Wastewater Resource Recovery in NYC

Virtual Wastewater 101 Session
July 26, 2022

Pam Elardo, P.E.
Deputy Commissioner
NYC DEP Bureau of Wastewater Treatment

NYC Environmental Protection

Agenda

- Welcome & Introductions
- About DEP
  - History of Wastewater Treatment in NYC
  - NYC Wastewater Treatment System today
  - NYC Water Quality
- Wastewater Treatment Process Primer
- Resource Recovery Goals and the Circular Economy
- Riker's Island Consolidation Opportunity
- Discussion / Q&A

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About DEP

Environmental
Protection

About DEP

The New York City Department of Environmental Protection (DEP) is the largest combined water and wastewater utility in the United States, with nearly 6,000 employees and an annual budget of more than $5 billion.

WATER SUPPLY

- Deliver nearly 1 billion gallons of water to 9 million New Yorkers every day and maintain 7,000 miles of water mains
- Protect approximately 2,000 square miles of watershed, including 19 reservoirs and three controlled lakes

WASTEWATER TREATMENT

- Treat almost 1.3 billion gallons of wastewater each day
- Operate and maintain 14 WRRFs, 96 pumping stations, and over 7,500 miles of sewers

AIR, NOISE, AND HAZARDOUS WASTE

- Enforce the NYC Air Pollution Control Code to reduce local emissions, enforce the NYC Noise Code, and regulate hazardous waste

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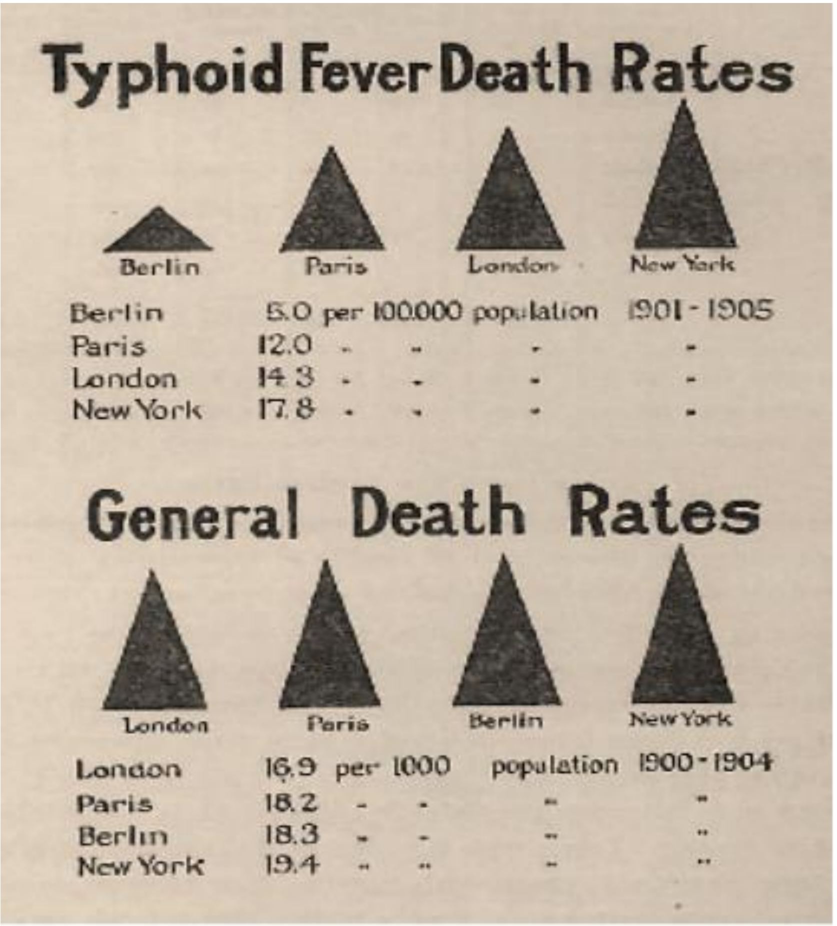
Why do we treat wastewater?

To prevent:

Disease

- Cholera
- Dysentery
- Hepatitis
- Etc.



To protect public health and enhance the environment-

NYC's harbor waters!

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Draining Waste to Waterways

- First NYC sewers were constructed in the mid-1800s to direct wastewater away from densely populated areas
- Early sewers carried untreated wastewater directly to nearby waterways
- Over time, the dumping of polluted water into New York Harbor became noticeable.

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Metropolitan Sewerage Commission

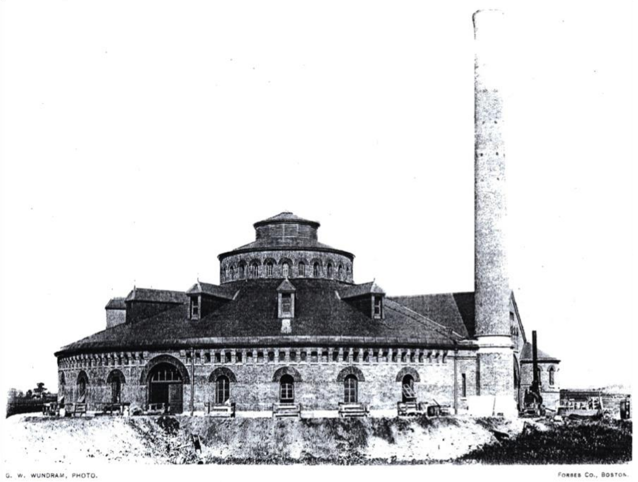
- Formed in 1906
- Began harbor surveys and water quality analysis
    - Performed studies of the tides
    - Studied harbor's natural flushing action
    - Found numerous "dead zones"
- Developed Master Plan for collection and treatment of sewage for NYC
  sewage for NYC

Cleaning Up NYC's Wastewater

- In 1886, NYC began treating wastewater for the very first time at the Coney Island facility in Brooklyn. We later built two additional facilities: 26th Ward (Brooklyn) in 1894, and Jamaica (Queens) in 1903.

- All three treatment facilities were placed in a high priority area, close to NYC's public beaches.

- These early facilities used a basic process to treat the wastewater and help control water pollution.

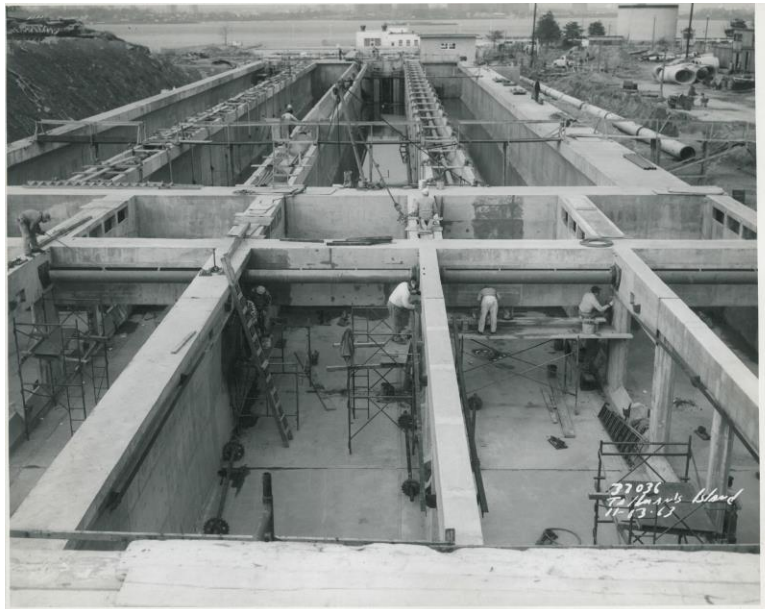


Sewage Treatment Works, 26th Ward.
Exterior View.

DEP's Wastewater Resource Recovery System Today

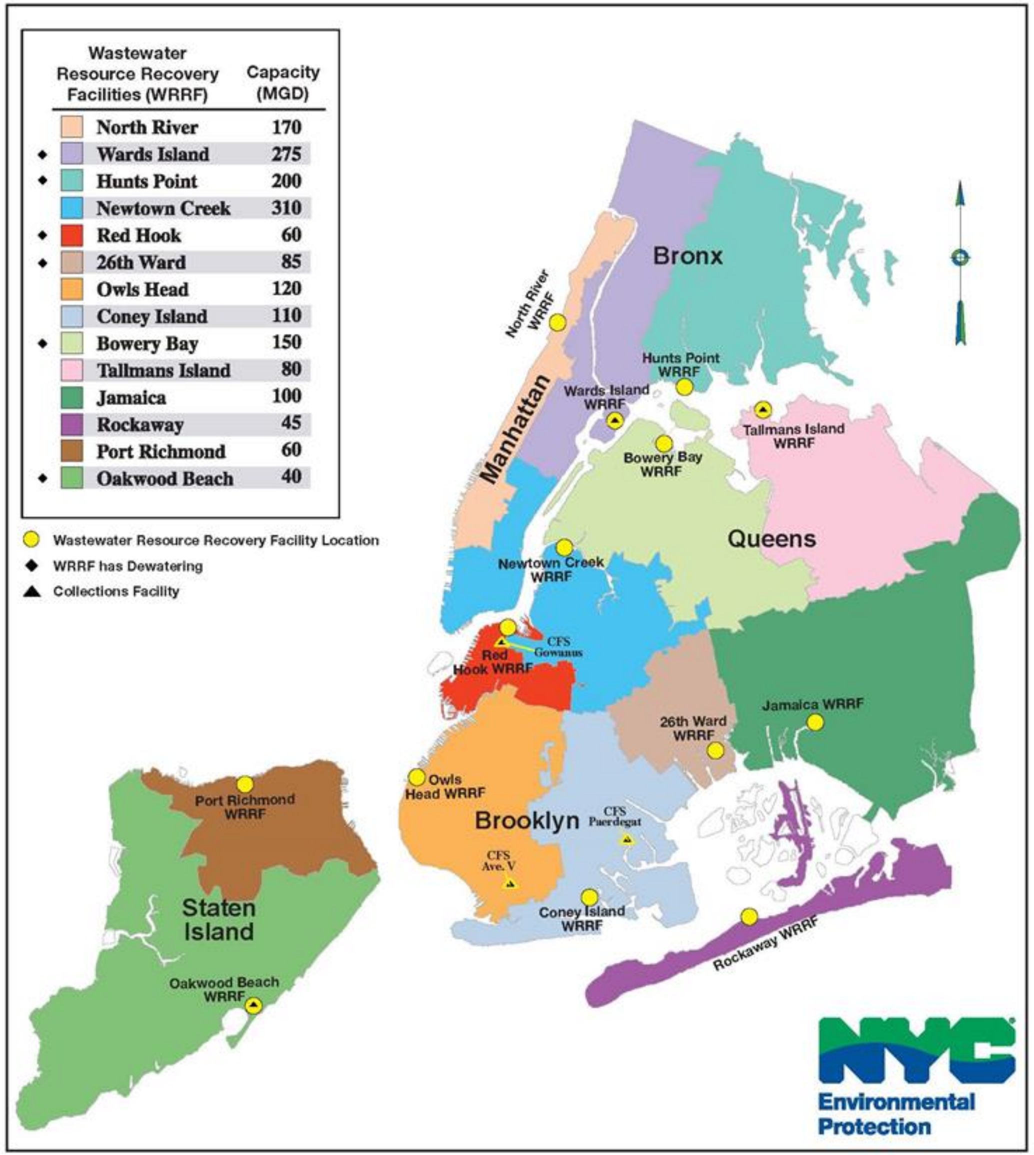
Over the course of the next 100 years, a total of 14 facilities would be built around NYC to properly treat our wastewater.

Today's facilities have a dry weather capacity of 1.8 billion gallons/day.



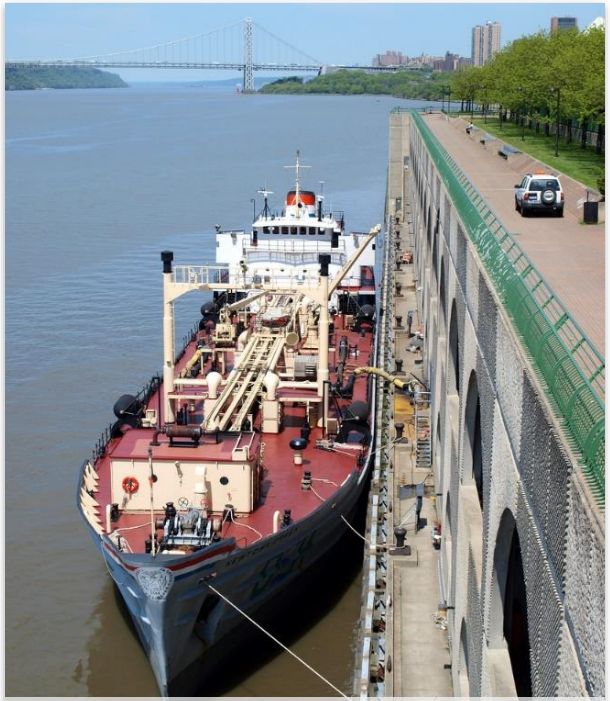
Under construction: workers upgrade settling tanks at the Tallman Island facility in Queens.

NEW YORK CITY DRAINAGE AREAS AND WASTEWATER RESOURCE RECOVERY FACILITIES



NYC Wastewater Treatment

- 14 Wastewater Resource Recovery Facilities (WRRFs)
- 6 Dewatering Facilities
- 96 Pump Stations
- 497 Regulators
- 4 CSO Storage Facilities
- 6 Laboratories
- 17 Inner Harbor Vessels
- ~1800 Staff


Sludge Vessel


Solar Panels at Port Richmond WRRF


Paerdegat Basin CSO Facility


Newtown Creek Digester Eggs

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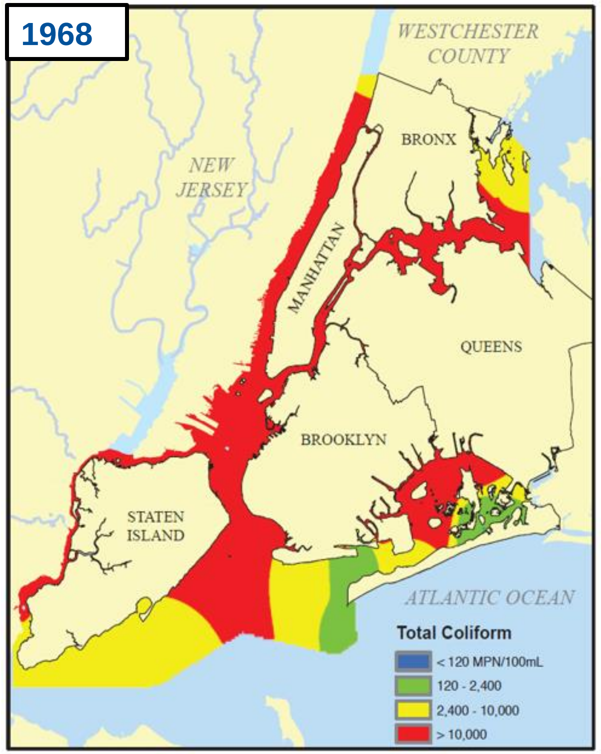
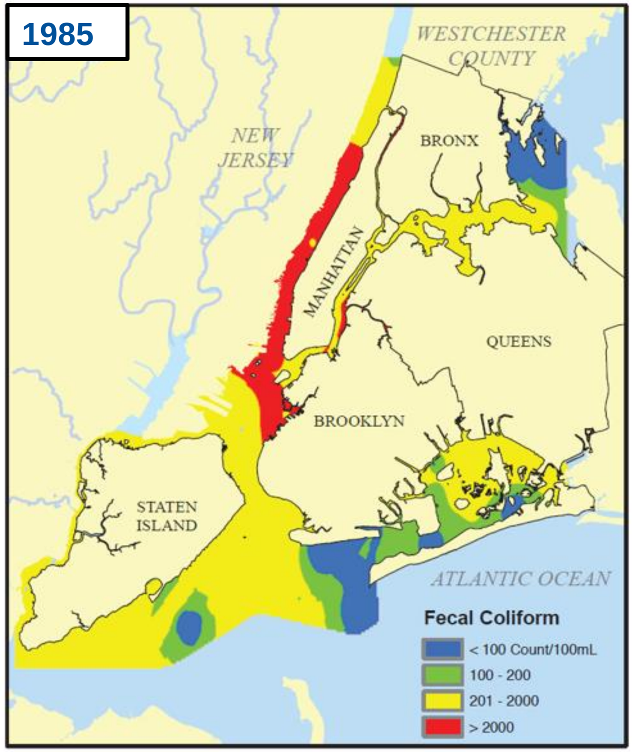
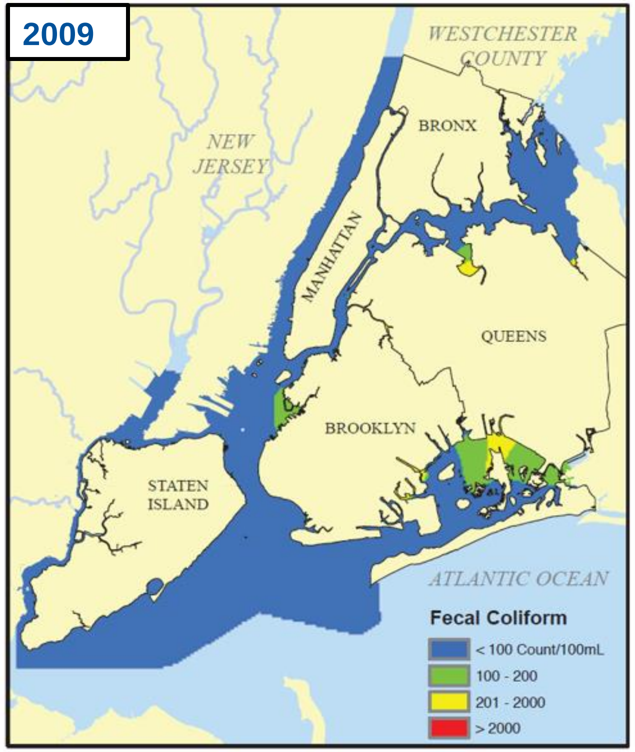
Improving the Quality of Our Waterways







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Wastewater Treatment Process Primer

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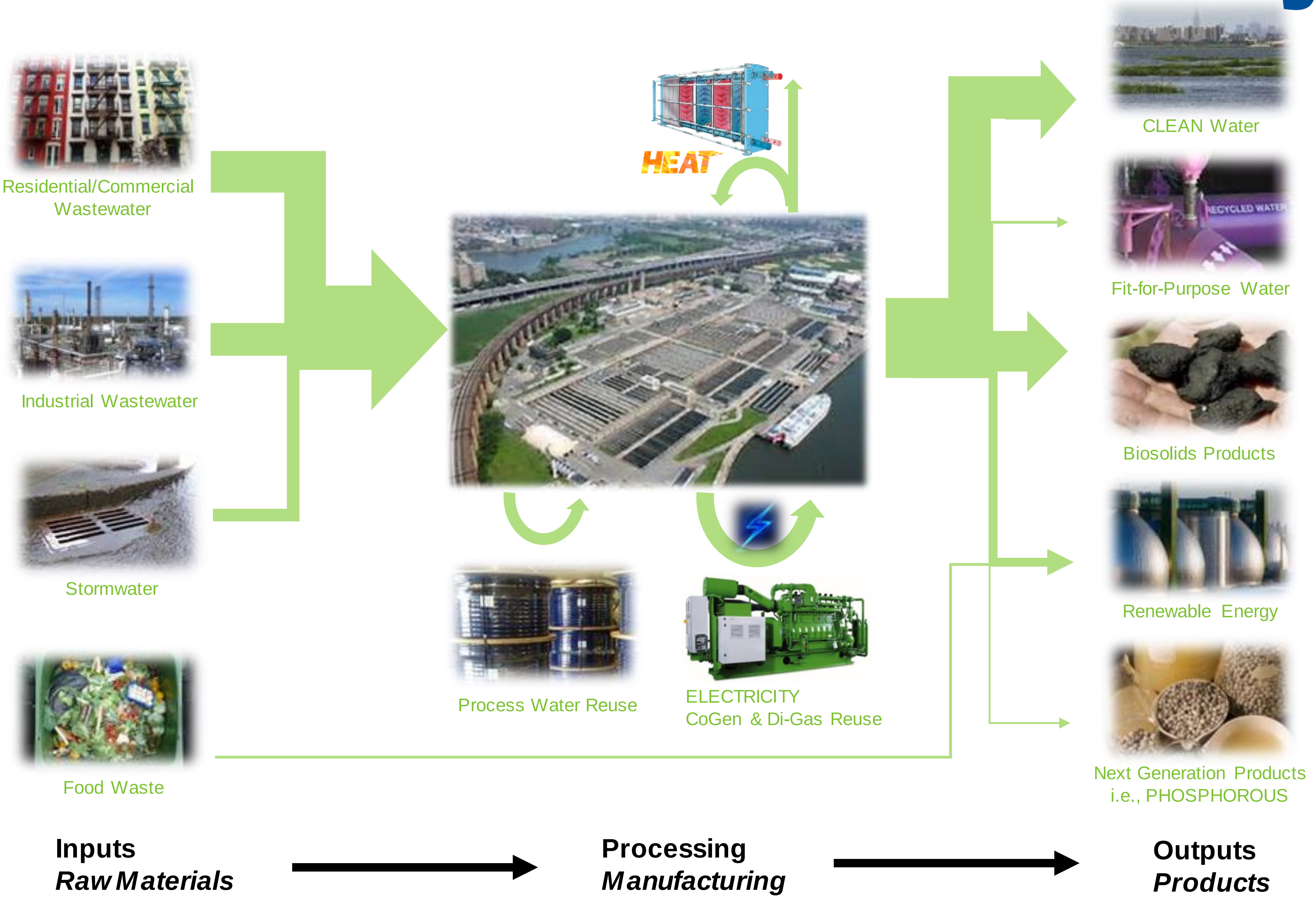
Wastewater Resource Recovery



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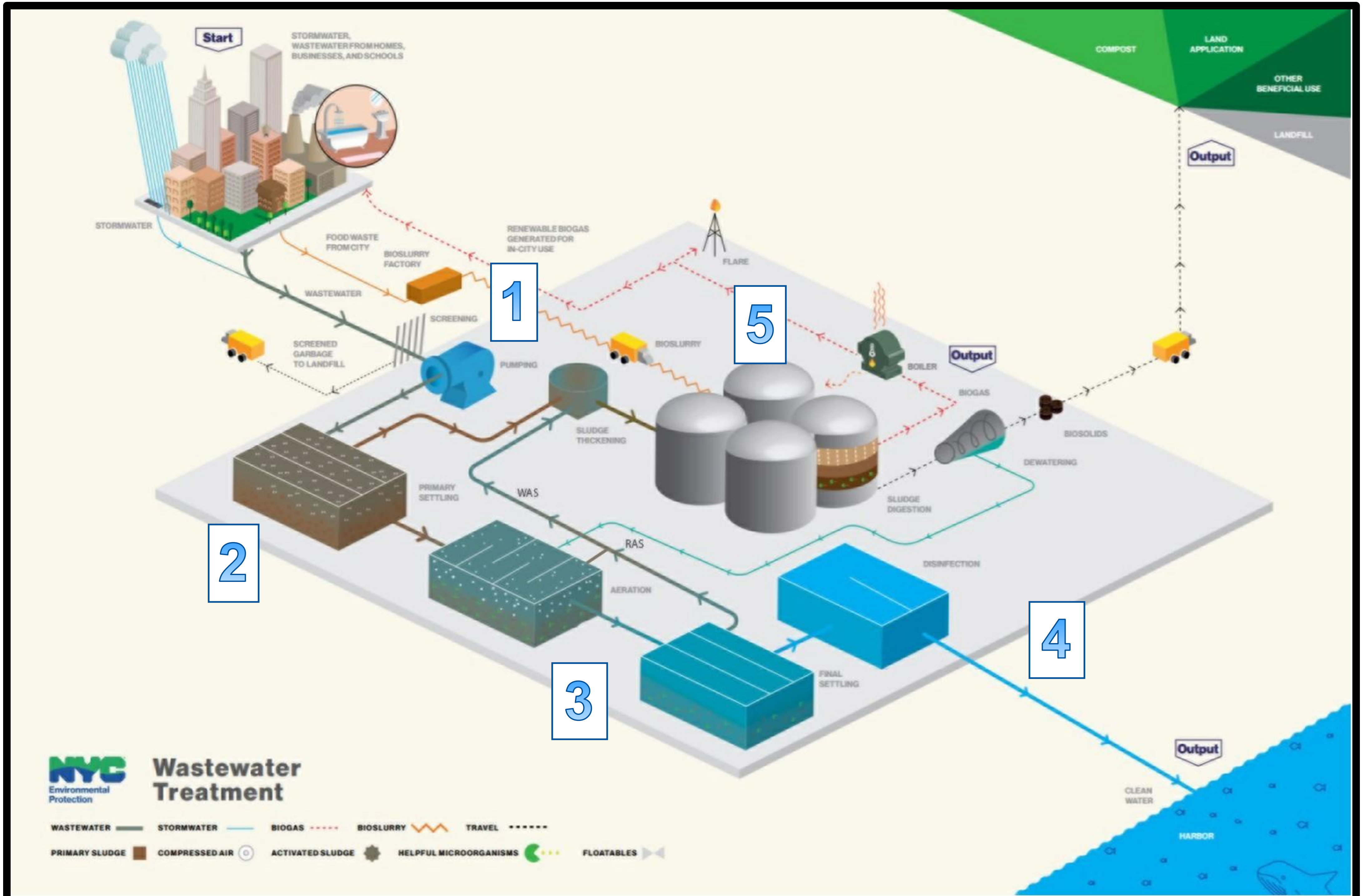

Start
STORMWATER, WASTEWATER FROM HOMES, BUSINESSES, AND SCHOOLS
STORMWATER
FOOD WASTE FROM CITY
BIOSLURRY FACTORY
RENEWABLE BIOGAS GENERATED FOR IN-CITY USE
FLARE
WASTEWATER
SCREENING
SCREENED GARBAGE TO LANDFILL
PUMPING
BIOSLURRY
BOILER
Output
BIOGAS
BIOSOLIDS
DEWATERING
SLUDGE THICKENING
PRIMARY SETTLING
WAS
RAS
SLUDGE DIGESTION
DISINFECTION
AERATION
FINAL SETTLING
COMPOST
LAND APPLICATION
OTHER BENEFICIAL USE
LANDFILL
Output
Output
CLEAN WATER
HARBOR
1
2
3
4
5
NYC Environmental Protection
Wastewater Treatment
WASTEWATER
STORMWATER
BIOGAS
BIOSLURRY
TRAVEL
PRIMARY SLUDGE
COMPRESSED AIR
ACTIVATED SLUDGE
HELPFUL MICROORGANISMS
FLOATABLES

Step 1: Preliminary Treatment

Screening: Wastewater passes through bar screens to remove items that shouldn't be flushed into the sewer as well as leaves, twigs, and litter collected from stormwater. This trash is collected and then trucked to landfills.

Pumping: Wastewater enters each facility at a low elevation, and main sewage pumps are used to allow gravity to facilitate the flow of wastewater through the treatment steps.

Grit removal: Separation technologies using gravity or centrifugal force are used to separate out grit, sand and other heavy debris from the waste stream.

Step 1: Preliminary Treatment Cont.

Trash and household waste products, like wet wipes, can clog sewers and damage pumping equipment, and this is very costly to our ratepayers.

Remember to **only flush the 4 Ps** - **P**ee, **P**oop, **P**uke, and toilet **P**aper!

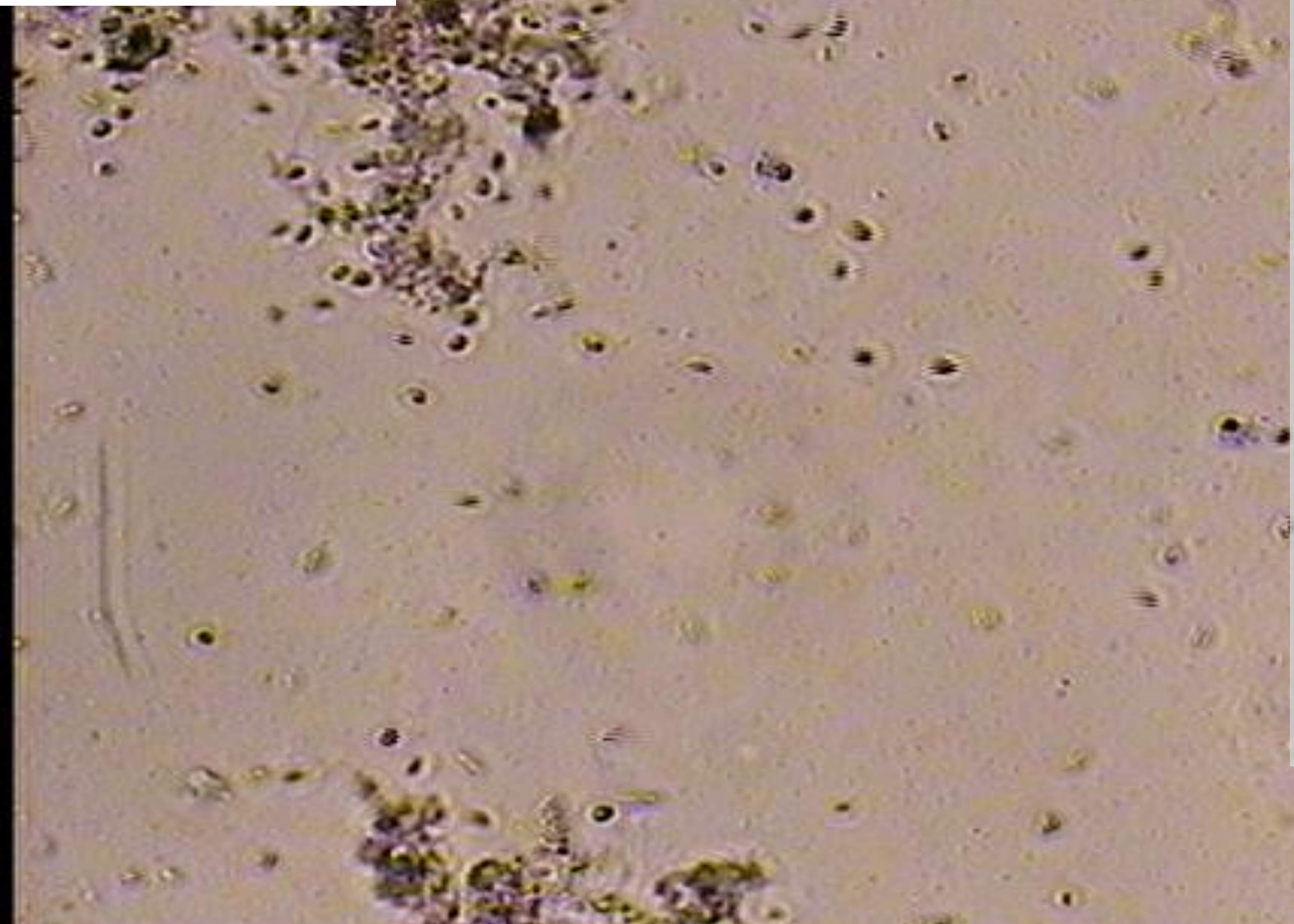
Step 2: Primary Treatment

Next, wastewater enters **primary settling tanks** that create a quiescent slow-moving condition that allows more grit and settleable solids to sink and greases to float. The "floaters" are skimmed off the surface for disposal and the "sinkers" are removed and sent to solids processing.

Step 3: Secondary Treatment

Aeration: In this process we add air and create conditions that enable specific communities of aerobic bacteria, called "activated sludge" that are oxygen-consuming microorganisms, to flourish. These helpful microorganisms consume the organic material in wastewater and continue to grow in size and multiply in number.

Step 3: Secondary Treatment Cont



Final Settling: This stage is another set of settling tanks, but here well-fed microorganisms settle to the bottom of the final settling tanks.

The settled microorganisms at this stage is called "sludge" and a large portion of it is sent back to the aeration basins to maintain the right mix to effectively treat wastewater. The rest is sent to the solids processing step.

Step 4: Disinfection

Finally, we add sodium hypochlorite, basically a high strength household bleach, to disinfect the wastewater and remove any potentially remaining disease-causing pathogens.

Clean water is then safely released to waterways creating a cleaner environment for all.

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Step 5: Solids Processing

Thickening: this step typically uses gravity to get the solids collected in the liquid treatment process prepared for digestion.

Digestion: this process works just like your stomach. Under anaerobic conditions (no oxygen), anaerobic bacteria help break down the incoming organic solids in sludge into methane biogas and an enriched solid product full of nutrients.

The Newtown Creek WRRF has eight unique Digester Eggs, which act like giant stomachs, digesting the sludge for several weeks.

Step 5: Solids Processing

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Dewatering: The final step of the process uses centrifuges for dewatering, which takes turns the solids into a soil-like cake The treated solids are now **biosolids**, a valuable fertilizer product that returns carbon to the soil.

This final dewatering step takes place at six of our 14 WRRFs. This means eight of our facilities use either pipelines or marine vessels (seen here) called "sludge boats" to transport the treated solids for dewatering.

Biosolids after the dewatering process

Wastewater Resource Recovery Goals and the Circular Economy

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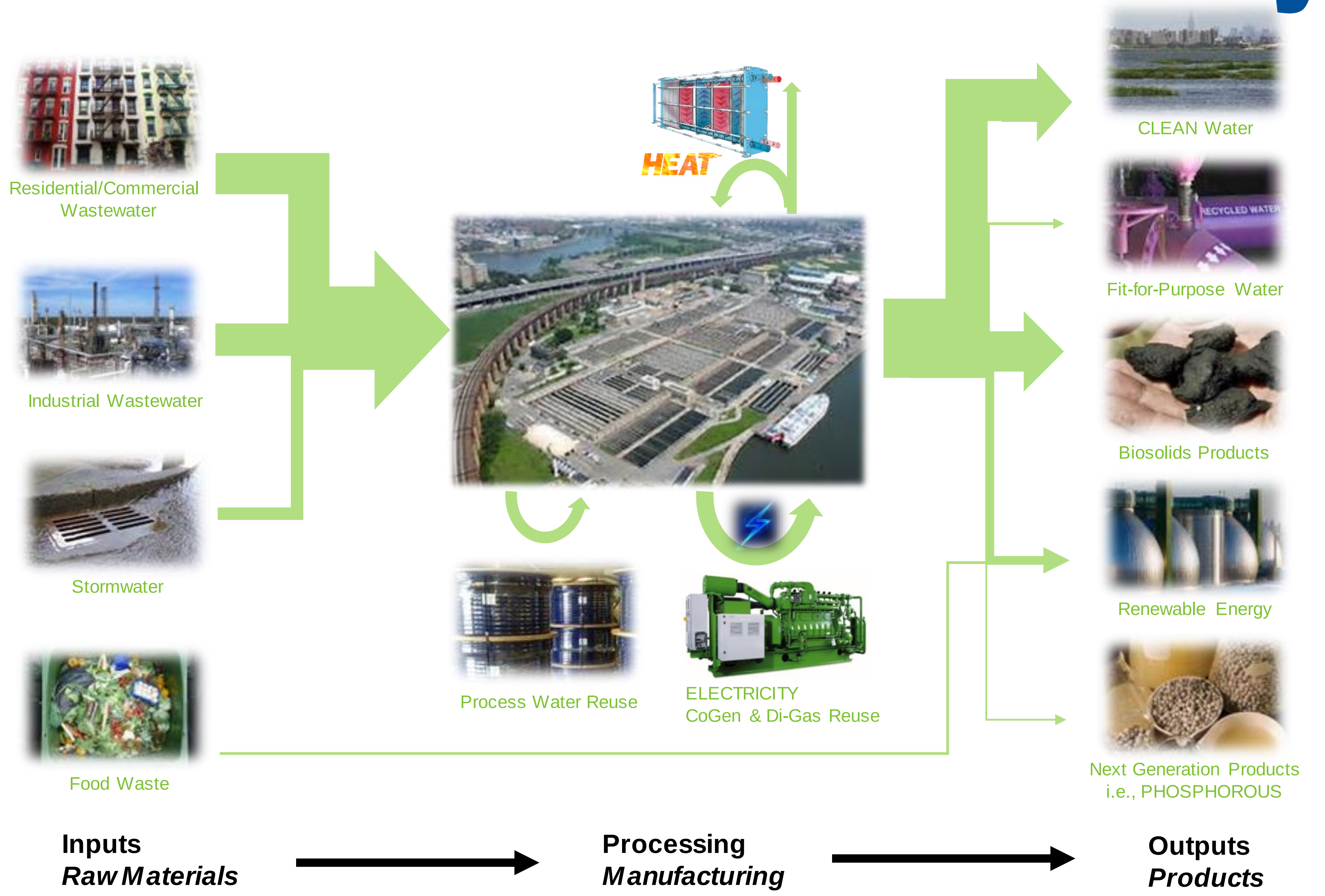
Wastewater Resource Recovery



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Food Waste Co-digestion

1. Source-separated organics are collected by DSNY and commercial haulers
2. Waste Management pre-processes food waste into a slurry off-site
3. Slurry is delivered to DEP's digesters at a feed-in station

Citywide Sustainability Goals

- **80% reduction in GHG emissions, and achieve carbon neutrality by 2050**
  - 40% reduction in GHG emissions by 2025 & 50% by 2030
  - 20% reduction in energy usage by 2025
- **Achieve energy-neutral wastewater treatment plants by 2050**
  - Increase energy efficiency, biogas & renewables production
  - maximize beneficial use
  - eliminate fugitive biogas
  - 100% biosolids beneficial use
  - Food waste to digesters

Strategies for Energy-Neutral WRRFs

12 MW Cogen at NR

Biogas Production at 14 WRRF for beneficial use

Micro wind turbines

1.2 MW Solar PV at PR
5 MW Solar PV at WI

Gas to Grid

Energy Efficient Processes and equipment

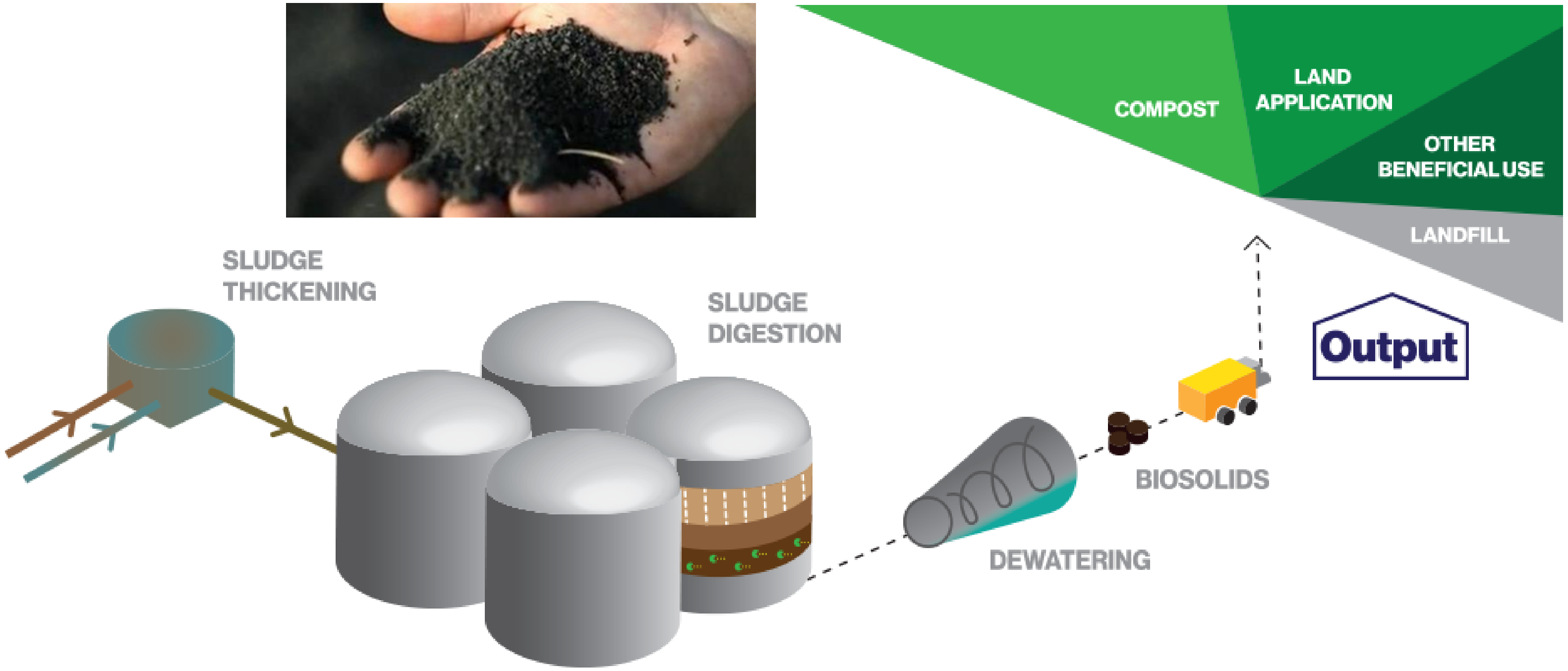
Innovative Renewables

Food Waste Codigestion

https://www.youtube.com/watch?v=TZ_VMXVgSTA

Beneficial Reuse of Biosolids

- Biosolids are a byproduct of anaerobic digestion
  - Valuable nutrient resource
  - Carbon sequestration
  - Carbon offsetting
- Not 100% destroyed by digestion
  - Residual energy/organic content
  - Fugitive methane if landfilled



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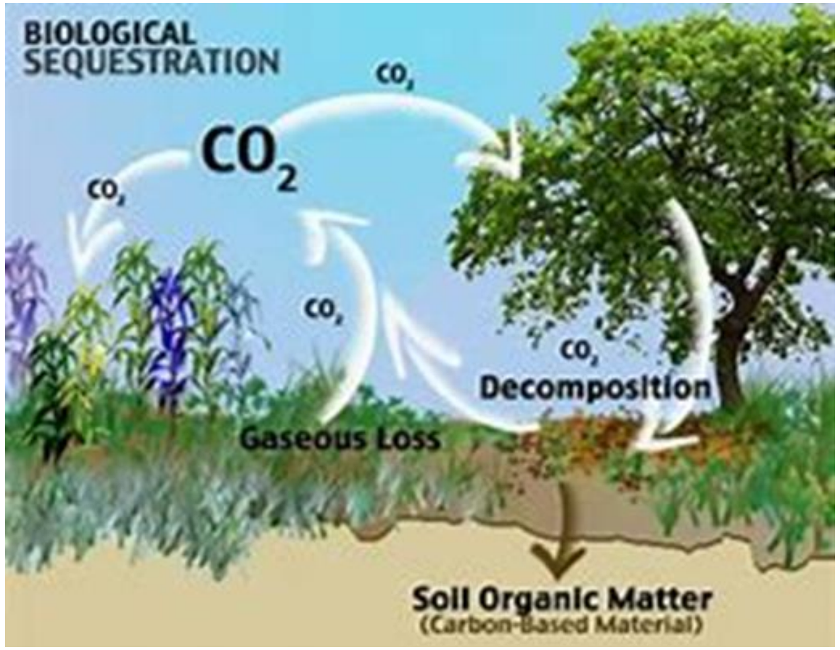
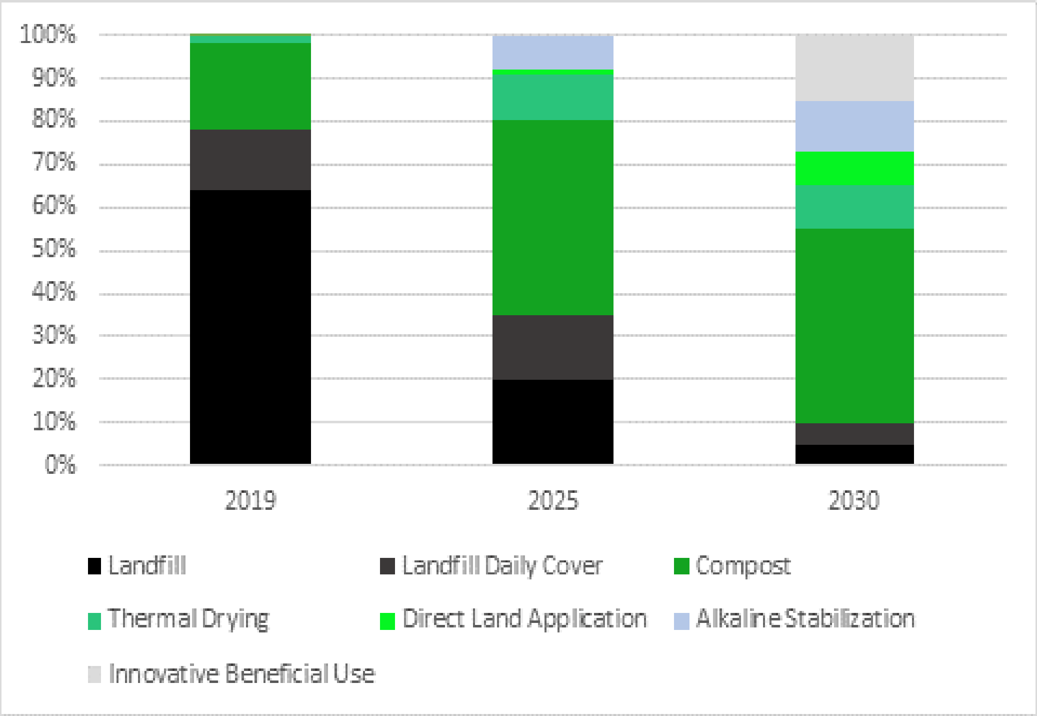
Biosolids for Carbon Neutrality

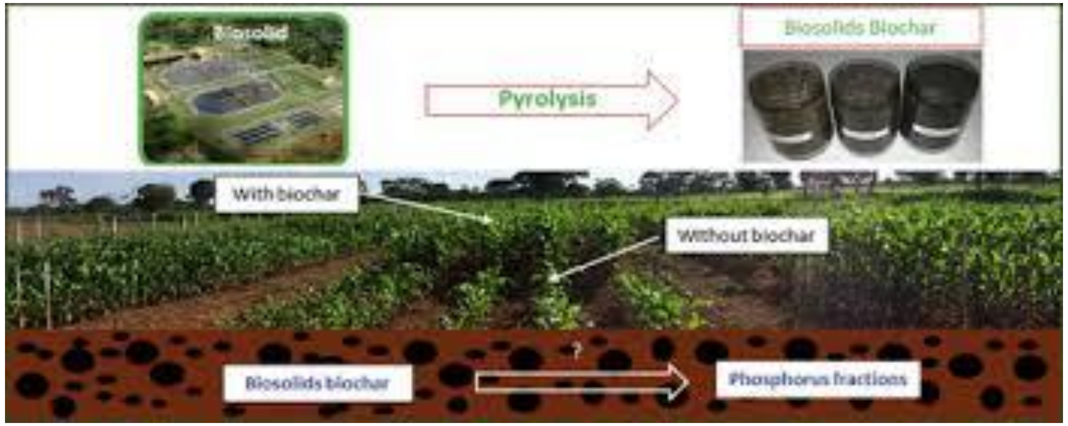
Developing a comprehensive biosolids production and management plan, requiring beneficial use and providing carbon sequestration benefits.



Projected Strategic Contracting Plan to Achieve Non-landfill Use



Beneficial Reuse of Biosolids



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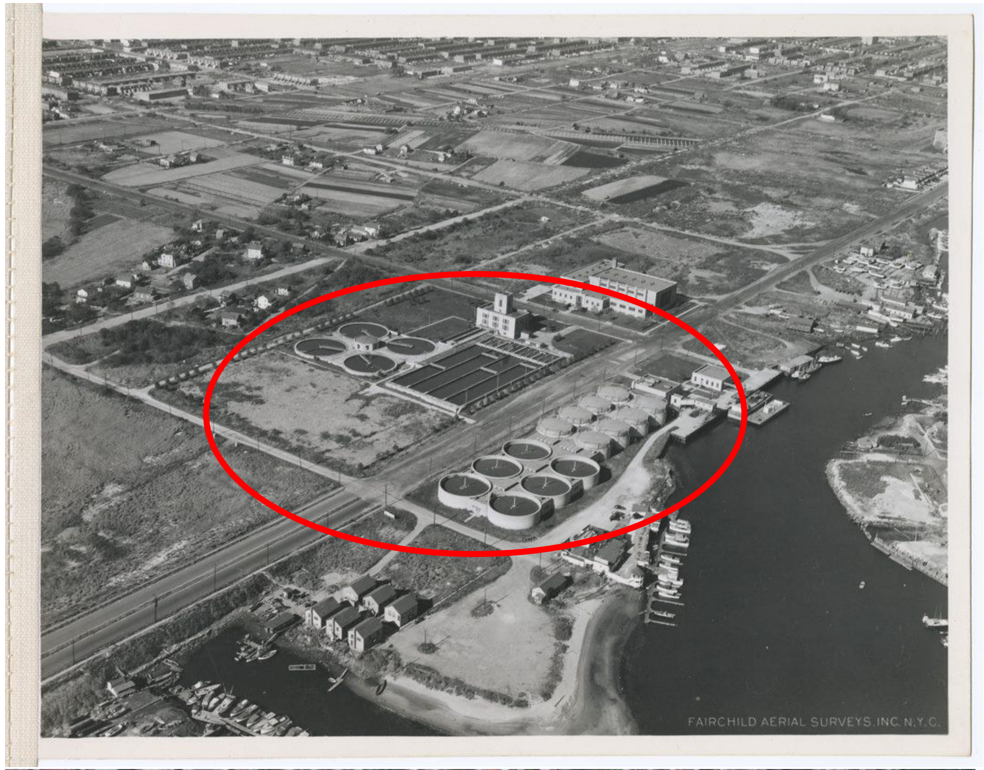
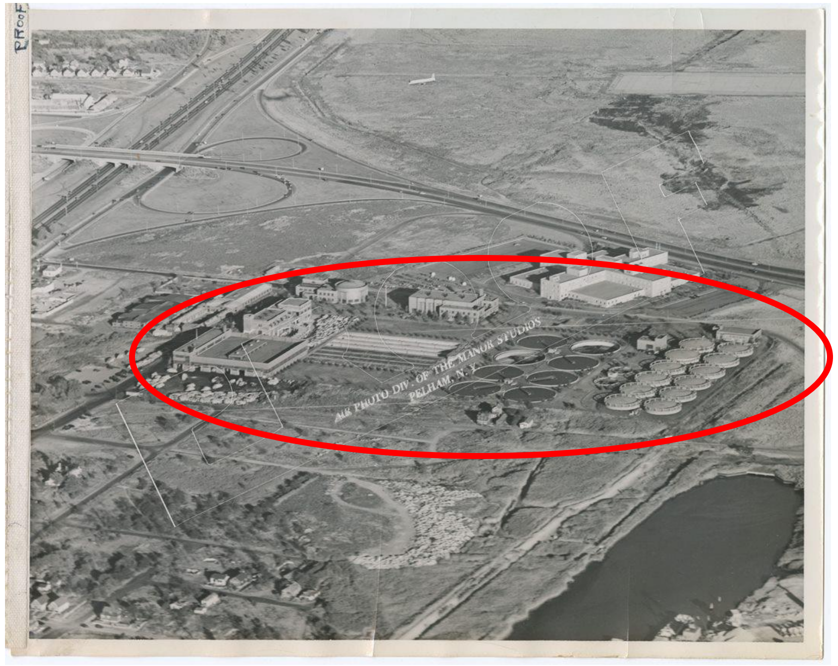
Then & Now



Coney Island 1951

Coney Island 2022



Jamaica 1952

Jamaica 2022

Riker’s Island Consolidation Opportunity

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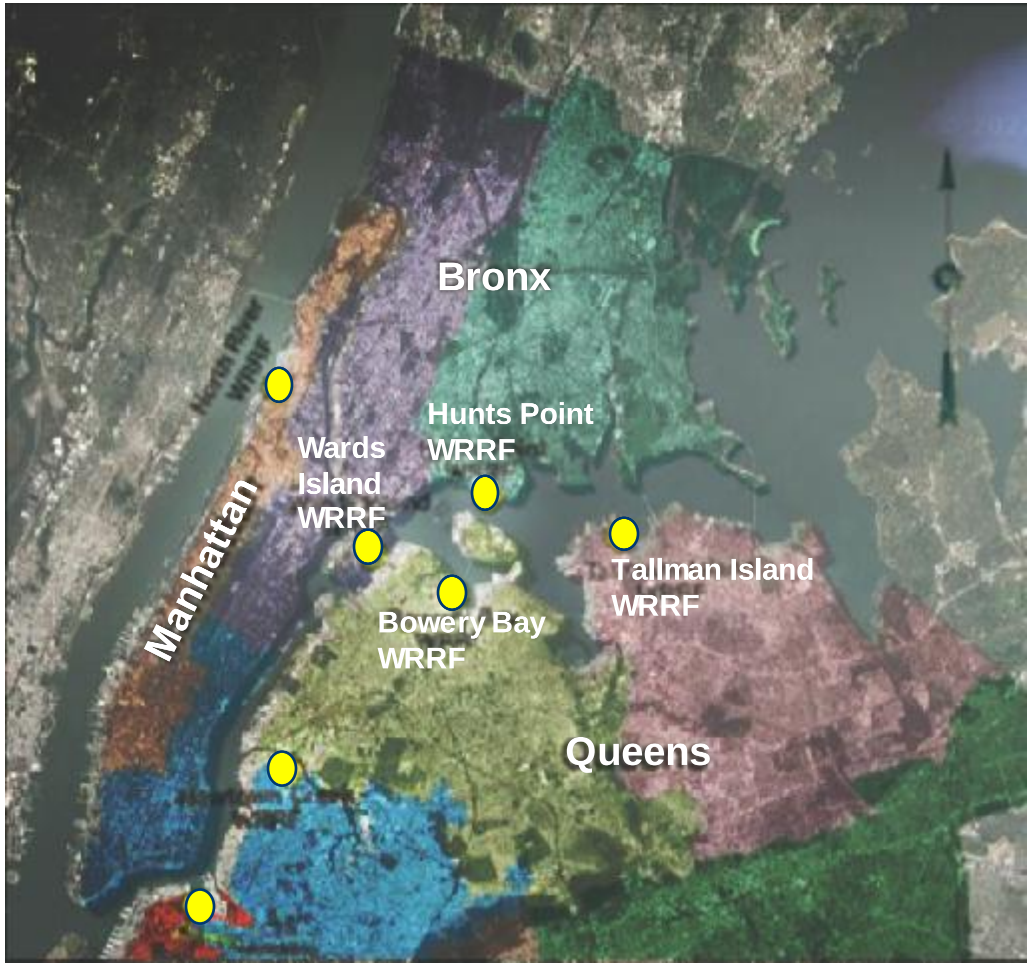
Study Area



Hunt's Point WRRF
- Population Served: 684,569
- Drainage Area: 16,664 acres

Ward's Island WRRF
- Population Served: 1,061,558
- Drainage Area: 12,056 acres

Tallman Island WRRF
- Population Served: 410,812
- Drainage Area: 16,860 acres

Bowery Bay WRRF
- Population Served: 848,328
- Drainage Area: 15,203 acres

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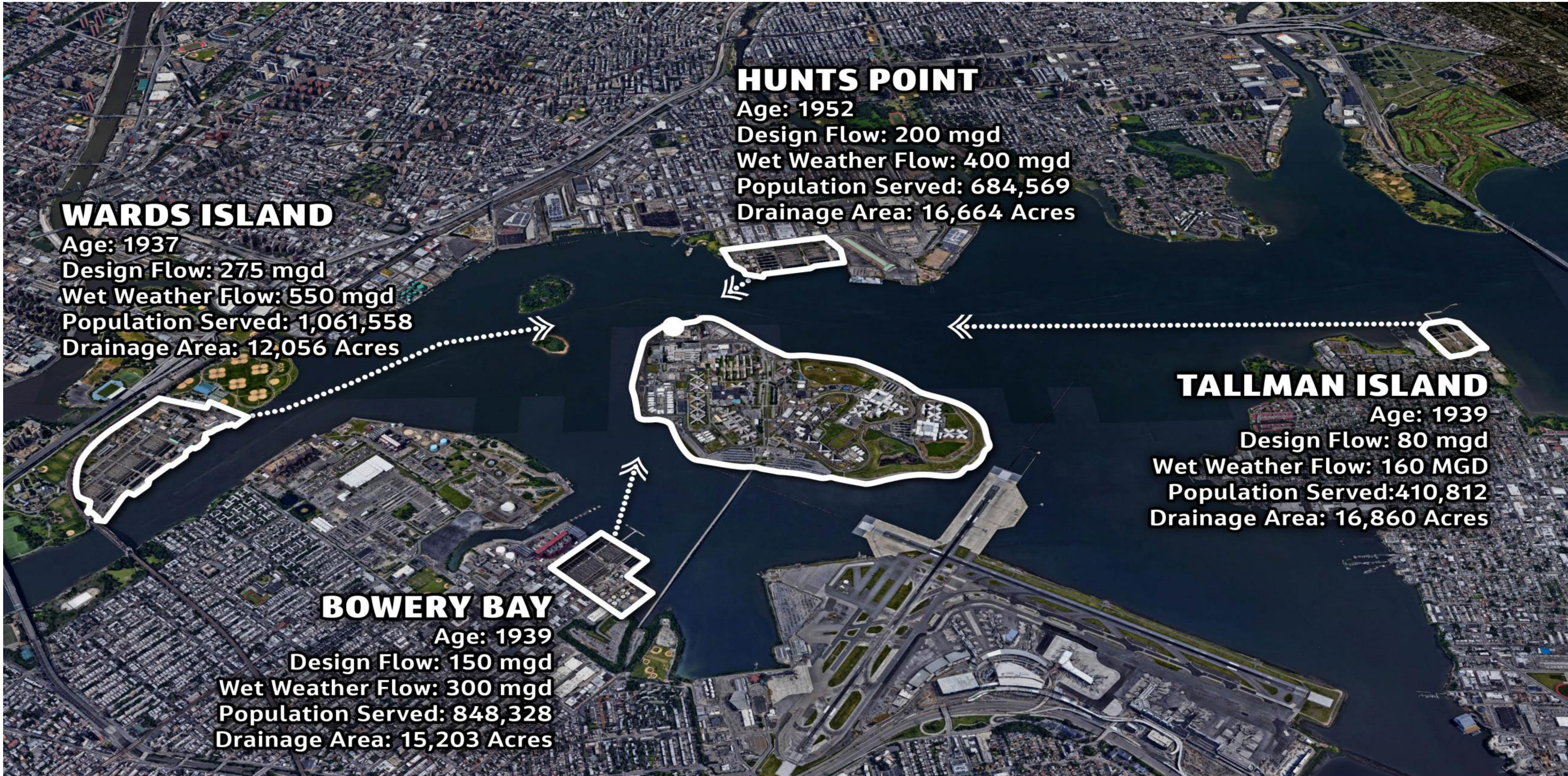
Consolidation



Rikers WRRF Consolidation Feasibility Study

Local Law 31 of 2021 requires DEP to conduct a study to assess the feasibility of constructing a wastewater treatment facility on Rikers Island

Project Tasks

- Project Management
- Site Assessment, Baseline Information, Studies, Surveys
- Establish Feasibility Study Guiding Principles
- Test Case Programs
- Conceptual Designs
- Environmental Review and Permitting
- Feasibility Study
- Public Outreach

Important Dates

- Consultant (Jacobs) Notice to Proceed April 11, 2022
- Anticipated Feasibility Study completion October 2023
- Local Law Study Due Date March 28, 2024

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Discussion/ Q&A Session

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