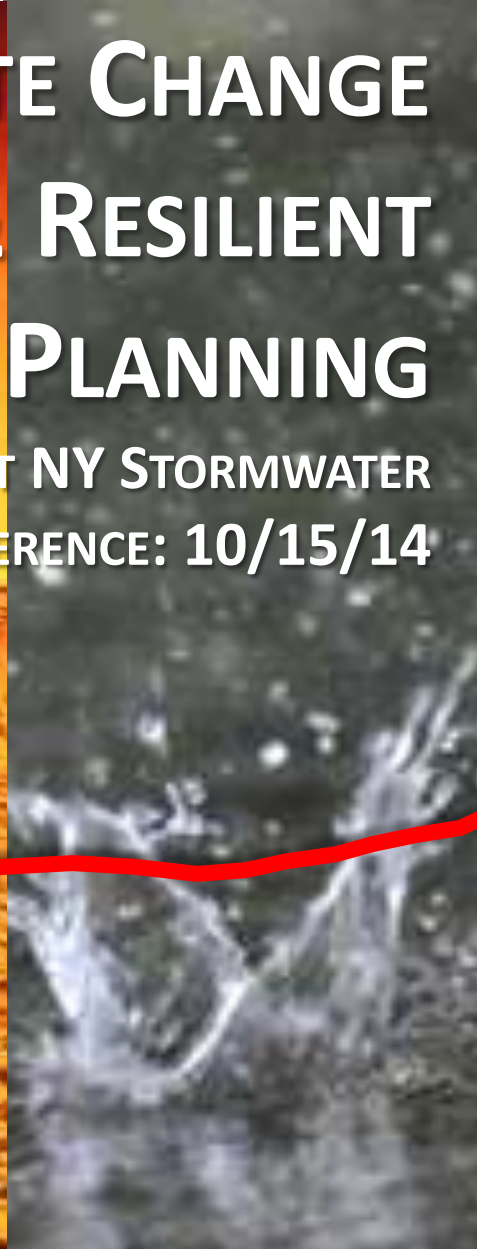


CLIMATE CHANGE & RESILIENT SITE PLANNING

SOUTHEAST NY STORMWATER
CONFERENCE: 10/15/14



The Chazen Companies

Russell Urban-Mead: CPG, Sr. Hydrogeologist, Vice President

Kelsey Carr: LEED AP BD+C, Project Engineer

THE
Chazen
COMPANIES®

Proud to be Employee Owned

Engineers
Land Surveyors
Planners
Environmental Professionals
Landscape Architects

CLIMATE CHANGE

Climate Change:

A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.

Climate change may be due to natural internal processes or external forcings or to persistent anthropogenic changes in the composition of the atmosphere or in land use.

SOURCES

Intergovernmental Panel on Climate Change (IPCC)

- Climate Change 2013: The Physical Science Basis
- Summary for Policymakers 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

NYSERDA

- 2011 Responding to Climate Change in New York State, Technical Report 11-18

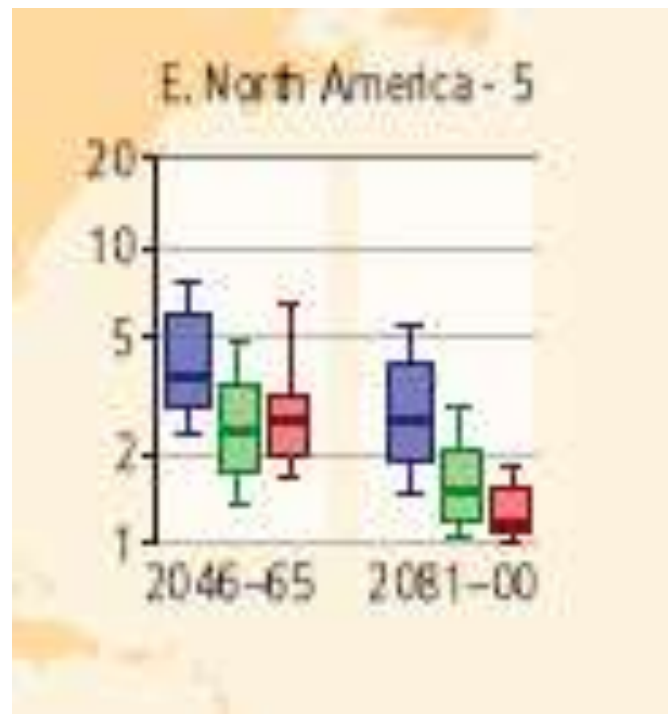
National Science Foundation

- 2009 Solving the Puzzle, Researching the Impacts of Climate Change around the World

TEMPERATURE CONSIDERATIONS

- NY State average temperatures have increased by approximately 0.6°F per decade since 1970, with winter warming exceeding 1.1°F per decade
- In the Northern Hemisphere, 1983–2012 was *likely* the warmest 30-yr period in 1400 years
- Predict hotter: up 1.5 to 3°F by 2020s
- 3 to 5.5° by 2050 ... and 4 to 9°F by 2080
- Ocean warming currently captures $\sim 90\%$ of increased energy stored in the climate system

HEAT EXTREMES - RECURRENCE



WHO CARES?

- More frequent and hotter heat waves; heat waves are silent killers; ozone days
- Stressed electric grid for A/C
- Material failures
- Ag zones move north. Dairy. Maple syrup.
- Hot (energy) oceans spawn storms
- Less winter snow pack – more rapid runoff (12 percent less snow cover in June over last 30 yrs)



CLIMATE CONSIDERATION

RISING TEMPERATURES



SITE DESIGN SOLUTIONS

REDUCE HEAT ISLAND EFFECT

- Minimize Impervious Surfaces/Conservation
- “Cool” Surfaces
- Green Roof

STRATEGIC LANDSCAPING

- Species Resistant to Extreme Temperatures
- Native & Adaptive Species
- Landscape Shading

BUILDING STRATEGIES

- Southern Orientation
- Taller is better

CASE STUDY No. 1: GREEN ROOF

RT. 7 BRIDGE RECONSTRUCTION – COBLESKILL, NY



Green Roof
on Bridge
Overpass

CASE STUDY No. 1: GREEN ROOF

RT. 7 BRIDGE RECONSTRUCTION – COBLESKILL, NY

Photo Looking Southwest



Current Google Earth Aerial

CASE STUDY No. 2: REDUCE HEAT ISLAND EFFECT

ESOPUS FARM HOTEL, RESTAURANT, & SPA – ESOPUS, NY



High SRI
Porous
Gravel
System



CASE STUDY No. 3: STRATEGIC LANDSCAPING

STATE PREPAREDNESS TRAINING CENTER – ORISKANY, NY



Bioretention Filters
in Parking Islands



CASE STUDY No. 4: “COOL” SURFACES

RESIDENTIAL HOME – HYDE PARK, NY

Solar Thermal
and PV
Systems

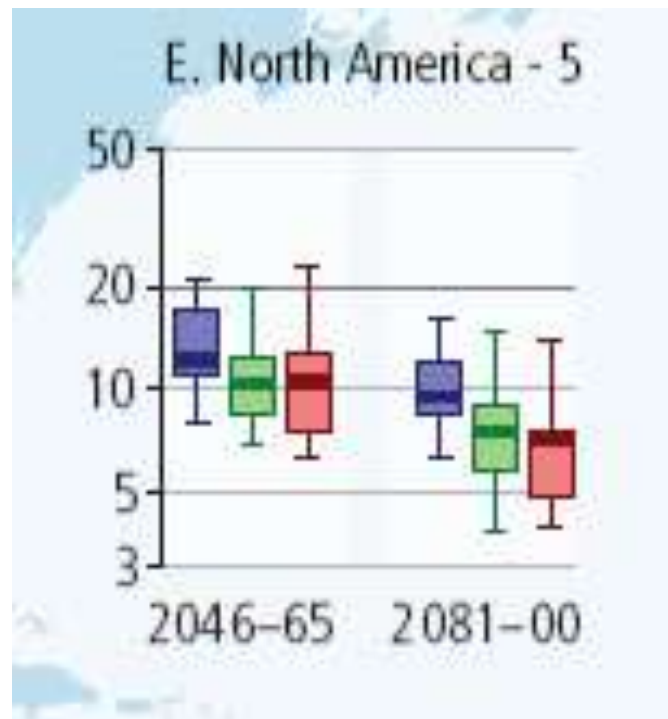


High SRI
Coating

PRECIPITATION CONSIDERATIONS

- More precipitation:
 - Up 5% by 2020
 - Up 10% by 2050
 - Up 15% by 2080
- USA northeast, only area w/ predicted increases
- But potentially biased to Winter, less in Summer
 - So, more flooding in winter?
 - and droughts in summer?

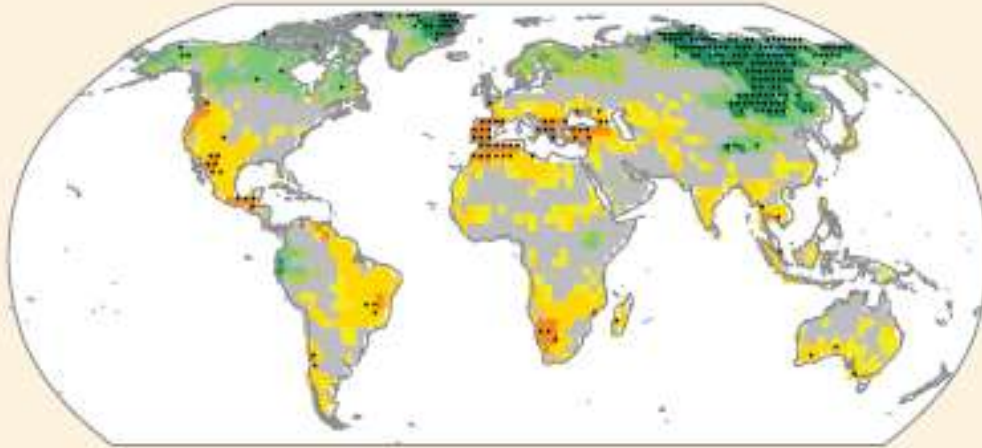
EXTREME PRECIPITATION - RECURRENCE



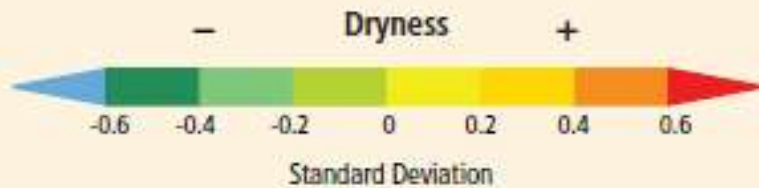
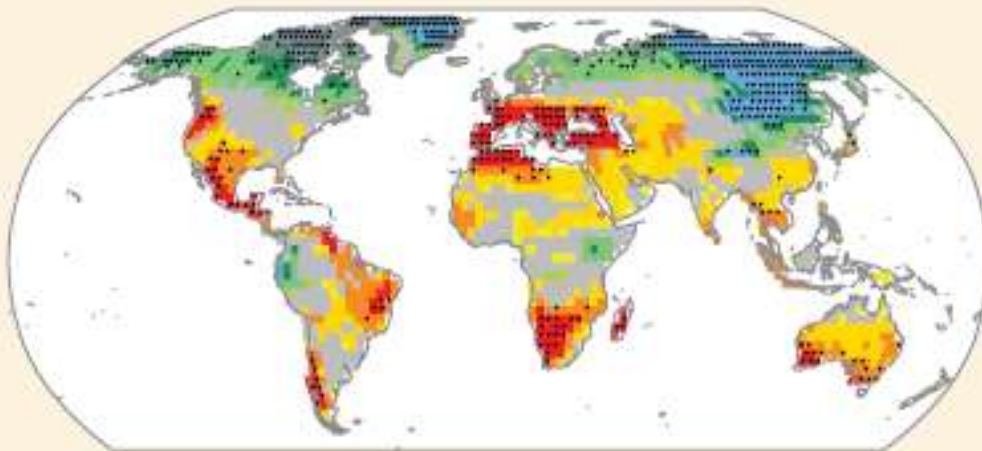
CONSECUTIVE DRY DAYS

Change in consecutive dry days (CDD)

2046 - 2065

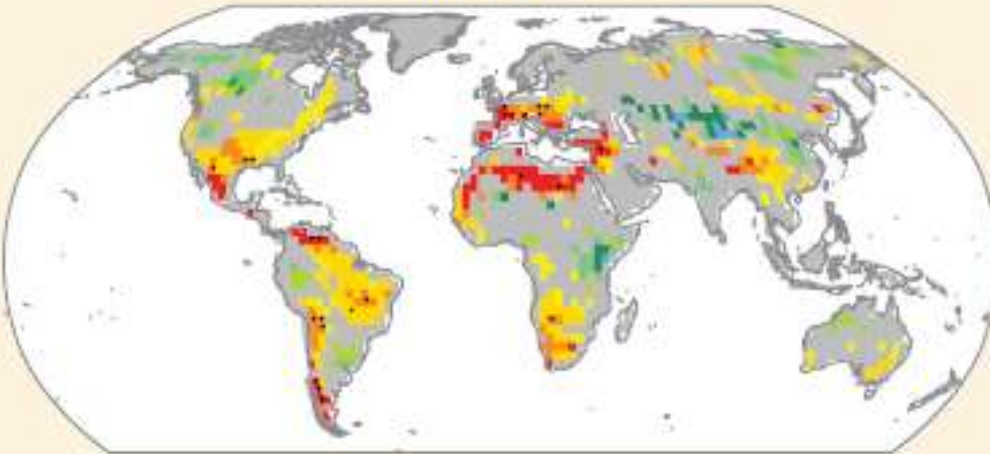


2081 - 2100

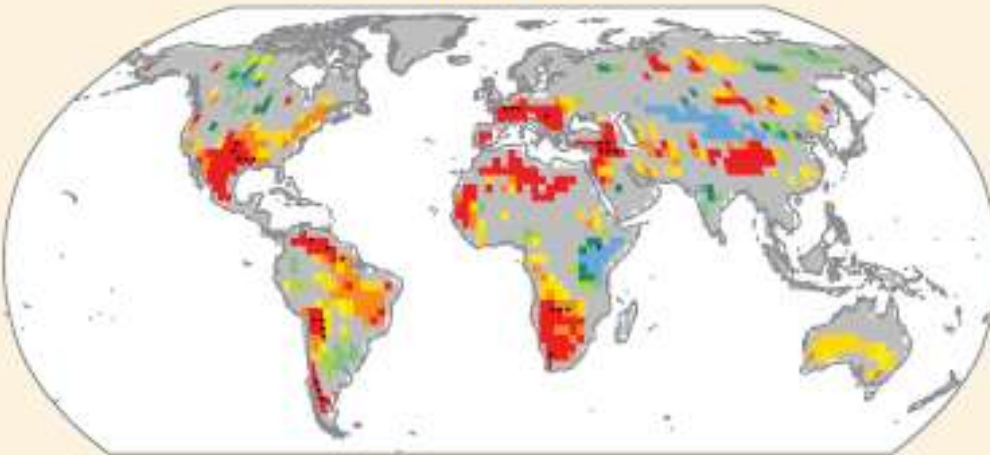


Soil moisture anomalies (SMA)

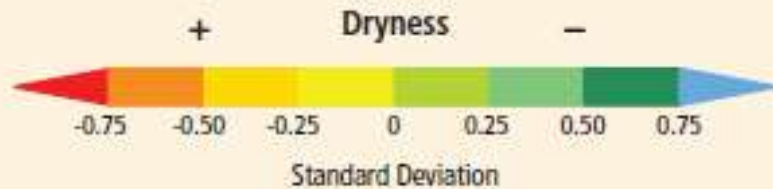
2046 - 2065



2081 - 2100



DRY SOIL



WHO CARES?

- Winter rain – flooding rather than snow pack.
Lost winter recreation \$
- General flooding: property damage
- Summer drought: water supplies and agriculture. Less summer aquifer recharge?
- Reservoir management dilemmas
- Summer fire risk

CLIMATE CONSIDERATION

PRECIPITATION



SITE DESIGN SOLUTIONS

AGGRESSIVE STORMWATER MANAGEMENT

- Capture SW at source
- Place Multiple SW Practices in Series
- Increased Volume for Flood Protection

REDUCE RUNOFF

- Promote Infiltration
- Porous Surfaces
- Rainwater Harvesting

ASSET PROTECTION

- Strategic Placement/Relocation of Critical Infrastructure
- Anticipate Expanding Flood Zones

CASE STUDY No. 2: ALL OF THE ABOVE

ESOPUS FARM HOTEL, RESTAURANT, & SPA – ESOPUS, NY



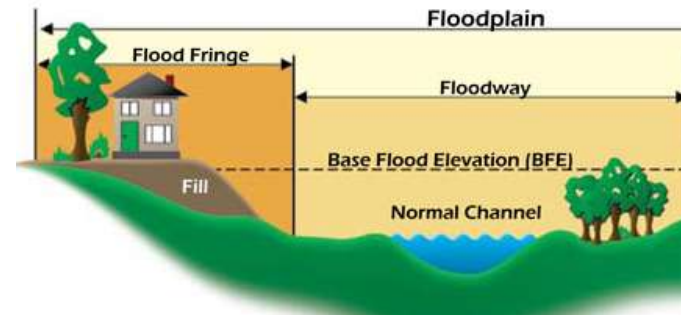
Rain Gardens



Porous Gravel System

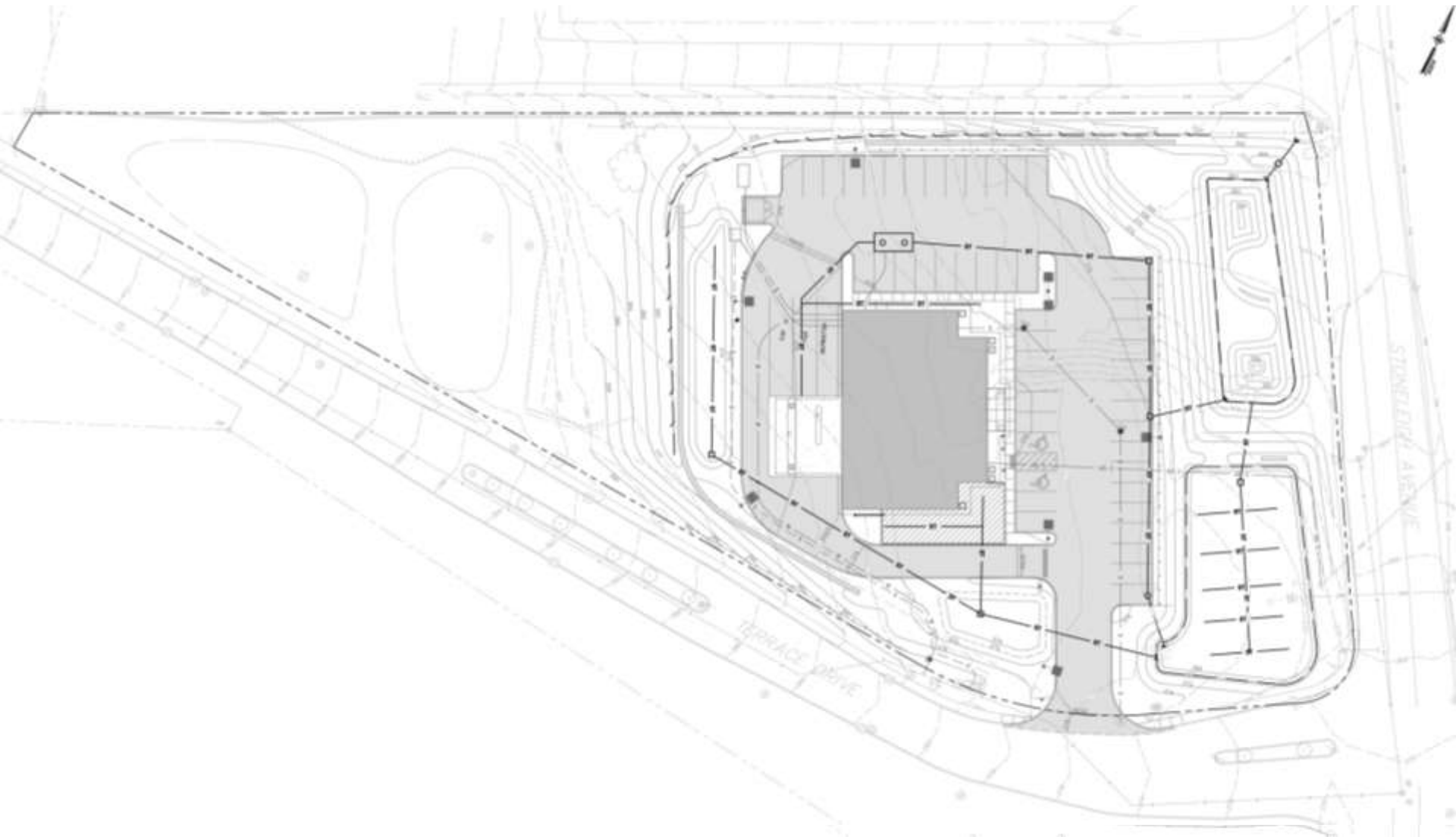


Asset Protection



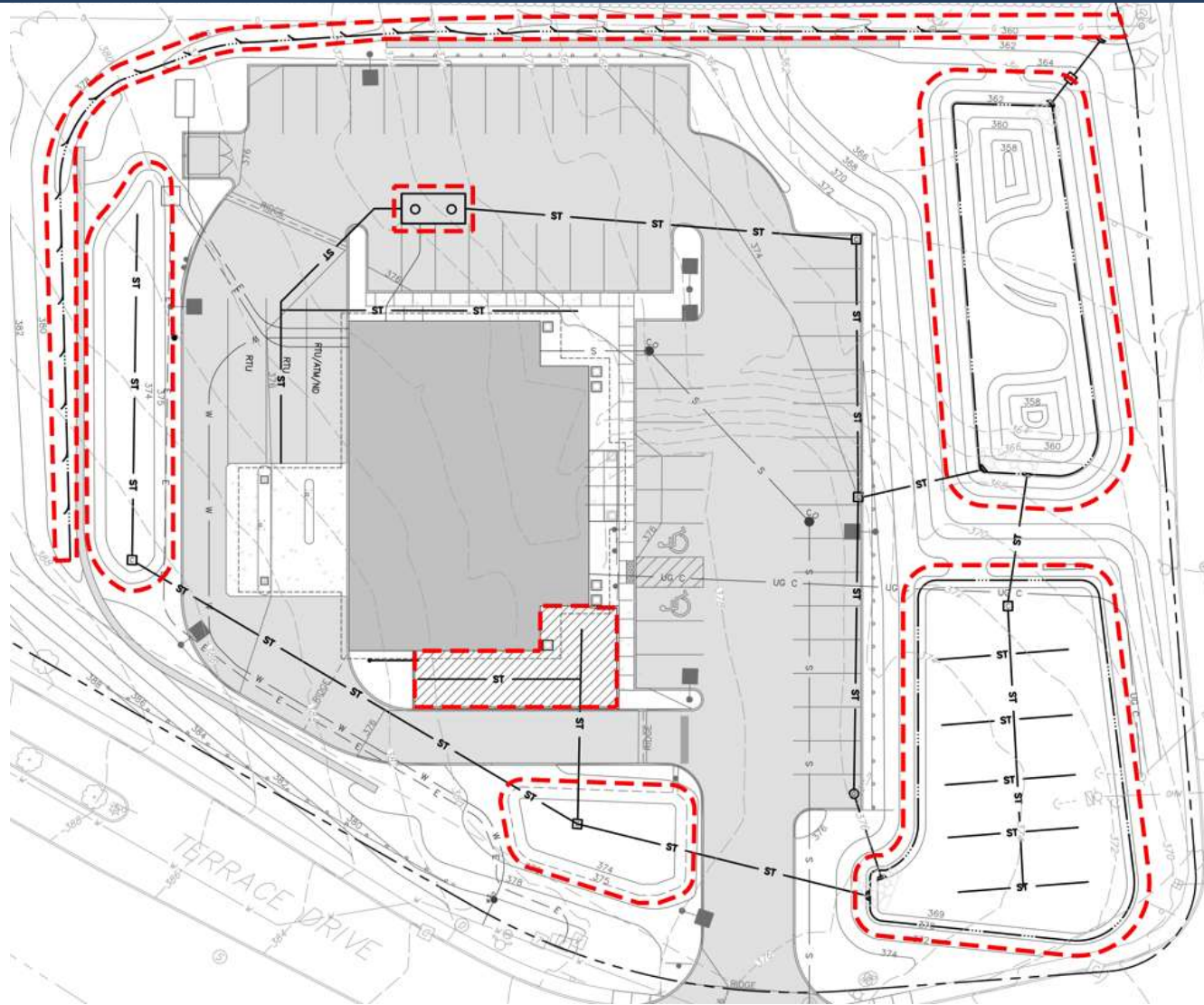
CASE STUDY No. 5: MULTIPLE PRACTICES IN SERIES

CREDIT UNION – CARMEL, NY



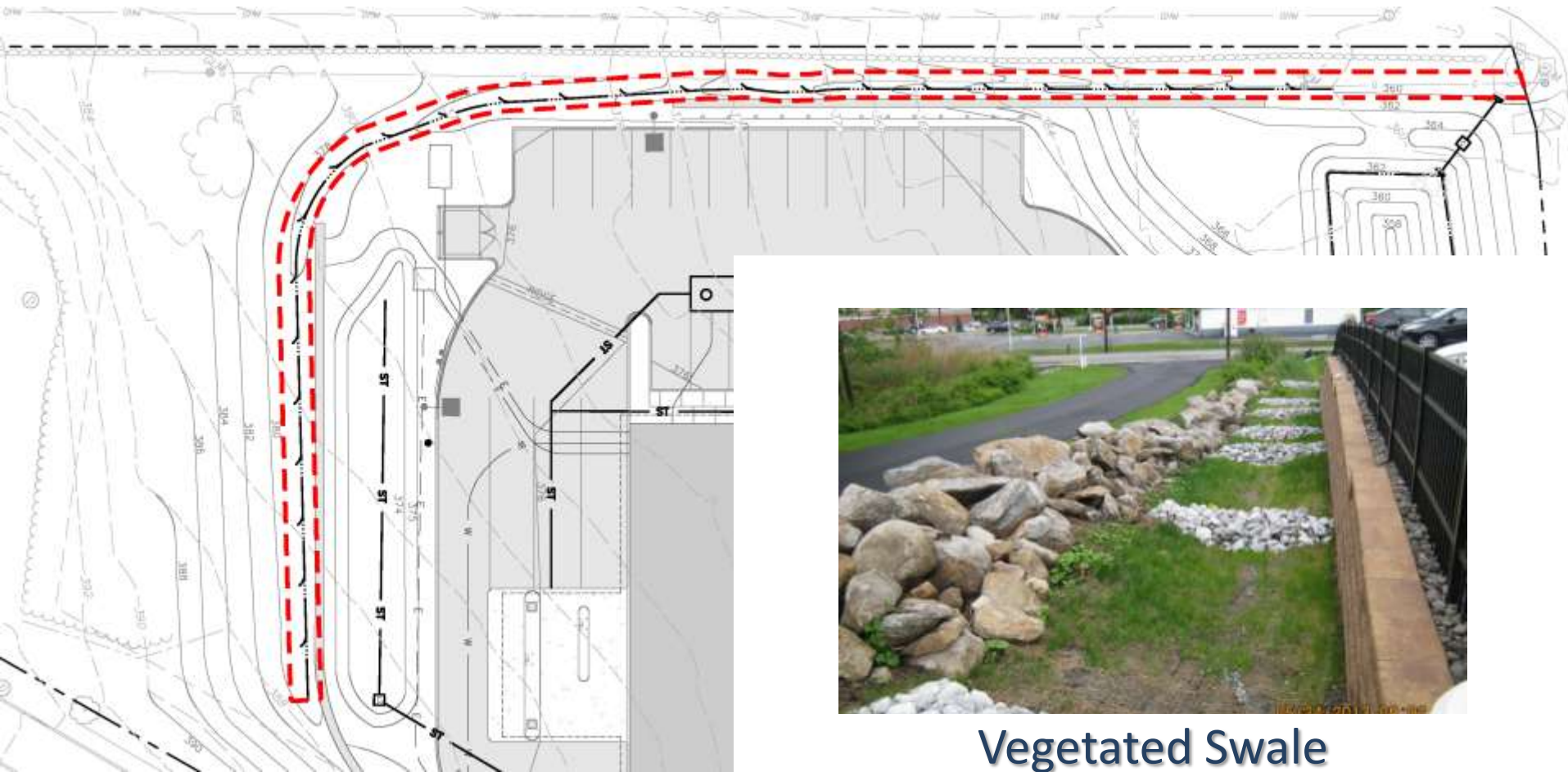
CASE STUDY No. 5: MULTIPLE PRACTICES IN SERIES

CREDIT UNION – CARMEL, NY



CASE STUDY No. 5: MULTIPLE PRACTICES IN SERIES

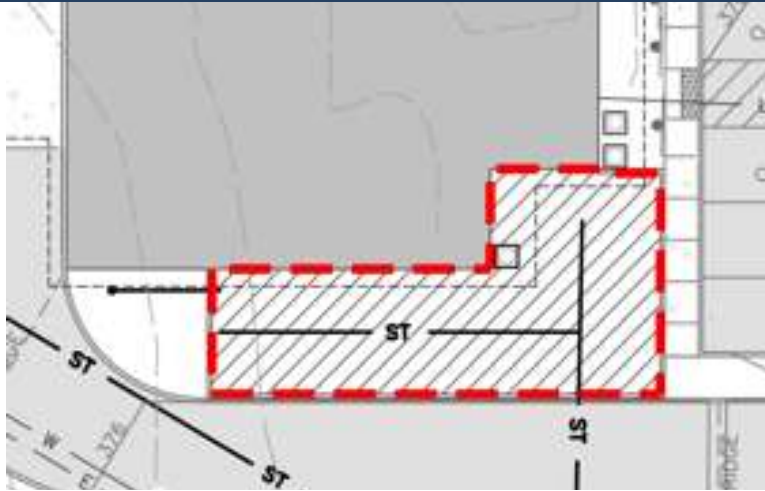
CREDIT UNION – CARMEL, NY



Vegetated Swale

CASE STUDY No. 5: MULTIPLE PRACTICES IN SERIES

CREDIT UNION – CARMEL, NY



Stormwater Planter



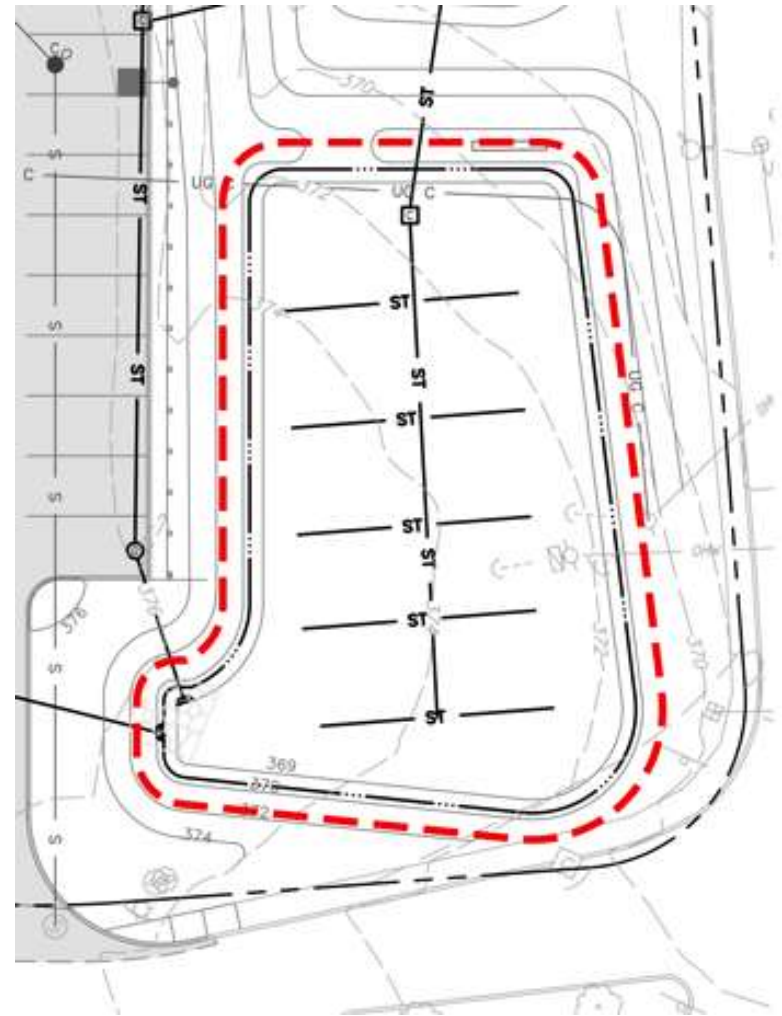
Below-Grade Cistern

CASE STUDY No. 5: MULTIPLE PRACTICES IN SERIES

CREDIT UNION – CARMEL, NY



Bioretention Filter

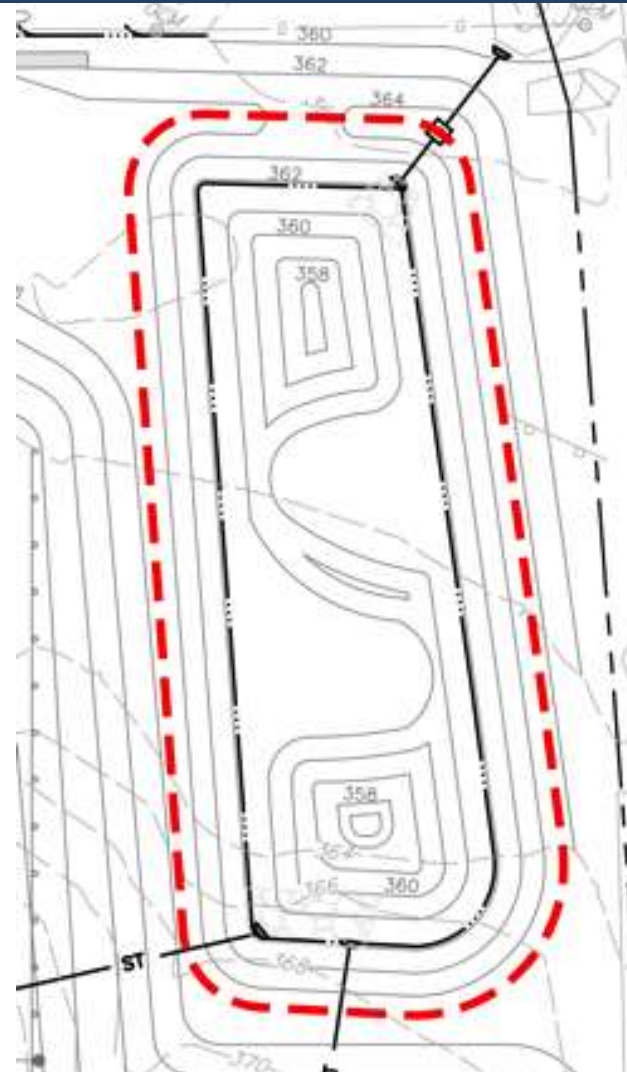


CASE STUDY No. 5: MULTIPLE PRACTICES IN SERIES

CREDIT UNION – CARMEL, NY



Pocket Wetland



CASE STUDY No. 6: REDUCE RUNOFF

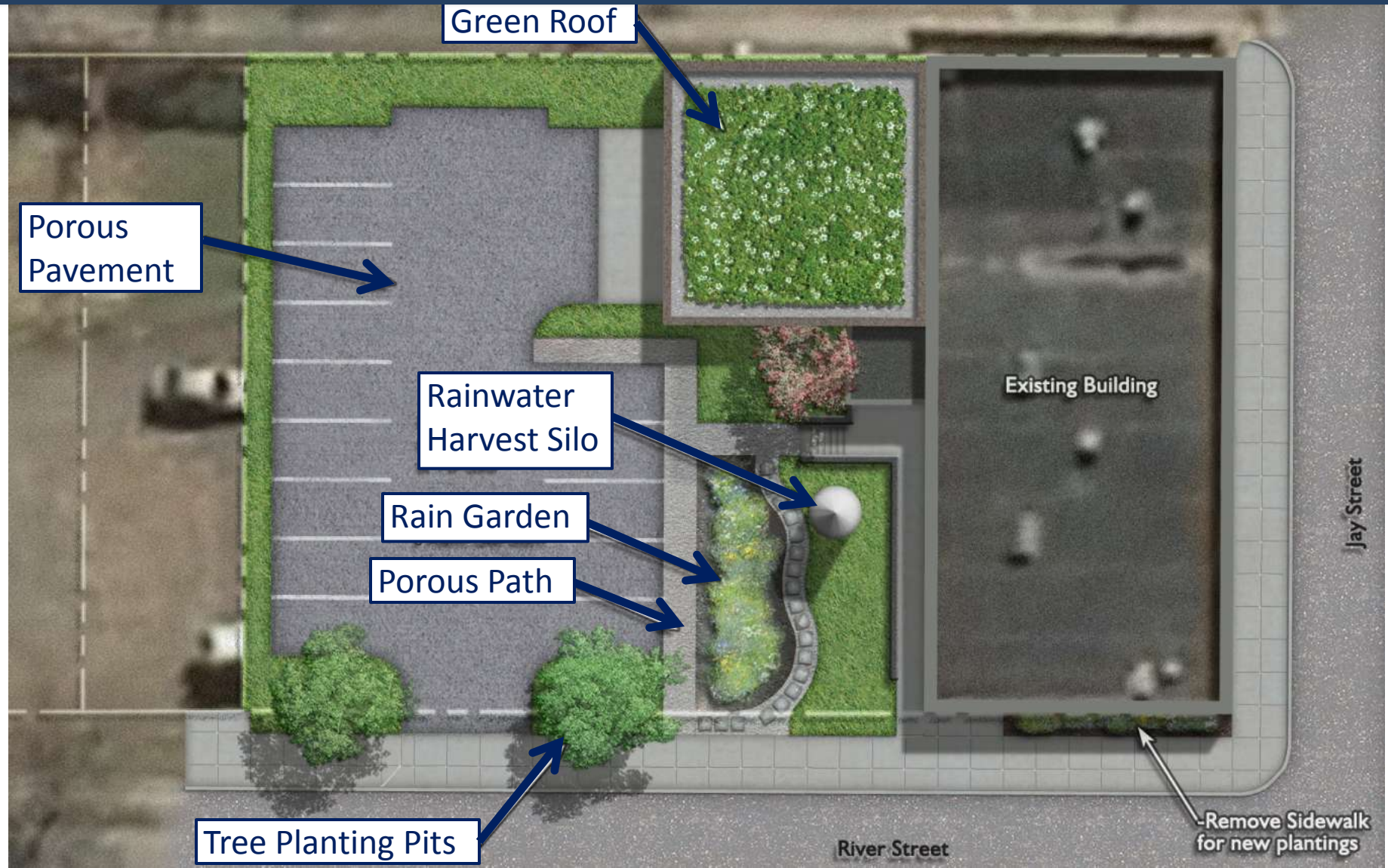
CAPITAL DISTRICT COMMUNITY GARDENS – TROY, NY



Existing Lot (Looking East)

CASE STUDY No. 6: REDUCE RUNOFF

CAPITAL DISTRICT COMMUNITY GARDENS – TROY, NY



CASE STUDY No. 6: REDUCE RUNOFF

CAPITAL DISTRICT COMMUNITY GARDENS – TROY, NY



SEA LEVEL CONSIDERATIONS

- Sea level along New York's coastline has risen by approximately 1 foot since 1900
- Sea level rise projections:
 - 1 to 5 inches by the 2020s
 - 5 to 12 inches by the 2050s
 - 8 to 23 inches by the 2080s
- PLUS: Risk of a rapid ice melt scenario, Sea level could rise 37 to 55 inches by the 2080s
- Coastal flooding increasingly common

WHO CARES?

- Influences shoreline buildable land calculations
- Requires unique hardscape/softscape approaches
- Presents unique exposure and hardening challenges
- Needs wetland/ecological evaluations under present & future scenarios
- Access and drainage may change over time

CLIMATE CONSIDERATION

RISING SEA LEVEL



SITE DESIGN SOLUTIONS

SHORELINE PROTECTION

- Enhanced Natural
- Soft Armoring
- Hard Armoring

ACCOMMODATION

- Elevated Structures
- Breakwaters
- Designing to Flood

ASSET PROTECTION

- Assess Vulnerability & Limit Development
- Strategic Relocation

DESIGN PRINCIPLES

- Expect at least incremental sea level rise
- Consider planning for Rapid sea level rise
- Track expanded storm surge/flooding areas
- Reduce exposure of vulnerable assets (e.g. relocation)
- Reduce vulnerability of unavoidable exposures
 - Use soft shoreline design options where possible
 - Minimize hard shoreline options
 - Engage responsive design (flow through, articulated, floating)
- Examine all costs
- Be aware of multiple permitting agencies

TOOLS FOR VISUALIZING SEA LEVEL RISE



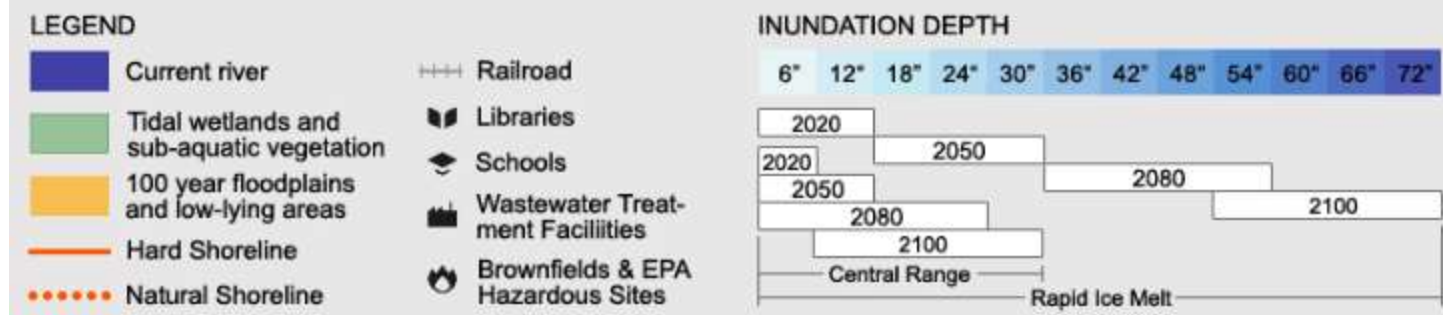
Typical Site – Today



Typical Site – plus 30"



Typical Site – plus 54"



Sea Level Rise Mapper

<http://www.scenichudson.org/slr/mapper#>

ECOLOGICAL CONSIDERATIONS

- Longer growing season, drier summer soil, growing zones move north
- Southern flora move north: kudzu, hemlock wooly adelgid, oaks (not maples)
- More insects, longer asthma season, more poisonous poison ivy
- + CO₂ acidifies ocean – harming coral & fisheries
- Southern critters move north: nutria, cockroaches, snakes; better deer habitat

WHO CARES?

- Mosquitoes: disease
- Nutria: eats wetlands leaving mudflats
- Cockroaches? Argh!
- Lost/reduced winter freeze pest kills
- New weeds & diseases for agriculture
- Extended pollen allergy seasons
- North can grow southern plants & animals.
What is an exotic?



CLIMATE CONSIDERATION

ECOLOGICAL



SITE DESIGN SOLUTIONS

CO₂ REDUCTION

- Reduced Electrical Demand
- Alternative Transportation

THERMAL IMPACT

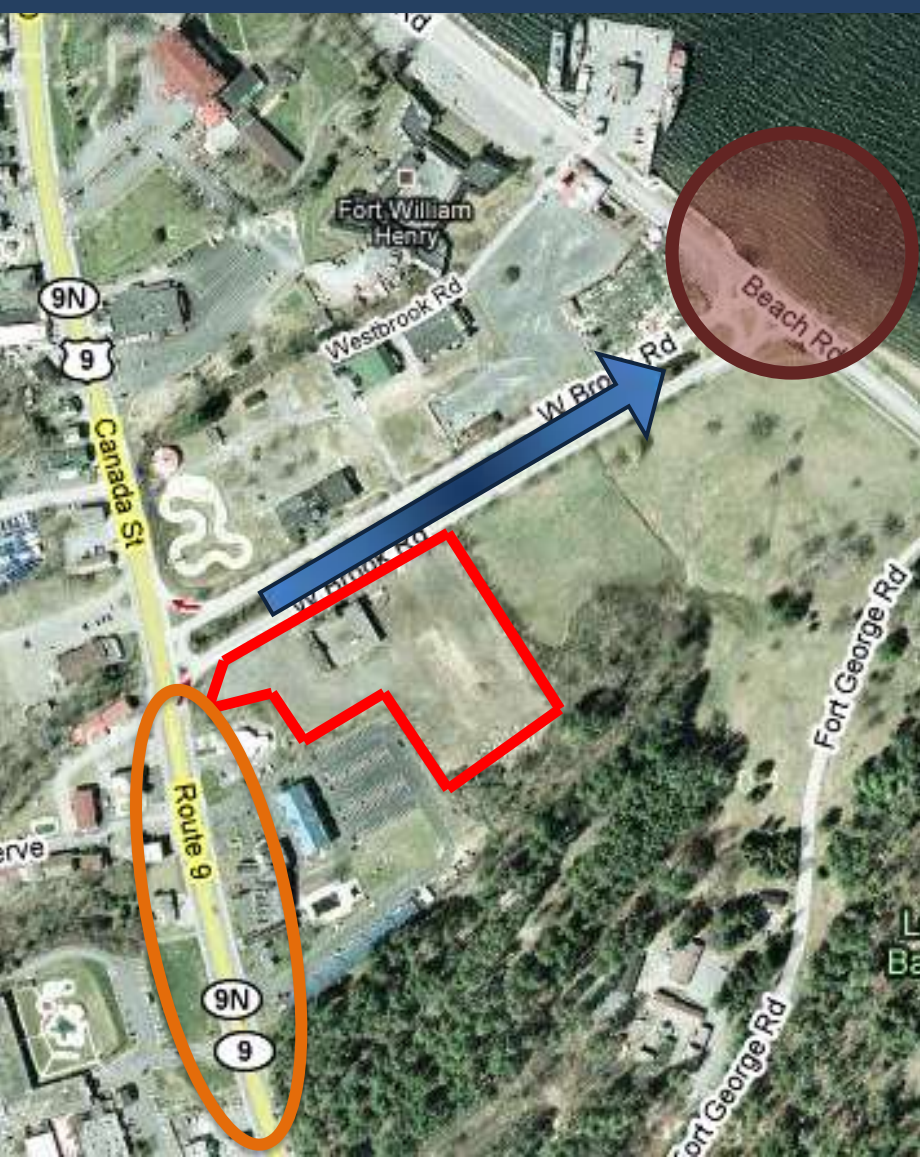
- Reduce Temperature of Runoff and Site

ADAPTIVE LANDSCAPING

- Plants with High Plasticity Index
- Genetic Variability
- Structural & Biological Diversity

CASE STUDY No. 7: THERMAL REDUCTION

WEST BROOK CONSERVATION INITIATIVE – LAKE GEORGE, NY



BACKGROUND - WEST BROOK

❖ *Trout Stream*



- 5,396 Acre Watershed
- Deteriorating Water Quality
- Contributes 50% of Pollutants to the South Basin of Lake George
- Expanding Sediment Delta

GOALS

❖ *Diminish Thermal Impact*

- Remove Sediment
- Reduce Nutrient Load
- Protect Ecology of both the Brook & the Lake

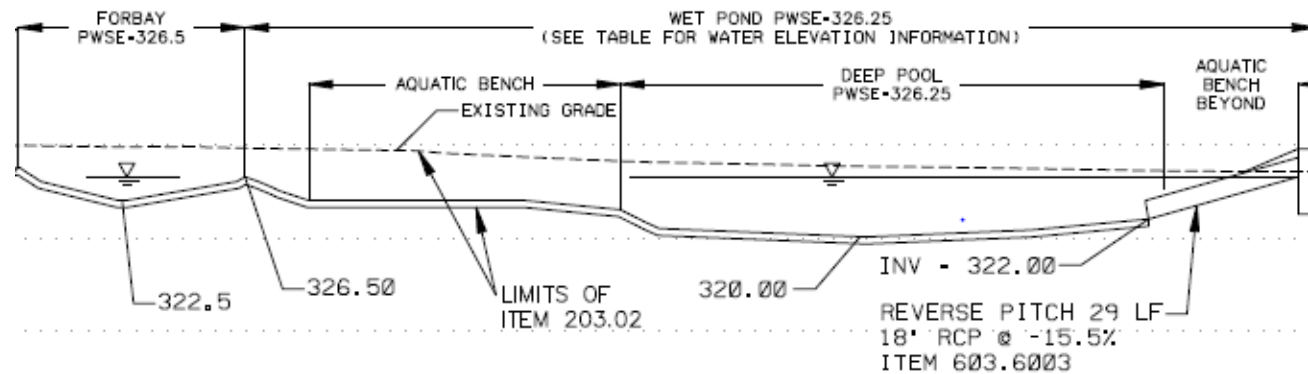
CASE STUDY No. 7: THERMAL REDUCTION

WEST BROOK CONSERVATION INITIATIVE – LAKE GEORGE, NY



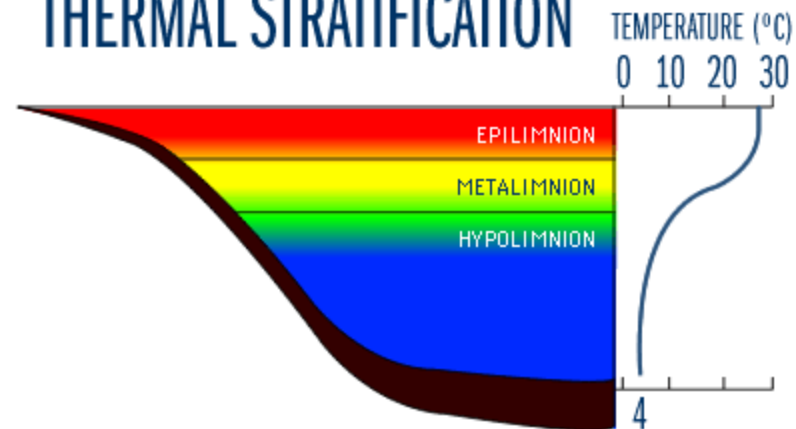
CASE STUDY No. 7: THERMAL REDUCTION

WEST BROOK CONSERVATION INITIATIVE – LAKE GEORGE, NY



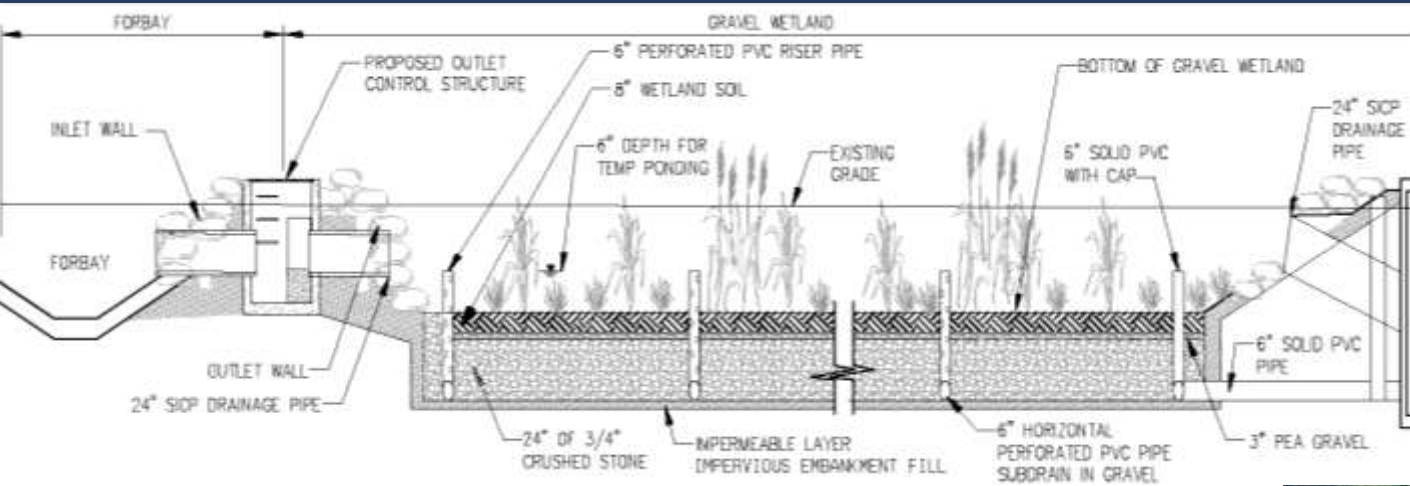
Wet Pond with Deep Pool

THERMAL STRATIFICATION

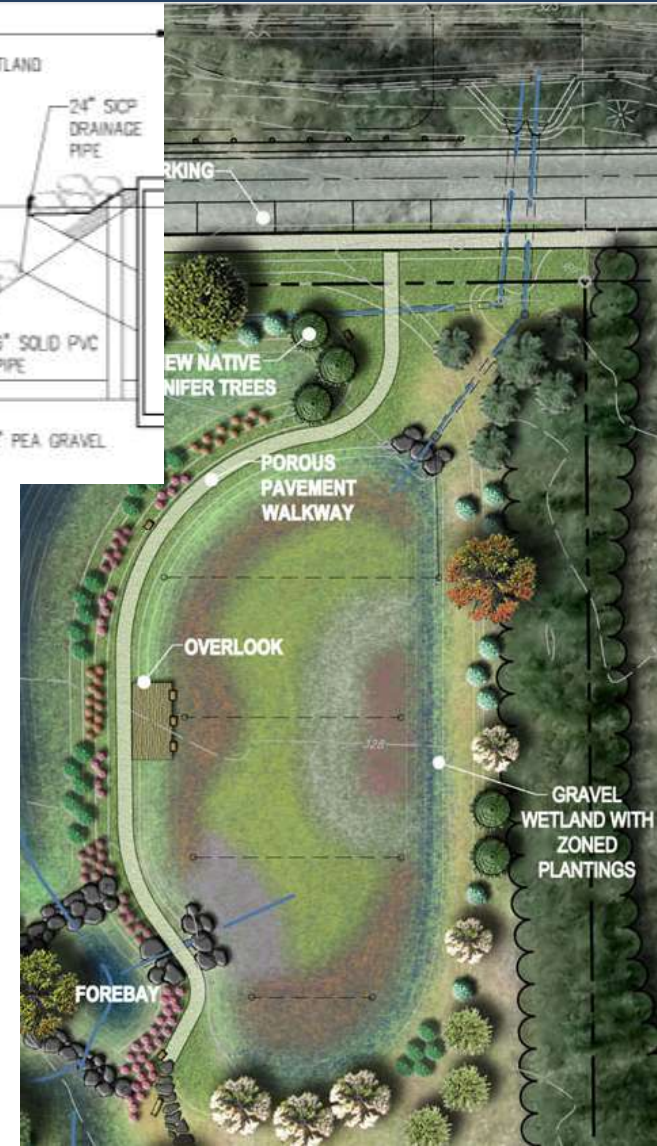


CASE STUDY No. 7: THERMAL REDUCTION

WEST BROOK CONSERVATION INITIATIVE – LAKE GEORGE, NY



Gravel Wetland



CASE STUDY No. 7: THERMAL REDUCTION

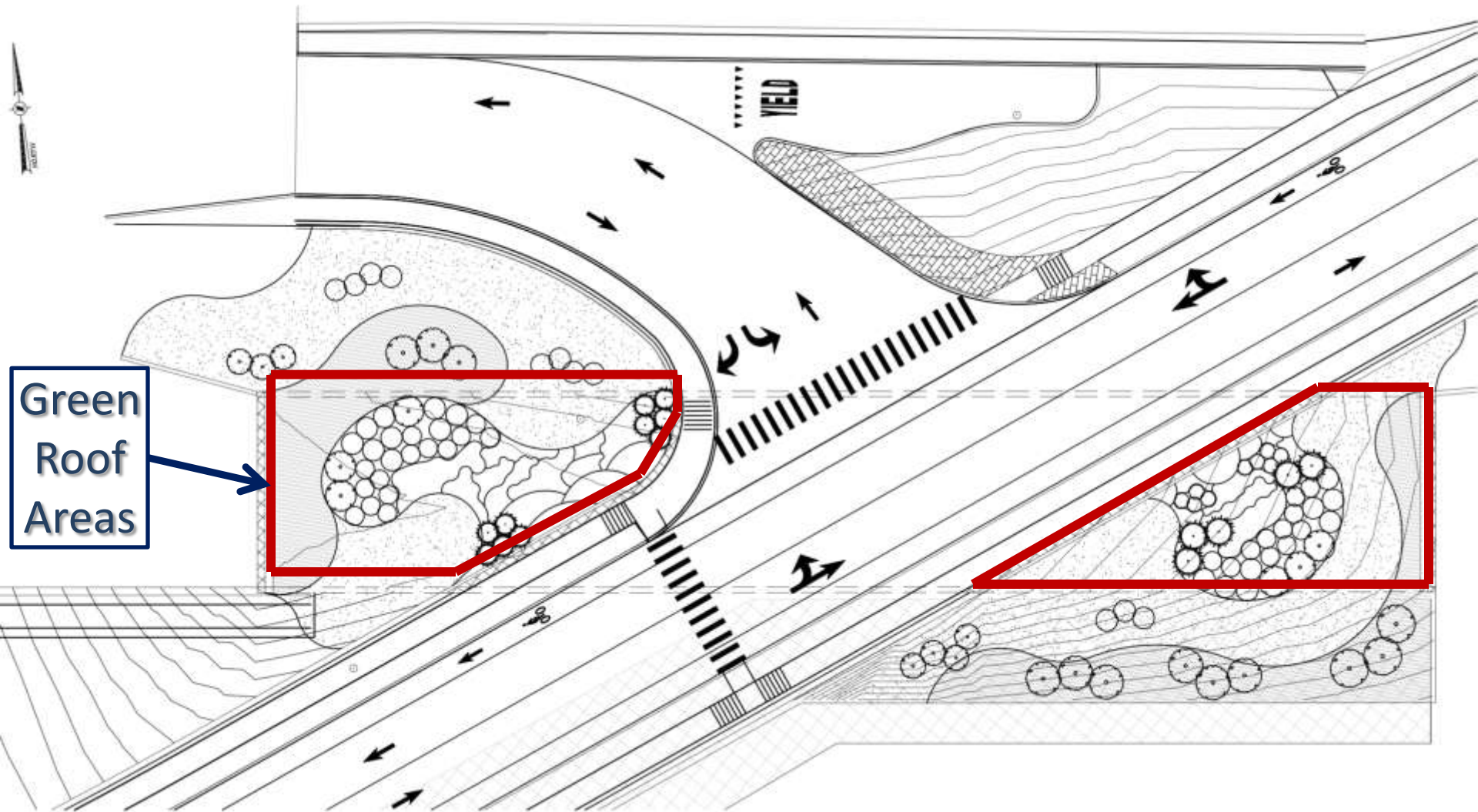
WEST BROOK CONSERVATION INITIATIVE – LAKE GEORGE, NY



Current Aerial Photo

CASE STUDY No. 1: ADAPTIVE LANDSCAPING

RT. 7 BRIDGE RECONSTRUCTION – COBLESKILL, NY



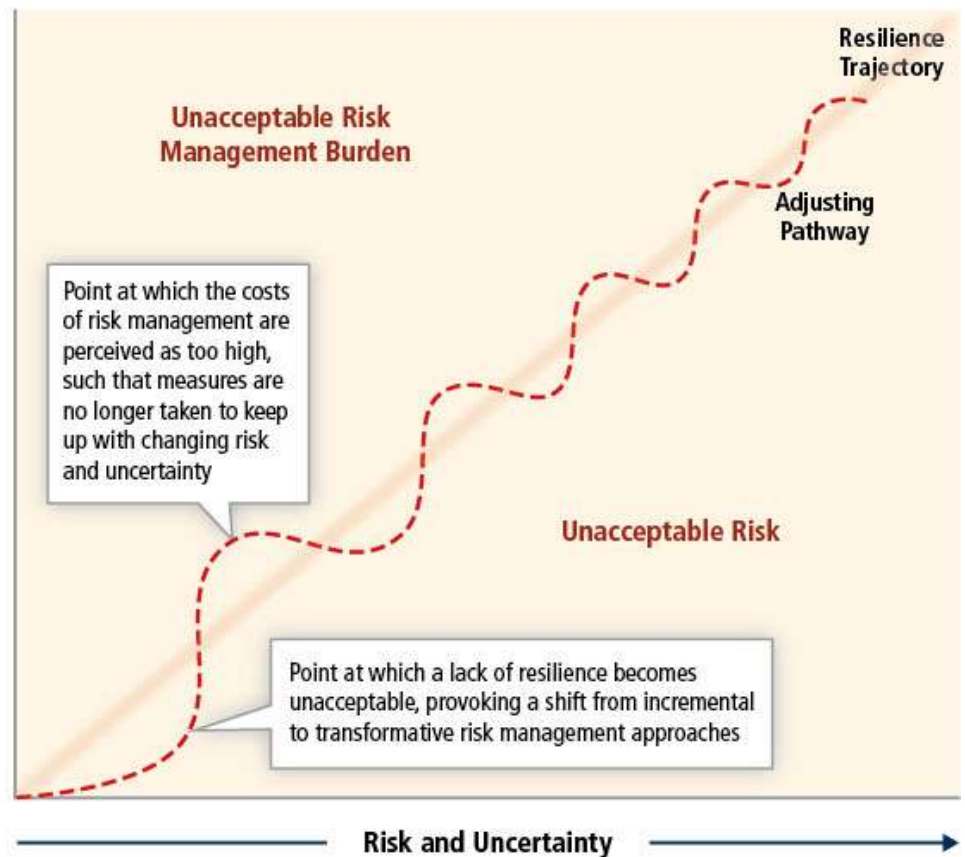
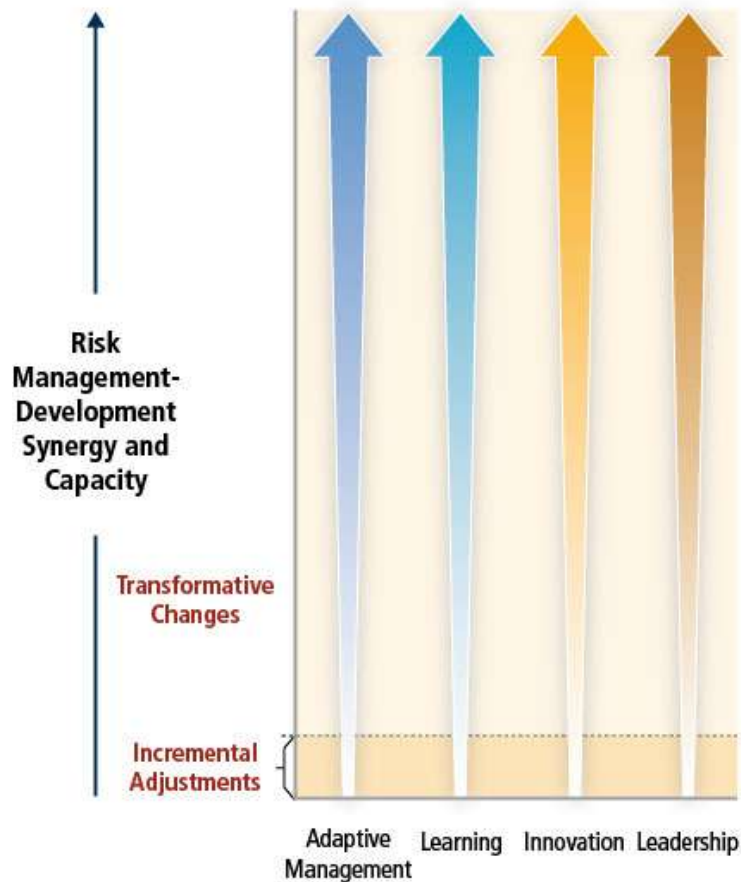
CASE STUDY No. 3: ADAPTIVE LANDSCAPING

STATE PREPAREDNESS TRAINING CENTER – ORISKANY, NY

‘Valley Forge’
American Elm



HOW ARE WE PROGRESSING?



CLIMATE RESILIENT SITE DESIGN

- Impervious reduction, “cool” surfaces, and landscape shading
- Landscaping for future drought, heat, floods, CO₂ & health/pollen
- Potential fire break options for larger sites
- Estuary shoreline function and resilience
- Source control stormwater management
- Infiltration of runoff and rainwater harvesting
- Solar orientation for PV, thermal, and passive options
- Conservative flood zone boundaries and foundation designs
- Material selection for future climate
- Water, wastewater, & general utility design resilience

SUMMARY

Climate Resilient Site Design

- Little dispute that change is occurring
- “Emergency weather events” have now become our “climate”
- Climate Resilient Site Design – new paradigm
- Planning for climate change is now a part of wise asset design/management
- Join us

CLIMATE CHANGE & RESILIENT SITE PLANNING



The Chazen Companies
Russell Urban-Mead: rum@chazencompanies.com
Kelsey Carr: kelsey@chazencompanies.com

THE
Chazen
COMPANIES®
Proud to be Employee Owned
Engineers
Land Surveyors
Planners
Environmental Professionals
Landscape Architects