



The Rail Park, Phase 1 Methods

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The full case study can be found at: <https://landscapeperformance.org/case-study-briefs/the-rail-park>

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Research Overview and Strategy



Figure 1: Oblique view of The Rail Park Phase I in Philadelphia, PA.

The Rail Park Phase I, a quarter-mile linear neighborhood park, opened in June 2018. As the only public park in the Callowhill and adjacent neighborhoods, The Rail Park Phase I has provided and continues to provide a much needed green and shady space for those who live, work in or near, and visit this section of Philadelphia.

The Rail Park Phase I is located within a ten-minute walk to Center City, the Pennsylvania Convention Center, and the Reading Terminal Market. Additionally, Callowhill is adjacent to Philadelphia's Chinatown.

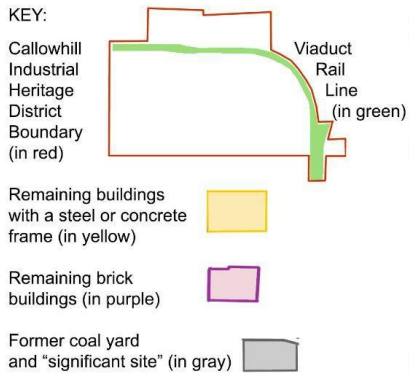
The Rail Park Phase I sits on what was known as “the Viaduct”, a partially elevated four-line abandoned railway that was built in the 1890s. Rail transportation declined from the 1940s-1970s as car, truck, and trolley transportation grew. Once rail transportation on the Viaduct was discontinued in 1984, the structure was left to decay and overgrow for over twenty years. Rather than dismantling the Viaduct, costs for which was estimated to be between \$35.5 million to \$51.5 million, the City of Philadelphia and Viaduct advocacy groups began to consider alternatives, primarily as a potential neighborhood green space and a park that would cost \$10.8 million. This alternative approach saved the City of Philadelphia up to \$41 million.

A community engagement process was conducted from 2013 to 2016 to generate ideas and gather feedback on the park's design concepts developed by landscape architecture firm Studio Bryan Hanes (SBH). Working with local stakeholders, including community residents and businesses, Friends of the Rail Park, Philadelphia's Center City District, and the Philly Department of Commerce, SBH proposed the following goals for the park:

Rail Park Phase I -- Project Goals

- **Provide a community park** for the surrounding Callowhill and Chinatown North neighborhoods and adjacent Chinatown and West Poplar neighborhoods, all of which lack public green space within a ten-minute walk.
- **Increase shaded outdoor social space for nearby residents**, many of whom live in converted factories without stoops, porches, or yards.
- **Increase cross-group interaction and social sustainability** between area residents, local organizations, stakeholder groups, and the Center City District by creating a venue for events.
- **Preserve a historic structure** by repairing and adapting it for new use.
- **Encourage the redevelopment of vacant land and surface parking areas**, especially for housing, as part of a goal of the 2004 Chinatown Neighborhood Plan and subsequent area plans located adjacent to and near the Rail Park.
- **Provide an experience of rich, thick vegetation using native species.**
- **Create the first segment of a cross-city green route** to link ten neighborhoods.

The park's design and features, including industrial materials such as weathering steel, and views of converted factory buildings and warehouses provide reminders of the Callowhill neighborhood's history as part of Philadelphia's status as "Workshop of the World" (Sanborn, 1950). In 2010, a 5.7-acre portion of the neighborhood was listed on the National Register of Historic Places as the "Callowhill Industrial Historic District" (see Figure 3, Jaslow, 2009). The viaduct is considered the only "contributing structure" of the thirty-three relevant industrial buildings, structures, and sites within this historic district.



Sanborn Fire Insurance Maps Key, 1950

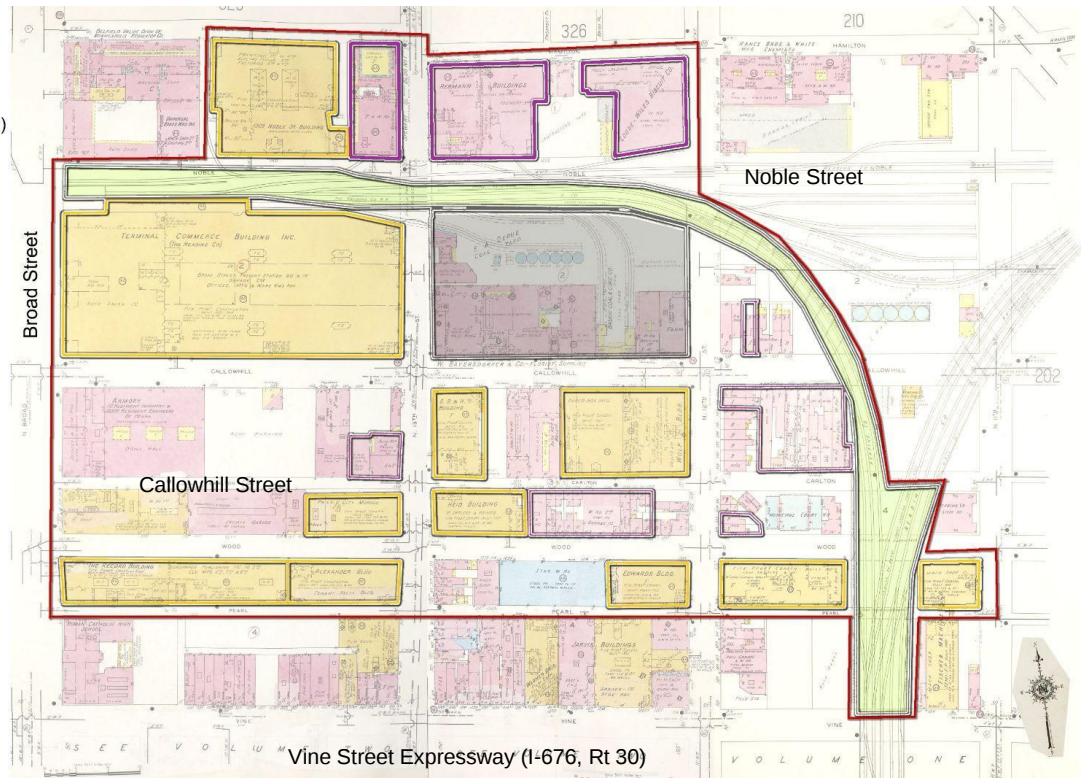
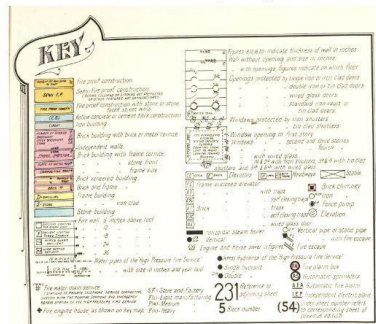


Figure 2: Sanborn Fire Insurance Map from 1950. The Callowhill Industrial Heritage District, listed on the National Register of Historic Places in 2010, is outlined in red. Remaining contributing buildings with a steel or concrete frame are outlined in yellow. Remaining and "contributing brick buildings are outlined in purple. The one relevant "site", the former coal yard adjacent to the Viaduct, is outlined in gray.

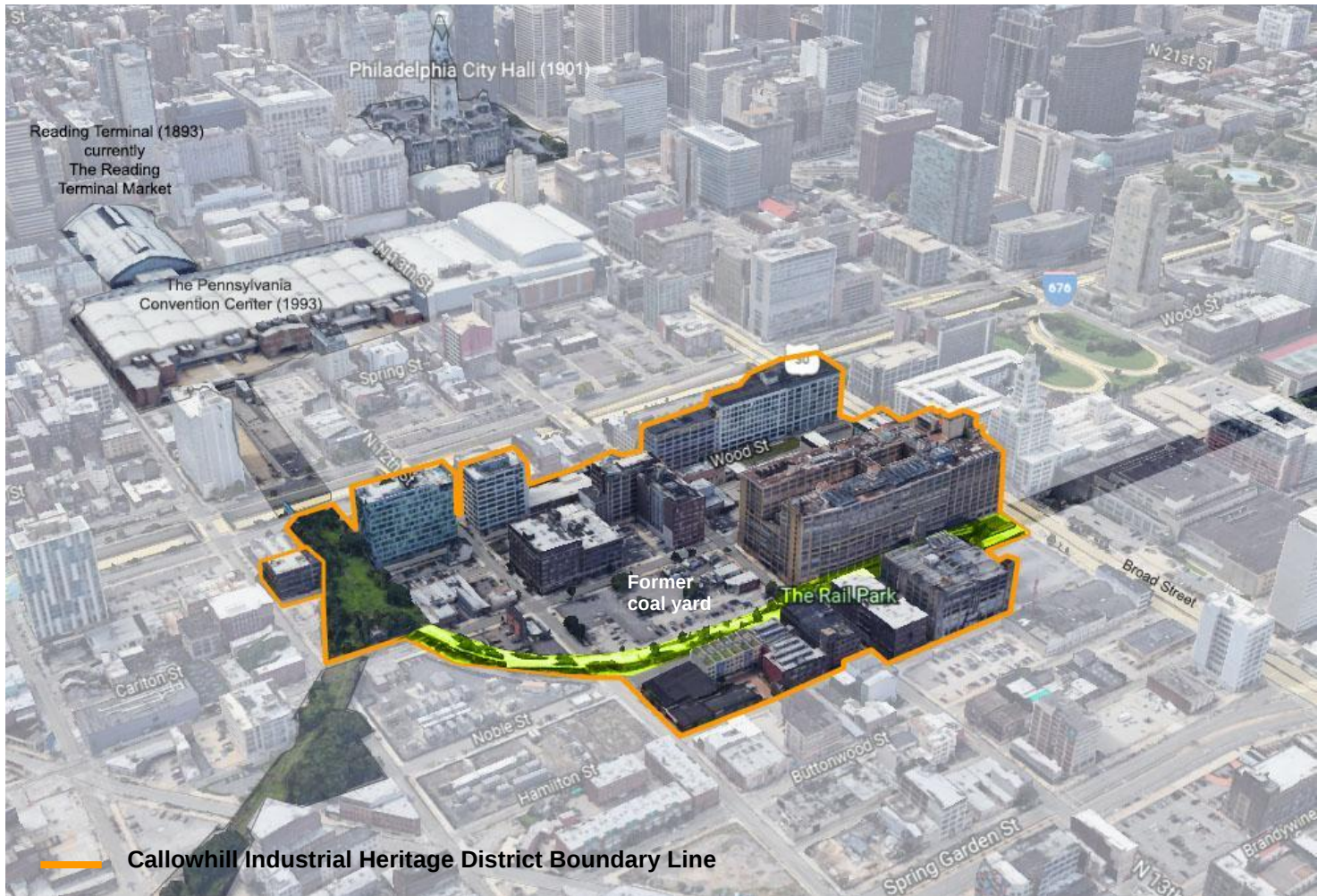


Figure 3: Aerial oblique image with the Callowhill Industrial Heritage District outlined in orange. Note the proximity to Philadelphia's Center City District, located across the Vine Street Expressway (I-676 / Route 30). Source: Google Earth, Accessed November 20, 2022.

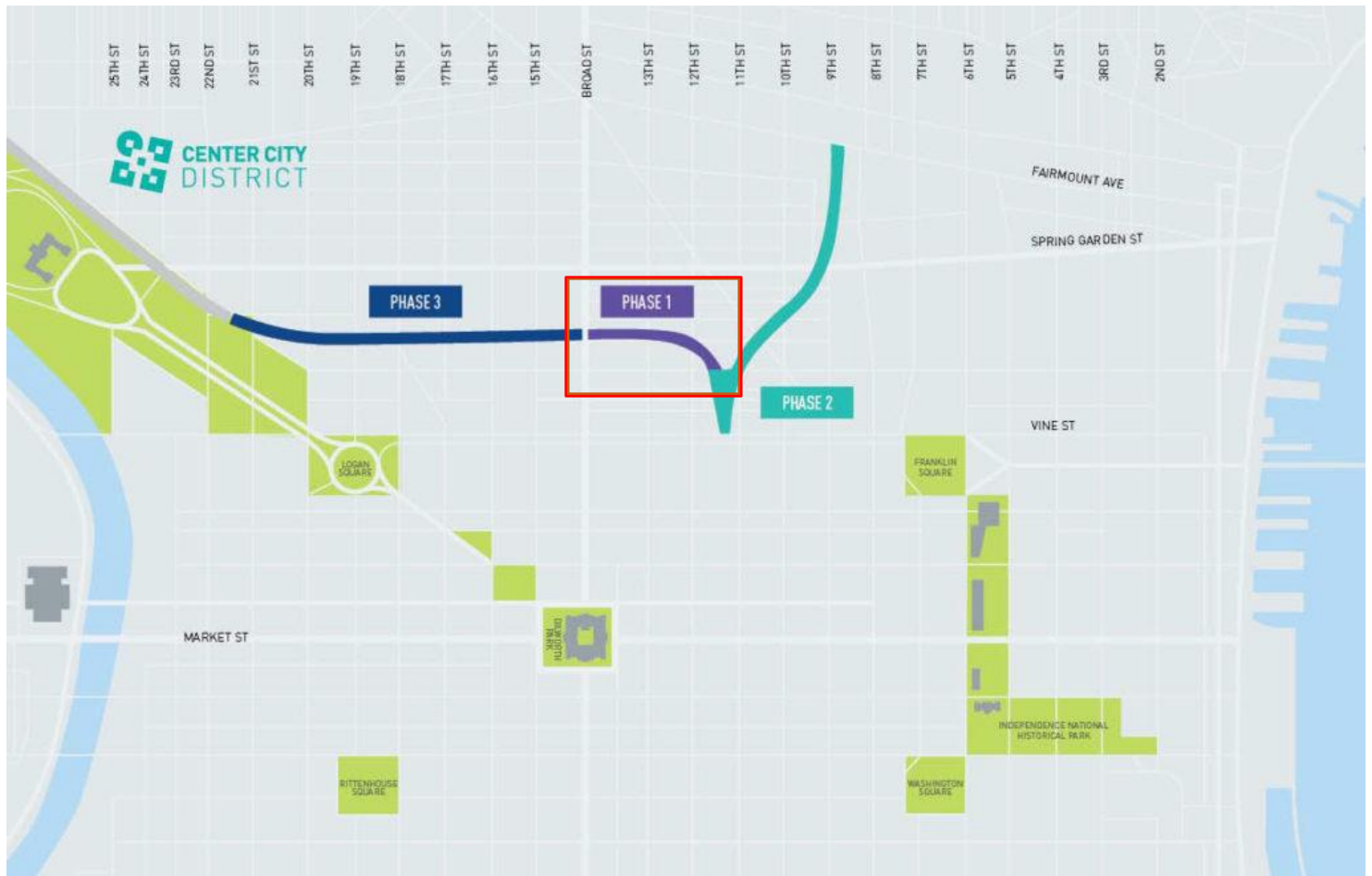


Figure 4: Philadelphia Center City District's map of the proposed three phases of the Viaduct's redevelopment. The Rail Park Phase 1 is set within the red rectangle. Source: Center City District, <https://centercityphila.org/pressroom/philadelphia-s-rail-park-opens-to-the-public>, accessed July 25, 2022.

The Rail Park Phase 1 represents the first of three park phases as seen in Figure 4. The Friends of the Rail Park are responsible for planning the next two phases. These next phases will lengthen the Rail Park to three miles and connect ten neighborhoods across Philadelphia. One of the primary goals of this investigation is to help inform the planning and design efforts of these next two phases.

This Case Study Investigation of the Rail Park Phase I took place between February to October 2022. At that time, the Rail Park Phase I had been open for four years. During those four years, significant cultural and public health related crises have substantially impacted Philadelphia, its residents, and visitors. The two most prominent examples are the COVID-19 pandemic, which began in late March 2020, and the Black Lives Matter protests which began in late May 2020. These have shifted Philadelphia's economy, perceptions and use of urban space, and social interactions.

Green space provides many benefits to a community, providing space for physical activity, social cohesion, stress management, and ecosystem regulation, which in turn positively impacts overall public health. This investigation has shown that the Rail Park Phase I offered much-needed public green space since its opening in 2018, particularly through the civil unrest of 2020 and ongoing COVID-19 pandemic, and has continued to serve as a valuable resource in 2022.

Our team's research approach relied heavily on information initially gathered during site visits and on discussions and collaboration with the Landscape Architecture Foundation's Megan Barnes, the design firm Studio Bryan Hanes, and stakeholders and individuals involved in previous research on the Viaduct and Rail Park Phase I. We also developed our understanding of landscape performance, methods, and techniques from reviewing previous CSI projects Methods Documents.

Particularly helpful in the initial stages of our research include: The Landscape Architecture Foundation's *Evaluating Landscape Performance: A Guidebook for Metrics and Methods selection*, Bo Yang's, *Landscape Performance: Ian McHarg's Ecological Planning in The Woodlands, Texas*, and the seven articles in the "Landscape Performance Special Journal Issue."

In the CSI project development and planning stages, the research team worked with SBH's project goals listed above as well as identified the following features that provide range of environmental, social, and economic benefits:

Site Features:

- Site reuse and remediation
- Reuse of historic infrastructure
- Historical interpretation
- Public art
- Scenic views
- Gathering platforms and benches
- Five large-scale porch swings
- One rain garden
- Over 1,100 native plants planted
- Use of engineered soil in planting beds
- Green space in a neighborhood that lacked green space within a 10-min walk
- Creation of a large, neighborhood-scale "front stoop"

For the three benefit categories (environmental, social, and economic) our research team posed the following questions:

Environmental benefits:

1. Is the Rail Park Phase I an improvement in terms of species richness relative to the undeveloped and overgrown rail line?
2. How much stormwater runoff is the Rail Park Phase I and the adjacent rain garden reducing and capturing?
3. Is this small park making an environmental impact by sequestering carbon?
4. Given the park is surrounded by concrete, asphalt, and buildings, can the park make an impact on the urban heat island effect and reduce air temperatures? How do the Rail Park Phase I's temperatures compare to the undeveloped rail line?

To answer these questions, we used the following methods, equipment, and software to gather data:

Environmental Benefits	Methods, Software, Equipment, and Data Source
1) Stormwater management – on the Rail Park surface 2) Carbon sequestration	• Caliper and measuring tape for measuring trees' "diameter at breast height" (DBH) • i-Tree Eco Software - Version 6 • Microsoft Excel
3) Stormwater management -- the Noble Street Rain Garden	• Secondary data provided by the Philadelphia Water Department
4) Species Richness	• Universal Floristic Quality Assessment tool -- <i>Coefficients of Conservatism (C)</i>, drawing from the Mid-Atlantic Coastal Plain database • Secondary data – plant lists provided by Studio Bryan Hanes and plant ecologist, Marion Holmes • Adobe Photoshop mapping studies • Microsoft Excel
5) Temperature and Urban Heat Island (UHI)	• FLIR One - thermal Imaging camera • iPhone and iPad + piece of 8.5x11" paper • Adobe Photoshop mapping studies • Secondary data – provided by Drexel University's Department of Engineering

Social Benefits:

Our research team worked with survey instruments and SOPARC observation study methods implemented in 2018-2019 by Andrew Mowen's research team from Penn State University's Department of Recreation, Parks, and Tourism Management. Both the 2018-2019 baseline study and our 2022 follow-up study asked the following questions:

1. How do park users perceive the park (e.g., perceived personal and neighborhood ownership, park design)? Have perceptions changed since the initial park opening?
2. How do users perceive the social atmosphere of the park (e.g., social interactions with other park visitors)? Have social interactions changed since the initial park opening?
3. How do park visitors perceive the impact of the Rail Park for themselves, their families, and the local community?

To answer these questions and to address the design goal of "increasing cross-group interaction and social sustainability," we used the following methods, equipment, and software to gather data:

Social Benefits	Methods, Software, Equipment, and Data Source
1) Recreational and social value 2) Health and well-being 3) Access and equity	• Visitor and Area Resident survey instruments – used Google Forms (in English, Mandarin, and Spanish) • Microsoft Excel and SPSS Statistics Base – Version 27 (and above) software – for statistical analyses. • Social media – images gathered from Facebook and Instagram • <i>ParkServe</i> – Trust for Public Land (TPL) website, with ESRI 2021 Demographic Forecast Block Groups data • Adobe InDesign used to create a flyer with a QR code • Secondary data – survey instrument provided by Penn State's Department of Recreation, Parks and Tourism Management

Economic Benefits:

We were particularly interested in understanding the economic impact that the Rail Park Phase I has had on the Callowhill neighborhood. To assess this impact, we asked the following questions:

1. Have property values changed as a result of the Rail Park Phase I's presence?
2. How has the Rail Park Phase I and the recent improvements to the Viaduct contributed to economic development in the neighborhood?

Economic Benefits	Methods, Software, Equipment, and Data Source
1) Property values	- Mapping studies using GIS and Phila.gov database - Microsoft Excel
2) Economic development	- Area businesses impact survey - Local stakeholder groups provided assisted with businesses' contact information and survey distribution - Adobe Photoshop

The research team was also interested in understanding the differences in benefits between the Rail Park Phase I and the High Line in New York City, since both have a similar design, layout, and vocabulary of design elements (Norden and Chan, 2021). Table 1 below presents the primary differences between these two park spaces.

We used the Trust for Public Land's *ParkServe* online mapping and demographics analytical tool and reviewed the High Line's *Case Study Investigation* Methods document from 2017 to better understand the differences and the benefits these two parks provide (see Appendix C for the *ParkServe* reports for both sites.)

Table 1: The Rail Park Phase I and The High Line – differences in length, acreage, neighborhoods and populations served, nearby parks, vegetation, and materials.

	The Rail Park Phase 1 Philadelphia, PA	The High Line Manhattan, New York City, NY
Length	0.27 mile	1.45 miles
Acres	0.60 acre	5.5 acres

Neighborhoods and populations served	The Rail Park serves three neighborhoods: Callowhill, Chinatown to the east and southeast, and West Poplar to the west. There are approximately 8,600 individuals that live within a 10-minute walk. Those living nearby are primarily adults with household incomes evenly split between low, middle, high incomes. Together, Black, Asian, and Hispanic communities comprise the majority of the area's population (66%.) (See Appendix E for the Trust for Public Land's <i>ParkServe</i> park demographics report. Data is derived from ESRI's 2021 Demographic Forecast Block Groups data.)	The High Line serves the neighborhoods of West Chelsea and the Meat Packing District. Currently, there are approximately 66,000 individuals who live within a 10-minute walk. The majority of these households are high income households (55%) and white adults (65%.) (See Appendix E for the Trust for Public Land's <i>ParkServe</i> park demographics report. Data is derived from ESRI's 2021 Demographic Forecast Block Groups data.)
Nearby parks	There are no other green spaces or public parks within a 10-minute walk of The Rail Park Phase 1.	There are ten small to larger-scale parks within a 10-minute walk of the High Line, including Chelsea Park and the Hudson River Park.
Vegetation	There are three planting zones in the Rail Park Phase 1: "the hedgerow", "the woodland", and "old field." 100% of the plants that were planted on the Rail Park Phase 1 are considered native to the Mid-Atlantic region. The plantings were inspired by the native plant types found on the undeveloped rail line. The hedgerow and woodland plants are planted on the rail bed that is located at grade and/or set within soil contained by retaining walls on either side (between Broad St. and N. 12th Street). The transition to old field plantings begins in the shallower, sandy soil matrix that the former rail line's bridge structure can accommodate -- between N. 12th Street to the Callowhill St. entrance.	There are sixteen distinct vegetation or garden zones on the High Line, all of which were inspired by native plant communities that formerly grew on the undeveloped elevated rail line and/or native plant communities found in the region. Approximately 50% of the plants on the High Line are native to North America. Roughly 30% of the native plants are considered endemic to the New York City region (Plunz and Moskalenko, 2017).

Materials	Primary materials used in the Rail Park Phase I are chipseal paving, lpe wooden platforms and benches, and weathering steel.	Primary materials used on the High Line include bonded aggregate, metal grating, and teak lumber.
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The most significant difference between these two parks is the social benefits the parks provide. The Rail Park Phase I was designed and intended to be a neighborhood park in a neighborhood with zero green space nearby. Prior to the Rail Park Phase I's development, there was no place for area residents and workers to gather outside.

The park has indeed become part of the neighborhood, a social space where the neighborhood's residents and workers can meet. The Rail Park Phase I is a place that promotes social cohesion, better health, and increased well-being.

The neighborhood demographics in Callowhill, Philadelphia and Chelsea, New York are significantly different. The Rail Park Phase I serves historically underserved populations and provides much needed access to green space to lower and middle-income area residents.

Lessons Learned:

The Rail Park provides area residents with much needed green space and ground for community building. Since the park's opening in 2018, the park has become firmly integrated into the community and the surrounding urban fabric, providing multiple environmental, social, and economic benefits.

There is room for improvement regarding "green gentrification" challenges resulting from The Rail Park's presence. The Friends of the Rail Park is committed to ensuring that the Chinatown/Chinatown North community members feel a sense of ownership over The Rail Park Phase I and are directly involved in the planning process for the Rail Park's future and future park phases.

Continued communication (in multiple languages), ongoing community engagement, and implementing an equitable design plan as well as inclusive policies will be critical for successfully designing and developing future phases of the park and green space in and around Callowhill.

Environmental Benefits

- ***Reduces stormwater runoff by 1,501 cu ft or 11,200 gallons annually in 102 newly-planted trees.***
- ***Projected to sequester an estimated 27,632 lbs of atmospheric carbon over the next 25 years, with an average carbon capture of 1,105 lbs per year.***

Method: On-site tree measurements of the 102 newly-planted trees were taken using Diameter

at Breast Height (DBH) measuring tape and a caliper tool. Measurements were entered into the i-Tree Eco Version 6's field data app. i-Tree Eco v6 is a model that uses tree measurements and characteristics to estimate ecosystem services of urban and rural forests.

i-Tree Eco v6 was developed by the US Forest Service, Davey Tree Expert Company, Arborday Foundation, Society of Municipal Arborists, International Society of Arboriculture, Casey Trees, and SUNY College of Environmental Science and Forestry.

An i-Tree analysis was conducted using a "Complete Inventory" which is typically used for smaller public areas or private properties such as corporate campuses, parks, apartment complexes, individual homes, or cemeteries. iTree Eco Version 6 analyzed the vegetation structure, function, and value of the urban forest at The Rail Park and produced a report that included percentage of tree cover, pollution removal, carbon storage and sequestration, oxygen production, avoided runoff, and replacement values. See Appendix A for the report.

Six indicators of tree species: condition, trunk circumference or diameter, sun exposure, distance from a building, adjacent building's construction date, and orientation of trees relative to adjacent buildings were entered into i-Tree Eco Version 6. The last three indicators are only considered when the tree is within 60 ft of a building. Tree conditions are categorized by excellent, good, fair, poor, critical, dying, and dead. Trunk circumference is measured at 4.5 feet above the ground. The diameter at this height is called "diameter at breast height" (dbh), which is the standard measurement of tree trunk width.

Calculations for surface runoff avoidance:

From iTree Eco Version 6.0.27 Ecosystem Analysis report:

- 1,510 cubic feet (x 7.48 gallons) is equivalent to 11,295.58 gallons per year.
- Avoided runoff is estimated based on local weather data from the nearest weather station. In 2019, The total annual precipitation was 49.6 inches at the Rail Park.

Calculations for carbon sequestration: Trees remove carbon dioxide from the atmosphere, this is called carbon sequestration. Currently, the park has 102 trees. 23.5% of these trees have a diameter of more than six inches. The twelve London Plane trees, which make up 11.5% of the park's tree population, sequester the majority of the carbon in The Rail Park, approximately 500 lbs annually.

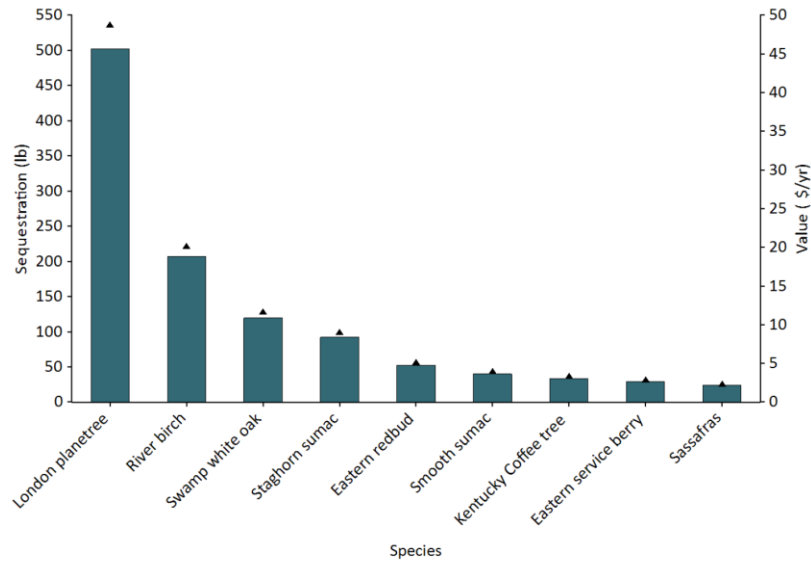


Figure 2: Estimated annual gross carbon sequestration (lbs) for urban tree species

Carbon Sequestration Over Time

Location: Philadelphia, Philadelphia, Pennsylvania, United States of America
 Project: The Rail Park, Series: Phase 1, Philadelphia, PA, Year: 2022, Forecast: Default
 Generated: 9/7/2022



Total Gross Carbon Sequestration	
Year	(pounds)
1	1,155.9
2	1,098.1
3	1,074.0
4	994.8
5	1,009.3
6	1,034.5
7	1,045.6
8	1,044.1
9	1,072.5
10	1,097.5
11	1,097.3
12	1,124.1
13	1,138.3
14	1,161.7
15	1,181.0
16	1,147.5
17	1,095.4
18	1,068.3
19	1,096.8
20	1,118.3
21	1,147.1
22	1,160.2
23	1,186.7
24	1,168.6
25	1,153.9

Figure 3 FORMLYERLY TABLE 1: Total Carbon Sequestration (lbs) estimated over twenty-five years.

Limitations:

i-Tree Eco V6 tools provide an estimate of the environmental effects and value of the study area's urban tree population using complete tree inventory field data coupled with local, hourly air pollution and meteorological data. i-Tree Eco V6 does not include groundcover in its analyses and while shrubs can be taken into account, they were not included in this analysis.

There were discrepancies in comparing the number of counted trees for iTree versus the planted ones in the planting plan because of tree deaths over the past few years. Losses among species include *Sassafras*, *Amelanchier*, and at least one *Cercis canadensis*. A few trees have been added since 2018. The landscape architecture firm does not always hear about dying trees. Landscape contractors with Philadelphia's Department of Parks and Recreation remove all dead trees.

Source:

i-Tree Eco v6.0.27. Accessed August 2022 <https://www.itreetools.org/tools/i-tree-eco/i-tree-eco-overview>

- ***Intercepts 8,419 gallons of stormwater per year in the Noble Street Rain Garden. This is the equivalent to 2,105 flushes of a 4-gallon toilet.***

Background: Studio Bryan Hanes designed and documented the Noble Street Rain Garden as part of the Rail Park Phase I. The Philadelphia Water Department (PWD) currently maintains it. The curb bump-out is a slow release SMP that is part of the city's Green City, Clean Waters green stormwater infrastructure program. It was completed in June 2018. The Green City, Clean Waters program is a 25-year plan implemented in 2011 with the goal to restore local waterways through the implementation of green stormwater infrastructure and investments in traditional infrastructure.

Method: Rain garden data were provided by the Philadelphia Water Department (PWD), Urban Engineers, and Studio Bryan Hanes. The following calculations used this data.

Calculations:

The Philadelphia Water Department measures their progress via *Greened Acres*. A *Greened Acre* is an expression of the volume of stormwater managed by green stormwater infrastructure, based on the design for the project, and is conditional on the proper operation and maintenance of the project.

One Greened Acre is equivalent to 1 inch of managed stormwater from 1 acre of drainage area, or 27,158 gallons of managed stormwater. These volumes are tracked as Greened Acres (GAs) using the following equation:

$$GA = IC * Wd$$

IC is the impervious cover using green stormwater infrastructure (acres). This quantity can include the area of the stormwater management feature itself, as well as the area that drains to it.

Wd is the depth of water over the impervious surface that can be physically managed in the facility (inches). Green stormwater infrastructure designs aim to control at least 1.0 inch of runoff, and up to 1.5 inches of runoff, unless otherwise deemed feasible by engineering design.

Calculation for the Rail Park - Phase I:

1 Greened Acre (GA) = 27,158 gallons

The project site is .31 GA

$(.31) \times 27,158 = 8418.98$ gallons

$8418.98/4 = 2104.75$ number of toilet flushes

Sources:

Green City, Clean Waters Year 10 Evaluation and Adaptation Plan

By the City of Philadelphia Water Department, May 30, 2022

<https://water.phila.gov/pool/files/gccw-year-10-eap.pdf>

Limitations:

Stormwater implementation has not been verified with on-site measurements. Results are based on the Construction Documentation.

- **Improves ecological integrity as compared to the previous undeveloped rail line as observed in test plots, with a mean C value of 4.2 at the Rail Park and 2.6 on the undeveloped rail line. In addition, the Rail Park's Floristic Quality Index (FQI) score is 15.7, as compared to 12.5 for the undeveloped rail line.**

Background: The plant community that thrived on the decommissioned rail line prior to its current use as a park included a mix of native and non-native woody and herbaceous plants. This same plant community can still be observed on the remaining undeveloped portions of the rail line. Stakeholders and community members worked closely with Studio Bryan Hanes to replace this "urban wild" with a plant community that kept the "urban wild" character while providing an exclusively native plant palette that would provide a richer and more diverse habitat for area wildlife and pollinators.

Method: On-site field data was gathered over the course of four site visits. A total of forty-eight square meters were surveyed, with twenty-four square meters in each the park and the undeveloped rail line. Taking measurements at both the park and the undeveloped rail line provided a means to compare the designed and "wild" plant communities.

On the undeveloped rail line we observed six, 2x2 meter plots for herbaceous species and six, 30' transects for woody species. In the Rail Park, we recorded species in plant beds in corresponding surface areas to the plots measured on the undeveloped rail line. Six, 30' transect studies were conducted in sections of the Rail Park with denser shrubs/tree cover. See Figure 6 for a map of the data points.

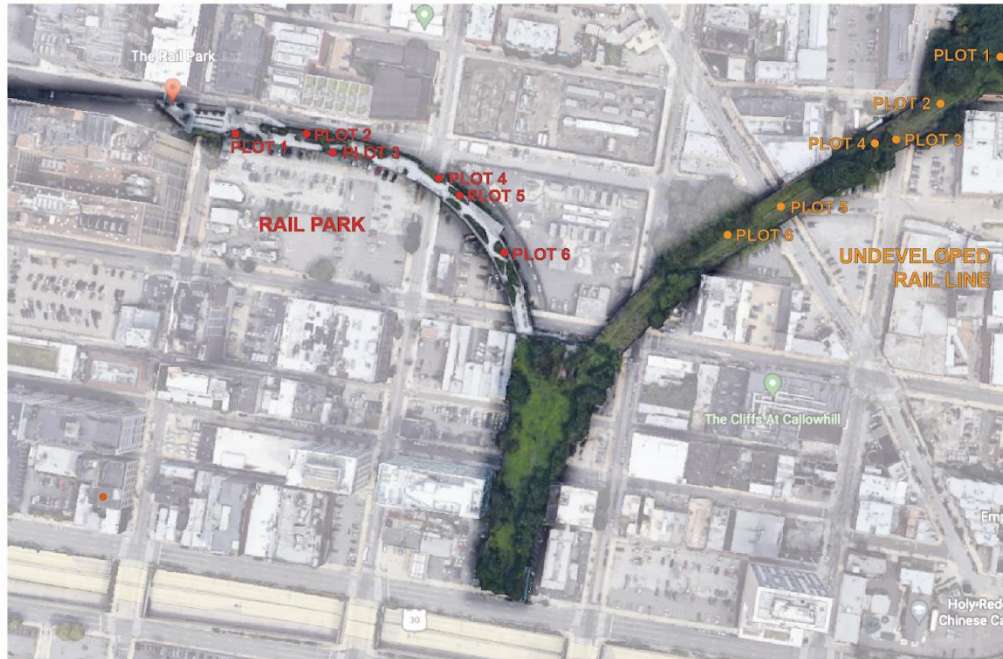


Figure 6: Aerial image of the Rail Park and undeveloped line with points showing the locations of vegetation assessment plots. Plot locations in the Rail Park Phase I are in red. Plot locations in the undeveloped viaduct are in orange.

Table 3: List of plant species observed and recorded at the Rail Park in Plots 1-6.

**Aesculus parviflora* and *Baptisia alba* are native to the southern regions of the United States and are not typically found in the mid-Atlantic region.

Scientific Name	Family	Acronym	Native?	C
<i>Aesculus parviflora</i>	Hippocastanaceae	n/a	non-native	0
<i>Aruncus dioicus</i>	Rosaceae	n/a	native	4
<i>Asclepias tuberosa</i>	Asclepiadaceae	n/a	native	3
<i>Baptisia alba</i>	Fabaceae	n/a	non-native	0
<i>Betula nigra</i>	Betulaceae	n/a	native	4
<i>Cercis canadensis</i>	Fabaceae	n/a	native	6
<i>Cornus racemosa</i>	Cornaceae	n/a	native	8
<i>Delphinium tricornis</i>	Ranunculaceae	n/a	native	7
<i>Deschampsia flexuosa</i>	Poaceae	n/a	native	4
<i>Itea virginica</i>	Grossulariaceae	n/a	native	7
<i>Platanus occidentalis</i>	Platanaceae	n/a	native	5
<i>Quercus imbricaria</i>	Fagaceae	n/a	native	6
<i>Rhus glabra</i>	Anacardiaceae	n/a	native	3
<i>Rhus typhina</i>	Anacardiaceae	n/a	native	2

Table 4 : List of plants observed and recorded on the undeveloped viaduct in Plots 1-6.

<i>Quercus bicolor</i>	Fagaceae	n/a	native	8
<i>Quercus rubra</i>	Fagaceae	n/a	native	6
<i>Rhus typhina</i>	Anacardiaceae	n/a	native	2
<i>Rubus phoenicolasius</i>	Rosaceae	n/a	non-native	0
<i>Solidago altissima</i>	Asteraceae	n/a	native	2
<i>Solidago canadensis</i>	Asteraceae	n/a	native	2
<i>Ulmus rubra</i>	Ulmaceae	n/a	native	4

» Species:

Scientific Name	Family	Acronym	Native?	C
<i>Artemisia vulgaris</i>	Asteraceae	n/a	non-native	0
<i>Asclepias syriaca</i>	Asclepiadaceae	n/a	native	1
<i>Celastrus orbiculatus</i>	Celastraceae	n/a	non-native	0
<i>Chamaecrista fasciculata</i>	Fabaceae	n/a	native	2
<i>Daucus carota</i>	Apiaceae	n/a	non-native	0
<i>Eupatorium hyssopifolium</i>	Asteraceae	n/a	native	1
<i>Juniperus virginiana</i>	Cupressaceae	n/a	native	3
<i>Liatris spicata</i>	Asteraceae	n/a	native	7
<i>Malus prunifolia</i>	Rosaceae	n/a	non-native	0
<i>Panicum virgatum</i>	Poaceae	n/a	native	4
<i>Parthenocissus quinquefolia</i>	Vitaceae	n/a	native	3
<i>Paulownia tomentosa</i>	Scrophulariaceae	n/a	non-native	0
<i>Petrorhagia prolifera</i>	Caryophyllaceae	n/a	non-native	0
<i>Platanus occidentalis</i>	Platanaceae	n/a	native	5
<i>Prunus maritima</i>	Rosaceae	n/a	native	7
<i>Prunus serotina</i>	Rosaceae	n/a	native	3

Calculations:

Method 1. The plant species from both the Rail Park and undeveloped line were analyzed using the Universal Floristic Quality Assessment tool. This analysis method uses *Coefficients of Conservatism (C)*, drawing from the Mid-Atlantic Coastal Plain database.

The (C) values are a number between 1-10 and are assigned to each plant species based on tolerance to degradation and faithfulness to remnant habitats. Introduced species have a coefficient of 0 while species >7 are associated with the least disturbance and <3 are the most anthropogenic. The mean C is the average C value for all species within an assessment area.

- The mean C of all the species on the Rail Park was 4.2 compared to the mean C of 2.6 on the undeveloped rail line.

Method 2. To account for species richness in addition to abundance, the Floristic Quality Index (FQI) is used. This calculation weighs mean C by species richness.

$$I = \bar{C}\sqrt{n},$$

Where $\bar{C}$ = mean C and n = species richness. The range for FQI categorizes values from 1-19 to be low habitat quality, 20-35 to be high quality, and greater than 35 to be exceptional quality.

See Appendix A for plant lists and Floristic Quality Assessment (FQA) data.

Sources:

Conversation with Marion Holmes on May 4, 2022.

“Universal FQA Calculator.” Universal FQA Calculator. Accessed October 20, 2022.
<https://universalfqa.org/>.

Freyman, William A., Linda A. Masters, and Stephen Packard. “The Universal Floristic Quality Assessment (FQA) Calculator: An Online Tool for Ecological Assessment and Monitoring.” *Methods in Ecology and Evolution* 7, no. 3 (2015): 380–83.
<https://doi.org/10.1111/2041-210x.12491>.

Lotze, Nate. “Floristic Quality Assessment.” Pennsylvania Land Trust Association, 2019.
<https://conservationtools.org/guides/33-floristic-quality-assessment>.

Limitations:

- Season that observations were made can limit which species were observed and recorded. The size of the sample plots also influences FQI, larger plots typically result in a higher mean C due to incorporating a wider range of species.
- Because FQA was created with regard to remnant native habitats, its place alongside habitat plantings, recreations, or other novel habitats is unclear. There is little guidance available for how comparisons of restorations vs. remnants should be made and interpreted (Spyreas, 2019). With that said, C values assignments have a degree of subjectivity and may be skewed to deliver higher values for advanced successional communities versus more disturbance-dependent communities.

Social Benefits

- ***Supports cross-group interaction, with 78% of 45 surveyed visitors reporting seeing people of different backgrounds interacting at the park in a 2022 survey. This is an increase from 2019, when 51% of 63 surveyed visitors reported seeing this type of interaction.***
- ***Provides an outdoor green space in which 32 surveyed nearby residents report feeling a sense of belonging (81%) and feeling welcome (94%) at the park.***
- ***Improves health and well-being according to 81% of 37 nearby residents surveyed. The number of surveyed residents reporting improved health and well-being increased by 22% from early in the project to the present day.***

Method: Our team conducted a follow-up, post-pandemic survey using an instrument developed and implemented in 2018-2019 by Penn State's Department of Recreation, Parks and Tourism Management. It was part of the *Reimagining the Civic Commons* initiative funded by the William Penn Foundation.

The Friends of the Rail Park reviewed the survey questions and determined which would be the most helpful to revisit in the 2022 follow-up survey instrument. Our survey instrument and flyer were translated into Mandarin and Spanish and distributed in-person as well as via social media, email, and with a QR code on flyers posted at The Rail Park.

Forty-five online and in-person surveys were collected between July-October 2022. Thirty-two area residents (n=32) and thirteen visitors who lived outside of the neighborhood boundary (n=13) completed the survey.

The area resident survey instrument consists of forty detailed questions and took resident residents approximately 15-30 minutes to complete. The visitor survey was shorter, consisting of twenty-five questions and taking 10-20 minutes to complete (see Appendix B).

Survey items pertained to the following:

- Visitor behaviors
- Use history
- Preferences
- Attitudes regarding the quality of the park
- Perceptions of belonging
- Health and wellbeing
- Social capital
- Trust
- Social interaction within the Rail Park
- Comparison of the landscape before and after construction
- Demographics

The research team used SPSS Statistics Version 27 and higher to calculate the statistical significance and effect sizes of the responses (see Tables 8-12).

Calculations:

The following calculations focused on statistical means of individuals responding to questions related to 1. “Social and cross-group interaction,” 2. “Personal ownership and sense of welcome,” 3. “Neighborhood ownership and community use,” 4. “Neighborhood Perceptions and sense of trust,” and 5. “Health and wellness.” See Appendix B for the full visitor and area resident survey instruments, the flyer with QR code, and data analysis.

1. Social and cross-group interactions

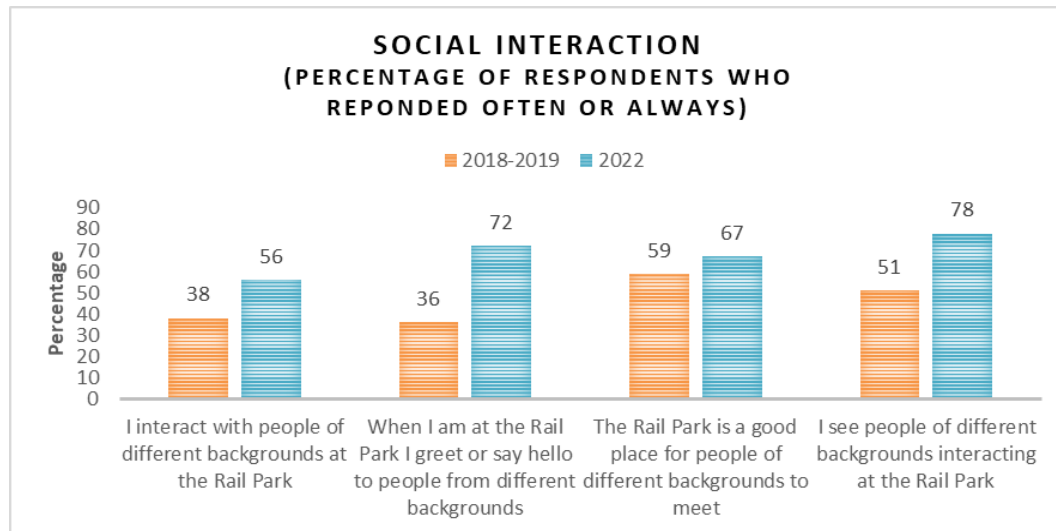


Figure 9: Bar chart of perceived social interactions at the park. The majority of respondents either responded with “often” or “always” with regard to social interaction. The data suggest that social cohesion has increased significantly since 2018-2019.

Social and cross-group Interactions	Mean (%) 2018-2019	Mean (%)* 2022	Standard Deviation 2022	p-value* 2022 (<0.05 = Null hypothesis is rejected)	Cohen's d* 2022	Cohen's d Interpretation Color Key: < 0.2 = minimal effect 0.2 = low effect 0.5 = moderate effect 0.8 = large effect
I interact with people of different backgrounds at the Rail Park	3.2 (38%)	3.63 (56%)	1.26	0.066	0.34	Lower effect or change since 2018-2019
When I am at the Rail Park, I greet or say hello to people from different backgrounds.	3.2 (36%)	3.78 (72%)	1.24	0.012	0.47	Moderate effect or change from 2018-2019
The Rail Park is a good place for people of different backgrounds to meet.	3.4 (59%)	4.09 (67%)	1.09	0.001	0.64	Moderate effect or change from 2018-2019
I see people of different backgrounds interacting at the Rail Park	3.3 (51%)	4.23 (78%)	1.08	0.00001	0.85	Large effect or change from 2018-2019

Table 8: Means, standard deviation, p-value, Cohen's d, and Cohen's d interpretation.

*P-value is used to indicate that there are significant differences between the data from 2022 and 2018-2019. Cohen's d indicates the size or amount of change (or effect) that has taken place from 2018-2019 to 2022.

The data suggest that moderate to large changes have taken place since the 2018-2019 surveys, indicating that the Rail Park is indeed providing a space for social cohesion and cross-group interaction.

2. Personal Ownership and Sense of Welcome

Personal Ownership and Sense of Welcome	Mean (%) 2019	Mean (%)* 2022	Standard Deviation 2022	p-value* 2022 (<0.05 = Null hypothesis is rejected)	Cohen's d* 2022	Cohen's d Interpretation – < 0.2 = minimal effect 0.2 = low effect 0.5 = moderate effect 0.8 = large effect
I feel a high degree of personal ownership for the Rail Park.	4.3 (37%)	5.59 (53%)	1.63	0.16	0.26	Low effect or change since 2018-2019
I sense that the Rail Park is mine.	4.3 (46%)	4.72 (47%)	1.68	0.89	0.03	Minimal effect or change since 2018-2019
The Rail Park is my park.	5.0 (65%)	4.34 (78%)	1.41	0.02	0.42	Low to moderate effect or change since 2018-2019
The Rail Park is for people like me.	5.4 (79%)	5.69 (86%)	1.40	0.26	0.21	Low effect or change since 2018-2019
I feel welcome at the Rail Park	6.1 (90%)	5.84 (94%)	1.08	0.19	0.24	Low effect or change since 2018-2019
I feel like I belong at the Rail Park	5.6 (77%)	5.74 (81%)	1.49	0.60	0.10	Minimal effect or change since 2018-2019

Table 9: Means, standard deviation, p-value, Cohen's d, and Cohen's d interpretation.

*P-value is used to indicate that there are significant differences between the data from 2022

and 2018-2019. Cohen's d indicates the size or amount of change (or effect) that has taken place from 2018-2019 to 2022.

The data suggests that in 2022, area residents felt a degree of personal ownership very similar to what they felt in 2018-2019. The data also indicates that there has been a slight increase in feeling that "the Rail Park is my park."

3. Neighborhood Ownership and Use

Community / Neighborhood Ownership and Use	Mean (%) 2018-2019	Mean (%) 2022	Standard Deviation 2022	p-value* 2022 (<0.05 = Null hypothesis is rejected)	Cohen's d* 2022	Cohen's d Interpretation Color Key: < 0.2 = minimal effect 0.2 = low effect 0.5 = moderate effect 0.8 = large effect
Our neighborhood feels a high degree of ownership for the Rail Park.	5.3 (70%)	5.0 (69%)	1.76	0.34	-0.17	Minimal effect or change since 2018-2019 (lower)
The Rail Park is our neighborhood park.	5.8 (87%)	5.97 (90%)	1.26	0.45	0.13	Minimal effect or change since 2018-2019
I sense that the Rail Park belongs to the local neighborhood.	5.7 (88%)	5.5 (78%)	1.54	0.47	-0.13	Minimal effect or change since 2018-2019 (lower)
People from the local neighborhood use the Rail Park for celebrations and events.	4.5 (52%)	5.13 (72%)	1.10	0.003	0.57	Moderate effect or change since 2018-2019
The Rail Park benefits the local neighborhood.	5.9 (92%)	6.09 (91%)	1.17	0.36	0.17	Minimal effect or change since 2018-2019

The Rail Park is a neighborhood meeting place.	5.15 (66%)	5.56 (84%)	1.19	0.06	0.35	Low effect or change since 2018-2019
The Rail Park is a very important part of this neighborhood.	5.8 (91%)	6.19 (91%)	1.18	0.07	0.33	Low effect or change since 2018-2019

Table 10: Means, standard deviation, p-value, Cohen's d, and Cohen's d interpretation.

*P-value is used to indicate that there are significant differences between the data from 2022 and 2018-2019. Cohen's d indicates the size of the effect between 2018-2019 to 2022.

The data suggests that in 2022 area residents felt a sense of neighborhood ownership similar to what they felt in 2018-2019, believing that "the Rail Park is their neighborhood park." The data indicates that there has been a moderate increase in feeling that "people from the local neighborhood use the Rail Park for celebrations and events."

It is important to note that The Friends of the Rail Park has played a significant role in providing numerous programs and events that create additional structured and unstructured opportunities for social and cross-group interactions, ultimately fostering social cohesion. These include events such as the "Summer Sunset" music series, block parties, clean-up and park stewardship events, "Final Fridays", "Spanish Yoga", plant swaps, and Chinese Lunar New Year celebrations.

4. Neighborhood perceptions and trust

Neighborhood Perceptions and Trust	Mean (%) 2018-2019	Mean (%) 2022	Standard Deviation 2022	p-value* 2022 (<0.05 = Null hypothesis is rejected)	Cohen's d* 2022	Cohen's d Interpretation Color Key: < 0.2 = minimal effect 0.2 = low effect 0.5 = moderate effect 0.8 = large effect
I'm starting to see a lot of good things happening in this neighborhood.	4.10 (84%)	3.75 (56%)	0.98	0.05	-0.36	Low effect or change since 2018-2019 (lower)

This neighborhood is heading in the right direction.	4.2 (89%)	3.84 (65%)	0.88	0.03	-0.40	Low to moderate effect or change since 2018-2019 (lower)
I feel optimistic about the future of this neighborhood.	4.3 (92%)	3.91 (75%)	0.89	0.02	-0.44	Low to moderate effect or change since 2018-2019 (lower)
I feel I can trust the people who live in my neighborhood.	3.6 (68%)	3.66 (53%)	0.87	0.71	0.07	Low to no effect or change since 2018-2019
I feel I can trust the managers of the Rail Park	3.9 (76%)	3.59 (56%)	0.95	0.08	-0.32	Low to moderate effect or change since 2018-2019 (lower)
I feel I can trust the police.	3.6 (66%)	2.72 (34%)	1.32	0.001	-0.67	Moderate to large effect or change since 2018-2019 (lower)
I feel like I can trust the local government.	3.4 (51%)	2.56 (15%)	0.98	0.00001	-0.85	Large effect or change since 2018-2019 (lower)

Table 11: Means, standard deviation, p-value, Cohen's d, and Cohen's d interpretation.

*P-value is used to indicate that there are significant differences between the data from 2022 and 2018-2019. Cohen's d indicates the size of the effect between 2018-2019 to 2022.

The data suggests that in 2022 area residents felt significantly more mistrust relative to those who responded in 2018-2019. In part, the data indicates that there has been a notable decline in trust in the local government and in the local police. Additionally, area residents are feeling less optimistic about the future and direction of the neighborhood than they did just three or four years ago.

1. Health and Wellness

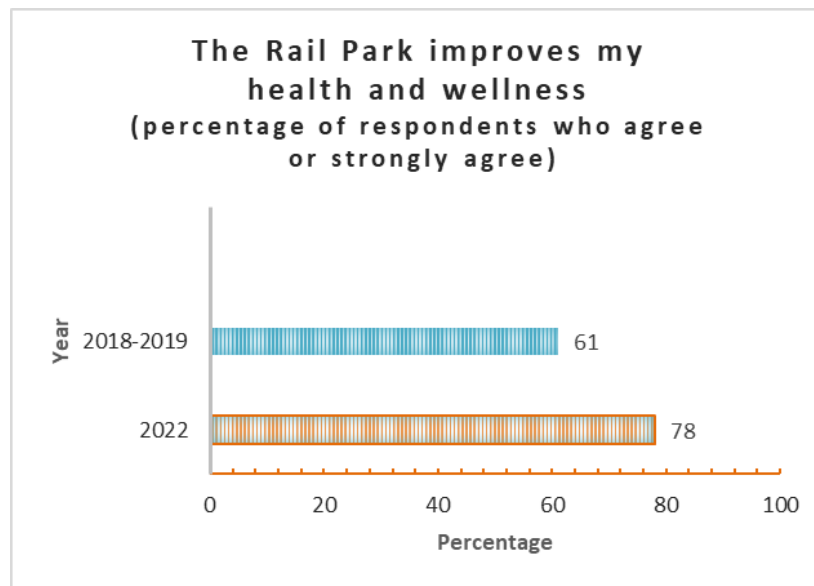


Figure 10: The sense of “health and wellness” felt by visitors and area residents increased 17% from 2019 to 2022 based on data provided by the forty-five survey respondents.

Health and Wellness	Mean (%) 2018-2019 (n=420)	Mean (%) 2022 (n=45)	Standard Deviation 2022	p-value* 2022 (<0.05 = Null hypothesis is rejected)	Cohen's d* 2022	Cohen's d Interpretation Color Key: < 0.2 = minimal effect 0.2 = low effect 0.5 = moderate effect 0.8 = large effect
The Rail Park improves my health and wellness.	3.7 (61%)	4.2 (78%)	0.84	0.0001	0.59	Moderate effect or change since 2018-2019

Table 12: Means, standard deviation, p-value, Cohen's d, and Cohen's d interpretation.

*P-value is used to indicate that there are significant differences between the data from 2022 and 2018-2019. Cohen's d indicates the size of the effect between 2018-2019 to 2022.

The data suggests that in 2022 a larger percentage of visitors *and* area residents found that the Rail Park improved their health and wellness than did those who responded in 2018-2019.

Open-ended question (n=45, visitors (n=13) and area residents' (n=32) responses):

In your opinion, what has been the impact of the Rail Park for yourself, your family, or for the local community?

Comments related to health, well-being, and recreation:

“... It's a nice place to clear my mind.”

“... It has been good for my mental health bc it gets me outside, allows me to relax and be mindful, when the pandemic hit this Park was my saving grace!”

“... An excellent place to walk and relax near our apartment. It's beautiful and I always enjoy it here. I just wish it were longer.”

“... A great place to take a walk any time of day.”

“... Green space mental need.”

“... It's quiet and a lovely place to relax.”

“... Relaxing”

“... cool place to hang out”

“... The Rail Park is one of the few public spaces near my home where I can sit and relax. The only alternatives are local businesses or parks that are too far away to walk to regularly.”

“... It's tough to say. My impression is that everyone loves it, and has been incredibly eager to see it expand. So there's been frustration and a loss of enthusiasm as it feels like expansion plans haven't moved (yes, I know the pandemic messed some things up). But it's so small right now. I see it used more as a relaxation place for individuals, dog walkers, and people reading or eating lunch, than I do for groups of people meeting up. It is beautiful and meditative and I think it contributes greatly to the mental well-being of the community. It COULD contribute to the physical well-being if it were longer. But as it is, you go there and either just walk through it in 3-4 minutes, or sit down.”

Comments related to green space, open space, vegetation, and nature:

“... Good place to be in nature in a neighborhood that severely lacks green space.”

“... preserving open space”

“... an outdoor space”

“... It's been a positive place to sit outside since we are in the city”

“... I love having a calm green space near my home. It feels like an escape from the city. Because of the tall greens, I feel like I am surrounded.”

“... Planted areas need more maintenance”

“... Philly has an unfortunate lack of high quality, safe, and well-maintained public spaces outside of the heart of the CBD. This park is the rare exception, and it is absolutely critical. There aren't other high quality spaces like it nearby.”

Comments related to social cohesion and dogs:

“... It was a massive help during the pandemic, providing an open space to see other people.”

“... It's beautiful, but I can't say that the community is involved here at all.”

“... Having just gotten a dog the Thanksgiving before, we quickly were able to make friends and connections with people in the immediate neighborhood at a time when we weren't seeing many if any of our traditional circles.”

“... Met a lot of dogs here. I wish it was longer and maybe had a dog park?”

“... A safe place for my dog to explore and to sit in the sun!”

“... a somewhat nice space to walk our dog and see neighbors”

Comments related to signage:

“... Signage/directions to Callowhill entrance is required.”

Comments related to safety:

“... Used to be a good place to meet others from the neighborhood over the past year people do not feel safe thus it's no longer a good meeting spot.”

“... It gives the community a place to be outdoors and be safely.”

Comments related to programming:

“... our friend Ava works for the Rail Park and I love the programming she brings here (musical performances)”

Comments related impact on the neighborhood and aesthetics:

“... Great for the neighborhood.”

“... proud”

“... It's still very small, but it represents an optimism about the future of the neighborhood.”

“... Very positive impact, it has become a central focal point of this area”

“... The Rail Park has been used as a means to take over our neighborhood and force us to pay a tax to support it. The neighbors organized and defeated CNA and then Arts and Crafts. Let Paul Levy pay for his pet project himself and leave us alone.”

“... I think it might be an addition to beautifying the neighborhood.”

“... I really, really like it and its minimalist aesthetic, but there's not a lot of comfortable seating. The big swings look nice, but are so big that everyone's legs dangle off and did no one anticipate how the materials would wear and tear? Because now all the swings squeak, clip, and grind as they move, so no one actually swings on them. The rest of the park has no other seating with back support--just benches or kind of awkwardly-shaped and angled (I don't know what to call them) ramps? Really, go there and try to find a place to sit and fully relax and sink into the seating for a long reading session or talk with someone. You can't really do that. So in the next sections, better seating would be really appreciated and maybe even tables and chairs. I would love to get my coffee at a nearby coffee shop and then meet a friend at a table in the rail park to talk.”

“... It is an excellent use of the space, is clean, not crowded, and has great aesthetics”

“... The impact has been very good. A pleasant Walkway for people living in the area.”

Sources:

Mowen, Andrew and Samantha L. Powers. “A Systematic Evaluation of the Rail Park: a full report of post-opening study results,” State College, PA: Penn State University, Department of Recreation, Park and Tourism Management, 2020.

Powers, Samantha L., Alan R. Graefe, Jacob A. Benfield, Benjamin Hickerson, Birgitta L. Baker, Lauren E. Mullenbach & Andrew J. Mowen. 2022. “Exploring the conditions that promote intergroup contact at urban parks,” *Journal of Leisure Research*, 53:3, 426-449. DOI: 10.1080/00222216.2021.1910089

Limitations: The sample size of survey respondents (n=45) for 2022 is smaller than that of the 2018-2019 Penn State area resident study (n=63.) In addition, it appears that few respondents (n=1 or 2) took the 2022 survey that historically had been concerned about “green gentrification” and cultural displacement resulting from the presence of the Rail Park. There were no respondents (n=0) to the survey instrument translated into both Mandarin and Spanish. Lastly, the length of the survey instrument (six pages for the visitor survey, twelve pages for the area resident survey) most likely played a role in smaller sample size.

- ***Increases access to public green space within a 10-minute walk (0.5 mile) for the neighborhood's 8,634 residents by 3,005 sf per 1000 residents.***
- ***Increases park access for Asian residents. 22% of Asian residents in the neighborhoods surrounding the Rail Park have access to a park within a 10-minute walk, while only 7.8% of Asian residents of Philadelphia as a whole have access to a park within a 10-minute walk.***

Method: The Trust for Public Land's *ParkServe* database and mapping app called *ParkReviewer* creates a 10-minute walkable service area using a nationwide walkable road network dataset provided by ESRI. Using park boundaries, *ParkReviewer* determines the 10-minute walkable service area and calculates several demographic variables, including race/ethnicity, age, and income, and a report with the data in tables and graphs. Population statistics are based on ESRI 2021 US Census Demographic Forecast Block Group data.

Calculations:

According to ESRI 2021 U.S. demographic estimates census data mapped in the Trust for Public Land's *ParkServe* database, The Rail Park Phase I serves a local and growing population of approximately 8,634 people, the majority between ages 20 to 64. 62% of the neighborhood residents are people of color. 37% are white. Household incomes are split nearly evenly between those with low, middle, and high incomes.

The neighborhood that The Rail Park serves lacked any public green space within a 10-minute walk (0.5 mile.) The development of The Rail Park Phase I introduced access to public green space within a ten-minute walk (0.5 mile) for the neighborhood's 8,634 residents. The Rail Park is 0.60 acres, which increased the park acreage per 1000 residents from 0 to 0.07 acres or 3,005 square feet, the equivalent of a typical four to five-bedroom single family home.

Approximate park acreage	Total population served	Approximate park acreage per 1000 residents
Philadelphia: 10,200.00	1,587,882	6.4 acres (=10,200/157,882 * 1000) (=6.4 * 43560 = 278,784 sq ft)
The Rail Park: 0.60	8,634	0.07 acres (=0.60/ 8,634 * 1000) (=0.07 * 43560 = 3,005.64 sq ft)

Table 13: Park acreage in Philadelphia relative to the neighborhood surrounding The Rail Park Phase 1.

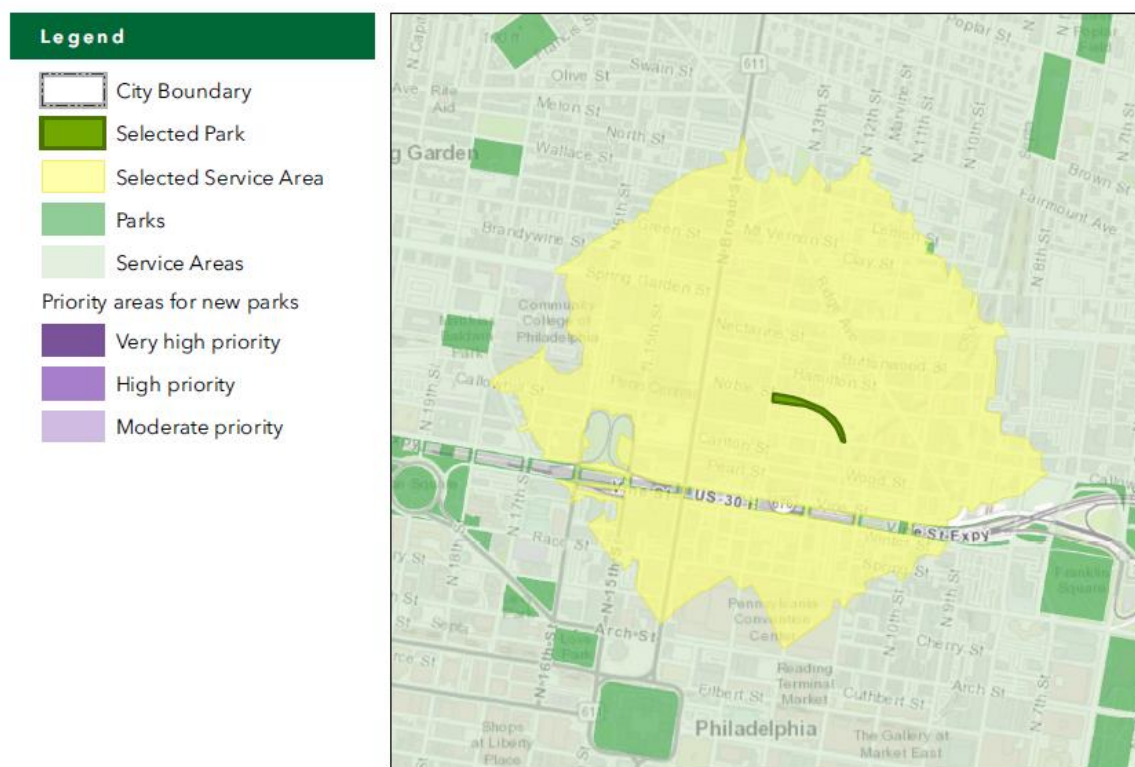


Figure 11: Parkserve map of the 10-minute walkable service area (yellow with a green boundary line) around The Rail Park.

Access to public green space for Asian populations in the neighborhood surrounding The Rail Park were compared to Asian populations in the City of Philadelphia that have access to parks within a 10-minute walk. These calculations used the ESRI 2021 US Census Demographic Forecast Block Group data in the Trust for Public Land's *ParkServe* database.

Number of people who live within a 10-minute walk of a park	Number (%) of Asian residents that live within a 10-minute walk of a park
In Philadelphia: 1,504,143	116, 803 (7.8%)
The Rail Park: 8,643	1,924 (22%)

Table 14: Total number of people and total number (%) of Asian residents in Philadelphia that live within a 10-minute walk to a park relative to the number of residents and Asian residents in the neighborhood surrounding The Rail Park Phase 1. This is an increase of 22% for the nearby Asian resident, providing access to park space to an historically underserved population.

Source:

Trust for Public Land *ParkServe* database. Accessed August 2022.
<https://www.tpl.org/parkserve/about>

Limitations: Calculations were performed using estimates from the ESRI 2021 US Census Demographic Forecast Block Group data. The data may be incomplete. In particular, it seems likely to omit people of lower economic status and to inaccurately reflect the incomes of those who participate in informal economies, and/or those whose wages are not fully reported.

Economic Benefits

- ***Contributed to a 238% increase in mean assessed property value of structures within a quarter mile of the Rail Park from 2015 to 2022.***

Background: The redevelopment of the Viaduct began in 2011 as political support, funding, news coverage, and public meetings began. The real estate market may have begun to shift in 2011 in response to plans for development of The Rail Park Phase I.

Method: Data was retrieved from the City of Philadelphia's *Atlas Property App* and Open Data Philly to gather information about a property's address, sales history, and value over time. Market value data from 2015, three years prior to the park's completion, was compared with 2022 market values. Inflation was accounted for by multiplying 2015 values by 1.25 per the "cumulative price change" of 25.02% between 2015 and 2022.

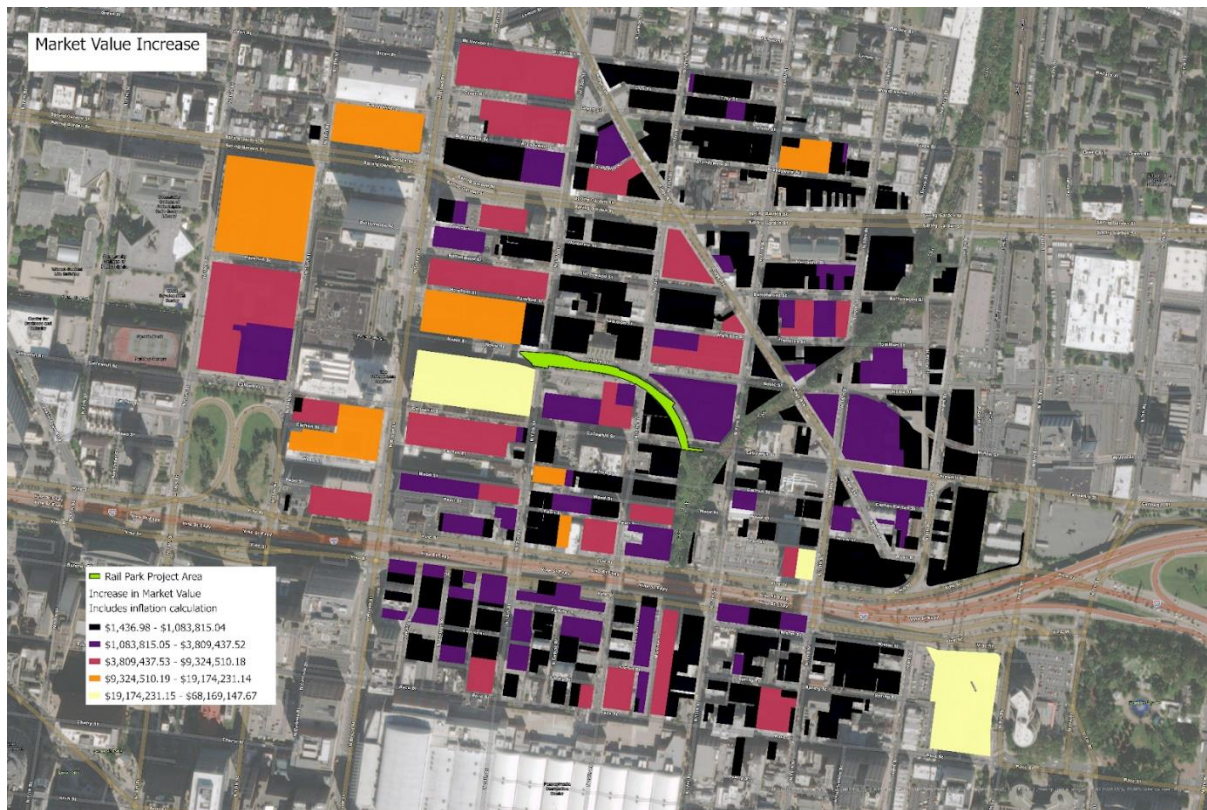


Figure 12: Map showing the Market Value increase surrounding a 0.25 mile of the Rail Park.

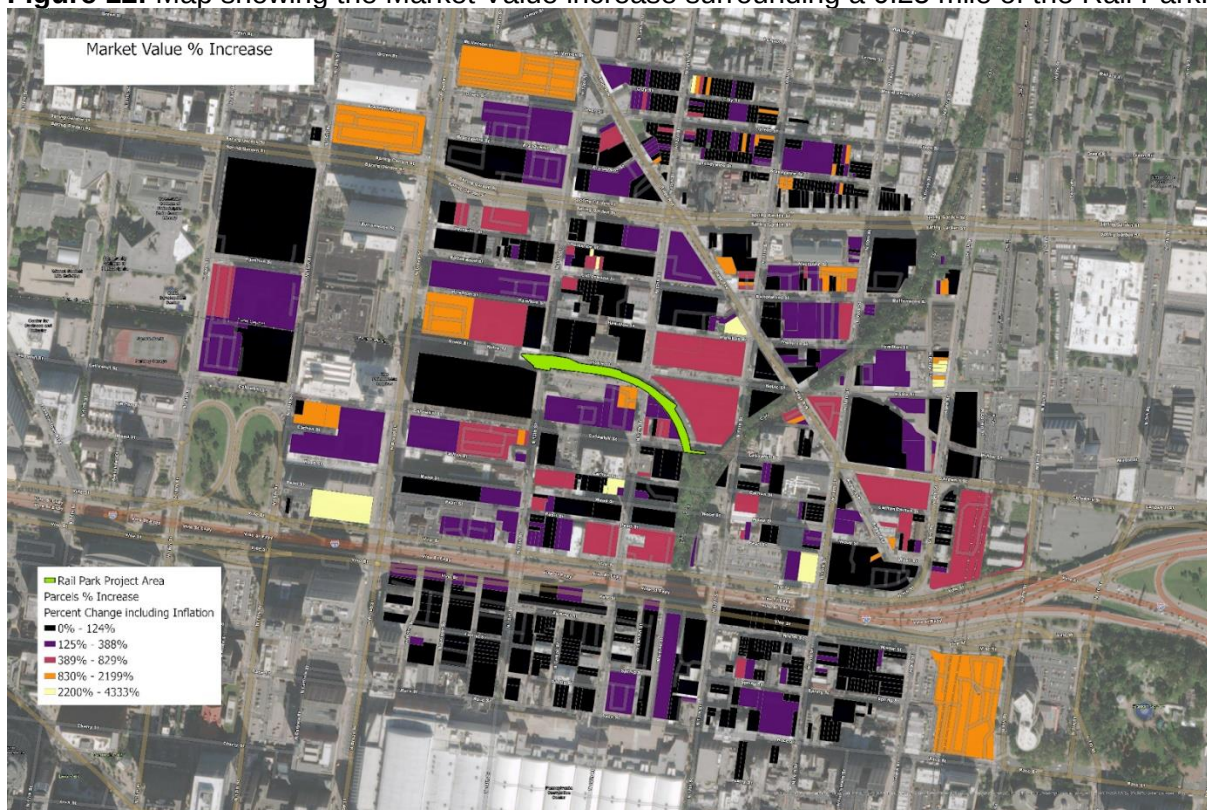


Figure 13: Map showing the percent increase in market value surrounding 0.25 mile of the Rail Park.

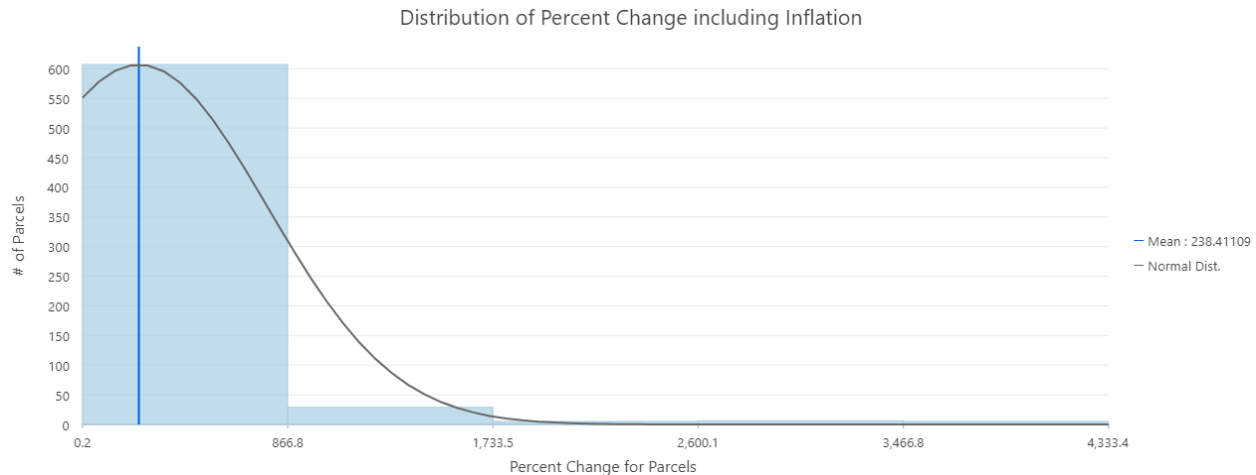


Figure 14: Graph indicating the distribution of percent change for parcels after accounting for inflation.

Sources:

Property Value Study: <https://property.phila.gov/>

Official Data Inflation Calculator. Accessed August 2022.
<https://www.officialdata.org/us/inflation/2015?amount=10>

Census tract 376 <https://censusreporter.org/profiles/14000US42101037600-census-tract-376-philadelphia-pa/>

Strategic Economics. "Philadelphia Rail Park Property Value Impact Study, Final Report," Philadelphia, PA: Philadelphia Chinatown Development Corporation, July 2020.

Limitations:

- This method does not account for other market factors that could impact property values around the Rail Park.
- Real estate appraisals and tax data are available from 2015 to 2022.
- Does not include decrease in property values.
- ***Supports at least 5 businesses and community organizations within a half-mile of the Rail Park who reported that the Rail Park has played a role in business decisions and positively impacted their customers. The park has served as a catalyst for the establishment of at 3 three new businesses within a quarter-mile radius of the park.***

Background: Economic benefits were evaluated using a business and organization impact survey. One of the significant challenges indicated by the Chinatown Development Corporation is the potential displacement and "green gentrification" resulting from Rail Park's presence. However, they noted that they have found partnering with the Friends of the Rail Park helpful

since it affirms their cultural identity and provides engaging and inclusive programming as well as open space for all.

Method: Interviewed businesses and organizations (n=11) located within a quarter-mile radius from both the Noble Street entrance and the Callowhill Street entrance to the park. The business survey asked five questions:

1. When was your business established?
2. If your business was established after 2018, did the Rail Park have something to do with your decision to open your business?
3. If your business was established prior to 2018, do you think the Rail Park had a positive, negative or no impact on your business?
4. Do you think the proximity of your business to the Rail Park has had any impact on your business? If so please describe:
5. What is your relationship to the business?

Calculations:

Eleven of the eighteen businesses and community organizations that were contacted responded to the survey via email. Eight were from businesses and five were from non-profit organizations generating a 61% response rate.

- Five (or 45%) of the businesses and community organizations that responded cited that the Rail Park has played a role in business decisions and has positively impacted their customers.
- Businesses located east and northeast of the park have seen little to no direct impact from the construction of The Rail Park, but these businesses and organizations stated that they are looking forward to the development of The Viaduct - Phase 2.
- Organizations noted that they enjoy partnering with The Friends of the Rail Park.
- Business and community organizations most positively impacted by the Rail Park include coffee shops, breweries, and a local homeless shelter, the Sunday Breakfast Rescue Mission.
 - The Volunteer and Community Relations Manager for the Sunday Breakfast Rescue Mission stated that *“The Rail Park has had a positive and welcoming impact on our guests. We even use The Rail Park in the spiritual care of our guests by taking them on field trips to The Rail Park to enjoy being outside, do devotionals, and build relationships. The fact that The Rail Park is intentional in using inclusive styles of benches, etc that do not intend to force the homeless out allows our guests to feel comfortable and cared for in their community.”*

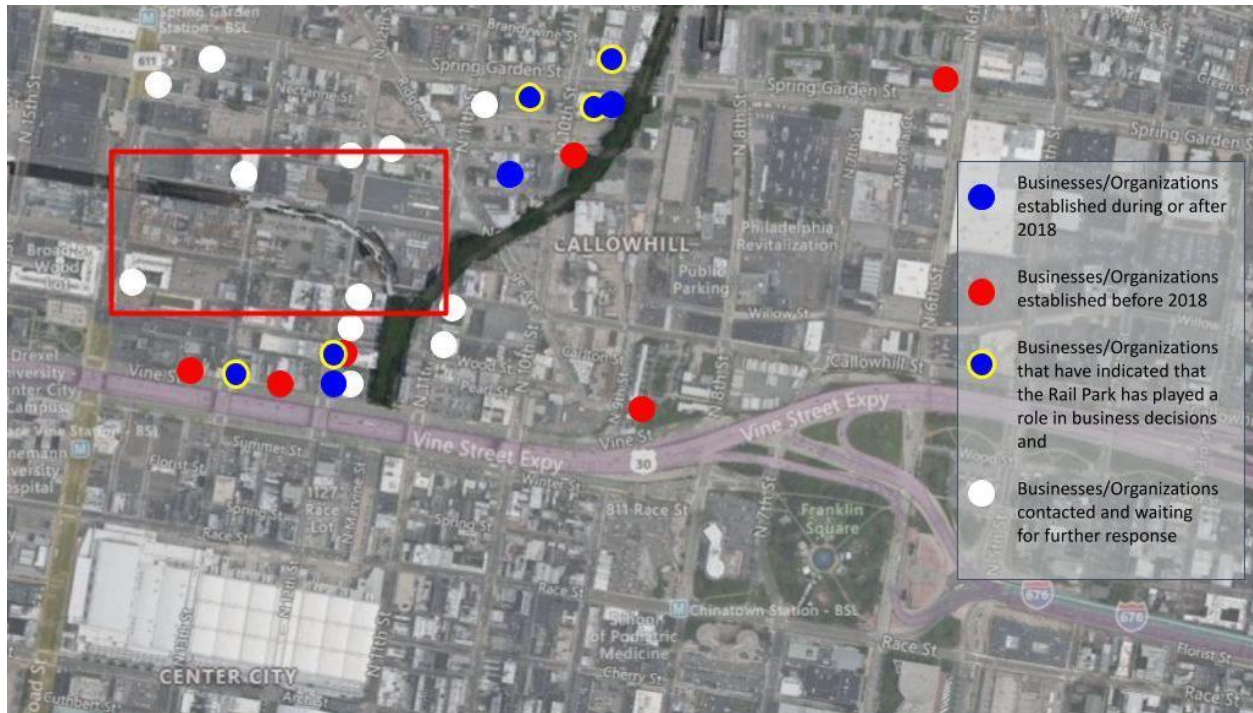


Figure 15: Locations of businesses and organizations (red, blue, blue and yellow, and white dots) that either completed the Business Impact Survey or were contacted by our research team. The Rail Park Phase I is located within the red rectangle. Businesses and organizations (in blue and yellow dots) noted that the Rail Park has played a role in their decision making processes and has had a positive impact on their users.

Sources:

Data from local businesses and organizations was collected with the Friends of the Rail Park's assistance.

Limitations:

- There were fewer responses than desired to either the online or in-person surveys, particularly by businesses and organizations located within a 0.25 mile radius of the Rail Park. Several business owners cited that they were short staffed and unable to complete the survey.

Inconclusive Benefit

- ***Reduces average surface temperature by 0.30°C relative to the surface temperature of the adjacent street and by 1.67°C relative to the undeveloped rail line compared to the adjacent street.***

Background: According to the Philadelphia Heat Vulnerability Index, the Rail Park case study area falls into a section of the city that is 1.7 degrees warmer than the average city temperature. This can be attributed to the high density of dark, paved surfaces that contribute to the Urban Heat Island (UHI) effect.

The Rail Park was designed with features intended to mitigate this effect, such as large shade-casting trees, densely vegetated beds, and high albedo surfaces. A 2020 Drexel Engineers without Borders study that took place over three days in July found that compared to a control block, the Rail Park only did not offer significant day time temperature reductions and had an average night time reduction of 1.11 C°. This case study seeks to add additional comparable data to further understand the effect of the Rail Park temperatures.

Method: According to the manufacturer, the FLIR Thermal imaging camera captures surface temperatures between -4°F — 248°F with $\pm 3^{\circ}\text{C}$ or $\pm 5\%$, typical Percent of the difference between ambient and surface temperature. It is designed to be compatible with Apple smartphones and iPads.

The rail park is composed of a variety of vegetation types and densities, high-albedo paving materials, varied path and plant bed widths, and differences in elevation. In order to account for the different structural elements of the park, thermal image readings will be taken from 2 distinct zones. Control readings will be taken from a surface level block of Callowhill street. Readings will be taken during the last week of July, since it is typically the hottest week in Philadelphia and would therefore be more likely to show the highest difference in UHI effect. Readings will be taken at 12:00PM, 4:00pm, and 8:00PM.

For daytime readings, surface temperatures are recorded in both sun and shade for each region and recorded alongside reported temperatures from the local weather station. Evening readings are taken from paved areas and planting beds.

- FLIR camera and attached smart device are placed 7' above ground angled towards the ground.
- Using the measurement tool on the FLIR app screen, select a point in the middle of the pavement. This will give a pavement temperature reading.
- Repeat the prior steps with the camera angled to a shaded area in the same study zone.



Figure 4: Aerial image of the Rail Park and undeveloped viaduct with the site locations of thermal imaging readings. Images were taken in both shade and sun and at the ground level on Callowhill Street.

Calculations:

Calculation information forthcoming

Sources:

Philadelphia Heat Vulnerability Index

<https://phl.maps.arcgis.com/apps/webappviewer/index.html?id=9ef74cdc0c83455c9df031c868083efd>

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Drexel Engineers without Borders Study

Limitations:

- Surface temperatures may vary from ambient air temperatures.

- The Rail Park's various surface materials, the undeveloped rail line, and surrounding streetscapes hold heat at different rates and may not be accurate as 1:1 comparisons

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Appendix A -
i-Tree Eco V6 - Ecosystems Report
Floristic Quality Assessment data and analysis

Appendix B -
Survey instrument, statistical analyses, and survey flyer

Appendix C -
Trust for Public Land's ParkServe reports for the Rail Park and High Line

