Water Quality 101

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ENVIROSCHOOL FOR COMMUNITIES
LOUISIANA DEPARTMENT OF ENVIRONMENTAL QUALITY

DEQ Organizational Chart

ENVIRONMENTAL SERVICES

- Water Permits
- Waste Permits
- Air Permits
- Permits Support Division

ENVIRONMENTAL COMPLIANCE

- Surveillance
- Enforcement
- Emergency Response & Radiological Services

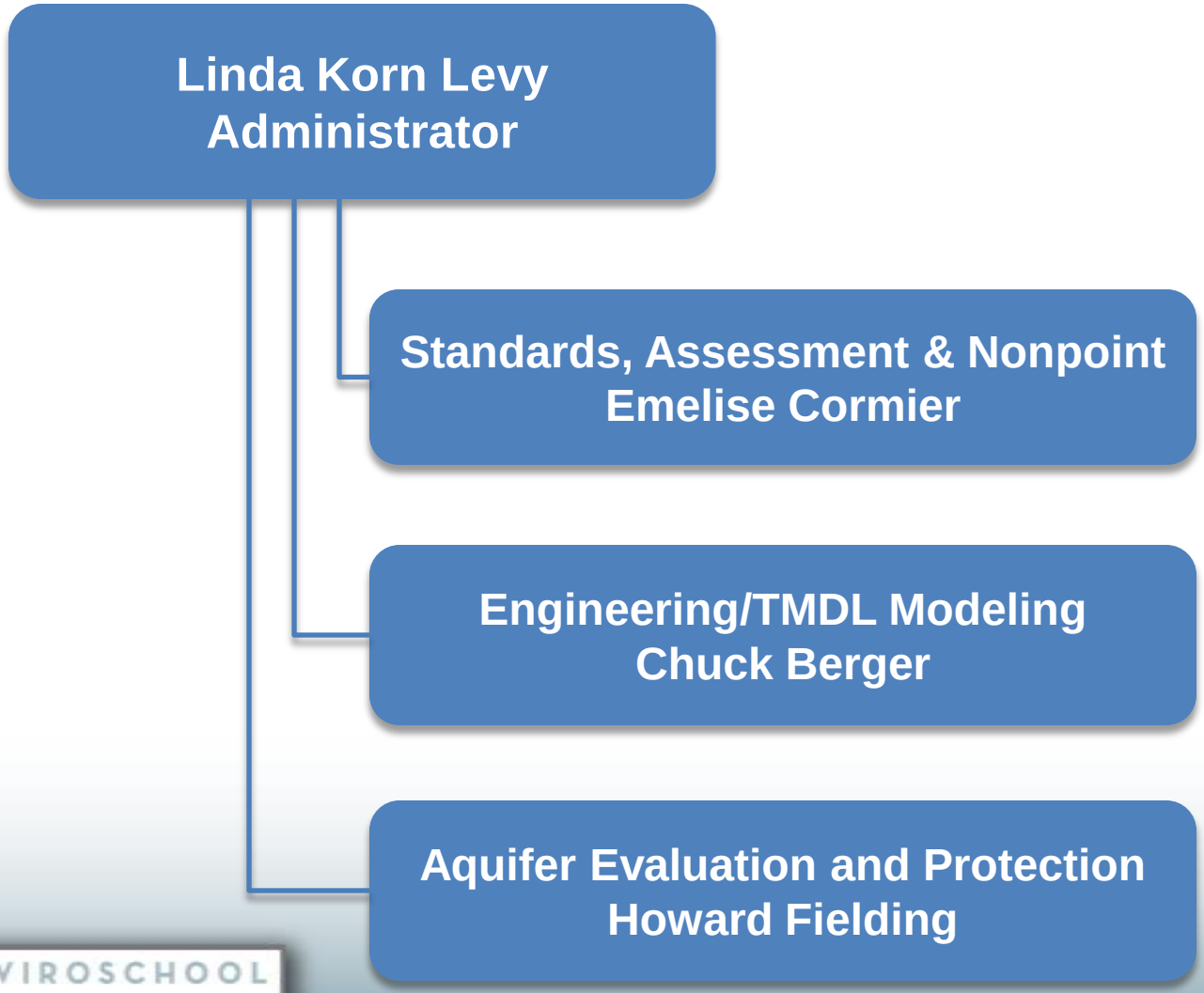
ENVIRONMENTAL ASSESSMENT

- Air Quality Assessment
- Water Quality Assessment
- Remediation
- Laboratory Services
- Underground Storage Tank

MANAGEMENT & FINANCE

- Financial Services
- Information Services
- General Services
- Human Resources

Water Quality Assessment



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Acronyms and Definitions

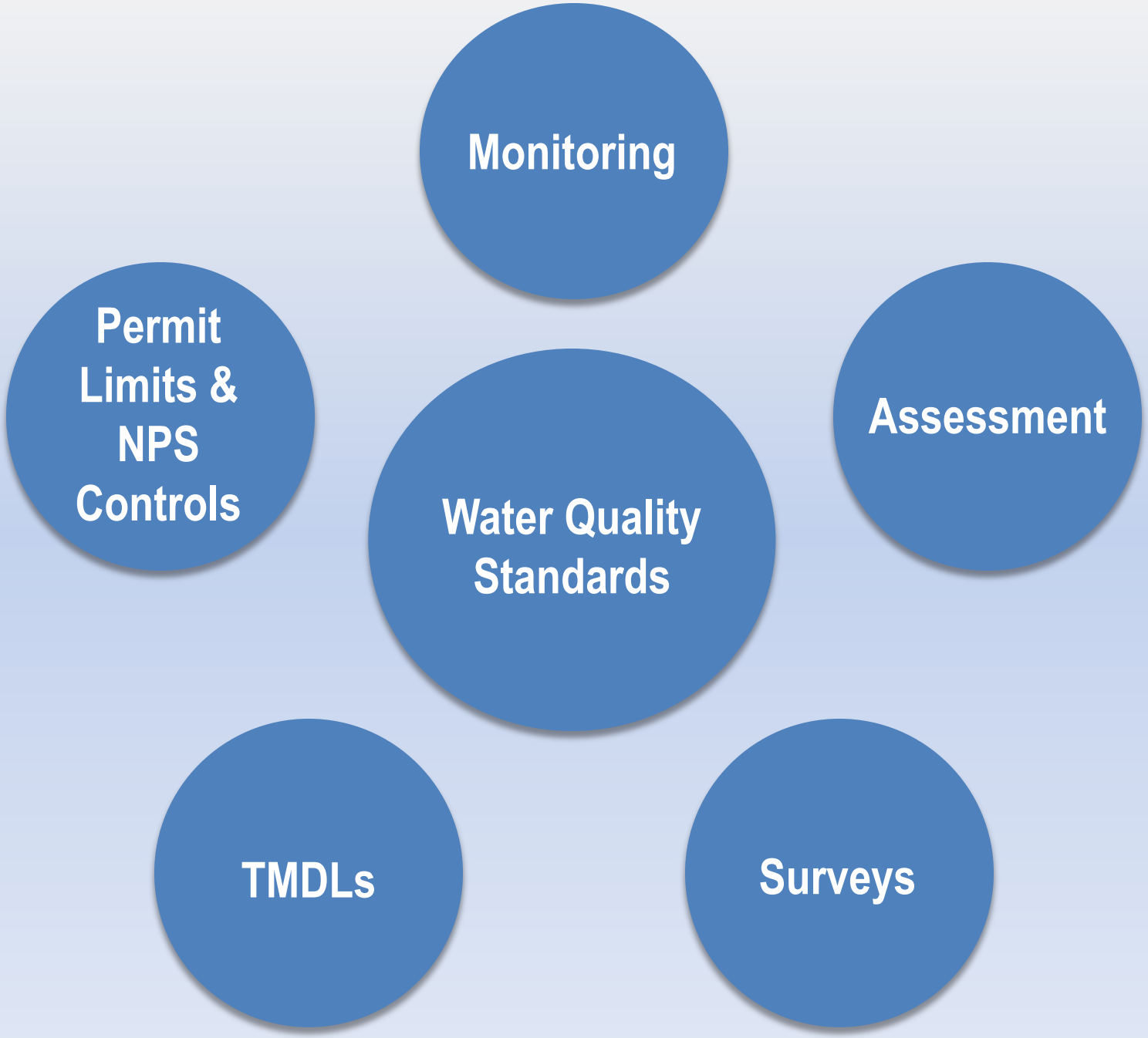
- AEPS – Aquifer Evaluation and Protection Section
- BMP – Baseline Monitoring Project
- BMP – Best Management Practices
- CWA – Clean Water Act
- L'EAU – Louisiana Environmental Assessment Utility
- LWCL – Louisiana Water Control Law
- NPS – Nonpoint Source
- SAN – Standards, Assessment and Nonpoint Source Section
- TMDL – Total Maximum Daily Load
- WQAD – Water Quality Assessment Division
- WQS – Water Quality Standard

Water Quality Assessment Division Role

- Set appropriate standards and criteria for maintenance of “healthy” state waters
- Evaluate water quality
- Determine TMDL for each water body
- Develop Watershed Plans for water body restoration

Water Quality Assessment Division Role

- Address Nonpoint Sources of Pollution through the state's NPS Management Plan
  - Education
  - Outreach
  - Implementation of BMPs
  - Encouraging public involvement and ownership
- Conduct Baseline Monitoring of Ground Water
- Source Water Protection Program


Monitoring
Permit Limits & NPS Controls
Water Quality Standards
Assessment
TMDLs
Surveys

Water Pollution Control Act Amendments of 1972

- PL 92-500
- Amended the Water Pollution Control Act of 1965; original WPCA 1956
- Commonly known as the Clean Water Act (CWA)
- Amended again in 1977, 1981, and 1987
- Current federal regulations
  - 40 CFR 130 and 131

Water Pollution Control Act Objective

- To restore and maintain the chemical, physical, and biological integrity of the Nation's waters (fishable/swimmable goal)
  - National goal to eliminate discharge of pollutants by 1985
  - National policy for development and implementation of nonpoint source control programs
  - National policy to prohibit discharge of toxic pollutants in toxic amounts

Louisiana Water Control Law

- Louisiana's version of the CWA
- Louisiana Water Control Law (R.S. 30:2072-2089)
- WQS are provisions of Louisiana State Law
- Goal of the law is to preserve, protect, and enhance:
  - The natural resources of LA's aquatic ecosystems
  - Public health and welfare
  - The quality of waters for their designated uses

Clean Water Act

- Section 303(c)
  - Provides the statutory basis for the current water quality standards program
- Section 303(d)
  - Each state shall identify those waters within its boundaries for which the effluent limitations required by (the Act) are not stringent enough to implement any water quality standard applicable to such waters.
  - The state shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.

Clean Water Act

- Section 305(b)
  - Each State shall prepare and submit (to EPA) …biennially…a report which shall include:
    - (A) a description of the water quality for all navigable waters….during the previous year;
    - (B) an analysis of the extent to which all navigable waters….provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities on the water……

Louisiana's Water Quality Standards

- Chapter 11, Part IX of the Louisiana Environmental Regulatory Code
- Development
  - …in its basic form a standard is a *use* and the *criteria* to maintain and protect that use.
- Include:
  - Designated use or uses for all surface waters of the state
  - Water quality criteria for all surface waters based on their uses
  - Antidegradation Policy

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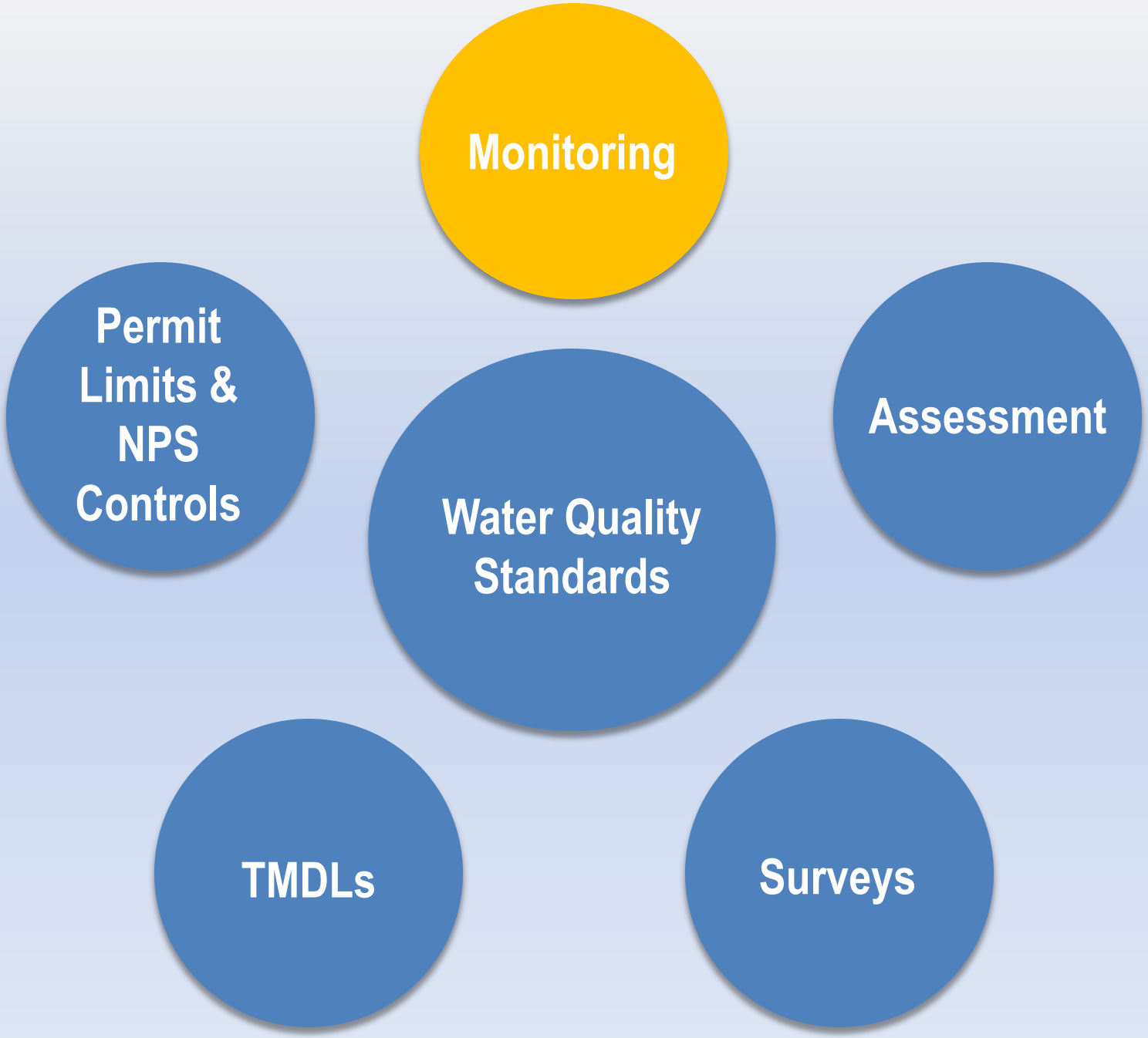
LA Water Quality Standards Designated Uses

1. Primary Contact Recreation (PCR)
2. Secondary Contact Recreation (SCR)
3. Fish & Wildlife Propagation (FWP)
4. Drinking Water Supply (DWS)
5. Oyster/Shellfish Propagation (SFP)
6. Agriculture (AGR)
7. Outstanding Natural Resource Waters (ONRW)
8. Limited Aquatic/Wildlife Use (LAW)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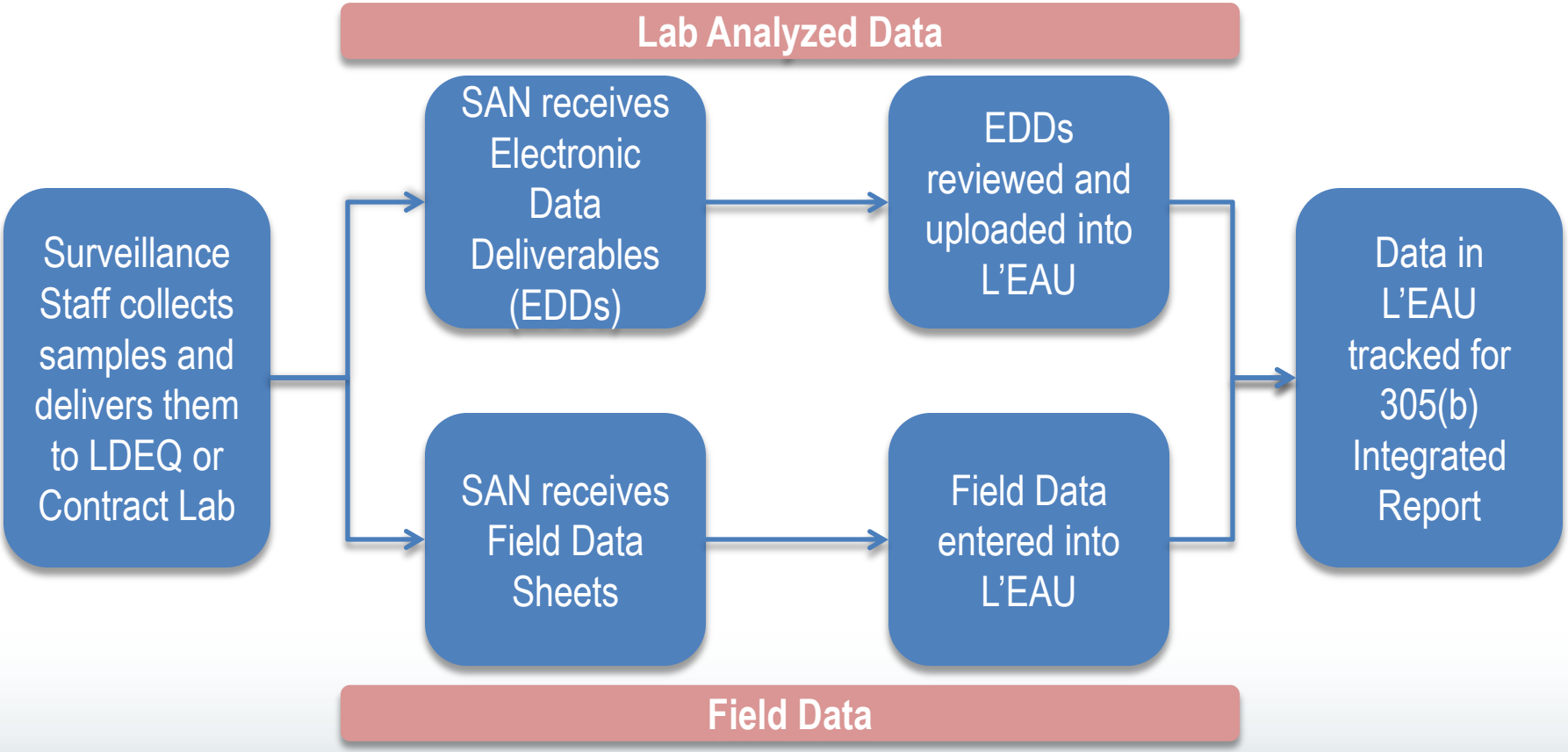
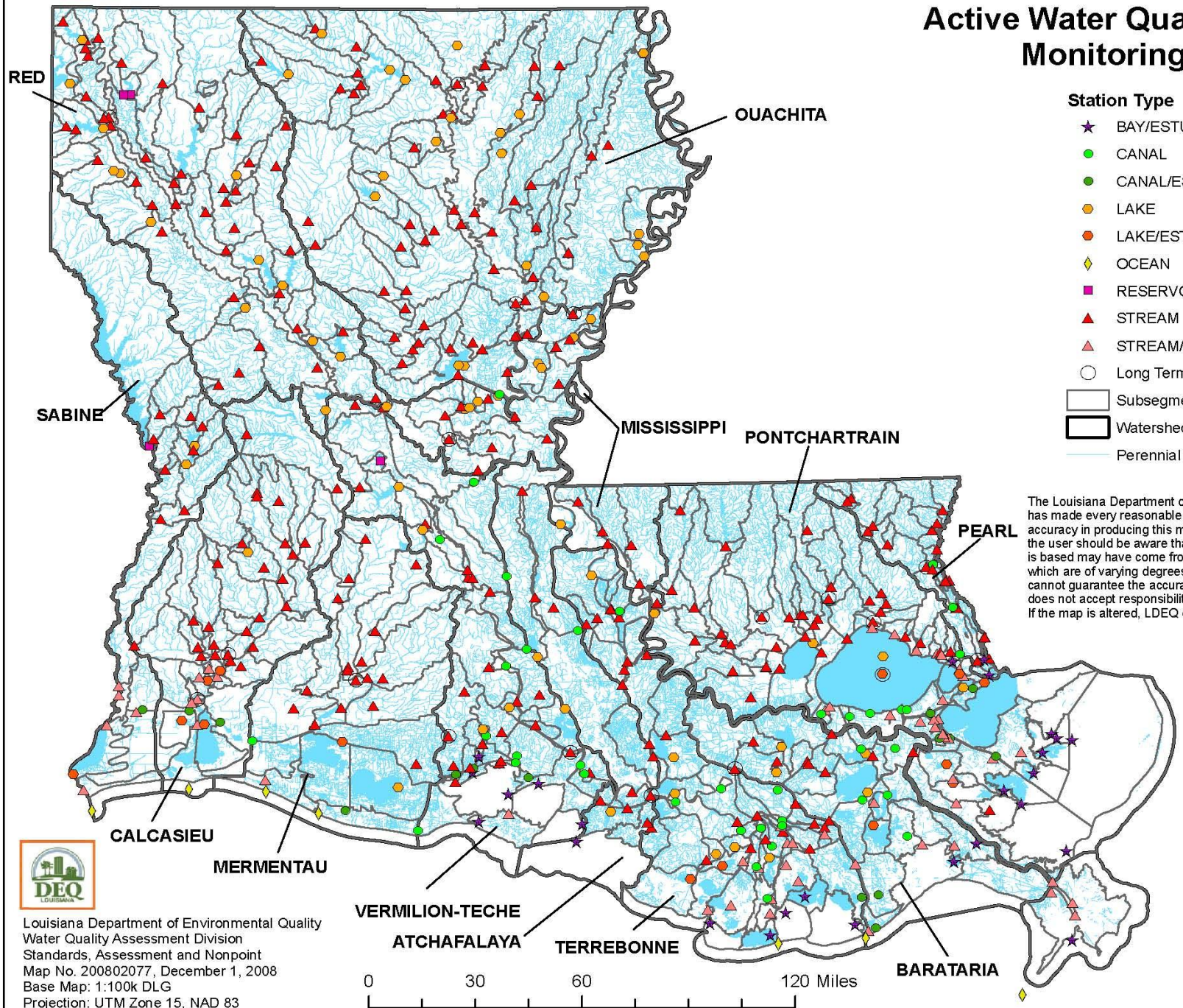
Ambient Monitoring

- Data is collected by the OEC/Surveillance Division
  - Monthly sampling
  - Ambient Monitoring Network (Project Code WQ1958001)
- A “water year” is defined as Oct 1 to Sep 30
- Not all ambient monitoring sites are scheduled to be sampled every year
  - Typically rotated on a 4-year schedule

Ambient Monitoring Data



Active Water Quality Network Monitoring Sites



Station Type

- BAY/ESTUARY
- CANAL
- CANAL/ESTUARY
- LAKE
- LAKE/ESTUARY
- OCEAN
- RESERVOIR
- STREAM
- STREAM/ESTUARY
- Long Term Monitoring Station
- Subsegment
- Watershed Basin
- Perennial Stream

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Louisiana Department of Environmental Quality
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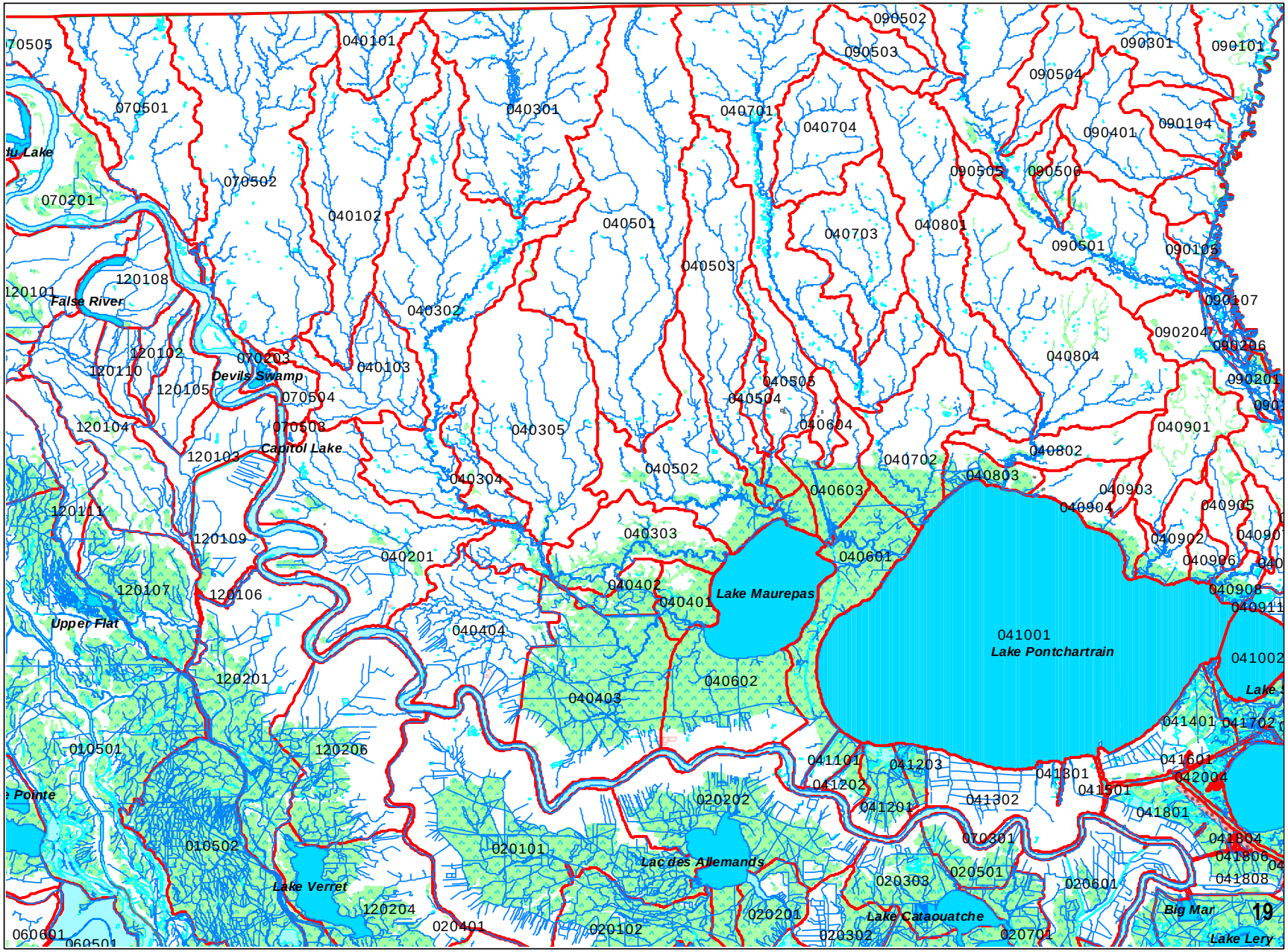
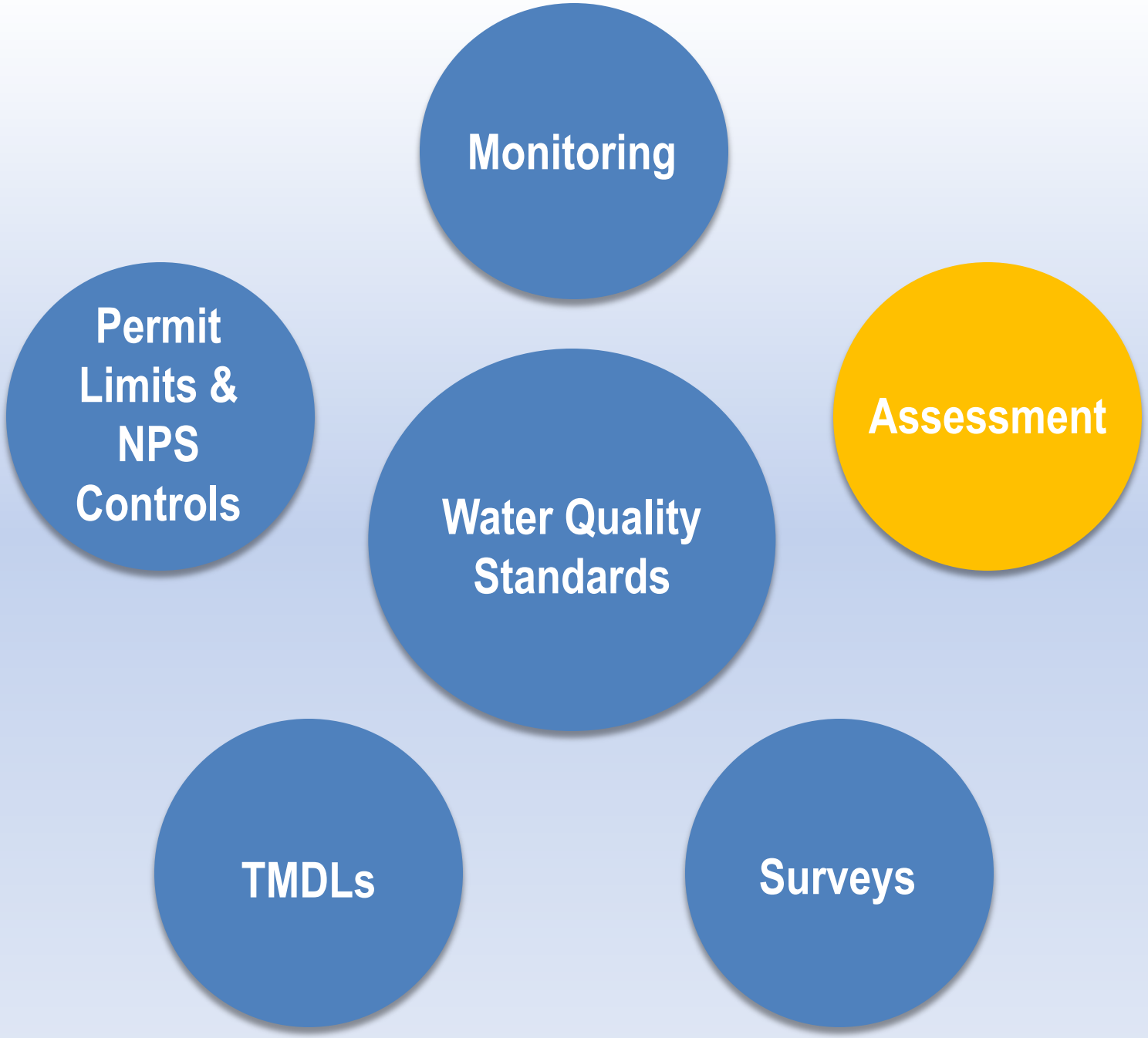
Standards, Assessment and Nonpoint
Map No. 200802077, December 1, 2008
Base Map: 1:100k DLG
Projection: UTM Zone 15, NAD 83

Subsegments

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Assessment of Water Quality: Conventional Parameters

- Data collected through Monitoring is used for Assessment
- Amount of data needed for Assessment:
  - Minimum of 5 sample points (i.e. 5 months sampled)
  - Preference for 12 sample points (i.e. 12 months sampled)
- Conventional Parameters include:
  - Chloride, Color, Dissolved Oxygen (DO), Fecal Coliform, pH, Sulfate, Temperature, and Total Dissolved Solids (TDS)

Assessment of Water Quality: Toxics

- Data collected through Monitoring is used for Assessment
- Amount of data needed for Assessment:
  - Minimum of 4 samples in a 3-year period are required
  - Two or more exceedances cause impairment
  - Sites are typically sampled quarterly for metals, volatile organic carbons (VOCs), and pesticides
- Toxics Parameters include:
  - Metals: Arsenic, Cadmium, Chromium III and IV, Copper, Lead, Mercury, Nickel, and Zinc
  - 47 organic compounds, including pesticides

Designated Uses and Parameters Assessed

1. Primary Contact Recreation (PCR)
   - Fecal Coliform (Primary)
   - Toxics: Human Health Criteria, Non-Drinking Water
   - Temperature
2. Secondary Contact Recreation (SCR)
   - Fecal Coliform

Designated Uses and Parameters Assessed

3. Fish & Wildlife Propagation (FWP)
    - Dissolved Oxygen (Primary)
    - Toxics: Aquatic Life Criteria (Primary)
    - pH
    - Temperature
    - Chloride
    - Sulfates
    - Total Dissolved Solids
    - Turbidity

Designated Uses and Parameters Assessed

4. Drinking Water Supply (DWS)
   - Toxics: Human Health, Drinking Water
5. Oyster/Shellfish Propagation (SFP)
   - Fecal Coliform
6. Agriculture (AGR)
   - None
7. Outstanding Natural Resource Waters (ONRW)
   - Turbidity

Assessment Results
Louisiana's Water Quality Integrated Report [The 305(b) Report and 303(d) List]

- Report generated every 2 years
  - Report due April 1 even numbered years
  - Process begins around September of odd numbered years
- Receive guidance document from EPA
- Analyze ambient water quality data around December using SAS (mathematical/statistical program)
- Analysis generally based on percentage of samples meeting criteria

Percentages Used for Assessment

Fully Supported	Partially Supported	Not Supported
≤ 10% samples exceed criteria	> 10% to ≤ 25% samples exceed criteria	≥ 25% samples exceed criteria
FULLY SUPPORTED	NOT SUPPORTED [303(d) List]	

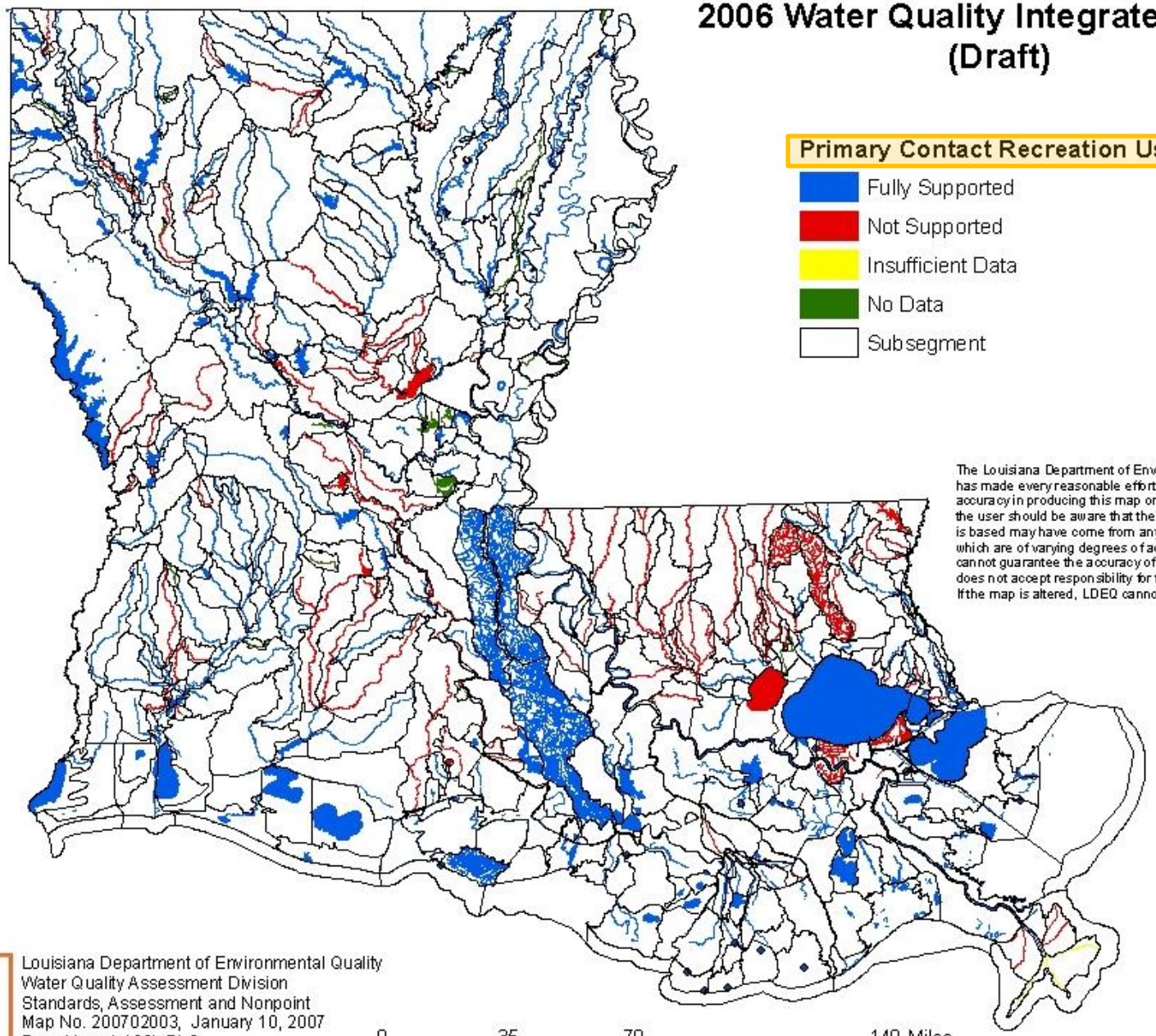
Integrated Report Development

- Water body subsegments are assessed for each parameter
- For each impaired subsegment:
  - Suspected impairment sources are assigned
  - Suspected impairment sources for each parameter are categorized

Integrated Report Categories

	Category	Description
	1	Not impaired, no causes of impairment
	2	Insufficient data
	3	Insufficient data
	4a	Impaired but TMDL completed
	4b	Impaired but other actions needed to address the problem
	4c	Impaired but not by a pollutant
303(d) List	5	Impaired but TMDL required
	5RC	Impaired but revising criteria (RC) before TMDL **New category*

2006 Water Quality Integrated Report (Draft)



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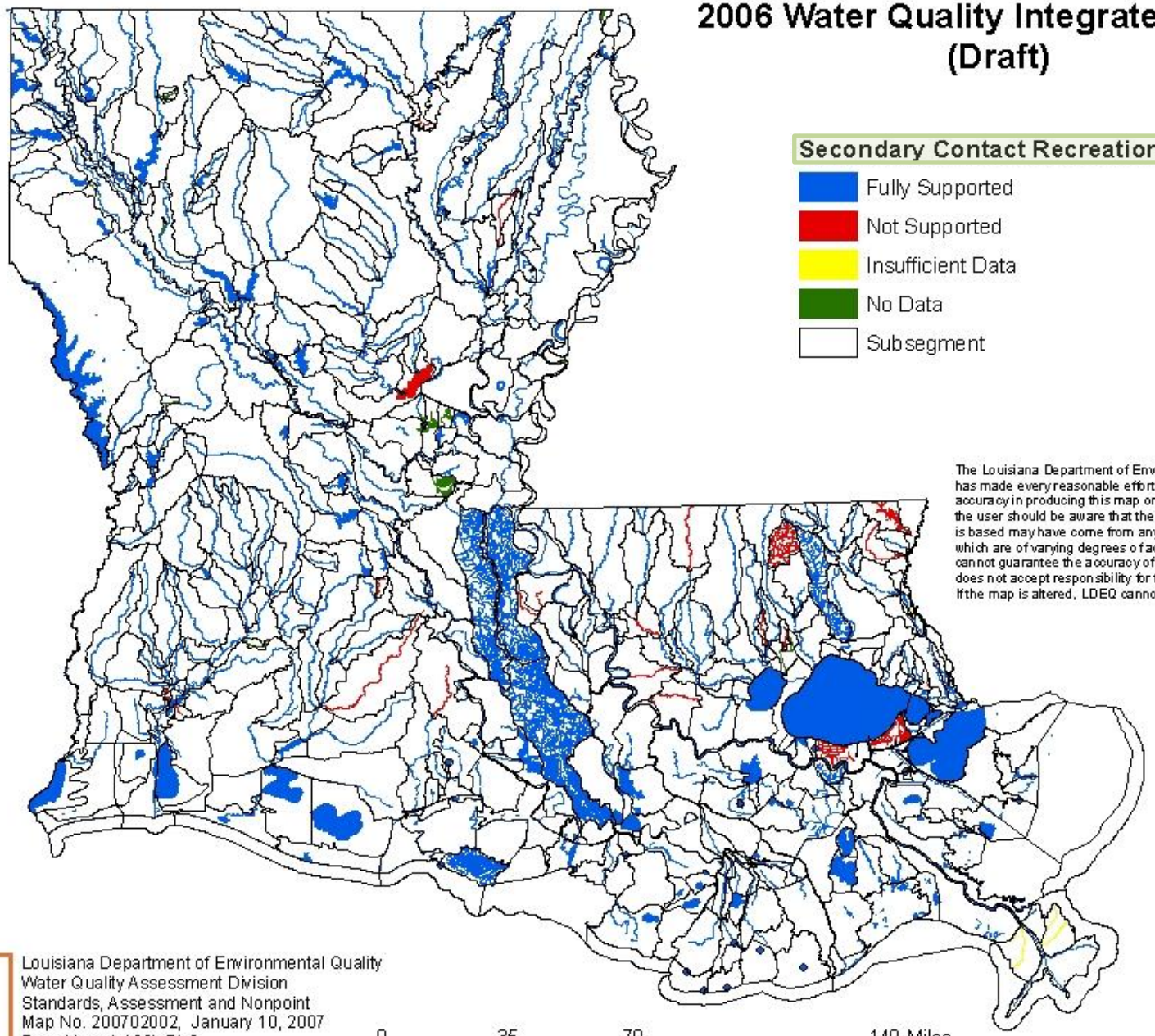
Louisiana Department of Environmental Quality
Water Quality Assessment Division
Standards, Assessment and Nonpoint
Map No. 200702003, January 10, 2007
Base Map: 1:100k DLG
Projection: UTM Zone 15, NAD 83

0 35 70 140 Miles

N W E S

2006 Water Quality Integrated Report (Draft)



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N W E S

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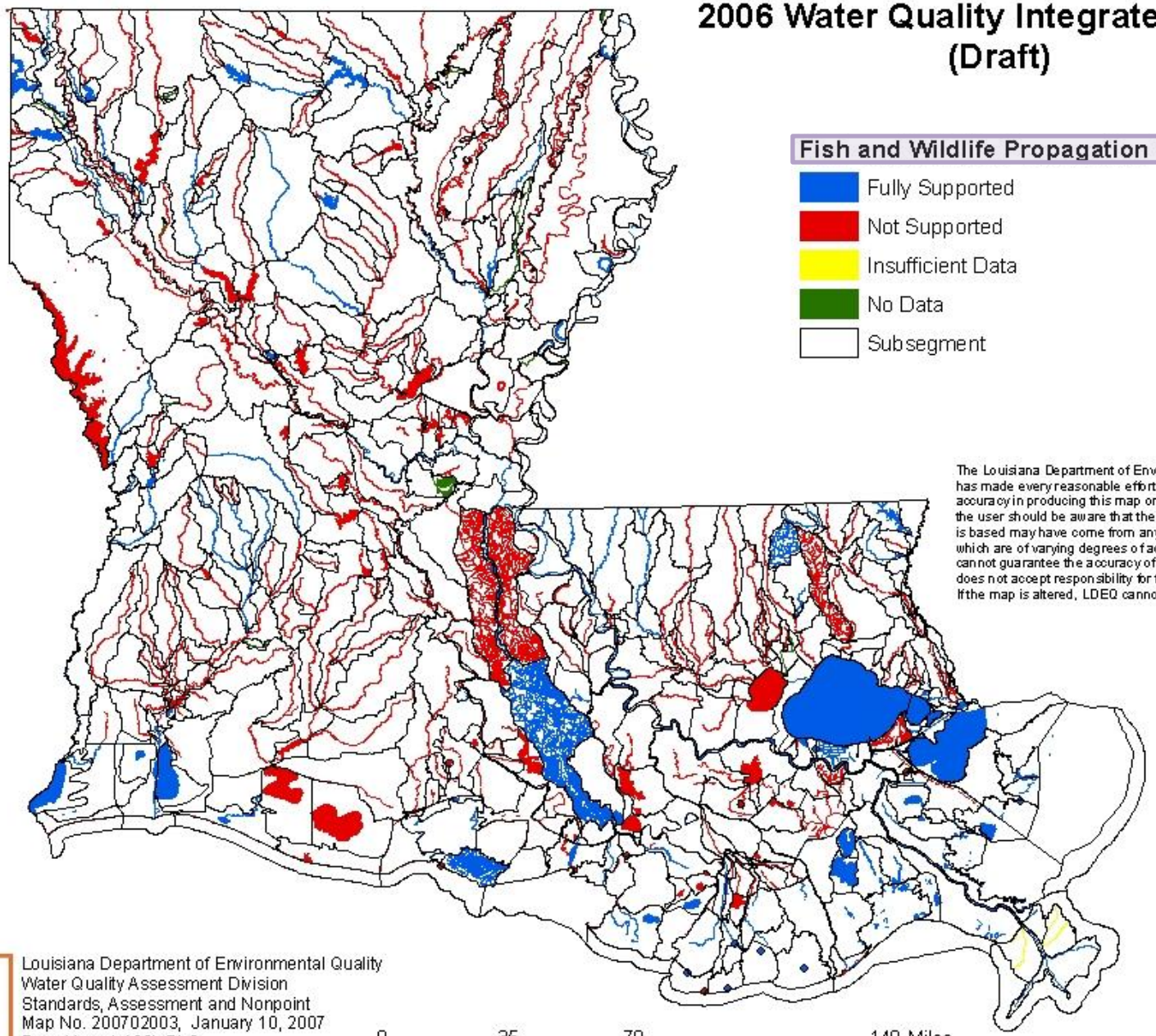

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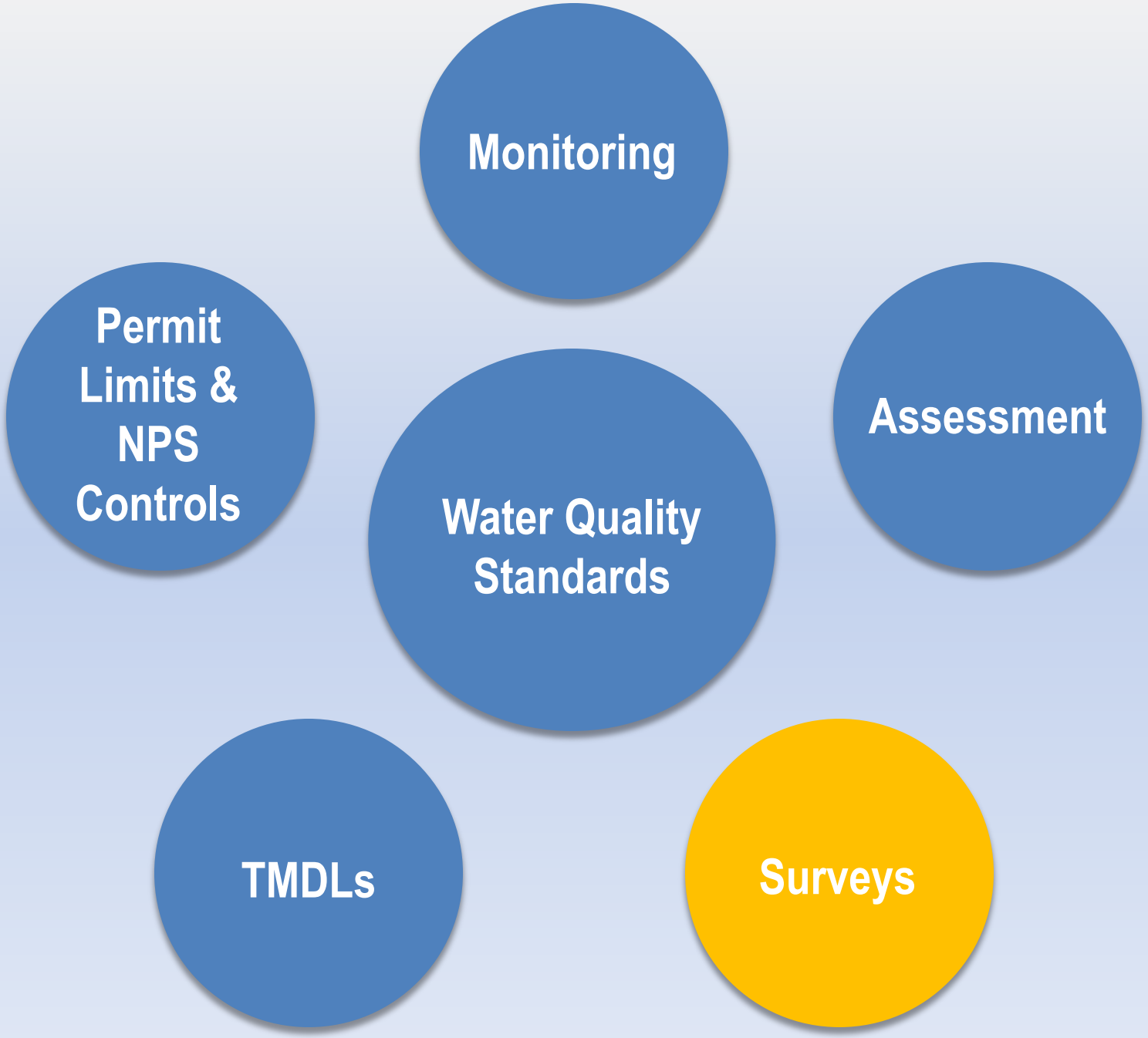
0 35 70 140 Miles

N W E S

Integrated Reports

- LDEQ's homepage: http://www.deq.louisiana.gov/portal/
- Louisiana's Integrated Reports located at: http://www.deq.louisiana.gov/portal/tabid/98/Default.aspx
- The 2008 Integrated Report will be placed at this same location.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Water Quality Surveys

- Collect data used in:
  - TMDL development
  - Revising standards
  - Special projects

Water Quality Surveys: TMDL Data Collection

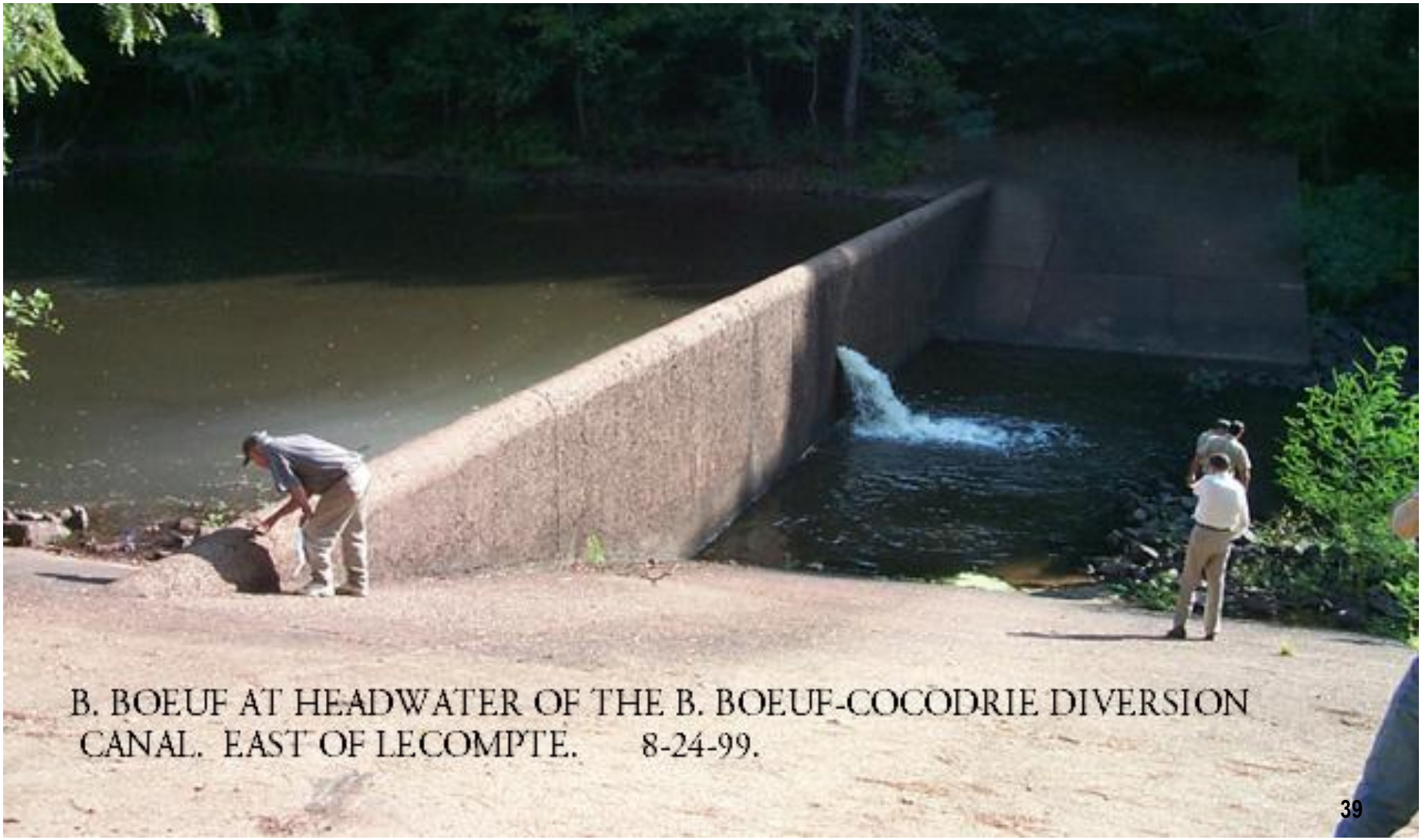
- Determine which water bodies require TMDLs
- Pre-Reconnaissance Planning
  - Surveys staff and Engineers determine scope of survey
  - Identify streams, dischargers (permitted facilities), and water intakes/agricultural activities in survey area
  - Review available stream data
    - USGS stream flow data
    - LDEQ water quality data
    - Louisiana Water Quality Inventory/305(b) Report

Water Quality Surveys: TMDL Data Collection

- Reconnaissance
  - Visit potential sampling sites on impacted stream and its tributaries/distributaries
  - Observe stream conditions to assess equipment needs
    - Flow, Depth, Dischargers, Accessibility, Obstructions, Bridges, Boat Board, Bridge Board, Wading, Width, etc.
  - GPS (Global Positioning System) potential sites

Aerial Reconnaissance of Big Creek

Obstructions on Water Body: Dam



B. BOEUF AT HEADWATER OF THE B. BOEUF-COCODRIE DIVERSION CANAL. EAST OF LECOMPTE. 8-24-99.

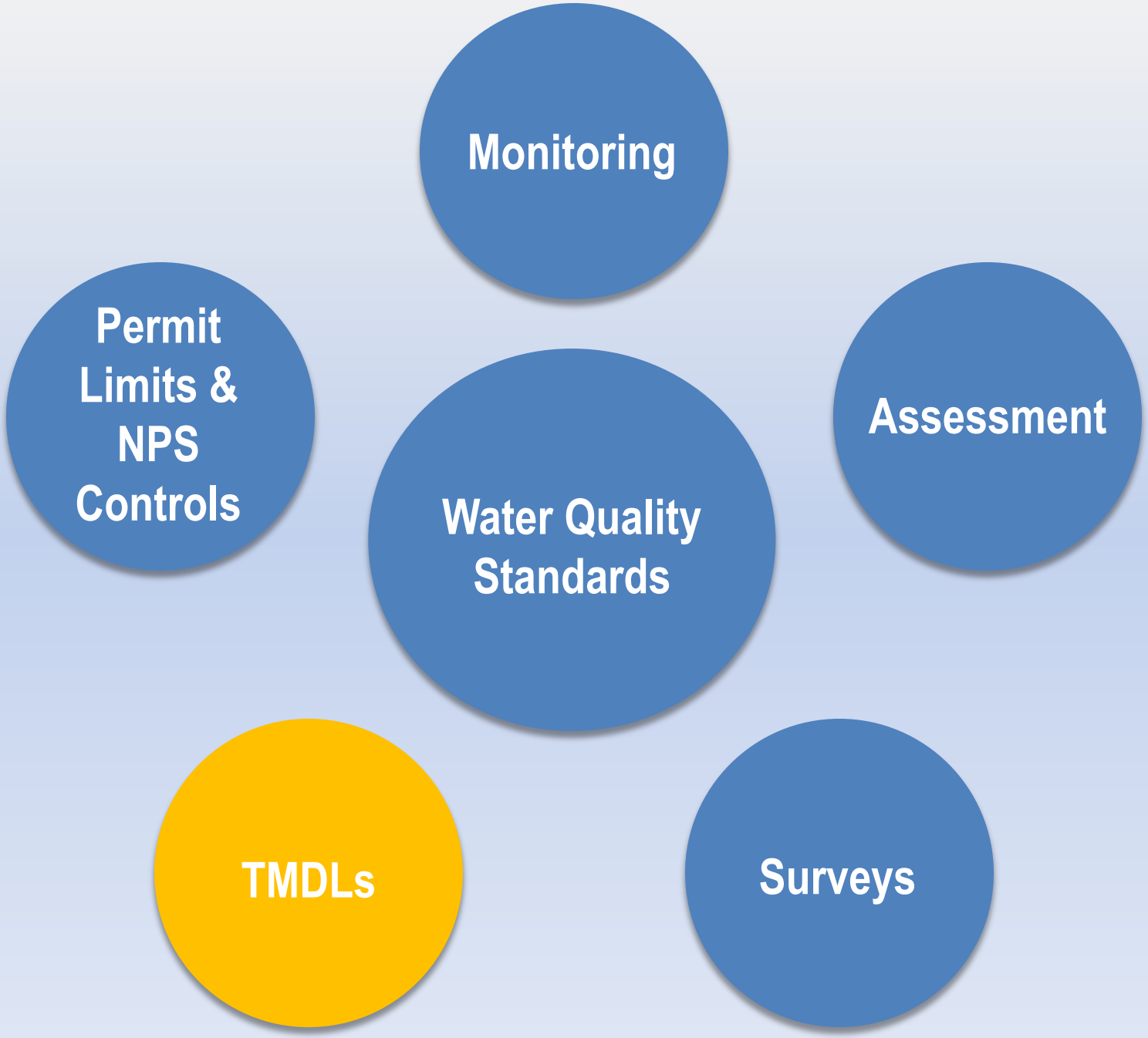
Obstructions on Water Body: Beaver Dam

Water Quality Surveys: TMDL Data Collection

- Pre-Survey Planning
  - Determine sampling sites and equipment needs
  - Determine parameters to be measured
    - BOD (Biological Oxygen Demand), Chlorophyll a, Total Organic Carbon (TOC)
    - “A” Bottle: Alkalinity, Chlorides, Color, Conductivity, Sulfates, Total Dissolved Solids, Total Suspended Solids, and Turbidity
    - “B” Bottle: Sodium (Na^+)
    - “C” Bottle: Hardness, Nitrates, Total Kjeldahl Nitrogen, Total Phosphorus

Water Quality Surveys: TMDL Data Collection

- Survey
  - Discharge Measurements
  - Measure a representative cross-section
    - i.e. map of the stream morphology
  - Collect water quality data
    - Ex: BOD, Chlorophyll a, TOC and A, B, C Bottle parameters
  - Collect continuous monitoring and grab water quality data
    - Ex: Dissolved oxygen, pH, and temperature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TMDLs

- Total Maximum Daily Load
  - A TMDL in a calculated allowable pollutant loading for a water body
  - That ensures the water body meets or maintains applicable water quality standards
  - And maintains its designated uses.

TMDL = WLA + LA + MOS

- **WLA** = **W**aste **L**oad **A**llocation to point sources
- **LA** = **L**oad **A**llocation to NPS or to natural background sources
- **MOS** = **M**argin **o**f **S**afety
  - Greater uncertainty = Larger MOS

Pollutants Targeted for TMDLs

LDEQ	EPA
• Biological Oxygen Demand (BOD) • Nutrients - Ammonia, Nitrogen, and Phosphorus • Metals - Cadmium, Copper, Lead, and Mercury	• Pathogen Indicators • Turbidity/Suspended Solids • Salinity/Total Dissolved Solids • Sulfate • Oil and Grease • Pesticides • Priority Organics

TMDL Challenges

- Warm temperatures
- Little or no slope
- Little or no flow
- High Sediment Oxygen Demand (SOD)
- Hydrologically altered streams
  - Weirs, dams, dredging, or channelization (straightening)

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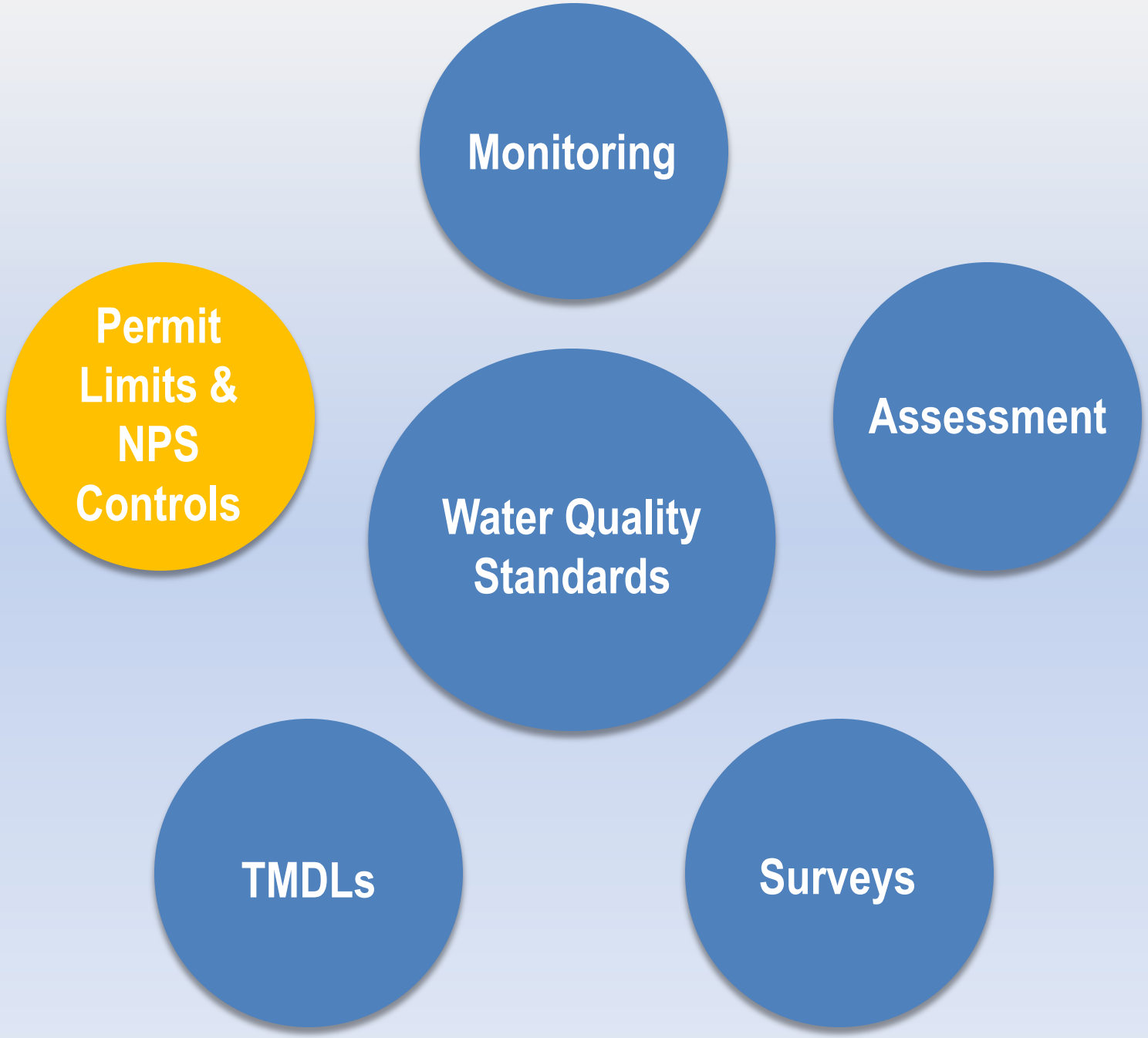
TMDL Findings

- Dissolved oxygen criterion (5 mg/L year-round) is not attainable in many Louisiana bayous and streams
  - Seasonal criteria are more appropriate
- A large portion of the total loading is natural:
  - Biological Oxygen Demand (BOD) loading from riparian bottomland forests and swamps
  - Sediment Oxygen Demand (SOD)
- A small portion of the total loading comes from point source loads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Implementation

Point Sources (Regulatory)	Nonpoint Sources (Non-Regulatory)
Permits will be issued based upon approved TMDLs	Watershed implementation plans are being developed
Compliance schedules will be employed	Nonpoint sources will be addressed through existing voluntary program
TMDLs will be revised as needed	Projected pollutant reductions will be goals

Section 319 of CWA

- Determine which water bodies are impacted by Nonpoint Source Pollution (NPS)
- Identify land-use activities that contribute to impacts on water quality
- Implement programs and practices to:
  - Reduce NPS
  - Restore the water body to its designated uses

NPS Management Plan

- Statewide approach
- Targets:
  1. Agriculture
  2. Forestry
  3. Urban Runoff
  4. Home Sewage Systems
  5. Sand and Gravel Mining
  6. Hydromodification

1. Agriculture

- NPS sources
  - Row crops, dairies, poultry operations, and pastures
- BMP Implementation
  - Section 319 Funds from LDAF
  - USDA Funds from Farm Bill
  - Master Farmer Program (Educational)

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2. Forestry

- NPS sources
  - Clear cut timber harvesting and forest roads
- BMP Implementation
  - Statewide Forestry BMP Manual
  - Master Logger Program
  - Sustainable Forestry Initiative
  - Statewide BMP Compliance

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3. Urban Runoff

- NPS sources
  - Construction, parking lots, residential, commercial, and industrial
- BMP Implementation
  - Storm Water Permits
    - Phase 1 and 2 Cities
  - Master Developer Program
  - Revised ordinances and Codes of Regulations for Cities and Parishes

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4. Home Sewage Systems

- NPS sources
  - Home sewage
- BMP Implementation
  - Permits from Louisiana Department of Health and Hospitals (LDHH)
  - 2-year maintenance agreement
  - Homeowner responsibility after 2-year period

5. Sand and Gravel Mining

- NPS sources
  - Sand and gravel mining
- BMP Implementation
  - New BMP Manual
  - Waster Water Permits
  - Educational Workshops

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6. Hydromodification

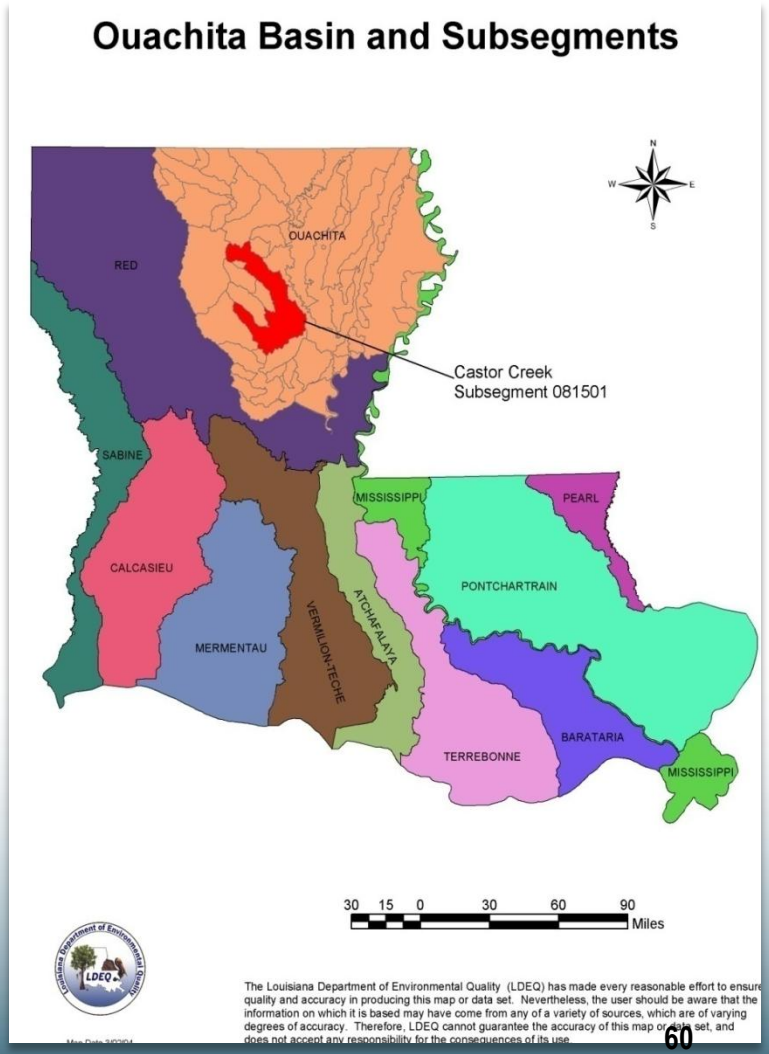
- NPS sources
  - Hydromodification
- BMP Implementation
  - 401 Water Quality Certification
  - BMPs for Riparian Restoration
  - Geomorphology (bioengineering)

How Do We Address NPS Issues?

- Implementation Plans
  - Description of study area
  - Water quality analysis
  - TMDL findings and recommendations
  - Identify:
    - Land uses
    - High priority areas
    - Sources of pollution
    - Solutions to NPS
  - Develop timeline for plan implementation

NPS Implementation Plan Case Study: Castor Creek

- Located in Quachita Basin
  - Subsegment 081501
- Headwaters in northern Jackson Parish
- Contains 36 tributaries
- Designated uses include:
  - PCR, SCR, and FWP
- Dissolved oxygen (DO) standard of 5 mg/L is not met



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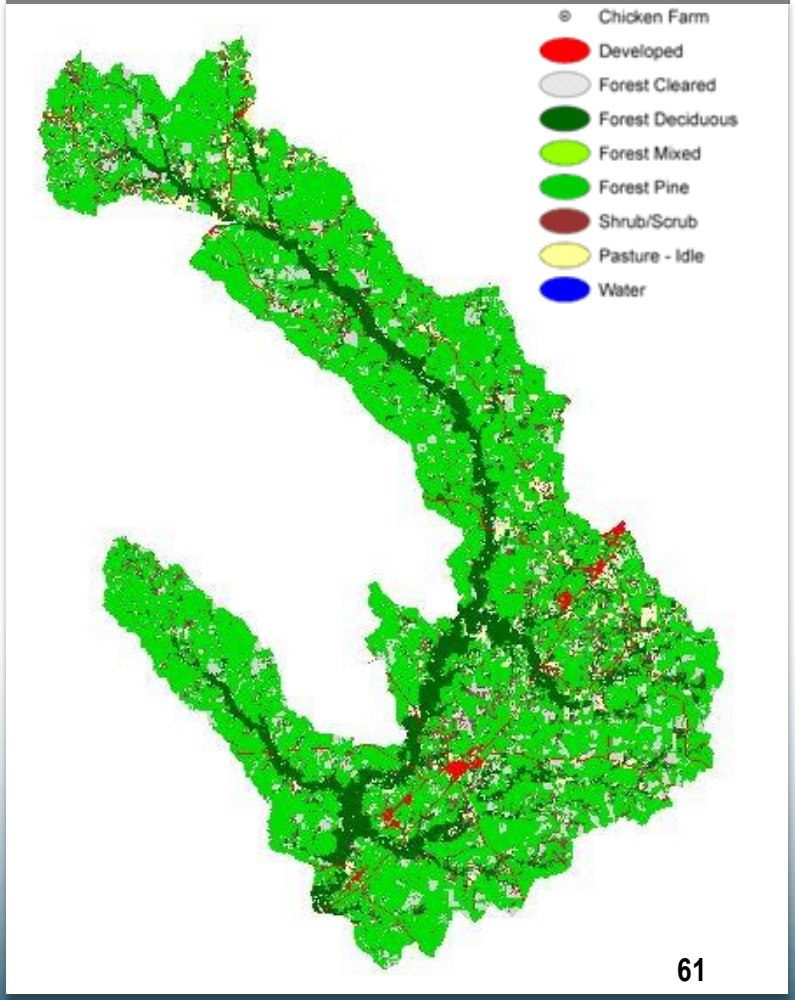
Case Study: Castor Creek
Implementation Plan Summary

- Priority land use
  - Forest
- Priority location
  - Riparian areas
- Due to low erosion rates and low flow conditions, likely that WQS for DO not met due to natural conditions

Land use map for Castor Creek watershed

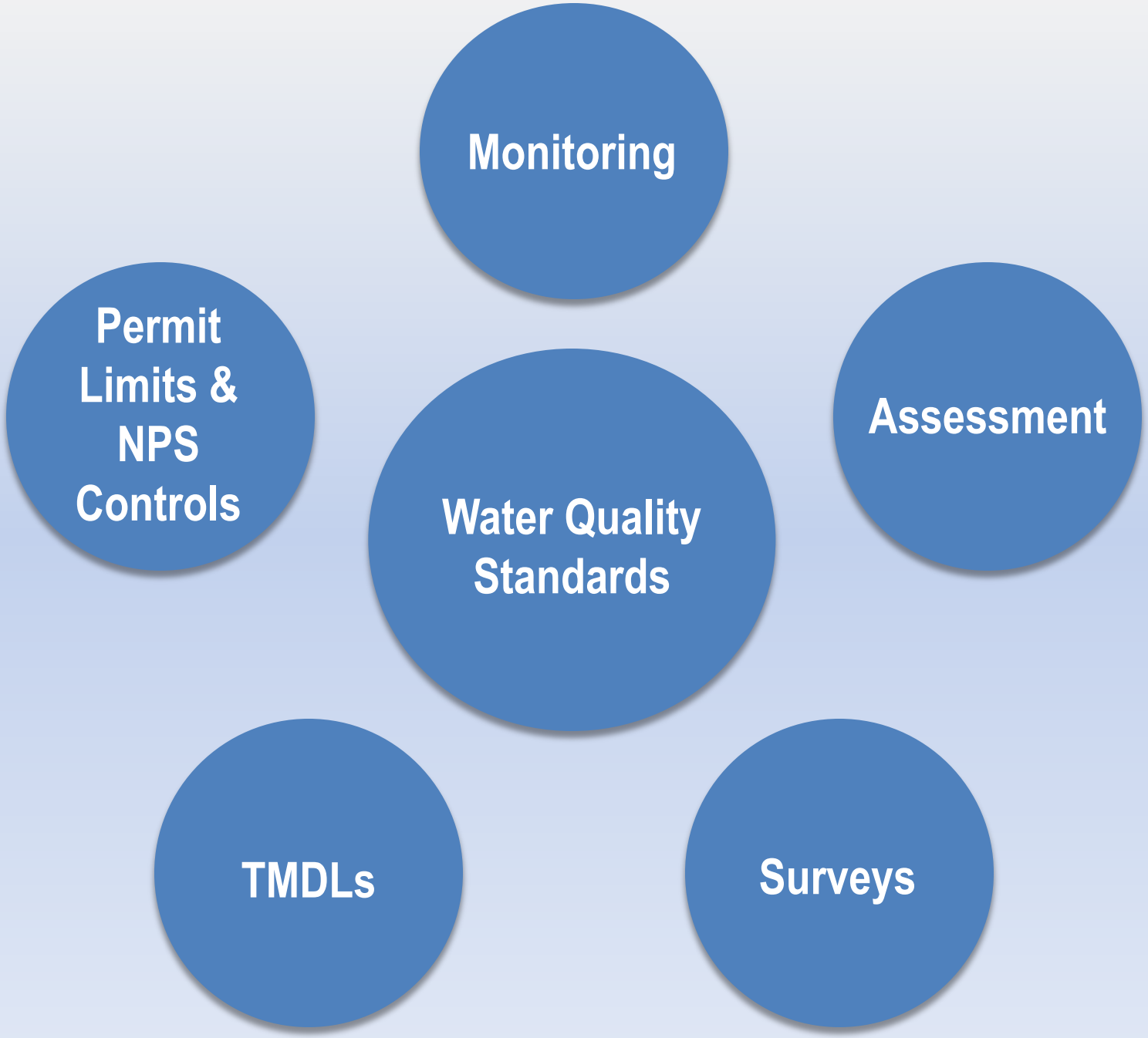


Case Study: Castor Creek Implementation

- Forestry BMPs
- Urban BMPs
- Education
- Streambank restoration for landowners
- Gully erosion and pasture land management

Case Study: Castor Creek
Translating Findings to the Public

- Louisiana Forestry Association
- Louisiana Office of Forestry
- Local Communities for Urban Issues
- Local Soil and Water Conservation Districts
- Local community involvement
  - Local Watershed Groups
  - Statewide Ad campaign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Specific WQAD Programs

I. Baseline Monitoring Program
   - To establish initial quality of ground water aquifers

II. Source Water Protection
   - To assist Louisiana communities in protecting their drinking water sources

III. Louisiana's Clean Waters Program
   - To reclaim and protect surface water resources through NPS abatement

IV. Ecoregional Criteria Development and Refinement
   - To determine appropriate criteria based on natural conditions for Louisiana's water bodies

I. Baseline Monitoring Program

- Statewide, voluntary
- Ambient ground water monitoring
- Targets aquifers
  - The number of wells targeted is determined by Aquifer Aeral Extent
- 3-year recurring schedule
- Determine initial (baseline) quality
- Track changes over time
- Contribute data to the Integrated Report (Assessment)

I. Baseline Monitoring Program History

- Program began in 1990 for 2 industrial corridors
  - Mississippi River Industrial Corridor
  - Lake Charles Industrial Corridor
- Not aquifer specific
- Majority of wells sampled have industrial use
- Only 20 wells sampled
- Funded by EPA, CWA Section 106

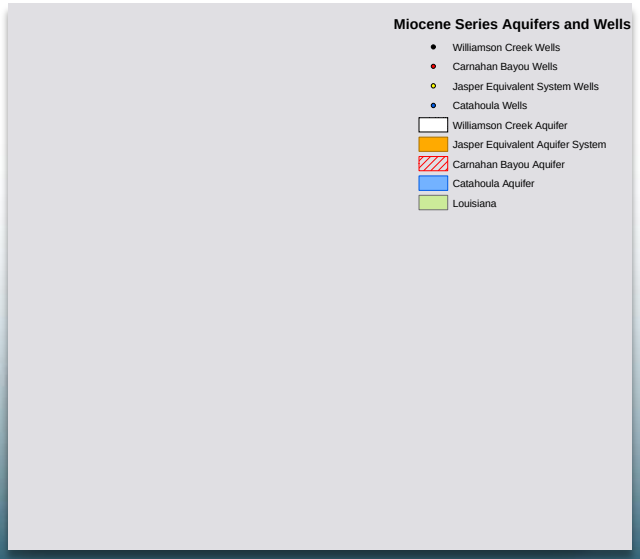
I. Baseline Monitoring Program Present

- Many well use-types sampled
  - Public Supply (99), Domestic (45), Industrial (32), Irrigation (20), Observation (4), Power Generation (2), Monitor (1), Recovery (1), Other (1)
- Targets 14 major aquifers and aquifer systems
- Approximately 200 wells sampled every 3 years
- Sampled over 250 wells about 1000 times
- Funded by USEPA, CWA Section 319 Grant

I. Baseline Monitoring Program Parameters Sampled

- Field parameters
- GPS locations
- Conventional water quality and nutrients
- Inorganic (total metals)
- VOCs and Semi-VOCs
- Pesticides and PCBs
- 164 parameters sampled at each site

I. Baseline Monitoring Program Well Locations



I. Baseline Monitoring Program Statewide Summary

- Youngest aquifers have the poorest quality
  - Mostly shallow aquifers from Pliestocene Age
- Mid-age aquifers tend to be best quality
  - Deeper aquifers from Pliocene and Miocene Ages
- Oldest aquifers somewhere in between
  - Mixed depth from Eocene-Paleocene Age

II. Source Water Protection

- Designed by LDEQ
- To assist Louisiana communities in protecting their drinking water sources
- To assist others in addressing a drinking water source impairment
  - Focus on potential NPS pollution prevention and drinking water protection

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II. Source Water Protection
Federal Register, Vol 68 205 60665

- Base 319 funds can be used to protect:
  - Sources of drinking water
  - Critical high quality-waters
  - Threatened waters from current or future threats
- States should make reasonable effort to:
  - Identify significant sources
  - Identify the management measures that will most effectively address those sources

II. Source Water Protection Assessment Program

- Identify significant sources through mapping of:
  - All public supply wells
  - Surface water intakes
  - Potential sources of contamination
- Purpose to assess potential susceptibility to contamination (impairment) of all sources of public drinking water supply

II. Source Water Protection Factors Affecting Susceptibility

- Types and numbers of potential sources of contamination in the source water protection area and their distance from the well or intake
- Ground water systems
  - Age and depth of well
  - Aquifer permeability
  - Recharge potential of aquifer
- Surface water systems
  - Age of intake
  - Average annual rainfall
  - Vegetative cover
  - Slope of land
  - Number of feeder streams (i.e. runoff)

II. Source Water Protection Sources of Pollution

- Nonpoint Source (NPS)
  - Defined as a diffuse source of water pollution that does not discharge through a point source
  - But instead, flows over exposed natural or man-made surfaces
    - Such as agricultural or urban runoff
    - And runoff from construction, mining, or silvicultural activities
  - Estimated to cause 40 to 50% of Louisiana's water quality problems

II. Source Water Protection
Potential Sources of Pollution

- Common Urban NPS
  - Gas station surfaces
  - Abandoned stations
  - Golf Courses
  - Dry Cleaners
  - Septic systems
  - Lawns/Gardens
  - Impervious surfaces
  - Construction activities
  - Body/Paint Shops
  - Above-ground storage tanks
  - Car washes and Repair Shops

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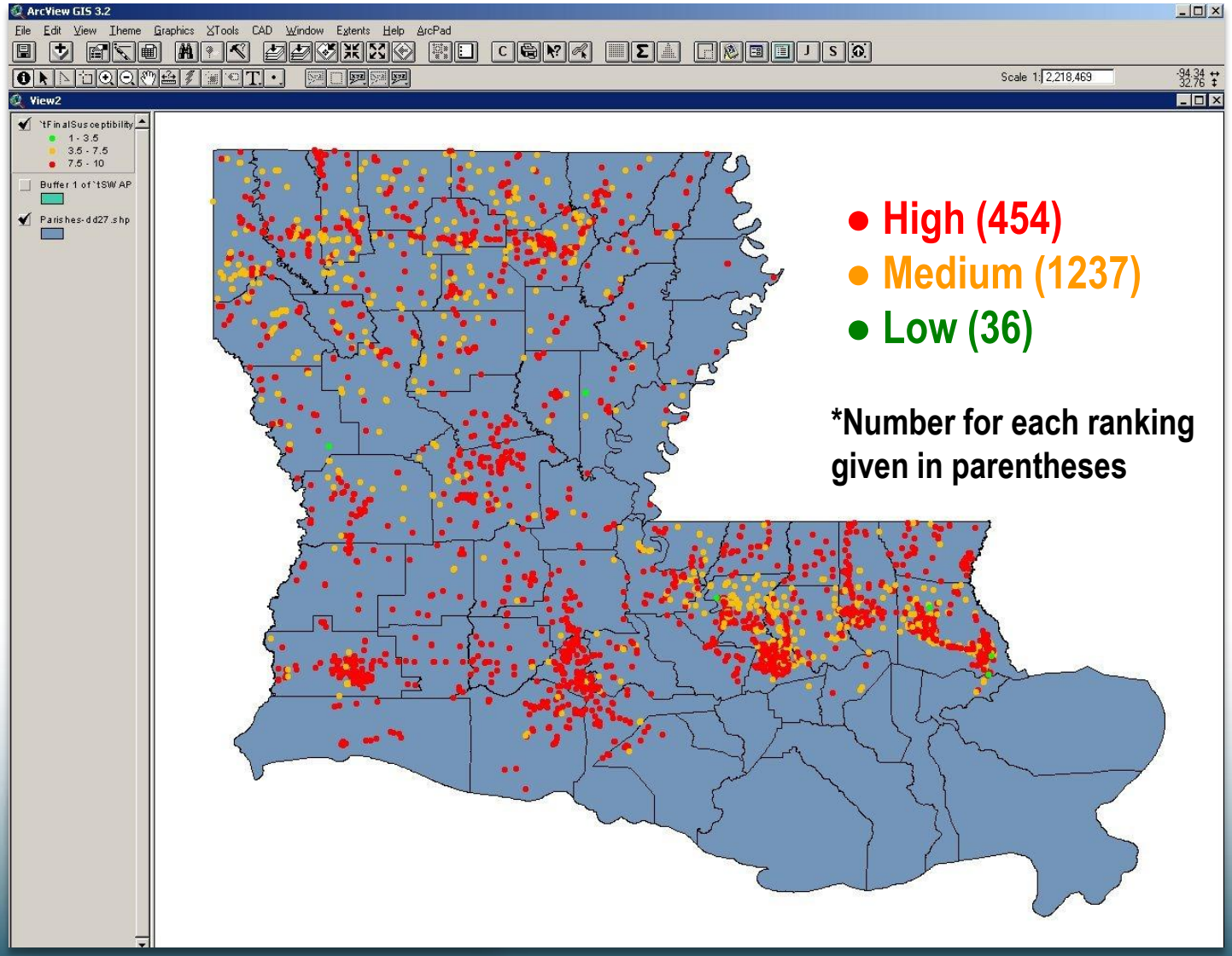
II. Source Water Protection Drinking Water Designated Use

- Under the CWA, drinking water is a designated use for a water body
- Aquifer Evaluation and Protection Section (AEPS) works with SAN Section (dealing with WQS)
  - To assure that all surface water drinking water bodies have that designated use
- Source Water Protection Program
  - Designed to prevent drinking water source impairment resulting in a required TMDL

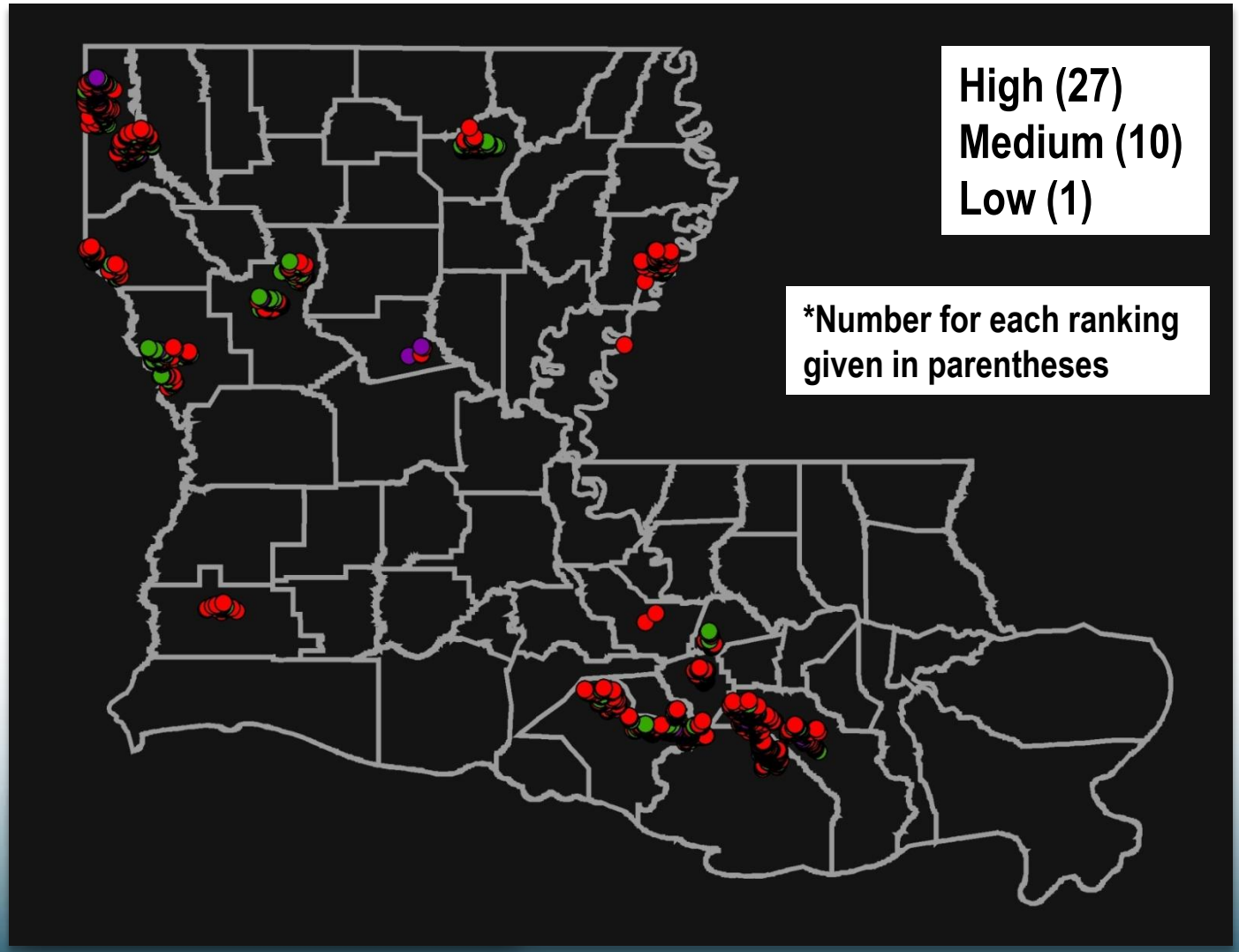
II. Source Water Protection
Targeting Systems for Protection

- Targeted on a parish-wide basis
  - Parishes with numerous systems having high susceptibility rankings are targeted first, especially in high population centers
  - Also those with impaired surface water drinking water bodies
- Currently focusing on:
  - Ouachita Parish (Monroe)
  - Calcasieu Parish (Lake Charles)

II. Source Water Protection Ground Water System Rankings



II. Source Water Protection Surface Water System Rankings



II. Source Water Protection National Measures

- To control NPS from Urban Areas
  - – High population areas
    - 69% of population lives on 2% of land in urbanized areas
- Ways to educate the public
  1. Drinking Water Protection Signs
  2. Workshops – Local Committee Training
  3. Outreach Materials – Handouts and Videos
  4. Source Water Protection Ordinances

II. Source Water Protection
1. Drinking Water Protection Signs

- Visit local officials to discuss Source Water Protection Program
- Signs
  - Provide highway signs to be placed at protection area boundaries

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II. Source Water Protection

2. Workshops – Local Committee Training

- Hold community meeting
  - Educate public
  - Solicit volunteers to join parish committee
- LDEQ trains committee

II. Source Water Protection
3. Outreach – Handouts and Videos

- Local stakeholders distribute:
  - Fact sheets to public
    - Ex: Septic System Maintenance
  - Activity sheets and Videos to schools
- Examples:
  - List of used oil recyclers posted in business and published in newspapers
  - Drinking water protection video provided to local access TV channels

II. Source Water Protection
4. Ordinances

- LDEQ provides local committee members with a model drinking water ordinance
- Committee members attend police jury and town council meetings to encourage adoption of ordinance, tailored to specific community needs
- 44 ordinances have been passed in 14 parishes

II. Source Water Protection Implementation of BMPs

- Requires coordination with SAN Section (Nonpoint source unit)
- Inform business owners located near public water supply well or intake on BMPs
- Provide window decal for business
  - For Drinking Water Protection Partners

III. Clean Waters Program

- To reclaim and protect surface water resources through NPS abatement
- Goal:
  - To reduce watersheds listed as impaired on 303(d) list
  - Enable and support local environmental efforts that reduce NPS

III. Clean Waters Program Specific Tasks

- Identify NPS sources
- Develop contacts with watershed stakeholders
- Make recommendations to LDEQ on existing watershed plans
- Assist in development of new or incomplete watershed plans

III. Clean Waters Program Specific Tasks

- Research water quality impacts within assigned watersheds
- Review available ambient data
  - Identify data gaps or areas of concern
- Form watershed committee
- Outreach and Education

III. Clean Waters Program Stakeholder Coordination

- Dependent upon discovered sources
- Strength (and credibility) in numbers
- Advantages of the Montage of Expertise
- Tools/Resource/Options Understanding and Availability
- Increase trust with sources positioned to provide water quality restorative action

IV. Ecoregional Criteria

- Many Louisiana water bodies do not meet nationally recommended water quality standards
  - Due to naturally occurring physical, chemical, and biological factors
- This is especially true for dissolved oxygen (DO) and the pollutants that impact DO (nutrients and sediments)

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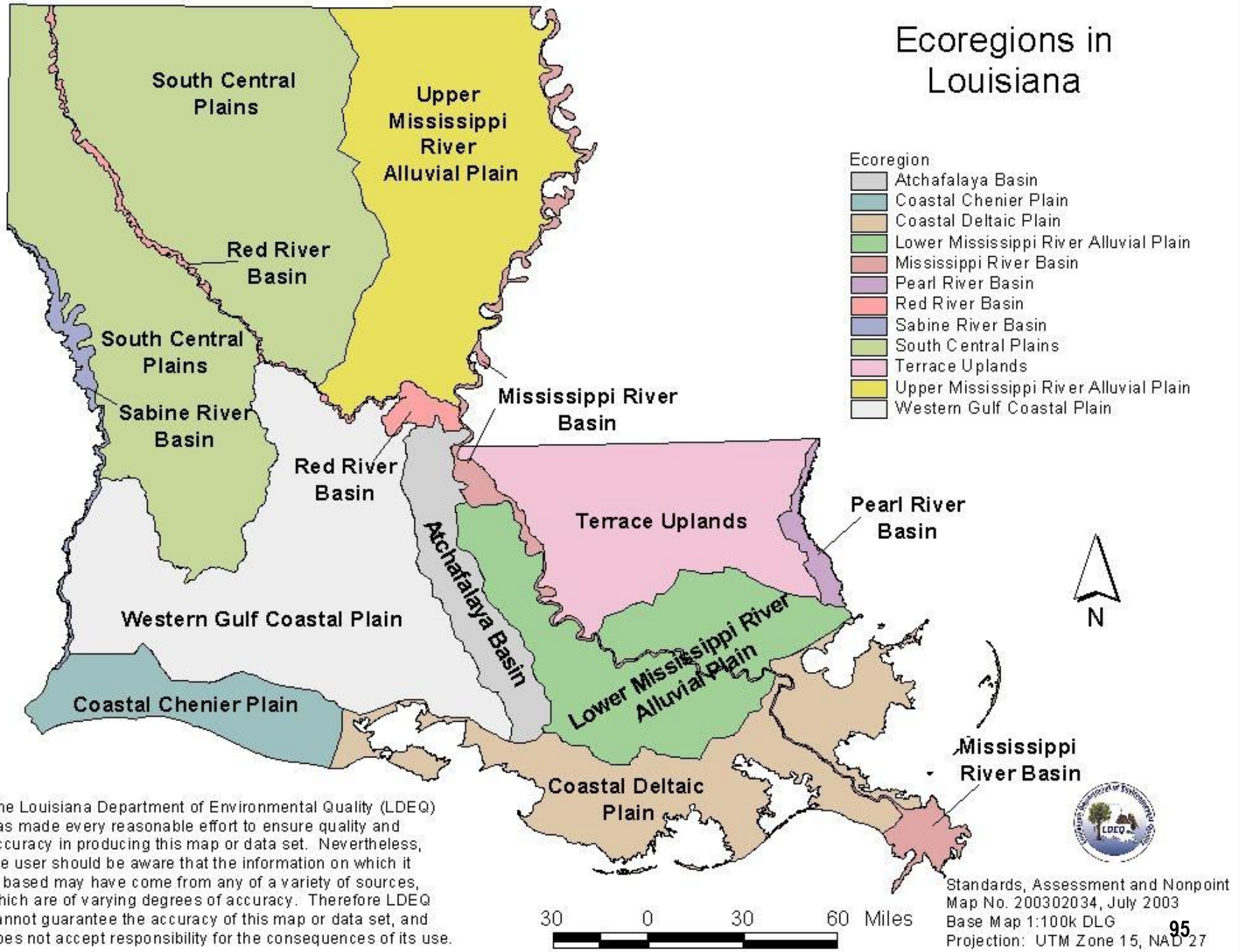
IV. Ecoregional Criteria

- Ecoregion = regional areas with similar ecological characteristics
  - Characteristics such as hydrology, soil, flora, fauna, climate, etc.
  - Such that, the water quality and aquatic life are more likely to be similar within an ecoregion
- Natural conditions at reference (or least-impacted sites) represent the best attainable conditions for an ecoregion

IV. Ecoregional Criteria Development and Refinement

- Ecoregion Concept
  - Supported by EPA and utilized by other states
- LDEQ and EPA-Region 6 developed protocol to use ecoregion approach for refining the dissolved oxygen criteria
- May also be used to develop or refine criteria for other water quality parameters
  - Such as nutrients and minerals



The Louisiana Department of Environmental Quality (LDEQ) has made every reasonable effort to ensure quality and accuracy in producing this map or data set. Nevertheless, the user should be aware that the information on which it is based may have come from any of a variety of sources, which are of varying degrees of accuracy. Therefore LDEQ cannot guarantee the accuracy of this map or data set, and does not accept responsibility for the consequences of its use.

Standards, Assessment and Nonpoint
Map No. 200302034, July 2003
Base Map 1:100k DLG
Projection: UTM Zone 15, NAD 27

IV. Ecoregional Criteria
Reference Site Selection

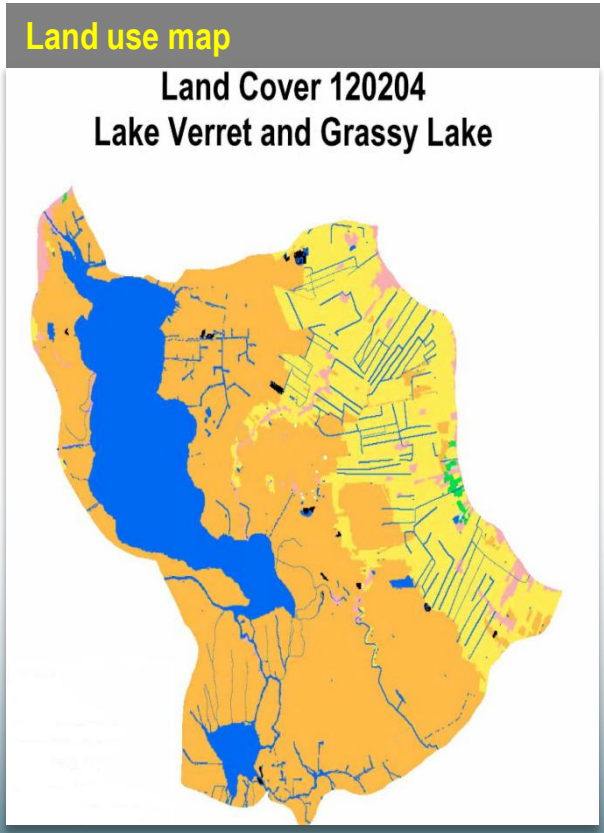
- Reference Site Selection Criteria
  - The entire watershed should be without any unusual or unique morphological or hydrological characteristics that are not exhibited by any other water body within the ecoregion
  - No significant point or nonpoint sources should discharge to or impact the water body
    - Examples: agricultural or silvicultural activities, urban developments, and gravel mining

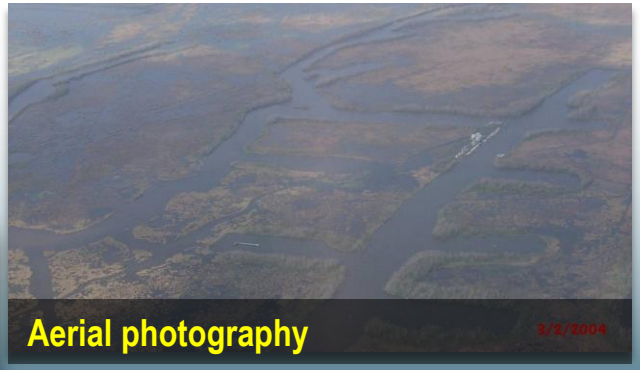
IV. Ecoregional Criteria
Reference Site Selection

- Reference Site Selection Criteria
  - The water body should be natural, preferably with no hydromodification
  - The water body should have a site that is accessible to the sampling crew
  - The water body should be able to be sampled with gear of choice for the ecoregion and water body type

IV. Ecoregional Criteria
Reference Site Selection

- Tools used for reference site selection
  - Land use maps
  - Aerial photography
  - Satellite imagery
  - Point source inventories
  - Reconnaissance surveys





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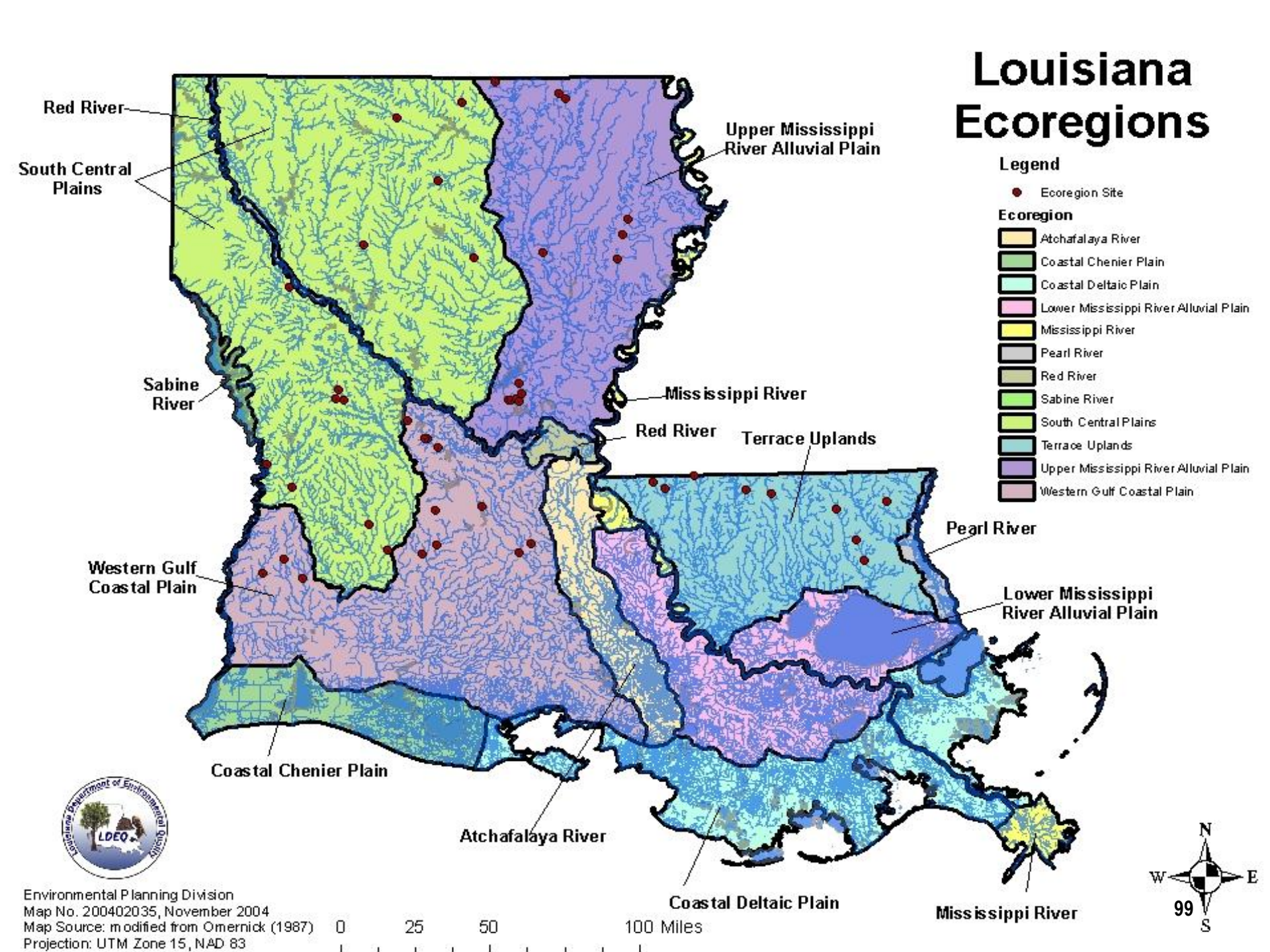
Louisiana Ecoregions
Legend
Ecoregion Site
Ecoregion
Atchafalaya River
Coastal Chenier Plain
Coastal Deltaic Plain
Lower Mississippi River Alluvial Plain
Mississippi River
Pearl River
Red River
Sabine River
South Central Plains
Terrace Uplands
Upper Mississippi River Alluvial Plain
Western Gulf Coastal Plain
Red River
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Upper Mississippi River Alluvial Plain
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Atchafalaya River
Coastal Deltaic Plain
Mississippi River
Louisiana Department of Environmental Quality
LDEQ
Environmental Planning Division
Map No. 200402035, November 2004
Map Source: modified from Omernick (1987)
Projection: UTM Zone 15, NAD 83
0 25 50 100 Miles
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IV. Ecoregional Criteria Data Collection

- Water quality
  - Dissolved oxygen, Temperature, pH, etc.
  - Grab and continuous monitoring (48 to 72 hours)
- Nutrients
  - Nitrogen, Phosphorus, Chlorophyll a, etc.
- Minerals
  - Chlorides, Total Dissolved Solids, Sulfates
- Habitat Assessments
- Biological
  - Fish


Deployment of continuous monitor

IV. Ecoregional Criteria Data Inventory

Existing Data	Physical		Chemical						Biological	
	Geomorphic	Habitat Assessments	DO *in situ*	DO Continuous monitoring	TKN	Nitrate-Nitrite	TP	Chlorophyll a	Fish	Benthic
Louisiana Department of Environmental Quality (LDEQ)										
Ecoregion Studies (WQ1991006)		X	X	X	X	X	X		X	X
DO Slope (ES2002003)	X			X	X	X	X			
Ambient Water Quality Network (WQ1958001)			X	X	X	X	X			
Reference Stream (Various Project Numbers)	X	X	X		X	X	X			
Louisiana Department of Wildlife and Fisheries (LDWF)										
Inland Fisheries Independent Monitoring									X	
Louisiana State University (LSU)										
Fish Assemblage Project (Kelso et al. 2008)	X	X	X	X	X	X	X	X	X	
Nutrient Project (Lane et al. 2008)			X		X	X	X	X		
U.S. Geological Survey (USGS)										
Regional Environmental Monitoring and Assessment (REMAP)		X	X	X					X	X
National Water Quality Assessment (NAWQA)	X	X	X			X	X			X

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IV. Ecoregional Criteria
Determine Appropriate Criteria

- Determining appropriate criteria for areas with naturally low dissolved oxygen
- Data collected is used to:
  - Determine the critical period for dissolved oxygen (DO)
    - Time of year when DO exceeds the current national benchmark (5 mg/L freshwater and 4 mg/L estuarine)
  - Characterize the diurnal (24-hour) pattern of DO
  - Characterize DO observed in morning hours

IV. Ecoregional Criteria
Barataria and Terrebonne Basins

[Coastal Deltaic Plains (CDP) and Lower Mississippi River Alluvial Plains (LMRAP) Ecoregions]

Ecoregion	Water body Type	Period	National Benchmark (mg/L)	10th percentile of reference data (6 am to 12 pm)	Criteria
CDP	Bay/Estuary	Critical (Apr-Aug)	4	4.5	4.0
CDP	Bay/Estuary	Non-Critical (Sep-Mar)	4	7.1	4.0
CDP	Canal	Critical (Jun-Aug)	4	3.8	3.8
CDP	Canal	Non-Critical (Sep-May)	4	5.5	4.0
CDP	Lake	Critical (Jun)	5	6.0	5.0
CDP	Lake	Non-Critical (Jul-May)	5	6.8	5.0
CDP	Stream	Critical (Apr-Aug)	5	3.8	3.8
CDP	Stream	Non-Critical (Sep-Mar)	5	6.3	5.0
LMRAP	Lake	Critical (Apr-Sep)	5	3.3	3.3
LMRAP	Lake	Non-Critical (Oct-Mar)	5	7.9	5.0
LMRAP	Stream	Critical (Mar-Nov)	5	2.3	2.3
LMRAP	Stream	Non-Critical (Dec-Feb)	5	5.4	5.0

IV. Ecoregional Criteria
Current Projects

- Rule number WQ075
  - Barataria-Terrebonne Basins rule change for dissolved oxygen criteria based on ecoregion approach
- Collecting water quality and other data from Inland Ecoregion streams for refinement of DO criteria
  - South Central Plains (SCP)
  - Terrace Uplands (TU)
  - Upper Mississippi River Alluvial Plains (UMRAP)
  - Western Gulf Coastal Plains (WGCP)

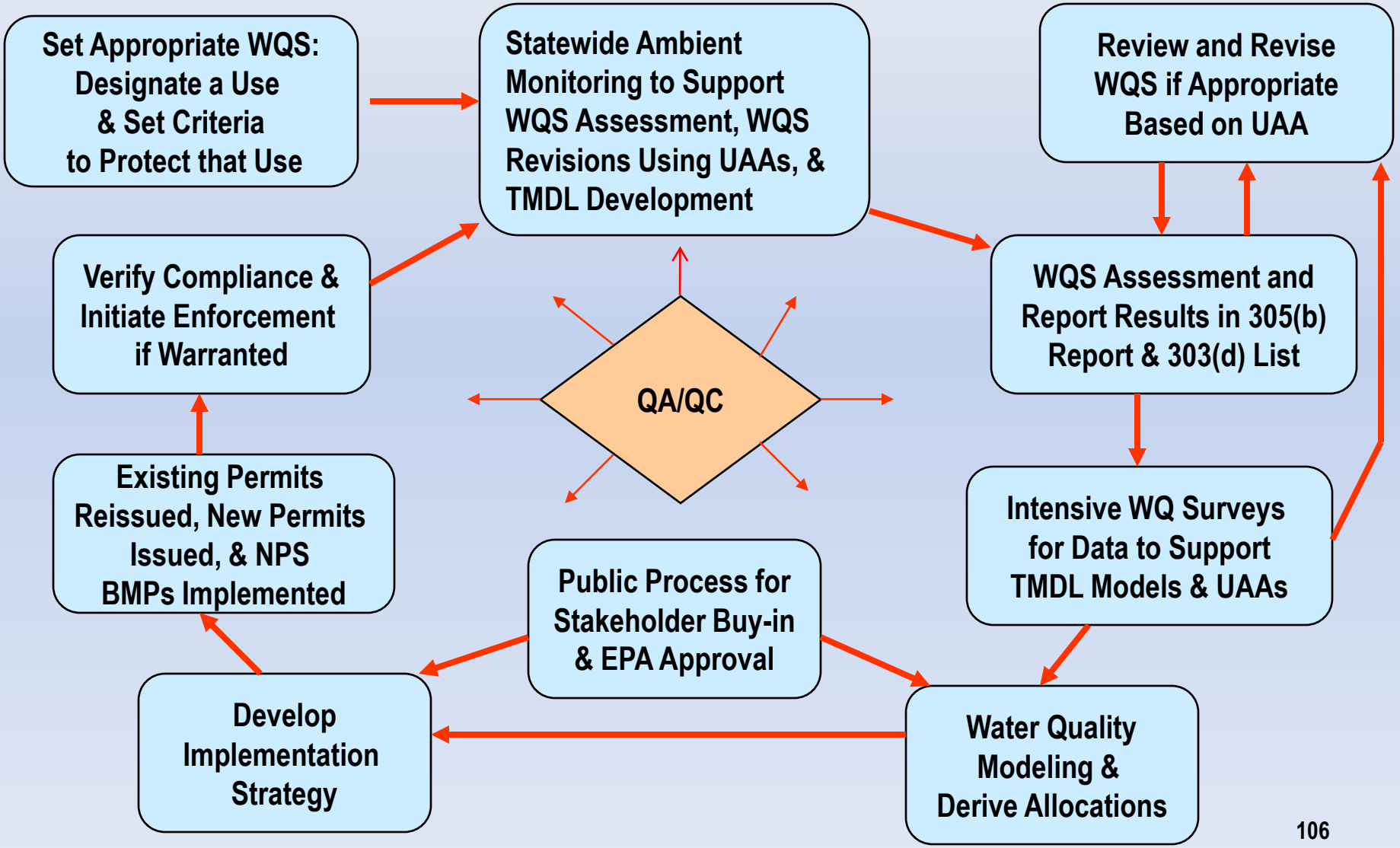
SCP Ecoregion – Beaucoup Creek

UMRAP Ecoregion – Cross Bayou

WGCP Ecoregion – Loving Creek

TU Ecoregion – West Fork Thompsons Creek

What's the Connection?




Questions?

Water Quality Assessment Division Web Resources

- LDEQ Homepage
  - http://www.deq.louisiana.gov/portal/
- Water Quality Assessment Division (WQAD) Homepage
  - http://www.deq.louisiana.gov/portal/tabid/69/Default.aspx
- Water Quality Regulations and Standards
  - http://www.deq.louisiana.gov/portal/Default.aspx?tabid=1674
- Ambient Water Quality Monitoring Data
  - http://www.deq.louisiana.gov/portal/tabid/2739/Default.aspx
- Integrated Reports
  - http://www.deq.louisiana.gov/portal/tabid/98/Default.aspx