

# Estimating Construction Quantities

The Design Engineer's **Opinion** of Probable Cost

A vintage Monroe 2020 Plus II calculator is shown at an angle. It has a light-colored plastic body and a dark blue display area. The display shows the number '1212.47' in green. Above the display, a paper tape printer is visible, with a strip of paper emerging from it. The paper tape has printed numbers and mathematical symbols, including '25+18 =', '50+18 =', '100+18 =', '3+60 =', and '1055+48 ='. The calculator's keypad is visible, featuring a numeric keypad, function keys like 'TAX+', 'TAX-', 'M+', 'M-', 'M\*', and 'M÷', and a 'C' (clear) key. The brand name 'MONROE' and model '2020 Plus II' are printed on the right side of the display area.

## Presentation Outline

---

- Major Cost Items
- Common Oversights/Errors
- Open Discussion/Q&A

# Main Components of an RSC

- Channel Fill (Sand/Woodchip)
- Woodchips
- Gravel
- Cobble
- Boulders



# Channel Fill Material

- Visit the site with the plans!
- Cut/Fill Volumes
  - Was a survey done?
- Run a rough hand calculation to confirm
  - Length of eroded channel X Width of channel X Average depth of fill
- Check quality of material/spec







# Woodchips/Hardwood Mulch – Media mix

- 20% of Sand Fill By Volume
- Woodchips/Hardwood Mulch
- Are there local woodchip sources that can allow a more aggressive bid, or will you need to purchase it?

# Gravel

- Gravel is often poorly accounted for
- Range of sizes
- Uses
- Installation Methods
- Volume Estimates



Cobble Gradation Table

# Cobble

- Identify the number of structures and their area
- Area can be approximated by a rectangular L X W
- Depth is usually 2 X D50, but note any minimum depth requirements
- Factor in the particle size distribution
- Don't forget cascades!

D50 MEDIAN STONE SIZE (INCHES)	% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE EQUIVALENT DIAMETER (INCHES)	TYPICAL STONE WEIGHT (POUNDS)
6	70 - 100 50 - 70 35 - 50 2 - 10	12 9 6 2	85 35 10 0.4
9	70 - 100 50 - 70 35 - 50 2 - 10	15 12 9 3	180 85 35 1.3
12	70 - 100 50 - 70 35 - 50 2 - 10	21 18 12 4	440 275 85 3
18	100 50 - 70 35 - 50 2 - 10	30 24 18 6	1280 660 275 10
24	100 50 - 70 35 - 50 2 - 10	42 33 24 9	3500 1700 650 35



# Boulders

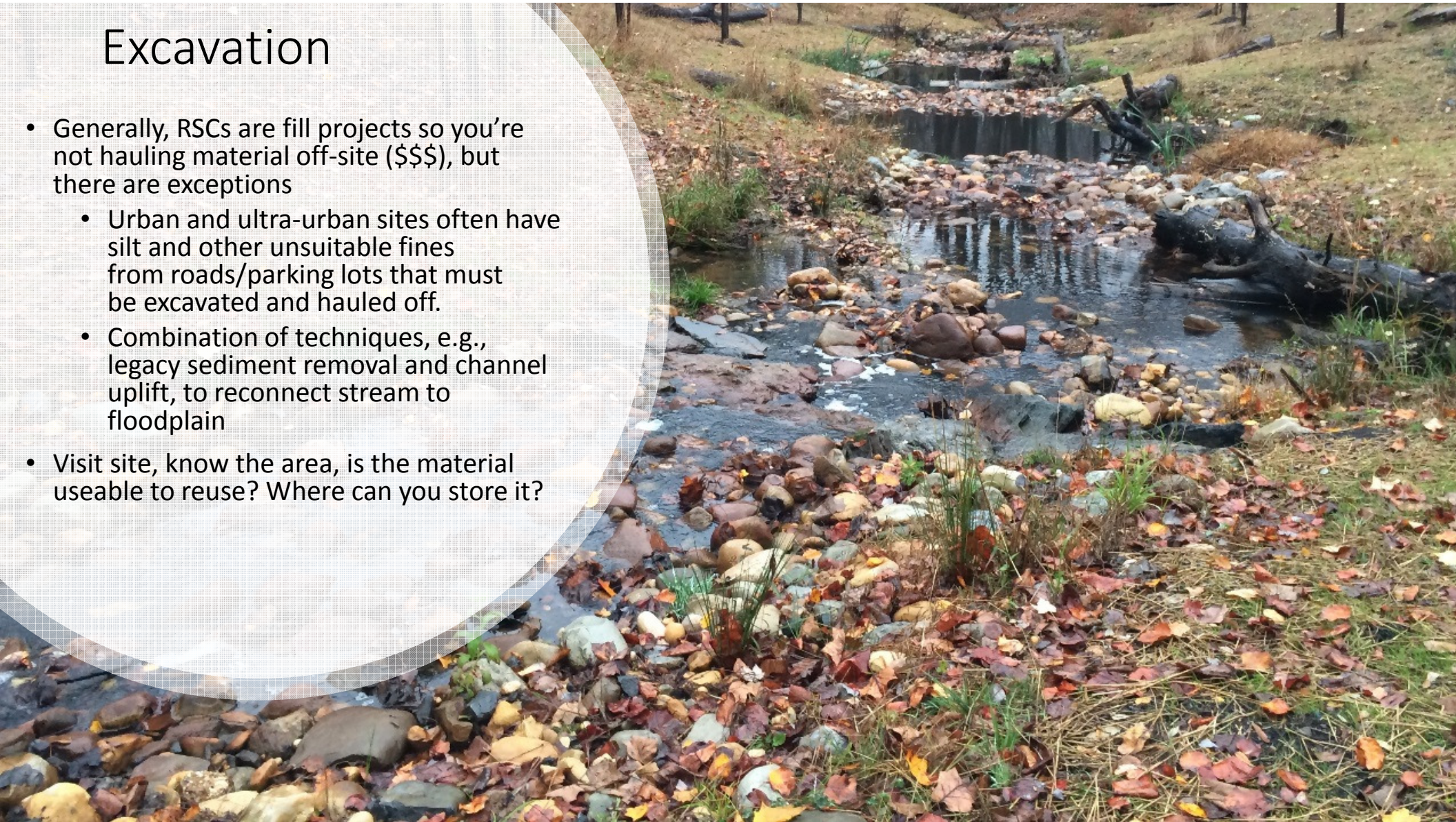
- Don't count boulder symbols
- Check your detail drawing- some designers vary.
- Generally, boulders placed in a double stack
- Boulders are usually tabular
- Use the structure width, the length of the long boulder axis, and a minimum depth of three feet.
- Know the material (sandstone vs. granite)





# Excavation

- Generally, RSCs are fill projects so you're not hauling material off-site (\$\$\$), but there are exceptions
  - Urban and ultra-urban sites often have silt and other unsuitable fines from roads/parking lots that must be excavated and hauled off.
  - Combination of techniques, e.g., legacy sediment removal and channel uplift, to reconnect stream to floodplain
- Visit site, know the area, is the material useable to reuse? Where can you store it?





# Don't miss any hard infrastructure

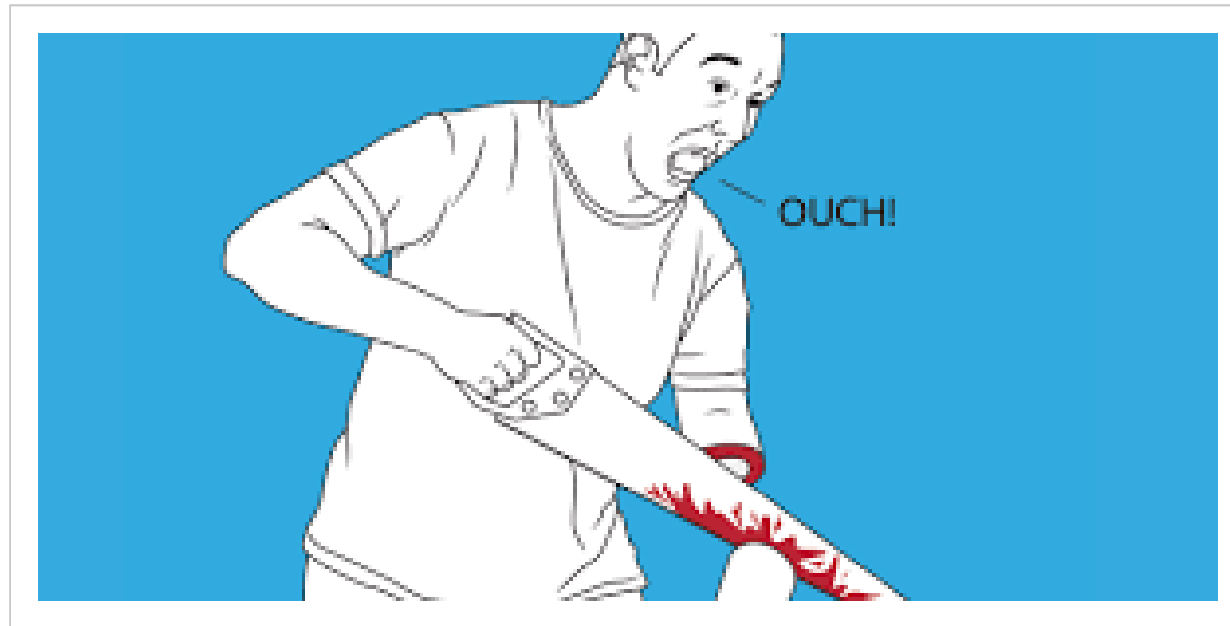
- Are you replacing any failed end sections?
- New concrete work?
- Any work to re-reroute drainage?
- Utility Protection Measures





# Extra materials

- Tie-ins/Key-ins
- Unsuitable material
- Adaptive management



# Common Oversights/Errors

# Units

Square Yards, Cubic Yards, or Tons- get conversions right

Common Unit Weights:

Sand (dry) → 100 lb/ft<sup>3</sup>

Cobble → 165 lb/ft<sup>3</sup>

Riprap → 165 lb/ft<sup>3</sup>

Sandstone → 145 lb/ft<sup>3</sup>

Granite Boulders → 170 lb/ft<sup>3</sup>

CY x 1.4 → # Tons (Typical, but this can vary based on density)



The background image shows a construction site in a wooded area. A large orange Hitachi excavator is positioned on a steep, dark brown soil slope. The excavator's arm is extended, and it appears to be working on the slope. The ground is uneven and covered with rocks and loose soil. In the background, there are many bare trees, suggesting a late autumn or winter setting. The sky is clear and blue. A semi-transparent circular overlay is on the left side of the image, containing the title and list.

# Access

- Review plans to see whether access is included in earthwork
- Some agencies do not require a graded access road
- You cannot drive machines down 20%+ slopes- you'll need to build a road.
- Permanent Maintenance Access vs Temporary Haul Road



# Sequencing

- Cut/fill doesn't tell the whole story
- Profitability demands efficiency. Move materials once. Deliver in place if possible.
- Understand the procedure
- Understand your E&S requirements

# Incidentals

- Woody material (you might need to import it!)
- Geotextile and Matting
- Backfill/Over excavation



# Material Supply and Rising Costs

- Be sure you can deliver or substitute appropriate material before bidding.
- We rely on historic data to estimate costs to the client
  - Despite more projects than ever- bid spread remains very large
  - We are working to keep pace, but need your help

## Q&A/Discussion

- What's proved to be the most difficult part to estimate?
- What could we do on the plans to make your quantifications easier?
- Has supply been an issue? Is it sustainable?
- Have you used salvaged material?