### DEVELOPMENT OF SEDspreads: Sediment Basin Design Tool

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#### SEDIMENT BASINS

**Definition:** Sediment control practices intended to temporarily detain and treat sediment-laden stormwater prior to discharging offsite.
- Designed to provide storage and detention time to allow for suspended sediment to settle through gravity.
- Standard guidance on sediment basin design typically implements the following common features intended to facilitate the retention of sediments: (1) volume sizing factors (VSFs), (2) typical sizing geometries, (3) baffles, (4) dewatering mechanisms, and (5) chemical treatment.

**Problem:** A one-size-fits-all approach is not applicable across all construction sites.

#### GIS BASED CURVE NUMBER & RAINFALL

- Curve Numbers (CN): CNs for “Developing Urban Areas w/ Newly Graded Areas” applied to hydrologic soil classes mined from CORUS-Soil databases.
- Precipitation depth (P): 2-yr, 24-hr design rainfall determined from NOAA Atlas 14 Precipitation Frequency Data Server.
- Data attributed by ZIP code to determine highest occurring per boundary.

#### VOLUME SIZING FACTOR (VSF)

Using 2-yr, 24-hr storm basin method recommended, SEDspreads determines an appropriate VSF based on CN and P inputs. VSF in ft³/acre (m³/ha) equals the total direct runoff volume per unit of drainage area.

\[
VSF = \frac{P \cdot 0.2 \cdot (1000 - CN)}{12 + \frac{P}{0.8\text{ (yr) \cdot (in.)}}}
\]

#### CASE STUDY

Comparing the input parameters, we see that although the projects are located in the same city, CN values differ, resulting in a VSF difference of 12% between the two sites. The calculated sediment basin volume is 3.6 times larger than the originally designed containment volume. Similarly, basin B was under designed in the 2-yr 24-hr rainfall event by a factor of 3.3.

#### DESIGN CONCLUSIONS

- Designed to efficiently and effectively design sediment basins using hydrologic data.
- Allows designers to efficiently and effectively design sediment basins using hydrologic data.
- SEDspreads enhances communication between designers and construction personnel to facilitate proper basin construction.

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#### BASIN GEOMETRY SIZING

- Using geometric relationships for a trapezoidal prism, equations were developed to determine the top width (WTOP), bottom width (WBOT), bottom length (LBOT), dead and live storage volume (VDS & VLS), spillway and freeboard volume (VFB), and total basin surface area (SA).

#### AUXILIARY WEIR AND SURFACE SKIMMER DESIGN

- Auxiliary weirs allow flow to pass through the basin when storage is exceeded.
- Flow depth is calculated based on the design spillway flow rate, QSW (ft³/s or m³/s), and length of spillway, LSW (ft or m), using the broad crested weir equation.

\[
\text{Weir flow depth} = \frac{Q}{(2 \cdot \text{LSW})^{1/2} \cdot (2 \cdot \text{LSW})^{1/2}}
\]

- Appropriately sized floating surface skimmers are necessary to achieve dewatering within the desired dewatering time. SEDspreads calculates the required dewatering rate, QSW (ft³/s or m³/s), by dividing the calculated VFB of the basin by the user-defined desired dewatering time (TDB).

\[
Q = \frac{Q_{\text{DB}}}{T_{\text{DB}}}
\]