

The Integrated Land and Resource Registry Project of British Columbia

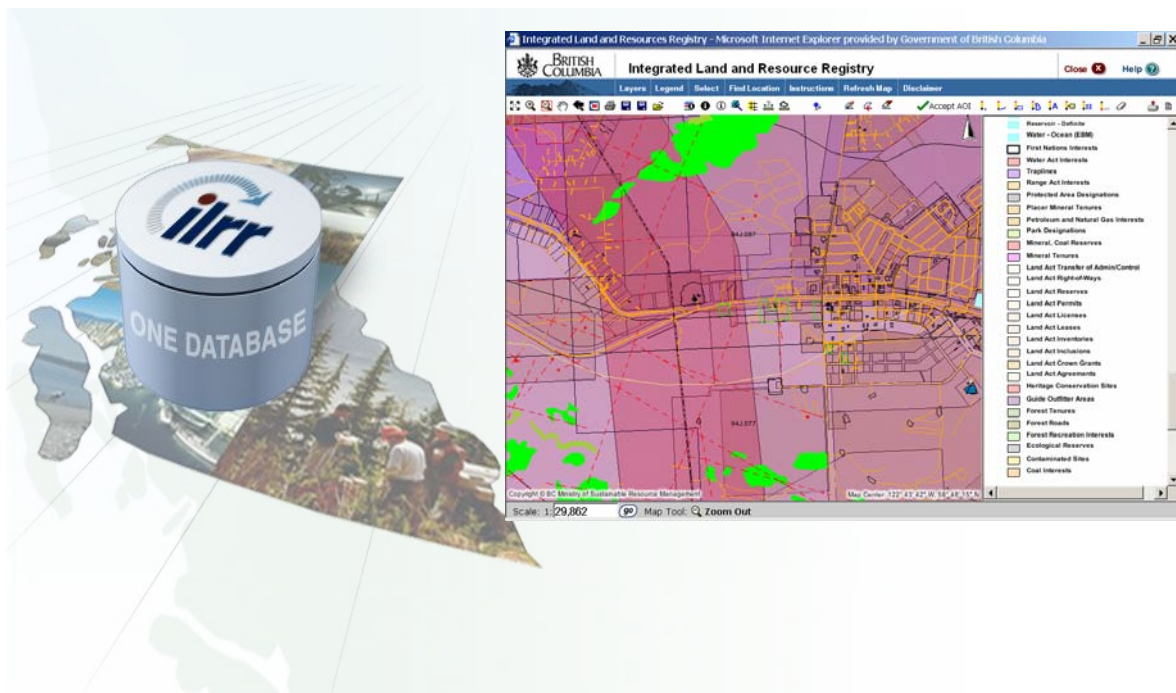
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Abstract:

Presently, land and resource tenure information in British Columbia is administered through a diverse set of disparate electronic databases. Government decision makers cannot effectively access a single information system to determine the status of crown land. The government's resulting inability to efficiently respond to land and resource applications has caused delays for all sectors of economic development in the province.

The **Integrated Land and Resource Registry (ILRR)** project will create a single comprehensive register for all legal land and resource interests. Spatially enabled by ESRI technology, the ILRR will enable government, business and public interests to operate more efficiently by replacing the current array of unrelated registries with an accessible "one-stop" window to official land and resource records in BC.

This paper will discuss the business and architectural aspects of the ILRR, and how ESRI technology and geospatial data management practices are being applied to achieve the project vision.



The Integrated Land and Resource Registry

1. Introduction

The Integrated Land and Resource Registry Project (ILRR) was undertaken in 2001 in response to the Premier of British Columbia's instruction to the Minister of Sustainable Resource Management to "Create a central registry for all tenures and other legal encumbrances on Crown land and resources".

The ILRR was intended to:

- support the effective management of 95 million hectares (235 million acres) of land and water on behalf of all British Columbians;
- enhance the decision process efficiency with publicly owned (known as Crown land) land and resources;
- reduce risk in decision making;
- provide a more competitive business climate to foster investment; and
- improve the delivery of information services to clients.

2. History of Land and Resource Information Management in BC

The disparate information and land management systems that support land and resource management in British Columbia (BC) evolved independently over the past century. Not only are there numerous administration systems, but there can also be a variety of co-existing active rights and interests¹ that could occupy the same land area (e.g., a forest cut licence, a water licence, a subsurface mineral claim, a guide outfitter area, a utility right of way, and a land act lease). Refer to Section 6 for more information.

Privately owned land has been historically administered using a Torrens based system so that the registration of title is all that is required for proof of ownership and the register is backed up by an assurance fund to protect property owners. All interest information is kept in one official register and administered in one operational system known as ALTOS. However, only eight percent of BC's land surface is privately owned and an even smaller percentage of the subsurface rights are privately owned.

The ILRR will create a corresponding single registrar for information on rights and interests on publicly owned Crown land which represents 92 percent of all BC land and water. The challenge in creating the ILRR was that there are over 240 different types of Crown land and resource interests that are managed by 19 different provincial rights granting agencies and

¹ *interests* a right or claim whereby the holders are entitled to or are bound by certain legal privileges or restrictions associated with tenure and land use activities, *rights* a type of interest that conveys to the holders certain legal privileges associated with tenure and land use activities

stored in 20 different operational systems plus paper records. In addition, ILRR users needed to be able to see the location and basic information of privately owned land.. Since the ALTOS private land system only contains attribute information, a spatial layer for private land was also needed to be compiled to support the ILRR's goal of a single source of information on all tenures and other legal encumbrances.

The first deployment of a fully functional ILRR was delivered in April 2005 for the Northeast portion of BC (see Section 4 for more information). Implementation of the ILRR will proceed in geographically distinct phases across the province with full deployment targeted for 2007.

3. Project Principles

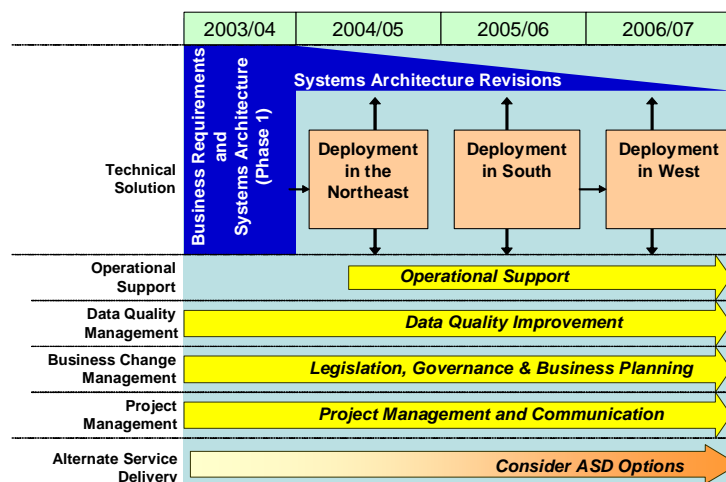
The project success is attributable to the following principles:

- strong mandate from government;
- ongoing consultation and communication using a variety of strategies;
- modeled openness and transparency on project decision making and progress;
- engaged partner agencies and stakeholder representatives at all levels throughout the lifecycle of the project; and
- minimized the ILRR's impact on partner ministries and agencies by maintaining their local decision making process and without increasing their cost of doing business.

4. The Approach

The ILRR used a multi-phased approach for project delivery that focused on clearly defining the business requirements, developing a legislative framework, data quality improvement, implementation support, as well as, the technology solution and application build. The project timeline, from the business requirements state to full deployment of the ILRR for the entire province, spans a period of four years.

Figure 1 - The project timelines



Although the first release of a fully operational version of the ILRR was delivered in April 2005, additional functionality and system refinement will occur until 2007. Data quality improvement efforts were focused only on the Northeast for the first deployment (refer to Section 9 for more detail). For areas of BC outside the Northeast, the first deployment of the ILRR did contain information on most of the main interest types (obtained directly from the interest granting agencies operational systems) however, caution is advised for users of this data as quality improvements are continuing in the next two years in the other geographic areas.

The project delivery timelines were very tight, and building an effective team of project staff and contractors was critical to project success.

- A small team of five staff in the government project management office has a well balanced mix of management, strategic, communications and technical expertise.
- Integration of the Ministry Information Management Branch expertise.
- The Contractor (a consortium of Sierra Systems Group as prime, Forte Consulting, and OA Solutions) brought together the expertise needed to deliver all aspects of the project including the system requirements, system architecture, and data architecture. Representatives from the three companies were able to quickly build a cohesive, well functioning team.

5. Governance Model

A multi-tier governance model was used with representation from all levels in partner ministries and agencies:

- Assistant Deputy Ministers Executive Steering Committee;
- Director level Senior Project Advisory Committee;
- Data quality working group (Club Data);
- Implementation Coordinators in each agency (middle management involved in implementation coordination support within their organization); and
- Champions/user testers (front line workers, statususers, planners) at all stages (input into screens appearance and content, implementation processes, user acceptance testing, etc.).

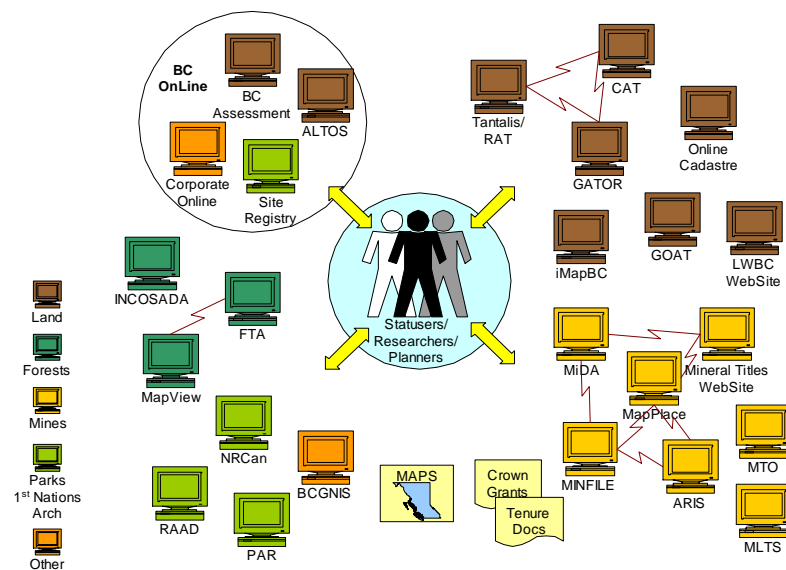
6. The Business Requirements

Deciding whether or not an interest or right to use the land can be granted is an extremely complex question. There are many different types of compatible land uses and also many restrictions or reservations on use that can occur in the same location at the same time. Decision making can also be impacted by: shifts in the public interests with respect to the best use of the land; historical changes to legislation; existing active and grandfathered rights and uses on the land; land use planning priorities; and First Nations interests.

In order for land rights to be issued, the issuing agency must first determine: is the land private or Crown; does government have the authority to issue the right or interest on the

land in question; is there any potential conflict with other interests that have already been issued for that area; are there any land use restrictions (e.g. park land); is there a duty to consult with First Nations or other stakeholders. Historically this has been a very time consuming manual process. Both applications and decision makers may have to visit multiple interest granting agencies or information systems to get the information they need; that is, assuming they even know they need to go there. Figure 2 below shows the results of interviews during the business requirements stage with government land planners and statusers who were asked to describe their existing business process and how they accessed the information they required.

Figure 2



Users wanted the ILRR to provide web based access to current real time information, the ability to view both spatial and attribute information, the ability to create and share reports, and notification if something changed within a specific area.

7. Access and Functionality

The ILRR is intended to be used by provincial government staff, other levels of government (municipal and federal), industry, professionals and the public using a standard internet browser. The level of access depends on the user; the public is restricted to using the map viewing tool. Some information in the ILRR is classified as sensitive and each interest type is assigned a default security level that ranges from: full access to details; existence (gives you summary level information and location only); notice (tells you a sensitive record exists and advises you to contact the interest granting agency responsible); and no access (can not view any information on the interest type). Sensitive records include applications for some types of rights and interests, archaeological site information, and personal interest holder information. Individual users in rights granting agencies can make application for a higher level of access so that they can view sensitive records if they have a job related reason for requiring higher than default level access.

The ILRR provides a suite of access and reporting tools to meet a variety of user needs (Appendix A provides some examples of ILRR screens):

- A user, such as a land planner or statuser, who has some information about a specific interest record (such as the business identifier) can use the “query interest record” to quickly get information on that specific record and view it on the map.
- The “create custom query” allows the user to define seven different parameters to create a custom report. The reports are generated using ORACLE and the user can view the reports on the screen or export the results in a variety of formats: PDF, CSV, RTF, HTML, SML, and GML.
- The user can save their query parameters, share them with others, or request a notification of change that affects the area of their query.
- The user can use the map viewer to create queries and view the location of rights and interests.

The map viewer is a key component of the ILRR; it uses the Internet Mapping Framework (IMF) tool that has been developed by the Government of British Columbia using the ESRI ArcIMS technology. The IMF application offers users the ability to view information and to customize those views using a variety of mapping functions such as red lining, importing shapes, selecting layers to allow users to run queries, and to generate maps and reports.

The ILRR also focused on ease of use and implementation support through an ILRR help desk, web based training, metadata, on-line help, glossaries, and a section on “known data problems”.

8. ILRR Technology

The ILRR systems architecture focused on leveraging proven standards and methodologies to avoid surprises and ensure the project met the timelines, budget limits and met reliability standards for the users.

The ILRR conceptual architecture which is made up of the following four communities:

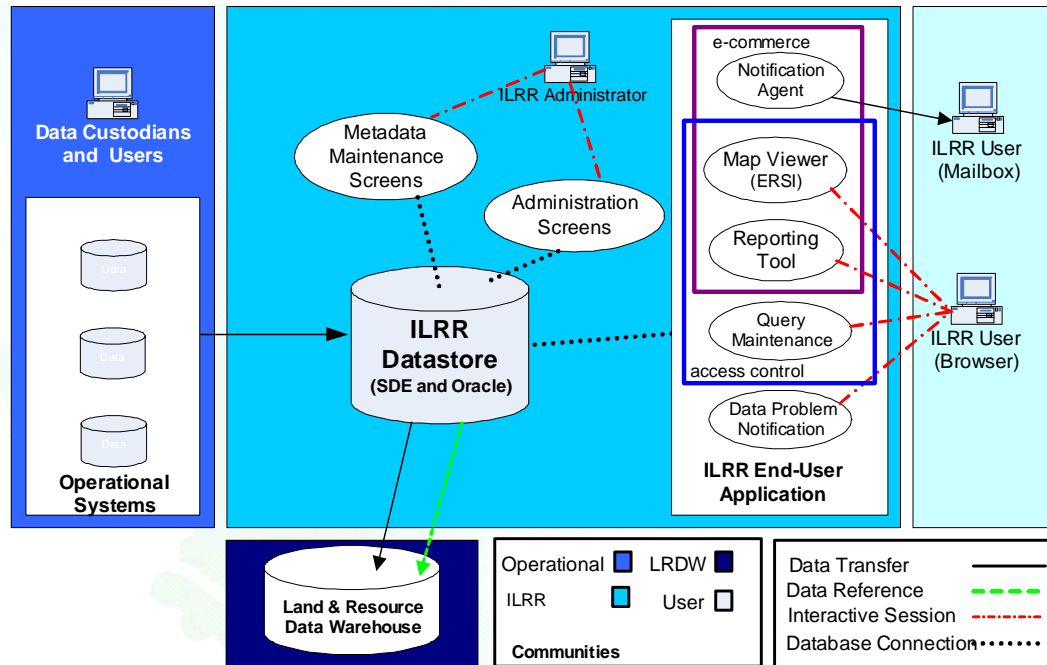
Community Name	Description
ILRR Community	<p>The purpose of the ILRR community is to:</p> <ul style="list-style-type: none"> • Serve as the province's legal registry of land and resource rights and interests for Crown land. This entails administering the ILRR and defining standards for the ILRR. • Make the registry's content available to User Community and the Interest Granting Community
Interest Granting Community	<p>The Interest Granting community includes a set of agencies and their operational systems which source the ILRR interest data.</p> <p>The ILRR Business Requirements defines these agencies as having 'statutory responsibility for the management of rights and interests in land and resources'.</p>

Community Name	Description
User Community	<p>The User Community represents the end consumers of the ILRR information. The members of this community will interact with the ILRR only in a read-only fashion (e.g. browse and query). The User community includes both members internal and external to government.</p> <p>The User Community is made up of the following groups:</p> <ul style="list-style-type: none"> • Non-Interest Granting BC Government Organizations; • Other governments (i.e. Local Government, Federal); • Non-government organizations Near Government Organizations (NGOs) (e.g. Land Trust, Ducks Unlimited); • Industry; • Professionals (Surveyors, Lawyers, Notaries, etc); and • General Public
LRDW Community	<p>The Land and Resource Data Warehouse (LRDW) Community is responsible for providing some of the supporting data for the ILRR application.</p>

The ILRR application is made up of a number of application components (refer to figure 3 for a diagram showing the technical solution). The following table presents these components and identifies the technologies used.

Component	Description	Technologies Used
ILRR Datastore	Persistent storage for the ILRR (i.e. a spatially enabled relational database).	<ul style="list-style-type: none"> • Oracle RDBMS 9.2.0.4 • ESRI SDE 8.3
Map Viewer	User Interface component for display of background maps with overlay of ILRR feature type (Interest) extents.	<ul style="list-style-type: none"> • ESRI ArcIMS 9 • IMF v4.0.6.18
User Interface	<p>Allows user to define and submit report request; generates and presents reports.</p> <p>This user interface application is integrated with the map viewer application.</p> <p>Allows users to maintain a set of stored query definitions.</p>	<ul style="list-style-type: none"> • Oracle Application Server 9.0.4.1 • ESRI SDE 8.3 Java API
Notification Agent	Enables ILRR to distribute notification of events (that have occurred within the ILRR datastore).	<ul style="list-style-type: none"> • Autonomous Java application • ESRI SDE 8.3 Java API
Registration Services	Facilitates the registration of interest transactions (creations, updates and deletes).	<ul style="list-style-type: none"> • Autonomous Java application • Oracle Advanced Queue • FME ICE^3 • SDE API

Figure 3 - The technical solution



9. Data Acquisition and Data Architecture

Quality, complete, and timely data is critical to the success of the ILRR; it is also the greatest challenge. The data was located in 20 different systems and in numerous formats, standards and in various stages of completeness and currency. As figure 2 demonstrates, 25 different tools and systems were being used to identify the status of rights and interests on the land.

Prior to project completion in 2007, the government will be passing legislation that will require all interest granting agencies to provide information to the ILRR in electronic format. Even though the legislation has not yet been drafted, the ILRR has had the full support of all granting agencies and the information was voluntarily provided in time for the Northeast delivery phase. Memorandums of Understanding are being used until such time as the legislation is completed.

The ILRR is providing funding to assist interest granting agencies to improve their data in support of the ILRR. Improvements are made directly in the agencies' operational systems; therefore data remains identical in both the originating system and the ILRR. By working cooperatively, significant quality improvements were made to data in the Northeast in time for the Northeast implementation.

The ILRR is underpinned by a sophisticated geospatial data integration infrastructure.

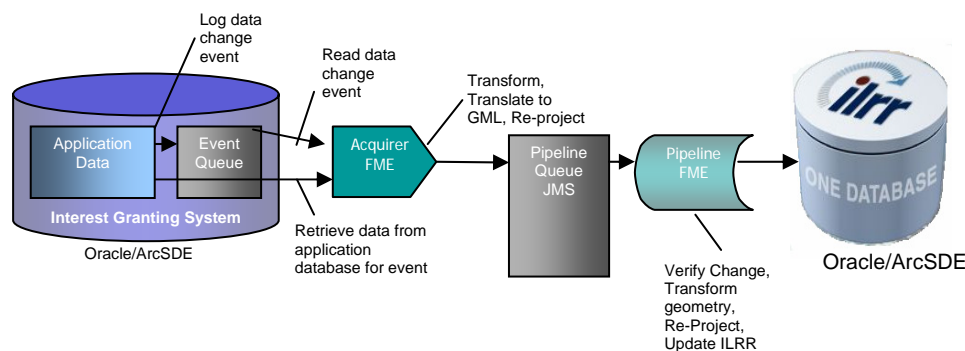
Data acquirers automatically move data on a continuous basis from their operational systems to ILRR through a population pipeline in near real time. This had to be accomplished with minimal impact to the agencies' operational systems. The solution also had to ensure data availability, currency and accuracy in the ILRR. Given the diversity of GIS systems in use, the variety of data formats and coordinate systems, the differing methods of collection and maintenance, coupled with the autonomous nature of provincial government departments and concerns about information security, this was no small task.

Geospatial data integration for the ILRR is tackled using two approaches – depending upon the architecture of the source system, frequency of data change (and the project development schedule). These are:

- **continuous update** of all data with frequent updates, changes and deletions; and
- **scheduled refresh** of stable data sets with infrequent changes (e.g. parks, land management area boundaries).

A number of the provincial government's business systems manage both attribute and spatial data within relational database management systems, principally Oracle with ArcSDE. This type of system provides the opportunity to extract 'change-only' data updates, if you are prepared to do a little work. The ILRR has a generic adapter that detects changes within ArcSDE-based systems and pulls those events from an event queue table, as illustrated below.

Figure 4 – Data Acquisition

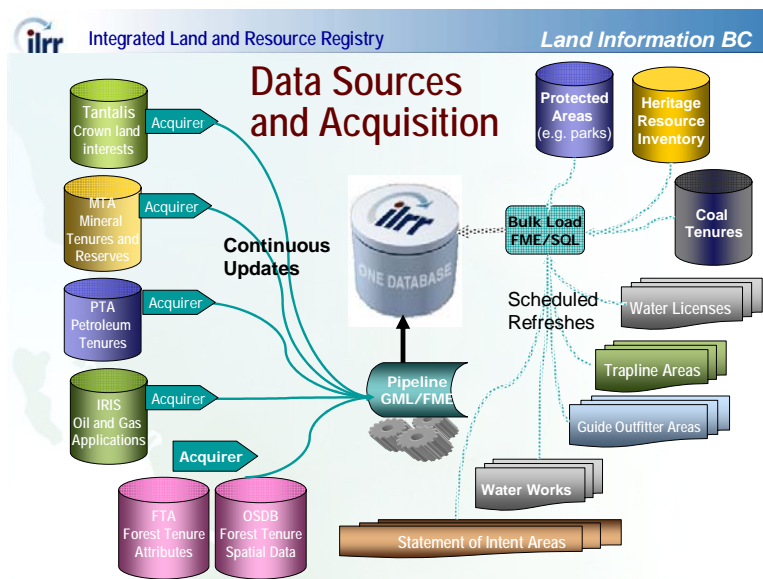


Continuous Updates Logical Architecture

An 'Acquirer' scans the queue to detect new events. It then queries a set of interfacing views in the application database to retrieve details about the Interest and other salient information. The Acquirer transforms the source data into a common representation, namely GML (Geographic Markup Language) and re-projects to the NAD 83 geographic coordinate system (the BC government standard) and packages it into a XML message and sends it to the 'Pipeline' Queue. As some applications may write to the database several times during the execution of a single business transaction, the Acquirers may compile multiple events to produce a single GML/SOAP message.

Each interest granting system has a dedicated Acquirer retrieving data changes and sending messages to the Pipeline queue, as illustrated by Figure 4. The Pipeline process reads that queue and writes the information into the ILRR. When new Interest records are created within the ILRR, a unique Interest Registration number is generated and assigned. This registration number is permanent and becomes the ILRR identifier for the Interest.

Figure 5 – Data Sources and Acquisition



The Pipeline determines the type of event that has taken place (new record, update to previous, etc.) and then writes the information to the ILRR database in such a way that the Registration number and selected historical information is preserved.

From a technology perspective, the Acquirer was developed using FMEObjects embedded within Java. The Pipeline makes extensive use of the ArcSDE java API, as well as, some FMEObjects. Queues were implemented using Oracle tables and JMS (Java Message Service) using Oracle AQ (Advanced Queuing).

As the ILRR transitions to become a legal registry, the registration number for each interest will flow back to the originating system for use on all documentation that refers to that interest. The data integration infrastructure will support this two way exchange of information between systems.

A key component of such infrastructures is the administrative capabilities that enable an Administrator to monitor the performance of the system. To effectively operate a highly integrated system such as the ILRR, it is essential that the Administrators have visibility into the vital statistics of the system such as: the number of messages in a queue at any point in time, processing rates, through flow times, expected time of arrival (ETA) of a given update event, rate

of exceptions, status of each integration component, etc. The team is currently developing administrator procedures to provide this capability.

Scheduled Refresh

For those interest granting systems that do not use relational database management system technology for attribute and spatial data, a bulk refresh mechanism has been developed to load data into the ILRR. This approach uses the more traditional spatial ETL (Extract, Transform and Load) model. Data extracts are obtained on a scheduled basis (depending upon rate of change, etc.). This data is transformed, translated, re-projected and loaded into a staging database. It is then ‘merged’ with the existing data in a way that ensures that previously assigned Registration numbers are preserved.

Although not as sophisticated as the Continuous Update mechanism, the Scheduled Refresh tool is a significant component of the geospatial data integration infrastructure. The Scheduled Refresh tool can be used with any type of data source, regardless of format; it works equally well with file-based data as it does with RDBMS-based data. It also functions as an essential disaster recovery tool and it provides the capability to quickly synchronize the ILRR with any of the source systems.

Acknowledgements

I want to acknowledge the efforts of my ILRR project team colleagues:

- Allison Bond, Assistant Deputy Minister, Land Information BC (executive sponsor)
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- Alvin Melon, Project Analyst
- Judite Costa, Project Administrative Assistant

I also want to acknowledge and support of the project Contractors Sierra Systems Consulting Services, Forte Consulting Ltd, and OA Solutions (see last page for contact information). A special thanks to:

- Sierra Systems Consultants’ Simon Lanoix (Project Manager) and Rob Frame (Technical Architect) for assistance with the ILRR technology section of this paper.
- Forte Consulting Ltd’s Graham Morgan, David van Blankenstein and John Samulski for assistance with the data acquisition and data architecture section of this paper.

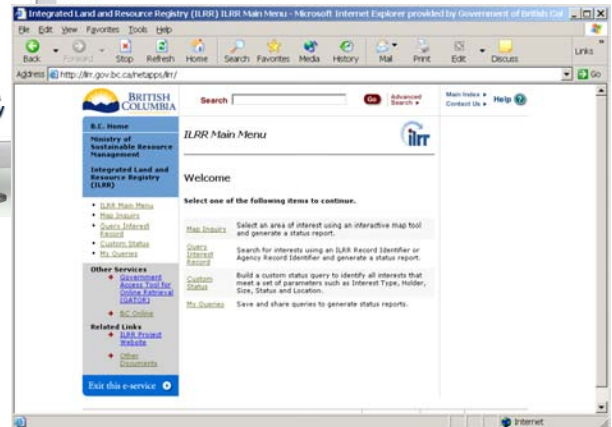
The ILRR could not have been delivered without strong support and expert advice from the Ministry’s Information Management Systems Branch. A special thanks goes to Business Analyst Sue Bergin, Application Analyst Dave Ostapovich, Technical analyst David Lee, and Manager of Application Development Doug Say.

In addition there were approximately 300 partner agency representatives and stakeholder representatives who provided information and attend countless meetings to provide input.



Appendix A

Welcome to www.ilrr.ca

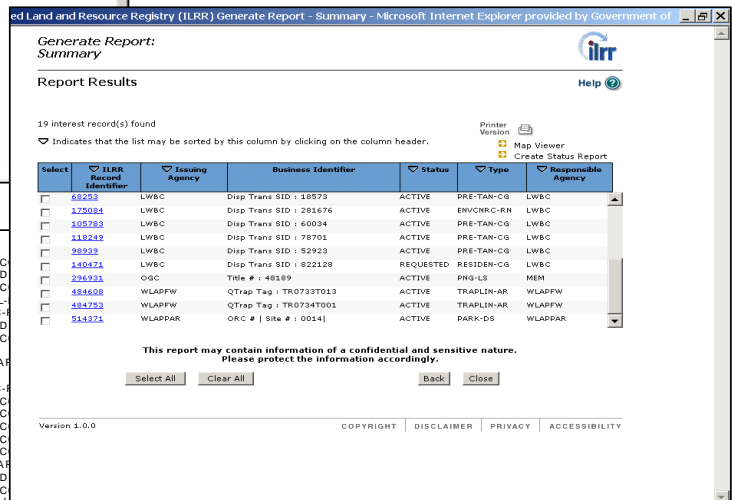


Screen Shots of ILRR Reports



View detail on a specific interest record

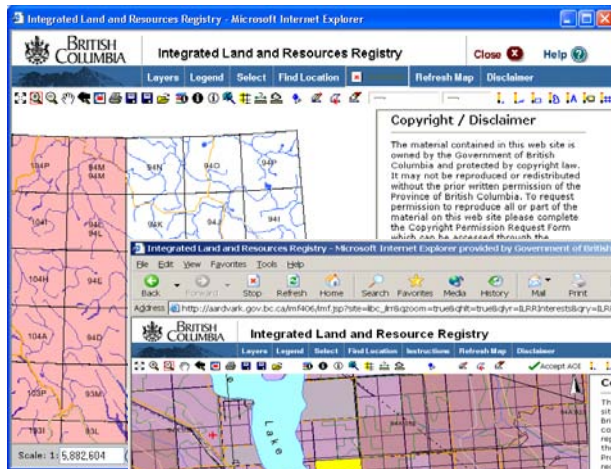
Create and view status report



ILRR Record ID	Issuing Agency ID	Business Identifier	Status	Type
57782	LWBC	Disp Trans SID: 124522	ACTIVE	PRE-TAN-C
149224	LWBC	Disp Trans SID: 277700	ACTIVE	RESIDEN-D
105076	LWBC	Disp Trans SID: 59262	ACTIVE	PRE-TAN-C
158039	LWBC	Disp Trans SID: 284516	ACTIVE	COMMRLCL
175029	LWBC	Disp Trans SID: 278991	ACTIVE	ENVCNRC-4
149187	LWBC	Disp Trans SID: 277661	ACTIVE	RESIDEN-D
120277	LWBC	Disp Trans SID: 82525	ACTIVE	PRE-TAN-C
295855	OGC	Title #: 49213	ACTIVE	PNG-LS
484608	WLAPFW	QTrap Tag: TR0733T013	ACTIVE	TRAPLIN-AR
291940	OGC	Title #: 6002	ACTIVE	PNG-LS
175084	LWBC	Disp Trans SID: 281676	ACTIVE	ENVCNRC-4
105783	LWBC	Disp Trans SID: 60034	ACTIVE	PRE-TAN-C
114891	LWBC	Disp Trans SID: 71869	ACTIVE	PRE-TAN-C
116831	LWBC	Disp Trans SID: 7571	ACTIVE	PRE-TAN-C
63965	LWBC	Disp Trans SID: 14289	ACTIVE	PRE-TAN-C
87140	LWBC	Disp Trans SID: 40414	ACTIVE	PRE-TAN-C
484605	WLAPFW	QTrap Tag: TR0733T012	ACTIVE	TRAPLIN-AR
149306	LWBC	Disp Trans SID: 277787	ACTIVE	RESIDEN-D
54007	LWBC	Disp Trans SID: 11809	ACTIVE	PRE-TAN-C
301483	OGC	Title #: 76	ACTIVE	NATRLGSL
149171	LWBC	Disp Trans SID: 277642	ACTIVE	RESIDEN-DP
145781	LWBC	Disp Trans SID: 34639	ACTIVE	PRE-TAN-DP
102042	LWBC	Disp Trans SID: 56099	ACTIVE	PRE-TAN-CG
128891	LWBC	Disp Trans SID: 95107	ACTIVE	PRE-TAN-CG
91225	LWBC	Disp Trans SID: 44786	ACTIVE	PRE-TAN-CG
58059	LWBC	Disp Trans SID: 12518	ACTIVE	PRE-TAN-CG
293836	OGC	Title #: 43106	ACTIVE	PNG-LS
148958	LWBC	Disp Trans SID: 277411	ACTIVE	RESIDEN-DP
106503	LWBC	Disp Trans SID: 60771	ACTIVE	PRE-TAN-CG
71264	LWBC	Disp Trans SID: 21663	ACTIVE	PRE-TAN-CG

Print status report

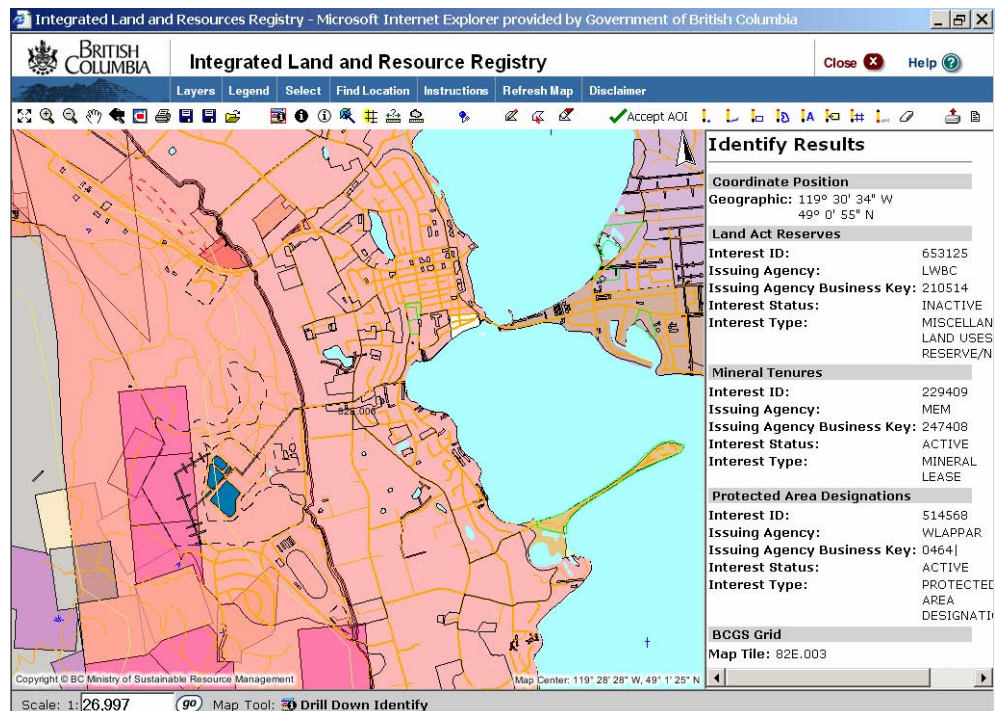
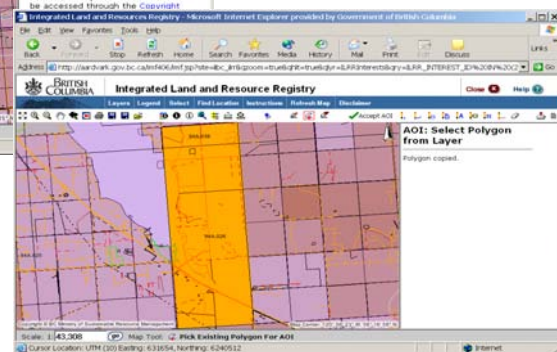
Internet Mapping Framework Map Viewer



The ILRR Map Viewer showing the Northeast

Select a using “find location”, zoom in or drawing tools

Select an area of interest for statusing



End Notes

References

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