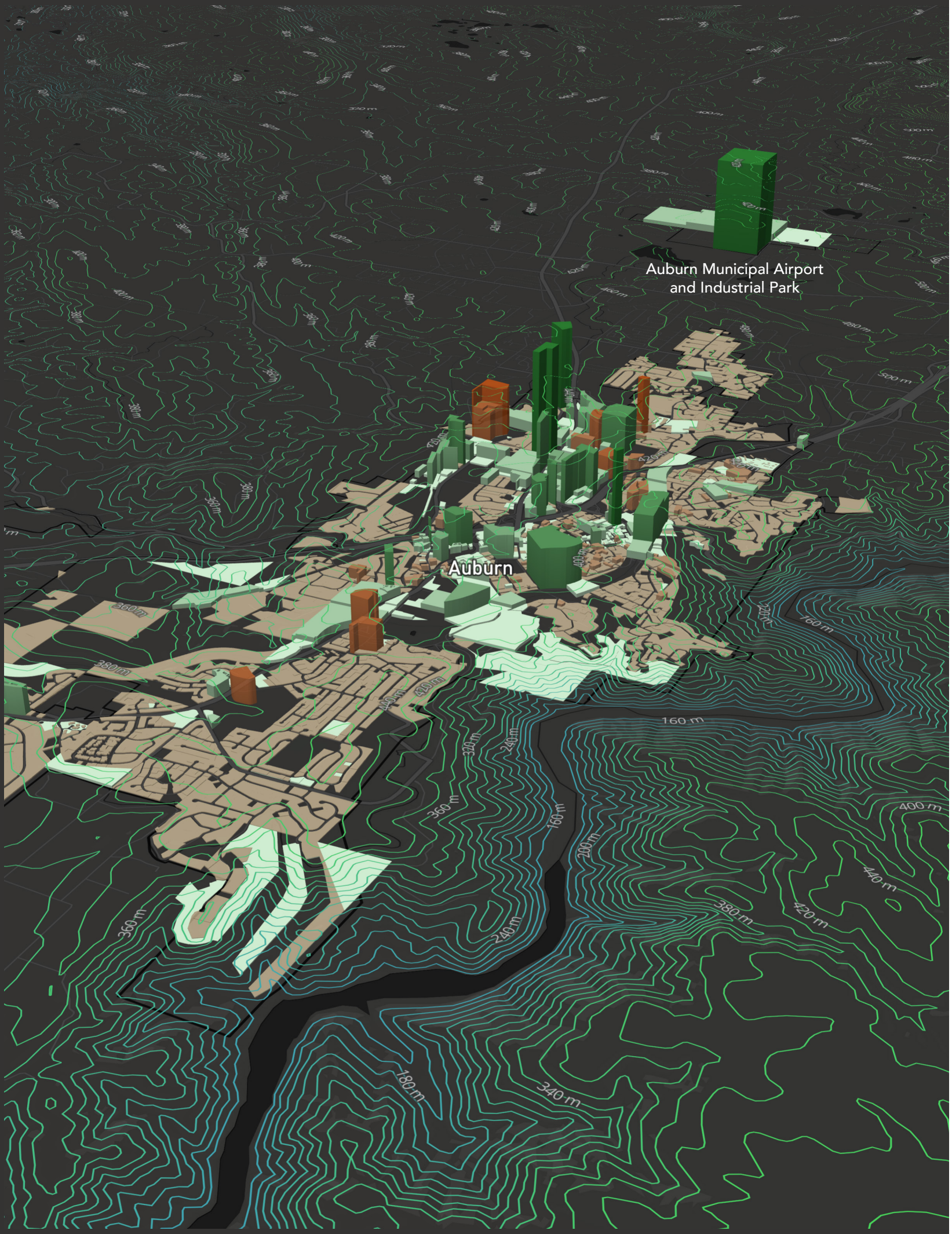
Resiliency & Sustainability Baseline Analysis

Prepared for the Sustainability Advisory Committee of the City of Auburn by:

Genevieve Marsh
DESIGN GROUP

Auburn, CA

September 2022


Auburn Municipal Airport
and Industrial Park
Auburn

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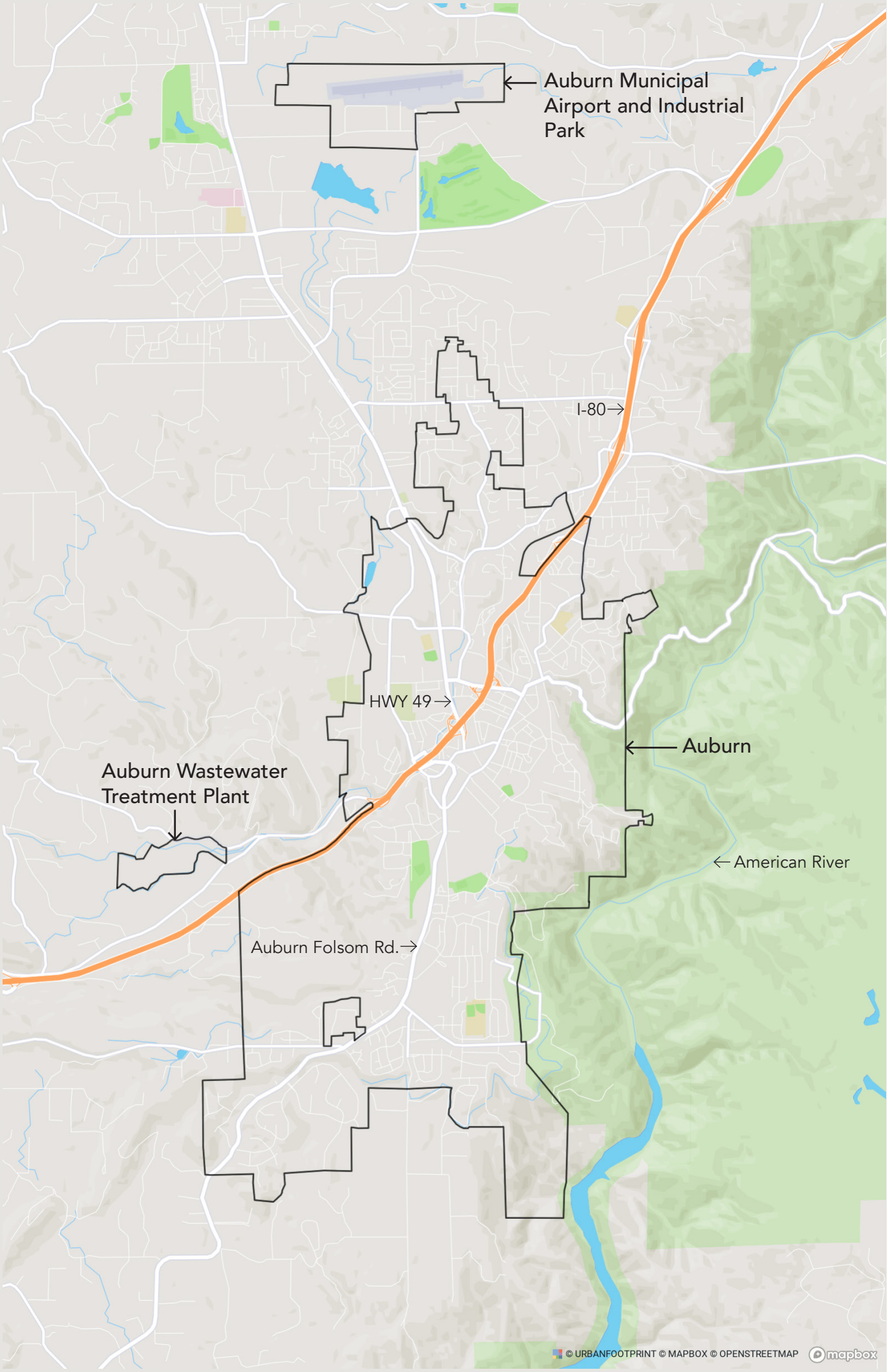
Getting Started

Baseline Analysis

Image to the left:
Artistic representation of the employment (green) and population (orange) distribution in downtown Auburn, CA.


Auburn Municipal Airport and Industrial Park
I-80
HWY 49
Auburn
Auburn Wastewater Treatment Plant
American River
Auburn Folsom Rd.
© URBANFOOTPRINT © MAPBOX © OPENSTREETMAP
mapbox

Introduction

The Sustainability Advisory Committee is entrusted to tackle some of society's toughest challenges. From climate change to resilience efforts across the city of Auburn, the committee and its partners are working to address how the community will support the next generation of growth, while fostering sustainable and equitable communities.

Urban data collection has advanced by leaps and bounds in recent years. Yet, it is more difficult than ever to distill this information into actionable insights to support smart, data-driven problem solving. Gathering the data necessary to understand existing conditions and future impacts is typically an arduous and time-consuming process. This report presents maps and analyses of Auburn's existing conditions using the program UrbanFootprint. With thousands of preloaded datasets and built-in analysis modules, UrbanFootprint helps obtain answers to complex planning questions.

One of the first steps of any planning project is a comprehensive assessment of existing conditions. This report presents existing conditions as a series of topical sections including resiliency, sustainability, and impacts of current land-use. Each section begins with a description of the analysis, the data sets involved, and instructions on how to interpret the results. The following maps, graphs, and tables for each section are designed to present information at a community-wide scale and show how the data aggregates from the individual person. This method reveals the impact scale of various project opportunities in relation to each other and outlines which parcels in the City of Auburn contribute to that opportunity.

Thank You

The collaborations of several organizations and individuals made this project possible. We need diversity of thought and resilience in this world to face new challenges. Thank you to those pursing new ways of seeing and thinking about sustainability and resilience across Auburn, CA.

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Prepared For:
Sustainability Advisory Committee of the City of Auburn

Summary Stats

The summary statistics quantify the town's existing capacity from a geospatial dataset that describes the existing built and natural environment. This detailed dataset constitutes a baseline assessment of land use, demographic characteristics, and other conditions, providing the foundation for analysis of the other metrics. The data is organized by parcel, which depicts development in terms of building types and yields analysis outputs at parcel resolution. This is well suited for detailed work at the city scale.

The fundamental parcel data is composed of a variety of commercial and publicly available data sources, which are combined using proprietary algorithms and processes. Each parcel includes over 70 attributes, including population, residential mix, employment mix, parcel area, building area, land use type, intersection density, irrigated area, and more. The parcel information is updated quarterly and combines commercially-sourced parcel data along with trusted public and open data sources using proprietary algorithms and data normalization processes. To ensure the highest quality and accuracy, the parcel data is validated against publicly available census data as well as internal benchmarks.

How to Interpret this Section

The summary statistics provide a full picture of the existing conditions of Auburn. It reflects how the town's land and buildings are currently being utilized, rather than an aspirational view of maximum build-out under the current zoning code. Parcel usage that is short term, such as jobs working from home and short-term rentals of business spaces, are not captured in these summary statistics.

Define Key Terms

Population: Residential population associated with occupied dwelling units. This excludes people residing in group quarters.

Land Use: Broad summary categories such as residential, commercial, and mixed-use.

Dwelling Unit: Occupied and unoccupied homes of all types (apartments, houses, ADUs).

Employment: Total jobs across all employment categories.

Land Use Intensity: The floor area ratio of a parcel is divided into development types of compact, low density, and vacant.

Large Lot: larger than 5,500 sf or 0.13 acres

Small Lot: smaller than 5,500 sf or 0.13 acres

Compact Development: Intersection density ≥ 150 per square mile, and Employees/gross acre ≤ 70 or dwelling units/gross acre ≤40

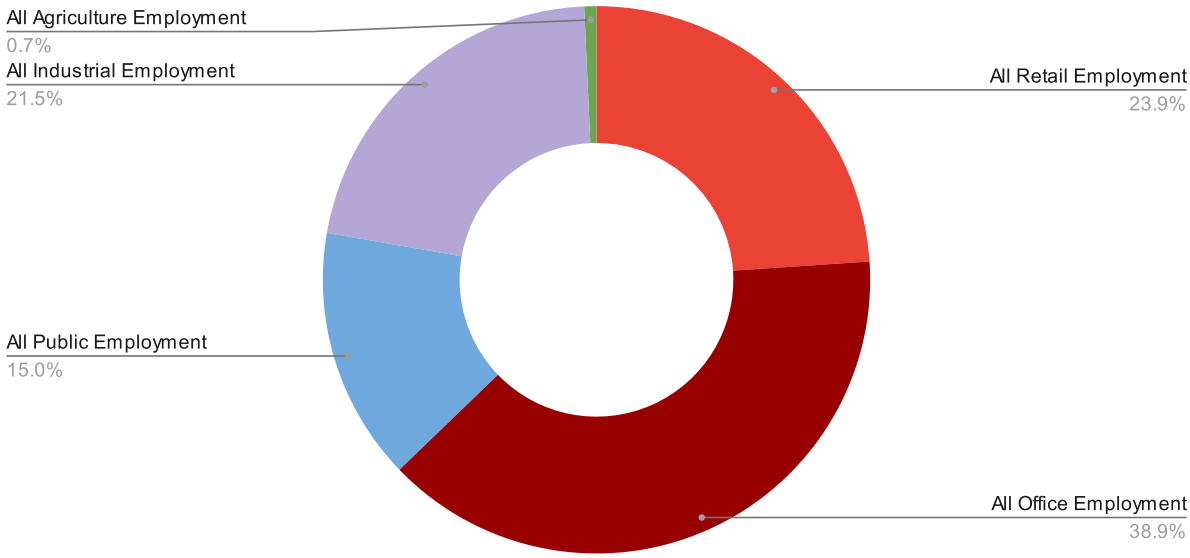
Standard Development: Intersection density < 150 per square mile

Data Sources

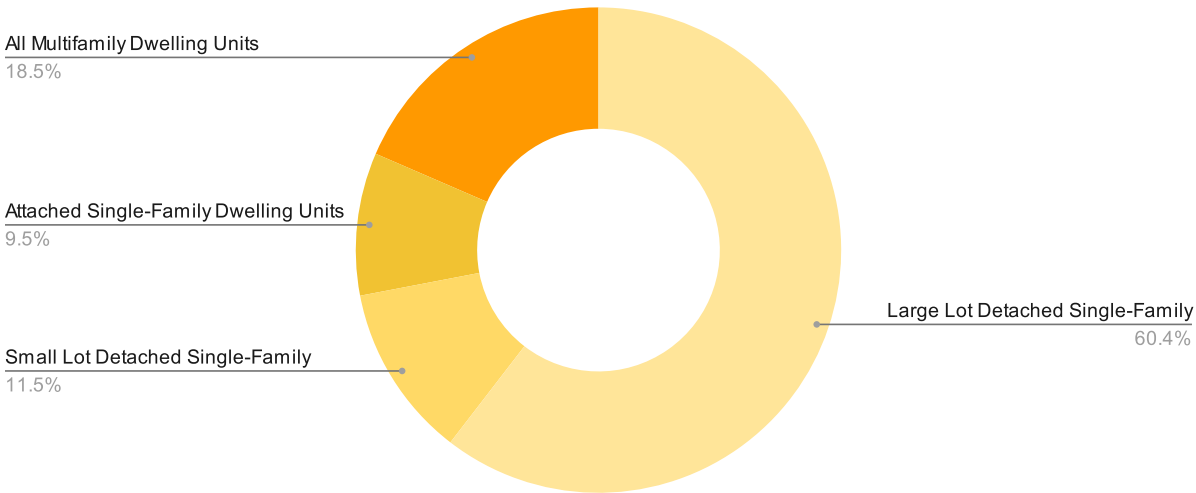
- Census data, used to allocate population, households, dwelling units, and employment
- CoreLogic parcel data, used to identify land uses and populate dwelling units, employment, and building attributes where available
- Point-of-interest data from supplemental sources, used for further identification of land uses
- Road data, used for calculating intersection density

Summary Statistics Report - City Wide		
Population	13,843	people
Housing	6,237	dwelling units
Households	5,885	households
Employment	8,097	jobs
Average Houshold Size	2.4	people
Job-Population Ratio	0.6	jobs / person
Job-Housing Ratio	1.3	jobs / dwelling unit
Housing by Type		
Large Lot Detached Single-Family Dwelling Units	3,770	dwelling units
Small Lot Detached Single-Family Dwelling Units	720	dwelling units
Attached Single-Family Dwelling Units (Townhomes)	593	dwelling units
All Multifamily Dwelling Units	1,154	dwelling units
Total	6,237	dwelling units
Jobs by Sector		
All Retail Employment	1,938	jobs
All Office Employment	3,146	jobs
All Public Employment	1,211	jobs
All Industrial Employment	1,744	jobs
All Agriculture Employment	58	jobs
Military Employment	-	jobs
Total	8,097	jobs
Building Area: Residential		
Large Lot Detached Single-Family Building Area	7,590,000	square feet
Small Lot Detached Single-Family Building Area	560,000	square feet
Attached Single-Family Building Area	740,000	square feet
Multifamily Building Area	1,150,000	square feet
Total	10,030,000	square feet
Building Area: Retail		
Retail Services Building Area	439,988	square feet
Restaurants Building Area	281,784	square feet
Arts & Entertainment Building Area	154,243	square feet
Accommodation Building Area	354,105	square feet
Other Retail Building Area	239,088	square feet
Total	1,469,207	square feet
Building Area: Office		
Office Services Building Area	928,026	square feet
Medical Services Building Area	746,462	square feet
Total	1,674,488	square feet
Building Area: Public		
Public Administration Building Area	262,012	square feet
Education Building Area	737,143	square feet
Total	999,155	square feet
Building Area: Industrial		
Transportation/Warehouses Building Area	122,007	square feet
Wholesale Building Area	171,438	square feet
Total	293,445	square feet

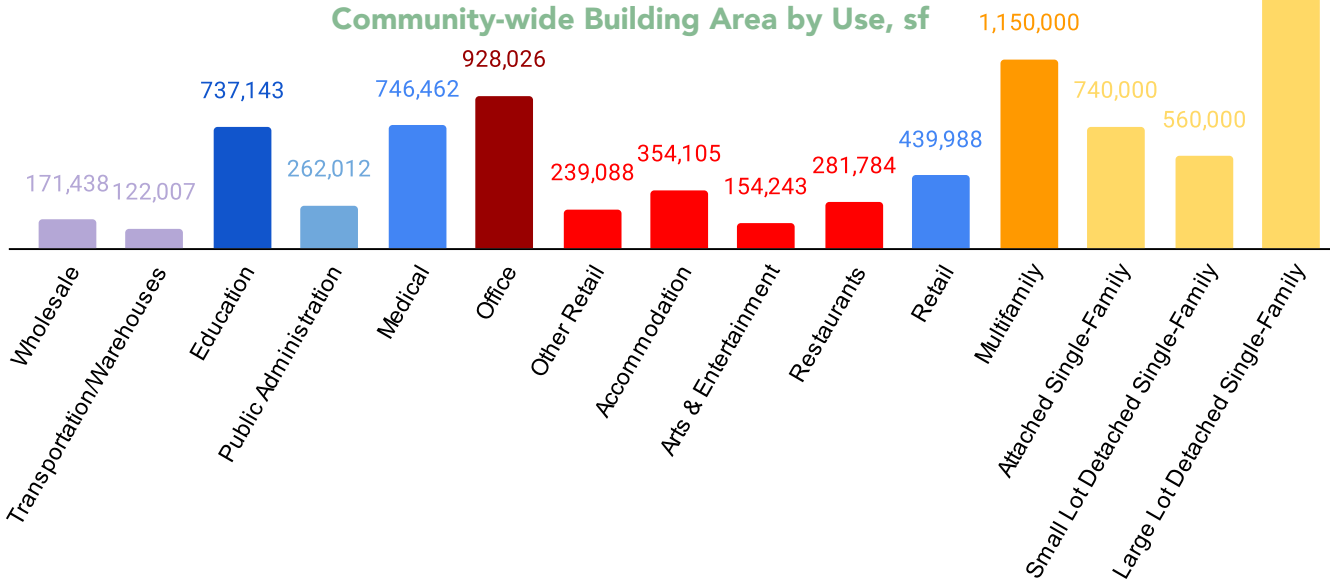
Jobs by Sector, %

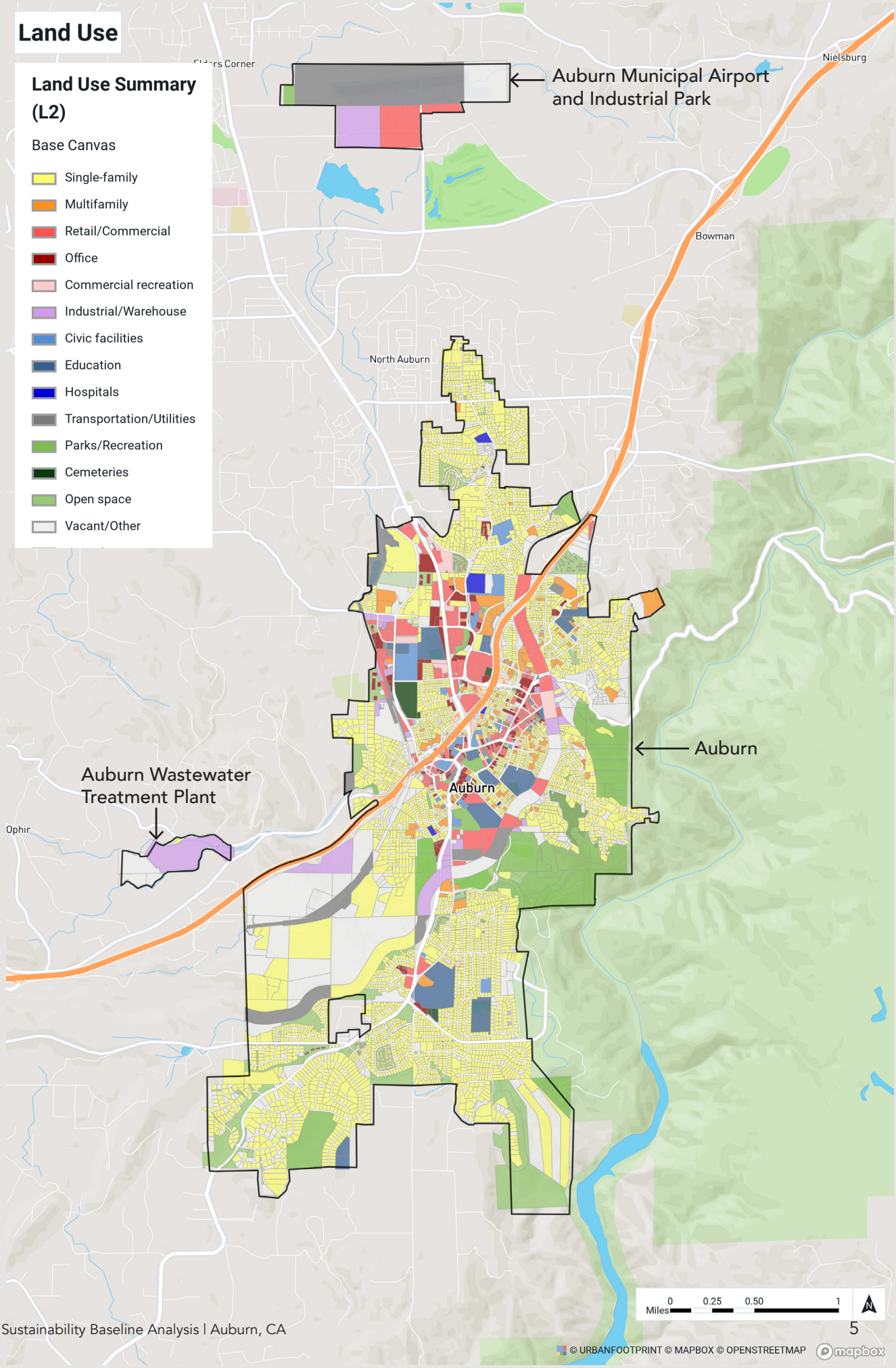


Dwelling Unit Types, %



Community-wide Building Area by Use, sf




Land Use
Land Use Summary (L2)
Base Canvas
Single-family
Multifamily
Retail/Commercial
Office
Commercial recreation
Industrial/Warehouse
Civic facilities
Education
Hospitals
Transportation/Utilities
Parks/Recreation
Cemeteries
Open space
Vacant/Other
Auburn Municipal Airport and Industrial Park
Nielsburg
Bowman
North Auburn
Auburn
Auburn
Auburn Wastewater Treatment Plant
Ophir
0
0.25
0.50
1
Miles
© URBANFOOTPRINT © MAPBOX © OPENSTREETMAP
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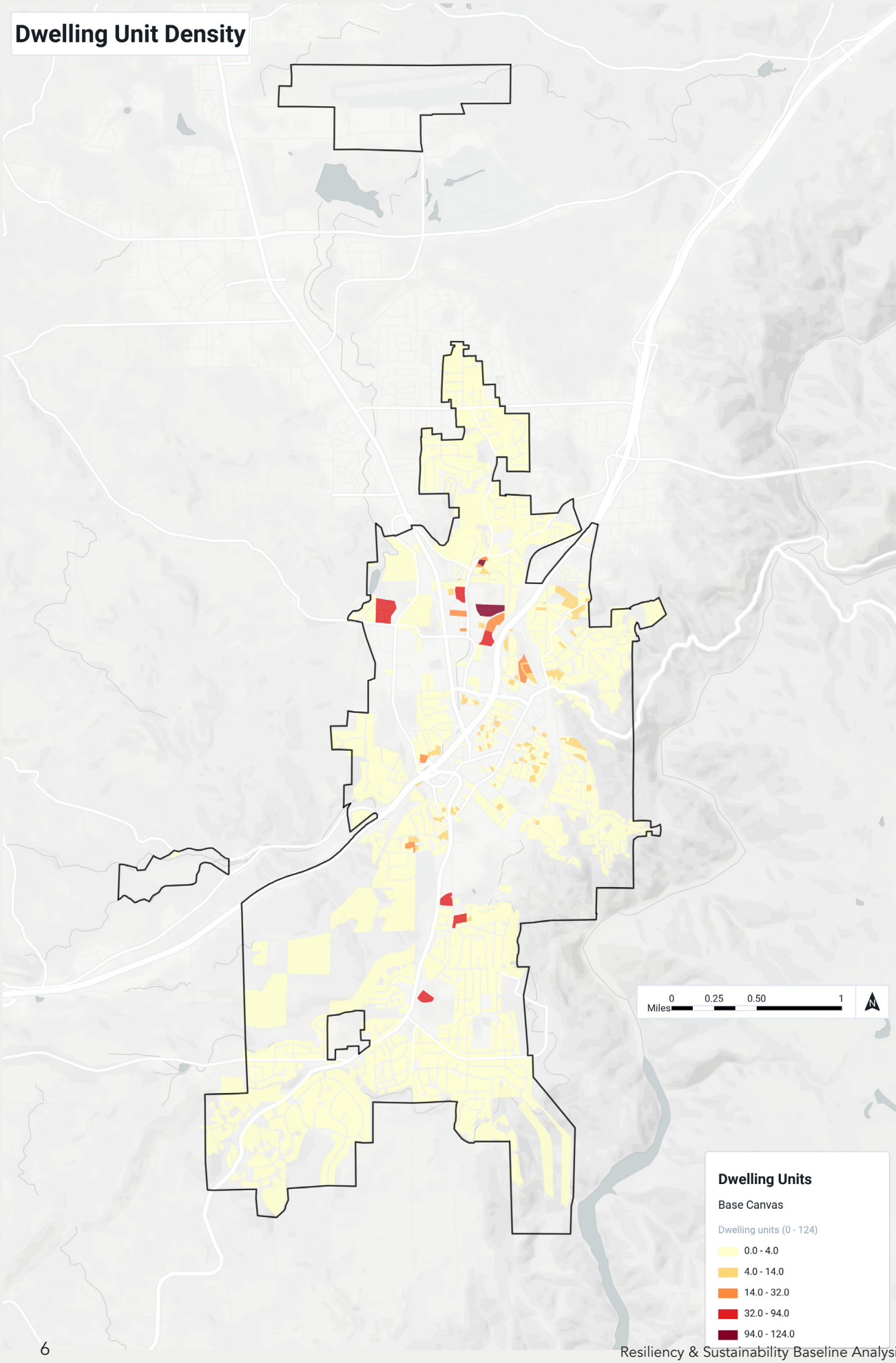
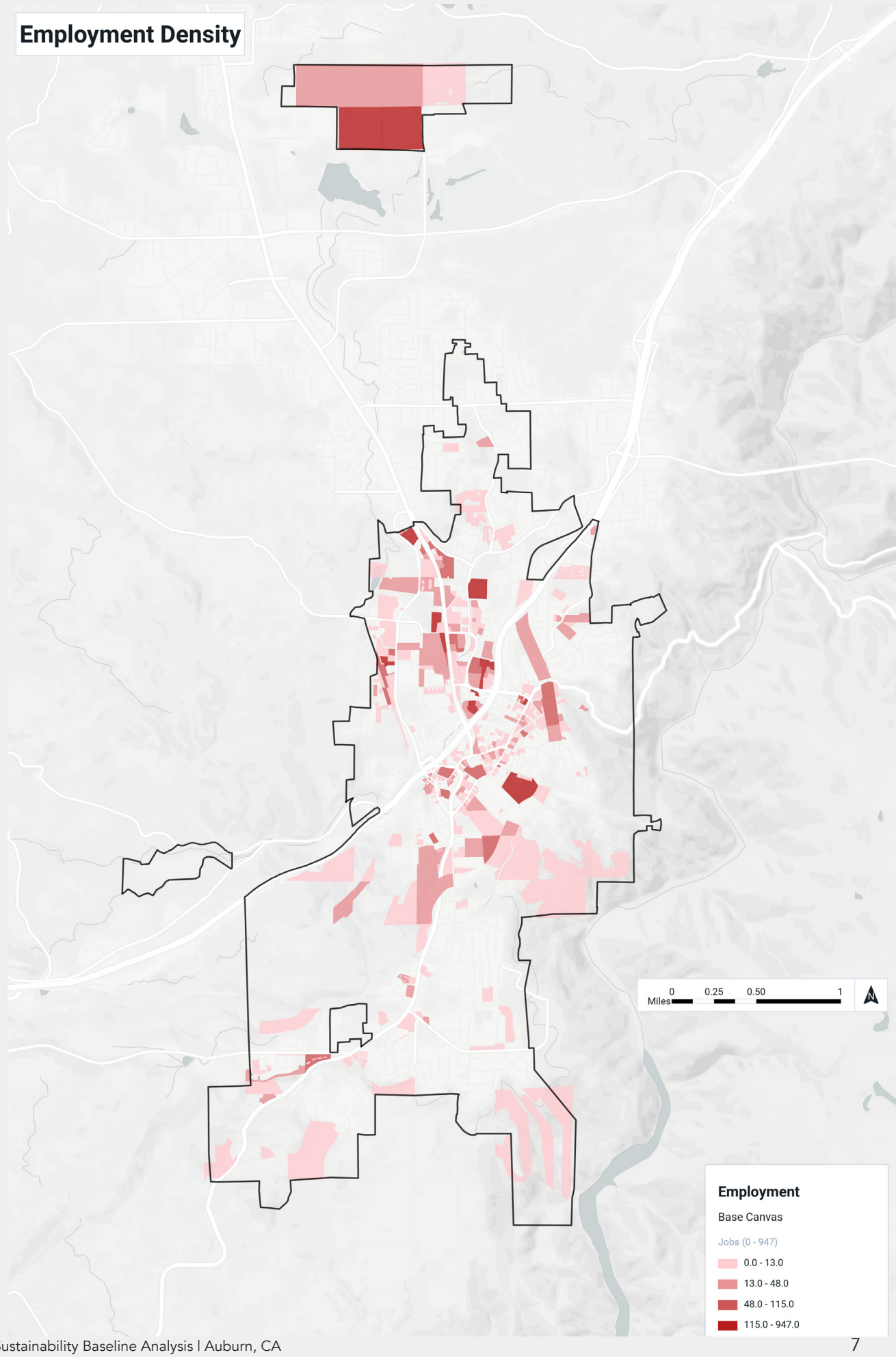
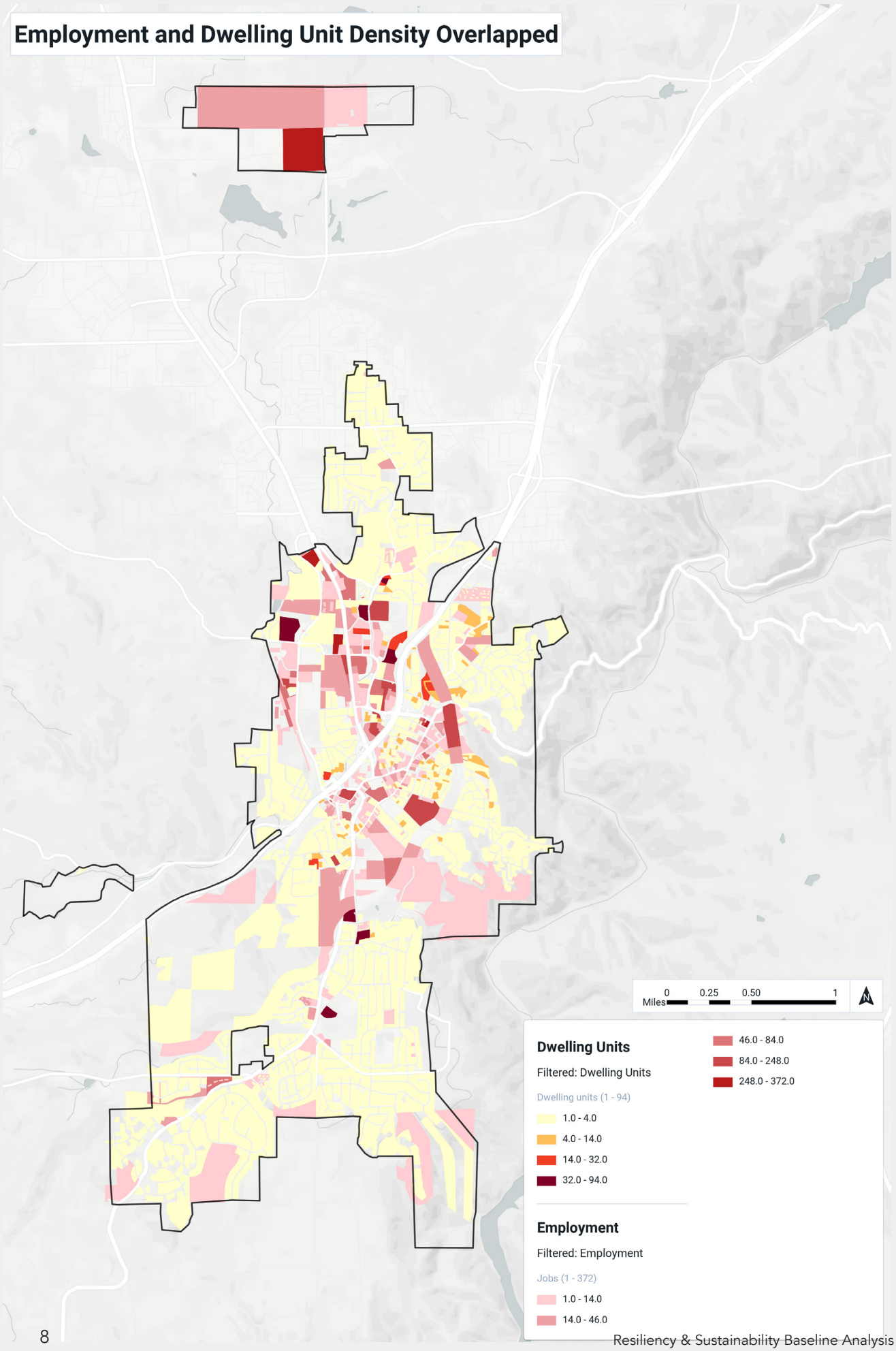
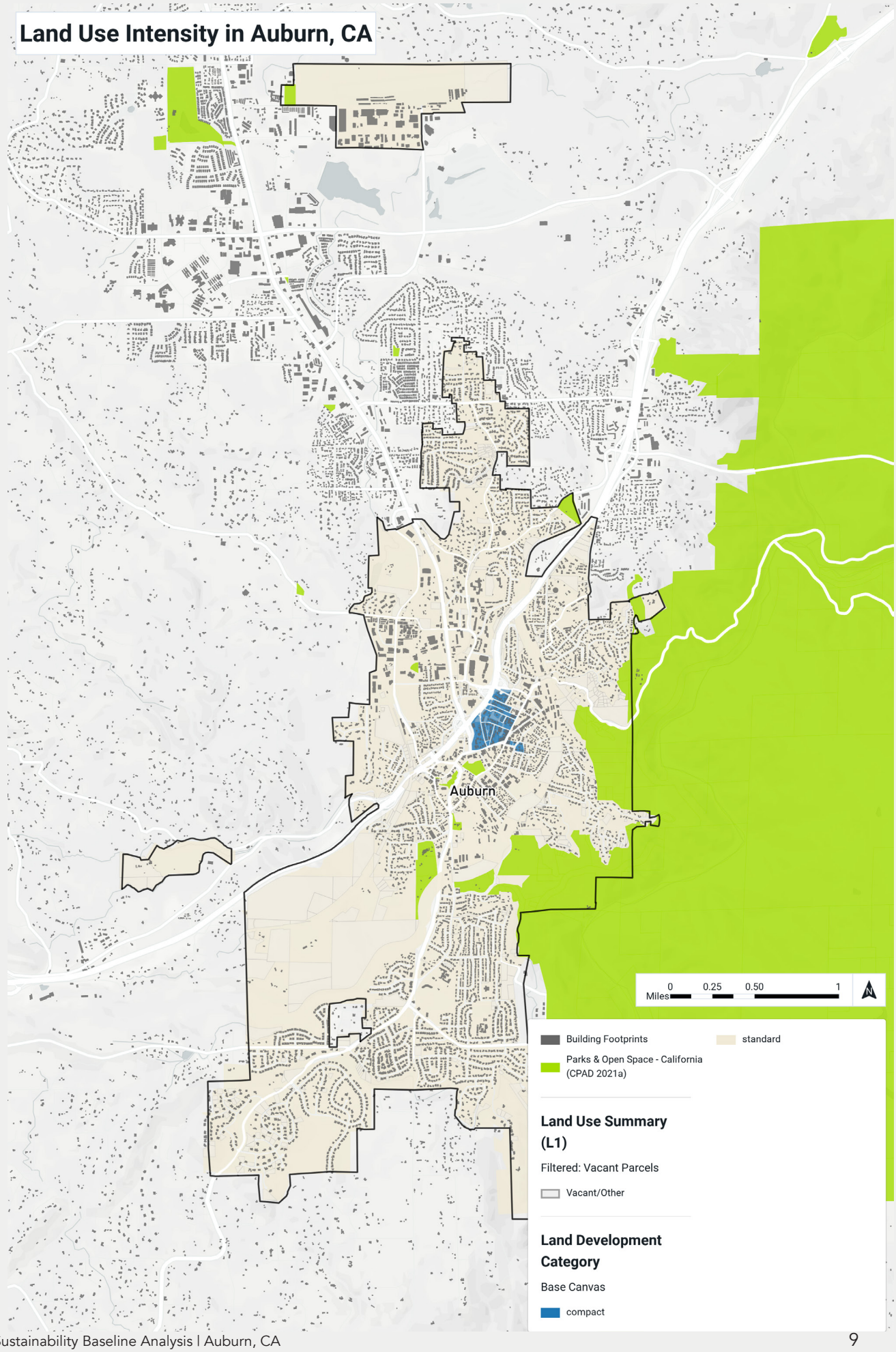
Dwelling Unit Density




Employment Density
0
0.25
0.50
1
Miles
Employment
Base Canvas
Jobs (0 - 947)
0.0 - 13.0
13.0 - 48.0
48.0 - 115.0
115.0 - 947.0

Employment and Dwelling Unit Density Overlapped




Land Use Intensity in Auburn, CA
Auburn
0
0.25
0.50
1
Miles
Building Footprints
standard
Parks & Open Space - California (CPAD 2021a)
Land Use Summary (L1)
Filtered: Vacant Parcels
Vacant/Other
Land Development Category
Base Canvas
compact

Energy Use

Indoor and Outdoor Consumption

The energy use analysis estimates electricity and natural gas use for residential and commercial buildings. Electricity and natural gas use are calculated on the basis of energy use rates: per dwelling unit by residential type, and per square foot for commercial floor area. We used a set of baseline rates for electricity and natural gas use that are derived from the California Energy Commission (CEC) Residential Appliance Saturation Study (RASS) and Commercial End-Use Survey (CEUS) datasets. These baseline rates vary by building type and climate zone and are appropriate for generalized estimates of energy use.

The same numbers of households and jobs can have different energy use profiles, dependent on the types of buildings used to accommodate the households and jobs. While a number of factors contribute to energy consumption patterns, residential energy use differs significantly by home size: more spacious and detached units generally require more energy. Similarly, commercial energy use is linked to building size, with the amount of floor area per employee varying according to built form assumptions. Thus, more compact development patterns and building types generally exhibit lower energy use profiles than more dispersed scenarios.

How to Interpret this Section

The analysis does not include energy use associated with other fuel types, including fuel oil, propane, and wood. It only includes information regarding electrical and natural gas use. It also does not differentiate between grid and site generated electrical power.

Define Key Terms

Energy: The sum of electricity and natural gas.

Electricity: electric power from the grid.

Natural Gas: Natural gas is a fossil energy source that forms deep beneath the earth's surface. The largest component of natural gas is methane.

Therms: A measurement of the amount of heat energy in natural gas, equal to 100,000 BTUs.

BTU: The British thermal unit is a unit of heat; it is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

GHG Emissions: The sum of greenhouse gas emissions of various gases: carbon dioxide, methane, nitrous oxide, and smaller trace gases such as hydrofluorocarbons (HFCs) and sulfur hexafluoride (SF6).

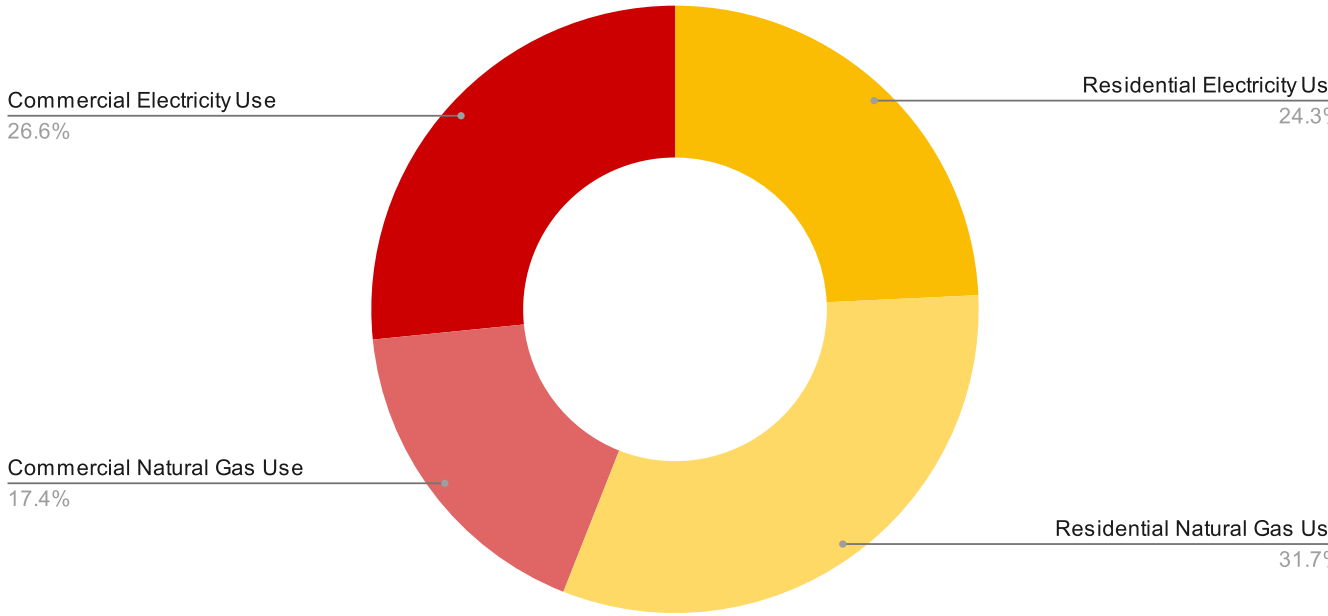
GHG Emissions per household: Average annual residential building energy emissions by household affected by household size and building type

GHG emissions per employee: Average annual commercial building energy emissions by employee affected by industry and building type

Data Sources

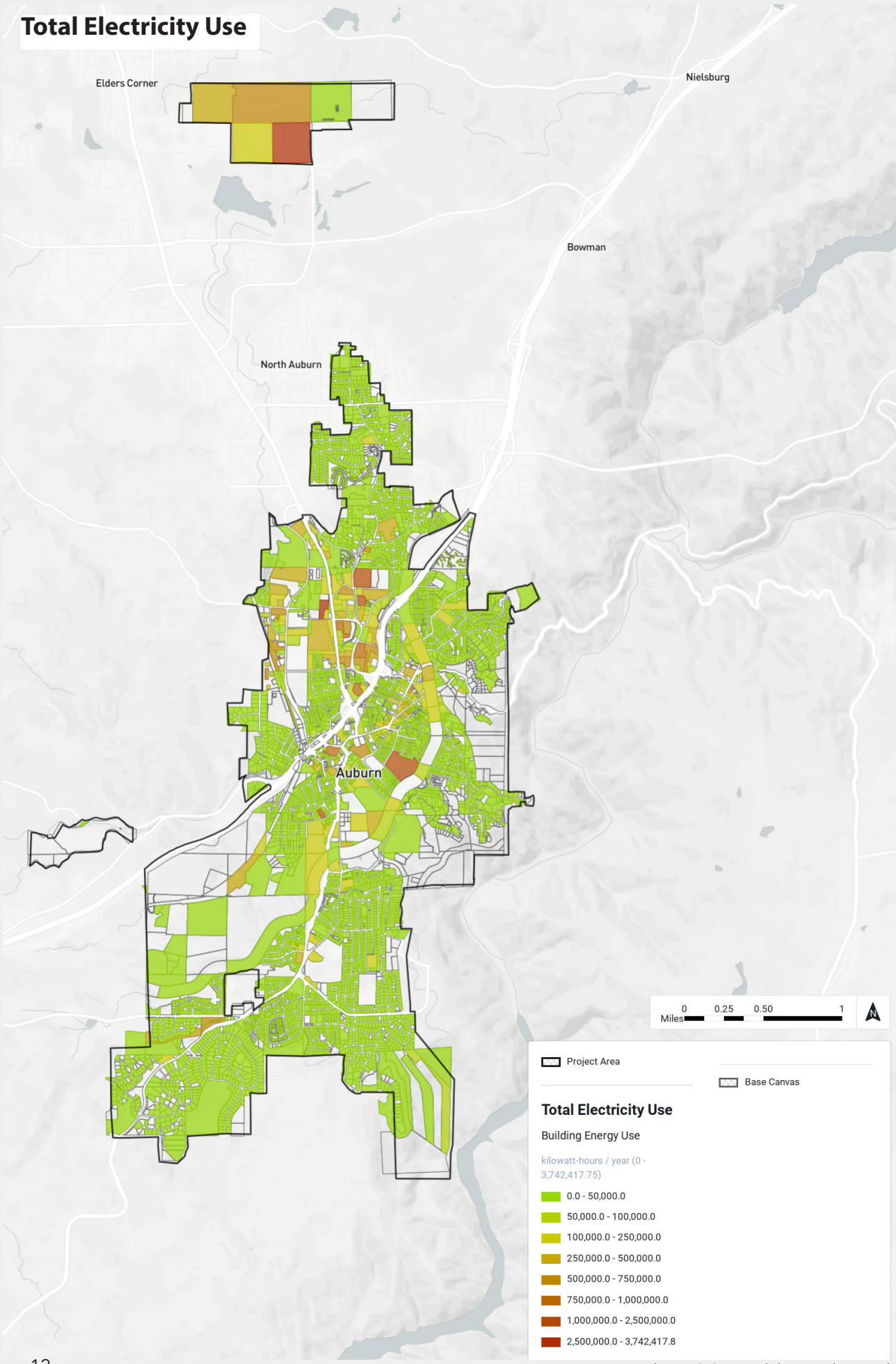
- California Energy Commission (CEC) Residential Appliance Saturation Study
- California Energy Commission (CEC) Commercial End-Use Survey (CEUS)

Community-wide Energy Use by Major Sector

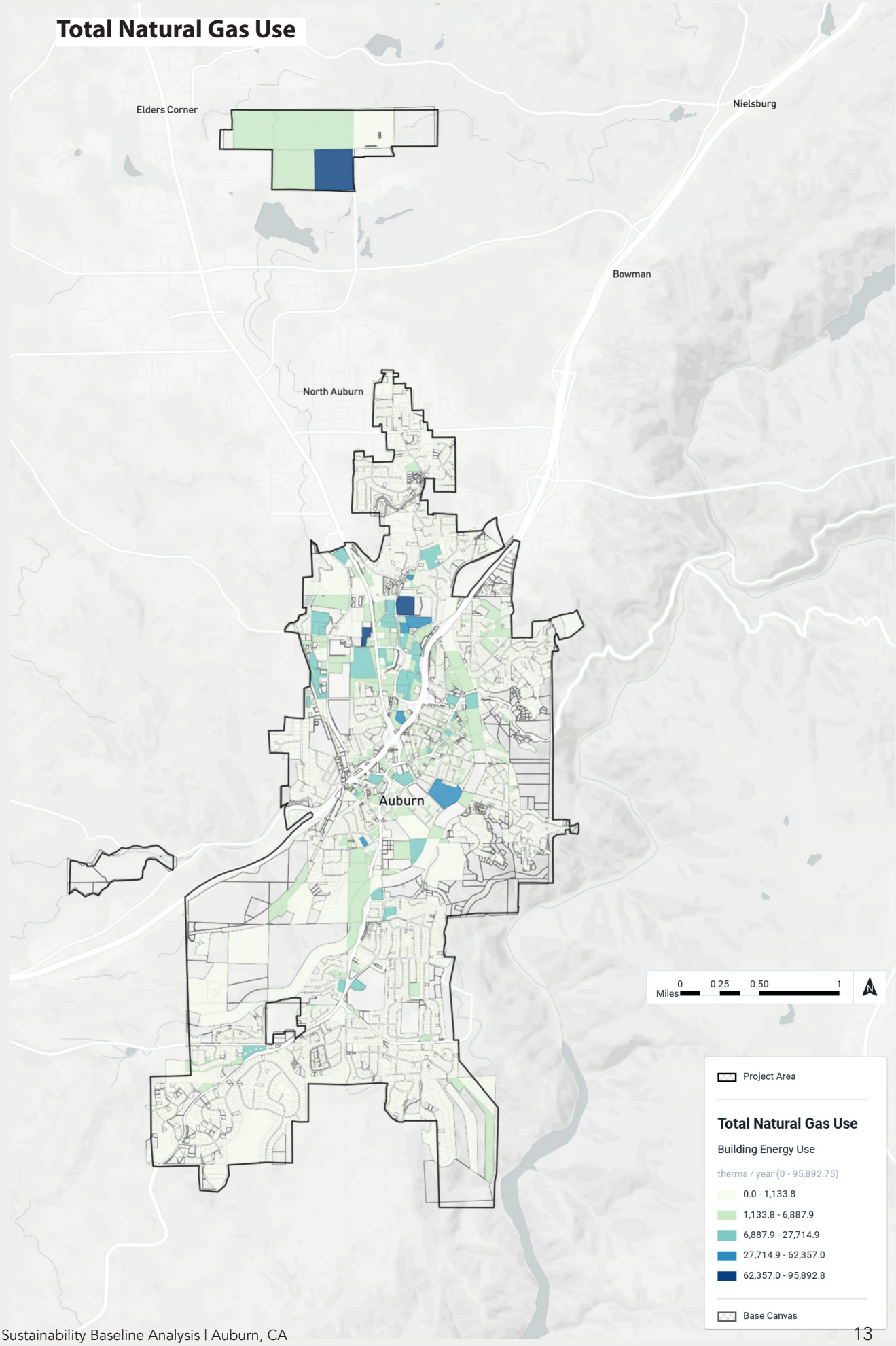


Energy Use Report - City Wide		
Total Annual Energy Use		
Residential Energy Use	450	billion BTU / year
Commercial Energy Use	354	billion BTU / year
Total	803	billion BTU / year
Annual Electricity Use		
Residential Electricity Use	57	million kilowatt-hours / year
Commercial Electricity Use	63	million kilowatt-hours / year
Total	120	million kilowatt-hours / year
Annual Gas Use		
Residential Natural Gas Use	3	million therms / year
Commercial Natural Gas Use	1	million therms / year
Total	4	million therms / year
Per Household Annual Energy Use		
Residential Energy Use per Household	76	million BTU / household / year
Annual Residential Energy Costs		
Residential Energy Cost	$13,530,000	/ year
Annual Building Energy GHG Emissions		
Total Building Energy GHG Emissions	45,844	metric tons / year

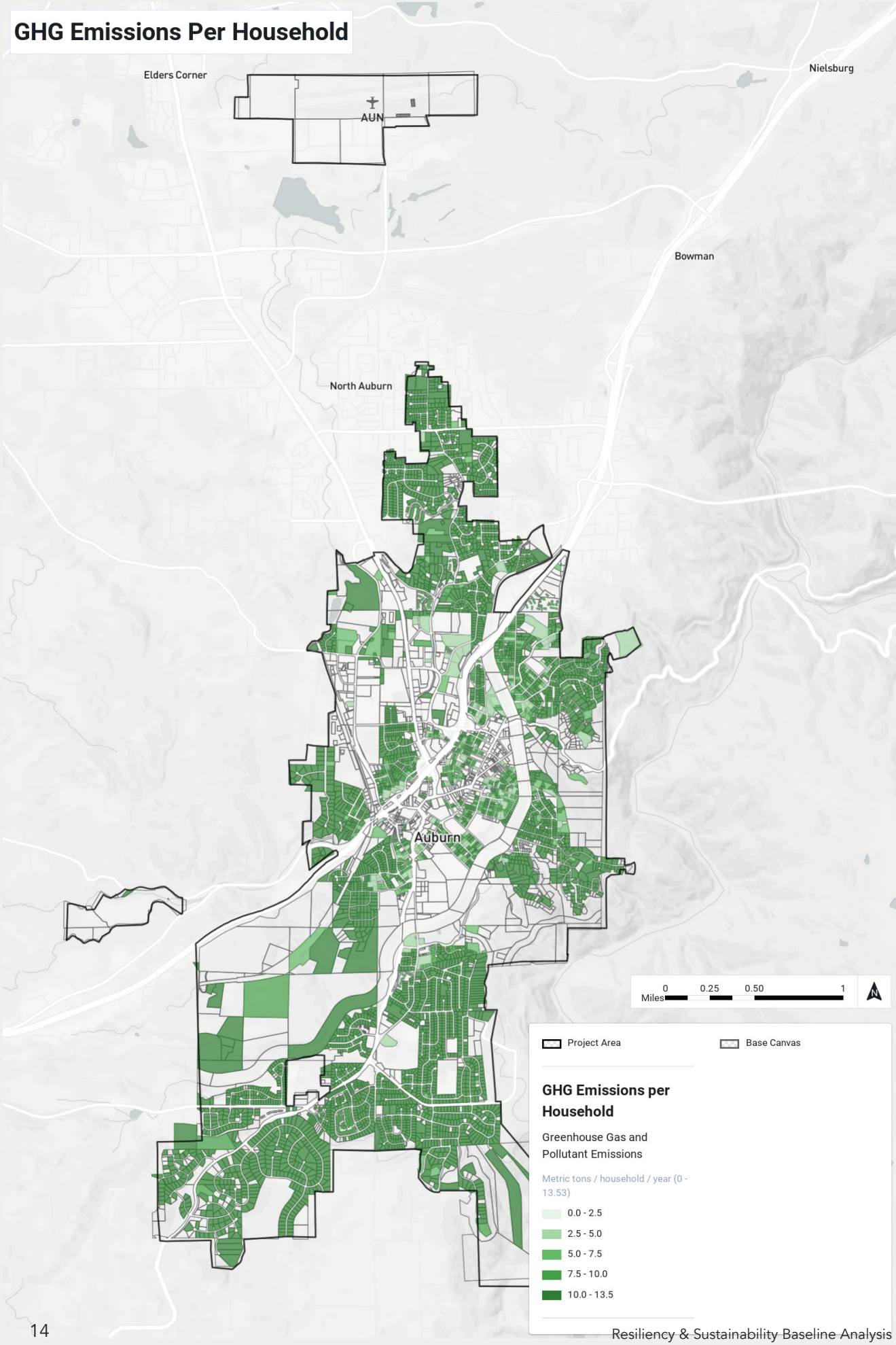
Total Electricity Use

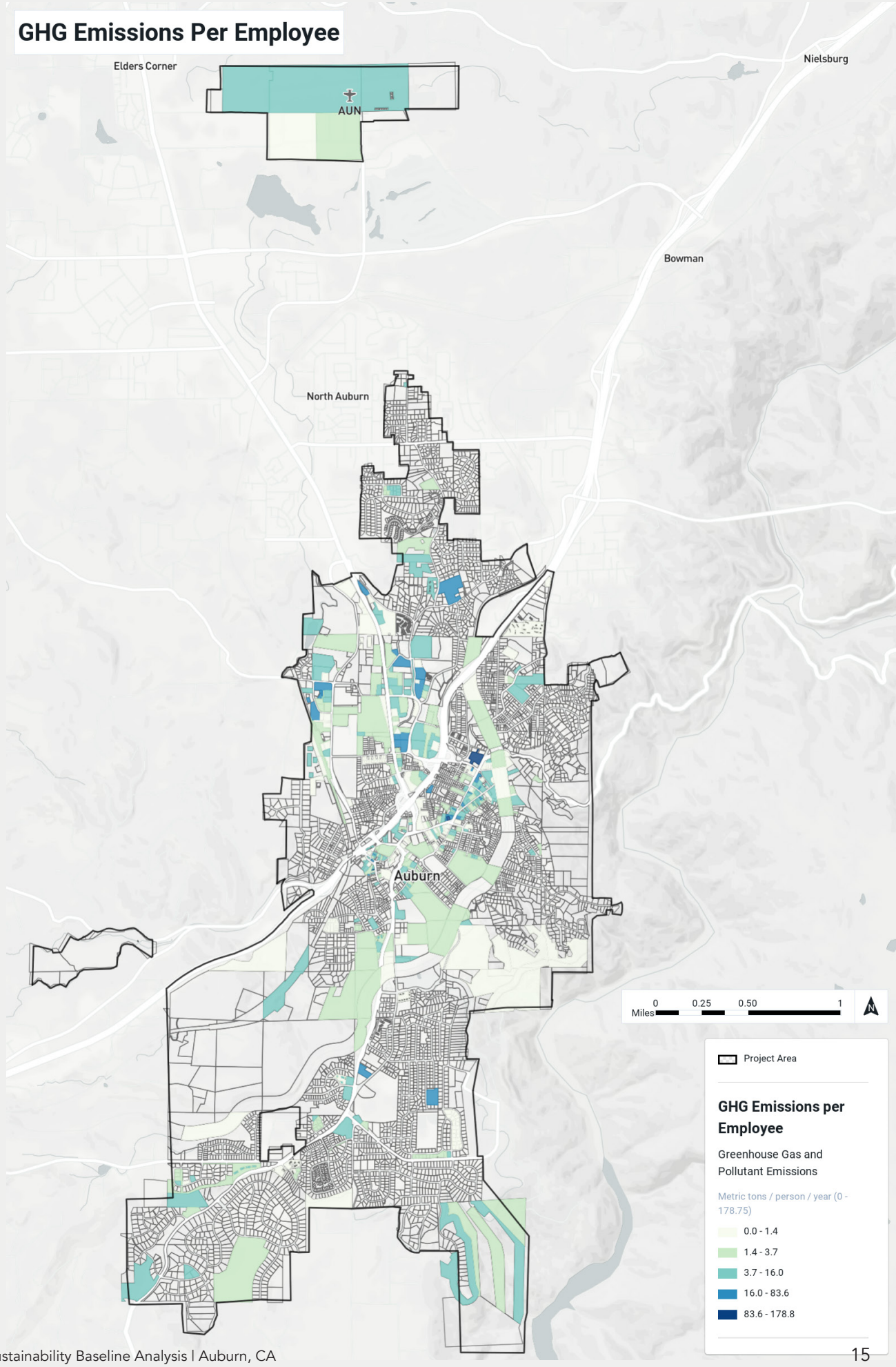


Total Natural Gas Use



GHG Emissions Per Household




GHG Emissions Per Employee
Elders Corner
AUN
Nielsburg
Bowman
North Auburn
Auburn
0
Miles
0.25
0.50
1
Project Area
GHG Emissions per Employee
Greenhouse Gas and Pollutant Emissions
Metric tons / person / year (0 - 178.75)
0.0 - 1.4
1.4 - 3.7
3.7 - 16.0
16.0 - 83.6
83.6 - 178.8

Water Use

Indoor and Outdoor Consumption

The Water Use analysis estimates the residential and commercial water use for existing buildings. Different development patterns have different impacts on water use. Building types may feature more or less outdoor landscaping with different watering needs based on their climate zone. Indoor residential water use does not vary significantly by climate, given the same building/fixture standards. For this reason, UrbanFootprint uses a single default set of residential indoor rates based on dwelling type. Large lot detached single-family houses use on average 55 gallons/person/day, while attached single-family houses and multi-family buildings use on average 45 gallons/person/day. Commercial indoor water use (including institutional and industrial use) is estimated on a per-employee basis. This approach is based on existing research and data that estimates commercial, institutional, and industrial water use by the employment sector, in units of gallons per employee per day. These estimates were derived from a combination of modeled and surveyed data, including general water uses (such as building, cooling, and restroom use) and water uses that relate to specific employment sectors (such as food service and medical care).

Outdoor water use is calculated based on irrigated area and reference evapotranspiration. Irrigated area is determined by the building and place types in the parcel data, while reference evapotranspiration varies according to climate zone.

How to Interpret this Section

These estimates are appropriate for generalized estimates of water use. It breaks down how consumption varies by use type. This is useful for identifying sectors where water efficiency measures could have the largest impact.

Define Key Terms

Indoor water use: interior fixture and appliance use

Outdoor water use: irrigated area

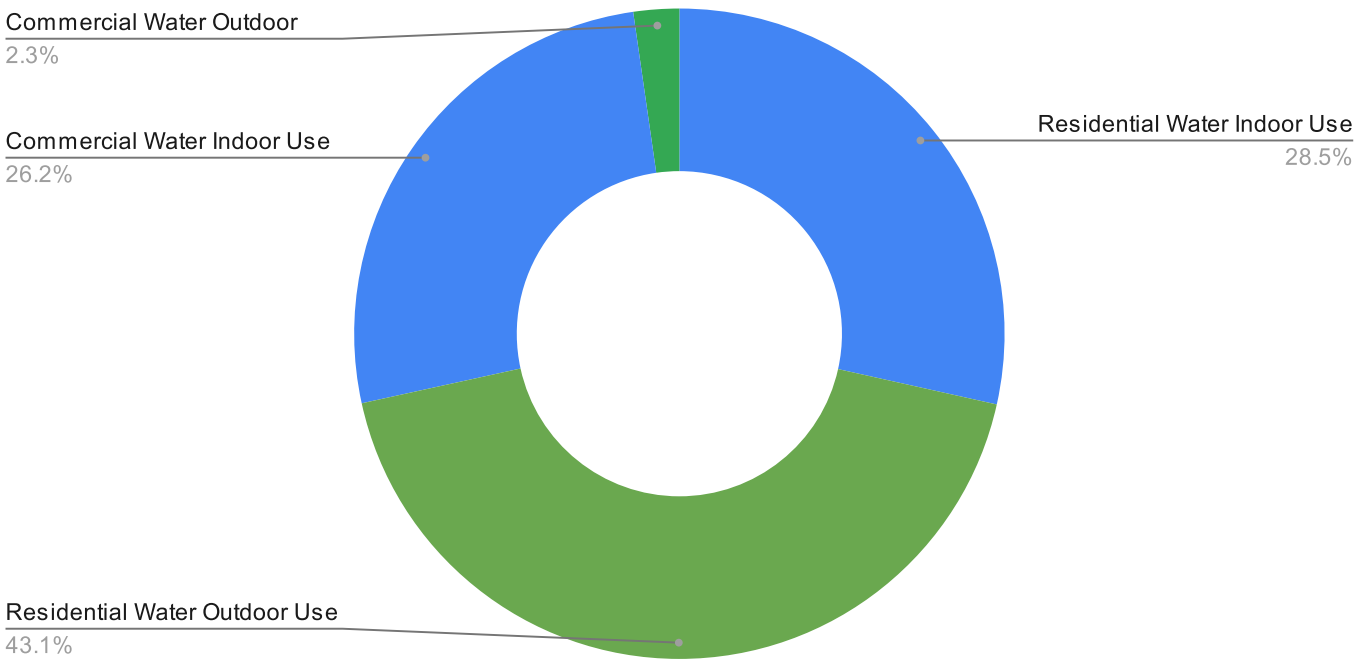
Evapotranspiration: the process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants.

Data Sources

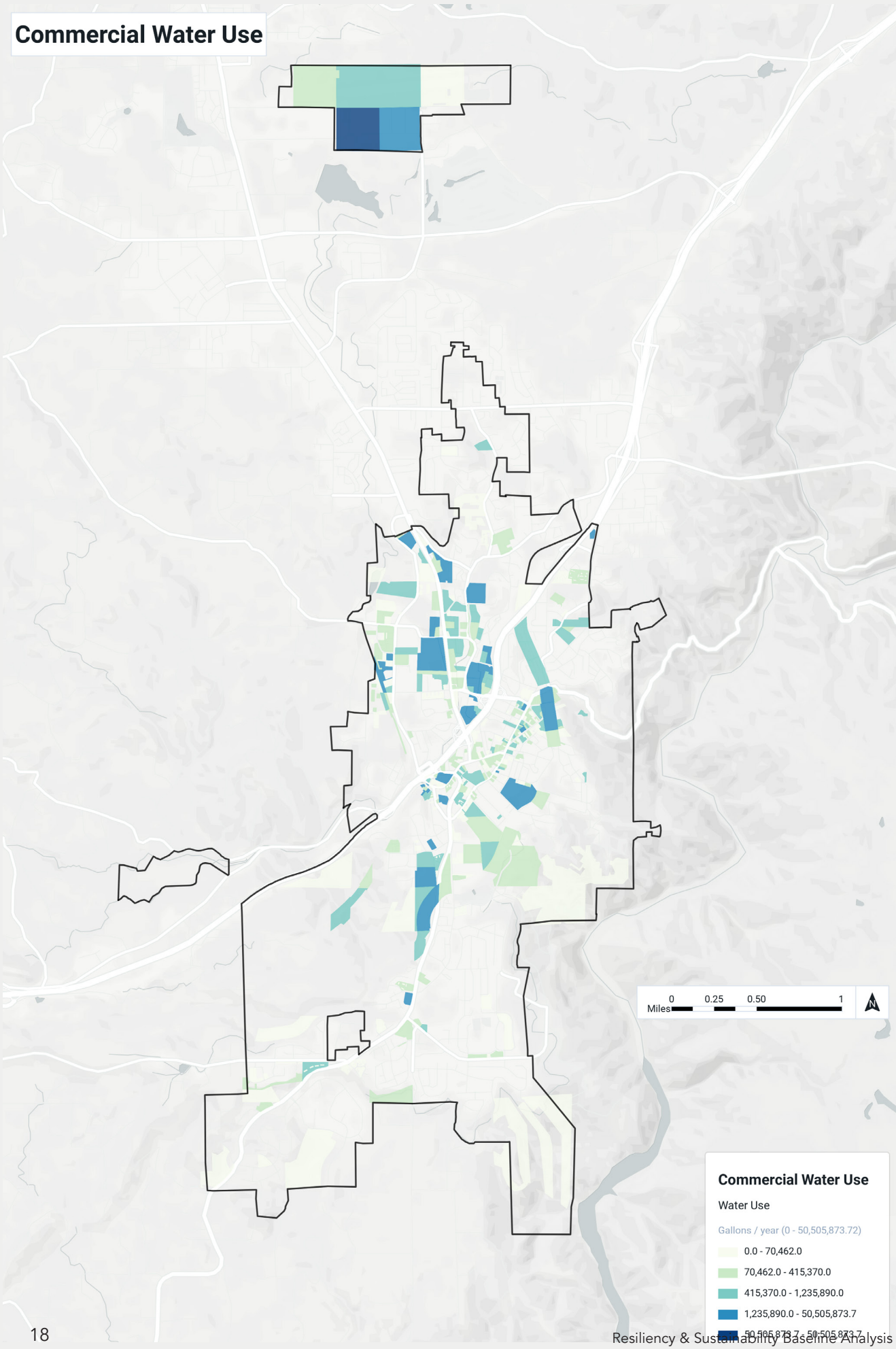
- Climatology Lab
- California Irrigation Management Information System
- University of Florida IFAS Extension

Commercial Indoor Water Use Parameters by Employee		
Retail Services	29	gallons / person / day
Restaurant Services	161	gallons / person / day
Accomodation Services	161	gallons / person / day
Arts Entertainment	161	gallons / person / day
Other Services	29	gallons / person / day
Office Employment	29	gallons / person / day
Education Employment	121	gallons / person / day
Public Administration	29	gallons / person / day
Medical Services	121	gallons / person / day
Wholesale	62	gallons / person / day
Transportation Warehousing	62	gallons / person / day
Construction	25	gallons / person / day
Utilities	25	gallons / person / day
Manufacturing	284	gallons / person / day
Extraction	19	gallons / person / day
Military	62	gallons / person / day
Agriculture	0	gallons / person / day

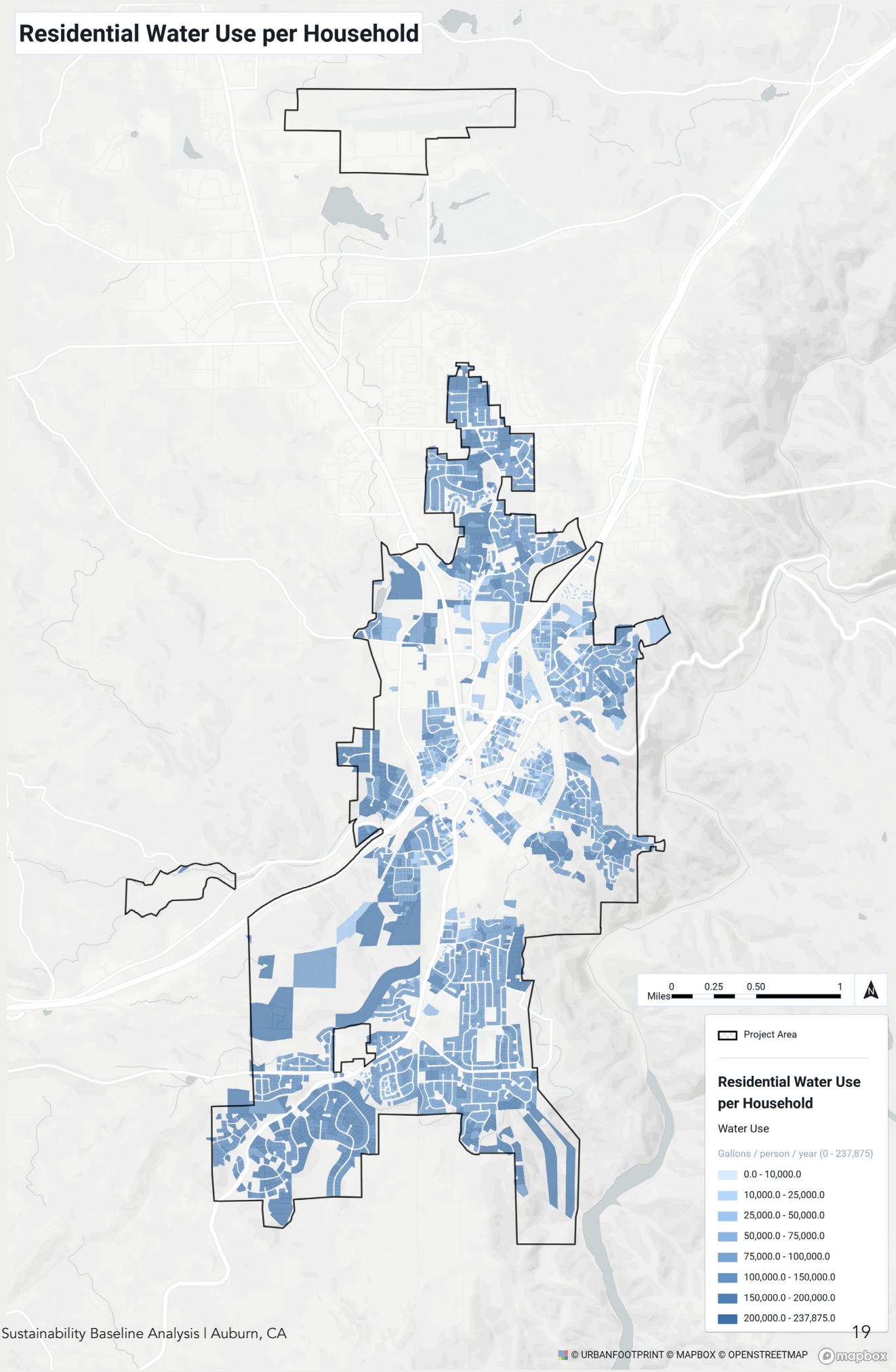
City-wide Water Use by Major Sector, %



Water Use Report - City Wide		
Total Annual Water Use		
Residential Water Use	666	million gallons / year
Commercial Water Use	264	million gallons / year
Total	930	million gallons / year
Annual Indoor Water Use		
Residential Water Indoor Use	265	million gallons / year
Commercial Water Indoor Use	243	million gallons / year
Total	508	million gallons / year
Annual Outdoor Water Use		
Residential Water Outdoor Use	401	million gallons / year
Commercial Water Outdoor Use	21	million gallons / year
Total	422	million gallons / year
Annual Residential Water Use		
Residential Water Indoor Use	265	million gallons / year
Residential Water Outdoor Use	401	million gallons / year
Total	666	million gallons / year
Annual Commercial Water Use		
Commercial Water Indoor Use	243	million gallons / year
Commercial Water Outdoor Use	21	million gallons / year
Total	264	million gallons / year
Per Capita Annual Residential Water Use		
Residential Water Use per Capita	48,088	gallons / person / year
Per Household Annual Residential Water Use,		
Residential Indoor Water Use per Household	45,029	gallons / person / year
Residential Outdoor Water Use per Household	68,087	gallons / person / year
Total	113,116	gallons / person / year


Commercial Water Use
0
0.25
0.50
1
Miles
Commercial Water Use
Water Use
Gallons / year (0 - 50,505,873.72)
0.0 - 70,462.0
70,462.0 - 415,370.0
415,370.0 - 1,235,890.0
1,235,890.0 - 50,505,873.7
50,505,873.7 - 50,505,873.7

Residential Water Use per Household



Walk Accessibility

Access from residences to town life

The Walk Accessibility module highlights opportunities and deficiencies in accessibility by measuring the proximity of each parcel to employment, population, housing, parks, schools, hospitals, retail, and transit stops within 50 kilometers. The modules are loaded with up-to-date network data for transit, walkable roads, and walk paths to support robust network-based analysis.

The accessibility metrics are reported in two forms. Firstly, travel time, in minutes, from a parcel to the nearest point of interest. This is the time necessary to reach a particular point of interest based on the shortest distance within the network data. Secondly, the number of destinations or opportunities one can reach within a specified amount of time. This includes, for example, the average time required to walk from a given parcel to the nearest hospital, or the number of jobs that can be reached on foot from that parcel within 30 minutes.

How to Interpret this Section

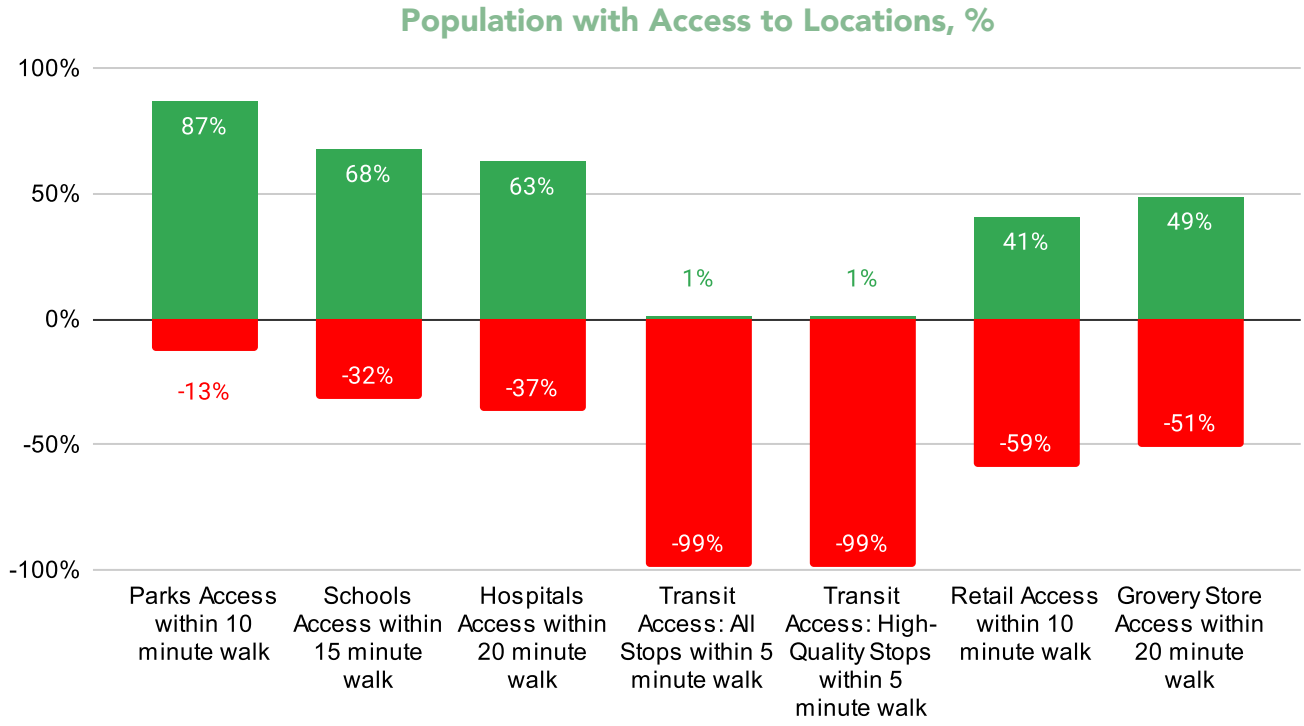
This section aggregates measures that indicate percentages of the total population in the City of Auburn that can reach their nearest amenity within a given period of time. This is useful for understanding how walkable the City is. This information could be used to inform streetscape improvements, pedestrian pathways, and the walkability of potential development locations.

Define Key Terms

High-Quality Transit Stop: tram, streetcar, light rail, subway, metro, rail, ferry, and cable tram

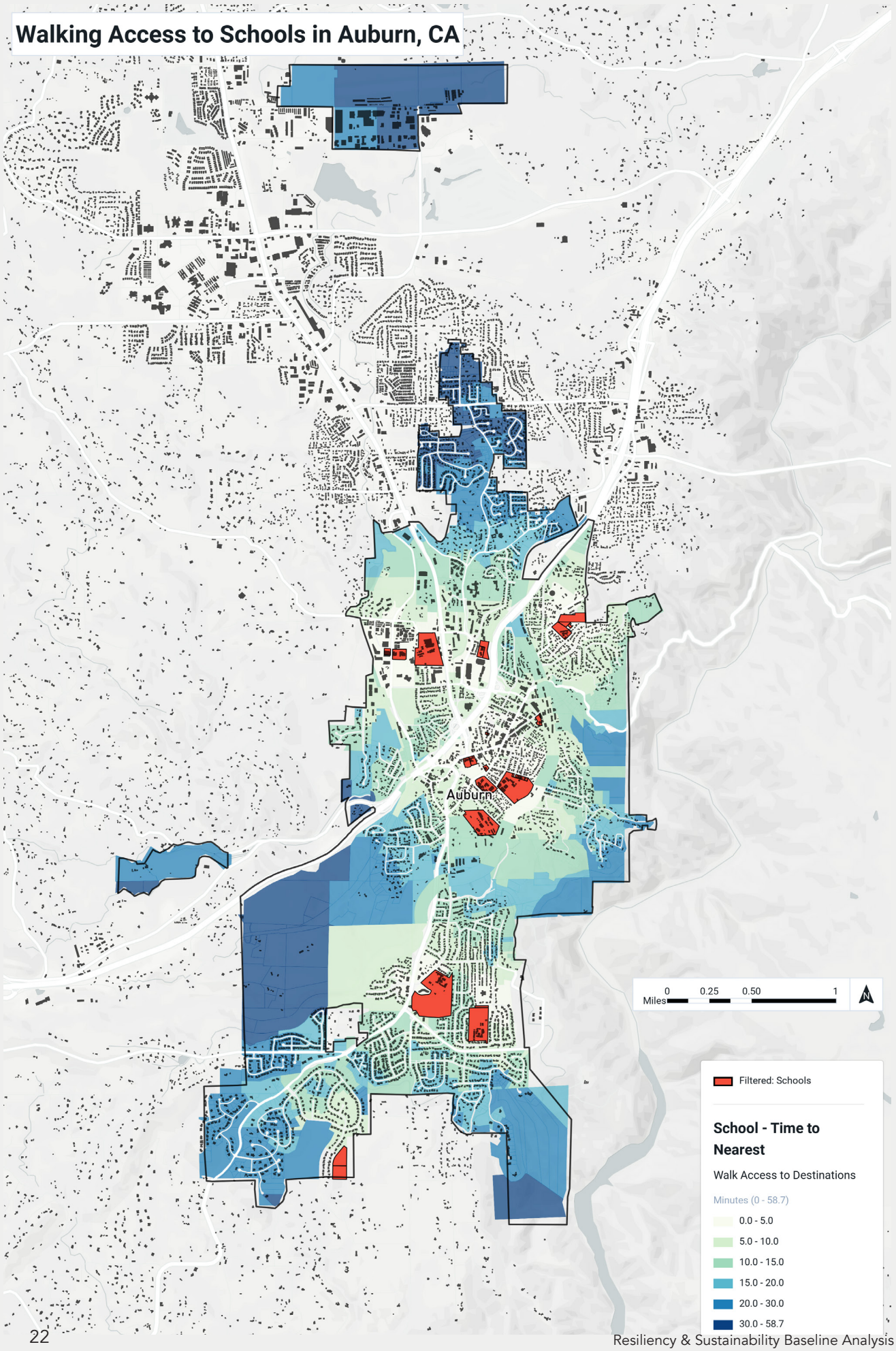
Data Sources

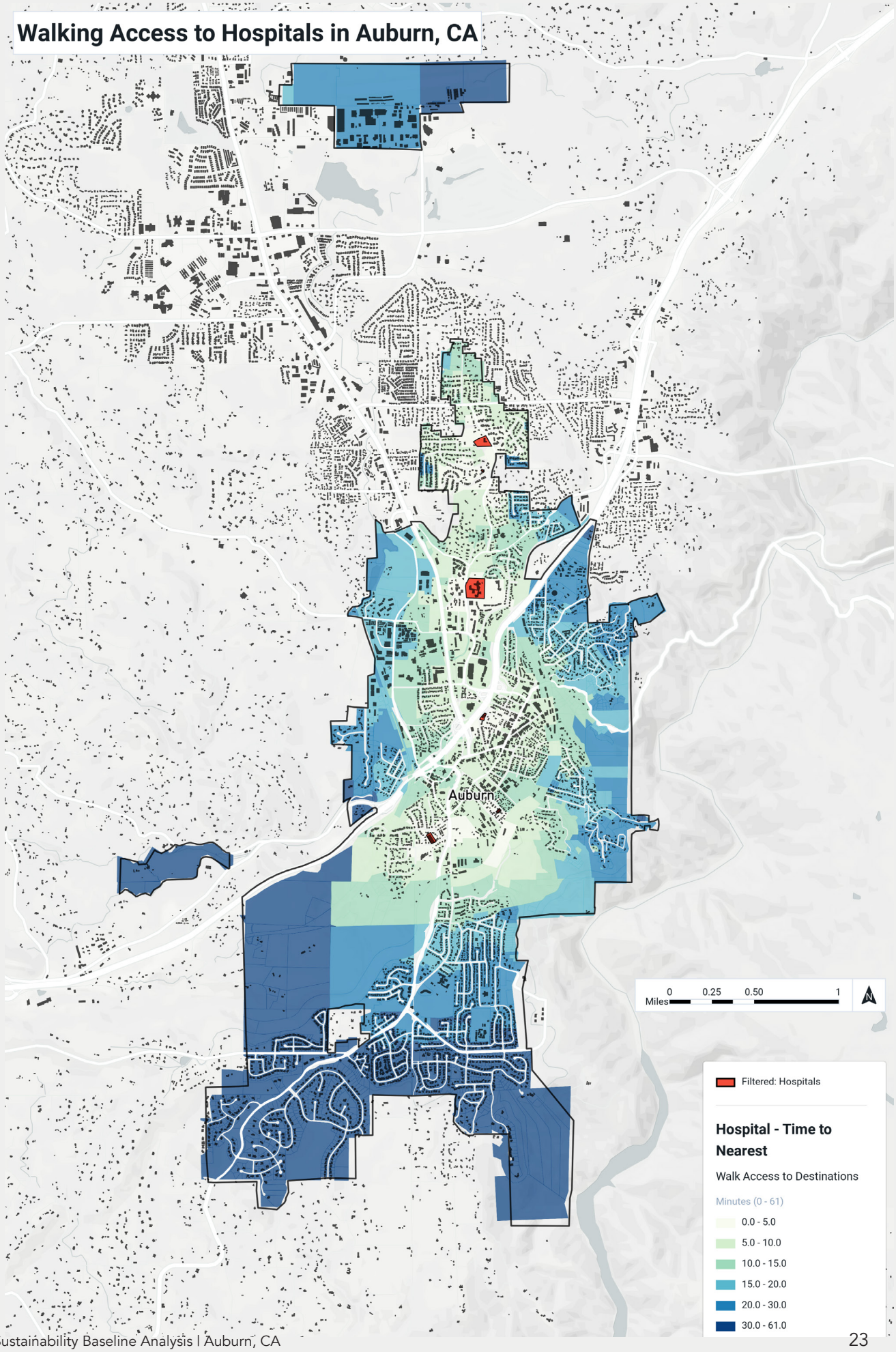
- The walk network is built based on data sourced from OpenStreetMap (OSM)
- The transit network is from TransitLand
- Hospitals: US Homeland Infrastructure Foundation, Federal Geographic Data Committee
- Parks: Esri, TomTom North America, Inc.; parks, gardens, and forests within the US
- Schools: US National Center for Education Statistics (NCES), School Attendance Boundary Information System (SABINS)
- U.S. Census Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES) data
- U.S. Census Decennial Census data

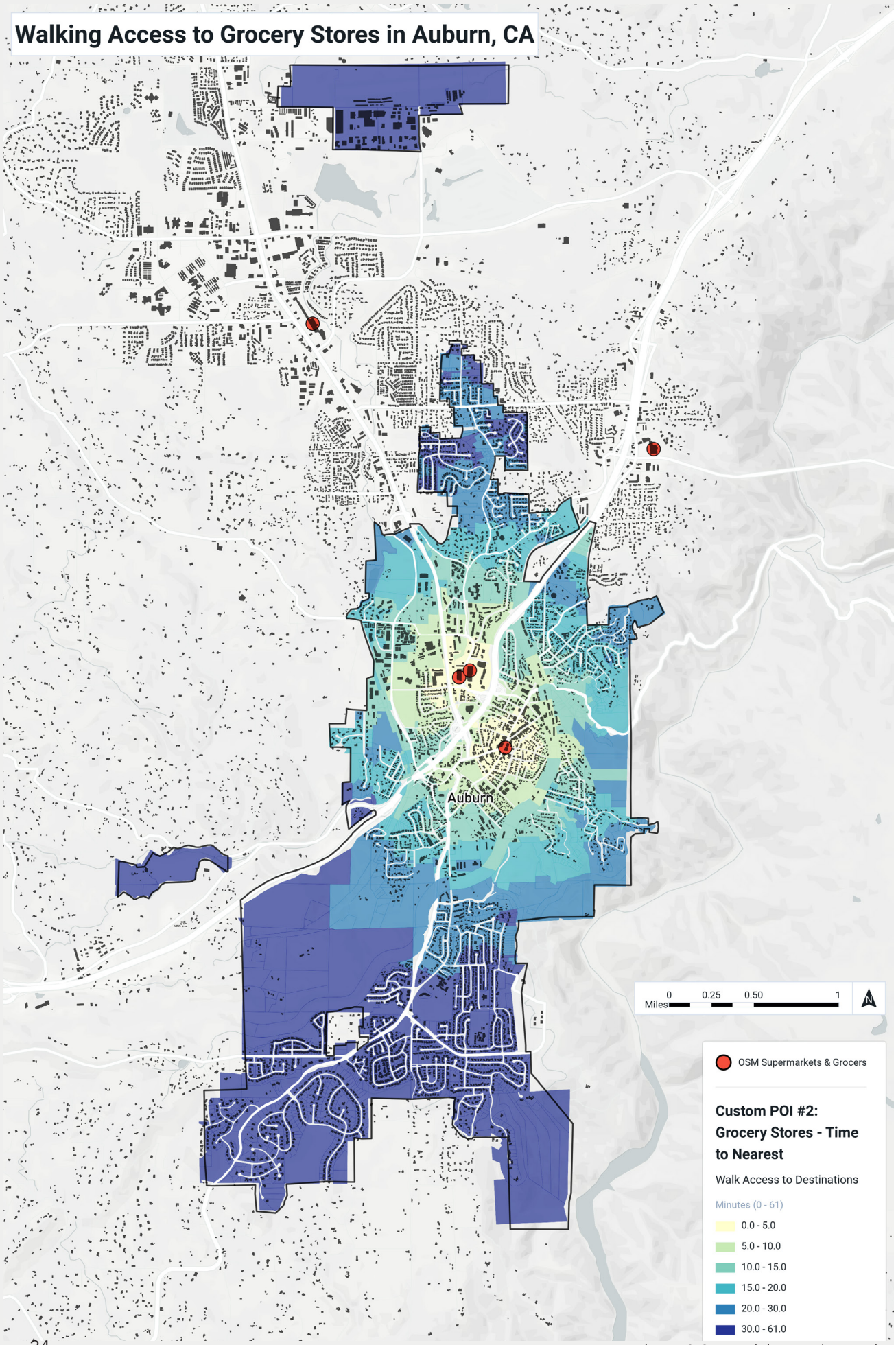


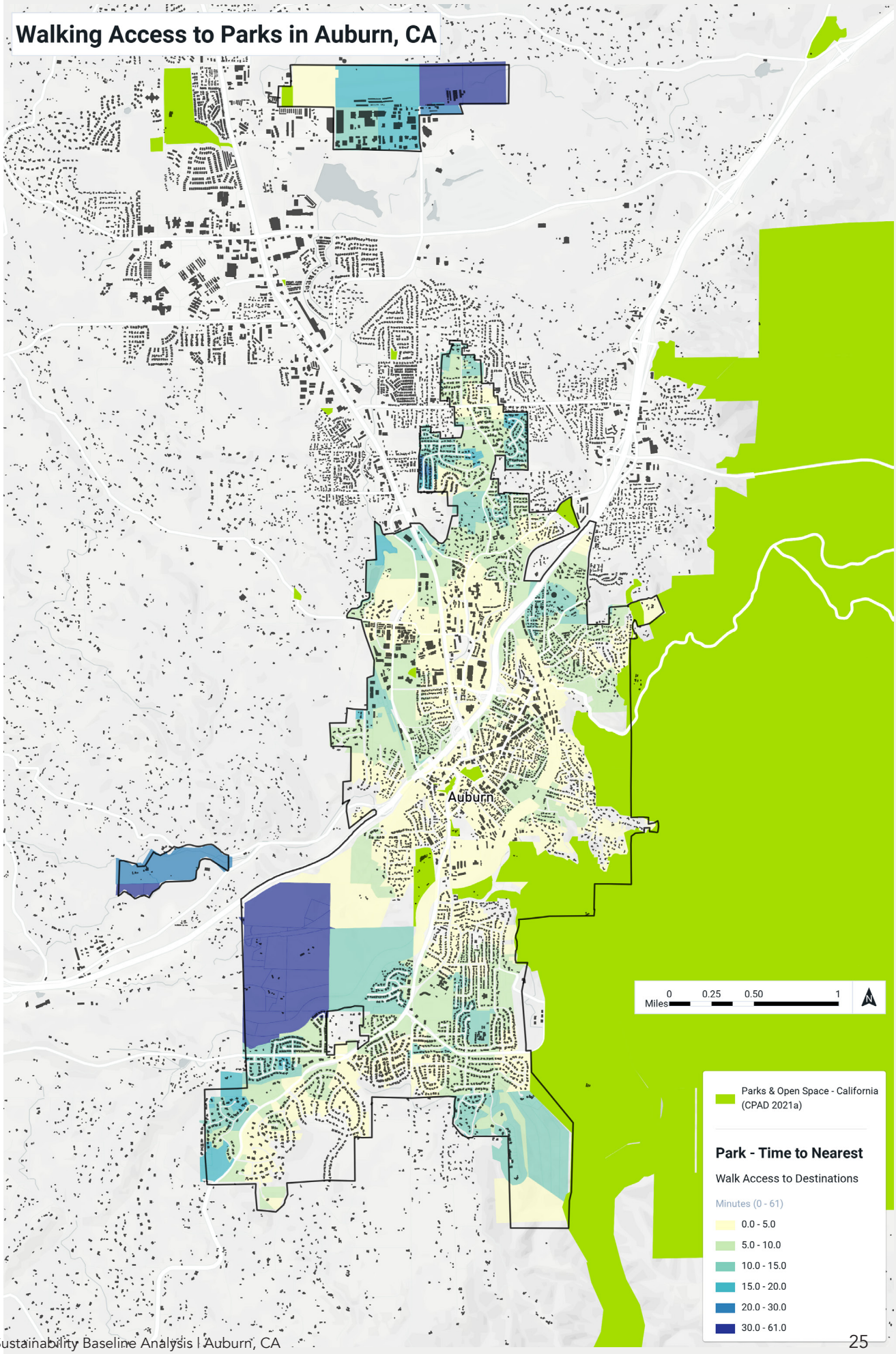
The of minutes of walking for each location is based on industry standards of how long the average person is willing to walk to get to a type of location.

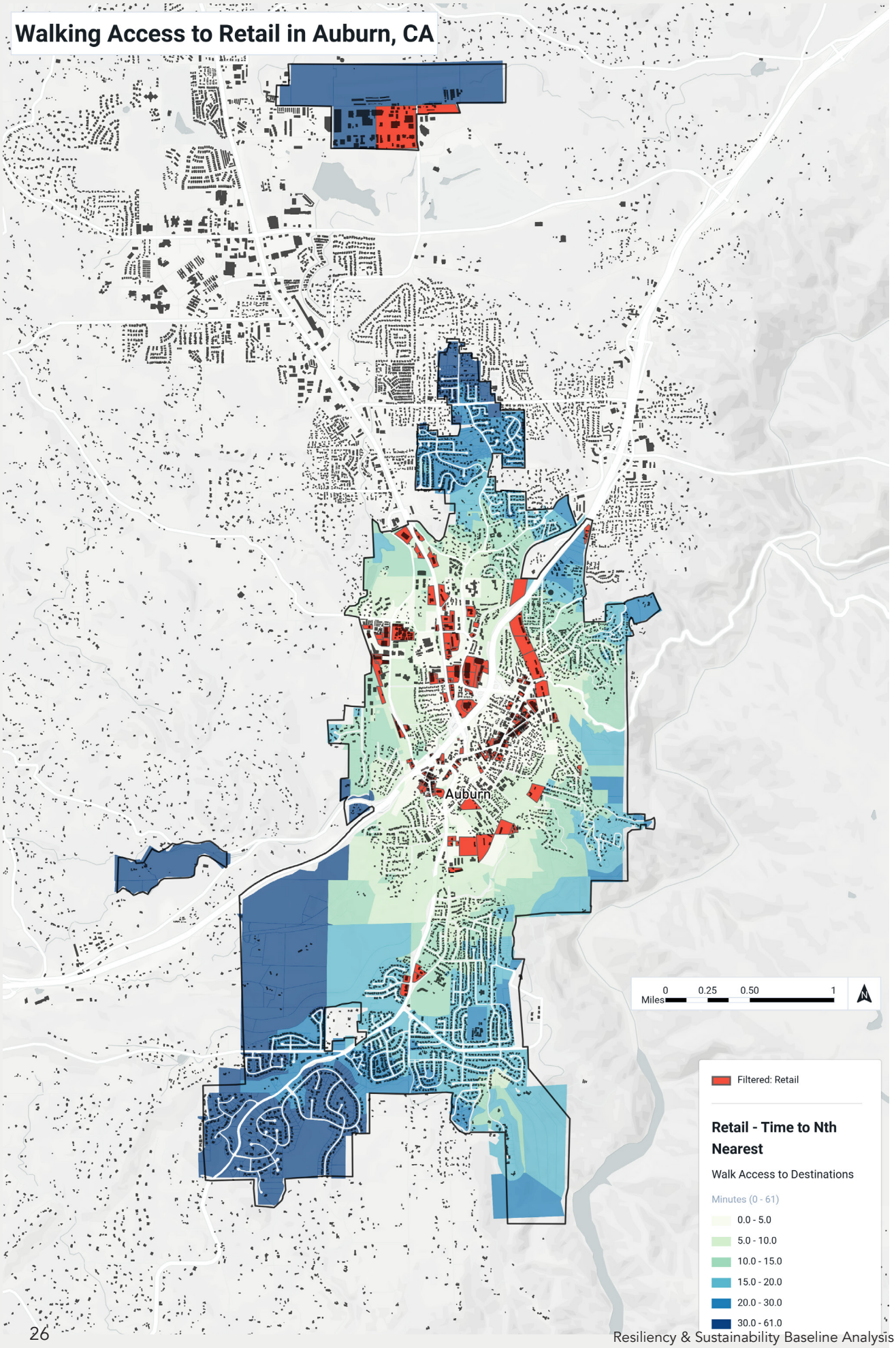
Walk Accessibility Report - City Wide		
Parks Access within 10 minute walk	87%	of residents
Schools Access within 15 minute walk	68%	of residents
Hospitals Access within 20 minute walk	63%	of residents
Transit Access: All Stops within 5 minute walk	1%	of residents
Transit Access: High-Quality Stops within 5 minute walk	1%	of residents
Retail Access within 10 minute walk	41%	of residents
Grovery Store Access within 20 minute walk	49%	of residents


Walking Access to Schools in Auburn, CA
Auburn
0
Miles
0.25
0.50
1
Filtered: Schools
School - Time to Nearest
Walk Access to Destinations
Minutes (0 - 58.7)
0.0 - 5.0
5.0 - 10.0
10.0 - 15.0
15.0 - 20.0
20.0 - 30.0
30.0 - 58.7

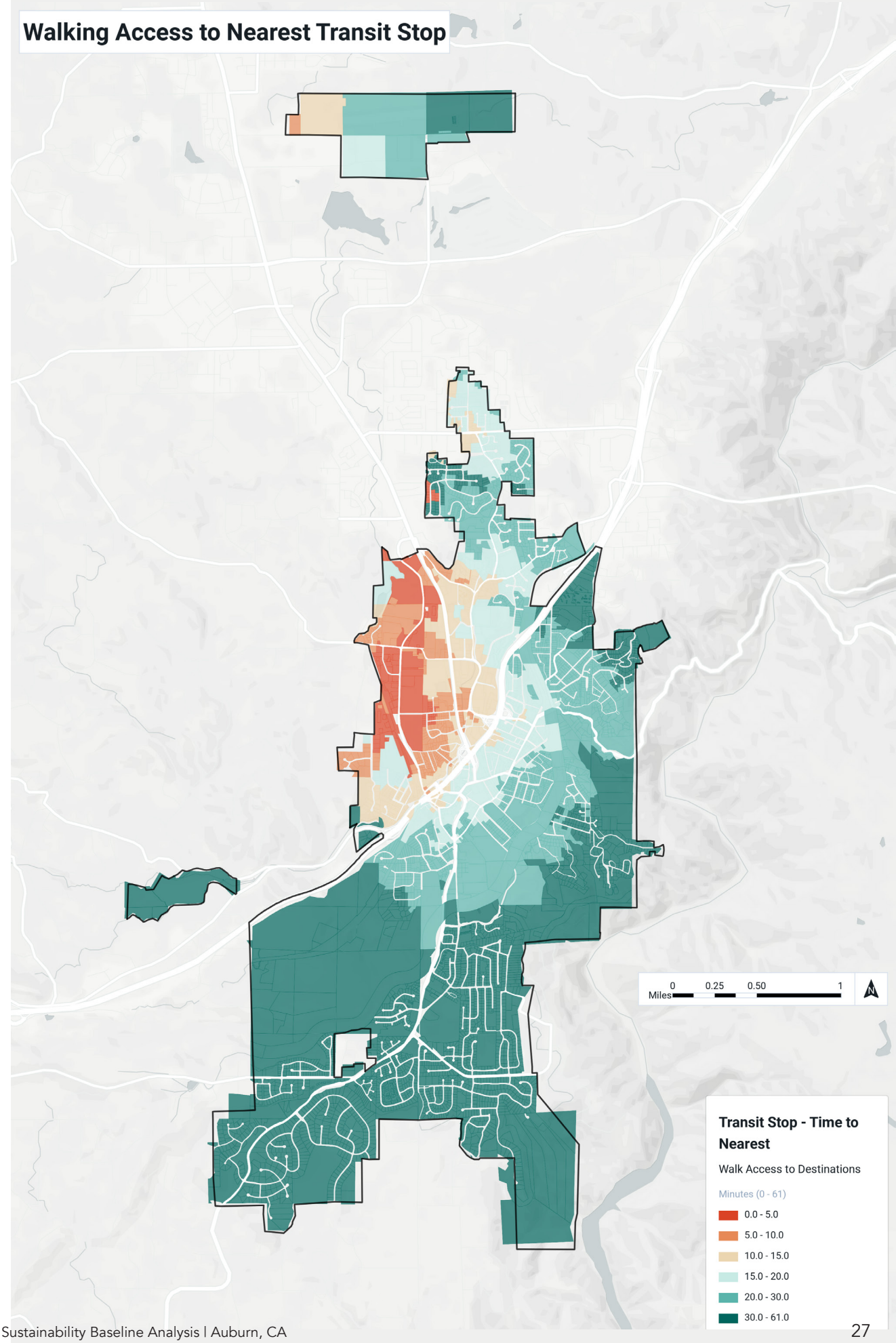

Walking Access to Hospitals in Auburn, CA
Auburn
0
Miles
0.25
0.50
1
N
Filtered: Hospitals
Hospital - Time to Nearest
Walk Access to Destinations
Minutes (0 - 61)
0.0 - 5.0
5.0 - 10.0
10.0 - 15.0
15.0 - 20.0
20.0 - 30.0
30.0 - 61.0


Walking Access to Grocery Stores in Auburn, CA
Auburn
0
Miles
0.25
0.50
1
OSM Supermarkets & Grocers
Custom POI #2: Grocery Stores - Time to Nearest
Walk Access to Destinations
Minutes (0 - 61)
0.0 - 5.0
5.0 - 10.0
10.0 - 15.0
15.0 - 20.0
20.0 - 30.0
30.0 - 61.0


Walking Access to Parks in Auburn, CA
Auburn
0
0.25
0.50
1
Miles
Parks & Open Space - California (CPAD 2021a)
Park - Time to Nearest
Walk Access to Destinations
Minutes (0 - 61)
0.0 - 5.0
5.0 - 10.0
10.0 - 15.0
15.0 - 20.0
20.0 - 30.0
30.0 - 61.0


Walking Access to Retail in Auburn, CA
Auburn
0
Miles
0.25
0.50
1
N
Filtered: Retail
Retail - Time to Nth Nearest
Walk Access to Destinations
Minutes (0 - 61)
0.0 - 5.0
5.0 - 10.0
10.0 - 15.0
15.0 - 20.0
20.0 - 30.0
30.0 - 61.0

Walking Access to Nearest Transit Stop



Transit Accessibility

Convenience of travel

The Transit Accessibility module measures proximity to amenities and accessibility to specific features or opportunities by foot and transit. To do this, the module first compiles an integrated network, composed of both walk path and transit service data. Then, location data, such as the location of schools, parks, and hospitals, are extracted from national reference datasets and resolved against the current conditions.

In addition, the parcel information is also used to generate data related to locations of jobs, households, population, and retail destinations as identified by the presence of retail employment. These datasets are then layered on top of the network based on their locations, in relation to nodes of the network. Lastly, a set of algorithms are performed to produce key proximity and accessibility metrics.

How to Interpret this Section

These transit accessibility values do not include Auburn's on-demand bus service.

Define Key Terms

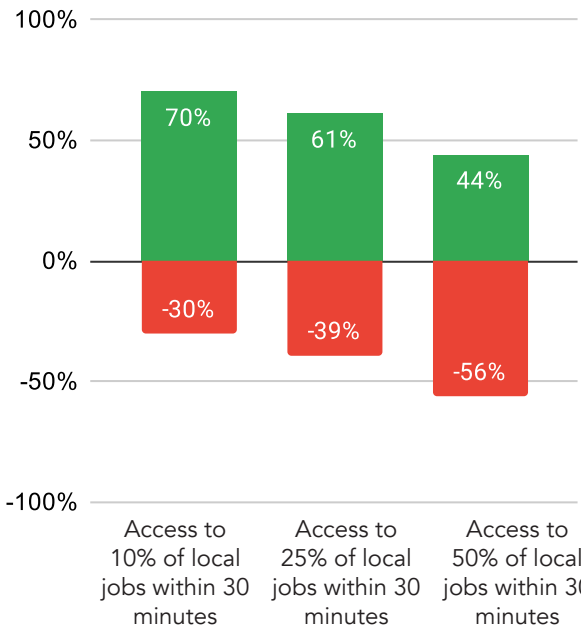
Employment access: number of jobs that can be reached within various walk and transit times

Population Access: the number of people that can be reached within 15 minutes of each parcel via walking and transit.

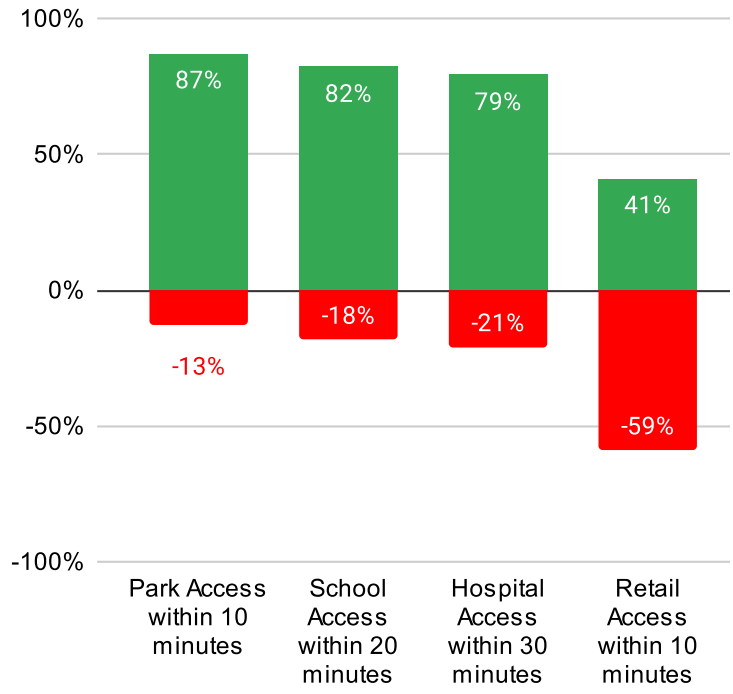
Data Sources

- Transit network is assembled based on transit data that are retained in the General Transit Feed Specification (GTFS) format and sourced from TransitLand, the largest transit data repository available. Placer County Transit was last updated 10-21-2021. Auburn Transit was last updated 12-27-2021, and includes: Routes include: the Auburn Loop, Confluence Route, North Route, South Route, and the Weekend/Off Hours route.
- OpenStreetMap

Population's Employment Access with Transit, %



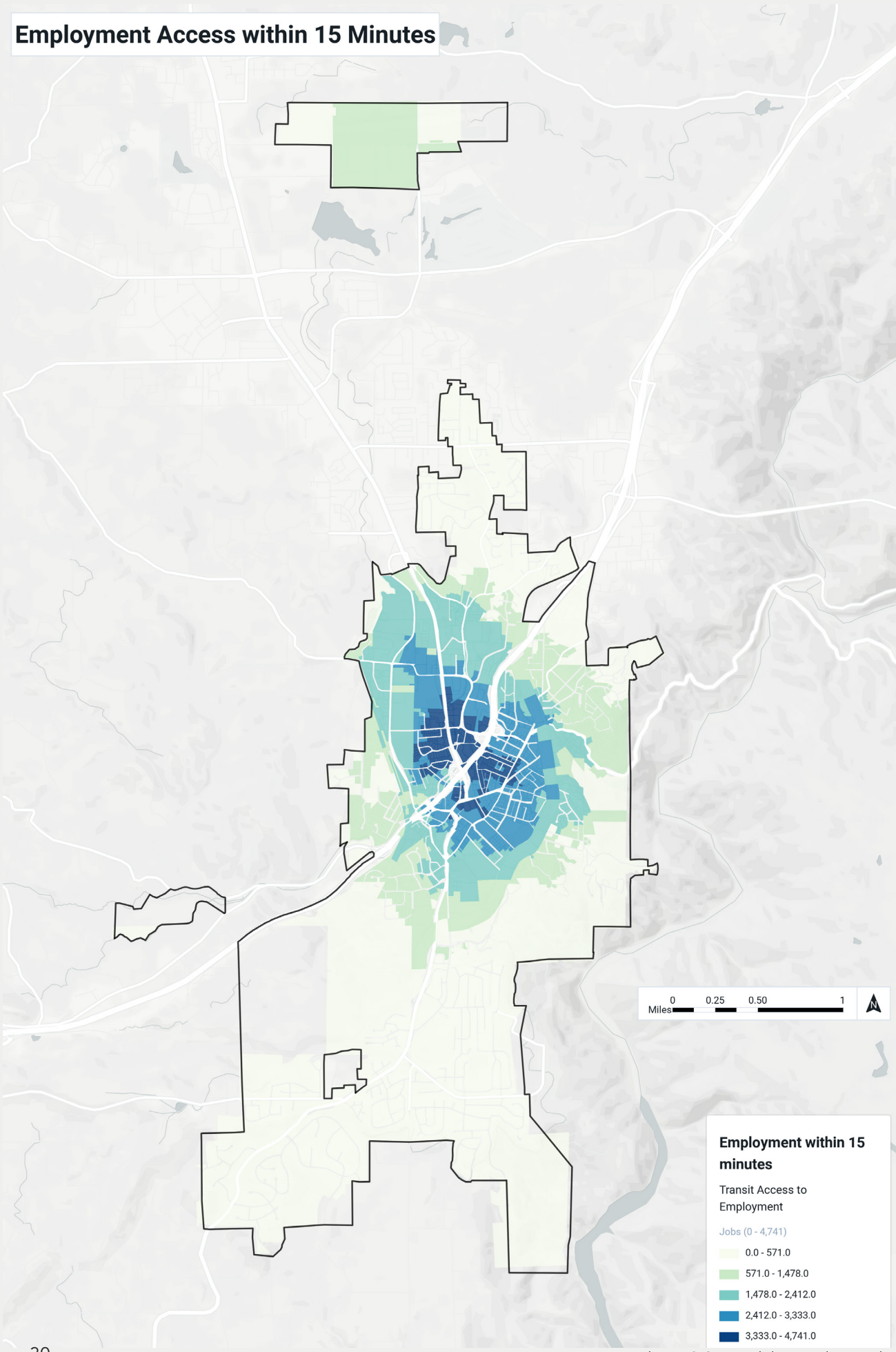
Population's Access on Transit, %



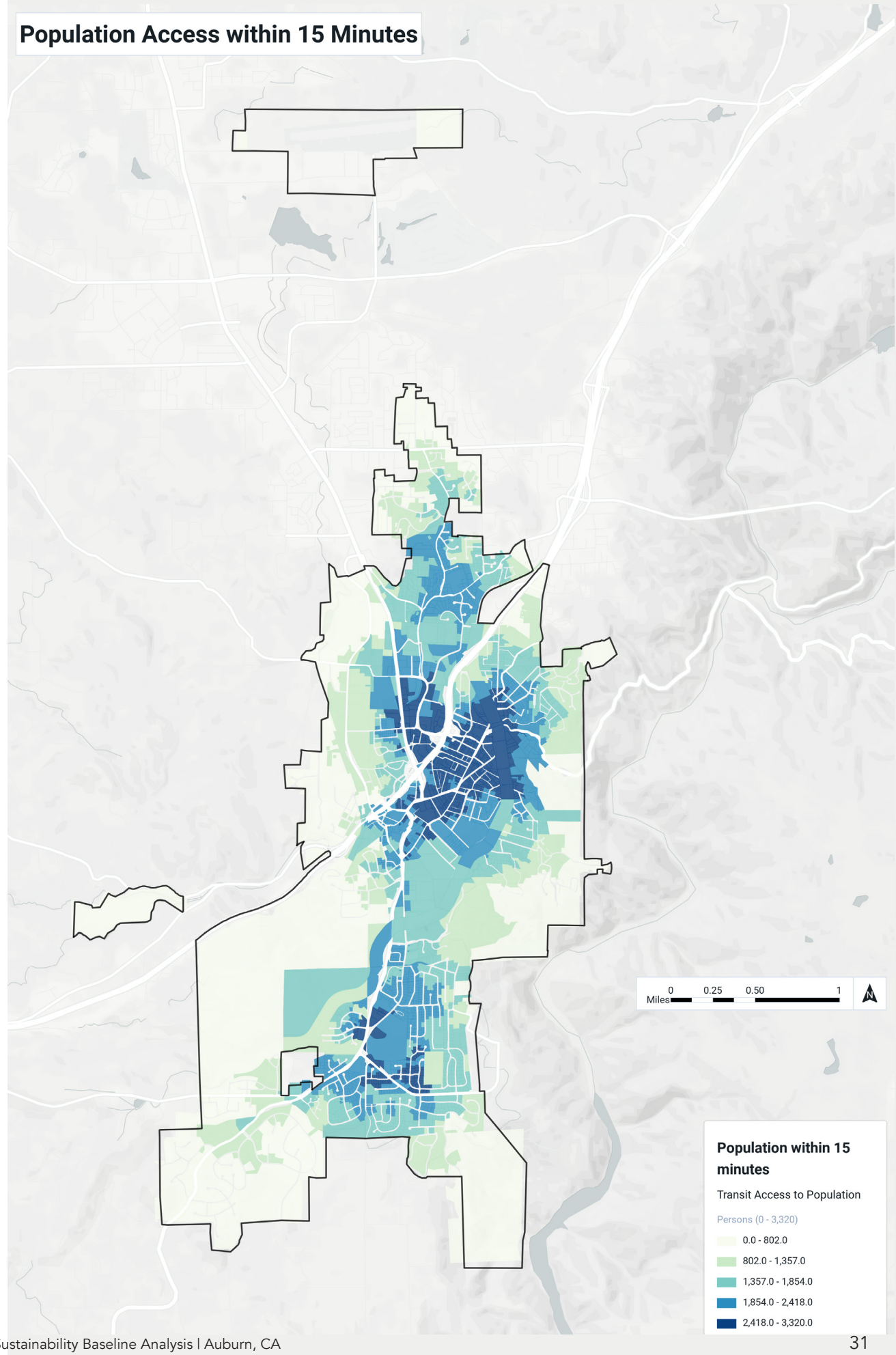
Please note these graphs do not factor in Auburn's on-demand bus service.

Transit Accessibility Report - City Wide	
Park Access within 10 minutes	87% of residents
School Access within 20 minutes	82% of residents
Hospital Access within 30 minutes	79% of residents
Retail Access within 10 minutes	41% of residents
Employment Access	
10% or more of jobs within 30 minutes	70% of residents
25% or more of jobs within 30 minutes	61% of residents
50% or more of jobs within 30 minutes	44% of residents

Employment Access within 15 Minutes



Population Access within 15 Minutes



Transportation

Travel modes, trip counts & effects

The Transportation module is a high-level travel model that produces estimates of the following metrics for land use and transportation: vehicle miles traveled (VMT), trips taken organized by mode, transportation costs, and greenhouse gas (GHG) emissions and pollutant emissions.

This module estimates VMT and mode share with sensitivities to the effects of the built environment on travel behaviors. These effects are quantified according to the Mixed-Use Development (MXD) method, which consists of statistical models based on research of observed relationships between characteristics ("D" factors) and travel behavior in cities and regions across the U.S. In turn, VMT estimates are used to calculate greenhouse gas (GHG) emissions, criteria pollutant emissions, and household auto costs. The 8 "D's" include:
1. Density – residential and employment concentrations
2. Diversity – jobs/housing, jobs mix, retail/housing
3. Design – connectivity, walkability of local streets, and non-motorized circulation
4. Destination – accessibility to regional activities
5. Distance to Transit – proximity to high-quality rail or bus service
6. Development Scale – critical mass and magnitude of compatible uses
7. Demographics – household size, income level, and auto ownership
8. Demand Management – pricing and travel disincentives

See Emissions Analysis and Household Costs for further information.

How to Interpret this Section

The travel forecasting capabilities of Urban-Footprint are based on a comprehensive body of research on the observed relationships between trip generation and characteristics of the built environment.

Define Key Terms

Vehicle Miles Traveled (VMT): Passenger vehicle mileage attributed to residents, workers, and visitors in the given area.

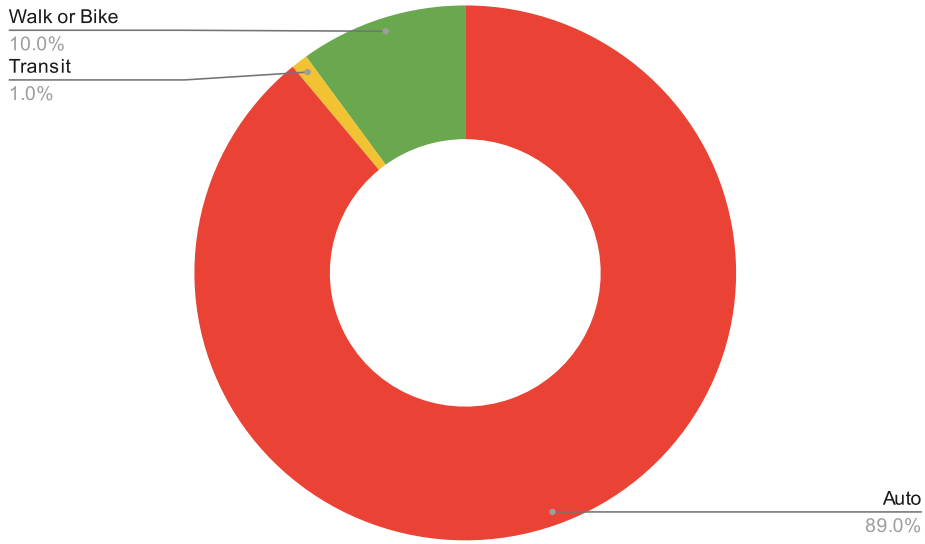
Travel Mode Share: Auto and transit mode share of all trips attributed by the MXD model to residents, workers, and visitors in the given parcel or census block.

Data Sources

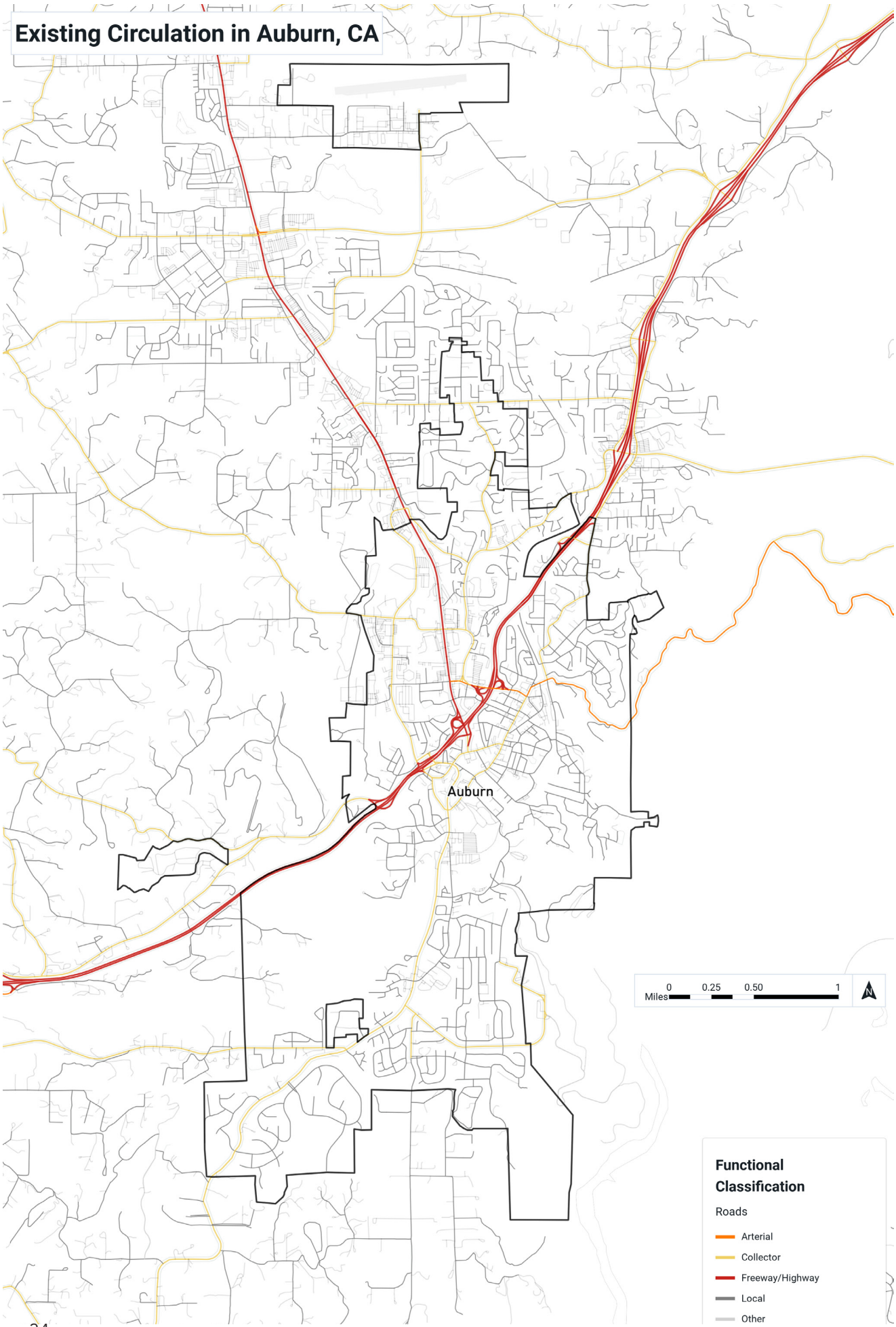
- Institute of Transportation Engineers (ITE) Trip Generation Manual
- National Cooperative Highway Research Program (NCHRP) person trip rates

Average Trip Generation Rates by Category	
Dwelling Unit Type / Employment Sector	Average Trip Generation Rate
Single Family Detached	9.57 vehicle trips / household
Single Family Attached	6.65 vehicle trips / household
Multifamily	4.18 vehicle trips / household
Retail	42.94 vehicle trips / 1,000 sf
Retaurant	75 vehicle trips / 1,000 sf
Entertainment	20 vehicle trips / 1,000 sf
Office	3.32 vehicle trips / job
Public	3.32 vehicle trips / job
Industry	3.02 vehicle trips / job

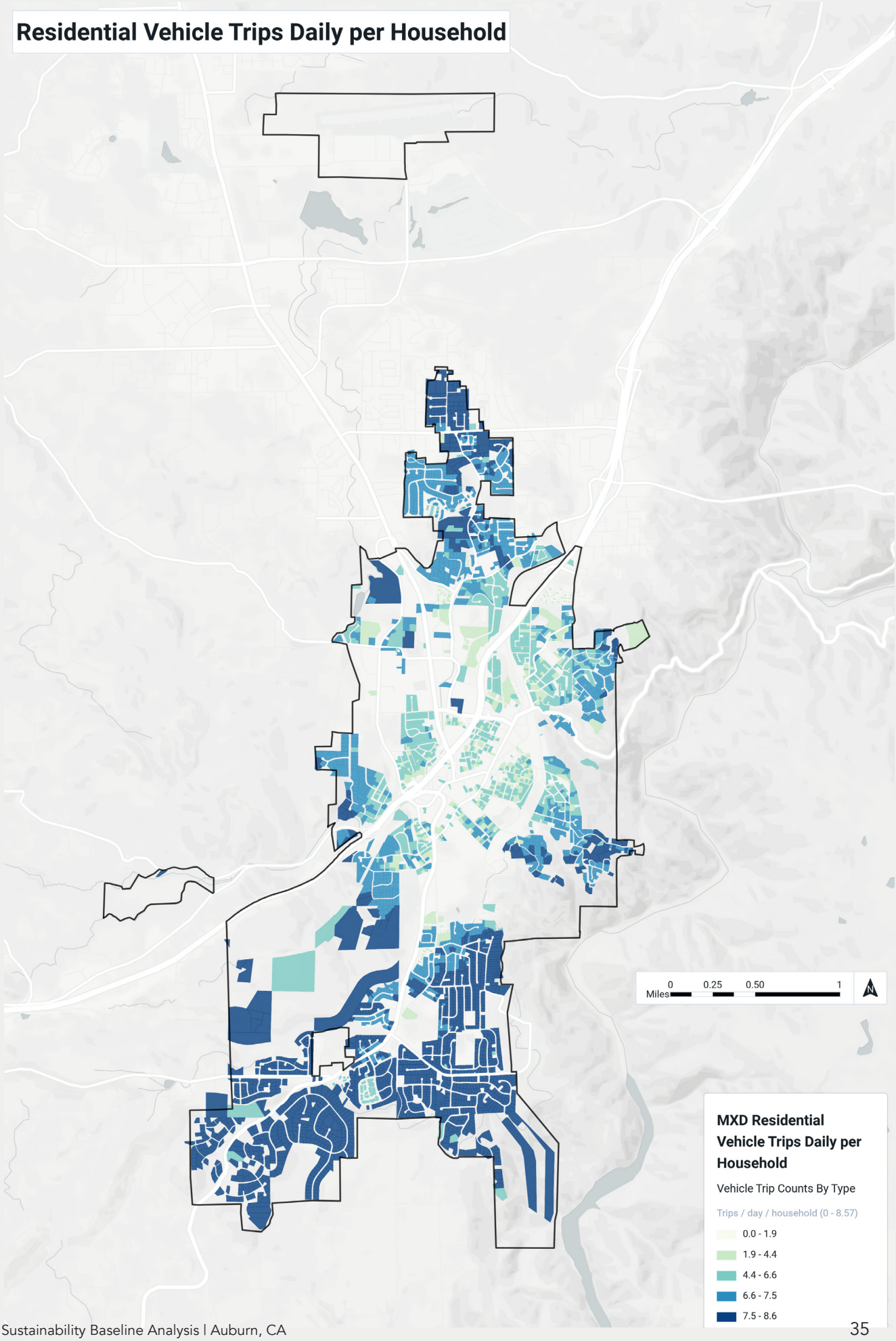
Travel Mode Breakdown, %



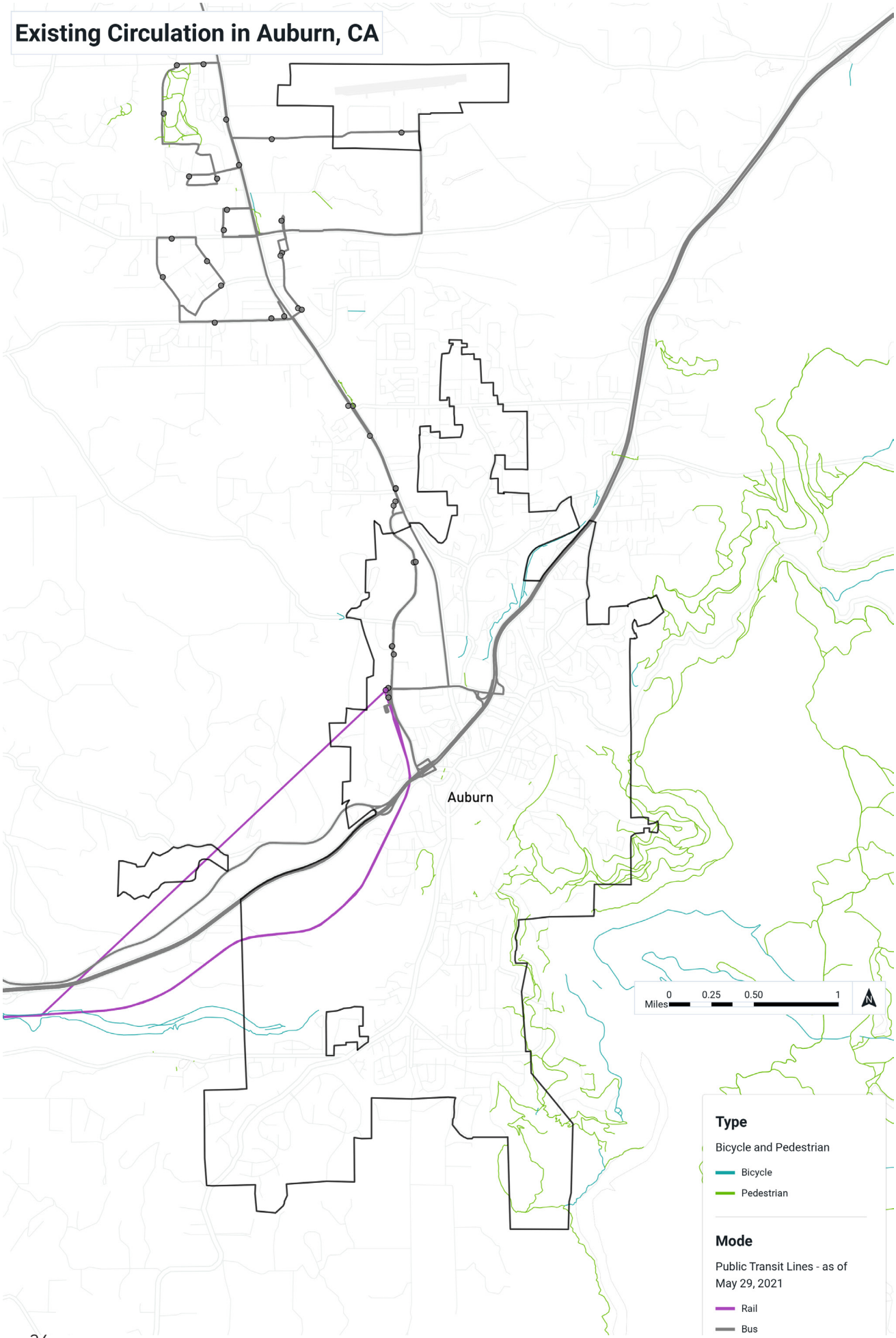
Transportation Report - City Wide		
Annual Total Vehicle Miles Traveled (VMT)	82	million miles / year
Average Annual Residential VMT per Capita	5,398	miles / year / person
Average Annual Residential VMT per Household	12,699	miles / year / household
Travel Mode Share		
Auto	89%	
Transit	1%	
Walk or Bike	10%	
Total	100%	
Total Vehicle Trips Daily	MXD Method	
Daily Total Vehicle Trips	91,603	trips / day
Total Vehicle Trips Annual	MXD Method	
Annual Total Vehicle Trips	32	million trips / year
Vehicle Trips Daily Per Capita	MXD Method	
Average Daily Vehicle Trips per Capita	3	trips / day / person
Vehicle Trips Daily Per Household	MXD Method	
Average Daily Vehicle Trips per Household	6	trips / day / household
Vehicle Trips Annual Per Capita	MXD Method	
Average Annual Vehicle Trips per Capita	904	trips / year / person
Vehicle Trips Annual Per Household	MXD Method	
Average Annual Vehicle Trips per Household	2,126	trips / year / household
Annual Passenger Vehicle GHG Emissions		
Total Passenger Vehicle Emissions	40,227	metric tons / year
Annual Passenger Vehicle Costs		
Transportation Cost	$58,340,000	/ year
Per Household Annual Auto Costs by Type		
Auto Auto Fuel Costs per Household	$2,022	/ household / year
Auto Ownership and Maintenance Costs per Household	$7,892	/ household / year
Total	$9,914	/ household / year


Existing Circulation in Auburn, CA
Auburn
0
0.25
0.50
1
Miles
N
Functional Classification
Roads
Arterial
Collector
Freeway/Highway
Local
Other

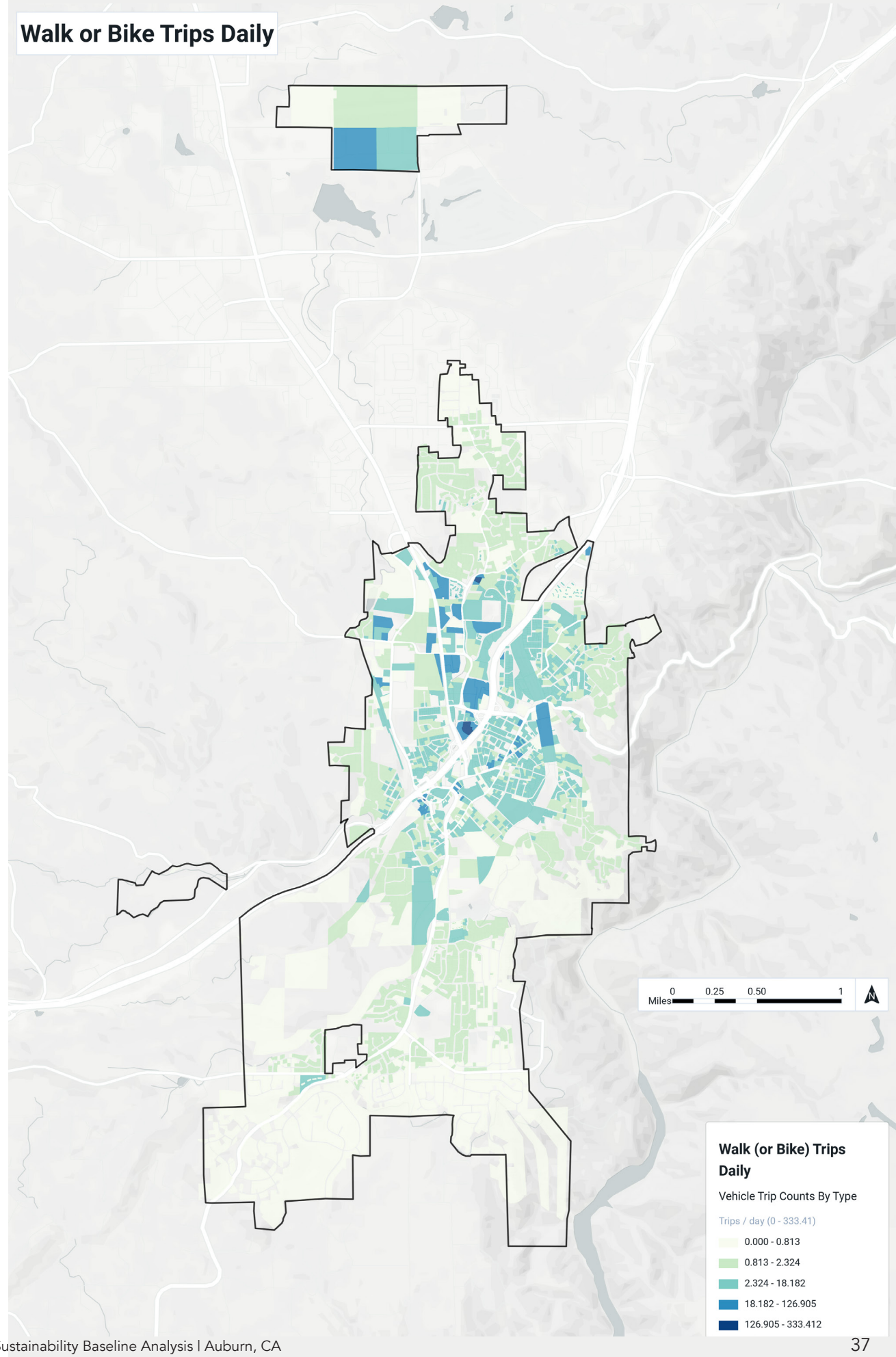
Residential Vehicle Trips Daily per Household



Existing Circulation in Auburn, CA



Walk or Bike Trips Daily



Conservation

Water, Carbon & Agriculture

The Conservation Module integrates the data and methods needed to measure a range of key conservation impacts. The metrics are organized around three themes: carbon sequestration, water supply and quality, and agriculture. UrbanFootprint's modeling methods for each of the themes were developed in partnership with policy and subject matter experts, including The Nature Conservancy (TNC), American Farmland Trust, UC Davis, and the Sonoma County Agricultural Preservation and Open Space District.

Watershed integrity has been used by several agencies as a 'health' indicator of water-related ecosystem processes, functions, and services. Natural land cover within the catchment supports water quality by decreasing the potential for non-point source pollution from runoff. Natural lands proximal to riparian areas play an important role in filtering out sediment, particles, nitrogen, phosphorous, and other pollutants. The presence of natural land cover in a riparian buffer supports natural flow, sediment, and water temperature regimes, and maintains natural levels of nutrient and organic matter input to streams (US EPA 2013).

The terrestrial carbon storage model focuses on measuring the stock change of carbon in natural vegetation and soil associated with various land use changes and management actions in the landscape. To better interpret the metrics, the changes in carbon stocks can be compared using equivalent passenger vehicles driven for one year (1 metric ton of Carbon = 0.775 passenger vehicles driven for one year).

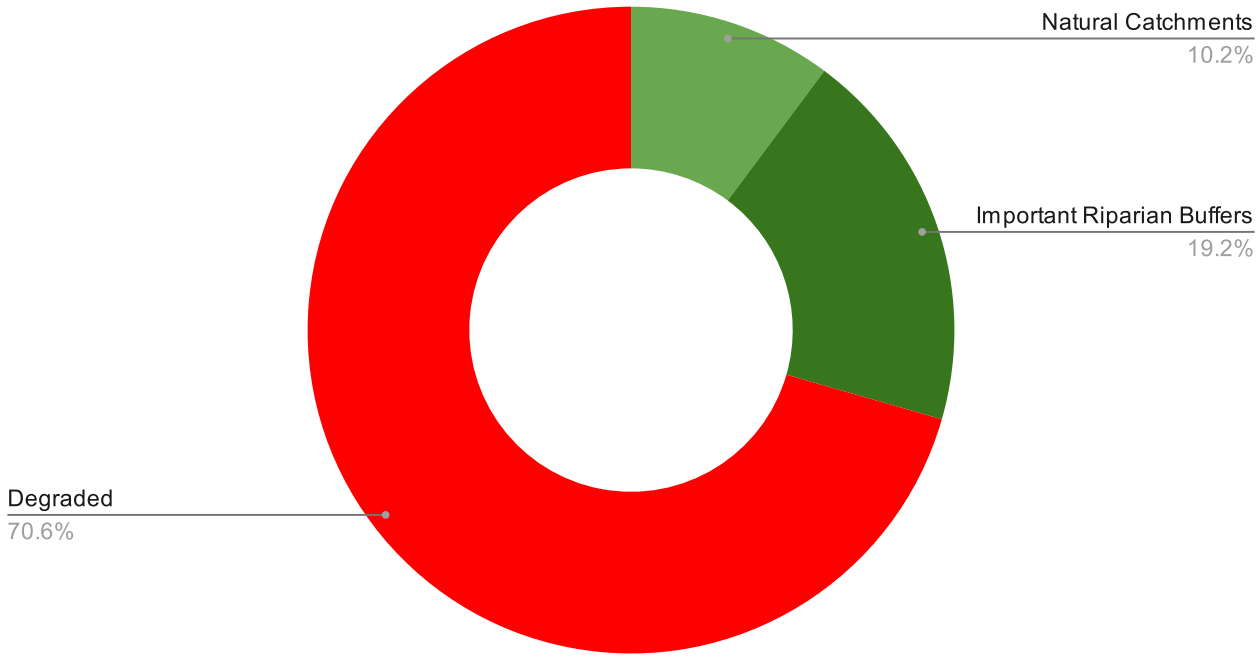
The agriculture theme classifies into two categories – agricultural production and agricultural capacity. Agricultural capacity looks at the impact of land conversion in areas considered important for agriculture. Agricultural production assesses how such changes affect the monetary value of crop production in the study region. When agricultural lands consume natural lands, agricultural production in that area may increase. Alternately, urban lands expanding into agricultural lands can reduce agricultural production. Production value also changes when agricultural lands convert from one agricultural type to another.

How to Interpret this Section

Watershed natural catchments (>70% natural) have land cover within the watershed that supports water quality by decreasing the potential for non-point source pollution from runoff. Important riparian buffer catchments have natural lands next to riparian areas (70% natural within 150m of the stream) that can filter sediment, particles, nitrogen, phosphorous, and other pollutants thereby enhancing water quality. Degraded catchments have non-natural land cover (<70%) in both the sub-watershed and riparian areas and are likely lead to lower water quality.

Groundwater recharge occurs when surface water, such as rain or snowmelt, filters down through the soil below the root zone. When recharge takes place above aquifers, irrigation and drinking water supplies are replenished for future use. However, recharge can be limited when the surface is disturbed by human activities such as paving, urban development, or logging. Groundwater recharge can be facilitated by creating retention ponds and rain gardens, which allow water to percolate into local water supplies.

Total Watershed Integrity Class Area by Type, %



Carbon density refers to carbon stored in natural vegetation. Trees and plants take carbon dioxide from the air and store it as carbon in tree trunks and other plant matter. Measuring and tracking the change to this carbon storage can be important for tracking progress towards the State's GHG reduction goals.

Define Key Terms

Watershed: the area of land that water, rain or snow flows through

Watershed Integrity: the capacity of a landscape, contributing surface water to a single location, to support and maintain the full range of ecological processes and functions essential to the long-term sustainability of watershed resources and services provided to society.

Carbon Stock: a system that has the capacity to store or release carbon

Above Ground Carbon Stock: carbon stocks in live vegetation

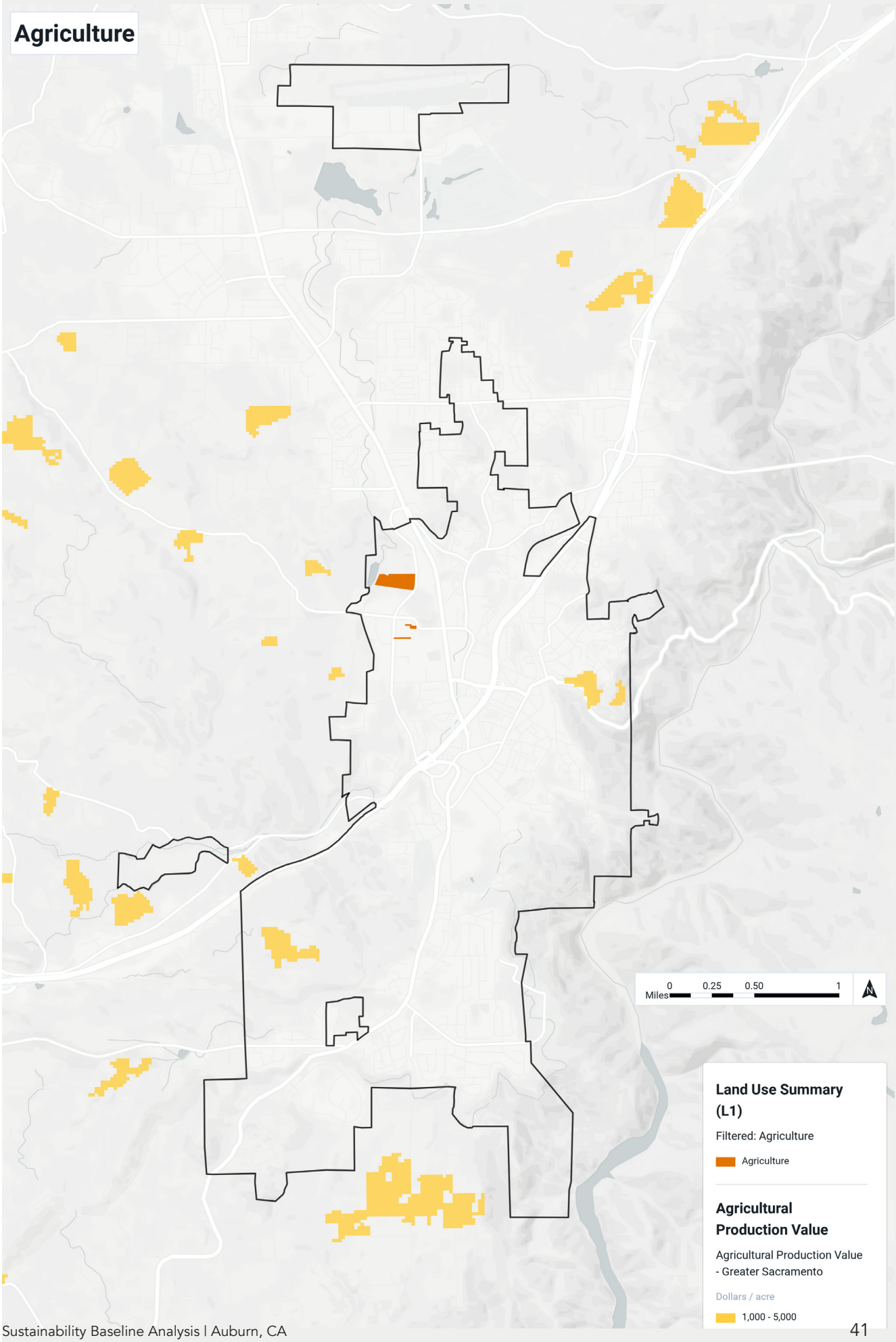
Below Ground Carbon Stock: carbon stocks in the soil up to a depth of 30 cm

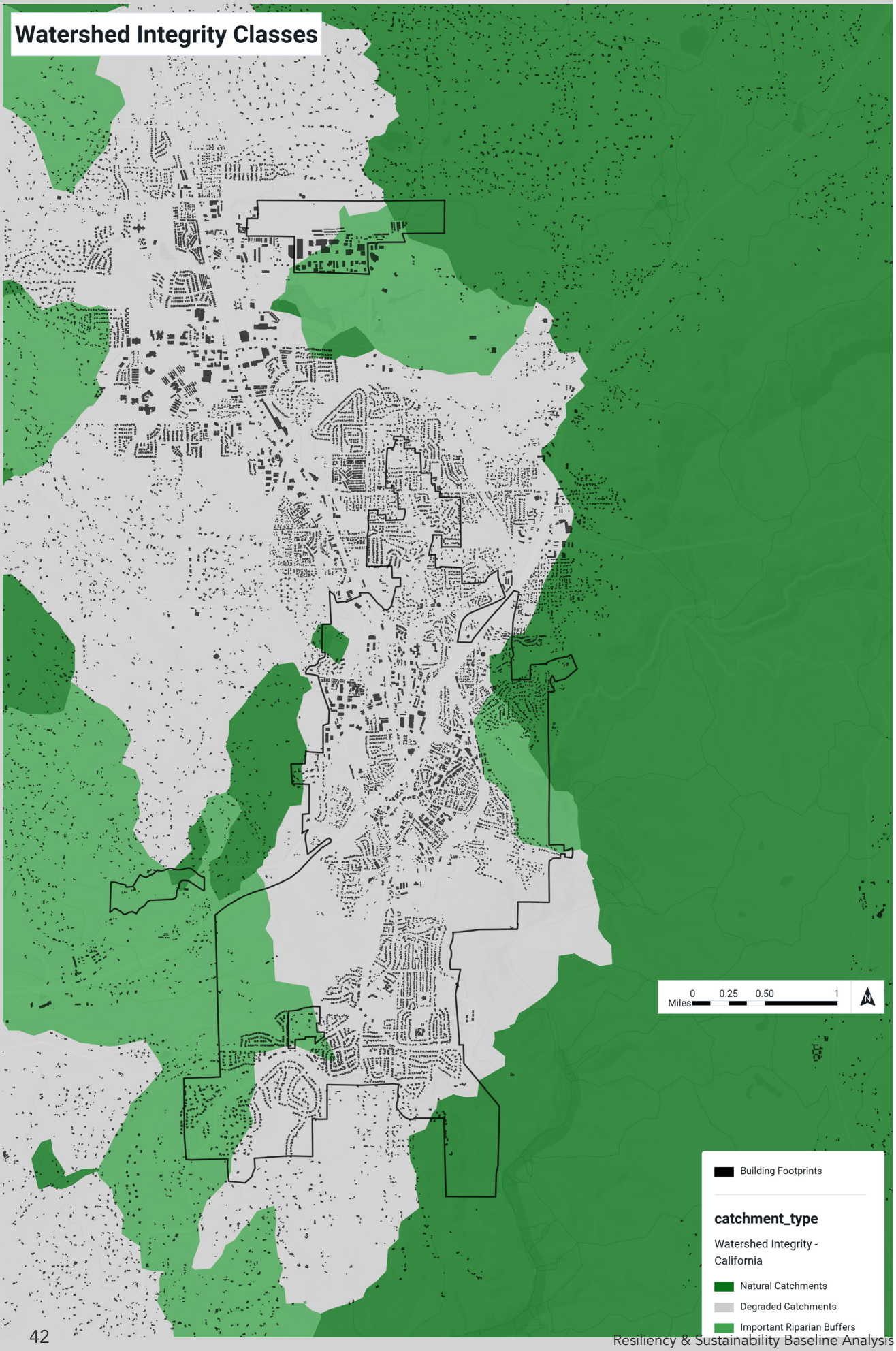
Data Sources

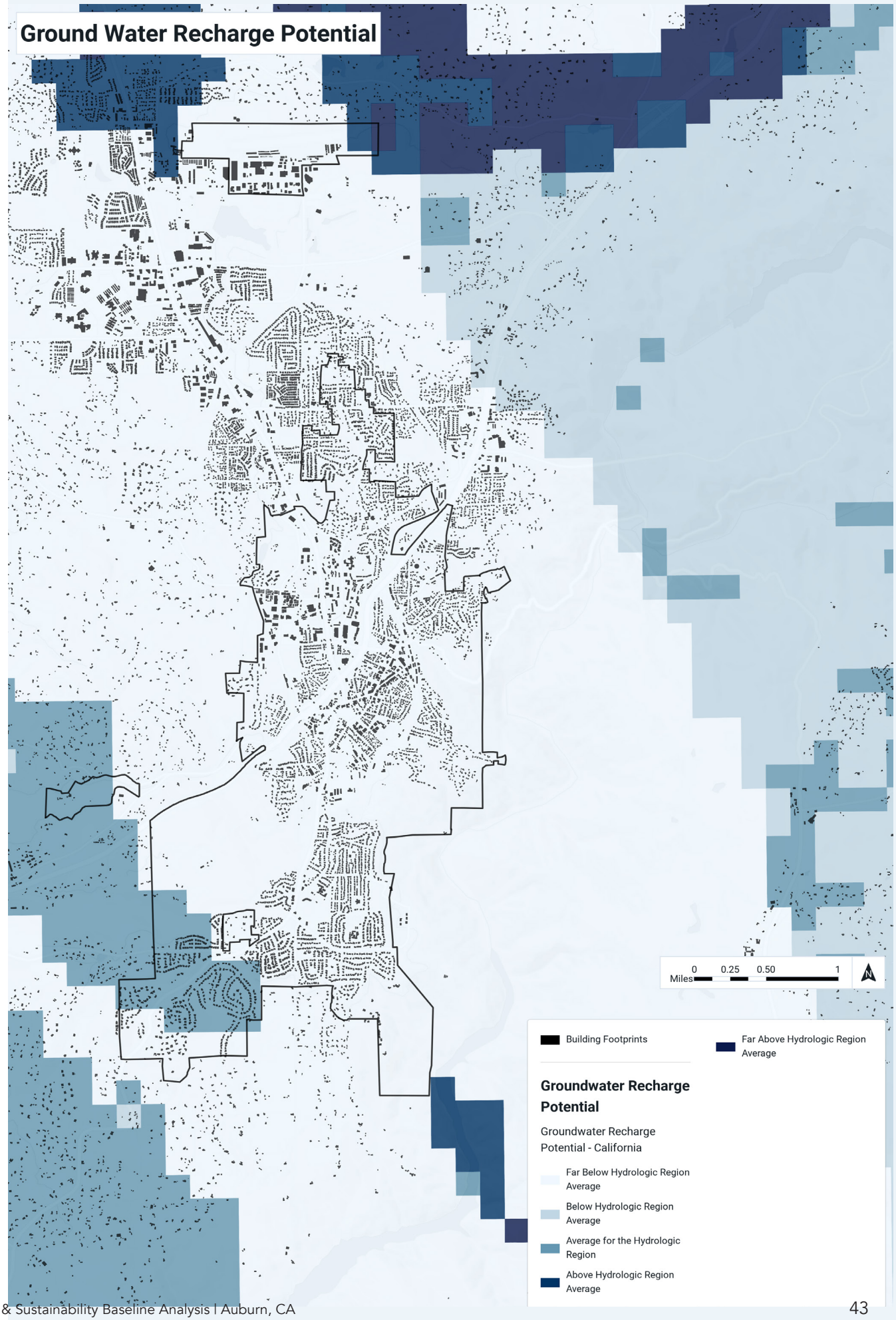
- California Ecosystem carbon density (2010) data (Gonzalez et. al, 2015)
- Soil Organic Carbon data from USDA Natural Resources Conservation Service (NRCS) Soil
- Survey Geographic Database (SSURGO)
- NHDPlus Version 2 Catchments
- Farmland Mapping and Monitoring Program (FMMP)
- Annual crop report from California Agricultural Commissioners (2014)
- UD Department of Agriculture National Agricultural Statistical Service

Conservation - Water Report		
Total Watershed Integrity Class Area by Type		
Natural Catchments	535	acres
Important Riparian Buffers	1,010	acres
Degraded	3,701	acres
Total	5,246	acres
Total Watershed Integrity Class Area by Type		
Cropland	151	acres
Vineyard	1	acres
Total	152	acres
Conservation - Carbon Report		
Total Carbon Stock		
Soil Carbon	47,203	metric tons
Above Ground Carbon	29,139	metric tons
Total	76,341	metric tons
Total Above Ground Carbon Stock		
Above Ground Carbon	29,139	metric tons
Total Below Ground Carbon Stock		
Soil Carbon	47,203	metric tons
Conservation - Agriculture Report		
Total Production Value		
Cropland	$61,746	
Vineyard	$1,590	
Total	$63,336	
Total Agricultural Area by Crop Class		
Cropland	50.04	acres
Vineyard	0.44	acres
Total	50.48	acres

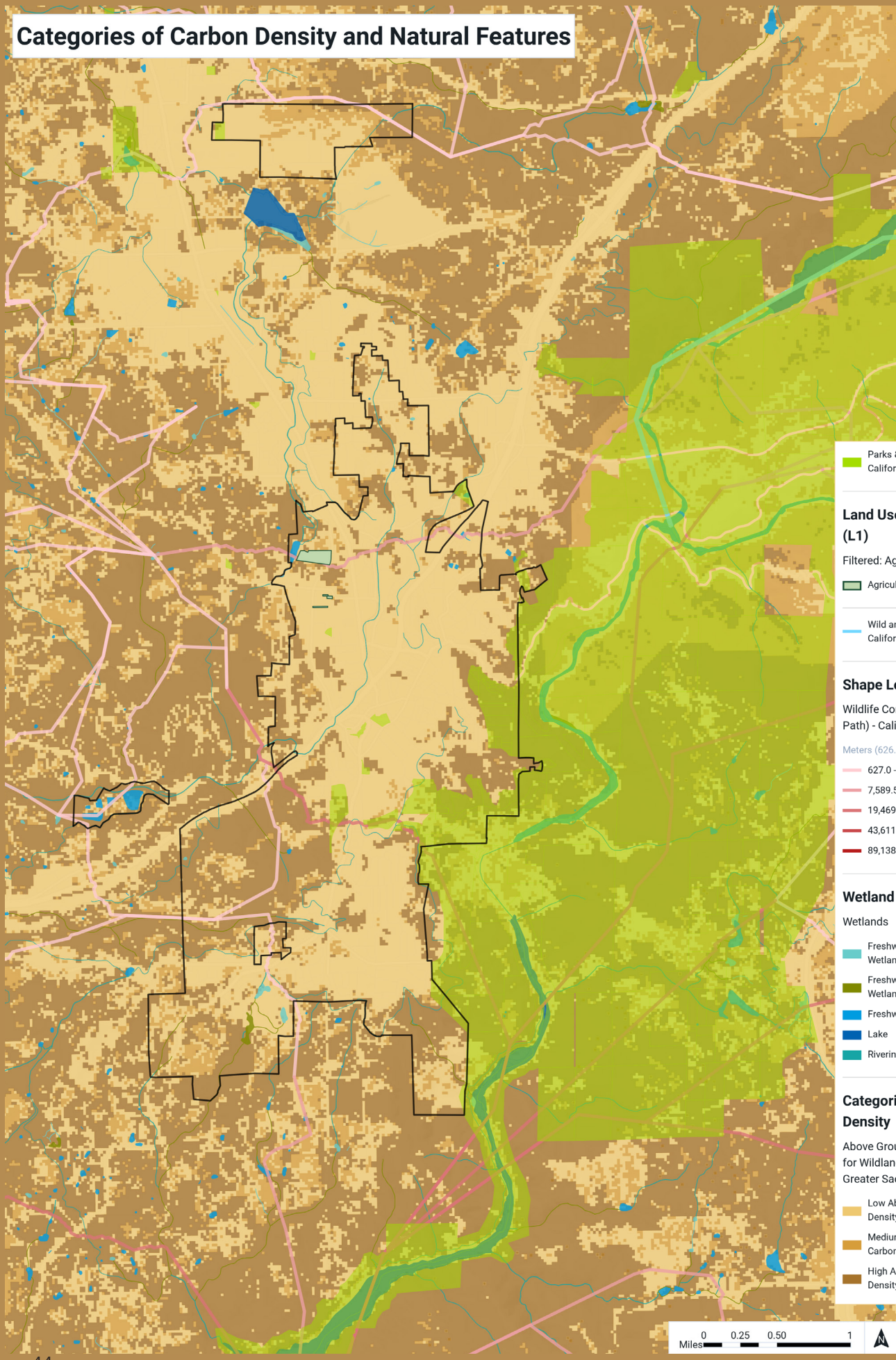
Agriculture



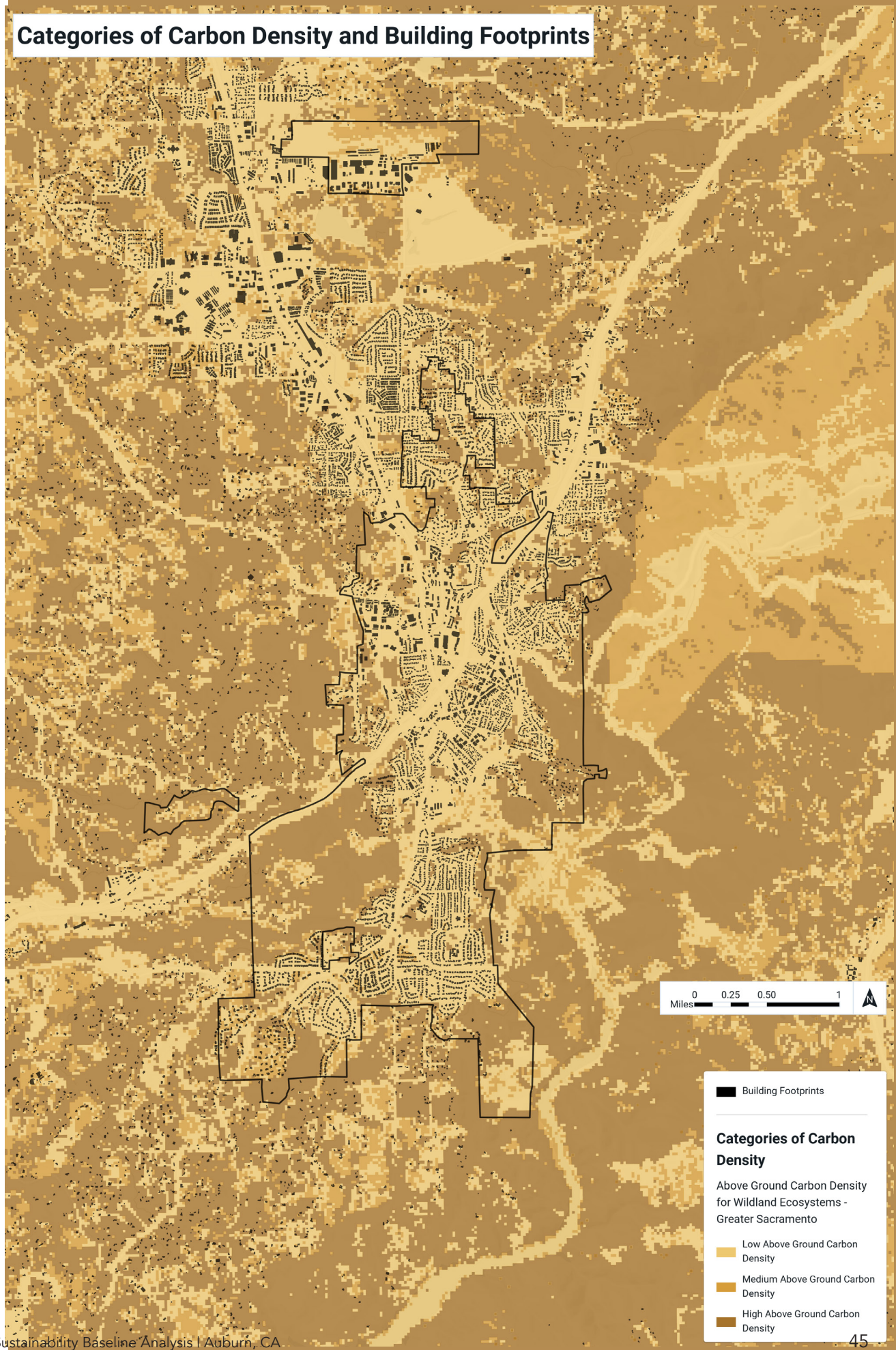

Watershed Integrity Classes
0
Miles
0.25
0.50
1
N
Building Footprints
catchment_type
Watershed Integrity - California
Natural Catchments
Degraded Catchments
Important Riparian Buffers


Ground Water Recharge Potential
0
0.25
0.50
1
Miles
N
Building Footprints
Far Above Hydrologic Region Average
Groundwater Recharge Potential
Groundwater Recharge Potential - California
Far Below Hydrologic Region Average
Below Hydrologic Region Average
Average for the Hydrologic Region
Above Hydrologic Region Average

Categories of Carbon Density and Natural Features



Categories of Carbon Density and Building Footprints



Risk & Resilience

flood and fire

The UrbanFootprint Risk and Resilience module measures the potential impacts of natural hazards, supporting analysis of flooding and fire risk. For the City of Auburn, the module reports the acreage, population, number of dwelling units, number of jobs, and number of parcels put at risk for each type of natural disaster.

How to Interpret this Section

Risk assessments for existing conditions and alternative land use scenarios yield insight into how natural hazards can impact regions now and into the future.

Define Key Terms

Fire Hazard Severity Zones: CalFire has ranked areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors for the State of California. These areas are classified into three fire hazard severity zones — Moderate, High, and Very High. Other classifications include Urban Unzoned and Non-Wildland/Non-Urban.

SFHL: Special Flood Hazard Zones as defined by FEMA

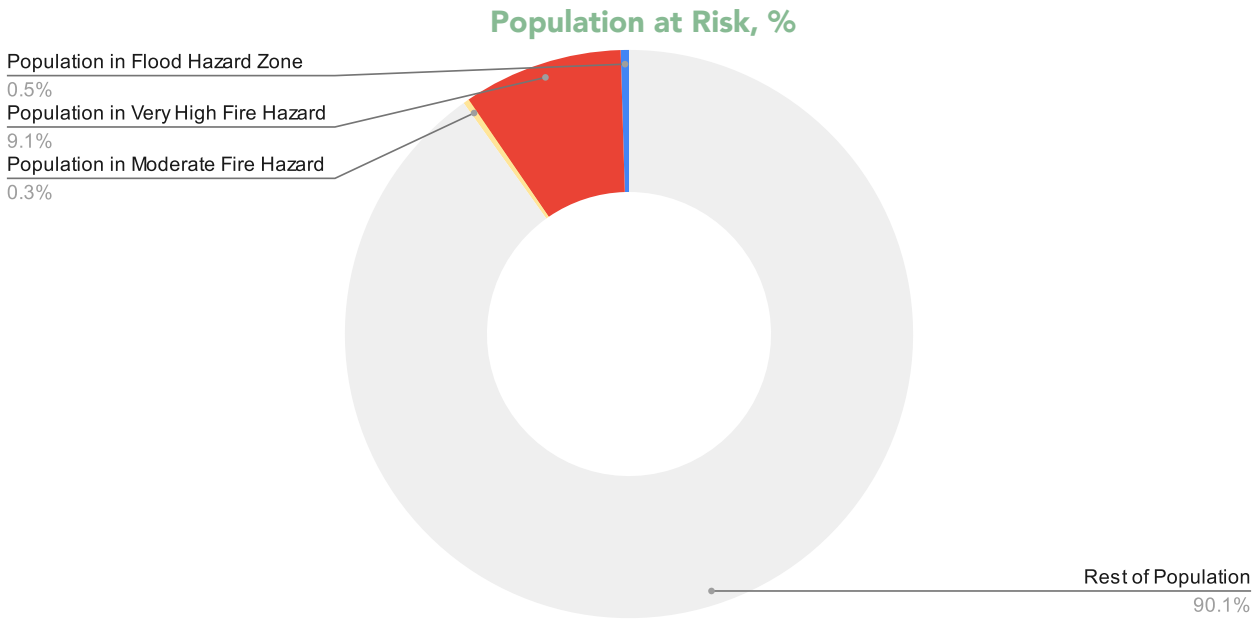
SFHL Zone AE: The base floodplain where base flood elevations are provided.

SFHL Zone A: Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or base flood elevations are shown within these zones.

SFHL Zone AO: River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones

Data Sources

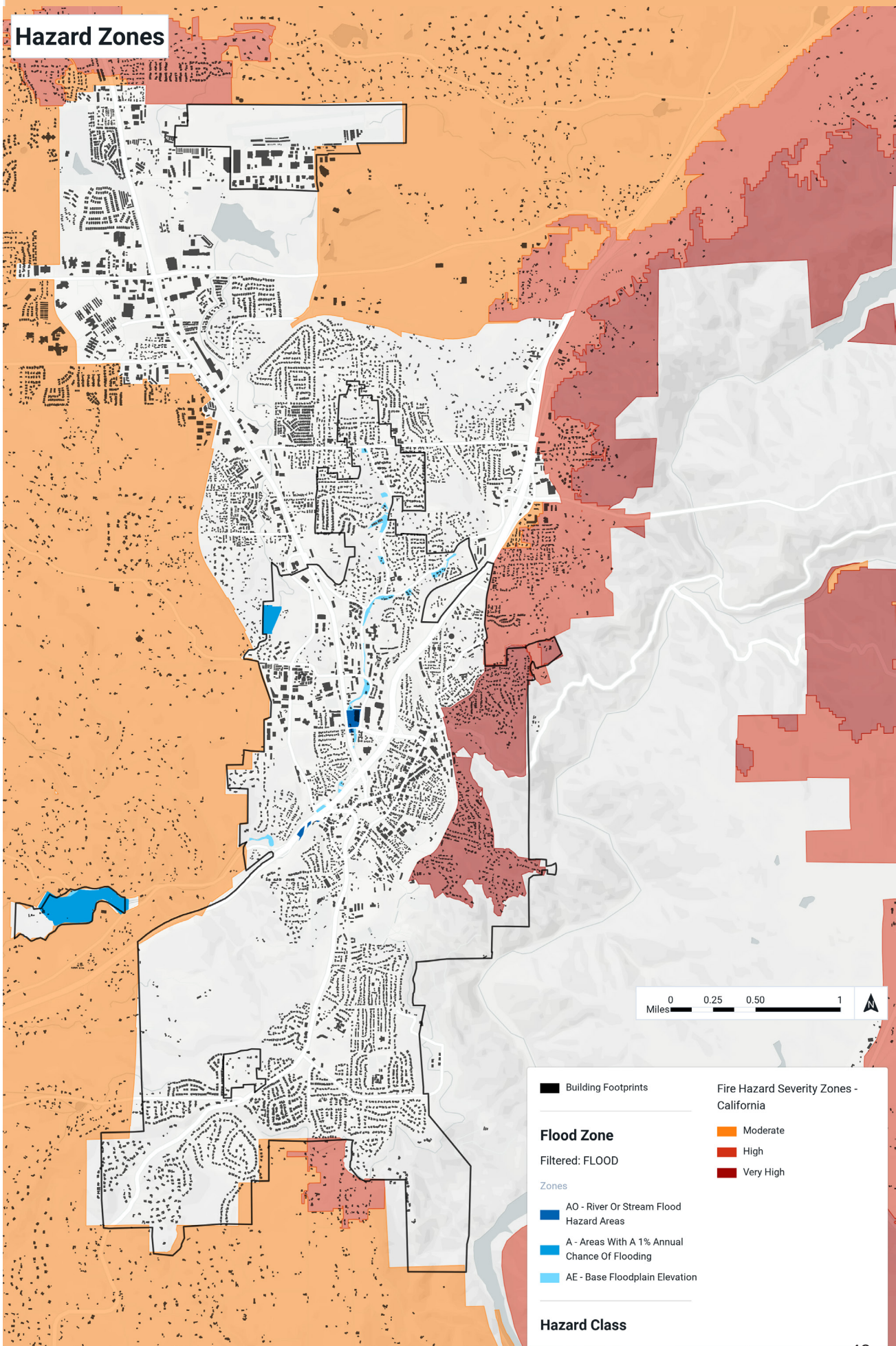
- The Federal Emergency Management Agency (FEMA) creates the National Flood Hazard Layer (NFHL) that contains current effective flood hazard mapping data
- Fire Hazard Severity Zones are produced by the California Department of Forestry and Fire Protection (CALFIRE)



Risk and Resilience Report		
Housing in Hazard Zones		
Dwelling Units in Fire Hazard Severity Zones	635	dwelling units
Dwelling Units in Special Flood Hazard Zones	32	dwelling units
Total	667	dwelling units
Population in Hazard Zones		
Population in Fire Hazard Severity Zones	1,304	people
Population in Special Flood Hazard Zones	65	people
Total	1,369	people
Jobs in Hazard Zones		
Jobs in Fire Hazard Severity Zones	66	employees
Jobs in Special Flood Hazard Zones	47	employees
Total	113	employees
Land Area in Hazard Zones		
Area in Fire Hazard Severity Zones	327	acres
Area in Special Flood Hazard Zones	74	acres
Total	401	acres
Parcels in Hazard Zones		
Parcels in Fire Hazard Severity Zones	731	parcels
Parcels in Special Flood Hazard Zones	60	parcels
Total	791	parcels
Housing in Flood Hazard Zones		
Dwelling Units in SFHL Zone AE	32	dwelling units
Population in Flood Hazard Zones		
Population in SFHL Zone AE	65	people
Jobs in Flood Hazard Zones		
Jobs in a base floodplain (SFHL Zone AE)	22	employees
Jobs in a 100 year floodplain (SFHL Zone A)	1	employee
Jobs in 100-year river flooplain (SFHL Zone AO)	24	employees
Total	47	employees
Land Area in Flood Hazard Zones		

(Table continued from previous page)

Population in Flood Hazard Zones		
Population in SFHL Zone AE	65	people
Jobs in Flood Hazard Zones		
Jobs in a base floodplain (SFHL Zone AE)	22	employees
Jobs in a 100 year floodplain (SFHL Zone A)	1	employee
Jobs in 100-year river flooplain (SFHL Zone AO)	24	employees
Total	47	employees
Land Area in Flood Hazard Zones		
Area in SFHL Zone AE	17	acres
Area in SFHL Zone A	51	acres
Area in SFHL Zone AO	6	acres
Total	74	acres
Parcels in Flood Hazard Zones		
Parcels in SFHL Zone AE	48	parcels
Parcels in SFHL Zone A	3	parcels
Parcels in SFHL Zone AO	9	parcels
Total	60	parcels
Housing in Fire Hazard Zones		
Dwelling Units in Moderate Fire Hazard Severity Zone	15	dwelling units
Dwelling Units in High Fire Hazard Severity Zone	1	dwelling units
Dwelling Units in Very High Fire Hazard Severity Zone	619	dwelling units
Total	635	dwelling units
Population in Fire Hazard Zones		
Population in Moderate Fire Hazard Severity Zone	44	poeple
Population in High Fire Hazard Severity Zone	3	poeple
Population in Very High Fire Hazard Severity Zone	1,257	poeple
Total	1,304	poeple
Jobs in Fire Hazard Zones		
Jobs in Very High Fire Hazard Severity Zone	66	employees
Land Area in Fire Hazard Zones		
Area in Moderate Fire Hazard Severity Zone	32	acres
Area in High Fire Hazard Severity Zone	6	acres
Area in Very High Fire Hazard Severity Zone	288	acres
Total	327	acres
Parcels in Fire Hazard Zones		
Parcels in Moderate Fire Hazard Severity Zone	19	parcels
Parcels in High Fire Hazard Severity Zone	4	parcels
Parcels in Very High Fire Hazard Severity Zone	708	parcels
Total	731	parcels


Hazard Zones
0
0.25
0.50
1
Miles
Building Footprints
Flood Zone
Filtered: FLOOD
Zones
AO - River Or Stream Flood Hazard Areas
A - Areas With A 1% Annual Chance Of Flooding
AE - Base Floodplain Elevation
Hazard Class
Fire Hazard Severity Zones - California
Moderate
High
Very High

Emissions

GHG from vehicles, buildings & water use

The UrbanFootprint Emissions module estimates greenhouse gas (GHG) emissions associated with passenger vehicle transportation, building energy and water use. The VMT, building energy, and water use calculations with which GHG emissions are estimated are described in the documentation for other modules: Transportation Analysis, Energy Use Analysis, and Water Use Analysis.

This module utilizes default carbon emissions rates for electricity use, natural gas use, and transportation fuel that are derived from U.S. Environmental Protection Agency (EPA) data. The Emissions module applies an on-road average fuel economy for all cars, and an average emissions rate for gasoline. The dataset contains the environmental characteristics of almost all electric power generated in the United States, including emissions rates, net generation, resource mix, and air emission of nitrogen oxides, sulfur dioxide, carbon dioxide, methane, and nitrous oxide. Specifically, the Emissions module uses an annual CO2-equivalent (CO2e) total output emission rate averaged by state (measured in pounds per megawatt-hour). The energy use associated with water supply — including treatment and pumping for conveyance and distribution — varies depending on the characteristics of local water systems and source water supply. While there is wide variability across the U.S., the module assumes a default national average that can serve to gauge the order of magnitude of water-energy emissions.

How to Interpret this Section

Along with transportation GHG emissions, the module estimates criteria pollutant emissions from passenger vehicle transportation, including nitrogen oxides (NOx), particulate matter (PM2.5 and PM10), sulfur oxides (SOx), carbon monoxide (CO), and volatile organic chemicals (VOC). These emissions, which are calculated on the basis of average per-mile factors, are intended to reflect comparative results at the city-wide scale, and not localized (for example, neighborhood-level) emissions impacts.

GHG emissions are subject to technical assumptions for vehicle and building performance, as well as emissions rates of energy sources for transportation and building energy. This documentation focuses on the calculations of emissions alone. The inputs do not directly account for alternative vehicle and fuel types.

Define Key Terms

Metric Ton: a unit of weight equal to 1,000 kilograms (2,205 lb).

NOx Emissions: Nitrogen oxides are a family of poisonous, highly reactive gases. These gases form when fuel is burned at high temperatures. NOx pollution is emitted by automobiles, trucks, and various non-road vehicles (e.g., construction equipment, boats, etc.) as well as industrial sources such as power plants, industrial boilers, cement kilns, and turbines. NOx often appears as a brownish gas. It is a strong oxidizing agent and plays a major role in the atmospheric reactions with volatile organic compounds (VOC) that produce ozone (smog) on hot summer days.

PM10 Emissions: Airborne particulate matter (PM) is not a single pollutant, but rather is a mixture of many chemical species. It is a complex mixture of solids and aerosols composed of small droplets of liquid, dry solid fragments, and solid cores with liquid coatings. Particles vary widely in size, shape, and chemical composition, and may contain inorganic ions, metallic compounds,

elemental carbon, organic compounds, and compounds from the earth's crust. Particles are defined by their diameter for air quality regulatory purposes. Those with a diameter of 10 microns or less (PM10) are inhalable into the lungs and can induce adverse health effects. Emissions from the combustion of gasoline, oil, diesel fuel, or wood produce much of the PM2.5 pollution found in outdoor air, as well as a significant proportion of PM10. PM10 also includes dust from construction sites, landfills, agriculture, wildfires and brush/waste burning, industrial sources, wind-blown dust from open lands, pollen, and fragments of bacteria.

PM2.5 Emissions: Fine particulate matter is defined as particles that are 2.5 microns or less in diameter (PM2.5). Therefore, PM2.5 comprises a portion of PM10. Emissions from the combustion of gasoline, oil, diesel fuel, or wood produce much of the PM2.5 pollution found in outdoor air.

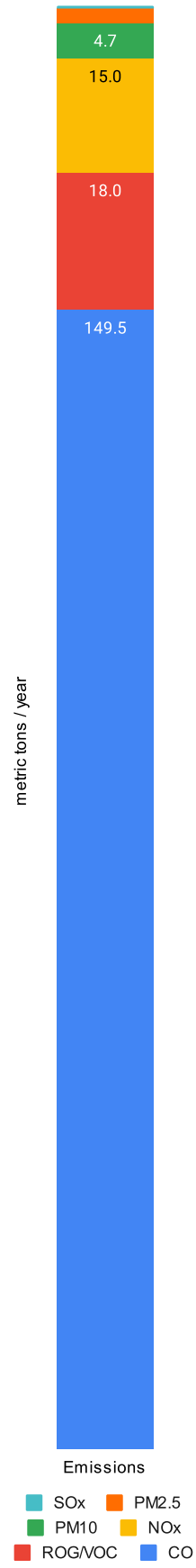
SOx Emissions: The largest source of SO2 in the atmosphere is the burning of fossil fuels by power plants and other industrial facilities. Smaller sources of SO2 emissions include industrial processes such as extracting metal from ore; natural sources such as volcanoes; and locomotives, ships, and other vehicles and heavy equipment that burn fuel with high sulfur content.

CO Emissions: Carbon monoxide (CO) is a colorless, odorless gas. It results from the incomplete combustion of carbon-containing fuels such as natural gas, gasoline, or wood, and is emitted by a wide variety of combustion sources, including motor vehicles, power plants, wildfires, and incinerators.

ROG/VOC Emissions: VOC stands for volatile organic compounds such as formaldehyde, d-Limonene, toluene, acetone, ethanol (ethyl alcohol) 2-propanol (isopropyl alcohol), hexanal. ROG is the old term for these kinds of compounds.

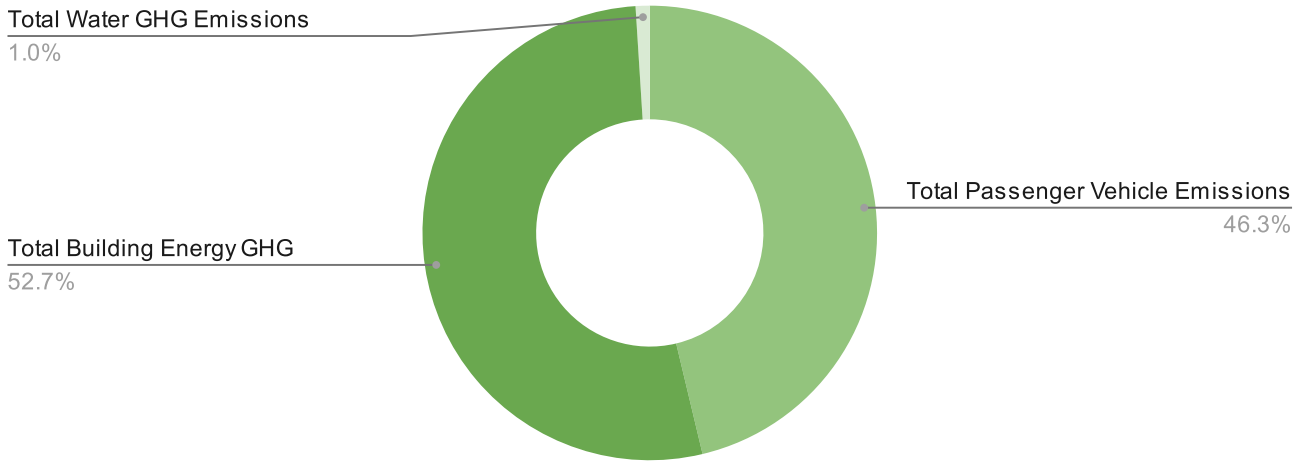
Data Sources

- Electricity Use and Management in the Municipal Water Supply and Wastewater Industries, Electric Power Research Institute and the Water Research Foundation, 3002001433, Final Report, November 2013.
- The default electricity GHG emission rates are based on data from the EPA Emissions & Generation Resource Integrated Database 2016 (eGRID).

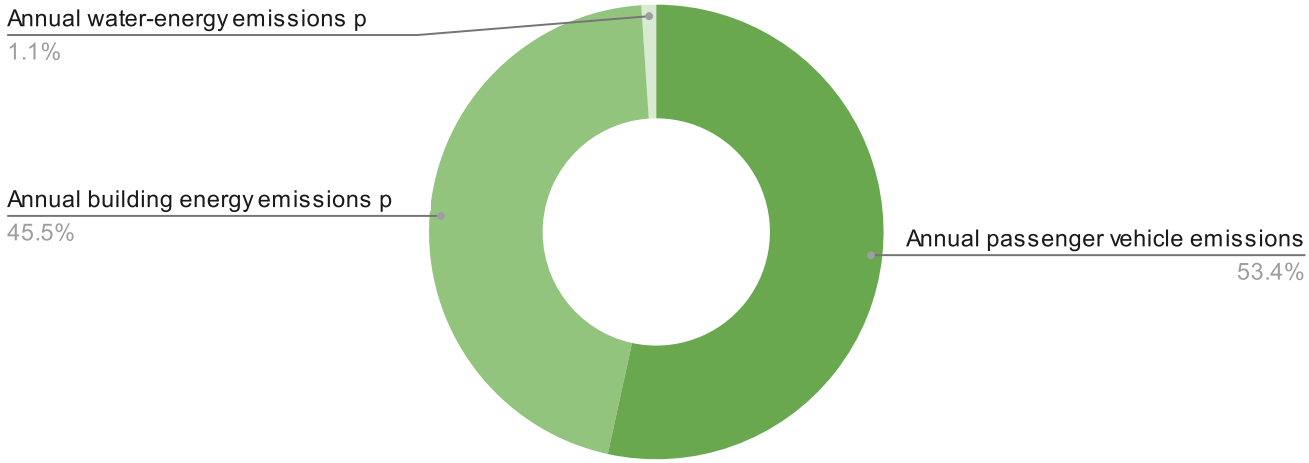


Annual Passenger Vehicle Pollutant Emissions by Type

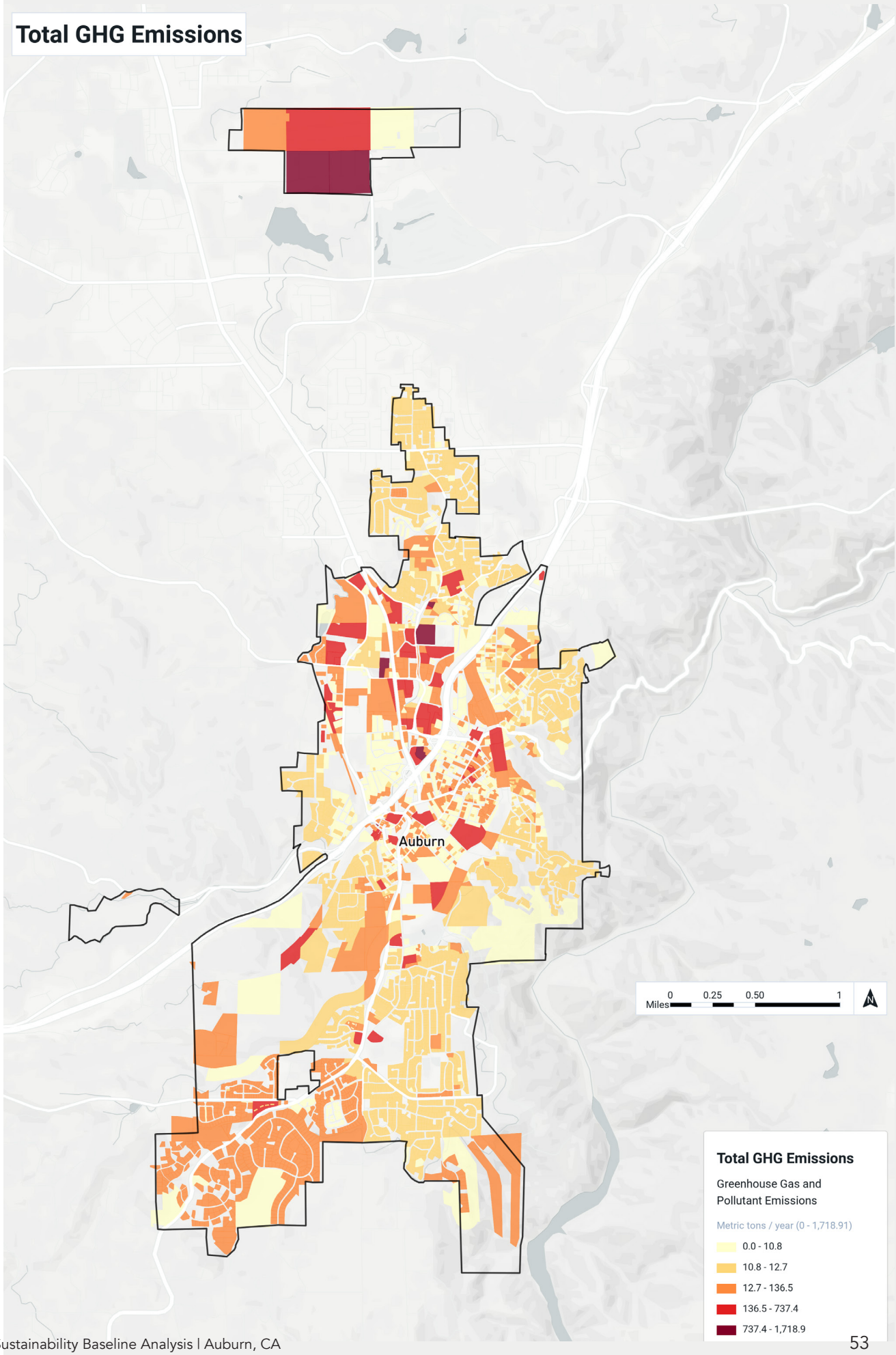
GHG Emissions by Major Category, %



Household GHG Emissions by Major Category, %



Emissions Report		
Annual GHG Emissions by Source		
Total Passenger Vehicle Emissions	40,227	metric tons / year
Total Building Energy GHG Emissions	45,844	metric tons / year
Total Water GHG Emissions	871	metric tons / year
Total	86,941	metric tons / year
Per Household Annual GHG Emissions by Source		
Annual passenger vehicle emissions per household	5.1	metric tons
Annual building energy emissions per household	4.3	metric tons
Annual water-energy emissions per household	0.1	metric tons
Total	9.5	metric tons
Annual Passenger Vehicle Pollutant Emissions by Type		
Total NOx Emissions	15.0	metric tons / year
Total PM10 Emissions	4.7	metric tons / year
Total PM2.5 Emissions	2.0	metric tons / year
Total SOx Emissions	0.4	metric tons / year
Total CO Emissions	149.5	metric tons / year
Total ROG/VOC Emissions	18.0	metric tons / year
Total	189.5	metric tons / year


Total GHG Emissions
Auburn
0
0.25
0.50
1
Miles
N
Total GHG Emissions
Greenhouse Gas and Pollutant Emissions
Metric tons / year (0 - 1,718.91)
0.0 - 10.8
10.8 - 12.7
12.7 - 136.5
136.5 - 737.4
737.4 - 1,718.9

Household Costs

Water, energy & vehicular expenses

The Household Costs module estimates annual household costs associated with passenger vehicle transportation, residential energy use, and residential water use. Together, these represent dimensions of housing affordability as it relates to location efficiency, which impacts travel behavior and vehicle miles traveled (VMT), and housing type, which impacts energy and water use.

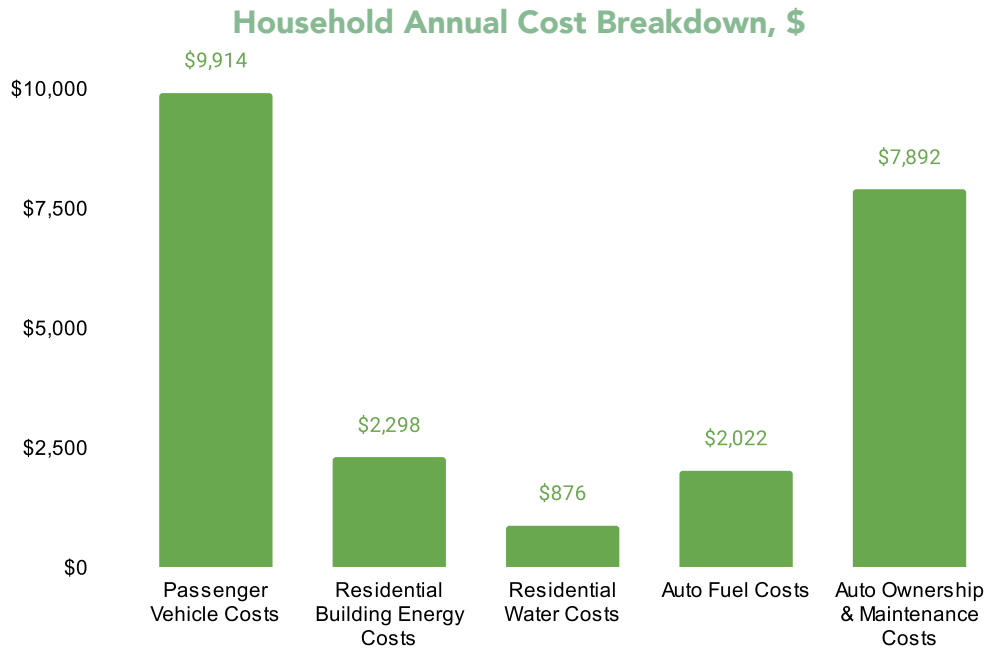
We have used averages for vehicle fuel economy, costs for auto fuel, ownership, and maintenance, residential electricity and natural gas costs, and residential water cost. National averages were used for vehicle performance, ownership, and maintenance costs. State averages were used for auto fuel, electricity, and natural gas.

How to Interpret this Section

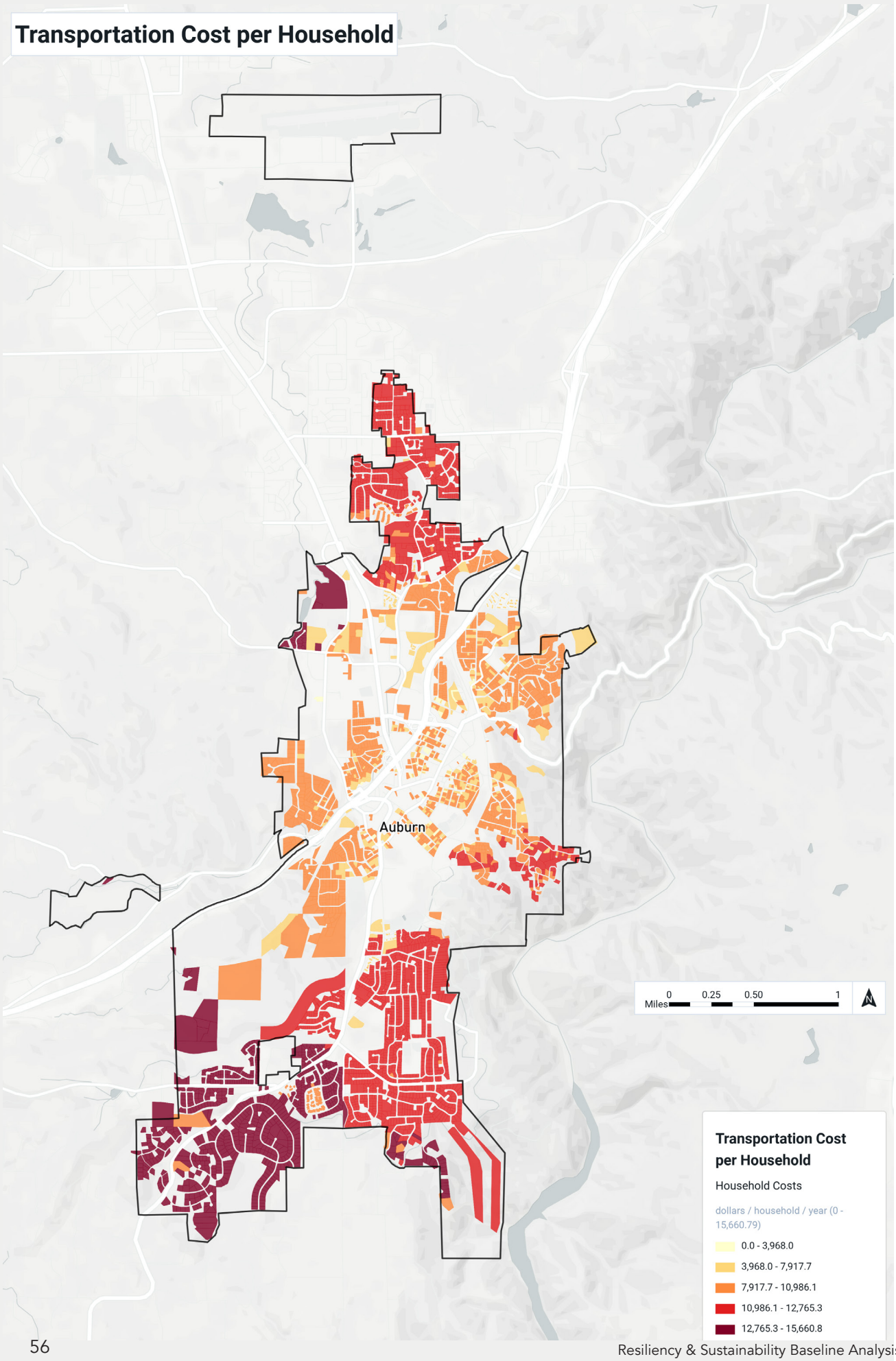
Household costs are subject to technical assumptions for vehicle and building performance, as well as cost assumptions for utilities, auto fuel, and auto ownership and maintenance. The VMT, building energy, and water use calculations upon which household cost estimates are based are described in the documentation for the Transportation, Energy Use, and Water Use modules.

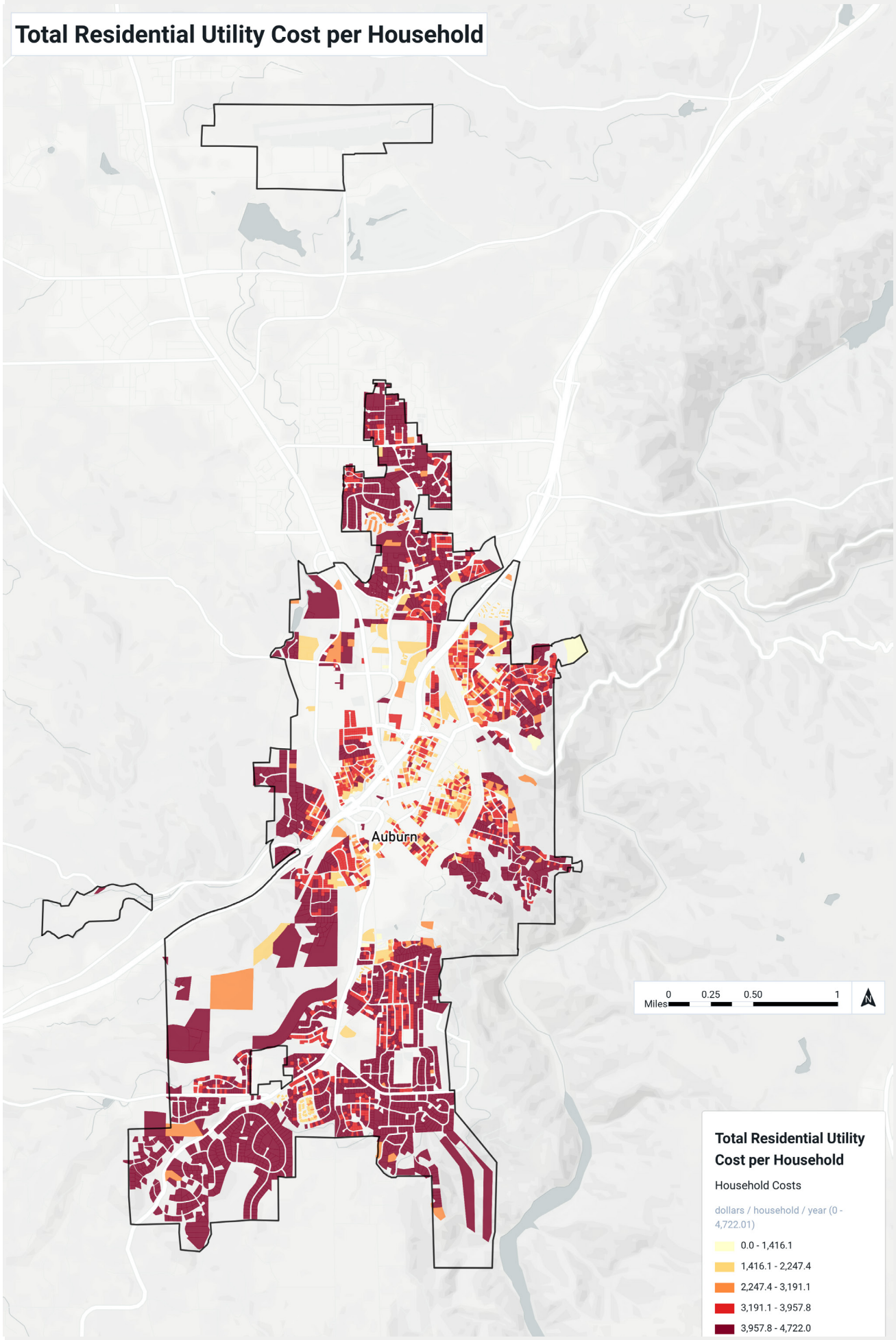
Data Sources

- Automobile fuel prices are generated from the Energy Information Administration (EIA) Weekly Retail Gasoline and Diesel Prices dataset.
- The default fuel efficiency rate for passenger vehicles comes from the 2016 USDOT National Transportation Statistics Average Fuel Efficiency of U.S. Light Duty Vehicles dataset.
- Electricity prices by state are generated from the U.S. Energy Information Administration (EIA) Monthly Electric Power Industry Report for the year 2017.



Household Costs Report	
Annual Residential Water Costs	
Residential Water Cost	$5,150,000 / year
Annual Residential Energy Costs	
Residential Energy Cost	$13,530,000 / year
Annual Passenger Vehicle Costs	
Transportation Cost	$58,340,000 / year
Per Household Annual Auto and Utility Costs	
Annual Passenger Vehicle Costs per Household	$9,914 / household / year
Annual Residential Building Energy Costs per Household	$2,298 / household / year
Annual Residential Water Costs per Household	$876 / household / year
Total	$13,088 / household / year
Per Household Annual Auto Costs by Type	
Auto Fuel Costs per Household	$2,022 / household / year
Auto Ownership and Maintenance Costs per Household	$7,892 / household / year
Total	$9,914 / household / year


Transportation Cost per Household
Auburn
0
Miles
0.25
0.50
1
Transportation Cost per Household
Household Costs
dollars / household / year (0 - 15,660.79)
0.0 - 3,968.0
3,968.0 - 7,917.7
7,917.7 - 10,986.1
10,986.1 - 12,765.3
12,765.3 - 15,660.8


Total Residential Utility Cost per Household
Auburn
0
0.25
0.50
1
Miles
Total Residential Utility Cost per Household
Household Costs
dollars / household / year (0 - 4,722.01)
0.0 - 1,416.1
1,416.1 - 2,247.4
2,247.4 - 3,191.1
3,191.1 - 3,957.8
3,957.8 - 4,722.0

Resiliency & Sustainability Baseline Analysis

Genevieve Marsh
DESIGN GROUP