Urban Soils and Vacant Land as a Storm Water Resource

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Problem Statement...

There has been a significant population loss in many cities throughout the US

Many of these buildings now lie vacant and abandoned

US Census Data for City of Cleveland, Ohio

<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Year</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1820</td>
<td>606</td>
<td>1920</td>
<td>796,841</td>
</tr>
<tr>
<td>1830</td>
<td>1,075</td>
<td>1930</td>
<td>900,429</td>
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<tr>
<td>1840</td>
<td>6,071</td>
<td>1940</td>
<td>878,336</td>
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<td>1850</td>
<td>17,034</td>
<td>1950</td>
<td>914,808</td>
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<td>1860</td>
<td>43,417</td>
<td>1960</td>
<td>876,050</td>
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<td>1870</td>
<td>92,829</td>
<td>1970</td>
<td>750,903</td>
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<td>1880</td>
<td>160,146</td>
<td>1980</td>
<td>573,822</td>
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<td>1890</td>
<td>261,353</td>
<td>1990</td>
<td>505,616</td>
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<td>1900</td>
<td>381,768</td>
<td>2000</td>
<td>478,403</td>
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<td>1910</td>
<td>560,663</td>
<td>2010</td>
<td>396,815</td>
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</table>
These abandoned buildings are hazards to the community

- Crime
- Safety
- Home Values

Recently, many cities have begun demolishing these abandoned buildings.

While an improvement, these vacant lots lead to the fracturing of neighborhood cohesiveness.
Many of these older cities have aging infrastructure, including a Combined Sewer System.

The cost to upgrade a Combined Sewer System is prohibitive.

- Cities have reduced populations and tax bases
Solution?

- Utilization of vacant lots for Green Infrastructure
- Vacant lots will attenuate stormwater flows, reducing CSO events
- Green Infrastructure will provide benefits to the community
Where do we start?

- SOILS (of course)

- In urbanized areas, USDA Soil Surveys label many of these areas as Urban Land

- Geotechnical investigations do not provide sufficient detail for an adequate assessment of soil conditions within these vacant lands
Conducted deep (8 – 12 ft) soil borings across vacant lots

Classified soil conditions in accordance with USDA-NCSS Guidelines

Measured surface permeability, density, as well as subsurface permeability

Measured soil physical and chemical measurements in the laboratory
Rediscovering Urban Soils...
Surprising amount of variability within native soils

Variability within fill characteristics between vacant lots

Variability within a lot based on the demolition practices for a lot
Natural Variability

Subsoil hydraulic conductivity (Native areas, cm/hr)
- 0.00000 - 0.07597
- 0.07600 - 1.71237
- 1.71238 - 4.19597
- 4.19598 - 26.66011
- 26.66012 - 65.22647

Lake Erie

streams

2006 cuyahoga streets
Human Variability
Demolition Variability
Despite all of the variability, given enough data points, soil relationships can be drawn throughout a neighborhood.

Based on these soil properties, you can design the appropriate stormwater BMP for a given site.

<table>
<thead>
<tr>
<th>Site Reference Number</th>
<th>Infiltration/Recharge</th>
<th>Bioretention/Rain Garden</th>
<th>Detention/Wet Pond</th>
<th>Urban Agriculture</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Severe</td>
<td>Moderate</td>
<td>Slight</td>
<td>Severe</td>
</tr>
<tr>
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<td>Slight</td>
<td>Slight</td>
<td>Severe</td>
</tr>
</tbody>
</table>
Vacant Lots offer potential for Green Infrastructure to reduce CSO events

The variability of soils within these lots is impacted by natural, human, and demolition

Because of this variability, detailed soils information is critical in the planning and design portions of this work
Additional Information

- Locations of existing CSO infrastructure
- Measured flow rates within a sewershed
- Community Input
Thank you...