# Mitigating Wastewater Odor Impacts Using Sensory and Modeled Observations

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**Orange County Sanitation District**

**ESRI User Conference**

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# Presentation Overview

- Background
- Review of Odor Data
- Spatial Analysis Methods
  - Kernel Density Estimation
  - Cluster Analysis
- Discussion of Results and Conclusions

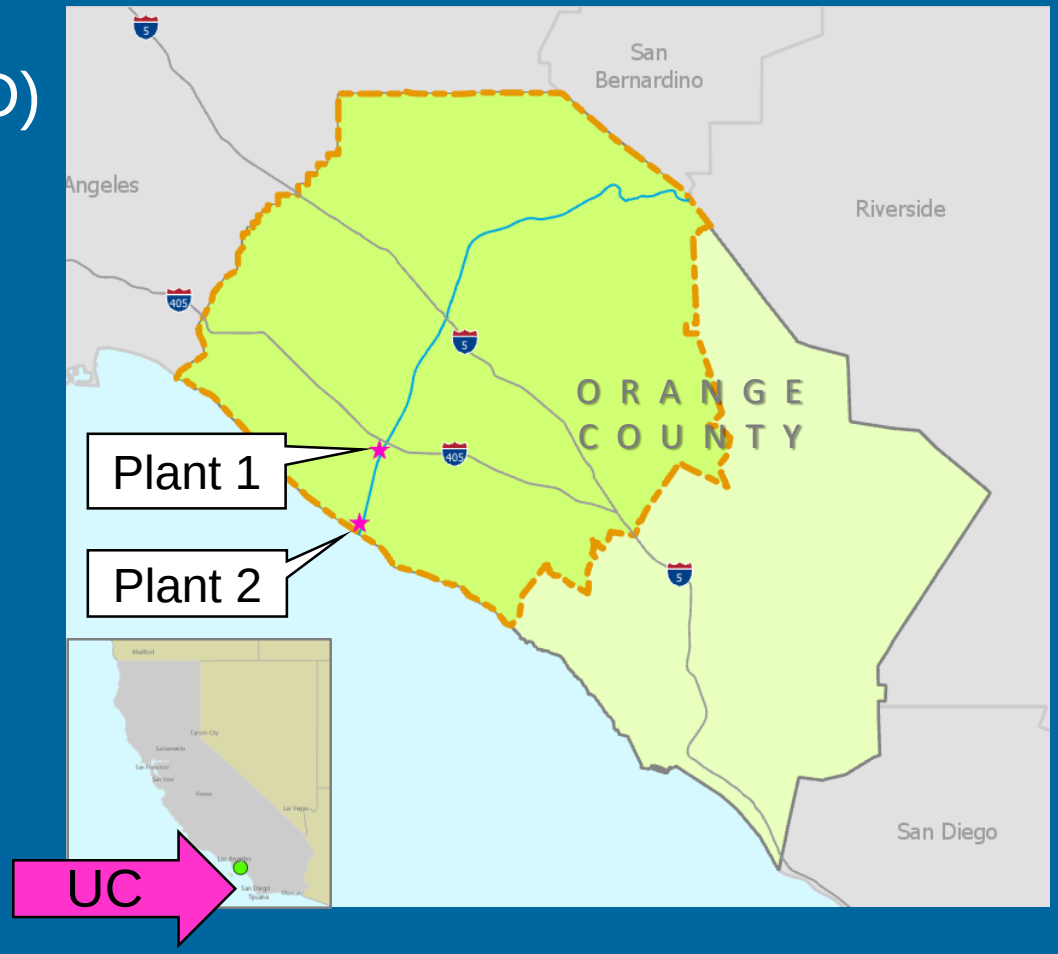
# Background - Area of Interest

- Orange County, CA
- Orange County Sanitation District (OCSD)
  - Regional wastewater agency
  - Serves 2.5 million people in central and northwest regions
  - 471 square-mile service area

  - Collection System
    - 400 miles of trunk sewers
    - 4640 manholes

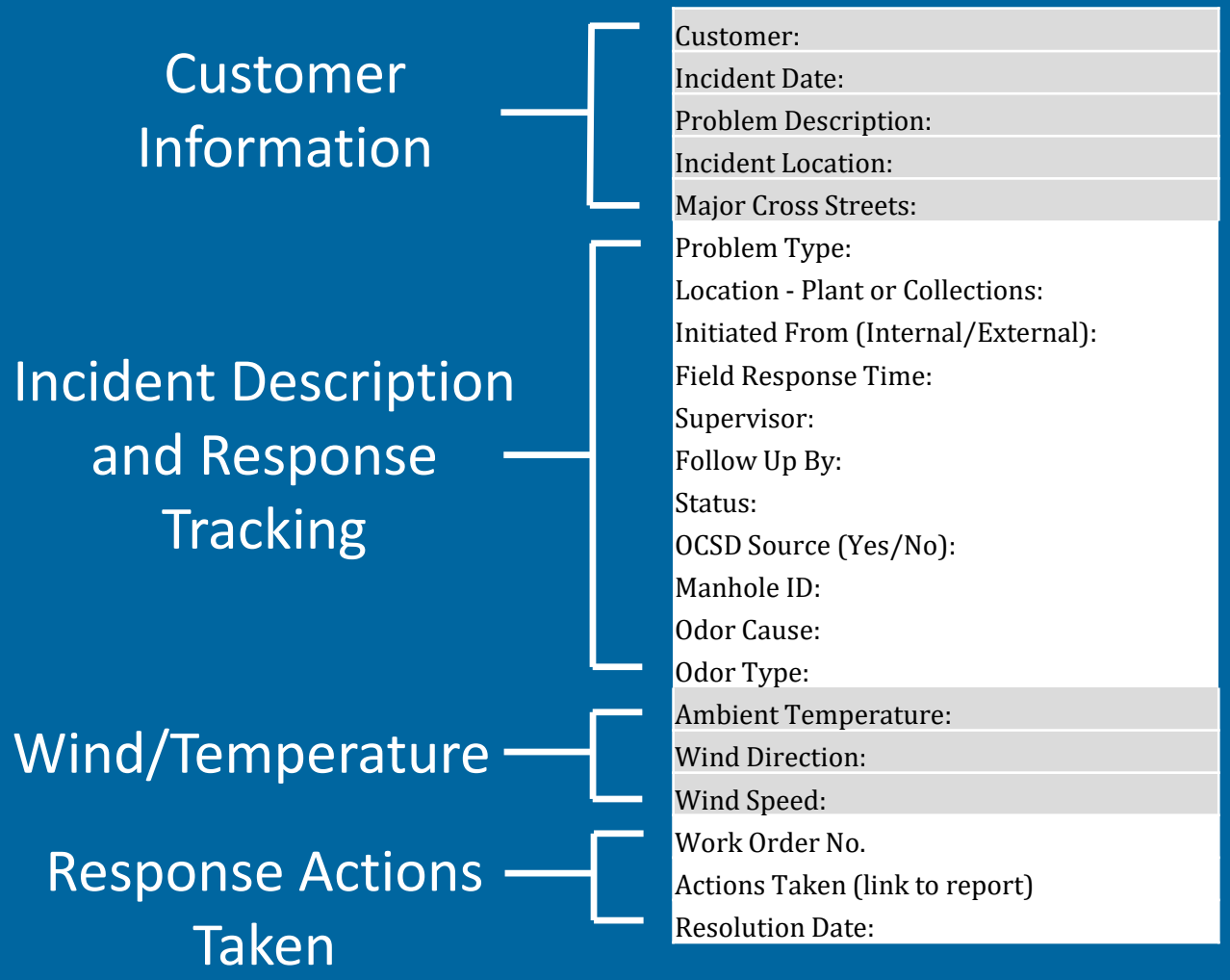
  - Reclamation Plant No. 1 – 97 MGD
    - *Fountain Valley, CA*

  - Treatment Plant Plant No. 2 – 103 MGD
    - *Huntington Beach, CA*

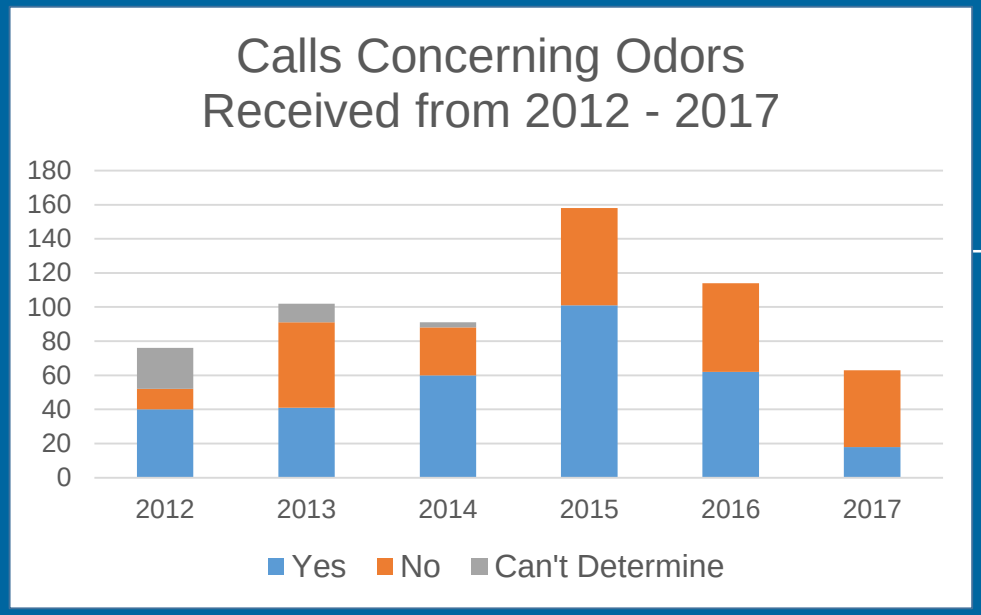


# Odor Call Event Response

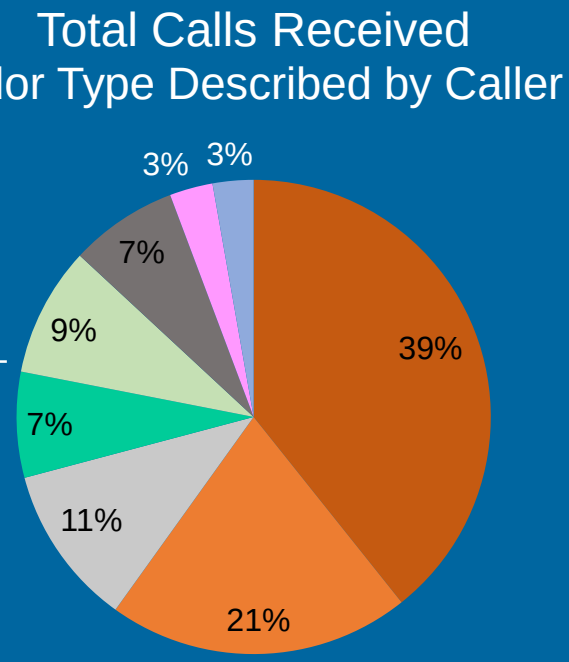
- The OCSD Call Center receives calls from the public related to odors, spills, construction, noise, damaged or loose manholes, and other incidents that may occur within the service area
- Reports of odors have been documented in electronic format since 2012



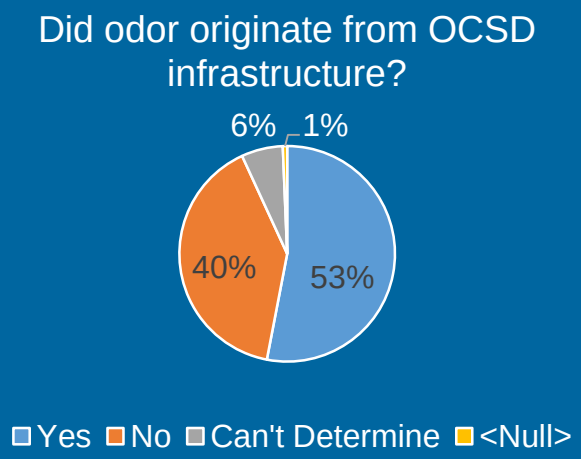
# Overview of Odor Call Data

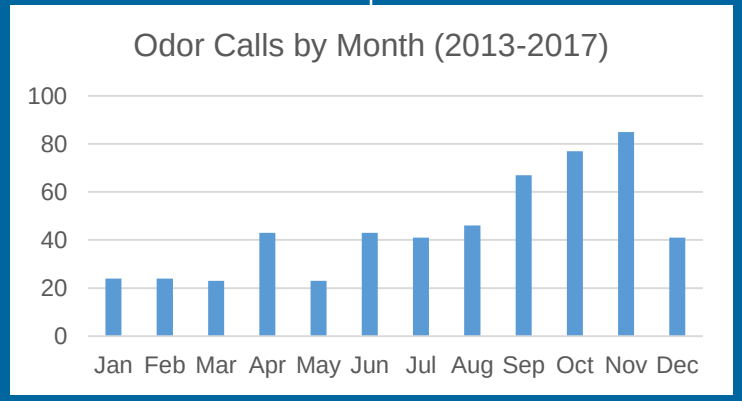



611 Odor Calls
April 2012 to
Dec. 2017

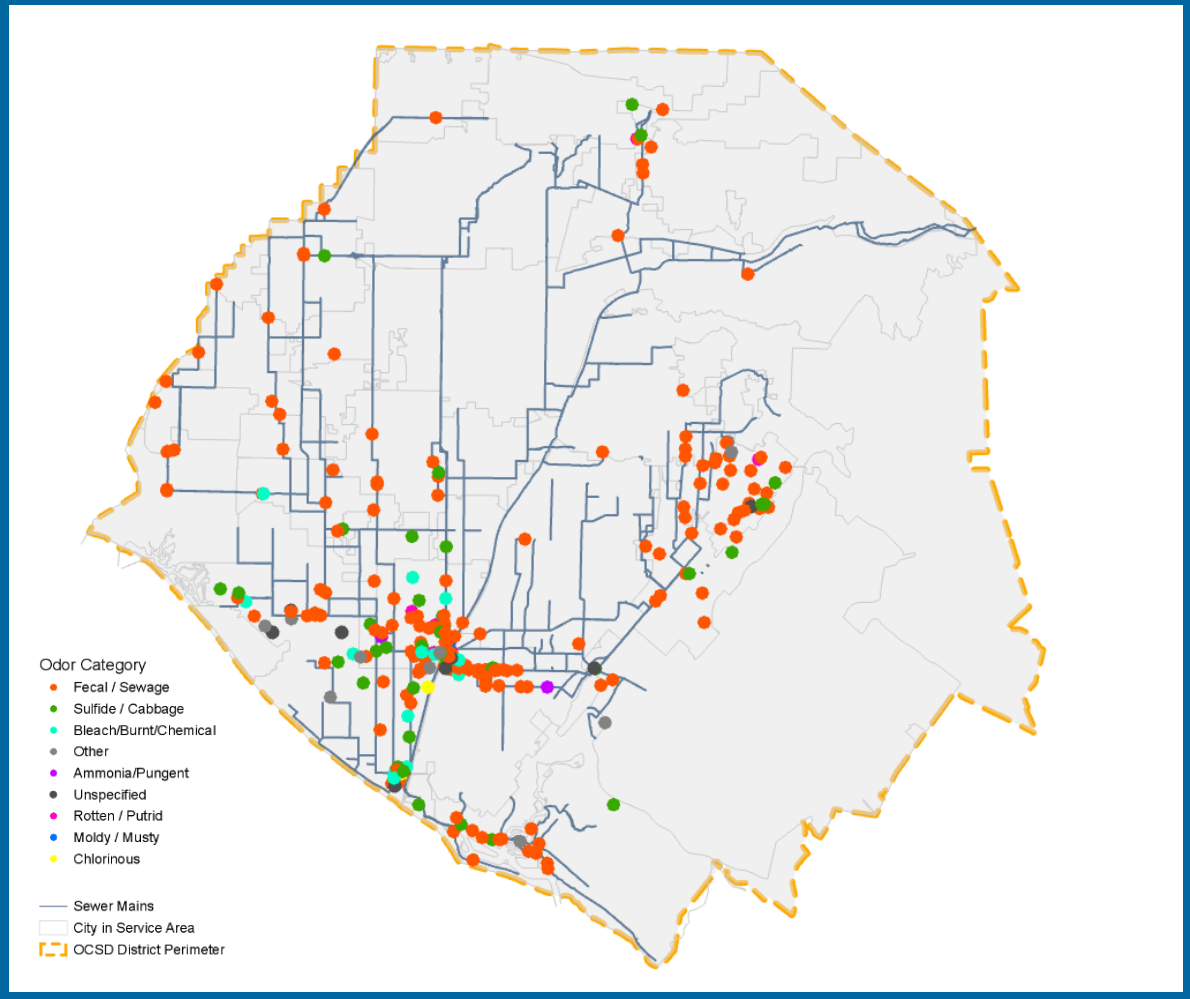


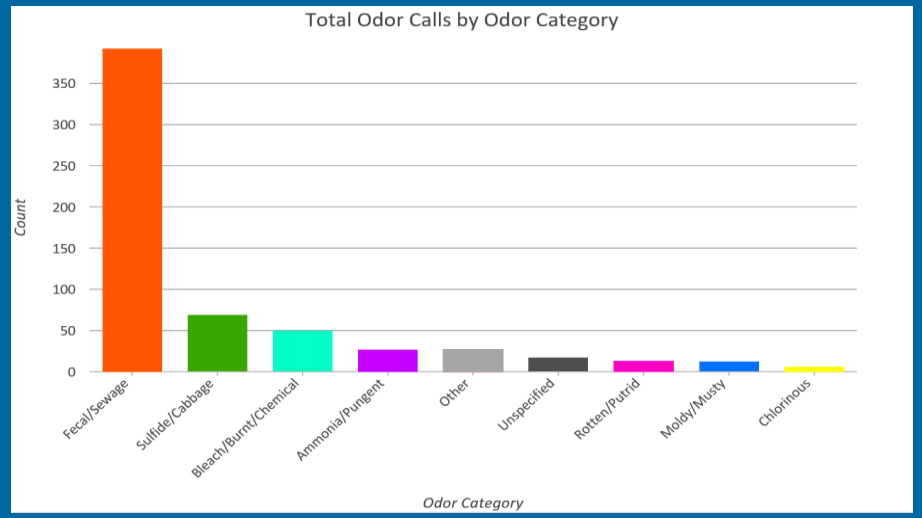

*Other includes Putrid/Rotten, Ammonia, Garbage, Gas, Chlorine, Burnt Rubber, Cabbage, Onion



# Odor Call Data – Spatial Distribution



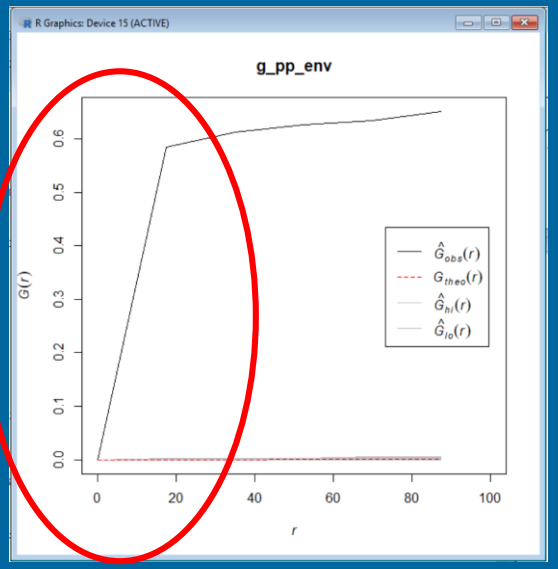
# Questions

- Is the point pattern of historic odor complaints random or not? Do calls occur in clusters or are they evenly spaced throughout the service area?
- If odor complaints appear to be grouped, where are these groups located and how well are they clustered?
- What is the extent of the population that is most likely to be impacted by odors from OCSD facilities?

# Point Pattern Analysis using R

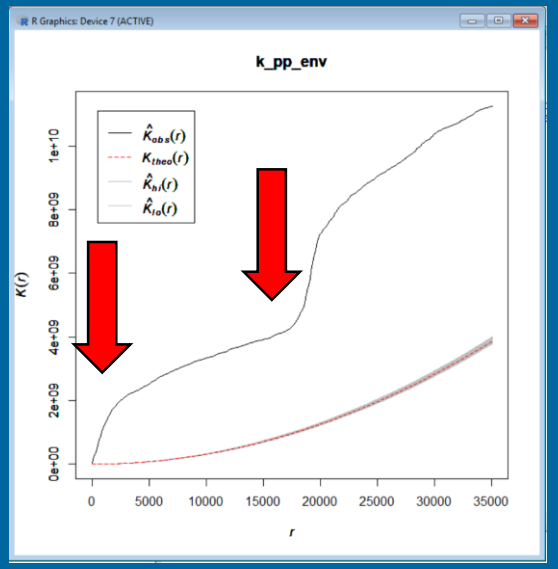
- R is a free statistical software package used for data analysis
- Examine **second-order effects**, degree of clustering in service area
- Distance-based functions:

**G-Function**




- Nearest neighbor distance

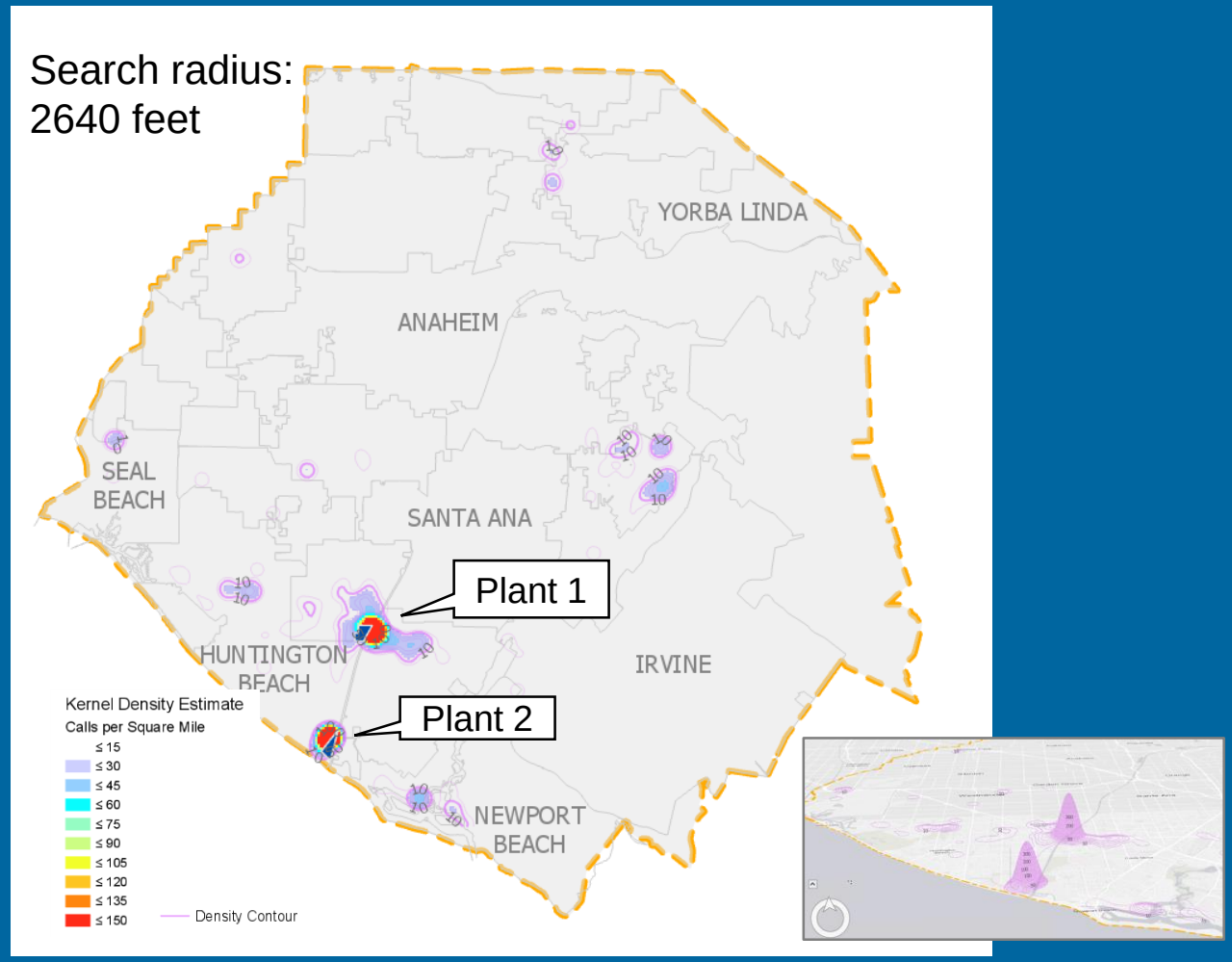
**K-Function**

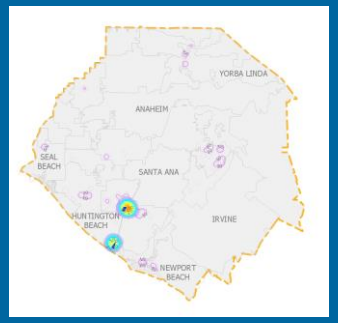



- Events in Proximity

# Spatial Analysis using Kernel Density Estimation

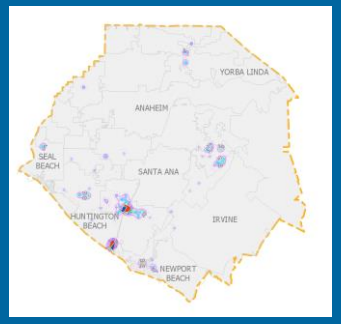
Examining first-order effects



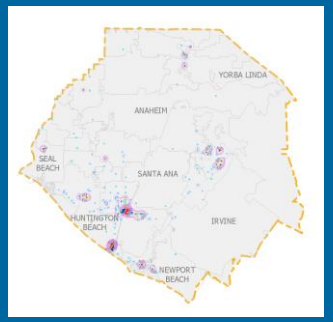



Sensitivity Analysis

Search radius:
6321 feet (Default)



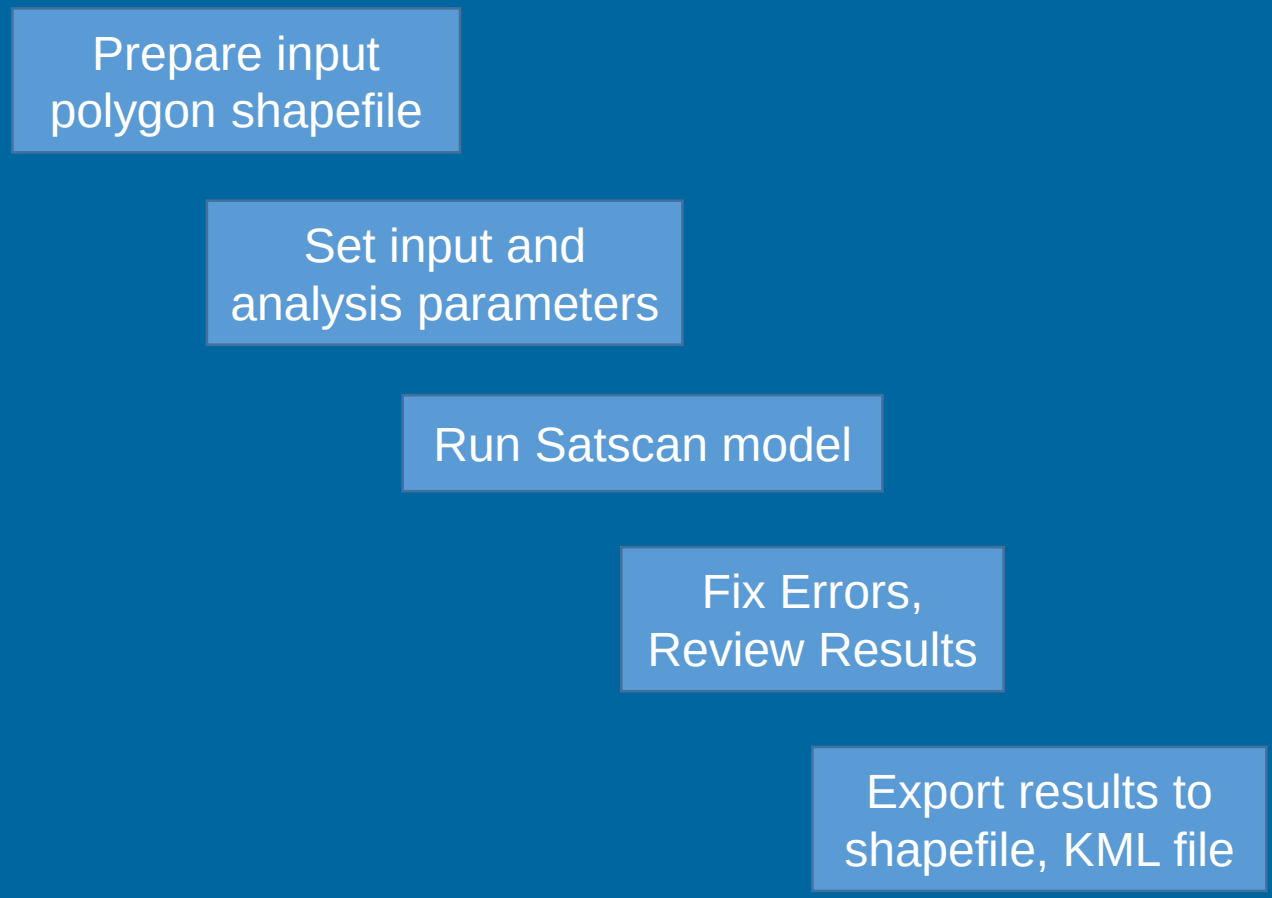
Search radius:
1320 feet



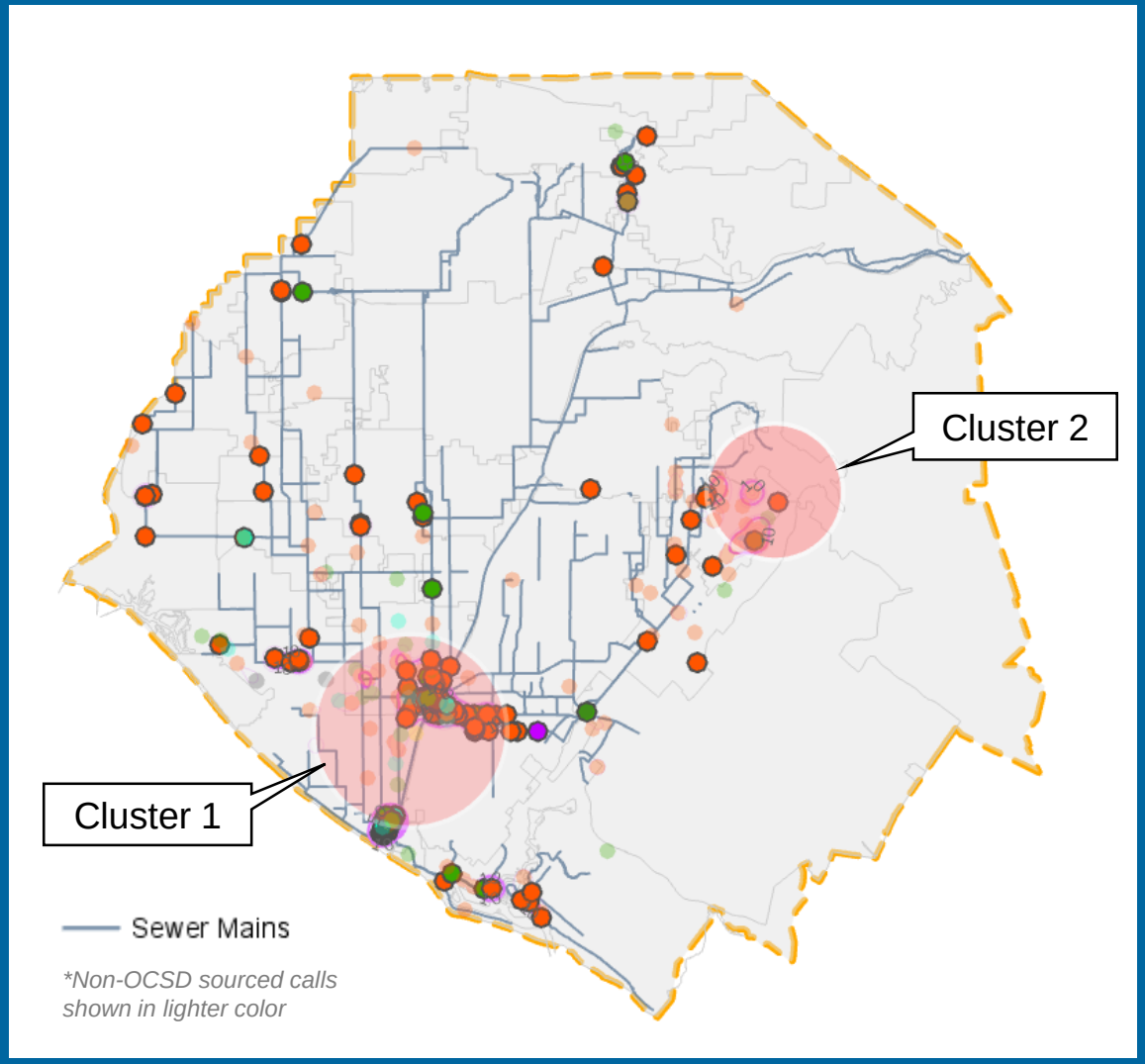
Search radius:
660 feet

# Cluster Analysis - SatScan

- Free software for analyzing data using spatial, temporal and space-time scan statistics
- Adjusts for the uneven geographical density of **background population**
- Detects spatial clusters and see if they are statistically significant

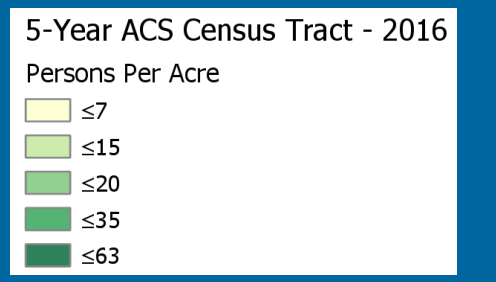


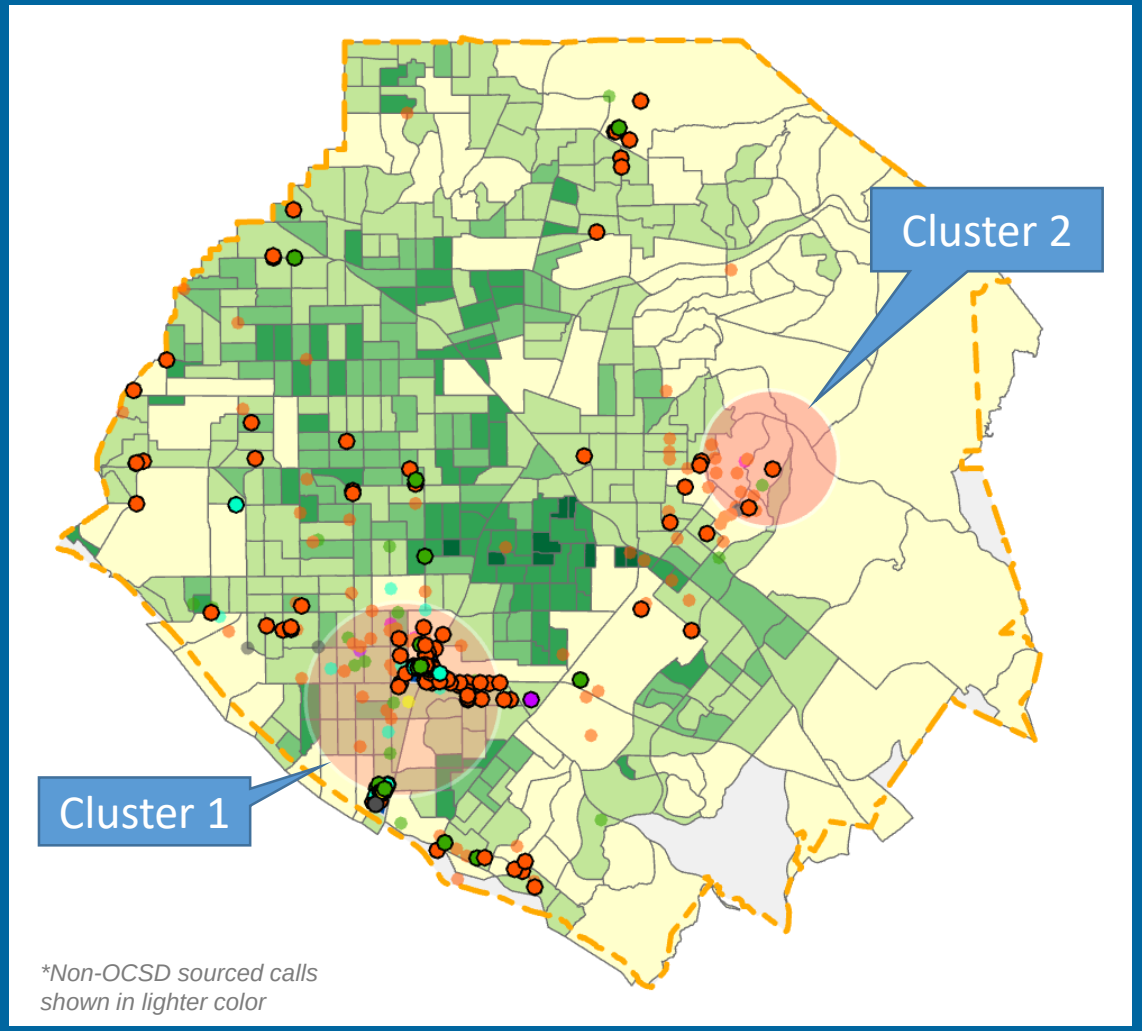
# Cluster Analysis – SatScan Results



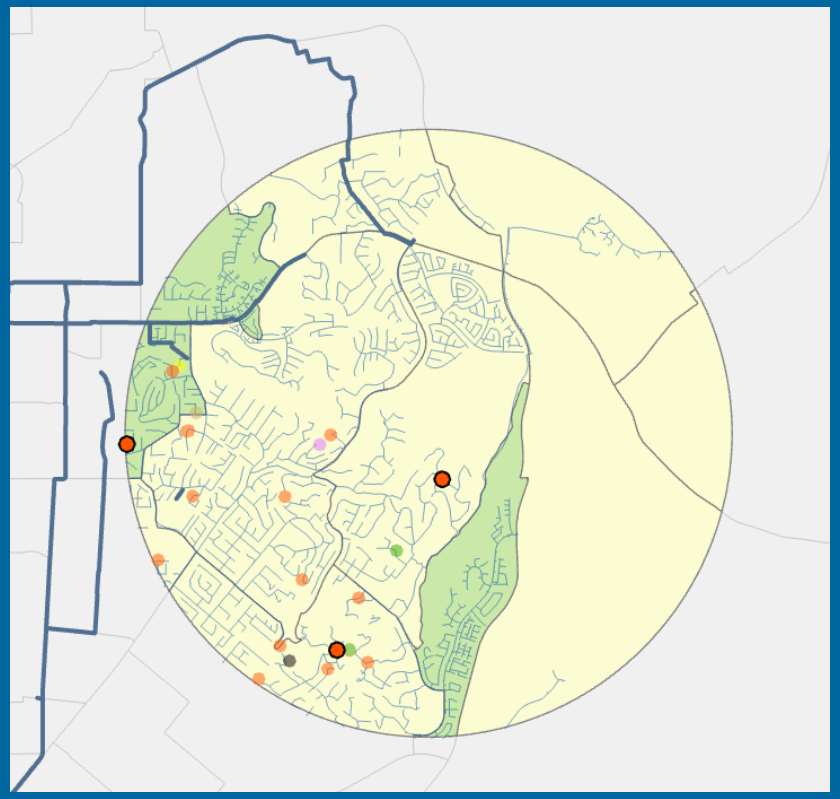
# Cluster Analysis - Population

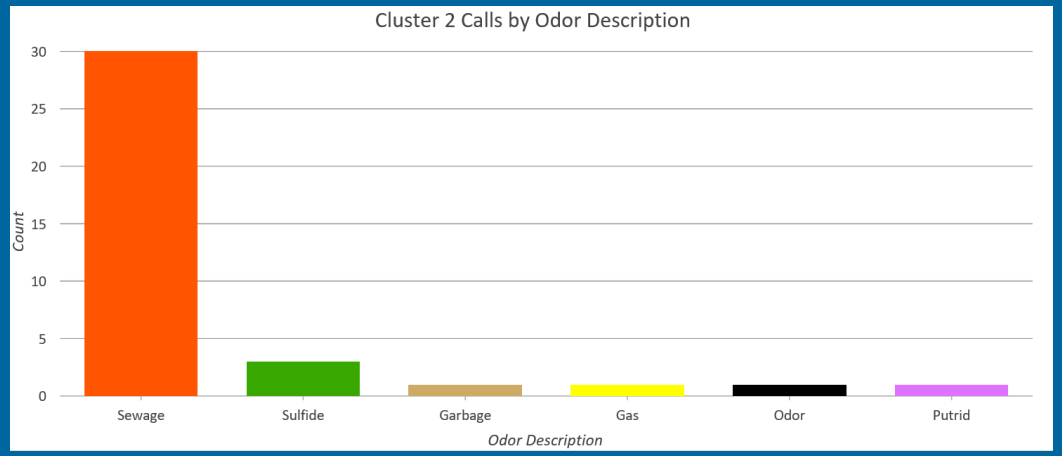
Entire Service Area:
611 Calls
2.54 million people
Incident Rate: 0.02%



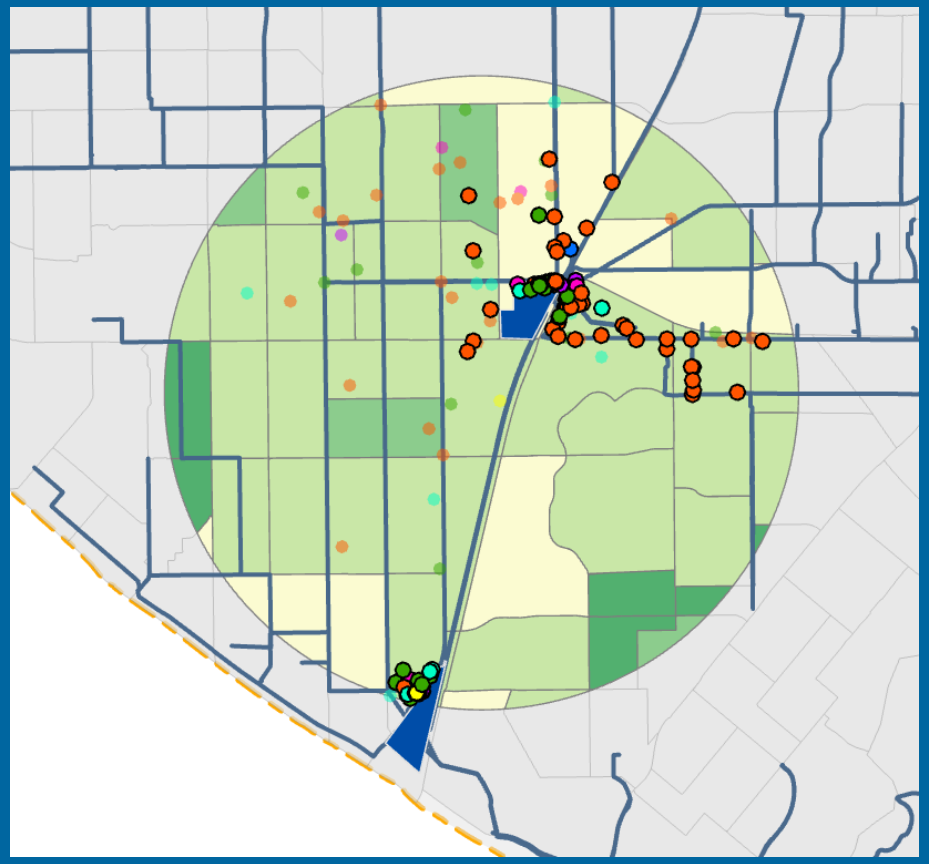
# Satscan Cluster 2

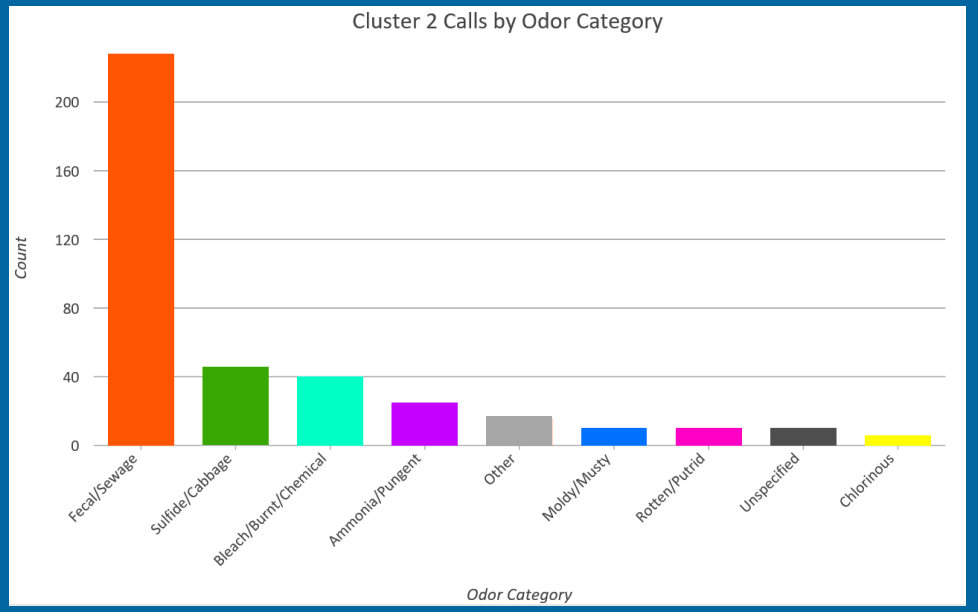





Cluster 2:
37 Calls (3 OCSD, 26 non-OCSD, 8 can't determine)
(25 unique customers)
31,278 people
Incident Rate: 0.12%

# SatScan Cluster 1

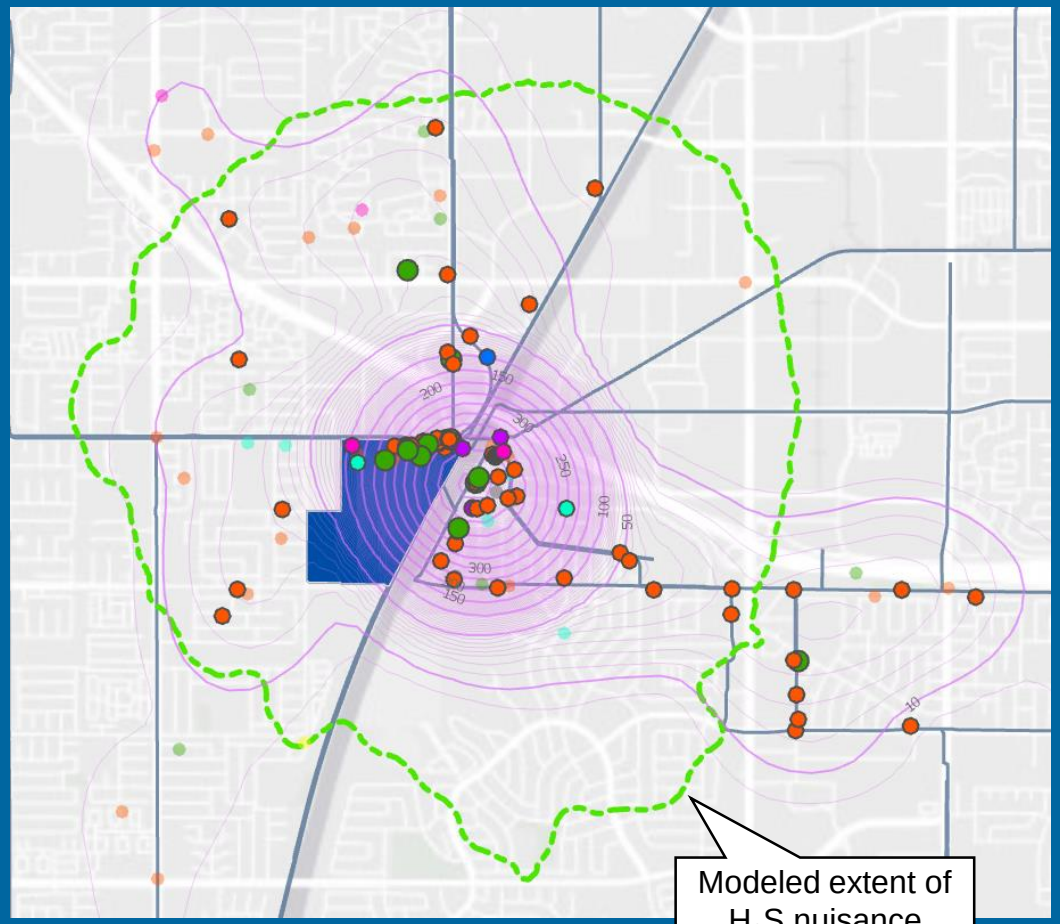




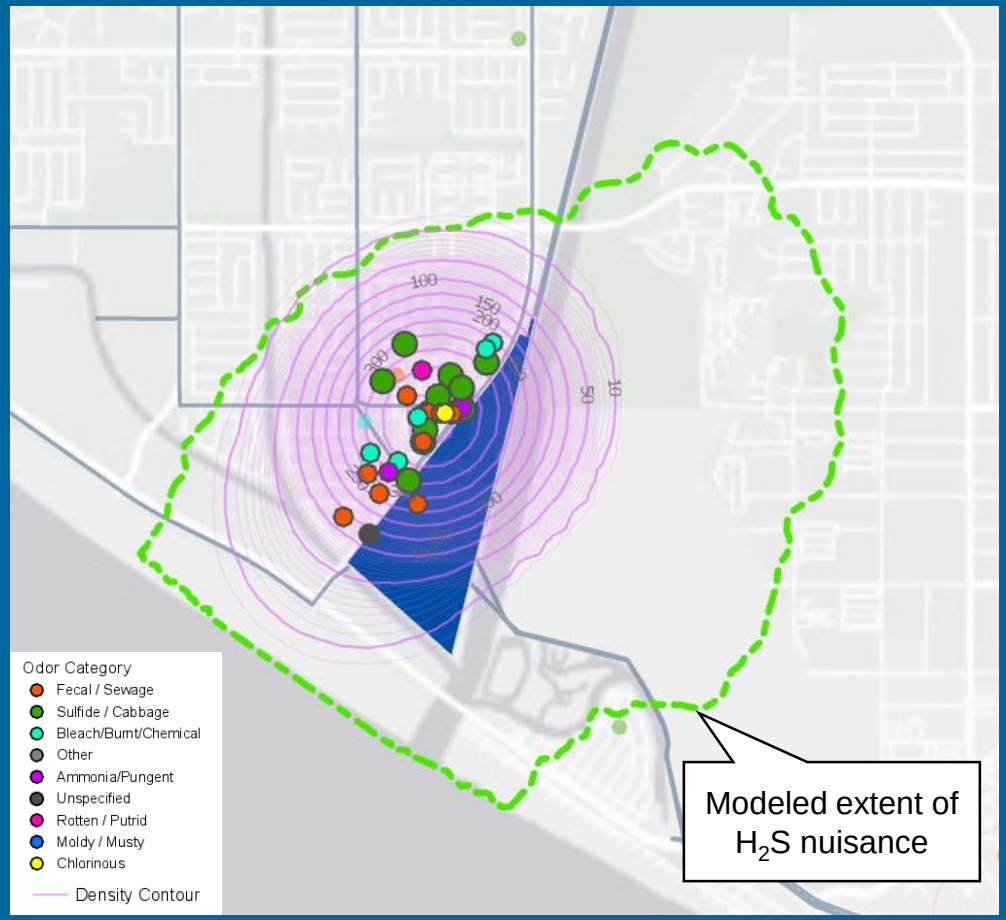

Cluster 1:
391 Calls (234 OCSD, 143 non-OCSD, 11 can't determine)
158,000 people
Incident Rate: 0.25 %

# Plant Odors – Sensory and Modeled Data

## Reclamation Plant 1



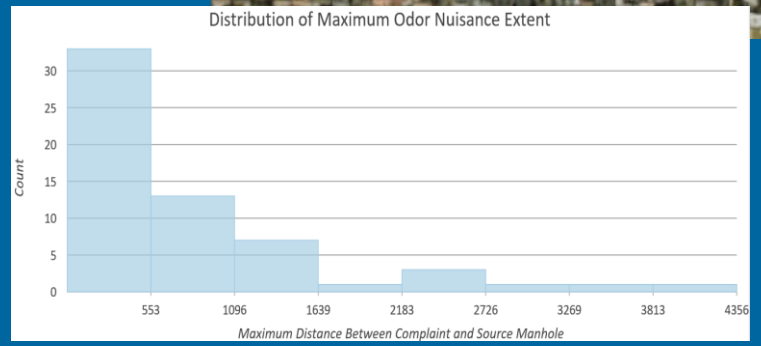

## Treatment Plant 2



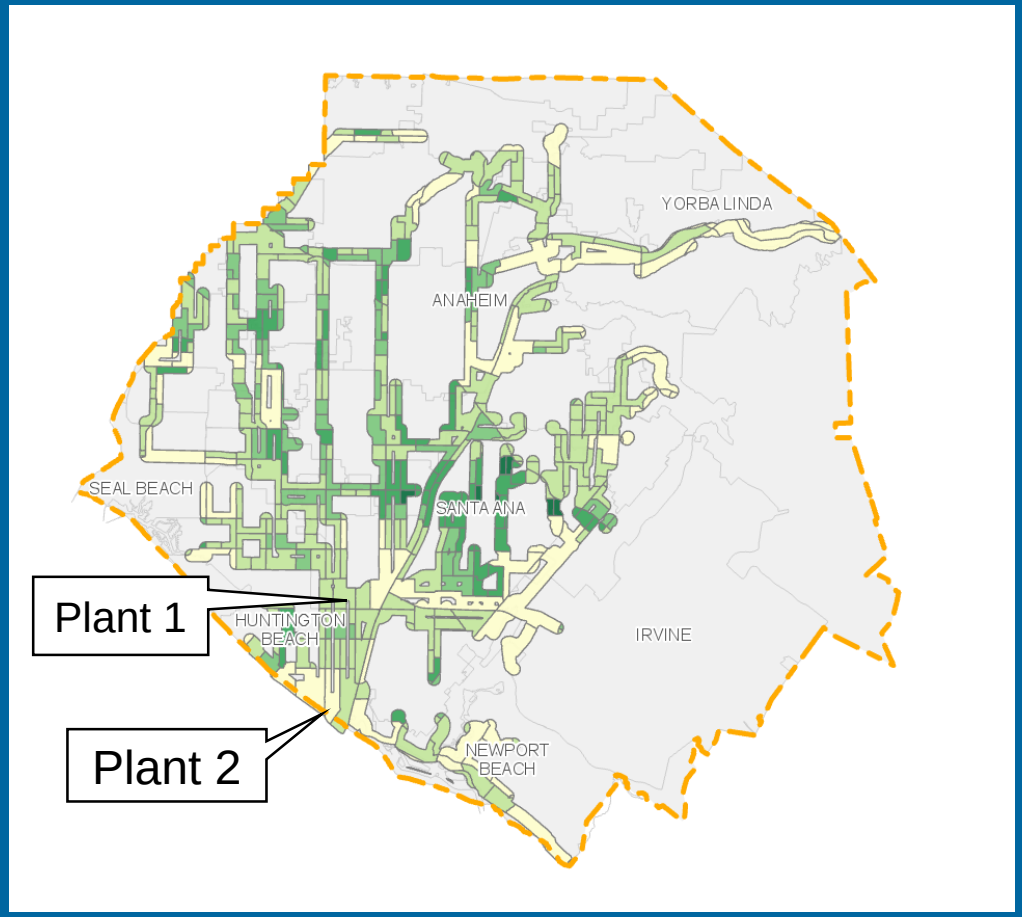
# Odors in Collection System

*Resident reports sewer odor*

*Resident stated odor was a strong sewage odor coming from a manhole cover.*



# Odor Impacts – Affected Population




5-Year ACS Census Tract - 2016
Persons Per Acre
- ≤7
- ≤15
- ≤20
- ≤35
- ≤63

<u>Buffer Zone</u>
Affected Population: 871,737
33% of all customers in service area
86% of all calls covered
96% of OCSD-sourced calls covered

# Conclusions

- Two significant clusters – Plant 1 and Plant 2
- Initial development of clustering in the service area, need more data
- “Zones”, areas to watch
  - Monitor for future calls
  - Target neighborhoods for outreach efforts
- Refined estimate of affected population

# Questions?

# Acknowledgements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Graduate Faculty and Staff

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