

Introducing CulvertFinder

Who: Strategic Systems Engineering Inc. is a specialized Environmental and Water Resources Engineering company in Winnipeg, Manitoba, Canada. We are committed to utilizing state of the art technology to help you get ahead of, and ultimately benefit from your local jurisdictional challenges - from climate-driven natural disasters, population changes and aging infrastructure.

What: CulvertFinder is a unique geospatial software tool developed internally by SSE that utilizes LiDAR derived hi-resolution digital elevation model data, along with detailed road network line data, in order to estimate the most likely real-world locations that a culvert would be present. Inspired by the needs of municipal and watershed districts, as well as our own water resources engineering staff, CulvertFinder's purpose is to set up a more accurate understanding for how water ultimately behaves in their jurisdictions – especially where field surveys or culvert inventory data are absent, through this AI and data-driven prediction.



The core issue is that elevation data at the outset usually does not capture the true paths that water will travel near control structures such as bridges and culverts, as the acquisition process will only show the tops of these since it is surveyed from overhead. Water flow as a result will not be accurate, since the roadways (or other features) will act as a wall, preventing its movement downstream. The elevation model data needs to be 'burned in' at these locations, which are not always known. In the absence of a inventory locating these structures, CulvertFinder fills the gap by providing a watershed level estimate of these culverts.

Using a suite of pathfinding algorithms and network analysis techniques, CulvertFinder works through each dataset to simulate water flow across ditch gradients as well as the general landscape and when done, places culvert line results that represent the rough location of possible real life culverts in an easy to use digital format compatible with Geographic Information System (GIS) software packages.

CulvertFinder data can then be used in a wide range of projects, ranging from hydrologic simulations to asset management initiatives.

Understanding how water interacts with the landscape is key to understanding a number jurisdictional issues, such as flood (and drought) risk CulvertFinder is inspired by the needs of municipal district managers for a reliable method of estimating the connectivity of flow networks in their regions



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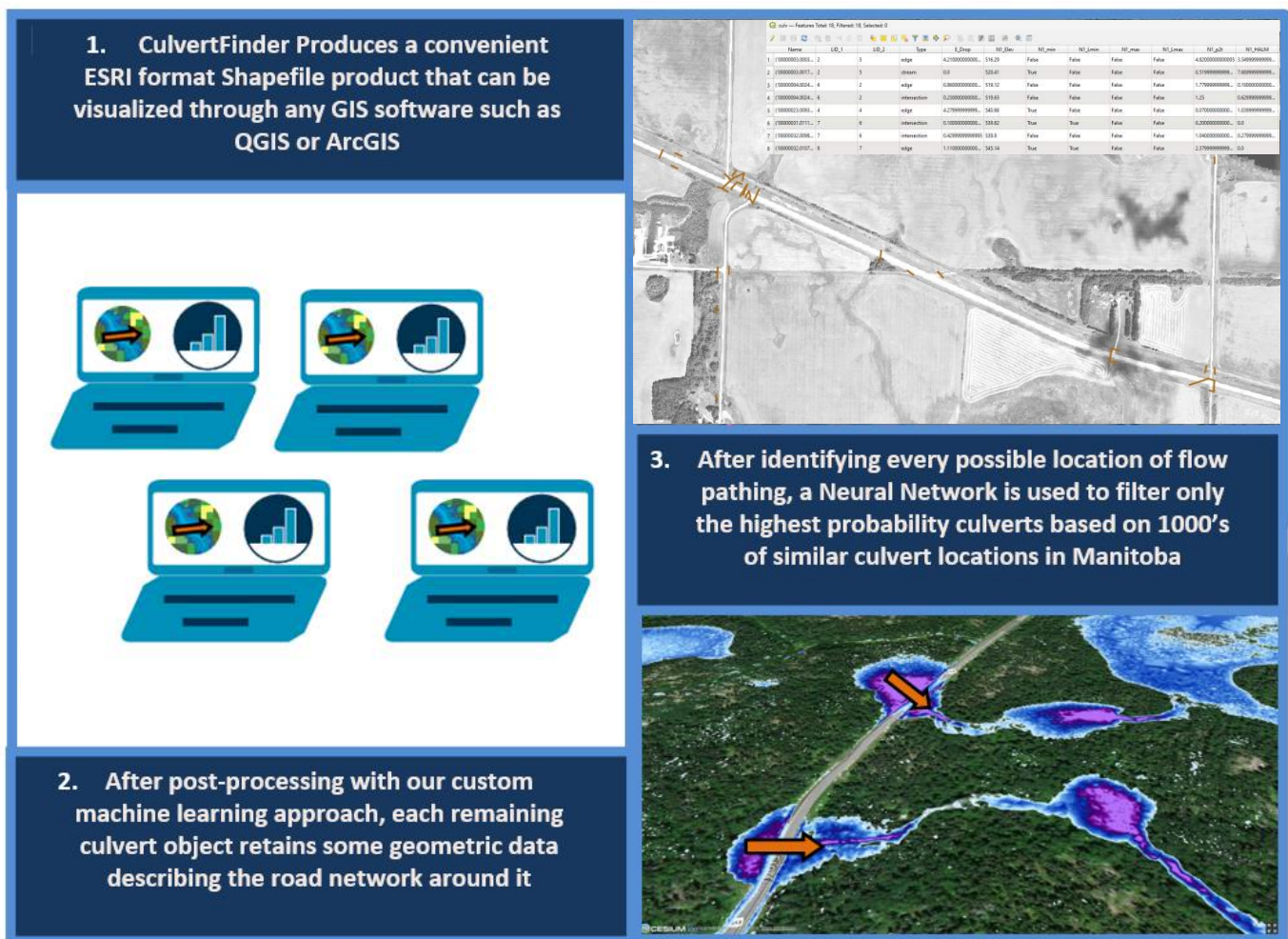
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Where: CulvertFinder can be used to assess any area for which both digital elevation model and road network line data are available. This means that it can be used to track and assess a wide variety of bridge and culvert features across most of southern Manitoba, along with many agricultural areas across Canada.

Why: Ditch networks and their culverts are important municipal assets, that when accurately mapped out, will allow for the best available insight into showing how water flows and interacts with the landscape and its associated infrastructure. This sets the stage for incorporating these risks and opportunities into maintenance and growth planning for jurisdictions when it comes to water resource management objectives, and adaptation to climate-change.

How it works



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CulvertFinder uses two different types of geospatial data as inputs – digital elevation model (DEM) data, alongside road network data. These are of different types, where the former is a gridded .tif image made of georeferenced pixels, and the latter is a network of digital line features within what is called a shapefile.

The LiDAR-derived DEM contains the elevation of each pixel in the entire gridded image, where most modern data is fine enough to be 1m by 1m in the real world.

The road network data might contain auxiliary attributes within it, but CulvertFinder is most interested in how the lines intersect and otherwise connect with each other.

Both are common data formats, that are recognized by virtually any GIS software. Both can be found online for free through the Manitoba Government's *Manitoba Land Initiative* portal at <https://mli.gov.mb.ca>

CulvertFinder first takes a look at the relationship between each road segment and cross references it with junctions to identify road intersections, and where driveway and bridge intersections may be – within each section of rural land. Then, attaching the DEM data onto each segment, analyzes the surrounding terrain to derive areas of notable slope and channelized depressions. Using a network analysis process called 'graphing', CulvertFinder then selects locations on the road network that are in these localized depressed areas that are characteristic of areas that experience channel flow of water either ephemerally or throughout the year.

CulvertFinder tracks certain statistics such as slope, distances and network connectivity, and outputs the result into a shapefile. Using GIS software, the results can be looked at further, in order to scrutinize them and/or to do further work.

CulvertFinder results are a direct prerequisite to our in-house automated hydro-conditioning, as a basis for our water resource planning and engineering offerings.

Contact us to find out how we can help you with your culvert identification and other water resource management issues today!



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