
North Coast Regional Water Quality Control Board

Cobble Fill Volume Calculation Memo

To: Gil Falcone, Senior Environmental Scientist, Non-Point Source and 401 Certification Unit

From: Scott Gergus, Engineering Geologist, Non-point Source and 401 Certification Unit

Date: October 15, 2021

Subject: Volumetric calculation of fill below alleged ordinary high water at 13940 Village Avenue, Healdsburg.

File: David Bent, 13940 Village Avenue, Healdsburg, Sonoma County.

Background

On August 31, 2021, Ryan Sharp with Permit Sonoma, referred a complaint to Gil Falcone of our office regarding rock armoring and 8 gabions placed on the bank of the Russian River without a permit. The site is located at 13940 Village Avenue (Site) in Healdsburg and owned by David Bent. The Site was inspected on September 17, 2021, to determine the fill volume Mr. Bent had placed on the riverbank of the Russian River. The inspection determined Mr. Bent had placed cobble rock armoring, wooden stairway, and cobble filled gabions consisting of stairs, canoe haul-out, and sitting area below the assumed ordinary high water on the left bank of the Russian River.

Volumetric Calculation

Due to inspection time limitations, all measurements are conservative estimations except for gabion dimensions. Emphasis was placed on fill placed below the alleged ordinary high water. Ordinary high water was estimated by Mr. Bent on his Site after several years of observations during flood events. It is important to note ordinary high water is determined by the United States Army Corps of Engineers and United States Geological Survey. Cobbles were placed above alleged ordinary high water in many scattered locations, but their location and volume were not recorded; however, photographs were taken of these locations memorializing the volume of fill. A majority of the cobbles were placed below alleged ordinary high water and the cobble layer was easily located and its area and estimated thickness recorded for volume calculations. Mr. Sharp and I estimated the cobble thickness by sight and did not disturb Mr. Bent's cobble rock armoring. Additionally, the cobble filled gabions were located and their number and dimensions were recorded for volume calculations.

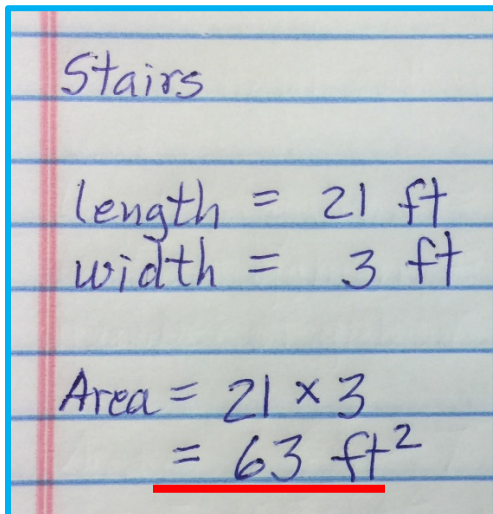
Alleged ordinary high water extended from the base of the green wooden retaining wall down to summer low flow when the Healdsburg Memorial Beach Dam is not in place. The area below alleged ordinary high water was divided into two areas when calculating cobble rock armor fill volumes. The terrace shown in Photographs 12, 14, and 20 in document 211008_SG2_13940VillageInspection_Memo was the dividing line between these two areas. Calculating the cobble rock armor fill volume above the terrace to the base of the green retaining wall was straight forward. The cobbled area above the terrace is estimated to be 40 feet long, 10 feet wide, and the depth of the cobbles 0.33 feet. Generally, the cobble rock armoring was a single layer and the cobbles were an average of 4 inches thick.

Calculating the cobble rock armor fill volume and gabion volume below the terrace was more involved. Mr. Bent's riverbank was estimated from Google Earth to be 60 feet long and the slope from the terrace down to the river's edge was estimated to be 21 feet. The slope length of 21 feet was used because that was the length of the canoe haul-out from the terrace down to the river's edge where the cobble rock armoring stopped. Mr. Sharp and I estimated the cobble rock armoring to average 0.8 feet in depth or 10 inches. The gabion area was excluded from the cobble rock armor fill volume calculation. Gabion fill is calculated separately.

Fill calculations are as follows:

Calculating the gabion area footprint.

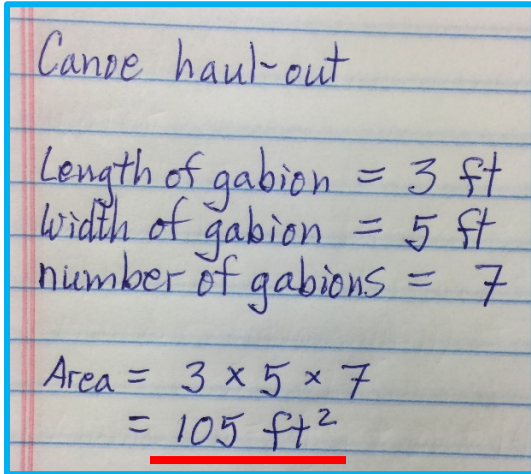
Gabion stairs area:



Stairs

$$\begin{aligned} \text{length} &= 21 \text{ ft} \\ \text{width} &= 3 \text{ ft} \\ \text{Area} &= 21 \times 3 \\ &= \underline{63 \text{ ft}^2} \end{aligned}$$

Gabion canoe haul-out area:

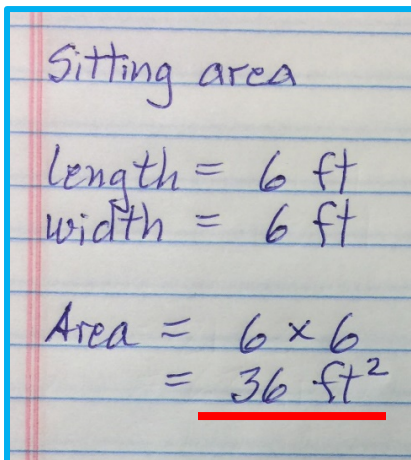


Canoe haul-out

Length of gabion = 3 ft
width of gabion = 5 ft
number of gabions = 7

Area = $3 \times 5 \times 7$
= 105 ft²

Gabion sitting area:

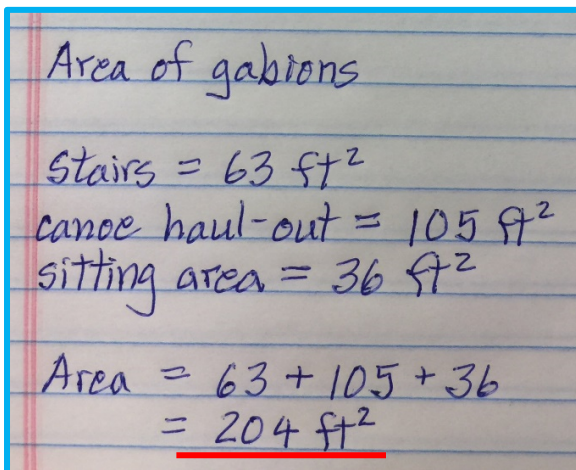


Sitting area

length = 6 ft
width = 6 ft

Area = 6×6
= 36 ft²

Total gabion area footprint:



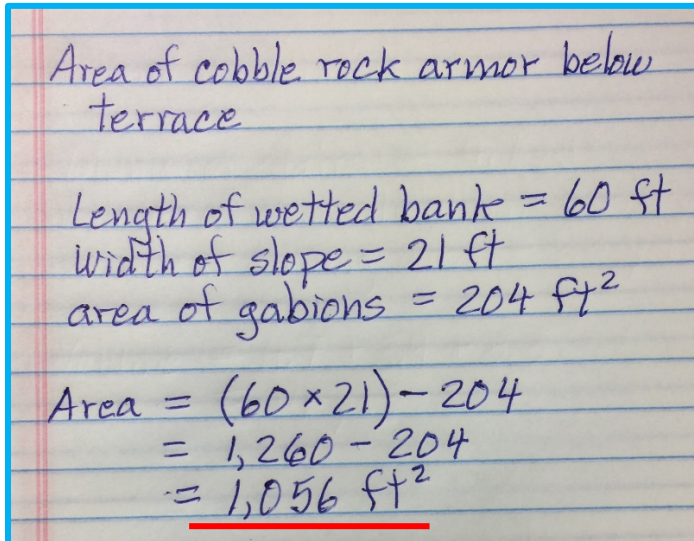
Area of gabions

stairs = 63 ft²
canoe haul-out = 105 ft²
sitting area = 36 ft²

Area = $63 + 105 + 36$
= 204 ft²

Calculating the cobble rock armor fill volume below the terrace to the summer low flow level minus the total gabion footprint.

Area of cobble rock armor below the terrace:



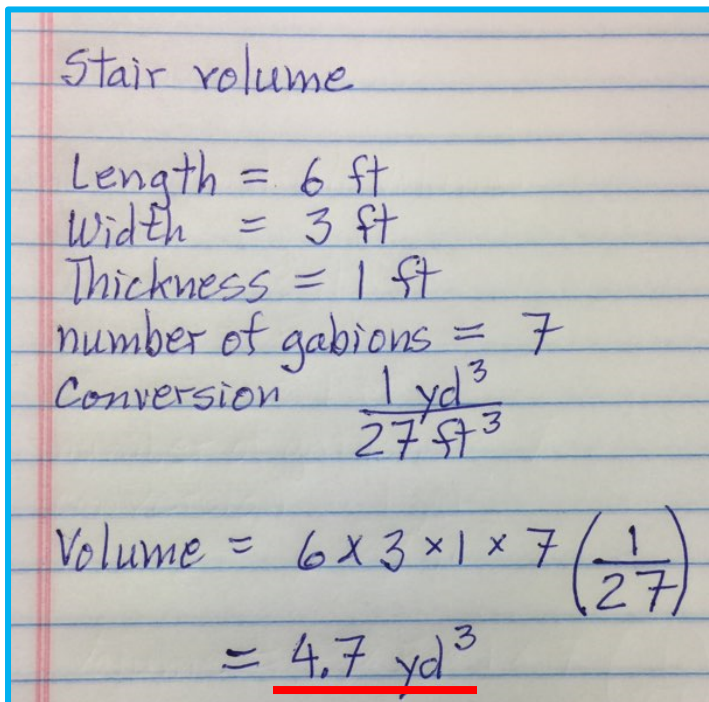
Area of cobble rock armor below terrace

Length of wetted bank = 60 ft
width of slope = 21 ft
area of gabions = 204 ft²

$$\begin{aligned} \text{Area} &= (60 \times 21) - 204 \\ &= 1,260 - 204 \\ &= \underline{1,056 \text{ ft}^2} \end{aligned}$$

Calculating the cobble gabion volume.

Gabion stairs volume:



Stair volume

Length = 6 ft
Width = 3 ft
Thickness = 1 ft
number of gabions = 7
Conversion $\frac{1 \text{ yd}^3}{27 \text{ ft}^3}$

$$\begin{aligned} \text{Volume} &= 6 \times 3 \times 1 \times 7 \left(\frac{1}{27} \right) \\ &= \underline{4.7 \text{ yd}^3} \end{aligned}$$

Gabion canoe haul-out volume:

Canoe haul-out volume

length = 3 ft
width = 5 ft
thickness = 1 ft
number of gabions = 7
conversion $\frac{1 \text{ yd}^3}{27 \text{ ft}^3}$

$$\text{Volume} = 3 \times 5 \times 1 \times 7 \left(\frac{1}{27} \right)$$
$$= \underline{3.9 \text{ yd}^3}$$

Gabion sitting area volume:

Sitting Area volume

length = 6
width = 6
thickness = 2
number of gabions = 2
conversion $\frac{1 \text{ yd}^3}{27 \text{ ft}^3}$

$$\text{Volume} = 6 \times 6 \times 2 \times 2 \left(\frac{1}{27} \right)$$
$$= \underline{5.3 \text{ yd}^3}$$

Total volume of gabions:

Volume of gabions

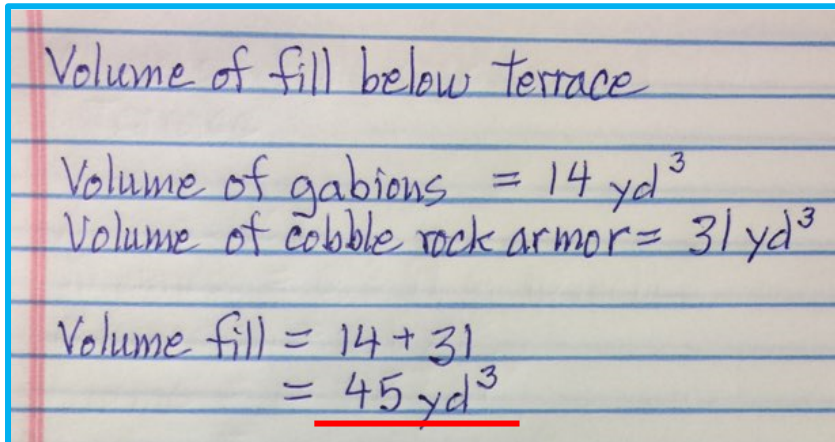
$$\begin{aligned} \text{Volume of stairs} &= 4.7 \text{ yd}^3 \\ \text{Volume of canoe haul-out} &= 3.9 \text{ yd}^3 \\ \text{Volume of sitting area} &= 5.3 \text{ yd}^3 \\ \text{Volume} &= 4.7 + 3.9 + 5.3 \\ &= \underline{14 \text{ yd}^3} \end{aligned}$$

Volume of cobble rock armor below the terrace.

Volume of cobble rock armor below
Terrace

$$\begin{aligned} \text{Area} &= 1,056 \text{ ft}^2 \\ \text{Thickness} &= 0.8 \text{ ft or 10 inches} \\ \text{Conversion} &= \frac{1 \text{ yd}^3}{27 \text{ ft}^3} \\ \text{Volume} &= 1,056 \times 0.8 \left(\frac{1}{27} \right) \\ &= \frac{845}{27} \\ &= \underline{31 \text{ yd}^3} \end{aligned}$$

Volume of fill below the terrace:

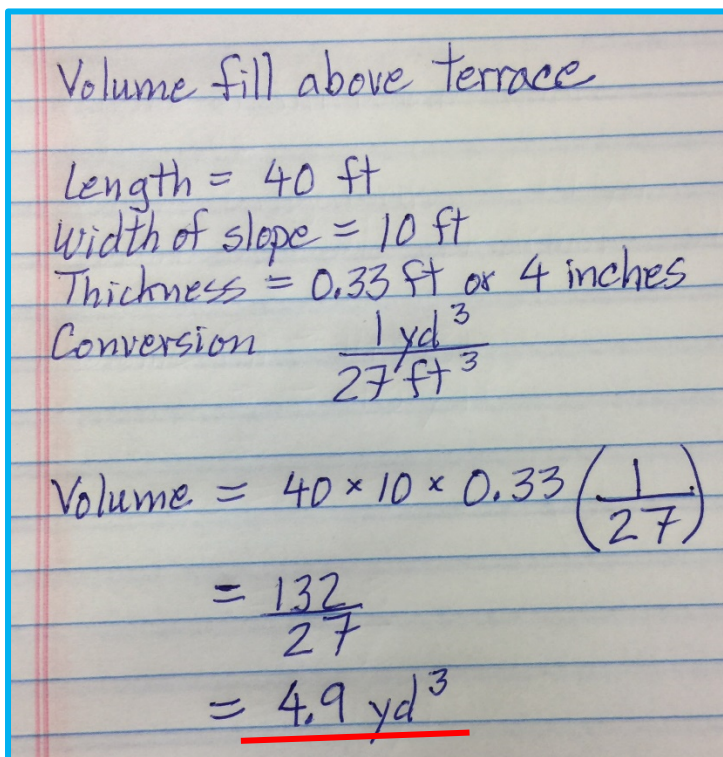


Volume of fill below terrace

$$\begin{aligned} \text{Volume of gabions} &= 14 \text{ yd}^3 \\ \text{Volume of cobble rock armor} &= 31 \text{ yd}^3 \\ \text{Volume fill} &= 14 + 31 \\ &= \underline{45 \text{ yd}^3} \end{aligned}$$

Fill volume above the terrace:

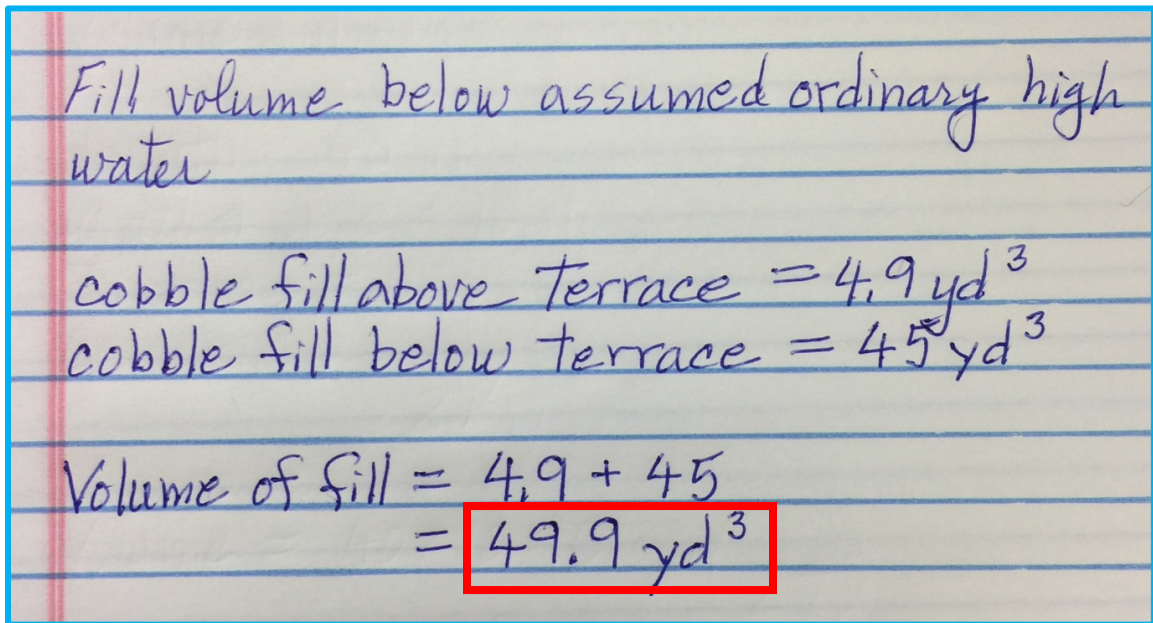
The area of cobble rock armoring above the terrace was difficult to determine because vegetation and stairways covered much of this area and exposed concrete debris was observed.



Volume fill above terrace

$$\begin{aligned} \text{Length} &= 40 \text{ ft} \\ \text{Width of slope} &= 10 \text{ ft} \\ \text{Thickness} &= 0.33 \text{ ft or 4 inches} \\ \text{Conversion} &= \frac{1 \text{ yd}^3}{27 \text{ ft}^3} \\ \text{Volume} &= 40 \times 10 \times 0.33 \left(\frac{1}{27} \right) \\ &= \frac{132}{27} \\ &= \underline{4.9 \text{ yd}^3} \end{aligned}$$

Fill volume below assumed ordinary high water:



Fill volume below assumed ordinary high water

cobble fill above Terrace = 4.9 yd^3
cobble fill below terrace = 45 yd^3

Volume of fill = $4.9 + 45$
= 49.9 yd^3

Conclusion

Due to time limitations during the inspection, all measurements are conservative estimations except for gabion dimensions. Emphasis was placed on fill placed below alleged ordinary high water. Ordinary high water was estimated by Mr. Bent after several years of observations during flood events. It must be noted ordinary high water is determined by the United States Army Corps of Engineers and United States Geological Survey. Cobbles were placed above alleged ordinary high water in many scattered locations, but their location and volume were not recorded; however, photographs were taken of these locations memorializing the volume of fill. A majority of the cobbles were placed below alleged ordinary high water and the cobble layer was easily located and its area and estimated thickness recorded for volume calculations. Mr. Sharp and I estimated the cobble thickness by sight and did not disturb Mr. Bent's cobble rock armoring. The volume of fill placed below the alleged ordinary high water without appropriate permits is 49.9 yd^3 .