October 7, 2002

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AU0304T
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Internal Audit Report

Enterprise Geographic Information System
Phase 1

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Executive Summary

- The EGIS project provides an enterprise solution that integrates a comprehensive suite of stakeholder applications such as Distribution Analysis and Design and PowerGrid with a common, easily accessible land base that facilitates better management and business decisions and processes.

- EGIS provides the strategic direction and infrastructure required to replace the old GFIS IBM discontinued product. EGIS is being implemented as a four-phased project. Audit scope for this report is Phase 1.

- The EGIS Project team practiced sound project management procedures. Phase 1 was completed on time, budget, and achieved expected objectives. Project pre-planning was extensive and a project completion report was prepared. Adequate quality assurance processes were in place.

- System owners and users are generally pleased with the Phase 1 implementation and acknowledge that benefits are still to come in future phases when the geospatial data becomes available throughout the province. User survey comments identify possible areas for improvement that should be considered in future phase implementation.

- A benefit tracking process has not been implemented to substantiate the realization of project benefits.

- The following opportunities for improvement are identified for future project phases:
  - The project plan should be submitted concurrently with the business case.
  - Reaffirm and update project benefits and success measures, improve effectiveness of the benefit tracking methodology, and file benefit support documentation in a central area.
  - Project Management should follow-up on user survey comments for other areas of improvement.
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EGIS User Survey Table
1. Background

- In 1992, Transmission & Distribution (T&D) successfully installed a Geographic Facilities Information System (GFIS) to convert all paper records to a digital geospatial database for the distribution system. However, increasing difficulties in supporting GFIS due to IBM discontinuing support, the Chief Information Officer’s recommendation to move to an enterprise-wide system, and a successful Enterprise Geographic Information System (EGIS) prototype, all led to the decision to proceed with a single enterprise-wide system.

- EGIS allows users across Lines of Businesses (LoBs) to access a common database of geospatial data that includes maps, drawings, operating diagrams and operating procedures. Several existing databases were merged to create an Enterprise Landbase and new applications were developed to form EGIS.

- The EGIS project is expected to cost $25.5M and take approximately 6 years (1999 to 2005) to complete. The project will now be completed in three phases, with capital funding being requested at each phase, since the original Phases 3 and 4 were recently combined. The project is currently nearing completion of Phase 2.

**Enterprise Geographic Information System**

- **Databases**
  - Power Grid
    - Transmission Lines
    - Substations
    - Hydro Electric Generation
  - Enterprise Land
    - Geospatial Features
    - Topographic Cadastral Maps
  - Distribution Electric
    - Construction Stds
    - Bills of Material
  - Distribution Land
    - Street Names, Lots
    - Municipal Boundaries

- **Applications**
  - Power Grid
    - Modeling and Analysis
    - Property Management (ROW)
    - Assets Management
  - DAD
    - Customer Request Distribution Analysis Design
  - PowerON
    - Distribution Service Restoration
1. Background

- Phase 1 created the project plan, established the new EGIS software platform, migrated GFIS distribution data to EGIS for the Lower Mainland, and added a select group of applications. The remaining 2 phases will consist mostly of data and land base establishment and further application development for the remainder of the province. The chart below shows the original four phases before the recent combination of Phases 3 and 4.

**Timeline**

- 1994 July  
  Enterprise Geographic Information System (EGIS) Plan developed
- 1998 June  
  EGIS Prototype Completion Report ratified EGIS strategy
- 1998 Dec  
  Phase 1 Business Case & CAR prepared
- 2000 Dec  
  Phase 1 Completion

![Implementation Schedule](chart.png)
2. Audit Objective and Scope

OBJECTIVE

- Provide assurance that EGIS Phase 1 is based on sound project management principles, stated business case benefits are realized, and system quality assurance processes exist to ensure data integrity.

SCOPE

- Review the business risks, processes, and controls which comprise, but are not restricted to, the following key components:
  - Project Management, including conformance with Corporate Project Management Procedures, and the monitoring and reporting of Phase 1 deliverables.
  - Project Investment including the Phase 1 project objectives and benefits.
  - Quality Assurance processes for Phase 1 data conversion, selected application controls, and general computer controls.

- Tests to ensure the controls are operating as intended included testing and review of supporting documentation and discussion with employees and management.

- The audit focused on Phase 1 with some review of Phase 2. At the time of the audit, Phase 2 was in progress with an expected completion date of October 2002.
3a. **Project Management**

**PROJECT PRE-PLANNING**
- EGIS project pre-planning was extensive and took four years to complete. EGIS strategy development was to use a phased implementation approach. The work included the creation of the Phase 1 business case and Capital Authorization Request (CAR), development of an EGIS prototype, external studies, and various reviews internal to BC Hydro.
- All the necessary Phase 1 reviews and approvals were obtained.

**PROJECT MANAGEMENT POLICY**
- The EGIS Project team complied with Corporate Project Management Procedures by:
  - designating a Sponsor and two Project Managers; and
  - preparing a business case, CAR, project plan, and project completion report for Phase 1.
- The Procedures require a project plan be submitted at the time of business case approval. The EGIS project plan was prepared one month after business case approval. While the document contained all required information to support the business case and was well done, it is recommended that the project plan accompany the business case to ensure that the project plan is consistent with the stated business case objectives and all risks are considered.

**SCHEDULE**
- The Phase 1 completion date was generally met. The Project team used a project schedule to achieve the desired project scope by the October 2000 completion date. The Project team held project status meetings and monitored estimated task completion dates to keep the project on schedule. The actual completion date was delayed to December 2000 due to project approval and training delays.
3a. Project Management

BUDGET AND COST TRACKING

- Phase 1 costs came in on budget and were effectively tracked. Actual capital and OMA costs of $6.9M were incurred against a budget of $6.5M. Project administration tracked costs effectively through task identification documented in a formal project plan. The over-expenditure was due to a restructuring of overhead cross charges.

COMMUNICATION AND TRAINING

- Project Management illustrated good skills in communication and training as these activities were well implemented. Users were able to access significant amounts of EGIS information and help via the BC Hydro intranet.

LESSONS LEARNED

- A project completion report was completed for Phase 1 and distributed within the T&D organization. Lessons learned included identification of a hardware performance issue, managing user expectations, and understanding the impact of approval delays on project scheduling. The report also identified that all expected benefits were not achieved and that additional benefits, not originally recognized in the business case, surfaced. The opportunities for improvement were carried forward to Phase 2.

PROJECT TEAM TURNOVER

- Phase 2 was implemented by the same project team using consistent project management principles found in Phase 1.
- With the realignment to the Lines of Business organizational structure and some project team member changes, reconsideration of project objectives, goals, and project team continuity are good management practises. While the EGIS project team has changed, continuity has been maintained as some original members continue to be involved from both Transmission and Distribution.
### 3a. Project Management

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Management Action Plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>For future phases of the EGIS project, it is recommended that the project plan be prepared at the same time as the business case and CAR request. Approval of these documents together will provide some assurance that all work tasks and risks are identified during the project approval stage.</td>
<td>Recommendation accepted. A project plan framework for Phase 3 was developed. The final project plan will be completed for the October 23, 2002 Board of Directors meeting.</td>
</tr>
<tr>
<td>Given the changes to the project, it is recommended that the project goals and objectives be re-confirmed to ensure successful project completion.</td>
<td>Discussions with senior management under the new Lines of Business were held to re-confirm project goals and objectives. This was completed in September 2002.</td>
</tr>
</tbody>
</table>
3b. Project Investment

PROJECT OBJECTIVES

- Phase I objectives were completed based on management discussions and observations of EGIS applications. Phase 1 objectives included the creation of the new EGIS Landbase that stores geospatial data, purchase of hardware infrastructure, implementation of Distributed Analysis and Design (DAD) applications, introduction of PowerGrid applications, and user training in the Lower Mainland.

- Project implementation exceeded plan with the creation of the new EGIS Landbase. The original project scope was to convert 50% of the old GFIS data to the new Landbase format, however, 100% of this task was completed.

BENEFITS

- The business case identified strategic, soft, and hard benefits. Realizing the difficulty in measuring the strategic and soft benefits, the project completion report reviewed only hard benefits. The total hard benefits were expected to amount to $985K per year for Phase 1 but actual benefits came in at $622K. The difference was mainly due to delay in the project approval and GFIS still being used in parallel during the early part of Phase 1.

- The audit was not able to review the supporting documentation for the hard benefits identified, as the supporting documentation was stored by one individual who continues to be on a medical leave. Therefore, no opinion is provided regarding the realization of the quantified benefits.

- In August 2002, the Corporate Financial Evaluation (CFE) group prepared a draft report that measured accumulated benefits from Phase 1 to Phase 2 inclusive. A framework for benefit calculation was developed and 14 of the original 42 benefits were selected for analysis. The draft report concluded that the EGIS project could realize its planned benefits overall provided that the benefits could be substantiated. CFE's draft report has not been audited but provides some evidence that the EGIS benefits can be achieved.
### 3b. Project Investment

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Given the organizational changes and difficulties encountered in supporting the measurement of the hard benefits, it is recommended that the key success measures and expected benefits be reviewed and updated.</td>
<td>Recommendation accepted. Estimated completion date is March 31, 2003.</td>
</tr>
<tr>
<td>A benefit tracking system, including the establishment of a common documentation location for knowledge sharing, should be developed and utilized to track key success measures and expected benefits (an example is the framework established by the CFE report).</td>
<td>Recommendation accepted. Estimated completion date is March 31, 2003.</td>
</tr>
</tbody>
</table>
3c. Quality Assurance Processes

- We observed that quality assurance processes were used to mitigate key risks found in the selected areas such as data conversion of legacy data, data input for EGIS applications, and security and backup. We are satisfied with the quality assurance processes in place and have no recommendations for these areas.

DATA CONVERSION

- Several controls were used to ensure data integrity in the data migration from the old systems to the new EGIS database. Westech and EGIS project team members identified the use of reconciliations between the old and new systems, counts of geospatial objects, and visual reviews.

DATA INPUT

- Quality assurance checks were used to ensure accurate data input for EGIS applications. For DAD applications, we observed connectivity checks through Area and Network Quality Assurance software, counts of objects translated, and visual map reviews. For PowerGrid applications, software use was the key quality assurance check for data verification, translation, merging, and import. We reviewed available documentation to confirm the software’s existence and relied on management’s positive opinion regarding the software’s quality checking effectiveness.

- Standards such as the GIS Data Capture Standards were documented and monitored. EGIS support teams monitor external contractors who provide EGIS input data. Management reported that the quality of data input improved as contractors became more familiar with the standards.

- Other programming checks, like mandatory fields and valid values and relationships, were used to ensure input data integrity. Our tests found these checks to be in place.
3c. Quality Assurance Processes

GENERAL COMPUTER CONTROLS

- Standard BC Hydro security, backup, and system processes are used and are effective. They include user logon identification, passwords, and quality assurance exception reports.

- Westech staff, who were used in developing EGIS applications, followed standard system development processes that ensure quality. These standards include obtaining user requirement signoffs and using computer program test scripts to test if applications perform as expected.
3d. Stakeholder Satisfaction

- The system owners are generally pleased with Phase 1 accomplishments. The significant goal of creating the EGIS infrastructure was achieved. Yet, they are aware of future challenges such as future funding requirements to further develop applications and complete database development that would allow full utilization of applications and achievement of original business case benefits.

- System users were pleased overall with Phase 1 results. They realize that Phase 1 provides the EGIS infrastructure that needs developing. Further data acquisition and new application development will be addressed in future EGIS phases. For Phase 1, PowerGrid use was planned and implemented for the Lower Mainland only.

- Audit conducted a survey to identify EGIS users’ satisfaction. The users were asked to respond to 17 questions regarding user benefits, training, communications, and provide comments. All user survey comments have been provided to the EGIS Project Manager for follow-up. Approximately 33% of 435 EGIS users responded to the survey. The responses are generally either in agreement or neutral to survey questions and suggest overall user satisfaction with EGIS (see Appendix). Given the timing of the survey, their responses relate to both Phases 1 and 2.
3d. Stakeholder Satisfaction

- User provided comments conveyed general themes for Phases 1 and 2 as follows:
  - System Performance
    » DAD system performance and availability could be improved in some areas of the province.
  - Business Objectives
    » EGIS provides mapping of utility objects that is useful for most jobs.
    » DAD staff are utilizing EGIS to reduce field visits.
    » Potential PowerGrid benefits are not fully realized since data is limited to Phase 1 (Lower Mainland). Future phases of EGIS will develop required land base data for remaining areas of the province.
    » PowerOn staff need DAD data for quick identification and resolution of electrical outages.
  - Common Landbase
    » Data accuracy requirements needed for EGIS need to be better communicated to users. Users uncertain as to why high accuracy levels needed.
    » Address matching in EGIS, required for CIS and PowerOn data, was on target at 95% as of June 2002.
    » Some features in DAD need to have better accuracy.
    » Backlog of plant alterations in the Fraser Valley were identified.
    » BC Hydro needs to work with external contractors, who provide mapping assistance to DAD, since the software that contractors use do not facilitate data exchange.
  - Training & Support
    » Users were positive about having follow-up training and communication.
3d. Stakeholder Satisfaction - Survey

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Review and consider follow-up of user survey comments for other areas of possible improvement.</td>
<td>Recommendation accepted. Estimated completion date is March 31, 2003.</td>
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</tbody>
</table>
## Appendix - Summary of EGIS Survey Results

<table>
<thead>
<tr>
<th>Survey Respondents</th>
<th>User Level of Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DAD</td>
</tr>
<tr>
<td>Total User Sample</td>
<td>360</td>
</tr>
<tr>
<td>Percent responding</td>
<td>34%</td>
</tr>
</tbody>
</table>

### User Benefits

1. Application & data is generally accessible (ie. system downtime is minimal)
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
2. Available data is current and timely
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
3. Data is comprehensive enough to do my job
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Disagree.png)
4. Data can be easily shared with both internal and external parties
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)
   (e.g. municipalities, developers, other utilities).
5. Data is sufficiently accurate to meet my needs.
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)
6. Duplication of data capture and data management is being minimized.
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
7. Applications generally meets my needs & functional expectations.
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
8. Data input and editing privileges are granted to appropriate personnel.
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
9. Development priorities have been appropriately set.
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)
10. Deliverables have been delivered as per implementation schedules.
    - ![User Level of Agreement](icons/Neutral.png)
    - ![User Level of Agreement](icons/Neutral.png)
    - ![User Level of Agreement](icons/Neutral.png)
11. Inaccurate data has not resulted in any significant risk or loss of productivity.
    - ![User Level of Agreement](icons/Neutral.png)
    - ![User Level of Agreement](icons/Agree.png)
    - ![User Level of Agreement](icons/Neutral.png)
12. Applications have resulted in significant productivity improvements when compared to previous system (GFIS-DCDS).
    - ![User Level of Agreement](icons/Neutral.png)
    - ![User Level of Agreement](icons/Agree.png)
    - ![User Level of Agreement](icons/Neutral.png)
13. Without DAD or PowerGrid, I could not fulfill my current and future work obligations effectively and efficiently.
    - ![User Level of Agreement](icons/StronglyAgree.png)
    - ![User Level of Agreement](icons/Neutral.png)
    - ![User Level of Agreement](icons/Neutral.png)

### Training and Communications

1. Initial training and support meets or exceeds my expectations.
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
2. Follow-up training is necessary.
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
3. Communication has been adequate.
   - ![User Level of Agreement](icons/StronglyAgree.png)
   - ![User Level of Agreement](icons/Agree.png)
   - ![User Level of Agreement](icons/Neutral.png)
4. I can usually find needed DAD information on the EGIS web site.
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)
   - ![User Level of Agreement](icons/Neutral.png)

### Legend

- ![User Level of Agreement](icons/StronglyAgree.png)
- ![User Level of Agreement](icons/Agree.png)
- ![User Level of Agreement](icons/Neutral.png)
- ![User Level of Agreement](icons/Disagree.png)

Note: cumulative scores did not result in any strongly agree, agree, or strongly disagree opinions.