

ESSENTIAL TO IDENTIFY LANDSCAPE SETTING

- **GEOMORPHIC SETTING**
 - **GEOLOGY**
 - **FORMATIVE PROCESSES**
 - **ABIOTIC PROCESSES**
- **HYDROLOGIC CONDITIONS**
 - **SURFACE**
 - **SUBSURFACE**
- **CLIMATE**

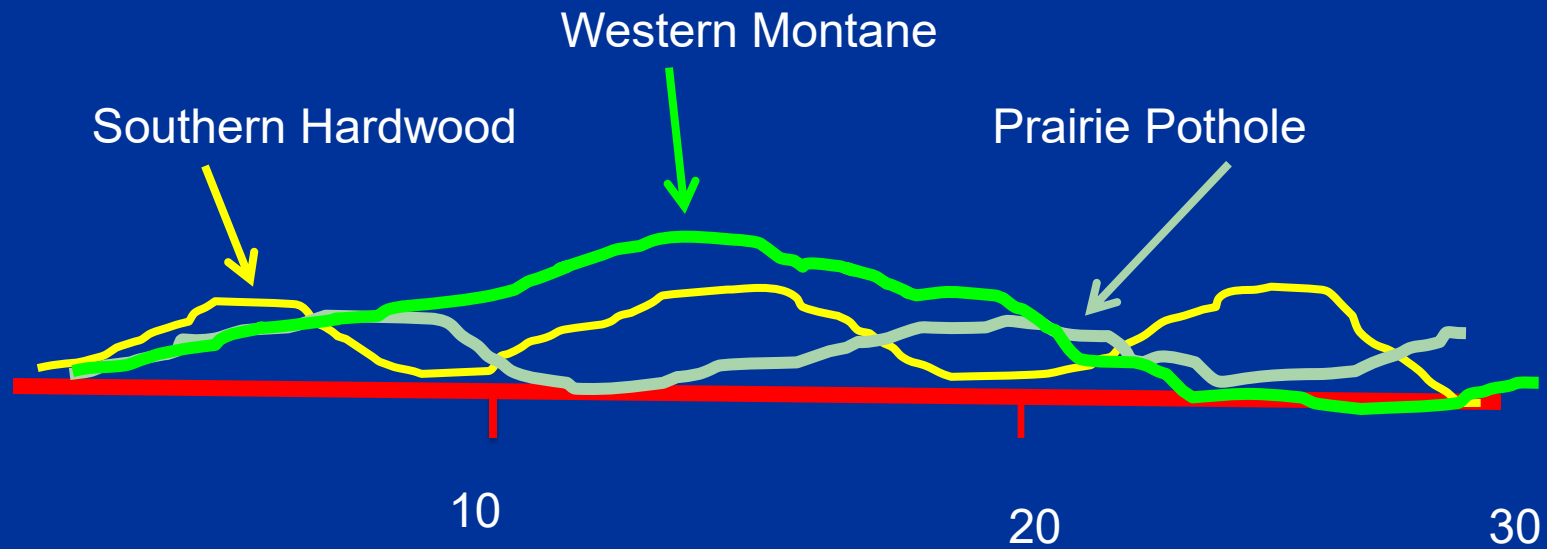
Geomorphic, Hydrologic, and Climate Setting for Successful Management

- Essential to know where you are in space.
- Essential to understand temporal scale

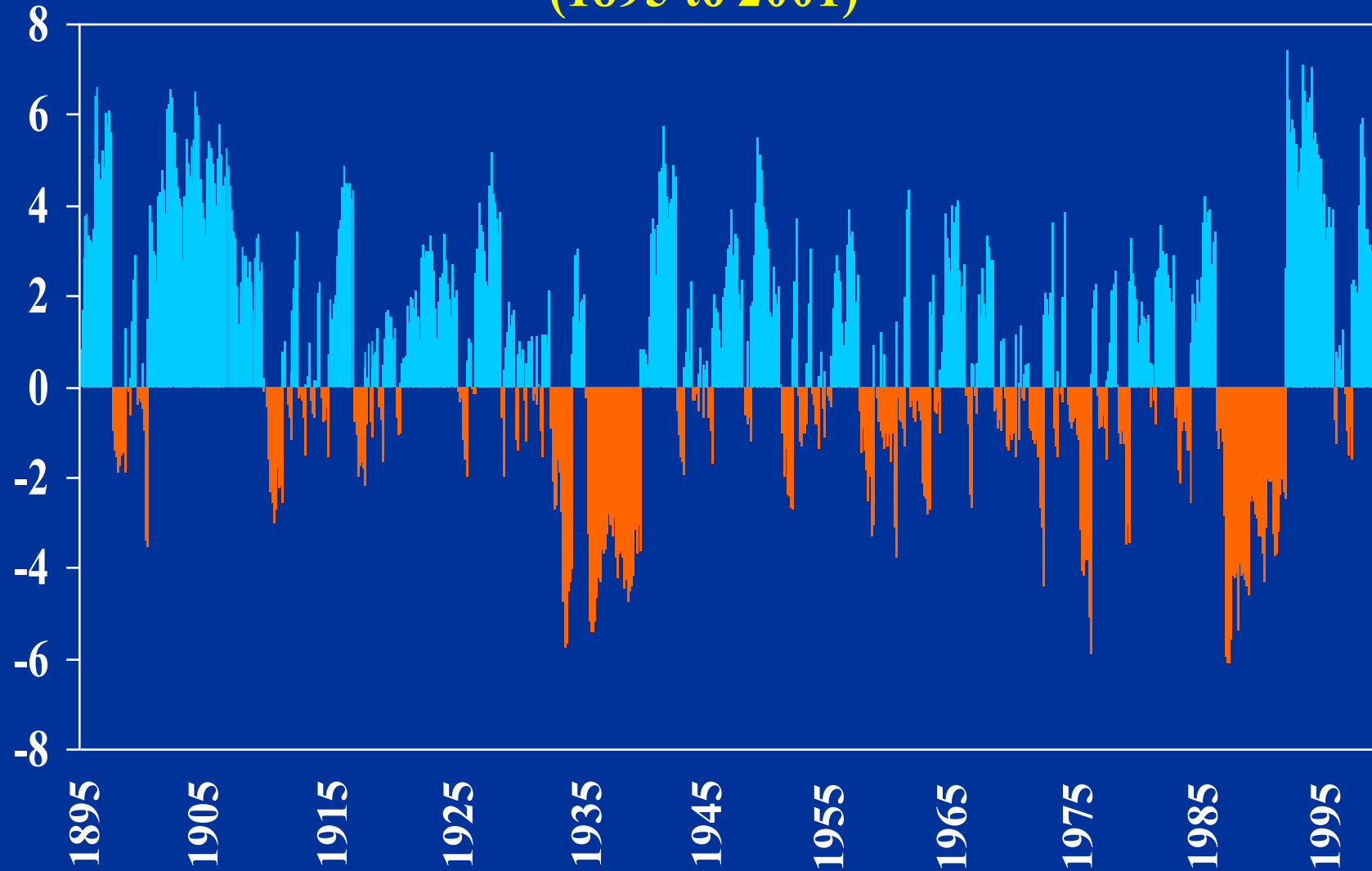
HOW DO YOU KNOW WHERE YOU ARE IN TIME AND SPACE??

- FORMATIVE PROCESSES
- GEOMORPHIC SETTING
- HOW DOES GEOMORPHIC SETTING INFLUENCE WATER AVAILABILITY AND FLOW?
- HOW OLD IS THE SURFACE?
- WHAT ARE ANTHROPOGENIC MODIFICATIONS
- WHAT ARE THE FEATURES OF THE SURFACE?
- WHAT IS DURATION OF WETLAND CYCLE
- WHAT IS THE STAGE IN THE WETLAND CYCLE

WETLAND CYCLE DURATION



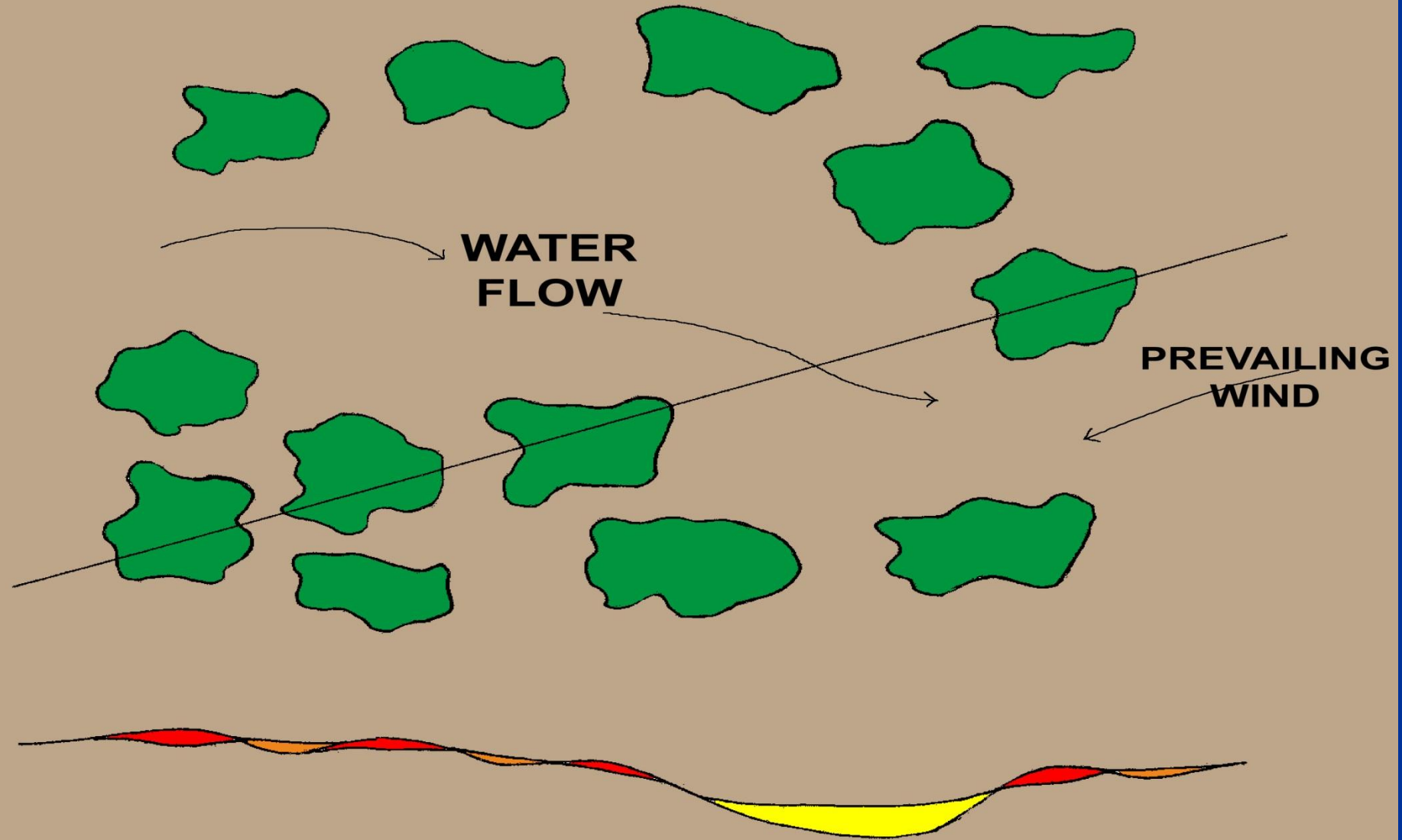
Palmer Drought Severity Index, Division 5, ND (1895 to 2001)



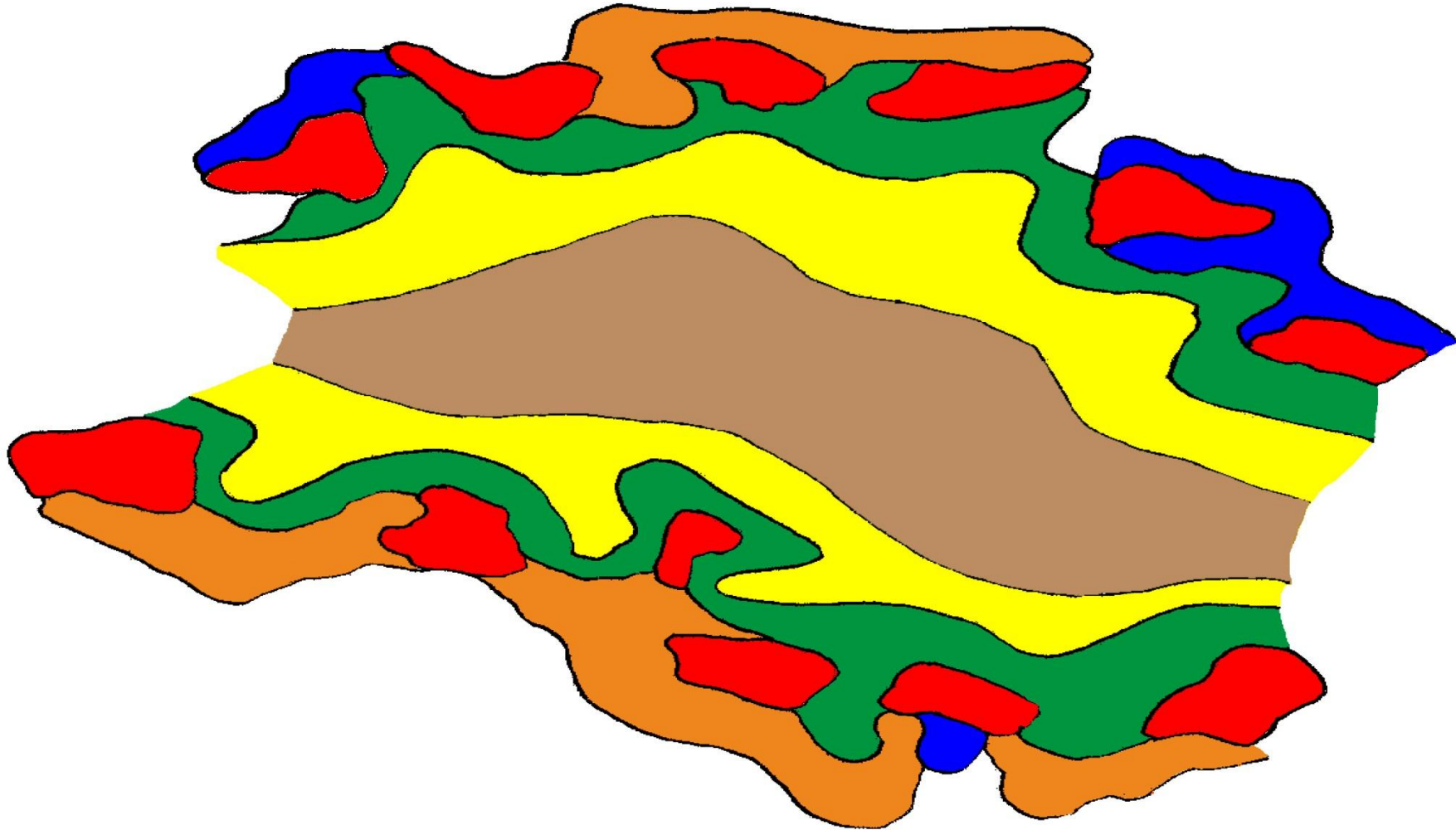
Formative Processes

- Always more than one
 - Water
 - Wind
 - Freezing
- Always on-going
 - Some subtle and steady
 - Some dramatic
- Constant change in influencing factors
 - Wet vs dry

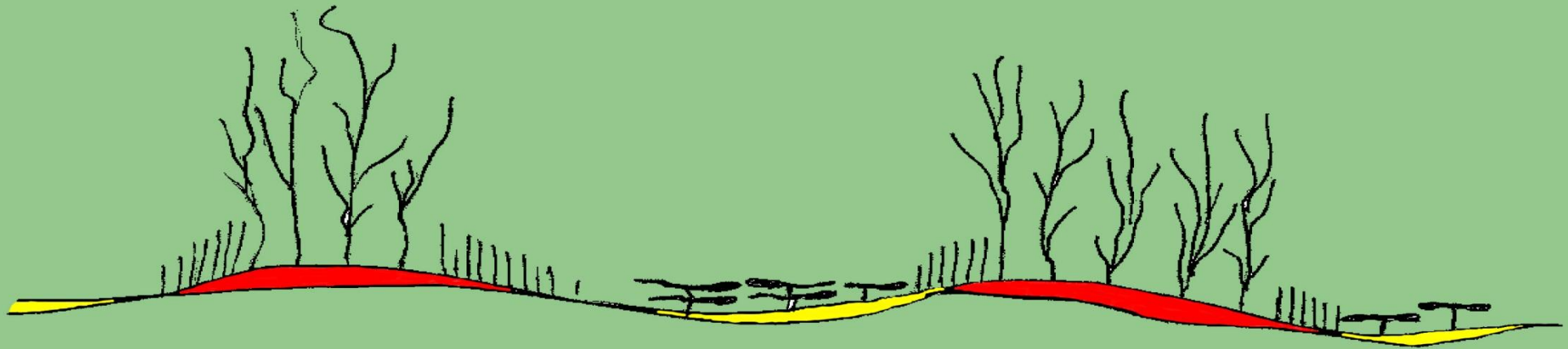
DEVELOPMENT OF TEXTURAL HETEROGENEITY



PLANT DISTRIBUTION AND HETEROGENEITY



PLANT RESPONSE TO MICROTOPOGRAPHIC AND TEXTURAL VARIABILITY

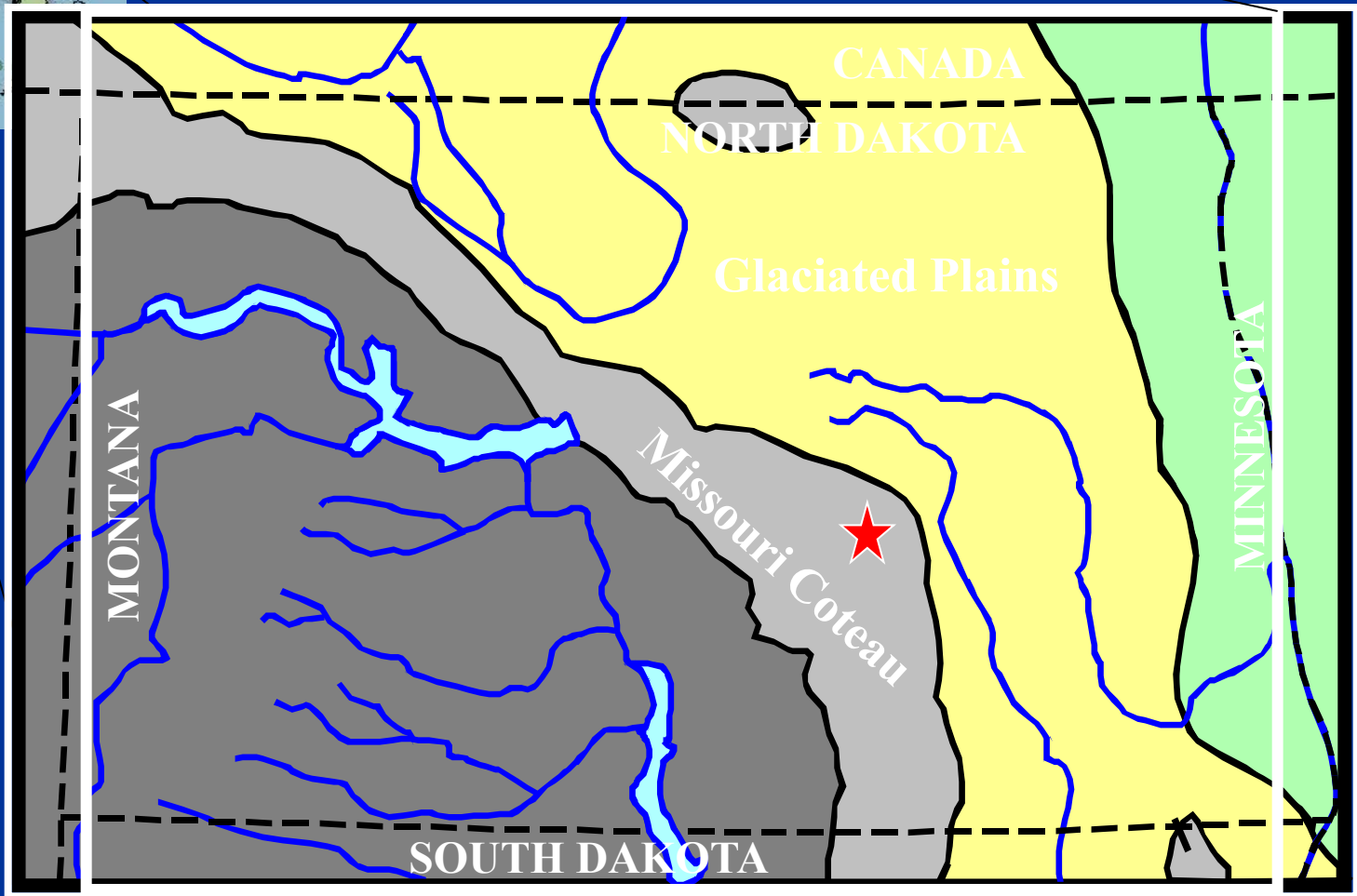


GLACIATED

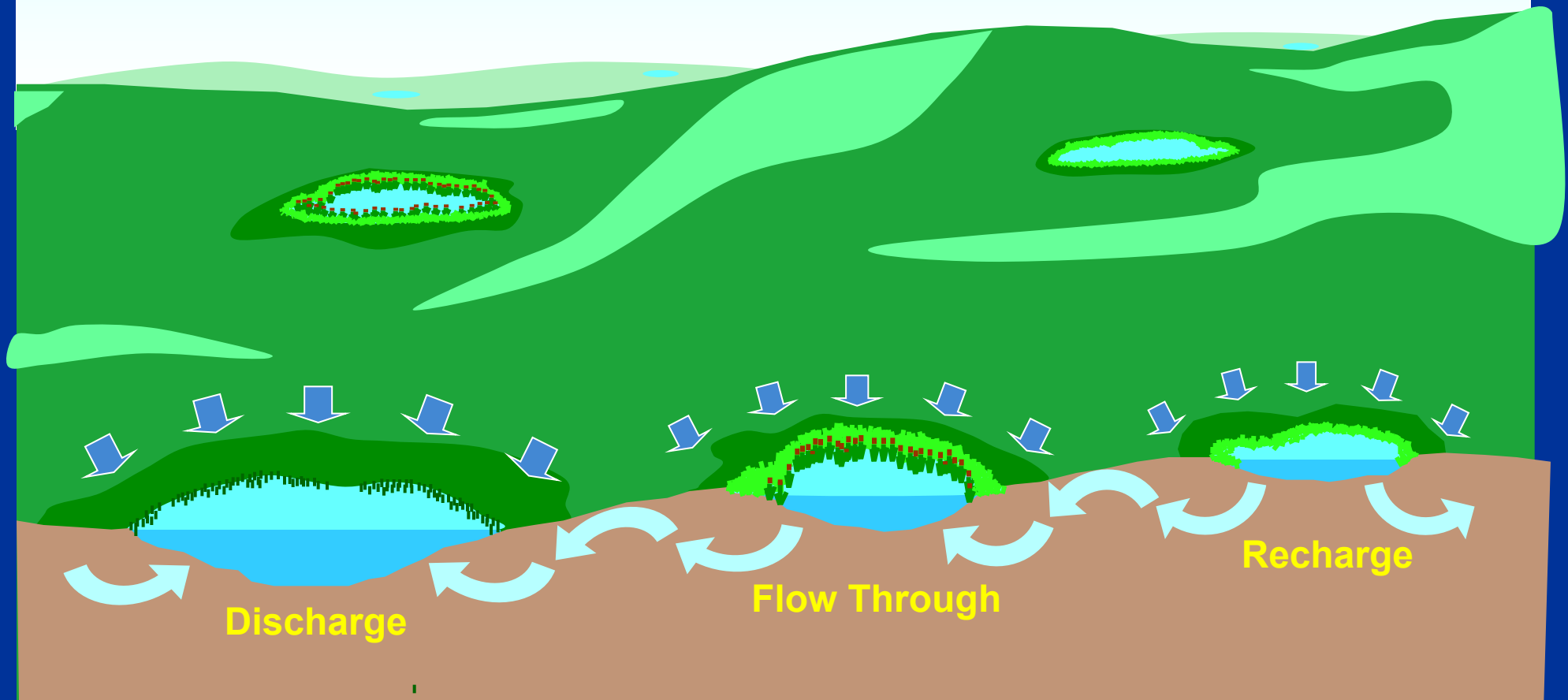
- EARLY WETLAND INFORMATION LARGELY CAME FROM STUDIES IN THE GLACIATED PRAIRIE COUNTRY OFTEN WHERE DRAMATIC ANTHROPOGENIC CHANGES HAD ALREADY RESHAPED THE LANDSCAPE AND WHERE SURFACE WATER WAS THE FOCUS
- Poorly developed drainage
- Complex groundwater movements
- Complex intermixed soil textures and strata
- Historic lake beds

WHAT IS POTHOLE COUNTRY?

- DIVERSITY OF GEOMORPHIC SURFACES
 - MORAINES
 - THE COTEAUS
 - ABANDONED FLOODWAYS
 - LAKE BEDS
- DIVERSITY OF HYDROLOGIC SETTINGS
 - SURFACE AND SUBSURFACE
- DIVERSITY OF ANTHROPOGENIC CHALLENGES
 - AGRICULTURE
 - WATER PROJECTS
 - ALL OTHER INFRASTRUCTURE



Wetland Hydrological Functions



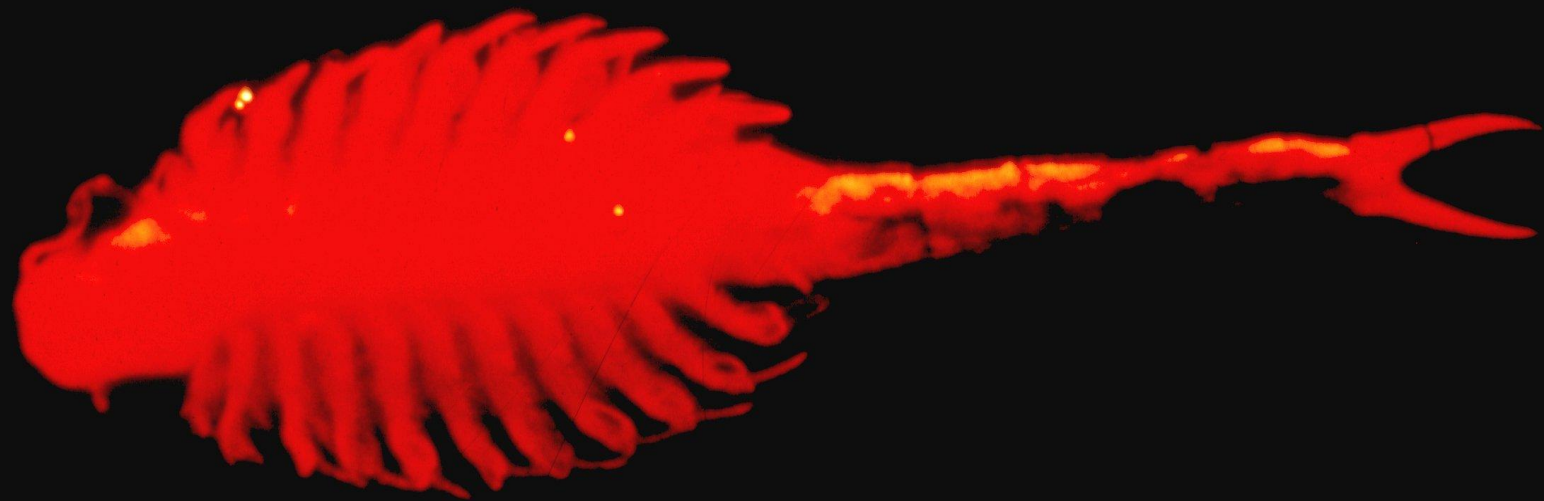
























Las Vegas NWR New Mexico



LONG LAKE NWR SALT MOVEMENT



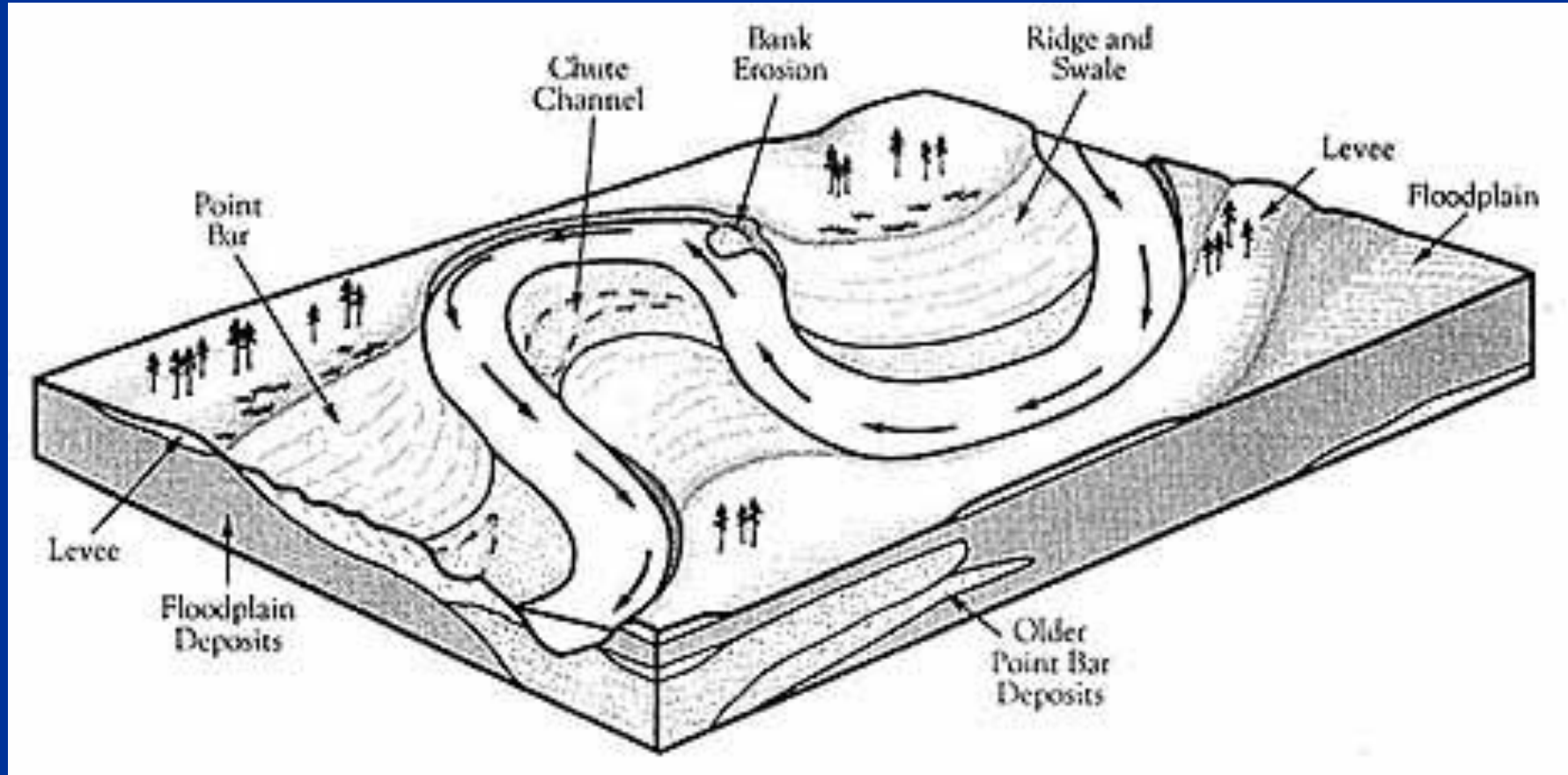
Long Lake NWR Salt Movement



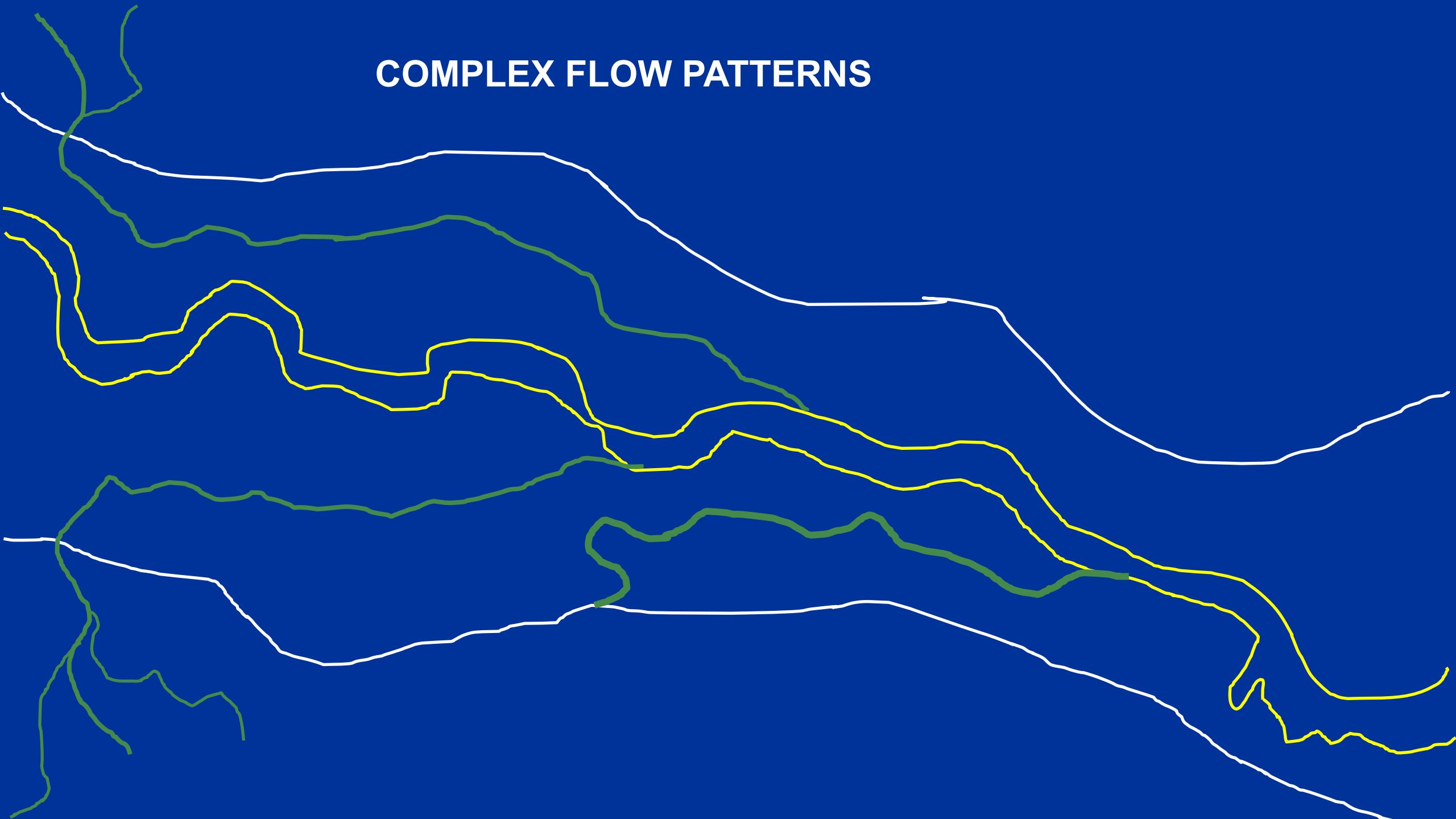
ALLUVIAL DEPOSITS

- NATURAL LEVEES – COARSE TEXTURE
- POINT BARS – TEND TOWARD COARSE
- BACK SWAMP – FINE TEXTURED
- CREVASSE SPLAY – COARSE TEXTURE
- ABANDONED CHANNEL – TEND TOWARD FINE TEXTURE
- BRAIDED CHANNEL – VERY HETEROGENOUS

Topographic Features



COMPLEX FLOW PATTERNS



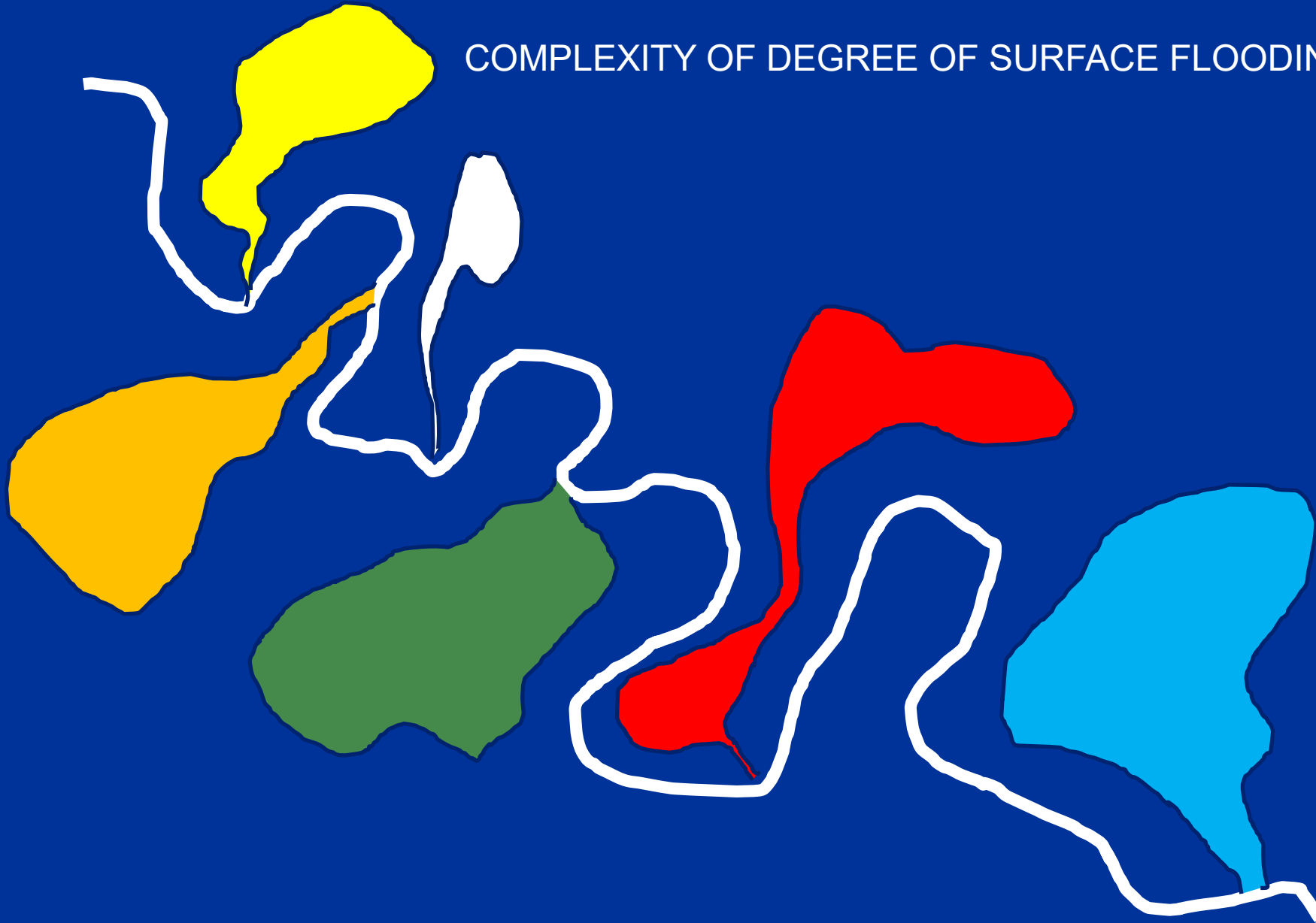
OLD DESCRIPTORS

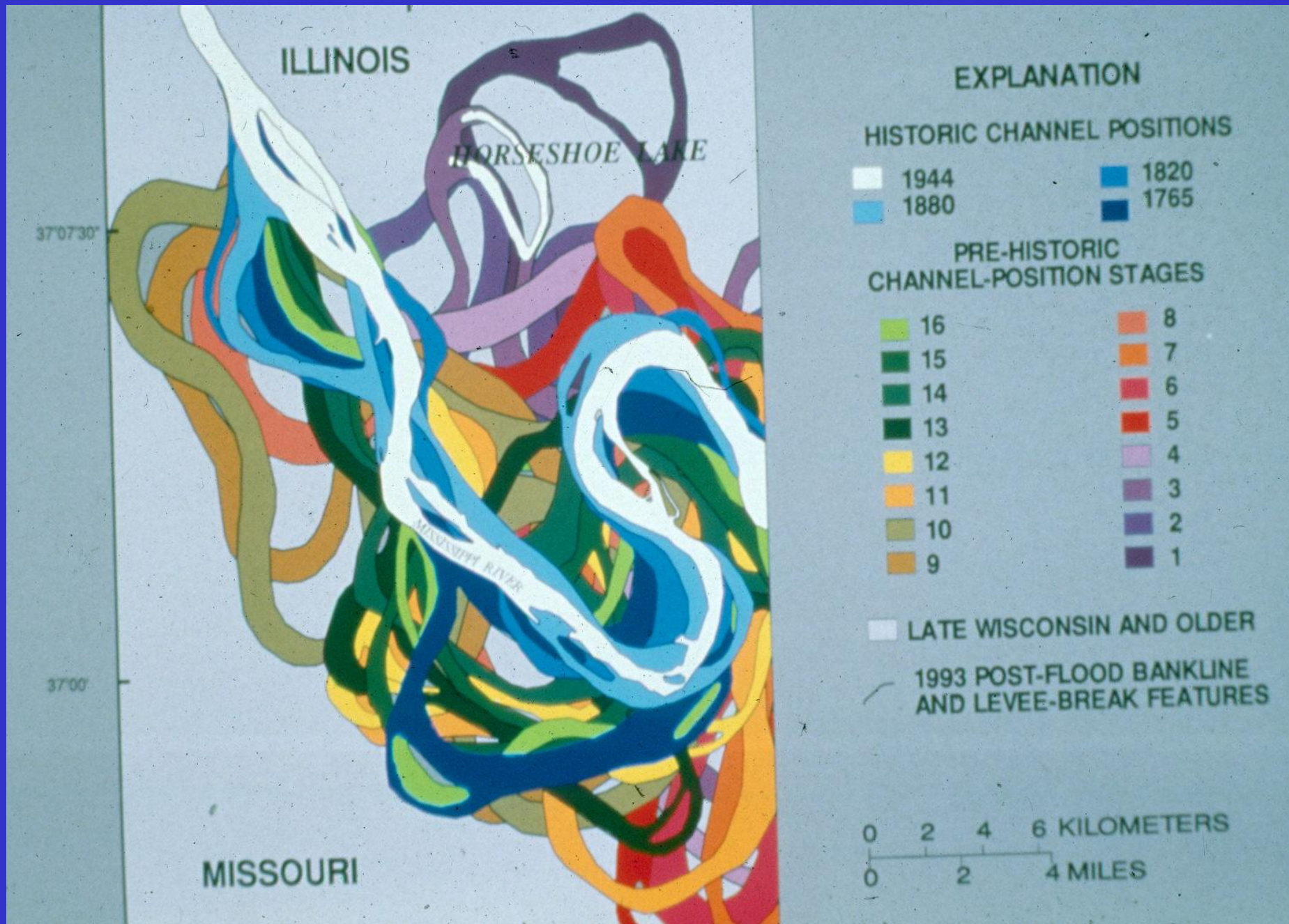


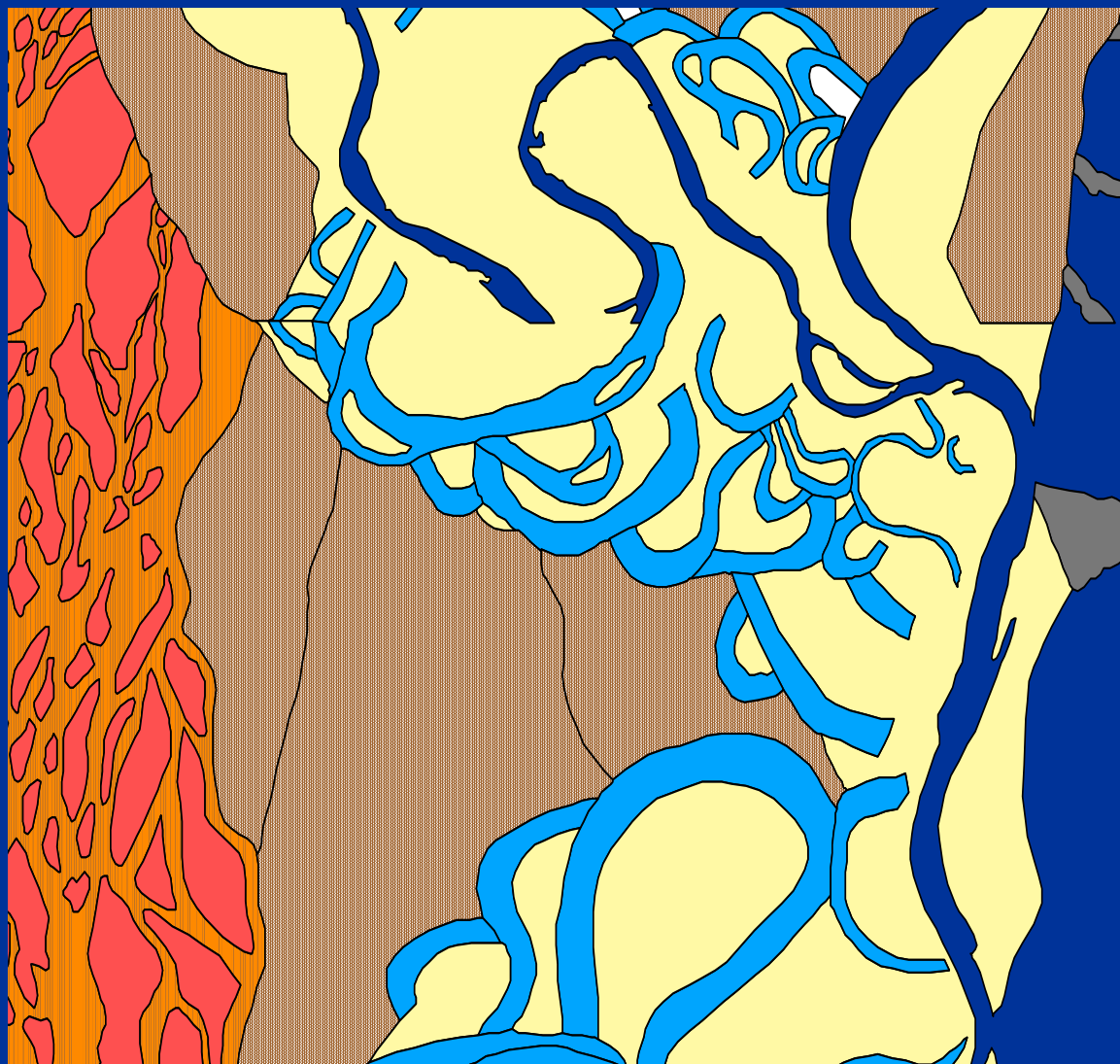
A TYPICAL FLOODPLAIN



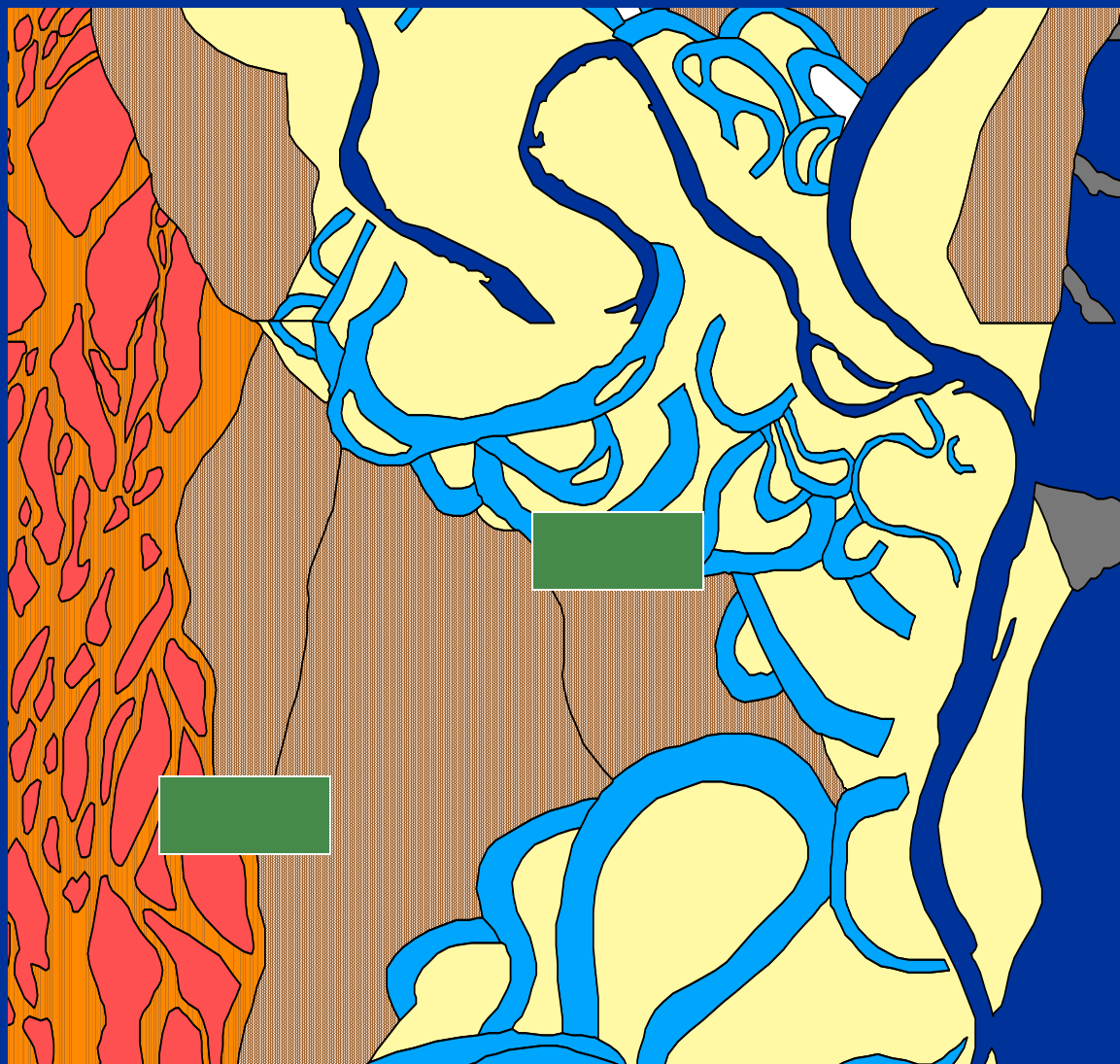
COMPLEXITY OF DEGREE OF SURFACE FLOODING ALONG DRAINAGES







8 0 8 16 Miles



 Natural Flood
 Other Water



<i>Coverage</i>	<i>Acres</i>	<i>Potential Acres</i>
State WMU's	7,997	9,588
Private Lands	4,680	13,245
Federal WMU's	8,301	9,625
MOP	44,021	-
Extended Forest	50,566	-



Background Imagery: Landsat 7 p23r34 and

WATER IN PORE SPACES

DRAINAGE



EVAPOTRANSPIRATION



SOIL STRUCTURE



TOPOGRAPHY



CRITICAL INFORMATION

- TOPOGRAPHY
- TEXTURAL VARIABILITY
- PRESENCE OF RESTRICTIVE LAYER
- DEPTH TO RESTRICTIVE LAYER
- SLOPE OF RESTRICTIVE LAYER
- GROUND WATER DISCHARGE

HYDROLOGIC VARIATION

- SHORT AND LONG-TERM VARIATION
- TIMING OF FLOWS
- DURATION OF FLOWS
- HIGH/LOW FLOWS
- SURFACE OR SUBSURFACE
- CONNECTION CONTINUOUSLY AND DISCONTINUOUSLY

SOIL TEXTURE AND PLANT ASSOCIATIONS

FINE TEXTURE

NUTSEDGES

SMARTWEED

CATTAIL

COARSE TEXTURE

MILLETS

HARDSTEM

BULRUSH

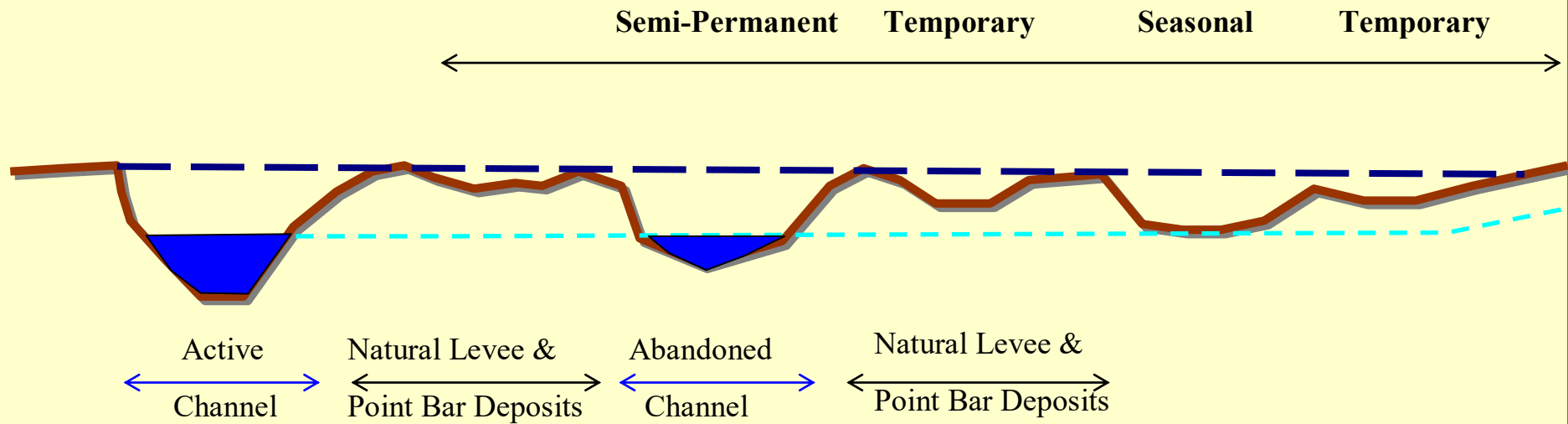
EFFECTS OF GROUND WATER AND SOILS

- MILLETS WITH MUCH HIGHER PRODUCTION WHERE RESTRICTIVE LAYER IS CLOSER TO SURFACE
- CHANGES IN SOIL MOISTURE RATES INFLUENCED BY DEPTH TO GROUND WATER IN COMBINATION WITH SOIL TEXTURE

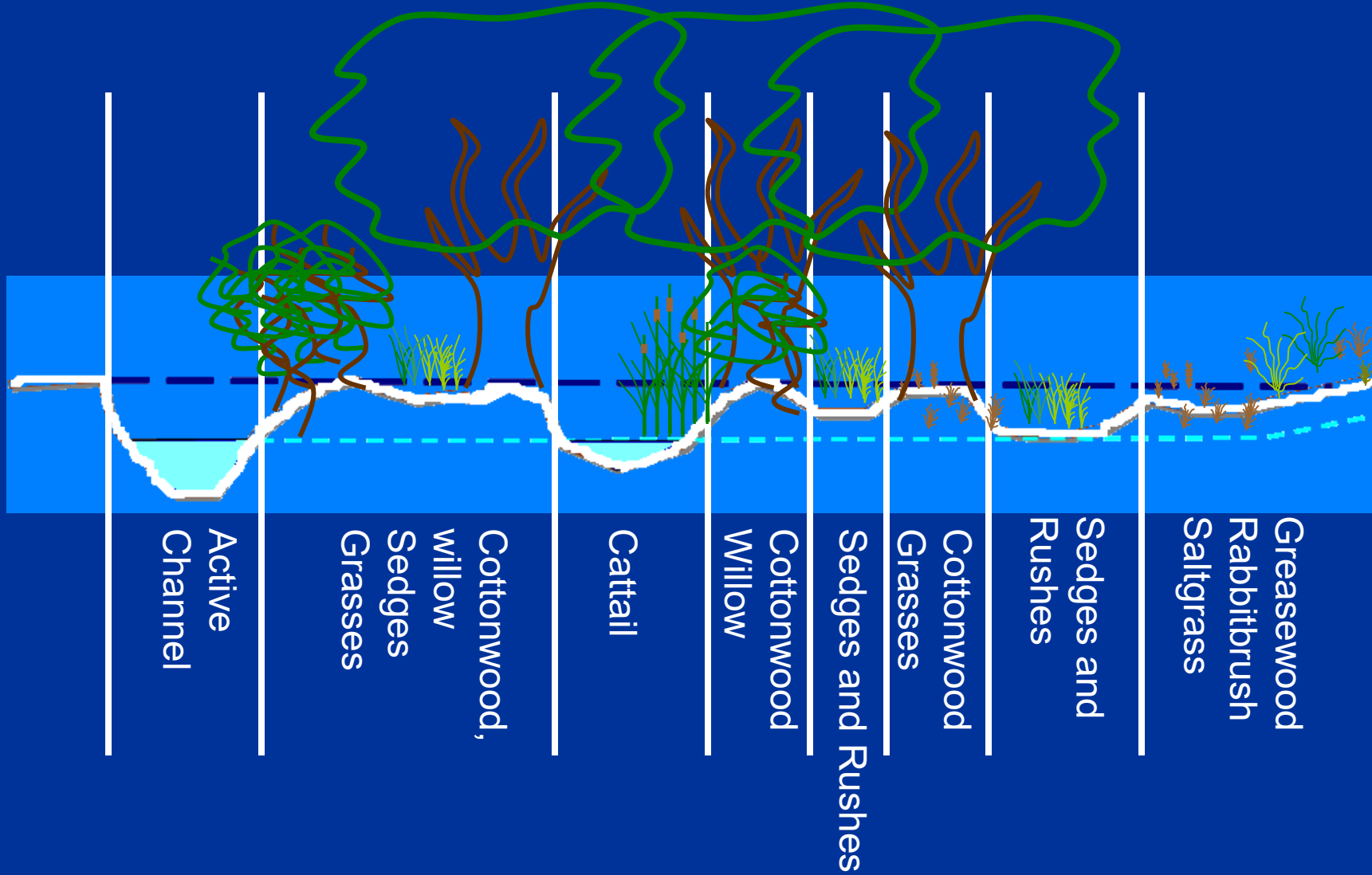
TEMPORAL SCALE

- CLIMATIC AND HYDROLOGIC VARIATION
 - DAILY
 - ANNUAL
 - LONG-TERM
 - WITHIN A LIFE TIME
 - OVER THOUSANDS OF YEARS
- DETERMINES FREQUENCY OF BREEDING OR GERMINATION TO MAINTAIN POPULATIONS
 - ONCE ANNUALLY??
 - ONCE EVERY ?? YEARS

Hydrologic Linkage and Juxtaposition of Riparian Wetland Environments



Vegetation in Relation to Hydrology and Salts Through the Wetlands



Number of Wetlands

	Historic	Current
Temporary	+ + + + +	+
Seasonal	+ + + +	+
Semi- Permanent	+ + +	+ +

HISTORIC CONDITION

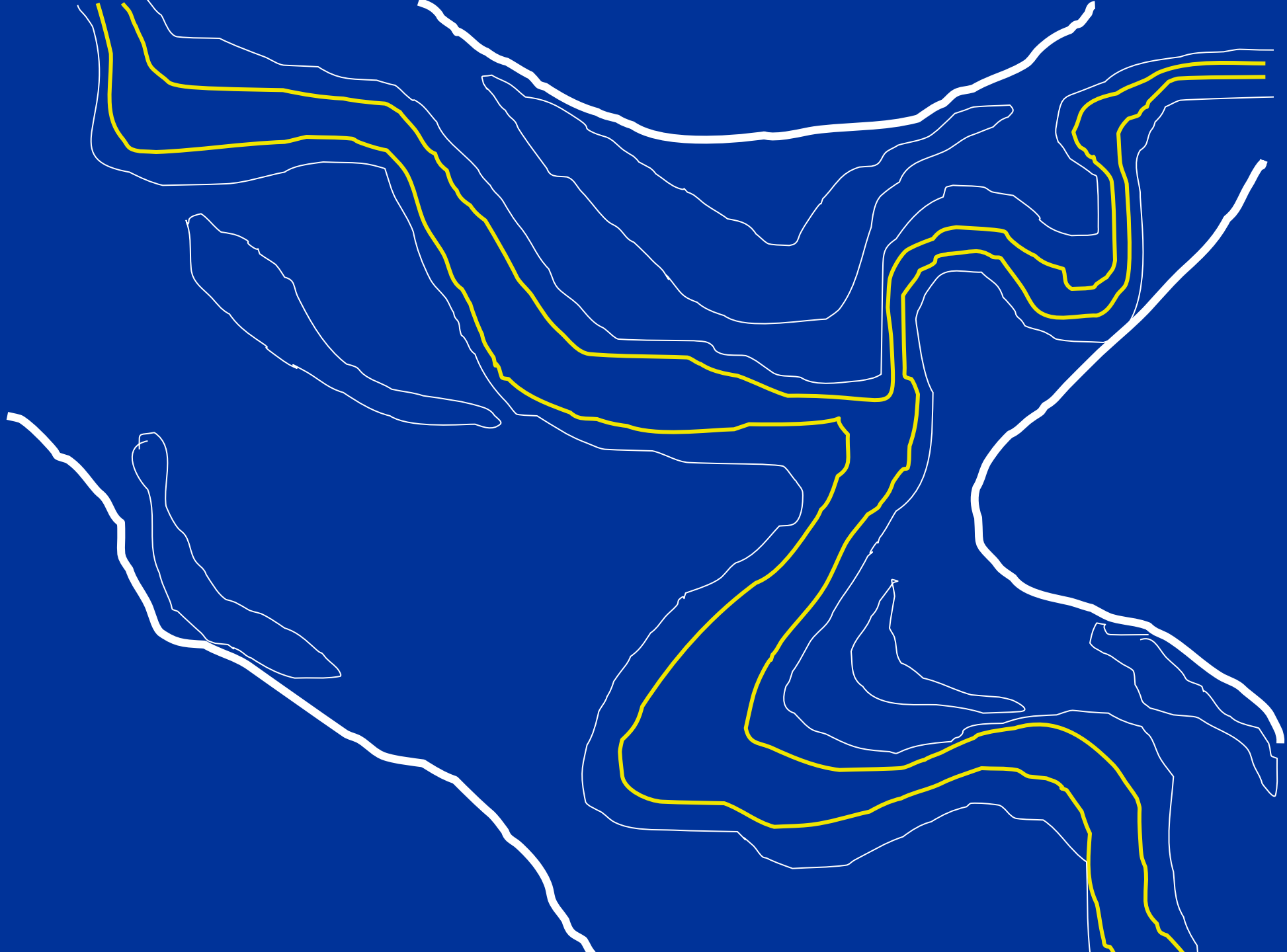
- A WIDE VARIETY OF WETLAND TYPES IN LARGE AND SMALL FLOODPLAINS ACROSS ANY REGION
- DIFFERENT HYDROPERIODS PROVIDED CONSTANTLY CHANGING HABITAT CONDITIONS RESULTING IN A DIVERSITY OF FOODS AND HABITAT STRUCTURE

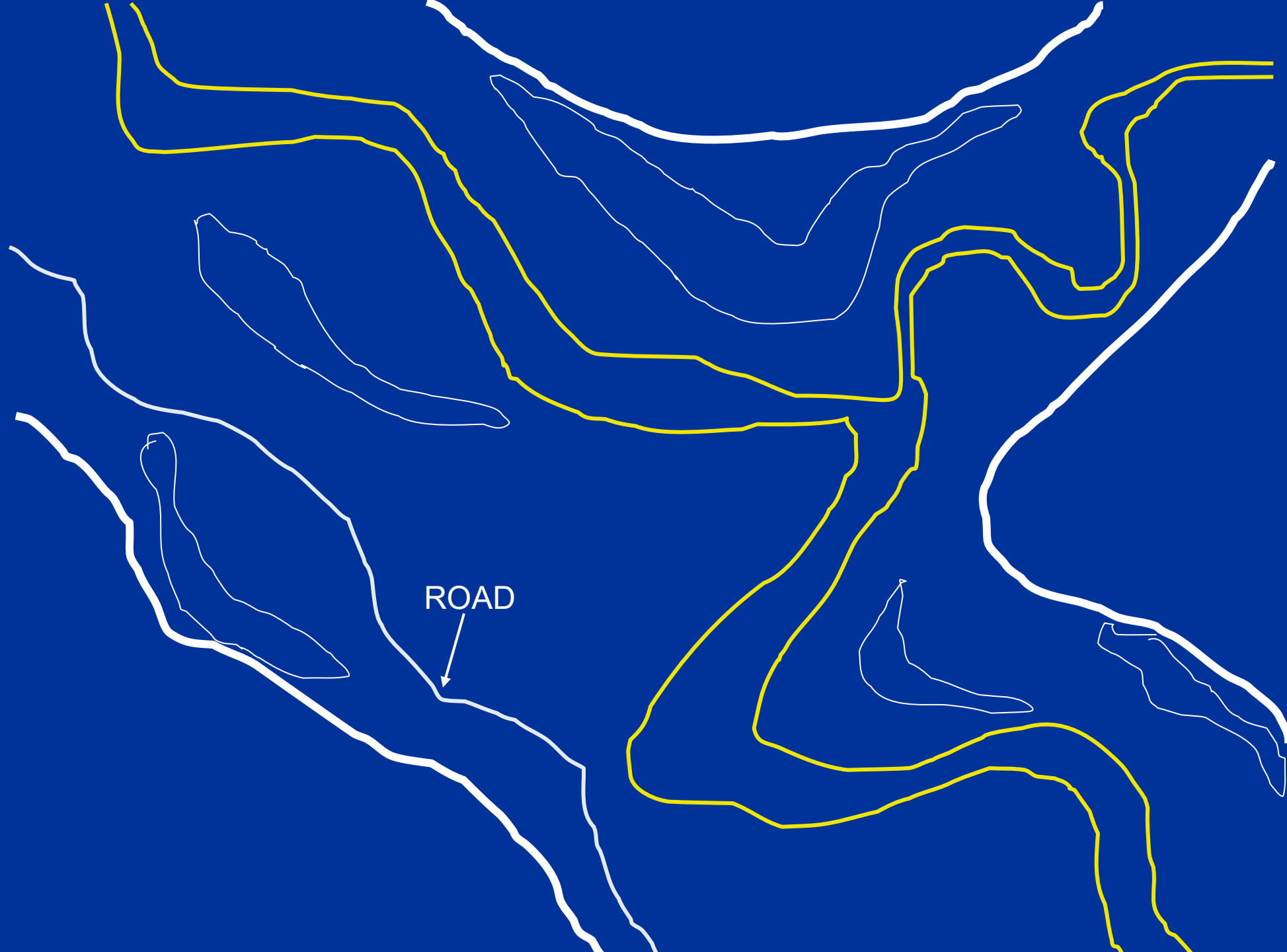
MAN INDUCED CHANGES TO LANDSCAPE

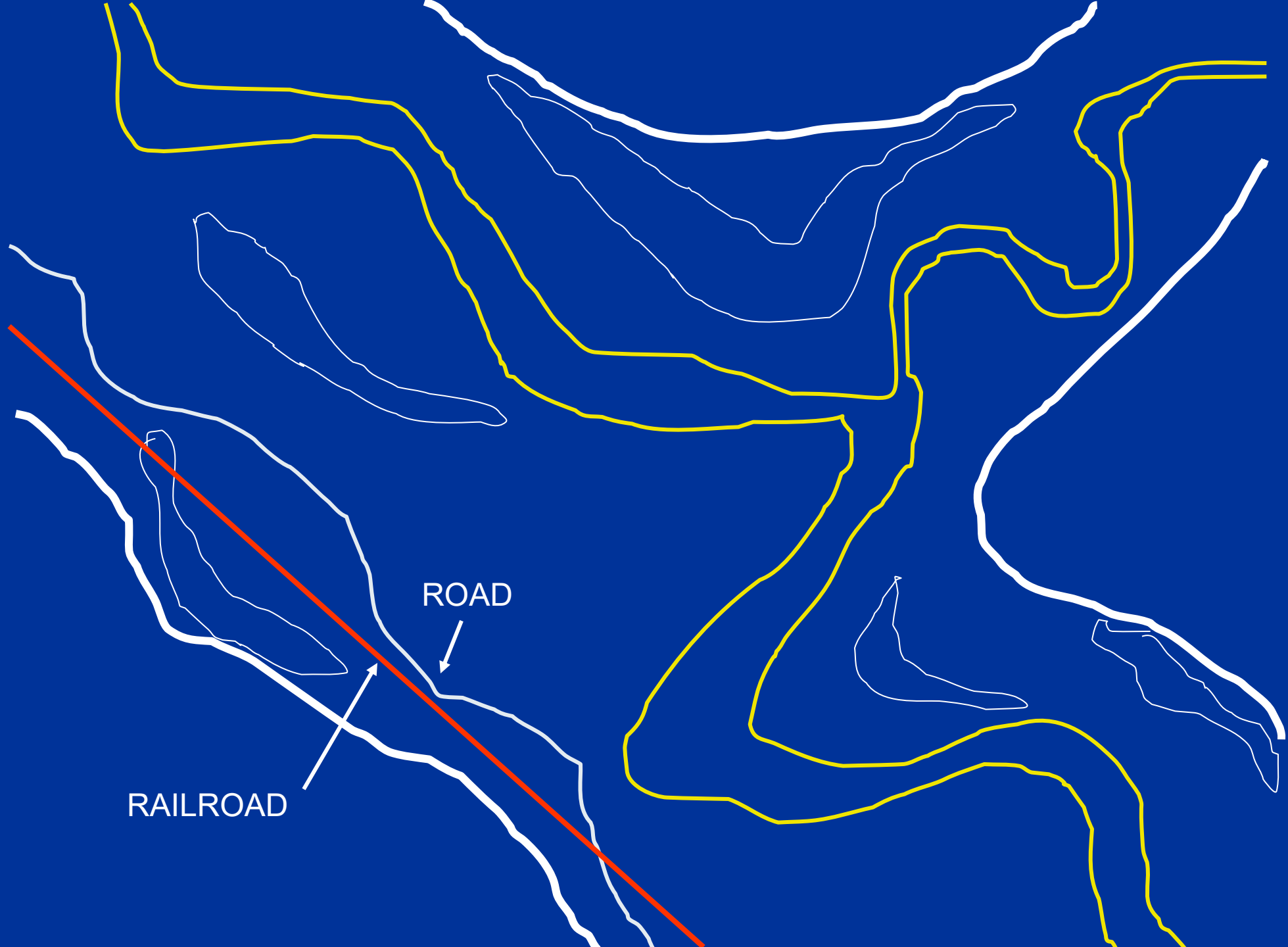
- REDUCED HABITAT AREA
- CHANGED COMPOSITION OF HABITAT TYPES
- CHANGED PHYSICAL CONDITIONS
- MODIFIED HABITAT FUNCTIONS

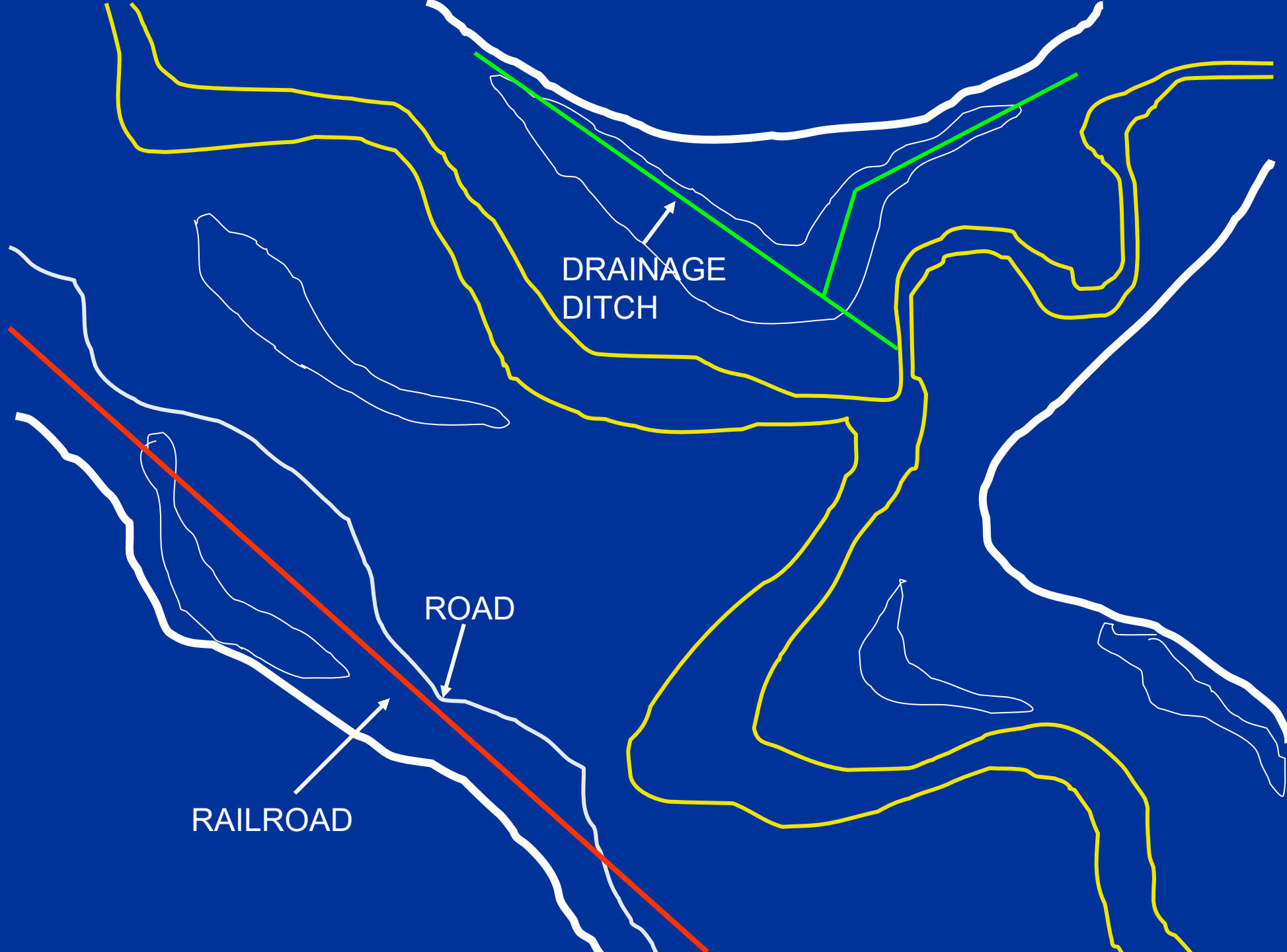
ANTHROPOMORPHIC MODIFICATIONS

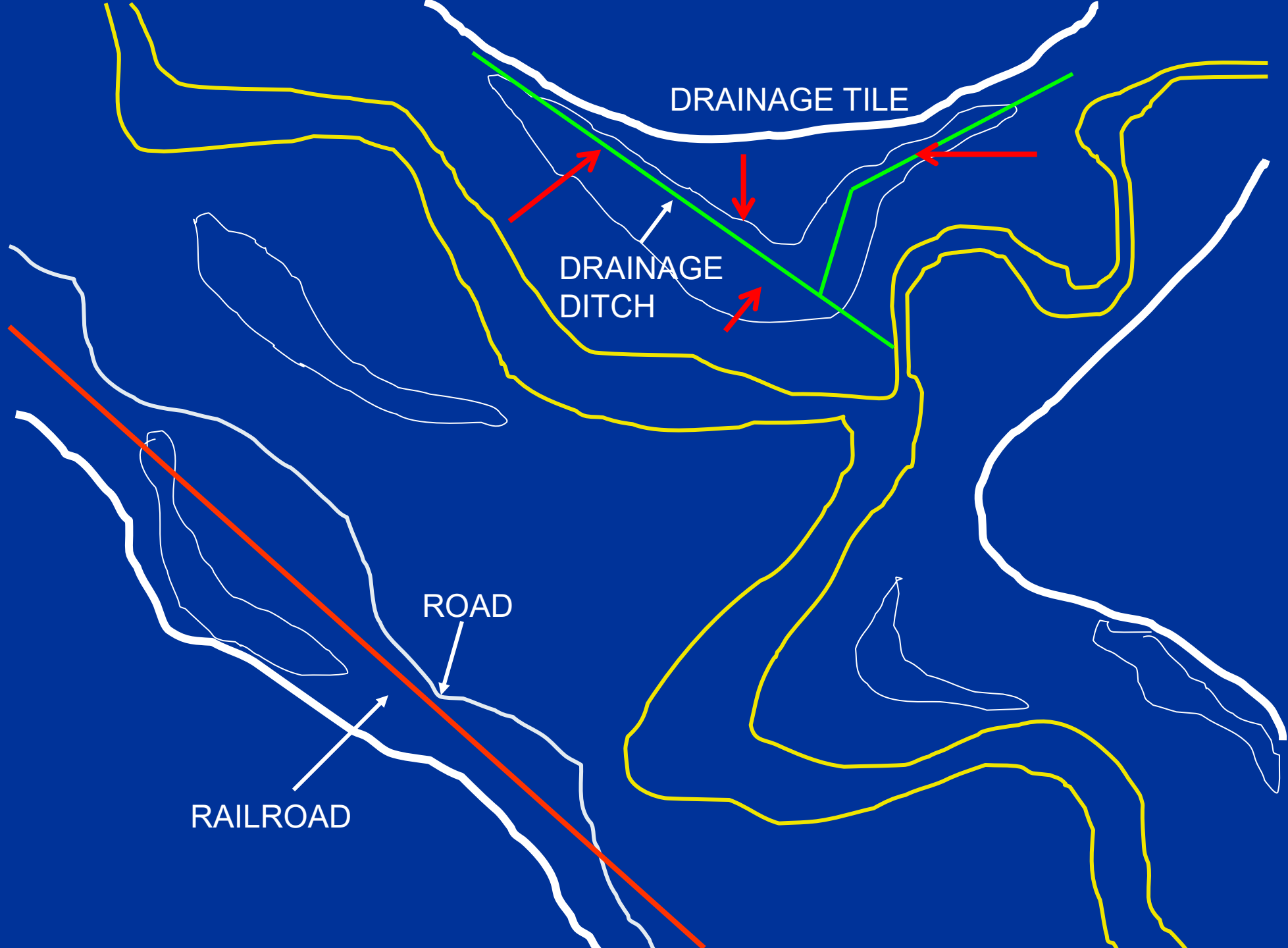
- ON SITE
- OFF SITE
- PHYSICAL
- PROCESSES
- LOCAL
- GLOBAL

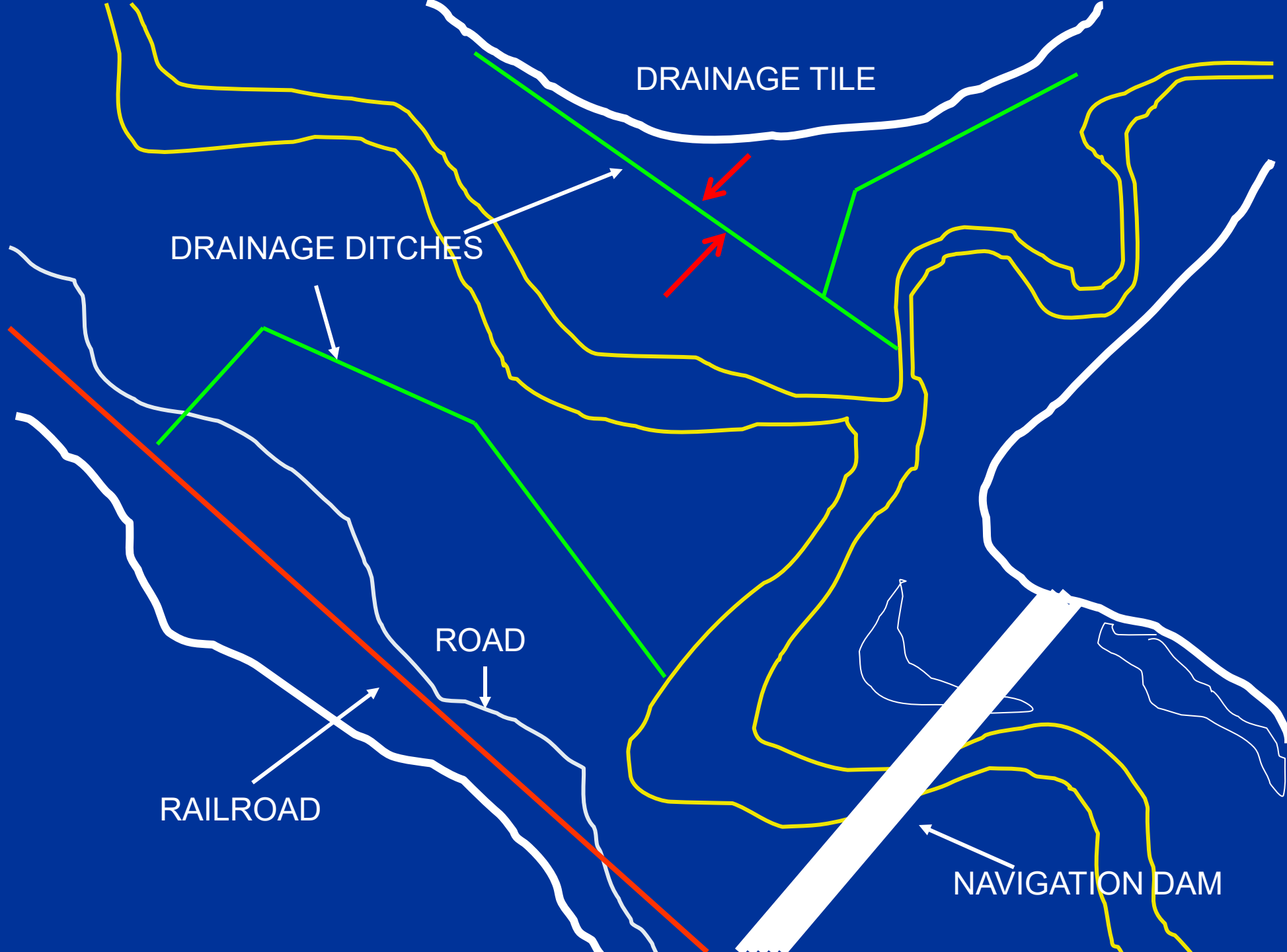


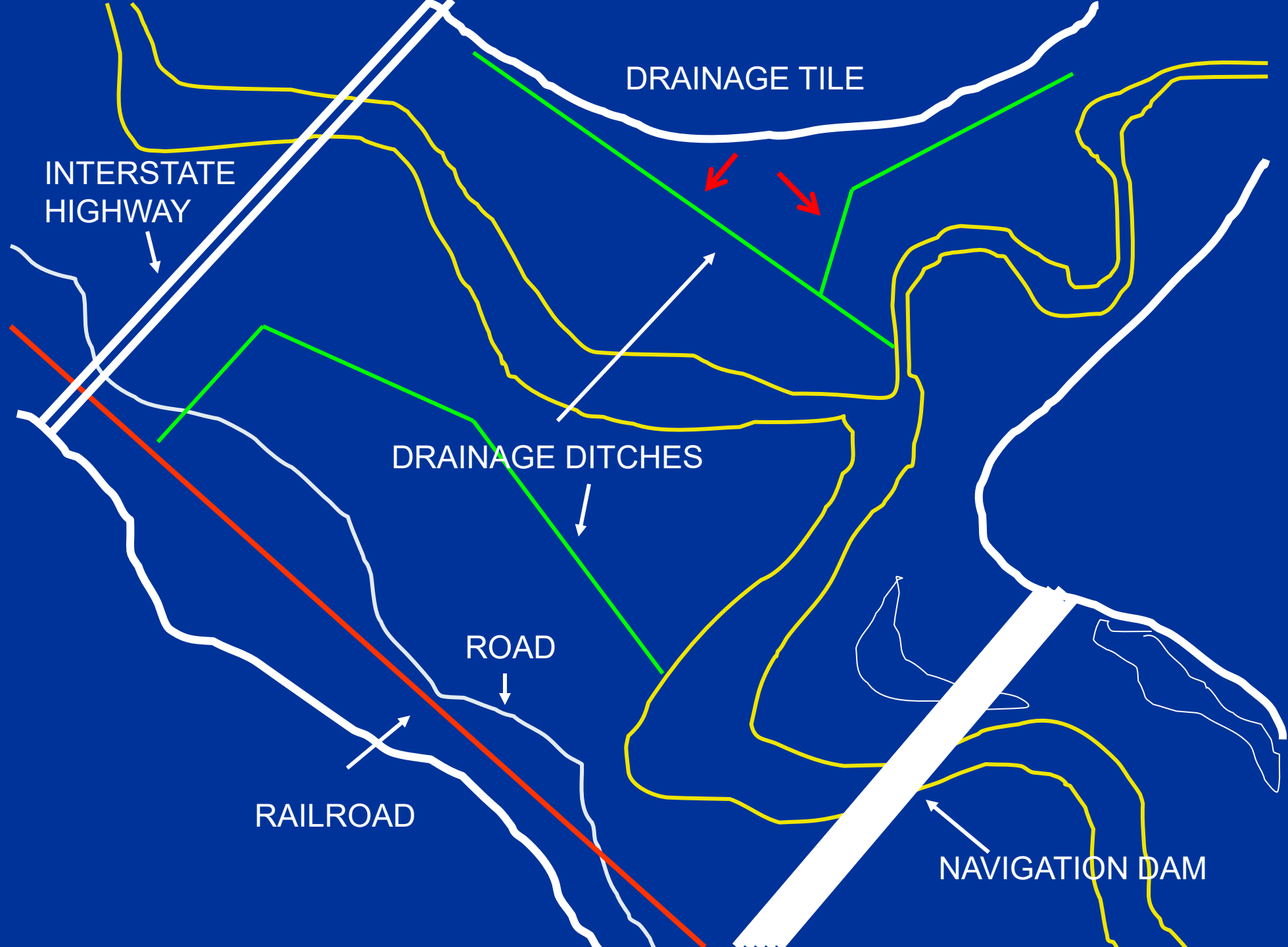


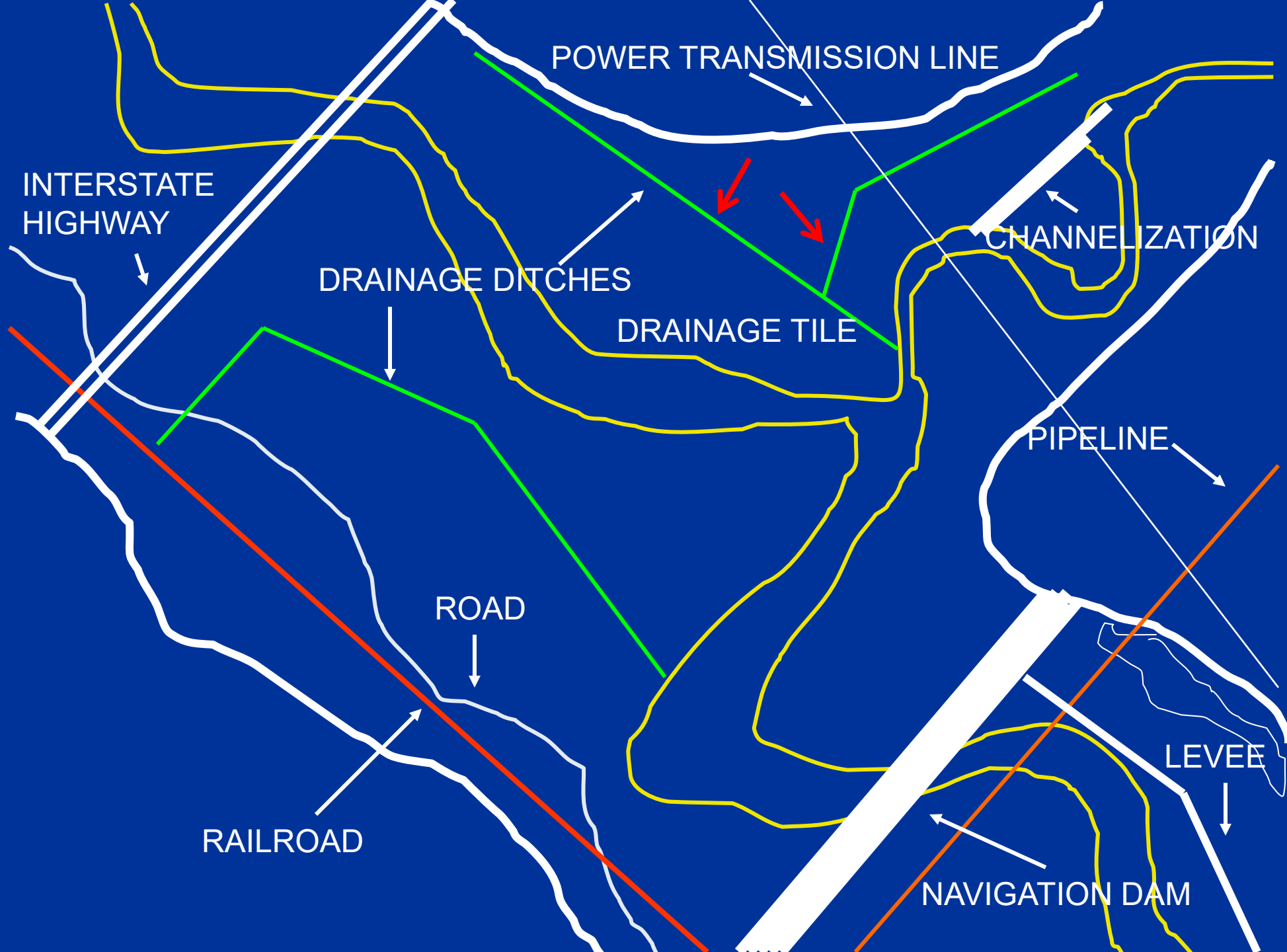


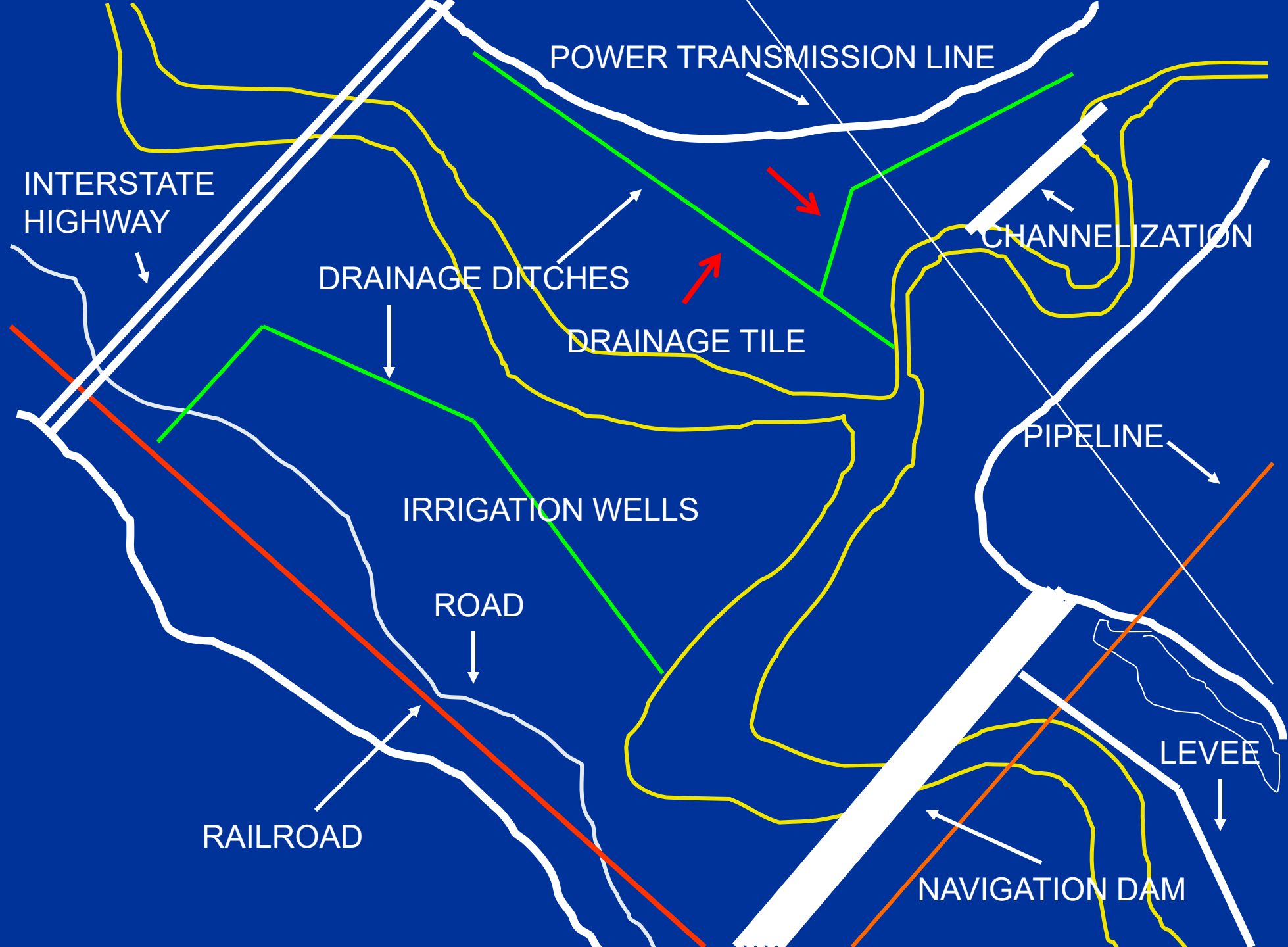


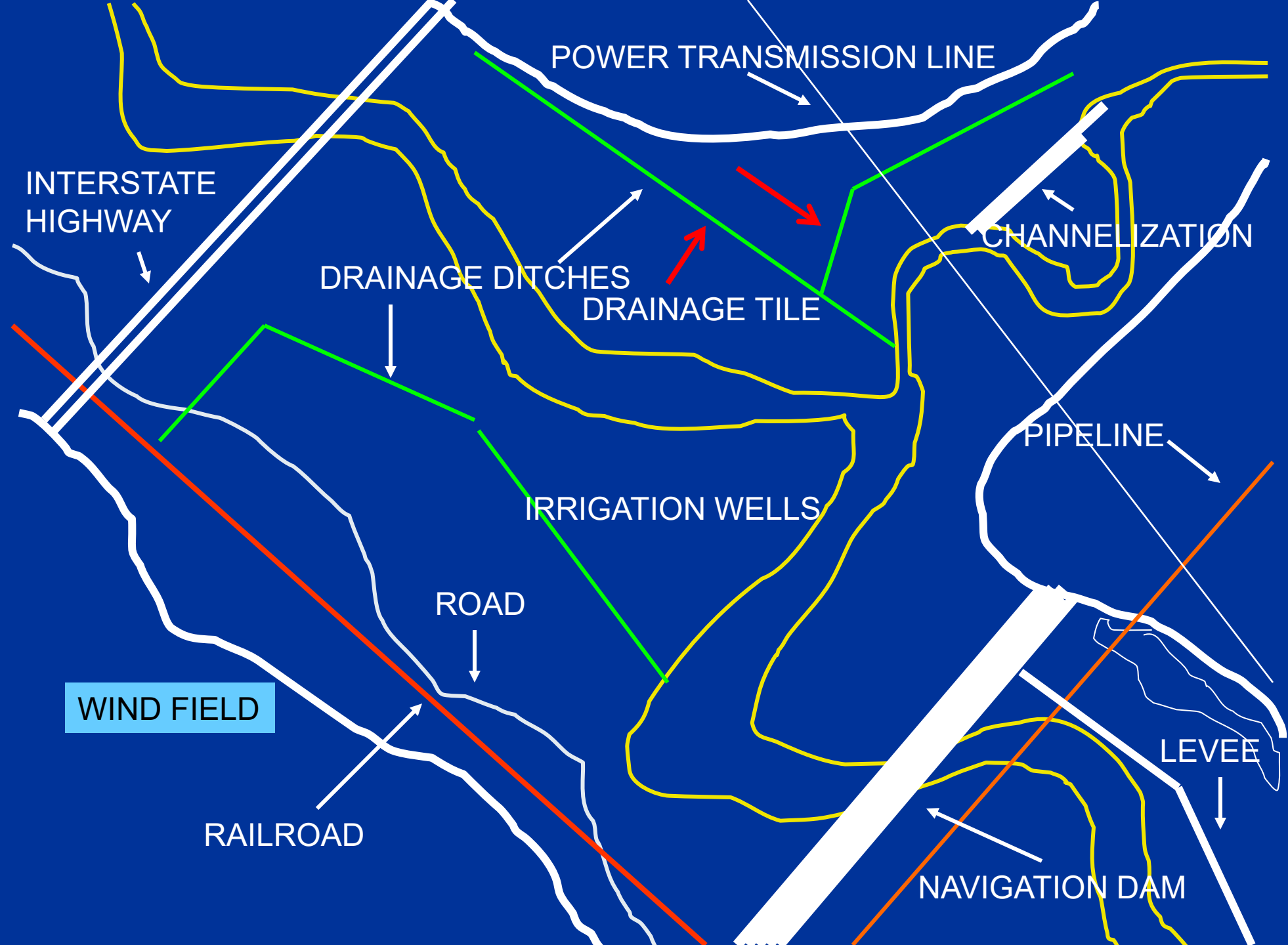












ECOLOGICAL PERTURBATIONS FROM MAN INDUCED MODIFICATIONS

- COMPROMISED SHEET FLOW
- CHANGED FLOW PATTERNS
- CONCENTRATED FLOW AT HIGH VELOCITY
- IMPEDED WATER MOVEMENTS
- REDUCED BASE FLOW
- MODIFIED GROUND WATER DISCHARGE
- MODIFIED DISTRIBUTION OF WATER OR LACK OF WATER IN PORE SPACES

CHANGES IN ECOLOGICAL FUNCTIONS

- CHANGED PLANT COMMUNITIES
 - COMPOSITION
 - DISTRIBUTION
 - DYNAMICS
- CHANGED WILDLIFE COMMUNITIES
 - OFTEN SMALLER POPULATIONS OF DESIRED SPECIES
 - OFTEN LARGER POPULATIONS OF UNDESIRABLE SPECIES
 - CHANGES IN DISTRIBUTION

**A MODEL FOR HABITAT
MANAGEMENT AND RESTORATION:
WETLAND EXAMPLES**

**RESTORATION/
CONSTRUCTION**

**ALTERED
PHYSICAL
NATURE**

**PRAIRIE
POTHOLES**

**TUNDRA
PONDS**

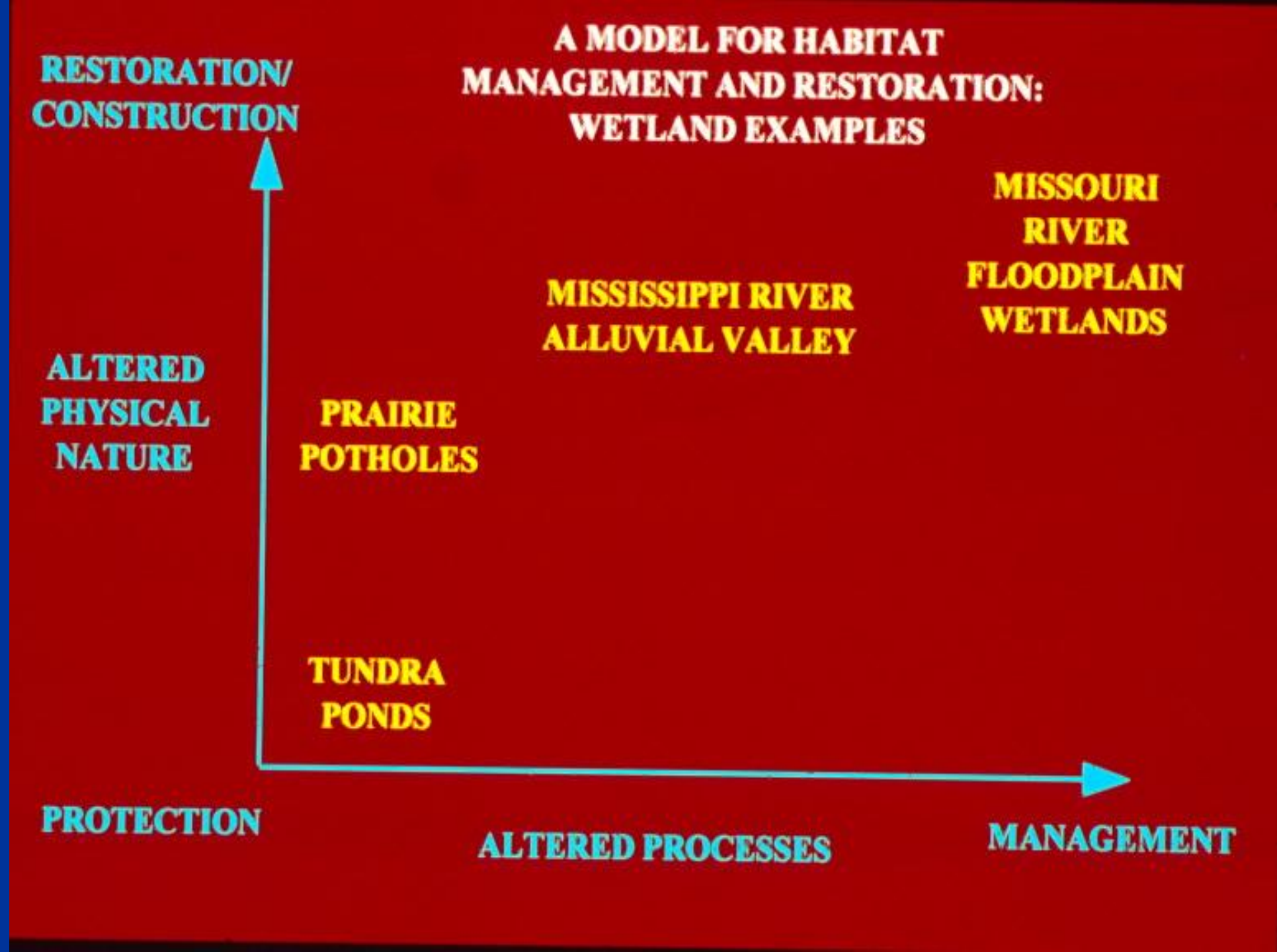
**MISSISSIPPI RIVER
ALLUVIAL VALLEY**

**MISSOURI
RIVER
FLOODPLAIN
WETLANDS**

PROTECTION

ALTERED PROCESSES

MANAGEMENT



HOW DO WE CHANGE??

- MENTORING BY THE PROS
- BE A SKEPTIC
- BE A GOOD LISTENER
- NEVER STOP LEARNING
- TRAVEL WHEN YOU CAN BUT WITH AN “OPEN EYE AND EAR”
- BE PATIENT
 - MODIFIED CONDITIONS TOOK YEARS TO DEVELOP
 - MAY TAKE 20 YEARS TO GAIN RANGE OF EXPERIENCE
 - SLOW CHANGES CAN LEAD TO SUCCESS
 - YOU MAY HAVE TO OUTLIVE SOME

DETECTING THE MODIFICATIONS AND THEIR IMPLICATIONS

- SETTING APPROPRIATE OBJECTIVES
 - IN RELATION TO SETTING
 - IN RELATION TO PROCESSES
 - TAXONOMICALLY CONNECTED
- UNDERSTANDING THE SYSTEM TO MEET THOSE OBJECTIVES
 - CONSISTENT OBSERVATIONS
 - MONITORING KEY COMPONENTS
 - CONSTANTLY TESTING
- FORENSIC ECOLOGY
 - OBSERVATIONS ACROSS ABIOTIC AND BIOTIC COMPONENTS

EFFECTIVE APPLICATION OF INFORMATION OR SCIENTIFIC METHOD

- GETTING BEAVERS TO DO YOUR WORK
- SIMPLE EXPERIMENTS

Management strategies change across the gradient of alteration

