

Information Services Activities, April 2019 to March 2020

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The Information Services group is responsible for developing and maintaining the Geoscience and Mines Branch (GMB) Geographic Information System and associated databases, the NovaScan publications and maps database, for supplying digital data and services to clients and staff, and for developing and maintaining the GMB Internet website. Permanent Information Services staff consists of Jeff Poole (supervisor), Jeff McKinnon (geologist/GIS specialist), Angie Barras (GIS specialist/ cartographer), Courtney MacMullen (geologist/GIS specialist), Sonya Cowper (GIS and map server specialist), and Eugene MacDonald (geologist/information and collection management specialist). Diane Webber is the manager for the group.

Digital Geoscience Data Products

A collection of digital geology maps, databases, and images of Nova Scotia (in Esri shapefiles, ArcGIS file geodatabase, KML/KMZ, DXF, ARC export, TIFF, JPEG, and MrSID formats in a UTM projection using the NAD83 datum, and in PDF format) has been developed, and is available for viewing or free download from the GMB website (<https://novascotia.ca/natr/meb/download/gis-data.asp>). ArcGIS file geodatabase and Esri shapefiles are now our main data distribution formats. We are no longer producing the ARC E00 export and DXF formats. The Branch has now adopted the Nova Scotia Open Government Licence (<https://novascotia.ca/opendata/licence.asp>) for all of its digital datasets. All new products will include a link to the Nova Scotia Open Government Licence. Legacy products will be updated to this new licence as time allows. Several of our datasets are also available through the Nova Scotia Government's Open Data Portal (<https://data.novascotia.ca/>).

GIS Development

Information Services GIS staff worked together with other GMB staff on numerous projects in 2019-2020. This included providing advice and assistance as requested, along with developing databases and maps for the projects outlined below.

Central Annapolis Valley Mapping: Section staff worked with Chris White to produce a 1:50 000 scale bedrock geology map of the central Annapolis Valley area and an accompanying digital product. The geology includes new work in the area as well as legacy compilation data. Open File Map ME 2019-006 was released in December 2019 (Fig. 1) and the Digital Product ME 443 was released in March 2020.

Parrsboro Map Project: Information Services staff provided GIS support to John Calder while he compiled data for outcrop and fossil locations from Black Rock to Moose River in the Parrsboro region of Cumberland County. Data were collected by Dr. Calder over several years and compiled by GIS staff. Open File Map ME 2019-001 was released in March 2019 and Digital Product ME 491 (Fig. 2) was released in August 2019.

Valley Aggregate Project: The Valley Aggregate dataset contains more than 9,000 aggregate site observations that are linked to 9,340 photos, 972 sample analyses, and site descriptions. After a delay in the project during the second half of the fiscal year, an additional layer was made that shows the bedrock aggregate potential for Hants, Kings, Annapolis, Digby, and Annapolis counties. These data, along with the publication of an online interactive map application for stone resource potential in western Nova Scotia, will likely be released in the next fiscal year. The application will provide valuable information to the stone resource

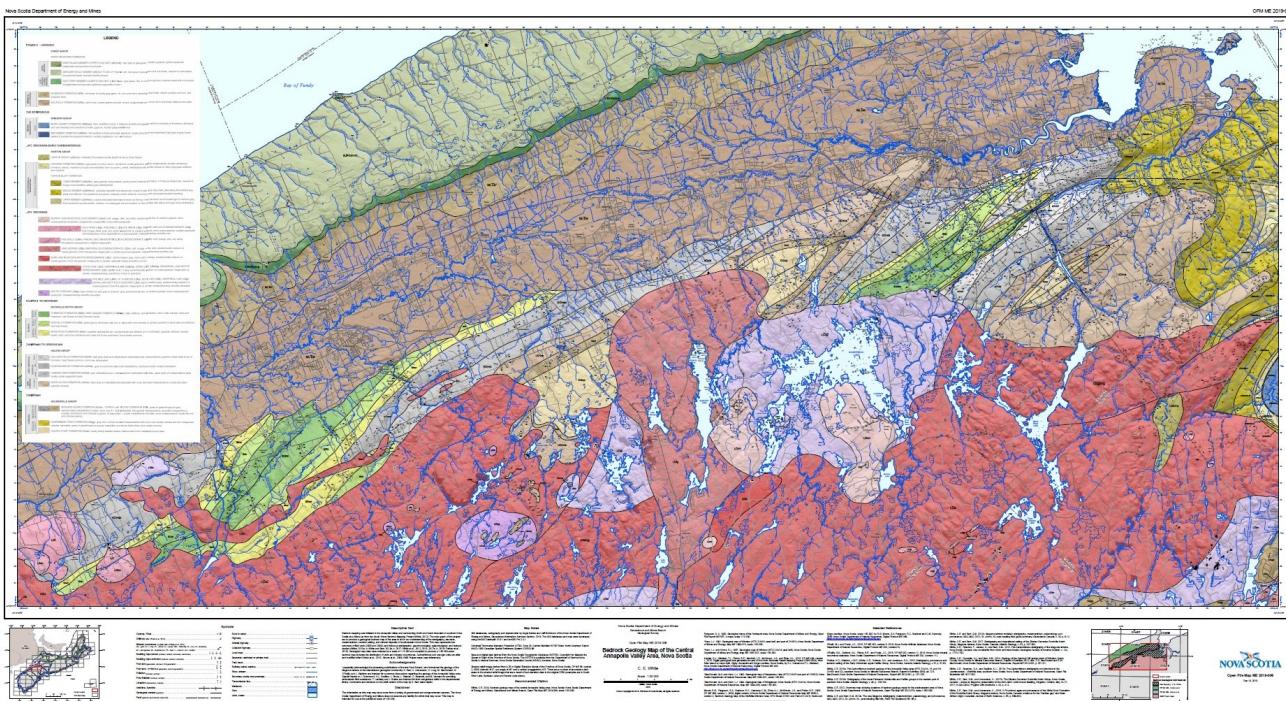


Figure 1. An over view image of Open File Map ME 2019-006, *Bedrock Geology of the central Annapolis Valley*.

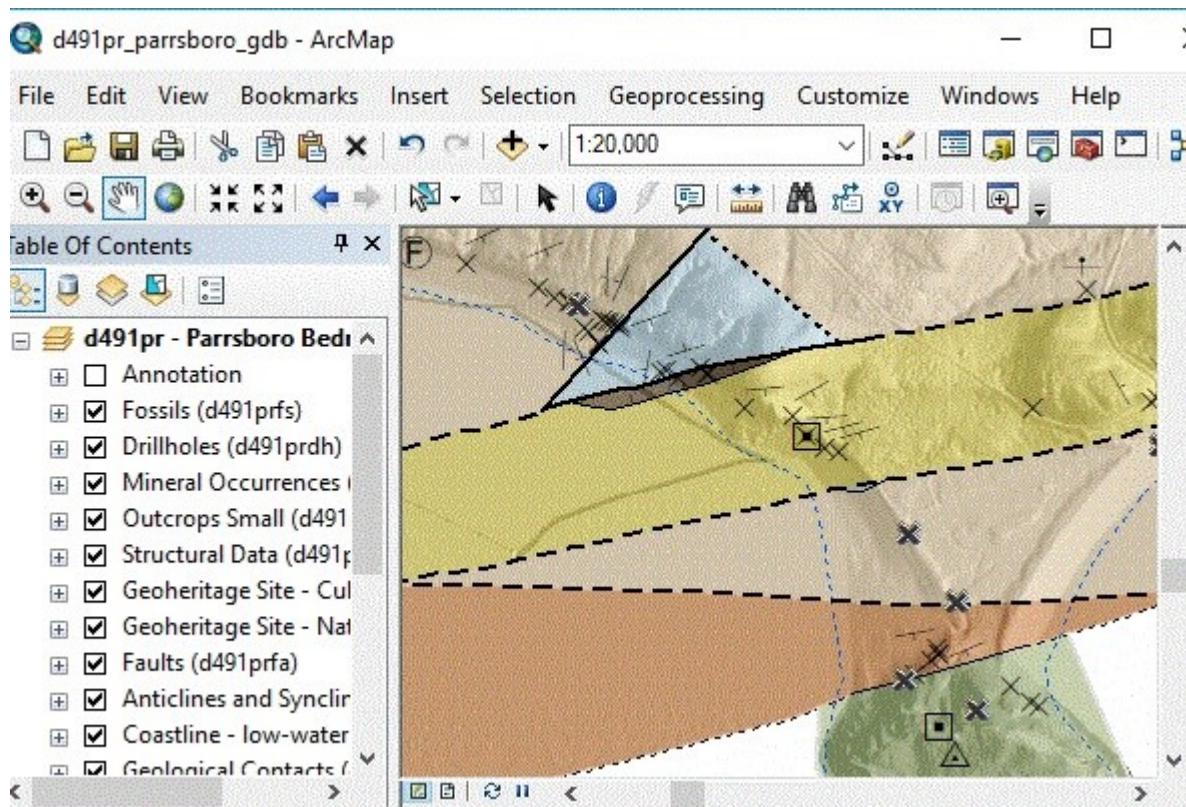


Figure 2. Digital Product ME 491, *Geology of the Parrsboro Shore, Black Rock to Moose River, Cumberland County, Nova Scotia*.

industry, public works agencies, and others looking for sources of materials to make stone-based products. The GIS group also put together a subset of the data into a story map application titled *From Earth and Rock: a Guide to the Stone Resource in the Annapolis Valley - Acadian Shore Region in Nova Scotia*.

Cobequid Highlands Project: This year Information Services staff worked with geologist Chris White on the ongoing compilation of data in the Cobequid Highlands area from Mount Thom to Cape Chignecto. This involved locating a large volume of data on the area that was collected by the late Trevor MacHattie. GIS data, structural data, geochronological data, geochemical data, CorelDraw figures, and photographs are being used to complete this section of mapping.

GIS Support to Field Staff: The GIS staff provided support to the field geologists in the Branch throughout the year. The group ensures that data are shared readily among branch staff and provides general GIS support and advice as required. This support ranges from creating and printing field maps to acquiring and/or processing digital data for staff. These data generally include vector topographical maps, satellite imagery, digital orthophotos, and lidar. Many field maps have been georeferenced and can therefore be used with applications such as Avenza to view GPS points in real time using the internal GPS of phones or tablets.

Many staff maintain spreadsheets and paper maps, and they continue to receive support in bringing these data into a GIS format when ready. The GIS group also encourages and helps staff transition to digital field data collection using mobile applications such as Collector and Survey123 for ArcGIS. By building customized collection apps for a geologist and their specific project needs, we can better integrate field data into our GIS model and maintain in-house standards. GIS staff accompanied several geologists in the field to observe work processes and assist in use of applications and GIS products where applicable.

In 2019-2020, GIS staff assisted with processing data from previous applications and with the creation of new applications for new surveys and forms, such as

- Denise Brushett: surficial geology survey, silt sediment survey

- Geoff Baldwin: Cape Breton Island alteration survey and resultant web application
- Amy Tizzard: Integrated Resource Management (IRM) inspection forms (in collaboration with IRM staff); sinkhole monitoring survey (in progress)

Eastern Shore Project: The GIS staff supported Chris White's work along the eastern shore of Halifax and Guysborough counties by assisting with the compilation of geological data and by creating 1:10 000 scale field maps that include base layers and SPOT satellite imagery. The group also downloaded and processed lidar imagery in the area provided by GeoNova.

Provincial Bedrock Geology Map: GIS staff are working to create a new provincial bedrock geology map. The goal is to compile and integrate the best and most up-to-date bedrock geological mapping for Nova Scotia and thus create a single, seamless digital dataset. This involves compiling recent mapping projects as well as legacy data from a variety of sources. This project is intended to update our current provincial bedrock map and corresponding databases, which were published in 2000. We are also working with our colleagues in the New Brunswick Geological Survey and the Atlantic Geoscience Society to produce a new geological highway map for the region in 2022.

Process Improvement: Staff continued work on the Workflow Process Improvement Project. The purpose of this project was to review and improve our current process of collecting, creating, and compiling data, which are ultimately published. The goal is to make the current process faster and more efficient, while ensuring the quality and format of published products are current and useful to our clients. After the completion of the "GIS Products Process Improvement" summary report, staff began working on the list of recommendations outlined in the report and have begun to implement these recommendations on several projects. The goal is to complete all the suggested recommendations in the coming months and have all upcoming projects to follow the new process. The summary report states that baseline data collection be initiated once all short-term recommendations are implemented. This will allow staff to measure the success of the new processes put in place. Staff will do this by monitoring projects that follow the new process, by keeping

track of the time and processing steps required for completion.

Geoparks: GIS staff continued to work with John Calder for the Cliffs of Fundy aspiring Geopark nomination. The *Cliffs of Fundy Aspiring Geopark* story map was built in the summer and fall of 2019. **Groundwater Projects:** Section staff worked with Gavin Kennedy throughout the year with the publication of groundwater chemistry maps, water well risk applications and updates to layers in the Groundwater Atlas summarized in subsequent sections of this report.

Registry of Mineral and Petroleum Titles

Database/ NovaROC: Staff made updates to several geospatial layers that will be incorporated into the next update of the NovaROC application. Staff also worked with registry staff to maintain the GIS digital product (Digital Product ME 493) *Nova Scotia Mineral Rights Database (NovaROC)*. The product is normally updated daily and released at 2:00 AM.

Mineral Inventory Files Articles Web Map: In the summer of 2019 the GIS student Braeden Gray compiled 70 PDFs from the popular series of articles titled *From the Mineral Inventory Files* by George O'Reilly and published from 1995 to the present in *The Nova Scotia Minerals Update* and *The Geological Record*. The articles supply historical and current information, photographs, and maps of interesting mineral properties in Nova Scotia. The outlines of the map figures in the articles were georeferenced and integrated into an online web map application to allow clients to interactively access the articles (Fig 3). The link to the application and a full listing of the articles can be found at <https://novascotia.ca/natr/meb/pdf/FTMIF.asp>.

GeoNova and Government IT Initiatives: In 2019 GIS staff of the GMB completed a government-wide plan to move all computer systems to the Windows 10 operating system. Geoscience and Mines Branch GIS staff were also involved in discussions with GeoNova on GIS metadata initiatives and ArcGIS Portal, the latest map server technology for delivering maps, data, and applications to clients and the public on the Internet. GIS staff have also been involved with the Nova Scotia Government's Open Data Portal (<https://data.novascotia.ca/>)

Internet Applications

The section continues to create and maintain a number of Internet applications including web map applications and Esri Story Maps. Section staff were also busy implementing ArcGIS for Enterprise and Portal for ArcGIS.

The section currently maintains the following web map applications:

- 1) **Geoscience Atlas** (Fig. 4) (<https://fletcher.novascotia.ca/DNRViewer/?viewer=Geoscience>)
- 2) **Groundwater Atlas** (data updated this year) (Fig. 5) (<https://fletcher.novascotia.ca/DNRViewer/?viewer=Groundwater>)
- 3) **Mineral Resource Land Use Atlas** (<https://fletcher.novascotia.ca/DNRViewer/?viewer=MRLU>)
- 4) **Potential for Radon in Indoor Air** (Fig. 6) (<https://fletcher.novascotia.ca/DNRViewer/?viewer=Radon>)
- 5) **Bedrock Acid Rock Drainage Potential for Southwestern Nova Scotia** (<https://fletcher.novascotia.ca/DNRViewer/?viewer=ARD>)
- 6) **Southwest Nova Bedrock Map** (<https://fletcher.novascotia.ca/DNRViewer/?viewer=SouthWestNova>)
- 7) **Arsenic Risk in Bedrock Water Wells** (https://fletcher.novascotia.ca/DNRViewer/?viewer=As_Risk_Wells)
- 8) **The Potential Impact of Drought to Private Wells** (data updated this year) (<https://fletcher.novascotia.ca/DNRViewer/?viewer=DroughtIndex>)
- 9) **Nova Scotia Real-Time Shallow Aquifer Monitoring Network** (https://fletcher.novascotia.ca/DNRViewer/index.html?viewer=Aquifer_Monitoring.Aquifer_Monitoring)
- 10) **Karst Risk Map** (added early 2019) (Fig. 7) (<https://fletcher.novascotia.ca/DNRViewer/?viewer=Karst>)

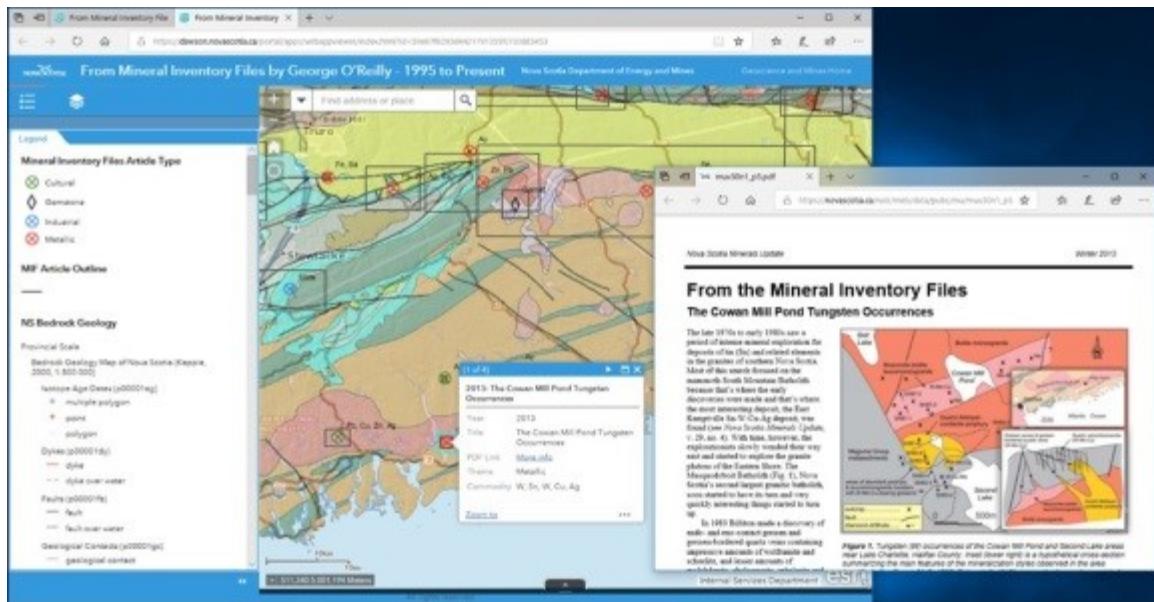


Figure 3. Screen capture of the *From the Mineral Inventory Files* online web map application.

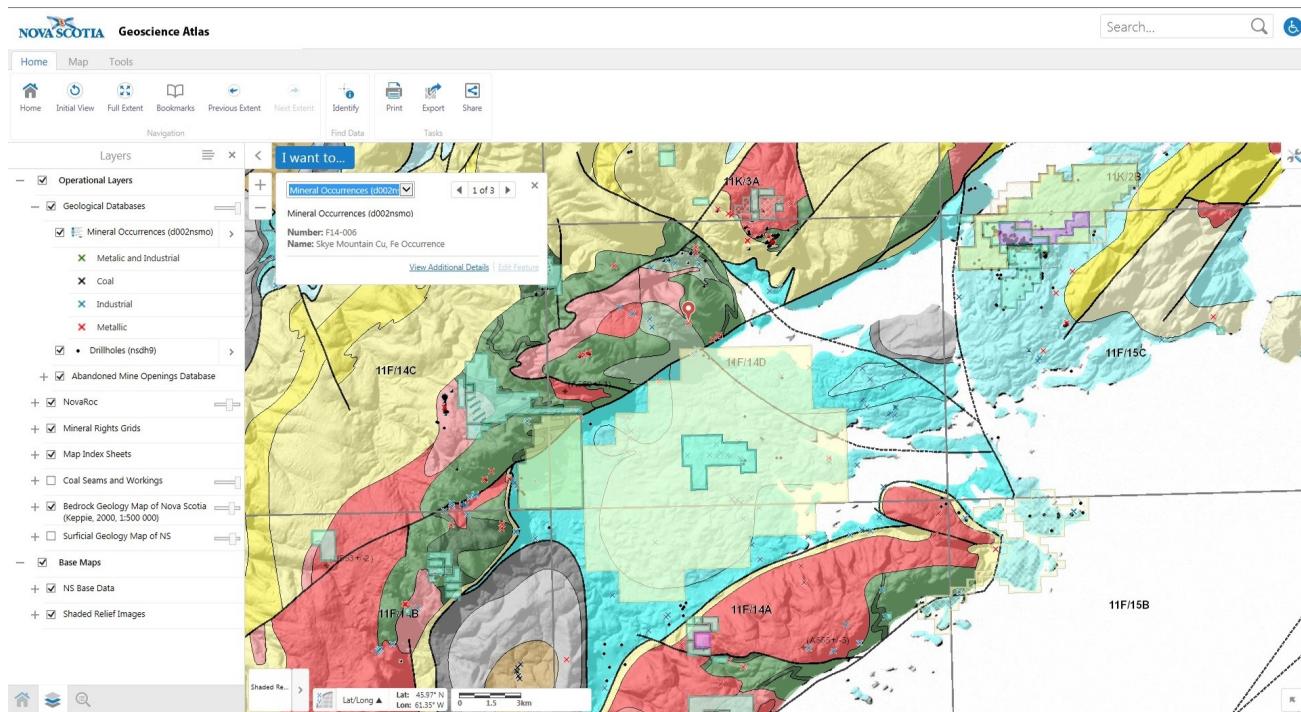


Figure 4. An example of the Geoscience Atlas application with shaded relief imagery turned on, transparency adjusted for the bedrock geology, NovaROC mineral rights layers turned on, and a mineral occurrence selected.

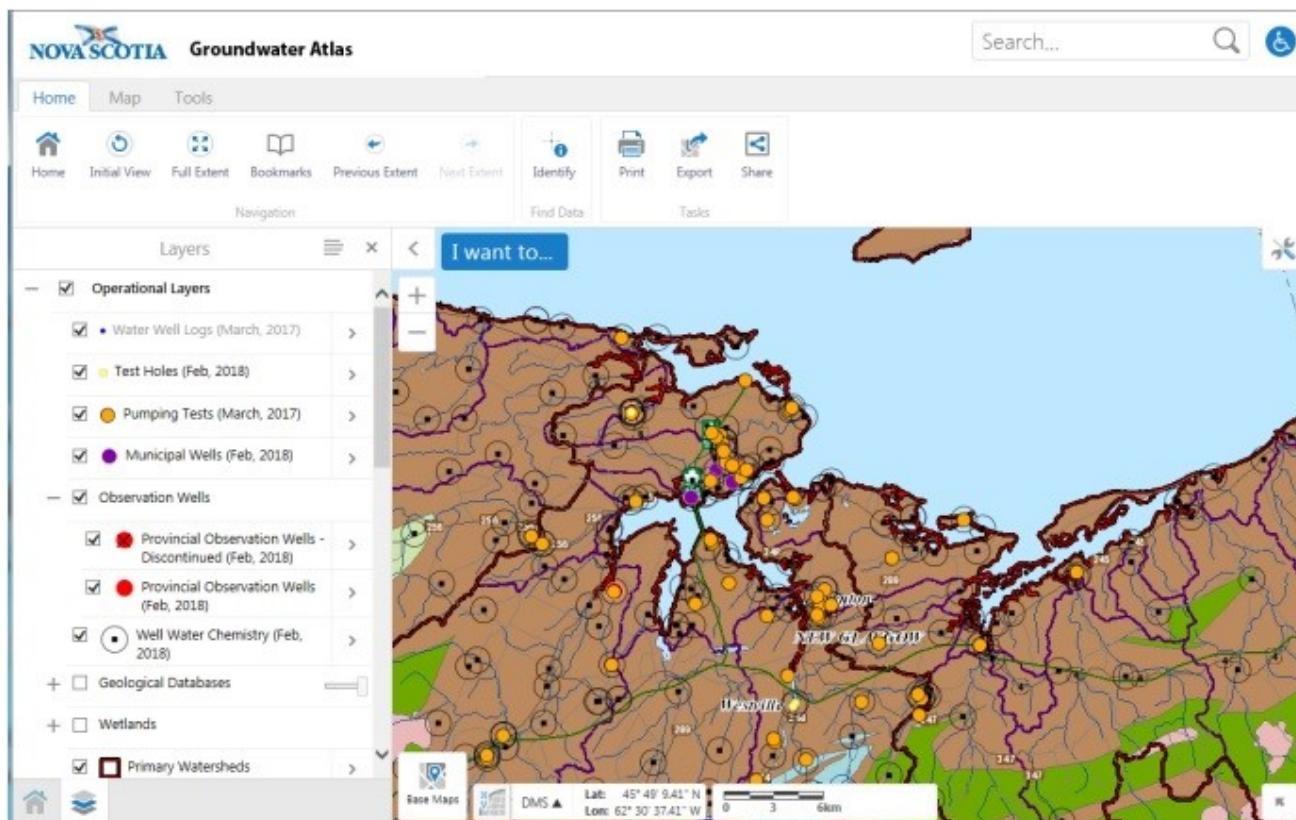


Figure 5. An example of the *Groundwater Atlas* application zoomed into the New Glasgow area.

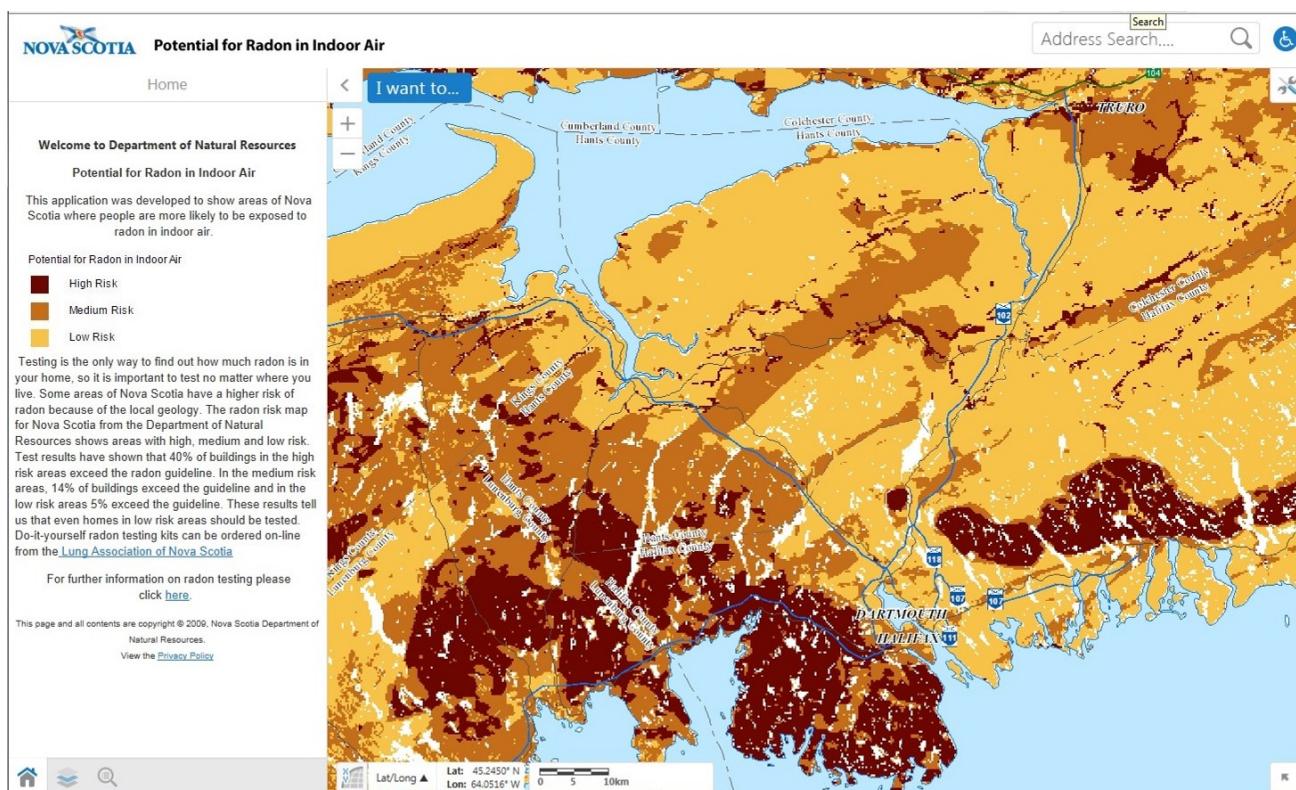


Figure 6. An example of *Potential for Radon in Indoor Air* application zoomed into central Nova Scotia.

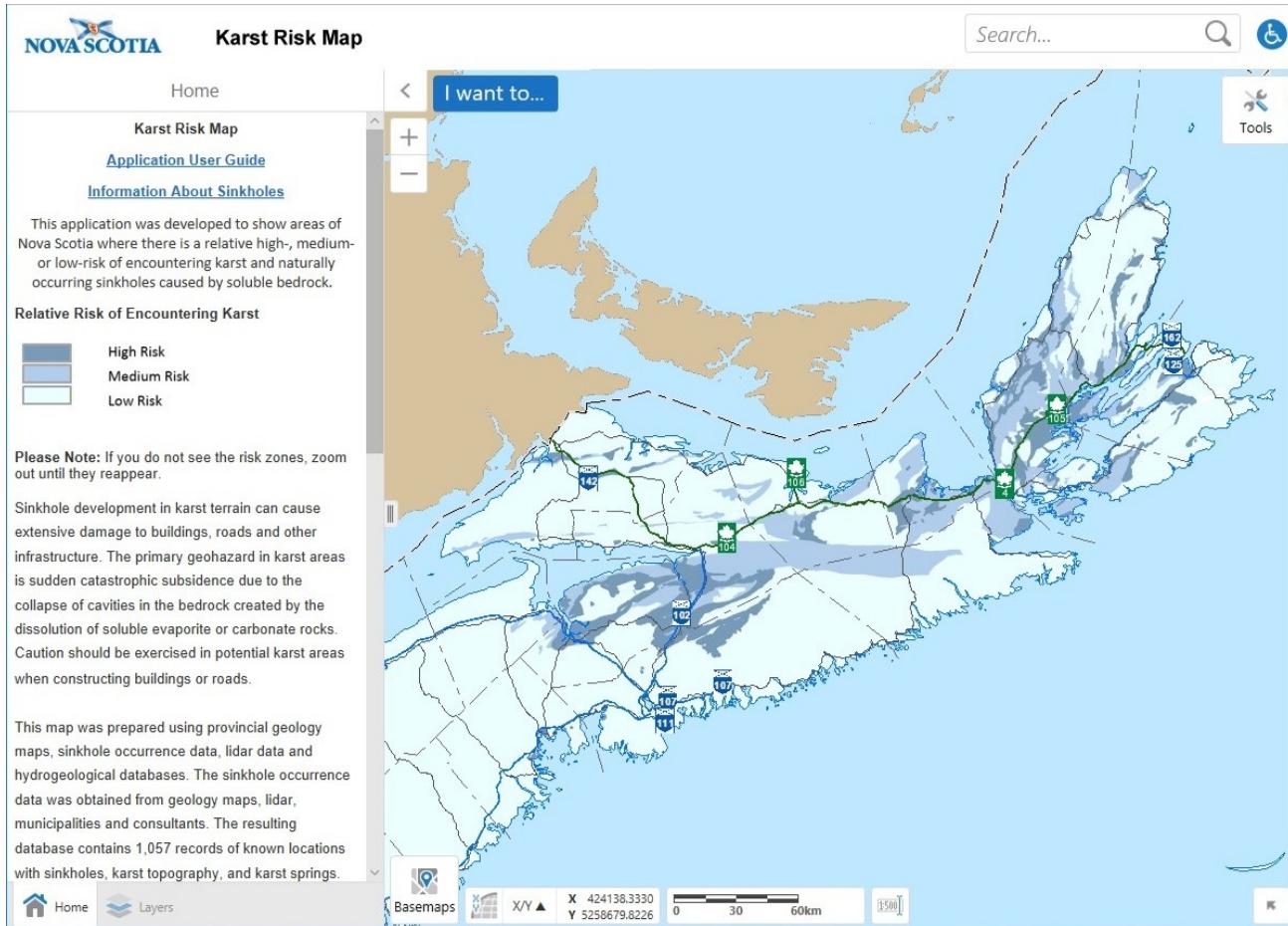


Figure 7. An example of the *Karst Risk Map* application.

11) Uranium Risk in Bedrock Water Wells
 (New) (Fig. 8) (https://fletcher.novascotia.ca/DNRViewer/index.html?viewer=Uranium_Risk)

12) Relative Risk of Corrosive Groundwater in Drilled Water Wells (New) (Fig. 9) (https://fletcher.novascotia.ca/DNRViewer/index.html?viewer=Drilled_Corrosive_Groundwater_NS.Relative_Corrosivity_of_Groundwater_in_Drilled_Water_Wells)

The GIS group also maintains three Esri Story Maps:

1) Nova Scotia's Geoheritage: A Billion Years in the Making (Fig. 10) (https://fletcher.novascotia.ca/geoheritage_ns_tour/index.html)

2) Cliffs of Fundy Aspiring Geopark (Fig. 11) (<https://storymaps.arcgis.com/stories/4fe5ddb9093a46eb920df5234773e8fd>)

3) From Earth and Rock: A Guide to the Stone Resource in the Annapolis Valley - Acadian Shore Region in Nova Scotia (Fig. 12) (<http://nsdnr.maps.arcgis.com/apps/MapJournal/index.html?appid=6ef51825248841d682e6842dfc5e13c1>)

GIS staff implemented ArcGIS Enterprise and Portal for ArcGIS this year (<https://dawson.novascotia.ca/portal/>). ArcGIS Enterprise is the foundational software system for the GMB GIS, powering mapping and visualization, analytics, and data management. It is also the backbone for all GMB custom applications.

All the applications are built using Geocortex and have a common look and feel. These applications all use HTML5, which makes them compatible with most browsers on many devices such as PCs, laptops, tablets, and handhelds. To keep current

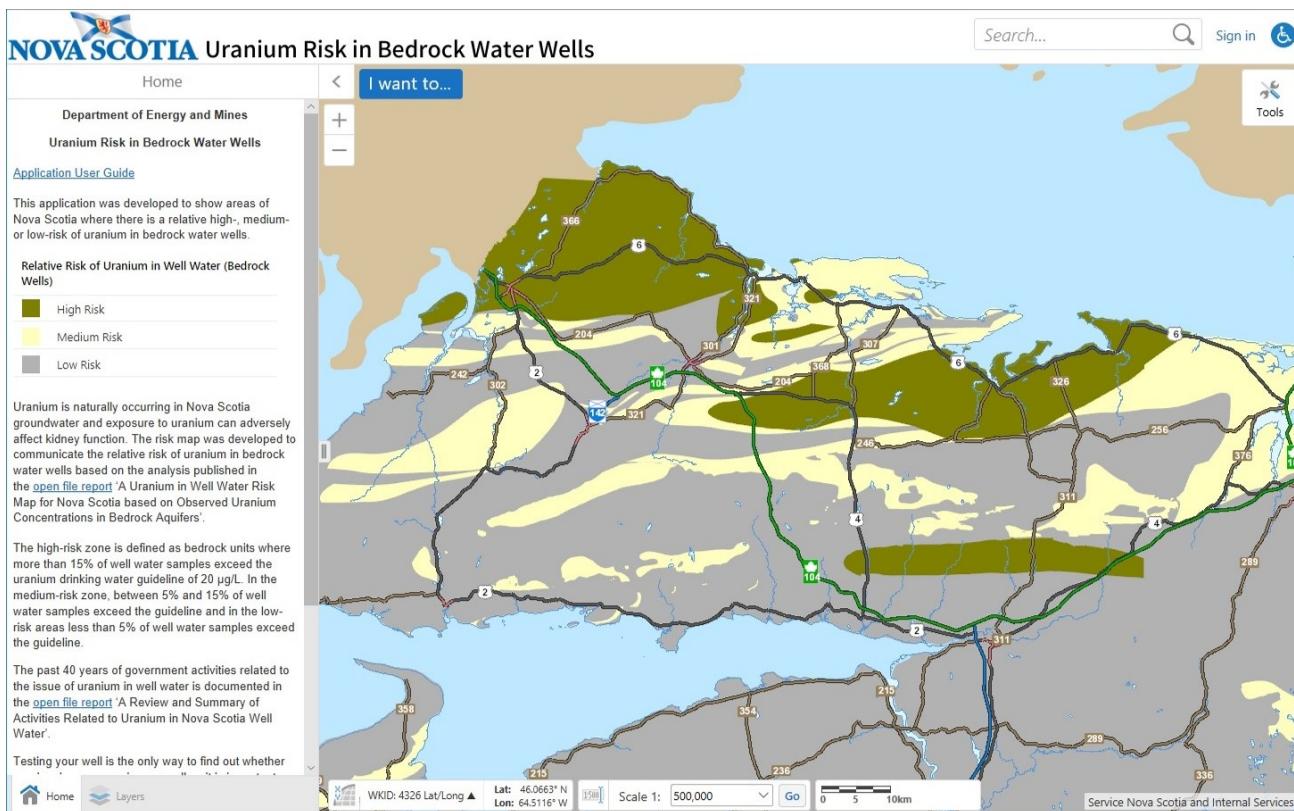


Figure 8. An example of the *Uranium Risk in Bedrock Water Wells* application zoomed into central Nova Scotia. Address searches are possible with this application by typing in an address or postal code in the box in the upper right of the application.

and use the latest technology, Geocortex was upgraded to 4.10 and the HTML5 Viewer to 4.12.

Web Application Usage Statistics

In late November 2019 Google Analytics was added to our web map applications to track our website traffic. Between November 28 and March 31, 2020, 6,856 different users accessed our applications. Almost 94% of those users were from Canada, 4% from the United States, and the remainder from elsewhere in the world. A total of 1,420 users returned to use the applications more than once. Fridays were the busiest days for views.

The *Potential for Radon in Indoor Air* is the most viewed application and the *Geoscience Atlas* the second. The karst, groundwater, and Mineral Resource Land-Use applications complete the top five applications. It should be mentioned that the karst application had a significant boost in popularity on February 28, 2020, when the CBC

ran a story about the sinkhole in Oxford, Nova Scotia, and referenced the application. Without this boost, *Arsenic Risk in Bedrock Water Wells* would be amongst the top five applications rather than the karst application.

Descriptions of Web Map Applications

The *Geoscience Atlas* application (Fig. 4) provides the public with a single geographic compilation of geoscience maps, databases, and images. The application displays a number of different layers from previously released digital products. Mineral occurrences, drillholes, and abandoned mines openings are present along with the provincial bedrock geology map and shaded relief imagery. Mineral rights information is available in the application through a connection to NovaROC and is up-to-the-minute in its currency. We also added private property and Crown land layers to the application in 2016. Layers were updated as required and included the Abandoned Mine

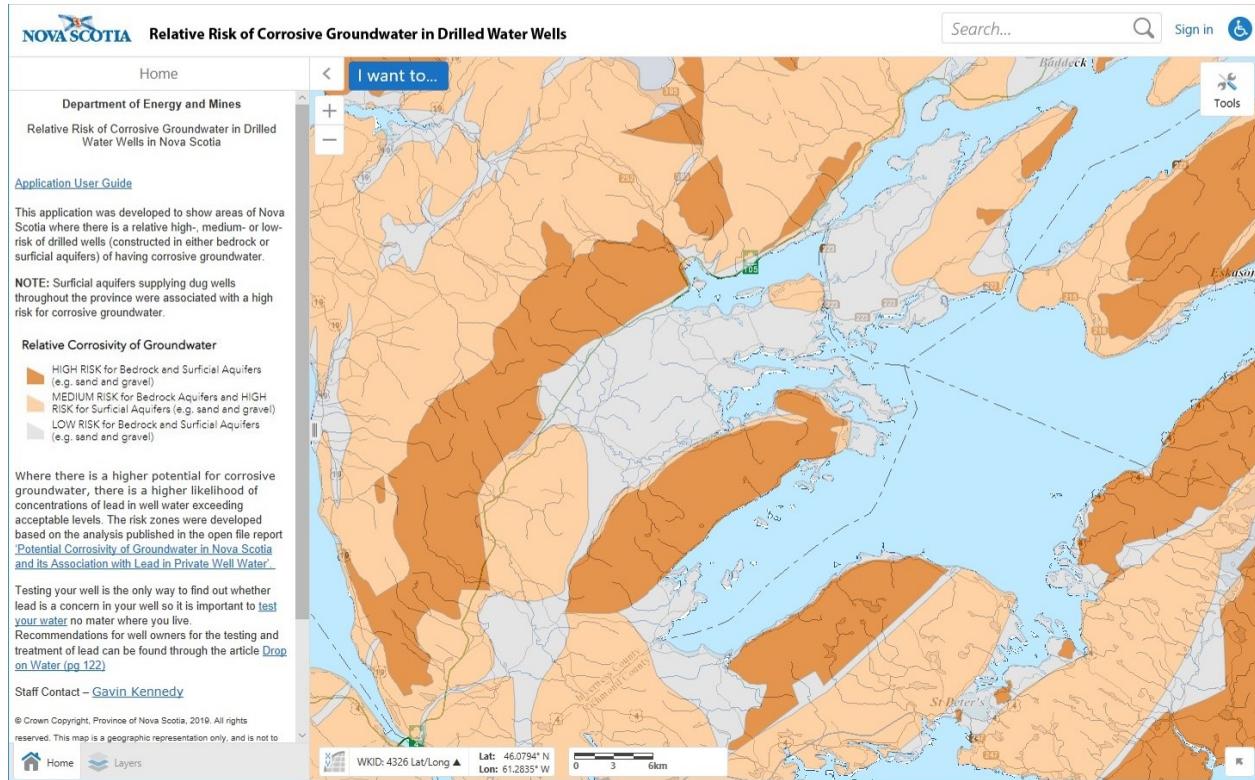


Figure 9. An example of the *Relative Risk of Corrosive Groundwater in Drilled Water Wells* application zoomed into Cape Breton Island.

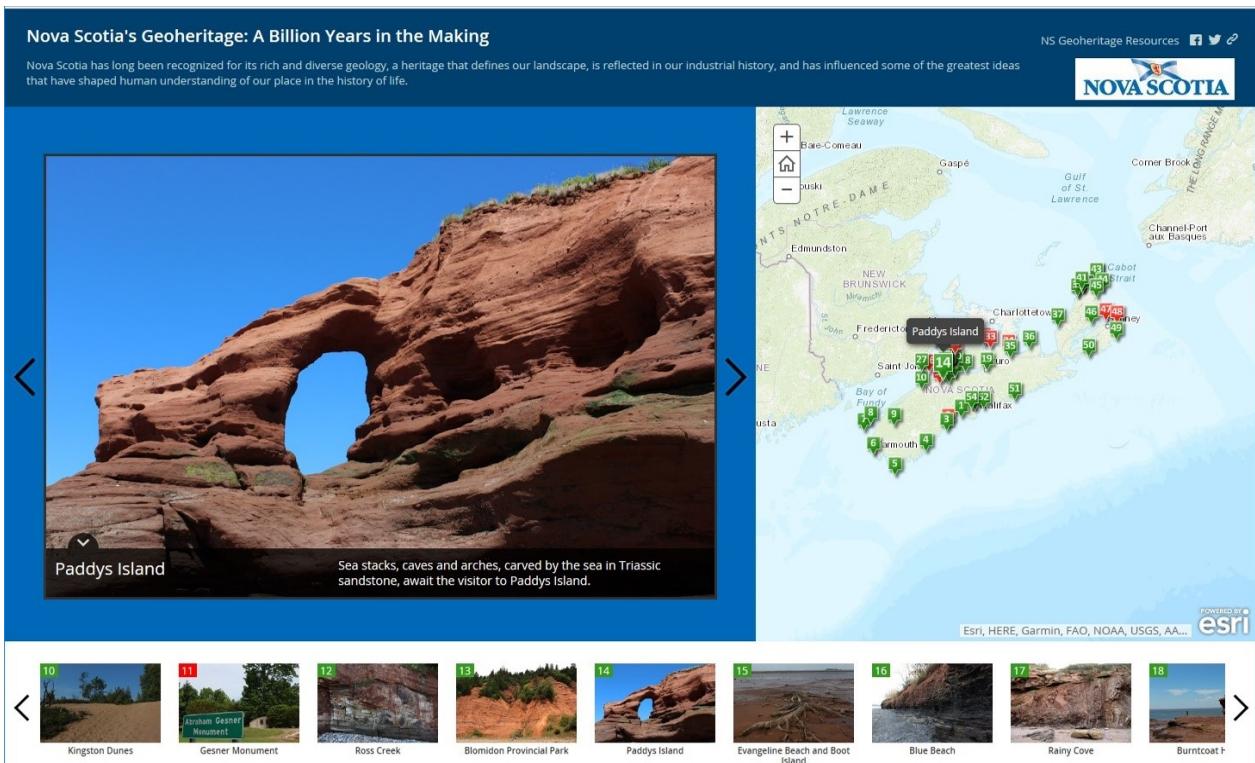


Figure 10. An example of the *Nova Scotia's Geoheritage: A Billion Years in the Making* story map.

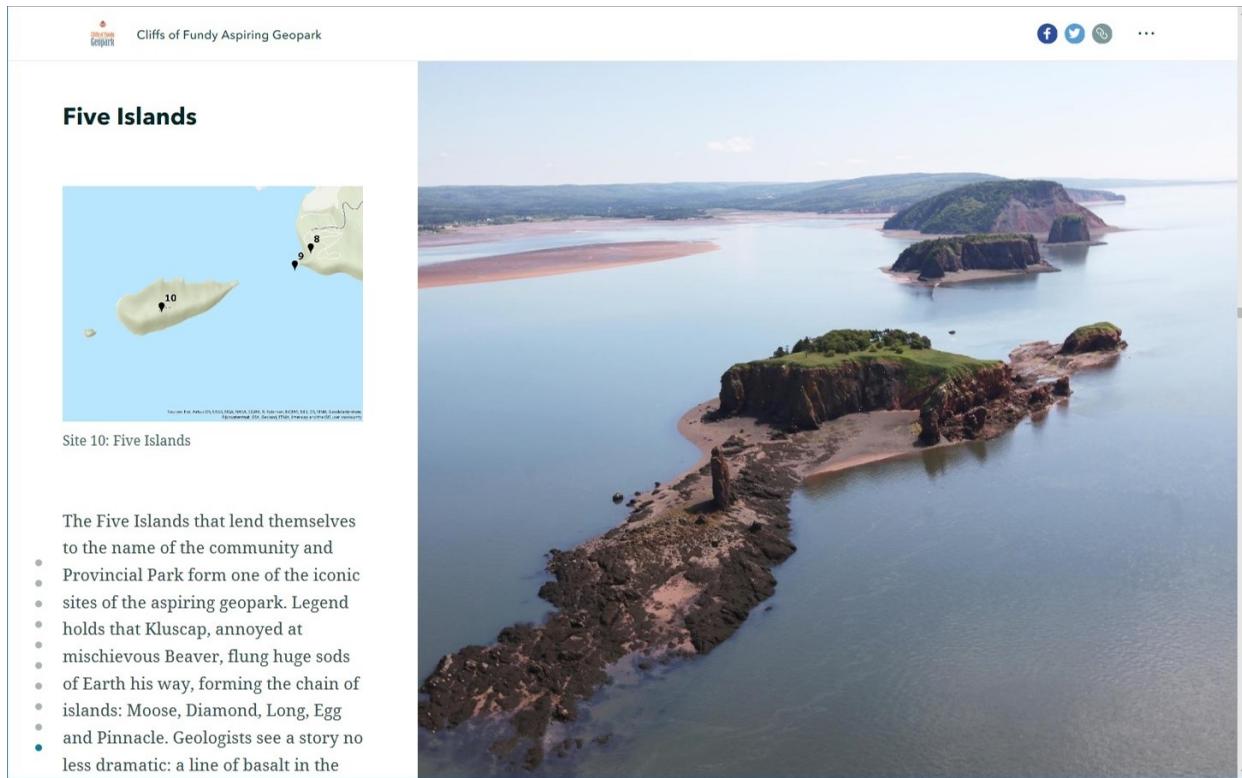


Figure 11. An example of the *Cliffs of Fundy Aspiring Geopark* story map.

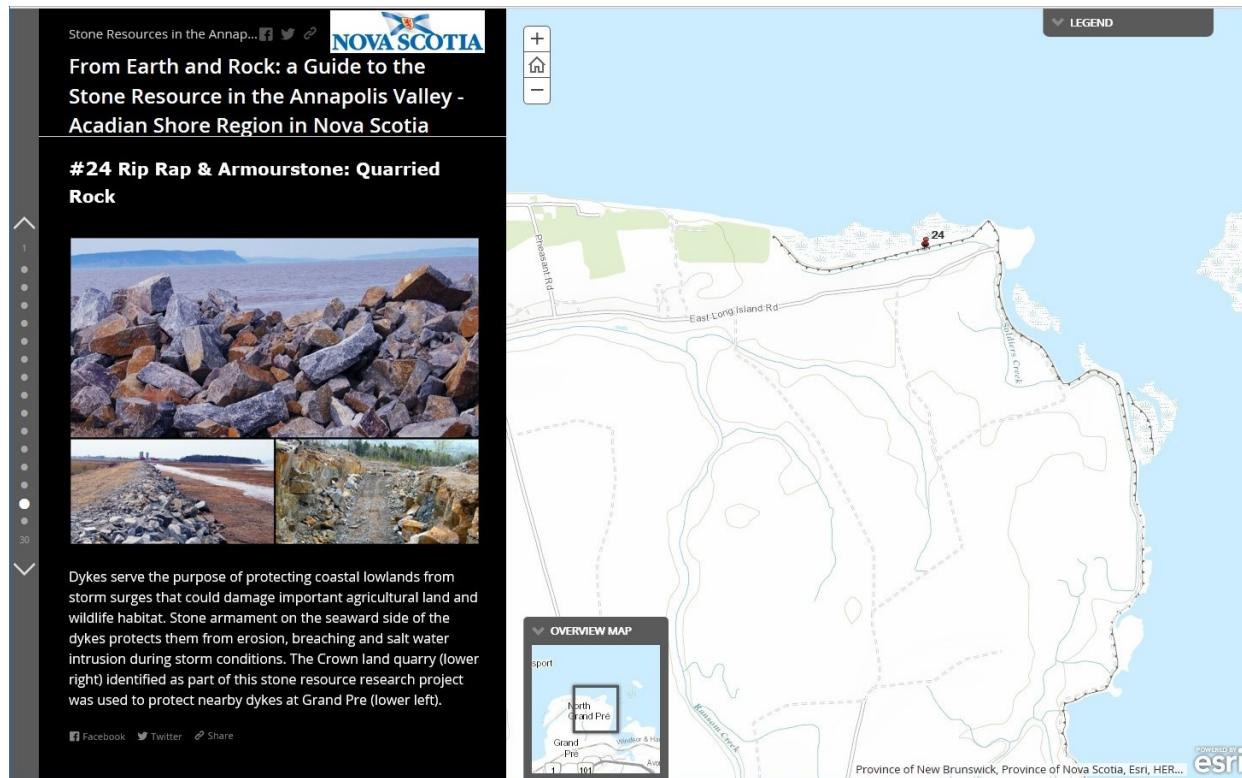


Figure 12. An example of the *From Earth and Rock: A Guide to the Stone Resource in the Annapolis Valley - Acadian Shore Region in Nova Scotia* story map.

Openings layer in July 2017. The URL link to the Geoscience Atlas application is <https://fletcher.novascotia.ca/DNRViewer/?viewer=Geoscience>.

The purpose of the *Groundwater Atlas* application (Fig. 5) is to provide the public with an interactive map application containing layers of spatially referenced maps, databases, grids, and images of interest to hydrogeologists, particularly those interested in the hydrogeological properties associated with the identified groundwater regions. Private property and wetlands layers were added to the application in 2016. There were updates to a number of layers in this application this year. The month and year are indicated at the end of many layer names to indicate their currency. The URL link to the Groundwater Atlas application is <https://fletcher.novascotia.ca/DNRViewer/?viewer=Groundwater>.

The main purpose of the *Mineral Resource Land-Use Atlas* (MRLU) interactive map application is to provide the public with a single geographic compilation of mineral resource and related land-use information at a reasonably detailed scale of 1:50 000. A key objective is to create a useful reference for practitioners working in land-use and environmental planning, geotechnical firms, and groups involved in community economic development. The MRLU displays the location and distribution of mineral and energy resources, activities related to these resources, and aspects of environmental geology that relate to land-use and environmental planning. Special land-use designations on Crown and some privately owned land are shown to indicate how Nova Scotia's land-base varies regarding the ability of mineral resource interests to access land and hold secure tenure. A major update of several protected land layers was made in the fall of 2016. The URL link to the Mineral Resource Land-Use Atlas application is <https://fletcher.novascotia.ca/DNRViewer/?viewer=MRLU>.

The *Potential for Radon in Indoor Air* application (Fig. 6) was developed to show areas in the province where people are more likely to be exposed to hazardous radon in indoor air. This application has an address and postal code search capability to help users find their home on the map. It provides a simple high-, medium-, and low-risk ranking scheme but emphasizes that the only way to know for sure how much radon is in your home is to test for it no matter where you live. The URL

link is <https://fletcher.novascotia.ca/DNRViewer/?viewer=Radon>.

The *Acid Rock Drainage Risk* application for southwest Nova Scotia shows the potential of bedrock to generate acid rock drainage (ARD) if it is physically disturbed or exposed. This map uses a simple high, moderate, and low ranking scheme to inform landowners and planners about the hazards of ARD if they plan to excavate to bedrock in a given area. The URL link is <https://fletcher.novascotia.ca/DNRViewer/?viewer=ARD>.

The *South West Nova Bedrock* application is an interactive map showing the compilation of geological data in southwestern Nova Scotia by Chris White. It shows many map layers including bedrock geological units, geological contacts, age dates, anticlines/synclines, drillholes, dykes, faults, fossils, bedrock geological units, geological contacts, gold districts, mines, mineral occurrences, outcrops, quarries, shafts, stockworks, structural data, and shear zones. The URL link is <https://fletcher.novascotia.ca/DNRViewer/?viewer=SouthWestNova>.

The *Arsenic Risk in Bedrock Water Wells* application was developed to show areas of Nova Scotia where there is a relative high, medium, or low risk of arsenic in bedrock water wells. It is emphasized that testing your well is the only way to find out whether arsenic is a concern in your well no matter where you live. The URL link is https://fletcher.novascotia.ca/DNRViewer/?viewer=As_Risk_Wells.

The *Potential Impact of Drought to Private Wells* application was developed to show areas of Nova Scotia where private-well owners are more likely to experience water shortages (especially owners of shallow wells) if drought conditions develop in the summer and fall of a given year. The application presents a new map every month in the summer and early fall and currently maintains an archive of past maps for the summer and fall of 2016, 2017, 2018, and 2019. The URL link is <https://fletcher.novascotia.ca/DNRViewer/?viewer=DroughtIndex>.

The *Karst Risk Map* application (Fig. 7) was developed late last year to show areas of Nova Scotia where there is a relative high, medium, or low risk of encountering karst and naturally occurring sinkholes caused by soluble bedrock.

The URL link is <https://fletcher.novascotia.ca/DNRViewer/?viewer=Karst>.

The *Uranium Risk in Bedrock Water Wells* application (Fig. 8) was developed this year to show areas of Nova Scotia where there is a relative high, medium or low risk of uranium in bedrock water wells. Testing your well is the only way to find out whether uranium is a concern in your well so it is important to test your water no matter where you live. The URL link is https://fletcher.novascotia.ca/DNRViewer/index.html?viewer=Uranium_Risk.

The *Relative Risk of Corrosive Groundwater in Drilled Water Wells* application (Fig. 9) was developed this year to show areas of Nova Scotia where there is a relative high, medium or low risk of drilled wells. (constructed in either bedrock or surficial aquifers) of having corrosive groundwater. Testing your well is the only way to find out whether lead is a concern in your well so it is important to test your water no matter where you live. The URL link is https://fletcher.novascotia.ca/DNRViewer/index.html?viewer=Drilled_Corrosive_Groundwater_NS.Relative_Corrosivity_of_Groundwater_in_Drilled_Water_Wells.

NovaScan

NovaScan is the geoscience publications and maps database on Nova Scotia and its offshore regions. As of April 1, 2020, the database contained 18,110 records, consisting of 9,048 mineral exploration assessment and property reports, 4067 publications, 1,452 open file reports, 2,133 maps and illustrations, 867 theses, 282 contribution series, 218 digital products, and 35 outside publications.

In order to provide better service to our staff and clients, the Branch maintains a public search application that allows the public to query records in the NovaScan database using an Internet browser. NovaScan can be searched by title, author/organization, subject, area, map sheet (NTS), map type, licence type, licence number, document type, document number, year, and map scale. NovaScan is updated monthly as new mineral exploration assessment reports, geoscience maps, publications, open files and theses become available. The search interface can be accessed at <https://gesner.novascotia.ca/novascan/DocumentQuery.faces>.

Products Released in 2019-2020

The following digital products and maps were released in 2019-2020. All digital products and maps can be downloaded for free from the URL listed with the product.

Digital Products

Digital Product ME 443, Version 1, 2019. Digital Geological Data Generated as Part of Geological Mapping of the Central Annapolis Valley Area, Nova Scotia. by C.E. White, J.C. Poole, A.L. Barras and J.S. McKinnon. Available in SHP and GDB formats from the Geoscience and Mines Branch web site: <https://novascotia.ca/natr/meb/download/dp443.asp>.

Digital Product ME 491, Version 1, 2019. Digital geological data generated as part of geological mapping of the Parrsboro Shore, Black Rock to Moose River, Cumberland County, Nova Scotia. by J.H. Calder, J.W.F. Waldron, R.D. Naylor, K.D. Adams, T.J. Fedak, E. George, T.G. MacHattie, A.L. Barras and C.C. MacMullen. Available in SHP and GDB formats from the Geoscience and Mines Branch web site: <https://novascotia.ca/natr/meb/download/dp491.asp>.

Open File Maps

Open File Map ME 2019-002. Manganese in Groundwater from Bedrock Aquifers in Nova Scotia, by G. W. Kennedy, Scale 1:500 000. Available as a free PDF download from the Geoscience and Mines Branch website: https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-002.asp.

Open File Map ME 2019-003. Erratum: Manganese in groundwater from bedrock aquifers in Nova Scotia (Open File Map ME 2019-002), by G. W. Kennedy. Available as a free PDF download from the Geoscience and Mines Branch website: https://novascotia.ca/natr/meb/data/mg/ofm/pdf/ofm_2019-003_er.pdf.

Open File Map ME 2019-004. Strontium in groundwater from bedrock aquifers in Nova Scotia, by G. W. Kennedy, Scale 1:500 000. Available as a free PDF download from the Geoscience and Mines Branch website: https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-004.asp.

[novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-004.asp.](https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-004.asp)

Open File Map ME 2019-005. Mineral Resources Development Fund approved grants: 2019-2020. - rev. September 2019, by J. C. Bonaparte, Scale 1:2 000 000. Available as a free PDF download from the Geoscience and Mines Branch website: [https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-005.asp.](https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-005.asp)

Open File Map ME 2019-006. Bedrock geology map of the central Annapolis Valley area, Nova Scotia, by C. E. White, Scale 1:50 000. Available as a free PDF download from the Geoscience and Mines Branch website: [https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-006.asp.](https://novascotia.ca/natr/meb/download/mg/ofm/htm/ofm_2019-006.asp)