios, and other development controls.

Planning Areas in Belize have three major types of requirements that can be addressed through GIS and the BNSDI. The first is the definition of planning areas as a product of a planning process. This can range from urban land use plans to protected areas zoning and forest management plans. The second type of requirement includes the use of plans as part of a development or use control framework. The third is in the utilization of plan information shared by multiple organizations as a foundation for collaborative planning and alignment.

The full range of BNSDI stakeholder activities that have some direct need for Planning Area data are depicted in Appendix B. According to this information, nearly 60% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for Planning Area data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Designate regional planned land use and zoning;
- Designate special economic development zones;
- Delineate regional areas for environmental protection;
- Delineate areas for transportation planning;
- Delineate areas for emergency planning;
- Delineate regional areas for special management treatment (e.g. regulated fishing areas);
- Indicate regional areas for watershed protection limiting land uses that can impact groundwater resources in key recharge areas;
- Identify regional staging areas for disaster contingency planning and response;
- Coordinate regional utility developments including utility service corridors;
- Designate regional areas for allocation of real estate;
- Designate areas for future landfills or other specific uses.
- Designate planned land use and zoning at the plot, site, or large scale area;
- Designate special economic zones;
- Delineate areas for environmental protection;
- Develop forest management plans;

- Establish well-head protection areas for limiting land uses that can impact groundwater resources;
- Identify specified staging areas for disaster contingency planning and response;
- Coordinate utility developments including utility service corridors;
- Issue and administer commercial licenses (with reference to zoning indicating what zones a particular commercial business may operate within);
- Building construction permitting (reference to planned land use and associated land use, setback, and other special building regulations);

Planning area delineation may be carried out at many levels from national down to individual neighborhoods, depending on the purpose and topic involved. For example, land use planning can include regional delineation of target development areas and the major infrastructure components needed to support them, versus neighborhood level zoning that will indicate the specific allowed land uses, building setbacks and height limitations, floor area ratios, and other development controls.

Current Situation: There are a wide variety of planning efforts crossing most of the BNSDI stakeholder community. Most of these ultimately related to place specific plans and projects that have interdependencies, overlaps and gaps that require alignment and can benefit from spatial mapping.

National Plans

- Horizon 2030 Development Strategy;
- 2009-2013 National Poverty Elimination Strategy and Action Plans (NPESAP);
- National Medium-Term Development Strategy (MTDS) (2010-2013).

Sector Specific Plans

- Agriculture Development Management and Operational Strategy (ADMOS);
- Belize Rural Area Development Strategy (BRADS);
- National Sustainable Tourism Master Plan (NSTMP);
- National Land Use Policy and Planning Framework (NLUPP);
- National Environmental Action Plan (NEAP);
- National Environmental Policy and Strategy;
- Sustainable Chemical Management Action Plan;
- National Protected Areas Policy and Systems Plan (NPAPSP);
- National Health Plan and Policy;
- National Plan of Action for Children and Adolescents;
- National Plan Toward Eradicating Child Malnutrition in Belize;
- Food and Security National Policy;
- Land Suitability Mapping System for Belize;
- National Energy Policy (NEP);
- National Water Master Plan (pending via NIWRA);

- Comprehensive Climate Change Adaptation Policy;
- Belize Climate Resilience Investment Plan (BCRIP);
- Belize Climate Resilient Infrastructure Project (CRIP).

Municipal Development Plans

- Municipal Development Project

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 11 – Data Sources Related to Planning Areas Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Corozal District North	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Tourism & Wildlife Reserves for the Northern Part of the Corozal District. The development plan was prepared by the Land Utilization Authority.
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Corozal District East	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Tourism & Wildlife Reserves for the Eastern portion of the Corozal District. The development plan was prepared by the Land Utilization .
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Orange Walk District East	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry and Wildlife Reserves & Environmental Protection for the Eastern portion of the Orange Walk District. The development plan was prepared by the Land Utilization Authority.
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Belize District Northeast	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry, Wildlife Reserves & Environmental Protection for the Northeastern portion of the Belize District. The development plan was prepared by the Land Utilization Authority as specified on the Land Utilization Act Chapter 188 Revised Edition 2003 whowing the Subsidiary Laws as at October 2003

MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Burrell Boom/Hattiev ille/Ladyville	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry, Wildlife Reserves & Environmental Protection for the portion of the Belize District known as Greater Belize Area which includes Burrell Boom Village, Hattiev ille Village & Ladyville Village. The development plan was prepared by the Land Utilization Authority.
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Manatee	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry, Wildlife Reserves & Environmental Protection for a portion of the Belize District in the Manatee Area. The development plan was prepared by the Land Utilization Authority.
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Manatee West	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry, Wildlife Reserves & Environmental Protection for a portion of the Belize District in the Manatee West Area. The development plan was prepared by the Land Utilization Authority.
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Cayo District West	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry, Wildlife Reserves & Environmental Protection for the Western Portion of the Cayo District which includes Benque Viejo, Santa Elena and San Ignacio Areas. The development plan was prepared by the Land Utilization Authority.
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Mango Creek	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry, Wildlife Reserves & Environmental Protection for the Mango Creek Area in the Stann Creek District. The development plan was prepared by the Land Utilization Authority.
MNRA	Lands and Surveys Department	Land Information Centre	Special Development Area Monkey River	This dataset demarcates the zonation and diversity of Different types of Development regarding to mainly Agriculture, Residential, Commercial, Tourism, Forestry, Wildlife Reserves & Environmental Protection for the Monkey River Area in the Toledo District. The development plan was prepared by the Land Utilization Authority.

MNRA	Lands and Surveys Department	Land Information Centre	Land Use Project Mapping System 2011	This folder contains all documents, maps and spatial data related to the Land use Project Mapping System 2011. The Mapping System is an integral part of the land use planning framework. In the absence of a national zoning strategy and zoning plan it will help in the visualization and analysis of spatially enabled data to support decision making. This was done through a consultancy by Jan Meerman, Marion Cayetano and John McGill, 2011.
Ministry of Forestry, Fisheries and Sustainable Development	Department of Forestry		Sustainable Forest Management plan (SFMP)	SFMP's must be produced by forestry companies as a comprehensive guide to the sustainable management of that the particular license area. It should take into consideration all the environmental idiosyncrasies of the area for optimum management for a term of the contract which ordinarily spans thirty to forty years. Every year thereafter they are required to submit an Annual Plan of Operations (APO) which details their activities for that particular logging year and all provisions being made to ensure compliance with license conditions and the approved SFMP guidelines.
Ministry Of Tourism, Culture and Civil Aviation	Ministry and Belize Tourism Board		Belize Tourism Attractors Map	A map of tourism attractors was developed as part of the preparation of the National Sustainable Tourism Masterplan for Belize 2030.
Ministry Of Tourism, Culture and Civil Aviation	Ministry and Belize Tourism Board		General Tourism Development Targets	A generalized map indicating areas and general tourism development approach as identified in the National Sustainable Tourism Masterplan for Belize 2030.
Ministry Of Tourism, Culture and Civil Aviation	Ministry and Belize Tourism Board		Tourism Development Model – National Level	A generalized map indicating areas and general tourism development models identified in the National Sustainable Tourism Masterplan for Belize 2030.
Ministry Of Tourism, Culture and Civil Aviation	Ministry and Belize Tourism Board		Tourism Development Model – Regional Level	A generalized map indicating areas and general tourism development models for a regional as identified in the National Sustainable Tourism Masterplan for Belize 2030.

Topics: General data topics that are expected to be included in the BNSDI under this theme include: Planned Land Use, Area Plans, Zoning Areas, Special Development and Other Use Restriction Areas.

- National Spatial Plan
- Area Plans
- Regional Plans

- Urban Design Areas
- Special Development Areas
- Natural Resource Management Plans

FGDS: In reality, there will ultimately be many specific FGDS layers that will fall within this general theme, and these will need to be incorporated to the FGDS identification process as they are identified and/or developed. In general, the following FGDS can be expected to be of common interest to the BNSDI community at the large and medium scales.

FGDS Name	Planning Areas
Description	Planning Areas include any areas that have been designated for some special land use, preservation or other management treatment or controls. This FGDS represents a suite of themes, each depicting the spatial aspects of specific plans, with linkages to the supporting documentation
Current Status	At present there is no central repository for planning area data across all sectors.
Future Program Considerations	The development of a central repository for planning area data across all sectors will require a government policy to do so and the technical standards and infrastructure, application software and standard operating procedures that would be required to streamline the capture and maintenance of this information from the various involved stakeholders.
Custodianship Considerations	Custodianship for Planning Area information should be maintained with the responsible agency for each plan. The facilitation and management of a centralized archive on behalf of the Government as a whole should be handled by the BNSDI coordination and support unit.
Security Considerations	It is not expected that this data presents any security considerations.

4.4 Political/Administrative Areas

Political/Administrative area boundaries delineate the extent of various municipal, national, and government jurisdictions. Political/Administrative Area boundaries are generally captured at the medium scale. However, knowing the administrative area of such large scale features as plots, buildings, or neighborhoods is critical information for many applications to verify jurisdiction.

General Considerations: Administrative areas refer to formally adopted jurisdictions that are defined for political or administrative purposes. The primary purpose of the political and administrative boundaries is to provide a general reference to jurisdictional distinctions across larger geographic areas. Depiction of these boundaries at the large scale is necessary to show

divisions at the sub-city and neighborhood levels. Depiction at the medium scale is more appropriate for a broader view of the boundaries, including those that transect large areas of unsettled territory, although even these may have very detailed legal survey descriptions associated with them, especially where these are defining international borders or highly formalized sub-country districts.

At any scale, political/administrative boundaries are depicted as polygons. Administrative boundaries are often defined as running along a street intersection or block face in urban areas, along distinct natural features in rural areas, or simply transecting large empty areas that have no defining features. These boundaries are usually defined and adopted through a political and legal process. Once adopted, usually one organization such as a national mapping organization is responsible for accurately reflecting these legal boundaries in mapped form.

Business Requirements. The full range of BNSDI stakeholder activities that have some direct need for Political/Administrative Boundary data are depicted in Appendix B. According to this information, nearly 74% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Clearly delineate the extent of municipal and town jurisdictional authorities and responsibilities to government entities and the public;
- Delineate election districts and manage voting process;
- Provide a common framework for the establishment of regional and local offices of the various government entities to best serve the public;
- Provide a logical geographic framework as a reference for community planning and design;
- Provide a common logical breakdown of areas for coordinated community development, utility coordination and services areas, and other purposes;
- Used in combination with population and voter registration data to support voting area redistricting;
- Provide a consistent and common framework for community data collection, statistical reporting and thematic mapping.

Current Situation: The following summarizes the current situation with political/administrative mapping in Belize as identified through the BNSDI Stakeholder Situation Survey:

National and subnational boundaries. No additional information provided

Municipal boundaries. No additional information provided

Electoral boundaries. Belize has two Electoral Management Bodies (EMB), The Elections and Boundaries Commission and The Elections and Boundaries Department. The Belize

Elections and Boundaries Commission is the primary electoral body in Belize and supervises all local and national elections. The Commission also establishes the boundaries of Belize's electoral divisions. The Belize Elections and Boundaries Department is the direct administrator of Belizean electoral politics. It was established in 1989 as a subordinate to the Elections and Boundaries Commission.

Exclusive Economic Zones. An exclusive economic zone (EEZ) is a sea zone prescribed by the United Nations Convention on the Law of the Sea over which a state has special rights regarding the exploration and use of marine resources, including energy production from water and wind. It stretches from the baseline out to 200 nautical miles (nmi) from its coast.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 12 – Data Sources Related to Political/Administrative Areas Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Belize Electoral Divisions	The Electoral Division layer shows the location and extent of all official Electoral Divisions across Belize. The Statutory Instrument (SI's) for the electoral divisions in Belize were compiled into a single layer covering the country. Each SI includes a textual description of the boundaries of each area, inclusive of UTM coordinates as well as other locational references.
MNRA	Lands and Surveys Department	Land Information Centre	Belize Polling Area	The Polling Areas layer shows the location and extent of all official Polling Areas that are areas depicted within electoral divisions. Each polling area represent a voting station, there can be several of these within an electoral division The Statutory Instrument (SI's) for the polling areas in Belize were compiled into a single layer covering the country. Each SI includes a textual description of the boundaries of each area, inclusive of UTM coordinates as well as other locational references.
MNRA	Lands and Surveys Department	Land Information Centre	Administrative Boundary	This folder contains maps or.mxd of all towns and cities in Belize, including street maps.
MNRA	Lands and Surveys Department	Land Information Centre	Baseline	Contains baseline maps such Baseline by country, baseline by district and which includes data such as administrative boundaries, roads, rivers and waterbodies
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: Administrative Boundary	Topographic Sheets (DOS)

MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: International Boundary	PAIGH/Topographic Sheets (DOS)
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: Town/City Boundary	Statutory Instruments/LIC
MNRA	Lands and Surveys Department	Land Information Center	Political/Electoral: Belize Electoral Divisions, Belize Polling Areas	Election & Boundaries/LIC
MNRA	Lands and Surveys Department	Land Information Center	Political/Electoral: Belize Electoral Divisions, Belize Polling Areas	Election & Boundaries/LIC
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Country Boundaries	date of publication: unknown. Originator: University of Edinburgh. Preferential Scale: 1:50,000. Notes: according to Chris Hecker's notes (BAS), this layer may actually have been digitized from 1:250,000 Ordnance Survey sheets rather than 1:50,000 sheets.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Boundary Line	date of publication: unknown. Originator: University of Edinburgh. Preferential Scale: 1:50,000. Notes: unlike the other country boundaries dataset listed above, this dataset is merely the line theme of the boundary line which separates Belize from Guatemala and Mexico.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		District Boundaries	date of publication: unknown. Originator: University of Edinburgh. Preferential Scale: 1:250,000 (?). Notes: this dataset seems to have been digitized from the 1:250,000 topographic sheets; the other possibility is that it was digitized from the finer detail 1:50,000 sheets; it should be noted that a number of versions of this dataset exist, including one without the boundaries for the Dangriga cayes, which the common version does include.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		District Boundaries	date of publication: unknown. Originator: Land Information Centre. Preferential Scale: 1:250,000 (?). Notes: this dataset was published on the CCAD web site and can be downloaded therefrom; this dataset is apparently just a merge of the above polyline dataset digitized from the

				1:250,000 topo sheets with the country boundaries polygon dataset.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Electoral Boundaries	date of publication: unknown. Originator: Land Information Centre. Preferential Scale: 1:50,000 (?). Notes: this is a dataset of Belize's existing 29 electoral divisions.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Electoral Boundaries	date of publication: 2005. Originator: Land Information Centre. Preferential Scale: 1:50,000 (?). Notes: in April 2005, the Land Information Centre, along with the Elections & Boundaries Commission, had completed a draft map of re-drawn electoral boundaries; this dataset contains 31 electoral divisions.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Territorial Waters	date of publication: 1993. Originator: Coastal Zone Management Project - World Conservation Monitoring Centre. Preferential Scale: 1:250,000. Notes: this dataset is one of a series that were digitized by Janet Gibson of the CZMP while visiting the WCMC (now UNEP-WCMC) in Cambridge; these were digitized on the 1:250,000 sheets; this dataset includes both a 3 mile and 12 mile maritime boundary.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Territorial Waters	date of publication: 2004. Originator: Meerman (National Protected Areas Policy & System Plan Project - NPAPSP). Preferential Scale: 1:100,000 (?). Notes: utilizing information contained within the Belize Maritime Areas Act of 1992, Meerman has re-drawn the boundaries of Belize's territorial waters and exclusive economic zone; this dataset includes both territorial waters and the exclusive economic zone (EEZ); it is possible that another version of this dataset was created by the Land Information Centre, but its existence cannot be confirmed.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Basemap	Spatial Layer: BASEMAP Source: Meerman, J. C. 2010. Belize Base-map featuring country and district boundaries including correct placement of offshore cays. This dataset corrects several errors and inconsistencies in the "district" basemap commonly used in Belize. Specifically it has the various offshore cays projected in their proper location and also provides greater detail for the district boundaries. Metadata included.

Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Districts	Spatial Layer: Districts. Source: Land Information Centre Spatial Layer [Made public through Paseo Pantera Consortium Univ. of Florida/USAID Digital Geographic Database: Maya Forest Region: Mexico, Guatemala, Belize. Version 1, August 19110.] Note: further modified by Jan Meerman
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Exclusive Economic Zone	Spatial Layer: Exclusive Economic Zone Source: Belize Maritime Areas Act 1992

Topics Topics for this theme include:

- National and Sub-National Boundaries
- Exclusive Economic Zone (EEZ)
- UNCLOS Continental Shelf marine jurisdiction extended
- Electoral Divisions
- Municipal Boundaries

FGDS: The FGDS that are expected to be of common interest to the BNSDI community as FGDS in this category include the following:

FGDS Name	National and Sub-National Boundaries
Description	This FGDS would include the official international and internal administrative boundaries for Belize including the national boundary and sub-national district boundaries.
Current Status	The national and sub-national boundaries for Belize were digitized by the MNRA LIC, apparently from Ordnance Survey topographic basemaps (WHAT SCALE??). It is not clear whether the level of accuracy of this data is sufficient for use at medium scale.
Future Program Considerations	Given the importance of the national and sub-national boundary information it will be important to ensure that this information is as accurate and up to date as possible. This may require going back to original statutory documents to reconstruct the boundary data according to the highest level of documented accuracy that is available.
Custodianship Considerations	Elections and Boundaries Commission
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Electoral Divisions
Description	This FGDS would include the current official Electoral Divisions and Polling Areas. Past boundaries may also be maintained for historical

	reference.
Current Status	Electoral Divisions and Polling Areas data was digitized by the MNRA LIC based on legal descriptions from the statutory documents that formed them.
Future Program Considerations	The actual accuracy of the digitized boundaries based on the automation process used is unclear and will require further validation.
Custodianship Considerations	Elections and Boundaries Commission
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Municipal Boundaries
Description	This FGDS would include the official boundaries for the city and town councils as described in the statutory documents.
Current Status	Municipal and town boundaries have been digitized by the MNRA LIC based on existing statutory documents.
Future Program Considerations	The actual accuracy of the digitized boundaries based on the automation process used is unclear and will require further validation.
Custodianship Considerations	IS THERE A SINGLE ENTITY RESPONSIBLE FOR APPROVING MUNICIPAL BOUNDARIES?
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Exclusive Economic Zone
Description	This FGDS would depict the extent of the Belize Exclusive Economic Zone (EEZ). An EEZ is a sea zone prescribed by the United Nations Convention on the Law of the Sea over which a state has special rights regarding the exploration and use of marine resources, including energy production from water and wind. It stretches from the baseline out to 200 nautical miles (nmi) from its coast. Within this zone can also be added other divisions such as territorial waters and contiguous zone, each of which has regulatory significance.
Current Status	Meerman (National Protected Areas Policy & System Plan Project - NPAPSP) information contained within the Belize Maritime Areas Act of 1992, Meerman has re-drawn the boundaries of Belize's territorial waters and exclusive economic zone; this dataset includes both territorial waters and the exclusive economic zone (EEZ). The MNRA LIC has also produced
Future Program Considerations	Given the importance of the national and sub-national boundary information it will be important to ensure that this information is as accurate and up to date as possible. This may require going back to

	original statutory documents to reconstruct the boundary data according to the highest level of documented accuracy that is available.
Custodianship Considerations	Elections and Boundaries Commission
Security Considerations	It is not expected that this data presents any security considerations.

4.5 Service Areas

General Considerations: Service areas are delineated to help organize and manage service provision for national or local government or other community service providers (such as utilities). Examples of service areas include utility districts, school districts, emergency service response districts, and postal districts.

Service area boundaries are usually delineated at the level that is appropriate to designate the areas in question. Most often service area boundaries are delineated that logically combine contiguous communities to be served by a single facility, regional office or other such division. Sometimes service areas are defined by the physical constraints of the service being provided. Service area boundaries are often utilized with jurisdiction information to determine what organization is responsible for providing what services to what areas.

Urban level service areas may be defined at the large scale as discussed previously, and combined with more general delineations that may be defined against more general information at the medium scale.

Business Requirements. The full range of BNSDI stakeholder activities that have some direct need for Service Area data are depicted in Appendix B. According to this information, nearly 47% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Clearly delineate the geographic extent of government service areas for schools, utilities, postal delivery, police beats, marine patrol areas and others;
- Associate jurisdiction and service areas to determine what organization is responsible for providing what services to what places;

Current Situation: Service areas are maintained by several entities in Belize. There can be no single boundary system that can serve all the entity service area needs. While several entities have developed service areas, many have not including schools and emergency services. It is likely that service areas would be most useful in an integrated layer for other entities to understand which service districts coincide or overlap in their districts, or to help the public contact individual service area offices.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 13 – Data Sources Related to Service Areas Data Theme

MNRA	Natural Resources Department	Industries, Aquaculture and Inland Fisheries, Cooperatives, Policy and Trade (Statistics), Marketing and Project Execution Unit	Belize Cooperatives Register	The MNRA Agriculture Department Cooperatives Unit presently maintains a database of all 265 registered cooperatives in an MS Excel spreadsheet and there is an intention to import this information to an MS Access database in the future. There is also a need to update and cull the information, as only about 56 of the Cooperatives registered are actually active and functioning. Information maintained in the spreadsheet includes the name, date of association, area of operation, number of members, activities they are engaged in and other basic information. In April an effort was started to record and monitor program budgeting baseline and performance indicators which are to be added to the database in the future.
MNRA	Natural Resources Department	Industries, Aquaculture and Inland Fisheries, Cooperatives, Policy and Trade (Statistics), Marketing and Project Execution Unit	Agricultural Extensions Service Areas	The MNRA Agriculture Department Marketing Unit has developed a GIS-based Agricultural Extensions Service Areas database indicating the location of agriculture extension offices and the boundaries of the service area for each.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Transit Zones and Routes	The MoWT Transport Department has in the past maintained a paper map of transit zones, routes and terminal locations. This information is not maintained on a regular basis although staff have indicated they would like to do this in a GIS format in the future and make this information available for use by the transit riding public
Utilities	Belize Water Supply Ltd.		Water Delivery Zones Map	A map of the water delivery zones in each city is maintained by the BWSL in AutoCAD format. This map depicts the zone boundaries and the main connectors, valves and meter locations between zones. Water delivered into each zone is metered and used to determine the difference between water delivered to the zone versus that consumed at metered customer locations, thus implying non-revenue water loss to system leakage or illegal tapping.

Topics: Topics for this theme include:

- Utility Service Areas
- Government Service Areas

FGDS: The following service areas are expected to be needed in common by the BNSDI community:

FGDS Name	Utility Service Areas
Description	This FGDS would include the delineation of the areas served by each of the utility companies in Belize, including any internal divisions that may help to refine what units service what areas (e.g. inspection zones, maintenance areas, electrical circuit areas, water district areas, etc.)
Current Status	The utility companies each has their own delineation of service areas that are used for operational purposes, but none have been captured in a digital GIS form. These are important for other government entities to be aware of, and may be of some significance for directing e-Government Portal users to the correct entity and office.
Future Program Considerations	The delineation and maintenance of service delivery areas can help to
Custodianship Considerations	Elections and Boundaries Commission
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Government Service Areas
Description	This FGDS would include the delineation of government service areas. This would include, as appropriate, school districts, postal code areas, solid waste pickup areas, police beats, agriculture extension service areas and others.
Current Status	There is presently no standardize or centralized database of government service areas in Belize. Each entity maintains their own maps of this information but most of these are not automated in a GIS form.
Future Program Considerations	The delineation and maintenance of service delivery areas can help to expedite connecting customers to service providers. Once developed, this sort of database can allow a government portal user to specify their location and quickly learn whom to contact in regards to a particular service. This online service could be an value-add to the eGovernment program.
Custodianship Considerations	Each government entity should be responsible for the development and maintenance of their own service area map and associated contact

	information. The BNSDI coordination unit should be responsible to compile this information along with other useful jurisdiction information to a centralized archive to support integrated access and use.
Security Considerations	It is not expected that this data presents any security considerations.

4.6 Special Management Areas

General Considerations: Special management areas are delineated for the purpose of protecting unique (rare) or representative sites of cultural or natural heritage, concession areas for mineral or petroleum exploration and/or production, or other areas that have special conditions that warrant special treatment. These types of areas have policies, laws or contracts that protect them, define how they will be managed and serve to limit their use for other purposes. Examples of special management areas include restricted fishing areas, wildlife protection areas, or archeological reserves. Although the boundaries are legally defined in most cases, their use is typical at the medium scale. Large scale use would be warranted if a particular management zone boundary was close to a site area that is impacted by the zone or a proposed activity was close to management area.

Special Management Areas may be established as part of a comprehensive land use planning program, or may be nominated by an environmental agency or other entity. Because these designations will represent an official designation that will impact land use entitlements and affect properties and livelihoods, establishing such areas normally involves a well-structured and systematic process and official recognition.

Business Requirements. Special Management Areas are an important reference in the BNSDI to both provide a consolidated view of the location and extent of controlled areas as well as support land use planning, development and permit approvals and any process that requires recognition of a special condition that may impact land use and related decision making.

While some aspects of this topic may be compiled through Large Scale mapping, most such areas will be mapped at Medium Scale, reflecting that some of these areas are only generally defined.

The full range of BNSDI stakeholder activities that have some direct need for Special Management Area data are depicted in Appendix B. According to this information, nearly 49% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Provide a consolidated view of all controlled use areas crossing all Ministries and sectors;
- Designate areas for special protection or limits of use to ensure the protection and preservation of special cultural and natural resources;
- Provide an input and overlay to long range land use and other planning efforts that may overlap or impact Special Management Areas;
- Ensure that special protection status is recognized in any development proposals or activity permitting (quarrying, fishing, tourist development, etc.);
- Highlight and raise awareness and appreciation of the special resources that are being protected within an Area;
- Preserve special areas for long term scientific study and monitoring;
- Limit certain land uses and practices in important groundwater recharge areas;

Current Situation: There are currently a variety of designated Special Management Areas in Belize today. While individual organizations maintain their own information regarding areas under their jurisdiction, the MNRA LIC has compiled a complete GIS layer coverage of all official protected areas. These were compiled from the Statutory Instruments that created them. Attribute fields were added for the type of reserve, reserve name, SI number, calculated acreage, documented acreage (official), management authority, IUCN category.

The CZMAI similarly developed a Marine Protected Areas (MPA) coverage based on bounding coordinates provided by Government of Belize Statutory Instruments which delineate the boundaries of the various protected areas dotting the marine landscape. While originally developed in 2003, the dataset is also current as of 2004, as the network remained unchanged until February of 2005 with the declaration of the St. George's Caye Mangrove Reserve (not included in this dataset).

CZMAI also compiled a protected areas coverage using the various issues of the Government Gazette Statutory Instruments with added information of private landholdings that opt to qualify as a Private Protected Areas within BAPPA. The latter are included for planning purposes, although as yet un-recognized, these candidate private PA's are typically being managed for biodiversity protection and thus form an extra tool in the management of national biodiversity resources. This is a work in progress with several inconsistencies (largely as a result of insufficient descriptions and generally lacking topology).

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 14 – Data Sources Related to Special Management Areas Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Protected Areas	The Protected Areas layer shows the location and extent of all official protected areas across Belize. The Statutory Instrument (SI's) for protected areas in Belize were compiled into a single layer covering the country. Each SI includes a textual description of the boundaries of each area, inclusive of UTM coordinates as well as other locational references. Attribute fields were added for the type of reserve, reserve name, SI number, calculated acreage, documented acreage (official), management authority, IUCN category.
MNRA	Lands and Surveys Department	Land Information Centre	Spawning Site/ Aggregation Sites	
MNRA	Lands and Surveys Department	Land Information Centre	Bird Sanctuaries	This layer shows a point location for all Bird Sanctuaries
MNRA	Lands and Surveys Department	Land Information Centre	Protected Areas	Contains data and maps related to all protected areas in Belize including marine reserves
MNRA	Lands and Surveys Department	Land Information Centre	Belize Audubon (BAS)	Contains baseline data and areas manage by Belize Audubon Society.
MNRA	Lands and Surveys Department	Land Information Center	Protected Area: Protected Area	Forest Dept/Min of Agric & Fisheries/LIC
MNRA	Lands and Surveys Department	Land Information Center	Protected Area: Spawning Site/ Aggregation Sites	Min of Agric & Fisheries/LIC
MNRA	Lands and Surveys Department	Land Information Center	Protected Area: Mayan Sites	NICH
MNRA	Lands and Surveys Department	Land Information Center	Protected Area: World Heritage Sites	UNESCO/CZMAI/Min of Agric & Fisheries
MNRA	Lands and Surveys Department	Land Information Center	Protected Area: Bird Sanctuaries	Forest Department
MNRA	Lands and Surveys Department	Land Information Center	Protected Area: Reef	CZMAI

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Protected Areas	date of publication: 2001. Originator: Land Information Centre. Preferential Scale: 1:100,000. Notes: this dataset, corresponding to the protected areas system in 2001, can be downloaded from the CCAD site; datasets of earlier protected areas coverages, are also in existence.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Protected Areas	date of publication: 2005. Originator: Meerman. Preferential Scale: 1:100,000. Notes: this is a significant update of earlier protected areas coverage data; updates to site boundaries have been done using data contained within Statutory Instruments; this dataset also contains Bird Sanctuaries and certain archaeological reserves not mapped in earlier datasets (but which nonetheless existed in earlier periods).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Protected Areas	date of publication: 2011. Originator: unknown. Preferential Scale: unknown.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Protected Areas	date of publication: 2011. Originator: Meerman. Preferential Scale: unknown. Notes: Digital protected area polygon data were created using the various issues of the Government Gazette Statutory Instruments with added information of private landholdings that opt to qualify as a Private Protected Areas within BAPPA. The latter are included for planning purposes, although as yet un-recognized, these candidate private PA's are typically being managed for biodiversity protection and thus form an extra tool in the management of national biodiversity resources. This is a work in progress with several inconsistencies (largely as a result of insufficient descriptions and generally lacking topology).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Protected Areas	date of publication: 2012. Originator: Land Information Centre. Preferential Scale: 1:100,000. Notes: The dataset was developed to assist the Ministry of Natural Resources and the Environment and Government of Belize for better decision making, sustainable development and conservation of our Natural Resources.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Marine Protected Areas	date of publication: 2004. Originator: Coastal Zone Management Institute. Preferential Scale: 1:100,000. Notes: The Marine Protected Areas (MPA) coverage developed by the Coastal Zone Management Institute is based on bounding coordinates provided by Government of Belize Statutory Instruments which delineate the boundaries of the various protected areas dotting the marine landscape. While originally developed in 2003, the dataset is also current as of 2004, as the network remained unchanged until February of 2005 with the declaration of the St. George's Caye Mangrove Reserve (not included in this dataset).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		No take Zones	date of production: 2011. Originator: Lands Information Centre. Preferential Scale: unknown. Notes: Digital protected area polygon data was created using the legal descriptions of the boundaries as published on the Government Gazette Statutory Instruments (legal decrees).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Archaeological Sites / Reserves	date of production: unknown. Originator: Land Information Centre. Preferential Scale: 1:250,000. Notes: this is a dataset of Archaeological Reserves, probably digitized directly from the most recent 1:250,000 topographic sheets; this dataset only contains 8 sites and may not be the most recent of the Archaeological Reserve datasets.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Archaeological Sites / Reserves	date of production: 2005. Originator: Meerman (National Protected Areas Policy & System Plan Project - NPAPSP). Preferential Scale: 1:100,000. Notes: this is a dataset of Archaeological Reserves; this contains 12 reserves.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Spawning and Agreggation Sites	date of production: 2003. Originator: unknown. Preferential Scale: unknown. Notes: developed from the 2003 protected areas layer.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Spawning and Agreggation Sites	date of production: 2011. Originator: Unknown. Preferential Scale: unknown. Notes: this was extracted from the 2011 protected areas layer to develop the spag sites that were added .
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Protected Areas	Spatial Layer: Protected Areas Source: GOB Gazettes

Topics: Data topics expected to be covered under this theme and of FGDS interest to the BNSDI community include the following.

- Protected Areas (marine and terrestrial);
- Designated Cultural Heritage;
- Designated Natural Heritage;
- Sensitive Habitat Areas;
- Mineral Concession Areas;
- Petroleum Concession Areas.

FGDS: FGDS for the theme include the following:

FGDS Name	Protected Areas
Description	This FGDS would include the location, extent, status and other essential information regarding all marine and terrestrial protected areas in Belize.
Current Status	Several organizations have compiled protected area boundaries at different times and for different purposes. MNRA LIC has compiled (a complete GIS layer coverage of all official protected areas. These were compiled from the Statutory Instruments that created them. The CZMAI similarly developed a Marine Protected Areas (MPA) coverage based on bounding coordinates provided by Government of Belize Statutory Instruments which delineate the boundaries of the various protected areas dotting the marine landscape. While originally developed in 2003, the dataset is also current as of 2004, as the network remained unchanged until February of 2005 with the declaration of the St. George's Caye Mangrove Reserve (not included in this dataset). CZMAI also compiled a protected areas coverage using the various issues of the Government Gazette Statutory Instruments with added information of private landholdings that opt to qualify as a Private Protected Areas within BAPPA. The latter are included for planning purposes, although as yet un-recognized, these candidate private PA's are typically being managed for biodiversity protection and thus form an extra tool in the management of national biodiversity resources. This is a work in progress with several inconsistencies (largely as a result of insufficient descriptions and generally lacking topology).
Future Program Considerations	The delineation and maintenance of service delivery areas can help to expedite connecting customers to service providers. Once developed, this sort of database can allow a government portal user to specify their location and quickly learn whom to contact in regards to a particular service. This online service could be an value-add to the eGovernment program.

Custodianship Considerations	Each government entity should be responsible for the development and maintenance of their own service area map and associated contact information. The BNSDI coordination unit should be responsible to compile this information along with other useful jurisdiction information to a centralized archive to support integrated access and use.
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Designated Heritage Area
Description	This FGDS would include the location, extent, status and other essential information regarding all designated natural and cultural heritage areas in Belize.
Current Status	Multiple organizations have compiled information regarding areas of Belize that have officially recognized cultural or natural heritage value, but have not been assigned a legal protected area status. This includes areas of substantial archeological resources, biodiversity value, sensitive landscape areas, and others
Future Program Considerations	Compiling all the officially identified natural and cultural heritage areas in a single mapped resource would be useful to alert land use and utility planners, developers and resource managers of the existence of special and/or sensitive resources that may impact their plans or activities.
Custodianship Considerations	The development and custodianship of this FGDS would logically be with the MFFSD in collaboration with other organizations involved in natural and cultural resource heritage conservation.
Security Considerations	It is not expected that this data presents any security considerations.

FGDS Name	Concession Areas
Description	This FGDS would include the location, extent, status and other essential information regarding all designated mineral, petroleum and other extractive industry concession areas in the Country..
Current Status	The management of concession area boundaries are carried out separately by the organizations that administer them.
Future Program Considerations	Compiling all of the concession area information to an integrated FGDS for use by the BNSDI community would help to ensure that these areas were considered in any land use or conservation planning activities.
Custodianship Considerations	The development and custodianship of the underlying concession information would logically be with the organizations that administer them. This information could be periodically consolidated to the

	integrated FGDS by the BNSDI spatial data coordination unit.
Security Considerations	It is not expected that this data presents any security considerations.

4.7 Statistical Areas

Statistical areas are defined as an area for statistical enumeration or as the basis for summarizing information that has been collected at a more detailed level. This includes census enumeration areas and other areas created solely for aggregating and reporting statistical data. At the large scale it is useful to know which statistical area a location such as address, building, plot, or small neighborhood lies to extract relevant statistical information about that location. Statistical data, including census data, is typically generalized and used at the medium to small scale.

General Considerations: Statistical areas are defined as the basis for summarizing tabular statistical information by geographic area. These may include pre-set boundaries within which the data collectors codify the information in aggregate form for summary reporting and thematic mapping purposes. Alternatively, information that has been collected at a very specific level can be aggregated upwards to more general areas by overlay analysis and statistical summarization in a GIS. Wherever practical, it is generally better to capture information in its most disaggregated form which then allows for a variety of spatial and topical summaries to be made depending on the purpose of each summary.

Statistical data such as population and industrial surveys, are often conducted at a household by household, or individual business basis. This means at its source, the data is collected at the most disaggregated level, however traditionally this information has been coded to an enumeration District, in part due to legacy complications in determining the exact geographic coordinate location of the building or feature location. With modern GPS and a variety of location-aware mobile devices it is now very practical to collect a more precise geographic location reference for each surveyed entity (family, business, etc.). The data can then be aggregated to the defined statistical area or other useful geographic areas as needed, while applying anonymization routines that preserve privacy. By maintaining the data at the source level, and utilizing GIS tools, disaggregated information can be summarized at a variety of useful geographies based on the need and subject area.

In addition, aggregated data can be overlaid with other information to create useful statistical summaries that are difficult or impossible to do without such tools. For example, administrative or service areas can be overlaid on utilities to select all the utility networks falling within such boundary and then generating a summary report about that information.

For statistical surveys or population census, the confidentiality of data collected at the disaggregated level needs to be maintained according to government policies and regulations. If information about individual survey participants is maintained as secure then participants

are much more likely to participate if they know their information is confidential. There are available internationally various anonymization rules and tools to apply them to ensure that the proper level of treatment of private information is maintained.

Most statistical area mapping is carried out at the medium and small scales. However, some boundaries that may be mapped at the large scale, such as administrative boundaries in discrete urban areas, which may also be used to generate more generalized views of this information.

The advantage of pre-set statistical reporting area boundaries is that historical statistics for the same area over time can be compared to understand changing conditions and trends. The disadvantage of this approach is that areas may change over time, so much so that the criteria by which they were originally defined are no longer relevant (e.g. an under developed area densifies or an administrative boundary is changed). By compiling the raw survey information at a more discrete level, it is then possible to recompile information for the same original geographic area, even if the enumeration and official reporting boundaries change over time.

Business Requirements. Statistical Areas and the tabular statistical information that are linked to them provide an important measurement of conditions and trends within an area, and the basis for making forward projections based on policy and planning scenarios.

The full range of BNSDI stakeholder activities that have some direct need for Statistical Area data are depicted in Appendix B. According to this information, over 50% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Support thematic mapping of population census data to better understand the location, extent and nature of the population of Belize by discrete geographic areas, and display and analyze these changes over time;
- Support thematic mapping and reporting of other sector data that has geographic relevance (income surveys, housing conditions, land use, solid waste generation, etc);
- Conduct spatial analysis of socioeconomic data to assess and compare requirements and access to various community facilities and services likes schools, health care, fire stations, polices stations and others;
- Analyze utility demands and loads;
- Provide input to traffic analysis models;
- Identify population profiles for transit route and stop designations;
- Overlay service area boundaries on census data to analyzed populations served;
- Overlay air quality and other ambient environmental monitoring data on geocoded patient data to assess environmental health linkages;

- Overlay various administrative or service area boundaries on geocoded building information to assess potential impacts and strains on these services that can be expected;
- Conduct service area analysis for various community facilities and service points using distance and accessibility factors;
- Analyze the distribution of certain types of businesses to identify un-served markets.

At any scale, statistical areas are represented as polygons. Statistical area boundaries such as those used for population census may be hierarchically nested, i.e. large area units represent aggregations of smaller ones that make them up.

Statistical area boundaries such as those used for population census are usually generated based on the needs of an initial survey, then updated and further subdivided in the future as a population grows and as urbanization extends to new areas. Each statistical area is assigned a unique number, and that number may be part of a concatenated key that reflects the geographically hierarchical nature of the units involved.

One of the key statistical data sets having special significance for the BNSDI community is the Census Enumeration area. As per the international standard definition, a Census Enumeration (EA) area is an area bounded on all sides typically by visible features, such as streets, roads, streams, railroad tracks, and by invisible boundaries, such as city, town, and Country limits, property lines, and short, imaginary extensions of streets and roads. Generally, census EAs are small in area; for example, a block bounded by city streets. However, census EAs in sparsely settled areas may contain many square kilometers of territory.

Current Situation: The Statistics Institute Belize (SIB) is responsible for all reporting of all government statistics. Today the majority of population census and housing statistics are reported by District. It has been recognized that this level of aggregation limits the usefulness of the data for community planning and area-specific policy analysis. The SIB is currently experimenting with the collection of raw data, where relevant, at the building or specific location coordinates thus allowing this information to be spatially aggregated to a variety of geographic boundaries.

It has been recognized that the presentation of certain information must be “anonymized” to preserve privacy, in accordance with national law. The SIB is investigating various international norms for carrying out this procedure and will be testing these in advance of the next population census.

Current Data Sources: All SIB data is either collected through original field surveys or the consolidation of information provided by each sector.

Topics: Topics in this theme include:

FGDS: The following data theme is expected to be of common FGDS interest to the BNSDI community. It is expected that additional statistical area boundaries will be added in the future.

FGDS Name	Census Statistical Areas
Description	Future
Current Status	To be implemented in the future
Future Program Considerations	The collection of building points and/or footprints to which original raw data can be tied will open new flexibility for how population census, housing and other original field collected data are analyzed and reported
Custodianship Considerations	SIB is the only entity in Belize authorized to compile and publish official government statistics
Security Considerations	Some data will need to be “anonymized” before publishing to be in compliance with the privacy provisions of the national statistical law

5.0 ENVIRONMENTAL

Environmental data typically include features of the natural environment such as land cover, soils, geology, archaeological sites, sensitive flora or fauna locations, and other information. The development of accurate environmental databases can help us to better understand our natural and cultural heritage, the environmental systems and interactions involved, and through this understanding to better inform rational physical planning, resource management and environmental protection.

Environmental information provides useful information about urban dynamics and its impacts on finer environmental conditions that effect population health as well as provide useful information for urban planning processes. Some environmental data are collected at the level of individual samples or observations (e.g. a soil sample pit, weather station readings or the observation point for an endangered bird). Sample information is often used to derive or inform the development of broader environmental interpretations (e.g. a soil map, average rainfall regimes, or habitat location and extent). Furthermore, multiple environmental variables may be combined and analyzed through GIS overlay analysis to define areas of high biodiversity and conservation value, environmental resources at risk from oil spills, and other such analysis results that can become FGDS data in their own right.

Most environmental information is compiled at the medium and small scales, thus is described in more detail in the Medium Scale section (**Error! Reference source not found.**, Environmental) of this report. The components described here are those that are relevant to large scale mapping.

5.1 Air & Climate

General Considerations: Air quality and climate data have been considered together as a theme, inclusive of Green House Gas (GHG) emissions related to climate change matters. Both air and climate data are collected either from fixed monitoring stations or remotely sensed data and can be dynamic and may change significantly during the day requiring frequent collection. Air and climate monitoring stations collect data often as much as several times per hour. Thus a near constant stream of data from either the fixed station or remotely sense source is necessary to capture air quality and weather data needed for some operations applications. However, many other uses of air and climate data require statistical summaries based on various time periods, such as daily, weekly, monthly, seasonal, yearly, and multi-year increments. In addition to these summaries being available for each monitoring station, if there is an adequate number and distribution pattern it is possible to utilize surface generation functions to derive continuous surface representations of the information from

which “heat map” or isohyet representations can be derived for mapping and spatial analysis purposes.

Climate change has been included in this theme, but involves the measurement and assessment of anthropogenic greenhouse gas (GHG) emissions that contribute to climate change, measurement and monitoring technologies are required to enhance and provide direct and indirect emissions measurements for point and mobile sources using data transmission and archiving, along with inventory-based reporting systems and local-scale atmospheric measurements or indicators. Climate change is measured on a more extended timeframe than most meteorological data, but compliance monitoring for GHG emissions control may dictate more frequent measurements.

Typically the same basic air and climate information derived from monitoring stations can be displayed at both medium and small scales.

Business Requirements. Air and Climate data are required to support a broad range of issues in Belize, and is especially critical to climate resiliency planning and adaptation. The full range of BNSDI stakeholder activities that have some direct need for Air and Climate data are depicted in Appendix B. According to this information, over 56% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- General information for public reference;
- Input to environmental studies and analysis;
- Environmental resources management;
- Agriculture planning and operations;
- Electricity load management;
- Water demand management;
- Urban green area irrigation management;
- Air quality monitoring, assessment and enforcement;
- Forestry planning and operations;
- Water resources management;
- Renewable energies studies (wind, solar, etc.);
- Flooding potential assessment and management;
- Urban planning and design;
- Aviation and marine navigation;
- Disaster contingency planning and response;
- Oil spill contingency planning and response;
- Tourist information services;
- Climate change analysis and forecasts.

Current Situation: The National Meteorological Office of Belize is the leading governmental authority on weather and climate. It provides meteorological and climate-based products and services to the Belizean public through systematic and accurate monitoring and data collection, reliable data analyses and timely dissemination of user-friendly information on regular and emergency events and processes. This is undertaken in order to contribute to the safety and well-being of the people of Belize and the sustainable development of the nation. To fulfil this mission, the Department maintains a network of meteorological observing stations, a Doppler radar, and an upper air observing station. The Weather Forecasting section of the Office is equipped with telecommunication equipment, data analysis and display workstations and satellite receiving equipment.

The National Meteorological Office is responsible for providing aviation weather information and forecasts, and specialized weather forecasts for agriculture, forestry, marine, military, and tourism. It also provides public weather forecasts for the media, which then distributes via newspapers, radio and television. Forecasts are also distributed by the Meteorological Office by facsimile, e-mail, the Department's website and recorded telephone messages. Data are not currently routinely distributed but are made available on a request basis.

The National Meteorological Office at one time also included a Hydrologic Unit that has since been moved to the MNRA NIWRA program. There is an important connection between the weather and hydrologic issues in regards to flooding and other climate related impacts that require close coordination and should be accommodated in the future development of the BNSDI and related information systems.

The National Meteorological Office has not routinely developed GIS-based output products from the weather data. However staff have utilized their own personal copy of Esri ArcGIS software to produce a variety of experimental outputs. Others have created climate related GIS databases for specific projects, but this information appears to have been derived from the National Meteorological Office sources.

According to the Belize National Climate Resilient Investment Plan (NCRIP), "The Belizean economy is highly sensitive to climate variability due to its dependence on natural resources. Tourism, agricultural production and export, and oil extraction are important pillars in Belize's economy which are natural resource based. Between 2008 and present, the country suffered losses in the agricultural and tourism sectors, sustained major impacts on the road networks, and had entire communities displaced for weeks at a time due to climatic events". Furthermore, the NCRIP identified as a priority investment component a hydro-meteorological, topographic and bathymetric data road-map to reinforce the hydrological and meteorological services within Belize by improving data capture as well as its' analysis to meet the specific information requirements of multiple sectors in improving resilience. Given the importance of this information across all sectors this matter should be given more attention in the near future as a fundamental priority related to the BNSDI.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 15 – Data Sources Related to Air and Climate Data Theme

Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize National Meteorological Office	Hydromet	Weather Station Locations Map	The Belize National Meteorological Office collaborated with the Ministry of Natural Resources and Agriculture (MNRA) Land Information Center (LIC) in the development of a map indicating the locations of all meteorological weather monitoring stations across the country. The 34 stations are identified by the name of the community or location in which they are situated.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)	Hydromet	Weather Monitoring Data	The Belize National Meteorological Office was originally entering weather monitoring information to <i>CLICOM</i> , a program for standardized weather data compilation and management prepared by the World Meteorological Organization, World Climate Data and Monitoring Programme (WCDMP). This program developed a standard for weather database management and involved the installation of PC-based climate database software, hardware and a comprehensive training program in more than 100 national meteorological organizations around the world.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Weather Balloon Data	The Belize National Meteorological Office launches a weather balloon from the Philip Gladson International Airport. This is launched daily to measure wind speed and direction, lapse rate, temperature and other factors to determine atmospheric stability and other conditions at different elevations. The balloon is tracked in terms of its geographic location and elevation. After about one hour and once the balloon reaches a certain elevation it bursts and the data recorder is collected and fed into a Weather Balloon Database and transmitted to the University of Wyoming. That information has not been used in other systems to visualize the track and recorded information, but staff indicated this would be a useful GIS application for the future.

Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Weather Radar Station Data	The Belize National Meteorological Office maintains a single weather radar station, located at the Philip Goldson International Airport. The Rainbow 5 system by Gematronik Weather Radar Systems. Rainbow® 5 is a comprehensive, state-of-the-art sensor management system for multi-radar network management, data analysis and display. It fulfills needs in the fields of radar management, weather monitoring/nowcasting, hydrology, aviation and research.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		CIMSS Weather Data Products	The Cooperative Institute for Meteorological Satellite Studies (CIMSS) is a Cooperative Institute formed through a Memorandum of Understanding between the University of Wisconsin-Madison (UW-Madison), the National Oceanic and Atmospheric Administration (NOAA), and the National Aeronautics and Space Administration (NASA) in 1980. CIMSS operates as an institute within the Space Science and Engineering Center (SSEC) at the University of Wisconsin-Madison. CIMSS scientists conduct research using remote sensing systems for meteorological and surface-based applications and provide a variety of products and online services for general use by the public and other meteorological organizations worldwide. The Belize National Meteorological Office utilizes many of the real-time, near real-time, historical and predictive CIMSS products that are made available online.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		National Hurricane Center Storm Tracking Data	The Belize National Meteorological Office utilizes data products from the National Oceanic and Atmospheric Administration (NOAA), U.S. National Weather Office, National Hurricane Center (NHC). The NHC is a component of the National Centers for Environmental Prediction (NCEP) located at Florida International University in Miami, Florida. The HSU prepares and issues analyses and forecasts in the form of text advisories and graphical products. The HSU issues coastal tropical cyclone watches and warnings for the United States and its Caribbean territories and provides watch and warning recommendations to other World Meteorological Organization (WMO) Region IV meteorological services.

Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality				The Geostationary Satellite system (GOES), operated by the United States National Environmental Satellite, Data, and Information Office (NESDIS), supports weather forecasting, severe storm tracking, and meteorology research. Spacecraft and ground-based elements of the system work together to provide a continuous stream of environmental data.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		NCEP Weather and Environmental Forecasts	The Office relies heavily on forecasting information through the United States National Centers for Environmental Prediction (NCEP) which delivers national and global weather, water, climate and space weather guidance, forecasts, warnings and analyses to its Partners and External User Communities. These products and services are based on a service-science legacy and respond to user needs to protect life and property, enhance that nation's economy and support the nation's growing need for environmental information. The centers form part of the National Weather Office.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Rainfall (isohyets)	date of publication: 1973. Originator: Walker. Preferential Scale: 1:250,000 (?). Notes: apparently Meerman digitized Walker (1973)'s map of Belize's isohyets, which was probably in turn generated from data collected or provided by the National Meteorological Service.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Wind Hazard	date of production: 1999. Originator: Caribbean Institute for Meteorology & Hydrology (OAS Caribbean Disaster Management Project). Preferential Scale: 1:4,000,000. Notes: according to the online documentation, this map was prepared by the Caribbean Institute for Meteorology & Hydrology for the OAS' Caribbean Disaster Management Project; the data is cited as having a 1km resolution, and being highly generalized; the TAOS model was used to generate the dataset.

Regional Organizations	CATHALAC		MM5 Weather Model Forecasts	The MM5 (short for Fifth-Generation Penn State/NCAR Mesoscale Model) is a regional mesoscale model used for creating weather forecasts and climate projections. It is a community model maintained by Penn State University and the National Center for Atmospheric Research. The last major MM5 release (3.7) was December 2004, with the last bug fix release in October 2006. Email support has been discontinued, and online documentation and tutorials have been frozen. The Weather Research and Forecasting model (WRF) was designed as the successor to MM5 and includes all capabilities available within the MM5.
Regional Organizations	Caribbean Catastrophe Risk Insurance Facility		NOAA-NHC H*WIND Algorithm	This algorithm rationalises all actual wind speed measurements collected on the ground and from flights and satellites. The H*WIND algorithm produces single wind footprints at a point in time. Also, the H*WIND estimates only surface winds over the open ocean, and therefore it does not include over-land friction and topographic effects (which the CCRIF model fully recognises).
Regional Organizations	Caribbean Catastrophe Risk Insurance Facility		Tropical Rainfall Measurement Mission (TRMM) Satellite Data	The Tropical Rainfall Measuring Mission (TRMM) is a joint mission between NASA and the Japan Aerospace Exploration Agency (JAXA) designed to monitor and study tropical rainfall. Since December 1997, TRMM and the instruments it carries have provided valuable information to researchers, the applications community, and the public.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Rainfall	Spatial Layer: Rainfall Source: Walker, S. H. 1973. Summary of climatic records for Belize. Land Res. Div. Surbiton, Surrey, England, Suppl. No. 3

Topics: The following topics of interest to BNSDI community included within this class of data.

- Meteorological Station Locations;
- Climate Summary Data;
- Derived Climate Isohyets;
- Air Quality Monitoring Station Locations
- Air Quality Data
- GHG Emissions.

FGDS: The following FGDS layers within this data class are of specific interest to the BNSDI Community:

FGDS Name	Meteorological Station Locations
Description	This FGDS will include all of the meteorological station locations linked to a database describing the equipment and characteristics of the station.
Current Status	The Belize National Meteorological Office collaborated with the Ministry of Natural Resources and Agriculture (MNRA) Land Information Center (LIC) in the development of a map indicating the locations of all meteorological weather monitoring stations across the country. The 34 stations are identified by the name of the community or location in which they are situated.
Future Program Considerations	The current data layer does not describe the equipment and characteristics of the existing mapped meteorological sites. This information would be valuable reference for researchers using the monitoring data. Also for possible consideration is the development of GIS-ready derived climate surfaces and isohyets as well as the refinement of international regional weather models that are currently used for forecasting purposes. This would require the use of topographic and other information for Belize and to ensure that the number and distribution of meteorological stations currently in place is sufficient to support surface and isohyet generation and more refined monitoring and forecasting.
Custodianship Considerations	The logical custodian for this information is the Belize National Meteorological Office
Security Considerations	There are no special security considerations associated with this data theme.

FGDS Name	Climate Summary Data
Description	This FGDS will include statistical summary climate information for each monitoring station. Summary information for each climate factor (e.g. air temperature, wind speed and direction, relative humidity, pressure, precipitation, evaporation, and sunshine duration) would be produced based on the broad needs of the stakeholder community. These needs would need to be defined through a more detailed study involving key users of climate and weather information, and can be expected to include information such as minimum and maximum annual values, seasonal averages, monthly averages and trends.
Current Status	The National Meteorological Office at present generates a variety of standardized weather data products, none of which is in GIS-ready form. Statistical summaries are generated for specific stations in tabular

	form but not in a form that can be easily linked to GIS.
Future Program Considerations	Climate and weather are critical to many aspects of the Belize economy and infrastructure resiliency. Development of additional standard weather information products for the stakeholder community can yield significant benefits across the agricultural, touristic and infrastructure sectors among others. The development of an additional program specifically addressing the needs of these communities in a manner that can be easily integrated with other datasets in a GIS environment will likely provide returns far beyond the cost of such a program.
Custodianship Considerations	The logical custodian for this information is the Belize National Meteorological Office
Security Considerations	There are no special security considerations associated with this data theme.

FGDS Name	Derived Climate Isohyets
Description	This FGDS will include isohyet interpretations of all relevant climate data (e.g. air temperature, wind speed and direction, relative humidity, pressure, precipitation, evaporation, and sunshine duration). Ideally these would be generated for each of the levels represented in the Climate Summary Data FGDS.
Current Status	The Belize National Meteorological Office has only generated GIS based isohyet information on an experimental basis.
Future Program Considerations	Generation of geostatistical surfaces and isohyets from the Climate Summary Data outline elsewhere in a GIS format will greatly increase the utilization of this information for planning purposes. This is especially relevant to climate resilient community and infrastructure planning. The accuracy of the geostatistical surfaces for this information is very much related to the density and distribution of the meteorological stations, as well as topographic features that can affect microclimate changes between monitoring stations. The adequacy of the existing network will require additional qualification.
Custodianship Considerations	The logical custodian for this information is the Belize National Meteorological Office
Security Considerations	There are no special security considerations associated with this data theme.

FGDS Name	Green House Gas (GHG) Emissions
Description	This FGDS will ultimately provide the information that is needed to support a national carbon accounting system. It will depict the location and extent of GHG emissions, derived from a variety of sources such as land use and land cover, industrial emissions, and other contributing

	factors.
Current Status	The Belize National Meteorological Office has only generated GIS based isohyet information on an experimental basis.
Future Program Considerations	Climate change has been included in this theme, but involves the measurement and assessment of anthropogenic greenhouse gas (GHG) emissions that contribute to climate change, measurement and monitoring technologies are required to enhance and provide direct and indirect emissions measurements for point and mobile sources using data transmission and archiving, along with inventory-based reporting systems and local-scale atmospheric measurements or indicators. The Intergovernmental Panel on Climate Change (IPCC) publishes guidelines to be used for measuring and calculating a given emission. GHG emissions include the following parameters: Carbon dioxide (CO ₂), Methane (CH ₄), Nitrous oxide (N ₂ O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulfur hexafluoride (SF ₆). This is an important component in responding to the Clean Development Mechanism (CDM), a flexibility mechanism under the Kyoto Protocol that allows countries to meet part of their emission reduction targets by buying Certified Emission Reductions (CERs) from projects hosted in countries with no obligation to reduce emissions.
Custodianship Considerations	The logical custodian for this information is the Department of Climate Change, Ministry of Forestry, Fisheries and Sustainable Development.
Security Considerations	There are no special security considerations associated with this data theme.

5.2 Waste

General Considerations: Several basic classes of material and associated processes by which this material is produced; this theme describes the sources of waste, while the Waste Management theme describes the processing and disposal of waste. Waste material, if not properly managed, can directly affect human health and safety and adversely impact other aspects of the natural environment and ecological resources and processes.

Waste addresses multiple waste streams including municipal solid waste, construction and demolition waste, landscape waste sources, hazardous waste sources, and medical waste sources. Each of the waste streams has its own associated processes, purpose and implications for environmental planning and management that dictate the subject matter, content and form of the data topics that fall under this general theme.

Business Requirements. Waste data are required to support waste management across multiple sectors in Belize. The full range of BNSDI stakeholder activities that have some direct need for Waste data are depicted in Appendix B. According to this information, nearly

26% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- General information for reference by leaders, managers and the public;
- Support more effective waste planning, management and operations;
- Support waste related policy and regulatory activities;
- Build awareness of the issues and challenges among all levels of stakeholders;
- Protect water resources;
- Protect human health and safety;
- Avoid impacts to biodiversity and general ecological health.

Current Situation: The Belize Solid Waste Management Authority (BSWaMA) in conjunction with Local Government bodies and other stakeholders, is responsible for the safe and environmentally sound management of solid waste in Belize. A key role of BSWaMA has been to facilitate, plan and oversee the construction and operations of solid waste management facilities (Transfer Stations and Sanitary Landfill) constructed under the Solid Waste Management Project (SWMP). While various types of geographic data were used in the planning and design of the regional center, GIS is not currently in use by BSWaMA.

The BSWaMA is not directly involved in the waste collection aspect of solid waste management, which is managed by local government units. There is no compiled version of solid waste management data (transfer station locations, garbage pickup routes, etc.).

A comprehensive analysis of the various waste streams for Belize has not been conducted. The Department of Environment within the Ministry of Forestry, Fisheries and Sustainable Development in 2004 developed a Registry of Wastes and Emissions Database but this has not been maintained.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 16 – Data Sources Related to Waste Data Theme

Ministry of Forestry, Fisheries and Sustainable Development	Department of Environment		Registry of Wastes and Emissions Database	The DOE developed a Registry of Wastes and Emissions Database in MS Access. This was created originally in 2004 but has not been maintained. (HOW MANY RECORDS IN THIS DATABASE? WHAT PERCENTAGE OF THESE HAVE THE LOCATION INFORMATION RECORDED?)
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Topics: Several topics that are of particular interest to the BNSDI community and/or that can be at least partially derived from basic information produced by various stakeholders include:

- Municipal Solid Waste;
- Construction and Demolition Waste Sources;
- Landscape Waste Sources;

- Hazardous Waste Sources;
- Medical Waste Sources;
- Industrial Emissions

FGDS: The following FGDS layers within this data class are of specific interest to the BNSDI Community:

FGDS Name	Waste and Emissions
Description	This FGDS will include all of waste and emissions locations across Belize, inclusive of both source, transfer and storage facilities. The location and extent of waste and emission related facilities will be indicated along with relevant attribute information describing the type, owner and characteristics of each location.
Current Status	The Department of Environment within the Ministry of Forestry, Fisheries and Sustainable Development in 2004 developed a Registry of Wastes and Emissions Database but this has not been maintained.
Future Program Considerations	This FGDS would need to be interpreted and compiled from a variety of sources that include both facilities (solid waste storage and transfer sites, industrial facilities, hospitals, etc.) as well as both existing and planned land use areas characterized by their waste source characteristics. This would ideally be developed in the context of a national waste stream analysis in support of a national waste management strategy.
Custodianship Considerations	The logical custodian for this information is the Belize National Meteorological Office
Security Considerations	There are no special security considerations associated with this data theme.

5.3 Cultural Resources

General Considerations: Cultural resources include those places, structures and objects that have historical, paleontological, or archaeological value. It can include tangible resources such as movable objects, historic buildings, archaeological sites, and cultural landscapes; which all have an obvious geospatial component – they exist at a physical location on the earth. It can also include intangible resources such as oral traditions and expressions; traditional music, dance and theatre; social practices, rituals, and festive events; knowledge and practices concerning nature and the universe, and traditional craftsmanship. These intangible resources can also be valuable in telling a story about a culture by positioning them in their locational context.

Often the locations of these resources are protected from general knowledge in order to protect them from accidental or intentional damage. While it is valuable to protect the

resources, it is also equally valuable to share information about the resources so that they can be understood and therefore better protected. To balance these needs, some historical and cultural information must be kept proprietary to authorized scientists and managers due to the threat of vandalism and theft or disturbance of artifacts. In addition, the actual location of the resources can be generalized to a grid cell or buffer area with a random offset to disguise the actual location while still alerting that there is a resource in the vicinity that needs consideration in regards to any development plans or other potential disturbance.

Cultural resources are mapped to represent the resource itself (an artifact such as a building, fossil, or a landscape feature such as a historical trade route or a range of a particular culture or language) or to represent an area that contains many related resources (such as a settlement or an inland sea). While cultural resources might be expected to include special management areas that are designated to protect those resources.

Resources are increasingly mapped with the assistance of GPS and high-resolution satellite imagery and LiDAR because this accuracy is often critical to the functions related to preservation and study. However, because of the simultaneous need to protect the resources, the information is only considered fundamental to the BNSDI community at the medium and small scales. It is at these scales that information about sensitive resources is critical for such uses as urban land use planning.

Business Requirements. Cultural resource data is important to manage and preserve cultural heritage in Belize. The full range of BNSDI stakeholder activities that have some direct need for Cultural data in some form are depicted in Appendix B. According to this information, nearly 42% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Mapping of known resources;
- Modeling and prediction of undiscovered resources;
- Exploratory research and documentation about the past
- Designation of areas for special protection;
- Education and awareness;
- Tourism;
- Public sector investment project formulation and assessment;
- Utility planning and corridor selection;
- National estate land allocation;
- Building permit review;
- Marine spill resources at risk assessment;
- Mineral exploration planning;
- Prepare environmental impact assessments;
- Development proposal assessment;
- Land use planning;
- Management and protection of resources;

- Evaluation of suitability for development activities;
- Place naming.

Existing Situation: The primary responsibility for the management of historical and archeological heritage in Belize is the National Institute for Culture and Heritage (NICH)

The preparation of Timber Stock Surveys and Environmental Impact Assessments require the identification and mapping of site-specific archeological information. This data is provided to NICH.

Other organizations have compiled and mapped archeological related information as areas and sites, including the MNRA LIC and the CZMAI, but these data are only updated if and when needed for specific projects.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 17 – Data Sources Related to Cultural Resources Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Mayan Sites	This layer shows a point location for selected Maya archeological sites (Elam to follow up)
MNRA	Lands and Surveys Department	Land Information Centre	World Heritage Sites	This layer shows the boundaries of the World Heritage Sites designated by UNESCO in Belize.
Ministry of Forestry, Fisheries and Sustainable Development	Department of Forestry		Timber Stock Survey	As part of the preparation of an SFMP, timber companies must prepare detailed Timber Stock Surveys for representative areas. This includes the mapping of every tree above a certain trunk diameter in a 1000 ha. Area. This survey also includes the recording of any other features that may affect timber production include archaeological sites and other factors. (HOW IS THIS INFORMATION PROVIDED AND MANAGED? HOW IS IT USED?)
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Archaeological Sites / Reserves	date of production: 1995. Originator: Paseo Pantera consortium. Preferential Scale: unknown. Notes: this dataset, re-published in Ford & Clarke's 2000 Maya Forest GIS database, contains points for 38 archaeological sites in Belize; the source of 37 of the 38 entries in the dataset is some other dataset called "National Geographic Land of the Mayas".

Topics: Topics for this theme include:

- Historic Sites
- Archeological Sites
- Paleontological Sites

FGDS: The following FGDS layers within this data class are of specific interest to the BNSDI Community:

FGDS Name	Historical Sites
Description	This FGDS will include a listing and descriptive information about all historically significant buildings and sites in Belize.
Current Status	No additional information provided
Future Program Considerations	This FGDS be developed and maintained as an official register of all significant historical buildings and sites in Belize as a common reference for the BNSDI community and the public. Sensitive information could be suppressed from generally available information, as required by Government of Belize policy.
Custodianship Considerations	The logical custodian for this information is the National Institute for Culture and Heritage (NICH)
Security Considerations	There may be a need to suppress or obscure some information from general access.

FGDS Name	Archeological Sites
Description	This FGDS will include a listing and descriptive information about all archeological sites in Belize.
Current Status	No additional information provided
Future Program Considerations	This FGDS be developed and maintained as an official register of all significant archeological sites in Belize. Much of this information will require restricted access for use only by government approved persons. In addition, there are several techniques that can be used to obscure this information such as summarization to a grid (e.g. 5 KM grid areas), buffer and offset, or “heat map” to alert planners and others to the likelihood of archeological resources existing in a general area, without disclosing the locations of actual sites.
Custodianship Considerations	The logical custodian for this information is the National Institute for Culture and Heritage (NICH)
Security Considerations	There will be a need to suppress or obscure some information from general access.

FGDS Name	Paleontological Sites
Description	This FGDS will include a listing and descriptive information about all known paleontological sites in Belize.

Current Status	No additional information provided
Future Program Considerations	This FGDS be developed and maintained as an official register of all significant paleontological sites in Belize. Much of this information will require restricted access for use only by government approved persons. In addition, there are several techniques that can be used to obscure this information such as summarization to a grid (e.g. 5 KM grid areas), buffer and offset, or “heat map” to alert planners and others to the likelihood of paleontological resources existing in a general area, without disclosing the locations of actual sites.
Custodianship Considerations	The logical custodian for this information is the National Institute for Culture and Heritage (NICH)
Security Considerations	There will be a need to suppress or obscure some information from general access.

5.4 Land & Aquatic Use/Cover

General Considerations: The land and aquatic use and cover topic includes terrestrial vegetation, non-vegetated areas, cultural land cover and land uses as well as benthic type within waterbodies and the marine environment. In an integrated, multi-user GIS environment, vegetation and the other related topics are often included under the broader mapping definition of land use/land cover. This classification approach acknowledges that there are many types of land cover, and where the cover is not some sort of vegetative community, it is likely an urbanized cover associated with some cultural land use, such as residential, commercial or industrial, farms, plantation forests, landfill, quarry, and others.

Also included within this theme are more detailed versions of existing land use for urban and agricultural areas at medium to large scale.

There are a variety of standards that have been used around the world for mapping Land Use and Land Cover, most often at the Medium Scale. Many of these (USGS, UN FAO) have been designed specifically with the use of remote sensing data in mind. The appropriate classification scheme for any given situation depends on the intended uses of this information. Likewise there are many lake and marine benthic classification schemes in use around the world, but these have all been developed for specific water bodies or regions.

For the purposes of the BNSDI, benthic type for waterbodies and the marine environment have been included in this data theme. This acknowledges the sometimes diffuse edges and ecological interdependencies among aquatic and terrestrial environments where the low relief coastal and marine areas of Belize are concerned. A more integrated approach to mapping and analyzing these features and their ecological interdependencies may be useful in supporting a more integrated approach to land use and natural resource management in Belize.

Existing land use for urban areas is often coded as attributes to plot data.

The mapping of specific fields within farms may be carried out as the basis for a detailed agriculture census and agricultural production monitoring over time.

Business Requirements. Land use and land cover data is important to regional land use planning, agriculture, forestry, parks and protected area management and many other issues that are critical to Belize. The full range of BNSDI stakeholder activities that have some direct need for land use/land cover data in some form are depicted in Appendix B. According to this assessment, nearly 71% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Citywide and regional land use planning;
- Environmental analysis and planning;
- Transportation planning;
- Utility planning;
- Statistical analysis and reporting;
- Water resource planning;
- Facility siting analysis (e.g. landfill, industrial, etc.);
- National parks and protected areas management;
- National carbon accounting and Clean Development Mechanism (CDM) management;
- Forest management;
- Environmental impact assessment;
- Scientific studies and research;
- Fisheries management;
- Coastal zone management;
- Biodiversity management.

Current Situation: The mapping of land use, land and coastal aquatic cover is perhaps the most frequently mapped subject in Belize. A number of studies have been carried out over the years, some involving a complete mapping of the country at a specific point in time and comparing conditions between certain years to determine the level of deforestation or land use change that occurred. Others have involved the study of specific categories of land use or land cover elements for specific projects. The majority of these mapping efforts have been carried out using satellite remote sensing data. The major land use, land and aquatic cover mapping activities uncovered in the current study are summarized in the Table below. These have been carried out by many different teams, for different purposes and utilizing different classification schemes, and several have been cross-purposed, with the output from one study being extracted and included in another. Many are currently available through the MNRA LIC. CZMAI has also been very active in compiling related mapping efforts, especially those within the coastal zone.

There has been some attempts to establish and maintain standardized land use/land cover classification schemes that would help to support longitudinal analysis of the changes that have occurred over time. Understanding these changes, their location, rate, drivers and impacts is important to being able to effectively manage land and sea resources in Belize.

The following efforts have initiated some level of standardization and periodic updates of land use/land cover information from a baseline:

- The MNRA LIC with support of the FAO conducted a deforestation analysis project that included the development of land cover inventories for 1989-'92 and 1994-'96 and a comparison of these two timeframes to determine the location, extent and rate of deforestation in Belize.
- A 1996 study was carried out by the MNRA LIC to create a dataset with a refined land use/land cover classification for a limited geographic area (Central Belize). The intention was to develop a standardized classification scheme and methodology that could be applied nationwide to update the current land use. The study area included portions of the Belize, Cayo and Stann Creek Districts.
- From 1998 - 2000, the CCAD (Comisión Centroamericana de Ambiente y Desarrollo), World Bank and the Netherlands collaborated in the production of the Map of the Ecosystems of Central America. The primary objective of the mapping project was to map and describe the ecosystems of Mesoamerica (Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama, using a comprehensive, regionally endorsed, classification system. Updates to the original map for Belize were conducted in 2004 and 2011. The original classification scheme has been largely preserved in the newer updates.
- A Mangrove data set was generated in 2010 as an update to the 1990 Zisman's mangrove coverage for Belize through a partnership between the World Wildlife Fund and CATHALAC. The study involved the assessment of mangrove cover change for the period 1980-2010 based on a remote sensing-based study utilizing satellite imagery for the years 1980, 1989, 1994, 2000, 2004, and 2010. While only addressing one specific type of special-interest vegetative cover, this effort is a reasonable example of baseline inventory and periodic ongoing monitoring of a land cover matter over time.

The mapping of existing land use for most municipalities was carried out at a general level in support of the Municipal Development Project. This information is available in GIS format from the MNRA LIC.

In 1998 the Ministry of Agriculture, and Fisheries & Cooperatives (MAFC) began a five stage program to stimulate development in the agriculture sector. The broad objective of the effort was to establish a sustainable registry of farms and a system of periodic surveys for updating

the registry through the introduction of appropriate data collection and statistical methodologies. Another agricultural census was conducted in 2010 and 2011. The census was based on a 16 page questionnaire that covers a broad range of topics, but was not mapped and the statistics can only be geo-coded to the Village level.

Topics: Land use and land cover topics of interest to the BNSDI community include:

- Land Use/Land Cover
- Aquatic Benthic Type (marine and waterbody bottom types)
- Existing Urban Land Use
- Agricultural Land Use

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 18 – Data Sources Related to Land and Aquatic Use/ Cover Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	1996 Deforestation Cover	This layer shows the extent of deforestation that occurred in mainland Belize between 1989/92 and 1994/96. Forest cover was mapped by computer-assisted analysis (image classification) of Landsat Thematic Mapper (TM) satellite imagery taken between 1994/1996
MNRA	Lands and Surveys Department	Land Information Centre	1989/1992 Land Use/Land Cover	The land use/land cover data 1992, is a project carried out by land and surveys department of the Ministry of Natural Resources with support from the Food and Agriculture Organization FAO. This study represents the most comprehensive analysis of land use carried out for Belize.
MNRA	Lands and Surveys Department	Land Information Centre	1995 Natural Vegetation	This dataset shows the different ecosystem and vegetation type dated 1995. This data was produced as part of the Central American Ecosystems Map (Worldbank/CCAD).
MNRA	Lands and Surveys Department	Land Information Centre	1996 Land Cover (Central Belize)	This dataset was developed with a refined land use/land cover classification in a limited geographic area (Central Belize) so that the classification and methodology used could potentially be applied nationwide to update the current land use. The study area included portion of the Belize, Cayo and Stann Creek Districts.
MNRA	Lands and Surveys Department	Land Information Centre	1990 Mangrove Dataset	the mangrove datasets shows the location and Formation of all mangrove cover for the entire coastline of Belize. The mangrove data has been classified as Tall, Medium and Dwarf, Mangrove Forest, Mangrove in Mixed Forest, mangrove savahanna and Mangrove over open water.
MNRA	Lands and Surveys Department	Land Information Centre	2010 Mangrove Dataset	This data set was generate as an update to the 1990 Zisman's mangrove coverage for Belize through a partnership between the World Wildlife Fund and CATHALAC. The study involved the assessment of mangrove cover change for the the period 1980-2010 based on a remote sensing-based study utilizing satellite imagery for the years 1980, 1989, 1994, 2000,

				2004, and 2010
MNRA	Lands and Surveys Department	Land Information Centre	NEW LIC DATA	Contains new data created or produce by LIC, such as the building foot prints, build up areas and other data created by interns.
MNRA	Lands and Surveys Department	Land Information Centre	Rural Development	Contains data requested by Rural development, these are spatial data of settlements/villages of their different project areas
MNRA	Lands and Surveys Department	Land Information Centre	Agriculture	This folder conatains all data and maps related to agriculture, such as the mappping of large farms in the Cayo District and Banana farms mapping in the Stann Creek District
MNRA	Lands and Surveys Department	Land Information Centre	Urban Land Use Data	This folder contians documents, maps and spatial data regarding the Municipal Development Plans. The Urban Land Use Project was under the direct supervision of the Physical Planning Unit of the MNRA and spearheaded by Ms. Keisha Rodrigues. Land Use data for all the Town were collected. IS THIS EXISTING OR PLANNED LAND USE?
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline:Villages/Settlements	LIC/Rural Development
MNRA	Lands and Surveys Department	Land Information Center	Land Use/Land Cover: Deforestation Cover	White Et Al
MNRA	Lands and Surveys Department	Land Information Center	Land Use/Land Cover: Land Use/Land Cover	LIC/Fairweather/Gray
MNRA	Lands and Surveys Department	Land Information Center	Land Use/Land Cover: Natural Vegetation	Iremonger/Browkaw
MNRA	Lands and Surveys Department	Land Information Center	Land Use/Land Cover: Land Cover (Central Belize)	Zisman Et all
MNRA	Lands and Surveys Department	Land Information Center	Land Use/Land Cover: Mangrove Coverage	No additional information provided
MNRA	Lands and Surveys Department	Land Information Center	Land Use/Land Cover: Mangrove	CATHALAC/SERVIR

MNRA	Lands and Surveys Department	Land Information Center	Relevant Reference Reports: Deforestation Analysis of Belize – Report	Type: Digital (48 Pages)
MNRA	Lands and Surveys Department	Land Information Center	Relevant Reference Reports: Land Use Report (1989/92)	Type: Digital (15 Pages including 9 maps)
MNRA	Lands and Surveys Department	Land Information Center	Relevant Reference Reports: Land Use/Land Cover - Central Belize Report (1996/98)	Type: Digital (34 Pages including 1 maps)
MNRA	Lands and Surveys Department	Land Information Center	Relevant Reference Reports: 1998 Central Belize Cohune Palm Forest Report	Type: Digital (34 Pages Including Maps)
MNRA	Natural Resources Department	Industries, Aquaculture and Inland Fisheries, Cooperatives, Policy and Trade (Statistics), Marketing and Project Execution Unit	2001 Agricultural Census	Following the change in Government in 1998, the Ministry of Agriculture, and Fisheries & Cooperatives (MAFC) began a five stage programme to stimulate development in the agriculture sector. The broad objective of the effort was to establish a sustainable registry of farms (farmers) and a system of periodic surveys for updating the registry through the introduction of appropriate data collection and statistical methodologies. Outputs were to include: A Belize Farm registry that contains basic information about all farms (and farmers) in Belize; A set of supply utilization accounts and food balance sheets; A sampling frame that can be used to select farmers as respondents for specialized surveys; A methodology, questionnaire and training material that can be used for periodic sample surveys that would be used to estimate crop production and livestock inventories; An agricultural statistics database accessible in the Ministry and its six district offices; An assemblance of adequate and reliable statistics on most aspects of agriculture so as to enable agriculture production of gear itself to the changing development in agriculture in the global environment; An agriculture statistics database that can be quickly and efficiently retrieved on a continuous basis; To make available specific statistics on Belizean agriculture to overseas parties; To forecast the country's main agriculture produce on a periodic basis.

MNRA	Natural Resources Department	Agriculture Department	Central Farm Facility Database	A University team in 2012 developed an initial basemap showing the location of the various areas on the farm, roads and buildings. This was created in an ArcGIS shapefile format, but this is not generally accessible and has not been updated. There is the potential to expand on this database to develop a more complete asset, land and program management system for Central Farm
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Settlement Maps	Jan Meerman/Belize Tropical Forest Studies (2012). (See Writeup for BERDS).
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Belize Land Cover Map	CATHALAC (2013). (See Writeup for CATHALAC).
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)			No additional information provided
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)			No additional information provided
Ministry of Forestry, Fisheries and Sustainable Development	Department of Forestry		Timber Stock Survey	As part of the preparation of an SFMP, timber companies must prepare detailed Timber Stock Surveys for representative areas. This includes the mapping of every tree above a certain trunk diameter in a 1000 ha. Area. This survey also includes the recording of any other features that may affect timber production include archaeological sites and other factors.

Ministry of Forestry, Fisheries and Sustainable Development	Department of Forestry		Tree Felling Permits for Private Lands	The Belize Private Forests Act, Chapter 217, Revised Edition 2000 indicates that the taking of any mahogany or cedar tree on private land requires a permit from the Ministry. It also states that the taking of any mahogany or cedar tree over 2 feet girth during the clearance of land for agriculture does not require a permit unless it is to be sold as timber.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Coral Reef	date of publication unknown. Originator: U.K. Ordnance Survey / Directorate of Overseas Surveys. Preferential Scale: 1:250,000. Notes: this highly generalized dataset was apparently digitized from the 1:250,000 Ordnance Survey sheets
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Coral Reef	date of publication: 2002. Originator: WWF (MACR database v 1.1). Preferential Scale: unknown. Notes: while CZMAI provided coral reef spatial data to this effort, it is unclear if the Belizean data included in WWF's regional map of the Mesoamerican reef is from CZMAI
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Coral Reef	date of publication: 2004. Originator: WRI (Reefs-at-Risk in the Caribbean project). Preferential Scale: unknown. Notes: the Belize reef data contained in WRI's regional dataset is from CZMAI (therefore see notes below); the sources for other datasets are listed in the attribute table for this dataset
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Coral Reef	date of publication: 2005. Originator: CZMAI (UNDP-GEF CZM Project). Preferential Scale: 1:100,000. Notes: extracted by WRI from CZMAI's national marine habitat map (see notes below on CZMAI national marine habitat map)
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Benthic Habitat	date of publication: 1997. Originator: CZMAI (UNDP-GEF CZM Project). Preferential Scale: 1:100,000. Notes: this effort was done through the UNDP-GEF Coastal Zone Management Project in 1997 (now the Coastal Zone Management Authority & Institute), with the collaboration of the University of Sheffield, Coral Caye Conservation, and the University of New Castle upon Tyne; the source of this data is LandSat TM imagery from 1996 (inner lagoon) and 1997 (atolls); the overall benthic classification was found to be 60% accurate for benthic classes, and 80% accurate for geomorphologic classes; commonly cited as the Pete Mumby marine habitat map, the lead author on this work was actually the CZMP's Hugo Matus
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Benthic Habitat	date of publication: 2001. Originator: Meerman & Sabido (Central America Ecosystems Mapping Project). Preferential Scale: 1:100,000. Notes: this is apparently a draft product digitized from the CZMAI national marine habitat map; it appears in printed format on the 1:2,100,000 Central America Ecosystems Map, and was apparently digitized for that project

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Benthic Habitat	date of publication: 2004. Originator: Meerman (National Protected Areas Policy & System Plan Project - NPAPSP). Preferential Scale: 1:100,000. Notes: based on the earlier digitization by Meerman, this work was completed through the auspices of the NPAPSP project, and is publicly available as a part of the 'bze_ecosys_2004.shp' dataset from which it can be extracted
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Reef Geomorphology	date of publication: 1997. Originator: CZMAI (UNDP-GEF CZM Project). Preferential Scale: 1:100,000. Notes: see notes on CZMAI national marine habitat map above; both benthic habitat and geomorphology are attributes of this dataset
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Data Set: Reef Geomorphology	date of publication: 2005. Originator: Institute for Marine Remote Sensing of the University of South Florida (Millennium Corals Mapping Project). Preferential Scale: 1:100,000. Notes: like the CZMAI national marine habitat map, reef geomorphologic information has been extracted from LandSat imagery (ETM); in the case of Belize, LandSat imagery was supplemented partially with IKONOS data (areas near Placencia); it should be noted that this effort used a slightly different classification scheme from the one employed in the CZMAI effort
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 1959. Originator: Wright et al. ("Land in British Honduras" publication). Preferential Scale: 1:250,000. Notes: source of this data is visual interpretation of aerial photography and in-depth field surveys by Charles Wright and his associates
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2004. Originator: ProNatura (Selva Maya EcoRegional Planning Project). Preferential Scale: 1:250,000. Notes: the main source of this data is the Meerman & Sabido ecosystem map, possibly supplemented with data from Wright et al's "natural vegetation" map.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2005. Originator: Emch et al. ("Forest Cover Change in the Toledo District" study). Preferential Scale: 1:100,000. Notes: the source of this data is sub-pixel supervised-classified LandSat MSS imagery; accuracy assessment reveals the results are highly accurate (90-95%); the classification scheme utilized is a simple six-class scheme
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2002. Originator: DiFiore (Master's thesis, Columbia University). Preferential Scale: 1:100,000. Notes: as a part of her master's degree thesis, DiFiore used supervised classification of LandSat imagery to investigate land cover change along the Belize River riparian corridor between 1989 and 2001

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 1994. Originator: Fairweather & Gray (FAO-funded "the Land Use of Belize 1989-92" study). Preferential Scale: 1:50,000. Notes: the source of this data was visually-interpreted SPOT XS satellite imagery, which possesses 20m resolution, and apparently supplemented with detailed ground surveys; the agricultural cover data corresponds well to the agricultural cover statistics for this period
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2005. Originator: Earth Satellite Corporation (GeoCover project). Preferential Scale: 1:100,000. Notes: this dataset is termed 'circa 1990' land cover, despite the fact that the imagery used ranges from 1989 to 1994; the Earth Satellite corporation utilized an unsupervised classification technique to develop this dataset in a standardized global classification scheme; visual analysis reveals that this dataset underestimates agricultural cover; hillshaded broadleaf forests tend to be classified instead as shrubland; satellite imagery used (see below for specific dates) also correspond to different phenological cycles.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 1995. Originator: Iremonger & Brokaw (Natural Resource Management Project - NARMAP). Preferential Scale: 1:250,000. Notes: the source of this data was visually-interpreted Landsat TM imagery for 1993, printed at 1:250,000 scale (instead of at 1:100,000 scale), and supplemented with LIMITED ground surveys / fly-overs; while this map has been referred to as the "natural vegetation map," this data also shows un-natural (i.e. human-induced) cover such as agriculture and settlements
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2004. Originator: Ek (Master's thesis, Ohio University). Preferential Scale: 1:100,000. Notes: as part of his master's thesis, Ek used supervised classification to investigate land cover change in central Belize (Landsat World Reference System path 19 row 48); the comparison is between scenes from 1993 and 2003; the latter classification results are reported as 92% accurate.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2001. Originator: Meerman & Sabido (Central America Ecosystems Mapping Project). Preferential Scale: 1:250,000. Notes: this map is intended to be an update and extension of Iremonger & Brokaw's map, supplemented with additional updated Landsat TM satellite imagery of central and western Belize (hence the 1996 and 1998 label); flyovers and a limited number of ground surveys were conducted; following on earlier works, the mapping technique used was visual interpretation.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 1998. Originator: White et al. ("Remote Sensing Analysis of Land Use and Land Cover, Central Belize" study). Preferential Scale: 1:100,000. Notes: building on White et al's earlier deforestation study, the team used ground control points to perform a supervised classification on an area of central Belize (roughly the southern half of the Belize district); the classification scheme used mirrors the one used by Fairweather & Gray (1994).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2005. Originator: Emch et al. ("Forest Cover Change in the Toledo District" study). Preferential Scale: 1:100,000. Notes: the source of this data is supervised-classified Landsat ETM imagery and field surveys; accuracy assessment reveals that the results are highly accurate (84-91%); the classification scheme utilized is a simplified six-class scheme
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2004. Originator: Penn et al. ("Vegetation of the Greater Maya Mountains" study). Preferential Scale: 1:50,000. Notes: the source of this data is a supervised classification of Indian Resource Satellite (IRS) imagery, which has 20m pixel resolution; this dataset classifies land cover into 32 classes.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2005. Originator: Earth Satellite Corporation (GeoCover project). Preferential Scale: 1:100,000. Notes: this data is termed 'circa 2000' land cover; see notes above on 'circa 1990' EarthSat GeoCover data.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2002. Originator: DiFiore (Master's thesis, Columbia University). Preferential Scale: 1:100,000. Notes: see notes above on 1989 DiFiore land use / land cover data.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2002. Originator: White et al. (Impacts of Hurricane Iris study). Preferential Scale: 1:100,000. Notes: the White et al team used both Landsat ETM imagery and data from another sensor, the Advanced Land Imager (ALI) to evaluate the impacts of Hurricane Iris in the Monkey River area by generating pre- and post- Hurricane Iris land cover datasets; classifications with both datasets proved highly accurate (86-97%).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2004. Originator: Ek (Master's thesis, Ohio University). Preferential Scale: 1:100,000. Notes: see notes above on 1993 Ek land use / land cover data.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2005. Originator: Meerman (National Protected Areas Policy & System Plan Project - NPAPSP). Preferential Scale: 1:100,000. Notes: this map is an update of the Meerman & Sabido map, supplemented by additional fieldwork; major updates are the expansion of agriculture, utilizing 2004 Landsat ETM imagery acquired through the NPAPSP project; following on earlier works, the mapping technique used is visual interpretation
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		land use / land cover (also otherwise described as 'vegetation,' and 'ecosystems')	date of publication: 2011. Originator: Jan Meerman (Biodiversity and Environmental Resource Data System of Belize - Belize Tropical Forest Studies). Preferential Scale: 1:100,001. Notes: Map of the Ecosystems of Belize version 2011 is an update from the 2001 Belize Ecosystems Map (Meerman & Sabido, 2001) and the subsequent 2004 version of the same. has been enhanced using a substantial set of new data. The data quality of the 2011 version has greatly improved over the 2001 and 2004 versions. The classification still follows the UNESCO system developed for the Central American Ecosystems Map and is thus completely consistent with that product. Some of the Ecosystem variants as used in the 2004 version have been collapsed and integrated in the parent classification.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Forest Cover	date of publication: 1996. Originator: White et al. ("Deforestation in Belize" study). Preferential Scale: 1:100,000. Notes: the first White et al (1996) study, and subsequent studies were collaborations between the University of Texas-Austin's Bureau of Economic Geology and Center for Spatial Research, and Belize's Forest Department and Land Information Centre; the deforestation study used supervised classification to extract forest cover data for three periods; the original classification scheme involved 17 classes, which for the purpose of analysis were aggregated to forest / non-forest.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Forest Cover	date of publication: 1996. Originator: White et al. ("Deforestation in Belize" study). Preferential Scale: 1:100,000. Notes: None
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Forest Cover	date of publication: 1996. Originator: White et al. ("Deforestation in Belize" study). Preferential Scale: 1:100,000. Notes: None.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Forest Cover	date of publication: 2000. Originator: unknown (Paseo Pantera project). Preferential Scale: unknown. Notes: while the original creation / publication date of this dataset is unknown, it was published on Ford & Clarke's 2000 Maya Forest data CD; forest cover is divided into "lowland rain forest," "inland swamp forest," "mangrove," and "pine forest".

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Mangrove Cover	date of publication: 1998. Originator: Zisman (doctoral dissertation). Preferential Scale: 1:40,000. Notes: this data is the second update of the original national mangrove mapping done by Zisman along with Murray and Gray; the original work utilized only LandSat TM imagery, while this and the prior update utilized both aerial photography and substantial ground surveys; this data is mainly relevant to mainland Belize because of only partial cover of the cayes and projection issues.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Mangrove Cover	date of publication: 1998. Originator: Zisman (doctoral dissertation). Preferential Scale: 1:40,000. Notes: this data is the second update of the original national mangrove mapping done by Zisman along with Murray and Gray; the original work utilized only LandSat TM imagery, while this and the prior update utilized both aerial photography and substantial ground surveys; this data is mainly relevant to mainland Belize because of only partial cover of the cayes and projection issues.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Mangrove Cover	date of publication: 2010. Originator: CATHALAC. Preferential Scale: 1:100,000. Notes: This dataset depicts fragmentation and resiliency of Belize's national mangrove cover in 2010, based on satellite-based mapping of Belize's mangroves for 1980, 1989, 1994, 2000, 2004, and 2010, and based on the earlier work of Simon Zisman (1998). Fragmentation was analyzed by identifying mangrove patches which had been reduced in size within the period analyzed. Based on that, a fragmentation history was compiled, and risk was estimated based off that history. In addition to the fragmentation history, an index of patch irregularity (related to the perimeter and area) was also developed. Resiliency was also identified based on identification of mangroves which had regrown after clearance. This data was developed for the World Wildlife Fund (WWF)'s Mesoamerican Reef program in July 2010.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Mines / Quarries	date of publication: 2004. Originator: Geology & Petroleum Department. Preferential Scale: 1:250,000. Notes: this dataset was digitized by Jan Meerman from coordinate data provided by the Geology & Petroleum Department; these data were probably acquired using non-differential handheld GPS units.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Mines / Quarries	date of publication: 2005. Originator: Geology & Petroleum Department. Preferential Scale: 1:250,000. Notes: this dataset is an update of the dataset digitized by Jan Meerman, using coordinate data provided by the Geology & Petroleum Department.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Agricultural Suitability	date of publication: 1992. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:100,000. Notes: the major output of the Land Resource Assessments was the re-classification of soil types into a simplified 5-class agricultural suitability system that indicates areas generally suited to agriculture; the tables contained within the individual NRI reports address specific crop suitability, though it is apparent that this has never been linked into the spatial data - a task that needs to be done at some point.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Timber Production Suitability	date of production: 1992. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:100,000. Notes: generally speaking, as indicated on p. 2 of King et al (1993), lands classified as having an agricultural suitability of 3-4 are recommended for 'forest management and production,'
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Fire Risk	date of production: 2004. Originator: Meerman. Preferential Scale: 1:250,000. Notes: as noted in the dataset's metadata, this dataset is "a digital approximation of wildfire risk to natural areas in Belize"; fire risk is divided into 19 classes from 0-18.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Agricultural Uses	date of production: 2011. Originator: Lands Information Centre(Follow up from Meerman and Sabido). Preferential Scale: 1:100,000. Notes: Map of the Ecosystems of Belize version 2011 is an update from the 2001 Belize Ecosystems Map (Meerman & Sabido, 2001) and the subsequent 2004 version of the same has been enhanced using a substantial set of new data. The data quality of the 2011 version has greatly improved over the 2001 and 2004 versions. The classification still follows the UNESCO system developed for the Central American Ecosystems Map and is thus completely consistent with that product. Some of the Ecosystem variants as used in the 2004 version have been collapsed and integrated in the parent classification.
Regional Organizations	CATHALA C		24 Hr Fire Hot Spot Maps	Actual or potential fire location maps are generated every 24 hours. These are derived from analysis of MODIS satellite data. The University of Maryland, Department of Geography (U.S.A.), provides access to archived and current fire locations on GIS-based interactive maps on its Fire Information for Resource Management System (FIRMS) website. Web fire maps can be retrieved for Brazil, Central and Southern, Africa, Continental U.S., Southeast Asia and at global level.

Regional Organizations	National Aeronautical and Space Agency (NASA)		Terra-I Habitat Change	Terra-i detects land-cover changes resulting from human activities in near real-time, producing updates every 16 days. It currently runs for the whole of Latin America and is being expanded over the next year to cover the entire tropics. This data is in RASTER ARC ASCII format at 250m spatial resolution, in decimal degrees and datum WGS84. It is derived from the USGS/NASA MODIS data. CIAT processed this data to provide habitat change maps. The detections were made using algorithms described by Reymondin et al. (2012). The data represents yearly cumulative detections of land cover change since 2004. The value 0 means that the pixel remained unchanged, whilst the other values represent on which 16 days period a given pixel has been detected as converted. For example if in the grid for 2004 you find a pixel with the value 1, it means it has been detected as converted the 2004.01.01 and with the value 2 it has been detected on the 2004.01.17
Regional Organizations	National Aeronautical and Space Agency (NASA)		Belize Forest Cover 2012	UN-SPIDER's Regional Support Office CATHALAC (Water Center for the Humid Tropics of Latin America and the Caribbean) has just developed the first version of a 2012 forest cover map of Belize. This research was carried out in collaboration with the Ministry of Forestry, Fisheries, and Sustainable Development of the Government of Belize, Lancaster University of the UK and the Environmental Research Institute of the University of Belize. The work – now pending field validation – was developed using NASA Landsat-7 imagery, and follows on the heels of an earlier 2010 USAID- and NASA-supported study assessing changes in forest cover in Belize over the period of 1980-2010.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Fire Risk	Spatial Layer: Fire Risk Source: Belize Fire Risk Map is a digital approximation of wild fire risk to natural areas in Belize. The data was compiled using a variety of parameters obtained from a number of different sources. Scale: 1:250,000
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: 2005 Fire Season Data	Spatial Layer: 2005 Fire Season Data Source: Belize Fire Season data was compiled using the NASA MODIS Satellite System
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Land Degredation Risk	Spatial Layer: Land Degredation Risk Source: J. Meerman. - Dataset combines a total of 8 variables to assess the potential for land degradation in Belize. These variables include; Soil pH, Shallow depth, Soil Fertility, Fire Risk, Slope, Geology and Rainfall. Within these, the soil pH and slope weigh heaviest. In general, those areas with a high combined land degradation value should be considered unsuitable for development, particularly agricultural development.

FGDS: Data layers that are expected to be of common interest as FGDS to the BNSDI community within this topical area include:

FGDS Name	Land and Aquatic Use/Cover (medium scale)
Description	This FGDS will include comprehensive inventory of the terrestrial land use/land cover and benthic bottom types for waterbodies and the coastal and marine areas of Belize at medium scale.
Current Status	Land and aquatic use and cover mapping has been conducted by several organizations for different purposes over time. At least three different efforts have been conducted to move towards a standardized classification and periodic updating, including the MNRA/FAO land cover inventories for 1989-'92 and 1994-'96, the MNRA 1996 study for Central Belize, and the 1998 - 2000, the 2000 CCAD Map of the Ecosystems of Central America with updates in 2004 and 2011.
Future Program Considerations	The development of a medium scale land and aquatic use and cover mapping program that establishes a baseline and provides periodic updates to understand change over time would be of tremendous value to many BNSDI stakeholders. Deriving a standardized classification scheme that meets the broadest practical range of stakeholder needs will require close collaboration across those organizations. This could also be augmented with utilization of the NASA Terra-i that detects land-cover changes resulting from human activities in near real-time, producing updates every 16 days. Ideally the creation and periodic updating of this information would be established as a consistent operational function in government.
Custodianship Considerations	This FGDS includes information that is not isolated to any one organization, therefore the logical custodianship will require further discussion and consideration. Regardless, the development of the classification scheme and conducting baseline and subsequent surveys will require inter-disciplinary collaboration across multiple sectors.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Urban Land Use (large scale)
Description	This FGDS will include existing land use information for urban areas, either coded to plots or as contiguous areas of a common land use type. (land use that was present at the time of the survey). This information could be updated on a periodic basis to provide a baseline and subsequent view of urban land use change over time.
Current Status	The existing plot information maintained by MNRA in the Landfolio system includes existing land use coding. Assessment of the classification scheme used for that coding will require further evaluation in terms of its suitability to meet the BNSDI stakeholder requirements.
Future Program Considerations	This FGDS be developed and maintained as an official register of all significant paleontological sites in Belize. Much of this information will require restricted access for use only be government approved

	persons. In addition, there are several techniques that can be used to obscure this information such as summarization to a grid (e.g. 5 KM grid areas), buffer and offset, or “heat map” to alert planners and others to the likelihood of paleontological resources existing in a general area, without disclosing the locations of actual sites.
Custodianship Considerations	The logical custodian for urban existing land use information is City and Town Councils.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Agricultural Land Use (large scale)
Description	This FGDS will include a delineation and classification of field-specific information for farms. Ideally this would become part of the Agriculture Census, providing a baseline condition and subsequent periodic updates over time to support change and trend analysis.
Current Status	In 1998 the Ministry of Agriculture, and Fisheries & Cooperatives (MAFC) began a five stage program to stimulate development in the agriculture sector. The broad objective of the effort was to establish a sustainable registry of farms and a system of periodic surveys for updating the registry through the introduction of appropriate data collection and statistical methodologies. Another agricultural census was conducted in 2010 and 2011. The census was based on a 16 page questionnaire that covers a broad range of topics, but was not mapped and the statistics can only be geo-coded to the Village level.
Future Program Considerations	This FGDS could provide an effective geospatial framework to support and strengthen the Belize agricultural census and the periodic updating that is required over time. This monitoring could be supported through a BNSDI remote sensing data program, with ongoing validation and refinement based on agricultural extension agent activities.
Custodianship Considerations	The logical custodian for this layer would be the MNRA Agriculture Department
Security Considerations	There are no special security considerations expected for this FGDS.

5.5 Biodiversity

General Considerations: This theme relates to the location, extent and characteristics of living things in the terrestrial and marine environments, as well as the habitats and ecosystem dynamics that support various stages of each species’ lifecycle. The classification of flora, fauna, and habitat data, for both terrestrial and marine environments, has been brought together under Biodiversity. This theme recognizes the interrelatedness and complexity of

plant and animal species within habitat zones. Terrestrial and marine plants, animals, and habitats are then addressed under specific data topics.

Ecosystem dynamics include such things as geohydrology, wind patterns, and marine currents that are addressed as physiographic topics in other sections of this report. This theme includes the animals (fauna), plants (flora), as well as the sum total of biological and physiographic elements and processes that comprise unique habitat types. Together these elements help us to understand the nature of living things in the environment, the complicated dynamics of the ecosystems that support them, and the implications of human impact pressures. It also provides a basis for assessing the population viability of commercially significant species, as well as selected keystone, culturally significant, and threatened or endangered species that are important for setting natural heritage conservation priorities and policies, compliance with various international treaties and conventions, and setting of sustainable biodiversity management strategies.

Business Requirements. Belize is rich in biodiversity and this is critical to the preservation of natural heritage, scientific research and tourism in the Country. The full range of BNSDI stakeholder activities that have some direct need for biodiversity data in some form are depicted in Appendix B. According to this assessment, over 44% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Establish baseline inventory of existing terrestrial and marine populations and indicator species that can be used as reference for ongoing environmental monitoring programs;
- Identification of areas with threatened and endangered species requiring special protection;
- Establishment and management of protected areas;
- Identification of the location and characteristics of commercially significant species (e.g. game fish) for special monitoring and management;
- Identification of habitats upon which significant species and high biodiversity value plant and animal populations rely upon throughout their lifecycle;
- Provide input to community and facility planning and design for consideration of the natural ecosystems and to minimize adverse impacts;
- Land use planning;
- Public sector investment project formulation analysis;
- Development review and approval process;
- Management, leasing and allocation of National Estate lands;
- Support the preparation of Environmental Impact Assessments;
- Preparation of Forest Management Plans;
- Mining and quarrying permitting process;
- Utility planning and corridor selection;
- Transportation planning and corridor selection;
- Marine spill resources at risk inventory and assessment;

- Coastal zone planning and management;
- Fisheries management;
- Tourism planning;
- Support education and awareness building;
- Support ecological research and knowledge building;
- Comply with international environmental conventions and treaties.

Current Situation: Belize is rich in biodiversity and has been the subject of a broad variety of related studies and research over the last few decades. A significant amount of this information is available in a digital and often GIS form, but there is also much information that is in spreadsheets, exhibits in scientific study reports and other forms that are not easily accessible or usable with other information. Studies that represent major compilations of biodiversity data include:

- Mesoamerican Barrier Reef. Many studies have been conducted in and around the Mesoamerican Barrier Reef, the second largest barrier reef system in the world. Much of this information has been compiled by the CZMAI and/or the MNRA LIC.
- Central America Ecosystems Map. From 1998 - 2000, the CCAD (Comisión Centroamericana de Ambiente y Desarrollo), World Bank and the Netherlands collaborated in the production of the Map of the Ecosystems of Central America. The primary objective of the mapping project was to map and describe the ecosystems of Mesoamerica (Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama, using a comprehensive, regionally endorsed, classification system. Updates to the original map for Belize were conducted in 2004 and 2011 by J. Meerman. The original classification scheme has been largely preserved in the newer updates.
- Mesoamerican Biological Corridor project. 2011 rendering of Principal Biological Corridors connecting Belize's protected areas based on a study in 2000 into the feasibility of Northern Biological Corridor and a consolidation study in 2002. In 2011 a study was conducted to determine a Central Belize Biological Corridor. These three studies are integrated and corrected with regards to the actual status of land development in each area.
- The Biodiversity & Environmental Resource Data System of Belize (BERDS) is a community-driven biodiversity and environmental data warehouse and research tool set. What makes BERDS unique is its integrated spatial approach to data analysis, management and dissemination. BERDS merges a wide array of useful data resources (*e.g.*, documents, people, organisations, projects, specimen collections, datasets, multimedia) with an integrated and comprehensive GIS mapping and analysis capability to form a powerful data visualization and investigation toolset for research and monitoring efforts. BERDS is hosted and maintained by Belize Tropical Forest Studies, however, the growth of its data holdings and its long-term financial

sustainability are driven by the participation of BERDS' national, regional and international partners. Since its launch in 1997, BERDS has grown to become the preeminent environmental data resource for Belize, including comprehensive and detailed baseline information on the 120 ecosystems, 92 protected areas and 35 watersheds found in Belize and data holdings including over 7,100 species records, 113,000 data records and providing visual and textual access to over 41 accurate spatial data sets as well as a unique visual-based search facility. There are 5 research case studies explaining how to use the system to solve real-world conservation problems and 11 step-by-step tutorials on using the BERDS facility itself. 30+ national and international organisations and the private sector have joined as active participants and the system has reached levels of financial self-sustainability.²

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 19 – Data Sources Related to the Biodiversity Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Reef	The reef data is a line feature depicting the location of the entire reef system in Belize.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Threats to Belize Barrier Reef (expert-mapped)	date of production: 2005. Originator: World Resources Institute (Reefs-at-Risk Caribbean project). Preferential Scale: 1:250,000. Notes: in a series of workshops hosted by BAS, CZMAI, WCS and WWF, a variety of then-current threats to the reef were mapped on hard copy maps and then transferred into a GIS; while the positional accuracy of this expert mapping cannot be confirmed, these compare favorably with the threats to the Belize Barrier Reef system modeled by the World Resources Institute in its follow-up analysis.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Threats to Belize Barrier Reef (modeled)	date of production: 2005. Originator: World Resources Institute (Reefs-at-Risk Caribbean project). Preferential Scale: 1:250,000. Notes: main modeled threat types are (i) coastal development, (ii) inland / watershed-based sources of pollution / sediment, and (iii) marine based threats; detailed notes on the modeling - which is based on weighting of threat indices - are included on the Belize Coastal Data CD compiled by WRI.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Biological Corridors	date of production: unknown. Originator: unknown (Paseo Pantera project). Preferential Scale: unknown. Notes: while the original creation / publication date of this dataset is unknown, it was re-published on Ford & Clarke's 2000 Maya Forest data CD.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Biological Corridors	date of production: 2002. Meerman et al (Mesoamerican Biological Corridor project). Preferential Scale: unknown. Notes: this dataset delineates primary and secondary corridor routes, as well as barriers to connectivity.

² <http://www.biodiversity.bz/>

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Biological Corridors	date of production: 2011. Originator: Meerman, Petracca & Zeller. Preferential Scale: unknown. Notes: 2011 rendering of Principal Biological Corridors connecting Belize's protected areas based on a study in 2000 into the feasibility of Northern Biological Corridor and a consolidation study in 2002. In 2011 a study was conducted to determine a Central Belize Biological Corridor. These three studies are integrated here and corrected with regards to the actual status of land development in the area.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		MARXAN Gap Analysis Results	date of production: 2005. Originator: Meerman & Cawich (National Protected Areas Policy & System Plan Project - NPAPSP). Preferential Scale: unknown. Notes: this dataset indicates possible priority areas for conservation; see Meerman report for full details on the generation of this dataset.
Regional Organizations	National Aeronautical and Space Agency (NASA)		Global Distribution of Coral Reefs	A new global coral reef database was released by the United Nations Environmental Programme World Conservation Monitoring Center (UNEP-WCMC). It represents the global distribution of tropical, sub-tropical coral reefs. It was created from multiple sources, including USF's Millennium Coral Reef Mapping Project Seascape database and merged together by UNEP-WCMC and the WorldFish Centre in collaboration with WRI and TNC. It should be seen as an "interim" global product. The Approximate % coverage of data sources are as follows - Millennium Coral Reefs (Unvalidated) 50% - Millennium Coral Reefs (Validated) 30% - Other sources 20%.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Biological Corridors	Spatial Layer: Biological Corridors Source: Meerman, J. C. 2001.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Biological Field Stations	Spatial Layer: Biological Field Stations Source: 2005. Belize Tropical Forest Studies
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Ecosystems	Spatial Layer: Ecosystems (incl. Agricultural Encroachment, Agricultural Use, Forest Types, Land Use, Mangroves, Marine Habitats and Wetlands Layers) - Updated 02 Feb 2012. Source: Meerman, J. C. and W. Sabido. 2001. Central America Ecosystems Map: Belize. CCAD/World Bank/Programme for Belize. Major Revision by J. Meerman and posted 02 Feb 2012

Non-Government Organizations	Friends for Conservation and Development		Illegal Activity Incident Reports	Both the Friends of Conservation and Development (FCD) rangers and patrolling Belize Defense Force (BDF) soldiers document significant observations and incidents of illegal activities that they encounter within the Chiquibul National Park area, including recording location information. GPS units have been issued to most teams and Cybertrak software is used to compile the location information. Collected information covers discovered trails, hunting camps, illegal logging, slash and burn areas, locations where people have been detained and other issues. This information has been recorded for nearly 30 years, but formal recording of incidents has been inconsistent. There is not currently a formal program to convert existing paper reports to digital form, but this is desired for the future.
Academic and Research Institution	Environmental Research Institute		NCRMN Database	The NCRMN database holds all data collected nationally regarding coral bleaching activities and disease. Raw data collected by biologists. Data is collected on a seasonal basis at monitored sites around the country. The data collected is then entered by biologists in formatted excel sheets and uploaded to the database through the online application. GPS points of areas stored as WGS84 UTM (Zone 16N). Data added seasonally. There are specific monitoring seasons where biologists monitor and collect data.
Academic and Research Institution	Environmental Research Institute		SPAGS Database	The SPAGS database holds all data collected regarding Fish spawning. Raw data collected by biologists. Data is collected on a seasonal basis at monitored sites around the country. The data collected is then entered by biologists in formatted excel sheets and uploaded to the database through the online application. GPS points of areas stored as WGS84 UTM (Zone 16N). Data added seasonally. There are specific monitoring seasons where biologists monitor and collect data.
Academic and Research Institution	Environmental Research Institute		Camera Trapping Data	A camera trap is a remotely activated camera that is equipped with a motion sensor or an infrared sensor, or uses a light beam as a trigger. Camera trapping is a method for capturing wild animals on film when researchers are not present, and has been used in ecological research for decades. In addition to applications in hunting and wildlife viewing, research applications include studies of nest ecology, detection of rare species, estimation of population size and species richness, as well as research on habitat use and occupation of human-built structures. The wildlife team is mostly interested in Jaguar sightings. Conducting this monitoring activity, can assist in wildlife species conservation efforts. Estimation of population size and species, occupancy and capture analysis, can be made among many other results. GPS coordinates and date/time stamps of captured images are stored in Excel spreadsheet files. (HOW MANY CAPTURED IMAGES ARE CURRENTLY IN THE COLLECTION? ARE THE RECORDS ALL IN ONE EXCEL FILE OR MULTIPLE?)

Academic and Research Institution	Environmental Research Institute		Jaguar Attack Incidents	This database managed by the UB ERI maintains the location of Jaguar attacks on farms, locations of farms, boundary lines of pastures, jaguar scat observations and related information. Due to unavailability of wildlife team and time, details not specified
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Topics: Since ecosystems do not stop at national boundaries, many environmental issues require regional as well as local analysis, and extend from very site-specific information to regional and even global levels. This theme comprises a variety of specific topics, including but not limited to:

- Habitat Types;
- Biological Survey Boundaries;
- Species Observation Points;
- Biological Plot Surveys;
- Animal Tracking Data;
- Species Range Data;
- Population Assessments;
- Biodiversity Value;
- Species of Special Concern Habitat;
- Protection Status and Gap Analysis.

FGDS: Specific data layers in this theme that will likely be of common interest as FGDS to the BNSDI community include the following:

FGDS Name	Habitat Types
Description	Habitat type layers may be developed for whole classes of habitats, or for specific species of concern. These depict the location and extent of general or species-specific habitat, based on a combination of biotic, physiographic and other characteristics needed to support all or part of the lifecycle requirements of species of interest.
Current Status	The existing BERDS program initiated and managed by the Belize Tropical Forest Studies (BTFS) has established a significant foundation of legacy biodiversity information. There are a variety of habitat studies that have been carried out by different organizations in Belize, many of which are available through BERDS.
Future Program Considerations	Existing biodiversity studies in Belize provide a significant starting point for the development of an integrated biodiversity map of Belize at medium to small scale. This could include the delineation of “eco-units” that combine vegetation, soils, geology, landform, and other topics into an integrated picture of the terrestrial environment. This could be combined with an equivalent analysis of the coastal and marine habitats, for a comprehensive and relatively detailed depiction of all the most significant habitats in Belize. This would support biological studies in terms of significant species population projections,

	conservation strategies, as well as development planning, environmental impact assessments and other such activities. The BNSDI should ensure that the BERDS collection, so far provided and maintained by a non-governmental effort, will be made accessible through the spatial data infrastructure, amongst other data provided by international and national organizations and the government. There is significant data on Belize from NGO`s and international sources like the United Nations and it should be ensured that this data can be accessed through the infrastructure as well.
Custodianship Considerations	The development of a national biodiversity inventory for Belize integrating both terrestrial and marine environmental data will have many direct contributors from several organizations. The most likely custodian facilitator of such a resource would likely be the Ministry of Forestry, Fisheries and Sustainable Development.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Biodiversity Study Data
Description	This FGDS could include a common repository of biodiversity study information from officially recognized scientists working in Belize, possibly build upon the existing BERDS program. This would include a delineation of where scientists have surveyed (including areas where they have looked and not found what they were looking for), species observations, and other relevant information that would be useful to the scientific community.
Current Status	Government agencies and other scientific organizations today collect their own information. With the independent Biodiversity and Environmental Resource Database System BERDS (www.biodiversity.bz), Belize has a good collection of environmental geospatial data that has been growing over the years.
Future Program Considerations	The existing BERDS program initiated and managed by the Belize Tropical Forest Studies (BTFS) has established a significant foundation of legacy biodiversity information. The BNSDI should ensure that this important collection, so far provided and maintained by a non-governmental effort, will be made accessible through the spatial data infrastructure, amongst other data provided by international and national organizations and the government. There is significant data on Belize from NGO`s and international sources like the United Nations and it should be ensured that this data can be accessed through the infrastructure as well. Determining what information exists that is needed but is not available through BERDS will require further focused study.
Custodianship	The breadth of contributors and stakeholders to the biodiversity study

Considerations	data theme are very broad across government, universities, NGO's and international organizations. Determining the appropriate custodian arrangement will require an equally broad consultative process, including consideration of building on the foundation that has already been established by BERDS.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Biodiversity Value
Description	Biodiversity is a complicated subject with many interdependencies. There is some value in identifying locations that support the greatest number and quality of habitats and species of interest, representing a cumulative biodiversity value that can be used to prioritize conservation efforts.
Current Status	There has been no comprehensive, systematically applied calculation of biodiversity value for all the terrestrial, coastal and marine areas of Belize.
Future Program Considerations	The development of a comprehensive calculation of biodiversity value for Belize inclusive of both terrestrial, coastal and marine environments could provide valuable input to national spatial planning and a common reference for those involved in more localized land use planning and conservation management.
Custodianship Considerations	The breadth of contributors and stakeholders to the biodiversity value data theme are very broad across government, universities, NGO's and international organizations. Determining the appropriate custodian arrangement will require an equally broad consultative process.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Biodiversity Protection Gap Analysis
Description	This FGDS would provide a nationwide summary of protection status and gap analysis for biodiversity protection.
Current Status	A comprehensive and systematically applied assessment of biodiversity protection status and gap analysis for all the terrestrial, coastal and marine areas of Belize has not been conducted.
Future Program Considerations	In Belize there exists a range of mechanisms by which areas of high biodiversity value are protected. These range from formal protection under the law, to protection in practice due to other controls or land ownership, or in the proximity or remoteness in relation to human activities. Characterization of protection status to a mapped form can be used to overlay onto biodiversity value maps to determine those areas of high diversity value that are in low protection status. This "gap"

	between value and protection can be used to determine those high value areas that are most vulnerable and that should be prioritized for conservation attention.
Custodianship Considerations	The breadth of contributors and stakeholders to the biodiversity gap analysis data theme are very broad across government, universities, NGO's and international organizations. Determining the appropriate custodian arrangement will require an equally broad consultative process.
Security Considerations	There are no special security considerations expected for this FGDS.

5.6 Surficial Hydrology

General Considerations: Surface hydrology data depict the location and extent of streams and rivers, water bodies, flood zones and associated information. Information such as stream gauge monitoring data, water quality sampling and aquatic species sampling may be associated and directly or indirectly linked with stream and river features through physical proximity or river reach, or other identifiers.

Also included in this category are inundation from marine storm surge and tsunami runup zones. The calculation of these phenomena are addressed under the "Marine Abiotic" theme.

Business Requirements. Surficial hydrology data are required to support a broad range of issues in Belize, and is especially critical to climate resiliency planning and adaptation. The full range of BNSDI stakeholder activities that have some direct need for surficial hydrology data are depicted in Appendix B. According to this information, over 67% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Analyze the predicted location and extent of flooding from a theoretical storm scenarios or actual storm events;
- Assess groundwater recharge potential;
- Environmental impact assessment;
- Environmental habitat modeling;
- Watershed analysis and protection;
- Drainage analysis and storm control system design;
- Hazard overlay mapping for land use planning;
- Use as a cartographic reference on topographic basemaps.

Current Situation: The Government of Belize in line with its approved Water Resources Strategy and Action Plan, ACTION 12: "Establish an agency to execute integrated water resources management", and after further modifications of the 2005 Cardona recommendations and in line with its policy 3 decided to "Establish a permanent National

Water Commission with responsibility for integrated water resources management, control and coordination, acting upon the interests of all stakeholders and adaptation measures necessary in response to climactic changes.” The Policy Coordination and Planning Unit is responsible to bring the NIWRA Master Plan to reality. The Goal of the Authority is to coordinate its activities with any person, organization, agency, Department of Government, Local Authority, and to undertake any appropriate studies, investigations and consultations with the objective of facilitating the implementation of the water policy of the Government of Belize. In advancement of official NIWRA commencement the Policy Coordination and Planning Unit is doing what it can with its limited staff to ensure that the Ministry is prepared to undertake the transformation to a full operational Authority.

At present the MNRA Hydrology Unit, The Department of the Environment, the National Meteorological Service, the Public Utilities Commission, and the Ministry of Health all maintain separate databases on water resources quantity and quality data. Such data for the most part are spatially exclusive, and generally unavailable to other water stakeholders. Combining all available data will extend the spatial coverage and expand the Authority’s database. Eventually it is intended that other contributing Agencies/Institutions will be provided with the data generated by the Authority.

The MNRA LIC has automated stream and river course data from the 1:50K Ordnance Survey topographic basemaps. These have limited attribute information associated with the features. This database is in use by many organizations in Belize as a standard cartographic reference.

Watershed boundaries have been automated by multiple organizations for different purposes. The various efforts involved are listed in the Table below.

The Hydrology Unit was originally established as a unit under the National Meteorological Service of Belize and has undergone several transformations and various administrative arrangements. Currently, the Hydrology Unit is housed at the Ministry of Natural Resources. Hydrology Unit continues to collect and manage a variety of hydrological information for the Country. This includes the collection and management of water level and discharge information from 28 monitoring stations covering 17 of Belize’s 35 rivers. All the hydrological data captured each day is being entered to the Hydrologic Operational Multipurpose System (HOMS) established by the World Meteorological Organization for the transfer of technology in hydrology and water resources. At present the Hydrology Unit is utilizing selected components of HOMS focused on water level and discharge levels for selected rivers. The component of HOMS being used by the Unit is a DOS-based data recording system. The coordinate locations for each monitoring station have been used by the MNRA LIC to map these locations. While the Unit is not utilizing GIS in its day to day operations, it wishes to do so in the future to be able to better assess and support water resources management in Belize.

The Friends for Conservation and Development (FCD) is co-manager of the Chiquibul National Park and Cave System has utilized the streams and rivers data acquired through the

MNRA-LIC. FCD staff have found this data does not always accurately represent the location of permanent, year-round streams and thus have been recording field observations to correct the stream information. This information is only being used for their own purposes and has not been submitted to MNRA-LIC or others for refinement of the original database as there has not been a systematic process for communicating these sorts of data issues or updates back to the LIC.

Flood mapping has been carried out for several studies. The most recent of these involved a collaboration between NEMO and CATHALAC in the development of Flood Susceptibility Maps for Belize. These maps were prepared for NEMO by the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC) based on data from the following sources: Flood susceptibility estimates by the Bruce King et al (1986-1992); Settlement maps by Jan Meerman/Belize Tropical Forest Studies (2012); Land Cover mapping by CATHALAC (2013). The flood susceptibility data were modified and re-classified. The topographic contours and shading on the resulting map products were generated through topographic modeling conducted by CATHALAC using the Ordnance Survey E755 topographic maps in addition to elevation data from ASTER, Intermap Star3i, SRTM and the University of the West Indies' Centre for Geospatial Studies (UWI-CGS).

In 1996, the Caribbean Disaster Mitigation Project (CDMP) completed a coastal storm hazard assessment for Belize. The goal of this project was to provide the Government of Belize the capability to predict river water levels based on rainfall rates. This capability would allow the Belize Meteorology and Hydrology offices (now Hydrology Unit within the Ministry of Natural Resources and Agriculture/ NIWRA program) to create floodplain maps for the country and to provide a flood early warning system for emergency response. The flood hazard maps were created through a flood hazard model integrated into a geographic information system (GIS).

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 20 – Data Sources Related to the Surficial Hydrology Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Flood Risk	The Flood Risk layer depicts the location and extent of calculated flood risk areas according to seven risk categories. This includes both areas subject to river or stream overflow as well as area flooding during times of peak rainfall, coastal inundation, swamps and mangrove forest.
MNRA	Lands and Surveys Department	Land Information Centre	Waterways (Rivers/ Creeks/ Streams)	The Waterways layer depicts the linear surface hydrology features digitized from the 1:50K topographic basemaps according to the classification scheme from the source maps, inclusive of river or stream names. These are used primarily for cartographic purposes.

MNRA	Lands and Surveys Department	Land Information Centre	Water Bodies (Inland and Offshore Lagoons)	The Waterways layer depicts the polygon surface hydrology features digitized from the 1:50K topographic basemaps. These polygons include water feature names and are used primarily for cartographic purposes.
MNRA	Lands and Surveys Department	Land Information Centre	Watershed	The Watershed layer shows the location and boundaries for 32 major watersheds across Belize, up to the national boundary.
MNRA	Lands and Surveys Department	Land Information Centre	Baseline	Contains baseline maps such Baseline by country, baseline by district and which includes data such as administrative boundaries, roads, rivers and waterbodies
MNRA	Lands and Surveys Department	Land Information Centre	Baseline	Contains baselin maps such Baseline by country, baseline by district and which includes data such as administrative boundaries, roads, rivers and waterbodies
MNRA	Lands and Surveys Department	Land Information Centre	Belize River valley buildings and flood hazard areas	No additional information provided
MNRA	Lands and Surveys Department	Land Information Centre	FHM_Belize	This folder contains a pilot study of flood modelling of the Crooked Tree Area, Belize District. This project was carried by Japan Internation Cooperation Agency (JICA) through the National Emergency Management Organization (NEMO).
MNRA	Lands and Surveys Department	Land Information Center	Hydrology: Flood Risk	Belize Topical Forest Studies (King Et Al)
MNRA	Lands and Surveys Department	Land Information Center	Hydrology: Waterways (Rivers/Creeks/Streams)	Topographic Sheets (DOS)
MNRA	Lands and Surveys Department	Land Information Center	Hydrology: Water Bodies (Inland and Offshore Lagoons)	Topographic Sheets (DOS)
MNRA	Lands and Surveys Department	Land Information Center	Hydrology: Watershed	Belize Topical Forest Studies (King Et Al)

MNRA	Natural Resources Department	Policy Coordination and Planning Unit, NIWRA and Hydrology Unit	Water Abstraction Case Files	Water Abstraction Case Files are maintained by the MNRA Agriculture Department, Policy Coordination Unit. These files contain applications for water abstraction permits, as well as all supporting documentation and communications. Each case file is identified by District, Year, and a chronologically assigned Sequence Number within that year. These are then organized to binders for each type of abstraction. The MNRA Agriculture Department Hydrology Unit is utilizing selected components of the Hydrologic Operational Multipurpose System (HOMS) recording water level and discharge information for 28 monitoring stations covering 17 of Belize's 35 rivers. 4 of the existing monitoring stations have automatic recorders but do not transmit the information and the information has to be downloaded manually at each station periodically. The other 24 stations are recorded manually twice a day, at 6:00 AM and 6:00 PM. The coordinate locations for each monitoring station have been used by the MNRA LIC to map these locations.
MNRA	Natural Resources Department	Policy Coordination and Planning Unit, NIWRA and Hydrology Unit	Hydrological Regions of Belize	The coding of the Hydrological regions of Belize conforms to the recommendations of the Central American Hydrological Project (PHCA), which is, that every main water course draining to the Atlantic Ocean gets an uneven number starting from the north.
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Belize Flood Hazard Assessment (2014)	NEMO collaborated with CATHALAC in the development of <i>Flood Susceptibility Maps for Belize</i> . These maps were prepared for NEMO by the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC) based on data from the following sources: Flood susceptibility estimates by the Bruce King et al (1986-1992); Settlement maps by Jan Meerman/Belize Tropical Forest Studies (2012); Land Cover mapping by CATHALAC (2013). The flood susceptibility data were modified and re-classified. The topographic contours and shading on the resulting map products were generated through topographic modeling conducted by CATHALAC using the Ordnance Survey E755 topographic maps. In addition to elevation data from ASTER, Intermap Star3i, SRTM and the University of the West Indies' Centre for Geospatial Studies (UWI-CGS).
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Belize Flood Susceptibility Estimates	Bruce King et al (1986-1992).

Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)			
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)		Belize River Flood Susceptibility Assessment (1996).	In 1996, the Caribbean Disaster Mitigation Project (CDMP) completed a coastal storm hazard assessment for Belize. The goal of this project was to provide the Government of Belize the capability to predict river water levels based on rainfall rates. This capability would allow the Belize Meteorology and Hydrology offices (now Hydrology Unit within the Ministry of Natural Resources and Agriculture/ NIWRA program) to create floodplain maps for the country and to provide a flood early warning system for emergency response. The flood hazard maps were created through a flood hazard model integrated into a geographic information system (GIS)
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Rivers	date of publication: unknown. Originator: University of Edinburgh. Preferential Scale: 1:50,000. Notes: digitized from 1:50,000 Ordnance Survey E755 sheets, which were in turn derived from high resolution aerial photographs; visual comparison with the scanned E755 sheets reveals a possible that a datum shift with the river data, which would have extreme implications on other derived data; according to Esselman and Meerman, digitizing of the stream network in southeastern Belize is better than the digitizing of rivers in the Maya Mountains.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Rivers	date of publication: 1998. Originator: ProNatura (Selva Maya EcoRegional Planning Project). Preferential Scale: 1:250,000. Notes: "synthetic stream network" derived from a digital terrain model; this data does not resemble the stream network digitized from the topographic sheets.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Rivers	date of publication: 2003. Originator: Esselman et al. Preferential Scale: 1:50,000. Notes: same as the dataset digitized by U. Edinburgh, but with extra attribute data such as geology, type, etc..
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Rivers	date of publication: 2005. Originator:USGS (IABIN-DGF project). Preferential Scale: 1:100,000. Notes: "synthetic stream network" derived from a 30m resolution digital surface model (SRTM); this dataset is considered an intermediate product and will require a great deal of refinement.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Rivers	date of publication: forthcoming. Originator: USGS (IABIN-DGF project). Preferential Scale: 1:100,000. Notes: see notes above on IABIN-DGF generated Belize / Guatemala synthetic stream network.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Rivers	Originator: Ordinance Survey Maps (UK); Jan Meerman (stream orders, names); Sandor Ricketts (digitizing); Peter Esselman (project rationale), Climate Resilience Project under the Global Facility For Disaster Reduction and Recovery" (2013). Notes: This dataset contains vector streamlines for all of the domestic watersheds of Belize. The lines were hand digitized from 1:50,000 maps from Belize that were scanned and georectified. Each stream segment has attributed indicating stream order, elevation, slope and where available names.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Lagoons / Water Bodies	date of publication: unknown. Originator: University of Edinburgh. Preferential Scale: 1:50,000. Notes: this dataset is fairly incomplete; digitized from 1:50,000 Ordnance Survey E755 sheets, which were in turn derived from high resolution aerial photographs.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Lagoons / Water Bodies	Originator: Peter Esselman and Sandor Ricketts. Preferential Scale: 1:50,000. Notes: This dataset contains water body polygons for all of the domestic and international watersheds of Belize. The polygons were hand digitized from 1:50,000 maps from Belize, Guatemala, and Mexico that were scanned and georectified.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Watersheds / Catchments	date of publication: 1992. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:250,000 (?). Notes: not much is known about the generation of this dataset, except that there are notable errors in the boundaries of the catchments; this dataset is generally treated as sacrosanct despite the fact that it is not "hydrologically correct" per se; in terms of origin the boundaries of the major catchments were probably roughly sketched out the NRI team.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Watersheds / Catchments	date of publication: 1995 (?). Originator: NARMAP. Preferential Scale: 1:250,000 (?). Notes: this dataset shows a better definition of the Sibun River watershed; from the attribute data, this dataset has also been further edited / updated by J. Meerman.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Watersheds / Catchments	date of publication: 2003. Originator: ProNatura (Selva Maya EcoRegional Planning Project). Preferential Scale: 1:250,000. Notes: the source metadata for this are obscure, but apparently this was generated using the 1:250,000 digital elevation model that ProNatura assembled using spot heights from the topographic sheets for the respective Selva Maya countries.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Watersheds / Catchments	date of publication: 2005. Originator: WRI (ICRAN-MAR project). Preferential Scale: 1:350,000. Notes: despite the fact that the source SRTM data represent a digital surface model, this dataset can be considered the most "hydrologically correct" watershed boundary dataset, despite obvious errors with regards to extremely small watersheds; hydrologica accuracy was assured by superimposing 1:50,000 river data into the elevation data ("burning rivers"); this dataset is also the third iteration produced through the ICRAN-MAR project.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Watersheds / Catchments	date of publication: 2005. Originator: USGS (IABIN-DGF project). Preferential Scale: 1:100,000. Notes: the hydrologic accuracy of this dataset is in question not only because of the fact that the SRTM is merely a surface model, but also because of the hydrologic corrections that were incorrectly incorporated (rivers were burned in from the 1:1,000,000 scale Hydro1K data instead of that of a comparable resolution to the elevation model)
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Watersheds / Catchments	date of publication: forthcoming. Originator: USGS (IABIN-DGF project). Preferential Scale: 1:100,000. Notes: see notes on IABIN-DGF Belize / Guatemala watershed dataset.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Watersheds / Catchments	date of publication: 2011. Originator: Jan Meerman Update of Emil Cherrington SERVIR CATHALAC. Preferential Scale: 1:50,000. Notes: Watershed layer for Belize originally prepared by Emil Cherrington for SERVIR (CATHALAC) using SRTM data sources. His original dataset was modified for most coastal watersheds based on field surveys and topography interpretation by Jan Meerman. Many boundaries of coastal watersheds were simplified. Errors (many slivers) were removed.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Flood Plains / Flood Risk	date of production: 1992. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:100,000. Notes: this dataset is also credited as the Land Information Centre, which extracted flood plain locations from King et al's land systems; King et al's Agricultural Development Prospects in Belize report (p. 113) explain that the team had already estimated flood risk across 16 classes; unfortunately, the tables correlating those classes with particular land systems cannot be found.
Regional Organizations	National Aeronautical and Space Agency (NASA)		SRTM Water Body Data (SWBD)	SWBD is a geographical dataset encoding high-resolution worldwide coastline outlines in a vector format, published by NASA and designed for use in geographic information systems and mapping applications. It was created by BAE Systems ADR for the US National Geospatial-Intelligence Agency (NGA) as a complementary product during editing of the digital elevation model database of the Shuttle Radar Topography Mission (SRTM). SWBD data covers the Earth's surface between 56° southern latitude and 60° northern latitude. It is distributed in ESRI shapefile format, divided into 12,229 files, each covering one 1°-by-1° tile of the Earth's surface. SWBD data is in the public domain and is made available online for free download by NASA.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Groundwater Provinces	Spatial Layer: Groundwater Provinces Source: USAID. 1984. Belize: Country Environmental Profile: A Field Study.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Hydraulic Gauging Stations	Spatial Layer: Hydraulic Gauging Stations Source: Belize Meteorological Service. 2005 http://www.hydromet.gov.bz/Hydro_station_page.html

Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Rivers and Streams	<p>Spatial Layer: Rivers and Streams Source: Land Information Centre Spatial Layer</p> <p>[Made public through Paseo Pantera Consortium Univ. of Florida/USAID Digital Geographic Database: Maya Forest Region: Mexico, Guatemala, Belize. Version 1, August 19110.]</p> <p>Note: further modified by Jan Meerman & Peter Esselman</p>
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Watersheds	<p>Spatial Layer: Watersheds Source: based on NARMAP 19110. Environmental water quality monitoring report. Final Report and Annexes. Department of the Environment, Belize.</p> <p>Note: further modifications using altitude, stream and ecological data by Jan Meerman and Jerod Clabaugh</p>
Non-Government Organizations	Friends for Conservation and Development		Hydrology	<p>The Friends of Conservation and Development (FCD) have utilized river and streams data from the MNRA-LIC. They have found that some of the streams are not actually existing on the ground, and have been updating their own copy of the data to reflect conditions that have been field verified, but there has not been a program established for this information to be provided back to the LIC.</p>

Topics: The following topics of interest to BNSDI community included within this class of data are:

- Rivers and Streams
- Flood Zones
- Coastal Storm Surge Zones
- Tsunami runup zones
- Springs
- Watersheds
- Waterbodies
- Surface Hydrology Monitoring Stations
- Surface Water Quality

FGDS: The following specific data layers are expected to be of common interest to the BNSDI community at this time:

FGDS Name	Rivers and Streams
Description	A comprehensive surface drainage dataset at medium scale would map include all the major and natural drainage features across the Country, inclusive of all natural and manmade surface drainage features.
Current Status	Several versions of medium to small scale maps of streams and rivers in Belize have been compiled. These have largely been compiled from available Ordnance Survey topographic basemaps at 1:250K and 1:50K.

	Some more localized renditions have been refined or updated using high resolution satellite imagery and aerial photography. The national coverage has not been systematically verified.
Future Program Considerations	There is a need for the development of a single, up to date, authoritative medium scale source for surficial hydrology in Belize, inclusive of both natural streams and rivers as well as major manmade drainage features. This information should be structured appropriately to accommodate hydrologic analysis as well as cartographic representation. This information would need to be periodically updated to capture changes within both the natural and manmade systems.
Custodianship Considerations	The logical custodian for this layer would be the MNRA NIWRA program, with the involvement and input of other stakeholders.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Watersbodies
Description	This FGDS will delineate the boundaries and essential characteristics of lakes and reservoirs in Belize.
Current Status	Several versions of watersbodies in Belize have been compiled. These have largely been compiled from available Ordnance Survey topographic basemaps at 1:250K and 1:50K.
Future Program Considerations	There is a need for the development of a single, up to date, authoritative source for waterbody boundaries in Belize, inclusive of both natural rivers and lakes as well as major manmade reservoirs. It is expected that waterbody information derived at medium scale can be used or generalized for use for small scale mapping purposes.
Custodianship Considerations	The logical custodian for this layer would be the MNRA NIWRA program, with the involvement and input of other stakeholders.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Watersheds
Description	This FGDS will include a hierarchical classification of river basins, sub-basins, and drainage such that smaller basins that feed into other watersheds.
Current Status	Several versions of watersheds in Belize have been compiled. These have largely been compiled from available Ordnance Survey topographic basemaps at 1:250K and 1:50K.
Future Program Considerations	There is a need for the development of a single, up to date, authoritative source for watershed boundaries in Belize, inclusive of both natural streams and rivers as well as major manmade drainage areas. It is expected that watershed information derived at medium scale can be

	used or generalized for use for small scale mapping purposes.
Custodianship Considerations	The logical custodian for this layer would be the MNRA NIWRA program, with the involvement and input of other stakeholders.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Flood Zones
Description	This FGDS will delineate areas of potential flooding for 10, 50 and 100 year storm events.
Current Status	Flood zones have been mapped by several entities in Belize over the years. The most recent was carried out by NEMO in collaboration with CATHALAC. Most of the existing national flood zone data has been compiled from various sources that were manually interpreted or based on local knowledge. The 1996 Caribbean Disaster Mitigation Project (CDMP) completed a coastal storm hazard assessment to provide the Government with the capability to predict river water levels based on rainfall rates. This capability would allow the Belize Meteorology and Hydrology offices (now Hydrology Unit within the Ministry of Natural Resources and Agriculture/ NIWRA program) to create floodplain maps for the country and to provide a flood early warning system for emergency response. The flood hazard maps were created through a flood hazard model integrated into a geographic information system. This model has not been applied to the rest of Belize.
Future Program Considerations	Areas with potential for flooding whose characteristics and delineation may be based on risk over a temporal scale, for example, flood zones for 10 year, 50 year or 100 years storm inundation, or through interpretation of areas of historical flooding that are evident from land characteristics. This information may be calculated very precisely at large scale where community development is concerned, and generalized for use at medium scale. Areas outside community development areas might be delineated less precisely at medium scale. This level of modeling will require much higher accuracy of topographic information than is currently available in Belize today. The potential for storm surge and tsunami runoff could be modeled separated and added to this FGDS.
Custodianship Considerations	The logical custodian for this layer would be the MNRA NIWRA program, with the involvement and input of other stakeholders.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Coastal Storm Surge
Description	This FGDS will delineate areas of potential coastal flooding due to

	storm surge.
Current Status	No comprehensive assessment of potential coastal flooding from storm surge was identified in the BNSDI Stakeholder Survey.
Future Program Considerations	The determination of coastal areas that may be susceptible to damaging storm surge during hurricanes is critical to land use planning, disaster reduction and recovery planning and climate resilient infrastructure investments. With the proper data inputs there are various models available from international sources that can be used to determine areas of potential storm surge inundation for any storm scenario. These models can be used to estimate areas of statistically high vulnerability as well as predict the impacts from actual storm events.
Custodianship Considerations	The logical custodian for this layer would be NEMO, with the involvement and input of other stakeholders.
Security Considerations	There are no special security considerations expected for this FGDS.

5.7 Subsurface Hydrology

General Considerations: Subsurface hydrology is the study of groundwater characteristics and processes. For the purpose of data modeling, this theme is broken down into the physical structures that influence ground water flow and the water itself. Mapping and analyzing the hydrogeology is a highly specialized field. Of more general interest to the BNSDI community at large is the assessment of groundwater quantity and quality and trend information that is normally derived through the measurement and monitoring of the groundwater system through a network of monitoring wells.

Business Requirements. Subsurface hydrology data are required for the effective management of groundwater resources in Belize. The full range of BNSDI stakeholder activities that have some direct need for subsurface hydrology data are depicted in Appendix B. According to this information, over 37% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Groundwater quantity and quality monitoring;
- Water abstraction permitting;
- Well permitting;
- Wellhead protection planning;
- Watershed management;
- Groundwater pollution modeling;
- Environmental assessment;
- Habitat modeling and assessment;
- Water security planning;

- Agricultural planning;
- Development review and approval process;
- Environmental impact assessment;
- Regional land use planning.

Current Situation: In 2013 a groundwater assessment consultancy supported by the UNDP was announced, tendered and awarded. The overall objective of the consultancy is to support the Government of Belize, Ministry of Natural Resources and Agriculture in completing an assessment of Belize's groundwater resources in the southern coastal water province of Belize referred to as the Savannah Groundwater province. The Consultant is providing expertise in conducting a hydrological assessment of existing ground water resources and associated supporting water catchment grounds and to the extent possible determine the extent of ground water resources degradation based on past and current land use practices as well as provision of estimates of the ground water potential in the delineated region.

Main deliveries of this project are to include the classification of the hydro-geological characteristics of the province, a definition of its boundaries, the provision of an aggregated overview of the current groundwater potential, and an integrated groundwater assessment study which is to serve as the basis for regional groundwater development master plan. Although needed for the whole Savannah Province, this assessment study is initially focusing on those areas which support growing population centers as well as those areas which are expected to support large expansions in the various developmental sectors including tourism, agriculture and aquaculture. For those areas supporting population centers a more detailed assessment of the spatial and vertical extent of the groundwater quality and quantity is required as a means of determining the feasibility of utilizing groundwater resource as an alternative for water supply options in the light of climate change

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 21 – Data Sources Related to the Subsurface Hydrology Data Theme

MNRA	Natural Resources Department	Policy Coordination and Planning Unit, NIWRA and Hydrology Unit	Hydrological Regions of Belize	The coding of the Hydrological regions of Belize conforms to the recommendations of the Central American Hydrological Project (PHCA), which is, that every main water course draining to the Atlantic Ocean gets an uneven number starting from the north.
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Ministry of ENERGY, SCIENCE & TECHNOLOGY AND PUBLIC UTILITIES	Geology, Energy, Science and Technology Departments and Public Utilities Commission		Borehole data	<i>Borehole data</i> being compiled in Belize includes lithography and geohydrologic information for upper strata that are not needed for petroleum exploration but is very relevant for groundwater resource management. Data for 85 wells is being compiled by a company TGS-NOPEC, who processes the information to a variety of information products that are then sold back to oil companies and consultants, with the government taking a share of that revenue.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Groundwater Provinces	Spatial Layer: Groundwater Provinces Source: USAID. 1984. Belize: Country Environmental Profile: A Field Study.

Topics: The following topics of interest to BNSDI community included within this class of data.

- Groundwater Monitoring Locations
- Groundwater Quality
- Groundwater Level
- Groundwater Basins
- Hydrogeologic Structure

FGDS: The information that is expected to be of most general interest to the BNSDI community includes the following:

FGDS Name	Groundwater Monitoring Locations
Description	This FGDS would provide a comprehensive inventory of the location and characteristics of all groundwater monitoring stations in Belize, linked to current and historical monitoring data for each location.
Current Status	In 2013 a groundwater assessment consultancy supported by the UNDP was announced, tendered and awarded. The overall objective of the consultancy is to support the Government of Belize, Ministry of Natural Resources and Agriculture in completing an assessment of Belize’s groundwater resources in the southern coastal water province of Belize referred to as the Savannah Groundwater province. There is no comprehensive assessment of groundwater resources for the rest of the country.
Future Program Considerations	A comprehensive assessment of groundwater resources across Belize is planned within the MNRA NIWRA program. The NIWRA has not yet been officially commenced by the Government of Belize and at the time of this writing there was no committed deadline for doing so.
Custodianship Considerations	The MNRA NIWRA is the logical custodian of this FGDS.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Groundwater Basins
Description	The FGDS would provide a delineation of groundwater basins and hydrogeologic processes including infiltration/exfiltration, interactions with surface water streams, rivers and water bodies that may be used in various resource conservation analyses.
Current Status	Groundwater basins have been mapped. In 2013 a groundwater assessment consultancy supported by the UNDP was announced, tendered and awarded. The overall objective of the consultancy is to support the Government of Belize, Ministry of Natural Resources and Agriculture in completing an assessment of Belize's groundwater resources in the southern coastal water province of Belize referred to as the Savannah Groundwater province. There is no comprehensive assessment of groundwater resources for the rest of the country.
Future Program Considerations	A comprehensive assessment of groundwater resources across Belize is planned within the MNRA NIWRA program. The NIWRA has not yet been officially commenced by the Government of Belize and at the time of this writing there was no committed deadline for doing so.
Custodianship Considerations	The MNRA NIWRA is the logical custodian of this FGDS.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Groundwater Model Outputs
Description	This FGDS would provide selected outputs of a groundwater model for Belize, based on stakeholder requirements for both current and historical conditions and trends. At a minimum this would include depth to groundwater and selected water quality parameters.
Current Status	In 2013 a groundwater assessment consultancy supported by the UNDP was announced, tendered and awarded. The overall objective of the consultancy is to support the Government of Belize, Ministry of Natural Resources and Agriculture in completing an assessment of Belize's groundwater resources in the southern coastal water province of Belize referred to as the Savannah Groundwater province. There is no comprehensive assessment of groundwater resources for the rest of the country.
Future Program Considerations	A comprehensive assessment of groundwater resources across Belize is planned within the MNRA NIWRA program. The NIWRA has not yet been officially commenced by the Government of Belize and at the time of this writing there was no committed deadline for doing so. The groundwater model for Belize would utilize parameters measured at

	monitoring wells and derive a surface for each that could be used in a GIS.
Custodianship Considerations	The MNRA NIWRA is the logical custodian of this FGDS.
Security Considerations	There are no special security considerations expected for this FGDS.

5.8 Soils

Soils surveys are generally carried out for large areas, resulting in maps that illustrate the location and extent of various soil classes. These classes are usually accompanied by tabular interpretive matrices that describe the physical, chemical and biological characteristics of each soil type, as well as interpretive matrices describing engineering characteristics and agricultural crop suitability. Soil maps usually focus on surface materials in the first 2-3 meters depth. Geotechnical studies also address soils and surface geologic conditions that are carried out to analyze the foundation bearing capacity of the soils and substrate to ensure that the weight of a building or other civil engineering works can be supported and that the building foundation or other structural measures are designed in accordance with the geotechnical properties of the land. Geotechnical studies are often concerned with deeper substrate than soils mapping.

Soil geospatial data are usually developed in vector format where each polygon represents a particular class of soil, with each class representing a unique combination of physical, chemical, and biological characteristics. In developing a classification scheme for soils, it is useful to use a hierarchical scheme such that similar soils can be aggregated into coarser categories, which is beneficial for illustrating soil information at various scales. For most applications, soil data are usually compiled at the 1:20k – 1:100k scales, depending on the purpose of the mapping. For particular applications within urban and city environments, a finer scale survey might be required or data gathered at smaller scales can be conflated to finer scales. Because soil information does not change on a regular basis, these data require less updates, however, this only stays true if the soil survey conducted is comprehensive its initial development.

In addition to the above, geotechnical studies are often carried out in the context of urban development and building projects. These are very site specific and related to specific building sites and are therefore carried out at a large scale. These geotechnical studies are mostly carried out by consulting engineering companies for submission to the DMA as part of the required studies for buildings and developments. A data project is underway by DMA, ADM, and DOT to create a database and information management system that collects the location and geotechnical data for the past geotechnical studies that have been conducted as part of a myriad of development projects in the Country. This information would be very

relevant at the large scale for site selection and development feasibility projects to consult past geotechnical and soils information.

Business Requirements. Soils maps and associated information from both soils sampling and geotechnical studies compiled to a common database over time can become a valuable reference for many different applications from regional land use and agriculture planning to site-specific engineering. The full range of BNSDI stakeholder activities that have some direct need for soils data are depicted in Appendix B. According to this information, nearly 47% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Highway corridor suitability analysis;
- Environmental planning;
- Agricultural planning and farm management;
- Forestry planning and forest management;
- Regional land use planning;
- Utility infrastructure planning;
- Transportation infrastructure planning and roadway design;
- Site design and engineering;
- Geotechnical analysis for buildings and civil works;
- Survey and mapping of terrestrial habitat;
- Identify sensitive environmental areas;
- Identify areas susceptible to landslides or erosion;
- Develop land suitability/capability maps for various development scenarios;
- Develop overall land characteristics that intersect geology, soils, hydrology and land cover;
- Aquaculture suitability analysis;
- Environmental impact assessment;
- Watershed management;
- Coastal zone management;
- Evaluate groundwater recharge conditions.

Current Situation: A soil survey conducted between 1986 and 1992 by King et al as a component of the NRI Land Resource Assessment is the most comprehensive soil survey conducted in Belize. This was prepared through extensive field work supplemented with aerial photo and satellite imagery visual interpretation and mapping at 1:100K scale. The soil types used were not a standard international classification and are idiosyncratic to Belize. The accompanying NRI reports contain the correlations that could be used to convert this map into standard FAO / USDA classifications. This data was digitized by CZMAI. This data has been used to create a variety of derivative products related to agricultural potential and land degradation threats.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 22 – Data Sources Related to the Soils Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Agricultural Potential	This layers shows the areas for agricultural potential based on financial investment. This data have five classifications, with one being the most suitable for agricultural purposes.
MNRA	Lands and Surveys Department	Land Information Centre	Crop Suitability	The Crop suitability layer shows areas that are suitable for specific crops, such as sugar, corn, beans, rice, etc. It conatins data such as the soil type, salinity and vegetation type.
MNRA	Lands and Surveys Department	Land Information Centre	Soils Map	This layer shows the location and extent of the different soils profile for the entire country of Belize. This include inforamtion on recent soil fromations, under condition of intermittent lime enrichment, soils from under condition of continous acid leaching immature.
MNRA	Lands and Surveys Department	Land Information Center	Land Systems: Agricultural Potential	King Et Al/NRI
MNRA	Lands and Surveys Department	Land Information Center	Land Systems: Crop Sustainability	King Et Al/NRI
MNRA	Lands and Surveys Department	Land Information Center	Land Systems: Soils Map	Charles Wright et al
MNRA	Agriculture Department	Industries, Aquaculture and Inland Fisheries, Cooperatives, Policy and Trade (Statistics), Marketing and Project Execution Unit	SIRDI Soils Maps	Sugar Industry Resource Development Institute (SIRDI) commissioned the preparation of detailed soils mapping within their area of interest (See Stakeholder Survey write-up containing SIRDI information).
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Soils	date of publication: 1959. Originator: Wright et al. ("Land in British Honduras" publication). Preferential Scale: 1:250,000. Notes: edited by J. Meerman to include updates by I. Baillie; soil types are not described in traditional classification (e.g. FAO), and are therefore idiosyncratic to Belize.

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Soils	date of publication: 1992. Originator: FAO-UNESCO (Soil Map of the World). Preferential Scale: 1:5,000,000. Notes: also referred to as the SOTER (soil & terrain) database, the world soil map was originally published between 1974 and 1978 in a number of sheets; in 1992, an updated digital version was released; the down-side of this dataset is obviously is extremely coarse scale.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Soils	date of publication: 1992. Originator: King et al (NRI Land Resource Assessments). Preferential Scale: 1:100,000. Notes: the source of this data is the most comprehensive soil survey conducted in Belize (mostly fieldwork, supplemented w/ aerial photography and some satellite imagery); conducted between 1986 and 1992; soil types are not described in standard classification (e.g. FAO or USDA), and are therefore idiosyncratic to Belize; the accompanying NRI reports contain the correlations that could be used to convert this map into standard FAO / USDA classifications.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Soils	date of publication: 2004. Originator: ProNatura (Selva Maya EcoRegional Planning Project). Preferential Scale: 1:250,000. Notes: from the metadata, it is unclear what the sources of this data are; this dataset is in the FAO classification scheme.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Relative Erosion Potential	date of production: 2004. Originator: World Resources Institute (Reefs-at-Risk Caribbean project). Preferential Scale: 1:4,000,000. Notes: a modified version of the Revised Universal Soil Loss Equation (RUSLE) was used ($REP = pct_slope * Land_cov_eros_rate * Precip_mm * porosity / 1,000$) to generate this dataset; datasets used were soil porosity from the 1:5M SOTER database, peak rainfall from the Global Arc CD, and 1992-93 land cover data from USGS' GLCC database; more detailed notes are contained within the Belize Coastal Data CD compiled by WRI.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Relative Erosion Potential	date of production: forthcoming. Originator: World Resources Institute (ICRAN-MAR project). Preferential Scale: 1:350,000 (?). Notes: as a part of its work under the ICRAN-MAR project, WRI will be revising its REP mapping using more detailed elevation and land cover data.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Land Degradation Risk	date of production: 2005. Originator: Meerman (UNCCD rapid land degradation survey). Preferential Scale: 1:250,000 (?). Notes: as stated in the metadata, 8 variables have been used to estimate potential for land degradation; done through the UNCCD rapid land degradation survey of Belize, this dataset represents the first effort to map overall potential for land degradation.

Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Soils	<p>Spatial Layer: Soils</p> <p>Source: Based on Wright, A. C, et al, 11109. Land in British Honduras. Colonial Res. Publ. No. 24.</p> <p>Note: Generated by PRONATURA for the TNC-led Selva Maya Project (draft form) Further modified to include information from Baillie, et al. 1993. Revised Classification of the Soils of Belize. NRI Bulletin No. 59.</p>
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Topics: Topics for this theme include:

- Soil Sample Points
- Soils Type Areas
- Geotechnical Sample Points

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Soil Type Areas
Description	This FGDS will depict soil classes for all land areas across Belize, inclusive of interpretive matrices that provide values of suitability for various engineering and horticultural purposes.
Current Status	A soil survey conducted between 1986 and 1992 by King et al as a component of the NRI Land Resource Assessment is the most comprehensive soil survey conducted in Belize. This was prepared through extensive field work supplemented with aerial photo and satellite imagery visual interpretation and mapping at 1:100K scale. This data was digitized by CZMAI. This data has been used to create a variety of derivative products related to agricultural potential and land degradation threats.
Future Program Considerations	A future program could include an updating and refinement of the original soil mapping by King et al, utilizing the more advanced aerial photography and satellite data that are available. For agricultural areas the map refinement could be carried out at 1:50K to support more precision that would be useful for agriculture production purposes. This increase in accuracy would likely require additional fieldwork for verification and/or refinement. In this process it should also be determined whether or not the data should be re-mapped to match FAO standards to be more comparable regionally. Another value add would be to provide interpretive tables of soil characteristics such as cut slope stability, compressibility, erosivity, and suitability to support various key crop types, from which thematic maps could be generated.
Custodianship Considerations	The logical custodian for this layer would be the MNRA LIC, in collaboration with a variety of other key stakeholders who require this information.
Security	There are no special security considerations expected for this FGDS.

Considerations	
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FGDS Name	Geotechnical Studies
Description	This FGDS will include a common repository of all geotechnical studies across the country and associated data. Geotechnical studies are often carried out for specific buildings and structures, or may be a network of test sites conducted for a broad area. In either case, the geotechnical studies include specific excavation or borehole sites and associated test measurements and lithographic interpretations that provide a picture of the geotechnical characteristics of the soils and geologic material within several meters of the surface.
Current Status	Geotechnical studies are required for all major building and infrastructure projects in Belize including highway and bridge construction, pipelines, electrical transmission towers, and major building structures. These data are submitted to the appropriate organization depending on the subject involved, including the Ministry of Transportation and Works (roads and bridges), the Central Building Authority (buildings), BEL (electrical transmission facilities), and BWS (water transmission and mainlines).
Future Program Considerations	A future program could include the development of a common archive that would include standardized geotechnical study data from all the relevant agencies. The process of compiling this information could be expedited by requiring engineering consultants to submit the information in a standardized form.
Custodianship Considerations	The logical technical custodian for this layer could be the MNRA LIC, in collaboration with the geotechnical subject matter experts from each of the participating organizations.
Security Considerations	There are no special security considerations expected for this FGDS.

5.9 Geology

General Considerations: Geology relates to the solid matter that constitutes the Earth at various depths. It encompasses such physical aspects as rocks, soil, minerals, gemstones, etc. and evaluates the composition, structure, physical properties and history. Generally, geologic information is provided in two forms: 1) surficial; and 2) subsurface. The former relates to surface layers related to soil or exposed bedrock, while the later relates to the deeper structure and content of Earth's materials. Additional geotechnical information is often collected for building sites as input to architecture and engineering design studies.

Generally, both surficial and subsurface geological information is collected as part of a comprehensive geological survey. Because of the effort required for subsurface geological surveys, the former is usually developed initially and informs the other. A well-considered sampling design is required for both types of surveys in order to account for the full variation in the geologic type distribution. A common practice used for gathering geologic samples is the use of bore holes.

Because geologic change is only significant for larger areas, these data are generally developed at smaller scales. The sample points obtained through the field surveys are used as the source points to then extrapolate to unsampled locations. Through this technique and expert interpretation of rock types, structures and geomorphology, a geologic coverage can be generated, usually in vector format where each polygon describes the class of geology, along with other information regarding geologic profiles, lithography and structure. Like soils, it is again useful to use a hierarchical scheme for the classification of each geologic type so that classes can be aggregated based on the scale at which the geologic information is being illustrated. In some cases, more detailed information may be required for urban and city scale scenarios. In these instances, additional surveys can be conducted to supplement the information provided via the smaller scale data. Because geologic information only changes over extremely large time periods, these data require infrequent updates.

Business Requirements. Geology mapping provides information that is needed for building and infrastructure engineering, petroleum and mineral exploration, water resource management and many other applications. The full range of BNSDI stakeholder activities that have some direct need for soils data are depicted in Appendix B. According to this information, over 31% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Oil exploration;
- Mineral exploration, permitting and mining;
- Identify potential earthquake seismicity, including faulting and shaking zones;
- Disaster reduction and emergency response;
- Evaluation of land capability and characteristics;
- Transportation planning;
- Utility infrastructure planning;
- Coastal zone planning and management;
- Landfill siting and design;
- Water resource assessment and management;
- Development review;
- Environmental impact assessment;
- Education and research.

Current Situation: There are selected units in Belize that are most involved with the development of geology information and many more that use this information.

The MNRA Mining Unit is responsible for managing all non-petroleum mineral resources in Belize, inclusive of any land areas, territorial sea (and beyond up to 200m depth), or in any spring, stream, river, lake or lagoon. This includes the full range of mineral resources from precious metals to industrial minerals such as clay, dolomite, granite, gypsum, limestone, sand, sandstone or salt, used for agricultural, building, roadmaking or industrial purposes, and construction minerals referring to stones, gravel, sand or clay used for constructing buildings, roads, dams, concrete structures, and similar works, or the making of blocks, bricks and tiles. The Unit manages and maintains geological information related to mineral resource assessments, mining and mineral extraction permits, and monitoring of mining and mineral extraction operations.

The Geology and Petroleum Department was established in 1984 as part of the Ministry of Natural Resources. In 2012 the department moved to the new Ministry of Energy, Science & Technology and Public Utilities. The department is responsible for governance of the petroleum industry in Belize and maintains a repository of geologic, seismic survey and other information relevant to petroleum exploration.

There have been several geologic studies conducted in Belize over several decades. The latest and most detailed geology map for the country was authored by Geologist Jean H. Cornec, a founding director of Belize Natural Energy (BNE), with additional updates in 2004. According to the author, this map represents a synthesis of the available geologic data generated over the previous 75 years. This map has been digitized by the MNRA LIC and has been distributed to multiple organizations.

Historical seismic surveys, test well borehole data and other information from pre-2012 studies conducted mostly during the 1960's and 1970's were either lost or only available in hardcopy format. Some of the companies that were conducting those studies at the time still have the information but want to charge high fees for providing the information. Therefore the MoESTPU has commissioned a company to digitize all the old seismic survey data that they have. This effort should be completed within 6 months of date of the BNSDI Stakeholder Survey report. All new contracts and operating licenses require that all collected data must be submitted to the Ministry in industry-standard format.

Borehole data being compiled by MoESTPU includes lithography and geohydrologic information for upper strata that are not needed for petroleum exploration but are very relevant for groundwater resource management.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 23 – Data Sources Related to the Geology Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	geophysical	NEED DESCRIPTIVE INFORMATION FROM LIC
MNRA	Natural Resources Department	Mining Unit	Mineral Studies Documents and Registry	The MNRA Department of Natural Resources Mining Unit maintains copies of all relevant mineral resource assessments and related studies. It also maintains a registry of these in digital MS Excel form
MNRA	Natural Resources Department	Mining Unit	Geologic Map of Belize (1980's)	UNDP (UNABLE TO LOCATE ADDITIONAL INFORMATION ABOUT THIS)
MNRA	Natural Resources Department	Mining Unit	Geologic Map of Belize (2003-04)	In 2003 there was an updated version of the geology map developed by Geologist Jean H. Cornec, a founding director of Belize Natural Energy (BNE), with additional updates in 2004. According to the author, this map represents a synthesis of the available geologic data generated over the previous 75 years.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Geotechnical and Material Testing Sites	Today the locations of geotechnical testing boreholes and sampling sites is not standardized. Some site samples and data have precise GPS-derived geographic coordinates while others may reference a sketch location on a plan. Standardization of the geolocation information would add value in the incremental compilation of a repository of accurately located testing information over time.
Ministry of Energy, Science & Technology and Public Utilities	Geology, Energy, Science and Technology Departments and Public Utilities Commission		Vintage Seismic Data	Petroleum exploration in Belize began in the 1930's. Oil exploration licenses were granted to the large oil companies such as Shell, Esso, Texaco, Gulf Oil, Anschutz and Chevron as well as smaller companies such as Occidental Petroleum and Phillips Petroleum and small independent oil companies to explore for petroleum in both the onshore and offshore areas of Belize. Many two dimensional seismic surveys were conducted most of which were done in the offshore waters of Belize and thousands of line kilometers of seismic data were acquired. Studies conducted mostly during the 1960's and 1970's were either lost or only available in hardcopy format. Some of the companies that were conducting those studies at the time still have the information but want to charge high fees for providing the information. Therefore the Ministry has commissioned a company to digitize all the old seismic survey data that they have. This effort should be completed within 6 months of this writing. All new contracts and operating licenses require that all collected data must be submitted to the Ministry in industry-standard format.

Ministry of Energy, Science & Technology and Public Utilities	Geology, Energy, Science and Technology Departments and Public Utilities Commission		Borehole data	<i>Borehole data</i> being compiled in Belize includes lithography and geohydrologic information for upper strata that are not needed for petroleum exploration but is very relevant for groundwater resource management. Data for 85 wells is being compiled by a company TGS-NOPEC, who processes the information to a variety of information products that are then sold back to oil companies and consultants, with the government taking a share of that revenue.
Ministry of Energy, Science & Technology and Public Utilities	Geology, Energy, Science and Technology Departments and Public Utilities Commission		Belize Geology Map.	There have been several geologic studies conducted in Belize over several decades. The latest and most detailed geology map for the country was authored by Geologist Jean H. Cornec, a founding director of Belize Natural Energy (BNE), with additional updates in 2004. According to the author, this map represents a synthesis of the available geologic data generated over the previous 75 years.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Geology (surface)	date of publication: 1986. Originator: Cornec. Preferential Scale: 1:250,000 (?). Notes: this dataset was probably digitized from a printed copy of Cornec's map, which was produced in the days of the UNDP-funded geology project.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Geology (surface)	date of publication: 2001. Originator: ProNatura (Selva Maya EcoRegional Planning Project). Preferential Scale: 1:250,000. Notes: from the metadata, it is unclear what the sources of this data are.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Geomorphology	date of publication: 2004. Originator: ProNatura (Selva Maya EcoRegional Planning Project). Preferential Scale: 1:250,000. Notes: from the metadata, it is unclear what the sources of this data are.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Geology	Spatial Layer: Geology Source: Cornec, J. 1986. Notes on the provisional geologic map of Belize, scale 1:250,000. UNDP/BZE/83/001. Petroleum Office, Ministry of Natural Resources, Belize. 22pp and fig. (unpub).

Topics: The following topics of interest to BNSDI community included within this class of data.

- Geologic Sample Sites
- Surficial Geology
- Subsurface Geology
- Mineral Resource Areas

FGDS: The following datasets within this theme will be of common interest to the BNSDI community:

FGDS Name	Geology
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Description	This FGDS provides geologic type and related features nationally across Belize.
Current Status	There have been several geologic studies conducted in Belize over several decades. The latest and most detailed geology map for the country was authored by Geologist Jean H. Cornec, a founding director of Belize Natural Energy (BNE), with additional updates in 2004. According to the author, this map represents a synthesis of the available geologic data generated over the previous 75 years.
Future Program Considerations	This may is being used by many organizations in Belize and appears to be meeting basic needs. This information can be further validated and/or refined over time with periodic review relative to new borehole information and field studies as this information is collected for various purposes.
Custodianship Considerations	Either the MNRA Mining Unit or MoESTPU would be the logical custodian for the geology map of Belize.
Security Considerations	There are no special security considerations expected for this FGDS.

5.10 Seismology

General Considerations: Seismology is best described as a science to study the earth motions during an earthquake or to predict the ground motions in the built environment, especially in areas of moderate to high seismic hazard and high seismic risk.

Because seismic events and sources cover large areas, the base scale required ranges from 1:25k – 1:250k with the highest accuracy required for urban areas or critical infrastructure. Due to the nature and relatively unpredictability of seismic events, less accuracy is required for the other features mentioned as part of this theme.

There is a close relationship with seismic data and geologic data. Usually, fault information is gathered as part of a geologic inventory and displayed on the same geologic maps. Other issues such as shaking intensity and liquefaction are modeled, based on theoretical events, the transmission of seismic energy through a regional geologic structure, and estimating the intensity of shaking and/or liquefaction that is likely to occur at the surface of the land along the way.

Business Requirements. Seismic risk in Belize is considered to be low, but is one area of study conducted by Geology Unit in the MoESTPU on behalf of the rest of the community and NEMO. Seismic mapping provides information that is needed for building and infrastructure engineering, emergency management and other applications. The full range of BNSDI stakeholder activities that have some direct need for seismic data are depicted in Appendix B. According to this information, over 24% of the activities carried out by BNSDI

stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Hazard and vulnerability assessment;
- Emergency planning and response;
- Urban planning;
- Building code development;
- Transportation planning;
- Critical infrastructure planning (dams, pipelines, electrical transmission lines, etc.)
- Support tsunami and inundation modeling;
- Environmental impact assessment;
- Coastal zone planning;
- Development project assessment.

Current Situation: The MoESTPU Geology Unit was the only organization covered in the current study that indicated an activity to assess seismic hazard conditions and vulnerability as part of the Unit’s environmental impact assessment review duties. Known fault locations are indicated in the existing geology map (Cornec et al documented elsewhere). Potential seismic hazard and vulnerability are interpreted by the staff geologist on a project by project basis based on the underlying geologic structure. No comprehensive assessment of seismic hazard and vulnerability has been conducted for Belize, in part because it is considered to be a low threat.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 24 – Data Sources Related to the Seismic Data Theme

MNRA	Natural Resources Department	Mining Unit	Geologic Map of Belize (2003-04)	In 2003 there was an updated version of the geology map developed by Geologist Jean H. Cornec, a founding director of Belize Natural Energy (BNE), with additional updates in 2004. According to the author, this map represents a synthesis of the available geologic data generated over the previous 75 years.
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Topics: The following topics of interest to BNSDI community included within this class of data.

- Seismic Faults
- Seismic Risk Zones
- Seismic Events

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Seismic Faults
Description	This FGDS will include the delineation of known seismic faults across the country and region.
Current Status	Geologic faults are included in the existing geology maps for Belize. However, this study uncovered no previous assessment of the seismic potential of these faults.
Future Program Considerations	Belize is not immune to earthquakes or tsunami, although the threat is considered low. A program could be undertaken to assess the threat of potentially active faults within Belize and the region as the basis for establishing a national seismic risk map.
Custodianship Considerations	The logical custodian for this layer would be the MoESTPU.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Seismic Risk Zones
Description	Known geologic faults, geology and input from seismic monitoring can be used to anticipate the level of seismic activity and intensity that may be experienced for certain areas. Proximity to known faults, calculated seismic shaking intensity, liquefaction potential and other issues can be analyzed individually and cumulatively to create an overall picture of seismic risk that can then be used for urban planning, refinements to building codes, and other applications.
Current Status	There was no national assessment of seismic risk uncovered during the current study.
Future Program Considerations	Belize is not immune to earthquakes or tsunami, although the threat is considered low. A program could be undertaken to assess the threat of potentially active faults within Belize and the region as the basis for establishing a national seismic risk map.
Custodianship Considerations	The logical custodian for this layer would be the MoESTPU.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Seismic Events
Description	This FGDS would include the location and essential information regarding measure seismic events within the region surrounding Belize.
Current Status	There was entity in Belize that is recording seismic events today, however international sources are monitored by the MoESTPU Geology Unit.

Future Program Considerations	The U.S. Geological Survey (USGS) monitors earthquake events globally and makes this information immediately available through a variety of channels. It would be possible to establish an FGDS that would record this information for the region of interest to Belize as a repository of current and historical earthquake information that could be used to better understand seismic activity in the region and possible future threats to Belize
Custodianship Considerations	The logical custodian for this layer would be the MoESTPU.
Security Considerations	There are no special security considerations expected for this FGDS.

5.11 Geomorphology

General Considerations: Geomorphology is the study of landforms, including their origin and evolution, and the processes that shape them. Geomorphologists seek to understand landform characteristics, history and dynamics, and predict future changes through a combination of field observation, physical experiment, and numerical modeling. The discipline is practiced within geology, geodesy, geography, archaeology and civil and environmental engineering. Early studies in geomorphology are the foundation for pedology, one of two main branches of soil science.

Geomorphologic data is generally derived from other land characteristics type data. For example, much geomorphologic information can be developed from a Digital Elevation Model (DEM) including slope, solar aspect, and elevation regimes. This information can then also be combined with soil, geologic, vegetative cover and hydrological data to provide a more detailed description of the landform characteristics at a particular location. Because of the various applications of this type of data, the data format can be both raster and vector. For the latter, geomorphologic information can be communicated in point (elevation), line (break lines, hydrology, and channel width) or polygon format (slope, landslide risk). These data are generally developed at scales smaller than 1:25k. Like soils and geology, these data require infrequent updates due to the long periods of time required for change to occur.

Business Requirements. Geomorphology provides a combination of topographic slope, soils, geology, solar aspect, elevation regime and other data that provide important insights to the behavior of the environment that formed the land, from which the implications of opportunities and constraints to various uses of the land can be assessed. The full range of BNSDI stakeholder activities that have some direct need for soils data are depicted in Appendix B. According to this information, over 64% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of

existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- National spatial planning;
- Development project formulation and assessment;
- Identification of suitable habitat and land allocation for preservation;
- Assess land use and development physical opportunities and constraints;
- Develop and apply predictive ecosystem models;
- Monitor and assess groundwater quantity and quality;
- Identify areas susceptible to landslides and erosion;
- Identify areas susceptible to flooding and inundation;
- Agriculture planning and management;
- Forestry planning and management.
- Agroforestry planning and management;
- Aquaculture planning;
- Utility planning;
- Transportation planning;
- Environmental impact assessment;
- Protected areas management;
- Water resource management;
- Archeological research;
- Landfill siting and management;
- Cave resource assessment and management;

Current Situation. There was no comprehensive assessment of the geomorphology of Belize identified in the current study, however several organizations have conducted studies related to geomorphological components such as topographic slope. Hillshading has also been generated, but primarily for cartographic purposes.

Slope mapping in Belize has largely been based on the SRTM 90 meter resolution digital elevation model (DEM) information. Historically this has been the most detailed comprehensive representation of elevation in Belize. However, the SRTM does not distinguish between the top of a tree canopy and the underlying terrain surface, therefore any derivative products from this information needs to be used with care with full understanding of the limitations.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 25 – Data Sources Related to the Geomorphology Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Slopes	This raster dataset depicts X classes of topographic slope based on 90m digital elevation model (DEM) data.
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Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Slope	date of publication: 2005. Originator: Shuttle Radar Topography Mission (SRTM). Preferential Scale: 1:100,000. Notes: generated (using slope command) from 30m digital surface model data; because of SRTM artifacts, will represent not the ground's slope, but the canopy's slope.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Slope	date of publication: 2004. Originator: Shuttle Radar Topography Mission (SRTM). Preferential Scale: 1:350,000. Notes: generated (using slope command) from 90m digital surface model data; because of SRTM artifacts, will represent not the ground's slope, but the canopy's slope.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Relief (hillshade)	date of publication: 2004. Originator: ProNatura (Selva Maya EcoRegional Planning Project). Preferential Scale: 1:380,000. Notes: generated using the hillshade command; specific solar azimuth / elevation parameters to which this data corresponds are unknown.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Relief (hillshade)	date of publication: 2004. Originator: Shuttle Radar Topography Mission (SRTM). Preferential Scale: 1:100,000. Notes: generated using the hillshade command from 30m digital surface model data; this hillshade refers to specific solar azimuth / elevation parameters.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Relief (hillshade)	date of publication: 2005. Originator: Shuttle Radar Topography Mission (SRTM). Preferential Scale: 1:350,000. Notes: generated using the hillshade command from 90m digital surface model data; unlike the 30m data, hillshades with unlimited solar azimuth / elevation parameters can be generated as the source DEM is available.
Non-Government Organizations	Friends for Conservation and Development		Chiquibul Cave System Map	A small portion of the 540,000 square-foot Chiquibul Cave System has been mapped.

Topics: The following topics of interest to BNSDI community included within this class of data.

- Geomorphology
- Solar Aspect
- Elevation Regimes
- Slope
- Landform

FGDS: The datasets that are expected to be of common interest to the BNSDI community include the following:

FGDS Name	Geomorphology
Description	This FGDS provides an interpreted characterization of all the prominent geomorphological types and associated natural processes within Belize that have led to the current character of the land.
Current Status	There was no comprehensive assessment of the geomorphology of

	Belize identified in the current study, however several organizations have conducted studies related to geomorphological components such as topographic slope
Future Program Considerations	The development of a comprehensive geomorphology map for Belize at medium scale would provide a wealth of information regarding the sum total of geologic, fluvial and other natural processes that have defined the current character and condition of the landscape. A better understanding of these processes would be invaluable to ensure that human introduced development and landscape change is carried out in a manner that acknowledges and aligns with those processes, thus maximizing the use of the landscape while avoiding unnecessary environmental impacts or natural disasters.
Custodianship Considerations	There is not entity in Belize with a specific responsibility for geomorphological mapping. Designing a program that meets the broadest range of needs will require a collaboration among key stakeholder with the support of specialist support.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Topographic Slope
Description	This FGDS would provide information regarding the slope of the land at medium scale, in several classes or ranges.
Current Status	There is a lack of terrain elevation data in Belize that could be used effectively to calculate topographic slope. As a result, organizations have used a variety of techniques to derive topographic information and derivative products that were at least adequate to meet certain project-specific needs.
Future Program Considerations	There is a need to develop well constructed, reasonably detailed topographic database for Belize that could be used to support a broad range of uses, and from which other needed derived data products could be produced.
Custodianship Considerations	There is not entity in Belize with a specific responsibility for geomorphological mapping. Designing a program that meets the broadest range of needs, including the design and development of topographic slope information that meets the broadest range of needs will require a collaboration among key stakeholder with the support of specialist support.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Elevation Regimes
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Description	This FGDS would provide information regarding elevation regimes at medium scale, in multiple classes or ranges.
Current Status	There is a lack of terrain elevation data in Belize that could be used effectively to calculate topographic products such as elevation regimes. As a result, organizations have used a variety of techniques to derive topographic information and derivative products that were at least adequate to meet certain project-specific needs.
Future Program Considerations	There is a need to develop well constructed, reasonably detailed topographic database for Belize that could be used to support a broad range of uses, and from which other needed derived data products such as elevation regimes could be produced.
Custodianship Considerations	There is not entity in Belize with a specific responsibility for geomorphological mapping. Designing a program that meets the broadest range of needs, including the design and development of elevation regime information that meets the broadest range of needs will require a collaboration among key stakeholder with the support of specialist support.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Solar Aspect
Description	This FGDS would provide information regarding solar aspect at medium scale, in multiple classes or ranges.
Current Status	There is a lack of terrain elevation data in Belize that could be used effectively to calculate topographic products such as solar aspect. As a result, organizations have used a variety of techniques to derive topographic information and derivative products that were at least adequate to meet certain project-specific needs.
Future Program Considerations	There is a need to develop well constructed, reasonably detailed topographic database for Belize that could be used to support a broad range of uses, and from which other needed derived data products such as solar aspect could be produced. Hillshade is a variant on the solar aspect subject and could be generated at the same time, largely to support cartographic production needs.
Custodianship Considerations	There is not entity in Belize with a specific responsibility for geomorphological mapping. Designing a program that meets the broadest range of needs, including the design and development of solar aspect information that meets the broadest range of needs will require a collaboration among key stakeholder with the support of specialist support.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Landform
Description	This FGDS would provide information regarding landform at medium scale, in multiple classes or ranges to be used as one factor in characterizing the geomorphology of an area.
Current Status	There is a lack of terrain elevation data in Belize that could be used effectively to calculate topographic products such as landform. As a result, organizations have used a variety of techniques to derive topographic information and derivative products that were at least adequate to meet certain project-specific needs.
Future Program Considerations	There is a need to develop well constructed, reasonably detailed topographic database for Belize that could be used to support a broad range of uses, and from which other needed derived data products such as landform could be produced.
Custodianship Considerations	There is no entity in Belize with a specific responsibility for geomorphological mapping. Designing a program that meets the broadest range of needs, including the design and development of landform information that meets the broadest range of needs will require a collaboration among key stakeholder with the support of specialist support.
Security Considerations	There are no special security considerations expected for this FGDS.

5.12 Marine Abiotic

General Considerations: Marine abiotic refers to all non-living things and factors in the marine environment including water, sediments, air, light, waves and minerals. Abiotic data are important to understand the environmental issues in the marine environment but also critical for shipping, navigation, port activities, fisheries, evaluating impacts of and for development activity in the marine zone, and other marine activities. Marine abiotic data is typically captured through fixed monitoring stations or field samples and utilized at the medium and large scale. Marine abiotic data includes:

- Temperature
- Pressure
- Light intensity
- Light wavelengths
- Tides
- Current strength and direction
- Waves
- Storm surge
- Tsunami runup zones

- Density of the water medium (dependent on temperature and dissolved materials)
- Salinity
- Concentration of other dissolved salts
- Concentration of dissolved minerals such as iron, phosphorus, calcium, magnesium
- Concentration of fixed nitrogen
- pH
- Concentration of dissolved carbon dioxide
- Concentration of dissolved oxygen
- Concentration of other dissolved solutes and nutrients
- Marine sediment type and distribution
- Magnetic field strength and direction

Business Requirements. Marine abiotic information provides a variety of information about the physical conditions and processes in the sea that affect the marine environment, marine resources and its use for human purposes. The full range of BNSDI stakeholder activities that have some direct need for marine abiotic data are depicted in Appendix B. According to this information, approximately 9% of the activities carried out by BNSDI stakeholders could derive direct benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Coastal zone management;
- Processing of Seabed and Coastal development permits;
- Marine fisheries management;
- Marine spill analysis and response;
- Emergency planning and response;
- Marine protected areas management;
- Marine conservation and protected species management;
- Coastal water quality management;
- Environmental impact assessment;
- Climate impact monitoring;
- Education and research.

Current Situation: Marine abiotic data related to currents, waves, tides, water quality and other changing water conditions have been measured by multiple organizations in Belize over different time periods and for specific projects and programs. There was no comprehensive baseline or long term persistent monitoring programs for marine abiotic information uncovered during the current study. Web research revealed only isolated research stations that are have been collecting this information for a limited geographic area of interest.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 26 – Data Sources Related to the Marine Abiotic Data Theme

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Storm Surge Hazard	date of production: 1999. Originator: Caribbean Institute for Meteorology & Hydrology (OAS Caribbean Disaster Management Project). Preferential Scale: 1:50,000. Notes: according to the online documentation, this map was prepared by the Caribbean Institute for Meteorology & Hydrology for the OAS' Caribbean Disaster Management Project; the data is cited as having been generated from the contour lines on the 1:50,000 topographic sheets; the TAOS model was used to generate the dataset.
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Topics: Topics for this theme include:

- Marine Monitoring Stations
- Marine Monitoring Data

FDGS: The following FGDS will be of interest to the BNSDI community:

FGDS Name	Marine Monitoring Stations
Description	This FGDS would include the location and essential information of permanent marine monitoring stations in Belize.
Current Status	There was no comprehensive baseline or long term persistent monitoring programs for marine abiotic information uncovered during the current study. Web research revealed only isolated research stations that are have been collecting this information for a limited geographic area of interest.
Future Program Considerations	No additional information provided
Custodianship Considerations	Determination of the logical custodian for this layer will require additional discussion.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Marine Monitoring Data
Description	This FGDS would include the data associated with permanent marine monitoring stations in Belize.
Current Status	There was no comprehensive baseline or long term persistent monitoring programs for marine abiotic information uncovered during the current study. Web research revealed only isolated research stations that are have been collecting this information for a limited geographic area of interest.
Future	No additional information provided

Program Considerations	
Custodianship Considerations	The logical custodian for this layer would be
Security Considerations	There are no special security considerations expected for this FGDS.

6.0 UTILITIES

The Utilities theme includes all those major infrastructure utility networks and associated structures and appurtenances. For the purposes of the BNSDI discussion these include the following data themes:

- Electrical Facilities
- Potable Water Facilities
- Sanitary Sewer Facilities
- Stormwater Sewer Facilities
- Telecommunication Facilities
- Waste Management Facilities

The utilities share common characteristics and business work flows across the board that are of interest to the BNSDI Community. The common lifecycle includes long range planning, capital improvement planning, construction, operations & maintenance and administration & finance. It is important for planning and utility coordination purposes that each utility be recorded in a manner that reflects these various stages of development. While some utility information such as transmission infrastructure may be compiled at medium scale, the majority of utility information must be compiled at the large scale to include the detail and accuracy that is needed to support the full range of applications. For the purposes of the wider BNSDI community, utilities data are useful at both the large and medium scale.

Each utility sector has its own requirements for data content and format as needed to support all its operational business needs. In most cases, international communities of interest have already developed extensive GIS models for utility information in each sector, and these are often a good starting point for the adaptation of these models to fit the specific needs of any given utility. For the purpose of FGDS, other stakeholders often do not need the operational details of the full data models, and are mostly interested in the location and basic characteristics that are needed to understand where the networks are located, the size and material of the network components, buried depth if underground, and other basic information.

Data security can be a concern for certain critical utility facilities that represent special danger or impact if this information is used for harmful purposes. Also, some utility information is of proprietary interest, especially where the utility is a private company, or subject to privatization. In such cases, detailed asset information may be of proprietary competitive interest to the entity involved. In cases where a private operator is commissioned to run a utility, but the utility assets themselves remain in government ownership, the detailed asset information is owned by the government. These issues must often be worked out on a case-by-case basis to ensure adequate information is made available to an SDI community, while

balancing this against security and proprietary rights to information. The Utility Working Group in several meetings deliberated on these issues and came to a consensus on the details of the data to be shared for each Utility taking into account the security aspects of the data and the proprietary rights of the utility companies.

Of particular significance to the BNSDI is the actual spatial accuracy of the utility information presented. The development, extension or refurbishing of existing utility networks involves a detailed design that is used for bidding and construction purposes. However, the realities encountered during construction may require changes to the location and configuration of the facilities, thus requiring the compilation of an “as-built” drawing to reflect the actual installed situation versus the “as-designed” representation in the original engineering drawings. It is the as-built information that is most important for incorporation to a GIS, and to an SDI where such information is to be shared across many organizations. In the past, the utilities in Belize have not always had had strict controls on the recording and field verification of as-built drawings before these are accepted. Therefore, the available record drawings may not represent the actual conditions in the field, and likewise the GIS databases that are based on that information. This issue is especially difficult to distinguish in regards to underground networks.

6.1 Electrical Facilities

General Considerations. Electrical Facilities refer to the entire electrical sector infrastructure services including power generation, power transmission and distribution. The majority of this infrastructure is represented in a GIS as interconnected points and lines, representing the cables and various appurtenances modeled as a topologically correct network. This provides a digital representation of the actual electrical network in a form that can be analyzed in terms of electrical flow and fault analysis. This model also represents each asset component in a form that a maintenance management system can reference to tie work orders and scheduled maintenance directly to the asset in the field, as well as provide the inventory of assets and pertinent information that can be linked to an asset financial analysis system for asset valuation and other purposes.

Business Requirements. The internal business requirements of the Utility and how these are achieved in a GIS are extensive and complex. However the needs of the other stakeholder across the BNSDI community are much more limited and focused on understanding the location, basic characteristics and status of the utility network (e.g. planned, existing, abandoned). The full range of BNSDI stakeholder activities that have some direct need for electric utility data are depicted in Appendix B. According to this information, nearly 50% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Utility planning, operations and management by custodian;
- Utility coordination;

- Underground service alert “call before you dig”;
- Development review and approval;
- Building permit review and approval;
- Capital investment planning and utility coordination;
- Site planning and design;
- Environmental impact assessment;
- Land use planning;
- National estate land leasing and allocation;
- Property valuation;
- Review and approval of mining and mineral permits;
- Transportation planning;
- Agriculture planning;
- Tourism planning;
- Planning by other utilities;
- Emergency planning and response;
- Management of municipal assets;
- Development project planning and preparation;
- Climate resilience planning and design;
- Real estate market analysis.

Current Situation: Belize Electricity Limited (BEL) is the primary distributor of electricity in Belize. The Company, serves a customer base of approximately 82,400 accounts and is regulated by the Public Utilities Commission (PUC). The BEL has developed several legacy digital systems for managing its assets and operations, and is currently undertaking efforts towards the development of a comprehensive GIS-supported enterprise automation program that will integrate a majority of the organization’s information. Efforts undertaken to date that have special significance to the BNSDI community include the following:

- The Utility developed an Electric Meter Database indicating the location and feeder information of nearly 98% of the meters across Belize. Geographic locations were determined with handheld GPS;
- BEL has maintained Electrical Distribution Network As-Built Drawings in AutoCAD format. These are not prepared in real-world coordinates, and typically use parcel maps from the MNRA LIC as a basemap. These digital files are organized by load center and feeders. In anticipation of updating the GIS information staff are no longer updating these maps, but continue to update the single-line schematics in support of the SCADA system.
- The Utility two years ago purchased GeoEye high resolution satellite imagery for all the urban areas in the country and uses the ESRI software to view that information.

- The BEL maintains information regarding each of its over 82,000 customers. A BEL Customer Care Database includes information about each customer including the location of the metered account by street address or location description, the mailing address of the property owner, current and past electricity consumption and billing information and a record of any significant complaints or other communications.
- In 2012 BEL generated a GIS database indicating the location and characteristics of the national electric transmission network. This database is to be updated under a GIS/ICT modernization program that has been proposed.
- The Utility has recognized the benefits of GIS and has been moving towards full implementation over the past 5 years. In 2011, the government took over the company and one of the key initial requirements was to develop a complete inventory and assessment of the Utility's assets. It was decided that GIS would be an appropriate technology for supporting this effort and the company spent the next 2.5 years capturing over 99% of the fixed assets at that time. This entire effort for the development of the BEL Electrical Asset Map and Database was carried out through direct field survey due to lack of confidence in the completeness and accuracy of record drawings maintained in the office. Main poles were surveyed with GPS to a sub-meter accuracy, and intermediary poles between them were interpolated. The acquisition of meter location information was done with handheld GPS and the horizontal accuracy is expected to be in the range of 3 meters. This database was completed in 2012 and is stored in ESRI's Arc SDE software. It has not been updated since that time.
- A major effort is being undertaken now to explore the incremental development of a complete enterprise management platform that would tie all of the Utility's systems together in an interoperable framework. BEL is discussing this matter with a major international software vendor with extensive professional service experience in the design and development of enterprise systems for electrical utilities. Under discussion are how to expand the current system to cover all the important facility mapping requirements while also considering how this database can be linked and integrated with all other major business systems across the utility (maintenance management, network modeling, SCADA, financials, customer care, fleet management, outage management and others). The original GIS database at the time of this writing is nearly two years old and has not been updated in the meantime. Part of the upgrade effort planned will involve confirming and updating the system information, again through direct field inspection.

In addition to BEL, the MoESTPU includes the Public Utilities Commission that oversees interests of the government and the public in how the utility is planned and operated. The Ministry has initiated an online application where persons or organizations that are utilizing distributed renewable energy production to register themselves. In addition, the Ministry has

issues a request for proposals for the development of new renewable energy generation public-private partnership programs.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 27 – Data Sources Related to the Electrical Facilities Data Theme

Ministry of ENERGY, SCIENCE & TECHNOLOGY AND PUBLIC UTILITIES	Geology, Energy, Science and Technology Departments and Public Utilities Commission		Renewable Energy Producer/User Sites	Through the website < http://estpu.gov.bz/images/media/renewable%20energy.pdf > the Unit is soliciting the assistance of companies and individuals to self-declare their own usage of distributed generation and/or renewable energy covering: Solar Panel, Wind Turbine, Hydro Plant, Diesel Generator, Biofuel Generator, Gasifier, Digester. Other. The online form includes locational reference by address as well as latitude and longitude coordinates (with note suggesting these be established using the provider's phone). Through this form the Unit is requesting a variety of information about the size, type and location of existing devices, as well as information about you're the user's experiences with the device, how successful it has been, and any challenges they may have encountered.
Ministry of ENERGY, SCIENCE & TECHNOLOGY AND PUBLIC UTILITIES	Geology, Energy, Science and Technology Departments and Public Utilities Commission		Energy Producer Proposals	The MESTPU, along with the Public Utilities Commission (PUC) of Belize on behalf of the Government of Belize (GOB), and the Belize Electricity Limited (BEL) identified the need for the phased addition of new generation or supply capacity to Belize's National Electricity System of some sixty (60) Mega-watts of Firm Capacity over the period from 2013 to 2023. Pursuant to the stated policy of the MESTPU/GOB to promote clean, renewable energy supply in Belize, and as a viable means of displacing higher cost thermal generation where feasible, a Request for Proposal (RFP) for the addition of some fifteen (15) MWe of rated capacity generation or supply facilities utilizing wind or solar technology or other non-firm renewable generation sources was published. Bids for facilities at specific locations will likely have an address or GPS coordinates that can be used to tie those proposals to locations on the map.
Utilities	Belize Electric Limited		Electric Meter Database	Compiled in 2012 by the Belize Electric Ltd. (BEL) this database includes a geographic coordinate for each meter, collected through handheld GPS and estimated to be within 3 meters actual accuracy. The database was completed for approximately 98% of the customer meters nationwide. This database is to be updated under a GIS/ICT modernization program that has been proposed.
Utilities	Belize Electric Limited		National Electric Transmission Network	The Belize Electric Ltd. (BEL) in 2012 generated a GIS database indicating the location and characteristics of the national electric transmission network. This database is to be updated under a GIS/ICT modernization program that has been proposed.

Utilities	Belize Electric Limited		Electric Distribution Network As-Built Drawings	Belize Electric Ltd. (BEL) has maintained Electrical Distribution Network As-Built Drawings in AutoCAD format. These are not prepared in real-world coordinates, and typically use parcel maps from the MNRA LIC as a basemap. These digital files are organized by load center and feeders. In anticipation of updating the GIS information in the near future staff are no longer updating these maps.
Utilities	Belize Electric Limited		Electrical System Single Line Schematic Diagram	Belize Electric Ltd. (BEL) maintains an Electrical System Single Line Schematic Diagram depicting all the major system components produced as an AutoCAD drawing file. This diagram is used to depict the networks and control devices monitored by the Utility's System Control and Data Acquisition (SCADA) system.
Utilities	Belize Electric Limited		BEL Electrical Asset Map and Database	In 2012 the Belize Electric Ltd. invested in the development of a GIS database in order to create an up to date and accurate accounting of the Utility's fixed assets nationwide. The entire database was developed through a 100% field survey due to lack of confidence in the completeness and accuracy of record drawings maintained in the office. Main poles were surveyed with GPS to a sub-meter accuracy, and intermediary poles between them were interpolated. The acquisition of meter location information was done with handheld GPS and the horizontal accuracy is expected to be in the range of 3 meters. This effort was carried out with the support of 6 contractors, involving approximately 9 people over a 16-month effort. This database was completed in 2012 and is stored in ESRI's Arc SDE software. It has not been updated since that time. Although the original survey was intended to support only the asset inventory matter, it was recognized that if structured correctly this information could be expanded in the future to a full enterprise GIS form. The BEL ICT staff developed a data model for the information to be captured in the field effort utilizing the <i>MultiSpeak</i> standard. The entire database is to be expanded, refined and updated as part of a proposed integrated enterprise systems development effort in the near future.

Topics: Topics for this theme include:

- Electrical Generation Facilities
- Electrical Transmission Facilities
- Electrical Distribution Facilities
- Communications Network

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Electrical Generation Facilities
Description	This FGDS would include the location and basic data associated with power generation facilities in Belize.
Current Status	This data is presently maintained in AutoCAD-based as-built and other

	records.
Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship Considerations	The logical custodian for this layer would be BEL
Security Considerations	There are no special security considerations expected for this FGDS, since only generalized information would be included.

FGDS Name	Electrical Transmission Facilities
Description	This FGDS would include the routing and basic data associated with the power transmission network facilities in Belize. Location information on primary substations, towers and power network (overhead lines and underground cables) will be needed including substations names and total capacity and nominal voltage for common reference and capacity coordination among the various stakeholders. Elevation and depth information as well as basic characteristics of conductors and cables respectively will be useful as well information on trenches locations and ducts.
Current Status	This data is presently maintained in AutoCAD-based as-built and other records.
Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship Considerations	The logical custodian for this layer would be BEL
Security Considerations	There are no special security considerations expected for this FGDS, since only generalized information would be included.

FGDS Name	Electrical Distribution Facilities
Description	This FGDS would include the routing and basic data associated with the power distribution network facilities in Belize. Location information on switching substations and distribution substations will be needed including substations names, references, total capacity and nominal voltage. Elevation and depth information as well as basic characteristics of conductors and underground cables will be useful with information on trenches locations and ducts. In addition, street lights location and basic characteristics will be useful. At the medium scale, only larger capacity conduits and key distribution facilities may be depicted.
Current Status	This data is presently maintained in AutoCAD-based as-built and other records.

Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship Considerations	The logical custodian for this layer would be BEL
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Electrical Utility Communications Facilities
Description	This FGDS would include the routing and basic data associated with the communication network that is used to support the electrical network automated operation and control. The information needed here is limited to the location of the underground infrastructure.
Current Status	This data is presently maintained in AutoCAD-based as-built and other records.
Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship Considerations	The logical custodian for this layer would be BEL
Security Considerations	There are no special security considerations expected for this FGDS.

6.2 Potable Water Facilities

General Considerations: Potable Water Facilities refer to the entire potable water sector infrastructure services including water production, water transmission and distribution. The majority of this infrastructure is represented in a GIS as interconnected points and lines, representing the pipes and various appurtenances modeled as a topologically correct network. This provides a digital representation of the actual potable water network in a form that can be analyzed in terms of hydraulic flow, mainbreak isolation analysis, water quality tracing and other such applications. This model also represents each asset component in a form that a maintenance management system can reference to tie work orders and scheduled maintenance directly to the asset in the field, as well as provide the inventory of assets and pertinent information that can be linked to an asset financial analysis system for asset valuation and other purposes.

Business Requirements. The internal business requirements of the Utility and how these are achieved in a GIS are extensive and complex. However the needs of the other stakeholder across the BNSDI community are much more limited and focused on understanding the location, basic characteristics and status of the utility network (e.g. planned, existing,

abandoned). The full range of BNSDI stakeholder activities that have some direct need for potable water utility data are depicted in Appendix B. According to this information, nearly 48% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Utility planning, operations and management by custodian;
- Utility coordination;
- Underground service alert “call before you dig”;
- Development review and approval;
- Building permit review and approval;
- Capital investment planning and utility coordination;
- Site planning and design;
- Environmental impact assessment;
- Land use planning;
- National estate land leasing and allocation;
- Property valuation;
- Review and approval of mining and mineral permits;
- Transportation planning;
- Agriculture planning;
- Tourism planning;
- Planning by other utilities;
- Emergency planning and response;
- Management of municipal assets;
- Development project planning and preparation;
- Climate resilience planning and design;
- Real estate market analysis.

Current Situation: Belize Water Services Limited is the water and sewerage utility for the country of Belize, serving the larger municipal areas of the country. As part of a privatization initiative of the Government of Belize (“GOB”), BWS was formed in January 2001 and vested with the assets and liabilities of the former Water and Sewerage Authority in March 2001. Some 83% of the shares of BWS were acquired by Cascal, a joint British-Dutch company, via an investment agreement with the GOB. In October 2005, GOB repurchased the majority shares from Cascal, thereby ensuring Belizean ownership.

BWS currently serves approximately 44,000 customers. Over 60% of the water supplied is produced using conventional water treatment processes with rivers as its sources. Satellite water wells are used for the majority of the other water systems. In San Pedro, BWS distributes water which has been treated by Reverse Osmosis, the conversion of sea water to drinking water. Since 2001, BWS has increased its investment in Assets and implemented improved procedures and controls to increase its efficiency.

Efforts undertaken by BWSL to date within the water utility that have special significance to the BNSDI community include the following:

- The Utility has maintained all of its as-built map information for Water Network Drawings information in AutoCad digital format. The process of converting the Sewer Network drawings to AutoCad is partially completed. These files are organized by zones for each system;
- BWSL engineers prepare water system extension or renovation projects in AutoCAD in real world coordinates and these are maintained in the system along with other existing water network and/or sewer information, but differentiated in line size and color. The digital water network data includes the lines, valves and other appurtenances of the system. Assets are identified to a project, but there is no asset-specific numbering scheme (e.g. valve numbers) in place at the moment. It is recognized that explicit asset identification will be needed in the future to integrate and optimize the organization's information infrastructure when the BWSL makes a move to convert the existing as-built record information to GIS and the use of this database as a spatially enabled fixed asset register
- All projects are recorded to a BWSL Projects Database in MS Access, however this information is not presently geocoded to precise project location;
- Requests for new connections are made through the customer service department. The department issues a work order request through the Job Tracking System (JTS). Customers can phone the department or visit the customer service desk at headquarters or one of the district office locations. A location is indicated initially by a street address or a physical description. Customer service performs a physical inspection prior to issuing a work order and collects a GPS geographic coordinate for the proposed service location. The coordinate is entered to Google Earth to indicate requested services on a map, and this information is used to schedule new service installations. These maps are being printed out, but the digital information is not being saved;

Other potable water utility information that may be relevant to the BNSDI community is summarized in the table below.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 28 – Data Sources Related to the Potable Water Facilities Data Theme

Utilities	Belize Water Supply Ltd.		Water Network Drawings	The BWSL has maintained all of its as-built map information for Water Network Drawings information in AutoCad digital format. Parcel boundary information from the MNRA Land Information Center (LIC) is used as the base map. Water network information is then updated in reference to the land base information in real world coordinates. Planned and in-progress additions to the network are likewise maintained in these files, differentiated by line size and color.
Utilities	Belize Water Supply Ltd.		Water Network As-Built Maps	The BWSL has maintained a copy of the original water network maps that were created in the 1980's for reference. These are transcribed to vellum and managed in a vertical hang filing system. These maps were delineated at various scales between 1"=40' (1:480) and 1"=100' (1:1200) based on those map sheets observed.
Utilities	Belize Water Supply Ltd.		Water Main Break Pin Map	A Water Main Break Pinmap is maintained to visualize where breaks have occurred. Breaks are identified through visual inspection or non-revenue water analysis followed by further analysis. The latter is conducted by analyzing water consumption within zone districts which are themselves metered. The difference between water supplied to the district versus what was consumed and billed then represents non-revenue water that may be caused by system leakage or illegal tapping.
Utilities	Belize Water Supply Ltd.		Meter Card File	This is a paper Meter Card for each meter that provides more specific information regarding the meter location and related information.
Utilities	Belize Water Supply Ltd.		Meter Reader Database	BWSL water meter readings are entered to the Meter Reader Database within the customer service system for the calculation of utility bills according to a standardized set rate.

Topics: Data topics for utilities often align directly with the FGDS due to the more formal data structure that has evolved in utility spatial data management systems over the years. Topics include:

- Water Production Facilities
- Water Distribution Facilities

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Water Production Facilities
Description	This FGDS would include the location and basic data associated with water production, abstraction and treatment facilities in Belize.
Current Status	No additional information provided
Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship	The logical custodian for this layer would be BWSL

Considerations	
Security Considerations	There are no special security considerations expected for this FGDS, since only generalized information would be included.

FGDS Name	Water Distribution Facilities
Description	This FGDS would include the routing and basic data associated with the power distribution network facilities in Belize. Location information water distribution pipes and valves and other appurtenances will be needed including references and total capacity. Elevation and depth information as well as basic characteristics of pipes will be useful with information on trench locations and ducts. At the medium scale, only larger pipes and most significant water distribution facilities will be depicted.
Current Status	This data is presently maintained in AutoCAD-based as-built and other records.
Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship Considerations	The logical custodian for this layer would be BWSL
Security Considerations	There are no special security considerations expected for this FGDS.

6.3 Sanitary Sewer Facilities

Data Considerations: Sanitary Sewer Facilities refer to the entire Sanitary Sewer sector infrastructure services including collection network, drainage network and treatment plants. The majority of this infrastructure is represented in a GIS as interconnected points and lines, representing the pipes and various appurtenances modeled as a topologically correct network. This provides a digital representation of the actual sanitary sewer network in a form that can be analyzed in terms of gravity and pressure flow, infiltration/exfiltration and other such applications. This model also represents each asset component in a form that a maintenance management system can reference to tie work orders and scheduled maintenance directly to the asset in the field, as well as provide the inventory of assets and pertinent information that can be linked to an asset financial analysis system for asset valuation and other purposes.

Business Requirements. The internal business requirements of the Utility and how these are achieved in a GIS are extensive and complex. However the needs of the other stakeholder across the BNSDI community are much more limited and focused on understanding the location, basic characteristics and status of the utility network (e.g. planned, existing, abandoned). The full range of BNSDI stakeholder activities that have some direct need for

potable water utility data are depicted in Appendix B. According to this information, nearly 42% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Utility planning, operations and management by custodian;
- Utility coordination;
- Underground service alert “call before you dig”;
- Development review and approval;
- Building permit review and approval;
- Capital investment planning and utility coordination;
- Site planning and design;
- Environmental impact assessment;
- Land use planning;
- National estate land leasing and allocation;
- Property valuation;
- Review and approval of mining and mineral permits;
- Transportation planning;
- Agriculture planning;
- Tourism planning;
- Planning by other utilities;
- Emergency planning and response;
- Management of municipal assets;
- Development project planning and preparation;
- Climate resilience planning and design;
- Real estate market analysis.

Current Situation: Belize Water Services Limited is the water and sewerage utility for the country of Belize, serving the larger municipal areas of the country. As part of a privatization initiative of the Government of Belize (“GOB”), BWS was formed in January 2001 and vested with the assets and liabilities of the former Water and Sewerage Authority in March 2001. Some 83% of the shares of BWS were acquired by Cascad, a joint British-Dutch company, via an investment agreement with the GOB. In October 2005, GOB repurchased the majority shares from Cascad, thereby ensuring Belizean ownership.

The BWSL provides potable water service to all the cities and towns in Belize, as well as a few villages, with 11 standalone systems throughout the Country. Three of the towns have sewer systems, but these are not covering all developed areas in each town. Efforts undertaken by BWSL to date in regards to the sanitary sewer system that have special significance to the BNSDI community include the following:

- The BWSL has converted some of the as-built sewer network information to an AutoCAD format. The process of converting the Sewer Network drawings to AutoCad is partially completed. These files are organized by zones for each system. The

original Sewer As-Built Drawings on vellum have been scanned to digital images that are maintained on the server where they are organized in a file system.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 29 – Data Sources Related to the Sanitary Sewer Facilities Data Theme

Utilities	Belize Water Supply Ltd.		Sewer Network Drawings	The BWSL has converted some of the as-built sewer network information to an AutoCAD format. (PLEASE EXPLAIN CURRENT STATUS AND PLANS FOR AUTOMATION OF REMAINDER OF SYSTEM)
Utilities	Belize Water Supply Ltd.		Sewer Network As-Built Maps	The BWSL has maintained a copy of the original water network maps that were created in the 1980's for reference. These are transcribed to vellum and managed in a vertical hang filing system.

Topics: Data topics for the sanitary sewer system that are of interest to the BNSDI community include:

- Sewer Collection Facilities
- Sewer Treatment Facilities

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Sewer Collection Facilities
Description	This FGDS would include the location and basic data associated with the sewer collection network and appurtenances in Belize.
Current Status	No additional information provided
Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship Considerations	The logical custodian for this layer would be BWSL
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Sewer Treatment Facilities
Description	Collected sewer is transported via the sewer collection system to sewer treatment plants where it is treated for reuse or discharge. This FGDS would include the location and basic data associated with the sewer treatment plants in Belize.
Current Status	No additional information provided

Future Program Considerations	This information is to be incorporated to the Utility's information modernization scheme and will presumably be captured in GIS format.
Custodianship Considerations	The logical custodian for this layer would be BWSL
Security Considerations	There are no special security considerations expected for this FGDS.

6.4 Stormwater Sewer Facilities (PLACEHOLDER)

Stormwater sewer facilities include the network of above and below ground channels, drains, pipes, culverts, storage facilities, and associated appurtenances that are used to manage stormwater and prevent flooding or other damage and mitigate danger to humans. In urban areas, this includes a delineation of impervious surfaces, catchments that shed to particular drains or inflow grates, and a network of channels or underground pipes leading to some outfall input to a stream, river, waterbody or the marine environment. Other elements may include manholes, pumping stations, above ground drainage canals, natural drainages and other components. These can all be modeled in GIS to provide a basis for conducting stormwater management plans and facility designs.

Business Requirements. In Belize the role of stormwater management in urban areas falls generally to the local government, however this information has not yet been automated for use in a GIS. Stormwater management facilities are now part of all new developments in urbanized areas and this information is captured in planning and as-built documents. The full range of BNSDI stakeholder activities that have some direct need for stormwater sewer network data are depicted in Appendix B. According to this information, over 42% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Storm drainage planning, operations and management by local government;
- Utility coordination;
- Underground service alert “call before you dig”;
- Development review and approval;
- Building permit review and approval;
- Capital investment planning and utility coordination;
- Site planning and design;
- Environmental impact assessment;
- Land use planning;
- National estate land leasing and allocation;
- Property valuation;
- Transportation planning;
- Agriculture planning;

- Tourism planning;
- Planning by other utilities;
- Emergency planning and response;
- Management of municipal assets;
- Development project planning and preparation;
- Climate resilience planning and design;

Current Situation. No additional information provided.

Current Data Sources. No additional information provided.

Topics: Topics associated with this theme include:

- Stormwater Sewer Collection Facilities
- Stormwater Sewer Catchment Areas

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Stormwater Sewer Collection Facilities
Description	This FGDS would include the location and basic data associated with the stormwater collection network and appurtenances in Belize. This future dataset will include a model of all the aboveground and belowground stormwater facilities including drains, pipes, culverts, outfalls, storage facilities, etc. Existing data, where available will need to come from the Municipalities and new information would come from as-builts of completed public and private projects. A data gap exists because existing stormwater facilities have not been consistently mapped in hard or soft copy format.
Current Status	No additional information provided
Future Program Considerations	No additional information provided
Custodianship Considerations	The logical custodian for this layer will require further discussion.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Stormwater Sewer Catchment Areas
Description	This FGDS would include the delineation of urban impervious surfaces and drainage areas. This future dataset will indicate areas of drainage to particular drainage inflow grates (with x, y, z values) within the urban areas. Existing data, where available will need to come from the Municipalities and new information would come from as-builts of

	completed public and private projects. A data gap exists because existing stormwater catchments have not been consistently mapped in hard or soft copy format.
Current Status	Xxxx
Future Program Considerations	Xxxx
Custodianship Considerations	The logical custodian for this layer would be ???
Security Considerations	There are no special security considerations expected for this FGDS.

6.5 Telecommunication Facilities

General Considerations. Telecom Facilities refer to the entire telecom sector infrastructure facilities including the transmission and access networks and telecom structures such as satellite stations, microwave towers, exchangers, and other appurtenances. The majority of this infrastructure in Belize is the property of Belize Telecommunications Limited (BTL).

Telecom facilities are captured typically at large scale (e.g. 1:1000) and generalized to smaller scales as needed for different visualization purposes i.e. 1:20K, 1:50K, 1:100K, etc. However, in the event where high accuracy basemap information may not yet be available by the municipalities such as in rural areas, the electric utilities may suffice themselves to basemap information that is captured at medium base scale such as 1:10,000. The GIS data format at medium scale is simplified to representation of the main components of the network i.e. exchangers, transmission and distribution network. In addition, the data is represented typically through its entire lifecycle i.e. planning, in-service until abandoned stage.

The data for the transmission network in particular (which travels large distances across cities and areas) is projected into a common framework in order to visualize the data seamlessly in an integrated environment. The medium scale representation is particularly useful to the mobile operator which allows him to visualize and analyze the network coverage over an entire city or area of interest. The telecom sector consists traditionally of several stakeholders including:

- Transmission carriers;
- Operators/ Service Providers;
- Mobile Operators;
- Satellite Operators;
- Cable TV Companies;
- Internet Service Providers.

Business Requirements. The internal business requirements of the Utility and how these are achieved in a GIS are extensive and complex. However the needs of the other stakeholder across the BNSDI community are much more limited and focused on understanding the location, basic characteristics and status of the utility network (e.g. planned, existing, abandoned). The full range of BNSDI stakeholder activities that have some direct need for telecom data are depicted in Appendix B. According to this information, nearly 42% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Utility planning, operations and management by custodian;
- Utility coordination;
- Underground service alert “call before you dig”;
- Development review and approval;
- Capital investment planning and utility coordination;
- Building permit review and approval;
- Site planning and design;
- Environmental impact assessment;
- Land use planning;
- National estate land leasing and allocation;
- Property valuation;
- Review and approval of mining and mineral permits;
- Transportation planning;
- Agriculture planning;
- Tourism planning;
- Planning by other utilities;
- Emergency planning and response;
- Management of municipal assets;
- Development project planning and preparation;
- Climate resilience planning and design;
- Real estate market analysis.

Current Situation. No additional information provided

Current Data Sources. No additional information provided

Topics: Topics associated with this theme include:

- Telephone Cable Network Facilities
- Wireless Towers

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Telephone Cable Network Facilities
Description	This FGDS would include the location and basic data associated with

	the telephone cable network and associated appurtenances in Belize.
Current Status	No additional information provided
Future Program Considerations	No additional information provided
Custodianship Considerations	The logical custodian for this layer would be BTL
Security Considerations	There are no special security considerations expected for this FGDS, since only the general information about the network is to be included. More detailed information may be proprietary to BTL.

FGDS Name	Wireless Towers
Description	This FGDS would include the location and basic data associated with the telephone cable network and associated appurtenances in Belize.
Current Status	No additional information provided
Future Program Considerations	No additional information provided
Custodianship Considerations	The logical custodian for this layer would be BTL
Security Considerations	There are no special security considerations expected for this FGDS, since only the general information about the network is to be included. More detailed information may be proprietary to BTL.

6.6 Waste Management Facilities

General Considerations. Waste management includes the collection, transportation, processing and disposal of waste. Waste management facilities include neighborhood collection points, transfer stations, recycling centers, waste processing centers, landfills, and vehicle storage and maintenance yards.

Business Requirements. Spatial data of concern to the BNSDI community includes waste collection routes, the location of facilities, and information about those facilities. These data would be of interest typically at the medium scale although there may be large scale applications at the individual facility level. The full range of BNSDI stakeholder activities that have some direct need for waste management facility data are depicted in Appendix B. According to this information, nearly 11% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. Typically, the waste management functions that require spatial data include:

- Siting of waste management facilities
- Evaluating the impacts of waste management facilities in terms of siting and operation

- Estimating the demand and necessary capacity for waste management facilities including landfills, transfer stations, recycling facilities, and pick up locations
- Evaluate waste management collection and disposal by area, population dynamics, and other factors.
- Developing waste transport routes for the movement of waste management facilities.
- Development review and approval;
- Building permit review and approval;
- Capital investment planning and utility coordination;
- Environmental impact assessment;
- Land use planning;
- Tourism planning.

Current Situation: The Belize Solid Waste Management Authority (BSWaMA) is a Statutory Authority governed by a Board of Directors and falling under the Ministry of Natural Resources and Agriculture (MNRA). The Authority was established to ensure that solid waste generated in the country is managed in an environmentally sound manner.

The BSWaMA, in conjunction with Local Government bodies and other stakeholders, is responsible for the safe and environmentally sound management of solid waste in Belize.

A key role of BSWaMA has been to facilitate, plan and oversee the construction and operations of solid waste management facilities (Transfer Stations and Sanitary Landfill) constructed under the Solid Waste Management Project (SWMP). The day to day operations of the facilities is carried out under contract by a private operator.

The planning, design and development of the current western corridor waste management facilities involved a series of technical studies, each of which has required the analysis and consideration of geographic information. These included but are not limited to water generation and characterization study, regional site analysis and selection, an extensive environmental impact assessment, and site specific engineering studies and design. Most of the previous studies and analyses were conducted with CAD tools and manual maps.

Local solid waste collection is handled at the local government level. Residential and commercial garbage collection is usually carried out by private operators under contract to the local City or Town Council.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 30 – Data Sources Related to the Waste Management Facilities Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Solid Waste	This folder stores all request for data and maps for Solid waste Unit (MNRA), this includes maps of disposal sites around the country.
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MNRA	Natural Resources Department	Belize Solid Waste Management Authority (BSWaMA)	Landfill Site Maps	The BSWaMA and the landfill operator have a series of maps depicting the landfill site, facilities, assets, leachate and surface water testing stations and borehole locations and characteristics. These are presently available only in hardcopy form.
MNRA	Natural Resources Department	Belize Solid Waste Management Authority (BSWaMA)	Solid Waste Weigh Bridge Data	The solid waste operators running the transfer stations and landfill are required to collect data from every truck. This information includes the identification of each truck, its weight before and after dumping load, and the total estimated load weight. The amount of material separated for recycling at the transfer station is also measured. This information is maintained in MS Excel spreadsheets and used to generate periodic performance reports to be submitted to BSWaMA

Topics: Topics within this theme include:

- Landfill Facilities
- Solid Waste Management Facilities
- Solid Waste Collection Routes

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Landfill Facilities
Description	This FGDS would include the location and basic data associated with each landfill facility in Belize. This would cover major regional facilities as well as smaller local facilities and known informal sites that may require more management and monitoring.
Current Status	BSWaMA maintains information regarding previous studies and analyses for the existing regional landfill in CAD tools and manual maps. This information is not available in GIS format as of yet.
Future Program Considerations	A future effort should be undertaken to develop a comprehensive inventory and characterization of all landfill sites across Belize, including managed facilities as well as known informal sites.
Custodianship Considerations	The logical custodian for this layer would be BSWaMA
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Solid Waste Management Facilities
Description	This FGDS would include the location and basic data associated with each non-landfill solid waste management facility in Belize. This would include recycling centers and transfer stations.
Current Status	BSWaMA maintains information regarding recycling centers and transfer stations but this information is not yet available in a digital GIS

	format.
Future Program Considerations	A future effort should be undertaken to develop a comprehensive inventory and characterization of all landfill sites across Belize, including managed facilities as well as known informal sites that may require more oversight and management in the future.
Custodianship Considerations	The logical custodian for this layer would be BSWaMA
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Solid Waste Collection Routes
Description	This FGDS would include the routing for all garbage collection in Belize.
Current Status	Local garbage collection is contracted to private operators by the local City and Town Councils. It is not clear if that information is mapped or available in a digital GIS format.
Future Program Considerations	A future effort should be undertaken to develop a comprehensive inventory of solid waste collection routes in Belize. In the future that information would be maintained by local government as part of their responsibility for managing those contracts.
Custodianship Considerations	The logical custodian for this layer would be BSWaMA
Security Considerations	There are no special security considerations expected for this FGDS.

7.0 TRANSPORTATION

Transportation data include roadways, highways, rail lines, bridges, airports and any other information related to transportation networks and facilities. This information can be used in a variety of spatial analyses and for general reference. For example, the street network if properly modeled can be used to route delivery trucks, school buses, public transport vehicles, emergency medical or police response, and other routing applications. It can also be used for network and proximity analysis, by correlating the street network with other information, such as population adjacent to the streets to be served by public transportation, and other factors.

Typical geographic topics in a transportation infrastructure GIS data set include:

- Land Transportation
- Water Transportation
- Air Transportation

Only Land Transportation is addressed in the current study due to time and resource constraints. However international experience suggests that linking this with water and air transportation is ultimately important to having a full picture of the transport sector, thus those additional categories are included here as placeholders for future reference.

7.1 Land Transportation

General Considerations: Land Transportation is identified as the means for transport of persons and goods by a network of roads or railways. Most land transportation GIS data are compiled and used at the medium scale, however it can be advantageous to derive transportation data for urban areas at the large scale to support basemap reference along highways through rural areas, or for centerline generalization and use at smaller scales thus avoiding the need to maintain this information redundantly.

At the engineering scale engineering features are generally captured as planimetric features and provide reference for detailed utility planning and design. The carriageway centerlines may be captured at the engineering level as part of the basemapping process.

Many mapping applications can suffice with only a simple centerline representation of the transportation network, but other applications require a “navigable” database that can be used for routing and logistical analysis. Such a navigable street database includes the necessary geometry and intelligence to recognize one-way streets, underpasses, overpasses, turning restrictions at intersections, and other issues. Typical applications that need this sort of information include but are not limited to bus routing, garbage collection routing, emergency ambulance, fire and police dispatch, maintenance crew daily planning, service call routing,

and others. A navigable street database that adequately models possible movements along a roadway is needed to support these applications. This may be structured as a very complicated model that includes detailed information for every lane of travel, or a more simplified one addressing each carriageway as one or more lanes with the same direction of travel.

There are several official and de facto “standards” for navigable street databases, including the Geographic Data File (GDF) ISO 14825:2004 developed by the International Standards Organization (ISO) for Intelligent Transportation System (ITS) applications. ISO 14825:2004 specifies the conceptual and logical data model and the exchange format for geographic data bases for Intelligent Transportation System (ITS) applications. It includes suggested specifications for contents (features, attributes and relationships), a specification of how these contents shall be represented, and of how relevant information about the database itself can be specified (metadata). The focus of this standard is on ITS applications and it emphasizes road and road-related information, but it also recognizes that ITS applications require information in addition to road and road-related information. These may include reference to addressing systems in order to specify locations and destinations, information about administrative postal areas, and other areas or Points of Interest (POIs).

In addition to navigability, the roads database also needs to support pavement and other roadway asset management. This is often accomplished through a “linear referencing system” whereby pavement condition and treatment information that is described as measured segments referenced against nodes in the street network. In this manner, the node-to-node structure of the street network does not have to be physically split to smaller nodal segments, but rather the measurements are simply referenced to the network for spatial analysis and display. Likewise, some road asset management systems likewise maintain the asset information in a tabular database with a linear reference to the street network to approximate the location, while others maintain these as separate geographic features.

Traffic incidents are another important information source to the BNSDI community that is related to the land transportation theme. An incident could be a traffic ticket, other legal infraction, health emergency or other incident occurring along a roadway. Though the incident may not be a direct result of the transportation system, its spatial correlation with this feature is of interest for health, safety and emergency response planning and operations.

Business Requirements. The Ministry of Works and Transport (MoWT), Transport Department is responsible for the oversight and regulation of all public transportation in the country and to ensure traffic safety along all roadways under the jurisdiction of the Ministry. The full range of BNSDI stakeholder activities that have some direct need for potable water utility data are depicted in Appendix B. According to this information, nearly 75% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. BNSDI community is interested in particular in roadway and other land transportation information to:

- Transportation planning, operations and asset management;
- Provide engineering and basemap related detail information along highways, bridges, roads that can be used as a common reference along roads outside of urban areas where no other detailed basemapping is available;
- Support the coordination of utilities that pass through transportation rights of way;
- Provide roadway information as the basis for road asset and pavement management;
- Support detailed roadway and traffic control studies, including turning movements, signage and striping, accident analysis, and others;
- Support health safety and emergency response planning;
- Plan, design, and develop transportation modeling and traffic management scenarios as part of transportation network current developments and operations;
- Provide a background information in cartographic maps on the existing land transportation infrastructure in the country i.e. highways and bridges and internal roads;
- Component of national multimodal transportation network;
- Support urban and regional planning;
- Rural development and poverty alleviation planning;
- Conduct property valuation;
- Hazard and vulnerability modeling;
- Support transit planning and management;
- Protected area planning and management;
- Tourism planning and development;
- Agriculture extension service management;
- Geocoding and analysis of traffic accident data;
- Agriculture planning and market access analysis;
- Disaster reduction and recovery planning;
- Climate resilient infrastructure planning;
- Development review and approval;
- Habitat modeling and conservation planning;
- Car navigation;
- Ambulance, fire truck and police dispatch routing;
- Neighborhood safety patrol planning;
- Bus routing;
- Solid waste collection routing;
- Routing for delivery of goods and services;
- Public service accessibility assessment;
- Conduct accessibility modeling for mineral and mining production;
- Foundation for location based services.

Current Situation. Several organizations in Belize have undertaken efforts to map the land transportation network of Belize at different times using different mapping sources, covering different geographic areas, using varying levels of accuracy and for different purposes. Until now there has been no unified and universally acceptable GIS transportation layer of

information that could be used in common across the community of GIS users in Belize. The wide variety of existing sources for land transportation related information are listed in the Table below. The most prevalent, complete and current of these include the following:

- The MNRA LIC has automated major roads from the U.K. Ordnance Survey 1:50K maps and has periodically updated this information for specific projects. This information has been widely distributed to other organizations;
- The CZMAI has updated the MNRA LIC roads database using more recent Landsat satellite imagery as a reference;
- The MNRA LIC has also digitize more detailed road centerlines for selected areas, suing the parcel information and imagery available in Google Maps and MS Bing Maps as a reference;
- The Ministry of Works and Transport (MoWT) previously developed and had maintained a roadway inventory system for pavement, bridges and culverts. This information was maintained in the Routine Maintenance Planning System software (ROMAPS), an off-the-shelf commercial application software that was developed originally in the 1980's by Roughton International. ROMAPS captured roadway pavement, appurtenances and activities in a tabular database as point or line events within a linear referencing scheme that identified events in kilometer reference to a point of beginning at designated locations. Geographic coordinates were captured for bridges, but not for culverts. The system had no GIS component therefore there was no mechanism for visualizing this information on a map or conducting geospatial analysis. The ROMAPS system has been maintained whenever data is collected and presented, but it has not been updated to the latest version and is to be replaced by the currently ongoing RMSI roadway inventory;
- The MoWT is currently undertaking a major project to prepare a complete inventory and assessment of the entire existing road network. The RMSI company was commissioned to carry out this project. Once completed, these data are to be added to the BNSDI data repository;
- The MoWT used to maintain as-built drawings for all road works conducted in the past. However most of this information has been lost over time and there is currently no actively maintained repository for as-built information;
- The MoWT currently maintains a manual record of all traffic accidents that it learns of. The form includes a highway milestone number. This is based on a common road reference system established by the Joint Intelligence Command Service (JICS) coordinated by the Police Department. This information is also collected by the Police and Ministry of Health, but there is presently no basis for coordination or sharing information among the three entities;
- The MoWT at one time maintained an inventory of all the major advertising signs situated along the highways. The Ministry is required to review and approve such signage. The database was included in the ROMAPS system but has not been maintained for a few years and is not being recorded in the RMSI system that will replace ROMAPS;

- The MoWT Transport Department has in the past maintained a paper map of transit zones, routes and terminal locations. This information is not maintained on a regular basis although staff have indicated they would like to do this in a GIS format in the future and make this information available for use by the transit riding public.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 31 – Data Sources Related to the Land Transportation Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Roads	The Roads layer covering five classes of roadways from highways down to unpaved tracks and paths.
MNRA	Lands and Surveys Department	Land Information Centre	Administrative Boundary	This folder contains maps or.mxd of all towns and cities in Belize, including street maps.
MNRA	Lands and Surveys Department	Land Information Centre	Baseline	Contains baselin maps such Baseline by country, baseline by district and which includes data such as administrative boundaries, roads, rivers and waterbodies
MNRA	Lands and Surveys Department	Land Information Centre	Roads 2012	Contains shapefile of updated roads in the Toledo, Stann Creek, and Corozal District, these data were generated from images such as Google Earth and Bing Maps, also the parcel database was use to generate the center lines of these roads.
MNRA	Lands and Surveys Department	Land Information Centre	BTB	This folder stores maps and other data pertaining to the Belize Tourist Board, these include adventure trails and other tourist attractions.
MNRA	Lands and Surveys Department	Land Information Centre	Belize City Council	Contains request for maps and spatial data for the Belize City Coucil, these include the updated street names, Valuation zones etc.
MNRA	Lands and Surveys Department	Land Information Centre	MOW	Contains request for maps and spatial data for the Ministry of Works, these include the updated roads, culvert and bridges data.
MNRA	Lands and Surveys Department	Land Information Centre	MOW	Contains request for maps and spatial data for the Ministry of Works, these include the updated roads, culvert and bridges data.
MNRA	Lands and Surveys Department	Land Information Center	Topography Baseline: Roads	Topographic Sheet (DOS)/LandSat
MNRA	Natural Resources Department	Belize Solid Waste Management Authority (BSWaMA)	BSWaMA Solid Waste Facilities and Hauling Routes General Map.	The Authority has a very generalized map depicting the location of various waste handling facilities and the general haul routes for moving the waste.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Roadway As-Built Records	Historical as-built records for roadway and bridge construction projects were maintained centrally in the past by the MoWT, but this function is no longer being carried out.

Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	MoWT Project Case Files	There are currently three different Project Execution Units (PEU's) administering the externally financed projects of the MoWT, one for each of the primary finance institutions including the IDB, European Union and OPIC. Each has different procedures, conventions and information management procedures depending upon the requirements of the funding entity. Case Files in paper form are compiled and maintained for all projects, but these are not integrated across the three PEU's. These contain contracts, plans, status reports, site visit notes, correspondence and other relevant reference information for each project.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Routine Maintenance Planning System (ROMAPS) Database	The Ministry previously developed and had maintained a roadway inventory system for pavement, bridges and culverts. This information was maintained in the Routine Maintenance Planning System software (ROMAPS), an off-the-shelf commercial application software that was developed originally in the 1980's by Roughton International. ROMAPS captured roadway pavement, appurtenances and activities in a tabular database as point or line events within a linear referencing scheme that identified events in kilometer reference to a point of beginning at designated locations. Geographic coordinates were captured for bridges, but not for culverts. The system had no GIS component therefore there was no mechanism for visualizing this information on a map or conducting geospatial analysis. The ROMAPS system has been maintained whenever data is collected and presented, it has not been updated to the latest version and is to be replaced by the currently ongoing RMSI roadway inventory.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	IRAP Road Assessment Database	The Ministry of Works in 2011 undertook a project to map over three hundred miles of paved roads in Belize. The purpose of the survey, supported by the International Road Assessment Program (iRAP) was to determine the state of the nation's roadways and to prioritize a capital investment program for road safety infrastructure improvements. The survey was carried out by a specially equipped vehicle which recorded images of the major highways from Corozal to Toledo and selected paved roads in between. The survey was carried out by the International Road Assessment Program, a London-based not-for-profit organization dedicated to saving lives through safer roads. This program resulted in the capture of road condition information including geo-referenced video imagery every 10m (IRAP Road Assessment Database). The GPS coordinates captured for all roadways surveyed, except for the Toledo District, were provided to the MNRA LIC in 2011.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	RMSI Road Inventory Database	No additional information provided

Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Traffic Accident Records	The MoWT currently maintains a manual record of all traffic accidents that it learns of. The form includes a highway milestone number. This is based on a common road reference system established by the Joint Intelligence Command Service (JICS) coordinated by the Police Department. This information is also collected by the Police and Ministry of Health, but there is presently no basis for coordination or sharing information among the three entities.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Highway Sign Inventory	The MoWT at one time maintained an inventory of all the major advertising signs situated along the highways. The Ministry is required to review and approve such signage. The database was included in the ROMAPS system but has not been maintained for a few years and is not being recorded in the RMSI system that will replace ROMAPS.
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Transit Zones and Routes	The MoWT Transport Department has in the past maintained a paper map of transit zones, routes and terminal locations. This information is not maintained on a regular basis although staff have indicated they would like to do this in a GIS format in the future and make this information available for use by the transit riding public
Ministry of Works and Transport	Works Department and Transport Department	Undifferentiated	Traffic Tickets	The MoWT Transport Department is responsible for carrying out traffic law enforcement outside of the municipalities. There are a total of 28 enforcement officers who patrol the country's highways. They are responsible for issuing traffic, equipment and other safety violation tickets and identifying drivers who may be driving under the influence of alcohol or drugs. In addition, the enforcement officers also inspect buses at terminals. The officers issue approximately 250 tickets each month. Each ticket includes the home address or community name of the offender and the approximate location of the offense, by address, street or intersection name, and highway milepost or landmark reference. The Department would like to upgrade the approach in the future to include automating the ticket system and establishing a more precise way to record geographic locations
Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	Belize City Council	Traffic Department	Traffic Ticket Database.	Belize City Council Traffic Department maintains a database of all traffic violation tickets issued by the Department. This includes all relevant information about each offending vehicle and its owner, including home address. Each ticket also includes a reference to location, which might be by street address, street name or other textual description. Tickets are issued in hardcopy in the field, and later key entered at the Traffic Department office. Copies of the paper ticket books are shared with the Police Department, however there is not sharing of the digital ticket information therefore there is no complete, integrated record of issued traffic tickets nationally.

Ministry of Labour, Local Government, Rural Development, Nemo and Immigration and Nationality	National Emergency Management Organization (NEMO)			
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Roads	date of publication: unknown. Originator: unknown. Preferential Scale: 1:50,000. Notes: apparently digitized from the 1:50,000 Ordnance Survey E755 sheets; the specific time period is unknown but were probably digitized from the most recent OS sheets; this dataset (along with most of the other OS sheet-derived data) was apparently digitized by the University of Edinburgh.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Roads	date of publication: unknown. Originator: University of Edinburgh (but updated by the Land Information Centre). Preferential Scale: 1:50,000. Notes: this data was apparently used by David Gray in his study with Chomitz, and constitutes one of the few roads datasets for which the time period is available; according to Gray, the road network digitized from the 1:50,000 sheets by the University of Edinburgh was updated by the Land Information Centre using differential GPS units.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Roads	date of publication: 2004. Originator: Meerman. Preferential Scale: 1:50,000. Notes: according to the metadata, this dataset is an update of the LIC's roads dataset, using 2000-03 LandSat imagery, and road coverage data for southern Belize from the ESTAP project.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Roads	date of publication: 2010. Originator: Meerman. Preferential Scale: 1:75,000. Notes: Road Shapefile for Belize based on 2008 Landsat Image.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Roads	date of publication: 2011. Originator: Meerman, Belize Tropical Forest Studies. Preferential Scale: 1:75,000. Notes: 2011 update from a road Shapefile for Belize based on 2008, 2010 and 2011 Landsat Images. Principal change with previous versions lies in the classification of roads.

Ministry Of Tourism, Culture and Civil Aviation	Ministry and Belize Tourism Board		Road Network Map 2010	A map of tourism attractors was developed as part of the preparation of the National Sustainable Tourism Masterplan for Belize 2030. This depicts the major land surface routes connecting the major urban centers and touristic destinations in Belize.
Ministry Of Tourism, Culture and Civil Aviation	Ministry and Belize Tourism Board		Road Network Map 2010	A map of major land surface routes connecting the major urban centers and touristic destinations in Belize was developed as part of the preparation of the National Sustainable Tourism Masterplan for Belize 2030.
Non-Government Organizations	Belize Tropical Forest Studies		Spatial Layer: Roads and Tracks	<p>Spatial Layer: Roads and Tracks Source: Spatial Presentation of Belizes Road system describing paved, unpaved roads and the most important tracks and trails</p> <p>Note: Generated by Jan Meerman Updated 30 Jun 2004 Projection: UTM Zone 16 Datum: NAD 27 Central Spheroid: Clarke 1866 EPSG Code: 26716</p>

Topics: Topics for the land transportation class include:

- Highways and Roads
- Transport Structures
- Street addresses
- Bicycle Routes
- Emergency Evacuation Routes
- Pedestrian Networks
- Transit Routes
- Rail (no active railways in Belize today)
- Tracks and Trails
- Road Incidents

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Road Network
Description	This FGDS would be a comprehensive, navigable road database covering all of Belize.
Current Status	Today there are many versions of the road network in Belize created by different organizations at different scales and levels of accuracy and for different purposes. The most recent road inventory has been conducted for major roads throughout the country by RMSI on behalf of the MoWT, however the main purpose of that database is to support

	roadway upgrading and maintenance. At present there is no comprehensive, consistent database that covers all the most important requirements of the BNSDI community.
Future Program Considerations	A future effort should be undertaken to develop a comprehensive and consolidated database of highways, roads, tracks and major trails for Belize. The level of accuracy could vary between rural and urban areas, but should be a topologically connected network and for all roadways inclusive of turning restrictions, speed limits and other information required to make this a navigable database suitable for use in car navigation systems and other routing programs.
Custodianship Considerations	It is expected that the features to be included in this database will include multiple jurisdictions, including the MoWT, City and Town Councils, and the MNRA LIC. The requirements for the database should be developed in consultation with all the key stakeholders throughout the BNSDI stakeholder community. Assignment of a single custodian with a responsibility to keep this information up to date may be best carried out by the BNSDI spatial data coordination unit in collaboration with the responsible organizations.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Roads Linear Referencing System
Description	This FGDS would be Linear Referencing System (LRS) scheme that would be adopted as a national standard for use across Belize.
Current Status	The Routine Maintenance Planning System software (ROMAPS) previously developed and maintained by MoWT was utilizing an LRS but has been discontinued in favor of the new database being created by RMSI. There is also a Joint Intelligence Command Service (JICS) LRS coordinated by the Police Department that would need to be further assessed.
Future Program Considerations	A future effort should be undertaken to develop a standardized LRS for Belize. An LRS is a logical framework that uses the nodes and segments of a comprehensive roads database to designate a common reference structure. The LRS identifies “from” and “to” nodes (usually at an intersection or other major feature in the network) to designate a route that may include multiple roadway segments. Measurements between the nodes can be automatically calculated without a need to topologically break the network. For example, a segment of highway requiring pavement repair can be described using a pair of milepost measurements, the location of which can be illustrated on the network without affecting its topology.
Custodianship	The definition of a standard LRS based on a new comprehensive

Considerations	coverage of Highways and Roads for Belize will require collaboration across multiple organizations. Assignment of a single custodian with a responsibility to keep this information up to date may be best carried out by the BNSDI spatial data coordination unit in collaboration with the responsible organizations.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Transit Routes
Description	This FGDS would include the scheduled routes of publicly accessible transit services throughout Belize.
Current Status	The MoWT Transport Department has in the past maintained a paper map of transit zones, routes and terminal locations. This information is not maintained on a regular basis although staff have indicated they would like to do this in a GIS format in the future and make this information available for use by the transit riding public
Future Program Considerations	A future effort should be undertaken to develop a standardized depiction of publicly accessible transit routes throughout Belize. This could be made available broadly for reference by residents and tourists alike.
Custodianship Considerations	The logical custodian for this FGDS is the MoWT.
Security Considerations	There are no special security considerations expected for this FGDS.

7.2 Water Transportation

General Considerations: A typical dataset at the medium scale includes water based routes for boats, shipping channels, ferries, container ship berths, and other forms of water transportation; stations, harbors, piers, marinas, boat launches, and others. This also includes various facilities associated with water transportation such as navigation buoys and other features that are included on typical nautical charts to aid navigation.

Business Requirements. The coastal and river waterways of Belize are a significant component of the Country's transportation infrastructure, especially supporting tourism, travel between coastal communities and the many cayes. The full range of BNSDI stakeholder activities that have some direct need for water transportation data are depicted in Appendix B. According to this information, over 36% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential

uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Provide a record of all publicly accessible water transportation facilities and services;
- Provide a background information in cartographic maps on the existing water transportation services in the country i.e. harbors, stations, and other points of interest;
- Plan, design, and develop water transportation and routes;
- Prepare and implement long range planning for water transportation infrastructure;
- Component of national multimodal transportation network;
- Prepare and implement capital improvement plans for water transportation infrastructure;
- Coordinate the development of utility infrastructure services that serve the ports area or will be affected by the new ports developments;
- Assess the environmental impact of new developments related to ports services in coordination with the environmental authorities;

Water transportation facilities such as harbors and ports are captured at large scale whereas shipping navigation lanes are captured at medium and small scale. The GIS data format may vary depending on the type of use. For instance, the trend is for operators to manage ports much as one would a small city, where the GIS maps are closely linked to operational models and applications that simulate the operations inside the ports such as traffic management, containers loading, cranes capacity management, warehouse management, utility management and other such functions. While the BNSDI community is not interested in the operation details inside ports, the ports authorities have interest on their side to develop GIS models that are compatible with SDI standards and international sound practices.

Current Situation: The MNRA LIC has developed a database indication the location of piers along the coast and in the cayes.

CZMAI has compiled data regarding shipping ports, shipping lanes, water taxi routes and other regular sea routes connecting major urban areas and tourist destinations along the coast and cayes.

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 32 – Data Sources Related to the Water Transportation Data Theme

MNRA	Lands and Surveys Department	Land Information Centre	Piers Data	The piers data shows the location and distributions of all the piers along the coast as well as in the cayes of Belize. Popular tourist destinations such as San Pedro and Caye Caulker have the most piers.
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MNRA	Lands and Surveys Department	Land Information Center	Piers: Placencia Piers, San Pedro/Ambergris Caye Piers, Caye Caulker Piers	Land Utilization Authority, Lands & Surveys
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Shipping Ports	date of publication: 2005. Originator: Coastal Zone Management Authority & Institute. Preferential Scale: 1:50,000. Notes: these ports were digitized directly from the 1:50,000 sheets by the Coastal Zone Management Institute for inclusion on the Belize Coastal Data CD compilation by WRI.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Shipping Lanes	date of publication: 1993. Originator: Coastal Zone Management Project - World Conservation Monitoring Centre. Preferential Scale: 1:250,000. Notes: this dataset is one of a series that were digitized by Janet Gibson of the CZMP while visiting the WCMC (now UNEP-WCMC) in Cambridge; these were digitized on the 1:250,000 sheets; general transportation routes were provided by the Belize Ports Authority.
Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Water Taxi Route	date of publication: unknown. Originator: Belize Port Authority, Coastal Zone Management Authority and Institute. Preferential Scale: unknown.
Ministry Of Tourism, Culture and Civil Aviation	Ministry and Belize Tourism Board		Regular Routes by Sea 2010	A map of regularly scheduled sea routes connecting the major coastal urban centers and touristic destinations in Belize was developed as part of the preparation of the National Sustainable Tourism Masterplan for Belize 2030.

Topics: Data topics related to this theme include:

- Boat Launches
- Marinas
- Ports and Harbors
- Piers
- Shipping Lanes
- Water Taxi Routes
- Aids to Navigation

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Water Transport Facilities
Description	This FGDS would be a comprehensive inventory of all water transportation facilities in Belize, inclusive of marinas, ports, harbors, piers, and boat launches.
Current Status	The LIC and CZMAI have compiled data regarding piers and ports, but

	this information is not actively maintained.
Future Program Considerations	A future effort could be undertaken to conduct a thorough inventory and recording of all water transport facilities in Belize.
Custodianship Considerations	The logical custodian for this FGDS will require further discussion.
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Water Transport Routes
Description	This FGDS would depict all the standard water transport routes including water taxis and shipping routes.
Current Status	This information has been mapped by the CZMAI but is not updated on a regular basis.
Future Program Considerations	A future effort should be undertaken to develop a comprehensive and consolidated database of all regular water transport routes in Belize.
Custodianship Considerations	The logical custodian for this FGDS will require further discussion
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Water Transport Aids to Navigation
Description	This FGDS would include all the standard aids to navigation including the delineation of shipping lanes, navigation buoys, lights, day beacons, foghorns, and other such structures.
Current Status	No additional information provided
Future Program Considerations	No additional information provided
Custodianship Considerations	No additional information provided
Security Considerations	There are no special security considerations expected for this FGDS.

7.3 Air Transportation

General Considerations: Air transportation datasets include air travel facilities such as airports and helipads, their characteristics and primary air routes. Air transportation facilities such as airports are captured at large scale (addressed in “Facilities” data theme) whereas

flight path envelopes may be delineated at medium scale and air routes are captured in a specialized manner for small scale air navigational charting. The GIS data format may vary depending on the type of use. For instance, the airports authorities manage airport facilities and structures using advanced simulation software for traffic management capacity management. While the BNSDI community is not interested in the operation details inside airports, the airports authorities have interest on their side to develop GIS models that are compatible with SDI standards and international sound practices.

Business Requirements: Air transportation is a significant component of the Country's transportation infrastructure, especially supporting tourism, expedient travel between remote communities and the many cays. In addition, access to heliports is critical for emergency transportation. The full range of BNSDI stakeholder activities that have some direct need for air transportation data are depicted in Appendix B. According to this information, over 34% of the activities carried out by BNSDI stakeholders could derive benefit from this information in some manner. The range of existing or potential uses for this data in Belize as identified through the Stakeholder Situation Survey and international practice include:

- Plan, design, and develop air transportation and routes navigation modeling as part of air transportation routes current developments;
- Airport planning and operations support;
- Component of national multimodal transportation network;
- Provide a background information in cartographic maps on the existing air transportation services in the country i.e. airports and airstrips;
- Delineate flight path envelopes and associated restricted airspace around primary airports;
- Prepare and implement long range planning for air transportation infrastructure;
- Prepare and implement capital improvement plans for air transportation infrastructure;
- Coordinate the development of utility infrastructure services that serve airports or will be affected by new airports developments;
- Tourism planning;
- Economic planning and development;
- Support regional and international trade development;
- Emergency planning and response;
- Climate resiliency planning;
- Assess the environmental impact of new developments related to airports services in coordination with the environmental authorities.

Current Situation: No additional information provided

Current Data Sources: The following data sources and related information were identified within the Stakeholder Situation Survey that are most closely related to this data theme:

Table 33 – Data Sources Related to the Air Transportation Data Theme

Ministry of Forestry, Fisheries and Sustainable Development	Coastal Zone Management Authority & Institute		Airstrips	date of publication: 2005. Originator: Civil Aviation Authority. Preferential Scale: 1:50,000. Notes: coordinate data were provided by the Civil Aviation Authority ("Authorized Aerodromes" document), but digitized by the Coastal Zone Management Institute; in a number of cases where only partial coordinate information was provided, points had to be verified / corrected using the 1:50,000 map sheets.
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Topics: Topics for the Air Transportation class include:

- Airports Location
- Airport Noise Contours
- Airstrips and Heliports Locations
- Air Routes and Flight Restriction Zones

FGDS: FGDS data of interest to the BNSDI community for this theme includes:

FGDS Name	Air Transportation Facility Locations
Description	This FGDS would depict the location and basic descriptive information regarding all air transportation facilities in Belize, including airports, airstrips and helipads. This could also include the identification of facilities that have been prequalified as suitable for emergency landing purposes in case of disaster response.
Current Status	The CZMAI has compiled data regarding airstrips. This issue was not fully covered in the current study due to time and resource constraints.
Future Program Considerations	A future effort could be undertaken to conduct a thorough inventory and recording of all air transport facility locations in Belize.
Custodianship Considerations	The logical custodian for this FGDS is the Civil Aviation Authority
Security Considerations	There are no special security considerations expected for this FGDS.

FGDS Name	Air Transportation Routes
Description	This FGDS would depict the location of all regular air transportation routes at all levels, as well as any adopted flight restriction zones that have been adopted.
Current Status	No additional information collected
Future Program Considerations	A future effort could be undertaken to conduct a thorough inventory and recording of all air transport facility locations in Belize.
Custodianship Considerations	The logical custodian for this FGDS is the Civil Aviation Authority

Security Considerations	There are no special security considerations expected for this FGDS.
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Appendix A: Glossary of Terms and Acronyms

<i>APAMO</i>	Association of Protected Areas Management Organizations
<i>BACONGO</i>	Belize Association of Conservation NGOs
<i>BAD</i>	Belize Archives Department
<i>BAHA</i>	Belize Agricultural Health Authority
<i>BAS</i>	Belize Audubon Society
<i>BBIS</i>	Belize Biodiversity Information System
<i>BCB</i>	Banana Control Board
<i>BCC</i>	Belize City Council
<i>BCCI</i>	Belize Chamber of Commerce and Industry
<i>BCS</i>	Belize Country Strategy for Adaptation of the Sugar Industry
<i>BEL</i>	Belize Electric Company Limited
<i>Bmp CITCO</i>	Belmopan City Council
<i>BNSDI</i>	Belize National Spatial Data Infrastructure
<i>BERDS</i>	Biodiversity and Environmental Resource Data System of Belize
<i>BEST</i>	Belize Enterprise for Sustainable Technology
<i>BLPA</i>	Belize Livestock Producers Association
<i>BNCC</i>	Belize NSDI Coordination Center. Function or unit proposed to provide the facilitation, coordination, promotion and support that is needed to build and operate an NSDI
<i>BNE</i>	Belize Natural Energy Ltd.
<i>BNSDI</i>	Belize National Spatial Data Infrastructure
<i>BRDP</i>	Belize Rural Development Programme
<i>BSI</i>	Belize Sugar Industry
<i>BTB</i>	Belize Tourism Board
<i>BWSL</i>	Belize Water Service Limited
<i>CARDI</i>	The Caribbean Agricultural Research and Development Institute (CARDI) was established in 1975 to serve the agricultural research and development needs of the member states of the Caribbean Community (CARICOM).
<i>CATHALAC</i>	Water Center for the Humid Tropics of Latin America and the Caribbean (in Spanish "CATHALAC"- Centro del Agua del Trópico Húmedo para America Latina y el Caribe) is an autonomous international organization dedicated to promote sustainable development through applied research and development, education, and technology transfer in the areas of integrated watershed management, climate change, environmental modeling and analysis, and risk management in Latin America and the Caribbean
<i>CARICOM</i>	Caribbean Community
<i>CBA</i>	Central Building Authority
<i>CBD</i>	Convention on Biological Diversity
<i>CBO</i>	Community Based Organization
<i>CCAD</i>	Comisión Centroamericana de Ambiente y Desarrollo (Central American Commission for Environment and Development)
<i>CCB</i>	Citrus Company of Belize
<i>CCCCC</i>	Caribbean Community Climate Change Center

<i>(5C's)</i>	
<i>CDB</i>	Caribbean Development Bank
<i>CEO</i>	Chief Executive Officer / Chief Environmental Officer
<i>CFR</i>	Chiquibul Forest Reserve
<i>CGA</i>	Citrus Grower's Association
<i>CH4</i>	Methane
<i>CIARMP</i>	Community Initiated Agricultural Resources Management Project
<i>CITES</i>	Convention on International Trade in Endangered Species of Wild Fauna and Flora
<i>CNP</i>	Chiquibul National Park
<i>CO</i>	Carbon Monoxide
<i>CO2</i>	Carbon Dioxide
<i>CPA</i>	Country Poverty Assessment
<i>CPACC</i>	Caribbean Planning for Adaptation to Climate Change
<i>CRIP</i>	Climate Resilient Infrastructure Project.
<i>CZMAI</i>	Coastal Zone Management Authority and Institute
<i>DfID</i>	Department for International Development (formerly ODA)
<i>EIA</i>	Environmental Impact Assessment
<i>EPA</i>	Environmental Protection Act.
<i>ERI</i>	Environmental Research Institute of the University of Belize
<i>ESTAP</i>	Environmental and Social Technical Assistance Project
<i>EU</i>	European Commission / Union
<i>FAO</i>	The Food and Agriculture Organization of the United Nations leads international efforts to defeat hunger. Serving both developed and developing countries, FAO acts as a neutral forum where all nations meet as equals to negotiate agreements and debate policy. FAO is also a source of knowledge and information. We help developing countries and countries in transition modernize and improve agriculture, forestry and fisheries practices and ensure good nutrition for all. Since our founding in 1945, we have focused special attention on developing rural areas, home to 70 percent of the world's poor and hungry people.
<i>FCD</i>	Friends for Conservation and Development
<i>FD</i>	Forest Department
<i>FGDC</i>	Federal Geographic Data Committee (USA)
<i>FGDS</i>	Fundamental Geospatial Data Set. This is any data theme or topic that is needed in common across a stakeholder community.
<i>FIRMS</i>	Fire Information for Resource Management System
<i>FPMP</i>	Forest Planning and Management Project
<i>GBIF</i>	Global Biodiversity Information Facility
<i>GDP</i>	Gross Domestic Product
<i>GEF</i>	Global Environment Facility.
<i>GeoNode</i>	GeoNode is an open-source, web-based application and platform for developing geospatial information systems (GIS) and for deploying spatial data infrastructures (SDI)

<i>GEO</i>	Group on Earth Observations
<i>GEO</i>	Global Environment Outlook
<i>GeoSMS</i>	Geographically enabled Small Messaging Service
<i>GHG</i>	Green House Gas
<i>GIS</i>	Geographic Information System. A Geographic Information System is a computer system designed to allow users to collect, manage, and analyze large volumes of spatially referenced and associated attribute data. The major components of a GIS are: a user interface system; data base management capabilities; data base creation/data entry capacity; spatial data manipulation and analysis packages; and display/product generation functions.
<i>GIZ</i>	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). German overseas development assistance organization
<i>GoB</i>	Government of Belize
<i>GPA</i>	Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (UNEP)
<i>GPS</i>	Global Positioning System
<i>HDI</i>	Human Development Index
<i>HIV/AIDS</i>	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
<i>Hydromet</i>	Belize National Meteorological Center
<i>IABIN</i>	Inter-American Biodiversity Information Network
<i>ICRAN</i>	International Coral Reef Action Network
<i>ICT</i>	Information and Communication Technologies
<i>IDB</i>	Inter-American Development Bank
<i>IICA</i>	The Inter-American Institute for Cooperation on Agriculture (IICA) is a specialized agency of the inter-American system, and its purposes are to encourage and support the efforts of its Member States to foster agricultural development and rural well-being in their territories.
<i>IP</i>	Internet Protocol
<i>IPCC</i>	Intergovernmental Panel on Climate Change
<i>ISO</i>	International Organization of Standardization
<i>ISP</i>	Internet Service Provider
<i>IT</i>	Information Technology
<i>IUCN</i>	International Union for Conservation of Nature
<i>IUU</i>	Illegal, Unreported and Unregulated
<i>IWRM</i>	Integrated Water Resource Management
<i>KB</i>	Kilobyte
<i>KCB</i>	The Ke'kchi Council of Belize
<i>LIC</i>	Land Information Centre
<i>LLES</i>	Limited Level Environmental Study.
<i>MAR</i>	Mesoamerican Reef
<i>MARPOL</i>	International Convention for the Prevention of Pollution from Ships
<i>MBRS</i>	Mesoamerican Barrier Reef System
<i>MDG</i>	Millennium Development Goals
<i>MEA</i>	Millennium Ecosystem Assessment
<i>Metadata</i>	Standardized catalog of information about each geospatial data set

<i>MFED</i>	Ministry of Finance and Economic Development
<i>MFFSD</i>	Ministry of Forestry, Fisheries and Sustainable Development
<i>MLGRD</i>	Ministry of Local Government and Rural Development
<i>MNRA</i>	Ministry of Natural Resources and Agriculture
<i>MoESTPU</i>	Min of Energy, Science & Technology, and Public Utilities
<i>MoFED</i>	Ministry of Finance and Economic Development
<i>MoH</i>	Ministry of Health
<i>MoWT</i>	Ministry of Works and Transport
<i>MPAs</i>	Marine Protected Areas
<i>MPFR</i>	Mountain Pine Ridge Forest Reserve
<i>NASA</i>	The National Aeronautics and Space Administration (NASA) is the agency of the United States government that is responsible for the nation's civilian space program and for aeronautics and aerospace research
<i>NAVCO</i>	National Association of Village Councils Organization
<i>NBII</i>	National Biological Information Infrastructure (USA)
<i>NBSAP</i>	National Biodiversity Strategy and Action Plan
<i>NCB</i>	National Coordinating Body
<i>NCCC</i>	National Climate Change Committee was established to advise government on issues regarding climate change
<i>NCRIP</i>	National Climate Resilient Investment Plan
<i>NEAC</i>	National Environmental Appraisal Committee. The Committee was established to review development projects in the context of the national environment.
<i>NEAP</i>	National Environmental Action Plan
<i>NEMO</i>	National Emergency Management Organization
<i>NFAB</i>	National Fisheries Advisory Board established to provide guidance on fisheries commodities extraction strategies and policies
<i>NFP</i>	National Focal Point
<i>NGO</i>	Non-Governmental Organization
<i>NICH</i>	National Institute for Culture and History
<i>NMS</i>	National Meteorological Service
<i>Node</i>	A facility that is connected to other facilities over the Internet for the purpose of publishing and sharing data
<i>NPAC</i>	National Protected Areas Committee. This Committee was established to advise the government of Belize on issues concerning the national protected area system
<i>NREPS</i>	Natural Resource and Environmental Sub- committee was established to increase the national understanding and acceptance of the linkages between natural resource and environmental protection and socio-economic development
<i>NSDI</i>	National Spatial Data Infrastructure. An institutional and technical framework for coordinating and sharing geospatial information across a stakeholder community.
<i>OAS</i>	Organization of American States
<i>ODA</i>	Overseas Development Administration
<i>OIRSA</i>	The International Regional Organization for Plant and Animal Health

	(OIRSA) is a technical organization established to provide administrative and technical support to the Ministries or Secretariats of Agriculture from its member countries, to protect and develop their agricultural resources in order to achieve a healthy production to satisfy population's demands and provide well-being. OIRSA's assistance is focused on its member countries' projects and plans for plant and animal health, food safety and facilitation towards agricultural commerce
<i>PACT</i>	Protected Areas Conservation Trust
<i>PAHO -</i>	Pan-American Health Organisation
<i>PCPU</i>	Policy Coordination and Planning Unit
<i>PEU</i>	Programme Execution Unit
<i>PFB</i>	Programme for Belize
<i>PUC</i>	Public Utilities Commission
<i>QuickStart</i>	An activity that is an accelerated portion of a longer term initiative, intended to result in near-term, visible and compelling results.
<i>RAMSAR</i>	Convention on Wetlands of International Importance Especially as Waterfowl Habitat
<i>REDD</i>	Reduction of Emissions from Deforestation and Degradation
<i>SERVIR</i>	Regional Visualization and Monitoring System
<i>SIB</i>	Statistics Institute of Belize
<i>SICB</i>	Sugar Industry Control Board
<i>SIF</i>	Social Investment Fund
<i>SIRDI</i>	Sugar Industry Research and Development Institute
<i>SISE</i>	San Ignacio/ Santa Elena Town Council
<i>SPAGs</i>	Spawning Aggregation Sites
<i>Spatial Data Clearinghouse</i>	Common repository of geospatial information, often composed of data provided by multiple custodians
<i>SIG</i>	Special Interest Group. A permanent multi-stakeholder body that is established to provide communication, coordination and support around a particular common interest or practice.
<i>Stakeholder</i>	Any organization or person that will be involved in the development and/or use of the Belize NSDI
<i>SCADA</i>	System Control and Data Acquisition
<i>SWMA</i>	Solid Waste Management Agency
<i>SWOT</i>	Strengths, Weaknesses, Opportunities and Threats
<i>TBSL</i>	Total Business Solutions Ltd.
<i>TNC</i>	The Nature Conservancy
<i>TOR</i>	Terms of Reference
<i>UB</i>	University of Belize
<i>UN</i>	United Nations
<i>UNCBD</i>	United Nations Convention on Biological Diversity
<i>UNCCD</i>	United Nations Convention to Combat Desertification
<i>UNCLOS</i>	United Nations Convention on the Law of the Sea
<i>UNDP</i>	United Nations Development Project
<i>UNEP</i>	United Nations Environment Program
<i>UNESCO</i>	United Nations Educational, Scientific and Cultural Organization

<i>UNFCCC</i>	United Nations Framework Convention on Climate Change
<i>USAID</i>	United States Agency for International Development
<i>WB</i>	World Bank
<i>WCMC</i>	World Conservation Monitoring Centre
<i>WCS</i>	Wildlife Conservation Society
<i>WMO</i>	World Meteorological Organisation (UN)
<i>Working Group</i>	A temporary body, normally consisting of representative members from multiple concerned organizations, assigned to address a particular subject over a certain period of time
<i>WRI</i>	World Resource Institute
<i>WWF</i>	World Wildlife Fund
<i>XML –</i>	eXtensible Markup Language

APPENDIX B – BUSINESS USE CASE REQUIREMENTS - PART 1 (BASEMAP-AREAS-ENVIRONMENT)

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT													
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic
MNRA	Lands and Surveys Department	Physical Planning Unit	Process Land Subdivision Applications	<ul style="list-style-type: none"> Log land subdivision applications geographically Review land tenure, administrative jurisdiction, environmental, and infrastructure context of proposed subdivision (current and planned) Conduct semi-automated review for planning and regulatory compliance Determine potential current hazards and those that may develop due to climate change Provide geographic linkage to land subdivision case files Produce map showing status of all pending land subdivision applications Illustrate historical land subdivision history 	1	1	1	1		1	1					1	1	1	1	1	1								1			1
MNRA	Lands and Surveys Department	Physical Planning Unit	Process Seabed and Public Coastal Areas Use/Construction Permits	<ul style="list-style-type: none"> Log seabed and public coastal area use/construction permit applications geographically Review land tenure, administrative jurisdiction, environmental, and infrastructure context of proposed seabed and public coastal area use/construction applications (current and planned) Conduct semi-automated review for planning and regulatory compliance Determine potential current and future hazards from climate change Provide geographic linkage to land subdivision case files Produce map showing status of all pending seabed and public coastal area use/construction permit applications Illustrate historical seabed and public coastal area use/construction permit history 	1	1		1		1	1					1		1	1	1	1	1	1								1	
MNRA	Lands and Surveys Department	Physical Planning Unit	Provide planning advisory support to other initiatives	<ul style="list-style-type: none"> Review planning context of other initiatives Identify potential existing hazards and those that may develop due to climate change 	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
MNRA	Lands and Surveys Department	Physical Planning Unit	Review Environmental Impact Assessments	<ul style="list-style-type: none"> Log environmental impact studies geographically Review land tenure, administrative jurisdiction, environmental, and infrastructure context of environmental impact studies (relative to current and planned conditions) Conduct semi-automated review for environmental compliance Determine potential current and future hazards from climate change Provide geographic linkage to environmental impact study case files Produce map showing status of all pending environmental impact studies Provide historical record of all historical environmental impact studies 	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
MNRA	Lands and Surveys Department	Physical Planning Unit	Support National Environmental Appraisal Committee (NEAC)	<ul style="list-style-type: none"> Provide environmental assessment tracking database Support NEAC review of individual and cumulative environmental impact assessments Provide historical record of all historical environmental impact studies 	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
MNRA	Lands and Surveys Department	Physical Planning Unit	Support National Protected Areas Committee (NPAC)	<ul style="list-style-type: none"> Monitor development and encroaching land use in and around national protected areas Notify proposed development or land use initiatives of potential issues relative to proximal national protected areas 	1	1	1	1	1	1	1			1	1	1	1		1	1	1	1	1	1	1	1				1		

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																												
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology														
MNRA	Lands and Surveys Department	Physical Planning Unit	Support National Land Use Planning Task Force	<ul style="list-style-type: none"> • Provide planning analysis in support of Municipal Development Project • Assess land use plans relative to land tenure, administrative jurisdiction, environmental, infrastructure and social context • Assess municipal development plans relative to projected climate change impacts and vulnerabilities • Assess cumulative societal implications of combined municipal development plans 	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
MNRA	Lands and Surveys Department	National Estate Section	Administer National Estate Land Leases	<ul style="list-style-type: none"> • Manage inventory of all National Estate lands • Log and track all National Estate land lease applications and leases • Assess land tenure, environmental, infrastructure context of land lease applications • Provide historical visualization of National Estate land leases 	1	1	1	1		1	1					1	1	1	1	1	1		1	1	1	1	1		1	1	1								1	1	1						
MNRA	Lands and Surveys Department	National Estate Section	Administer National Estate Land Purchase	<ul style="list-style-type: none"> • Manage inventory of all National Estate lands • Log and track all National Estate land sales • Assess land tenure, environmental, infrastructure context of land sale applications • Provide historical visualization of National Estate land sales 	1	1	1	1		1	1					1	1	1	1	1	1		1	1	1	1	1		1	1	1										1	1	1				
MNRA	Lands and Surveys Department	Land Registry Section	Process and Record Property Titles and Related Transactions	<ul style="list-style-type: none"> • Manage comprehensive inventory of plot boundaries and land titles for both Declared and Undeclared lands • Link all property transaction case files to geographic location • Provide online access to land ownership information 	1	1		1								1																															
MNRA	Lands and Surveys Department	Valuation Section	Conduct Property Valuation	<ul style="list-style-type: none"> • Provide access to property and property improvement information • Provide access to environmental, social and infrastructure conditions that may affect property use and value • Provide access to comparable property sales information • Provide access to information concerning private lands to be acquired for public purposes • Provide access to administrative jurisdiction boundaries 				1		1						1		1	1	1	1																						1	1			
MNRA	Lands and Surveys Department	Survey and Mapping Section	Authenticate Plans for Both National and Private Lands	<ul style="list-style-type: none"> • Log, store and manage land survey project data • Maintain geographically-linked database of all licensed land surveyors • Provide tools for capturing and managing field survey information • Provide means to visualize historical land survey activities over time 	1	1	1	1		1	1				1	1																															
MNRA	Lands and Surveys Department	Survey and Mapping Section	Support Land Registry Cadastral Updating for Grants and Leases	<ul style="list-style-type: none"> • Manage comprehensive land registry database for all grants and leases • Provide tools for capture of land survey data • Provide access to imagery and basemap information to support land survey efforts • Geographically link land survey activity case files 	1	1	1	1		1						1										1																					
MNRA	Lands and Surveys Department	Survey and Mapping Section	Manage National Geodetic Control Network	<ul style="list-style-type: none"> • Manage national geodetic network data • Provide national survey services through CORS/RTK system 	1																																										
MNRA	Lands and Surveys Department	Survey and Mapping Section	Provide Survey and Mapping Products and Services to Other Agencies and the Public	<ul style="list-style-type: none"> • Provide GIS and survey services to other agencies and the public • Manage survey project data • Produce and disseminate survey related information upon request 	1	1	1	1		1	1																																				

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																	
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology			
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Implement NIWRA Master Plan.	<ul style="list-style-type: none"> Conduct and record a comprehensive inventory and assessment of water resources and associated infrastructure in Belize Maintain water rights, allocations and relevant jurisdictions database Establish inventory of all permitted emissions and sources of water pollution Establish inventory of all water abstraction and related use permits Establish and manage suitable hydrologic monitoring network Establish direct data sharing linkages with National Meteorologic Office Conduct and record a comprehensive inventory and assessment of current and projected demand for water resources Assess potential affects of climate change on water resources Prepare spatial masterplan for the development and sustainable management of water resources Identify and formulate water resource development projects 	1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Process Water Abstraction Licenses.	<ul style="list-style-type: none"> Define watershed boundaries at multiple levels Provide access to Person and Business registries for authentication purposes Log and manage water abstraction license applications Monitor and analyze water abstraction licenses and operational reports by groundwater basin, watershed and stream Provide access to relevant environmental, social, health, hazard and infrastructure information contextual to a water abstraction license application Provide map interface linkage for accessing water abstraction license case files Monitor and assess climate and precipitation trends and impacts on water resources 		1	1	1		1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Collect and Manage Hydrological Data.	<ul style="list-style-type: none"> Conduct a geographic assessment of current hydrologic monitoring network and identify requirements and gaps for additional stations, and upgrading of key stations to automated reading and data transmission Provide access to topographic, hydrographic, soils, land use/land cover and other information needed to understand behaviours of the hydrological systems Collect, manage and model hydrologic data Establish real-time linkage to National Meteorological Office weather data stations for active monitoring 			1	1	1								1	1		1	1	1	1	1	1	1	1	1	1	1	1	1				
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Conduct Special Projects.	<ul style="list-style-type: none"> Utilize GIS maps and visualizations to communicate land degradation issues to the public in clear and compelling ways Conduct analyses in support of policy formulation and refinement processes Utilize geospatial data and methods for original and applied research Utilize geospatial data and analysis to support water resource and related development planning, design, operations, monitoring and evaluation Provide a map interface for the access of water resource information, plans and license information by geographic area or location Utilize GIS to conduct special services for government and other sectors 	1	1	1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Conduct Groundwater Resource Assessment	<ul style="list-style-type: none"> Develop geohydrologic model for Belize Monitor groundwater levels, quantity and quality Conduct groundwater modeling and assessment Conduct groundwater assessments by geohydrologic basin Publish maps and statistical reports regarding groundwater conditions and trends 			1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																				
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology						
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Conduct Water Resource Outreach	<ul style="list-style-type: none"> Publish compelling map and statistical reporting graph to raise awareness of water issues to policy makers and the public Conduct population demographic analysis to customize outreach to particular socioeconomic communities in specific environments 			1	1	1	1	1	1					1	1	1	1	1	1	1						1	1	1								
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Obtain, compile, store and disseminate data concerning the water resources of Belize;	<ul style="list-style-type: none"> Provide and manage a central clearinghouse for access to water resource data throughout Belize Access and utilize data from other BNSDI stakeholders that is useful for water resource matters (topography, weather and climate, land use and land cover, etc.) Provide tools for others to access data, maps and statistical information 			1	1	1	1	1	1					1	1	1	1	1	1	1	1					1	1	1								
MNRA	Natural Resources	Belize Solid Waste Management Authority	Oversee execution and implementation of the Solid Waste Management Project	<ul style="list-style-type: none"> Conduct community specific waste analysis and characterization Conduct siting analysis for solid waste transfer stations Conduct regional siting analysis for solid waste landfill facilities Conduct regional solid waste transport and access analysis Assess future community growth and solid waste trends Conduct solid waste facility site planning and design Conduct environmental impact assessments for planned solid waste facilities Conduct ongoing monitoring and evaluation of solid waste management facilities and operations Maintain complete inventory of solid waste facilities across Belize 						1							1		1	1	1		1	1	1		1	1	1								1		
MNRA	Natural Resources	Belize Solid Waste Management Authority	Oversee and Monitor the Operations of the Transfer Stations and Regional Sanitary Landfill.	<ul style="list-style-type: none"> Collection, compile and analyze transfer station and landfill operations data Produce transfer station and landfill operations current situation and trend statistics Re-calibrate waste stream analysis according to measured trends over time Provide new insights to solid waste policies, plans and operational procedures as needed to improve the waste management program over time Provide inventory of all waste management facilities and assets 							1								1		1		1	1	1		1	1	1										
MNRA	Natural Resources	Belize Solid Waste Management Authority	Conduct public relations and outreach activities.	<ul style="list-style-type: none"> Compile and assess community-specific surveys regarding solid waste issues Utilize population census information with community based surveys to understand different attitudes and issues regarding solid waste Link outreach programs to specific communities, schools and other channels Develop map visualizations and geostatistical charts and graphs to illustrate solid waste issues and where they occur 																		1																	
MNRA	Natural Resources	Belize Solid Waste Management Authority	Conduct institutional strengthening and working with local municipalities to optimize their waste collection routes	<ul style="list-style-type: none"> Provide geospatial analysis for nation-wide policy and planning analysis; Provide tools and data for solid waste collection and hauling route optimization; Provide waste management considerations and land allocation inputs to municipal land use planning; Provide tools for fleet tracking and monitoring; Conduct waste stream tracking and monitoring; Develop and manage solid waste fixed assets; Conduct real-time monitoring of waste movements at transfer station and landfill locations; Record the location and characteristics of significant informal dump sites to support evaluation and cleanup; Provide foundation of information to support siting and feasibility assessment for alternative waste management 							1												1																

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT														
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology
MNRA	Agriculture Department	Marketing	Promote and support agricultural market development	<ul style="list-style-type: none"> Analyze farm locations relative to markets where commodities are being sold; Monitor weather forecasts and other information to strategize best times to bring products to market; Assess how climate change may affect some commodities in geographic locations around the Country so that remedial action can be taken; Move towards more real-time treatment of market price information (e.g. Trinidad example utilizing smart phones equipped with GPS); Add supermarket prices to the market price tracking; Build a GIS unit to accommodate the variety of geospatial analyses that can be conceived to support the marketing of agricultural products in Belize. 	1	1	1	1		1					1	1	1	1	1	1	1	1	1	1	1				1	1			
MNRA	Agriculture Department	Projects Execution Unit	Administer, monitor and support projects execution	<ul style="list-style-type: none"> Provide project location and characteristics information throughout the lifecycle of the project; Provide access to contextual information that can assist in project formulation and feasibility assessment; Provide better coordination and alignment among projects from different sectors planned for the same area; Allow the government to monitor and geographically track all relevant projects across all sectors (essentially adding a geographic element to the existing Public Investment Strategy Programme (PSIP) managed by the Ministry of Finance and Economic Development); Provide map interface for access to agriculture projects case files 		1	1	1		1					1	1	1	1	1	1	1	1	1	1	1	1				1	1		
MNRA	Agriculture Department	Policy and Trade – Statistics	Develop and disseminate agricultural statistics and information	<ul style="list-style-type: none"> Provide a geographically based, comprehensive national farms registry Conduct geographically linked farmer surveys Conduct geostatistical analysis of farms inventory data Produce a national agricultural census maps and statistics Prepare and publish national agriculture maps and statistical reports Assess farms vulnerability to climate change projections Access geographic data from other BNSDI stakeholders Monitor agricultural trends over time Perform food security analysis Assess trends and provide information and recommendations to policy makers 		1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1				1	1			
MNRA	Agriculture Department	Central Farm	Provide Mechanical and Land Preparation Services	<ul style="list-style-type: none"> Geocode service requests, providing ability to track current and past projects geographically; Access agricultural census and farmer registries and associated information to help build awareness and market the tractor services; Access protected areas and other information to ensure requested work can be carried out within regulatory directives; Access land ownership information to confirm service requestor is land owner; Keep track of tractor locations; Monitor and evaluate outcomes and cost effectiveness of tractor service program over time. 		1	1	1		1					1						1							1	1				
MNRA	Agriculture Department	Central Farm	Promotion and Support for Development of Sustainable Aquaculture Industry	<ul style="list-style-type: none"> Continue geocoding aquaculture farm locations to track their distribution on a map; Suitability analysis (soils, slope, water access, market and transport access, etc.); Access protected areas and other information to ensure proposed aquaculture can be carried out within regulatory directives; Access land ownership information to confirm service requestor is land owner; Monitor and evaluate outcomes and effectiveness of 		1	1	1		1					1	1	1	1	1	1	1	1	1	1	1	1				1	1		

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS							ENVIRONMENT													
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MoWT	Works Department	Section	Support transportation planning	<ul style="list-style-type: none"> • Inventory and assessment of existing transportation infrastructure; • Inventory and assessment of high priority trip origination and destination points and areas; • Traffic modeling and monitoring; • Transport optimum corridor selection based on cumulative social, environmental and engineering issues, opportunities and constraints, including consideration of potential future climate change issues; • Roadway conceptual design; • Cost, value engineering and feasibility assessment; • Environmental impact assessment; • Right of way acquisition assessment and planning; • Stakeholder engagement and coordination; • Public outreach and communications. 	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1					1	1	1			1
MoWT	Works Department	Section	Manage materials lab.	<ul style="list-style-type: none"> • Link borehole, geotechnical and material lab test results to geographic locations • Publish selected test results by geographic location for use by engineers 	1	1	1	1		1	1				1									1	1			1	1	1			
MoWT	Works Department	Section	Oversee road design and construction.	<ul style="list-style-type: none"> • Basemap and inventory of existing conditions (topography, soils, slope, surficial geology, land use, land cover, land ownership, existing infrastructure and structures, protected areas, administrative boundaries, etc.); • Planning and management of temporary traffic diversions and signage during construction; • Asset takeoff and as-built inventory for roadway and associated appurtenances; • Construction oversight status reporting; • Management of as-built records for roads, georeferenced to location; • Public awareness and outreach (maps for newspaper and television, etc.); 	1	1	1	1		1	1				1	1	1	1	1	1	1	1	1					1	1	1			1
MoWT	Works Department	Section	Maintain roads infrastructure.	<ul style="list-style-type: none"> • Maintain complete and up to date inventory of road assets nationwide; • Provide geographic basis for understanding road network asset conditions and maintenance priorities; • Spatial representation of preventive maintenance priorities and schedules; • Monitor and track reactive maintenance activities to identify repeat visit areas that may need more proactive remedial treatment; • Maintenance fleet management; • Integrate MoWT roads with roads administered by others for a complete picture of the transportation network. This could also be used as the basis for a complete and accurate navigable road database to support car navigation; • Link traffic violations and accidents to roadway conditions as a reference for future maintenance and enhancements; • Maintain geo-referenced repository of roadway as-built records; • Monitor and assess the effectiveness of road maintenance programs over time. 																													

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MoWT	Works Department	Section	Maintain other civil infrastructure	<ul style="list-style-type: none"> Complete inventory and assessment of inland waterways; Development of preventive inspection and maintenance schedules for inland waterways; Plan, track and monitor reactive maintenance activities to resolve inland waterway issues; Utilize geospatially enabled social media and crowd-sourcing to help identify existing and potential inland waterway issues; Complete inventory and assessment of government buildings; Development of preventive inspection and maintenance schedules for government buildings; Plan, track and monitor reactive maintenance activities to resolve inland government building issues; Utilize geospatially enabled social media and crowd-sourcing with government staff to help identify issues with government building maintenance. 	1	1		1			1													1														
MoWT	Works Department	Section	Manage road safety	<ul style="list-style-type: none"> Complete inventory of street markings and signage; Tracking and analysis of traffic accidents and causative factors; Maintain common road linear referencing scheme; Provide common operational picture in support of the JICS. 	1	1		1				1																										
MoWT	Works Department	Section	Administer driver and vehicle licensing registration	<ul style="list-style-type: none"> Validate which jurisdiction a person is in to determine the responsible agency for licensing. Track violation locations countrywide, including linkages to municipality-issued tickets; Geocode licensed drivers and vehicles to visualize distribution and level of transactions in various areas over time. 							1						1																					
MoWT	Transport Department	Section	Conduct transit planning.	<ul style="list-style-type: none"> Current transit situation assessment and modeling (existing and planned demand and supply); Assess the transit implications of existing and planned land use; Socioeconomic data and public transit rider profile assessment (current and projected); Existing roads and road conditions; Existing public and private transit routes and carrier information; Existing and planned terminals and stops; Multi-modal connections and flow modeling. 		1	1	1			1					1	1	1	1	1			1															
MoWT	Transport Department	Section	Manage and regulate public and private transit and operate terminals.	<ul style="list-style-type: none"> Maintain accurate and up to date bus route information; Monitor ridership on each route and bus terminal throughput; Track and monitor public and private buses (location, ridership, compliance with speed limits, stops, schedule performance, etc.); Terminal asset management and security 		1					1										1																	
MoWT	Transport Department	Section	Conduct traffic enforcement.	<ul style="list-style-type: none"> Geocode violators and violation locations and provide the basis for analyzing and visualizing this information over time; Provide a means for enforcement officers to identify and communicate road safety and maintenance issues to the Department by geographic location; Monitor patrols and support computer aided dispatch; Allow traffic violation information to be retrieved by location on a map; Monitor traffic violations over time, assess patterns and determine need for remedial measures. 	1	1																																

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MoWT	All Departments	All Sections	Participate in emergency planning and response.	<ul style="list-style-type: none"> Identify hazards and vulnerabilities of public works and transportation infrastructure (e.g. flooding and probable storm-related damages); Identify vulnerable populations, responder ingress/egress and population evacuation routes; Identify alternative routes for carrying relief supplies; Prepare and record transport component of emergency contingency plans; Inventory location and characteristics of MoWT equipment that can be used to support emergency response; Monitor and coordinate emergency response logistics; Plan and execute disaster recovery measures. 	1	1	1	1		1	1					1	1							1					1	1	1	
MLLGR D	Village Councils	Section	Manage local elections	<ul style="list-style-type: none"> Maintain geocoded voter registration database and illustrate in mapped form that qualified voters reside within the appropriate jurisdiction; Provide access to population census information for comparison against voter turnout; Plan, implement and manage polling stations. 		1										1																
MLLGR D	Village Councils	Section	Develop and administer municipal development plans and land use zoning	<ul style="list-style-type: none"> Assess physical setting, environmental and natural assets, cultural and historical assets, inter-region transportation links Assess historical and cultural resources and conditions Assess past, current and projected future population characteristics, household cohorts; age and sex distribution, migration; ethnicity and education Inventory and assess local community facilities Inventory and assess local community infrastructure and utilities Existing land use and land cover Environmental hazards and vulnerabilities Develop and record land use plans and zoning Monitor changes in the urban and natural landscape; Conduct development proposal review and conditioning; Track building and infrastructure development; Monitor and evaluate plan effectiveness over time; Develop plan refinements and adaptation over time based on evolving conditions and requirements. 	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MLLGR D	Village Councils	Section	Issue development permits	<ul style="list-style-type: none"> Review development proposals relative to municipal development plans; Track and monitor development projects and building permits; Evaluate development trends and impacts over time. 		1	1	1		1			1	1			1				1	1	1		1	1		1	1			
MLLGR D	Village Councils	Section	License and inspect petrol stations and garages	<ul style="list-style-type: none"> Record and process petrol station license application submissions; Assess potential impacts on surrounding land uses; Schedule and monitor inspections; Track license compliance over time 		1		1		1	1			1							1	1	1	1	1	1			1			
MLLGR D	Village Councils	Section	Maintain streets and street lighting	<ul style="list-style-type: none"> Maintain inventory of the location and characteristics of all street lights; Identify and plan areas for new street lights; Link preventive maintenance for light poles and bulbs to the geospatial information; Provide an smart phone application to allow the public to report street light issues; Plan and track street light maintenance activities. 		1		1					1	1																		
MLLGR D	Village Councils	Section	Facilitate utility coordination	<ul style="list-style-type: none"> Maintain inventory of the location and characteristics of all utilities and infrastructure (data provided by those utilities); Track utility and infrastructure projects planned, or under construction within the jurisdiction; Provide one-stop coordination for site clearance for underground trenching 	1	1	1	1		1	1			1	1	1														1		

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MLLGR D	Village Councils	Section	Facilitate and support community services coordination	<ul style="list-style-type: none"> Maintain inventory of the location and characteristics of local community facilities and services; Identify gaps in community service provision and promote the appropriate government and non-government organizations to get involved; Maintain spatially enabled system for citizen reporting regarding community services 	1	1					1							1	1																						
MLLGR D	Village Councils	Section	Maintain storm drainage system	<ul style="list-style-type: none"> Maintain inventory of existing storm drainage systems; Identify areas susceptible to flooding; Prepare storm drainage improvement plans; Manage storm drainage improvement construction activities; Maintain storm drain system preventive maintenance schedule; Participate in preparation of emergency response plans; Participate in emergency response activities. 	1	1	1	1	1	1	1				1	1	1	1	1	1		1		1	1								1			1					
MLLGR D	Village Councils	Section	Manage refuse	<ul style="list-style-type: none"> Maintain inventory of local waste stream; Manage garbage collection activities and contracts; Plan, build and maintain landfill facilities; Monitor and record random dumping incidents; Raise awareness regarding the reduction, reusing and recycling of waste material. 		1		1			1								1	1		1																			
MLLGR D	Village Councils	Section	Issue littering tickets	<ul style="list-style-type: none"> Maintain inventory of ticket issuance locations; Maintain inventory of observed illegal trash dumping; Provide social media platform for citizen reporting of illegal littering and trash dumping; Monitor littering and illegal trash dumping and identify neighborhood "hotspots" for focused awareness building and education. 		1											1																								
MLLGR D	Village Councils	Section	Manage parks and recreation areas	<ul style="list-style-type: none"> Maintain inventory of existing park locations and facilities; Conduct place-based surveys regarding community attitudes about local park and recreation assets and programs; Plan and track park maintenance; Integrate park and recreation areas into local land use planning; Incorporate park and recreation concerns into new development review and conditioning 	1	1	1	1			1	1						1						1		1						1				1					
MLLGR D	Village Councils	Section	Manage public slaughterhouse facilities	<ul style="list-style-type: none"> Maintain inventory of existing public slaughterhouse facilities; Track, record and report slaughterhouse operational statistics and revenues; Conduct siting analysis for new facilities 		1					1								1		1																				
MLLGR D	Village Councils	Section	License, rent and inspect market facilities	<ul style="list-style-type: none"> Maintain inventory of existing permanent and weekly markets; Manage market leases by location and specific space; Plan and carry out market inspections; Track market inspection infractions; Monitor market activities and make plans for market expansion and new markets. 		1					1								1		1																				
MLLGR D	Village Councils	Section	Manage local cemetery	<ul style="list-style-type: none"> Maintain an inventory of cemetery locations and plots, name and family connections of the interred and related information; Plan and implement cemetery maintenance activities; Plan for cemetery extension and new cemetery areas 		1	1	1			1	1						1					1	1		1										1					
MLLGR D	Village Councils	Section	Manage local property taxation	<ul style="list-style-type: none"> Maintain a geographically based inventory of all properties being taxed; Monitor status of property tax payments; Monitor property tax non-payment and plan follow-up; Track and report property tax revenue geographically over time 		1		1			1							1						1		1												1			

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MLLGR D	Village Councils	Section	Manage licensing of motor vehicles, liquor and trade	<ul style="list-style-type: none"> Maintain a geographically based inventory of the registration addresses for all vehicle licenses (motorized and non-motorized); Maintain a geographically based inventory for all trade and liquor licenses; Plan and conduct trade establishment inspections; Track trade and liquor license renewals and payments; Publish trade license business locations on the web as a community resource; Provide trade license business location information for use in car navigation and other consumer and government applications; 		1				1						1																		
MLLGR D	Village Councils	Section	Manage swing bridge operations	<ul style="list-style-type: none"> Maintain a geographically based inventory of swing bridge locations; Maintain schedule for planned bridge swing operations and fees paid; Maintain record of ad hoc bridge swing requests and fees; Monitor and report swing bridge operational trends over time 		1				1													1											
MLLGR D	Village Councils	Section	Manage public water closets and latrines	<ul style="list-style-type: none"> Maintain a geographically based inventory of public water closet and latrine facilities; Prepare and implement maintenance schedules for public water closet and latrine facilities Provide location-aware social media for public to comment on water closet and latrine facilities; Monitor trends and complaints as input to the planning for the expansion of existing latrine facilities and planning of new ones 		1				1						1																		
MLLGR D	Village Councils	Section	License billboards and banners	<ul style="list-style-type: none"> Maintain a geographically based inventory of billboard and banner locations; Issue and track billboard and banner licenses; Monitor and track billboard and banner license payments; Prepare and maintain plans for future billboard and banner locations; Provide location-aware social media for public to comment on billboard and banner issues. 	1	1				1	1		1																					
MLLGR D	Belize City Council	Section	Manage local public health	<ul style="list-style-type: none"> Provide map base for planning, conducting and tracking weed abatement inspections and infractions; Monitor weed abatement repeat offenses and patterns over time; Record and maintain locations and information for food vendors; Record and track food vendor inspection activities; Record locations and abatement activities related to environmental health hazards; Share information with other departments and organizations regarding mutually relevant subjects (pest vector control, solid waste, food poisoning cases, etc.) 		1				1					1																			
MLLGR D	Belize City Council	Section	Manage local tourism	<ul style="list-style-type: none"> Monitor and track crime incidents and patterns in and around tourism areas; Track and analyze tourist complaints; Develop online tourism support services, maps and guides; Develop and maintain tourism maps of Belize City; Utilize location-aware social media for engagement with the tourist community; Record and monitor tourism-oriented facilities and activities 		1				1				1			1																	
MLLGR D	Belize City Council	Section	Manage city traffic and licensing	<ul style="list-style-type: none"> Geocode driver licenses, vehicle registration and traffic tickets information to addresses or other discrete location reference, thus providing a basis for understanding the geographic distribution of drivers, vehicles and traffic/parking infractions; Record and maintain bus routes; Share integrated information with other partner agencies (Ministry of Works and Transport, Police Department, etc.); 	1	1																												

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MLLGR D	Belize City Council	Section	Manage public works	<ul style="list-style-type: none"> • Maintain accurate inventory and condition assessment for municipal assets (streets, parks, buildings, drainage system, bridges, etc.); • Provide foundation information for street furniture and pavement management; • Provide foundation information of storm drainage system management; • Provide foundation information for park management; • Provide foundation information for municipal building maintenance and space planning; • Provide foundation information for municipal vehicle fleet management; • Provide asset register as the basis for municipal asset financial management; • Provide geographically-based asset register to support preventive and as-needed maintenance planning and response; • Provide linkage to maintenance management system to track maintenance activities over time; • Track maintenance performance indicators; 	1	1	1	1		1	1							1	1	1	1	1	1			1		1						
MLLGR D	Belize City Council	Section	Conduct city planning activities	<ul style="list-style-type: none"> • Access and utilize data from other organizations (population census, natural resources, land ownership, business locations, community facilities, utilities, etc.) • Prepare general plans, including information and tools for: • Population forecasting and future needs assessment; • Natural hazard and vulnerability mapping (flood prone areas, storm surge, sea level rise); • Alternative future scenario development and visualization; • Land use requirement and siting assessment; • Traffic analysis; • Infrastructure requirement and siting assessment; • Community facility and service requirements and siting analyses; • Support community engagement and visualization of future plans and planning issues; • Develop general plan and zoning map databases; • Provide public online access to planning and zoning information; • Monitor plan build-out and variations; • Provide tools for plan revision and refinement based on changing conditions over time. 	1	1	1	1	1	1	1								1	1	1	1	1	1	1	1	1	1	1				1	
MLLGR D	Belize City Council	Section	Manage environmental sanitation	<ul style="list-style-type: none"> • Use location-enabled mobile phone reporting of loose garbage or hotspot locations by the public, as well as any other environmental sanitation complaints; • Track culvert blockages and cleaning activities; • Track lot cleaning and weeding activities; • Track derelict vehicle reports and removal activities; • Monitor trash pickup routes, schedules and performance; • Record and manage landfill assets and operations 	1	1				1				1	1					1		1												
MLLGR D	Belize City Council	Section	Manage Municipal facility security	<ul style="list-style-type: none"> • Provide contextual base mapping for security planning; • Tie all incidents and reports to geographic locations; • Record and access building floor plans; • Provide online secure access to security cameras from map interface 	1	1				1	1																							

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MLLGR D	Belize City Council	Section	Conduct emergency planning and response	<ul style="list-style-type: none"> Hazard and vulnerability assessment (flooding, storm surge, high winds, etc.); Resources at risk analysis (settlements, infrastructure, environmental resources, etc.); Record and describe the locations of emergency response assets; Identify emergency staging areas; Preparation and dissemination of emergency response contingency plans; Provide common operating picture for emergency response; Provide common operating picture for post-emergency damage assessment, recovery planning and activities. 	1	1	1	1		1	1			1	1	1	1	1	1		1	1	1					1	1	1	
MLLGR D	Belize City Council	Section	Conduct property valuation	<ul style="list-style-type: none"> Maintain property boundary maps; Link valuation data to lot features in GIS; Plan and track property valuation activities; Develop and maintain inventory of trade establishments. Track trade licenses and associated information by location; Prepare and disseminate property valuation maps; Track property tax payments and delinquencies 		1				1				1		1	1		1		1		1					1			
MLLGR D	Belize City Council	Section	Collect and monitor city revenues	<ul style="list-style-type: none"> Develop and manage a geographically based inventory of all properties, facilities, trade establishments and activities that pay fees to the City; Link fee data to locations and produce map-based revenue visualization and reporting information; Track and monitor fee-paying activities and facilities; Utilize location-based social media for monitoring public comments or complaints regarding fee-paying facilities and activities; Produce maps illustrating historical City revenue generation and trends; Produce maps illustrating future City revenue projections 		1				1				1		1															
MLLGR D	Belize City Council	Section	Manage city council information systems	<ul style="list-style-type: none"> Maintain GIS as an integral component of the City Council information infrastructure 	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MLLGR D	NEMO	Section	Hazard and vulnerability assessment	<ul style="list-style-type: none"> Provide access to a broad variety of geospatial information from multiple custodians Identify the location, extent and potential severity of various natural hazard conditions (e.g. flooding, wind damage, storm surge, coastal erosion, etc.) Identify vulnerable populations, community and government facilities and infrastructure Conduct vulnerability assessment 	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1
MLLGR D	NEMO	Section	Disaster contingency planning	<ul style="list-style-type: none"> Identification and assessment of vulnerable populations, facilities and infrastructure Conduct impact assessment based on plausible scenarios Prepare a geographically-based inventory of response equipment and people Identify and characterize staging areas and evacuation routes Prepare and maintain geographically based inventory of shelter 	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1
MLLGR D	NEMO	Section	Emergency response	<ul style="list-style-type: none"> Provide a "common operating picture" based on data and inputs from all involved sectors Provide real-time monitoring of disaster impacts and near-term projections Support damage assessment Track the deployment of human, vehicle and equipment response assets Monitor disaster response status 	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1

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MLLGRD	NEMO	Section	Disaster recovery	<ul style="list-style-type: none"> • Conduct post-disaster damage assessment • Conduct recovery planning and prioritization • Coordinate and monitor recovery actions (social, community facilities, infrastructure, etc.) 	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1	
MLLGRD	NEMO	Section	Education, Communication and Warning	<ul style="list-style-type: none"> • Identify vulnerable communities for pre-disaster planning awareness and emergency alert early focus; • Provide geographically based information concerning the location and nature of possible natural disasters; • Early place-specific warning analysis based on current and near-term projected storm and associated impact modeling (e.g. national hazard atlas, with neighborhood specific maps for high vulnerability areas; • Collaborate with urban planning, land administration, utilities, insurance companies and other relevant entities to ensure that hazards are taken into consideration in any future plans and mitigation measures; • Include place-based community communications measures within contingency plans; • Organize and monitor post-disaster communications and community outreach; • Record activities and assess effectiveness for post-disaster refinement of contingency plans. 	1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	1	1
	NEMO	Section	Medical and Relief Measures	<ul style="list-style-type: none"> • Record precise locations for medical and relief material; • Record work and home locations for medical and relief personnel; • Identify and manage medical and relief staging areas; • Track flow of people and material during emergency response (smart phones, and tracking devices on major equipment); • Record activities and assess effectiveness for post-disaster refinement of contingency plans 	1	1		1		1				1						1				1	1					1		1	
	NEMO	Section	Housing and Shelter	<ul style="list-style-type: none"> • Pre-identify specific neighborhoods and structures that are likely to be damaged in major events. Work this information into contingency and response plans; • Record staging areas and facilities for temporary housing and shelter accommodation post disaster; • Manage housing and shelter status information during response; • Record activities and assess effectiveness for post-disaster refinement of contingency plans. 	1	1		1		1				1	1					1					1	1				1		1	
	NEMO	Section	Search, Rescue and Initial Clearance	<ul style="list-style-type: none"> • Pre-identify specific neighborhoods, structures and infrastructure that are likely to be damaged in major events. Work this information into contingency and response plans; • Track and manage field staff activities during response; • Post event damage assessment and clearance planning; • Track and monitor status of initial clearance activities; • Record activities and assess effectiveness for post-disaster refinement of contingency plans. 	1	1		1		1				1	1			1		1	1				1	1				1		1	
	NEMO	Section	Collection, Control and Distribution of Food and Material	<ul style="list-style-type: none"> • Pre-identify specific neighborhoods, structures and infrastructure that are likely to be damaged in major events. Work this information into contingency and response plans; • Identify precise locations of food and material storage facilities and enterprises; • Track and manage field staff activities during response and recovery operations; • Record activities and assess effectiveness for post-disaster refinement of contingency plans 	1	1		1		1				1	1			1		1					1	1				1		1	
	NEMO	Section	Assessment and Evaluation of Damage	<ul style="list-style-type: none"> • Pre-identify vulnerable populations, structures and infrastructure. Maintain accurate inventory and valuation of assets; • Collaborate with insurance industry and government to develop financial mitigation and recovery measures; • Conduct post-event damage assessment and losses; 	1	1		1	1	1					1	1			1		1			1	1	1				1		1	

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				• Manage and track damage repair and mitigation activities																																											
	NEMO	Section	Foreign Assistance disaster management	<ul style="list-style-type: none"> Identify hazardous conditions and ensure that settlement and infrastructure projects avoid these areas; Pre-identify vulnerable populations, structures and infrastructure. Establish disaster mitigation and post-event recovery assistance strategies 		1	1	1		1				1	1					1		1			1	1			1								1										
	NEMO	Section	Transport disaster management	<ul style="list-style-type: none"> Pre-identify vulnerable populations, structures and infrastructure. Identify transportation routes that should remain viable for emergency response, evacuation and relief supply provision purposes; Consider natural disaster hazard conditions for the planning and design of new highways; Identify transportation infrastructure that may be impacted by natural disaster events and develop mitigation plans for protection and recovery 		1	1	1		1				1	1					1		1			1	1			1										1								
	NEMO	Section	Environment and Utilities disaster management	<ul style="list-style-type: none"> Pre-identify vulnerable infrastructure and environmental resources. Consider natural disaster hazard conditions for the planning and design of new utilities; Identify transportation infrastructure that may be impacted by natural disaster events and develop mitigation plans for protection and recovery 		1	1	1	1	1				1	1				1		1		1		1	1			1												1						
MLLGR D	National Meteorological Office	Section	Conduct weather monitoring	<ul style="list-style-type: none"> Develop and manage inventory of meteorological stations Provide map interface for accessing meteorological data Conduct geographic analysis to determine need and feasibility for more monitoring stations based on multiple stakeholder requirements Cooperate with other organizations in weather data collection (e.g. estimate of precipitation via cellular telephony signal analysis between towers) Provide geographic interface for recording and visualizing weather balloon readings Provide geospatial tools to support combination of radar, meteorological station, satellite and other related information for improved weather monitoring Link local GIS with regional weather model outputs 		1	1	1	1										1		1				1																1						
MLLGR D	National Meteorological Office	Section	Analyze and report weather information and forecasts	<ul style="list-style-type: none"> Develop and manage inventory of meteorological stations Provide map interface for accessing meteorological data Conduct geographic analysis to determine need and feasibility for more monitoring stations based on multiple stakeholder requirements Cooperate with other organizations in weather data collection (e.g. estimate of precipitation via cellular telephony signal analysis between towers) Provide geographic interface for recording and visualizing weather balloon readings Provide geospatial tools to support combination of radar, meteorological station, satellite and other related information for improved weather monitoring 		1	1	1	1											1		1				1																	1				
MLLGR D	National Meteorological Office	Section	Analyze weather and prepare agrometeorology reports for the agricultural sector.	<ul style="list-style-type: none"> Provide more geographically specific reports to farming communities; Customize reports according to specific clusters of farmlands, crop types, types of infrastructure, and other context. 		1	1	1	1					1							1				1																						

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT													
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MLLGR D	National Meteorological Office	Section	Participate in emergency preparedness and response	<ul style="list-style-type: none"> Provide geographically specific weather input to hurricane reporting Provide geographically specific forecasts and reporting for storm surge Provide geographically specific forecasts and reports for potential flooding Utilize locally available data to refine regional models, reports and forecasts Generated geographically specific scenarios to support hazard and vulnerability assessment scenarios for contingency planning purposes Generate geographically specific scenarios to support emergency preparedness drills Conduct downstream flooding and damage assessment for various levels of dam break scenarios 		1	1	1	1	1				1	1			1				1			1	1			1	1	1	
MLLGR D	National Meteorological Office	Section	Provide data on as-needed basis	<ul style="list-style-type: none"> Provide geographic interface for access to community specific weather information and forecasts Provide online mechanism for outside entities to access and download selected Hydromet data and model output information for specific geographic regions Provide online web map services for data and analytical products that can be consumed by other mapping interfaces and websites directly 		1	1	1								1				1			1			1			1	1		
MHUD	Central Building Authority	Section	Intake, review and approve building permits	<ul style="list-style-type: none"> Log building permit applications with geographic reference (explicit coordinates or verifiable street address or plot number) Support "one-stop-shop" for digital building permit submissions and initial review by multiple agencies Capture spatial footprint of proposed structure, and allow "status" to be adjusted as the building permit process moves forward to final occupancy permit or commissioning Utilize contextual data from multiple organizations to assess proposed building compliance Add climate change related potential hazards as an element for consideration in building permitting 	1	1	1	1		1				1	1		1	1			1	1	1	1	1	1			1	1	1	
MHUD	Central Building Authority	Section	Conduct building/site inspections;	<ul style="list-style-type: none"> Utilize GIS to plan and track building inspection schedules Provide geographic interface for accessing building permit case files Produce building permit status maps and reports Conduct building history and trend maps and statistical information over time 	1	1		1		1					1	1						1		1		1			1			
MHUD	Central Building Authority	Section	Carry out soil testing;	<ul style="list-style-type: none"> Log soil testing sites geographically Provide access to soil testing online through a map interface Utilize soil testing as input to soil mapping and geotechnical assessment efforts 	1																						1	1	1			
MHUD	Central Building Authority	Section	Carry out concrete testing.	<ul style="list-style-type: none"> Log concrete testing results geographically Provide access to concrete testing online through a map interface Maintain historical record of concrete tested sites and results over time 	1					1																						
MESTP U	Geology and Petroleum Department	Section	Facilitate and oversee geologic and petroleum exploration studies	<ul style="list-style-type: none"> Develop and maintain GIS-based digital archive of past geology mapping efforts Maintain location and borehole information for all exploration wells Maintain location and results of seismic line testing information Manage petroleum contracts boundaries Develop and maintain an archive of all historical petroleum exploration information Collect and make available topographic, bathymetric and bottom type information 	1		1	1	1	1				1	1	1	1	1			1		1		1	1	1	1	1		1	1

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MESTP_U	Geology and Petroleum Department	Section	Administer petroleum operating concessions	<ul style="list-style-type: none"> • Tie operational reports to specific wells and contract areas • Generate petroleum product maps and statistical reports for current status, historical trends and future projections • Maintain inventory of petroleum production and transport assets 				1		1					1	1		1			1						1	1		
MESTP_U	Geology and Petroleum Department	Section	Review environmental impact assessments	<ul style="list-style-type: none"> • Log all environmental impact assessments geographically • Provide tools for accessing and analyzing geologic aspects of submitted environmental impact assessments • Conduct seismicity analysis modeling for hazard and vulnerability assessment • Provide access to wide variety of population, community facilities, infrastructure and jurisdiction information for contextual reference. 	1	1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MESTP_U	Energy Unit	Section	Develop and support national renewable energy development	<ul style="list-style-type: none"> • Conduct analysis to determine renewable energy sources • Assess the location and characteristics of energy demand • Assess the location and characteristics of existing energy supply • Perform siting analysis for proposed renewable energy projects • Develop and maintain national inventory of renewable energy generation sites and facilities • Monitor and assess performance of renewable energy facilities over time • Prepare smart energy atlas and master plan for Belize representing a diversified, sustainable energy portfolio for the country 	1	1	1	1	1	1					1	1		1		1	1	1	1	1	1	1	1		1	
MESTP_U	Energy Unit	Section	Promote and support energy efficiency initiatives	<ul style="list-style-type: none"> • Track the locations and characteristics of existing energy efficiency case studies; • Monitor energy consumption rates by neighborhood as the basis for targeted energy efficiency promotion and outreach efforts; • Leverage above analysis by providing to the private sector to support their marketing of energy efficiency products and services; • Track the effectiveness of energy efficiency awareness and outreach programs over time. 		1		1		1								1			1		1					1		
MESTP_U	Energy Unit	Section	Promote and support clean energy production initiatives - Public Utilities Commission Act	<ul style="list-style-type: none"> • Accurate accounting of all public utility assets by location • Monitoring of utility consumption by areas • Monitoring of outages and complaints by areas • Monitoring of utility bill payments by areas • Utility capital improvement planning based on land use and development plans • Monitoring preventive and ad hoc maintenance activities by area • Access to accurate data from others (population census, community locations and statistics, buildings and topographic information, flooding areas and other environmental hazards, protected areas, land ownership, etc.) • Maximize sustainable use of renewable energy sources • Ensure electric utility generation, transmission and distribution facilities are designed and operated in an environmentally and financially sustainable manner 	1	1	1	1		1					1		1	1	1	1	1	1	1					1		
	Energy Unit	Section	Promote and support clean energy production initiatives - Electricity Act	<ul style="list-style-type: none"> • Accurate accounting of all electric utility assets • Monitoring of electric consumption by areas • Monitoring of outages and complaints by areas • Monitoring of electric bill payments by areas • Electricity network system control and data acquisition (SCADA) – geospatial as well as network schematic visualization • Electrical supply capital improvement planning • Monitoring preventive and ad hoc maintenance activities by area 		1		1		1					1		1	1	1	1	1	1	1							

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MFFSD	Department of Forestry	Section	Protected Areas Management Program;	<ul style="list-style-type: none"> Maintain mapped inventory of all protected areas and the resources and infrastructure within them Develop conservation and landscape management plans for protected areas Monitor activities and performance of co-management agreements within protected areas Monitor changes in land use, land cover and infrastructure development within areas around protected areas that may impact them Conduct socioeconomic studies and surveys of populations related to protected areas, and develop education and outreach programs to encourage stewardship behavior Assess potential impacts to protected areas from climate change Provide online access to mapped information about protected areas for education, awareness and tourism purposes Provide access to protected area data services for use by research scientists and students 		1	1	1	1	1				1		1	1					1	1	1	1	1	1	1	1												
MFFSD	Department of Forestry	Section	Forest Resources Planning and Management Program;	<ul style="list-style-type: none"> Record and track forestry lease areas and associated planned production information; Monitor changes in forest land cover using aerial or satellite imagery and correlate this to planned production; Identify illegal logging; Support permit application review, monitoring and enforcement; Support development of national forest inventory; Provide access to reference information from other organizations (cadastral, environmental, population census, land use, mining and petroleum leases, etc.) to support assessment and monitoring activities; Manage Sustainable Forest Management plans in GIS format. 		1	1	1	1	1				1	1	1						1	1	1	1	1	1	1	1	1											
MFFSD	Department of Forestry	Section	Forest Revenue and Exploitation Control Program;	<ul style="list-style-type: none"> Monitor extraction and revenue by specific area; Monitor land cover change and correlate to planned extraction locations and rates to identify any illegal activity; Estimate potential sustainable forestry revenues based on national forest inventory 	1	1	1	1							1	1	1	1						1														1			
MFFSD	Department of Forestry	Section	Law Enforcement Program;	<ul style="list-style-type: none"> Provide Ministry staff with access to activities within forest areas that have been permitted by other organizations (mining, agriculture, settlement, etc.); Monitor land cover change relative to permitted extractions and other approved activities to help identify areas of potential offences; Utilize location-aware social media for reporting of potential offences by the public; Record and track infractions and associated enforcement actions; Share all of the above information among the relevant stakeholders; Build awareness of monitoring and enforcement actions to deter would-be offenders. 		1	1	1	1	1						1	1	1	1					1	1	1													1		
MFFSD	Department of Forestry	Section	Wildlife Program;	<ul style="list-style-type: none"> Record and track wildlife by habitat; Utilize social media to identify potential wildlife infractions; Record locations and data concerning infractions including followup and status; Track hunting licenses and permitted takings. 	1	1	1	1		1						1	1	1	1					1	1	1			1	1											
MFFSD	Department of Forestry	Section	National and International Partnership Program;	<ul style="list-style-type: none"> Record, monitor and report all features, habitats, species and activities related to various conventions and treaties; Access geospatial data of others that may relate to the above. 	1	1	1	1		1						1	1	1	1					1	1	1			1	1											
MFFSD	Department of Forestry	Section	Manage National Herbarium.	<ul style="list-style-type: none"> Provide a map interface indicating the location where each herbarium specimen was collected; Link geographic locations with database, imagery and scientific reference material for each specimen; Provide habitat maps indicating the range where each type of 	1	1	1	1	1														1	1	1	1	1	1	1	1											

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MFFSD	Department of Environment	Section	Conduct environmental monitoring and enforcement	<ul style="list-style-type: none"> Track locations of environmental permits and inspections; Route and track environmental inspection activities; Monitor, collect, and analyze effluent and other pollutants; Maintain a register of all wastes, discharges, emissions, deposits or other sources of emissions or substances that are of danger or potential danger to the environment; Undertake surveys and investigations into the causes, nature, extent, and prevention of pollution and generate reports of the investigations; Identify and monitor areas for pollution cleanup and resource recovery improvements; Georeference environmental complaints; Track violation tickets, stop orders and abatement notices by location; Conduct place-based surveys on environmental matters; Assess environmental hazards, vulnerabilities and resources at risk; Prepare and assess contingency scenarios for environmental emergency response; Conduct assessment of individual and cumulative development environmental impacts on land, sea and air; Record and monitor Environmental Compliance Plans (ECP's) for existing and new projects; Prepare environmental maps and geographic visualizations to support public awareness and education 	1	1	1	1	1	1			1	1	1	1	1	1		1	1	1	1	1	1	1	1			
MFFSD	Department of Environment	Section	Manage environmental projects	<ul style="list-style-type: none"> Project area assessment and formulation; Project design; Project management and reporting; Project monitoring and evaluation. 	1	1	1	1	1	1									1										1	
MFFSD	Department of Environment	Section	Conduct environmental awareness and outreach	<ul style="list-style-type: none"> Support environmental education with access to current and historical environmental information and geographic visualizations of environmental issues; Provide public with access to environmental information in a form that can be easily understood by lay audience; Prepare environmental analyses to support state of environment reporting and symposia presentations; Generate environmental maps and graphics for the press and public awareness campaigns, presentations and speeches; Support EIA public hearings and consultations with environmental issue data visualizations; Maintain access to related data maintained by other organizations through the BNSDI; Maintain georeferenced bibliographic information; Maintain information regarding environmental conditions, trends and projections; Monitor and assess changes in the natural environmental systems and analyze drivers and pressures that are causing these changes; Monitor and assess the cumulative impact of permitted emissions; Continuously Review The Adequacy Of Existing Data Management Systems And Data Bases; Upkeep And Maintain The Department's Information System And Equipment; Provide supporting material for national activities relative to international environmental days of recognition (e.g. World Environment Day, Earth Day, Ozone Day, International Beach Clean-Up Day, etc.); Utilize geospatially enabled social media and other media to facilitate two-way exchange of information with the public concerning environmental issues and conditions; 																									1	1

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				<ul style="list-style-type: none"> Track and monitor the locations and characteristics of community-based and civil society environmental planning, monitoring, enforcement and assessment activities; Support the preparation of annual state of the environment reporting and planning; Monitor, assess and track environmental complaints from the public 																											
MFSD	Department of Fisheries	Section	Conduct fisheries assessments;	<ul style="list-style-type: none"> Conduct fish habitat and population studies Monitor fish catch statistics and trends by location over time Monitor fish habitat and population statistics over time Provide fisheries assessment data and recommendations to policy makers in maps and statistical graphics that me the issues and remedies understandable and compelling Maintain inventory of fisherman, fishing infrastructure, and fish markets 		1	1	1							1	1	1	1					1			1			1	1	1

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MFFSD	Department of Fisheries	Section	Prepare marine reserve management plans;	<ul style="list-style-type: none"> • Provide a map representation of the general context for each marine reserve; • Provide a mapped database of critical habitats; • Provide a mapped database of existing marine and terrestrial ecosystem resources and services; • Provide a mapped database of human settlements and infrastructure; • Provided a mapped database of touristic facilities, resources and services; • Provide a mapped database of commercial facilities and activities; • Provide a mapped database of climatic conditions; • Provide a mapped database of historic storm tracks and impacts; • Provide a mapped database of geologic, soils and geophysical features; • Provide a mapped database of topographic and bathymetric information; • Provide a mapped database of tides, waves and currents; • Provide a mapped database of sea bottom types; • Provide a mapped database of plant and animal species observations; • Provide access to fish catch and fisheries trend information; • Provide a mapped database of previous research activities; • Provide a mapped database of archeological sites; • Conduct conservation issue, opportunity and constraint analysis; • Conduct conservation suitability assessment; • Identify and analyze alternative management scenarios; • Delineate and record conservation use zones; 	1	1	1	1	1	1				1	1	1	1			1	1	1				1	1					1	1	1		
MFFSD	Department of Fisheries	Section	Manage marine protected areas	<ul style="list-style-type: none"> • Develop and manage marine protected areas boundary maps • Prepare patrol and marine protected area surveillance plans • Monitor human activities within and around marine protected areas • Issue and track violation notices • Utilize remote sensing techniques to detect illegal activities 	1	1		1	1								1		1				1			1						1	1			
	Department of Fisheries	Section	Participate in regional marine protection and fisheries initiatives	<ul style="list-style-type: none"> • Develop and maintain portions of regional marine databases within Belize territorial waters • Conduct special studies • Develop and manage data in support of regional collaborative efforts (e.g. Mesoamerican Barrier Reef System (MBRS) study. • Develop and disseminate methods and tools for use of GIS for marine protection and fisheries management • Participate in regional marine ecosystem monitoring and assessment 	1	1		1	1							1		1					1			1						1	1			

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MFSD	Coastal Zone Management Authority and Institute	Section	Manage coastal water quality and monitoring programmes	<ul style="list-style-type: none"> Develop and maintain inventory of coastal and marine resources; Maintain inventory of protected area boundaries and assets; Develop baseline water quality information (chemical, biological, physical properties) and subsequent monitoring updates over time; Leverage the BNSDI to access relevant data from other agencies; Maintain inventory and monitoring of water quality drivers and pressures over time; Provide tools for the spatial and temporal analysis of water quality monitoring information over time; Provide hydrodynamic analysis tools to better understand the relationships between water quality causes and effects; Provide tools for the analysis and visualization of water quality issues in ways that can be clearly understood by a lay audience; Provide analysis tools to model the implications of various intervention options (plans, policies, operations, enforcement, etc.); Establish location-aware social media channels for two way communication between the coastal water using stakeholders and the government. 	1	1	1	1	1	1		1	1	1	1	1	1		1		1		1	1	1	1	1	1	1	1	1	1									
MFSD	Coastal Zone Management Authority and Institute	Section	Conduct manatee research	<ul style="list-style-type: none"> Develop and maintain inventory of manatee habitat; Develop baseline and maintain manatee population census information over time by location; Maintain inventory and monitoring of manatee habitat and population impact drivers and pressures over time; Conduct habitat and population trend analyses; Track tagged animals spatially to understand movement and migration patterns; Provide tools for the analysis and visualization of manatee habitat and population viability issues in ways that can be clearly understood by a lay audience; Provide analysis tools to model the implications of various intervention options (plans, policies, operations, enforcement, etc.); Establish location-aware social media channels for two way communication between the public and the government. 	1	1	1	1	1	1		1	1	1			1	1	1				1			1					1	1									
MFSD	Coastal Zone Management Authority and Institute	Section	Manage sport fishing program	<ul style="list-style-type: none"> Track fishing licenses by licensee address and district Provide mobile phone application for voluntary reporting of fish catch information Track commercial sport fishing boat activities Produce maps and charts illustrating sports fish activities and catch statistics 	1	1	1	1	1	1		1	1	1			1	1				1	1		1															1	

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MFSD	Coastal Zone Management Authority and Institute	Section	Carry out coastal planning	<ul style="list-style-type: none"> • Develop and maintain inventory of coastal and marine resources and their state over time; • Leverage the BNSDI to access relevant data from other agencies; • Develop inventory and monitor the characteristics of socioeconomic drivers and pressures on coastal environmental resources and ecosystems over time; • Monitor impacts of drivers and pressures on resource and ecosystem state over time; • Provide tools for environmental impact forecasts and early warnings; • Maintain inventory of protected area boundaries and assets; • Support environmental system modeling to understand and forecast complex interactions between ecosystems and manmade and natural systems (e.g. climate change); • Provide tools for the analysis and visualization of coastal environmental resource issues in ways that can be clearly understood by a lay audience; • Provide analysis tools to model the implications of various intervention options, including the intersection, alignment and cumulative effects of interventions by multiple organizations (plans, policies, operations, enforcement, etc.); • Establish location-aware social media channels for two way communication between the coastal stakeholders and the government • Monitor and evaluate intervention program effectiveness over time and provide tools, information and multi-stakeholder processes to calibrate interventions over time. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
MFSD	Coastal Zone Management Authority and Institute	Section	Develop and support education and awareness programmes	<ul style="list-style-type: none"> • Provide the public with access to basic data and easy to understand analysis and visualization regarding coastal environmental issues; • Provide easy to understand visualizations of coastal environmental issues to the local and international media; • Establish location-aware social media channels for two way communication between the coastal stakeholders and the government; • Utilize the BNSDI for streamlining data sharing among coastal stakeholder organizations; • Develop web-based and smart phone applications that orient and sensitize coastal users to the nature and sensitivities that characterize each area; 	1	1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MFSD	Coastal Zone Management Authority and Institute	Section	Manage coastal data	<ul style="list-style-type: none"> • Provide data repository for the development and management of coastal data • Provide geoportal for exploring, locating and accessing coastal data and online data services • Establish standards for coastal resource monitoring data • Establish agreements for the sharing of coastal data among relevant stakeholders • Establish credentials, authority and agreements for selective accessing of sensitive coastal data (endangered species locations, archeological sites, etc.) • Provide online services, templates and tools for field data capture 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1													1	1		
MTCCA	Ministry	Section	Oversee portfolio governance	<ul style="list-style-type: none"> • Maintain access to all Ministry geospatial and related data • Facilitate GIS data coordination across the Ministry • Facilitate access to BNSDI data network on behalf of Ministry departments • Monitor and evaluate Ministry department projects and outcomes over time 	1	1	1	1		1	1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	

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MTCCA	Ministry	Section	Represent tourism and aviation sectors in national planning and policy making	<ul style="list-style-type: none"> Maintain geographically-based inventory of all tourism facilities, attractions and infrastructure; Maintain geographically-based inventory of all civil aviation facilities and infrastructure; Monitor tourism development issues and trends; Develop geographically based analysis of tourism development issues, opportunities and challenges and provide reporting and mapped visualizations to support policy and decision making. 		1	1	1		1									1	1													1	
MTCCA	Ministry	Section	Oversee tourism planning and development	<ul style="list-style-type: none"> Overview of existing tourism resources in the Country relative to projected or potential future demand; Overview of the infrastructure and program development of other sectors that could impact tourism development (transport, urban development, environmental resource management plans, public investment plans, etc.); Monitor tourism facility and infrastructure development; Monitor and evaluate tourism related revenue and tax generation over time. 		1	1	1		1									1	1												1		
MTCCA	Belize Tourism Board	Section	Conduct planning for sustainable national tourism development	<ul style="list-style-type: none"> Prepare location-based inventory of all touristic facilities, sites and attractions (cultural, nature-based, sun and beach, cruise, nautical, leisure and entertainment); Map historical and cultural routes; Assess tourism infrastructure capacity (transportation, water, energy, telecommunications, waste management, sewage, etc.); Plan, design and implement tourism oriented signage and wayfinding; Capture and manage tourism activities and revenues by location; Identify tourism development physical opportunities and constraints; Assess potential impacts of climate change on existing and potential tourism sites; Identify opportunities for tourism expansion plans in specific locations; Prepare and record tourism development plans for specific destinations; Conduct environmental impact assessments for tourism development plans; Promote and support private sector investment in tourism development at specific sites; Provide data and analysis tools for tourism development project formulation and finance; Monitor tourism development and revenues over time. 	1	1	1	1		1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	
MTCCA	Belize Tourism Board	Section	Manage tourism data	<ul style="list-style-type: none"> Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; Provide analytical tools to project tourism site, infrastructure and program development based on alternative options and scenarios; Utilize geospatial tools to develop tourism development analyses and visualizations to keep leadership and investors informed of progress, trends and opportunities for investment. 		1	1	1		1									1	1	1	1												
MTCCA	Belize Tourism Industry Association	Section	Identify and monitor needs and priorities of the BTIA membership	<ul style="list-style-type: none"> Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; Provide location-based register of members; Utilize spatially-enabled social media to establish two-way engagement with membership and illustrate issues and opinions geographically; Provide membership with information regarding urban, infrastructure and other 	1	1				1																								

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS							ENVIRONMENT																		
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MTCCA	Belize Tourism Industry Association	Section	Promote sustainable tourism development	<ul style="list-style-type: none"> Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; Provide interactive map for the public to explore tourism destinations and facilities in Belize; Provide geo-enabled interactive map and schedule of cultural events and other activities that would be interesting to tourists. 	1	1	1	1		1	1									1			1														1	1
MTCCA	Belize Tourism Industry Association	Section	Promote tourism development government policies, planning and investment	<ul style="list-style-type: none"> Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; Provide geographic analysis and visualization tools to explain issues, trends or opportunities affecting touristic development in Belize; Provide a location-based inventory of all touristic and supporting infrastructure public sector investment projects and privately funded developments. 	1	1	1	1		1				1	1	1	1	1	1	1	1	1	1	1	1	1									1	1		
MTCCA	National Institute for Culture and History	Institute of Archeology	Maintain inventory of archeological sites;	<ul style="list-style-type: none"> Maintain inventory of archeological sites 	1	1	1	1		1	1			1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1							
MTCCA	National Institute for Culture and History	Institute of Archeology	Conduct archeological research and education;	<ul style="list-style-type: none"> Conduct archeological research and education; 	1	1	1	1		1	1			1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1							1	
MTCCA	National Institute for Culture and History	Institute of Archeology	Manage archeological parks and reserves.	<ul style="list-style-type: none"> Manage archeological parks and reserves. 	1	1	1	1		1	1			1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	
MTCCA	National Institute for Culture and History	Museums of Belize and Houses of Culture	Develop and manage museum exhibitions and tours	<ul style="list-style-type: none"> Develop and manage museum exhibitions and tours 	1	1	1	1		1	1			1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	
MTCCA	National Institute for Culture and History	Institute for Social and Cultural Research	Conduct social and cultural research and publications;	<ul style="list-style-type: none"> Conduct social and cultural research and publications; 	1	1	1	1		1									1	1	1		1	1	1	1	1									1		
MTCCA	National Institute for Culture and History	Institute for Social and Cultural Research	Promote social and cultural initiatives	<ul style="list-style-type: none"> Promote social and cultural initiatives 	1	1		1		1									1	1	1	1	1	1	1	1										1		
MFED	All Departments	Section	Planning and design of transportation network facilities and upgrades	<ul style="list-style-type: none"> Accurate and up to date inventory and condition assessment of existing transportation infrastructure; Trip origination and destination assessment; Traffic modeling and capacity analysis; Identification and analysis of transport network construction and upgrade options; Identification, formulation and feasibility analysis for transport master plan and associated priority projects. 	1	1	1	1		1				1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1						1	
MFED	All Departments	Section	Bridge construction and refurbishment	<ul style="list-style-type: none"> Inventory and condition assessment of existing bridges; Identify bridge vulnerability to natural disasters and importance to emergency response activities; Identification, formulation and feasibility analysis for priority bridge construction and refurbishing projects. 	1	1	1																		1													
MFED	All Departments	Section	Road and highway construction and refurbishment	<ul style="list-style-type: none"> Provide basemap and geophysical data to support roadway and highway engineering design; Provide geographically based project tracking and management system; Produce transportation asset inventory to support maintenance and financial asset management activities; 	1	1	1	1		1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																	
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MFED	All Departments	Section	Improve road safety	<ul style="list-style-type: none"> Map and assess traffic accidents and other road safety related events; Analyze road safety issues, opportunities and constraints; Identify road safety intervention measures Prepare plan for road safety intervention actions; Track and manage road safety intervention actions; Monitor and evaluate road safety interventions and calibrate plans to optimize positive impacts and improvements over time. 	1	1		1		1							1																			
MFED	All Departments	Section	Rehabilitation and construction of drainage facilities	<ul style="list-style-type: none"> Assess drainage facility capacity and vulnerability to major storm events; Provide basemap and geophysical data to support drainage facility engineering design; Provide geographically based project tracking system; Produce drainage asset inventory to support maintenance and financial asset management activities; 	1		1	1	1	1												1		1			1			1						
MFED	All Departments	Section	Preparation of feasibility studies for roads and bridges	<ul style="list-style-type: none"> Provide basemap, geophysical and environmental data to support road and bridge feasibility assessments; Provide geographically based bibliography for transportation studies; 	1	1	1	1	1	1					1		1	1			1	1	1	1			1	1	1	1						
MFED	All Departments	Section	Improve road and drainage conditions in selected communities as part of poverty alleviation program	<ul style="list-style-type: none"> Provide access to population census socio-economic information to identify the most economically disadvantaged communities and neighborhoods; Utilize poverty information as another dimension for the prioritization of road and drainage capital investment projects 		1			1	1								1			1		1					1								
MFED	All Departments	Section	General improvement of municipal infrastructure and its management	<ul style="list-style-type: none"> Provide access to municipal infrastructure asset information; Provide access to land use and population data; Provide access to land ownership and tenure information; Identify natural hazards and associated vulnerability of municipal infrastructure Provide geospatial tools for municipal infrastructure assessment and planning. 	1	1	1	1		1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1			
MFED	All Departments	Section	Construction and refurbishment of community facility buildings	<ul style="list-style-type: none"> Provide access to community facility asset information; Provide access to existing land use and population data; Provide access to land use plans and projections; Provide access to land ownership and tenure information; Provide geospatial tools for community facility assessment, planning and siting. 	1	1	1	1		1				1		1	1					1		1			1			1						
MFED	All Departments	Section	Upgrade and rehabilitation of airstrip facilities	<ul style="list-style-type: none"> Inventory and condition assessment of existing airstrips and helipads; Preparation of upgrade and rehabilitation plans for priority airstrips and helipads; Track and manage airstrip and helipad upgrade projects. 	1	1	1	1		1					1		1	1				1		1			1			1						
MFED	All Departments	Section	Planning and design of potable water network facilities and upgrades	<ul style="list-style-type: none"> Accurate and up to date inventory and condition assessment of existing potable water infrastructure; Current and near term future water demand analysis; Water system modeling and capacity analysis; Identification and analysis of water network construction and upgrade options; Identification, formulation and feasibility analysis for potable water master plan and associated priority projects. 	1	1	1	1		1	1				1	1	1	1	1		1	1	1	1			1			1						
MFED	All Departments	Section	Design of potable water supply systems and upgrade projects	<ul style="list-style-type: none"> Provide basemap and geophysical data to support potable water facility engineering design; Provide geographically based project tracking system; Produce potable water system asset inventory to support operations and maintenance and financial asset management activities; 	1	1	1	1		1	1				1	1	1	1	1	1	1	1	1	1			1			1						

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MFED	All Departments	Section	Construction and upgrading of potable water production and storage facilities	<ul style="list-style-type: none"> Provide access to water resource master plan information Provide basemap and geophysical data to support potable water production engineering design; Provide geographically based project tracking system; Produce potable water production system asset inventory to support operations and maintenance and financial asset management activities 	1	1	1	1		1	1				1	1	1	1	1		1						1		1				
MFED	All Departments	Section	Construction and upgrading of water supply network	<ul style="list-style-type: none"> Provide basemap and contextual data to support water supply network engineering design; Provide geographically based project tracking system; Produce water supply network asset inventory to support maintenance and financial asset management activities; 	1	1	1	1		1					1	1	1	1	1				1						1		1		
MFED	All Departments	Section	Improve rural water and sanitation governance	<ul style="list-style-type: none"> Inventory and assessment of rural water supplies, including quantity and quality of extracted water; Inventory and assessment of sanitation facilities; Provide access to rural building and population data; Establish a mapped basis indicating the location and jurisdiction of all local water boards. 	1	1	1	1		1					1	1	1	1	1	1			1		1						1		
MFED	All Departments	Section	Construction and upgrading of sanitary sewer system	<ul style="list-style-type: none"> Accurate and up to date inventory and condition assessment of existing sanitary sewer infrastructure; Provide access to existing and planned land use information; Current and near term future sewer system demand analysis; Sewer system modeling and capacity analysis; Identification and analysis of sewer network construction and upgrade options; Identification, formulation and feasibility analysis for sewer master plan and associated priority projects. 	1	1	1	1		1					1	1	1	1	1	1		1									1		
MFED	All Departments	Section	Institutional capacity building for water system governance	<ul style="list-style-type: none"> Incorporate GIS management and technical capacity building in to the water system governance program 	1	1	1	1		1	1				1	1	1	1	1	1		1	1	1	1			1	1	1			
MFED	All Departments	Section	Development of solar energy generation demonstration project	<ul style="list-style-type: none"> Conduct geospatial siting analysis for optimum location for solar energy generation demonstration project; 	1	1	1	1		1					1	1	1				1	1	1								1		
MFED	All Departments	Section	Provision of electricity from renewable energy sources to rural and peri-urban areas	<ul style="list-style-type: none"> Conduct geospatial analysis for high potential renewable energy sources (solar, hydro, biomass, wind, etc.); Identification of rural and peri-urban economically disadvantaged neighborhoods; Identification, formulation and feasibility analysis for sewer master plan and associated priority projects. 		1	1	1	1	1					1	1	1	1	1	1		1	1										
MFED	All Departments	Section	Extend electrical services to disadvantaged communities	<ul style="list-style-type: none"> Identification of economically disadvantaged neighborhoods; Identification, formulation and feasibility analysis for electrical network extension projects. 	1	1	1	1		1					1	1	1	1				1	1							1			
MFED	All Departments	Section	Plan, design and implement agriculture services program	<ul style="list-style-type: none"> Develop a geographically based inventory of the existing and potential demand for agricultural services; Develop a geographically based inventory of the existing and planned provision of agricultural services; Conduct a geographically based gap analysis between the demand for agricultural services and the existing and planned supply programs and activities; Prepare plan for the augmentation of agricultural services to fill gaps; Monitor and evaluate agricultural service provision and use findings to calibrate service provision programs for maximum positive impact 	1	1	1	1	1	1						1	1	1	1	1		1	1	1	1				1				

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MFED	All Departments	Section	Promote and support the development of integrated farming systems	<ul style="list-style-type: none"> Provide geographically based farm inventory; Assess potential and readiness for integrated farming system introduction; Prepare plan for outreach and capacity building program; Monitor program execution; Monitor and evaluate program outcomes over time, and calibrate plans and activities to reflect lessons learned and evolving context. 	1	1	1	1		1							1			1		1					1			1		
MFED	All Departments	Section	Upgrade research and extension facilities	<ul style="list-style-type: none"> Add GIS and utilization of the information resources of the BNSDI as a focal research and extension support function within the agricultural sector 	1	1	1	1		1	1					1	1	1	1	1	1	1	1	1	1	1	1	1				
MFED	All Departments	Section	Conduct farmer training and capacity building activities	<ul style="list-style-type: none"> Support farmer training and extension service capacity building 		1										1	1	1	1			1		1	1		1		1			
MFED	All Departments	Section	Prepare agriculture irrigation and drainage policy and national strategic plan	<ul style="list-style-type: none"> Provide national inventory and assessment of farms; Identify irrigation and drainage issues; Prepare geographically based agriculture irrigation and drainage strategy. 		1	1	1	1	1						1	1	1				1		1		1		1				
MFED	All Departments	Section	Conduct community project for improvement of agriculture production for poor families	<ul style="list-style-type: none"> Provide access to population census socio-economic data at the community and neighborhood levels; Identify target populations for improvement of agricultural production; Assess and record community level needs and priorities; Prepare and record community based agriculture production improvement mechanisms; Track and manage community based agriculture production improvement mechanisms; Monitor and evaluate the effectiveness of community based agriculture production improvement activities and calibrate plans and activities to optimize positive impact over time. 				1	1	1						1	1	1	1			1		1	1	1	1	1		1		
MFED	All Departments	Section	Promote and provide training for better agriculture technology and methods	<ul style="list-style-type: none"> Provide access to population census socio-economic data at the community and neighborhood levels for rural areas; Provide access to geographically based agricultural census; Identify target beneficiary communities for training, and define the technologies and methods that may be appropriate for each based on existing situation and context. Track training activities geographically; Monitor and evaluate program outcomes over time. 	1	1	1	1		1						1	1	1	1			1		1	1		1		1			
MFED	All Departments	Section	Support the expansion of rice seed production	<ul style="list-style-type: none"> Provide access to geographically based agricultural census; Inventory and assess existing rice cultivation and identify areas for potential future expansion; Track seed distribution; Monitor and evaluate rice production over time and adjust program efforts to maximize positive outcomes. 	1	1	1	1		1						1	1	1	1			1		1	1		1		1			
MFED	All Departments	Section	Promote and provide training for better food processing technology and methods	<ul style="list-style-type: none"> Provide access to population census socio-economic data at the community and neighborhood levels for rural areas; Provide access to geographically based agricultural census; Provide geographically based inventory of existing food processing plants including accounting of what technologies are being used currently; Identify target beneficiary stakeholders for training for food processing technologies and methods; Track training activities geographically; Monitor and evaluate program outcomes over time. 	1	1	1	1		1						1	1	1	1			1		1	1		1		1			

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MFED	All Departments	Section	Promote and provide training for better aquaculture technology and methods	<ul style="list-style-type: none"> Provide access to population census socio-economic data at the community and neighborhood levels for rural areas; Provide access to geographically based agricultural census, inclusive of aquaculture sites; Identify target beneficiary stakeholders for training for aquaculture technologies and methods; Track training activities geographically; Monitor and evaluate program outcomes over time. 	1	1	1	1	1					1		1	1	1		1			1			1			1							
MFED	All Departments	Section	Conduct capacity building to improve agriculture disease management	<ul style="list-style-type: none"> Provide geographically based agriculture disease and pest monitoring and assessment system; Establish mobile phone based agricultural extension service for disease diagnosis; Track disease incidence and spread; Develop and apply intervention strategies to stop disease spread; Monitor and evaluation system effectiveness over time and improve/refine systems based on lessons learned and new disease or pest challenges/ 	1	1	1	1	1						1		1	1	1		1			1			1			1						
MFED	All Departments	Section	Conduct national cattle testing and certification program	<ul style="list-style-type: none"> Provide access to geographically based agricultural census, inclusive of cattle farming sites; Prepare cattle testing and certification plan; Conduct and track cattle testing and certification activities; Track meat products from farm to fork or export. 	1	1	1	1	1					1		1	1	1		1			1			1			1							
MFED	All Departments	Section	Prepare master plan for the improvement of sustainable tourism	<ul style="list-style-type: none"> Prepare inventory of existing high potential tourism resources and facilities Assess resource pressures and sustainability; Assess potential for diversification of overnight tourism product for emerging destinations 	1	1	1	1	1	1					1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1		1	
MFED	All Departments	Section	Support targeted lending	<ul style="list-style-type: none"> Identify areas for targeted lending based on criteria (low-income housing, agriculture, industrial development, etc.); Conduct feasibility and lending risk analysis; Monitor and evaluation loan performance and development outcomes. 														1					1				1									
MFED	All Departments	Section	Support capacity building for Belize Coalition of Service Providers	<ul style="list-style-type: none"> Record location and characteristics of Coalition members; Monitor and assess program member performance 		1		1	1								1							1												
MFED	All Departments	Section	Support financial services for poor farmers and rural communities	<ul style="list-style-type: none"> Conduct population data analysis to identify target neighborhoods; Inventory and record access to existing financial services; Conduct geographically based analysis of financial service gaps; Prepare master plan for improvement of specific financial services within each target community, neighborhood or farming area; Track and assess utilization of financial services over time. 				1	1	1								1						1												
MFED	All Departments	Section	Administer small scale enterprise grants	<ul style="list-style-type: none"> Identify target areas for small scale enterprise grants; Track the location and characteristics of grant applications; Conduct rapid feasibility analysis for small grant applications and advise candidates of areas for improvement; Track the location, characteristics and performance of grantee enterprises 	1	1	1	1	1						1	1	1	1	1		1			1			1			1						
MFED	All Departments	Section	Promote and support rural household employment in gardening and horticulture	<ul style="list-style-type: none"> Identify target areas and populations; Prepare outreach and engagement program by area; Track and monitor program activities 	1	1	1	1	1						1						1			1			1			1						

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP							AREAS							ENVIRONMENT																				
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MFED	All Departments	Section	Plan, design and support development of specialized economic development facilities	<ul style="list-style-type: none"> Assess areas for special economic development (e.g. Maya House of Cacao and Chocolate Museum or National Enterprise Development Center) Conduct geographic siting analysis; Provide geographically based project tracking system; Monitor and evaluate 	1	1	1	1		1					1		1	1			1	1													1				
MFED	All Departments	Section	Improvement of land management capacity	<ul style="list-style-type: none"> Inventory and characteristics of land ownership and tenure status for all lands in Belize Provide tools for the processing and tracking of land tenure transactions; Provide access to land tenure information by all agencies involved in land administration, management and infrastructure activities; 	1	1	1	1	1	1						1		1			1	1	1	1												1			
MFED	All Departments	Section	Improvement of solid waste management capacity	<ul style="list-style-type: none"> Prepare geographically based assessment of current and projected future waste stream processes; Conduct landfill siting analysis in consideration of waste generation, transport and environmental issues, opportunities and constraints; Monitor and evaluate landfill operations and impacts over time. 	1	1	1	1		1					1		1	1			1	1	1	1													1		
MFED	All Departments	Section	Strengthen protected areas management	<ul style="list-style-type: none"> Provide mapped inventory of the location, boundaries and resources of each land or marine protected areas; Identify key threats to each protected area; Conduct protected area gap analysis (spatial, policy, legal, etc.) Prepare and implement protected area strengthening plan; Monitor effectiveness of protected area management programs over time 	1	1	1	1	1	1						1	1				1	1	1	1	1													1	
MFED	All Departments	Section	Strengthen capacity for climate change adaptation planning and reporting	<ul style="list-style-type: none"> Provide access to relevant information from all sectors Conduct climate change hazard assessment; Conduct climate change vulnerability assessment for populations, infrastructure and resources at risk; Develop plans for climate change adaptation in all sectors; Monitor climate change variables and calibrate adaptation schemes according to observations and refined projections over time; Calculate and report on carbon emission reductions, climate change observations, planning and reporting to the UNFCCC COP and other venues. 				1	1	1	1									1	1																		1
MFED	All Departments	Section	Manage marine fisheries	<ul style="list-style-type: none"> Inventory and assessment of commercial and recreational fish stock within Belize territorial waters; Prepare fisheries forecasts under status quo; Define sustainable fisheries intervention options and assess the environmental and economic impacts of each; Develop and record sustainable fisheries program; Implement fisheries management programs, including definition of enforcement areas and actions to be taken; Record and manage fisheries program assets; Support public education programs with map and geographic visualizations regarding fisheries issues and responses; Monitor fisheries conditions and calibrate programs to maintain sustainability over time. 					1																													1	
MFED	All Departments	Section	Manage pollutant release and transfer registration	<ul style="list-style-type: none"> Register geographically and report permitted and accidental pollutant releases to land, sea and air; Track the transfer of hazardous chemicals; Assess potential hazards and vulnerabilities for pollutant and hazardous material storage, transfer, or accidental release; Prepare and record emergency response contingency plans for pollutant and hazardous material release; Support the management of cleanup and recovery efforts following accidental pollutant or hazardous material release; Monitor environmental and social cumulative impacts of permitted pollutant release over time. 	1	1			1	1											1	1	1	1	1	1													

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MFED	All Departments	Section	Enhancement of education policies, strategies and facilities	<ul style="list-style-type: none"> Mapped inventory and assessment of schools and school facilities, assets, students and programs; Identification of education targets and gaps by school district; Identification of policies and strategies needed to improve the education sector nationally and specific foci within each district; Identification of requirements for new schools, or the extension or refurbishment of existing schools; Identification of community specific teacher training program requirements; Provide a geographically based school project tracking and management system; Provide a geographically based school facility space planning, maintenance and asset management system. 	1	1		1		1										1	1										1							
MFED	All Departments	Section	Control and prevention of HIV/AIDS	<ul style="list-style-type: none"> Provide a geographically based inventory of current and past HIV/AIDS incidence; Identify exposed and vulnerable populations to HIV/AIDS spread; Develop geographically targeted programs to control and prevent HIV/AIDS spread; 	1	1				1																												
MFED	All Departments	Section	Improvement of children's health and nutrition	<ul style="list-style-type: none"> Provide access to population census data at the neighborhood level; Identify poorest and most vulnerable populations; Inventory and assess capacity of existing NGO's and community based organizations; Develop and record geographically based assessment of child health and nutrition issues in target communities and neighborhoods; Develop and record child health and nutrition intervention strategies at the community and neighborhood levels; Support the development of community based programs to enhance child health and nutrition programs; Monitor and assess child health and nutrition program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1		1		1												1																
MFED	All Departments	Section	Improve health conditions among the poorest populations	<ul style="list-style-type: none"> Provide access to population census data at the neighborhood level; Identify poorest and most vulnerable populations; Inventory and assess capacity of existing NGO's and community based organizations; Develop and record geographically based assessment of local health conditions; Develop and record health improvement strategies at the community and neighborhood levels; Support the development of community based programs to enhance community health initiatives; Monitor and assess health program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1		1		1												1																
MFED	All Departments	Section	Develop plans for the achievement of target MDG's	<ul style="list-style-type: none"> Provide access to multi-sector data that relates to MDG's; Conduct MDG assessment at the community and neighborhood levels to the extent this can be supported by available information; Develop community level requirements analysis for the achievement of target MDG's; Develop and record community level interventions for the achievement of target MDG's; Implement and track intervention program activities; Monitor and assess health program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1		1		1												1																

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MFED	All Departments	Section	Support the development of social transformation and poverty alleviation projects	<ul style="list-style-type: none"> • Provide access to community level analysis of social and economic conditions and trends; • Geocode neighborhood social and economic surveys; • Support neighborhood level analysis of social and economic issues and opportunities; • Develop and assess alternative program elements for addressing social and economic issues; • Plan and implement social programs and track progress at the community and neighborhood levels; • Monitor and assess social and economic program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1		1			1							1		1	1	1	1	1						1						
MFED	All Departments	Section	Conduct customs reform	<ul style="list-style-type: none"> • Support the capture of trade data include recording for good the point of entry and shipping destination 	1	1				1									1																	
MFED	All Departments	Section	Computerization of Driver's Licensing system	<ul style="list-style-type: none"> • Support the standardization and integration of the nationwide system; • Support geocoding of driver home address; • Support linkage of driver license information to geocoded traffic ticket and accident reports; 	1	1				1						1																				
MFED	All Departments	Section	Assessment and upgrade to the PSIP-MIS	<ul style="list-style-type: none"> • Provide a foundation for recording and tracking PSIP's by location; • Provide access to geospatial information from all sectors to support better project formulation and appraisal; • Assess PSIP geographic distribution and potential interrelationships, providing a basis for better project coordination and alignment; • Provide tools for the reporting of project status, monitoring and evaluation according to the requirements of each donor or IFI; • Provide geographic based tools for PSIP monitoring and evaluation, individually and cumulatively. 	1	1		1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MFED	All Departments	Section	Enhance rural development program activities	<ul style="list-style-type: none"> • Provide geographic based assessment of rural development issues, opportunities and constraints; • Develop and maintain location-based inventory of rural small and medium sized micro-enterprises; • Assess infrastructure requirements and gaps for rural small and medium sized micro-enterprises; • Develop community and neighborhood specific plans for the enhancement of rural small and medium sized micro-enterprises. 	1	1	1	1		1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MFED	All Departments	Section	Develop and manage disaster risk management plan	<ul style="list-style-type: none"> • Assess natural disaster risks nationally; • Identify vulnerable populations, infrastructure and resources at risk; • Prepare disaster mitigation and emergency response contingency plans; • Identify and record the locations and inventory of government owned and other potential disaster response assets; • Support disaster response activities; • Support disaster cleanup and recovery process; • Support disaster resistant community planning and design; • Monitor climate change trends, forecast impacts to disaster emergency preparedness and calibrate planning and emergency preparedness plans over time. 	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MFED	All Departments	Section	Support public safety and crime prevention	<ul style="list-style-type: none"> • Provide data and tools to support crime analysis and response support; • Provide a basis for geocoding crime incidents; • Provide geographic map basis for computer aided police dispatch; • Provide vehicle tracking capability. 	1	1		1		1						1						1		1								1				
MFED	All Departments	Section	Support fire safety	<ul style="list-style-type: none"> • Conduct geographically based assessment of fire hazard and vulnerability; • Provide geographic basis for the inventory and assessment of existing fire response facilities and assets; • Assess the need for and siting of new fire stations; • Assess the need for and siting of new fire hydrants. 		1				1				1								1										1				

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MFED	Central Information Technology Organization	Section	Develop and oversee ICT plans, policies, procedures, guidelines and standards.	<ul style="list-style-type: none"> Ensure that ICT policies, procedures, guidelines and standards reflect and support matters that are specific to geospatial data and application services and the objectives of the BNSDI; 	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
MFED	Central Information Technology Organization	Section	Design and development of e-solutions and government-wide applications	<ul style="list-style-type: none"> CITO is currently facilitating acquiring a government site license for ESRI's ArcGIS software; Beyond the basic software and associated functional modules there will be a variety of geospatial services that could be useful for multiple organizations. Consideration will need to be given to where and how these services should be provided to the BNSDI community 	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
MFED	Central Information Technology Organization	Section	Provide data center and internet services	<ul style="list-style-type: none"> Ensure that the current and planned GoB network considers and can support the type and level of network traffic that could be generated though the BNSDI. 	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
MFED	Central Information Technology Organization	Section	Provide information security services	<ul style="list-style-type: none"> Establish a geospatial data security framework within the overall ICT security strategy Ensure that proper credentials and channels are established to allow access to sensitive geospatial data only by authorized persons 	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
MFED	Central Information Technology Organization	Section	Develop and implement E-Government and ICT policies, strategy and plan of action	<ul style="list-style-type: none"> Coordinate closely with BNSDI to ensure geospatial matters are well represented in national e-Gov and ICT policy frameworks and strategies 	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
MFED	Central Information Technology Organization	Section	Provide ICT related training to government employees and the general public	<ul style="list-style-type: none"> Incorporate basic GIS awareness as part of basic ICT training Ensure universal access to GIS technical training for interested government employees and the public Provide GIS as one component of a "Leadership and Technology" summit aimed at raising the awareness of country leadership in regards to the use of information technology as a component of progressive government transformation 	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
MFED	Central Information Technology Organization	Section	Conduct eGovernment and ICT stakeholder engagement and coordination across government	<ul style="list-style-type: none"> Facilitate geospatial special interest group participation in e-Government for a Align BNSDI with e-Government stakeholder community engagement programs 	1	1	1	1		1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
MFED	Statistical Institute Belize	Section	Collect, compile and analyze statistical information	<ul style="list-style-type: none"> Compile place-based statistical information across all sectors Develop statistical thematic maps by administrative areas Provide tools for field survey data capture Conduct geostatistical analysis of place-based data Access multi-sector data from other organizations for geostatistical analysis Provide geostatistical mapping and graphics Produce geostatistical maps and outputs for statistical atlas of Belize 	1	1	1	1		1									1	1	1	1	1	1	1	1					
MFED	Statistical Institute Belize	Section	Conduct population census - Census Planning and Preparations	<ul style="list-style-type: none"> Utilize GPS and/or national building database to assist in planning enumeration areas and to establish exact coordinates for most household locations; Use up to date high resolution imagery to verify that all settled areas are being accounted for in the census; Provide accurate and up to date maps to support pre-census household count verification; Produce electronic enumeration district maps to be used by enumerators 	1	1		1	1	1							1			1											
MFED	Statistical Institute Belize	Section	Conduct census taking	<ul style="list-style-type: none"> Provide enumerators with location-aware devices to capture information in digital form in the field while also verifying location; Track and monitor census taking activities and status on a daily basis; Expedite data quality assurance and control workflow 	1	1		1	1							1			1												

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MFED	Statistical Institute Belize	Section	Census publishing and distribution	<ul style="list-style-type: none"> Support the delineation of statistically logical census reporting areas based on population numbers and typologies (not restricted to original enumeration districts); Publish census maps and statistics online for immediate consumption by all stakeholders; Provide tools to support download of population census information to various formats for use by stakeholders in other systems. 	1	1		1		1						1		1																				
MFED	Statistical Institute Belize	Section	Conduct between-census population estimation	<ul style="list-style-type: none"> Provide tools to tie between-census household surveys to specific locations, and to extrapolate that information to derive place-specific estimations of population change 	1	1		1	1	1						1					1																	
MFED	Statistical Institute Belize	Section	Conduct special analysis of population data	<ul style="list-style-type: none"> Generate population and socioeconomic statistics by police beat; Generate population and socioeconomic statistics for settled areas with no official boundaries; Generate population and socioeconomic statistics by electrical distribution feeder area, water pressure zone, or sewer collection area; Derive consumer profile maps based on profiles provided by commercial vendors of products and services; Generate probably public transit ridership statistics by block face; Identify financially vulnerable populations down to the block level; 		1									1	1	1	1	1	1		1																
MFED	Statistical Institute Belize	Section	Publish and disseminate statistical information	<ul style="list-style-type: none"> Support the delineation of statistically logical reporting areas based on analysis of location-based raw data; Publish statistic maps and statistics online for immediate consumption by all stakeholders; Provide tools to support download of geostatistical information to various formats for use by stakeholders in other systems. 		1	1	1		1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MFED	Statistical Institute Belize	Section	Develop special products	<ul style="list-style-type: none"> Provide online tools for different views and combinations of geostatistical information Provide geostatistical analysis services upon request Provide online geostatistical atlas Plan and manage special surveys; Conduct geospatial analysis to derive statistical summaries (e.g. average distance between students and where they go to school, persons within walking distance of a park, etc.); Create geostatistical summaries and analyses from existing geospatial data from other agencies; Produce geostatistical visualizations to better communicate key issues to decision makers and the public; 	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MFED	Statistical Institute Belize	Section	Conduct original surveys	<ul style="list-style-type: none"> Provide tools for location-based field collection 	1	1		1		1	1					1	1			1														1				
MFED	Statistical Institute Belize	Section	Compile economic statistics	<ul style="list-style-type: none"> Utilize location-specific business and revenue information to prepare neighborhood and community level economic statistics 		1				1						1	1					1																
MFED	Statistical Institute Belize	Section	Research and implement new methods and technologies	<ul style="list-style-type: none"> Provide tools for location-based field data collection; Explore use of heterogenous data sources with algorithms for statistical pattern analysis for new insights; Test effectiveness of various geostatistical visualizations for communicating issues and concepts Test tools and methods for real-time analysis of information from sensor networks Test new geostatistical tools application to existing raw data 	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MFED	Social Investment Fund	Section	Identify potential projects	<ul style="list-style-type: none"> Provide a geospatial reference to submitted project requests; Provide a map interface to access and track submitted project requests over time. 	1	1	1	1		1						1	1	1	1	1	1		1		1													

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MFED	Social Investment Fund	Section	Conduct community needs and assets assessments;	<ul style="list-style-type: none"> • Provide access to neighborhood level socioeconomic data; • Provide access to development and environmental context data; • Provide access to community infrastructure information; • Identify community level natural hazards and vulnerabilities, including those related to climate change; • Link community needs surveys to location for current and future reference; • Utilize location-aware social media to solicit feedback from community members; 	1	1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	1												
MFED	Social Investment Fund	Section	Carry out project appraisals	<ul style="list-style-type: none"> • Provide access to wide variety of socioeconomic, infrastructure and environmental data to support needs and feasibility assessment; • Utilize available data to explain issues and opportunities to community leaders and residents; • Track project proposal status geographically. 	1	1	1	1		1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1			
MFED	Social Investment Fund	Section	Facilitate project approval process	<ul style="list-style-type: none"> • Provide data, visualization and reporting tools to support presentation of proposed projects to the Board of Directors; • Provide data, visualization and reporting tools to support presentation of proposed projects to international finance institutions. 		1	1	1		1					1		1		1	1	1	1	1	1	1								1				
MFED	Social Investment Fund	Section	Manage project bidding process	<ul style="list-style-type: none"> • Provide bidders with contextual information needed for preparing responsive bid; • Provide a map that indicates the location of all registered contractors; • Track what projects were carried out by what contractors over time as a historical reference; 	1	1	1	1		1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					1	
MFED	Social Investment Fund	Section	Supervise project implementation	<ul style="list-style-type: none"> • Link project management and status reporting information to project locations on a map; • Create thematic maps indicating location, characteristics and status of all projects being undertaken; • Provide a compiled and geo-located history of all projects overseen by BSIF 		1		1		1						1	1	1			1		1														
MFED	Social Investment Fund	Section	Conduct monitoring and evaluation	<ul style="list-style-type: none"> • Monitor and assess the specific and cumulative outcomes of development projects 		1		1		1										1			1														
MFED	Social Investment Fund	Section	Maintain contractor registry	<ul style="list-style-type: none"> • Maintain geocodes for contractor office locations 		1				1						1																					
MOH	All Departments	Section	Provide medical laboratory services;	<ul style="list-style-type: none"> • Provide ability to link medical samples and test results to geographic locations; • Provide selected access to geographically referenced test results for use by planners and researchers. 	1	1				1					1				1			1															
MOH	All Departments	Section	Manage medical stores;	<ul style="list-style-type: none"> • Record and display geographic locations of all public health facilities and health centers; • Track delivery of medical supplies nationally; • Provide spatially enabled dashboard showing the status of supplies in all health facilities and centers; • Produce statistical maps and reports of medical supply usage at the facility level; • Assess the location effectiveness of existing medical supply facilities and site new facilities; • Provide planners and research analysts with access to dispensary data as part of early warning system for disease outbreaks. 		1				1																											

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MOH	All Departments	Section	Provide public dental services;	<ul style="list-style-type: none"> • Provide map of all facilities where public dental services are offered; • Track and monitor mobile clinic locations and history; • Track and monitor urban and rural school dental visits and history; • Utilize location-aware social media for connecting with dental patient community; • Assess the location effectiveness of existing dental health facilities and services and site new programs; • Analyze dental service delivery facilities relative to population census information; • Produce statistical reports and maps concerning dental health at the community level; • Track and analyze dental service delivery by locations over time. 		1				1						1															
MOH	All Departments	Section	Support environmental health;	<ul style="list-style-type: none"> • Track and monitor the locations of reported environmental health issues; • Assess conditions where environmental health issues arise; • Utilize population census data to assess potential exposures to environmental health issues; • Utilize location-aware social media to engage with the public in regards to environmental health issues; • Analyze environmental health issues and trends over time; • Produce statistics concerning environmental health issues at the community level; • Monitor and assess effectiveness of responses to environmental health issues over time 		1				1					1	1	1	1		1	1						1				
MOH	All Departments	Section	Monitor and assess chronic and communicable disease;	<ul style="list-style-type: none"> • Track and monitor the locations of reported chronic and communicable disease incidents; • Assess contextual conditions where epidemiological and chronic disease conditions arise; • Utilize population census and public facility data to assess potential exposures to disease outbreaks; • Utilize location-aware social media to engage with the public in regards to communicable and chronic disease issues; • Plan and track disease outbreak intervention activities; • Analyze communicable and chronic disease issues and trends over time; • Produce statistical reports and maps regarding communicable and chronic disease at the community level; • Monitor and assess effectiveness of responses to disease outbreaks and chronic health issues over time. 	1	1				1					1	1			1		1	1					1				
MOH	All Departments	Section	Manage health education and participation bureau program;	<ul style="list-style-type: none"> • Monitor public health issues across the country geographically; • Assess historical, current and project future public health conditions and trends; • Assess public health issues relative to population census segments; • Prepare maps and reports to assist in communicating public health issues and programs to the public; • Utilize a map interface to support public health information access, sharing and analysis country-wide; • Produce statistics concerning health education and public participation at the community level; • Utilize location-aware social media to support two-way engagement with the public in regards to health related issues 																											

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MOH	All Departments	Section	Manage maternal and child health program;	<ul style="list-style-type: none"> Record and access mapped locations of urban and rural health centers; Provide access to birth data; Provide access to population census information and annual updates; Record and monitor pre and postnatal care services by patient location and health care facility; Record and track child immunizations by child home location and health care facility; Record and track micronutrient delivery areas; Record and monitor immune-preventable disease incidents in children by location; Record and track HIV incidents by patient home location; Produce statistics regarding maternal and child health issues at the community level; Assess the location effectiveness of existing maternal and child health facilities and services and site new programs; Record, analyze and track acute respiratory infections in children Monitor, report and evaluate effectiveness of maternal and child health care program interventions over time. 	1	1					1						1	1	1																														
MOH	All Departments	Section	Manage mental health program;	<ul style="list-style-type: none"> Record and access mapped locations of urban and rural mental health program facilities; Provide access to population census data; Record and monitor mental health cases; Monitor mobile clinic facility locations and movements; Track mental health issues and trends geographically across the country; Assess the location effectiveness of existing mental health facilities and services and site new facilities and service programs; Produce national statistics concerning mental health issues and trends at the community level; Monitor, report and evaluate effectiveness of mental health care program interventions over time. 	1	1					1						1	1				1																											
MOH	All Departments	Section	Manage nutrition and healthy lifestyle promotion program;	<ul style="list-style-type: none"> Monitor and track health and lifestyle conditions and trends nationally; Provide access to population census data at the neighborhood level; Provide access to Ministry of Health health statistics at the community level; Map and track nutrition education and outreach activity locations; Provide interactive online maps regarding the conditions and trends of health and lifestyle issues for access by the public; Support research and analysis on health and lifestyle issues in Belize; Monitor and evaluate the effectiveness of public health interventions on health and lifestyle condition in Belize. 	1	1					1						1	1				1																											
MOH	All Departments	Section	Manage pharmaceutical services and supplies;	<ul style="list-style-type: none"> Provide map locations for all government pharmacies; Provide map locations for all licensed pharmacies; Track all over the counter and prescriptions provided at each pharmacy. Ideally this would be a real-time system that could be used as an early warning system for disease outbreak; Monitor pharmaceutical inventories geographically; Provide access to population census information; Assess the location effectiveness of existing pharmacies and site new facilities and service programs. 	1	1					1						1	1				1																											

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MOH	All Departments	Section	Conduct public health planning and policy development;	<ul style="list-style-type: none"> Analyze public health issues and trends nationally; Record, monitor and assess the effectiveness of public health facilities and services across the country; Compare public health statistics and indicators at the community level relative to national and international standards; Define and model the potential impacts in public health planning and policy scenarios 	1	1				1							1	1	1	1			1															
MOH	All Departments	Section	Manage health sector reform project;	<ul style="list-style-type: none"> Geographically based analysis of public and private health facility and service demand and supply; Support the formulation of public health sector policies, facilities, services and operations plans and strategies; Track and monitor projects geographically; Monitor and evaluate impacts of health sector reform community, district and national levels. 	1	1				1								1	1	1	1		1		1	1	1							1				
MOH	All Departments	Section	Develop and manage public health information system	<ul style="list-style-type: none"> Manage geospatial component of all health information records 	1	1				1					1	1	1	1	1		1	1		1														
MNS	Police Department	HNCIB	Investigate crimes	<ul style="list-style-type: none"> Geocode crimes, incidents and complaints to locations; Conduct crime analysis, including the assessment of the geographic patterns of crimes over time; Manage and retrieve crime case file information by location; Trace car navigation system information; 	1	1				1													1															
MNS	Police Department	Special Branch	Conduct internal intelligence gathering and analysis	<ul style="list-style-type: none"> Capture, manage, distribute and correlate geo-intelligence information among multiple organizations; Track gun and ammunition sales and use by location; Define and assess infrastructure and resources vulnerability; Develop contingency response plans; Monitor and track suspicious land, air and sea vessel traffic; 		1				1													1															
MNS	Police Department	Commander Operations	Conduct police dispatch activities	<ul style="list-style-type: none"> Capture, manage, distribute and correlated geo-intelligence information among multiple organizations; Map and monitor suspected drug production, transport and distribution networks; Develop and implement intervention plans. 	1	1				1			1	1	1	1	1	1	1	1	1		1															
MNS	Police Department	Commander Operations	Conduct drug intervention activities	<ul style="list-style-type: none"> Capture, manage, distribute and correlated geo-intelligence information among multiple organizations; Map and monitor suspected drug production, transport and distribution networks; Develop and implement intervention plans. 	1	1			1	1			1	1	1	1	1	1	1	1	1		1															
MNS	Police Department	Commander Operations	Monitor and track released felons	<ul style="list-style-type: none"> Track released felons by residential and work address or other geographic location; Make released felon information accessible for crime analysis and related policing functions; Support and track probation officer activities 	1	1				1								1	1																			
MNS	Police Department	Commander Operations	Carry out preventative patrols	<ul style="list-style-type: none"> Monitor locations of incidents, complaints, and reports; Monitor released felon locations; Utilize geospatially enabled social media to strengthen interface with local neighborhoods; Geospatially enabled computer aided dispatch; Crime analysis and asset deployment management; Fleet tracking and management. 		1				1																												
MNS	Police Department	Commander Operations	Conduct gang suppression activities	<ul style="list-style-type: none"> Tracking gang areas and activities; Tracking of released felons with gang associations; Utilize geospatially enabled social media to strengthen interface with local neighborhoods; Crime analysis and asset deployment management; Track known gang member residence by address; Monitor gun and ammunition purchase and use. 	1	1				1								1	1	1																		

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																		
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology				
MNS	Police Department	Commander Operations	Conduct national traffic management	<ul style="list-style-type: none"> Record and analyze traffic accidents by location Develop and maintain inventory of traffic safety signage, markings, pedestrian crossings and other relevant features Analyze traffic accident concentrations and trends over time Produce traffic accident analysis and statistical output maps and reports 	1	1		1		1									1																		
MNS	Police Department	Commander Operations	Conduct special patrol operations	<ul style="list-style-type: none"> Prepare special patrol plans; Provide common operating picture for special patrol activities; Monitor and track special patrol activities. 		1			1		1								1				1														
MNS	Police Department	Commander Operations	Support joint emergency response	<ul style="list-style-type: none"> Maintain inventory of security staging facilities and equipment Identify security risks associated with natural hazard vulnerable populations, facilities and infrastructure Support preparation of the security component of the national emergency contingency and response plans Provide access to common operating picture mapping during emergency response Provide tools for tracking vehicles and human resources during emergency response 	1	1	1	1		1	1			1						1				1		1						1				1	
MNS	Police Department	Police Information Technology Unit	Conduct facility and asset management	<ul style="list-style-type: none"> Develop and maintain inventory of police facilities, fixed and movable assets Prepare maintenance plans and contracts Maintain police facility space plans Plan and conduct maintenance inspections Plan for facility and equipment refurbishment and replacement 		1			1					1						1	1																
MNS	Police Department	Police Information Technology Unit	Develop, manage and operate crime information system	<ul style="list-style-type: none"> Provide GIS support to address the needs of the Belize Police Department Maintain facility map and records for police ICT network assets Support GIS training for police personnel Provide online mapping capability Provide geospatial tools for application development ICT geospatial research, assessment, testing and documentation Administration and Training of all ICT services including GIS Provide GIS tools for the development, infrastructural management and administration of the Crime Information Management System (CIMS) Support ICT Crisis Emergency Response Support location-based public education and communication (social network) Support geospatial aspects of systems analysis GIS software development Crime Mapping Geospatial data quality assurance Geospatial analysis of CIMS records 	1	1	1	1		1										1				1		1						1					1
Regional	CCCCC	Sections	Conduct climate modeling;	<ul style="list-style-type: none"> Analyze and assess climate conditions and trends; Refine regional models utilizing locally available national data; Provide input to climate change vulnerability analysis; Monitor and refine trend forecasts and vulnerability assessments over time. 		1	1		1											1	1			1		1										1	
Regional	CCCCC	Sections	Conduct CARIWIG Project;	<ul style="list-style-type: none"> Assess climate change related hazards and vulnerabilities Compile and manage from hydro-meteorological and environmental data Prepare hazard and vulnerability maps Train project participants in climate change tools and methods 	1	1	1	1	1		1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																	
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				various groups currently involved in managing, monitoring or using water resource data;																																
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Energy: Use, Generation, Availability	<ul style="list-style-type: none"> • Provide geospatial framework for the inventory and monitoring of existing energy supply and demand; • Support geographic-based forecasting for future energy demand; • Support the inventory and analysis of potential new renewable energy resources; • Support the planning, design and development of new energy infrastructure; • Support the operations and maintenance of energy infrastructure; • Assess the vulnerability of existing and planned energy sources to climate change; • Provide framework for sharing of information among all the various groups currently involved in managing, monitoring or using energy resource data; 	1	1	1	1	1	1									1			1		1												
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Socio-Economic Status	<ul style="list-style-type: none"> • Support the inventory and monitoring of commercial and industrial activities; • Inventory and monitor the job market and household income levels and trends; • Monitor and assess socio-economic status at the neighborhood level; • Identify communities that are most susceptible to natural disaster impacts and economic shocks • Provide framework for sharing of information among all the various groups currently involved in the planning, development and supply of community and social services; 	1	1	1	1		1										1			1		1											
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Critical and Emergency Infrastructure	<ul style="list-style-type: none"> • Conduct hazard assessment and identify vulnerable populations and infrastructure at risk; • Formulate adaptation strategies to minimize risks to populations and infrastructure; • Prepare and record emergency contingency and response plans; • Inventory and record location of emergency response resources; • Provide a common operating picture for multi-user coordination during emergency response events (rescue and evacuation, food, water, medical supplies, etc.); • Support the planning and implementation of post-disaster recovery activities. 	1	1	1	1	1	1						1			1	1	1	1	1	1	1	1					1					
Regional	CCCCC	Sections	Conduct EU GCCA project	<ul style="list-style-type: none"> • Support the compilation, management and analysis of climate monitoring data • Provide more detailed local data to calibrate and refine regional climate models • Conduct climate analysis and impact studies • Conduct hazard and vulnerability analysis for populations, community facilities, infrastructure and environmental resources • Provide information and tools to support the identification, formulation, design, implementation, monitoring and assessment of climate adaptation projects • Support the formulation of programs and projects that can increase access to carbon financing 	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																						
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Regional	CCCCC	Sections	Coordinate 2011-2015 Caribbean regional resilience development implementation plan;	<ul style="list-style-type: none"> Utilize the BNSDI as a comprehensive common repository for access to information about Belize; Support better and more defensible project formulation, design and feasibility analysis; De-risk projects through systematic analysis and utilization of accurate, authoritative data, and thereby attracting a broader range and diversity of project financing options for development of new climate smart infrastructure; Support more coordinated efforts among organizations and sectors; Provide a comprehensive information framework for project monitoring and evaluation; Provide a project dashboard to understand the location, extent and status of funded project works; Provide a geographically based historic record of projects and trends; Assess cumulative impact and program effectiveness. 	1	1	1	1		1	1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Regional	CCCCC	Sections	Coordinate 2012-2013 Caribbean risk management program;	<ul style="list-style-type: none"> Provide GIS and NSDI as an enabling environment for climate smart government and development; Provide GIS and NSDI as an enabling environment for climate smart coral reef science, policy and management; Support the inventory and assessment of coral reefs throughout the Mesoamerican barrier reef system; Monitor and assess reef health and trends over time; Provide a geographic basis for reef protection and regulatory enforcement; Provide framework for sharing of information among all the various groups currently involved in the protection, management and use of coral reef environments. 	1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Regional	CCCCC	Sections	Coordinate 2012-2014 Australian Caribbean Coral Reef Collaboration;	<ul style="list-style-type: none"> Support inventory and assessment of coastal ecosystems and ecosystem services; Assess the vulnerability of coastal ecosystems and services to various climate change impacts; Support the formulation and modelling of alternative investment options; Provide a geographic basis for coastal ecosystem monitoring and adaptive management; Capacity building using geospatial tools, methods and “spatial thinking” to address coastal ecosystem management matters in a holistic, systemic and place-based manner. 	1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Regional	CCCCC	Sections	Manage coastal protection for climate change adaptation in the small island states in the Caribbean;	<ul style="list-style-type: none"> Compile and maintain repository of geospatial data Provide geoportal for discovery and discovery of available geospatial data resources Link to other relevant local, regional and international data federations 	1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Regional	CATHALAC	Sections	Manage the organization's information and communications infrastructure.	<ul style="list-style-type: none"> Provide access to technical education courses and infrastructure; Provide channel for student exchange and study abroad Establish and maintain online learning opportunities 	1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Regional	CATHALAC	Sections	Provide education and training	<ul style="list-style-type: none"> Provide access to specialized technical expertise and infrastructure; Technical cooperation and sharing of information and methods for environmental modeling and analysis; Technical cooperation and sharing of information and methods for integrated water resource management; Technical cooperation and sharing of information and methods for hazard and vulnerability assessment; Technical cooperation and sharing of information and methods for environmental monitoring. 	1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Regional	CATHALAC	Sections	Provide specialized services		1	1	1	1	1	1						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT														
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Regional	CATHALAC	Sections	Compile, manage and publish geographic information	<ul style="list-style-type: none"> Provide infrastructure and tools for the compilation, processing, discovery and dissemination of geospatial data Provide analytical and visualization tools to support the development and dissemination of specialized derivative information products Provide online access to data and application services in standardized formats 	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1				1	
Regional	CATHALAC	Sections	Support regional cooperation	<ul style="list-style-type: none"> Participate in regional and international initiatives for disaster management and emergency response; Participate in regional and international initiatives for water and environmental management; Participate in regional and international technical advisory fora 	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	
Regional	Inter-American Institute for Cooperation on Agriculture	Sections	Compile, manage and disseminate agriculture knowledge and information;	<ul style="list-style-type: none"> Provide access to information regarding the application of GIS and SDI to the agriculture sector; Provide a geographic framework for geo-referencing and accessing bibliographic information regarding projects, reports, technical bulletins, and other resources 	1	1	1	1	1	1					1	1	1	1	1	1	1		1		1	1	1	1	1				
Regional	Inter-American Institute for Cooperation on Agriculture	Sections	Support agricultural development strategies and projects	<ul style="list-style-type: none"> Provide access to comprehensive agricultural census and farm data; Provide access to population census at the community and neighborhood levels; Provide access to topographic and natural resources information; Provide access to geographically based natural hazard information; Provide access to climate change induced hazard forecast information; Support analysis of existing situation and identification of issues, opportunities and constraints; Provide tools and information infrastructure to support agriculture research and development activities; Provide geographic framework for working with local communities and compiling local knowledge about the current situation; Provide maps and information to support farming community meetings and workshops; Strengthen the formulation and assessment of proposed agriculture development projects; Provide tools and data to support community based problem identification and solution development; Monitor and evaluate program outcomes geographically over time. 	1	1	1	1	1	1					1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	1		
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Determine areas subject to hurricane wind exposure	<ul style="list-style-type: none"> Compile historical hurricane wind data; Refine existing wind models with topography, land cover data and other relevant information; Assess extreme and average local hurricane wind exposure geographically utilizing refined wind model. 		1	1	1	1										1			1							1				
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Determine areas subject to storm surge and wave exposure	<ul style="list-style-type: none"> Compile historical storm surge data; Refine existing storm surge models with topography, bathymetry, and land use/land cover data for coastal areas; Assess extreme and average storm surge exposure geographically utilizing refined storm surge model. 		1	1	1	1												1				1					1	1		
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Determine areas subject to flooding from excessive rainfall	<ul style="list-style-type: none"> Compile historical flooding and stream gauge data; Refine existing wind models with topography and drainage data; Assess extreme and average flooding exposure geographically utilizing refined flooding model. 		1	1	1		1				1						1			1		1			1		1			
Regional	Caribbean Catastrophe Risk Insurance	Sections	Calculate risk and establish policy - Identify built environment resources	<ul style="list-style-type: none"> Identify buildings and structures within areas exposed to wind, storm surge or flooding; Identify transportation routes, bridges and structures within areas exposed to wind, storm surge or flooding; 		1	1	1		1				1			1				1			1			1		1				

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS							ENVIRONMENT															
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	Facility		at risk	<ul style="list-style-type: none"> Identify electrical, water, telephone and other critical infrastructure within high risk areas. 																															
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify government and other critical facilities at risk	<ul style="list-style-type: none"> Identify critical government offices and facilities within areas exposed to wind, storm surge or flooding; Identify hospitals, schools, and other social critical facilities within high risk areas. 		1	1	1		1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify touristic and other commercial facilities at risk	<ul style="list-style-type: none"> Identify touristic and other commercial buildings, facilities and commercial enterprises within areas exposed to wind, storm surge or flooding that could be disrupted. 		1	1	1		1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify populations at risk	<ul style="list-style-type: none"> Identify population concentrations within high risk areas 		1	1	1	1	1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify agricultural resources at risk	<ul style="list-style-type: none"> Identify agricultural farms, facilities and fields within areas exposed to wind, storm surge or flooding that could be damaged. 		1	1	1	1	1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate built environment vulnerability	<ul style="list-style-type: none"> Determine the vulnerability of buildings and structures to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the structures; Determine the vulnerability of transportation routes, bridges and structures to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the roadways and structures; Determine the vulnerability of electrical, water, telephone and other critical infrastructure within high risk areas based on the type and degree of exposure and the physical characteristics of each utility network. 		1	1	1	1	1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate vulnerability of government and other critical facilities at risk	<ul style="list-style-type: none"> Determine the vulnerability of government buildings and other critical facilities to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the structures; 		1	1	1	1	1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate vulnerability of touristic and other commercial facilities	<ul style="list-style-type: none"> Determine the vulnerability of touristic and other commercial buildings and facilities to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the structures and facilities; 		1	1	1	1	1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate vulnerability of populations at risk	<ul style="list-style-type: none"> Determine the vulnerability of populations within high risk areas based on the potential structural damage to homes and sources of employment. Assess socioeconomic situation and financial resilience and potential self-reliance of neighborhoods during an emergency 		1	1	1	1	1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted damage to built environment	<ul style="list-style-type: none"> Calculate potential damage based on exposure and vulnerability assessments. 		1	1	1	1	1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted damage to government and other critical facilities	<ul style="list-style-type: none"> Calculate potential damage based on exposure and vulnerability assessments. 		1	1	1	1	1																									

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Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted damage to touristic and other commercial facilities	<ul style="list-style-type: none"> Calculate potential damage based on exposure and vulnerability assessments. 		1	1	1	1	1								1									1								
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted impacts to populations at risk	<ul style="list-style-type: none"> Calculate potential loss of life and injury based on exposure and vulnerability assessments. 		1	1	1	1	1									1									1							
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of damage to built environment	<ul style="list-style-type: none"> Calculate cost of damage based on coefficients. 						1								1																	
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of damage to government and other critical facilities	<ul style="list-style-type: none"> Calculate cost of damage based on coefficients. Calculate cost of restoring priority facilities to operational condition for disaster recovery. 						1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of damage to touristic and other commercial facilities	<ul style="list-style-type: none"> Calculate cost of damage based on coefficients; Calculate lost revenue and economic activity for each facility. 						1																									
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of impacts to populations at risk	<ul style="list-style-type: none"> Calculate cost of emergency response to each neighborhood based on predicted loss and injury, access, and other issues. 		1	1			1								1				1						1							
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Process post-disaster payout.	<ul style="list-style-type: none"> Calculate hazard scenario and correlate to insurance provisions 		1	1		1	1								1				1		1	1	1		1							
Regional	National Aeronautical and Space Agency	Sections	Collect and publish satellite remote sensing data;	<ul style="list-style-type: none"> Provide integrated tools to discover and assess available geospatial data and imagery Provide online access to data and applications services for basic and derived data 		1		1	1							1																			
Regional	National Aeronautical and Space Agency	Sections	Conduct and/or support special studies.	<ul style="list-style-type: none"> Provide access to specialized technical expertise and infrastructure; Technical cooperation and sharing of information and methods for environmental modeling and analysis; Technical cooperation and sharing of information and methods in multiple disciplines Provide funding and technical support for special studies 	1	1	1	1	1	1									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS							ENVIRONMENT													
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Utilities	Belize Electric Ltd.	Sections	Electric utility systems planning	<ul style="list-style-type: none"> • Monitor urban development plans and changes in land ownership; • Monitor population growth, densification and expansion geographically; • Monitor power consumption rates and trends geographically; • Monitor socioeconomic trends; • Monitor long term climate trends and assess impacts on hydroelectric power generation; • Monitor the adoption of local power generation from renewable sources (solar, wind, etc.); • Track new highway and road development; • Model all of the above to assess potential future demand and load growth scenarios geographically over time; • Assess feasibility of supplying powers to more remote communities; • Assess emerging technologies and methods for smart power management; • Conduct utility siting opportunity and constraint modeling to determine best potential routes for future power transmission and substation facilities; • Conduct spatial analysis to determine optimum routing for distribution networks; • Plan for land acquisition to accommodate power facilities; • Environmental impact assessment for planned facilities; • Develop and illustrate defensible future electrical utility expansion plans in a compelling manner that can be easily understood by the utility Board, Public Utilities Commission (PUC), policy makers and the general public; • Develop renewable energy atlas for Belize to support planning, design and development of sustainable energy for the Country (also see MESTPU stakeholder survey write-up); • Monitor, assess and recalibrate plans proactively over time based on changing conditions and trends. 	1	1	1	1	1	1	1			1		1	1	1			1		1		1								
Utilities	Belize Electric Ltd.	Sections	Electrical network design and construction	<ul style="list-style-type: none"> • Base mapping – providing up to date and accurate information concerning existing roads, buildings, and other infrastructure; • Land ownership and land use; • Demand load forecasting and system modeling; • Facility siting analysis; • Alternative network design analysis; • Construction drawings in real world coordinates, usable with other information in GIS; • Construction management and status tracking; • As-built data consolidation; • Transfer of as-built inventory to fixed asset inventory. 	1	1	1	1		1				1		1			1		1	1		1	1		1	1					

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					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology					
Utilities	Belize Electric Ltd.	Sections	Electrical network operations and maintenance	<ul style="list-style-type: none"> • Provide a complete geospatially located fixed asset inventory; • Common fixed asset registry between mapping, financial and maintenance management system components; • Schedule and route preventive maintenance activities, and tie work orders to specific maintained assets; • Identify and route ad hoc maintenance activities and tie work orders to specific maintained assets; • Rapid outage analysis and response support; • Tie customer complaint calls to location; • Automatically generate schematic diagrams for SCADA visualization and control from the GIS maps, thus eliminating redundant data maintenance and ensuring systems data is consistent and up to date; • Provide mobile devices to field crews to access as-built network data and record redlining and other observations in the field to correct or update the facility mapping database; • Assess historical maintenance activities to identify repeat problem areas or devices; • Provide geospatially enhanced view of all fixed assets and preventive and reactive maintenance and trends over time for planning and PUC reference. 	1	1	1	1		1	1						1																					
Utilities	Belize Electric Ltd.	Sections	Customer care	<ul style="list-style-type: none"> • Geospatially located meters and ability to tie customer information to locations and to analyze and visualize the character and distribution of consumption, complaints and other transactions over time; • Route meter readers • Cluster and route complaint followup activities for more rapid and efficient response; • Maintain geographically enhanced customer satisfaction profiles and monitor key performance indicators over time 	1					1							1																					
Utilities	Belize Electric Ltd.	Sections	Manage ICT systems	<ul style="list-style-type: none"> • Provide geospatial data and tools as an integral component of the utility's information infrastructure • Provide user assistance and technical support for geospatial matters • Provide programming tools for the integration of geospatial functions within enterprise business application software systems • Utilize geospatial dimension as a mechanism for integrating and associating disparate databases together • Provide specialized tools and methods for the administration of geospatial data 	1	1	1	1		1							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS							ENVIRONMENT																							
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology										
Utilities	Belize Water Supply Ltd.	Sections	Water and sewer utility systems planning	<ul style="list-style-type: none"> • Monitor urban development plans and changes in land ownership; • Monitor population growth, densification and expansion geographically; • Monitor water consumption rates and trends geographically; • Monitor socioeconomic trends and their impacts on water consumption; • Monitor long term climate trends and assess impacts on water resources; • Track new highway and road development; • Model all of the above to assess potential future demand and demand growth scenarios geographically over time; • Assess feasibility of supplying water and sewer services to more communities; • Assess emerging technologies and methods for smart water and sewer system management; • Conduct utility siting opportunity and constraint modeling to determine best potential routes for future water source and transmission facilities, sewer treatment plant and related works; • Automate design and as-built record management; • Conduct spatial analysis to determine optimum routing for distribution networks; • Plan for land acquisition to accommodate water production and sewer treatment facilities; • Environmental impact assessment for major planned facilities; • Develop and illustrate defensible future water and sewer utility expansion plans in a compelling manner that can be easily understood by the utility Board, Public Utilities Commission (PUC), policy makers and the general public; • Monitor, assess and recalibrate plans proactively over time based on changing conditions and trends 	1	1	1	1	1	1					1	1	1	1	1	1	1	1	1	1	1									1									
Utilities	Belize Water Supply Ltd.	Sections	Water and sewer network design and construction	<ul style="list-style-type: none"> • Base mapping – providing up to date and accurate information concerning existing roads, buildings, and other infrastructure; • Land ownership and land use; • Demand and contribution calculations and system modeling; • Facility siting analysis; • Alternative network design analysis; • Construction drawings in real world coordinates, usable with other information in GIS; • Construction management and status tracking; • As-built data consolidation; • Transfer of as-built inventory to GIS-enabled fixed asset inventory. 	1	1	1	1		1						1								1	1	1	1										1						

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																							
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology									
Private Sector	Total Business Solutions Ltd.	Sections	Provide geospatial consulting and technical services	<ul style="list-style-type: none"> • Provide stakeholders with technical consulting support; • Support GIS users in developing and maintaining their GIS infrastructure; • Support geospatial database development projects; • Support geospatial application software development projects; • Conduct geospatial analysis and visualizations projects on behalf of clients; • Prepare capacity building and training programs. • Work with Esri to Develop a National Basemap for Belize 	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Private Sector	Total Business Solutions Ltd.	Sections	Provide geospatial computing infrastructure and software products	<ul style="list-style-type: none"> • Provide stakeholders with quality hardware and software products and support; • Introduce and promote new emerging products to the marketplace; • Expand the geospatial technology user community through marketing and sales activities. • Provide immediate access to Esri's growing Partner Community for required software 		1		1		1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Private Sector	Total Business Solutions Ltd.	Sections	Support geospatial awareness, education and training	<ul style="list-style-type: none"> • Build awareness and appreciation for geospatial technology across all sectors in Belize; • Support GIS incorporation to all levels of the education system by hosting events (World GIS Day, My Virtual City Competition, Presentation to Teachers) to support its GIS Education for Primary and Secondary Schools initiative • Provide technical geospatial software and hardware training; • Provide student internships for gaining practical skills in a private sector setting 	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Record and promote membership	<ul style="list-style-type: none"> • Provide member with access to selected government data that are relevant to the Real Estate industry; • Provide real estate geographically based information services that attract new membership to the association. 		1		1	1	1					1		1	1	1	1	1	1	1	1	1	1	1														1	
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Lobby relative to policies and regulations affecting the real estate market;	<ul style="list-style-type: none"> • Lobby for access to government geospatial information that is relevant to the real estate industry; • Analyze the potential impacts of policies and regulatory proposals and options on development and real estate; • Monitor and evaluate the impacts of policies, regulations and activities on the real estate market over time. 		1		1		1					1		1	1	1																							
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Disseminate information regarding real estate in Belize;	<ul style="list-style-type: none"> • Provide member with access to selected government data that are relevant to the Real Estate industry; • Provide a geographically enabled multiple listing service to track properties for sale; • Provide a geographically enabled method for tracking real estate sales and analyzing comparable properties for market valuation purposes; • Provide an ability to track development projects and analyze development and property value trends over time; • Provide access to natural hazard information and identification of vulnerable properties; • Identify properties that may be impacted by climate change over time; • Provide access to real estate information over the internet, both to support local as well as international users; • Forecast the likely impacts of policies, regulations and trends on the real estate market over time and make this information available to association members. 	1	1	1	1		1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Build capacity of real estate professionals in Belize	<ul style="list-style-type: none"> • Conduct workshops to raise the awareness regarding how GIS and BNSDI can be used to support real estate activities; • Provide access and training in the use of GIS enhanced tools for real estate marketing, valuation, trend analysis, development tracking and other relevant issues. 	1	1	1	1		1					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																		
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology				
NGO's	Belize Tropical Forest Studies	Sections	Develop and maintain BERDS	<ul style="list-style-type: none"> • Provide a geospatial data warehouse for the storage and management of commonly needed information; • Provide metadata catalog and tools to allow stakeholders to locate useful information; • Provide online mapping services to allow stakeholders to access and use geospatial information for their own purpose; • Provide help desk and technical support for BERDS stakeholders; • Link geospatial location data with other information media (sample, photo, observation, sound, video, etc.). 	1	1	1	1	1	1						1	1	1	1							1	1	1	1	1	1	1	1				1
NGO's	Belize Tropical Forest Studies	Sections	Conduct biodiversity assessments of protected areas and private lands	<ul style="list-style-type: none"> • Access and compile geospatial and related information from multiple sources; • Conduct and record environmental species observations; • Delineate habitat and other environmental resource data based on image interpretation combined with ground truthing; • Observe species movement with tracking devices; • Assess species habitat, population and population status and trends information; • Assess and delineate species ranges, including migratory patterns; • Conduct environmental issue, opportunity and constraint analysis; • Prepare environmental impact assessment analyses and reporting 	1	1	1	1	1	1													1	1	1												
NGO's	Belize Tropical Forest Studies	Sections	Participate in technical partnerships	<ul style="list-style-type: none"> • Coordination and alignment of activities and resources where shared interests are involved; • Sharing of geospatial data resources among partners; • Conduct joint research; • Jointly lobby for changes in policies and practices affecting GIS or BNSDI 	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	
NGO's	Friends for Conservation and Development	Sections	Conduct co-management of the Chiquibul National Park and Cave System;	<ul style="list-style-type: none"> • Map and record inventory of ecological resources of the National Park and surrounding bio-geographical region; • Map and record communities and other human land use; • Analyze park development issues, opportunities and constraints; • Conduct ecological analysis and identify conservation issues, opportunities and constraints; • Maintain ongoing geographically referenced record of incidents; • Monitor land use change; • Coordinate and share incident information with Belize Defense Force and Police; • Utilize geo-enabled social media for two-way exchange with local communities; • Coordinate and share information with other stakeholders; • Prepare and record national park management plan; • Monitor and assess ecological and biodiversity status over time; • Produce tourism maps and information for the National Park; 	1	1	1	1	1	1				1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1	1				
NGO's	Friends for Conservation and Development	Sections	Conduct environmental education and awareness;	<ul style="list-style-type: none"> • Produce education and awareness materials; • Link surveys to locations where they were conducted; • Link education and awareness programs to specific communities where these have been conducted. 	1	1	1	1	1	1				1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1	1					
NGO's	Friends for Conservation and Development	Sections	Conduct community support programs;	<ul style="list-style-type: none"> • Share population census information for communities that affect the National Park on both sides of the border; • Plan and track community outreach programs; • Establish location aware social media channels for two way interaction with communities; • Provide geographically based recording of community based conservation success stories. 	1	1	1	1		1								1	1	1	1	1	1	1	1	1	1	1	1	1	1						

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																					
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology							
NGO's	Friends for Conservation and Development	Sections	Conduct environmental monitoring and research;	<ul style="list-style-type: none"> Monitor biological resource conditions and trends; Monitor ecosystem health and landscape change; Track locations and associated information regarding specific research studies; Utilize environmental monitoring and research results for conservation planning and policy making. 	1	1	1	1	1	1								1	1	1		1		1	1	1														
NGO's	Friends for Conservation and Development	Sections	Development and promotion of policy recommendations;	<ul style="list-style-type: none"> Monitor and report biological resource conditions and trends, and identify priority issue "hot spots"; Solicit opinions regarding community based conservation ideas and priorities; Model the likely outcomes of various policy and plan scenarios; Utilize geographic information and visualization tools to explain complex issues to decision makers and the public. 	1	1	1	1	1	1				1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1									
NGO's	Friends for Conservation and Development	Sections	Conduct bi-national cooperation;	<ul style="list-style-type: none"> Support sharing of geographic information across national borders; Share incident and related security information; Plan and implement coordinated community education programs and monitor outcomes; Share research information and research program planning and execution. 	1	1	1	1	1	1				1	1	1	1	1		1		1	1	1	1	1	1	1	1	1	1									
NGO's	Friends for Conservation and Development	Sections	Conduct cave management;	<ul style="list-style-type: none"> Develop and record comprehensive inventory of the cave system and related information; Conduct issue, opportunity and constraint analysis for use of portions of cave system for touristic development, ongoing research, and other uses or conservation; Support cave system environmental monitoring and assessment; Utilize cave data to support education and awareness programs 			1	1								1			1		1		1	1	1				1	1										
Academic & Research	University of Belize	Environmental Research Institute	Manage the National Biodiversity Monitoring Program (NBMP)	<ul style="list-style-type: none"> Analyze and establish monitoring priorities and sites; Develop and disseminate data collection and content standards; Collect, manage and disseminate biodiversity management data; Provide data analysis and visualization maps and reports regarding biodiversity conditions and trends; Provide access to wide range of contextual data from other BNSDI stakeholder organizations; Identify and monitor threats to biodiversity and habitat; Monitor biodiversity issues, opportunities and trends and provide input to the formulation of policies, plans and projects 	1	1	1	1	1	1				1	1	1	1		1		1		1	1	1				1	1										
Academic & Research	University of Belize	Environmental Research Institute	Manage the Belize Spawning Aggregation Working Group (SPAGS)	<ul style="list-style-type: none"> Provide geographic base for the management, monitoring and patrolling of spawning aggregation sites; Develop location aware social media applications to help support the involvement of multiple stakeholders in monitoring, research and patrolling of spawning aggregation sites; Collect, manage and disseminate spawning aggregation data; Provide geospatial and statistical analysis tools to assess spawning conditions and trends, identify pressures, and monitor enforcement actions; Formulate and provide recommendations for conservation, protection and sustainable use of spawning aggregation sites; Support development of educational materials for stakeholders and the public; Produce analysis and visualization outputs to advocate and build support for the management, conservation, protection and sustainable use of the spawning aggregation sites; Provide data and analysis results for input to the formulation of related policies, plans and activities of other organizations. 	1	1	1	1	1								1			1		1				1														

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	BASEMAP								AREAS						ENVIRONMENT																
					Geodesy	Places	Elevation	Imagery	Remote Sensing Data	Structures	Planimetric Features	Grids and Indexes	Geographic Reference System	Cadastral	Activity Areas	Planning Areas	Pol/Admin Boundaries	Service Areas	Special Mgmt Areas	Statistical Areas	Climate	Waste	Cultural & Historical	Land Use & Land Cover	Biodiversity	Surface Hydro	Sub-Surface Hydro	Marine Hydro	Soils	Geology	Geomorphology	Marine Abiotic	Seismology		
Academic & Research	University of Belize	Environmental Research Institute	Support the National Coral Reef Monitoring Network (NCRMN)	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of coral reef monitoring data; • Utilize location aware social media applications to help support the involvement of multiple stakeholders in monitoring and reporting coral reef observations; • Provide geospatial and statistical analysis tools to assess coral reef conditions and trends, identify pressures, and monitor interventions; • Formulate and provide recommendations for conservation, protection and sustainable use of coral reefs; • Support development of educational materials for stakeholders and the public; • Produce analysis and visualization outputs to advocate and build support for the management, conservation, protection and sustainable use of coral reefs; • Provide data and analysis results for input to the formulation of related policies, plans and activities of other organizations. 	1	1	1	1	1	1								1						1	1					1					
Academic & Research	University of Belize	Environmental Research Institute	Conduct Terrestrial Mapping	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of coral reef monitoring data; 	1	1	1	1	1	1								1	1					1	1					1					
Academic & Research	University of Belize	Environmental Research Institute	Assess Potential Impacts of Climate Change on Belize Water Resources	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of surface and groundwater quantity and quality information; • Provide access to current and historical weather data and forecasts; • Provide access to water extraction permits and monitoring information; • Provide access to topographic, land use, land cover, soils and other data available from the BNSDI community; • Provide geographic-based tools for the assessment, monitoring and reporting of water resource conditions and trends; • Develop and model the potential impacts of water resource management policy and plan options; • Produce easy to understand analysis output maps and reports to help communicated water resource management issues to decision makers and the public. 	1	1	1	1	1	1							1	1	1	1					1				1	1	1				
Academic & Research	University of Belize	Environmental Research Institute	Conduct Sea Turtle Nest and Wildlife Monitoring	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of wildlife monitoring data among qualified stakeholders; • Provide tools for the analysis and visualization of wildlife monitoring data and trends; • Assess threats and pressures to wildlife populations; • Generate analysis maps and reports regarding wildlife population issues and trends for decision makers and the public; • Provide wildlife consideration inputs to the policies, plans and activities of other organizations. 	1	1	1	1	1	1					1	1	1	1	1					1	1					1					
Academic & Research	University of Belize	Environmental Research Institute	Conduct National Training Program for Protected Areas Management (NTPPAM)	<ul style="list-style-type: none"> • Incorporate geospatial tools and methods to the Protected Areas Management program; • Provide access to wide range of environmental and related contextual GIS data from the BNSDI community; 	1	1	1	1	1	1							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	

APPENDIX B – BUSINESS USE CASE REQUIREMENTS - PART 2 (UTILITIES-TRANSPORTATION-COMMUNITY FACILITIES)

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES					
					Electrical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry	
MNRA	Lands and Surveys Department	Physical Planning Unit	Process Land Subdivision Applications	<ul style="list-style-type: none"> Log land subdivision applications geographically Review land tenure, administrative jurisdiction, environmental, and infrastructure context of proposed subdivision (current and planned) Conduct semi-automated review for planning and regulatory compliance Determine potential current hazards and those that may develop due to climate change Provide geographic linkage to land subdivision case files Produce map showing status of all pending land subdivision applications Illustrate historical land subdivision history 	1	1	1	1	1	1	1					1	1	1	1	1
MNRA	Lands and Surveys Department	Physical Planning Unit	Process Seabed and Public Coastal Areas Use/Construction Permits	<ul style="list-style-type: none"> Log seabed and public coastal area use/construction permit applications geographically Review land tenure, administrative jurisdiction, environmental, and infrastructure context of proposed seabed and public coastal area use/construction applications (current and planned) Conduct semi-automated review for planning and regulatory compliance Determine potential current and future hazards from climate change Provide geographic linkage to land subdivision case files Produce map showing status of all pending seabed and public coastal area use/construction permit applications Illustrate historical seabed and public coastal area use/construction permit history 	1	1	1	1	1	1	1	1				1	1	1	1	1
MNRA	Lands and Surveys Department	Physical Planning Unit	Provide planning advisory support to other initiatives	<ul style="list-style-type: none"> Review planning context of other initiatives Identify potential existing hazards and those that may develop due to climate change 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MNRA	Lands and Surveys Department	Physical Planning Unit	Review Environmental Impact Assessments	<ul style="list-style-type: none"> Log environmental impact studies geographically Review land tenure, administrative jurisdiction, environmental, and infrastructure context of environmental impact studies (relative to current and planned conditions) Conduct semi-automated review for environmental compliance Determine potential current and future hazards from climate change Provide geographic linkage to environmental impact study case files Produce map showing status of all pending environmental impact studies Provide historical record of all historical environmental impact studies 	1	1	1	1	1	1	1	1			1	1	1	1	1	1
MNRA	Lands and Surveys Department	Physical Planning Unit	Support National Environmental Appraisal Committee (NEAC)	<ul style="list-style-type: none"> Provide environmental assessment tracking database Support NEAC review of individual and cumulative environmental impact assessments Provide historical record of all historical environmental impact studies 	1	1	1	1	1	1	1	1				1	1	1	1	1
MNRA	Lands and Surveys Department	Physical Planning Unit	Support National Protected Areas Committee (NPAC)	<ul style="list-style-type: none"> Monitor development and encroaching land use in and around national protected areas Notify proposed development or land use initiatives of potential issues relative to proximal national protected areas 	1	1	1	1		1	1	1	1			1	1	1	1	1
MNRA	Lands and Surveys Department	Physical Planning Unit	Support National Land Use Planning Task Force	<ul style="list-style-type: none"> Provide planning analysis in support of Municipal Development Project Assess land use plans relative to land tenure, administrative jurisdiction, environmental, infrastructure and social context Assess municipal development plans relative to projected climate change impacts and vulnerabilities Assess cumulative societal implications of combined municipal development plans 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MNRA	Lands and Surveys Department	National Estate Section	Administer National Estate Land Leases	<ul style="list-style-type: none"> Manage inventory of all National Estate lands Log and track all National Estate land lease applications and leases Assess land tenure, environmental, infrastructure context of land lease applications Provide historical visualization of National Estate land leases 	1	1	1	1		1	1	1								

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES					
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry	
MNRA	Lands and Surveys Department	National Estate Section	Administer National Estate Land Purchase	<ul style="list-style-type: none"> • Manage inventory of all National Estate lands • Log and track all National Estate land sales • Assess land tenure, environmental, infrastructure context of land sale applications • Provide historical visualization of National Estate land sales 	1	1	1	1		1	1	1								
MNRA	Lands and Surveys Department	Land Registry Section	Process and Record Property Titles and Related Transactions	<ul style="list-style-type: none"> • Manage comprehensive inventory of plot boundaries and land titles for both Declared and Undeclared lands • Link all property transaction case files to geographic location • Provide online access to land ownership information 																
MNRA	Lands and Surveys Department	Valuation Section	Conduct Property Valuation	<ul style="list-style-type: none"> • Provide access to property and property improvement information • Provide access to environmental, social and infrastructure conditions that may affect property use and value • Provide access to comparable property sales information • Provide access to information concerning private lands to be acquired for public purposes • Provide access to administrative jurisdiction boundaries 	1	1	1	1			1	1								
MNRA	Lands and Surveys Department	Survey and Mapping Section	Authenticate Plans for Both National and Private Lands	<ul style="list-style-type: none"> • Log, store and manage land survey project data • Maintain geographically-linked database of all licensed land surveyors • Provide tools for capturing and managing field survey information • Provide means to visualize historical land survey activities over time 																
MNRA	Lands and Surveys Department	Survey and Mapping Section	Support Land Registry Cadastral Updating for Grants and Leases	<ul style="list-style-type: none"> • Manage comprehensive land registry database for all grants and leases • Provide tools for capture of land survey data • Provide access to imagery and basemap information to support land survey efforts • Geographically link land survey activity case files 							1									
MNRA	Lands and Surveys Department	Survey and Mapping Section	Manage National Geodetic Control Network	<ul style="list-style-type: none"> • Manage national geodetic network data • Provide national survey services through CORS/RTK system 																
MNRA	Lands and Surveys Department	Survey and Mapping Section	Provide Survey and Mapping Products and Services to Other Agencies and the Public	<ul style="list-style-type: none"> • Provide GIS and survey services to other agencies and the public • Manage survey project data • Produce and disseminate survey related information upon request 																
MNRA	Lands and Surveys Department	Land Information Center	Develop and Disseminate GIS Data	<ul style="list-style-type: none"> • Provide tools for capture, management, analysis, display and dissemination of geospatial data • Scan and geo-register paper maps • Conduct field data collection (gps coordinates, photos, tabular data, etc.) • Acquire and manage satellite imagery and aerial photography • Apply analytical processes to created derived data from original sources • Log and manage geospatial data and service requests • Publish geospatial data online for viewing or downloading • Manage secure access to and use of geospatial data • Develop geostatistical analysis map and report outputs 	1	1	1	1	1	1	1	1	1			1	1	1	1	1
MNRA	Lands and Surveys Department	Land Information Center	Publish Environmental Statistics	<ul style="list-style-type: none"> • Provide access to broad range of environmental and other relevant data • Provide tools for geostatistical analysis, map visualization and statistical report and graphic generation • Provide online access to environmental statistics and dashboards 					1											
MNRA	Lands and Surveys Department	Land Information Center	Support Data Custodianship On Behalf of Other Organizations	<ul style="list-style-type: none"> • Provide GIS services in support of other agencies • Log and track geospatial service activities • Manage geospatial data repository information for others • Manage online map data and application services delivery • Manage metadata catalog 	1	1	1	1		1	1	1	1	1		1	1	1	1	
MNRA	Lands and Surveys Department	Land Information Center	Support Capacity Building	<ul style="list-style-type: none"> • Provide access to broad range of data for peers from other agencies, student and intern use • Provide access to geospatial infrastructure, tools and professionals to support training efforts • Provide technical support to peers from other agencies 	1	1	1	1		1	1	1	1	1		1	1	1	1	

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
MNRA	Lands and Surveys Department	Land Information Center	Provide Ad Hoc Technical Services	<ul style="list-style-type: none"> • Provide infrastructure for the provision of geospatial services • Establish and maintain technical staff skillsets in step with new developments • Log and track service requests • Provide access to broad range of data from across government to support service requests • Provide software tools to support broad range of analytical and visualization capabilities • Provide products and services online • Develop and disseminate standardized products • Develop derived data through the manipulation and analysis of original source information • Raise awareness through the creation of specialized products for high visibility subjects • Develop standard products and services for public use 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MNRA	Lands and Surveys Department	Land Information Center	Facilitate the Belize NSDI	<ul style="list-style-type: none"> • Establish and manage common GeoPortal node • Develop and maintain common geospatial metadata catalog • Maintain data repository • Facilitate working groups for development and management of common standards • Facilitate the development of common data sharing agreements • Facilitate coordination of commonly needed geospatial data sets with custodians and user stakeholders • Develop and manage BNSDI policies • Coordinate project formulation support activities with Ministry of Finance and other project stakeholders 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MNRA	Central Administration	IT Department	Prepare and implement IT Strategy.	<ul style="list-style-type: none"> • Include geospatial component in any Enterprise-wide system requirements analysis • Integrate geospatial capabilities as a core technology within the MNRA's information architecture strategy • Integrate geospatial data modeling within the MNRA enterprise data model • Include access to BNSDI data as opportunity for optimizing MNRA use of information technology 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MNRA	Central Administration	IT Department	Conduct system and database administration.	<ul style="list-style-type: none"> • Administer geospatial system and database • Maintain specialized geospatial system equipment • Manage impacts of geospatial data on the organization's networks 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MNRA	Central Administration	IT Department	Provide general IT support.	<ul style="list-style-type: none"> • Provide specialized IT support for GIS users 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MNRA	Central Administration	IT Department	Support application development and maintenance.	<ul style="list-style-type: none"> • Consider geospatial capability as an integral component of application software development where this can help to meet user requirements • Incorporate GIS licensing and maintenance within enterprise configuration management program 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MNRA	Central Administration	IT Department	Develop and maintain MNRA website.	<ul style="list-style-type: none"> • Maintain links to BNSDI website and GeoPortal • Utilize MNRA website to raise geospatial awareness 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MNRA	Central Administration	IT Department	Maintain BNSDI geographic portal.	<ul style="list-style-type: none"> • Establish, build and maintain MNRA GeoPortal as a model system • Link and coordinate MNRA GeoPortal with other BNSDI nodes • Support other agencies to publish their data online through MNRA if they are not prepared to administer own GeoPortal now. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MNRA	Natural Resources	Mining Section	Conduct Mineral Resource Assessments	<ul style="list-style-type: none"> • Log, record and track the locations of all mineral resource assessments • Provide geographic interface for accessing mineral resource assessment data and documents • Access geologic information from other stakeholders • Prepare national mineral resource assessment atlas 							1	1							

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES					
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry	
MNRA	Natural Resources	Mining Section	Issue Mining and Mineral Extraction Permits	<ul style="list-style-type: none"> Log and track all mining and mineral extraction permit applications Prepare national atlas of all established mining and mineral extraction permits Provide map interface for accessing digital mining and mineral extraction permit case files Provide tools for capture of site visit information Provide access to environmental, social, jurisdictional and other information that is needed to assess the viability of mining and mineral extraction permit applications Provide a historical visualization of mining and mineral extraction activities in Belize over time 	1	1				1	1	1			1	1	1	1	1	
MNRA	Natural Resources	Mining Section	Monitor Mining and Mineral Extraction Operations	<ul style="list-style-type: none"> Monitor mining and mineral extraction permit reporting over time Prepare mineral extraction map and statistical reports and dashboards for use by policy and decision makers Provide historical record of mining and mineral extraction activities in Belize 																
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Implement NIWRA Master Plan.	<ul style="list-style-type: none"> Conduct and record a comprehensive inventory and assessment of water resources and associated infrastructure in Belize Maintain water rights, allocations and relevant jurisdictions database Establish inventory of all permitted emissions and sources of water pollution Establish inventory of all water abstraction and related use permits Establish and manage suitable hydrologic monitoring network Establish direct data sharing linkages with National Meteorologic Office Conduct and record a comprehensive inventory and assessment of current and projected demand for water resources Assess potential affects of climate change on water resources Prepare spatial masterplan for the development and sustainable management of water resources Identify and formulate water resource development projects 	1	1	1	1	1		1				1	1	1	1	1	
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Process Water Abstraction Licenses.	<ul style="list-style-type: none"> Define watershed boundaries at multiple levels Provide access to Person and Business registries for authentication purposes Log and manage water abstraction license applications Monitor and analyze water abstraction licenses and operational reports by groundwater basin, watershed and stream Provide access to relevant environmental, social, health, hazard and infrastructure information contextual to a water abstraction license application Provide map interface linkage for accessing water abstraction license case files Monitor and assess climate and precipitation trends and impacts on water resources 		1			1		1									
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Collect and Manage Hydrological Data.	<ul style="list-style-type: none"> Conduct a geographic assessment of current hydrologic monitoring network and identify requirements and gaps for additional stations, and upgrading of key stations to automated reading and data transmission Provide access to topographic, hydrographic, soils, land use/land cover and other information needed to understand behaviours of the hydrological systems Collect, manage and model hydrologic data Establish real-time linkage to National Meteorological Office weather data stations for active monitoring 				1												
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Conduct Special Projects.	<ul style="list-style-type: none"> Utilize GIS maps and visualizations to communicate land degradation issues to the public in clear and compelling ways Conduct analyses in support of policy formulation and refinement processes Utilize geospatial data and methods for original and applied research Utilize geospatial data and analysis to support water resource and related development planning, design, operations, monitoring and evaluation Provide a map interface for the access of water resource information, plans and license information by geographic area or location Utilize GIS to conduct special services for government and other sectors 												1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Conduct Groundwater Resource Assessment	<ul style="list-style-type: none"> Develop geohydrologic model for Belize Monitor groundwater levels, quantity and quality Conduct groundwater modeling and assessment Conduct groundwater assessments by geohydrologic basin Publish maps and statistical reports regarding groundwater conditions and trends 															
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Conduct Water Resource Outreach	<ul style="list-style-type: none"> Publish compelling map and statistical reporting graph to raise awareness of water issues to policy makers and the public Conduct population demographic analysis to customize outreach to particular socioeconomic communities in specific environments 		1					1				1	1	1	1	1
MNRA	Agriculture Department	Policy Coordination Unit, NIWRA and Hydrology Unit	Obtain, compile, store and disseminate data concerning the water resources of Belize;	<ul style="list-style-type: none"> Provide and manage a central clearinghouse for access to water resource data throughout Belize Access and utilize data from other BNSDI stakeholders that is useful for water resource matters (topography, weather and climate, land use and land cover, etc.) Provide tools for others to access data, maps and statistical information 		1					1								
MNRA	Natural Resources	Belize Solid Waste Management Authority	Oversee execution and implementation of the Solid Waste Management Project	<ul style="list-style-type: none"> Conduct community specific waste analysis and characterization Conduct siting analysis for solid waste transfer stations Conduct regional siting analysis for solid waste landfill facilities Conduct regional solid waste transport and access analysis Assess future community growth and solid waste trends Conduct solid waste facility site planning and design Conduct environmental impact assessments for planned solid waste facilities Conduct ongoing monitoring and evaluation of solid waste management facilities and operations Maintain complete inventory of solid waste facilities across Belize 							1				1	1	1	1	1
MNRA	Natural Resources	Belize Solid Waste Management Authority	Oversee and Monitor the Operations of the Transfer Stations and Regional Sanitary Landfill.	<ul style="list-style-type: none"> Collection, compile and analyze transfer station and landfill operations data Produce transfer station and landfill operations current situation and trend statistics Re-calibrate waste stream analysis according to measured trends over time Provide new insights to solid waste policies, plans and operational procedures as needed to improve the waste management program over time Provide inventory of all waste management facilities and assets 					1		1								
MNRA	Natural Resources	Belize Solid Waste Management Authority	Conduct public relations and outreach activities.	<ul style="list-style-type: none"> Compile and assess community-specific surveys regarding solid waste issues Utilize population census information with community based surveys to understand different attitudes and issues regarding solid waste Link outreach programs to specific communities, schools and other channels Develop map visualizations and geostatistical charts and graphs to illustrate solid waste issues and where they occur 											1	1	1	1	1
MNRA	Natural Resources	Belize Solid Waste Management Authority	Conduct institutional strengthening and working with local municipalities to optimize their waste collection routes	<ul style="list-style-type: none"> Provide geospatial analysis for nation-wide policy and planning analysis; Provide tools and data for solid waste collection and hauling route optimization; Provide waste management considerations and land allocation inputs to municipal land use planning; Provide tools for fleet tracking and monitoring; Conduct waste stream tracking and monitoring; Develop and manage solid waste fixed assets; Conduct real-time monitoring of waste movements at transfer station and landfill locations; Record the location and characteristics of significant informal dump sites to support evaluation and cleanup; Provide foundation of information to support siting and feasibility assessment for alternative waste management scenarios, waste to energy schemes, recycling efforts, and other potential future innovations. 							1				1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
MNRA	Agriculture Department	Industries Section	Participate in and support agricultural industry associations	<ul style="list-style-type: none"> Inventory of the location and characteristics of farm properties, farmers, and production statistics; Inventory of the location and characteristics of processing plants and other agriculture related infrastructure; Crop production forecasting; Land capability and suitability mapping; Local and export market analysis; Access to markets and export infrastructure analysis; Farm feasibility assessment and planning; Market location price monitoring and product sources; Production and forecasting tracking; Climate change agriculture risk and vulnerability assessment and mitigation planning; Disaster damage assessment and recovery planning; Provide trade associations with access to government geospatial resources to support their planning and operations; Monitor and evaluate the status and effectiveness of government agricultural policies and intervention actions over time. 	1	1					1							
MNRA	Agriculture Department		Testing for livestock disease as part of trade agreements	<ul style="list-style-type: none"> Record and monitor livestock disease testing Prepare livestock disease monitoring maps and statistics 														
MNRA	Agriculture Department	Aquaculture and Inland Fisheries	Support the promotion and development of aquaculture and inland fisheries	<ul style="list-style-type: none"> Continue geocoding aquaculture farm locations to track their distribution on a map; Suitability analysis (soils, slope, water access, market and transport access, etc.); Access protected areas and other information to ensure proposed aquaculture can be carried out within regulatory directives; Access land ownership information to confirm service requestor is land owner; Monitor and evaluate outcomes and effectiveness of aquaculture promotion and support programs over time. 	1	1				1	1	1						1
MNRA	Agriculture Department	Cooperatives	Promote and support agricultural cooperatives	<ul style="list-style-type: none"> Cooperative office locations and boundaries of areas of interest; Market analysis and projections; Training in the use of ICT and GIS to support Cooperative business; Use of cell phones and other mobile devices for Cooperative community crowd sourcing of various information; Special geospatial analysis projects (e.g. analysis of pesticide use in Papaya fields adjacent to declining honey bee production area); Web based training and information dissemination; Monitoring and assessment of Cooperative policies and programs over time. 							1				1			1
MNRA	Agriculture Department	Marketing	Promote and support agricultural market development	<ul style="list-style-type: none"> Analyze farm locations relative to markets where commodities are being sold; Monitor weather forecasts and other information to strategize best times to bring products to market; Assess how climate change may affect some commodities in geographic locations around the Country so that remedial action can be taken; Move towards more real-time treatment of market price information (e.g. Trinidad example utilizing smart phones equipped with GPS); Add supermarket prices to the market price tracking; Build a GIS unit to accommodate the variety of geospatial analyses that can be conceived to support the marketing of agricultural products in Belize. 	1	1				1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
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MNRA	Agriculture Department	Projects Execution Unit	Administer, monitor and support projects execution	<ul style="list-style-type: none"> • Provide project location and characteristics information throughout the lifecycle of the project; • Provide access to contextual information that can assist in project formulation and feasibility assessment; • Provide better coordination and alignment among projects from different sectors planned for the same area; • Allow the government to monitor and geographically track all relevant projects across all sectors (essentially adding a geographic element to the existing Public Investment Strategy Programme (PSIP) managed by the Ministry of Finance and Economic Development); • Provide map interface for access to agriculture projects case files 	1	1				1	1	1	1	1	1				1
MNRA	Agriculture Department	Policy and Trade – Statistics	Develop and disseminate agricultural statistics and information	<ul style="list-style-type: none"> • Provide a geographically based, comprehensive national farms registry • Conduct geographically linked farmer surveys • Conduct geostatistical analysis of farms inventory data • Produce a national agricultural census maps and statistics • Prepare and publish national agriculture maps and statistical reports • Assess farms vulnerability to climate change projections • Access geographic data from other BNSDI stakeholders • Monitor agricultural trends over time • Perform food security analysis • Assess trends and provide information and recommendations to policy makers 							1								1
MNRA	Agriculture Department	Central Farm	Provide Mechanical and Land Preparation Services	<ul style="list-style-type: none"> • Geocode service requests, providing ability to track current and past projects geographically; • Access agricultural census and farmer registries and associated information to help build awareness and market the tractor services; • Access protected areas and other information to ensure requested work can be carried out within regulatory directives; • Access land ownership information to confirm service requestor is land owner; • Keep track of tractor locations; • Monitor and evaluate outcomes and cost effectiveness of tractor service program over time. 															
MNRA	Agriculture Department	Central Farm	Promotion and Support for Development of Sustainable Aquaculture Industry	<ul style="list-style-type: none"> • Continue geocoding aquaculture farm locations to track their distribution on a map; • Suitability analysis (soils, slope, water access, market and transport access, etc.); • Access protected areas and other information to ensure proposed aquaculture can be carried out within regulatory directives; • Access land ownership information to confirm service requestor is land owner; • Monitor and evaluate outcomes and effectiveness of aquaculture promotion and support programs over time. 	1	1				1	1	1	1	1	1				1
MNRA	Agriculture Department	Central Farm	Promote and Support Agro-Processing in Belize	<ul style="list-style-type: none"> • Record and track the location and characteristics of farmers that are involved in agro-processing; • Access environmental, infrastructure and other information that would support or hinder agro-processing development around each rural community; • Based on the above, assess needs and develop program responses that are suitable for each geographic area; • Track school locations and their participation in school feeding program; • Monitor and evaluate outcomes and effectiveness of agro-processing promotion and support programs over time. 	1	1				1	1	1	1	1	1		1		1
MNRA	Agriculture Department	Central Farm	Promote and Support Crop Development	<ul style="list-style-type: none"> • Record and track the location and characteristics of various farms, their crops and outputs nationally; • Conduct agricultural crop suitability assessment (soils, rainfall, access to supplemental water supply, access to markets and transportation, outside of protected areas, etc.). Calibrate this over time with crop production information from farms producing certain crops within various ecotypes; • Identify high potential areas for investment and make this information available to potential investors; • Monitor and evaluate outcomes and effectiveness of crop promotion, development and support programs over time. 															

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES					
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry	
MNRA	Agriculture Department	Central Farm	Promote and Support Livestock Production	<ul style="list-style-type: none"> Record and track livestock farmers; Record and track services to livestock farmers; Identify areas suitable for livestock development; Monitor livestock development and production; Monitor and evaluate outcomes and effectiveness of livestock development and support programs over time. 	1	1				1	1	1	1	1	1				1	
MNRA	Agriculture Department	Central Farm	Provide Extension Services to Small to Medium Sized Farmers	<ul style="list-style-type: none"> Record and track all farms and farmers; Spatially enable the agricultural census for a complete geographically based picture of the agricultural sector across the Country; Track agricultural census extension services; Monitor agricultural output across all sectors; Monitor and evaluate outcomes and effectiveness of agricultural extension programs over time. 	1	1				1	1	1	1	1	1				1	
MNRA	Agriculture Department	Central Farm	Conduct Special Agriculture Research Studies	<ul style="list-style-type: none"> Record and track all locations and characteristics of special studies; Agricultural study formulation and feasibility assessment; Monitor and evaluate outcomes and effectiveness of research programs over time. 	1	1				1	1	1	1	1	1	1				1
MNRA	Agriculture Department	Central Farm	Provide Facilities and Infrastructure for Agricultural Research and Development	<ul style="list-style-type: none"> Provide geospatial computing infrastructure, facilities, data and technical support to support applied research activities in the agriculture sector Support student internships and international exchange program Conduct special studies in support of communities and business 	1	1				1	1	1	1	1	1	1				1
MoWT	Works Department	Section	Support transportation planning	<ul style="list-style-type: none"> Inventory and assessment of existing transportation infrastructure; Inventory and assessment of high priority trip origination and destination points and areas; Traffic modeling and monitoring; Transport optimum corridor selection based on cumulative social, environmental and engineering issues, opportunities and constraints, including consideration of potential future climate change issues; Roadway conceptual design; Cost, value engineering and feasibility assessment; Environmental impact assessment; Right of way acquisition assessment and planning; Stakeholder engagement and coordination; Public outreach and communications. 	1	1			1	1	1	1	1	1	1	1	1	1	1	
MoWT	Works Department	Section	Manage materials lab.	<ul style="list-style-type: none"> Link borehole, geotechnical and material lab test results to geographic locations Publish selected test results by geographic location for use by engineers 																
MoWT	Works Department	Section	Oversee road design and construction.	<ul style="list-style-type: none"> Basemap and inventory of existing conditions (topography, soils, slope, surficial geology, land use, land cover, land ownership, existing infrastructure and structures, protected areas, administrative boundaries, etc.); Planning and management of temporary traffic diversions and signage during construction; Asset takeoff and as-built inventory for roadway and associated appurtenances; Construction oversight status reporting; Management of as-built records for roads, georeferenced to location; Public awareness and outreach (maps for newspaper and television, etc.); 	1	1	1	1		1	1	1		1						

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
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MoWT	Works Department	Section	Maintain roads infrastructure.	<ul style="list-style-type: none"> Maintain complete and up to date inventory of road assets nationwide; Provide geographic basis for understanding road network asset conditions and maintenance priorities; Spatial representation of preventive maintenance priorities and schedules; Monitor and track reactive maintenance activities to identify repeat visit areas that may need more proactive remedial treatment; Maintenance fleet management; Integrate MoWT roads with roads administered by others for a complete picture of the transportation network. This could also be used as the basis for a complete and accurate navigable road database to support car navigation; Link traffic violations and accidents to roadway conditions as a reference for future maintenance and enhancements; Maintain geo-referenced repository of roadway as-built records; Monitor and assess the effectiveness of road maintenance programs over time. 	1	1	1	1		1	1								
MoWT	Works Department	Section	Maintain other civil infrastructure	<ul style="list-style-type: none"> Complete inventory and assessment of inland waterways; Development of preventive inspection and maintenance schedules for inland waterways; Plan, track and monitor reactive maintenance activities to resolve inland waterway issues; Utilize geospatially enabled social media and crowd-sourcing to help identify existing and potential inland waterway issues; Complete inventory and assessment of government buildings; Development of preventive inspection and maintenance schedules for government buildings; Plan, track and monitor reactive maintenance activities to resolve inland government building issues; Utilize geospatially enabled social media and crowd-sourcing with government staff to help identify issues with government building maintenance. 				1			1			1					
MoWT	Works Department	Section	Manage road safety	<ul style="list-style-type: none"> Complete inventory of street markings and signage; Tracking and analysis of traffic accidents and causative factors; Maintain common road linear referencing scheme; Provide common operational picture in support of the JICS. 							1								
MoWT	Works Department	Section	Administer driver and vehicle licensing registration	<ul style="list-style-type: none"> Validate which jurisdiction a person is in to determine the responsible agency for licensing. Track violation locations countrywide, including linkages to municipality-issued tickets; Geocode licensed drivers and vehicles to visualize distribution and level of transactions in various areas over time. 							1								
MoWT	Transport Department	Section	Conduct transit planning.	<ul style="list-style-type: none"> Current transit situation assessment and modeling (existing and planned demand and supply); Assess the transit implications of existing and planned land use; Socioeconomic data and public transit rider profile assessment (current and projected); Existing roads and road conditions; Existing public and private transit routes and carrier information; Existing and planned terminals and stops; Multi-modal connections and flow modeling. 															
MoWT	Transport Department	Section	Manage and regulate public and private transit and operate terminals.	<ul style="list-style-type: none"> Maintain accurate and up to date bus route information; Monitor ridership on each route and bus terminal throughput; Track and monitor public and private buses (location, ridership, compliance with speed limits, stops, schedule performance, etc.); Terminal asset management and security 							1	1	1	1	1	1	1	1	1

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MoWT	Transport Department	Section	Conduct traffic enforcement.	<ul style="list-style-type: none"> • Geocode violators and violation locations and provide the basis for analyzing and visualizing this information over time; • Provide a means for enforcement officers to identify and communicate road safety and maintenance issues to the Department by geographic location; • Monitor patrols and support computer aided dispatch; • Allow traffic violation information to be retrieved by location on a map; • Monitor traffic violations over time, assess patterns and determine need for remedial measures. 							1					1	1	1	1	1
MoWT	All Departments	All Sections	Participate in emergency planning and response.	<ul style="list-style-type: none"> • Identify hazards and vulnerabilities of public works and transportation infrastructure (e.g. flooding and probable storm-related damages); • Identify vulnerable populations, responder ingress/egress and population evacuation routes; • Identify alternative routes for carrying relief supplies; • Prepare and record transport component of emergency contingency plans; • Inventory location and characteristics of MoWT equipment that can be used to support emergency response; • Monitor and coordinate emergency response logistics; • Plan and execute disaster recovery measures. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MLLGRD	Village Councils	Section	Manage local elections	<ul style="list-style-type: none"> • Maintain geocoded voter registration database and illustrate in mapped form that qualified voters reside within the appropriate jurisdiction; • Provide access to population census information for comparison against voter turnout; • Plan, implement and manage polling stations. 												1				
MLLGRD	Village Councils	Section	Develop and administer municipal development plans and land use zoning	<ul style="list-style-type: none"> • Assess physical setting, environmental and natural assets, cultural and historical assets, inter-region transportation links • Assess historical and cultural resources and conditions • Assess past, current and projected future population characteristics, household cohorts; age and sex distribution, migration; ethnicity and education • Inventory and assess local community facilities • Inventory and assess local community infrastructure and utilities • Existing land use and land cover • Environmental hazards and vulnerabilities • Develop and record land use plans and zoning • Monitor changes in the urban and natural landscape; • Conduct development proposal review and conditioning; • Track building and infrastructure development; • Monitor and evaluate plan effectiveness over time; • Develop plan refinements and adaptation over time based on evolving conditions and requirements. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MLLGRD	Village Councils	Section	Issue development permits	<ul style="list-style-type: none"> • Review development proposals relative to municipal development plans; • Track and monitor development projects and building permits; • Evaluate development trends and impacts over time. 	1	1	1	1	1	1	1									
MLLGRD	Village Councils	Section	License and inspect petrol stations and garages	<ul style="list-style-type: none"> • Record and process petrol station license application submissions; • Assess potential impacts on surrounding land uses; • Schedule and monitor inspections; • Track license compliance over time 	1	1	1	1		1	1									1
MLLGRD	Village Councils	Section	Maintain streets and street lighting	<ul style="list-style-type: none"> • Maintain inventory of the location and characteristics of all street lights; • Identify and plan areas for new street lights; • Link preventive maintenance for light poles and bulbs to the geospatial information; • Provide an smart phone application to allow the public to report street light issues; • Plan and track street light maintenance activities. 	1						1									

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
MLLGRD	Village Councils	Section	Facilitate utility coordination	<ul style="list-style-type: none"> Maintain inventory of the location and characteristics of all utilities and infrastructure (data provided by those utilities); Track utility and infrastructure projects planned, or under construction within the jurisdiction; Provide one-stop coordination for site clearance for underground trenching 	1	1	1	1	1	1	1								
MLLGRD	Village Councils	Section	Facilitate and support community services coordination	<ul style="list-style-type: none"> Maintain inventory of the location and characteristics of local community facilities and services; Identify gaps in community service provision and promote the appropriate government and non-government organizations to get involved; Maintain spatially enabled system for citizen reporting regarding community services 					1						1	1	1	1	1
MLLGRD	Village Councils	Section	Maintain storm drainage system	<ul style="list-style-type: none"> Maintain inventory of existing storm drainage systems; Identify areas susceptible to flooding; Prepare storm drainage improvement plans; Manage storm drainage improvement construction activities; Maintain storm drain system preventive maintenance schedule; Participate in preparation of emergency response plans; Participate in emergence response activities. 	1	1	1	1		1	1								
MLLGRD	Village Councils	Section	Manage refuse	<ul style="list-style-type: none"> Maintain inventory of local waste stream; Manage garbage collection activities and contracts; Plan, build and maintain landfill facilities; Monitor and record random dumping incidents; Raise awareness regarding the reduction, reusing and recycling of waste material. 					1		1				1	1	1	1	1
MLLGRD	Village Councils	Section	Issue littering tickets	<ul style="list-style-type: none"> Maintain inventory of ticket issuance locations; Maintain inventory of observed illegal trash dumping; Provide social media platform for citizen reporting of illegal littering and trash dumping; Monitor littering and illegal trash dumping and identify neighborhood "hotspots" for focused awareness building and education. 					1		1								
MLLGRD	Village Councils	Section	Manage parks and recreation areas	<ul style="list-style-type: none"> Maintain inventory of existing park locations and facilities; Conduct place-based surveys regarding community attitudes about local park and recreation assets and programs; Plan and track park maintenance; Integrate park and recreation areas into local land use planning; Incorporate park and recreation concerns into new development review and conditioning 	1	1	1	1			1	1	1		1	1	1	1	1
MLLGRD	Village Councils	Section	Manage public slaughterhouse facilities	<ul style="list-style-type: none"> Maintain inventory of existing public slaughterhouse facilities; Track, record and report slaughterhouse operational statistics and revenues; Conduct siting analysis for new facilities 		1	1	1	1		1				1				1
MLLGRD	Village Councils	Section	License, rent and inspect market facilities	<ul style="list-style-type: none"> Maintain inventory of existing permanent and weekly markets; Manage market leases by location and specific space; Plan and carry out market inspections; Track market inspection infractions; Monitor market activities and make plans for market expansion and new markets. 		1	1	1			1				1				1
MLLGRD	Village Councils	Section	Manage local cemetery	<ul style="list-style-type: none"> Maintain an inventory of cemetery locations and plots, name and family connections of the interred and related information; Plan and implement cemetery maintenance activities; Plan for cemetery extension and new cemetery areas 							1								
MLLGRD	Village Councils	Section	Manage local property taxation	<ul style="list-style-type: none"> Maintain a geographically based inventory of all properties being taxed; Monitor status of property tax payments; Monitor property tax non-payment and plan follow-up; Track and report property tax revenue geographically over time 	1	1	1	1			1								

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
MLLGRD	Village Councils	Section	Manage licensing of motor vehicles, liquor and trade	<ul style="list-style-type: none"> Maintain a geographically based inventory of the registration addresses for all vehicle licenses (motorized and non-motorized); Maintain a geographically based inventory for all trade and liquor licenses; Plan and conduct trade establishment inspections; Track trade and liquor license renewals and payments; Publish trade license business locations on the web as a community resource; Provide trade license business location information for use in car navigation and other consumer and government applications; 							1				1				1
MLLGRD	Village Councils	Section	Manage swing bridge operations	<ul style="list-style-type: none"> Maintain a geographically based inventory of swing bridge locations; Maintain schedule for planned bridge swing operations and fees paid; Maintain record of ad hoc bridge swing requests and fees; Monitor and report swing bridge operational trends over time 							1	1	1						
MLLGRD	Village Councils	Section	Manage public water closets and latrines	<ul style="list-style-type: none"> Maintain a geographically based inventory of public water closet and latrine facilities; Prepare and implement maintenance schedules for public water closet and latrine facilities Provide location-aware social media for public to comment on water closet and latrine facilities; Monitor trends and complaints as input to the planning for the expansion of existing latrine facilities and planning of new ones 		1	1				1								
MLLGRD	Village Councils	Section	License billboards and banners	<ul style="list-style-type: none"> Maintain a geographically based inventory of billboard and banner locations; Issue and track billboard and banner licenses; Monitor and track billboard and banner license payments; Prepare and maintain plans for future billboard and banner locations; Provide location-aware social media for public to comment on billboard and banner issues. 							1				1				
MLLGRD	Belize City Council	Section	Manage local public health	<ul style="list-style-type: none"> Provide map base for planning, conducting and tracking weed abatement inspections and infractions; Monitor weed abatement repeat offenses and patterns over time; Record and maintain locations and information for food vendors; Record and track food vendor inspection activities; Record locations and abatement activities related to environmental health hazards; Share information with other departments and organizations regarding mutually relevant subjects (pest vector control, solid waste, food poisoning cases, etc.) 					1		1								
MLLGRD	Belize City Council	Section	Manage local tourism	<ul style="list-style-type: none"> Monitor and track crime incidents and patterns in and around tourism areas; Track and analyze tourist complaints; Develop online tourism support services, maps and guides; Develop and maintain tourism maps of Belize City; Utilize location-aware social media for engagement with the tourist community; Record and monitor tourism-oriented facilities and activities 												1			
MLLGRD	Belize City Council	Section	Manage city traffic and licensing	<ul style="list-style-type: none"> Geocode driver licenses, vehicle registration and traffic tickets information to addresses or other discrete location reference, thus providing a basis for understanding the geographic distribution of drivers, vehicles and traffic/parking infractions; Record and maintain bus routes; Share integrated information with other partner agencies (Ministry of Works and Transport, Police Department, etc.); 							1		1						

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
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MLLGRD	Belize City Council	Section	Manage public works	<ul style="list-style-type: none"> Maintain accurate inventory and condition assessment for municipal assets (streets, parks, buildings, drainage system, bridges, etc.); Provide foundation information for street furniture and pavement management; Provide foundation information of storm drainage system management; Provide foundation information for park management; Provide foundation information for municipal building maintenance and space planning; Provide foundation information for municipal vehicle fleet management; Provide asset register as the basis for municipal asset financial management; Provide geographically-based asset register to support preventive and as-needed maintenance planning and response; Provide linkage to maintenance management system to track maintenance activities over time; Track maintenance performance indicators; 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MLLGRD	Belize City Council	Section	Conduct city planning activities	<ul style="list-style-type: none"> Access and utilize data from other organizations (population census, natural resources, land ownership, business locations, community facilities, utilities, etc.) Prepare general plans, including information and tools for: Population forecasting and future needs assessment; Natural hazard and vulnerability mapping (flood prone areas, storm surge, sea level rise); Alternative future scenario development and visualization; Land use requirement and siting assessment; Traffic analysis; Infrastructure requirement and siting assessment; Community facility and service requirements and siting analyses; Support community engagement and visualization of future plans and planning issues; Develop general plan and zoning map databases; Provide public online access to planning and zoning information; Monitor plan build-out and variations; Provide tools for plan revision and refinement based on changing conditions over time. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MLLGRD	Belize City Council	Section	Manage environmental sanitation	<ul style="list-style-type: none"> Use location-enabled mobile phone reporting of loose garbage or hotspot locations by the public, as well as any other environmental sanitation complaints; Track culvert blockages and cleaning activities; Track lot cleaning and weeding activities; Track derelict vehicle reports and removal activities; Monitor trash pickup routes, schedules and performance; Record and manage landfill assets and operations 				1	1		1								
MLLGRD	Belize City Council	Section	Manage Municipal facility security	<ul style="list-style-type: none"> Provide contextual base mapping for security planning; Tie all incidents and reports to geographic locations; Record and access building floor plans; Provide online secure access to security cameras from map interface 							1				1				
MLLGRD	Belize City Council	Section	Conduct emergency planning and response	<ul style="list-style-type: none"> Hazard and vulnerability assessment (flooding, storm surge, high winds, etc.); Resources at risk analysis (settlements, infrastructure, environmental resources, etc.); Record and describe the locations of emergency response assets; Identify emergency staging areas; Preparation and dissemination of emergency response contingency plans; Provide common operating picture for emergency response; Provide common operating picture for post-emergency damage assessment, recovery planning and activities. 	1	1	1	1		1	1	1	1	1	1	1	1	1	

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
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MLLGRD	Belize City Council	Section	Conduct property valuation	<ul style="list-style-type: none"> Maintain property boundary maps; Link valuation data to lot features in GIS; Plan and track property valuation activities; Develop and maintain inventory of trade establishments. Track trade licenses and associated information by location; Prepare and disseminate property valuation maps; Track property tax payments and delinquencies 	1	1	1	1			1							
MLLGRD	Belize City Council	Section	Collect and monitor city revenues	<ul style="list-style-type: none"> Develop and manage a geographically based inventory of all properties, facilities, trade establishments and activities that pay fees to the City; Link fee data to locations and produce map-based revenue visualization and reporting information; Track and monitor fee-paying activities and facilities; Utilize location-based social media for monitoring public comments or complaints regarding fee-paying facilities and activities; Produce maps illustrating historical City revenue generation and trends; Produce maps illustrating future City revenue projections 							1		1		1	1		1
MLLGRD	Belize City Council	Section	Manage city council information systems	<ul style="list-style-type: none"> Maintain GIS as an integral component of the City Council information infrastructure 	1	1	1	1		1	1	1	1	1	1	1	1	1
MLLGRD	NEMO	Section	Hazard and vulnerability assessment	<ul style="list-style-type: none"> Provide access to a broad variety of geospatial information from multiple custodians Identify the location, extent and potential severity of various natural hazard conditions (e.g. flooding, wind damage, storm surge, coastal erosion, etc.) Identify vulnerable populations, community and government facilities and infrastructure Conduct vulnerability assessment 	1	1	1	1		1	1	1	1	1	1	1	1	1
MLLGRD	NEMO	Section	Disaster contingency planning	<ul style="list-style-type: none"> Identification and assessment of vulnerable populations, facilities and infrastructure Conduct impact assessment based on plausible scenarios Prepare a geographically-based inventory of response equipment and people Identify and characterize staging areas and evacuation routes Prepare and maintain geographically based inventory of shelter 	1	1	1	1		1	1	1	1	1	1	1	1	1
MLLGRD	NEMO	Section	Emergency response	<ul style="list-style-type: none"> Provide a “common operating picture” based on data and inputs from all involved sectors Provide real-time monitoring of disaster impacts and near-term projections Support damage assessment Track the deployment of human, vehicle and equipment response assets Monitor disaster response status 	1	1	1	1		1	1	1	1	1	1	1	1	1
MLLGRD	NEMO	Section	Disaster recovery	<ul style="list-style-type: none"> Conduct post-disaster damage assessment Conduct recovery planning and prioritization Coordinate and monitor recovery actions (social, community facilities, infrastructure, etc.) 	1	1	1	1		1	1	1	1	1	1	1	1	1
MLLGRD	NEMO	Section	Education, Communication and Warning	<ul style="list-style-type: none"> Identify vulnerable communities for pre-disaster planning awareness and emergency alert early focus; Provide geographically based information concerning the location and nature of possible natural disasters; Early place-specific warning analysis based on current and near-term projected storm and associated impact modeling (e.g. national hazard atlas, with neighborhood specific maps for high vulnerability areas; Collaborate with urban planning, land administration, utilities, insurance companies and other relevant entities to ensure that hazards are taken into consideration in any future plans and mitigation measures; Include place-based community communications measures within contingency plans; Organize and monitor post-disaster communications and community outreach; Record activities and assess effectiveness for post-disaster refinement of contingency plans. 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
	NEMO	Section	Medical and Relief Measures	<ul style="list-style-type: none"> Record precise locations for medical and relief material; Record work and home locations for medical and relief personnel; Identify and manage medical and relief staging areas; Track flow of people and material during emergency response (smart phones, and tracking devices on major equipment); Record activities and assess effectiveness for post-disaster refinement of contingency plans 	1	1	1	1		1	1	1	1	1	1	1	1	1
	NEMO	Section	Housing and Shelter	<ul style="list-style-type: none"> Pre-identify specific neighborhoods and structures that are likely to be damaged in major events. Work this information into contingency and response plans; Record staging areas and facilities for temporary housing and shelter accommodation post disaster; Manage housing and shelter status information during response; Record activities and assess effectiveness for post-disaster refinement of contingency plans. 	1	1	1	1		1	1	1	1	1	1	1	1	1
	NEMO	Section	Search, Rescue and Initial Clearance	<ul style="list-style-type: none"> Pre-identify specific neighborhoods, structures and infrastructure that are likely to be damaged in major events. Work this information into contingency and response plans; Track and manage field staff activities during response; Post event damage assessment and clearance planning; Track and monitor status of initial clearance activities; Record activities and assess effectiveness for post-disaster refinement of contingency plans. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	NEMO	Section	Collection, Control and Distribution of Food and Material	<ul style="list-style-type: none"> Pre-identify specific neighborhoods, structures and infrastructure that are likely to be damaged in major events. Work this information into contingency and response plans; Identify precise locations of food and material storage facilities and enterprises; Track and manage field staff activities during response and recovery operations; Record activities and assess effectiveness for post-disaster refinement of contingency plans 	1	1	1	1		1	1	1	1	1	1	1	1	1
	NEMO	Section	Assessment and Evaluation of Damage	<ul style="list-style-type: none"> Pre-identify vulnerable populations, structures and infrastructure. Maintain accurate inventory and valuation of assets; Collaborate with insurance industry and government to develop financial mitigation and recovery measures; Conduct post-event damage assessment and losses; Manage and track damage repair and mitigation activities 	1	1	1	1		1	1	1	1	1	1	1	1	1
	NEMO	Section	Foreign Assistance disaster management	<ul style="list-style-type: none"> Identify hazardous conditions and ensure that settlement and infrastructure projects avoid these areas; Pre-identify vulnerable populations, structures and infrastructure. Establish disaster mitigation and post-event recovery assistance strategies 	1	1	1	1		1	1	1	1	1	1	1	1	1
	NEMO	Section	Transport disaster management	<ul style="list-style-type: none"> Pre-identify vulnerable populations, structures and infrastructure. Identify transportation routes that should remain viable for emergency response, evacuation and relief supply provision purposes; Consider natural disaster hazard conditions for the planning and design of new highways; Identify transportation infrastructure that may be impacted by natural disaster events and develop mitigation plans for protection and recovery 	1	1	1	1		1	1	1	1	1	1	1	1	1
	NEMO	Section	Environment and Utilities disaster management	<ul style="list-style-type: none"> Pre-identify vulnerable infrastructure and environmental resources. Consider natural disaster hazard conditions for the planning and design of new utilities; Identify transportation infrastructure that may be impacted by natural disaster events and develop mitigation plans for protection and recovery 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
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MLLGRD	National Meteorological Office	Section	Conduct weather monitoring	<ul style="list-style-type: none"> Develop and manage inventory of meteorological stations Provide map interface for accessing meteorological data Conduct geographic analysis to determine need and feasibility for more monitoring stations based on multiple stakeholder requirements Cooperate with other organizations in weather data collection (e.g. estimate of precipitation via cellular telephony signal analysis between towers) Provide geographic interface for recording and visualizing weather balloon readings Provide geospatial tools to support combination of radar, meteorological station, satellite and other related information for improved weather monitoring Link local GIS with regional weather model outputs 							1							
MLLGRD	National Meteorological Office	Section	Analyze and report weather information and forecasts	<ul style="list-style-type: none"> Develop and manage inventory of meteorological stations Provide map interface for accessing meteorological data Conduct geographic analysis to determine need and feasibility for more monitoring stations based on multiple stakeholder requirements Cooperate with other organizations in weather data collection (e.g. estimate of precipitation via cellular telephony signal analysis between towers) Provide geographic interface for recording and visualizing weather balloon readings Provide geospatial tools to support combination of radar, meteorological station, satellite and other related information for improved weather monitoring 							1			1	1			1
MLLGRD	National Meteorological Office	Section	Analyze weather and prepare agrometeorology reports for the agricultural sector.	<ul style="list-style-type: none"> Provide more geographically specific reports to farming communities; Customize reports according to specific clusters of farmlands, crop types, types of infrastructure, and other context. 							1							
MLLGRD	National Meteorological Office	Section	Participate in emergency preparedness and response	<ul style="list-style-type: none"> Provide geographically specific weather input to hurricane reporting Provide geographically specific forecasts and reporting for storm surge Provide geographically specific forecasts and reports for potential flooding Utilize locally available data to refine regional models, reports and forecasts Generated geographically specific scenarios to support hazard and vulnerability assessment scenarios for contingency planning purposes Generate geographically specific scenarios to support emergency preparedness drills Conduct downstream flooding and damage assessment for various levels of dam break scenarios 							1							
MLLGRD	National Meteorological Office	Section	Provide data on as-needed basis	<ul style="list-style-type: none"> Provide geographic interface for access to community specific weather information and forecasts Provide online mechanism for outside entities to access and download selected Hydromet data and model output information for specific geographic regions Provide online web map services for data and analytical products that can be consumed by other mapping interfaces and websites directly 							1							
MHUD	Central Building Authority	Section	Intake, review and approve building permits	<ul style="list-style-type: none"> Log building permit applications with geographic reference (explicit coordinates or verifiable street address or plot number) Support "one-stop-shop" for digital building permit submissions and initial review by multiple agencies Capture spatial footprint of proposed structure, and allow "status" to be adjusted as the building permit process moves forward to final occupancy permit or commissioning Utilize contextual data from multiple organizations to assess proposed building compliance Add climate change related potential hazards as an element for consideration in building permitting 	1	1	1	1		1	1							
MHUD	Central Building Authority	Section	Conduct building/site inspections;	<ul style="list-style-type: none"> Utilize GIS to plan and track building inspection schedules Provide geographic interface for accessing building permit case files Produce building permit status maps and reports Conduct building history and trend maps and statistical information over time 	1	1	1	1			1							

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MHUD	Central Building Authority	Section	Carry out soil testing:	<ul style="list-style-type: none"> Log soil testing sites geographically Provide access to soil testing online through a map interface Utilize soil testing as input to soil mapping and geotechnical assessment efforts 							1									
MHUD	Central Building Authority	Section	Carry out concrete testing.	<ul style="list-style-type: none"> Log concrete testing results geographically Provide access to concrete testing online through a map interface Maintain historical record of concrete tested sites and results over time 							1									
MESTPU	Geology and Petroleum Department	Section	Facilitate and oversee geologic and petroleum exploration studies	<ul style="list-style-type: none"> Develop and maintain GIS-based digital archive of past geology mapping efforts Maintain location and borehole information for all exploration wells Maintain location and results of seismic line testing information Manage petroleum contracts boundaries Develop and maintain an archive of all historical petroleum exploration information Collect and make available topographic, bathymetric and bottom type information 							1									
MESTPU	Geology and Petroleum Department	Section	Administer petroleum operating concessions	<ul style="list-style-type: none"> Tie operational reports to specific wells and contract areas Generate petroleum product maps and statistical reports for current status, historical trends and future projections Maintain inventory of petroleum production and transport assets 							1									
MESTPU	Geology and Petroleum Department	Section	Review environmental impact assessments	<ul style="list-style-type: none"> Log all environmental impact assessments geographically Provide tools for accessing and analyzing geologic aspects of submitted environmental impact assessments Conduct seismicity analysis modeling for hazard and vulnerability assessment Provide access to wide variety of population, community facilities, infrastructure and jurisdiction information for contextual reference. 	1	1	1	1		1	1					1	1	1	1	1
MESTPU	Energy Unit	Section	Develop and support national renewable energy development	<ul style="list-style-type: none"> Conduct analysis to determine renewable energy sources Assess the location and characteristics of energy demand Assess the location and characteristics of existing energy supply Perform siting analysis for proposed renewable energy projects Develop and maintain national inventory of renewable energy generation sites and facilities Monitor and assess performance of renewable energy facilities over time Prepare smart energy atlas and master plan for Belize representing a diversified, sustainable energy portfolio for the country 	1						1									
MESTPU	Energy Unit	Section	Promote and support energy efficiency initiatives	<ul style="list-style-type: none"> Track the locations and characteristics of existing energy efficiency case studies; Monitor energy consumption rates by neighborhood as the basis for targeted energy efficiency promotion and outreach efforts; Leverage above analysis by providing to the private sector to support their marketing of energy efficiency products and services; Track the effectiveness of energy efficiency awareness and outreach programs over time. 	1						1									
MESTPU	Energy Unit	Section	Promote and support clean energy production initiatives - Public Utilities Commission Act	<ul style="list-style-type: none"> Accurate accounting of all public utility assets by location Monitoring of utility consumption by areas Monitoring of outages and complaints by areas Monitoring of utility bill payments by areas Utility capital improvement planning based on land use and development plans Monitoring preventive and ad hoc maintenance activities by area Access to accurate data from others (population census, community locations and statistics, buildings and topographic information, flooding areas and other environmental hazards, protected areas, land ownership, etc.) Maximize sustainable use of renewable energy sources Ensure electric utility generation, transmission and distribution facilities are designed and operated in an environmentally and financially sustainable manner 	1						1									

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
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	Energy Unit	Section	Promote and support clean energy production initiatives - Electricity Act	<ul style="list-style-type: none"> Accurate accounting of all electric utility assets Monitoring of electric consumption by areas Monitoring of outages and complaints by areas Monitoring of electric bill payments by areas Electricity network system control and data acquisition (SCADA) – geospatial as well as network schematic visualization Electrical supply capital improvement planning Monitoring preventive and ad hoc maintenance activities by area 	1						1							
	Energy Unit	Section	Promote and support clean energy production initiatives - Environmental Protection Act	<ul style="list-style-type: none"> Support planning for the sustainable use of renewable energy sources while protecting biodiversity and natural and cultural heritage Facility siting and routing in consideration of environmental factors Minimize environmental impacts from energy operational activities 	1						1			1	1	1	1	1
	Energy Unit	Section	Promote and support clean energy production initiatives - National Integrated Water Resources Act	<ul style="list-style-type: none"> Maximize sustainable utilization of water resources for hydroelectric and other purposes Plan and design electrical facilities to maximize sustainable usage of water resources while minimizing adverse impacts 	1													
	Energy Unit	Section	Promote and support clean energy production initiatives - Land Acquisition (Public Purpose) Laws	<ul style="list-style-type: none"> Plan electrical utility facility and route siting to minimize impact on privately owned lands 	1													
	Energy Unit	Section	Promote and support clean energy production initiatives - Forest Act	<ul style="list-style-type: none"> Plan, design and operate electrical utility facilities and routes to avoid conflicts with high economic and environmental value forests 	1													
	Energy Unit	Section	Promote and support clean energy production initiatives - Wildlife Protection Act	<ul style="list-style-type: none"> Plan, design and operate electrical utility facilities and routes to avoid impacts to endangered species, biodiversity and habitat 	1													
	Energy Unit	Section	Promote and support clean energy production initiatives - Project Development Process	<ul style="list-style-type: none"> Access broad range of relevant data to support project formulation, design and bidding Access broad range of contextual data to support bid evaluation Provide information to support project site-specific design Provide GIS linked asset inventory Link and monitor planned and reactive operations and maintenance activities to geographically located assets Monitor and evaluate individual and cumulative projects performance over time 	1						1							
MESTPU	Science and Technology Unit	Section	Promote and support the development and application of science and technology in Belize	<ul style="list-style-type: none"> Promote the use of geographic information science, systems and thinking in support of better planning and decision making in Belize Promote and support open public access to selected government-produced data that can support civil society, government transparency, education uses, and development of new applications and services by the private sector 	1	1	1	1		1	1	1	1	1	1	1	1	1
MESTPU	Public Utilities Commission	Section	Participate in Public Utility Strategic Planning.	<ul style="list-style-type: none"> Provide improved basis for understanding the geographic distribution of current and future energy demand and supply Utilize place-aware social media for two-way exchange of information with utility customer communities Develop diversified energy portfolio that optimizes available renewable energy resources and supply of energy to key demand sectors in the most effective manner 	1						1							

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
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MESTPU	Public Utilities Commission	Section	Review and approve Public Utility rates.	<ul style="list-style-type: none"> Utilize GIS to provide geographically linked public utility assets register Utilize GIS linked asset register for financial and maintenance management Improve customer satisfaction through streamlined and more reliable utility operations and timely response to customer requests and inquiries Minimize total cost of running utility by improving planning, design, operations, maintenance and administrative processes 	1						1							
MESTPU	Public Utilities Commission	Section	Monitor Public Utility Performance	<ul style="list-style-type: none"> Monitor the location and characteristics of customer complaints Monitor and assess trends in utility disruption and outage management Monitor water quality testing Monitor and assess preventive and ad hoc maintenance activities 	1						1							
MFFSD	Department of Forestry	Section	Protected Areas Management Program;	<ul style="list-style-type: none"> Maintain mapped inventory of all protected areas and the resources and infrastructure within them Develop conservation and landscape management plans for protected areas Monitor activities and performance of co-management agreements within protected areas Monitor changes in land use, land cover and infrastructure development within areas around protected areas that may impact them Conduct socioeconomic studies and surveys of populations related to protected areas, and develop education and outreach programs to encourage stewardship behavior Assess potential impacts to protected areas from climate change Provide online access to mapped information about protected areas for education, awareness and tourism purposes Provide access to protected area data services for use by research scientists and students 							1			1	1			1
MFFSD	Department of Forestry	Section	Forest Resources Planning and Management Program;	<ul style="list-style-type: none"> Record and track forestry lease areas and associated planned production information; Monitor changes in forest land cover using aerial or satellite imagery and correlate this to planned production; Identify illegal logging; Support permit application review, monitoring and enforcement; Support development of national forest inventory; Provide access to reference information from other organizations (cadastral, environmental, population census, land use, mining and petroleum leases, etc.) to support assessment and monitoring activities; Manage Sustainable Forest Management plans in GIS format. 							1				1	1		
MFFSD	Department of Forestry	Section	Forest Revenue and Exploitation Control Program;	<ul style="list-style-type: none"> Monitor extraction and revenue by specific area; Monitor land cover change and correlate to planned extraction locations and rates to identify any illegal activity; Estimate potential sustainable forestry revenues based on national forest inventory 														
MFFSD	Department of Forestry	Section	Law Enforcement Program;	<ul style="list-style-type: none"> Provide Ministry staff with access to activities within forest areas that have been permitted by other organizations (mining, agriculture, settlement, etc.); Monitor land cover change relative to permitted extractions and other approved activities to help identify areas of potential offences; Utilize location-aware social media for reporting of potential offences by the public; Record and track infractions and associated enforcement actions; Share all of the above information among the relevant stakeholders; Build awareness of monitoring and enforcement actions to deter would-be offenders. 														
MFFSD	Department of Forestry	Section	Wildlife Program;	<ul style="list-style-type: none"> Record and track wildlife by habitat; Utilize social media to identify potential wildlife infractions; Record locations and data concerning infractions including followup and status; Track hunting licenses and permitted takings. 														
MFFSD	Department of Forestry	Section	National and International Partnership Program;	<ul style="list-style-type: none"> Record, monitor and report all features, habitats, species and activities related to various conventions and treaties; Access geospatial data of others that may relate to the above. 														

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
MFFSD	Department of Forestry	Section	Manage National Herbarium.	<ul style="list-style-type: none"> • Provide a map interface indicating the location where each herbarium specimen was collected; • Link geographic locations with database, imagery and scientific reference material for each specimen; • Provide habitat maps indicating the range where each type of plant can be found 														
MFFSD	Department of Environment	Section	Develop and manage environmental policies	<ul style="list-style-type: none"> • Monitor the affects and impacts of existing legislation as related to environmental issues; • Identify and analyze alternative policy and regulatory scenarios; • Monitor, assess and align government agencies' plans, programmes and activities that affect the environment; • Define and analyze alternative recommendation scenarios for national policies and standards to promote improvement in environmental quality to meet the conservation, social, economic, health and other goals of Belize; • Assess and define environmental program priorities; • Help to shape environmentally sustainable projects to be funded through international funding agencies; • Provide geographically-enable method for coordinating among Department units (Project Evaluation & EIA Unit, Public Awareness and Information, and the Enforcement and Monitoring Unit); • Support management and compliance with all International Environmental Conventions and Protocols for which Belize is a Party or is contemplating becoming a Party, including assessment of benefits and costs of commitments • Track and monitor national and regional environmental issues as part of international cooperation efforts 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFFSD	Department of Environment	Section	Administer environmental impact assessments	<ul style="list-style-type: none"> • Record and track EIA locations; • Support analysis of EIA's by the National Environmental Appraisal Committee (NEAC); • Conduct initial assessment of project location and scope to help determine whether an EIA is required or not; • Support the development of Environmental Compliance Plans (ECP's) for projects that have been granted environmental clearance by the NEAC; • Monitor, assess and refine EIA criterial and regulations; • Assess individual and cumulative environmental impact of development, industrial and all other activities that may have significant impact on the environment; • Record, track and monitor permitted projects and activities; • Provide public with information regarding EIA's and their significance as a planning tool and for safeguarding public safety and welfare; • Provide geographically based information and visualizations to support public hearings; • Provide information access to other agencies to support strengthening of intra and inter-ministerial cooperation and coordination; • Provide information and tools to support EIA training; • Provide environmental baseline and analytical tools to support environmental planning for key areas such as Coastal Zone, islands, and proposed tourism, residential and industrial sites; • Record and track approved project locations; • Record and track locations of companies or individuals involved in the preparation of EIA's in Belize; • To conduct and coordinate investigations, studies, surveys and research on issues related to the state of the environment and issues impacting ecosystems in Belize; • Monitor projects that have been granted environmental clearance 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES					
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MFFSD	Department of Environment	Section	Conduct environmental monitoring and enforcement	<ul style="list-style-type: none"> Track locations of environmental permits and inspections; Route and track environmental inspection activities; Monitor, collect, and analyze effluent and other pollutants; Maintain a register of all wastes, discharges, emissions, deposits or other sources of emissions or substances that are of danger or potential danger to the environment; Undertake surveys and investigations into the causes, nature, extent, and prevention of pollution and generate reports of the investigations; Identify and monitor areas for pollution cleanup and resource recovery improvements; Georeference environmental complaints; Track violation tickets, stop orders and abatements notices by location; Conduct place-based surveys on environmental matters; Assess environmental hazards, vulnerabilities and resources at risk; Prepare and assess contingency scenarios for environmental emergency response; Conduct assessment of individual and cumulative development environmental impacts on land, sea and air; Record and monitor Environmental Compliance Plans (ECP's) for existing and new projects; Prepare environmental maps and geographic visualizations to support public awareness and education 	1						1				1	1			1	
MFFSD	Department of Environment	Section	Manage environmental projects	<ul style="list-style-type: none"> Project area assessment and formulation; Project design; Project management and reporting; Project monitoring and evaluation. 																
MFFSD	Department of Environment	Section	Conduct environmental awareness and outreach	<ul style="list-style-type: none"> Support environmental education with access to current and historical environmental information and geographic visualizations of environmental issues; Provide public with access to environmental information in a form that can be easily understood by lay audience; Prepare environmental analyses to support state of environment reporting and symposia presentations; Generate environmental maps and graphics for the press and public awareness campaigns, presentations and speeches; Support EIA public hearings and consultations with environmental issue data visualizations; Maintain access to related data maintained by other organizations through the BNSDI; Maintain georeferenced bibliographic information; Maintain information regarding environmental conditions, trends and projections; Monitor and assess changes in the natural environmental systems and analyze drivers and pressures that are causing these changes; Monitor and assess the cumulative impact of permitted emissions; Continuously Review The Adequacy Of Existing Data Management Systems And Data Bases; Upkeep And Maintain The Department's Information System And Equipment; Provide supporting material for national activities relative to international environmental days of recognition (e.g. World Environment Day, Earth Day, Ozone Day, International Beach Clean-Up Day, etc.); Utilize geospatially enabled social media and other media to facilitate two-way exchange of information with the public concerning environmental issues and conditions; Track and monitor the locations and characteristics of community-based and civil society environmental planning, monitoring, enforcement and assessment activities; Support the preparation of annual state of the environment reporting and planning; Monitor, assess and track environmental complaints from the public 																

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MFFSD	Department of Fisheries	Section	Conduct fisheries assessments;	<ul style="list-style-type: none"> Conduct fish habitat and population studies Monitor fish catch statistics and trends by location over time Monitor fish habitat and population statistics over time Provide fisheries assessment data and recommendations to policy makers in maps and statistical graphics that me the issues and remedies understandable and compelling Maintain inventory of fisherman, fishing infrastructure, and fish markets 							1	1			1	1	1		1	
MFFSD	Department of Fisheries	Section	Prepare marine reserve management plans;	<ul style="list-style-type: none"> Provide a map representation of the general context for each marine reserve; Provide a mapped database of critical habitats; Provide a mapped database of existing marine and terrestrial ecosystem resources and services; Provide a mapped database of human settlements and infrastructure; Provided a mapped database of touristic facilities, resources and services; Provide a mapped database of commercial facilities and activities; Provide a mapped database of climatic conditions; Provide a mapped database of historic storm tracks and impacts; Provide a mapped database of geologic, soils and geophysical features; Provide a mapped database of topographic and bathymetric information; Provide a mapped database of tides, waves and currents; Provide a mapped database of sea bottom types; Provide a mapped database of plant and animal species observations; Provide access to fish catch and fisheries trend information; Provide a mapped database of previous research activities; Provide a mapped database of archeological sites; Conduct conservation issue, opportunity and constraint analysis; Conduct conservation suitability assessment; Identify and analyze alternative management scenarios; Delineate and record conservation use zones; 	1				1	1	1	1			1	1	1	1	1	
MFFSD	Department of Fisheries	Section	Manage marine protected areas	<ul style="list-style-type: none"> Develop and manage marine protected areas boundary maps Prepare patrol and marine protected area surveillance plans Monitor human activities within and around marine protected areas Issue and track violation notices Utilize remote sensing techniques to detect illegal activities 																
	Department of Fisheries	Section	Participate in regional marine protection and fisheries initiatives	<ul style="list-style-type: none"> Develop and maintain portions of regional marine databases within Belize territorial waters Conduct special studies Develop and manage data in support of regional collaborative efforts (e.g. Mesoamerican Barrier Reef System (MBRS) study. Develop and disseminate methods and tools for use of GIS for marine protection and fisheries management Participate in regional marine ecosystem monitoring and assessment 																

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MFFSD	Coastal Zone Management Authority and Institute	Section	Manage coastal water quality and monitoring programmes	<ul style="list-style-type: none"> Develop and maintain inventory of coastal and marine resources; Maintain inventory of protected area boundaries and assets; Develop baseline water quality information (chemical, biological, physical properties) and subsequent monitoring updates over time; Leverage the BNSDI to access relevant data from other agencies; Maintain inventory and monitoring of water quality drivers and pressures over time; Provide tools for the spatial and temporal analysis of water quality monitoring information over time; Provide hydrodynamic analysis tools to better understand the relationships between water quality causes and effects; Provide tools for the analysis and visualization of water quality issues in ways that can be clearly understood by a lay audience; Provide analysis tools to model the implications of various intervention options (plans, policies, operations, enforcement, etc.); Establish location-aware social media channels for two way communication between the coastal water using stakeholders and the government. 			1	1	1			1	1				1			1	
MFFSD	Coastal Zone Management Authority and Institute	Section	Conduct manatee research	<ul style="list-style-type: none"> Develop and maintain inventory of manatee habitat; Develop baseline and maintain manatee population census information over time by location; Maintain inventory and monitoring of manatee habitat and population impact drivers and pressures over time; Conduct habitat and population trend analyses; Track tagged animals spatially to understand movement and migration patterns; Provide tools for the analysis and visualization of manatee habitat and population viability issues in ways that can be clearly understood by a lay audience; Provide analysis tools to model the implications of various intervention options (plans, policies, operations, enforcement, etc.); Establish location-aware social media channels for two way communication between the public and the government. 								1					1			1	
MFFSD	Coastal Zone Management Authority and Institute	Section	Manage sport fishing program	<ul style="list-style-type: none"> Track fishing licenses by licensee address and district Provide mobile phone application for voluntary reporting of fish catch information Track commercial sport fishing boat activities Produce maps and charts illustrating sports fish activities and catch statistics 														1			1
MFFSD	Coastal Zone Management Authority and Institute	Section	Carry out coastal planning	<ul style="list-style-type: none"> Develop and maintain inventory of coastal and marine resources and their state over time; Leverage the BNSDI to access relevant data from other agencies; Develop inventory and monitor the characteristics of socioeconomic drivers and pressures on coastal environmental resources and ecosystems over time; Monitor impacts of drivers and pressures on resource and ecosystem state over time; Provide tools for environmental impact forecasts and early warnings; Maintain inventory of protected area boundaries and assets; Support environmental system modeling to understand and forecast complex interactions between ecosystems and manmade and natural systems (e.g. climate change); Provide tools for the analysis and visualization of coastal environmental resource issues in ways that can be clearly understood by a lay audience; Provide analysis tools to model the implications of various intervention options, including the intersection, alignment and cumulative effects of interventions by multiple organizations (plans, policies, operations, enforcement, etc.); Establish location-aware social media channels for two way communication between the coastal stakeholders and the government Monitor and evaluate intervention program effectiveness over time and provide tools, information and multi-stakeholder processes to calibrate interventions over time. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
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MFSD	Coastal Zone Management Authority and Institute	Section	Develop and support education and awareness programmes	<ul style="list-style-type: none"> • Provide the public with access to basic data and easy to understand analysis and visualization regarding coastal environmental issues; • Provide easy to understand visualizations of coastal environmental issues to the local and international media; • Establish location-aware social media channels for two way communication between the coastal stakeholders and the government; • Utilize the BNSDI for streamlining data sharing among coastal stakeholder organizations; • Develop web-based and smart phone applications that orient and sensitize coastal users to the nature and sensitivities that characterize each area; 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
MFSD	Coastal Zone Management Authority and Institute	Section	Manage coastal data	<ul style="list-style-type: none"> • Provide data repository for the development and management of coastal data • Provide geoportal for exploring, locating and accessing coastal data and online data services • Establish standards for coastal resource monitoring data • Establish agreements for the sharing of coastal data among relevant stakeholders • Establish credentials, authority and agreements for selective accessing of sensitive coastal data (endangered species locations, archeological sites, etc.) • Provide online services, templates and tools for field data capture 							1								
MTCCA	Ministry	Section	Oversee portfolio governance	<ul style="list-style-type: none"> • Maintain access to all Ministry geospatial and related data • Facilitate GIS data coordination across the Ministry • Facilitate access to BNSDI data network on behalf of Ministry departments • Monitor and evaluate Ministry department projects and outcomes over time 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MTCCA	Ministry	Section	Represent tourism and aviation sectors in national planning and policy making	<ul style="list-style-type: none"> • Maintain geographically-based inventory of all tourism facilities, attractions and infrastructure; • Maintain geographically-based inventory of all civil aviation facilities and infrastructure; • Monitor tourism development issues and trends; • Develop geographically based analysis of tourism development issues, opportunities and challenges and provide reporting and mapped visualizations to support policy and decision making. 	1	1	1	1		1	1	1	1	1	1	1	1	1	
MTCCA	Ministry	Section	Oversee tourism planning and development	<ul style="list-style-type: none"> • Overview of existing tourism resources in the Country relative to projected or potential future demand; • Overview of the infrastructure and program development of other sectors that could impact tourism development (transport, urban development, environmental resource management plans, public investment plans, etc.); • Monitor tourism facility and infrastructure development; • Monitor and evaluate tourism related revenue and tax generation over time. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MTCCA	Belize Tourism Board	Section	Conduct planning for sustainable national tourism development	<ul style="list-style-type: none"> • Prepare location-based inventory of all touristic facilities, sites and attractions (cultural, nature-based, sun and beach, cruise, nautical, leisure and entertainment); • Map historical and cultural routes; • Assess tourism infrastructure capacity (transportation, water, energy, telecommunications, waste management, sewage, etc.); • Plan, design and implement tourism oriented signage and wayfinding; • Capture and manage tourism activities and revenues by location; • Identify tourism development physical opportunities and constraints; • Assess potential impacts of climate change on existing and potential tourism sites; • Identify opportunities for tourism expansion plans in specific locations; • Prepare and record tourism development plans for specific destinations; • Conduct environmental impact assessments for tourism development plans; • Promote and support private sector investment in tourism development at specific sites; • Provide data and analysis tools for tourism development project formulation and finance; • Monitor tourism development and revenues over time. 	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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MTCCA	Belize Tourism Board	Section	Manage tourism data	<ul style="list-style-type: none"> • Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; • Provide analytical tools to project tourism site, infrastructure and program development based on alternative options and scenarios; • Utilize geospatial tools to develop tourism development analyses and visualizations to keep leadership and investors informed of progress, trends and opportunities for investment. 							1				1	1			1
MTCCA	Belize Tourism Industry Association	Section	Identify and monitor needs and priorities of the BTIA membership	<ul style="list-style-type: none"> • Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; • Provide location-based register of members; • Utilize spatially-enabled social media to establish two-way engagement with membership and illustrate issues and opinions geographically; • Provide membership with information regarding urban, infrastructure and other 												1			1
MTCCA	Belize Tourism Industry Association	Section	Promote sustainable tourism development	<ul style="list-style-type: none"> • Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; • Provide interactive map for the public to explore tourism destinations and facilities in Belize; • Provide geo-enabled interactive map and schedule of cultural events and other activities that would be interesting to tourists. 	1						1	1	1	1		1			1
MTCCA	Belize Tourism Industry Association	Section	Promote tourism development government policies, planning and investment	<ul style="list-style-type: none"> • Provide geographic basemap for recording, analyzing and visualizing current and historical tourism data; • Provide geographic analysis and visualization tools to explain issues, trends or opportunities affecting touristic development in Belize; • Provide a location-based inventory of all touristic and supporting infrastructure public sector investment projects and privately funded developments. 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MTCCA	National Institute for Culture and History	Institute of Archeology	Maintain inventory of archeological sites;	<ul style="list-style-type: none"> • Maintain inventory of archeological sites 							1								
MTCCA	National Institute for Culture and History	Institute of Archeology	Conduct archeological research and education;	<ul style="list-style-type: none"> • Conduct archeological research and education; 	1	1	1	1			1				1	1	1		1
MTCCA	National Institute for Culture and History	Institute of Archeology	Manage archeological parks and reserves.	<ul style="list-style-type: none"> • Manage archeological parks and reserves. 	1	1	1	1			1				1	1	1		1
MTCCA	National Institute for Culture and History	Museums of Belize and Houses of Culture	Develop and manage museum exhibitions and tours	<ul style="list-style-type: none"> • Develop and manage museum exhibitions and tours 	1	1	1	1			1				1	1	1		1
MTCCA	National Institute for Culture and History	Institute for Social and Cultural Research	Conduct social and cultural research and publications;	<ul style="list-style-type: none"> • Conduct social and cultural research and publications; 															
MTCCA	National Institute for Culture and History	Institute for Social and Cultural Research	Promote social and cultural initiatives	<ul style="list-style-type: none"> • Promote social and cultural initiatives 							1				1	1	1	1	1
MFED	All Departments	Section	Planning and design of transportation network facilities and upgrades	<ul style="list-style-type: none"> • Accurate and up to date inventory and condition assessment of existing transportation infrastructure; • Trip origination and destination assessment; • Traffic modeling and capacity analysis; • Identification and analysis of transport network construction and upgrade options; • Identification, formulation and feasibility analysis for transport master plan and associated priority projects. 	1	1	1	1		1	1	1	1	1	1	1	1	1	1

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MFED	All Departments	Section	Bridge construction and refurbishment	<ul style="list-style-type: none"> Inventory and condition assessment of existing bridges; Identify bridge vulnerability to natural disasters and importance to emergency response activities; Identification, formulation and feasibility analysis for priority bridge construction and refurbishing projects. 							1									
MFED	All Departments	Section	Road and highway construction and refurbishment	<ul style="list-style-type: none"> Provide basemap and geophysical data to support roadway and highway engineering design; Provide geographically based project tracking and management system; Produce transportation asset inventory to support maintenance and financial asset management activities; 	1	1	1	1		1	1									
MFED	All Departments	Section	Improve road safety	<ul style="list-style-type: none"> Map and assess traffic accidents and other road safety related events; Analyze road safety issues, opportunities and constraints; Identify road safety intervention measures Prepare plan for road safety intervention actions; Track and manage road safety intervention actions; Monitor and evaluate road safety interventions and calibrate plans to optimize positive impacts and improvements over time. 							1									
MFED	All Departments	Section	Rehabilitation and construction of drainage facilities	<ul style="list-style-type: none"> Assess drainage facility capacity and vulnerability to major storm events; Provide basemap and geophysical data to support drainage facility engineering design; Provide geographically based project tracking system; Produce drainabe asset inventory to support maintenance and financial asset management activities; 				1												
MFED	All Departments	Section	Preparation of feasibility studies for roads and bridges	<ul style="list-style-type: none"> Provide basemap, geophysical and environmental data to support road and bridge feasibility assessments; Provide geographically based bibliography for transportation studies; 	1	1	1	1		1	1									
MFED	All Departments	Section	Improve road and drainage conditions in selected communities as part of poverty alleviation program	<ul style="list-style-type: none"> Provide access to population census socio-economic information to identify the most economically disadvantaged communities and neighborhoods; Utilize poverty information as another dimension for the prioritization of road and drainage capital investment projects 							1									
MFED	All Departments	Section	General improvement of municipal infrastructure and its management	<ul style="list-style-type: none"> Provide access to municipal infrastructure asset information; Provide access to land use and population data; Provide access to land ownership and tenure information; Identify natural hazards and associated vulnerability of municipal infrastructure Provide geospatial tools for municipal infrastructure assessment and planning. 	1	1	1	1		1	1	1	1	1	1	1	1	1	1	
MFED	All Departments	Section	Construction and refurbishment of community facility buildings	<ul style="list-style-type: none"> Provide access to community facility asset information; Provide access to existing land use and population data; Provide access to land use plans and projections; Provide access to land ownership and tenure information; Provide geospatial tools for community facility assessment, planning and siting. 	1	1	1	1		1	1				1	1	1	1	1	
MFED	All Departments	Section	Upgrade and rehabilitation of airstrip facilities	<ul style="list-style-type: none"> Inventory and condition assessment of existing airstrips and helipads; Preparation of upgrade and rehabilitation plans for priority airstrips and helipads; Track and manage airstrip and helipad upgrade projects. 							1			1						
MFED	All Departments	Section	Planning and design of potable water network facilities and upgrades	<ul style="list-style-type: none"> Accurate and up to date inventory and condition assessment of existing potable water infrastructure; Current and near term future water demand analysis; Water system modeling and capacity analysis; Identification and analysis of water network construction and upgrade options; Identification, formulation and feasibility analysis for potable water master plan and associated priority projects. 	1	1	1	1		1	1									
MFED	All Departments	Section	Design of potable water supply systems and upgrade projects	<ul style="list-style-type: none"> Provide basemap and geophysical data to support potable water facility engineering design; Provide geographically based project tracking system; Produce potable water system asset inventory to support operations and maintenance and financial asset management activities; 	1	1	1	1		1	1									

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MFED	All Departments	Section	Construction and upgrading of potable water production and storage facilities	<ul style="list-style-type: none"> Provide access to water resource master plan information Provide basemap and geophysical data to support potable water production engineering design; Provide geographically based project tracking system; Produce potable water production system asset inventory to support operations and maintenance and financial asset management activities 	1	1	1	1		1	1							
MFED	All Departments	Section	Construction and upgrading of water supply network	<ul style="list-style-type: none"> Provide basemap and contextual data to support water supply network engineering design; Provide geographically based project tracking system; Produce water supply network asset inventory to support maintenance and financial asset management activities; 	1	1	1	1		1	1							
MFED	All Departments	Section	Improve rural water and sanitation governance	<ul style="list-style-type: none"> Inventory and assessment of rural water supplies, including quantity and quality of extracted water; Inventory and assessment of sanitation facilities; Provide access to rural building and population data; Establish a mapped basis indicating the location and jurisdiction of all local water boards. 	1	1	1	1	1	1	1							
MFED	All Departments	Section	Construction and upgrading of sanitary sewer system	<ul style="list-style-type: none"> Accurate and up to date inventory and condition assessment of existing sanitary sewer infrastructure; Provide access to existing and planned land use information; Current and near term future sewer system demand analysis; Sewer system modeling and capacity analysis; Identification and analysis of sewer network construction and upgrade options; Identification, formulation and feasibility analysis for sewer master plan and associated priority projects. 			1				1							
MFED	All Departments	Section	Institutional capacity building for water system governance	<ul style="list-style-type: none"> Incorporate GIS management and technical capacity building in to the water system governance program 	1	1	1	1		1	1							
MFED	All Departments	Section	Development of solar energy generation demonstration project	<ul style="list-style-type: none"> Conduct geospatial siting analysis for optimum location for solar energy generation demonstration project; 	1													
MFED	All Departments	Section	Provision of electricity from renewable energy sources to rural and peri-urban areas	<ul style="list-style-type: none"> Conduct geospatial analysis for high potential renewable energy sources (solar, hydro, biomass, wind, etc.); Identification of rural and peri-urban economically disadvantaged neighborhoods; Identification, formulation and feasibility analysis for sewer master plan and associated priority projects. 		1	1	1			1							
MFED	All Departments	Section	Extend electrical services to disadvantaged communities	<ul style="list-style-type: none"> Identification of economically disadvantaged neighborhoods; Identification, formulation and feasibility analysis for electrical network extension projects. 	1						1							
MFED	All Departments	Section	Plan, design and implement agriculture services program	<ul style="list-style-type: none"> Develop a geographically based inventory of the existing and potential demand for agricultural services; Develop a geographically based inventory of the existing and planned provision of agricultural services; Conduct a geographically based gap analysis between the demand for agricultural services and the existing and planned supply programs and activities; Prepare plan for the augmentation of agricultural services to fill gaps; Monitor and evaluate agricultural service provision and use findings to calibrate service provision programs for maximum positive impact 							1							
MFED	All Departments	Section	Promote and support the development of integrated farming systems	<ul style="list-style-type: none"> Provide geographically based farm inventory; Assess potential and readiness for integrated farming system introduction; Prepare plan for outreach and capacity building program; Monitor program execution; Monitor and evaluate program outcomes over time, and calibrate plans and activities to reflect lessons learned and evolving context. 							1							
MFED	All Departments	Section	Upgrade research and extension facilities	<ul style="list-style-type: none"> Add GIS and utilization of the information resources of the BNSDI as a focal research and extension support function within the agricultural sector 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	All Departments	Section	Conduct farmer training and capacity	<ul style="list-style-type: none"> Support farmer training and extension service capacity building 							1				1			1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES						
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry		
			building activities																		
MFED	All Departments	Section	Prepare agriculture irrigation and drainage policy and national strategic plan	<ul style="list-style-type: none"> • Provide national inventory and assessment of farms; • Identify irrigation and drainage issues; • Prepare geographically based agriculture irrigation and drainage strategy. 				1													
MFED	All Departments	Section	Conduct community project for improvement of agriculture production for poor families	<ul style="list-style-type: none"> • Provide access to population census socio-economic data at the community and neighborhood levels; • Identify target populations for improvement of agricultural production; • Assess and record community level needs and priorities; • Prepare and record community based agriculture production improvement mechanisms; • Track and manage community based agriculture production improvement mechanisms; • Monitor and evaluation the effectiveness of community based agriculture production improvement activities and calibrate plans and activities to optimize positive impact over time. 							1				1					1	
MFED	All Departments	Section	Promote and provide training for better agriculture technology and methods	<ul style="list-style-type: none"> • Provide access to population census socio-economic data at the community and neighborhood levels for rural areas; • Provide access to geographically based agricultural census; • Identify target beneficiary communities for training, and define the technologies and methods that may be appropriate for each based on existing situation and context. • Track training activities geographically; • Monitor and evaluate program outcomes over time. 							1				1						1
MFED	All Departments	Section	Support the expansion of rice seed production	<ul style="list-style-type: none"> • Provide access to geographically based agricultural census; • Inventory and assess existing rice cultivation and identify areas for potential future expansion; • Track seed distribution; • Monitor and evaluate rice production over time and adjust program efforts to maximize positive outcomes. 							1				1						1
MFED	All Departments	Section	Promote and provide training for better food processing technology and methods	<ul style="list-style-type: none"> • Provide access to population census socio-economic data at the community and neighborhood levels for rural areas; • Provide access to geographically based agricultural census; • Provide geographically based inventory of existing food processing plants including accounting of what technologies are being used currently; • Identify target beneficiary stakeholders for training for food processing technologies and methods; • Track training activities geographically; • Monitor and evaluate program outcomes over time. 							1				1						1
MFED	All Departments	Section	Promote and provide training for better aquaculture technology and methods	<ul style="list-style-type: none"> • Provide access to population census socio-economic data at the community and neighborhood levels for rural areas; • Provide access to geographically based agricultural census, inclusive of aquaculture sites; • Identify target beneficiary stakeholders for training for aquaculture technologies and methods; • Track training activities geographically; • Monitor and evaluate program outcomes over time. 							1				1						1
MFED	All Departments	Section	Conduct capacity building to improve agriculture disease management	<ul style="list-style-type: none"> • Provide geographically based agriculture disease and pest monitoring and assessment system; • Establish mobile phone based agricultural extension service for disease diagnosis; • Track disease incidence and spread; • Develop and apply intervention strategies to stop disease spread; • Monitor and evaluation system effectiveness over time and improve/refine systems based on lessons learned and new disease or pest challenges/ 							1				1						1
MFED	All Departments	Section	Conduct national cattle testing and certification program	<ul style="list-style-type: none"> • Provide access to geographically based agricultural census, inclusive of cattle farming sites; • Prepare cattle testing and certification plan; • Conduct and track cattle testing and certification activities; • Track meat products from farm to fork or export. 							1				1						1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
MFED	All Departments	Section	Prepare master plan for the improvement of sustainable tourism	<ul style="list-style-type: none"> Prepare inventory of existing high potential tourism resources and facilities Assess resource pressures and sustainability; Assess potential for diversification of overnight tourism product for emerging destinations 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	All Departments	Section	Support targeted lending	<ul style="list-style-type: none"> Identify areas for targeted lending based on criteria (low-income housing, agriculture, industrial development, etc.); Conduct feasibility and lending risk analysis; Monitor and evaluation loan performance and development outcomes. 							1							
MFED	All Departments	Section	Support capacity building for Belize Coalition of Service Providers	<ul style="list-style-type: none"> Record location and characteristics of Coalition members; Monitor and assess program member performance 	1	1					1				1			1
MFED	All Departments	Section	Support financial services for poor farmers and rural communities	<ul style="list-style-type: none"> Conduct population data analysis to identify target neighborhoods; Inventory and record access to existing financial services; Conduct geographically based analysis of financial service gaps; Prepare master plan for improvement of specific financial services within each target community, neighborhood or farming area; Track and assess utilization of financial services over time. 	1	1					1				1			1
MFED	All Departments	Section	Administer small scale enterprise grants	<ul style="list-style-type: none"> Identify target areas for small scale enterprise grants; Track the location and characteristics of grant applications; Conduct rapid feasibility analysis for small grant applications and advise candidates of areas for improvement; Track the location, characteristics and performance of grantee enterprises 	1	1	1	1		1	1	1	1		1			1
MFED	All Departments	Section	Promote and support rural household employment in gardening and horticulture	<ul style="list-style-type: none"> Identify target areas and populations; Prepare outreach and engagement program by area; Track and monitor program activities 							1							
MFED	All Departments	Section	Plan, design and support development of specialized economic development facilities	<ul style="list-style-type: none"> Assess areas for special economic development (e.g. Maya House of Cacao and Chocolate Museum or National Enterprise Development Center) Conduct geographic siting analysis; Provide geographically based project tracking system; Monitor and evaluate 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	All Departments	Section	Improvement of land management capacity	<ul style="list-style-type: none"> Inventory and characteristics of land ownership and tenure status for all lands in Belize Provide tools for the processing and tracking of land tenure transactions; Provide access to land tenure information by all agencies involved in land administration, management and infrastructure activities; 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	All Departments	Section	Improvement of solid waste management capacity	<ul style="list-style-type: none"> Prepare geographically based assessment of current and projected future waste stream processes; Conduct landfill siting analysis in consideration of waste generation, transport and environmental issues, opportunities and constraints; Monitor and evaluate landfill operations and impacts over time. 	1	1	1	1	1	1	1							
MFED	All Departments	Section	Strengthen protected areas management	<ul style="list-style-type: none"> Provide mapped inventory of the location, boundaries and resources of each land or marine protected areas; Identify key threats to each protected area; Conduct protected area gap analysis (spatial, policy, legal, etc.) Prepare and implement protected area strengthening plan; Monitor effectiveness of protected area management programs over time 							1				1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
MFED	All Departments	Section	Strengthen capacity for climate change adaptation planning and reporting	<ul style="list-style-type: none"> • Provide access to relevant information from all sectors • Conduct climate change hazard assessment; • Conduct climate change vulnerability assessment for populations, infrastructure and resources at risk; • Develop plans for climate change adaptation in all sectors; • Monitor climate change variables and calibrate adaptation schemes according to observations and refined projections over time; • Calculate and report on carbon emission reductions, climate change observations, planning and reporting to the UNFCC COP and other venues. 														
MFED	All Departments	Section	Manage marine fisheries	<ul style="list-style-type: none"> • Inventory and assessment of commercial and recreational fish stock within Belize territorial waters; • Prepare fisheries forecasts under status quo; • Define sustainable fisheries intervention options and assess the environmental and economic impacts of each; • Develop and record sustainable fisheries program; • Implement fisheries management programs, including definition of enforcement areas and actions to be taken; • Record and manage fisheries program assets; • Support public education programs with map and geographic visualizations regarding fisheries issues and responses; • Monitor fisheries conditions and calibrate programs to maintain sustainability over time. 														
MFED	All Departments	Section	Manage pollutant release and transfer registration	<ul style="list-style-type: none"> • Register geographically and report permitted and accidental pollutant releases to land, sea and air; • Track the transfer of hazardous chemicals; • Assess potential hazards and vulnerabilities for pollutant and hazardous material storage, transfer, or accidental release; • Prepare and record emergency response contingency plans for pollutant and hazardous material release; • Support the management of cleanup and recovery efforts following accidental pollutant or hazardous material release; • Monitor environmental and social cumulative impacts of permitted pollutant release over time. 			1	1			1	1			1	1	1	1
MFED	All Departments	Section	Enhancement of education policies, strategies and facilities	<ul style="list-style-type: none"> • Mapped inventory and assessment of schools and school facilities, assets, students and programs; • Identification of education targets and gaps by school district; • Identification of policies and strategies needed to improve the education sector nationally and specific foci within each district; • Identification of requirements for new schools, or the extension or refurbishment of existing schools; • Identification of community specific teacher training program requirements; • Provide a geographically based school project tracking and management system; • Provide a geographically based school facility space planning, maintenance and asset management system. 	1	1	1	1		1	1		1			1		
MFED	All Departments	Section	Control and prevention of HIV/AIDS	<ul style="list-style-type: none"> • Provide a geographically based inventory of current and past HIV/AIDS incidence; • Identify exposed and vulnerable populations to HIV/AIDS spread; • Develop geographically targeted programs to control and prevent HIV/AIDS spread; 							1				1			
MFED	All Departments	Section	Improvement of children's health and nutrition	<ul style="list-style-type: none"> • Provide access to population census data at the neighborhood level; • Identify poorest and most vulnerable populations; • Inventory and assess capacity of existing NGO's and community based organizations; • Develop and record geographically based assessment of child health and nutrition issues in target communities and neighborhoods; • Develop and record child health and nutrition intervention strategies at the community and neighborhood levels; • Support the development of community based programs to enhance child health and nutrition programs; • Monitor and assess child health and nutrition program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1	1	1		1	1	1	1		1		1	

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
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MFED	All Departments	Section	Improve health conditions among the poorest populations	<ul style="list-style-type: none"> • Provide access to population census data at the neighborhood level; • Identify poorest and most vulnerable populations; • Inventory and assess capacity of existing NGO's and community based organizations; • Develop and record geographically based assessment of local health conditions; • Develop and record health improvement strategies at the community and neighborhood levels; • Support the development of community based programs to enhance community health initiatives; • Monitor and assess health program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1	1	1	1	1	1	1	1	1	1	1		
MFED	All Departments	Section	Develop plans for the achievement of target MDG's	<ul style="list-style-type: none"> • Provide access to multi-sector data that relates to MDG's; • Conduct MDG assessment at the community and neighborhood levels to the extent this can be supported by available information; • Develop community level requirements analysis for the achievement of target MDG's; • Develop and record community level interventions for the achievement of target MDG's; • Implement and track intervention program activities; • Monitor and assess health program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1	1	1		1	1	1		1		1		
MFED	All Departments	Section	Support the development of social transformation and poverty alleviation projects	<ul style="list-style-type: none"> • Provide access to community level analysis of social and economic conditions and trends; • Geocode neighborhood social and economic surveys; • Support neighborhood level analysis of social and economic issues and opportunities; • Develop and assess alternative program elements for addressing social and economic issues; • Plan and implement social programs and track progress at the community and neighborhood levels; • Monitor and assess social and economic program effectiveness over time and calibrate programs to maximize positive outcomes. 	1	1	1	1		1	1	1		1		1		1
MFED	All Departments	Section	Conduct customs reform	<ul style="list-style-type: none"> • Support the capture of trade data include recording for good the point of entry and shipping destination 							1	1	1	1				
MFED	All Departments	Section	Computerization of Driver's Licensing system	<ul style="list-style-type: none"> • Support the standardization and integration of the nationwide system; • Support geocoding of driver home address; • Support linkage of driver license information to geocoded traffic ticket and accident reports; 							1				1			
MFED	All Departments	Section	Assessment and upgrade to the PSIP-MIS	<ul style="list-style-type: none"> • Provide a foundation for recording and tracking PSIP's by location; • Provide access to geospatial information from all sectors to support better project formulation and appraisal; • Assess PSIP geographic distribution and potential interrelationships, providing a basis for better project coordination and alignment; • Provide tools for the reporting of project status, monitoring and evaluation according to the requirements of each donor or IFI; • Provide geographic based tools for PSIP monitoring and evaluation, individually and cumulatively. 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	All Departments	Section	Enhance rural development program activities	<ul style="list-style-type: none"> • Provide geographic based assessment of rural development issues, opportunities and constraints; • Develop and maintain location-based inventory of rural small and medium sized micro-enterprises; • Assess infrastructure requirements and gaps for rural small and medium sized micro-enterprises; • Develop community and neighborhood specific plans for the enhancement of rural small and medium sized micro-enterprises. 	1	1	1	1		1	1	1	1		1	1	1	1
MFED	All Departments	Section	Develop and manage disaster risk management plan	<ul style="list-style-type: none"> • Assess natural disaster risks nationally; • Identify vulnerable populations, infrastructure and resources at risk; • Prepare disaster mitigation and emergency response contingency plans; • Identify and record the locations and inventory of government owned and other potential disaster response assets; • Support disaster response activities; • Support disaster cleanup and recovery process; • Support disaster resistant community planning and design; • Monitor climate change trends, forecast impacts to disaster emergency preparedness and calibrate planning and emergency preparedness plans over time. 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
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MFED	All Departments	Section	Support public safety and crime prevention	<ul style="list-style-type: none"> • Provide data and tools to support crime analysis and response support; • Provide a basis for geocoding crime incidents; • Provide geographic map basis for computer aided police dispatch; • Provide vehicle tracking capability. 							1				1	1	1	1	1
MFED	All Departments	Section	Support fire safety	<ul style="list-style-type: none"> • Conduct geographically based assessment of fire hazard and vulnerability; • Provide geographic basis for the inventory and assessment of existing fire response facilities and assets; • Assess the need for and siting of new fire stations; • Assess the need for and siting of new fire hydrants. 		1					1				1				
MFED	Central Information Technology Organization	Section	Develop and oversee ICT plans, policies, procedures, guidelines and standards.	<ul style="list-style-type: none"> • Ensure that ICT policies, procedures, guidelines and standards reflect and support matters that are specific to geospatial data and application services and the objectives of the BNSDI; 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Central Information Technology Organization	Section	Design and development of e-solutions and government-wide applications	<ul style="list-style-type: none"> • CITO is currently facilitating acquiring a government site license for ESRI's ArcGIS software; • Beyond the basic software and associated functional modules there will be a variety of geospatial services that could be useful for multiple organizations. Consideration will need to be given to where and how these services should be provided to the BNSDI community 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Central Information Technology Organization	Section	Provide data center and internet services	<ul style="list-style-type: none"> • Ensure that the current and planned GoB network considers and can support the type and level of network traffic that could be generated through the BNSDI. 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Central Information Technology Organization	Section	Provide information security services	<ul style="list-style-type: none"> • Establish a geospatial data security framework within the overall ICT security strategy • Ensure that proper credentials and channels are established to allow access to sensitive geospatial data only by authorized persons 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Central Information Technology Organization	Section	Develop and implement E-Government and ICT policies, strategy and plan of action	<ul style="list-style-type: none"> • Coordinate closely with BNSDI to ensure geospatial matters are well represented in national e-Gov and ICT policy frameworks and strategies 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Central Information Technology Organization	Section	Provide ICT related training to government employees and the general public	<ul style="list-style-type: none"> • Incorporate basic GIS awareness as part of basic ICT training • Ensure universal access to GIS technical training for interested government employees and the public • Provide GIS as one component of a "Leadership and Technology" summit aimed at raising the awareness of country leadership in regards to the use of information technology as a component of progressive government transformation 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Central Information Technology Organization	Section	Conduct eGovernment and ICT stakeholder engagement and coordination across government	<ul style="list-style-type: none"> • Facilitate geospatial special interest group participation in e-Government for a • Align BNSDI with e-Government stakeholder community engagement programs 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Statistical Institute Belize	Section	Collect, compile and analyze statistical information	<ul style="list-style-type: none"> • Compile place-based statistical information across all sectors • Develop statistical thematic maps by administrative areas • Provide tools for field survey data capture • Conduct geostatistical analysis of place-based data • Access multi-sector data from other organizations for geostatistical analysis • Provide geostatistical mapping and graphics • Produce geostatistical maps and outputs for statistical atlas of Belize 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Statistical Institute Belize	Section	Conduct population census - Census Planning and Preparations	<ul style="list-style-type: none"> • Utilize GPS and/or national building database to assist in planning enumeration areas and to establish exact coordinates for most household locations; • Use up to date high resolution imagery to verify that all settled areas are being accounted for in the census; • Provide accurate and up to date maps to support pre-census household count verification; • Produce electronic enumeration district maps to be used by enumerators 	1	1	1	1		1	1	1	1	1	1	1			1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
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MFED	Statistical Institute Belize	Section	Conduct census taking	<ul style="list-style-type: none"> • Provide enumerators with location-aware devices to capture information in digital form in the field while also verifying location; • Track and monitor census taking activities and status on a daily basis; • Expedite data quality assurance and control workflow 	1	1	1	1		1	1	1	1		1	1			1
MFED	Statistical Institute Belize	Section	Census publishing and distribution	<ul style="list-style-type: none"> • Support the delineation of statistically logical census reporting areas based on population numbers and typologies (not restricted to original enumeration districts); • Publish census maps and statistics online for immediate consumption by all stakeholders; • Provide tools to support download of population census information to various formats for use by stakeholders in other systems. 	1	1	1	1		1	1	1	1		1	1			1
MFED	Statistical Institute Belize	Section	Conduct between-census population estimation	<ul style="list-style-type: none"> • Provide tools to tie between-census household surveys to specific locations, and to extrapolate that information to derive place-specific estimations of population change 							1								
MFED	Statistical Institute Belize	Section	Conduct special analysis of population data	<ul style="list-style-type: none"> • Generate population and socioeconomic statistics by police beat; • Generate population and socioeconomic statistics for settled areas with no official boundaries; • Generate population and socioeconomic statistics by electrical distribution feeder area, water pressure zone, or sewer collection area; • Derive consumer profile maps based on profiles provided by commercial vendors of products and services; • Generate probably public transit ridership statistics by block face; • Identify financially vulnerable populations down to the block level; 															
MFED	Statistical Institute Belize	Section	Publish and disseminate statistical information	<ul style="list-style-type: none"> • Support the delineation of statistically logical reporting areas based on analysis of location-based raw data; • Publish statistic maps and statistics online for immediate consumption by all stakeholders; • Provide tools to support download of geostatistical information to various formats for use by stakeholders in other systems. 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Statistical Institute Belize	Section	Develop special products	<ul style="list-style-type: none"> • Provide online tools for different views and combinations of geostatistical information • Provide geostatistical analysis services upon request • Provide online geostatistical atlas • Plan and manage special surveys; • Conduct geospatial analysis to derive statistical summaries (e.g. average distance between students and where they go to school, persons within walking distance of a park, etc.); • Create geostatistical summaries and analyses from existing geospatial data from other agencies; • Produce geostatistical visualizations to better communicate key issues to decision makers and the public; 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Statistical Institute Belize	Section	Conduct original surveys	<ul style="list-style-type: none"> • Provide tools for location-based field collection 							1	1	1	1	1	1	1	1	1
MFED	Statistical Institute Belize	Section	Compile economic statistics	<ul style="list-style-type: none"> • Utilize location-specific business and revenue information to prepare neighborhood and community level economic statistics 							1				1	1			1
MFED	Statistical Institute Belize	Section	Research and implement new methods and technologies	<ul style="list-style-type: none"> • Provide tools for location-based field data collection; • Explore use of heterogenous data sources with algorithms for statistical pattern analysis for new insights; • Test effectiveness of various geostatistical visualizations for communicating issues and concepts • Test tools and methods for real-time analysis of information from sensor networks • Test new geostatistical tools application to existing raw data 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MFED	Social Investment Fund	Section	Identify potential projects	<ul style="list-style-type: none"> • Provide a geospatial reference to submitted project requests; • Provide a map interface to access and track submitted project requests over time. 							1								

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
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MFED	Social Investment Fund	Section	Conduct community needs and assets assessments;	<ul style="list-style-type: none"> • Provide access to neighborhood level socioeconomic data; • Provide access to development and environmental context data; • Provide access to community infrastructure information; • Identify community level natural hazards and vulnerabilities, including those related to climate change; • Link community needs surveys to location for current and future reference; • Utilize location-aware social media to solicit feedback from community members; 		1	1	1	1	1	1	1	1	1	1	1	1	1
MFED	Social Investment Fund	Section	Carry out project appraisals	<ul style="list-style-type: none"> • Provide access to wide variety of socioeconomic, infrastructure and environmental data to support needs and feasibility assessment; • Utilize available data to explain issues and opportunities to community leaders and residents; • Track project proposal status geographically. 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	Social Investment Fund	Section	Facilitate project approval process	<ul style="list-style-type: none"> • Provide data, visualization and reporting tools to support presentation of proposed projects to the Board of Directors; • Provide data, visualization and reporting tools to support presentation of proposed projects to international finance institutions. 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	Social Investment Fund	Section	Manage project bidding process	<ul style="list-style-type: none"> • Provide bidders with contextual information needed for preparing responsive bid; • Provide a map that indicates the location of all registered contractors; • Track what projects were carried out by what contractors over time as a historical reference; 	1	1	1	1		1	1	1	1	1	1	1	1	1
MFED	Social Investment Fund	Section	Supervise project implementation	<ul style="list-style-type: none"> • Link project management and status reporting information to project locations on a map; • Create thematic maps indicating location, characteristics and status of all projects being undertaken; • Provide a compiled and geo-located history of all projects overseen by BSIF 							1							
MFED	Social Investment Fund	Section	Conduct monitoring and evaluation	<ul style="list-style-type: none"> • Monitor and assess the specific and cumulative outcomes of development projects 	1	1	1	1		1	1	1				1	1	1
MFED	Social Investment Fund	Section	Maintain contractor registry	<ul style="list-style-type: none"> • Maintain geocodes for contractor office locations 														
MOH	All Departments	Section	Provide medical laboratory services;	<ul style="list-style-type: none"> • Provide ability to link medical samples and test results to geographic locations; • Provide selected access to geographically referenced test results for use by planners and researchers. 							1				1			
MOH	All Departments	Section	Manage medical stores;	<ul style="list-style-type: none"> • Record and display geographic locations of all public health facilities and health centers; • Track delivery of medical supplies nationally; • Provide spatially enabled dashboard showing the status of supplies in all health facilities and centers; • Produce statistical maps and reports of medical supply usage at the facility level; • Assess the location effectiveness of existing medical supply facilities and site new facilities; • Provide planners and research analysts with access to dispensary data as part of early warning system for disease outbreaks. 							1				1			
MOH	All Departments	Section	Provide public dental services;	<ul style="list-style-type: none"> • Provide map of all facilities where public dental services are offered; • Track and monitor mobile clinic locations and history; • Track and monitor urban and rural school dental visits and history; • Utilize location-aware social media for connecting with dental patient community; • Assess the location effectiveness of existing dental health facilities and services and site new programs; • Analyze dental service delivery facilities relative to population census information; • Produce statistical reports and maps concerning dental health at the community level; • Track and analyze dental service delivery by locations over time. 							1				1			

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
MOH	All Departments	Section	Support environmental health;	<ul style="list-style-type: none"> Track and monitor the locations of reported environmental health issues; Assess conditions where environmental health issues arise; Utilize population census data to assess potential exposures to environmental health issues; Utilize location-aware social media to engage with the public in regards to environmental health issues; Analyze environmental health issues and trends over time; Produce statistics concerning environmental health issues at the community level; Monitor and assess effectiveness of responses to environmental health issues over time 	1	1	1	1		1	1				1		1		
MOH	All Departments	Section	Monitor and assess chronic and communicable disease;	<ul style="list-style-type: none"> Track and monitor the locations of reported chronic and communicable disease incidents; Assess contextual conditions where epidemiological and chronic disease conditions arise; Utilize population census and public facility data to assess potential exposures to disease outbreaks; Utilize location-aware social media to engage with the public in regards to communicable and chronic disease issues; Plan and track disease outbreak intervention activities; Analyze communicable and chronic disease issues and trends over time; Produce statistical reports and maps regarding communicable and chronic disease at the community level; Monitor and assess effectiveness of responses to disease outbreaks and chronic health issues over time. 		1	1	1			1	1	1	1	1	1	1	1	1
MOH	All Departments	Section	Manage health education and participation bureau program;	<ul style="list-style-type: none"> Monitor public health issues across the country geographically; Assess historical, current and project future public health conditions and trends; Assess public health issues relative to population census segments; Prepare maps and reports to assist in communicating public health issues and programs to the public; Utilize a map interface to support public health information access, sharing and analysis country-wide; Produce statistics concerning health education and public participation at the community level; Utilize location-aware social media to support two-way engagement with the public in regards to health related issues 															
MOH	All Departments	Section	Manage maternal and child health program;	<ul style="list-style-type: none"> Record and access mapped locations of urban and rural health centers; Provide access to birth data; Provide access to population census information and annual updates; Record and monitor pre and postnatal care services by patient location and health care facility; Record and track child immunizations by child home location and health care facility; Record and track micronutrient delivery areas; Record and monitor immune-preventable disease incidents in children by location; Record and track HIV incidents by patient home location; Produce statistics regarding maternal and child health issues at the community level; Assess the location effectiveness of existing maternal and child health facilities and services and site new programs; Record, analyze and track acute respiratory infections in children Monitor, report and evaluate effectiveness of maternal and child health care program interventions over time. 							1						1		
MOH	All Departments	Section	Manage mental health program;	<ul style="list-style-type: none"> Record and access mapped locations of urban and rural mental health program facilities; Provide access to population census data; Record and monitor mental health cases; Monitor mobile clinic facility locations and movements; Track mental health issues and trends geographically across the country; Assess the location effectiveness of existing mental health facilities and services and site new facilities and service programs; Produce national statistics concerning mental health issues and trends at the community level; Monitor, report and evaluate effectiveness of mental health care program interventions over time. 							1						1		

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
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MOH	All Departments	Section	Manage nutrition and healthy lifestyle promotion program;	<ul style="list-style-type: none"> • Monitor and track health and lifestyle conditions and trends nationally; • Provide access to population census data at the neighborhood level; • Provide access to Ministry of Health health statistics at the community level; • Map and track nutrition education and outreach activity locations; • Provide interactive online maps regarding the conditions and trends of health and lifestyle issues for access by the public; • Support research and analysis on health and lifestyle issues in Belize; • Monitor and evaluate the effectiveness of public health interventions on health and lifestyle condition is Belize. 							1						1		
MOH	All Departments	Section	Manage pharmaceutical services and supplies;	<ul style="list-style-type: none"> • Provide map locations for all government pharmacies; • Provide map locations for all licensed pharmacies; • Track all over the counter and prescriptions provided at each pharmacy. Ideally this would be a real-time system that could be used as an early warning system for disease outbreak; • Monitor pharmaceutical inventories geographically; • Provide access to population census information; • Assess the location effectiveness of existing pharmacies and site new facilities and service programs. 							1						1		1
MOH	All Departments	Section	Conduct public health planning and policy development;	<ul style="list-style-type: none"> • Analyze public health issues and trends nationally; • Record, monitor and assess the effectiveness of public health facilities and services across the country; • Compare public health statistics and indicators at the community level relative to national and international standards; • Define and model the potential impacts in public health planning and policy scenarios 	1	1	1	1		1	1				1		1		
MOH	All Departments	Section	Manage health sector reform project;	<ul style="list-style-type: none"> • Geographically based analysis of public and private health facility and service demand and supply; • Support the formulation of public health sector policies, facilities, services and operations plans and strategies; • Track and monitor projects geographically; • Monitor and evaluate impacts of health sector reform community, district and national levels. 	1	1	1	1		1	1				1		1	1	1
MOH	All Departments	Section	Develop and manage public health information system	<ul style="list-style-type: none"> • Manage geospatial component of all health information records 							1				1		1		
MNS	Police Department	HNCIB	Investigate crimes	<ul style="list-style-type: none"> • Geocode crimes, incidents and complaints to locations; • Conduct crime analysis, including the assessment of the geographic patterns of crimes over time; • Manage and retrieve crime case file information by location; • Trace car navigation system information; 							1				1				
MNS	Police Department	Special Branch	Conduct internal intelligence gathering and analysis	<ul style="list-style-type: none"> • Capture, manage, distribute and correlate geo-intelligence information among multiple organizations; • Track gun and ammunition sales and use by location; • Define and assess infrastructure and resources vulnerability; • Develop contingency response plans; • Monitor and track suspicious land, air and sea vessel traffic; 							1	1	1	1	1	1	1	1	1
MNS	Police Department	Commander Operations	Conduct police dispatch activities	<ul style="list-style-type: none"> • Capture, manage, distribute and correlated geo-intelligence information among multiple organizations; • Map and monitor suspected drug production, transport and distribution networks; • Develop and implement intervention plans. 							1	1	1	1	1	1	1	1	1
MNS	Police Department	Commander Operations	Conduct drug intervention activities	<ul style="list-style-type: none"> • Capture, manage, distribute and correlated geo-intelligence information among multiple organizations; • Map and monitor suspected drug production, transport and distribution networks; • Develop and implement intervention plans. 							1	1	1	1	1	1	1	1	1
MNS	Police Department	Commander Operations	Monitor and track released felons	<ul style="list-style-type: none"> • Track released felons by residential and work address or other geographic location; • Make released felon information accessible for crime analysis and related policing functions; • Support and track probation officer activities 							1				1	1	1	1	1

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MNS	Police Department	Commander Operations	Carry out preventative patrols	<ul style="list-style-type: none"> Monitor locations of incidents, complaints, and reports; Monitor released felon locations; Utilize geospatially enabled social media to strengthen interface with local neighborhoods; Geospatially enabled computer aided dispatch; Crime analysis and asset deployment management; Fleet tracking and management. 							1				1	1	1	1	1
MNS	Police Department	Commander Operations	Conduct gang suppression activities	<ul style="list-style-type: none"> Tracking gang areas and activities; Tracking of released felons with gang associations; Utilize geospatially enabled social media to strengthen interface with local neighborhoods; Crime analysis and asset deployment management; Track known gang member residence by address; Monitor gun and ammunition purchase and use. 							1				1	1	1	1	1
MNS	Police Department	Commander Operations	Conduct national traffic management	<ul style="list-style-type: none"> Record and analyze traffic accidents by location Develop and maintain inventory of traffic safety signage, markings, pedestrian crossings and other relevant features Analyze traffic accident concentrations and trends over time Produce traffic accident analysis and statistical output maps and reports 							1				1				
MNS	Police Department	Commander Operations	Conduct special patrol operations	<ul style="list-style-type: none"> Prepare special patrol plans; Provide common operating picture for special patrol activities; Monitor and track special patrol activities. 							1								
MNS	Police Department	Commander Operations	Support joint emergency response	<ul style="list-style-type: none"> Maintain inventory of security staging facilities and equipment Identify security risks associated with natural hazard vulnerable populations, facilities and infrastructure Support preparation of the security component of the national emergency contingency and response plans Provide access to common operating picture mapping during emergency response Provide tools for tracking vehicles and human resources during emergency response 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
MNS	Police Department	Police Information Technology Unit	Conduct facility and asset management	<ul style="list-style-type: none"> Develop and maintain inventory of police facilities, fixed and movable assets Prepare maintenance plans and contracts Maintain police facility space plans Plan and conduct maintenance inspections Plan for facility and equipment refurbishment and replacement 							1				1				
MNS	Police Department	Police Information Technology Unit	Develop, manage and operate crime information system	<ul style="list-style-type: none"> Provide GIS support to address the needs of the Belize Police Department Maintain facility map and records for police ICT network assets Support GIS training for police personnel Provide online mapping capability Provide geospatial tools for application development ICT geospatial research, assessment, testing and documentation Administration and Training of all ICT services including GIS Provide GIS tools for the development, infrastructural management and administration of the Crime Information Management System (CIMS) Support ICT Crisis Emergency Response Support location-based public education and communication (social network) Support geospatial aspects of systems analysis GIS software development Crime Mapping Geospatial data quality assurance Geospatial analysis of CIMS records 	1	1	1	1		1	1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
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Regional	CCCCC	Sections	Conduct climate modeling;	<ul style="list-style-type: none"> Analyze and assess climate conditions and trends; Refine regional models utilizing locally available national data; Provide input to climate change vulnerability analysis; Monitor and refine trend forecasts and vulnerability assessments over time. 														
Regional	CCCCC	Sections	Conduct CARIWIG Project;	<ul style="list-style-type: none"> Assess climate change related hazards and vulnerabilities Compile and manage from hydro-meteorological and environmental data Prepare hazard and vulnerability maps Train project participants in climate change tools and methods 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	CCCCC	Sections	Manage SIDS DOCK Program;	<ul style="list-style-type: none"> Conduct renewable energy potential geographic analysis; Prepare inventory and assessment of existing energy supply and demand; Support Climate-Smart energy program planning and development; Provide a repository (knowledge network) of data and information regarding the application of geospatial tools and data to renewable energy planning and development; Support renewable energy project formulation and feasibility assessment; Support renewable energy project engineering and design; Provide asset management framework for renewable energy system operations and maintenance; Monitor and evaluate single and cumulative project effectiveness over time. 	1					1	1				1	1	1	1
Regional	CCCCC	Sections	Manage Pilot Program for Climate Resilience:	<ul style="list-style-type: none"> Develop and pilot geospatial tools, techniques and data modeling sound practices and standards for climate risk assessment and resiliency planning; Support capacity building for use of geospatial technology and methods; Support integrated surveillance system (ISS) and early warning systems for vector borne disease; Develop and disseminate geospatial tools and methods for improving regional climate monitoring and projections, and applying multi-sector (water, health, agriculture and marine) adaptation strategies; Provide framework for scaling pilot geospatial tools and methods to other countries and regionally; Establish NSDI in member countries to institutionalize optimum coordination, information sharing and utilization for climate-smart, sustainable development. 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	CCCCC	Sections	Planning for climate compatible development in the Caribbean regional framework;	<ul style="list-style-type: none"> Introduce GIS and NSDI as an integral aspect of scientific and evidence-based climate change risk assessment and adaptation strategy development across all potentially impacted sectors; Establish institutional and technical mechanisms to facilitate open access to shared information resources across national and regional stakeholder communities; Provide visualization tools to communicate issues and alternative plans to decision makers and the public; Develop place-based strategies and defensible project plans for optimizing renewable energy utilization and attracting new investment; Assess climate change vulnerable populations and infrastructure and develop effective mitigation and resilience measures; Provide tools and methods for the effective inventory, management and utilization of standing forests; Provide effective tools and information for geographically based monitoring, evaluation and adaptive management options related to climate change related environmental and infrastructure conditions and trends; 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Meteorological and Hydrological Data and Projections	<ul style="list-style-type: none"> Provide geospatial framework for precipitation and general meteorological monitoring; Conduct a spatial assessment to support expansion of the meteorological monitoring network; Support geographically-based climate modeling and forecasting; Assess potential climate change impacts to agricultural productivity, tourism, and infrastructure Conduct a spatial assessment to support expansion of the hydrologic monitoring network; Provide framework for sharing of information among all the various groups currently maintaining meteorological and hydrological data and projections 											1	1		1

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Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Hazards and Risks	<ul style="list-style-type: none"> Conduct flooding vulnerability assessment based on conditions and trends; Forecast drought conditions and possible impacts to agriculture and water availability; Assess current and future projected hazard potential and vulnerability of communities, infrastructure and resources at risk of damage from hurricanes and storm surge impact; Assess and monitor beach erosion; Assess risk to disease and pest distribution and impacts to human health and agriculture; Provide framework for sharing of information among all the various groups currently hazard and risk assessments; 	1	1	1	1		1	1				1	1	1	1	1
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Geographical and Biophysical Environment	<ul style="list-style-type: none"> Support detailed topographic modeling and analysis; Provide a geographic basis for terrestrial ecosystem and biodiversity monitoring and assessment of potential climate change impacts; Provide framework for sharing of information among all the various groups currently maintaining terrestrial resource and monitoring data; 															
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Coastal Zone and Ocean	<ul style="list-style-type: none"> Support detailed bathymetric and hydrodynamic modeling and analysis; Provide a geographic basis for marine ecosystem and biodiversity monitoring and assessment of potential climate change impacts; Provide framework for sharing of information among all the various groups currently maintaining marine resource and monitoring data; 															
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Land Cover and Land Use	<ul style="list-style-type: none"> Provide geospatial framework for the inventory and monitoring of land use and land cover change; Forecast potential impacts to existing land use and land cover from climate change; Support the management of protected areas and parks in both terrestrial and marine environments; Provide framework for sharing of information among all the various groups currently involved in managing, monitoring or enforcing protected areas and parks; 							1								
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Agriculture and Food Security	<ul style="list-style-type: none"> Provide geospatial framework for the inventory and monitoring of agriculture and agricultural productivity; Assess and monitor existing agricultural productivity; Assess and forecast seasonal agricultural productivity and potential impacts of climate change; Support the mapping and assessment of soils for various agricultural purposes; Provide framework for sharing of information among all the various groups currently involved with food security and planning 							1								
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Water: Availability, Quality, and Use	<ul style="list-style-type: none"> Support the inventory, monitoring and assessment of water availability, quality and use; Assess the potential impacts of climate change on water availability; Provide a geographic basis for monitoring water abstractions and trends; Provide framework for sharing of information among all the various groups currently involved in managing, monitoring or using water resource data; 		1					1								
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Energy: Use, Generation, Availability	<ul style="list-style-type: none"> Provide geospatial framework for the inventory and monitoring of existing energy supply and demand; Support geographic-based forecasting for future energy demand; Support the inventory and analysis of potential new renewable energy resources; Support the planning, design and development of new energy infrastructure; Support the operations and maintenance of energy infrastructure; Assess the vulnerability of existing and planned energy sources to climate change; Provide framework for sharing of information among all the various groups currently involved in managing, monitoring or using energy resource data; 	1						1								
Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Socio-Economic Status	<ul style="list-style-type: none"> Support the inventory and monitoring of commercial and industrial activities; Inventory and monitor the job market and household income levels and trends; Monitor and assess socio-economic status at the neighborhood level; Identify communities that are most susceptible to natural disaster impacts and economic shocks Provide framework for sharing of information among all the various groups currently involved in the planning, development and supply of community and social services; 							1								1

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Regional	CCCCC	Sections	Caribbean regional environmental change observing network - Critical and Emergency Infrastructure	<ul style="list-style-type: none"> Conduct hazard assessment and identify vulnerable populations and infrastructure at risk; Formulate adaptation strategies to minimize risks to populations and infrastructure; Prepare and record emergency contingency and response plans; Inventory and record location of emergency response resources; Provide a common operating picture for multi-user coordination during emergency response events (rescue and evacuation, food, water, medical supplies, etc.); Support the planning and implementation of post-disaster recovery activities. 	1	1	1	1		1	1	1	1	1	1	1	1	1	
Regional	CCCCC	Sections	Conduct EU GCCA project	<ul style="list-style-type: none"> Support the compilation, management and analysis of climate monitoring data Provide more detailed local data to calibrate and refine regional climate models Conduct climate analysis and impact studies Conduct hazard and vulnerability analysis for populations, community facilities, infrastructure and environmental resources Provide information and tools to support the identification, formulation, design, implementation, monitoring and assessment of climate adaptation projects Support the formulation of programs and projects that can increase access to carbon financing 	1	1	1	1		1	1				1	1	1	1	
Regional	CCCCC	Sections	Coordinate 2011-2015 Caribbean regional resilience development implementation plan;	<ul style="list-style-type: none"> Utilize the BNSDI as a comprehensive common repository for access to information about Belize; Support better and more defensible project formulation, design and feasibility analysis; De-risk projects through systematic analysis and utilization of accurate, authoritative data, and thereby attracting a broader range and diversity of project financing options for development of new climate smart infrastructure; Support more coordinated efforts among organizations and sectors; Provide a comprehensive information framework for project monitoring and evaluation; Provide a project dashboard to understand the location, extent and status of funded project works; Provide a geographically based historic record of projects and trends; Assess cumulative impact and program effectiveness. 	1	1	1	1		1	1	1	1	1	1	1	1	1	
Regional	CCCCC	Sections	Coordinate 2012-2013 Caribbean risk management program;	<ul style="list-style-type: none"> Provide GIS and NSDI as an enabling environment for climate smart government and development; 	1	1	1	1		1	1	1	1	1	1	1	1	1	
Regional	CCCCC	Sections	Coordinate 2012-2014 Australian Caribbean Coral Reef Collaboration;	<ul style="list-style-type: none"> Provide GIS and NSDI as an enabling environment for climate smart coral reef science, policy and management; Support the inventory and assessment of coral reefs throughout the Mesoamerican barrier reef system; Monitor and assess reef health and trends over time; Provide a geographic basis for reef protection and regulatory enforcement; Provide framework for sharing of information among all the various groups currently involved in the protection, management and use of coral reef environments. 															
Regional	CCCCC	Sections	Manage coastal protection for climate change adaptation in the small island states in the Caribbean;	<ul style="list-style-type: none"> Support inventory and assessment of coastal ecosystems and ecosystem services; Assess the vulnerability of coastal ecosystems and services to various climate change impacts; Support the formulation and modelling of alternative investment options; Provide a geographic basis for coastal ecosystem monitoring and adaptive management; Capacity building using geospatial tools, methods and "spatial thinking" to address coastal ecosystem management matters in a holistic, systemic and place-based manner. 	1	1	1	1		1	1	1	1	1	1	1	1	1	
Regional	CCCCC	Sections	Manage the organization's information and communications infrastructure.	<ul style="list-style-type: none"> Compile and maintain repository of geospatial data Provide geoportal for discovery and discovery of available geospatial data resources Link to other relevant local, regional and international data federations 	1	1	1	1		1	1	1	1	1	1	1	1	1	
Regional	CATHALAC	Sections	Provide education and training	<ul style="list-style-type: none"> Provide access to technical education courses and infrastructure; Provide channel for student exchange and study abroad Establish and maintain online learning opportunities 	1	1	1	1		1	1	1	1	1	1	1	1	1	

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Regional	CATHALA C	Sections	Provide specialized services	<ul style="list-style-type: none"> • Provide access to specialized technical expertise and infrastructure; • Technical cooperation and sharing of information and methods for environmental modeling and analysis; • Technical cooperation and sharing of information and methods for integrated water resource management; • Technical cooperation and sharing of information and methods for hazard and vulnerability assessment; • Technical cooperation and sharing of information and methods for environmental monitoring. 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	CATHALA C	Sections	Compile, manage and publish geographic information	<ul style="list-style-type: none"> • Provide infrastructure and tools for the compilation, processing, discovery and dissemination of geospatial data • Provide analytical and visualization tools to support the development and dissemination of specialized derivative information products • Provide online access to data and application services in standardized formats 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	CATHALA C	Sections	Support regional cooperation	<ul style="list-style-type: none"> • Participate in regional and international initiatives for disaster management and emergency response; • Participate in regional and international initiatives for water and environmental management; • Participate in regional and international technical advisory fora 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	Inter-American Institute for Cooperation on Agriculture	Sections	Compile, manage and disseminate agriculture knowledge and information;	<ul style="list-style-type: none"> • Provide access to information regarding the application of GIS and SDI to the agriculture sector; • Provide a geographic framework for geo-referencing and accessing bibliographic information regarding projects, reports, technical bulletins, and other resources 	1	1	1	1		1	1			1	1			1
Regional	Inter-American Institute for Cooperation on Agriculture	Sections	Support agricultural development strategies and projects	<ul style="list-style-type: none"> • Provide access to comprehensive agricultural census and farm data; • Provide access to population census at the community and neighborhood levels; • Provide access to topographic and natural resources information; • Provide access to geographically based natural hazard information; • Provide access to climate change induced hazard forecast information; • Support analysis of existing situation and identification of issues, opportunities and constraints; • Provide tools and information infrastructure to support agriculture research and development activities; • Provide geographic framework for working with local communities and compiling local knowledge about the current situation; • Provide maps and information to support farming community meetings and workshops; • Strengthen the formulation and assessment of proposed agriculture development projects; • Provide tools and data to support community based problem identification and solution development; • Monitor and evaluate program outcomes geographically over time. 	1	1	1	1		1	1			1	1	1	1	1
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Determine areas subject to hurricane wind exposure	<ul style="list-style-type: none"> • Compile historical hurricane wind data; • Refine existing wind models with topography, land cover data and other relevant information; • Assess extreme and average local hurricane wind exposure geographically utilizing refined wind model. 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Determine areas subject to storm surge and wave exposure	<ul style="list-style-type: none"> • Compile historical storm surge data; • Refine existing storm surge models with topography, bathymetry, and land use/land cover data for coastal areas; • Assess extreme and average storm surge exposure geographically utilizing refined storm surge model. 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Determine areas subject to flooding from excessive rainfall	<ul style="list-style-type: none"> • Compile historical flooding and stream gauge data; • Refine existing wind models with topography and drainage data; • Assess extreme and average flooding exposure geographically utilizing refined flooding model. 				1			1			1	1	1	1	1
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify built environment resources at risk	<ul style="list-style-type: none"> • Identify buildings and structures within areas exposed to wind, storm surge or flooding; • Identify transportation routes, bridges and structures within areas exposed to wind, storm surge or flooding; • Identify electrical, water, telephone and other critical infrastructure within high risk areas. 	1	1	1	1		1	1	1	1	1	1	1	1	1

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Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify government and other critical facilities at risk	<ul style="list-style-type: none"> Identify critical government offices and facilities within areas exposed to wind, storm surge or flooding; Identify hospitals, schools, and other social critical facilities within high risk areas. 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify touristic and other commercial facilities at risk	<ul style="list-style-type: none"> Identify touristic and other commercial buildings, facilities and commercial enterprises within areas exposed to wind, storm surge or flooding that could be disrupted. 	1	1	1	1		1	1	1	1	1		1		
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify populations at risk	<ul style="list-style-type: none"> Identify population concentrations within high risk areas 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Identify agricultural resources at risk	<ul style="list-style-type: none"> Identify agricultural farms, facilities and fields within areas exposed to wind, storm surge or flooding that could be damaged. 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate built environment vulnerability	<ul style="list-style-type: none"> Determine the vulnerability of buildings and structures to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the structures; Determine the vulnerability of transportation routes, bridges and structures to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the roadways and structures; Determine the vulnerability of electrical, water, telephone and other critical infrastructure within high risk areas based on the type and degree of exposure and the physical characteristics of each utility network. 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate vulnerability of government and other critical facilities at risk	<ul style="list-style-type: none"> Determine the vulnerability of government buildings and other critical facilities to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the structures; 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate vulnerability of touristic and other commercial facilities	<ul style="list-style-type: none"> Determine the vulnerability of touristic and other commercial buildings and facilities to wind, storm surge or flooding damage based on type and degree of exposure and the physical characteristics of the structures and facilities; 	1	1	1	1		1	1	1	1	1		1		
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Calculate vulnerability of populations at risk	<ul style="list-style-type: none"> Determine the vulnerability of populations within high risk areas based on the potential structural damage to homes and sources of employment. Assess socioeconomic situation and financial resilience and potential self-reliance of neighborhoods during an emergency 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted damage to built environment	<ul style="list-style-type: none"> Calculate potential damage based on exposure and vulnerability assessments. 	1	1	1	1		1	1	1	1	1	1	1	1	1
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted damage to government and other critical facilities	<ul style="list-style-type: none"> Calculate potential damage based on exposure and vulnerability assessments. 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted damage to touristic and other commercial facilities	<ul style="list-style-type: none"> Calculate potential damage based on exposure and vulnerability assessments. 	1	1	1	1		1	1	1	1	1	1			
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model predicted impacts to populations at risk	<ul style="list-style-type: none"> Calculate potential loss of life and injury based on exposure and vulnerability assessments. 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of damage to built environment	<ul style="list-style-type: none"> Calculate cost of damage based on coefficients. 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of damage to government and other critical facilities	<ul style="list-style-type: none"> Calculate cost of damage based on coefficients. Calculate cost of restoring priority facilities to operational condition for disaster recovery. 										1		1	1	
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of damage to touristic and other commercial facilities	<ul style="list-style-type: none"> Calculate cost of damage based on coefficients; Calculate lost revenue and economic activity for each facility. 											1			
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Calculate risk and establish policy - Model cost of impacts to populations at risk	<ul style="list-style-type: none"> Calculate cost of emergency response to each neighborhood based on predicted loss and injury, access, and other issues. 														
Regional	Caribbean Catastrophe Risk Insurance Facility	Sections	Process post-disaster payout.	<ul style="list-style-type: none"> Calculate hazard scenario and correlate to insurance provisions 	1	1	1	1		1	1	1		1	1	1	1	1
Regional	National Aeronautical and Space Agency	Sections	Collect and publish satellite remote sensing data;	<ul style="list-style-type: none"> Provide integrated tools to discover and assess available geospatial data and imagery Provide online access to data and applications services for basic and derived data 							1							
Regional	National Aeronautical and Space Agency	Sections	Conduct and/or support special studies.	<ul style="list-style-type: none"> Provide access to specialized technical expertise and infrastructure; Technical cooperation and sharing of information and methods for environmental modeling and analysis; Technical cooperation and sharing of information and methods in multiple disciplines Provide funding and technical support for special studies 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES					
					Electrical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry	
Utilities	Belize Electric Ltd.	Sections	Electric utility systems planning	<ul style="list-style-type: none"> • Monitor urban development plans and changes in land ownership; • Monitor population growth, densification and expansion geographically; • Monitor power consumption rates and trends geographically; • Monitor socioeconomic trends; • Monitor long term climate trends and assess impacts on hydroelectric power generation; • Monitor the adoption of local power generation from renewable sources (solar, wind, etc.); • Track new highway and road development; • Model all of the above to assess potential future demand and load growth scenarios geographically over time; • Assess feasibility of supplying powers to more remote communities; • Assess emerging technologies and methods for smart power management; • Conduct utility siting opportunity and constraint modeling to determine best potential routes for future power transmission and substation facilities; • Conduct spatial analysis to determine optimum routing for distribution networks; • Plan for land acquisition to accommodate power facilities; • Environmental impact assessment for planned facilities; • Develop and illustrate defensible future electrical utility expansion plans in a compelling manner that can be easily understood by the utility Board, Public Utilities Commission (PUC), policy makers and the general public; • Develop renewable energy atlas for Belize to support planning, design and development of sustainable energy for the Country (also see MESTPU stakeholder survey write-up); • Monitor, assess and recalibrate plans proactively over time based on changing conditions and trends. 	1						1				1	1	1	1	1	
Utilities	Belize Electric Ltd.	Sections	Electrical network design and construction	<ul style="list-style-type: none"> • Base mapping – providing up to date and accurate information concerning existing roads, buildings, and other infrastructure; • Land ownership and land use; • Demand load forecasting and system modeling; • Facility siting analysis; • Alternative network design analysis; • Construction drawings in real world coordinates, usable with other information in GIS; • Construction management and status tracking; • As-built data consolidation; • Transfer of as-built inventory to fixed asset inventory. 	1	1	1	1		1	1				1	1	1	1	1	
Utilities	Belize Electric Ltd.	Sections	Electrical network operations and maintenance	<ul style="list-style-type: none"> • Provide a complete geospatially located fixed asset inventory; • Common fixed asset registry between mapping, financial and maintenance management system components; • Schedule and route preventive maintenance activities, and tie work orders to specific maintained assets; • Identify and route ad hoc maintenance activities and tie work orders to specific maintained assets; • Rapid outage analysis and response support; • Tie customer complaint calls to location; • Automatically generate schematic diagrams for SCADA visualization and control from the GIS maps, thus eliminating redundant data maintenance and ensuring systems data is consistent and up to date; • Provide mobile devices to field crews to access as-built network data and record redlining and other observations in the field to correct or update the facility mapping database; • Assess historical maintenance activities to identify repeat problem areas or devices; • Provide geospatially enhanced view of all fixed assets and preventive and reactive maintenance and trends over time for planning and PUC reference. 	1															
Utilities	Belize Electric Ltd.	Sections	Customer care	<ul style="list-style-type: none"> • Geospatially located meters and ability to tie customer information to locations and to analyze and visualize the character and distribution of consumption, complaints and other transactions over time; • Route meter readers • Cluster and route complaint followup activities for more rapid and efficient response; • Maintain geographically enhanced customer satisfaction profiles and monitor key performance indicators 	1											1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
				over time															
Utilities	Belize Electric Ltd.	Sections	Manage ICT systems	<ul style="list-style-type: none"> • Provide geospatial data and tools as an integral component of the utility's information infrastructure • Provide user assistance and technical support for geospatial matters • Provide programming tools for the integration of geospatial functions within enterprise business application software systems • Utilize geospatial dimension as a mechanism for integrating and associating disparate databases together • Provide specialized tools and methods for the administration of geospatial data 	1	1	1	1		1	1				1	1	1	1	1
Utilities	Belize Water Supply Ltd.	Sections	Water and sewer utility systems planning	<ul style="list-style-type: none"> • Monitor urban development plans and changes in land ownership; • Monitor population growth, densification and expansion geographically; • Monitor water consumption rates and trends geographically; • Monitor socioeconomic trends and their impacts on water consumption; • Monitor long term climate trends and assess impacts on water resources; • Track new highway and road development; • Model all of the above to assess potential future demand and demand growth scenarios geographically over time; • Assess feasibility of supplying water and sewer services to more communities; • Assess emerging technologies and methods for smart water and sewer system management; • Conduct utility siting opportunity and constraint modeling to determine best potential routes for future water source and transmission facilities, sewer treatment plant and related works; • Automate design and as-built record management; • Conduct spatial analysis to determine optimum routing for distribution networks; • Plan for land acquisition to accommodate water production and sewer treatment facilities; • Environmental impact assessment for major planned facilities; • Develop and illustrate defensible future water and sewer utility expansion plans in a compelling manner that can be easily understood by the utility Board, Public Utilities Commission (PUC), policy makers and the general public; • Monitor, assess and recalibrate plans proactively over time based on changing conditions and trends 	1	1	1	1		1	1				1	1	1	1	1
Utilities	Belize Water Supply Ltd.	Sections	Water and sewer network design and construction	<ul style="list-style-type: none"> • Base mapping – providing up to date and accurate information concerning existing roads, buildings, and other infrastructure; • Land ownership and land use; • Demand and contribution calculations and system modeling; • Facility siting analysis; • Alternative network design analysis; • Construction drawings in real world coordinates, usable with other information in GIS; • Construction management and status tracking; • As-built data consolidation; • Transfer of as-built inventory to GIS-enabled fixed asset inventory. 	1	1	1	1		1	1								

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
Utilities	Belize Water Supply Ltd.	Sections	Water and sewer network operations and maintenance	<ul style="list-style-type: none"> • Provide a complete geospatially located fixed asset inventory for all water and sewer systems; • Common fixed asset registry between mapping, financial and maintenance management system components; • Schedule and route preventive maintenance activities, and tie work orders to specific maintained assets; • Access up to date and accurate land use, cadastral, detailed aerial photography, high resolution satellite and other information from other entities; • Identify and route ad hoc maintenance activities and tie work orders to specific maintained assets; • Rapid main break analysis and response support; • Tie customer complaint calls to location; • Automatically generate schematic diagrams for water control system from the GIS maps, thus eliminating redundant data maintenance and ensuring systems data is consistent and up to date; • Provide mobile devices to field crews to access as-built network data and record redlining and other observations in the field to correct or update the facility mapping database; • Assess historical maintenance activities to identify repeat problem areas or devices; • Provide geospatially enhanced view of all fixed assets and preventive and reactive maintenance and trends over time for planning and PUC reference. 		1	1								1	1	1	1	1
Utilities	Belize Water Supply Ltd.	Sections	Customer care	<ul style="list-style-type: none"> • Geospatially located meters and ability to tie customer information to locations and to analyze and visualize the character and distribution of consumption, complaints and other transactions over time; • Cluster and create routes for complaint follow-up activities for more rapid and efficient response; • Maintain geographically enhanced customer satisfaction profiles and monitor key performance indicators over time 		1	1								1	1	1	1	1
Utilities	Belize Water Supply Ltd.	Sections	Participate in emergency preparedness and response activities.	<ul style="list-style-type: none"> • Pre-identify specific neighborhoods and water and sewer infrastructure that is likely to be damaged in major events. Work this information into contingency and response plans; • Record sources and measures for temporary potable water supply and sanitary accommodation post disaster; • Manage water and sewer system status information during response; • Track and manage field staff activities during response; • Manage and track damage repair and mitigation activities; • Record activities and assess effectiveness for post-disaster refinement of contingency plans. 		1	1			1					1	1	1	1	1
Utilities	Belize Water Supply Ltd.	Sections	Manage ICT systems	<ul style="list-style-type: none"> • Provide geospatial data and tools as an integral component of the utility's information infrastructure • Provide user assistance and technical support for geospatial matters • Provide programming tools for the integration of geospatial functions within enterprise business application software systems • Utilize geospatial dimension as a mechanism for integrating and associating disparate databases together • Provide specialized tools and methods for the administration of geospatial data 	1	1	1	1		1	1				1	1	1	1	1
Private Sector	Total Business Solutions Ltd.	Sections	Provide geospatial consulting and technical services	<ul style="list-style-type: none"> • Provide stakeholders with technical consulting support; • Support GIS users in developing and maintaining their GIS infrastructure; • Support geospatial database development projects; • Support geospatial application software development projects; • Conduct geospatial analysis and visualizations projects on behalf of clients; • Prepare capacity building and training programs. • Work with Esri to Develop a National Basemap for Belize 	1	1	1	1		1	1	1	1	1	1	1	1	1	1
Private Sector	Total Business Solutions Ltd.	Sections	Provide geospatial computing infrastructure and software products	<ul style="list-style-type: none"> • Provide stakeholders with quality hardware and software products and support; • Introduce and promote new emerging products to the marketplace; • Expand the geospatial technology user community through marketing and sales activities. • Provide immediate access to Esri's growing Partner Community for required software 	1	1	1	1		1	1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
Private Sector	Total Business Solutions Ltd.	Sections	Support geospatial awareness, education and training	<ul style="list-style-type: none"> Build awareness and appreciation for geospatial technology across all sectors in Belize; Support GIS incorporation to all levels of the education system by hosting events (World GIS Day, My Virtual City Competition, Presentation to Teachers) to support its GIS Education for Primary and Secondary Schools initiative Provide technical geospatial software and hardware training; Provide student internships for gaining practical skills in a private sector setting 	1	1	1	1		1	1	1	1	1	1	1	1	1
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Record and promote membership	<ul style="list-style-type: none"> Provide member with access to selected government data that are relevant to the Real Estate industry; Provide real estate geographically based information services that attract new membership to the association. 	1	1	1	1		1	1	1	1	1	1	1	1	1
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Lobby relative to policies and regulations affecting the real estate market;	<ul style="list-style-type: none"> Lobby for access to government geospatial information that is relevant to the real estate industry; Analyze the potential impacts of policies and regulatory proposals and options on development and real estate; Monitor and evaluate the impacts of policies, regulations and activities on the real estate market over time. 							1							
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Disseminate information regarding real estate in Belize;	<ul style="list-style-type: none"> Provide member with access to selected government data that are relevant to the Real Estate industry; Provide a geographically enabled multiple listing service to track properties for sale; Provide a geographically enabled method for tracking real estate sales and analyzing comparable properties for market valuation purposes; Provide an ability to track development projects and analyze development and property value trends over time; Provide access to natural hazard information and identification of vulnerable properties; Identify properties that may be impacted by climate change over time; Provide access to real estate information over the internet, both to support local as well as international users; Forecast the likely impacts of policies, regulations and trends on the real estate market over time and make this information available to association members. 	1	1	1	1		1	1	1	1	1	1	1	1	1
Professional Associations	Association of Real Estate Brokers of Belize	Sections	Build capacity of real estate professionals in Belize	<ul style="list-style-type: none"> Conduct workshops to raise the awareness regarding how GIS and BNSDI can be used to support real estate activities; Provide access and training in the use of GIS enhanced tools for real estate marketing, valuation, trend analysis, development tracking and other relevant issues. 	1	1	1	1		1	1	1	1	1	1	1	1	1
NGO's	Belize Tropical Forest Studies	Sections	Develop and maintain BERDS	<ul style="list-style-type: none"> Provide a geospatial data warehouse for the storage and management of commonly needed information; Provide metadata catalog and tools to allow stakeholders to locate useful information; Provide online mapping services to allow stakeholders to access and use geospatial information for their own purpose; Provide help desk and technical support for BERDS stakeholders; Link geospatial location data with other information media (sample, photo, observation, sound, video, etc.). 							1					1		
NGO's	Belize Tropical Forest Studies	Sections	Conduct biodiversity assessments of protected areas and private lands	<ul style="list-style-type: none"> Access and compile geospatial and related information from multiple sources; Conduct and record environmental species observations; Delineate habitat and other environmental resource data based on image interpretation combined with ground truthing; Observe species movement with tracking devices; Assess species habitat, population and population status and trends information; Assess and delineate species ranges, including migratory patterns; Conduct environmental issue, opportunity and constraint analysis; Prepare environmental impact assessment analyses and reporting 														
NGO's	Belize Tropical Forest Studies	Sections	Participate in technical partnerships	<ul style="list-style-type: none"> Coordination and alignment of activities and resources where shared interests are involved; Sharing of geospatial data resources among partners; Conduct joint research; Jointly lobby for changes in policies and practices affecting GIS or BNSDI 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
NGO's	Friends for Conservation and Development	Sections	Conduct co-management of the Chiquibul National Park and Cave System;	<ul style="list-style-type: none"> Map and record inventory of ecological resources of the National Park and surrounding bio-geographical region; Map and record communities and other human land use; Analyze park development issues, opportunities and constraints; Conduct ecological analysis and identify conservation issues, opportunities and constraints; Maintain ongoing geographically referenced record of incidents; Monitor land use change; Coordinate and share incident information with Belize Defense Force and Police; Utilize geo-enabled social media for two-way exchange with local communities; Coordinate and share information with other stakeholders; Prepare and record national park management plan; Monitor and assess ecological and biodiversity status over time; Produce tourism maps and information for the National Park; 	1	1				1	1		1		1	1	1	1	1
NGO's	Friends for Conservation and Development	Sections	Conduct environmental education and awareness;	<ul style="list-style-type: none"> Produce education and awareness materials; Link surveys to locations where they were conducted; Link education and awareness programs to specific communities where these have been conducted. 	1	1				1	1		1		1	1	1	1	1
NGO's	Friends for Conservation and Development	Sections	Conduct community support programs;	<ul style="list-style-type: none"> Share population census information for communities that affect the National Park on both sides of the border; Plan and track community outreach programs; Establish location aware social media channels for two way interaction with communities; Provide geographically based recording of community based conservation success stories. 	1	1				1	1		1		1	1	1	1	1
NGO's	Friends for Conservation and Development	Sections	Conduct environmental monitoring and research;	<ul style="list-style-type: none"> Monitor biological resource conditions and trends; Monitor ecosystem health and landscape change; Track locations and associated information regarding specific research studies; Utilize environmental monitoring and research results for conservation planning and policy making. 															
NGO's	Friends for Conservation and Development	Sections	Development and promotion of policy recommendations;	<ul style="list-style-type: none"> Monitor and report biological resource conditions and trends, and identify priority issue "hot spots"; Solicit opinions regarding community based conservation ideas and priorities; Model the likely outcomes of various policy and plan scenarios; Utilize geographic information and visualization tools to explain complex issues to decision makers and the public. 	1	1				1	1		1		1	1	1	1	1
NGO's	Friends for Conservation and Development	Sections	Conduct bi-national cooperation;	<ul style="list-style-type: none"> Support sharing of geographic information across national borders; Share incident and related security information; Plan and implement coordinated community education programs and monitor outcomes; Share research information and research program planning and execution. 	1	1				1	1		1		1	1	1	1	1
NGO's	Friends for Conservation and Development	Sections	Conduct cave management;	<ul style="list-style-type: none"> Develop and record comprehensive inventory of the cave system and related information; Conduct issue, opportunity and constraint analysis for use of portions of cave system for touristic development, ongoing research, and other uses or conservation; Support cave system environmental monitoring and assessment; Utilize cave data to support education and awareness programs 															
Academic & Research	University of Belize	Environmental Research Institute	Manage the National Biodiversity Monitoring Program (NBMP)	<ul style="list-style-type: none"> Analyze and establish monitoring priorities and sites; Develop and disseminate data collection and content standards; Collect, manage and disseminate biodiversity management data; Provide data analysis and visualization maps and reports regarding biodiversity conditions and trends; Provide access to wide range of contextual data from other BNSDI stakeholder organizations; Identify and monitor threats to biodiversity and habitat; Monitor biodiversity issues, opportunities and trends and provide input to the formulation of policies, plans and projects 															

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES			
					Electical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious
Academic & Research	University of Belize	Environmental Research Institute	Manage the Belize Spawning Aggregation Working Group (SPAGS)	<ul style="list-style-type: none"> • Provide geographic base for the management, monitoring and patrolling of spawning aggregation sites; • Develop location aware social media applications to help support the involvement of multiple stakeholders in monitoring, research an patrolling of spawning aggregation sites; • Collect, manage and disseminate spawning aggregation data; • Provide geospatial and statistical analysis tools to assess spawning conditions and trends, identify pressures, and monitor enforcement actions; • Formulate and provide recommendations for conservation, protection and sustainable use of spawning aggregation sites; • Support development of educational materials for stakeholders and the public; • Produce analysis and visualization outputs to advocate and build support for the management, conservation, protection and sustainable use of the spawning aggregation sites; • Provide data and analysis results for input to the formulation of related policies, plans and activities of other organizations. 														
Academic & Research	University of Belize	Environmental Research Institute	Support the National Coral Reef Monitoring Network (NCRMN)	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of coral reef monitoring data; • Utilize location aware social media applications to help support the involvement of multiple stakeholders in monitoring and reporting coral reef observations; • Provide geospatial and statistical analysis tools to assess coral reef conditions and trends, identify pressures, and monitor interventions; • Formulate and provide recommendations for conservation, protection and sustainable use of coral reefs; • Support development of educational materials for stakeholders and the public; • Produce analysis and visualization outputs to advocate and build support for the management, conservation, protection and sustainable use of coral reefs; • Provide data and analysis results for input to the formulation of related policies, plans and activities of other organizations. 														
Academic & Research	University of Belize	Environmental Research Institute	Conduct Terrestrial Mapping	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of coral reef monitoring data; 														
Academic & Research	University of Belize	Environmental Research Institute	Assess Potential Impacts of Climate Change on Belize Water Resources	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of surface and groundwater quantity and quality information; • Provide access to current and historical weather data and forecasts; • Provide access to water extraction permits and monitoring information; • Provide access to topographic, land use, land cover, soils and other data available from the BNSDI community; • Provide geographic-based tools for the assessment, monitoring and reporting of water resource conditions and trends; • Develop and model the potential impacts of water resource management policy and plan options; • Produce easy to understand analysis output maps and reports to help communicated water resource management issues to decision makers and the public. 		1								1	1	1	1	1
Academic & Research	University of Belize	Environmental Research Institute	Conduct Sea Turtle Nest and Wildlife Monitoring	<ul style="list-style-type: none"> • Provide geographic base for the compilation, management and sharing of wildlife monitoring data among qualified stakeholders; • Provide tools for the analysis and visualization of wildlife monitoring data and trends; • Assess threats and pressures to wildlife populations; • Generate analysis maps and reports regarding wildlife population issues and trends for decision makers and the public; • Provide wildlife consideration inputs to the policies, plans and activities of other organizations. 														
Academic & Research	University of Belize	Environmental Research Institute	Conduct National Training Program for Protected Areas Management	<ul style="list-style-type: none"> • Incorporate geospatial tools and methods to the Protected Areas Management program; • Provide access to wide range of environmental and related contextual GIS data from the BNSDI community; 	1	1	1	1		1	1	1	1	1	1	1	1	1

ADMIN_L1	ADMIN_L2	ADMIN_L3	MAJOR_FUNCTION	GEOSPATIAL ACTIVITY	UTILITIES						TRANSPORTATION				COMMUNITY FACILITIES				
					Electrical	Potable Water	Sanitary Sewer	Storm Water	Waste Management	Telecommunications	Road Network	Water Transport	Transit	Air Transport	Government	Tourism and Recreation	Health and Education	Cultural and Religious	Commerce and Industry
			(NTPPAM)																