



Analyzing Card Information and Service Points with Online Geographic Information Mapping and Overlays

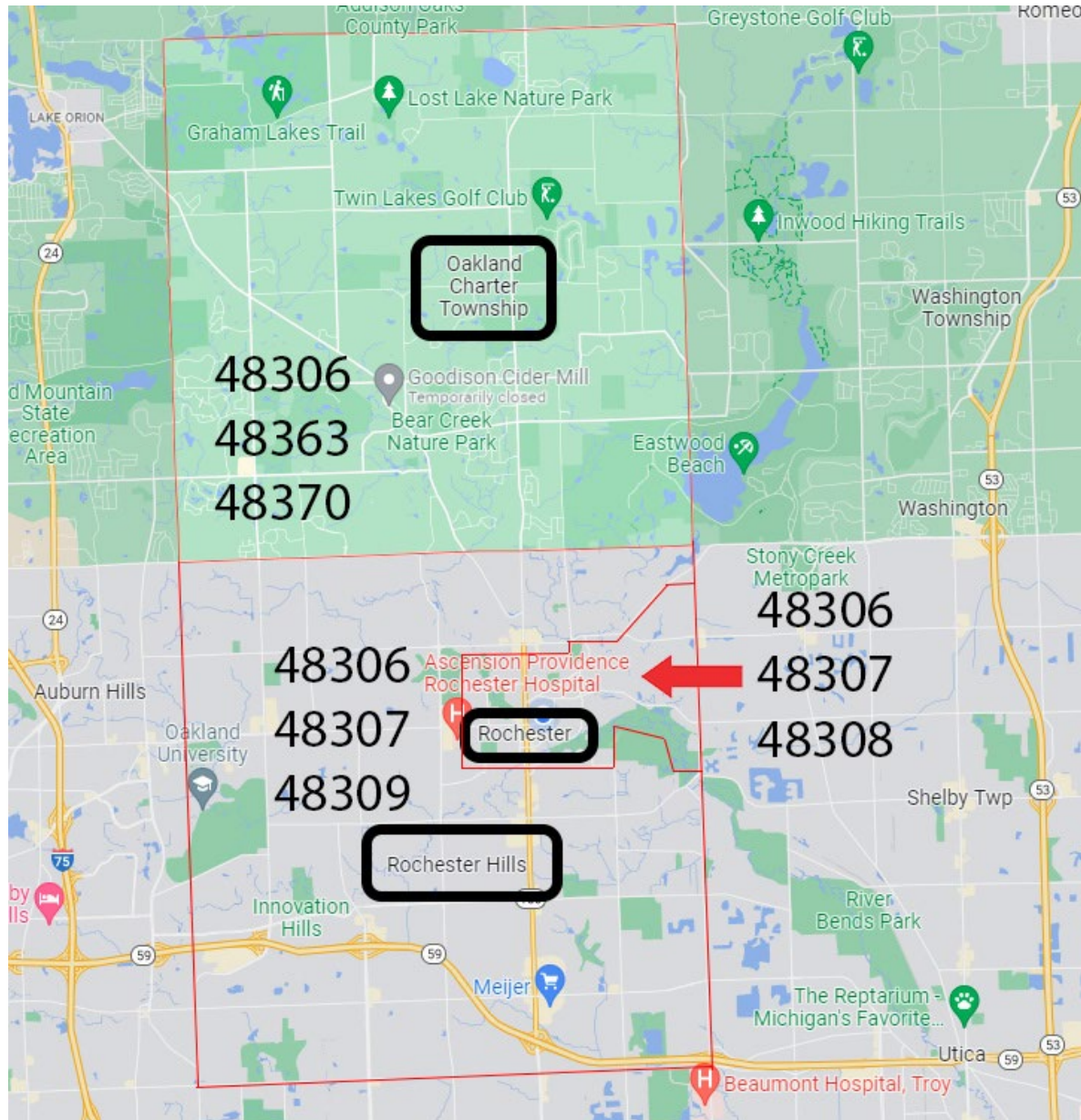
Derek Brown (Director of IT and Building Services at the Rochester Hills Public Library)



Introduction for myself and our Library.

- Derek Brown (Director of Information Technology and Building Services for the Rochester Hills Public Library).
- IT professional with an educational background in public administration.
- Served on the IUG Steering Committee in the past as well as a new tenure beginning in 2022.
- The Rochester Hills Public Library is a single location with two bookmobiles and multiple of mini-branches.
- Circulation of roughly two million items (pre-covid yearly) with 68,000+ active library cards.

Confused Service Population



RHPL serves the largest population size in Oakland County (Second largest county in Michigan).

Rochester Hills: 76,300

Oakland Township: 20,067

Rochester: 13,035

Total Population Served: 109,402

No one really knows where they live... Zip codes overlap.

Michigan drivers licenses are often wrong. Google is often wrong.

Washington residents use our post office as their home branch as well as some students attend our schools.

Project Outline

Short-term Goals:

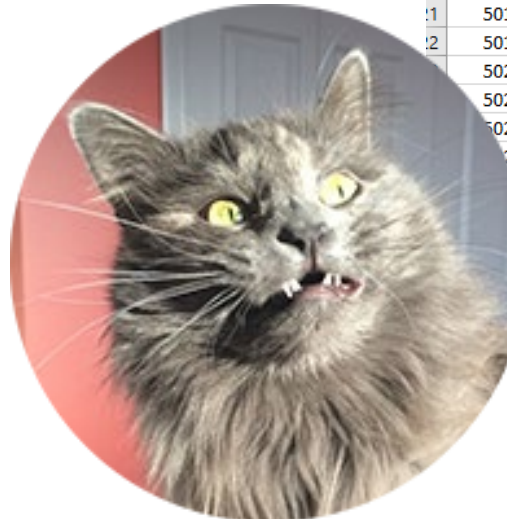
- Clean up existing resident library card address data for imperfections (mistypes, invalid symbols/characters, misspellings).
- Standardize our data with organized prefix/suffix/case of text/abbreviations.
- Re-evaluate all city data based on valid authority records (Misconceptions, drivers license abnormalities, etc.).

Long-term Goals:

- Incorporate our data with ArcGIS (leveraging Rochester Hills GIS team) to visualize our addresses with robust overlays such as census data (ages, household sizes, primary languages, income, etc.) and population density (assisting mobile services – bookmobile).
- Increasing library card enrollment by targeting specific areas with low adoption rating.
- Maintaining valid data for accurate reporting.

BAD data is BAD (examples)

- Apartments, Suites, Units, etc. formatting was all over the place. Some used Apartment, Apt, APT., #?
- Addresses often were missing prefixes, suffixes, or in the wrong spot.
- Some addresses were capitalized while others were missing case.
- Commas were a common occurrence.
- Some were not located in the state of Michigan...
- Misspellings abundant.



AddressID	StreetOne	PostalCod	City	State
181294	1582 Nadine S			
181353	638 Lexington			
90106	1632 Newcastle			
344371	332 Knorrwood Dr			
344373	332 Knorrwood Dr			
344411	2790 Harrington			
344426	52 South Plaza Blvd #268			
344430	140 Cloverport			
314831	305 Meadow Bridge Dr #90			
501371	376 ABBEY WOOD DR			
501524	1860 Haverhill			
501585	613 Dorchester Drive #116			
501717	511 Yorkshire			
501858	744 Southwood Court			
501862	1424 Deerhurst Lane			
501864	2760 Upper Ridge Dr. #13			
501870	1729 Snowden Circle			
501875	2649 Mohawk Lane			
501889	2349 Millbrook Court			
501926	1527 Porter Circle			
501930	640 W South Blvd			
502023	435 S. Livernois,			
502039	4220 Oak Arbor Ct			
502046	208 Parsons			
502109	875 W. Avon Rd. #304C			
502126	1775 Cliffview Dr #N743			
502167	2131 S Bretton Dr			
502185	141 Rose Brier			
502112	3027 Richmond			
502136	1075 Seville			
5021356	2969 Powderhorn Ridge			
5021408	2640 Galloway Ct #202			

Book	Sheet	N	Cell	Value
Roches...	Roch...	\$B\$8		52 South Plaza Blvd #268
Roches...	Roch...	\$B\$...		305 Meadow Bridge Dr # 90
Roches...	Roch...	\$B\$...		613 Dorchester Drive #116
Roches...	Roch...	\$B\$...		2760 Upper Ridge Dr. #13
Roches...	Roch...	\$B\$...		875 W. Avon Rd. #304C
Roches...	Roch...	\$B\$...		1775 Cliffview Dr #N743
Roches...	Roch...	\$B\$...		3640 Galloway Ct #202
Roches...	Roch...	\$B\$...		2384 Wiltshire Court #102
Roches...	Roch...	\$B\$...		941 Ironwood Sq #272
Roches...	Roch...	\$B\$...		751 Ironwood Dr #237
Roches...	Roch...	\$B\$...		175 East Nawakwa #242
Roches...	Roch...	\$B\$...		975 Woodlane Drive #1
Roches...	Roch...	\$B\$...		654 Old Perch Rd #1
Roches...	Roch...	\$B\$...		1651 Lodge Pole Ln #230
Roches...	Roch...	\$B\$...		545 Timberlea Dr #156
Roches...	Roch...	\$B\$...		712 Green Circle #205
Roches...	Roch...	\$B\$...		1725 Bedford Sq Dr #203
Roches...	Roch...	\$B\$...		2780 Upper Ridge Dr apt #2
Roches...	Roch...	\$B\$...		569 Great Oaks Blvd #26
Roches...	Roch...	\$B\$...		2083 Yarmuth Drive #95

Local Partnerships

- We worked directly with the City of Rochester Hills' GIS team to acquire lists of all known addresses for all three areas of importance (postal mailing information only – no personal information).
- The GIS team had direct access into the Oakland County records which allowed us to bypass Freedom of Information Act requests for both the City of Rochester and the Charter Township of Oakland.
- Initial efforts were direct to the smaller entities, but they do not have the dedicated staffing like the City of Rochester Hills (making the FOIA request necessary).
- Rochester Hills GIS also recommended ArcGIS due to their familiarization with the product and it being a market leader in GIS mapping.
- Alternatively; Michigan's municipalities use BS&A (bsaonline.com) for all public records online. This is a great tool to pinpoint exactly where an address pays it's taxes, but searches are 1:1.

Local GIS Data

The master list (CSV) from Rochester Hills allowed us to easily see accurate data to make direct comparisons.

Having the pre-directions, post-directions, street type, and apartment number segmented helped us to track down oddities.

Rochester and Oakland Township handled their apartment numbers differently and did not segment their information.

Site	Street Address	CITY	STATE	HOUSE NUMBER	STREET	Apartment No	Pre Direction	Street Name	Street Type	Post Direction	SITE ZIP5
1	1385 Mahaffy Ave	Rochester Hills	MI	1385	Mahaffy Ave			Mahaffy Ave			48307
3	1488 N Rochester Rd	Rochester Hills	MI	1488	N Rochester Rd		N	Rochester	Rd		48307
4	1480 N Rochester Rd	Rochester Hills	MI	1480	N Rochester Rd		N	Rochester	Rd		48307
5	216 Nawakwa Rd	Rochester Hills	MI	216	Nawakwa Rd			Nawakwa	Rd		48307
6	2160 South Blvd W	Rochester Hills	MI	2160	South Blvd W			South	Blvd	W	48309
7	546 S Rochester Rd	Rochester Hills	MI	546	S Rochester Rd		S	Rochester	Rd		48307
8	2699 Hartline Dr	Rochester Hills	MI	2699	Hartline Dr			Hartline	Dr		48309
9	2713 Hartline Dr	Rochester Hills	MI	2713	Hartline Dr			Hartline	Dr		48309
10	3850 Walnut Brook Dr	Rochester Hills	MI	3850	Walnut Brook Dr			Walnut Brook	Dr		48309
11	923 S Rochester Rd	Rochester Hills	MI	923	S Rochester Rd		S	Rochester	Rd		48307
12	1454 N Rochester Rd	Rochester Hills	MI	1454	N Rochester Rd	APT. 112	N	Rochester	Rd		48307
13	1454 N Rochester Rd	Rochester Hills	MI	1454	N Rochester Rd	APT. 111	N	Rochester	Rd		48307
14	1490 N Rochester Rd	Rochester Hills	MI	1490	N Rochester Rd		N	Rochester	Rd		48307
15	80 E Tienken Rd	Rochester Hills	MI	80	E Tienken Rd		E	Tienken	Rd		48306
16	3210 Crooks Rd	Rochester Hills	MI	3210	Crooks Rd			Crooks	Rd		48309
17	208 Cloverport Ave	Rochester Hills	MI	208	Cloverport Ave			Cloverport	Ave		48307
18	1039 S Rochester Rd	Rochester Hills	MI	1039	S Rochester Rd		S	Rochester	Rd		48307
19	6700 N Rochester Rd	Rochester Hills	MI	6700	N Rochester Rd		N	Rochester	Rd		48306
20	2466 Hessel Ave	Rochester Hills	MI	2466	Hessel Ave			Hessel	Ave		48307
21	2474 Hessel Ave	Rochester Hills	MI	2474	Hessel Ave			Hessel	Ave		48307
22	3828 Walnut Brook Dr	Rochester Hills	MI	3828	Walnut Brook Dr			Walnut Brook	Dr		48309
23	691 Mountain Cir	Rochester Hills	MI	691	Mountain Cir			Mountain	Cir		48306
24	687 Mountain Cir	Rochester Hills	MI	687	Mountain Cir			Mountain	Cir		48306
25	280 Dalton Dr	Rochester Hills	MI	280	Dalton Dr			Dalton	Dr		48307
26	855 S Rochester Rd	Rochester Hills	MI	855	S Rochester Rd		S	Rochester	Rd		48307
27	262 Dalton Dr	Rochester Hills	MI	262	Dalton Dr			Dalton	Dr		48307
28	1454 N Rochester Rd	Rochester Hills	MI	1454	N Rochester Rd	APT. 104	N	Rochester	Rd		48307
29	1454 N Rochester Rd	Rochester Hills	MI	1454	N Rochester Rd	APT. 103	N	Rochester	Rd		48307
30	1454 N Rochester Rd	Rochester Hills	MI	1454	N Rochester Rd	APT. 102	N	Rochester	Rd		48307
31	1454 N Rochester Rd	Rochester Hills	MI	1454	N Rochester Rd	APT. 101	N	Rochester	Rd		48307
32	2344 Oklahoma Ct	Rochester Hills	MI	2344	Oklahoma Ct			Oklahoma	Ct		48309
33	636 Langley Rd	Rochester Hills	MI	636	Langley Rd			Langley	Rd		48309
34	658 Langley Rd	Rochester Hills	MI	658	Langley Rd			Langley	Rd		48309
35	647 Wellington Cir	Rochester Hills	MI	647	Wellington Cir			Wellington	Cir		48309
36	551 Wellington Cir	Rochester Hills	MI	551	Wellington Cir			Wellington	Cir		48309
37	539 Wellington Cir	Rochester Hills	MI	539	Wellington Cir			Wellington	Cir		48309
38	527 Wellington Cir	Rochester Hills	MI	527	Wellington Cir			Wellington	Cir		48309

Verified Data on Polaris

Uploading verified address data into our Polaris SQL allows us to make cross-references for address checks.

We kept each city segmented due to inconsistencies (ex. Rochester Hills uses APT.Number versus Oakland Township uses Apt #Number).

This also makes it easy to find patrons in the wrong city with the verified street data.

The screenshot shows the Microsoft SQL Server Management Studio interface. The Object Explorer on the left displays the database structure for 'S-POLPROD01 (SQL Server 15.0.2080.9 - [redacted])'. The 'Tables' folder is expanded, showing various tables including 'dbo.Otmaster', 'dbo.RHmaster', and 'dbo.Rmaster'. The main window displays a SQL query in the 'Query Editor' pane:

```
SELECT TOP (100000) [StreetOne]
, [City]
, [StreetTwo]
, [Zip]
, [PostalCodeID]
FROM [Polaris].[dbo].[RHmaster]
```

The 'Results' pane shows the output of the query, displaying a list of records with columns: StreetOne, City, Street Two, Zip, and PostalCodeID. The results are filtered to show records for Rochester Hills.

	StreetOne	City	Street Two	Zip	PostalCodeID
1...	1404 Sylvan Cir	Rochester Hills		48307	26936
1...	1446 Sylvan Cir	Rochester Hills		48307	26936
1...	1442 Sylvan Cir	Rochester Hills		48307	26936
1...	1456 Sylvan Cir	Rochester Hills		48307	26936
1...	912 Pine Trail Dr	Rochester Hills		48307	26936
1...	875 W Avon Rd	Rochester Hills		48307	26936
1...	875 W Avon Rd	Rochester Hills	APT. 124	48307	26936
1...	875 W Avon Rd	Rochester Hills	APT. 126	48307	26936
1...	875 W Avon Rd	Rochester Hills	APT. 205	48307	26936
1...	875 W Avon Rd	Rochester Hills	APT. 221	48307	26936
1...	875 W Avon Rd	Rochester Hills	APT. 223	48307	26936
1...	875 W Avon Rd	Rochester Hills	APT. 226	48307	26936
1...	950 W Avon Rd	Rochester Hills		48307	26936
1...	950 W Avon Rd	Rochester Hills		48307	26936
1...	702 Glen Cir	Rochester Hills		48307	26936
1...	750 Glen Cir	Rochester Hills		48307	26936
1...	754 Glen Cir	Rochester Hills		48307	26936
1...	758 Glen Cir	Rochester Hills		48307	26936
1...	692 Glen Cir	Rochester Hills		48307	26936
1...	694 Glen Cir	Rochester Hills		48307	26936
1...	696 Glen Cir	Rochester Hills		48307	26936
1...	698 Glen Cir	Rochester Hills		48307	26936
1...	1098 Northview Ln	Rochester Hills		48307	26936

The status bar at the bottom indicates 'Query executed successfully.' and 'Ln 1'.

Phase 1: Examine Existing Data

Distinct Address IDs associated with Patron records inspected during the first pass-through

Rochester Hills (w/ apts)	47,158	10,830 unmatched
Rochester:	10,109	5,324 unmatched
Oakland Township:	8,119	2,135 unmatched

72.03% Validity

Initial bulk clean up completed...

Rochester Hills:	47,158	5,776 unmatched
Rochester:	Untouched	
Oakland Township:	Untouched	

Phase 2: Street, City, and Zip Corrections

After a detailed cleaning of all three service populations we've found significant changes to our data

Rochester Hills (w/o apts):	41,199	1,493 unmatched
Rochester:	9,072	973 unmatched
Oakland Township:	10,075	191 unmatched

95.59% Validity

Phase 3: Verified accounts and future planning

- We use a nightly SQL job to mark our accounts with “verified” addresses. The code inspects all accounts (new or old) comparing the existing card data to our known addresses for all patron codes that are considered “residents”.
- Marking an account as “not verified” allows our staff to build record sets and perform manual inspection for data clean up. Once the low hanging fruit has been completed the next step will be to notify patrons for corrections. There are addresses that are impossible to correct without patron involvement.
- Our team wants to build SQL statements that will cross-compare addresses for automatic switching of zip/city since this is the majority of our issues (ex. Rochester -> Rochester Hills).
- We hope to embark on developing a library card sign-up page that will handle the majority of all address verification prior to account creation. Using our known address data to pre-populate street addresses as a patron fills out information.
- Added complexity layer: RHPL and Rochester Community Schools synchronizes card data every week and their data is often dirty.
- Our goal is to have (and to hold onto) +98% validity for all residents by the end of 2022.

Object Explorer

Connect

- Tables
 - System Tables
 - FileTables
 - External Tables
 - Graph Tables
 - dbo.actemp
 - dbo.addressfix
 - dbo.bigdata
 - dbo.bkmconf
 - dbo.clean
 - dbo.CNV_rhp_LostItems
 - dbo.hoopla
 - dbo.OTmaster
 - dbo.productionimport
 - dbo.RCSaccountcreate
 - dbo.RCSMaster
 - dbo.RHmaster**
 - dbo.RHPLc
 - dbo.RHPLc2
 - dbo.rhplid
 - dbo.RHPLIDPool
 - dbo.Rmaster
 - Polaris._AuthorityDiacr
 - Polaris._AuthoritySubfi
 - Polaris._AuthorityTemp
 - Polaris._BibliographicD
 - Polaris._BibliographicSi
 - Polaris._BibTemplateSu
 - Polaris._Cat_BulkBibCh
 - Polaris._CNV_DupAuth
 - Polaris._InvoiceAmts96
 - Polaris._Invoices9633_
 - Polaris._IRREcords_
 - Polaris._IRREcordStores
 - Polaris._PatronAddress
 - Polaris._POAmounts96
 - Polaris.AccessSpecifiers

```
-- Inspect addresses from Rochester Hills and flag verified
Update Polaris.polaris.patronregistration
SET User3 = 'Verified'
FROM polaris.polaris.patronregistration as PR with (nolock)
inner join polaris.polaris.patrons as P with (nolock) on PR.PatronID = P. PatronID
inner join polaris.polaris.PatronAddresses as PA with (nolock) on PR.PatronID = PA.PatronID
inner join polaris.polaris.Addresses as AD with (nolock) on PA.AddressID = AD.AddressID
inner join polaris.polaris.PostalCodes as PC with (nolock) on AD.PostalCodeID = PC.PostalCodeID
where PC.City = 'Rochester Hills'
AND AD.StreetOne in (
Select RH.StreetOne
from polaris.dbo.RHmaster as RH with (nolock))

-- Cleaning data after inspection to make sure patrons with multiple of addresses are marked unverified

-- Inspect addresses to remove from Oakland Township and unflag unverified
Update Polaris.polaris.patronregistration
SET User3 = 'Not Verified'
FROM polaris.polaris.patronregistration as PR with (nolock)
inner join polaris.polaris.patrons as P with (nolock) on PR.PatronID = P. PatronID
inner join polaris.polaris.PatronAddresses as PA with (nolock) on PR.PatronID = PA.PatronID
inner join polaris.polaris.Addresses as AD with (nolock) on PA.AddressID = AD.AddressID
inner join polaris.polaris.PostalCodes as PC with (nolock) on AD.PostalCodeID = PC.PostalCodeID
where PC.City = 'Oakland Township'
AND AD.StreetOne not in (
Select OT.StreetOne
from polaris.dbo.OTmaster as OT with (nolock))

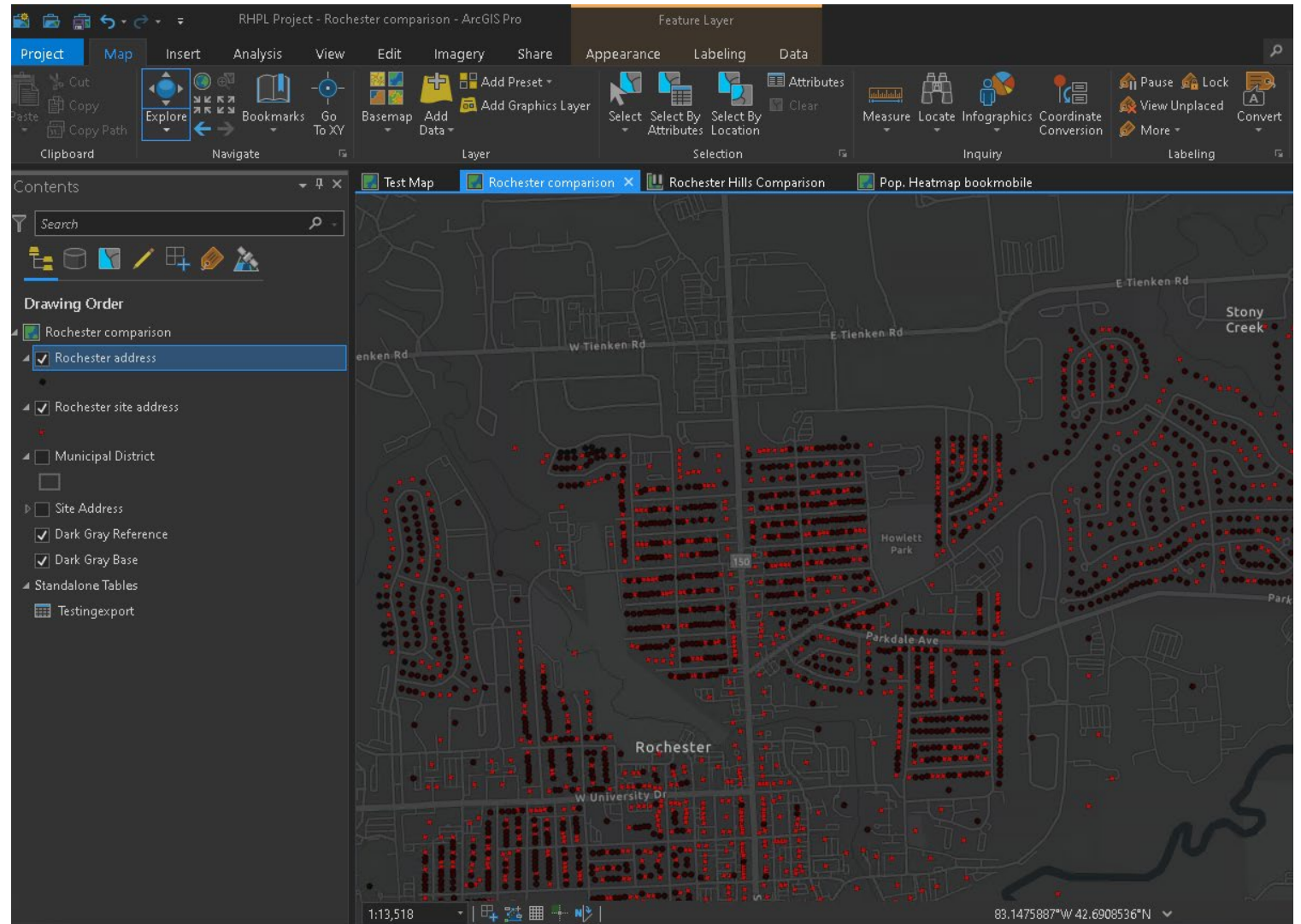
-- Inspect addresses to remove from Rochester and unflag unverified
Update Polaris.polaris.patronregistration
SET User3 = 'Not Verified'
FROM polaris.polaris.patronregistration as PR with (nolock)
inner join polaris.polaris.patrons as P with (nolock) on PR.PatronID = P. PatronID
inner join polaris.polaris.PatronAddresses as PA with (nolock) on PR.PatronID = PA.PatronID
inner join polaris.polaris.Addresses as AD with (nolock) on PA.AddressID = AD.AddressID
inner join polaris.polaris.PostalCodes as PC with (nolock) on AD.PostalCodeID = PC.PostalCodeID
where PC.City = 'Rochester'
AND AD.StreetOne not in (
Select R.StreetOne
```

100 %

Connected. (1/1)

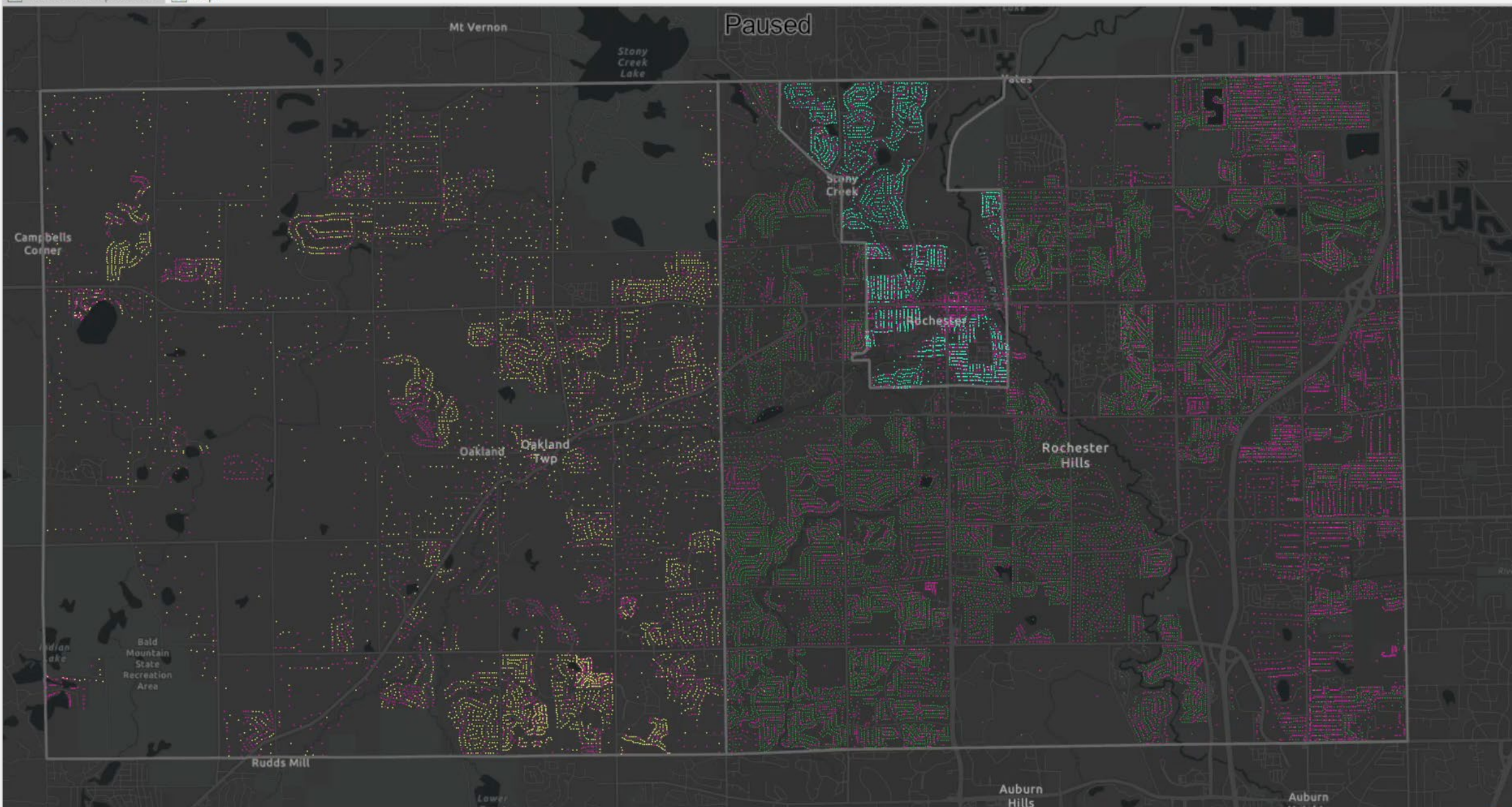


- ESRI Non-profit organizational program pricing is extremely affordable: \$100 desktop bundle.
- That includes ArcGIS Pro + access to ArcGIS Living Atlas of the World (global layers and data points – ex. Census info)
- ESRI is the market leader in the GIS industry and is used globally.
- Ability to scale up to larger models if necessary (SaaS products like ArcGIS Online).



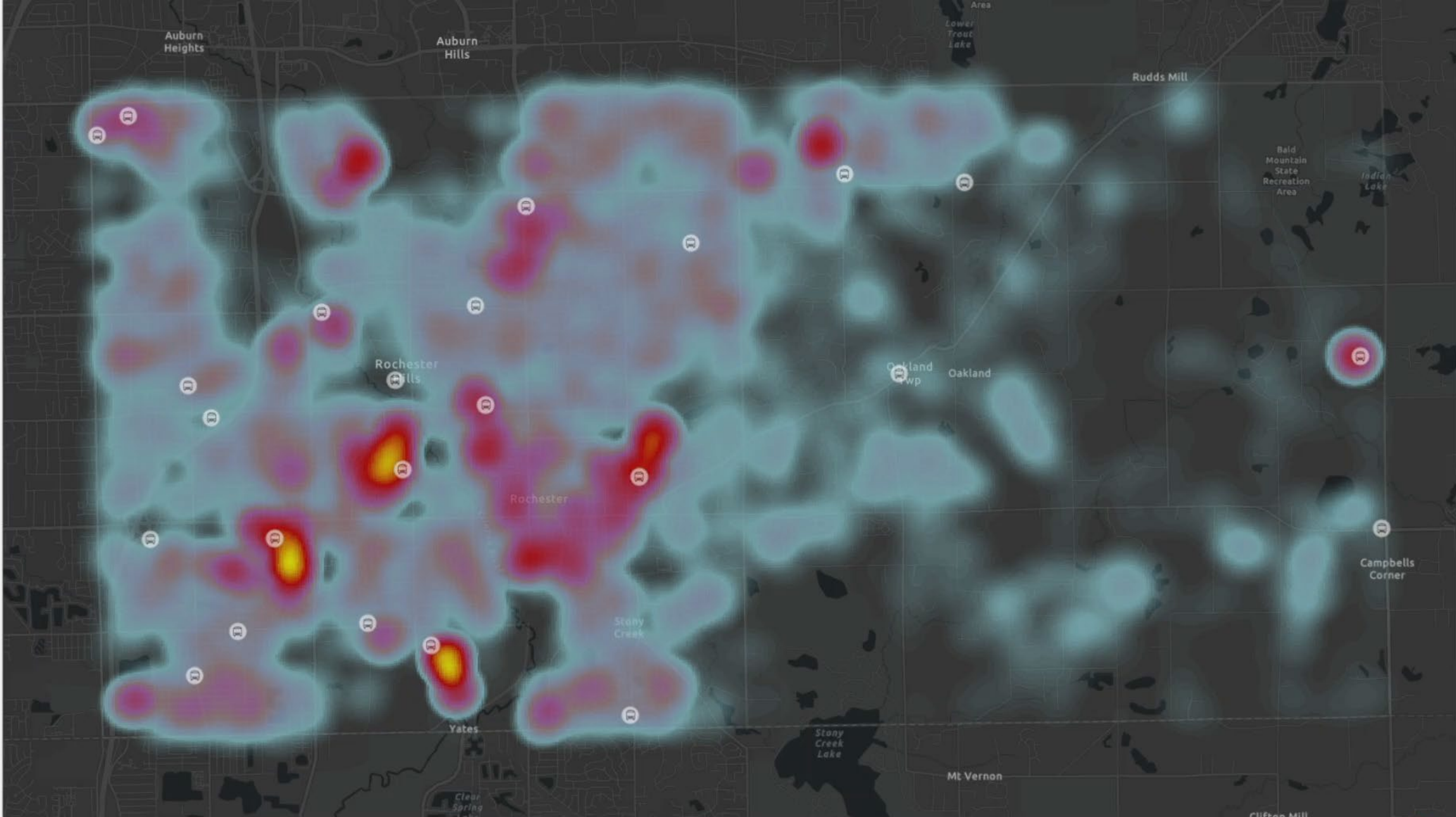
Ex. Rochester's postal address data with RHPL's card holder data layered on top (black)

Paused



GIS: Displaying Cardholder Data

- Removing business and industrial zoned addresses from our current mapping. This is a bit more difficult for us since the Oakland County data came restricted and uneditable (at least for now...)
- Overlaying census data (Living Atlas) on our cardholder data to help develop strategic planning (ex. English as a second language, income levels, lack of cellular service, etc.).
- Determine how to visually represent multi-card addresses such as large households, apartments, senior centers, university students, etc.
- Finding deficits in our cardholder addresses and possibly using targeted mailing to increase enrollment. We sent out over 500+ snail mail surveys to residential non-cardholder addresses for their input.



GIS: Bookmobile locations

- Existing bookmobile locations were often based on ease of parking rather than on necessity of our patrons.
- This will allow our Outreach librarians to evaluate real world data rather than intuition.
- We can develop heat maps to find where the bookmobiles will not overlap service points.

Work in progress...

- We'd love to hear your experiences! This is a long term project for our library and speaking with other libraries can help us determine the usefulness of big data.
- Have you used big data to develop strategic planning at your library? If so what did you find the most useful?
- Have you taken on a large-scale address clean up? Do you have any recommendations for other libraries that we can share during the open questions segment?
- Do you current verify all new library cardholder data? If so, how do you do this? Third-party? In-house? Any recommendations are appreciated!
- Please feel free to email me ahead of time with any questions or suggestions for other libraries: Derek.Brown@rhpl.org or call my direct line (248) 650-7123.



THANK YOU

Questions?