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Floodplain Reconnection Unintended Consequences

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Interpretation of "Connected Floodplain" as Used in Chesapeake Bay Program

Water at Top of Bank and Enters Floodplain at Any Size Storm Event

Not Consistent with All Interpretations e.g. flooding at storms of 1-2 year recurrence interval

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Misconceptions of "Disconnected" Floodplains

- Flooding May Still Occur Frequently
- Incised Channels Do Not Always Completely Drain Adjacent Wetlands
  - Most Wetlands Associated with Smaller Streams are Sustained Primarily by Groundwater

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Streams Re-connected or Have Increased Connection by Several Methods

Raising Stream Bed by Fill

Raising Water Level by Structure

Excavation of Floodplain

Combination of Approaches

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Unintended Consequences Depend upon Condition of Project Reach and Floodplain, Project Design and Implementation, and Upstream and Downstream Areas

Unintended Consequences Potentially Greater for Existing Sensitive and Functioning Resources and Critical Infrastructure

The less disturbance, the more existing functions and working processes at the site, the greater risk of unintended consequences from a design which does not take these considerations into account

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More Severe Consequences from Greater Depths of Water on Floodplain and Longer Retention Times

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Presentation Based upon Published Studies, Monitoring Results, Direct Observations, Anecdotal information, Other Scientific Results, and Modeling Results

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Unintended Consequences May Include Undesirable:

- Changes to Water Chemistry
- Loss of Vegetation
- Increase in Invasive Species
- Blockages to Passage of Aquatic Life
- Reduction of Hyporheic Exchange
- Increase is sedimentation/erosion from failed structure

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Unintended Consequences Cont.

- Loss of Baseflow from Failed Structure
- Decline in Wetland Functions, including Denitrification
- Change in Aquatic Resource Type or Decline in Habitat
- Degradation of Soil Processes from Construction
- Finite Capacity for Sediment Retention-Not Self Sustaining
- Damage to Infrastructure, Safety Hazards, Loss of Flood Insurance

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Water Chemistry

- Changes found: lowered DO, increased pH, Iron flocculation, increased temperature
- Many related to increases in water levels which result in loss of vegetation and shade
- Also disturbance of highly acidic soils
- Designs which maintain shade or spring flow, or expose cold water springs may not have temperature increases
- May Result in New Impairment Listings and TMDL Requirements

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Loss/Change in Vegetation from Increased Water Levels

Plants require oxygen to roots, are stressed by low oxygen and toxins in soil. Most tree species die with prolonged inundation and saturation

Broad range of tolerance to increased water levels– species specific

Tree seedlings more sensitive

N, P uptake by Trees may decrease in wetter soils with lower redox potential

Changes in plant community type or aquatic resource type and habitats – Decline in macroinvertebrate scores

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Blockages to Passage to Aquatic Life

- **Blockages May be Physical or Chemical**
  - **If there is too great "drop" from top of structure to water in channels, aquatic species movement may be prevented or impaired**

    Structure with openings allowing flow may allow movement

  - **Chemical blockages and/or mortality from temperature increase and possibly DO decrease**

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Reduction in Hyporheic Exchange

Hyporheic exchange depends upon flow; groundwater levels; hydraulic conductivity (heterogeneous sediments and bed complexity and topography; and features such as wood) and permeability in streambed; DOC; residence time; microbial communities

Structures which may slow flow or force more too rapid downwelling may reduce effective instream denitrification

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Increased Sedimentation and Erosion in channel

Loss of Baseflow in Channel

Resulting from Failed Structures or Improperly Placed Structures

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Increase in Flood Hazards

Higher water levels weaken vegetation, sometimes transporting vegetation debris downstream to damage infrastructure and cause more flooding

Higher water levels may damage and transport other objects in floodplain

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Potential Conflicts With Other CBP Commitments

- Wetlands BMP crediting: Accepted rehabilitation (return to previous condition) rejected enhancement -favors one service over others e.g. water quality
- Stream Health
- Fish/aquatic life Passage
- Riparian forest buffers

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Reducing Unintended Consequences

Consider existing functions and other factors in site design

Consider adverse effect of increasing water in floodplain

Design and build for specific site conditions and retain natural system and processes where feasible

Recognize that more modest alterations may be most beneficial overall

Address problems at source

- **Maximize upland treatment**
- **Properly size culverts and other crossings, if undersized structures resulted in erosive flows**