Guide to Greening Multimodal Buffers

City of Richmond

April 2025

Prepared by Toole Design in partnership with City of Richmond Public Works and Timmons Group.

Information contained in this document is for planning purposes and should not be used for final design of any project. All results, recommendations, concept drawings, cost opinions, and commentary contained herein are based on limited data and information and on existing conditions that are subject to change.

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Message From The Mayor

Richmond is a city on the move—toward a healthier, greener, and more connected future. As we work to create safer, more vibrant streets for all, we must also recognize the power of nature to transform our public spaces. The Guide to Greening Multimodal Buffers is a first-of-its-kind resource designed to help us integrate more green infrastructure into our transportation network, ensuring that every sidewalk, bikeway, and shared-use path is not just a corridor for movement but a space for people to thrive.

This Guide provides City staff and partners with a framework for making informed, site-specific decisions about introducing greenery into our streetscapes. Whether through permeable materials, native plantings, or tree canopy expansion, these strategies enhance environmental sustainability, improve air and water quality, and make our streets more comfortable and inviting. More than just an aesthetic improvement, greening our multimodal buffers is an investment in public health, safety, and climate resilience.
By embracing these principles, we have the opportunity to lead by example—demonstrating how a city can be both innovative and rooted in natural solutions. I encourage all of us to use this Guide to shape a Richmond that prioritizes people, nature, and mobility in equal measure. Together, we can build a city where green streets are the foundation of a thriving community.

Dr. Danny Avula

Mayor, City of Richmond

"The Guide to Greening Multimodal Buffers will help Richmond make its streets cooler, safer, and healthier. The transportation planning and urban greening best practices in this guide will foster a healthier and more active community by ensuring that our city's streets are more pleasant for biking and walking."

Peter Braun
Built Environment Policy Analyst, Virginia Department of Health

"Cities are increasingly integrating greenery back into the ecology of urban life. The City of Richmond's Guide to Greening Multimodal Buffers is a practical tool that city planners and community members alike can use to make streets in neighborhoods greener and more inviting to everyone, and is a great complement to the NACTO Urban Street Stormwater Guide."

Ryan Russo
Executive Director, National Association of City Transportation Officials (NACTO)

"The Dutch Cycling Embassy is honored to have played a small part in the development of this game-changing document. It is inspiring to see standards that raise their sights; not focused simply on designing better bicycle facilities, but on using mobility as a tool to build a more livable, inclusive, and prosperous city. We're excited to support its implementation in the coming years, and help Richmond become a place that works for all its residents, regardless of age, ability, or income."

Chris Bruntlett
International Relations Manager, Dutch Cycling Embassy

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OVERVIEW

The City of Richmond's first-of-its-kind **Guide to Greening Multimodal Buffers** is a resource for City staff and their partners. The Guide provides direction on what greening opportunities are appropriate for a buffer depending on a variety of contextual and physical factors. A buffer is being defined herein as the area between the back of the curb or edge of road pavement and either a bikeway, a shared use path, or a sidewalk, which provides separation from moving vehicle traffic. This Guide encompasses six levels of greening, ranging from high-albedo and permeable materials to understory plantings and trees.

The extensive environmental, social, and economic benefits of urban greening are becoming increasingly understood, and as a result, cities across North America are searching for opportunities to introduce more greening into the urban fabric through redevelopment projects or underutilized space. Redevelopment projects require the work to be done by or in partnership with other entities (private developers or institutions). Buffers within the City of Richmond's right-of-ways can either be maintained by the City on its own, or through maintenance partnerships that support greater density and complexity of planting.

This Guide identifies types of applicable greening treatments and provides direction on the decision-making process for implementing the treatments to existing or planned buffers. Before and after images illustrate potential greening through retrofitting existing multimodal buffers on Malvern Avenue, Warwick Road, and Williamsburg Avenue.

City of Richmond: Existing Guidance

The City's existing standards and guidelines that provide a framework for greening within roadway corridors are summarized below. In general, existing documents provide guidance on greening in a limited way with documents providing high-level strategies for climate resilience and equity or discrete guidance for individual design elements such as tree species or ideal buffer width.

Better Streets Manual, 2018.

- Defines six context-based street types and six street overlays, which help guide street design and land development.
- Street Types:
  - Industrial
  - Mixed-Use
  - Downtown
  - Commercial Connector
  - Neighborhood Connector & Residential
  - Parkways
- Street Overlays:
  - Bicycle Network Streets
  - Transit Streets
  - Land Use Areas
  - School Zones (K-12, Universities)
  - Vision Zero Priorities
  - Freight Routes
- Defines preferred and minimum widths for elements in the sidewalk zone and curbside zone based on street type.
- Specific guidance of note includes:
  - Sidewalk buffer zone should be 4-6 feet wide
  - Plant material should be native and non-invasive
  - Planting strips should be avoided in areas adjacent to on-street parking and/or constrained conditions with high pedestrian volumes. Frequent breaks facilitate faster walking speeds and pedestrian passing.
  - Urban Forester must be consulted when planting street trees

RVA Green 2050, Climate Equity Action Plan 2030, 2023.

- Sets a series of objectives, strategies and actions towards equitable climate resilience by 2030 within five pathways:
  - Buildings and Energy
  - Community
  - Environment
  - Transportation and Mobility
  - Waste Reduction and Recovery
- Goals include urban heat island reduction, increased urban tree canopy, increased flood resilience, improved air quality, multimodal connectivity, and integrating street trees with biking and walking infrastructure.
- Aims to provide access to resources for all, regardless of neighborhood or identity.
- Prioritizes resources for communities that experience the greatest inequities, disproportionate impacts, and have the greatest unmet needs.
- Greening multimodal buffers align with the individual goals listed above as well as larger efforts for improving the environment, transportation and mobility.

Bicycle Master Plan, 2015.

» Provides guidance on cycle track separation and placement, including minimum and recommended dimensions:

- Cycle track separation mentioned include bollards, parking, a planter, an extruded curb, on-street parking, or other methods. Does not mention vegetated buffers specifically.

» One-way Cycle Tracks:
- 7' recommended minimum to allow passing.
- 5' minimum width in constrained locations.
- When adjacent to parking, the buffer should be 3' wide to allow for passenger loading and to prevent door collisions.

» Two-way Cycle Tracks:
- 12' recommended minimum for two-way facility
- 8' minimum in constrained locations
- When adjacent to parking, the buffer should be 3' wide to allow for passenger loading and to prevent door collisions.

» Includes considerations for bikeway design at street parking, intersections, driveway crossings, transit stops, buffer openings, visibility, and more:

- Openings in the buffer are needed at intersections and driveways or other access points to allow vehicle crossing and bicyclist access.
- Drop cycle track buffer and transition to bike lane 16' in advance of the intersection.
- Remove parking 16' -50' in advance of the buffer termination.
- Provide access into and out of the cycle track for users to access destinations on either side of the street.
- The cycle track should have priority over driveways and crossings of minor streets.
- Furnishings and other features should accommodate a 20' sight triangle from minor intersection crossings, and 10' from driveway crossings.

DPW Urban Forestry Division's Recommended Tree Species for City Right-of-Way

» Provides three species lists categorized by height: small ornamental trees, medium trees, and large shade trees.

- Small Ornamental Trees: generally have a mature height of less than 30', which makes them suitable for planting in small tree wells and under utility lines.
- Medium Trees: generally reach 40'-55' at maturity, providing shade and benefits for areas that can't accommodate large trees.
- Large Shade Trees: can exceed 60' in height. These provide the most benefit to the community, and should be used whenever site conditions allow.

» Does not specify approved native species, which are required by the Betters Streets Manual.

DPW Standard Drawings, 2019

» Provides construction details for roadway sections, sidewalks and pathways, paving, and curbs and gutters.

» Includes standard details for sidewalk buffer and medians, but lacks details for other multimodal buffers.

» Lacks standard details for tree planting in buffers.

Emerging Trends

Greening multimodal buffers is a trend seen in different cities across North America and beyond. This Guide for the City of Richmond is informed by emerging trends from cities with established greening policies and design guidance as summarized below. Notably, this Guide is a first-of-its-kind resource for planning-level guidance that comprehensively addresses a broad spectrum of greening options.

Vancouver, BC has implemented various retrofit projects to construct multimodal buffers that include understory vegetation and trees in different contexts, such as Pacific Street, 10th Avenue, and Richards Street. As part of the decade-long effort of Vancouver's Greenest City 2020 Action Plan, a large amount of bikeways were constructed and upgraded with green buffers. In terms of guidance, the City of Vancouver Engineering Design Manual sets standards for multimodal buffers for widths, materials, and tree placement. Buffer types include painted buffers (≥2'), raised (≥2.5'), raised with trees (≥5'), and boulevards (buffers at sidewalk level). The manual specifies that boulevards can be planted or hard surface, and should include street trees if space permits (≥4').

Denver, CO has developed guidance for implementing green buffers and determining their design characteristics. The Denver Green Continuum Streets Guidelines identify five levels of green and establish a decision framework for determining which level is best suited for a given project. While the document has a strong emphasis on green stormwater infrastructure, it also categorizes types of greening treatments by vegetation typology and tree canopy cooling benefits. For example, if existing conditions do not allow or require stormwater management, there can be opportunities for reducing impervious area by planting trees and understory vegetation. Levels of Green can also be combined on a project to provide multiple outcomes and benefits. By offering a greater suite of intervention options, the city can more rapidly implement green infrastructure solutions.

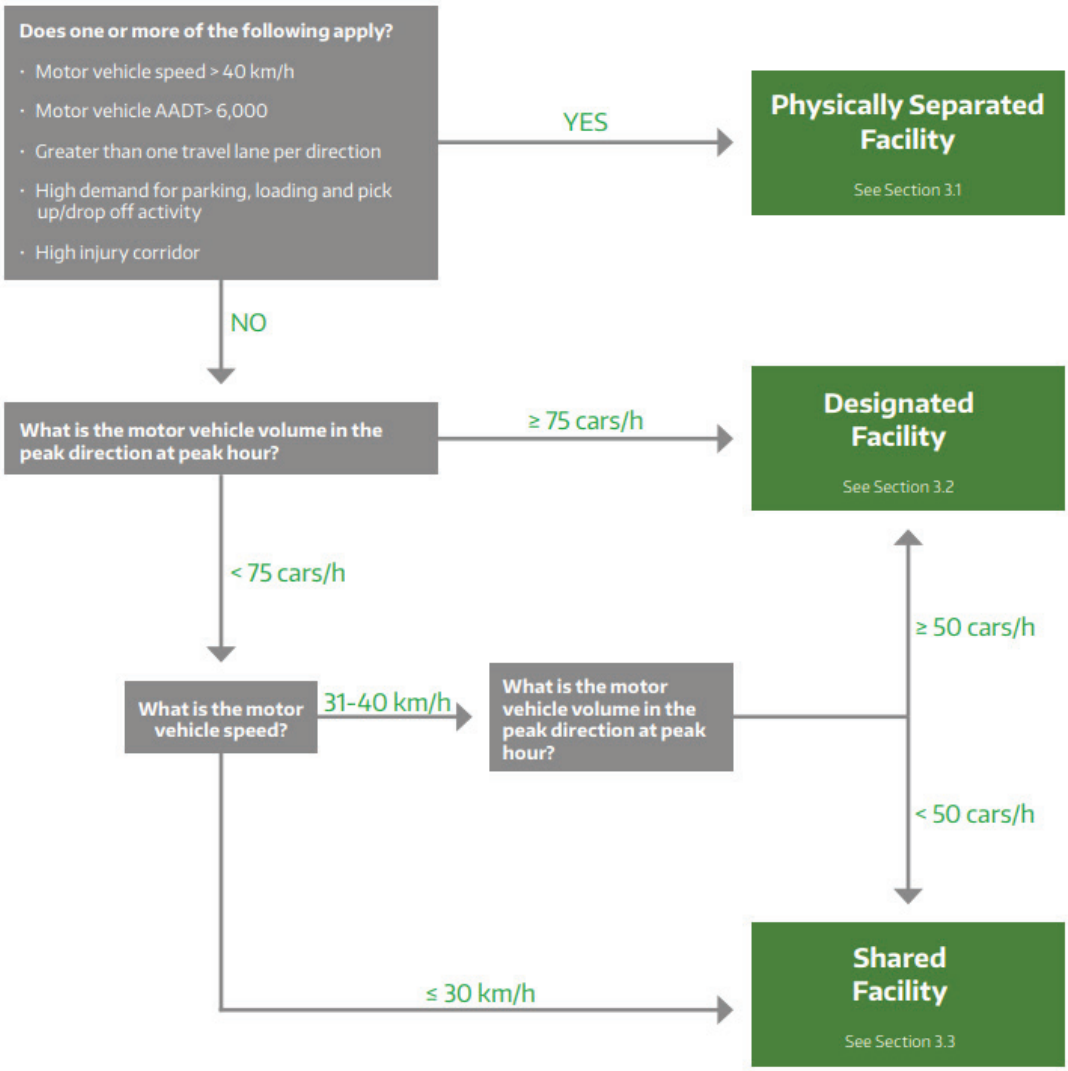
Vancouver, BC[1]

Vancouver, BC[2]

The City of **Toronto, ON** has developed guidance for bike facility and buffer selection which includes planted multimodal buffers. The Toronto On-Street Bikeway Design Guide includes a decision matrix for facility selection and a table with bicycle/motor vehicle separation types and minimum buffer widths, as well as design guidance for bicycle/pedestrian separation and facility design. Bicycle/motor vehicle separation types listed are flex bollards and modular curb (≥1'), poured concrete curb/median (≥1'), planted median (≥3'), planter boxes (≥3'), semi-rigid guard rail (≥3'), and concrete barrier (≥2.5'). The document states that, on the approach to driveways or intersections, the effect of separation width and height on sight-lines should be considered, and the buffer may need to widen or narrow to provide appropriate visibility. The type of separation should be selected based on the characteristics of the street, such as motor vehicle speed, presence of on-street parking, and available road or right-of-way space.

These cities can serve as precedents not only for building and retrofitting green multimodal buffers, but also for the guidance and decision-making processes that help to make these projects happen.

City of Toronto Facility Selection Matrix



DECISION-MAKING GUIDE

How to Use this Guide

The decision-making guide on the following pages provides planning-level guidance on opportunities for greening multimodal buffers. Each step in the guide represents a different decision point. Within the worksheets, users are prompted to document the results of each step to create a clear path to the final result. Guidance related to community engagement is generally omitted from this Guide as appropriate engagement activities will depend on a variety of factors. Similarly, maintenance for each possible intervention will also depend on a variety of factors is also omitted.

A visual menu of the recommended greening levels is provided on pages 8-9 prior to the worksheets for each decision-making step. The six greening levels range from high-albedo treatments (Level 1) to green stormwater infrastructure (Level 6). Each level is represented with a brief description, precedent imagery, a brief overview of benefits, and relative cost. Specific plant selection guidance is not included, however vegetation should align with City of Richmond goals related to use of native species.

To determine the appropriate level for a specific buffer, the decision-making process moves through four sequential steps.

1. **Expedited Visioning:** This step determines the Ideal Range of greening levels. This step sets the foundation for the decision-making process and should include collaboration across City of Richmond departments.

2. **Spatial Constraints:** This step uses information about the size of the buffer to narrow down the Ideal Range to a Target Level. This process may need to be repeated for buffers that vary greatly in terms of spatial constraints (e.g., a street with narrow buffers that widen out substantially at intersections).

3. **Potential Conflicts:** This step uses information about utilities and curbside access to determine the Planned Level. Depending on severity and fixed nature of potential conflicts, the Planned Level may end up lower than the Target Level from Step 2. This step also provides basic design guidance for keeping utilities in place and maintaining the Target Level. For levels 1-3, this is the final step in the decision-making process. This process may need to be repeated for buffers that vary greatly in terms of potential conflicts (e.g., can existing travel lanes be narrowed or removed to increase the buffer).

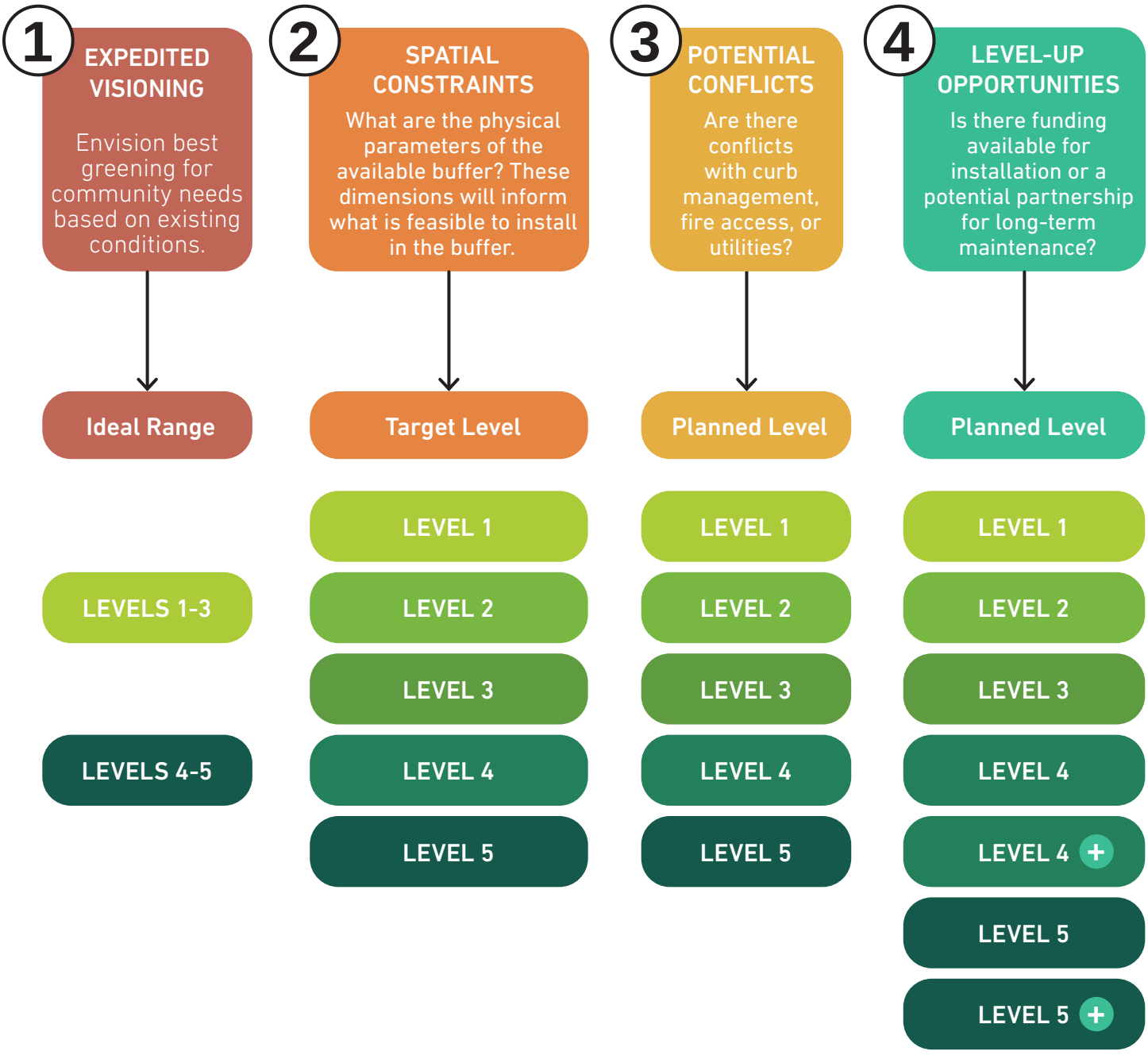
4. **Level-Up Opportunities:** This step only applies to Levels 4 and 5 and determines if additional funding or partnerships are available to increase the Planned Level from standard recommendations to become Level 4+ or Level 5+.

Additional notes:

- This process prompts users to question whether existing conditions that may pose a constraint have flexibility to be altered or reconsidered (e.g., can existing travel lane widths be narrowed to increase the buffer).

- This process may need to be repeated for buffers that vary greatly in terms of spatial constraints (e.g., a street with narrow buffers that widen out substantially at intersections) and/or potential conflicts (e.g., a street with pressurized sewer main conflicts for 4 blocks of the 10 blocks being considered).

Decision-Making Steps



Levels of Greening

The potential greening outcomes for multimodal corridors are described below.

	DESCRIPTION	PRECEDENTS
LEVEL 6	Green Stormwater Infrastructure (GSI)	 
LEVEL 5	Raised buffer with understory planting and street trees	 
+	partnership to support greater density and complexity of planting = Level 5+	
LEVEL 4	Raised buffer with understory planting without street trees	 
+	partnership to support greater density and complexity of planting = Level 4+	
LEVEL 3	Install curbed permeable hardscape	 
LEVEL 2	Install cast-in-place concrete curb buffers	 
LEVEL 1	Paint pavement to be a lighter color to increase the surface albedo (public art opportunity)	 

	PUBLIC BENEFITS	COST SCALE
	safety lower temperatures air quality wildlife habitat stormwater management water quality neighborhood aesthetics	$ $ $ $ $
		$ $
		$ $
	safety water quality stormwater management lower temperatures	$ $ $
	safety lower temperatures	$ $
	visibility lower temperatures placemaking	$

Buffer Name and Extents:

1 EXPEDITED VISIONING

Envision best greening for community needs based on existing conditions. Compare existing conditions to precedents to determine Ideal Range. Include staff from multiple departments to collaboratively determine the Ideal Range. The RVAGreen Virtual Resilience Hub provides much of the critical data for the decision-making process.

NEEDS CONSIDERATIONS

- What is the amount of green within the right-of-way?
- What is the amount of green on the adjacent parcels?
- Is this a neighborhood that is underserved by greening?
- Is the corridor in an area identified for greening or resilience in RVA Green?

Are there stormwater issues at the buffer?

No | Yes

LEVEL 6

There is a right-of-way with stormwater issues in need of green stormwater infrastructure (GSI).

LEVELS 1-3

There is a fair amount of greening in the neighborhood. The area would benefit from more green but it is not in as dire need as other street corridors.

mature street tree canopy with understory planting

LEVELS 4-5

There is little greening in the neighborhood. The area would truly benefit from more green.

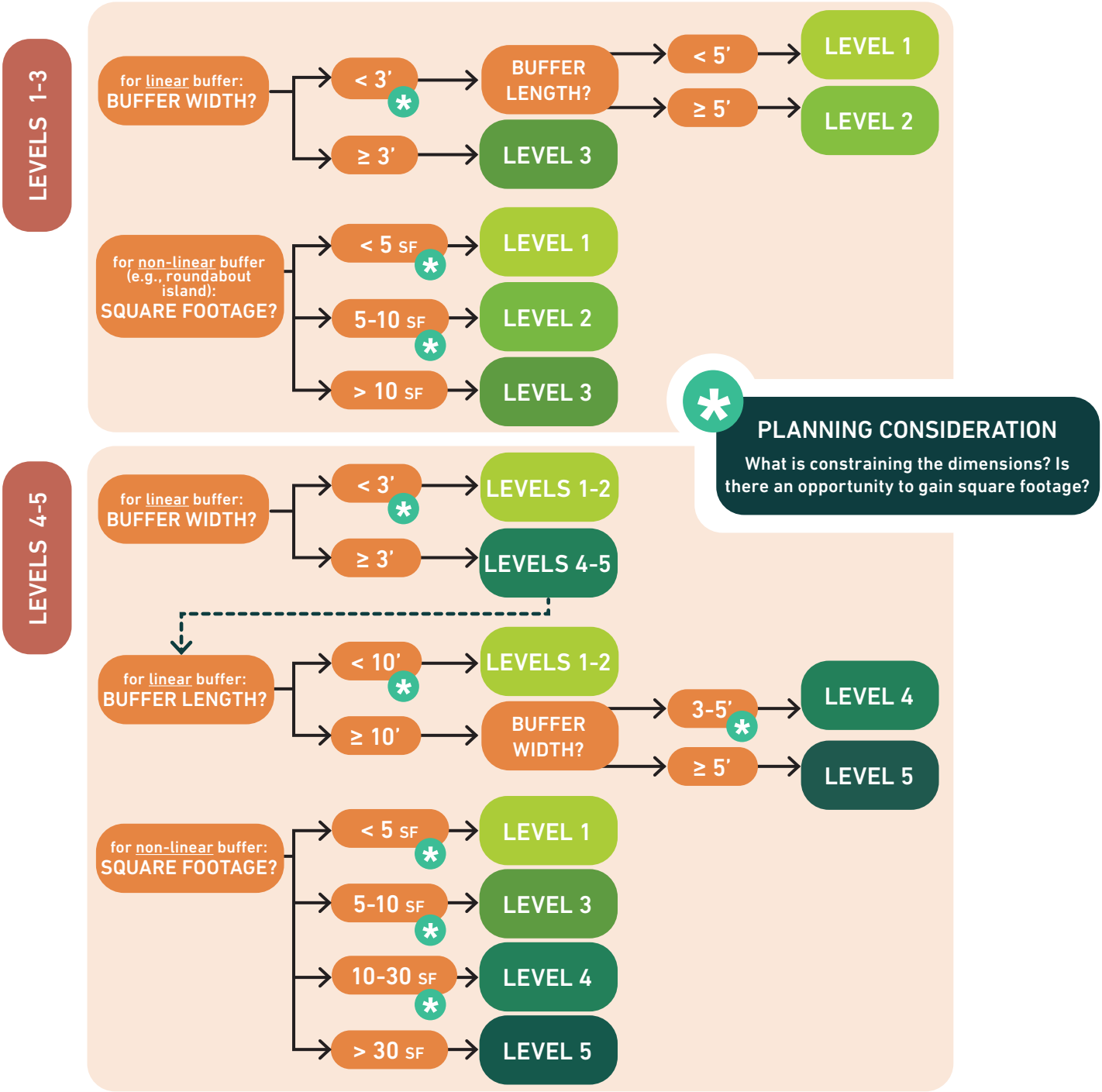
corridors with healthy trees only on one side of the street or unhealthy trees

Ideal Range (circle one): LEVELS 1-3 LEVELS 4-5

Ideal Range (circle one): LEVELS 1 - 3 LEVELS 4 - 5

2 SPATIAL CONSTRAINTS

What are the physical parameters of the available buffer? These dimensions will inform what is feasible to install in the buffer. Repeat this process for different sections of a corridor with buffers that have significant variation in spatial constraints.



Target Level (circle one): LEVEL 1 LEVEL 2 LEVEL 3 LEVEL 4 LEVEL 5

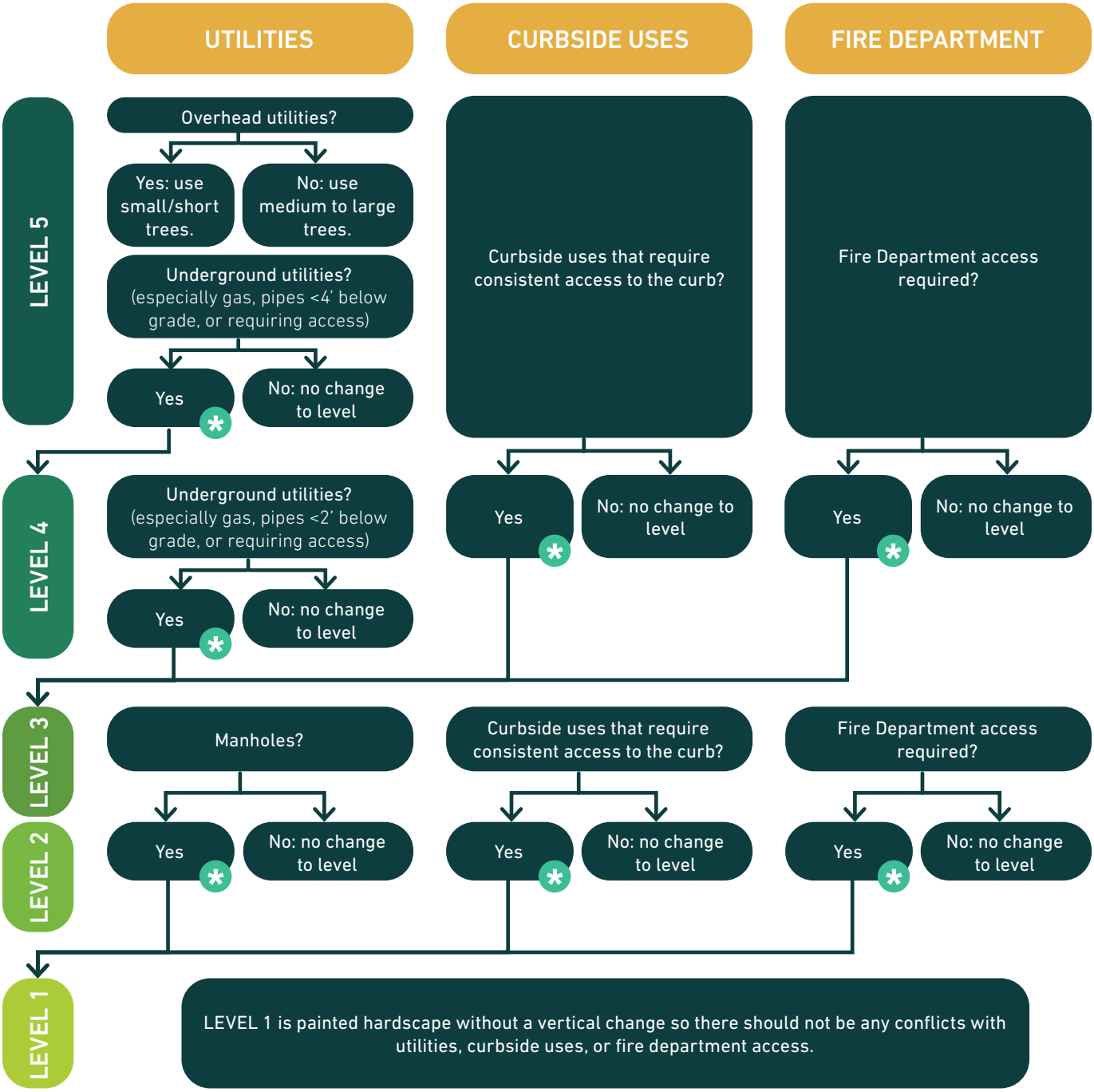
Target Level (circle one): LEVEL 1 | LEVEL 2 | LEVEL 3 | LEVEL 4 | LEVEL 5

3 POTENTIAL CONFLICTS

Are there conflicts with curb management, fire access, or utilities? Repeat this process for different sections of a corridor with buffers that have significant variation in potential conflicts.

PLANNING CONSIDERATIONS: Try not to level down. Can...

- utilities be relocated? curbside uses be consolidated? manhole rims be raised?
- breaks in a buffer or trees be strategically placed?
- buffer be driven over by using beveled curbs and vehicle-rated paving or reinforced grass?



Planned Level (circle one): LEVEL 1 | LEVEL 2 | LEVEL 3 | LEVEL 4 | LEVEL 5

Planned Level (circle one): LEVEL 1 LEVEL 2 LEVEL 3 LEVEL 4 LEVEL 5

4 LEVEL-UP OPPORTUNITIES

Is there funding available for installation or a potential partnership for long-term maintenance?

For Level 4 and Level 5 only,
if there is support for increase plant spacing and complexity,
circle the + symbol below.

Planned Level (circle one): LEVEL 1 LEVEL 2 LEVEL 3 LEVEL 4 LEVEL 5

+ +

LEVEL 4+

LEVEL 5+

VISUALIZATIONS

The following before and after graphics illustrate potential greening through retrofitting existing multimodal buffers on Malvern Avenue, Warwick Road, and Williamsburg Avenue.

Malvern Avenue

- Landscaped buffer for separated bikeway
- Trees possible in parking bulb outs/end caps

BEFORE

AFTER

Malvern Avenue, Richmond

Warwick Road

- Landscaped buffer for separated bikeway
- Buffer is wide enough for trees
- Buffer can become pedestrian refuge at the intersection (obscured by vegetation at this angle)
- Conflict markings added at intersection
- Visualization shows trees at mature height
- Break in buffer for right-turning vehicles provided behind the view of the camera

BEFORE

AFTER

Warwick Road, Richmond

Williamsburg Avenue

- Landscaped buffer for separated bikeway
- Floating bus stop with bikeway ramping up to flush condition
- Replaced crepe myrtles with canopy trees in median
- Added trees behind sidewalk

BEFORE

AFTER

Williamsburg Avenue, Richmond

Image List

1. Vancouver, BC bikeway. https://momentummag.com/50-million-to-enhance-active-transportation-across-british-columbia/
2. Vancouver, BC bikeway. https://www.flickr.com/photos/hnbd/5985674849
3. Permeable hardscape buffer. https://chi.streetsblog.org/2022/01/10/who-should-we-be-really-building-bikeways-for
4. Permeable hardscape buffer. https://bikeportland.org/2016/05/06/vancouver-biking-doubles-passing-portland-with-downtown-protected-bike-lane-network-182716
5. Permeable hardscape buffer. https://bicyclenetwork.com.au/newsroom/2022/03/10/melbournes-bike-lanes-a-history-of-misguided-opposition/
6. Painted buffer. https://mississauga.ca/arts-and-culture/arts/public-art/temporary-public-art/interconnection/
7. Same as above
8. Same as above
9. Seattle, WA bikeway. https://betterbikeshare.org/2021/07/02/new-study-bike-lanes-arent-associated-with-displacement/


VISION
ZERO
RICHMOND, VIRGINIA