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### 1. Open Air Burning Permits

The Fire Department issues [Open Air Burning Permits](#) annually, for burning between January 15th and May 1<sup>st</sup>. One of the associated regulations requires burning to take place at a location greater than 75 feet from any building, within the bounds of the property for which the permit is issued. Jason proposed developing a GIS-based tool for the Fire Department, showing locations throughout Town that meet the 75-foot requirement. Here's how I did so.

<p>Created a 75-foot buffer (pink) around each feature in the Buildings layer</p>	<p><b>Layers</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Buildings</li> <li><input checked="" type="checkbox"/> 75 ft Buffer</li> <li><input checked="" type="checkbox"/> Fee Parcels</li> </ul>		<p>ArcToolbox</p> <ul style="list-style-type: none"> <li>3D Analyst Tools</li> <li>Analysis Tools</li> <li>Extract</li> <li>Overlay</li> <li>Proximity</li> <li><b>Buffer</b></li> </ul>
<p>Merged the individual buffers together (thick red outline)</p>	<p><b>Layers</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Buildings</li> <li><input type="checkbox"/> 75 ft Buffer</li> <li><input checked="" type="checkbox"/> 75 ft Buffer Merge</li> <li><input checked="" type="checkbox"/> Fee Parcels</li> </ul>		<p>ArcToolbox</p> <ul style="list-style-type: none"> <li>3D Analyst Tools</li> <li>Analysis Tools</li> <li>Cartography Tools</li> <li>Conversion Tools</li> <li>Data Interoperability Tools</li> <li>Data Management Tools</li> <li>General</li> <li><b>Merge</b></li> </ul>

<p>Used the merged buffer like a cookie cutter to clip the Parcels layer, leaving only the Safe-To-Burn portions (dark green)</p>	<p><b>Layers</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Clipped Parcels</li> <li><input checked="" type="checkbox"/> Buildings</li> <li><input type="checkbox"/> 75 ft Buffer</li> <li><input checked="" type="checkbox"/> 75 ft Buffer Merge</li> <li><input checked="" type="checkbox"/> Fee Parcels</li> </ul>		
<p>Identified the Parcels with no Safe-To-Burn area (orange)</p>	<p><b>Layers</b></p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Clipped Parcels</li> <li><input checked="" type="checkbox"/> Buildings</li> <li><input checked="" type="checkbox"/> No Burning</li> <li><input checked="" type="checkbox"/> 75 ft Buffer Merge</li> </ul>		
<p>Symbolized the Safe-To-Burn portions according to area</p>	<p><b>Layers</b></p> <p><input checked="" type="checkbox"/> Safe To Burn</p> <p>Square Feet</p> <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: red; border: 1px solid black;"></span> 0 - 50</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: orange; border: 1px solid black;"></span> 51 - 100</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; border: 1px solid black;"></span> 101 - 200</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: lightgreen; border: 1px solid black;"></span> 201 - 300</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span> 301 and up</li> <li><input checked="" type="checkbox"/> Buildings</li> </ul>		
<p>Created a <a href="#">web map</a> for easy reference by the Fire Department</p>	<p><b>Legend</b></p> <p>SF Available for Burning</p> <p>Square Feet Available</p> <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: green; border: 1px solid black;"></span> 301 and up</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: lightgreen; border: 1px solid black;"></span> 201 - 300</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: yellow; border: 1px solid black;"></span> 101 - 200</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: orange; border: 1px solid black;"></span> 51 - 100</li> <li><span style="display: inline-block; width: 15px; height: 15px; background-color: red; border: 1px solid black;"></span> 0 - 50</li> <li><input checked="" type="checkbox"/> Buildings</li> </ul>		

After reviewing the webmap, Chief Judge emailed us to say, “this will be a great tool for us to use for enforcement regarding complaints, and in making determinations in cases of extremely questionable permits.”

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## 2. How I Use GIS: Will Holden

Land Manager Will Holden, of the Natural Resources Division, has been working over the past few months to update the Town-wide trails map. This map provides residents and visitors specific locations of publicly-accessible trails throughout Town, and also includes relevant information such as property ownership, topography, parking areas, and more. Will’s update has generated a variety of improvements to our GIS Trails data layer.

Perhaps the simplest trail GIS data improvement is the addition of newly-built trails. After the construction of a new trail on Town land, Will uses a GPS device to gather specific location data for that trail. He then applies a combination of ArcGIS tools to convert GPS data points into finished Trail features:

Import GPS Track Point data into ArcGIS shapefile format		<ul style="list-style-type: none"> <li>ArcToolbox</li> <li>3D Analyst Tools</li> <li>Analysis Tools</li> <li>Cartography Tools</li> <li>Conversion Tools</li> <li>Excel</li> <li>From GPS</li> <li><b>GPX To Features</b></li> </ul>
Convert Point data to a Line feature		<ul style="list-style-type: none"> <li>Conversion Tools</li> <li>Data Interoperability Tools</li> <li>Data Management Tools</li> <li>Feature Class</li> <li>Features</li> <li><b>Points To Line</b></li> </ul>
Smooth the Line feature if desired		<ul style="list-style-type: none"> <li>ArcToolbox</li> <li>3D Analyst Tools</li> <li>Analysis Tools</li> <li>Cartography Tools</li> <li>Annotation</li> <li>Cartographic Refinement</li> <li>Data Driven Pages</li> <li>Generalization</li> <li><b>Smooth Line</b></li> </ul>

Will has also been correcting existing GIS Trail features. Data on the dozens of miles of publicly accessible trails in Town was captured over many years from various different sources, resulting in some data inconsistencies. Correction of this data is done either through use of aerial imagery to trace visible trails, by gathering new GPS information on the ground, and/or by seeking out new data from other landowners.

Below is an example of trail data improvement at Heywood Meadow.



Additional improvements have included deleting permanently closed trails and inaccurate trails, improving trail symbology, and adjusting trail classifications. Says Will, "It's been a collaborative effort to make these improvements. I'm often gathering information on the ground for Jill to integrate into the master Trails layer." And Jill is delighted to do so!

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### 3. Parcel Line Dimensioning

Unlike in many towns, Concord's tax maps do not (yet!) include annotation showing the official surveyed length of each and every parcel line segment throughout town. We have over 18,000 parcel line segments, and each has two lengths associated with it, one from each of the deeds of the two abutting parcels.




To remedy this, the Assessors and the GIS team have, over the past five years, engaged contractors to capture Survey Lengths for all possible parcel lines based on Assessor documents.

This phase of the project is now complete – **hooray!!**

- **96%** of Parcel line segments have been reviewed against Assessor deeds and plans
- **77%** of Parcel line segments have an official [non-zero] survey length



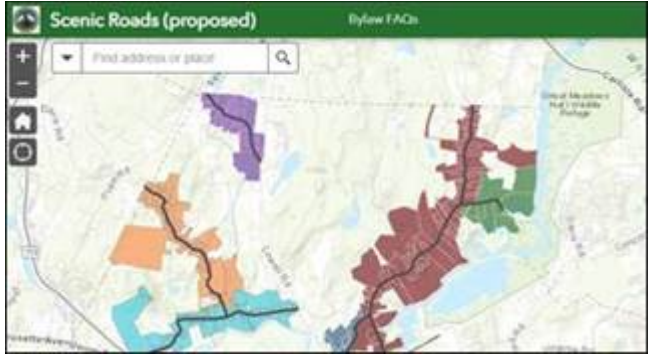


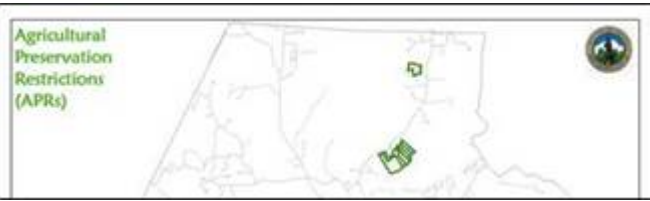

[Many many](#) thanks to **Carolyn Dee** in Assessing for five l-o-n-g years of steadfastly loading up documents for our contractors!!

We've now begun Phase 2, extending our search for useful plans and deeds to the 56,000+ documents the Town has stored in our PeopleGIS Document Manager (which feeds the Documents  layer on our WebGIS.) After that, we will likely be seeking an intern to pore through the Registrar of Deeds' online database ... in hopes of minimizing in-person searching at the Registry!

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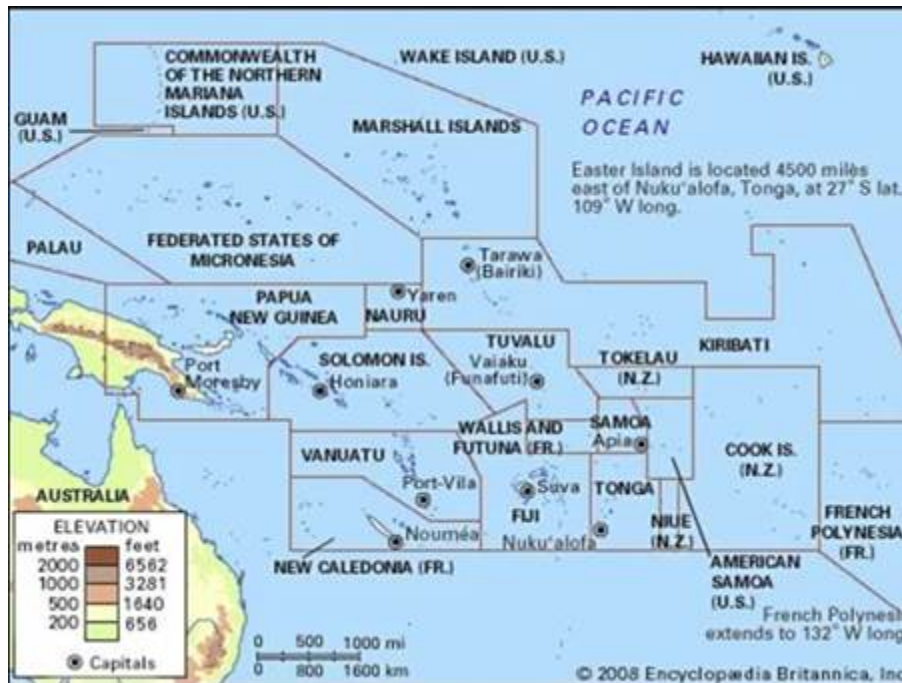
## 4. Map/App Gallery

*CTRL-Click on a thumbnail to view a full-size map*

<p><b>Scenic Roads</b></p>		<p>Created a <a href="#">web app</a> of the proposed Scenic Roads for Elizabeth H, who incorporated this information into the Bylaw's <a href="#">FAQ webpage</a> – very nice!</p>
<p><b>Voter Precincts</b></p>		<p>Modified the Polling Place pop-up on the <a href="#">Voter Precinct app</a> for Kaari T. It's now on the Town Clerk's <a href="#">elections and voting</a> page!</p>
<p><b>Conservation Grant</b></p>		<p>Developed a <a href="#">locus map</a> for a conservation grant application, for Natural Resources</p>
<p><b>Agricultural Preservation Restrictions</b></p>		<p>Developed a new Agricultural Preservation Restrictions (APR) layer for Natural Resources</p>
<p><b>Historic Districts Commission</b></p>		<p>Ran an analysis for Heather G and the HDC, looking at lots within the historic districts that have 150' frontage with around a 70.4' setback, to assist with an application</p>

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## 5. Navigating the Pacific Islands ... before GPS



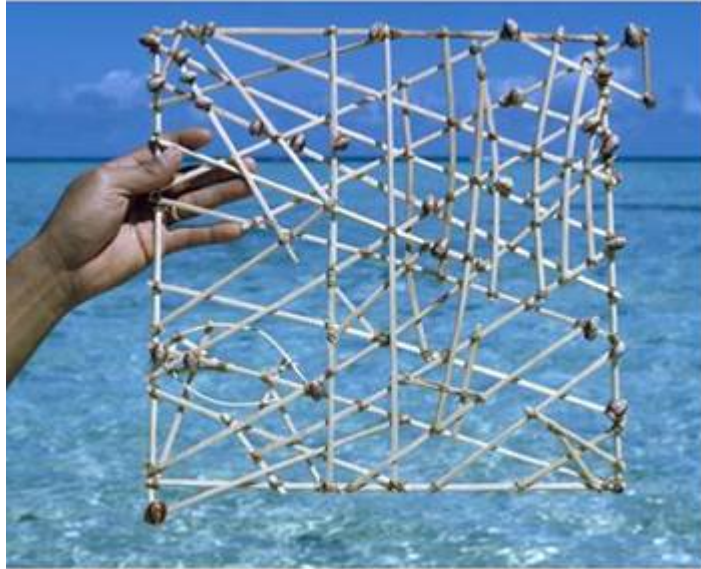
Source: [Britannica.com](https://www.britannica.com), accessed 3/7/2022

Many centuries before GPS and GIS, Pacific Islanders routinely travelled between isolated island groups widely scattered across enormous expanses of ocean using a variety of traditional navigation methods. While navigation by reference to sun and stars was used for aiming in the correct general direction, low-lying islands and atolls are very easy to miss. A high island, like the Big Island of Hawai'i, nearly three miles high, can be seen from 100 miles away, but an atoll whose highest points are coconut trees can only be seen from 7-10 miles off.

Specialized techniques served to “expand the target” and reduce the risk of a potentially deadly miss. Aiming for a block or “screen” of islands was crucial. Most Pacific islands lie in groups – for example, the Hawaiian Islands extend more than 1000 miles east to west; the major islands form a north-south screen of about 240 miles.

When approaching the target area, the wayfinder watched for land-based birds such as the Noddy Tern, which flies within 40 miles of its home base; near sunrise or sunset its flight path indicates the direction to take toward land. Clouds were another navigational aid, creating distinctive formations above land masses still over the horizon; sun- or moonlight also could reflect off calm lagoon waters and white-sand beaches onto the clouds above.

But what caught the attention of this cartographer, and caused me to write about it here, is the technique of swell pattern sensing.



Source: [National Geographic](#), accessed 3/4/2022

The map above illustrates ocean swell patterns (sticks) and the relative positions of islands (shells). Prevailing long swells are distorted by land masses; such distortions can be sensed 20 or more miles away, well before the island or atoll is visible. Swell pattern sensing is taught to aspiring navigators in a general way using these maps, but is best learned – and later applied – while lying in the bottom of a voyaging canoe to feel the nuances of its movement in the water. (Sounds like a nice job...except for the high cost of failure!)

To view more examples, click on [Polynesian stick maps](#).

Bon voyage!

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