

2018 Western National Rangeland Assessment CDE Part 2B - Habitat Improvement Problem

You work for a non-profit called Riparian Restoration in the Cache Valley area. You work with land owners who come to the non-profit for help and produce plans to address challenges and opportunities on rangelands. A rancher approaches you telling you about a perennial stream that runs through his 450 acre ranch.

About 25 years ago, the stream meandered (flowed in a snake-like pattern) through the middle of the ranch (see Figure 1) and had a large population of Rainbow Trout species. The previous owner decided to straighten, or channelize, the stream. The result of channelizing the stream has caused the flow to become quicker and has reduced total riparian area. The increased flow velocity has increased bank erosion and scour (streambed erosion). This has decreased the ability of the stream to flood into the floodplain in times of high water flow. Occasional flooding is natural and important in healthy riparian areas. These higher erosion rates also causes streambank instability. As a result of all these changes, trout are no longer found in the stream. The current owner would like to reestablish a population of Rainbow Trout in the stream and decrease erosion rates.

Because of water, riparian areas are naturally high in forage production and species diversity. These areas are important for all species of wildlife and livestock in terms of cover and water accessibility. Increasing the size of riparian areas increases the total production of grazing and browsing areas. The rancher would like to raise forage production and create easier access to water for better grazing distribution in addition to bringing back trout.

The restoration plan would include restoring the stream's natural meandering pattern to increase total riparian area and create desirable trout habitat.

- Re-meander the stream: To stop water from flowing into the old channel, the previous owner built banks, called "plugs." These plugs will be dug out to allow water back into the old channel and new plugs will be built in the current channel to stop the flow of water in the channelized stream. The rancher has his own backhoe that he will operate that will be used for both jobs. It is expected to take an additional mixture of 60% cobble, 20% gravel, and 20% sand to stabilize the new plugs. Each mixture will need to fill a space that's 9 feet long, 3 feet wide, and 2 feet deep. A total of nine plugs will be needed (see Figure 1). See table below for costs.
- Sandbar rebuilding: Three of the old sandbars have disappeared from the old stream channel. New ones will be built (see Figure2) to stabilize the stream restructuring. These will be made of sand, gravel, and cobble. Each sandbar will be 3 feet deep, 4 feet wide (average), and 10 feet long. 50% of the total cubic feet will be sand, 25% will be cobble, and 25% will be gravel. See table below for costs.
- Logging for log supports: Logs will be used to help stabilize the rebuilt sandbars (see Figures 2 & 3). A chainsaw crew will be hired to log some of the trees on the ranch. A crew of two people will take two days to log the area working 10-hour shifts. Each crew member will be paid \$18/hour. Two teams of draft horses will pull the logs to the stream. It will take the two teams three days of 8-hour shifts. Each driver will be paid \$20/hour.
- Log support fixation: Once the log supports are placed in the stream, stakes will be placed in front of and behind each log support. Each sandbar will have three log supports (see Figure 2). Each log support will have eight stakes tied to it (see Figure 3). Stakes come in bundles of 20. Each bundle cost \$15.65. (Hint: you can't buy just a portion of a bundle)
- Maintenance and repair: The next three years after the stream re-meandering, maintenance and repair will be expected on the sandbar log supports and new plugs of the stream. Cost is expected to take a five man crew four days of 10-hour shifts each year. Each crew member will be paid \$16/hour.

Cost of Cobble, Gravel, and Sand

Type of Medium	Cost per Cubic Foot
Cobble	\$12.30
Gravel	\$3.50
Sand	\$1.20

What is the total cost for the stream re-meandering and sandbar rebuild? (32 points)

What will be the expected additional cost of maintenance for two years after stream re-meandering (not including first year)? (8 points)

Make sure to show calculations. Round to the nearest hundredth decimal point.

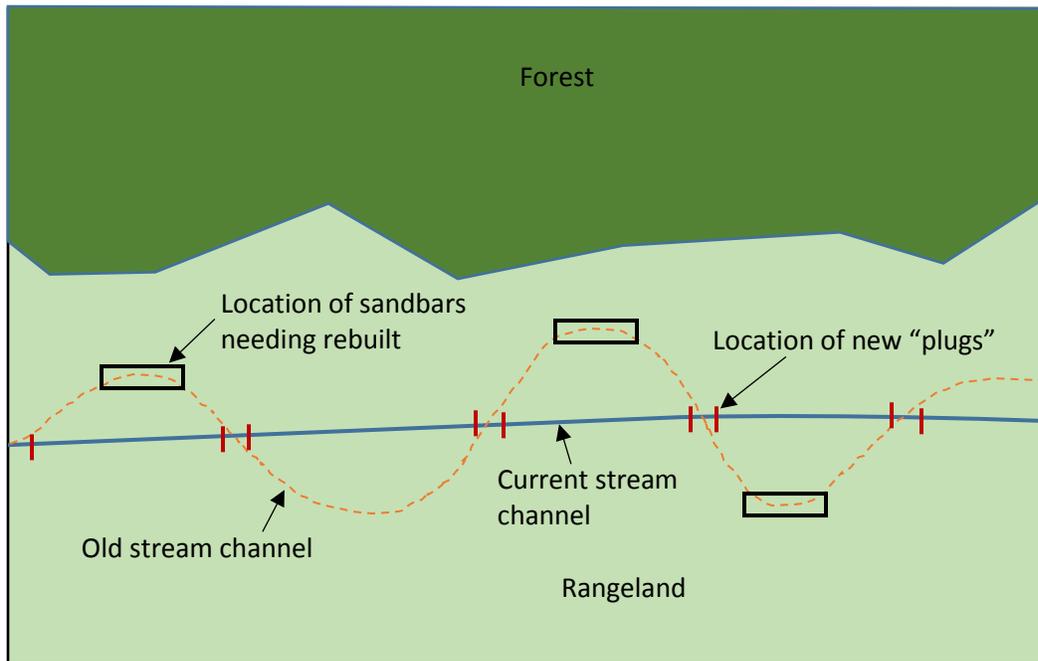


Figure 1 - Map of ranch; shows the old stream channel, current stream channel, and sections that will be worked on for restoration process.

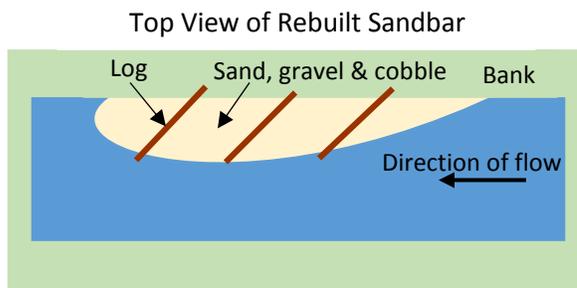


Figure 2 - Diagram of rebuilt sandbar as viewed from above.

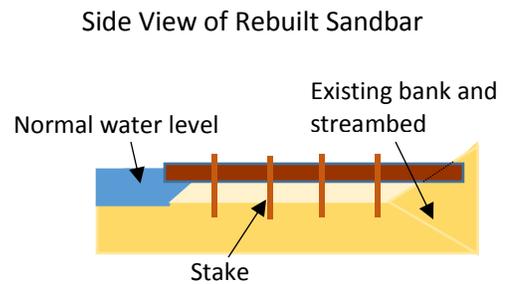


Figure 3 - Diagram of rebuilt sandbar showing how the log support will be fixed to the sandbar.

Key

Re-meander the stream

9 ft x 3 ft x 2 ft = 54 cubic ft

Cobble - 54 cubic ft x .6 = 32.4 cubic ft x \$12.30/cubic ft = \$398.52

Gravel - 54 cubic ft x .2 = 10.8 cubic ft x \$3.50/cubic ft = \$37.80

Sand - 54 cubic ft x .2 = 10.8 cubic ft x \$1.20/cubic ft = \$12.96

Total = \$398.52 + \$37.80 + \$12.96 = \$449.28/plug x 9 plugs = \$4,043.52

Sandbar rebuilding

3 ft x 4 ft x 10 ft = 120 cubic ft

Cobble – 120 cubic ft x .25 = 30 cubic ft x \$12.30 = \$369.00

Gravel – 120 cubic ft x .25 = 30 cubic ft x \$3.50 = \$105.00

Sand – 120 cubic ft x .5 = 60 cubic ft x \$1.20 = \$72.00

Total = \$369.00 + \$105.00 + \$72.00 = \$546.00/sandbar x 3 = \$1,638.00

Logging for log supports

Chainsaw crew - 2 days x 10-hour shifts/day x 2 people = 40 hours

40 hours x \$18/hour = \$720

Drivers - 3 days x 8-hour shifts/day x 2 people = 48 hours

48 hours x \$20/hour = \$960

Total = \$720 + \$960 = \$1,680.00

Log support fixation

3 log supports/sandbar x 8 stakes/log support x 3 sandbars = 72 stakes

72 stakes ÷ 20 stakes/bundle = 3.6 bundles

Round up to 4 bundles

4 bundles x \$15.65 = \$62.60

Total cost for re-meandering of stream and rebuilding sandbars

\$4,043.52 + \$1,638.00 + \$1,680.00 + \$62.60 = \$7,424.12

Maintenance and repair

4 days x 10-hour shifts/day x 5 people = 200 hours

200 hours x \$16/hour = \$3,200.00

2 years x \$3,200/year = \$6,400.00

What is the total cost for the stream re-meandering and riparian area restoration? \$7,424.12

What will be the expected additional cost of maintenance for two years after stream re-meandering (not including first year)? \$6,400.00