



MIND THE GAP

Resolving Pennsylvania Addressing
& Sub-Addressing Issues in NG911

INTRODUCTION – JMT Technology Group



Nick DiPaolo

- More than 20 years of experience working on Technology and Geospatial Information Systems (GIS) projects
- Member of the NENA GIS Model V2 Working Group
- Volunteer fire fighter of over 19 years



Agenda

- Addressing in NG911
- Define Sub-Address
- Project Lessons Learned
- Tools to Fill Addressing Gaps
- Developing Addressing Protocols to Maintain Data

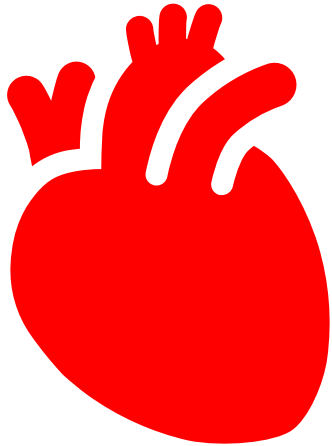
WHY is NEXT GEN 911 NEEDED?



Delivery and service-oriented apps can find your location more quickly and accurately than emergency services – that's a problem.



IN an EMERGENCY – EVERY SECOND COUNTS



According to the American Heart Association, chance of survival decreases by 7% - 10% for every minute without defibrillation.

Reference: <https://pubmed.ncbi.nlm.nih.gov/8214853/>

ADDRESS ACCURACY for EMERGENCY RESPONSE

- Locating the incident
- Improved Dispatch and Routing
 - One route significantly shorter

911: What is your emergency?

Caller: Someone is having a heart attack, in Foot Locker at the King of Prussia Mall



WHAT IS A SUB-ADDRESS?

- NENA refers to as a “unit” within a building or structure

NENA Standard for NG9-1-1 GIS Data Model
NENA-STA-006.1.1-2020, February 18, 2020

4.138 Unit

Description: A group or suite of rooms within a building that are under common ownership or tenancy, typically having a common primary entrance.

Domain: None

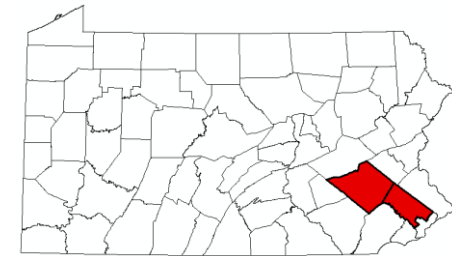
Example: Apartment C2; Penthouse; Suite 710

- Not just a field in the attributes
- Each unit requires a unique point in the Site Structure Address Point Layer
- Ideally point placed at unit entrance
- Not always reflected in ALI
- Can account for up to 25% of address points



PA NG911 PROJECTS

- Addressing Authority with individual municipalities for each project
 - Required significant stakeholder communication and coordination
- Both projects consisted of multiple-phases funded through PEMA's Interconnectivity Grant
 - JMT provided assistance with estimates for grants
- **Montgomery County, PA**
 - Create NENA Format Address Point GIS Layer for county (325K points)
 - Develop Best Practices Document to define County-wide Addressing Protocol
 - Web-based Address Verification Toolkit to support Best Practices
 - MCM Consulting Group assisted with QC and address point creation
- **Berks County, PA**
 - Update address points to include sub-address in City of Reading
 - 27k address points before project, added 13k points (50% increase)
 - Phase 2 expands project to 34 additional municipalities



HOW WE GOT THERE



Stakeholder Engagement

Identified opportunities for stakeholder interaction

Meet face-to-face (if possible) may bring stakeholders together for first time



Creation of Address and Sub-Address Points

Utilize multiple data sources to update address points.

Develop standards for editing common address scenarios in GIS



Address Protocol

Develop formal guidance to establish workflows

In PA, many municipalities have addressing authority but County responsible for maintaining the NG911 GIS data



Tools to Support Maintenance

Provide tools and training for stakeholders to follow address protocol

Web-based (if possible) for easier deployment and access

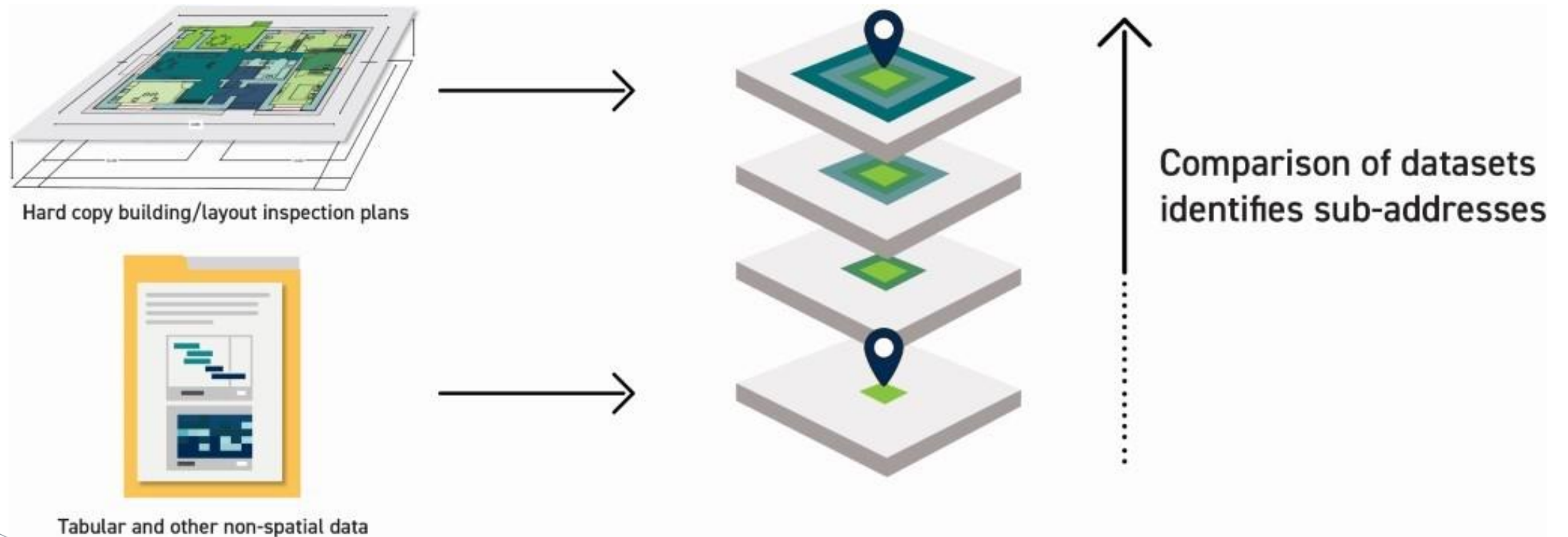
CAST a WIDE NET

- No one data source will provide all sub-address detail
- Identify all Local Stakeholders to acquire data
 - Police: SPAD details
 - Fire: preplans
 - Public Works: waste pickup
 - Code Enforcement: Inspections/permits
 - Voter Registration
 - USPS: Carrier Sheets
 - Utilities (water, sewer, gas and electric): Premise Locations
 - TELCOM: ALI (Intrado)
 - Housing Authority: Floor plans
 - Tax Board: Parcels
 - Property Managers/Landlord: Unit info, Floor plans
- Get people talking
 - Many local departments still operate in silos
 - Hold workshops
 - Online Surveys
- Help make connections between stakeholders
- Stay connected but be patient



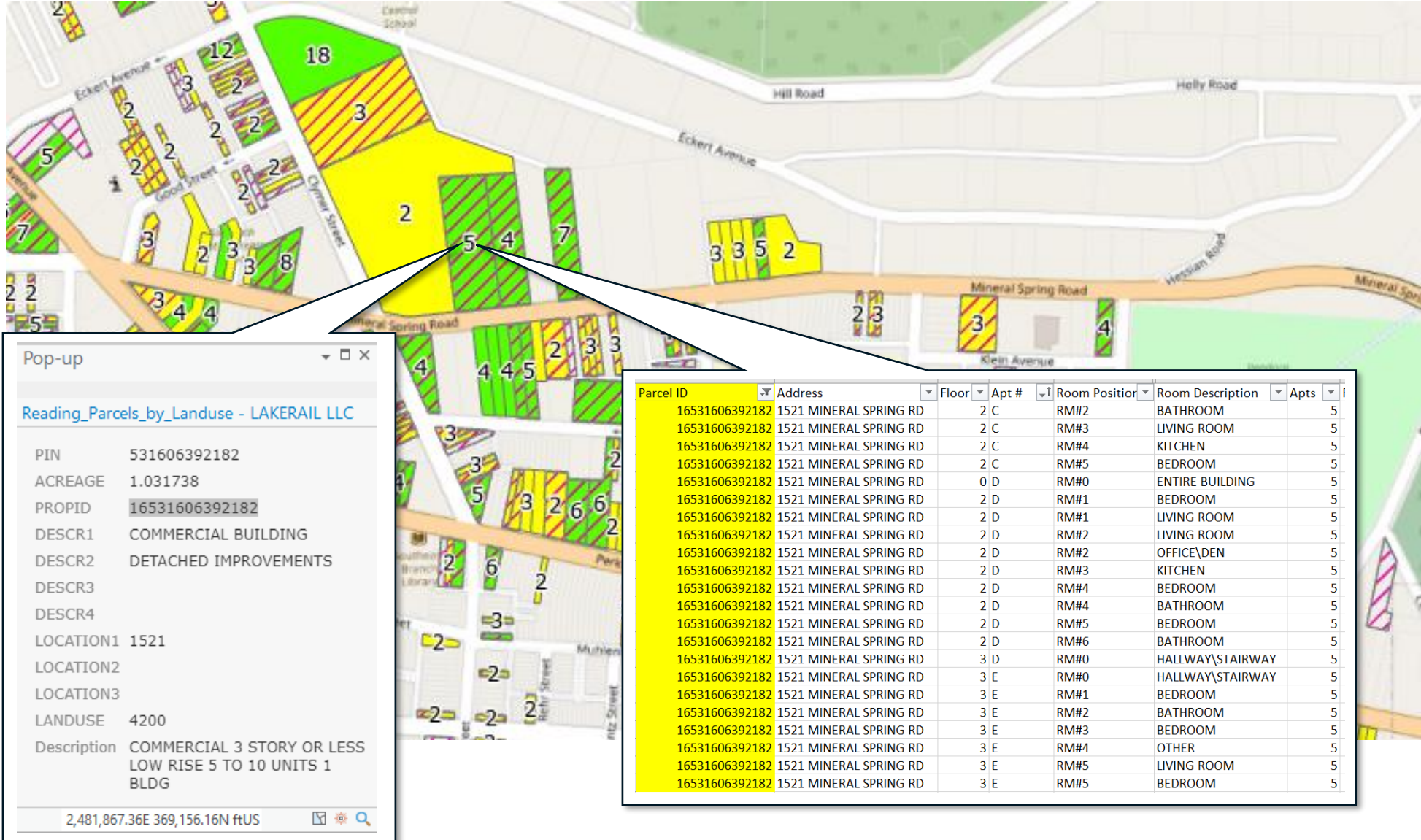
OVERLAY to IDENTIFY PATTERNS

- Identify where multiple data sources are consistent
- Discrepancies in datasets may identify other concerns



FINDING the PATTERNS

- ☒ Parcels by Landuse
☐ Not Expected
☐ Vacant
☒ Yes
- ☒ Parcels by Units
 totalUnits
☐ ≤3
☐ ≤96
☐ ≤201
☐ ≤392
☐ ≤526



- Example: Using Parcel and other Municipal sources

STAKEHOLDER ENGAGEMENT



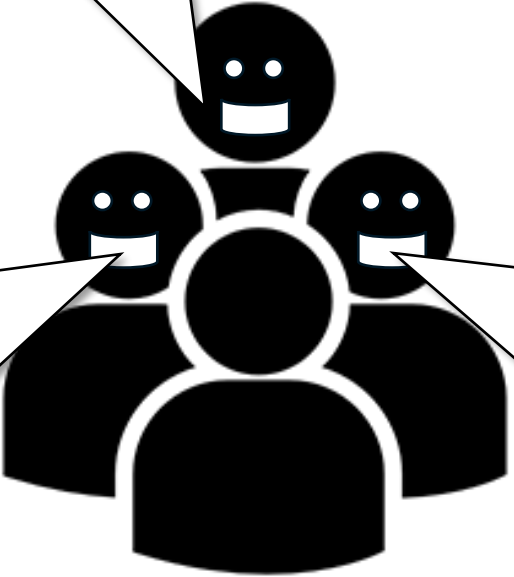
- Incorporate engagement opportunities into all stages of project
- Probably more stakeholders than you originally think
- Stakeholder participation may require several communication “points of contact”
- Some stakeholders may not be as engaged as you anticipate

STAKEHOLDER COORDINATION

Municipal Data

BU UNIT	BU ADDRESS	BU TYPE	BLDG ADDRESS	MODULE	PIN	MAIL BUSINESSNAME
APT 110	100 CYPRESS CT APT 110	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 111	100 CYPRESS CT APT 111	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 114	100 CYPRESS CT APT 114	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 116	100 CYPRESS CT APT 116	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 117	100 CYPRESS CT APT 117	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 115	100 CYPRESS CT APT 115	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 210	100 CYPRESS CT APT 210	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 211	100 CYPRESS CT APT 211	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 212	100 CYPRESS CT APT 212	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 213	100 CYPRESS CT APT 213	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 214	100 CYPRESS CT APT 214	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 215	100 CYPRESS CT APT 215	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 216	100 CYPRESS CT APT 216	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 217	100 CYPRESS CT APT 217	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 310	100 CYPRESS CT APT 310	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 311	100 CYPRESS CT APT 311	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 312	100 CYPRESS CT APT 312	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 313	100 CYPRESS CT APT 313	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 314	100 CYPRESS CT APT 314	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41
APT 315	100 CYPRESS CT APT 315	Apartment	100 CYPRESS CT	rental	370001621007	Westfield 41

Property Management



USPS

USPS 05-6889
SAN MATEO TBSC
REPORT LFA220F2

U.S. POSTAL SERVICE - ADDRESS MANAGEMENT SYSTEM
ROUTE LISTING REPORT

DATE: 10/1/2020
PAGE: 4

ZIP CODE: 19468 ROUTE: C015 BUNDLE TYPE: ONE BUNDLE

SEQ #	PRIMARY ADDRESS	COMPLETE STREET NAME	SECT ABBR	SECT UNIT #	DELV TYPE	USG CODE	NO STAT	VAC IND	ADDR SORT	L I F CELL	S 1	DR OP	NDD BTHNFS	CO RLV NG	ADDR #	MR	+4 CODE	ADDITIONAL INFO	ALTERNATE ZIP / RTE
99200		HOLLY DR	APT	204	CBU	R									04			4483	
100200			APT	205	CBU	R				2								4484	APTS 205 THRU 306
101200			APT	206	CBU	R												4484	
102200			APT	207	CBU	R												4484	
103200			APT	208	CBU	R												4484	
104200			APT	209	CBU	R												4484	
105200			APT	210	CBU	R												4484	
106200			APT	211	CBU	R												4484	
107200			APT	212	CBU	R												4484	
108200			APT	213	CBU	R												4484	
109200			APT	214	CBU	R												4484	
110200			APT	301	CBU	R												4484	
111200			APT	302	CBU	R												4484	
112200			APT	303	CBU	R												4484	
113200			APT	304	CBU	R												4484	
114200			APT	305	CBU	R												4484	
115200			APT	306	CBU	R												4484	
116200			APT	307	CBU	R				1								4484	APTS 307 THRU 414
117200			APT	308	CBU	R												4484	
118200			APT	313	CBU	R												4484	
119200			APT	314	CBU	R												4484	
120200		CYPRESS CT	APT	110	CBU	R				1								4485	APTS 110 THRU 115
121200			APT	111	CBU	R												4485	
122200			APT	114	CBU	R												4488	
123200			APT	115	CBU	R												4488	
124200			APT	116	CBU	R												4488	
125200			APT	117	CBU	R												4488	



USPS Carrier Sheets – Key to Success

- Authoritative Source for Zip Code
- Lists all carrier routes within the Zip Code
- Contains all addresses & sub-addresses USPS delivers to
- Not easy to get but worth their weight in gold

USPS 05-6889
SAN MATEO IBSSC
REPORT LFA220P2

U.S. POSTAL SERVICE - ADDRESS MANAGEMENT SYSTEM ROUTE LISTING REPORT

DATE: 3/16/2021

PAGE: 1

ZIP CODE: 19608

ROUTE: C042

BUNDLE TYPE: ONE BUNDLE

SEQ #	PRIMARY ADDRESS	COMPLETE STREET NAME	SECTY ABBR	SECTY UNIT #	DELV TYPE	USG CODE	NO STAT	VAC IND	ADDR SORT	L F CELL	S I	DR OP	NDD SMTWHS	CO NG	RLY #	ADDR MKR	+4 CODE	ADDITIONAL INFO	ALTERNATE ZIP / RTE
**R1	1 3911	PENN AVE			OTH	B				1/2							1167	FABRIC MART	
	2 3998		UNIT	A	OTH	B				"							1168		
	3 3998				OTH	B				1/2							1168	CASE/ST FARM	
	4 3996		APT	A	OTH	R				"							1168	A	
	5 3996		APT	B	OTH	R				1/2							1168	B	
	6 3992		STE	1	OTH	B				"							2203	1	
	7 3992		APT	2	OTH	R				1/2							2203	2	
	8 3992		APT	3	OTH	R				"							2203	3	
	9 3992		STE	4	OTH	B				1/2							2203	4	
	10 3992		STE	5	OTH	B				"							2203	5	
	11 3992		APT	6	OTH	R				1/2							2203	6	
	12 3992		APT	7	OTH	R				"							2203	7	
	13 3992		STE	8	OTH	B				1/2							2203	8	
	14 3992		APT	10	OTH	R				"							2203	10	
	15 3992		APT	11	OTH	R				1/2							2203	11	
	16 3986				OTH	B				"							1168	LIGHT SATELITE	
	17 3984		OFC		OTH	B				1/2							1144		
	18 3984		APT	1	OTH	R				"							1144	1	
	19 3984		APT	2	OTH	R				1/2							1144	2	
	20 3978		APT	B	OTH	B				"							1146	OFC, STE1, APT1	
	21 3978		STE	A	OTH	B											1146		
	22 3978		APT	C1	OTH	R											1162		
	23 3976		OFC		OTH	R				T	1/2						1168	FRONT	
	24 3976		SIDE		OTH	R				"							1168	SIDE	
	25 3968		APT	1	OTH	R				1							2204	1-8	
	26 3968		APT	2	CENT	R											2204		
	27 3968		APT	3	CENT	R											2204		
	28 3968		APT	4	CENT	R											2204		
	29 3968		APT	5	OTH	R											2204		
	30 3968		APT	7	OTH	R											2204		
	31 3968		APT	6	OTH	R											2204	6&8	
	32 3968		APT	8	OTH	R											2204		
	33 3966				OTH	R				1/2							1168		
	34 3964				OTH	R				"							1168		

Maximize USPS Sheets

- Conversion to excel results in “compressed records”
- Multiple lines from sheet compressed into 1 line in Excel
- Hidden extra spaces, white space, etc. appear in Excel
- Unable to geocode

USPS 05-6889
SAN MATEO IBSSC
REPORT LFA220P2

U.S. POSTAL SERVICE - ADDRESS MANAGEMENT SYSTEM
ROUTE LISTING REPORT

DATE: 3/16/2021
PAGE: 1

ZIP CODE: 19608 ROUTE: C042 BUNDLE TYPE: ONE BUNDLE

SEQ #	PRIMARY ADDRESS	COMPLETE STREET NAME	SECY ABBR	SECY UNIT #	DELV TYPE	USG CODE	NO STAT	VAC IND	ADDR SORT	L F CELL	S I	DR OP	NDD BMTWHS	CO NG	RLY #	ADDR MKR	+4 CODE	ADDITIONAL INFO	ALTERNATE ZIP / RTE
**R1	1 3911	PENN AVE	UNIT	A	OTH	B				12				06			1167	FABRIC MART	
	2 3998		OTH	B						12							1168		
	3 3998		OTH	B						12							1168	CASE/ST FARM	
	4 3996		APT	A	OTH	R				12							1168	A	
	5 3996		APT	B	OTH	R				12							1168	B	
	6 3992		STE	1	OTH	B				12							2203	1	
	7 3992		APT	2	OTH	R				12							2203	2	
	8 3992		APT	3	OTH	R				12							2203	3	
	9 3992		STE	4	OTH	B				12							2203	4	
	10 3992		STE	5	OTH	B				12							2203	5	
	11 3992		APT	6	OTH	R				12							2203	6	
	12 3992		APT	7	OTH	R				12							2203	7	
	13 3992		STE	8	OTH	B				12							2203	8	
	14 3992		APT	10	OTH	R				12							2203	10	
	15 3992		APT	11	OTH	R				12							2203	11	
	16 3996		OTH	B						12							1168	LIGHT SATELITE	
	17 3984		OFC	1	OTH	B				12							1144		
	18 3984		APT	1	OTH	R				12							1144	1	
	19 3984		APT	2	OTH	R				12							1144	2	
	20 3978		APT	8	OTH	B				12							1146	OFC, STE1, APT1	
	21 3978		STE	A	OTH	B				12							1146		
	22 3978		APT	C1	OTH	R				12							1162		
	23 3976		OFC		OTH	R				12							1168	FRONT	
	24 3976		SIDE		OTH	R				12							1168	SIDE	
	25 3968		APT	1	OTH	R				12							2204	1-8	
	26 3968		APT	2	CENT	R				12							2204		
	27 3968		APT	3	CENT	R				12							2204		
	28 3968		APT	4	CENT	R				12							2204		
	29 3968		APT	5	OTH	R				12							2204		
	30 3968		APT	7	OTH	R				12							2204		
	31 3968		APT	6	OTH	R				12							2204	668	
	32 3968		APT	8	OTH	R				12							2204		
	33 3966		OTH	R						12							1168		
	34 3964		OTH	R						12							1168		



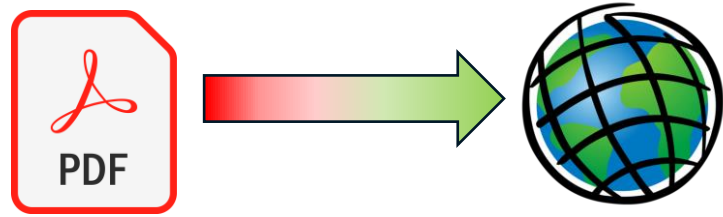
Results Messages

	PRIMARY_ADDRESS	COMPLETE_STREET_NAME	SECY_ABBR	SECY_UNIT	DELV_TYPE	ID1
10	600 600 600 600	WILLOW ST S 7TH ST	APT APT APT APT	3 4 5 6	OTH OTH OTH OTH	248
11	604 606 608 610	WILLOW ST S 7TH ST	NULL	NULL	OTH OTH OTH OTH	249
12	612 614 620 620	WILLOW ST S 7TH ST	FRNT REAR	1	OTH OTH OTH OTH	250
13	620 449 447 445	WILLOW ST S 7TH ST	REAR	2	OTH OTH OTH OTH	251
14	443 441 439 437	WILLOW ST S 7TH ST	NULL	NULL	OTH OTH OTH OTH	252
15	435 433 433 433	WILLOW ST S 7TH ST	REAR SIDE FRNT	NULL	OTH OTH OTH OTH	253
16	431 429 427 1/2 427	WILLOW ST S 7TH ST	NULL	NULL	OTH OTH OTH OTH	254
17	423 421 419 417	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	256
18	415 413 411 409	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	257
19	407 401 400 402	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	258
20	404 406 408 410	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	259
21	412 414 416 418	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	260
22	420 422 424 426	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	261
23	428 430 432 436	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	262
24	440 442 444 446	S 7TH ST	NULL	NULL	OTH OTH OTH OTH	263
25	448 450	S 7TH ST	NULL	NULL	OTH OTH	264

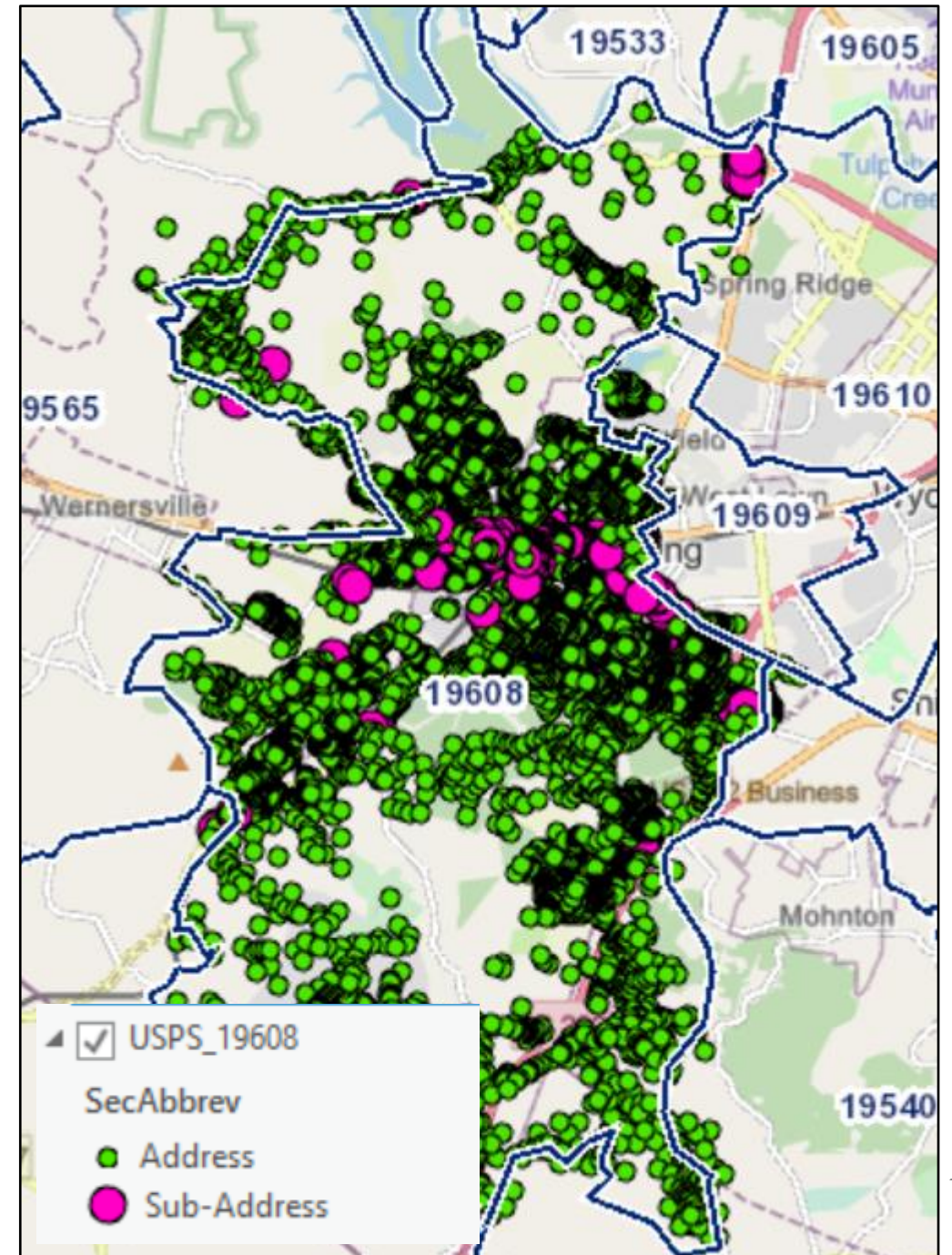
Results Messages

	PRIMARY_ADDRESS	COMPLETE_STREET_NAME	SECY_ABBR	SECY_UNIT	DELV_TYPE	ID1
1	206 601 517	SPRUCE ST FRANKLIN ST	NULL	NULL	OTH OTH OTH	214
2	550 548 548 550	FRANKLIN ST	FL APT APT FL	1 1 2 2	OTH CENT CENT OTH	253
3	533 1/2	FRANKLIN ST	NULL	NULL	OTH	300
4	841 841 501	HANCOCK BLVD	STE	50	OTH OTH OTH	768
5	1001 1017	SCOTT ST	NULL	NULL	OTH OTH	926
6	420 46 423	GRACE ST LANCASTER AVE	NULL	NULL	OTH OTH OTH	1341
7	112 102 110	BARTLETT ST MORGANTOWN RD	OFC	NULL	CURB OTH OTH	1418
8	110 110 110 110	BARTLETT ST MORGANTOWN RD	APT APT APT APT	1 2 3 4	OTH OTH OTH OTH	1419
9	124 132 125 125	BARTLETT ST MORGANTOWN RD	STE STE	1 2	OTH OTH OTH OTH	1420
10	125 125 125 308	PARK AVE	STE STE STE	3 4 5	OTH OTH OTH OTH	1421

Convert PDF to GIS



- In-house extraction tool to process export to Excel
- Resolves most compressed records
- Unresolved records saved in error log
- Auto-populates gaps in Complete Street Name
- Geocode table
- Symbolize by Secondary Abbreviation field
 - Sub-address designators (unit, apartment, suite, etc.)

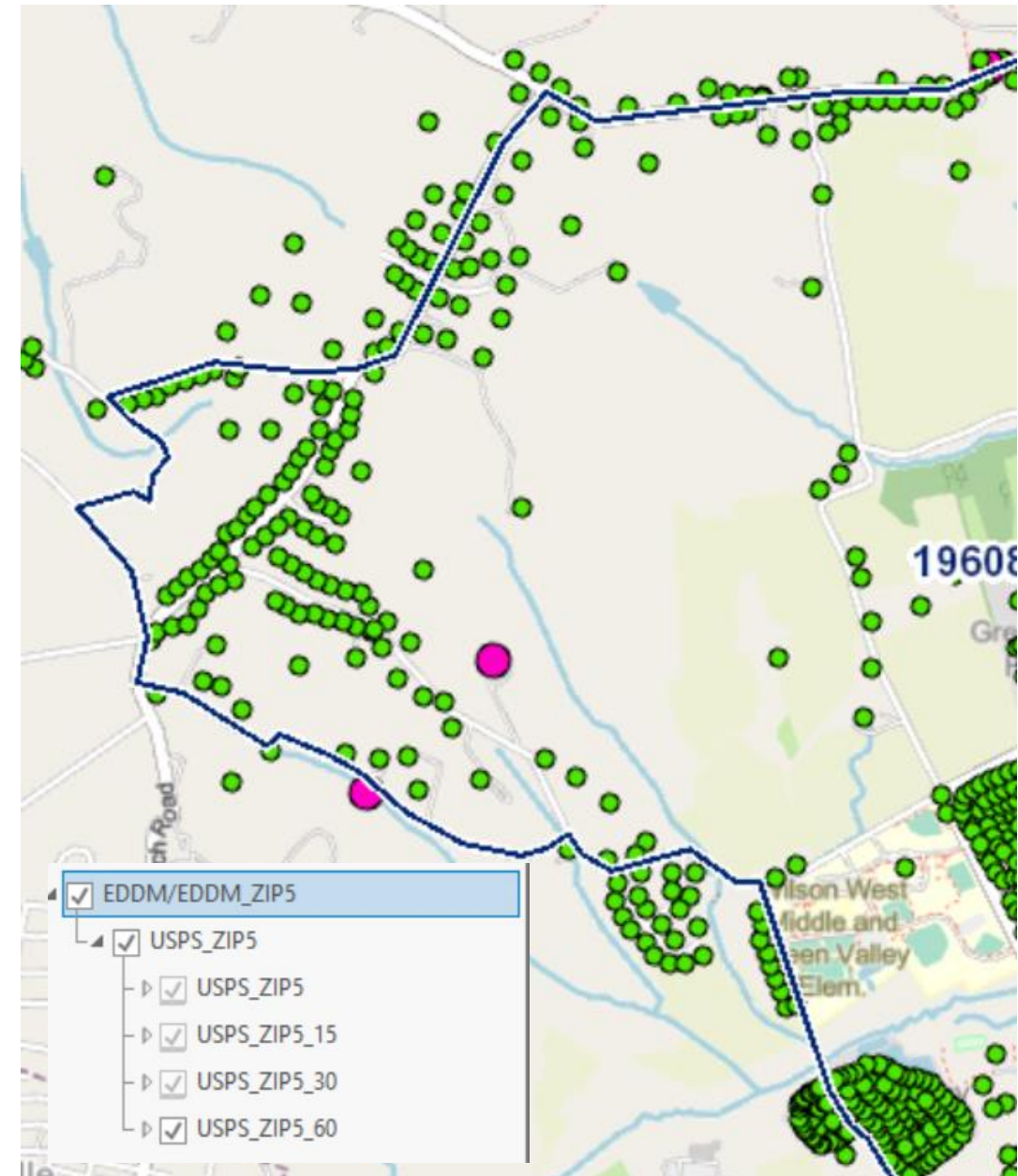


Value in the Conversion

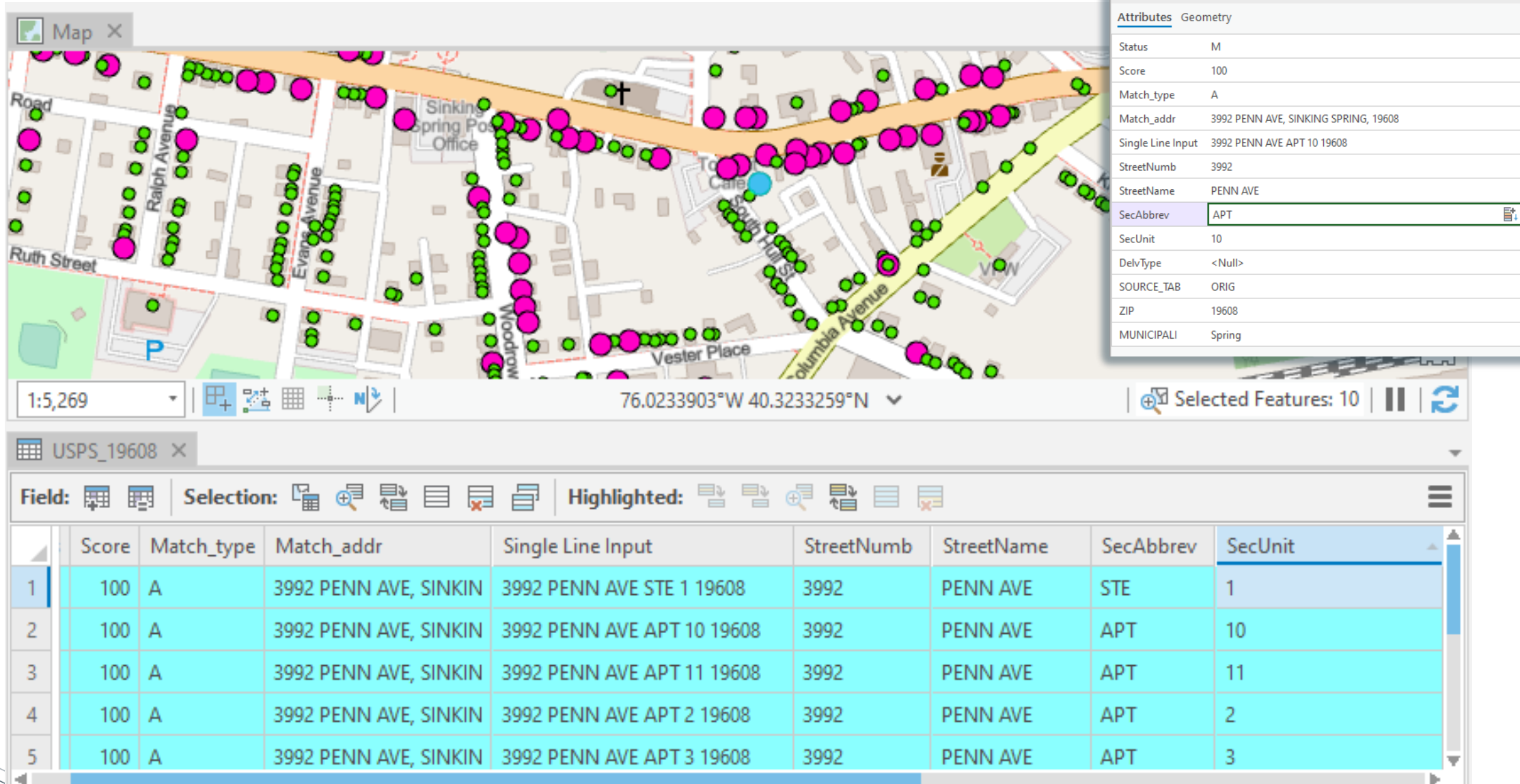
- Reminder – Carrier sheets are authoritative dataset for Zip Codes
- USPS Every Door Direct Mail map service does not match exactly geocoded carrier sheet
 - Carrier Routes frequently updated
- Update Address Points
- Identify Sub-Address with Unit #
- Additional Value Add
 - Confirm Left and Right Zip in Streets
 - Confirm Zip in Parcel, Voting, etc.

▼ Data Source Set Data Source...

Data Type	ArcGIS Map Service
Server	https://gis.usps.com/arcgis/rest/services/EDDM/EDDM_ZIP5/MapServer
Service Name	EDDM/EDDM_ZIP5
Is Cached	No
Vertical Units	Meter



Identify Sub-Addresses



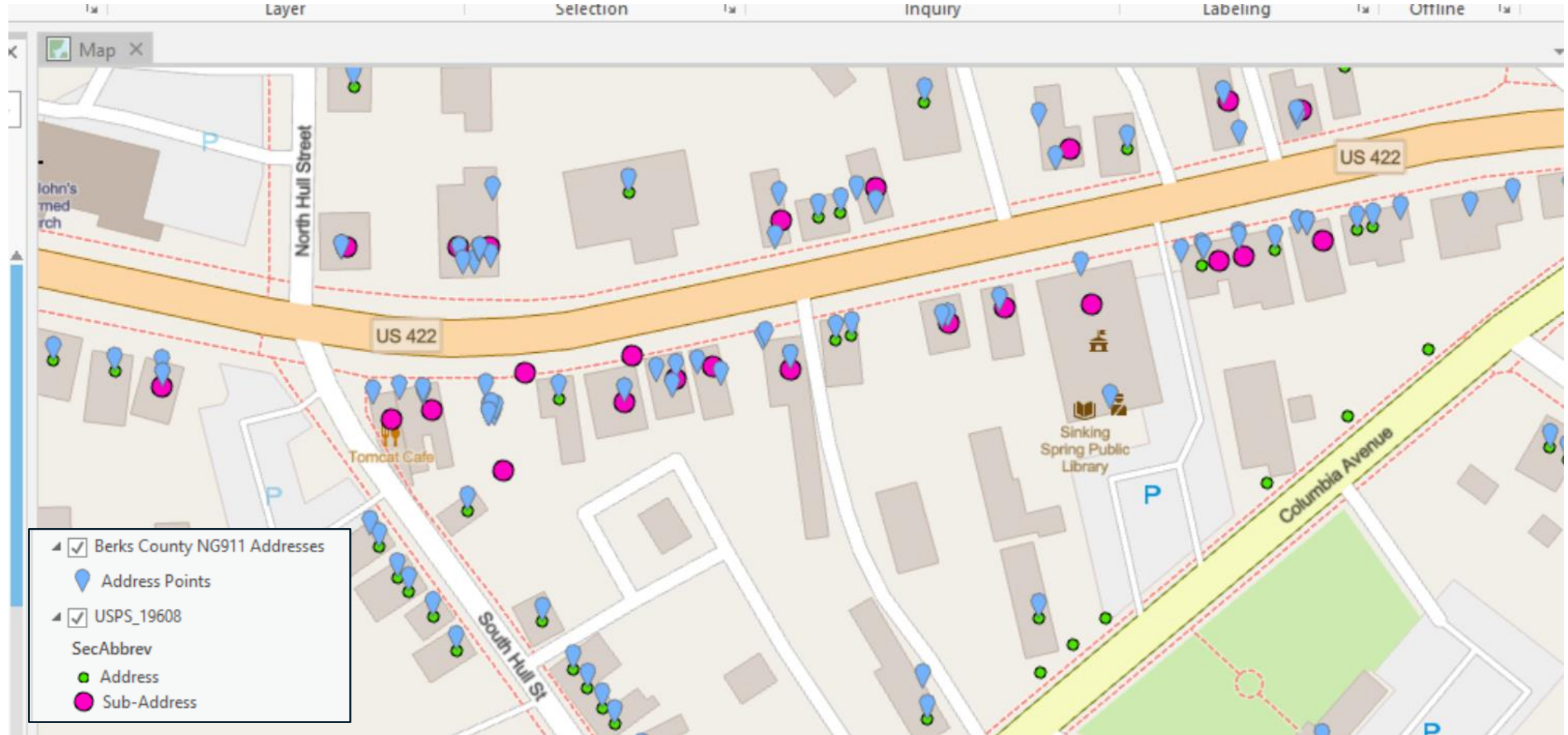
The screenshot displays a GIS application interface. The top map shows a residential area with streets like Ruth Street, Ralph Avenue, Evans Avenue, Woodrow, Vester Place, and Columbia Avenue. A pop-up window titled "USPS 19608 (11)" shows the following attributes:

Attributes	Geometry
Status	M
Score	100
Match_type	A
Match_addr	3992 PENN AVE, SINKING SPRING, 19608
Single Line Input	3992 PENN AVE APT 10 19608
StreetNumb	3992
StreetName	PENN AVE
SecAbbrev	APT
SecUnit	10
DelvType	<Null>
SOURCE_TAB	ORIG
ZIP	19608
MUNICIPALI	Spring

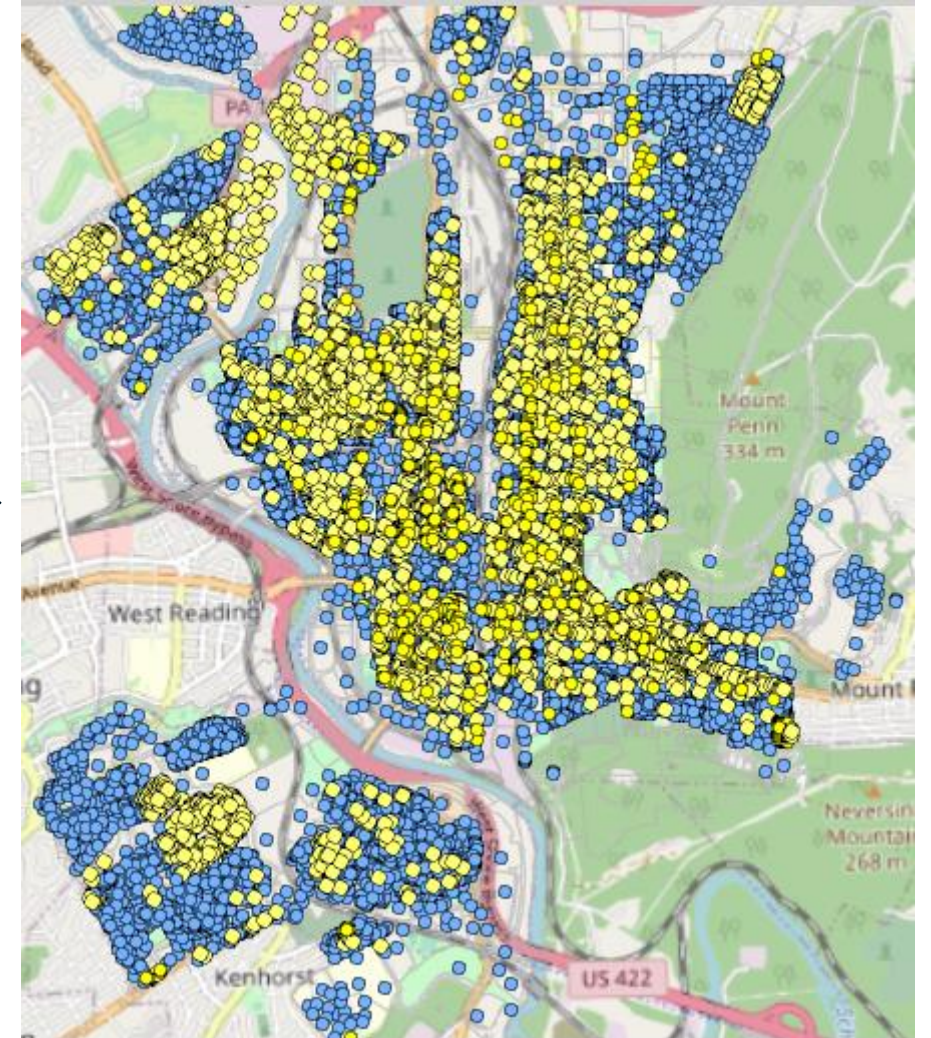
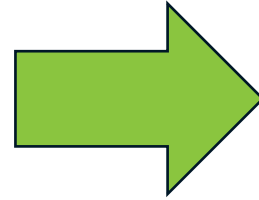
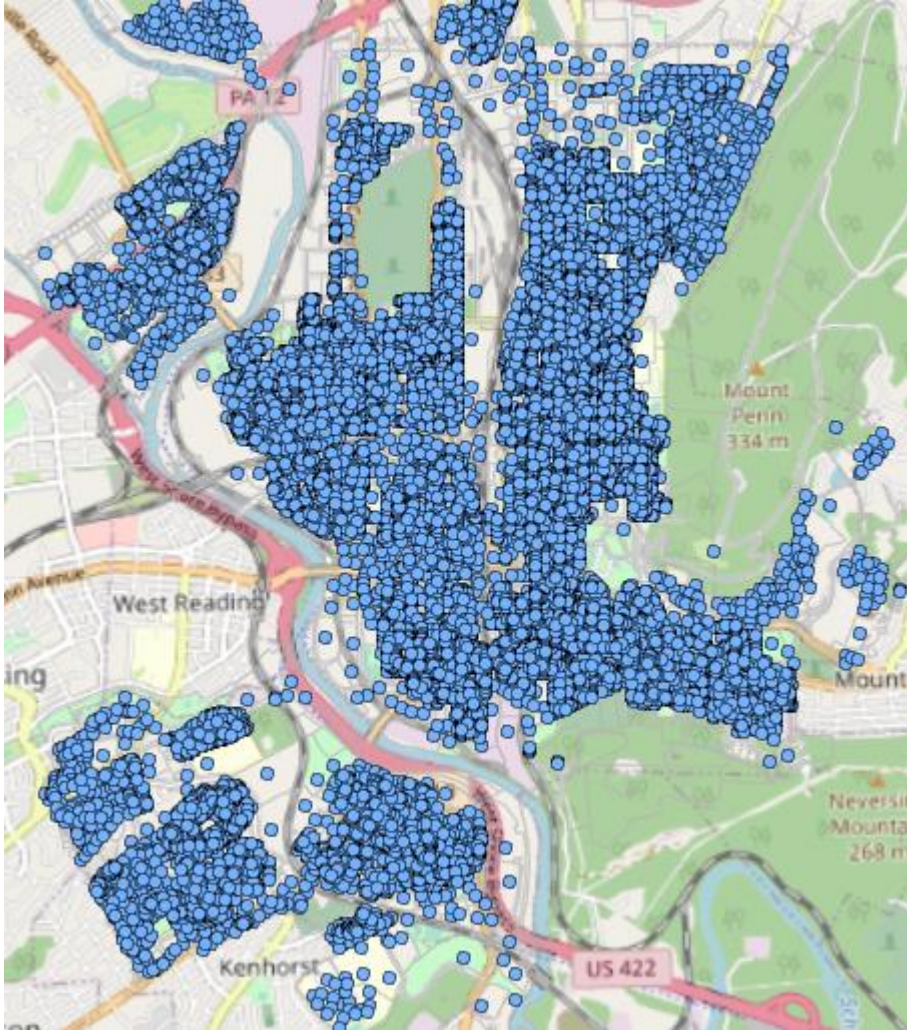
Below the map, a table titled "USPS_19608" displays a list of features. The table has the following columns: Score, Match_type, Match_addr, Single Line Input, StreetNumb, StreetName, SecAbbrev, and SecUnit. The first five rows are highlighted in blue.

	Score	Match_type	Match_addr	Single Line Input	StreetNumb	StreetName	SecAbbrev	SecUnit
1	100	A	3992 PENN AVE, SINKIN	3992 PENN AVE STE 1 19608	3992	PENN AVE	STE	1
2	100	A	3992 PENN AVE, SINKIN	3992 PENN AVE APT 10 19608	3992	PENN AVE	APT	10
3	100	A	3992 PENN AVE, SINKIN	3992 PENN AVE APT 11 19608	3992	PENN AVE	APT	11
4	100	A	3992 PENN AVE, SINKIN	3992 PENN AVE APT 2 19608	3992	PENN AVE	APT	2
5	100	A	3992 PENN AVE, SINKIN	3992 PENN AVE APT 3 19608	3992	PENN AVE	APT	3

Update SSAP with Sub-Addresses



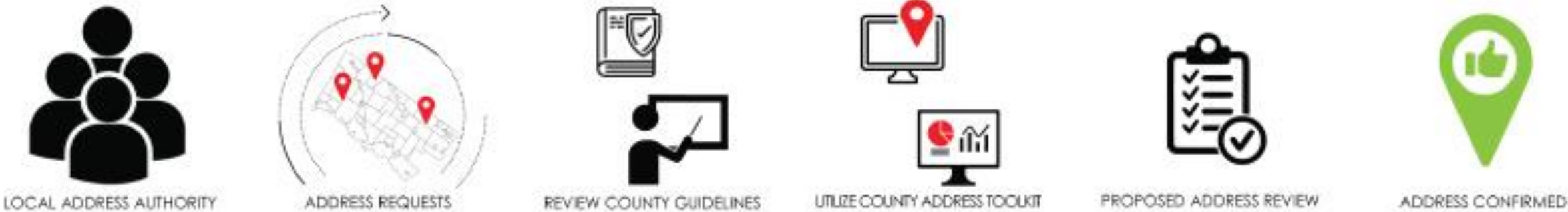
RESULTS in CITY of READING, PA



- Initially 26K address points
- 28k unique ALI records
- 98% match rate to Street Centerlines

- Created 10K sub-addresses
- Updated 5K addresses with unit details

ADDRESSING PROTOCOL SNAPSHOT

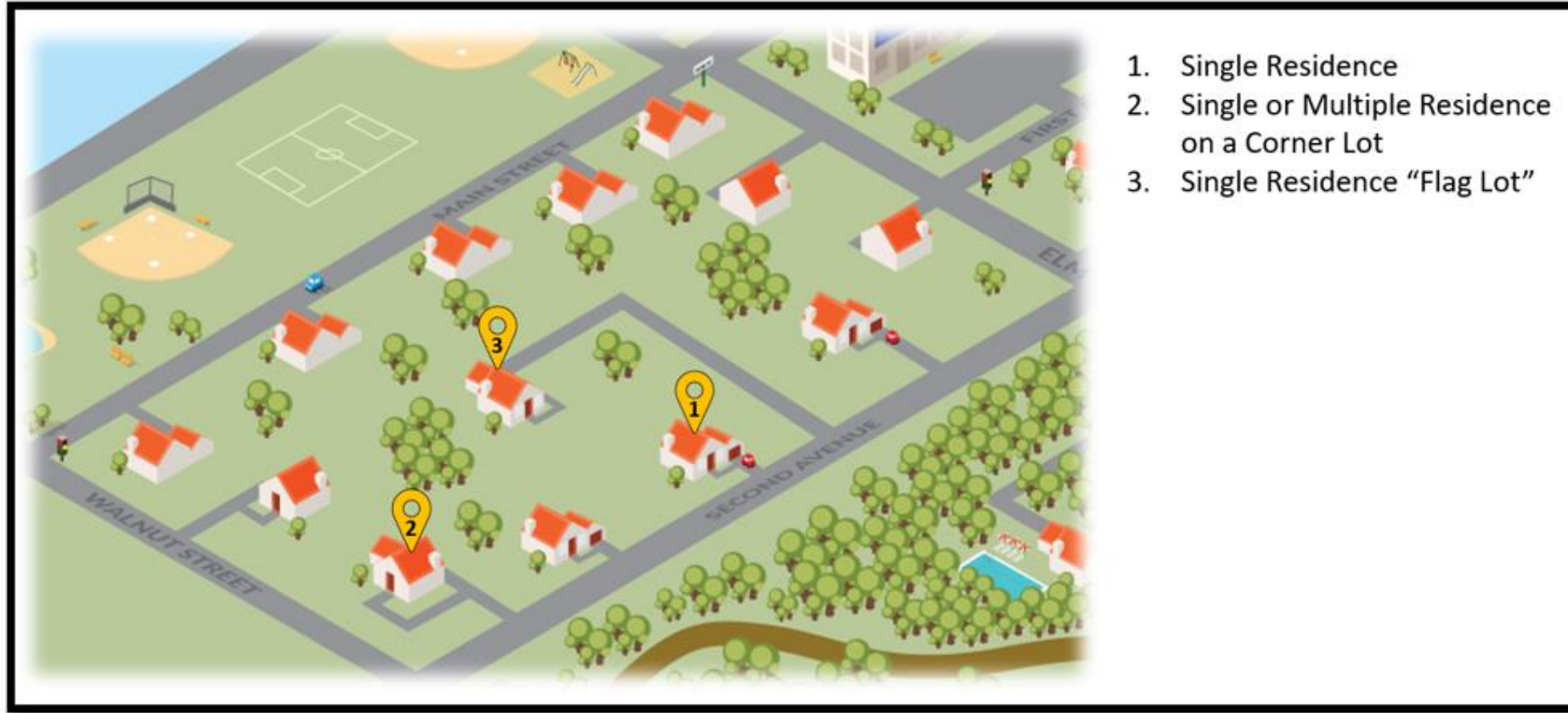


BEST PRACTICES GUIDANCE

- Build on NENA and PEMA guidance
- Focused on scenarios specific to PSAP
- Pictogram developed to visualize guidance



BEST PRACTICES GUIDANCE - EXAMPLE

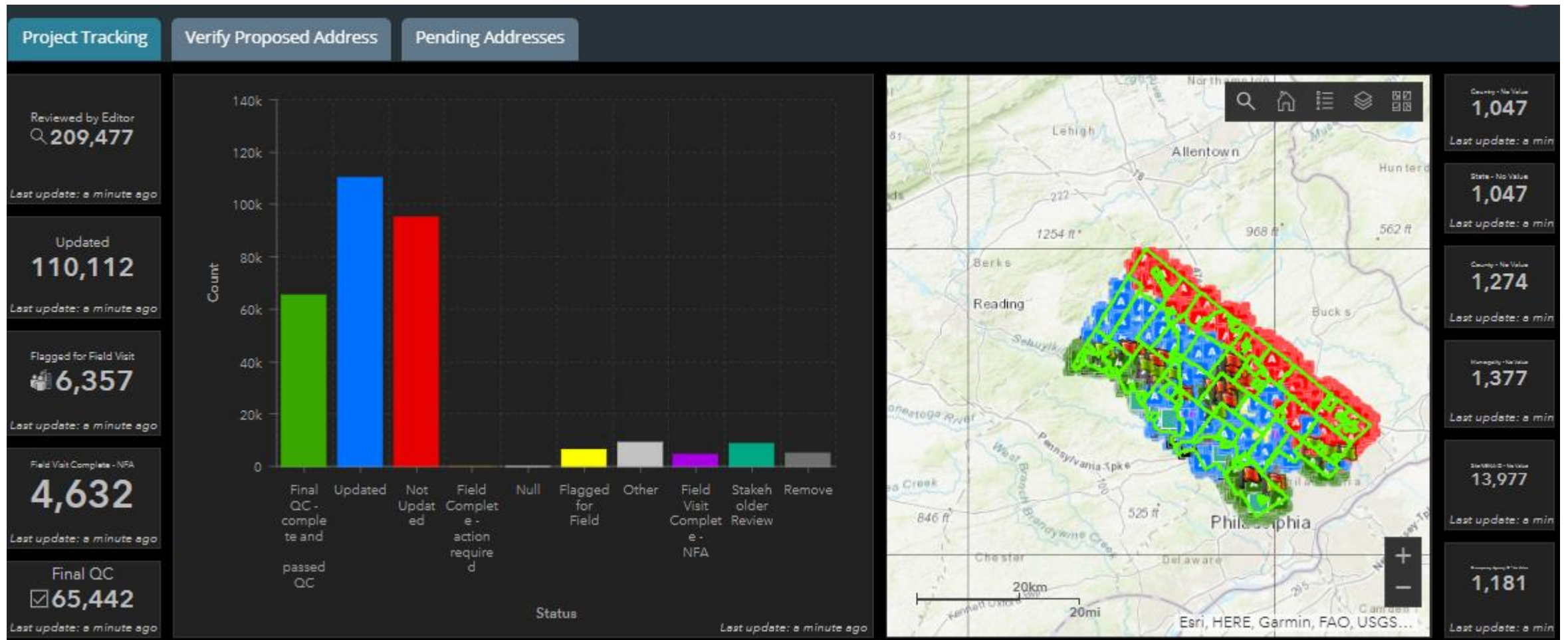


Residential Addressing Scenarios

Single or Multiple Residence on a Corner Property Lot

- Example: Driveway connects to side street on addressed street, but the primary entrance is facing another street (usually a larger road)
- Placement: Place address point at primary entrance to structure (front door of the house, regardless of which street addressed on)
- Numbering: Primary Address Numbering

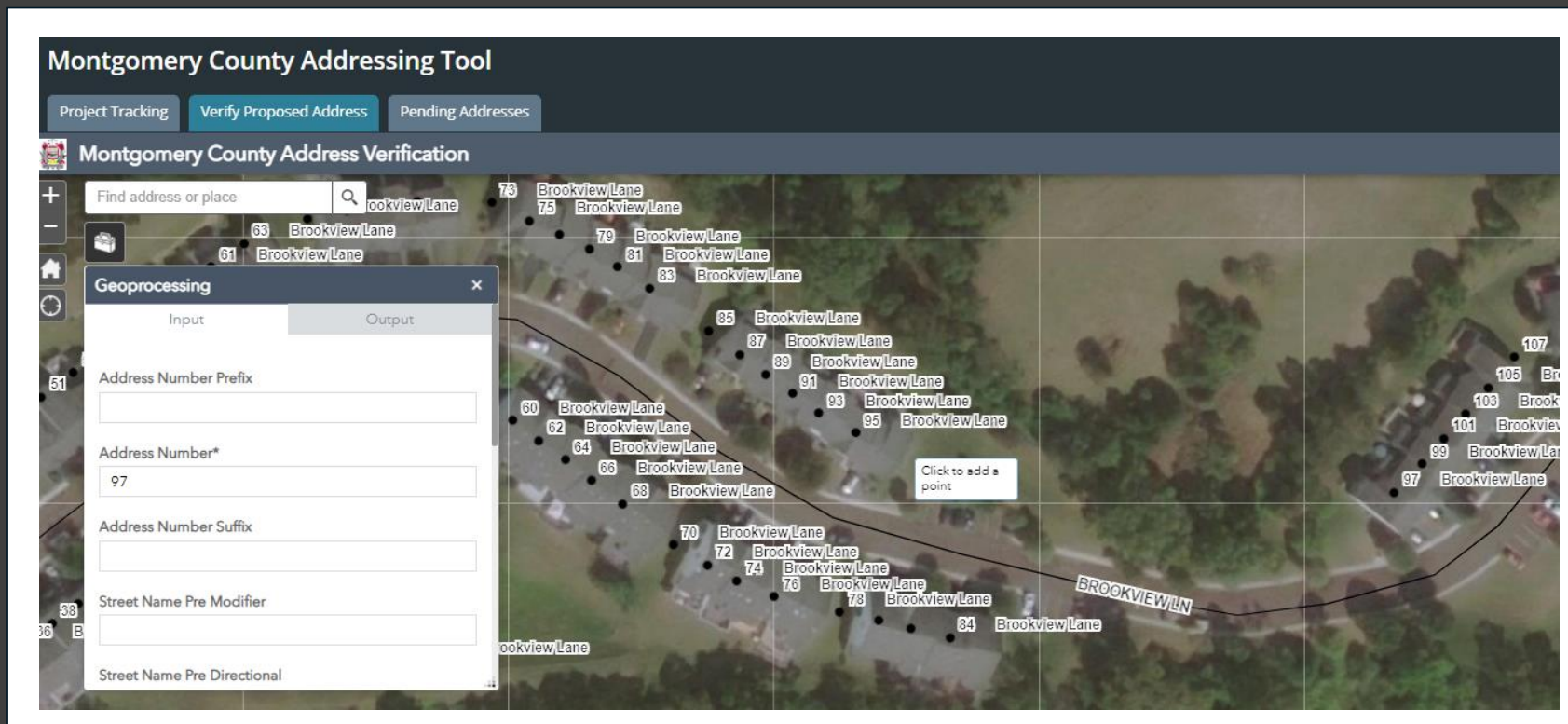
PROJECT TRACKING



- Dashboards in ArcGIS Online
- Provide access to stakeholders
- Track progress and provide transparency
- widgets can perform critical data checks

ADDRESS WEB TOOLKIT

- Proposed Address verification
- Validates address uniqueness
- Generates NENA-Compliant Address
- Establishes Stakeholder Review Process
- Easily deployed to stakeholder



Geoprocessing

Input

Output

Output Message

The address 133 Brookview Lane 19464 Pottstown Lower Pottsgrove Township is not in use and will be sent to the county EMS and GIS departments for validation



Geoprocessing

Input

Output

Output Message

The address 97 Brookview Lane 19464 Lower Pottsgrove Township already exists, please try another address

THANK YOU

- Reach out to discuss your NG911 needs and plans, from technical requirements to grant estimating, or GIS generally
- Sign up for periodic updates from JMT Tech Group
- <https://rebrand.ly/JMTUpdates>
- Let's stay connected:



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QUESTIONS?