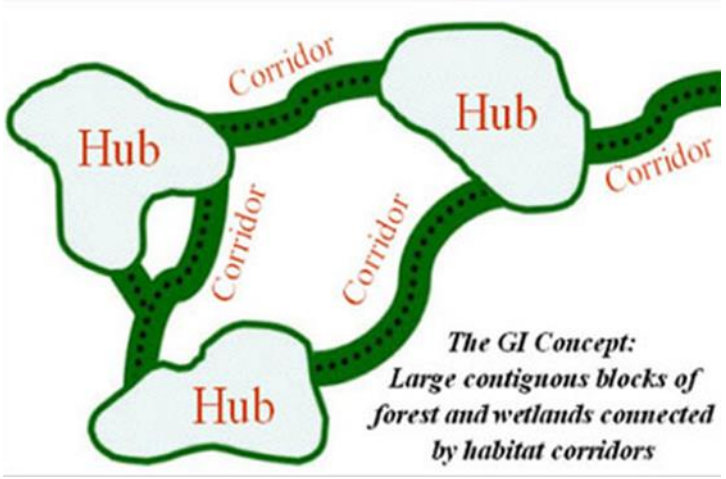
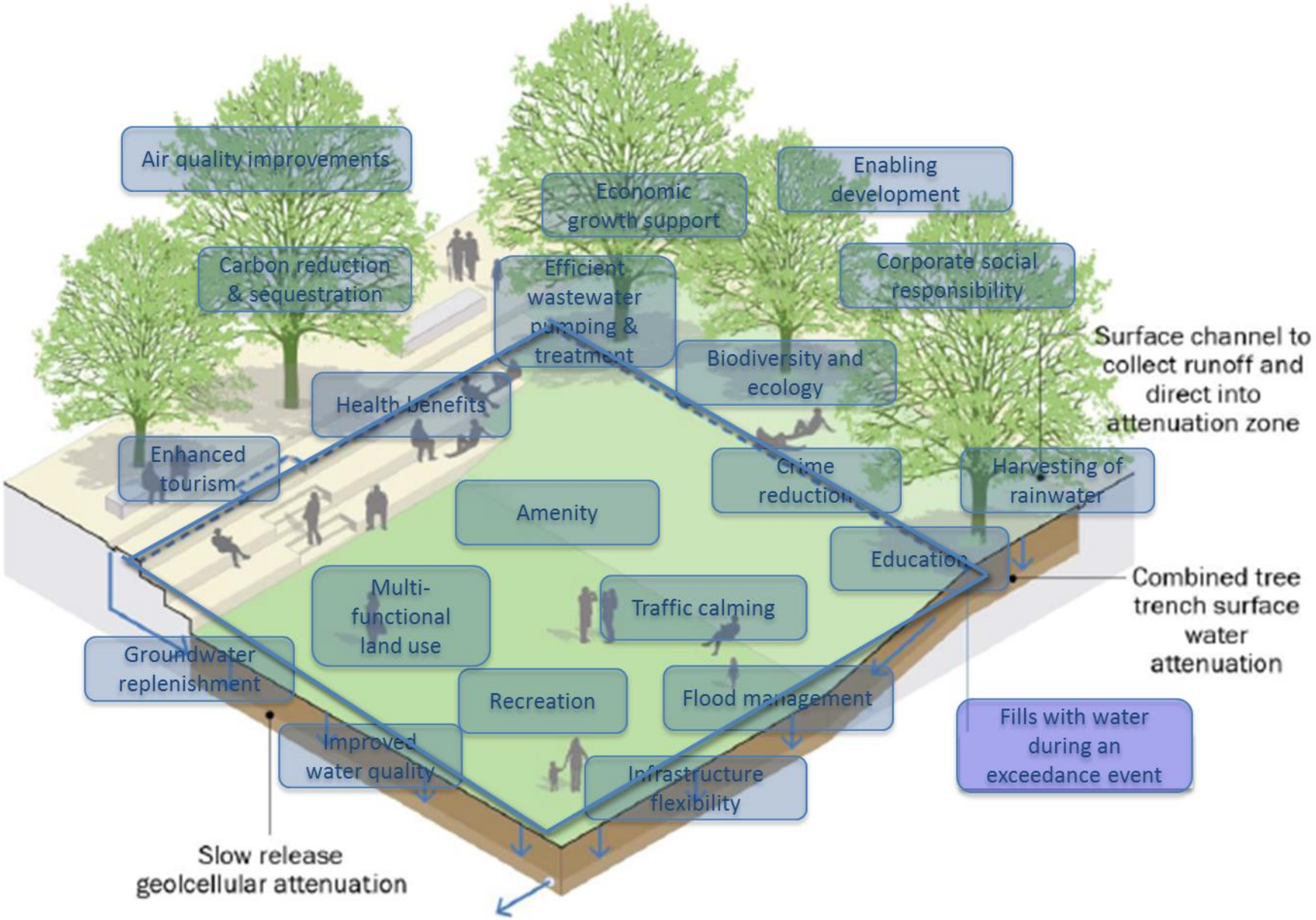
Multiple benefits of vegetated SuDS

- SuDS – Sustainable Drainage Systems (stormwater management systems)
  - Green roofs
  - Ponds
  - Street trees
  - Rain gardens …
- Green Infrastructure for healthy/liveable cities



Virginia Stovin
University of Sheffield



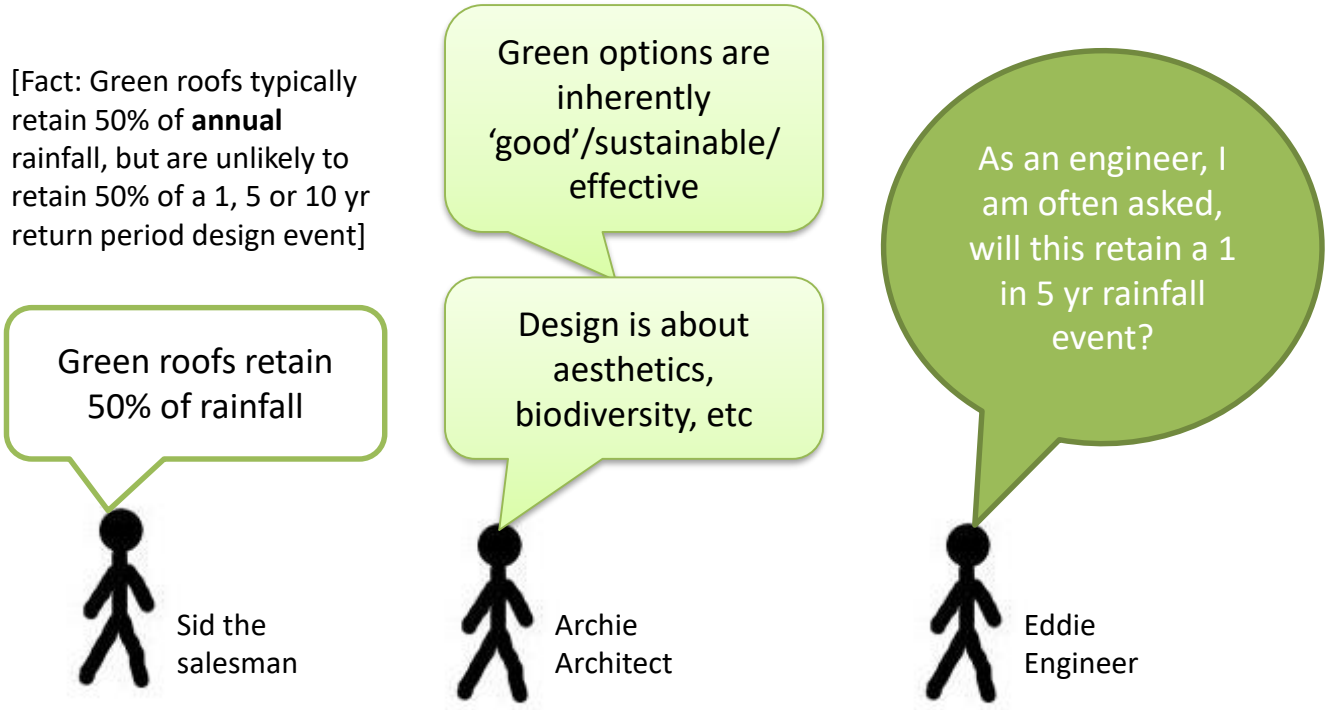
Multiple benefits of vegetated SuDS

Challenges:

1. ‘Over enthusiasm’;
2. Numbers/models as ‘scary’ concepts
3. Numbers/models as ‘dirty, mechanistic, detail’
4. Numbers/models as essential evidence
5. Case-by-case design – no ‘one-size-fits-all’

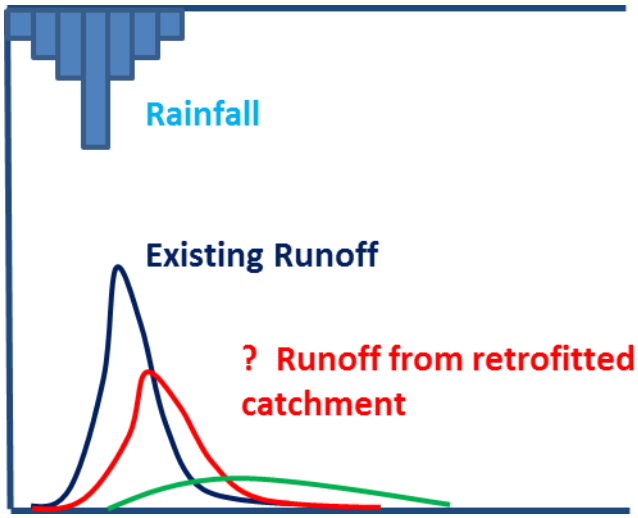
Need for robust science that account for variability in ‘greener’ approaches

[Fact: Green roofs typically retain 50% of **annual** rainfall, but are unlikely to retain 50% of a 1, 5 or 10 yr return period design event]



Greening Meadowhall Retail Park ..

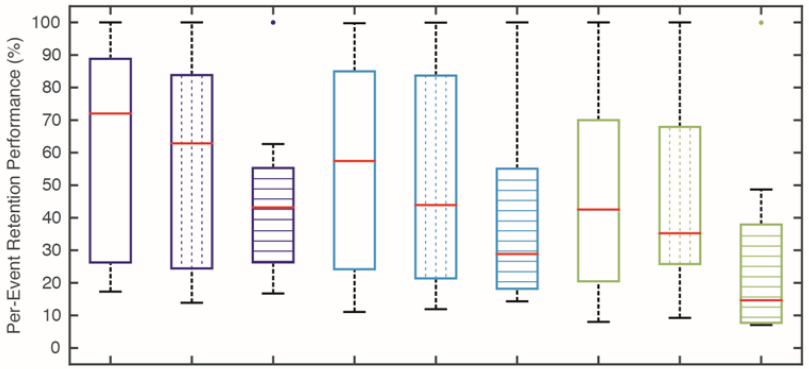
Myth and reality – research and evidence …

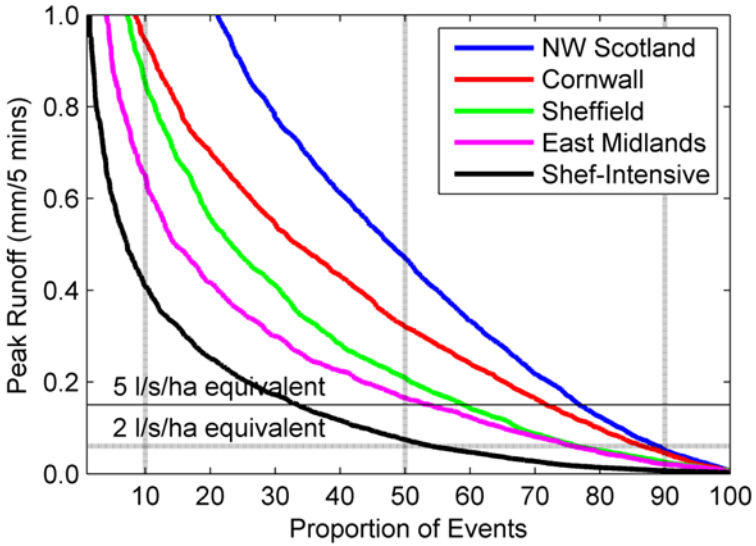


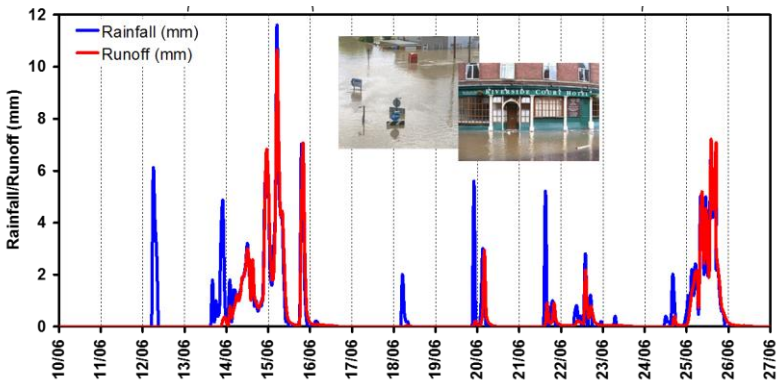
- Flood risk and resilience to climate change – How do SuDS devices perform in response to extreme rainfall?
  - Monitoring
  - Model development and validation
- Water Framework Directive – How do these devices affect water quality?
- Building energy savings
- How do these devices contribute to biodiversity and amenity?

Green Roofs:

- Field monitoring of rainfall & runoff
- Detailed understanding of how the substrate (soil) and plants affect hydrological performance, e.g. through evapotranspiration
- Model development
- Scenario analysis using UKCP Weather Generator
- Retention is reduced for large events







Benefit category	What it covers
Flood risk management	Impact on people and property
Water quality management	Surface water quality improvements to aesthetics, health, biodiversity, etc
Biodiversity and ecology	Sites of ecological value
Amenity	Attractiveness and desirability of an area
Air quality	Impact on health from
Building temperature	Thermal comfort, it coo insulation (winter).
Carbon reduction and sequestration	Operational and embo together with sequestr
Crime	Crimes against people
Economic growth	Business, jobs and proc
Education	Enhanced educational
Enabling development	Water infrastructure capacity (headroom) for housing/other growth
Flexible infrastructure/ climate change adaptation	Improved ability to make incremental changes and adapt infrastructure (no regrets)
Groundwater recharge	Improved water availability or quality
Health and wellbeing	Physical, emotional, mental health benefits from recreation and aesthetics
Pumping wastewater	Reduced flows of wastewater to treatment works
Rainwater harvesting	Reduced flows in sewers, pollution or dependence on potable (mains) water
Recreation	Involvement in specific recreational activities
Tourism	Attractiveness of tourist sites
Traffic calming	Reducing the risk of road accidents or increasing street-based recreation opportunities
Treating wastewater	Reduced volume of wastewater to treat from combined drainage systems

From www.susdrain.org

From the Literature:

Water Quality:

- Rainfall may be relatively unpolluted
- Not important for a green roof to address water quality, but it does matter for a rain garden or a pond receiving highway runoff
- Vegetated SuDS can leach nutrients, i.e. act as a source of pollutants

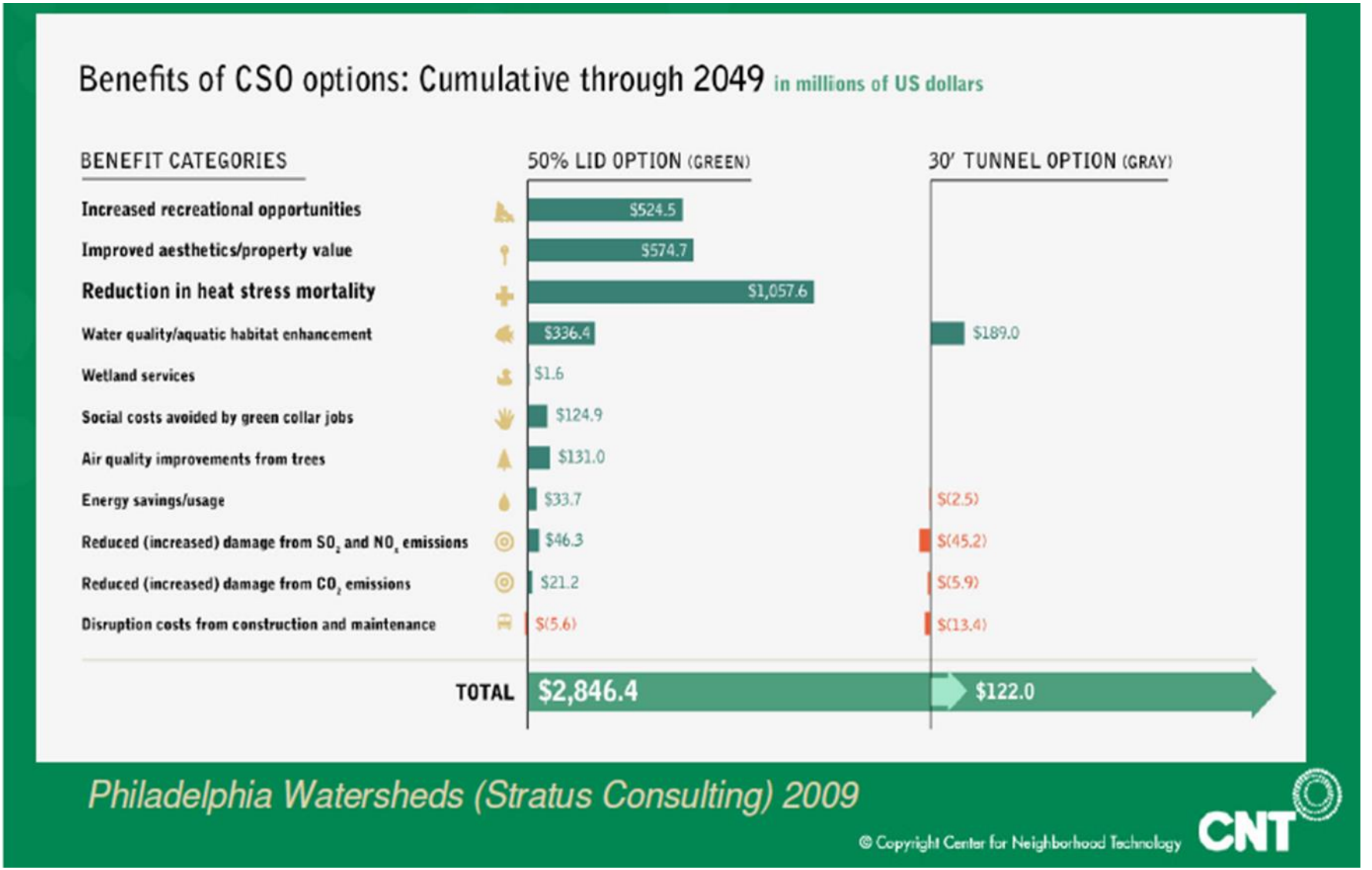
Building Energy Savings:

- Modern building codes require high levels of insulation – a green roof is unlikely to make much difference
- Summer evapotranspiration can contribute to cooling, but only if there's moisture available in the substrate
- Not relevant for most other types of SuDS

Biodiversity

- Lightweight roofs typically support monocultures
- But significant opportunities exist with interconnected swales, rain gardens and ponds

Important to think about these criteria in context


Benefits of CSO options: Cumulative through 2049 in millions of US dollars
BENEFIT CATEGORIES
50% LID OPTION (GREEN)
30' TUNNEL OPTION (GRAY)
Increased recreational opportunities
$524.5
Improved aesthetics/property value
$574.7
Reduction in heat stress mortality
$1,057.6
Water quality/aquatic habitat enhancement
$336.4
$189.0
Wetland services
$1.6
Social costs avoided by green collar jobs
$124.9
Air quality improvements from trees
$131.0
Energy savings/usage
$33.7
$(2.5)
Reduced (increased) damage from SO2 and NOx emissions
$46.3
$(45.2)
Reduced (increased) damage from CO2 emissions
$21.2
$(5.9)
Disruption costs from construction and maintenance
$(5.6)
$(13.4)
TOTAL
$2,846.4
$122.0
Philadelphia Watersheds (Stratus Consulting) 2009
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CNT

Discussion:

- Need for solid evidence derived from robust science and qualified experts
- Ample evidence of partial contributions to multiple benefits
- CIRIA's BeST (Benefits of SuDS) tool
- How do we deal with partial contributions?
    - Treatment trains
    - Hybrid options
    - Alternative design standards – e.g. probabilistic
- Who benefits?
    - Multiple stakeholders
- Who pays?
    - Multiple stakeholders

- Are cities/communities better-placed to take an integrated & balanced approach compared with the water companies?