## Biological Resources (Con't.)

- Aquatic Systems
- Wetlands
- Threatened & Endangered Species

## Assessing Impacts to Aquatic Systems

- **Identify Source of Potential Impacts**
  - Changes in Water Quality
  - Change Hydrology (de-water/flood)
  - Placement of Fill
  - Shading
  - Changes in Aquatic Vegetation (invasive species)
- **Determine Study Area**
  - Generally areas of direct impact
- **Determine Existing Conditions**
  - Field Visit for Habitat
  - Species Likely to Occur
  - Fish Surveys (electroshocking/seines/traps)
  - Macroinvertebrates Surveys
  - HEP/HES
- **Identify Standard**
  - Usually none except for E & T species

## Aquatic Systems (cont.)

- **Impact Prediction**
  - Direct Taking
  - Change in Hydrology
  - Shading
  - Water Quality Effects
  - HEP/HES
  - Invasive Species
- **Assess Significance of Impacts**
  - Percentage/Professional Judgment
  - Unique Characteristics/ Sensitive Species
  - Economic Value
- **Mitigation**
  - Avoid/Minimize Sensitive Areas
  - Enhance Habitat (HEP/HES)
  - Control Invasive Species

## Habitat Evaluation System (HES)

- Assumes abundance of species is determined by presence of habitat.
- 2 Aquatic Systems (streams and lakes)
- 5 Terrestrial Systems
- Steps of HES
  - Derive Habitat Quality Index (HQI) scores
  - Derive Habitat Unit Values
  - Calculate Difference With and Without Project
  - Use to Determine Mitigation

## Assessing Impacts to Wetlands

- **Identify Source of Potential Impacts**
  - **Placement of Fill**
  - **Change Hydrology (de-water)**
  - **Shading**
  - **Toxic Substances**
  - **Spills**
  - **Mining**
  - **Non-indigenous Species**
- **Determine Study Area**
  - **Generally Areas of Direct Fill or Changes to Hydrology**
- **Determine Existing Conditions**
  - **Aerial Photographs**
  - **Field Visit**
  - **Wetland Delineation**
  - **Wetland Evaluation Technique (WET)**
  - **Hydrogeomorphic Approach (HGM)**

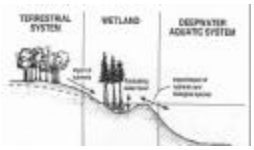
## Wetlands (cont.)

- **Identify Standard**
  - Federal/State Permits
    - **Nationwide**
    - **Individual**
- **Impact Prediction**
  - Direct Taking
  - Change in Hydrology
  - Shading
  - WET/HGM
- **Assess Significance of Impacts**
  - Individual Permit
  - Percentage/Professional Judgment
  - Unique Characteristics/ Sensitive Species
- **Mitigation**
  - Avoid/Minimize Sensitive Areas
  - Compensate (WET/HGM)
  - Banking

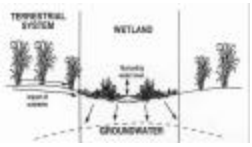
## Wetland Basics

- Definition: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas. (US Army Corps of Engineers, 1977)

## Wetlands Basics (cont.)




Transitional Wetlands




Depressional Wetlands

## Wetland Functions

- Abiotic Functions
  - Flood Mitigation
  - Storm Abatement
  - Aquifer Recharge
  - Water Quality
    - Nutrient retention
    - Sediment trapping
  - Bank Stabilization
- Biotic Functions
  - Wildlife Habitat
  - Aquatic Habitat
  - Food Chain Support
- Human Functions
  - Active Recreation
  - Passive Recreation
  - Resource Harvest

## Wetland Evaluation

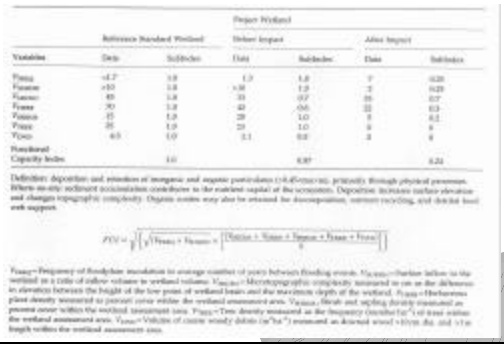
- Wetland Evaluation Technique **(WET)**
  - 11 Functions
  - Evaluated on:
    - Social Significance
    - Effectiveness
    - Opportunity
- Hydrogeomorphic Analysis **(HGM)**
  - Wetland Group by;
    - Geomorphic setting
    - Water source
    - Hydrodynamics
  - Groups have different functions
  - Functional capacity models for region
  - Reference wetlands
  - Functional capacity units

## HGM Wetland Classification

**Table 1**
**Hydrogeomorphic Classes of Wetlands Showing Dominant Water Sources, Hydrodynamics, and Examples of Subclasses**

| Hydrogeomorphic Class (geomorphic setting) | Water Source (dominant) | Hydrodynamics (dominant) | Examples of Regional Subclass | |
|---|---|---|---|---|
| | | | Eastern USA | Western USA and Alaska |
| Riverine | Overbank flow from channel | Unidirectional and horizontal | Bottomland hardwood forests | Riparian forested wetlands |
| Depressional | Return flow from groundwater and interflow | Vertical | Prairie pothole marshes | California vernal pools |
| Slope | Return flow from groundwater | Unidirectional, horizontal | Fens | Avalanche chutes |
| Mineral soil flats | Precipitation | Vertical | Wet pine flatwoods | Large playas |
| Organic soil flats | Precipitation | Vertical | Peat bogs; portions of Everglades | Peat bogs |
| Estuarine fringe | Overbank flow from estuary | Bidirectional, horizontal | Chesapeake Bay marshes | San Francisco Bay |
| Lacustrine fringe | Overbank flow from lake | Bidirectional, horizontal | Great Lakes marshes | Flathead Lake marshes |

## HGM Computations



## HGM Output

## Assessing Impacts to Species of Concern (T&E, Rare)

- **Identify Source of Potential Impacts**
  - Clearing and Grubbing
  - Change Hydrology (de-water/flood)
  - Toxic Substances
  - Spills
  - Placement of Fill
  - Shading
  - Noise
  - Human Contact
  - Non-Indigenous Species
- **Determine Study Area**
  - Generally Areas of Direct
- **Determine Existing Conditions**
  - Consultation with US Fish & Wildlife service
  - Habitat for Species Likely to Occur
  - Field Visit for Habitat
  - Survey for Species

## Species of Concern (cont.)

- **Identify Standard**
  - Jeopardy
- **Impact Prediction**
  - Biological Assessment
    - Direct Taking
    - Habitat Alternation
  - Biological Opinion
- **Assess Significance of Impacts**
  - Affect on Wildlife Species of Concern
    - No Jeopardy
    - Jeopardy
- **Mitigation**
  - Avoid/Minimize Sensitive Areas
  - Enhance Habitat
  - Move Species

# ESA Consultation Process