North Central Texas Council of Governments

A Discussion of Real-World Data on Trash in Texas through Two Case Studies

NCTCOG Webinar
November 29, 2022

Prepared in cooperation with the Texas Commission on Environmental Quality and U.S. Environmental Protection Agency

Elena Berg, NCTCOG
eberg@nctcog.org

United States Environmental Protection Agency

North Central Texas Council of Governments Environment & Development

www.nctcog.org/WaterResources

Procedures for Webinar

- The webinar is being recorded and will be posted to NCTCOG's website under the green banner called "Webinars" here:

https://www.nctcog.org/envir/natural-resources/water-resources

- If you submitted an RSVP for this webinar, you will receive an email with the presentation slides, and eventually, a link to the recording. If you did not RSVP and would like these webinar materials, please email eberg@nctcog.org.

- Please keep your microphone on mute until the Question-and-Answer period at the end of each presentation.

- Thank you!

Webinar Agenda

- **Using Data from the Texas Litter Database**
  - Dr. Stephanie Glenn, Houston Advanced Research Center
  - Dr. Erin Kinney, Houston Advanced Research Center
- **Field Survey of Litter in Austin, Texas**
  - Andrew Clamann, City of Austin
  - Mateo Scoggins, City of Austin
- **Overall Discussion and Questions for Speakers**
- **Wrap-Up**

Speaker Introduction

Dr. Stephanie Glenn

- Vice President Research, Water
- Houston Advanced Research Center

Dr. Erin Kinney

- Research Scientist
- Houston Advanced Research Center

TAKING ACTION: TEXAS TRASH LITTER DATABASE AND INNOVATIVE DEBRIS DETECTION METHODS

TXLITTER.ORG

HARC

OVERVIEW

Dr. Erin Kinney and Dr. Stephanie Glenn, HARC

The Beginning: Galveston Bay Watershed Aquatic Debris Action Plan and Partners in Litter Prevention

Taking Action: Innovative Methods in Debris Prevention: Remote Sensing of Debris and Texas Litter Database

Website Tour: Data Visualizations and the Texas Litter Database

HARC

The Beginning: Action Plan and Partners in Litter Prevention

- Non-regulatory
- Stakeholder lead
- 25 government agencies, departments, non-profits, private organizations
- Annual Trash Summits began May 2017
- Workshops to brainstorm goals
- Created *Galveston Bay Watershed Aquatic Debris Action Plan*

WHY DID GALVESTON BAY STAKEHOLDERS COME TOGETHER?

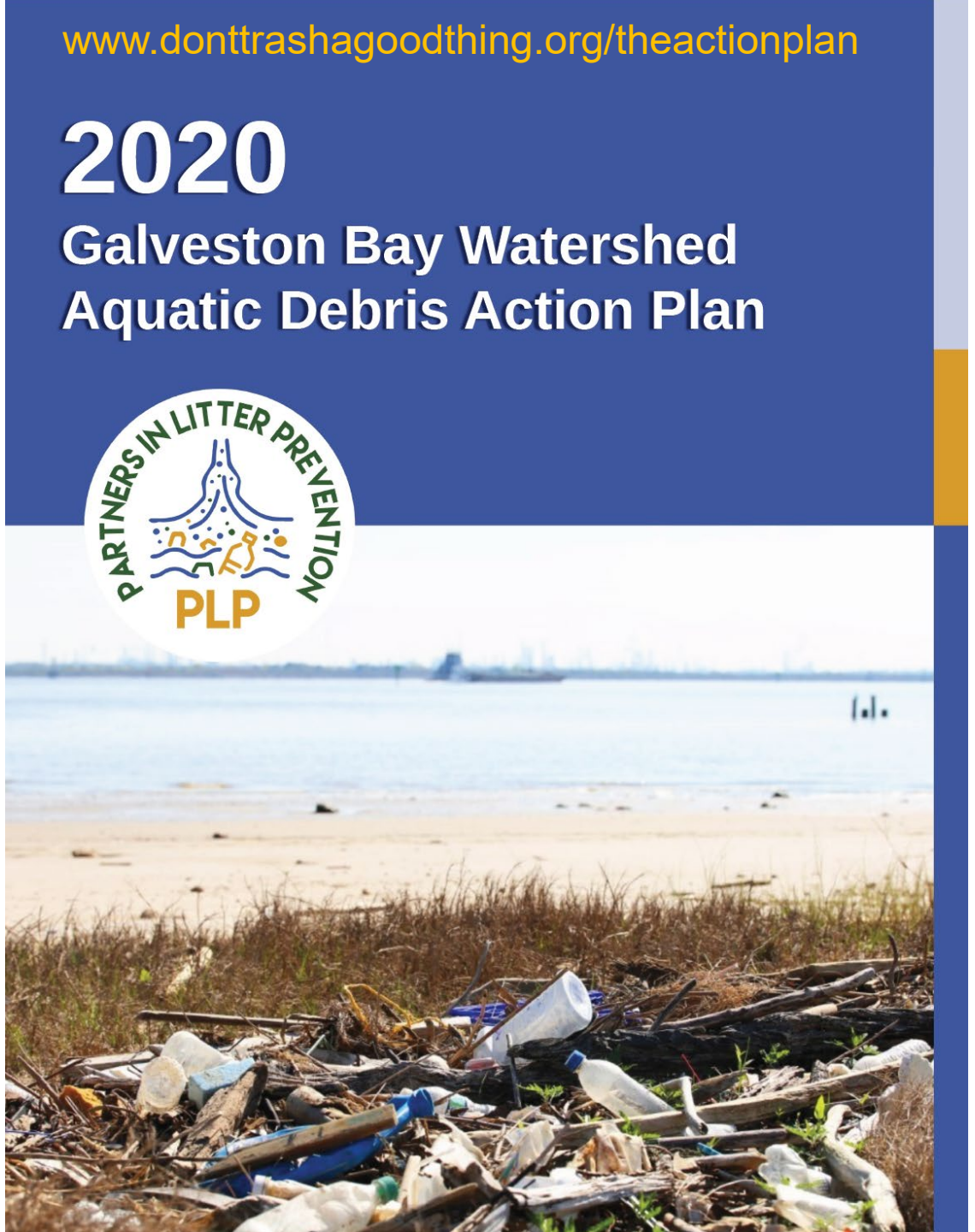
Identified Need For:

- Research & Assessment
- Coordination
- Prevention
- Removal, Emergency Response & Preparedness

WHAT IS THE ACTION PLAN?

A non-regulatory guidance document

- The document is not intended to be regulatory or specifically binding on actions or timeframes.
- Plan addresses many aspects of marine debris and aquatic trash: removal, prevention, awareness, education, outreach, research, etc.



TAKING ACTION: TEXAS TRASH LITTER DATABASE AND INNOVATIVE DETECTION METHODS

Need identified in *Galveston Bay Watershed Trash Action Plan:*

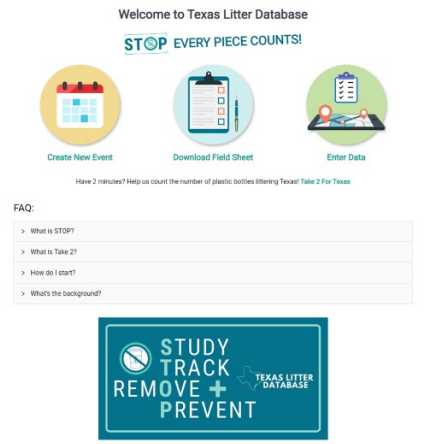
Goal 1: Conduct High Quality Research and Needs Assessment

Texas Litter Database:
TXLitter.org

HARC

HARC

Keep Texas Beautiful
KEEP AMERICA BEAUTIFUL AFFILIATE



black cat
GIS and Biological Services

GARVER • BLACK • HILYARD
FAMILY FOUNDATION

DEBRIS MAPPING WITH LIGHT DETECTION AND RANGING (LIDAR)

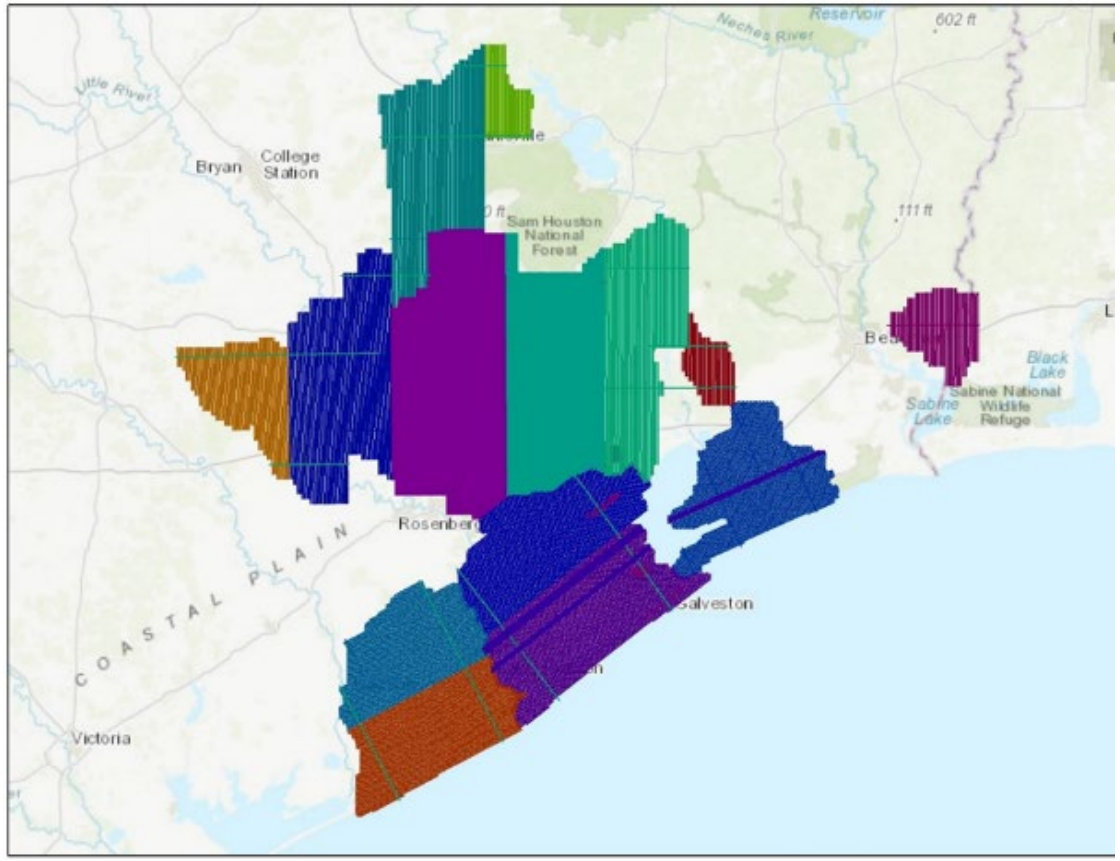
Goal: Test the feasibility of using remote sensing data for automatic recognition of debris hotspots

Nature, “Semi-automatic recognition of marine debris on beaches,” study on marine debris and LiDAR

- Their successful experiment involved an open beach with debris planted (tracked by type and location)
- LiDAR flown and analyzed to determine if signatures for the different classes could be developed
- LiDAR is much more efficient and less time-intensive than traditional methods (involving field work) of quantifying marine debris composition

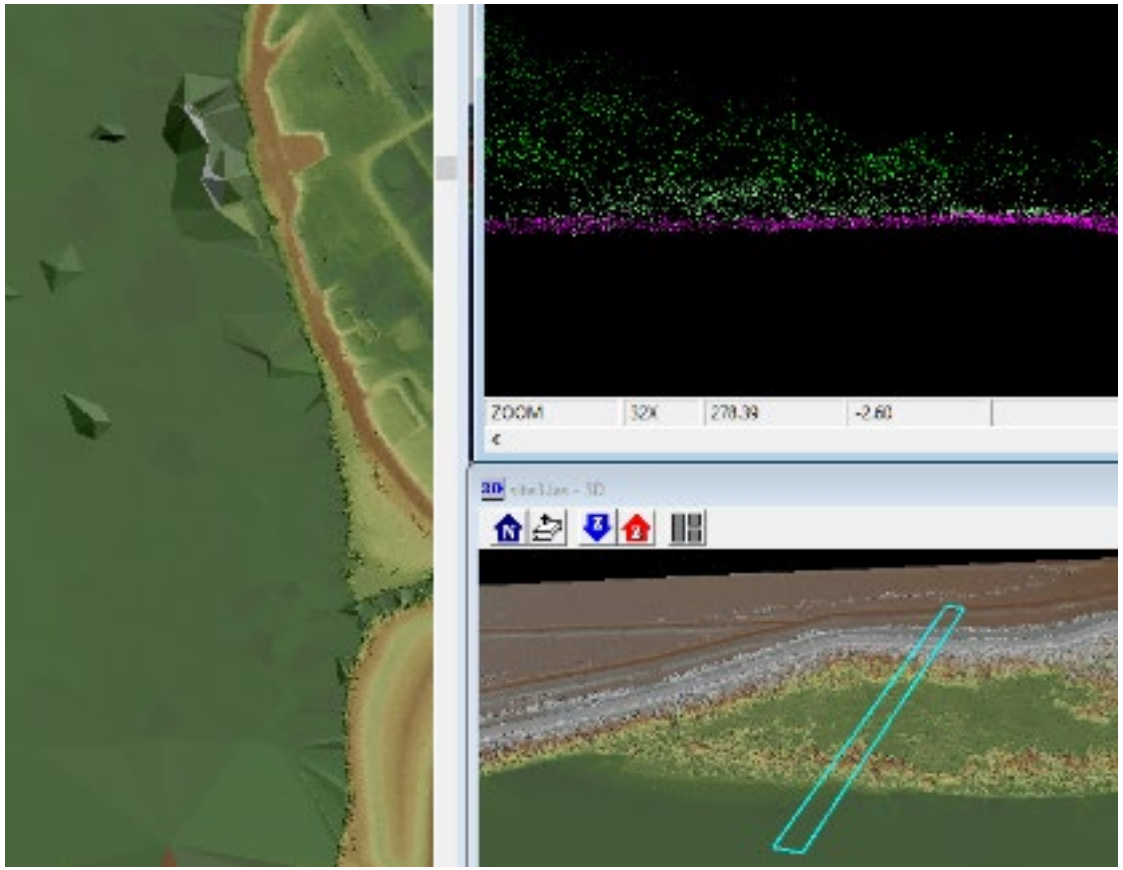
FUGRO

*Ge, Z. et al. Semi-automatic recognition of marine debris on beaches. Sci. Rep. 6, doi: 10.1038/srep25759 (2016).



FUGRO FEASIBILITY STUDY

- Utilized 4 points per square meter (ppsm) and 25 ppsm LiDAR data collected over bayous, beaches, and waterways to attempt detection of floating or land-based debris fields in the environment.
- HARC provided known “hotspots” of litter for field truthing. (from the Partners in Litter Prevention (PLP) and BlackCat GIS)



FUGRO FEASIBILITY STUDY

- Fugro and HARC had theorized that with the 4 and 25 ppsm data, areas of @100 square feet might indicate debris could be identified.
- However, in the sites reviewed potential debris had similar characteristics to most shoreline environments and were not able to be distinguished from natural features such as existing organic debris and vegetation.
- Fugro's report state that 22% of floatable screen locations and 40% of the litter hotspot areas were reviewed and none of these showed any obvious debris spots with the LiDAR.

LESSONS LEARNED

Limitations: In the image the tape measure is locked at 50 cm. One kitchen tile represents a pixel or what could be represented by one point at 50 cm post spacing.

The footprint of the laser beam by the time it reaches the ground is not a pinpoint. As it travels from the sensor it diffuses to more of a circular footprint. The resulting kitchen tile would have one intensity value and one elevation value.

Reflection values change based on environmental conditions. Grass' typical value changes after a rain event or during a drought. For debris, intensity values change based on angle, the presence of moisture, mud, and organic material mixed in.

Higher density data will allow us to leverage the elevation and intensity information in the lidar data. A color value may help in determining natural versus manmade objects.

Graphical representation -one kitchen tile represents a pixel, or what could be represented by one point at 50 cm post spacing

LESSONS LEARNED

4 ppsm and 25 ppsm LiDAR data had issues

100 ppsm data – early investigation looks promising - the current availability of 100 ppsm data is limited.

Recommendation for feasibility study of 100 ppsm data: Place debris spots in a known project area before flying so known debris areas are cataloged

For full write-up on study:

https://harcresearch.org/research/marine-debris-study/

FliMap colorized point cloud of construction site viewed in SIMmetry

Oblique and nadir lidar with concurrent imagery by FliMap provides detail near bridges visualized in SIMmetry

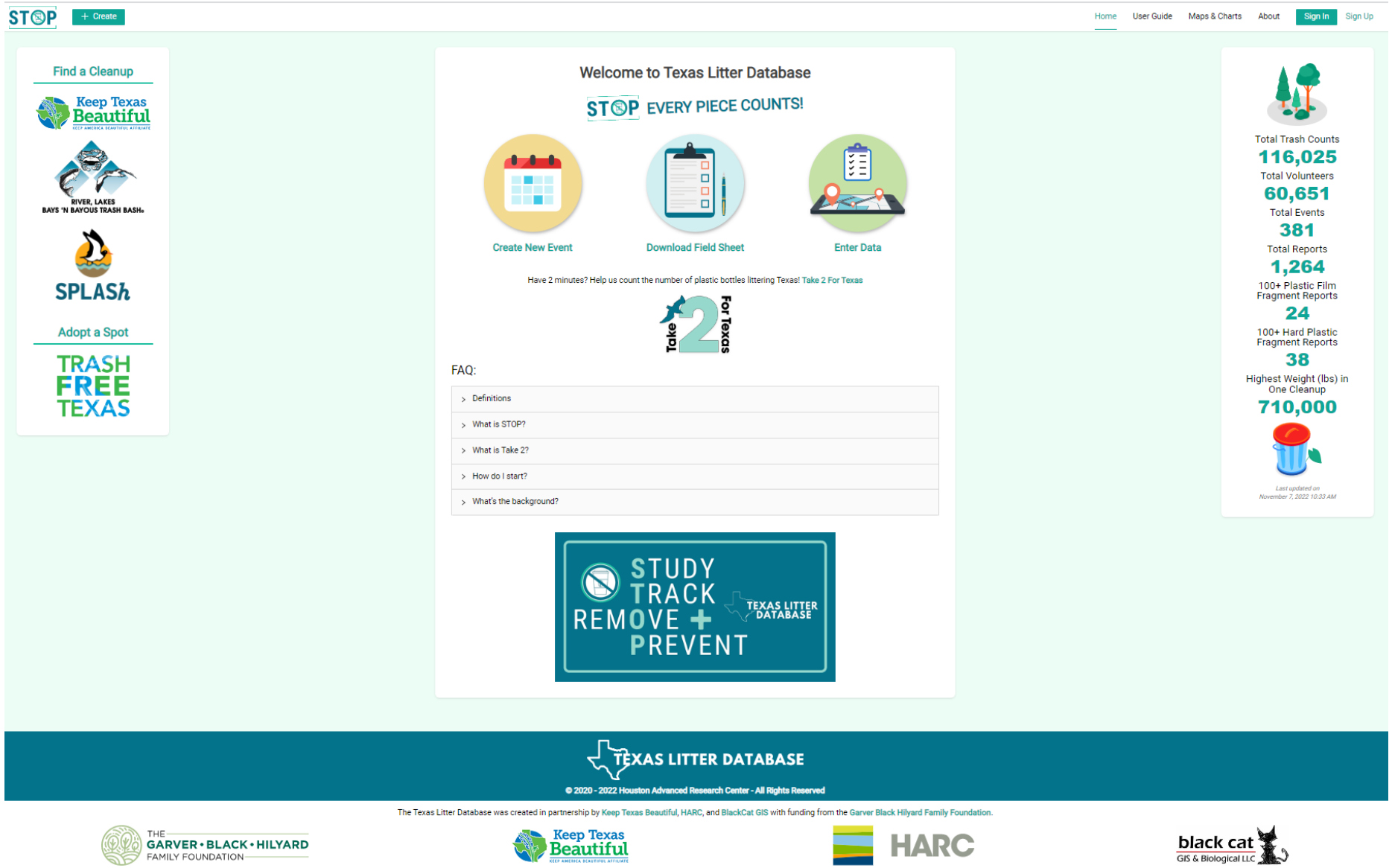
TEXAS LITTER DATABASE TEAM

- Funded by the Garver Black Hilyard Family Foundation
- Developed by HARC with guidance from Black Cat GIS and KTB
- Tested by Black Cat GIS and KTB
- Working with other collaborators
- Housed at KTB

TEXAS LITTER DATABASE

- Answered a Need for a State-Wide Litter Cleanup Database
- Can accommodate large multi-site cleanup events and small single-cleanups
- Site for Take 2 for Texas rapid assessment
- Easy to download data
- Mapping and graphing capability

TXLITTER.ORG



Thank You!

@HARCresearch.org

Questions?

Speaker Introduction

Andrew Clamann

- Conservation Program Supervisor
- Watershed Protection Department, City of Austin

Mateo Scoggins

- Section Manager
- Watershed Protection Department, City of Austin

Trash in Creeks

Field Investigation Report
and
Benchmark Research Study

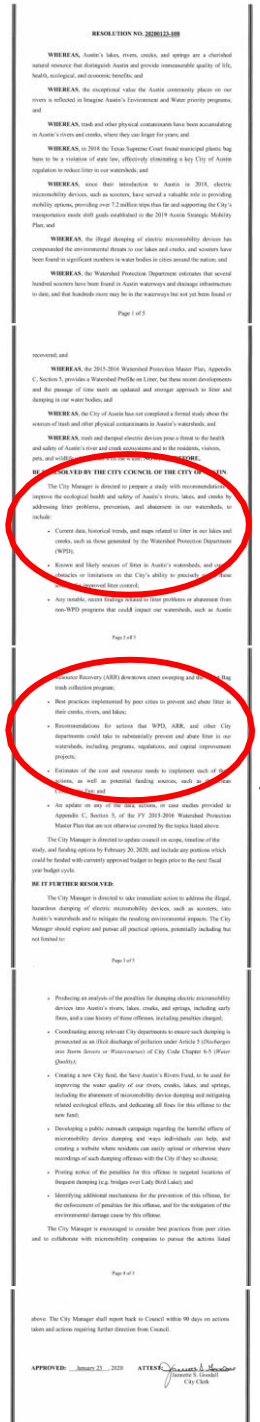
Andrew Clamann

City Council Work Session 9/27/2022

City of Austin
WATERSHED PROTECTION

Andrew.Clamann@austintexas.gov
Mateo.Scoggins@austintexas.gov
Leila.Gosselink@austintexas.gov

Resolution No. 20200123-108 (CIUR 2234)



BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF AUSTIN:

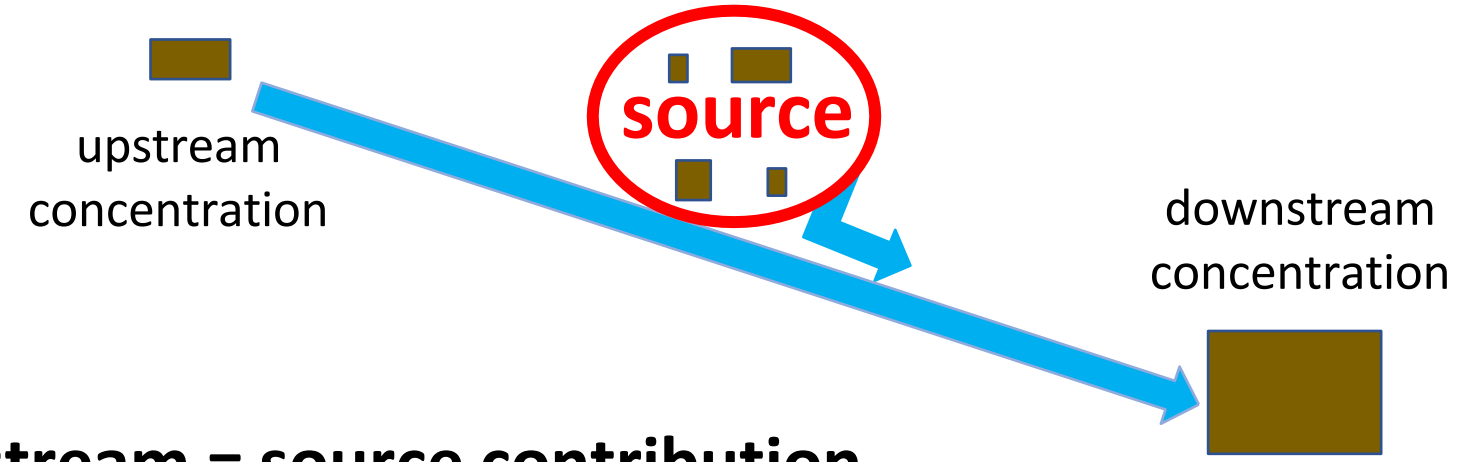
The City Manager is directed to prepare a study with recommendations to improve the ecological health and safety of Austin's rivers, lakes, and creeks by addressing litter problems, prevention, and abatement in our watersheds, to include:

- Current data, historical trends, and maps related to litter in our lakes and creeks, such as those generated by the Watershed Protection Department (WPD);
- Known and likely sources of litter in Austin's watersheds, and current obstacles or limitations on the City's ability to precisely assess these sources for improved litter control;

field study

- Best practices implemented by peer cities to prevent and abate litter in their creeks, rivers, and lakes;
- Recommendations for actions that WPD, ARR, and other City departments could take to substantially prevent and abate litter in our watersheds, including programs, regulations, and capital improvement projects;

benchmark report



Typical pollutant assessment:

downstream – upstream = source contribution

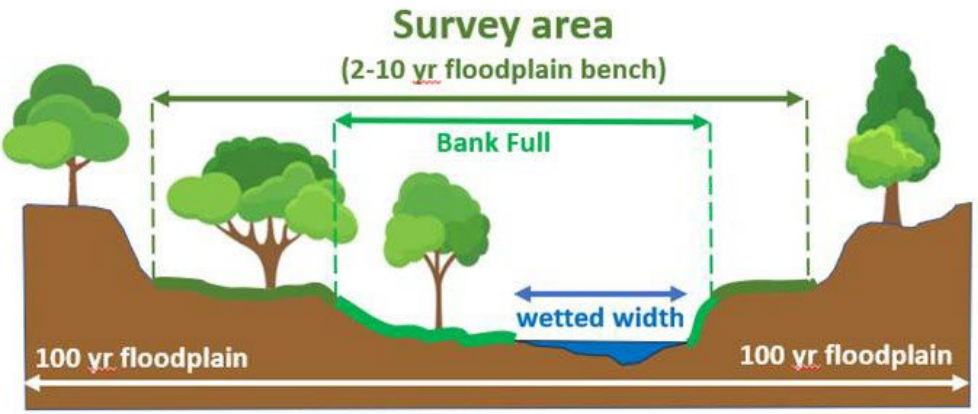
This assessment does not work for trash

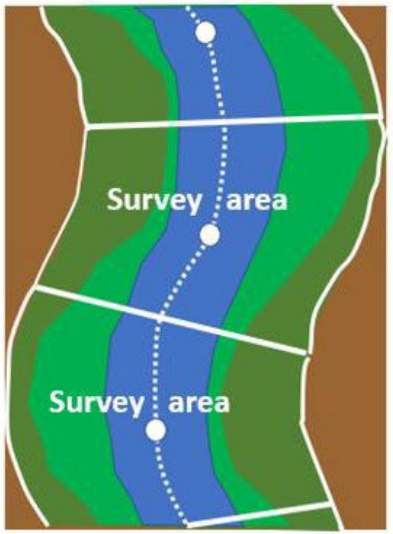
Variability in storm intensity

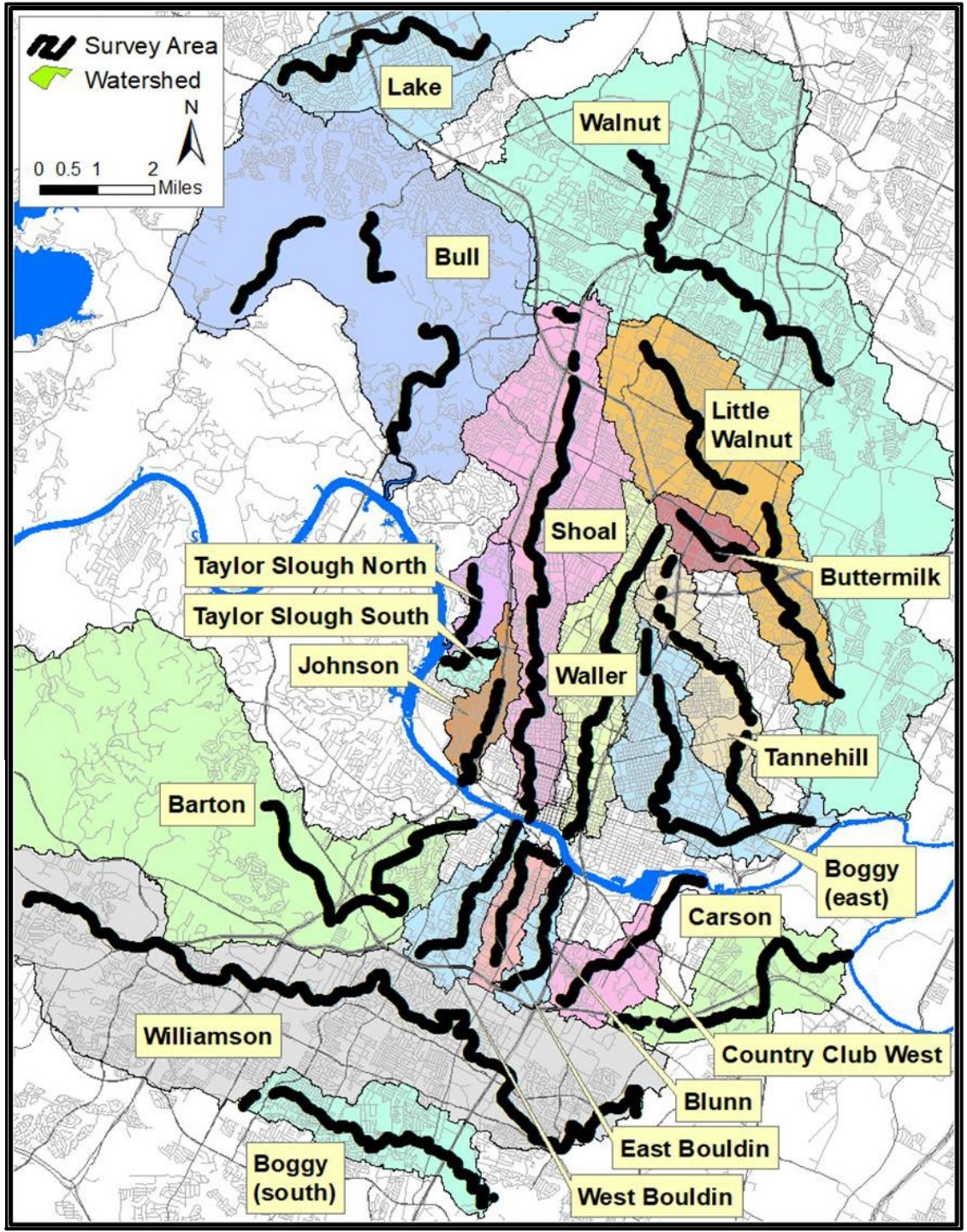
Variability in stream character

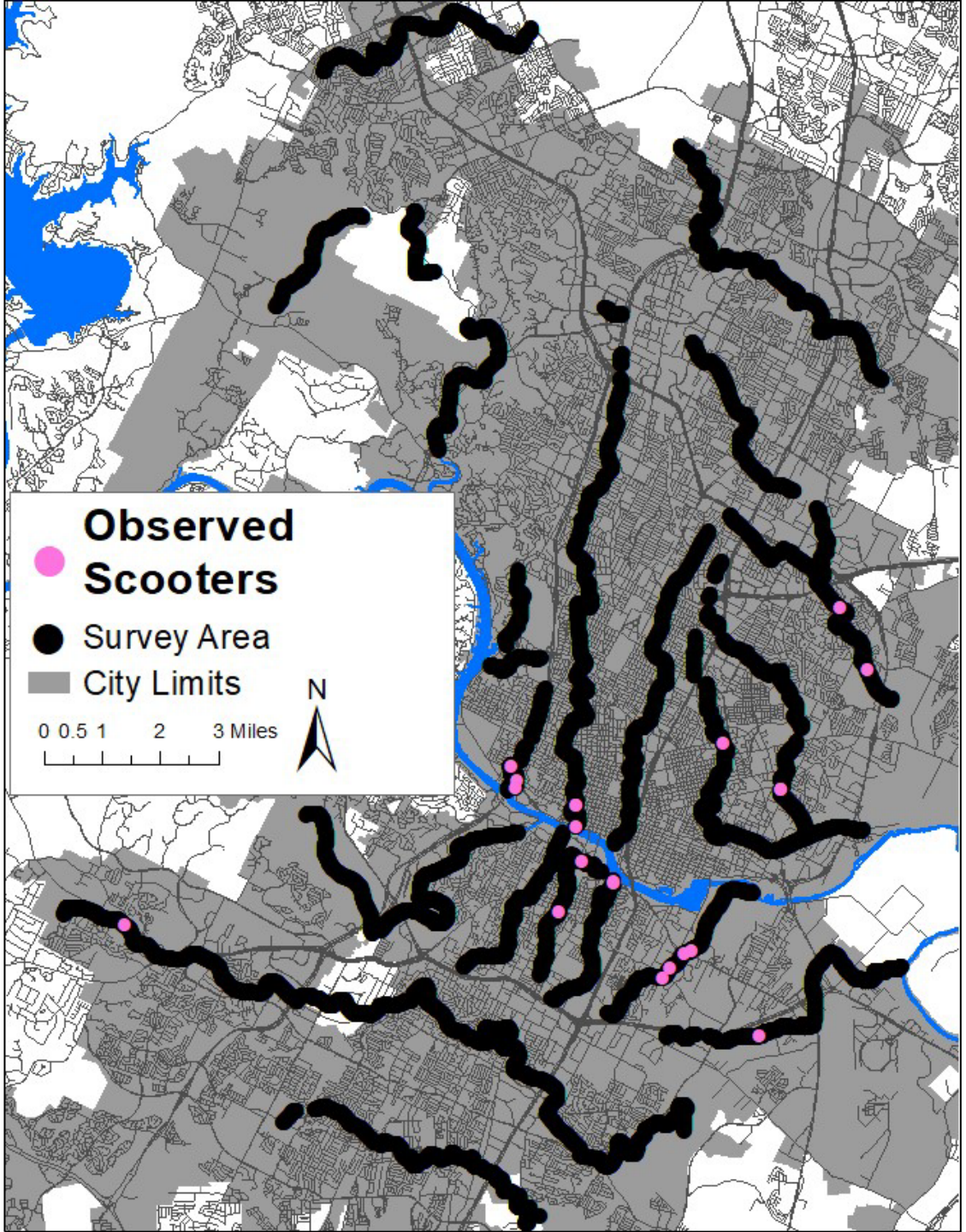
Data Collection

- 20 Creeks
- 110 miles
- Observations every 30ft
- **<u>19,467</u>** data points







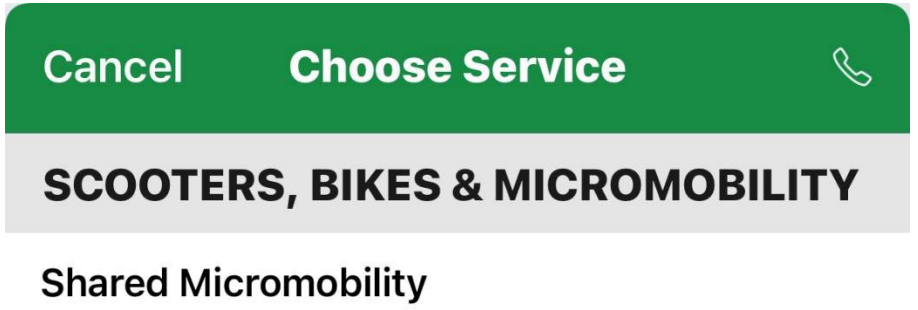


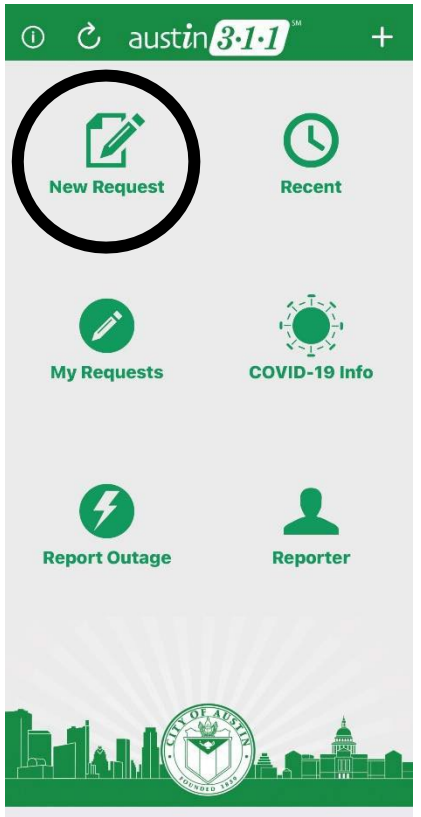
Scooters

only 21 found

Small number of occurrence due to:

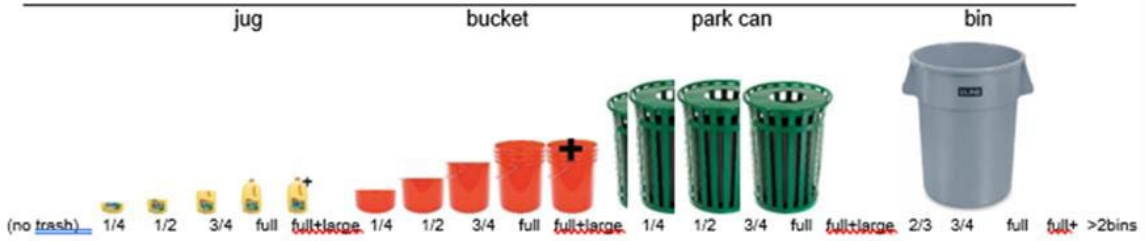
- reduced permitted fleets (since 2020)
- improved process for reporting (311)
- efficient process for removal (vendor)





Visual Trash Intensity Rubric for Creek Walk

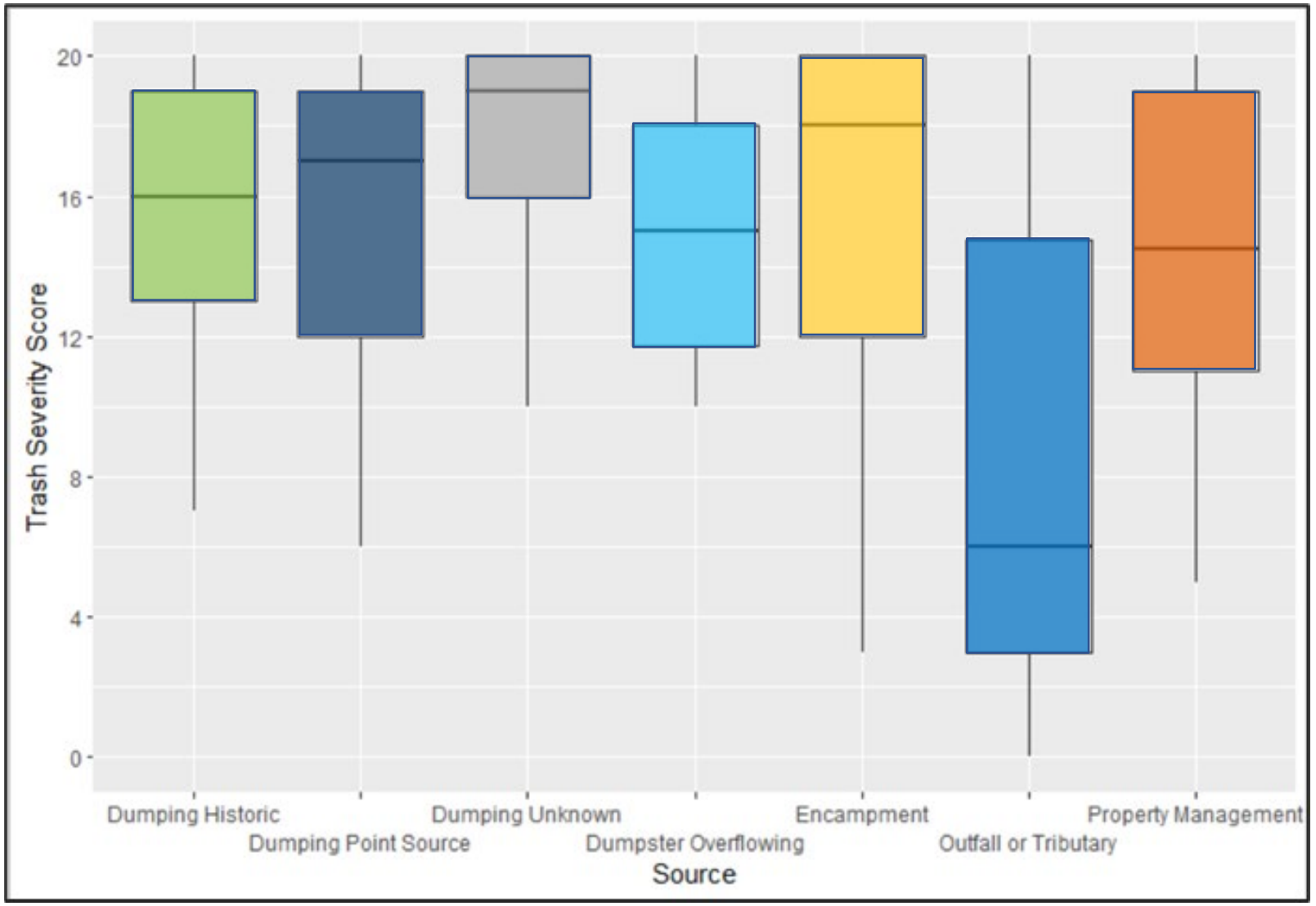
1) Score is recorded at the center of a 30ft creek segment (15ft upstream and 15ft downstream of point)
2) Survey area extends outward to the high bank (perceived floodplain) visible from the channel banks, to include areas that trash will imminently reach the stream in a storm event even if above high bank
3) Accumulations of dead vegetation will not be considered trash, however if contained in bags, the bags will be considered trash (presume the bag is separated from leaves). Same with sandbags.
4) Immobile abandoned infrastructure (e.g., pipelines in channel, large blocks of concrete) will not be considered trash if infeasible (without heavy equipment) to remove/cleanup by hand), however, portions that could be easily cut off with hand tools (exposed rebar, cables, etc.) and removed will be considered trash. Small construction debris (bricks, cinderblocks, asphalt etc.) that can mobilize during storm events are considered trash. Materials that are in-place but failing are not considered trash (fence sagging, erosion matting dangling, etc.), but can be considered trash if no longer in-place and mobile

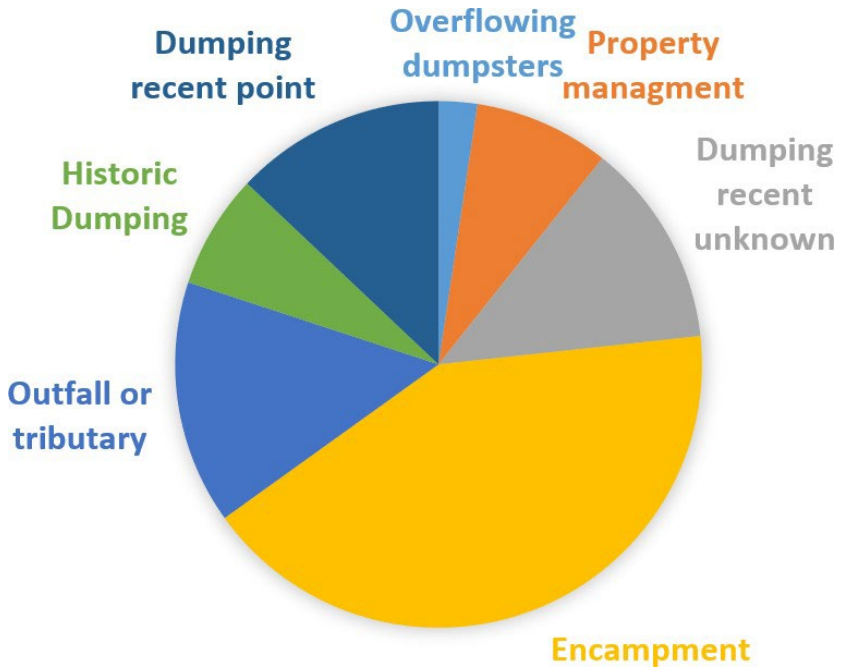


	Minimal					Apparent					Abundant					Dense				
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
No litter observed within survey area	**Description:** "good" Few items here or there but not very noticeable. If noticeable, few **Volume**: The cumulative amount could easily fit within a 1-gallon milk jug, however, a single item that is larger than a milk jug (but still fits in a 5-gal bucket) can still be in this category **Effort:** Site could be easily and quickly cleaned by one person (<5 minutes)					**Description:** "not bad" Trash is noticeable but doesn't define the site **Volume**: The cumulative amount could easily fit within a 5-gallon bucket, however, a single item that is larger than a bucket (but still fits in a 25-gallon can) can still be in this category **Effort:** Site could easily be cleaned by one person but not quickly (~5-15 minutes)					**Description:** "bad" Site has obvious and salient accumulation. "Trashy" is forefront **Volume**: The cumulative amount could easily fit within a 25-gallon park trash can, however, a single item that is larger can still be in this category **Effort:** Site looks like a two-person job but could be cleaned by one person (~15-30 minutes)					**Description:** "horrible" Trash defines the site and offends the visitor. Desire for cleanup is overwhelming **Volume**: The cumulative amount requires the big 55-gallon bin(s) **Effort:** Site would take a long time for one person, (~30+ minutes) but site is better suited for a team				

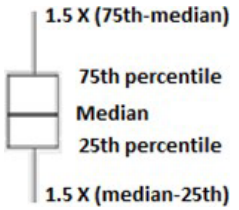
Trash intensity score + source presence

- Overflowing dumpster
- Outfall/tributary
- Encampment
- Dumping historic site
- Dumping point source
- Dumping unknown
- Property management





Sources by occurrence

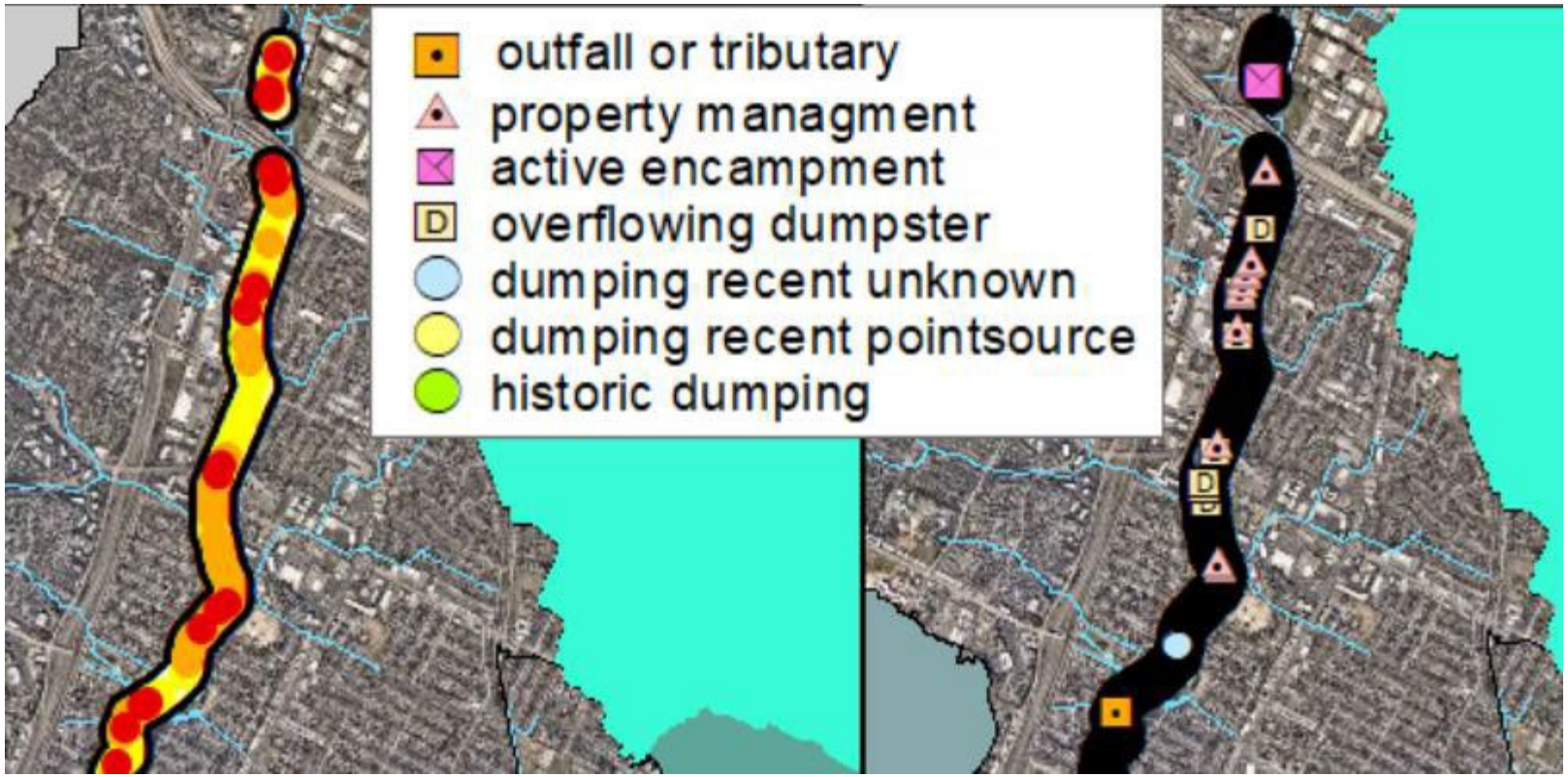


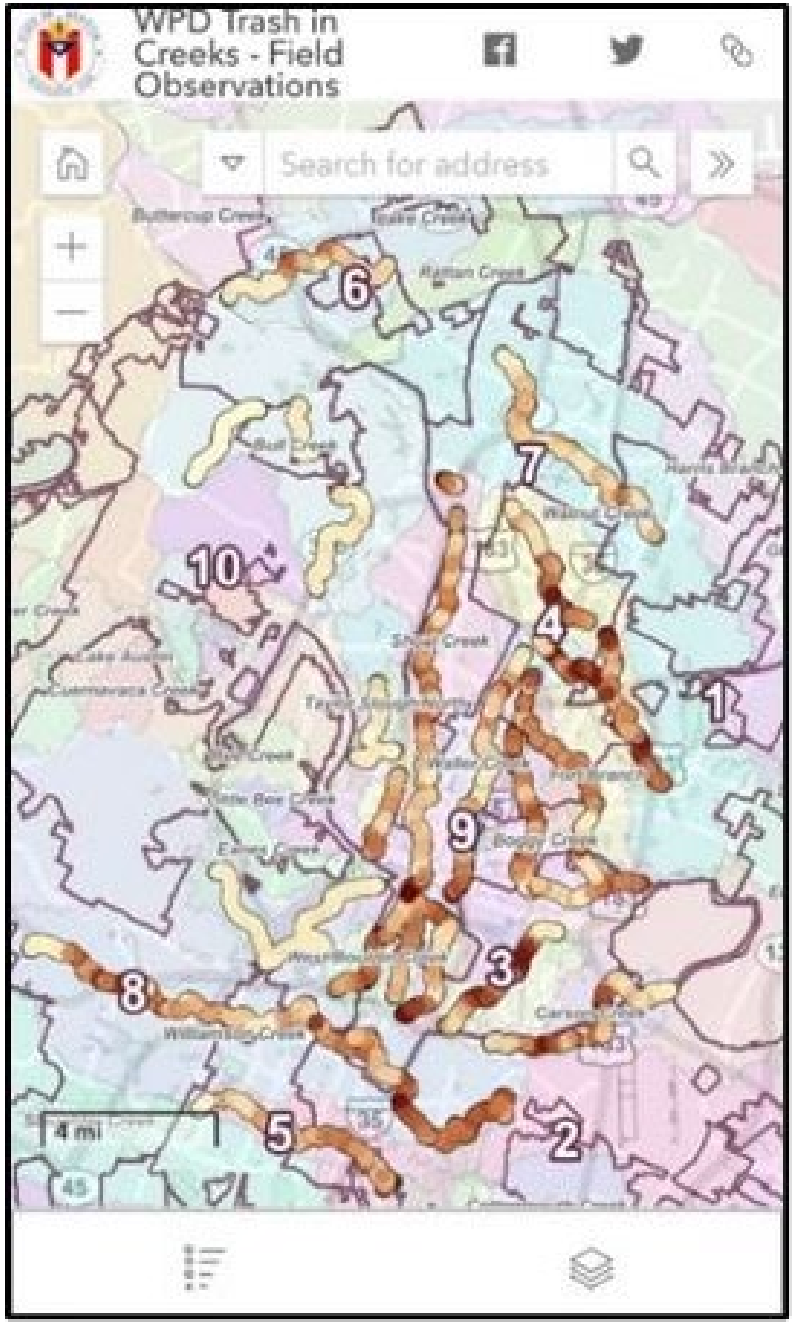
Takeaway # 1

Encampment was the most commonly-observed source,
but is similar in intensity and range to most other sources

Result: A georeferenced map of intensity* and sources

example: upper shoal creek

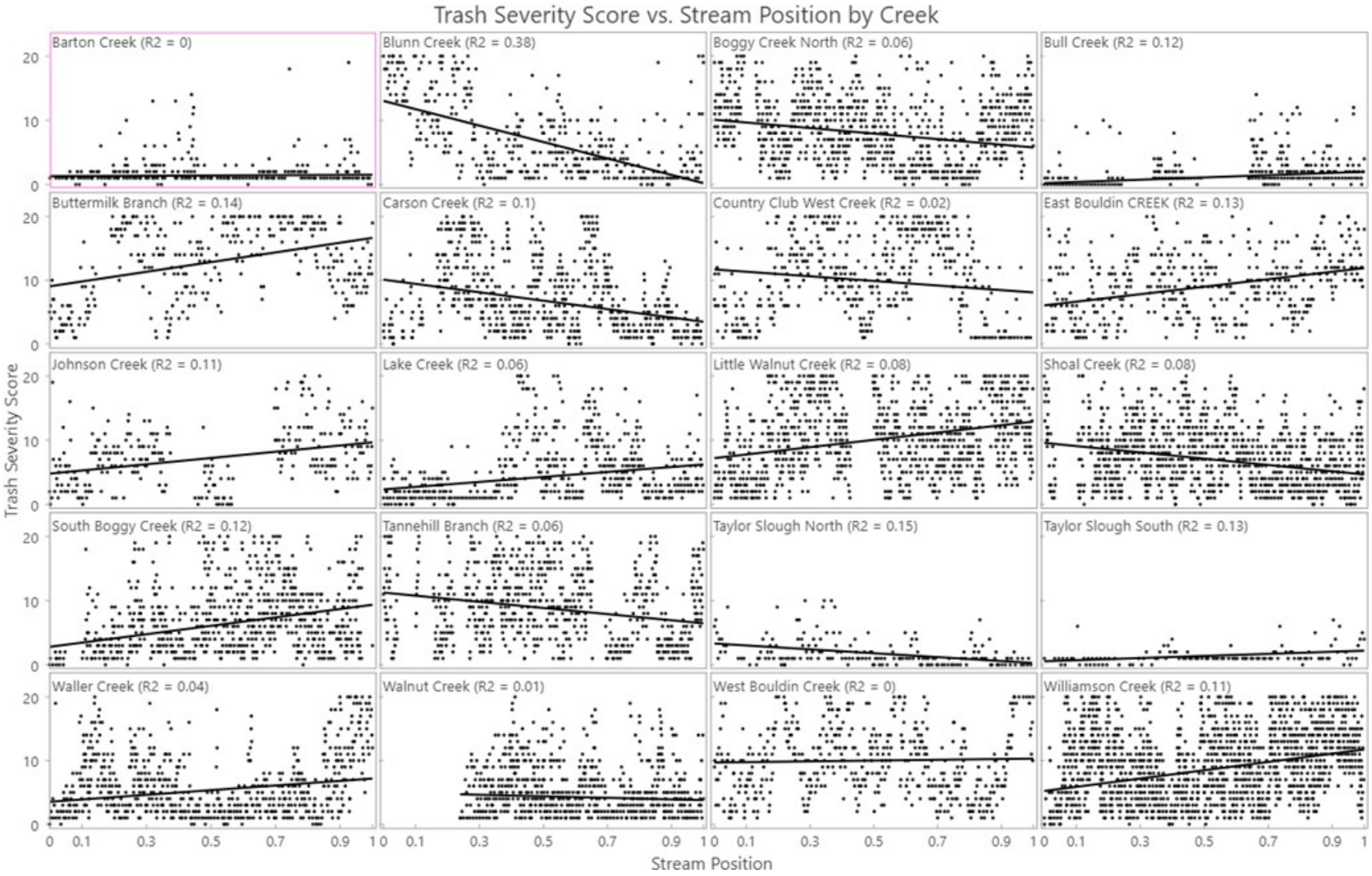




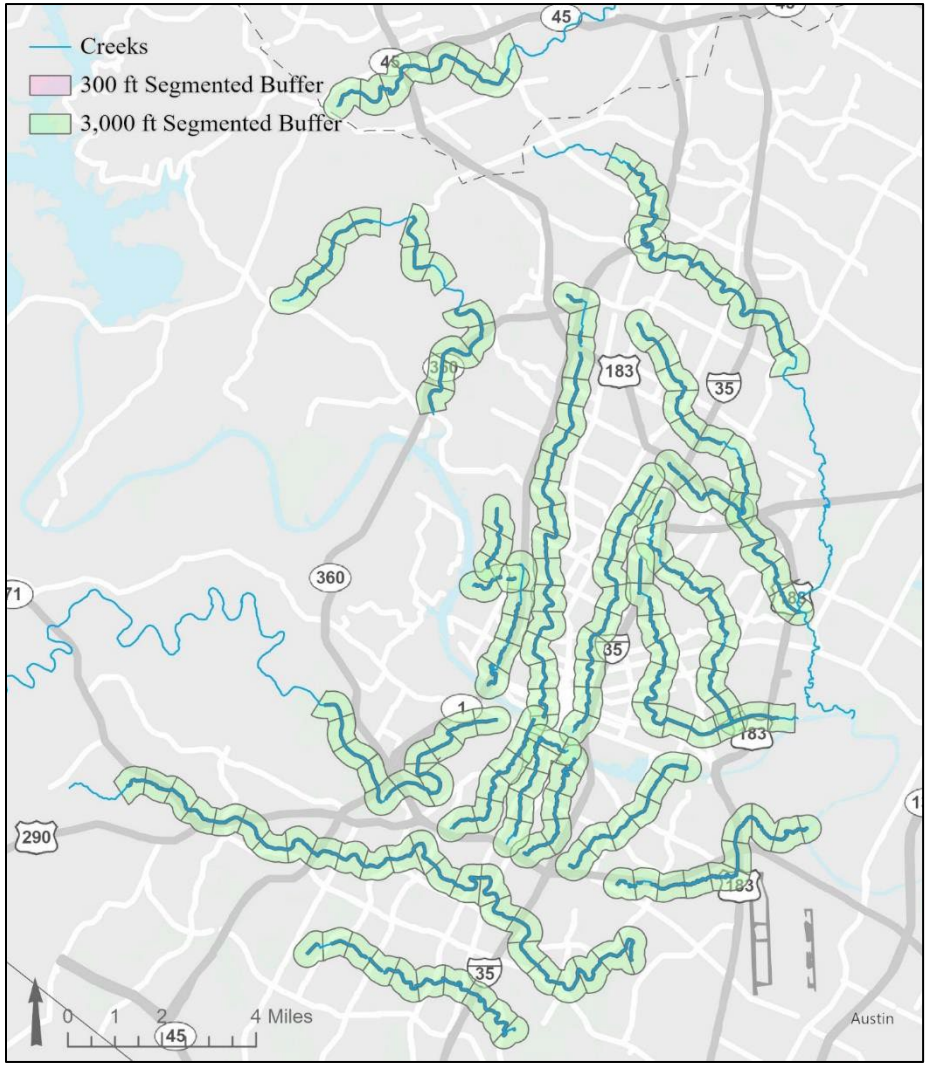
*can be used by internal or external partners for strategic cleaning

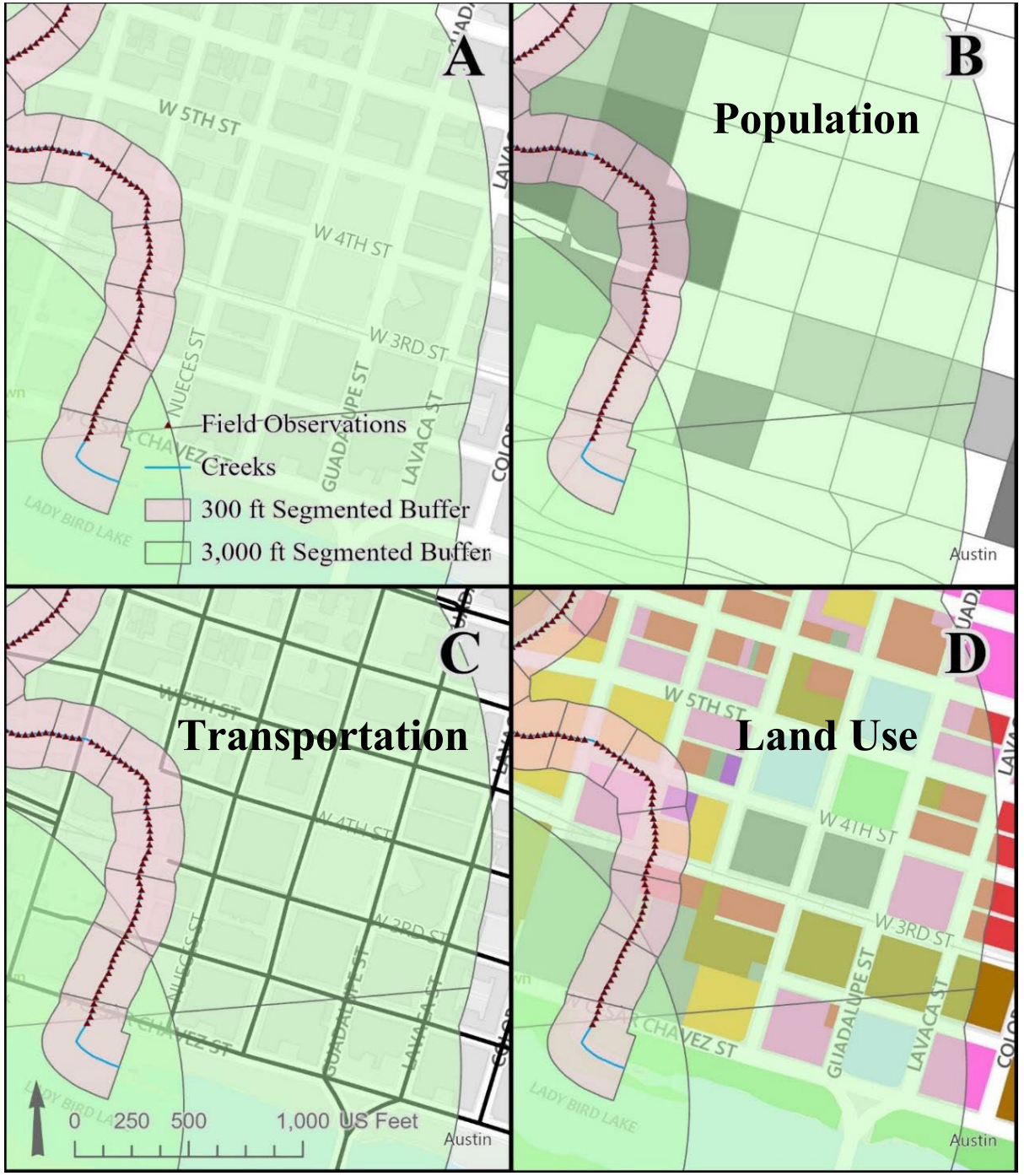
https://arcg.is/0z48bj0

Takeaway # 2 Trash intensity is not proportional to its drainage area (source input locations are deceiving)



Geospatial analysis using 300’ and 3000’ buffers

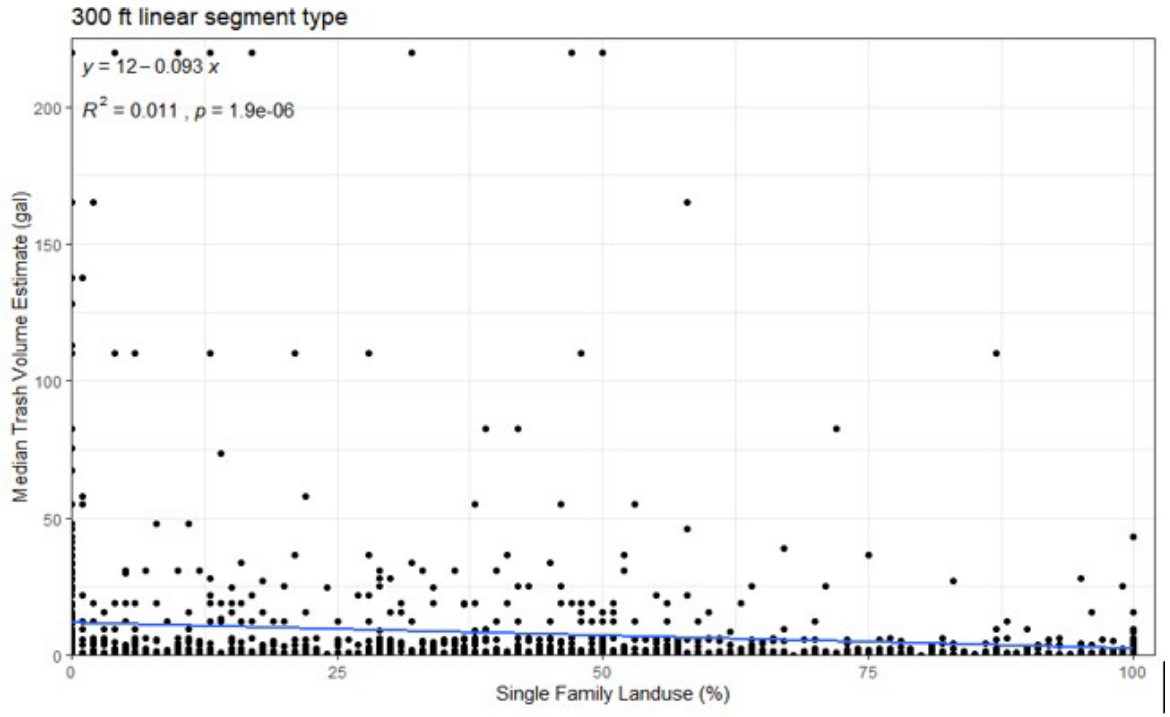


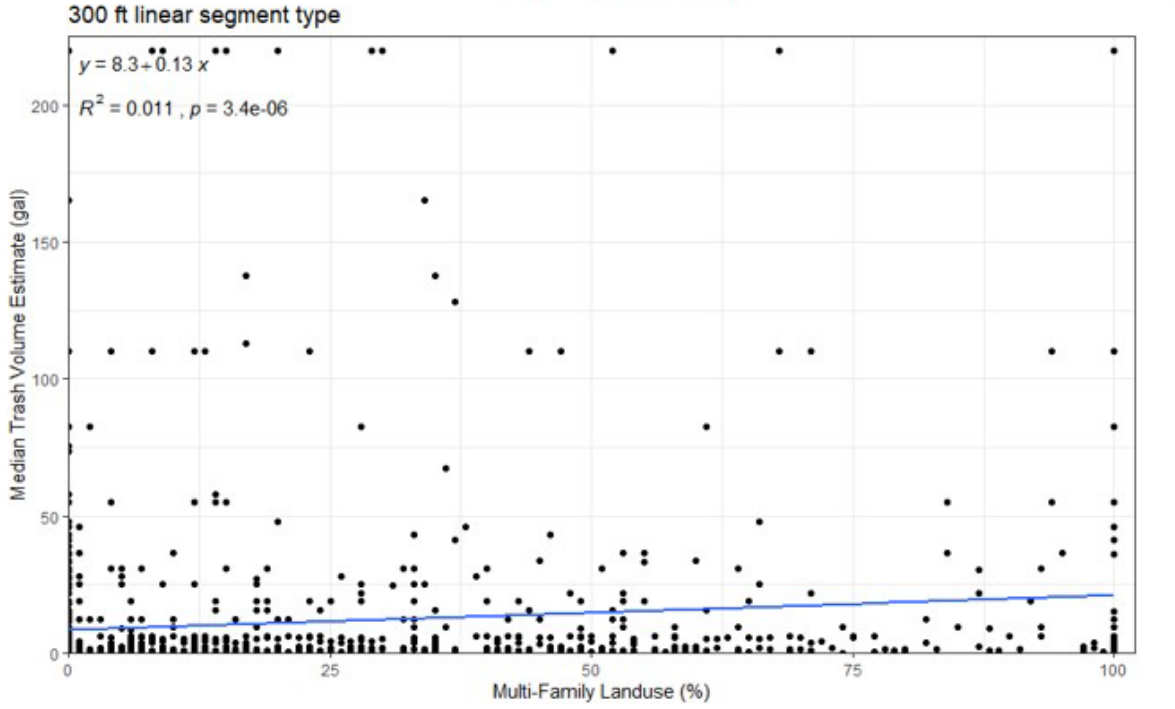


Takeaway # 3

There were no statistically significant correlations between trash intensity and:

- landuse,
- census,
- transportation,
- parks, etc.





Takeaway # 4

Virtually anything can be found in creeks, but

single use plastics were the most common item

clothing, tents, bedding

recreation items, toys

erosion matting, silt fences

packaging, shipping

office, household

lawn tools, mulch bags, garden hoses, appliances

medical, electronics, textiles, hardware

traffic cones, barriers, safety

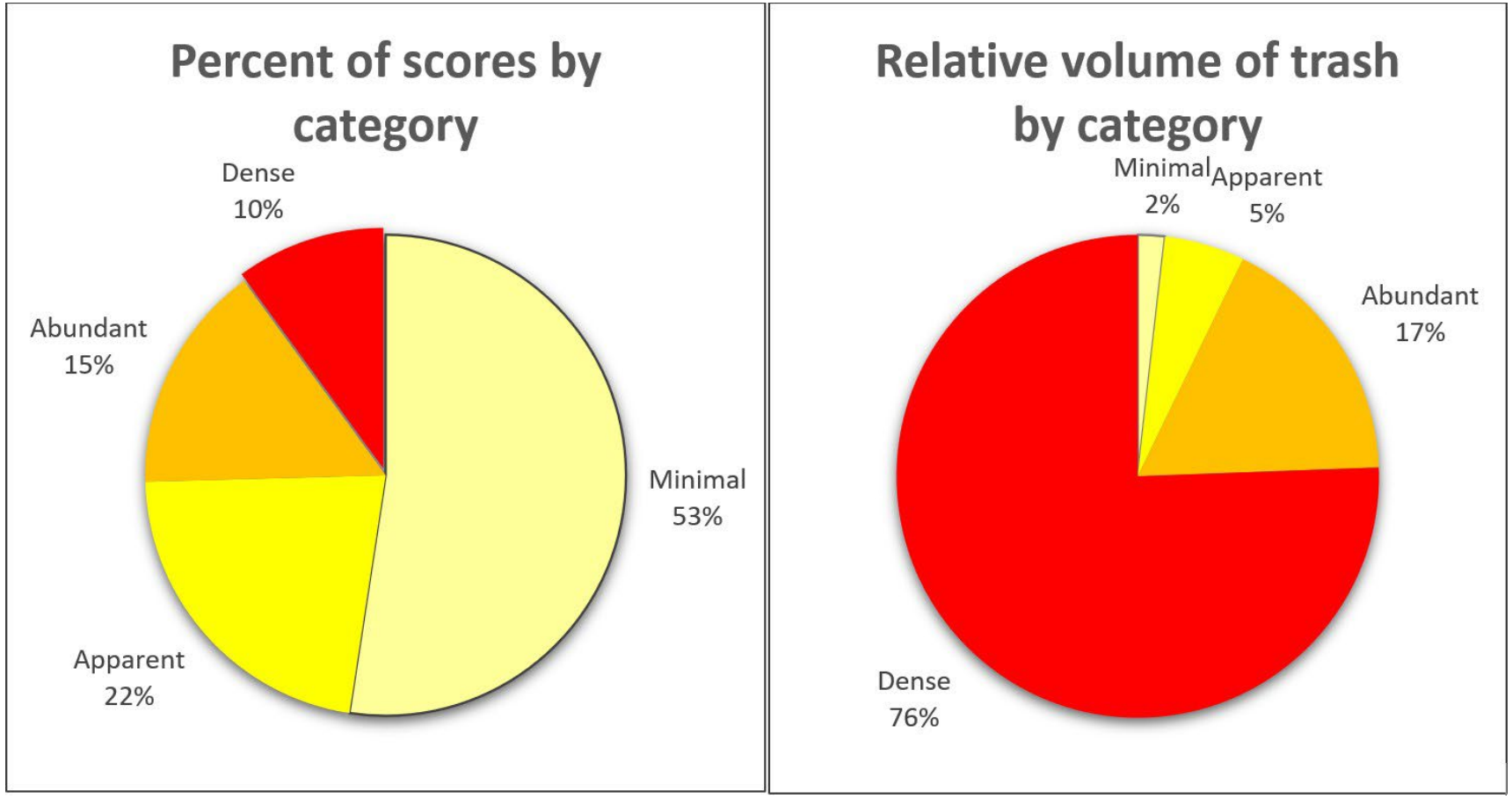
construction materials, asphalt, lumber

Telecommunication cables, displaced infrastructure

500+ shopping carts

Takeaway # 5

76% of the trash is found in 10% of the area



(opportunity for strategic site selection for cleanups by COA, partners, contractors, volunteers)

Field report provides diverse assemblage of recommendations at different scales

- site-specific cleanups,
- improved rules for dumpsters,
- structural controls,
- enforcement,
- education/outreach,
- coordination with partners,
- etc

Benchmarking Research Report

- **EXTRACTION** (physically removing trash from waterways)

  ex: structural controls, machines, manual labor

- **INTERCEPTION** (keeping trash from entering waterways)

  ex: education, enforcement, landscape cleanups, structural controls

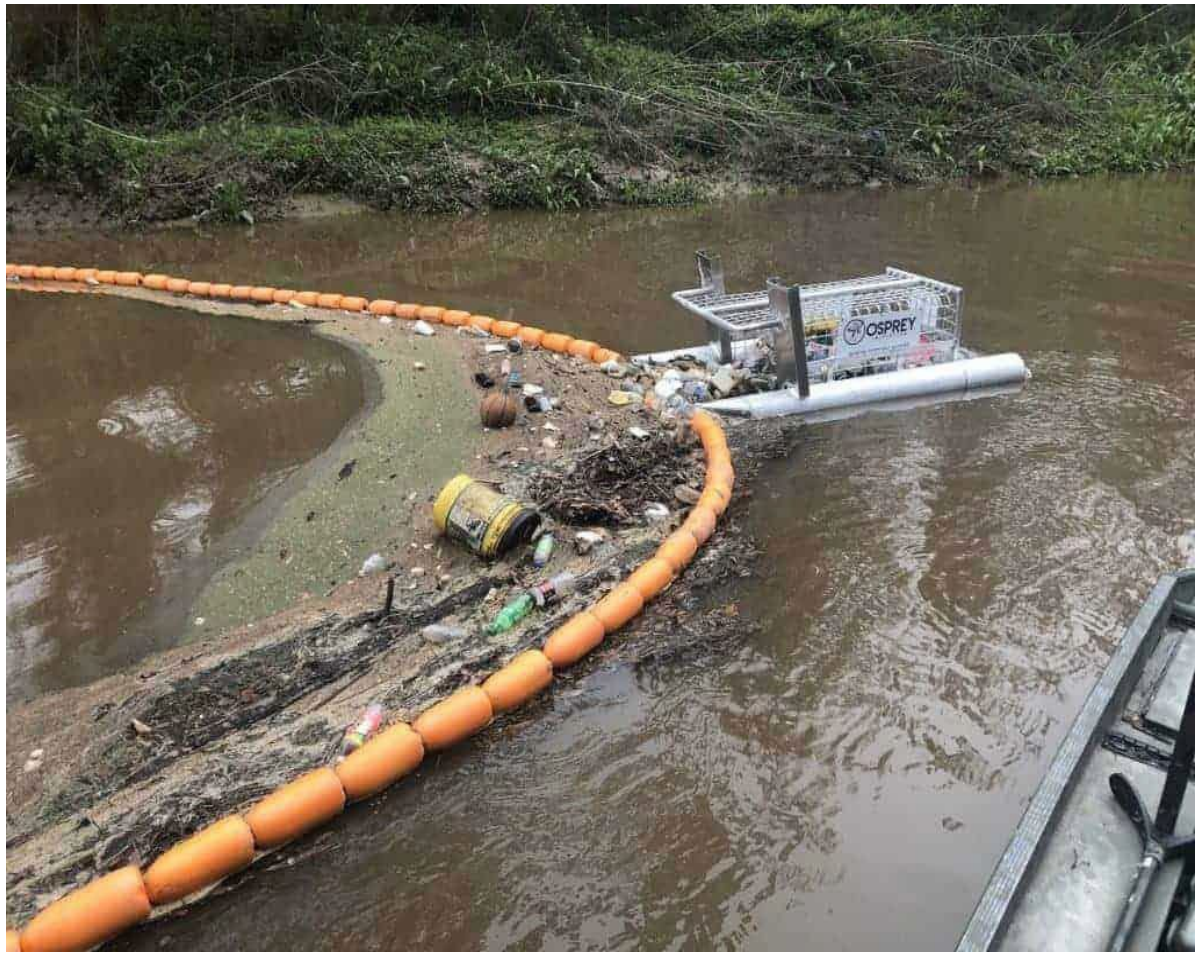
- **SOURCE REDUCTION** (stemming the flow into our community)

  ex: limit single use plastics

Extraction

- creek and lake cleanups*
- requirement/enforcement of vendors/individuals to clean up
- targeted cleanups at "hot spots"
- novel devices to concentrate trash and/or ease retrieval

  (e.g. booms, trash traps, etc)

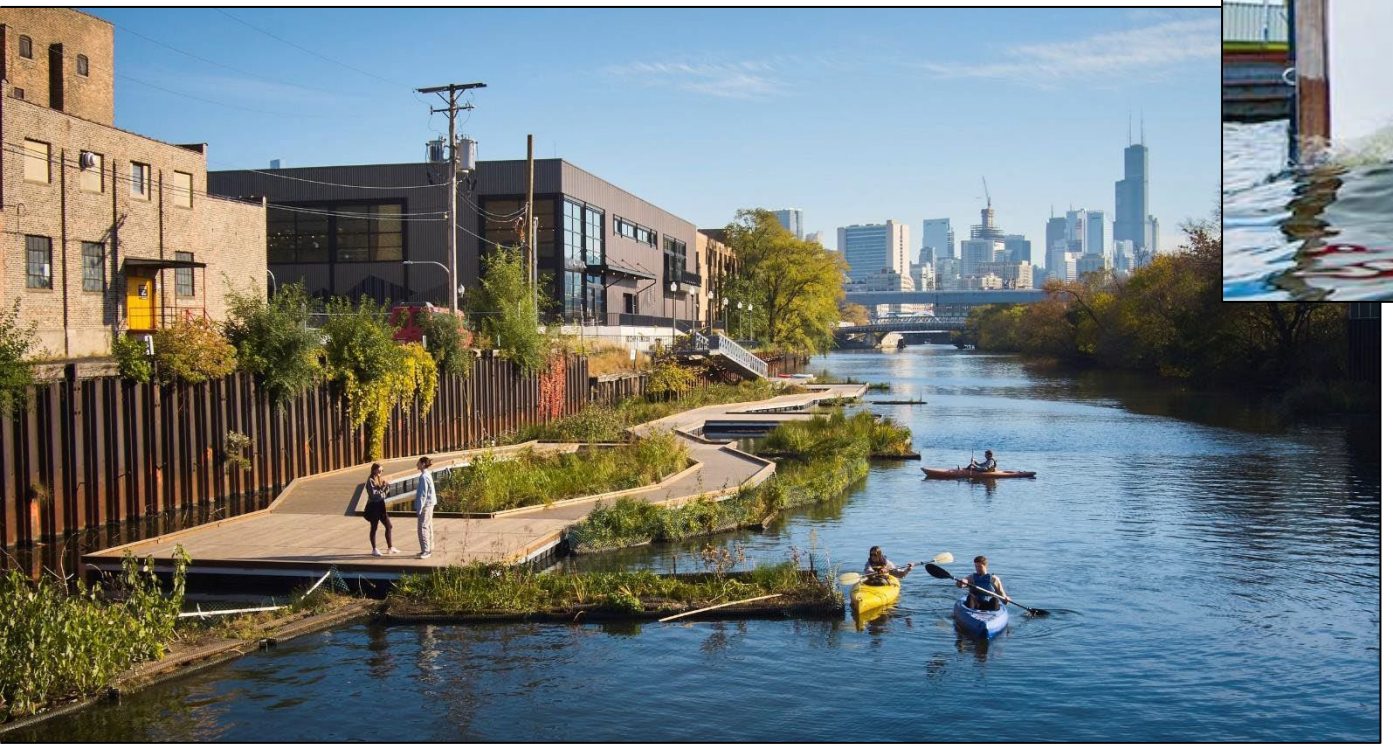


*Partners, contractors, COA staff, ARR “Clean Creeks Crew” staffed and operational this year,

Examples of highly visible incentivized community participation

Free kayaks for cleanup commitment

- Urban Rivers Chicago, River Rangers



Tourist "Trash Fishing"

-Netherlands (photo)

-Individual boats Troy, MI

Interception

- Enforcement and facilitated reporting

  ex: Philadelphia's "Sweep Program" including citations and fines

- Ordinances to reduce incidence and effects of overflowing dumpsters
- Shopping cart on-site retention
- Telecommunications cable removal

Interception

Capacity, proximity, accessibility

- Solar compacting bins
- Mesh bags on water (Buffalo River)
- Litter Boat
- Increase waste receptacles at picnic tables
- Free Dump Days
- Continue/increase services at encampments

Evaluate street sweeping

Evaluate drainage system controls

- Curb inlet guards with street sweeping or Adopt-A-Drain
- WQ/Detention ponds retention/removal of floatables

Source Reduction

New Braunfels Can Ban

Education and outreach

Solicit voluntary partnership/cooperation with businesses

- example: HEB leadership during/after the bag ban

Water stations to reduce dependance on bottles

Restriction/requirements

- glass/Styrofoam restriction/requirements in city-owned properties
- education/check-point at entry and launch points providing mesh bags and limiting Styrofoam coolers & glass (example: San Marcos)

Campaigns or strategies to reduce use of single-use plastics and Styrofoam

- Regulations/bans (novel strategies)
- Political considerations

Collaboration for a citywide, integrated trash management effort

Bottom Line

Trash in creeks is a result of the entire community;
there is no “one source” primarily to blame

COA and Partners are actively engaged in the solution;
there is room for improvement and innovation

Next Steps

COA is working to improve efficiency and effectiveness
of programs to extract, intercept, and reduce trash

The results and recommendations from reports can inform
site selection and strategies to address trash in creeks

Appreciation

Benchmark research

- Leila Gosselink

Design, fieldwork and report

- Mateo Scoggins
- Jeremy Walker-Lee
- Ryan Burke
- Lauren Parrish
- Todd Jackson
- Brent Bellinger

Data management and analysis

- Rob Clayton
- James Collins
- William Burdick
- Abel Porras
- Ed Peacock

Partners

Austin Resource Recovery
PARD
WPD Field Operations
Keep Austin Beautiful
The Other Ones Foundation
Austin Parks Foundation
Contractors and Volunteers

Questions?

Overall Discussion and Questions for Speakers

What are your questions or thoughts on litter in Texas?

Wrap-Up

- If you submitted an RSVP for this webinar, you will receive an email with the presentation slides and a subsequent email with a link to the recording.

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https://www.nctcog.org/envir/natural-resources/water-resources

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North Central Texas Council of Governments

Thank you for attending!

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Prepared in cooperation with the Texas Commission on Environmental Quality and U.S. Environmental Protection Agency

Elena Berg, NCTCOG
eberg@nctcog.org

North Central Texas Council of Governments
Environment & Development

www.nctcog.org/WaterResources