

Guam Historic Resources Division (GHRD)

GIS Needs Assessment

FINAL REPORT

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EXECUTIVE SUMMARY

Project Background

Guam Historic Resources Division (GHRD) selected **GIS GLOBAL** to complete the following studies:

1. GIS Needs Assessment
2. Conceptual System Design
3. Implementation Plan and Training Session

This report represents the first phase or the GIS Needs Assessment. GHRD hired GIS GLOBAL to identify division needs that could be solved or improve using GIS technology. In addition to identifying division needs, several other objectives were established for the project including the interagency needs for federal and local agencies; data standards used by these entities; GIS technology needs; data security; and GIS training needs for the division. Finally, the GIS Needs Assessment was initiated to guide GHRD in accomplishing its mission “... *to engage in a comprehensive historic preservation program that promotes the use, conservation, preservation, and presentation of historic properties. Our Goal is to implement projects and activities that help us achieve our planned goals.*”

Project Methodology

To accomplish the project objectives, GHRD assembled a project team consisting of staff from several GHRD program areas to direct GIS GLOBAL in conducting the GIS Needs Assessment. This phase was conducted in three stages:

- Collection of Data
- Information Compilation And Analysis
- Recommendations

Interview process was completed with in-person interviews over a period of several weeks. Information from these interviews was compiled to identify business functions and needs that could benefit from the utilization of GIS technology. The information from the summary of interviews was used to systematically assess the needs and answer the following questions:

- **GIS Needs** - what business needs had been identified from the interviews that could benefit from the inclusion of GIS technology?
- **Spatial data needs for GIS** - given the business needs identified, what was the requirement for spatial data in GHRD?
- **Technology needs for GIS** - what technology is required to successfully implement GIS given the business and spatial data needs?
- **Organization needs for GIS** - what organizational aspects from extra staff or training are needed to achieve the functions outlined for the program?

Summary Of Findings

GIS GLOBAL compiled and analyzed the data gathered in the GIS Application Description Forms, the personal interviews, and from the focus group. Gaps in knowledge and information necessary to complete the Needs Assessment were identified. The findings of the information compilation and analysis exercise are outlined in **Section 4** of this report. These include the GHRD's organization chart, Current Procedures, Program Descriptions, Computer Hardware and Software.

Issues

GIS GLOBAL identified issues that GHRD staffs viewed as most important in implementing the GIS and included the following:

- Data Server needs to be fixed and available everyday to share important databases such as the RC Master Database
- RC Mater Database needs to be upgraded into a user friendly interface
- GIS training on simple searching, editing, creating and printing maps will enhance the GHRD's GIS capabilities
- GHRD staff must be able to easily create various reports at any time of the year
- Manual counting of weekly/monthly reports must be automated
- New GIS data layer for GHRD's purposes must be created
- Computerized existing manual entry of data on paper
- Level of security must be present on all databases

The issues are detailed in Section 5.

Recommendations

Finally, GIS GLOBAL recommendations were grouped into the following categories and detailed in Section 6 of this report:

- Core GIS hardware and software
- Customized Database and Graphic User Interface (GUI)
- Creation of a New GHRD-Geodatabase
- Data standards
- Data security
- Staffing and training

SECTION 1 - INTRODUCTION

The Guam Historic Resources Division (GHRD) of the Department of Parks and Recreation carries out a central role in preservation by both territorial and federal law. It is designated to serve as the "State" Historic Preservation Office for Guam for purposes of the National Historic Preservation Act. It has similar mandated responsibilities with respect to territorial law. The main responsibilities include:

- Keeping a comprehensive inventory of sites which have been considered as potentially historic in any preservation review.
- Nominating significant places for formal inclusion in the Guam and National Registers of Historic Places.
- Reviewing undertakings of federal and territorial agencies for potential effects on significant historic places, and commenting or advising on appropriate responses to such effects when they may occur.
- Organizing a territory wide survey (search) for significant historic places. Administering the federal grants program within Guam.
- Advising other agencies with respect to integration of preservation into their on-going programs and activities.
- Disseminating public information regarding preservation and fostering broad public participation in preservation decisions.

The on-going programs and activities of the Historic Resources Division are under the general oversight of the Guam Historic Preservation Review Board, as well as under the direct supervision of the Director of the Department of Parks and Recreation. Public Law 20-151 specifically requires the Historic Preservation Officer to issue certificates of approval to a wide range of programs, projects, licenses, and permits by other government of Guam agencies when these may affect historic places. The judgments of the Guam Historic Preservation Officer with respect to the significance of historic sites or the appropriateness of mitigation measures when there is an adverse effect can be reviewed by the Guam Historic Preservation Review Board. In both existing federal and territorial law, direct responsibility to carry out preservation activities is placed on each and every agency that owns or controls significant historic places, or whose actions have the potential to affect significant historic places. The GHRD serves as a source of reliable information and preservation expertise so that these agencies can more easily and effectively meet their own direct responsibilities.

Finally, it is also a primary role of the Historic Resources Division to encourage and foster positive preservation initiatives in both the private and public sectors, and to encourage public knowledge of and interest in historic places.

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1.1 Purpose of Needs Assessment

A Geographic Information System (GIS) is a powerful data management and analysis tool used to integrate diverse sources of information. The common element among all spatial data is that it can be tied to a location on the earth's surface. GIS provides the ability to combine maps with databases that contain descriptive information about features on the earth's surface

A needs assessment is the first step in implementing a successful Geographic Information Systems (GIS) within any organization. A needs assessment is a systematic look at how sections or departments function and the spatial data needed to do their work. In addition to the final needs assessment report that is generated, intangible benefits are realized by an organization. Conducting a GIS needs assessment fosters cooperation and enhanced communication among employees and departments by working together on a common technology and state of the art set of tools.

Finally, the needs assessment activity itself serves as a learning tool where potential users in each participating department learn about GIS and how it can serve the department. The largest benefit for an entity adopting a GIS is to realize efficiencies from common "base data" and the sharing of data among departments.

1.2 Scope of Project

The Scope of Work includes the following:

- Conduct a briefing session or “start-up” workshop to describe the entire needs assessment procedure to GHRD employees.
- Interview staff members of GHRD. The interviews will be thorough and will be utilized to identify three kinds of GIS requirements:
 1. **GIS applications** - these will be tasks that can be performed by the GIS such as preparing a map, processing a query, or conducting a GIS analysis.
 2. **GIS activity** - these are situations where information needs to be kept on some activity or process important to the user, such as issuing building clearances or permits, conducting field inspections, etc.
 3. **GIS data** – these are the different kinds of spatial data such as shape files and personal geodatabases that are critical in structuring the GIS. Existing data such as Excel, Dbase and Access files that need to be migrated to the GIS are also covered.
- Identify and describe all potential GIS applications, functions and existing resources such as hardware, software, data and staff.

- Prepare the final needs assessment report. This report shall include detailed findings identifying the possible applications, necessary data, and required resources for GHRD.

At the conclusion of a needs assessment, GHRD will have all of the information needed to plan the development of a GIS. This information can be grouped into the following categories:

Applications to be developed. - After evaluating the responsibilities and work flow within GHRD, certain tasks are identified that can be accomplished more efficiently or effectively in a GIS. These tasks will form the basis of GIS applications. Application descriptions prepared as part of the needs assessment will describe these tasks.

GIS functions required. - For each application identified, certain GIS functions will be required. These will include standard operations such as query and display, spatial analysis functions such as routing, overlay analysis, buffering, and possibly advanced analysis requiring customize-programming.

Data needed in the GIS database. - Most departments in local government use data that has a spatial component. Much of this data are hard copy maps or tabular data sets that have a spatial identifier such as lot numbers, addresses and zip codes or X-Y values (latitude-longitude, state plane coordinates, or other coordinate system). A needs assessment will identify how this information will be used by GIS applications.

Data maintenance procedures - By looking at the work flow and processes within and between departments, responsibility for data creation, updates and maintenance will become apparent.

SECTION 2 - SUMMARY OF GIS CONCEPTS

This section of the report is a summary of basic GIS concepts including a definition and description of spatial data and a description of the relationship between spatial data and descriptive data.

2.1 Definition of a Geographic Information System (GIS)

A geographic information system (GIS) may be defined as "...a computer-based information system which attempts to capture, store, manipulate, analyze and display spatially referenced and associated tabular attribute data, for solving complex research, planning and management problems"(Fischer and Nijkamp, 1992). GIS have taken advantage of rapid developments in microprocessor technology over the past several decades to address the special challenges of storing and analyzing spatial data. Geographers have referred to GIS as simultaneously providing "...the telescope, the microscope, the computer and the Xerox machine" for geographic and regional analysis (Abler, 1987).

2.2 Unique Features of a GIS- Why Planning Process Is Needed?

GIS belongs to the class of computer systems that require the building of large databases before they become useful. Unlike many micro-computer applications where a user can begin use after the purchase of the hardware and software, the use of a GIS requires that large spatial databases be created, appropriate hardware and software be purchased, applications be developed, and all components be installed, integrated and tested before users can begin to use the GIS. These tasks are large and complex, so large in fact, as to require substantial planning before any data, hardware or software is acquired.

2.3 Spatial Data

Spatial data shows the location, shape and relationships between features on the earth's surface. Each map feature has a specific geographic location that is defined in terms of a coordinate system such as latitude/longitude or State Plane. A GIS data layer contains a set of related features such as roads or property boundaries, each uniquely defined by a precise location on the earth's surface.

Spatial data can be represented in either vector or raster format. Vector format data consists of a coordinate-based data structure and is represented as: points, lines, and polygons. A point is used to illustrate a feature whose shape is too small to be defined as an area on a map. Examples include sign posts, bridges or rural wells. A line is used to illustrate the location of a linear feature that is too narrow to be displayed as an area on a map. Examples include road centerlines, railroads and streams. A line can also represent information with no physical shape such as a contour line. A polygon is used to represent a feature that has an area large enough to be displayed on a map. Examples include lakes and reservoirs; city limits and land use boundaries and land parcels.

Raster (or grid) format data is composed of rows and columns of cells. Each cell is assigned an attribute value and represents a portion of the earth such as one square meter or one square mile. Generally speaking, the smaller the cell size, the better the resolution when viewing features within a GIS. A feature on the earth's surface can be composed of one grid cell or multiple grid cells depending on its size. Digital Orthogonal Quads (DOQ's) such as aerial photography and Digital Raster Graphics (DRG's) such as topographic maps are forms of raster data

2.4 Descriptive Data

Each map feature can have descriptive data tied to it through database files. Each piece of data that describes a feature is called an attribute. Descriptive data is typically derived from pre-existing database files such as Excel, Access or other database files. Descriptive information can be in the form of words, text strings, numbers, and alphanumeric characters. Scanned image documents or digital photos can also be displayed as attributes to map features.

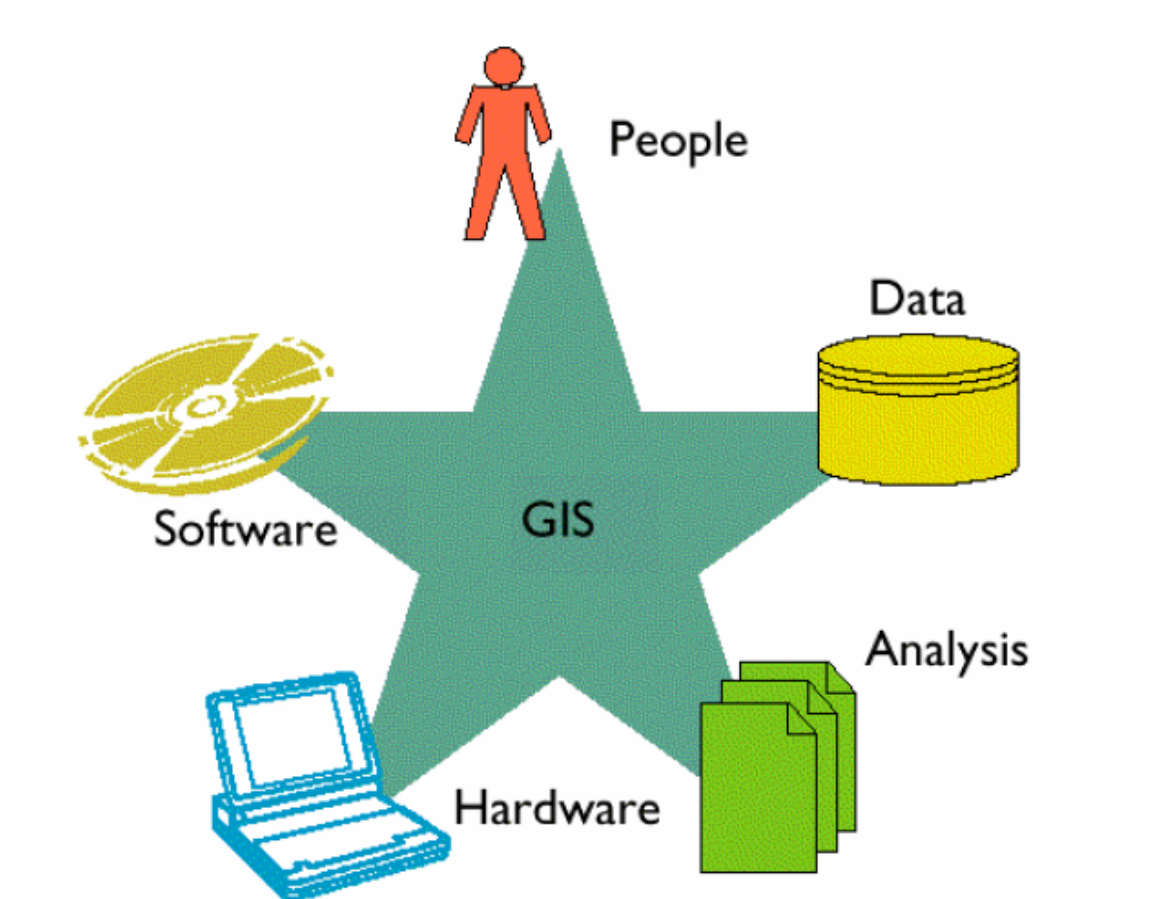
Utilizing simple GIS commands, descriptive information contained in attribute files or tables can be illustrated on a map as labels or as color patterns to distinguish between feature types. In a land use map, for example, areas of different land use categories can be shaded with a different color and/or pattern. The land use symbol displayed for each polygon can be determined by referencing unique land use codes or names associated with each land use category within a GIS attribute table.

2.5 Components of GIS

GIS is often thought of as a mapping system; however, over the past 30 years, GIS has evolved into an enterprise-wide information system. This information system that is geographic in nature is composed of the following five major components:

1. **People-** people are the most important component in a GIS. People must develop the procedures and define the tasks of the GIS to make the entire system effective. This component includes adequately trained users and support staff.
2. **Data-** the availability and accuracy of data can affect the results of any query or analysis. This component includes both spatial and non-spatial attribute data necessary to support the analysis.
3. **Hardware-** hardware capabilities affect processing speed, ease of use, and the type of output available. This hardware can include not only desktop computers but also servers on a wide area network, handheld computers, and peripheral devices such as printers or plotters.
4. **Software-** this includes not only actual GIS software but also various databases as well as drawing, statistical, imaging, or other software.
5. **Analysis-** analysis requires well-defined, consistent methods to produce accurate, reproducible results.

The diagram below illustrates the five components of GIS.



SECTION 3 - PROJECT METHODOLOGY

This chapter contains a description of the steps that GIS GLOBAL followed to complete the GIS Needs Assessment. GIS GLOBAL conducted the needs assessment in three (3) stages:

- Collection of Data
- Information Compilation and Analysis
- Recommendations

3.1 Collection of Data

The Data Collection Stage was completed in four (4) steps:

- Briefing session or “start-up” workshop
- GIS Application Description Forms
- Personal interviews
- Focus Group Site Inspection

3.11 Briefing Session

GIS GLOBAL started by conducting a briefing session or “start-up” workshop with the GHRD personnel and Division Supervisor to obtain further understanding of the goals and objectives of the study. This permitted a review and a discussion of the approach and context of the data collection process.

The “start-up” workshop addressed the following topics:

- Definitions:
 - What is GIS?
 - How is a GIS used by local government?
 - What are the typical applications of GIS?
- Interview procedure:
 - What the interviewee will do?
 - What is expected from the interviewee?
 - Who approves the application descriptions?
 - How the information from the application descriptions will be used?
- Group discussion:
 - It is often useful to have the group identify an initial set of GIS applications as candidates for further documentation. The discussion of possible applications between interviewers and users will start to reveal what is suitable for a GIS application. One or more applications can be described in the process by the group so everyone sees how the process will work.

3.1.2 GIS Application Description Forms

During the “start-up” workshop, four (4) different forms were given to GHRD staff. These forms were used to describe displays produced by the GHRD’s GIS and activities supported by the GIS. Sample of these forms can be seen on Appendix B.

1. **GIS Application Description Form**– used to enter application identification, description of purpose, type of application, map scale, query key, frequency and required response time
2. **Map Display Form**- used to draw a sample of any maps to be produced by the application.
3. **Table Display Form**- used to show samples of any tables to be produced by the application.
4. **Data Flow Diagram**- used to draw a data flow diagram of flow chart when an application is complex. This chart is usually drawn by the GIS analyst to document complex calculations or descriptions of activities that will need GIS support.

3.1.3 Personal Interviews

For the needs assessment, eight (8) out of the eleven (11) GHRD personnel were interviewed in person and by phone. The notes and associated material provided by the participants form the body of knowledge on which recommendations were based in this needs assessment. The table below includes a list of the interviewees and their position.

Individual	Position
Lynda B. Aguon	Guam Historic Preservation Officer (SHPO)/Division and Program Supervisor
Victoriano April	Territorial Archeologist
William Hernandez	Historic Preservation Specialist III
Jose Garrido	Historic Preservation Specialist I
Alfred Masga	Archeological Technician I
Cheryl Bustos	Program Coordinator I
Christine Olkeriil	Computer Data Librarian
Richard Olmo	Consultant Archeologist

3.1.4 Core Interview Questions

The questions listed below formed the basis of the in-person and phone interview. Additional questions were asked as the interview developed.

Business and Organizational Needs

- What program areas do you work with?
- What are your duties and responsibilities? Do they relate to GIS?
- Do you serve on any committees or workgroups outside your agency?
- What other Government of Guam (GovGuam) agencies or Federal agencies do you coordinate with?

Data Needs

- What type of spatial and descriptive data are you utilizing?
- What type of data is exchanged or available to all GHRD personnel in Real-time?
- What type of data or information is exchanged between GHRD and other GovGuam or Federal agencies? Where do you get the data from? How is the relationship working and how could it be improved?
- What are your current needs regarding policy, data, communications within GHRD and between local and federal agencies?

Technology Needs

- Do you use maps to meet your job responsibilities?
- Do you use a computerized mapping system? What type? Is it meeting your business needs?
- Do you utilized GPS handheld system or laptop on the field?

3.1.5 Site Inspection Focus Group

Input from the personal interviews and discussions with the GHRD staff identified the need for one focus group session. The objective of the focus group was to test those issues identified through the interview process, document site inspection procedures and identify the needs and priorities for the system implementation at GHRD. The session focused on the Field or Site inspection with two (2) GHRD employees: Historic Preservation Specialist I, Jose Garrido, and Archaeological Technician I, Alfred Masga; and a GIS GLOBAL Analyst. The group conducted a site inspection and the summary of the field inspection focus group discussion is explained in detail on Section 6.

3.2 Information Compilation And Analysis

GIS GLOBAL compiled and analyzed the data gathered in the GIS Application Description Forms, the interviews, and from the focus group. Gaps in knowledge and information necessary to complete the Needs Assessment were identified.

The findings of the information compilation / analysis exercise are outlined in **Section 4** of this report.

Section 5 identifies the issues associated with the findings.

3.3 Recommendations

Based from the information gained from the data collection and summary of interviews combined with the subsequent technology and resource analysis , recommendations for a GIS system is presented in **Section 6**.

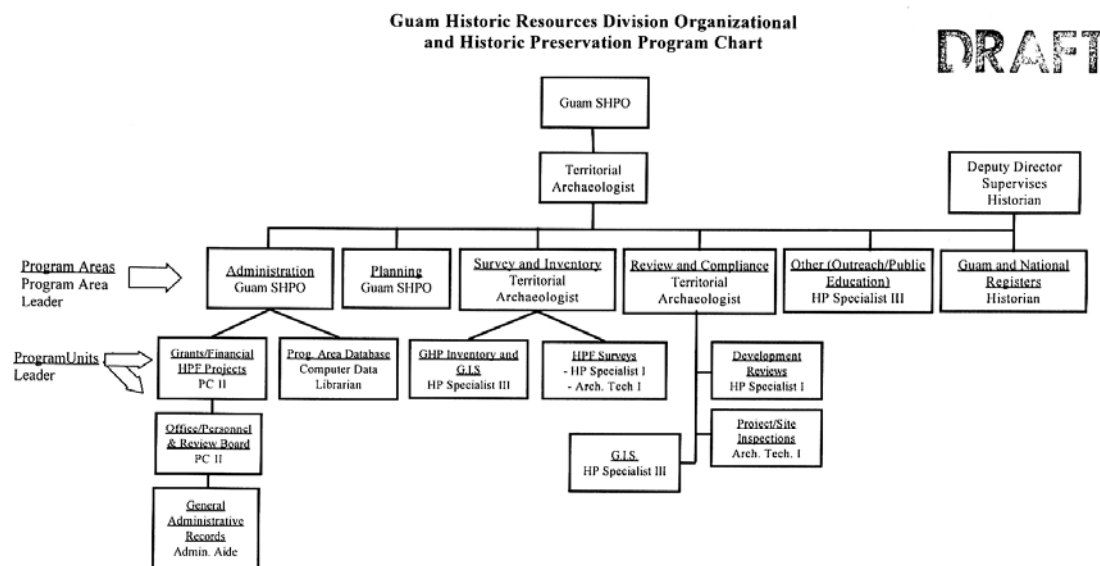
SECTION 4 - SUMMARY OF FINDINGS

4.1 GHRD Organizational and Historic Preservation Program Chart

The Historic Preservation Program is administered by the GHRD, Department of Parks and Recreation. The National Park Service (NPS) approved Guam's participation in the National Program since 1975. The Division is supervised by the Guam (State) Historic Preservation Officer. The Division Manages six (6) NPS-approved program areas:

1. Administration Program Area
2. Historic Preservation Planning Program Area
3. Survey Inventory Program Area
4. Review and Compliance Program Area
5. Guam and National Registers Program Area
6. Other (Outreach/Public Education) Activities Program Area

For a description of program areas and eligible/ineligible activities refer to Chapter 6- NPS Historic Preservation Fund Manual available at the GHRD main office also known as the State Historic Preservation Office (SHPO), located at 490 Chalan Palasyo, Agana Heights, 96910, across from the U.S. Naval Regional Hospital. Below is the GHRD's Organizational and Historic Preservation Program Chart.



The Historic Preservation Program is administered by the Guam Historic Resources Division, Department of Parks and Recreation. The National Park Service (NPS) approved Guam's participation in the National Program since 1975. Guam receives Historic Preservation Fund (HPF) Grants on approved annual grant applications. The Division is supervised by the Guam (State) Historic Preservation Officer. The Division manages six NPS-approved program areas. For a description of program areas and eligible/ineligible activities refer to Chapter 6 - NPS Historic Preservation Fund Manual.

Program Staff:

1. Guam SHPO, Lynda B. Aguon; FTE 100% General Fund
2. Territorial Archaeologist, Victoriano April; FTE 100% General Fund. Territorial Archaeologist supervises the Division in the absence of Guam SHPO
3. Historic Preservation Specialist III, William Hernandez; FTE 100% HP
4. Historic Preservation Specialist I, Jose U. Garrido; FTE 100% HPF
5. Archaeological Technician I, Alfred Masaga; FTE 100% HP
6. Program Coordinator II, Marie DelaRosa; FTE 100% HP
7. Program Coordinator I, Cheryl Bustos; FTE 100% HPF
8. Administrative Aide, Jayna U. Borja; FTE 100% General Fund
9. Computer Data Librarian, Christine Olkerill; FTE - Limited Term 100% HPF
10. Historian, Anthony Ramirez; FTE 100% General Fund. Historian is supervised by the Deputy Director.

August 10, 2006

Two of the six Historic Preservation Program Areas are directly linked to the GIS technology. These two areas are Survey and Inventory, and Review and Compliance.

4.2 Program Descriptions

- **Survey and Inventory Program Area** - survey is activity directly pertinent to the location, identification, and evaluation of historic and archeological resources. Inventory relates to the maintenance and use of previously gathered information on historic and archaeological resources within the State.
- **Review and Compliance Program Area** – refers to State activities that advise and assist public (Federal, State, and local government) agencies in carrying out their historic preservation responsibilities broadly described and established under Sections 106 and 110 of the National Historic Preservation Act, as amended, and implemented through 36 CFR 60, 61, 63 and 800; as well as in other Federal historic preservation-related law. State and local government responsibilities are those established in specific State or local legal and regulatory mandates which parallel in intent and objective the Federal laws city above.

4.3 Current Procedures

- Requestor from a Federal agency, Government of Guam Agency, company, firm or a private individual arrives at the GHRD office with a request form. Majority of the request form originates from Department of Public Works (DPW) as a “Building Permits & Inspection Section Application for Permit & Plan Review.” The rest of the forms are federal and Government of Guam Agency custom made forms such as the GPA utility clearance sheet.
- Program Coordinator I, Cheryl Bustos, generates an R/C number from the “**Review and Compliance (RC) Master Database**” and writes the R/C number on the request form. The RC Database is a Microsoft Access database created in-house by GHRD Computer Data Librarian. Below are some of the pertinent fields (actual field names and type) from the RC database:

<i>(RC Master) Field Name</i>	<i>Type</i>
RC#	Text
Doc Date	Date
Date Recd1	Date
Doc From	Text
RPE	Text
Rsp Date	Text
Applicant/POC	Text
Company	Text
FED	Text

Local Agency	Text
Arch Firm	Text
Project/Title	Text
Area/Village	Text
Lot #	Text
Project/Permit #	Text
Acreage/Hectares	Text
Comments	Memo
Report(s)Rec'd	Text
Findings 1	Text
Findings 2	Text

- GHRD-Review and Compliance (RC) staff is called to review the request. If the location of the subject area is readily known to be cleared of historic sites, then the request form is signed and cleared. However, if the area is unknown further research is conducted. The request form and the Department of Land Management (DLM) property Map are photo copied.
- An RC Info Sheet is printed from Microsoft Word. The RC Info sheet basically duplicates the fields from the RC Master Database. However, the RC Info Sheet is created independently and not interfaced with the RC Master Database. RC Info Sheet is attached with the DPW Plan Review copy and the DLM map copy. The documents are routed to GHRD review staff. Below is the data structure of the RC Info Sheet:

(RC Info Sheet) FieldName	Type
Today's Date	Date
Date Recd	Date
Document Date	Date
RC#(s) Existing	Text
New#	Text
RD Dbase Project Title	Text
New Project Title	Text
Federal Agencies	Text
Local Agency/Company/Firm	Text
Arch Firm	Selection
Latest Response	Yes/No
SHPO Notes	Text

- There are three ways of conducting the research:

1. Manually search the printed maps and documents from the **Guam Historic Properties Inventory (GHPI) -**
2. Manually search the library of **Survey Reports**
3. Utilize the **ArcView/ArcGIS 9.1** software to search the spatial data - the following shape files and raster data are used to query the location of the area in question:

(ArcView) Data Set	Data Format	File Type	Feature Type
IKONOS Guam Ortho Aerial	Raster		
Quickbird Satellite Ortho	Raster		
Buildings	Vector	Shapefile	Point
Business	Vector	Shapefile	Polygon
Coastal Features	Vector	Shapefile	Point
Coastal Reserve	Vector	Shapefile	Polygon
Contours	Vector	Shapefile	Polyline
Geo_roads	Vector	Shapefile	Polyline
Historical Sites	Vector	Shapefile	Point
Land_parcel	Vector	Shapefile	Polygon
Municipal	Vector	Shapefile	Polygon
Soil	Vector	Shapefile	Polygon
Watershed	Vector	Shapefile	Polyline
Wetlands	Vector	Shapefile	Polyline

- The vicinity map is printed from ArcView and field/site inspection is scheduled with the requestor. An active RC file folder is created by the Administrative Aide, Jayna Borja, and given to one of the RC staffs for processing:

William Hernandez	Historic Preservation Specialist III
Jose Garrido	Historic Preservation Specialist I
Alfred Masga	Archeological Technician I

- Below is the summary of the site/field inspection procedures:
 1. Schedule an Appointment. Contact the owner of the property or contractor and inform them about the schedule of your visit to the site.
 2. Field Equipments/Tools- GPS Handheld Trimble Geoexplorer, Digital Camera and Hard Hat
 3. Verify the site's vegetation

4. Check the type of plants or grass in the area and note if there are any old trees in the area or any sign that the area has been untouched for years
 5. Check the landscaping – look for any sign of previous digging, construction or development made
 6. Check the location – is the building project suitable for the area? Is it next to the beach or river? What kind of buildings is present around the area? Is it Commercial or industrial?
 7. Utilize the GPS handheld to acquire the coordinate (longitude & latitude) of the site. The coordinate is not saved or recorded on the GPS handheld unit. The coordinate is manually written on the field notebook.
 8. Take digital photographs of the vegetation and landscaping.
 9. Save the information on the PC computer– save the documentation and image file on the RC site inspector's computer
- Back in the GHRD office, the RC field inspector updates the printed site-area inspection report log (SAIR) by manually writing the information on the paper. Below is the structure of the printed hard copy:

(SAIR) FieldName	Type
SAIR Number	Text
Date of Inspection	Date
Permit Number	Text
RC Number	Text
Lot Number/ Area	Text
Project Location/Title	Text
Inspection Results/Determination	Text
Permit Status	Text
HP Staff	Text

- A GHRD Site/Area Inspection Report is prepared by the RC site inspector through the software called OMNIFORM. This software is not interfaced with the RC Master Database. The printed inspection report and hard copies of field photos are forwarded to the Territorial Archaeologist, Victoriano April, and Guam SHPO, Lynda Aguon, for review and comments. The following fields are included in the OMNIFORM Inspection Report:

(OMNIFORM) FieldName	Type
Brief Description Property	Text
Date of Inspection	Date
Disposition of report	Selection
Documents Attached	Yes/No
GHPO Comments	Text
GHRD Reference Number	Text
GHRD Staff	Text
Inspection Results	Text
Land Use	Text
Location of Photographs	Selection
Lot Numbers	Text
Lot Size	Text
Municipality	Text
Other Individuals Present	Text
Project Name	Text
Project Owner	Text
Property Condition	Text
Recommendation	Selection
References	Text
Report Prepared by	Text
Report Reviewed by	Text
Results of Inspection	Selection
Site in close proximity to Lot	Yes/No
Site Type	Selection
Village	Text

- The Territorial Archaeologist or Guam SHPO determines if the requestor needs to hire an archaeologist to conduct a site study on the project area. If the site inspection does not require an archaeologist, then the requestor is contacted and the request form is signed and cleared. The Site Inspection Report (Omniform) is forwarded to Administrative Aide, Jayna Borja for filing; copy of the RC request form (i.e. DPW building permit review) is given to Archeological Technician I, Alfred Masga for filing; and the original digital photos are saved on the RC staff's individual workstation hard drive.
- Program Coordinator I, Cheryl Bustos, updates the status of the RC Master Database which is currently saved on her workstation's hard drive due to the inoperable Data Server.
- If the Territorial Archaeologist or Guam SHPO determines that the requestor needs to hire an archaeologist for the project area, RC staff provides a listing of available

archaeologists on the island. Once the requestor provides the proof of document that an archaeologist has been hired, the request form is signed and cleared.

- The hired-archaeologist submits a site report to GHRD based on research/design. One of the most important data required by GHRD on the report is the **GPS coordinate(s)** of the new site(s) stored in digital format. If a new site is discovered on the project area, a **Guam Historic Properties Inventory (GHPI)** form is completed and submitted by the project's archaeologist to GHRD. A new GHPI number is manually generated by GHRD staff. The GHPI listing is not stored in a digital database. It is currently stored and maintained on a hard cover-paper-notebook. There are currently 2133 sites on the listing with the following fields:

(GHPI) FieldName	Type
Area	Text
Completed or Pending	Selection
Date Entered	Date
HP Staff	Text
Lot Number	Text
Municipality	Text
Site Name	Text
Site Number	Text
USGS Quad Number	Text

- Once the project is completed, the archaeologist's site report is filed on GHRD's library while the GHPI form is stored with the rest of the GHPI's.
- Several weekly, monthly, semi-annual and yearly reports are created by GHRD staff using both manual counting method and automated querying on the RC Master Database. Below are some of the important reports created mostly in Microsoft Excel and Word:
 1. Weekly Report Log of RC
 2. Monthly Report Log of RC
 3. Semi-Annual Report-Performance Report Permit Chart#2 for State CZM Program with "Networked" Agencies
 4. Exhibit 7-E Cumulative Products Table- End of Year Report/Program Area and Products
 - 7E-1 Review and Compliance
 - 7E-2 National Register
 - 7E-2 Preservation Tax Incentives
 - 7E-3 Survey and Inventory
 - 7E-3 Planning

- 7E-4 Local Government Certification/Pass-Through
- 7E-4 Development, Acquisition, and Covenants
- 7E-4 Other Activities

4.4 Other GIS Procedures

Consultant Archaeologist, Richard Olmo, is currently researching the Site Reports (Book) and transferring the Longitude and Latitude in Degree/Minute/Second format from the Reports into an excel file named “Historic_sites_convert.xls.” The Longitude and Latitude are entered manually in the excel sheet. Once completed, ESRI ArcView is opened and the list of coordinates from the excel sheet are imported inside ArcView to create vector point-features. The vector point-features are then saved as a shape file.

4.5 Computer Hardware and Software

4.5.1 Workstations

GHRD currently has nine (9) individual workstations ranging from Intel PIII 500MHz to Intel P4 3.0 GHz. The installed RAM (Random Access Memory) ranges from 192 MB to 1 GB. Only one workstation, PC4, is attached to a printer, HP LaserJet 5Si, which is shared on the network. The rest of the workstations are capable of printing on the shared printer. In addition, the workstations are allowed to print on the Xerox machine (Xerox Work Center Pro C3545PS Colored Printer/Copier) attached on the network.

Two (2) computers, PC1 and PC5, are equipped with DVD+RW optical drives while the rest have CD-RW. Only five (5) computers; PC1, PC3, PC4, PC5 and PC8, have at least 40 MB of hard drive storage capacity. In addition, only three (3) workstations, PC1 and PC8, have video cards with at least 128 MB of memory. The workstations are mapped on three network drives named: pagemaker (drive X), data (drive Y) and omniform (drive Z). There is no external hard drive attached to any of the computers.

Only three (3) of the nine (9) computers; PC1, PC4 and PC5, meet the minimum system requirements for ArcView - at least 512 Mb of RAM and 1 GHz of PC-Intel processor. Out of these three GIS capable computers, only one (1) has the **ESRI ArcGIS 9.1**. This GIS workstation, PC5, is a generic cloned system with the following configuration:

- Intel Celeron 2.4 GHz CPU
- 1 GB of RAM
- Two hard drives: 60 GB for Operating System (OS) Drive and 40 GB for Data Drive
- S3 ProSavage 32MB(onboard Video Card)
- OS- Win XP-Pro SP1
- Antivirus- Norton 2006
- Firewall- Norton Protection Center
- Productivity Software- Microsoft Office XP Standard and **ESRI ArcGIS 9.1**

This GIS workstation is being utilized by four (4) GHRD staffs:

- Willian Hernandez
- Jose Garrido
- Alfred Masga
- Richard Olmo

Overall, the work stations utilize the following pertinent software:

- **Operating System-** Win 2000 SP4, Win XP-Pro SP1 and Win XP-Pro SP2
- **Antivirus** – Norton Corporate, Norton, Norton 2006 w/ internet security and Norton 2006 (All workstations)
- **Firewall-** Symantec and Norton Protection Center (Only PC1, PC4 and PC5)
- **Productivity-** Microsoft Office 2003 Standard, Microsoft Office XP Standard, Nero Express 5.5, Adobe PDF Reader and **ArcGIS 9.1(only 1 license)**. Microsoft Access, Excel, Word and Acrobat PDF Reader are the most utilized applications from the productivity softwares.

4.5.2 Server

GHRD has a Dell Power Edge 1600 SC Data Server with 1.8 GHz Intel XEON CPU, 1 GB of RAM, 12 GB Storage for OS Drive, 120 GB Storage for Data Drive (Raid/Mirror) running on Windows 2000 Server OS. The data server's domain controller, proxy, email exchange and print/file sharing have not been configured during the time that GIS GLOBAL performed the data collection. The data server's folders were shared to all users on the local area network (LAN). User management and security levels were unavailable. Few weeks before completing this final needs assessment report, the data server became inoperable and still currently under repair.

Below are the complete listings of the workstations and Data Server with detail information.

Hardware	PC1	PC2	PC3
Brand Name	IBM ThinkCenter	Nobilis	Dell Optiplex GX280
YearMade			
CPU	P4 3.0GHz HT	P3 500MHz	P4 2.8GHz
RAM	1GB	192MB	256MB
HDD	80GB (56GB free)	6GB(C:) 30GB(D:and F:)	40GB (30GB Free)
VideoCard	Intel (onboard)128MB	Trident 9680 (onboard) 1MB	Radeon 128MB
Floppy		1.44	1.44
Optical Drives	DVD+RW	CD-RW and CD-Rom	DVD, CD-RW Combo
Ports IO	USB 2front 4back	USB 2back	USB 2front 2back
External Device	none	none	none
Printer	network printer(HP5Si)		network printer(HP 5Si)
Scanner	none	none	none
Other Storage	2 mapped drive Y,Z named data,omniform		3mapped drive pagemakerX,dataY,omniformZ
Software			
Operating System	Win XP-Pro SP2	Win 2000 SP4	Win XP-Pro SP1
AntiVirus	Norton Corporate	Norton	Norton 2006 w/ internet security
Firewall	Symantec	none	
Productivity	Office 2003 Standard	Office 2000 Standard, Nero Express5.5	Office XP Standard
DirectX Version		9	9
Network			
IP(if static)	168.123.134.68	168.123.134.82	168.123.134.77
Gateway	168.123.134.65	168.123.134.65	168.123.134.65
NIC(wired or wireless)	Wired Cat5	Wired Cat5	Wired Cat5
PC Name(networkID)	OFFICE1	Hpofc.ghpo.local	OFFICE8
WorkGroup/Domain	GHPO	ghpo.local	GHPO
task	mostly word files		Excel, Word, AcrobatPDF

Hardware	PC4	PC5
Brand Name	Dell Optiplex GX270	Clone System
YearMade		
CPU	P4 2.2 GHz	Celeron 2.4GHz
RAM	512MB	1GB
HDD	80GB (63GB Free)	C:60GB, F:40GB
VideoCard	Ge-force mx 440 64MB	S3 ProSavage 32MB(onBoard)
Floppy	1.44	1.44
Optical Drives	CD-RW	DVD+RW
Ports IO	USB 2front 2back	USB 2front 4back
External Device		
Printer	HP LaserJet 5Si (Shared on the network)	network printer (HP LaserJet 5Si)
Scanner		
Other Storage	3mapped drive pagemakerX,dataY,omniformZ	3mapped drive pagemakerX,dataY,omniformZ
Software		
Operating System	Win XP-Pro SP1	Win XP-Pro SP1
AntiVirus	Norton 2006 w/ internet security	Norton 2006
Firewall	Norton ProtectionCenter	Norton Protection Center
Productivity	Office 2003 Standard	office xp Standard, ArcGIS 9.1
DirectX Version	9	9
Network		
IP(if static)	168.123.134.74	168.123.134.78
Gateway	168.123.134.65	168.123.134.65
NIC(wired or wireless)	Wired	Wired
PC Name(networkID)	OFFICE2_ghpo.local	GIS
WorkGroup/Domain	ghpo.local (domain)	GHPO
task	Word Excel PDF	word, wxcel

Hardware	PC6	PC7	PC8
Brand Name	Nobilis	Nobilis	Dell Optiplex GX280
YearMade			
CPU	Intel Celeron 2.4GHz	Intel Celeron 2.4GHz	P4 2.8GHz
RAM	192MB	192MB	256MB
HDD	12GB(C:)	20GB(C:)	40GB (30GB Free)
VideoCard	S3G 3259(onBoard)	S3G 3259(onBoard)	Radeon 128MB
Floppy	1.44	1.44	1.44
Optical Drives	CD-ROM CD-RW	CD-ROM CD-RW	DVD, CD-RW Combo
Ports IO	USB 2back	USB 2back	USB 2front 2back
External Device			none
Printer	HP LaserJet 5Si(network)	HP LaserJet 5Si(network)	network printer(HP 5Si)
Scanner			none
Other Storage	3mapped drive pagemakerX,dataY,omniformZ	3mapped drive pagemakerX,dataY,omniformZ	3mapped drive pagemakerX,dataY,omniformZ
Software			
Operating System	Win XP-Pro SP1	XP-Pro SP1	Win XP-Pro SP1
AntiVirus	Norton 2006	Norton 2006	Norton 2006 w/ internet security
Firewall			
Productivity	Office 2003 Standard	Office XP	Office XP Standard
DirectX Version			9
Network			
IP(if static)	168.123.134.79	168.123.134.101	
Gateway	168.123.134.65	168.123.134.65	168.123.134.65
NIC(wired or wireless)	Wired	Wired	Wired Cat5
PC Name(networkID)	vicapril	almasga	OFFICE5
WorkGroup/Domain	GHPO	GHPO	GHPO
task	Word	Word, Excel	Excel, Word, AcrobatPDF

Hardware	PC9	SERVER
Brand Name	Nobilis	DELL PowerEdge1600SC
YearMade		
CPU	Intel Celeron 2.4GHz	Intel XEON 1.8GHz
RAM	192MB	1GB
HDD	20GB(C:)	12GB(c:) 120(d:)
VideoCard	S3G 3259	ATI DAC 8MB
Floppy		1.44
Optical Drives	CD-ROM CD-RW	CD-ROM CD-RW
Ports IO	USB 2back	
External Device		
Printer	HP LaserJet 5Si(network)	
Scanner		
Other Storage	3maped drive pagemakerX,dataY,omniformZ	
Software		
Operating System	XP-Pro SP1	Windows 2000 Server
AntiVirus	Norton 2006	
Firewall		
Productivity	Office XP	
DirectX Version		
Network		
IP(if static)		168.123.134.100
Gateway	168.123.134.65	168.123.134.65
NIC(wired or wireless)	Wired	
PC Name(networkID)		ghposvr.ghpo.local
WorkGroup/Domain	GHPO	ghpo.local
task	Word, Excel	Server (Data Storage)

4.5.3 Network

GHRD's computers are connected on a LAN (Local Area Network) at 10/100 Mbs. In addition, GHRD has a high-speed DSL (1.5 Mb) internet connection. Since the data server is still under repair, the LAN is only utilized for network printing and emailing.

SECTION 5 - ISSUES

GIS GLOBAL identified the issues that GHRD staffs viewed as most important in implementing the GIS :

- Data Server needs to be fixed and available everyday to share important databases such as the RC Master Database
- RC Master Database must be available for viewing, inputting and updating to GHRD staffs
- RC Mater Database needs to be upgraded into a user friendly interface
- Old computers need to be upgraded
- GIS training on simple searching, editing, creating and printing maps will enhance the GHRD's GIS capabilities
- GPS handheld training on how to save the coordinates on the unit
- Microsoft Access training is required
- Protocol on moving, renaming and creating folders on the GIS workstation must be put in place
- GHRD staff must be able to easily create various reports at any time of the year
- Manual counting of weekly/monthly reports must be automated
- Computerized existing manual entry of data on paper
- New GIS data layer for GHRD's purposes must be created
- Existing GIS coordinates with unknown projections must be corrected
- Level of security must be present on all databases

SECTION 6 - RECOMMENDATIONS

Recommendations are grouped into the following categories:

- Core GIS hardware and software
- Customized Database and Graphic User Interface (GUI)
- Creation of a New GHRD-Geodatabase
- Data standards
- Data security
- Staffing and training

6.1 Core GIS Hardware and Software Needs

The following hardware and software are recommended for GHRD's GIS needs:

Software

- Acquire at least one (1) more license of ESRI ArcView /ArcGIS Version 9.1 or higher to supplement the existing one (1) GHRD license
- Obtain one (1) license of ESRI **ArcGIS Publisher**. ArcGIS Publisher gives the freedom to easily share and distribute GIS maps and data with anyone. ArcGIS Publisher is an extension to the ArcGIS Desktop products (ArcView, ArcEditor, and ArcInfo) used to create published maps (PMFs) that can be viewed, explored, or printed by anyone with the **ArcReader** application. ArcReader™ is a **free**, easy-to-use product that allows anyone to view, explore, and print published map files (PMFs).

With ArcGIS Publisher GHRD can:

- Easily provide interactive maps to all the staff by using the free ArcReader.
- Protect GHRD maps and data from inappropriate use.
- Create rich interactive maps that meet the users' needs
- Provide efficient and controlled access to enterprise GIS data
- Easily package the required data and maps for distribution
- Build custom map viewers for the maps.

ArcGIS Publisher appeals to a wide range of users including:

- Organizations that need to distribute maps within their organization
- Government agencies that need to distribute data and maps to the public
- GIS programmers who want to build simple, custom map viewers

Check <http://www.esri.com/arcreader> for more information

Hardware

- One (1) ea. **Trimble GPS Handheld GeoCollector with Arc Pad** for field/site inspections. Information on this product is available on the web link below:

http://store.esri.com/ESRI/showprod.cfm?SID=2&Category_ID=63

- Two (2) ea. High-capacity **External Hard Drive** (minimum capacity of 120 GB) USB 2.0 connection (e.g., Maxtor, Western Digital) for the two GIS workstations
- Upgrade** Existing GHRD workstations and Data Server to the following specifications:

Hardware	PC1	PC2	PC3
Brand Name	IBM ThinkCenter	Nobilis	Dell Optiplex GX280
YearMade			
CPU	P4 3.0GHz HT	P3 500MHz	P4 2.8GHz
RAM	1GB	192MB	256MB
HDD	80GB (56GB free)	6GB(C:) 30GB(D:and F:)	40GB (30GB Free)
VideoCard	Intel (onboard)128MB	Trident 9680 (onboard) 1MB	Radeon 128MB
Floppy		1.44	1.44
Optical Drives	DVD+RW	CD-RW and CD-Rom	DVD, CD-RW Combo
Ports IO	USB 2front 4back	USB 2back	USB 2front 2back
External Device	none	none	none
Printer	network printer(HP5Si)		network printer(HP 5Si)
Scanner	none	none	none
Other Storage	2 mapped drive Y,Z named data,omniform		3mapped drive pagemakerX,dataY,omniformZ
Upgrade Required	128-256MB 8X AGP Video Card	128MB PCI Video Card Additional 512MB PC100/133 SDRAM 80GB HDD (or Replace entire System)	Additional 512MB DDR RAM 80GB HDD

Hardware	PC4	PC5
Brand Name	Dell Optiplex GX270	Clone System
YearMade		
CPU	P4 2.2 GHz	Celeron 2.4GHz
RAM	512MB	1GB
HDD	80GB (63GB Free)	C:60GB, F:40GB
VideoCard	Ge-force mx 440 64MB	S3 ProSavage 32MB(onBoard)
Floppy		1.44
Optical Drives	CD-RW	DVD+RW
Ports IO	USB 2front 2back	USB 2front 4back
External Device		
Printer	HP LaserJet 5Si (Shared on the network)	network printer (HP LaserJet 5Si)
Scanner		
Other Storage	3mapped drive pagemakerX,dataY,omniformZ	3mapped drive pagemakerX,dataY,omniformZ
Upgrade Required	128-256MB 8X AGP Video Card	128-256MB 8X AGP Video Card

Hardware	PC6	PC7	PC8
Brand Name	Nobilis	Nobilis	Dell Optiplex GX280
YearMade			
CPU	Intel Celeron 2.4GHz	Intel Celeron 2.4GHz	P4 2.8GHz
RAM	192MB	192MB	256MB
HDD	12GB(C:)	20GB(C:)	40GB (30GB Free)
VideoCard	S3G 3259(onBoard)	S3G 3259(onBoard)	Radeon 128MB
Floppy		1.44	1.44
Optical Drives	CD-ROM CD-RW	CD-ROM CD-RW	DVD, CD-RW Combo
Ports IO	USB 2back	USB 2back	USB 2front 2back
External Device			none
Printer	HP LaserJet 5Si(network)	HP LaserJet 5Si(network)	network printer(HP 5Si)
Scanner			none
Other Storage	3mapped drive pagemakerX,dataY,omniformZ	3mapped drive pagemakerX,dataY,omniformZ	3mapped drive pagemakerX,dataY,omniformZ
Upgrade Required	128-256MB 8X AGP Video Card Additional 512MB DDR333 RAM 80GB HDD	128-256MB 8X AGP Video Card Additional 512MB DDR333 RAM 80GB HDD	Additional 512MB DDR333 RAM 80GB HDD

Hardware	PC9	SERVER
Brand Name	Nobilis	DELL PowerEdge1600SC
YearMade		
CPU	Intel Celeron 2.4GHz	Intel XEON 1.8GHz
RAM	192MB	1GB
HDD	20GB(C:)	12GB(c:) 120(d:)
VideoCard	S3G 3259	ATI DAC 8MB
Floppy		1.44
Optical Drives	CD-ROM CD-RW	CD-ROM CD-RW
Ports IO	USB 2back	
External Device		
Printer	HP LaserJet 5Si(network)	
Scanner		
Other Storage	3mapped drive pagemakerX,dataY,omniformZ	
Upgrade Required	128-256MB 8X AGP Video Card Additional 512MB DDR333 RAM 80GB HDD	Upgrade CPU from 1.8 to 2.8 GHz Replace Defective RAM 1GB PC2100DDR Add Additional 1 GB RAM PC2100 DDR Upgrade 12 GB OS HDD to 80GB

The recommended desktop system requirements for ArcView are shown on **Appendix C**.

6.2 Customized Database and Graphic User Interface (GUI)

Revamp RC Master Database

The RC Master Database needs a major overhaul and upgrade. Presently, the RC database is accessed directly via the Table/Datasheet View. This raw view is designed for the programmer or database administrator and not for the regular users. Table view is not user friendly and allows accidental erasures or mistakes to occur on the database. Forms shall be created to act as Graphic User Interface (GUI) between the users and the raw table. Forms will allow drop-down list selection, combo boxes, check boxes and other control buttons to be easily utilized by the user.

GIS GLOBAL is recommending a two-stage process for upgrading the RC Database:

Phase 1

- Create new database field structure in Access using GIS industry data standard
- Disseminate a survey form of what additional fields are needed by GHRD staffs
- Schedule group meeting and discuss essential issues pertaining to the RC Database
- Consolidate all fields related with the RC request in this new database (e.g. fields from RC Info Sheet and (SAIR) Site-Area Inspection Report Log)
- Generate new Forms in Access to act as Graphic User Interface (GUI) for the users
- Request approval of new database structure design and new forms from Guam SHPO, Lynda Aguon
- Finalize new database field structure and new forms in Access for implementation
- Map and migrate existing data to new database structure
- Share the new database on the Data Server to be available for viewing, inputting and updating by GHRD staffs

Phase 2

- Create new Queries in Access such as weekly, monthly and yearly reports
- Generate new Reports in Access such as weekly, monthly and yearly reports
- Cease the redundant printing of **RC Info Sheet** from Microsoft Word and initiate the RC Info Sheet form from the new RC Database
- Eliminate the manual logging of the Site-Area Inspection Report Log (**SAIR**) and update site-inspection data by accessing the new RC database
- Replace the printing of the Site Inspection Report Form in **OMNIFORM** software with the creation of a new site inspection report form in the new RC database
- Require the **Archaeological Site Report** to include the GPS coordinate (longitude and latitude) of each new site and the type of coordinate system/projection used in digital format. This information shall be inputted in the new RC database.
- Formulate a GHRD RC database Protocol
- Request approval of new Queries, Reports and Protocol from Guam SHPO, Lynda Aguon
- Finalize the new Queries, Reports and Protocol for implementation
- Share the new Queries and Reports on the Data Server for accessibility

- Import a copy of the new RC Database in ArcView for joining/relating purposes with the new GHRD Personal Geodatabase (to be discussed on the next section)

Moreover, GIS GLOBAL recommends that a **standard protocol** concerning the **digital photo** taken from the site inspection must be implemented. The following topics must be discussed:

- Standard Naming Convention for the folder and photos must be setup
- Downloading and saving all digital photos on the Data Server

When the folder and photo names are properly setup, these photos can be included in the new RC database. Consequently, the digital photos will be accessible in ArcView when searching for an RC request number.

In summary, the implementation of the new RC database results in effective real-time tracking of RC request; elimination of time-consuming manual counting method; consolidation and prompt printing of various reports at any given time of the year; elimination of redundant reports such as RC Info Sheet and SAIR; ability to join the descriptive data with the spatial data in ArcView; and ultimately, improve the employees' self-confident and morale.

Automation of GHPI Tracking System on PC (Personal Computer)

Presently, the **Guam Historic Properties Inventory (GHPI)** numbering and tracking system is manually updated on paper. GIS GLOBAL recommends the automation of the GHPI on Access Database:

- Create new database field structure in Access using existing GHPI fields
- Distribute a survey form of what additional fields are needed by GHRD staffs
- Initiate a group discussion and discuss essential issues that affects the automation of the GHPI
- Generate new Forms (GUI), Queries and Reports in Access
- Formulate a Protocol for the new GHPI Tracking System
- Request approval of new database structure design, new forms, queries, reports and the protocol from Guam SHPO, Lynda Aguon
- Finalize the new database field structure, Queries, Reports and Protocol for implementation
- Migrate existing data to new database structure by manually typing the fields
- Share the new database on the Data Server to be available for viewing, inputting and updating by GHRD staffs

The advantages of automating the GHPI Tracking System on the PC are:

- Efficient real-time inventory management of the GHPI
- New reports can be created instantaneously based on the historical data

- New reports can be easily printed, saved in other digital formats, and emailed as attachments
- Duplicate Digital Data can be backed-up without photo-copying
- Fast results and Powerful search/query are easily achieved

6.3 Creation of a New GHRD-Personal Geodatabase

- Create a new GHRD-Personal Geodatabase using the ArcGIS/ArcCatalog and/or Microsoft Access programs. This geodatabase will include pertinent relational field that will allow joining of attribute data with the descriptive data from the new RC Database mentioned above.
- Conduct group meetings with GHRD staff concerning the type of fields, attributes, feature classes and tables to be included in the geodatabase. The final field structure and feature classes shall be presented and approved by Guam SHPO.
- Design new point, line and polygon feature classes, and import descriptive tables (e.g. Dbase, Excel and new RC Access Database) in the geodatabase. It is imperative that the new geodatabase meets the industry's data standard for compatibility with other local and federal agencies' GIS system (this is further explained on the next section).
- Add the new feature classes from the geodatabase as new layers on ArcView and implement a protocol on its usage. The new spatial-vector data can be created in various methods shown below. GHRD personnel must be trained these procedures (discussed in later Section).
 1. Import coordinates from Excel, Dbase or Access Database
 2. Import coordinates from shape files created with third party software such as Trimble's Pathfinder/GPS handheld
 3. Create coordinates by manually editing and creating point, line, or polygon attributes in ArcView

The main purpose of this new geodatabase is to successfully track all RC requests and other GHRD projects with spatial-vector features. This will allow GHRD staffs to **perform powerful searches and queries inside ArcView** by accessing both spatial data located on the geodatabase and descriptive data saved on the new RC database. The future goal of this geodatabase project is to attach all documents related to the RC number or project with the spatial feature on the ArcGIS. These include descriptive data such as Word and Excel documents, paper documents or hard-copies such as site inspection reports, GHPI papers, survey reports and more. **Scanning** of hard-copies will be required in order to attain these results. The ultimate goal is to expedite the processing of RC requests and dramatically improve the inventory management system of GHRD's documents and data.

6.4 Data Standards

GIS GLOBAL recommends that GHRD conforms to the industry's data standards. Consequently, in the near future, GHRD will be exchanging data with several external agencies such as GPA, GEPA, DPW etc. Thus, it is necessary to establish the use of data standards. Data standards fall into several categories and are approved by many bodies such as American National Standards Institute (ANSI), and International Standards Organization (ISO), among others. The first category, metadata, refers to data about data and second, standards for spatial data and its content.

Metadata Standards

Although it is described as data about data, metadata includes vital information about the dataset's collection date, accuracy and precision, its location, and the creating agency, among many other fields of information. This information allows users to make informed decisions about their use of the data being provided. Metadata standards are mostly defined by the FGDC (<http://www.fgdc.gov>).

Data Content Standards

Having well-defined data standards allows for simplified data access by internal and external programs. Data standards ensure consistent results for display and analysis by all responders. Although ad hoc geospatial industry standards have arisen around published data formats, such as ESRI's shapefile, there are many organizations that have proposed other standards for content.

- Homeland Security Infrastructure Program (HSIP) Minimum Essential Datasets (MEDS). Although not an official standard, MEDS details minimum datasets recommended for homeland security. Using The National Map (USGS) as a foundation, it includes other enhanced datasets important for infrastructure protection.
- U.S. Army Corps of Engineers (<http://tsc.wes.army.mil/products/TSSDSTSFMS/tssds/html/>). The standard sponsored by the army is known as "Spatial Data Standards for Facilities, Infrastructure, and Environment," or SDSFIE. SDSFIE is FGDC and ANSI INCITS L1 compliant. The standard covers many different data layers, provides naming conventions, and defines a standard list for the extra information that is collected and stored with the data. The group provides tools for creating ESRI geodatabases that are compliant with the standard. The standard covers a wide range of data layers, not all of which would be relevant to GHRD. Selection of data layers to use should follow industry focused recommendations such as MEDS or the ESRI Homeland Security Data Model and internal GHRD requirements for data types and attributes.
- ESRI Homeland Security Data Model (<http://support.esri.com/datamodels>) Created in collaboration with users in the field who see a need for easily shared standard data models that represent their industry, geodatabase data models are a starting point for users to create their own database. The ESRI Homeland Security Data Model is a blend

of the DHS MEDS recommendation and the U.S. Army Corps of Engineers SDSFIE data model with users own real-world experience.

6.5 Data Security

Data security is a major issue for public and private entities. Different datasets may have different requirements for security, which must be clarified with the data provider in the data sharing agreement. Data produced by GHRD must be viewed and analyzed to determine whether it is appropriate to publish it to a wider audience.

Principle of Least Privilege

A basic fundamental principle that underlies secure systems is the principle of least privilege. The principle of least privilege is that users are only granted the minimum set of privileges that still allow them to complete their job specifications. To meet the principle of least privilege, database roles can be used to grant specific sets of privileges to groups of users working on similar tasks.

Roles to Control Access

The use of roles provides a selection of privileges that are granted to groups of people. Many different roles could be created for different groups of people who will need to access data in the database. Some sample roles that could be created are:

- **Administrator**—Administrators are users who will administer the database.
- **Developers**—Developers create and deploy applications based on data in the database.
- **Data Editor**—Editors are users who will edit data in one or more databases.
- **Data Viewer**—Viewers need to have read-only access to data relevant to their role in the program with which they work. Depending on the number of viewers required or the number of sensitive layers stored in the database, there may be more than one unique viewer role created.

Based on GHRD's need assessment, GIS GLOBAL recommends the following roles:

- **Administrator** - Guam SHPO, Lynda Aguon
- **Developer** - Computer Data Librarian, Christine Olkeriil
- **Data Editors** – Archaeological Technician I, Alfred Masga; HP Specialist I, Jose Garrido; HP Specialist III, William Hernandez; Territorial Archaeologist, Victoriano April and Consultant Archaeologist, Richard Olmo
- **Data Viewer** – the rest of GHRD's staff

6.6 Staffing and Training Needs

This section describes GIS user roles, GIS support roles and responsibilities, and training requirements for each role.

6.6.1 GIS User Roles

GIS user roles can be generalized into three distinct types based on the level of functionality required to meet the GIS business needs.

- **GIS Viewers**—Users who need to see the information on a map; they do not need to analyze the data. These users typically require ArcView only.
- **GIS Analysts**—Users who will take the information being presented and analyze the information to help decision makers. The results of the analysis may be fed back into the centralized database for use by the viewers. These users typically require ArcInfo.
- **GIS Editors**—Users who are responsible for those who will be maintaining data in the enterprise geodatabase. These users typically require ArcEditor or ArcInfo.

Based on GHRD's need assessment, GIS GLOBAL recommends the following GIS user roles:

- **GIS Analysts** - Guam SHPO, Lynda Aguon or contract to outside consulting company
- **GIS Editors** - Archaeological Technician I, Alfred Masga; HP Specialist I, Jose Garrido; HP Specialist III, William Hernandez; Territorial Archaeologist, Victoriano April and Consultant Archaeologist, Richard Olmo
- **GIS Editors** - Computer Data Librarian, Christine Olkeriil
- **GIS Viewers** – the rest of GHRD's staff

6.6.2 GIS Support Roles

To make the GIS operational, several key support roles are required. In some cases, one person may fill multiple roles or several people may contribute to a single role. Below is a list of GIS support roles and a description of the responsibilities for each role.

GIS Coordinator

This person is responsible for directing the planning and execution of all activities defined in the GIS implementation plan and the overall effectiveness of the GIS program. Additional responsibilities include coordinating activities with external agencies and project activities with internal GHRD program staff that utilize GIS.

GIS Technical Lead Staff

Members assigned to this role are responsible for providing technical assistance to GIS users in each program area. Additionally, this role provides technical support services such as training, installation, and troubleshooting technical problems when necessary.

Database Administrator

In some cases, this role can be split into two areas of responsibility. The first area is that of managing the hardware and software for the database server. Tasks in this area include system installation, configuration and monitoring, version upgrades, and data backup and restoring. The second area of responsibility is that of a data administrator for designing, developing, loading, and tuning of the actual data on the database server

GIS Application Programmer

Staff-members assigned to this role are responsible for developing and enforcing application development procedures and standards. Tasks in this role include application design, development, testing, and deployment. In addition, this role provides support to the other staff in troubleshooting custom functionality.

Web Application Administrator

This role is responsible for the installation, configuration, and maintenance of hardware and software required to support Web-based applications. Tasks in this role include monitoring system performance and planning and executing version upgrades.

System Administrator

This role is often filled by staff members from the IT/management information system department who help the database administrator and Web application administrator. Staff in this role are responsible for the network infrastructure; communication technology, such as e-mail; operating systems on desktops and servers; and overall system configuration and maintenance.

More information is available on GIS organizational structure and staffing from the ESRI Project Center Web site at the following Web link.

<http://support.esri.com/index.cfm?fa=projectCenter.gateway&pageID=13>

Based on GHRD's needs assessment, one person may fill multiple roles and several people may contribute to a single role. Below are the recommendations:

- **GIS Coordinator-** Guam SHPO, Lynda Aguon
- **Database Administrator & GIS Application Programmer** - Computer Data Librarian, Christine Olkeriil

- **GIS Technical Lead Staff** – HP Specialist III, William Hernandez; and Consultant Archaeologist, Richard Olmo
- **System Administrator and Web Application Administrator** – can be contracted to outside consulting companies

6.6.3 Training for GIS Users

Needs for GIS users were identified in each of the program areas within GHRD. These users will be viewing, editing, or analyzing data from the new RC database and GHRD-personal geodatabase. Users will need to be trained according to the skill level requirements. Below is the recommended training based on the GIS user roles:

GIS Analysts – ArcPublisher Training on publishing maps for ArcExplorer

GIS Editors – Standard and Advance desktop ArcView Training which includes viewing, querying, creating and printing maps, editing features and table attributes, geoprocessing and more. In addition, GPS mobile handheld training on how to properly utilize the GPS unit must be included. Training includes saving GPS coordinates on the handheld's data file; editing existing data file on the field; creating data dictionaries; using Pathfinder Software to download and upload files to and from the PC; perform differential correction on coordinate data file and more. Finally, Microsoft Access training is also recommended to understand the database structure.

GIS Viewers- ArcExplorer Training for viewing, querying and printing maps prepared by ArcPublisher GIS extension software

6.7 Conclusion

This report sets a course to achieve the vision of building GIS as the foundation for an effective information system to support GHRD's mission statement. The comprehensive GIS Needs Assessment identified detailed GIS needs and pertinent issues from GHRD personnel. The result of the needs assessment produced key findings that were defined and ordered in a phased approach with specific recommendations. These recommendations will provide a guide for GHRD to continue in the second phase of the GIS Strategic Development and Implementation Project which is to provide a GIS Analysis, Conceptual System Design and Customized GIS Training.

Appendix A – Glossary of Terms and Acronyms

Data Model

1. The result of the conceptual design process. A generalized, user-defined view of the data related to applications.
2. A formal method of describing the behaviour of the realworld entities. A fully developed data model specifies entity classes, relationships between entities, integrity rules and operations on the entities.

Database Design - the formal process of analyzing facts about the real world into a structured database model. Database design is characterized by the following phases: requirement analysis, logical design and physical design.

DPR Department of Public

DPW Department of Public Works

DLM Department of Land Management

ESRI

FEMA Federal Emergency Management Agency

FGDC Federal Geographic Data Committee

GEPA Guam Environmental Protection Agency

GHPI Guam Historic Properties Inventory

GHRD Guam Historic Resources Division

GIS Geographic Information System

GovGuam Government of Guam

GPS Global positioning System

GUI Graphic User Interface

HP Historic Preservation

IT Information Technology

NPS National Park Service

PC Personal Computer

PDF Portable Document Format (An Adobe created document format)

RC Review and Compliance

SAIR Site Area Inspection Report

SHPO Guam/State Historic Preservation Officer

System Design - the methodology of designing a computer system that takes into account such factors as user needs, performance levels, database design, hardware specifications, and data management.

Appendix B – GIS Application Description Forms

GIS Application Description

Name of Government Geographic Information System Requirements Analysis

Application Identification #:

Application Name:

Department:

Defined by:

Purpose and Description:

Type of Application:

Display

Query

Query & Display

Map Analysis

Spatial Model

Display/Map Scale:

Query Key:

Response Time:

Frequency:

Data Required:

Features (entities):

Attributes:

Prepared by:

Approved by:

Date:

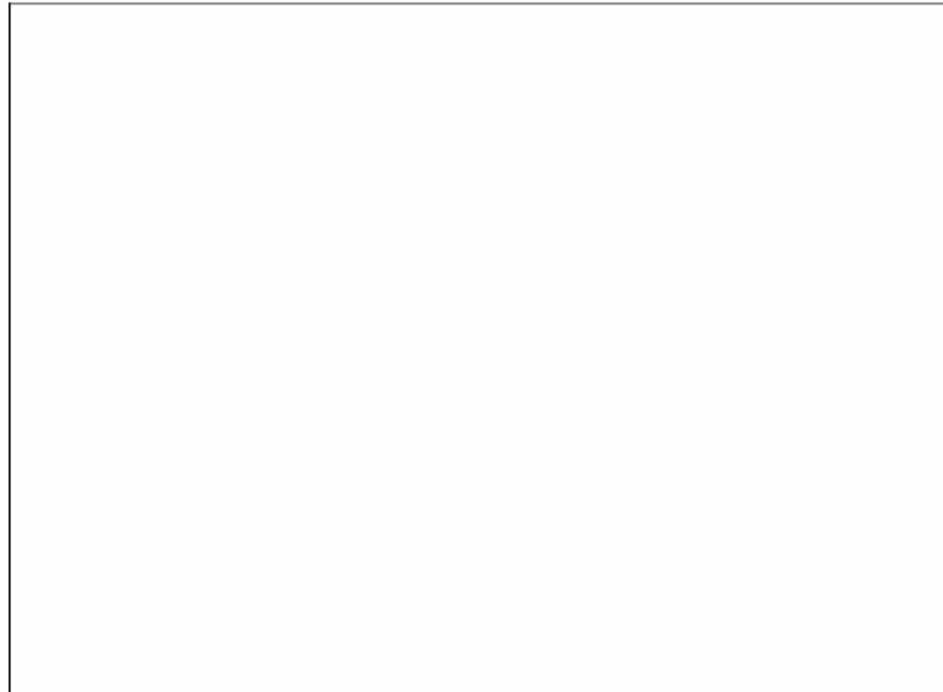
Appendix B – GIS Application Description Forms**Map Display****Name of Government
Geographic Information System
Requirements Analysis**

Application Identification #:
Application Name:
Department:
Defined by:

Graphical Output Sample:

Screen:

Hard Copy:



Symbols/Legend

Prepared by:

Approved by:

Date:

Appendix B – GIS Application Description Forms

Table Display

Name of Government Geographic Information System Requirements Analysis

Application Identification #:

Application Name:

Department:

Defined by:

Report Layout/Format:

Screen:

Hard Copy:

HEADINGS

SUB-HEADINGS

SUB-TOTALS/TOTALS:

Prepared by:

Approved by:

Date:

Appendix B – GIS Application Description Forms

Data Flow Diagram**Name of Government
Geographic Information System
Requirements Analysis**

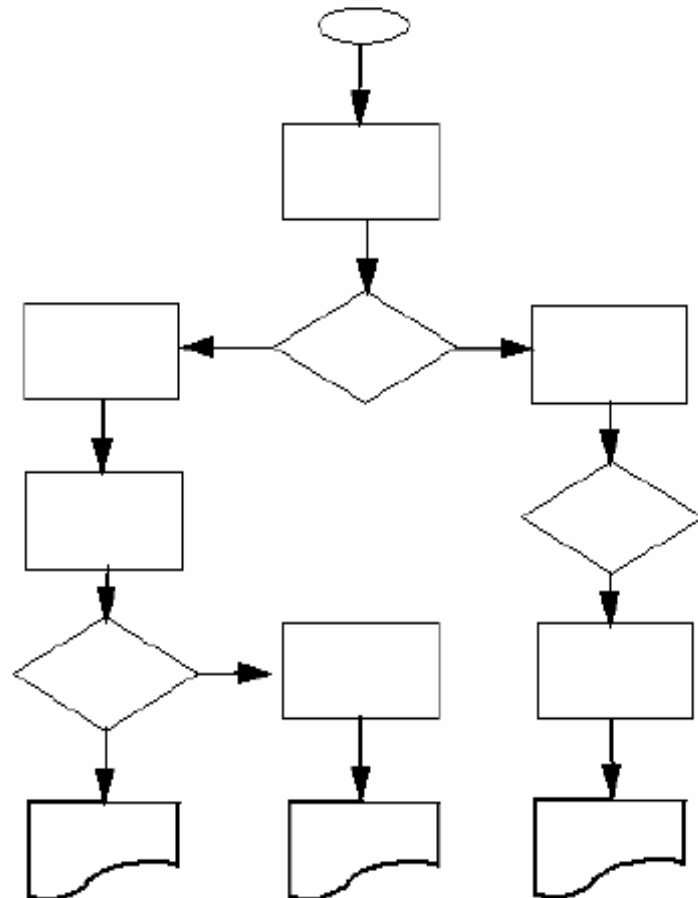
Application Identification #:

Application Name:

Department:

Defined by:

Process Description: Data Flow Diagram or Flow Chart



Prepared by:

Approved by:

Date:

Appendix C - Recommended Desktop System Requirements for ArcView

CPU Speed:

800 MHz minimum

1.0 GHz recommended or higher

Processor:

Pentium or Xeon Processors (i.e. Intel Workstation or Server)

Memory/RAM:

256 MB minimum

512 MB recommended or higher

Display Color:

Greater than 256 colors

Swap Space:

300 MB minimum

Utilizing Windows Terminal Server technology may require additional MB, depending on the number of clients accessing the server.

Disk Space:

605 MB NTFS

690 MB FAT32

Disk Space Requirements:

Disk space does not include the 50 MB of system drive space needed for installation (typically C:\Winnt\System32). The disk space requirement for each of the ArcEditor 9.0 components is provided in the Setup program.

Best Performance Configuration:

For best performance, the following is recommended:

A PC with a fast Pentium chip 800 MHz Minimum (1.0 GHz or higher recommended)

256 MB RAM Minimum (512 MB RAM recommended)

An OpenGL graphics card is recommended to optimize performance in ArcScene.

Texture mapping will be better optimized using an OpenGL graphics card with 32 MB or more of on-board texture memory.

Installation on a fast, NTFS (New Technology File System) hard drive is strongly recommended for the Desktop Application.



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