FY21 RSM Mid-Year IPR
Riprap and Scour Calculator:

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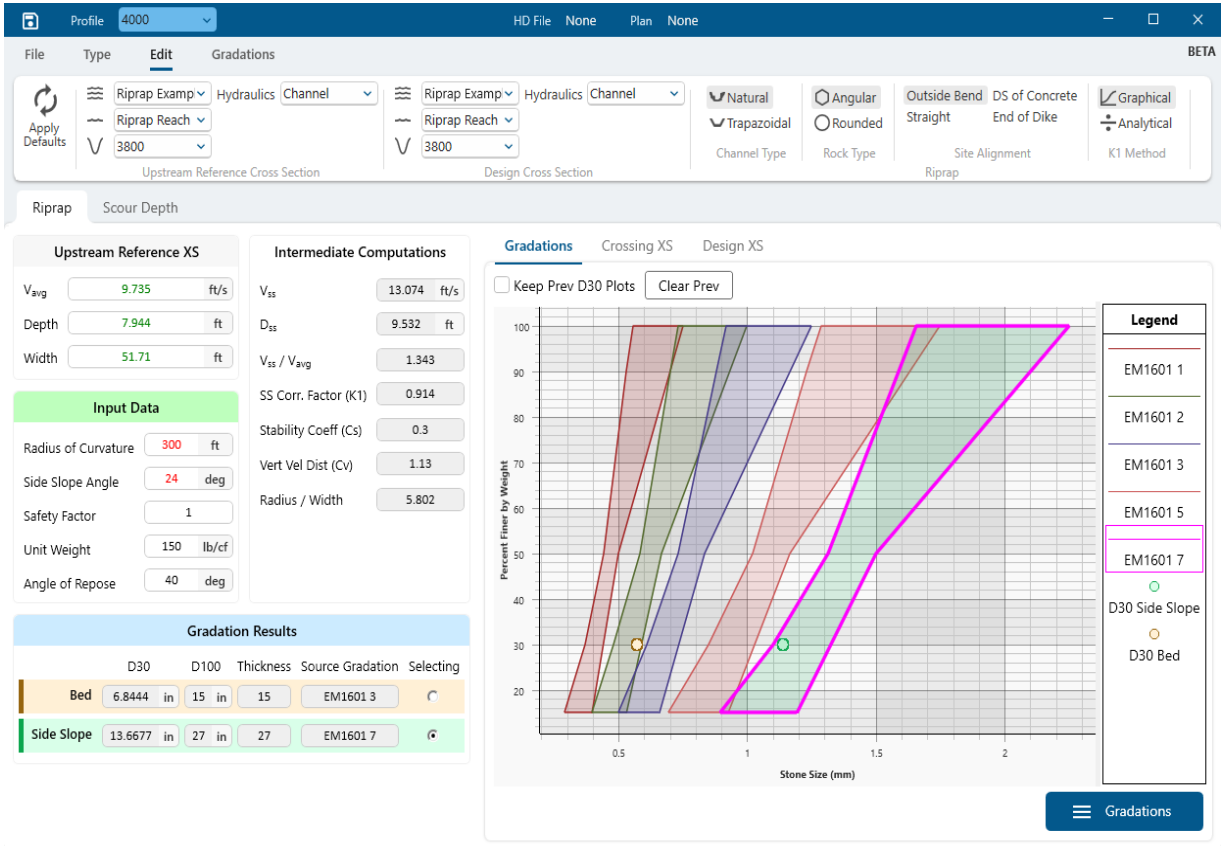
BLUF: We developed and documented a Riprap and Toe Scour calculator that computes riprap size based on HEC-RAS hydrodynamics.

Activities:

1. **Software Release**
   - Riprap
   - Scour
2. **Documentation**
3. **Training Videos**



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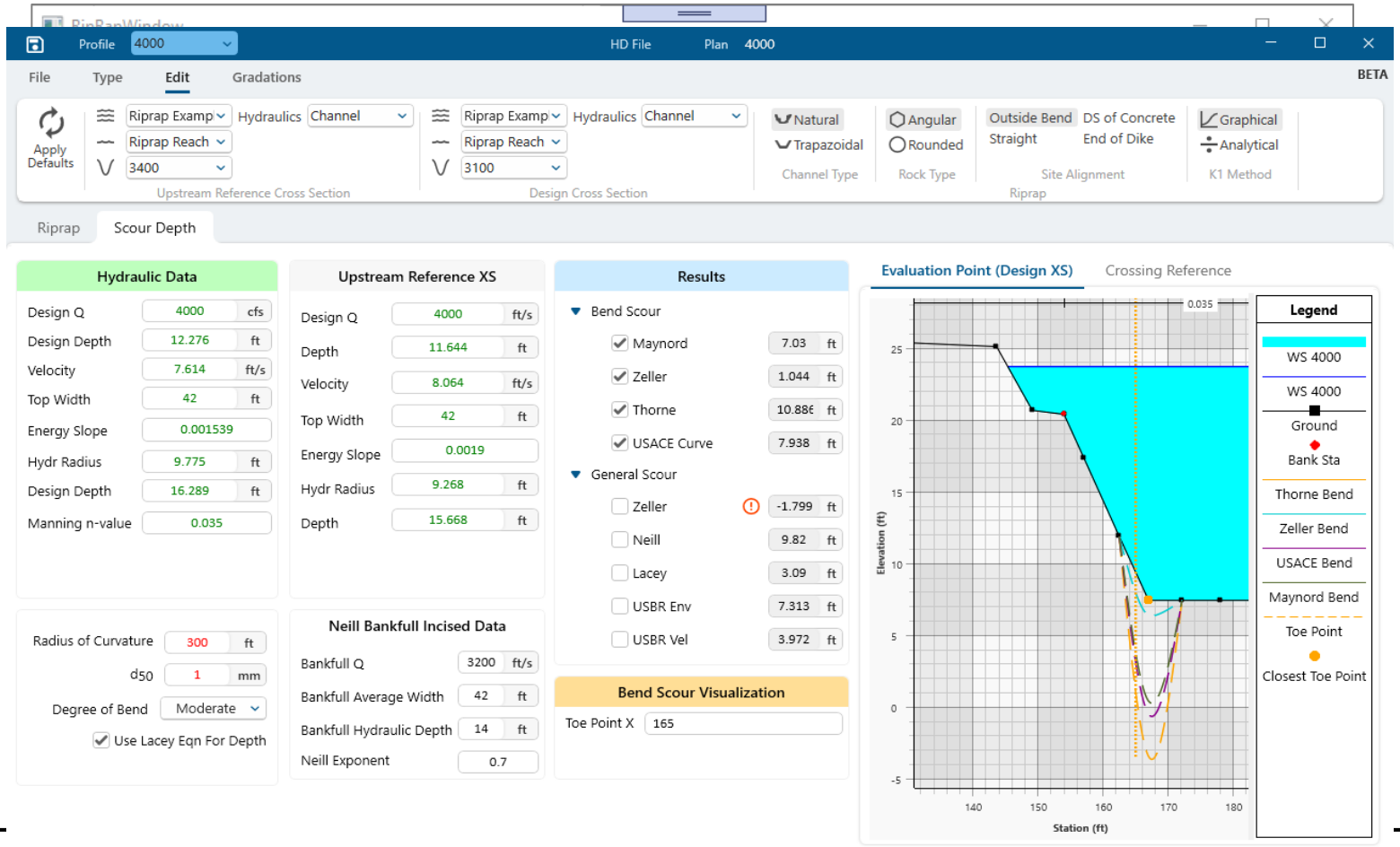
Riprap and Scour Calculator:

“Headline Feature” in HEC-RAS 6.1

Redesigned with Modern Look/Feel



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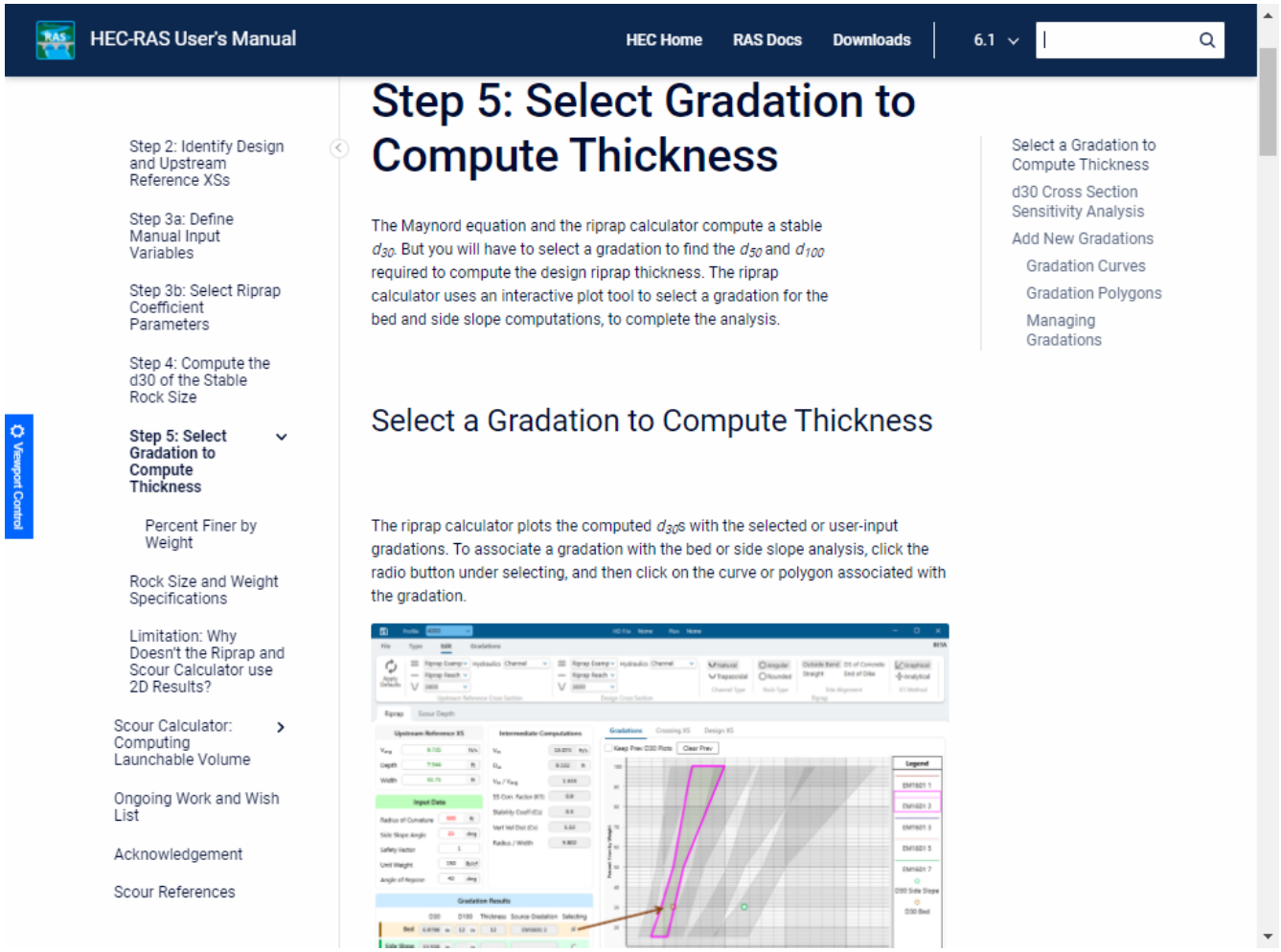
Riprap and Scour Calculator:

Documentation



User Manual:
- -Online
- -Stand-Alone (56p)

Example Project

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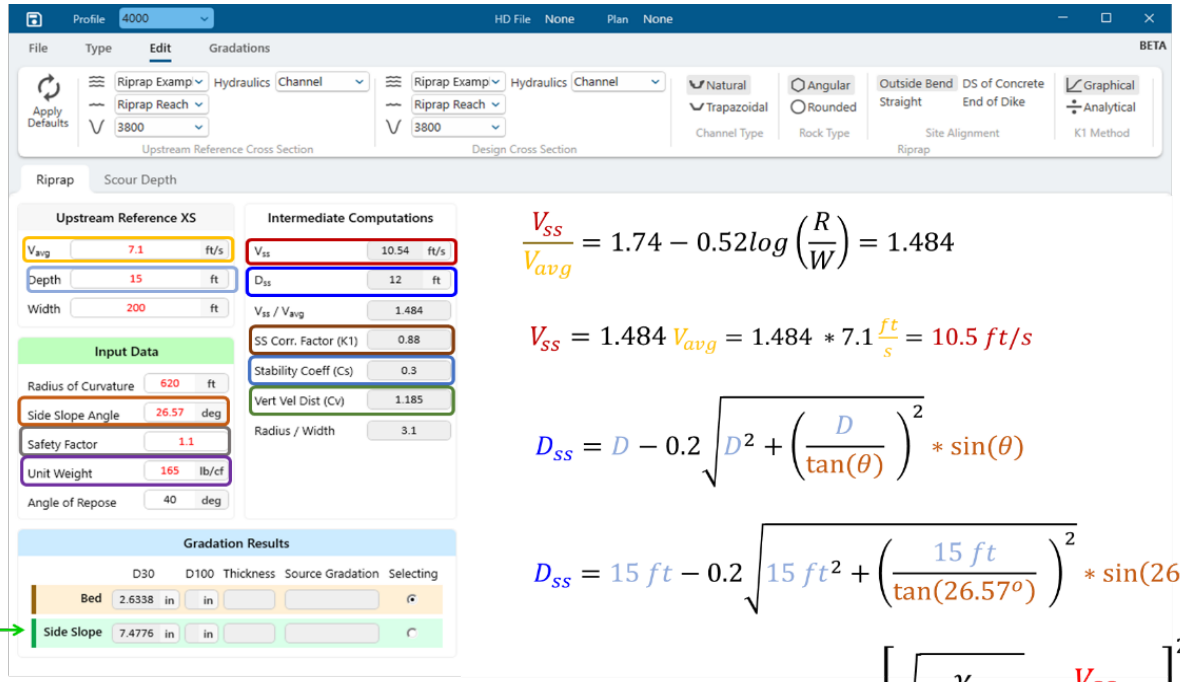
Riprap and Scour Calculator:

Validation and Verification: V&V



$$\frac{V_{ss}}{V_{avg}} = 1.74 - 0.52log\left(\frac{R}{W}\right) = 1.484$$

$$V_{ss} = 1.484\, V_{avg} = 1.484 * 7.1\frac{ft}{s} = 10.5\ ft/s$$

$$D_{ss} = D - 0.2\sqrt{D^2 + \left(\frac{D}{\tan(\theta)}\right)^2} * \sin(\theta)$$

$$D_{ss} = 15\ ft - 0.2\sqrt{15\ ft^2 + \left(\frac{15\ ft}{\tan(26.57^o)}\right)^2} * \sin(26.57^o) = 12\ ft$$

$$d_{30(SS)} = SF \cdot C_s C_v D_{SS}\left[\sqrt{\frac{\gamma_w}{\gamma_s - \gamma_w}}\frac{V_{ss}}{\sqrt{K_1 g D_{SS}}}\right]^{2.5}$$

$$7.5\ in \leftarrow 0.623\ ft = 1.0 \cdot 0.3 \cdot 1.185 \cdot 12ft\left[\sqrt{\frac{62.4\frac{lb}{ft^3}}{165\frac{lb}{ft^3} - 62.4\frac{lb}{ft^3}}}\frac{10.5\ ft/s}{\sqrt{0.9 \cdot 32.2\frac{ft}{s^2} \cdot 12ft}}\right]^{2.5}$$

EM 1601 Example + Several Others

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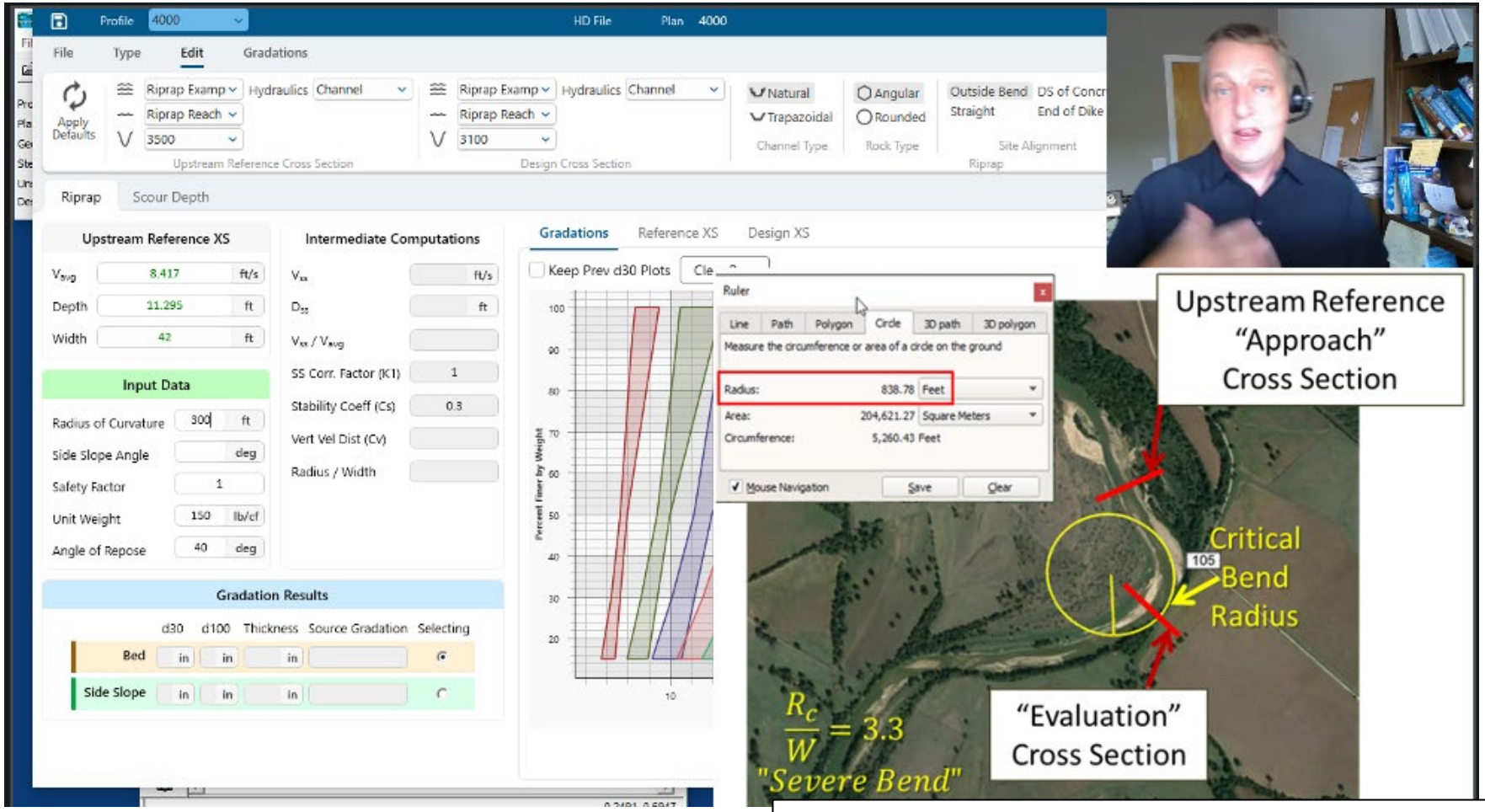
Riprap and Scour Calculator:
Training Videos



- Alpha Release Quick Start Guide
- Full Release Riprap Video
- Scour Video (in progress)

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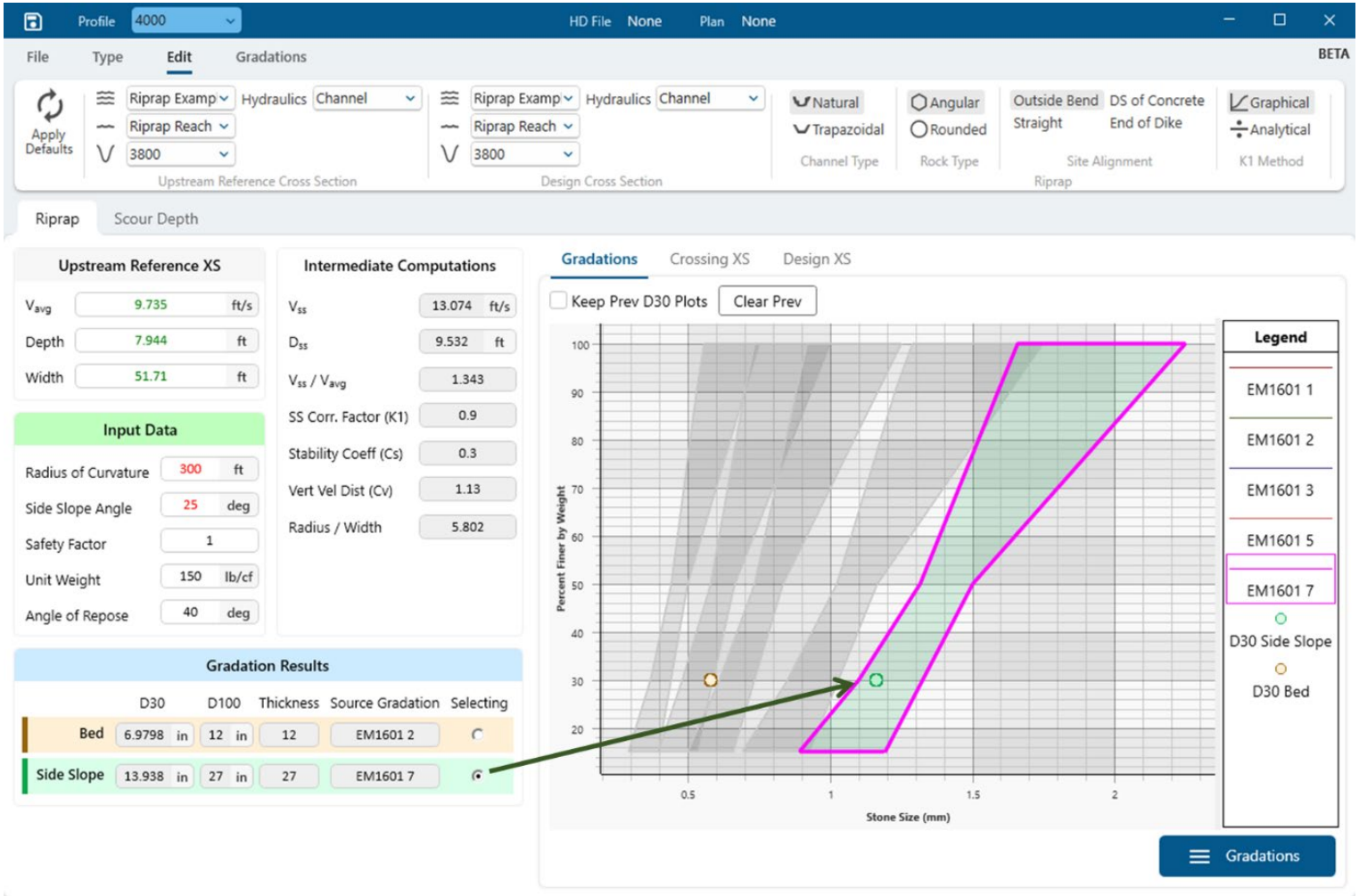
Riprap and Scour Calculator:
Live Demo



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District, Title

What challenges did you face to get your project to implementation and how did you move past them?

- **Software Development Resources**
- **Loss of Institutional Expertise**

FY21 RSM IPR
District, Title

How is this project benefiting the USACE and Nation?

- The USACE places millions of dollars of rock per year.
- This calculator will help save money on those annual efforts in three ways:
  - Improve the efficiency of the calculations
  - Improve the accuracy of the calculations and formalize an institutional process, which will…
    - Save money from costly overdesigns
    - Avoid costly and embarrassing failures