NATURAL AND WORKING LANDS ELEMENT

Technical Report

Prepared by: Cascadia Partners

September 20th, 2021

CLIMATE SMART
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Funding Partners:

City of San José, Environmental Services Department

Ken Davies, Deputy Director – Climate Smart San José

Julie Benabente, Environmental Services Program Manager

Carol Boland, Supervising Environmental Services Specialist

Santa Clara Valley Open Space Authority

Matt Freeman, Assistant General Manager

Jake Smith, Conservation GIS Coordinator

Technical Contributors:

California Department of Conservation
Carbon Cycle Institute
City of San José, Department of Transportation
The Nature Conservancy
Santa Clara County, Office of Sustainability
Tuckman Geospatial
Santa Clara University, Department of Environmental Studies and Science
University of California, Cooperative Extension

Consultant Team:

Cascadia Partners

Alex Steinberger, Managing Partner

Sachi Arakawa, Senior Associate

Julia Michel, Senior Associate

Ayano Healy, Senior Associate

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SECTION A: Glossary

Definitions

Base Year - The existing conditions or "starting point" for a policy, strategy, or scenario.

Carbon Sequestration - The process of capturing, securing, and storing carbon dioxide (CO2) from the atmosphere. The process sequesters atmospheric carbon in the form of soil carbon, roots, and organic matter.

Class A Biosolids – Residuals from the wastewater treatment process that have been treated to meet the vector attraction and pollution concentration limits specified in 40 CFR Part 503 and pathogen reduction standards specified in 40 CFR Part 503.32(a).

Class B Biosolids - Residuals from the wastewater treatment process that have been treated to meet the vector attraction and pollution concentration limits specified in 40 CFR Part 503 and pathogen reduction standards specified in 40 CFR Part 503.32(b).

Compost - The product of the managed, aerobic, thermophilic biological decomposition of organic materials. The process eliminates or significantly reduces viable pathogens and weed propagules and stabilizes the embedded carbon and nutrients. Compost is typically used as a soil amendment to enhance overall soil quality and may also reduce or eliminate the need for additional plant nutrients and increase soil water holding capacity.

Co-benefits – Societal, economic and/or environmental benefits that accrue as a side effect of a single targeted policy or measure.

Greenhouse Gas Emissions (GHGs) - The sum of emissions of various gasses (methane, carbon dioxide, and nitrous oxide) known to cause climate change.

Greywater – Untreated wastewater generated in households or commercial buildings from laundry machines, sinks, showers, and bathtubs intended for reuse in irrigation and other non-potable uses. Greywater does not include wastewater from sources such as toilets that include fecal and other serious contaminants.

Horizon Year - End date through which a plan or strategy is analyzed. The horizon year for this project is 2040, in accordance with the Envision San José 2040 General Plan.

High-Quality Transit Areas (HQTAs) - Areas within one-half mile from major transit stops and high-quality transit corridors and based on the language in Senate Bill (SB) 375.

Land Use Policy - A strategy, program, regulation, or action designed to guide the location of real estate development and NWL conservation. Typically enacted through zoning, general plans, incentives, or California Environmental Quality Act (CEQA) processes.

Land Use Scenario - A collection of land use changes that occur between the base year and the horizon year of a project that reflect land use policies or actions of real estate developers.

Middle Housing – A term that describes a wide range of multi-unit housing types, such as plexes, cottage clusters, townhouses, and stacked flats, that are compatible in scale and form with detached single family homes.

Mulch - Soil covering used to control weeds or erosion, retain moisture in soil and insulate soil from cold and hot weather. It is also used for aesthetic purposes in horticultural and landscape situations. Organic materials commonly used for mulch include wood chips, ground up landscape trimmings, shredded bark, coarse compost material, straw, and shredded paper.

Natural and Working Lands (NWL) - Forests, woodlands, grasslands, shrubland, wetlands, riparian areas, rangeland, farmland, coastal areas, and greenspaces within urban and built environments (including the urban forest and street trees in the public right-of-way). as defined by the *California 2030 Natural and Working Land Climate Change Implementation Plan*.

Non-soil carbon - Plant matter or biomass generally including leaves, branches, trees, and roots, above and below ground.

NWL Strategy - A program or action designed to protect or enhance the overall quality and carbon sequestration potential of Natural and Working Lands.

Place Type - In future scenarios analysis, place types are generic representations of land use change. They contain assumptions about the density, uses, and building types that comprise land use change. In UrbanFootprint, they are assigned or “painted” to parcels to represent change, and that change is quantified based on their attributes.

San Jose’s Designated Natural and Working Lands (Designated NWL)– Land within Open Space, Parklands, Habitat, Agriculture, and Open Hillside land use designations as defined in the *Envision San Jose 2040 General Plan*.

Soil Carbon - Also known as below ground carbon, soil carbon is the organic and inorganic carbon that exists within soils, excluding carbon in plant roots (which is classified as non-soil carbon).

Sphere of Influence (SOI) - A planning boundary outside of an agency’s legal boundary (such as the city limit line) that defines the probable ultimate physical boundaries and service area of a local governmental agency, as determined by the Local Agency Formation Commission (LAFCo).

UrbanFootprint - Cloud-based land use and transportation “sketch planning” tool used to create land use policy scenarios.

Urban Retreat – A land use policy that involves the voluntary removal of existing development from environmentally hazardous or sensitive lands.

Acronyms

CAP – City of San José's Climate Action Plan

CARB – California Air Resources Board

CARI – California Aquatic Resource Inventory

CLN – Conservation Lands Network

CSSJ – Climate Smart San José

DBH – Diameter at Breast Height (when referring to tree base measurements)

DWR – Department of Water Resources

FAR – Floor Area Ratio

FMMP – Farmland Mapping & Monitoring Program

GHG – Greenhouse Gas

HQTA - High-Quality Transit Areas

LIDAR – Light Detection and Ranging

NWL – Natural and Working Lands

SFEI – San Francisco Estuary Institute

SFR – Single Family Residential

SOI – Sphere of Influence

VMT – Vehicle Miles Traveled

SECTION B: Executive Summary

Climate Smart San José (CSSJ), San Jose's climate action plan, identified the need to assess how the protection and enhancement of San José natural and working lands can contribute to helping San Jose meets its greenhouse gas (GHG) reduction targets aligned with the Paris Climate Agreement. The CSSJ defined natural and working lands as those areas designated in the *Envision San Jose 2040 General Plan* as Open Space, Parklands, Habitat, Agriculture, and Open Hillside land use designations (hereinafter referred to as Designated NWL). However, this definition excludes areas that may currently be functioning as natural and working lands but are planned to be converted to other uses in the *Envision San Jose 2040 General Plan*. In order to understand the types, location, and magnitude of benefits from potential actions across all natural and working lands, this report uses a broader definition of natural and working lands, which includes the forests, woodlands, grasslands, shrubland, wetlands, riparian areas, rangelands, farmlands, coastal areas, and urban greenspaces within the City of San Jose (NWL). This report then examines the potential GHG reduction and co-benefits from the following land use, management, and restoration strategies across areas that fall within this more inclusive definition of NWL:

- **Land Use:** Greenfield Land Conservation, Restricting Development on Environmentally Sensitive Lands, Urban Retreat, Reducing Parking Requirements, and Increased density in Downtown San Jose
- **Land Management:** Cropland Management, Grazing Land Management, Urban Forest Expansion, Street Tree Planting, Compost Application, Class B Biosolids Application, Mulching Application, and Greywater Application
- **Land Restoration:** Native Grasslands, Oak Woodlands, Freshwater Wetland and Bayland, and Riparian Restoration

The City of San Jose recognizes that, given the urgency of climate change and potential scale of climate change impacts, it will need to consider bold measures to mitigate its GHG emissions. Some NWL strategies will require further evaluation of emissions impacts (e.g. displacement and equity concerns, jobs and transportation impacts) in order to ensure full knowledge of the ramifications before moving forward with policy recommendations. Regardless, NWL strategies can play a significant role in helping the City meet its GHG reduction targets and providing a suite of important co-benefits that increase the City's resilience to climate change.

For the next stage of its NWL work, the City will utilize the findings from this technical report to develop an NWL element – identifying initial NWL measures and metrics for integration into CSSJ.

SECTION C: NWL Analysis Summary

Introduction

The Climate Smart San José (CSSJ) plan is the climate action plan (CAP) for San José (City). It includes analysis and recommendations related to a range of strategies to help the City meet the goals of the Paris Climate Agreement. One of the topics identified by the CSSJ plan for further study was to assess how the protection and enhancement of San José's Designated Natural and Working Lands – defined as the Open Space, Parklands, Habitat, Agriculture, and Open Hillside land use designations identified in the *Envision San Jose 2040 General Plan* - can help the City of San José meet its GHG reduction target while also provide a suite of environmental and community benefits. The City and the Santa Clara Valley Open Space Authority partnered on this work to understand and demonstrate how municipalities and local land conservation and stewardship agencies can work together to help communities mitigate and adapt to the changing climate.

The following technical report provides an overview to evaluate how land use may impact the City's GHG emissions trajectory and how the protection and enhancements of Natural and Working Lands (NWLs), looking at a full array of strategies for more broadly defined NWLs, could help the City meet its GHG reduction targets. The NWL analysis modeled multiple land use, land management, and land restoration strategies (NWL Strategies) to understand their relative performance.

To better illustrate the tradeoffs associated with future land use and policy decisions within the City's Sphere of influence (SOI), each land use alternative (comprised of a unique set of NWL Strategies) was evaluated according to twelve metrics that cover a broad range of topics including:

- Greenhouse Gas Emissions
- Carbon Sequestration Potential
- Gentrification and Displacement Risk
- NWL Land Availability
- Vehicle Miles Traveled
- Habitat Connectivity
- Groundwater Recharge Potential
- Criteria Pollutant Emissions
- Terrestrial Habitat Preservation
- Fiscal Revenue
- Fire Hazard Impacts
- Flood Impacts

The findings included in the NWL Analysis show that many NWL strategies can play a significant role in helping the City meet its GHG reduction targets and providing a suite of important co-benefits that increase the City's resilience to climate change. However, more work needs to be done to understand how to implement these NWL Strategies in a thoughtful and coordinated way.

It is intended that the NWL analysis will be used to develop a Natural and Working Lands Element for CSSJ and will be incorporated into CSSJ as a plan amendment. The City is currently in the process of seeking funding for this work and timing for how it can be integrated in the CSSJ Plan.

San José's Natural and Working Lands

According to the California Air Resources Board (CARB), natural and working lands include forests, rangelands, farms, urban green spaces, wetlands, and soils[1]. This definition implies a broader set of lands than would typically be described as "natural" or "working". It defines NWLs as everything from San José's open spaces and farm fields to urban parks and even residential back yards. This expansive view of NWLs is critical if we are to maximize their potential to meet the state's ambitious GHG emissions reductions and climate change mitigation goals.

To fully assess the benefits of NWL strategies, the extent of San José's NWLs needs to be fully understood. The NWL analysis conducted for the NWL element includes a full accounting of existing NWLs including existing carbon sequestered in soil and non-soil biomass. For non-soil carbon, a detailed land cover dataset was developed from various sources to identify urban and non-urban carbon stocks. For soil carbon, all soils within the SOI were mapped and their embodied carbon was quantified. It should be noted that the base year carbon is only a snapshot of the carbon embodied

[1] (California Air Resources Board, 2021)

in soil and biomass at the time of measurement. Embodied carbon is constantly in flux as plants grow or die and properties of the soil change.

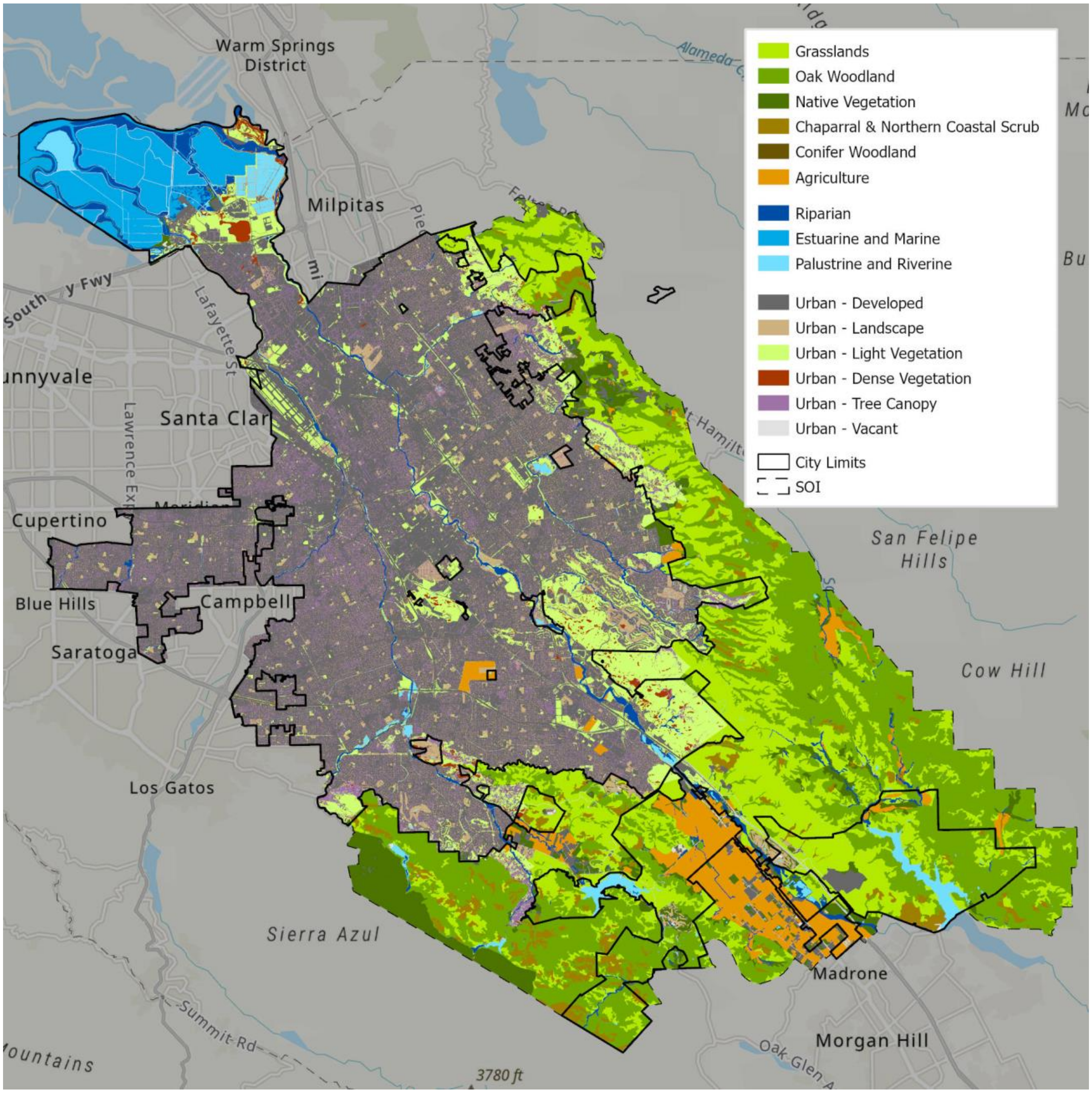

Figure 1: Composite Land Cover Dataset

Why NWLs Matter

As the map above shows, San José's SOI contains a wide variety of forests, rangelands, wetlands, farms and urban green spaces. **Despite being home to more than one million inhabitants, over 65% of the City of San José's SOI is comprised of NWLs.** These lands exist not only in the places you would expect like San José's well-loved open spaces and productive farmland, but they are also woven throughout the urban environment on lands that are not typically thought of as "natural" or "working." More information on the data sources used to develop this map and carbon stock estimates can be found in **Section D: Analysis Methods and Assumptions.**

This report argues that NWLs are a foundational element of San José's quality of life, character, and economy. Most importantly, the findings in this document show how NWLs can serve as a foundational element of San José's greenhouse gas reduction strategy. The ability for these NWLs to sequester carbon into the future will depend on the choices we make today. In order to leverage the full sequestration potential of NWLs, policy decisions will need to incorporate the preservation, expansion, and enhancement of NWLs.

NWLs and the General Plan

One of the key findings of this report is that the General Plan has an outsized influence on NWLs, even though it does not include the phrase "Natural and Working Lands." The impact of land use and transportation policy on agriculture, open spaces, and wildlands does not end at the urban edge. Incentives and regulations that lower barriers to infill development in our most urban places: Downtown San José, its Urban Villages, and high-quality transit areas, all have an important role to play. Enabling development to occur within urbanized areas of San José relieves pressure on greenfield sites where NWLs proliferate, making it easy to preserve, expand, and enhance them.

Growth Management and VMT Reduction

By preserving NWLs, San José has the potential to de facto manage where growth occurs. Moreover, the location of existing and potential future NWLs coincide with areas of immitigable VMT defined by the City's VMT policy. Thus, by preserving and expanding NWLs, the City can address transportation greenhouse gas emissions from their source while increasing sequestration.

A Generational Investment

NWL strategies vary widely in their costs, benefits, and longevity. The most impactful strategies, based on aggregate sequestration, also take the longest to mature. Fully accounting for these benefits requires a long-term view and a generational perspective on a strategy's return on investment.

NWL Strategies

NWL strategies include conserving and expanding natural and working lands as well as enhancing their ability to sequester carbon. The NWL analysis covers three classes of strategies in the following sub-sections: land use, management, and restoration.

Land Use Strategies

One way to approach conservation and expansion of NWLs is through the lens of land use policy. Land use policies, such as those that are regulated through San José's Envision 2040 General Plan, can have a major impact on the continued existence of NWLs as well as their future expansion. Policy impacts can be direct, through the entitlements granted on NWLs or through restrictions on development adjacent to sensitive areas. They can also have an indirect impact by managing and encouraging development in certain areas while discouraging it in others.

The Envision 2040 General Plan already includes numerous policies that imply both direct and indirect impacts. Policies with direct impacts to NWLs include those that recognize San José's agricultural lands and open spaces as a resource to be protected and/or expanded, for example:

> *"Respect the Greenline/Urban Growth Boundary to preserve the beauty and natural resources of the rural and hillside areas, to maintain the fiscal health of the City, to direct private and public investment within identified growth areas, and to preclude development in areas subject to natural hazards."*
>
> *– Envision 2040 General Plan, Land Use and Transportation Goal #19*

Policies with indirect impact on NWLs include those that focus on improving environmental quality, or managing growth in a more efficient and sustainable manner, for example:

> *"Establish a land use pattern that fosters a more fiscally and environmentally sustainable, safe, and livable city."*
>
> *– Envision 2040 General Plan, Land Use and Transportation Goal #19*

In addition to those policies already incorporated into the General Plan, this study analyzed several additional land use policies with potential for direct and indirect impact on NWLs. They are summarized below. For more information on existing local, regional, and state policies that could potentially impact NWLs, see **Section E: Related Planning Efforts.**

Direct NWL Land Use Strategies

Greenfield Land Conservation

While the Envision 2040 General Plan provides an overall vision for growth in "compact and centralized locations" [2], edges of the City's urban area where NWLs exist, such as Northern Coyote Valley, are currently identified as "growth areas". This report explores the impact of shifting job growth away from planned greenfield locations in the General Plan to preserve these locations as NWLs. The shifts primarily pertain to a reduction in jobs in the Coyote Valley planning area and an increase in jobs in the Downtown/Central planning area.

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[2] (City of San José, 2020) / LU-2

Restricting Development on Environmentally Sensitive Lands
This group of strategies involves restricting future development on sensitive lands. Currently, the General Plan includes goals such as "Protect lives and property from risks associated with fire-related emergencies at the urban/wildland interface" and "Protect the community from flooding and inundation and preserve the natural attributes of local floodplains and floodways"[3]. While these goals aim to minimize economic, personal, and environmental harm in sensitive areas, they do not restrict the location of future development.

With increasing volatility of weather events leading to more flooding and fires, as well as the potential for sea levels to rise as global temperatures warm, development in these environmentally sensitive areas could yield disastrous results. To further explore the potential benefits restricting future growth on and around sensitive lands, this study analyzes impacts related to flood hazard zones, areas of wildfire risk, riparian areas, and areas of potential 10-foot sea level rise.

Urban Retreat
Like the policy above, urban retreat policies pertain to environmentally sensitive lands. However, rather than dealing only with new development, urban retreat involves the removal of existing development in sensitive riparian areas as well as areas likely to be impacted by flooding, fires, and sea level rise. These policies would restore previously developed areas into lands suitable for NWL strategies, thereby expanding the land available for NWLs beyond what exists today. For many reasons, including high political, social, and economic costs, urban retreat is likely to be the most challenging strategy to implement. The costs of urban retreat, as well as its potentially large benefits, are discussed later in this section.

Indirect NWL Impacts

Reducing Parking Requirements
Parking requirements exist to ensure a minimum number of off-street parking spaces are included within new development. Requirements are typically based on the amount dwelling units or square footage of commercial area. Requiring parking within a development has the dual impact of reducing achievable densities, thereby creating more auto-oriented urban form, and encouraging driving, by providing access to free and convenient auto parking.

The General Plan lays out a strong foundation for infill development through the concept of Urban Villages, which are planned for "a balanced mix of job and housing growth at relatively high densities"[4]. In many cases, existing parking ratios conflict with this goal because they limit the feasibility of the infill development needed to transform Urban Villages. Moreover, a policy that reduces parking ratios can increase the feasibility of infill development which, to some extent, can relieve some of the pressure to develop on greenfield sites. In order to explore the impact of lowering parking requirements, the land use scenarios discussed later in this report measure the benefits of reducing parking requirements city-wide.

Increased Density in Downtown San José
This policy is loosely modeled after changes to height and floor-to-area (FAR) maximums currently being considered to offer additional entitlements Downtown in exchange for off-site carbon sequestration through a carbon exchange program. The resulting impacts to the built environment are anticipated to be larger, more dense buildings that maximize the allowable height and FAR entitlements. Much like the indirect impacts that could result from lower parking requirements,

[3] (City of San José, 2020) / EC-5, EC-8
[4] (City of San José, 2020) / MS-5

increasing the density and intensity of new development in transit and amenity-rich Downtown San José could reduce development pressure on areas currently classified as NWLs.

Opportunity Housing

Opportunity housing refers to allowing middle housing types in predominantly single-family neighborhoods that are currently zoned Single Family Residential (SFR) or have a "Residential Neighborhood" General Plan land use designation. Two geographically specific policies were considered: allowing opportunity housing in high quality transit areas (HQTAs) and allowing opportunity housing in SFR areas citywide not at risk from wildfire, flooding, or inundation from sea level rise. These policies are intended to reduce barriers to housing development in infill areas thereby reducing the need to develop greenfield sites.

Land Management Strategies

Land management strategies involve managing the use and development (in both urban and rural settings) of NWL resources and may include agricultural practices, reforestation, application of sequestration enhancements, or management of urban greenspace. Examples include management of croplands through reduced tillage and crop rotation as well as the application of class B biosolids to certain lands to enhance their existing sequestration potential. What makes land management unique among NWL strategies is that it is typically applied to urban and working lands. In the following sub-section, the following eight land management strategies are presented:

- Cropland Management
- Grazing Land Management
- Urban Forest Expansion
- Street Tree Planting
- Compost Application
- Class B Biosolids Application
- Mulching Application
- Greywater Application

Each strategy was evaluated based on land availability (both current and future), carbon sequestration characteristics, and total carbon sequestration benefit on lands available within the SOI. On the following pages, the eight land management strategies are explained in greater detail. Included with each description is a map of existing lands where these strategies could be applied, based on their existing use, and lands where strategies could be applied in the future, given historic ecology or other characteristics. In addition, the following summary statistics are included:

Land Availability – acres of land available today given existing land uses and acres of land for application potentially available in the future given land use changes.

Sequestration Potential – per acre and SOI-wide cumulative carbon sequestration potential of applied strategy over a 130-year time horizon. While many strategies reach peak sequestration much sooner, this time horizon was used to account for strategies that could take over 100 years to reach maturity.

Years to Peak Sequestration – time needed for strategies to reach maximum carbon sequestration. In some cases, ranges are provided to account for several sub strategies.

Note that the following individual strategy sections quantify strategy application in isolation despite having some lands exist with other strategies. These strategy application conflicts are taken into account in scenario evaluations to avoid double counting strategies. Detailed assumptions and methods are summarized in **Section D: Analysis Methods and Assumptions.**

Cropland Management

The cropland management strategy includes a package of specific management practices that provide multiple agronomic and environmental benefits beyond carbon sequestration, such as reducing soil erosion, maintaining and increasing soil quality and organic matter content, improving air quality, minimizing nonpoint source pollution from agricultural nutrients and chemicals, and enhancing soil moisture efficiency. These include:

Cover Crops

Planting of grasses, legumes, and forbs for seasonal vegetative cover to reduce erosion from wind and water, maintain or increase soil health and organic matter content, reduce water quality degradation by utilizing excessive soil nutrients, suppress excessive weed pressures and break pest cycles, improve soil moisture use efficiency, and minimize soil compaction.

Strip Cropping

Growing planned rotations of row crops, forages, small grains, or fallow in a systematic arrangement of strips across a field to reduce soil erosion from water, transport of sediment and other water-borne contaminants, reduce soil erosion from wind, and protect growing crops from damage by windborne soil particles.

Conventional Tillage to No Till

Limiting soil disturbance to manage the amount, orientation, and distribution of crop and plant residue on the soil surface year-round to reduce sheet, rill, or wind erosion, reduce tillage-induced particulate emissions, maintain or increase soil quality and organic matter content, reduce energy use, increase plant-available moisture, and provide food and escape cover for wildlife.

Conservation Crop Rotation

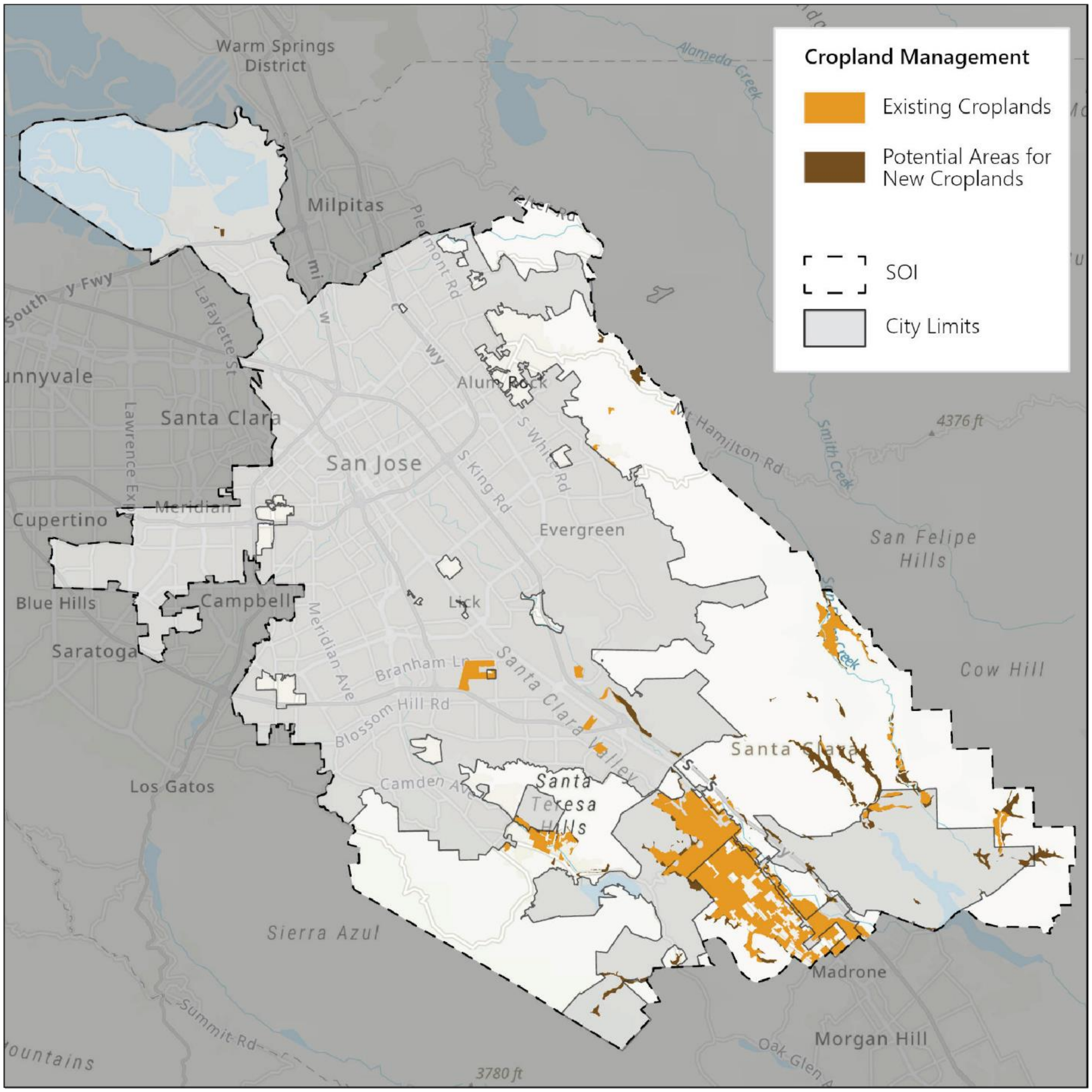
A planned sequence of crops grown on the same ground over a period of time (the rotation cycle) to reduce sheet, rill, and wind erosions, maintain or increase soil health and organic matter content, reduce water quality degradation due to excess nutrients, improve soil moisture efficiency, reduce the concentration of salts and other chemicals from saline seeps, reduce plant pest pressures, provide feed and forage for domestic livestock, and provide food and cover habitat for wildlife, including pollinator forage and nesting opportunities.

Conventional Tillage to Reduced Tillage

A practice that manages the amount, orientation, and distribution of crop and other plant residue on the soil surface year-round while limiting the soil-disturbing activities used to grow and harvest crops in systems where the field surface is tilled prior to planting. This reduces sheet, rill, and wind erosion, reduces tillage-induced particulate emissions, maintains or increases soil quality and organic matter content, reduces energy use, and increases plant-available moisture.

Note: The above mix of five management practices were blended to represent a single strategy. The total carbon sequestration benefit of this strategy, summarized on the following page, reflects an average of the benefits of each strategy individually. Each strategy's sequestration potential was applied as 20% of the total.

Cropland Management Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: 5,625 Ac.	PER ACRE: .6 Mg C	1 - 10
POTENTIAL FUTURE: +1,668 Ac.	SOI TOTAL: 4,375 Mg C	

Figure 2: Cropland Management - Applicability and Sequestration Potential

Grazing Land Management

Grazing lands are lands where livestock roam and forage on vegetation accessible within a few feet of ground level. Conservation objectives for grazing lands include the provision of improved and sustainable forage, improved soil and water quality, reduced erosion, improved shade for livestock and cover for wildlife, reduction of fire hazards, and increased carbon sequestration in biomass and soils. The land management practices modeled as a part of this strategy include:

Prescribed Grazing

Prescribed grazing involves practices to prevent overgrazing, compaction, and grassland quality declines, while increasing the transfer of carbon from the atmosphere to the soil.

Range Planting

Range planting increases carbon sequestration in the soil, especially on lands that have been previously degraded. According to the US Department of Agriculture (USDA), it involves establishment of adapted perennial or self-sustaining grasses, shrubs, or trees[5]. In addition to its carbon sequestration benefits, it has the added benefit of improving forages for livestock.

Silvopasture Establishment

This strategy involves planting of trees or shrubs on grazing land to introduce long-term carbon storage through woody biomass, increase herbaceous biomass production, improve system hydrology and improve microclimatic conditions for livestock. Well-managed silvopastures incorporate native pasture grasses, nitrogen-fixing legumes, and rotation grazing systems that maximize plant growth[6].

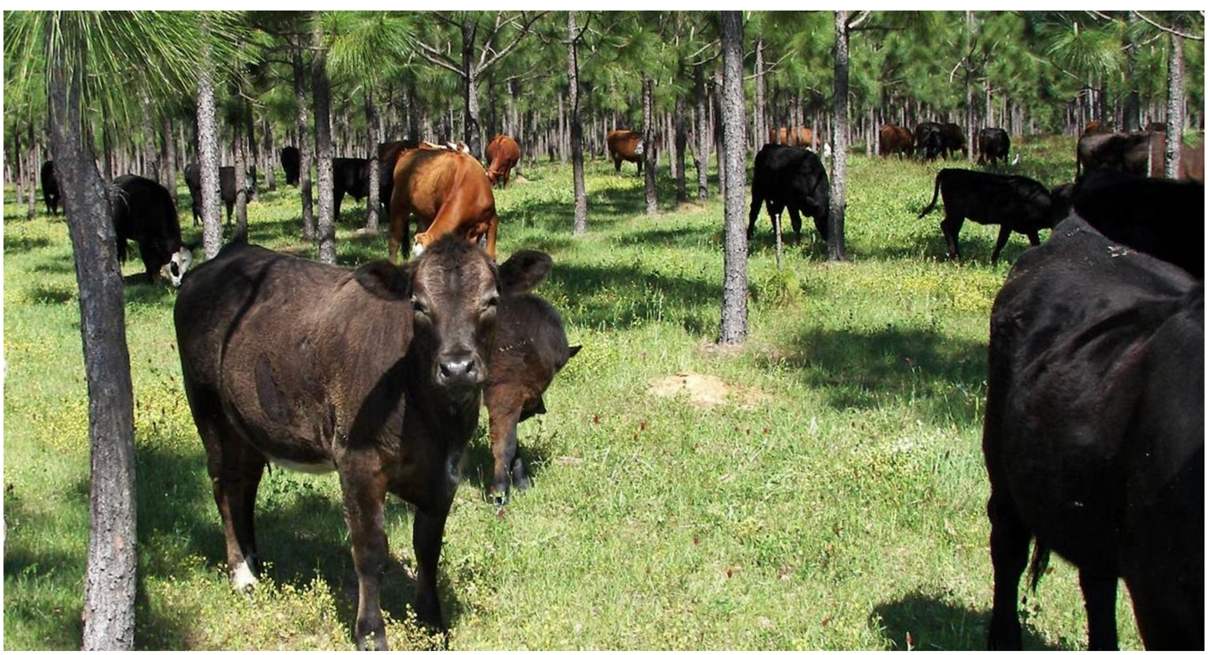


Figure 3: Silvopasture is the intentional integrated management of trees, forages, and grazing livestock for a production benefit. (Image Credit: CivilEats)

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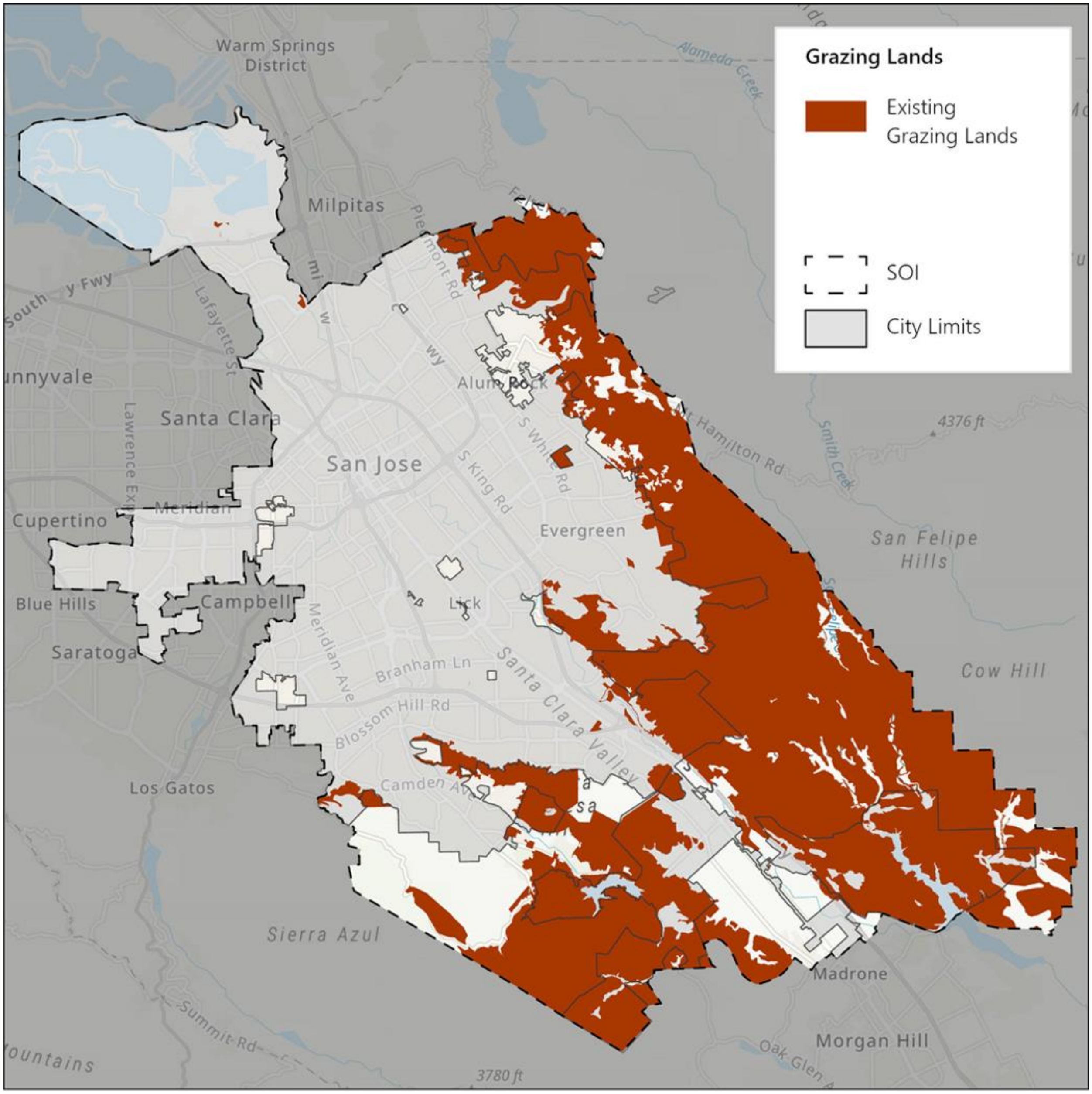
[5] (US Department of Agriculture, 2011)
[6] (US Department of Agriculture, 2020)

Grazing Land Management Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: 64,496 Ac.	PER ACRE: 14.8 Mg C	20 - 100
POTENTIAL FUTURE: +0 Ac.	SOI TOTAL: 955,000 Mg C	

Figure 4: Grazing Land Management - Applicability and Sequestration Potential

Urban Forest Expansion

Urban forest expansion focuses on increasing tree canopy outside of the public right-of-way (trees in the right-of-way are considered "street trees"), in areas such as parks, open spaces, and on private property. The trees that can be planted in this area generally have less constraints (such as narrow planting strips and overhead high voltage wires) than street trees in terms of the size and species of tree that can be planted.

Urban forests provide numerous environmental, societal, and monetary benefits. In addition to the carbon they sequester, urban forests help reduce urban heat island effects, a climate and health equity issue that disproportionally impacts socioeconomically vulnerable communities often residing in neighborhoods with fewer permeable surfaces and tree cover[7]. Their presence can also calm traffic, improve local air quality for residents and reduce the costs of cooling home and commercial spaces.

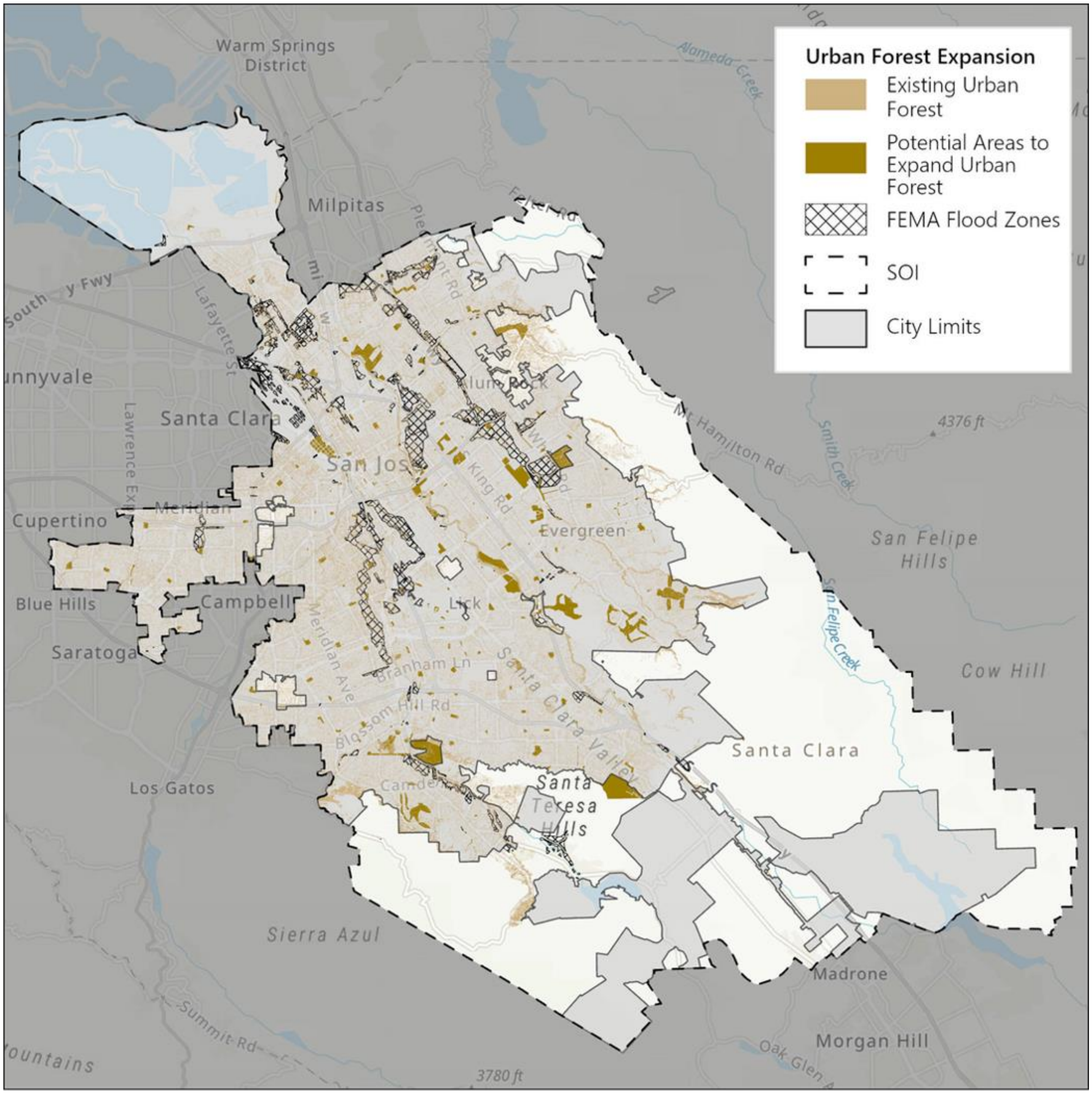
The annual carbon sequestration rate assumed for urban forest expansion is based on a blended average of a variety of frequently planted and climate appropriate tree species of a variety of functional types (large-medium-small form, evergreen and deciduous dormancy) with a focus on natives and tree types that sequester the greatest amounts of carbon.

The lands where urban forests currently exist is based on light detection and ranging (LIDAR) estimates of urban tree canopies, excluding street trees. Lands where future urban forests could exist include private open spaces, golf courses, landfills[8], and areas of parks without existing tree cover. It should be noted that urban retreat provides the potential to further increase the area of San José's urban forest in degraded riparian areas and floodways.

Figure 5: Urban forest expansion can happen in many parks and open spaces around the city. (Image Credit: Santa Clara University)

[7] (Chakraborty, Hsu, Maya & Sheriff, 2019)
[8] Tree planting on capped landfills is not feasible today due to potential issues with tree roots puncturing the landfill cap, however with emerging research and technologies it may be feasible in the future.

Urban Forest Expansion Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: 11,995 Ac. POTENTIAL FUTURE: +3,090 Ac.	PER ACRE: 233.5 Mg C SOI TOTAL: 721,500 Mg C	80 - 150

Figure 6: Urban Forest Expansion - Applicability and Sequestration Potential

Street Tree Planting

Street trees are trees that are primarily in the public right-of-way such as parking strips and medians, adjacent to or within a street. There are currently over 248,000 street trees in San José[9], and locations have been identified to plant approximately 125,000 more. The County of Santa Clara intends to plant 1000 trees per year from 2020-2023.

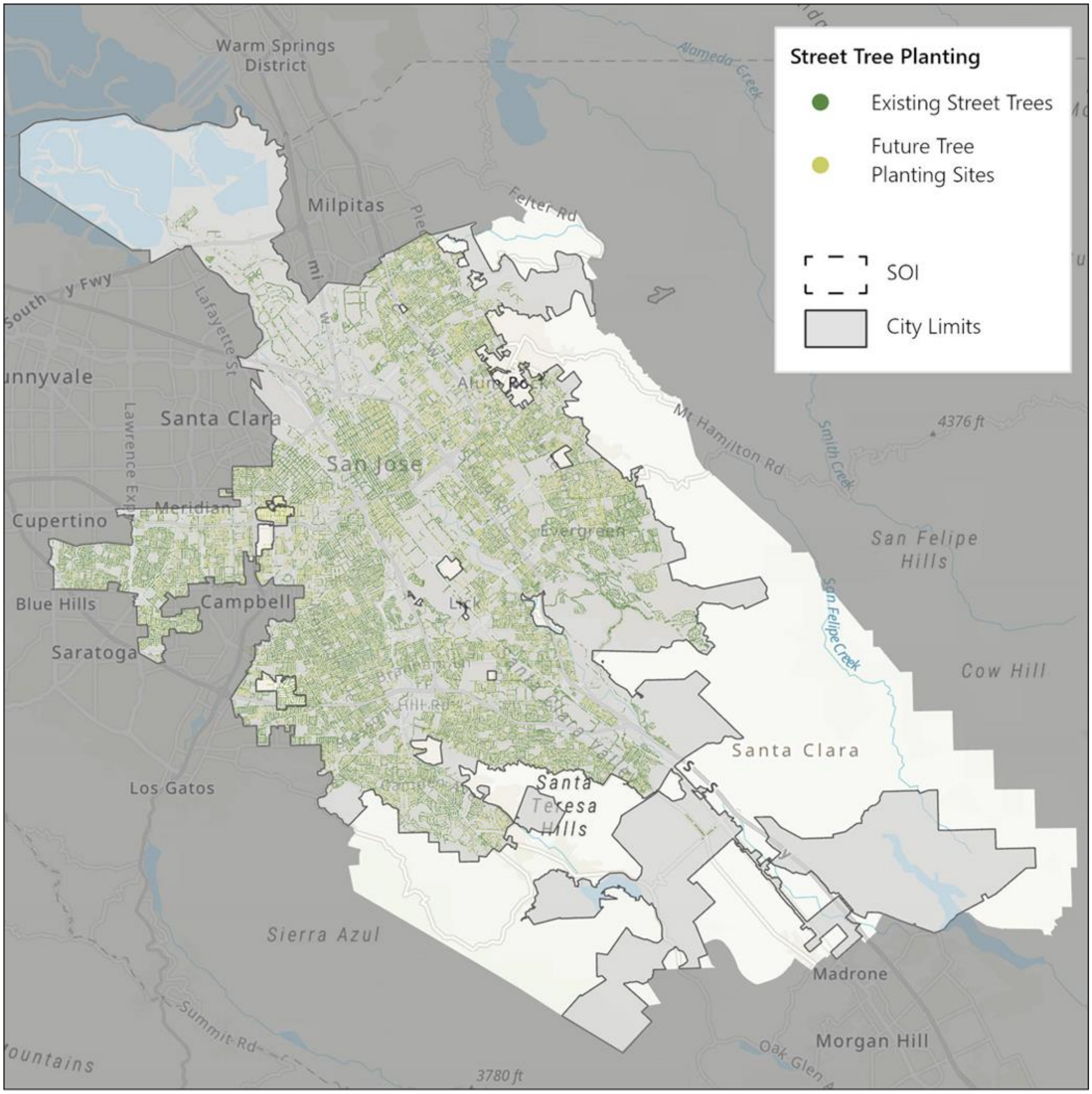
Street trees are part of what the City of San José terms the "Community Forest". Much like the benefits summarized in the urban forest expansion strategy, street trees provide similar benefits to surrounding property values, business activity, public health, and environmental quality. In 2019, it was estimated that San José's street trees contain over 100,000 Mg of carbon and provide annual monetary benefits of nearly $1 million[10].

The carbon sequestration potential of planting new street trees is assessed by applying an average of a mix of tree species. The tree mix was chosen from frequently planted and climate appropriate tree species of a variety of functional types (large-medium-small form, evergreen and deciduous dormancy) considering the limitations and opportunities of the range of available potential planting locations. Potential locations for the planting of new street trees comes from an assessment performed by the City for the 2012 San José Canopy Study.

Figure 7: Street trees live in the public right-of-way, often in planting strips along streets and sidewalks. (Image Credit: Phys.org)

[9] (City of San José, 2019)
[10] (City of San José, Department of Transportation, 2020)

Street Tree Planting Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: **248,000 Trees**	PER TREE: **1.8 Mg C**	**40 - 150**
POTENTIAL FUTURE: **+125,000 Trees**	SOI TOTAL: **225,000 Mg C**	

Figure 8: Street Tree Planting - Applicability and Sequestration Potential

Compost Application

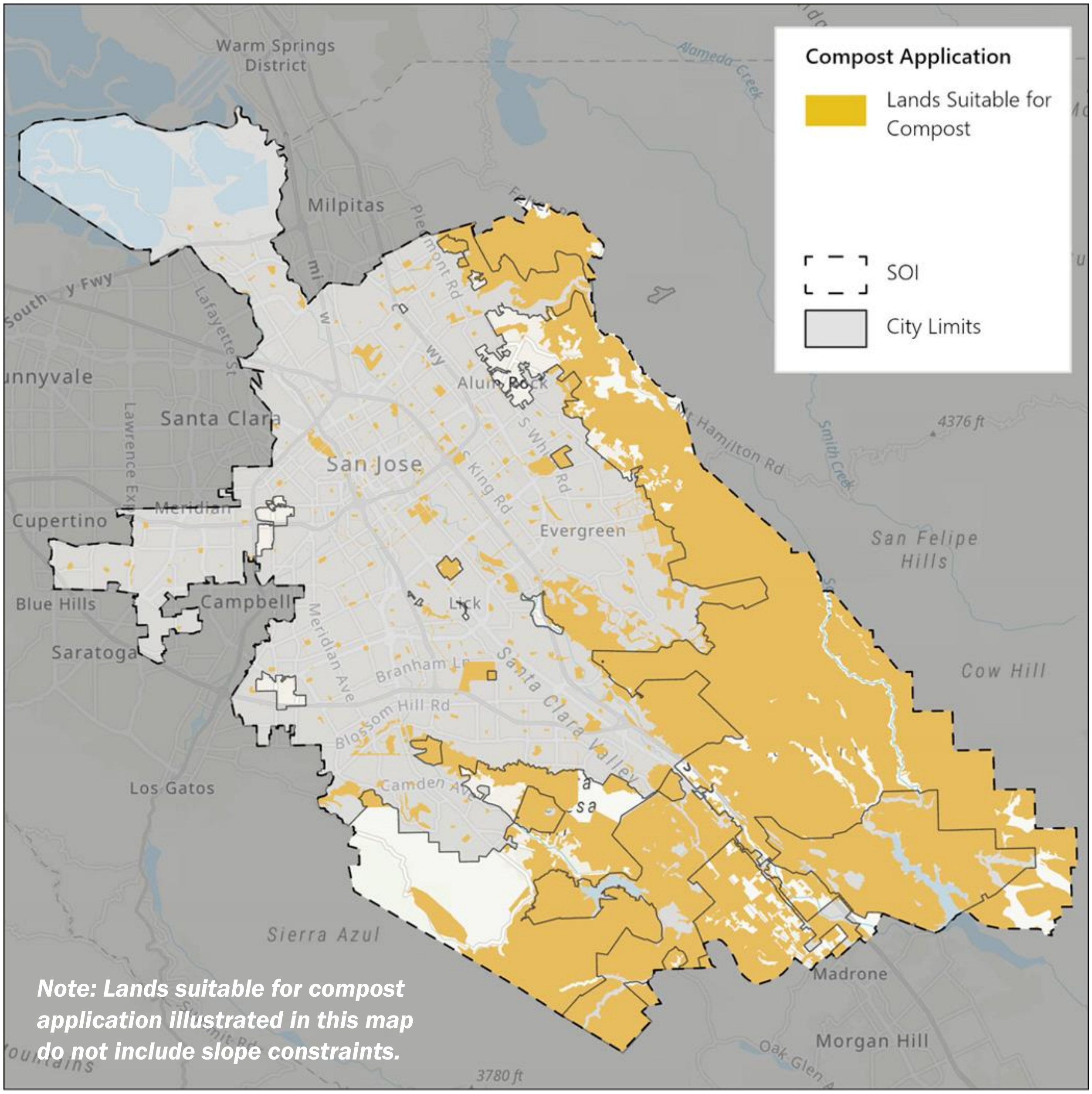
The compost application strategy involves both reducing or eliminating petroleum-derived soil amendments and replacing them with organic materials. This strategy is based on carbon cycle science, which shows that petroleum-derived fertilizers transfer carbon from fossil fuels to the atmosphere, thereby increasing the atmospheric concentration of global warming gases. Its use has been shown to increase the amount of carbon stored in both grassland and cropland soils and has important co-benefits, such as increased crop yields and water-holding capacity.

The composting strategy can be applied as a sequestration enhancement to cropland management or grazing land strategies (slope limitations and treatment standards exist) as well as urban open space lands. Sequestration rates from compost vary for each underlying use. Compost cannot be applied to areas within 100 ft from native riparian habitats, within 50 ft from streams, with serpentine soil or existing high-value native grassland communities. For the purposes of this report, a blended mix of grazing lands and croplands were assumed to generate SOI-wide sequestration estimates.

Note: Slope was not considered when identifying lands suitable for compost application during this project but should be considered for future refinement of suitable land inventories. Lands were deemed suitable for compost application under the assumption that the compost applied is pathogens and weed free. Furthermore, constraints such as limited vehicle access to application sites and the costs of hauling materials to the sites were not included in this analysis but could be considered in future studies.

Figure 9: Compost can be used as a soil amendment to replace traditional nitrogen fertilizers. (Image Credit: WesternCity.com)

Compost Application Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: 73,780 Ac.	PER ACRE: 4.5 – 4.7 Mg C	GRAZING LANDS: 20 - 100
POTENTIAL FUTURE: +0 Ac.	SOI TOTAL: 331,000 Mg C	CROPLANDS: 1 - 10

Figure 10: Compost Application - Applicability and Sequestration Potential

Class B Biosolids Application

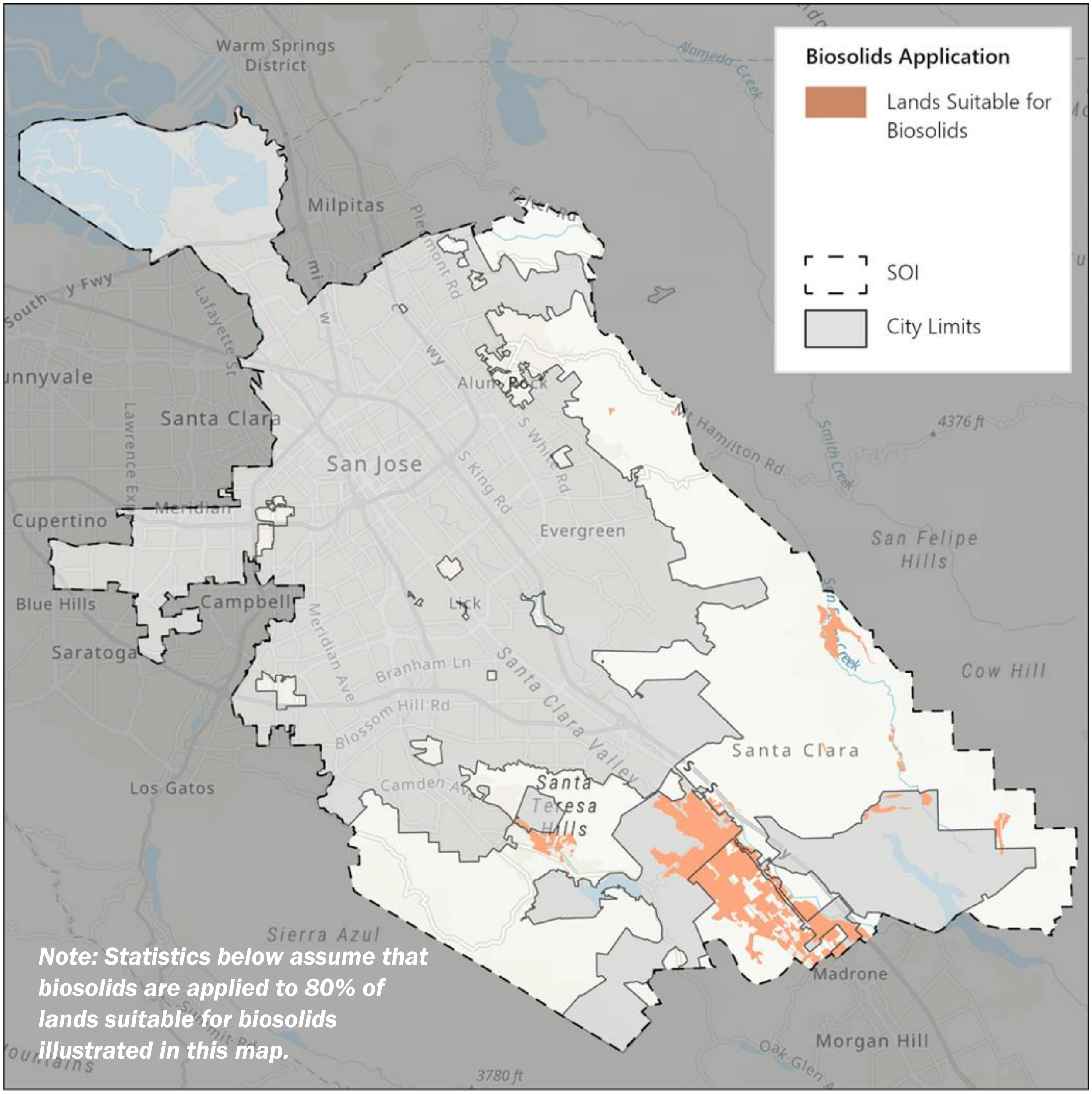
The biosolids application strategy involves the application of treated residuals (biosolids) from the wastewater treatment process onto agricultural lands. Because they are nutrient-rich, biosolids are considered a sustainable alternative to synthetic fertilizers. They not only help sequester and store a significant amount of carbon directly to the soil for long periods of time, but they also improve plant growth. Their ability to improve soil structure also helps prevent erosion and runoff. Depending on their level of treatment, biosolids can be Class A or Class B. Class A biosolids are processed to a greater degree and can be applied to a broader set of lands than Class B biosolids. For this report, only the land application of Class B biosolids was studied. The performance of Class A biosolids application in the Santa Clara Valley should be further evaluated and later incorporated into this strategy to increase its overall carbon sequestration benefit.

Lands where the application of Class B biosolids might be appropriate are limited. For instance, they are restricted from being applied to any lands immediately accessible to the public or grazing animals. They can only be applied to croplands growing crops not meant for direct human consumption. The California State Water Resources Control Board places additional restriction on where biosolids may be applied relative to property lines, domestic water supplies, marshes, drainages, and surface water. For the purposes of this study, it was assumed that Class B biosolids could be applied to all croplands within the SOI. In practice, only crops not intended for direct human consumption would qualify. In addition, to account for certain distance requirements set by the State Water Resources Control Board, it was assumed that biosolids can only be applied to 80% of the total lands suitable for application.

Note: Unfortunately, the FMMP data used to identify croplands in the Santa Clara Valley do not distinguish cropland cover types. As a result, the biosolids strategy is applied as a dial-up strategy to all cropland types with the understanding that the overall calculated carbon sequestration benefit of biosolids application is overestimated.

Figure 11: Biosolids are used as a soil amendment on a variety of Natural and Working Lands. (Image Credit: NWBiosolids.org)

Class B Biosolids Application Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: 5,625 Ac.	PER ACRE: 1.94 Mg C	1 - 10
POTENTIAL FUTURE: +0 Ac.	SOI TOTAL: 10,900 Mg C	

Figure 12: Class B Biosolids Application - Applicability and Sequestration Potential

Mulching Application

The mulching strategy involves the spreading of organic materials on soil as a top dressing. The material used could be shredded wood, straw, or similar materials, depending on the context of the land cover type where the mulch would be applied. The benefits of mulching include limiting weed growth, moderating soil temperature, reducing the potential for erosion, enhancing moisture retention in the underlying soil, improved soil structure, and added nutrients from decomposition such as carbon.

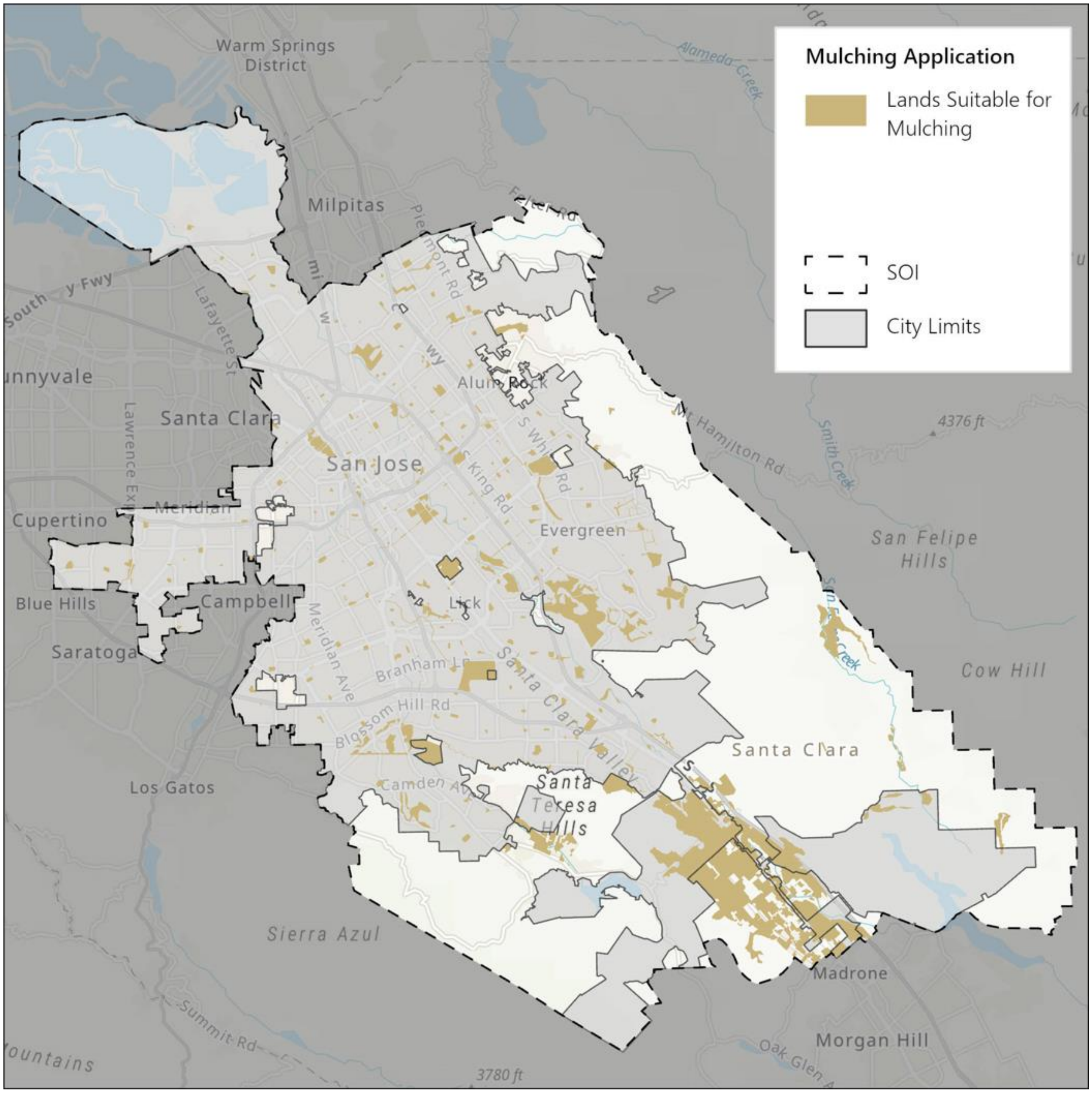
According to the City of San José Tree Policy Manual, mulch can provide water savings, improve water penetration, and serve as an aid to the roots of woody plants. In addition to promoting mulch in street tree and urban forest applications, the City of San José also actively encourages private homeowners to utilize mulch in their landscaping.

For the purposes of this study, the mulching strategy was assumed to be applicable as a sequestration enhancement to all croplands as well as urban open space lands. It was assumed that mulch cannot be applied to areas within 100 feet of native riparian habitats, to areas with serpentine soils, or existing high-value native grassland communities. Sequestration potential from mulch application in private yards and other properties was not included in the following estimates.

Note: The lands were deemed suitable for mulch application under the assumption that the mulch applied is pathogens and weed free. Furthermore, constraints such as limited vehicle access to application sites and the costs of hauling materials to the sites were not included in this analysis but could be considered in future studies.

Figure 13: Mulching on top of soil has many benefits including improved moisture retention and soil structure. (Image Credit: University of California, Agriculture and Natural Resources)

Mulching Application Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: **11,388 Ac.**	PER ACRE: **.21 Mg C**	**1 - 10**
POTENTIAL FUTURE: **+0 Ac.**	SOI TOTAL: **2,391 Mg C**	

Figure 14: Mulching Application - Applicability and Sequestration Potential

Greywater Application

Greywater application involves diverting household greywater from the city sewer system for use in irrigating trees and perennial shrubs within household yards during periods when evaporation exceeds precipitation (to protect groundwater quality, three-way valves are used to allow greywater to flow to the city sewer during periods when precipitation exceeds evaporation, i.e. the rainy season). As a homeowner-initiated strategy, greywater application could be applied residential areas comprised of single-family homes.

The total area to which this strategy could be applied was determined by assessing the portion of the single family lots in the City covered by front and back yard area, using a combination of zoning information and aerial imagery case studies. Using this approach, it was determined that rural, suburban, and urban residential properties tend to exhibit non hardscaped areas at roughly 85%, 45%, and 30% of lot area, respectively. To determine the percent of yard area available for greywater application, a case study approach using aerial imagery indicated that roughly 29% of non-hardscaped lot area tends to be actively landscaped and suitable for greywater.

Note: It should be noted that research related to carbon sequestration and greywater is still emerging. Though some research suggests benefits from the use of greywater for plant irrigation, this research is not conclusive. While it was not possible to confirm any carbon sequestration benefits to the application of greywater in residential yards, it is well-documented that greywater application provides a significant water savings co-benefit, which can be modeled using data from a landscaping water budget calculator[11].

Figure 15: Greywater can be used to irrigate residential landscaping (Image Credit: EcologyArtisans.com)

IRRIGABLE LAND	WATER SAVINGS PER RESIDENTIAL ACRE	SOI TOTAL WATER SAVINGS
RURAL: 2,196 Ac. SUBURBAN: 2,416 Ac. URBAN: 1,043 Ac.	59,195 G/Ac./Yr.	2.3 Billion G/Yr.

Figure 16: Greywater Application - Applicability and Sequestration Potential

[11] (City of Sunnyvale, n.d.)

Restoration Strategies

According to the Santa Clara Valley Historical Ecology Study, oak woodland and grassland were widespread across the San José area with corridors of riparian vegetation leading to freshwater wetlands and baylands rich with biodiversity[12]. Within San José's SOI, much of this original land cover has been degraded or displaced by urbanization. NWL restoration strategies focus on areas of San José's SOI where this degradation coincides with high value historical ecology.

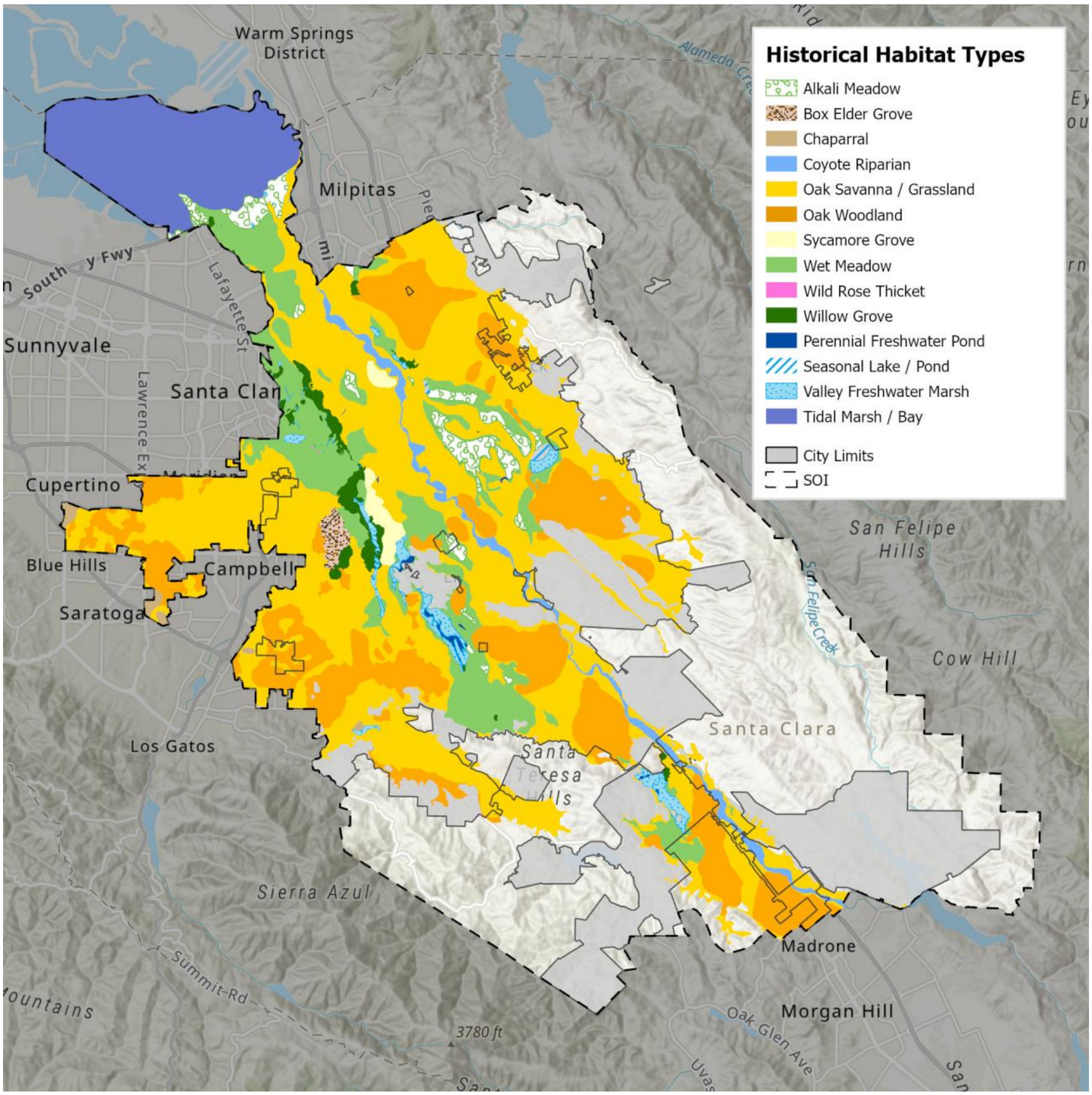


Figure 17: Historical Ecology, San José Area

12 (San Francisco Estuary Institute, 2019)

Natural community restoration strategies involve restoring natural areas whose biological communities and ecosystems have been substantially degraded or destroyed. In addition, they assume a complete re-growth of native plant communities starting from and above-ground sequestration baseline of zero as soil carbon is not removed in the process.

In the following sub-section, the following four land management strategies are presented:

- Native Grasslands Restoration
- Oak Woodlands Restoration
- Freshwater Wetland and Bayland Restoration
- Riparian Restoration

Each strategy was evaluated based on land availability (both current and future), carbon sequestration characteristics, and total carbon sequestration benefit on lands available within the SOI. On the following pages, the four restoration strategies are explained in greater detail. Included with each description is a map of existing lands where these strategies could be applied, based on their existing use, and lands where strategies could be applied in the future, given historic ecology or other characteristics. Note that the following individual strategy sections quantify strategy application in isolation despite having some lands exist with other strategies. These strategy application conflicts are taken into account in scenario evaluations to avoid double counting strategies. Detailed assumptions and methods are summarized in **Section D: Analysis Methods and Assumptions.**

Native Grassland Restoration

Grasslands are ecosystems dominated by grasses and forbs. This strategy involves the restoration of native grasslands (which tend to be perennial), on areas currently covered by non-native grasses (which tend to be annual) and associated species. Native grass species tend to have deeper root systems to allow them to reach deeper soil moisture to survive periods of extended drought; these deep root systems also sequester much more carbon than non-native grasses, which tend to have more shallow root systems.

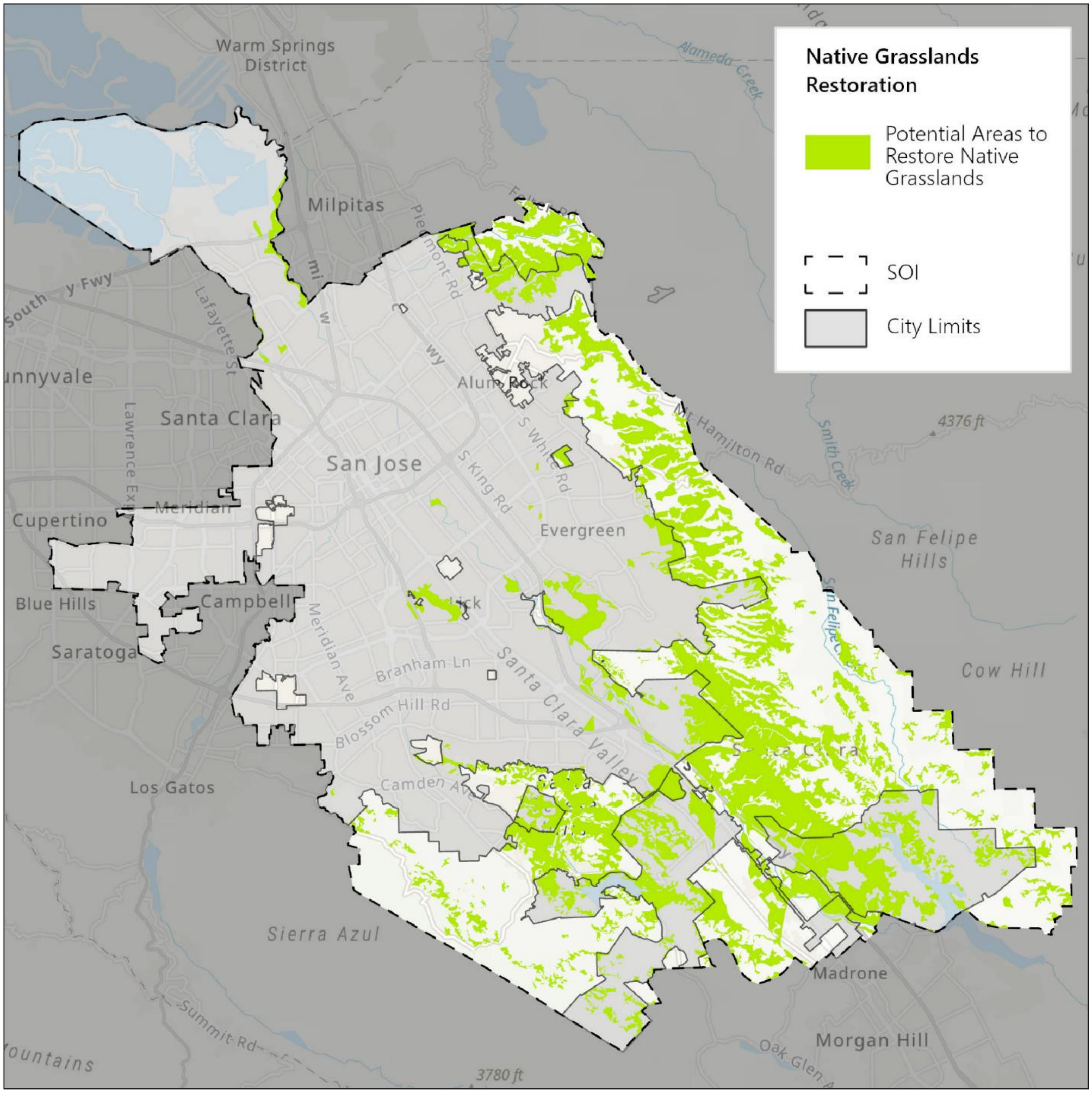
Since native grasslands tended to exist on prime soils or in valley bottoms, these tended to transition to orchards, and then residential subdivisions as San José and surrounding communities urbanized[13]. The spatial extent to which the native grassland restoration strategy could be applied comes from the Santa Clara Valley Habitat Agency Land Cover assessment of the extent of existing grassland and the SFEI inventory of the historical extent of the native grassland ecological community.

Note: Because no non-degraded native grasslands currently exist within the SOI, the following map and summary statistics show no existing NWLs of this type.

Figure 18: UC Davis staff demonstrating a study of native grassland restoration. (Image Credit: Sonoma Mountain Institute)

[13] (San Francisco Estuary Institute, 2019)

Native Grassland Restoration Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: **0 Ac.** POTENTIAL FUTURE: **+31,733 Ac.**	PER ACRE: **9.1 Mg C** SOI TOTAL: **288,770 Mg C**	**20**

Figure 19: Native Grassland Restoration - Applicability and Sequestration Potential

Oak Woodland Restoration

This strategy involves the restoration of oak woodlands on areas currently covered by non-native grasses where oak woodland ecological communities were historically located. Oak woodlands currently cover over 295 square miles of Santa Clara County's rural hillsides and ranchlands. The need for oak woodland restoration is a result of three kinds of threats: loss of existing oak woodlands due to urbanization, lack of regeneration (i.e. failure to reproduce), and habitat fragmentation. Oak woodlands serve a number of important ecological functions including sequestering and storing significant amounts of carbon. In addition, they improve watersheds, provide critical wildlife habitat, enhance scenic beauty, and provide a foundation for other NWL management strategies that enhance working lands, such as silvopasture[14]. While oak woodlands can store significant amounts of carbon, it should be noted that it can take over a century for oaks to reach peak sequestration[15].

Even within the oak woodland community, there is tremendous biodiversity. Ten of the 18 native oak species found in California are located in the San José SOI including black, blue, canyon, coast, valley, and live oaks. For the purposes of this study, the annual carbon sequestration rate was estimated as a blended average of a variety of native oak species. The spatial extent to which the restoration of oak woodlands (across the ranges of blue oak and valley oak) strategy is applied comes from the Conservation Lands Network (CLN) and San Francisco Estuary Institute (SFEI) inventories of the historical extent of oak woodland ecological communities. The Santa Clara Valley Habitat Agency landcover dataset was used to identify and omit existing and mature oak woodland habitats from the SFEI and CLN defined inventory of lands suitable for restoration. In addition, areas where present-day land cover is grassland or other candidate land cover classes were included.

Figure 20: California oak woodland is a plant community historically and currently found throughout several regions of Santa Clara County. (Image Credit: University of California, Berkeley)

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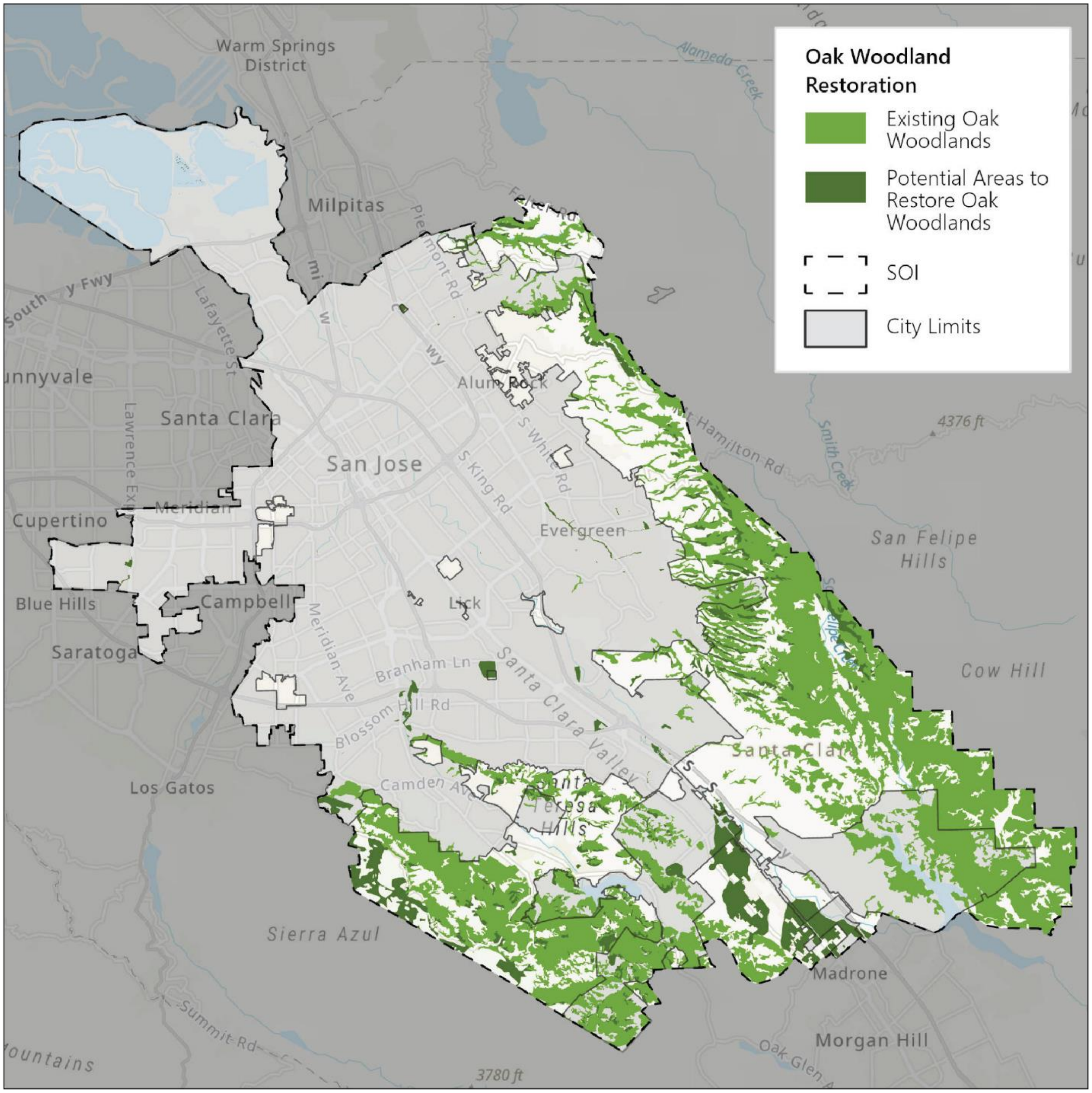
14 (Santa Clara County, 2005)
15 (Matzek, Stella, & Ropion, 2018)

Oak Woodland Restoration Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: **33,692 Ac.**	PER ACRE: **5,689 Mg C**	**70 - 220**
POTENTIAL FUTURE: **+5,993 Ac.**	SOI TOTAL: **34 Million Mg C**	

Figure 21: Oak Woodland Restoration - Applicability and Sequestration Potential

Wetland Restoration

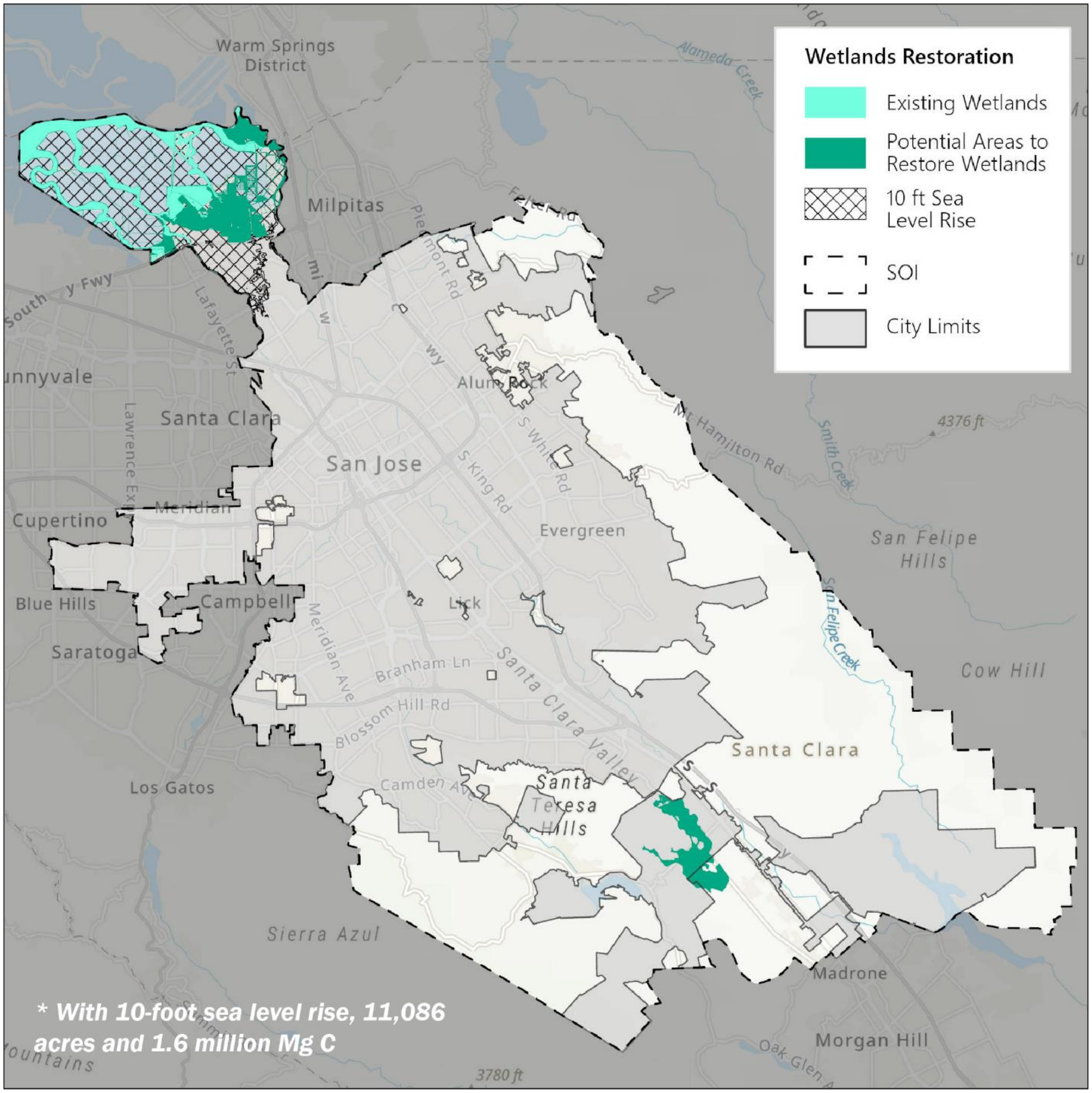
The wetlands restoration strategy includes the restoration of saline wetlands (baylands) and freshwater wetlands. Baylands are those subject to tidal inundation by waters of the San Francisco Bay. Freshwater wetlands are scarce in San José with only Laguna Seca, one of the largest remaining freshwater wetlands in the Bay Area, as a permanently protected wetland. Restored wetlands have the potential to help reduce GHG emissions through the restoration of plant habitats that sequester carbon and bury it within accumulating soil. However, it should be noted that carbon accounting for wetlands is still an emerging field of research, and there are many factors that need to be understood before we can accurately quantify the impact of so called "blue carbon". For instance, we do not know how much carbon has been captured since restoration began and whether that submerged carbon will continue to build over time. Additionally, wetlands, especially those that are freshwater, are known to emit high rates of methane that can often negate their carbon sequestration benefits. Our lack of understanding and scarce literature explaining this dynamic limits our ability to accurately estimate the net benefits of wetland restoration strategies.

The spatial extent to which wetlands restoration strategy is applied comes from the California Aquatic Resources Inventory (CARI) for identifying existing baylands and SFEI Historical Ecology for identifying the extent of the Laguna Seca freshwater wetlands. Land that the National Oceanic and Atmospheric Administration (NOAA) expects to be inundated as a result of a projected 10 feet rise in sea level is also modeled for restoration in the long term through the study's "urban retreat" scenarios.

Note: Since this restoration strategy includes two sub strategies, the land availability map on the following page combines lands for both strategies, but the sequestration summary provides estimates separately.

Figure 22: Baylands and their associated vegetation are believed to have high carbon sequestration potential. (Image Credit: San José Mercury News)

Wetland Restoration Summary



LAND AVAILABILITY

EXISTING:
2,494 Ac.

POTENTIAL FUTURE:
+3,478 *

SEQUESTRATION POTENTIAL

PER ACRE:
28.6 / 1,158.5 Mg C
(SALINE / FRESH)

SOI TOTAL:
1.3 Million Mg C*

YEARS TO PEAK SEQUESTRATION

100

Figure 23: Wetland Restoration - Applicability and Sequestration Potential

Riparian Restoration

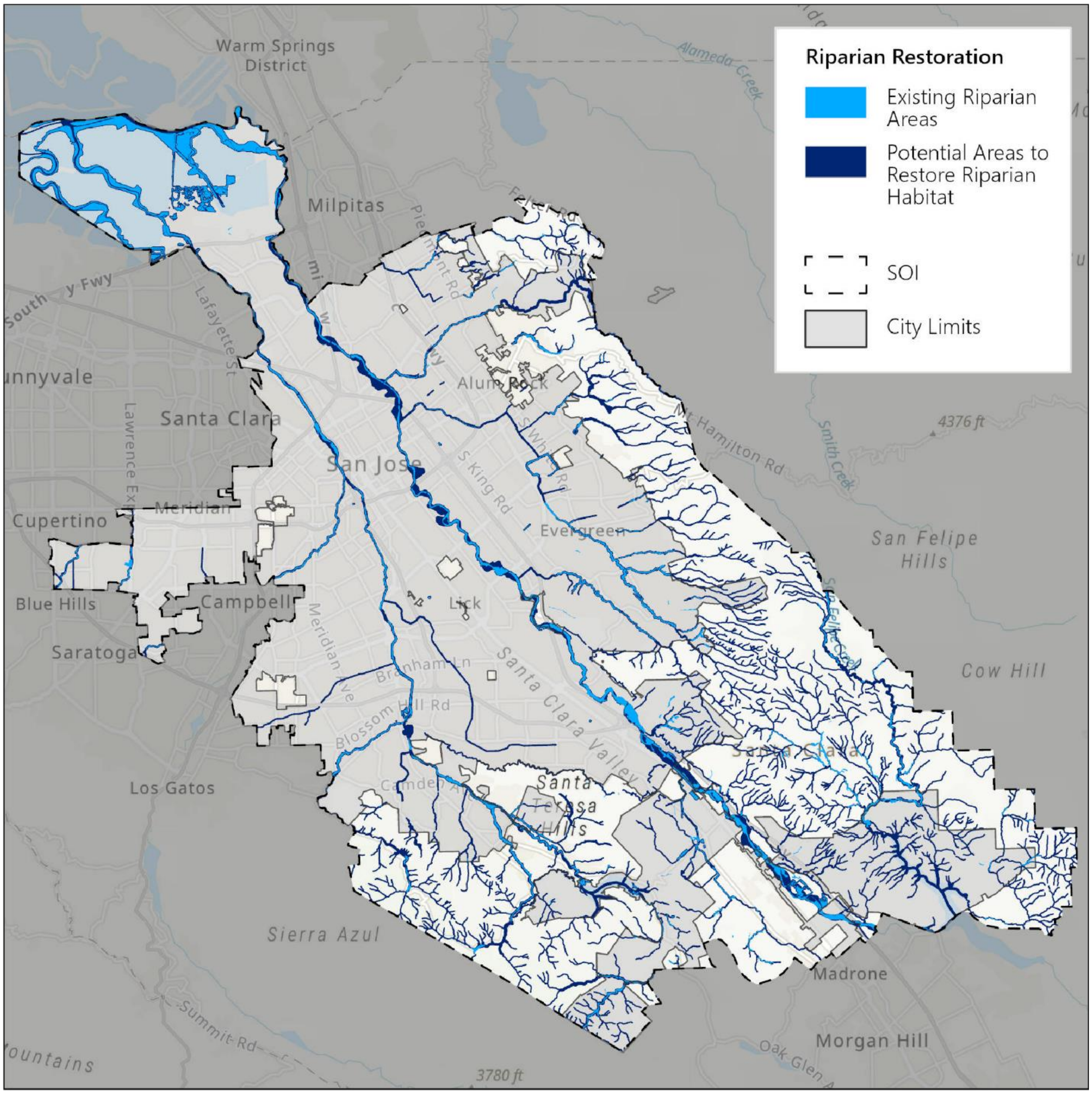
The riparian restoration strategy involves increasing woody perennial vegetation densities in areas in and around stream and river channel beds.

The annual carbon sequestration rate is based on a blended planting community of riparian species of trees and shrubs including native oaks, willow, alder, and understory woody shrubs. No restoration strategies were applied to existing native riparian areas defined by the California Department of Water Resources (DWR) and Santa Clara Habitat land cover data. The geographies suitable for the application of the riparian restoration strategy outside of existing riparian areas are defined as follows:

- All areas below the top of bank
- Within 100 ft from streams and top of bank
- Within 100 ft from the midline of uncovered creeks
- Within Category 1 Stream buffers
- Additional areas that encompass the historical extent of the Coyote riparian community as defined in the San Francisco Estuary Institute (SFEI) dataset.

Figure 24: Riparian areas are lands that occur along waterways and water bodies, including flood plains and streambanks. (Image Credit: ValleyWaterNews.org)

Riparian Restoration Summary



LAND AVAILABILITY	SEQUESTRATION POTENTIAL	YEARS TO PEAK SEQUESTRATION
EXISTING: 4,709 Ac.	PER ACRE: 2,878 Mg C	90
POTENTIAL FUTURE: +17,918 Ac.	SOI TOTAL: 51.5 Million Mg C	

Figure 25: Riparian Restoration - Applicability and Sequestration Potential

NWL Conservation Scenarios

The City of San José sets policies related to land use and urban growth through its General Plan. Because these policies impact where and how land is developed, they also impact where and how NWL strategies can be deployed. To account for the direct and indirect impacts on NWLs from land use policies, this project focuses not only on the theoretical impact of NWL strategies, but also on their ability to be applied to lands in San José's SOI given various future land use conditions.

Figure 26: Land use policies influence land use patterns which influence the performance of NWL strategies

Seven land use scenarios were developed to estimate the impact of potential General Plan policies on land availability for NWL strategies, as well as well as other co-benefits. Each scenario represents land use change across the entire San José Sphere of Influence (SOI) under a set of future policy conditions in the year 2040. Scenarios were built using UrbanFootprint, a sketch planning tool used by jurisdictions across California to model policy impacts in long range planning processes.

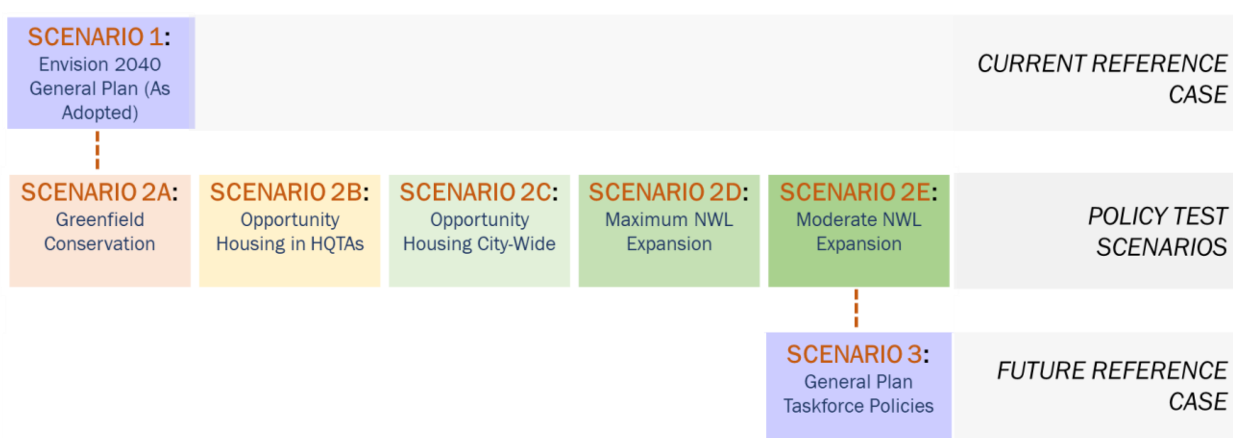


Figure 27: The seven land use policy scenarios developed for the NWL Analysis

Scenarios Overview

Three types of scenarios were tested as part of the NWL analysis: a current reference case, policy test scenarios, and a future reference case. The purpose of the two reference cases is to provide a benchmark for how NWL strategies could perform given policies that are either already adopted or likely to be adopted in the near term. The purpose of the policy test scenarios is to explore the benefits of land use policies that are currently not under consideration for implementation or that would face significant challenges to implement. The following table summarizes the policy assumptions across the seven scenarios.

San José NWL Project Scenario Development Matrix		**Scenario 1:** General Plan As Adopted	**Scenario 2A:** Greenfield Conservation	**Scenario 2B:** Opportunity Housing in HQTAs	**Scenario 2C** Opportunity Housing City-Wide	**Scenario 2D:** Maximum NWL Expansion	**Scenario 2E:** Moderate NWL Expansion	**Scenario 3:** General Plan Taskforce Policies
Place Types	**Existing Parking Ratios**	x				x		x
	Reduced Parking Ratios		x	x	x		x	
	Max FAR/Height DT		x					
	Opportunity Housing			x	x		x	x
Location	**Job Growth in Coyote Valley**	x						
	Job Shift from Coyote Valley		x	x	x	x	x	x
	Opportunity Housing Near Transit			x	x		x	x
	O.H. in SFR Citywide				x		x	x
Environmental	**Emp/DU GROWTH in Flood Zones**	x	x					x
	Emp/DU GROWTH in Fire Zones	x	x					x
	Emp/DU GROWTH in Riparian Areas							
	Emp/DU GROWTH in Sea Level Rise Areas	x	x	x	x			x
	Emp/DU GROWTH in Greenfield Sites	x						X^5
Urban Retreat	**Remove Emp/DU from Flood Zones**					x	X^1	
	Remove Emp/DU from Fire Zones					x	X^2	
	Remove Emp/DU from Riparian Areas					x	X^3	
	Remove Emp/DU from Sea Level Rise Areas					x	X^4	
	Remove Emp/DU from Large Opportunity Sites					x	x	

X^1 - Civic facilities and underutilized light and heavy industrial revert to NWL

X^2 - Civic facilities, golf courses, and residential on 10 acres or more revert to NWL

X^3 - Heavy and light industrial revert to NWL, civic uses restore and retreat from lands within 100ft riparian buffer

X^4 - Civic facilities, and underutilized uses of all types revert to NWL

X^5 - Only sites located within General Plan Planned Growth Areas

Figure 28: Scenario Policy Assumptions

Current Reference Case (Scenario 1)

The General Plan includes a "preferred scenario" for urban growth through 2040 based on currently adopted policies. Scenario 1 serves as a basis-of-comparison that models growth in projected growth areas that are governed by General Plan land use designations, including northern Coyote Valley. Development densities were calibrated based on observed development activity within each General Plan Land Use category. Projects listed in the City's pipeline report[16] were painted in this scenario to reflect development that is likely to proceed regardless of policy changes.

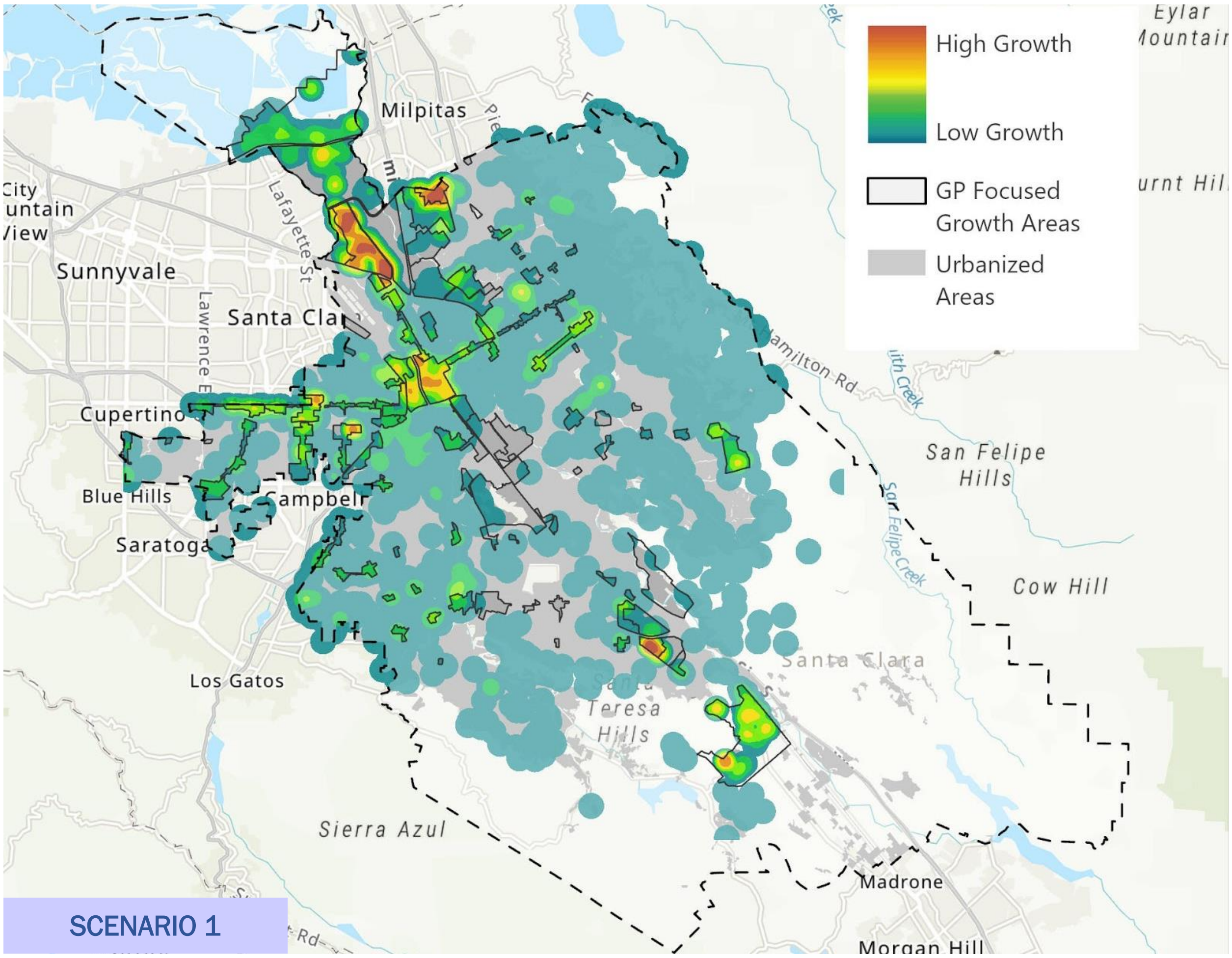


Figure 29: Map of Future Growth Intensity, Current Reference Case (Scenario 1)

Policy Test Scenarios

General Plans are policy documents that evolve over time. On-going policy discussions and state mandates will likely result in new policies, plan amendments, and updates in the coming years, including through the General Plan Four Year Update process that is currently underway. To account for potential shifts in City policy, the NWL analysis includes "policy test" land use scenarios that test policies currently being considered by the City of San José. The intent of these scenarios is not to be prescriptive, but rather to provide guidance to policymakers as they consider changes to the General Plan that could impact the efficacy of NWL strategies.

[16] (City of San José, Planning, Building, and Code Enforcement, 2020)

Scenario 2A: Greenfield Conservation

Scenario 2A uses scenario 1 as a starting point, but shifts jobs in accordance with proposed changes to the General Plan being considered as part of the plan's 4-year update. These changes propose removal of jobs from the Almaden, Alum Rock, Berryessa, Cambrian/Pioneer, and Coyote planning areas, and reallocation of those jobs to the Downtown/Central and Alviso planning areas. In addition, it also allows for significantly higher densities for properties with long range plan designations of "Downtown" to reflect the potential impact of a carbon credit program. Finally, scenario 2A assumes no parking requirements within high-quality transit areas (HQTAs) and lower parking ratios throughout the City. Any parcels listed in the City's pipeline report were painted in this scenario to account for development that is likely to proceed regardless of future policy changes.

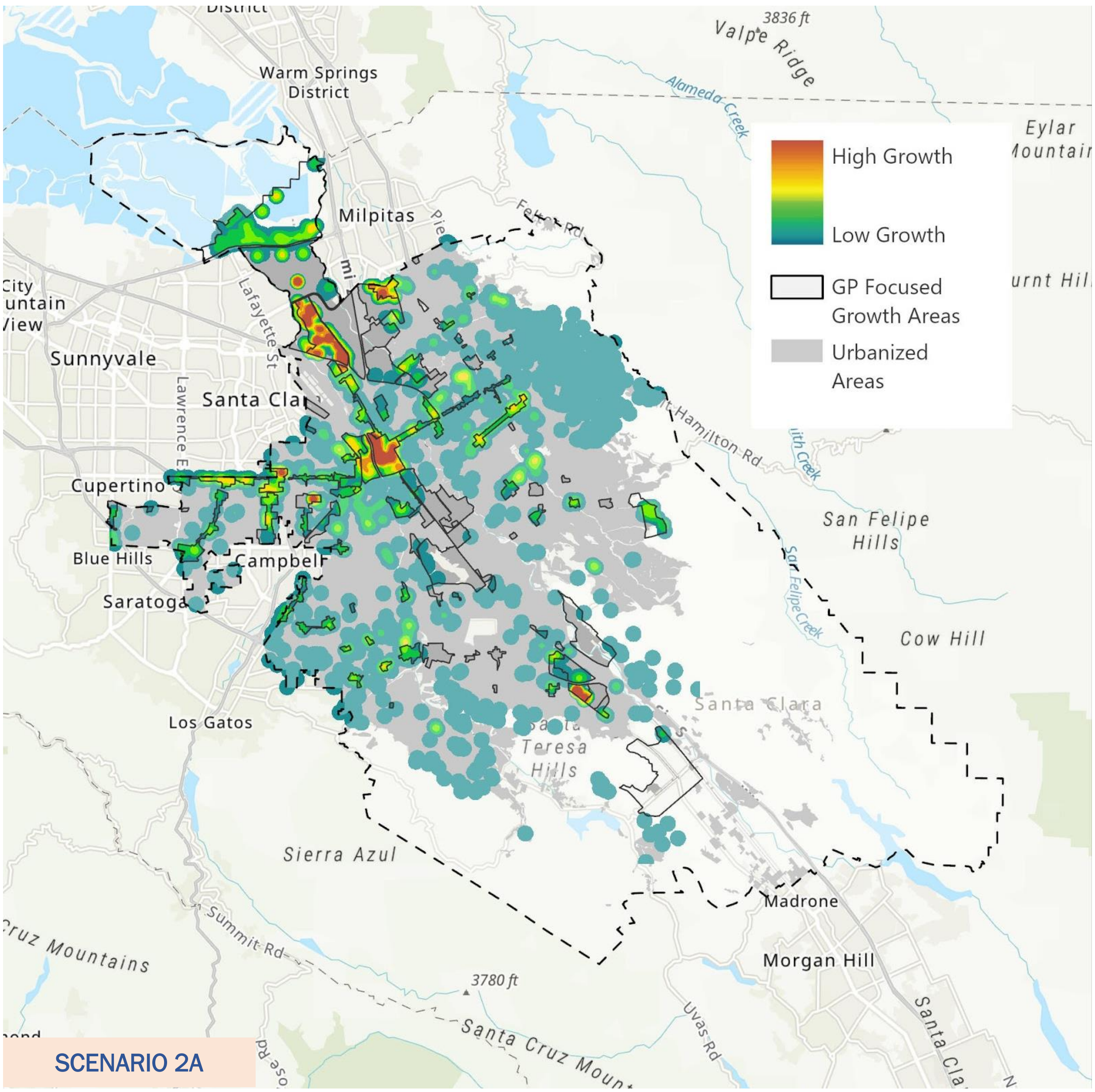


Figure 30: Map of Future Growth Intensity, Scenario 2A

Scenario 2B: Opportunity Housing in HQTAs

Like scenario 2A, scenario 2B assumes job shifts out of Coyote and other planning areas and reduced parking ratios as scenario 2A. Where it differs is in its allowance of opportunity housing in high quality transit areas (HQTAs). Opportunity housing includes all middle housing types such as plexes, cottage clusters, and stacked flats. Resulting increases in housing units above SOI control totals were then re-balanced by removing growth in greenfield areas outside the existing urbanized area. Any parcels listed in the City's pipeline report were painted in this scenario to account for development that is likely to proceed regardless of future policy changes.

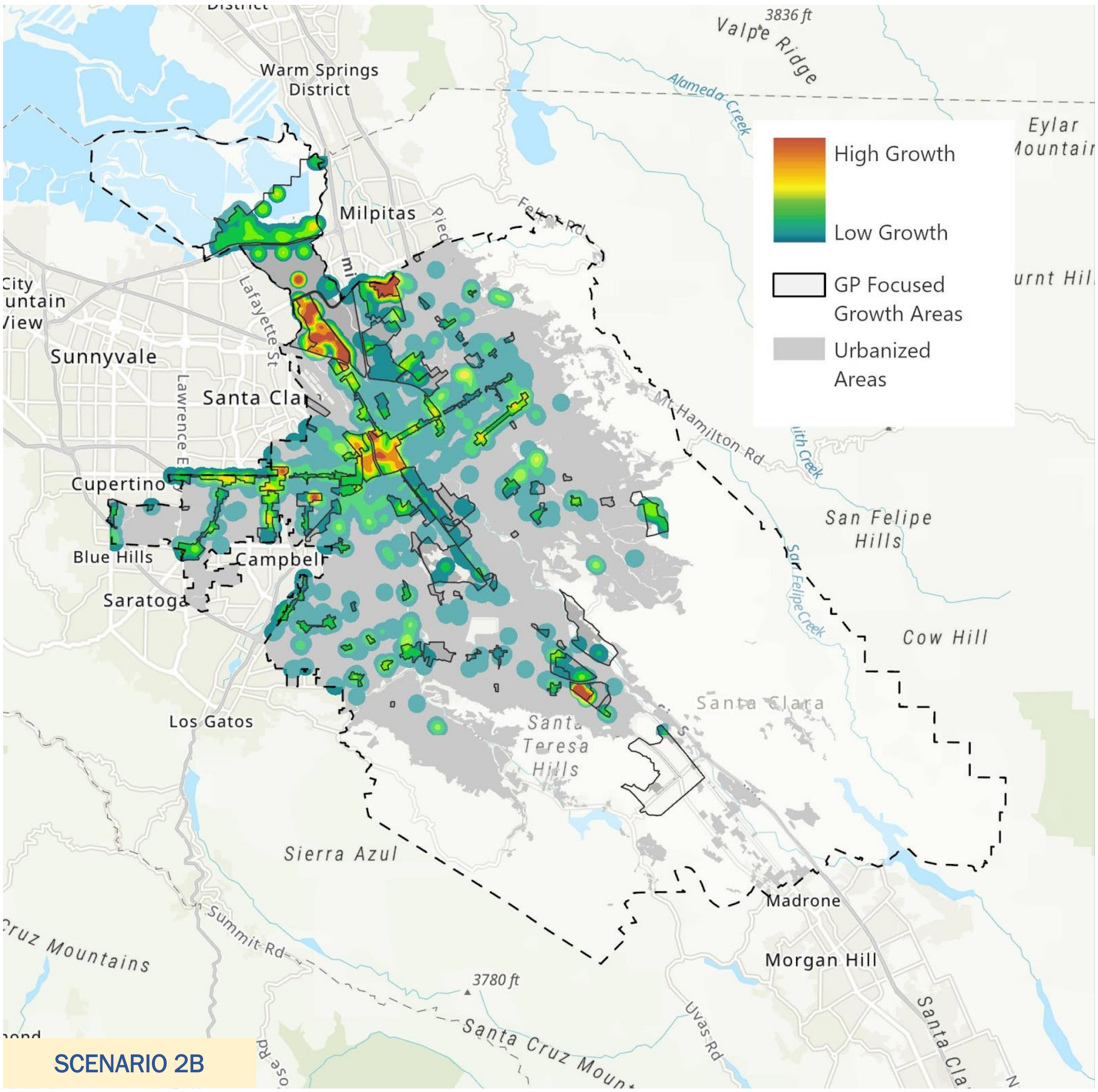


Figure 31: Map of Future Growth Intensity, Scenario 2B

Scenario 2C: Opportunity Housing City-Wide

As in scenario 2B, scenario 2C allows for Opportunity Housing (~36 units/acre) in HQTAs and Regional & Local Transit Urban Villages. Lower density Opportunity Housing (~23 units/acre) was then painted in residential areas that were not in FEMA-defined flood zones or USFS defined high to very high wildfire hazard areas citywide. Like scenario 2B, excess growth above control totals was rebalanced by removing growth in greenfield areas. Any parcels listed in the City's pipeline report were painted in this scenario to account for development that is likely to proceed regardless of future policy changes.

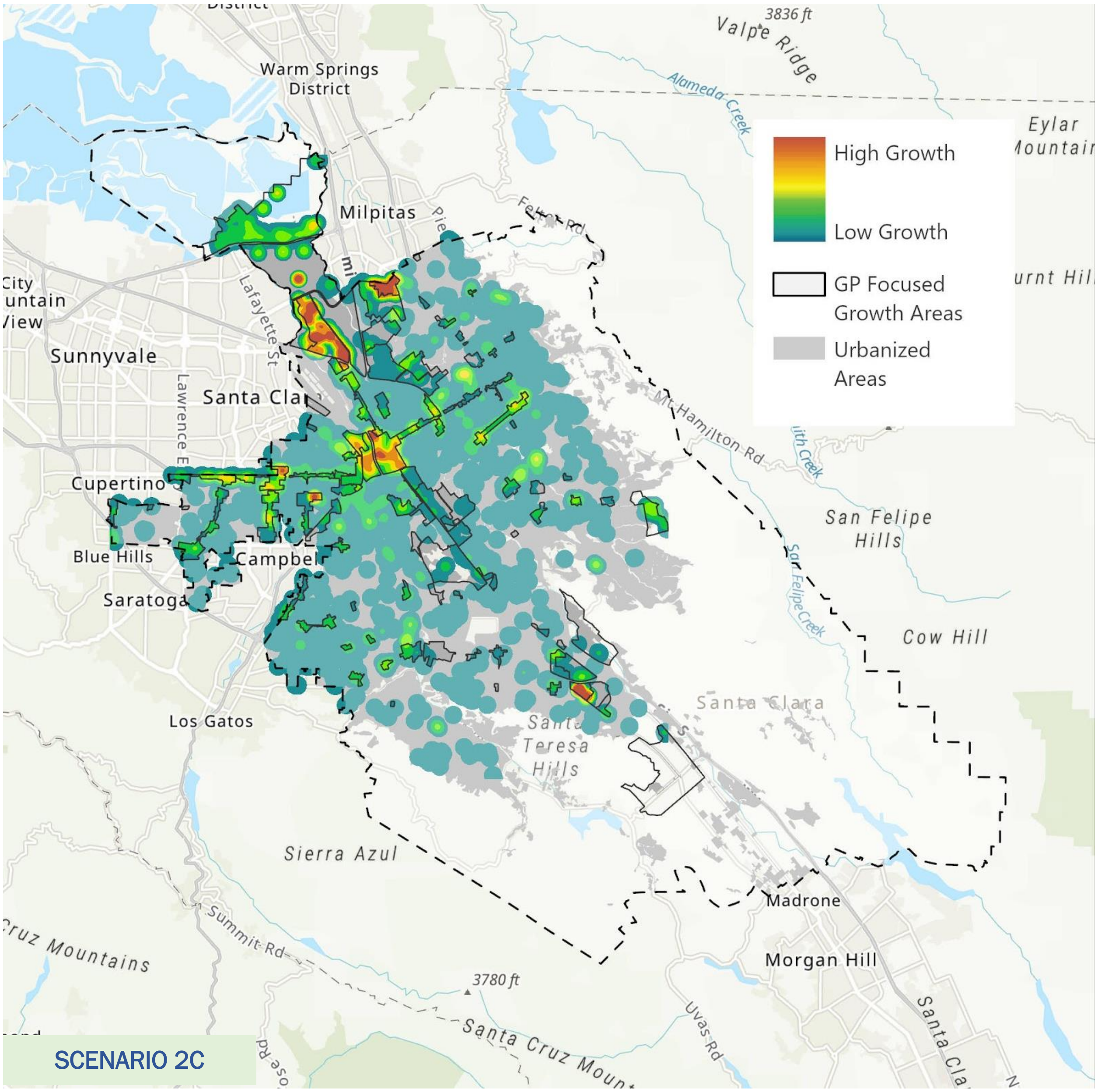


Figure 32: Map of Future Growth Intensity, Scenario 2C

Scenario 2D: Maximum NWL Expansion

The "Maximum NWL Expansion" scenario explores the impacts that widespread urban retreat could have on NWL strategy performance and other co-benefits. It does so by removing development in the following hazard/environmental impact areas: flood hazard zones, areas of wildfire risk, riparian areas, and areas of potential 10-foot sea level rise. To take their place, areas of sea level rise were assumed to be restored as saline wetlands (baylands), flood hazard areas were restored as urban forests, and riparian and fire hazard areas were restored to their underlying historical ecology. Though politically and financially unrealistic, this "what if" scenario provides insights into the potential benefits of urban retreat. It begs the question – what could a more rational and realistic urban retreat policy look like? For more information on the assumptions underlying "maximum" urban retreat, see **Section D: Analysis Methods and Assumptions.**

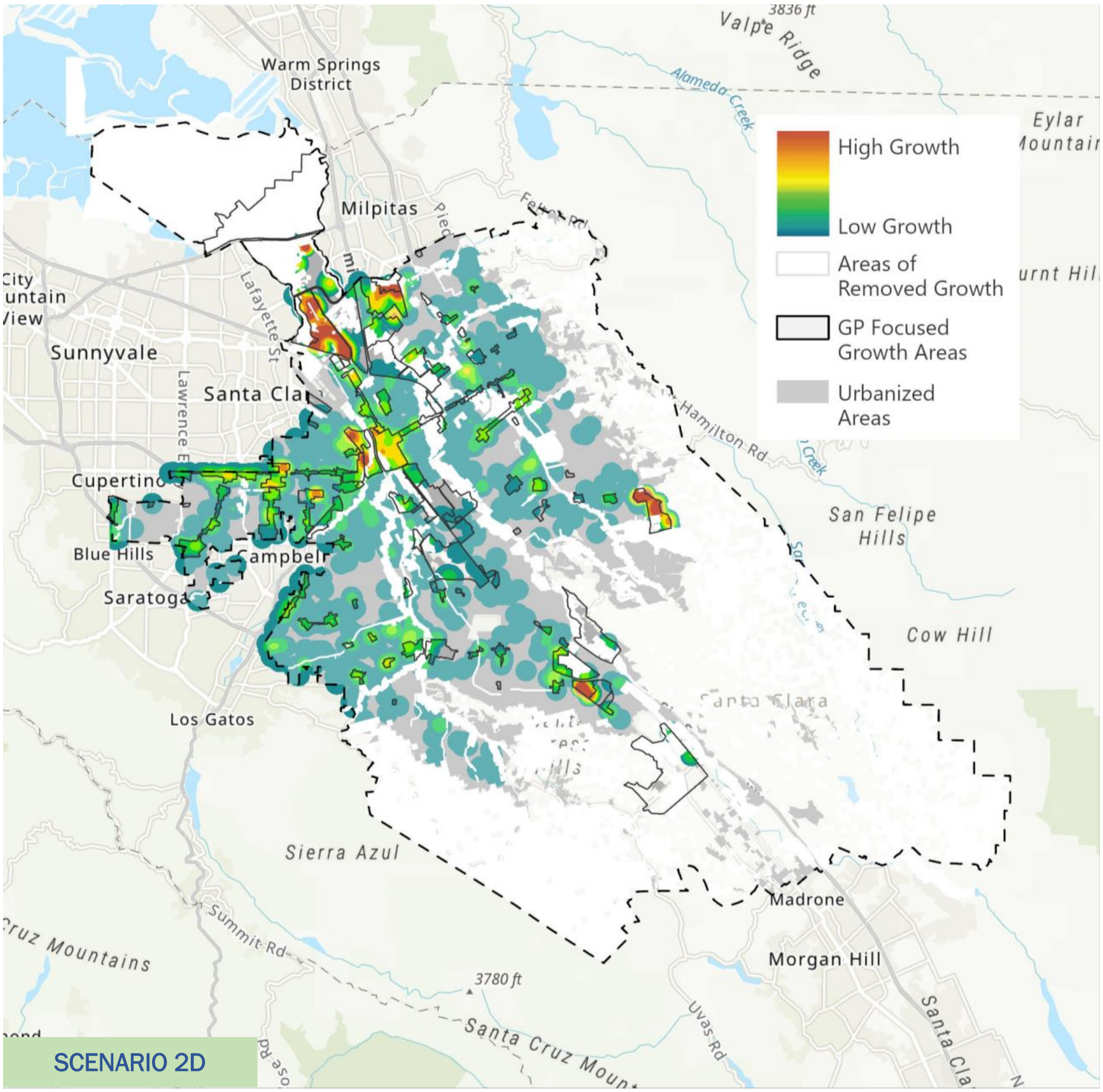


Figure 33: Map of Future Growth Intensity, Scenario 2D

Scenario 2E: Moderate NWL Expansion

The "Moderate NWL Expansion" scenario takes the "Maximum NWL Expansion" scenario as a starting point, but attempts to balance the benefits of urban retreat against its potential costs. These costs, discussed further in the next section, are both societal and fiscal. Societal costs include the intangible impact of displacement and the political will needed to carry out voluntary urban retreat in a sensitive manner. Fiscal costs are simply the costs of acquiring and reverting urbanized lands to their natural state. Urban retreat was greatly scaled back in this scenario to minimize displacement of dwelling units and jobs while maximizing the land area protected from future hazards. For more information on the assumptions underlying "moderate" urban retreat, see **Section D: Analysis Methods and Assumptions.**

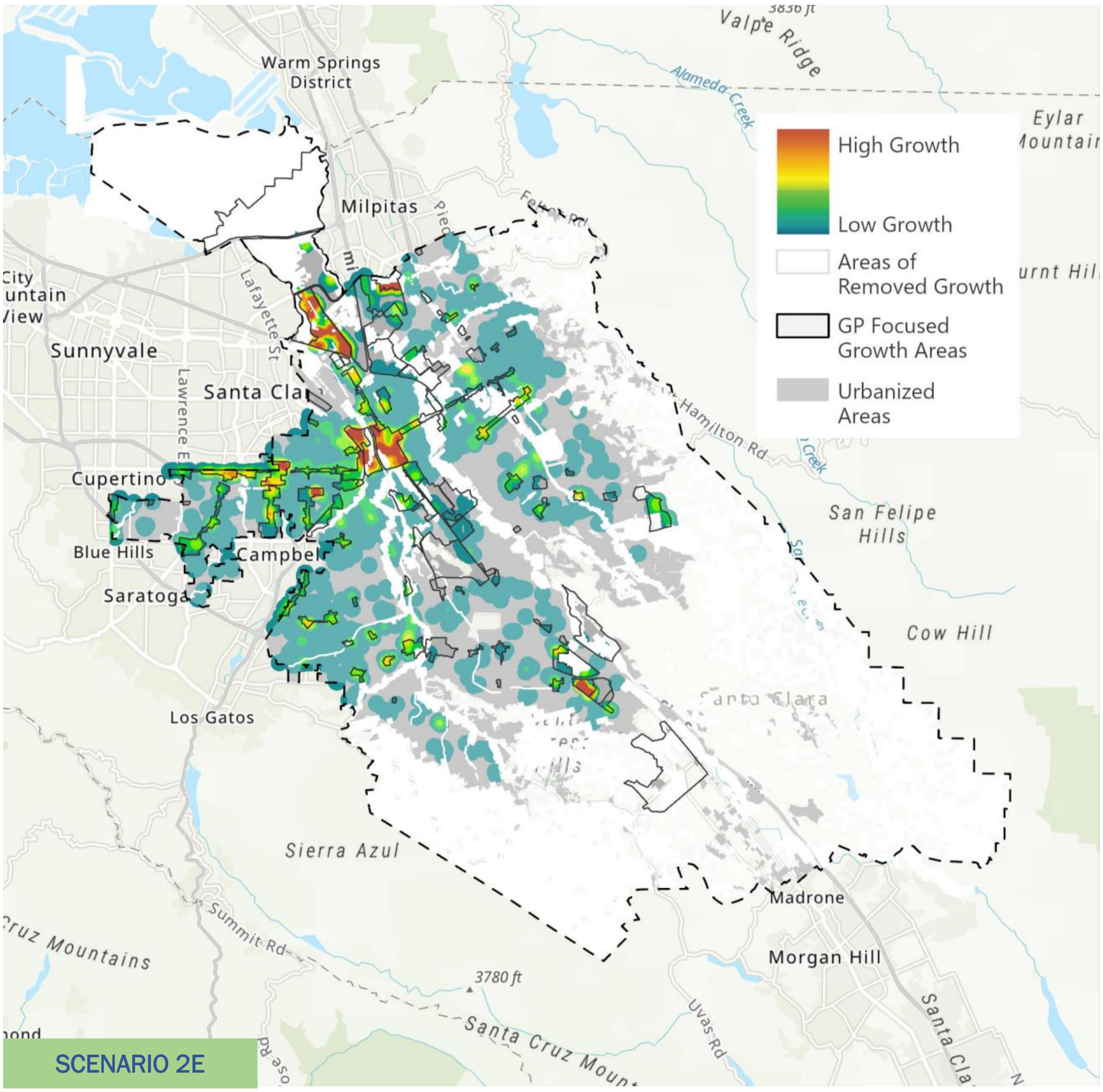


Figure 34: Map of Future Growth Intensity, Scenario 2E

Future Reference Case (Scenario 3)

Scenario 3 represents the most recent set of recommended policy amendments from the General Plan Update Task Force to the Envision 2040 General Plan, through November 2020[17]. The intent of this scenario is to serve as an updated reference case and show the impact of policies likely to be adopted on land availability for NWL strategies. It is not a "preferred" scenario, rather it provides a reference against which to judge the efficacy of the policies analyzed in the "policy test" scenarios. By doing so, it will make it easier to separate the benefit of NWL strategies from land use policies which may or may not be adopted in the future.

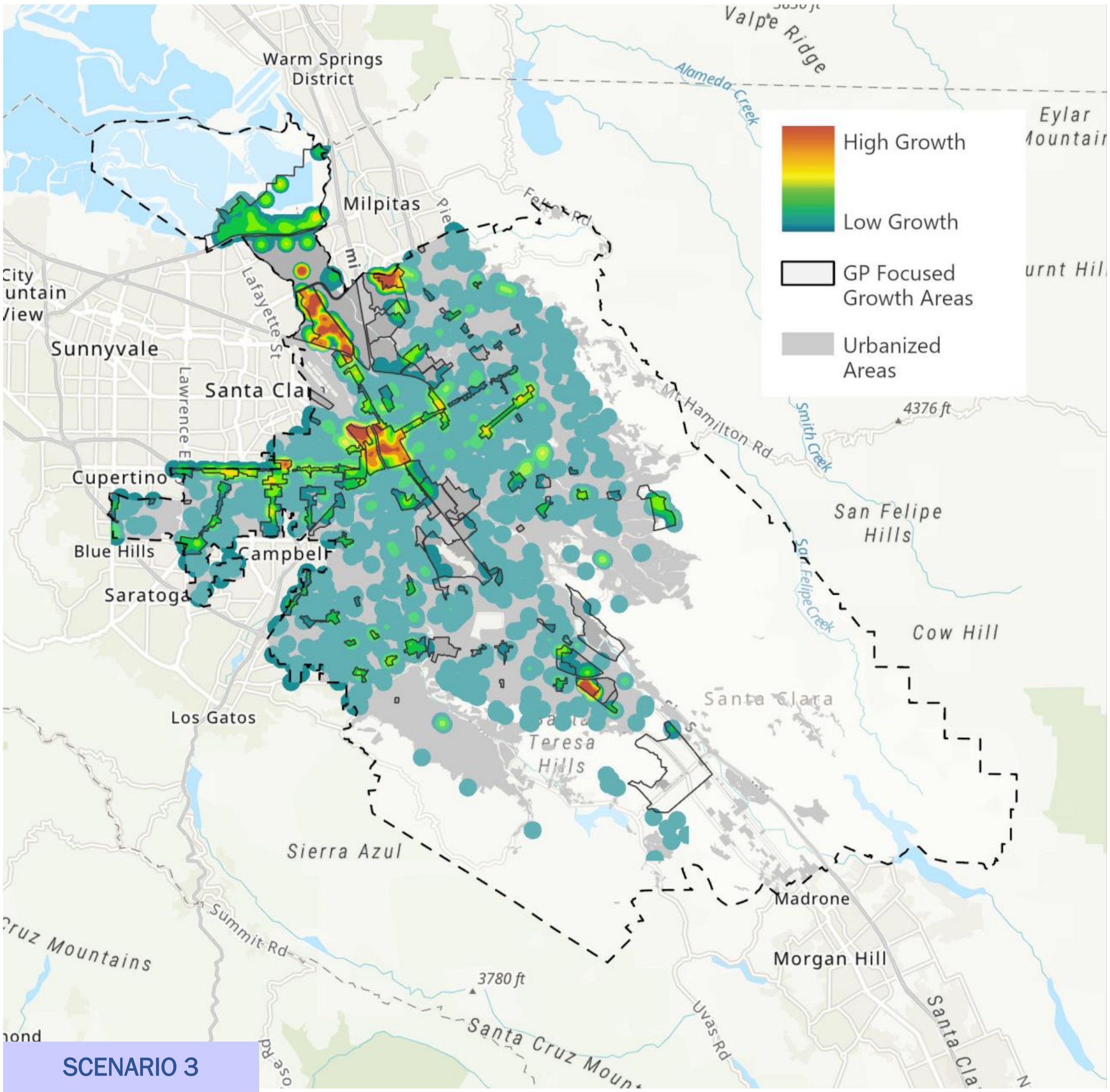


Figure 35: Map of Future Growth Intensity, Scenario 3

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[17] (City of San José, 2020)

Scenario Evaluation and Key Findings

Scenarios were evaluated using UrbanFootprint Analysis Modules as well as the I-Tree model and a custom-built strategy evaluation model. For more information on the assumptions and calibration that was undertaken in the use of these models, see **Section D: Analysis Methods and Assumptions.**

While the NWL analysis was primarily focused on assessing the carbon sequestration potential of selected NWL strategies given land use policies, sequestration is not and should not be the only factor driving policy adoption. Sound land use policy should be evaluated through a wide-ranging lens in order to understand its potential impacts on General Plan priorities such as fiscal health, equity, and transportation. To address this, the evaluation of the seven land use policy scenarios includes twelve metrics that cover a broad range of topics including:

- Greenhouse Gas Emissions
- Criteria Pollutant Emissions
- NWL Land Availability
- Fire Hazard Impacts
- Groundwater Recharge Potential
- Gentrification and Displacement Risk
- Fiscal Revenue
- Habitat Connectivity
- Carbon Sequestration Potential
- Terrestrial Habitat Preservation
- Vehicle Miles Traveled
- Flood Impacts

Control Totals

Each of the seven scenarios were controlled to roughly the same dwelling unit and job totals within the SOI to match growth assumptions of 429,352 dwelling units and 751,672 jobs in the Envision 2040 General Plan[18].

	Existing Condition (2019)	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Population	1,050,663	1,314,194	1,314,347	1,313,295	1,313,530	1,310,411	1,314,199	1,315,159
Jobs	435,725	751,213	751,967	751,868	751,509	751,414	751,660	751,694
Dwelling Units	330,214	428,743	429,593	429,661	429,393	429,488	429,660	429,895

Figure 36: Control Total Results

Greenhouse Gas Emissions

Greenhouse gas emissions include emissions of carbon dioxide, methane, and nitrous oxide and other gasses known to contribute to climate change. Greenhouse gas emissions were measured across the scenarios using UrbanFootprint's Emissions Module[19], assuming future average fuel economy of 35 miles per gallon[20]. As the table below shows, by far the lowest vehicle emissions are achieved in the two urban retreat scenarios: 2D and 2E. Compared to the "General Plan As

[18] (City of San José, 2020)
[19] (U.S. Environmental Protection Agency, 2017)
[20] (UrbanFootprint, 2019)

Adopted" scenario, scenario 2D achieves a reduction equivalent to taking roughly 45,000 cars off the road[21]. This is due primarily to two factors: higher densities of new development needed to accommodate both future population and existing population previously housed within sensitive or hazardous areas and the removal of urbanized uses from areas of the SOI where vehicle miles traveled (VMT) tends to be higher. Note: building energy emissions take the renewable energy portfolio of the San José Clean Energy Program into account.

	Scenario 1: General Plan As Adopted	**Scenario 2A:** Greenfield Conservation	**Scenario 2B:** Opportunity Housing in HQTAs	**Scenario 2C** Opportunity Housing City-Wide	**Scenario 2D:** Maximum NWL Expansion	**Scenario 2E:** Moderate NWL Expansion	**Scenario 3:** General Plan Taskforce Policies
Passenger Vehicle Emissions (MT CO2e)	2,016,529	1,975,720	1,929,714	1,948,298	1,864,695	1,887,517	1,969,720
Building Energy Emissions (MT CO2e)	1,260,598	1,264,667	1,251,117	1,251,731	1,209,264	1,250,590	1,257,363
Water Delivery Emissions (MT CO2e)	62,172	59,485	60,209	60,307	56,938	58,059	58,636
Total	**3,339,299**	**3,299,872**	**3,241,040**	**3,260,336**	**3,130,897**	**3,196,166**	**3,285,719**

Figure 37: Annual Metric Tons of CO_2e produced in the horizon year, by source

Criteria Pollutant Emissions

Criteria pollutants are air pollutants that are known to be health hazards and were defined by the EPA under the Clean Air Act[22]. UrbanFootprint measures certain criteria pollutants resulting from transportation including nitrogen oxides (NO_x), particulate matter (PM2.5 and PM10), sulfur oxides (SO_x), carbon monoxide (CO), and volatile organic compounds (VOCs)[23]. Again, as development becomes increasingly compact (scenarios 2A through 2C), criteria pollutants generally decrease as trips get shorter. The lowest criteria pollutant emissions are exhibited by scenarios 2D and 2E which further concentrate growth and remove existing development from higher VMT areas.

	Existing Condition (2019)	**Scenario 1:** General Plan As Adopted	**Scenario 2A:** Greenfield Conservation	**Scenario 2B:** Opportunity Housing in HQTAs	**Scenario 2C** Opportunity Housing City-Wide	**Scenario 2D:** Maximum NWL Expansion	**Scenario 2E:** Moderate NWL Expansion	**Scenario 3:** General Plan Taskforce Policies
NOx Emissions	939	1,149	1,126	1,100	1,110	1,063	1,076	1,122
PM10 Emissions	305	373	366	357	360	345	349	364
PM2.5 Emissions	129	158	154	151	152	146	147	154
SOx Emissions	23	28	28	27	27	26	27	28
CO Emissions	9,312	11,394	11,163	10,903	11,008	10,536	10,665	11,129
VOC Emissions	1,127	1,378	1,351	1,319	1,332	1,275	1,290	1,346
Total	**11,834**	**14,480**	**14,187**	**13,857**	**13,991**	**13,390**	**13,554**	**14,144**

Figure 38: Annual Passenger Vehicle Pollutant Emissions by Type, metric ton / year

[21] (U.S. Environmental Protection Agency, 2020)
[22] (U.S. Environmental Protection Agency, 2015)
[23] (UrbanFootprint, 2019)

Vehicle Miles Traveled

The vehicle miles traveled (VMT) metric was estimated using UrbanFootprint's Transport Module[24]. It uses multiple factors, including land use and accessibility factors, to predict travel behavior. As the following table shows, VMT tends to decrease with more compact development patterns, which is well-documented in academic literature[25]. The two scenarios with the lowest VMT are those that include urban retreat (scenarios 2D and 2E). This is due to the fact that they not only require higher densities to accommodate growth, but they also remove existing development from high VMT areas.

	Existing Condition (2019)	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Average Daily VMT	15,797,233	19,535,133	19,081,138	18,599,525	18,801,469	17,969,508	18,126,859	19,023,380
VMT per Service Population	10.6	9.5	9.2	9.0	9.1	8.7	8.8	9.2

Figure 39: Average Daily VMT, Total and Per Service Population

Groundwater Recharge Potential

Groundwater recharge refers to the re-entry of rainwater into the aquifer through deep drainage or percolation through the soil. Groundwater comprises about 20 percent of the Bay Area's water supply and is used for human consumption as well as agriculture[26]. It faces numerous threats from industrial spills and runoff to reductions in pervious surfaces through increased urbanization. The quality of San José's groundwater is of particular concern due to increased saltwater intrusion from the San Francisco Bay.

Groundwater recharge potential was measured using UrbanFootprint's Conservation Module, which was developed in partnership with the Nature Conservancy[27]. As the following table shows, scenarios 1, 2a, 2b, 2c, and 3 all result in net reductions to groundwater recharge potential. This is because, as the City of San José grows, new development is likely to negatively impact recharge potential through the addition of impervious surfaces. However, those scenarios that exhibit compact infill development tend to exhibit the smallest negative impacts (scenario 2B and 2C). Note also that the two urban retreat scenarios provide a net increase in groundwater recharge potential – this is due to their removal and reversion of some existing urbanized land to a natural state.

	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Net Change in Recharge Potential (Ac.-Ft.)	-330	-66	-34	-34	1,107	316	-66

Figure 40: Net Annual Change in Groundwater Recharge Potential (Acre-Feet)

[24] (UrbanFootprint, 2019)
[25] (Cervero & Ewing, 2010)
[26] (California Water Boards, 2020)
[27] (UrbanFootprint, 2018)

Terrestrial Habitat Preservation

San José's SOI includes habitat for several endangered species including the California Tiger Salamander, Bay Checkerspot Butterfly, and the San Joaquin Kit Fox as well as numerous species classified as threatened. Continued urbanization threatens these species, but growth and preservation need not be mutually exclusive. Like the groundwater recharge metric, impacts to terrestrial habitat for threatened and endangered species were measured using UrbanFootprint's Conservation Module. As the results in the table below show, compact growth and infill-focused policies can help minimize degradation of critical habitats for species of concern. In addition, urban retreat has the potential to greatly expand the habitat available for these species.

	Scenario 1: General Plan As Adopted	**Scenario 2A:** Greenfield Conservation	**Scenario 2B:** Opportunity Housing in HQTAs	**Scenario 2C** Opportunity Housing City-Wide	**Scenario 2D:** Maximum NWL Expansion	**Scenario 2E:** Moderate NWL Expansion	**Scenario 3:** General Plan Taskforce Policies
Degraded Area	190	88	40	43	-	-	91
Improved Area	-	-	-	-	2,397	1,257	-

Figure 41: Habitat Change: Threatened and Endangered Species, acres

Habitat Connectivity

Habitat connectivity is critical to allow the natural movement of animals to food and water sources and between increasingly separated patches of habitat. Acres of high species movement potential, areas that provide critical connections to disparate areas of habitat, were used as a proxy for habitat connectivity. They were measured relative to changing urbanized land use patterns using Urban Footprint's Conservation Module. Much like the terrestrial habitat metric shown above, more compact development patterns in scenarios 2B and 2C minimize disruption to these areas. It is important to also understand that large increases in both urban retreat scenarios are the result of restoration of key corridors, particularly riparian areas and floodways, that represent major improvements to species movement potential.

	Scenario 1: General Plan As Adopted	**Scenario 2A:** Greenfield Conservation	**Scenario 2B:** Opportunity Housing in HQTAs	**Scenario 2C** Opportunity Housing City-Wide	**Scenario 2D:** Maximum NWL Expansion	**Scenario 2E:** Moderate NWL Expansion	**Scenario 3:** General Plan Taskforce Policies
Acres of High Species Movement Potential	-347	-257	-90	-90	9,101	3,969	-255

Figure 42: Net Change in Species Movement Potential, acres

Fire Hazard Impacts

As the 2020 wildfire season showed, wildfires are growing increasingly more frequent and volatile due to climate change. In addition, continued urban expansion into the wildland-urban interface, means greater potential for loss of life and property. Hillside areas in San José's SOI are extremely fire prone and their historical plant communities, such as oak woodlands, grew accustomed to frequent fire events[28]. As these lands have been encroached upon by urban development, a regime

[28] (Holmes, Veblen, Young, & Berry, 2006)

of fire suppression has contributed to the growing severity of fires. As the following table shows, the currently adopted General Plan allows significant growth in fire prone areas of the SOI. While more restrictions on development in these areas coupled with Infill strategies can reduce the number of units exposed to fire hazards in the future, the large number of existing dwelling units in these areas can only be impacted through urban retreat and voluntary buyouts.

	Existing Condition (2019)	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Dwelling Units Within	1,792	4,130	2,543	1,792	1,885	1,175	1,719	1,993
Dwelling Units Removed	0	0	0	0	0	617	73	0

Figure 43: Units at Risk and Removed from Fire Hazard Areas (USDA Wildfire Hazard Potential, "High" or "Very High" designation)

Flood Hazard Impacts

Continuing with the theme of hazards, flood hazards were measured using UrbanFootprint's Risk and Resilience Module[29]. Two types of flood hazards were measured: floodways and areas potentially impacted by sea level rise. The metric summarized in the table below combines both flood types. Currently, there are approximately 25,000 dwelling units within both risk categories. The following table shows that the currently adopted General Plan could allow for a near doubling of the number of units within these hazard areas. This is largely due to growth allocated to the Alviso planning area which is currently at risk of flooding if sea levels rise by 10 feet. It should be noted that this assumption does not consider construction of a sea wall to protect the northern portion of the SOI.

	Existing Condition (2019)	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Dwelling Units Within	24,915	42,885	43,848	34,925	30,879	208	20,848	42,645
Dwelling Units Removed	-	-	-	-	-	24,707	4,067	-

Figure 44: Units at Risk and Removed from Flood Hazard Areas (10 Ft Sea Level Rise and Floodways)

Fiscal Revenue

Fiscal revenue represents the annual property tax revenue received in each scenario in the horizon year (2040). It was estimated using UrbanFootprint's Fiscal Revenue Module, calibrated to San José market conditions. Though the total residential and commercial property tax revenues are highest in scenario 1, that scenario exhibits the lowest revenue per acre. Revenue per acre, or revenue density, is a proxy for fiscal health – more compact development patterns generally cost less to serve with infrastructure, so greater concentrations of revenue likely yield lower costs of service[30].

[29] (UrbanFootprint, 2020)
[30] (Strong Towns, 2018)

	Existing Condition (2019)	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Total Property Tax Revenue	$2.90 Billion	$4.12 Billion	$4.07 Billion	$4.06 Billion	$4.09 Billion	$4.05 Billion	$4.07 Billion	$4.08 Billion
Revenue per Urbanized Acre	$33,631	$41,326	$44,796	$47,089	$47,374	$65,151	$55,346	$46,958

Figure 45: Commercial and Residential Property Tax (Total and per Acre) in the Horizon Year (2040)

Gentrification and Displacement Risk

Assessing gentrification and displacement risk related to land use policies is complex and requires a multifaceted approach. For this study, displacement impacts were measured based on observed rates to displacement from redevelopment on existing developed parcels. Gentrification impacts were measured based on the income needed to "afford" the average home in each scenario[31]. Finally, additional elements of the typical household budget were estimated including transportation and utility costs.

	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Existing Dwelling Units on Newly Developed Parcels	6,439	5,001	4,681	5,603	5,439	5,194	6,147
Income Needed to Afford the Average New Home	$108,811	$105,789	$90,798	$92,809	$86,767	$91,532	$98,808
Annual Passenger Vehicle Costs per Household	$10,635	$10,644	$10,383	$10,472	$9,955	$10,242	$10,589
Annual Residential Building Energy Costs per Household	$1,534	$1,527	$1,515	$1,515	$1,481	$1,514	$1,521
Annual Residential Water Costs per Household	$748	$677	$638	$640	$622	$638	$649

Figure 46: Selected Gentrification and Displacement Risk Metrics

As the preceding table shows, even scenarios that concentrate growth exhibit high numbers of displaced units. While not as high as the adopted General Plan, scenario 2C sheds light on one of

[31] (U.S. Dept. of Housing and Urban Development, 2017)

the potential challenges with allowing higher density housing in single-family neighborhoods citywide. Moreover, the urban retreat scenarios (2D and 2E) require significant redevelopment on existing developed parcels to accommodate shifted and new growth within the SOI. Clearly, any strategy dealing with infill or urban retreat needs to include a thorough analysis of its displacement impacts and anti-displacement strategies need to be part of the policy package.

Regarding housing and other household costs, the story is very different. Those scenarios that exhibit the most compact development also exhibit the lowest housing, transportation, and utility costs. This is due to two factors: unit sizes and location efficiency. Compact development, including opportunity housing, tends to produce units that are more valuable per square foot than traditional detached single-family housing, but less expensive overall. In addition, the concentration of growth in low VMT areas mean the more infill-focused scenarios allow households to take shorter trips and access a wider range of transportation options.

NWL Land Availability

Land availability for NWLs was measured using UrbanFootprint's Conservation Module. As mentioned previously, many land use policies have an indirect impact on NWLs even if that is not their direct intent. These include policies that focus growth in specific areas, enable compact development, or conversely, promote auto-oriented development in greenfield locations. As the table below shows, the currently adopted General Plan expands the developed lands at the expense of NWLs. As scenarios get more infill-focused, these net changes in land cover become less pronounced. Only with urban retreat do developed acres revert to natural uses as can be seen in scenarios 2D and 2E.

	Scenario 1: General Plan As Adopted	**Scenario 2A:** Greenfield Conservation	**Scenario 2B:** Opportunity Housing in HQTAs	**Scenario 2C** Opportunity Housing City-Wide	**Scenario 2D:** Maximum NWL Expansion	**Scenario 2E:** Moderate NWL Expansion	**Scenario 3:** General Plan Taskforce Policies
Developed Acres	1,423	564	278	288	-9,333	-3,891	576
Natural Acres	-543	-348	-117	-126	10,065	4,427	-360
Agricultural Acres	-880	-216	-161	-162	0	0	-217

Figure 47: Net Change in Land Cover, by Type

NWL Carbon Sequestration Potential

The potential carbon sequestration over the General Plan's planning horizon (2021 – 2040) was estimated using UrbanFootprint and the NWL Strategy Model developed for this study. This estimate assumes maximum application of the highest performing NWL strategy in all applicable locations within the SOI given land availability in each scenario. In addition, this metric includes a 5% increase in carbon stocks on non-urbanized lands where no strategy was deemed applicable such as private yards or urban landscaping.

The table below summarizes carbon sequestration potential from NWLs in two ways: total carbon sequestration and sequestration as a percent of 20-year vehicle emissions. The second metric considers both the land available for NWL strategies and the emissions associated with VMT in each scenario. For more information about the assumptions associated with this metric and the NWL Strategy Model, see **Section D: Analysis Methods and Assumptions.**

As the table below shows, carbon sequestration potential is related to land availability for NWL strategies which is least impacted when infill-focused policies are implemented. Moreover, urban retreat has the potential to greatly increase the lands available to NWLs, thus increasing carbon sequestration overall. It should also be noted that the General Plan Taskforce Policies scenario (scenario 3) represents a significant improvement over the currently adopted General Plan as it includes many of the infill-focused policies exhibited by scenarios 2A – 2C.

	Scenario 1: General Plan As Adopted	**Scenario 2A:** Greenfield Conservation	**Scenario 2B:** Opportunity Housing in HQTAs	**Scenario 2C** Opportunity Housing City-Wide	**Scenario 2D:** Maximum NWL Expansion	**Scenario 2E:** Moderate NWL Expansion	**Scenario 3:** General Plan Taskforce Policies
20-Year Passenger Vehicle Emissions (MT CO2e)	48.7 Million	48.3 Million	47.8 Million	48.0 Million	47.1 Million	47.3 Million	48.2 Million
20-Year Building Energy Emissions (MT CO2e)	24.3 Million	24.4 Million	24.2 Million	24.3 Million	23.8 Million	24.2 Million	24.3 Million
20-Year Water Delivery Emissions (MT CO2e)	1.4 Million	1.3 Million	1.3 Million	1.3 Million	1.3 Million	1.3 Million	1.3 Million
20-Year Vehicle, Building, and Water, Emissions (MT CO2e)	**74.4 Million**	**74.0 Million**	**73.4 Million**	**73.6 Million**	**72.2 Million**	**72.9 Million**	**73.8 Million**
20-Year Carbon Seq. Potential from NWLs (MT CO2e)	4.8 Million	5.9 Million	6.4 Million	6.4 Million	9.2 Million	8.2 Million	6.9 Million
Percent of 20-Year Vehicle, Building, and Water, Emissions	**6.4%**	**8.0%**	**8.7%**	**8.6%**	**12.7%**	**11.2%**	**9.3%**

Figure 48: Carbon Sequestration Potential of NWLs in the San José SOI

As previously mentioned, ensuring that land use policies consider the NWL value of land is critical to its ability to deliver carbon sequestration benefits to the region. As the figure below shows, it is possible to reduce NWL loss entirely through progressive land use policies such as opportunity housing, lower parking requirements, increased entitlements in key locations such as Downtown, and greenfield conservation. In addition, through urban retreat, it is possible to create an even larger pool of NWL lands than exist today.

Figure 49: Change in Land Availability Relative to Existing Conditions by Scenario and Strategy.[32]

Maximizing San José's NWLs

Given the benefits of strategies analyzed in this report and their land availability, it is possible to estimate maximum potential footprint of NWLs within the SOI. The map below lays out a vision for San José's NWLs that can coexist with the city's future as a growing metropolis. The first key to achieving this vision is minimizing loss of existing NWLs. As we have shown, this can be achieved through infill-focused strategies such as opportunity housing and greenfield conservation. The other element that would be required to realize this "maximum NWL" future is urban retreat. As we learned from San José's historical ecology, riparian corridors, marshes, and native grasslands all once existed where our urban landscape is today. A key to unlocking the potential of that landscape, while saving harm to lives and property, is the voluntary removal of urbanized land uses from areas of sea level rise impact, flooding, and wildfire risk. However, consideration of such measures would require further evaluation of emissions impacts (e.g. displacement and equity concerns, jobs and transportation impacts) in order to ensure full knowledge of the ramifications. A first step in that process would be avoiding future development in hazard areas.

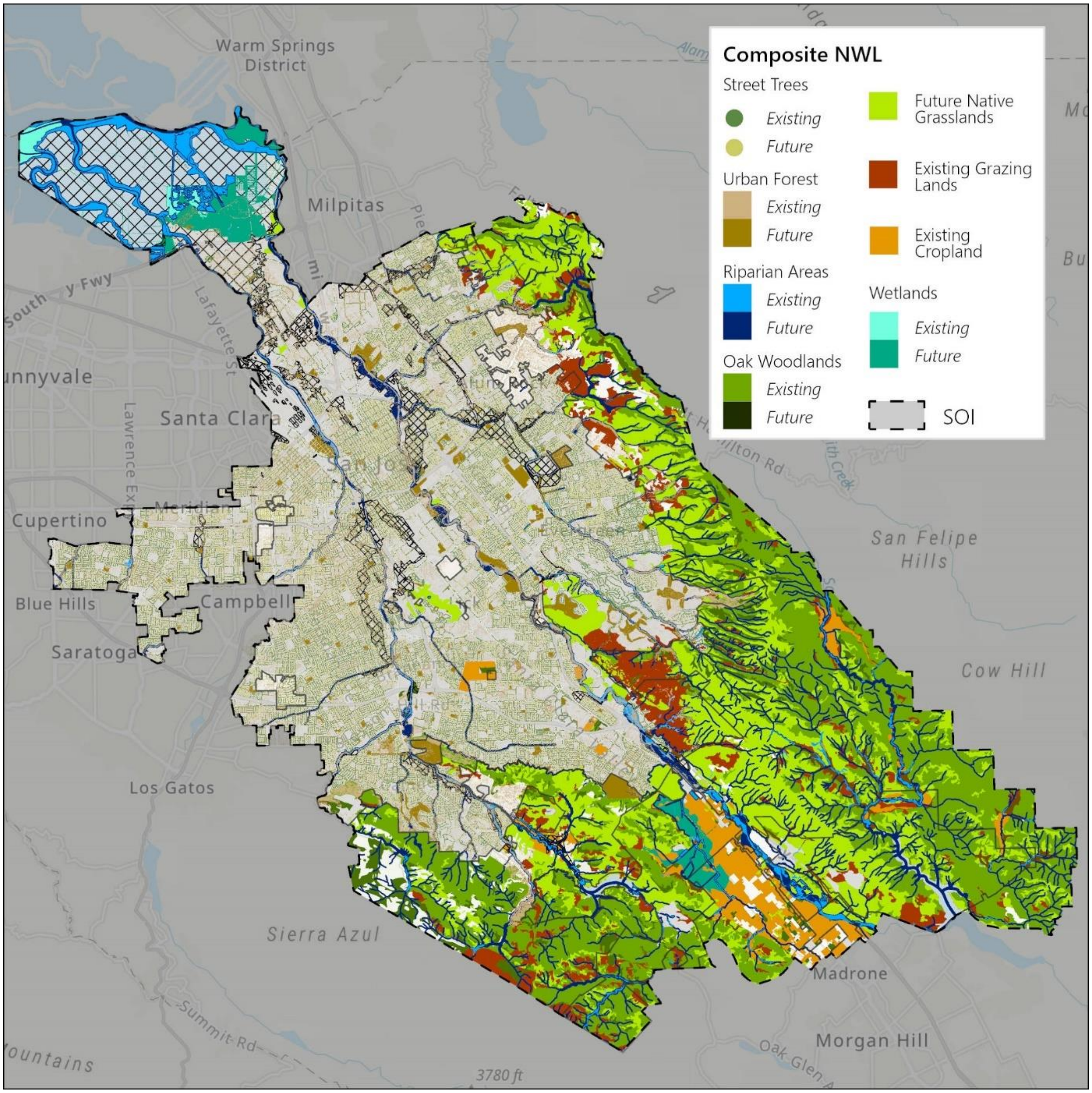


Figure 50: Maximum Composite NWL Application, San José SOI

Land Use Policy Recommendations

As the preceding section showed, land use policies have a significant impact on the sequestration potential of NWLs as well as a range of other critical co-benefits. In terms of every metric analyzed, the policies being considered as part of the 4-year General Plan update appear to provide significant benefits over the currently adopted General Plan. However, several of the policies included in as "policy test" scenarios that are listed below are not currently being considered as part of the update and show promise for additional sequestration and other co-benefits. Clearly there is more work to be done in the arenas of land use policy and NWL strategies.

Opportunity Housing

As was demonstrated through the scenarios in the preceding section, opportunity housing has the potential to provide significant benefits across a range of topic areas. As a method to encourage infill and help the City of San José reach its housing production goals, it is a clear winner. Successful implementation of this policy will mean greater housing options for current and future residents, and potentially lower demand for housing on greenfield land that could reduce the supply of NWLs. However, it is critical that the displacement impacts of such a policy be thoroughly analyzed, especially if it is to be implemented broadly across the City. With strong anti-displacement policies, opportunity housing has the potential to produce new market-rate housing at a variety of price points while reducing VMT and GHG emissions.

Greenfield Conservation

Greenfield development opportunities are becoming increasingly rare in San José's SOI. Given the region's rapid growth, it is safe to assume that most greenfield sites will develop if allowed to do so by the General Plan. As the scenarios have shown, development of areas such as Coyote Valley for jobs or housing could push San José off course for meeting its climate, housing, and fiscal goals. While the City is taking proactive steps to preserve NWLs in Coyote Valley, numerous other greenfield sites with high NWL potential remain in jeopardy. Existing entitlements on those sites may make reducing their developability challenging, so the City and its partners should explore opportunities to acquire these lands to protect them in perpetuity.

Location Efficiency

With the policies currently being considered as part of the 4-Year General Plan update, the City of San José is already beginning to guide growth to lower VMT areas. These areas, such as Regional Transit Station Areas, Local Transit Urban Villages, and Downtown, are "location efficient". This means they provide close access to daily destinations and jobs so that residents and workers take shorter trips and have more transportation options. General Plan land use designations and zoning regulations such as height, FAR, density, setbacks, and parking should be adjusted to allow these areas to develop at the highest densities the market is willing to deliver to maximize their ability to absorb future residents and jobs.

Enabling Infill Development

While the General Plan already identifies infill development as a goal, numerous barriers continue to make infill development challenging. Greenfield development will continue to remain viable if infill development provides greater risk and cost to developers. Parking requirements have a major impact on the feasibility of small-scale infill developments, particularly in areas where underground parking is too expensive to build. Moreover, aging infrastructure in infill locations means infill developers are often presented with high infrastructure costs that are difficult to predict. In order to meet the goals set forth in the General Plan, the City should explore ways to lower barriers to infill development through district infrastructure studies, enhanced infrastructure financing districts (EIFDs), and gap financing in the form of low interest loans or tax abatements.

Urban Retreat

As the scenarios showed, urban retreat has the potential to provide wide-ranging benefits. These benefits would accrue not only in the form of carbon sequestration, but also in terms of air and water quality, VMT reductions, and lower housing costs. However, there are costs associated with urban retreat that are social and fiscal. Social costs include the displacement of legacy businesses and long-time homeowners, many of whom have deep connections to their homes and places of work. It should be recognized that racist lending practices such as red lining may have contributed to the disproportionate settlement of communities of color in areas of flood risk, sea level rise impact, and elevated fire hazards. Because urban retreat would likely be voluntary, fiscal costs would be incurred to purchase homes and businesses in sensitive areas at fair market values. More in-depth analysis would need to be done to determine the social, fiscal, and environmental implications of an urban retreat strategy before it can be considered as a City policy option.

Long-Term Sequestration Benefits

The benefits of NWL strategies should be calculated over a very long term, ideally 200 years. Many strategies, including some considered in this study, require decades of even centuries to fully mature. While these strategies provide less up-front benefit in terms of carbon sequestration, their potential long-term benefits are significant and should be quantified appropriately. As we have shown in the scenario modeling, maximizing NWLs across a range of land use scenarios can mitigate greenhouse gas emissions from anywhere between 6% and 11.7%. Variance depends on both how much land is available for NWL preservation, expansion, and enhancement, and on the location efficiency of new development.

NWL Strategy Costs

This study has provided a detailed analysis of the carbon sequestration benefits of various NWL strategies. These strategies were evaluated based on their ability to sequester carbon and the total sequestration benefit they pose for San José's SOI give land availability now and in the future. To-date, this analysis has not considered the costs of implementing such strategies. Weighing the costs against the potential benefits of each strategy will be an important step to implementing a robust NWL preservation and management program. Moreover, costs per Mg of carbon are a central metric in the Climate Smart San José plan and will be needed to fully incorporate this work into the update of the CSSJ plan.

Recommendations for Further Study

The Natural and Working Lands Element – Technical Report covers the benefits of preservation, expansion, and enhancement of San José's NWLs. Through this work, two recommendations were developed for future phases of work:

Integrate Findings With CSSJ

Climate Smart San José (CSSJ) is slated for a 5-year update in the 2021 – 2023 timeframe. The work contained in this report should be directly integrated into CSSJ as one of the plan strategies to help the City meet its climate goals. An analysis of the costs associated with NWL strategies should be included in this effort so that a full "return on investment" accounting can be done as is already the case with other strategies in CSSJ.

Study Equity Impacts

Equity impacts are alluded to in this work, but more analysis and outreach is needed to fully understand the impacts – positive and negative – associated with NWL enhancement, expansion, preservation, and land use strategies. It is recommended that equity indicators be developed in partnership with the City of San José and stakeholders in environmental justice communities.

SECTION D: Analysis Methods/Assumptions

The following section details the analytical approach and methods used to estimate sequestration potential and land availability of NWL strategies and their total carbon benefit within San José's SOI.

Existing Carbon

To fully understand the sequestration benefits of NWLs and the impacts of NWL enhancement strategies, it is necessary to have a full accounting of existing carbon sequestered in soil and non-soil biomass. It should be noted that base year carbon is only a snapshot of the carbon embodied in soil and biomass at the time of measurement. Embodied carbon is constantly in flux as plants grow or die and properties of the soil change. Carbon stock and carbon stock change is still an emerging science with a constantly developing body of literature, so estimates come with some uncertainty.

Soil Carbon

The total amount of carbon stored in soils within San José's SOI was estimated using the Soil Properties and Class 100m Grids dataset, a combination of three datasets: the NCSS Characterization Database, the National Soil Information System (NASIS), and the Rapid Carbon Assessment (RaCA) dataset. These datasets were combined with remote sensing images and detailed conventional soil polygon maps, and used to generate complete-coverage gridded predictions of soil properties (percent organic carbon, total nitrogen, bulk density, pH, and percent sand and clay) and classes (taxonomic great group and particle size in the control section).[33]

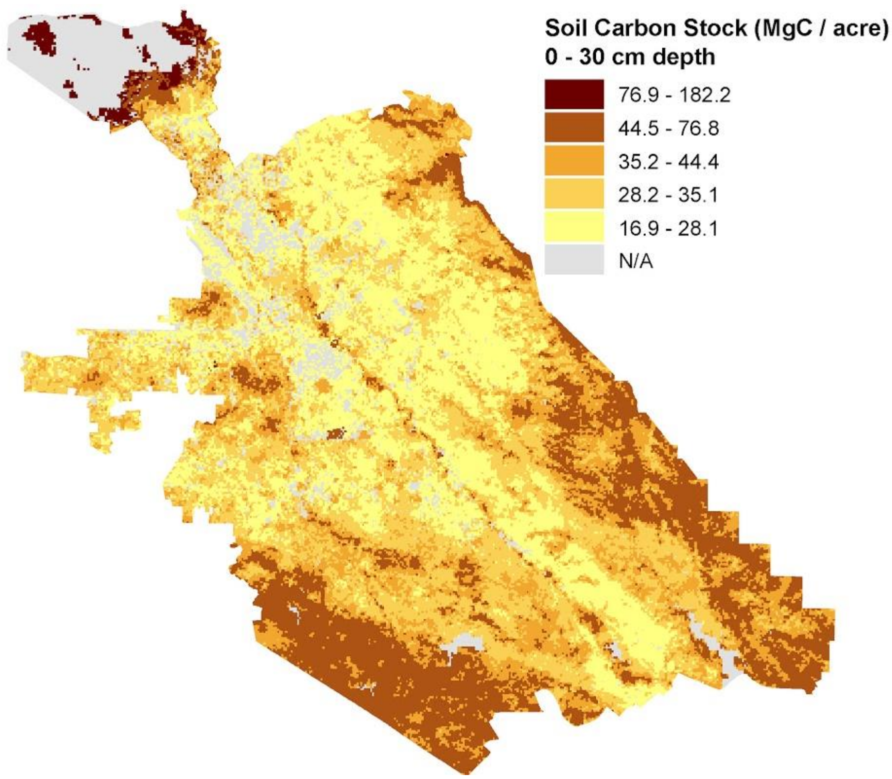


Figure 51: Soil carbon stock density based on the Soil Properties and Class 100m Grids dataset for the San José SOI.

[33] (Ramcharan, et al., 2017)

Non-Soil Carbon

Non-soil carbon includes above-ground biomass and below-ground root stock. For the purposes of this analysis, embodied carbon in other above-ground forms, such as buildings and vehicles, was not included. Existing non-soil carbon was modeled using multiple data sources to develop a detailed composite land coverage. Land cover designations were then related to non-soil carbon densities (carbon per acre) from TerraCount.

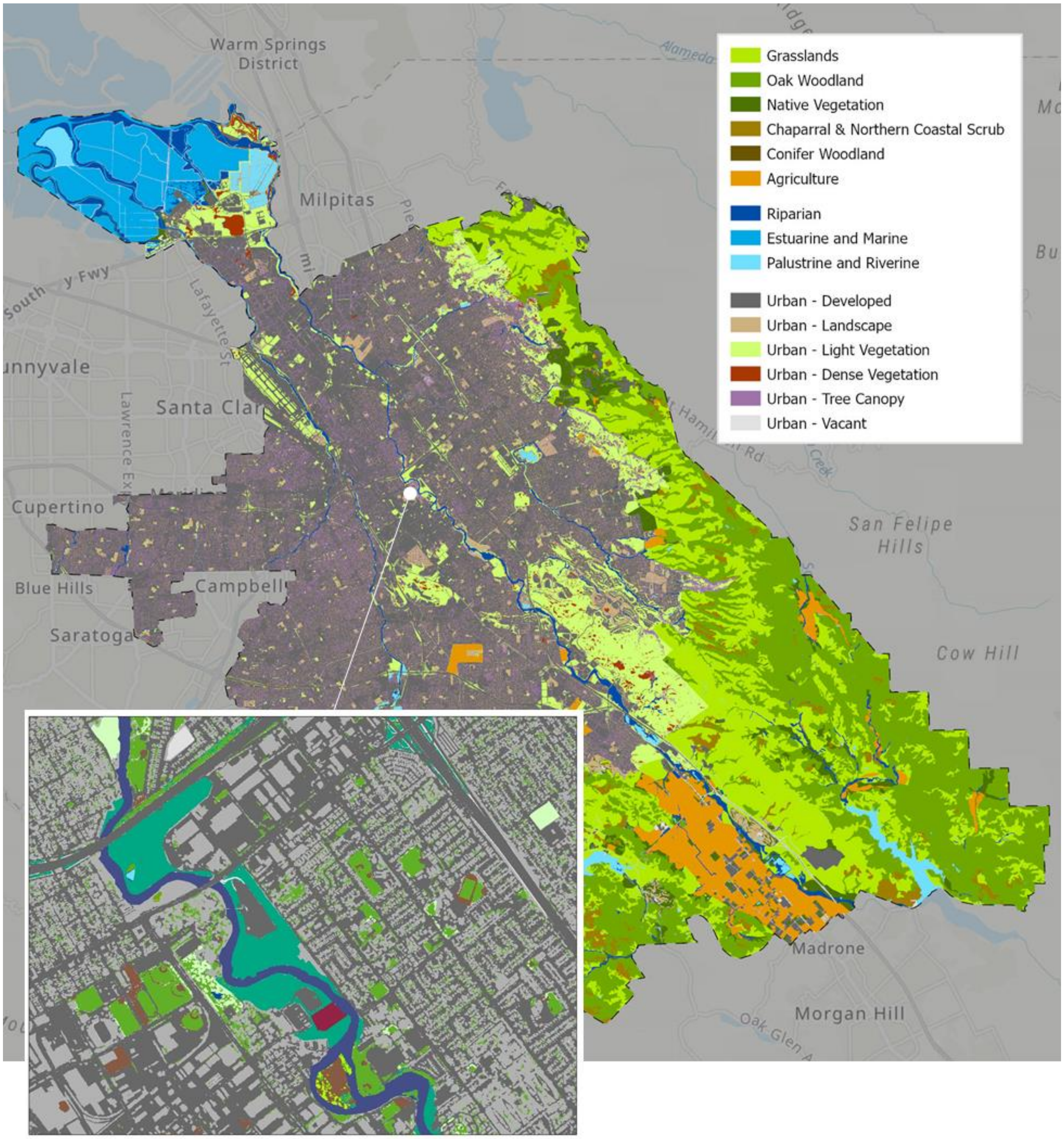


Figure 52: Composite Non-Soil Carbon Dataset

The extent of vegetative land cover comes from these data sources (see Table 2 in Appendix 1 for additional information on data sources):

- The Department of Water Resources (DWR) 2014 Land Use Survey, to identify native riparian areas and other vegetative lands outside the city's urbanized areas where the Santa Clara Valley Habitat Agency Land Cover dataset is missing data.
- The Santa Clara County 2018 Important Farmland Mapping & Monitoring Program (FMMP), to identify agricultural lands within the SOI.
- LANDFIRE, to derive percentages for weighting the carbon sequestration rates for the native vegetation category from the DWR data into forested areas, shrubland, and grassland.
- The LIDAR-derived tree dataset from the 2012 San José Canopy Study, to parse the urbanized area categories into buildings & other non-vegetated areas, separate from grasses, shrubs, or trees.
- The Santa Clara Valley Habitat Agency Land Cover dataset, to identify areas outside the city's urbanized area and DWR defined agricultural lands.
- The California Aquatic Resource Inventory (CARI) statewide California Wetland Monitoring Workgroup (CWMW), to identify wetlands.

Areas outside of the urbanized area, riparian areas, agricultural lands and wetlands are identified by overlapping the DWR and the Santa Clara Valley Habitat Agency Land Cover datasets.

The table below summarizes datasets used to construct the composite land cover layer and the methodology used to resolve conflicts between overlapping layers.

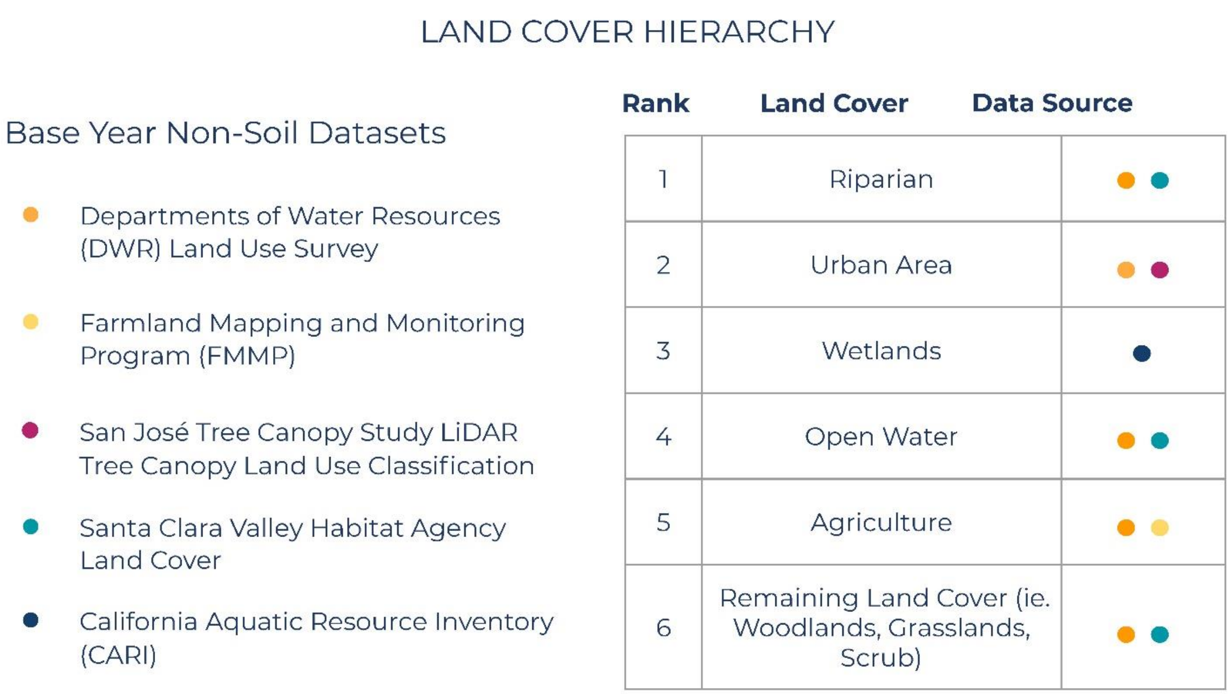


Figure 53: Composite Land Cover Sources and Hierarchy

For each land cover type identified through the five datasets listed above, carbon stock densities (Mc C / Acre) were estimated based on the Carb 01 table included in the Resilient Merced TerraCount analysis. Those determinations were made as shown in the table below.

Land Cover Database	Database Attributes	Land Cover Equivalent from Carb01
Santa Clara Valley Habitat Agency Land Cover Dataset	Chaparral & Northern Coastal Scrub	Southern California Coastal Scrub
	Conifer Woodland	Central and Southern California Mixed Evergreen Woodland
	Grasslands	Grasslands
	Oak Woodland	California Central Valley Mixed Oak Savanna
	Open Water (Aquatic)	Water - Open Water
	Riparian Forest and Scrub	Inter-Mountain Basins Montane Riparian Shrubland
	Wetland	Wetland
FMMP	Farmland of Statewide Important	Mix based on DWR
	Farmland of Local Importance	Mix based on DWR
	Prime Farmland	Mix based on DWR
	Unique Farmland	Mix based on DWR
	Farmland of Local Potential	Mix based on DWR
DWR	Native - Barren	Barren
	Native - Riparian	Mix: Riparian Woodlands (50%), Riparian Shrubland (50%)
	Native - Vegetation	Mix based on LANDFIRE
	Urban	Urban - Developed
	Urban Commercial	Urban - Developed
	Urban Industrial	Urban - Developed
	Urban Landscape	Urban - Developed
	Urban Residential	Urban - Developed
	Urban Vacant	Urban - Developed
Tree Canopy LIDAR	Asphalt	Urban - Developed
	Building	Urban - Developed
	Concrete	Urban - Developed
	Dense Veg	Mix: Woodlands (75%), Shrubland (25%)
	Light Veg	Mix: Shrubland (25%), Grassland (75%)
	Dirt	Barren
	Tree Canopy	Nowak's carbon estimate per canopy area[1]
	Water	Water - Open Water
	Grass	Xu and Baldocchi's carbon estimate of exotic annual grasslands[2]
SFEI Wetlands (CARI)	Fluvial Channel	Wetland
	Lake, Reservoir and associated vegetation	Water - Open Water
	Playa	Water - Open Water
	Pond	Water - Open Water
	Pond and associated vegetation	Water - Open Water
	Subtidal Water	Wetland
	Tidal Channel	Wetland
	Tidal Flat	Wetland
	Tidal Marsh	Wetland

[1] *Nowak, D. J., Greenfield, E. J., Hoehn, R. E., & Lapoint, E. (2013). Carbon storage and sequestration by trees in urban and community areas of the United States. Environmental Pollution, 178, 229–236. https://doi.org/10.1016/j.envpol.2013.03.019*

[2] *Xu, L., D.D. Baldocchi. (2004). Seasonal variation in carbon dioxide exchange over a Mediterranean annual grassland in California. Agricultural and Forest Meteorology, 123:79-96.*

Figure 54: Land cover mapping categories and associated data sources. Note: existing / Base Year Mapping categories come from the Carb 01 table, with the exception of LIDAR Tree Canopy and Grass categories.

Total Existing Carbon

Based on the land cover and soil types analyzed in the previous sections and the TerraCount relationships established, the following table summarizes carbon density and total carbon stocks for soil and non-soil carbon sources within the San José SOI.

Land Cover Type	Carbon Stock Density (Mg C / Acre)	Acres	Total Carbon Stock (Mg C)
Agriculture	2.4	5,908	14,121
Chaparral & Northern Coastal Scr	15.8	3,959	62,394
Conifer Woodland	45	1	47
Dense Vegetation	36.5	1,344	49,023
Estuarine and Marine	1.2	5,082	6,173
Grasslands	0.2	23,906	4,925
Light Vegetation	2.7	13,059	34,761
Native Vegetation	35	6,393	223,979
Oak Woodland	40.4	31,921	1,288,631
Palustrine and Riverine	1.2	1,568	1,905
Riparian	30.4	4,710	143,215
Urban - Developed	-	58,890	-
Urban - Landscape	0.2	9,245	1,721
Urban - Tree Canopy	36.5	11,995	437,411
Urban -Vacant	0.2	588	109
Water	-	1,970	-
Soils			5,149,563

Figure 55: Total Existing Carbon by Soil or Land Cover Type, San José SOI

NWL Strategies Assumptions

The Project Management Team (PMT) and Technical Advisory Committee (TAC) worked with the project team to identify twelve NWL strategies to test for potential effectiveness at carbon sequestration and/or emissions reductions. Each of the twelve strategies is modeled independently, with results combined with the base-year existing carbon assessment to produce a full accounting of existing and potential future carbon sequestration. These strategies do not represent an exhaustive list of carbon sequestration strategies, and other strategies, particularly some carbon farming strategies, exist and could be modeled in future work.

Strategies may involve rehabilitating existing sets of degraded lands by planting additional trees and vegetation to increase biome health and therefore carbon sequestration. For instance, riparian areas exist currently, but are largely in a degraded state; the riparian restoration strategy involves returning riparian areas to a more natural condition involving complete ecosystems. Strategies may also be applied to new lands that are not currently functioning as natural or working lands. An example of this is street tree planting; currently, there are many opportunity sites where street trees could be planted, that currently have little to no vegetation of any sort, and certainly no trees. The area to which many strategies are applied thus may expand over time as a function of the application of the strategy. For more details on data sources used for land application assumptions, see **Appendix C: NWL Strategy Data Sources.**

Class B Biosolids

Strategy Definition

Biosolids are a product/residual from the wastewater treatment process. This strategy is designed for Class B biosolids application only. To account for certain distance requirements set by the State Water Resources Control Board, it was assumed that biosolids can only be applied to 80% of the total lands suitable for application.

Application

Class B biosolids are restricted from being applied to any lands immediately accessible to the public or grazing animals. They can only be applied to croplands growing crops not meant for direct human consumption. Unfortunately, the FMMP data used to identify croplands in the Santa Clara Valley do not distinguish cropland cover types. As a result, the biosolids strategy is applied as a dial-up strategy to all cropland types with the understanding that the overall calculated carbon sequestration benefit of biosolids application is overestimated.

According to the State Water Resources Control Board Water Quality Order 2004 -0012 - DWQ[34], biosolids application areas shall be at least:

- 10 feet from property lines,
- 500 feet from domestic water supply wells
- 100 feet from non-domestic water supply wells
- 50 feet from public roads and occupied onsite residences
- 100 feet from surface waters, including wetlands, creeks, ponds, marshes,
- 33 feet from primary agricultural drainage ways,
- 500 feet from occupied non-agricultural buildings and off-site residences,
- 400 feet from a domestic water supply reservoir,
- 200 feet from a primary tributary to a domestic water supply,
- 2,500 feet from any domestic surface water supply intake, and
- 500 feet from enclosed water bodies that could be occupied by pupfish.

Due to the specificity and lack of available data required to define these constrained areas, estimating the total acreage of suitable lands using spatial data is not feasible. As an alternative, three parcels for agricultural use were chosen as case studies to estimate the approximate percentage of land that would be suitable for biosolids application given the list of constraints. Using satellite imagery, we manually excluded land that would be constrained within each parcel and calculated the total parcel area that was remaining. We concluded that based on the 3 case studies, approximately 80% of each parcel's total area was suitable for biosolids application. As a result, applying biosolids to 80% of total suitable lands was the chosen approach to consider the State Water Resources Control Board Water Quality Order 2004 -0012 requirements. Constraints such as limited vehicle access to application sites and the costs of hauling materials to the sites were not included in this analysis but could be considered in future studies.

Biosolid application geography data sources include:

- Santa Clara County 2018 Important Farmland Mapping & Monitoring Program (FMMP)
- Urban Footprint Base Canvas (to exclude suitable lands from urban areas)

[34] (California State Water Control Board, 2004)

Source of Sequestration Rates

The carbon sequestration resulting from the application of biosolids is calculated based on Thorman, Williams and Chamber's 2009 research on the impact on recycling biosolids to agricultural lands[35]. They use IPCC's 2006 methodology and two alternative methods to estimate nitrous oxide and methane emissions as well as soil carbon storage. The rate (1.94 Mg C / acre) represents an additive or "enhancement" rate that is applied on top of an existing NWL such as croplands.

Underlying Strategy	Sequestration Rate (Mg C/ Acre)	Enhancement Rate (Mg C / Acre)
Croplands	0.30	1.94
Other / Sole Application	0.19[36]	1.94

Compost Application

Strategy Definition

The compost strategy involves both reducing or eliminating petroleum-derived soil amendments and replacing them with organic materials enhancing soil quality. This management strategy is based on carbon cycle science, which shows that petroleum-derived fertilizers are using sequestered carbon, in the form of fossil fuels, and transferring it to the atmosphere, increasing the atmospheric concentration of global warming gases, and the risk of catastrophic climate change. Organic materials, including biosolids, animal manure, compost, and mulch, all represent the re-use of carbon that is already in the atmosphere or otherwise part of the biogenic carbon cycle, and thus do not represent net additions to the level of atmospheric carbon. In addition, the application of organic amendments, such as compost or biosolids, increases soil carbon stocks- at the expense of atmospheric C- when implemented over extended periods.

Application

The composting strategy can be applied as a dial-up to cropland management or grazing land strategies, modeling the impact of applying compost to portions of those lands, as well as open urban space lands. Compost cannot be applied to areas within 100 ft from native riparian habitats, within 50 ft from streams, or areas with serpentine soil or existing high-value native grassland communities.

According to a study of carbon sequestration potential on Santa Clara County grazing lands by the Carbon Cycle Institute, compost cannot be applied to grazing lands with certain slope limitations. Slope was not considered when identifying lands suitable for compost application during this project but should be considered for future refinement of suitable land inventories.

Lands were deemed suitable for compost application under the assumption that the compost applied is pathogen and weed free. Furthermore, constraints such as limited vehicle access to

[35] (Thorman, Williams, & Chambers, 2009)
[36] (Zirkle, Lal, & Augustin, 2011)

application sites and the costs of hauling materials to the sites were not included in this analysis but could be considered in future studies.

Compost application geography data sources include:

- Santa Clara County 2018 Important Farmland Mapping & Monitoring Program (FMMP)
- Santa Clara Valley Habitat Agency Stream Buffers (to exclude land within 50ft from streams)
- City of San José Parks data (queried for urban parks only)
- DWR 2014 Land Use Survey (to exclude lands within existing riparian areas)

Source of Sequestration Rates

The carbon sequestration rates for the nutrient management/composting strategy are calculated based on California Air Resources Board (CARB) methods for quantifying GHG emissions for compost application in California croplands. Carbon sequestration rates for high nitrogen compost differ when applied to annual crops, perennial crops, and grazing lands[37].

These applied rates are additive, increasing carbon sequestration potential of existing lands and land management strategies. It is important to note that carbon sequestration rates that result from cropland and grazing land management strategies are calculated using methods from the Comet Planner evaluation tool while methods of calculating sequestration rates for compost application come from CARB. Further refinement of this strategy would require a reconciliation of both methods to ensure rates are applied appropriately.

Underlying Strategy	Sequestration Rate (Mg C/ Acre)	Enhancement Rate (Mg C / Acre)
Croplands	0.30	4.48
Grazing Lands	0.34	4.69*
Other / Sole Application	0.19	4.48**

*Based on DWR 2014 Land Use Survey identified percent share of perennial and annual croplands

**CARB does not estimate C/CO2 sequestration rates of compost application to urban landscape. Rates for compost application to grazed grasslands is used as a proxy for application to urban landscapes.

Mulching Application

Strategy Definition

The mulching strategy involves the spreading of organic materials on soil as a top dressing. The benefits of mulching include moderating soil temperature, reducing the potential for erosion, enhancing moisture retention in the underlying soil, improved soil structure, and added nutrients from decomposition such as carbon.

[37] (Research Division, Transportation and Toxics Dvision, California Air Resources Board, 2017)

Application

The mulching strategy can be applied as a dial-up to all croplands, modeling the impact of applying mulch to portions of those lands, as well as open urban space lands. Mulch cannot be applied to areas within 100 ft from native riparian communities and areas with serpentine soil or existing high-value native grassland communities.

Lands were deemed suitable for mulch application under the assumption that the mulch applied is pathogens and weed free. Furthermore, constraints such as limits of vehicle access to application sites and the GHG costs of hauling materials to the sites were not included in this analysis but could be considered in future studies.

Mulching application geography data sources include:

- Santa Clara County 2018 Important Farmland Mapping & Monitoring Program (FMMP)
- City of San José Parks data (queried for urban parks only)
- DWR 2014 Land Use Survey (to exclude existing riparian areas from urban parks)

Source of Sequestration Rates

The resulting carbon sequestration/GHG emission reduction numbers from the mulching strategy is calculated based on Comet Planner's conservation practice rates for mulch added to croplands in Santa Clara County[38].

Underlying Strategy	Sequestration Rate (Mg C/ Acre)	Enhancement Rate (Mg C / Acre)
Croplands	0.30	0.21*
Other / Sole Application	0.19	0.21*

*Source Data: C/C02 sequestration rates from Comet Planner - from "Download COMET Planner Results" table

Cropland Management

Strategy Definition

The cropland management strategy includes a package of specific management practices that provide multiple agronomic and environmental benefits beyond carbon sequestration. A mix of five management practices were included in this strategy.

These include:

- Cover Crops
- Strip Cropping
- Conventional Tillage to No Till
- Conservation Crop Rotation
- Conventional Tillage to Reduced Tillage

[38] http://comet-planner.com/

Application

The extent of cropland areas comes from the 2018 SCC Important Farmland Mapping & Monitoring Program (FMMP) dataset.

Cropland management geography data sources include:

- 2018 SCC Important Farmland Mapping & Monitoring Program (FMMP)

Source of Sequestration Rates

The carbon profile benefits of annual and perennial agriculture-specific uses are quantified by carbon sequestration rates from Comet Planner.

Note on annual crops: According to IPCC Chapter 5 'Cropland', the amount of carbon stored in and emitted or removed from permanent cropland depends on crop type, among other factors. Specifically, annual crops (cereals, vegetables) are harvested each year, so there is no long-term storage of carbon in biomass. However, perennial woody vegetation in orchards, vineyards, and agroforestry systems can store significant carbon in long-lived biomass, the amount depending on species type and cultivar, density, growth rates, and harvesting and pruning practices. Carbon stocks in soils can be significant and changes in stocks can occur in conjunction with soil properties and management practices, including crop type and rotation, tillage, drainage, residue management and organic amendments. For this reason, is it important to distinguish whether cropland management strategies are being applied to annual or perennial croplands. Since FMMP does not identify cropland types, the DWR agriculture designated land use types are used as a proxy to establish the annual and perennial share of croplands identified by FMMP.

Mix	Strategy Type	MG CO2/acre/yr
20%	COVER CROPS	0.66
20%	STRIPCROPPING	0.11
20%	CONVENTIONAL TILLAGE TO NO TILL	0.35
20%	CONSERVATION CROP ROTATION	0.26
20%	CONVENTIONAL TILLAGE TO REDUCED TILLAGE	0.12
Blend		**0.3**

Crop Type	%*	Years to Maturity
Perennial	26%	10
Annual	74%	1

*DWR 2014 Land Use Survey identified percent share of perennial and annual croplands

Grazing Land Management

Strategy Definition

Grazing lands are lands where livestock roam and forage on vegetation accessible within a few feet of ground level. Conservation objectives for grazing lands include the provision of improved and sustainable forage, improved soil and water quality, reduced erosion, improved shade for livestock and cover for wildlife, reduction of fire hazards, and increased carbon sequestration in biomass and soils.

The land management practices modeled as a part of this strategy include:

- Prescribed grazing
- Range planting
- Silvopasture establishment

Application

Grazing or pastureland areas to be modeled for the application of grazing land management strategies come from FMMP of the extent of grazing lands.

Grazing land management application geography data sources include:

- Santa Clara County 2018 Important Farmland Mapping & Monitoring Program (FMMP)

Source of Sequestration Rates

The rates of carbon sequestration associated with each of these come from Comet Planner.

Mix	Strategy Type	MG CO2/acre/yr*	Years to Peak*
33%	RANGE PLANTING	0.34	20
33%	SILVOPASTURE ESTABLISHMENT	0.66	100
33%	PRESCRIBED GRAZING	0.03	20
Blend		**0.34**	**46.7**

*Source for all C/C02 sequestration rates from Comet Planner - from "Download COMET Planner Results" table

Native Grassland Restoration

Strategy Definition

Grasslands are ecosystems dominated by grasses and forbs. This strategy involves the restoration of native grasslands (which tend to be perennial), on areas currently covered by non-native grasses (which tend to be annual) and associated species. Native grass species tend to have deeper root systems to allow them to reach deeper soil moisture to survive periods of extended drought; these deep root systems also sequester much more carbon than non-native grasses, which tend to have more shallow root systems.

Application

The spatial extent to which the native grassland restoration strategy is applied comes from the Santa Clara Valley Habitat Agency Land Cover assessment of the extent of existing grassland and the SFEI inventory of the historical extent of the native grassland ecological community.

Native grassland application geography data sources include:

- Santa Clara Valley Habitat Agency Land Cover
- San Francisco Estuary Institute Historic Ecology

Source of Sequestration Rates

The carbon sequestration rates for native grassland come from Koteen et al (2009)[39], Kroeger et al (2010)[40] and Valentini et al (1995)[41]. Growth rate assumptions were based on Yang et al (2019)[42].

Strategy Type	MG CO2/acre/yr	Years to Peak
NATIVE GRASSLAND RESTORATION	0.54	20

Oak Woodland Restoration

Strategy Definition

This strategy involves the restoration of oak woodlands on areas currently covered by non-native grasses where oak woodland ecological communities were historically located. The need for oak woodland restoration is a result of management practices that have degraded or destroyed these historic ecosystems. Oak woodlands serve a number of important ecological functions including sequestering and storing significant amounts of carbon.

Application

The spatial extent to which the restoration of oak woodlands (across the ranges of blue oak and valley oak) strategy is applied comes from the CLN and SFEI inventories of the historical extent of oak woodland ecological communities. The Santa Clara Valley Habitat Agency landcover dataset was used to identify and omit existing and mature oak woodland habitats from the SFEI and CLN defined inventory of lands suitable for restoration. Assessment of areas where present-day land cover is grassland or other candidate land cover classes. A certain amount of this area is modeled for restoration in each future year.

Oak woodland definitions for existing NWLs include:

- Santa Clara Valley Habitat Agency Land Cover

Oak woodland application geography data sources for restoration include:

- DWR 2014 Land Use Survey
- Urban Footprint Base Canvas (to exclude urban areas and San José airport)
- San Francisco Estuary Institute Historic Ecology
- Conservation Lands Network Historic Ecology

[39] (Koteen, Harte, & Baldocchi, 2009)
[40] (Kroeger, Casey, Alvarez, Cheatum, & Tavassoli, 2010)
[41] (Valentini, Gamon, & Field, 1995)
[42] (Yang, Tilman, Furey, & Lehman, 2019)

Source of Sequestration Rates

Oak woodlands restoration carbon sequestration rates by oak species came from Virginia Matzek, who is creating an oak woodlands model for the Department of Conservation[43].

Mix	Species	*Sequestration by Hectare*
12.5%	BLACK	162.3
12.5%	BLUE	71.8
12.5%	CANYON	161.0
12.5%	COAST	158.9
12.5%	GARRY	219.5
12.5%	INTERIOR	121.2
12.5%	MIXED	264.2
12.5%	VALLEY	98.4
100%	**BLEND**	**157.1**
Per ACRE		**63.6**

Street Tree Planting

Strategy Definition

The street trees strategy involves pairing an assessment of the carbon in existing trees, from iTree Eco, with an assessment within the spreadsheet model of the carbon potential of planting new trees.

Application

Potential locations for the planting of new street trees comes from an assessment performed by the City for the 2012 San José Canopy Study.

The street tree planting location data sources include:

- San José Street Tree Inventory
- 2012 San José Canopy Study

Source of Sequestration Rates

The carbon sequestration potential of planting new street trees was assessed by applying an average of a mix of tree species representing those likely to be planted, considering the limitations and opportunities of the range of available potential planting locations. The carbon sequestration potential of each tree species is modeled based on its size at maturity, age until maturity, and estimated DBH at horizon year (2040). Total carbon sequestration in any future year is based on the number of trees planted each year, and growth curves applied to estimate the total carbon sequestration potential in any year for that mix of species and ages.

Mix***	Species	Rate MG C/yr/tree*	Peak Age**	Peak DBH	Growth / Yr	Horizon Year DBH
10%	Zelkova	0.03	100	40	0.40	8.00
10%	Accolade Elm	0.02	150	35	0.23	4.67

43 Matzek, Unpublished

10%	Coast Live Oak	0.07	100	42	0.42	8.40
10%	Common Hornbeam	0.02	60	20	0.33	6.67
10%	Desert Willow	0.002	40	14	0.35	7.00
10%	Frontier Elm	0.01	100	15	0.15	3.00
10%	Hollyleaf Cherry	0.003	80	10	0.13	2.50
10%	Ginko	0.01	150	25	0.17	3.33
10%	Red Maple	0.03	100	30	0.30	6.00
10%	Strawberry Tree	0.01	100	20	0.20	4.00
100%		**0.0205**	**98**			

*Source data: National Tree Benefits Calculator for carbon sequestration rates per tree by species or when species was unavailable, functional type

**Age at peak growth and DBH at peak growth estimated with assistance from Naresh Duggal, City of Santa Clara IPM Program Manager

***Tree mix created with assistance from Naresh Duggal, Russell Hanson from City Arborist for the City of San José, and Igor Lacan, University of California Cooperative Extension Advisor

Urban Forest Expansion

Strategy Definition

The urban forest expansion strategy involves pairing an assessment of the carbon in existing trees, from iTree and the National Tree Benefit Calculator, with an assessment within the spreadsheet model of the carbon potential of planting new trees. Urban forest expansion focuses on increasing tree canopy outside of the public right-of-way (trees in the right-of-way are considered "street trees"), in areas such as parks and open spaces. The trees that can be planted in this area generally have less constraints (such as narrow planting strips and overhead high voltage wires) than street trees in terms of the size and species of tree that can be planted.

Application

Potential locations for the planting of new urban forest come from Urban Footprint base canvas identifying publicly owned parks as well as larger open spaces that could be repurposed in the future such as golf courses. FEMA flood zones where urban retreat may occur in certain scenarios are also identified as areas for potential urban forest expansion. A certain amount of these potential locations were modeled for restoration in each future year.

Urban forest definitions for existing NWLs include:

- San José Tree Canopy Study LiDAR Tree Canopy Land Use Classification

Source of lands for future NWL expansion include:

- Urban Footprint Base Canvas (to identify open spaces, golf courses, landfills, parks and exclude San José airport)
- DWR 2014 Land Use Survey (to filter for urban areas only)

Source of Sequestration Rates

The carbon sequestration potential of planting new urban forest trees is assessed within the spreadsheet model by applying an average of a representative mix of tree species selected by urban forestry experts for the City of San José, with a mix of function-type and species to maximize diversity and carbon benefits.

The carbon sequestration potential of each tree species is modeled based on its size at maturity, age until maturity, and resulting total carbon sequestration potential, calculated by the National Tree Benefits Calculator, a tool based on i-Tree's street tree assessment tool called STREETS. Total carbon sequestration in any future year is based on the number of trees planted each year, and growth curves applied to estimate the total carbon sequestration potential in any year for that mix of species and ages.

Species Mix Calibration	Species	Rate MG C/yr/tree	Rate MG C/yr/ac*	Age at peak	DBH at peak	Growth/year (diameter)	DBH at Horizon Year (2050)**
10%	Valley Oak	0.066	3.96	100	50	0.50	10.00
10%	California Black Oak	0.066	3.96	100	40	0.40	8.00
10%	Big Leaf Maple	0.04	2.4	100	40	0.40	8.00
10%	Toyon	0.006	0.36	80	16	0.20	4.00
10%	California Sycamore	0.04	2.4	100	51	0.51	10.20
10%	California Buckeye	0.015	0.9	80	25	0.31	6.25
10%	Coast Live Oak	0.066	3.96	100	42	0.42	8.40
10%	Canyon Live Oak	0.066	3.96	100	40	0.40	8.00
10%	Common Manzanita	0.004	0.24	80	13	0.16	3.25
10%	Interior Live Oak	0.066	3.96	150	40	0.27	5.33
100%		**0.0435**	**2.61**				

*Assumed 60 trees per acre

**Input into National Tree Benefit Calculator to derive C sequestration rate

Riparian Restoration

Strategy Definition

The riparian restoration strategy involves increasing woody perennial vegetation densities in areas in and around stream and river channel beds back to levels that were found prior to the settlement of the Santa Clara Valley by European-descended peoples, when the density of riparian vegetation was lower but the extent was larger.

Application

No restoration strategies were applied to existing native riparian areas defined by DWR and Santa Clara Habitat land cover data. The geographies suitable for the application of the riparian restoration strategy outside of existing riparian areas are defined as follows:

- All areas below the top of bank
- Within 100 ft from streams and top of bank
- Within 100 ft from the midline of uncovered creeks
- Within Category 1 Stream buffers
- Additional areas as defined in the San Francisco Estuary Institute (SFEI) dataset describing the historical extent of Coyote riparian community.

Riparian definitions for existing NWLs include:

- DWR 2014 Landuse Survey
- Santa Clara Valley Habitat Agency Land Cover

Source of lands for future NWL expansion include:

- Santa Clara Valley Habitat Agency Stream Buffers
- Santa Clara Valley Water District
- Open Space Authority Top of Bank

Source of Sequestration Rates

Riparian restoration strategies were modeled using carbon sequestration rates from the lookup table in Matzek et al.[44] appendix 2. Plant communities include those that are specifically adapted to wetter areas adjacent to the stream/river channel, those that are more adapted to the conditions above the top of bank, and variations between those two conditions based on elevation and the surrounding topography, soil, and aspect.

Carbon Source	***Mg C / Hectare***
Tree Carbon	57.5
Down Dead Carbon	2.87
Forest Floor Carbon	16.00
Understory Carbon	3.91
Soil Carbon Accumulation	3.9
Total Carbon Accumulation	***84.2***
Acre conversion	***34.1***

[44] (Matzek, Stella, & Ropion, 2018)

Species Mix Assumptions*	
20.0%	QUERCUS (OTHER)
4.0%	AESCULUS CALIFORNICA
2.0%	ALNUS (OTHER)
2.0%	FRAXINUS LATIFOLIA
50.0%	OTHER UNDERSTORY SHRUBS
4.0%	SALIX
10.0%	QUERCUS LOBATA
8.0%	OTHER CANOPY TREE
*Species Mix curated with assistance from Patricia Hickey of the Carbon Cycle Institute	

Wetland Restoration

Strategy Definition

The wetlands restoration strategy includes the restoration of saltwater and freshwater wetlands. Saltwater wetlands are those subject to tidal inundation by waters of the San Francisco Bay. Freshwater wetlands are few in San José with only Laguna Seca, one of the largest remaining freshwater wetlands in the Bay Area, as a permanently protected wetland.

Application

The spatial extent to which wetlands restoration strategy is applied comes from the California Aquatic Resources Inventory (CARI) (see Table 2 in Appendix 1) identifying existing saline wetlands and SFEI identifying the extent of the Laguna Seca freshwater wetlands. Land that the National Oceanic and Atmospheric Administration (NOAA) expects to be inundated as a result of a projected 10 feet rise in sea level is also modeled for restoration in the long term.

Wetlands definitions for existing NWLs include:

- San Francisco Estuary Institute Wetlands

Source of lands for future NWL expansion include:

- Urban Footprint Base Canvas (to exclude urban areas and San José airport)
- San Francisco Estuary Institute Historic Ecology
- Conservation Lands Network Historic Ecology
- Plant Master Plan boundaries

Source of Sequestration Rates

The carbon sequestration rates for saline wetlands come from Callaway, J. et al. research of carbon sequestration and sediment accretion in San Francisco Bay tidal wetlands[45]. Rates for freshwater wetlands come from Miller, R. and Fujii, R. research on wetland re-establishment in the Sacramento-San Joaquin Delta area[46]. Although research on the long-term trajectory of carbon stock change in restored saline and freshwater wetlands remain uncertain, the model adopts findings from site specific studies performed in the United Kingdom that estimate it takes 100 years for restored wetland sites to reach equivalent carbon pool levels of natural wetlands[47].

Wetland Type	Carbon Sequestration MG/AC/YR
Saline	0.32
Freshwater	12.95

Greywater Application

Strategy Definition

Greywater application involves diverting household greywater from the city sewer system for use in irrigating trees and perennial shrubs within the yard during periods when evaporation exceeds precipitation (to protect groundwater quality, three-way valves are used to allow greywater to flow to the city sewer during periods when precipitation exceeds evaporation, i.e. the rainy season).

Application

The total area to which this strategy could be applied was determined by assessing the portion of the single family lots in the city covered by front and back yard area, using a combination of zoning information and aerial imagery case studies. Using this approach, it was determined that rural, suburban, and urban residential properties tend to exhibit non hardscaped areas at roughly 85%, 45%, and 30% of lot area, respectively. To determine the percent of yard area available for greywater application, a case study approach using aerial imagery indicated that roughly 29% of non-hardscaped lot area tends to be actively landscaped and suitable for greywater.

Residential Type	Gross DU / Ac.	% Yard Coverage	% Plantable Yard Area	% Plantable Parcel Area
Rural	0.1 – 1.0	85%	29%	25%
Suburban	1.1 – 7.0	45%	29%	13%
Urban	7.1+	30%	29%	9%

Source of Sequestration Rates

Greywater Application underwent preliminary evaluation as a carbon sequestration strategy, but ultimately not included in our final list of modeled strategies because there is inconclusive evidence

[45] (Callaway, Borgnis, Turner, & Milan, 2012)
[46] (Miller & Fujii, 2010)
[47] (Burden, Garbutt, & Evans, 2019) (Burden A. , Garbutt, Evans, Jones, & Cooper, 2013)

that it has a net positive impact on carbon sequestration, though it does provide other co-benefits such as water conservation. Widespread reuse of household greywater has the potential to contribute significant water savings, up to 40% of residential consumption[48]. Water savings were modeled based on the City of Sunnyvale's Landscape Water Budget Calculator[49].

Limitations

Emissions from NWLs

Based on carbon accounting as practiced by Climate Smart San José, in compliance with IPCC and other carbon accounting guidelines[50], emissions from NWL that should be accounted for are those due to the decomposition of organic matter. This project only looked at the carbon sequestration potential of each strategy, therefore, emissions are not accounted for in the model. The impact of emissions should be further studied to gauge the full extent of environmental benefits that result from each strategy.

Wetlands

Restored wetlands have the potential to help reduce GHG emissions through the restoration of plant habitats that sequester carbon and bury it within accumulating soil. However, this is still an emerging field of research, and there are many factors that need to be understood before we can accurately quantify the impact of so called "blue carbon". For instance, we do not know how much carbon has been captured since restoration began and whether that submerged carbon will continue to build over time. Additionally, wetlands, especially those that are freshwater, are known to emit high rates of methane that can often negate the benefits of carbon sequestration in wetlands. Our lack of understanding and scarce literature explaining this dynamic limits our ability to accurately estimate the carbon benefits of wetland restoration strategies.

Scenario Development

Land use policy scenarios were developed to estimate the impact of future land development on land availability for NWL strategies, as well as to show the benefits of more compact growth patterns that preserve NWL rather than developing them to accommodate job and/or housing growth. Each scenario represents land use change across the entire San José Sphere of Influence (SOI) at the parcel scale under a particular set of future policy conditions. Scenario performance modeling is performed in UrbanFootprint, a sketch planning tool used by jurisdictions across California to model policy impacts of land use change in long range planning processes.

UrbanFootprint scenarios are built on a base year parcel data canvas that represents the existing built and natural environment, including both demographic and built form characteristics. Scenarios are representative of changes in land use relative to the base canvas. Changes occur when users apply Place Types to parcels. Place Types are representations of future land use that include assumptions about the height, density, and use of buildings as well as natural features. Scenarios differ from one another based on what Place Types are painted, where they are painted, and how much of each is painted. Based on these attributes, UrbanFootprint is able to estimate the total number of jobs, dwelling units, and people in each scenario.

[48] (Cohen, 2009)
[49] (City of Sunnyvale, 2020)
[50] (IPCC, 2006), (Eve, et al., 2014)

Additional performance metrics can also be used to evaluate scenarios. These performance metrics are calculated by running "analysis modules" which measure existing conditions and future plan impacts across a range of topic areas including water use, energy use, and GHG emissions.

Model Calibration and Validation

UrbanFootprint is a sketch scenario planning tool that allows users to "paint" future land uses, such as General Plan designations, onto a base year canvas. The canvas used for this project approximates a 2020 base year (though it is based on an amalgam of data sources describing existing conditions, some of which may use rates that date back as far as the 2010 Census) and includes existing population, jobs, and dwelling units enumerated at the parcel scale. Future growth in all six scenarios approximates the 2040 dwelling unit and employment capacities assumed in the city's General Plan: 429,350 dwelling units and 751,450 jobs.

	Existing Condition (2019)	Scenario 1: General Plan As Adopted	Scenario 2A: Greenfield Conservation	Scenario 2B: Opportunity Housing in HQTAs	Scenario 2C Opportunity Housing City-Wide	Scenario 2D: Maximum NWL Expansion	Scenario 2E: Moderate NWL Expansion	Scenario 3: General Plan Taskforce Policies
Population	1,050,663	1,314,194	1,314,347	1,313,295	1,313,530	1,310,411	1,314,199	1,315,159
Jobs	435,725	751,213	751,967	751,868	751,509	751,414	751,660	751,694
Dwelling Units	330,214	428,743	429,593	429,661	429,393	429,488	429,660	429,895

Figure 56: Scenario Control Totals

Model calibration and validation proceeded along two tracks: calibration of UrbanFootprint Place Types, and validation of UrbanFootprint's Transport module.

Place Types

Place Types are collections of modeled "real world" buildings that were used in this project to reflect General Plan land use designations. For each General Plan land use designation, basic entitlement information relating to floor-to-area ratio (FAR), allowed uses, and densities was gathered. Because development often does not reflect maximum entitlements, research was conducted to determine what amount of overall entitlements are "typically" utilized by developers in each land use designation. The results of this analysis were then compiled in a Place Type menu, which was vetted by the project's technical advisory committee and others within the San José Department of Planning, Building, and Code Enforcement (PBCE).

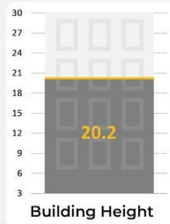
COMMERCIAL DOWNTOWN

Uses: Office, hotel, retail, service, and entertainment

Notes: *Avoid conflicts with Historic Preservation Policies. Transition to adjacent SFR zones at edge.*

Urban Footprint building types: Hotel High, Mid-Rise Office, Parking Structure+Ground-Floor Retail, Hotel High, Low-Rise Office

Building Height
UF: 20.2 floors (avg)
GP: *3 to 30 stories*



FAR
UF: 4.86 (avg)
GP: *Up to 15*

PARKING (spcs/1000ft²)
UF: 0.48
GP: *not specified*

Residential Density (du/ac)
UF: 0 GP: *not specified*

Employment Density (emp/ac)
UF: 449.38 GP: *not specified*

Figure 57: Example of a placetype and its entitlement information

Transport Module

The UrbanFootprint transportation module is a “sketch” travel model that produces estimates of vehicle miles traveled (VMT) and travel mode share for land use + transportation scenarios. As a sketch tool, it is important to highlight how it differs from the travel demand forecast (TDF) model and region Bay-Cast trip-based model used by the City of San José. Unlike those models, which assign trip productions and attractions to zones based on a transportation network, Urban Footprint’s transport module uses the Mixed-Use Development (MXD) method, which consists of statistical models based on research of observed relationships between characteristics known as “D” factors (density, design, distance to transit, etc) and travel behavior in regions across the US.

Given the differences between UrbanFootprint’s travel model and the models used to estimate VMT for the City of San José’s General Plan, it is expected that the tools would report different VMT results. In conversations with City modeling staff, it was agreed that such variations would still allow for acceptable comparisons of “interim” policy scenarios with the General Plan, so long as the geographic distribution of VMT was similar between the two tools. As the table below shows, the VMT reported in the General Plan is consistently higher than what is reported by UrbanFootprint by roughly 15%. By accounting for this difference, UrbanFootprint’s VMT results can be adjusted and mapped in a manner comparable to the City’s estimates for their base year (2015). Given the clear similarities in the distribution of VMT in the maps below, we feel confident that UrbanFootprint’s Transport Module provides a valid “sketch” comparison to VMT reported in the City’s General Plan.

VMT Comparison San Jose SOI	City of San Jose 2015 Base	UrbanFootprint 2020 Base Canvas
Total Daily VMT	17,052,437	15,797,233
Average Daily VMT / Service Population	12.55	10.63
Daily Residential VMT	11,792,433	10,832,230
Average Daily VMT per Capita	12	10

Figure 58: Comparison of Base Year VMT

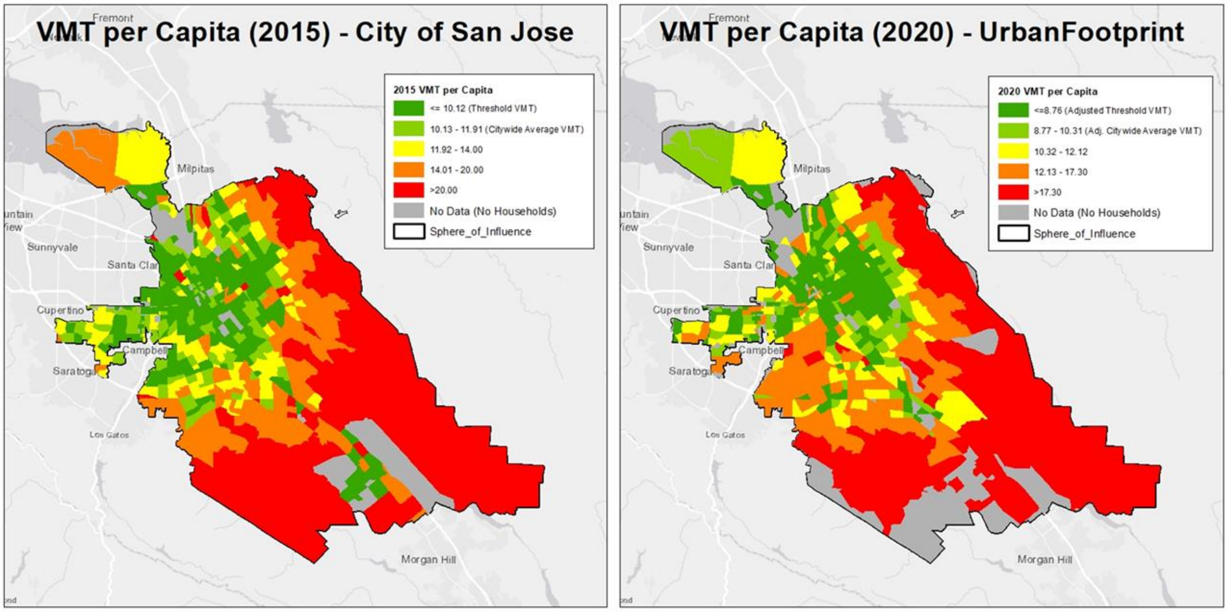


Figure 59: Comparison of VMT per Capita between City of San José's 2015 UrbanFootprint's 2020 base years.

Scenario 1: General Plan Calibration

The General Plan Build-Out scenario serves as a basis-of-comparison scenario that models growth in projected growth areas that are governed by General Plan land use designations. Average parking ratios for this scenario assume the current parking ratios from the City's existing zoning code, roughly 2 parking spaces for every 1 residential unit and 1 parking space per 200sf for most types of employment areas. Residential and employment densities were calibrated based on observed development activity within each General Plan Land Use zone, within the limits set for each zone by the General Plan. Any parcels listed in the pipeline report were painted in this scenario to account for development that is likely to proceed regardless of future policy changes.

As mentioned previously, this scenario was controlled to an overall future dwelling unit (DU) capacity of 429,350 and an employment capacity (EMP) of 751, 450, per the assumptions in the Envision 2040 General Plan. Furthermore, growth was controlled within +/- 5% of the General Plan's allocation to the City's 15 Planning Areas.

	Control Totals		UrbanFootprint GP Scenario	
Planning Areas	DU 2040	EMP 2040	DU 2040	EMP 2040
Almaden	12,585	5,286	13,655	5,066
Alum Rock	50,436	43,473	49,650	43,030
Alviso	736	19,675	771	19,126
Berryessa	26,615	77,532	26,742	76,803
Cambrian/Pioneer	31,197	26,194	31,167	26,867
Central	63,191	153,090	62,460	147,871
Coyote	335	38,022	465	40,607
Edenvale	53,765	62,065	53,002	59,708
Evergreen	28,314	23,920	28,384	23,866
North	38,955	190,820	37,157	191,934
San Felipe	175	8	3	39
South	30,472	27,398	30,508	27,819
West Valley	53,205	52,376	51,617	50,914
Calero	184	407	154	73
Willow Glen	39,187	31,406	40,960	31,030

Figure 60: Calibrated Control Totals for Planning Area Geographies

Scenario 2A: Greenfield Conservation Calibration

Scenario 2A uses the General Plan Build-Out scenario as a starting point but shifts jobs in accordance with proposed changes to the General Plan being considered as part of the plan's 4-year update. These changes propose removal of jobs from the Almaden, Alum Rock, Berryessa, Cambrian/Pioneer, and Coyote planning areas, and reallocation of those jobs to the Downtown/Central and Alviso planning areas as shown in the table below. Any parcels listed in the pipeline report were painted in this scenario to account for development that is likely to proceed regardless of future policy changes.

Planning Areas	Job Shift
Almaden	-100
Alum Rock	-200
Alviso	+5,000
Berryessa	-17,050
Cambrian/Pioneer	-1,000
Central	+47,150
Coyote	-35,000

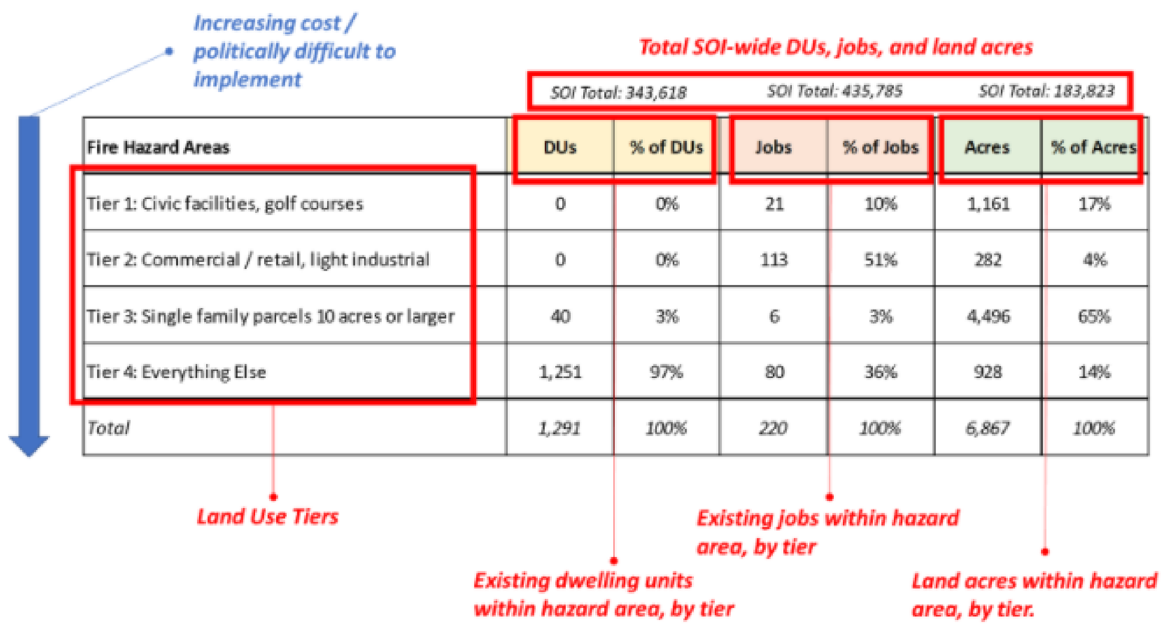
Figure 61: Reallocation of Jobs per the 4-Year General Plan Update

Scenario 2E: Moderate Urban Retreat

In scenario 2D, "urban retreat" was characterized by converting all existing developed lands into undeveloped lands in the following hazard/environmental impact areas: flood hazard zones (FEMA 100 Year Base Flood), areas of wildfire risk (USDA Wildfire Hazard Potential, "High" or "Very High" designation), riparian areas (DWR NCCAG Riparian areas + 100ft buffer), areas of potential 10-foot sea level rise (NOAA National Geodetic Survey).

The removal of all development from environmentally hazardous or sensitive lands is neither politically nor financially feasible. For scenario 2E, a more logical method was employed to "scale back" urban retreat to resemble a more realistic policy. The general idea was that for each hazard/sensitivity area, certain existing land uses would be prioritized for urban retreat based on the dwelling units or jobs they would displace and the land area (acreage) they would preserve.

In order to determine the tiers of land to be used for each urban retreat type (flooding, sea level rise, etc), the PMT was asked to fill out a short survey that asked them to prioritize land use types based on the number of dwelling units and jobs they contained versus the land area they represented.



Fire Hazard Areas	DUs	% of DUs	Jobs	% of Jobs	Acres	% of Acres
Tier 1: Civic facilities, golf courses	0	0%	21	10%	1,161	17%
Tier 2: Commercial / retail, light industrial	0	0%	113	51%	282	4%
Tier 3: Single family parcels 10 acres or larger	40	3%	6	3%	4,496	65%
Tier 4: Everything Else	1,251	97%	80	36%	928	14%
Total	*1,291*	*100%*	*220*	*100%*	*6,867*	*100%*

Figure 62: Excerpt from PMT survey to determine how scenario 2E would be scaled back

Based on the responses received from the survey, the following criteria were established for urban retreat:

- Fire Hazard Areas
    - Civic facilities, golf courses and single-family parcels larger than 10 acres in fire hazard areas
- Riparian Areas
    - Light industrial / industrial uses revert to NWL
    - Riparian restoration occurs on Civic facilities
- Flood Hazard Areas
    - Civic facilities revert to NWL in flood hazard areas
    - Low-value improvements in all other categories

- Sea Level Rise Areas
    - Civic facilities revert to NWL in sea level rise areas
    - Low-value improvements in all other categories

The map below shows the resulting to change to areas prioritized for urban retreat (pink were areas included in scenario 2D, but not in 2E).

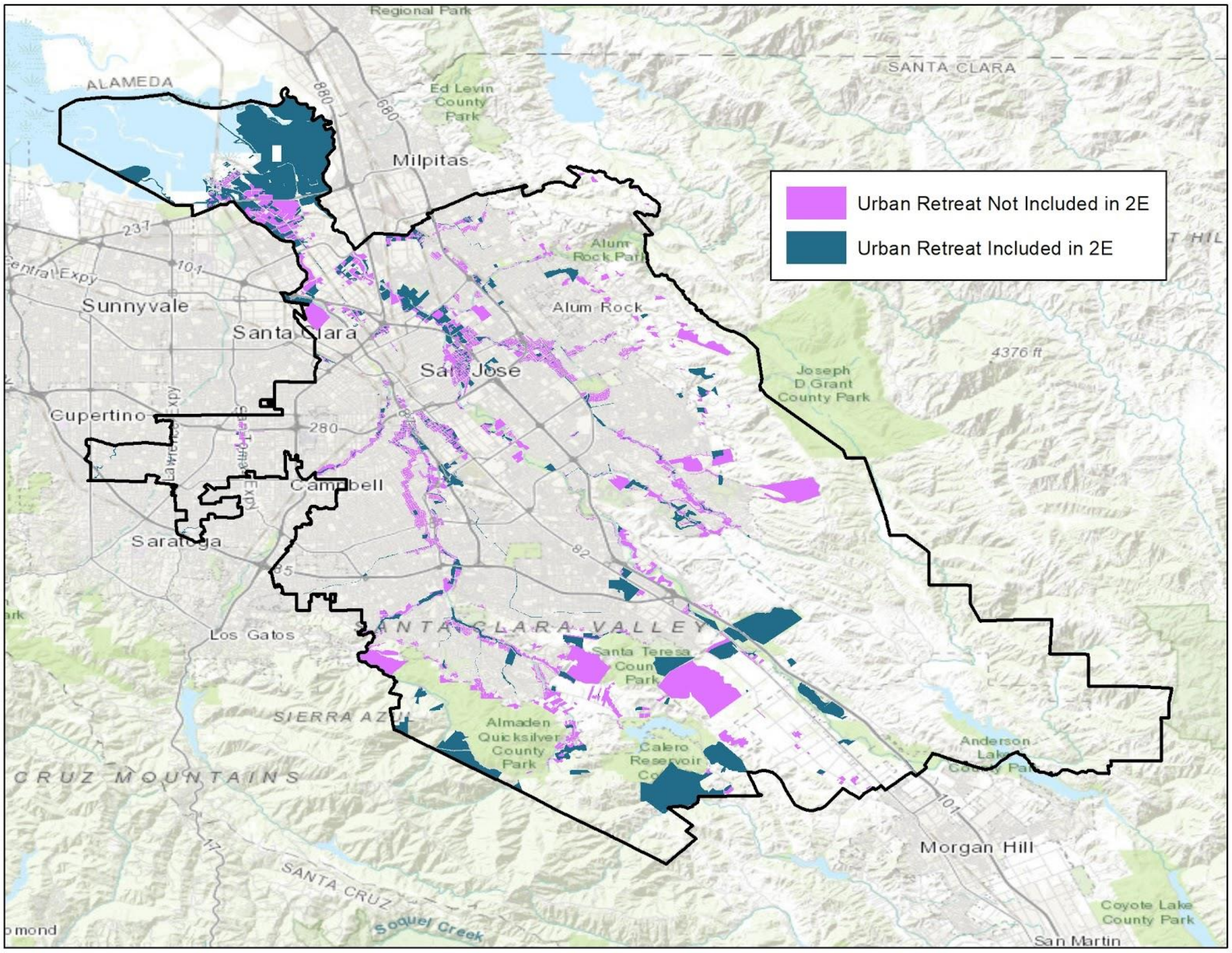


Figure 63: Urban retreat in scenario 2E vs 2D

Based on these changes, Cascadia Partners calculated the impacts to dwelling units and jobs in sensitive areas and the acreage of lands protected in each scenario.

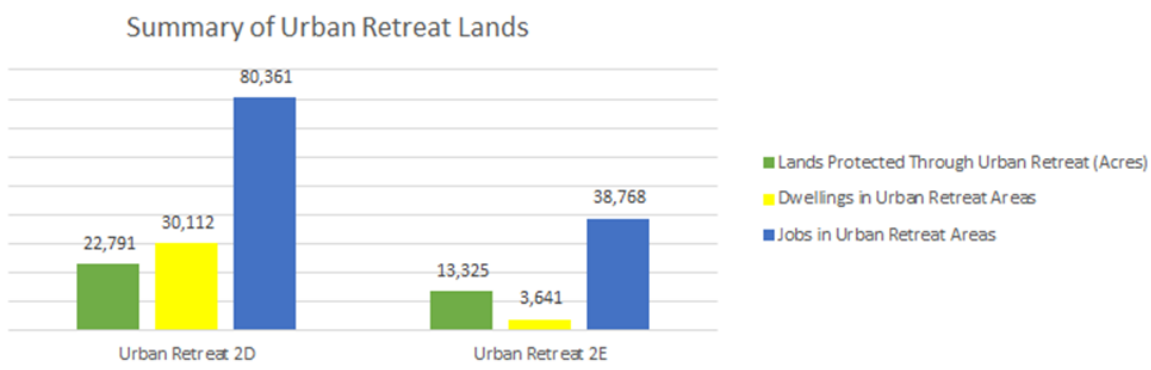


Figure 64: Though scenario 2E protects 42% less acreage than scenario 2D, it displaces 88% fewer dwelling units and 52% fewer jobs.

Analysis Tools

In addition to UrbanFootprint, the NWL Analysis makes use of several additional "analysis tools" including I-Tree, the NWL Strategy Model, and a custom spreadsheet model that calculates NWL land availability in each scenario.

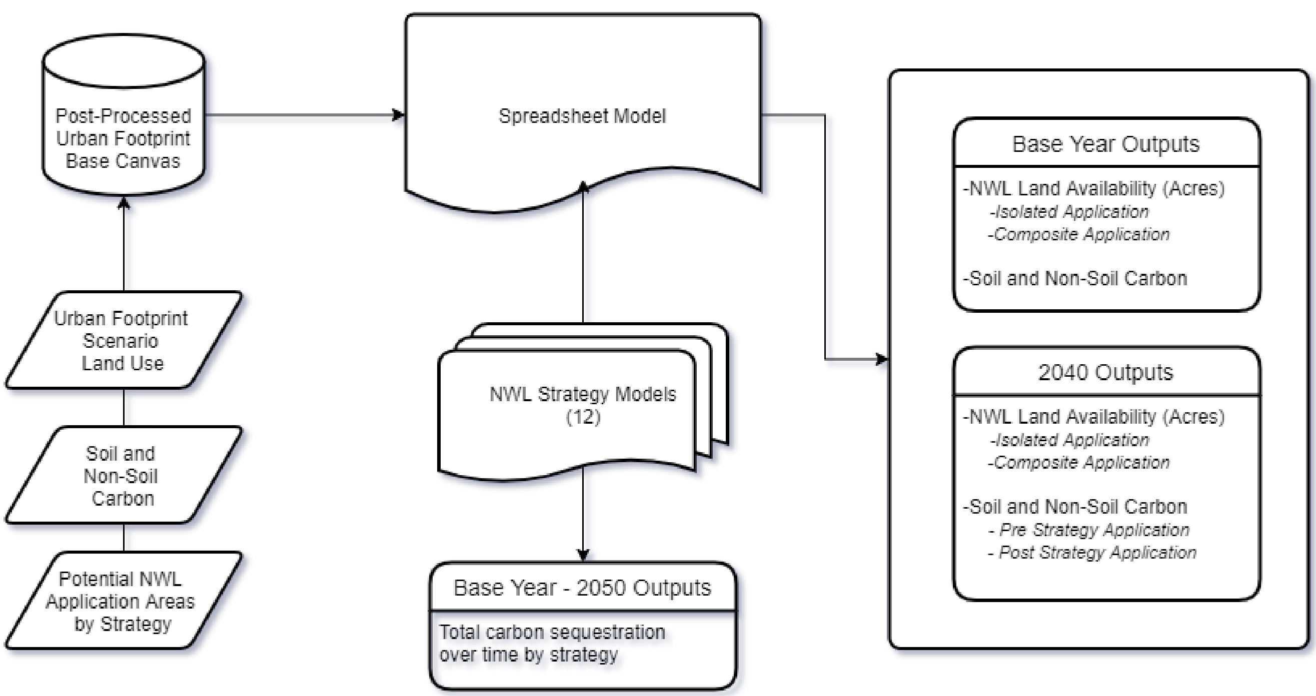
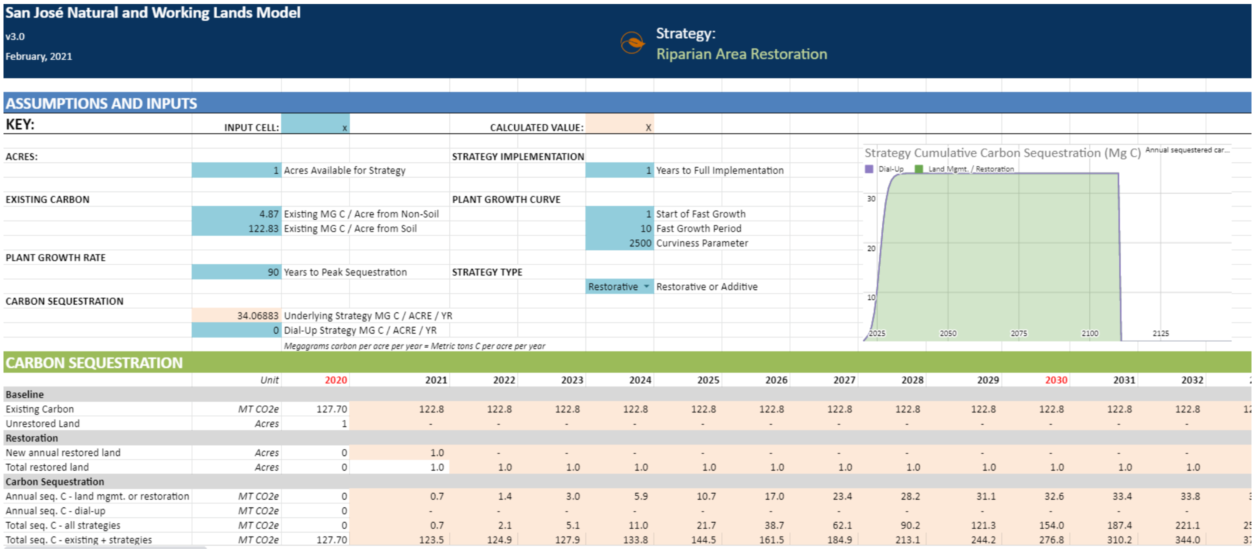


Figure 65: NWL Analysis Model Framework

NWL Strategy Model

The NWL Strategy Model is a spreadsheet-based tool that includes a separate tab for each of the twelve NWL strategies analyzed as part of this project. Each tab is its own stand-alone module that estimates carbon sequestration over a time horizon of up to 130 years. Each tab is calibrated with the inputs users need to perform analysis, all that is required is an estimate of existing carbon on a site and the site's size. All assumptions are documented and visible to the user and can be augmented if desired.



San José Natural and Working Lands Model
v3.0
February, 2021

Strategy:
Riparian Area Restoration

ASSUMPTIONS AND INPUTS

KEY: INPUT CELL: x — CALCULATED VALUE: x

ACRES:			STRATEGY IMPLEMENTATION		
	1	Acres Available for Strategy		1	Years to Full Implementation
EXISTING CARBON			PLANT GROWTH CURVE		
	4.87	Existing MG C / Acre from Non-Soil		1	Start of Fast Growth
	122.83	Existing MG C / Acre from Soil		10	Fast Growth Period
				2500	Curviness Parameter
PLANT GROWTH RATE					
	90	Years to Peak Sequestration	STRATEGY TYPE		
				Restorative	Restorative or Additive
CARBON SEQUESTRATION					
	34.06883	Underlying Strategy MG C / ACRE / YR			
	0	Dial-Up Strategy MG C / ACRE / YR			
		Megagrams carbon per acre per year = Metric tons C per acre per year			

CARBON SEQUESTRATION

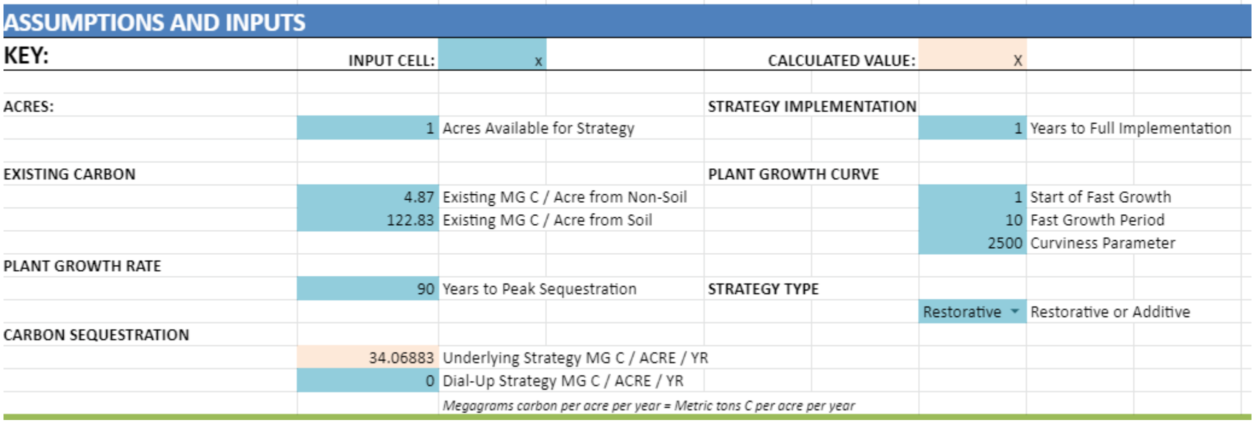
	Unit	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Baseline														
Existing Carbon	MT CO2e	127.70	122.8	122.8	122.8	122.8	122.8	122.8	122.8	122.8	122.8	122.8	122.8	122.8
Unrestored Land	Acres	1	-	-	-	-	-	-	-	-	-	-	-	-
Restoration														
New annual restored land	Acres	0	1.0	-	-	-	-	-	-	-	-	-	-	-
Total restored land	Acres	0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Carbon Sequestration														
Annual seq. C - land mgmt. or restoration	MT CO2e	0	0.7	1.4	3.0	5.9	10.7	17.0	23.4	28.2	31.1	32.6	33.4	33.8
Annual seq. C - dial-up	MT CO2e	0	-	-	-	-	-	-	-	-	-	-	-	-
Total seq. C - all strategies	MT CO2e	0	0.7	2.1	5.1	11.0	21.7	38.7	62.1	90.2	121.3	154.0	187.4	221.1
Total seq. C - existing + strategies	MT CO2e	127.70	123.5	124.9	127.9	133.8	144.5	161.5	184.9	213.1	244.2	276.8	310.2	344.0

Figure 66: Example tab from the NWL Strategy Model

Model Operation

Each strategy tab includes an input dashboard. Input cell colors indicate whether values are calculated from elsewhere or directly editable by the user. The "Acres" input is pre-populated with 1 "notional" acre, but can be edited for a specific site. Existing carbon is pre-populated with average values for the base land cover type within the San José SOI. These parameters should be edited if analysis is to be done on a specific parcel. Plant growth rates and carbon sequestration rates are pre-defined, but editable. Note: dial-up strategy input refers to compost, mulching, and biosolids application, which increase the sequestration of other strategies.

Strategy implementation asks the user to define the number of years until all acres have been restored or managed. The plant growth curve parameters alter the sigmoid growth curve attributed to the plant community in question. The "strategy type" input asks the user to specify whether the strategy is restorative (starting from a base year carbon value of zero) or additive (adding to base year carbon).



ASSUMPTIONS AND INPUTS

KEY:	INPUT CELL: x		CALCULATED VALUE: X	
ACRES:			STRATEGY IMPLEMENTATION	
	1	Acres Available for Strategy	1	Years to Full Implementation
EXISTING CARBON			PLANT GROWTH CURVE	
	4.87	Existing MG C / Acre from Non-Soil	1	Start of Fast Growth
	122.83	Existing MG C / Acre from Soil	10	Fast Growth Period
			2500	Curviness Parameter
PLANT GROWTH RATE				
	90	Years to Peak Sequestration	STRATEGY TYPE	
			Restorative	Restorative or Additive
CARBON SEQUESTRATION				
	34.06883	Underlying Strategy MG C / ACRE / YR		
	0	Dial-Up Strategy MG C / ACRE / YR		
		Megagrams carbon per acre per year = Metric tons C per acre per year		

Figure 67: NWL Strategy Model Input Dashboard

In addition to receiving a read-out of annual and cumulative sequestration, the user can see real-time changes to the sigmoid curve graph shown below. This graph shows annual sequestration over time. The area under the curve represents cumulative carbon sequestration over the life of the strategy.

Carbon Sequestration					
Annual seq. C - land mgmt. or restoration	*MT CO2e*	0	0.7	1.4	3.0
Annual seq. C - dial-up	*MT CO2e*	0	-	-	-
Total seq. C - all strategies	*MT CO2e*	0	0.7	2.1	5.1
Total seq. C - existing + strategies	*MT CO2e*	127.70	123.5	124.9	127.9

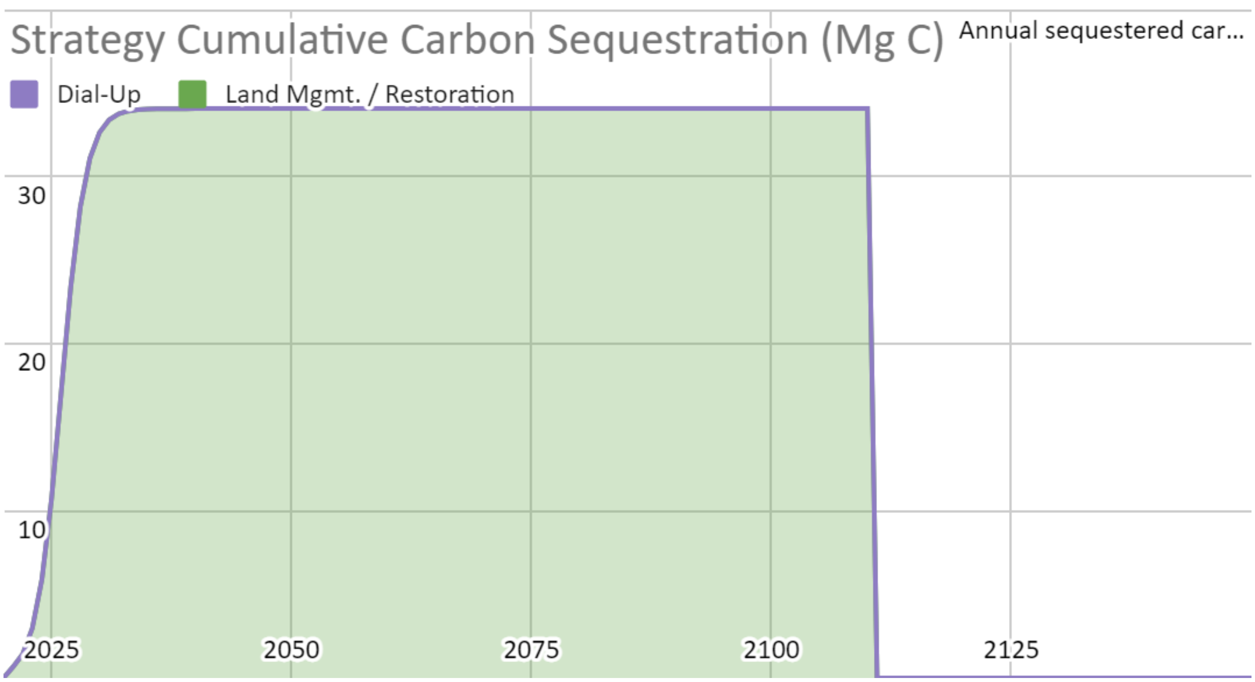


Figure 68: NWL Strategy Model Sequestration Results

Estimating Future NWL Carbon Sequestration (Spreadsheet Model)

Estimating future NWL carbon sequestration potential within San José's SOI brings together the cumulative sequestration values determined in the NWL Strategy Model and the land use patterns dictated by each UrbanFootprint land use scenario.

At the core of the NWL Strategy Model is the ability to measure the potential carbon sequestration and other impacts of each strategy and to provide an accurate assessment of the acreage available for the application of each strategy. The ability to measure existing base year carbon sequestration on areas already functioning as NWLs similarly depends on an accurate assessment of the acres of each modeled land cover class. The modeling framework consists of a post-processed UrbanFootprint base canvas that interacts with the spreadsheet model to produce estimates of land availability, future year carbon stock, and carbon sequestration over time.

The post-processed UrbanFootprint base canvas includes three classes of information: land use designation, carbon stocks, and NWL strategy land availability. Land use designations come from UrbanFootprint and define what is developed and non-developed based on existing uses and land use changes. Carbon stock includes soil and non-soil carbon at the parcel level (derived from soil grid and composite land cover). It too is influenced by changes in land use from UrbanFootprint. Finally, NWL strategy land availability summarizes acreage available for applicable NWL strategies.

Model Operation

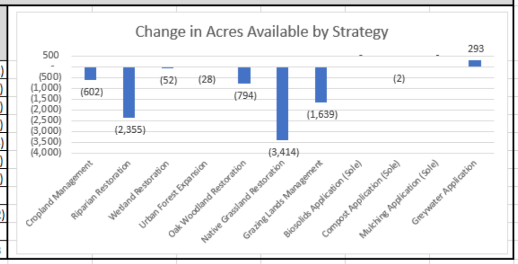
The Spreadsheet Model works by loading in scenario canvases exported directly from UrbanFootprint as .CSV files. Each .CSV file includes land use information that is compared against the base canvas to determine which parcels have urbanized and which have remained or become natural or agricultural. This determination allows the model to then calculate future land availability by NWL strategy along with the associated sequestration potential for each strategy.

The image below shows the spreadsheet model dashboard. This tab has two sections. The first summarizes the acres of land available by strategy. Land availability is measured based on "individual application" and "composite application" both in the base year and the horizon year. Individual application refers to the strategy being applied in the absence of any other. Since strategy geographies often overlap, the composite application considers overlap by prioritizing strategies based on their 20-year carbon sequestration potential. The chart at the right of this section displays the change in land availability by strategy relative to the base year.

The second section summarizes total carbon stocks and the base year and the horizon year both before and after NWL strategies are applied.

LOAD SCENARIO | ☐ Urban Retreat

Summary Table	Acres Available: Base Year (Individual Application)	Base Year (Composite Application)	Future Year (Individual Application)	Future Year (Composite Application)	Difference (Individual Application)	Difference (Composite Application)
Cropland Management	5,897	5,897	5,295	5,295	(602)	(602)
Riparian Restoration	11,868	10,493	9,425	8,138	(2,443)	(2,355)
Wetland Restoration	1,481	307	1,148	255	(333)	(52)
Urban Forest Expansion	1,545	1,103	1,506	1,075	(39)	(28)
Oak Woodland Restoration	5,993	2,135	4,665	1,342	(1,328)	(794)
Native Grassland Restoration	20,842	8,656	13,252	5,243	(7,590)	(3,414)
Grazing Lands Management	50,921	8,886	35,246	7,248	(15,675)	(1,639)
Biosolids Application (Sole)	4,275	-	3,761	-	(514)	-
Compost Application (Sole)	56,929	138	40,737	135	(16,192)	(2)
Mulching Application (Sole)	7,712	-	7,118	-	(594)	-
Greywater Application	5,587	5,587	5,881	5,881	293	293



	Existing (2021) Non-Soil Carbon (Mg C)				Existing (2021) Soil Carbon (Mg C)				Existing (2020) Total Carbon (Mg C)			
Summary Table	Base Year (Individual Application)	Base Year (Composite Application)	Future Year (Individual Application)	Future Year (Composite Application)	Base Year (Individual Application)	Base Year (Composite Application)	Future Year (Individual Application)	Future Year (Composite Application)	Base Year (Individual Application)	Base Year (Composite Application)	Future Year (Individual Application)	Future Year (Composite Application)
Cropland Management	48,303	48,303	45,523	45,523	208,362	208,362	187,045	187,045	256,665	256,665	232,568	232,568
Riparian Restoration	242,781	217,106	193,798	169,272	443,943	391,509	353,486	304,154	686,724	608,615	547,285	473,426
Wetland Restoration	10,840	4,670	9,244	4,466	57,917	14,095	42,914	10,508	68,757	18,765	52,158	14,974
Urban Forest Expansion	10,965	8,100	10,800	7,938	49,633	34,848	48,924	34,191	60,597	42,948	59,724	42,129
Oak Woodland Restoration	74,500	34,353	59,921	27,407	224,694	85,153	176,140	56,616	299,194	119,506	236,061	84,024
Native Grassland Restoration	53,221	18,178	33,985	11,149	645,688	260,890	408,706	158,102	698,910	279,068	442,691	169,251
Grazing Lands Management	1,100,509	304,589	878,140	271,283	1,998,334	392,951	1,453,051	338,280	3,098,843	697,539	2,331,191	609,563
Biosolids Application (Sole)	19,594	-	17,646	-	151,029	-	132,564	-	170,624	-	150,211	-
Compost Application (Sole)	1,112,776	452	889,659	441	2,186,499	2,950	1,623,724	2,895	3,299,275	3,402	2,513,383	3,335
Mulching Application (Sole)	45,248	-	42,874	-	251,859	-	231,393	-	297,107	-	274,266	-
Remaining Lands	-	*1,446,265*	-	*1,285,494*	-	*3,758,806*	-	*4,057,773*	-	*5,205,070*	-	*5,343,267*

Figure 69: Spreadsheet Model Dashboard Overview

To run the model on a given land use scenario, the user must click the “load scenario” button. This will trigger a file browser to open, wherein the user must browse to his or her UrbanFootprint scenario .CSV file. Double clicking on that file will run a macro that loads the appropriate fields from the scenario file. Once complete, the user will see changes to the table as well as the land availability chart and sequestration totals.

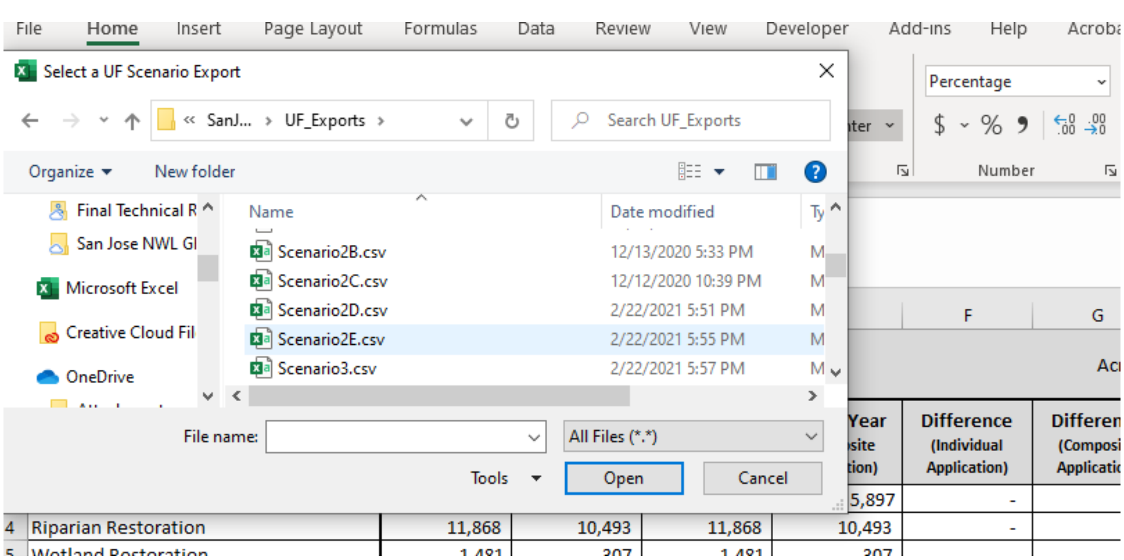


Figure 70: A user must browse to his or her scenario file in the browser window

Once a user has selected their scenario file and the macro has completed its work, they will have the option to edit two additional parameters. First, the user can specify whether they want their scenario to assume urban retreat. They can do so by checking the “urban retreat” check box directly to the right of the “load scenario” button. Doing this will apply the urban forest strategy to any undeveloped parcels in floodways and wetland restoration to any undeveloped parcels in sea level rise areas.

SECTION E: Related Planning Efforts

This section provides a brief summary of related planning efforts and suggests ways that consideration for San José's NWLs could be incorporated in future plan updates.

Climate Smart San José

Agency: City of San José
Year Adopted: 2018
Frequency of Update: ~5 years
Regulatory Authority: City of San José Climate Policy and GHG Reduction Targets

About the Plan

Climate Smart San José (CSSJ) is the City of San José's Climate Action Plan. It defines a framework for climate action, organized around three pillars: "A Sustainable and Climate Smart City", "A Vibrant City of Connected and Focused Growth", and "An Economically Inclusive City of Opportunity." Within each pillar, the plan lays out a total of 9 climate and water strategies that cover topics of renewable energy, urban form, transportation, and more.

CSSJ includes a Greenhouse Gas (GHG) emissions inventory as well as targets to 2050 for three "low-carbon growth milestones" associated with each strategy. CSSJ also quantifies the sequestration potential and cost burden of each strategy and shows how implementation of the strategies over time can help San José meet the goals set by the Paris Climate Agreement.

Summary of NWL Impacts

Direct Impacts

CSSJ acknowledges the carbon sequestration potential of areas with Open Space, Parklands, Habitat, Agriculture, Open Hillside land use designations in the City's General Plan. It also notes that urban forestry and other NWL interventions discussed in the NWL technical report are not included in its estimates of GHG reduction potential. CSSJ identifies quantifying carbon sequestration from NWLs as a key step for a future iteration of the plan. This statement is what prompted the City of San José and The Santa Clara Valley Open Space Authority to fund current efforts described in this document.

Indirect Impacts

CSSJ's indirect impacts on NWLs come from its strategies dealing with land use and transportation. These are contained in "Pillar 2: A Vibrant City of Connected & Focused Growth" and include "Strategy 2.1: Density our city to accommodate our future neighbors" and "Strategy 2.4: Develop integrated, accessible public transport infrastructure."

Strategy 2.1 focuses on compact growth or "densification" as a way to limit building and transportation GHG emissions while providing a range of co-benefits. These include reducing vehicle collisions, promoting walking and biking, reducing fiscal costs, and promoting cultural vibrancy. While preservation of sensitive natural habitats and working lands is not explicitly mentioned, the strategy does state that densification will "proactively plan for new residents in the city while minimizing sprawl." The goal of reducing sprawl is directly aligned with preserving existing NWLs and leaving more lands available for future sequestration enhancement. With this strategy, CSSJ has reinforced important policies in the General Plan, including focusing development in transit and urban villages.

Strategy 2.4 summarizes the GHG reduction and "good life" benefits of improving San José's public transport infrastructure. This includes local bus improvements, high capacity transit, and regional rail. Transit investments and other infrastructure upgrades that are typically associated with them (i.e. enhanced pedestrian crossings and streetscape improvements) have been shown to attract development. The potential for such investments to encourage denser development and a "car light" lifestyle could take pressure off of development of greenfield locations as the city grows. Thus, investments in San José's public transit are one way to indirectly preserve NWLs.

Opportunities for Future NWL Considerations

It is intended that the findings of this report be incorporated as into the next update of the CSSJ plan. As previously mentioned, the need to study NWLs and integrate findings on their sequestration potential into CSSJ is already identified as a key next step. Updating CSSJ with NWL findings would require a number of modifications to the plan's structure as well as additional research specific to NWLs.

In order to integrate findings into the CSSJ framework, a new strategy would need to be added to Pillar 1: A Sustainable & Climate Smart City. This strategy should address the preservation and enhancement of San José's NWLs. New sections will need to be created to match the depth of information included with other strategies. This would include "good life benefits", low carbon growth milestones, and information on NWL leadership to-date. In addition, cost estimates for the any NWL strategies that will be incorporated would be needed in order to provide the "$/MT C" calculations that are used to quantify the benefits of many of CSSJ's strategies. Equity impacts, both positive and negative, should also be quantified for NWL strategies. Finally, it is recommended that NWLs be mentioned more directly within, at a minimum, strategy 2.1 to capture the indirect NWL impacts associated with land use policies.

San José 2040 General Plan

Agency: City of San José
Year Adopted: 2011, amended 2016 and 2020
Frequency of Update: ~5 years
Regulatory Authority: Land Use, Circulation, Housing, Conservation, Open Space, Noise, and Safety

About the Plan

The City of San José's General Plan is its long-term vision for growth. The State of California requires that all jurisdictions maintain general plans and update them on a specific timeframe. The General Plan is currently in the process of being updated through the 4-year update process. It contains the statutorily required elements of land use, circulation, housing, conservation, open space, noise, and safety organized across 7 chapters: introduction, thriving community, environmental leadership, quality of life, interconnected city, land use and transportation, and implementation.

As part of the NWL analysis, a comprehensive review of existing General Plan policies was undertaken. Each chapter was analyzed along with their major goals and strategies. This policy analysis determined that, while numerous policies have critical but "indirect" impacts on NWLs, there are very few directly reference or plan for their continued existence. It was found that the "natural and working lands" does not appear in the currently adopted General Plan. As the City's long range plan governing land use, urban form, transportation, and housing, the policies it puts in place are critical to the continued preservation and future enhancement of San José's NWLs. *For a complete listing of General Plan policies with NWL impacts, see Appendix C.*

Summary of NWL Impacts

Direct Impacts

Direct NWL impacts in the General Plan include policies that make mention of preserving open space as well as those that focus on expanding and promoting agricultural productivity. Examples include:

Urban Agriculture – LU 12:
Expand the cultivation and sale of locally grown agriculture as an environmentally sustainable means of food production and as a source of healthy food for San José residents. (Though not part of the actual goal text, just above the goal reads "Urban Agriculture Goals, Policies, and Implementation Actions are intended to preserve agricultural land")

Hillside / Rural Preservation – LU 17:
Preserve the valuable natural resources of the hillsides, and protect their aesthetic and habitat amenities to enhance the rural character of these areas.

Community Forest – MS 21:
Preserve and protect existing trees and increase planting of new trees within San José to create and maintain a thriving Community Forest that contributes to the City's quality of life, its sense of community, and its economic and environmental wellbeing.

Bay and Baylands – ER 3:
Preserve and restore natural characteristics of the Bay and adjacent lands, and recognize the role of the Bay's vegetation and waters in maintaining a healthy regional ecosystem

Indirect Impacts

In general, policies that may have indirect impacts on or references to NWL preservation and enhancement are far more numerous than those with a direct impact. These can be organized around three broad categories: compact urban form, fiscal and economic health, and environmental quality. Examples of each are included below:

Growth Areas – LU 2 (Compact Urban Form):
Focus new growth into identified Growth Areas to preserve and protect the quality of existing neighborhoods, including mobile home parks, while establishing new mixed use neighborhoods with a compact and dense form that is attractive to the City's projected demographics i.e., a young and senior population, and that supports walking, provides opportunities to incorporate retail and other services in a mixed-use format, and facilitates transit use.

Fiscally Sustainable Land Use Framework – FS 3 (Fiscal and Economic Health):
Make land use decisions that improve the City's fiscal condition. Manage San José's future growth in an orderly, planned manner that is consistent with our ability to provide efficient and economical public services, to maximize the use of existing and proposed public facilities, and to achieve equitable sharing of the cost of such services and facilities.

Water Conservation – MS 18 (Environmental Quality)
Continuously improve water conservation efforts in order to achieve best in class performance. Double the City's annual water conservation savings by 2040 and achieve half of the Water District's goal for Santa Clara County on an annual basis.

Opportunities for Future NWL Considerations

As the General Plan is currently being updated, now is a critical time for the City of San José to consider indirect and directly applicable NWL policies. It is recommended that the 4-year General Plan update include NWLs as a criterion for meaningful City policy including:

Growth Areas

The concept of growth areas is important in defining the areas within the City's SOI where growth should be concentrated and encouraged. The currently adopted General Plan includes many location-efficient growth areas such as urban and transit villages. However, it also includes growth areas that are less advantageous for NWL preservation and enhancement. Most specifically this includes Northern Coyote Valley, which is slated for 35,000 new jobs but contains some of the most productive farmland in the region.

NWL Preservation Policies

As mentioned previously, there are currently no references to NWLs within the adopted version of the General Plan. As this study demonstrates, NWLs are a critical component of San José's economic, environmental, and cultural resources. In addition, NWLs have the potential to be an important contributor to meeting the City's climate goals. It is recommended that the city include goals that directly reference NWL preservation, enhancement, and further study.

Indirect Impacts

Many of the goals and policies included in the General Plan are already working to protect and enhance NWLs. Where these impacts exist, it is recommended that NWL preservation be mentioned as an important co-benefit.

Climate Change Adaptation

It is recommended that climate change adaptation and resilience be more directly integrated into General Plan goals and policies.

City of San José VMT Policy

Agency: City of San José
Year Adopted: 2018
Frequency of Update: Unknown
Regulatory Authority: CEQA (implements SB 743)

About the Plan

San José's VMT policy, Council Policy 5-1, is designed to support San José's climate commitments to reduce greenhouse gases emissions by measuring and monitoring the amount of vehicle miles traveled (VMT) generated by new development projects. The policy implements the General Plan by eliminating regulatory barriers for infill and transit-oriented development in areas with low VMT and makes it more difficult and costly for projects to be built in areas with high VMT. It implements SB 743 by setting VMT thresholds and by defining geographies used for tiering and screening of projects.

The State of California passed State Bill 743 in 2013, requiring state and local agencies to adopt new methods to evaluate transportation impacts of a development project under CEQA. SB 743 mandates that jurisdictions no longer use automobile delay, commonly measured as 'level of service', when analyzing a project's transportation impacts under CEQA. The State now requires evaluation of a project's impact based on 'vehicle miles traveled'. By regulating the amount of driving a project induces, SB 743 will help meet California's goals of reducing greenhouse gas emissions and traffic-related air pollution, promote the development of a multimodal transportation system, and provide clean and efficient access to destinations. In accordance with SB 743, the city of San José adopted the San José VMT policy that replaces the Level of Service metric with a VMT metric in CEQA's transportation analysis. The policy includes project screening criteria, a VMT analysis process and threshold of significance and project mitigation options.

Summary of NWL Impacts

Direct Impacts

While the City's VMT policy does not directly reference NWLs, it implements a state statute, SB 743, that is intended to discourage greenfield development. Unlike the previous CEQA transportation metric of "level of service", shifting to a goal of reduced VMT acknowledges the connection between land use and travel behavior. The VMT policy discourages greenfield development by defining areas of low and high VMT. This is important because the characteristics of a development will only determine travel behavior to a certain degree. The urban context into which a development is built plays a much greater role in determining the VMT it will produce. Through the VMT policy, development is streamlined in areas of low VMT and is discouraged in areas of high VMT through either higher costs of mitigation or outright not allowing for certain kinds of development in high VMT areas.

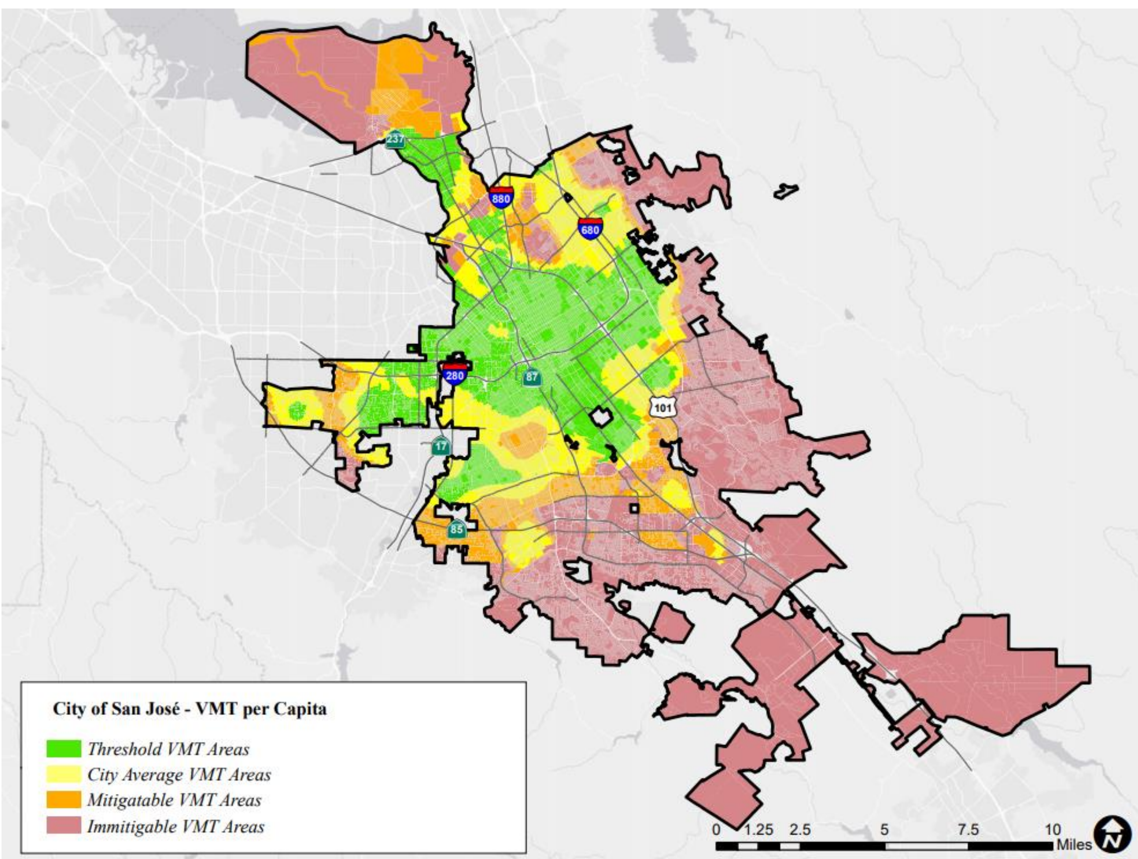


Figure 71: VMT per Capita Map, Source: City of San José VMT Metric

By discouraging development in areas of high VMT, the City of San José is helping to protect current and future NWLs. This is because areas of high NWL value tend to be in areas of high VMT. As the map below shows, many of the “immitigable VMT” areas within city limits coincide with current and future NWLs. Deterring new development from occurring in areas where one primarily uses a car to reach destinations, in other words areas that generate high VMT, is a compatible approach to strategies designed to preserve NWLs that are outlined in this report.

Note: Though the City’s VMT policy does not currently define areas of high VMT outside the city limits but within the SOI, it can be reasonably assumed that all of these areas would fall into the “immitigable VMT” category.

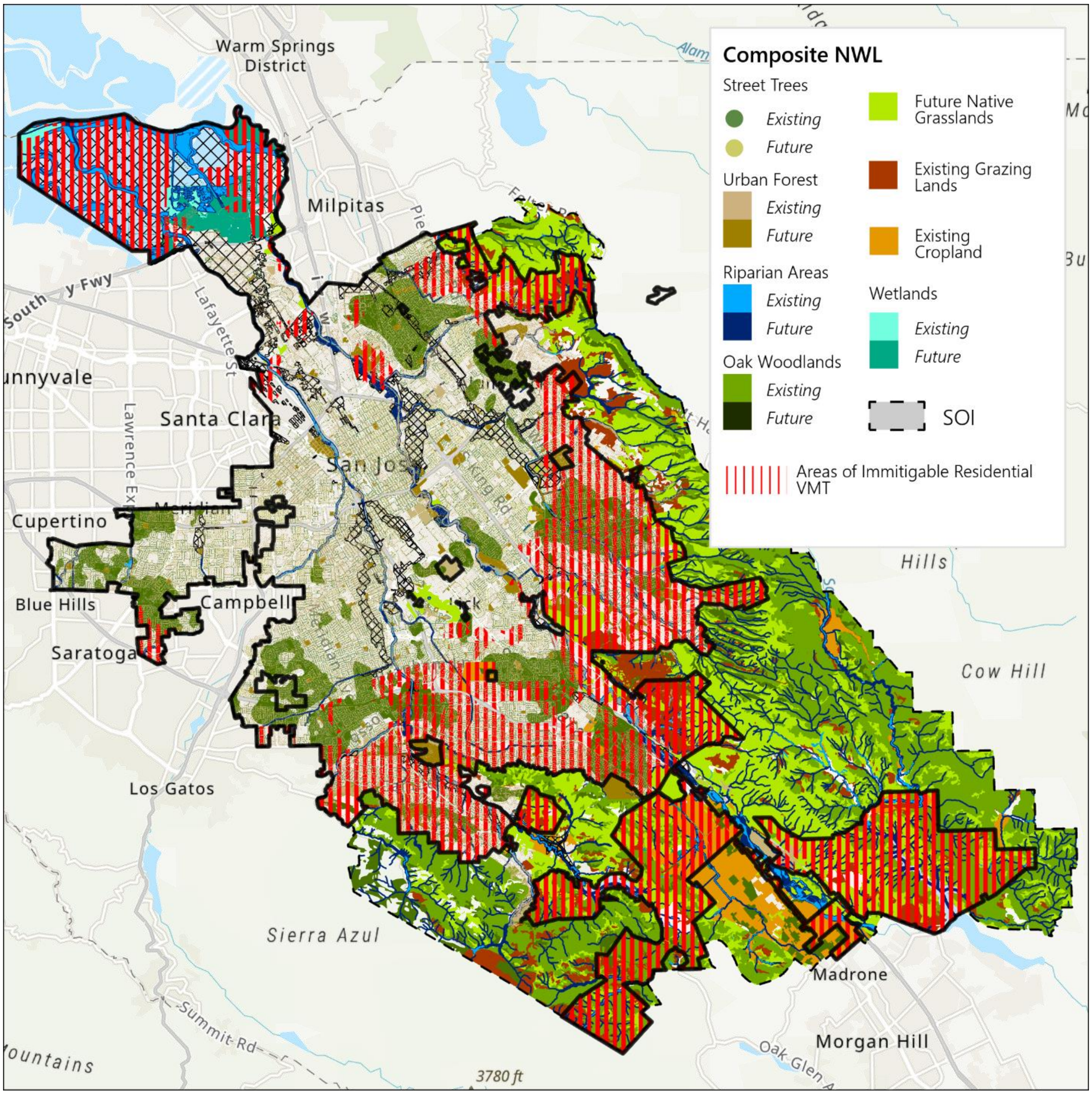


Figure 72: Areas of Immitigable VMT with Current and Potential Future NWLs

Indirect Impacts

The City's VMT policy provides opportunities for development projects to be exempted from transportation analysis under CEQA. These "streamlining" provisions are aimed and encouraging infill development near transit and within areas of low VMT, CEQA's previous level of service measure often penalized infill development projects because they generate additional automobile trips in urban and built out areas that are near or beyond their trip capacity. Attempts to mitigate automobile delays caused by a new development in dense urban settings is difficult, costly, and often not feasible. Instead of prioritizing automobile use, the VMT policy redirects regulation to prioritize infill development in areas that already have good access to transportation.

By creating opportunities for project streamlining, the City's VMT policy lowers some of the barriers that typically exist to infill development. It thereby encourages developers to search for development opportunities within the city instead of in greenfield areas, which can often be much more straightforward. By increasing the feasibility of infill development and making greenfield development more difficult, it is likely to reduce the demand for lands with high NWL value.

Opportunities for Future NWL Considerations

Updates to the City's VMT policy will happen incrementally as lead agencies in the region update their long-range plans. This includes MTC's Metropolitan Transportation Plan and Sustainable Communities Strategy (MTP/SCS) and the City's General Plan. San José is currently working on its first update of the policy. The update is focused on further streamlining transportation analysis for development projects and focusing the funds that come from development on VMT reducing improvements. The following is an opportunity improve and expand the policy:

Expand Mapping of Areas of Immitigable VMT to the SOI

The City currently maps areas of immitigable VMT within city limits. Given the large areas of NWLs within the SOI but outside city limits, it may be advantageous to extend the VMT analysis to the entire SOI. This would allow for future expansions of urban services to be judged in the context of VMT mitigation and the likelihood that projects could comply with CEQA even if adequate infrastructure existed to serve them.

City of San José Greenhouse Gas Reduction Strategy

Agency: City of San José
Year Adopted: 2015
Frequency of Update: Updates occur when the state updates its emission reduction goals
Regulatory Authority: Impacts the climate action plan (CSSJ) and is required by SB 32

About the Plan

The Greenhouse Gas Reduction Strategy (GHGRS) was created by the city of San José in 2015 and updated in August 2020. The GHGRS is the city's response to Senate Bill (SB) 32 greenhouse gas emissions reduction goals for 2030. The strategy leverages existing plans and policies that advance urban sustainability to provide a set of strategies and actions for achieving the state's 2030 targets. GHGRS also serves as a Qualified Climate Action Plan that applies relevant General Plan and GHGRS policies through a streamlined review process for proposed development projects that are subject to review under the California Environmental Quality Act (CEQA).

SB 32, also known as the California Global Warming Solutions Act of 2006, designated the State Air Resources Board as the regulatory authority charged with monitoring and regulating sources of greenhouse gas emissions. SB 32 requires that greenhouse gas emissions reduce to at least 40%

below the 1990 levels by 2030 to meet long term target of carbon neutrality by 2045. The Board is also tasked with developing compliance options and enforcement mechanisms to ensure action is taken to meet reduction targets. At the regional level, the Bay Area Air Quality Management District (BAAQMD) encourages local governments to adopt a qualified GHG reduction strategy that is consistent with SB 32 and recommends the strategy include elements identified in the state CEQA Guidelines, Section 15183.5 as a minimum standard to meet the GHG reduction strategy thresholds of significance option. Elements include:

- Quantify existing and projected greenhouse gas emissions over a specific time period
- Establish a GHG emissions target that meets and exceeds the goals of SB and AB 32
- Identify and analyze emissions reductions from anticipated actions to understand the amount of additional reductions needed to meet emissions target
- Specify what group of measures that would collectively achieve specified emissions levels and quantify reduction potential
- Establish a monitoring framework
- Be adopted in a public process after environmental review

Using these elements, the city of San José prepared the GHGRS in combination with the Envision San José 2040 General Plan and associated policies to estimate the city's potential future greenhouse gas emissions and ensure the General Plan can achieve the 2030 greenhouse gas emission reduction targets stated in SB 32.

Summary of NWL Impacts

Direct Impacts

GHGRS strategies have no direct impact on NWLs. The seven strategies listed in the document are more focused on reducing the emissions from large emission sources (such as energy, infrastructure, and transportation) than they are focused on enhancing the carbon sinks that help reduce emissions (such as NWLs). Direct NWL impacts are only referenced in the city of San José tree policy under the 'Other GHG Reduction Areas' section 4.4 in the GHGRS. Although the policy helps highlight an urban forest expansion strategy to expand carbon sequestration potential and help reduce GHG emissions, the policy itself is only added as a reference and is not integrated in the overall strategy approach.

Indirect Impacts

GHGRS recognizes the role land use and transportation policy plays in addressing greenhouse gas emissions and takes them into account in its GHG total emissions reduction. Policies referenced include the General Plan's Growth Areas policies. In addition, water conservation is one of the seven strategies listed in the GHGRS.

Opportunities for Future NWL Considerations

The GHGRS leverages several strategies from Climate Smart San José (CSSJ), Green Vision and the General Plan in order to create its seven listed strategies to reach GHG emission reduction targets. Since the GHGRS is built on the pillars and strategies within the CSSJ, a GHGRS update would require that CSSJ updates, such as the NWL element, are incorporated in the updated GHGRS. Because the NWL element will become an important pillar in the CSSJ, we recommend that the GHGRS consider adding NWL preservation and restoration as an eighth strategy. The reduction potential of NWL strategies can be estimated using the spreadsheet model provided in this report.

It should be acknowledged that NWL strategies offer significant carbon sequestration benefits but they take more time to reach their peak potential. Oak woodland restoration, the highest performing strategy in terms of carbon sequestration benefits, can take over 20 years to start demonstrating significant carbon sequestration capabilities. The GHGRS horizon target of 2030 would show a much lower and potentially misleading impact of NWL strategies if they were included. Extending the time horizon of the GHG Reduction Strategy or notation of the on-going and increasing benefits that accrue with NWLs will need to be included.

Table 3.6 – 2030 GHG Reduction Strategies and Reduction Potential

Strategy Title	2030 Reductions MT CO_2e/year	Strategy Origins
GHGRS – 1 **San José Clean Energy**	655,104	Green Vision Goal 3 Climate Smart San José (CSSJ) Strategy 1.1
GHGRS – 2 **Zero Net Carbon Residential Construction**	43,678	California Energy Efficiency Strategic Plan CSSJ Strategy 2.2 General Plan Goal MS-14
GHGRS – 3 **Renewable Energy Development**	63,697	Green Vision Goal 3 CSSJ Strategy 1.1 General Plan Goal MS-2
GHGRS – 4 **Existing Building Retrofits – Natural Gas**	208,986	Senate Bill 350 CSSJ Strategy 2.2 General Plan Goal MS-2
GHGRS – 5 **Zero Waste Goal**	207,956	Green Vision Goal 5 General Plan Goal MS-5 Council Resolution 74077
GHGRS – 6 **Caltrain Modernization Project**	12,547	CSSJ Strategy 2.4
GHGRS – 7 **Water Conservation**	3,106	CSSJ Strategy 1.2 General Plan Goal MS-3
Total Emission Reductions (MT CO_2e/year)	**1,195,074**	-
Total Emission Reductions in MMT CO_2e/year	**1.2**	-

CSSJ = Climate Smart San José

Figure 73: GHG Reduction Strategies, Source: City of San José GHGRS

Santa Clara County Community Climate Action Plan (CCAP)

Agency: Santa Clara County
Year Adopted: Under development
Frequency of Update: TBD
Regulatory Authority: TBD

About the Plan

Santa Clara County's Office of Sustainability (OOS) is currently developing a Community Climate Action Plan (CCAP). The CCAP is a comprehensive roadmap that outlines actions the County and partners will take to reduce greenhouse gas emissions. The CCAP will include a big picture understanding of the region to develop actions tailored to the unincorporated areas of the County and complement other local strategies that allow for efficient Countywide collaboration. There are four key components of the CCAP: (1) countywide greenhouse gas emissions inventory and forecasting; (2) an online interactive map tool that will provide a catalog of climate action/adaptation activities being undertaken by organizations and cities in the County; (3) greenhouse gas emissions reduction measures, and a menu of priority strategies; and (4) strategic outreach throughout the process.

The CCAP builds upon the County's recently adopted Sustainability Master Plan (SMP), which presents a vision and road map to integrate sustainability as a core function within County operations, coordinate and support cross-departmental sustainability efforts, empower collective action and transformation, and provide transparency on progress to build a livable, equitable and resilient County. The Sustainability vision is achieved through promoting solutions that combined include 8 goals, 30 strategies, and 90 targets to meet the County's carbon neutrality goals and adapt to a changing global climate, enhance natural resources and the environment, foster a prosperous and just regional economy, and meet the needs of current and future generations. More information about the SMP can be found at www.sccgov.org/sustainabilityplan.

Summary of NWL Impacts

Direct Impacts

Climate action plans are designed to tackle climate change from all angles, in the effort to reduce greenhouse gas emissions to the best of their abilities. They often acknowledge the carbon sequestration potential of NWLs and include strategies to preserve these lands as valuable carbon sinks that are essential to emission reduction strategies.

Indirect Impacts

One of the most common ways climate action plans tend to approach NWL preservation is through land use policy. Introducing strategies that support and encourage compact growth and mixed-use development that facilitate the use of transit will help direct new development away from sprawling into NWLs that exist on the edge of urban areas.

Opportunities for Future NWL Considerations

Through the development of its CCAP, the County is currently looking to identify, prioritize, and engage with existing local and regional sustainability climate defense efforts – including San Jose's NWL strategies. Since 2018, when the County Board of Supervisors adopted the Santa Clara Valley Agricultural Plan (Ag Plan), the County has been developing and implementing multiple strategies related to those in San Jose's NWL element. Through the ongoing implementation of the Ag Plan, and with the CCAP still in development, there is a timely opportunity for the County and City to explore areas of integration and collaboration in their efforts. Natural and working lands amount to a substantial portion of the unincorporated county and represent an important resource within the County's jurisdiction that can be invested in to reduce GHG emissions. This report illustrates the value of restoring and preserving NWLs with regard to reducing GHG emissions and studies the many co-benefits that emerge from NWL-related policies, such as habitat preservation, natural hazard management, and fiscal revenue. These findings can serve as a focal point for efforts to align priorities and strategies between the City and County.

In collaboration with the County of San Mateo, under a grant from the State Department of Conservation, the County of Santa Clara has assessed the sequestration potential of NWLs using a related approach and set of strategies similar to those identified in CSSJ's NWL element. This grant-funded project, Integrating Agriculture into Climate Mitigation, will inform the County's development of its CCAP and will be a good point of comparison to the work undertaken to develop CSSJ's NWL strategies.

Although the NWL Element that is set to be integrated in Climate Smart San Jose only applies to San Jose's sphere of influence, the element provides a framework for the County and City to compare NWL strategies and collaborate on implementation measures across jurisdictions.

Coyote Valley Conservation Program (AB948) and Coyote Valley Conservation Areas Master Plan

Agency: Santa Clara Valley Open Space Authority
Year Adopted: Under Development
Frequency of Update: ~5 years
Regulatory Authority: Land Use, Land Management, Land Restoration

About the Plan

In September of 2019, the California State Legislature passed Assembly Bill No. 948 which officially designated Coyote Valley as a landscape of statewide significance and authorized the Authority to establish and administer the Coyote Valley Conservation Program. In November of 2019, an innovative partnership among the Authority, POST, and the City of San José, protected 937 acres of open space in North Coyote Valley, including the heart of the historic Laguna Seca wetland. Additional acreage was secured in North Coyote Valley in 2020, resulting in the creation of the 953-acre North Coyote Valley Conservation Area on land previously slated for industrial development. Additional lands have been conserved to the south, along the course of Fisher Creek in Mid-Coyote Valley. This network of conserved lands will continue to grow as the Authority and its conservation partners continue to protect strategic properties in Coyote Valley. The on-going conservation of these lands has unlocked opportunities to implement a vision to protect and restore Coyote Valley's significant NWLs, creating a landscape of regional, state, and even national significance.

Beginning in Fall 2021, the Coyote Valley Conservation Areas Master Plan will be developed over a 3-5 year planning process that will create a roadmap for implementing a resilient landscape linkage on Coyote Valley's conserved lands; one that can sustain biodiversity and facilitate wildlife movement in a changing climate while also carefully managing/restoring water resources and providing opportunities for quality of life/economic benefits including public access and agriculture. The Plan will be managed by the Santa Clara Valley Open Space Authority in close partnership with the Peninsula Open Space Trust, and the City of San José, and will be created via an inclusive public planning process that is science based, collaborative, innovative, integrated, and reflective of the values of each agency and the communities they serve.

Summary of NWL Impacts

Oversight of the Coyote Valley Program and implementation of the Coyote Valley Conservation Areas Master Plan will balance an integrated set of goals that seek to create a resilient network of NWLs in Coyote Valley. These goals will have direct and indirect benefits to NWLs.

Direct Impacts

The Coyote Valley Conservation Areas Master Plan includes a set of initial goals that will directly benefit NWLs, including:

Goal 1. Enhance Wildlife Habitat & Ecological Connectivity. Realize Coyote Valley's irreplaceable role as a critical, "last chance," landscape linkage between the Santa Cruz Mountains and Diablo Range by restoring diverse habitats and carbon sinks, reestablishing safe movement corridors across the landscape for species threatened by habitat fragmentation, and by bridging barriers created by infrastructure and roadways.

Goal 2. Sustainably Manage and Restore Water Resources. Restore the historic Laguna Seca and the floodplain of Fisher Creek and improve the land's ability to capture stormwater, recharge groundwater supplies, improve water quality, support rare groundwater dependent habitats that sequester carbon, and reduce the severity of downstream flooding.

Goal 6. Adapt to Changing Climate Conditions. Strengthen Coyote Valley's resilience to changing climate conditions, leveraging the landscape's ability to serve as natural infrastructure that can buffer communities from the effects of climate change, and helps the region meet the State and Federal Government's "30x30" goals for protecting 30% of the planet's land and water by 2030.

Goal 7. Support Local Agriculture. Bolster Coyote Valley's role as a regional foodshed by strategically designating some conserved lands for regenerative agricultural uses that are designed and managed to support local community needs for healthy food, educate the public on the benefits of sustainable local agriculture, and support the agricultural economy of Santa Clara Valley.

Goal 8. Leverage Unique Landscape Features to Boost the Local Economy. Leverage the potential for Coyote Valley's conserved lands to support the local economy in ways that are consistent with overarching conservation goals through programs, activities, and amenities that incentivize agricultural land conservation, promote green jobs and workforce development, and generate revenue via nature-based activities.

Goal 10. Consider a Holistic Vision for the Entire Coyote Valley. Look beyond the boundaries of currently conserved lands in Coyote Valley to consider how they fit into the mosaic of privately and publicly held lands across the entire Coyote Valley and create a flexible plan that can be adapted as additional lands are conserved.

Indirect Impacts

The Coyote Valley Conservation Areas Master Plan includes a set of initial goals that will also indirectly benefit NWLs, including:

Goal 3. Improve Public Health via Access to Nature. Improve public health and quality of life by providing equitable access to people from throughout the region via carefully sited trails, visitor-serving amenities, and preserved scenic vistas to support nature-based educational and wellness-focused programming.

Goal 4. Foster On-going & Inclusive Community Engagement. Employ a robust and inclusive community engagement strategy that invites people from all walks of life to enjoy Coyote Valley and participate in both the planning and on-going stewardship of its unique landscapes; with a special focus on initiatives and programs that promote justice, equity, diversity, inclusion and access (JEDIA).

Goal 5. Respect, Honor, Preserve, & Interpret Cultural Heritage & Historic Resources. Work closely with indigenous communities and other local experts to identify and appropriately preserve, interpret, and steward natural, cultural, and historic resources within the conserved lands of Coyote Valley.

Goal 9. Promote Equitable and Sustainable Transportation. Promote equitable and sustainable transportation modes to and from conserved lands in Coyote Valley via street design improvements, welcoming access/activity nodes, and programs or services that promote access via walking, biking, and public transit and other sustainable modes of transportation.

Opportunities for Future NWL Considerations

The Coyote Valley Conservation Program and the Coyote Valley Conservation Areas Master Plan are focused on the conservation, management, and restoration of NWLs in Coyote Valley. It is expected that the City of San José will be closely engaged throughout oversight and implementation of these linked efforts that will support the City's goals and programs that directly and indirectly benefit NWLs. This includes the development of a pilot Coyote Valley Environmental Credits Program that aims to protect and enhance NWLs by shifting planned (potential future) development to infill locations in the City through a "credits" system that ties the full accounting of benefits of preservation, restoration enhancement of NWLs in the CV to accelerate transit-oriented development in infill locations within in the City.

APPENDIX A: Model Evaluation

Figure 74: NWL strategy evaluation involved UrbanFootprint as well as two ancillary models.

For the NWL project, Cascadia Partners was tasked by the City of San José with deploying scenario planning tools and supplemental models to measure the potential impact of NWL strategies on carbon emissions and sequestration within the city's Sphere of Influence (SOI). After extensive research and consultation with experts, it was decided to pursue the development of a new spreadsheet-based model to calculate the potential carbon sequestration benefits of a chosen set of strategies, to supplement the carbon emissions and sequestration calculations made within the Urban Footprint tool.

Potential model research was conducted with the assumption that UrbanFootprint would be the primary model used for scenario planning, and that up to two supplemental models would be chosen based on strategic and project-goal priorities. Identifying the supplemental model(s) to pair with UrbanFootprint required Cascadia Partners to conduct a review of models that evaluate NWL management or preservation strategies and quantify the GHG and carbon sequestration impacts of those strategies.

Ten models, tools, or model data sources were given a cursory review, and by way of prioritization and consultation of technical and project advisors, four models were identified to receive a more thorough review.

This section describes the spreadsheet-based model, as well as the model research process that led to the decision to pursue its development. It also details questions that have arisen during the model development process, and opportunities for future work.

Model Research

The table below lists and provides a brief description of the ten models, tools, or model data sources were initially reviewed for consideration in determining the Natural and Working Lands Element evaluation model set.

Model	Description
UrbanFootprint	Scenario Planning Tool which links together urban and regional planning decisions with GHG emissions and other scenarios. Data outputs include conservation-related, emissions, transit accessibility, and other metrics.
CALAND	Scenario planning tool & database accounting model focused on NWL GHG emissions. Models expected impacts of land conservation, restoration, and management activities.
COMET-Planner	COMET-Planner is focused on evaluating carbon and GHG impacts for conservation practice planning.
COMET-Farm	COMET-Farm is a whole farm and ranch carbon and greenhouse gas accounting system.
Climate Smart San José	A sophisticated cost-benefit analysis of climate action strategies defined in the Climate Smart San José Plan.
CREEC (Carbon in Riparian Ecosystems Estimator of California)	CREEC measures land conservation strategy carbon sequestration potential in riparian areas.
Urban Heat Island Tools (UC Davis)	Statewide process to develop data on the environmental benefits of urban trees and forests, and to provide a baseline from which future benefits resulting from tree planting and management campaigns may be assessed.
Biomass Estimation for U.S. Tree Species	Carbon content estimation process for trees to support large-scale carbon accounting processes.
Urban Heat Island (Shandas, Portland State University)	Processes to predict Urban Heat Island distribution & severity based on input factors
iTree	Software that provides, among other outputs, estimation of carbon sequestration and storage by tree species
Terra Count	Scenario Planning Tool to analyze effects of different management activities and development patterns on future sequestered carbon and a host of environmental co-benefits

Figure 75: NWL Model Descriptions

TerraCount

TerraCount is a comprehensive scenario planning tool designed to analyze effects of different management activities and development patterns on future sequestered carbon and a host of environmental co-benefits. Benefits of TerraCount include its use of California-specific data to measure the impacts strategies on carbon sequestration potential. Its methodology is similar to UrbanFootprint and draws heavily on Comet Planner, making it more compatible and universally accepted. See Appendix 2 for further details about calibrating TerraCount to run for other counties.

COMET-Planner

COMET-Planner is focused on evaluating carbon and GHG impacts for conservation practice planning. Similar to TerraCount, it measures the impacts of NWL strategies on carbon sequestration potential but provides more detailed activities for agriculture-specific uses. COMET-Planner uses a national dataset and does not include all land use types most common to Santa Clara County.

CREEC (Carbon in Riparian Ecosystems Estimator of California)

CREEC uses high quality, California-specific data to measure the impacts of riparian-area conservation strategies on carbon sequestration potential. CREEC is limited to riparian areas and does not include a broad set of land types.

iTree

iTree quantifies the benefits and value of trees and tree planting, by specifically measuring the impacts of tree planting strategies on carbon sequestration potential. This tool includes detailed activities specific to tree planting, however, it is specific to urban forestry. It runs using a national dataset and requires detailed information about tree Diameter at Breast Height (DBH) and species in order to produce reports about tree benefits.

Model Attributes Comparison Table

The table below compares TerraCount, COMET-Planner, CREEC, and iTree in the land cover types they are built to evaluate, scalability, data availability, and their overlap with other models evaluated for this project.

	TerraCount	COMET-Planner	CREEC	iTree
Landcover types included	Barren, Forest, Shrubland, Wetland, Grassland, Ag, Urban	Agricultural lands only	Riparian lands only	Trees and woody areas – intended for urban forestry
City scale analysis	Yes	Specific to farms and farmland	Specific to riparian areas	Yes
What is the primary reason chosen?	Evaluates land conservation activities as well as their co-benefits	Robust evaluation of land conservation activities related to farmlands	Evaluates riparian area-specific conservation practices	Quantifies benefits and value of trees and tree planting
Data Availability	Primarily runs off California LANDFIRE data.	Nationwide dataset	California	May require field data and tree measurements be added by user
Overlap with other tools?	Some overlap with Comet-Planner, CREEC and iTree	Some overlap with TerraCount, CREEC, and iTree	Comet-Planner and TerraCount cover some riparian restoration	Comet-Planner also evaluates urban forestry practices

Figure 76: Model attributes comparison

Final Model Recommendation

After a cursory evaluation of the ten models, and an in-depth analysis of four, the project team concluded that none of the “off-the-shelf” models reviewed would meet all of the project’s needs for a supplemental model. iTree was identified as being useful for modeling urban forest and street tree strategies. TerraCount initially rose to the top as being the best general model for this project based on its comprehensiveness in the ability to test a wide range of NWL strategies. However, the effort required to calibrate TerraCount for the area was prohibitive for this project. Ultimately it was decided to create a new custom spreadsheet model, which would allow the evaluation of all the chosen strategies, and for the analysis to be replicated more easily than would be possible with a tool like TerraCount (in its current form). This model will incorporate iTree’s predetermined tree structure and benefits estimates for quantification of urban trees.

iTree Model

i-Tree is a collection of peer-reviewed urban and rural forestry analysis and benefits assessment tools, designed and developed by the United States Forest Service. The collection of tools are used to quantify forest structure and the environmental benefits that trees provide, with the intent to help strengthen forest management and advocacy efforts. iTree Eco is designed to model the ecosystem services and values of trees using tree data collected within a defined area.

For the modeling purposes of this project, the iTree Eco model is used to estimate the value and benefits of existing street trees in San José using an existing street tree inventory developed for the city of San José (see Table 2 in Appendix 1). Model results provide an in-depth analysis of the urban forest structure and composition as well as the pollution removal benefits, including carbon sequestration rates and total carbon stored. These results were used to inform the calibration of the street tree planting and urban forest expansion strategies in the custom spreadsheet model as well as provide an estimated base year carbon assessment of San José’s existing street trees.

NWL Strategy Model

The custom “NWL Strategy” spreadsheet model is designed to analyze the effects of different conservation and land management activities on future sequestered carbon in a spreadsheet-based calculator. It builds off of the work of several of the models evaluated, including TerraCount, iTree, CREEC, and Comet-Planner. Unlike models like TerraCount, the spreadsheet model does not have a direct link to a spatial (mapped) component, though it does require the use of a GIS to determine the acreages to which each of its modeled strategies are applied/.

Data Inputs:

- Land acreage where specified conservation activity can be applied
- Carbon sequestration rates for specified conservation activities
- Land acreage of existing land cover by class
- Existing non-soil and soil ground carbon rates by land cover class
- Growth curve calibration settings

Data Outputs:

- Estimated existing embodied carbon on current NWL
- Estimated carbon sequestration benefits of each conservation strategy over a specified time horizon.

APPENDIX B: TerraCount Evaluation

TerraCount is a comprehensive scenario planning tool designed to analyze effects of different management activities and development patterns on future sequestered carbon and a host of environmental co-benefits. It was created to help Merced County planners understand the impacts of land use/landcover changes on carbon storage and locate where conservation goals are closely aligned with potential emission reduction opportunities. The model is deployed through an ArcGIS toolbox that can be run in ArcMap or ArcGIS Pro. It runs from “built-in” data inputs from the nationwide LANDFIRE program.

The tool can be used to run scenarios at the county level or on user-defined sub-areas within the county. Running the tool outside of Merced County requires “calibration" - including potential custom reclassification of LANDFIRE data and processing of data in preparation for consumption by the GIS tool. The TerraCount framework has the capability of being widely applied at a county level throughout the United States but would need updates to make this application easily accessible and efficient.

TerraCount was evaluated as part of the SJ NWL project’s ancillary model selection process. While the useability of the tool overall was good, ultimately the tool was not selected because it lacked key aspects of replicability that were necessary to deploy the tool for our study area. Below is detailed information about how the tool works, and the areas that would need improvement before being implemented for our project.

How it Works

The tool can be used to run scenarios for an entire county or for any defined sub-area within the county. It can be used to model the effects of a wide range of land-use policies, conservation and land-management strategies, and restoration programs.

The tool currently uses the land cover data developed for the 2014 jurisdictional inventory (LANDFIRE data supplemented with custom classifications). The tool also requires a 2030 (or some horizon year) estimate of land cover. For the Merced project, that estimate was based on outputs of the models ST-SIM (for natural landscapes) and Envision Tomorrow (for urban landscapes).

TerraCount calculates the landscape carbon impacts associated with each activity by:

1. Identifying the land covers suitable for the activity
2. Identifying the geographies suitable for the activity
3. Randomly selecting—from among the areas defined in steps 1 and 2—a subset of suitable areas based on user-defined timing of implementation
4. Applying the activity reductions to the areas selected in step 3

The scenario analysis engine runs through a graphical user interface (GUI) in ArcGIS (Pro or Desktop) through the TerraCount toolbox. The toolbox was developed using Python and relies heavily on tables created through the Python Data Analysis Library (PANDAS).

Landcover Types Analyzed:

Barren, Forest, Shrubland, Wetland, Grassland, Irrigated pasture, Orchard, Rice, Row crops, Vineyard, Urban, Water

Model Inputs

- Base year and horizon year landscape GHG data (from jurisdictional carbon inventory)
- Horizon year development footprints
- Activities (conservation activities such as riparian restoration, tree planting, etc)
- Co-benefits (a suite of environmental benefits that fall into five categories: water, agriculture, human well-being, biodiversity, and resilience)
- User-defined conservation and user-defined development

Model Outputs

- Landscape carbon total
- Landscape carbon by activity
- Co-benefit total
- Multi-benefit by activity

Useability

The toolbox GUI that we tested in ArcPro (for Merced County) is simple to install and run. The toolbox in ArcGIS would be easy to use for an intermediate user of ESRI products. It would require an ArcGIS license to use, which could be a barrier for users without an ESRI license. TerraCount's methodology draws from UrbanFootprint, Envision Tomorrow, and Comet Planner, giving it potential compatibility across platforms. TerraCount also includes a wide range of land cover types in which it is able to evaluate, when compared to other carbon accounting models that only model specific land cover types such as the CREEC tool for riparian areas or iTree for the urban forest.

Recommendations:

Make a plug-in or toolbox that is compatible with QGIS or some other open-source spatial analysis software to reduce barriers to entry for those without an ESRI license.

OR

Make the tool web-based, without software requirements - i.e. COMET Planner

Replicability

The TerraCount framework has the potential to be widely applied at a county level throughout California and even the United States, though currently there are several barriers to the tool's replicability. To use TerraCount in another county, the tool's underlying carbon inventory data and cobenefit datasets would need to be acquired and preprocessed for that county, representing a significant time and resource commitment.

Data Preprocessing

The evaluation of TerraCount's input data can take a significant amount of time, expertise, and resources. In addition, the preparation of simulated horizon year landcover, and the transfer of data to python tables, represents potentially hundreds of hours of work. This intensive data preparation process is the primary barrier for those wanting to deploy TerraCount outside of Merced County.

Data Inputs

The primary land use data driving the tool are the 2001 LANDFIRE, 2014 LANDFIRE, and a simulation of 2030 land cover produced using ST-SIM and Envision Tomorrow. LANDFIRE is a nationwide and regional dataset that provides classification of existing vegetation type, cover, and height. LANDFIRE data are generally not as precise as local data but do serve as a comprehensive cross-boundary dataset. The accuracy of LANDFIRE data at smaller scales such as watershed or sub-watershed needs to be carefully evaluated and varies depending on the area and the vegetation type. Even after being evaluated for accuracy and re-classified when necessary, this data set is intended for regional-scale analysis—not for parcel-level or landowner-level analysis and decision-making.

Anyone considering deploying TerraCount outside of Merced County needs to consider the availability of resources (funding and expertise) to do the custom classification work, and to evaluate how much accuracy ultimately matters in the local context.

Recommendations

Calibrating LANDFIRE data, calculating horizon year landcover estimates, and feeding data into the toolbox all require time and expertise that proved cost-prohibitive for our project.

1. Look at datasets other than LANDFIRE with better local accuracy and finer spatial resolution. LEMMA was suggested.
2. Design a “plug and play” method of updating data for both base and horizon years
3. Simplify the data pipeline between the landcover data and the tables that feed the toolbox (transfer of data to Python tables, etc) OR
4. Create a statewide tabular dataset that can feed the toolbox so that the tool can be deployed in any county in California without having to calibrate and prepare data.

APPENDIX C: NWL Strategy Data Sources

Summary of Strategy Application Geographies

The following tables summarize the data sources used to identify lands applicable for each of the twelve NWL strategies.

Existing NWLs for Potential Strategy Application		Natural Community Restoration*			
Land Cover Database	**Select Database Attributes**	**Riparian restoration**	**Native grassland restoration**	**Oak woodland restoration**	**Wetlands restoration**
Santa Clara Valley Habitat Agency Land Cover Dataset	Oak Woodland			X	
	Riparian Forest and Scrub	X			
	Wetland				
FMMP	Farmland of Statewide Important				
	Farmland of Local Importance				
	Prime Farmland				
	Unique Farmland				
	Grazing Land				
DWR	Native - Riparian	X	There are no native grasslands in the project SOI		
Tree Canopy LIDAR	Tree Canopy				
UrbanFootprint Base Canvas	Developed within UF Scenario	0		0	0
City of San José Parks Data	Urban Open Space				
SFEI Wetlands (CARI)	Subtidal Water				X
	Tidal Channel				X
	Tidal Flat				X
	Tidal Marsh				X
Street Tree Inventory	Existing Street Trees				

* Strategies do not apply to existing native communities and existing urban trees

Figure 77: Applicable Lands, Existing NWLs, Natural Community Restoration Strategies

Existing NWLs for Potential Strategy Application		Land Management Strategy							
Land Cover Database	**Select Database Attributes**	**Street tree planting***	**Urban forest expansion***	**Cropland management**	**Grazing lands**	**Greywater application**	**Biosolids application**	**Mulching**	**Compost**
Santa Clara Valley Habitat Agency Land Cover Dataset	Oak Woodland					No longer valid strategy			
	Riparian Forest and Scrub								
	Wetland								
FMMP	Farmland of Statewide Important			X			X	X	X
	Farmland of Local Importance			X			X	X	X
	Prime Farmland			X			X	X	X
	Unique Farmland			X			X	X	X
	Grazing Land				X				X
DWR	Native - Riparian						0	0	0
Tree Canopy LIDAR	Tree Canopy		X						
UrbanFootprint Base Canvas	Developed within UF Scenario	0	0	0	0		0	0	0
City of San José Parks Data	Urban Open Space							X	X
SFEI Wetlands (CARI)	Subtidal Water								
	Tidal Channel								
	Tidal Flat								
	Tidal Marsh								
Street Tree Inventory	Existing Street Trees	X							

Figure 78: Applicable Lands, Existing NWLs, Land Management Strategies

Future NWLs for Potential Strategy Application		Natural Community Restoration			
Land Cover Database	**Select Database Attributes**	**Riparian restoration**	**Native grassland restoration**	**Oak woodland restoration**	**Wetlands restoration**
Santa Clara Valley Habitat Agency Land Cover Dataset	Grasslands		X		
FMMP	Farmland of Local Potential				
DWR	Native - Barren			X	
	Native - Riparian (100 ft buffer)	X			
	Urban Vacant				
UrbanFootprint Base Canvas	Selected Opportunity Sites				
	Plant Master Plan sites				X
	Developed within UF Scenario	0	0	0	0
City of San José Parks Data	Urban Open Space				
Santa Clara County	Category 1 Stream Buffers	X			
Valley Water	Top of Bank (100 ft buffer)	X			
	Creeks (100 ft buffer)	X			
SFEI Historic Ecology	Coyote Riparian: Bar w/ Woodland	X			
	Coyote Riparian: Island w/ Woodland	X			
	Coyote Riparian: Low Flow Channel	X			
	Oak Savanna / Grassland		X		
	Oak Woodland			X	
	Salt Flat / Salina				X
	Shallow Bay				X
	Shallow Tidal Channel				X
	Tidal Flat / Channel				X
	Tidal Marsh				X
	Tidal Marsh Panne				X
	Laguna Seca Site				X
CLN Historic Ecology	Blue Oak Woodland			X	
	Coastal Oak Woodland			X	
	Saline Emergent Wetland				X
	Valley Oak Woodland			X	
NOAA	10 year Sea Level Rise				X
FEMA	FEMA 100 yr flood plain				

Figure 79: Applicable Lands, Future Potential, Natural Community Restoration Strategies

Future NWLs for Potential Strategy Application

Land Cover Database	Select Database Attributes	Land Management Strategy: Street tree planting	Urban forest expansion	Cropland management	Grazing lands	Greywater application	Biosolids application	Mulching	Compost
Santa Clara Valley Habitat Agency Land Cover Dataset	Grasslands	Future street trees are planted by yearly amount, not by land availability.			No future grazing lands were identified	No longer valid strategy	Biosolids cannot be applied to future restored natural community	Mulching cannot be applied to future restored natural community	Compost cannot be applied to future restored natural community
FMMP	Farmland of Local Potential			X					
DWR	Native - Barren								
	Native - Riparian (100 ft buffer)								
	Urban Vacant		X						
UrbanFootprint Base Canvas	Selected Opportunity Sites		X						
	Plant Master Plan sites								
	Developed within UF Scenario		0	0					
City of San José Parks Data	Urban Open Space		X						
Santa Clara County	Category 1 Stream Buffers								
Valley Water	Top of Bank (100 ft buffer)								
	Creeks (100 ft buffer)								
SFEI Historic Ecology	Coyote Riparian: Bar w/ Woodland								
	Coyote Riparian: Island w/ Woodland								
	Coyote Riparian: Low Flow Channel								
	Oak Savanna / Grassland								
	Oak Woodland								
	Salt Flat / Salina								
	Shallow Bay								
	Shallow Tidal Channel								
	Tidal Flat / Channel								
	Tidal Marsh								
	Tidal Marsh Panne								
	Laguna Seca Site								
CLN Historic Ecology	Blue Oak Woodland								
	Coastal Oak Woodland								
	Saline Emergent Wetland								
	Valley Oak Woodland								
NOAA	10 year Sea Level Rise								
FEMA	FEMA 100 yr flood plain		X						

Figure 80: Applicable Lands, Potential Future, Land Management Strategies

Summary of NWL Strategy Data Sources

Conservation Strategy	Data Sources	Carbon Stock Impacted	Related Model/Tool
Biosolids Application	Eve et al, 2014; Thorman, Williams & Chambers, 2009; The State Water Resources Control Board Order 2004 -0014	Soil carbon	Comet-Planner
Compost: carbon addition	Eve et al, 2014; CARB	Soil carbon	Comet-Planner
Cropland Management	Swan, et al, YEAR; IPCC, 2006	Non-soil and soil carbon	Comet-Planner
Grazing Land Management	Eve et al, 2014; IPCC, 2006	Non-soil and soil carbon	Comet-Planner
Mulching	Eve et al, 2014;	Soil carbon	Comet-Planner
Native Grassland Restoration	Koteen (2007) and Koteen et al. (2005)	Non-soil carbon	Comet Planner
Oak Woodland Restoration	Virginia Matzek	Non-soil and soil carbon	N/A
Riparian Restoration	Matzek et al, 2018 Appendix S2	Non-soil and soil carbon	CREEC
Street Tree Planting	iTree Eco; National Tree Benefit Calculator	Non-soil and soil carbon	iTree, National Tree Benefits Calculator
Urban Forest Expansion	San José Canopy Study, 2013; iTree; National Tree Benefit Calculator	Non-soil and soil carbon	iTree, National Tree Benefits Calculator
Wetland Restoration	Callaway, J. et al., 2012; Miller, R. and Fujii, R, 2010	Non-soil and soil carbon	N/A

Figure 81: NWL Strategy Sequestration Rate Assumptions

Datasets	Data Source	Description	Use in Model
The Department of Water Resources (DWR) Landuse Survey	https://data.cnra.ca.gov/dataset/statewide-crop-mapping/resource/3bba74e2-a992-48db-a9ed-19e6fabb8052	A dataset providing agricultural land use, managed wetlands, and urban boundaries for all 58 counties in California in 2014.	DWR data are used to identify riparian areas and other areas outside of the city's urbanized areas within the SOI and derive percentages for weighting the carbon sequestration rates for agricultural lands from FMMP data.
Santa Clara County Important Farmland Mapping & Monitoring Program (FMMP)	Acquired from Open Space Authority staff.	A dataset used for analyzing impacts on California's agricultural resources, using aerial imagery, public review, and field reconnaissance, updated in 2018.	FMMP data are used to identify agricultural lands and grazing lands.
LANDFIRE	Acquired from city staff.	Raster data collected in 2016 of Existing Vegetation Cover (EVC) represents the vertically projected percent cover of the live canopy layer for a 30-m cell. Percentage tree, shrub, and herbaceous canopy cover training data are generated using plot-level ground-based visual assessments and lidar observations.	LANDFIRE data are used to derive percentages for weighting the carbon sequestration rates for the native vegetation category from the DWR data into forested areas, shrubland, and grassland.
San José Tree Canopy Study LiDAR Land Use Classification	https://gisdata-csj.opendata.arcgis.com/datasets/tree-canopy-land-use-class-2012-raster-download	Raster data collected in 2012 with a 1-foot pixel resolution, each defined into 9 land cover categories: asphalt, concrete, building, grass, exposed dirt, tree canopy, light vegetation, dense vegetation, water.	The LIDAR-derived dataset is used to parse the urbanized area categories into buildings & other non-vegetated areas, separate from grasses, shrubs, or trees.
Santa Clara Valley Habitat Agency Land Cover dataset	https://gisdata2-sccplanning.opendata.arcgis.com/datasets/land-cover	A dataset defining boundaries representing habitat plan land cover within Santa Clara County, updated in 2020.	Santa Clara Valley Habitat Agency Land Cover data are used to identify areas outside the urbanized area and FMMP defined agricultural lands.

The California Aquatic Resource Inventory (CARI) dataset	https://www.sfei.org/data/california-aquatic-resource-inventory-cari-version-03-gis-data#sthash.JD7jvu4A.dpbs	A dataset was initiated in 2009 by the California Wetland Monitoring Workgroup (CWMW) with the goal of achieving an updateable, standardized map that could be used by environmental managers, planners and the public to assess the diversity and abundance of wetlands across the State, updated in 2017.	CARI data are used to identify saline wetlands.
City of San José Street Tree Inventory	https://data.sanJoséca.gov/dataset/street-tree1	Locations of all street trees in the City of San José, updated in 2020. Street trees are trees along the city right-of-way and sidewalk, but do not include trees on private property or large lots like parks.	The San José Street Tree inventory is used to locate all existing street trees in San José and used as an input to the iTree Eco tool to get a total estimate of carbon stored by street trees.
San Francisco Estuary Institute (SFEI) Historical Ecology dataset	https://www.sfei.org/content/santa-clara-valley-historical-ecology-gis-data#sthash.YOOYQgTD.dpbs	Geospatial data describing the historical conditions of Santa Clara Valley were developed to provide information for flood protection, watershed management, habitat restoration, local education, and research, last updated in 2015.	The San Francisco Estuary Institute Historical Ecology Dataset is used to identify historical land conditions to which restorative strategies can be applied to in the future and define the Laguna Seca freshwater wetland site.
Conservation Lands Network (CLN) Historical Ecology dataset & Stream Valleys dataset	https://www.bayarealands.org/maps-data/	The CLN 2.0 dataset, released in 2019, is based on new and updated data, and incorporates the importance of habitat connectivity for wildlife movement and climate resilience.	The Conservation Lands Network Historical Ecology and Stream Valleys datasets are used to identify historical land conditions to which restorative strategies can be applied to in the future.
NOAA Sea Level Rise dataset	Urban Footprint Risk and Resilience Module	These data, last updated in 2019, depict the potential inundation of coastal areas resulting from a projected 10 feet rise in sea level above current Mean Higher High Water (MHHW) conditions.	The NOAA Sea Level Rise dataset is used to determine the extent of urban retreat and identify flood prone lands due to sea level rise where bayland restoration strategies can apply in an urban retreat scenario.
FEMA National Flood Hazard Layer dataset	Urban Footprint Risk and Resilience Module	The National Flood Hazard Layer (NFHL) data determines the flood zone, base flood elevation, and floodway status for a particular location.	The FEMA National Flood Hazard dataset is used to determine the extent of urban retreat and identify flood prone zones where urban forest expansion strategies can apply in an urban retreat scenario.

USFS Wildfire Hazard Potential	Urban Footprint Risk and Resilience Module	The wildfire hazard potential (WHP) data is produced by the USDA Forest Service, Fire Modeling Institute to inform evaluations of wildfire risk or prioritization of fuels management needs across very large landscapes, last updated in 2018. There are 5 classes of Wildfire Hazard Potential - very low, low, moderate, high, and very high.	The WHP dataset is used to determine the extent of urban retreat in an urban retreat scenario.
Valley Water datasets	https://data-valleywater.opendata.arcgis.com/	These datasets include all Santa Clara County Valley Water District related data.	Valley Water data are used to identify the location of creeks, streams and top of banks in the SOI.

Figure 82: Land Cover Datasets

APPENDIX D: General Plan Policy Analysis

Chapter 1: Major Strategies

Major Strategy	*DIRECT*	*INDIRECT*	*JUSTIFICATION*
Major Strategy #2 - Form Based Plan		x	Use the General Plan Land Use / Transportation Diagram designations and Plan Goals and Policies to address the form and character as well as land uses and **densities for the future development of San José.**
Major Strategy #3 - Focused Growth	x	x	**Strategically focus new growth into areas of San José that will enable the achievement** of City goals for economic growth, fiscal sustainability and **environmental stewardship** and support the development of new, attractive urban neighborhoods. This approach reflects the built-out nature of San José, the limited availability of additional "infill" sites for development compatible with established neighborhood character, and **the emphasis in the Plan Vision to reduce environmental impacts while fostering transit use and walkability.** The General Plan **does not support the conversion of industrial areas to residential use or the urbanization of the Mid-Coyote Valley or South Almaden Valley Urban Reserves or lands outside of San José's Urban Growth Boundary. Planning sites for higher density residential development.** Further **employment land conversions or dramatic expansions of the City outside of its current boundaries would have significant negative environmental**, fiscal and economic implications and be clearly contrary to those objectives.
Major Strategy #4 - Innovation/Regional Employment Center		x	The Plan focuses employment growth in the Downtown, in proximity to regional and local transit facilities and on existing employment lands citywide.
Major Strategy #5 - Urban Villages		x	The General Plan policies and Land Use / Transportation Diagram **strongly direct that new job and housing growth** within Regional Transit Urban Villages **occur at the highest feasible concentration and density**, with particular emphasis upon employment growth to support the Regional Employment Center Strategy. Urban Villages...are **planned for a balanced mix of job and housing growth at relatively high densities. Development of Urban Villages at environmentally and fiscally beneficial locations** throughout the city is a key Plan strategy.
Major Strategy #7 - Measurable	x		San José will encourage and participate in cooperative regional **efforts intended to improve the**

Major Strategy	DIRECT	INDIRECT	JUSTIFICATION
Sustainability / Environmental Stewardship			**quality of air and water and to conserve land, soil, water, energy and ecosystems** such as San Francisco Bay, forests, riparian corridors, fisheries and grasslands.
Major Strategy #8 - Fiscally Strong City		x	San José will maintain a Fiscally Strong City, by providing adequate land for uses that generate revenue for the City and by focusing new growth in developed areas where existing infrastructure (e.g., sewers, water lines, and transportation facilities), and City facilities and services (e.g., libraries, parks and public safety) are already available, resulting in maximum efficiency.
Major Strategy #10 - Life Amidst Abundant Natural Resources	x		…Reinforcing the Greenline / Urban Growth Boundary as the **limit of the City's urbanized area and to preserve the surrounding hillsides largely as open space.** The Greenline/Urban Growth Boundary is intended to develop a clearer identity for San José by defining where urban development ends and **by establishing policies to preserve valuable open space resources. Natural resources surrounding the lands within the Greenline/Urban Growth Boundary are the inspiration for this concept.** City of San José and the County of Santa Clara support that **urban development should occur only within the Urban Service Areas of cities where it can safely and reasonably be accommodated and where urban services can efficiently be provided. Lands outside of the Greenline/Urban Growth Boundary are identified as those that are intended to remain permanently rural in character** and that should remain under the jurisdiction of the County. Both the City and the County are committed to the success of this arrangement.
Major Strategy #11 - Design for a Healthful Community		x	Parks, Trails, Open Space, and Recreation policies also encourage activity by promoting good and convenient access to a large and diverse variety of parks, trails and recreations facilities for all City residents.
Major Strategy #12 - Plan Horizons and Periodic Major Review		x	The Plan provides a tool for phasing the development of new Urban Village areas and gives highest priority to the location of new housing growth in the Downtown, connecting transit corridors, BART station area, and North San José.
Specific Plans		x	The City's adopted Specific Plans generally have a residential orientation, providing significant capacity for residential and mixed-use development at important infill sites throughout the City and often in proximity to the Downtown.

Major Strategy	DIRECT	INDIRECT	JUSTIFICATION
Employment Lands		x	Significant job growth is planned through intensification of each of the City's Employment Land areas; These Employment Lands are planned to accommodate a wide variety of industry types and development forms, including high-rise and mid-rise office
Regional Transit Stations		x	Both the Lundy/Milpitas and Berryessa BART station areas support large amounts of new mid-rise and high-rise employment uses, while the Berryessa BART Urban Village is also planned for additional housing development.
Local Transit Urban Villages		x	A large and balanced amount of job and housing growth capacity is planned for the Transit Villages and Corridors. The goal is to maximize the opportunity for creating new mixed-use villages in these areas.
Commercial Corridor and Center Urban Villages		x	…They contain large parcels which may have greater potential for redevelopment and are generally located in areas with a high degree of accessibility which is advantageous for intensified commercial development.

Chapter 2: Thriving Communities

Goal	DIRECT	INDIRECT	JUSTIFICATION
IE-1 – Land Use and Employment		x	IE-1.3, IE-1.5, IE-1.6, IE-1.13: compact development and intensification of commercial, Village, Industrial Park and Employment Center job Growth Areas to create complete, mixed-employment areas that can serve daily needs of employees, in close proximity to transit corridors; maximizing utilization of land use along corridors as employment areas
IE-3 – Regional, State, and National Leadership		x	IE-3.6: work with partners to support development for higher-density, clustered, transit-oriented development patterns
AC-1 – San José as the Silicon Valley Cultural Center		x	AC-1.9: encourage retrofitting existing structures to accommodate spaces for arts and culture activities
FS-2 – Cultivate Fiscal Resources		x	FS-2.3: encourage redevelopment of existing older or marginal industrial areas that could support intensified employment activity, particularly in locations that facilitate efficient commute patterns
FS-3 – Fiscally Sustainable Land Use Framework		x	FS-3.3: promote land use policy that increases the ratio of jobs to employed residents; FS-3.8-FS-3.11: maintain the City's current Urban Service Area and expand only when consistent with LAFCO rules,

Goal	DIRECT	INDIRECT	JUSTIFICATION
			discourage expansion of utilities if outside of the USA and consider annexation only if its within the UGB
FS-4 – Promote Fiscally Beneficial Land Use		x	FS-4.8: Emphasize mixed-use development for most new development, to achieve service efficiencies from compact development patterns and to maximize job development and commercial opportunities near residential development.
FS-5 – Fiscally Sustainable Service Delivery	x	x	FS-5.2: Support the development of compact communities that reduce the demand for service expansions, facilitate more efficient service delivery and generate greater revenue per acre relative to cost for the City. FS-5.9: Expansion of the Urban Service Area into the South Almaden Valley and Central Coyote Valley Urban Reserves will not be considered until after 2040. FS-5.10: Maintain the rural and agricultural character of Central Coyote Valley and do not expand the Urban Service Area to include it.

Chapter 3: Environmental Leadership

Goal	DIRECT	INDIRECT	JUSTIFICATION
MS-9 – Service Delivery		X	Improve quality of waste management systems, including finding appropriate locations for waste management infrastructure, and increasing accessibility of recycling and zero waste programs
Goal MS-10 – Air Pollutant Emission Reduction		X	Several policies directed towards TOD and generally encourage transit-orientation and minimizing auto-dependance in new development. MS-10.2: Consider the cumulative air quality impacts from proposed developments for proposed land use designation changes and new development, consistent with the region's Clean Air Plan and State law.
MS-11 – Toxic Air Contaminants		X	Monitoring and assessing health risks of locating new development (primarily residential) near freeways or industrial uses to avoid exposure to air pollution. MS-11.5 Encourage the use of pollution absorbing trees and vegetation in buffer areas between substantial sources of TACs and sensitive land uses
MS-12 – Objectionable Odors	X	X	Requires that new residential development projects and projects categorized as sensitive receptors to be located an adequate distance from facilities that are existing and potential sources of odor, such as landfills, green waste and resource recovery facilities, wastewater treatment facilities, asphalt batch plants, and food processors - could this potentially relate to biosolids?
MS-13 – Construction Air Emissions		X	Minimal connection. Relates to improved air quality.

Goal	*DIRECT*	*INDIRECT*	*JUSTIFICATION*
Goal MS-14 – Reduce Consumption and Increase Efficiency		X	Promotes compact growth in certain areas (near transit and amenities), encourages energy and resource efficient new building and rehab construction.
Goal MS-15 – Renewable Energy		X	Encourages use of renewable energy and energy efficient technologies
Goal MS-16 – Energy Security		X	Encourages use of renewable energy and energy efficient technologies
Goal MS-17 – Responsible Management of Water Supply	X	X	Water use efficiency including low impact and water-efficient development. MS-17.4 Create partnerships and governance structures that allow for a comprehensive approach to water supply management that improves the reliability of local and imported water supplies, explores new sources of water, and thereby protects and enhances the Sacramento-San Joaquin River Delta ecosystem.
Goal MS-18 – Water Conservation		X	Water conservation through water consumption reduction and increased water efficiency
MS-19 – Water Recycling		X	Water conservation through reuse of wastewater.
MS-20 – Water Quality	X	X	Encourages flood protection measures and stormwater infiltration practices that protect groundwater quality. This would be particularly relevant if there are water resources in Coyote Valley.
MS-21 – Community Forest	X	X	Preservation of current canopy and goal of increasing planting and conservation efforts. MS-21.1, MS-21.2, are especially relevant.
ER-1 – Grassland, Oak Woodlands, Chaparral and Coast Scrub	X		Preservation, protection, and restoration of oak woodlands, chaparral and coastal scrub in hillside areas.
ER-2 – Riparian Corridors	X		Contains some protections of riparian corridors from new development, though limited.
ER-3 – Bay and Baylands	X		Protect, preserve and restore the baylands. Contains some language around avoiding new development that impacts baylands habitat value. ER-3.4
ER-4 – Special-Status Plants and Animals	X		ER-4.1 Preserve and restore, to the greatest extent feasible, habitat areas that support special-status species. Avoid development in such habitats unless no feasible alternatives exist and mitigation is provided of equivalent value
ER-5 – Migratory Birds	X		ER-5.1 Avoid implementing activities that result in the loss of active native birds' nests, including both direct loss and indirect loss through abandonment, of native birds. Avoidance of activities that could result in impacts to nests during the

Goal	DIRECT	INDIRECT	JUSTIFICATION
			breeding season or maintenance of buffers between such activities and active nests would avoid such impacts
ER-6 – Urban Natural Interface	X		ER-6.2 Design development at the urban/natural community interface of the Greenline/ Urban Growth Boundary (UGB) to minimize the length of the shared boundary between urban development and natural areas by clustering and locating new development close to existing development. Key areas where natural communities are found adjacent to the UGB include the Baylands in Alviso, the Santa Teresa Hills, Alum Rock Park, and Evergreen. ER-6.8 Design and construct development to avoid changes in drainage patterns across adjacent natural areas and for adjacent native trees, such as oaks
ER-7 – Wildlife Movement	X		ER-7.4 To facilitate the movement of wildlife across Coyote Valley, work with the appropriate transportation agencies to replace portions of the median barrier on Monterey Road with a barrier that maintains human safety while being more permeable to wildlife movement and implement other improvements to benefit wildlife movement. ER-7.5 Support the on-going identification and protection of critical linkages for wildlife movement in the Mid-Coyote Valley.
ER-8 - Stormwater	X		ER-8.8 Consider the characteristics and condition of the local watershed and identify opportunities for water quality improvement when developing new or updating existing development plans or policies including, but not limited to, specific or area land use plans
ER-9 – Water Resources	X		ER-9.1 In consultation with the Santa Clara Valley Water District, other public agencies and the SCVWDs Water Resources Protection Guidelines and Standards (2006 or as amended), restrict or carefully regulate public and private development in streamside areas so as to protect and preserve the health, function and stability of streams and stream corridors. ER-9.2 In consultation with the SCVWD restrict or carefully regulate public and private development in upland areas to prevent uncontrolled

Goal	DIRECT	INDIRECT	JUSTIFICATION
			runoff that could impact the health and stability of streams.
ER-10 – Archaeology and Paleontology		X	Protects specific cultural and historic resources, including Native American burial sites
ER-11 – Extractive Resources	X	X	ER-11.1 When urban development is proposed on lands which have been identified as containing commercially usable extractive resources, consider the value of those resources. ER-11.3 When making land use decisions involving areas which have a SMARA designation of regional significance, balance mineral values against alternative land uses and consider the importance of these minerals to their market region as a whole and not just their importance to San José.
EC-4 – Geologic and Soil Hazards		X	Could make an argument that some NWL are subject to soil and geologic hazards and should not be developed on.
EC-5 – Flooding Hazards	X		EC-5.1 The City shall require evaluation of flood hazards prior to approval of development projects within a Federal Emergency Management Agency (FEMA) designated floodplain. EC-5.2 Allow development only when adequate mitigation measures are incorporated into the project design to prevent or minimize siltation of streams, flood protection ponds, and reservoirs. EC-5.3 Preserve designated floodway areas for non-urban uses. EC-5.7 Allow new urban development only when mitigation measures are incorporated into the project design to ensure that new urban runoff does not increase flood risks elsewhere EC-5.10 Encourage the preservation and restoration of urban creeks and rivers to maintain existing floodplain storage. When in-channel work is proposed, engineering techniques which include the use of plant materials (bioengineering) are encouraged
EC-7 – Environmental Contamination		X	EC-7.1 For development and redevelopment projects, require evaluation of the proposed site's historical and present uses to determine if any potential environmental conditions exist that could adversely impact the community or environment

Goal	DIRECT	INDIRECT	JUSTIFICATION
EC-8 – Wildland and Urban Fire Hazards		X	Minimize development in very high fire hazard zone areas. Plan and construct permitted development so as to reduce exposure to fire hazards and to facilitate fire suppression efforts in the event of a wildfire
IN-1 – General Provision of Infrastructure	X	X	IN-1.4 Give priority to the development of infrastructure within identified Growth Areas to support the amount, type and location of new development planned through the Land Use/Transportation Diagram and other Envision General Plan goals and policies. Water, wastewater, storm, solid waste, recycling and other infrastructure systems will be expanded concurrent with new development, employment and population growth. As most new growth will occur within the already urbanized areas, new infrastructure projects will generally focus on expansions and enhancements to existing infrastructure; supporting intensification of the Downtown, North San José and other employment areas; transit areas including the Urban Villages; and other planned Growth Areas.
IN-3 – Water Supply, Sanitary Sewer and Storm Drainage		X	IN-3.11 For future development, consider factors such as flooding risks, proximity to waterways, and the potential for implementing flood protection measures IN-3.8 In designing improvements to creeks and rivers, protect adjacent properties from flooding consistent with the best available information and standards from the Federal Emergency Management Agency (FEMA) and the California Department of Water Resources (DWR). Incorporate restoration of natural habitat into improvements where feasible.'
IN-4 – Wastewater Treatment and Water Reclamation	X	X	IN-4.3 Adopt and implement new technologies for the operation of wastewater treatment and water reclamation facilities to achieve greater safety, energy efficiency and environmental benefit IN-4.7 Support programs to maximize the beneficial use of wastewater treatment and water reclamation byproducts, which may include water, bio-solids and nutrients
IN-5 – Solid Waste-Materials Recovery / Landfill	X	X	IN-5.6 Promote secondary uses at MRF and landfill sites, including economically beneficial recovery of solid waste resources, waste-to-

Goal	DIRECT	INDIRECT	JUSTIFICATION
			energy conversion, organic materials processing, and development of resource recovery parks IN-5.9 Locate and operate solid waste disposal facilities in a manner which protects environmental resources and is compatible with existing and planned surrounding land uses IN-5.16 Plan for the eventual phased restoration to recreational or open space uses, including revegetation with native plant species, the portions of landfill facilities located outside of the Urban Growth Boundary, where waste processing and composting operations are not maintained

Chapter 4: Quality of Life

Goal	DIRECT	INDIRECT	JUSTIFICATION
Goal VN-1 – Vibrant, Attractive, and Complete Neighborhoods		X	Encourages shared parking facilities to promote pedestrian and bicycle activities in new developments.
Goal VN-3 – Access to Healthful Foods		X	Encourages walking and public transit use to retailers of healthful food.
Goal CD-1 – Attractive City	X	X	Promotes installation and maintenance of environmentally sustainable urban infrastructure: water features, pocket parks, etc. Require developers to provide pedestrian amenities, such as trees, recycling and refuse containers. Promotes preservation of ordinance-sized and other significant trees, particularly natives.
Goal CD-2 – Function		X	Create streets that promote pedestrian and bicycle transportation. Integrate Green Building Goals into site design.CD-2.10: Use land use regulations to require compact, low-impact development that efficiently uses land planned for growth.
Goal CD-3 – Connections		X	Promotes sustainable transportation.
Goal CD-7 – Urban Villages Design		X	CD-7.7 Maintain and implement land use policies that are consistent with the urban nature of Urban Village areas. Incorporate spaces and support outdoor uses for limited 24-hour uses, so long as the potential for significant adverse impacts is mitigated

Goal	*DIRECT*	*INDIRECT*	*JUSTIFICATION*
Goal CD-9 – Access to Scenic Resources		X	CD-9.2 Preserve the natural character of Rural Scenic Corridors by incorporating mature strands of trees, rock outcroppings, streams, lakes and reservoirs and other such natural features into project designs.
Goal H-3 Housing – High Quality Housing and Great Places		X	Promotes high density residential and mixed residential/commercial development.
Goal H-4 Housing - Environmental Sustainability		X	Reduce contribution to greenhouse gas emissions through the implementation of green building principles in housing and infrastructure.
Goal ES-2 – Libraries		X	ES-2.2 Construct and maintain architecturally attractive, durable, resource-efficient, and environmentally healthful library facilities
Goal PR-1 – High Quality Facilities and Programs	X		**PR-1.1** Provide 3.5 acres per 1,000 population of neighborhood/community serving parkland through a combination of 1.5 acres of public park and 2.0 acres of recreational school grounds open to the public per 1,000 San José residents. **PR-1.2** Provide 7.5 acres per 1,000 population of citywide/regional park and open space lands through a combination of facilities provided by the City of San José and other public land agencies. **PR-1.3** Provide 500 square feet per 1,000 population of community center space.
Goal PR-2 – Contribute to a Healthful Community	X		Promotes creation of community gardens for personal-use food production.
Goal PR-6 – Sustainable Parks and Recreation	X		PR-6.5 Design and maintain park and recreation facilities to minimize water, energy and chemical (e.g., pesticides and fertilizer) use. Incorporate native and/or drought-resistant vegetation and ground cover where appropriate.
Goal PR-7 – Interconnected Parks System		X	PR-7.1 Encourage non-vehicular transportation to and from parks, trails, and open spaces by developing trail and other pleasant walking and bicycle connections to existing and planned urban and suburban parks facilities.
Goal PR-8 – Fiscal Management of Parks and Recreation Resources		X	PR-8.6 Develop or renovate facilities using a fiscally sustainable approach to minimize costs and maximize revenue generation (from amenities such as softball fields), where possible.

Chapter 5: Land Use and Transportation

Goal	DIRECT	INDIRECT	JUSTIFICATION
General Land Use LU-1		X	-NWL might be the most fiscally and environmentally sustainable land use at city's edge. -Policies 1.2, 1.3, and 1.7 voice support for minimizing VMT and promoting walking and transit. Preserving NWL might push development to locate in urban areas where those policies would be more easily achieved.
Growth Areas LU-2		X	-Edges of the city and some existing NWL are currently designated as Growth Areas (e.g. North Coyote Valley). This contradicts the overall aspiration to grow in "compact and centralized locations, thereby reducing fiscal and environmental impacts, fostering transit use and walkability" (286).
Industrial Lands LU-6		X	-Edges of the city and some NWL are currently zoned for industrial uses. LU-6.1 states San José should "prohibit lands designated for industrial uses and mixed industrial-commercial uses to be converted to non-employment uses," impairing efforts to revert industrial zones to non-working natural lands.
Attract New Industrial Uses LU-7		X	-LU-7.2 states San José should "seek out industrial uses that are environmentally sustainable or create environmentally beneficial products in order to maintain a healthful environment and preserve natural resources." For industrially zoned lands currently hosting NWL uses, NWL may meet these sustainability and preservation criteria despite being non-industrial.
Urban Agriculture LU-12	X		-Envision 2040 intends to preserve a type of NWL, agriculture, within San José's sphere of influence so long as that land is "not planned for urbanization in the timeframe of the Envision General Plan" (LU-12.3, 298). Preservation is supported, but NWL currently zoned for industrial or other growth uses are exempted. -Aquifer recharge is another listed concern, though only in non-urban areas (LU-12.4).
Historic Preservation LU-13		X	-NWL might preserve history and community identity, could be worthy of designation as a a 'Conservation Area': "a geographically definable area of urban or rural character with identifiable attributes embodied by: (1) architecture, urban design, development patterns, setting, or geography; and (2) history" (300). -NWL might be worthy of historic preservation in so far as they act somewhat like urban historic preservations do: they 1) tell a story of the community's past, 2) provide identity, 3) generate an economic (climate) advantage, 4) provide a sense of

Goal	DIRECT	INDIRECT	JUSTIFICATION
			permanency, and 5) once lost, can't be recovered (paraphrased from 299).
Public Awareness LU-15		X	-LU-15.1 and 2 invite community engagement/discussion about what is historic and what should be preserved, perhaps open to NWL
Hillside/Rural Preservation LU-17	X		-Some NWL are already slated for preservation, especially on slopes, on environmental and aesthetic grounds. This sets precedents for preservation as well as its justifications.
Urban Growth Boundary LU-19		X	-LU-19.1 states that San José should, "Maintain the Greenline/Urban Growth Boundary to delineate the extent of existing and future urban activity and to reinforce fundamental policies concerning the appropriate location of urban development" (310). This provides for the city, during a Major Plan Update, to amend the UGB to reinforce notions of where urban development is appropriate, potentially excluding NWL.
Rural Agriculture LU-20	X	X	This goal and its preamble describe the benefits of and ways to protect NWL within San José's sphere of influence that aren't zoned for growth. The section openly acknowledges the importance of preserving rural agriculture/NWL: "Either directly or indirectly, the Rural Agriculture Goals, Policies, and Implementation Actions promote every Element of the Plan Vision" (313). The Mid and South Coyote Valley are identified as key places to maintain permanently as agriculture: "Explore use of agricultural easements, transfer/purchase of development rights, or other options to keep Mid-Coyote Valley as permanent agriculture."
Balanced Transportation System TR-1		X	The plan acknowledges that San José " can greatly influence ridership through land use and zoning decisions" (322). Policies TR-1.1 and 1.2 call for reductions in VMT and considerations of how new development will impact mode share and mobility. Developing NWL at the edge likely emphasizes car use first, rather than bike, walking, and transit first.
Tier I-III VMT Reduction TR-9, 10, and 11		X	Developing NWL at the city's edges rather than more central, transit oriented locations may promote vehicular travel.
Trail Network TN-1.1		X	Trails serve as one way to protect natural lands. In the Trail Network introduction, the plan states that one of San José's high level trail goals is to, "Support environmental protection by permitting stakeholders to access, enjoy and protect open spaces and natural resources." Policies 1.2 and 1.3 cite trails as a way to minimize environmental disturbance and enhance sensitive natural areas.

APPENDIX E: References

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