City of Phoenix
ASU Green Infrastructure Project Study

SOS 321: Policy & Governance in Sustainable Systems
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Without GI

With GI

City of Phoenix GI Issue

-How can Phoenix better manage its storm surge?

-What are the environmental impacts?

-What green infrastructure is available?

-What solutions are available and how are they being used?

Chemical Hazards

-The mixing of chemicals and rain water
-Now moves through the system, creating more and more toxic water
-Studies show high amounts of Nitrogen, Lead, and Zinc
Sources:
-Lawns / Agriculture
- -Loss of Biodiversity
- -Over fertilization
- -Smog

-Mishandling of Oil
- -One Oil Change mishandled pollutes 1 million gallons

Damaging Currents

-Natural vegetation removed by human activities
-Large increases in small and largescale floods
-Making canals narrower through the use of bridges
-Loss of protections along river banks

- -Larger storm surge
- -Movement of sediment
- -Further erosion
- -Faster moving waterflow

Green Infrastructure

-Natural vegetation is covered with impervious surfaces

-Grey infrastructure

- -Concrete channels, pipes, and detention basins
- -These exacerbate flooding, destroy wildlife habitat, and do not allow water to infiltrate ground

-Green infrastructure

- -Natural and living systems to capture, clean, and retain stormwater
- -Benefits include cleaning of stormwater, shading and cooling of areas, wildlife habitat, and natural beauty

Green Infrastructures

Reduce/Disconnect Paved Surfaces - Eliminating surfaces that are not necessary, reducing or converting impervious surfaces, and disconnecting impervious surfaces from flowing directly into local waterways so water is able to be absorbed into the ground

Permeable Pavement - A surface that allows stormwater to go through it in order to decrease flooding and as water goes through the permeable pavement, it filters pollutants from the water

Traffic Chicanes or “Bump Outs” - A curb extension that narrows the road by either the sides of the street or the middle or the street and there is typically vegetation inside of the extension that helps to reduce stormwater flooding

Curb Cuts/Curb Cores - Holes or cutouts in a curb that allow runoff to be directed into previous areas and filtered through LID features

Bioretention Basins/Biofiltration - Ornamental landscape areas planted with native or adapted deep-rooting vegetation in a shallow depression that are designed to hold water for a short period of time

Vegetative Swales - Shallow and slightly sloped channels that are filled with plants to help filter and infiltrate stormwater

Reduce/Disconnect Paved Surfaces

Case: Town of Hammonton, New Jersey

- In urban areas, stormwater runoff from parking lots, driveways, sidewalks, and rooftops generally flow to drainage pipes
- Town of Hammonton
  - Harvested runoff from 1.25 in. storm could supply 169 homes with water for a year
- Disconnecting practices
  - Channel water to bioretention areas or similar rather than drains, pipes, etc.
  - Rainwater harvesting

Cost/Maintenance:

- $9 to disconnect a downspout from sewer to ground
- ~$90 to connect to a rain barrel

Permeable Pavements

Cost/Maintenance:

- Per square foot to be installed
  - $0.50 to $1.00 for porous asphalt
  - $2.00 to $6.50 for porous concrete
  - $1.50 to $5.75 for grass or gravel pavers
  - $5.00 to $10.00 for interlocking concrete paving blocks
- Permeable asphalt ~10-15% higher initial cost than traditional
- Permeable concrete ~25% higher initial cost than traditional
- Fewer costs associated with inlets, pipes, and detention pools
- Takes on sediment, clear debris by sweeping or vacuuming
  - $400-500 per year for vacuum sweeping a half acre parking lot 3-4 times annually

Lifespan

- 20-30 years for porous concrete, 15-20 years for porous asphalt, 20-30 years for interlocking pavers

Effectiveness

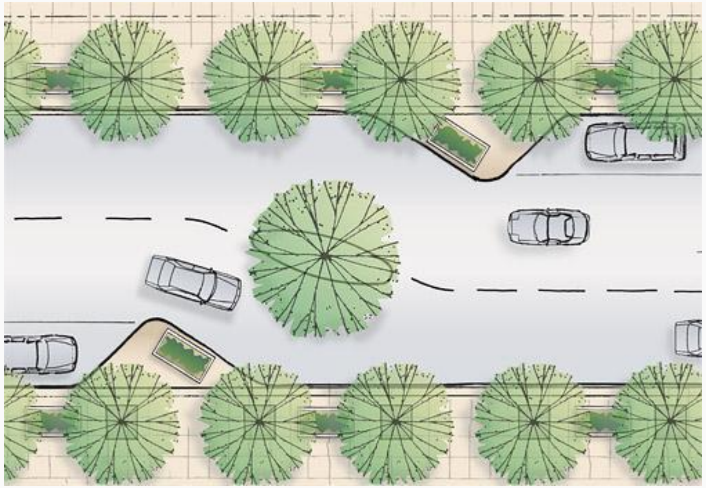
- Study in Denver, CO
  - 33% reduction in water flow for interlocking concrete, 38% reduction for pervious concrete

Traffic Chicanes or “Bump Outs”

Owner: City & County (San Francisco, CA)

Cost/Maintenance:

- $5,000 to $20,000
  - Depends on site conditions and landscaping
  - Landscaped chicanes
    - $10,000 (for a set of three chicanes)
      - for asphalt street
    - up to $30,000 on concrete street
- Fronting property owners responsible for
  - maintenance and upkeep of
    - sidewalk paving
    - sidewalk elements directly fronting their property
      - (trees, landscaping, and streetscape furnishings)



Curb Cuts/Curb Cores

Owner: Private (Tucson, AZ)

Cost/Maintenance:

- $45 a permit
- $160 base cost for crew
  - Includes 5 curb cuts
  - More than 5, $30 each
- No specific maintenance besides ensuring the curb is clear to allow water flow

Bioretention Basins/Biofiltration

Owner: City (Wilmington, NC)

Cost/Maintenance:
$5,000 to $10,000 per acre drained
most intensive period of maintenance is during plant establishment (first two years)

Effectiveness:
Study in Lakewood, CO
Basin able to reduce average runoff vol. by 53%

Vegetative Swales

Owner: State (Pennsylvania)

Cost/Maintenance:

$4.50 - 8.50 per linear foot when vegetated from seed

$1 annually per linear foot

$15-20 per linear foot when vegetated from sod

$2 annually per linear foot

Cheapest compared to others

Expected lifetime is 50 years

Right of Ways provide opportunities to install vegetative swales

Importance of Stakeholder Engagement

Ballard Roadside Raingardens - Seattle

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San Antonio Suburban Forest

Since 1985 suburban forest declined 22% & medium tree canopy decreased by 43%.

Result: estimated 73 million cubic feet of stormwater flow during peak storm event

City offered to plant trees and manage for two years, natural way to manage stormwater

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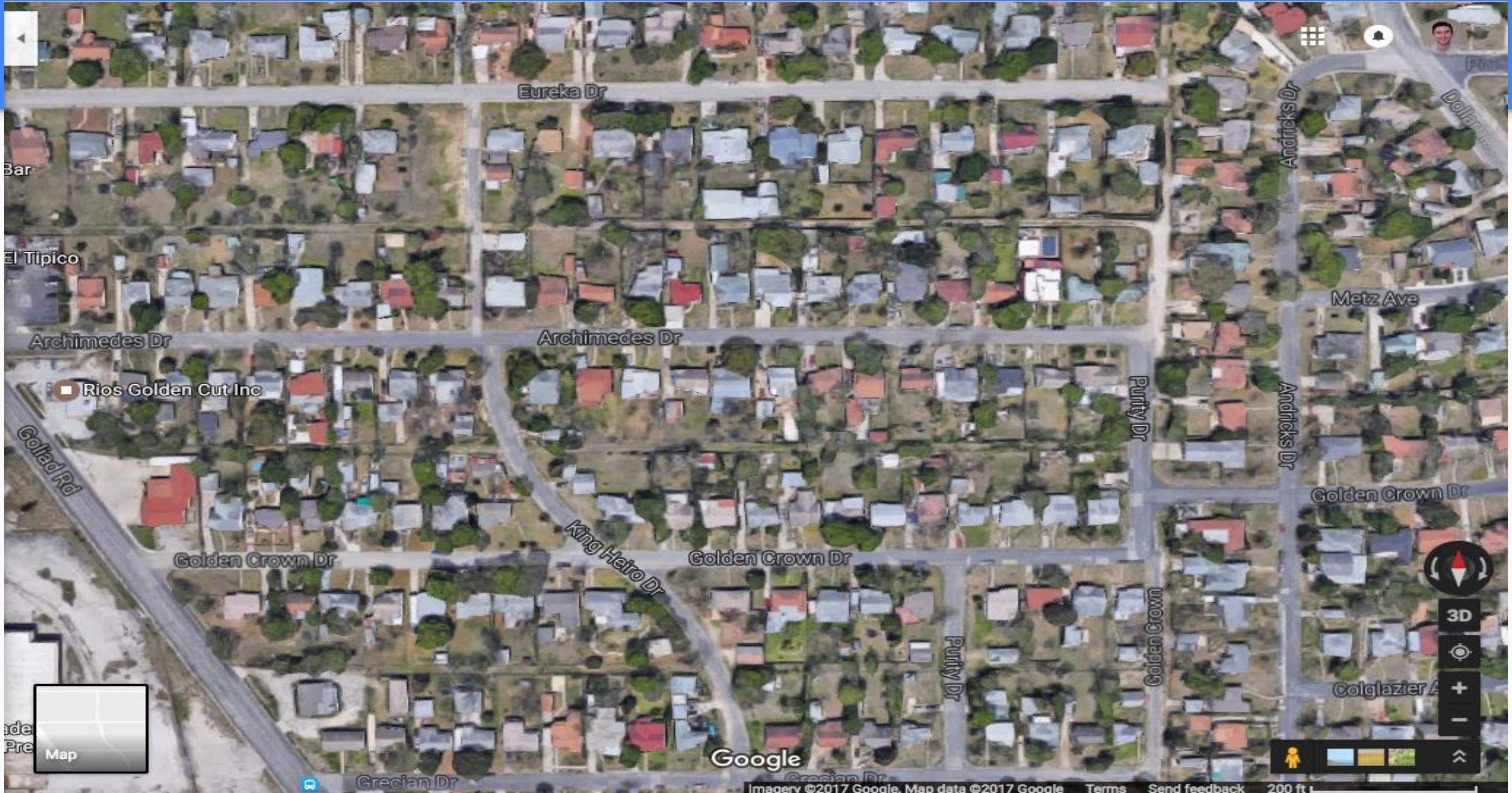

Takeaways for Engagement

Neglecting to involve citizens is a recipe for poor results
Seattle suggests informing the community two years before project start date
Think about Flint, MI….and then don’t do that

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Recommended Solution for the City of Phoenix

City of Phoenix

- Engage and inform community beforehand
- Bump outs
- Permeable Pavement
- Repurposing land along roadways (vegetative swales inside bioretention basins)
- Plant lots of trees

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City of Phoenix

Questions/Comments

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New way to organize pres.?

-Explain stormwater (Cody environmental section, laying out the problem)
-Explain GI (Generally what it is and why it matters)
-Go through the 6 different GI features, one by one (each of us contribute what we know for this, which Ashley and Lucas probably have the most information about from their research)
    -For each one: Explain what it is, how it works, costs and maintenance, and give example of it in use. (Also, add in any cons if you know of any)
-Stakeholder information (Nick, after reading your research, it looks like you have several cases where stakeholder engagement in GI implementation was lacking, and why it mattered). For this section of the presentation, you could go over these errors made and why it's important to engage stakeholders.
-Any other obstacles we should cover?
-Recommendations
    -Which ones we recommend and why
    -Phoenix must engage stakeholders
    -Anything else?