**UNITED STATES DEPARTMENT OF THE INTERIOR**
**Bureau of Ocean Energy Management, Regulation and Enforcement**
**Office of Offshore Alternative Energy Programs**
April 21, 2011

# Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information Pursuant to 30 CFR Part 285

## I. Introduction

Before the U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) will approve the siting of a facility, structure or cable proposed for a project on the Outer Continental Shelf (OCS), an applicant must submit with its Site Assessment Plan (SAP), Construction and Operations Plan (COP), or General Activities Plan (GAP), as applicable, the results of its site characterization surveys, with supporting data, to BOEMRE. Unless stated otherwise, the following guidelines refer collectively to SAPs, COPs and GAPs as "plans." Site characterization activities in these guidelines refer only to geophysical and geological surveys, hazards surveys, and archaeological surveys conducted for the purpose of preparing plans. While site characterization activities covered by these guidelines could identify other resource types, such as benthic communities, recommendations for conducting and reporting the results of other baseline collection studies (e.g., biological) will be provided by BOEMRE in separate guidelines.

These guidelines provide recommendations for complying with the following geological and geophysical survey, hazards survey, and archaeological survey information requirements of BOEMRE's renewable energy regulations at 30 CFR Part 285:

- The applicant must demonstrate that they are prepared to conduct the activities proposed in the plan in a manner that: conforms to all applicable laws, regulations, and lease or grant provisions; is safe; and does not cause undue harm or damage to objects of historical or archaeological significance (§ 285.606(a)(1),(2) and (4); § 285.621(a),(b) and (d); § 285.641(a),(b) and (d)).
- With a COP, the applicant must also submit an overall site investigation report for the facility that integrates the findings of the shallow hazards surveys and geological surveys, and if required, the subsurface surveys with supporting data (§ 285.626(a)(6)).
- The applicant must submit one paper copy and one electronic version of the plan (§ 285.607; § 285.622(a); and § 285.642(a)).
- The applicant must include in the plan, the results of geophysical and geological surveys, hazards surveys, and archaeological surveys with the supporting data, as described in § 285.605(b)(1)(2), 285.610(b)(1)-(4); § 285.626(a)(1)-(2) and (4)-(5).
- To assist BOEMRE in complying with NEPA and other relevant laws, the plan must describe hazards information and archaeological resources that could be affected by the activities proposed in the plan, or that could affect the activities proposed in the plan. (§ 285.611(a),(b)(1), and (b)(6); § 285.627(a)(1) and (6); and § 285.646(a) and (f)).

- If, in its SAP or GAP, the applicant applies for a project easement and/or proposes to fabricate and install a facility or combination of facilities that BOEMRE determines to be complex or significant, the applicant must comply with the requirements of subpart G. This includes the submission of a geotechnical report (i.e., listing of all data from boring and recommended design parameters) with the Facility Design Report before fabricating and installing facilities described in the approved plan (§ 285.700; § 285.701(a)(10)). All developers required to submit a COP must comply with the requirements of subpart G.
- Activities for which a proposed revision to the applicant's plan will likely be necessary include, but are not limited to, changes in the location of seafloor/bottom-disturbances by 500 feet (~150 meters) or greater (§ 285.617(c)(6), § 285.634(c)(6), 285.653(c)(6)). The revision may be approved if BOEMRE determines the revision is designed to not cause undue harm or damage to natural resources; life (including human and wildlife); property; the marine, coastal, or human environment; or sites, structures, or objects of historical and archaeological significance (§ 285.617(e)(1); § 285.634(e)(1); § 285.641(e)(1); § 285.655(e)(1)).
- The applicant should not unreasonably interfere with other uses on the OCS (§ 285.606(a)(3), § 285.621(c), (§ 285.641(c)). Potential applicants should also be aware they are independently responsible for complying with other applicable Federal laws, such as the Coastal Zone Management Act, Endangered Species Act, and the Marine Mammal Protection Act, while conducting site characterization activities on the OCS.

## II. Pre-Survey Meeting and Coordination

BOEMRE recommends that applicants request a pre-survey meeting with BOEMRE as early as possible in the planning process. This meeting would help ensure surveys are designed in a manner to provide results that meet the information requirements listed above. A pre-activity meeting may include, but is not limited to, discussions regarding:

- survey plan (navigation pre-plot (1:12,000));
- survey logistics (proposed survey area, dates, times, weather limitations, etc.);
- vessel characteristics (size, equipment, etc.);
- field techniques and equipment to be utilized/specifications of data acquisition systems;
- data to be acquired;
- seafloor characteristics expected based on available information (depth, slope, substrate, etc.);
- data processing and analysis; and
- data and information to be submitted.

## III. Site Characterization Survey Information

This section describes the information that BOEMRE will need in order to process a plan. It also identifies and describes the form in which BOEMRE prefers to receive the data (see also Appendices A-C).

This section of the guidance also includes descriptions of various survey and sampling strategies, techniques, and elements (refer to Table 1 and 2 below). Although there is no requirement that applicants conduct their survey and sampling activities in any particular manner, BOEMRE is presenting these strategies, techniques, and elements to assist potential applicants in obtaining the information necessary for BOEMRE to process a plan. Though it may be possible to obtain this information through means other than those described below, BOEMRE is confident that the strategies, techniques, and elements discussed in this guidance will produce the data necessary to readily determine the absence or presence of geological/geophysical or hazardous features and/or sites, structures, or objects of historical or archaeological significance.

**High-Resolution Geophysical Information and Core Sampling/Testing (Geotechnical) Information**

BOEMRE anticipates that site characterization information would be derived from both high-resolution geophysical (HRG) surveys and from core sampling/testing (geotechnical) surveys. The HRG and core sampling/testing results need to provide information on all seafloor and sub-seafloor conditions, hazards, and archaeological resources, relevant to project siting, design, construction, and operations. BOEMRE will use information submitted by the applicant to evaluate the impact of the seafloor and sub-seafloor conditions on the installation, operation, and structural integrity of a proposed project as well as to assess the potential effects of construction and operations of the proposed project on hazardous features and/or sites, structures, or objects of historical or archaeological significance.

The area surveyed and resolution of the data presented should be sufficient to reliably cover any portion of the site that would be affected by the activities proposed in the plan, including all seafloor/bottom-disturbing activities. BOEMRE recommends the survey area be the widest area possible in cases where uncertainty exists regarding the ultimate methods that the applicant will employ in constructing, operating, maintaining, or decommissioning the proposed project. A larger survey area will give the applicant greater flexibility for placement of structures and methods of construction, operation and decommissioning in the future.

BOEMRE recognizes that HRG data acquisition and core sampling/testing technologies continually evolve and that no single strategy will necessarily be optimum for the variety of conditions that may be present. Applicants should develop plans that utilize best available survey and sampling technologies in ways that address the specific needs of a proposed project and ensure the plan is consistent with the objectives of reliable detection and accurate evaluation of the project area.

Table 1. High-Resolution Geophysical: Strategies, techniques and elements.

| Strategies | Techniques | Elements |
|---|---|---|
| The geophysical survey grid for the project area should include bathymetric charting, hazards assessments, and archaeological resources assessments. These should be oriented with respect to the bathymetry, geologic structure, and renewable energy structure locations whenever possible. The grid pattern for each survey should cover the project area including areas of all anticipated physical disturbances.<br>•Line spacing for all geophysical data collection for hazards and archaeological resource assessments for side scan sonar/sub-bottom profilers should not exceed 150 meters throughout the project area.<br>•Line spacing for bathymetric charting using multi-beam technique or side scan sonar mosaic construction should be suitable for the water depths encountered and provide both full coverage of the seabed plus suitable overlap and resolution of small discrete targets of 0.5m - 1.0m in diameter. | Instrumentation should be deployed in a manner that minimizes interference between the instrumentation systems, results in the least environmental impact practicable, and records all data at the maximum sampling rate of the equipment for the depth/sweep rate used.<br>•All data recorders should interface with the navigation system to ensure proper integration of information.<br>•All instruments should be adequately calibrated and all recorded data readable, accurate, and properly annotated.<br>•A state-of-the-art navigation system should continuously determine the surface position of the survey vessel.<br>•The precision of the navigation system should be ± 1 meter and it should continuously log position fixes digitally along the vessel track and annotate them on all records at intervals not to exceed 100 meters. | **Bathymetry/Depth Sounder**<br>The depth sounder system should record with a sweep appropriate to the range of water depths expected in the survey area. BOEMRE encourages the use of a multi-beam bathymetry system particularly in areas characterized by complex topography or fragile habitats.<br>**Magnetometer**<br>Magnetometer survey techniques should be capable of detecting and aiding the identification of ferrous, ferric, or other objects having a distinct magnetic signature. The magnetometer sensor should be towed as near as possible to the seafloor, but should not exceed an altitude of greater than 6 meters above the seafloor (as typically when it is flown greater than 6 meters above the seafloor the magnetometer does not produce data that can be adequately assessed). The sensor should be towed in a manner that minimizes interference from the vessel hull and the other survey instruments. The magnetometer sensitivity should be 1 gamma or less and the background noise level should not exceed a total of 3 gammas peak to peak. |

| Strategies | Techniques | Elements |
|---|---|---|
| •All track lines should run generally parallel to each other. Tie-lines running perpendicular to the track lines should not exceed a line spacing of 150 meters throughout the project area.<br><br>•Line spacing for all geophysical data collection for archaeological resource assessments (i.e., magnetometer) should not exceed 30 meter line spacing within the area where impacts to the seafloor or bottom-disturbance will occur from sea-floor investigations (e.g., borings), construction activities, installation (e.g., facilities, cable arrays, transmission cables), and/or anchorages or appurtenances. Note: at water depths of greater than 200 meters (generally the depth at which it is difficult to maintain 30 meter line-spacing with any degree of accuracy) the applicant may find it necessary to use other innovative techniques to obtain information.<br><br>The geophysical survey grid for proposed transmission cable route(s) should include a minimum 300 meter-wide corridor centered on the transmission cable location(s). Line spacing should follow that of the respective instrumentation above. | | **Sea Floor Imagery/Side Scan Sonar**<br><br>Recording should be of optimal quality (good resolution, minimal distortion) resulting in displays automatically corrected for slant range, lay-back and vessel speed. BOEMRE encourages the use of a digital dual-frequency side scan sonar system with preferred frequencies of 445 and 900 kHz and no less than 100 and 500 kHz to record continuous planimetric images of the seafloor. The recorded data should be mosaicked to provide a true plan view that provides 100 percent coverage of the project area.<br><br>The side scan sonar sensor should be towed above the seafloor at a distance that is 10 to 20 percent of the range of the instrument. The instrument should be calibrated to enhance echo returns from small nearby objects and features without sacrificing the quality of echo returns from more distant objects and features.<br><br>**Shallow & Medium (Seismic) Penetration Sub-bottom Profilers**<br><br>A high-resolution “chirp” sub-bottom profiler should be used to delineate near-surface |

| Strategies | Techniques | Elements |
|---|---|---|
| | | geologic strata and features. The sub-bottom profiler system should be capable of achieving a vertical bed separation resolution of at least 0.3 meters in the uppermost 15 meters below the mud-line.<br><br>A boomer profiler system should be capable of penetrating greater than 10 meters beyond any potential foundation depth and the vertical resolution should be less than 6 meters. The seismic source should deliver a simple, stable, and repeatable signature that is near to minimum phase output with usable frequency content. When choosing a sub-bottom profiler the applicant should be aware that National Marine Fisheries Service (NMFS) currently considers sound levels above 160 dB re 1 µPa to constitute Level B harassment under the Marine Mammal Protection Act. Sounds above 180 dB re 1 µPa are considered Level A harassment. Thus BOEMRE recommends that, where practicable, sound should be kept below these levels. Note that marine mammal monitoring plans are required by NMFS above these sound thresholds. BOEMRE highly discourages the use of air guns or any instrumentation that exceeds NMFS specifications. |

Table 2. Core Sampling/Testing (Geotechnical): Strategies, techniques and elements.

| Strategies | Techniques | Elements |
|---|---|---|
| Sampling/testing protocols generally use one or more of the following: soil borings, cone penetrometers, and vibracores to elucidate the geotechnical (and geological) aspects of soils and sediments. BOEMRE should be provided with a detailed geotechnical evaluation of the structure's foundation(s) based on analysis of soil borings and cone penetrometers at the site. The results of the tests should allow for a thorough investigation of the stratigraphic and geoengineering properties of the sediment that may affect the foundations or anchoring systems of the structure(s). There should also be sufficient geological/geotechnical sampling and testing of foundation soils to thoroughly categorize engineering conditions within the proposed transmission cable corridor.<br><br>The principal purposes of the tests are to: (1) assess the suitability of shallow foundation soils to support the renewable energy structure or associated transmission cable under extreme operational and environmental conditions that might be encountered; and (2) document soil characteristics necessary for design and installation of all structures and transmission cables. | The results of the hazards survey should be used in planning the geotechnical tests and in selecting locations/depths of soil samples and in-situ tests and should be able to:<br>• Provide analysis of in-situ and laboratory soil test data to estimate foundation soil response to maximum anticipated static and dynamic loads.<br>• Determine embedment depth and predict susceptibility of the foundation to liquefaction and scour phenomena.<br>• Characterize liquefaction potential specifically in the context of regional seismicity.<br>• Evaluate the potential for seafloor erosion and scour in the context of empirically derived current velocity data for the project area.<br>• Integrate the results of the geotechnical and hazards investigations to provide a comprehensive analysis of foundation stability for the site. | Geotechnical testing protocols should retrieve:<br>• The results of adequate in-situ testing, boring, and/or sampling (i.e. cone penetrometer test, vibracorings, etc.) at each foundation location and at every kilometer of the transmission cable route to shore, to examine all important sediment and rock strata to determine its strength classification, deformation properties, and dynamic characteristics.<br>• The results of a minimum of one "deep" soil boring (with soil sampling and testing) at each edge of the project area and within the project area as needed to determine the vertical and lateral variation in seabed conditions and to provide the relevant geotechnical data required for design. To be considered a "deep boring," the soil boring depth should be at least 10 meters deeper than the design penetration of the foundation piles. For areas with highly variable subsea soil conditions, it may be appropriate to obtain a much higher number of deep borings than the minimum described in 30 CFR 285.626(a)(4)(iii), and it may be necessary to obtain one at each turbine foundation location to adequately characterize the stratigraphic and geoengineering properties for each foundation design. |

## IV. Protection of Archaeological Resources

### A) Mitigation through avoidance

BOEMRE recommends avoidance as a primary mitigation strategy. Avoidance strategies seek to ensure that harm or damage to objects of historical or archaeological significance will be less likely (§ 285.606(a)(1),(2) and (4); § 285.621(a),(b) and (d); § 285.641(a),(b) and (d)). The applicant has the option to demonstrate through additional investigations (§ 285.802(b)) that an archaeological resource either does not exist or would not be adversely affected by the seafloor/bottom-disturbing activities.

### B) Unanticipated Discoveries (Chance Finds)

If the applicant, while conducting activities, discovers a potential archaeological resource such as the presence of a shipwreck (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of historic objects, piles of ballast rock), prehistoric artifacts, and/or relict landforms, etc. within the project area the applicant is to:

1) Immediately halt seafloor/bottom-disturbing activities within the area of discovery;
2) Notify the appropriate BOEMRE/OAEP Environmental Branch Chief within 72 hours of its discovery;
3) Keep the location of the discovery confidential and take no action that may adversely affect the archaeological resource until BOEMRE has made an evaluation and instructs the applicant on how to proceed (§ 285.802(a)(1)-(3), § 285.902(e)).

BOEMRE may require the applicant to conduct additional investigations to determine if the resource is eligible for listing in the National Register of Historic Places (§ 285.802(b)).

## V. Contact and Mailing Address

Bureau of Ocean Energy Management, Regulation and Enforcement
Office of Offshore Alternative Energy Programs
Chief, Environmental Review Branch
Mail Stop 4090
381 Elden Street
Herndon, Virginia 20170-4817
703-787-1340

# Appendix A
# Site Characterization Survey Report Preparation

The applicant must submit one paper copy and one electronic version of the plan or application (§ 285.607; § 285.622(a); § 285.642(a)). For the digital report, applicants should provide Adobe PDF versions of all large format map layouts. A digital version of the report should be submitted on a compact disc (CD) or digital video disc (DVD) in PDF format. Applicants are encouraged to provide the results of the overall site characterization information in the following report format:

1. Description of Surveyed Area
OCS lease number(s), block number(s), and lease area(s); and minimum and maximum water depths of the survey area.

2. Reproducible (photocopy) geographic area map (generally page size = 8.5" x 11" and/or 11" x 17" fold-out) showing proposed facility and transmission cable route relative to nearby geographic features.

3. Personnel list noting their functional responsibilities.
A list of the individuals involved in survey planning, fieldwork, and report preparation, and a brief description of their duties.

4. A summary of field operations, including unusual incidents.

5. Technical specifications of survey equipment:

- A brief description of the navigation system with a statement of its estimated accuracy for the surveyed area.
- A brief description of survey instrumentation including scale and sensitivity settings, sampling rates, and tow heights off the seafloor for the magnetometer and side scan sonar sensors.
- A description or diagram of the survey vessel, including its size, sensor configuration, navigation antenna location, cable lengths, and distances from sensors to navigation antenna.
- Vessel speed, course changes, sea state and weather conditions.
- A complete copy of the daily survey operations log (for the entire duration of the mobilization(s)).
- A description of survey procedures, including a statement of survey and record quality, a comparison of data from survey line crossings, and a discussion of any problems that may have affected the ability of the geophysicist or geologist to identify and analyze hazards in the surveyed area.

6. Maps

Applicants should annotate all maps to be submitted with linear bar-scales (feet and meters), geographic and plane coordinates (latitude and longitude, Universal Transverse Mercator (UTM)), lease boundaries, lease numbers, geologic/geotechnical sampling locations, proposed facility site(s) and cable transmission corridors. Large-scale map data should be in a format compatible with the BOEMRE Geographic Information System (GIS) in current use.

Applicants should submit the following set of maps at a standard scale (generally1:12,000) and oriented to true north:

- Navigation Post-Plot Map of the surveyed area, showing survey lines and directions, and navigational SPs at intervals of no more than 100 meters.
- Bathymetry Map at contour intervals of 0.3m to 15m depending on seafloor morphology.
- Geologic Features Maps (from shallow/medium penetration profiler data)
- Side Scan Sonar Contacts Map (map symbol = green square)
- Magnetic Anomalies Map (map symbol = red triangle)
- Magnetic Contour Map
- Shallow Isopach Map showing thickness of unconsolidated Holocene/late-Pleistocene sediments (in meters).
- Hazards Anomaly Map showing significant subsurface conditions of interest, including areas of shallow gas for hazards assessment, keyed to anomaly table in the survey report.
- Shallow Structure Map showing contours (in meters) on top of a late-Pleistocene unconformity prominent within the study area.
- Map for transmission cable pre-installation surveys, the x and y coordinates of the origin and terminus of the proposed transmission cable route and the points where the route crosses safety fairway and anchorage area boundaries, existing pipelines, OCS block lines, and the Federal/state boundary.
- Map of soil borings, cone penetrometer (CPT), and vibracore locations with relatable attributes for geotechnical data.

7. Hazards Assessment

An assessment of the potential for hazards within the surveyed area. This should include, but need not be limited to, discussions of:

- General geological background.
- Bathymetry.
- Seafloor features, including side scan sonar contacts or Remotely Operated Vehicle (ROV) video documentation.
- Geological structure, slumping and sliding, slope gradients, buried channels, submarine canyons, river channels, exposed hard bottoms, and karst areas.
- Shallow gas, gas hydrate, and shallow-water flow.
- Magnetic anomalies.
- Unstable seafloor areas.

8. Magnetic Anomalies Data

- A list of all magnetic anomalies in a dbase .dbf table.
- Provide latitude/longitude to six decimal places.
- Add additional fields to the table as needed (see sample table below).
- Report total percentage of survey area flown above 6 meters.
- Provide the above information in a tabular format in the report.

9. Side Scan Sonar Contacts

- A list of all side scan sonar contacts of unknown source in a dbase .dbf table.
- Provide latitude/longitude to six decimal places.
- Add additional fields to the table as needed (see sample table below).
- Provide the above information in a tabular format in the report.

10. Geotechnical data/analysis

Provide (in tabular format) latitude/longitude to six decimal places for all soil borings, cone penetrometers, and/or vibracores.

11. 2D Seismic Data

Applicants should provide the complete processes data sets in industry standard formats directly to the Data Acquisition and Special Projects Unit (DASPU) representative:

- Two-dimensional final processed seismic volumes recorded on LTO4, LTO3, LTO2, Super DLT Tape 2 or DVD media in SEG-Y standard exchange format.
- A digital copy of SEG-Y byte positions for the two-dimensional data and a list of 2D lines including SP and CDP ranges for each line on CD.
- A final edited ASCII navigation file formatted in standard SEG-P1, UKOOA P1-90 format. Identify line name and locations for the first, last and every tenth shot point (SP) including latitude/longitude, and projected XY locations on CD or DVD. Identify the geocentric ellipsoid used as a reference for the data and the associated projection system used.
- A digital copy of the processing sequences that were applied to the data on CD.
- A digital images plot of the survey, projected with OCS blocks on CD.

12. Archaeological resources and other sensitive habitats keyed to maps, with locations presented in latitude and longitude (decimal degrees) and UTM coordinates.

13. Results and conclusions of the hazards evaluation

A summary of conclusions and recommendations supported by the survey data and analyses, including a discussion of known or potential hazards and any potential archaeological resources or sensitive habitat areas to be avoided or that may require further investigations.

# Appendix B
# Contents of Archaeological Resources Assessment

BOEMRE encourages submission of the archaeological resources assessment in the site characterization report (Appendix A) as a separate appendix.

The assessment should include an evaluation and synthesis of the data gathered during the archaeological resource survey in an archaeological resource report prepared, signed, and dated by an archaeologist and a geophysicist. Applicants should ensure that these professional personnel have the credentials and experience sufficient to qualify them to perform the necessary work (qualifications for professional archaeologists can be found at 36 CFR Part 61.4.) As needed, specialists in other fields may participate in data analysis and report preparation.

The following information should be included in the archaeological resource report:

A. An analysis of the potential for prehistoric sites within the survey area that includes:

1. A review of current literature on late Pleistocene and Holocene geology, paleogeography, and sea level change in the area (if relevant); marine and coastal prehistory (if relevant); and previous archaeological resource reports in the area, if available.

2. A discussion of relict geomorphic features and their archaeological potential, which includes the type, age, and association of the mapped features; the acoustic characteristics of channels and their fill material; evidence for preservation or erosion of channel margins; evidence for more than one generation of fluvial downcutting; and the sea level curves used in the assessment.

3. A discussion, based on the capabilities of current technology in relation to the thickness and composition of sediments overlying the area of a potential site, of the potential for identification and evaluation of buried prehistoric sites.

B. A current review of existing records for reported shipwreck locations in the survey area and adjacent areas, and the following, as appropriate:

1. A table of the unidentified magnetic anomalies with the OCS block, SP, and survey line location (corrected for sensor offset); gamma intensity; lateral extent (duration); whether the anomaly is characterized by a dipolar, monopolar, or complex signature; the magnetometer sensor tow height off seafloor; the appropriate decimal degree coordinates of the center of each unidentified anomaly; and the recommended avoidance zone.

2. A table of side scan sonar contacts with the lease block, SP, and survey line location (corrected for sensor offset); size; shape; height of protrusion above the seafloor; the appropriate decimal degree coordinates; and recommended avoidance distance of each.

3. A discussion of any magnetic anomalies and side scan sonar contacts of unknown source in terms of their potential as historic shipwrecks (include an analysis of reported nearby wrecks and their potential association with these contacts on the basis of vessel size and anomaly characterization);

4. A discussion of any correlation between magnetic anomalies or side scan sonar contacts and known or probable sources;

5. For any archaeological resources that can be positively identified from remote-sensing records, an analysis of their possible significance and recommendations for any further research or special precautions that may be necessary.

6. A discussion of the potential for shipwreck preservation in terms of bottom sediment type and thickness, and the effects of past and present marine processes in the survey area.

7. A discussion of the potential for identification and evaluation of potential shipwrecks considering the capabilities of current technology in relation to the water depth, probable thickness and composition of sediments overlying the potential shipwreck location, and the preservation potential.

C. Representative data samples from each survey instrument in the vicinity of proposed seafloor/bottom-disturbance to demonstrate the quality of the records. If appropriate, include the following data samples, which may be used in lieu of the representative data samples:

1. Provide a sample of sub-bottom profiler data for each type of relict landform identified. When more than one generation of fluvial channeling is evident, include a sample that depicts each generation. Make sure that each sample is readable and includes horizontal and vertical scales. If any interpretive highlighting or annotation of the sample data is provided, do so on either a separate overlay or a copy of the sample data. Do not highlight original survey data.

2. Copies of all side scan sonar data, where contacts representing unidentified objects are recorded. Make sure that the copies are readable and include the scale. If any interpretive highlighting or annotation of the sample side scan sonar data is provided, do so on a separate overlay or a copy of the sample data. Do not highlight original survey data. For all transmission cable surveys, include a digital copy of the computer-generated mosaics as a geo-referenced Tagged Image Format (TIF) file.

D. A summary of conclusions and recommendations supported by the archaeological resource field survey data and archaeological analyses including:

1. A discussion of known or potential archaeological resources.

2. Recommendations for avoidance or for further archaeological investigations citing the relevant language as found in the National Historic Preservation Act (NHPA) (1966, as amended).

E. A discussion of the data and results from any additional investigations that BOEMRE may have directed.

F. The following are suggested tables, including sample information, for listing unidentified magnetic anomalies and side scan sonar contacts in archaeological resource reports.

1. Magnetic Anomalies

| **Anomaly Number** | **Area/ Block** | **Line No.** | **Shot Pt.** | **Tow Height (meters)** | **Signature** | **Intensity (gammas)** | **Duration (meters)** | **NAD 83 Coordinates (in decimal degrees)** | **Minimum Avoidance Distance (meters)** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | MP 100 | 002 | 11.4 | 18 | Dipole | 15 | 75 | | 150 |

2. Side Scan Sonar Contacts

| **Anomaly Number** | **Area/ Block** | **Magnetometer Association** | **Dimensions LxWxH (meters)** | **Shape** | **NAD 83 Coordinates (in decimal degrees)** | **Minimum Avoidance Distance (meters)** |
|---|---|---|---|---|---|---|
| 1 | MP 100 | Mag. Anomaly 1, Line 0020, SP 11.4 | 100 x 50 x 5 | Linear | | 225 |

# Appendix C
# Format for Digital Maps
# ArcGIS Geodatabase / Feature Dataset (group) / Feature Class (layer)

The applicant must submit one paper copy and one electronic version of the plan or application (§ 285.607; § 285.622(a); § 285.642(a)). All elements of the HRG and geotechnical survey information should be separate layers of Feature Classes of an Environmental Systems Research Institute, Inc. (ESRI) Geodatabase oriented to the appropriate North American Datum (NAD83) and coordinate system based on latitude and longitude. Applicants are encouraged to provide the results of the overall site characterization information the following report format:

**Group 0**

Applicants should label the first layer as the base map or number zero (0). This layer is the base layer on which all other layers are created. It contains the background data used for plotting features, lines, points, etc. It is not the layer on which points, lines, features, labels, etc. are visible.

**Annotation and General Information Feature Dataset (Feature Class layers 100-199)**

Layers 100 through 199 contain all pertinent reference information found on the map (including labels, block lines, and other reference information for the overall map). This group is separate from the other groups containing the location of data features on the map. It serves only to provide a legend and background information for understanding the data placed on the overall map. Include the following layers in this group:

1. Overall legend including all symbols used for depiction of:
(a) Infrastructure (such as cables).
(b) Biological features including live bottoms, topographic features, and chemosynthetic communities.
(c) Geophysical characteristics such as acoustic voids.
(d) Other features such as unidentified magnetic anomalies and side scan sonar targets (with avoidance radii), buried channels, and shipwrecks.

2. Applicants should ensure that each item keyed into a legend and appears as a separate layer within one of the following items:
(a) project area map
(b) map scale
(c) map title
(d) company names
(e) personnel names, dates, file and job numbers, and map numbers (e.g., map 1 of 2)
(f) map borders
(g) north arrow
(h) OCS area name(s) and block number(s)
(i) lease numbers

(j) Federal/state boundaries
(k) graticules used in delineating latitude and longitude
(l) tic marks used to delineate state plane or UTM coordinates
(m) table of unidentified sonar targets depicted on the map (when appropriate)
(n) table of unidentified magnetic anomalies (when appropriate)

**Infrastructure Feature Dataset (Feature Class layers 200-299)**

Layers 200 through 299 contain all industry infrastructure. Place all labels pertaining to infrastructure in this group on a separate layer (i.e., all transmission cables, anchorages, structure removal labels may be on one layer and that layer located within the category of infrastructure). Include the following layers in this group:

200- transmission cables
201- proposed activities
202- anchorage areas
203- fairways
204- traffic separation schemes
205- precautionary/caution areas
204- removed structures

**Navigation Data and Bathymetry Feature Dataset (Feature Class layers 300-399)**

Layers 300 through 399 contain the post-plot of the navigation data as well as all bathymetric data. Place all labels pertaining to the post-plot of navigation data or bathymetry data in this group on a separate layer (i.e., all SPs and line labels may be on one layer and that layer located within the category of navigation data). Include the following layers in this group:
300- survey lines and SPs
301- bathymetry data

**Seafloor Feature Dataset (Feature Class layers 400-499)**

Layers 400 through 499 contain all of the geological features and unidentified side scan sonar targets and magnetic anomalies located by the hazards survey. Identify these features and anomalies with their appropriate symbols. Place all labels pertaining to these individual features in separate layers (magnetic anomalies have a layer that has only labels corresponding to the individual magnetometer targets; unidentified side scan sonar contacts have their own label layer; etc.). Include the following layers in this group:

400- unidentified side scan sonar contacts (map symbol = green square)
401- unidentified magnetic anomalies (map symbol = red triangle)
402- magnetic contours
403- artificial reefs and artificial reef planning areas
404- seafloor fluid expulsion features and shallow gas vents
405- brine seeps and brine pools
406- seafloor scarps with height
407- mounds

408- organic reefs and relict reefs
409- coral locations
410- outcrops and hard bottoms
411- live bottoms
412- named topographic features and their protection zones
413- areas of seafloor slumping, debris flows, mud slides, and collapse depressions
414- scour and furrows
415- natural and dredged channels
416- other seafloor features and anomalies (e.g., shipwrecks, pockmarks, can holes)

**Subsurface Feature Dataset (Feature Class layers 500-599)**

Layers 500-599 contain all subsurface features located by the hazards survey.
Place all labels pertaining to these individual features in separate layers (e.g., all labels for channel margin features should be on one layer). Include the following layers in this group:

500- buried faults with depth labels
501- shallow gas as seen on shallow penetration sub-bottom profiler (acoustic voids)
502- shallow gas as seen on medium penetration seismic profiler or conventional seismic reflection data (2-D or 3-D) (high amplitudes, bright spots) with depth labels
503- buried slumping
504- buried hydrates (e.g., bottom simulating reflector (BSR), seismic blanking)
505- shallow waterflow zones
506- salt
507- boulders, glacial till
508- significant geologic features
509- karst features
510- buried channel features

**Metadata**
Applicants should include metadata for each feature class using all relevant fields in ArcCatalog's metadata **FGDC ESRI** stylesheet template.