



NORTHERN DYNASTY MINES INC.

**DRAFT ENVIRONMENTAL BASELINE STUDIES
2006 STUDY PLANS**

**CHAPTER 19. DATA MANAGEMENT
AND GIS**

JULY 2006

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Table 19-1, Data Management and GIS for 2004-2006

ACRONYMS

ERDs	Entity Relationship Diagrams
FGDC	Federal Geographic Data Committee
GIS	geographic information system
GPS	global positioning system
HGM	hydrogeomorphic
NDM	Northern Dynasty Mines Inc.
RDI	Resource Data Inc.
SHP	Shape file
USACE	U.S. Army Corps of Engineers

19. DATA MANAGEMENT AND GIS

Resource Data Inc. (RDI) is providing geographic information system (GIS) and data management services to support the Pebble Project. The GIS and scientific data generated as part of the permitting process are a valuable asset to Northern Dynasty Mines Inc. (NDM). In the short term, NDM will make the data available to the environmental baseline project team. In the long term, the data will support the environmental impact statement and permitting process, and ultimately will support monitoring throughout the life of the Pebble Mine. A sound data management plan will ensure that the data are accurate, timely, and integrated into a multidisciplinary database.

Proactively managing the data will ensure the data are accurate and readily available. The project strategy calls for a data management process that is completely automated. The plan is to provide data sources with clear requirements for data deliverables and to provide the tools for the data sources to verify compliance prior to delivery.

The data management and GIS scope of work is divided into two sections:

- Support for wetlands/habitat program
- Website and data management

Support for the wetlands/habitat program covers managing all the mapping data collected during the baseline studies, creating and loading basemap and Pebble-specific data, providing GIS support for the wetlands study, and providing cartographic services to support the entire project.

Website and data management includes building and maintaining a central data repository for the project, providing web-based tools to enter and report on project data, and providing tools to upload data into the project database. The website and database will be designed to provide long-term storage of and access to baseline data throughout the life of the mine.

Table 19-1 summarizes work for the data management and GIS program for 2004 through 2006.

19.1 Support for Wetlands/Habitat Program

Objectives

The objectives of the activities in support of the wetlands/habitat program are to:

- Support the habitat-mapping team.
- Support the 2006 field season.
- Maintain the project website.
- Load proposed road and facility data.

- Provide mapping for the powerline project.

Proposed Study Plan

The scope of services includes professional services in GIS and data management to support the 2006 Pebble wetlands and habitat-mapping program.

Activity 1: Ongoing Support for Wetlands/Habitat Mapping Program

Support will be provided to the wetlands/habitat-mapping team in the wetland-delineation and habitat-mapping programs.

The following activities will be required to complete this activity:

- Conduct habitat-data scrubbing (close polygons, remove slivers, etc.).
- Provide analysis of habitat mapping, such as presentation-quality summary tables showing acreage of disturbance, jurisdictional wetland mapping, vegetation type, and hydrogeomorphic (HGM) classification.
- Provide ongoing support for alternative impact analysis as needed.
- Maintain the master data set throughout the mapping process.
- Provide ongoing documentation of GIS data sets and load to www.pebbleproject.com. Documentation is compliant with current Federal Geographic Data Committee (FGDC) standards.
- Provide agency-meeting support for the wetlands/habitat-mapping team (agency meetings to be held in October or November). Attend meetings and provide reports.
- Provide printing services.

Activity 2: 2006 Wetland Field Season Support

The following tasks will be required to complete this activity:

- Modify global positioning system (GPS) camera scripts to the specifications developed by the wetlands/habitat-mapping team, supporting the additional wetland data-collection effort.
- Create field maps to support the wetlands field surveys and data analysis.
- Process photos and photo locations and create a single-point data set which links the digital photos to their sample location.
- Produce photo reports for the wetlands/mapping-habitat team as needed.

Activity 3: Pebble Website Maintenance

General site maintenance will be conducted to keep the Pebble website environments (Development, Test, and Production) running and in good working order and to protect the integrity of the data contained in the database and website. Tasks required to complete the activity include:

- General site maintenance.
- Modifications to the wetlands application as specified by the wetlands/habitat-mapping team. This includes:
 - Modifications to the plant community report.
 - Functional assessment updates and modifications.
 - Updates to the soils report.
- Performance tuning and maintenance of the Oracle 9i database.
- Minor website source-code changes.
- Documentation—updates to database Entity Relationship Diagrams (ERDs), updates to website diagrams, and creation/modification of supporting technical documents.

Activity 4: Load Facilities and Road Data

Proposed facilities and road-alignment data will be loaded into the GIS. This includes processing mine development concepts, road designs, and powerline designs. The following tasks are necessary to complete this activity:

- Translate Pebble Mine designs.
- Translate road designs.
- Translate powerline designs.

Activity 5: Annual Software Maintenance

Annual software licensing and network connections renewals will include:

- ESRI ArcIMS.
- ESRI ArcView.
- Oracle Maintenance.
- DSL Line.
- Domain Name Registration.
- SSL license.

Activity 6: 2006 Wetland Delineation Corps of Engineers Manual

The current Pebble Wetland Website will be prepared and converted into a site capable of using either the original delineation method, which the site currently uses, or the new method outlined by the Regional

Supplement to the U.S. Army Corps of Engineers (USACE) original *Wetland Delineation Manual: Alaska Region*. The following functionality will be added:

- Dominance test for hydrophytic vegetation.
- Prevalent index calculation.
- Wetland cryptogam calculation.
- Morphological adaptation indicator.
- Determination changes.
- Hydrology changes.

Approach

The established NDM GIS environment will be maintained. Digital and hardcopy data will continue to be acquired and loaded into the GIS for distribution to the project team. ArcInfo will continue to be used to create coverages and output as shape (SHP) files. This is the most expedient method to process data, and SHP files are the preferred format for the environmental team. Most of the data loaded into the GIS are available in digital format. Data available only in hardcopy will be digitized. Distribution will be accomplished by transferring media such as compact disks and portable hard-disk drives. Smaller files will be published on the project website for download.

19.2 Database/Website Development/NDM Support

The project website will be further developed with added functionality in uploading, storing, and analyzing data. Additionally, RDI will provide support to NDM.

Objectives

The objectives of the website and data management activities described in this document are as follows:

- Enhance the functionality for managing and capturing environmental information.
- Support data analysis and reporting.
- Create cartographic map products.

Proposed Study Plan

A wide range of activities are necessary to enhance the website and data management system. These activities are described below.

Activity 1: Document Repository Enhancements

The following requested enhancements to the document repository will be made:

- Add ability to move documents between folders.
- Add ability to rename folders.
- Improve upload and download speeds.

Activity 2: Analytical Data Loader Modifications

The following functionality will be added to the data loader:

- The ability to upload ZIP files. This will facilitate the loading of very large files and improve performance for loading smaller data files.
- The ability to modify data without reloading data sets. This will be accomplished by adding a new web module called a “Data Changer.”
- Development of a standard environmental baseline document report, which includes developing standard templates for use with the Data Extractor to assure that report tables are output in a standard format for all contractors.

Activity 3: Other Environmental Data

Prepare the database to manage environmental data identified by NDM and Shaw. After NDM and Shaw have determined which data sets must be stored, use the list of data sets to develop reporting formats that will define how data must be formatted for database uploading.

Activity 4: Cartographic Services/GIS Data Management

Maps and graphics will be provided as needed for use in meetings with agencies and will be provided for the final documents. The collection and distribution of GIS data from the consultants will also be managed. Map printing will be provided.

Approach

The project team will develop the new functionality on the same technology as the existing website. Processes developed to facilitate capturing the data in the master NDM repository will be refined. Cartographic products will be generated in ArcGIS and will be available in digital format via the project website.

Table 19-1
Pebble Project Environmental Studies
Data Management and GIS for 2004-2006
Consultant: Resource Data, Inc.

Discipline	2004 Completed Activities	2005 Completed Activities	2006 Activities to be Completed
Pebble GIS	Compile Basemap Data		
	Load Pebble Data	Load Facilities & Road Data	Load Facilities & Road Data
	Load Environmental Data		
	Load Wetlands Data	Wetlands Field Support	Wetlands Field Support (modify camera scripts, habitat mapping analysis)
	Provide Cartographic Services	Provide Cartographic Services	Provide Cartographic Services
	General GIS Management Services	General GIS Management Services	General GIS Management Services
		Generate Accurate Native Allotment Data	
Data Management & Pebble Website	Initial Website Framework / Application Design	General Website Maintenance	General Website Maintenance
	Provided Data Access and Storage / Initial Database Design	Database Support	Database Support
	Field Input Forms Design	Field Form Modifications	
	Document Repository Design		Document Repository Enhancements
	Initial Project Applications Design		Wetlands Applications Modifications
	Data Acquisition & Management / Application Design	Data Management, Analytical Data Modifications	Analytical Data Loader Modifications
	Site Administration	Site Administration	Site Administration
	Migration Plan Design		
	Website GIS / Map Design	Extended Mapping for Powerline Project	
		Ongoing support for wetlands/habitat mapping program	Ongoing support for wetlands/habitat mapping program
		Data Scrubbing	Data Scrubbing
		E-Chain Integration	
			Acquisition of Additional Environmental Data / Report Format Development
		Wetland Delineation COE Manual creation	
Project Management	Project Planning	Senior Analysis	Senior Analysis
		Staff Meetings, Staff Management	Staff Meetings, Staff Management
		Status Reporting	Status Reporting