Focus on the Outdoor Standard: *Measurement, Equation, and Experts React!*

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

rachio

Presentation Overview

- **Outdoor Standard Overview**
- **Landscape Area Measurement**
  - Jaz Molloy, Eagle Aerial
- **Demonstrating Targets with Math**
  - Charles Bohlig, EBMUD
  - Rob Whipple, Western Municipal
- **Experts React: To Sweat or Not to Sweat –** Panel Discussion

Santa Rosa WATER

OUR FUTURE IN EVERY DROP

The Outdoor Standard:

Overview and Timeline

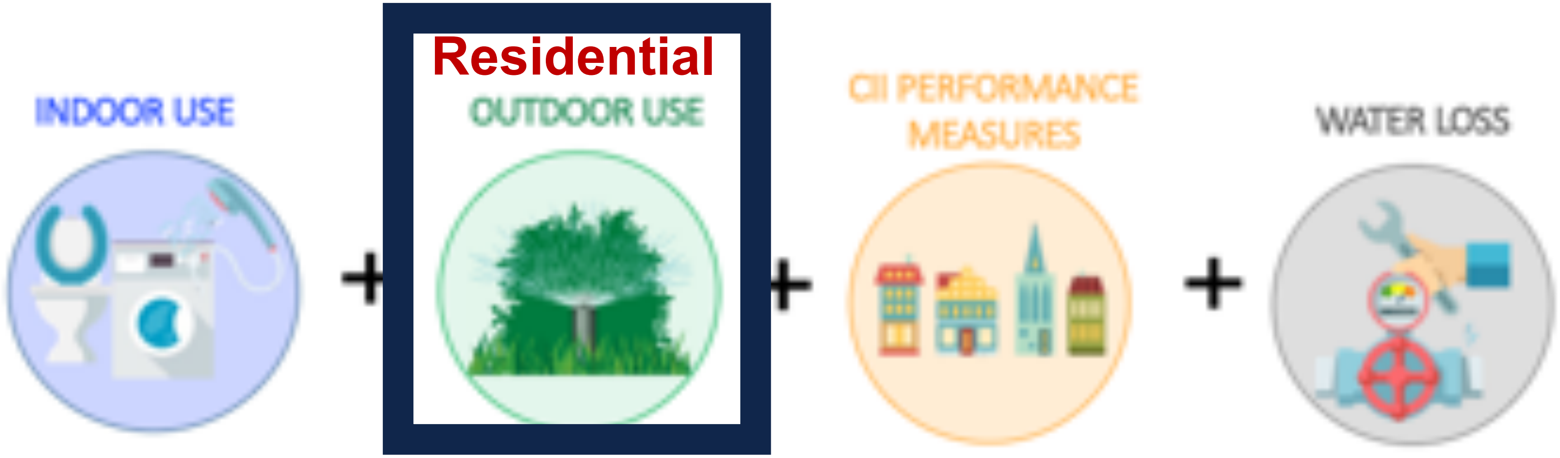
Claire Nordlie
Water Use Efficiency Manager

Santa Rosa WATER

OUR FUTURE IN EVERY DROP

Calculating water objectives

Providers will need to meet the SUM of the standards



+ (Variances) + (Recycled Water Bonus)

= WATER PROVIDER'S UNIQUE WATER TARGET

Outdoor Residential Standard Timeline

1. (DWR) Workgroup Meetings - 2020
2. (DWR) Provide data to calculate aggregated outdoor residential water use – Jan 1, 2021
3. (DWR) Recommendations on outdoor residential use standard – Oct 1, 2021
4. Public Comment – May 30, 2022
5. Adoption by SWRCB – June 30, 2022
6. (SWRCB) Annual Reporting on urban water use objective – Nov 1, 2023
7. (SWRCB) Enforcement (DWR will offer technical assistance)
   - Informational Order – Nov 1, 2023
   - Written notice and request corrective action – Nov 1, 2024
   - Conservation order – Nov 1, 2025

Santa Rosa WATER

OUR FUTURE IN EVERY DROP

Ways to Get Involved

- DWR Primer
  - www.water.ca.gov/programs
- Landscape Area Measurement Workgroup
  - WUE@water.ca.gov
- Request access to Sharepoint Site
  - Diana Brooks: diana.brooks@water.ca.gov
- CalWEP Framework Resource Hub:
  - https://calwep.org/my-calwep/framework-hub/
- ACWA Outdoor Standards workgroup
  - Chelsea Haines: Chelseah@acwa.com

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DWR Verification Portal

DWR Landscape Measurement and Classification
Project Update & What to Expect

Presenter: Jazmine Molloy, PM

Deliverables to Water Agencies

Data Package from DWR: Includes 1 ZIP file and 2 PDF's

Water District Data Shapefile Zip

- Total Service Area Data
  - AOI (Area of Interest)
  - Total residential irrigated, irrigable not irrigated and non-irrigable area
  - LandMask (AG, Void, Horse Corral)
- Parcel level estimates:
  - Included Parcels: single family and multi-family parcel irrigated, irrigable not irrigated and non-irrigable area estimations
  - Disputed Parcels

Deliverables to Water Agencies

Data Package from DWR: Includes 1 ZIP file and 2 PDF’s

Water District Data PDF:

- Parcel Level Estimates:
    - A_UID Summary.csv & B_UID Summary.csv
- Accuracy report for each water agency
    - Landscape Area Estimate Project README.pdf

Introduction

In August of 2018, the California Department of Water Resources (CADWR) contracted Quantum Spatial, Inc., an NV5 company, with support from Eagle Aerial Solutions, to provide landscape area estimates for single-family and multi-family residential parcels for all urban retail water suppliers in California. The results of this endeavor will aid in the designation of urban retail water use efficiency standards and objectives under Assembly Bill (AB) 1668 and Senate Bill (SB) 606. This report, specific to Example Water District, briefly outlines some key summary statistics about the water district area of interest (AOI), the parcels included in the analysis, as well as key results of the analysis.

Note: Results for water districts completed during the Phase 2B pilot stage were generated using one-foot resolution, 4-band imagery collected in 2016. Results for water districts completed during Phase 3 were generated using one-foot resolution, 4-band imagery collected in 2018. The imagery for Example Water District was collected in 2018.

Additionally, due to the presence of overlap in the original parcel layers (the 'A' layer), a topologically corrected version of the parcel layer (the 'B' layer) is created in order to summarize landscape area estimates at the district level without duplicating areas. The parcels selected for training and validating the district model were selected from the topologically corrected parcel layer and then related back to the original layer using the crosswalk table provided in the file geodatabase deliverable.

For reference, the Example Water District is shown in Figure 1, along with its location in the state of California.

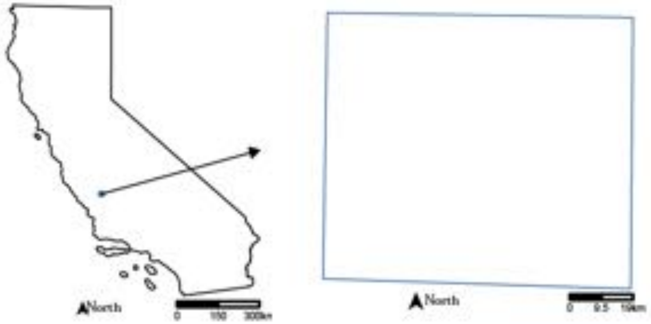


Figure 1: Location of the water district in California (left) and area of interest of the water district (right)

Landscape Area Estimates Process Overview

In the Landscape Area Estimates Project, remote sensing and advanced machine learning techniques are leveraged in order to measure the landscaped areas of Example Water District. Here, we briefly describe a high-level overview of the modeling procedure.

For each water district, four band, one-foot resolution imagery is utilized to model land cover and land use across the parcel areas. In the initial stages, water district imagery is segmented into objects by grouping zones of like-valued pixels called super-pixels. These super-pixels become the foundational classification unit for this project. After the imagery has been segmented, a unique model is trained for each water district using parcel similarity relationships and reference parcel data that are manually digitized by human photo interpreters. A graphic showing the primary phases of imagery classification is shown in Figure 2.

Additionally, manually derived land masks that identify large and challenging to model areas are created by Quantum Spatial's digitizing team and reviewed by the California Department of Water Resources. Three land masks are used to classify undeveloped lands, agricultural lands, and horse corrals (an example of the derived land masks is shown in Figure 4). These masks are used to ensure that correct land use classifications are captured across the entire water district.

Throughout the modeling process, rigorous internal checks are used to ensure satisfactory model performance. Once modeling has been completed, an independent validation is performed using manually digitized parcel data that was withheld from the modeling process. An example of the final classification for Example Water District is shown in Figure 5.

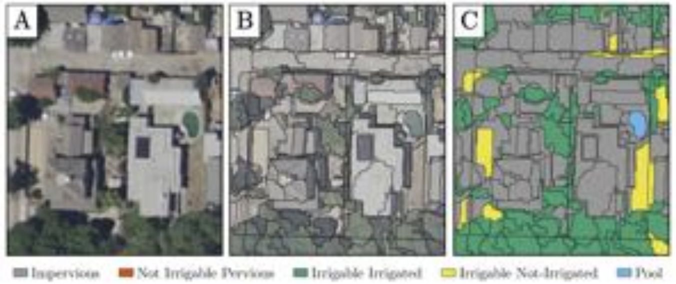


Figure 2: High level modeling process in the Landscape Area Estimates Project. (A) Water district imagery. (B) Imagery segmentation into super-pixel objects. (C) Classified super-pixel objects.

Classification example

Figure 5 shows an example of model classification for an image tile in the Example Water District, to showcase model performance.

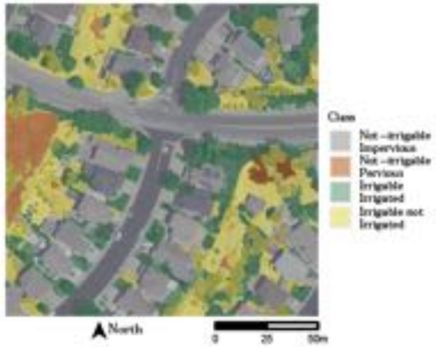


Figure 5: Example of modeling (bottom) on a selected image tile (top). This visualization represents the 8 classes being delivered to DWR. For 8-class definitions, please see Table A2 of the appendix.

Derived Land Masks

The derived land masks created as a part of this analysis are used to manually capture regions of undeveloped land, agriculture, and horse corrals due to their visual similarity to other irrigated or irrigable not-irrigated landscapes throughout the water district. When applied to the Landscape Area Estimates product, they classify the covered regions of super-pixels as not-irrigable landscapes. Of the parcels in the analysis, 13 (0.24%) contain some amount of horse corral, 1,417 (26.32%) contain some amount of undeveloped lands, and 4 (0.07%) contain some amount of agriculutral lands. In total, the AOI contains 4.60 acres, of horse corral, 1,518.74 acres of undeveloped lands, and 17.02 acres of agricultural lands. Examples of both horse corral and undeveloped lands identification are provided in Figure 4.

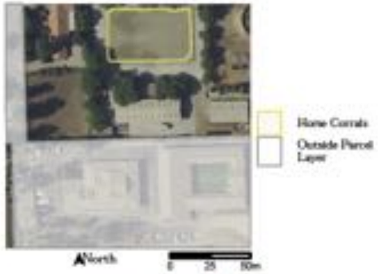


Figure 4: Example of horse corral (top) and undeveloped lands (bottom) identification.

Summary of Results

The 5,384 single-family and multi-family residential parcels in Example Water District are composed of 69.1 percent not irrigable, 18.6 percent irrigated, and 12.3 percent irrigable not-irrigated landscapes. The district-level weighted accuracy of the classification is 98.13% with a confidence interval of [98.08%, 98.18%]. Table 10 shows the water district accuracy statistics at the point, parcel, and district level. The total area at the three-class level for the whole district is provided in Table 4. In addition, the irrigation status summary and mean and median percent of irrigation classes found in parcels of each LUC are provided in Tables 5 and 6. The average class coverage by parcel size and a summary of canopy cover by parcel size are included in Table 7 and Table 8.

Table 4: Total predicted area for the district by irrigation status level. For irrigation status definitions, please see Table A1 of the appendix.

Class	Percent of area in analysis	Total area (sq. ft.)	95% confidence interval (sq. ft.)
Not-irrigable	69.1	34,487,738.12	3,015,970.16
Irrigable irrigated	18.6	9,300,154.60	2,071,769.01
Irrigable not-irrigated	12.3	6,153,870.85	1,402,367.47

Table 5: Total predicted area by LUC at the irrigation status level in square feet. For irrigation status definitions, please see Table A1 of the appendix. For LUC definitions, please see Table A19 of the appendix.

LUC	Total NI area (sq. ft.)	Total II area (sq. ft.)	Total INI area (sq. ft.)
0010	948,397.21	122,905.03	71,864.14
1000	9,612.80	53.23	0.00
1001	22,035,368.78	8,256,935.95	5,221,400.85
1004	149,352.24	69,360.28	24,221.74
1006	9,273.15	1,888.65	1,045.94
1008	7,918,149.15	159,980.97	400,410.58
1100	18,524.35	6,123.00	10,612.44
1109	1,517,374.11	102,408.63	96,800.09
1112	1,831,166.70	573,262.05	320,325.19
9106	50,544.41	7,294.80	7,230.69

Table 6: Percent coverage of LUC at the irrigation status level. For irrigation status definitions, please see Table A1 the appendix. For LUC definitions, please see Table A19 of the appendix.

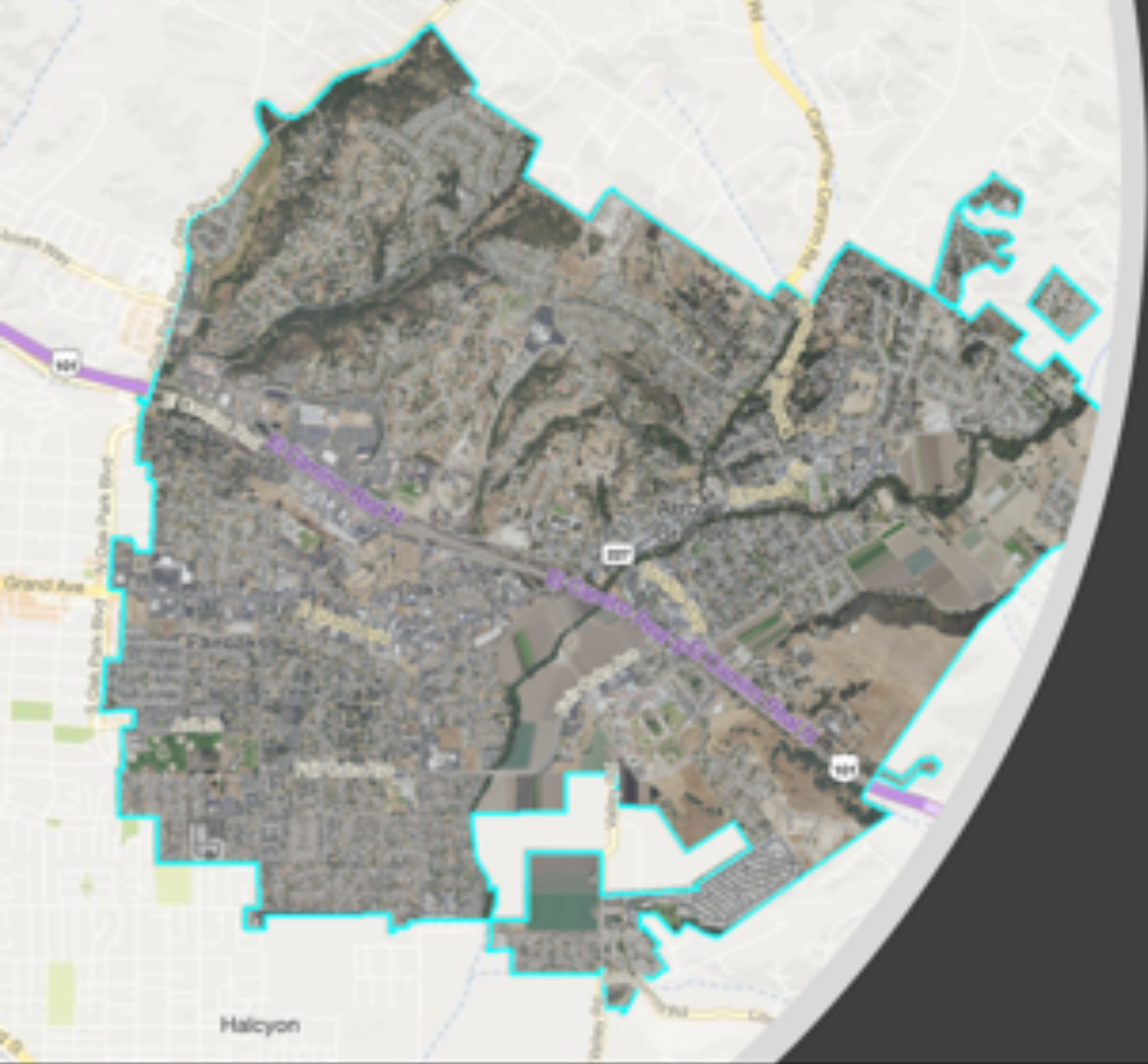
	NI		II		INI	
LUC	Median (%)	Mean (%)	Median (%)	Mean (%)	Median (%)	Mean (%)
0010	83.8	82.9	5.6	10.8	4.2	6.3
1000	99.4	99.4	0.6	0.6	0.0	0.0
1001	63.8	64.1	21.8	22.6	10.0	13.2
1004	78.3	78.3	10.4	16.0	1.8	5.8
1006	76.7	76.7	14.5	14.5	8.8	8.8
1008	91.7	84.8	1.6	5.0	6.2	10.2
1100	52.5	52.5	17.4	17.4	30.1	30.1
1109	82.7	83.3	6.5	10.1	4.7	6.6
1112	69.4	69.0	18.1	18.4	9.8	12.6
9106	77.7	77.7	11.2	11.2	11.1	11.1

Deliverables to Water Agencies

Login credentials sent from support@eagleaerial.com

Access to DWR's Verification Portal:

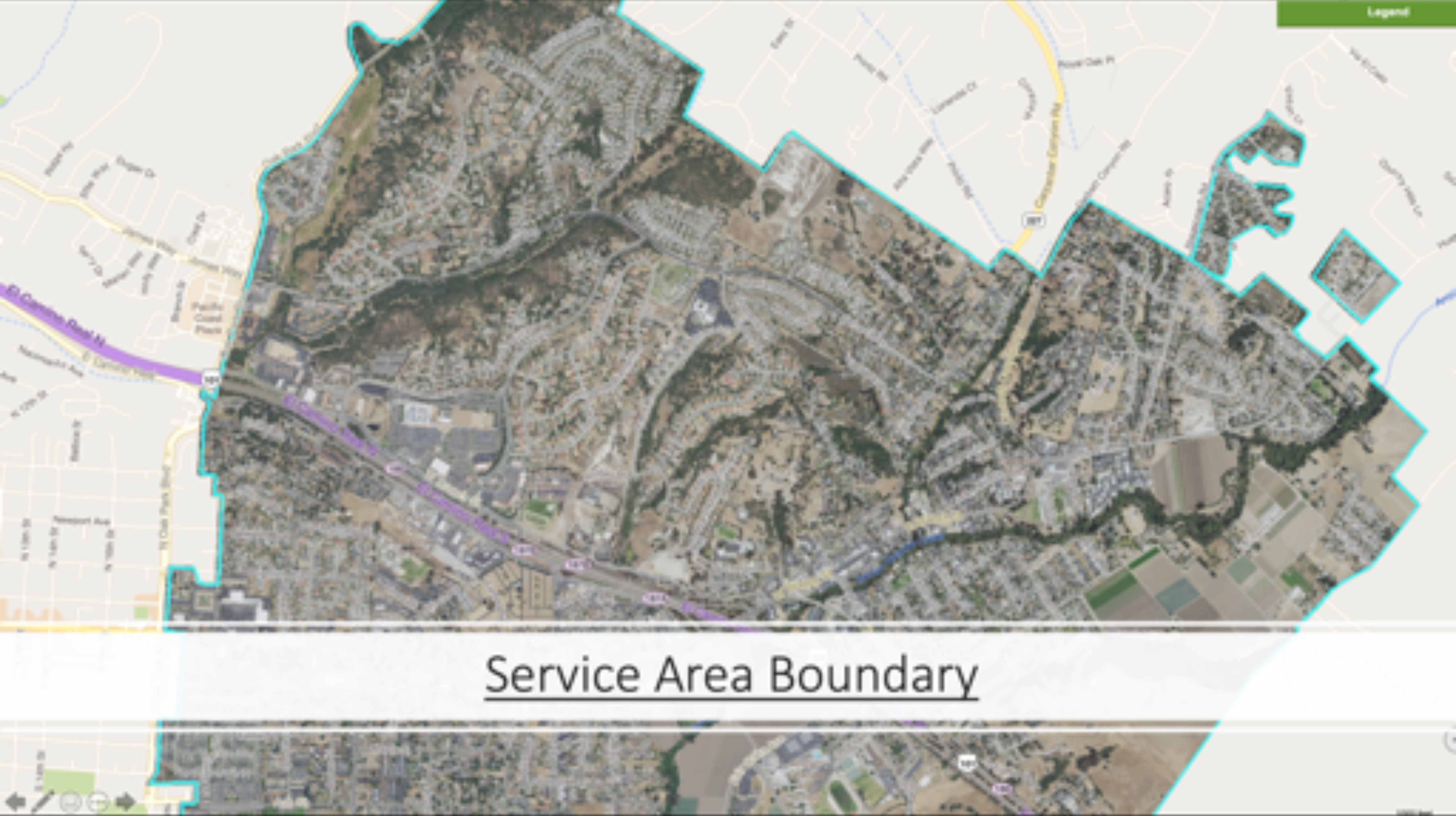
- Browser based online portal
- Provides the land classification results in a GIS environment
- Contains 3 active data layers + 1ft Imagery used in analysis
- Available to all agencies for 6 months



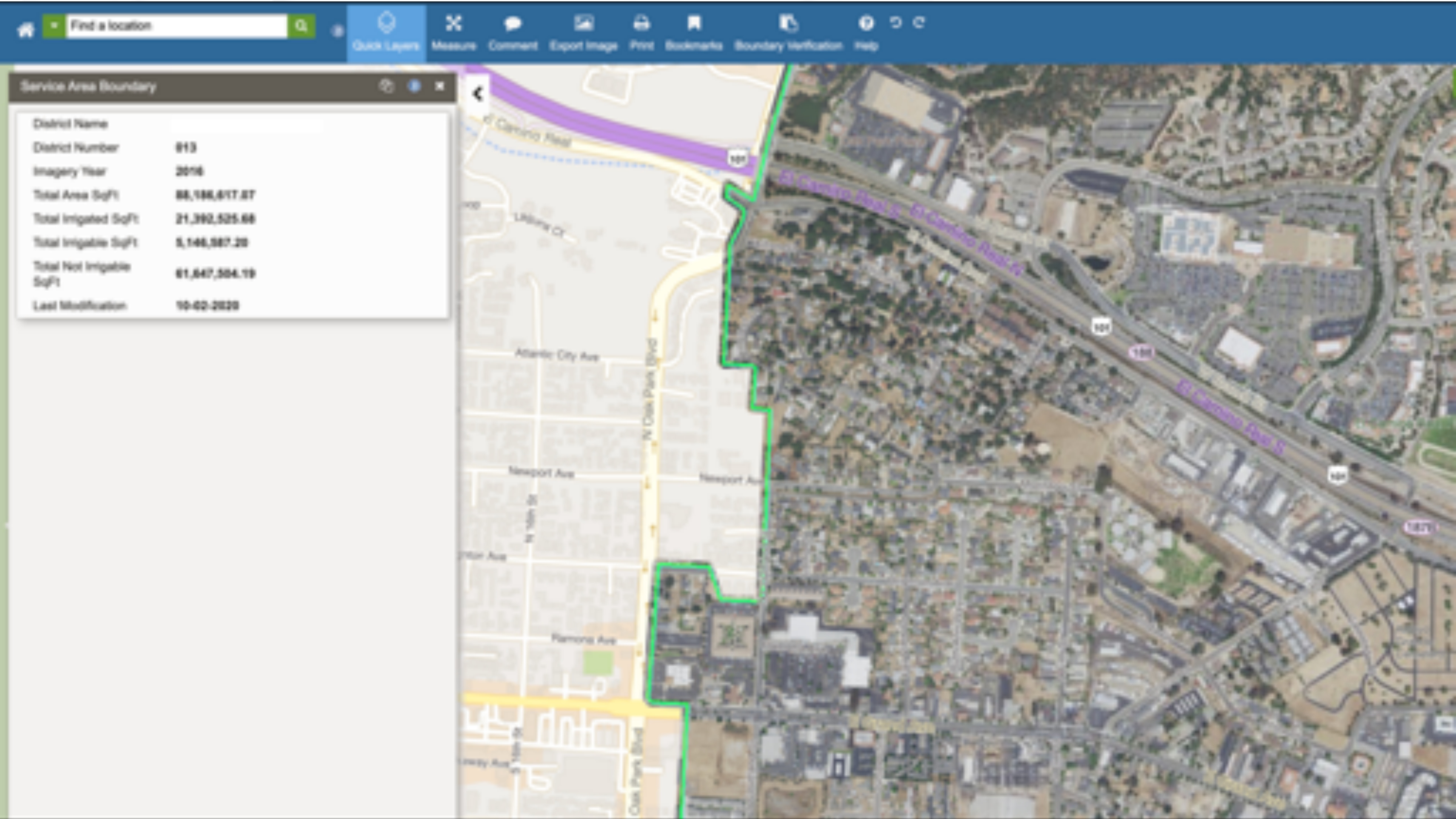
Verification Portal

3 Active Data Layers:

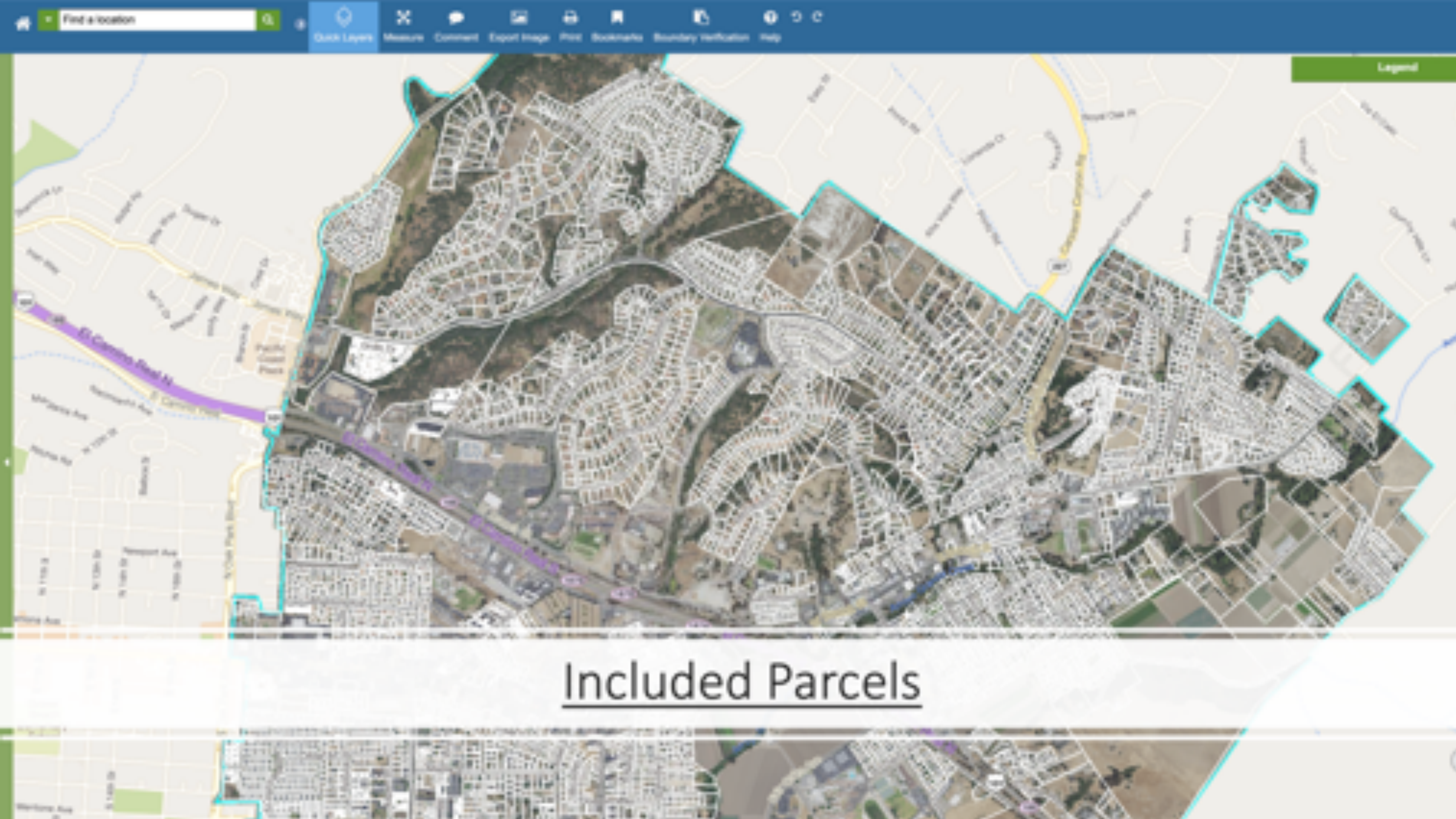
- ✓ Service Area Boundary
- ✓ Included Parcels
- ✓ Disputed Parcels



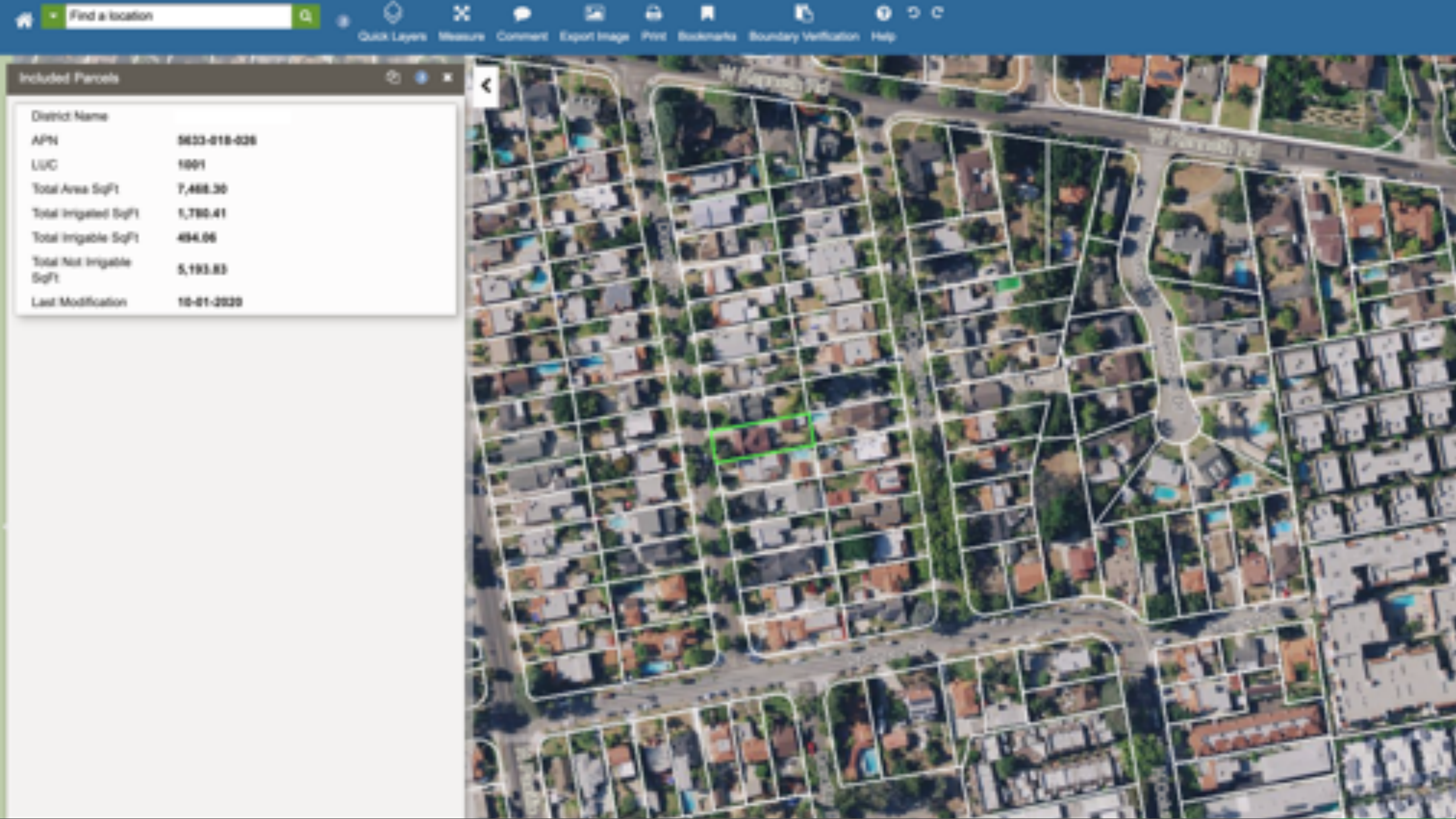
Service Area Boundary



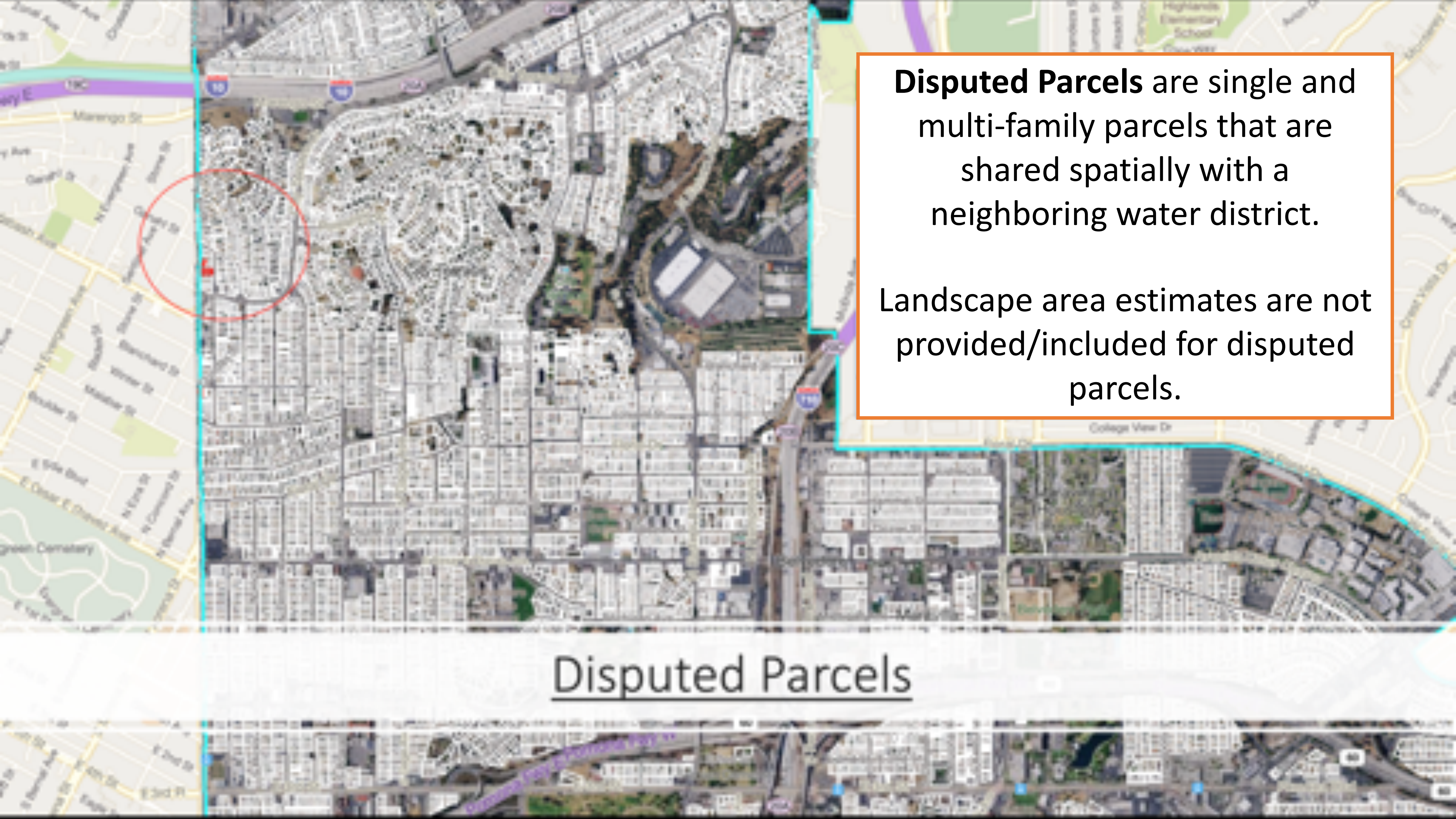
Find a location
Quick Layers
Measure
Comment
Export Image
Print
Bookmarks
Boundary Verification
Help
Service Area Boundary
District Name
District Number 013
Imagery Year 2016
Total Area SqFt 88,186,617.07
Total Irrigated SqFt 21,392,525.68
Total Irrigable SqFt 5,146,587.20
Total Not Irrigable SqFt 61,647,504.19
Last Modification 10-02-2020
El Camino Real
El Camino Real S
El Camino Real N
101
Atlantic City Ave
Newport Ave
N Oak Park Blvd
Ramona Ave



Included Parcels


Find a location
Quick Layers
Measure
Comment
Export Image
Print
Bookmarks
Boundary Verification
Help
Included Parcels
District Name
APN 5633-018-026
LUC 1001
Total Area SqFt 7,468.30
Total Irrigated SqFt 1,780.41
Total Irrigable SqFt 494.06
Total Not Irrigable SqFt 5,193.83
Last Modification 10-01-2020

Disputed Parcels



Disputed Parcels are single and multi-family parcels that are shared spatially with a neighboring water district.

Landscape area estimates are not provided/included for disputed parcels.

Disputed Parcels

APN	5229-024-011
LUC	1101
District Name	
District Number	47
OVLP District Name	
OVLP District Number	203
Imagery Year	2016
Last Modification	10-02-2020

EAGLE AERIAL SOLUTIONS

Your Updated Contact Information is Needed

DWR is preparing data packs and Eagle is creating Verification Portal accounts for all agencies.

We want to be sure the data gets to the right person!

Please send contact information to:

WUE_LAM@water.ca.gov

Questions?

Feel free to reach out at any time!

jmolloy@eagleaerial.com or support@eagleaerial.com

(714) 754-7670 ext 700

EAGLE AERIAL SOLUTIONS

Presenter: Jazmine Molloy, PM

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OF SOUTHERN CALIFORNIA

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TARGET PRACTICE

WITH CHARLES AND ROB

PEER TO PEER 2020

STATE TARGETS
(PER AB1668 AND SB606)

Urban Water Supplier targets are aggregates:

1. Aggregate estimated efficient indoor residential water use
2. Aggregate estimated efficient outdoor residential water use
3. Aggregate estimated efficient outdoor irrigation of landscape areas with dedicated irrigation meters or equivalent technology in connection with CII water use
4. Aggregate estimated efficient water losses
5. Aggregate estimated water use for variances

DON'T SWEAT THE SMALL STUFF!

TARGET (CCF) = $\dfrac{\text{IRRIGABLE AREA} \times ET_O \times ETAF}{1200}$

Irrigable Area to be provided by DWR

- Three classes: Irrigated, Irrigable But Not Currently Irrigated, Not Irrigated
- Irrigated + Irrigable But Not Currently Irrigated = Irrigable Area
- One reason not to sweat the small stuff

TARGET (CCF) = $\frac{\text{IRRIGABLE AREA X ETo X ETAF}}{1200}$

Evapotranspiration (ET)

- The quantity of water evaporated from adjacent soil and other surfaces and transpired by plants during a specified time

ETo is Reference Evapotranspiration

- A standard measurement of environmental parameters which affect the water use of plants. ETo is expressed in inches per day, month, or year and is an estimate of the evapotranspiration of a large field of four-to-seven-inch tall, cool-season grass that is well watered

TARGET (CCF) = $\frac{\text{IRRIGABLE AREA X } ET_O \text{ X ETAF}}{1200}$

- ET data to be provided by DWR later. Source of ET data to be determined
- ET ranges:
  - Eureka: 27.5 inches/year, .5 inch in December and 3.7 inches in July
  - Needles: 92.1 inches/year, 2.7 inches in December and 12.8 inches in July
- EBMUD – ranges from 42 inches to 48 inches across service area
- Riverside – ranges from 56 inches to 57 inches across service area

TARGET (CCF) = $\frac{\text{IRRIGABLE AREA X ETO X ETAF}}{1200}$

2015 MWELO definitions

- "ET adjustment factor" (ETAF) means a factor of 0.55 for residential areas and 0.45 for non-residential areas, that, when applied to reference evapotranspiration, adjusts for plant factors and irrigation efficiency, two major influences upon the amount of water that needs to be applied to the landscape. *Note a majority of the State ETAF for existing non-rehabilitated landscapes is 0.8*

- ETAF for calculations to be provided by DWR

TARGET (CCF) = $\frac{\text{IRRIGABLE AREA X ETO X ETAF}}{1200}$

Plant Factor (Kc) or crop co-efficient

- "plant factor" or "plant water use factor" is a factor, when multiplied by ETo, estimates the amount of water needed by plants. Example: the plant factor for cool-season turf grass is 0.8 of ET meaning that cool-season turf can survive on about 80% of the reference ET

Irrigation Efficiency (IE)

- "irrigation efficiency" (IE) means the measurement of the amount of water beneficially used divided by the amount of water applied. The irrigation efficiency for purposes of this ordinance are 0.75 for overhead spray devices and 0.81 for drip systems

TARGET (CCF) = $\frac{\text{IRRIGABLE AREA X ET}_{\text{O}}\text{ X ETAF}}{1200}$

Outdoor:

Square feet	ET-inches	ETAF .8	Conversion to CCF	CCF	Acre-feet
200,000,000	55.7	0.8	1,200	7,426,667	17,048

Indoor:

Population	GPCD	Gallons	Days/Year	Acre-feet
90,000	55	4,950,000	365	5,545
			Outdoor + Indoor	22,593

EXAMPLES OF SMALL STUFF

- Parcel lines don't quite line up
  - Should be ok since targets are aggregate across the agency

- Square footage in sample parcel isn't exact
  - Should be ok since targets are aggregate across the agency

- Three classes will not be perfect on validation parcels because of estimation
  - Confusion matrix is used to balance the three classes. If one parcel has too much then another has too little, but the total is still close

- Small stuff in general won't appreciably change your target

QUESTIONS?