GeoConvention 2015
GEOSCIENCE
new horizons
Telus Convention Centre • 4-8 May 2015 • Calgary, AB Canada

Annual Water Use Reporting in Alberta

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Summary

This poster outlines the advantages of storing the data required for preparing annual water use reports, required under the Water Act, in a database structure that is capable of capturing quality assurance information and can support a variety of water supply needs . This content will be primarily focussed on streamlining workflows, standardizing final products and using software and databases to create a variety of consistent deliverables that are easily generated by most users. Additional comments will speak to the value and challenges of utilizing databases to house large volumes of data.

Introduction

In Alberta, protection of provincial water resources is governed by the Water Act. An industrial user of Alberta's water resources must apply for a license before the water can be used. If the license is approved, the user is subsequently required to prepare a summary of the diversion volumes and well performance at regular intervals defined by the license. The licensee is typically required to maintain a monitoring network and report on transient groundwater presssures in this network as well.

Historically, reporting on the water usage has been an exercise of compiling data, aggregating and cleaning data and presenting data. These methods varied in efficiency, repaeatability and ease of reproduction but most licensees rely on file based storage of hydraulic head and water use data.

Starting in the reporting year of 2013, several Annual water Use Reports were prepared in a more uniform way, using preformatted templates and leveraging our in-house Structured Query Language (SQL) database Server, Physical Hydrogeology Database (PHD). Taking the complexity of generating standard figures and tables out of the hydrogeologists hands gives them more time to analyze the data, which is their primary domain of expertise. The proximate advantage of the automated generation of figures and tables is increased efficiency in the generation of the report. The ultimate advantage of the automated generation is that staff are required to apply quality assurance to the entire time series dataset; this means that insight into the data that is gained during the Annual Water Use Reporting, is ensured to be preserved on a high-frequency 'single version of the truth'. This work flow avoids the common pitfall of having multiple spreadsheet or text based files with different frequencies of measured data and different levels of quality assurance stored in many different locations.

Method

Data for annual Water Use Reports (often compiled by the operator) are usually acquired early in January, following the year to be reported on. These data are sometimes collected throughout the year by Matrix. These data are received from a variety of sources and typically measured in varying units and recorded using various frequencies. In some cases recording frequencies can be as high as 1

measurement per minute resulting in more than 500,000 measurements for the year. When received, the raw data are loaded into PHD which is hosted on our corporate SQL Server database. Following the database uploading process, the data are archived and the original files and consider them to be a "snapshot" of the data. In order to reduce data accuracy conflicts, the database is considered to be the most accurate, current understanding of the data. With this paradigm, we can easily re-extract the data as needed and this can be used in various software packages or it can be sent to the client in a pre-agreed format for rapid import into their in-house database.

Custom queries were created in Microsoft™'s SQL Server Management Studio to extract the appropriate data for producing Water Use Reports including pumping rates, water levels, estimated static water level and the elevation of the top of aquifer. A key functionality of the database is a conversion process which allows a user to upload a variety of typical water level measurements (e.g. manual water level tape measurements and pressures recorded by a downhole instrument) and have them automatically converted to a uniform unit, typically an equivalent freshwater hydraulic head. Having this conversion in place facilitates display of the data in an easily understood unit that is immediately comparable across different sites and locations. This structure ensures a rapid correction of the hydraulic head data when new or improved information becomes available such as a revised well elevation survey.

These SQL queries were then moved into SQL Server Reporting Services. This software package has tools for building interfaces and reports to user's specifications. Through creative connections between SQL queries and the built interface, it became possible to generate figures in a short number of mouse clicks. Users are simply required to select the project name, geological unit and some other defining attributes and then the chart and associated metadata is populated on an easily exportable figure. In some cases, numerous figures could be generated following the initial selection of appropriate source well locations.

Additional queries were linked to make generating tables and apply automated quality control. Hyperlinks were added to execute queries that summarized water usage above thresholds and water levels summarized by day for each particular well.

An added benefit to this process is that once the data are loaded into the Physical Hydrogeology Database, these data become available for any future work including generating regional groundwater flow maps, developing conceptual or numerical models of groundwater flow, and analytical evaluation of the data in commercially available pumping test software..

Conclusions

Creating a more efficient method to produce the charts for Annual Groundwater Use Reports has proved to be a positive move for Matrix's clients. Through the use of databases we have moved beyond the typical spreadsheet approach to collect and house our data in a central database. Storing raw data and having a unit conversion processes in place gives us the flexibility to easily work with the data in many different software packages. Through this initiative, we have become more efficient in preparing the figures and tables for Water Use Reports, improving the data quality and reconciling data differences between our data and the client's data.