Overview of using ESRI Products at HTC

Edward Gause

Edward Gause, GISP

- Worked at HTC for 18 years!
- Started in Programming and moved up to Director of Information Services.
- In charge of Engineering Application Development, Database Administration and GIS Infrastructures and System Development

HTC

Horry Telephone Cooperative

- **Founded in 1952**
- **HTC is the largest Telephone Cooperative in the US**
- **18th Largest Telephone Company**
- **HTC offers Telephone, Data, CATV, Home Security, Long Distance, Mobile Phone/Data Service, Computer Repair, and other advance telecommunication services.**
- **ILEC & CLEC**
- **Last Mile Carrier and Long Distance Carrier**

Where are we located?

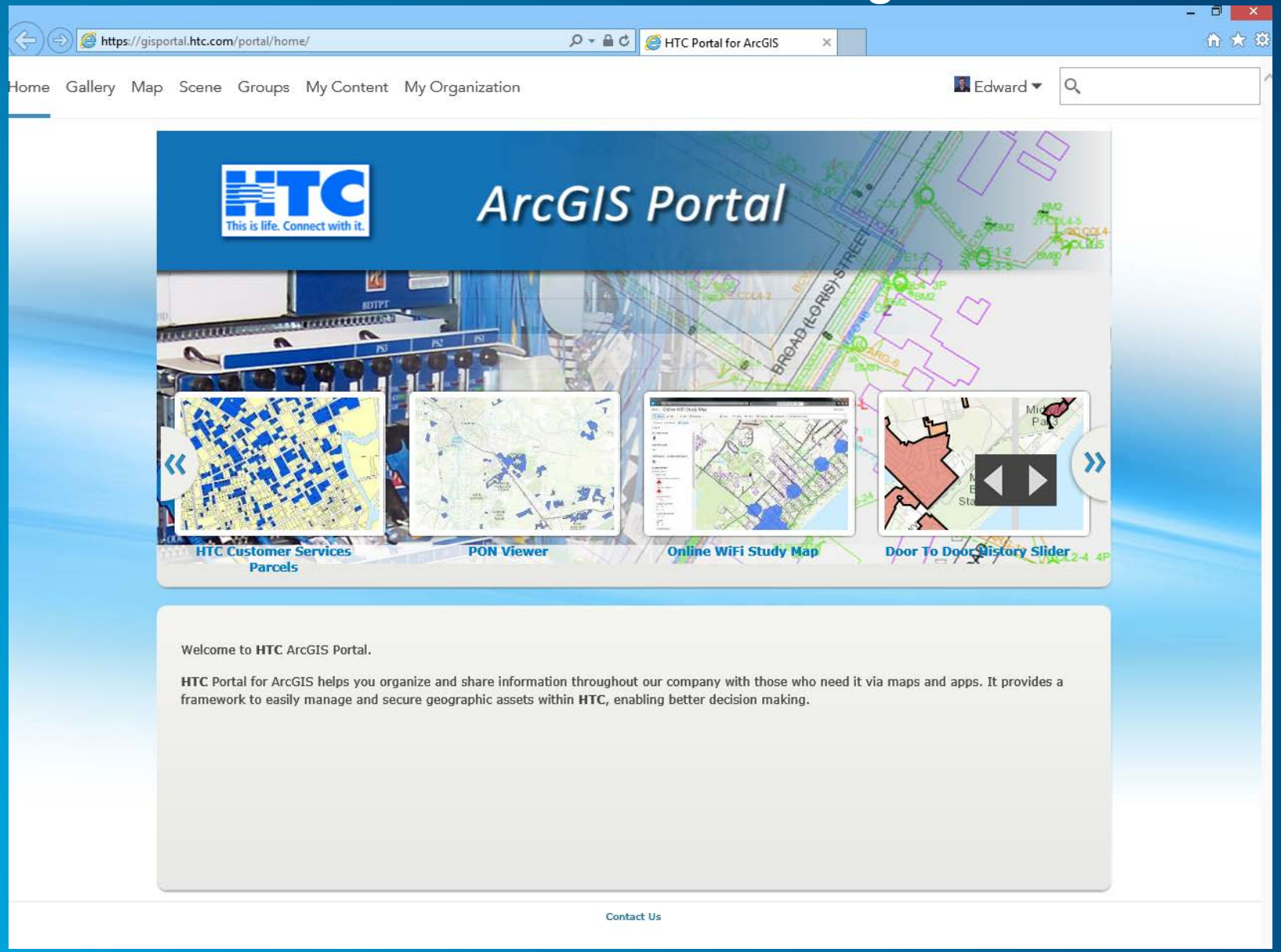
Products we use here at HTC.

- ArcGIS Desktop – ArcMap, Model Builder, ArcCatalog, Spatial Analysis, Schematics, Network Analyst and Geostatistical Analyst
- ArcGIS Server
- Portal for ArcGIS
  - Operational Dashboard
- Business Analysis Online
- Model Builder
- JavaScript API for ArcGIS
- Python API for ArcGIS
- ArcGIS Runtime SDK for Java

Portal for ArcGIS Usage

- Currently our CEO uses the Portal for simple presentations where he needs to mark out a set of Counties, Census Blocks, Cellular Market Areas, and etc.
- He mainly does this when he is presenting to other companies and organizations, or when he presents to the Board and Executive Staff.
- He is not creating Map Content to share, but he is creating his own Maps for Presentations.
- Marketing, Information Services and the GIS department are creating content together that the CEO and other groups use.
- Outside Plant Design and the GIS Department have created and maintain our Wireless, Fiber, Coax, and Copper Network Infrastructure in the GIS System. The Portal has a live feed of these networks.

Portal for ArcGIS Usage



Portal for ArcGIS - QueryS

https://gisportal.htc.com/portal/home/webmap/viewer.html?useExisting=1&services=1f8e4e5c80944b3fbe3ddabffb73872

HOME

QueryStandard

NEW M

Details | Add | Basemap | Save | Share | Print | Measure | Bookmarks | Find address or place

Legend

QueryStandard

Query Standard

Copper Plant

REMOTECENTRALOFFICE

CENTRALOFFICE

COPPERSERVICEPOINT

CROSSCONNECT
N

DLCADVANCED
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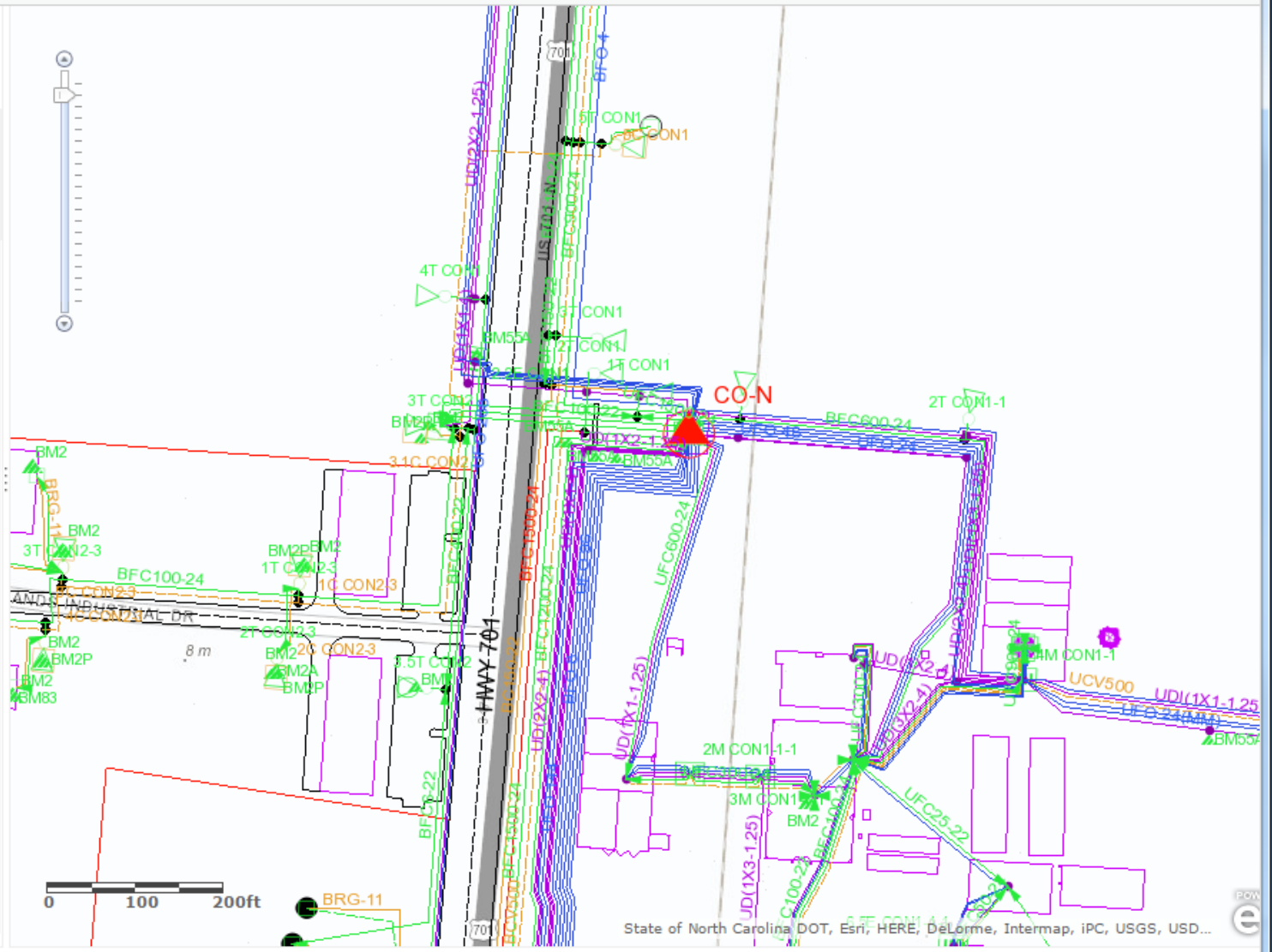
LOADPOINT
N

PEDESTALCOPPER
N
X

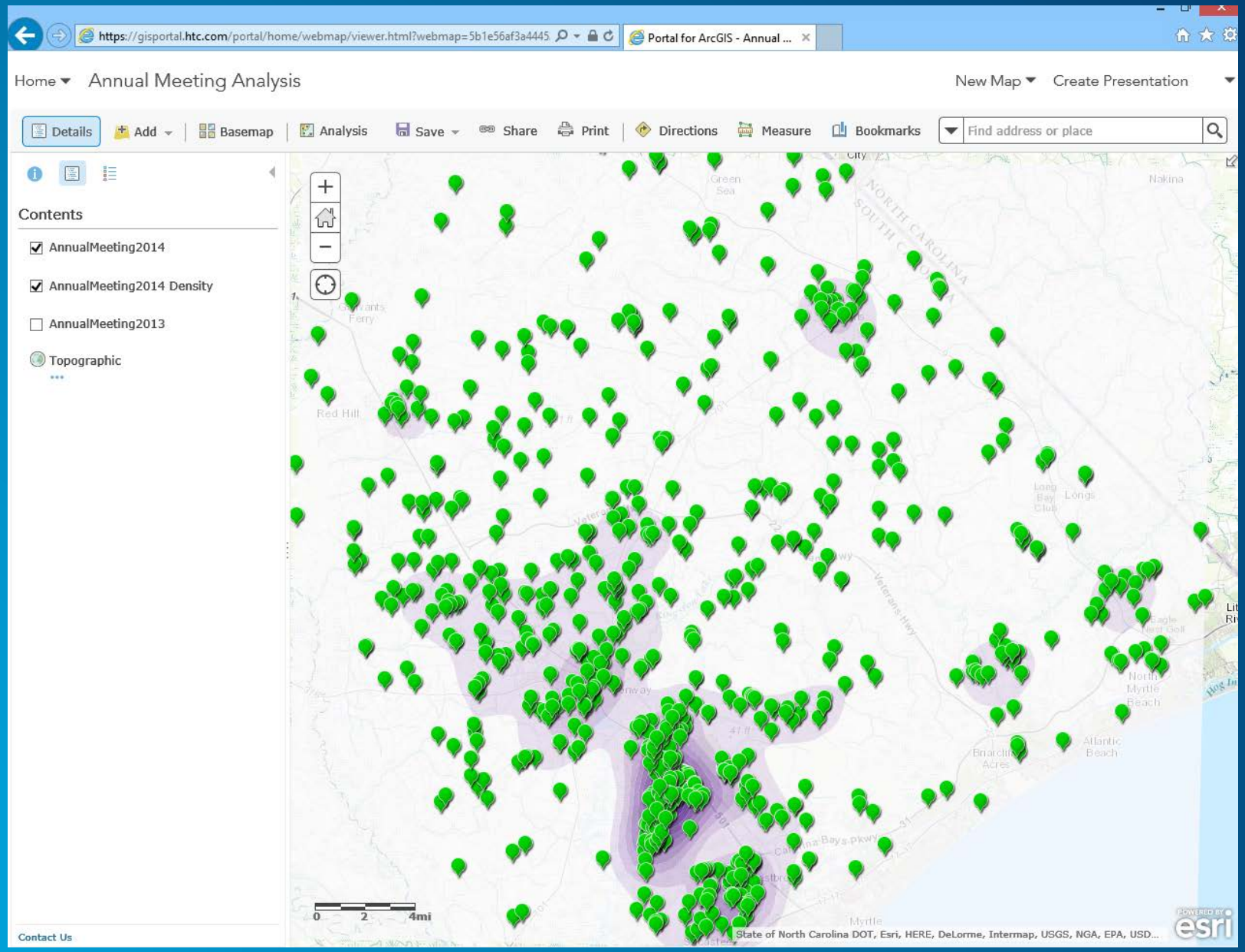
REPEATER
N

SPLICEBURIED

SPLICESTRAIGHT



Analyzing Annual Meeting of the Cooperative



https://gisportal.htc.com/portal/home/webmap/viewer.html?webmap=c7bd6e77394e47

Portal for ArcGIS - Census B...

Home

Census Block Customer Saturation Web Map

New Map

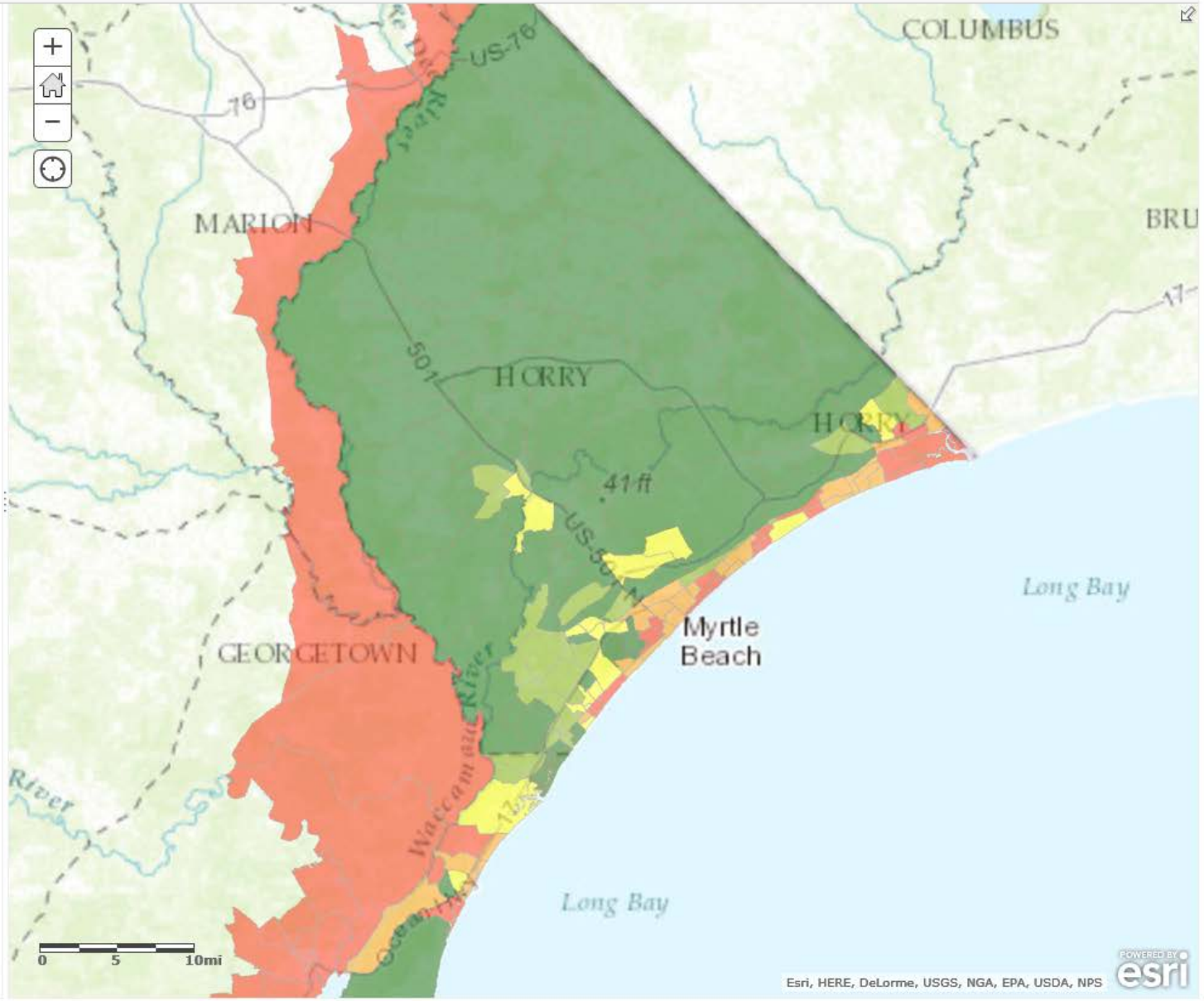
Details | Add | Edit | Basemap | Analysis | Save | Share | Directions | Measure | Bookmarks | Find address or place

Legend

CensusBlockCustomerSat - Sat

CustGISPortal.GISPORTAL.Sat

- 78% - 100%
- 51% - 77%
- 26% - 50%
- 6% - 25%
- 0% - 5%



Contact Us

https://gisportal.htc.com/portal/home/webmap/viewer.html?layers=469a5fe391f24279b

Portal for ArcGIS - SOCensu...

Home ▾ SOCensusBlkNetGain

New Map ▾

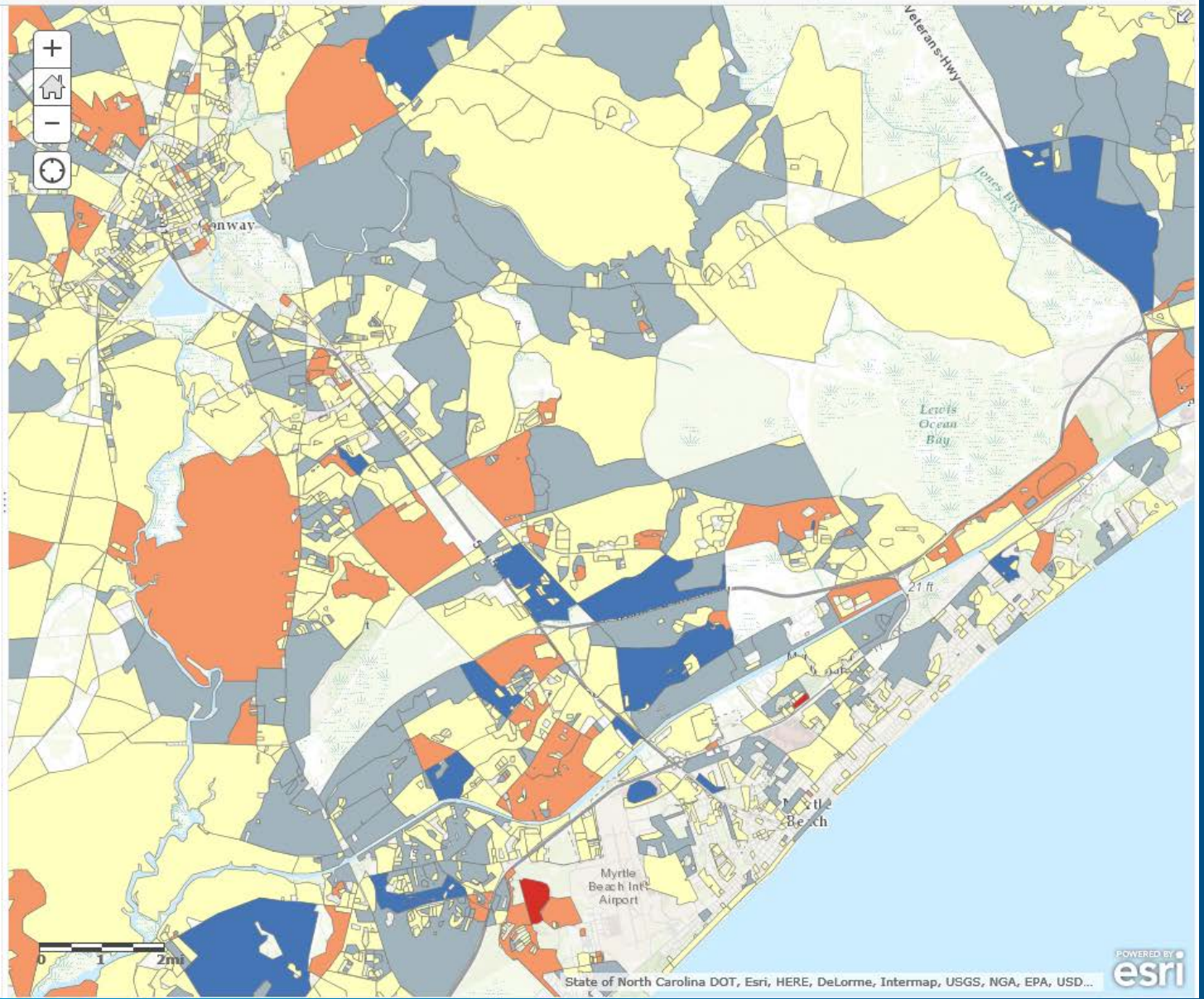
Details | Add ▾ | Basemap | Analysis | Save ▾ | Share | Print | Directions | Measure | Bookmarks | Find address or place

Legend

SOCensusBlkNetGain - SOCensusBlock

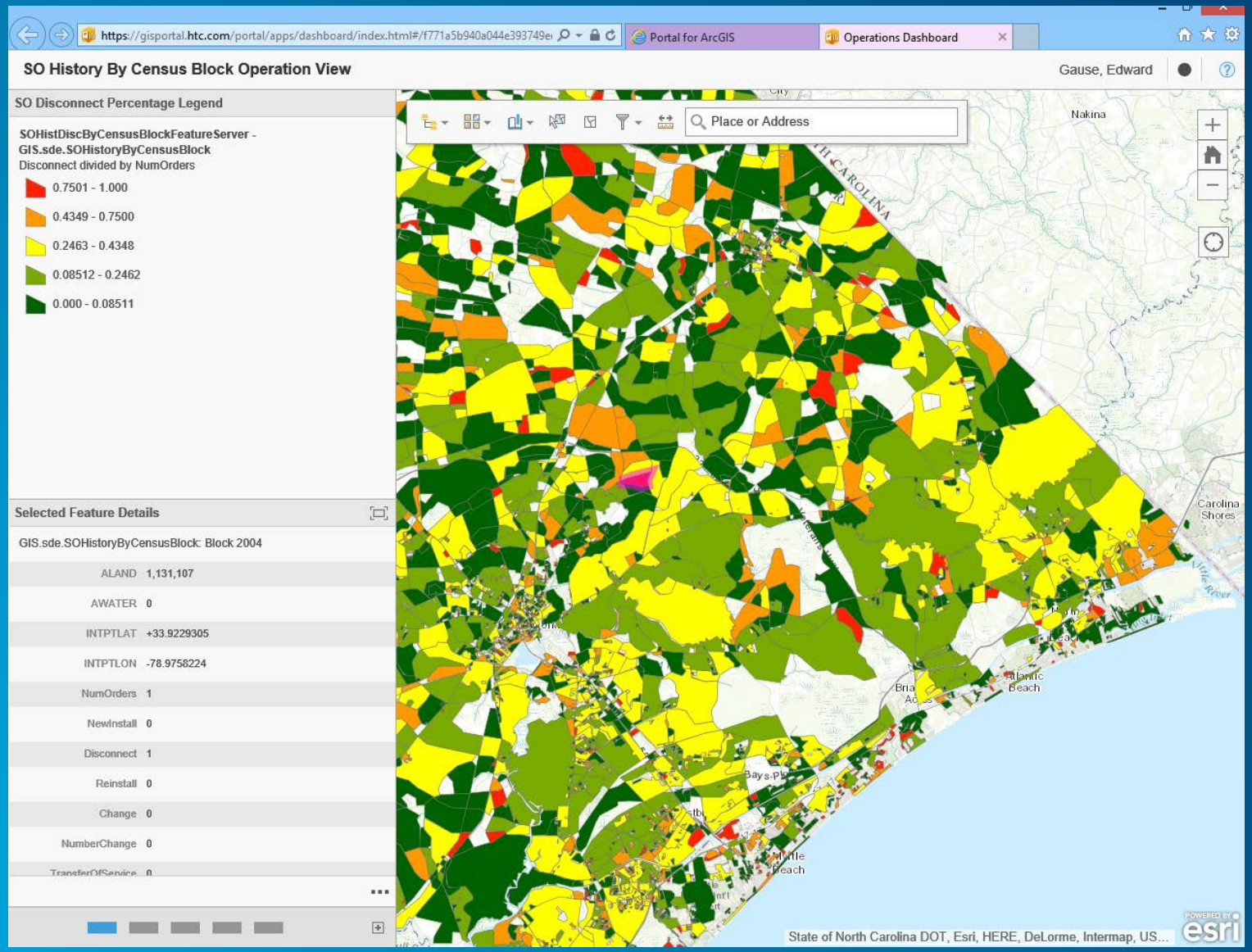
NetGain

- 39 - 94
- 5 - 38
- -1 - 4
- -11 - -2
- -44 - -12



Contact Us

Operation Dashboard Example



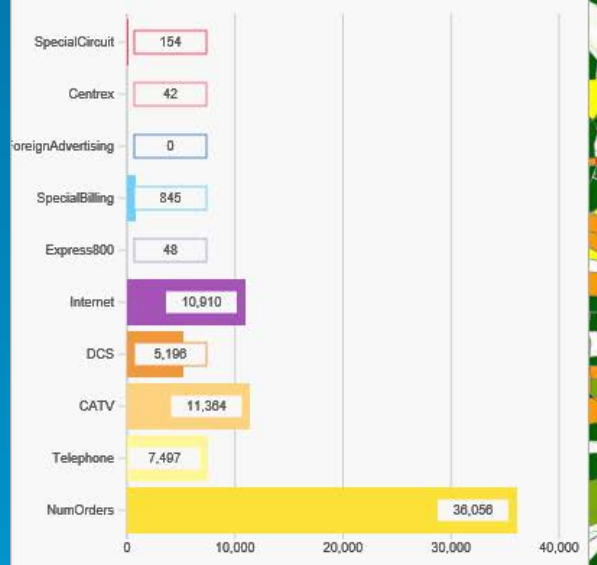
https://gisportal.htc.com/portal/apps/dashboard/index.html#/f771a5b940a044e393749e

Portal for ArcGIS | Operations Dashboard

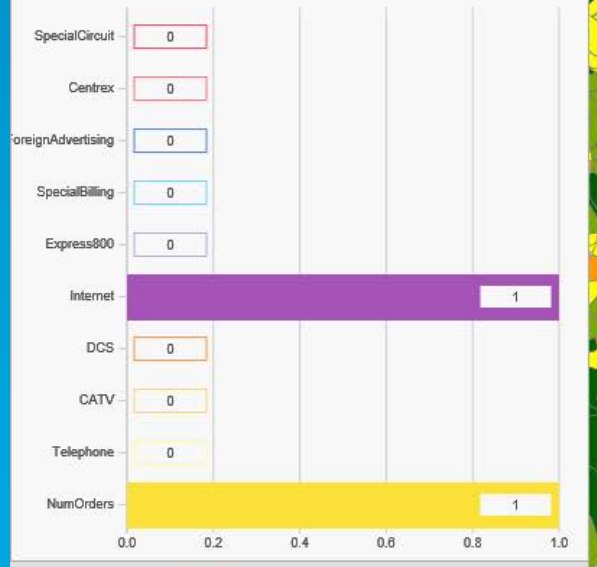
SO History By Census Block Operation View

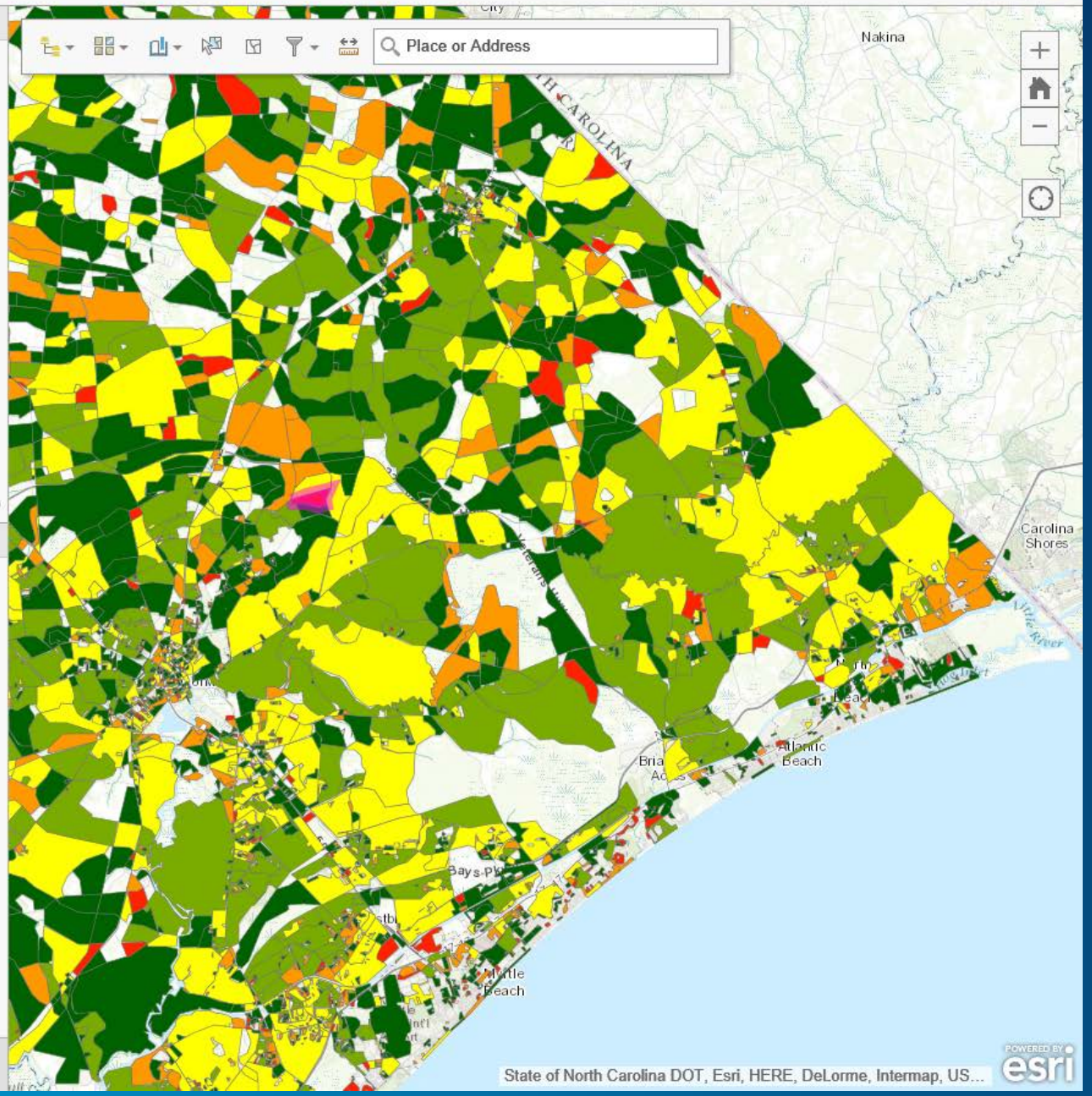
Gause, Edward

All Service Types Bar Chart



Selected Service Types Bar Chart





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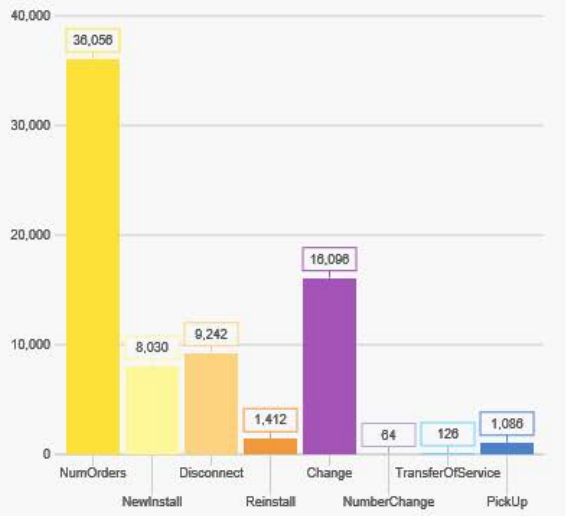
Portal for ArcGIS | Operations Dashboard

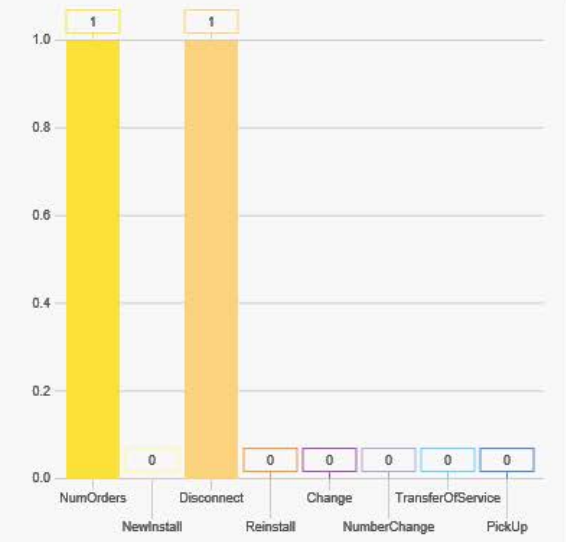
SO History By Census Block Operation View

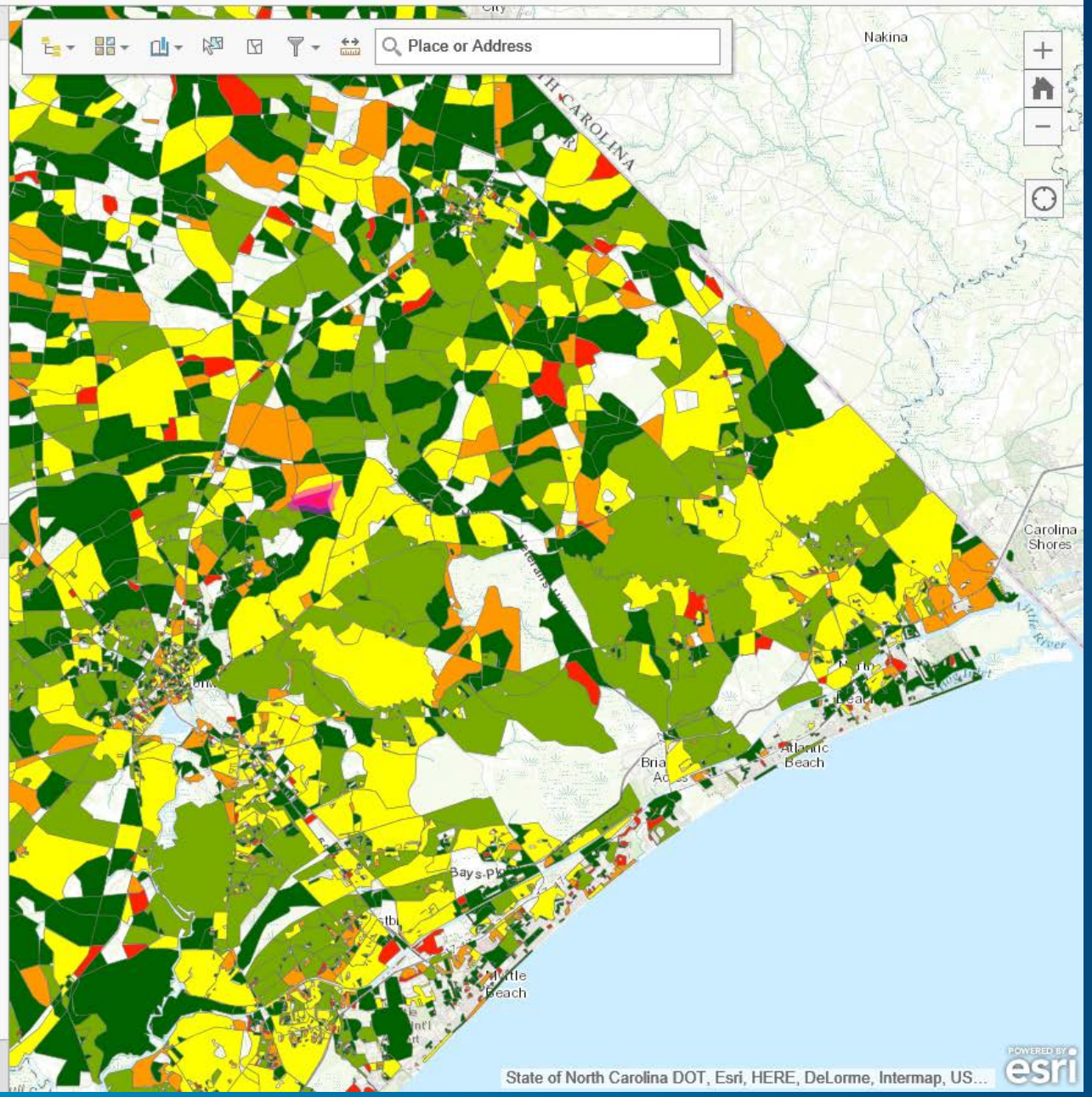
Gause, Edward

All Order Activity Bar Chart



Selected Order Activity Bar Chart





User Acceptance

- Marketing, Outside Plant Design and our Engineering Clerks use the Portal maps to track progress of a new service area our company has.
- Marketing and Door to Door Sales Team uses maps Information Services has generated to know where to target their Sales Campaigns.

Gallery | Portal for ArcGIS - Lumbe

https://gisportal.htc.com/portal/home/webmap/viewer.html?useExisting=1

HOME [redacted] Map

NEW M

Details | Add | Basemap | Save | Share | Print | Measure | Bookmarks | Find address or place

About | Content | Legend

Legend

[redacted]_Map

BluewaveNC Customer

BluewaveNC Customer TELE

BluewaveNC Customer INET

BluewaveNC Customer CATV

New Install Service Order

[redacted] Facility SRS

Service Area

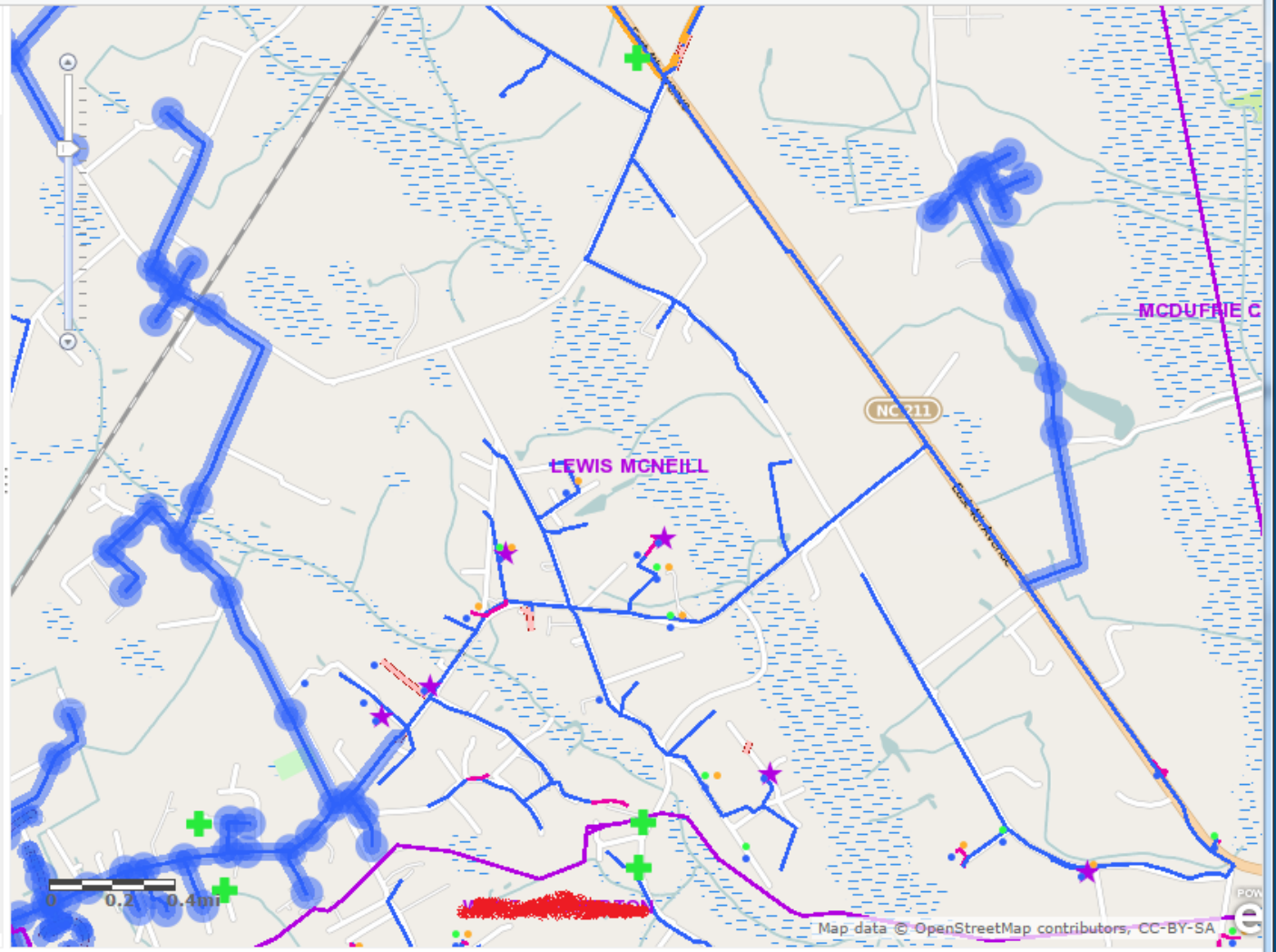
[redacted]

Proposed and Future

Proposed and Future Splice Points

Proposed and Future Path

Proposed and Future Cable



User Acceptance

- Professional Services used the Portal during their sales to a local community organization.
- They needed to show the organization:
  - Where the cameras would be placed
  - In what phase they would be placed
  - What is the coverage area of those cameras being places

Portal for ArcGIS - Camera

https://gisportal.htc.com/portal/home/webmap/viewer.html?webmap=8b2e0c4d49b745ecb39e087e9e158d13

HOME

Camera View Angle

NEW MAP

Details | Add | Basemap | Save | Share | Print | Measure | Bookmarks | Find address or place

Legend

Phase4CameraViewAngle - CameraView4

Phase3CameraViewAngle - CameraView3

Phase2CameraViewAngle - CameraView2

Phase1CameraViewAngle - CameraView1

Portal for ArcGIS is Great!

- True GIS Power Users feel a little limited by the Portal Capabilities, but that is because they are use to all the power of ArcMap.
- Non-GIS Employees love the ease of Portal for ArcGIS and having access to all the map content.
- However there are still situations where we needed to build our own maps using the JavaScript API and ArcGIS Server.

JavaScript API for ArcGIS

- LBS Service tool has map tied in it with this technology.
- OSP tool has maps tied in it for the following modules:
  - Service Order Module – used to manage assignment of orders, so map shows orders, vehicles and our Telecommunication Network (Fiber, Copper and Coax). It shows all orders on map from the search results.
  - Circuit Module – shows location of the circuits on the map, based off of the search results.
  - We have several other integrations like these using the JavaScript API and plan to do a lot more integrations.

JavaScript API for ArcGIS Integration in our Home Grown OSP Web App

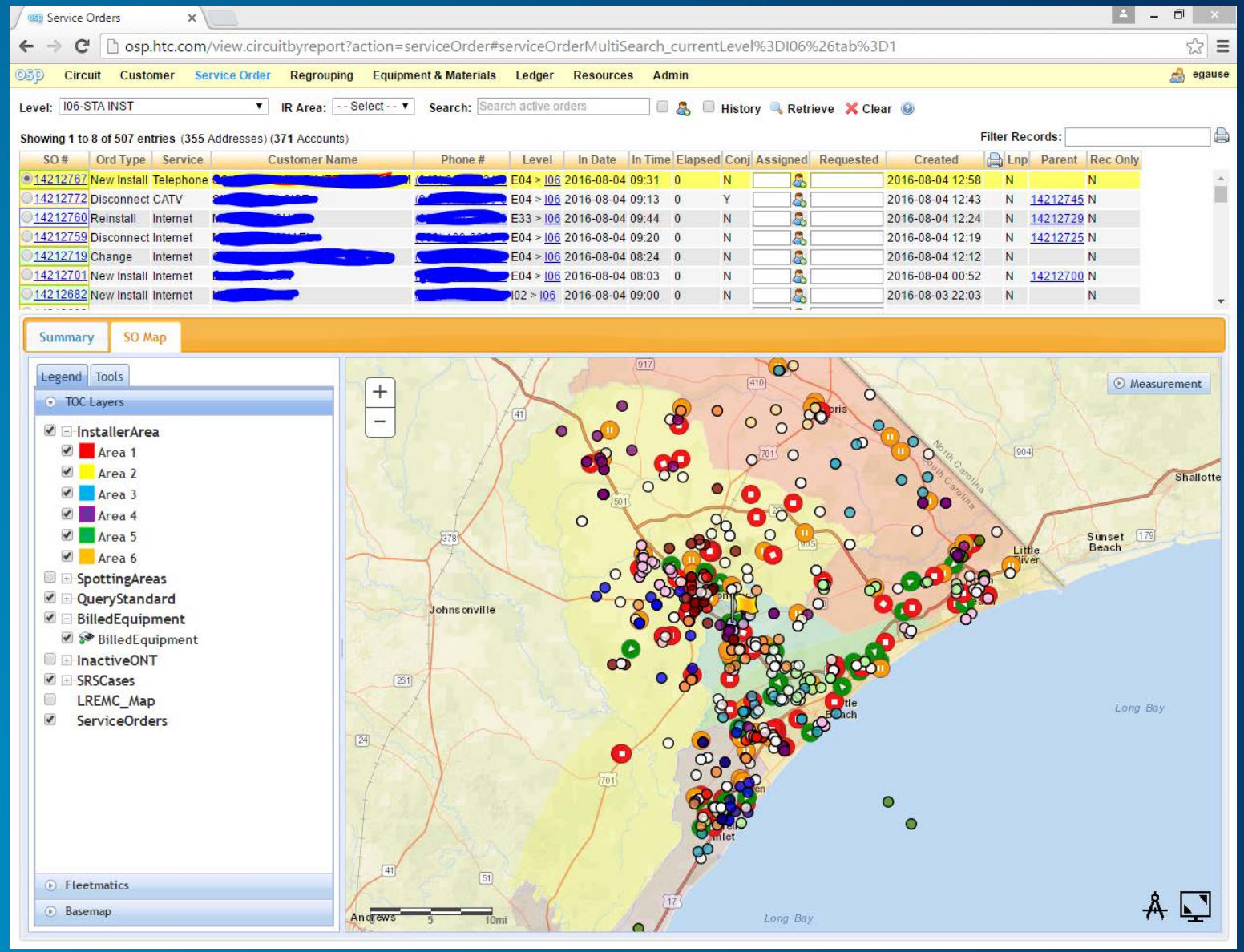
OSP is an application we built using Java, JavaScript, HTML, CSS, Spring Framework and a Hibernate like Entity Framework.

The ESRI JavaScript API made it real easy to integrate with our existing web applications, so we added it to this OSP web app.

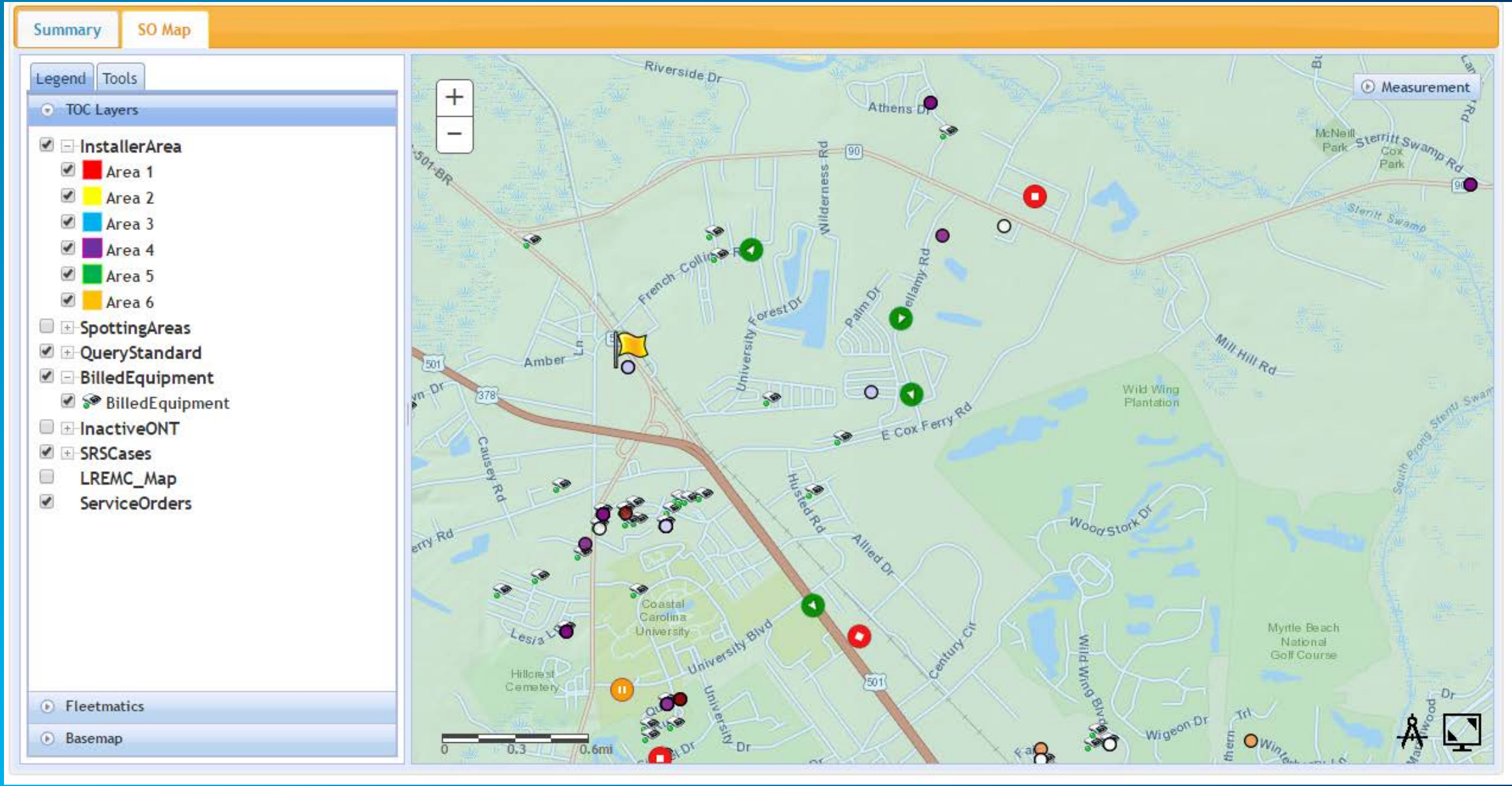
We also integrated vehicle tracking using Fleetmatics, which is the Green Play, Orange Pause, and Red Stop icons on the map.

The other points represent the Service Orders listed at the top of the page. They are color code by Installer.

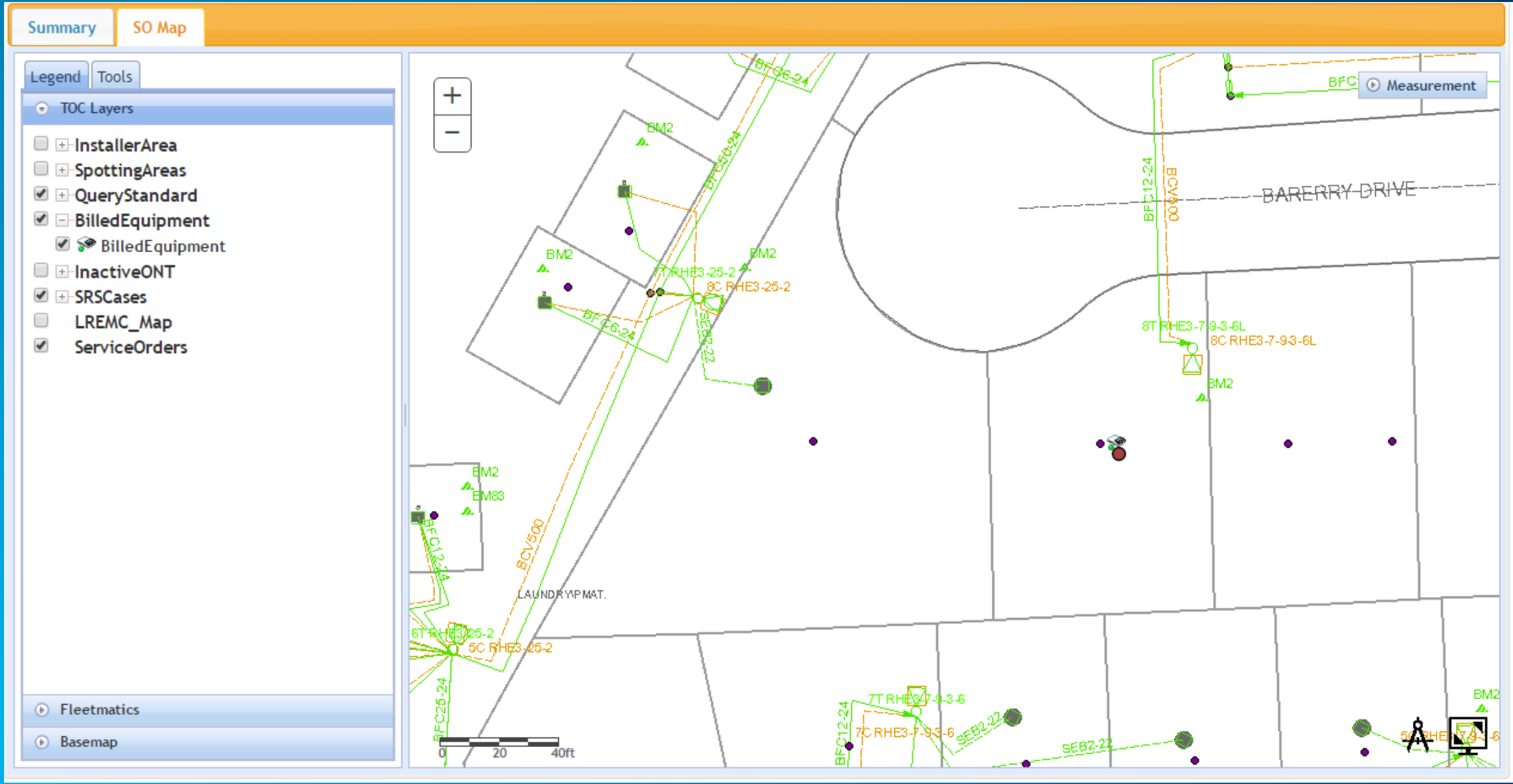
The flag represents the current row selected in the top Service Order table.



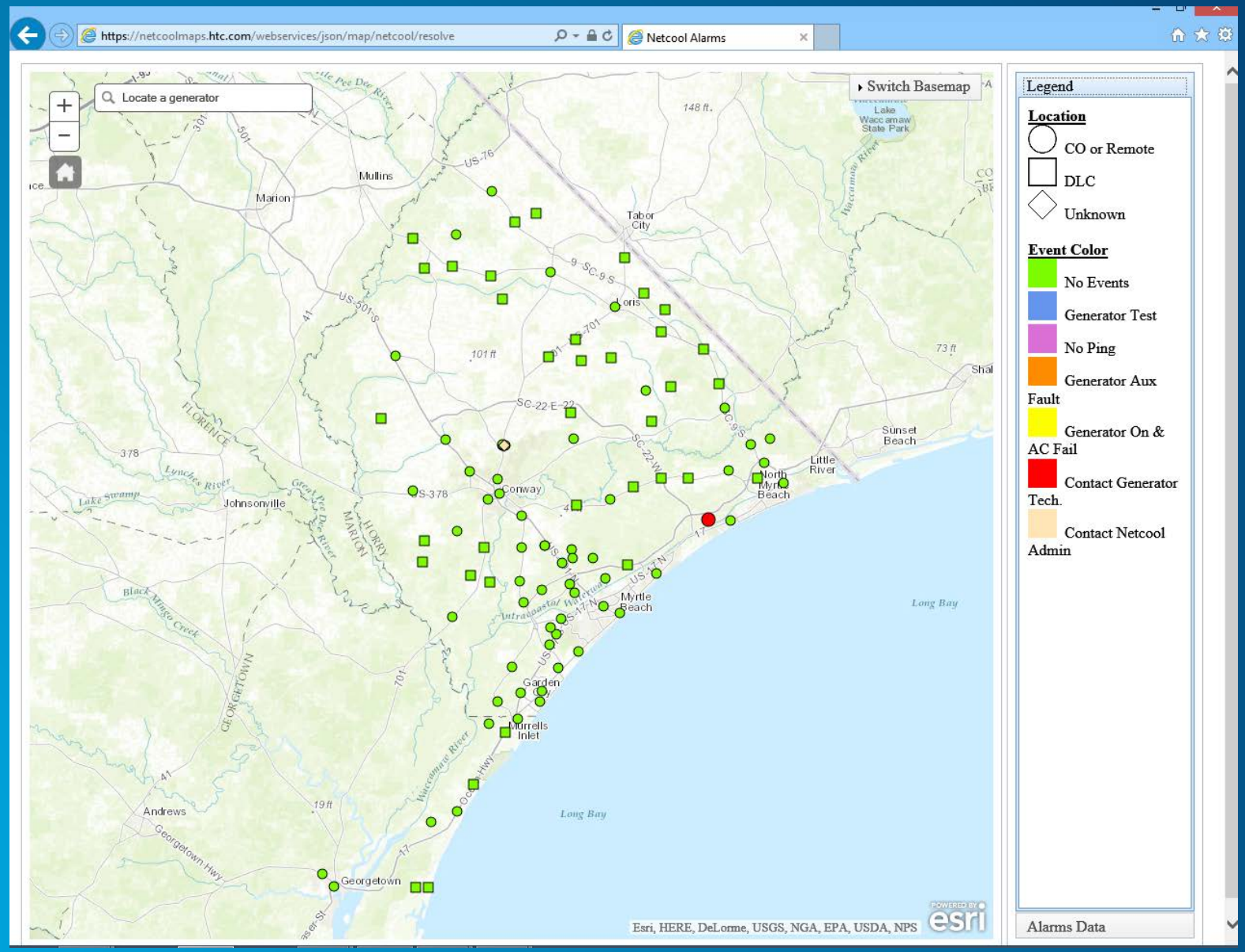
Zoomed in a little bit more



Zoomed in a little bit more



Pulling data from NetCool to create Generator Map of Alarms

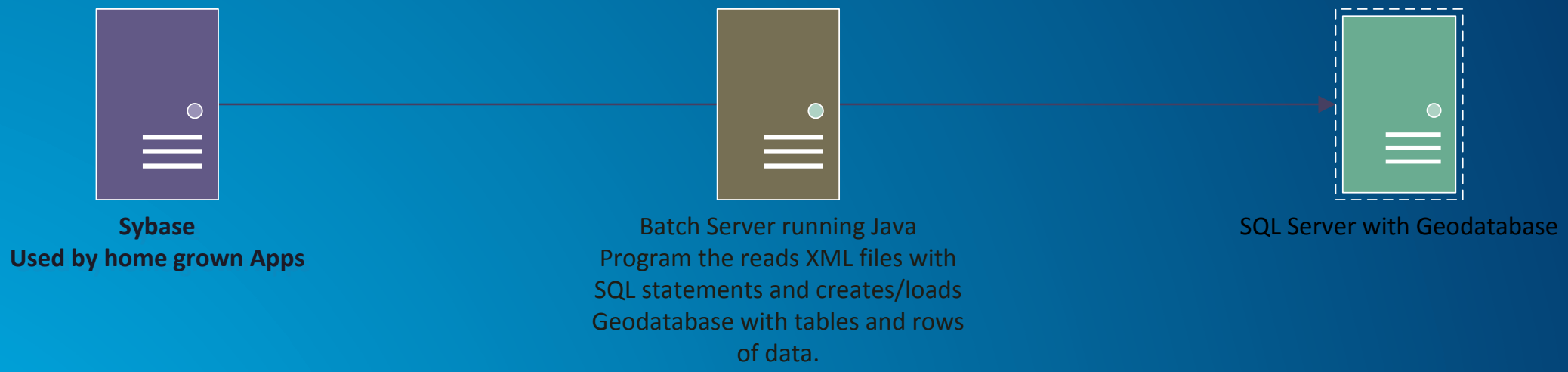


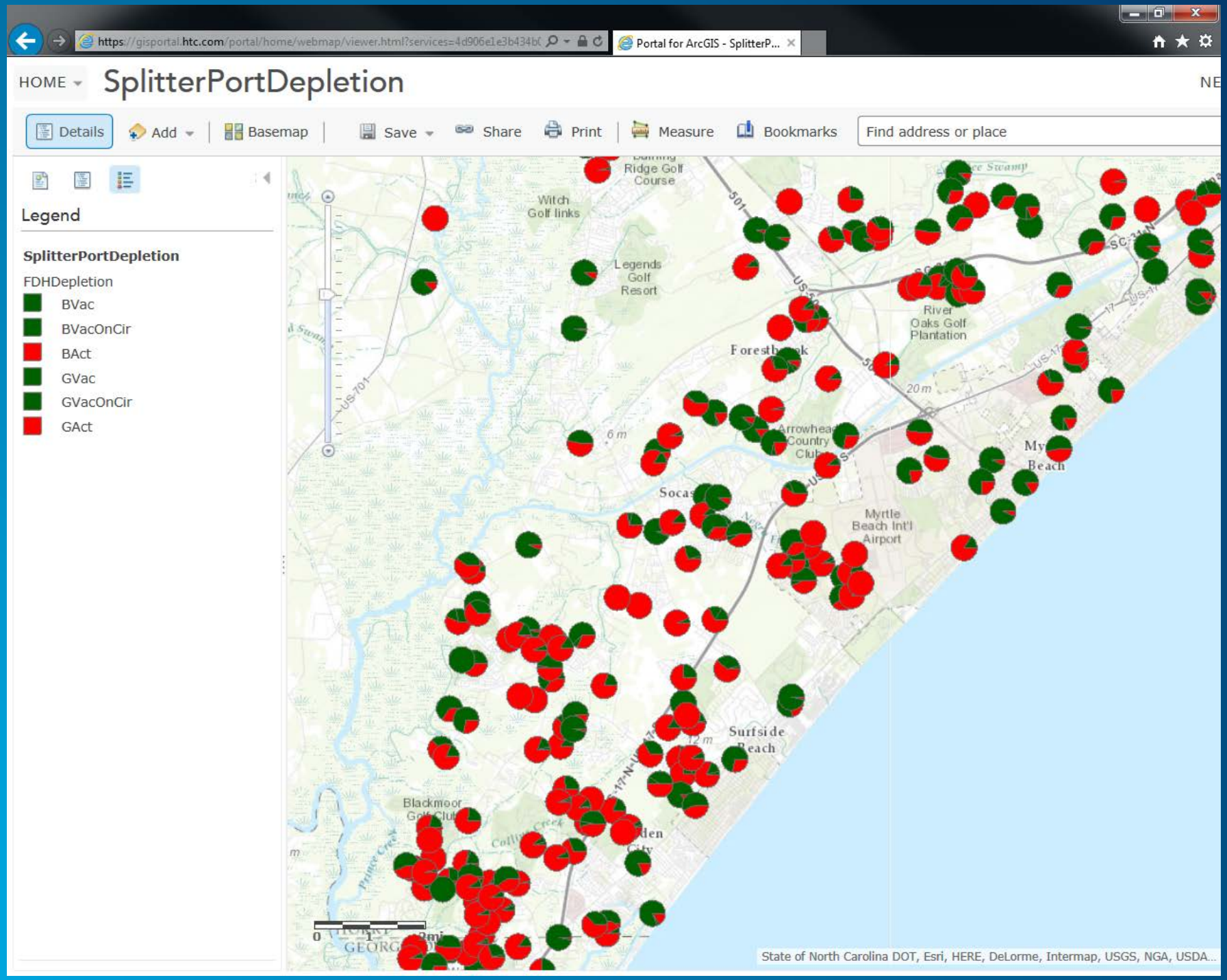
User Acceptance

- Information Services has created several geoprocesses to build Feature Layers nightly that analyze data from our non-GIS systems and puts them into a form that can be mapped. The Portal has a live feed of this nightly data.

Nightly Geo-processes to Create Tables and Shapefiles

- Billed Equipment – that has not been returned by customer after disconnect
- In-Active ON (Fiber Terminals) – so they can be re-used at another location if installer doesn't have one on his truck.
- CATV Node Summary
- Customer Services
- Capacity Summary for Serving Stations, Remotes & Central Offices, Repeaters and Fiber Distribution Hubs.
- Internet Summary Statistics for DSL, Cable Modems and ONT's
- Subdivision Summary of Services
- Payment History
- Audit of distance between Premise Address and Serving Station (used to find data issues).
- Service Order Activity for the last 3 months
- Trouble Ticket Activity for the last 3 months


Sybase
Used by home grown Apps
Batch Server running Java Program the reads XML files with SQL statements and creates/loads Geodatabase with tables and rows of data.
SQL Server with Geodatabase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Portal for ArcGIS - SplitterP...
HOME
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Details
Add
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Bookmarks
Find address or place
Legend
SplitterPortDepletion
FDHDepletion
BVac
BVacOnCir
BAct
GVac
GVacOnCir
GAct
Witch Golf links
Legends Golf Resort
River Oaks Golf Plantation
Arrowhead Country Club
Myrtle Beach Int'l Airport
Surfside Beach
Blackmoor Golf Club
State of North Carolina DOT, Esri, HERE, DeLorme, Intermap, USGS, NGA, USDA...

HTC’s use of ArcMap

- Design our Copper, Fiber and Coax in ArcMap (Stakers, Plant Designers and Inspectors)
- Analyze Customer Penetration, Order Activity and Revenue by aggregating to Subdivisions and Census Blocks. (Used Census Blocks so we can compare with demographics.) Used to target Door to Door Sales.
- Used Space-Time Analysis of Trouble Tickets to see where DSL, Catv, Cable Modems, Fiber and other services are having issues over time. (Have map in back of room demonstrating this analysis.)
- Storm Surge Analysis
- Pick new Office Location

ArcMap

- Engineering uses ArcMap to enter GIS data for Service Areas, Copper Cables, Fiber Cables and Coax Cables
- GIS team made up of Engineering GIS Department and Information Services Engineering Applications Department is using it for creating GIS based reports and doing GIS based Analysis.
- Finance and Marketing are using the tool also for GIS based reports and GIS based Analysis, but requires the help of Engineering GIS and IS Engineering Apps team to accomplish their analysis.

ArcMap Analysis

- An example of the types of analysis we do in ArcMAP follows:

Analyzing Service Order Activity

- One method is to aggregate data to a polygon.
  - We will use a Hexagon for the presentation, so that we have a consistent area comparison that is granular enough to see which area’s perform better.
  - You could use Census Blocks so that you can compare Demographic Information against the performance of the order activity in the polygon.
- Optimized Hot Spot Analysis
- Space Time Analysis using Emerging Hot Spot Tool and NetCDF Cube.

SQL to create CSV File

```
select so.SONbr, convert(CHAR(10),sod.SODate, 111) as "SODate",  so.ServiceType, st.Descr, so.OrderType,
        case so.OrderType when '1' then 'New Install' when '2' then 'Disconnect' else 'DontCare' end as
"OrderTypeDesc",
        case so.OrderType when '1' then 1 when '2' then -1 else 0 end as "ActivityValue",
        geo.Longitude, geo.Latitude
from serviceorder..serviceorder so
join customer..ServiceType st on (st.ServiceType = so.ServiceType)
join serviceorder..SODate sod on (sod.SONbr = so.SONbr and sod.SODType = 'A')
join serviceorder..SOPremiseAddress sop on (sop.SONbr = so.SONbr)
join customer..SAGGeocoded geo on (geo.SAGID = sop.SagId)
where so.OrderType in ('1','2')
--------------------------------------------------------------------------------
```

We are pulling the data from a system that does not have GIS capabilities. We had worked with Horry County to get their address points, and had Geocoded all our addresses based on Horry County Data. That is where I am pulling the Longitude and Latitude from.

The OrderType is either New Install (1) or Disconnect (2), so I assign either an ActivityValue of 1 or -1 so that I can track activity.

The output of the SQL looks like this

Table

SpaceTimeAnalysisSOS.csv

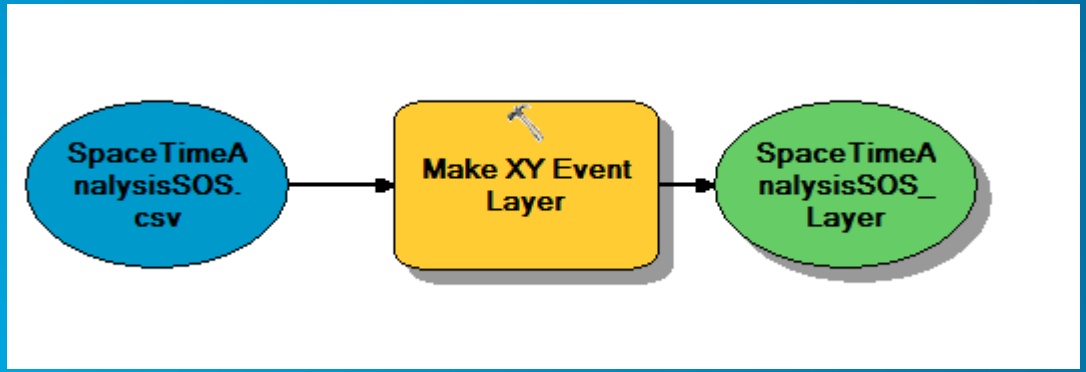
SONbr	SODate	ServiceType	Descr	OrderType	OrderTypeDesc	ActivityValue	Longitude	Latitude
14073003	2/23/2016 10:11:23.960 AM	1	Telephone	1	New Install	1	-78.992916	33.770928
14207926	7/29/2016 2:45:28.086 PM	1	Telephone	1	New Install	1	-78.992916	33.770928
14207982	7/29/2016 3:05:04.036 PM	1	Telephone	1	New Install	1	-78.992916	33.770928
13909949	8/6/2015 8:09:18.213 AM	1	Telephone	2	Disconnect	-1	-79.02565	33.710919
98056298	4/7/1998 11:58:59.800 AM	1	Telephone	1	New Install	1	-78.948487	33.717188
98062282	4/17/1998 2:05:58.180 PM	1	Telephone	1	New Install	1	-78.993811	33.684806
99057312	3/31/1999 11:05:17.650 AM	1	Telephone	2	Disconnect	-1	-79.02294	33.70393
13980000	10/27/2015 3:03:25.403 PM	1	Telephone	1	New Install	1	-79.021862	33.73941
98057413	4/8/1998 5:01:57.110 PM	1	Telephone	1	New Install	1	-78.948045	33.719846
14195464	7/15/2016 1:45:40.256 PM	1	Telephone	2	Disconnect	-1	-79.01555	33.740945
98071429	5/4/1998 3:31:30.910 PM	1	Telephone	1	New Install	1	-78.99328	33.684769
13962267	10/5/2015 2:48:16.840 PM	1	Telephone	2	Disconnect	-1	-78.964027	33.720966
99170056	9/10/1999 1:10:35.850 PM	1	Telephone	1	New Install	1	-78.928975	33.713821
99169807	9/10/1999 11:24:50.960 AM	1	Telephone	1	New Install	1	-78.928975	33.713821
99170070	9/10/1999 1:14:30.430 PM	1	Telephone	1	New Install	1	-78.928975	33.713821
99169823	9/10/1999 11:39:23.020 AM	1	Telephone	1	New Install	1	-78.928975	33.713821
99169847	9/10/1999 11:42:50.640 AM	1	Telephone	1	New Install	1	-78.928975	33.713821
99169855	9/10/1999 11:46:18.970 AM	1	Telephone	1	New Install	1	-78.928975	33.713821
99169864	9/10/1999 11:50:06.740 AM	1	Telephone	1	New Install	1	-78.928975	33.713821
99169880	9/10/1999 12:01:24.470 PM	1	Telephone	1	New Install	1	-78.928975	33.713821

1 (0 out of *2000 Selected)

SpaceTimeAnalysisSOS.csv

Turn table into a Point Feature

- **The CSV file did not have a Shape column, so the next step is to add a shape column of points.**



Re-project into SC State Plane NAD83

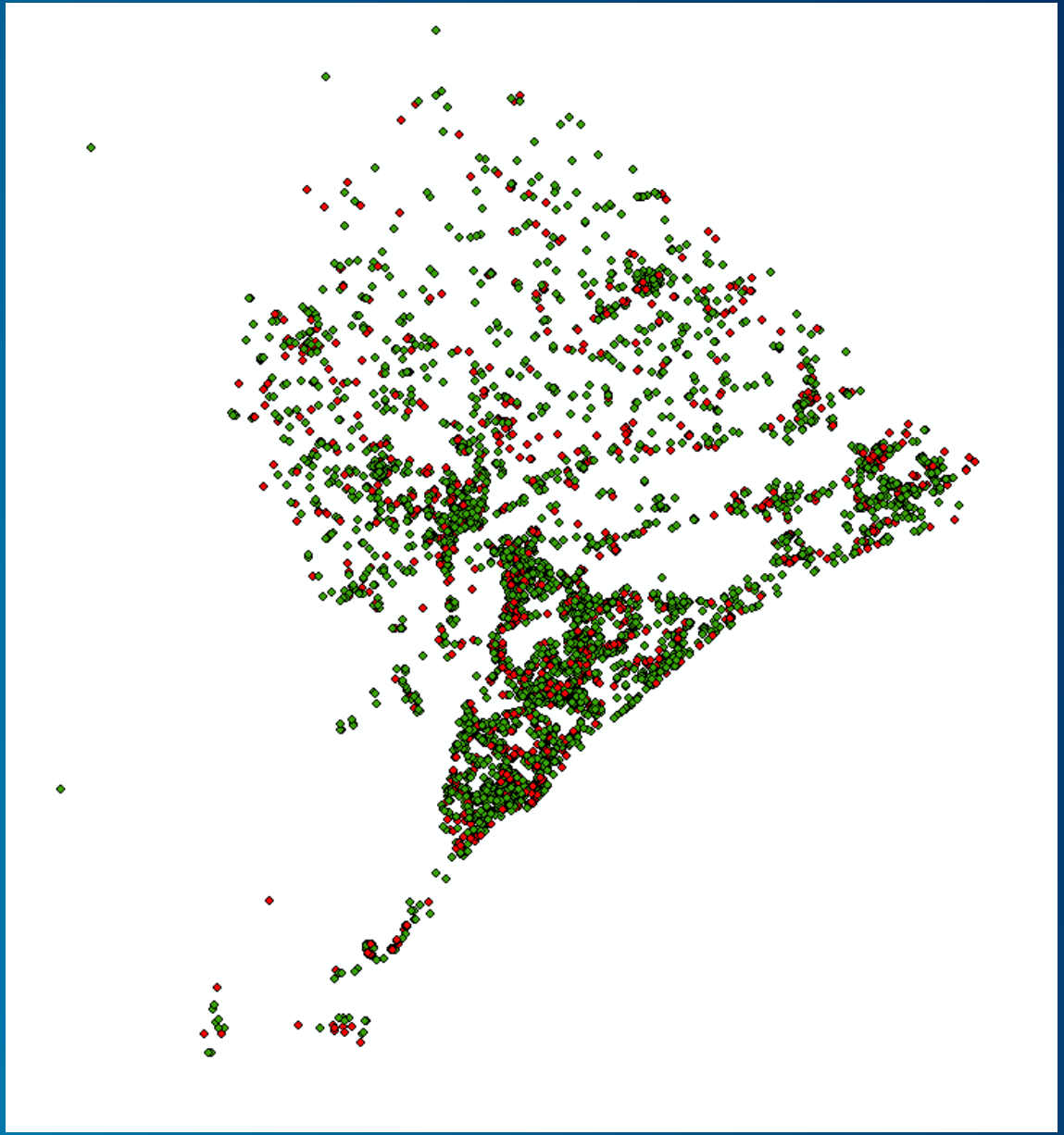
- Space Time Cube requires that you work in a Projected Map System, so once my Feature Layer is created, I changed the ArcMap to project in SC State Plane.
- Next I exported the feature layer and used the Projected System from the Map and not the layer since the layer was in Geographic Coordinate System.

Symbolize on OrderType

Symbolize based off of the following:

- Green is New Install
- Red is Disconnect

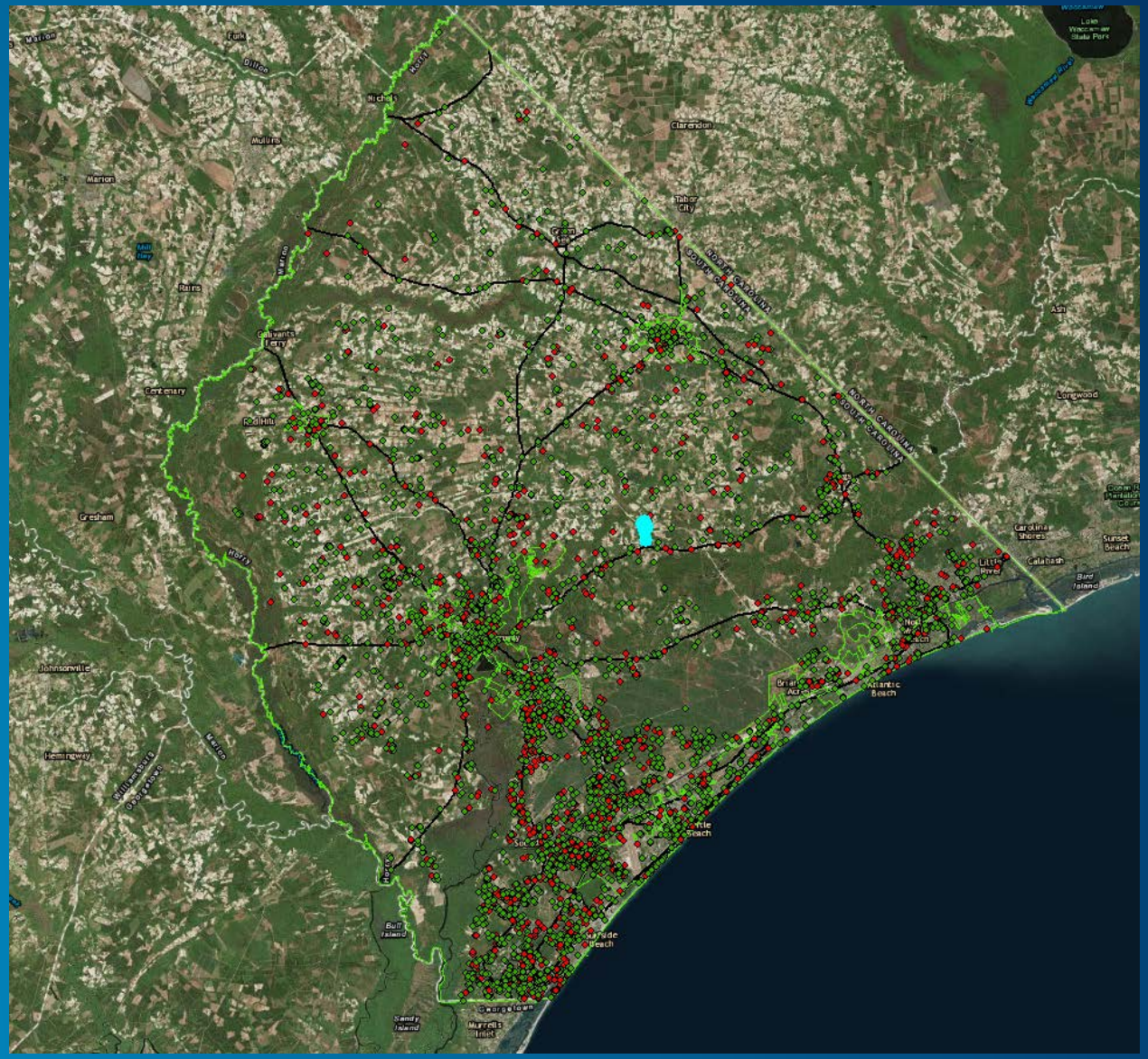
Notice it is hard to identify the activity, because Green Points could be hiding Red Points.



Clip the points to remove Outliers

- Since I had data outside of Horry County in my dataset, I will need to clip this result using Horry County Polygon. This will remove any outliers due to the distances between the points not being in Horry County.

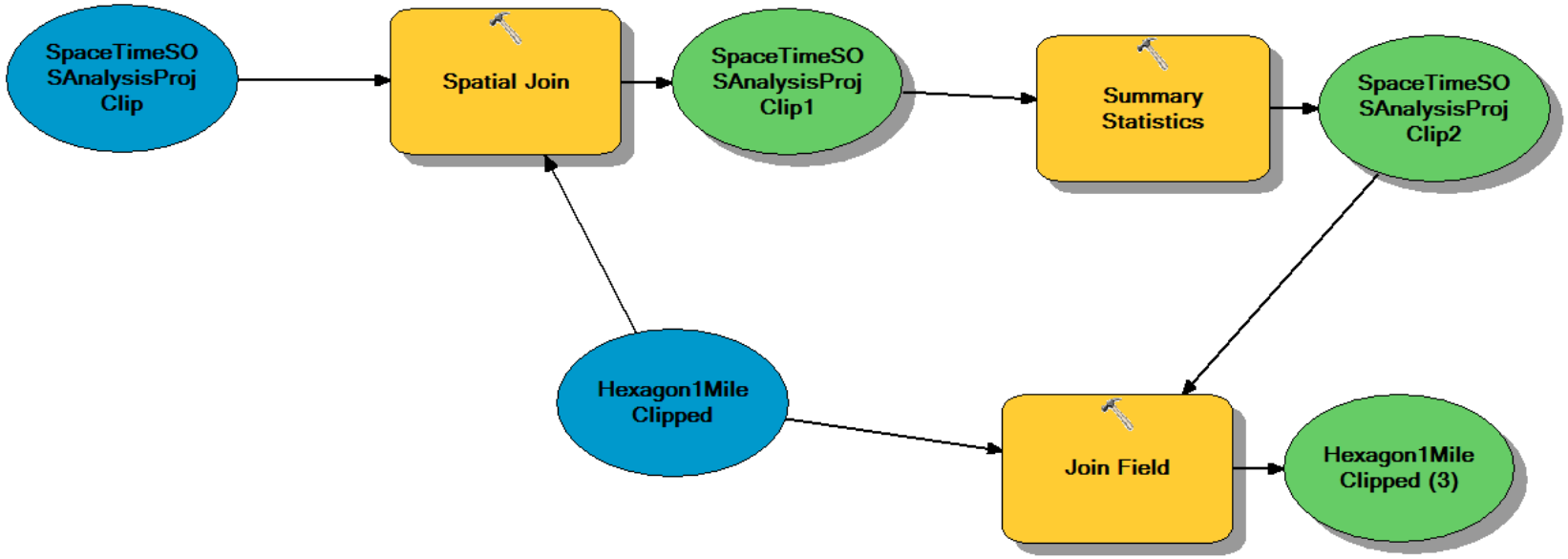
- This Clipping will be very important to the Hot Spot Analysis



Aggregate by Hexagon Polygon

- In order to aggregate by Hexagon Polygon, you will need to have the Hexagon Polygons. To create you can search for “Hexagon” the result will show a “Generate Tessellation” tool.
- You can use this “Generate Tessellation” tool to also create Triangles and Square polygons to use for Aggregation.
  - There was a performance issue with using Feet to define how big the polygon should be, so instead of using 2640 feet use 0.5 miles and you will get the Hexagons created much faster.

Aggregate by Hexagon Polygon using GRID_ID as the key



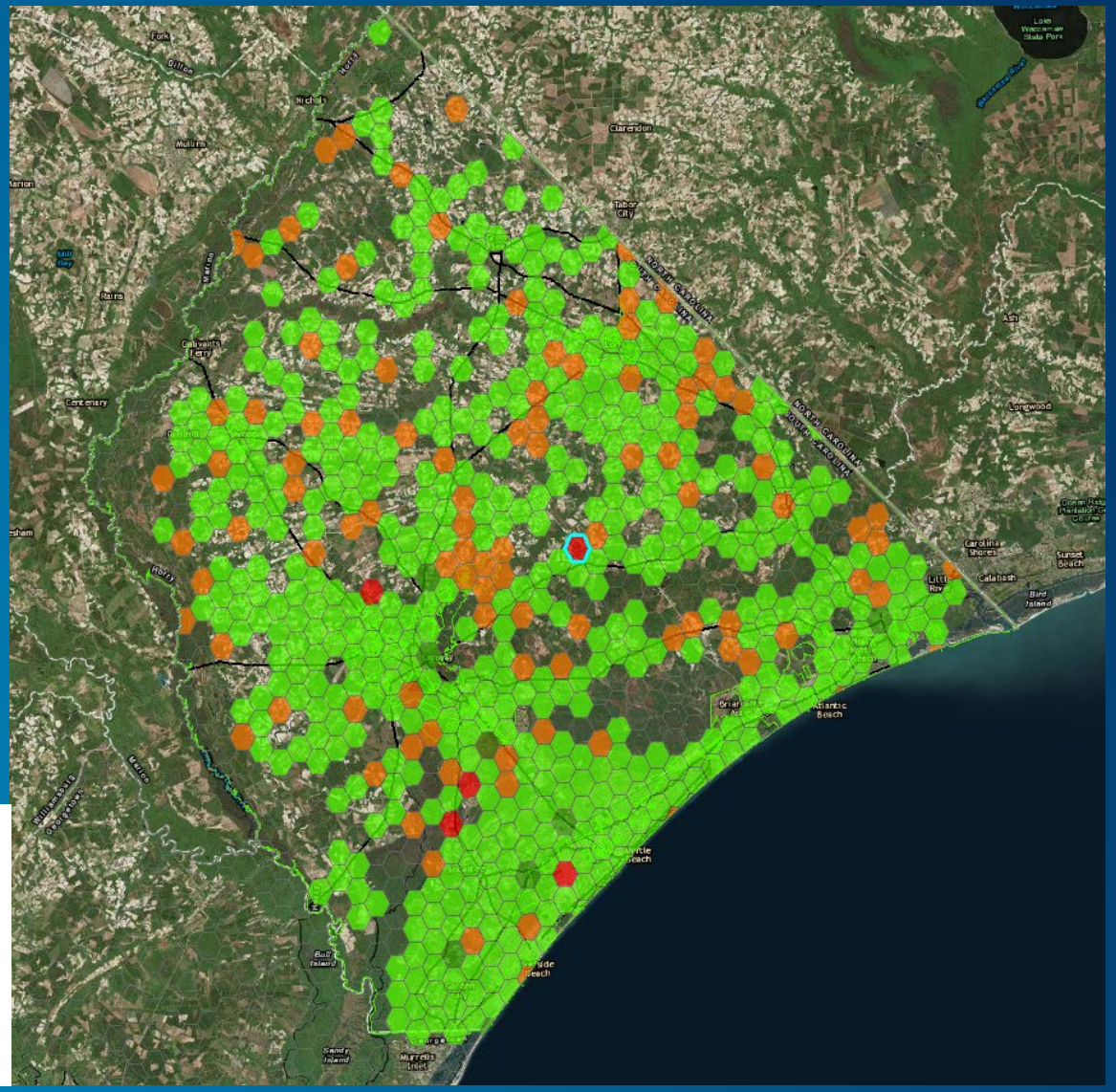
Aggregate Service Order Activity into the Hexagon Polygon

You notice that now we can start to see patterns of where we would need to focus.

- We should ask ourselves why are we losing customer services in the red and orange hexagons?

If the change in Order Activity was Zero, I decided not to fill that Hexagon in, but leave it blank.

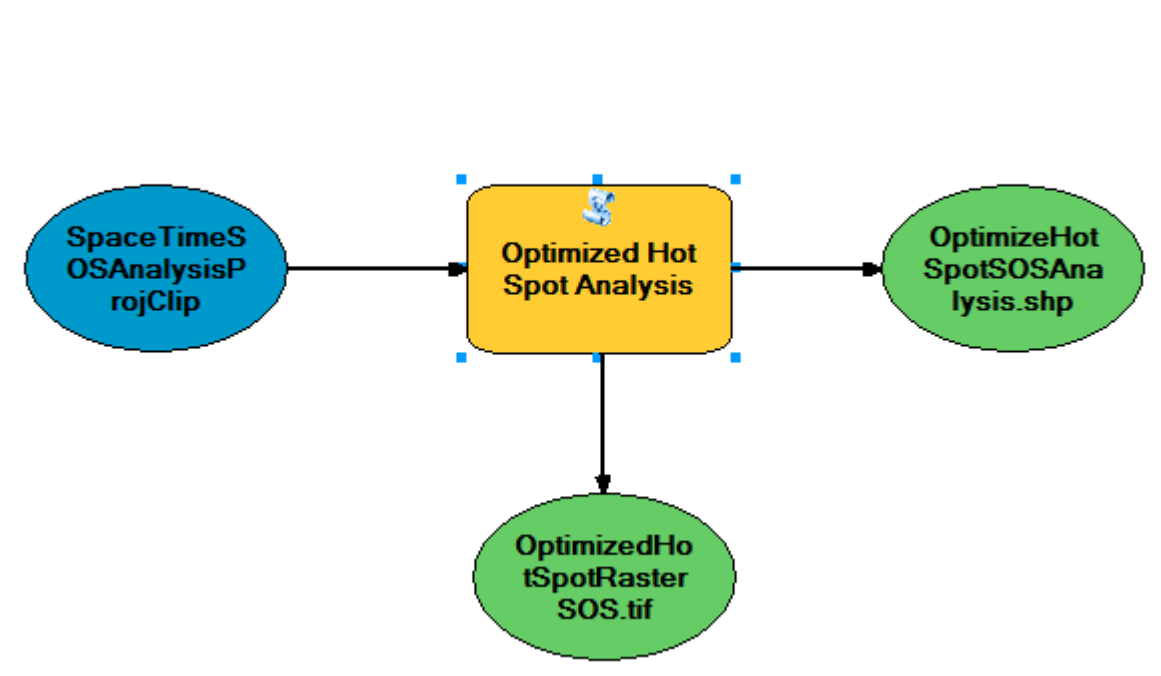
These patterns however do not show effect over time, but instead looks at all of the history at once.



Hexagon1MileClipped
SUM_Activi
-7.000000 - -5.000000
-4.999999 - -0.000001
0.000000
0.000001 - 50.000000
50.000001 - 90.000000
90.000001 - 268.000000

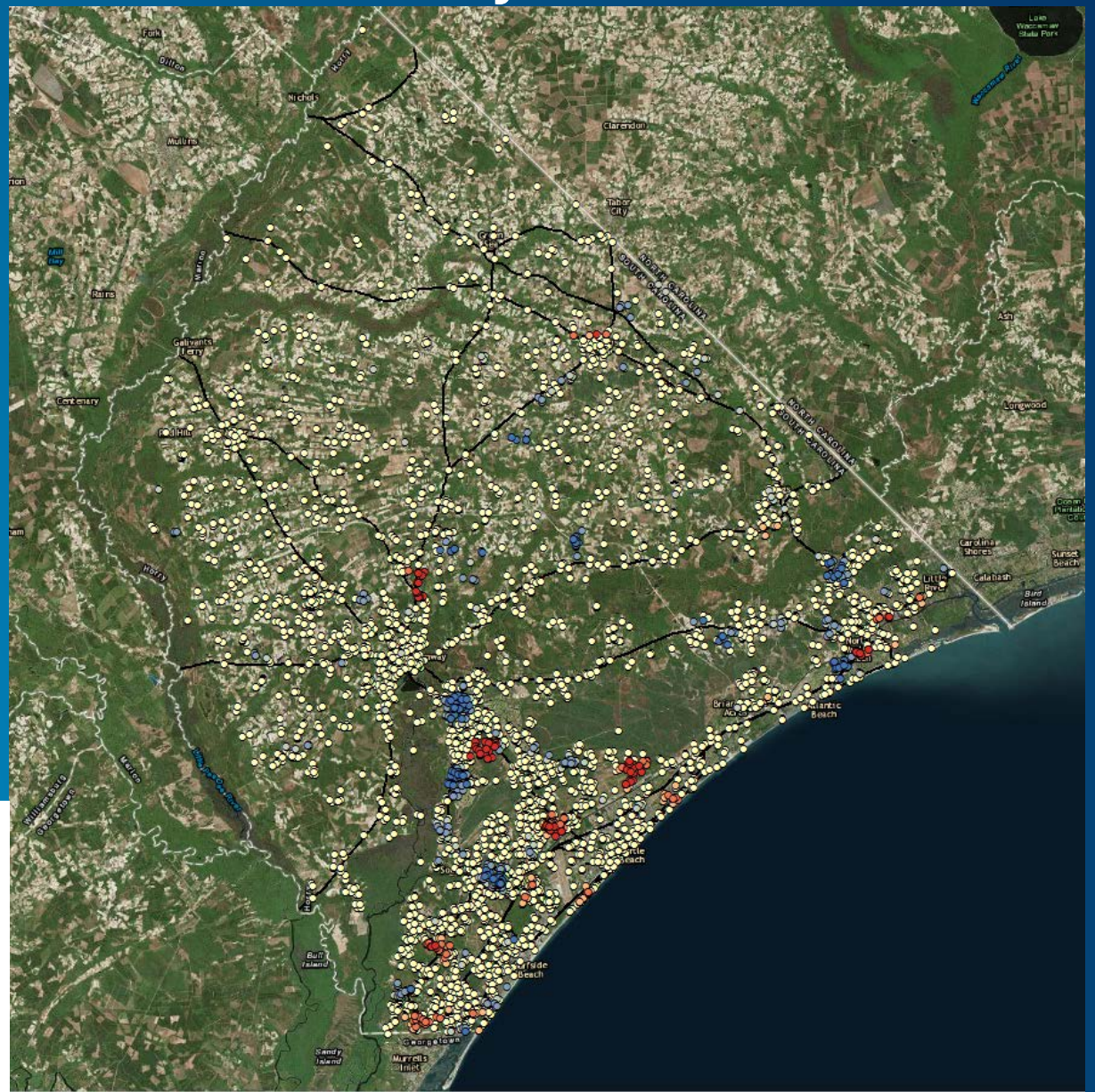
Optimized Hot Spot Analysis

- This tool will pick the optimized parameters to analyze your dataset.
- Again, it does not consider time into the equation.



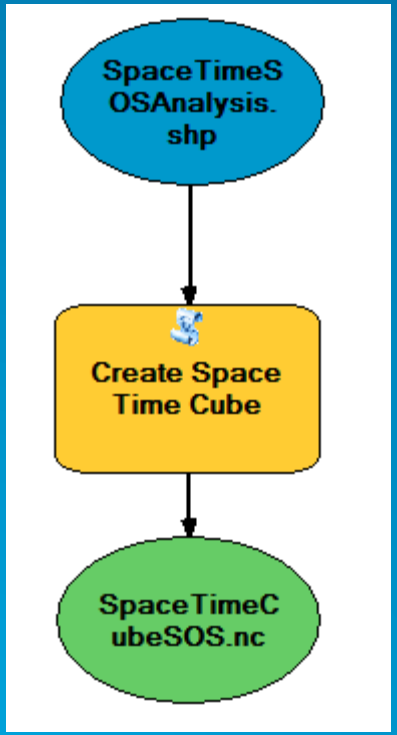
Optimized Hot Spot Analysis of Service Order Activity

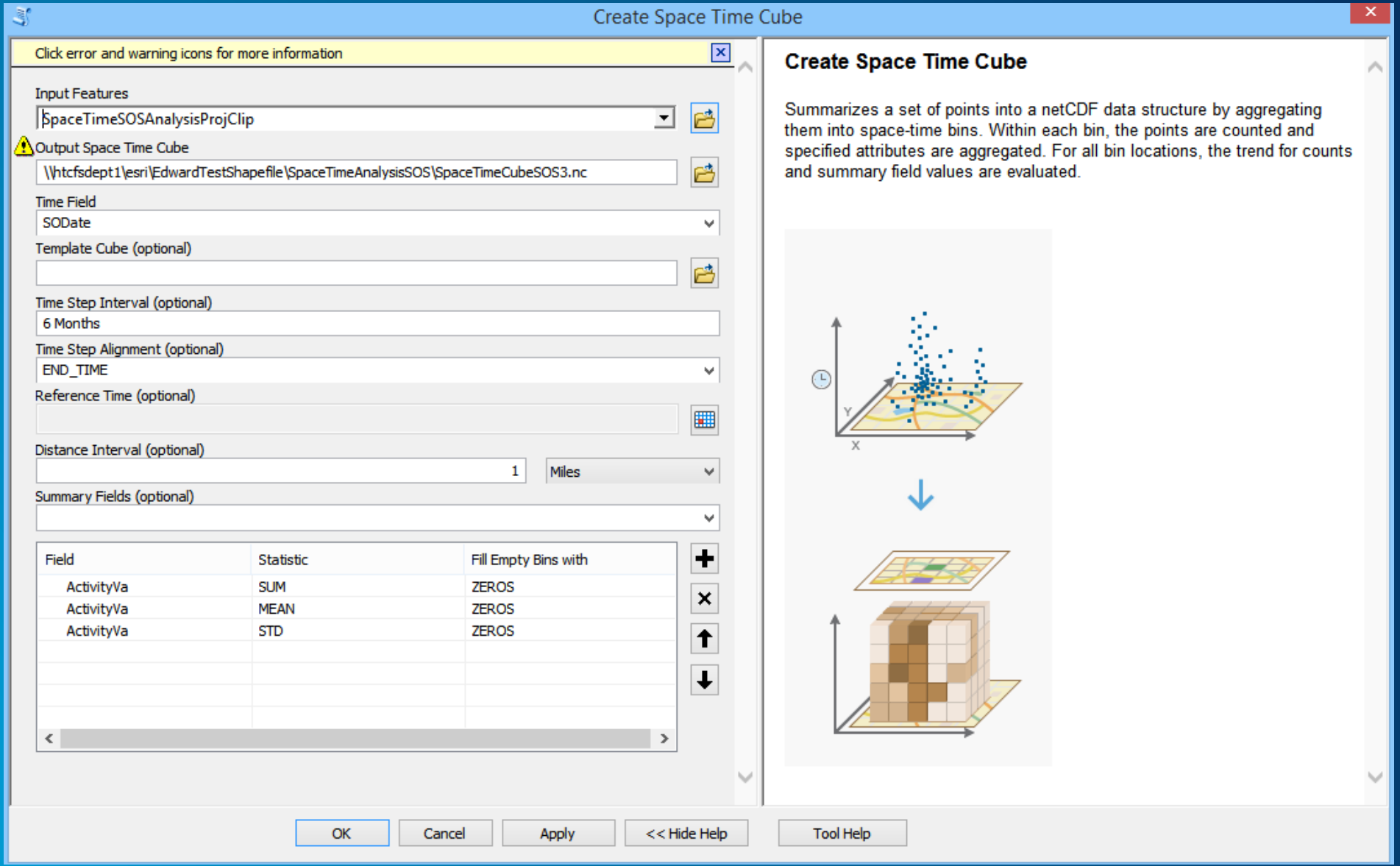
- Not every Red Point is a New Install, and not every Blue Point is a Disconnect.
- The Red Points show where we have a significant area of New Install Activity
- The Blue Points show where we have a significant area of Disconnects.
- Not using Time in analysis, so this covers all of History.

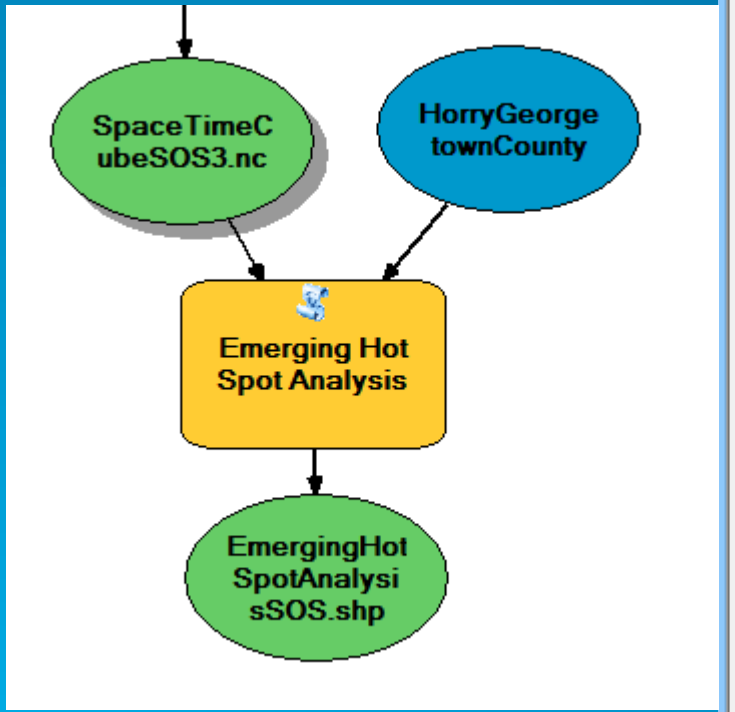


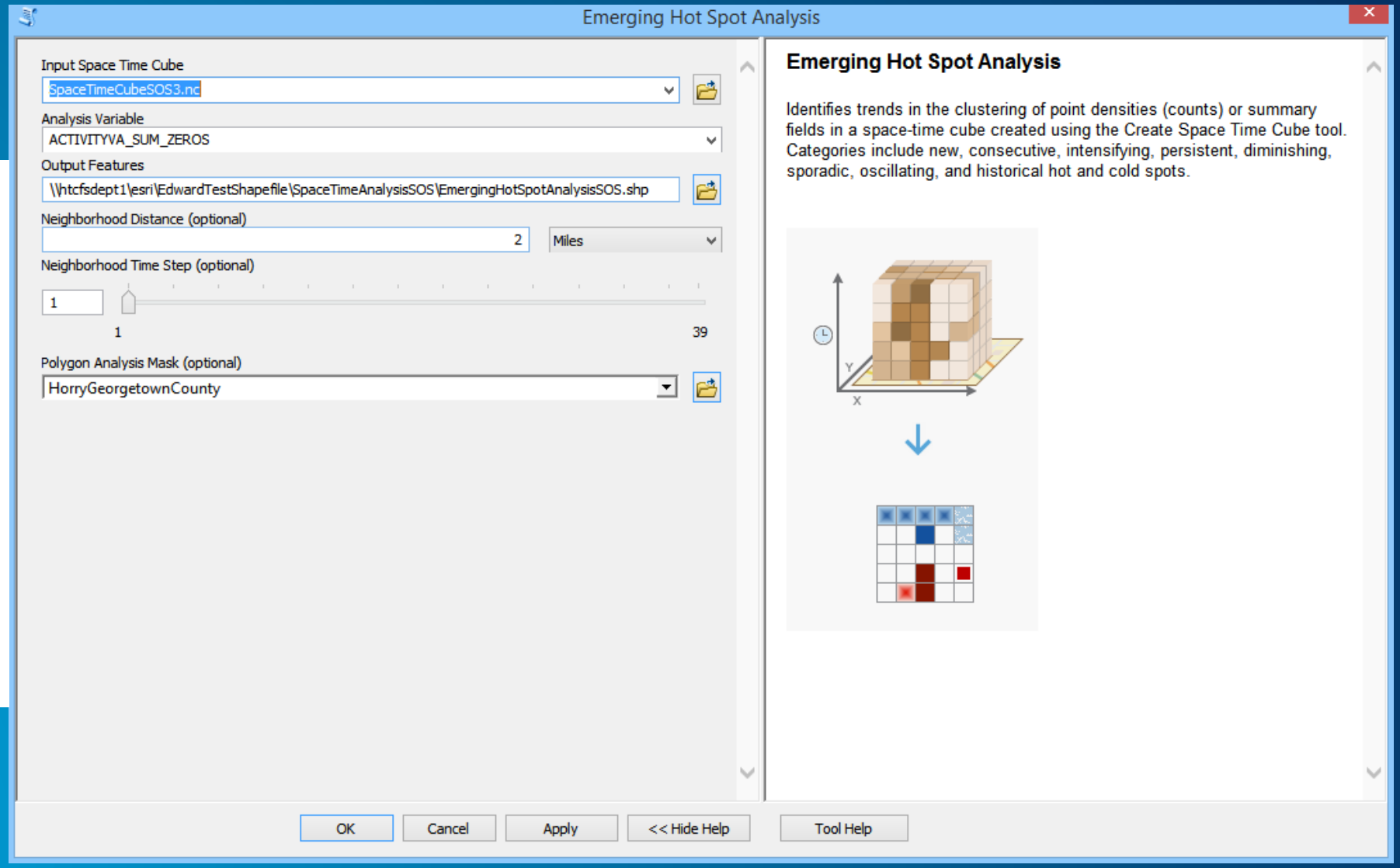
OptimizeHotSpotSOSAnalysis
Gi_Bin
- Cold Spot - 99% Confidence
- Cold Spot - 95% Confidence
- Cold Spot - 90% Confidence
- Not Significant
- Hot Spot - 90% Confidence
- Hot Spot - 95% Confidence
- Hot Spot - 99% Confidence

Create Space Time Cube



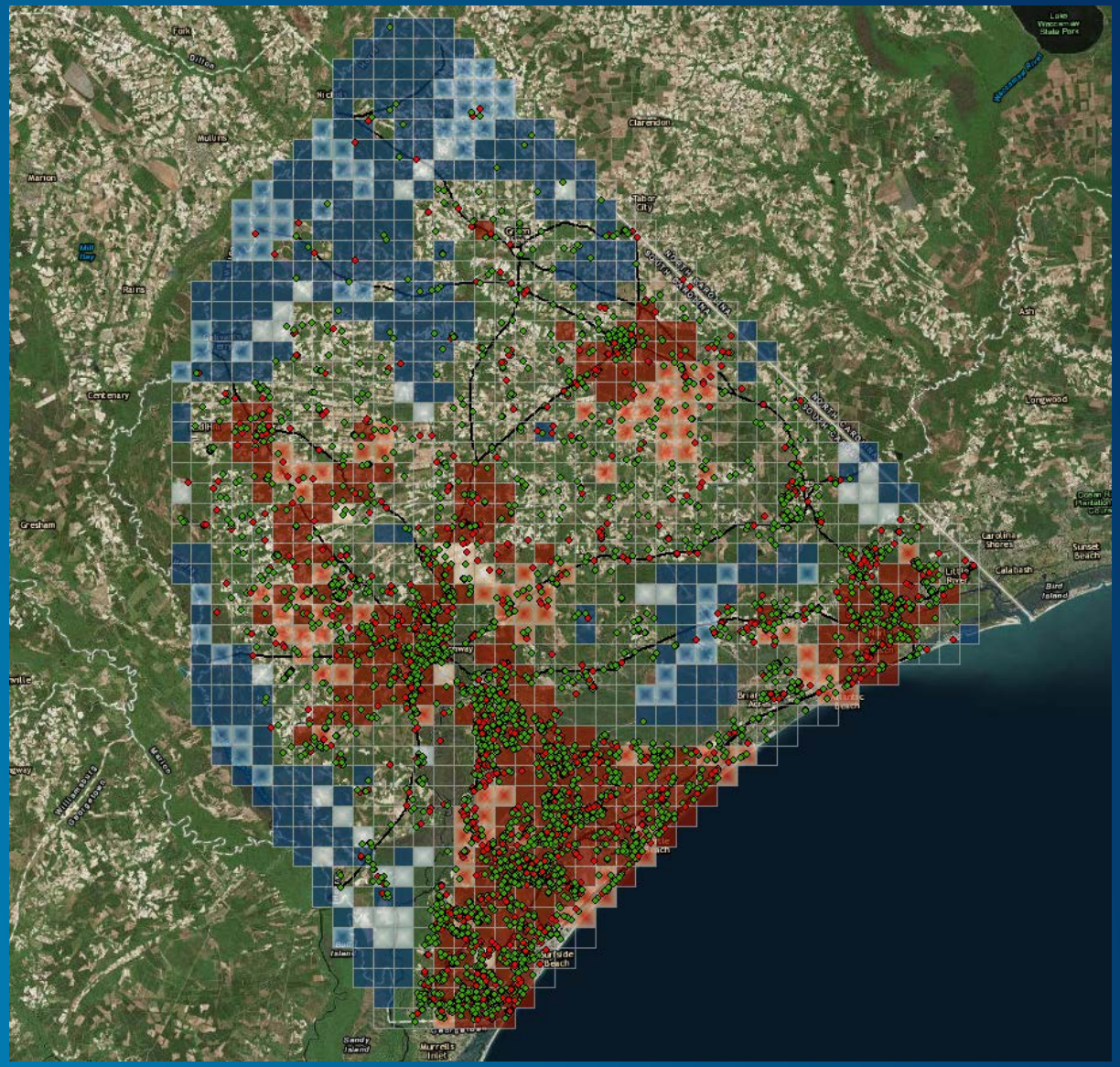



SpaceTimeCubeSOS3.nc
HorryGeorgetownCounty
Emerging Hot Spot Analysis
EmergingHotSpotAnalysisSOS.shp

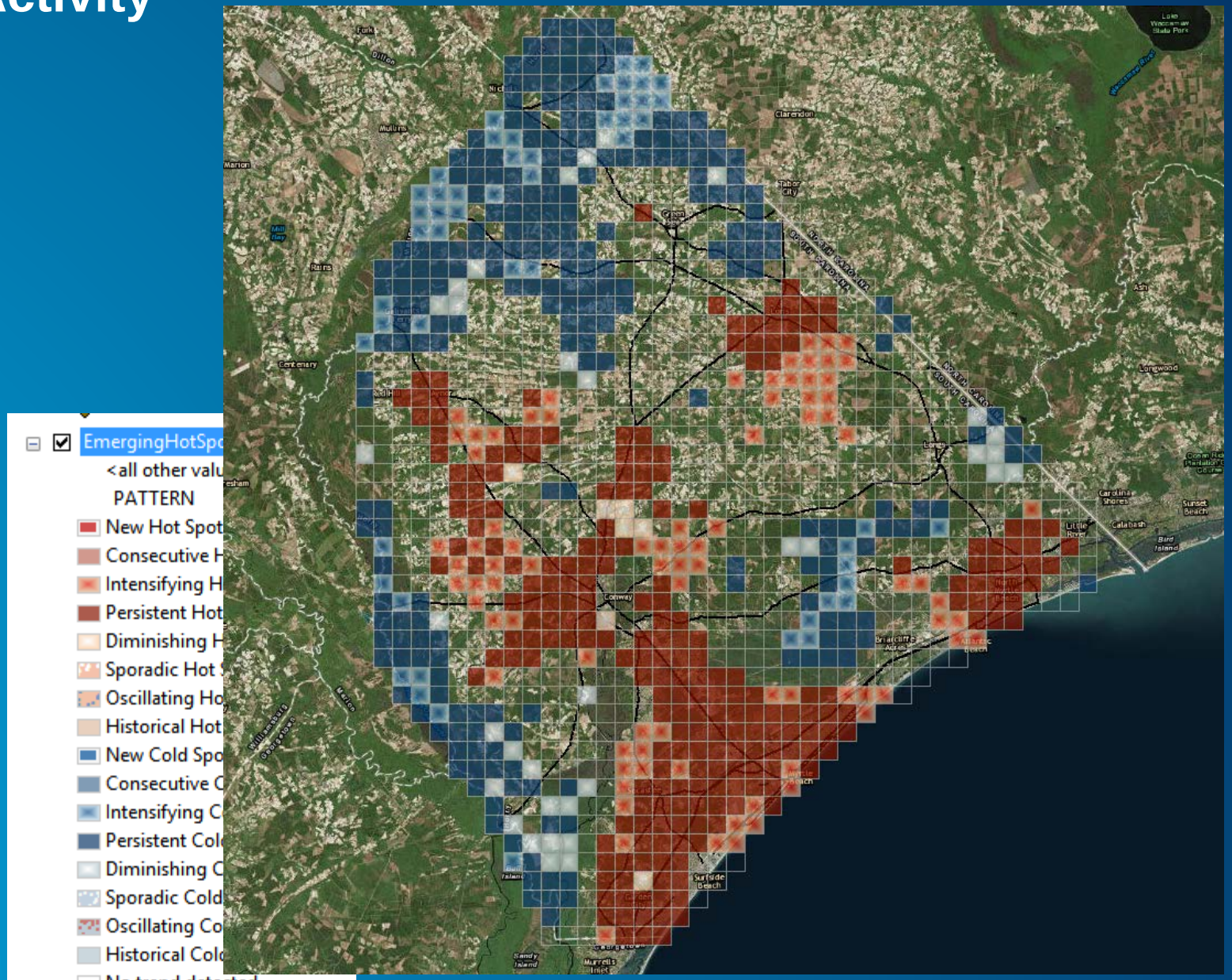

Emerging Hot Spot Analysis
Input Space Time Cube
SpaceTimeCubeSOS3.nc
Analysis Variable
ACTIVITYVA_SUM_ZEROS
Output Features
\\htcfsdept1\esri\EdwardTestShapefile\SpaceTimeAnalysisSOS\EmergingHotSpotAnalysisSOS.shp
Neighborhood Distance (optional)
2
Miles
Neighborhood Time Step (optional)
1
1
39
Polygon Analysis Mask (optional)
HorryGeorgetownCounty
Emerging Hot Spot Analysis
Identifies trends in the clustering of point densities (counts) or summary fields in a space-time cube created using the Create Space Time Cube tool. Categories include new, consecutive, intensifying, persistent, diminishing, sporadic, oscillating, and historical hot and cold spots.
Y
X
OK
Cancel
Apply
<< Hide Help
Tool Help

Comparing Output with our created Points

You need to do a sanity check to make sure that the Hot Spot are where you think they should be.



How to read the results of the Space Time Analysis of Order Activity



Questions

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