Exploring Roles for Greenroofs in Greater Vancouver

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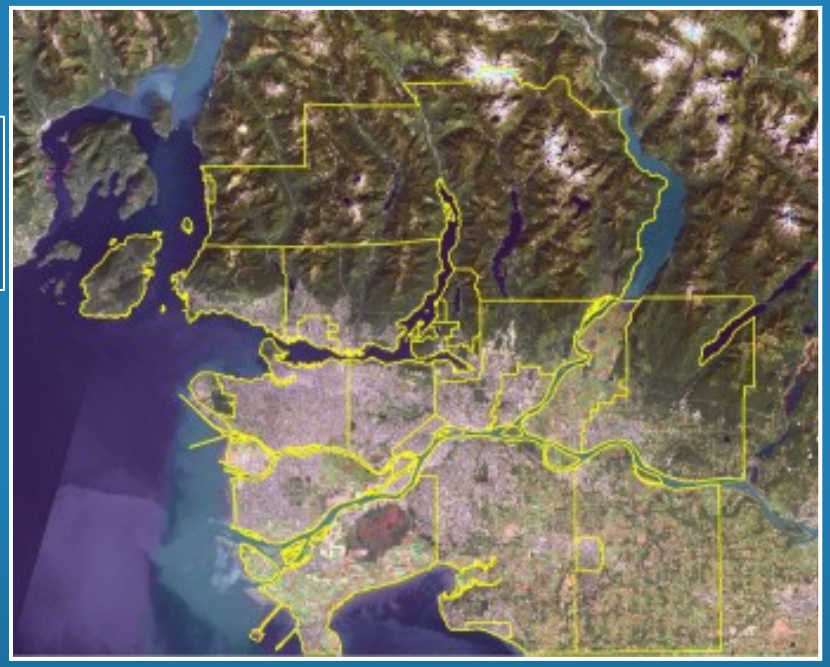

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Greater Vancouver Regional District
Policy and Planning Department
Regional Utility Planning Division

Exploring Roles for Greenroofs in Greater Vancouver

Part 3: Finding the Fit

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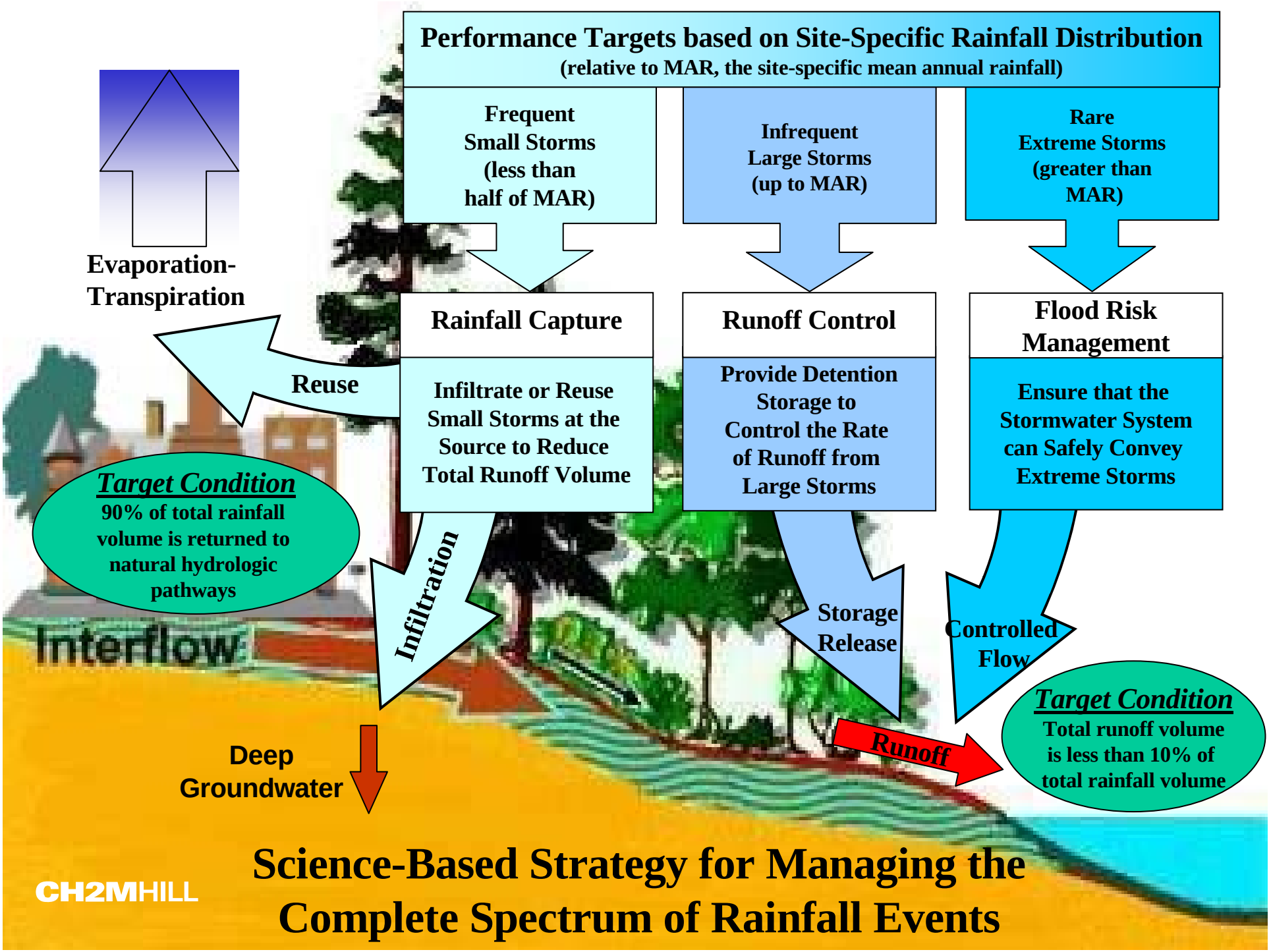
Finding a Fit for Greenroofs

- Where can greenroofs manage runoff rates and volumes, thereby assisting in stormwater infrastructure and stream health management?
- Long-term infrastructure planning horizons are typically 50 years and the current regional land redevelopment cycle is 50 years
- What are the opportunities to phase-in solutions like greenroofs through urban renewal to manage long-range impacts from growth and climate change?


Performance Targets based on Site-Specific Rainfall Distribution
(relative to MAR, the site-specific mean annual rainfall)
Frequent Small Storms (less than half of MAR)
Infrequent Large Storms (up to MAR)
Rare Extreme Storms (greater than MAR)
Evaporation-Transpiration
Rainfall Capture
Runoff Control
Flood Risk Management
Reuse
Infiltrate or Reuse Small Storms at the Source to Reduce Total Runoff Volume
Provide Detention Storage to Control the Rate of Runoff from Large Storms
Ensure that the Stormwater System can Safely Convey Extreme Storms
Target Condition
90% of total rainfall volume is returned to natural hydrologic pathways
Infiltration
Storage Release
Controlled Flow
Interflow
Runoff
Target Condition
Total runoff volume is less than 10% of total rainfall volume
Deep Groundwater
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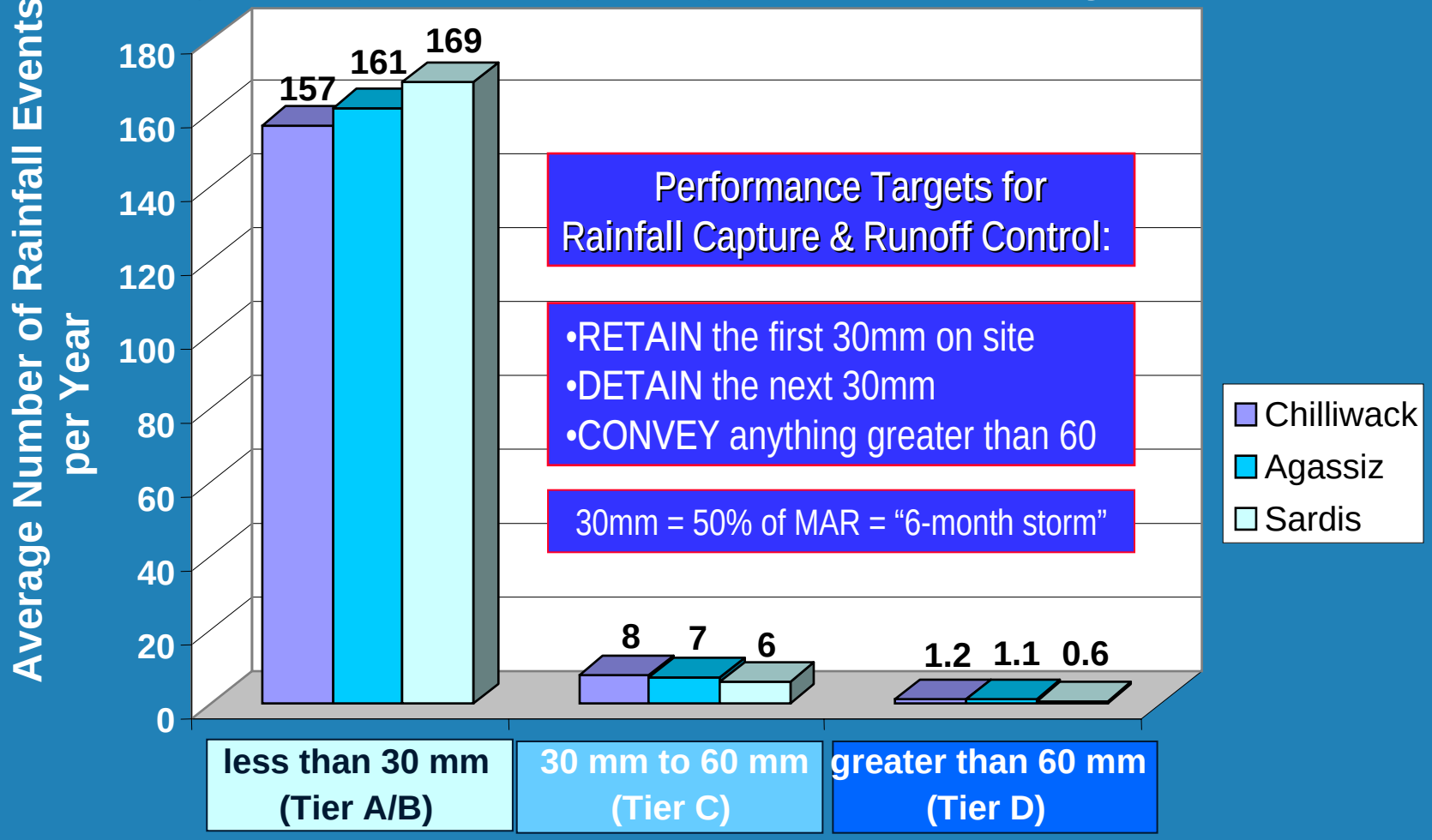
Science-Based Strategy for Managing the Complete Spectrum of Rainfall Events

Distribution of Number of Annual Rainfall Events Chilliwack Region



Rainfall Event* Size

** Rainfall events is defined as total daily rainfall depth (24 hrs)*

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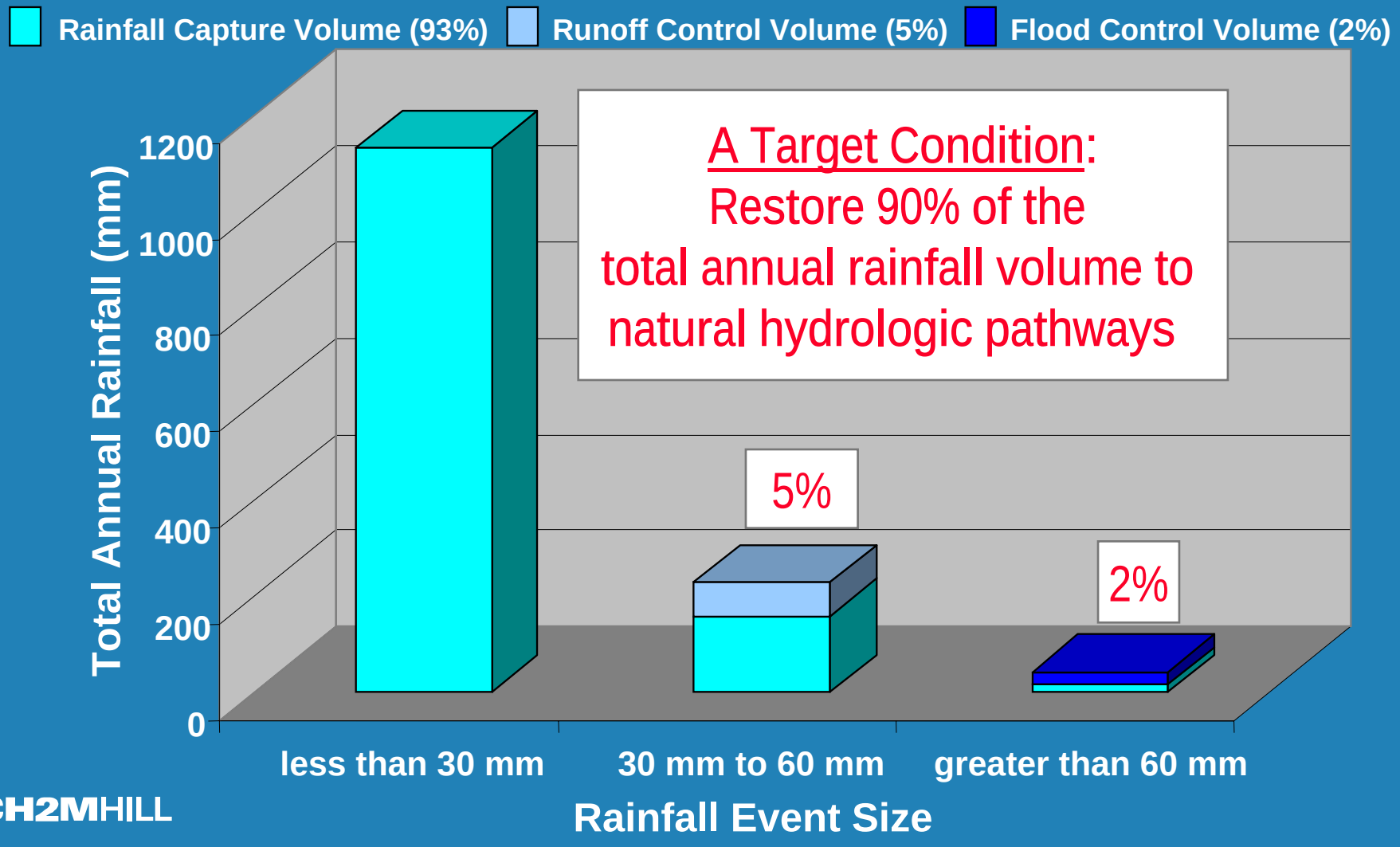
Distribution of Annual Rainfall Volume (Sardis)



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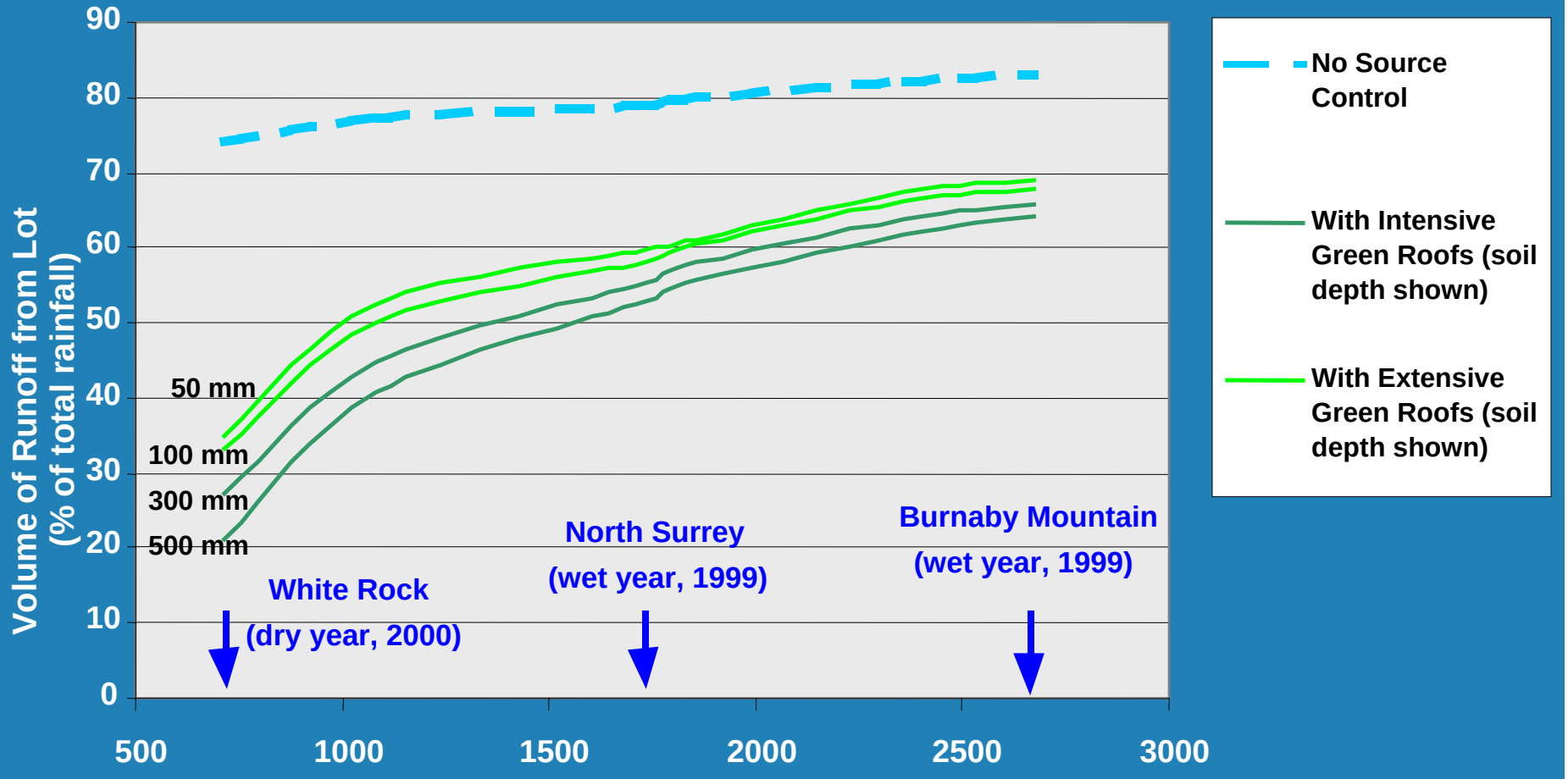
Effect of Rainfall on Green Roof Performance

Medium Density Multi-Family Lot (70% lot coverage, mostly rooftop)



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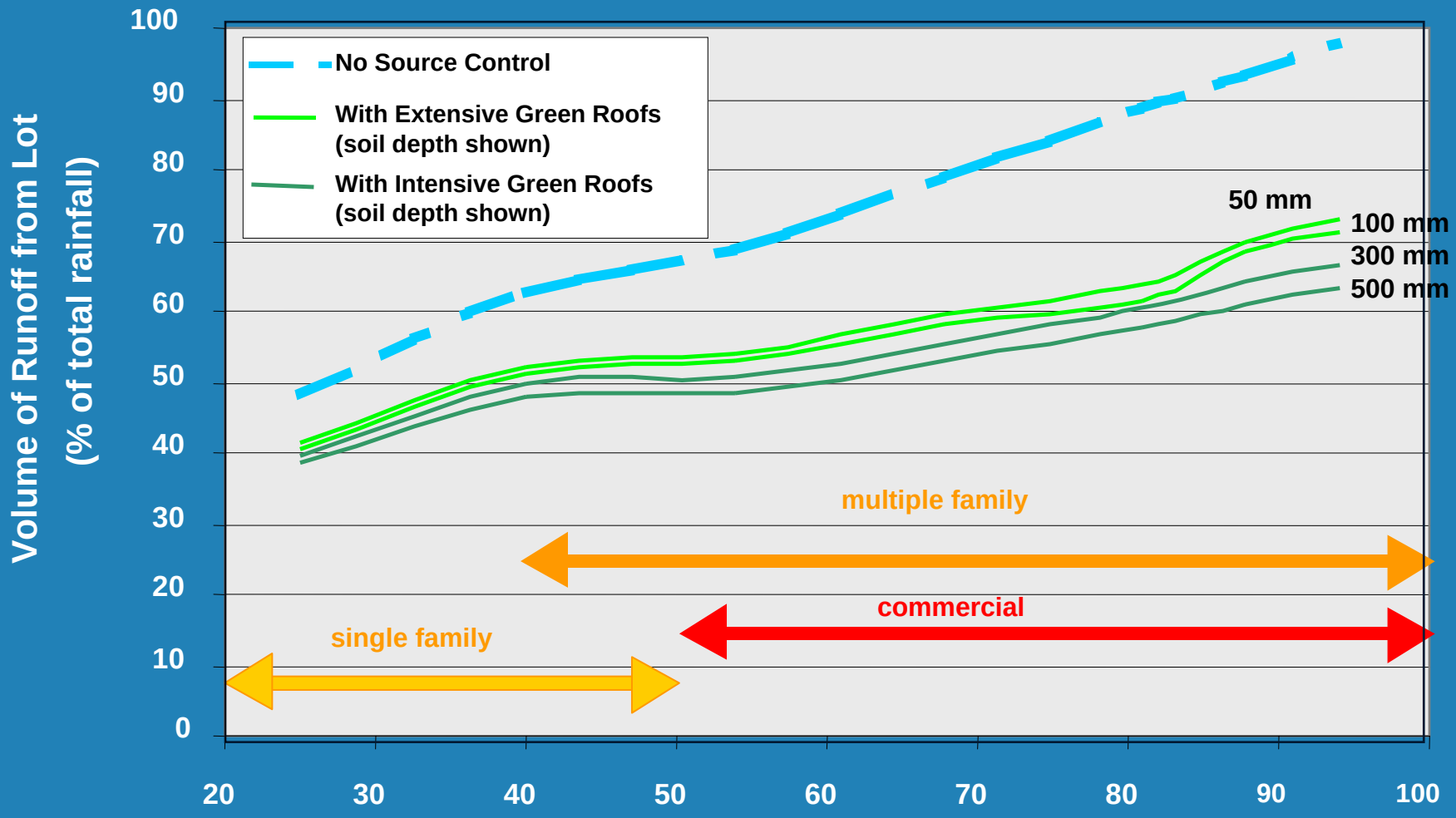
Benefits of Green Roofs for Different Land Uses

(Runoff Volume Reduction)

North Surrey Rainfall (wet year, 1999)



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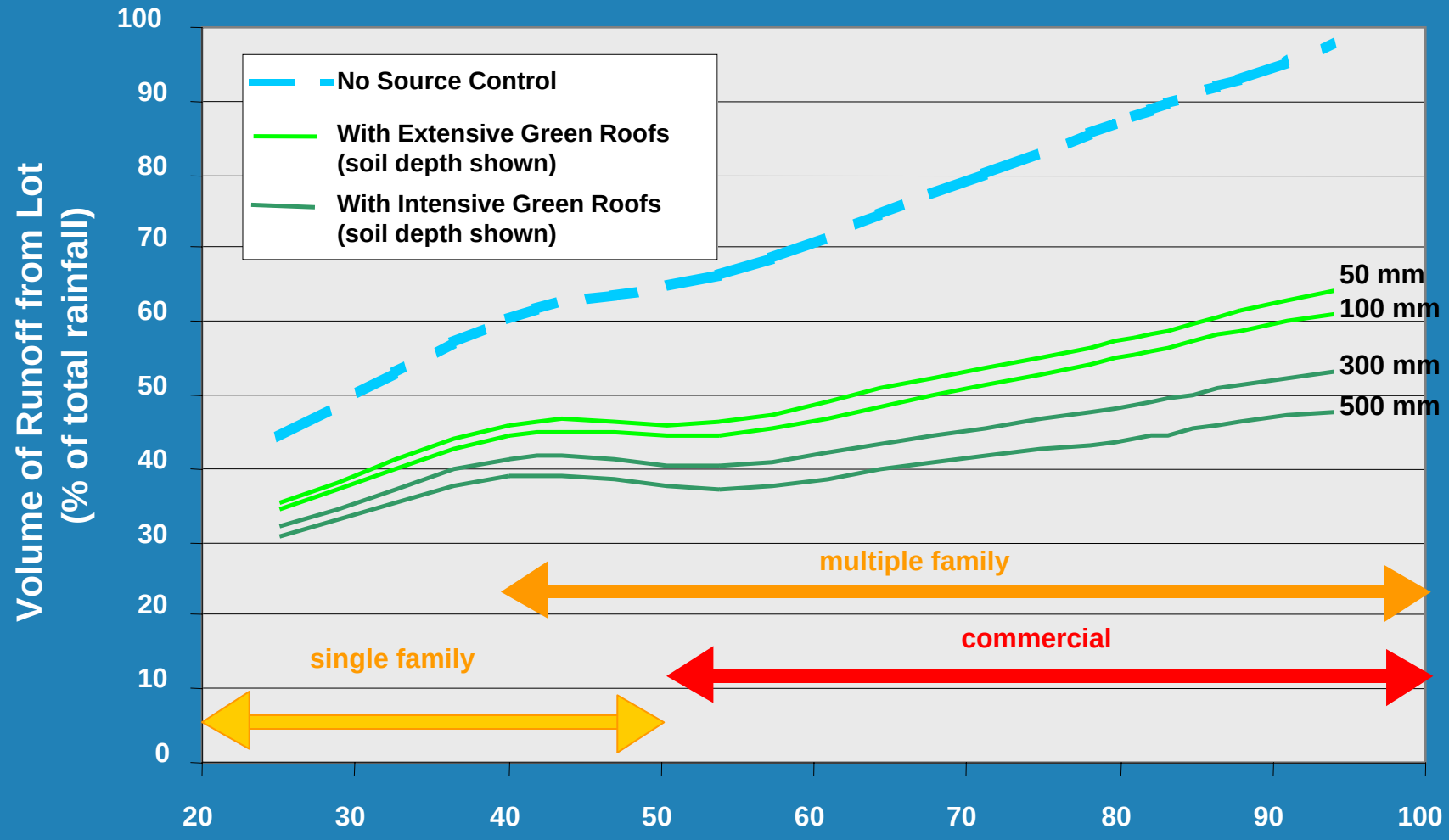
Benefits of Green Roofs for Different Land Uses

(Runoff Volume Reduction)

White Rock Rainfall (wet year, 1999)



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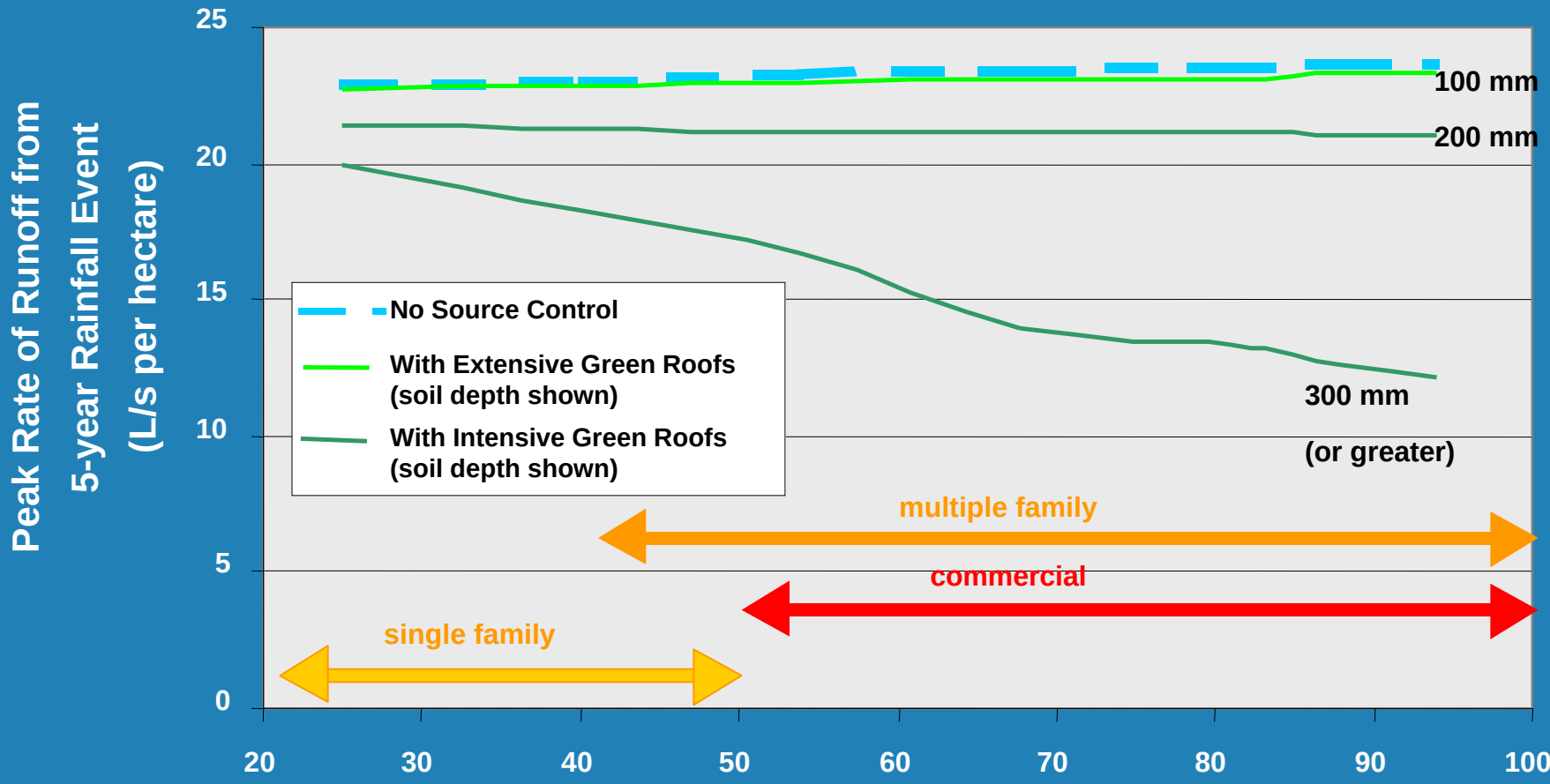
Benefits of Green Roofs for Different Land Uses

(Runoff Rate Reduction)

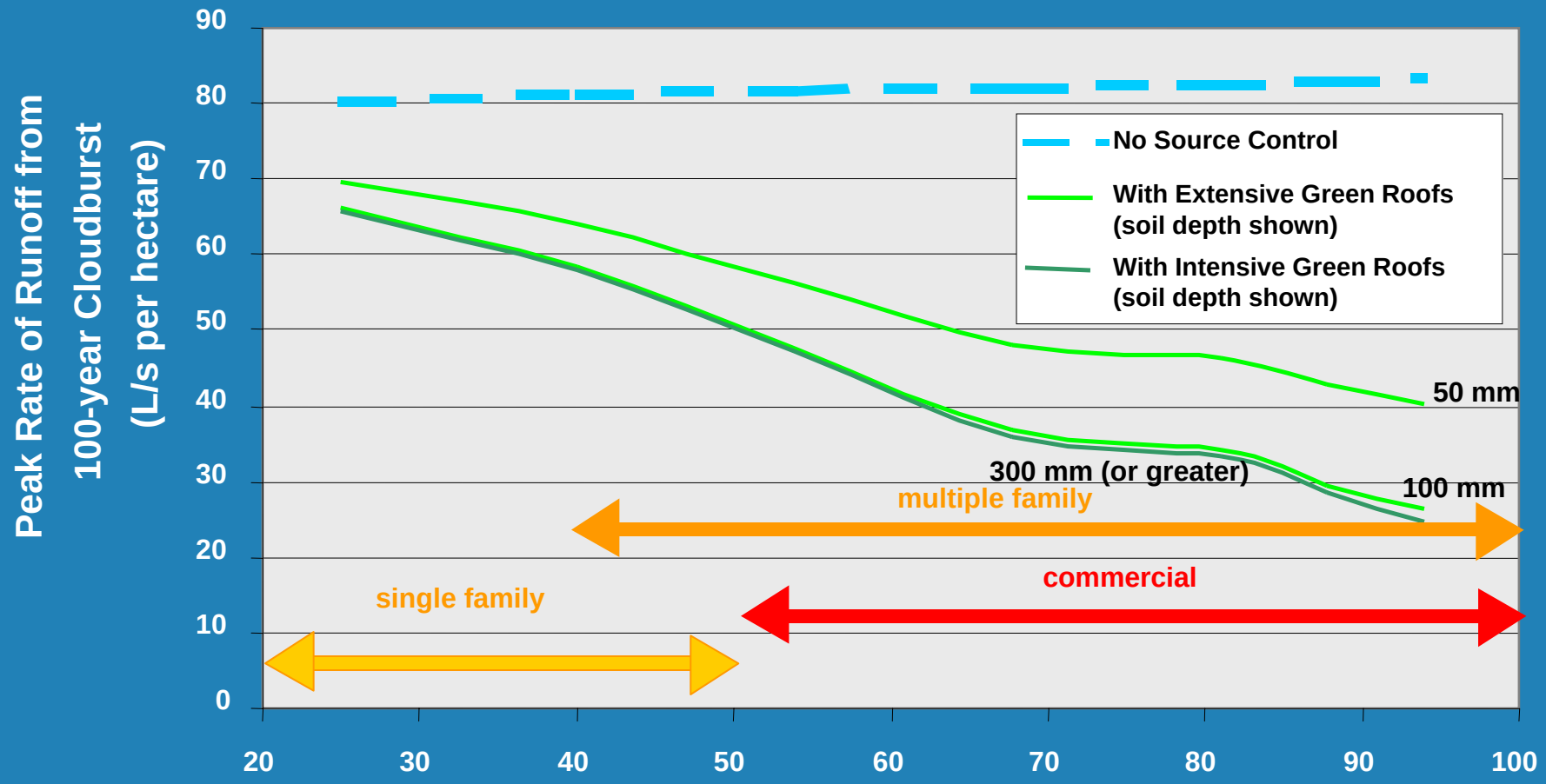
North Surrey Rainfall
Long Duration Storm



Benefits of Green Roofs for Different Land Uses

(Runoff Rate Reduction)

White Rock Rainfall
Short Duration Storm



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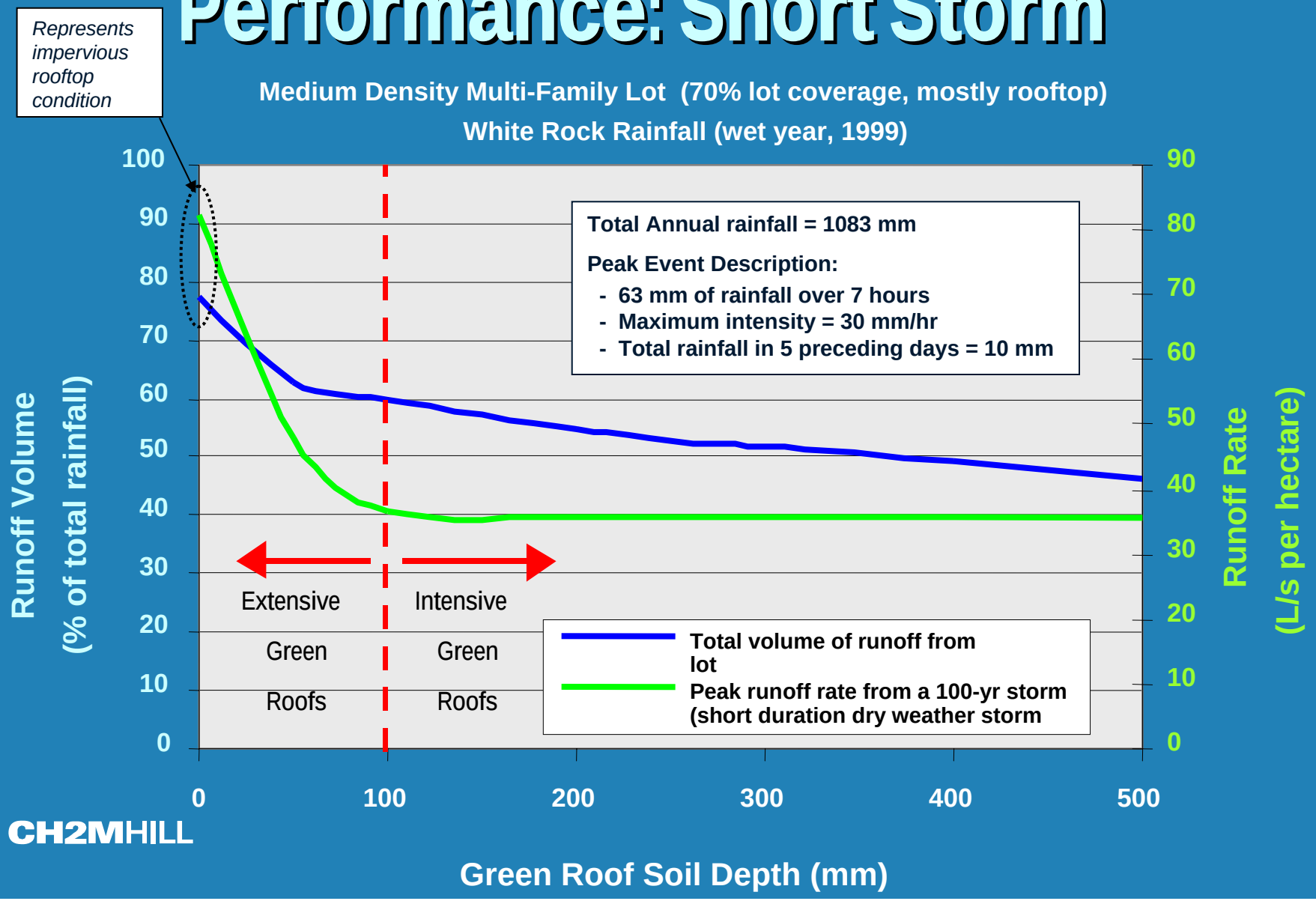
Effect of Soil Depth on Green Roof Performance: Short Storm



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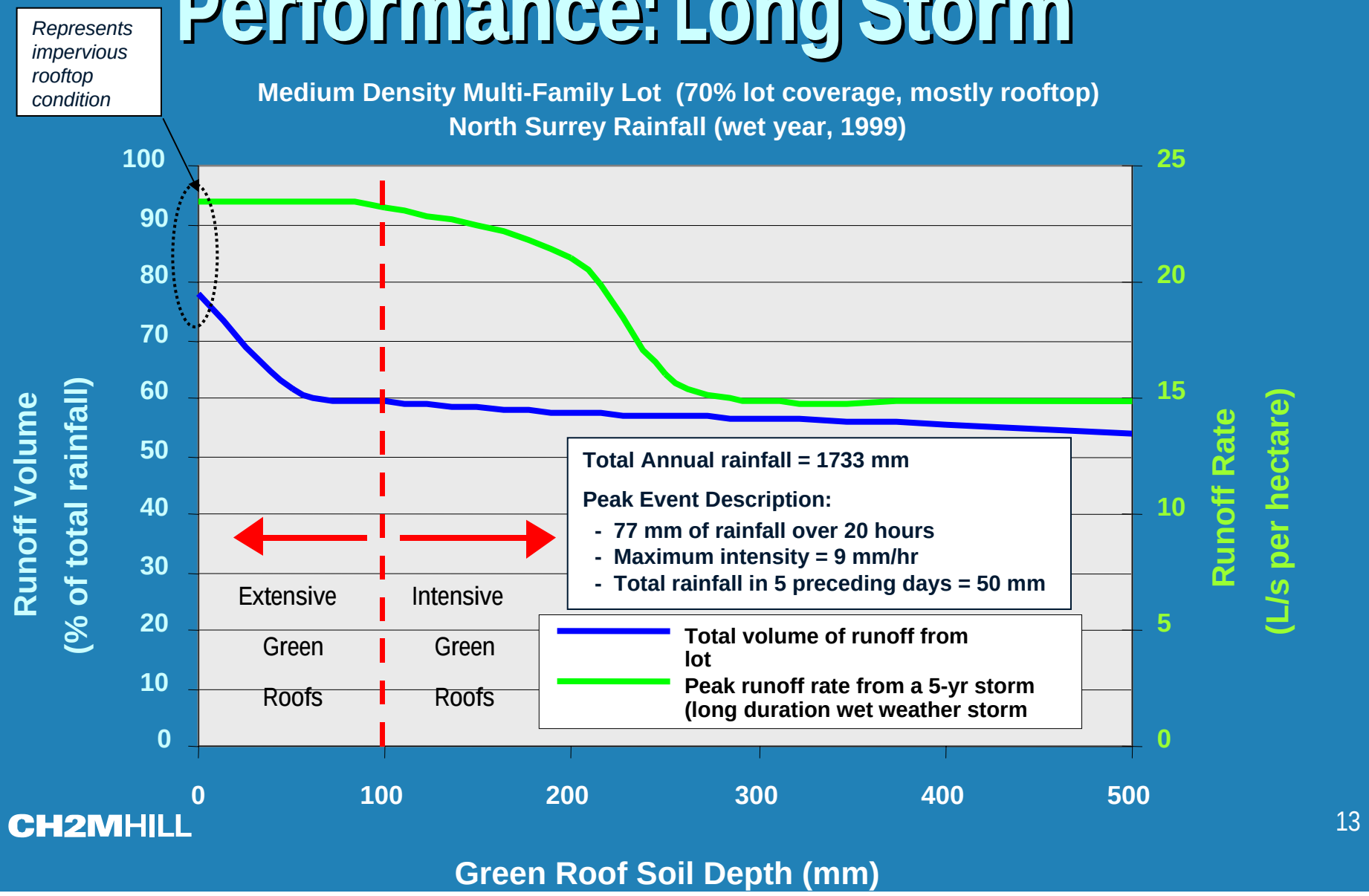
Effect of Soil Depth on Green Roof Performance: Long Storm



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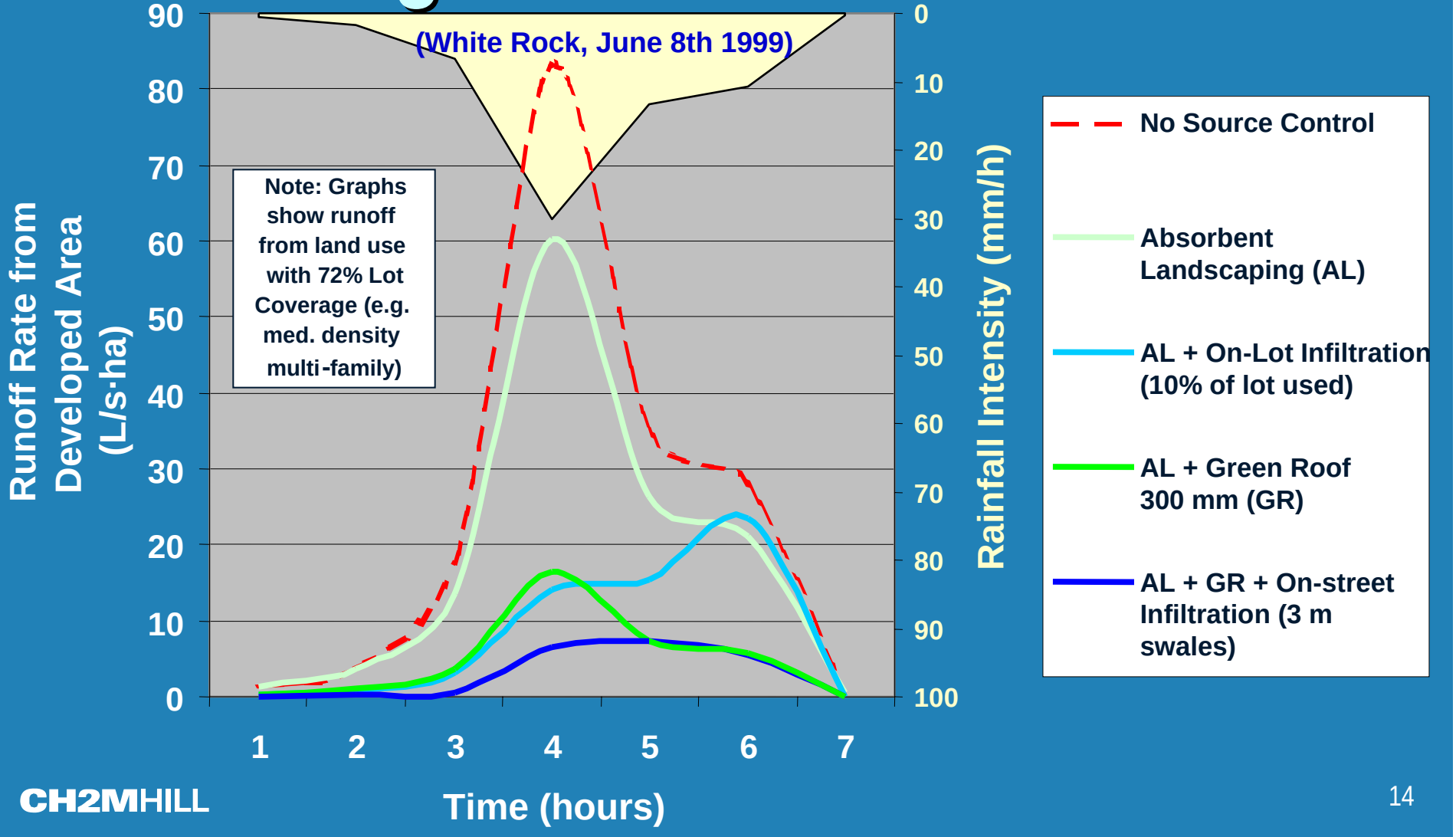
Source Control Effectiveness During an Intense Cloudburst



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Greenroof Performance as Stormwater Source Control

- Modelled performance is dependant upon soil depth and local rainfall characteristics
- Thinner, extensive roofs can manage extreme short duration extreme rainfalls but cannot manage the less extreme, long duration rain events as effectively
- All greenroofs are potentially very beneficial to watershed/stream health and offer watershed specific benefits to flood management

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Part 3: The Long-term Role

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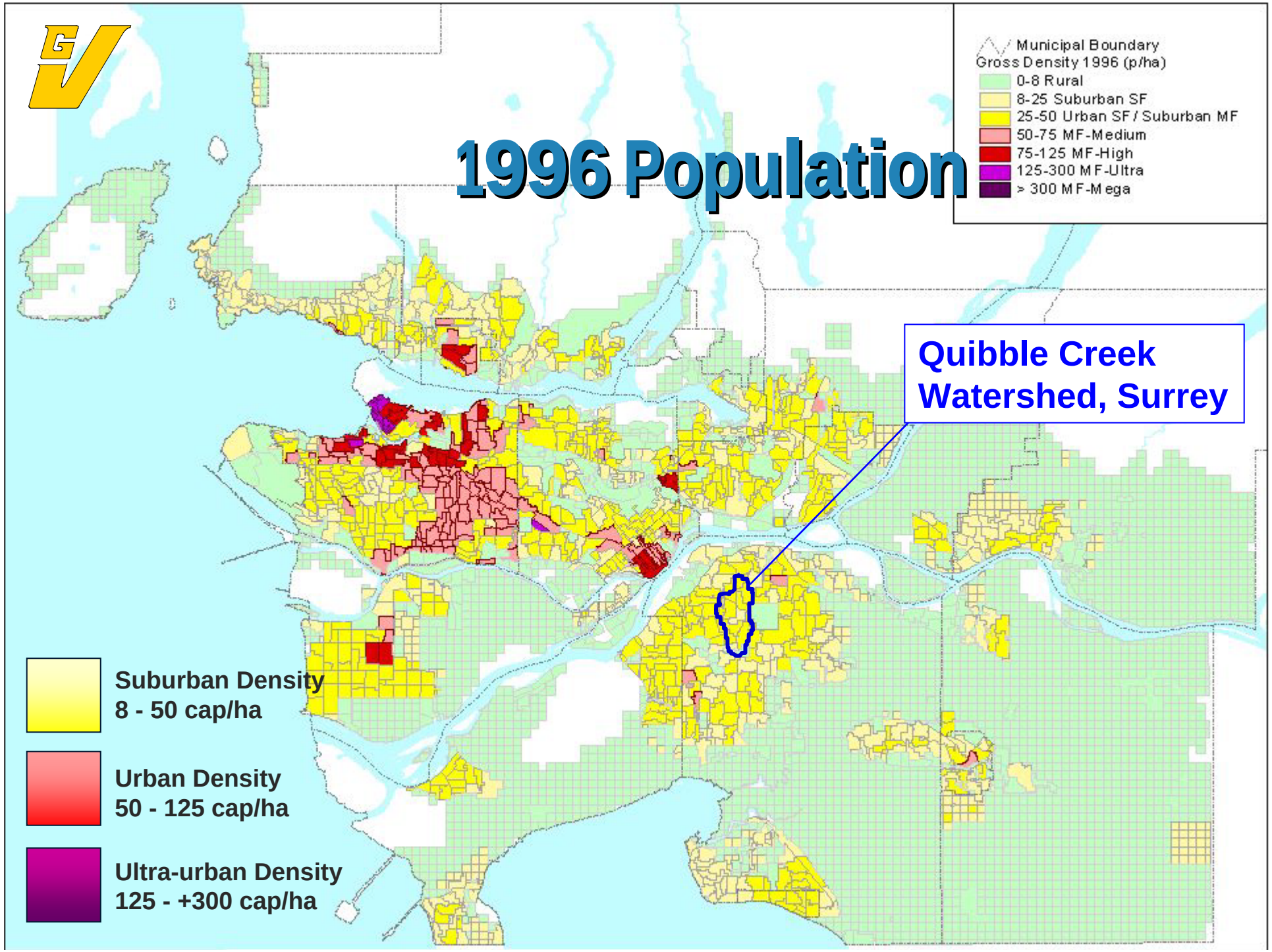
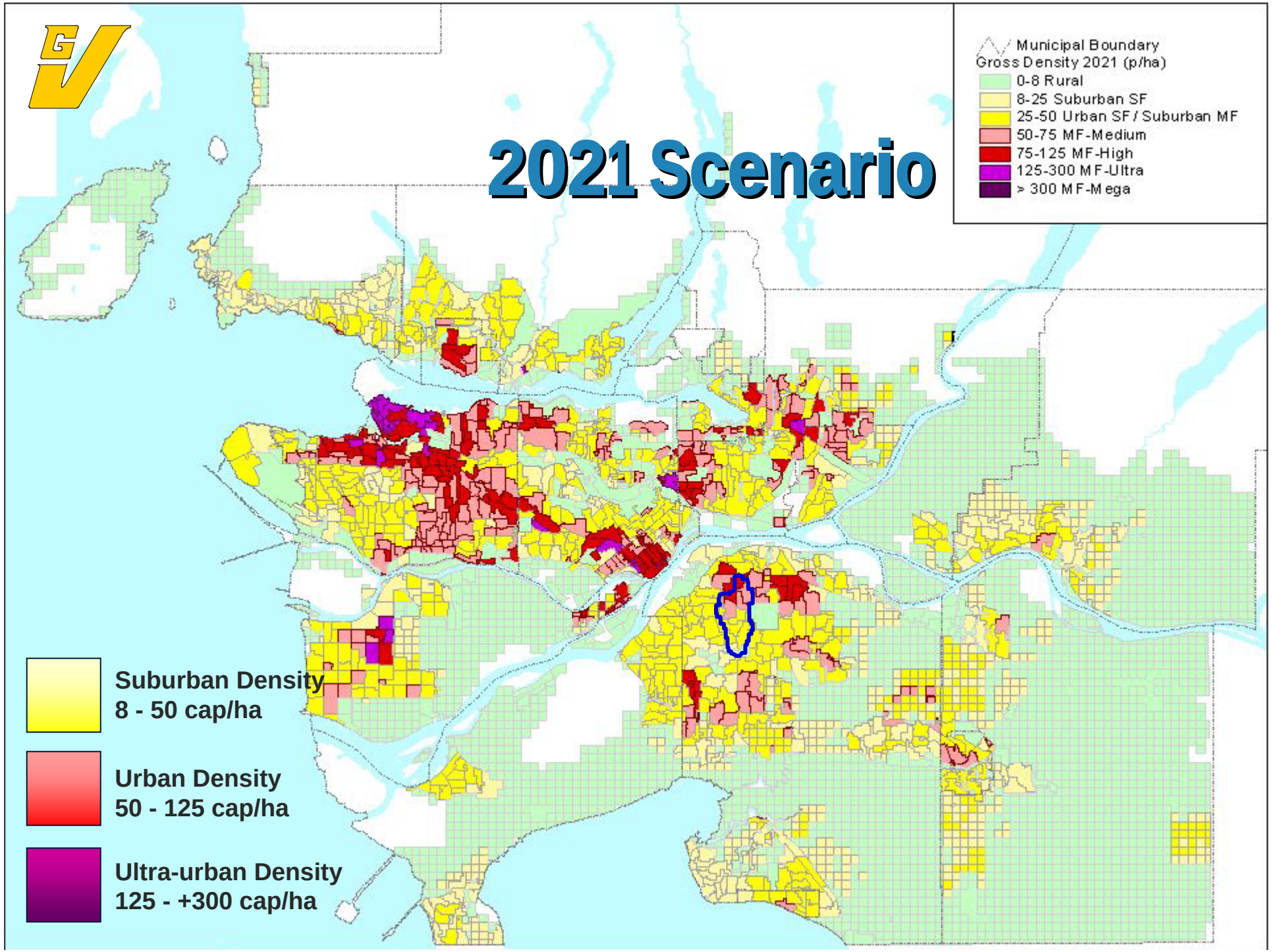
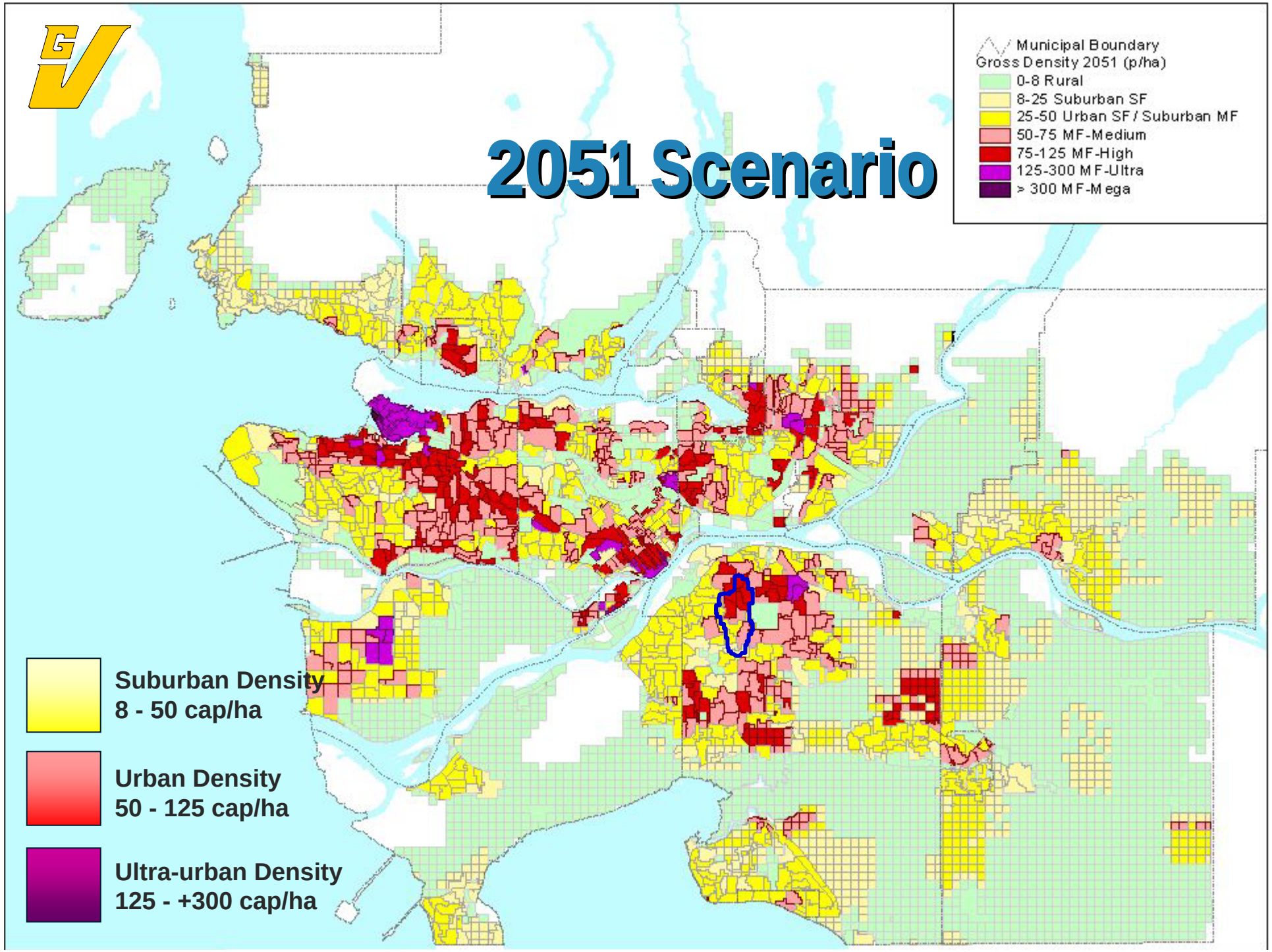

1996 Population
Municipal Boundary
Gross Density 1996 (p/ha)
0-8 Rural
8-25 Suburban SF
25-50 Urban SF / Suburban MF
50-75 MF-Medium
75-125 MF-High
125-300 MF-Ultra
> 300 MF-Mega
Quibble Creek Watershed, Surrey
Suburban Density
8 - 50 cap/ha
Urban Density
50 - 125 cap/ha
Ultra-urban Density
125 - +300 cap/ha

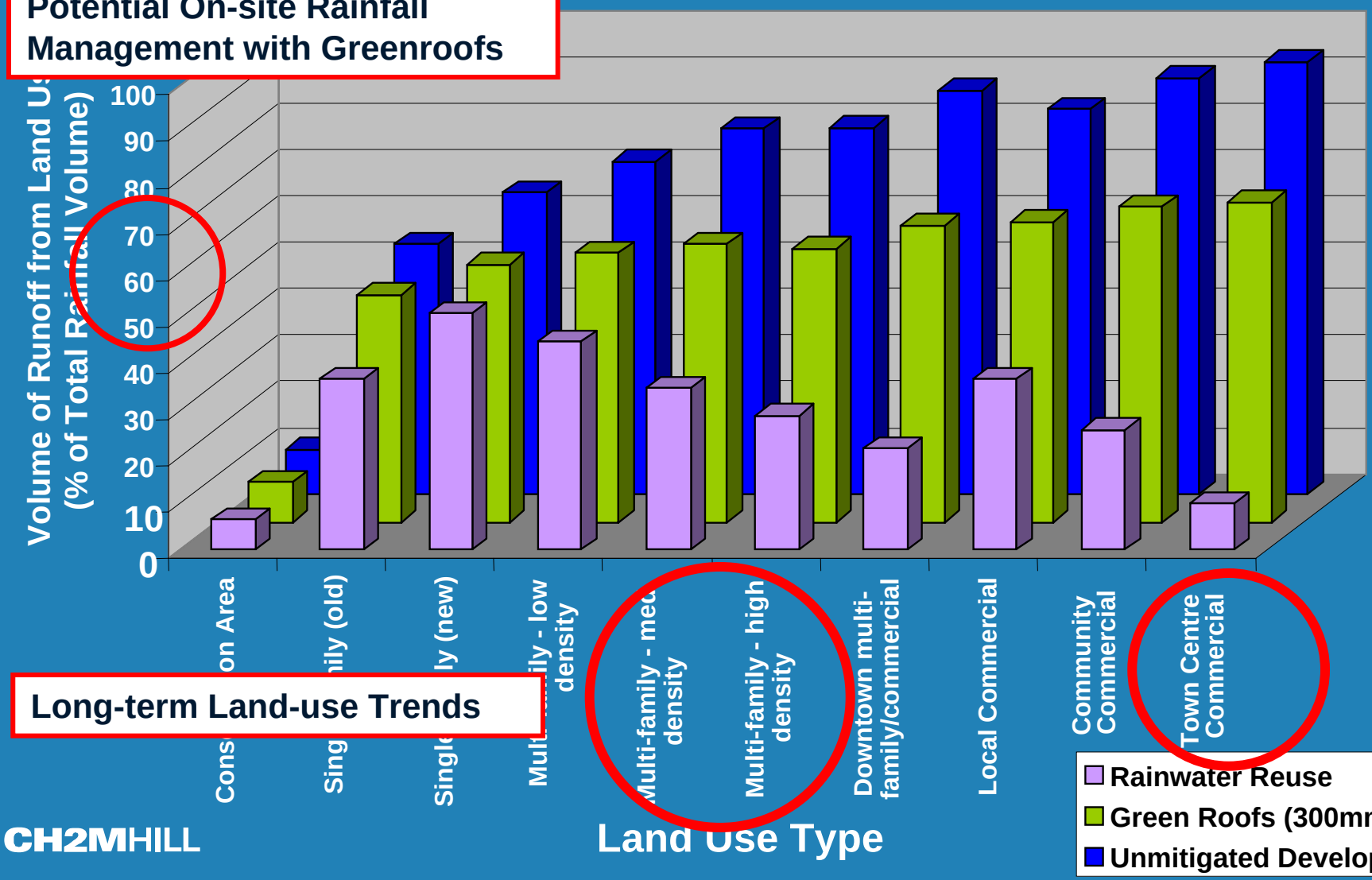

2021 Scenario
Municipal Boundary
Gross Density 2021 (p/ha)
0-8 Rural
8-25 Suburban SF
25-50 Urban SF / Suburban MF
50-75 MF-Medium
75-125 MF-High
125-300 MF-Ultra
> 300 MF-Mega
Suburban Density
8 - 50 cap/ha
Urban Density
50 - 125 cap/ha
Ultra-urban Density
125 - +300 cap/ha


2051 Scenario
Municipal Boundary
Gross Density 2051 (p/ha)
0-8 Rural
8-25 Suburban SF
25-50 Urban SF / Suburban MF
50-75 MF-Medium
75-125 MF-High
125-300 MF-Ultra
> 300 MF-Mega
Suburban Density
8 - 50 cap/ha
Urban Density
50 - 125 cap/ha
Ultra-urban Density
125 - +300 cap/ha

Quibble Creek Watershed, Surrey

Runoff Volume Reduction - Green Roofs and Rainwater Reuse

Potential On-site Rainfall Management with Greenroofs



Long-term Land-use Trends

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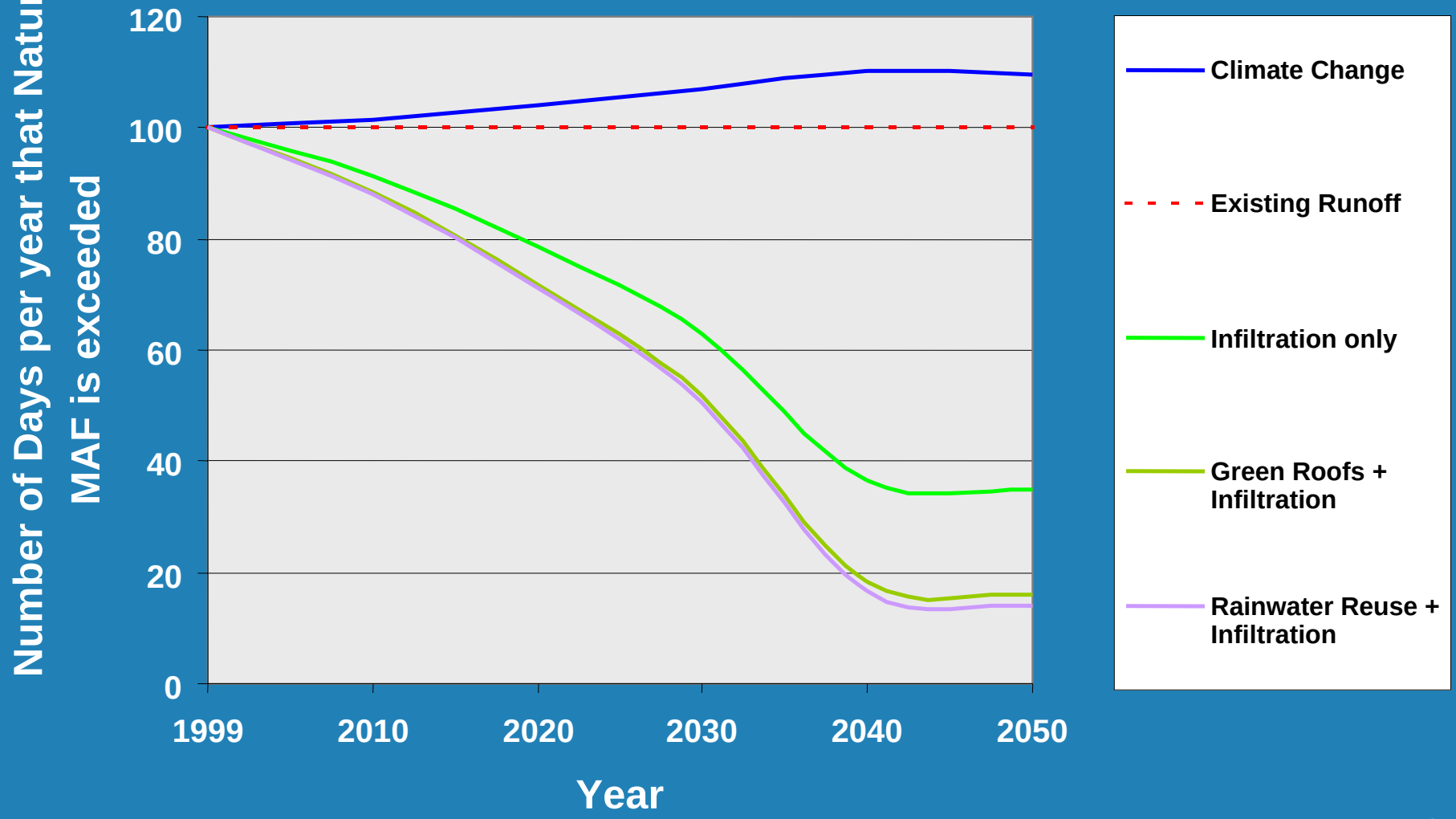
Quibble Creek Watershed Retrofit Scenarios

Reduction in Frequency of Erosive Streamflow



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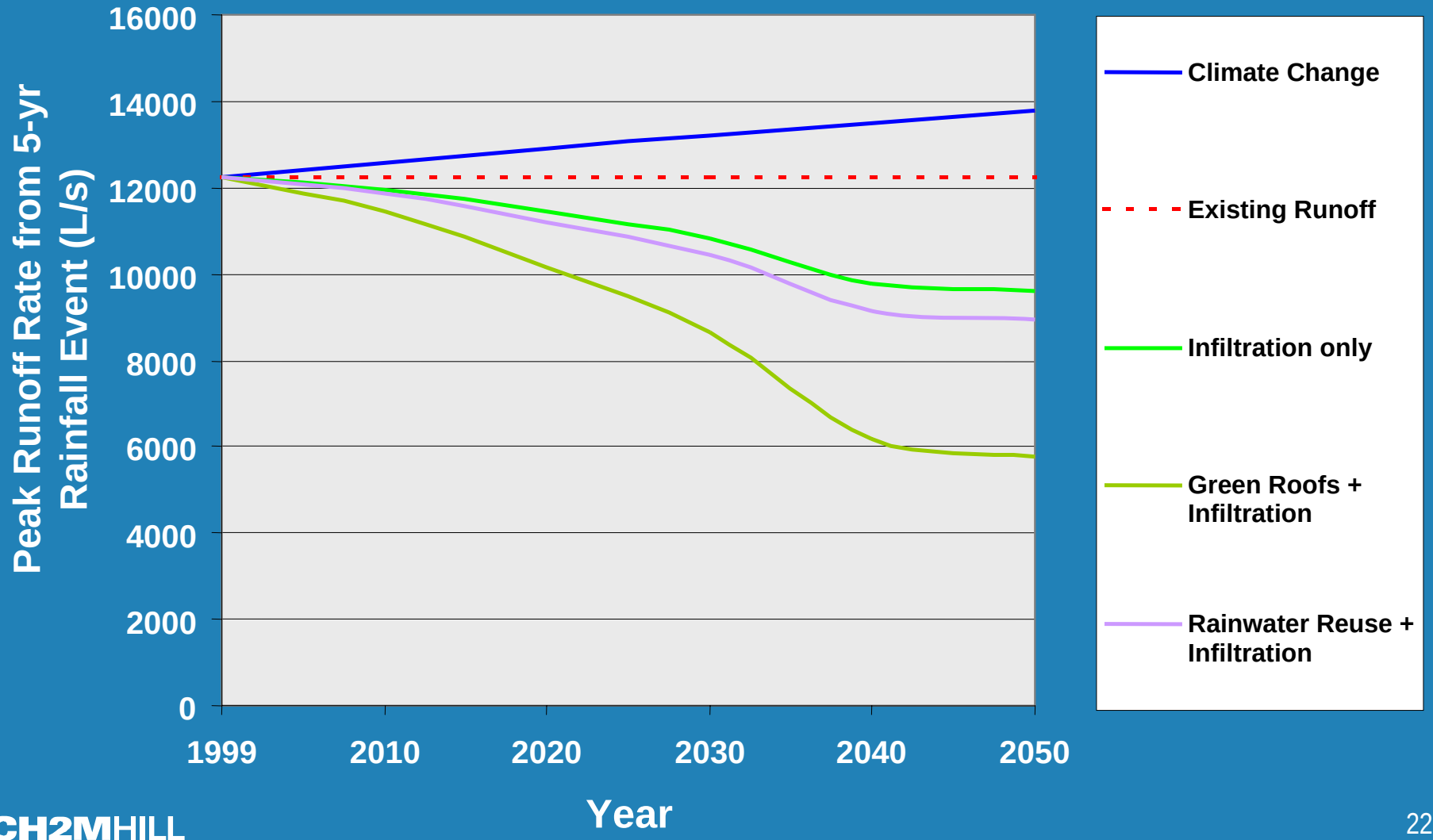
Quibble Creek Watershed Retrofit Scenarios

Peak Flow Reduction



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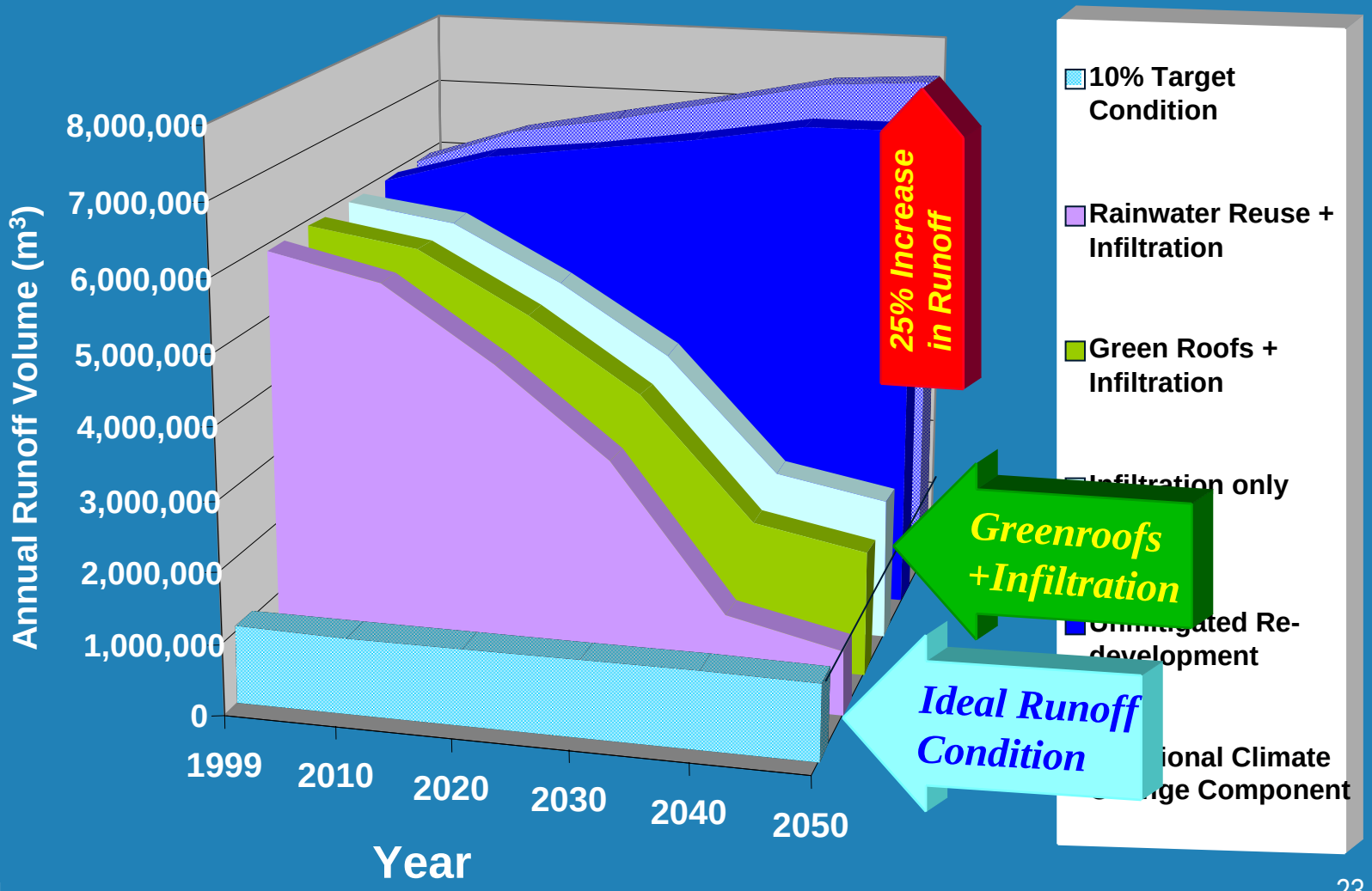
Quibble Creek Watershed Retrofit Scenarios

Runoff Volume Reduction



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Greenroofs: A Long-term Role

- Stormwater source control modelling shows that greenroofs have excellent stormwater management potential to protect streams and manage infrastructure needs
- Greenroofs can be phased-in as part of the urban redevelopment process
- However, we have still to leap from theoretical models to real world 'engineered' applications

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