

Engineering Reliability & Effectiveness of Restoration Practices

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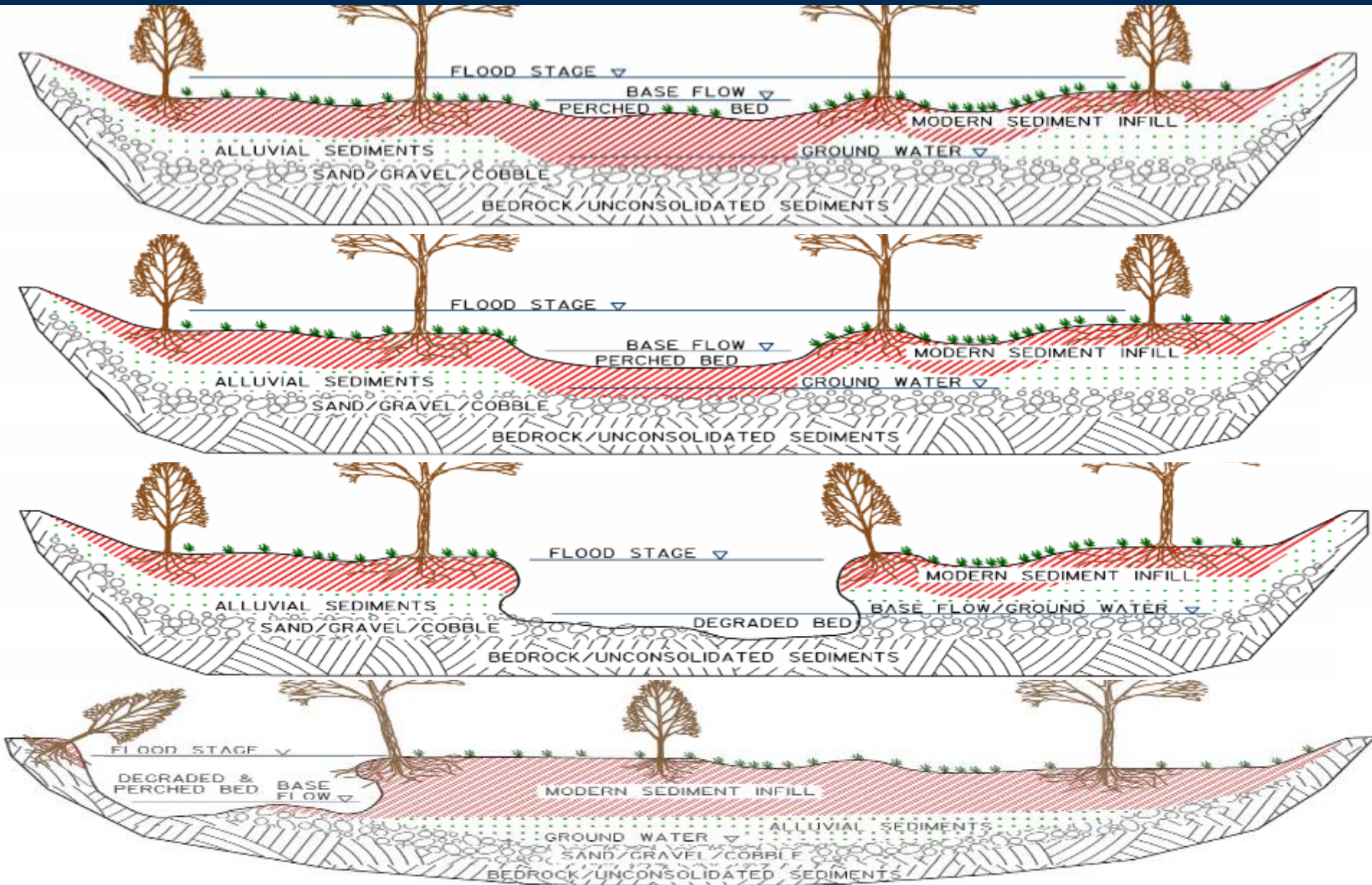
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Lost Functions of Impacted Streams



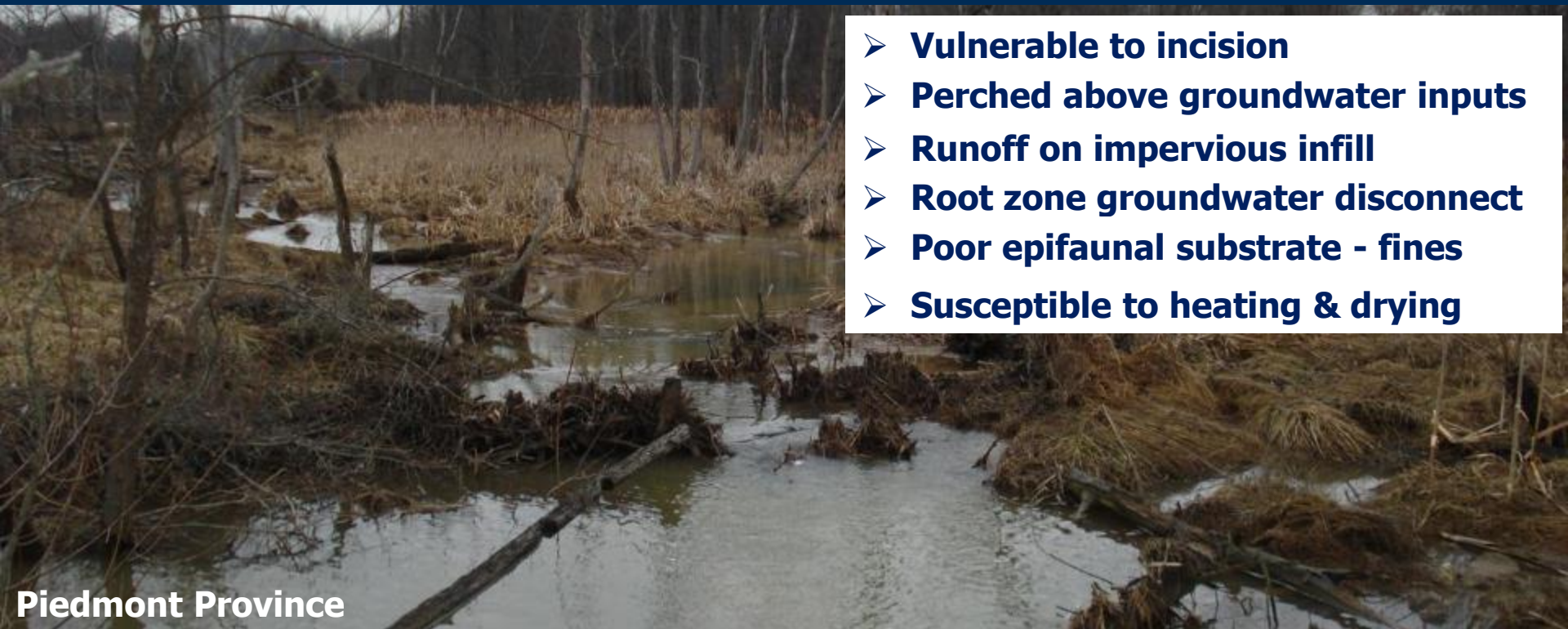
Common Post-Settlement Forms

Historic and modern anthropogenic impacts



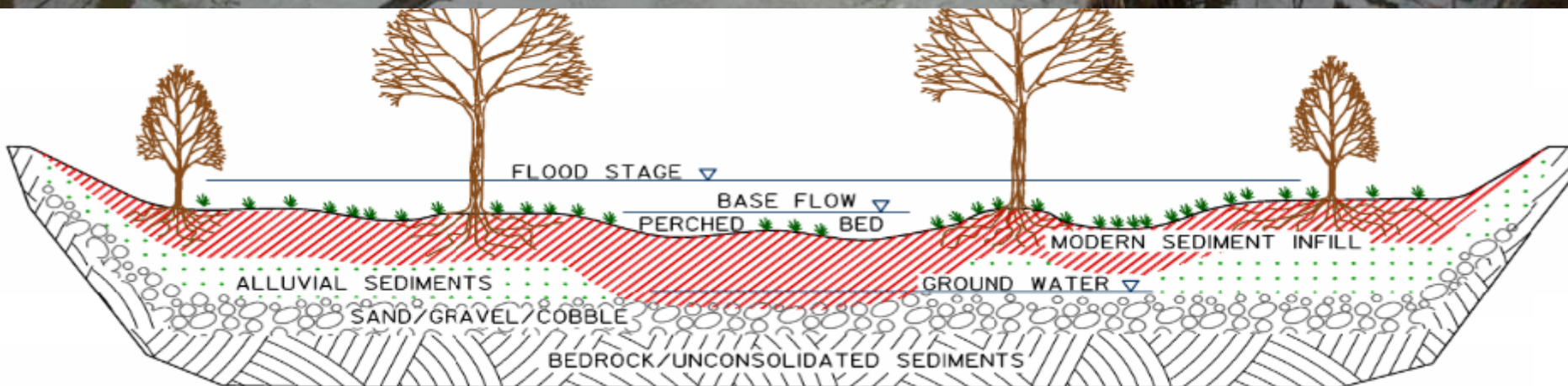
Common Post-Settlement - Form A

Non-incised and perched streambed – primarily wetland riparian zone



- **Vulnerable to incision**
- **Perched above groundwater inputs**
- **Runoff on impervious infill**
- **Root zone groundwater disconnect**
- **Poor epifaunal substrate - fines**
- **Susceptible to heating & drying**

Piedmont Province



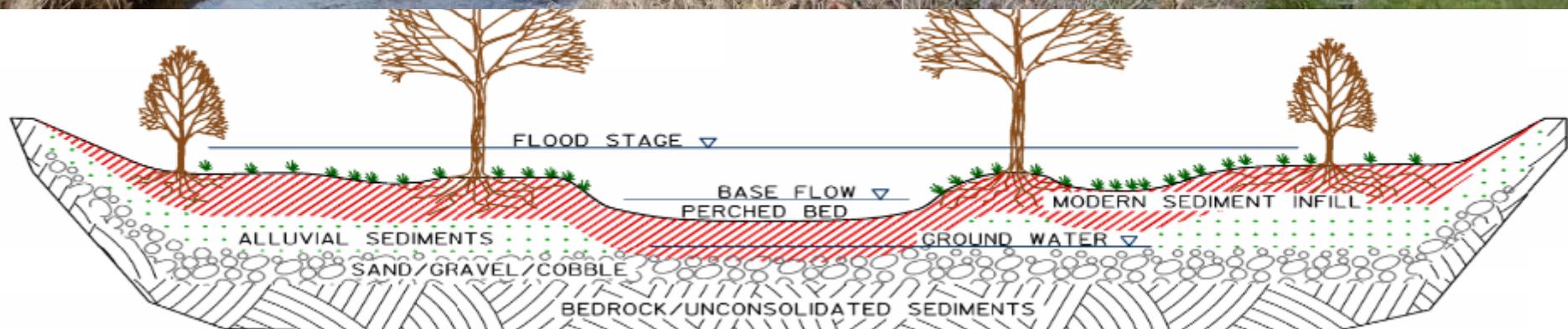
Common Post-Settlement - Form B

Incised and perched streambed – primarily non-wetland riparian zone



- **Vulnerable to incision & widening**
- **High in-channel stress**
- **Susceptible to freeze/thaw erosion**
- **Runoff on impervious infill**
- **Root zone groundwater disconnect**
- **Poor epifaunal substrate – fines**
- **Susceptible to heating & drying**

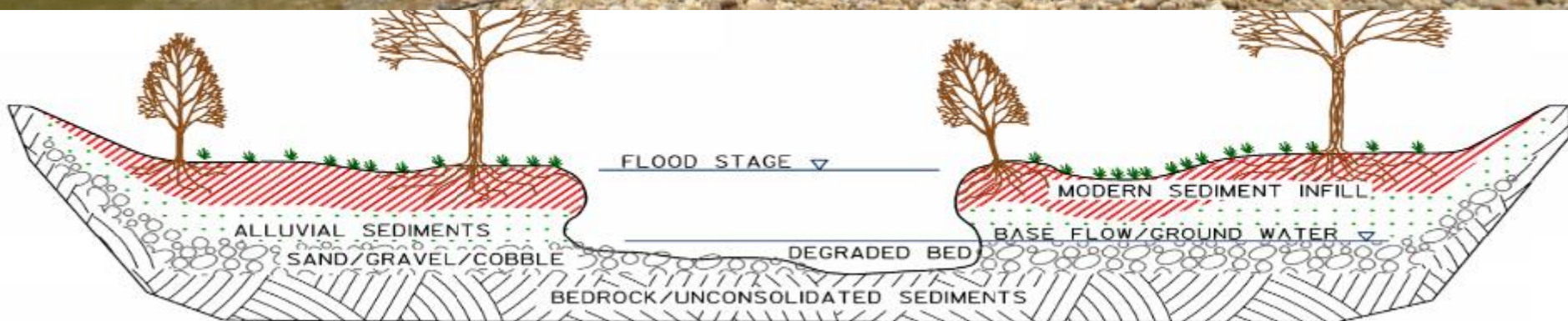
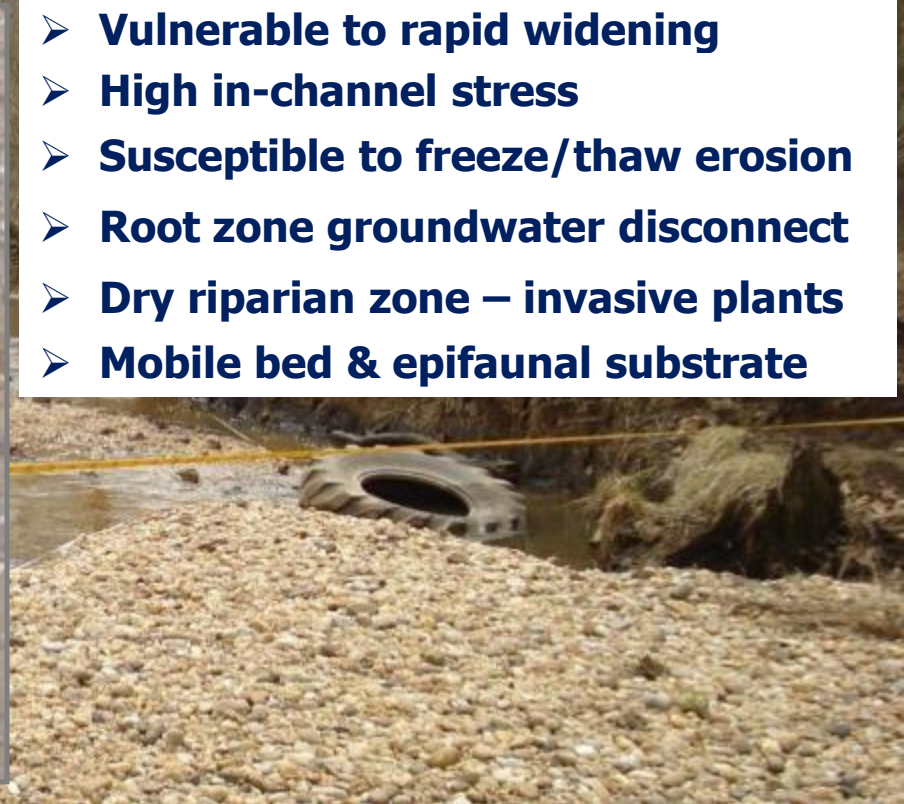
Piedmont Province



Common Post-Settlement - Form C

Incised and non-perched streambed – primarily non-wetland riparian zone

- **Vulnerable to rapid widening**
- **High in-channel stress**
- **Susceptible to freeze/thaw erosion**
- **Root zone groundwater disconnect**
- **Dry riparian zone – invasive plants**
- **Mobile bed & epifaunal substrate**



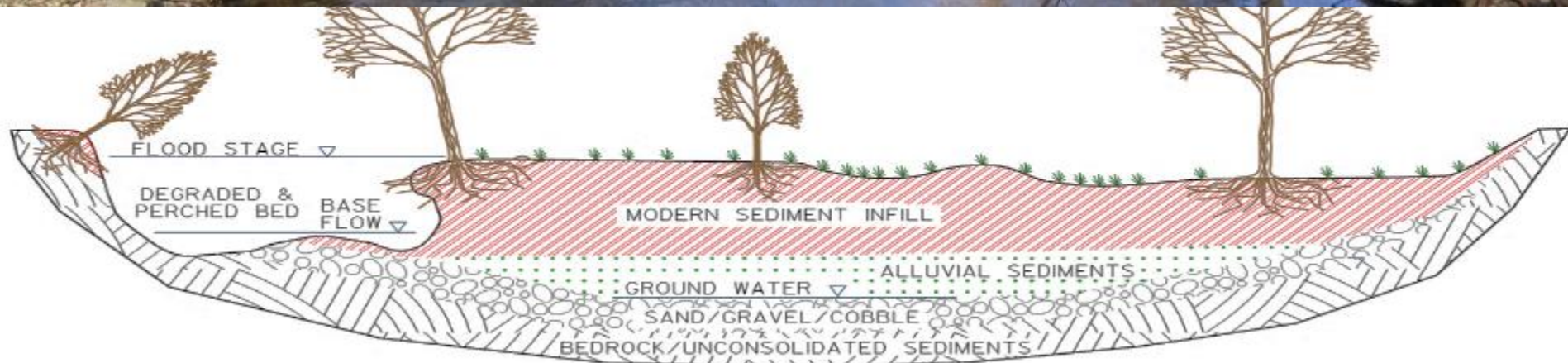
Common Post-Settlement - Form D

*Incised and relocated channel perched on valley margins
- primarily non-wetland riparian zone*



- **Root zone groundwater disconnect**
- **Dry riparian zone – invasive plants**
- **Mobile bed & epifaunal substrate**

Piedmont Province





“Reference” Form



Pre-Settlement Conditions

Floodplain vegetation connected to groundwater with expansive wetlands

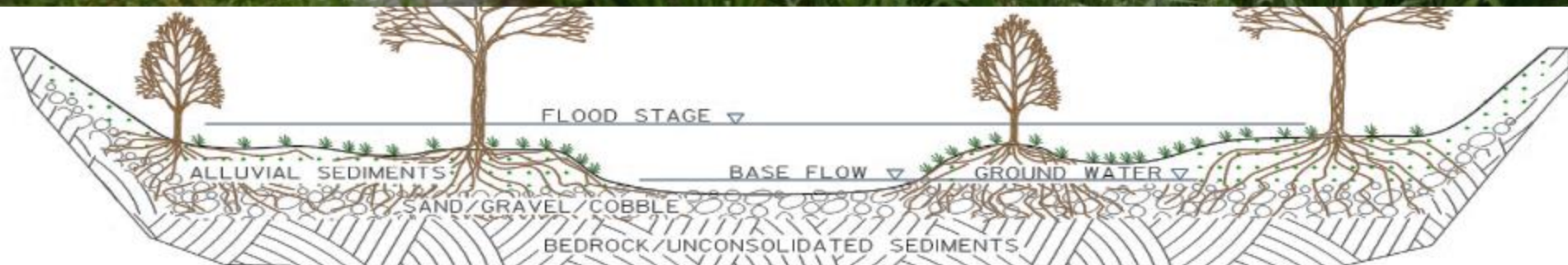


- **Small/highly stable flow pathways**
- **Low stress - sediment/nutrient retention/treatment**
- **Limited to no freeze/thaw erosion**
- **Root zone connection to groundwater, base flow & flood flow**
- **Stable epifaunal substrate**
- **Retention of organic carbon**
- **Groundwater temp regulation**

Integrated Stream & Wetland System



Ridge & Valley Province





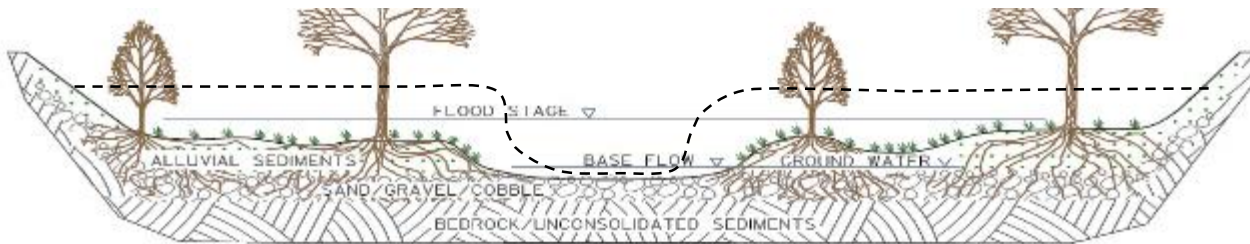
Restoration Strategies

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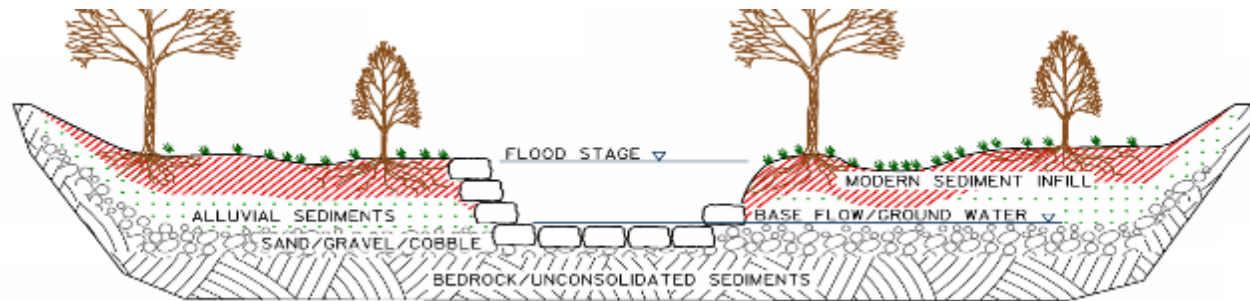
Incised Stream Intervention

Basic Design Strategies

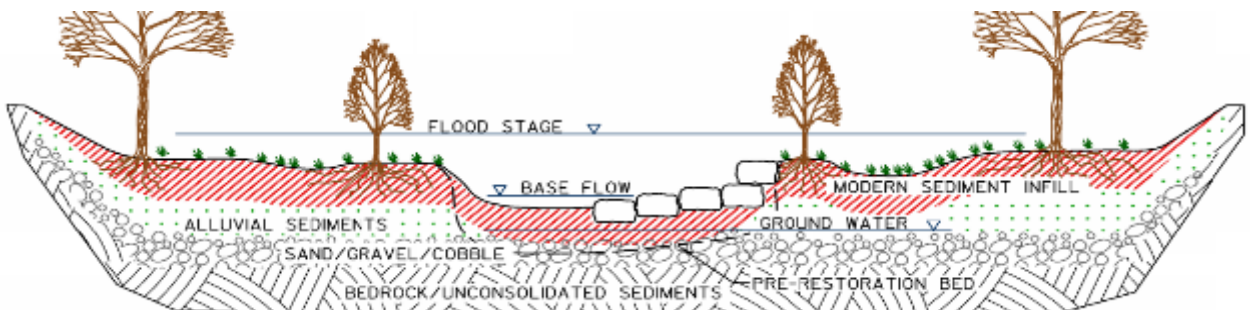
1 Removal of modern sediment to re-connect floodplain.



2 Incised channel stabilization to store modern sediment.

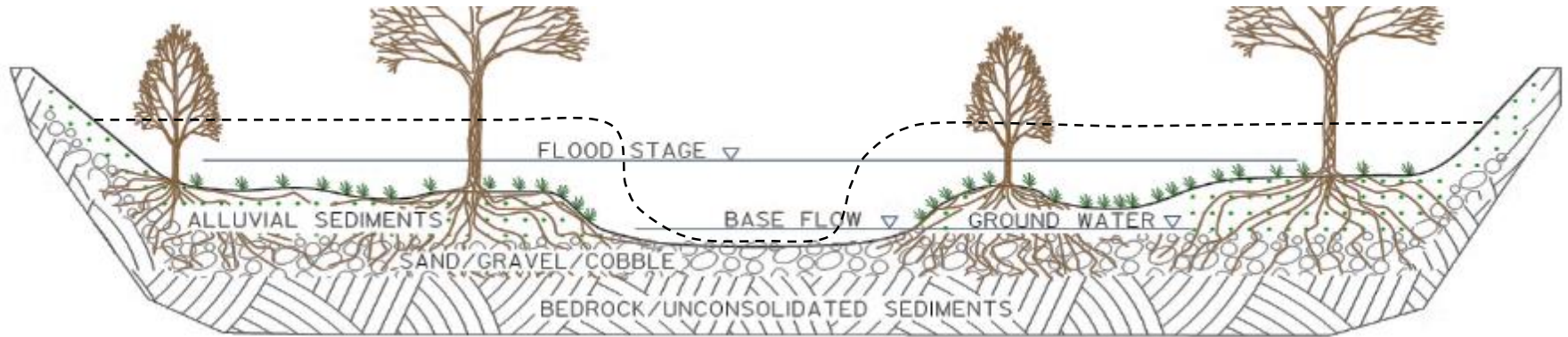


3 Raise streambed to store modern sediment and tie into modern terrace.



Intervention Approach 1

Eliminate incised channel by modern sediment removal

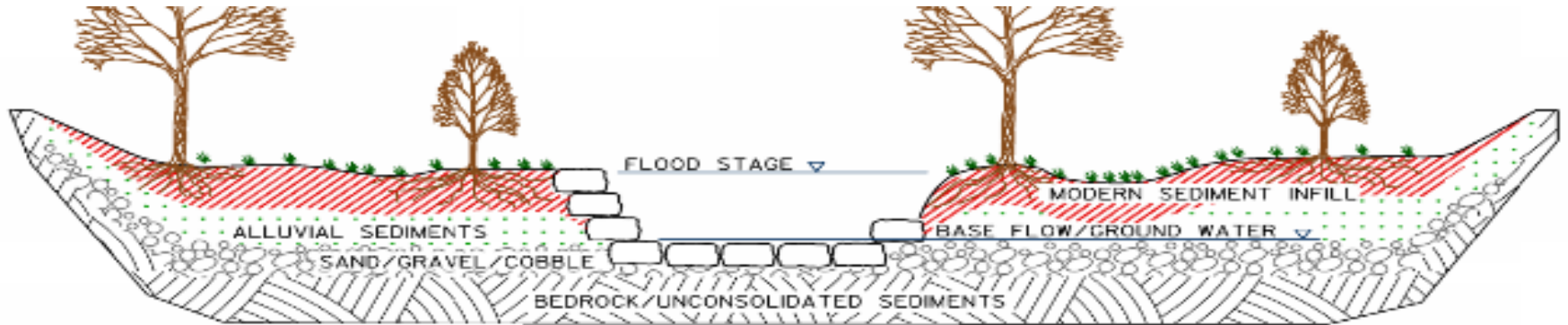


Approach 1 Goals/Methods:

- Strive to connect floodplain root zone to groundwater, base flow and flood flows
- Promote retention of carbon, sediment and nutrient
- Rely on vegetation and native materials for stability
- Create frequent floodplain connection
- Increase flood storage & base flow residence time
- Move evolutionary trend forward

Intervention Approach 2

Incised channel stabilization to store modern sediment

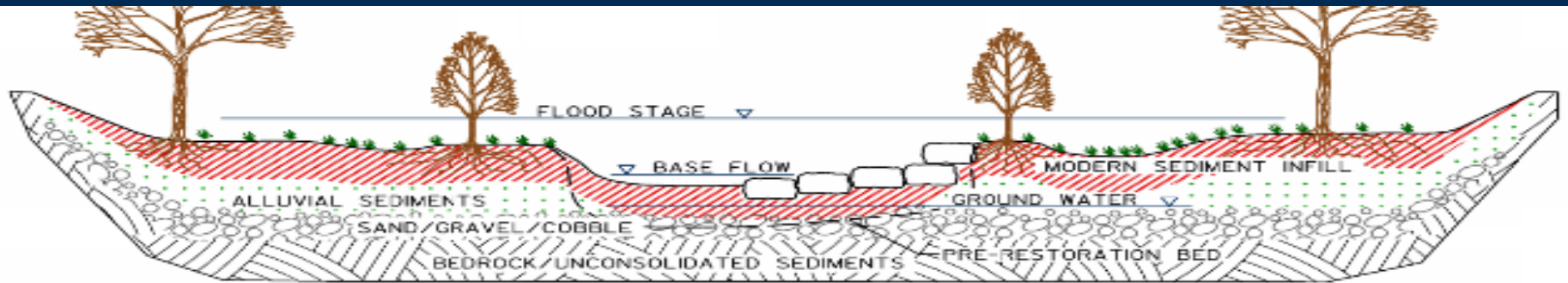


Approach 2 Goals/Methods:

- Rely on in-channel structures
- Combat high stress environment
- Promotes transport of sediment, nutrients & carbon
- Infrequent floodplain connection
- Hold evolutionary trend

Intervention Approach 3

Elevate streambed to store modern sediment



Approach 3 Goals/Methods:

- Strive to connect floodplain to base flow and flood flow
- Disconnection to groundwater inputs - susceptible to drying
- Promote retention of carbon, sediment and nutrient
- Rely heavily on grade control(s)
- Long-term stability challenges, especially in larger watersheds
- Reverse evolutionary trend

Reliable Assessment & Design Methods



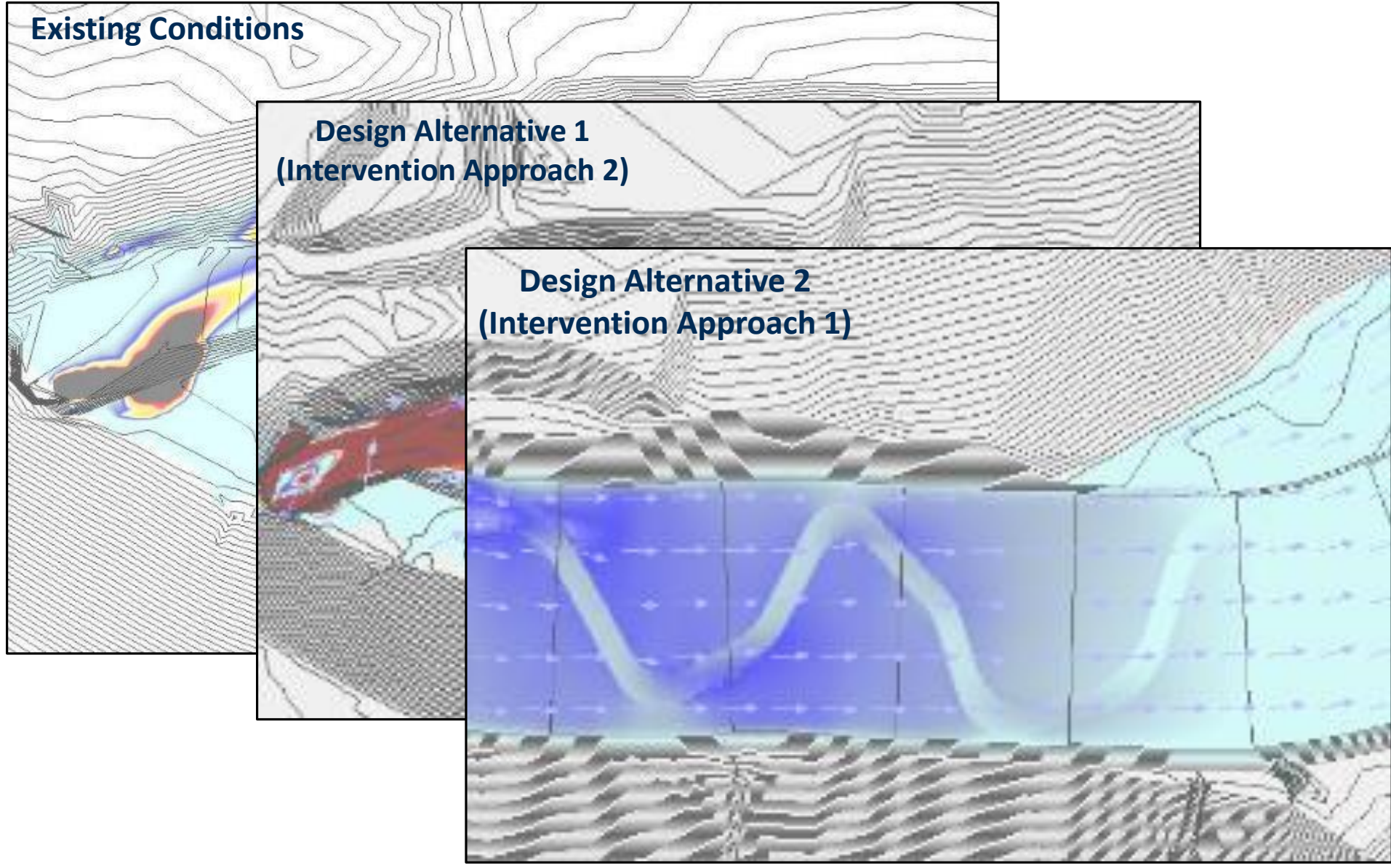
Hydrodynamic Design Analysis

Vulnerability Assessment

Existing Conditions

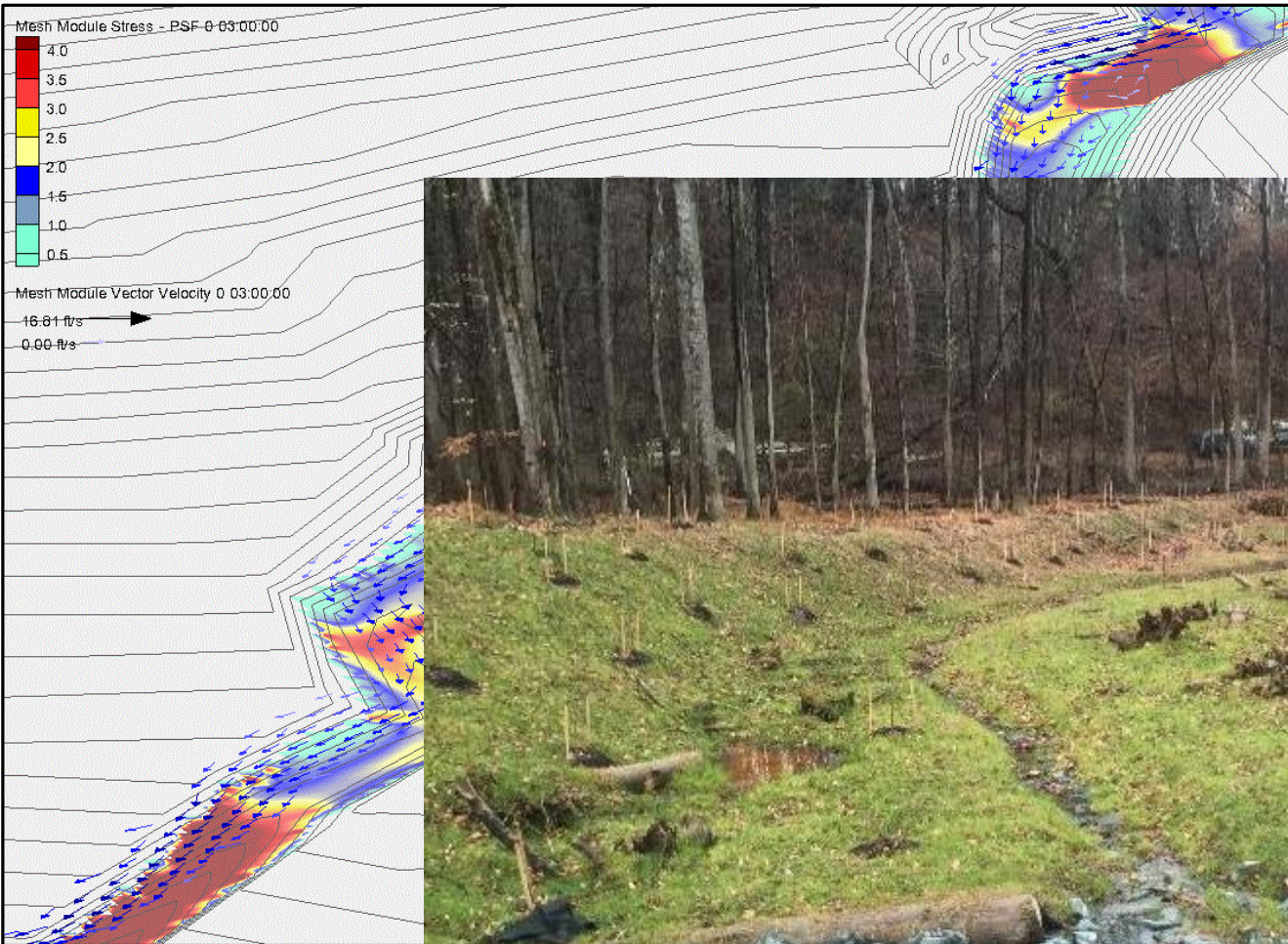
**Design Alternative 1
(Intervention Approach 2)**

**Design Alternative 2
(Intervention Approach 1)**



Restoration of Lost Functions

Integrated Stream and Floodplain Restoration Approach



**Piscataway Tributary
Existing Conditions**



**Piscataway Tributary
Proposed Conditions**

Questions?



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