

CONSTRUCTED WETLANDS: An Overview of the Technology



Presentation For:

**Peconic River Remedial Alternatives
Workshop**

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Environmental Services and Management

What Is A Constructed Wetland?

Definition:

A designed and man-made complex of:

- ➔ Saturated Substrates
- ➔ Emergent and Submergent Vegetation
- ➔ Animal Life
- ➔ Water That Simulates Natural Wetlands



Present Treatment Applications

- ➔ **Municipal and Industrial Wastewaters**
- ➔ **Acid Mine Drainage**
- ➔ **Landfill Leachates**
- ➔ **Agricultural Runoff**
- ➔ **Urban Stormwater**





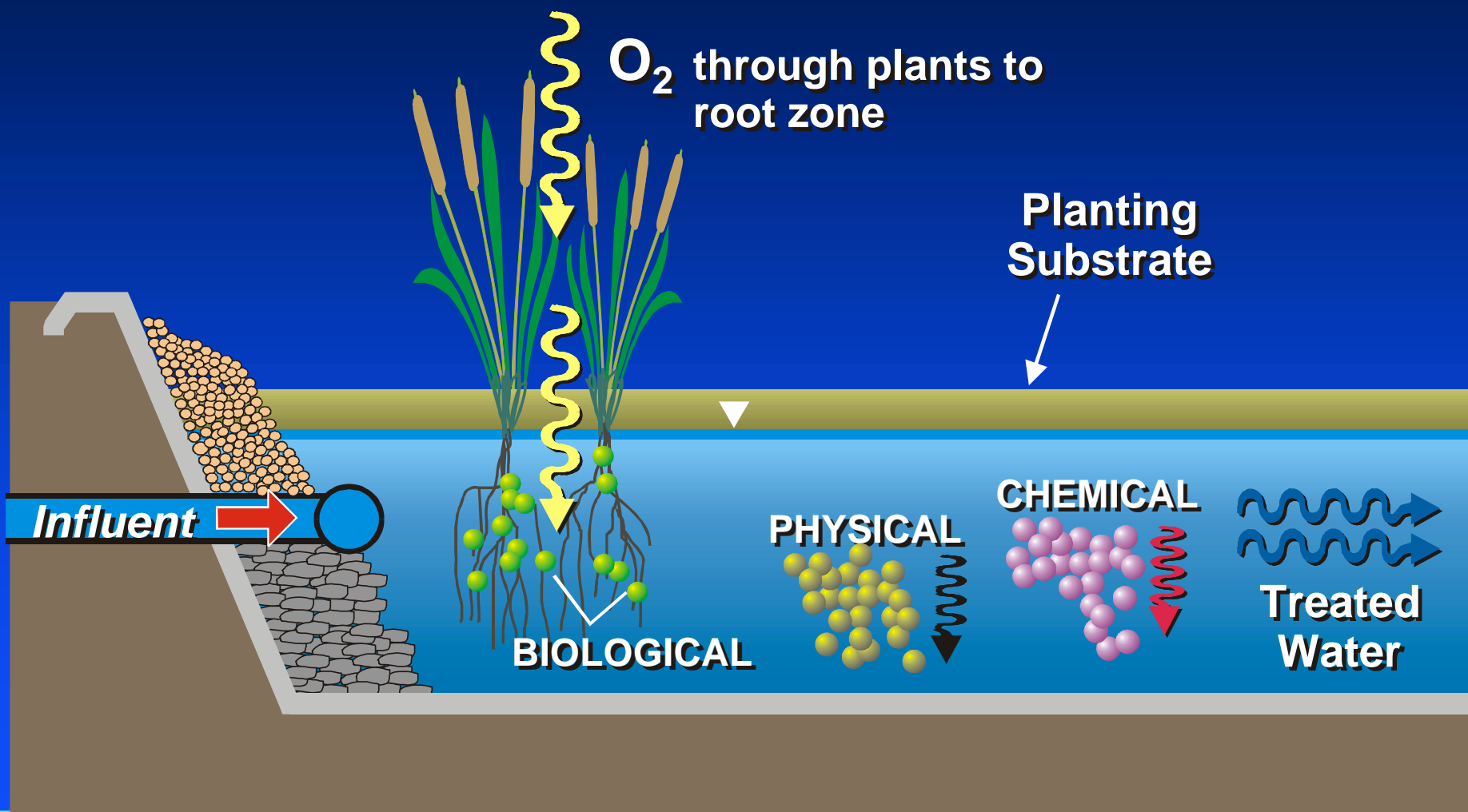








Contaminant Removal Mechanisms: *Multiple Processes At Work*



Specific Removal Processes

PHYSICAL

Sedimentation

Filtration

Adsorption

Volatilization

CHEMICAL

Precipitation

Adsorption

Hydrolysis

Oxidation/Reduction

BIOLOGICAL

Bacterial Metabolism

Plant Metabolism

Plant Absorption

Natural Die-Off

Types of Contaminants Removed

- *Organic Substances*
- *Nutrients*
- *Heavy Metals*
- *Suspended and Colloidal Materials*
- *Pathogens*

Types of Constructed Wetlands



Free Water Surface Systems

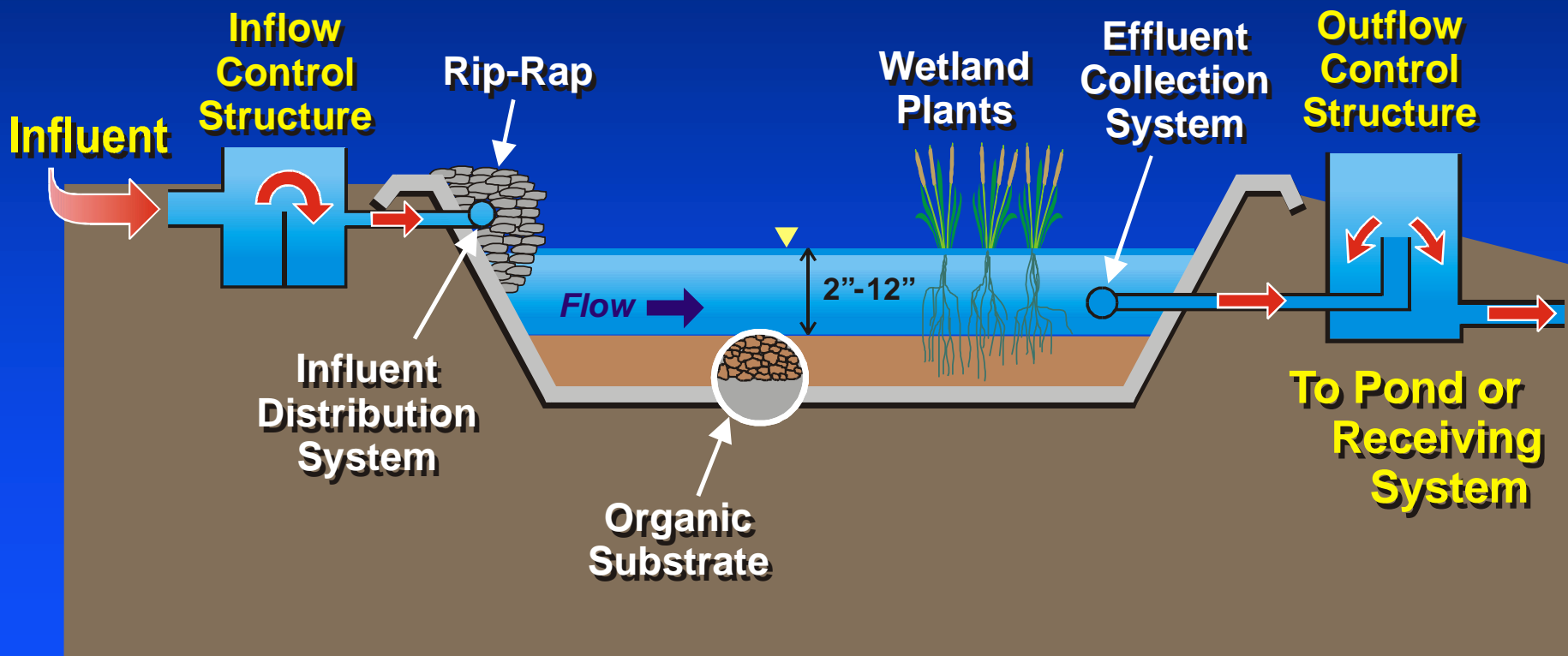
Marsh - Pond - Meadow Sequence



Subsurface Flow Systems

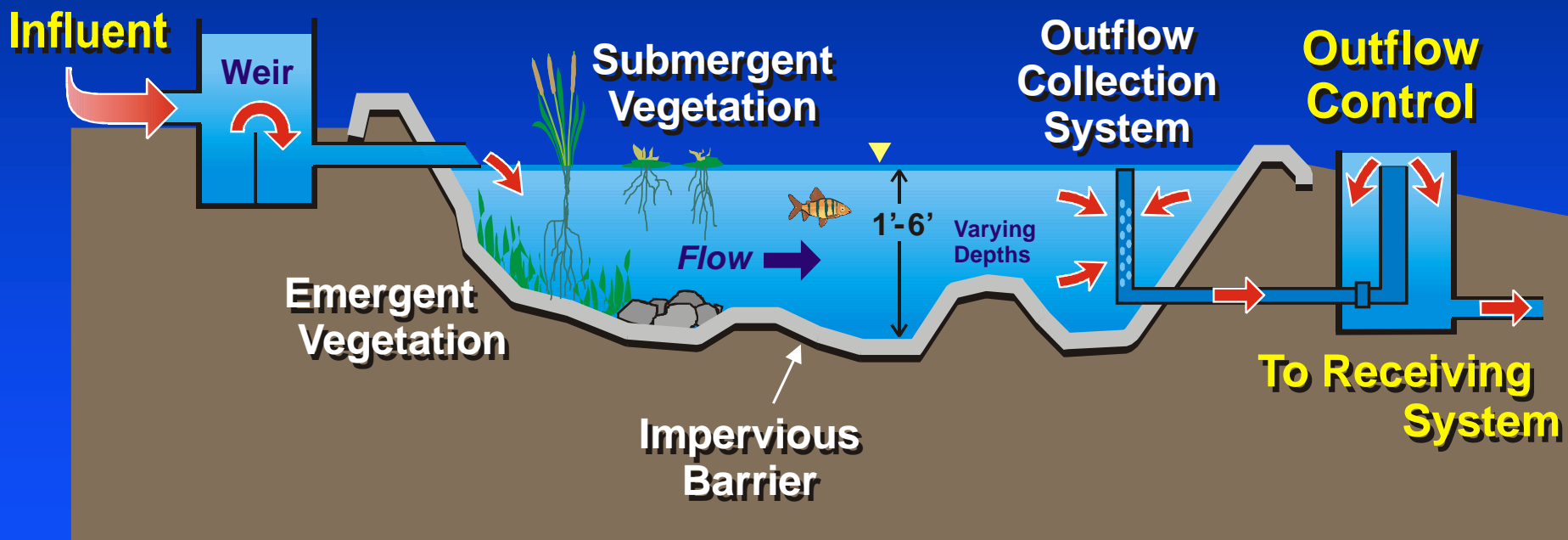
Engineered cells containing gravel, soil and/or sand treatment media

Free Water Surface Wetland: *Marsh Component*





Free Water Surface Wetland: *Open Water Pond*

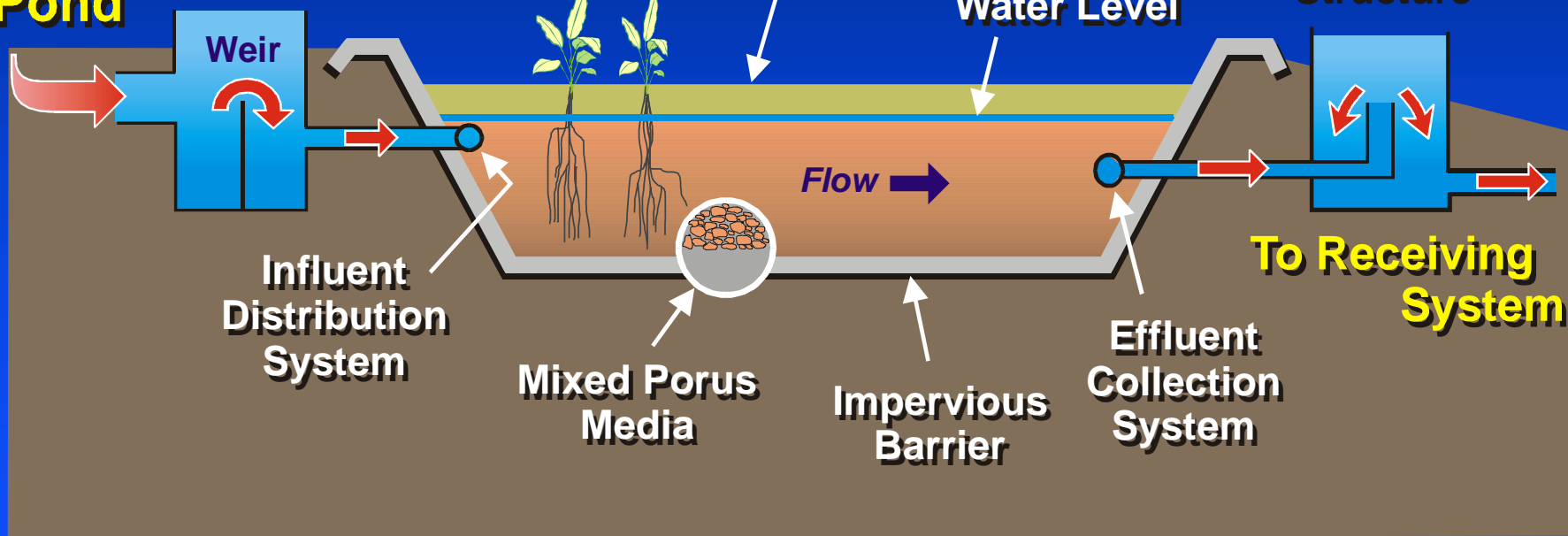




Free Water Surface Wetland: Meadow

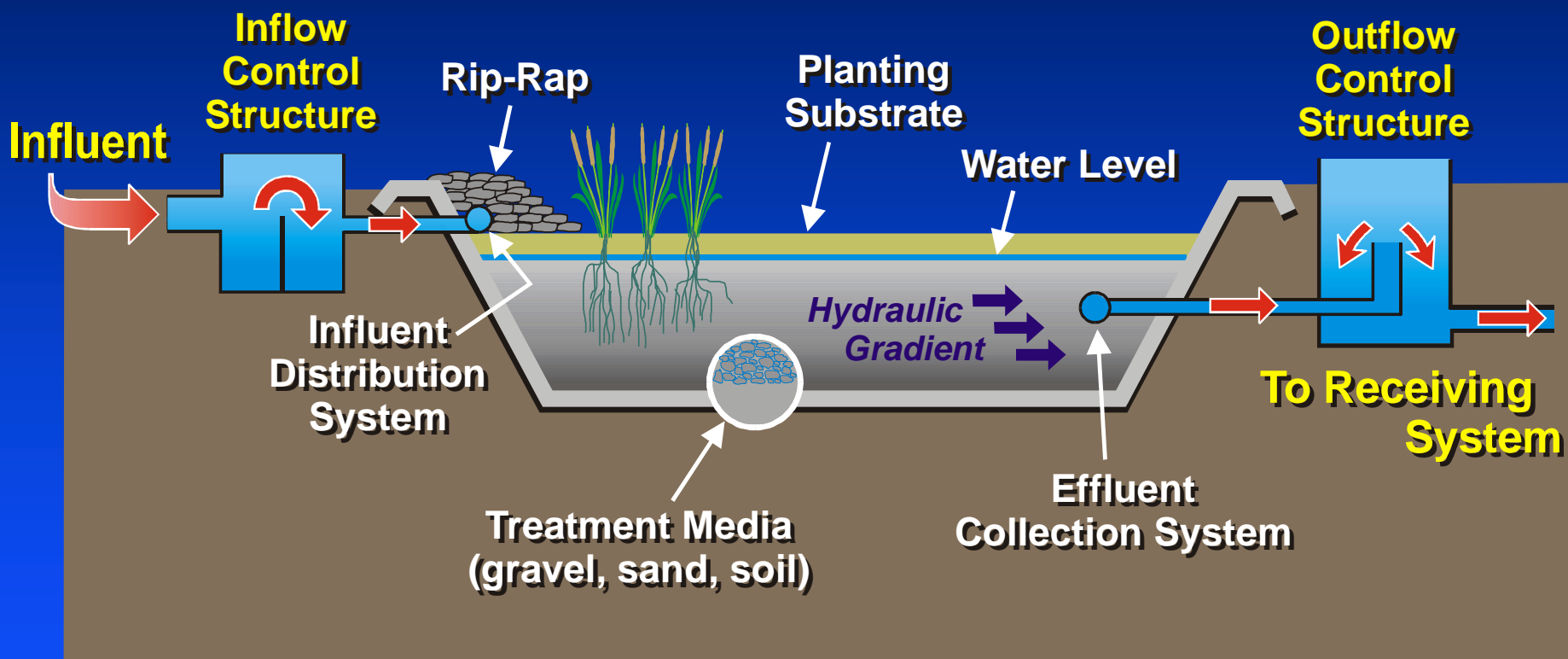


Influent from Pond





Subsurface Flow Systems







CASE STUDIES

BASF, Williamsburg, Virginia

City of Glen Cove, New York

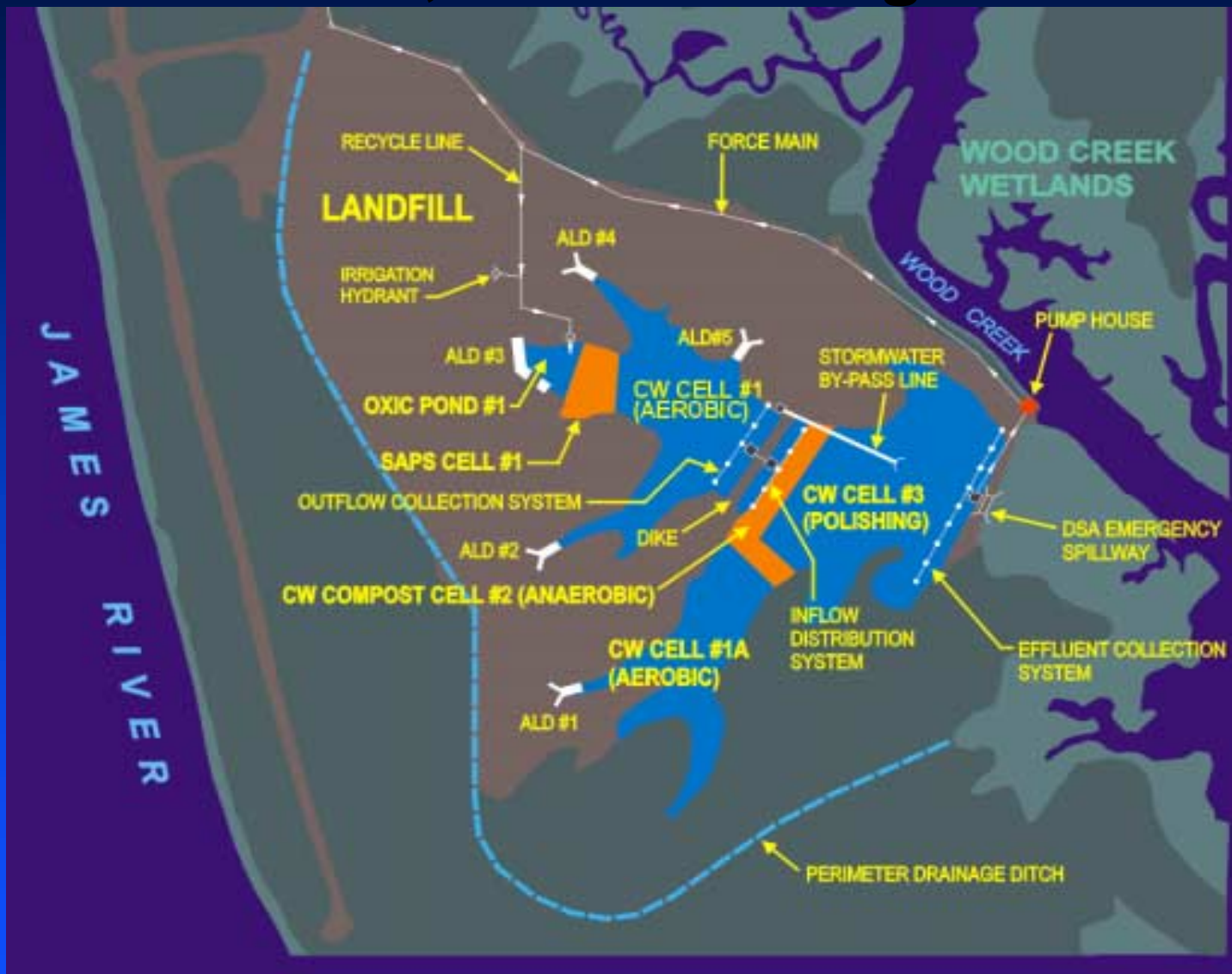
Designed and Currently Operate BASF, Williamsburg CW

- COC's: Zinc, Iron, and Acidity
- Typical Zinc influent: 800 mg/L
- Typical Zinc effluent: 0.10 to 1.5 mg/L
- Treatment Target - 2.0 mg/L
- Performance to Date: $\geq 99.9\%$
- Flow range: 125,000 to 150,000 gpd
- Completed construction January, 1999

BASF, Williamsburg Pre-Construction Photo



BASF, Williamsburg CW Site Plan



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



BASF, Williamsburg



City of Glen Cove, New York Stormwater Treatment Constructed Wetlands

COCs: TSS, Nitrogen, Lead, and Copper

Typical Nitrogen Influent: 4.24 mg/l

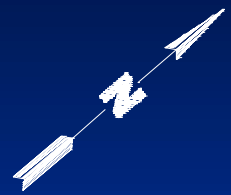
Projected Nitrogen Removal: 45 lbs/day

Treatment Design Flow Rate: Base Flow = 8 cfs
First Flush = 25 cfs

First Flush Hydraulic Retention Time: 12 Hours

Hydraulic Design Flow Rate: 450 cfs

Construction Completion Expected: April 2001



STUDY AREA SITE PLAN



PRECONSTRUCTION

Debris Waste and Iron Stained Seep Area



PRECONSTRUCTION Severely Eroded Hillside



UNDER CONSTRUCTION

Stop Log Structure and Diversion Channel



POST- CONSTRUCTION Completed Micropool



Advantages of Constructed Wetland Treatment Systems

- ▲ Inexpensive to construct
- ▲ Very low operation and maintenance costs
- ▲ Easy to maintain
- ▲ Can be designed to provide habitat enhancements and contaminant mitigation
- ▲ Tolerant of fluctuating hydraulic and contaminant loading rates
- ▲ Provide increased educational opportunities

Potential Disadvantages of Constructed Wetland Treatment Systems

- ▼ Require relatively large land areas
- ▼ Lack precise design criteria
- ▼ Potential vector control concerns