

## **BIOGRAPHICAL INFORMATION**

Bernie J. Osiowy  
Manager Hydro Planning Department  
Manitoba Hydro

### Specific Responsibilities

The Hydro Power Planning Department is responsible for the engineering portion of the planning associated with the development of new sources of hydraulic generation.

### Past Experience

Mr. Osiowy has over forty years of experience in the planning, design, construction and commissioning of hydraulic generating stations.

### Educational Information

BS – Engineering, University of Saskatchewan

### Professional Memberships

Registered professional engineer  
Professional Engineering Association of Manitoba

## **BIOGRAPHICAL INFORMATION**

Richard Kalisch  
Principal Consultant  
Boreas Group LLC

### Specific Responsibilities

Mr. Kalisch serves as an advisor and program manager to distribution utilities in the area of IT application systems and process improvements.

### Past Experience

Mr. Kalisch has over twenty years of experience in the planning, development and implementation of utility application systems including GIS applications with organizations such as Andersen Consulting, American Electric Power, R.W. Beck and Convergent Group.

### Educational Information

B.S. – Mathematics, Florida State University  
MBA - Management Science, Graduate School of Business, Georgia State University

## **UTILITY HYDRO GENERATION GIS APPLICATIONS**

Bernie J. Osiowy  
Manitoba Hydro  
820 Taylor Avenue  
Winnipeg, Manitoba  
Canada R3M 3T1

Richard A. Kalisch  
Boreas Group LLC  
9018 Heritage Bay Circle  
Orlando, FL 32836

### **ABSTRACT**

The power generation business unit of Manitoba Hydro (Power Supply) has been using GIS technologies for several years to support the planning, construction and operations of hydro generation facilities. The development and expansion of GIS to support hydro projects has followed an evolutionary path based on the positive experiences of the organization and advances in GIS technology. A recently completed analysis of the business unit outlines a long-term plan for expansion of GIS.

## **MANITOBA HYDRO BACKGROUND**

Manitoba Hydro, owned by the Province of Manitoba, serves the entire province providing electricity to about a half million customers and natural gas to approximately one quarter of a million customers. The Power Supply business unit operates sixteen (16) generating stations, [fourteen (14) hydroelectric and two (2) thermal sites], which produce the electricity generated and distributed by Manitoba Hydro. Three additional hydro generating stations are in the planning phase. Wuskwatim (200MW) is planned to be the next hydro generating station with an anticipated completion in 2010.

### **HISTORY OF GIS TO SUPPORT HYDRO GENERATION**

Through the use of GIS technology, Power Supply has found that information regarding features such as land contours, rivers, roads, facilities, and parcel boundaries can be conveyed in visual terms that have more relevance particularly with community or special interest groups. GIS technology has allowed information to be presented in a more natural and user-friendly method of conveying information versus reports and statistics that is more easily understood and accepted by non-engineering and non-technical personnel. Information can be conveyed in visual terms regarding the location of Manitoba Hydro boundaries and facilities in relation to other features or layers such as land boundaries, trap lines, wild life areas or other environmental interests. In addition, GIS technology has provided the ability to perform visual sensitivity and “what if” analysis that is not practical to perform with other tools. GIS technology has also provided the tools to electronically access and analyze spatial information internally across the entire organization.

The initial use of GIS technologies began about 4 years ago primarily to support planning and licensing activities for new hydro generation stations. The GIS environment evolved during this period based on the use of AutoCAD and ESRI tools including Intranet browser GIS capabilities using MapGuide. GIS data that is centrally stored in the Power Supply Data Warehouse serves as the repository for source GIS data files to support the above capabilities. The Data Warehouse is used by GIS technicians or GIS technical users using AutoCAD and ESRI tools to assemble selected GIS data sets to create custom plots or to support specific GIS analysis. In addition, project planning engineering and environmental documents are electronically maintained in a Power Supply database that is linked to GIS points. The GIS Intranet provides information for the Wuskwatim, Gull and Notigi hydro generating stations that are in the planning phase such as:

- Landbase contours
- Survey Control Points
- Orthographic Imagery
- Satellite Imagery
- Treaty Land Entitlements
- Resource Management Areas
- Proposed Hydro Facilities (such as coffer dam, power house, and spillway)
- Terrain Classifications
- Transmission Lines

- Construction Camps
- Forebay Flooding Area
- Photos
- Borrow areas
- Access routes
- Helicopter pads
- Ecological Land Classification (ELC)
- Forestry Classification Data (FRI)

The GIS Intranet environment supports a wide range of users involved in engineering, environmental impact, and community interests based on a browser interface with minimal training.

### **HYDRO GENERATION GIS REQUIREMENTS**

Recently, Power Supply conducted a study to review the use of GIS information and analysis being conducted for new hydro generation planning purposes and to investigate the potential expansion of GIS capabilities to more Power Supply functions. This included investigating the use of GIS to support the ongoing engineering and operations activities of existing hydro generation stations. The study identified approximately 130 GIS features that one or more departments used to support their functions. One of the purposes of the study was to identify common features that were important to a large number of departments as a basis to prioritize future GIS efforts. These GIS features were categorized into the following areas:

- Land features
- Cadastral
- Photographic images
- Transportation
- Manitoba Hydro boundaries
- Hydro (water) features
- Geotechnical (soil / substrata)
- Utility facilities
- Ecological
- Meteorological
- Property and land use

For example, boundaries such as the license area, flood areas, and water management areas are of interest to almost all Power Supply departments. On the other hand, geotechnical features such as soil and subsurface geology are of interest to fewer departments with civil engineering having a primary need for this information.

The use of GIS related information by Power Supply organizations can be categorized into three areas: licensing approvals and renewals, engineering and operations. The requirements of licensing approvals and renewals involving environmental compliance, litigation and relations with First Nations and other community interests involves presenting information on a timely

basis that is complete, understandable and defensible. Power Supply has seen a significant increase over the last several years in the demands for external information and analysis. These demands are projected to continue to grow, as more external agencies seek information from Manitoba Hydro. This includes the impact of more stringent licensing requirements for new hydro facilities and re-licensing of existing facilities. There are also stringent information demands involved in supporting environmental issues. Internally, Power Supply engineering and technical personnel have the need to efficiently access spatial information. The ability to access spatially related data such as time series bore hole measurements or access the most recent version of a rating curve eliminates inefficiencies and rework. For operations, the ability to readily access information that is related to a GIS feature such as data for a remote real time water monitoring point expedites access to this information and helps insure that the correct data is obtained.

## **HYDRO GENERATION APPLICATIONS AND INTERFACES**

The Power Supply GIS study also identified a number of GIS applications and interfaces to support the business unit's business goals and objectives. It is envisioned that individual applications may be purchased or developed internally based on detailed requirements and availability. A list of these applications and interfaces is provided below.

### **Applications**

- Water Resources Management
  - Water Use Facilities - Identifies docks, ramps, piers, wharfs, and structures including facilities data, maintenance history and photos.
  - Debris Management - Provides debris mitigation status and photos by date.
  
- Land Use Management
  - Vegetation / Brush Management - Provides vegetation and brush inspection, maintenance history, and project vegetation growth based on growth models.
  - Alternative Use Management - Provides information on land use such as agriculture, recreation, development, and future development.
  
- Environmental Management & Compliance
  - Environmental Event Impact – Associates an environmental event such as drought or fire to related features before and after the event.
  - Aquatic Management - Provides information on fish inventory, stream buffering, and downstream impact assessment and fish habitat management.
  - Sensitive Sites Awareness - Provides information on heritage, cemeteries, and archeological sites.
  - Habitat Management - Provides information on ranges of species or specific species by time.
  - Spill Management - Application uses modeling (trickle tracing) to project spread of spill by time to simulate the route of materials or substances along a water or drainage network. For example, if a pesticide spill occurred at a facility the GIS application can simulate the area and speed of the movement of contaminants.

- Disposal Areas -Provides information on disposal areas and garbage dumps with survey and monitoring history.

#### Engineering & Operations

- Borrow Materials - Identifies borrow material areas with information on type, ownership, quantity and permits.
- Dyke Database - Provides data on dyke construction, elevation monitoring data, inspection, testing, maintenance and other safety related information.
- Shoreline Database - Provides information on shoreline history, surveys and photos.
- Transportation Access - Based on selection of transportation origination and destination points, provides air access or road access recommendations based load limits and barriers including seasonal conditions.
- Transportation Management - Identifies asset characteristics, permits and maintenance information (includes helipads, Manitoba Hydro access roads, bridges, culverts, gates and signs).
- Hydrometric Profile Database - Based on selection of water feature, application provides engineering information such as flow profiles, cross sections, erosion sections, benchmarks, rating curves and storage curves.
- Ice Mapping - Based on selection of a water feature, application provides information on ice survey history and related data.
- Meteorological Measurement and Forecasting - Based on selection of measurement point, application provides meteorological measurement and forecasting data. Meteorological data is largely received from external sources with access provided through GIS.

#### Photo Management

- Flight-Line / Reference Photo Index / Aerial Photo Index - Geo-referenced index to locate box number and photo number of related aerial photo flight lines and individual physical photos.

#### Emergency Safety Preparedness

- Emergency Safety Notification - Based on selection of emergency or inundation area, application identifies property owners within affected area with contact information.
- Emergency Safety Management - Based on selection of inundation scenario, application identifies impact on private/public facilities and landowners within inundation area.

#### Property Management

- Property Ownership, Easements and Leases – Application provides information such as legal owner(s) with address and Manitoba Hydro easements and leases based on selection of property parcel, area, or adjoining parcel.
- Permit Management - Based on selection of property plot, application provides information on issued permits. Functions would include identification of property owner; permit status, facilities within the easement plus the ability to generate notifications to property owner based on a selected map area.
- Land Agreements and Claims - Provides information on applicable land agreements or claims with supporting information such as Northern Flood Agreement, Treaty Land Entitlements, and land claims.

- Structures, Buildings and Roofs - Provides information on building history, survey conditions, maintenance history and photos.

## Interfaces

The following interfaces provide for access to data, analysis, documents and drawings from other systems.

### Drawing and Document Management

- Power Supply SCI document repository - Repository developed by Power Supply to maintain non-engineering DWG data sets such as documents or reports based on SCI numbering standard
- EDMS - Corporate Engineering Drawing Management System

### Engineering and Operations

- Bore Hole database – This system maintains information on bore hole data such as type, depth, geometry, measurement & testing results (time series) by bore hole identifier.
- Water Resource Information Database – This system maintains time series data regarding water elevation and flow at water monitoring points.
- Streamflow Forecasting - Application provides forecast of water flow in streams, rivers and lakes based on rainfall predictions in selected watershed areas with interface to GIS to present results.

### Land Use Management

- Trapline database – This application maintains information associated with traplines, trappers, trapping history, species trapped, market values by year, trapping times, and land cover type.

### Environmental Management & Compliance

- TEACT & CEMSpec - These systems maintain air emissions monitoring data regarding thermal generation units for environmental compliance reporting.

## **CONCLUSION**

The Power Supply organization has obtained significant benefits to date through the use of GIS technologies primarily to support the engineering and environmental planning and licensing of new hydro generation facilities. Power Supply plans to continue to evolve the use of GIS technology through out the organization. As a first priority, GIS capabilities will be used to support the planning and licensing requirements for new hydro generation stations such as the current Wuskwatim project. It is anticipated that additional GIS capabilities and greater experience with these capabilities will foster greater use of GIS to support the need to analyze and present special information on a timely basis that is complete, understandable and defensible. Additionally, the use of GIS technology and applications will be expanded to support current engineering and operations functions. These functions will benefit by being able to more efficiently and accurately access, analyze and present spatially related engineering and operations data improving productivity and quality.