



# Richmond Livable Corridors Sustainability Guidelines

City of Richmond, CA



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## Introduction

As Richmond looks to revitalize its traditional main streets and neighborhoods, sustainable development will help the city achieve status as a destination for residents, businesses and visitors. Richmond is committed to the environmental, economic and social values of sustainable design.

The first step toward implementation of sustainability on a city scale is to create guidelines and benchmarks to measure progress. The purpose of this document is to provide relevant high-level sustainability metrics as a reference for individual parcel design, and as a starting point for the development of official corridor-wide form-based code adoption of sustainable performance requirements for future development. The metrics provided in this document represent the forefront of sustainable design, yet are also commonly-accepted high-level strategies. They were selected in the context of recent policies in the State of California, as well as the unique environment of sustainability specifically in the San Francisco Bay Area.

The Richmond Sustainability Guidelines are organized into five major elements: Ecology/Landscape, Water, Energy, Materials, Community.

For each organizing element the overarching context of the element's significance is presented and then a combination of strategies and metrics that could help direct design or future regulation. Because the nature of sustainable design is one of integration, it should be kept in mind that the strategies within the organizing elements, should not be thought of as exclusively applying to that organizing element; instead, designers and regulators should actively seek out ways to apply a strategy in as many ways as possible, optimizing environmental, economic, and social benefits.

Examples of how specific strategies might be implemented on a building/site scale are provided in sustainability axons for typical building types the city expects to build in the coming years. Lastly, this document also begins to link sustainability guidelines to the Richmond Transect presented in the main text of the Richmond Livable Corridors Form-Based Code. Appropriate transect-based siting is provided for strategies within the Landscape/Ecology, Water and Energy organizing elements within SmartCode Modules.

### Ecology/Landscape

- Urban Agriculture
- Urban Ecology
- Active and Passive Open Space

### Water

- Stormwater Management
- Indoor Water Conservation
- Outdoor Water Conservation

### Energy

- Renewable Energy
- Conservation and Building Design
- Vehicular / Air Quality

### Materials

- Building Materials
- Waste Stream Diversion
- Waste Source-Separation

### Community

- Health
- Safety and Security
- Access

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### Description

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## Ecology/Landscape



*Urban forest - Passive open space*

### Description

Ecological design considers a comprehensive and cohesive system from the soils and water to the flora and fauna, which they support. In the built urban environment, many of the services that humans receive from natural eco-systems, such as shade from the sun, water purification, food production, climate regulation, air purification, and carbon sequestration are compromised. Increased impervious area increases the urban heat island effect. Paved, vehicular dimensioned transportation corridors decrease urban dwellers' utilization of open space. In other cases, well-intentioned open space may introduce non-native, invasive vegetation, or increase burdens on the potable water supply due to additional irrigation demand. Development in Richmond should incorporate provision of landscape and ecology to provide shade from sun, shelter from wind, and humidity, dust and microclimate control. Green spaces must be considered in context of the built environment, but also as components of a larger network of spaces connected by corridors such as green streets, linear parks, riparian zones, and migratory pathways.

### Metrics

- Residential uses to be located within a 5 minute walking distance of fresh food or community garden space



*Caption*



*Active open space*



*Urban farming as community-building*

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## Urban Ecology

Provision of open/green space in the urban environment should take into consideration the pre-development ecological conditions of the site in addition to any eco-services the space is expected to supply. This way, the space has both a restorative effect, and contributes to the human environment. One example of this restorative-functional duality could be a green roof planted with grasses and wildflowers native to the Bay Area. The restorative effect would be to connect the site to its ecological context, restoring bee pollination and bird populations. The built function provided is stormwater purification, and urban heat island effect mitigation. Urban ecology should be managed to promote an increase of biodiversity in Richmond. Ecological inventories should be taken to track species' ranges and prevalence.

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## Active and Passive Open Space

A variety of active and passive open space should be provided in Richmond. In order to maximize open space, priority should be given to development within dense urban centers, so that land can be preserved for both active and passive open space. Active open space may refer to athletic turf fields, while passive open space should provide an urban retreat into nature, with native plantings.

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## Urban Agriculture

A food desert is a district with limited access to fresh and affordable foods that disproportionately affect low income neighborhoods in the United States. "Access" not only refers to physical access to fresh foods, but also to financial access and consumers' knowledge about nutrition and food preparation. Urban agriculture, or "urban food islands" are a way to promote physical, financial and psychological access to healthy foods. Roofs, courtyards, and public areas can be devoted to community food gardens or beehives.

# Water



*Urban stormwater cleansing wetland*

## Description

Protection of urban water resources includes protection of surface water from urban runoff and sanitary sewer overflows, as well as conservation of potable water resources. The San Francisco Bay watersheds are home to sensitive ecosystems that are negatively affected by untreated urban runoff, as well as erosion and associated sedimentation due to increased urbanization. The final version of California’s 20x2020 plan was released in 2010, providing a roadmap to achieving the state’s goal of urban water efficiency, reducing per capita water demands by 20% by 2020. Richmond’s sustainability goals around water align to address the above issues.

## Metrics

- Reduce per capita water usage by 20% to align with California 20x2020 goals
- Reserve 4% of total site parcel area for stormwater management BMPs



*Rain garden*



*Filtration through vegetated swale*



*Utilization of native plants for landscaping*

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## Stormwater Management

Stormwater management systems should not only be designed to collect and naturally treat runoff from all surfaces of future development, storage and reuse for larger projects should also be encouraged. Stormwater design should consider both decentralized approaches for smaller projects as well as regional green infrastructure that can integrate with larger projects such as greenways and parks. Where possible, utilization of surface conveyance of stormwater through vegetative swales allows filtration and natural toxin decomposition, and slowing of flows. Other volume-based BMPs can provide detention or retention, mitigating peak flows and runoff volumes. Design should be encouraged to both utilize stormwater management BMPs that meet and exceed Contra Costa County requirements.

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## Indoor Water Conservation

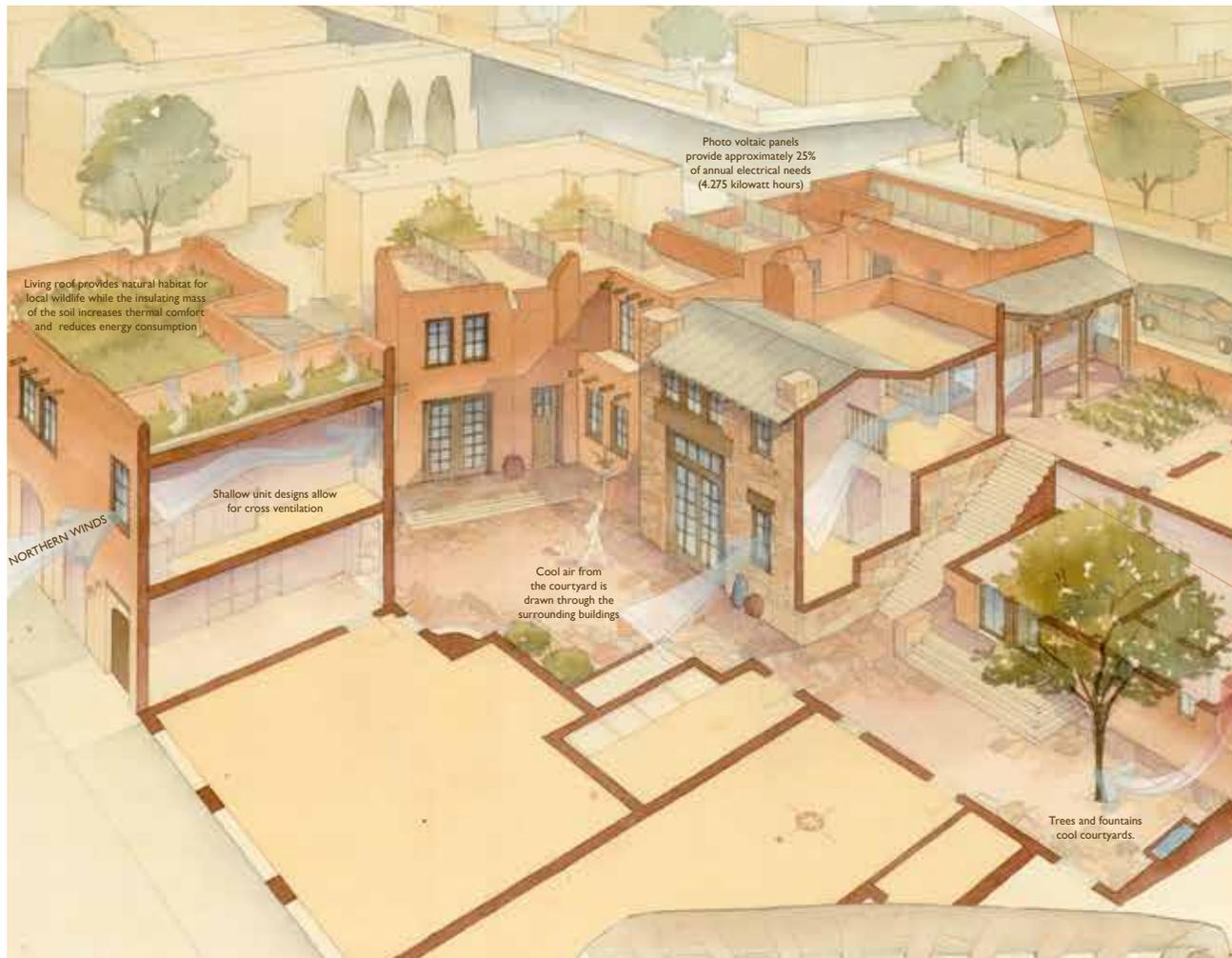
Indoor water conservation can be achieved through the installation of water-efficient fixtures including low-flow toilets, urinals, sinks, and showerheads. In addition, some in-building demands, such as water used to flush toilets and urinals, and mechanical cooling water demands, and janitorial water demands do not require water of a potable quality to be used. Where appropriate, utilization of municipal recycled water or site-treated gray or blackwater for reuse should be encouraged inside of buildings.

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## Outdoor Water Conservation

Outdoor water for irrigation could constitute up to 50%-75% of a site's total water demand in the Bay Area, due to the annual seasonal distribution of rain. Utilization of native plant palettes and xeriscaping will reduce irrigation demand. Water efficient irrigation systems, such as drip irrigation should be encouraged to minimize the amount of water lost to evaporation, and municipal or site-produced recycled water should be preferred to potable water for irrigation uses.

## Energy



*Passive cooling strategies*

### Description

The environmental footprint of fuel sourcing and use is significant. Standard energy production (fossil fuel combustion) degrades air quality and alters our climate by emitting greenhouse gases. It is essential to Richmond's sustainable design strategy to identify and maximize methods for energy conservation from construction through operations, as well as maximize opportunities for clean and renewable power generation.

### Metrics

- Minimum 10% building energy improvement in energy efficiency above baseline
- 5% of parking capacity devoted to low-emitting or fuel-efficient vehicles, or car-share programs

## Renewable Energy

Sourcing of renewable energy in the form of solar thermal and solar PV should be encouraged for sites with good solar access. Where economic reasons prohibit installation of renewable energy technologies, mechanical space should be allotted on rooftops, along with the necessary building-shell infrastructure to allow these technologies to be installed once the technology becomes economically feasible (“future-proofing”). Installation of solar PV cells should also be considered for large open spaces, such as parking lots. California has a goal to transition to 33% clean energy by 2020. San Francisco’s Board of Supervisors recently approved Clean Power SF, which offers residents the option of purchasing 100% renewable Energy. Development in Richmond should align with state and regional efforts and goals to increase availability of clean energy.



*Kinetic wind structure*



*PV canopy*

## Conservation and Building Design

Building energy demands make up about 40% of the total energy demand and 74% of energy demand in the United States. Strategies such as utilizing building massing, orientation, green roofs, passive ventilation systems, and high-reflectivity building shell materials can all contribute to a building’s energy performance. Buildings should be encouraged to utilize smart control systems that dim or turn off building lighting during unoccupied hours. Outdoor lighting should take into account public safety, energy conservation, and light pollution. Buildings can also consider installation of photovoltaic solar panels, solar thermal collectors, and solar water heaters. These strategies should be integrated with strategies for stormwater management compliance, materials selection, and landscaping and ecology design criteria.

## Vehicular / Air Quality

Richmond is known in the Bay Area as having poor air quality, some of which is a result of vehicular emissions, especially along Interstates 580 and 80, which pass through the city. Exposure to particulate pollution has been linked to difficult breathing and prevalence of respiratory symptoms. Strategies to reduce exposure to vehicular emissions include: increasing landscaping which removes particulates from the air; encourage proper use of operable windows to ensure they remain closed during “spare the air days”; encouraging the use of low-emitting and fuel-efficient vehicles; and overall reduction of vehicular miles traveled (VMT). Residents can be encouraged to utilize public transportation by increasing development density and prioritizing development near existing services, amenities and bus stops. Secure bike racks and dedicated bike lanes should be provided. To discourage private vehicles, parking spots should be limited, with priority spots provided for low-emitting and fuel-efficient vehicles, and car-share and carpool programs.

# Materials



*The U.S. Mint in Washington D.C. is certified LEED Gold (Photo courtesy of: new.usgbc.org)*

## Description

Materials embody carbon and have the potential to impact on-going energy performance and improve physical comfort of buildings. Much of the waste entering landfills can actually be recycled, reused, or composted.

## Metrics

- Achieve 75% waste diversion by 2018
- Achieve Zero Waste by 2025
- 20% renewable and local materials for all new construction



Waste management hierarchy



High albedo roof material; Source-separated streetside wastebin



Recycled concrete

### Building Materials

When selecting building materials, sustainable design considers the overall building lifecycle, environmental implication of the material sourcing (embodied carbon) and the indoor air quality impacts of the material. Developers should prioritize local (sourced within 500 miles of the project site) materials, rapidly renewable materials (harvested within a 10-year or shorter cycle), and certified wood for new construction. Any glues, adhesives, paints, polishes or varnishes should also be free of volatile organic chemicals as certified by a third party. Selection of building materials for building exteriors should consider reflectivity to decrease urban heat island effect and effects on interior lighting for adjacent buildings. Where possible, new construction and renovation projects should consider utilizing materials recovered from other sites that otherwise would enter the waste stream. Such materials can enhance the local character of the building and can often be purchased at a fraction of the cost of virgin materials.

### Waste Stream Diversion and Source-Separation

Richmond should adopt local ordinances regarding the treatment of waste, such as the San Francisco "Mandatory Recycling and Composting Ordinance". The ordinance should include source requirements that landfill waste, compostable waste and recyclable waste bins to be provided within buildings, and in public areas. Construction and demolition debris should be collected in city-registered containers by registered transporters to increase debris recovery. Separate waste stream diversion programs should be developed for generators of unique waste streams, such as food service providers. Waste generation—including superfluous packaging, non-compostable plastic and paper bag usage and non-biodegradable materials—should be discouraged through regulation, tax incentives or additional fees producers. Building lifecycle—especially for developments known to be temporary infill projects—should take into account feasibility for materials recovery and waste stream diversion.

## Community



*With the promotion of utilized sidewalks, a lively, community-building plaza is possible.*

### Description

Urban public spaces can be designed to mitigate the loss of open space created by dense development. A well designed public realm can provide the community a beautiful healthy environment. The effectiveness of the public realm can be measured by its contribution to the quality of life in the community. Implementation of strategies related to the other four organizing elements should emphasize the importance of community. Sustainability can be achieved through the integration of these sustainable strategies into community development programs.

### Metrics

- Improve average annual household income by 15%
- Improve high school, trade school, and higher education graduation rates by 10%
- Decrease health care costs by 10%



Mural



Sidewalk bulb out and bike lane



A rooftop restaurant

**Community**

**Promotion of Health and Sustainable Lifestyles**

Implementation of nutrition and education programs

Construction of public use gardens

Support of community based environmental, economic and social justice groups

Provision of views, comfort, and interior daylighting

**Safety and Security**

Provide proper street and path lighting

Provide secure bike racks

Install street side source-separated litter bins

Provide pedestrian-dimensioned streets, pedestrian crossing striping and clearly designated bike lanes

Street retrofits should include traffic-calming curbing, bulb outs, and islands

Install clear way-finding signage

**Access**

Encourage public/private portals

Allow privately owned public open space

Encourage roof access and diverse utilization

Expand parks and public access trails

Promote vibrant street life, mixed use, and sidewalk utilization

**Economics**

Foster local business promotion programs

Cater local business services to the needs of local residents

Establish an incentive to businesses by creating a vibrant public realm

Promote reinvestment by local businesses in community initiatives

Expand institutional partnerships with regional universities and non-profit groups

Seek out state and interstate partnerships to expand the City's resource base

## Sustainability Guidelines



### Ecology/Landscape

Provide **Urban Agriculture** space for tenants.

Provide **Street Trees** to improve thermal comfort and street character.

Use **Vegetated Roofs** to decrease building cooling loads, provide pleasant views for tenants, and opportunities for urban agriculture.

Provide only the **Minimum Parking** needed to encourage alternative transportation.

Provide **Underground Parking** where possible to maximize the surface open space and reduces the "heat island" effect.

Limit the number of curb cuts and use minimum curb return radii for private driveway.

Plant **Shade Trees** to shade surface parking lots.

Design buildings with a **Courtyard**, or if naturally cooler, with a contiguous building core.

Plant **Trees** to block the wind, and induce a favorable microclimate.

Use **Native Vegetation** to minimize maintenance and water demands.

Consider **Solar Access** on the south side of buildings when planting landscape.

Provide lot treatment **rain gardens**.



### Water

Allocate a minimum of 4% of every site for **Stormwater Management**.

All parking areas should flow directly to a landscaped **Stormwater Management** area.

Roof runoff should be channeled into **Flow-Through Planters** for filtration or **Rain Barrels** for lawn and garden use.

Use **Permeable Pavers** to reduce run-off entering municipal storm drain system.

**Drip Irrigation** systems should be used to meet irrigation needs. Sprinkler heads should not be used.

Exclude external hose bibs from home design, thereby irrigating only by rain barrel or reuse water.

Provide **Curbside Biotreatment Areas** along the sidewalk and in curb extensions for urban conditions to treat stormwater treatment while providing a streetscape amenity.

Use **Bioswales** improve stormwater quality, mitigate urban flooding, and give opportunity for infiltration in less urban areas and open spaces where subsurface conditions allow.

**Rainwater Conveyance** systems can double as local art features.



### Energy

Design buildings to utilize **Passive Heating and Cooling** by providing glazing to heat the structure from the south, and cross-ventilation to cool with flow-through air.

Use **Operable Windows** to provide cross-ventilation where possible, especially in hallways, and allow for **Passive Thermal Control**.

Use **High Efficiency Glazing** in windows to reduce energy demands for heating and cooling.

Create **Thermal Mass** in the building design to help minimize heating needs.

Create a **Well-Sealed Building Envelope** to improve building efficiency.

Construct buildings as **Solar Energy-Ready**.

Use of **Retractable Awnings** in to protect from the summer sun.

Encourage tenants and patrons to cycle by providing regular amenities for **Bike Parking**.

Flat roofs are ideal for alternative lighting structures, such as **Solar Magnification Skylights** that use mirrors to capture sunlight for indoor spaces.

Provide **Car Charging Stations** and reserve **Preferred Parking** for alternate-fuel vehicles.

Wire all garages to with 220V electricity for future installation of **Car Charging Stations**.

**Orient Courtyards** and open space toward south to take advantage of sun and summer wind, and block winter winds.



### Materials

Select **Building Materials** based on full life-cycle analysis, salvageability, and environmental impact at deconstruction.

Use **Reclaimed Materials** when possible.

Use **Locally-Sourced, Sustainably Certified Building Materials**.

Use **High SRI Materials** on the south face of buildings to increase light on the opposing north face.

Use **High SRI Materials** on the roof where PV and vegetated roofs are not practical.

Reduce heat island effect by using **High SRI Materials** in parking lots, and permeable paving where conditions allow.

Provide **Source-Separated Streetside Wastebins** (trash and recycling) and **Compost Bins** with instructions to decrease prevalence of litter on site, and improve landfill avoidance.

Provide **Food Service-Specific Compostables Collection Bins** for restaurants and other food-service type uses.

Use City Registered **Construction/ Demolition Debris Collection Bins** and encourage the **Recovery of Construction/Demolition Debris** to help divert waste from landfills.



### Community

Provide **Rooftop Access** to maximize value of views and open space.

Maximize **Usable Roof Space** by centralizing and tucking away building mechanical systems.

Encourage **Diverse Rooftop Usage** with both commercial and residential use of roof space.

Maximize tenant views and **Balcony Access**.

Provide **Outdoor Seating** to activate sidewalk space in front of mixed-use development and encourage community vitality.

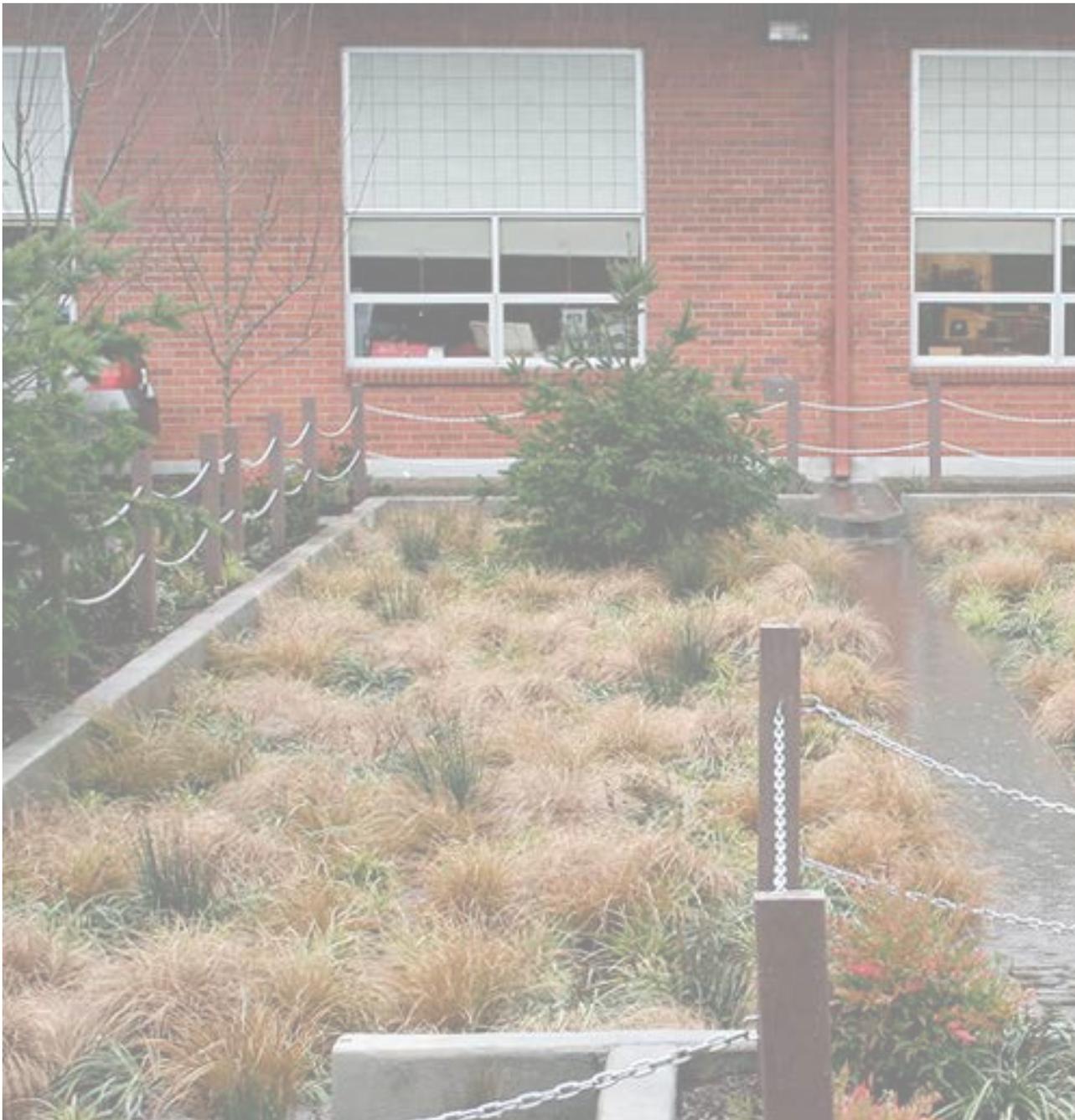
Provide **Awnings** to shelter from the elements and places where people can comfortably sit

Provide **Bike Racks** and **Covered Bicycle Storage** to encourage bicycle use.

Use **Local Artists** to design wall murals, public art, and unique decorative bollards.

Provide **Shared Courtyards** to improve community interaction and vitality.

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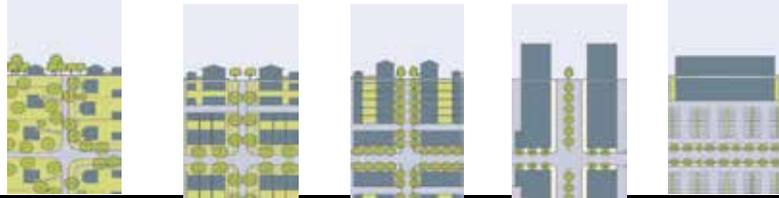
### **Description**

This section begins to link sustainability guidelines to the Richmond Transect presented in the main text of the Richmond Livable Corridors Form-Based Code. Appropriate transect-based siting is provided for strategies within the Landscape/Ecology, Water and Energy organizing elements.

# Renewable Energy

*Sustainability*

**Renewable Energy.** This table shows opportunities for the placement of solar-powered and wind powered devices within the Transect.



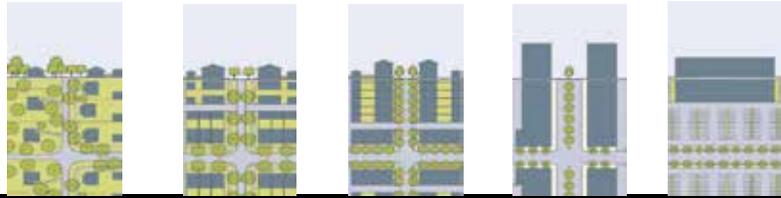
**T3**      **T4**      **T5**      **T6**      **SD**

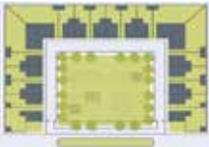
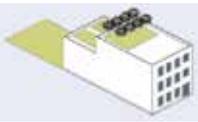
	T3	T4	T5	T6	SD
<p>Roof Mounted Solar Panels</p>  <p>Solar PV panels mounted on building or structures' rooftops.</p>	■	■	■	■	■
<p>Solar Panel Public Furniture</p>  <p>integrated with local artists' work and public environment such as shade structures and light posts.</p>	■	■	■	■	■
<p>Horizontal Axis</p>  <p>Horizontal axis wind turbines have the main rotor shaft arranged horizontally so that the rotor blades spin similar to a pinwheel. Horizontal axis wind turbines are better suited to lower density areas because of their large size, and requirement that the head have capability for full rotation to receive wind from any direction.</p>	■				■
<p>Vertical Axis</p>  <p>Vertical axis wind turbines have the main rotor shaft arranged vertically, so that the rotor blades rotate in a plane parallel to the ground. Vertical axis wind turbines are more suited to higher density urban areas because it is significantly smaller than the horizontal axis type, less noisy, can operate with non-directional wind current and are more attractive in urban areas when in proximity to buildings.</p>	■	■	■	■	■
<p>Wind Turbine Public Furniture</p>  <p>Vertical or horizontal axis wind turbines located in public areas. Can be integrated with local artists' work and public environment.</p>	■	■	■	■	■

# Food Production

*Sustainability*

**Food Production.** This table shows ways of incorporating types of food production along the Transect.

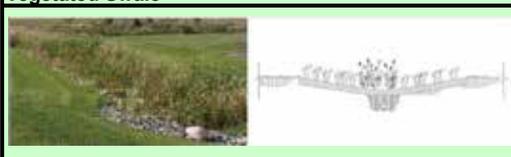


	T3	T4	T5	T6	SD
Farm 					■
Agricultural Plots 	■				■
Vegetable Garden 	■	■			
Urban Farm 	■	■	■		
Community Garden 	■	■	■	■	
Green Roof - Extensive - Semi Intensive - Intensive 	■	■	■	■	■
Vertical Farm 			■	■	■

# Stormwater Treatments

		Zone						
		T1	T2	T3	T4	T5	T6	SD
Infiltration Rate	Low							
	High							

**Vegetated Swale**



		T1	T2	T3	T4	T5	T6	SD
Infiltration Rate	Low							
	High							

Vegetated swales are shallow drainage ways that employ landscaping to stabilize the soil while providing water quality treatment via biofiltration. They are designed to remove silt and sediment-associated pollutants before discharging to storm sewers and to reduce volume if soils allow for infiltration. The treatment area can be planted in a variety of grasses, sedges and rushes shrubs, while the side slopes can be planted with shrubs or groundcover.

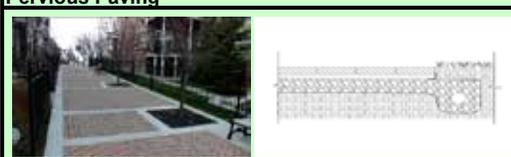
**Green Roof**



		T1	T2	T3	T4	T5	T6	SD
Infiltration Rate	Low	◆	◆	◆	◆	◆	◆	◆
	High	◆	◆	◆	◆	◆	◆	◆

Green Roofs are a way of managing stormwater in urban areas with limited space for more land intensive BMPs. Green roofs are able to store stormwater in the soil medium during rain events, helping to detain runoff. Some of the stormwater will be taken up by the roots of the plants and some will be evaporated from the soil medium, reducing the amount of runoff from the roof. Pervious paving systems allow water to pass freely through interstitial space ingrained throughout the paving matrix, thereby transforming traditionally impervious surfaces. Several examples are pervious concrete and asphalt, interlocking pavers, and reinforced gravel and grass paving.

**Pervious Paving**



		T1	T2	T3	T4	T5	T6	SD
Infiltration Rate	Low*							
	High							

Pervious paving systems allow water to pass freely through the interstitial space ingrained throughout the paving matrix, thereby transforming traditionally impervious surfaces. Several examples are pervious concrete and asphalt, interlocking pavers, and reinforced gravel and grass paving.

**Rain Gardens**



		T1	T2	T3	T4	T5	T6	SD
Infiltration Rate	Low*	◆	◆	◆	◆	◆	◆	◆
	High	◆	◆	◆	◆	◆	◆	◆

Rain Gardens are flat-bottomed landscaped depressions that can be built to any size or shape. Also known as 'bioretention cells', they are designed to allow water to settle and infiltrate into the soil. They reduce the peak discharge rate from a site via detention. Water quality improvements are achieved through particle settling, nutrient uptake, and filtration as water soaks into the ground.

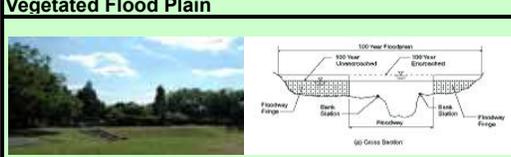
**Disconnected Downspouts**



		T1	T2	T3	T4	T5	T6	SD
Infiltration Rate	Low							
	High							

In lower density residential areas downspouts should be disconnected from stormdrain systems and directed towards landscaped areas. This reduces the burden on the stormdrain network and allows runoff to slow and infiltrate before overflowing to stormdrains.

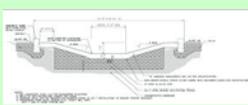
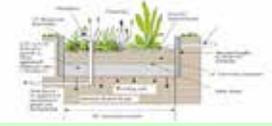
**Vegetated Flood Plain**



		T1	T2	T3	T4	T5	T6	SD
Infiltration Rate	Low							
	High							

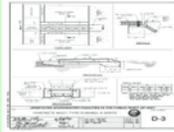
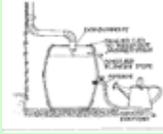
Flood plains can be integrated with parks, playing fields, or unmanaged landscapes. Frequent storm events can be detained by smaller decentralized means, while larger storm events should be directed to non priority vegetated landscapes for temporary detention.

Key  
 ◆ Contra Costa County C3 Compliant Strategy  
 \* Underdrain Required  
 Technology Not Feasible in this Transect  
 Feasible

		Zone								
		Infiltration Rate	T1	T2	T3	T4	T5	T6	SD	
<b>Urban Flood Plain</b>										
	Low									Urban hardscapes can be used for temporary storage of large storm events. Smaller events should be mitigated by decentralized means, while the larger events can be directed toward non priority spaces which are planned and designed for the temporary storage of stormwater flows.
	High									
<b>Bioretention</b>										
 	Low*	◆	◆	◆	◆	◆	◆	◆	◆	Bioretention is an upland water quality and water quantity control practice that uses the chemical, biological and physical processes of plants, microbes, and soils for removal of pollutants from stormwater runoff. This same principle of utilizing biological systems has been widely used in the retention and the transformation of pollutants and nutrients found in agricultural and wastewater treatment practices.
	High	◆	◆	◆	◆	◆	◆	◆	◆	
<b>Riffle Pools</b>										
  	Low									Connected landscapes provide retention of runoff by integrating intermittent vertical drops and damming in a watercourse. The retained runoff is then allowed to infiltrate into the groundwater table.
	High									
<b>Flow Through Planters</b>										
 	Low*	◆	◆	◆	◆	◆	◆	◆	◆	Flow-through planters are landscape features that also provide stormwater runoff control and treatment. Flow-through planters are sealed on all sides and fitted with an underdrain. They only absorb as much water as soil and plants in the planter can accommodate. Once the planter is at capacity, water is then discharged through the underdrain. They are ideal for receiving roof runoff from downspouts and can be incorporated into foundation walls.
	High	◆	◆	◆	◆	◆	◆	◆	◆	
<b>Infiltration Trench/ Gallery</b>										
 	Low									Infiltration trenches are subsurface facilities designed to provide on-site stormwater retention in areas of good infiltration by collecting and recharging stormwater runoff into the ground. Trenches filter pollutants to improve water quality and contribute towards groundwater recharge. Infiltration trenches are relatively low maintenance and can be easily retrofitted into existing sidewalk areas and medians.
	High	◆	◆	◆	◆	◆	◆	◆	◆	
<b>Naturalized Channel</b>										
 	Low									A natural channel is a meandering, vegetated watercourse with natural banks. It is buffered from development zones by large uncultivated landscape.
	High*									

Key  
 ◆ Contra Costa County C3 Compliant Strategy  
 \* Underdrain Required  
 Technology Not Feasible in this Transect  
 Feasible

# Stormwater Treatments (continued)

		Zone								
		Infiltration Rate	T1	T2	T3	T4	T5	T6	SD	
<b>Community Swale</b>										
 	Low									Community swales are similar in size to a natural swale, but more linear in design to conform to the adjacent development zones (i.e. walkways, roadways, and buildings).
	High									
<b>Urban Channel</b>										
 	Low									Urban channels are narrow vegetated or stone lined conveyances framed by vertical stone or concrete banks abutting cultivated landscapes or hardscapes.
	High									
<b>Road Swale</b>										
 	Low									Road swales are shallow paved or stone lined water courses integral with a vehicular or pedestrian circulation route. These conveyances often include intermittent inlets and are underlain by a collection pipe.
	High									
<b>Rain Barrels</b>										
 	Low									Rain barrels are connected directly to downspouts to capture and store runoff for future use. Stormwater discharge is slowed down and water can be reused for irrigation. Fifty gallons of storage is suggested as a minimum. Barrels must also have a cover to prevent insect and debris collection.
	High									
<b>Cisterns</b>										
 	Low	◆	◆	◆	◆	◆	◆	◆	◆	Cisterns function similar to rain barrels by collected stormwater and storing it for reuse, but on a much larger scale. Cisterns can be stored above ground, buried below ground, or located inside of buildings. They typically store rainwater for reuse in irrigation, mechanical uses, toilet flushing, and fire prevention.
	High	◆	◆	◆	◆	◆	◆	◆	◆	

Key  
 ◆ Contra Costa County C3 Compliant Strategy  
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 Feasible



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### Description

Examples of how specific strategies might be implemented on a building/site scale are provided in sustainability axons for typical building types the city expects to build in the coming years.

Mid-Rise Building Type



**Ecology/Landscape**

**Urban Rooftop Farming/Gardening.** Garden space available for tenants. **A**

**Street Trees.** Tree boxes/wells improve thermal comfort and street character. **B**

**Water**

**Flow-Through Stormwater Treatment Planters.** Improve quality of urban runoff. **C**

**Bioswales.** Bioswales improve stormwater quality, mitigate urban flooding, and give opportunity for infiltration where subsurface conditions allow. **D**

**Energy**

**Awnings.** Awnings provide street-level shading and rain shelter. **E**

**Bike Racks.** Encourage tenants and patrons to cycle by providing regular amenities for bike parking. **F**

**Solar-Powered Street Lighting.** **G**

**Materials**

**Recovered Materials.** Encourage recovery and reuse of building materials from other local construction sites. **H**

**Source-Separated Streetside Wastebins.** Publicly accessible wastebins decrease prevalence of litter on site, and improve landfill avoidance. **I**

**Community**

**Roof Access.** Encourage rooftop access to maximize value of views and open space. **J**

**Diverse Rooftop Usage.** Encourage both commercial and residential use of roof space. **K**

**Outdoor Seating.** Activating sidewalk space in front of mixed-use development encourages community vitality. **L**

Mid-Rise Building Type (continued)



**Ecology/Landscape**

**Green Roof.** Planted roofs decrease building cooling loads, and provide pleasant views for tenants. M

**Subgrade Parking.** Underground parking maximizes surface open space and reduces the "heat island" effect. N

**Water**

**Rainwater Conveyance.** Rainwater collection systems can double as local art features. O

**Rooftop Water Cistern.** P

**Energy**

**Solar Panels.** Roofs constructed as solar-ready. Q

**Solar-Powered Lighting.** R

**Windows.** High efficiency glazing reduces energy demands for heating and cooling. S

**Solar Magnification Skylights.** Flat roofs are ideal for alternative lighting structures use mirrors to capture maximum sunlight for indoor spaces. T

**Electric Vehicles.** Preferred parking and charging stations can be reserved for electric vehicles. U

**Materials**

**High SRI Roof Materials.** V

**Building Materials.** Encourage use of local, sustainable, life-cycle assessed building materials. W

**Community**

**Usable Roof Space.** Maximized by centralizing and tucking away building mechanical systems. X

Mixed-Use Building Type, Southern Side of Street



**Ecology/Landscape**

**Vegetated Roofs.** Maximize open rooftop spaces with vegetated roofs for urban agriculture and open space. **A**

**Tree Cover.** Plant trees to shade the parking lot. **B**

**Water**

**Roof Runoff.** Channel roof runoff into flow-through planters for filtration. **C**

**Energy**

**Cross-Ventilation.** Maximize natural cross-ventilation. **D**

**Passive Thermal Comfort.** Require high-efficiency glazing and user-operable windows to improve occupants' thermal comfort. **E**

**Solar Panels.** Construct buildings as solar energy-ready. **F**

**Materials**

**Parking Lot Materials.** Reduce heat island effect by using high SRI materials in parking lots, and permeable paving where conditions allow. **G**

**Community**

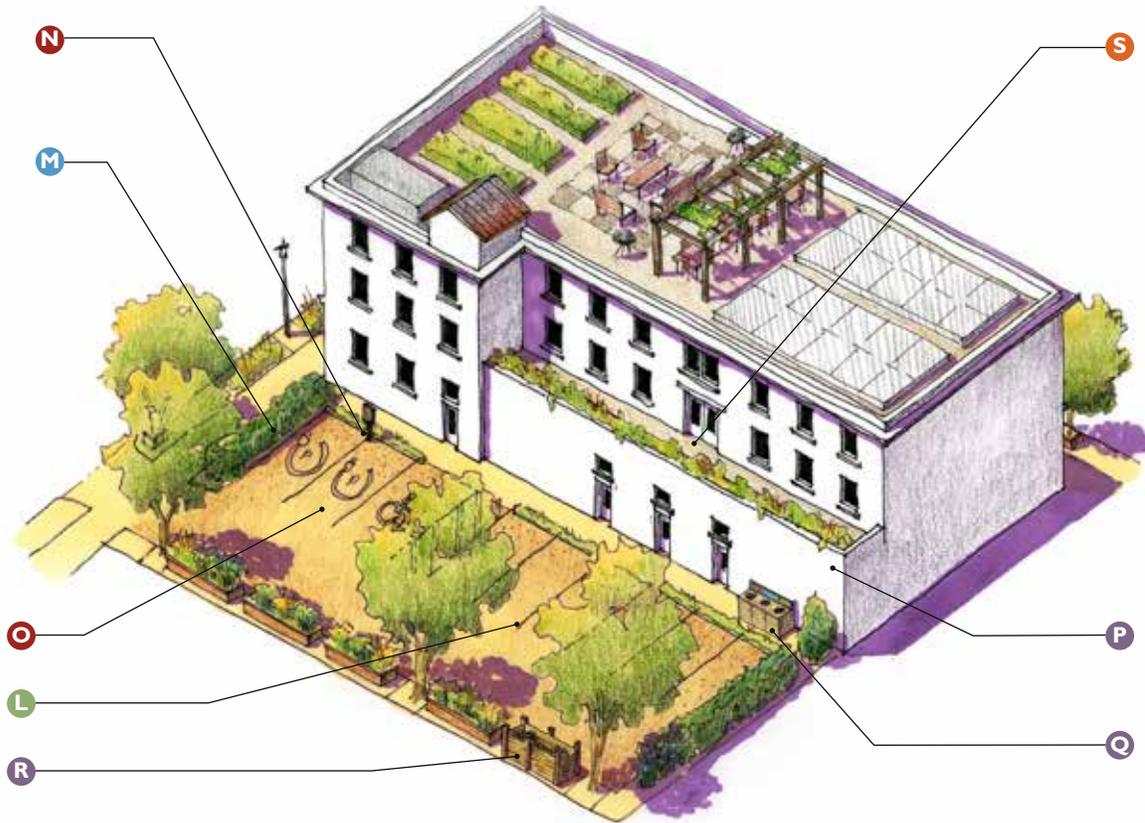
**Rooftop Mechanical Unit.** (Centralize and) Tuck away rooftop mechanical units to maximize usable open space. **H**

**Operable Windows.** Provide operable windows to give flexibility to tenants. **I**

**Awnings.** Provide shelter from the elements. **J**

**Bike Racks.** Encourage bicycle use. **K**

Mixed-Use Building Type, Southern Side of Street (continued)



**Ecology/Landscape**

**Minimum Parking.** Provide only the minimum parking needed to encourage alternative transportation. L

**Water**

**Stormwater Management.** Allocate a minimum of 4% of site to vegetated stormwater treatment. M

**Energy**

**Car-Charging Station.** Provide electric vehicle charging stations. N

**Preferred Parking.** Provide preferred parking for alternate-fuel vehicles, in addition to handicap parking. O

**Materials**

**South-Facing Materials.** Use high-reflectivity materials on the south face of buildings to increase light on the opposing north face. P

**Dedicated Waste Source Separation Area.** Q

**On-site Residential Composting.** R

**Community**

**Balcony Access.** Maximize tenant views and balcony access. S

Mixed-Use Building Type, Northern Side of Street



**Ecology/Landscape**

**Courtyard or Contiguous Building.** Design buildings with a courtyard, of if naturally cooler, with a contiguous building core. **A**

**Tree Planting.** Plant trees to block the wind, and induce a favorable microclimate. **B**

**Water**

**Rain Barrels.** Recommend rain barrels to capture roof run-off for lawn and garden use. **C**

**Stormwater Management.** Require 4-5% of every site be devoted to stormwater treatment, water infiltration where conditions allow. **D**

**Energy**

**Solar Panels.** Design all buildings to be solar electric-ready and/or require solar panels to provide for 100% of the hot water demand. (Additional capacity for space heating recommended). **E**

**Energy (continued)**

**High-Efficiency Building.** Create a well-sealed building envelope to improve building efficiency. **F**

**Cross Ventilation.** Encourage cross-ventilation in design to allow passive building cooling. **G**

**Materials**

**Existing Building Shell.** Reuse existing building shell where applicable to save on cost and embodied energy. **H**

**Reclaimed Furniture, Fittings, & Equipment.** **I**

**Community**

**Usable Rooftops.** Provide access to flat roofs for outdoor open space. Support use for recreational space or a community garden. **J**

**Decorative Bollards.** Incorporate local artists to design unique decorative bollards. **K**

**Courtyard Building Type**



**Ecology/Landscape**

**Native Vegetation.** Encourage native plantings to minimize maintenance and water demands. **A**

**Street Plantings.** Require planting street trees and vegetation where sidewalk widths permit. **B**

**Water**

**Permeable Pavers.** Encourage permeable pavers, potentially through building incentives, to reduce runoff and filter stormwater on site. **C**

**Curbside Biotreatment Areas.** Biotreatment areas along the sidewalk may help stormwater treatment while providing a streetscape amenity. **D**

**Energy**

**Courtyard Orientation.** Orient open space toward south when possible to take advantage of sun and summer wind, and block winter winds, encouraging active use. **E**

**Cross-Ventilation.** Encourage cross-ventilation in design to allow passive building cooling. **F**

**Energy (continued)**

**Energy Saving Incentives.** Provide incentives for choosing energy-saving source control measures, such as glazed windows. **G**

**Preferential Parking.** If parking is limited, consider giving environmentally-friendly vehicles preference. **H**

**Solar Panels.** Require new construction projects to create solar ready buildings. **I**

**Materials**

**Roof Materials.** Use high SRI roof materials. **J**

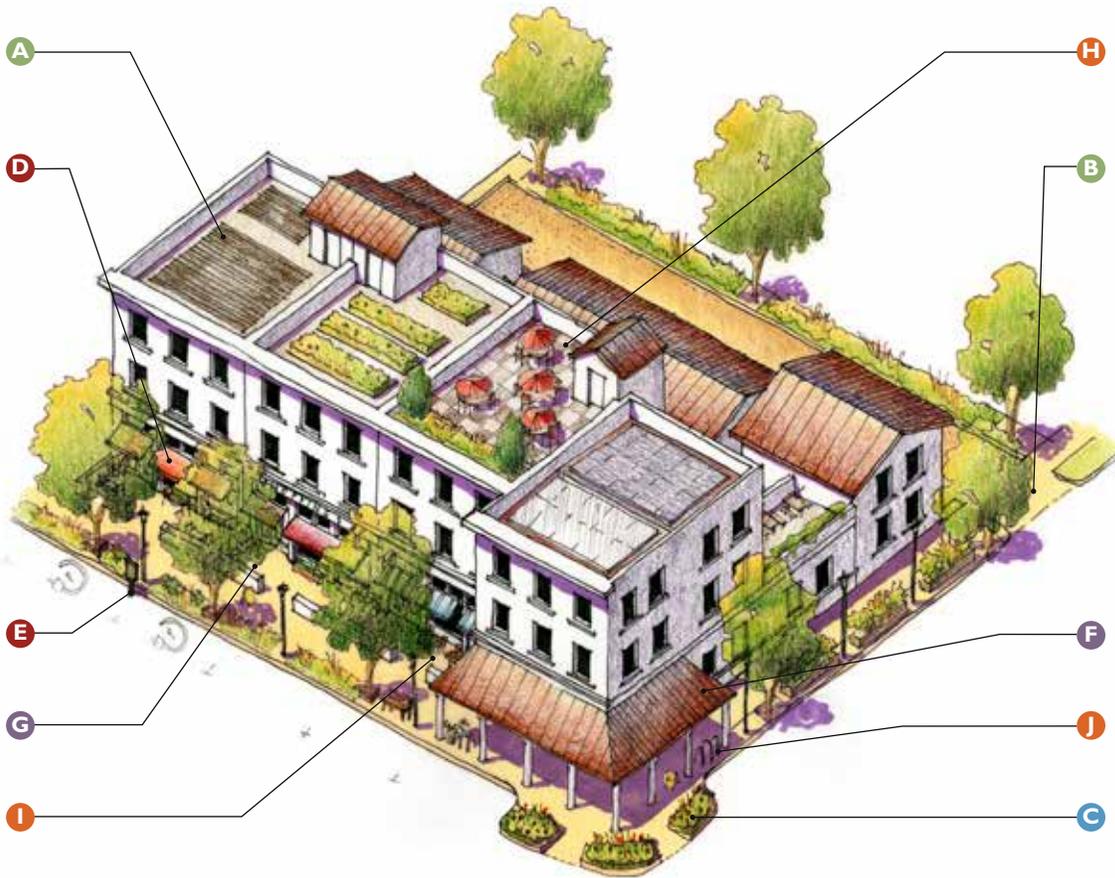
**Waste Source Separation.** Locate color-coded landfill, compost, and recycling bins in convenient areas. **K**

**Community**

**Roof Access.** Provide access to flat roofs for outdoor open space, especially in areas with hillside views. Support use as a community garden or similar program. **L**

**Covered Bicycle Storage.** **M**

Live/Work Building Type



**Ecology/Landscape**

**Active Space.** Allow some portion of outdoor space to be used for public open-space, potentially active space. **A**

**Private Driveway.** Require minimal curb cuts and curb return radii. **B**

**Water**

**Bulb-Outs.** Encourage or require bulb-outs on street corners as a traffic-calming measure and stormwater quality improvement measure. **C**

**Energy**

**Retractable Awnings.** Encourage the use of retractable awnings in storefront design, to protect from the summer sun. **D**

**Car Charging Stations.** Provide electric charging stations to promote the use of alternate-fuel vehicles. **E**

**Materials**

**Roof Materials.** Use high SRI roof materials where PV or vegetated roofs are not practical. **F**

**Recycling and Compost Bins.** Encourage establishments to have an area for compost and recycling bins, in addition to trash bins. **G**

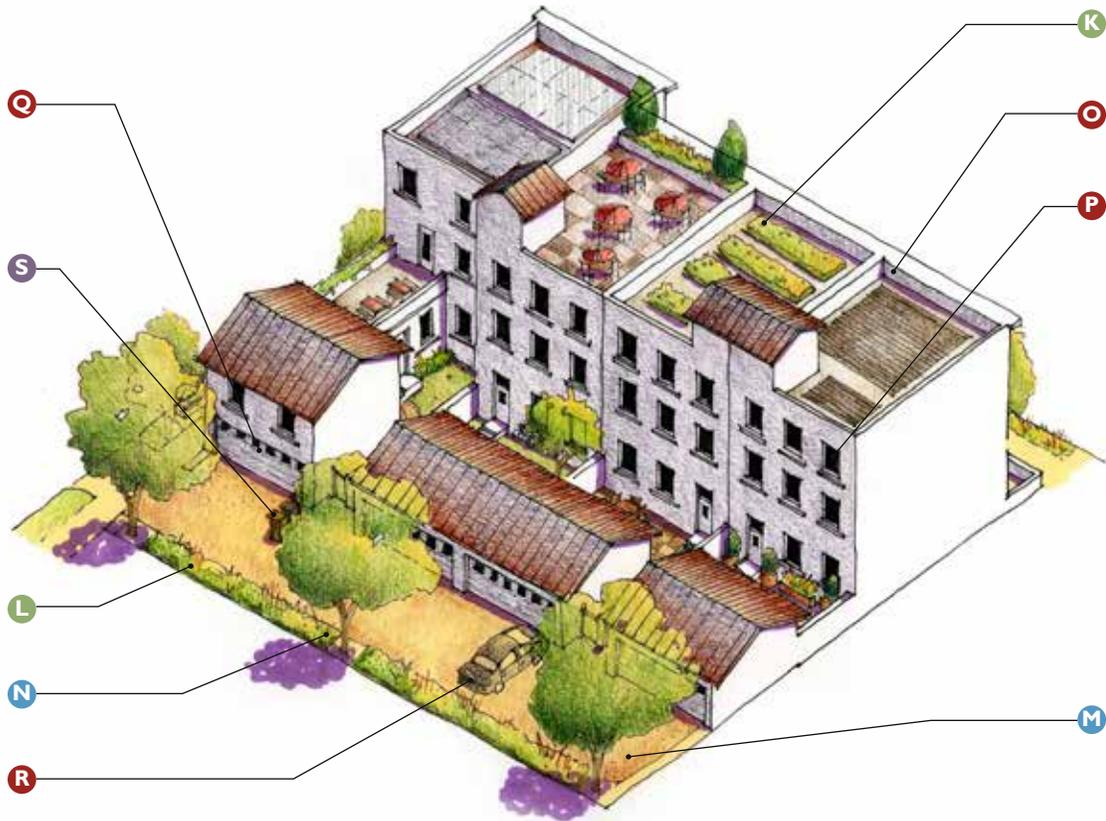
**Community**

**Residential Access.** Provide residential access to flat rooftops, creating usable open space. **H**

**Outdoor Seating.** Encourage establishments to provide outdoor seating and outdoor spaces. **I**

**Covered Bicycle Storage.** **J**

Live/Work Building Type (continued)



**Ecology/Landscape**

**Vegetated Roofs.** Promote vegetated roofs, skylights or directed sunlight to improve the quality of life in interior apartments. K

**Setbacks.** Provide setbacks for landscaping.. L

**Water**

**Permeable Pavers.** Encourage permeable paving through permits, tax credits, or grants. M

**Stormwater Management.** Require all parking areas flow directly to a landscaped stormwater management area. N

**Energy**

**Thermal Mass.** Create thermal mass in the building design to help minimize heating needs. O

**Operable Windows.** Require operable windows to provide cross-ventilation where possible, especially in hallways. P

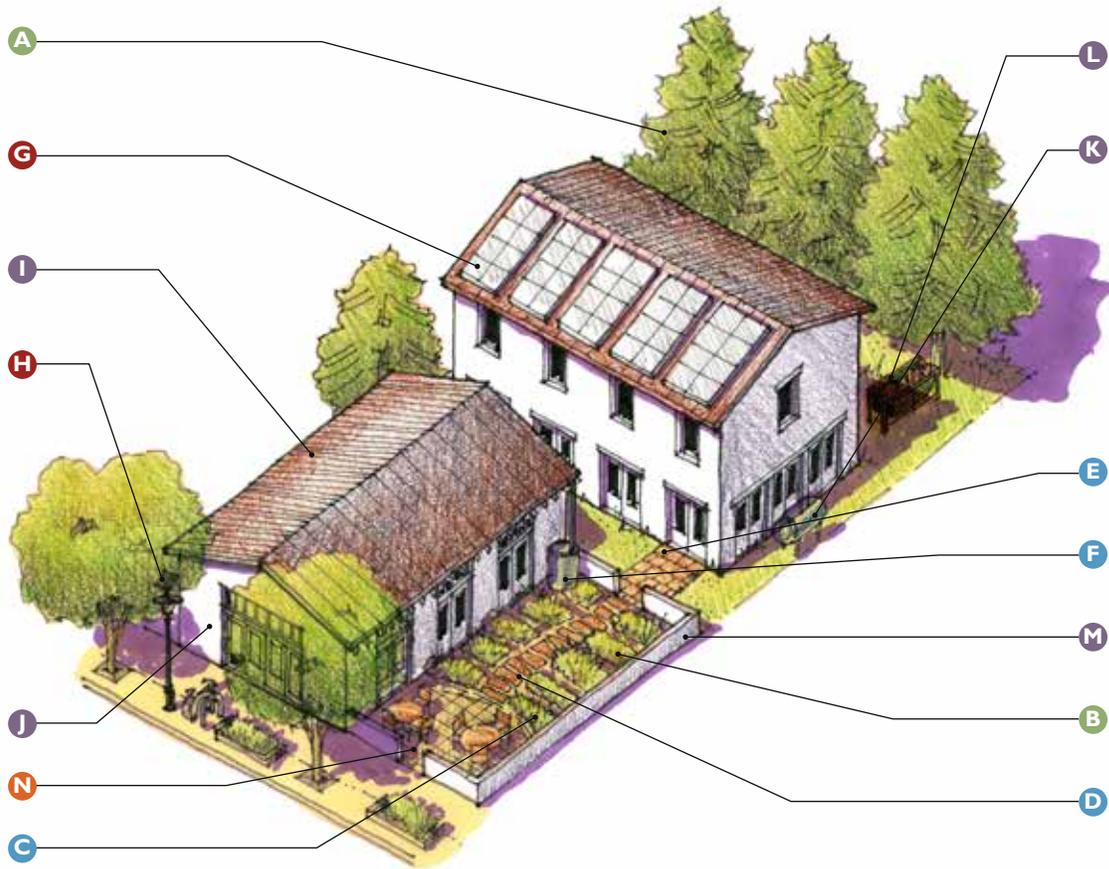
**Wired Garages.** Require all garages to be wired with 220V electricity for future installation of car charging stations. Q

**Preferred Parking.** Use preferred parking for environmentally-friendly vehicles if parking is limited. R

**Materials**

**Food Service-Specific Compostables Collection Bins.** S

Temporary Infill Building Type.



Ecology/Landscape	
<b>Tree Planting.</b> Trees shelter buildings against winter winds.	A
<b>Urban Farming.</b> Shared courtyard may be used for small-scale cultivation.	B
Water	
<b>Drip Irrigation.</b> Irrigation needs met with drip irrigation systems only; no sprinkler heads.	C
<b>Site Run-off Management.</b> Site's stormwater run-off is directed through garden for volume reduction and quality improvement.	D
<b>Permeable Pavers.</b> Reduce run-off entering municipal storm drain system.	E
<b>Rainwater Cistern.</b> Cistern collects roof runoff for use in on-site garden.	F
Energy	
<b>Solar Panels.</b> South-facing roofs are constructed as solar ready.	G
<b>Solar-Powered Street Lighting.</b>	H

Materials	
<b>Roof Materials.</b> Use high SRI roof materials.	I
<b>Building Materials.</b> Building material selection considers full life-cycle analysis, salvageability, and environmental impact at deconstruction.	J
<b>On-site Composting.</b> On-site composting generates organic nutrients for gardens.	K
<b>City-Registered Construction/Demolition Debris Collection Bins.</b>	L
<b>Recovered Construction/Demolition Debris.</b> Encourage re-use of materials to help divert waste from landfills.	M
Community	
<b>Shared Courtyards.</b> Improve community interaction and vitality.	N

Carriage House Building Type



**Ecology/Landscape**

**South-Side Planting.** Consider solar access on the south side of buildings when planting landscape. **A**

**Urban Farming.** Encourage small-scale cultivation. **B**

**Rain Garden.** Provide lot treatment rain gardens. **C**

**Water**

**Water Infiltration.** Allow water to percolate in sub-surface conditions. **D**

**Greenway.** Use the greenway as a stormwater capture, conveyance and treatment feature. **E**

**No Hose Bibs.** Exclude external hose bibs from home design, thereby irrigating only by rain barrel or reuse water. **F**

**Flow-Through Stormwater Treatment Planter.** **G**

**Energy**

**Strategic Shading.** **H**

**Glazing.** Design glazing to heat the structure from the south, and cool through cross-ventilation. **I**

**Materials**

**Locally-Sourced, Sustainably Certified Building Materials.** **J**

**Compost Bins.** Require compost bins with instructions for homeowners. **K**

**Community**

**Public/Private Portal.** **L**

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