



POTENTIAL TREE PLANTING ANALYSIS

Supplemental Map Series

SUMMARY

This document summarizes a high-level GIS analysis to identify where there may be potential locations for new tree plantings throughout the city. The locations identified in this map book represent hypothetical planting locations that can serve as a strategic planning tool as Charlottesville continues to enhance its urban forest.

Prepared for the City of Charlottesville by the Green
Infrastructure Center Inc.

January 2017

Potential Tree Planting Location Density

Potential Tree Planting Location Density – Right-of-Way

Relative Temperature

Relative Temperature – Right-of-Way

Household Income

Household Income – Right-of-Way

Sub-catchment Imperviousness

Sub-catchment Imperviousness – Right-of-Way

Population Density

Population Density – Right-of-Way

The information shown in this map book is intended to be used as a high-level, city-wide planning tool. A citywide screening of where there may be potential to plant trees is a useful first step in understanding not only where and how many trees might be planted, but also what benefits might be associated with planting in a given location. This map book is part of a supplemental map series that provides an overview of potential tree planting locations at a neighborhood level. The supplemental map series was created to summarize five metrics that provide insight into potential benefits of tree planting. The five metrics are:

1. Potential tree planting location density
2. Relative temperature
3. Household income
4. Sub-catchment imperviousness
5. Population density

Each metric is summarized in two forms, citywide and right-of-way-specific, for a total of ten map books in the supplemental map series. This map book shows ***the relative temperature at each potential tree planting location***. Trees provide shade and mitigate the “urban heat island” effect. This map series shows where temperatures are highest and lowest at each potential tree planting location, which indicates where trees may provide maximum benefit for temperature reduction. Temperature data was obtained from LANDSAT Enhanced Thematic Mapper thermal radiation images during several summer months.

These points were created by the Green Infrastructure Center (GIC) using the best available GIS data, not field surveys. The datasets included in the methodology are under constant revision, and may not be perfectly accurate or current. This analysis is not a suitability study and does not represent recommended tree planning sites. The locations identified may include areas where trees could not be physically planted, and could also include areas that may not be suitable for planting. Further field investigation will be needed to determine if the points identified are suitable for planting and to identify the precise tree planting site.

Methodology:

The basic outline of this process was to first update the provided “possible planting area” (PPA), create tree points within the final PPA, calculate a variety of metrics to attach to each point, and finally create map books to help guide future tree plantings.

A variety of datasets were used to complete this analysis. The primary data source for this analysis was created for the City of Charlottesville by Plan-It Geo. They developed a full land cover classification, as well as deriving the PPA from the created land cover dataset. Their product was derived from 2014 aerial imagery, which is one of the major limitations of the analysis because trees planted after 2014 are not accounted for, unless their specific location has been tracked by the City. Many of the datasets used as both exclusion factors and point metrics are updated on a regular basis by City of Charlottesville staff. This will allow the City of Charlottesville to update this analysis in the future when it becomes outdated.

The potential tree planting locations are semi-random points that have been placed to maximize the number of trees that can be planted in the PPA. The PPA was created by mapping several types of land cover, including turf grass and bare soil, while excluding land cover types where trees cannot be planted, like buildings and roads. This analysis only considers pervious PPA. This does not include impervious PPA, such as parking lots, even though it may be possible to plant trees in these areas. Additional exclusion factors (places where trees cannot be planted) were applied to refine the PPA:

- The Meadow Creek Restoration area (the area was replanted, but not captured in the land cover dataset)
- Railroad right-of-way
- A 10-foot buffer around existing trees
- A 10-foot buffer around existing buildings
- A 15-foot buffer around recent tree plantings
- A 10-foot buffer around underground utilities
- Sidewalks
- Private alleyways (alleyways that do not receive public maintenance, but must remain clear for vehicles)
- Un-addressable buildings – ranging from sheds to parking decks

Additionally, points were given a 40-foot separation distance. A 15-foot buffer was used around the available dataset of overhead utilities, but points that fell within this buffer were not removed, only flagged as constrained. Trees can still be planted in these locations, they are simply not ideal for larger trees. These final two constraints were chosen because they are consistent with codes and best practices for tree planting and maintenance in Charlottesville.

Additionally, for planning and analysis purposes, a number of metrics were collected for each identified point. These were:

- Census Data (by block group)
 - Population Density (Persons/Acre)
 - Median Household Income
- Proximity (up to 328 feet (100 meters)) to Major Roads (including ADT numbers)
- Proximity (up to 33 feet (10 meters)) to Trails (Existing and Proposed)
- Proximity (up to 49 feet (15 meters)) to Bike Lanes (Existing and Proposed)
- Proximity (up to 656 feet (200 meters)) to Streams
- Near Forest Cores (100 Feet)
- Sub-catchment Imperviousness Percentage
- Relative Temperature
- Type of Framework Street (50 Feet)
- Zoning
- Steep Slopes
- Floodplain

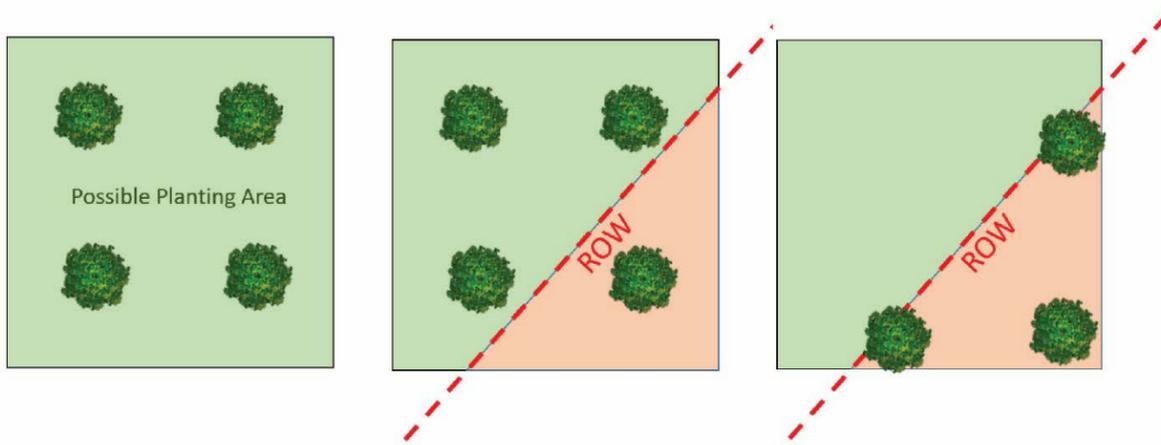
- Underneath overhead power lines (Dominion Data)
- Entrance Corridor
- State Owned Property
- City/County Owned Property
- School Property
- UVa Property
- Walking Distance to Schools (1/4 Mile)

If a metric does not have a discrete value, such as population density, it was given a value of 0 if it does not meet the metric, and a 1 if it does. Metrics that include “Proximity” have distances included. For the metrics that include proximity, a distance of -1 indicates that the point falls outside of the maximum range to be considered for that metric.

Trees can provide many benefits, from stormwater mitigation to reducing urban heat island, and this supplemental information helps identify where these benefits can be realized. While all of the metrics are embedded in each point, these map books help visualize this information spatially. This map book can identify potential tree planting projects, but the exact location of trees should be adjusted based on the realities of the specific site.

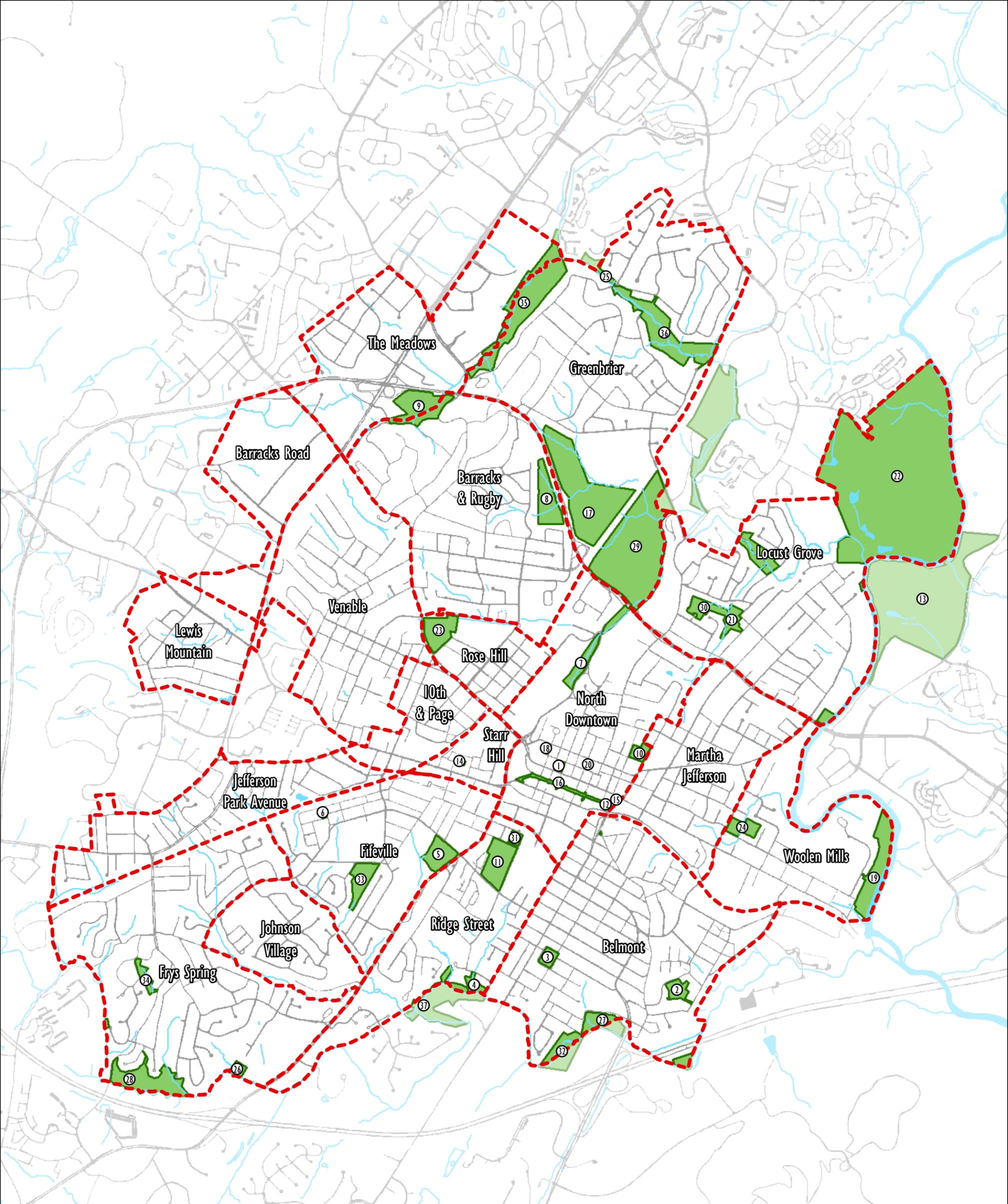
Right-of-Way Analysis:

Right-of-way possible planting area points are calculated from their own analysis, not a selection from all potential tree planting locations. This is because the points were placed randomly to maximize the number of points. The random points did not take into account the right-of-way, leading to an under-estimation of points that could fit into the right-of-way. A second, identical calculation was done on just the PPA within the right-of-way so that the number of points were not under-represented. The total points and the points in the right-of-way should be treated as separate analysis.



This series of images demonstrates the difference between the possible planting points generated specifically inside the right-of-way. The image at left shows where possible planting points would be located by ArcGIS to maximize the number of points in a given possible planting area (green square) and a specified minimum spacing between points. The middle image demonstrates what would happen assuming the portion of the PPA shown in orange was in the ROW. Under this scenario, only one point would be found to be in the ROW. The image at right shows what would happen if the same analysis is run **only considering the ROW**. Under this scenario, three points can be located in the ROW, using the same assumptions.

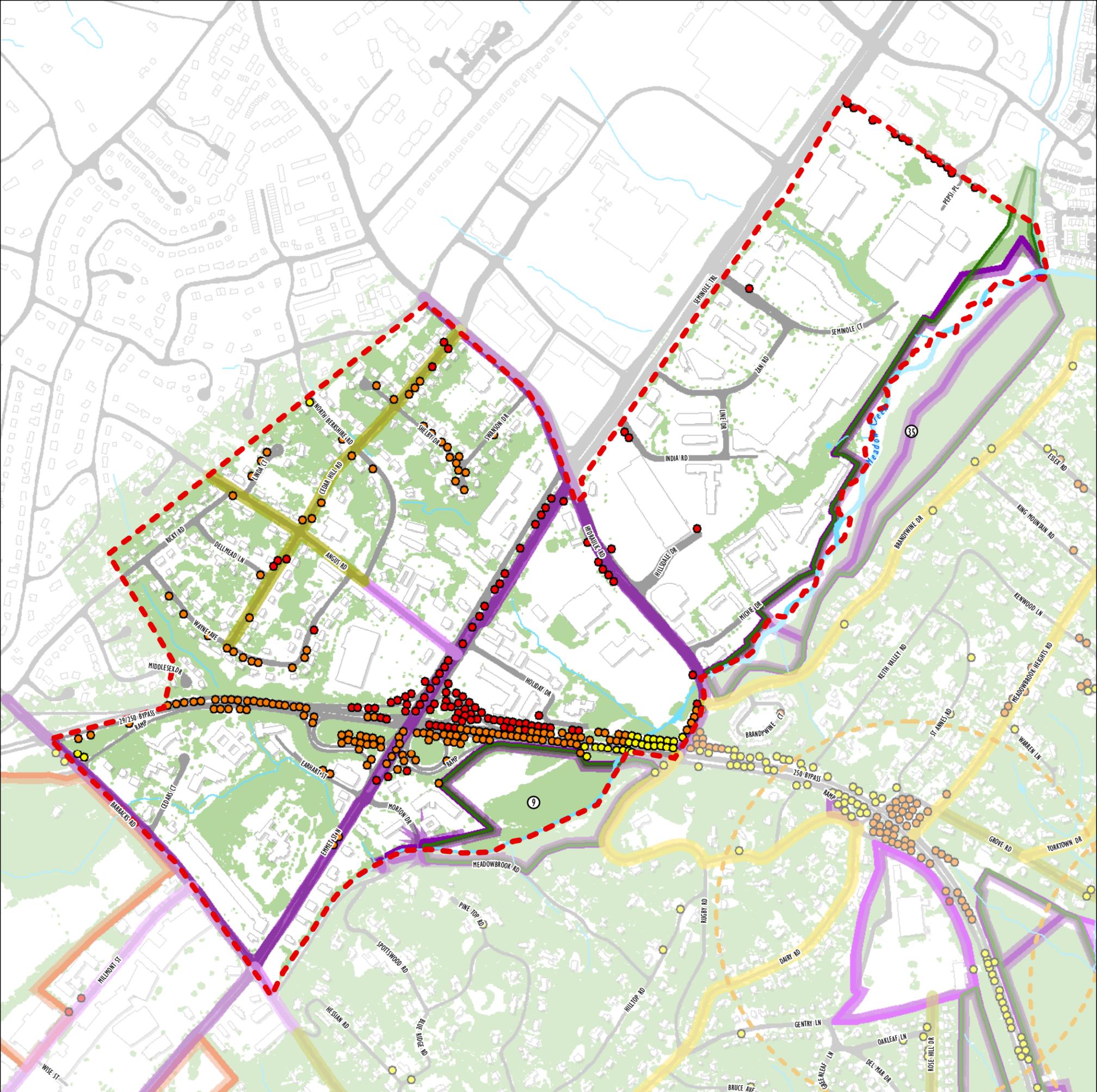
Thus, if one is interested in only what can be done in the ROW, the ROW-specific analysis should be used, as it looks at how planting sites can be maximized in only the ROW.



Parks			
1: Market Street Park	10: Maplewood Cemetery	20: Court Square Park	30: Davis Field
2: Rives Park	11: Oakwood Cemetery	21: Northeast Park	31: Daughters of Zion Cemetery
3: Belmont Park	12: Downtown Pavilion	22: Pen Park	32: Quarry Park
4: Jordan Park	13: Darden Towe	23: Washington Park	33: Forest Hills Park
5: Tonsler Park	14: Starr Hill	24: Meade Park	34: Fry's Springs
6: Fifeville Park	15: Rothwell	25: Meadow Creek Valley	35: Meadow Creek Valley
7: Schenk's Greenway	16: Downtown Mall	26: Longwood Park	36: Greenbrier Park
8: Greenleaf Park	17: McIntire Park	27: Quarry Park	37: Hartman's Mill
9: Meadowcreek Gardens & Disc Golf	18: McGuffey Park	28: Azalea Park	
	19: Riverview Park	29: McIntire Park	

Neighborhoods Overview





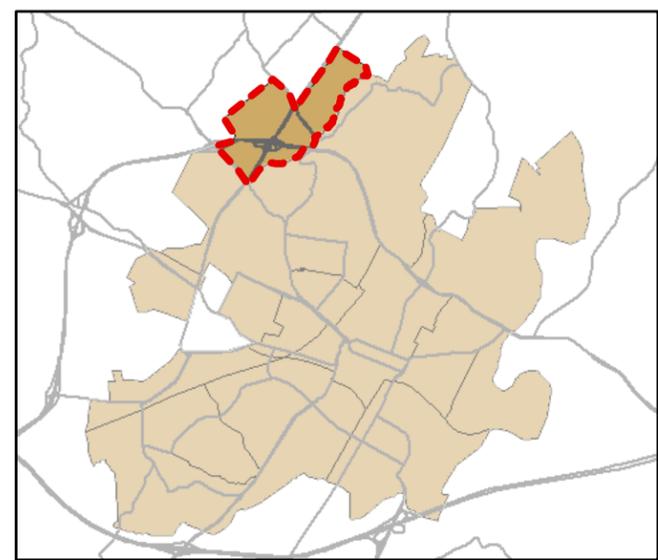
The Meadows

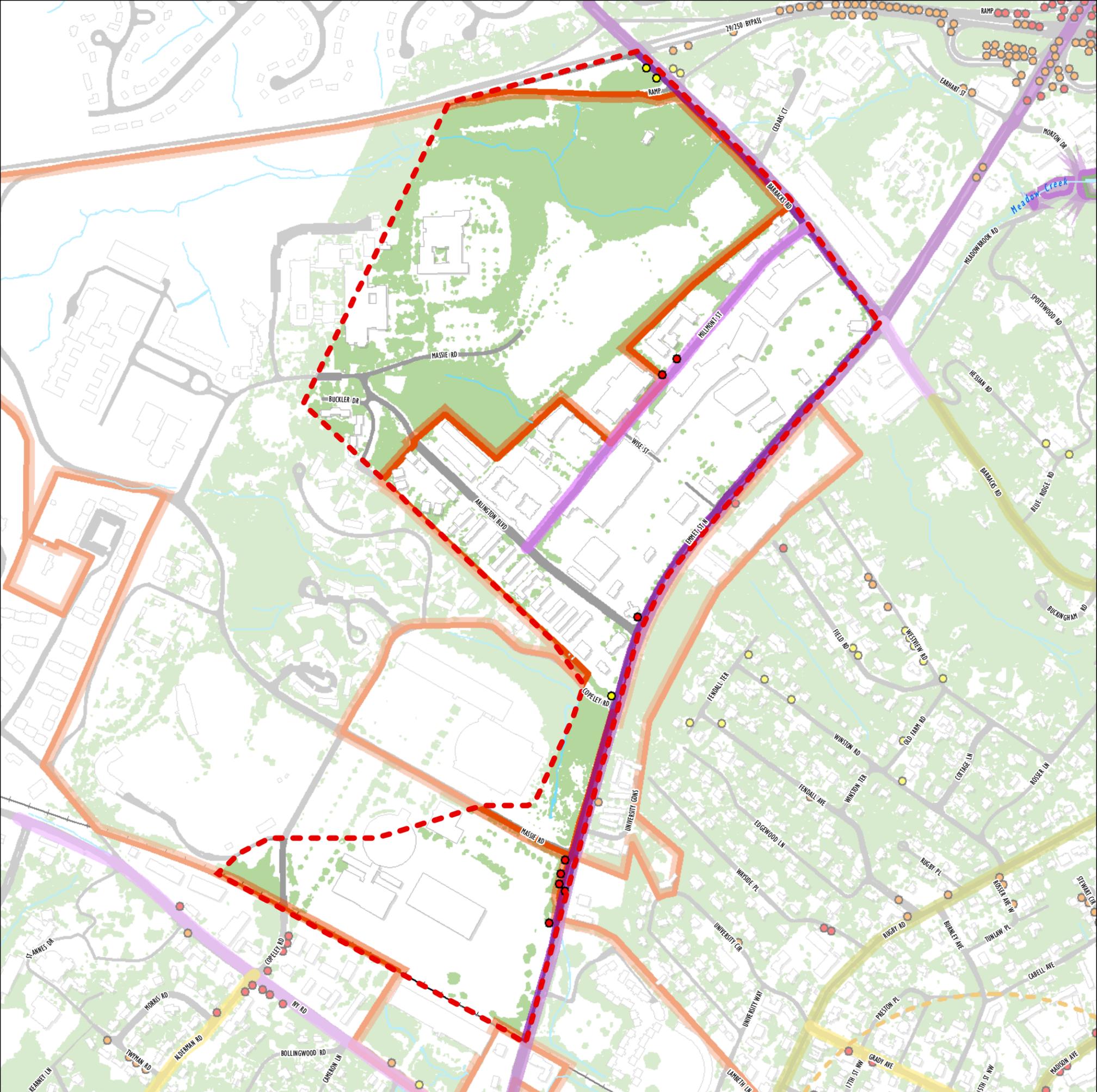


Legend

- Potential Tree Planting Locations (Right-of-Way)**
 - Higher Temperatures
 - Lower Temperatures
- Relative Temperature**
 - Streams
- Framework Streets - Typology**
 - Mixed Use A
 - Mixed Use B
 - Neighborhood A
 - Neighborhood B
 - Neighborhood Boundaries
- Potential Tree Planting Locations (Right-of-Way)**
 - 5 Minute School Walkzones
 - Tree Canopy
 - Parks
 - School Parcels
 - State-Owned Parcels
 - UVa Parcels
 - City Parcels

Parks 9: Meadowcreek Gardens & Disc Golf





Barracks Road



Legend

Potential Tree Planting Locations (Right-of-Way)  5 Minute School Walkzones

Relative Temperature

-  Higher Temperatures
-  Lower Temperatures
-  Lower Temperatures

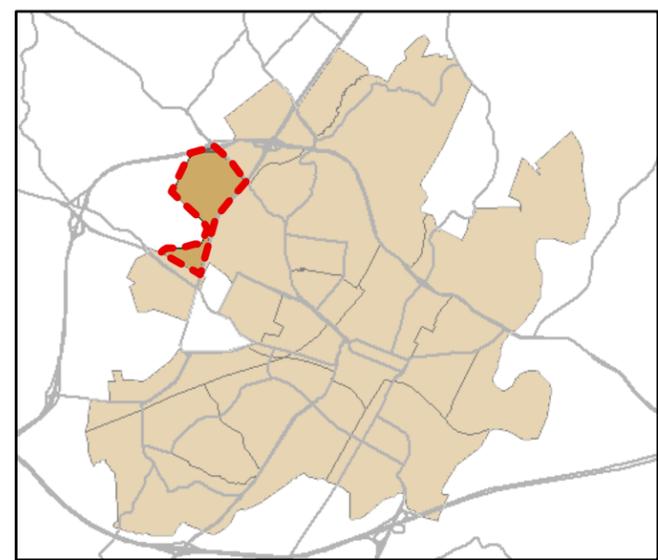
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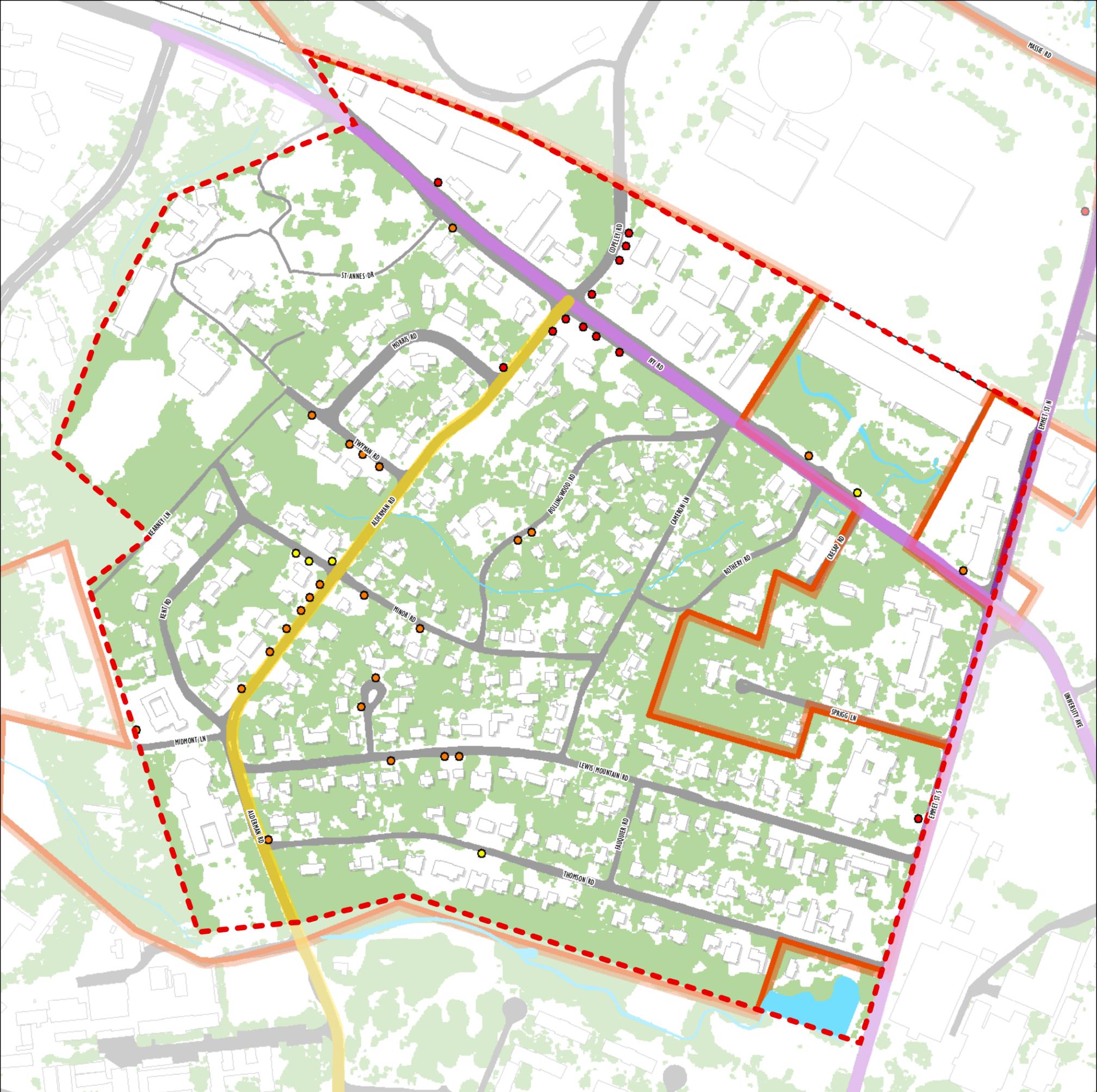
Framework Streets - Typology

Street Typology

-  Mixed Use A
-  Mixed Use B
-  Neighborhood A
-  Neighborhood B
-  Neighborhood Boundaries

-  Tree Canopy
-  Parks
-  School Parcels
-  State-Owned Parcels
-  UVa Parcels
-  City Parcels





Lewis Mountain



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

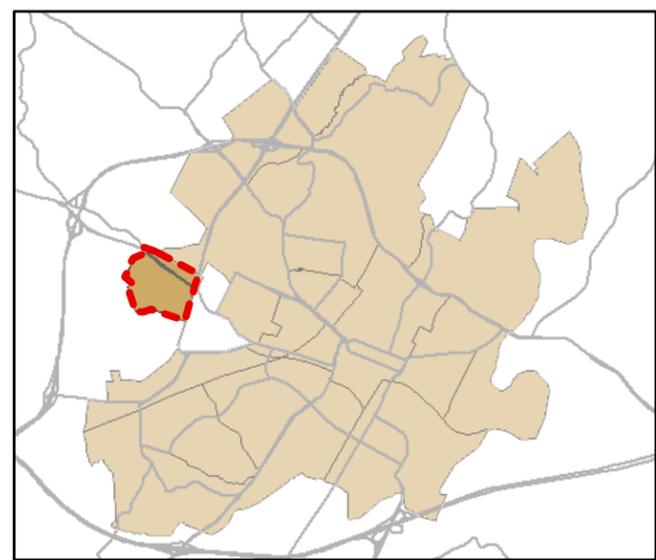
— Streams

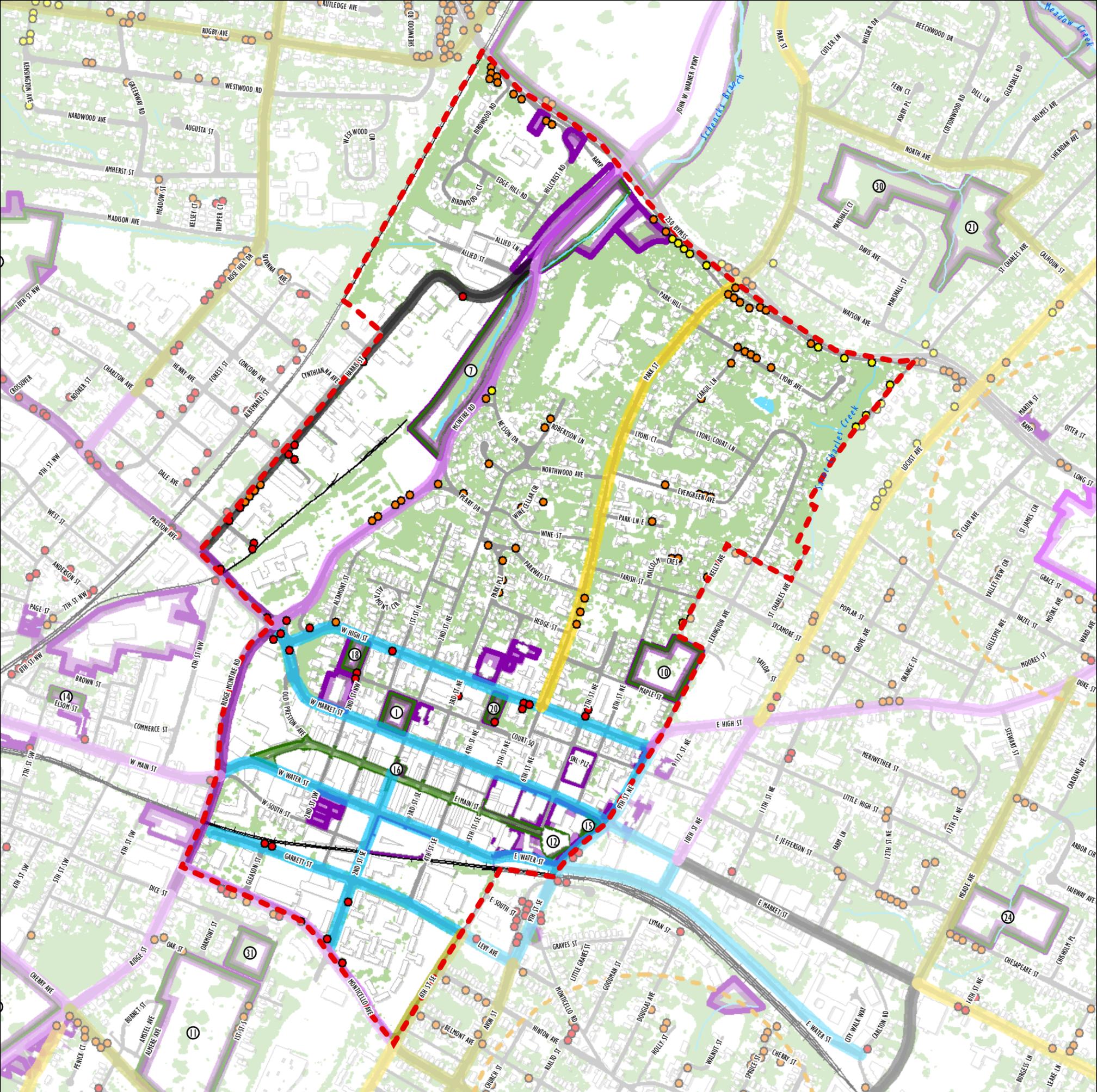
Framework Streets - Typology

Street Typology

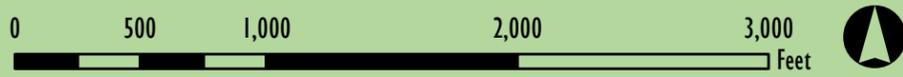
- Mixed Use A
- Mixed Use B
- Neighborhood B
- - - Neighborhood Boundaries
- - - 5 Minute School Walkzones

- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels





North Downtown



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

Streams

Framework Streets - Typology

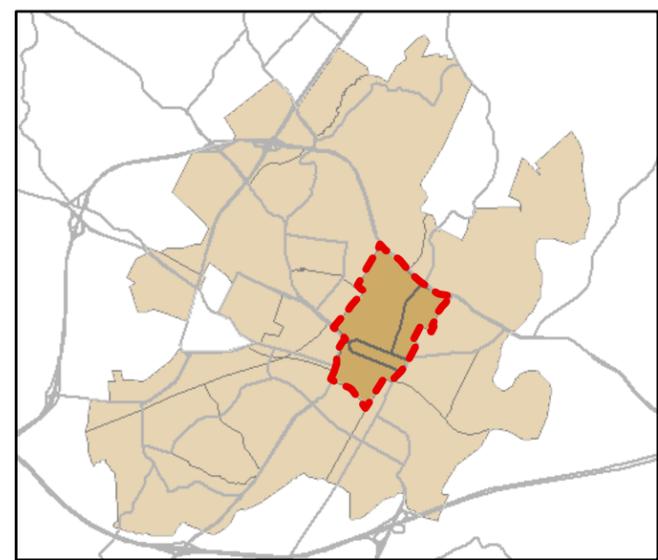
Street Typology

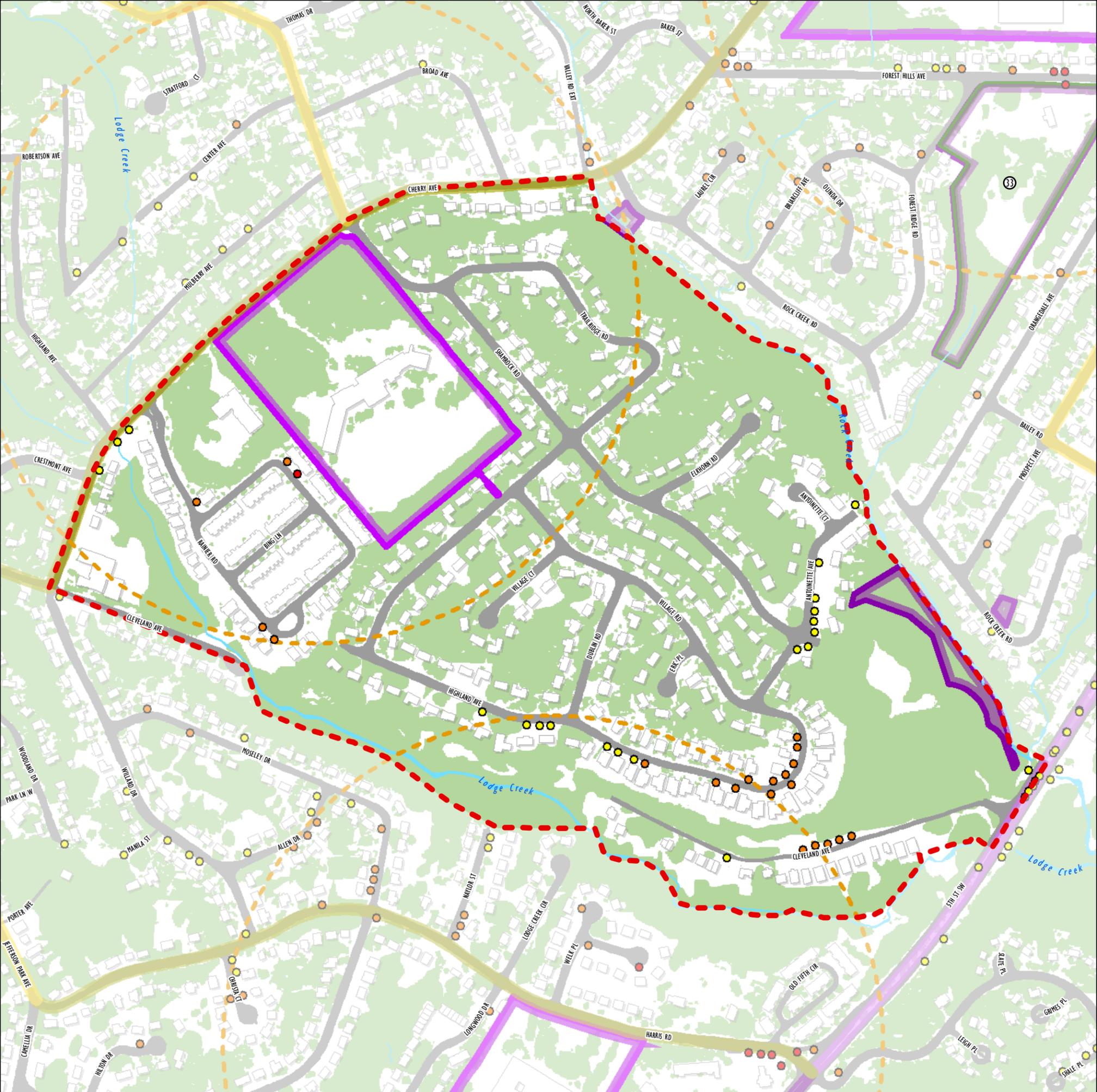
- Downtown
- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A

- Neighborhood B
- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks

- 1: Market Street Park
- 7: Schen's Greenway
- 10: Maplewood Cemetery
- 12: Downtown Pavilion
- 15: Rothwell
- 16: Downtown Mall
- 18: McGuffey Park
- 20: Court Square Park



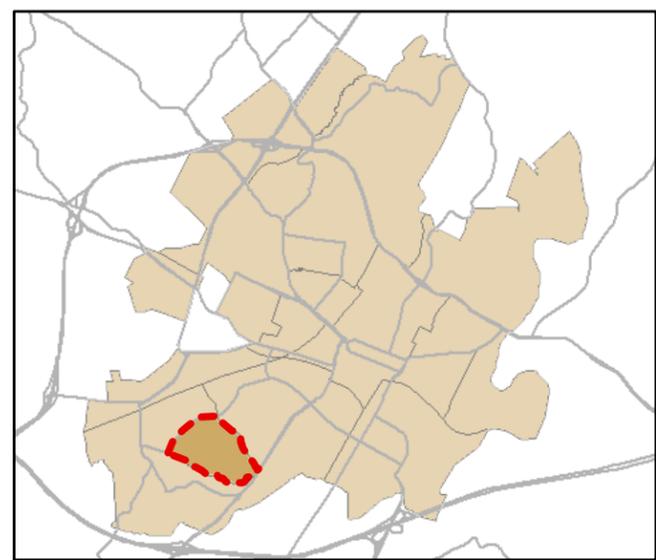


Johnson Village



Legend

- Potential Tree Planting Locations (Right-of-Way)**
 - 5 Minute School Walkzones
- Relative Temperature**
 - Higher Temperatures
 - Lower Temperatures
 - Streams
- Framework Streets - Typology**
 - Tree Canopy
 - Parks
 - School Parcels
 - State-Owned Parcels
 - UVa Parcels
 - City Parcels
- Street Typology**
 - Mixed Use A
 - Mixed Use B
 - Neighborhood A
 - Neighborhood B
 - Neighborhood Boundaries





Frys Spring

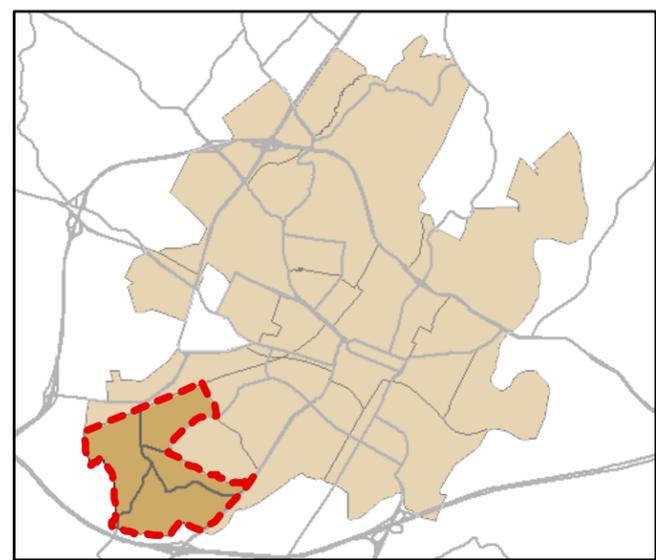


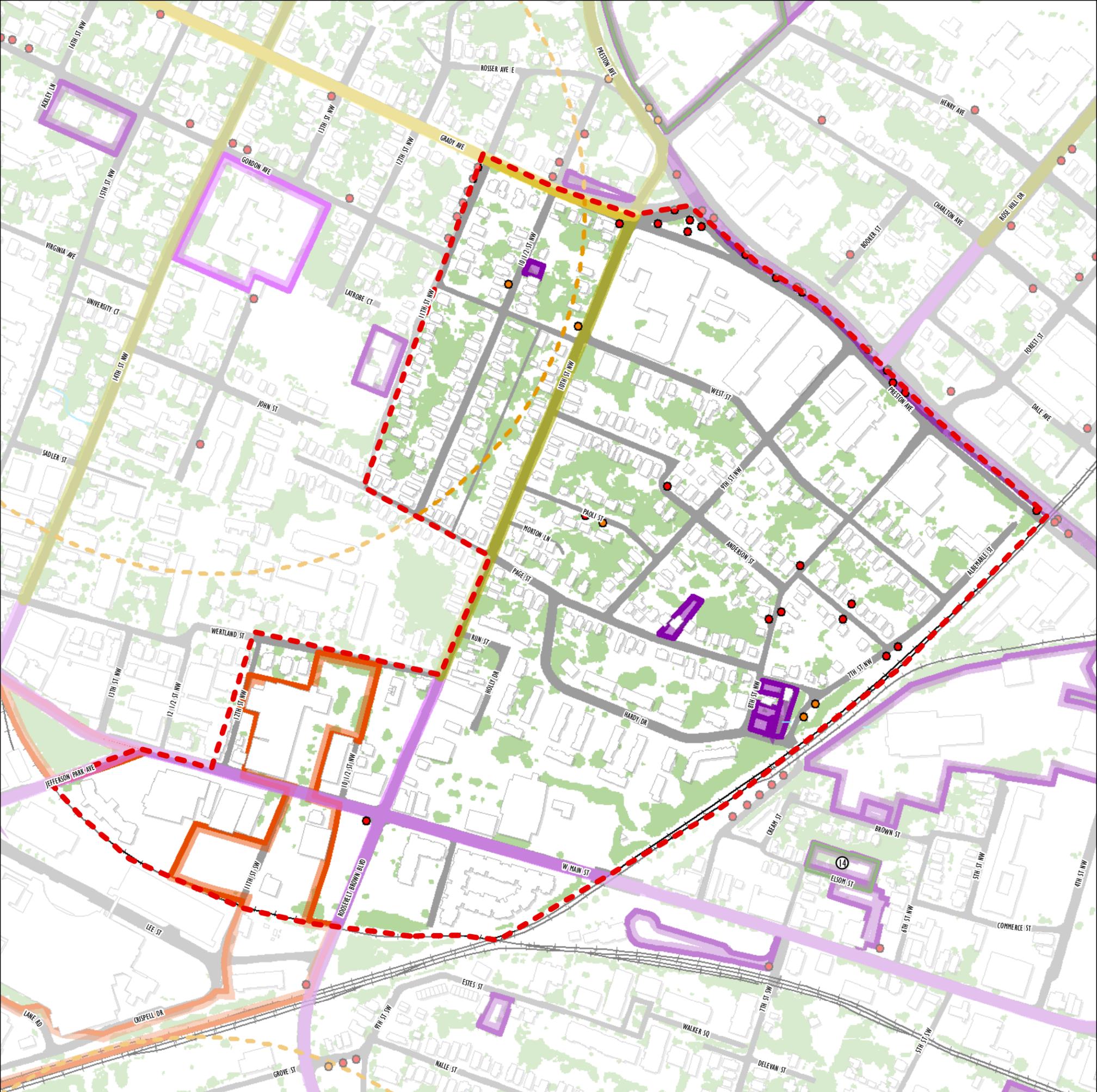
Legend

- Potential Tree Planting Locations (Right-of-Way)**
- Higher Temperatures
- Lower Temperatures
- Streams
- Framework Streets - Typology**
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B
- - - Neighborhood Boundaries
- - - 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks

- 28: Azalea Park
- 34: Fry's Springs
- 26: Longwood Park





10th & Page



Legend

Potential Tree Planting Locations (Right-of-Way) 5 Minute School Walkzones

Relative Temperature

Higher Temperatures

Lower Temperatures

Streams

Framework Streets - Typology

Mixed Use A

Mixed Use B

Neighborhood A

Neighborhood B

Neighborhood Boundaries

Tree Canopy

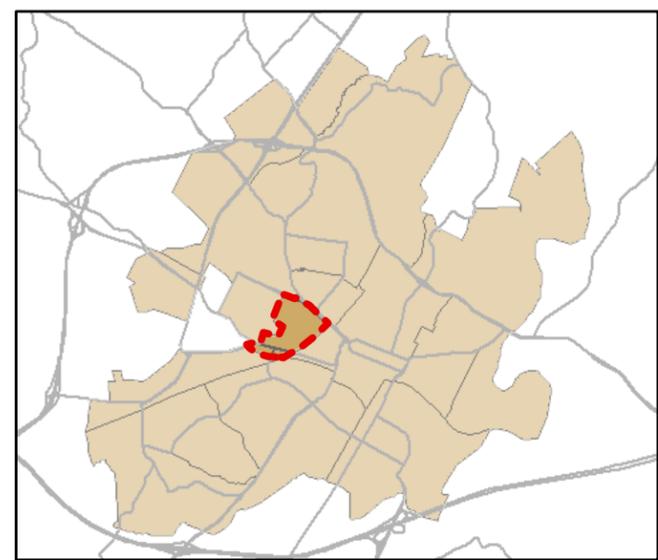
Parks

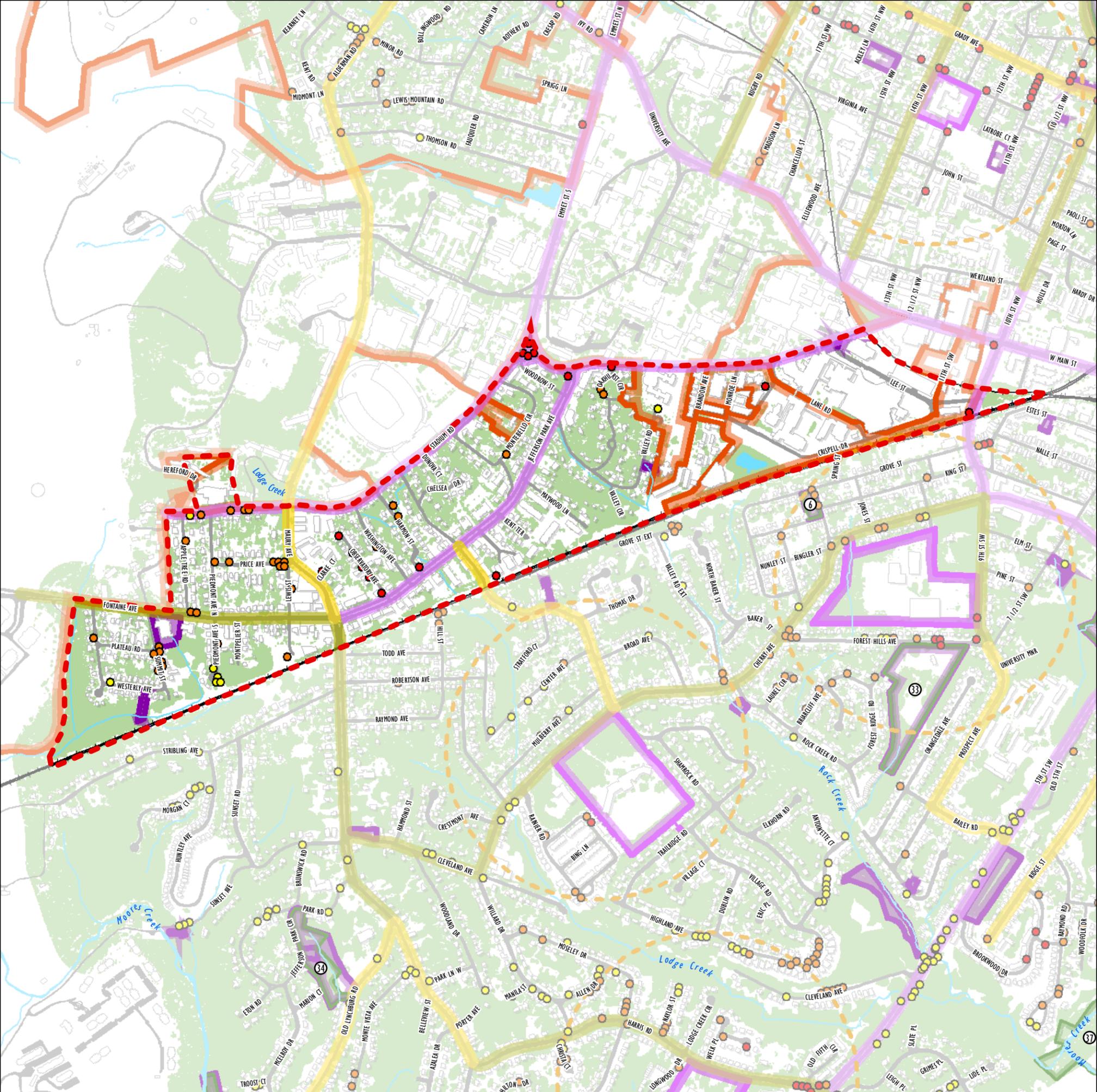
School Parcels

State-Owned Parcels

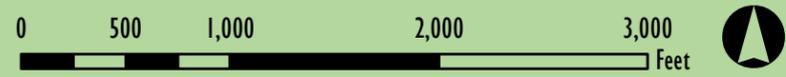
UVa Parcels

City Parcels





Jefferson Park Avenue



Legend

Potential Tree Planting Locations (Right-of-Way)  5 Minute School Walkzones

Relative Temperature

 Higher Temperatures

 Lower Temperatures

 Streams

Framework Streets - Typology

 Mixed Use A

 Mixed Use B

 Neighborhood A

 Neighborhood B

 Neighborhood Boundaries

 Tree Canopy

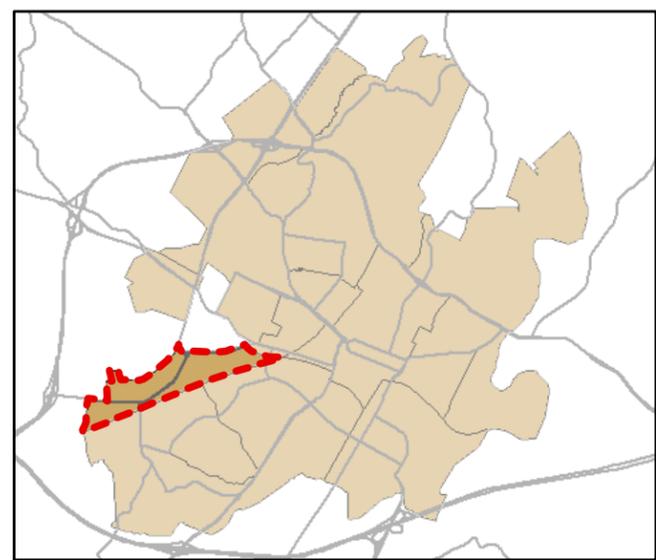
 Parks

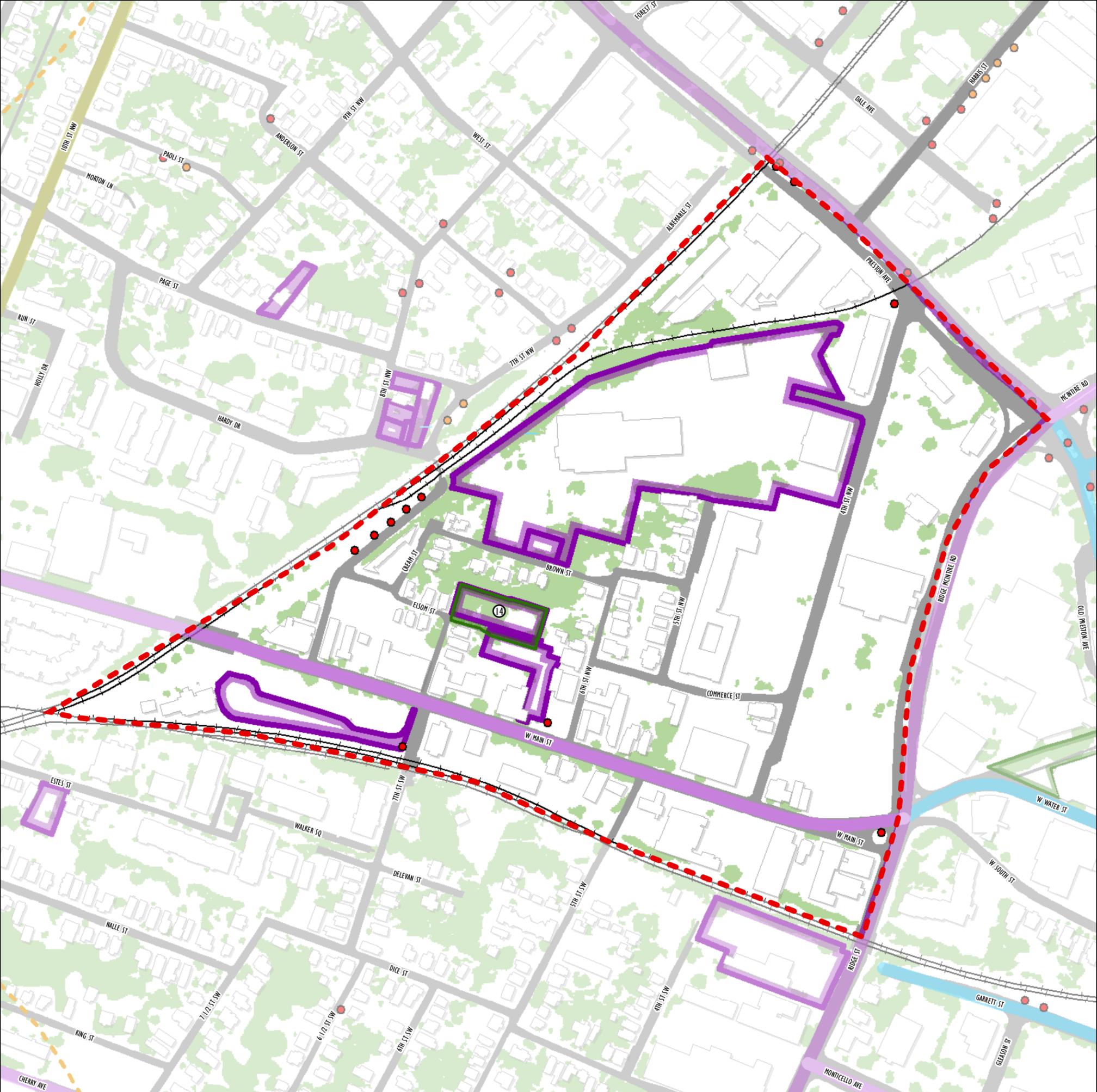
 School Parcels

 State-Owned Parcels

 UVa Parcels

 City Parcels





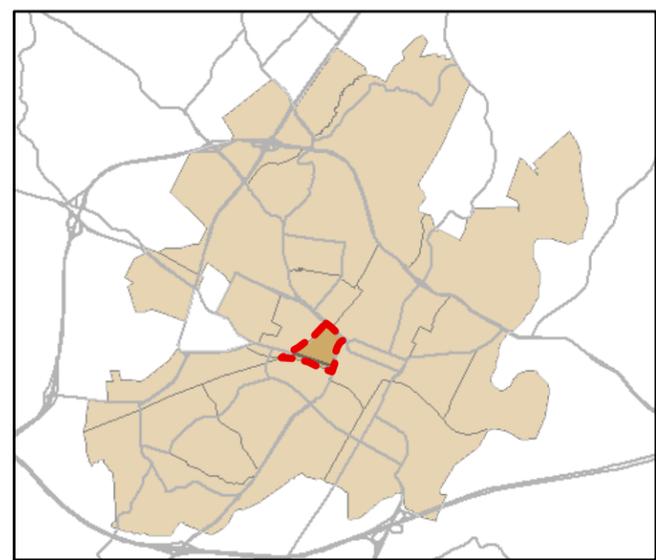
Starr Hill

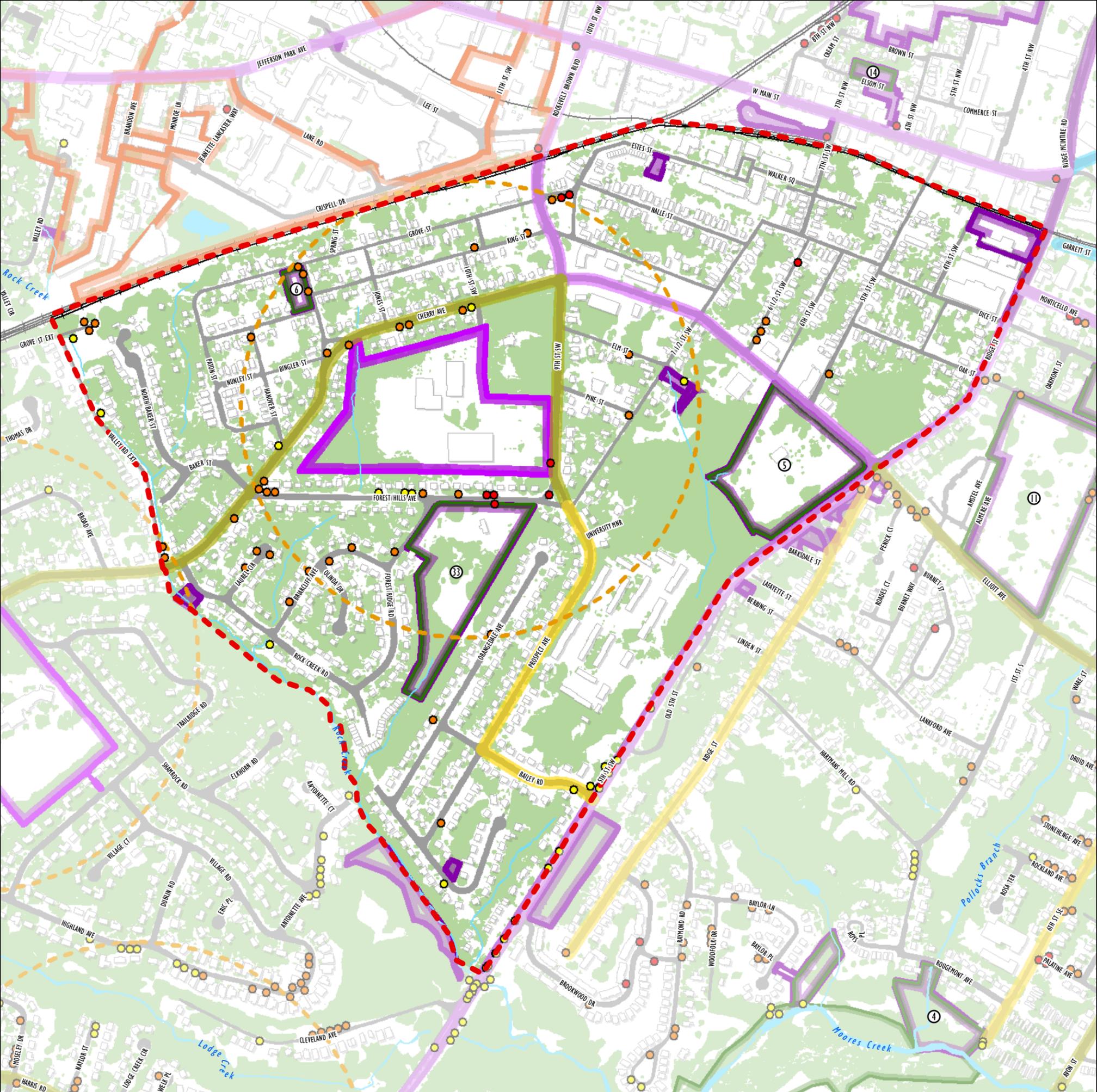


Legend

- Potential Tree Planting Locations (Right-of-Way)**
- Relative Temperature
 - Higher Temperatures
 - Lower Temperatures
- Streams
- Framework Streets - Typology**
- Street Typology
 - Downtown
 - Industrial
 - Mixed Use A
 - Mixed Use B
 - Neighborhood A
- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks 14: Starr Hill





Fifeville



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

— Streams

Framework Streets - Typology

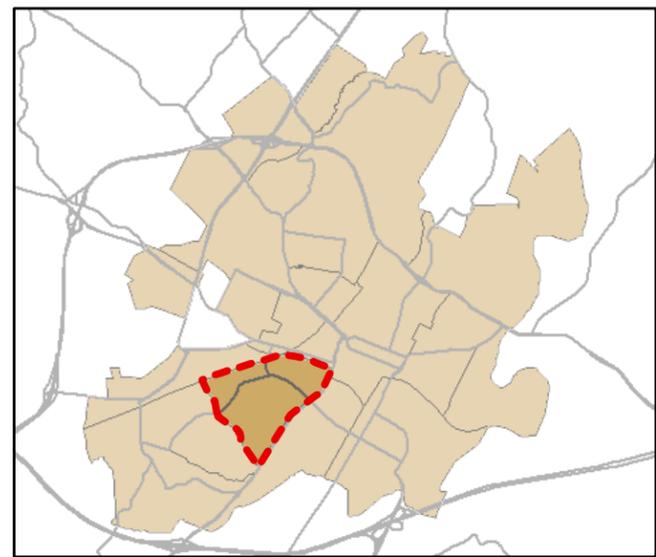
Street Typology

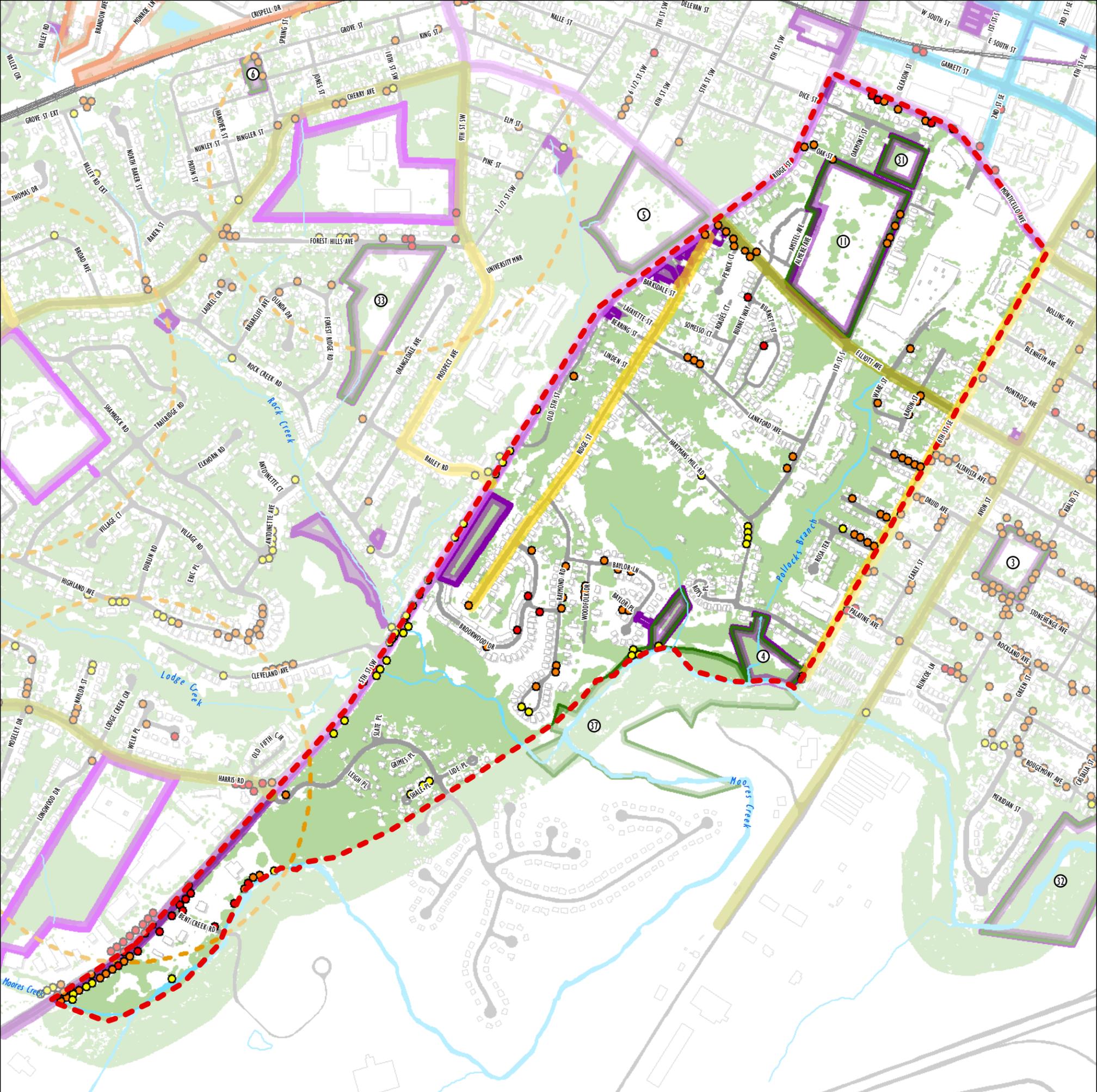
- Downtown
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks

- 6: Fifeville Park
- 33: Forest Hills Park
- 5: Tonsler Park





Ridge Street



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

Streams

Framework Streets - Typology

Street Typology

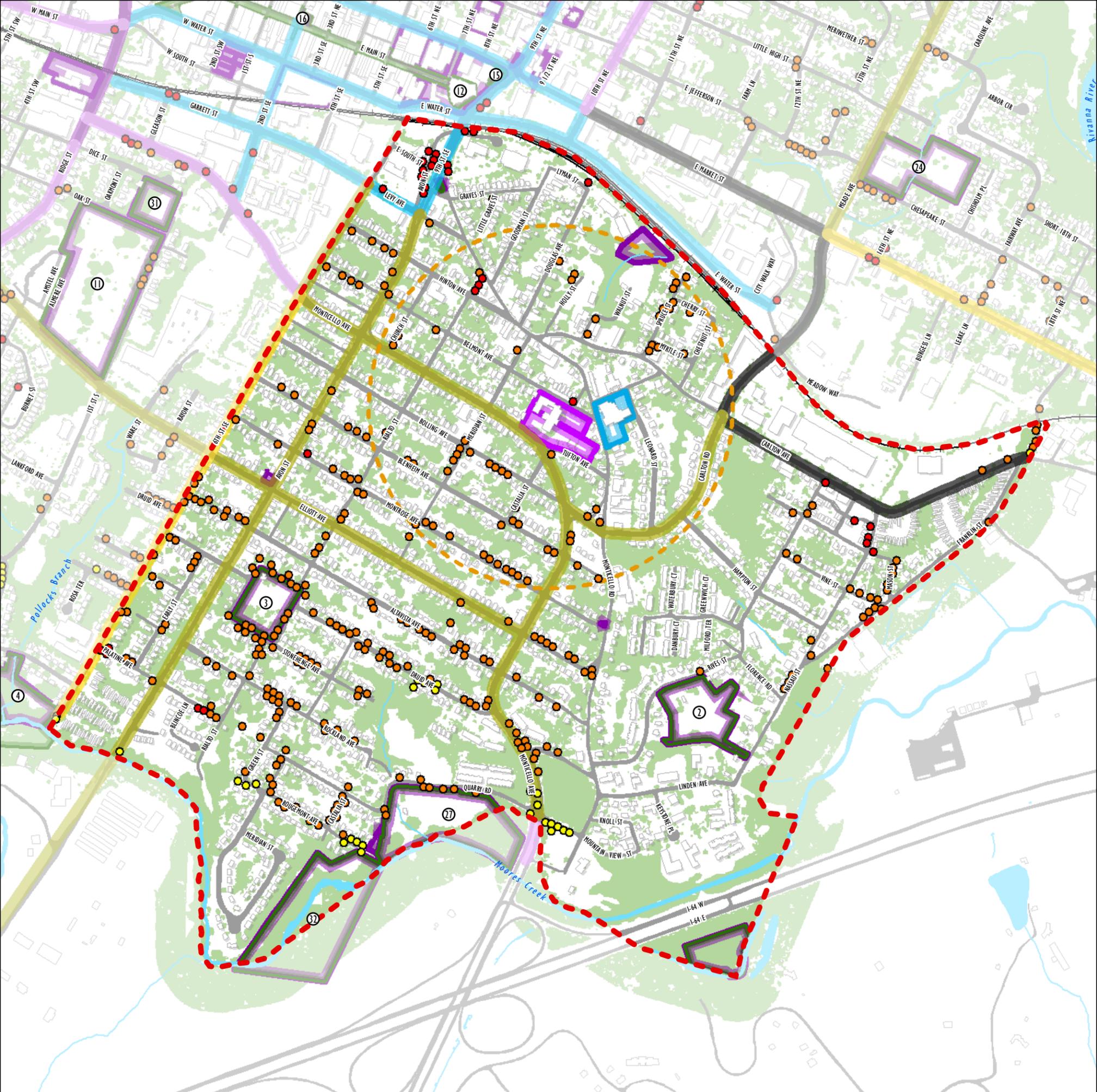
- Downtown
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks

- 11: Oakwood Cemetery
- 31: Daughters of Zion Cemetery
- 4: Jordan Park





Belmont



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

Streams

Framework Streets - Typology

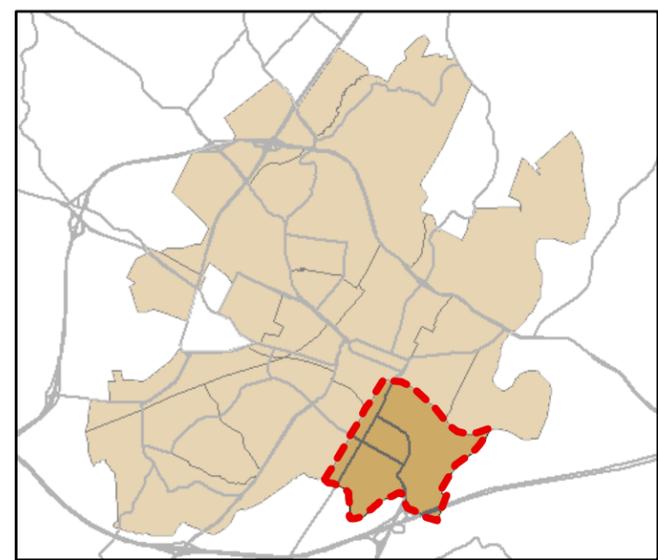
Street Typology

- █ Downtown
- █ Industrial
- █ Mixed Use A
- █ Mixed Use B
- █ Neighborhood A

- █ Neighborhood B
- █ Neighborhood Boundaries
- █ 5 Minute School Walkzones
- █ Tree Canopy
- █ Parks
- █ School Parcels
- █ State-Owned Parcels
- █ UVa Parcels
- █ City Parcels

Parks

- 3: Belmont Park
- 27: Quarry Park
- 2: Rives Park
- 32: Quarry Park





Woolen Mills



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

— Streams

Framework Streets - Typology

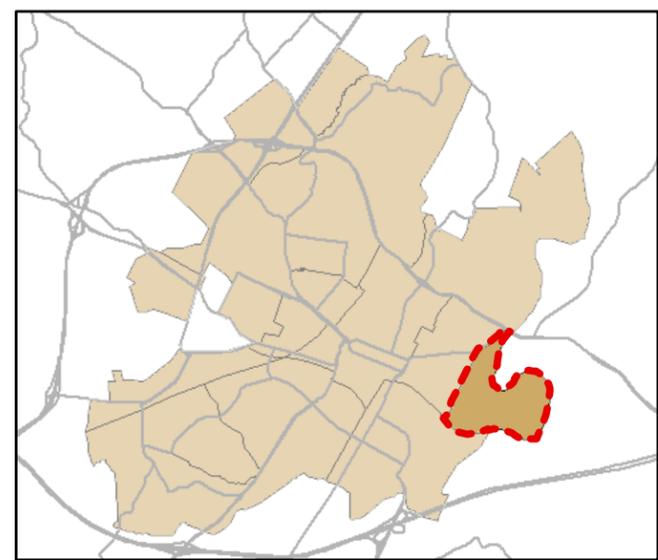
Street Typology

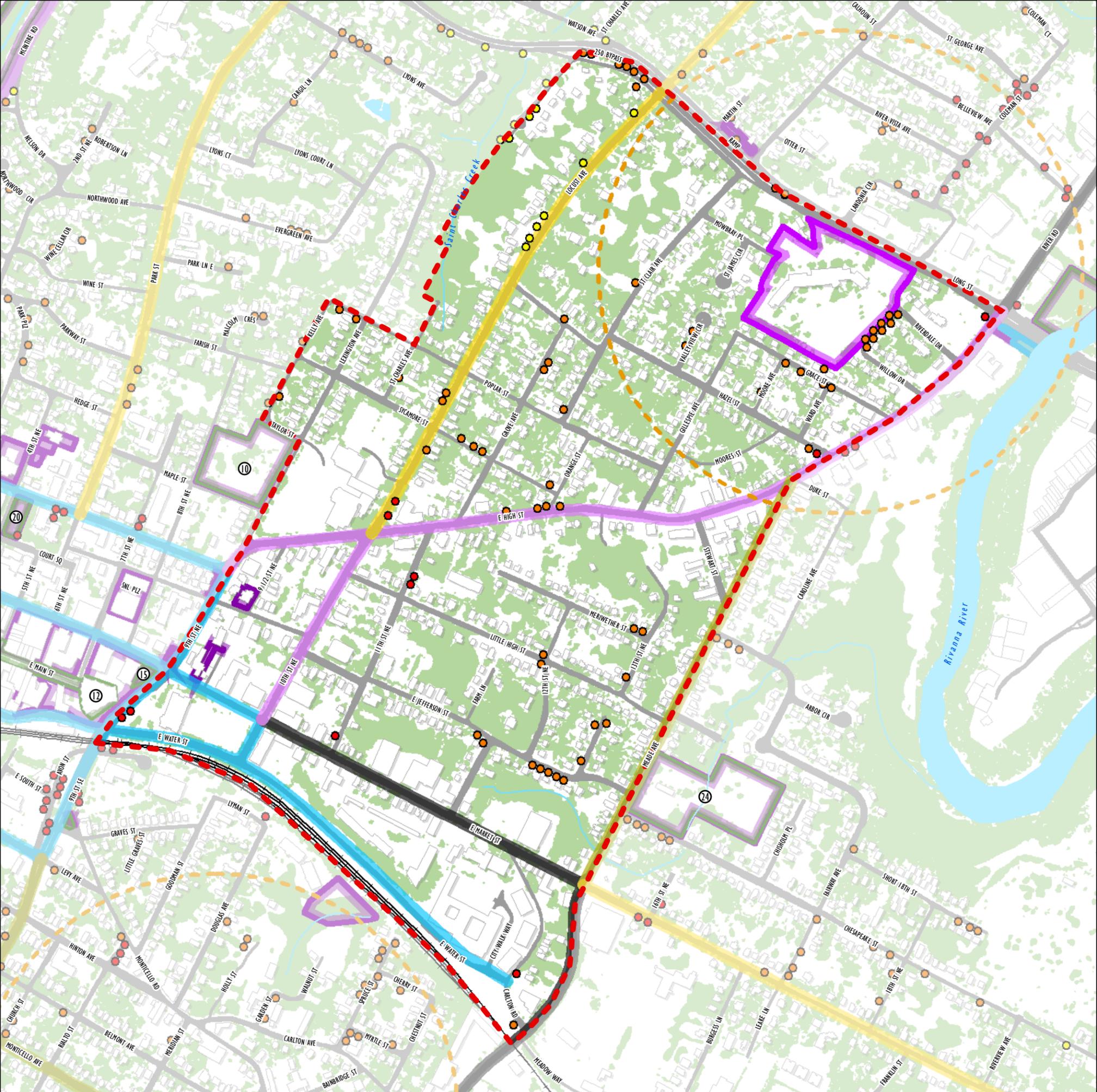
- Downtown
- Industrial
- Mixed Use B
- Neighborhood A
- Neighborhood B

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- 5 Minute School Walkzones
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- Parks
- School Parcels
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- UVa Parcels
- City Parcels

Parks

- 19: Riverview Park
- 24: Meade Park



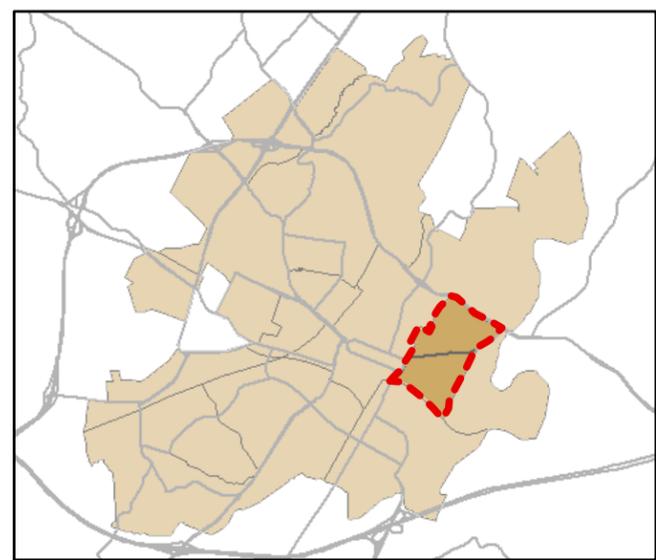


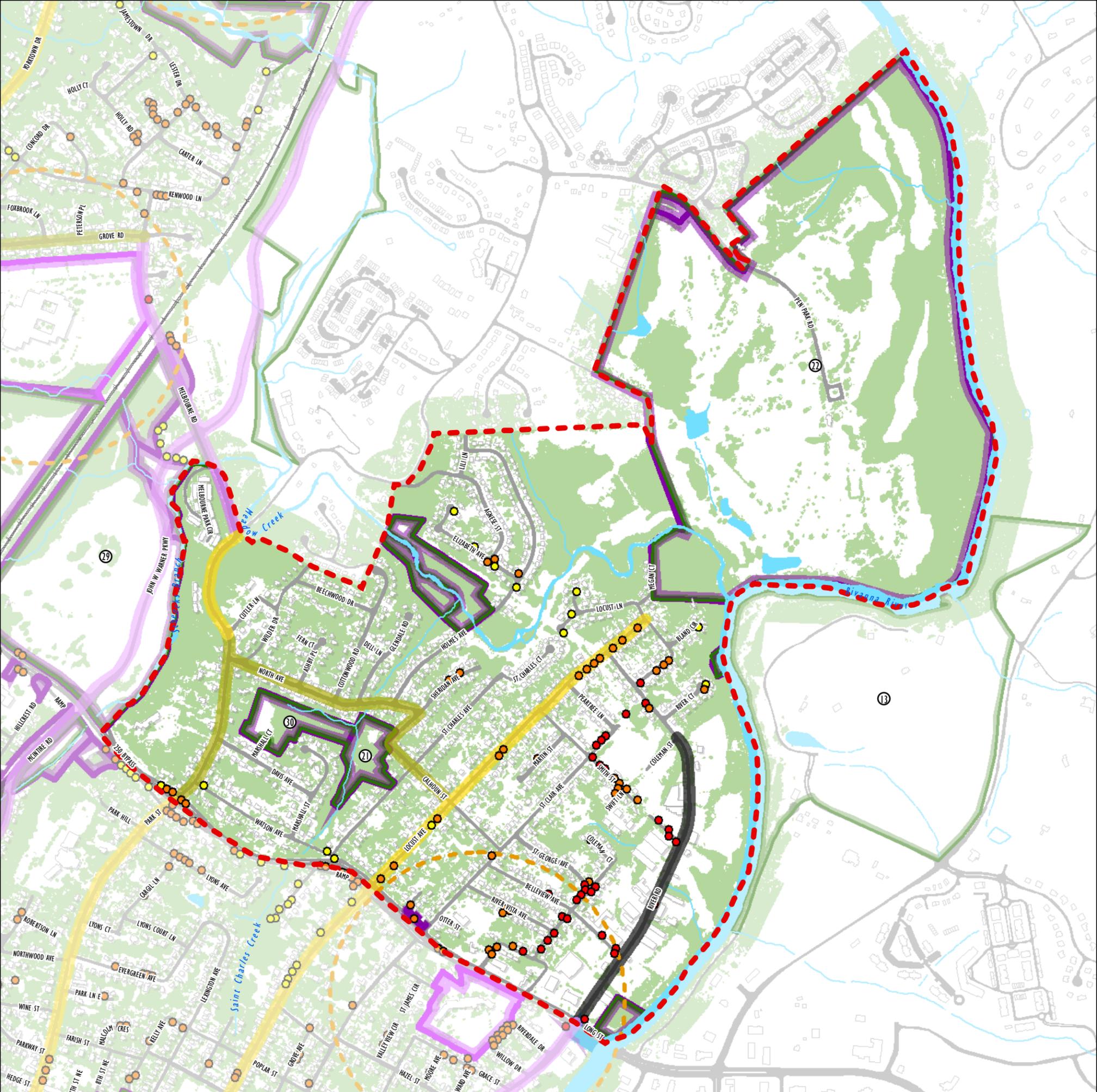
Martha Jefferson



Legend

- Potential Tree Planting Locations (Right-of-Way)**
- Higher Temperatures
- Lower Temperatures
- Streams
- Framework Streets - Typology**
- Downtown
- Industrial
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- Neighborhood B
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- UVa Parcels
- City Parcels





Locust Grove



Legend

Potential Tree Planting Locations (Right-of-Way) 5 Minute School Walkzones

Relative Temperature

- Higher Temperatures
- Lower Temperatures

Streams

Framework Streets - Typology

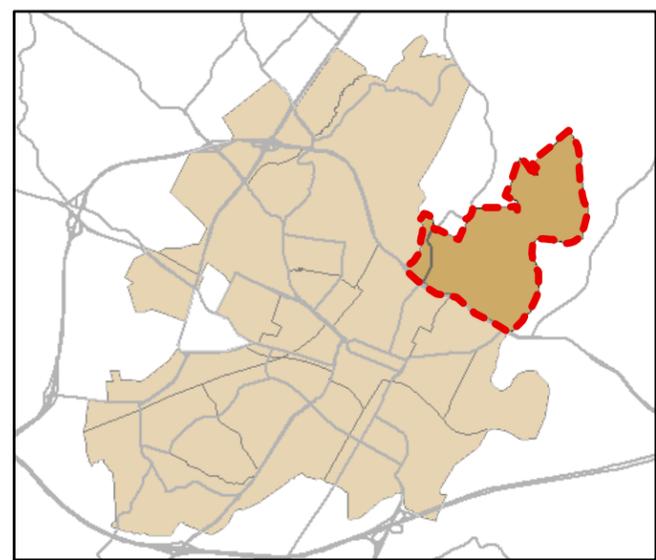
Street Typology

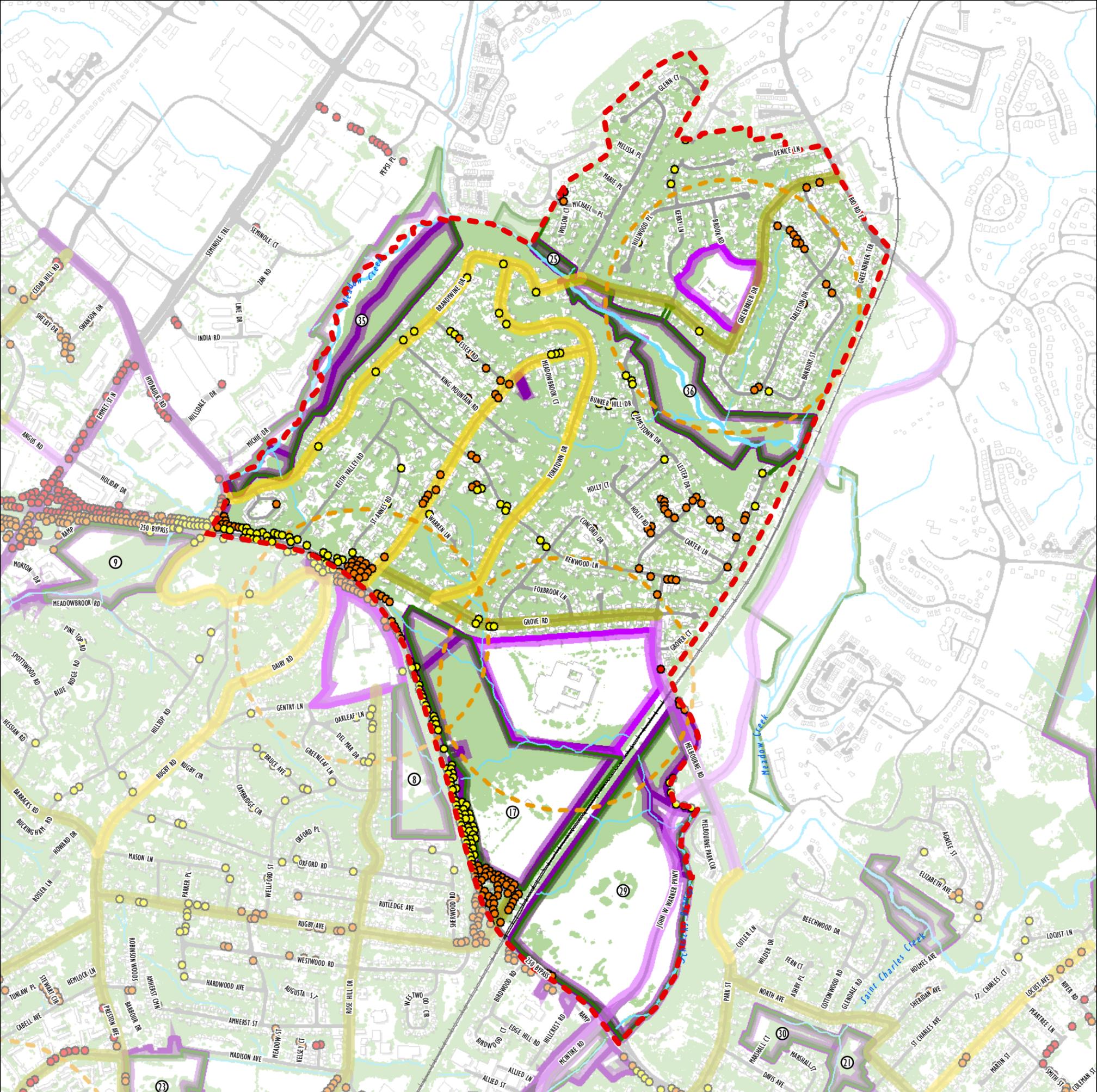
- Industrial
- Mixed Use B
- Neighborhood A
- Neighborhood B
- Neighborhood Boundaries

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- Parks
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- UVa Parcels
- City Parcels

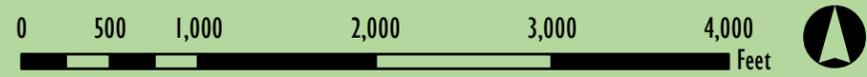
Parks

- 22: Pen Park
- 30: Davis Field
- 21: Northeast Park





Greenbrier



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures
- Lower Temperatures
- Streams

Framework Streets - Typology

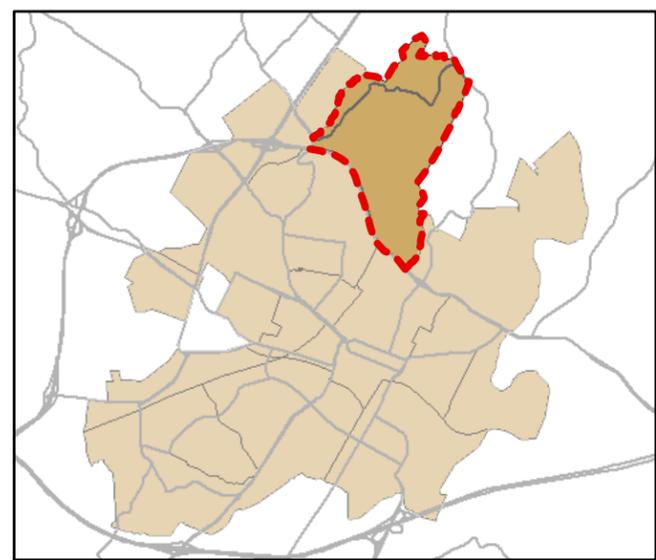
Street Typology

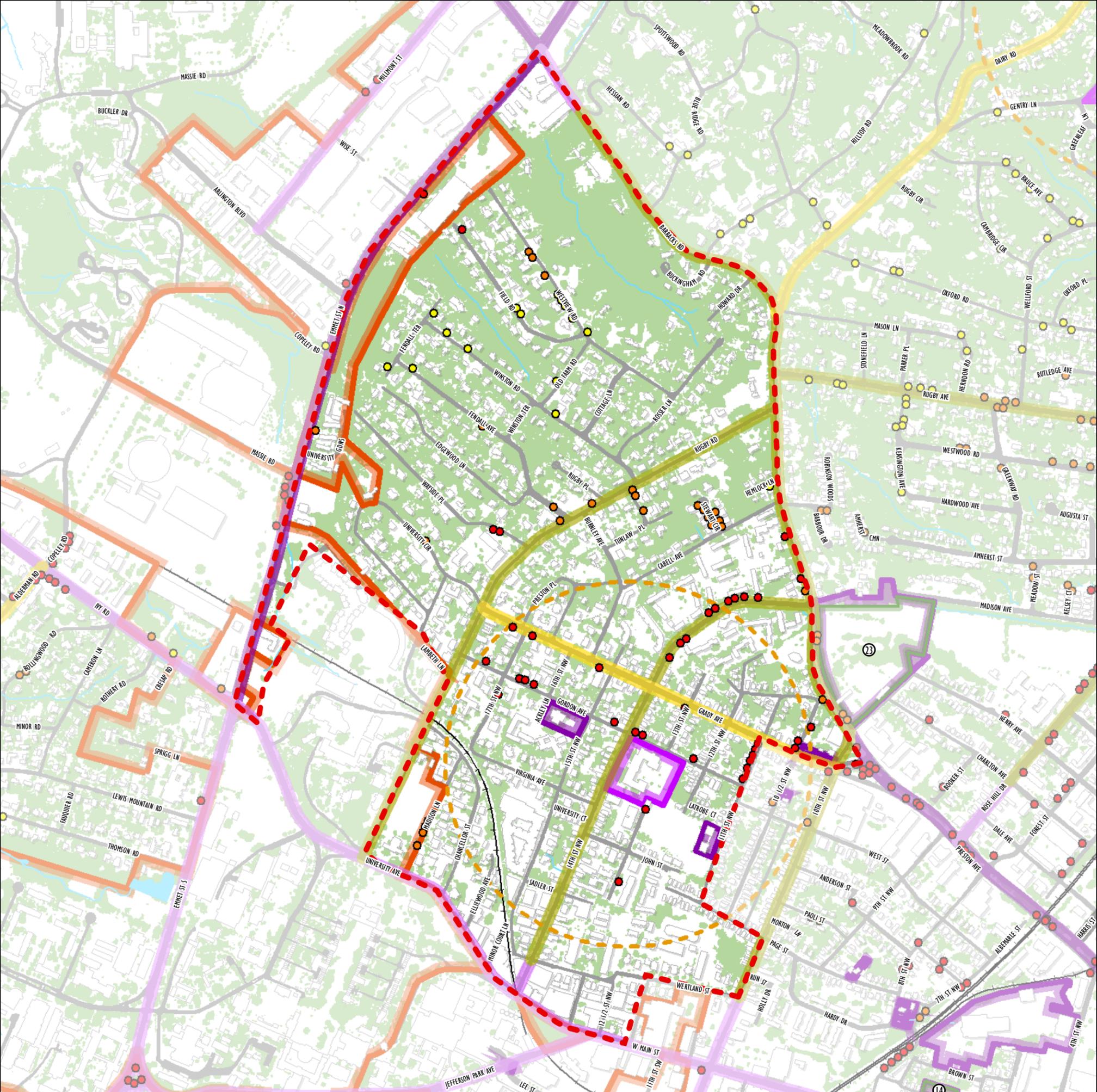
- Industrial
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- Mixed Use B
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- Neighborhood B

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- Tree Canopy
- Parks
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- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks

- 17: McIntire Park
- 25: Meadow Creek Valley
- 29: McIntire Park
- 35: Meadow Creek Valley
- 36: Greenbrier Park





Venable



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

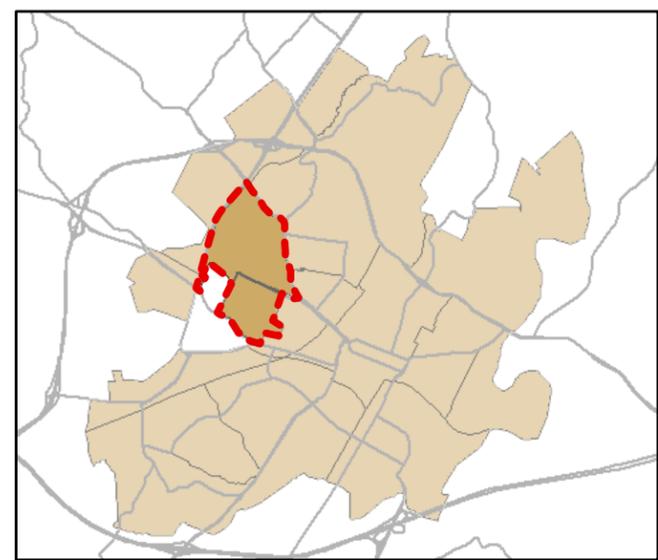
— Streams

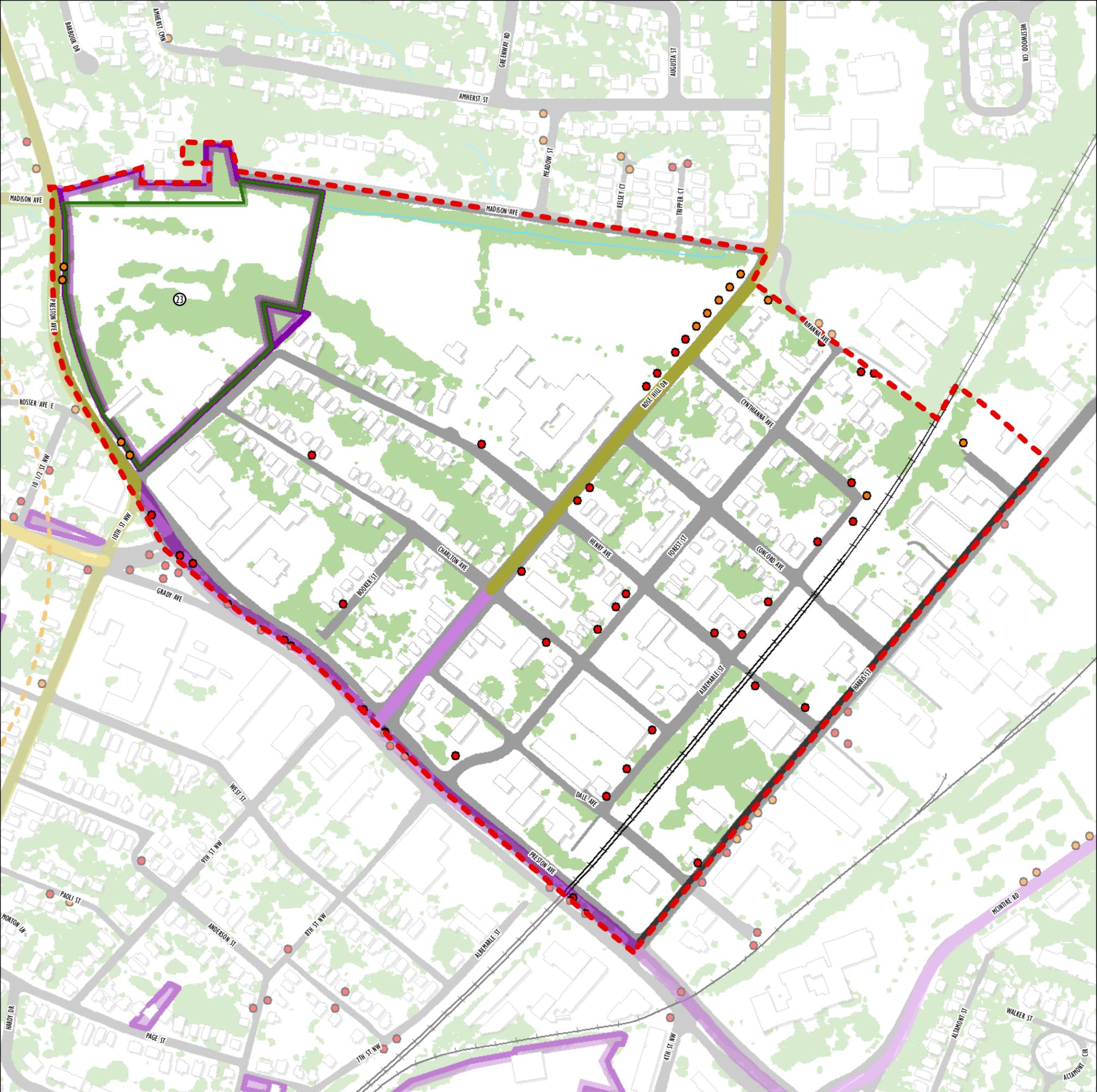
Framework Streets - Typology

Street Typology

- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels





Rose Hill



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

Streams

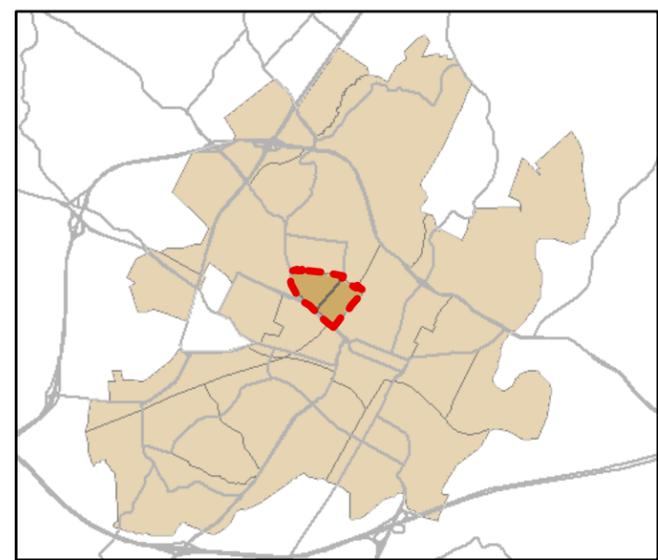
Framework Streets - Typology

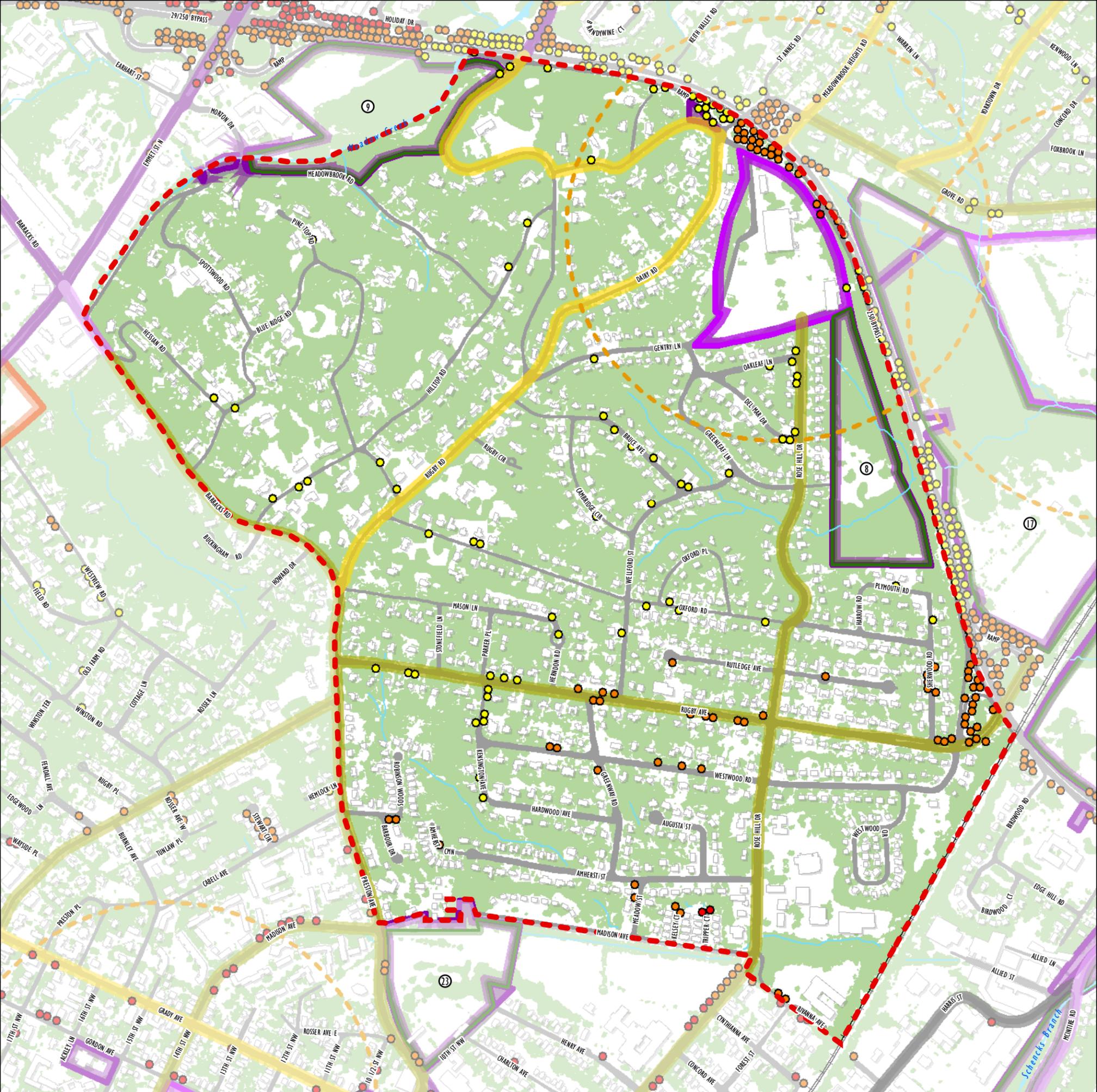
Street Typology

- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks 23: Washington Park





Barracks & Rugby



Legend

Potential Tree Planting Locations (Right-of-Way)

Relative Temperature

- Higher Temperatures
- Lower Temperatures

— Streams

Framework Streets - Typology

Street Typology

- Industrial
- Mixed Use A
- Mixed Use B
- Neighborhood A
- Neighborhood B

- Neighborhood Boundaries
- 5 Minute School Walkzones
- Tree Canopy
- Parks
- School Parcels
- State-Owned Parcels
- UVa Parcels
- City Parcels

Parks 8: Greenleaf Park

