# Climate Change Adaptation at the Philadelphia Water Department

**AMWA Executive Management Conference**

**Marc Cammarata, Deputy Commissioner,**
**Planning & Environmental Services**

October 16, 2018

PHILADELPHIA WATER DEPARTMENT

*Photo by Randy Calderone*

# Philadelphia Water Department
## One Water Utility

### Drinking Water

- Source: Delaware and Schuylkill Rivers
- 1.7 million drinking water customers
- Three Water Treatment Facilities
- Over 300 million gallons treated per day
- 3,000 miles of water mains, 25+ pumping stations

### Wastewater

- 2.2 million wastewater customers
- 3 Water Pollution Control Plants
- Over 522 million gallons treated per day
- 3,716 miles of sewers, 19 pumping stations
- Biosolids handling facility

### Stormwater

- Roughly 60% Combined Sewer, 40% Separate Sewer
- Green City, Clean Waters - Large-scale green stormwater infrastructure program
- To date, the program has reduced CSOs by more than 1.5 billion gallons annually with over 440 GSI sites

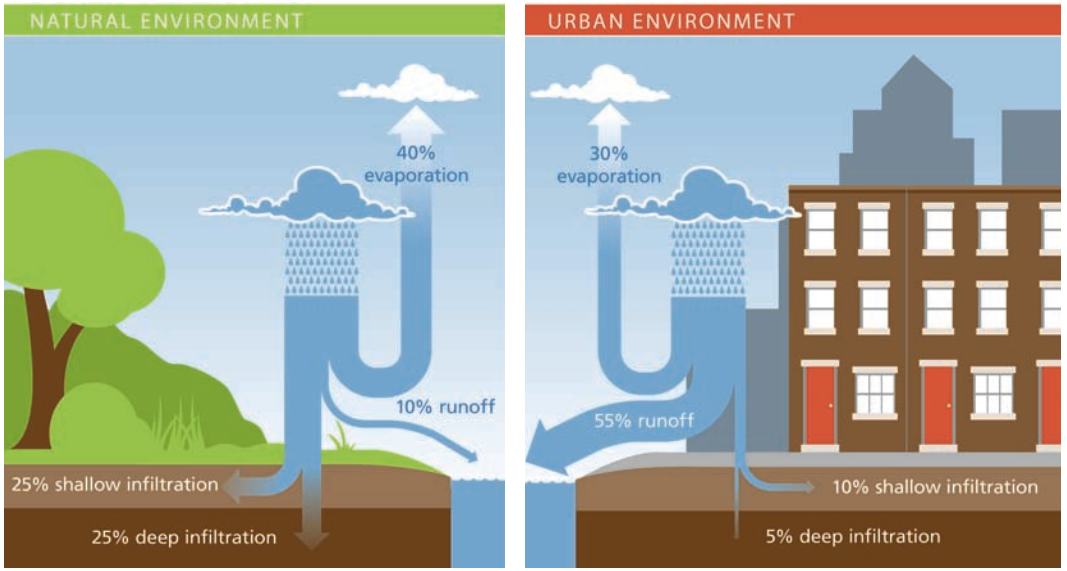
**Southeast Philadelphia**
**10th & Moyamensing**
**Photo by Andrew Dobshinsky**

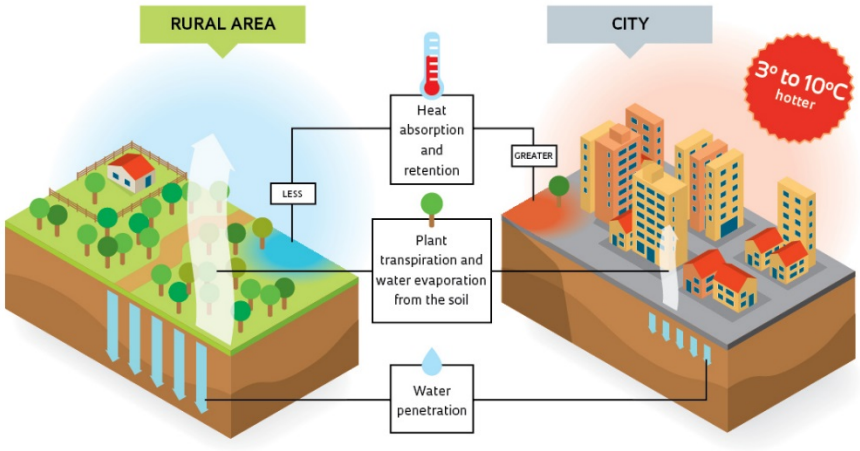


PHILADELPHIA WATER DEPARTMENT

# Urban Development + Climate Change

- Climate change **exacerbates** environmental challenges already seen in cities
  - *Urban heat island effect*
  - *Stormwater management*
  - *Lack of biodiversity*
  - *Invasive species*
- Density amplifies impacts
- Essential services are interdependent
- Infrastructure is aging and deteriorating
- Adaptive capacity is influenced by social inequalities






PHILADELPHIA WATER DEPARTMENT

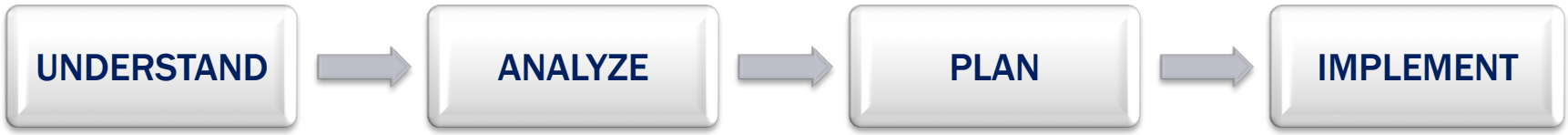
# Our Mission Statement

The primary mission of the Philadelphia Water Department is to *plan for, operate, and maintain both the infrastructure and the organization necessary to purvey high quality drinking water, to provide an adequate and reliable water supply for all household, commercial, and community needs, and to sustain and enhance the region's watersheds and quality of life by managing wastewater and stormwater effectively*.

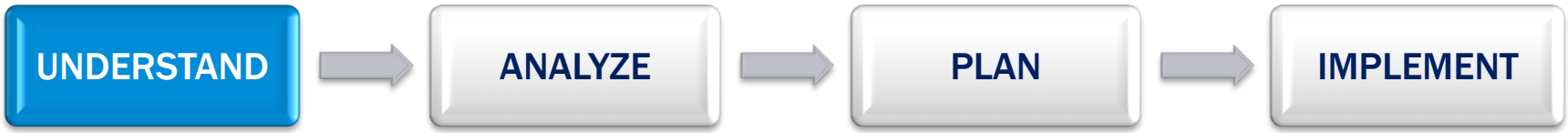
In fulfilling its mission, the utility seeks to be *customer-focused, delivering services in a fair, equitable, and cost-effective manner, with a commitment to public involvement.* Having already served the City and region for nearly two centuries, the utility's vision for the future includes an *active role in the economic development of Greater Philadelphia and a legacy of environmental stewardship.*

# The work we do to achieve our mission is…

- **DRIVEN BY DATA AND BEST AVAILABLE SCIENCE**
  - Understand existing conditions and potential future conditions
- **BASED ON SOPHISTICATED TOOLS**
  - Analyze how our systems and infrastructure perform under a range of conditions
- **FOUNDED ON COMPREHENSIVE, WATERSHED-WIDE PLANNING**
  - Evaluate risks and develop short and long-term strategies to reduce risks
- **IMPLEMENTED USING INNOVATIVE APPROACHES**
  - Adaptive management, policy changes, advanced technologies, bilateral and multilateral networks and partnerships



# Data & Best Available Science



# Global Climate Model Projections for Philadelphia

Precipitation ↑

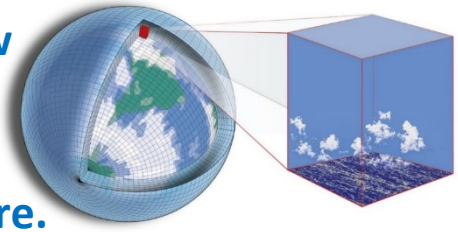
Extreme storm events* ↑

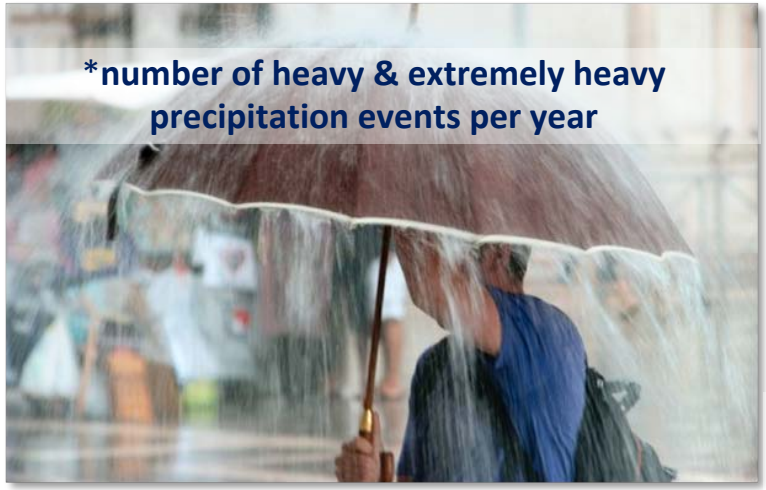
Sea levels ↑

Air temperature ↑

Drought? ↑ ↓ —

**GCM output allows us to understand how meteorological conditions may change in the future.**

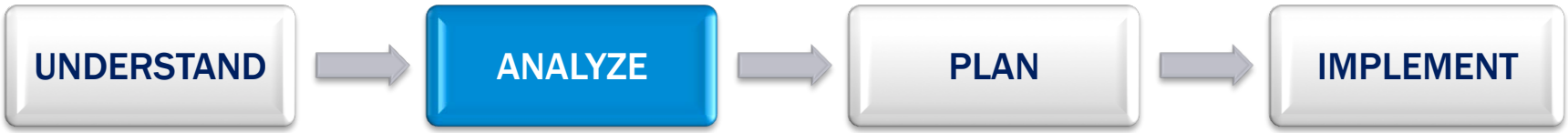




***number of heavy & extremely heavy precipitation events per year**

**Flooding during Hurricane Irene, 2011**
Source: Philadelphia Bicycle Coalition

# Sophisticated Tools



# Examples of Sophisticated Tools

## Hydrologic & Hydraulic Models

- Watershed runoff (SWMM)
- Drainage system performance (SWMM)

## Hydrodynamic and Water Quality Models

- Delaware River and tidal tributaries (EFDC)
- Non-tidal tributaries (EFDC)

## Reservoir Optimization Model

- Source water supply (OASIS)

## Water Pollution Control Plant (WPCP) Modeling

- Hydraulic models (MS Excel, Infoworks)
- Computational Fluid Dynamics (CFD)
- Treatment process (BioWin)

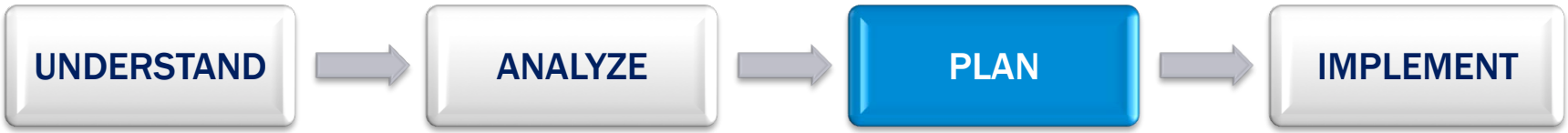
## Warning System Tools

- Early Warning System (drinking water supply)
- Contaminant Warning System (distribution system)
- CSOcast (combined sewer collection system)

## Actionable Climate Science Needed to Simulate Future Conditions

- High resolution precipitation projections
- Sea level rise and storm tide projections
- Temperature projections

# Comprehensive, Watershed-Wide Planning



# Comprehensive, watershed-wide planning

## Modeling supports short and long-term infrastructure planning & analysis of changing regulations

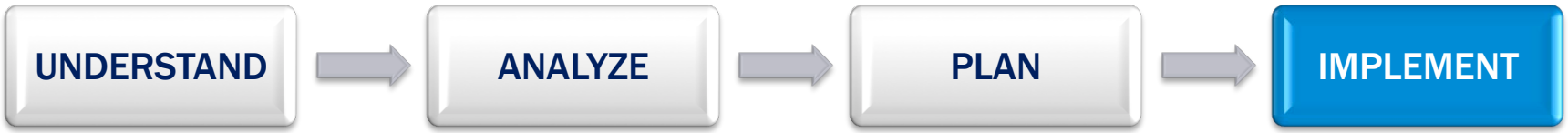
PWD planning initiatives include:

- Long-term infrastructure investment plans
- Water supply planning
- Watershed protection
- Wet weather compliance plans

# Climate-Related Planning Needs

| | | | |
|---|---|---|---|
| **CLIMATE IMPACT** | Increasing precipitation + extreme storms | Sea level rise + extreme storms | Increasing air temperature + sea level rise |
| **LOCAL CONSEQUENCE** | More runoff, higher peak intensities | Higher tide and storm surge elevations | Increasing source water temperatures, potentially more drought |
| **MANAGEMENT CHALLEGE** | Performance of drainage systems and green stormwater infrastructure | Flooding of major assets and facilities | Finished water quality impacts and salt line migration |
| **PWD TECHNICAL RISK ASSESSMENT** | **Precipitation Analysis** | **Inundation Analysis** | **Drinking Water Supply Analysis** |

# Innovative Approaches



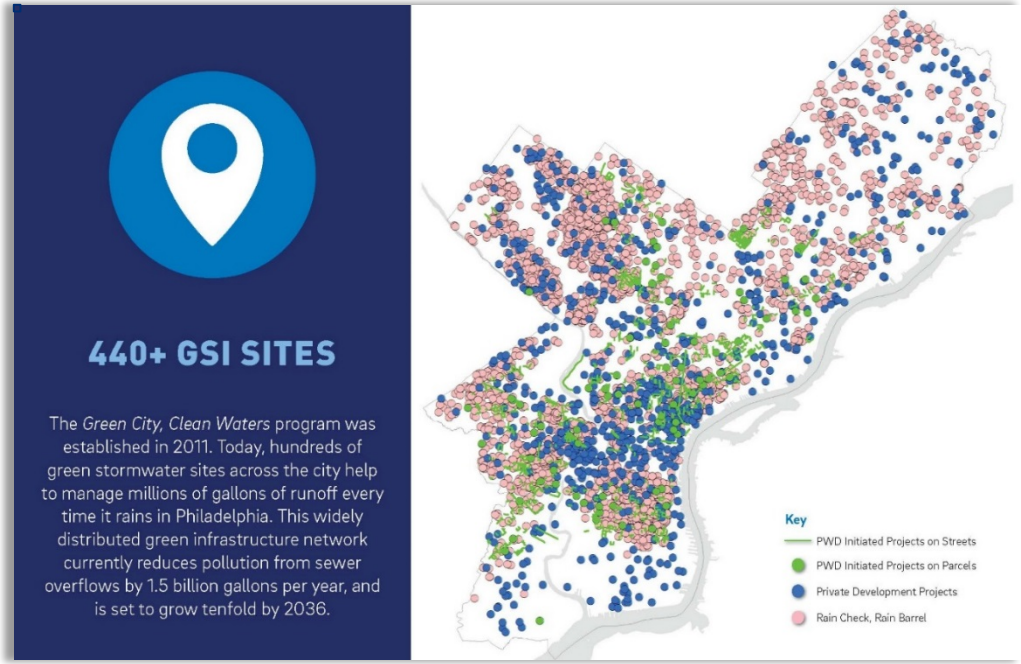
# Innovative Approaches

*As a leader among water, wastewater and stormwater utilities, PWD employs innovative technologies, leading research and adaptive management strategies to ensure high levels of safety and service. –PWD Statement on Climate Change*

- Adaptive Management: Green Stormwater Infrastructure

- Policy Changes:
  - Stormwater Development Regulations
  - Climate Resiliency Planning/Design Guidelines *(in development)*

- Partnerships: Water Utility Climate Alliance (WUCA)






PHILADELPHIA WATER DEPARTMENT

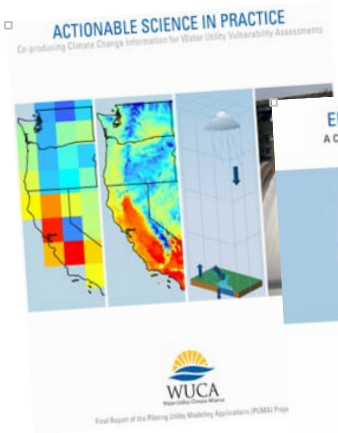
# Water Utility Climate Alliance




PHILADELPHIA WATER DEPARTMENT

# Seeking WUCA Input on…

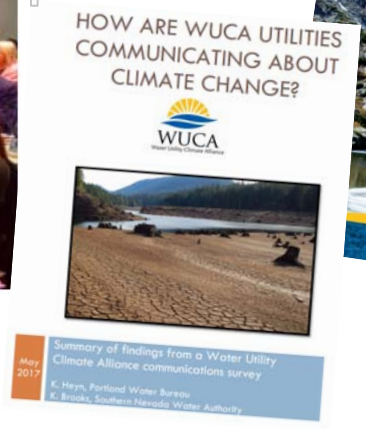
- State of the science (sea level rise and temperature)
- Planning under deep uncertainty
- Adaptation best practices (urban flooding)
- Climate change communications
- Federal/national adaptation efforts and assessments



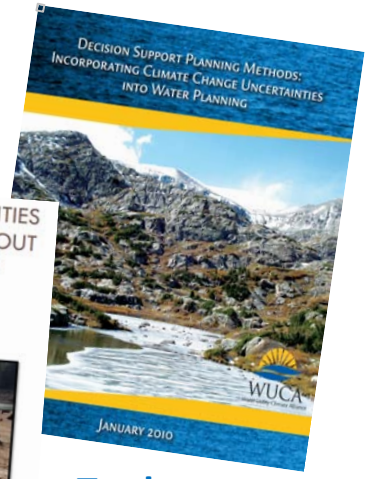

Research


Case Studies

Trainings




Best Practices




Tools



PHILADELPHIA WATER DEPARTMENT

# Thank You!

**Marc Cammarata**
**marc.cammarata@phila.gov**

PHILADELPHIA WATER DEPARTMENT



PHILADELPHIA WATER DEPARTMENT