SEEP

SOLAR ENERGY ESTIMATIONS & PROJECTIONS

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PROJECT UPDATE

July 11, 2016

10 Pages

Summary

This document was prepared as an update for the Solar Energy Estimations & Projections project, produced in the SAIT Polytechnic class Applied GIS Capstone Project. The following sections show an overview of the current progress of the project – from its completed data acquisition & management, to progress on the analyses and final deliverables.

Contents

1 Introduction & Project Problem Statement

This project seeks to create an approachable and interactive map that reveals its users' solar energy potential – with solar energy estimates and projections. To this end-goal, tremendous progress has been made, and will be discussed in the following, concise methodology sections: Data Acquisition (2.1), Management (2.2), Analysis (2.3), and Output (2.4). For your information, a Team Summary has also been included in the following sub-section (1.1).

1.1 Team Summary

Nick B – Project Manager

Responsible for organizing and assigning tasks to be completed by team members in a timely basis – ensuring timelines are met. Nick has previous experience in project logistics and management in the mining industry, and has helped to plan and run several drilling projects; all completed successfully and on time and budget.

David Bouchard – Technical Lead

Responsible for ensuring technical aspects of the projects are defined and completed on time. David has previous experience in a variety of technical and scientific roles, including as a lead programmer and dataset control for aviation manufacturing. His strong multidisciplinary and technical background makes him a strong Technical Lead for any project.

Josh L – Project Administrator

Responsible for administrative project tasks, such as technical writing, metadata management, and task scheduling. Josh has a background in Geography, customer service, and technical writing, making him a strong team candidate for maintaining the project's data, communication, and supporting documentation.

2 Methodology

2.1 Data Acquisition

The bulk of the project's data was acquired from the Calgary Region Open Data website (Calgary Regional Partnership, 2016). The City of Airdrie has provided their LIDAR data as LAS files, originally acquired by AltaLIS. Furthermore, the City of Airdrie has their Census information available online, which will be used for power consumption estimates, as needed, by neighbourhood (City of Airdrie, 2016). Power consumption data, if census information is used, uses data from Statistics Canada publications: Households and the Environment: Energy Use (Statistics Canada, 2015). The following figures show examples of the LIDAR data acquired.

Figure 1 - Example of LIDAR Point Cloud from the City of Airdrie's LAS files. Part of the Woodside Neighbourhood is shown here.

2.2 Data Management

Data is managed in a cloud-based scalable data structure, backed up in dataset versions for security and version histories. Currently stored on a shared Google Drive between team members, and is also stored on the SAIT BGIS servers. Regular group reviews ensure data quality and documentation is maintained. The following figure shows a snapshot of the project's data structure.
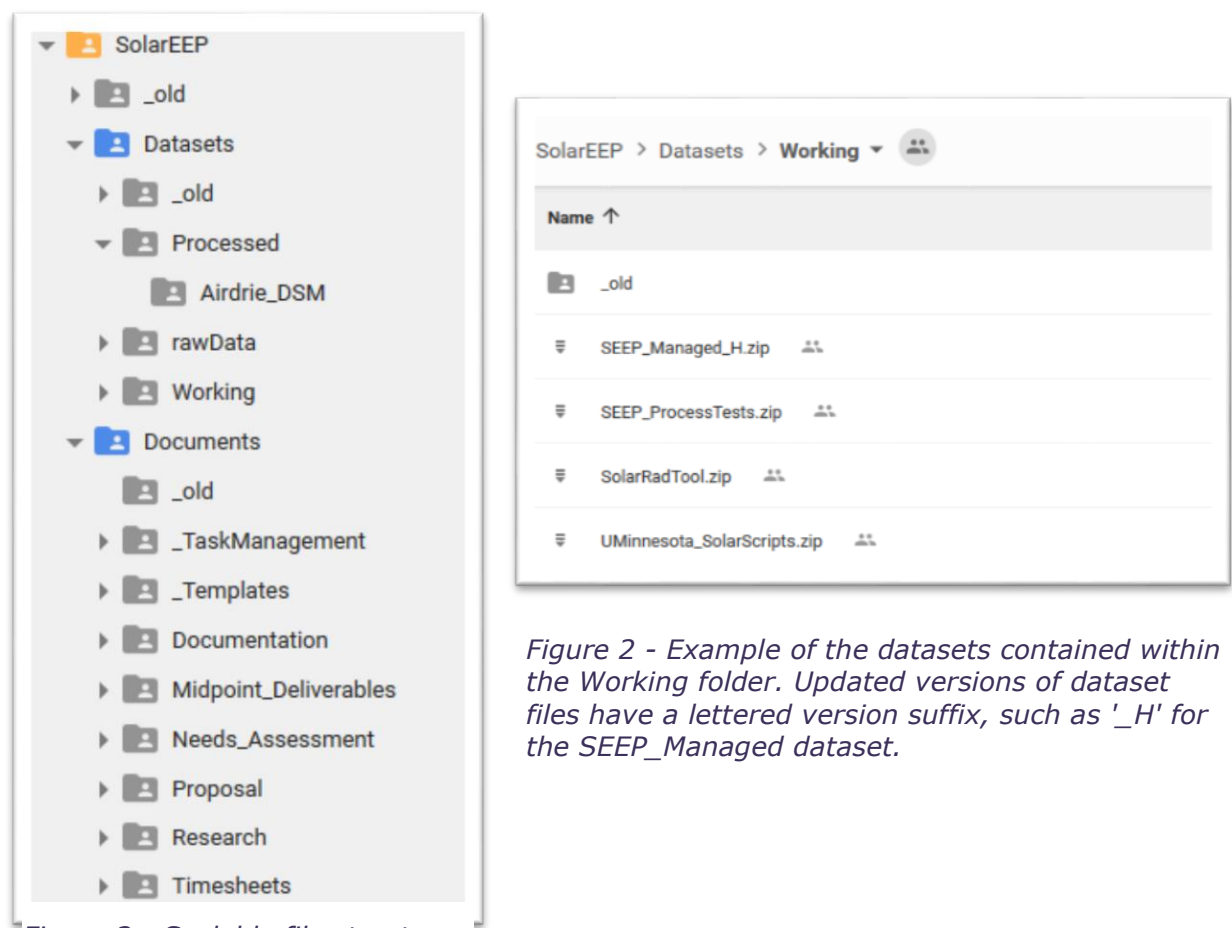

Figure 2 - Example of the datasets contained within the Working folder. Updated versions of dataset files have a lettered version suffix, such as '_H' for the SEEP_Managed dataset.

Figure 3 - Scalable file structure in the shared Google Drive.

2.3 Data Analysis

Data analysis for this project is done in steps: creation of a digital surface model (DSM), producing solar radiation points, and finally, creation of building footprint features with solar energy estimates included as attributes. Currently, our tools are able to produce all steps reliably, yet more work is needed to refine the attributes produced by the tools. The following figures show examples of the models used, and their outputs.

DSM Creation

Digital surface models are produced from the LAS files using the following three models.
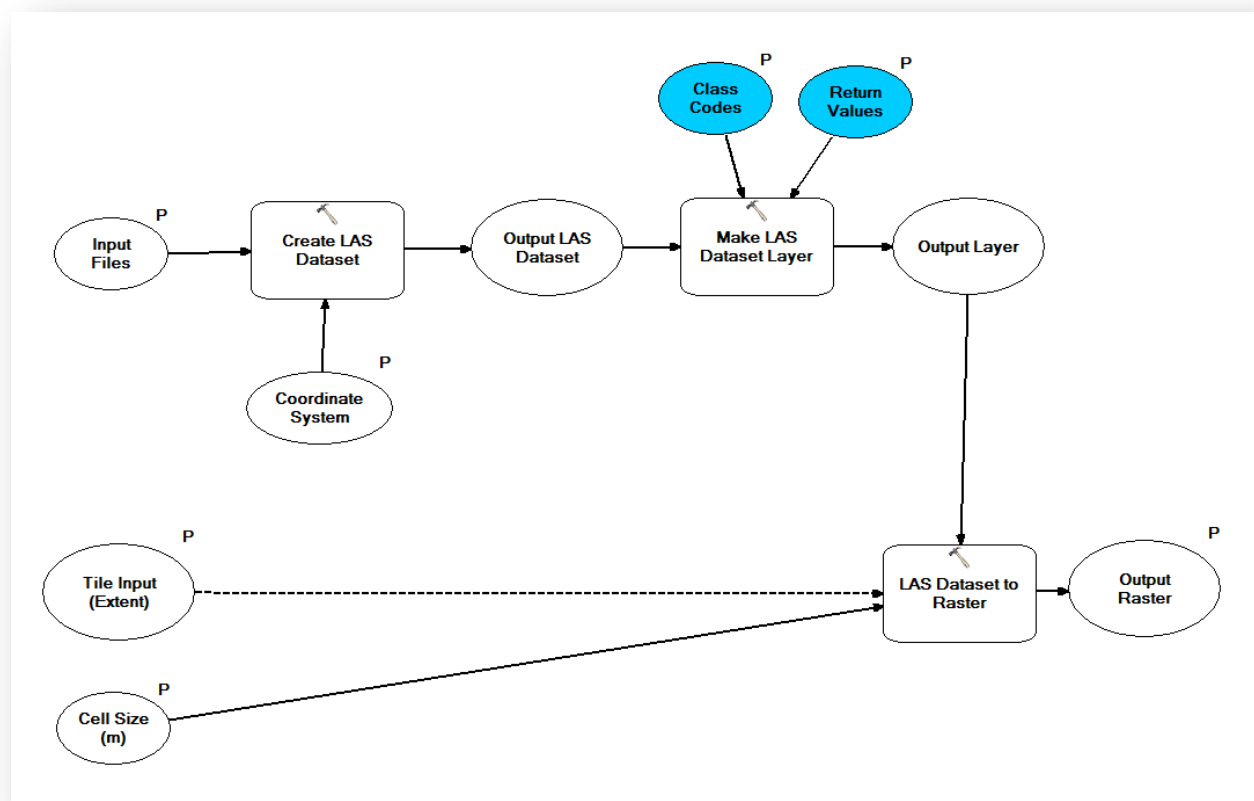
Figure 4 - DSM Creator Tool - Processes a single LAS tile into an output DSM raster file
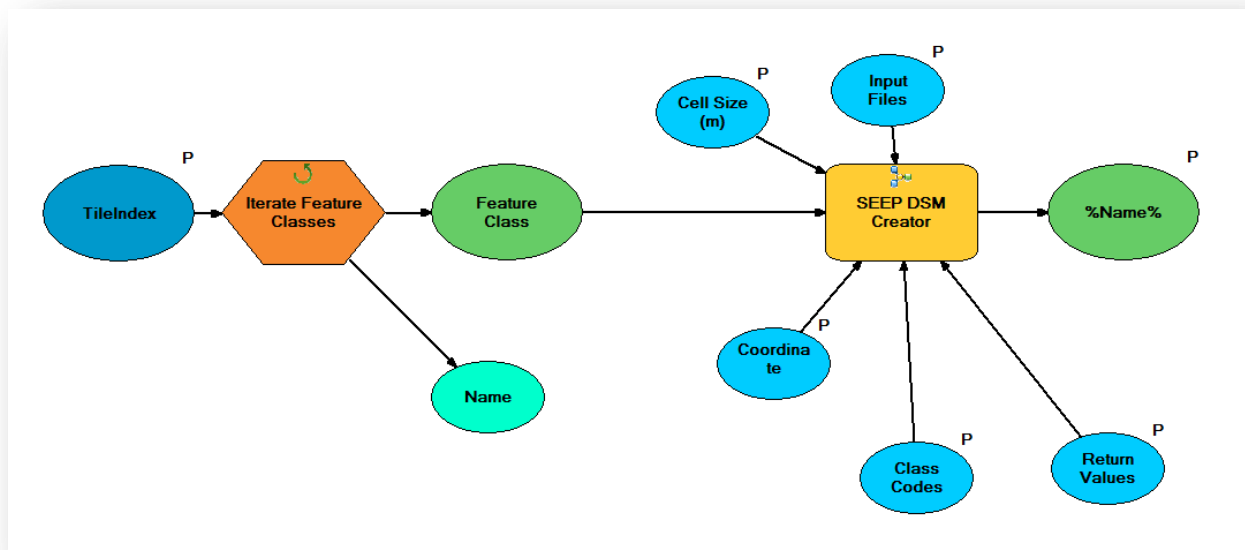
Figure 5 - Batch DSM Creator - this tool calls the previous DSM Creator tool numerous times, based on the wanted tiles in the TileIndex
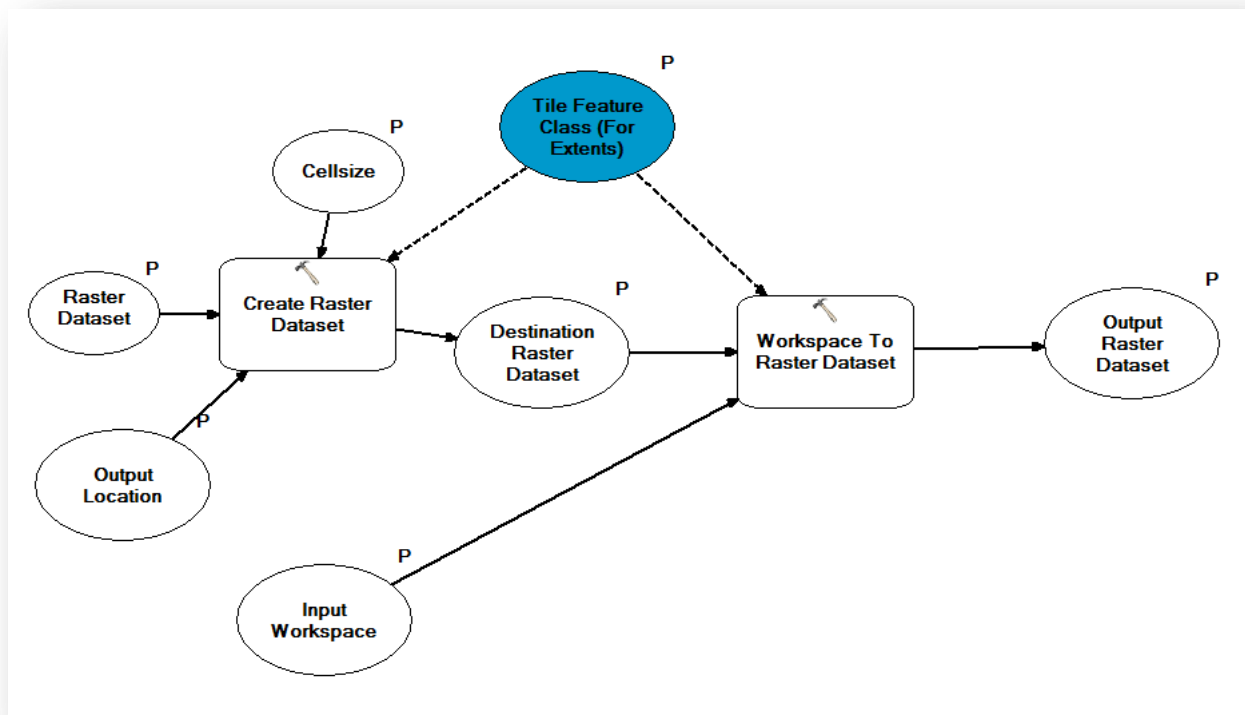

Figure 6 - The output DSM tiles from the previous tools are then merged into a large DSM raster file using this tool.
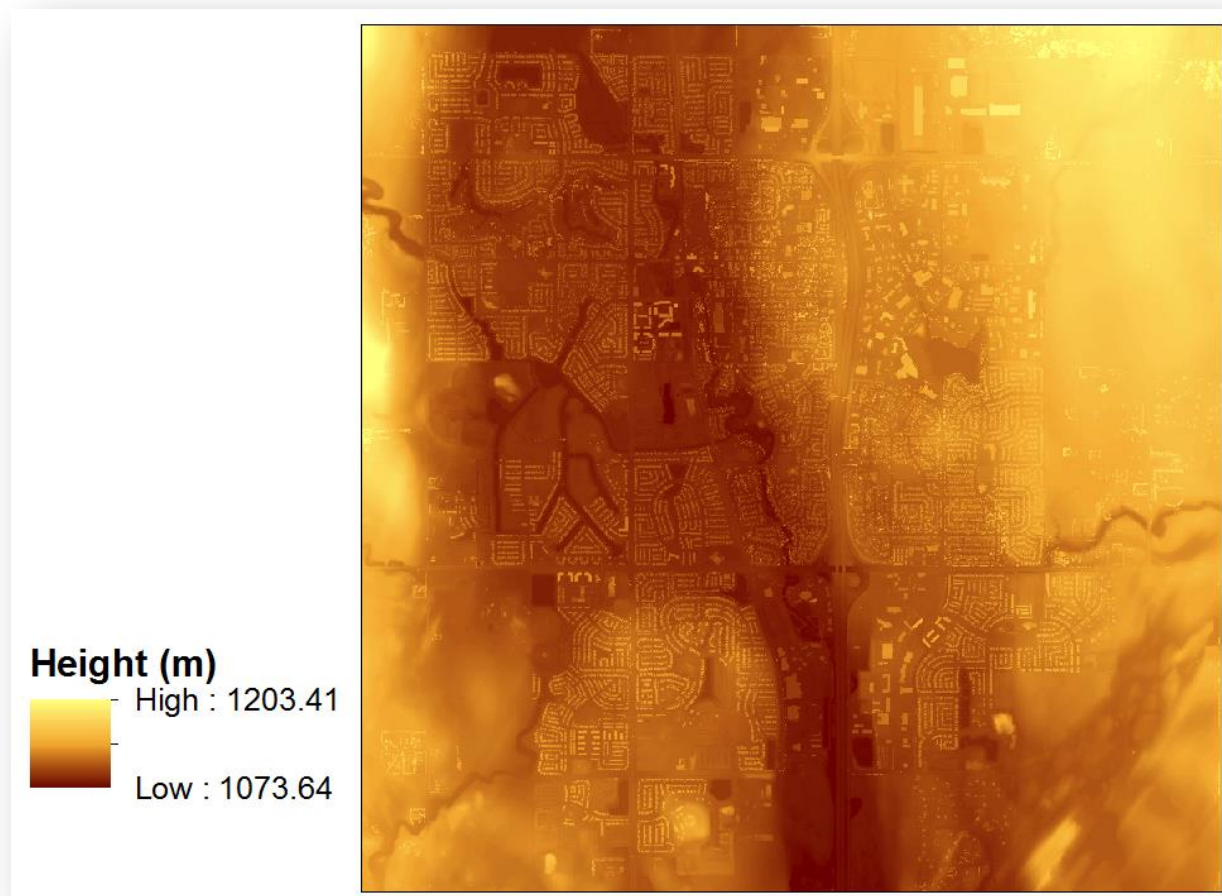
Figure 7 - Full DSM of developed areas of the City of Airdrie, produced with SEEP DSM tools.

Solar Radiation Points

Solar radiation points are produced based on the DSM created, the building footprints and their addresses (from the Calgary Region Open Data site).
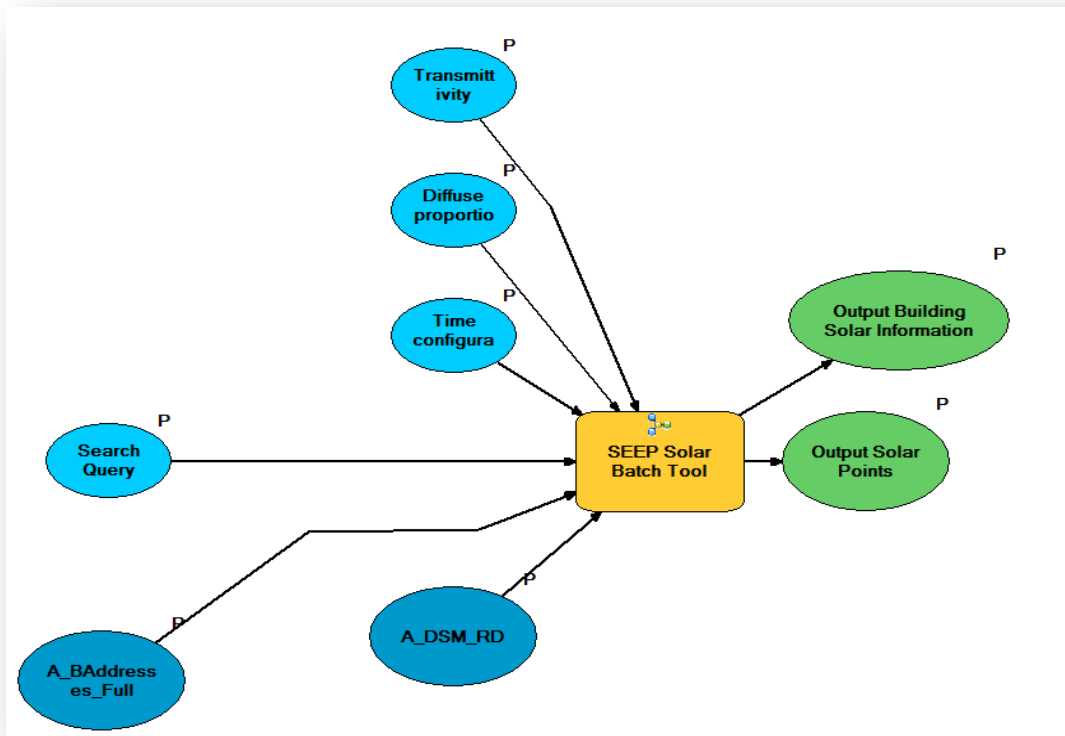

Figure 8 - The SEEP Solar Main tool; this tool uses many sub-models to batch the process of acquiring the rooftop solar radiation by location, based on the input query. Processing is underway for all 40,000+ buildings in the City – processed by neighbourhood. Uses ArcGIS's Point Solar Radiation tool.
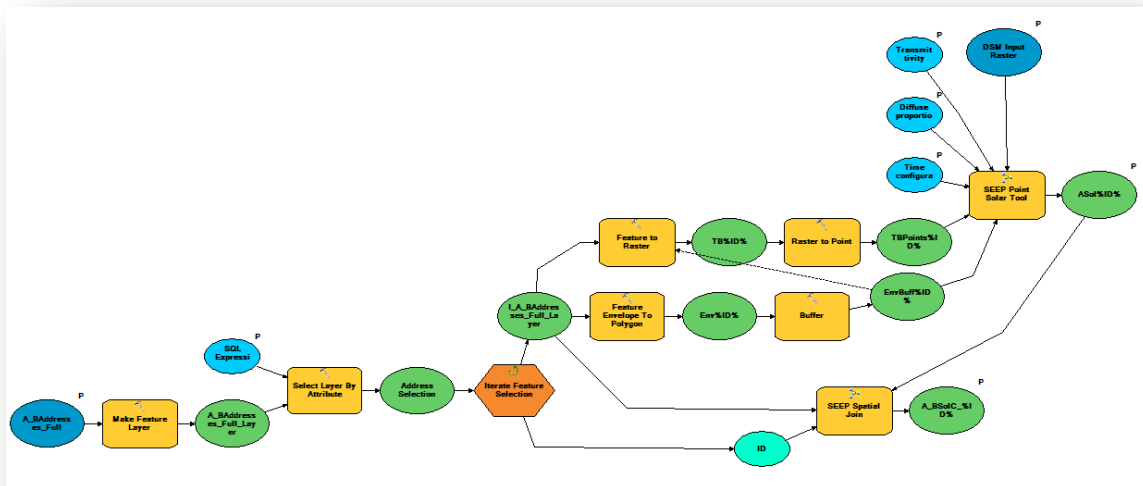
Figure 9 - The Solar Batch Tool; limits the extent around a building, then calculates Point Solar Radiation based on the building footprint. This Batch tool will run for every feature returned in the Search Query from the previous tool.
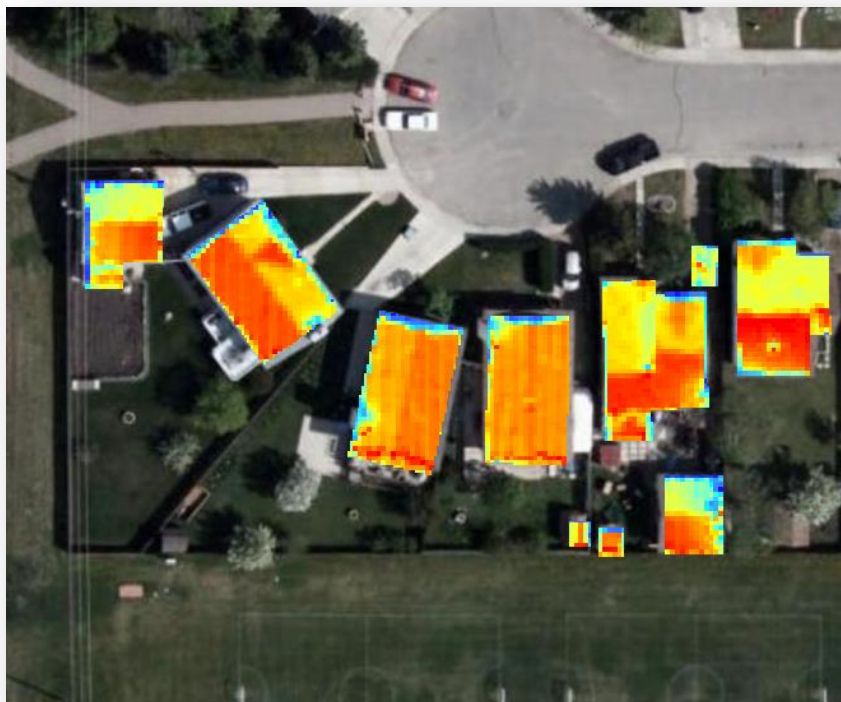

Figure 10 - An example of the rasterized outputs from the above tools; darker reds have more solar radiation in a year than the dark blue areas. Raster was overlayed on Esri Imagery.
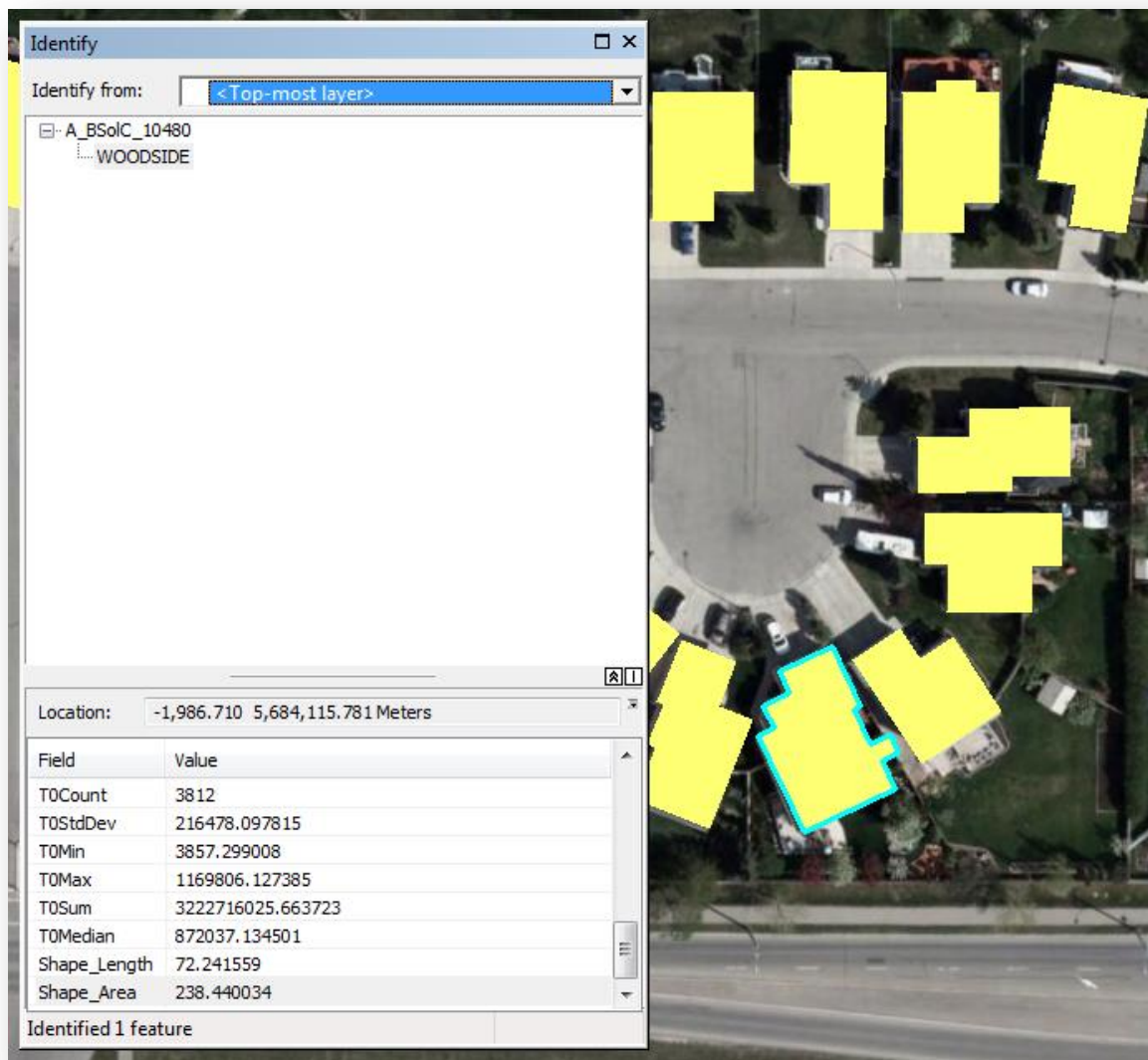
Figure 11 - The output from the main solar tool produces these 'T0' attributes, which are the solar radiation values for the year, in Watt-hours per square meter.

2.4 Data Output

The web application is the main output for the project, and ArcGIS Online and their Web App builder will be used to create it. The next figure shows our current (limited) progress on this portion of the project; but with the data acquisition, management, and analysis portions of the project mostly completed, the remainder of our focus is on this portion of the project.
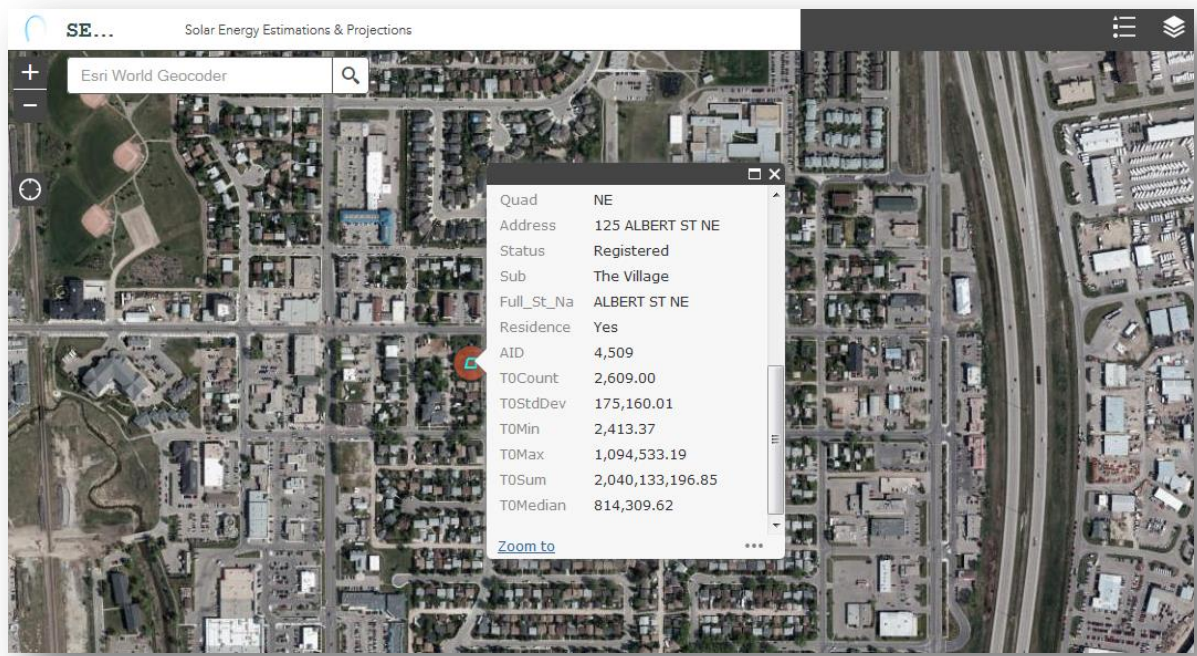

Figure 12 - An early sample of the SEEP web application - produced in ArcGIS Online with Web App Builder, and the data used was created using the Main Solar Tool.

3 References

Calgary Regional Parternship. (2016). Calgary Region Open Data. Retrieved from:

http://www.calgaryregionopendata.ca/ on July 11, 2016.

City of Airdrie. (2016). City of Airdrie – Census. Retrieved from:

http://www.airdrie.ca/index.cfm?serviceID=245 on July 11, 2016.

Statistics Canada. (2015). Households and the Environment: Energy Use: Tables. Retrieved

from: http://www.statcan.gc.ca/pub/11-526-s/2013002/tablesectlist-

listetableauxsect-eng.htm on July 11, 2016.