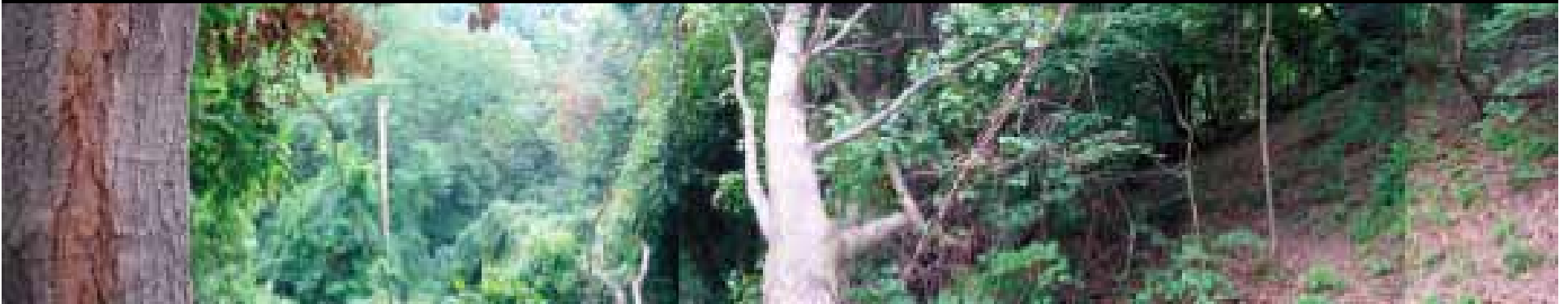


No city of equal size in America or perhaps the world is compelled to adapt its growth to such difficult complications of high ridges, deep valleys and precipitous slopes as Pittsburgh

Frederick Law Olmsted Jr.

Pittsburgh's Hillside: Using GIS to Investigate the Post-Industrial Landscape



Presentation for the 2005 ESRI International User Conference
Lena Andrews, STUDIO for Creative Inquiry



Authors

Tim Collins, M.F.A.

Priya Lakshmi Krishna, M.S.

Susan Kalisz, Ph.D.

Henry Prellwitz, Ph.D.

Kostoula Vallianos, M.E.M.

Lena Andrews, M.S.

Contributors

Jessica Dunn

Editors: Tim Collins and Reiko Goto

Designer: John Oduroe

Graphics: Noel Hefele

Funding: The Heinz Endowments

3R2N – STUDIO FOR CREATIVE INQUIRY, CARNEGIE MELLON UNIVERSITY

Outline



Section 1a. Project Purpose and Goals
Section 1b. General Methodology

Section 2. Context: Watershed Scale
Neighborhood Scale

Section 3. Decisions: Slope Polygons
Soil Polygons
Parcel by Parcel

Section 4. Natural Systems: Field Studies
Geology Studies
Botany Studies

Section 5. Synthesis

I. Purpose and Goals



Project Description

Research, analysis and tools that will inform a hillsides zoning ordinance for the City of Pittsburgh.

Purpose

To provide analysis of quantitative and empirical data that can inform rational decision making on steep slope properties at the level of zoning policy, regulation and enforcement.

Goals

Contextual analysis at watershed scale, open space analysis at the neighborhood scale, decision analysis at the parcel scale.

1.2 General
Methodology

The matrix - each parcel in the city can be analyzed and sorted into areas for preservation, conservation or development.

Preservation: land deemed environmentally unfit for development

Conservation: land with sensitive but not exclusionary environmental characteristics, with some of the infrastructure necessary to support development

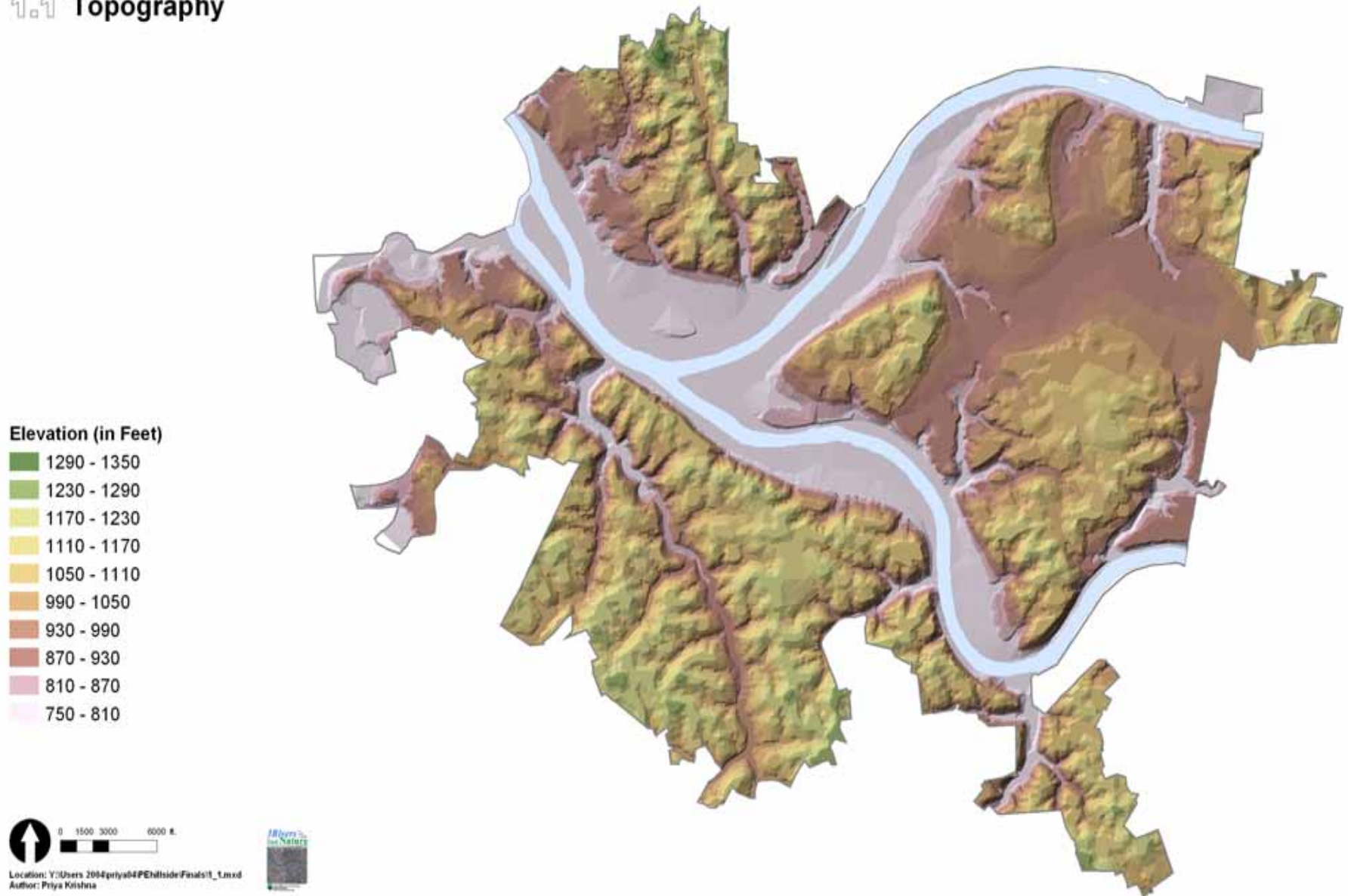
Development: land with both the environmental characteristics for safe building practices and available infrastructure

Section II. CONTEXT

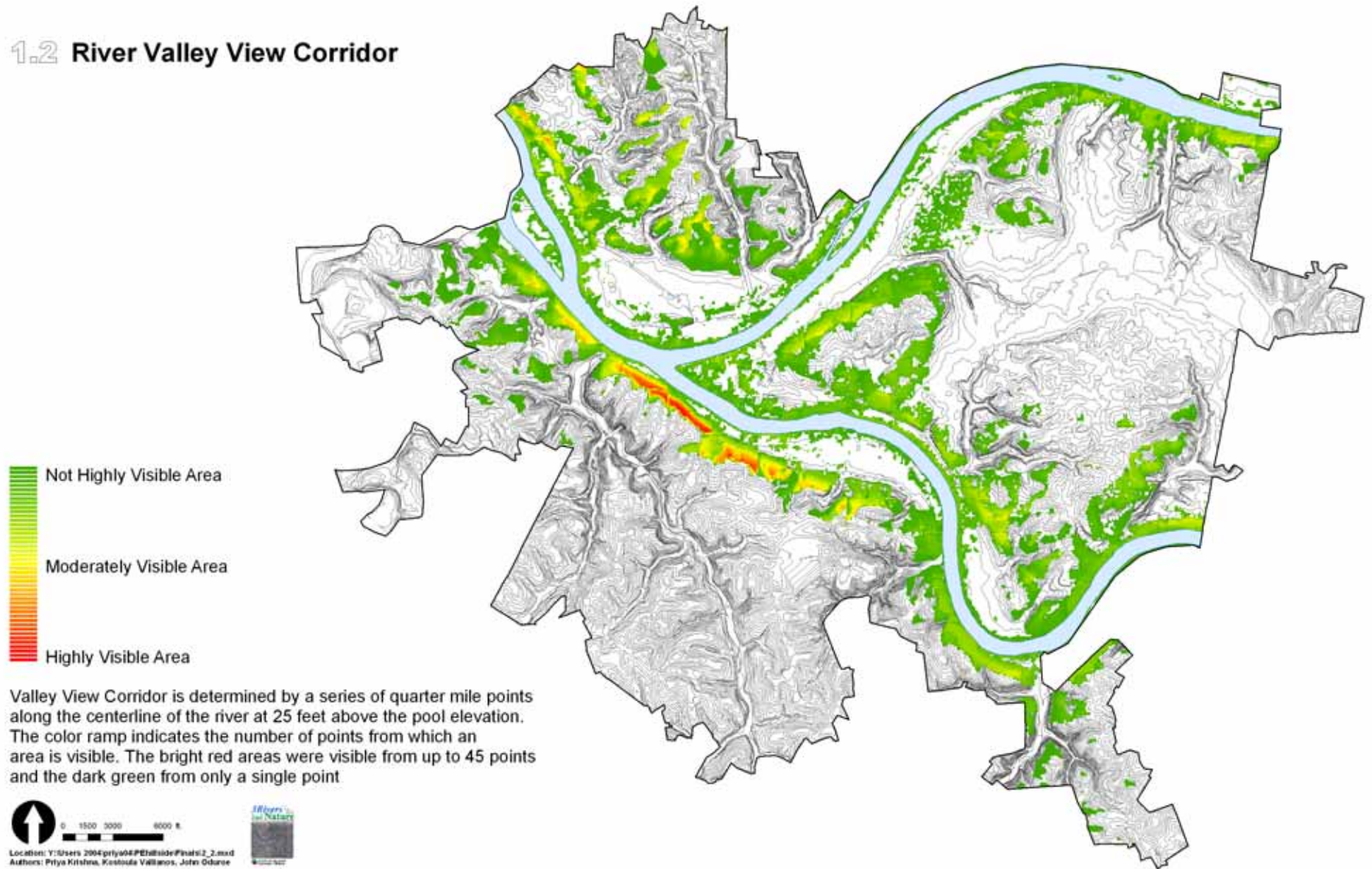
Watershed Scale



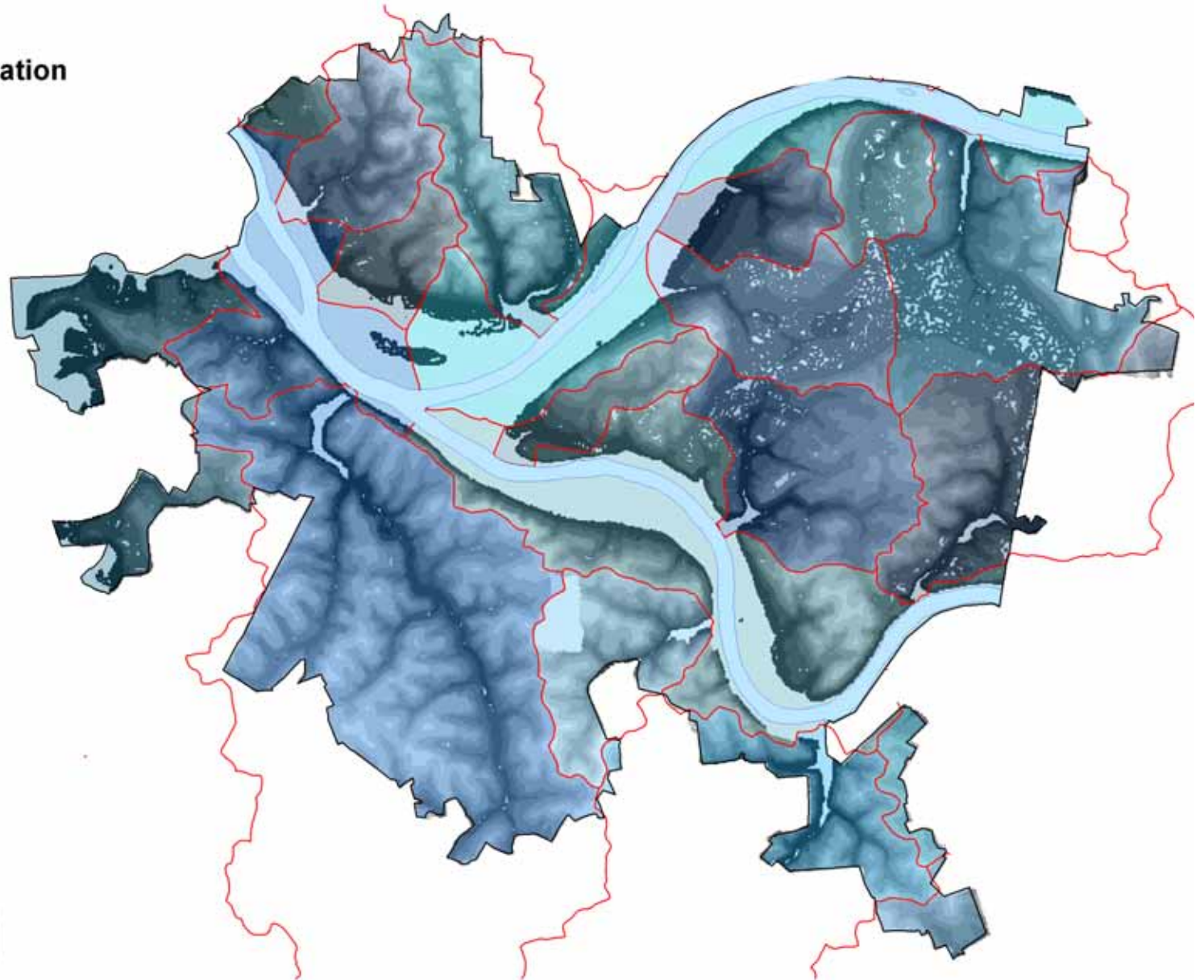
1.1 Topography



1.2 River Valley View Corridor



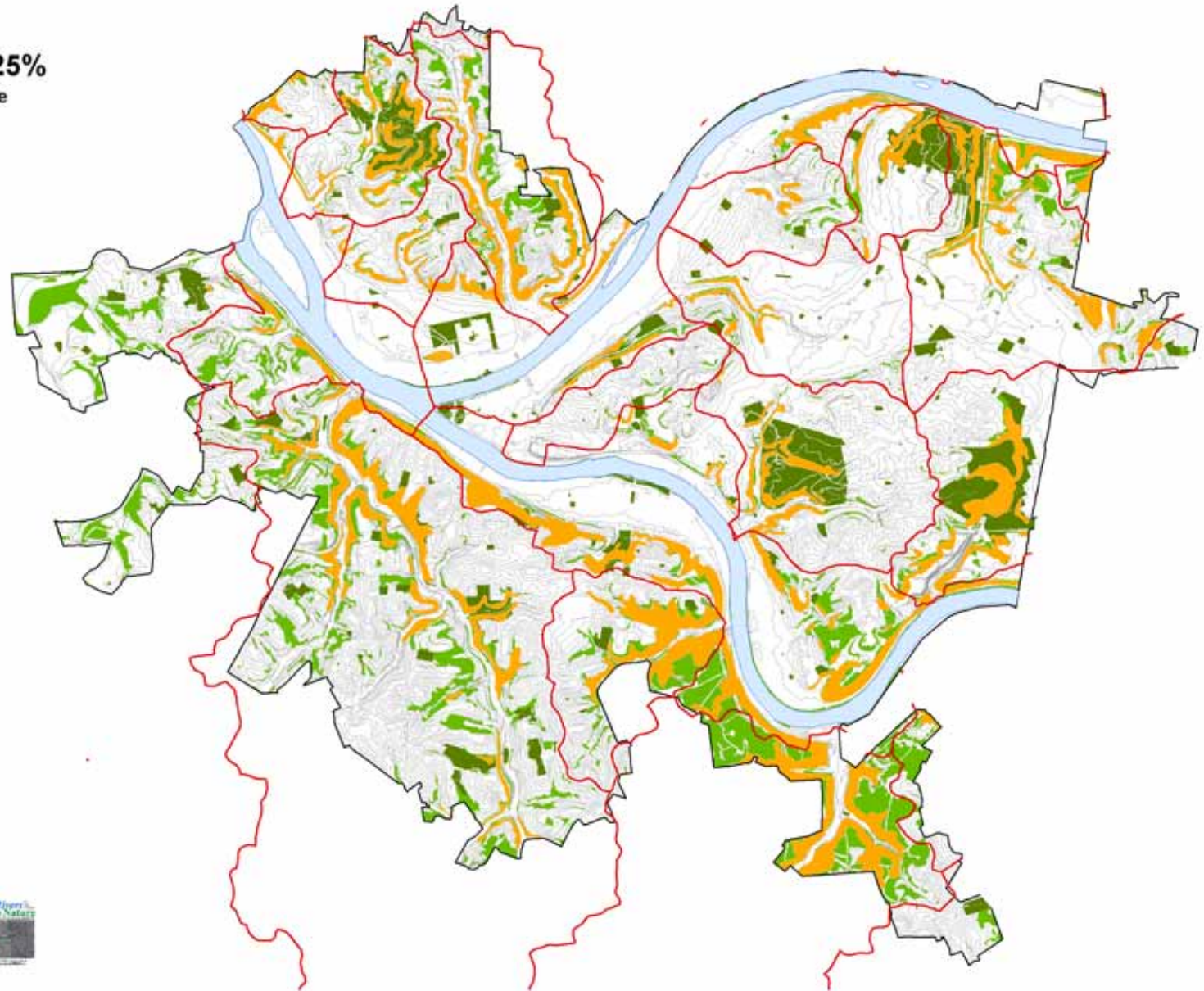
1.3 Watershed Delineation for Pittsburgh



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1.5 Slopes above 25% at the Watershed Scale

- 25% slope and above
- Parks
- Woodland
- Watersheds Boundary

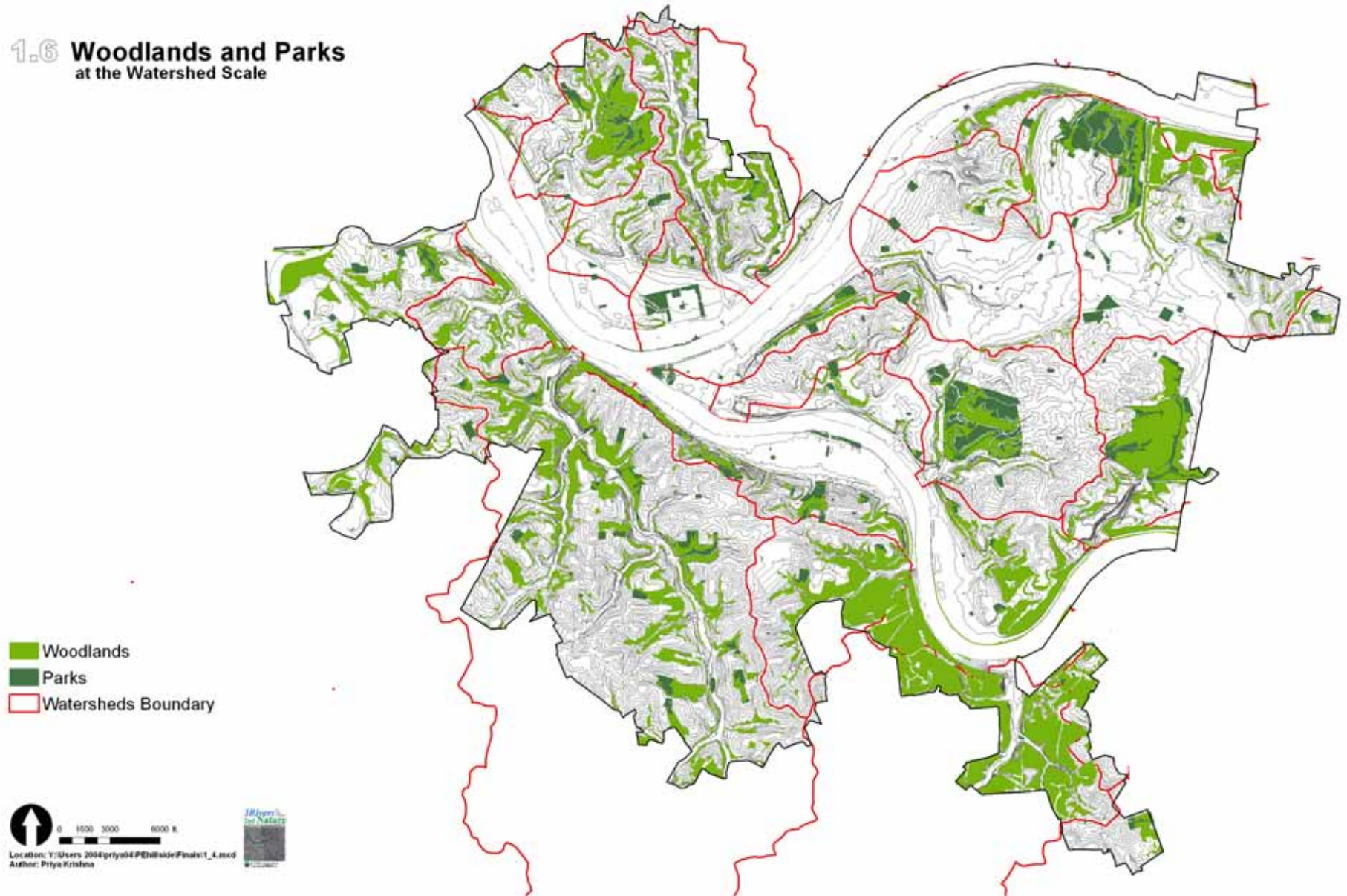


0 1500 3000 6000 ft

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Author: Priya Krishna

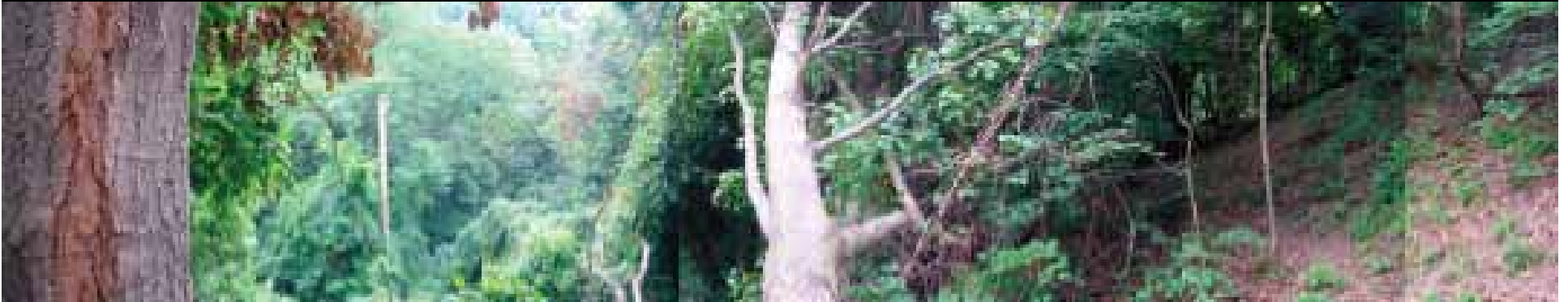


1.6 Woodlands and Parks at the Watershed Scale

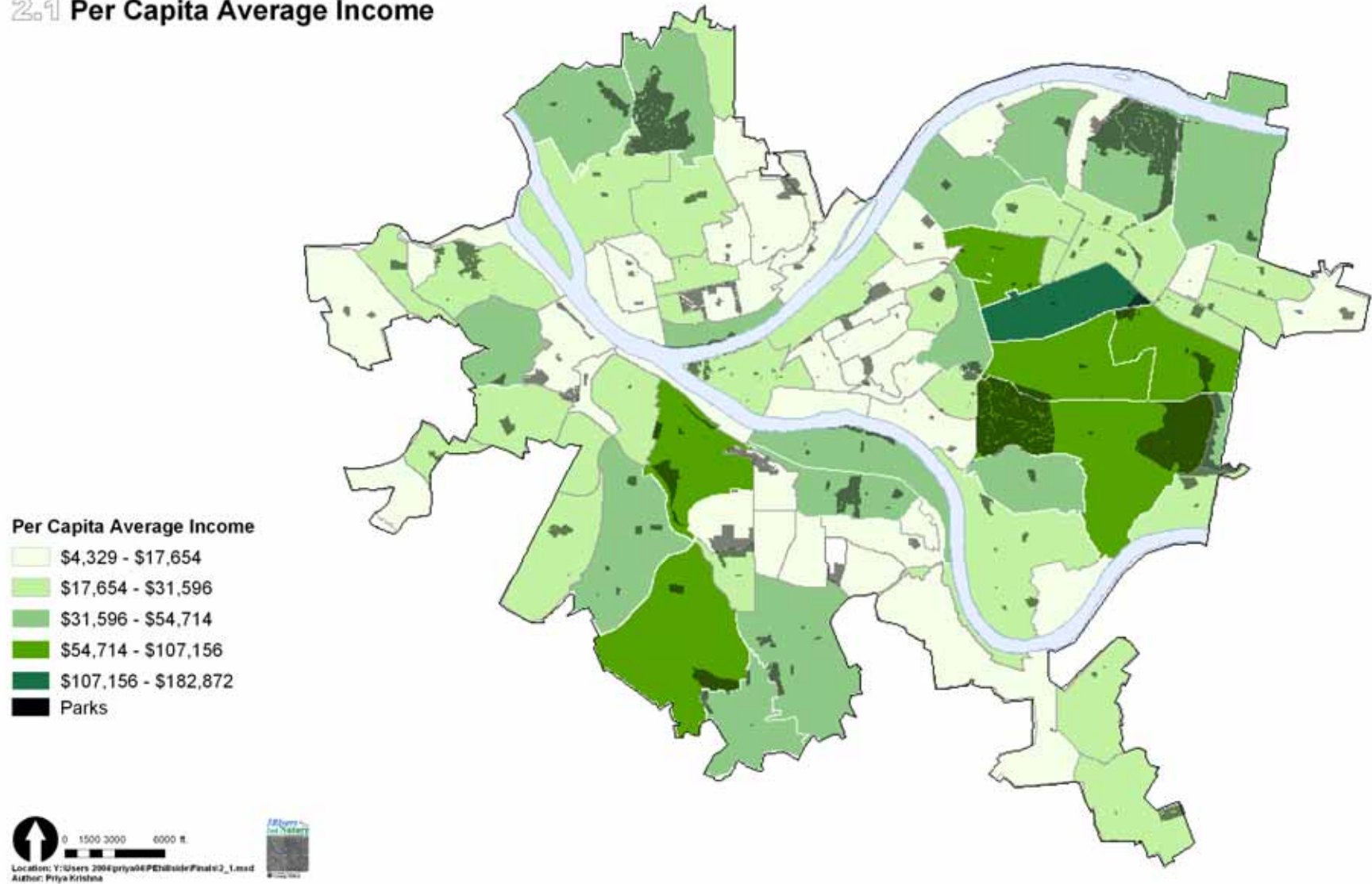


Section II. CONTEXT

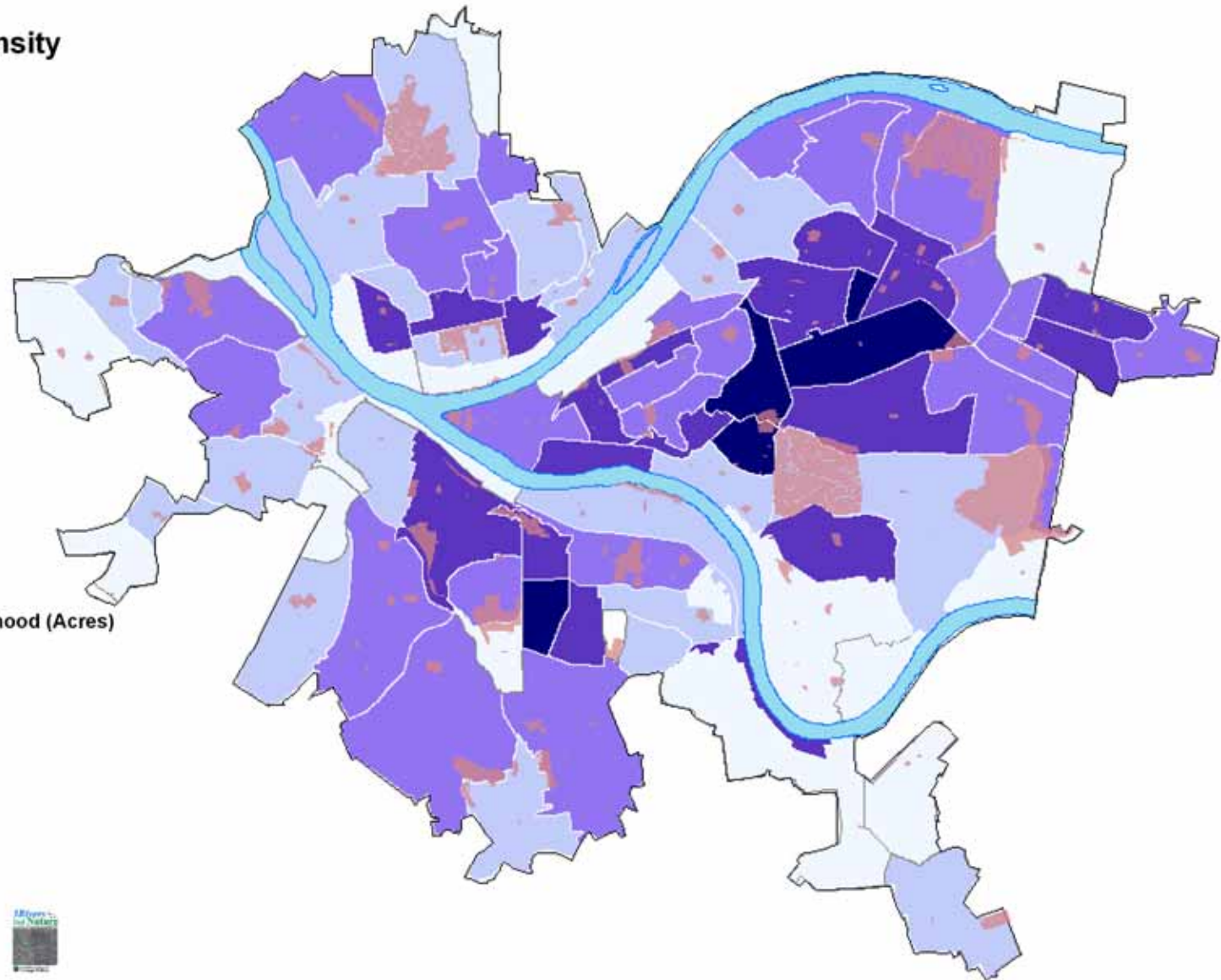
Neighborhood Scale



2.1 Per Capita Average Income



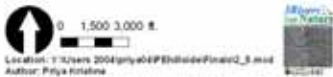
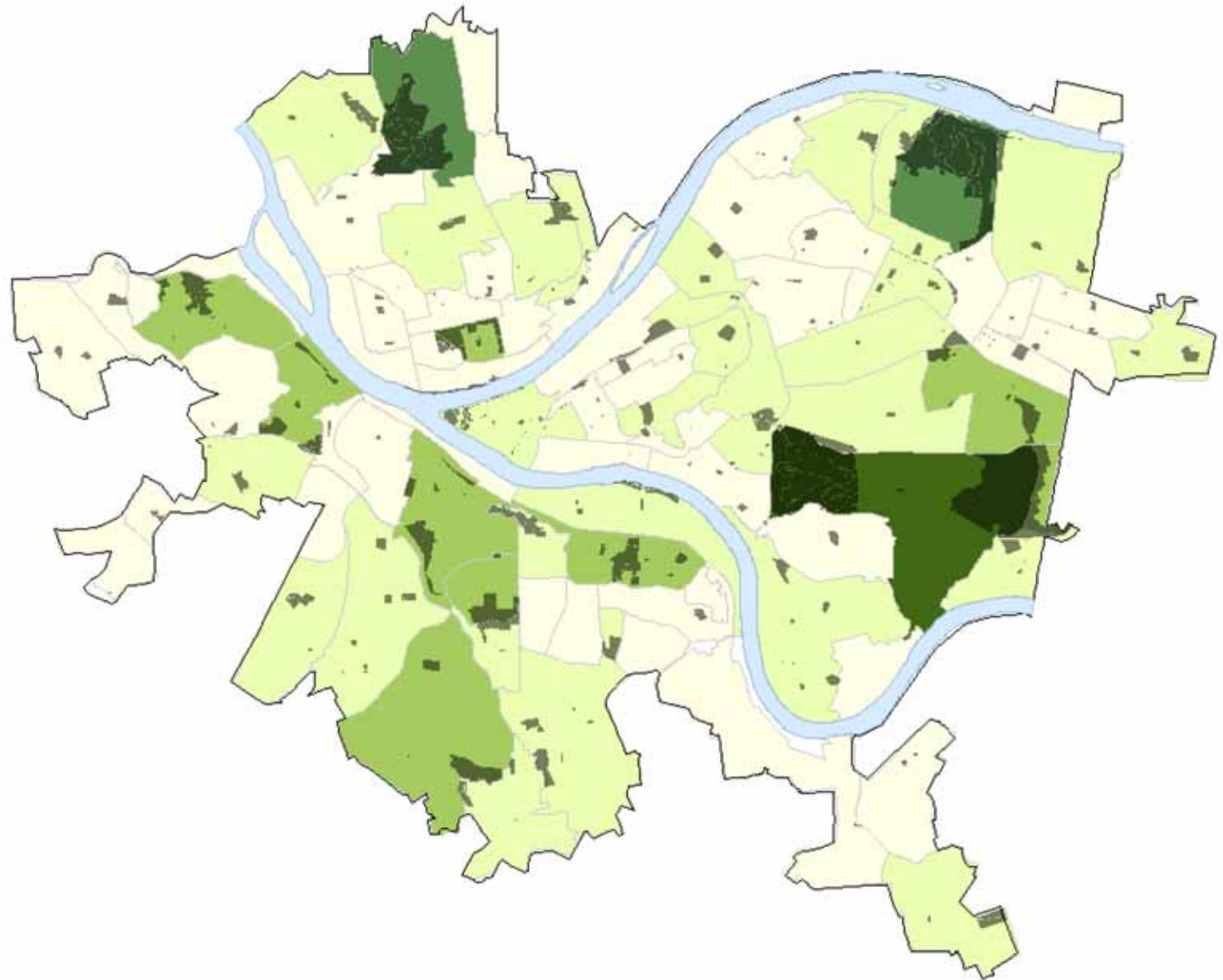
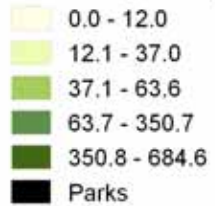
2.3 Population Density by Neighborhood



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2.5 Park Area by Neighborhood

Park Area per Neighborhood



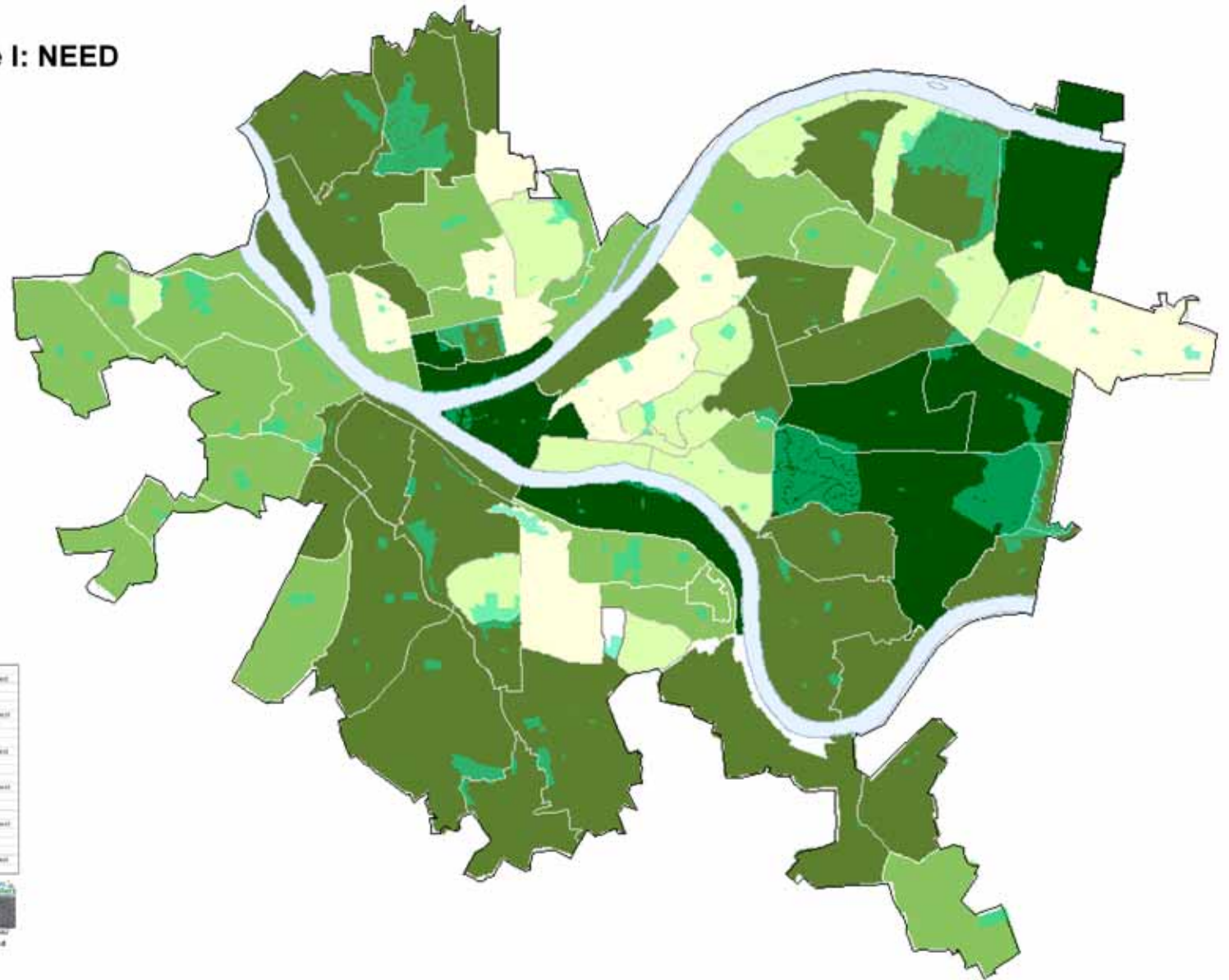
2.6 Cumulative Value I: NEED by Neighborhoods



2.1 Per Capita Income	2.2 Average Value of Neighborhood	2.4 Total Population
10000	100000	10000
15000	150000	15000
20000	200000	20000
25000	250000	25000
30000	300000	30000
35000	350000	35000
40000	400000	40000
45000	450000	45000
50000	500000	50000
55000	550000	55000
60000	600000	60000
65000	650000	65000
70000	700000	70000
75000	750000	75000
80000	800000	80000
85000	850000	85000
90000	900000	90000
95000	950000	95000
100000	1000000	100000



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Author: Polya Kishina

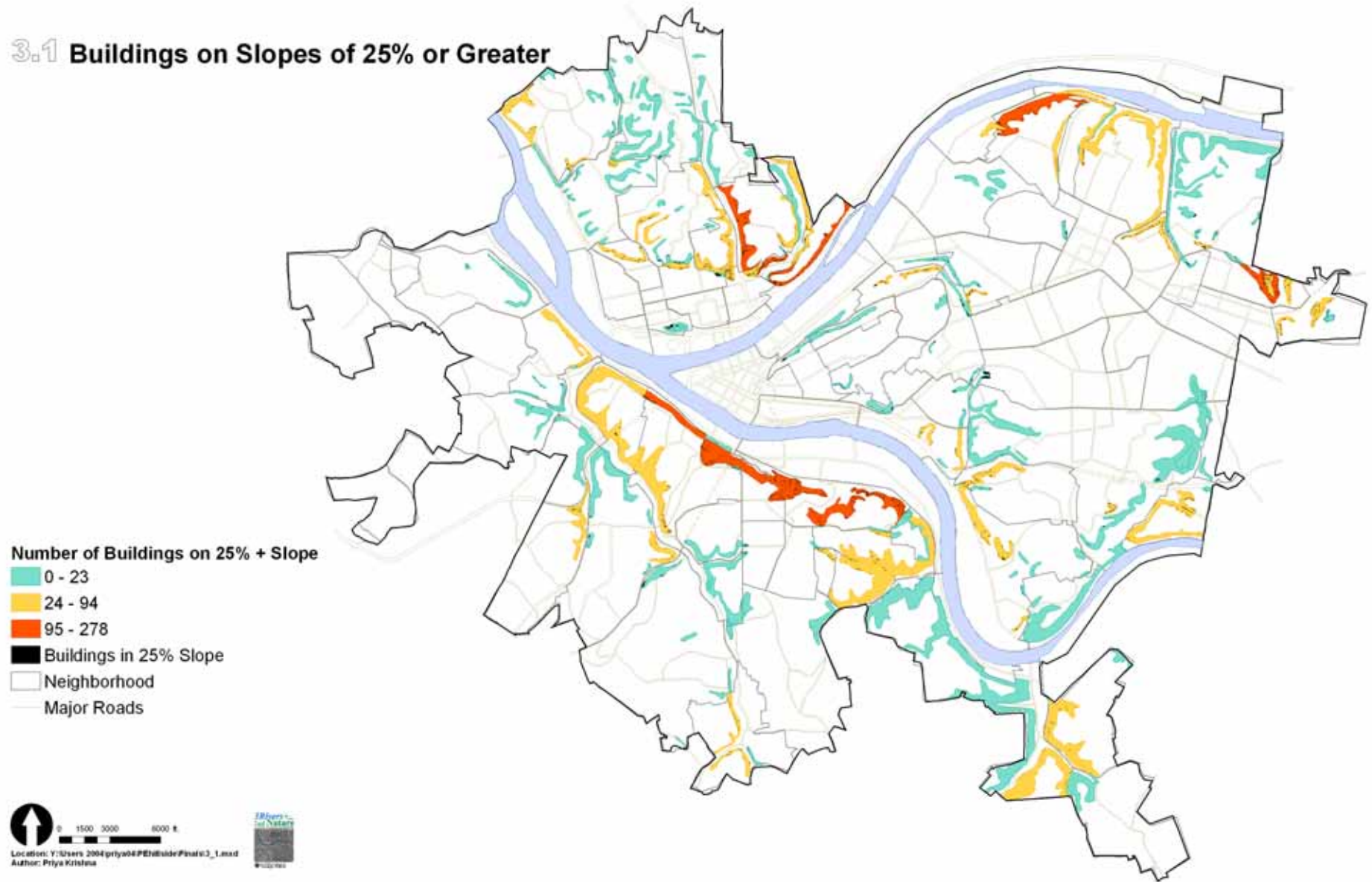


Section III. Decisions

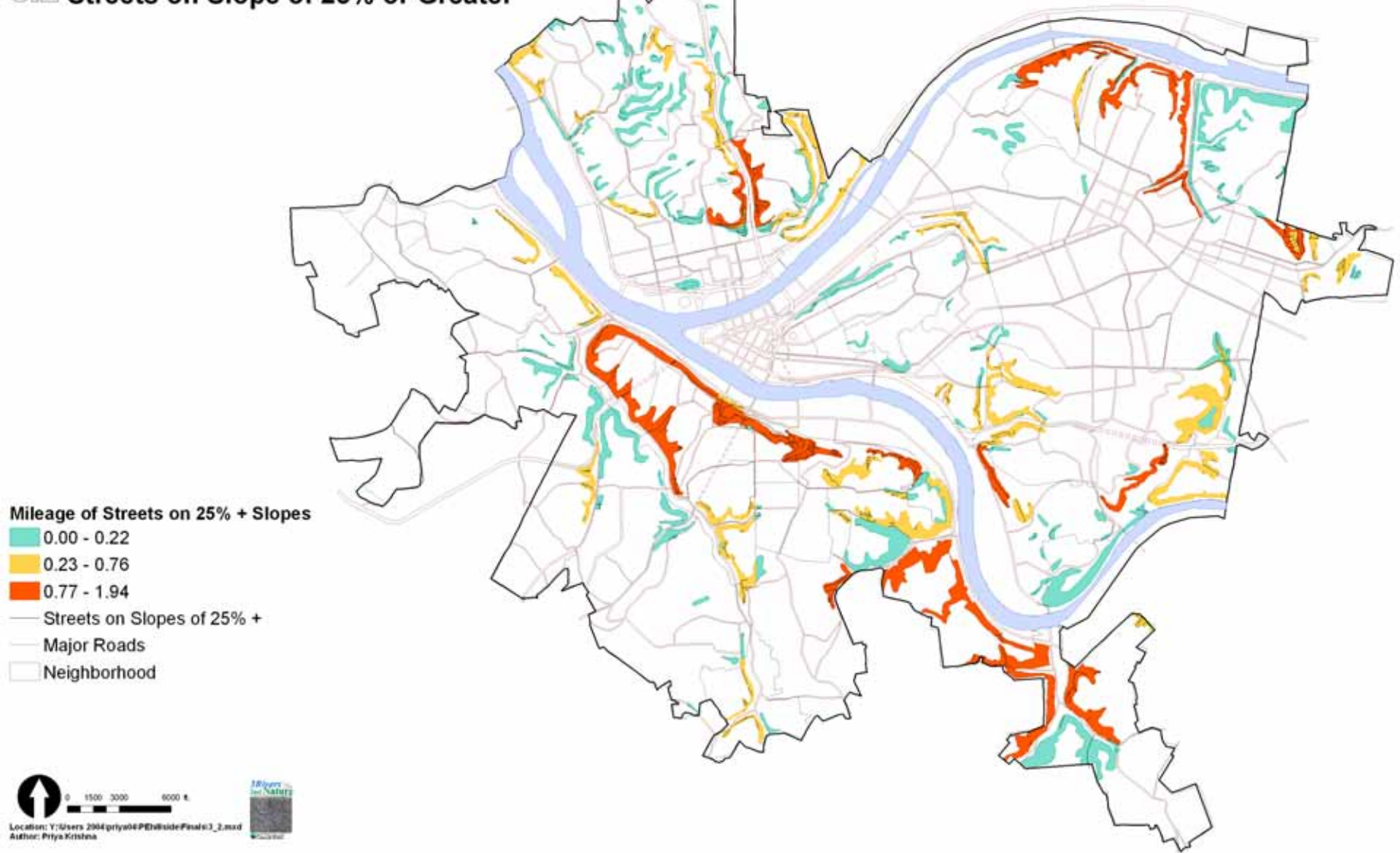
Slope Polygons



3.1 Buildings on Slopes of 25% or Greater



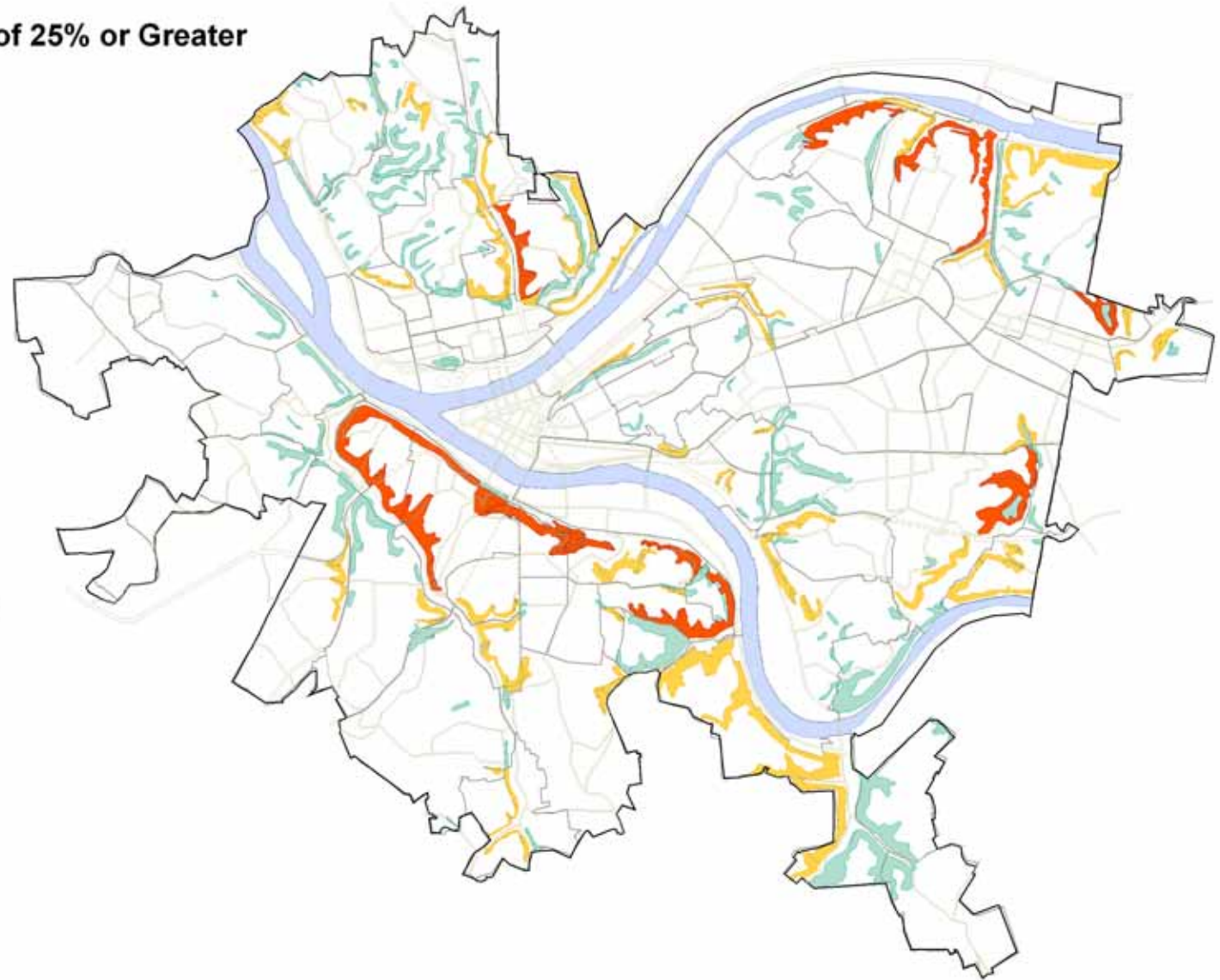
3.2 Streets on Slope of 25% or Greater



3.3 Sewers on Slopes of 25% or Greater

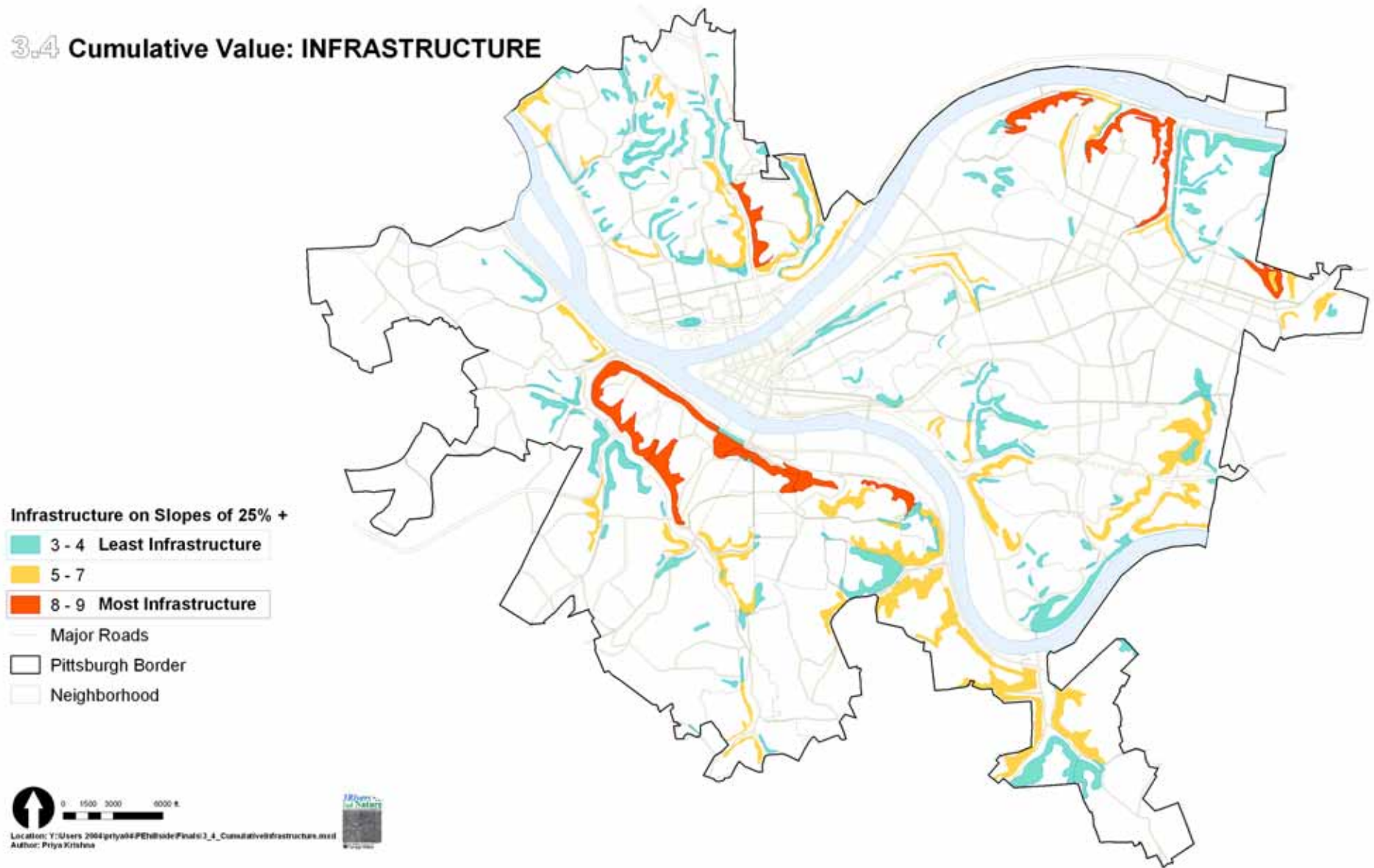
Mileage of Sewers on 25% + Slopes

- 0.00 - 0.31
- 0.32 - 1.04
- 1.05 - 2.22
- Sewers in Slopes of 25% +
- Major Roads
- City of Pittsburgh Boundary
- Neighborhood



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Author: Priya Kishore

3.4 Cumulative Value: INFRASTRUCTURE



Section III. Decisions

Soil Polygons



3.2 Soil Polygons



Soil limitations ratings slight, moderate and severe.

Slight - soil properties generally are favorable for the rated use, limitations are minor and easily overcome.

Moderate - some soil properties are favorable, those that are not can be overcome or modified by special planning and design.

Severe - some soil properties are so unfavorable to development and so difficult to correct or overcome that major soil reclamation, special design or intensive maintenance are required.

4.1 Erosion Hazards

Erosion Hazard

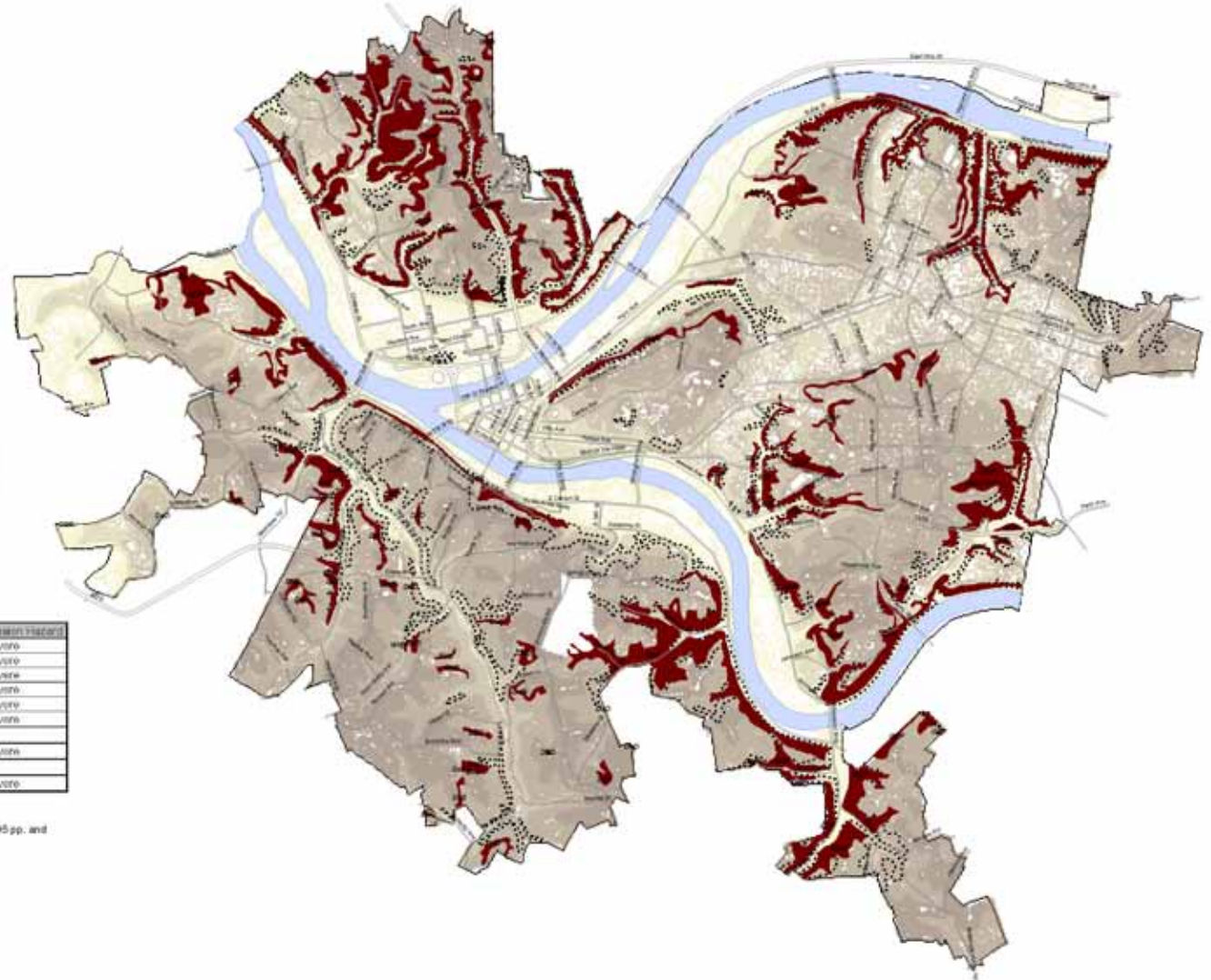
- Severe** Soils that are very severely limited by the hazard of erosion unless protective cover is maintained
- Major Roads
- Boundary of slopes greater than 25%
- River

Code	Name	Slope	Single Stability	Erosion Hazard
D1C	Dumontsiltloam	15to.25percent/slopes	Severe	Severe
E1D	Emersiltloam	15to.25percent/slopes	Severe	Severe
G1D	Guermansiltloam	15to.25percent/slopes	Severe	Severe
G1D	Guermansiltloam	15to.25percent/slopes	Severe	Severe
W1C	Whartonsiltloam	15to.25percent/slopes	Severe	Severe
G1E	Geins-Vandegriftloam	15to.25percent/slopes	Severe	Severe
D1E	Dumontsiltloam	25to.35percent/slopes	Severe	Severe
G1F	Geins-Uppshurcomplex	greater than 40 percent	Severe	Severe

Reference:
United States Department of Agriculture, 1981, Soil Survey of Allegheny County, Pennsylvania, 95 pp. and maps, Page 72



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Author: Priya Kishore



4.3 Soil Instability for Roads

Instability for Roads

- Severe
- Moderate
- Slight
- Major Roads
- Boundary of slopes greater than 25%

Soil	Soil Name	Reacts	Reacts
AuG	Allegheny silt loam, coarse subsoil variant, 8 to 15 percent	Moderate	Slope
ClC	Clarksburg silt loam, 8 to 15 percent slopes	Moderate	Slope
DuC	Dunsmuir silt loam, 8 to 15 percent slopes	Moderate	Slope
ErC	Ermine silt loam, 8 to 15 percent slopes	Moderate	Slope
FvC	Franklin/Vandergrift silt loams, 8 to 15 percent slopes	Moderate	Slope
GaC	Gauley silt loam, 8 to 16 percent slopes	Moderate	Slope
QvC	Quincy/Vandergrift silt loams, 8 to 13 percent slopes	Moderate	Slope
RaC	Rainbow silt loam, 8 to 15 percent slopes	Moderate	Slope
WhC	Wharton silt loam, 8 to 15 percent slopes	Moderate	Slope

Soil	Soil Name	Reacts	Reacts
CvD	Clymer silt loam, 13 to 25 percent slopes	Severe	Slope
CvD	Culbucka silt loam, 15 to 25 percent slopes	Severe	Slope
CvD	Culbucka/Walker shaly silt loams, 15 to 25 percent slopes	Severe	Slope
DvD	Dunsmuir silt loam, 15 to 25 percent slopes	Severe	Slope
DvC	Dunsmuir silt loam, 25 to 35 percent slopes	Severe	Slope
ErD	Ermine silt loam, 15 to 25 percent slopes	Severe	Slope
OpD	Olean-Uplsher complex, very steep	Severe	Slope
OpD	Olean, Walker, and Olesene shaly silt loams, very steep	Severe	Slope
OpD	Olean silt loam, 15 to 25 percent slopes	Severe	Slope
OpD	Olean-Uplsher complex, 15 to 25 percent slopes	Severe	Slope
OrD	Olean-Vandergrift silt loams, slumped, 15 to 25 percent slopes	Severe	Slope
QuD	Quincy silt loam, 15 to 25 percent slopes	Severe	Slope
QuD	Quincy/Vandergrift silt loams, 15 to 25 percent slopes	Severe	Slope
HvK	Hagerstown loam, steep	Severe	Slope
WvK	Walker/Ross outcrop complex, very steep	Severe	Slope
WhD	Wharton silt loam, 15 to 25 percent slopes	Severe	Slope

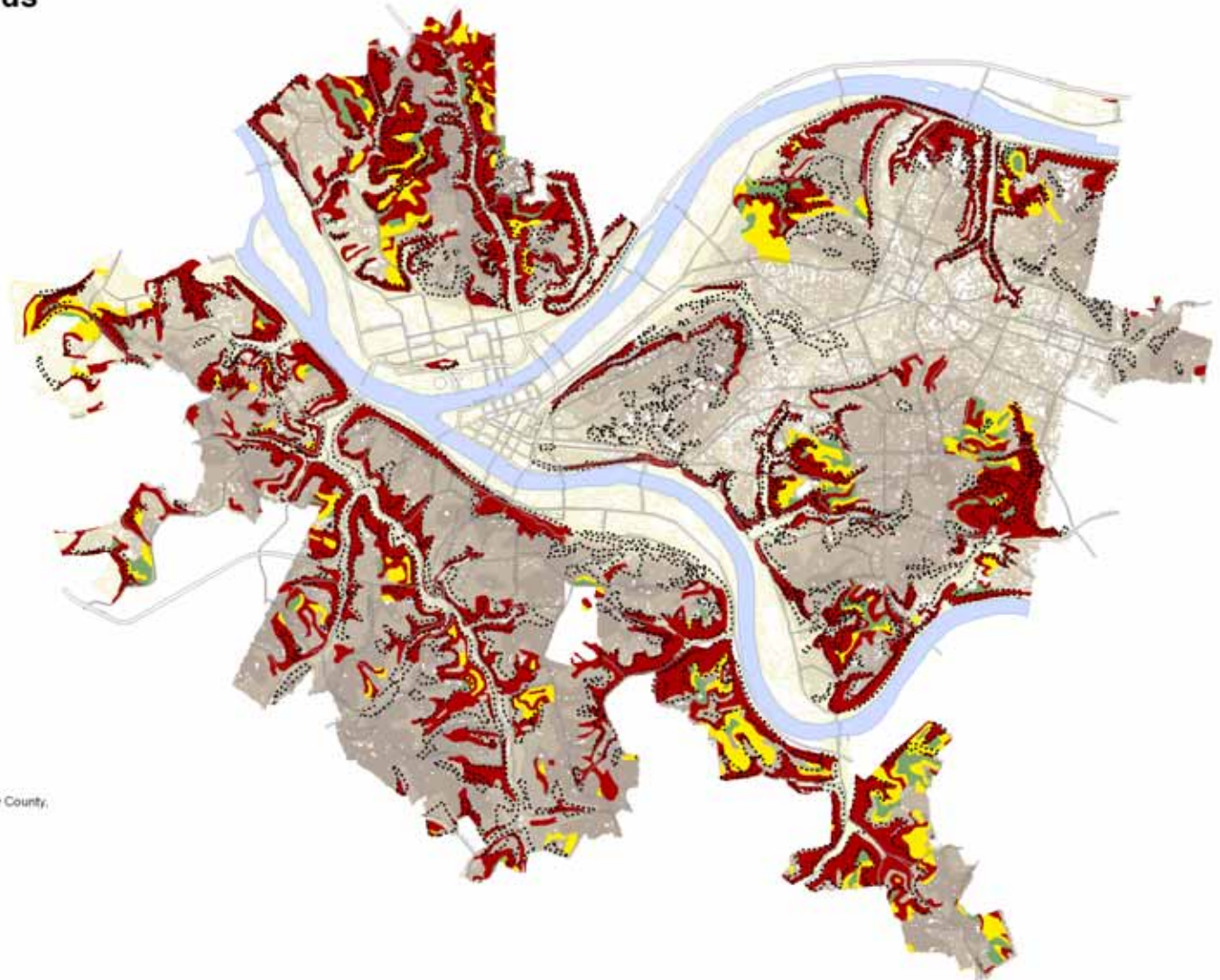
Reference:
United States Department of Agriculture, 1981, Soil Survey of Allegheny County, Pennsylvania. 95 pp. and maps Table 5: Page 54

Severe Classification:
Soil slope is so unfavorable and so difficult to correct that major soil reclamation, special designs, or intensive maintenance are required

Moderate Classification:
Soil slope is unfavorable but can be overcome or modified by special planning and design



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Author: Petya Kizilina



Section III. Decisions

Parcel by Parcel

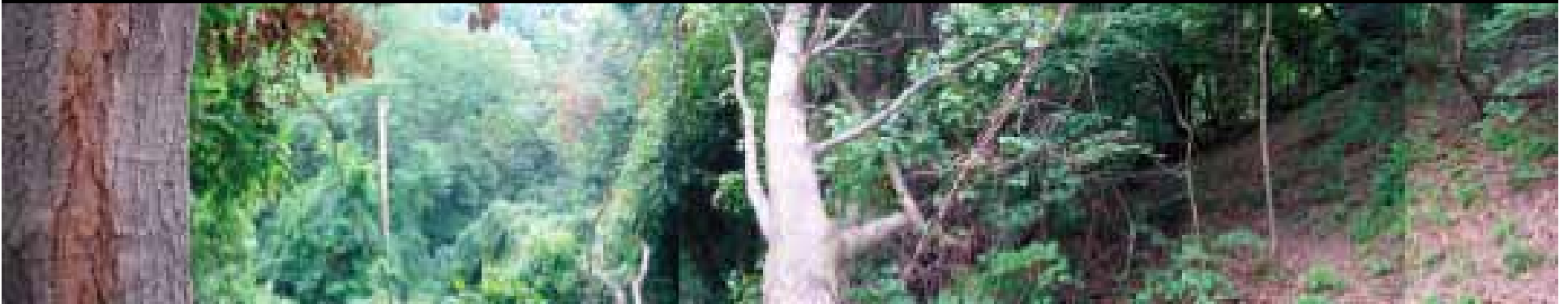


Parcel Identifier makes parcel-level data accessible

Lot Block Number	<input type="text" value="10B117"/>	Lot Block Lookup	<input type="text"/>
Soil: Erosion	<input type="text" value="4"/>		
Soil: Dwellings	<input type="text" value="2"/>		
Soil: Roads	<input type="text" value="2"/>	Recommendatio	<input type="text" value="Preservation"/>
Infrastructre: Buildings	<input type="text" value="1"/>		
Infrastructure: Roads	<input type="text" value="1"/>	Coal Seam	<input type="checkbox"/>
Infrastructure: Sewers	<input type="text" value="2"/>	Woodland	<input type="checkbox"/>
Total Score	<input type="text" value="14"/>		



Section IV. Natural Systems Field Studies



Prellwitz, Kalisz and Dunn with Hefele

4.0 Introduction to Fieldwork



SITE A - Steep recovering urban forest with disturbed soils.

SITE B1 and SITE B2 - Steep remnant urban forest, mostly natural soils.

SITE C - A large steep grade urban forest on natural soils, undermined soils and industrial fill. A mix of remnant and recovering forest.

Section IV. Natural Systems Geology Studies



4.1 Geology Fieldwork



All three sites studied

Conditions indicate the import of field checking soil maps prior to development

Proposed Methodology

1. consult maps for soils
2. consult maps for coal burden
3. field check any hillside proposed for development
4. if conditions appear favorable – request geotech study

4.2 Geology Fieldwork



The Soil Survey for Planning

Based upon

grain size of particles

thickness of the soils

water retention capability

topography upon which the soils occur

Stability ratings for building, roads and erosion

Section IV. Natural Systems

Botany Studies



4.1 Field Botany



Data relevant to land use guidance

Lists of native woody species

Lists of invasive woody species

Lists of native herbaceous

Abundance and diameter tables

Inform flora protection

Section V. Synthesis



5.1 Synthesis



5. 1 Application of data to zoning

Maps and texts in section II Context are intended as narrative background for discussions about the remnant and recovering ecosystems as well as the social-cultural need for open space.

The Hillside ecology team believe that these elements of our report are essential to the moral and ethical discussions that attend zoning discussions but are not part of the legally defensible package that we were charged with developing.

5.1 Synthesis



5. 1 Application of data to zoning

The maps and texts in Section III Decisions are intended as primary material for parcel based zoning decision making.

The “Parcel Identifier” is a data base tool that is easy to use and accurate. It provides detailed information about the relative dangers inherent to parcel soils and the availability or adjacency of parcel infrastructure.

5.1 Synthesis



5. 1 Application of data to development guidelines

The field work on the three selected sites provide us with baseline knowledge about nature in the city. This information can be used to set development guidelines, for instance:

Occurring on all three sites	Occurring on two of three sites
American Ash	Sycamore Maple
Black Cherry	Yellow Birch
Red Oak	Redbud
Basswood	Virginia Creeper
	White Oak
	Blackberry Raspberry
	American Elm



The end.