

# Illegal Dumping / AI / Drones

A Case Study of Bayview San Francisco

Brian Johnson  
April 20th 2023



# Brian Johnson

## About Me

Father & Husband

Volunteer,

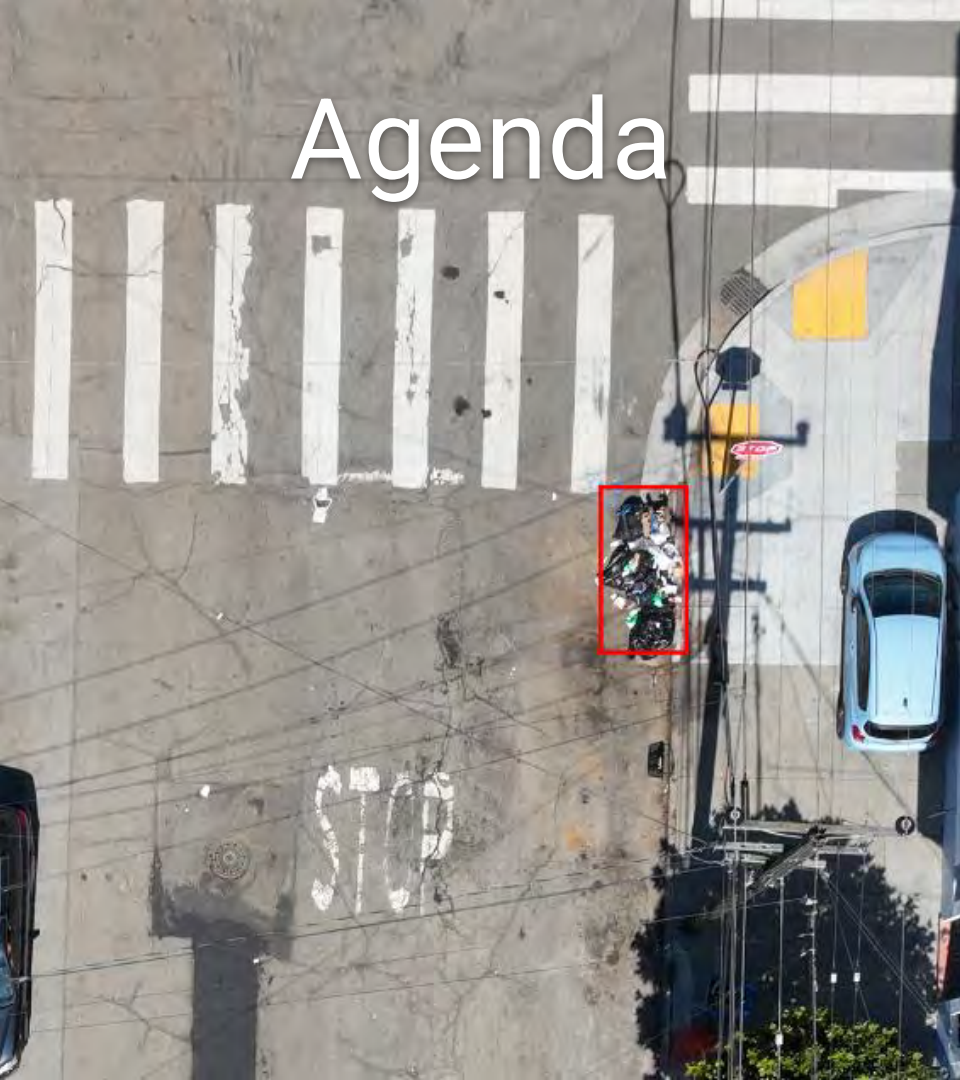
**Computer Engineer w/ 2 decades**

**A partner for  
solving illegal dumping**



We can solve illegal dumping.

# Agenda



- Why you, why now?
- What? Solve ID
- How? Drone + AI = Data
- Learning? consistent = cleaner
- A call to action: Consider us
- Q&A (15 minutes)

Why you Brian?





Education

Eradication

Enforcement



**Waste on streets**

**Drone flies**

**AI detects waste**

**Agent reports 311**

**311 routes to, and  
DPW picks up**

**Clean**



play the video...

A remote location (½ mile)



Away from road



# Large dump sites

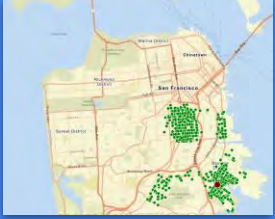




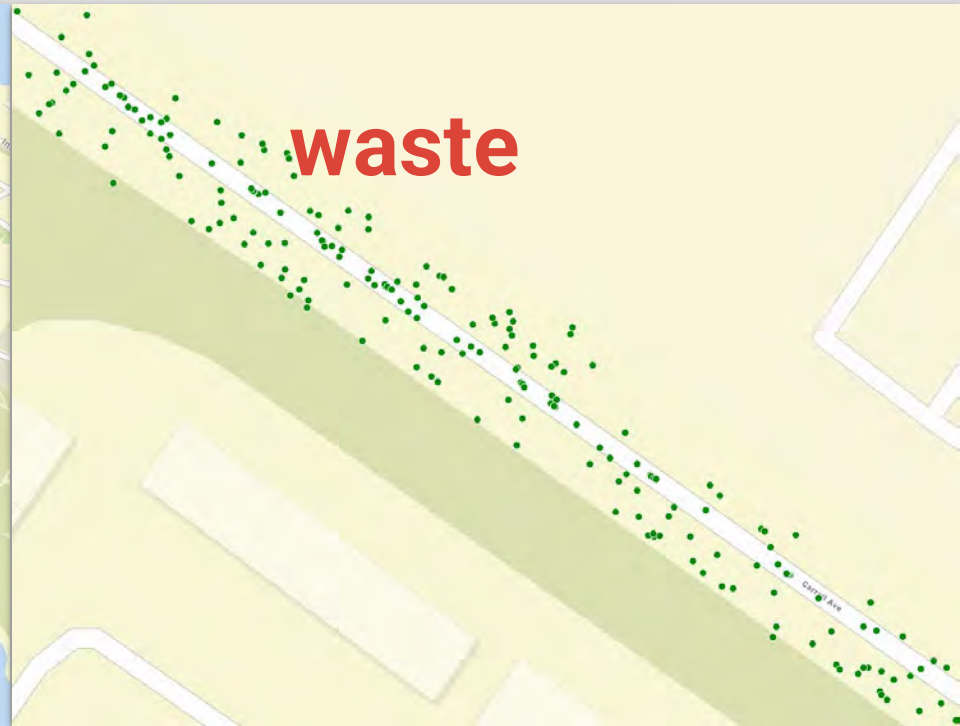
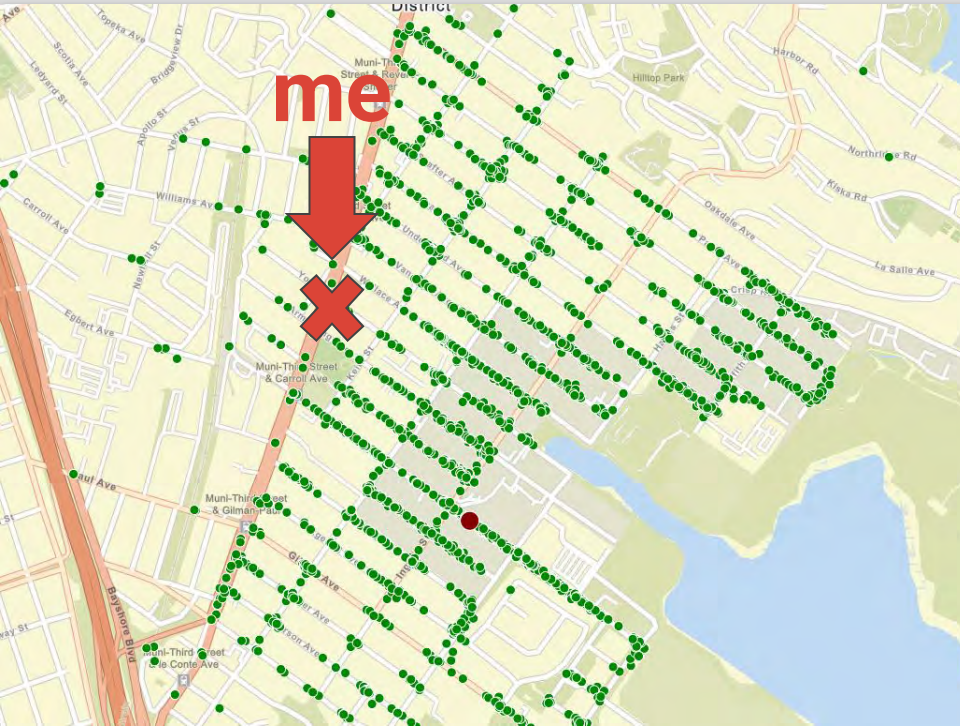
**Bags and loose debris**

Hidden behind vehicles





# Dump sites near my home





Man that's a lot of waste,  
but what are those **green** dots  
and **red** boxes?

An aerial photograph of a landscape with a road and several buildings. Numerous small green dots are scattered across the road and surrounding areas, representing data points for dumpsites. The word "Data" is overlaid in large blue font.

# Data

- Where are all dumpsites?
- How much volume?
- What is being dumped?
- When?

With **good data**, you **can**  
(correctly) answer these questions.

Detect, measure,  
describe, and report.



## Street or Sidewalk Cleaning at San Francisco

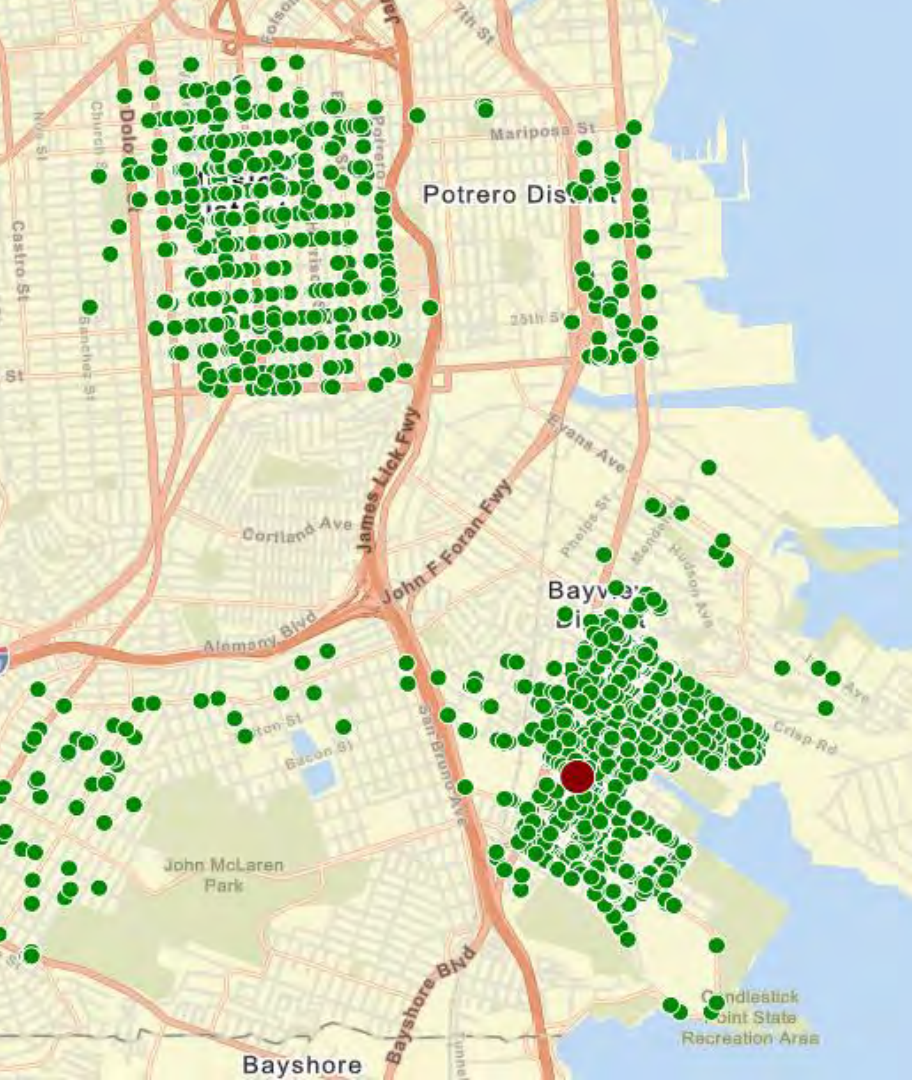
**CLOSED** Case Transferred. packer size load at this location. - 3 days ago #16667055

Submitted Thu Apr 13, 2023



more than a truckload on the road, containing, mattress, garbage bags, loose debris, furniture, construction debris, appliances, cardboard boxes, pallets

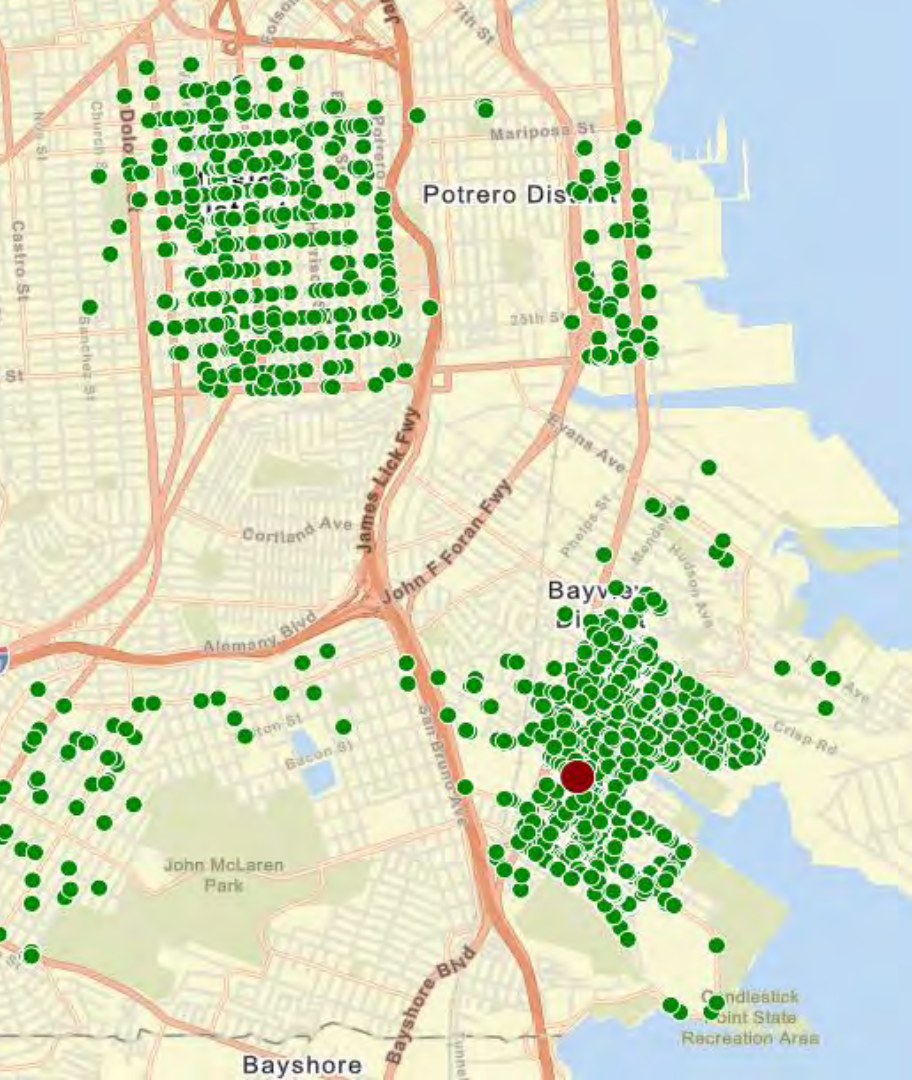
One drone and one pilot.



A single pilot can collect data for this entire area in 3.5 hours!

How?





80 miles,

32 miles/hour

2.5 hours

Mavic 3 enterprise can cover  
1 square mile in 30 minutes  
on a single battery.

# Automation Means Efficiency

Flight programming / automation

Machine vision + automation

# Flight path and photos are pre-programmed

Ascend to Start Point

Safe Takeoff Altitude (ALT)  m

Altitude Mode

Above Ground Level  m

Flight Speed  m/s

Aircraft Yaw

Gimbal Control



# Machine vision finds waste

Locates, crops, presents

The interface displays a search for waste clusters. At the top, filters include dates (04/13/2023 to 04/17/2023), a search term 'all', and a 'use confidence' checkbox checked at 98%. A 'Get Results' button is visible. Below the filters, a slider shows 60 clusters. The main area contains six panels, each with a '1 detections' indicator and navigation arrows. Each panel shows an aerial view of a waste site with a bounding box and a confidence score. The top-middle panel includes a status message: 'Case Resolved. Loose debris.' The bottom panels show various views of waste, including a large pile of debris and a smaller pile near a fence.

04/13/2023 04/17/2023 all use confidence 98 100 Get Results

Clusters: (60)

1 detections

99.09 Thu Apr 13 2023 open

98.32 Thu Apr 13 2023 closed Case Resolved. Loose debris.

98.75 Thu Apr 13 2023

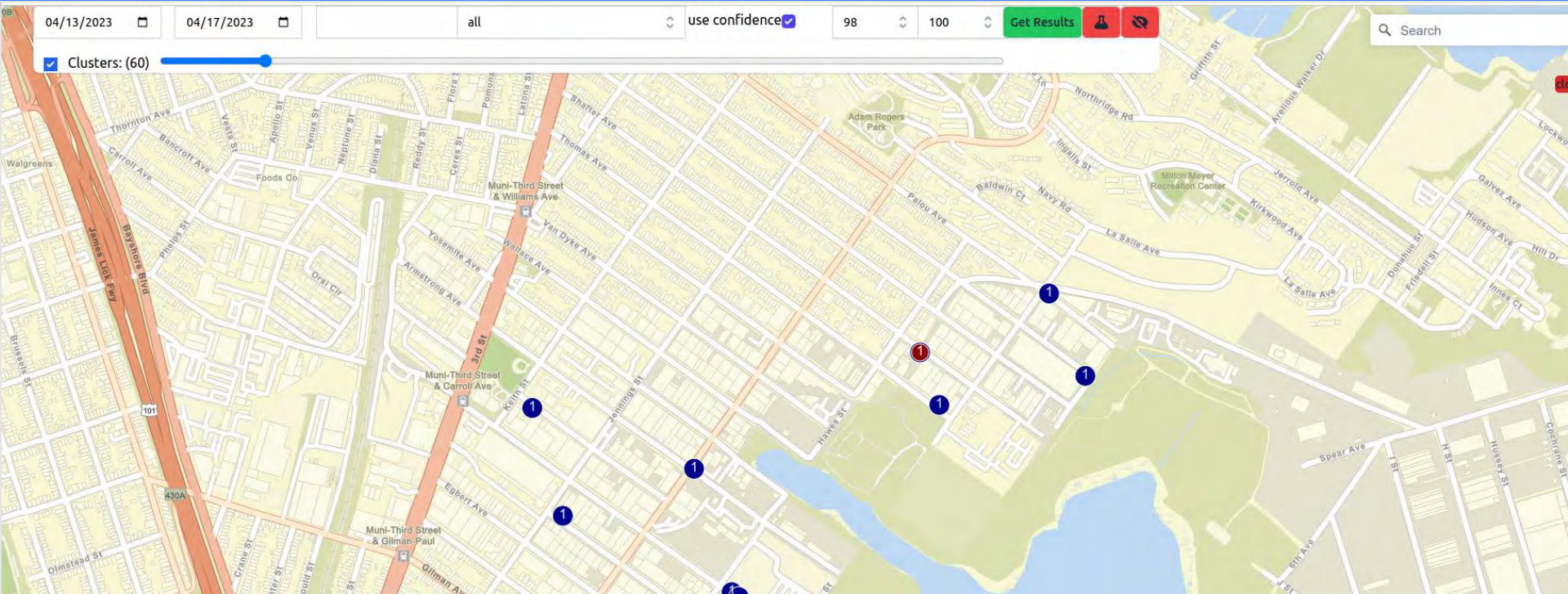
99.11 Thu Apr 13 2023

99.05 Thu Apr 13 2023

98.1 Thu Apr 13 2023

# Operator can see waste

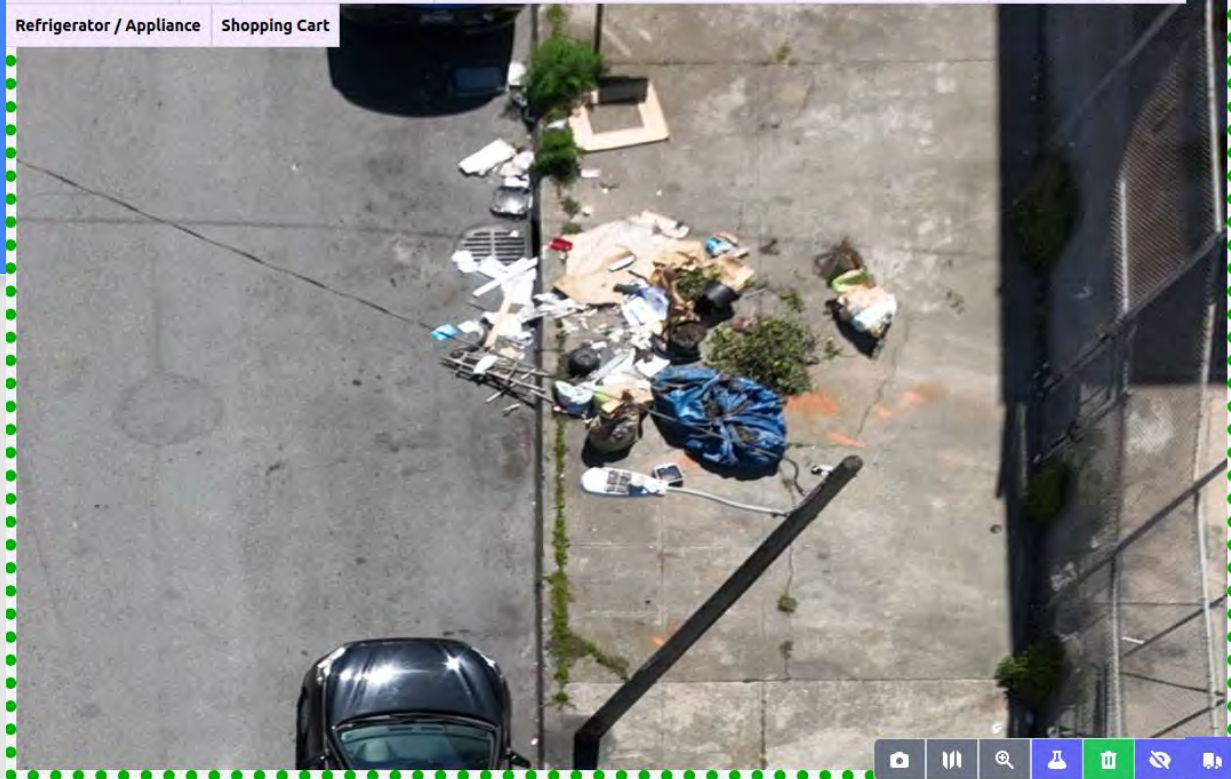
## Clustered, deduplicated, and mapped



- Other Loose Garbage / Debris
- Other Contained Garbage
- Mattress
- Furniture
- Overflowing Public Garbage Can
- Trash on transit shelter
- Electronics/E-Waste
- Glass
- Human / Animal Waste
- Medical Waste
- Neglected Building (Blight)
- Oil / Paint / Other Spill
- Overgrown Lot (Blight)
- Refrigerator / Appliance
- Shopping Cart

# Waste is reported

Photo is cropped  
 GPS calculated  
 Description  
 Reported to 311



a small pile containing a medium pile containing a large pile containing more than a truckload containing mattress garbage bags loose debris toxic waste furniture construction debris appliances cardboard boxes pallets blocking handicap access behind barricade in tree well near encampment on the road on the curb on the sidewalk by the city boxes on the grass/field by the power pole by the sign post by the fire hydrant by the city garbage can between parked cars behind fence touching building touching fence covering drain near dumpster full-photo

# 2 month Bayview case study

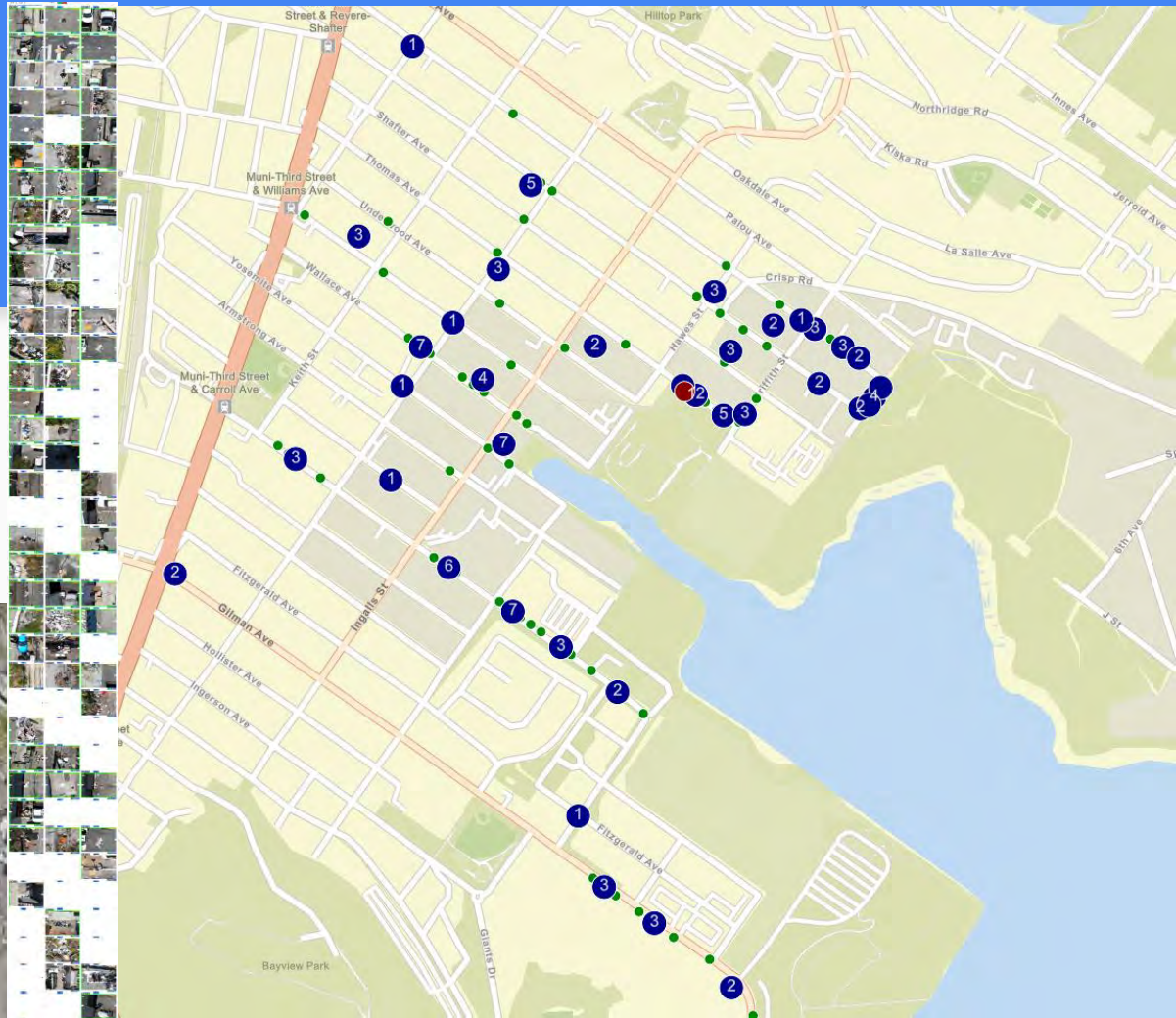
- **Context:** Bayview SF, epicenter of illegal dumping
- **Objective:** Report every illegal dumping site
- **Methodology:** One man, one drone, one application
- **Conclusion:** Continuous reporting changed my neighborhood



# May 9th, 2022

(after a dozen flights over 3 months)

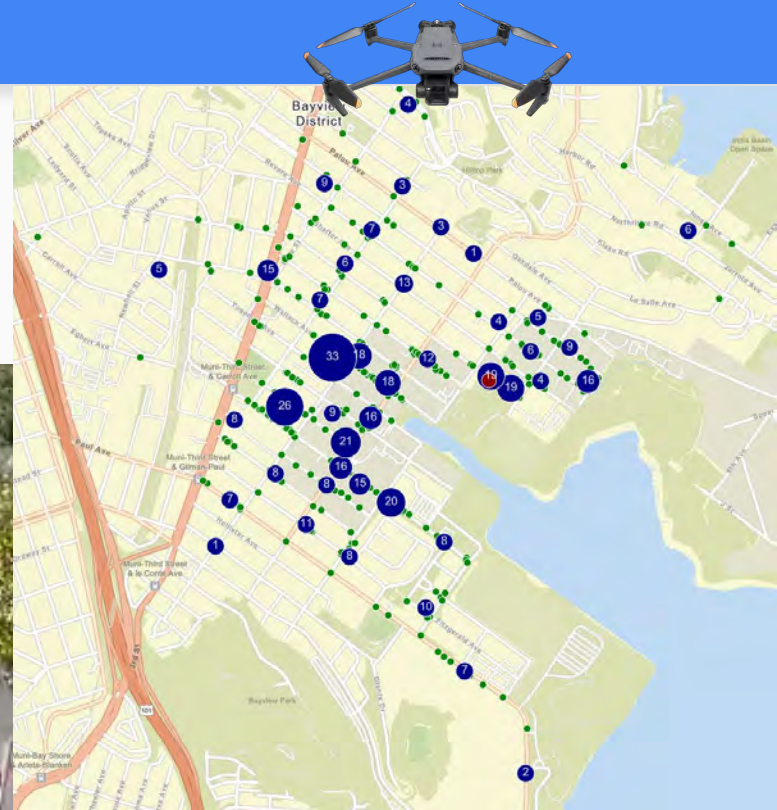
# 118 dump sites



So, I reported **every day** for 26 days.

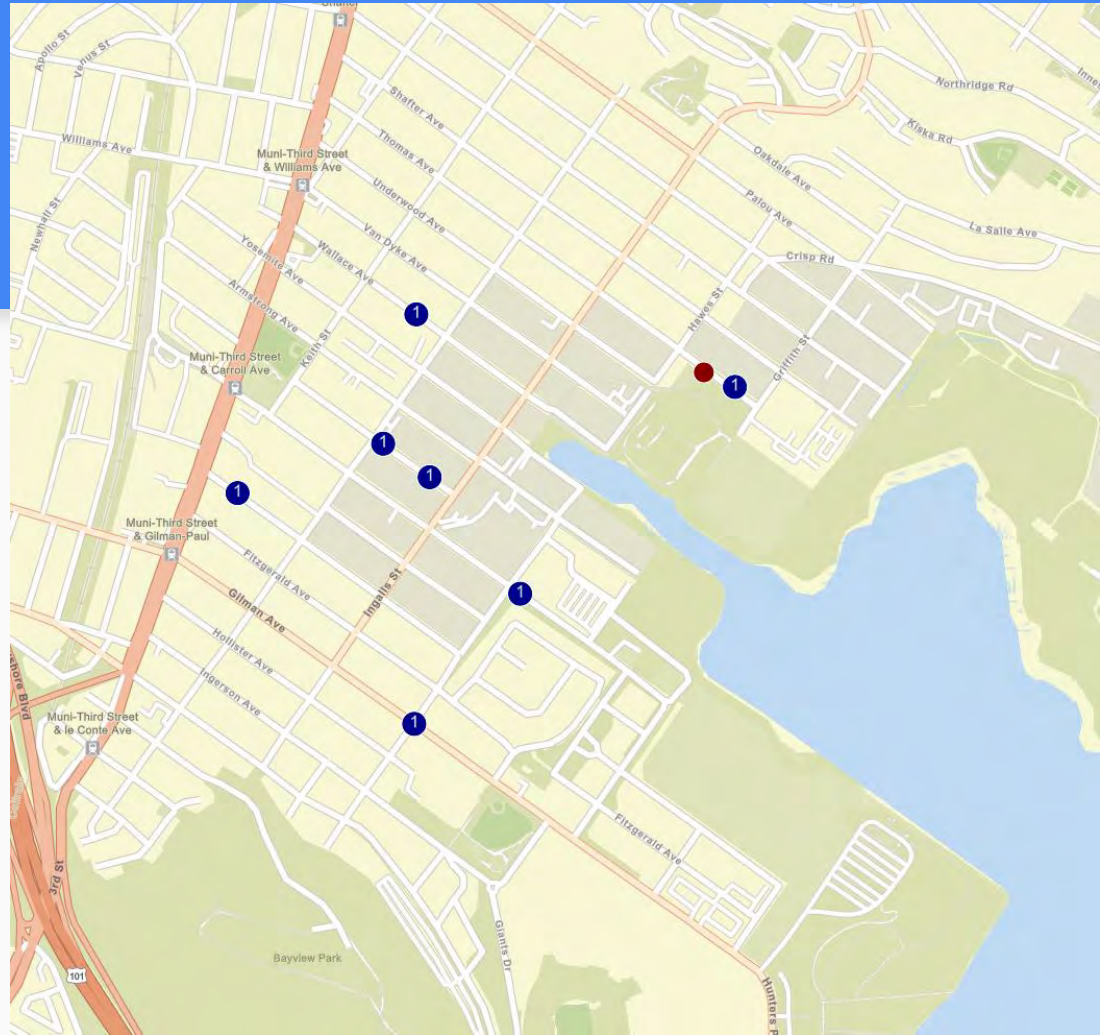
(26 days)  
May 9th - May 24th

444 reports



May 24th, 2022

7 dump sites



# 2 week break

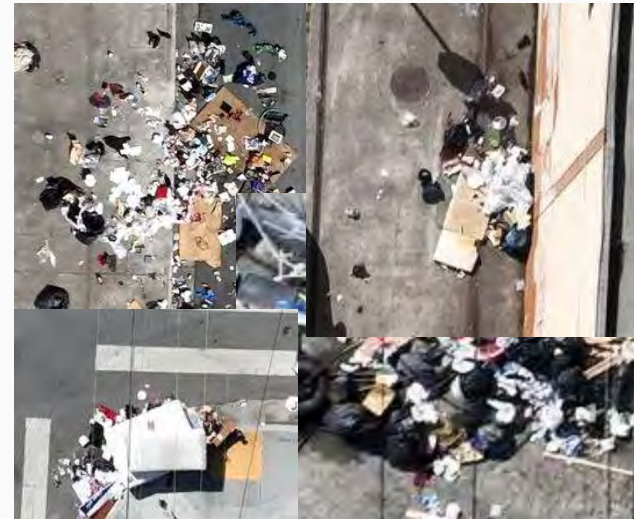
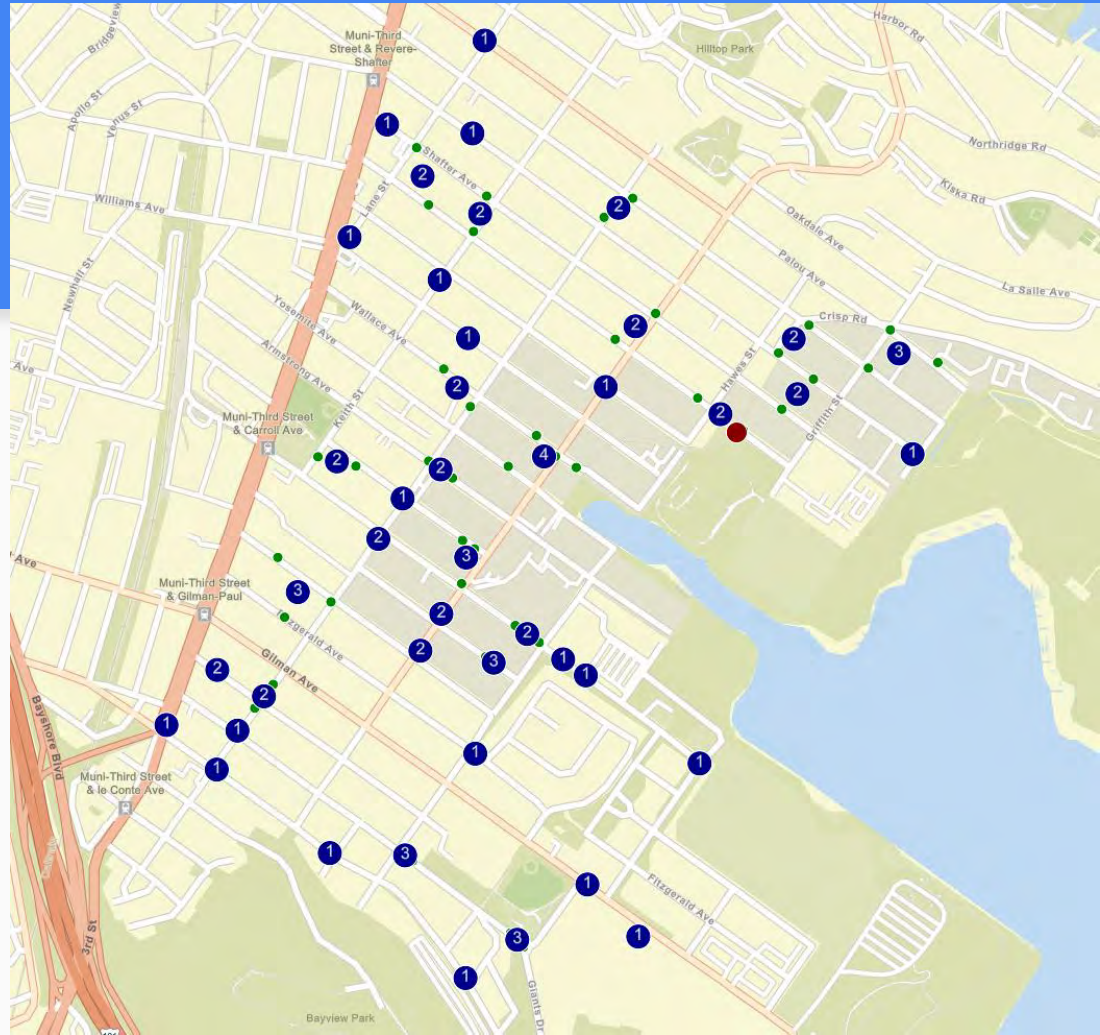
**0** reports are sent to 311

...and when I got back...

# June 6th, 2022

# 73

dump sites



So, I reported **every day** for 24 days.



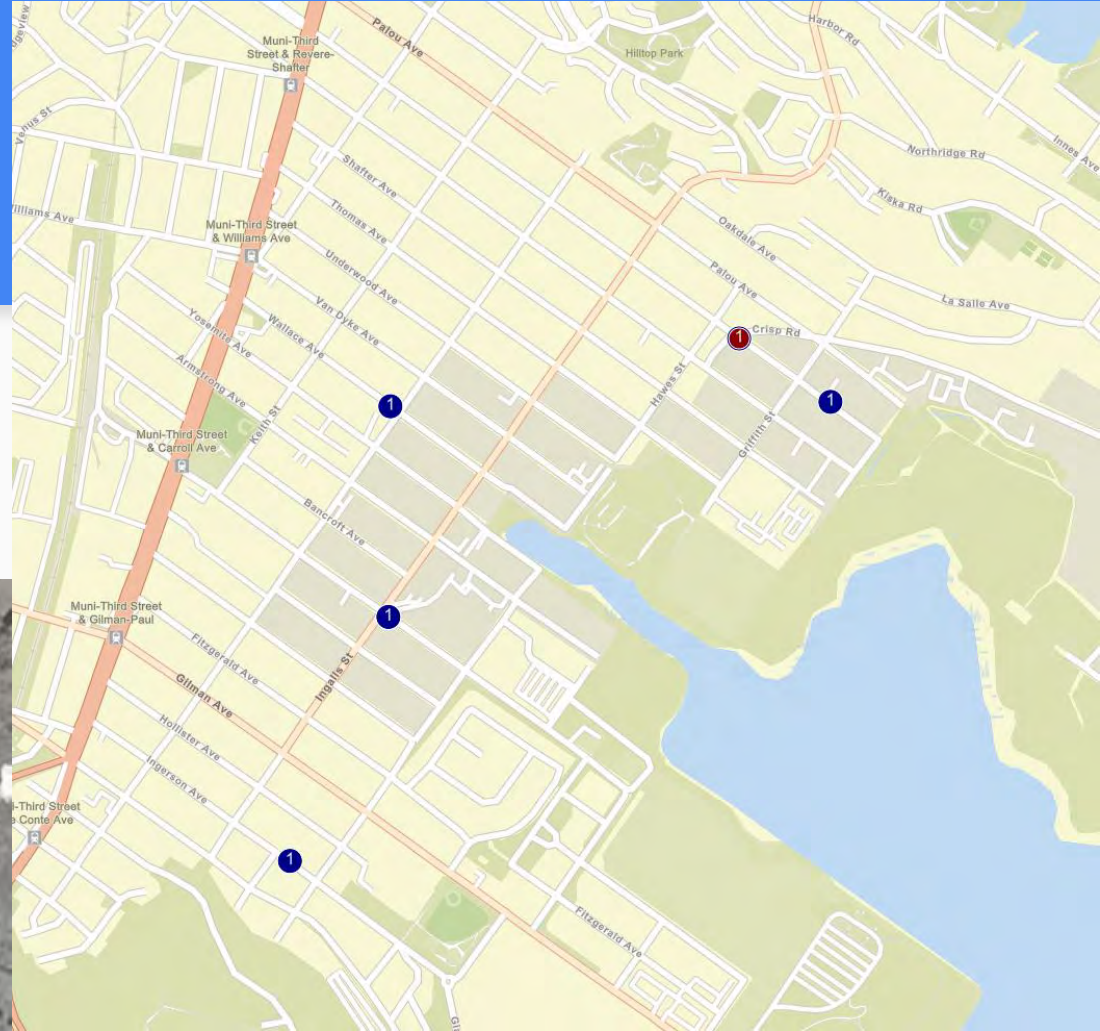
(24 days)  
June 6th - June 29th

# 410 reports



June 29th, 2022

5 dumpsites

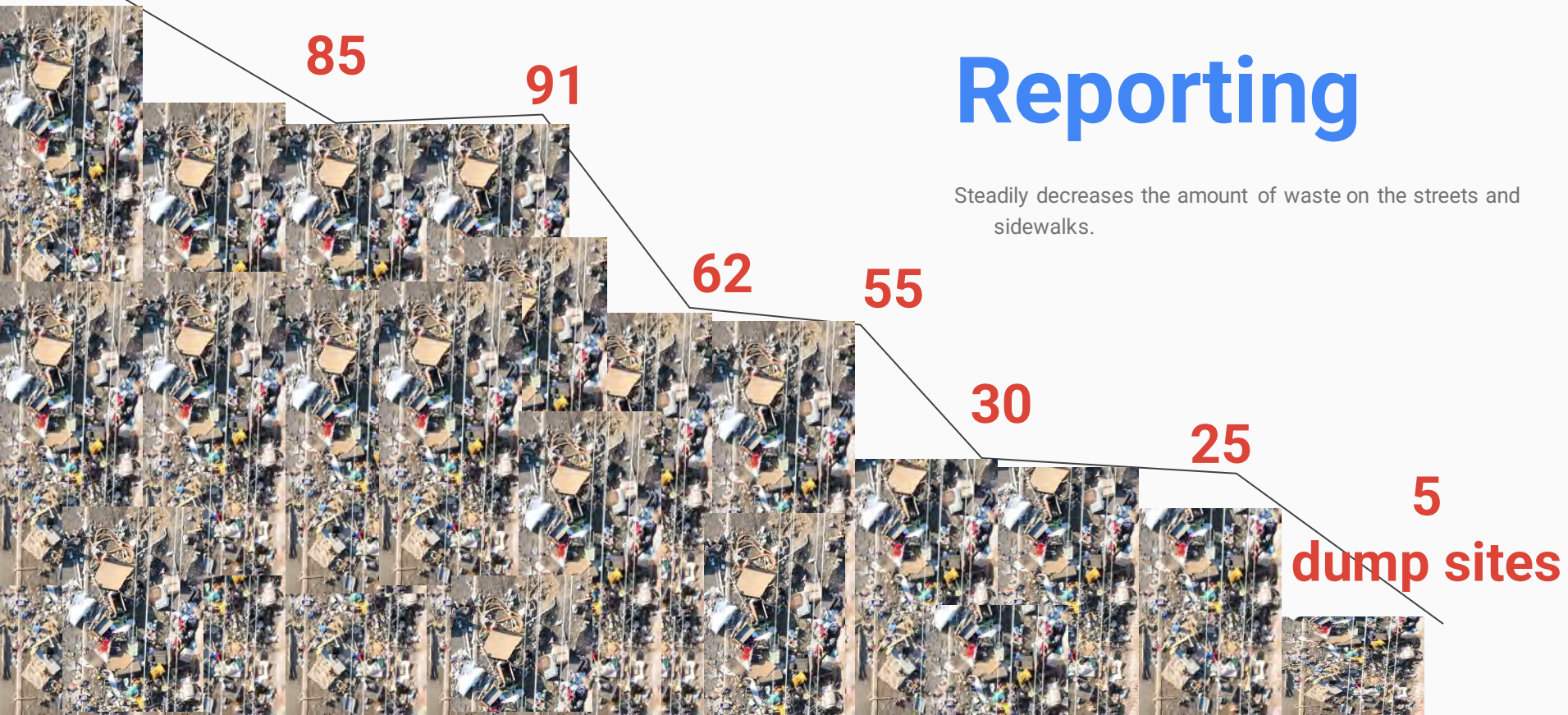


It's steady improvement...

**118  
dump sites**

# Continuous Reporting

Steadily decreases the amount of waste on the streets and sidewalks.



**5  
dump sites**

# Bayview Dumpsites (one year)

4,441

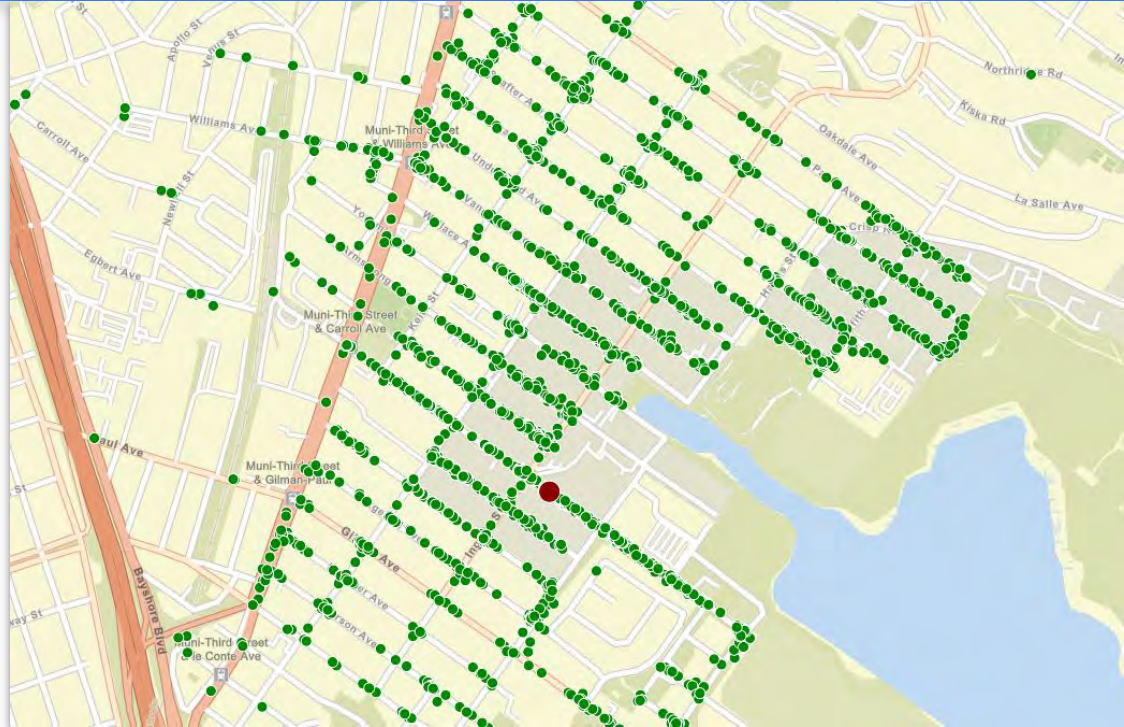
Dump sites (Bayview) in 1 year

3rd Street to Bay,  
Jamestown Ave to Palou Ave

Bayview Neighborhood

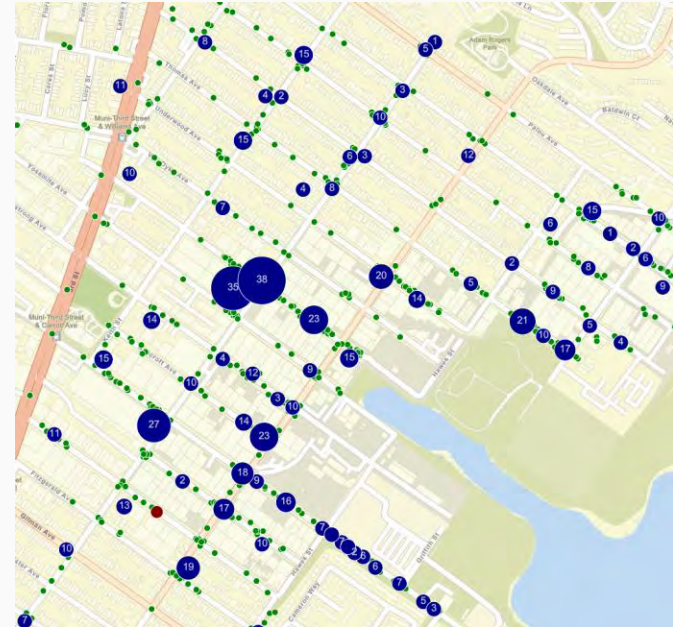
District 10

San Francisco



# Bayview, SF Case Study Results

- Number of illegal dumping sites May 9 - June 29 : 888 dumpsites detected and reported
- Types of waste found:
  - a. furniture, loose debris, construction, household, mattress, bags, loose, automotive
- Areas with the highest incidence of illegal dumping
  - a. Wallace Ave. / Jennings St.
  - b. Carroll Ave. / Jennings St.
  - c. Thomas Ave. / Griffith St.
- Actions taken to address the problem
  - a. Every dumpsite reported to SF 311
  - b. Every dumpsite cleaned up by DPW/Recology
  - c. Working with SF 311 to provide better reporting capabilities



Why is this important?

# Benefits

**1600x** as efficient **10x** as fast

**36x** Cleaner neighborhoods

**Equity**

Government **satisfaction**



# Considerations

Develop technology

Logistics

Privacy, PII, PI, Regulation

# Why do you need this?

- Increase ground crew capacity and efficiency
- Improve ground coverage (869 miles in SF)ets
- Gain valuable information and insights

# Not replacing Community

- Public awareness campaigns
- Community engagement and reporting



## Submit Street or Sidewalk Cleaning Request

Location:

Map  Satellite




Photo:  No file chosen

Description:

\* Object:

Contact

First name:

Last name:

Email:

Phone:

## Street or Sidewalk Cleaning

### Expected Response Time

Transit Shelter/Platform	3 calendar day(s)
Electronics/Appliance	4 business hour(s)
Furniture	4 business hour(s)
Human / Animal Waste	12 to 24 hour(s)
Mattress	4 business hour(s)
Medical Waste	12 to 24 hour(s)
Neglected Building (Blight)	21 calendar day(s)
Oil / Paint / Other Spill	8 hour(s)
Overflowing Public Garbage Can	2 hour(s)
Overgrown Lot (Blight)	21 calendar day(s)
Shopping Cart	4 business day(s)
Other Loose Garbage/Debris	24 to 48 hour(s)
Other Contained Garbage	4 business hour(s)

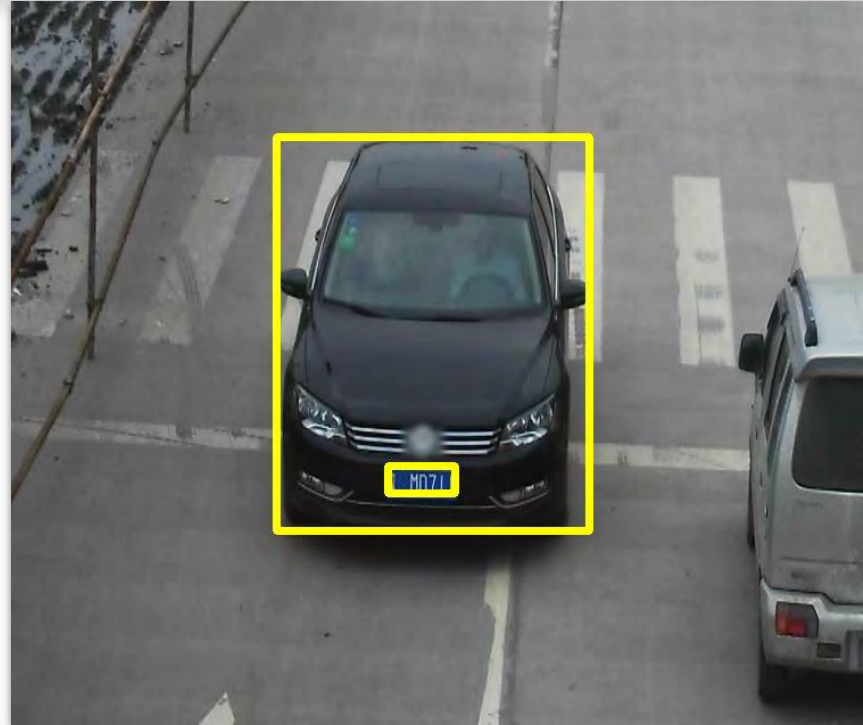
### Instructions

Describe the issue you wish to report, including a photo and/or a description. \* Indicates a required field.

Hint: Drag the pin to the location of the service request.

# Not replacing Surveillance Cameras

- Surveillance cameras and monitoring
- Strict enforcement and penalties



# Not replacing Trucks and Crews

- Waste disposal infrastructure



# Conclusion

- Consistent dumpsite reporting leads to cleaner neighborhoods
- It's cost effective, fast, and reliable to use Drones and AI
- This technology gets better every week
- Good data helps officials, departments, and communities.
- Every city should be looking at this technology

# Q&A

## Comments, Questions?

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March 22nd-now  
125 missions  
117,793 photos  
5100 detections  
4376 reports

