Arts Management &
Technology Laboratory

Using Spatial Data to Advance Programming Missions:
A Site Desirability Study for Public Art Projects in the City of Pittsburgh, PA

By

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INTRODUCTION

Spatial data, also known as geospatial data, is information that relates to or identifies a specific geographic location. Geospatial data can cover a large area, a state or a country, or refer to a specific point on a map, for example, the location of a school, or anything in between. Most importantly, it is data that can be placed in a map using Geographic Information Systems (GIS) software.

Spatial data analysis is used by many types of organizations. It can be used to analyze water supply systems or earthquake risk zones; it can also be used by businesses to improve their shipping logistics or create marketing campaigns. The use of spatial data as a tool for advancing arts organizations will be discussed here and illustrated through a case study of site desirability for public art projects in Pittsburgh.

The public art field was chosen because its projects are, by nature, embedded in a physical location. However, it could be easily translated into any community outreach program design, where the analysis would concentrate on who the targeted audience is and where they are located. In either case, spatial data analysis for an arts organization incorporates two fundamental processes: audience research and site selection.

Audience Research – Perhaps the most fundamental component of GIS analysis conducted by arts organizations is related to understanding who the organization wants to reach. Arts organizations can go further to understand the demographics of their cities,

develop programs according to that information or make budgeting decisions according to the expected interest of a particular population for a specific program.

Site Selection – After (or while) conducting audience research, it is possible to develop a process to determine a specific location to do a project. The example in this paper starts by combining audience research and location analysis to narrow down areas within the city of Pittsburgh in order to provide specific recommendations for public art projects.

GIS SOFTWARE OVERVIEW

The GIS software used to conduct this research is ArcMap for Desktop from ESRI. The largest GIS software company, ESRI develops a variety of products and tools for ArcMap, of which the most relevant to arts organizations are mapping and visualization, spatial analysis, data management, and geocoding capabilities. ESRI offers ArcMap for free to qualified nonprofit organizations as part of its Nonprofit Organization Program. While the program is designed to provide conservation and humanitarian nonprofit organizations around the world an affordable means of acquiring ArcGIS software and services, other types of nonprofit organizations are also eligible for the program, based on tax-exempt status and the nature of the work performed.

Like Photoshop or Illustrator, GIS software builds maps from layers, and the first layers needed are particular to geography: political boundaries, water features, school districts, and streets, for example. The United States Census

Bureau offers a nationwide database of these features, called TIGER/Line® Shapefiles, which can be manipulated to focus on a particular area of interest. These Shapefiles can be polygons, lines, or points, and have geographic entity codes (GEOIDs). They do not include demographic information themselves, but can be linked to Census demographic data, which also uses GEOIDs. Data tables from other sources can be joined to the Shapefiles using various methods, determined by the available parameters, most commonly by zip code or street address.

Spatial Analysis – These tools allow users to calculate population density and the distance between two points, perform statistical analysis, and overlay multiple layers.

Data Management – ArcGIS supports more than 70 data formats; users can integrate all types of data for visualization and analysis. This capability allows the user to import and display demographic and spatial information, as well as to record, view, and manage metadata.

Geocoding Software – This software allows the user to import and display data with longitude and latitude information (XY coordinates) or, alternatively, with geocoding tools and a layer that represents the streets in the area being analyzed. Locations stored as addresses on a spreadsheet can also be displayed on the same map.

Mapping and Visualization – Maps can be exported at any zoom level as images in various formats and resolution levels. The software also has a layout view that allows the user to produce images that include information like scale bars, labels, or any other element that aids in the interpretation of a map.

THE ANALYSIS PROCESS

Even if an arts organization is not planning on doing spatial data analysis itself, it is necessary to know what types of questions can be answered using GIS technology before assigning the task to a consultant. Questions will be defined by the scope of a particular project, and most importantly, by what data are available. Once a particular project is decided upon, the next questions for the organization to ask are what data it wants and what the sources of those data are.

In the following case study, what data are needed is determined by indicators of site desirability for a public art project in Pittsburgh, PA. To define indicators for a specific project, an arts organization should begin by identifying desired outcomes, and then design the project to maximize the possibility of reaching those outcomes. In this case, *Public Art – A Guide to Evaluation,* published by the Arts Council England's public art think tank group, ixia, provides guidelines by which to evaluate public art. The guide describes possible outcomes in four areas: Artistic, Social, Environmental and Economic. While not every outcome is necessarily related to the specific location of a public work of art (some pertain to the characteristic of the artwork itself), those related to social and economic values can assist in selecting the ideal site for a public art project.

An edited version of the selected variables and parameters used in the City of Pittsburgh project, are:

- **Community Development –** Potential to increase community esteem or neighborhood improvement, depending on how many people will be impacted by a particular work and by other cultural resources available to them. **Indicators:** Population Density, Foot Traffic, Museums, Public Art

- **Poverty and Social Inclusion –** The promotion of social inclusion of minority ethnic groups, disabled people, or other potentially disadvantaged groups. **Indicators:** Minority Population, Income

- **Crime and Safety –** Potential to improve safety (as demonstrated by reductions in crime or accidents) and/or improved perceptions of safety. **Indicator:** Vandalism

- **Personal and Interpersonal Development –** The promotion of personal development, such as self-esteem or identity, or interpersonal development, such as intergenerational or intercultural relationships. **Indicators:** Minority Population, Population Density

- **Marketing/Neighborhood Identity** – Potential for the project to contribute to neighborhood identity, either as a landmark or as a center or activity. **Indicators:** Existing Public Art Projects, Cultural Institutions

- **Education:** Contribution to education in the community and/or benefits to specific audiences. **Indicator:** Educational Attainment

DATA SOURCES

The next step in the analysis process is to identify available sources of data that measure the project's desired indicators. For the case study here, those sources include:

Decennial Census and American Community Survey (U.S Census Bureau)

The smallest unit for which the U.S. Census Bureau publishes data are blocks (mostly city blocks), then wider areas like block groups, census tracts (larger block groups within a county, used for statistical purposes), counties, states, divisions (e.g. Middle Atlantic), regions (e.g. Northeast), and finally the whole nation. Data from the decennial census, as well as one, three, and five-year estimates from the American Community Survey, are available for download without charge at [American Fact Finder](). Most variables are available at the block group level and higher; however, limited data are provided for public use at the block level, to protect privacy. Below is a description of American Fact Finder data used in the Pittsburgh analysis:

- **U.S. Census population,** including sex and race at the block group level (2010)

- **ACS five-year estimates of median household income** in the past 12 months (adjusted for inflation), by census tract (2011)

- **ACS five-year estimates of educational attainment** of adults 25 and over, by census tract (2010)

City of Pittsburgh GIS Website

As cities embrace open data efforts and make datasets available for general use, information about specific municipalities is increasingly available. However, the amount of local data available varies greatly from city to city, so the best way of determining what is available for a specific location is to visit the local government website.

In the case of Pittsburgh, the Pittsburgh GIS website makes available for download TIGER/Line® Shapefiles from the U.S Census Bureau for neighborhoods, census tracts, and block groups. Other data available directly from the city website are Shapefiles for museums, PAT bus stops, parks, vacant city property, water features, and the city boundary.

Office of Public Art

The Office of Public Art is a partnership between the City of Pittsburgh's Department of City Planning and the Greater Pittsburgh Arts Council. The office was contacted by the author via email to solicit information about public artwork in the City of Pittsburgh. Staff provided a spreadsheet containing all public artwork owned by the city and their corresponding locational coordinates. The dataset also included war memorials and ornamental water

fountains, which were removed from the spreadsheet before importing into GIS.

Additional Sources

The book *Pittsburgh Art in Public Places* (GPAC, 2013) supplemented the data provided by the Office of Public Art. Pittsburgh crime data for the months January to October 2010, downloaded from a server available to graduate students at Carnegie Mellon University's Heinz College, were also used.
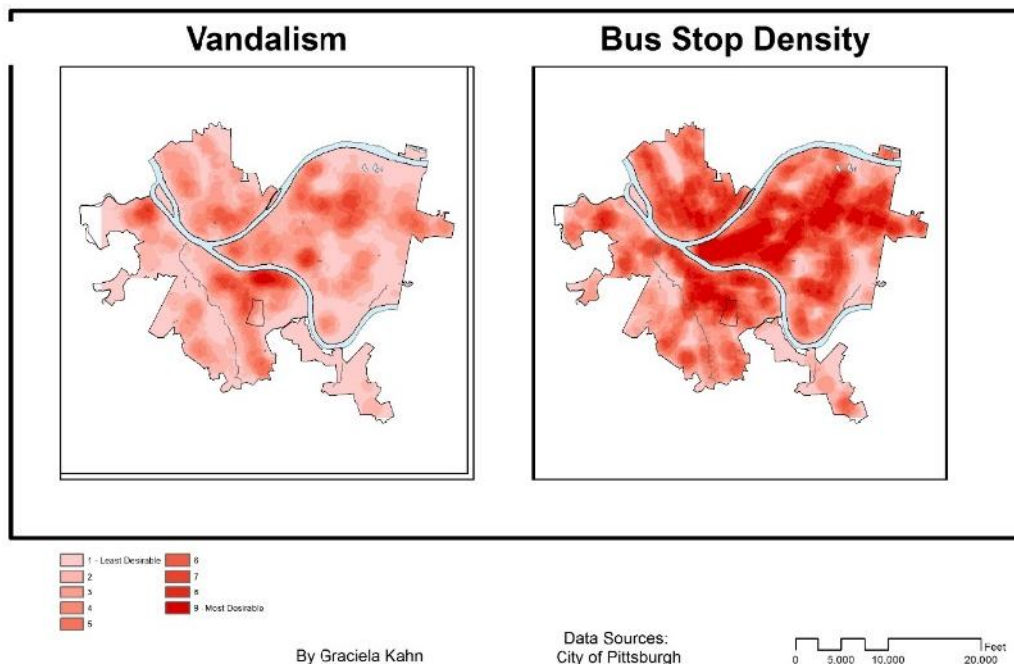
CASE STUDY

As a proof of concept, this paper analyzes and provides recommendations for desirable areas for public art projects in the city of Pittsburgh. According to the indicators previously explained, a total of eight variables are mapped and classified by their indication of desirability. A scale from 1 to 9 was used to classify indicator variables by quintiles, with 1 being the least desirable and 9 being the most desirable. Where insufficient were available to use this method (museums and public art), a manual classification in the same range of desirability was applied. Desirability is symbolized using a scale from white to red; in every case the red means most desirable, although in some cases, like public art, it might mean a lower density currently exists.

INDICATOR MAPS

1. **Vandalism:** Places with high concentration of vandalism incidents are more desirable.

2. **Bus stop density:** Used as a foot traffic and accessibility indicator; places with higher bus stop density are more desirable

3. **Museums:** Neighborhoods without museums are more desirable

4. **Public Art:** Areas without public art projects are more desirable

5. **Minority Population Density:** A high rate of minority population is more desirable

6. **Population Density:** A higher population density is more desirable

7. **Educational Attainment:** A higher concentration of people without degrees (associate or higher) is more desirable

8. **Median Household Income:** A lower median household income is more desirable
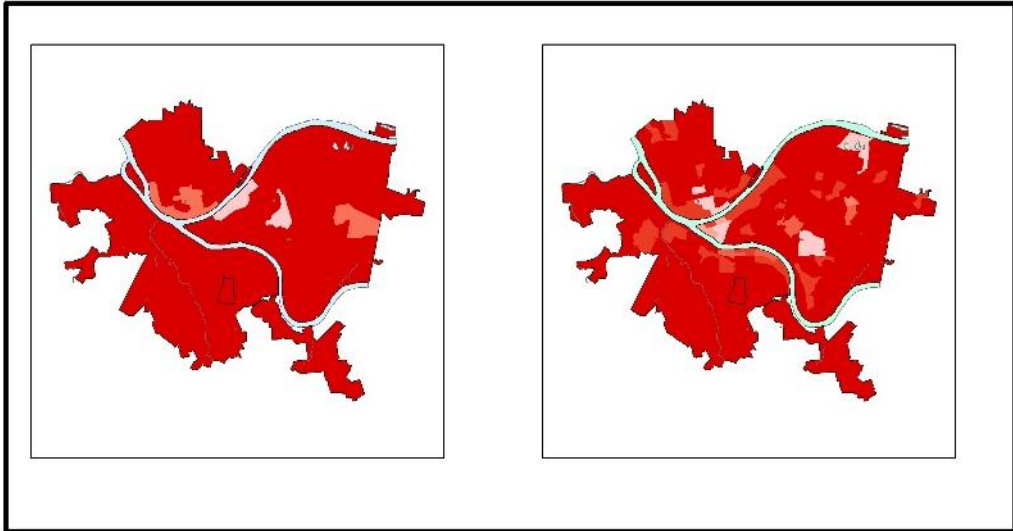

Public Art Site Desirability
City of Pittsburgh, PA

Vandalism   Bus Stop Density

1 - Least Desirable   6
2   7
3   8
4   9 - Most Desirable
5

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Data Sources:
City of Pittsburgh

Feet
0   5,000   10,000   20,000

Public Art Site Desirability
City of Pittsburgh, PA

Museums

Public Art

Museums

	0
	5
	9

Data Sources:
Office of Public Art
Pittsburgh Art in Public Places
City of Pittsburgh

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Public Art

	0		7
	5		8
	6		9

Feet
0   5,000   10,000   20,000
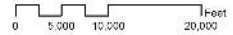
Public Art Site Desirability
City of Pittsburgh, PA

Minority Population

Population Density

	1 - Least Desirable		6
	2		7
	3		8
	4		9 - Most Desirable
	5		
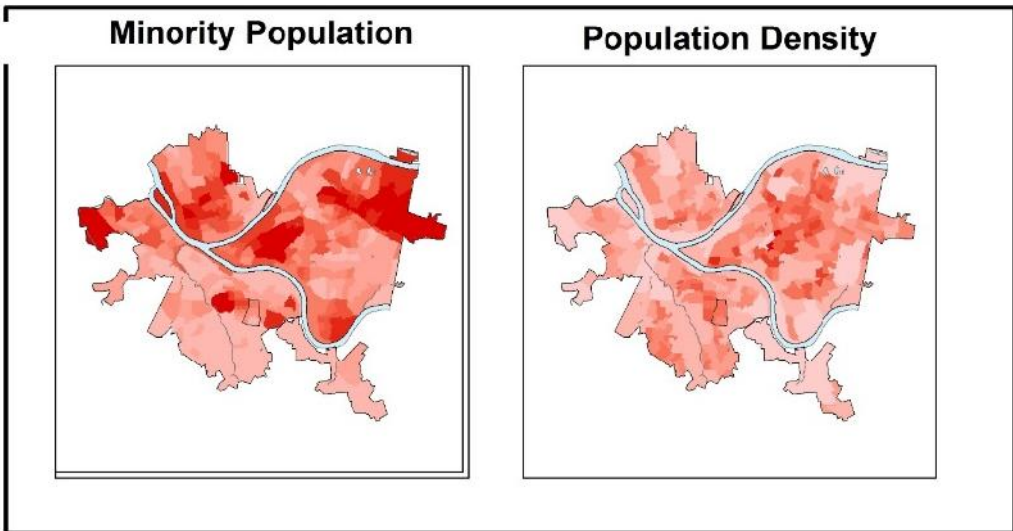
By Graciela Kahn

Data Source: US Census Bureau

Feet
0   5,000   10,000   20,000

8

Public Art Site Desirability
City of Pittsburgh, PA

Education

Median Household Income

1 - Least Desirable   6
2   7
3   8
4   9 - Most Desirable
5

By Graciela Kahn   Data Source: American Community Survey   Feet 0 5,000 10,000   20,000
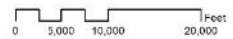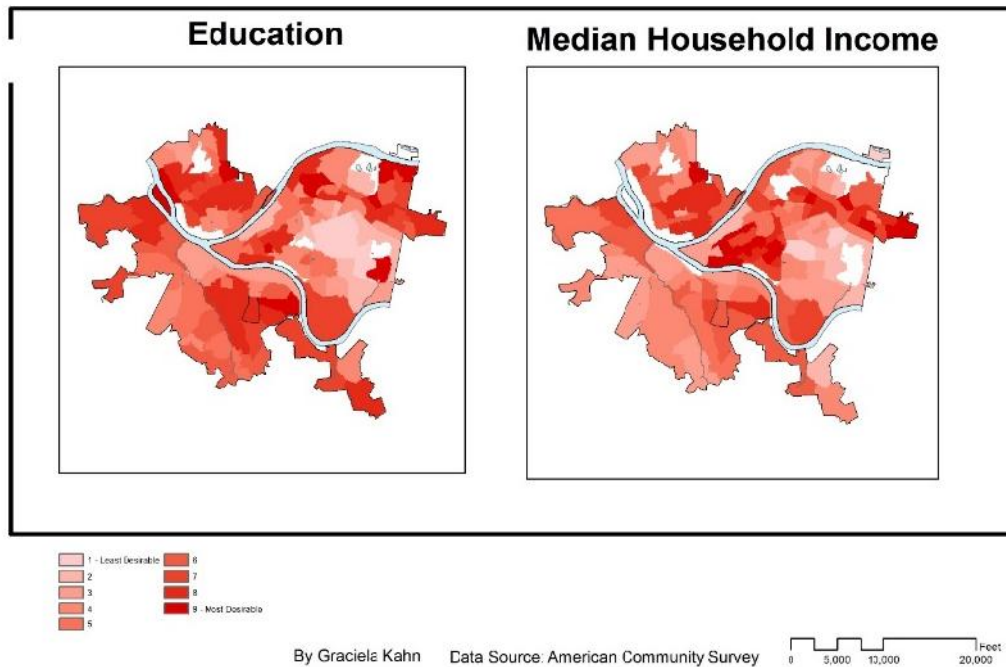
RESULTS

After creating and normalizing the maps for each variable, a weighted sum was performed using ArcMap. Values for each variable were assigned according to their impact; for example, museums only have a 5% weight because they affect the results of whole neighborhoods and don't necessarily have the same benefits as public art. In contrast, the existence of public art projects was assigned a greater weight, 20%, because this analysis concentrates on finding areas that are not currently being served.

PUBLIC ART DESIRABILITY					
PARAMETERS		RESULTS		CLASSIFICATION	
Variable	Weight	Statistic	Result	Desirability	Range
Bus Stop Density	.05	Min	1.5	Not Desirable	5 or less
Vandalism	.14	Max	8.16	Somewhat Desirable	5.01 to 6
Museums	.05	Range	6.68	Desirable	6.01 to 7
Public Art	.2	Mean	5.16	Highly Desirable	7 or higher
Population Density	.14	Standard Dev.	1.03		
Minority Population	.14				
Educational Attainment	.14				
Household Income	.14				

A classification method for these results was next designed to integrate all indicators into a single desirability rating. Any site with a desirability classification below the mean was labeled "Not Desirable." With a standard deviation of approximately 1.00, the remaining data were divided into three desirability categories: "Somewhat Desirable" (5.01 to 6.00), "Desirable" (6.01 to 7.00), and "Highly Desirable" (above 7.00). This classification scheme reveals four main areas within Pittsburgh where public art projects will have the most potential impact, as displayed in first map, "Preliminary Results." The second map identifies specific areas with corresponding neighborhoods that are considered highly desirable (score 7 or higher) according to the classification method described above.
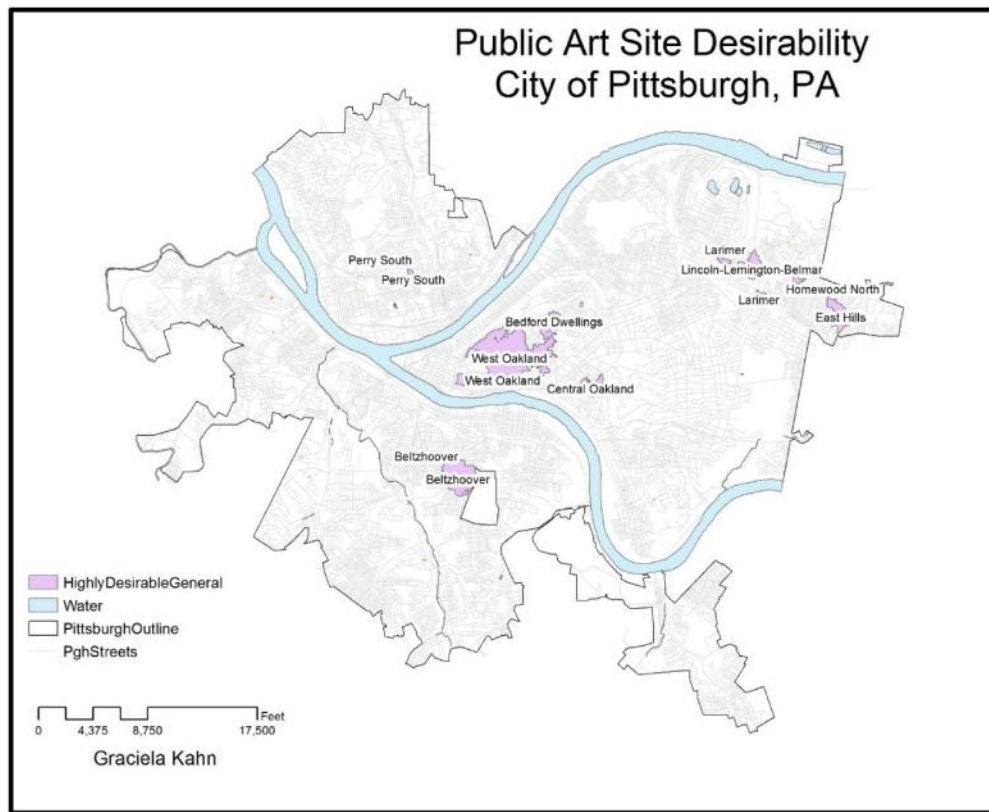

Preliminary Results

Public Art Site Desirability
City of Pittsburgh, PA

Not Desirable
Somewhat Desirable
Desirable
Highly Desirable

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Data Sources:
Office of Public Art
City of Pittsburgh
American Community Survey
U.S Census Bureau

0   5,000   10,000   20,000   Feet

Public Art Site Desirability
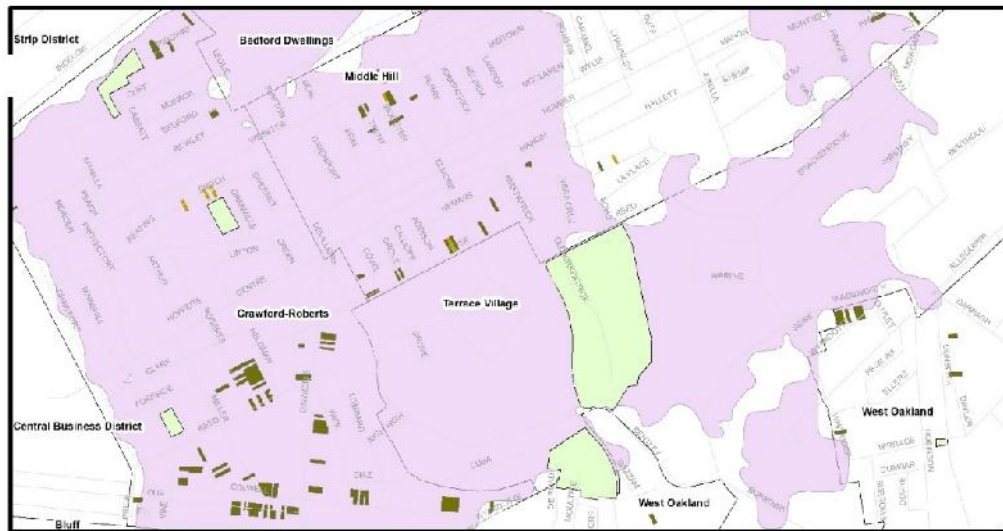City of Pittsburgh, PA

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RECOMMENDATIONS

Because funds for art projects are limited, the decision was made to recommend areas classified as highly desirable and larger in size as priority investments. Subsequent public art projects could be placed on the other, smaller, highly desirable areas identified in the previous map, and then in the areas classified as desirable and somewhat desirable. This map is only meant to show areas for new public art developments, and not those where maintenance and conservation efforts should of existing projects should continue.
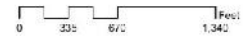
Recommendation 1

Water
PghStreets
Parks
VacantCityPropertyDemolished
VacantCityProperty
HighlyDesirableDetail

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Feet
0   335   670   1,340

Recommendation 2

Water
PghStreets
Parks
VacantCityPropertyDemolished
VacantCityProperty
HighlyDesirableDetail

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Feet
0   390   750   1,560

FUTURE WORK

As mentioned, the analysis presented in the case study here is meant to aid in the planning process. Once a proposed project is approved and the design and selection is underway, a specific site for each artwork has to be selected. When a location and general information about the artwork (theme, artist or materials) are available, another GIS analysis can be performed to understand the specific demographics around a particular public art project, in order to design appropriate educational and community outreach programs. With regards to the current case study, an analysis of the greater Pittsburgh region—not just the city itself—could also be conducted as part of a broader effort for regional funding opportunities. Finally, including additional indicators in the analysis, such as age and access to art education in public schools, might also provide valuable insights.

CONCLUSION

The previous analysis can be used as supporting documentation for a grant application or as a guideline in a request for proposals or a request for qualifications, both basic aspects of the planning process when programming public art. If the site selection process is based on the recommendations from this spatial data analysis, the project will have an increased potential to create a meaningful impact on the most people, including those who might otherwise not experience visual art. The ability to integrate multiple variables into a spatial data analysis is one advantage of the method, and is easily translated to other planning efforts, such as community outreach programming, for example.

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