



City of Saint Paul

Urban Canopy Assessment 2011

**Saint Paul, Minnesota
Urban Canopy Assessment
2011**

Prepared by the Saint Paul Department of Parks and Recreation-Forestry Unit

Land Cover Classification Data provided by the University of Minnesota Remote Sensing and
Geospatial Analysis Laboratory

Atlas prepared by Zachary Jorgensen



The Most Livable
City in America



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Saint Paul's Urban Forest

Urban forests provide a broad range of environmental, economic, and social benefits as an integral part of Saint Paul's green infrastructure network. These benefits improve the quality of life within the urban environment by reducing stormwater runoff, improving air quality, mitigating the urban heat island effect, conserving energy, and increasing property values while providing access to nature and improving the experiential vitality and aesthetic richness of Saint Paul. An urban canopy assessment was conducted to map the spatial distribution and extent of Saint Paul's existing (Existing UTC) and possible tree cover (Possible UTC) in order to establish a city wide canopy goal that outlines preferable canopy increases and guides management strategies that will enhance the extent and benefits provided by the urban canopy.

Results reveal that in 2009 Saint Paul had an existing canopy cover of 32.5% or 11,680 acres of tree cover. A possible addition of 22.6%, or 8,200 acres, of tree cover is achievable on land currently identified as existing low vegetation or bare soils, increasing the total possible canopy cover of Saint Paul to 55%. Impervious surfaces account for an additional 8,500 acres, or 24% of city land area, where moderate levels of additional tree cover could be established. Residential property, with a canopy cover of 39%, is the single largest land use in Saint Paul containing 47% of current canopy cover and providing the most significant opportunity for canopy growth. Public lands account for 46% of city tree cover including parks, with a canopy cover of 54%, and the public right of way, with a canopy cover of 36%. The remaining 7% of existing canopy cover is distributed across commercial, state and municipal, and industrial land.

This assessment is the first comprehensive map of Saint Paul's urban tree canopy and provides a baseline data set for the establishment of a city wide canopy goal. The data also serves as a reference for subsequent assessments allowing Forestry to track changes in urban tree cover while providing valuable information for forest management and public outreach at a time when dramatic changes to Saint Paul's urban forest are likely due to the discovery of emerald ash borer in 2009.

Saint Paul's Urban Forest

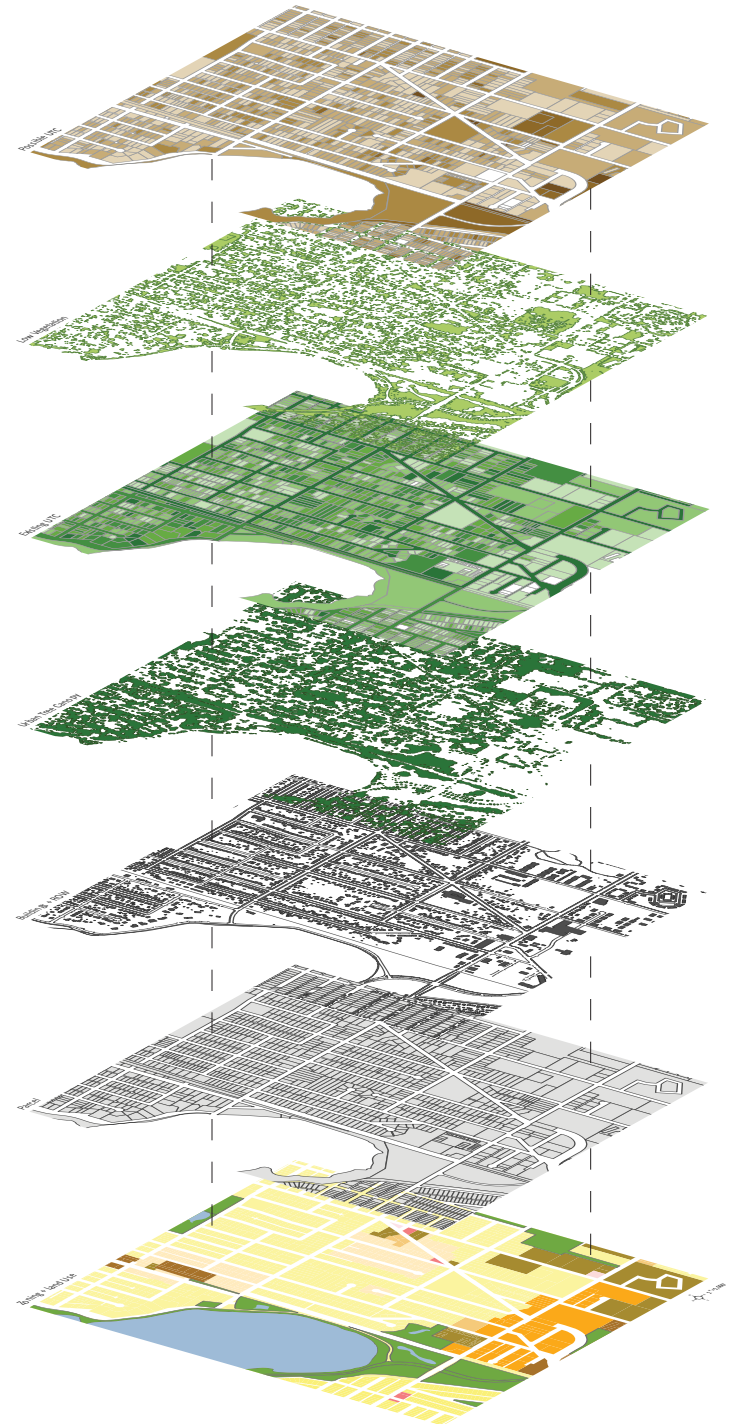
Saint Paul's urban canopy cover was determined using land cover data created by the University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory. Satellite imagery and LiDAR generated elevation data collected in 2009 were analyzed to classify land cover and map the distribution of existing tree cover, low vegetation, bare soils, water, building structures, and impervious surface.

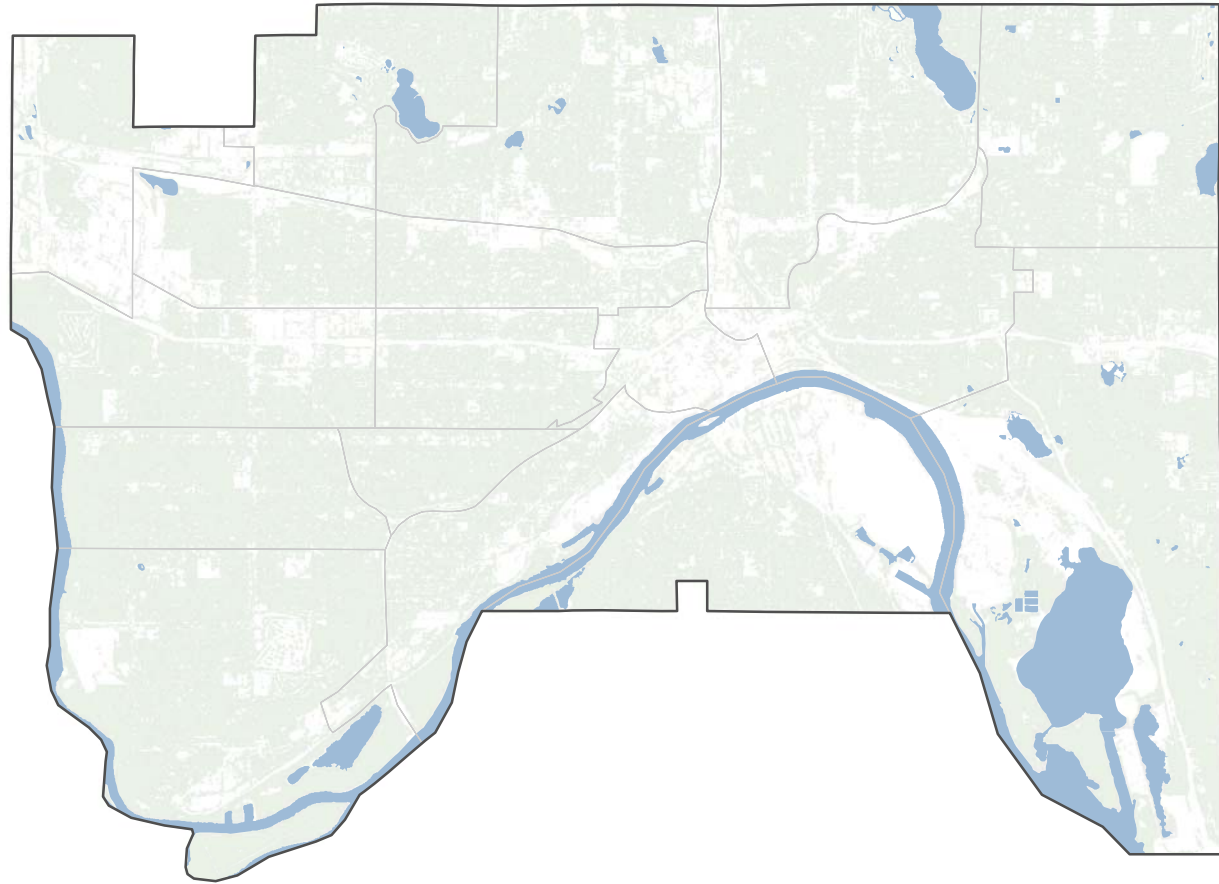
The resulting land cover data was used to analyze city tree cover through detailed mapping overlays of existing tree canopy classified by council ward, planning district, individual parcel, and zoning use giving additional attention to the amount of tree cover on commercial, industrial, residential, and park lands. Further analysis at the zoning and land use scale was conducted to better understand the necessary balance of public and private planting initiatives based on ownership patterns and assess the need for public/private partnerships and outreach to meet future canopy goals. The resulting maps provide canopy cover data across planning scales highlighting the areas where significant canopy cover levels exist as well as areas where additional tree cover is possible, outlining achievable canopy increases within each ward, district, and land use type.

Understanding the spatial extent and distribution of the urban canopy will allow the City of Saint Paul to establish a canopy goal that considers research based canopy recommendations and examples from other municipalities while remaining contextually rooted in the city's current canopy coverage and management goals. This assessment provides information that can be used to plan targeted canopy management strategies including tree planting, maintenance, and outreach that will enable Saint Paul and its residents to maximize the amount of canopy cover and the green infrastructure benefits provided by the urban forest.

The next step involves the development of a canopy goal and determining preferable planting locations where canopy increases are desirable based on social, financial, and environmental considerations.

The canopy data used to generate this report was created by the University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory and was made possible through funding provided by the Minnesota Environment and Natural Resources Trust Fund. Maps are available to the public through GISmo, Saint Paul's online mapping service.

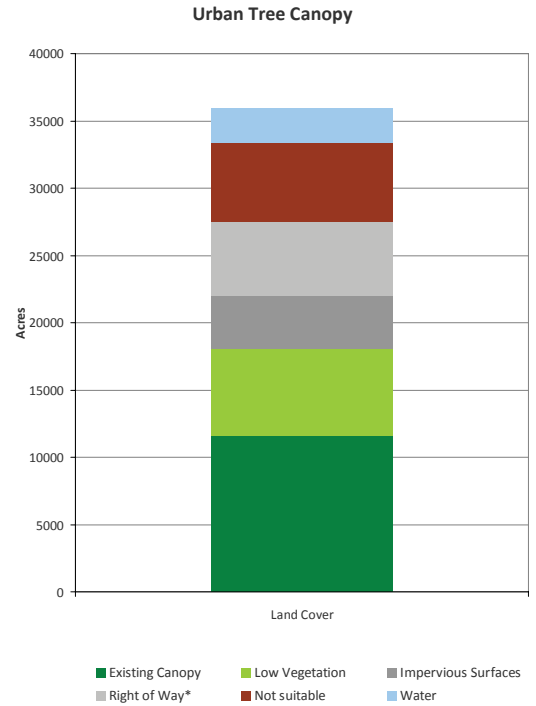




Saint Paul

City Land Cover Council Ward Planning District
Parcel Land Use/Zoning Parks Right of Way

City Level Analysis

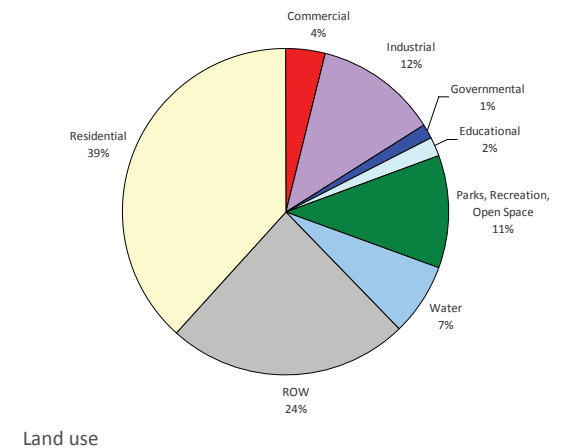


Land Cover Classification: Existing Canopy, Low Vegetation, + Impervious Surface are considered possible canopy. Right of Way land cover can also support increased tree canopy though not at 100%. Non-suitable land and water cannot support tree canopy.

Saint Paul Urban Tree Canopy

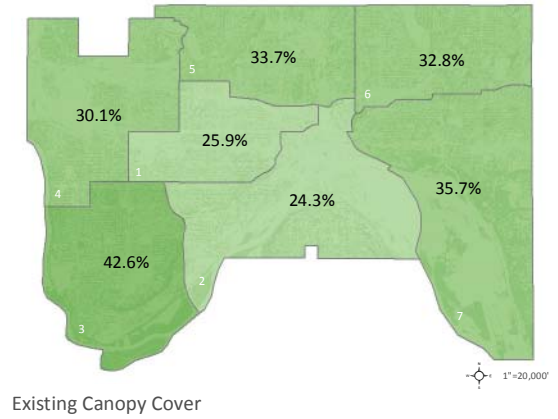
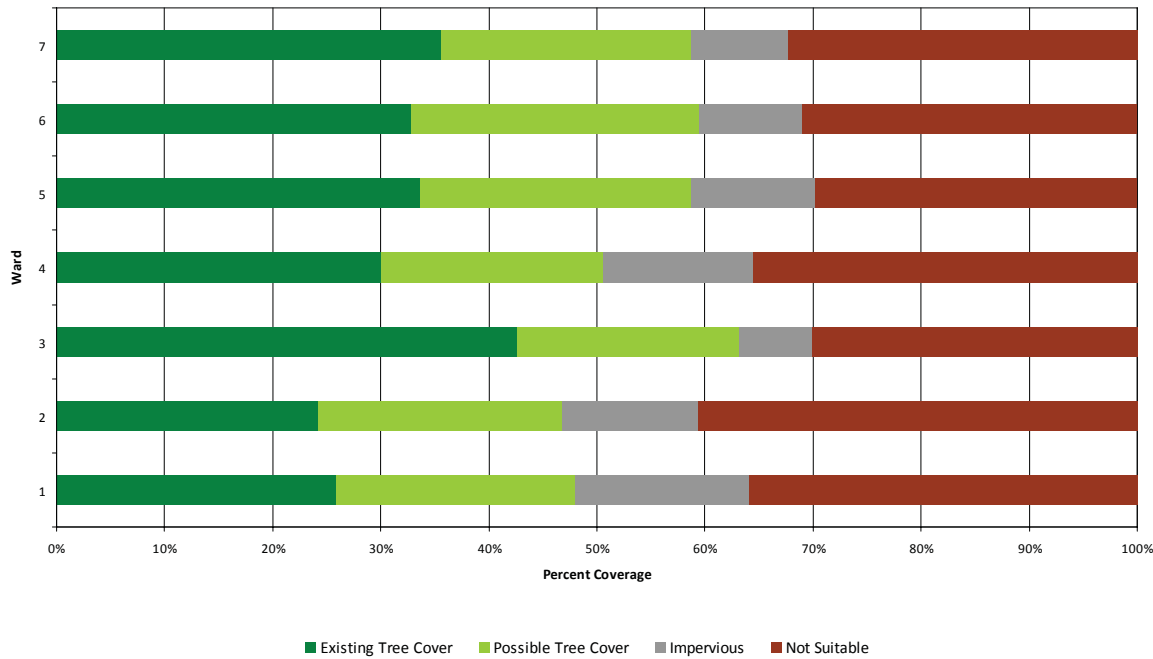
Analysis of satellite data collected in 2009 shows an estimated canopy cover of **32.5%** or approximately 11,680 acres of tree canopy in Saint Paul. An additional 8,100 acres of low vegetation have been identified where conditions would allow for a possible canopy cover increase of 22.8%. Further canopy increases are possible over impervious surfaces which account for 23.9% of land area with an additional 10.9% of possible canopy cover over private property impervious surface resulting in a total **possible canopy cover of 66.2%**. The remaining 33.8% of land area has been identified as non-suitable including buildings, streets, and water. Based on existing canopy cover, establishing **a canopy goal of 35% would require 900 acres of new trees (90,000 trees) and a canopy goal of 40% would require 2700 acres of new trees (270,000 trees).**

Chicago IL 17.2% / New York City NY 24% / Des Moines IA 27% / Minneapolis MN 31.5% / **Saint Paul 32.5%** / Washington DC 35% / Chattanooga TN 51.4%

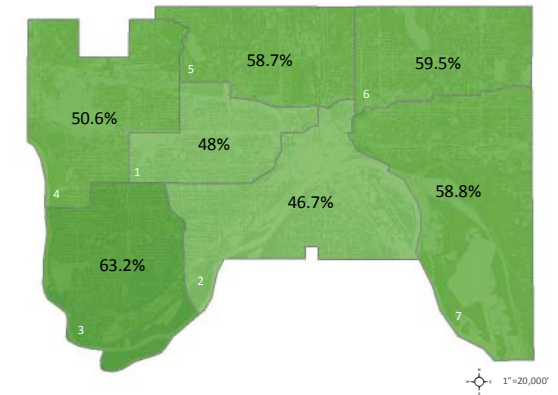


Ward Level Analysis

Council Ward Analysis: Existing and Possible Canopy Cover



Existing Canopy Cover



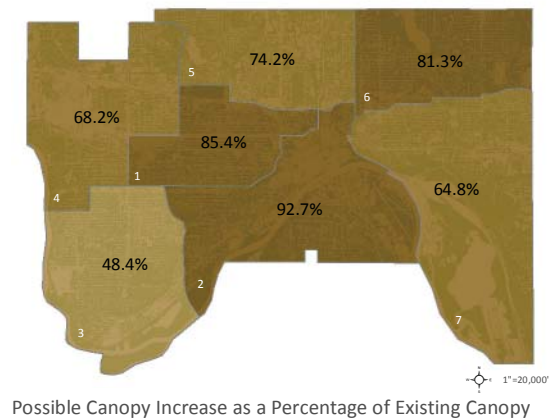
Possible Canopy Cover

Canopy Cover Classified by City Council Wards

Canopy cover within the Council Wards of Saint Paul ranges from **24.3%** in Ward 2 to **42.6%** in Ward 3 representing a difference of 18.3% between the highest and lowest coverage. Land use directly impacts canopy cover. While Ward 3 is primarily composed of residential neighborhoods amenable to tree planting Ward 2 includes the central business district and large areas of industrial land which limit canopy development. Canopy increases of 20%+ are achievable in each ward resulting in a **total canopy cover above 40% in each ward**, with the largest increase possible in Ward 2, increasing that ward's canopy coverage by 93%. Land use will influence future canopy development particularly in wards with a greater percentage of commercial and industrial land.

Trees to achieve 35%/40% canopy cover:

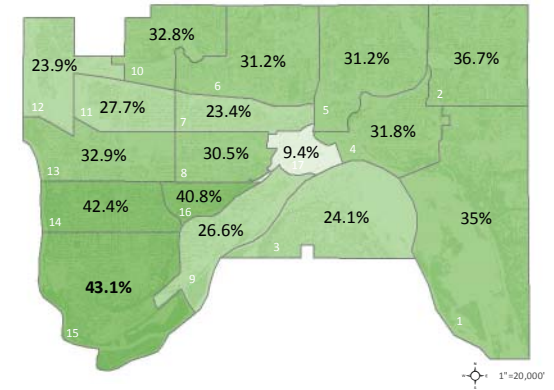
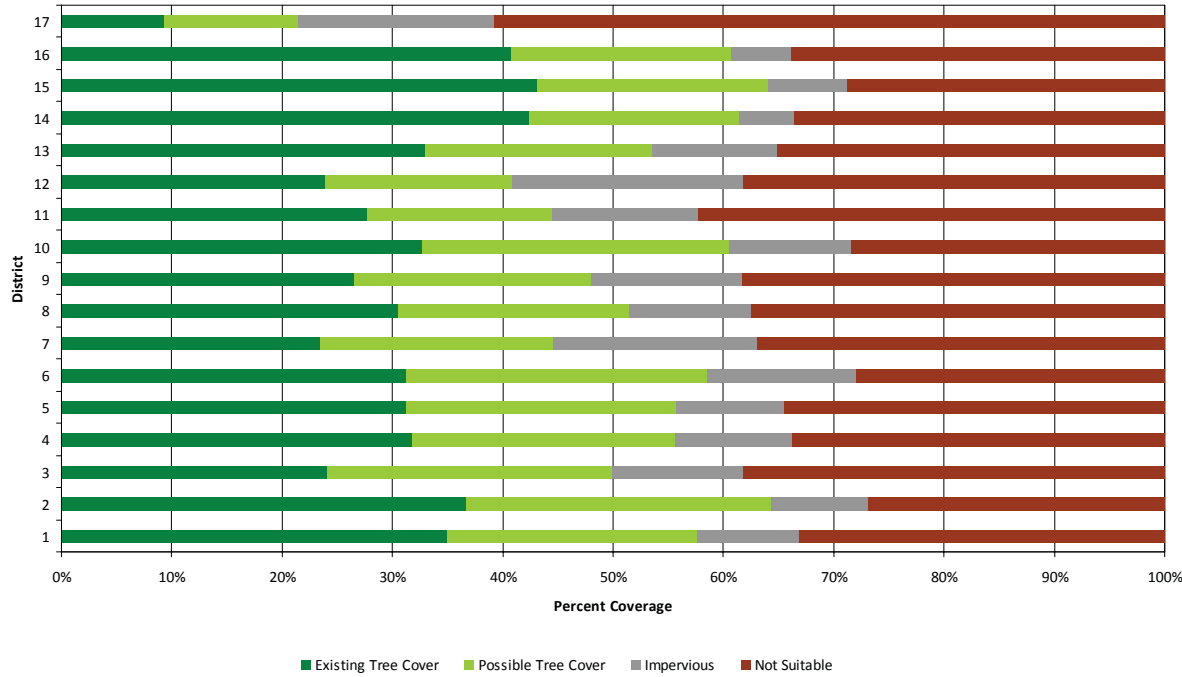
- Ward 1 **27,864/43,174**
- Ward 2 **68,617/100,532**
- Ward 3 **0/0**
- Ward 4 **25,887/52,142**
- Ward 5 **2,169/25,204**
- Ward 6 **8,700/28,655**
- Ward 7 **0/34,377**
- Total **136,237/284,084**



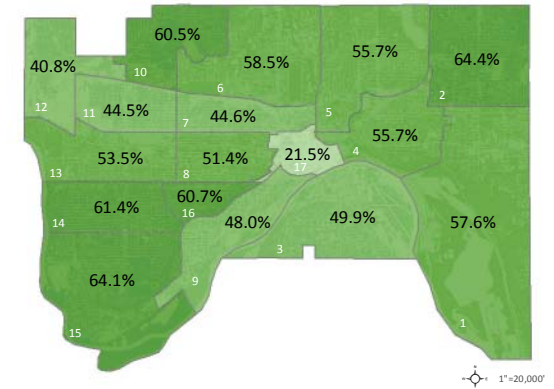
Possible Canopy Increase as a Percentage of Existing Canopy

District Level Analysis

Planning District Analysis: Existing and Possible Canopy Cover



Existing Canopy Cover



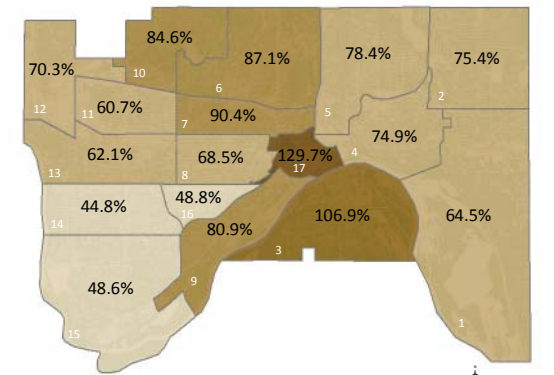
Possible Canopy Cover

Canopy Cover Classified by Planning District

District canopy cover ranges from **9.4%** in District 17 to **43.1%** in the largely residential District 15 representing a difference of 33.7% largely attributable to land use and development density which also influence existing and possible canopy cover in districts with large areas of industrial land and transportation networks. **Each district can achieve a canopy cover above 40%** with the exception of District 17 where tree planting is limited by dense development and impervious surfaces.

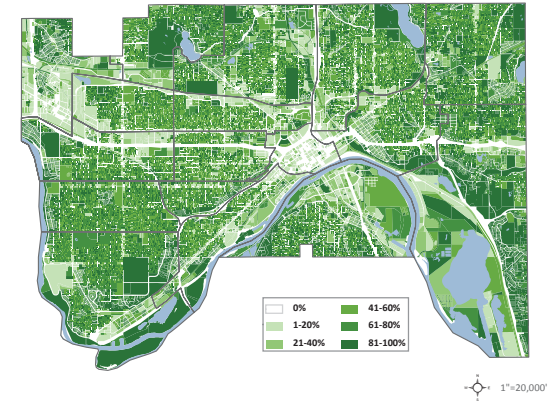
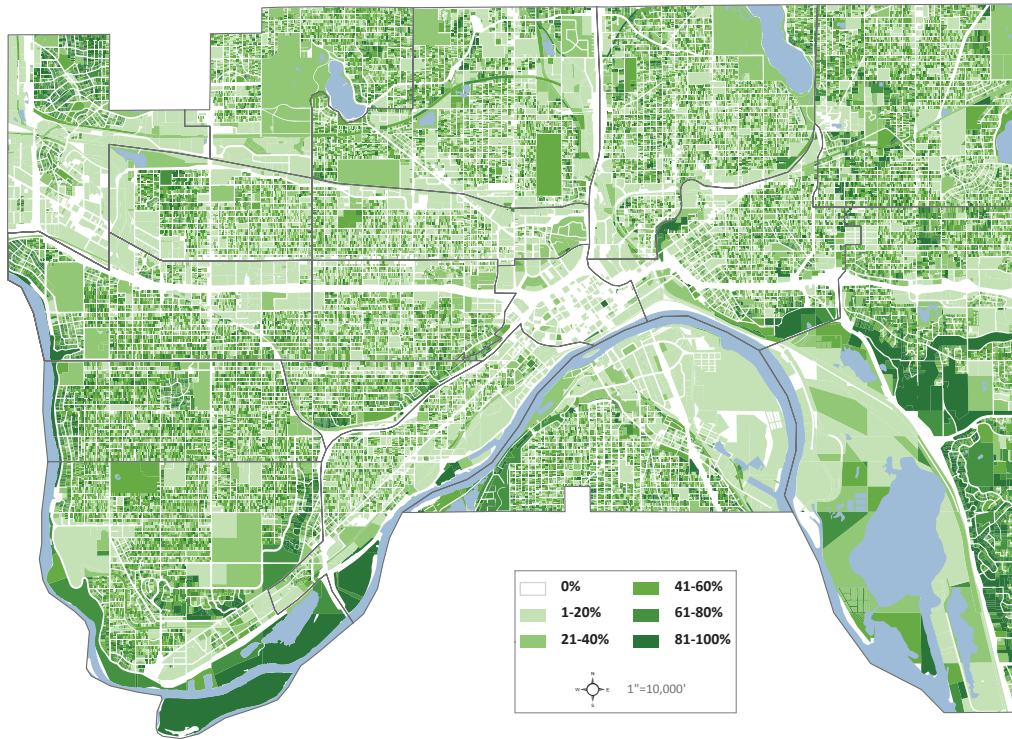
Trees required to achieve a 35% + 40% canopy cover:

- | | | | |
|------------|---------------|--------------|------------------------|
| District 1 | 0/30,545 | District 10 | 3,529/11,549 |
| District 2 | 0/8,276 | District 11 | 8,964/15,104 |
| District 3 | 32,678/47,668 | District 12 | 17,327/24,132 |
| District 4 | 5,821/14,916 | District 13 | 4,005/13,540 |
| District 5 | 10,349/23,989 | District 14 | 0/0 |
| District 6 | 10,279/23,804 | District 15 | 0/0 |
| District 7 | 12,748/18,243 | District 16 | 0/0 |
| District 8 | 5,207/10,992 | District 17 | 16,589/19,829 |
| District 9 | 14,960/23,865 | Total | 142,466/287,452 |

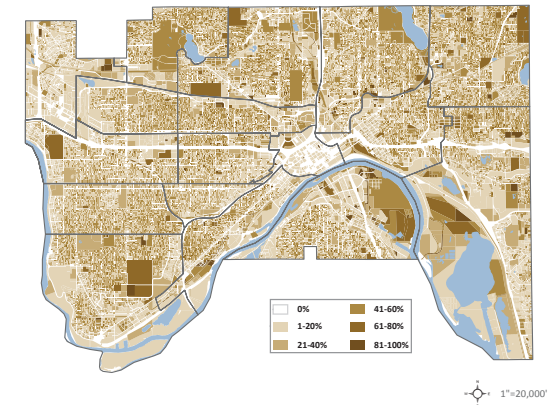


Possible Canopy Increase as a Percentage of Existing Canopy

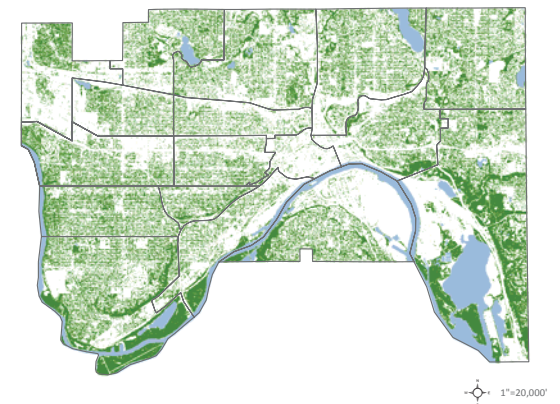
Parcel Level Analysis



Possible Canopy Cover



Possible Increase in Canopy Cover



Existing Tree Canopy

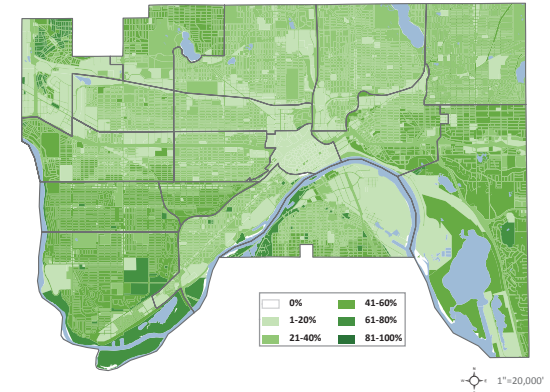
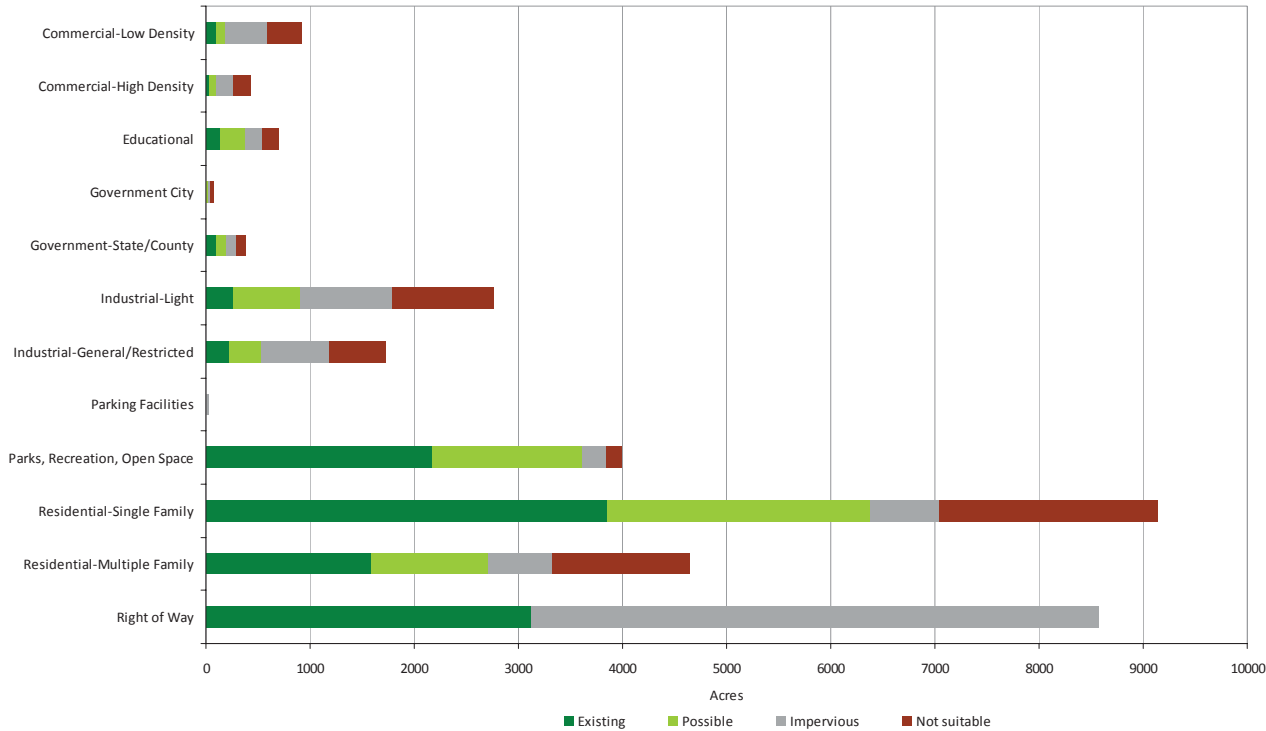
Canopy Cover Classified by Parcel

Parcel data represents the land area of Saint Paul outside of the public right of way and, with the exception of park land, property outside the management of Saint Paul Forestry. Parcels within Saint Paul have an **existing canopy cover of 32.7%** with a possible city wide canopy increase of 25% for a **total possible canopy cover of 58.3%** on private property and park lands. Nearly 80% of all parcels are under one fifth of an acre, requiring an approach that includes public/private partnerships and educational outreach to encourage and expand tree planting on private lands including residential property where the largest opportunity for canopy increases exist.

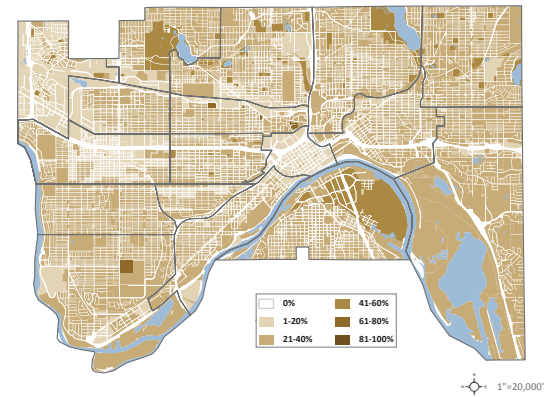
Canopy cover on city owned parcels is estimated at 30.5% with much of this represented by park land. Significant increases are possible within these parks though canopy cover increases will need to be balanced with active recreational uses.

Land Use + Zoning

UTC by Land Use



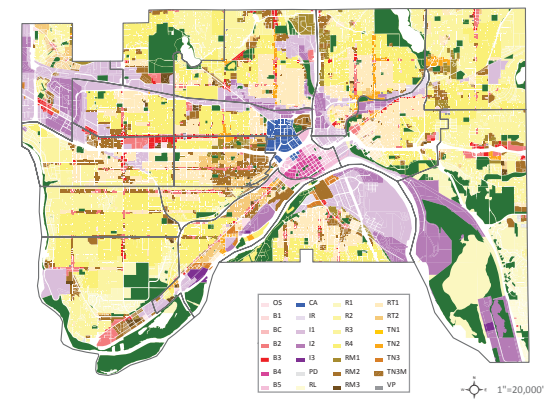
Existing Canopy Cover



Possible Increase in Canopy Cover

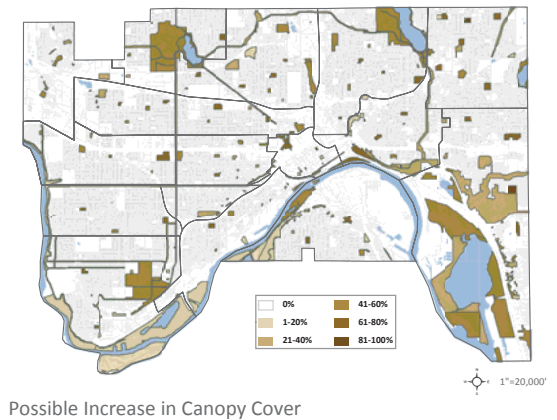
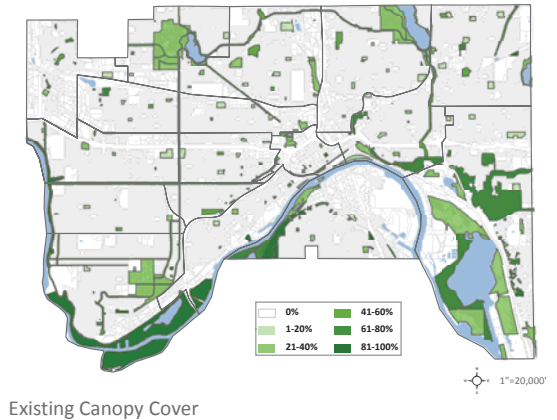
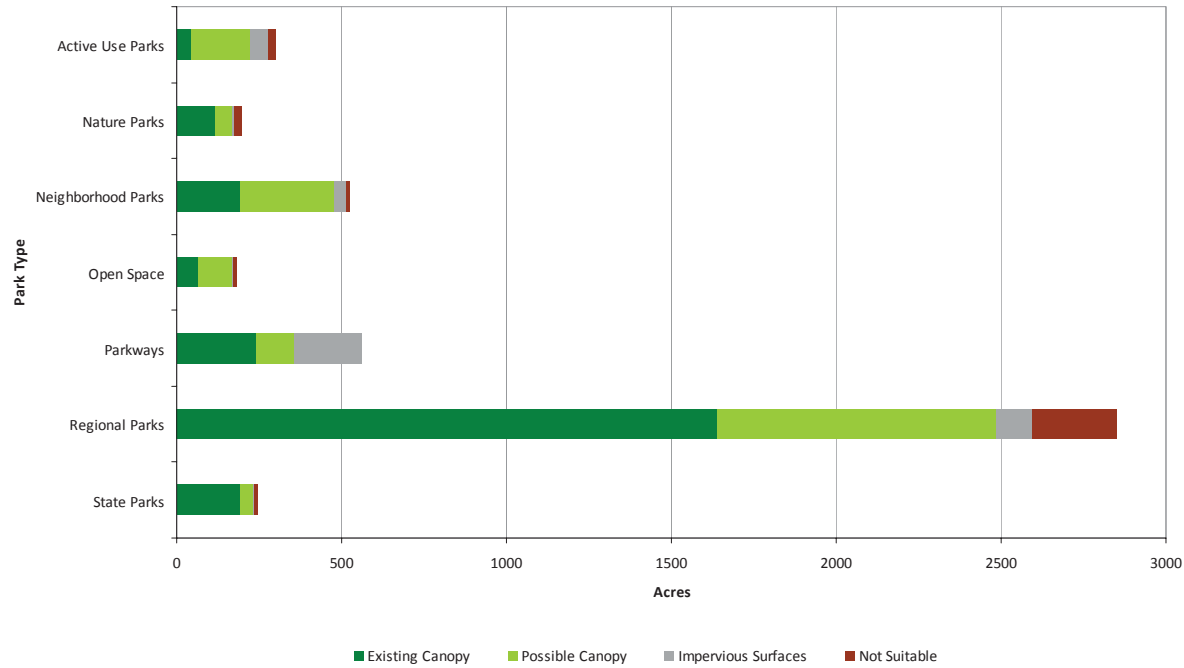
Canopy Cover Classified by Parcel

Canopy cover is directly influenced by land use resulting in canopy cover levels of 7.3% in downtown, 11.9% in commercial lands, 11.1% in industrial lands, and 39.4% in residential lands. At 54.4%, park land represents the largest percentage of canopy cover by land use though private residential land holds the largest portion of the urban forest with 5400 acres of canopy at 39.4% canopy cover. Residential land also represents the greatest opportunity for future canopy development with a possible increase of 3600 acres resulting in a possible residential canopy cover of 66% highlighting the significance of tree planting by residents. Currently at 36.4% canopy coverage, the public right of way represents a continued opportunity for canopy growth over impervious surfaces, both mitigating stormwater runoff and urban temperatures. Planting efforts should target easily accessible planting locations as well as more difficult locations that maximize the environmental, economic, and social benefits provided by trees across land use type.



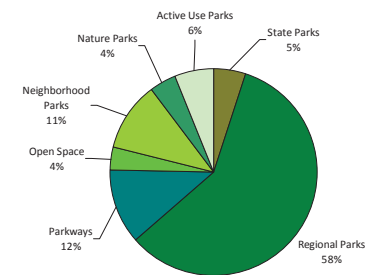
Park Land Analysis

Park Analysis: Existing and Possible Canopy Cover



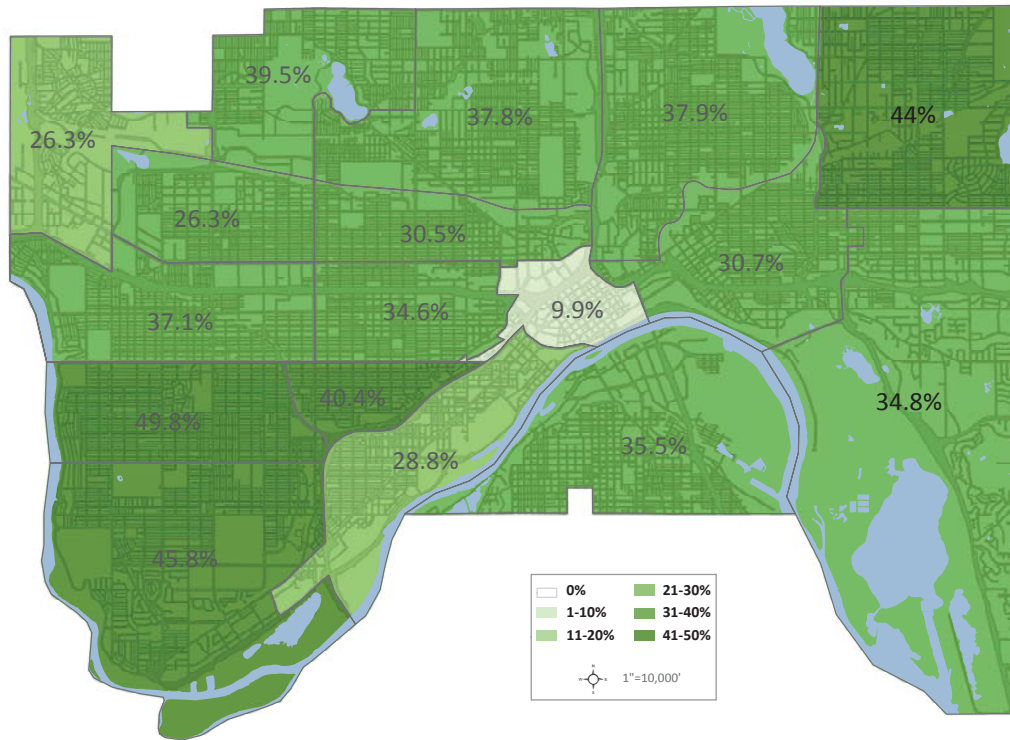
Canopy Cover Classified by Park Land

Parks and open space represent a land area of nearly 4,000 acres with an **existing canopy cover of 54.5%** across the complete park and parkway system. Forest cover in the region prior to the growth of Saint Paul has been estimated at 70% (Kromroy, 2006) and significant canopy increases of 1,617 acres are possible within park lands resulting in a **total possible canopy cover of 84.7%**. The largest increases are available within the regional park system including Como and Phalen Regional Parks. Planting along an additional 413 acres of impervious surfaces, primarily located in the parkway system, could further increase total park land canopy cover. City parks serve a number of functions and recreational uses must be considered in canopy development. Sports fields, golf courses, and recreational lawns are an important use within active use and regional parks ultimately limiting the placement of trees and requiring a designed approach to canopy increases in these parks. As regional centers for outdoor activity, parks can demonstrate effective strategies to increase canopy cover.



Park Land Distribution

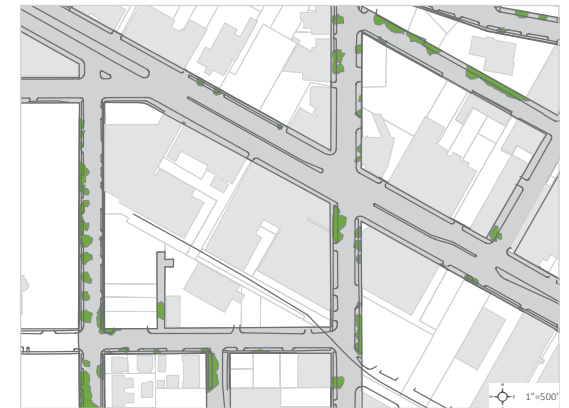
Public Right of Way



Existing Canopy Cover Classified by District



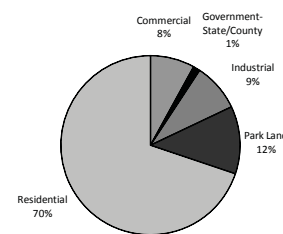
Residential Land Use: Summit Ave-Cleveland Ave



Industrial Land Use: University Ave-Raymond Ave

Canopy Cover on the Public Right of Way

Trees on the public right of way (ROW) are managed by Saint Paul Forestry and form an **existing canopy cover of 36.4%** with eleven planning districts above the city average of 32.5%. Adjacent land use significantly influences ROW tree cover reflected in the divergent 10.7% canopy cover in commercial and industrial areas and the 40.7% canopy cover in residential areas. Projecting possible ROW canopy coverage is difficult but residential streets with narrower road beds and nearly 70% of the ROW-parcel frontage represent the largest opportunity for increased tree canopy approaching a theoretical 100% where large tree species can completely span the street. Large increases in canopy cover in commercial and industrial areas, each with about 8% of ROW-parcel frontage, are achievable but may be more costly due to the potential need for engineered soils. Planting projects in these areas should be considered due to the significant environmental, economic, and social benefit trees provide.



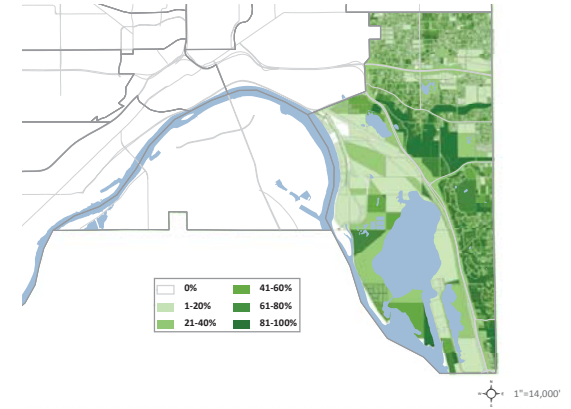
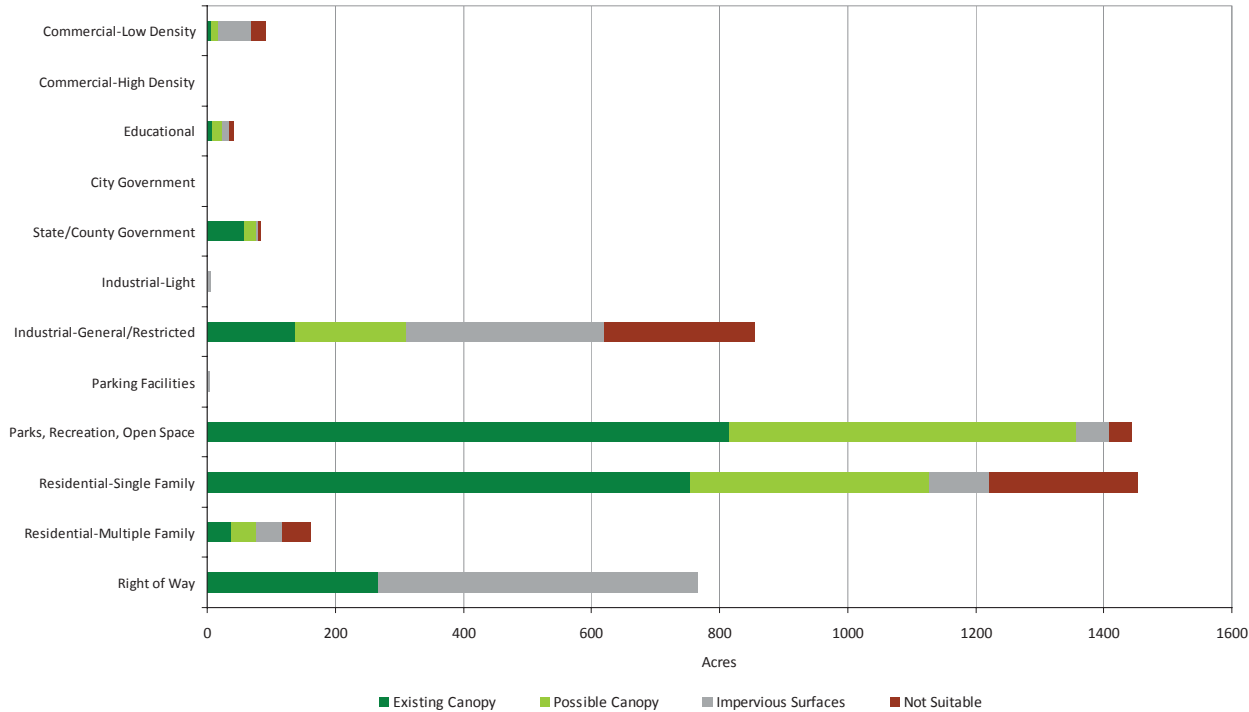
ROW Frontage/Canopy Cover:
 Commercial **7.8%/10.7%**
 Industrial **8.7%/10.7%**
 Parks **12.2%/43.2%**
 Residential **69.8%/40.7%**



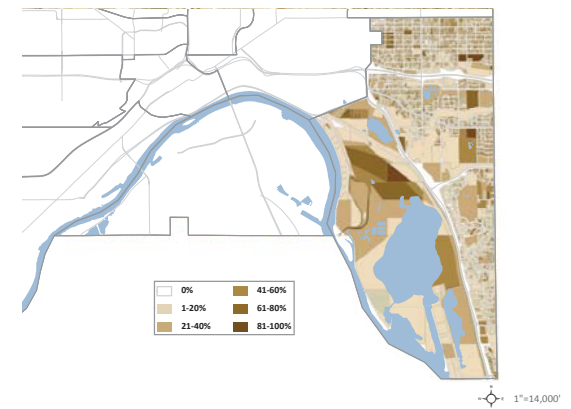
State and County Roads

District 1-Battle Creek

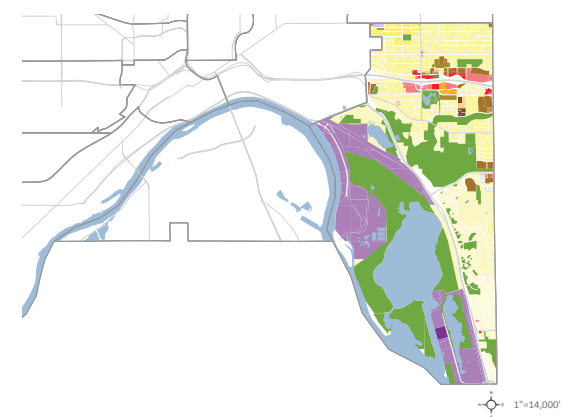
District 1 Canopy Cover



Existing Canopy Cover



Possible Increases in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 1 has an **existing canopy cover of 35%** due in part to the suburban character of residential development and expansive network of parks and open space including Battle Creek Regional Park and Mounds Park overlooking the Mississippi River valley. The city's only tree preservation district encompasses the area south of Lower Afton Road placing tree protection regulations on the urban canopy. A possible canopy increase of 22.6%, or 1,380 acres of new canopy, is achievable in District 1 resulting in a **total possible canopy cover of 57.6%**.

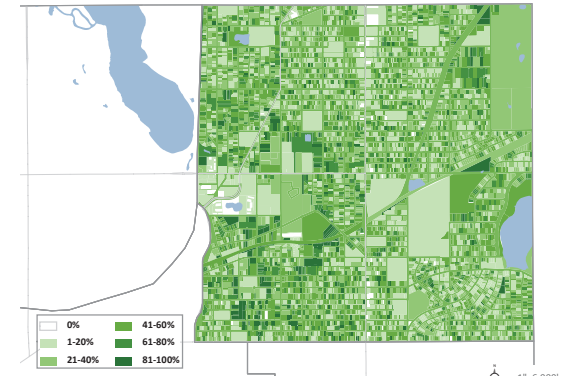
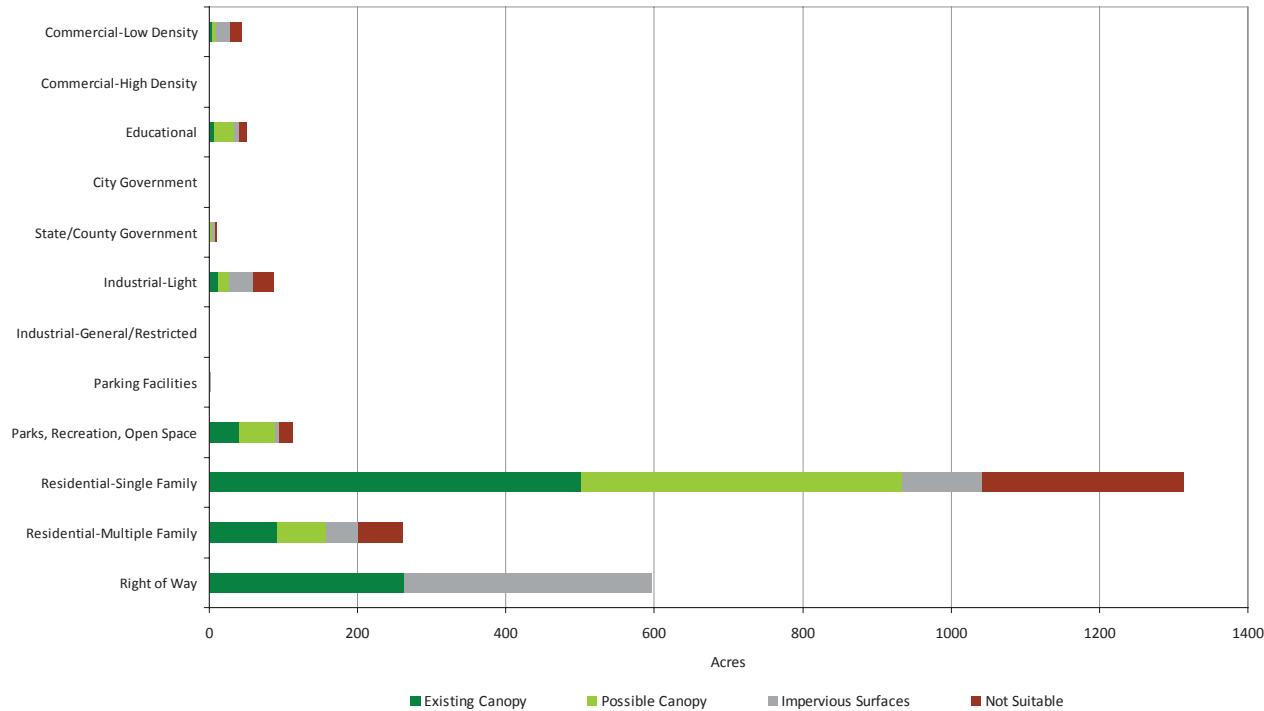
Acres of new trees required to meet a 35%/40% canopy goal: **0/305**

New trees required to meet a 35%/40% canopy goal: **0/30,545**

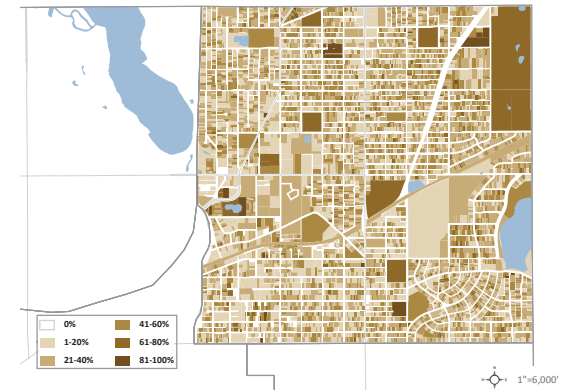
Acres of possible new canopy cover: **1,380**

District 2-Greater East Side

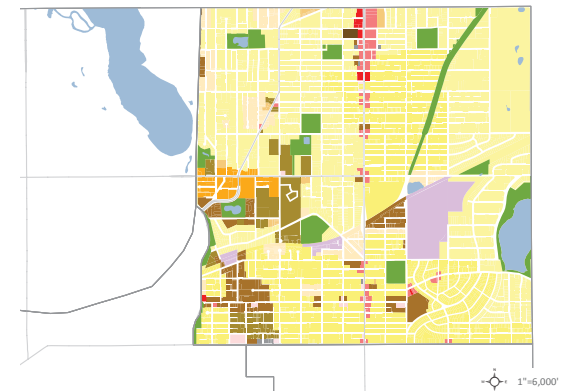
District 2 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

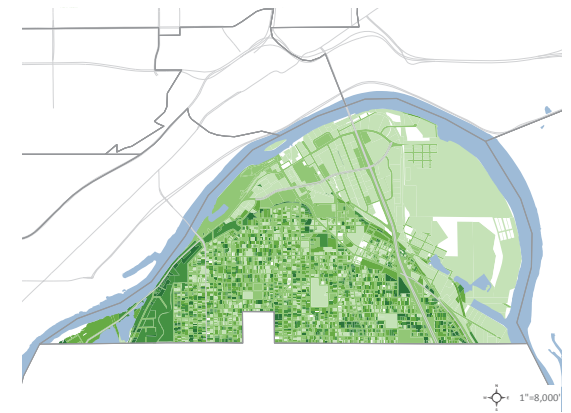
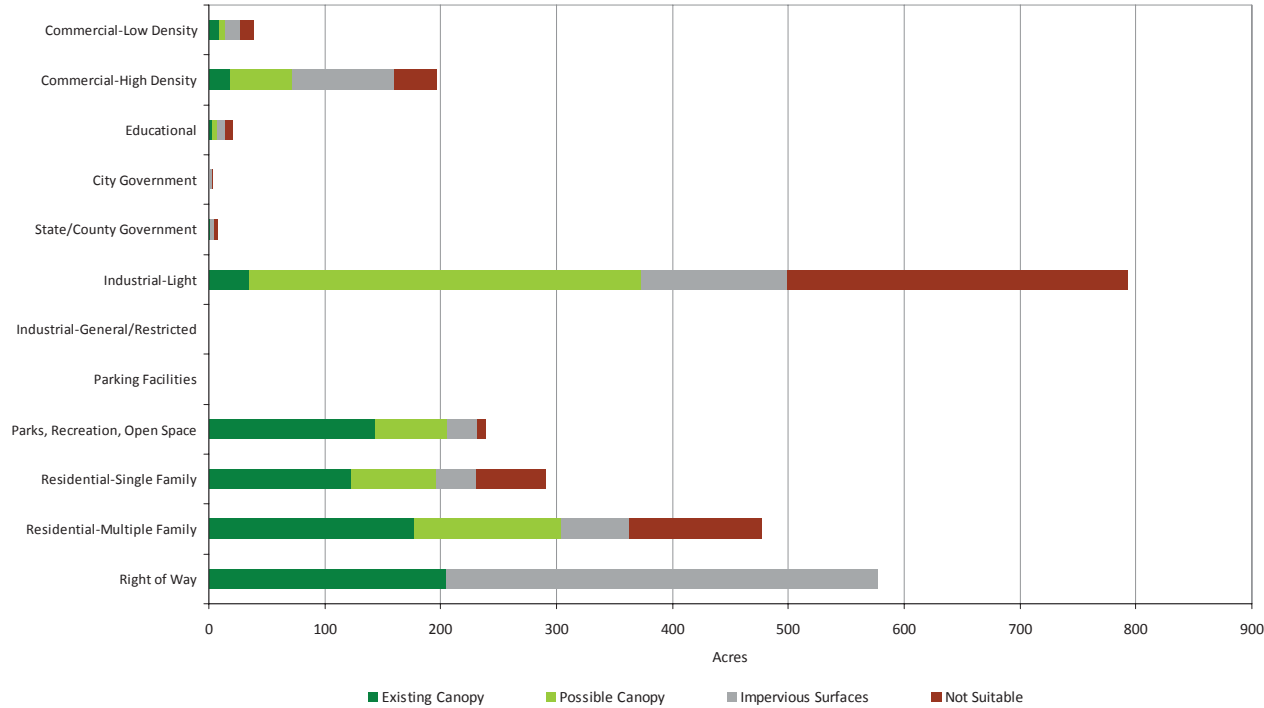
Canopy Cover Analysis

District 2 has an **existing canopy cover of 36.7%** largely located on private residential property which comprises 63% of the district’s land area. A possible canopy increase of 27.6%, or 694 acres, is achievable resulting in a **total possible canopy cover of 64.4%** with the most significant increases possible on residential property. Additional canopy increases are possible on the public right of way which has an existing canopy cover of 44%. While industrial properties represent a small percentage of district land use, increased canopy opportunities have the potential to reduce the amount of contiguous impervious surface providing additional economic and environmental benefits.

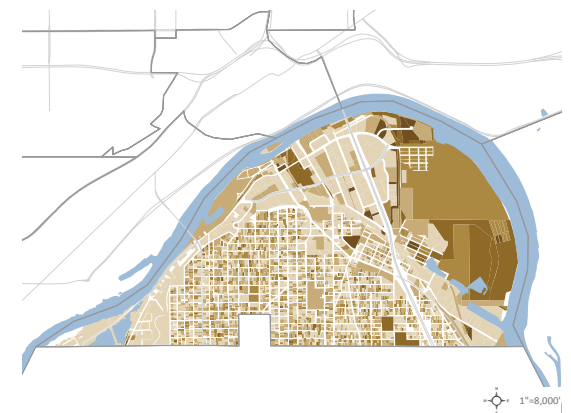
Acres of new trees required to meet a 35%/40% canopy goal: **0/83**
 New trees required to meet a 35%/40% canopy goal: **0/8,276**
 Acres of possible new canopy cover: **694**

District 3-West Side

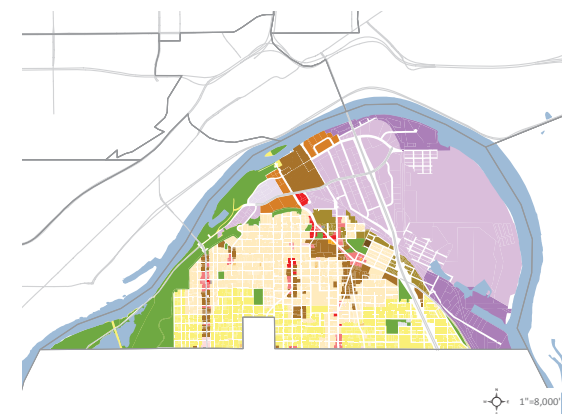
District 3 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 3 is evenly divided between industrial land (26.4% of land area) located on the river flats and residential neighborhoods (25.6% of land area) located on the uplands leading to an **existing canopy cover of 24.1%**. A possible canopy increase of 25.8%, or 773 acres, is achievable resulting in a **total possible canopy cover of 49.9%**. Industrial lands represent the single largest opportunity for increased canopy cover though certain land uses will limit potential increases including the downtown airport and the corresponding flight path clearance zones as well as impervious surfaces required for industrial operations.

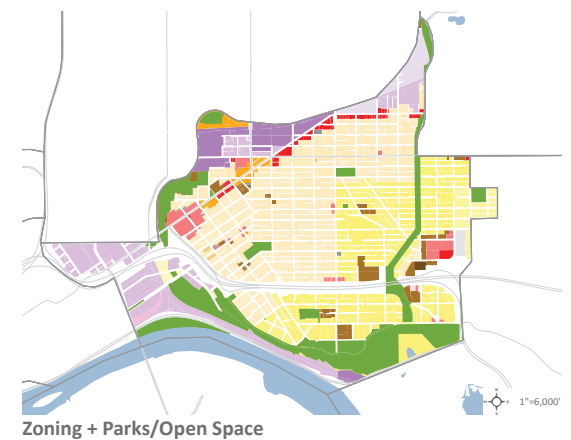
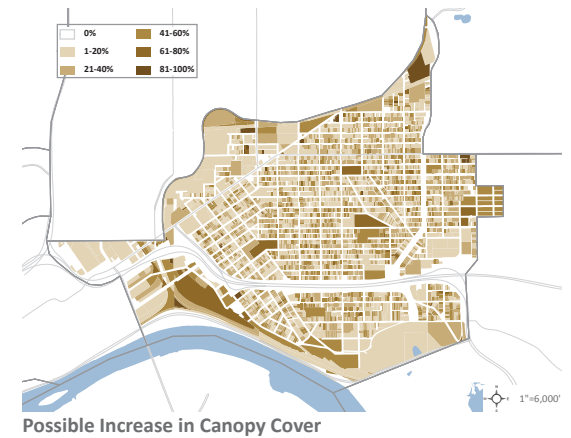
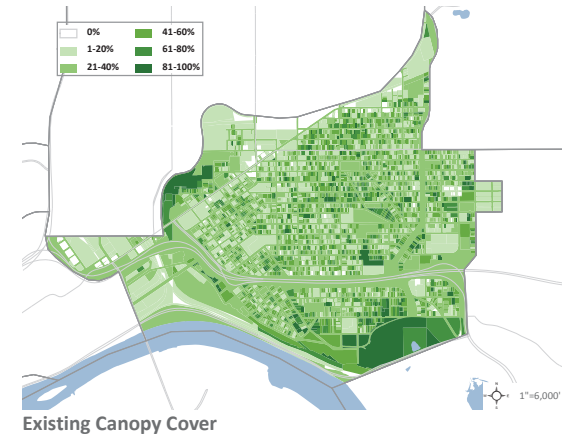
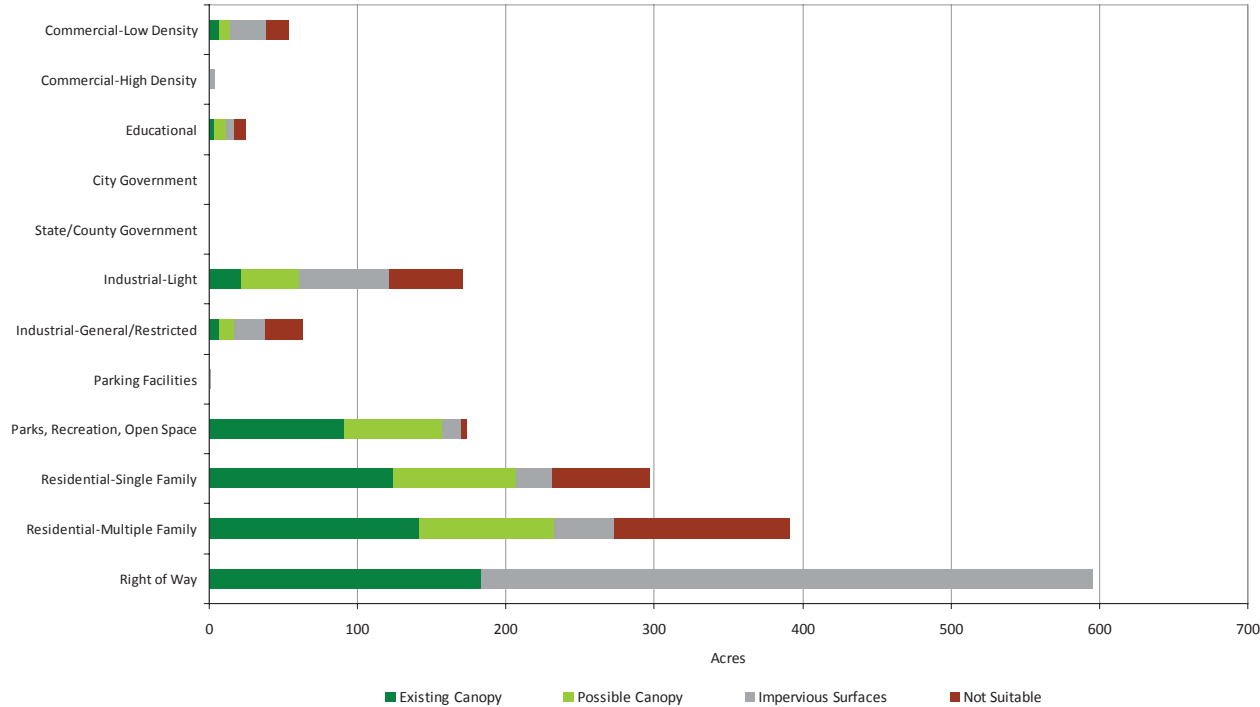
Acres of new trees required to meet a 35%/40% canopy goal: **327/477**

New trees required to meet a 35%/40% canopy goal: **32,678/47,668**

Acres of possible new canopy cover: **773**

District 4-Dayton's Bluff

District 4 Canopy Cover



Canopy Cover Analysis

District 4 has an **existing canopy cover of 31.8%** located primarily on residential property and park land. A possible canopy increase of 23.9%, or 434 acres, is achievable resulting in a **total possible canopy cover of 55.7%**. Increased urban density and land use patterns associated with the district's proximity to downtown Saint Paul, large transportation corridors including Interstate 94, and industrial land along the western edge of District 4 may limit significant canopy growth to residential property, which accounts for 38% of land area, and the public right of way.

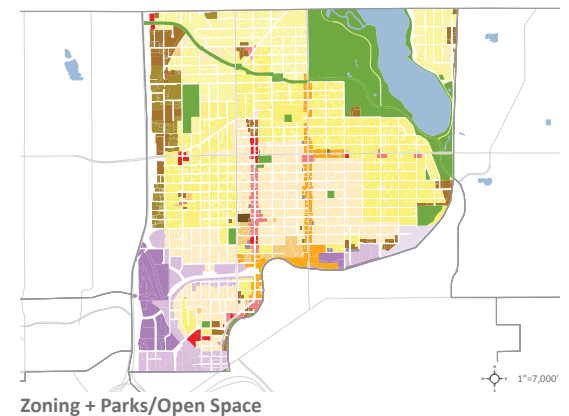
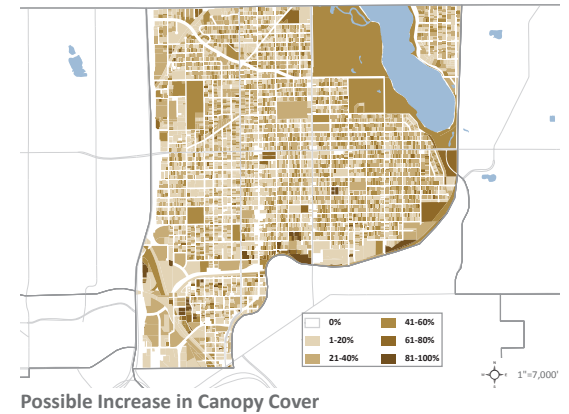
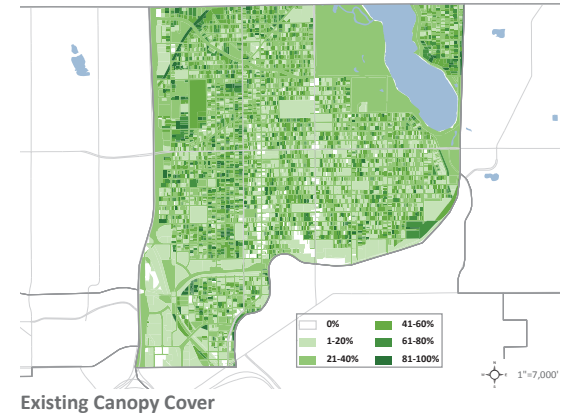
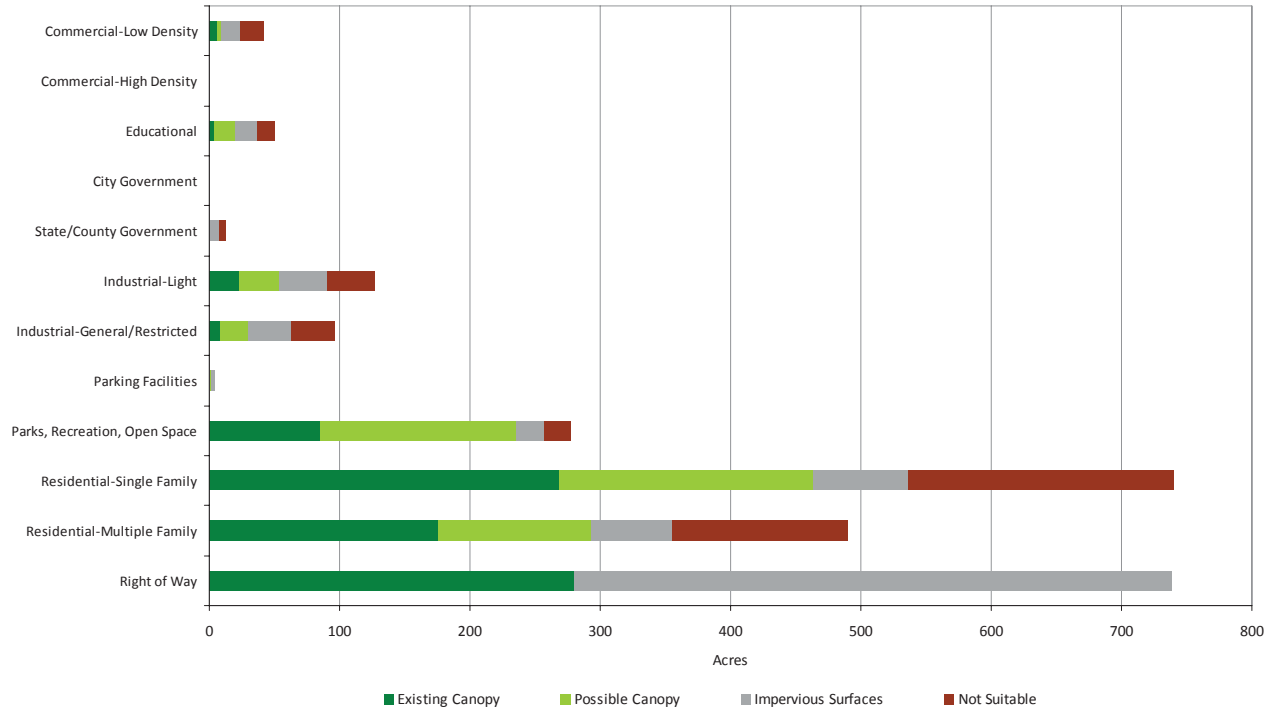
Acres of new trees required to meet a 35%/40% canopy goal: **58/149**

New trees required to meet a 35%/40% canopy goal: **5,821/14,916**

Acres of possible new canopy cover: **434**

District 5-Payne/Phalen

District 5 Canopy Cover



Canopy Cover Analysis

District 5 has an **existing canopy cover of 32.2%**, largely on residential land and the public right of way. A possible canopy increase of 24.5%, or 667 acres, is achievable resulting in a **total possible canopy cover of 55.7%**. Most canopy increases are attainable on residential property (45% of district land area) with additional increases available on the public right of way. Park lands including Phalen Regional Park represent a significant opportunity for canopy development but must balance increased tree cover with recreational uses including the Phalen golf course.

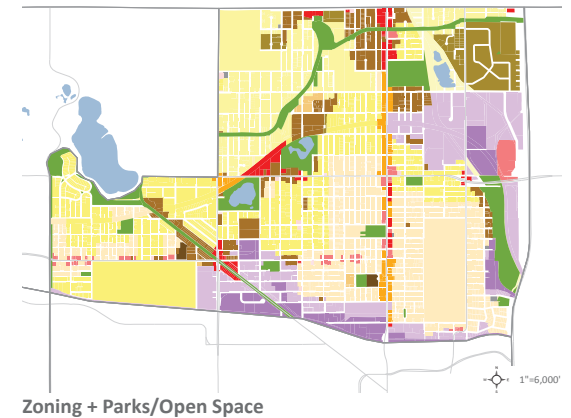
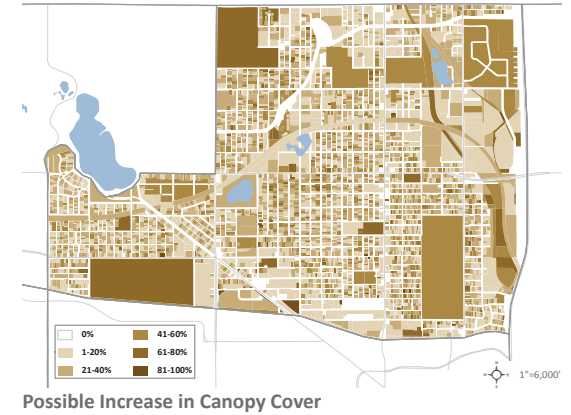
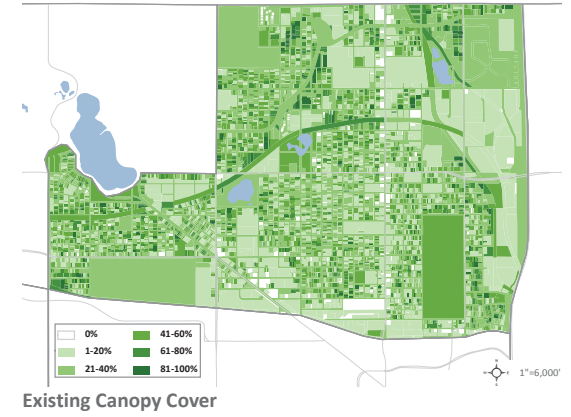
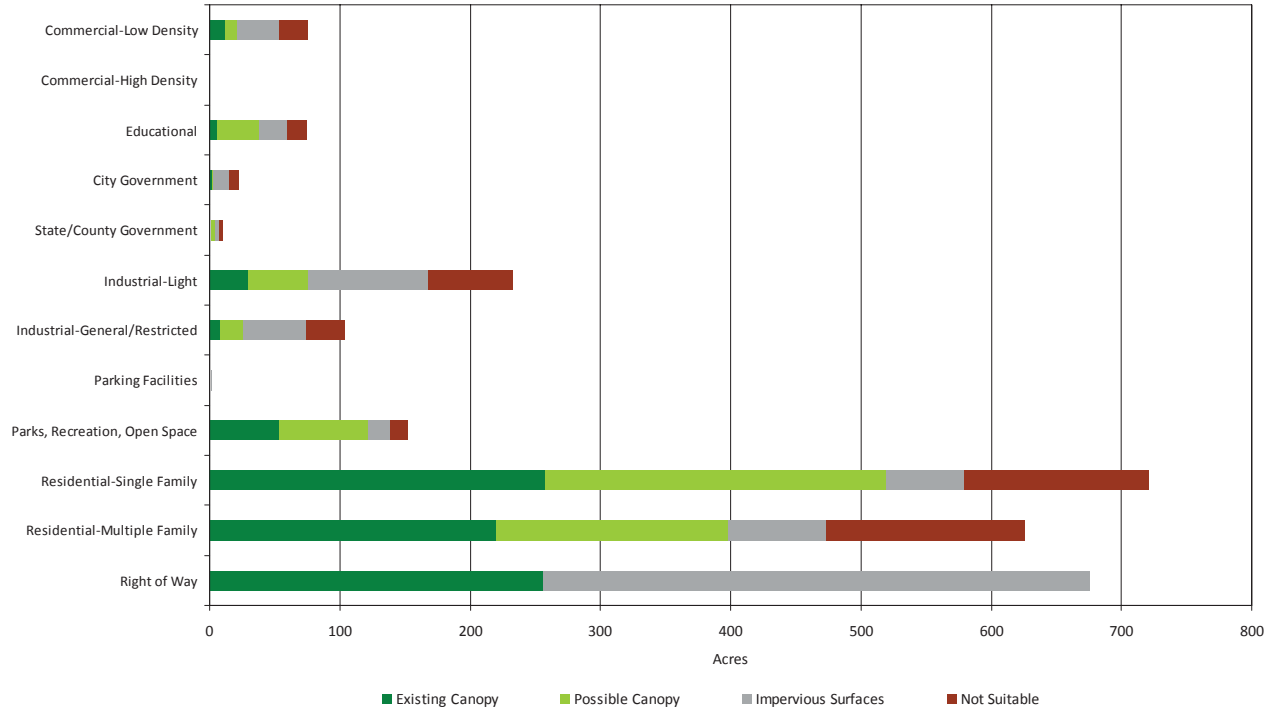
Acres of new trees required to meet a 35%/40% canopy goal: **103/240**

New trees required to meet a 35%/40% canopy goal: **10,349/23,989**

Acres of possible new canopy cover: **667**

District 6-North End

District 6 Canopy Cover



Canopy Cover Analysis

District 6 has an **existing canopy cover of 31.3%** with the highest levels of tree cover found on the public right of way and on residential land. A possible canopy increase of 27.3%, or 737 acres, is achievable resulting in a **total possible canopy cover of 58.5%**. Significant canopy increases of 16% are possible on residential land which represents 50% of the district land area with additional increases available on the public right of way, in parks, and on industrial lands.

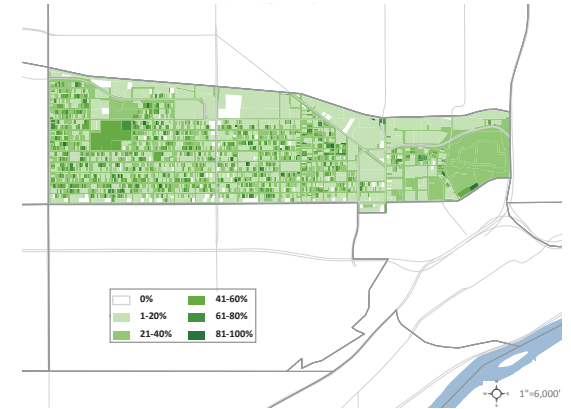
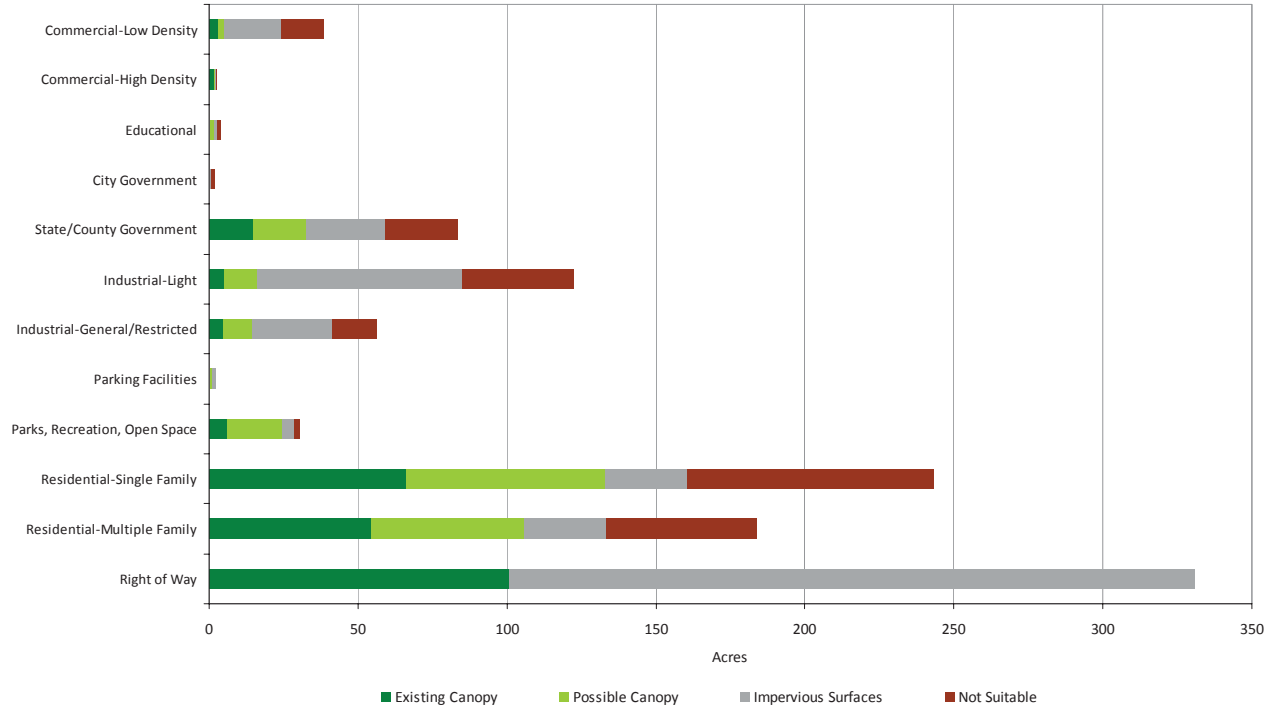
Acres of new trees required to meet a 35%/40% canopy goal: **103/238**

New trees required to meet a 35%/40% canopy goal: **10,279/23,804**

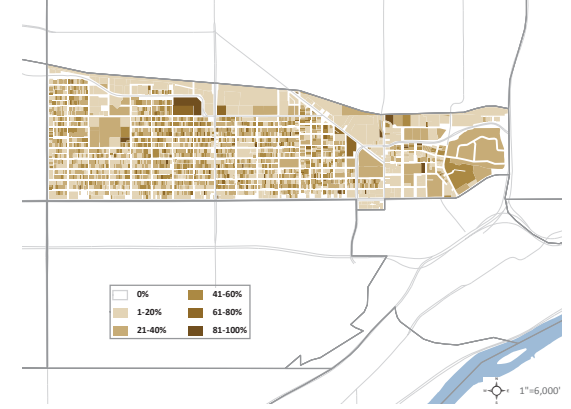
Acres of possible new canopy cover: **737**

District 7-Thomas/Dale

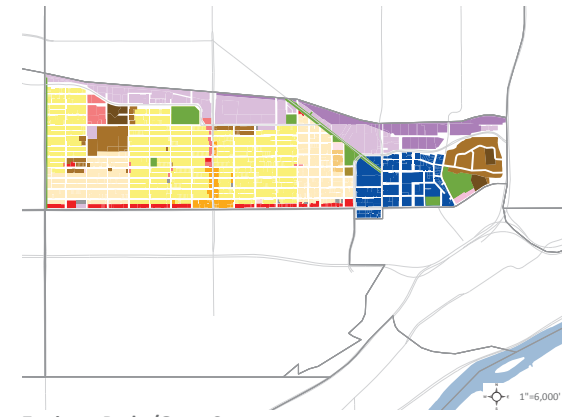
District 7 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 7 has an **existing canopy cover of 23.4%** with the highest level of tree cover found on the public right of way at 30.5%. A possible canopy increase of 21.2%, or 233 acres, is achievable for a **total possible canopy cover of 44.6%**. Canopy increases will have to occur across land use types to achieve significant canopy growth with residential property, 39% of district land area, providing the largest potential increase of 10.8% new canopy. Canopy increases between 2%-10.6% are possible on industrial land, however, additional planning and resources may be necessary where conditions require the use of engineered soils and additional site design.

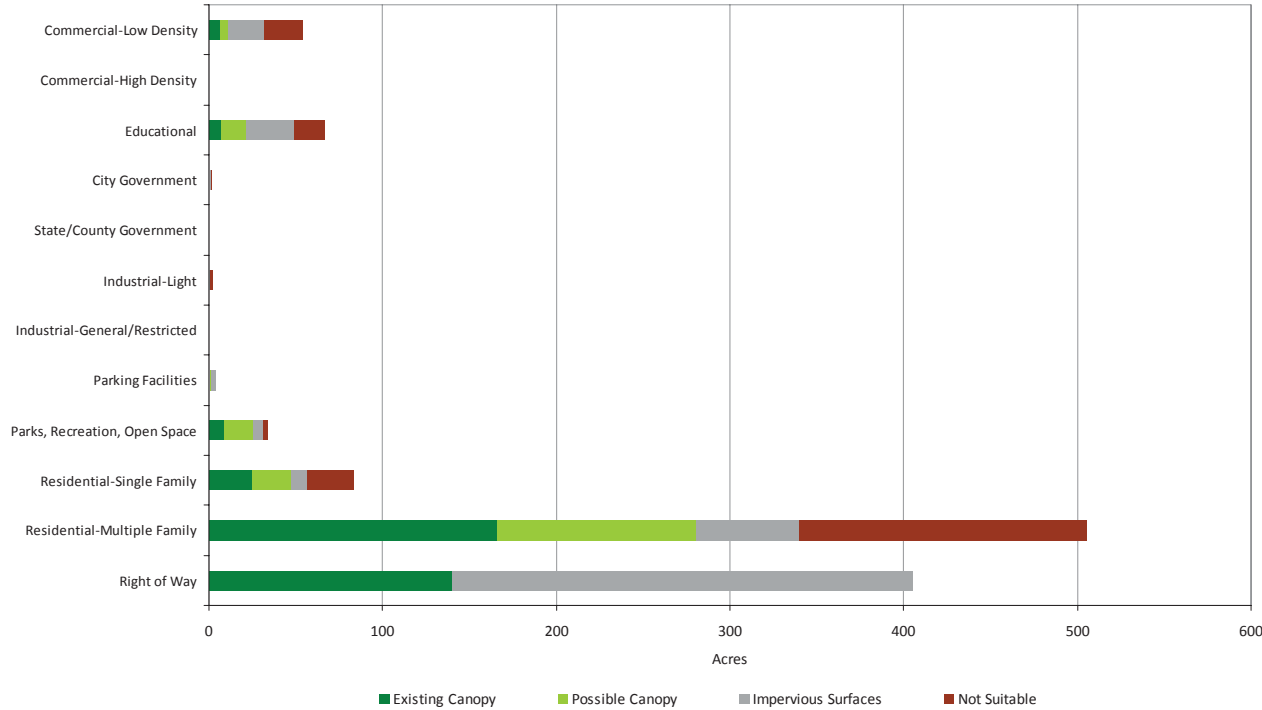
Acres of new trees required to meet a 35%/40% canopy goal: **127/182**

New trees required to meet a 35%/40% canopy goal: **12,748/18,243**

Acres of possible new canopy cover: **233**

District 8-Summit/University

District 8 Canopy Cover



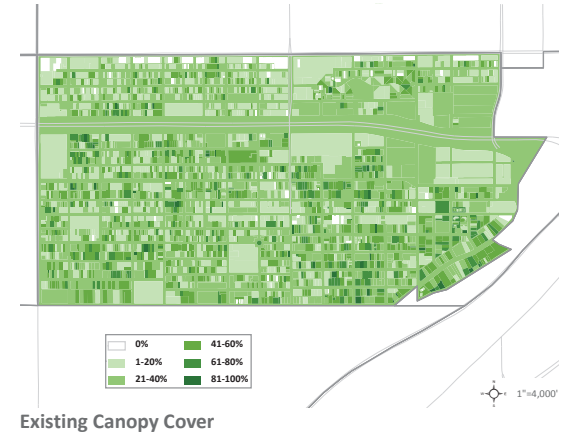
Canopy Cover Analysis

District 8 has an **existing canopy cover of 30.5%** located primarily on residential lands, which account for 51% of the district’s land area, and the public right of way. A possible canopy increase of 20.9%, or 242 acres, is achievable resulting in a **total possible canopy cover of 51.4%**. Significant increases are possible on residential land and the public right of way with additional increases available on school and park property. Limits on future canopy development are imposed by land uses including Interstate 94 and commercial corridors along University Avenue and Grand Avenue.

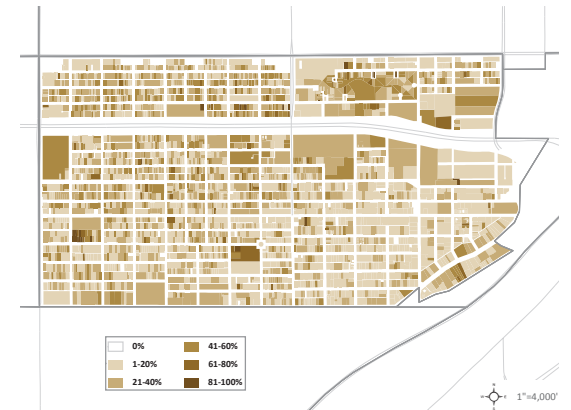
Acres of new trees required to meet a 35%/40% canopy goal: **52/110**

New trees required to meet a 35%/40% canopy goal: **5,207/10,992**

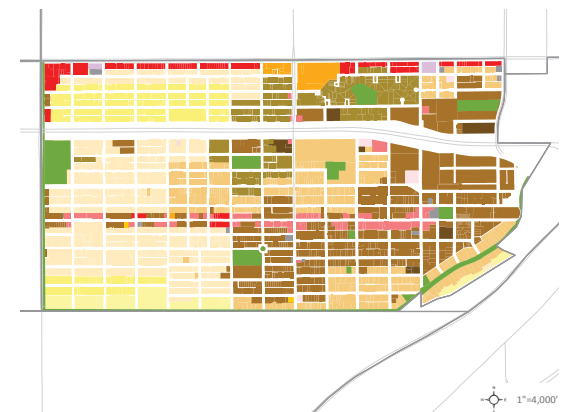
Acres of possible new canopy cover: **242**



Existing Canopy Cover



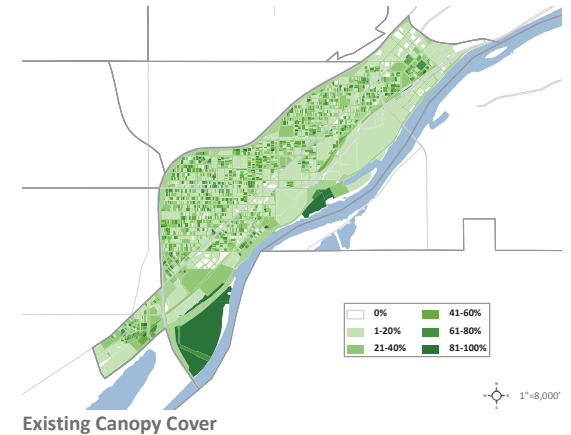
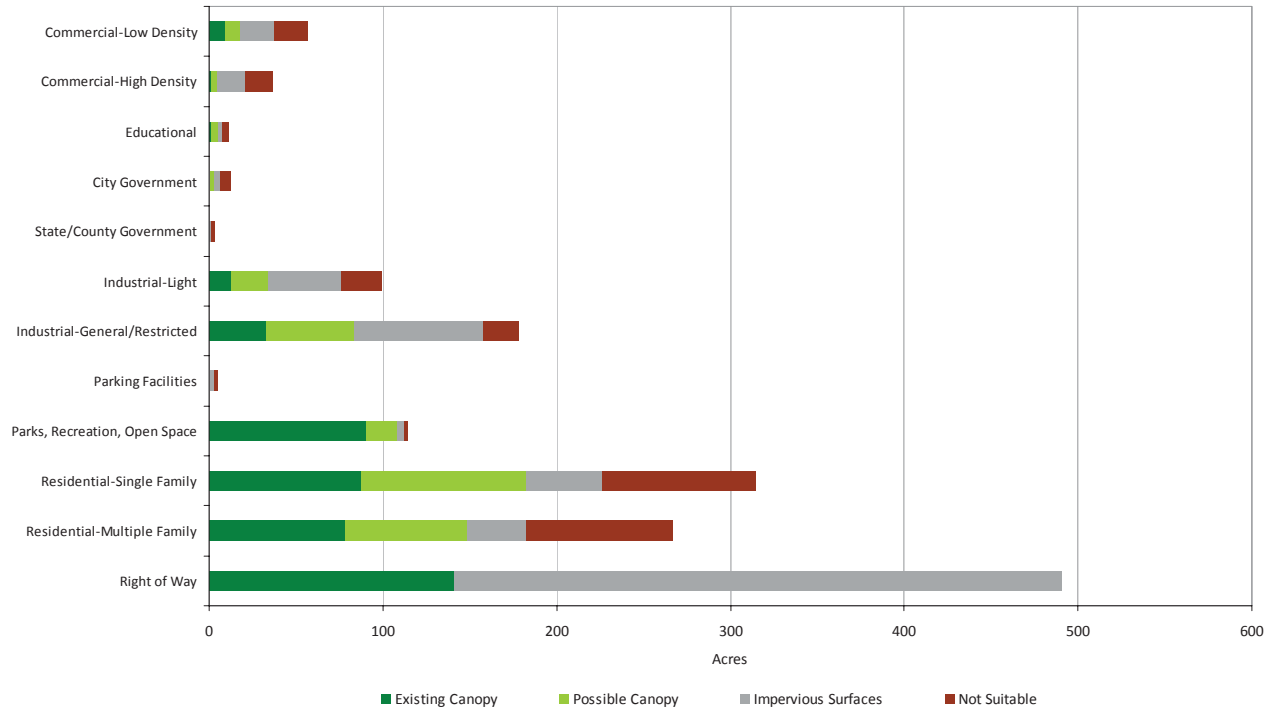
Possible Increase in Canopy Cover



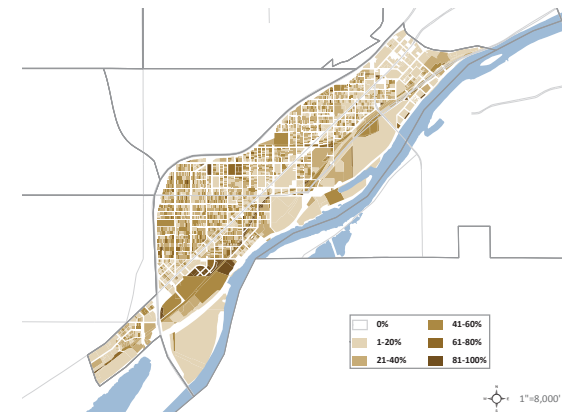
Zoning + Parks/Open Space

District 9-West Seventh

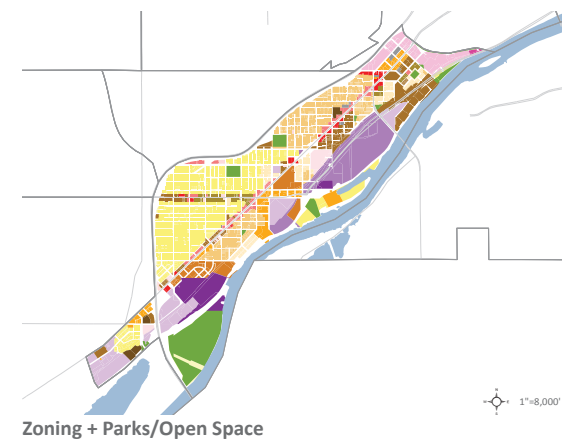
District 9 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 9 has an **existing canopy cover of 26.6%** reflecting the limits placed on canopy growth by the district's industrial heritage and presence of major transportation corridors. A possible canopy increase of 21.5%, or 382 acres, is achievable for a **total possible canopy cover of 48%** with similar increases possible on residential, industrial, and right of way lands. However, additional planning and resources may be necessary to increase tree cover over industrial land where conditions may require the use of engineered soils and site design. Land within the Mississippi National River and Recreation Area between West 7th and the Mississippi River could support additional canopy cover providing numerous ecological benefits and recreational opportunities.

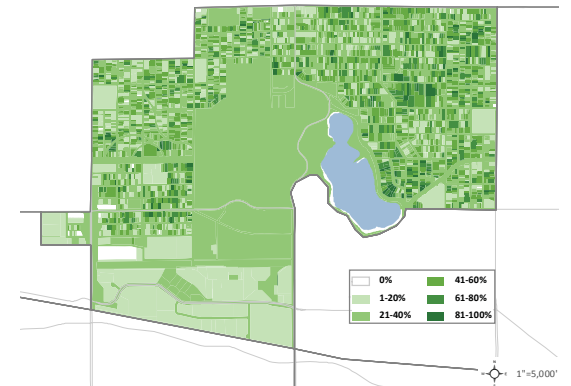
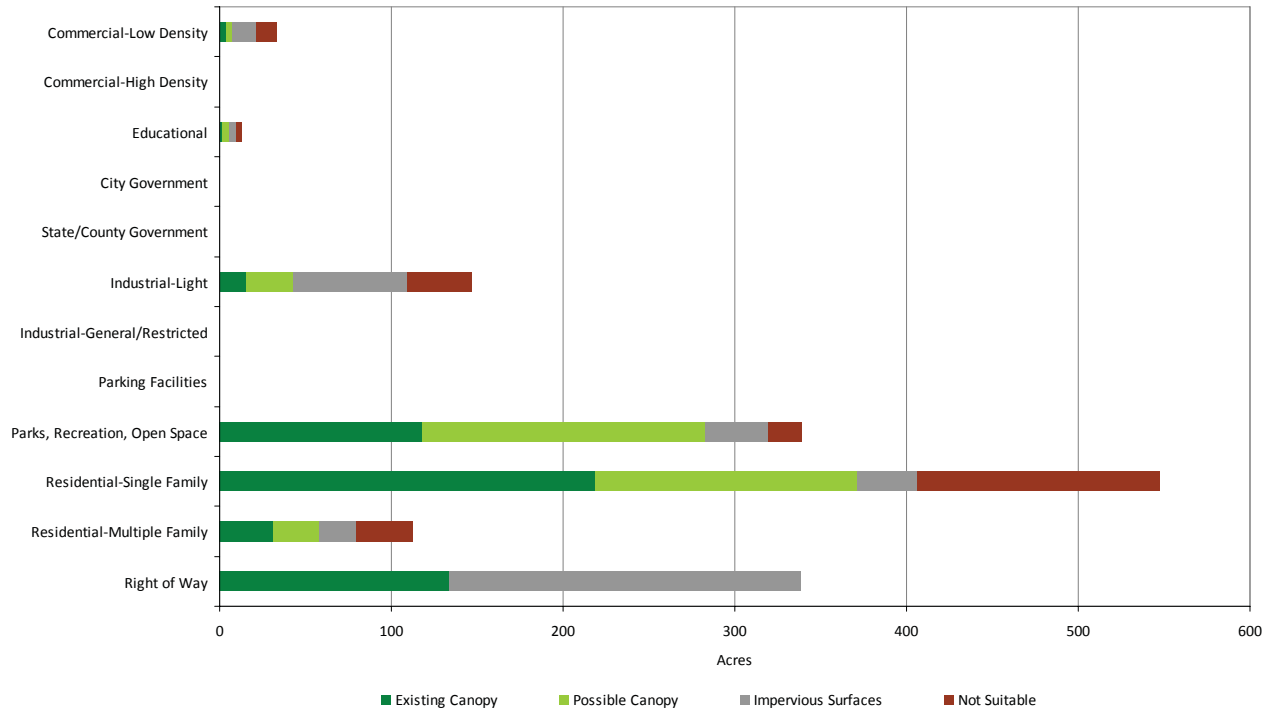
Acres of new trees required to meet a 35%/40% canopy goal: **150/239**

New trees required to meet a 35%/40% canopy goal: **14,960/23,865**

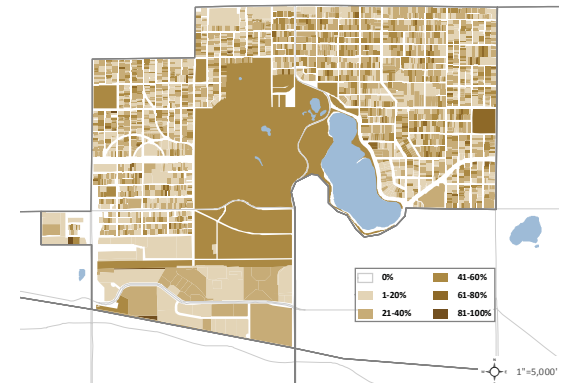
Acres of possible new canopy cover: **382**

District 10-Como Lake

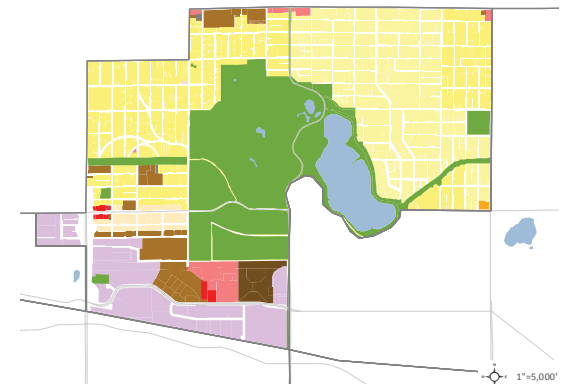
District 10 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 10 is composed of residential neighborhoods surrounding Como Regional Park with industrial land at its southern boundary and has an **existing canopy cover of 32.8%**. A possible canopy increase of 27.8%, or 445 acres, is achievable resulting in a **total possible canopy cover of 60.5%**. Significant canopy increases are possible on both residential and park land though canopy development may be limited by the broad range of recreational uses that occur within Como Regional Park. Additional canopy increases are possible on the city right of way which has a current canopy cover of 39.5%.

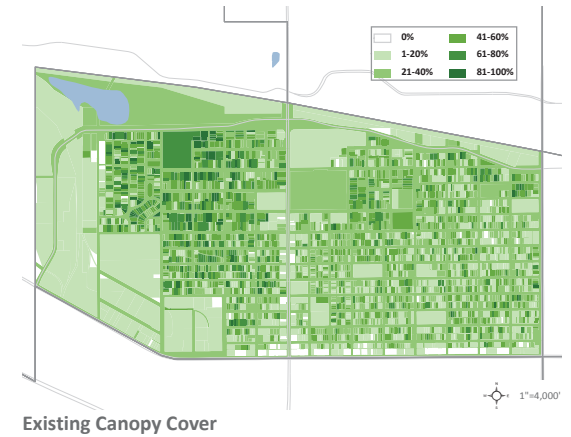
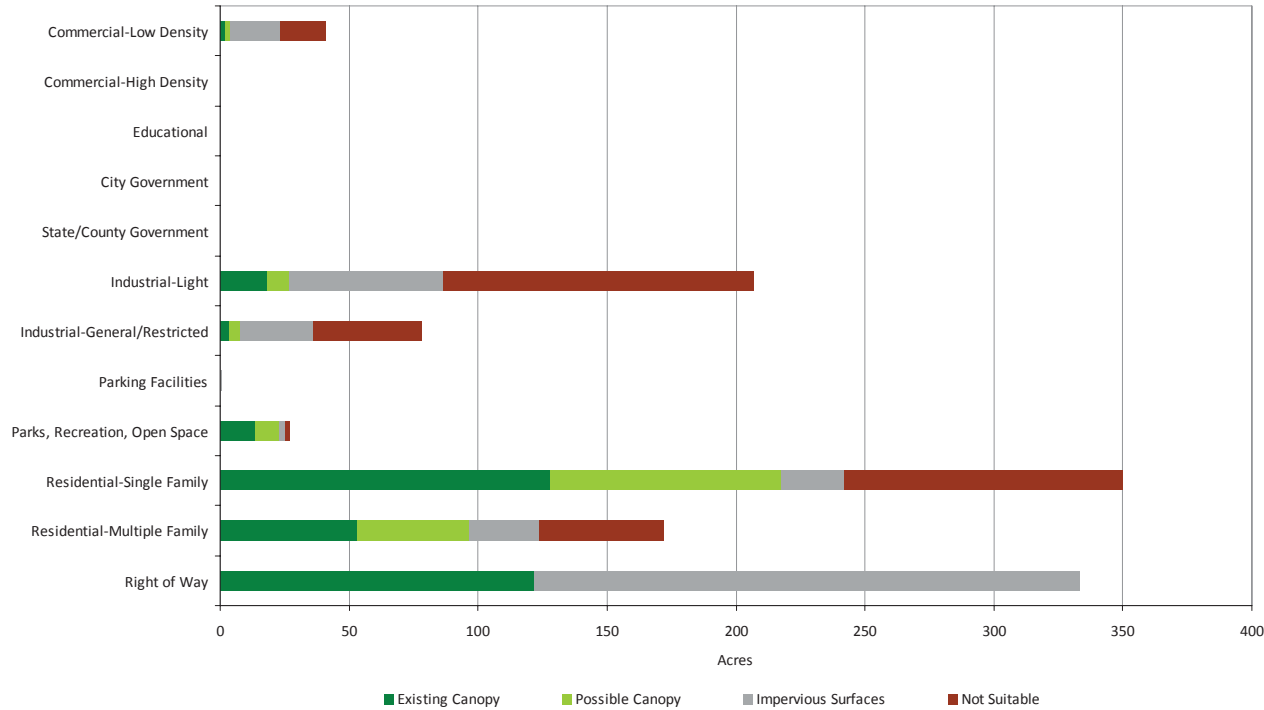
Acres of new trees required to meet a 35%/40% canopy goal: **35/115**

New trees required to meet a 35%/40% canopy goal: **3,529/11,549**

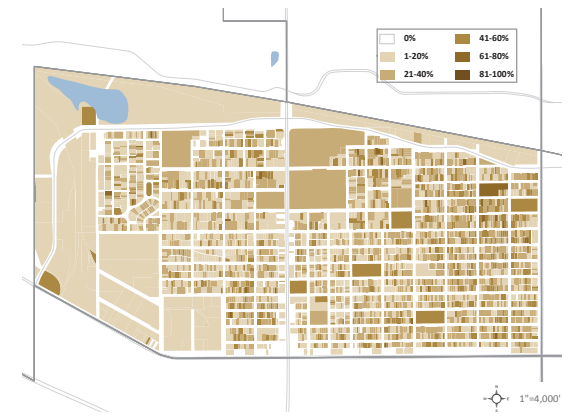
Acres of possible new canopy cover: **445**

District 11-Hamline/Midway

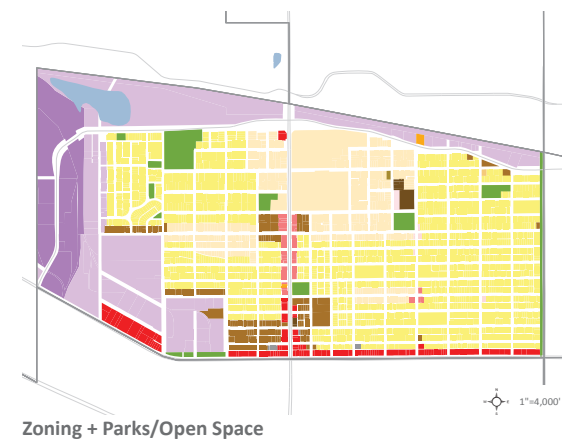
District 11 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 11 has an **existing canopy cover of 27.7%** found primarily on residential property and the right of way. A possible canopy increase of 16.8%, or 206 acres, is achievable resulting in a **total possible canopy cover of 44.5%**. The largest increases of 11% are possible on residential property with additional canopy increases available on the adjacent public right of way. Environmentally significant canopy increases of 8% are possible on industrial lands, mitigating the effects of large areas of impervious paving, though additional site design and resources may be necessary to increase tree cover over these heavily developed parcels.

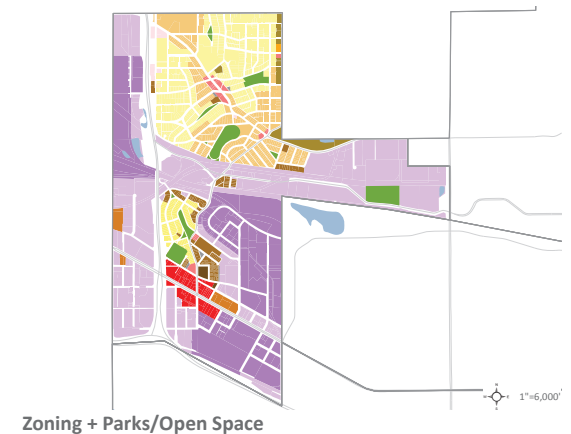
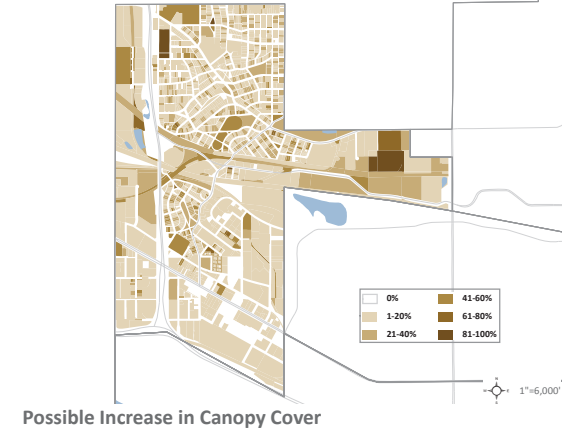
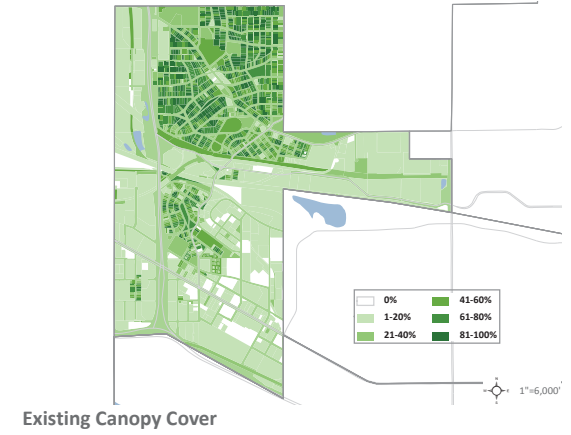
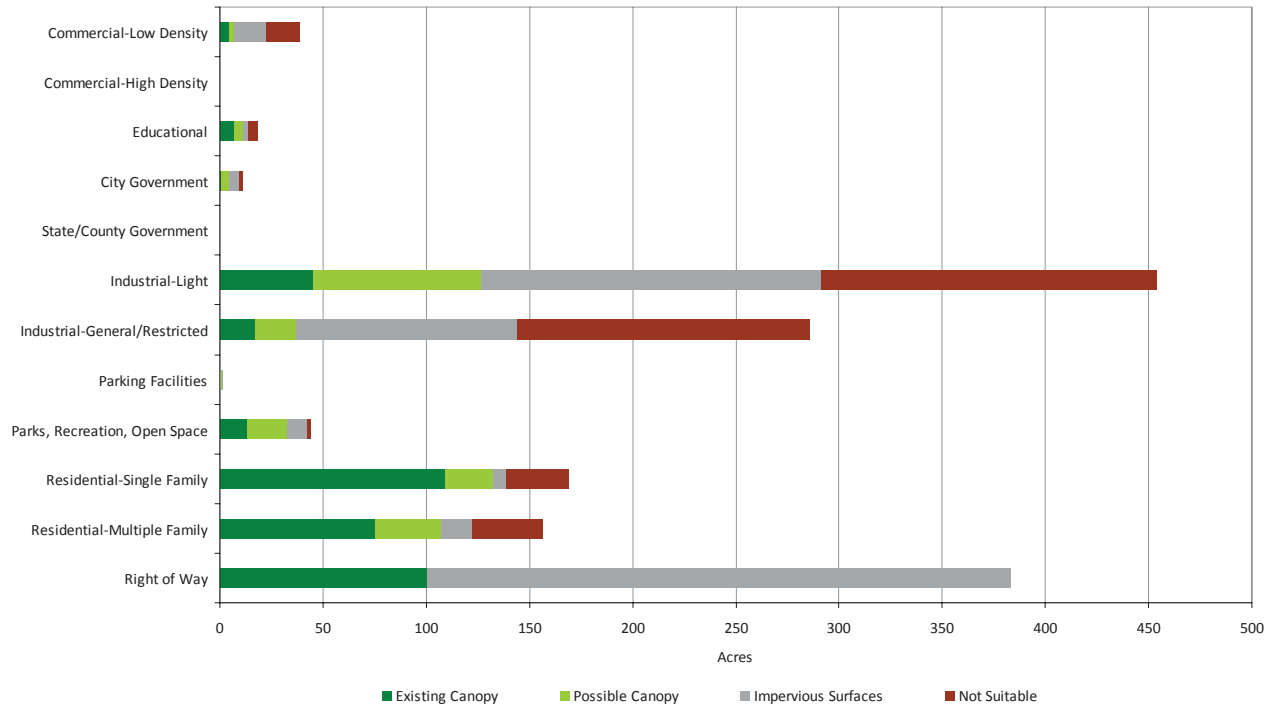
Acres of new trees required to meet a 35%/40% canopy goal: **90/151**

New trees required to meet a 35%/40% canopy goal: **8,964/15,104**

Acres of possible new canopy cover: **206**

District 12-Saint Anthony Park

District 12 Canopy Cover



Canopy Cover Analysis

District 12 has an **existing canopy cover of 24%** with significant differences in canopy across land uses. Industrial land covers 47% of District 12 but contains only 4% of the urban canopy while residential land, which covers 21% of the district, contains 50% of the canopy cover. The public right of way covers 25% of the district and contains an additional 27% of the total canopy cover. A possible canopy increase of 16.8%, or 263 acres, is achievable resulting in a **total possible canopy cover of 40.8%**. The most significant canopy increases are available on industrial land where canopy growth of 6%-17% is possible. However, additional site design and resources may be necessary to increase tree cover over these heavily developed parcels. Emerald ash borer was initially discovered in Saint Anthony Park in 2009 and continues to impact the district's canopy cover. As of May 2011, ash trees represent 12.2% of right of way tree cover and an unspecified number of private trees.

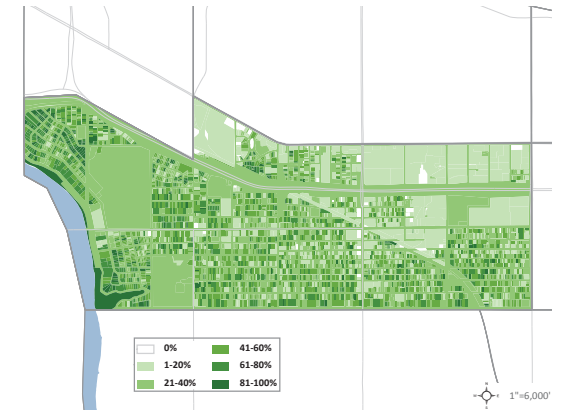
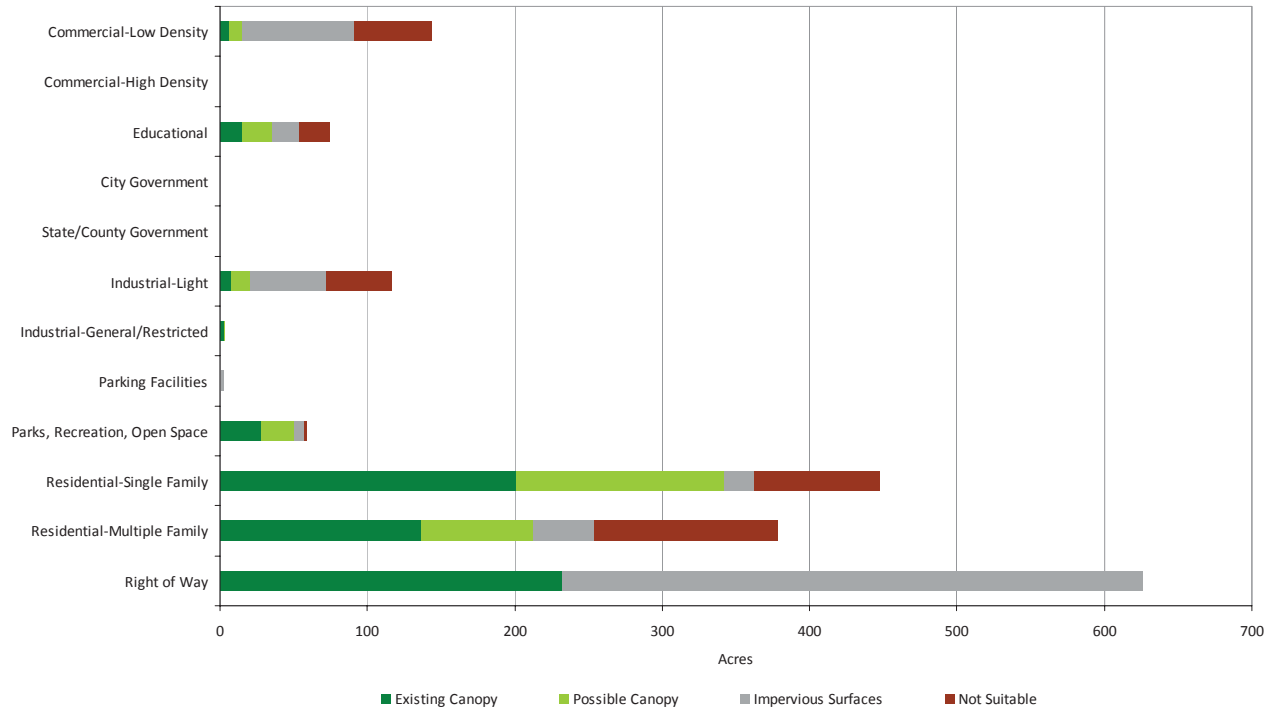
Acres of new trees required to meet a 35%/40% canopy goal: **173/241**

New trees required to meet a 35%/40% canopy goal: **17,327/24,132**

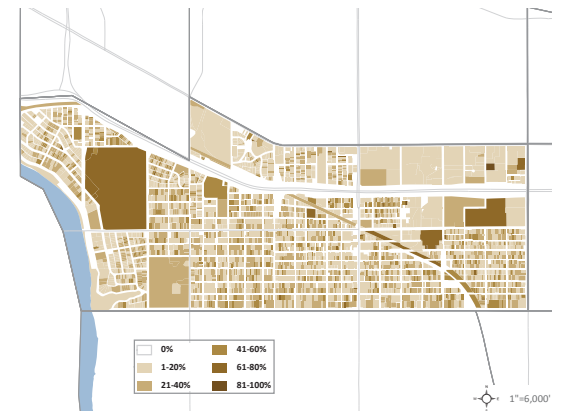
Acres of possible new canopy cover: **263**

District 13-Union Park

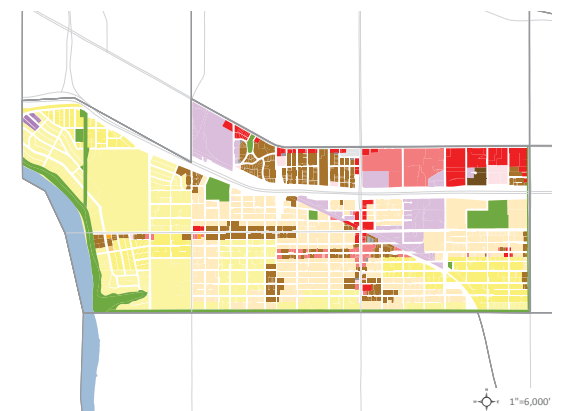
District 13 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 13 has an **existing canopy cover of 32.9%**. A possible canopy increase of 20.5%, or 391 acres, is achievable resulting in a **total possible canopy cover of 53.5%**. Residential property is the primary land use of District 13 accounting for 43.4% of land area and representing the largest opportunity for canopy development. Significant canopy increases in the commercial and industrial lands adjacent to Interstate 94 are possible, providing tree cover over large impervious areas and important environmental benefits to the district. Additional canopy increases are possible in the public right of way which currently has a canopy cover of 37.1%.

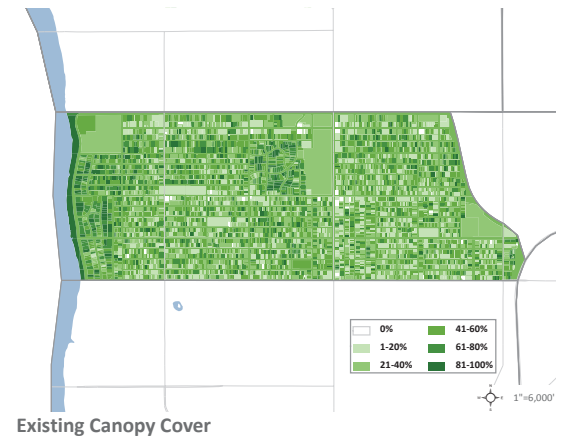
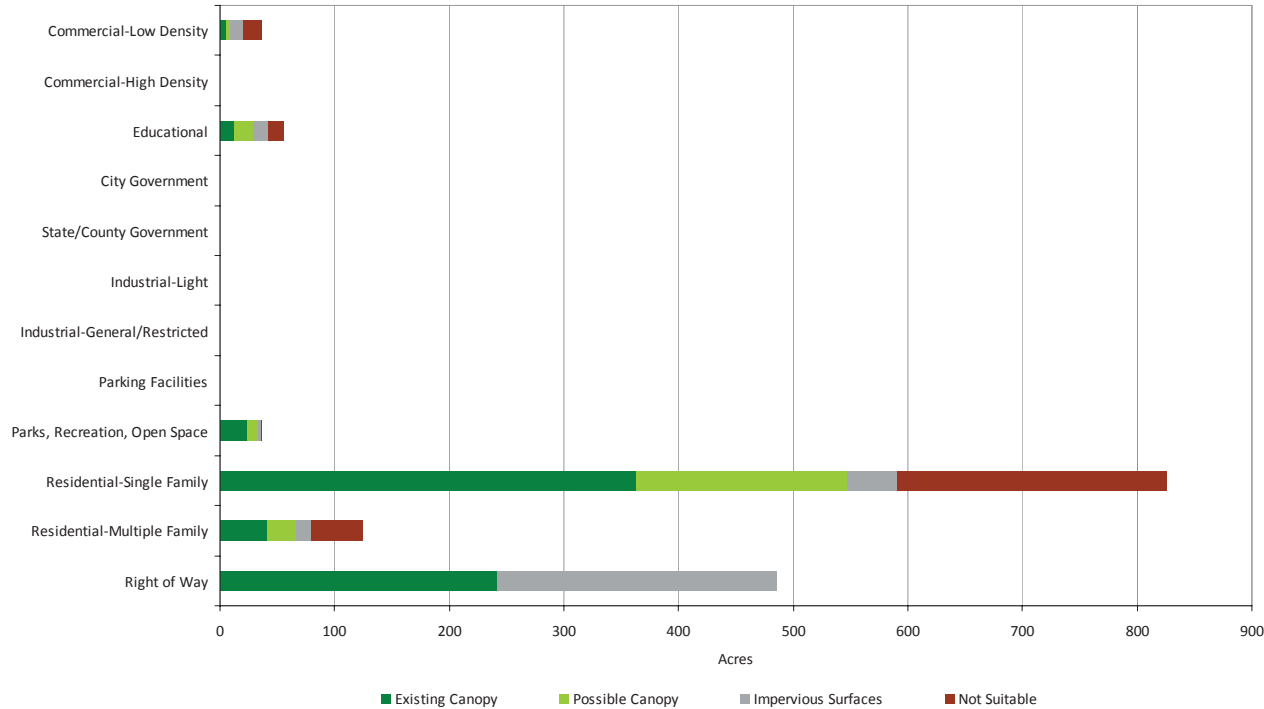
Acres of new trees required to meet a 35%/40% canopy goal: **40/135**

New trees required to meet a 35%/40% canopy goal: **4,005/13,540**

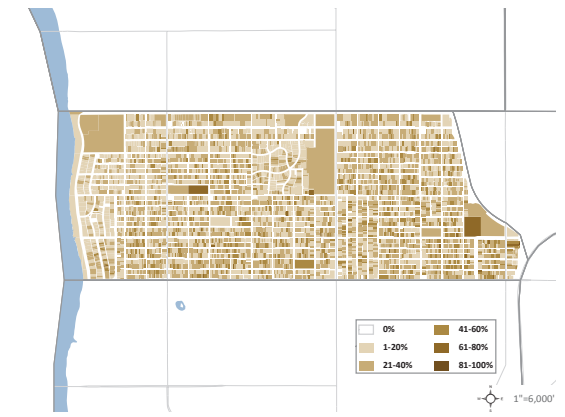
Acres of possible new canopy cover: **391**

District 14-Macalester/Groveland

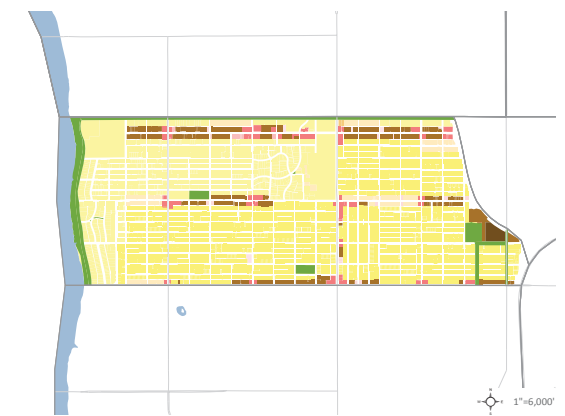
District 14 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 14 has an **existing canopy cover of 42.4%**, the second highest in the city and above American Forest’s recommendations. This largely residential district (58.6% of land area) benefits from forested park lands and a right of way canopy cover of nearly 50% which is the highest in the city. A possible canopy increase of 19%, or 308 acres, is achievable resulting in a **total possible canopy cover of 61.4%** with most increases achievable on private residential property. While a modest increase, schools could also support additional tree cover providing a number of benefits including educational opportunities for students.

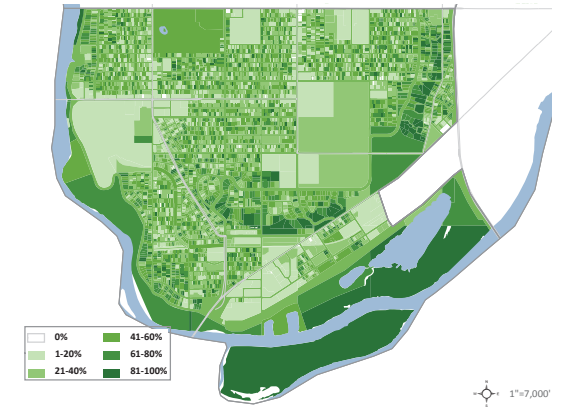
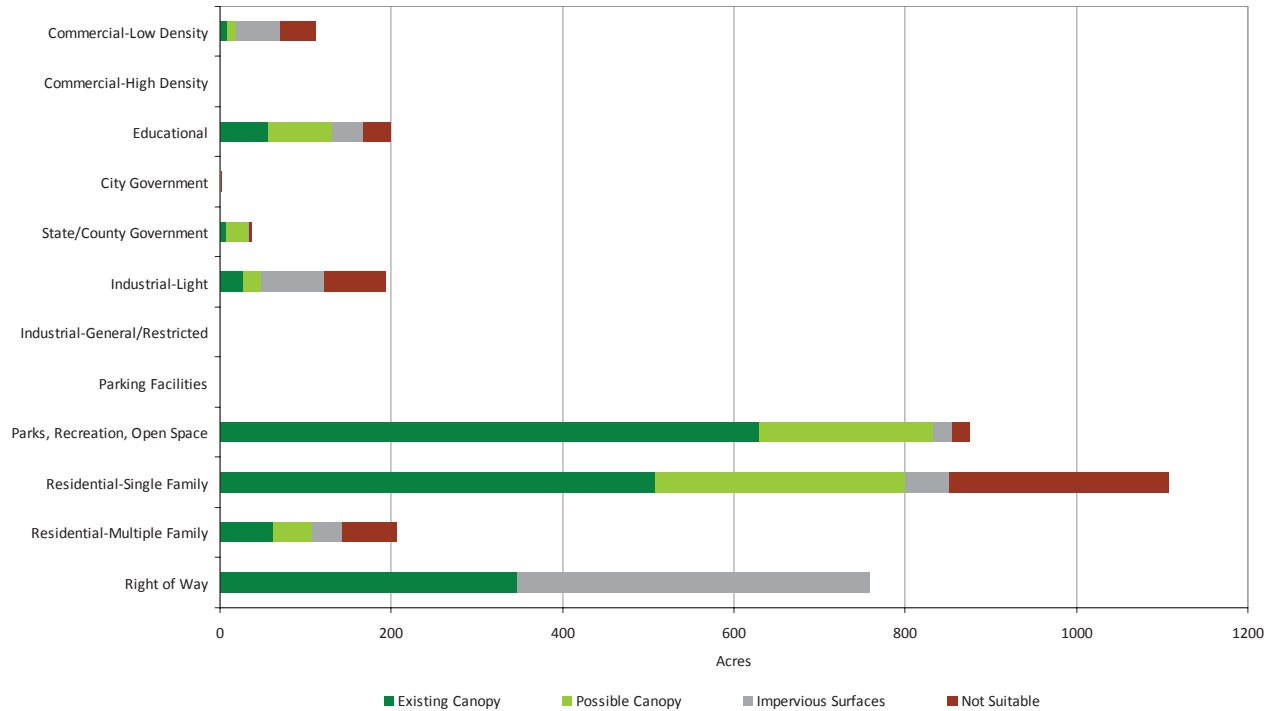
Acres of new trees required to meet a 35%/40% canopy goal: **0/0**

New trees required to meet a 35%/40% canopy goal: **0/0**

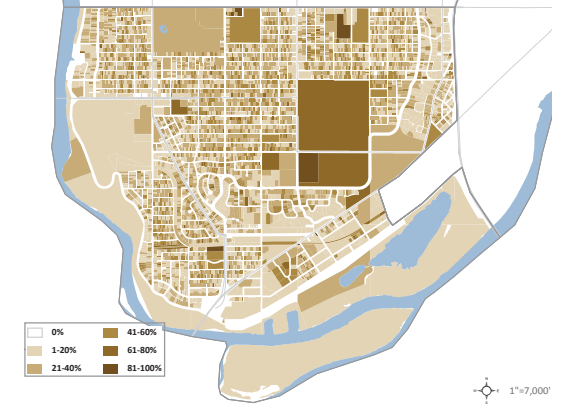
Acres of possible new canopy cover: **308**

District 15-Highland Park

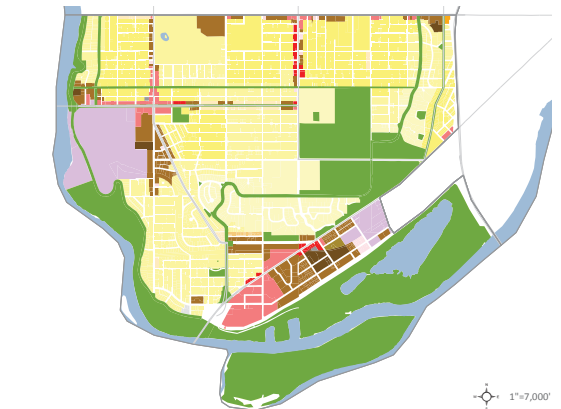
District 15 Canopy Cover



Existing Canopy Cover



Possible Increase in Canopy Cover



Zoning + Parks/Open Space

Canopy Cover Analysis

District 15 has an **existing canopy cover of 43.1%**, which is the highest level of canopy cover in Saint Paul and above American Forest’s recommendations. The large percentage of residential land (34% of district land area), park land (23% of district land area with a 72% canopy cover), and a 46% right of way canopy cover contribute to this total. A possible canopy increase of 21%, or 812 acres, is achievable resulting in a **total possible canopy cover of 64.1%** with the largest increases possible on residential property and park land, though recreational activities may limit tree planting in parks. The arrival of emerald ash borer in Saint Paul may severely impact the district’s future canopy cover. As of May 2011, ash trees represent 27% of the right of way canopy and an unspecified number of private trees.

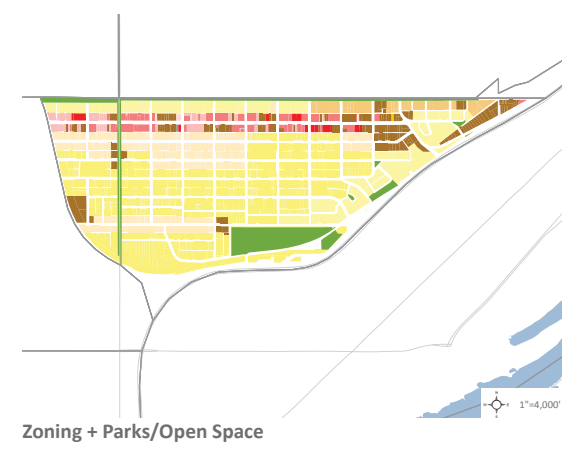
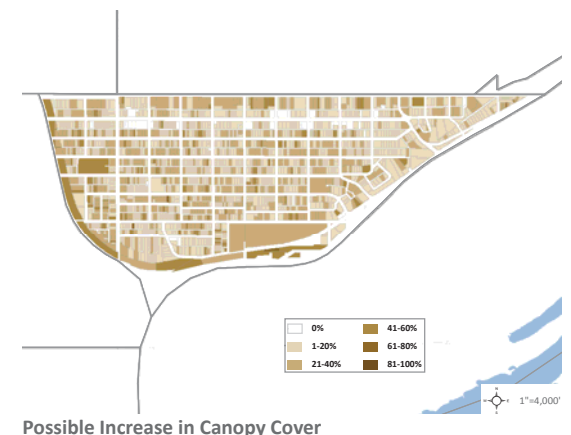
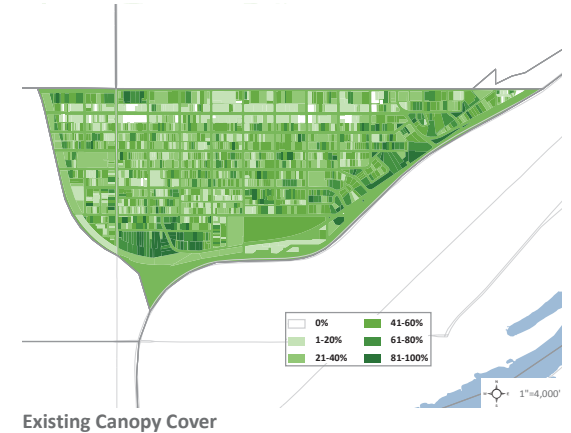
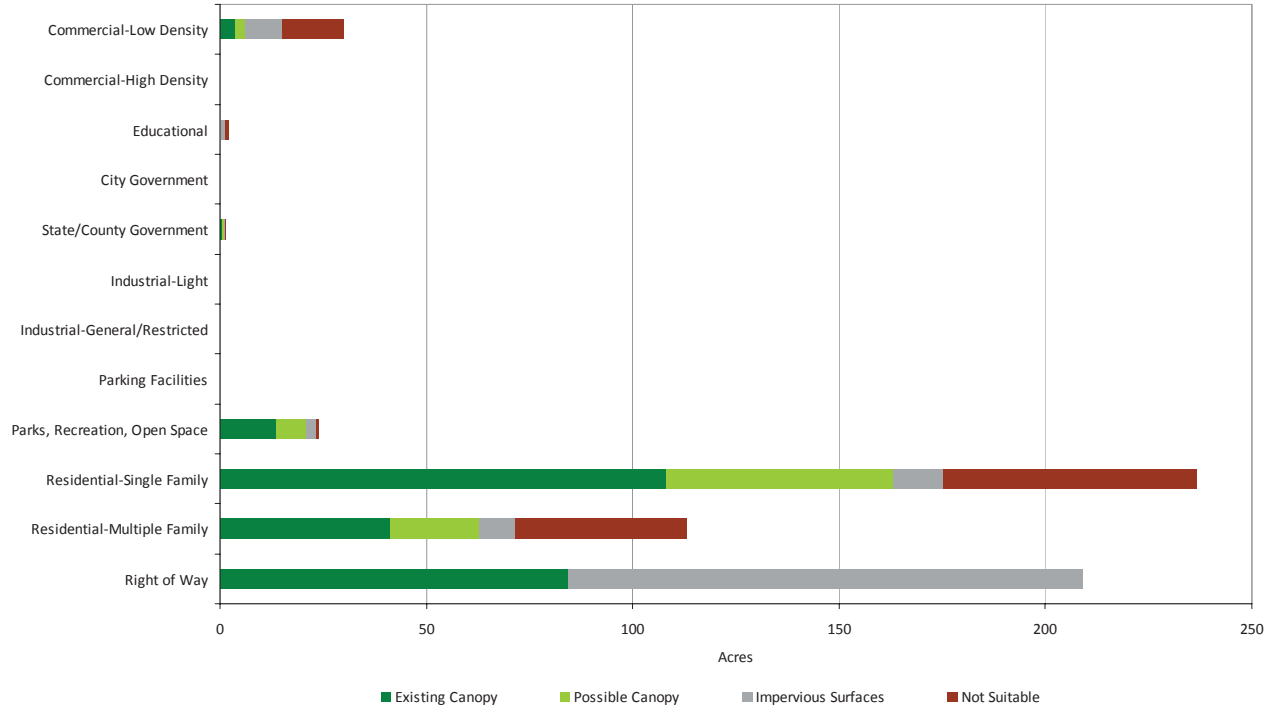
Acres of new trees required to meet a 35%/40% canopy goal: **0/0**

New trees required to meet a 35%/40% canopy goal: **0/0**

Acres of possible new canopy cover: **812**

District 16-Summit Hill

District 16 Canopy Cover



Canopy Cover Analysis

District 16 has an **existing canopy cover of 40.8%**, a level of tree cover greater than the city average and national canopy recommendations proposed by American Forests. A significant canopy increase of 19.9%, or 123 acres, is still achievable resulting in a **total possible canopy cover of 60.7%**. The largest share of this increase is possible on residential property which covers nearly 57% of the district's land area, has an existing canopy cover of 42.6%, and could support an additional 22% canopy increase. Further canopy increases are possible on the public right of way which has an existing cover of 40.4%.

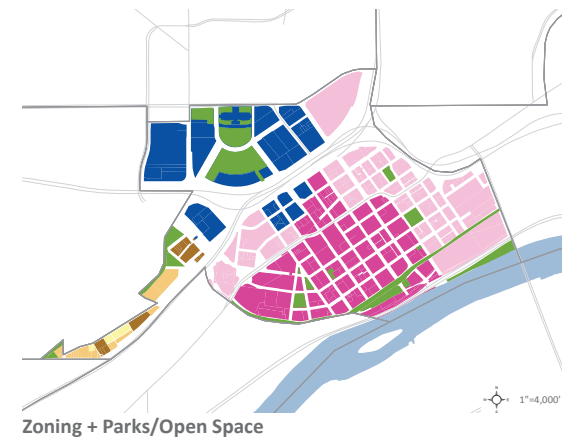
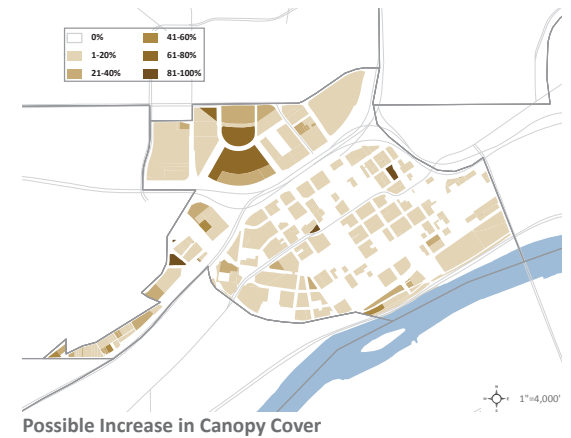
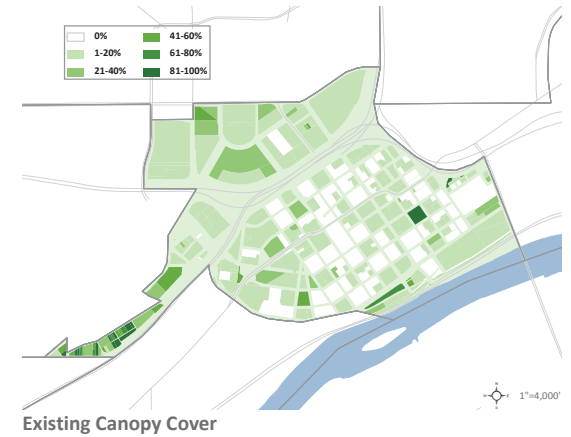
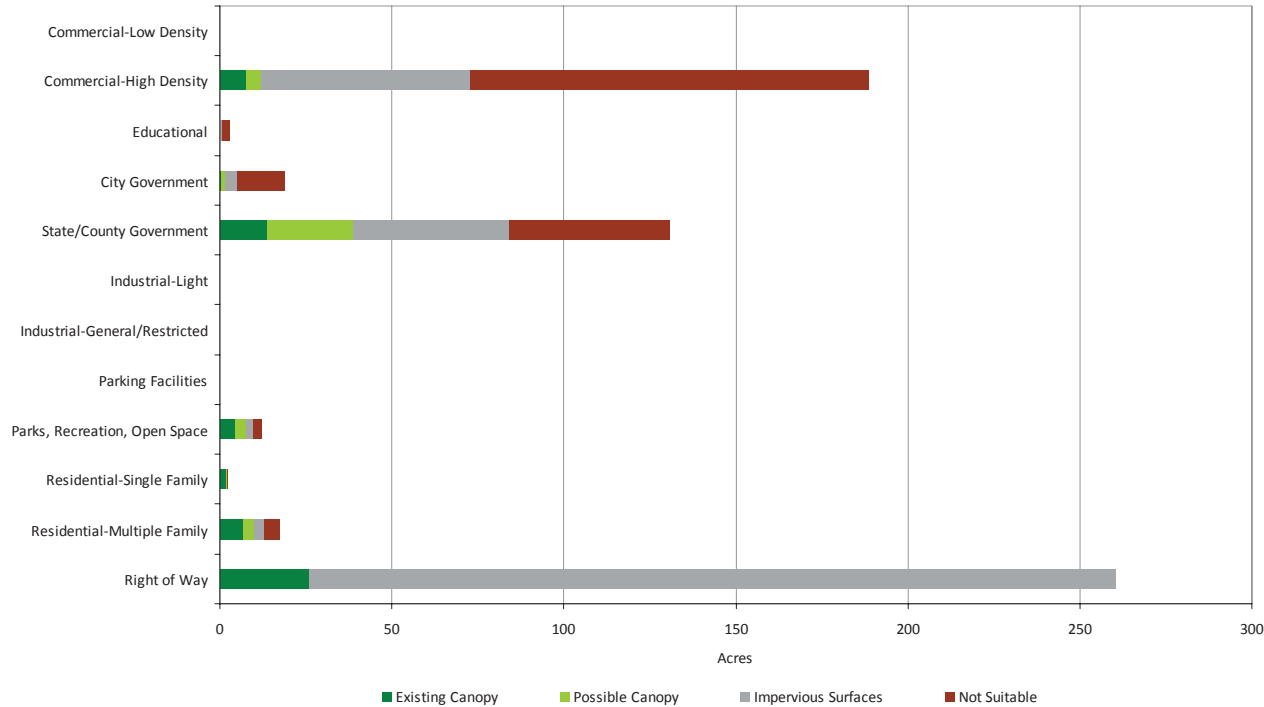
Acres of new trees required to meet a 35%/40% canopy goal: **0/0**

New trees required to meet a 35%/40% canopy goal: **0/0**

Acres of possible new canopy cover: **123**

District 17-Capital River/Downtown

District 17 Canopy Cover

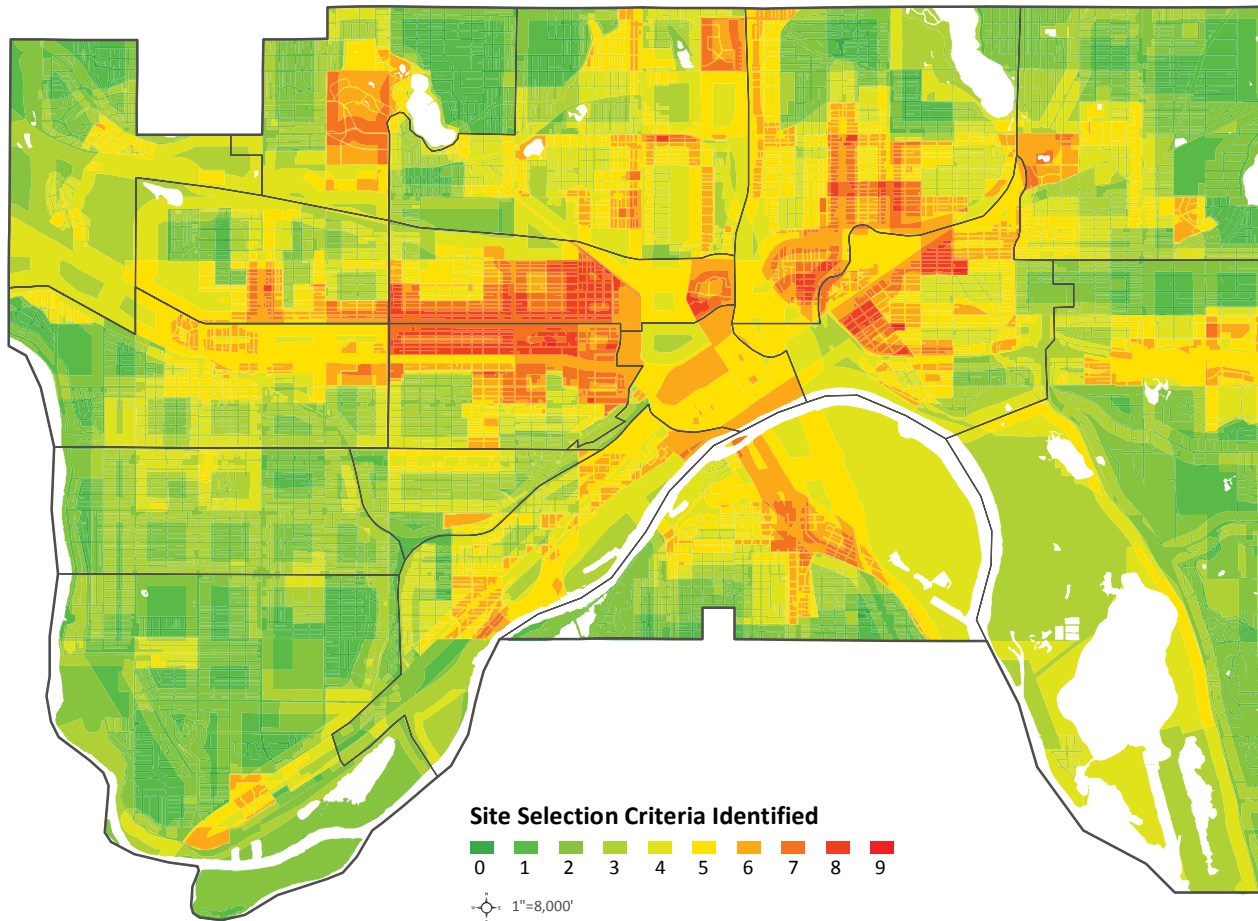


Canopy Cover Analysis

District 17 includes the central business district of Saint Paul and has an **existing canopy cover of 9.4%**, significantly lower than the city average of 32.5%. Existing tree cover in the downtown is located on park land and the public right of way with potential increases in canopy cover reduced by the difficult planting and growing conditions imposed by limited soils and the dense built environment. A possible canopy increase of 12.1%, or 79 acres, is achievable resulting in a **total possible canopy cover of 21.5%** with the most significant increases possible on the public right of way. Planting trees in District 17 will likely require a larger per tree investment but the environmental, economic, and social benefits of an increased canopy cover in downtown can be substantial, improving the pedestrian environment, mitigating urban temperatures, and reducing stormwater runoff.

Acres of new trees required to meet a 35%/40% canopy goal: **166/198**
 New trees required to meet a 35%/40% canopy goal: **16,589/19,829**
 Acres of possible new canopy cover: **79**

Site Selection Model



Tree Cover Analysis

Trees provide numerous benefits to the urban environment. Determining where increased tree cover could provide additional benefits based on existing environmental and demographic conditions can direct forest management efforts to increase canopy benefits where they may otherwise be lacking. Nine attributes were mapped and assigned a value of 0 or 1 (condition exists or does not exist). These values were then added together resulting in a site selection map indicating locations where additional tree cover may be preferable on a scale of 0 (low priority) to 9 (high priority).

Site Selection Attributes

Population Density

Based on 2010 census data, population density measures the number of people per square mile indicating areas where increased tree cover will benefit the highest number of people as well as mitigate the environmental impacts of increased urban development.

Median Income

Based on the 2005 American Community Survey, census block groups were classified by the median household income of \$46,026. Areas below the city median income level were identified as potential locations for future planting efforts.

Crime

Spatial crime data was used to measure the total number of crimes per map block. Research indicates that the presence of trees may reduce crime rates while providing additional social benefits. Locations with an above average crime density were mapped designating areas where additional tree planting may complement other crime strategies.

Canopy Density

Census block groups with a canopy cover below the city average of 32.5% were mapped indicating areas where additional tree planting would benefit overall canopy development.

Impervious Density

Census block groups with an impervious land cover above the city average of 23.8% were mapped indicating areas where canopy development would reduce the amount of impervious surface area, mitigating stormwater runoff and urban heating caused by exposed impervious surfaces.

Urban Ecology

City, county, and state park lands as well as the Mississippi National River and Recreation Area (MNRRA) were mapped indicating key areas of urban habitat, outdoor recreational opportunity, and open space within the developed urban matrix.

Project District

Invest Saint Paul is an initiative to promote investment to strengthen communities through economic development, environmental and transit, education and family health, and improved housing and quality of life. Tree planting is an important aspect of enhancing the environmental quality of these neighborhoods.

Road Buffer (Air Quality + Noise Levels)

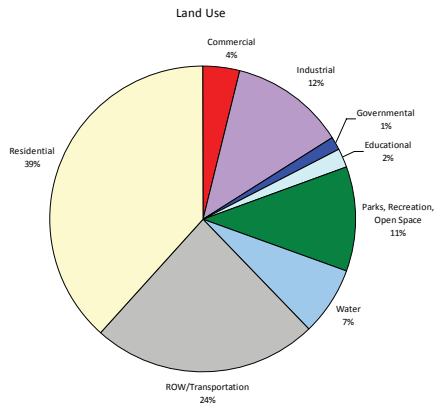
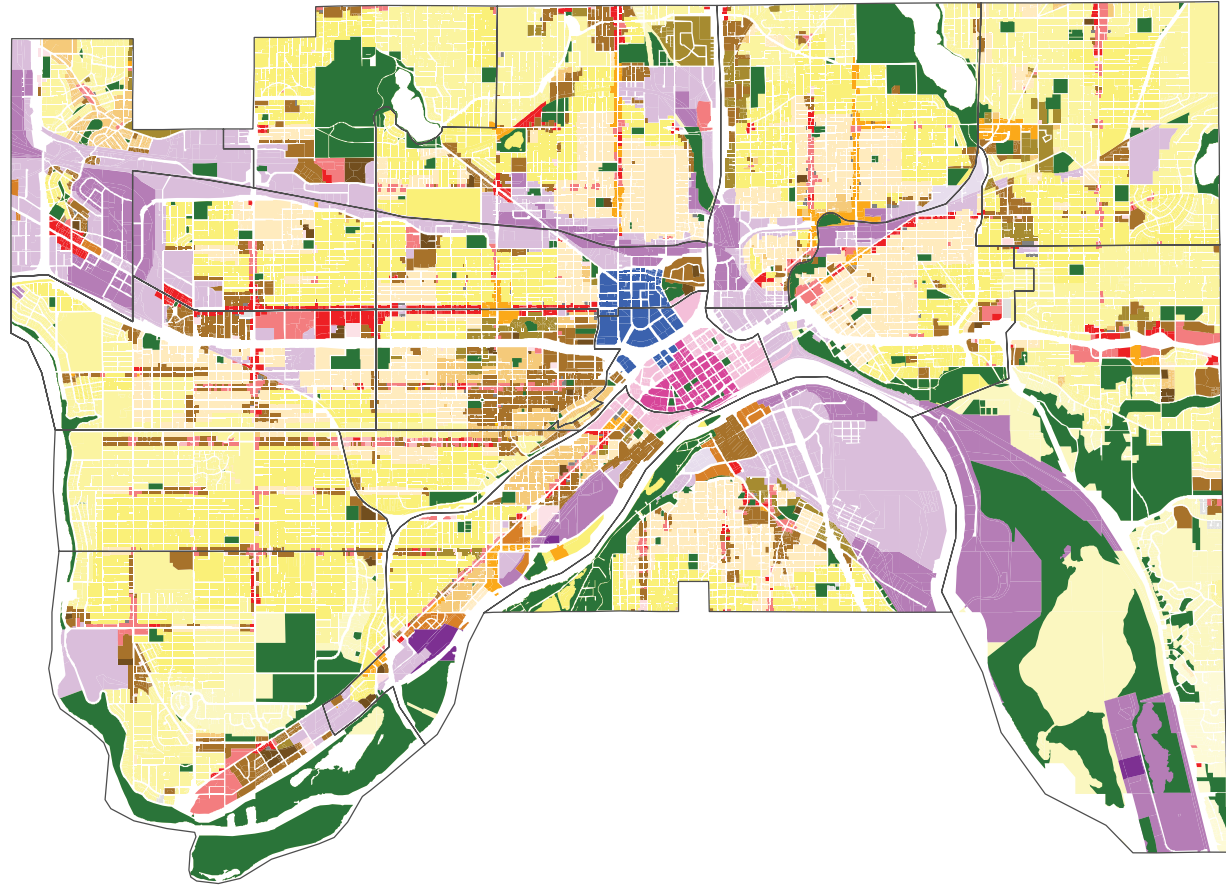
Roadways are a significant source of air pollution and particulate matter that can impact health. A 500 foot buffer was applied to roadways with average daily traffic volumes (ADT) above 5,000 vehicles per day.

Zoning

Residential land accounts for the single largest land use in Saint Paul and was mapped to indicate areas where increased canopy cover would provide the greatest and most direct benefit to the neighborhoods where people live and spend a significant amount of their time.

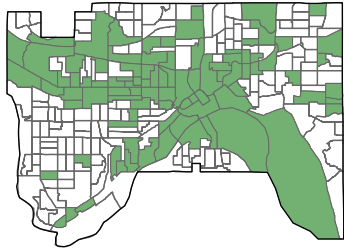
References + Resources

Resource: Zoning Classifications



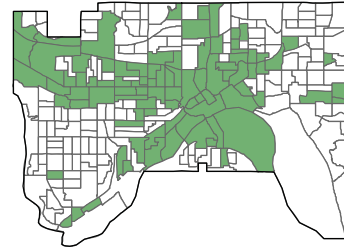
- | | | | |
|-----------------------------------|--------------------------------|-------------------------|------------------------------|
| OS Office-Service | CA Capital Area Jurisdiction | RL One-Family Large Lot | RM3 Multiple-Family |
| B1 Local Business | IR Light Industrial Restricted | R1 One-Family | RT1 Two-Family |
| BC Community Business (converted) | I1 Light Industrial | R2 One-Family | RT2 Townhouse |
| B2 Community Business | I2 General Industrial | R3 One-Family | TN1 Traditional Neighborhood |
| B3 General Business | I3 Restricted Industrial | R4 One-Family | TN2 Traditional Neighborhood |
| B4 Central Business | PD Planned Development | RM1 Multiple-Family | TN3 Traditional Neighborhood |
| B5 Central Business Service | VP Vehicle Parking | RM2 Multiple-Family | TN3M TN3 with Master Plan |

Resource: Site Selection Model Attributes



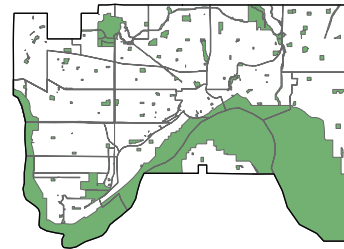
Canopy Density

Canopy density was generated by classifying canopy cover by census block group. Block groups with a canopy cover less than the city average of 32.5% were coded as '1' and used to map areas where increased canopy cover may be desirable.



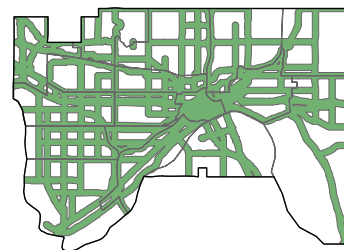
Impervious Density

Impervious density was generated by classifying impervious cover by census block group. Block groups with an impervious cover greater than the city average of 23.8% per census block group were coded as '1' and used to map areas where increased canopy cover may be desirable.



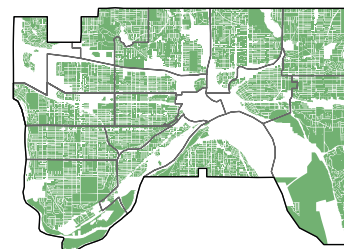
Urban Ecology

Created by combining Saint Paul park property and the Mississippi River Critical Area and Mississippi National River and Recreation Area (MRCA/MNRRRA) data to map open spaces, habitat, and natural areas within the city.



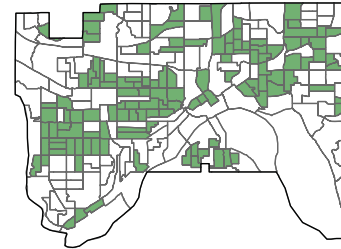
Road Buffer (Air Quality + Noise Levels)

Major roadways with average daily traffic volumes of 5,000 or more vehicles were buffered by a distance of 500 feet to account for air pollution caused by vehicle emissions. Traffic data is from the Minnesota Department of Transportation's 2008 traffic volume map for Saint Paul. The buffer distance of 500 feet is close to the 150 meter (492 ft) minimum value cited in air quality reports on the health impacts of roadways.



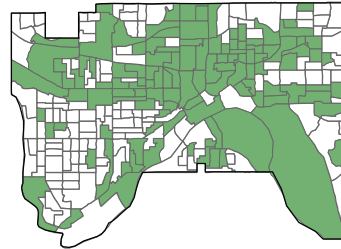
Zoning

Land use data classified as residential of any type was exported from the city shapefile "zoning3" available from the City of Saint Paul to create this layer. Residential lands were selected as a variable since residents spend a significant amount of time in these areas including recreation and leisure activities.



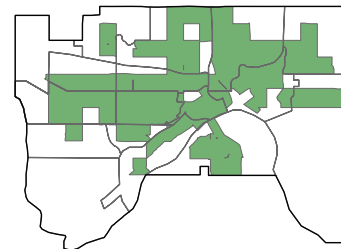
Population Density

Population density (residents per square mile) was calculated using 2010 census data classified by census block group and the average determined. Block groups with a population density above the city average were assigned a value of '1' and those below with a value of '0'. The resulting map indicates where a dense urban environment may require more tree cover to mitigate the environmental impacts of development and where more people will benefit from the increased tree cover.



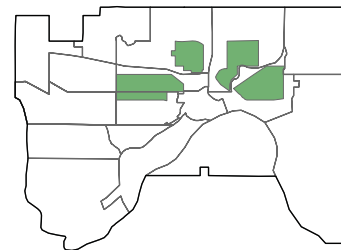
Median Income

Median income was determined using 2005 American Community Survey 5 year data available from the Census Bureau and the 2000 census block group map. Using the median household income of \$46,026, provided by American FactFinder, block groups were classified and those below the median income level assigned a value of '1' and those above with a value of '0'.



Crime

Crime incidence data points collected for 2010 were summed for each grid unit within the Saint Paul crime grid map and an average crime count of .4167 crimes per acre was calculated. Crime grids with an average number of crimes per acre above this level were classified as '1' and exported to create the map layer.

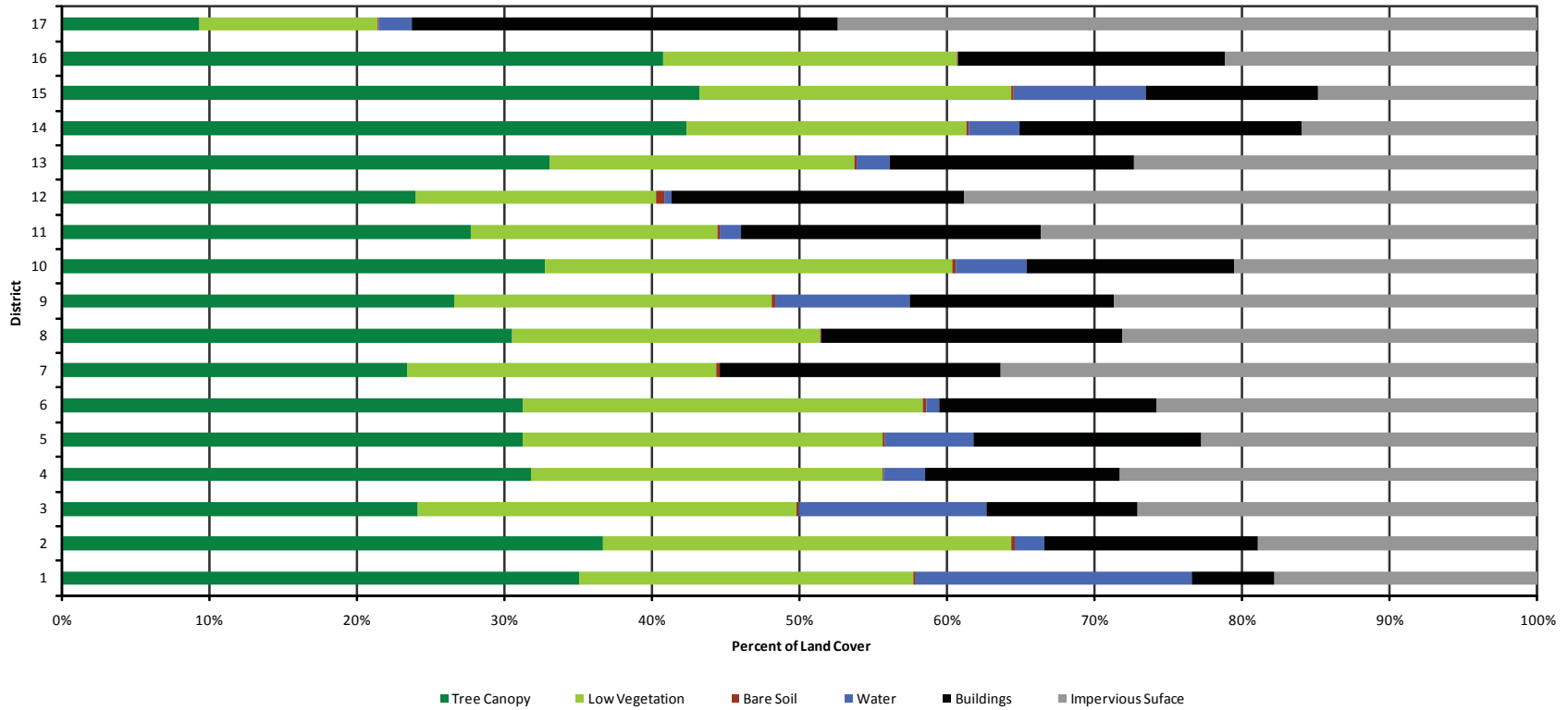


Project Districts

Invest Saint Paul districts were digitized over the Tax Parcel shapefile (partax 08162004) using the Invest Saint Paul map found in GISmo as a guide. These districts are areas that have been identified for increased investment to strengthen the communities through economic development, environmental and transit improvements, education and family health, and improved housing and quality of life.

Resource: Land Cover

Land Cover Classification



Land cover classification totals as provided by the University of Minnesota Remote Sensing and Geospatial Laboratory

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