Best Practices Workshop

Coastal Protection
Stormwater Management
Green Infrastructure/Complete Streets
Microgrid Technology

December 5, 2013

Purpose

- Review key reconstruction concepts discussed in the four Community Reconstruction (CR) areas
- Provide clarity to the identified strategies and their benefits
- Provide information and examples of best practices
- Conduct discussion groups and development of questions
  - Coastal Protection
  - Stormwater Management
  - Green Infrastructure/Complete Streets
  - Microgrid Technology
- Conduct a general question and answer discussion period with experts

Flooding

- Review different sources of flooding
- Consider impact and recurrence intervals
- Evaluate protection options
- Understand allocation of efforts and resources

Reconstruction Plan Considerations

- Investment Strategies and Projects include
  - Smaller-scale protection (short-term)
    - More frequent flood risk but less catastrophic events
  - Larger-scale protection (long-term)
    - Less frequent flood risk but more catastrophic events
- Comprehensive approach is necessary
  - Perimeter Coastal Protection
  - Coastal Resilience via Land Use Planning
  - Integrated and Related Systems
  - Tiers/Layers of Protection
- Additional study, analysis and assessment will be required, including:
  - Permitting and Environmental Impact
  - Cost Benefit Analysis

Items for Consideration

During the Discussion Period

- Bayside Protection
- Impact on Neighboring Communities
- Regulatory and Jurisdictional Issues
- Environmental Impact
- Regionalization
- Effectiveness, Pros and Cons
- Maintenance
- Coordination with Utilities
- Feasibility and Practicability
- Development and Implementation

Comprehensive Planning

- Integration with hazard mitigation strategies, climate change, land use
- Promote high density, and sustainable development

Learn from the Dutch:

- National spatial policy is used to stimulate integration between water management and land use/spatial planning.
- Coordination between country, region, and local authorities
- Perimeter protection combined with interior protection and mitigation

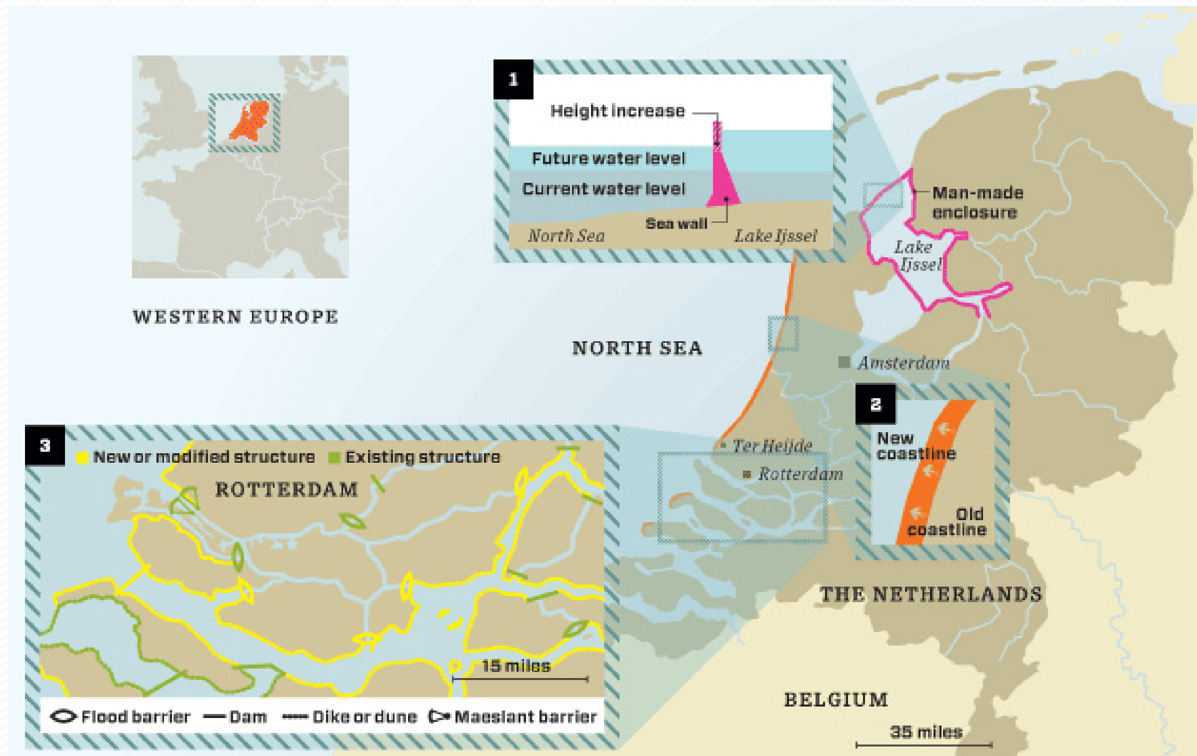
Photo: Deltacommissie

Photo: Deltacommissie

Photo: BugBog Travel

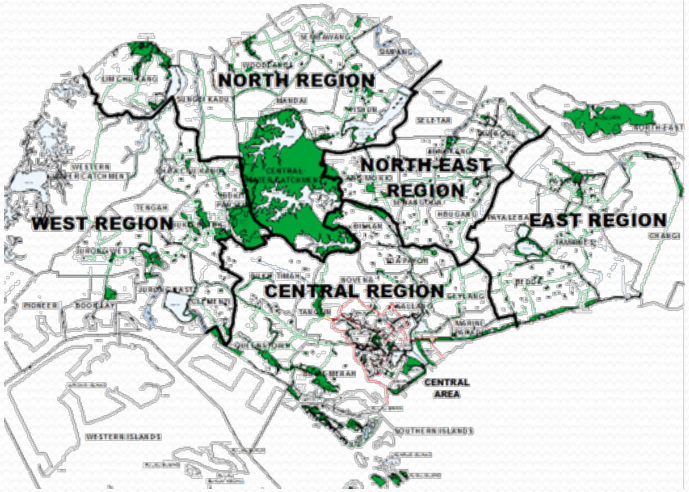
Integrate Climate Change

- Include future projections, not just historic data
- Build in projections for more accurate scenarios
- Climate scenarios, mitigation, adaptation, integration and communication



Preserve Natural Resources and Environmental Areas of Local Importance

- Preserve or expand environmentally sensitive areas
- Reduce impervious surfaces where viable
- Improve water quality and retention
- Encourage mixed land-use



Learn from Singapore

- Parks and Waterbodies Plan as a part of national land use planning strategy
- Provides buffer zones to stormwater, natural area preservation
- Scenic and recreational opportunities


Photo: Singapore URA

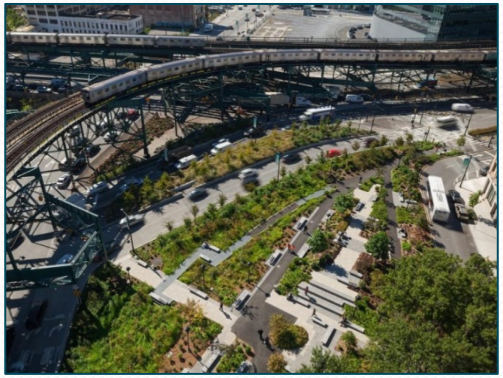
Land Use Planning Implementation

Dutch Kills Queen Urban Plaza, Queens, New York

Boneyard Creek Detention Project, Champaign, IL

Northerly Island, Chicago, IL

Expand Natural Areas



Plan for Climate Change

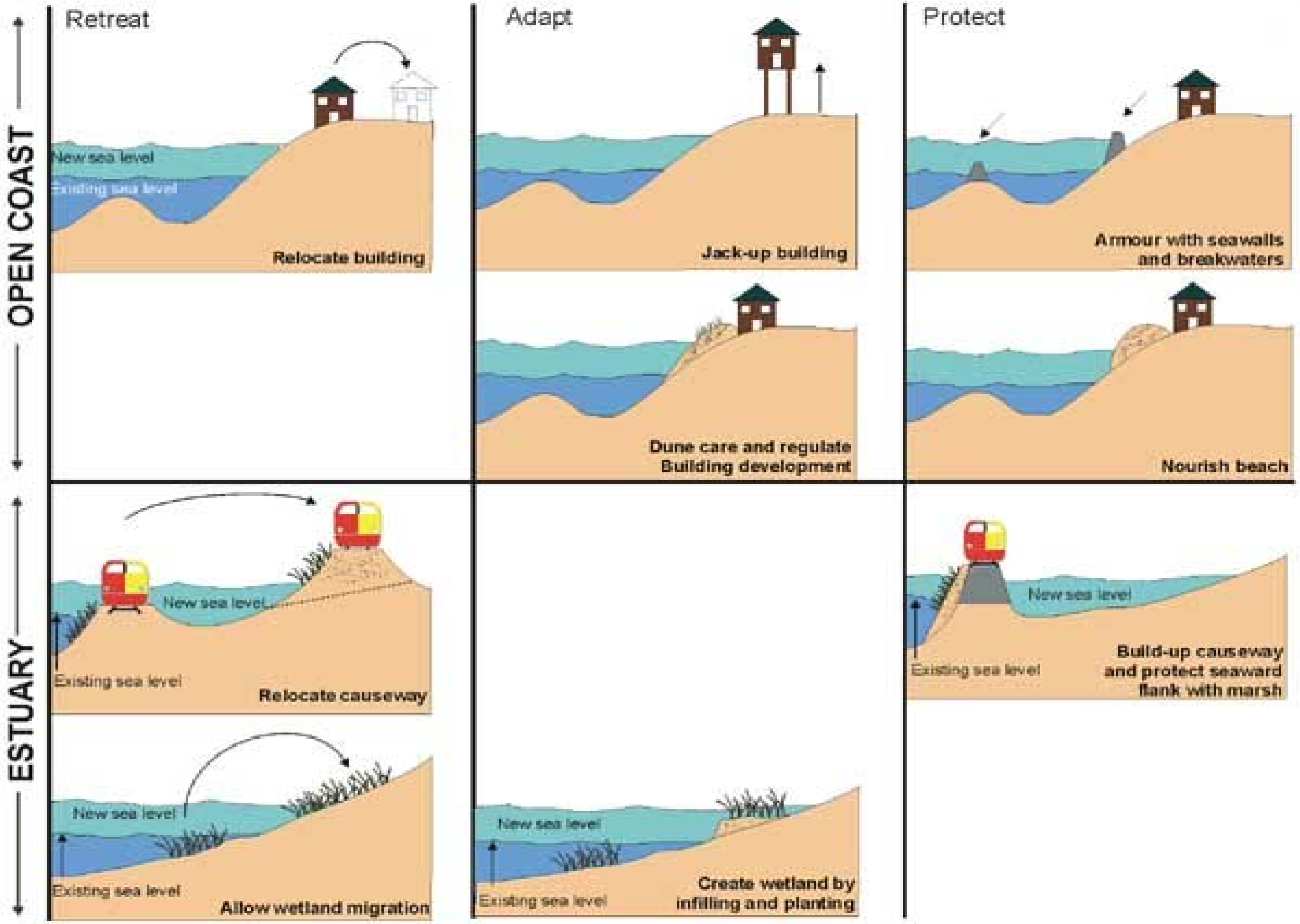
Create Buffer Zones

Coastal Protection

Tiers/Layers of Protection and Mitigation

- Generic Approaches
- Beach Nourishment and Dunes
- Groins or Jetties
- Living Shoreline
- Natural Resources
- Storm Surge Barriers/Floodgates
- Levees and Floodwalls
- Seawalls, Revetments and Bulkheads
- Deployable Floodwalls
- Flood Walls and Building Flood Protection

Generic Approaches



Beach Nourishment and Dunes

- Replenishing beach sands provides an increased buffer between the waterfront and upland areas.
  - Taller and wider sand dune creation provides greater protection.
- Dunes may be “Natural” or “Created”
  - Both require stabilization, plantings and protection from excessive foot and vehicular traffic
  - “Created” man-made dunes require proper engineering and installation
  - “Created” man-made dunes require time to develop and stabilize until which they are more vulnerable

Example of beach restoration in-progress from FEMA’s Beach Nourishment and Dune Construction Fact Sheet http://www.fema.gov/media-library-data/1380817703193-db852b9457140501bd6a873c94569e2c/Beach+Nourishment+Fact+Sheet_FINAL.pdf

Groins or Jetties

- Groins or Jetties are familiar structures installed perpendicular to shorelines to protect beach sands and beach nourishment projects.
  - Interrupt "littoral" drift and "preserve" beaches
  - Trap sand upstream but scour sand downstream
  - Debatable effectiveness and utility in reducing risk
  - DEC regulatory permitting issues

Groins at Pacific Palisades. The beach is wider on the near side of the groins than on the far side. Longshore transport of sand is from the lower right to the upper left, deposited on the near side of the groins and eroded from the downcurrent side due to longshore current eddies. ©AGS1963. geol.ucsb.edu

Hardened beach structures on the North Carolina shore built before the passage of the current ban.
Photo: Program for the Study of Developed Shorelines

Living Shoreline

"Natural" Coastal Storm Barrier

- Living Shoreline projects use a suite of bank stabilization and habitat restoration techniques to:
  - Reinforce the shoreline, minimize coastal erosion, and
  - Maintain coastal processes while
  - Protecting, restoring, enhancing, and creating natural habitat for fish and aquatic plants and wildlife
    (NOAA Restoration Center)
  - Provides stabilization of the shoreline with the creation of an expanded natural habitat
  - Can use plants, sand, stone, oyster reefs, etc. to develop expanded "living shoreline"
  - TOH initiatives to re-establish oyster beds at leeward side of marsh islands

A newly created marsh island protects the sandy shoreline from waves and wind while allowing for natural movement of sand and water. CHESAPEAKE BAY WATERSHED chesapeake bay foundation

Living Shoreline – San Francisco Bay

Nearshore Linkages Project

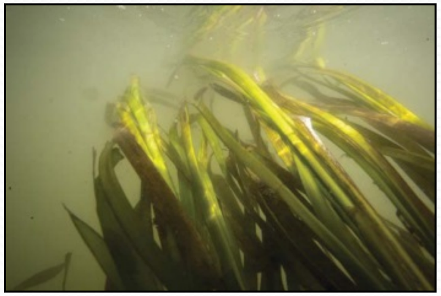
Coastal Conservancy

- Reduces the need for engineered hard shoreline protection devices and
- Provides habitat functions and values
- Elements – Eelgrass and Native Oysters
  - Eelgrass Planting and Seeding
  - Oyster Substrate Units
    - Shell Bag Mounds
    - Dome Style Reef Balls
    - Reef Ball Stacks
    - Layer Cakes
    - Reef Castles

Shell Bag Mounds

Oyster

Dome Style Reef Balls



Eelgrass

Layer Cakes

Reef Castles

Natural Resources

- Protect coastal areas through such natural, soft measures as dunes and restore and protect marshes and water quality
- Promotes resiliency and public health and wellness

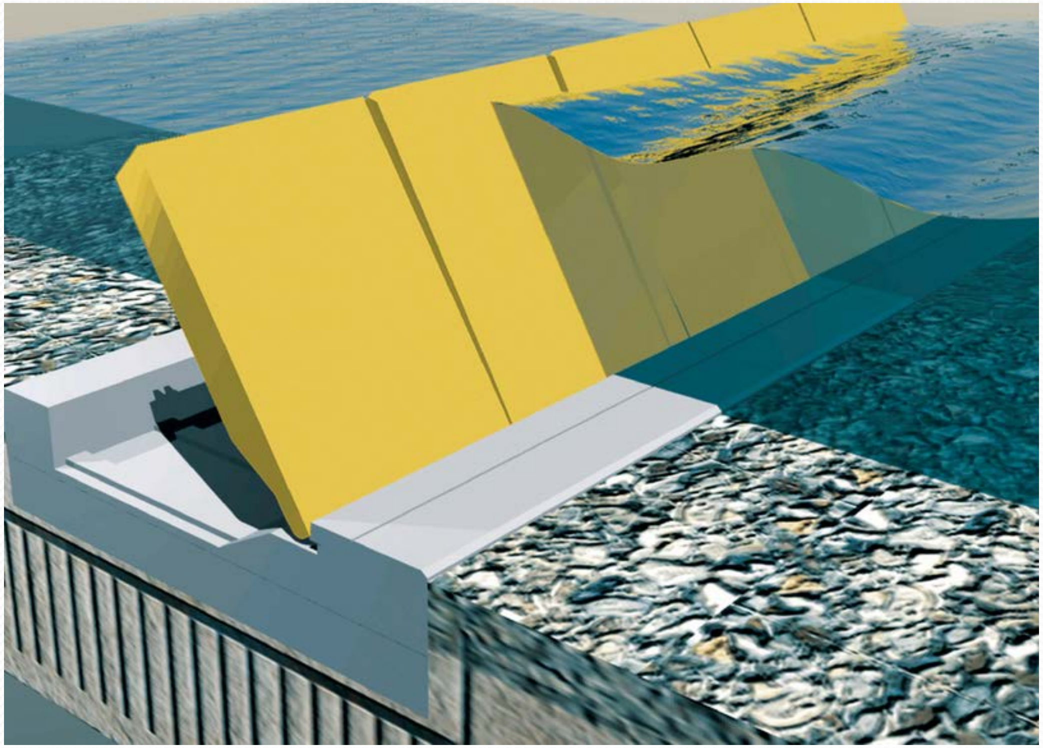
Fencing shown on the right keeps ducks and geese from browsing and pulling out recently planted marsh grass plugs (next to the biolog) and warm-season grasses (on the slope.)

After the first full growing season, fences can usually be removed.

CHESAPEAKE BAY WATERSHED
chesapeake bay foundation

Storm Surge Barrier System

- Storm Surge/Tidal Barrier, Lock or Gate
- Can be Local (close to an inlet) or Regional



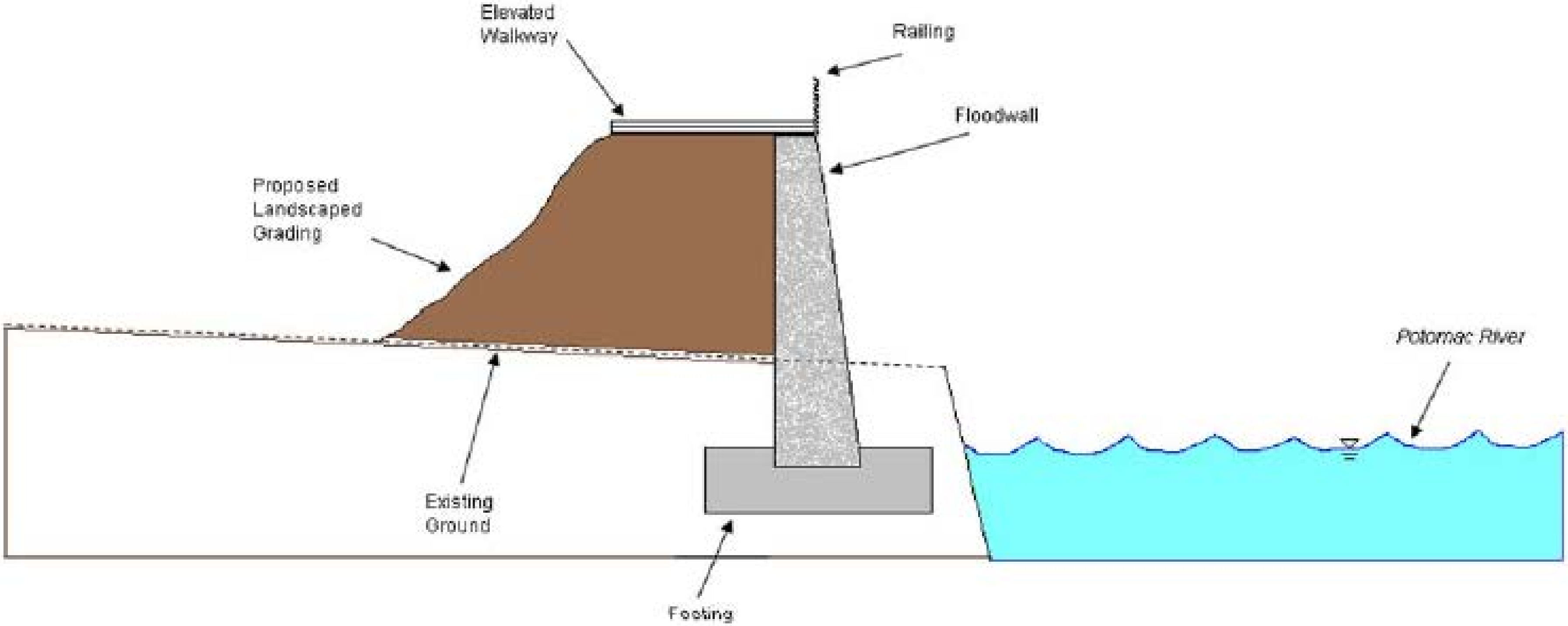
Venice Floodgates (MOSE), Venice, Italy
(Modulo Sperimentale Elettromeccanico)

- A 10 year, $7.3 billion water barrier system construction project in progress to protect from extreme flooding and sea level rise.
- More than 1 Mile Long, 78 Metal Flap Gates across 3 inlets that connect the Venice Lagoon to the Adriatic Sea
- Gates are 92 Feet Long, 65 Feet Wide and Weigh 300 Tons
- Integrated with other coastal reinforcement measures, the raising of the quaysides and paving, and improvements to the lagoon environment

Example of "Moses" tide gate project in Venice, Italy (http://www.npr.org/templates/story/story.php?storyId=112995748)

Levees and Floodwalls

- Large flood control structures, such as levees and floodwalls, provide protection against inland flooding



Example of conceptual floodwall design from URS's City of Alexandria, VA Potomac River Waterfront Flood Mitigation Study

Seawalls, Revetments, Bulkheads, Riprap

- Smaller structures such as seawalls, revetments, bulkheads can stabilize the shoreline and provide erosion control.
- Armored shorelines (e.g. massive stones or rip-rap) can be used to provide erosion control
- Existing structures can be raised to provide additional protection

Waterfront Retaining Wall Restoration, Avalon, California

Deployable Floodwalls

- Temporary floodwalls are less expensive than permanent floodwalls, but need to be actively deployed.

Example of temporary floodwall deployment from
FEMA Publication #551 Selecting Appropriate Mitigation Measures for Floodprone Structures
http://www.fema.gov/media-library-data/20130726-1608-20490-6445/fema551_ch_05.pdf)

Flood Walls and Building Flood Protection

- Flood Walls and Barriers
- Protection of Key Areas and Assets

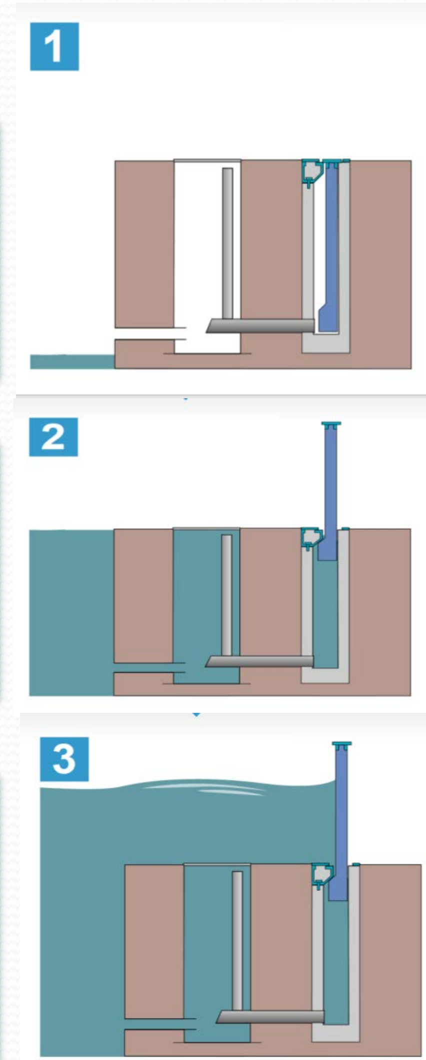
Self Closing Flood Barriers

Photo: www.globalfloodds.com

Install floating entrenched wall and reinforcement by laminated steel strips and protected by Kevlar for impact strength.

As soon as the basin is totally filled up with water, the closing surface will “lock” the barrier into a watertight position.

Once the water level subsides to a normal level, the basin is drained through a drain pipe with non return valves or by a pump.



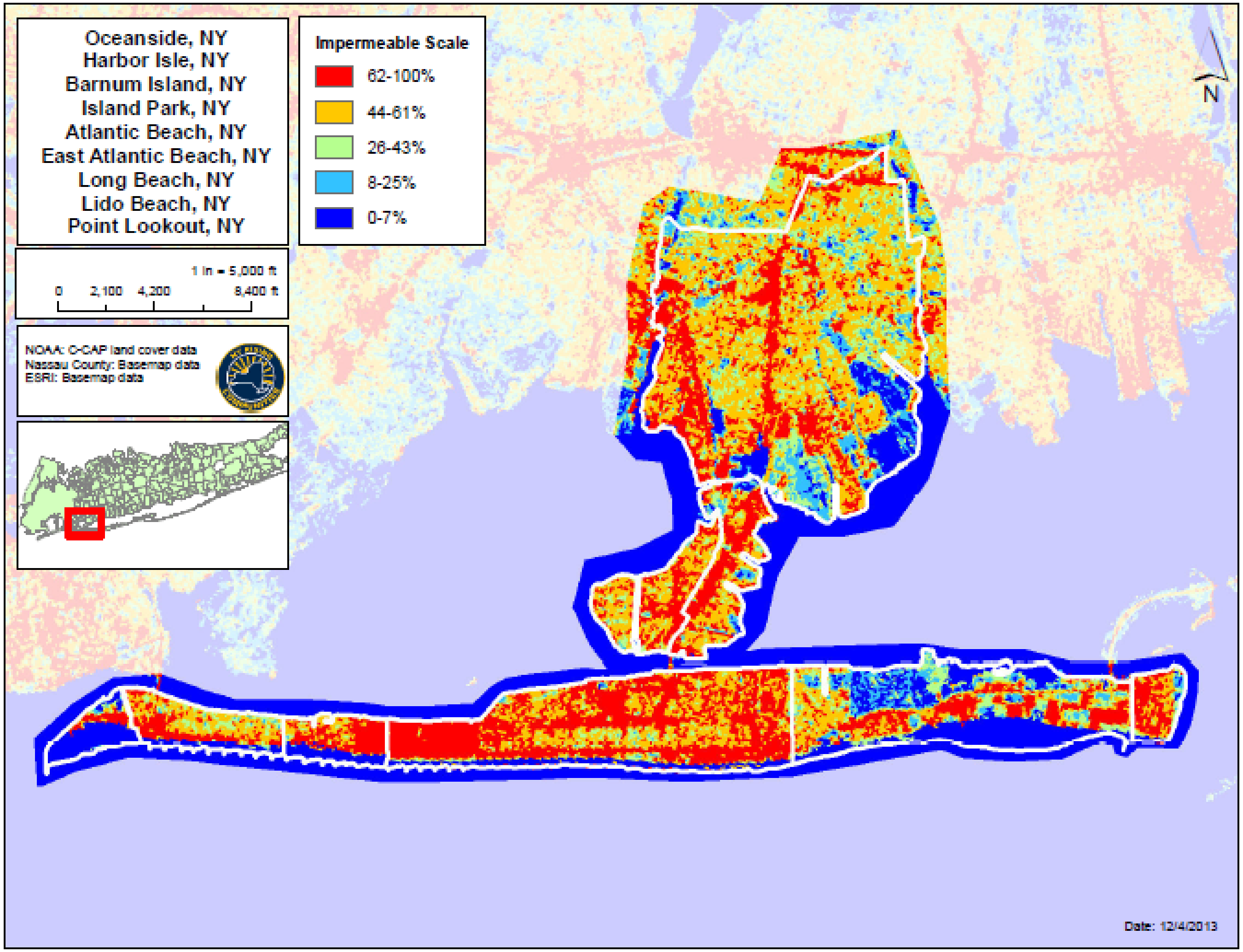
Stormwater

Integration with Green Infrastructure

- Permeability and Opportunity
- Bioswales
- Retention Basins
- Weir Walls, Orifice Plates
- Rain Gardens
- Backflow Prevention
- Tide Flex Valves
- Forced Mains
- Treatment
- Garvanza Park Stormwater Project

Permeability and Opportunity

- Predominately Impermeable Surfaces
- Utilize Available Areas
- Creation of Permeable Surfaces
- Utilize Below Surface Storage
- Sub-surface Saturation Limitations
- Soils – Clay and Sand



Bioswales – Large Scale

Hunter's Point South Waterfront Park, Long Island City, NY   Photo credit: ESTO

At the park's perimeter, a bioswale filters stormwater from the new Center Boulevard and surrounding streets, minimizing impact on the city's stormwater infrastructure. A pleated roof also collects rainwater which is used to nourish the bioswales.

Bioswales – Small Scale

- Bioswales allow stormwater to collect and leave the ponding area through a diverted, controlled outfall.
- Bioswales can be integrated with a Complete Streets program

Retention Basins

- Retention Basins allow stormwater to collect and leave the ponding area through a controlled outfall.

- Weir Walls and Orifice Plates control the amount of flow through a storm drain structure or pipe.

Open Channels

- Land area intensive – limited opportunity
- Greatest opportunity where there are available areas for utilization
- Can slow the flow of runoff compared to drainage in a piped system
- Can also carry a larger volume of runoff and provide storage in overbank areas



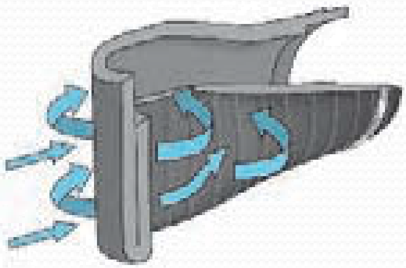
Backflow Prevention and Flap Gates

- Flap Gates keep backflow from entering the storm drain system.
- Maintenance is required.



Tide Flex Valves

- Tideflex valves prevent tidal backflow and infiltration.
- The Tideflex® Check Valve opens with positive pressure.
- Reverse pressure seals the Curved Bill of theTideflex® Check Valve to prevent backflow.


Forced Mains

- Pump Stations
- Integrity of Piping
- Tidal Pressure
- Potential for Selective Low Lying Areas

Anderson-Pump-Station-and-Force-Main-Design_2_U

Stormwater Treatment

- Pollutants Removal: essential component of stormwater management.
- Contaminants: roadway oils, sediment, trash, debris, organic and inorganic materials.
- Methodologies:
  - Biofilters –combination biocollection + filtration, runoff reduction and treatment
  - Filtration – contaminants and pollutants
  - Vortex Hydrodynamic Swirl Type separators - gross solids, trash and debris

UrbanGreen™ BioFilter

Filtration, Contech

Vortex Chamber, Mt. Zion School, Vortechs

Garvanza Park Stormwater Project, Los Angeles, CA

- Primary goals to reduce the amount of polluted runoff that enters storm drains, streams and oceans and maximizing the amount of stormwater infiltrating back into underground aquifers.
  - Public park in a heavily urbanized area of northeast LA within an 85-acre sub-watershed.
  - Existing park houses a below-ground water treatment facility, enhances water quality, and also holds close to half of the collected rainwater for irrigation use within the park.
  - Estimated that to capture and use 50 acre-feet of stormwater runoff per year.

Garvanza Park Stormwater Project,
LA Sanitation, Los Angeles, CA

Awarded Outstanding Stormwater
Best Management Practice (BMP) Implementation Award from
the California Stormwater Quality Association (CASQA)

Green Infrastructure/Complete Streets

Integration with Stormwater Management

- Permeability and Opportunity
- Rain Gardens and Bio-Infiltration
- Curb Extensions with Below-Grade Storage
- Pervious Paving and Small Scale Bioswales
- Pervious Sidewalks with Below-Grade Storage
- Complete Streets

Permeability and Opportunity

- Predominately Impermeable Surfaces
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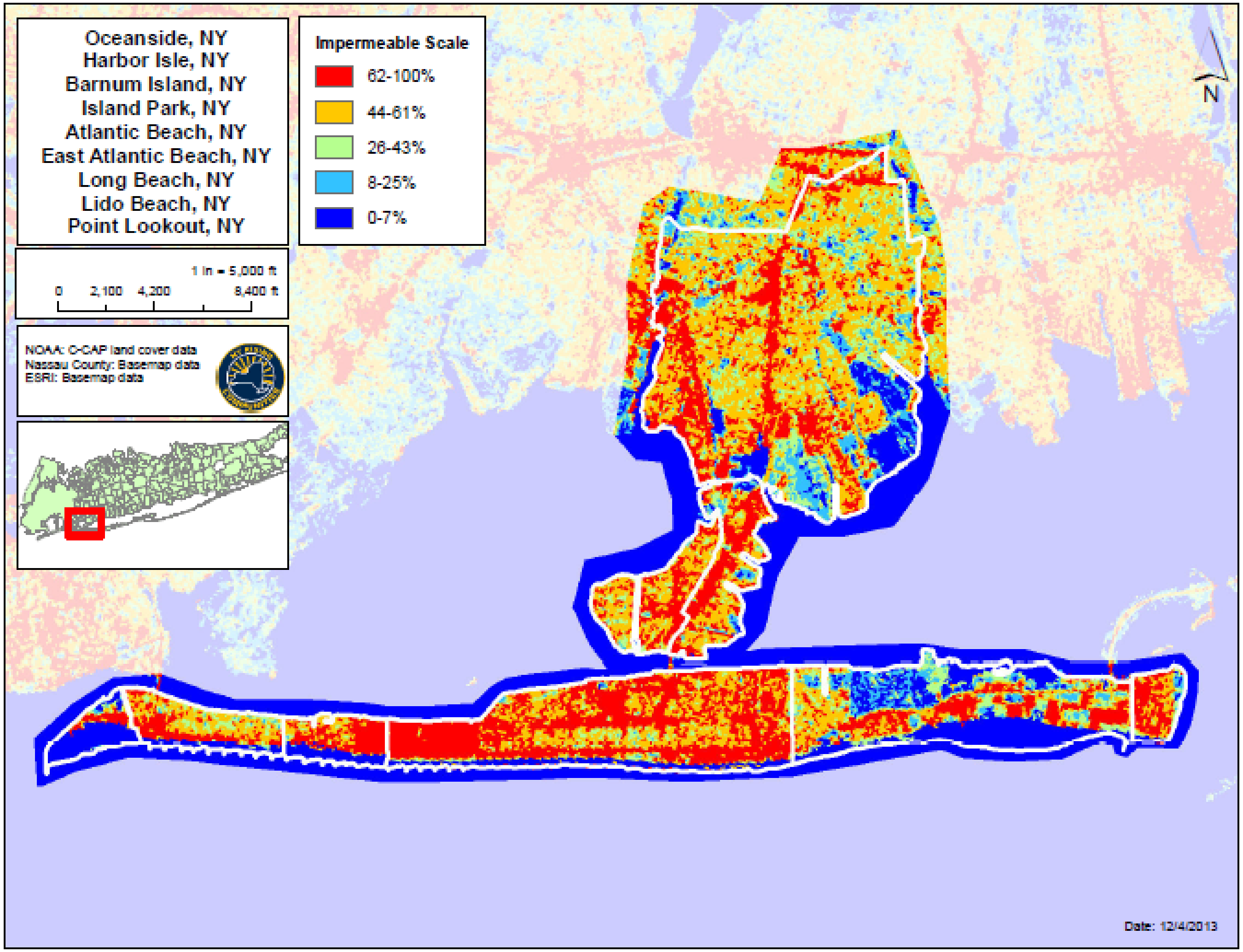


Rain Gardens and Bio-Infiltration Devices

- Planter boxes and rain gardens and are appropriate for dense areas with limited space.

Curb Extensions with Below-Grade Storage

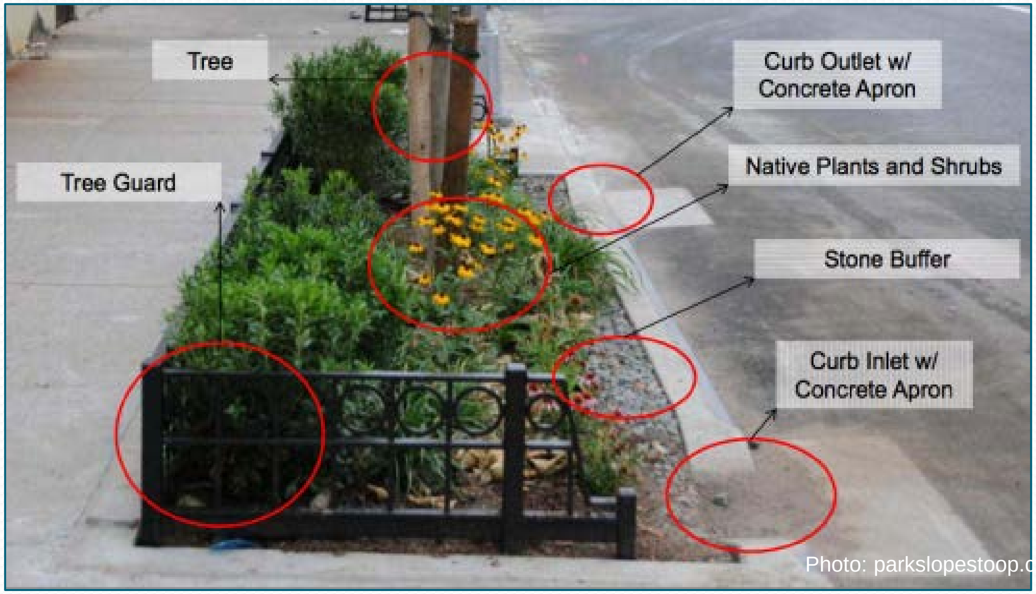
- Stormwater Collection Focal Points
- Neighborhood Streetscape Improvements
- Traffic Calming

Photos: URS

Pervious Paving and Small Scale Bioswales

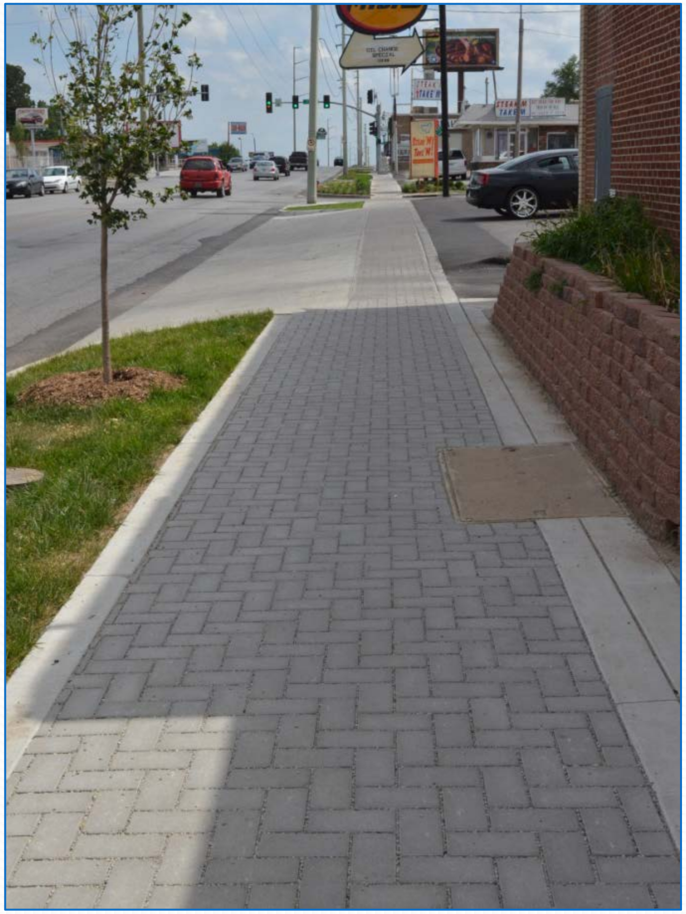
Pervious Roadway

Pervious Parking Area



Bioswale – Small Scale

Pervious Sidewalks with Below-Grade Storage



Pervious Sidewalks

Below Grade Storage & Detention

Complete Streets Program

This street is welcoming for pedestrians, bicyclists, and transit while maintaining plentiful street greenery.

Photo: Dan Burden, Walkable and Livable Communities Institute

An example of green streets, with permeable surfaces and buffer vegetation.

Left: Brandon Milar, California Asphalt Pavement Association.

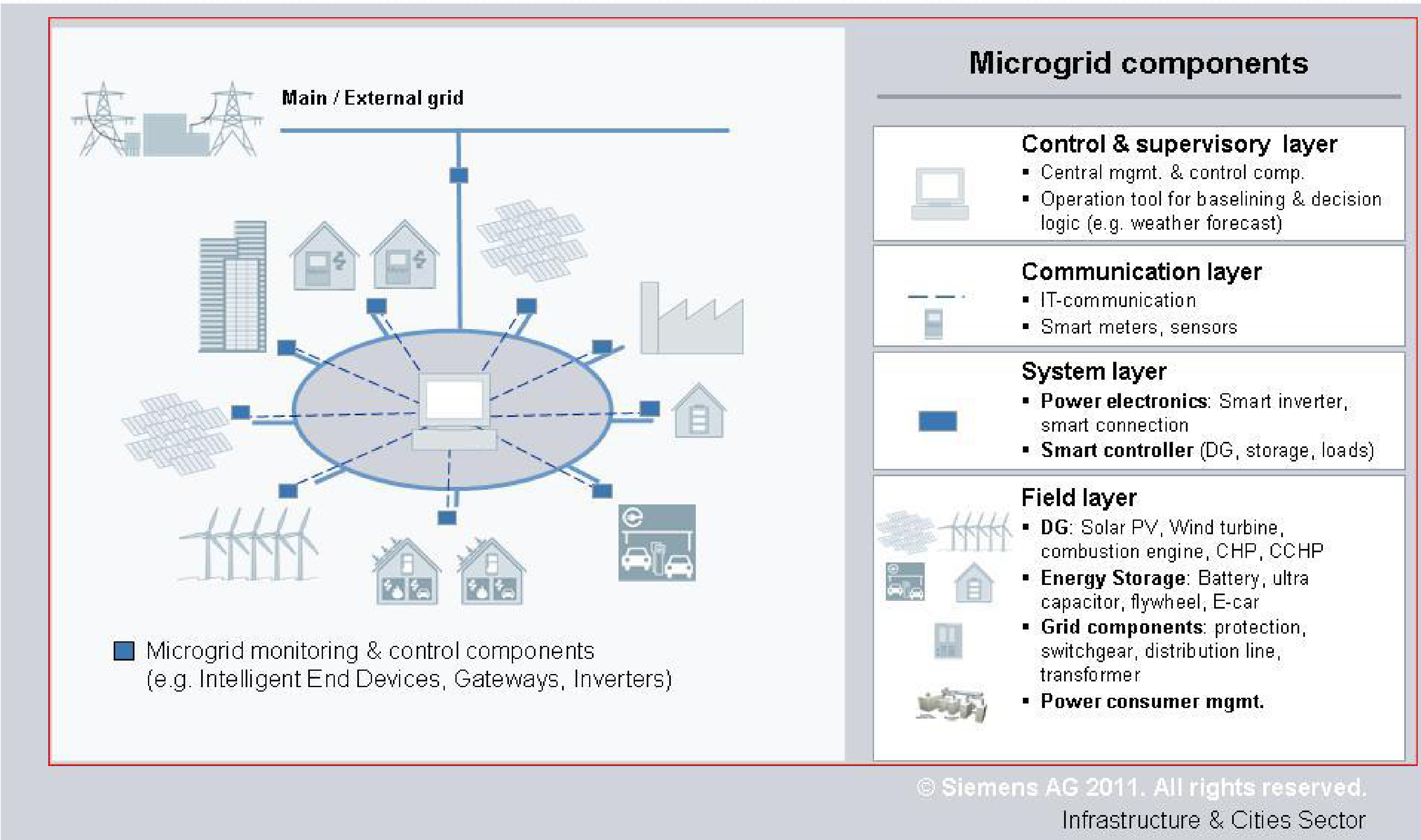
Right: Dan Burden, Walkable and Livable Communities Institute

Microgrid Technology

Integration with Utilities – Potential Resiliency for Emergency Use

- Community
- Residential
- Renewable Energy Pilot Program
- Peak Shaving and Heat Recovery
- Tidal Energy

Microgrid


Main / External grid
Microgrid monitoring & control components
(e.g. Intelligent End Devices, Gateways, Inverters)
Microgrid components
Control & supervisory layer
▪ Central mgmt. & control comp.
▪ Operation tool for baselining & decision logic (e.g. weather forecast)
Communication layer
▪ IT-communication
▪ Smart meters, sensors
System layer
▪ Power electronics: Smart inverter, smart connection
▪ Smart controller (DG, storage, loads)
Field layer
▪ DG: Solar PV, Wind turbine, combustion engine, CHP, CCHP
▪ Energy Storage: Battery, ultra capacitor, flywheel, E-car
▪ Grid components: protection, switchgear, distribution line, transformer
▪ Power consumer mgmt.
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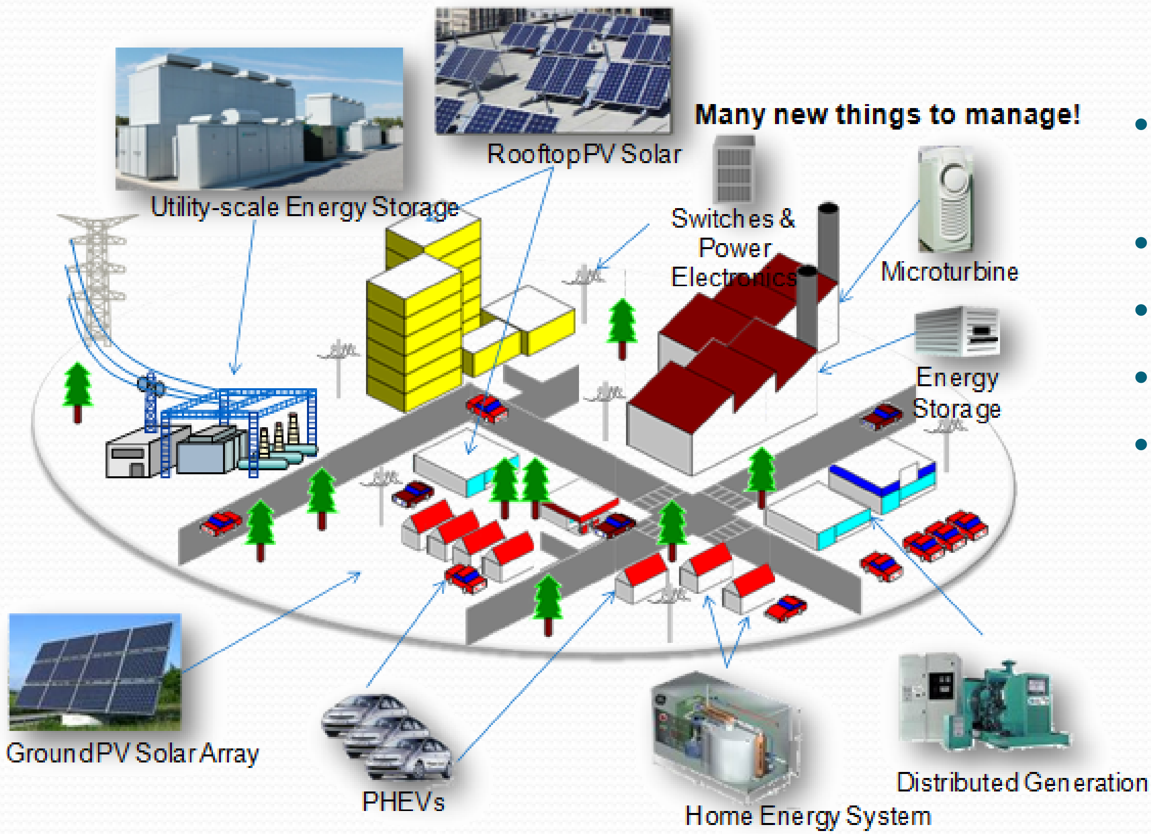
Infrastructure & Cities Sector

Microgrid - Community



- Small scale versions of centralized electric systems
- Work well on a community level
- Reliable source of energy
- Reduce carbon emission
- Provides energy cost reduction

Microgrid for Communities in India and South Africa

Photo: Echelon

Microgrid - Residential

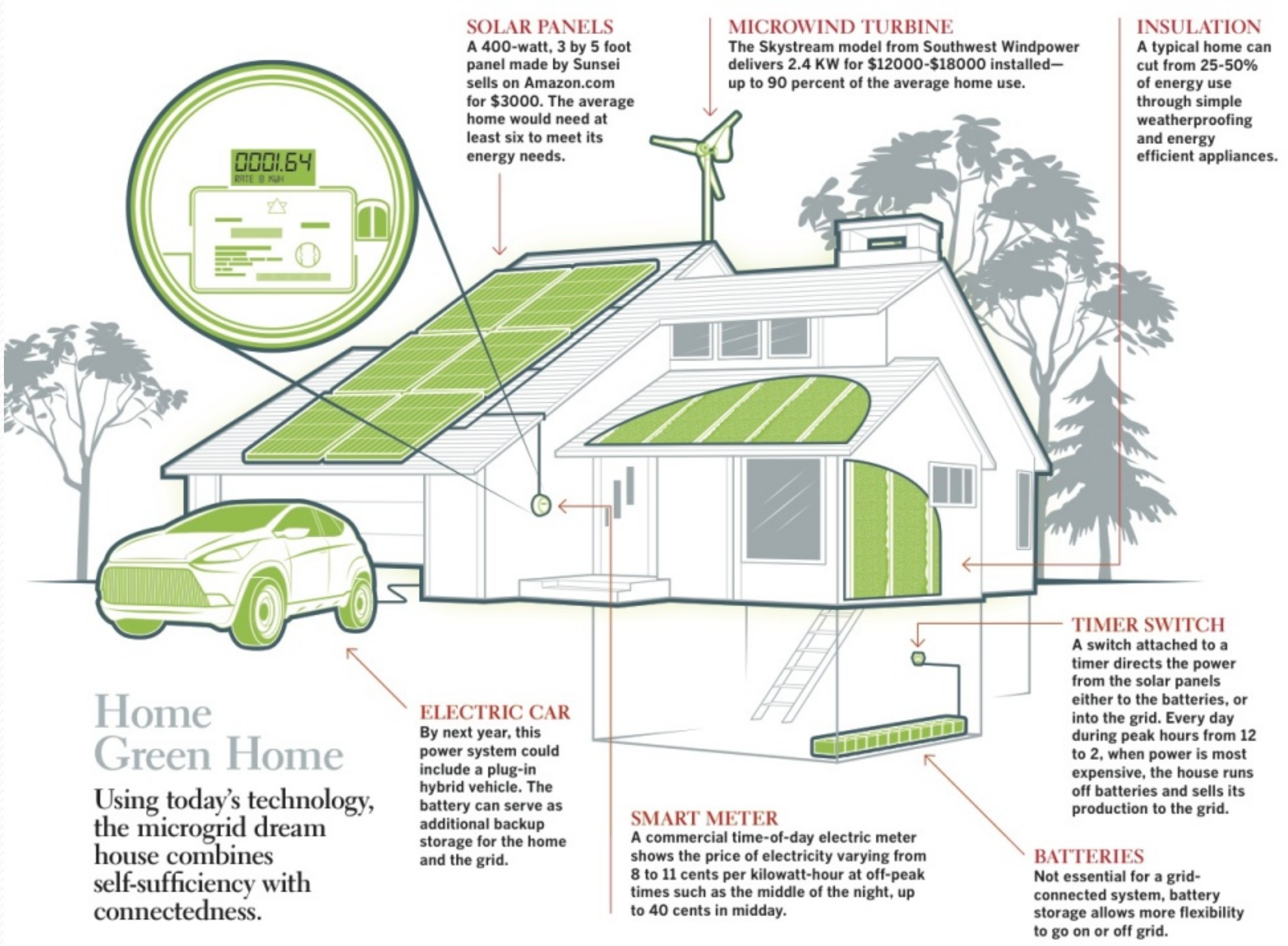
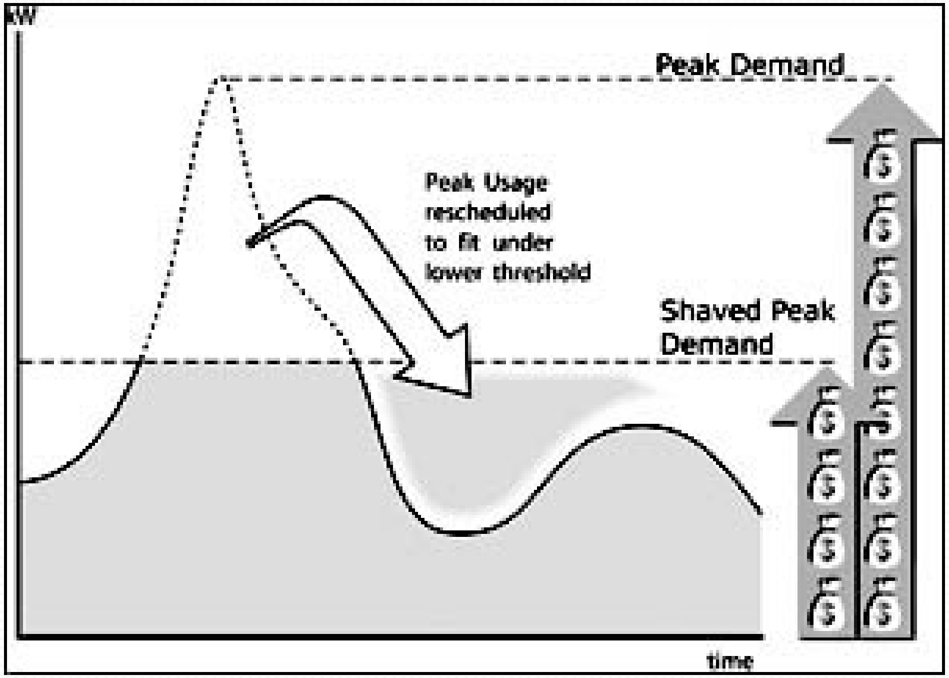


Photo: austinspc.com

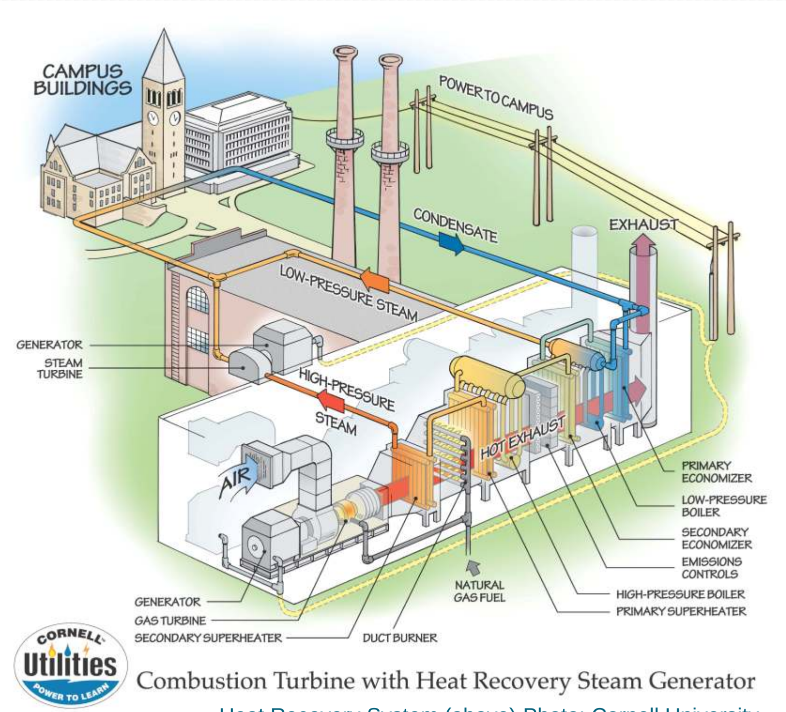
Renewable Energy Pilot Program Proposal

Brightwater Towers, Coney Island Regional Renewable Energy Pilot Study Program,
CUNY & American Renewable Energy Associates

Peak Shaving & Heat Recovery



Australian Government Department of Industry



Heat Recovery System (above) Photo: Cornell University

Peak Shaving

- Reduces the cost of electricity by providing alternative power at peak times through solar, wind, generators

Heat Recovery

- Reduces energy requirements via heat capture and recovery

Tidal Energy

Electricity via Axial-Flow Tidal Turbines

SeaGen Power Plant, Siemens

Northern Irish Seas Narrows

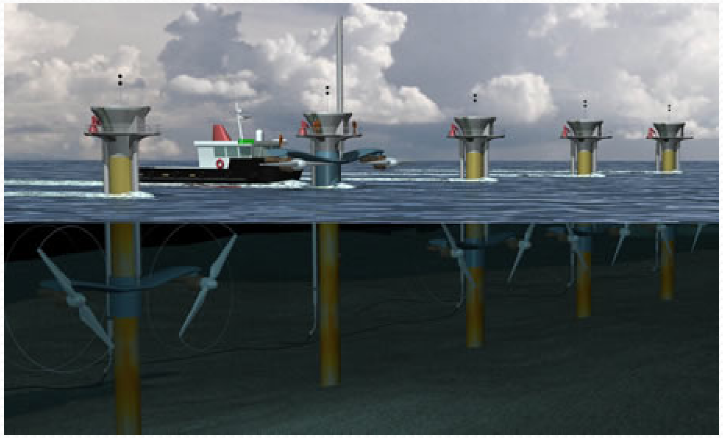
- Two axial-flow turbines with a combined capacity of 1.2 megawatts (MW) supply electricity to around 1,500 households
- In October 2012 SeaGen generated:
  - 22.53 megawatt hours in one day,
  - One gigawatt hour in 68 days, and
  - A total of six gigawatt hours since the middle of 2008

SeaGen, Northern Irish Seas, Siemens
Turbine rotors shown above water

SeaGen-S Power Plant, Siemens

Northwestern Coast of Wales

- Scheduled to go into service in 2015
- Five axial-flow turbines with a combined capacity of 10 megawatts (MW) will supply electricity to around 10,000 homes



SeaGen, Northwestern Coast of Wales, Siemens
Turbine rotors shown below water

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For Further Information
Community Reconstruction Program Website:
http://stormrecovery.ny.gov/community-reconstruction-program

NY RISING COMMUNITIES