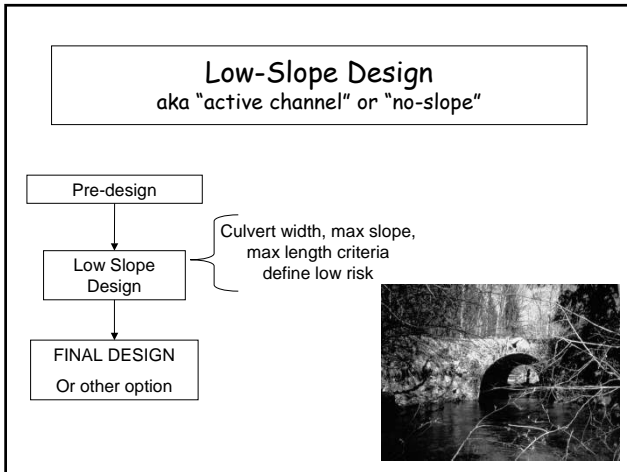
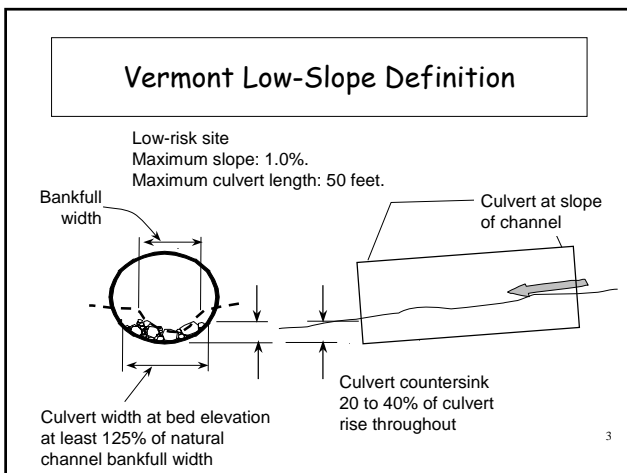


Design of Stream-Road Crossings for Aquatic Organism Passage in Vermont



- Three design options - Premises**
- Low-slope: The design of an oversized culvert in a low risk site can be simplified and built with little risk
 - Hydraulic: A structure with appropriate hydraulic conditions will allow target species to swim through it.
 - Stream Simulation: A channel that simulates characteristics of the adjacent natural channel, will present no more of a challenge to movement of organisms than the natural channel.



- Low-slope option;
general application**
- Purpose: small, low-risk sites
 - New and replacement culverts in stable channels.
 - Simple installations
 - Max slope 1.0%
 - Max length 50 ft.
 - Moderately confined channel
 - No special design expertise or survey information required for fish passage design.
 - Pre-design and slope must be well understood.

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Example of Low-slope application with no VAP

- Site description
 - Channel slope = 1.0 %
 - Culvert length = 50 ft
 - BF Channel width = 8 ft
- Design by criteria
 - Culvert slope 1.0%
 - Culvert span
 - Bed width = 10 ft
 - Span = 12.5 ft
 - Culvert rise
 - 2.5 ft embed, Rise = 12.5 ft
 - 5.0 ft embed, Rise = 10.2 ft

-(Check capacity, countersink with bed material)

Example of Low-slope application with significant VAP

- Site description
 - Channel slope = 1.0 %
 - Culvert length = 50 ft
 - BF Channel width = 8 ft
 - VAP = -2.0 ft (channel expected to degrade 2.0 ft)
- Design by criteria
 - Culvert slope 1.0%
 - Culvert span
 - Min culvert bed width = 10 ft
 - Span = 12.5 ft
 - Culvert rise
 - Assume 12.5 ft rise
 - By VAP, Rise = 10 ft (2.0/.20)

-(Check capacity, countersink with bed material)

Low-slope design Information needed

- Thorough pre-design assessment
 - Range of potential profiles
- Average natural channel bed width
- Natural channel slope
 - Project slope
- Evaluation of headcut impacts (for replacements)
- Flood hydrology and capacity

Low-slope culvert bed

- Intent is to have a natural streambed
- Streambed recruits in mobile bed, otherwise place material (becomes stream simulation?)
- Add disrupters for diversity
- Do not constrict floodplain
 - allowable constriction = $f(\text{mobility})$

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