

A scenic landscape photograph showing a river flowing through a valley. The river is dark blue with white rapids. The valley floor is covered in green and yellow grass. The hillsides are covered in dry, yellowish grass and have patches of snow. In the background, there are evergreen trees under a blue sky with white clouds.

Natural Process Erosion Control

-Craig Sponholtz-

Channel Systems Have 4 Primary Jobs:

- **Transport runoff**
- **Transport sediment**
- **Store moisture**
- **Transform energy**



Converging flow lines illustrate the Continuity Principle

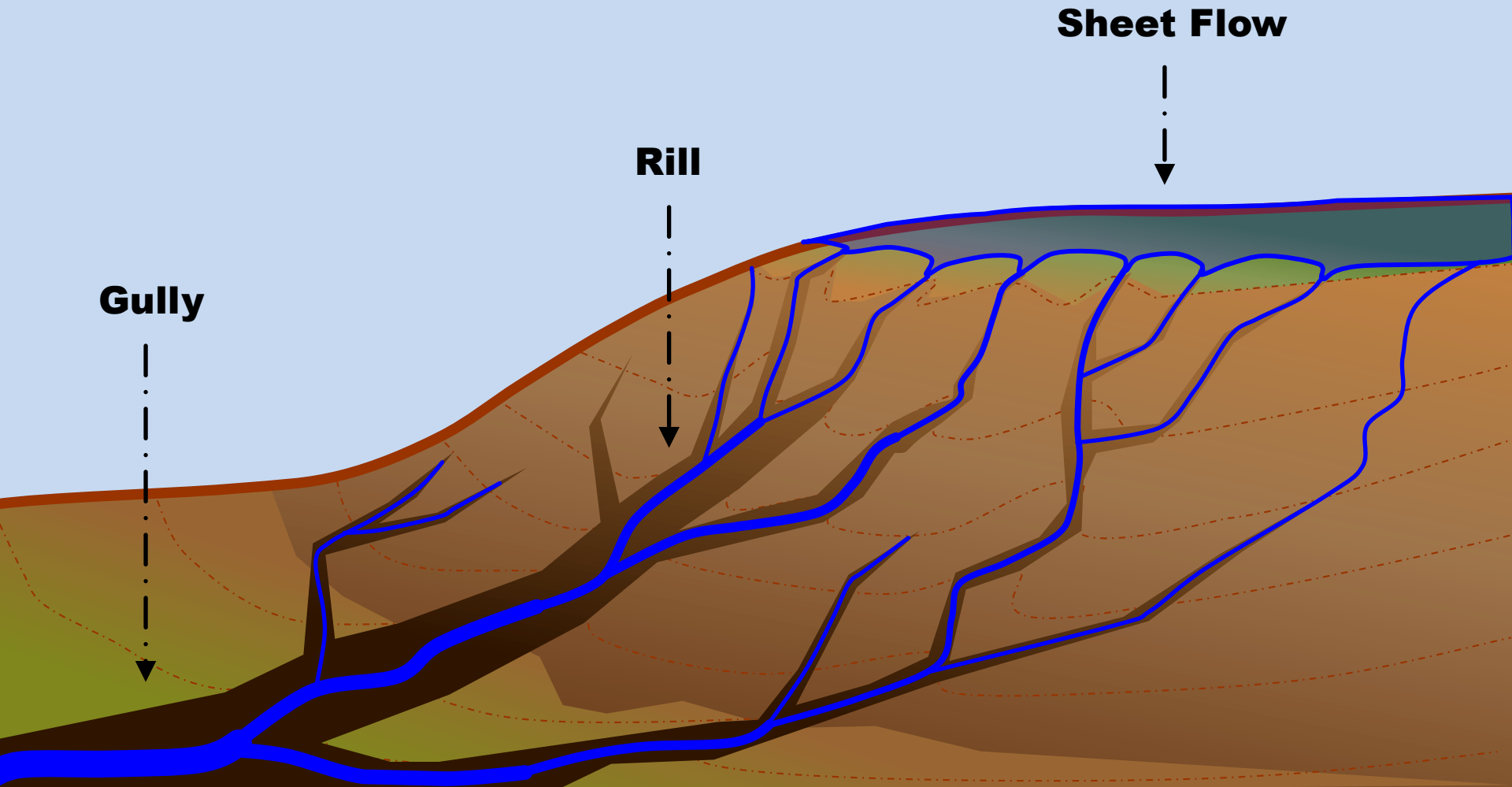


When velocity increases, cross sectional area decreases
or
When cross sectional area decreases, velocity must increase.



Runoff and Erosion Processes

Forms of Runoff Transmission

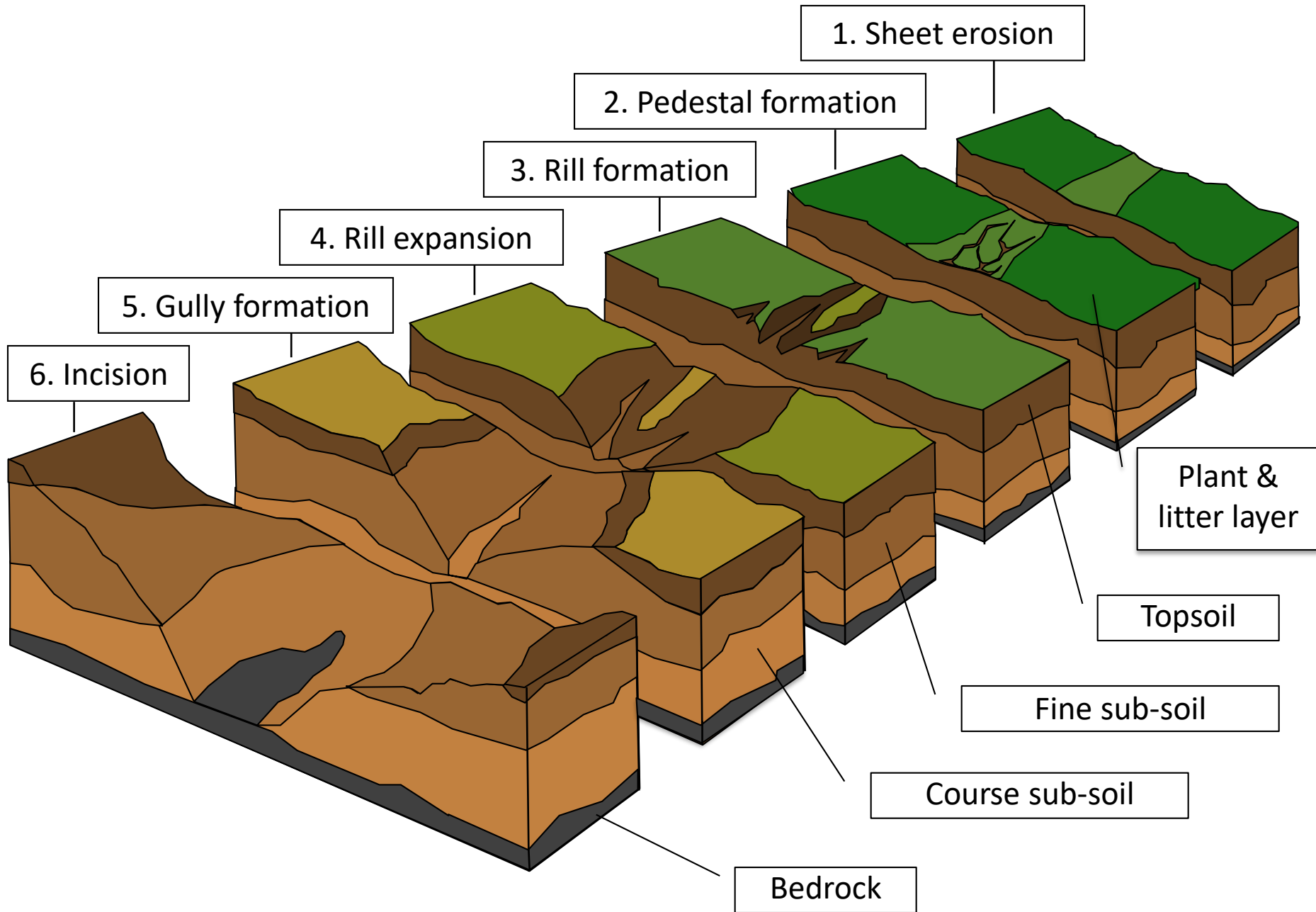


Runoff Erosion Processes

Erosion is a symptom of land degradation



Stages of Gully Development



Bank
Erosion

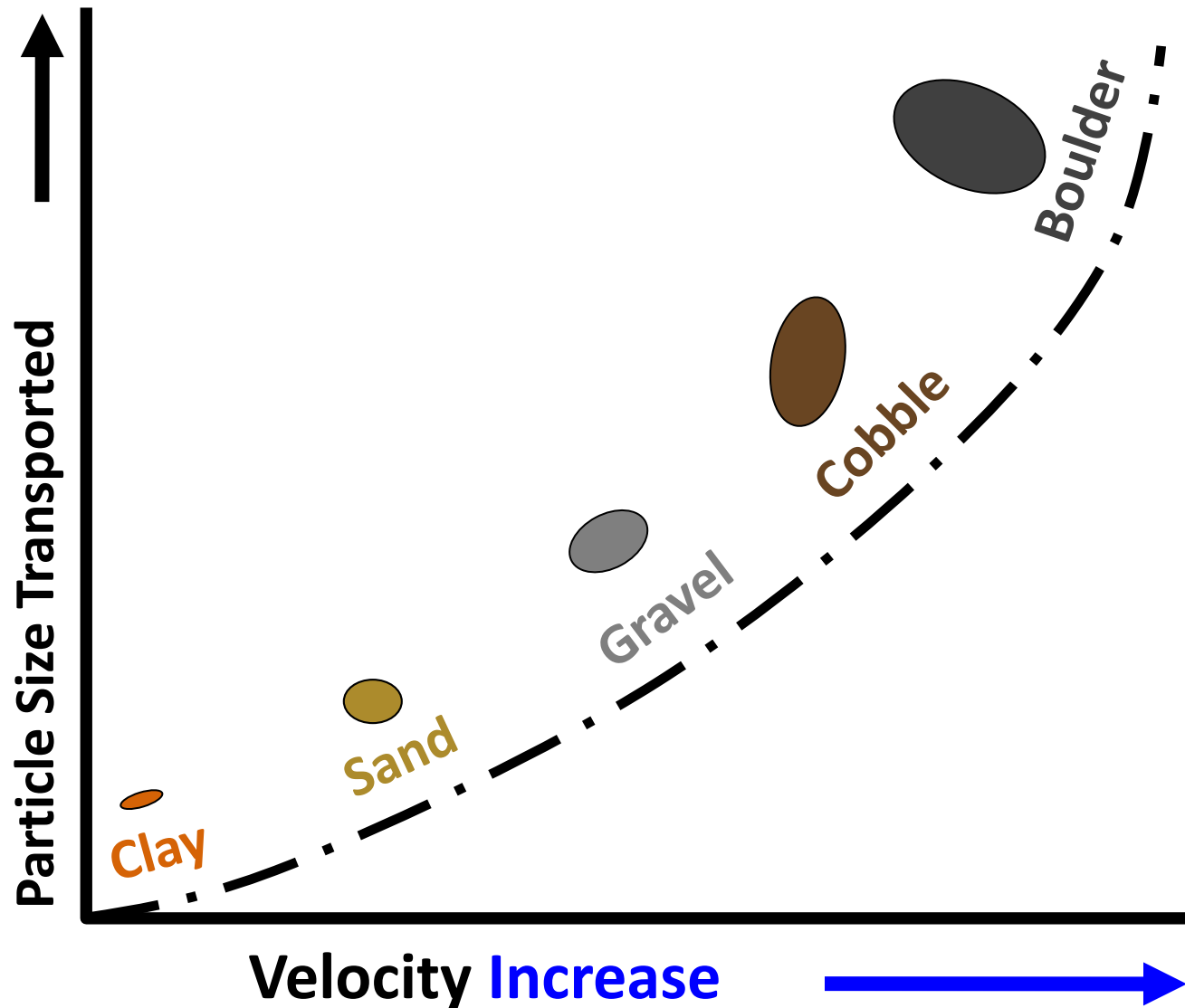


The rate of erosion on bare soil is 80 times greater than soil covered with vegetation.



Sediment Transport

Soil Erosion and Sediment Transport



Exponential relationship- Increased velocity 2x = increased particle size by 4x



Sediment Sorting in Streams

Channelization and Incision

Channel Incision

A photograph showing a stream channel with a headcut. The water is flowing from the top of the frame down a steep, eroded bank. The bank is composed of reddish-brown soil and is covered with sparse, dry grass. The water is turbulent and white with foam as it falls over the edge of the bank. The channel is narrow and deep, with the water flowing in a single line down the center.

Headcutting

Headcuts Reduce Floodprone Area

Pre-incision floodprone area

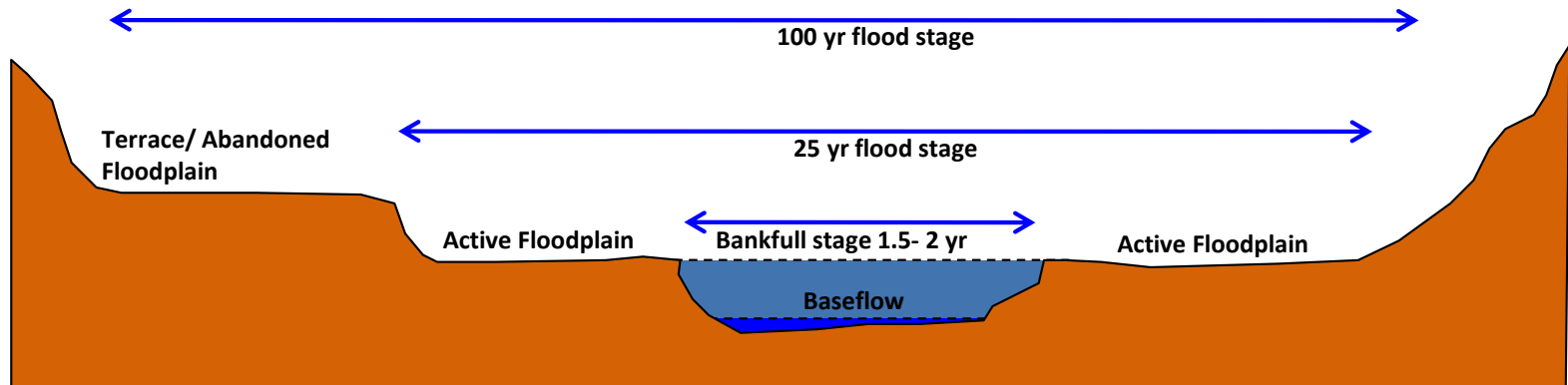
Post-incision floodprone area







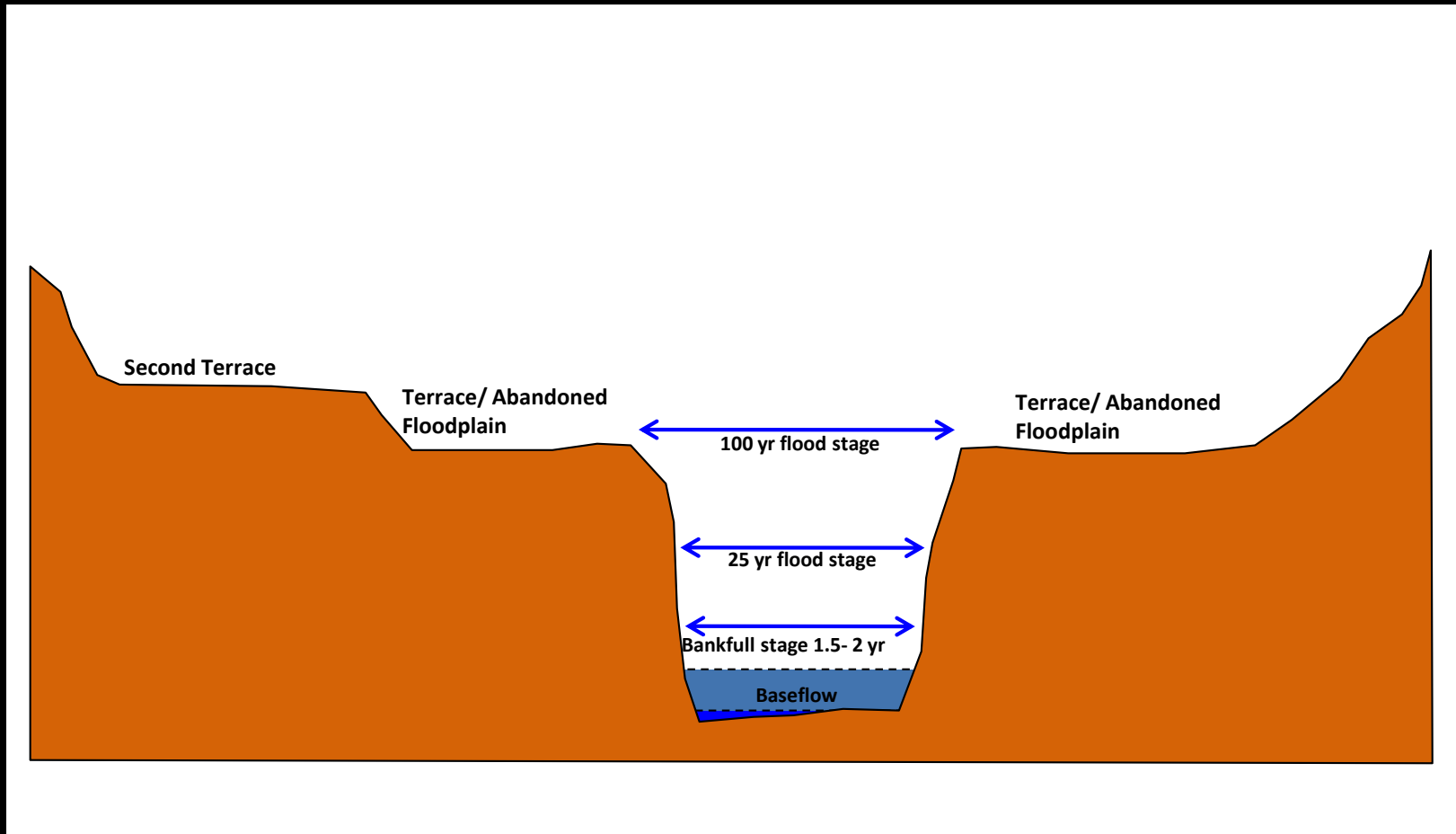
Floodplain Access





Floodplains reduce velocity and increase infiltration

Incised Channel



Remember the continuity equation...

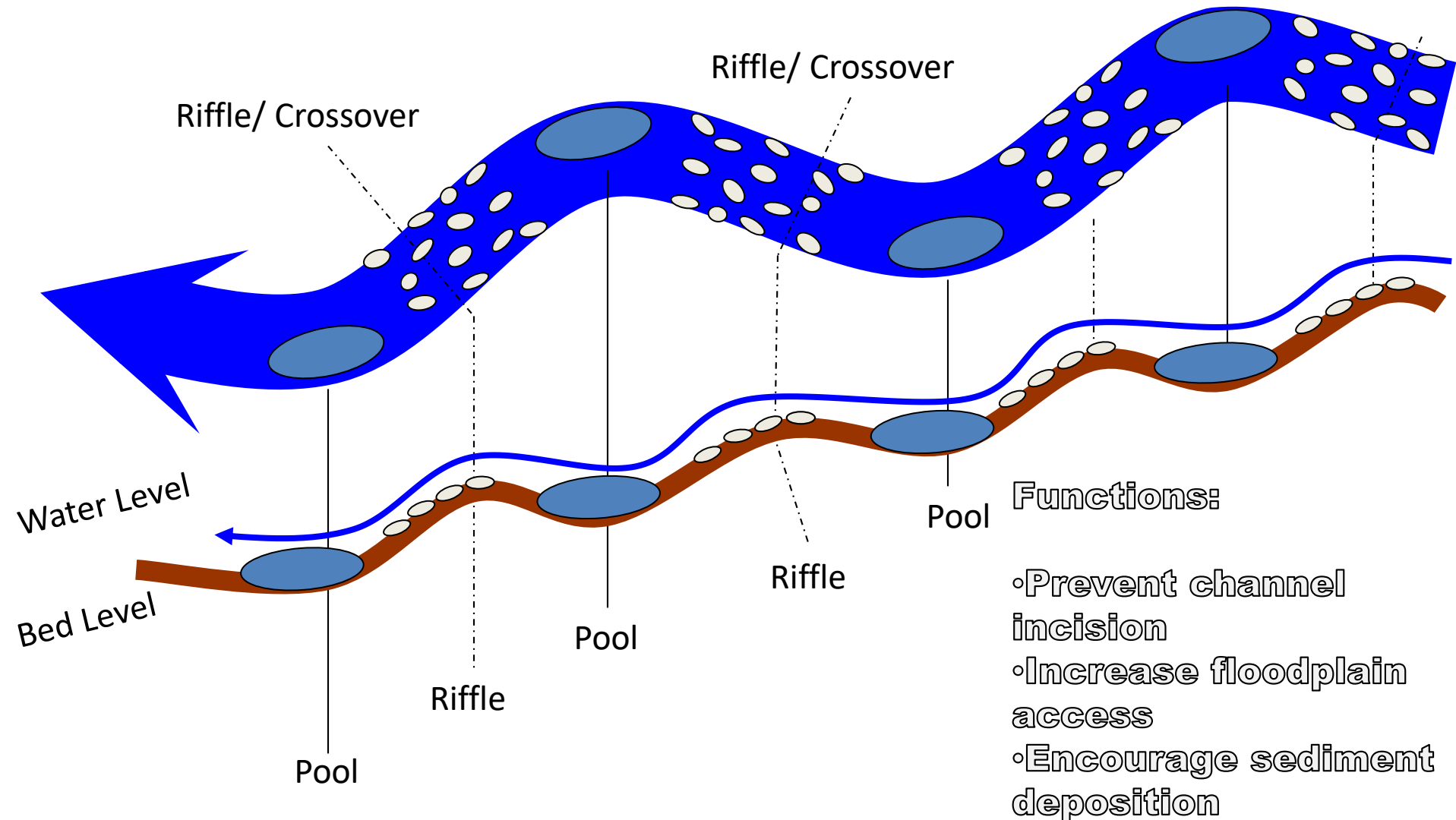
Five Principles of Natural Process Erosion Control

- 1. Protect and expand moisture storing areas of the landscape.**
- 2. Stabilize active erosion and prevent further degradation.**
- 3. Restore dispersed flow and increase infiltration at every opportunity.**
- 4. Cultivate regenerative plant communities to build soil.**
- 5. Create site-specific solutions using natural forms and processes.**

Grade Control Structures



Riffles Provide Natural Grade Control

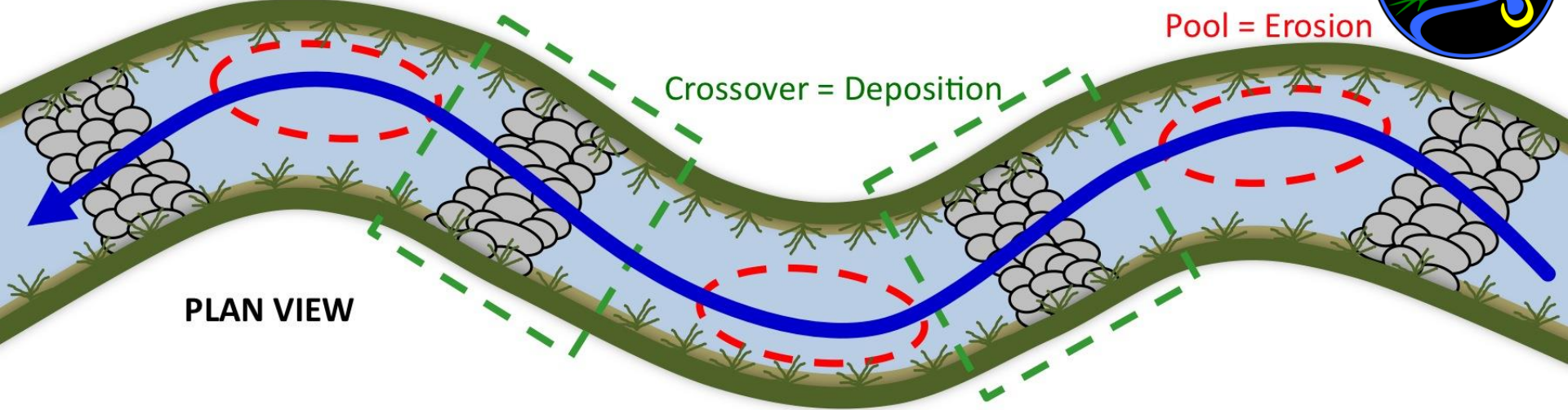


Riffle/ Pool Sequence

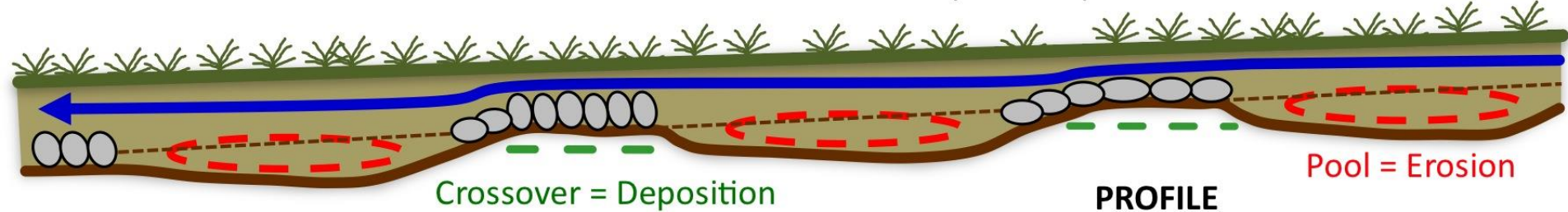
ONE ROCK DAM



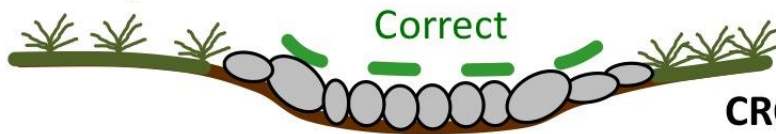
1. Always position grade control structures at meander crossovers.



2. Placement at crossovers maintains natural erosion and deposition patterns.



3. Always maintain channel cross section to protect banks.



CROSS SECTION





One Rock Dams can expand bank vegetation







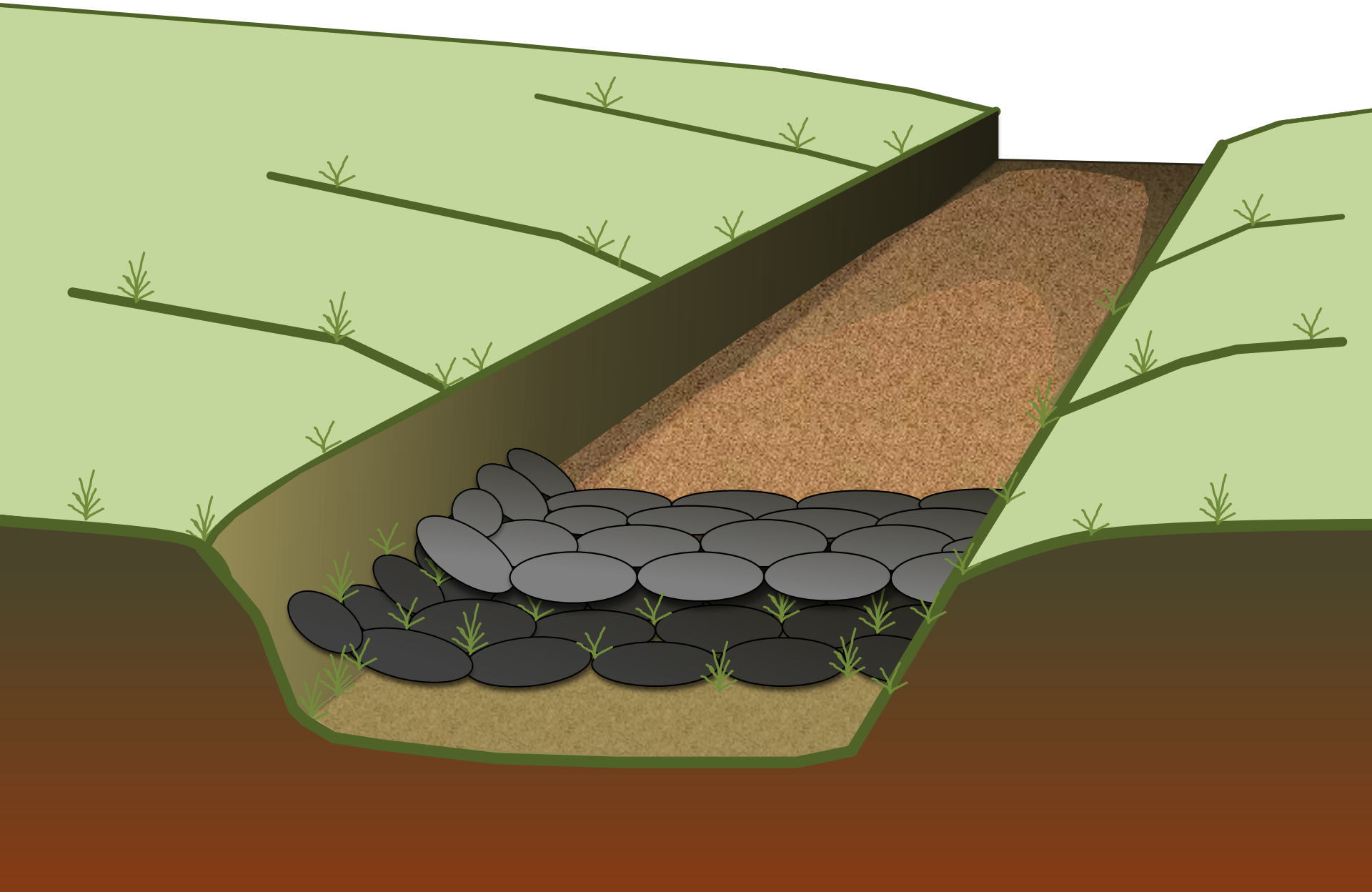
One Rock Dams increase roughness at riffles



One Rock Dams increase floodprone area



A second layer of rocks increases deposition







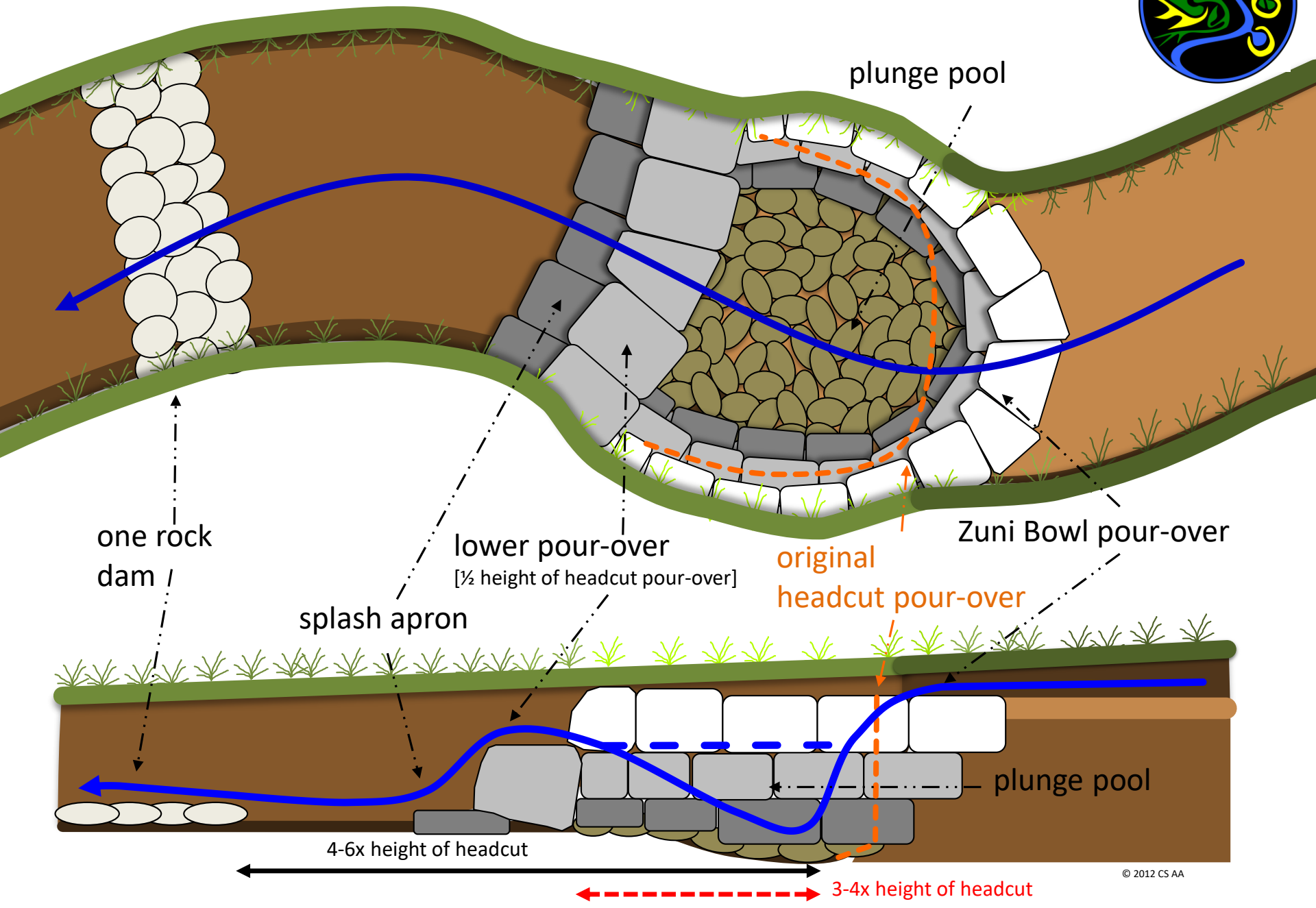
In-Channel Headcut Treatments



In-Channel Headcut Stabilization

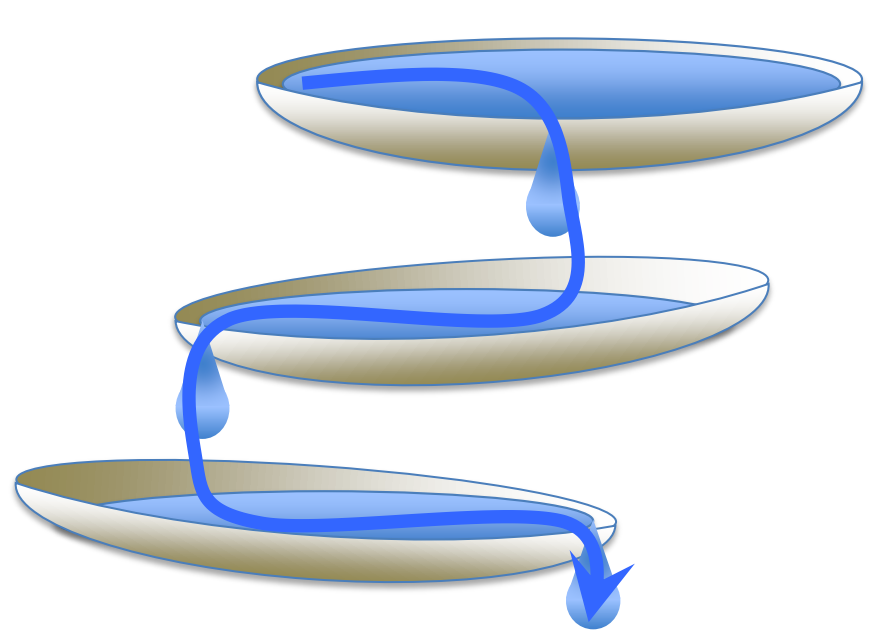
Why: To prevent further channel incision and loss of floodprone area

ZUNI BOWL









**Multi-Step Zuni Bowl
for Larger Headcuts
>3' (1m)**



1. Cut back and shape headcut face to simplify rockwork.



2. Cover face of headcut with geotextile fabric to prevent soil piping.



3. Fill the **gap** between fabric and rock with gravel as each tier is built up.

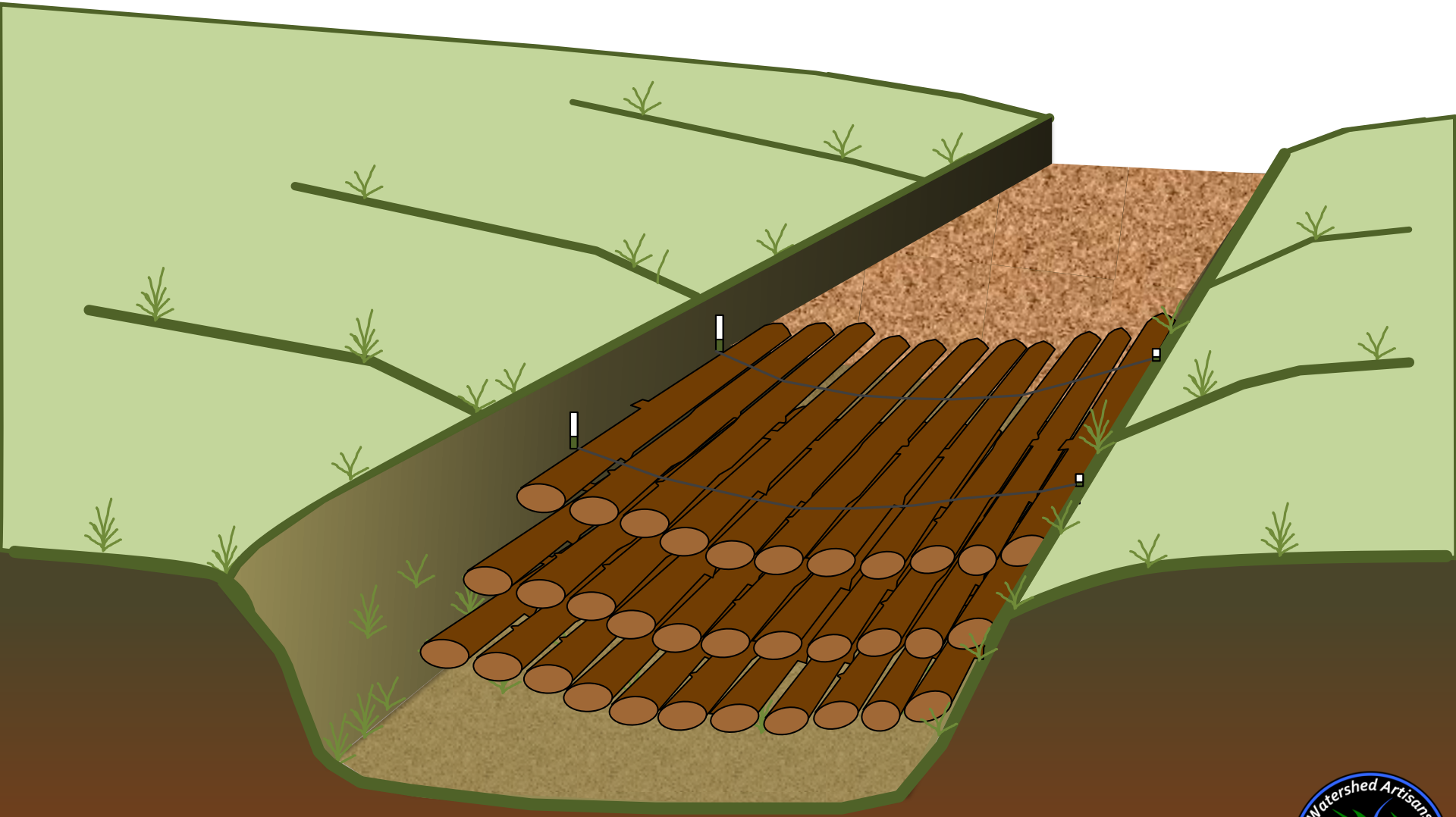








Log Stepdown









Plan View

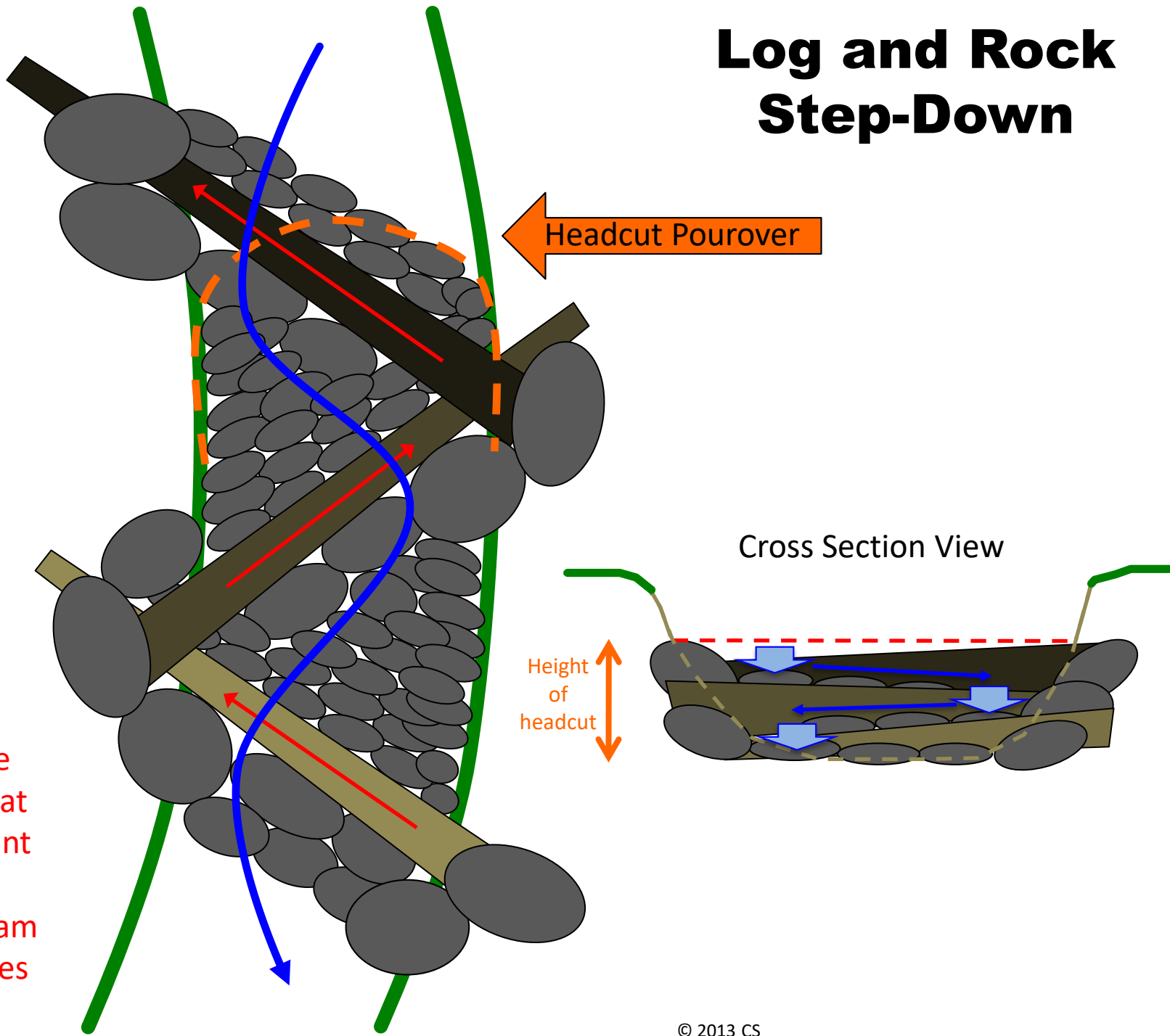
Log and Rock Step-Down

Headcut Pourover

Cross Section View

Height of headcut

Logs should be oriented so that the lowest point of the log is always upstream (arrow indicates low side).









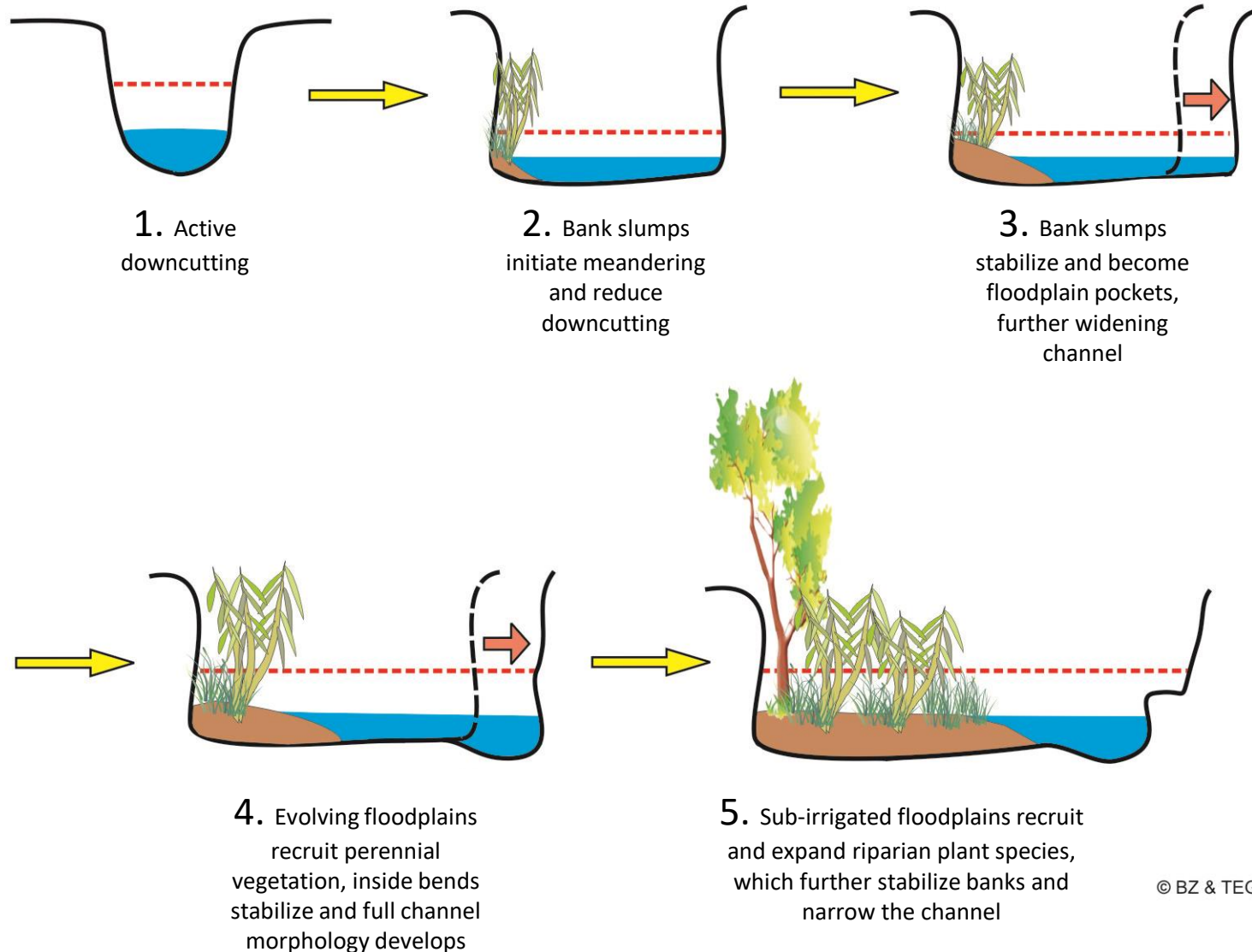




Induced Meandering Restoration Method

Induced Meandering accelerates the natural processes that allow an actively incising channel to evolve into a stable channel with and in-set floodplain.

Channel Evolution Phase



A diagram of a rectangular field. The width is labeled as 12 ft. and the length is labeled as 220 ft.

1998

110 ft.

6 ft.

baffle 1

weir 1

55 ft.

6 ft.

baffle 2

weir 2

55 ft.

6 ft.

baffle 3

2000

original channel bank

21 ft.

point bar

channel length = 296 ft.

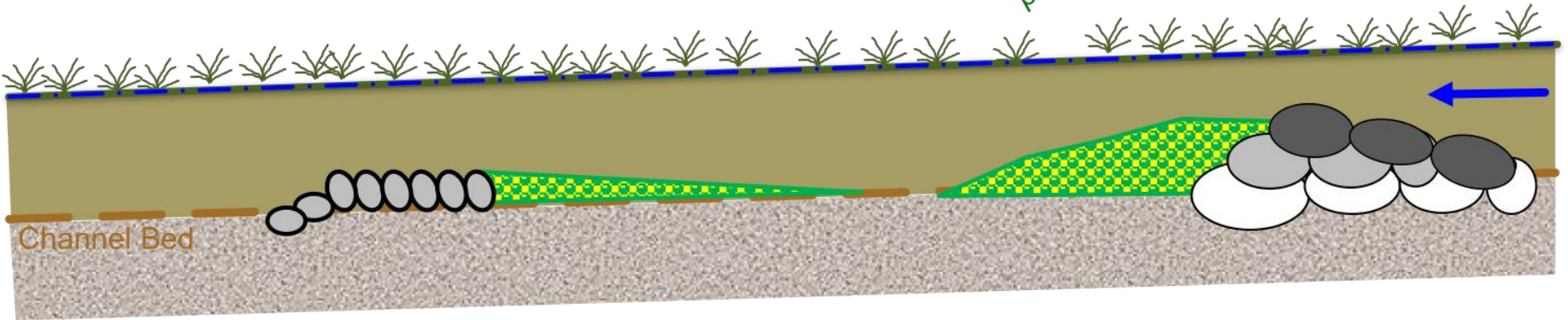
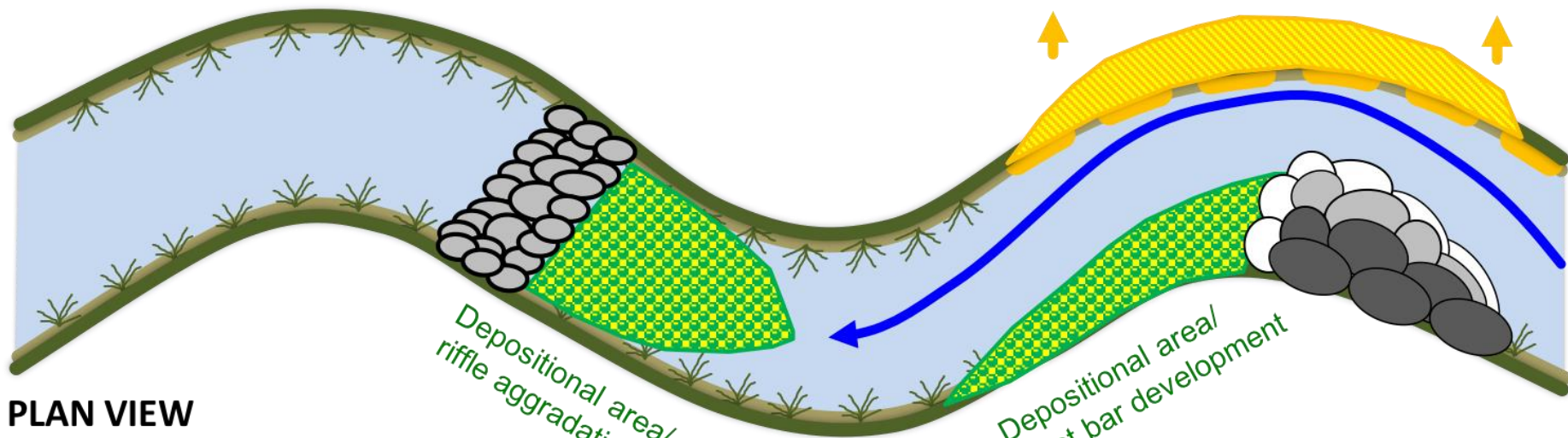
This diagram illustrates a meandering river channel. A solid black line represents the current channel, while a dashed black line represents the original straight channel. The river is shown with several point bars, which are deposits of sediment on the inner curve of the meander. A green arrow indicates a width of 21 ft. for one of the point bars. A pink dashed line follows the curve of the channel, and a label indicates the total channel length is 296 ft. The number 2000 is at the top left.

The diagram shows a channel with a curved black boundary. At the top, a black line is labeled "Goal". Two vertical dashed lines are positioned in the channel. Between these lines, there are three green rectangular structures labeled "extended baffle 1", "extended baffle 2", and "extended baffle 3". Each baffle has a purple arrow pointing towards the goal. Between the baffles are two sets of structures labeled "extended weir structure", each consisting of two rows of brown and grey stones. A green double-headed arrow between the first two weirs is labeled "28 ft.". A pink dashed line runs along the right side of the channel, ending in a blue oval labeled "POOL". On the right side, text indicates "channel length = 310 ft.".

Boulder One Rock Dam

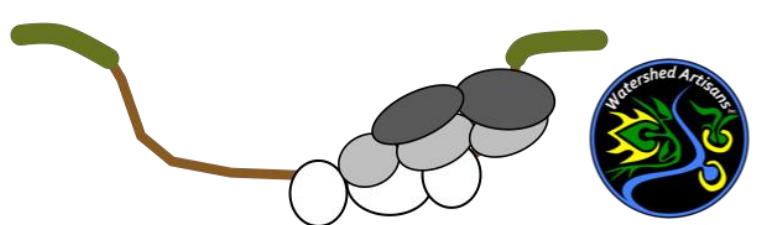
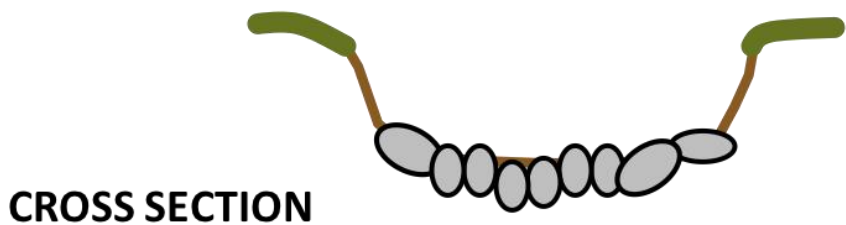
Boulder Baffle

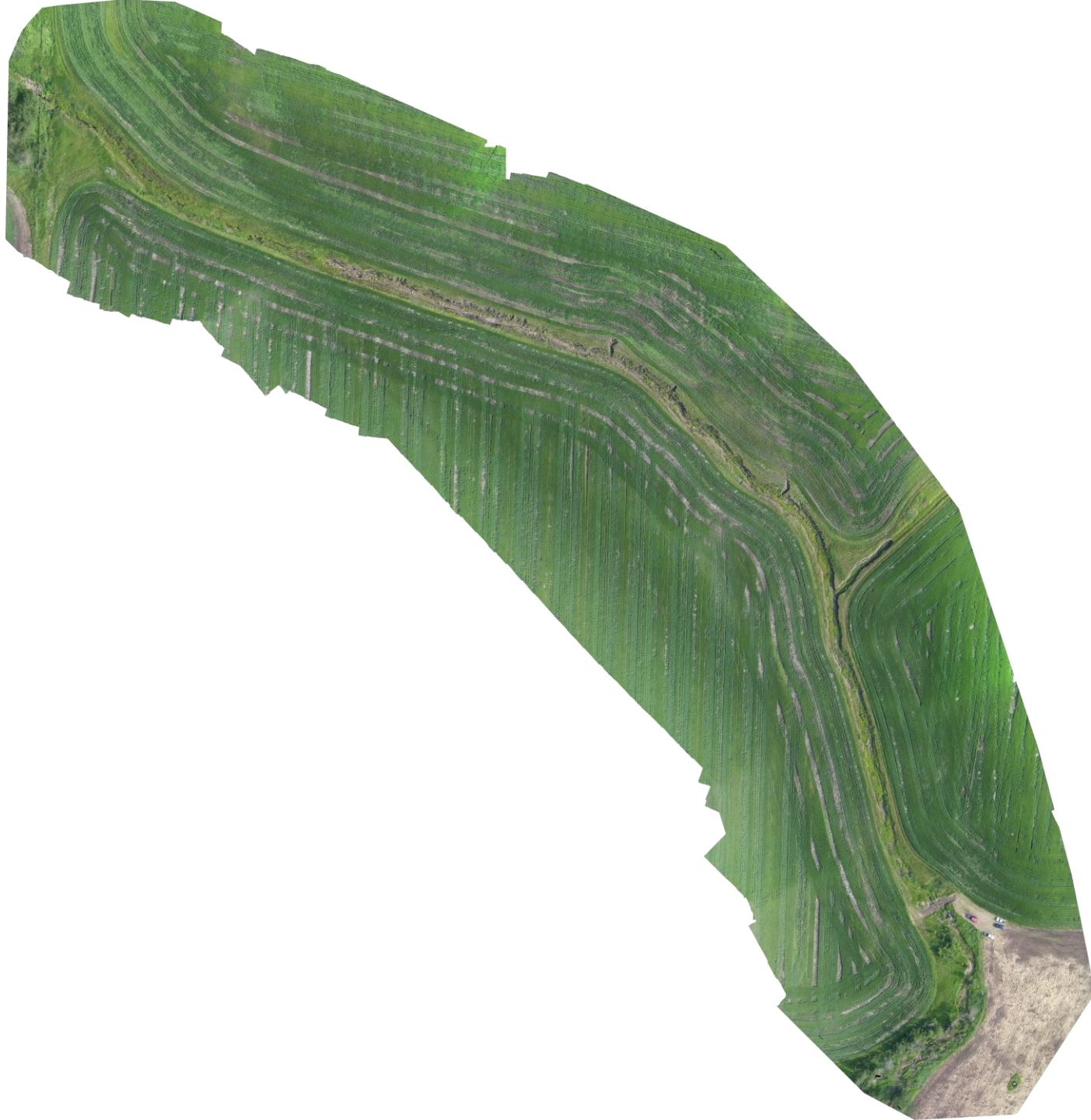
Actively Receding Bank



Boulder One Rock Dam





Boulder Baffle

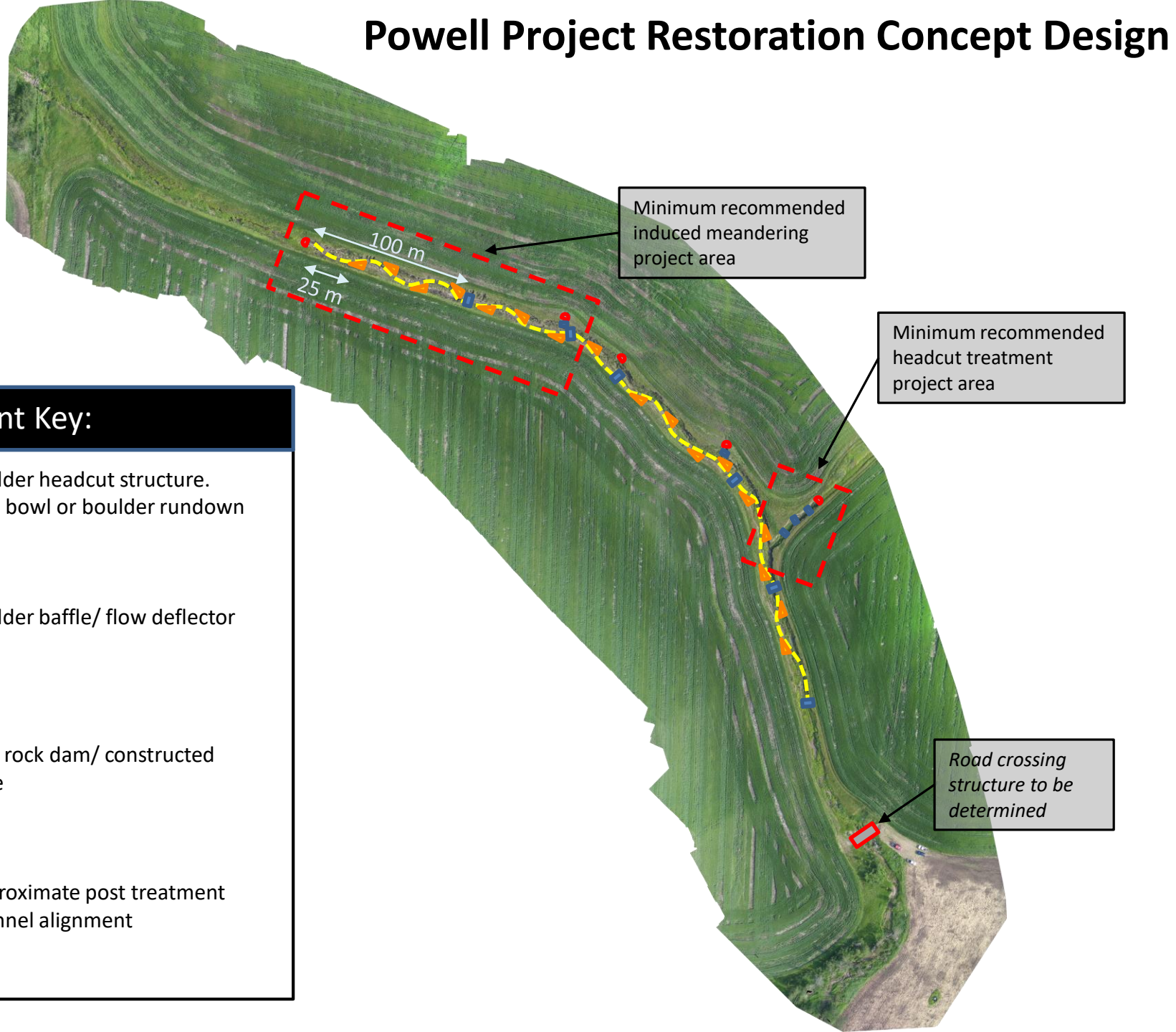




Powell Project Restoration Concept Design

Treatment Key:

-  Boulder headcut structure.
Zuni bowl or boulder rundown
-  Boulder baffle/ flow deflector
-  One rock dam/ constructed riffle
-  Approximate post treatment channel alignment



Thank You!



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