National Water Quality Monitoring Conference, May 2006

Recovery and Monitoring Challenges with Water Quality Issues in New Orleans during Hurricane Katrina Recovery Operations

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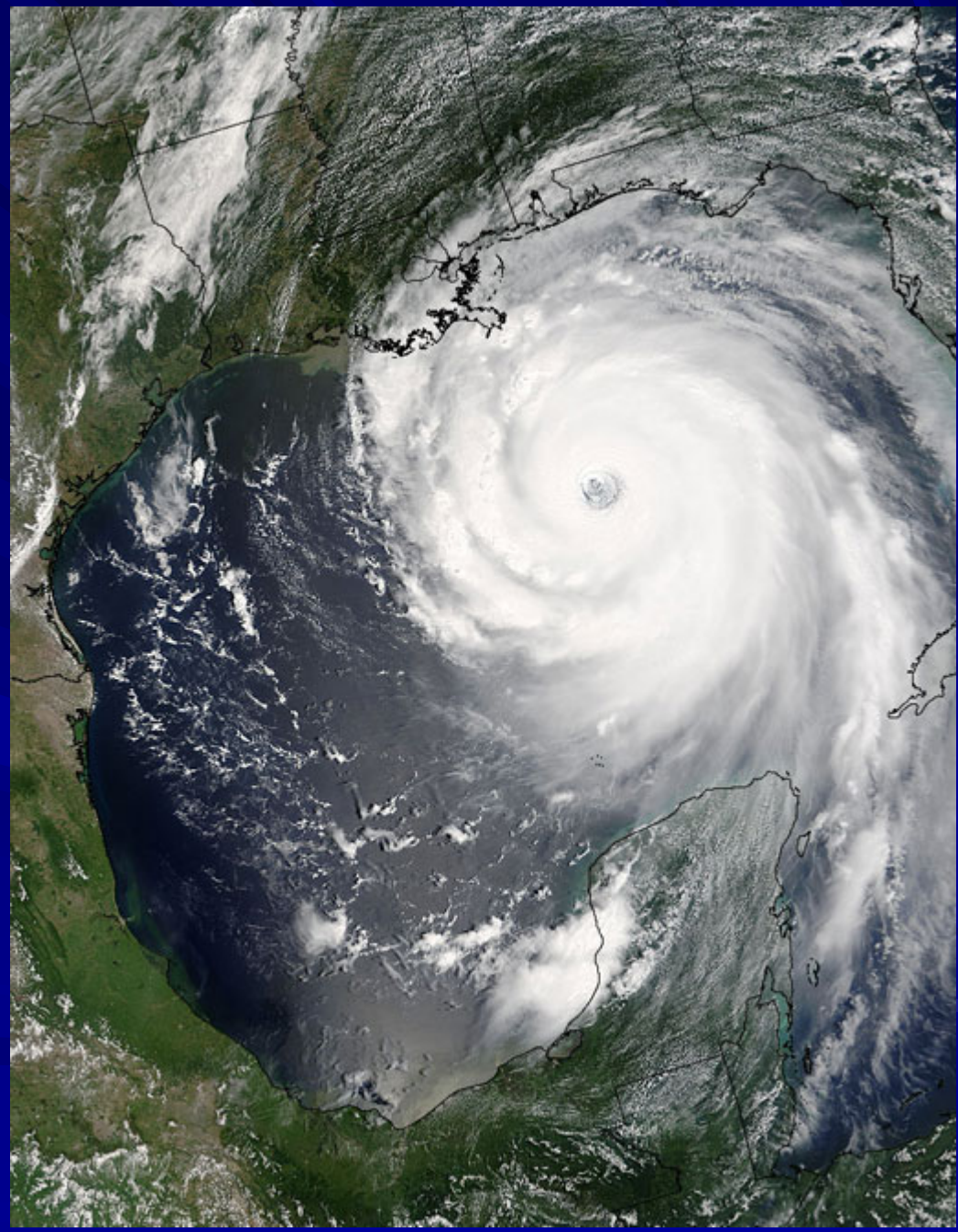
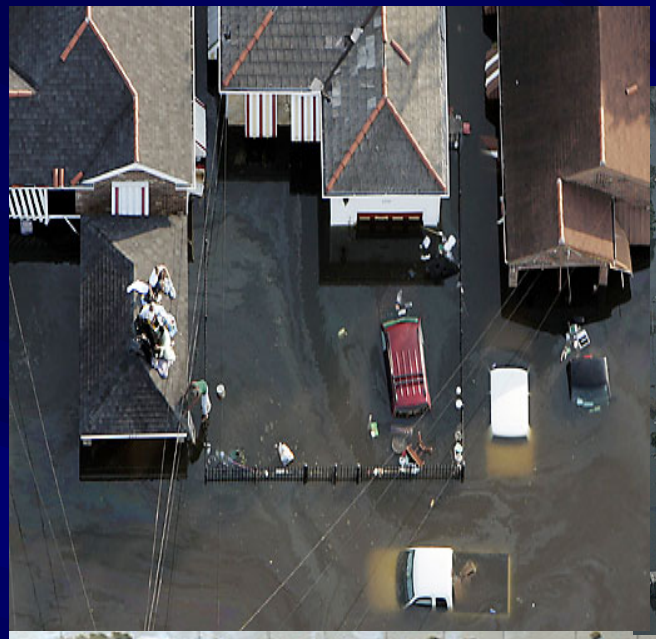
Project Collaborators

- Jane Moore: EPA Office of Wastewater Management
- Margaret Heber: Chair of Measurement Group, EPA, OWOW
- David Shepp HQ, US Army Corps of Engineers
- Federal Agency Joint Task Force and affiliated support organizations

Satellite Image of Hurricane Katrina





EPA

22
22L05I

Debris Issues (and Damaged Buildings)

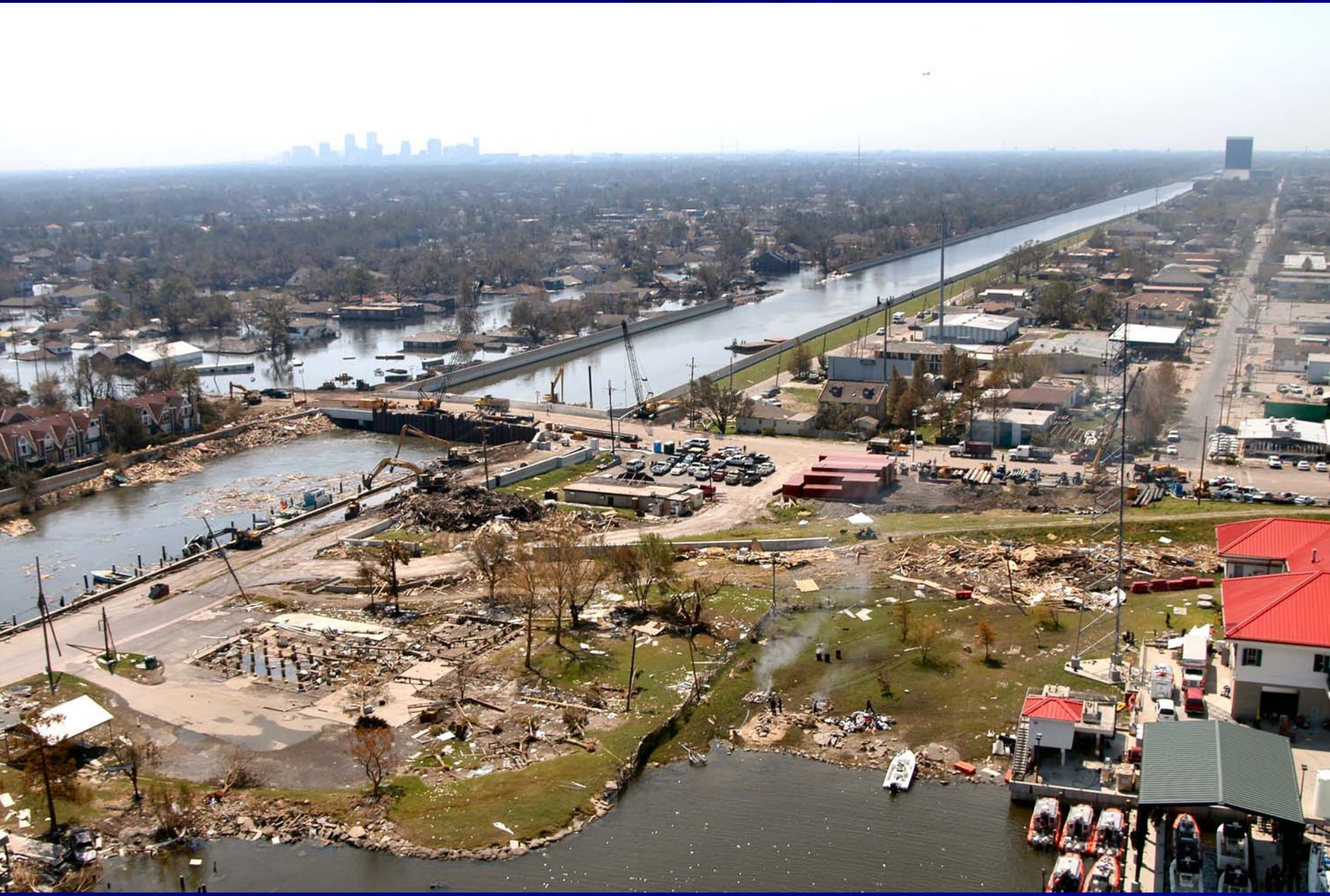
Emergency Hurricane Debris Burning Guidance
EPA resources on debris
Other federal resources on debris

The U.S. Environmental Protection Agency and other federal, state and local officials are urging individuals to use caution when returning to hurricane-damaged homes and buildings. EPA today issued an advisory to the public that provides general guidance to help address potential hazards in structures damaged by hurricane Katrina.

EPA urges the public to be on the alert for leaking containers and reactive household chemicals, like caustic drain cleaners and chlorine bleach, and take the following necessary precautions to prevent injury or further damage:

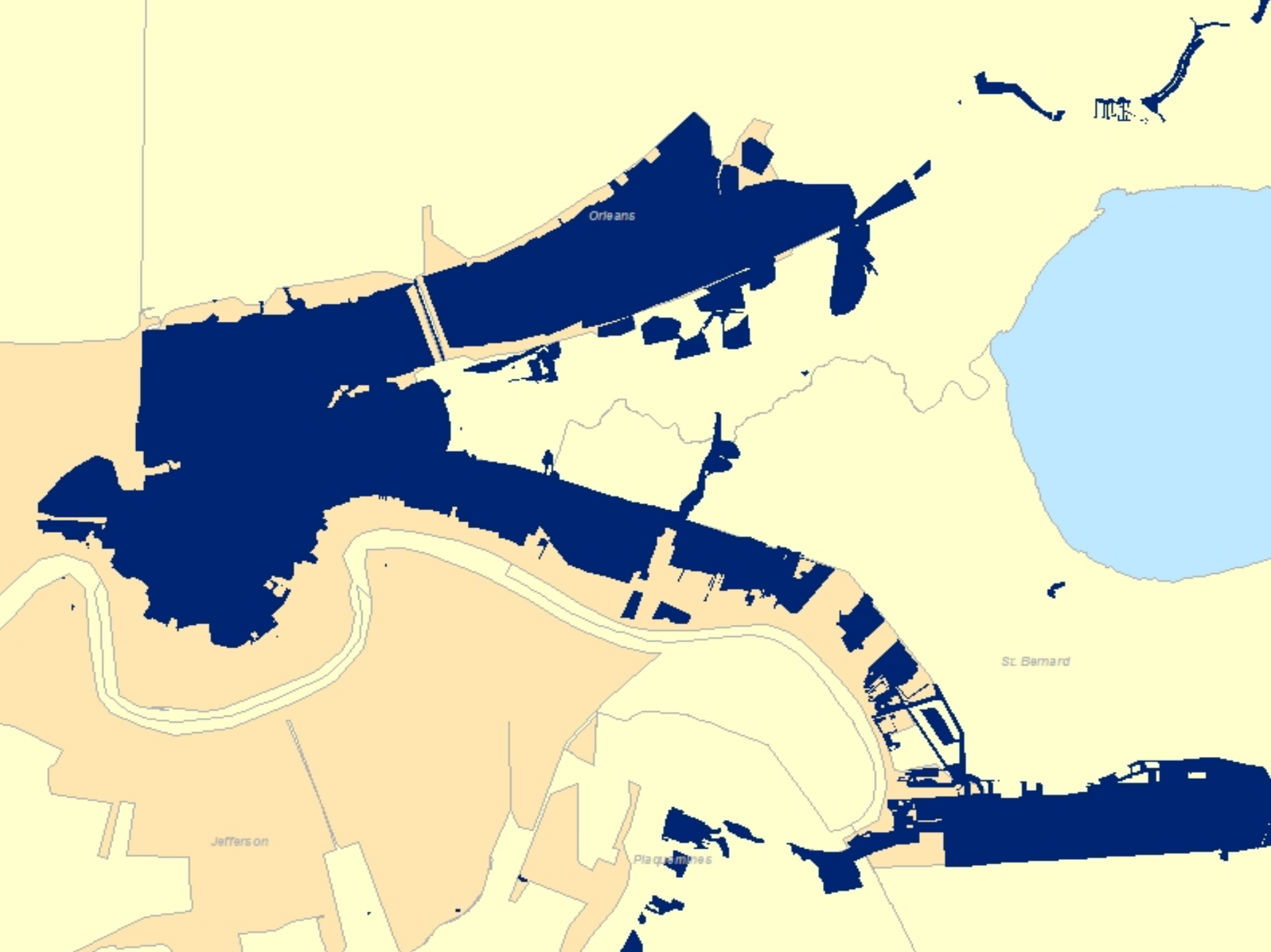
- Keep children and pets away from leaking or spilled chemicals.
- Do not combine chemicals from leaking or damaged containers as this may produce dangerous or violent reactions.
- Do not dump chemicals down drains, storm sewers or toilets.
- Do not attempt to burn household chemicals.
- Clearly mark and set aside unbroken containers until they can be properly disposed of
- Leave damaged or unlabeled chemical containers undisturbed whenever possible.

Second Failure of 9th Street Levee



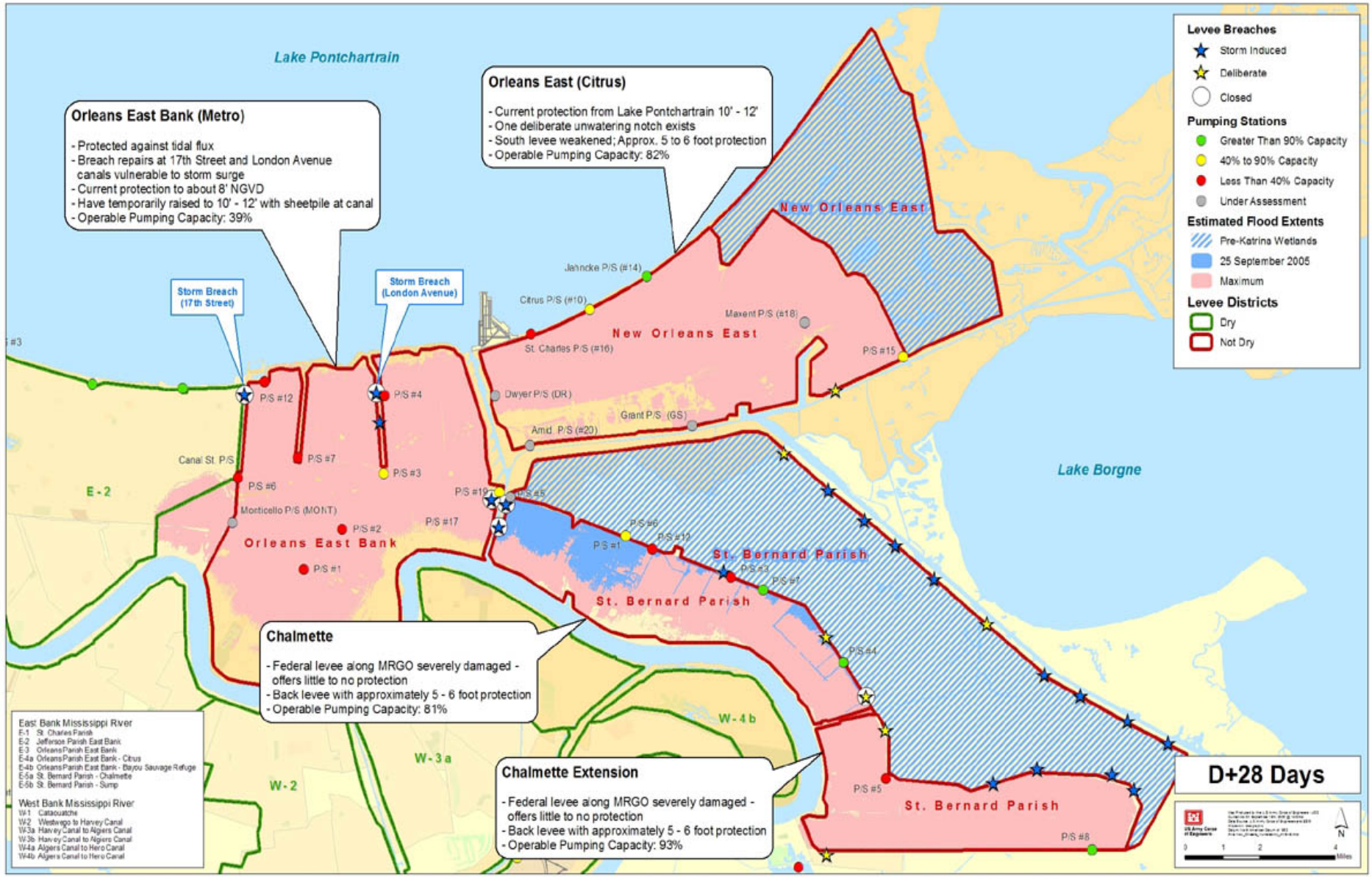
Katrina and Rita Affected area Roughly the size of the United Kingdom

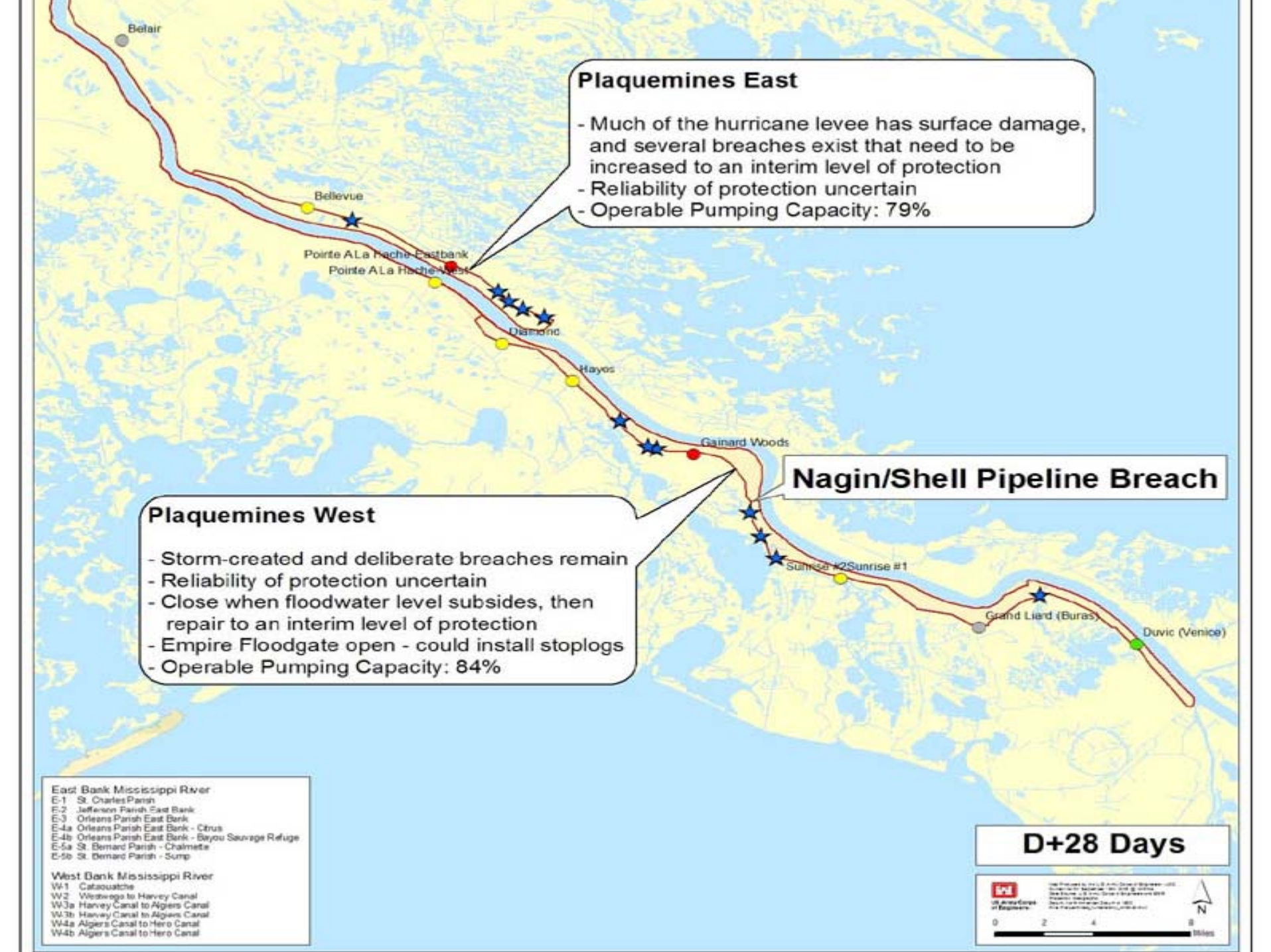
- 1.2 million households received $3.5 billion in federal disaster assistance
- 43 million meals served by the American Red Cross and Salvation Army
- 285,000 cars damaged by floods
- Over 1,000 deaths in Louisiana
- Over $200 billion in damages

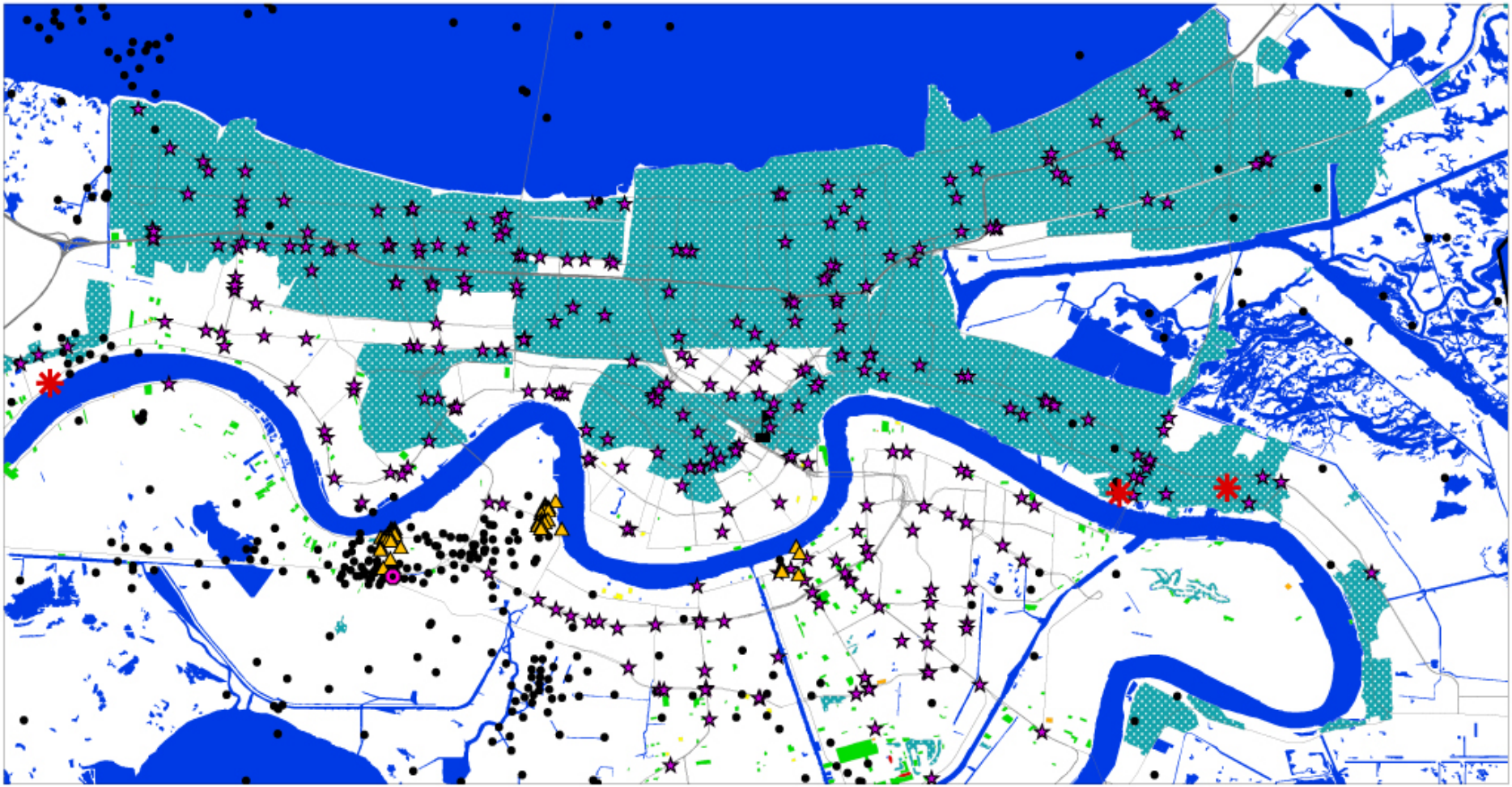

Orleans
St. Bernard
Jefferson
Plaquemines

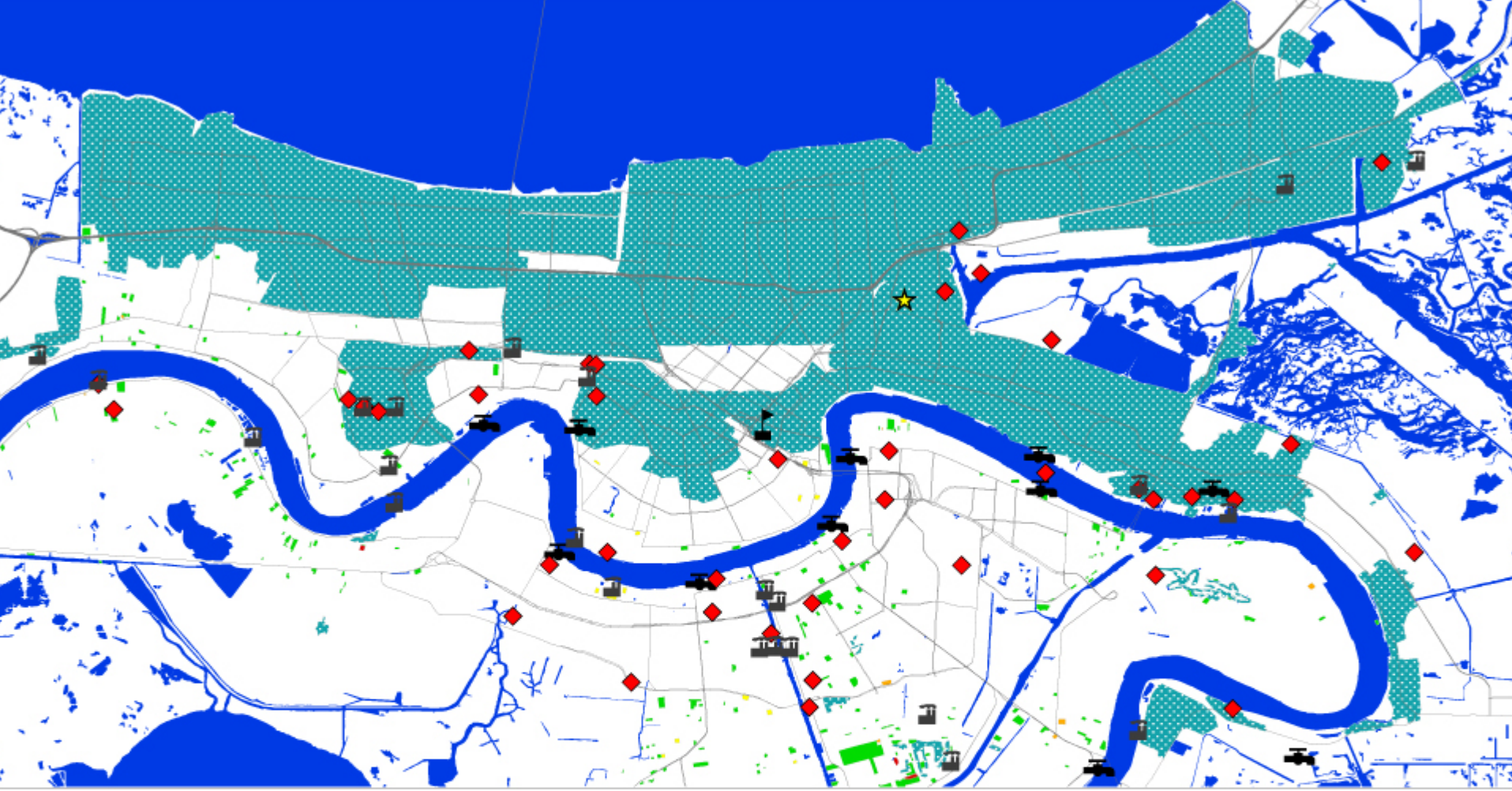
New Orleans Vulnerabilities

Current as of 25 Sep 05 - 1430hrs




Belair
Bellevue
Pointe A La Hache Eastbank
Pointe A La Hache West
Diamond
Hayes
Gainard Woods
Sunrise #2
Sunrise #1
Grand Liard (Buras)
Duvic (Venice)
Plaquemines East
- Much of the hurricane levee has surface damage, and several breaches exist that need to be increased to an interim level of protection
- Reliability of protection uncertain
- Operable Pumping Capacity: 79%
Nagin/Shell Pipeline Breach
Plaquemines West
- Storm-created and deliberate breaches remain
- Reliability of protection uncertain
- Close when floodwater level subsides, then repair to an interim level of protection
- Empire Floodgate open - could install stoplogs
- Operable Pumping Capacity: 84%
East Bank Mississippi River
E-1 St. Charles Parish
E-2 Jefferson Parish East Bank
E-3 Orleans Parish East Bank
E-4a Orleans Parish East Bank - Citrus
E-4b Orleans Parish East Bank - Bayou Sauvage Refuge
E-5a St. Bernard Parish - Chalmette
E-5b St. Bernard Parish - Sump
West Bank Mississippi River
W-1 Catahoutche
W-2 Westwego to Harvey Canal
W-3a Harvey Canal to Algiers Canal
W-3b Harvey Canal to Algiers Canal
W-4a Algiers Canal to Hero Canal
W-4b Algiers Canal to Hero Canal
D+28 Days
N
0 2 4 8
Miles


Damage as of August 30, 2005
Limited
Moderate
Extensive
Catastrophic
Flood
Superdome
Major Roads
Legend
Crude Petroleum and Natural Gas Production and Extraction Operations
Petroleum Product Storage Stations and Terminals
Refineries
Gas stations
Oil and gas wells
N
0 2 4 6 8 10 12 14 Kilometers



Damage as of August 30, 2005

- Limited
- Moderate
- Extensive
- Catastrophic
- Flood

Legend

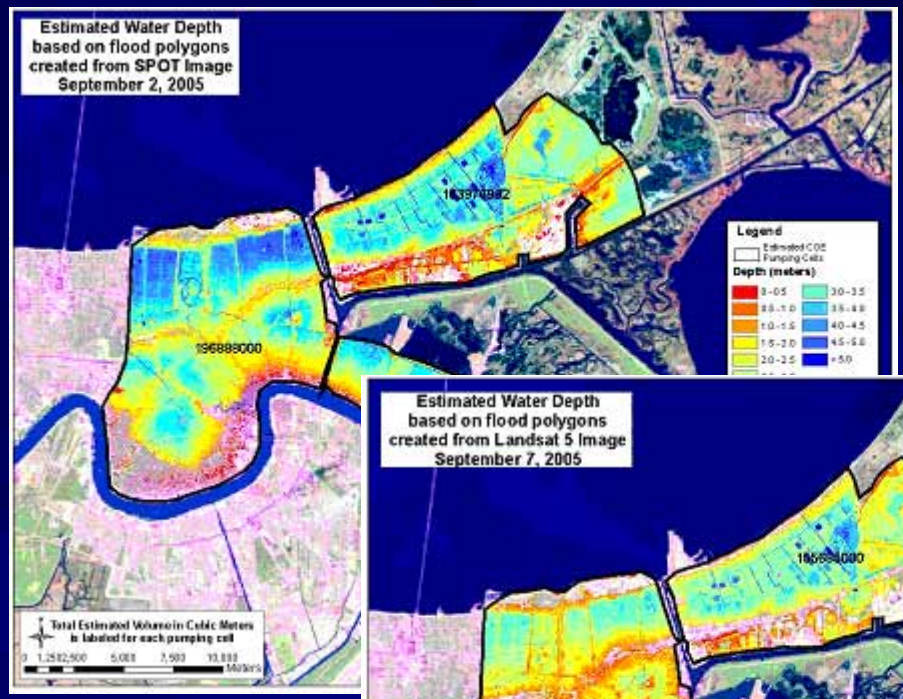
- National Priority List Sites
- TRI-Reporting Facilities 2003
- Drinking water surface intakes
- Hazmat locations
- Superdome
- Major Roads

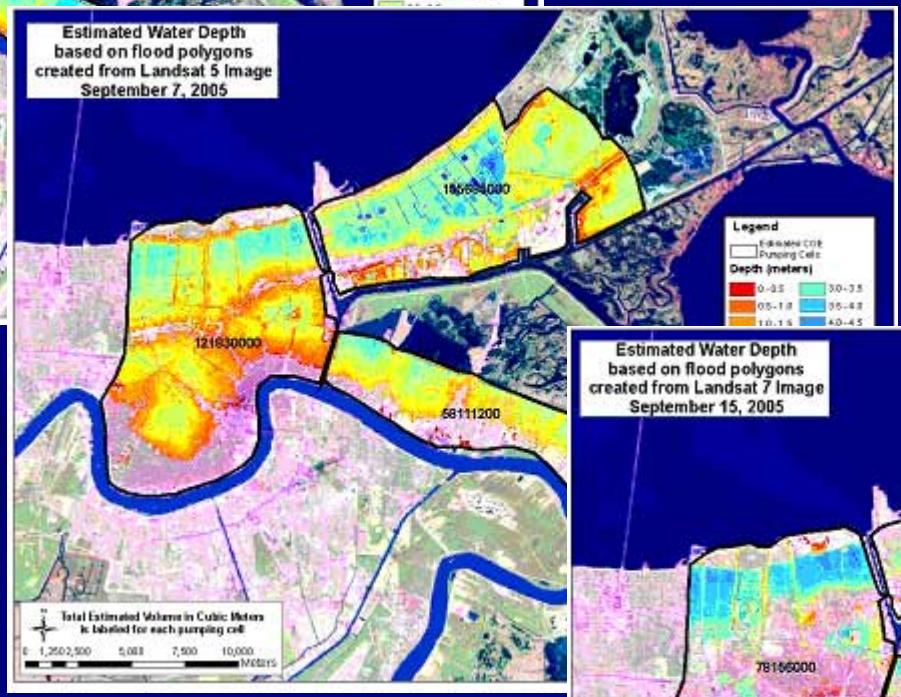
N

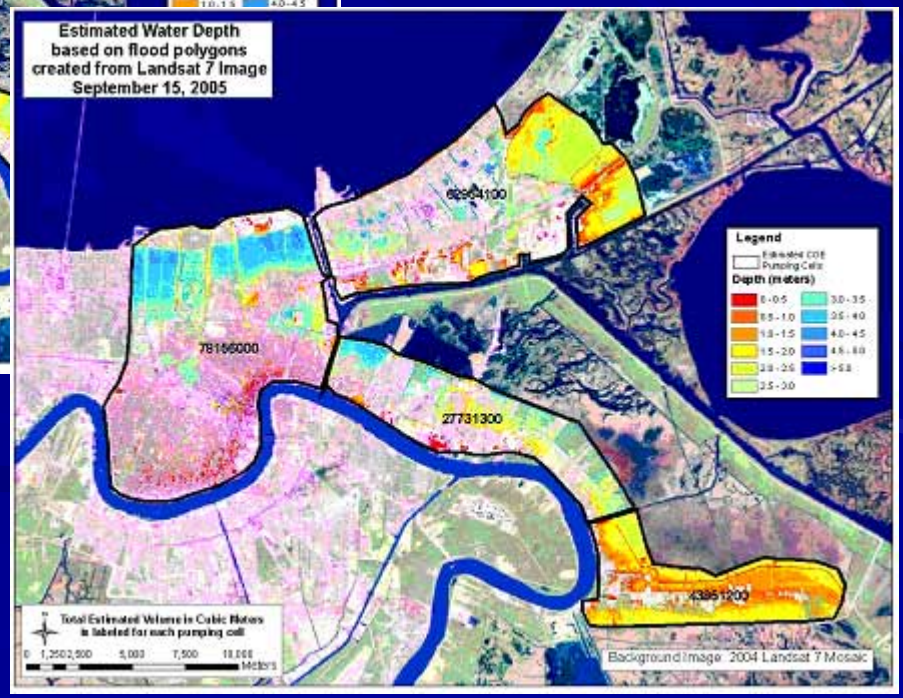
0 2 4 6 8 10 12 Kilometer

New Orleans Dewatering Operation

- Restoration of existing pump stations
- Establish and operate 34 temporary pump stations
- 24/7 operation to maximize dewatering
- Averaged 5 billion gals per day over 43 day dewatering operation
- Address water quality issues without slowing pumping operation
- Collect water borne deceased with dignity


Estimated Water Depth
based on flood polygons
created from SPOT Image
September 2, 2005
196889000
Legend
Depth (meters)
Total Estimated Volume in Cubic Meters
is labeled for each pumping cell

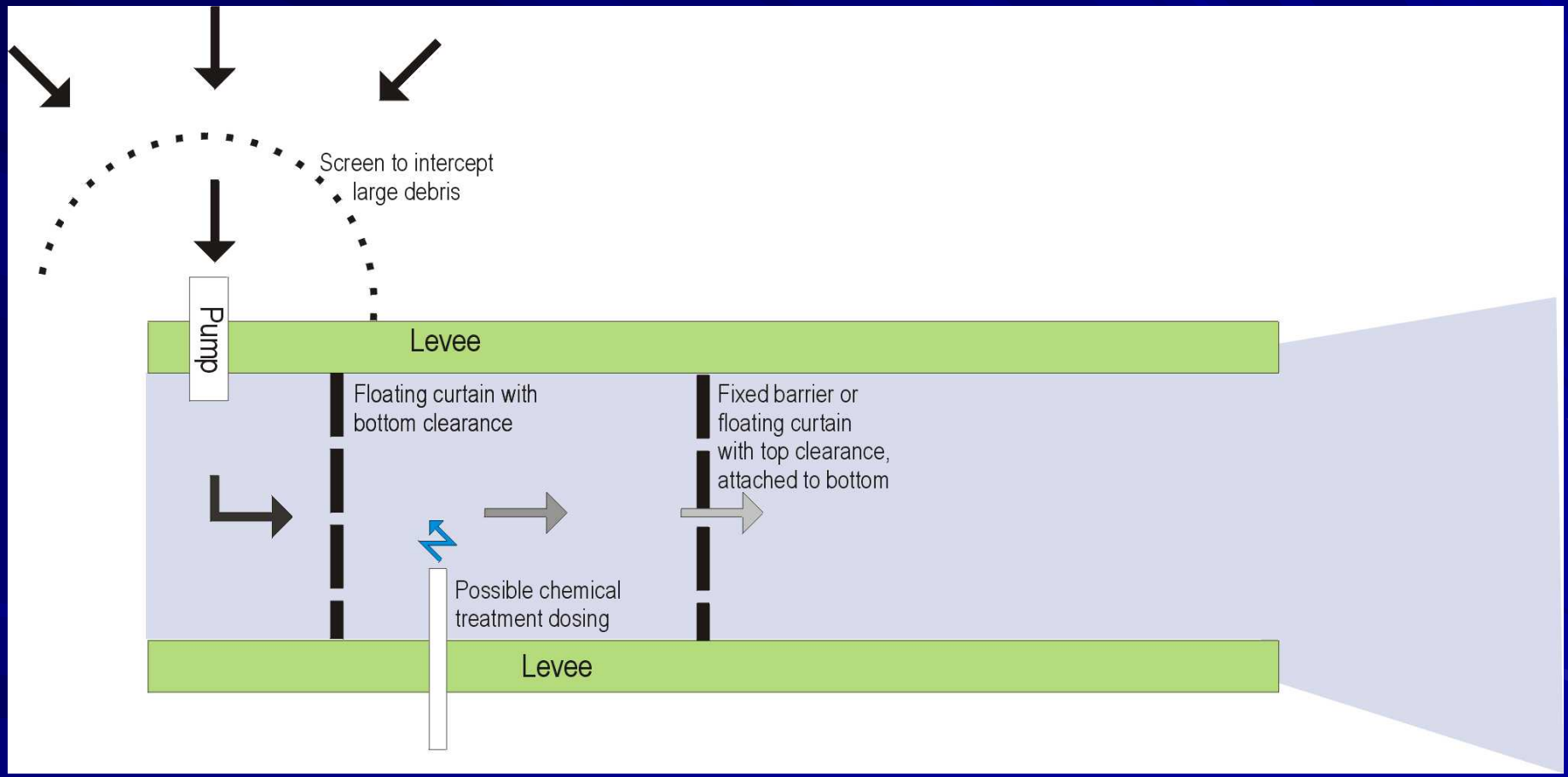

Estimated Water Depth
based on flood polygons
created from Landsat 5 Image
September 7, 2005
121630000
58111200
Legend
Depth (meters)
Total Estimated Volume in Cubic Meters
is labeled for each pumping cell

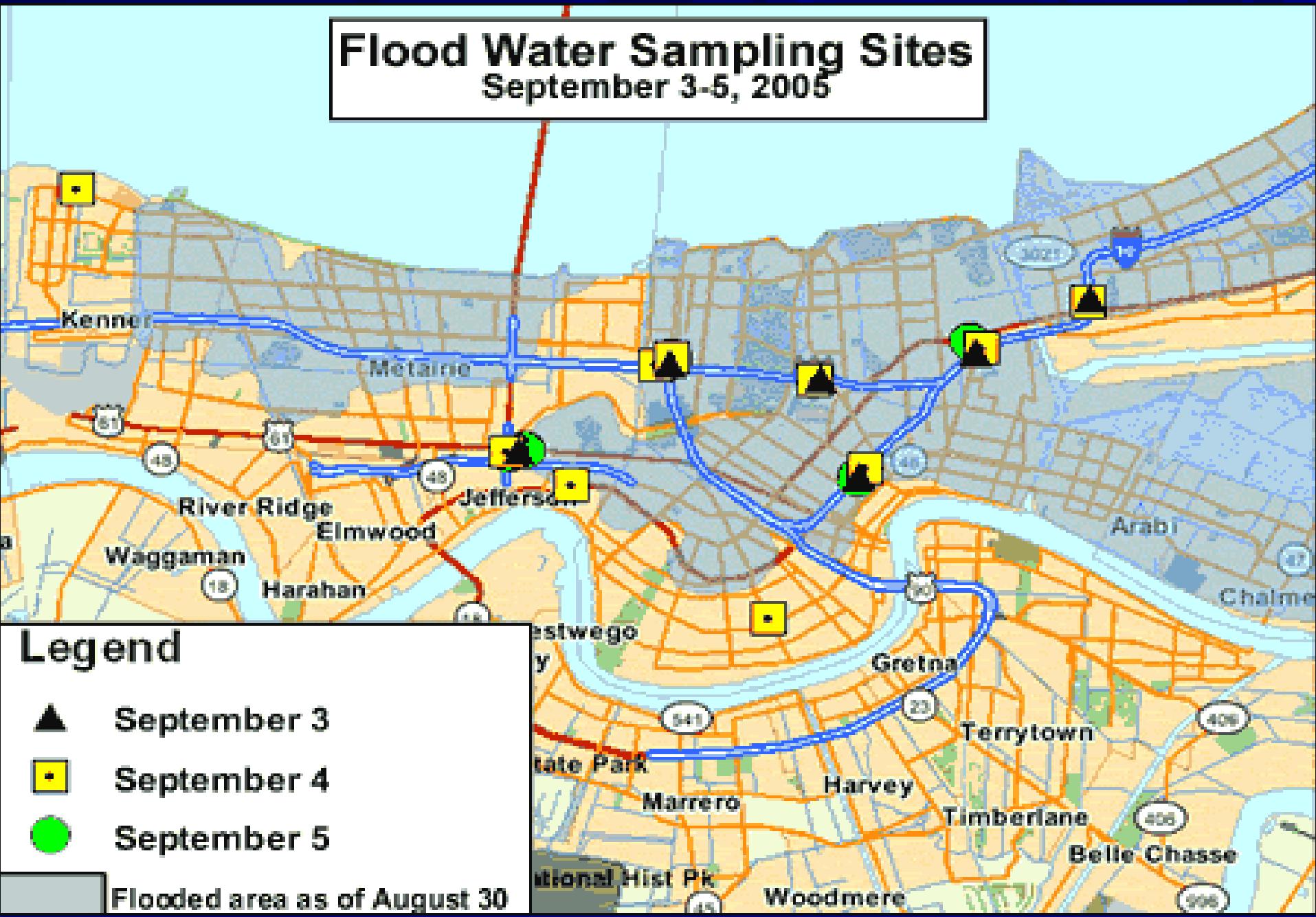

Estimated Water Depth
based on flood polygons
created from Landsat 7 Image
September 15, 2005
78156000
27731300
Legend
Depth (meters)
Total Estimated Volume in Cubic Meters
is labeled for each pumping cell
Background Image: 2004 Landsat 7 Mosaic

Water Quality

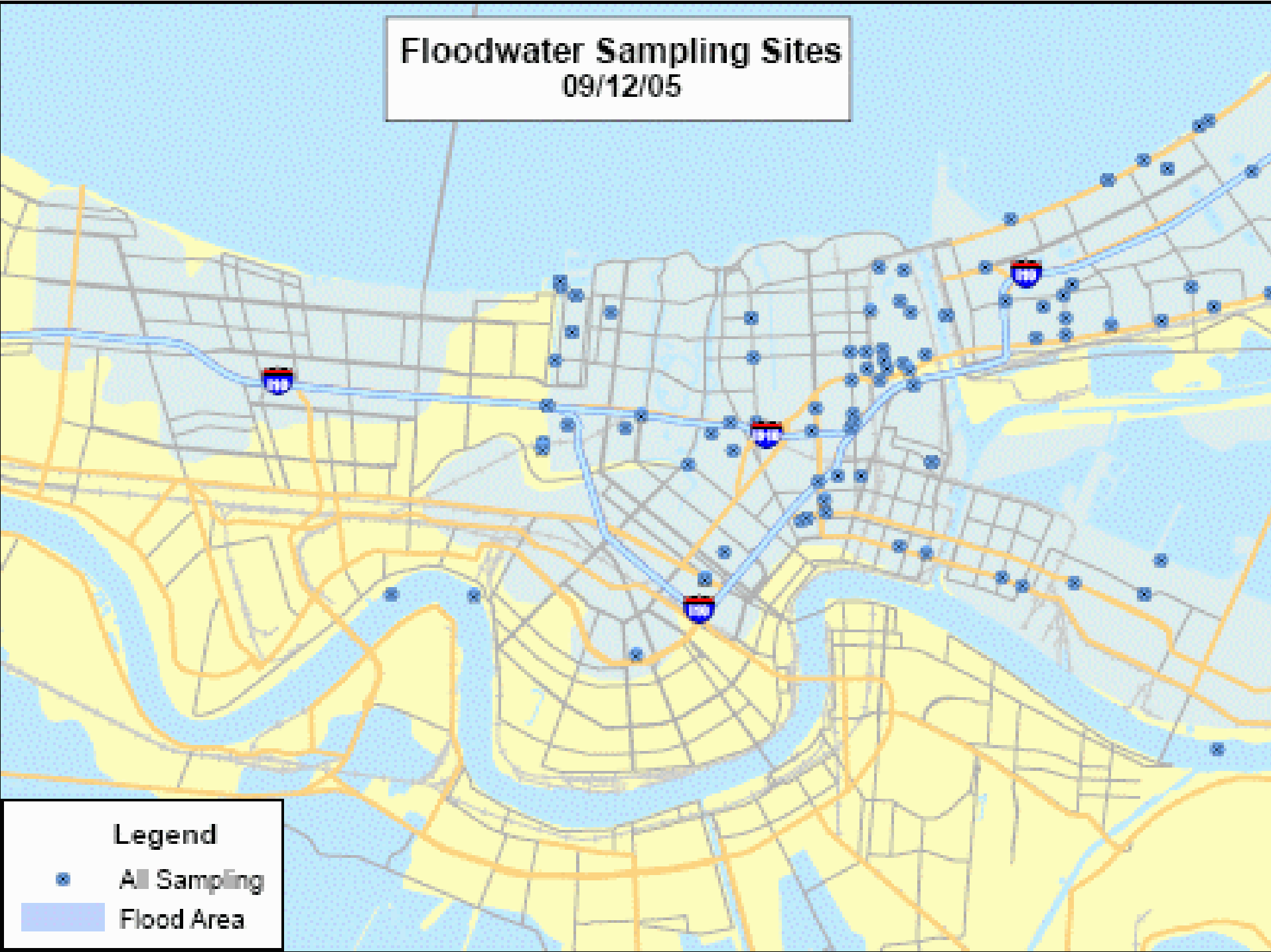
- Establish floating debris diversion and collection systems
- Install absorbent booms before and after pump locations
- Operate floating aerators before and after pump locations
- Monitor water quality and sediments throughout the system

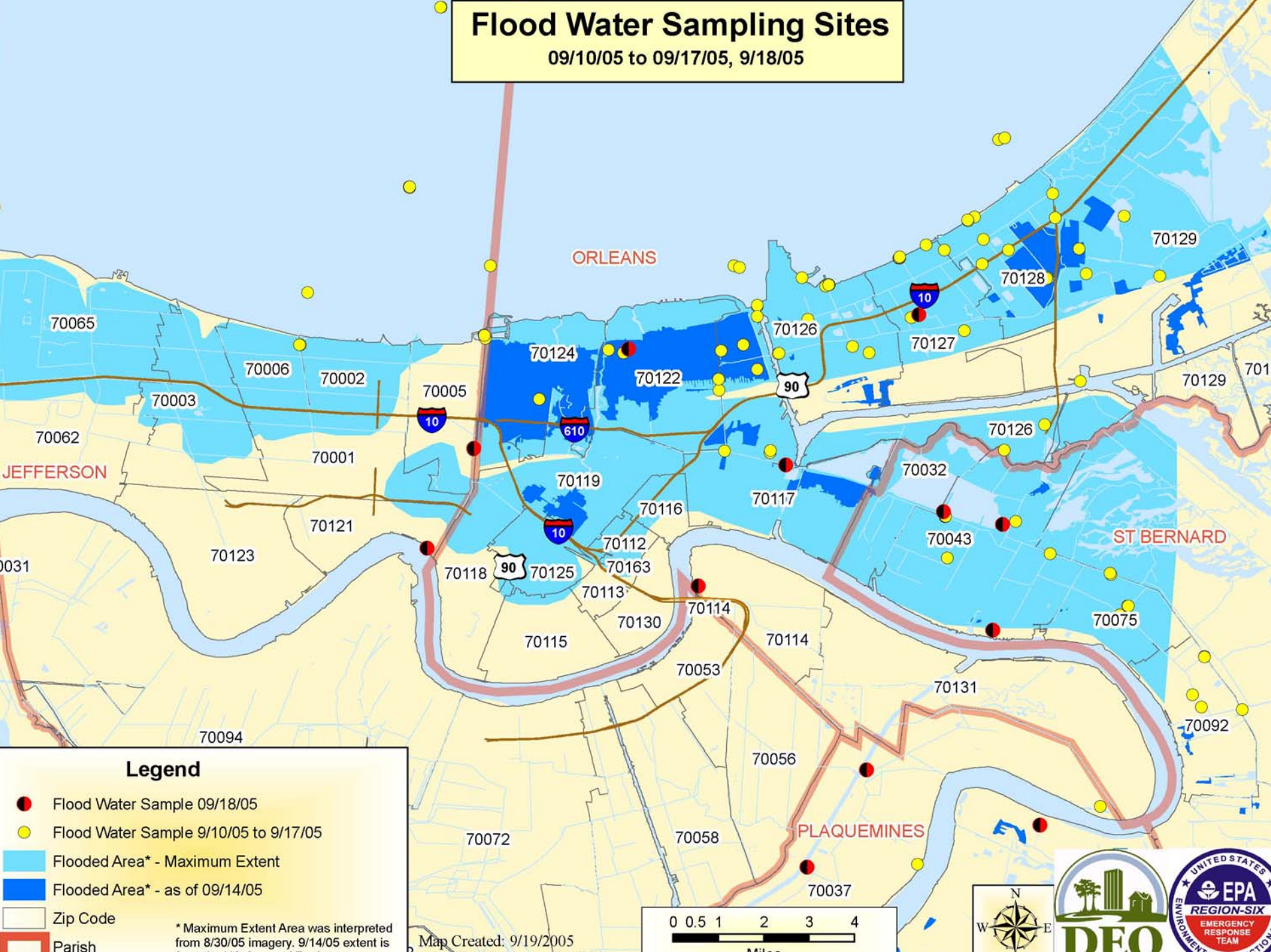
Illustration of in-canal expedient water treatment system




Flood Water Sampling Sites
September 3-5, 2005
Kenner
Metairie
River Ridge
Elmwood
Waggaman
Harahan
Jefferson
Arabi
Gretna
Terrytown
Harvey
Marrero
Timberlane
Belle Chasse
Woodmere
Legend
September 3
September 4
September 5
Flooded area as of August 30

WATER QUALITY MONITORING
UNWATER NEW ORLEANS
(OCTOBER 9, 2005)
Lake Pontchartrain
Lakefront
Chemical Oxygen Demand - 150 mg/L
Chemical Oxygen Demand - 140 mg/L
Chemical Oxygen Demand - 110 mg/L
OP#16 (St Charles) (30.032, -90.011)
OP#10 (Citrus) (30.047, -89.989)
OP#14 (Jahncke) (30.055, -89.967)
OP#12 (30.021, -90.114)
OP#4 (30.016, -90.068)
Dwyer Road (30.018, -90.025)
Grant Street (30.006, -89.949)
Elaine Street (30.002, -89.934)
OP#20 (Amid) (29.995, -90.012)
Intracoastal Waterway
OP#7 (29.994, -90.101)
OP#3 (29.985, -90.068)
OP#17 (Station D) (29.987, -90.046)
OP#15 (29.982, -90.024)
OP#5 (29.980, -90.019)
OP#6 (29.987, -90.124)
OP#2 (29.969, -90.034)
OP#1 (29.954, -90.059)
Monticello Upper (29.971, -90.126)
Pritchart (29.968, -90.128)
Fortification #1 (29.966, -89.975)
Jean Lafitte #6 (29.966, -89.975)
Guichard #2 (29.962, -89.965)
Mississippi River
0 2,000 4,000 Feet
Legend
Pump Stations
Sample Locations
Aerator Locations
Shaw® a world of Solutions


Floodwater Sampling Sites
09/12/05
Legend
All Sampling
Flood Area


Flood Water Sampling Sites
09/10/05 to 09/17/05, 9/18/05
ORLEANS
JEFFERSON
ST BERNARD
PLAQUEMINES
70065
70006
70002
70003
70005
70062
70001
70124
70122
70126
70127
70128
70129
70119
70116
70117
70032
70043
70121
70123
70118
70125
70112
70163
70113
70114
70130
70115
70053
70075
70131
70092
70094
70056
70072
70058
70037
10
90
610
Legend
Flood Water Sample 09/18/05
Flood Water Sample 9/10/05 to 9/17/05
Flooded Area* - Maximum Extent
Flooded Area* - as of 09/14/05
Zip Code
Parish
* Maximum Extent Area was interpreted from 8/30/05 imagery. 9/14/05 extent is
Map Created: 9/19/2005
0 0.5 1 2 3 4
N
W
E
DEQ
UNITED STATES
EPA
REGION-SIX
EMERGENCY RESPONSE TEAM

Sampled and Found Exceeds EPA Limits

CASNumber	Name	Measured Level (µg/L)	EPA Limit (µg/L)
7439-92-1	Lead	20	15

Table 1: Sampled, Found Exceeds EPA Limits

Sampled and Found meets EPA Limits

CASNumber	Name	Measured Level (µg/L)	EPA Limit (µg/L)
7440-39-3	Barium	210	2000
7440-50-8	Copper	62	1300
57-12-5	Cyanide	29.7	200

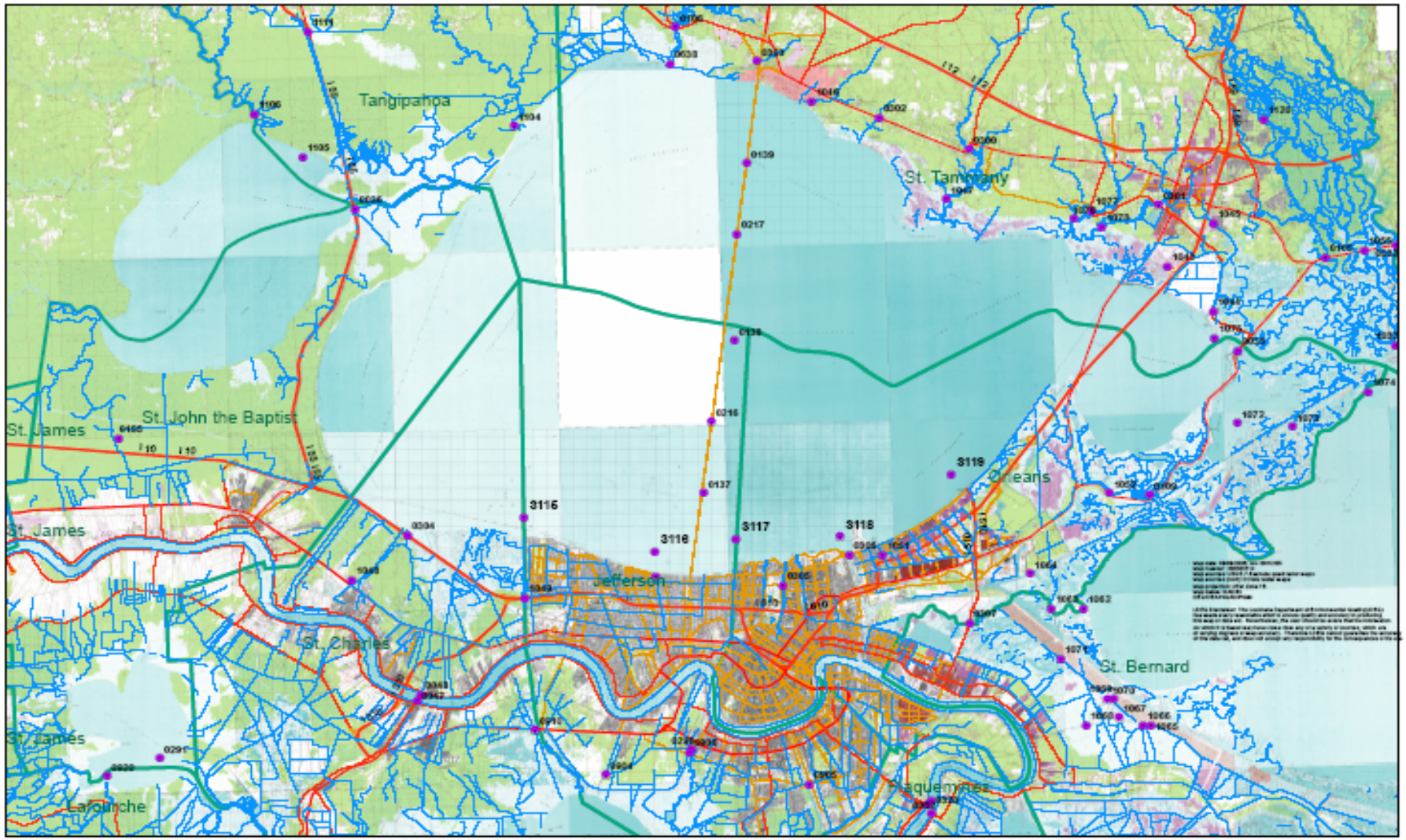
Sampled & Found but No EPA Limits Currently

CASNumber	Name	Measured Level (µg/L)
7429-90-5	Aluminum	1290
7440-70-2	Calcium	111000
7439-89-6	Iron	1930
7439-95-4	Magnesium	99200
7439-96-5	Manganese	669
7440-02-0	Nickel	22
7440-09-7	Potassium	52700
7440-22-4	Silver	12
7440-23-5	Sodium	724000
7440-66-6	Zinc	292

Example EPA Biological Water sample data

Sample Date	County	Location Description	Sample Number	Bacteria	Colonies/100 mL
9/8/2005	JEFFERSON	Bonneville Canal	15178	E. coli	5818
9/8/2005	JEFFERSON	Outfall	15561	E. coli	6260
9/8/2005	JEFFERSON	Outfall	15562	E. coli	7568
9/8/2005	ORLEANS	Louisa & Almonaster	15172	E. coli	462
9/8/2005	ORLEANS	Independence & Marais	15175	E. coli	7308
9/8/2005	ORLEANS	Independence & Marais	15176	E. coli	8212
9/8/2005	ORLEANS	Kenilworth Canal	15177	E. coli	5702

Lake Pontchartrain Water Impact Assessment

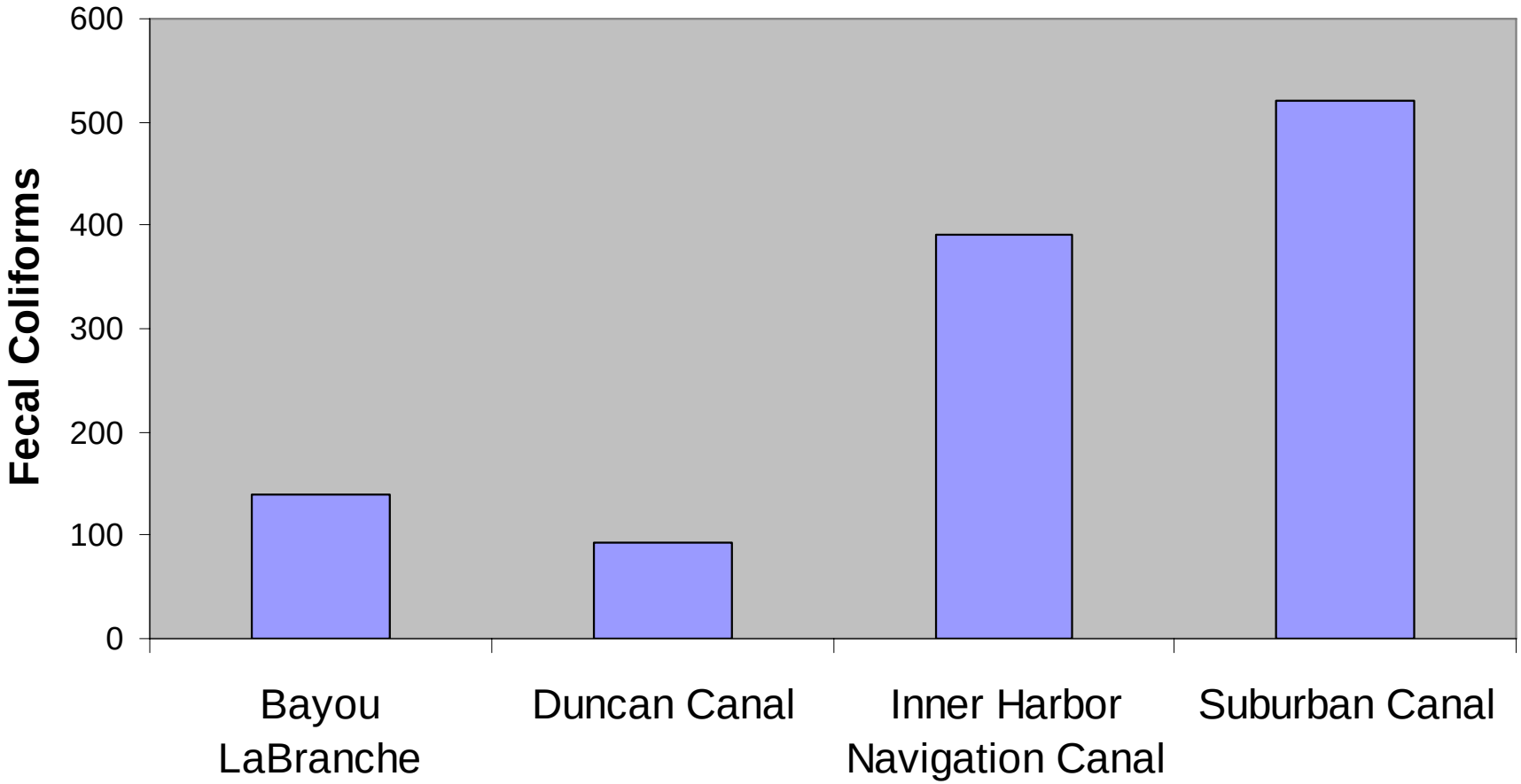


Planning Map for Water Quality Assessment Impacts of Katrina

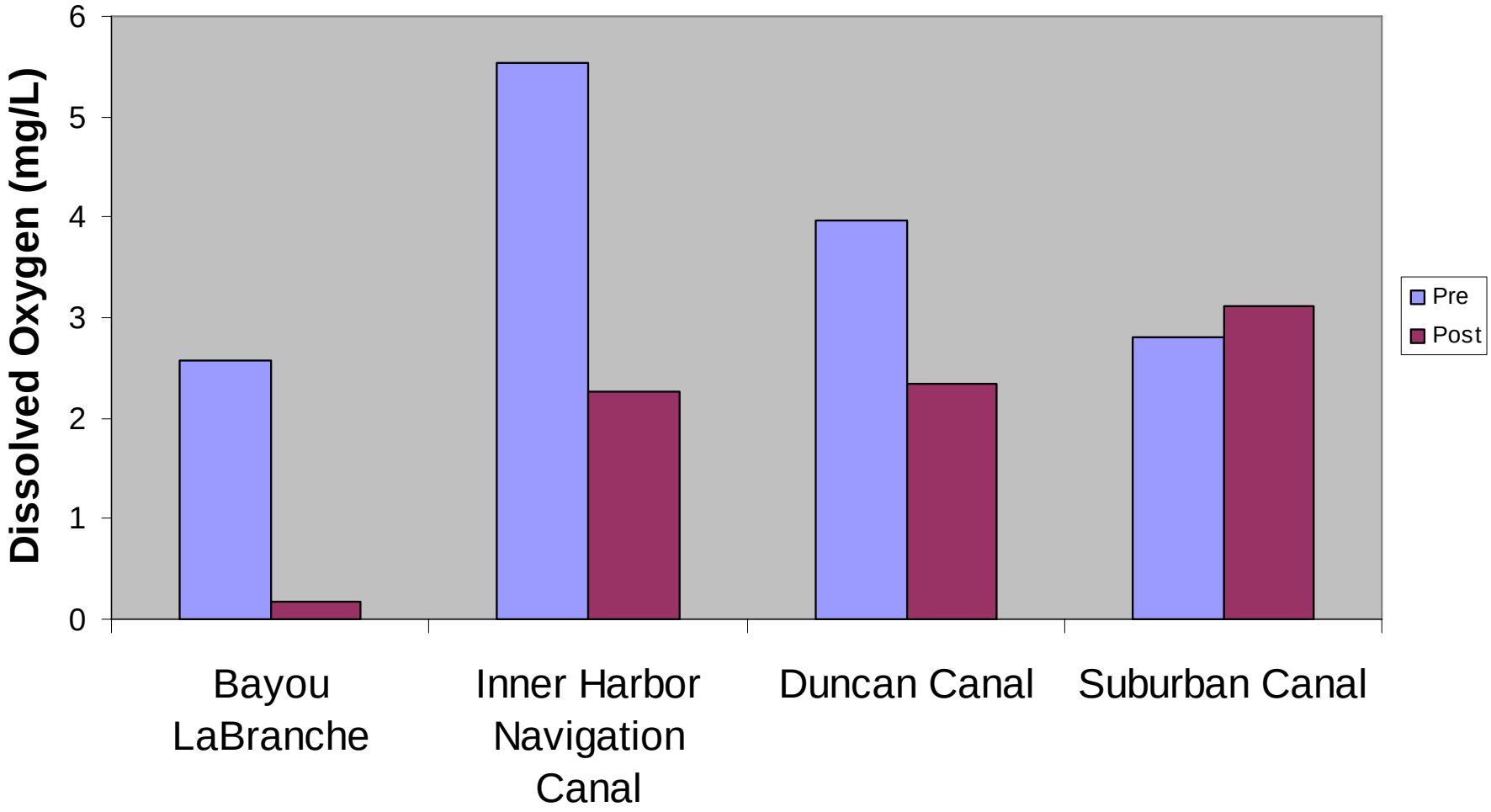
Lake Pontchartrain Impact Area - Map 2 of 4

0 1.5 3 6 9 12 Miles

Fecal Coliform Density at Southshore Canal Sites



Average Dissolved Oxygen Concentrations at Southshore Canals

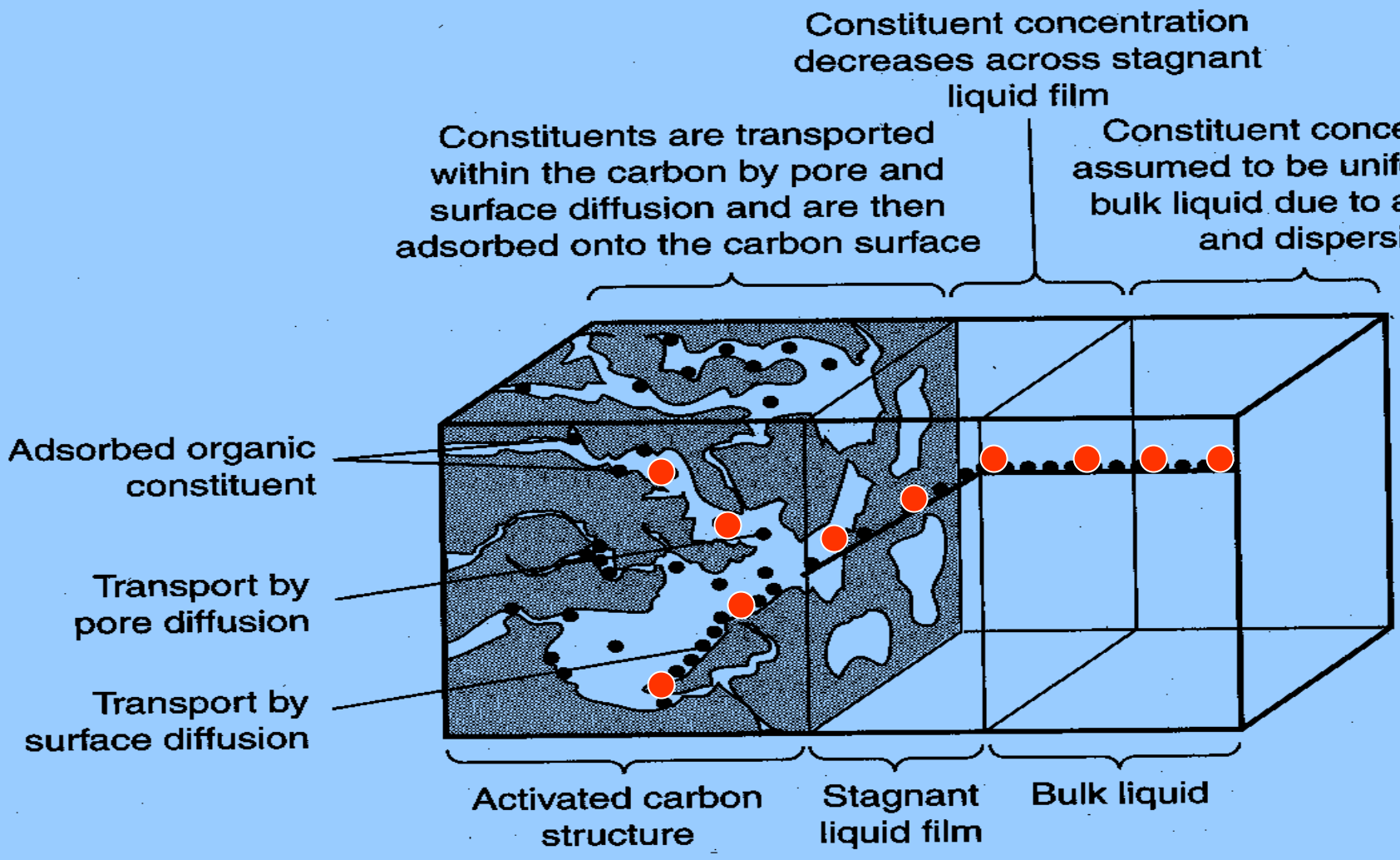


Agriculture Street Landfill Superfund Site

Contaminant Sorption / Flocculation

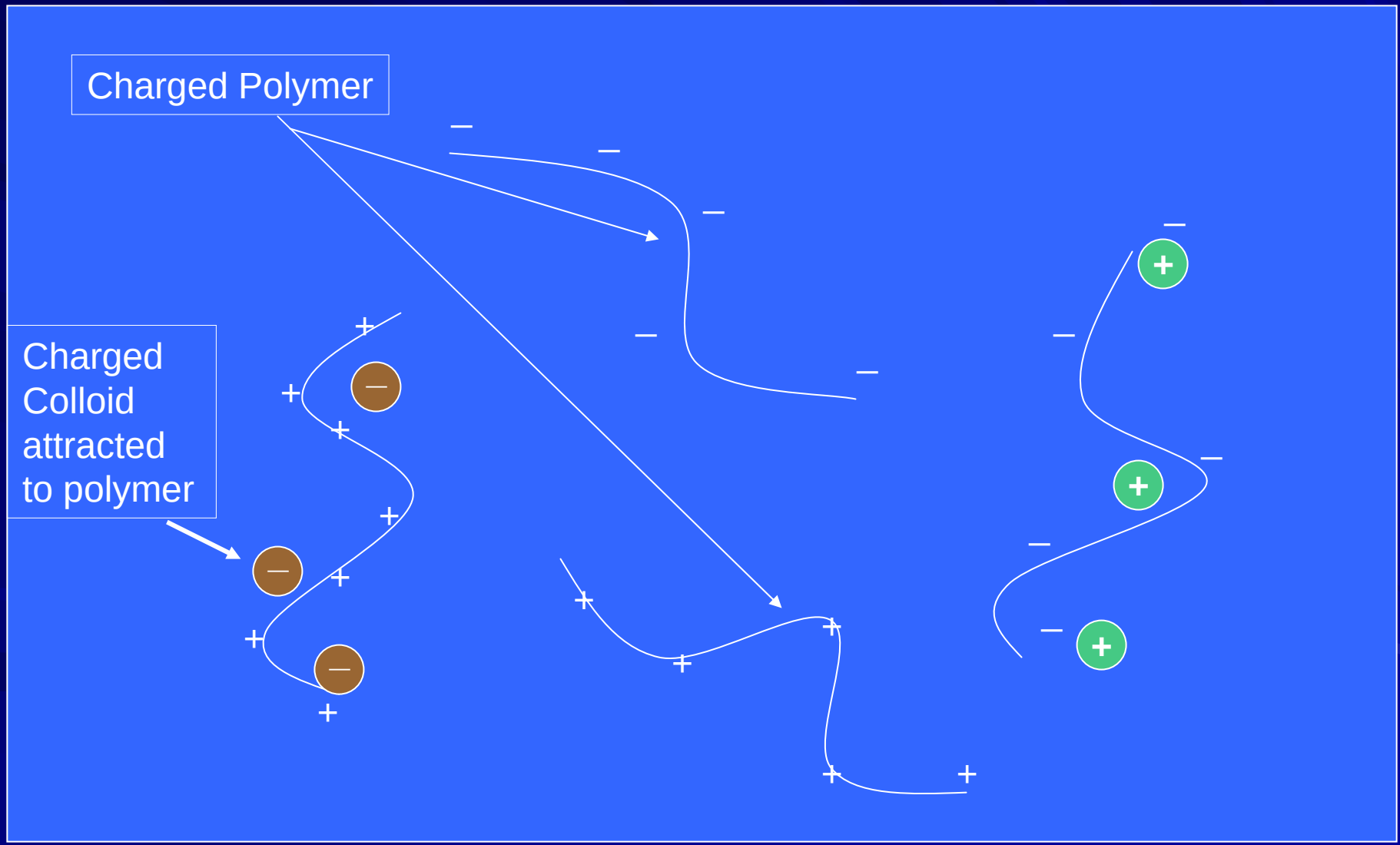
- Commonly used concept in Water Treatment
- Powdered Activated Carbon (PAC)
  - Sorbs contaminants (fuel…)
  - Reduces turbidity
- Polymer
  - Chain with positive and negative charges to bind to charged particles
  - Binds to colloidal particles creating a “floc”
  - Binds to PAC / contaminants into a “floc”
  - Increases particle size and “floc” settles out

Activated Carbon Concept



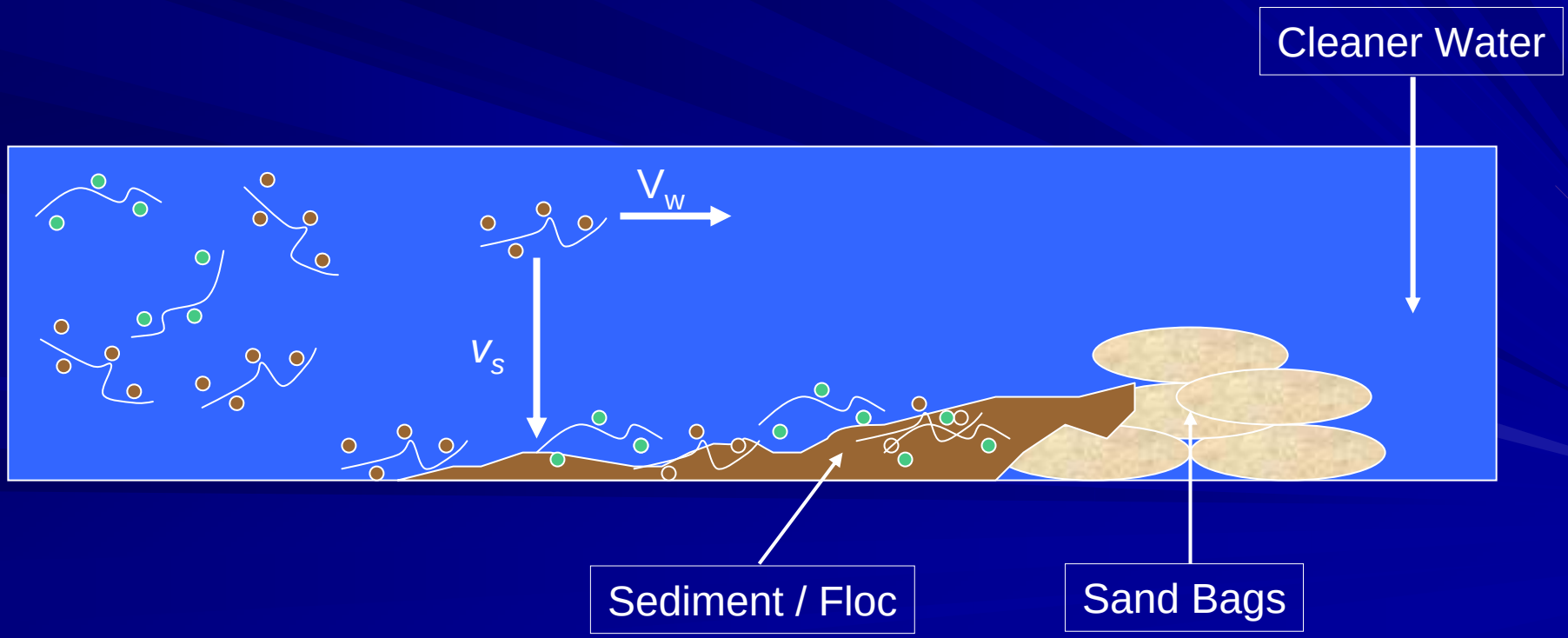
- Contaminant (Fuel, microbes…)

Polymer Concept



Contaminant Sorption / Flocculation

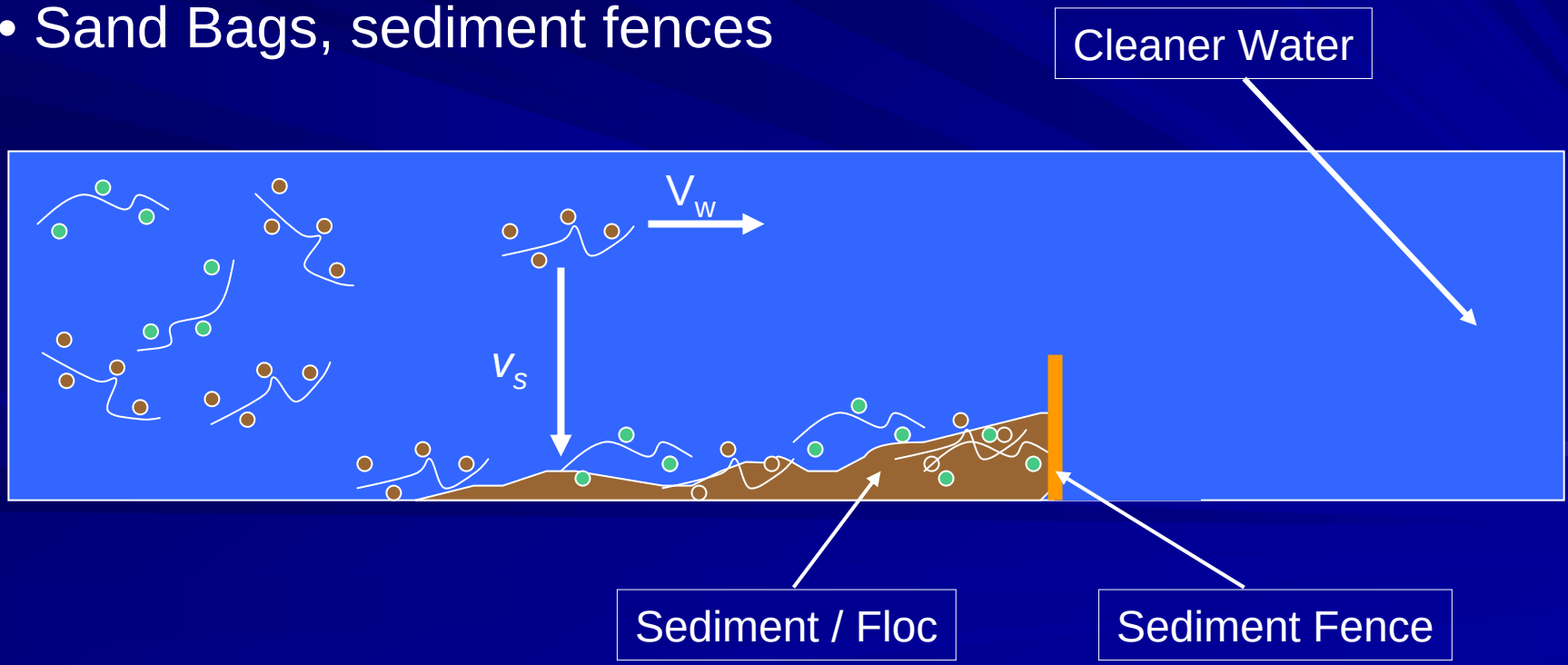
- Particle settling velocity is greater than horizontal water velocity
- V_s >> Vw



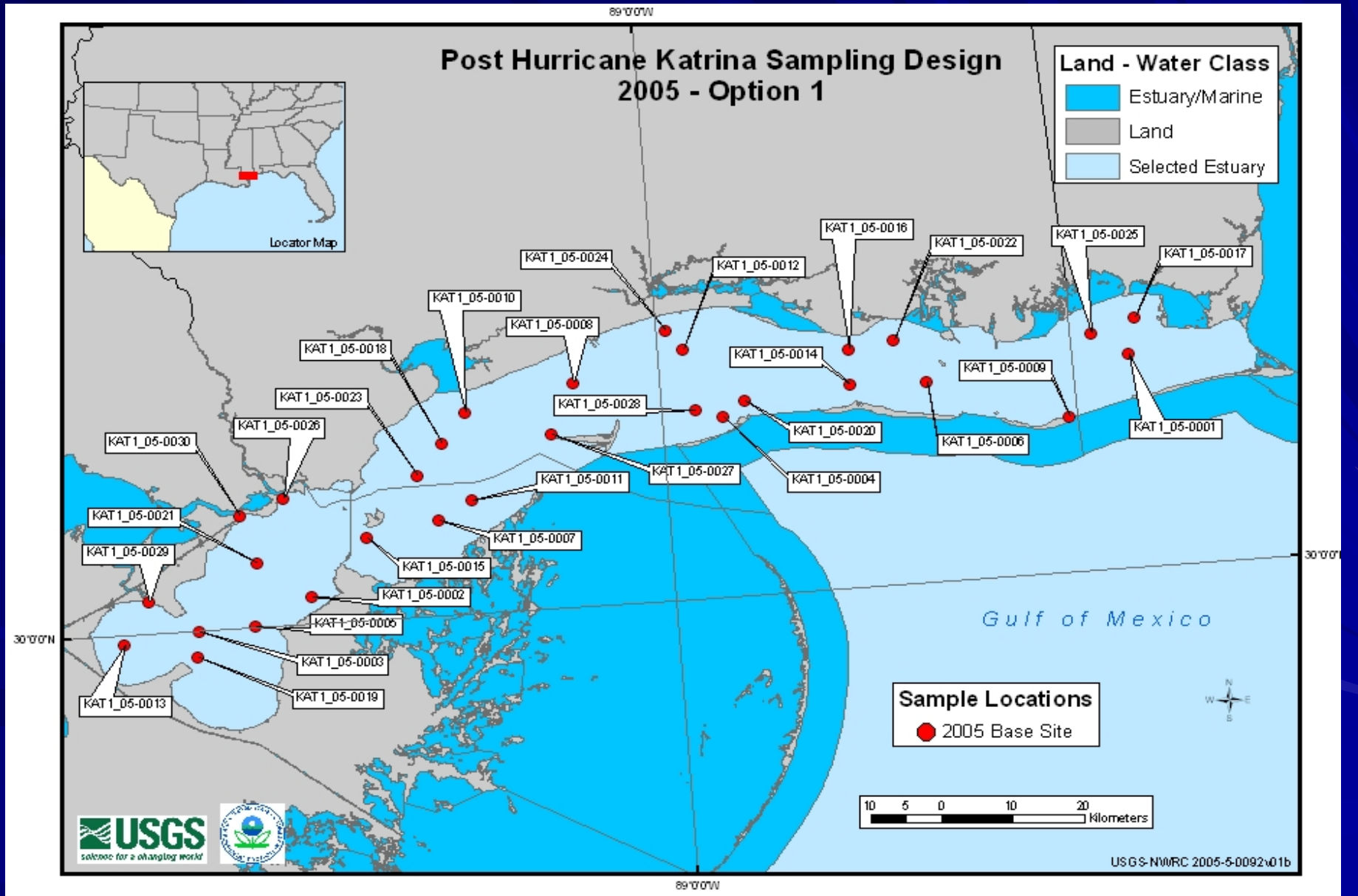
Contaminant Sorption / Flocculation

Use:

- In front of storm water drains
- Around suspect pools
- Sand Bags, sediment fences



Tissue Sampling Sites in the Gulf Coastal Area



Summary

- Fast Reaction Environment
- Many Agencies and Organization Involved
- Expedient water quality protection measures were integrated with dewatering
- GIS and remote sensing provided an important information management framework
- Initial water conditions were much better than expected largely due to enormous dilution
- Water quality continues to be monitored and longer term impacts will be evaluated

Managing Water Quality Issues During Hurricane Katrina Recovery Operations

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