# Stormwater Project Types

What kinds of stormwater investments fit best within each of Pittsburgh's unique terrain types?

# Stormwater Project Types

- Stormwater Project Types are targeted project groupings recommended for distinct Pittsburgh terrains.

- Project Types provide the "building blocks" to define the initial investment strategy within target areas as defined by the four lenses mapping

- Project Types refer to physical project installations as well as the incentives and policies that make the projects possible.

| Terrain Type | Description |
|---|---|
| Upper Plateau and Hilltops | Areas located in the upper watershed typically with ground slopes ranging from 0 to 5 percent. |
| Sloped Hillside | Areas located in a transition zone from the upper plateaus to the pocket ravine with ground slopes ranging from 5 to 20 percent. |
| Pocket Ravines | Smaller narrow ravines typically containing culverted historic streams or seasonally ephemeral streams. These areas act as funnels for stormwater generated from upper plateaus and sloped hillsides. Stormwater concentrates and moves fast in these areas especially during intense rain events. |
| Floodplains | Medium to larger valley and ravines containing larger streams with perennial base stream flows. These areas act as the second funnel from water originating from smaller pocket ravines. In these areas stormwater is often dangerous and sometimes life threatening. |
| Dense Urban Area and River Flats | Dense urban areas typically consisting of a mix of commercial, industrial, and residential properties. These are primarily located in areas along the main three rivers and neighborhoods around the universities. |

# Stormwater Project Types

| Terrain | Objectives | Stormwater Project Types |
|---|---|---|
| Upper Plateau and Hilltops | Concentrate, Store, Treat | Store in larger more centrally located facilities that require lower maintenance. Look to provide treatment via filtration especially in MS4 areas. |
| Sloped Hillside | Move, Protect, Store (with modifications) Treat | Centrally located facilities to store stormwater typically smaller in size. Storage sites may require more costly modifications (check dams, liners, velocity control) and generally not recommended unless on large perched flat open area. Where storage not available or cost prohibitive, provide protective flood mitigation in the form of increased surface (new curbing and inlets) and subsurface conveyance (new or upsized sewers), road raising, or backflow prevention on private laterals. |
| Pocket Ravines | Move, Protect, Treat | Storage naturally concentrated but potentially more challenging due to slope, narrow valleys, and access constraints. Where not possible to store, move water through the ravine to downstream larger floodplains. Provide flood protection, increased conveyance, and backflow prevention. Incorporate ecological restoration aspects where possible. |
| Floodplains | Store, Treat, Protect | Reconnect stream with adjacent floodplains. Provide storage in floodplain to allow for flood relief and water quality treatment. Couple with stream restoration and bank stabilization for MS4 credits. Explore buyouts for repetitive loss properties for potential floodplain restoration sites. Coordination with adjacent transportation opportunities with major roadway flooding (Washington Blvd, Saw Mill Run Blvd) |
| Dense Urban Area and River Flats | Move, Protect, Store (private land) | Provide storage in private areas such as parking lots and common areas as part of redevelopment likely most cost effective. Consider grant and incentive programs to invest public dollars in these areas. Avoid right-of-way work in dense areas due to greater cost risks. Increase sewer and surface conveyance and provide flood protection (e.g., via smart valves and inline storage). |

Note: For all terrains - look for continuous vacant lots typically at intersections and large public open areas (parks, greenways, schools, parking lots). Incorporate a neighborhood integrated environmental full delivery approach as part of vacant lot areas to ensure equitable outcomes (see Alternative Delivery slides).

# *Core Technologies*

**Create storage**

- Distributed Infrastructure
- Regional (i.e., downstream)
- In-line and "smart-sewers"
- Floodplain creation
- Retrofit existing storage

**Improve/create conveyance**

- Larger sewers
- New sewers
- Sewer separation
- Surface conveyance
  - Curb and gutter
  - Stream restoration / separation
- New inlets
- Bridge/culvert replacement
- Pump stations

**Protect existing assets**

- Buy-outs
- Flood proofing
- Roadraising
- Backflow valves

# Upper Plateau and Hilltops Terrain

## Common issues:

Overland flooding, basement backups, water quality, contribution to downstream issues

## Technologies:

Distributed storage, new piping, new inlets, partial separation, surface conveyance improvements

## Implementation challenges:

Utility constraints, urban uses, lack of sufficient drainage area, lack of slope

## Co-benefits:

Passive recreation, urban heat island reduction, repaving, streetscape improvements, complete streets, cost sharing, environmental justice

## Example areas in Pittsburgh:

Homewood, Larimar, Point Breeze, Morningside, Knoxville/Beltzhoover, Lower Garfield/Friendship, Upper Hill District, Squirrel Hill
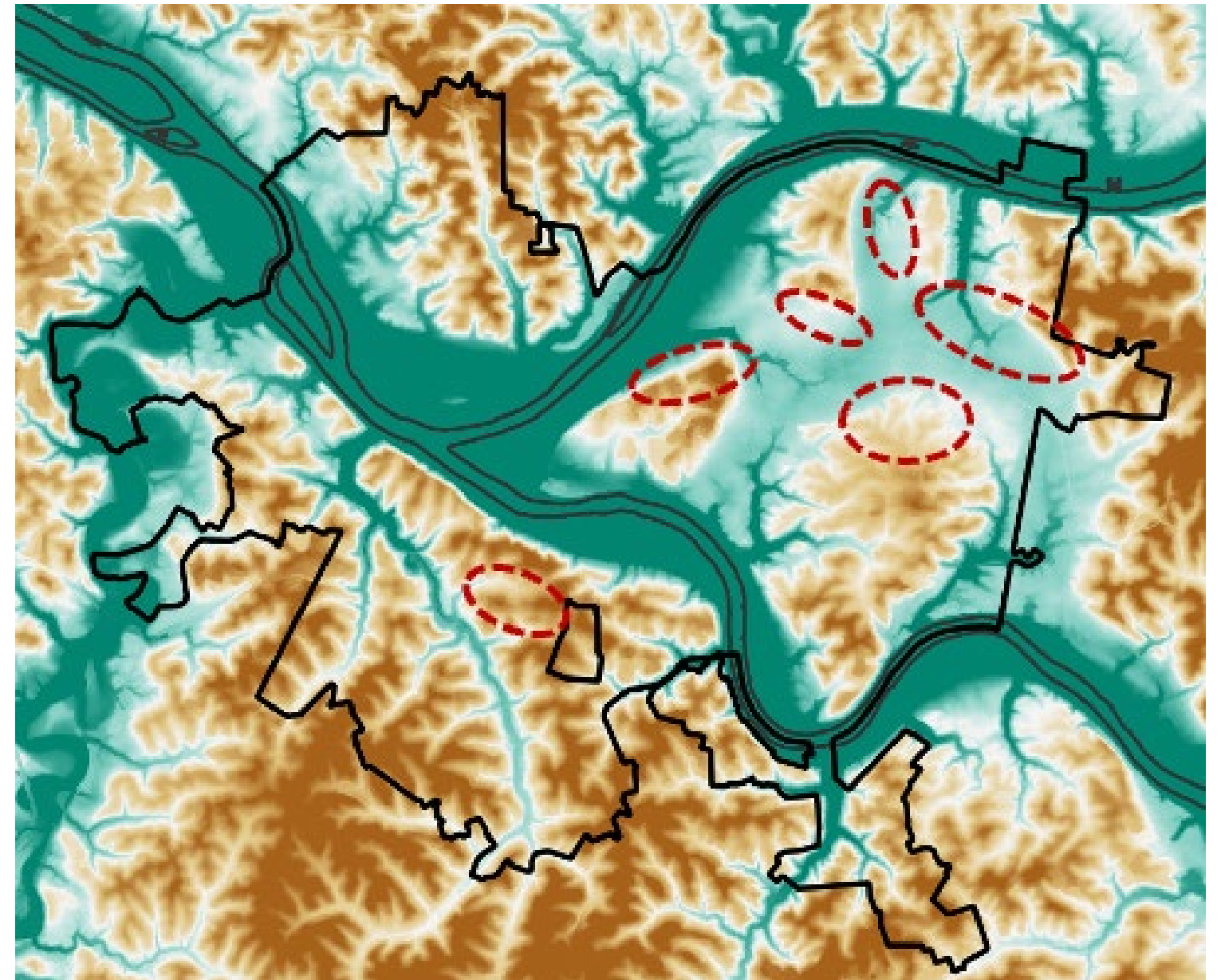


*Note: Identified areas are for illustrative purpose only and not representative of all areas fitting this terrain.*

# *Upper Plateau Terrain*

## *Key precedent: Fourth Ward Park Atlanta, GA*

Before

After

# Upper Plateau Terrain

## Key precedent: Towerside District, Minneapolis, MN

*The system includes a first-of-its-kind district stormwater agreement between four private landowners. The system collects storm water runoff from six development parcels totaling eight acres, conveying that runoff into two biofiltration basins for treatment, storage, and reuse on nearby development sites and community garden.*
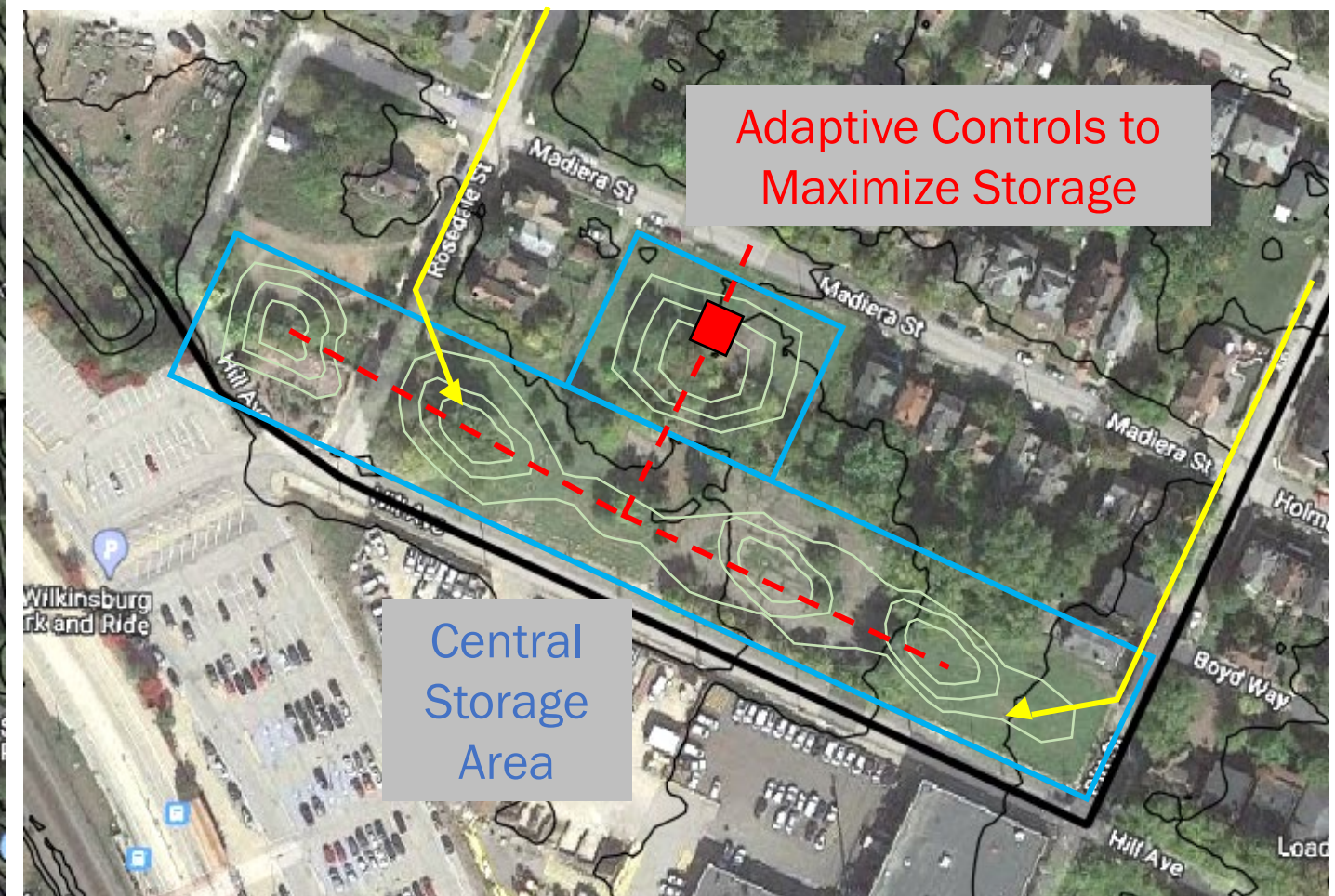


*The agreement made with property owners makes it possible to manage stormwater for future development jointly and reduce each individual property owners' expense, while also unencumbering a portion of their property to allow more flexibility for development and reducing surface and groundwater pollution.*

*http://towersidemsp.org/*

# Upper Plateau Terrain Example Concept

*Focus Area: Homewood*



New Storm Sewers, Inlets, and Manholes
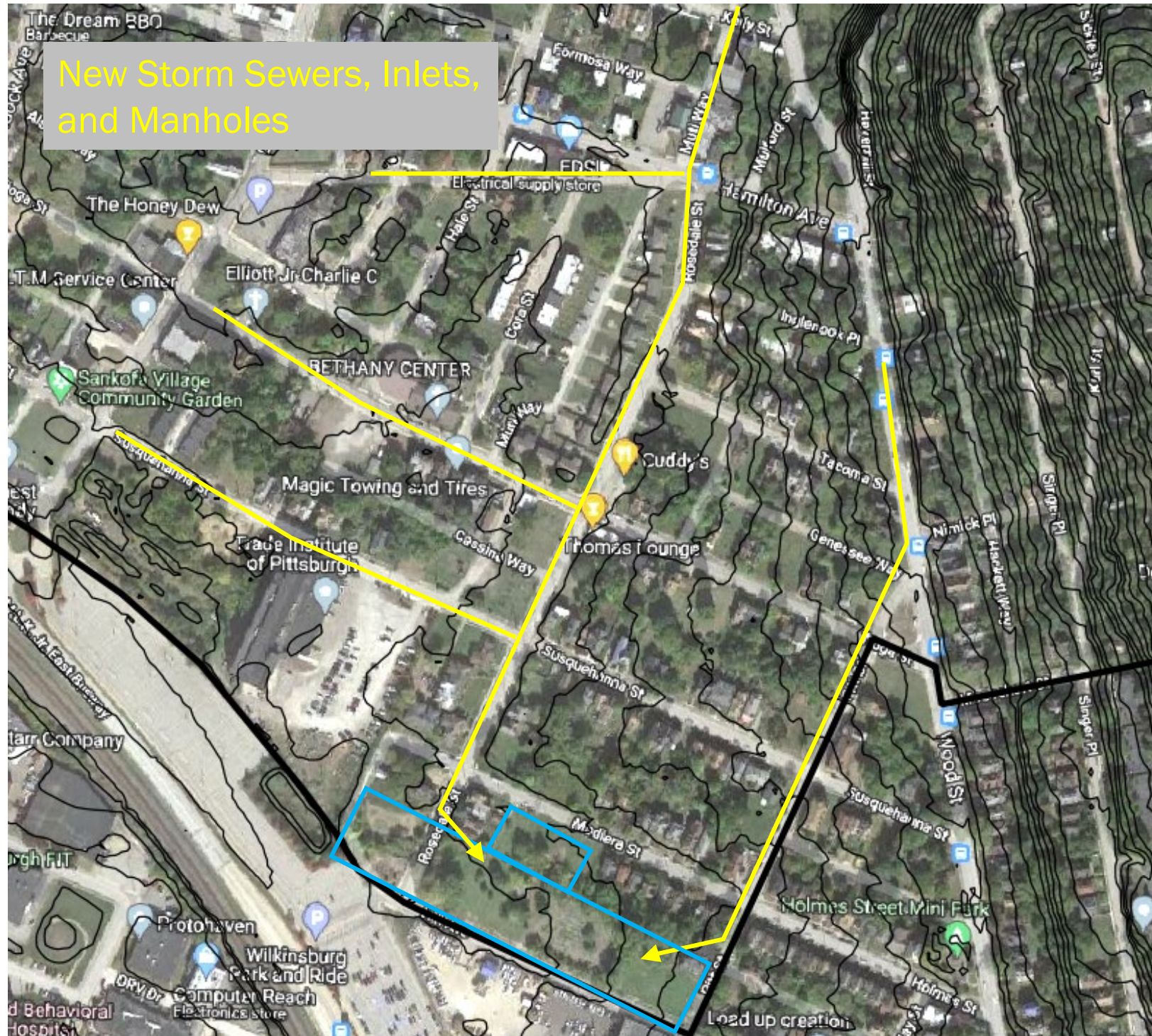
Large Continuous Vacant Lot Adjacent to Wilkinsburg Park and Ride

Adaptive Controls to Maximize Storage

Central Storage Area

# Sloped Hillside Terrain

**Common issues:**

Overland flooding, landslides, groundwater seeps and springs, water quality and AMD

**Technologies:**

Some storage in limited areas, larger sewers, new sewers, surface conveyance improvements, new inlets
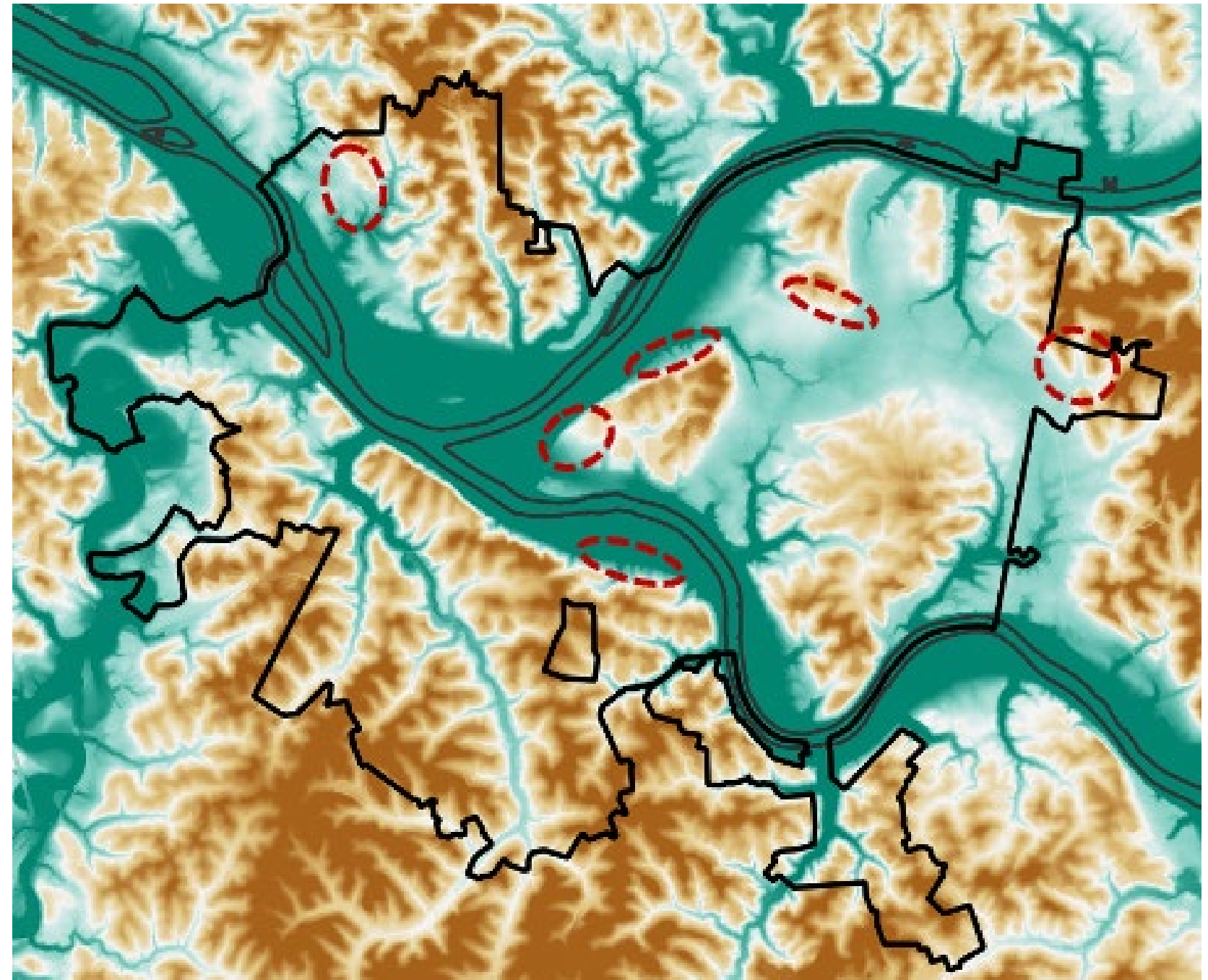
**Implementation challenges:**

Wooded or naturalized areas, steep slopes

**Co-benefits:**

Active Recreation, Passive Recreation, Cost Sharing
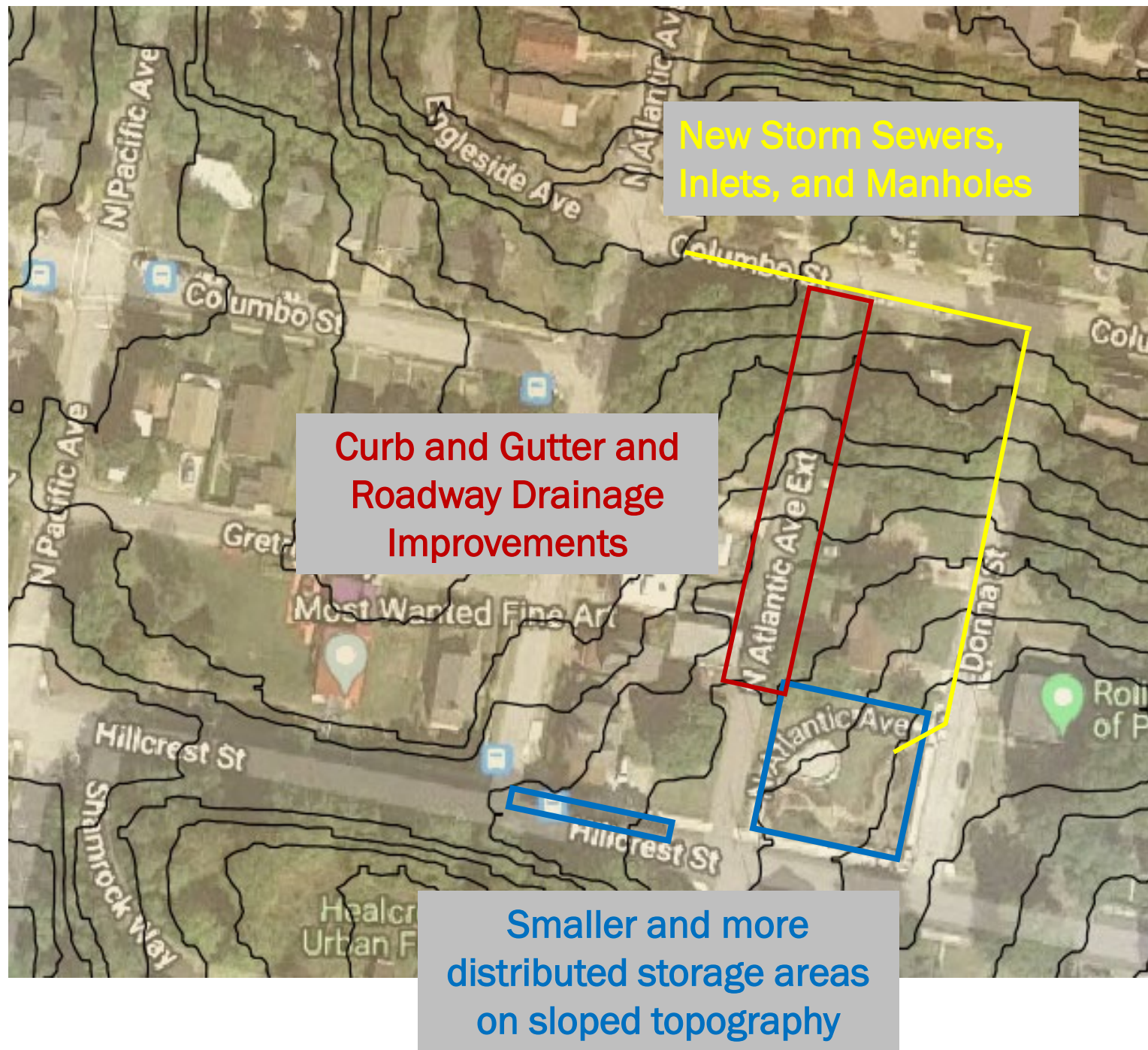
**Example areas in Pittsburgh:**

Brighton Heights, Upper Garfield, Polish Hill, Lower Hill District, East Hills, South Side Slopes, Carrick



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# Sloped Hillside Terrain Example Concept

## Hillcrest GSI



New Storm Sewers, Inlets, and Manholes

Curb and Gutter and Roadway Drainage Improvements

Smaller and more distributed storage areas on sloped topography

Storage possible but would be more challenging and costly per acre managed.

Greater maintenance costs over full life cycle.

Installation of impermeable liners, concrete formed check dams, and flow junction boxes required.

# *Sloped Hillside Terrain*

## *Other Representative Projects*

Polish Hill – Melwood and Finland

Lower Hill District – Sports Authority Street Tree Trenches

Red Oak and Hayson Bioswales

Steward Avenue Stormwater Improvements (future)



Polish Hill Cobble Swale and Subsurface Storage

Curb and Gutter and Roadway Drainage Improvements

Inlet to Subsurface Storage System



Slopes Required: Many Distributed Systems in Series | Internal Check Dams Within Pits

Lower Hill District Street Tree Pits

# *Sloped Hillside Terrain Example Concept*

*Stewart Ave Project Recommendations*

Increase surface conveyance (move), provide cost effective treatment (MS4)



Lack of adequate ROW drainage capacity leading to flooding complaints.

Overland flooding complaint property owners

# Sloped Hillside Terrain Example Concept
## Stewart Ave Project Recommendations

Increase surface conveyance (move)



- Upgrade curb, gutter and sidewalk

- Regrade road with proper crown

- Construct new sewers and stormwater inlets

- Develop standardized approach and cost share with DOMI

- Lack of ROW capacity a widespread issue city-wide

# Sloped Hillside Terrain Example Concept

## Stewart Ave Project Recommendations

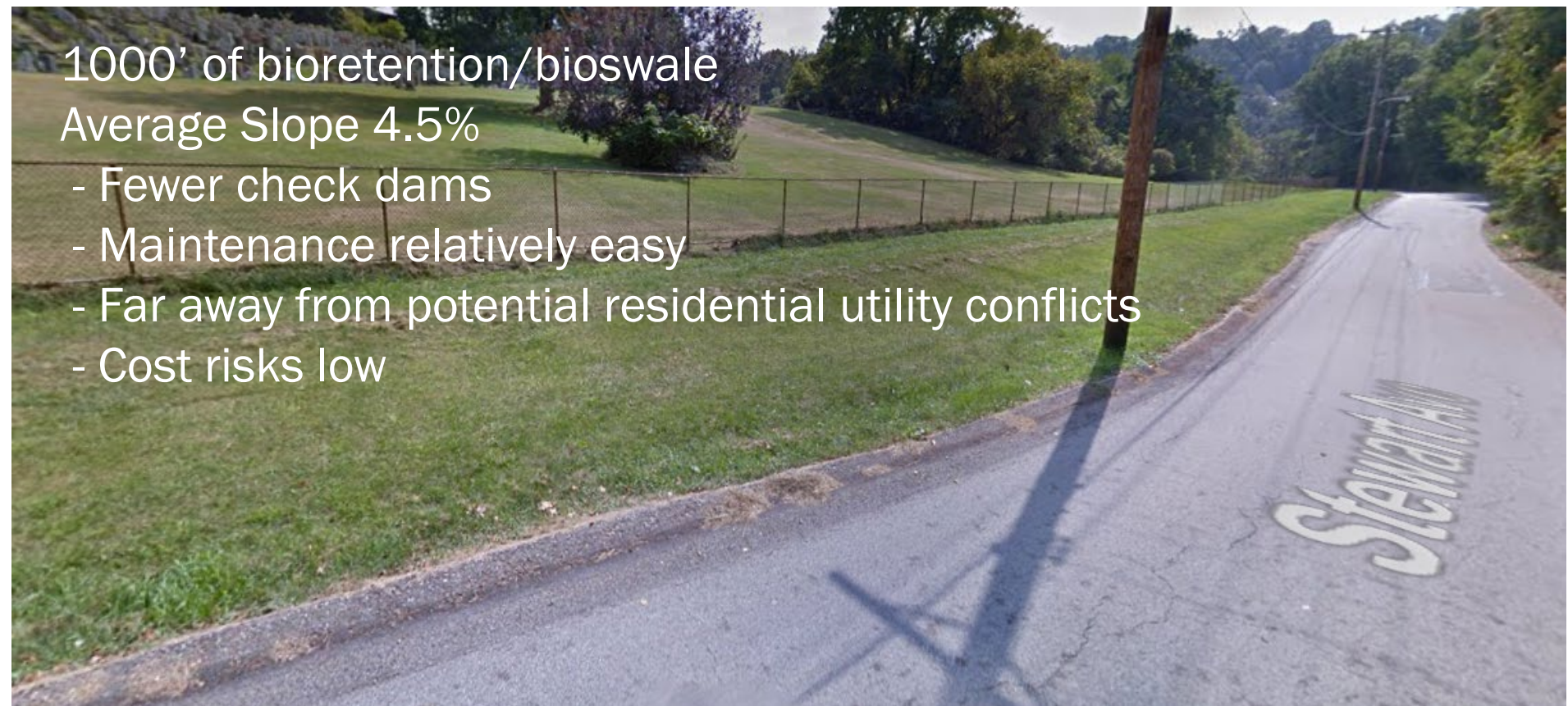Provide cost effective treatment (MS4)
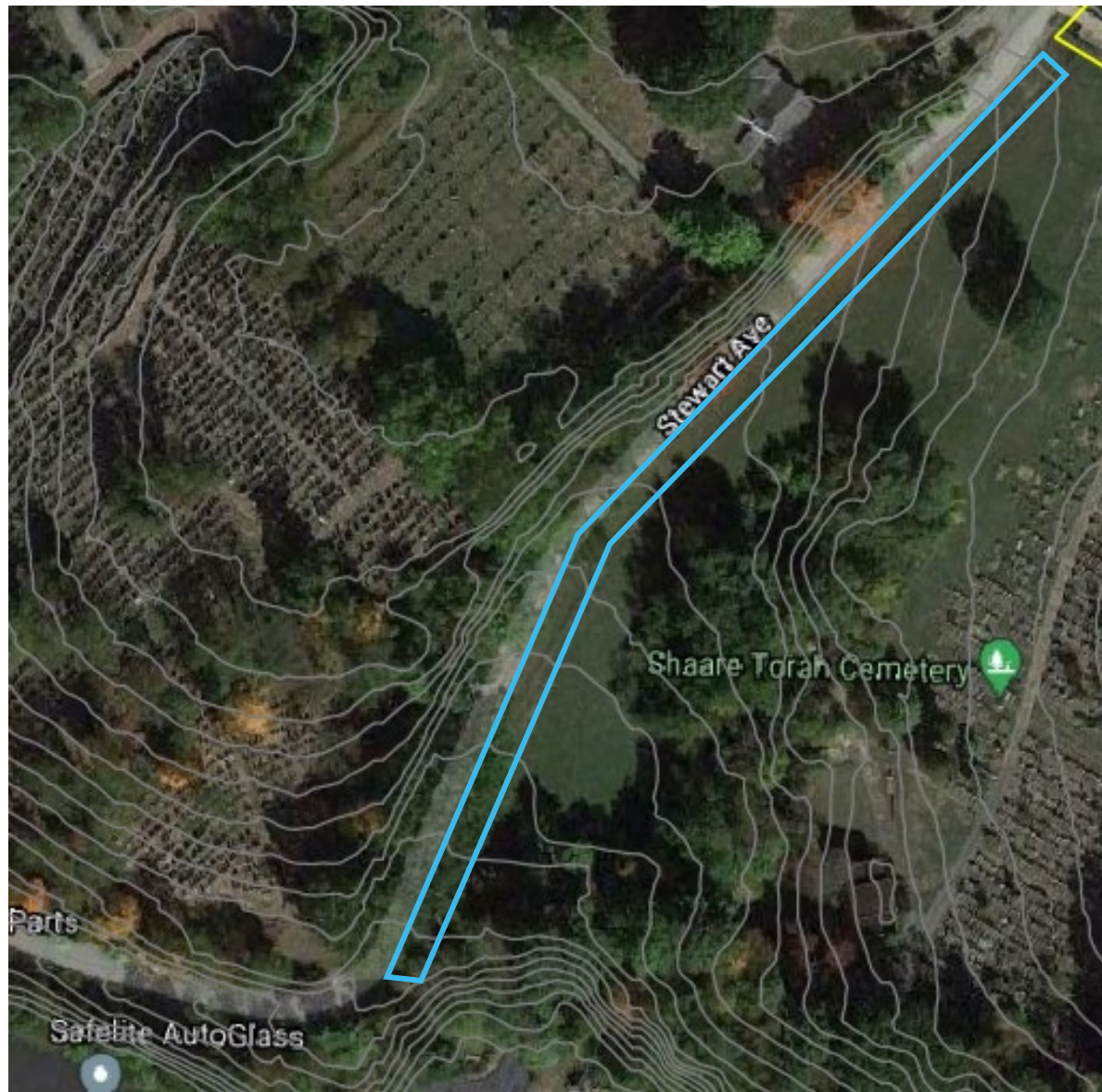


Integrate Downstream Bioswale into new stormwater conveyance for MS4 water quality treatment. Topography flattens out near bottom of Stewart Avenue.

1000' of bioretention/bioswale
Average Slope 4.5%
- Fewer check dams
- Maintenance relatively easy
- Far away from potential residential utility conflicts
- Cost risks low

# Pocket Ravines Terrain

## Common issues:

Overland flooding, flash flooding, landslides, water quality, groundwater seeps and springs, AMD

## Technologies:

Smaller floodplain and storage creation, increased conveyance (piping and surface), limited ephemeral stream restoration, storm sewer separation
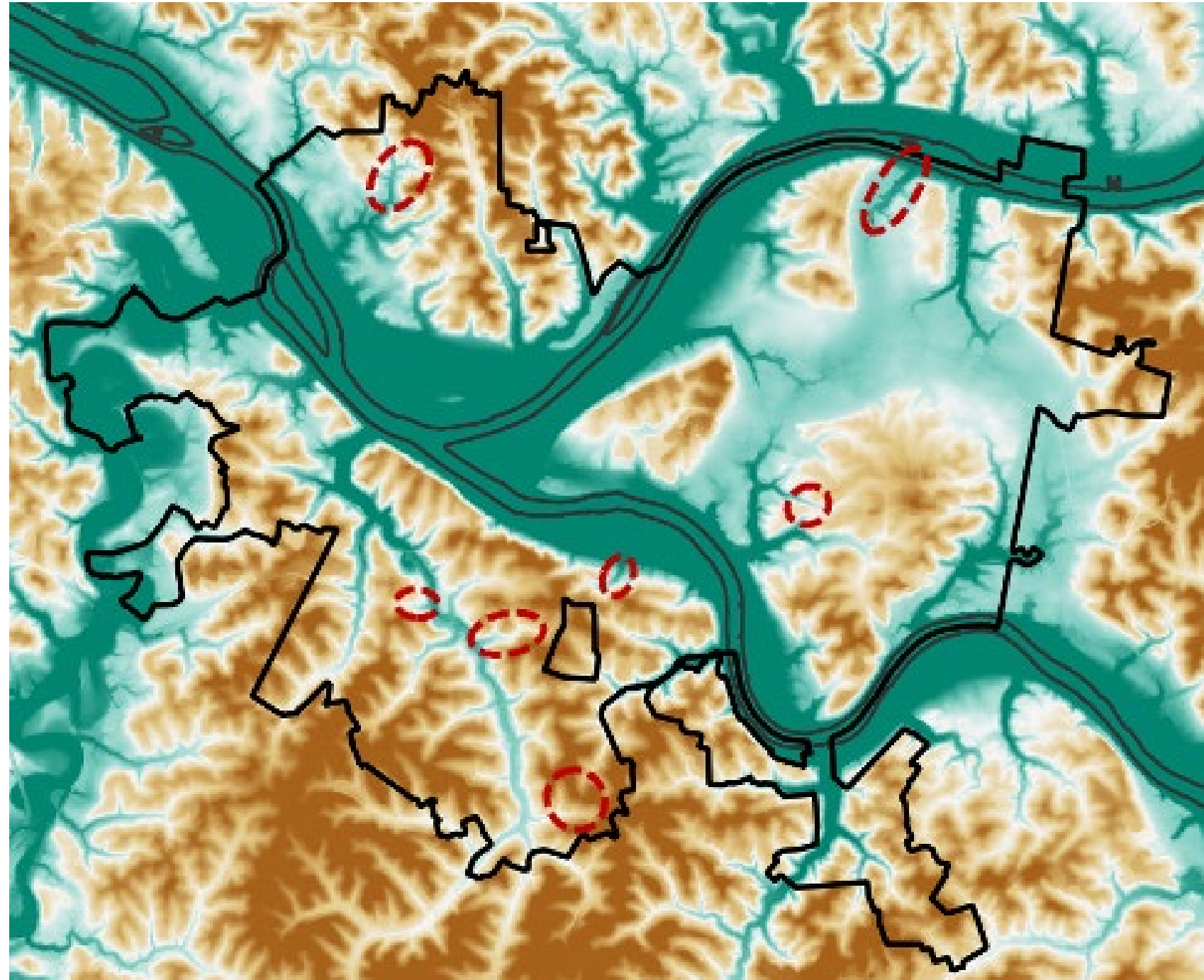
## Implementation challenges:

Wooded or naturalized areas, steep slopes, equipment access, landslide prone

## Co-benefits:

Active Recreation, Passive Recreation, Complete Streets, Cost Sharing
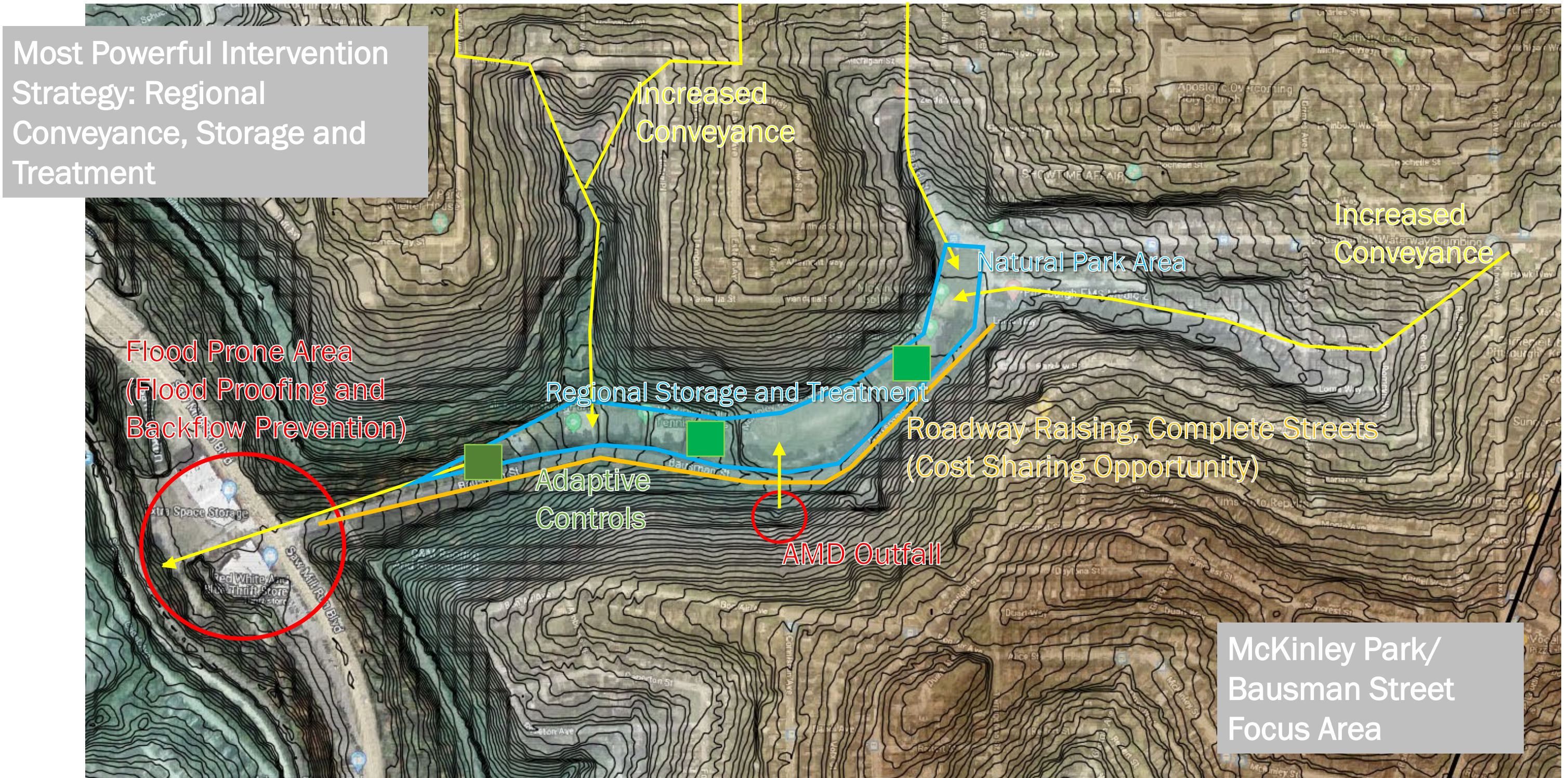
## Example areas in Pittsburgh:

Woods Run, Heth's Run, McKinley Park/Bausman Street, Moore Park, Naylor Run, Southside Park

*Note: Identified areas are for illustrative purpose only and not representative of all areas fitting this terrain.*

# Pocket Ravines Terrain Example Concept



Most Powerful Intervention Strategy: Regional Conveyance, Storage and Treatment

Increased Conveyance

Increased Conveyance

Natural Park Area

Flood Prone Area (Flood Proofing and Backflow Prevention)

Regional Storage and Treatment

Roadway Raising, Complete Streets (Cost Sharing Opportunity)

Adaptive Controls

AMD Outfall

McKinley Park/ Bausman Street Focus Area

# Floodplain Terrain

## Common issues:

Severe overland flooding, dangerous flash flooding, water quality

## Technologies:

Regional Storage, Floodplain creation, Storage Retrofits, Buy-outs, Flood Proofing, Road Raising, Storm sewer separation

## Implementation challenges:

Wooded or naturalized areas, existing occupied structures/floodplain encroachment, utility conflicts, transportation conflicts

## Co-benefits:

Active Recreation, Passive Recreation, Urban Heat Island Reduction, Economic Development, Repaving, Streetscape Improvements, Complete Streets, Cost Sharing, Environmental Justice.

## Example areas in Pittsburgh:

Lower Four Mile Run, Saw Mill Run, Streets Run, Washington Boulevard, Lower Chartiers
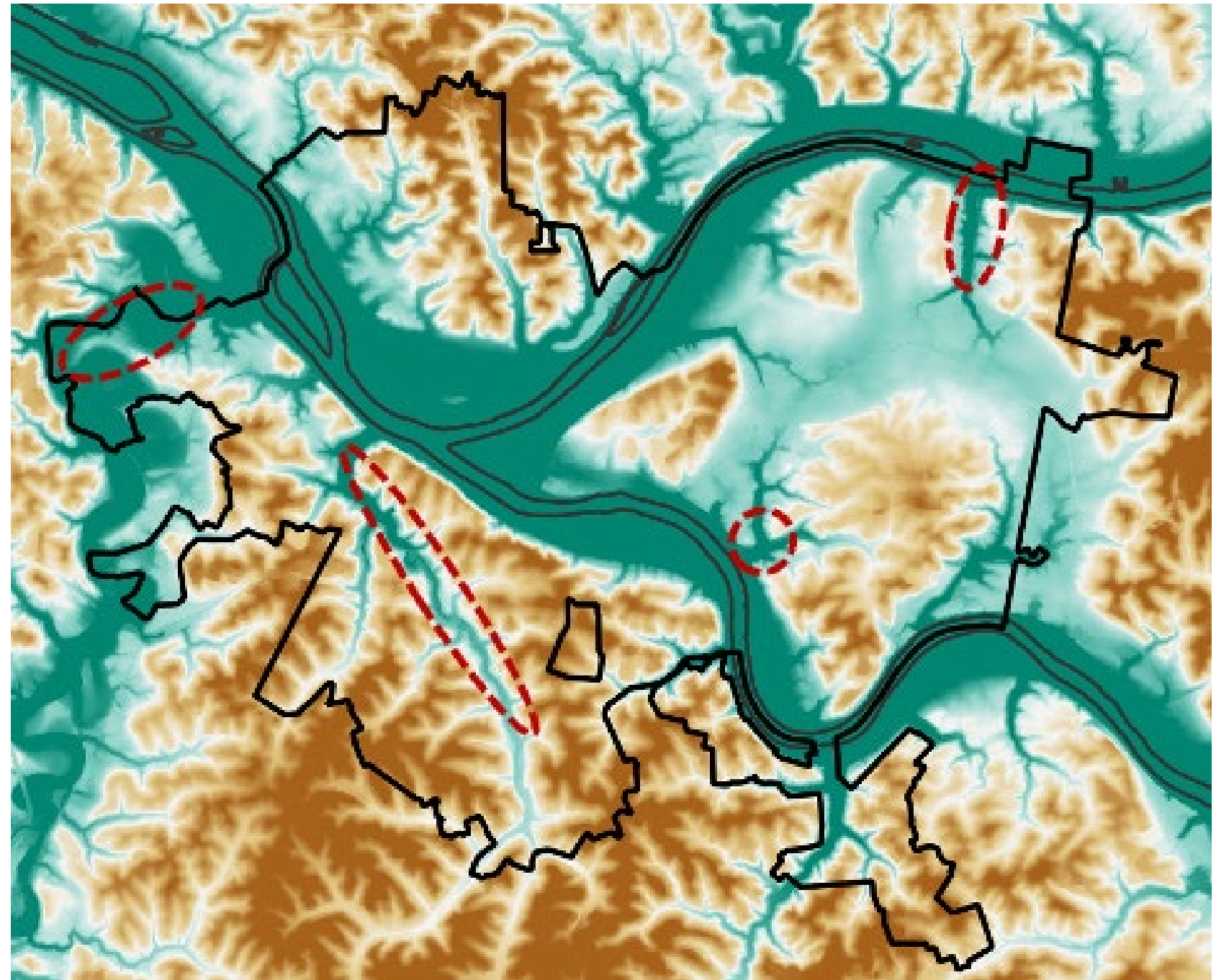
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# Floodplain Terrain Project Example

## Key precedent: Foster Floodplain Natural Area - Portland, Oregon



- 60 property buyouts/families relocated

- Obtained $2.7M FEMA grants via Pre-disaster Mitigation Program (now BRIC)

- Flood storage

- Habitat enhancement

- Neighborhood improvements

- Trails and recreation

# Floodplain Terrain Project Concept

## Saw Mill Run Ansonia Place Floodplain Restoration
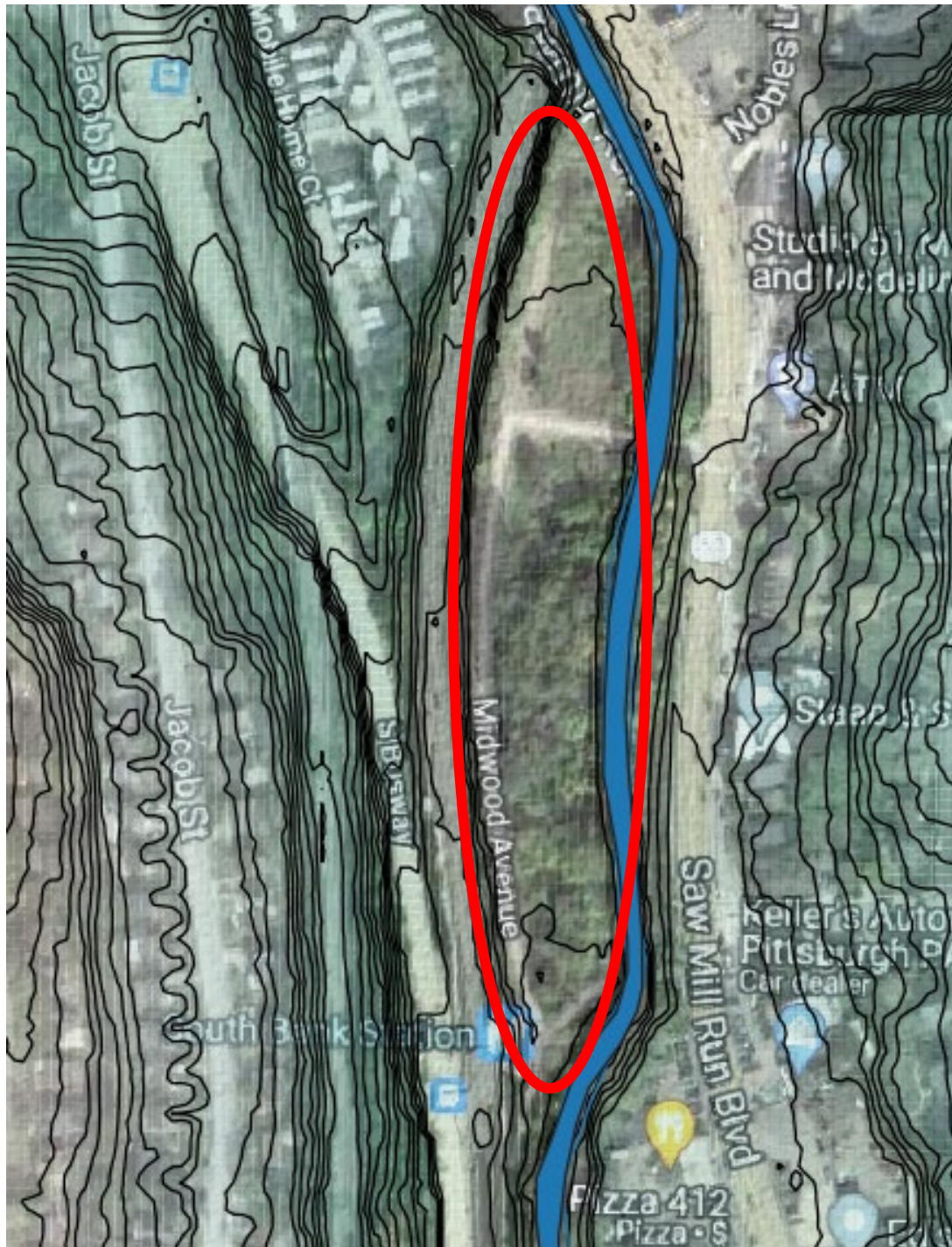


- Approx. 3.5 acres
- Floodplain reconnection
- Streambank stabilization
- Constructed wetlands and storage

# Dense Urban Areas/River Flats Terrain

## Common issues:

Riverine flooding, surface flooding, water quality

## Technologies:

Distributed storage in private redevelopment, subsurface storage, larger sewers, new sewers, new Inlets, full storm separation

## Implementation challenges:

Utility constraints, urban uses, lack of slope, transportation conflicts

## Co-benefits:

Active Recreation, Passive Recreation, Urban Heat Island Reduction, Economic Development, Repaving, Streetscape Improvements, Complete Streets, Cost Sharing, Environmental Justice.

## Example areas in Pittsburgh:

Northside, Strip District, Lawrenceville, Oakland/Shadyside/Bloomfield, Southside Flats, Hazelwood, West End Village
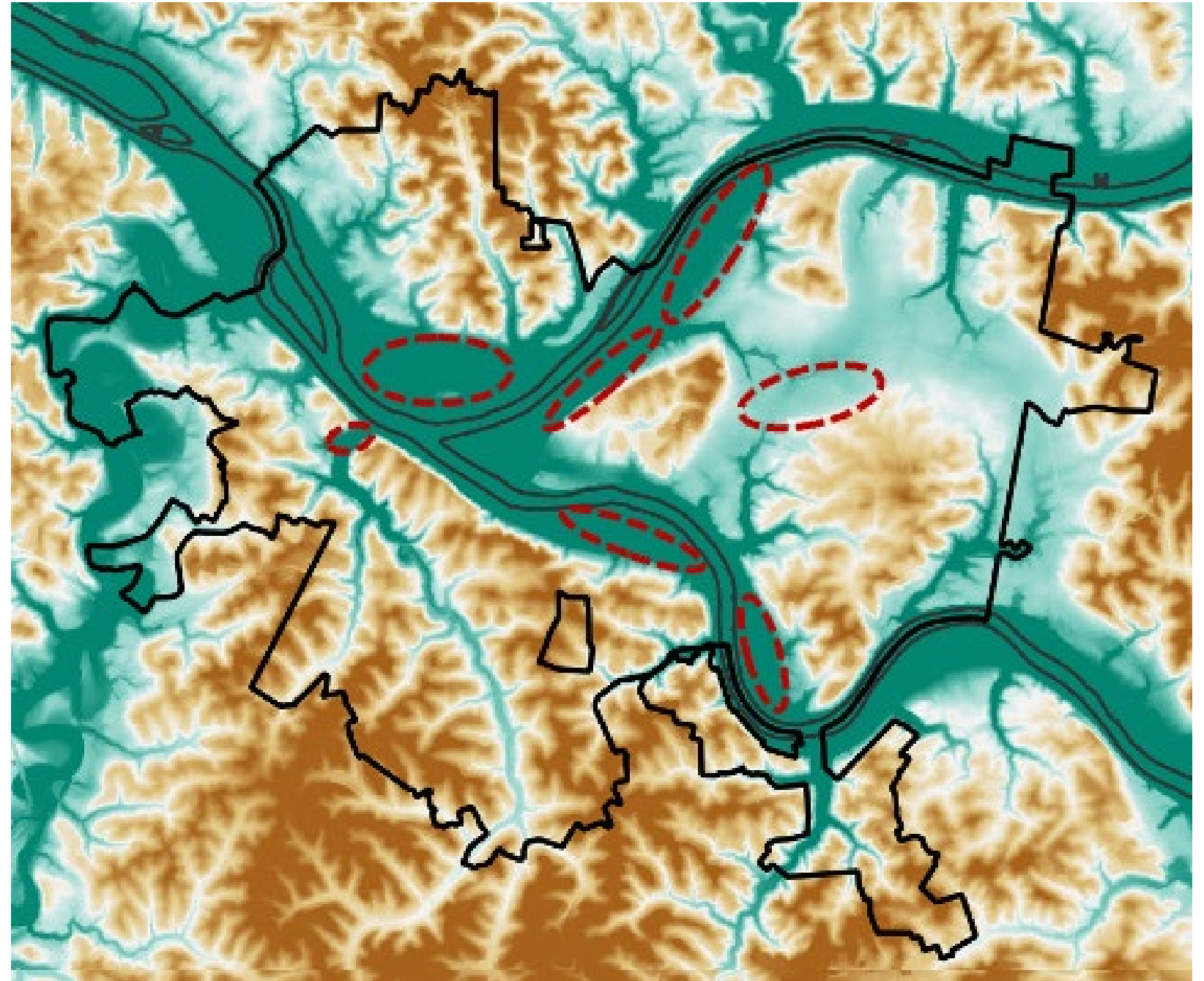


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# Dense Urban Areas/River Flats

## Key precedents:

- Strip District Storm Sewer Separation Project

- South Side Flats Storm Sewer Separation (On-Going PWSA Project)

- Continue to look for opportunities to leverage past sewer separation work as part of new and redevelopment projects

# Terrain/Stormwater Project Types Summary

| Terrain | Description of Terrain | Common Issues | Stormwater Project Types | Typical Technologies | Potential Challenges | Potential Co-benefits | Example Area |
|---|---|---|---|---|---|---|---|
| Upper Plateaus and Hilltops | Areas located in the upper watershed typically with ground slopes ranging from 0 to 5 percent. | Overland flooding, basement backups, water quality, contribution to downstream issues | Store in centrally located facilities that require lower maintenance. Look for vacant lots typically at intersections and large public open areas (parks, greenways, schools, parking lots). | Distributed storage, new piping, new inlets, partial separation, surface conveyance improvements | Utility constraints, urban uses, lack of sufficient drainage area, lack of slope | Passive recreation, urban heat island reduction, repaving, streetscape improvements, complete streets, cost sharing, environmental justice | Homewood, Larimar, Point Breeze, Morningside, Knoxville/Beltzhoover, Lower Garfield/Friendship, Upper Hill District, Squirrel Hill |
| Sloped Hillsides | Areas located in a transition zone from the upper plateaus to the pocket ravine with ground slopes ranging from 5 to 20 percent. | Overland flooding, landslides, groundwater seeps and springs, water quality and AMD | Centrally located facilities to store stormwater less available. Storage sites may require more costly modifications (check dams, liners, velocity control). Protective flood measures may be required in the form of improved surface and subsurface conveyance. | Some storage in limited areas, larger sewers, new sewers, surface conveyance improvements, new inlets | Wooded or naturalized areas, steep slopes | Active Recreation, Passive Recreation, Cost Sharing | Brighton Heights, Upper Garfield, Polish Hill, Lower Hill District, East Hills, South Side Slopes, Carrick |
| Pocket Valleys | Smaller narrow ravines typically containing culverted historic streams or seasonally ephemeral streams. These areas act as funnels for stormwater generated from upper plateaus and sloped hillsides. Stormwater concentrates and moves fast in these areas especially during intense rain events. | Overland flooding, flash flooding, landslides, water quality, groundwater seeps and springs, AMD | Storage may be challenging due to slope and access constraints. Moving and conveying water to downstream floodplains may be more cost effective. May need to include flood protection, improved surface conveyance, and backflow prevention. | Smaller floodplain and storage creation, increased conveyance (piping and surface), limited ephemeral stream restoration, storm sewer separation | Wooded or naturalized areas, steep slopes, equipment access, landslide prone | Active Recreation, Passive Recreation, Complete Streets, Cost Sharing | Woods Run, Heth's Run, McKinley Park/Bausman Street, Moore Park, Naylor Run, Southside Park |
| Large Floodplains | Medium to larger valley and ravines containing larger streams with perennial base stream flows. These areas act as the second funnel from water originating from smaller pocket ravines. In these areas stormwater is often dangerous and sometimes life threatening. | Severe overland flooding, dangerous flash flooding, water quality | Storage in floodplain areas allows for water quantity peak flow reductions and water quality treatment. Land management strategies such as floodplain ordinance, floodplain buyout programs, and zoning critical. Flood proofing and protection for some properties may be needed. | Regional Storage, Floodplain creation, Storage Retrofits, Buy-outs, Flood Proofing, Road Raising, Storm sewer separation | Wooded or naturalized areas, existing occupied structures/floodplain encroachment, utility conflicts, transportation conflicts | Active Recreation, Passive Recreation, Urban Heat Island Reduction, Economic Development, Repaving, Streetscape Improvements, Complete Streets, Cost Sharing, Environmental Justice. | Lower Four Mile Run, Saw Mill Run, Streets Run, Washington Boulevard, Lower Chartiers |
| Urban River Flats | Dense urban areas typically consisting of a mix of commercial, industrial, and residential properties. These are primarily located in areas along the main three rivers and neighborhoods around the universities. | Riverine flooding, surface flooding, water quality | Fewer available opportunities for publicly owned off right-of-way storage facilities. Greater cost risks due to work in the dense right-of-way. Storage in private areas such as parking lots and common areas as part of redevelopment likely most cost effective. Increasing public conveyance and providing flood protection . | Distributed storage in private redevelopment, subsurface storage, larger sewers, new sewers, new Inlets, full storm separation | Utility constraints, urban uses, lack of slope, transportation conflicts | Utility constraints, urban uses, lack of slope, transportation conflicts | Northside, Strip District, Lawrenceville, Oakland/Shadyside, Southside Flats, Hazelwood, West End Village |