Markets, Policies & Tools for Green Infrastructure

Research Team & Project

- EPA-funded research grant to study GI implementation in Philadelphia

- Team: urban planners, real estate market and policy analysts, landscape architects
  - <u>Faculty:</u> D. Hsu, J. Landis, T. Daniels, S. Wachter
  - <u>Students and Staff:</u> H. Hu, T.C. Lim, E. Harrington, E. Hosek, B. Leopold, P. Amos, D. Karp
  - <u>Consultants:</u> Azavea, AKRF, PEC, OLIN

- Objective: To enable citizens and owners to invest in green infrastructure in Philadelphia

U.S. Stormwater Policy

- National CSO Control Policy of 1994
    - Expedited compliance with the U.S. CWA
    - Water quality measured for uses:
        - swimming, aquatic life, industry and agriculture
    - Criteria are numerical and narrative
    - Anti-degradation policy

- Control discharges from CSOs
    - NPDES permitting process
    - authorization necessary to discharge to waterways

- Wet Weather Quality Act of 2000

"Green City, Clean Waters Plan"

- Philadelphia is not the first, but <u>the biggest post-industrial city</u>, to pursue controlling stormwater runoff almost entirely with green infrastructure.

- Approximately $2 <u>billion</u> plan.

- Result of a 2011 consent order and agreement (COA) with PA Department of Environmental Protection
  - Reduce CSO volumes
  - Pollutant removal
  - Proof of concept
  - Adaptive management
  - 34.5%+ greening of the city

Green Infrastructure in Philadelphia
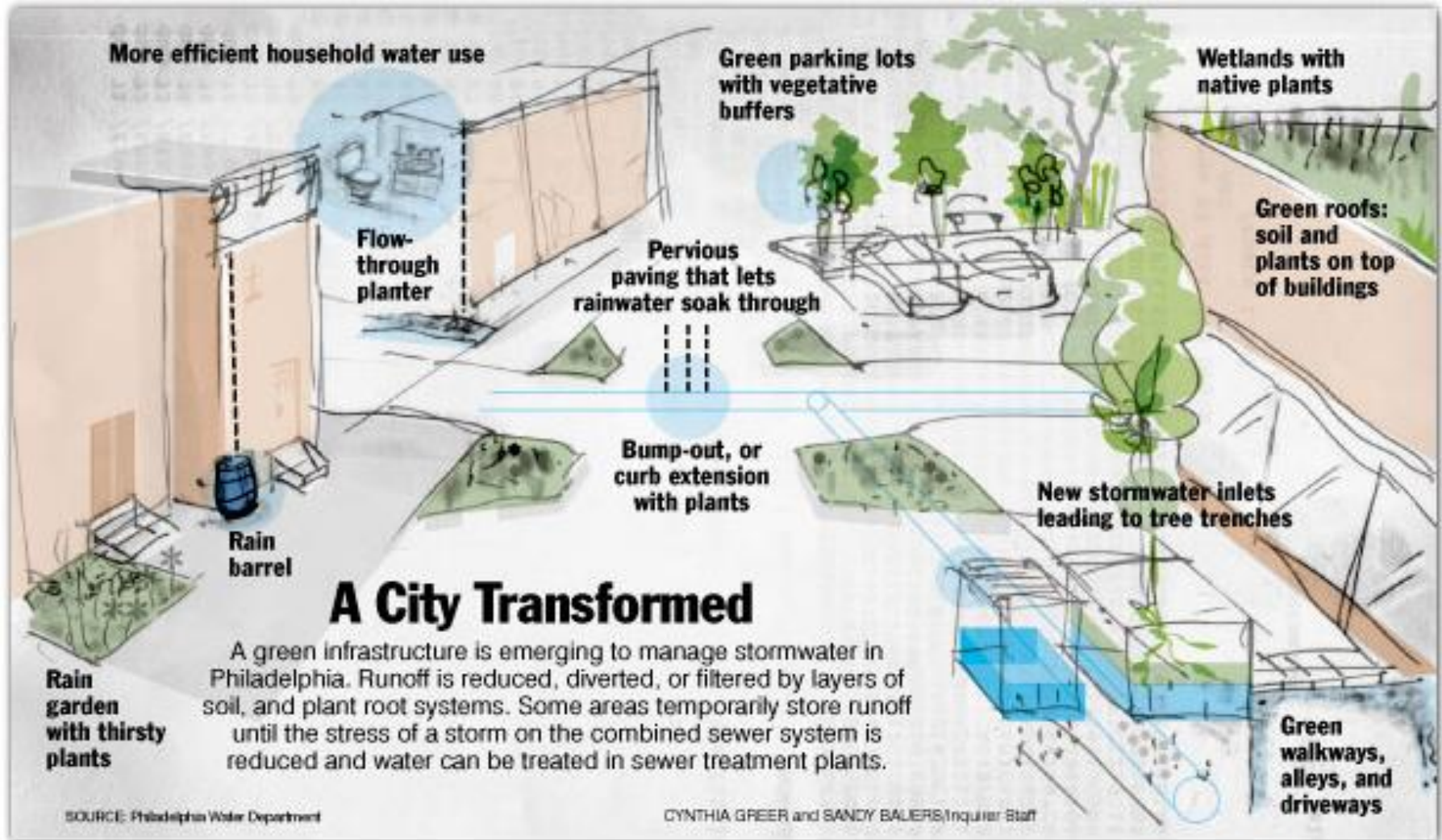
Southeast Philadelphia (10th & Moyamensing), photo by Andrew Dobshinsky

Math Problem

- COA / LTCP requires 10,000 greened acres by 2035
  - cost of GA in right-of-way: $50-400k
  - cost of GA through SMIP grants: $82k
  - [cost of GA through GARP program: ~$90k]
  - plus historic re-development rate: 0.5%

- Q: How much can PWD pay to meet target?
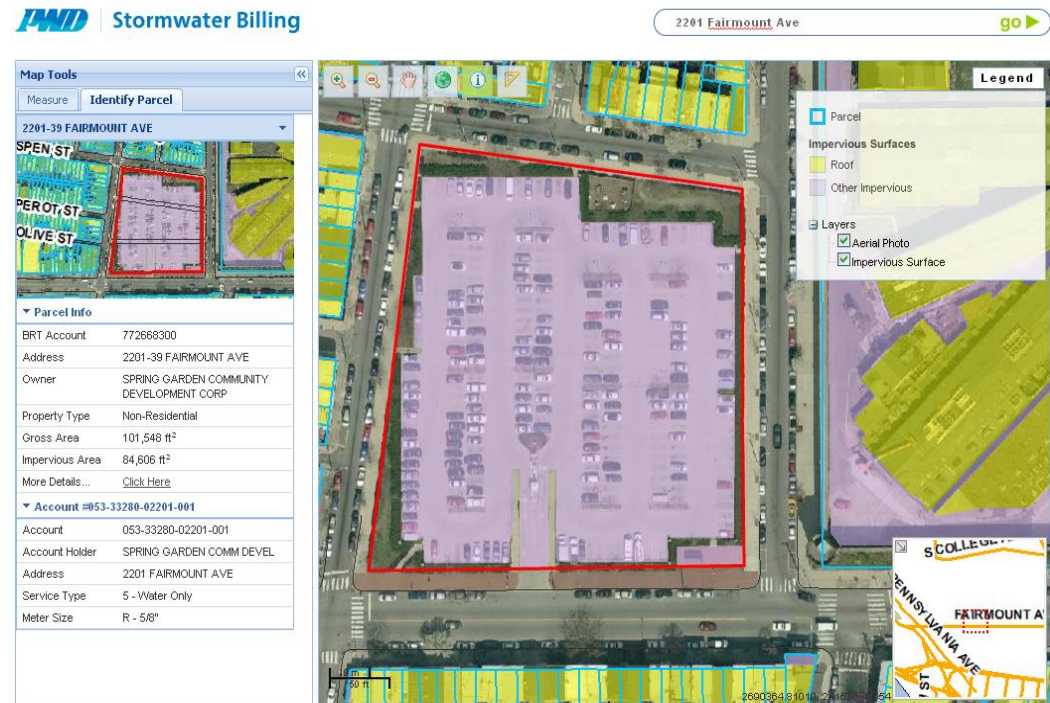- A: If cost of GA declines smoothly to 2035:

Cost	10%	20%	30%	40%	50%	60%	70%	80%	90%
Year	2020	2024	2026	2028	2030	2031	2032	2034	2035

Policies and Tools

- ## Stormwater Development Regulations
  - 15,000 SF threshold for new and re-development triggers stormwater requirements
  - capture first inch
  - water quality, quantity, and channel protecion
  - goal is >10% of impervious cover over next 25 years

- ## Stormwater Management Incentives
  - credit for retrofitting properties with GI

- ## Green Acre Retrofit Program
  - targeted program to aggregate large sites
  - again offers credits for GI retrofit, site assembly

Area-Based Stormwater Billing

- Previously meter-based.

- Now:
  - Gross area charge: $0.69 / 500 sf / month
  - Impervious cover: $4.75 / 500 sf / month

- Substantial re-distribution of externality costs.

Market Effects: Plus / Minus

- Competitive market for GI does not yet exist
  - ✓ Existing efforts are small scale (~100 GA)
  - ✓ Lack of information, awareness
  - ✓ Lack of financial / technical capital
  - ✓ High transaction costs (20-40% of cost)

- Supply of GA:
  - ✓ Costs decrease as experience grows
  - ✓ Costs decrease as market grows
  - ✓ Supply increases as stormwater charges go up
  - ✓ Costs increase as best sites go first

Social & Institutional Barriers

40 years of energy efficiency efforts show that significant market barriers exist to retrofitting buildings and properties!

Barrier	Policy response
Externalities / lack of incentives	Area-based stormwater fee ✓
	Redevelopment ordinance ✓
Lack of knowledge	Outreach to developers ✓
Lack of upfront capital	SMIP / GARP grants ✓
Matching people to programs	Alternative financing sources
	Targeted incentives / subsidies
	Site acquisition / aggregation

Markets Need Information

Daniel Kahneman:

- "we can be blind to the obvious and we are blind to our blindness"

Daniel J. Simons and Christopher F. Chabris, "Gorillas in Our Midst: Sustained Inattentional Blindness for Dynamic Events." Perception 28 (1999): 1059, 1070.

Ajzen's Theory of Planned Behavior (TPB); technology acceptance model (TAM); "reasoned action"
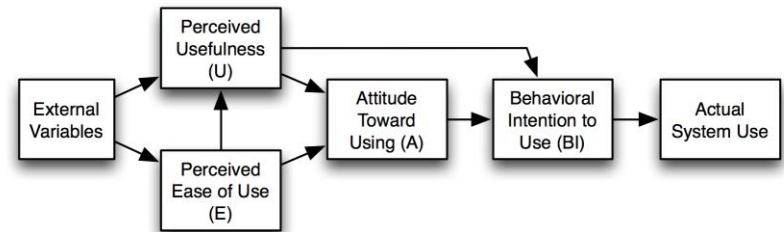
Wikimedia / Theory of Planned Behavior

Market Transaction Model

PWD Investors

Developers

Owners

Engineers
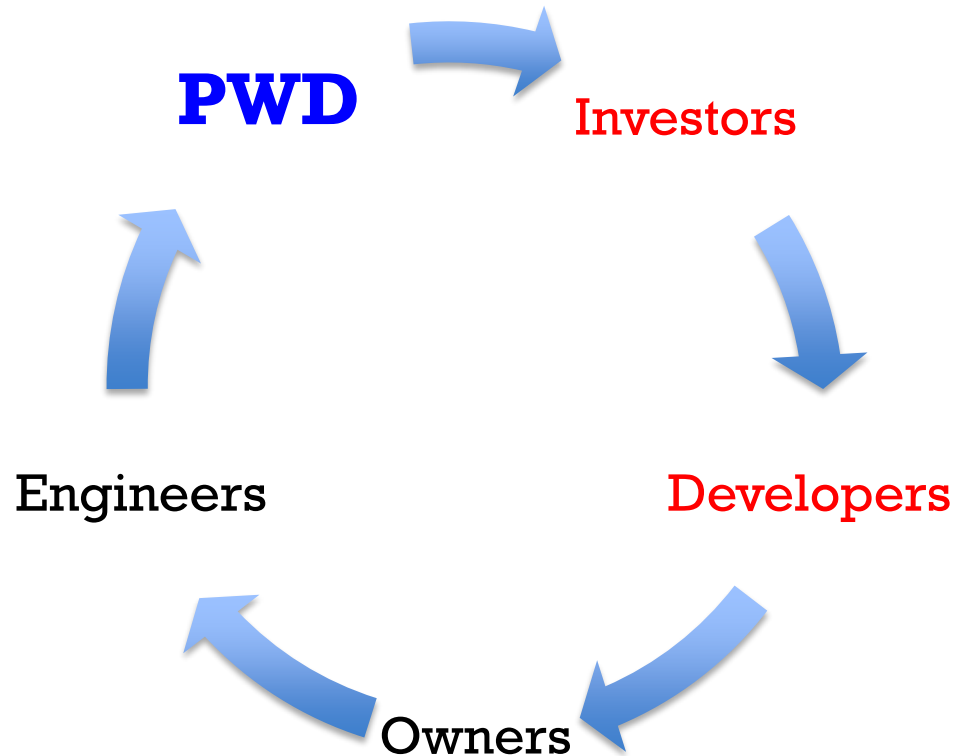
Web-Based Tools for Information

"Daylighting" Information for Action
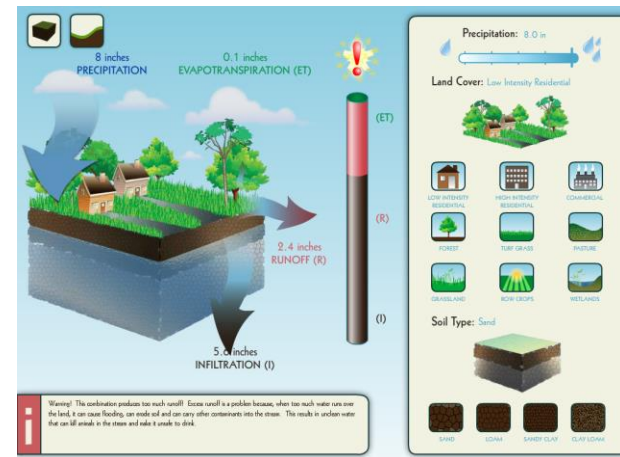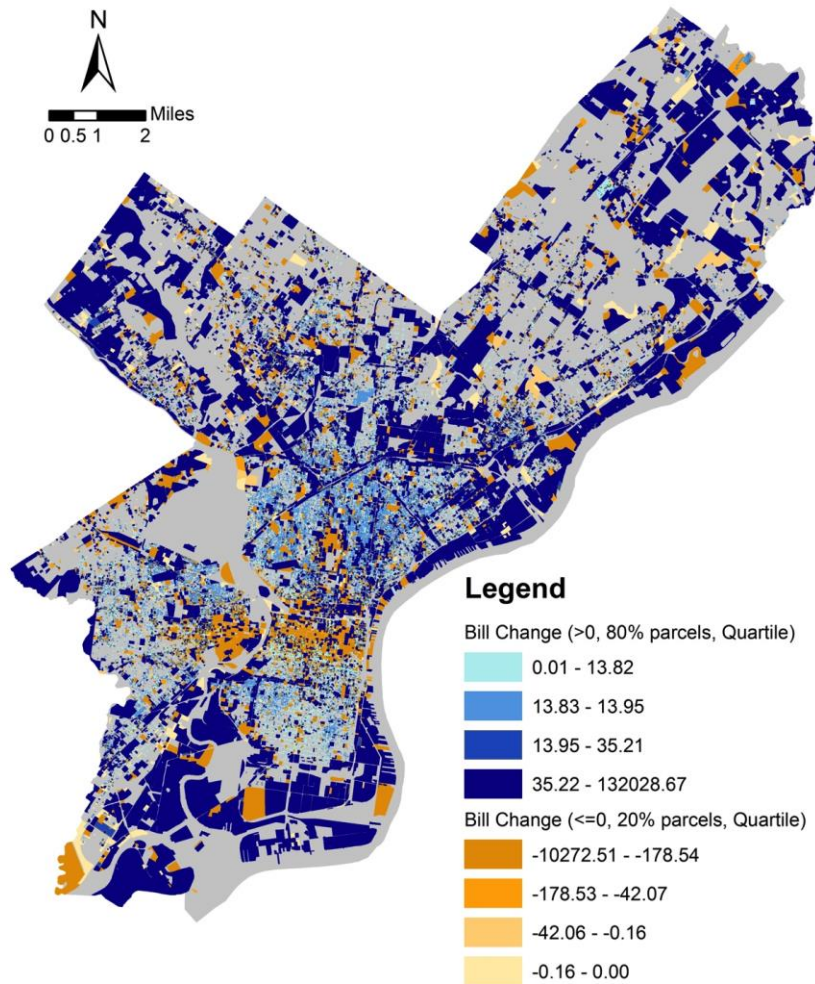
Thank you!

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