

## Sources of Knowledge

Sources of information, design guidance, and standards for in-stream structures include:

- Government-issued/approved design standards.
  - Federal, state, and local standards may exist separately.
  - Interests and goals differ depending on source agency or organization.
- Scholarly research, especially hydraulic studies.
- Evaluation and monitoring of existing sites.
- Stream restoration professionals' hands-on experience in designing in-stream structures.
- Design standards and experience of private consultants and firms (often proprietary).

In-stream structures face a high risk of structural failure due to their placement within the stream channel, but their ability to control bank erosion and improve aquatic habitat makes identification of knowledge gaps in design standards and synthesis of available information worthwhile.

## Structure Design Life

**How long should an in-stream structure be designed to remain in place?**

- Structure design life (SDL): the period of time a structure is designed to remain structurally sound and functional.
- Structure design flow (SDF): the magnitude of flow for which a structure is designed to remain structurally sound and functional.

**A few considerations:**

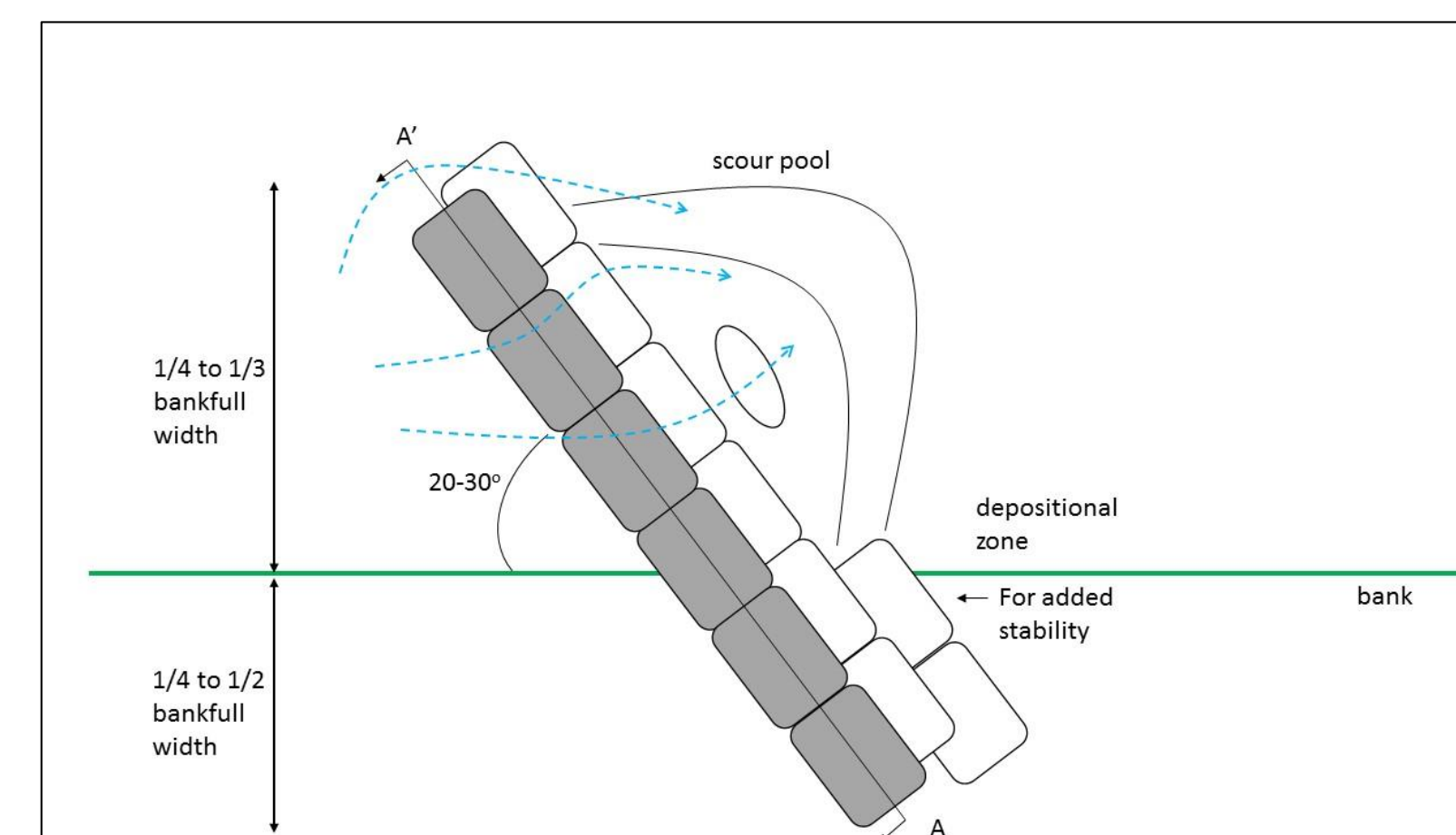
- Level of acceptable risk associated with a project should drive selection of SDL/SDF on an individual project basis.
- Consider how long the structure *needs* to remain.
- Woody materials will decompose – use for shorter SDL.
- Budget constraints: longer SDL = higher material costs.

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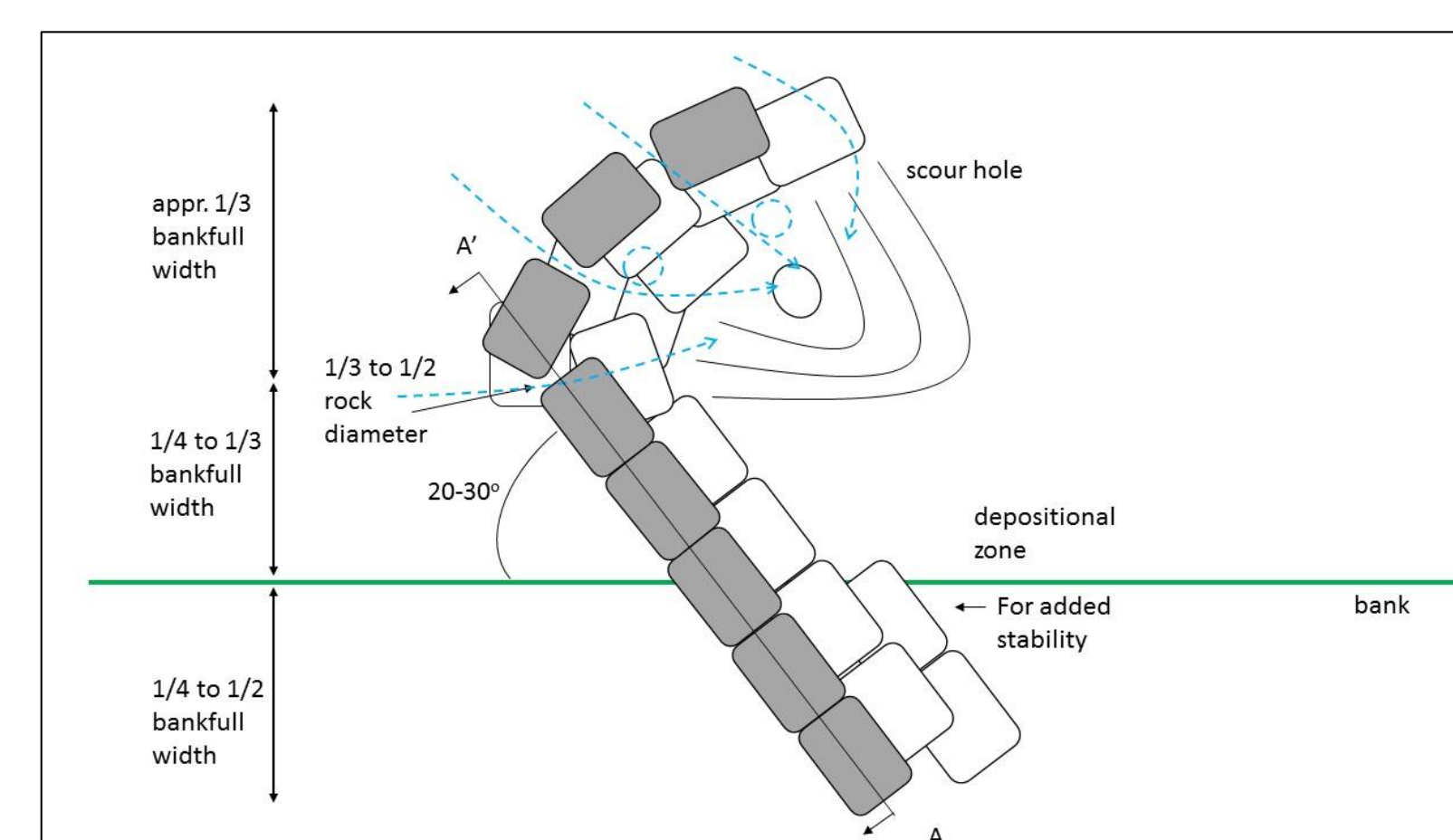
## Current Design Guidance

Four specific in-stream structures are under consideration:

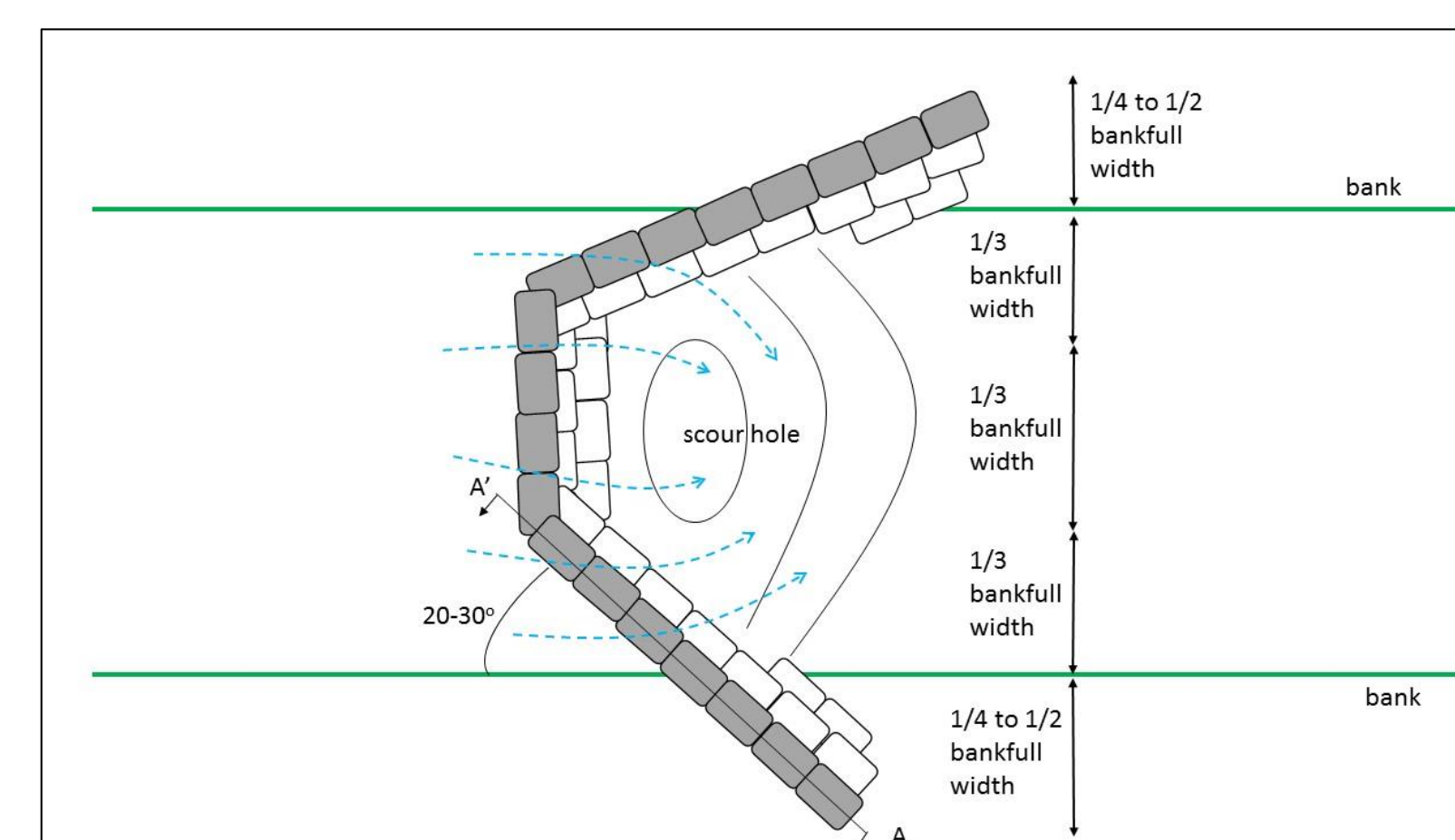
### Single-Arm Vane



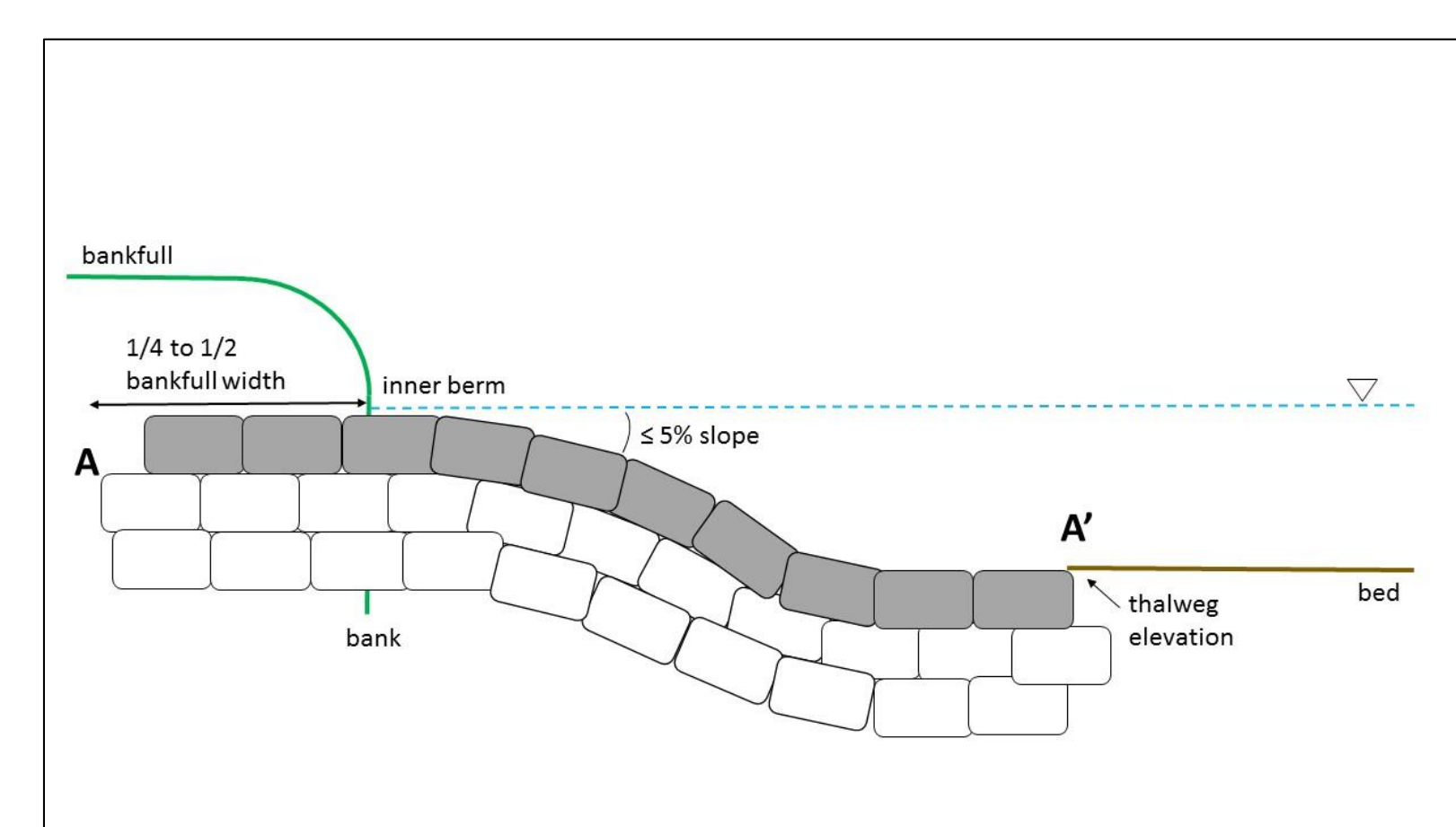
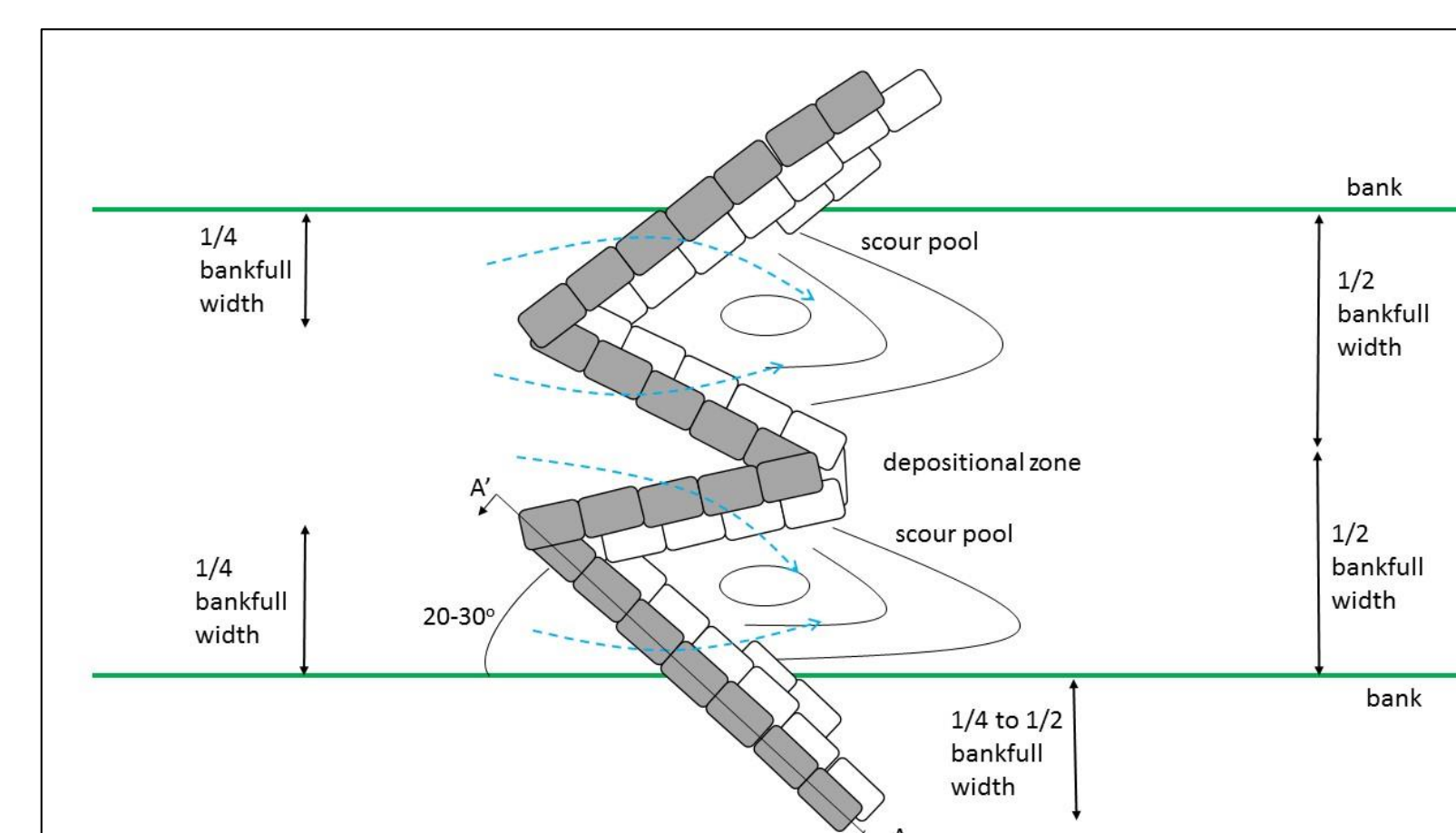
### J-Hook Vane



### Cross Vane



### W-Weir



### General Profile View

## Further Considerations

### Material Sizing

- What method is best to determine what size material to use in the structure?
- What are reliable methods to determine stream properties such as applied shear stress at a particular cross-section?
- What factors other than SDL/SDF ought to be considered?
- Should a factor of safety be used when sizing materials?

### Depth of Expected Pool Scour

- What are reliable methods for predicting scour depths?
- To what depth should footer rocks and pilings extend?

### Monitoring

- How can we best identify and treat symptoms of future structural failure?
- How do we determine whether a structure has succeeded or not?

## Future Directions

- In-Stream Structures Design Workshop
- Stream Restoration Practitioners Survey
- Finalization of In-Stream Structure Design Factsheet Series

## Sources Consulted

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