

# Assessing Flood-Induced Waste Contamination Risks in the Beaumont–Port Arthur Area in Texas

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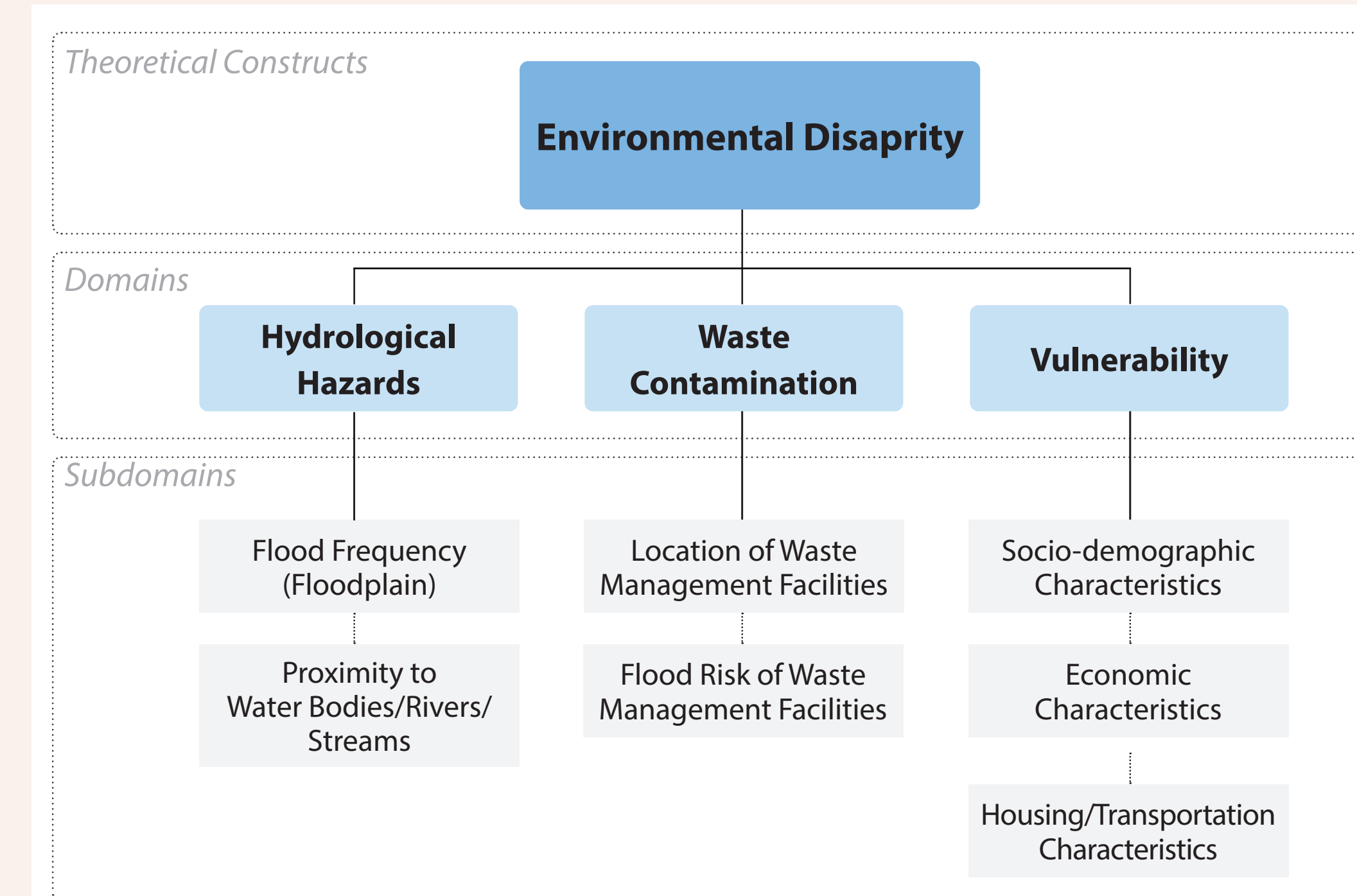
## Problem Statement

Coastal cities like Port Arthur, TX, are now facing increasing threats from flooding, and considering the geographical context of concentrated industries, the risk of contamination induced by floods has been increasing as well. While physical damages are the primary focus in flood research, the secondary hazard of hazardous residue dispersion from waste management facilities remains critically overlooked. Existing research is often focused on small-scale chemical pollution, leaving a gap in the understanding of widespread waste contamination risks. Furthermore, existing studies focused on isolated facilities rather than considering the overall impact of various waste management facilities. Especially in the United States, although a lot of Gulf Coast communities that act as industrial hubs are facing a high risk of flood-induced contamination, there is a significant lack of studies. This gap in risk assessment studies leads to low public awareness of environmental risks induced by floods, leaving residents unprepared for hazards. Also, it left municipal stakeholders failing to protect vulnerable communities. To address this gap, this research develops a parcel-scale risk assessment framework to quantify and map the overlooked flood-induced waste contamination in Port Arthur.

## Research Outline

### Research Question:

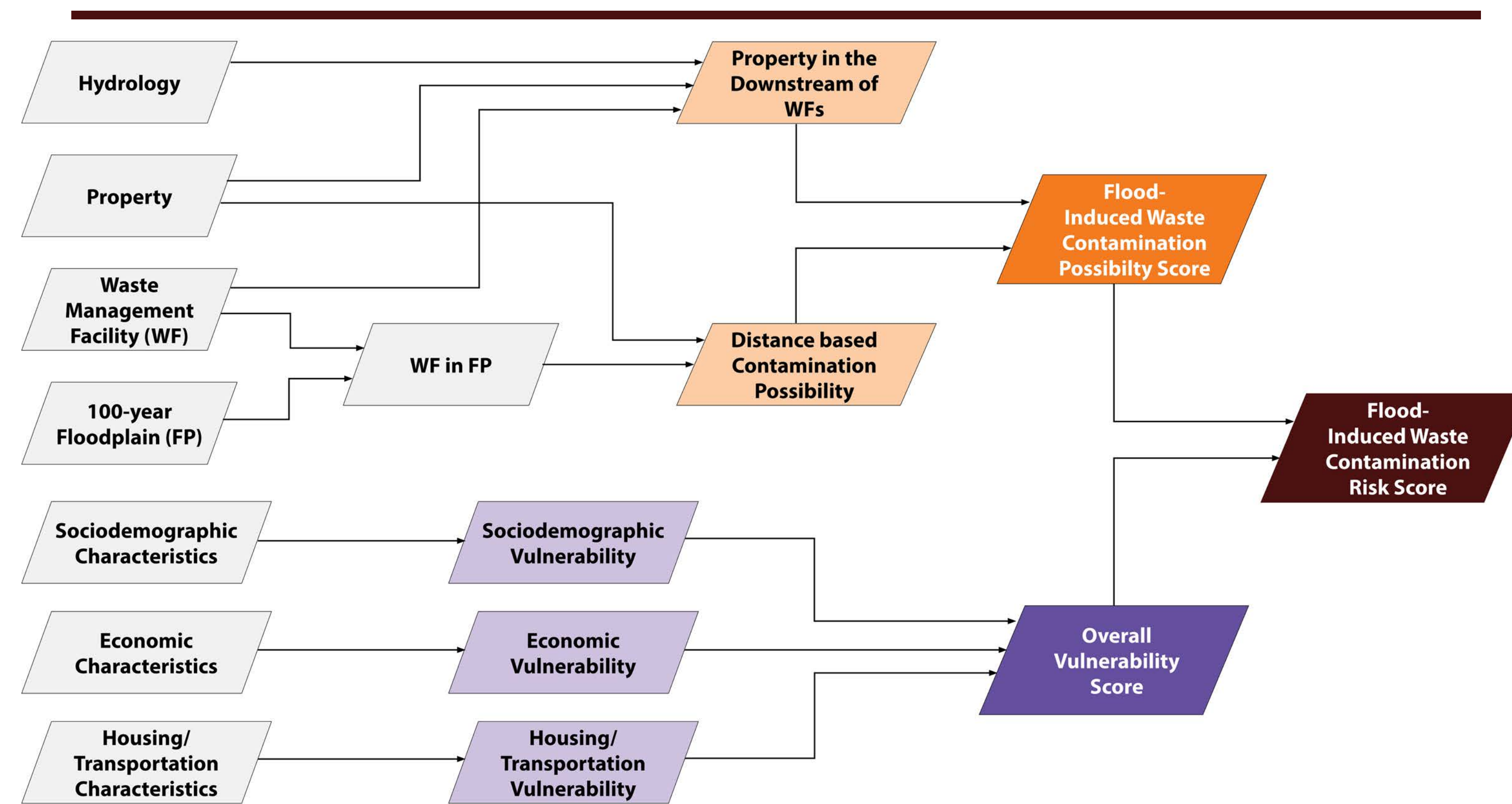
How does flood-induced contamination from waste management facilities affect environmental disparities in industrial communities with high flood risks?



## Data Description

Data Name	Description	Source
<b>Geographic Boundaries</b>		
City Boundary	Use 10km buffer to include nearby facilities	TxGIO
Property Data	Residential Land Parcels	
<b>Waste Facilities—Waste Contamination Probability</b>		
Industrial and Hazardous Waste (IHW) Facility	Location of permitted Industrial and Hazardous Waste Facility (IHW)	Texas Commission on Environmental Quality (TCEQ)
Municipal Landfill	Location of Municipal Solid Waste Management Facility	
Petroleum Storage Tank	Location of Petroleum Storage Tanks	
Scrap Tire Handler/Facility	Location of Scrap Tire Handlers and Facilities	
Dry Cleaner	Location of Dry Cleaners	
<b>Flood Probability</b>		
100-year Floodplain	Cursory floodplain mapped with LiDAR imagery data (3 m resolution)	Texas Water Development Board (TWDB)
Hydrological data	River/Stream and Waterbodies	TxGIO
<b>Vulnerability – Block Group</b>		
<b>Sociodemographic characteristics</b>		
Educational Attainment	Ratio of population with no high school diploma	American Community Survey 5-year (ACS 5-year, 2024)
Old population	Ratio of population age over 65 years old	
Young population	Ratio of population age below 18 years old	
Ethnic Minority	Ratio of Hispanic population	
Racial Minority	Ratio of population without White	
Household Structure	Ratio of single-parent household	
Disabilities	Ratio of household with disabled person	
English Proficiency	Ratio of household with low English proficiency	
<b>Economic characteristics</b>		
Poverty	Ratio of household below poverty level	
Employment	Ratio of unemployed population	
<b>Housing/Transportation characteristics</b>		
Vulnerable Housing Structures	Ratio of mobile homes/boats/RV/van/etc.	
No Vehicle	Ratio of household without vehicles	

## Work Flow



## Results

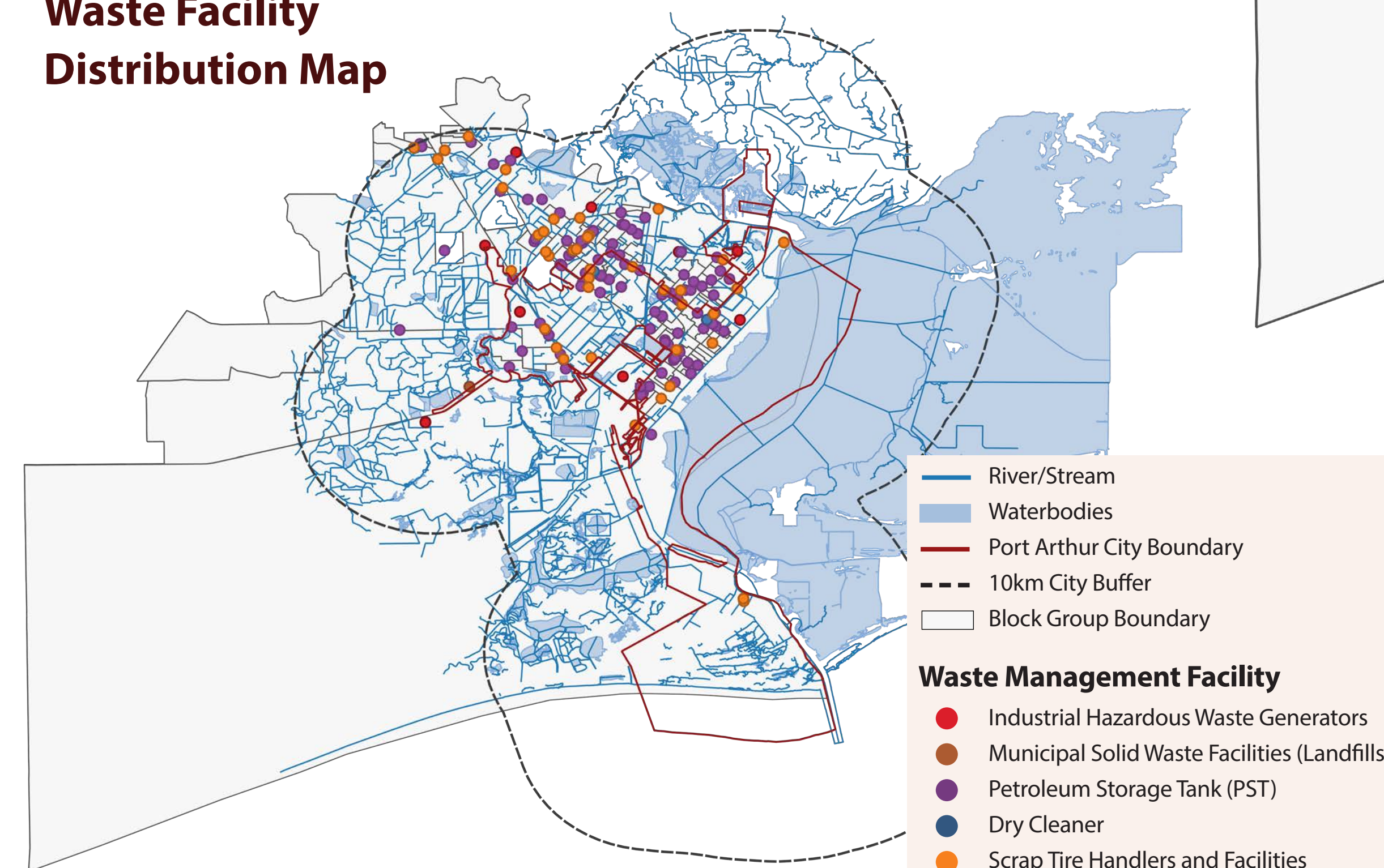
Total of 157 Waste facilities are existing in Beaumont-Port Arthur area (10 IHW facilities, 1 Landfill, 103 PSTs, 2 Dry cleaners, and 41 Scrap tire handlers), and 82 facilities are located in 100-year floodplain.

The darkest red areas reveal a high flood-induced waste contamination risk hotspots where have both high possibility of contamination and higher concentration of vulnerable populations. These hotspots follow a distinct path toward the coast which indirectly suggests that the local topography and drainage networks serve as channels for potential contamination when flood occurs.

- The largest hotspot is observed near Sabine Lake, which is one of the largest waterbodies in this area. This has concentrated waste facilities, and most of them are within the 100-year floodplain. As the continuous sea-level rise is expected, this area is the one where need the prior attention for mitigation.
- The next largest hotspot is observed near the border of the city boundary. This area has a distinctively high vulnerability score compared to other hotspots.
- The smooth dispersion of the risk score shown in the map showed that this study successfully captured the possibility of toxic dispersion when a flood happens.

The findings suggest a need for multidimensional mitigation strategies that simultaneously address floods and secondary contamination. Furthermore, by integrating this risk data into local government planning frameworks, the persistent environmental disparities faced by local communities can be effectively incorporated from the early stage of the decision-making process. Ultimately, this research promotes increased public awareness and provides a data-driven foundation for developing policies that safeguard vulnerable coastal communities from both the natural hazards and secondary contamination risks.

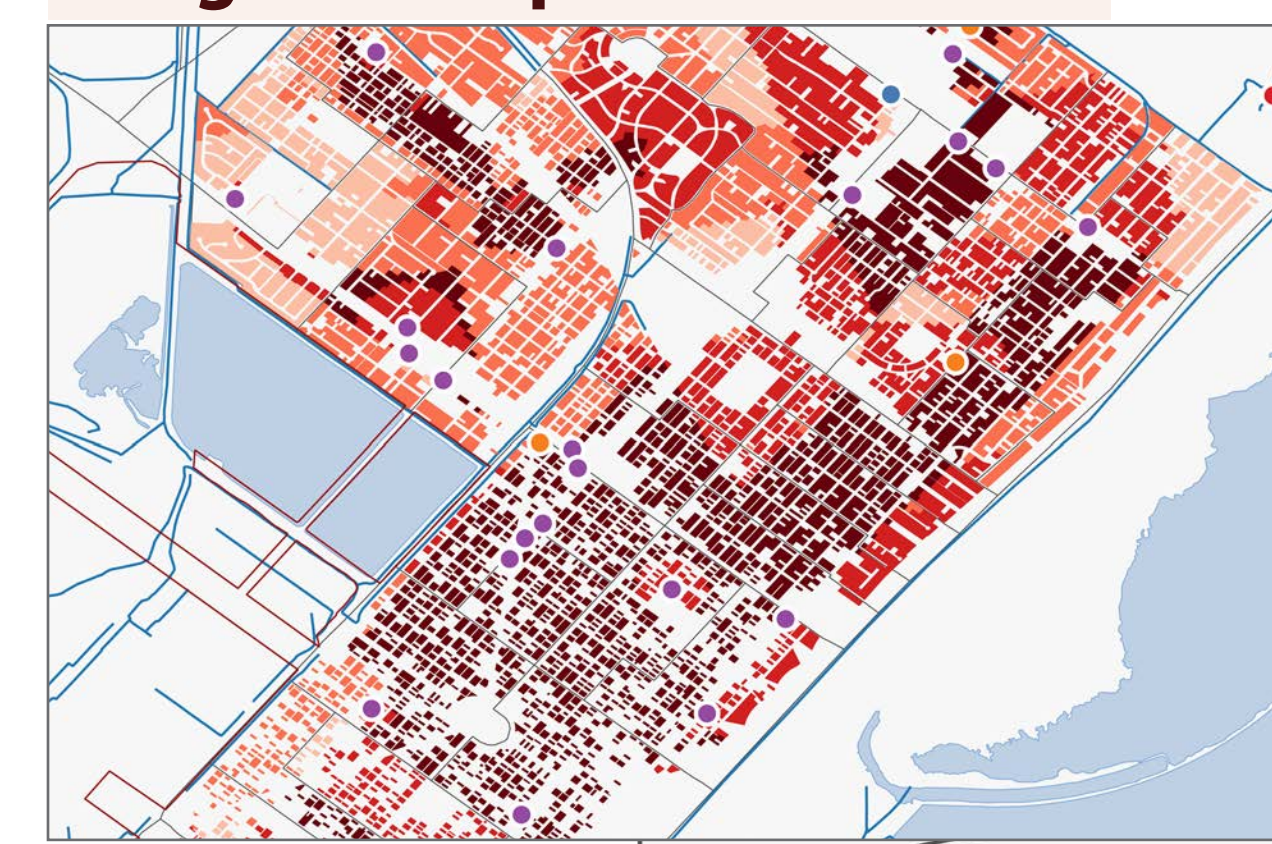
## Waste Facility Distribution Map



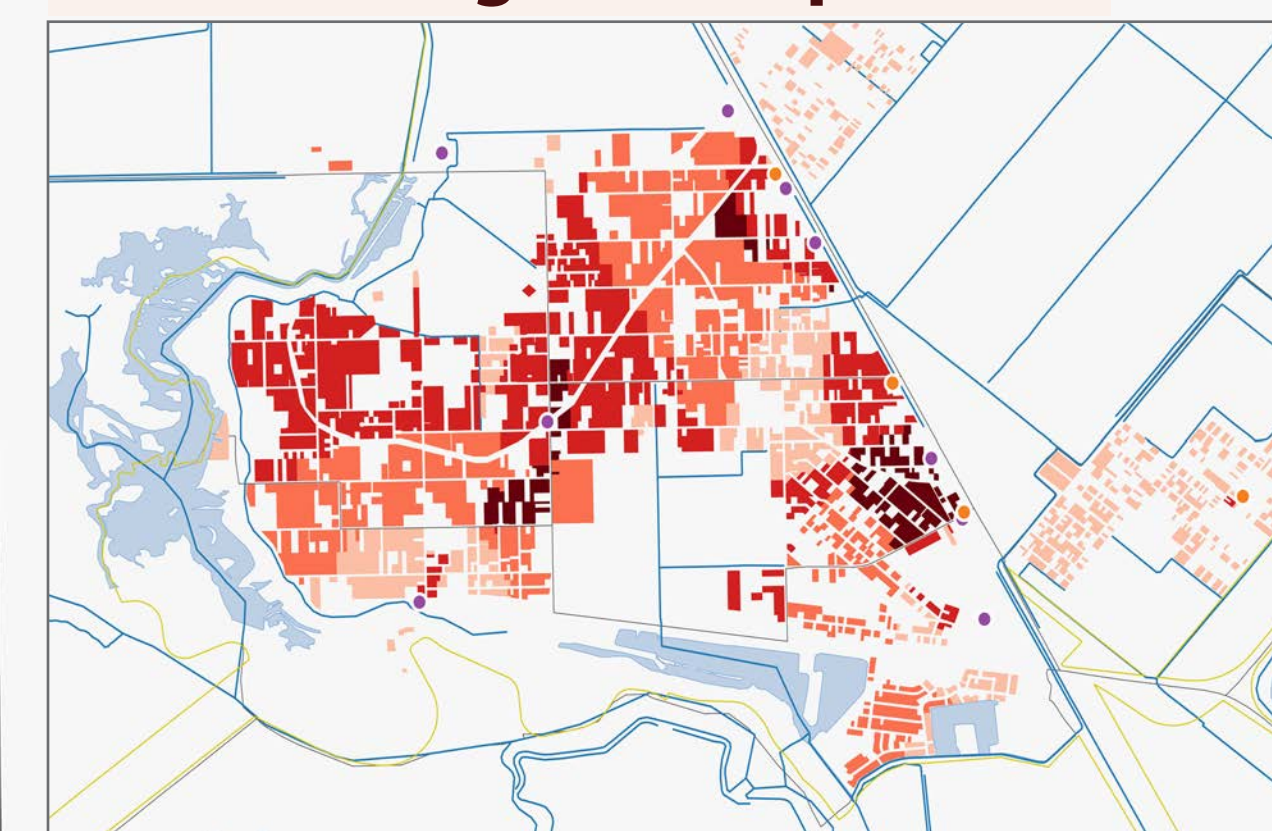
## Takeaways

- This research fills the gap of current flood-related risk studies by quantifying the often-overlooked secondary risk of flood-induced waste contamination, revealing critical environmental disparities in the coastal industrial hub
- By integrating spatial modeling of potential waste contamination threats with neighborhood-level socioeconomic and demographic data, this research provides a framework for identifying high-risk regions that require prioritized mitigation and environmental impact reduction action
- The findings highlight the necessity of addressing the subsequent mobilization of residues from waste management facilities to ensure the disaster resilience of communities

## Largest Hotspot



## Second Largest Hotspot



## Flood-Induced Waste Contamination Risk Map



## References

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