### Calculation Cover Sheet

**Project:** INEEL V-Tank Remediation Project  
**Number of Sheets:** 1 of 5

**Site:** INEEL Test Area North, Idaho Falls, Idaho

**Calculation Number:** ABQ06 – CE002  
**Work Order Number:** 12393.002.001

**Subject:** Excavation – Estimated Excavated Soil Volume/Storage Requirements

<table>
<thead>
<tr>
<th>Rev #</th>
<th>Date</th>
<th>Revision</th>
<th>Calculated by</th>
<th>Checked by</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>KAA</td>
<td>5/31/01</td>
<td>60%</td>
<td>Rob Ederer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAB</td>
<td>5/31/01</td>
<td>90%</td>
<td>Rob Ederer</td>
<td>Berg Keshian</td>
<td>Berg Keshian</td>
</tr>
<tr>
<td>RAC</td>
<td>6/27/01</td>
<td>90% Polish</td>
<td>Berg Keshian</td>
<td>D. Brennecke</td>
<td>B. Keshian</td>
</tr>
<tr>
<td>RAD</td>
<td>9/27/01</td>
<td>Draft Final</td>
<td>Berg Keshian</td>
<td>D. Brennecke</td>
<td></td>
</tr>
</tbody>
</table>
Problem Statement:
Estimate the volume of excavated soil, soil container capacity, and quantity of containers.

Method of Solution:
1. Estimate the weight of soil and compare to weight capacity of the bags.
2. Estimate the volume of soil to be excavated.
3. Estimate the number of bags required.

Assumptions:
Average dry soil density is 95.5 pcf.
Average total density is 111 pcf.
Soil bag capacity is 258 cubic ft.

Sources of Formulas and References:
INEEL-BWRI Engineering Data – Soils test results (see Calculation ABQ05 – CE001)
LiftBag Product Literature
Design Drawings

Calculation:
1. Estimate volume of soil for tank excavation

Depth: 15'  Area: 48' x 26' = 1248 SF

Vol = 1248 x 15/27 = 693 CY

Exclude volume of tanks to spring line

\[
\frac{\pi D^2}{4} \times \frac{x_3}{2} = \frac{3.14 \times 10^2 \times 19.5}{4} \times \frac{3}{27} = 85 \text{ CY}
\]

Volume of Soil = 693 - 85 = 608 CY
2. Determine volume of soil for U9 Value Box Excavation

Assume depth of 12' depth

Vol = 18' wide x 12' long x 12' deep / 27

= 96 cu y

Exclude U9 Tank and Value Box

U9 Tank is 400 gal

400 gal / 7.45 gal/cu ft = 53.67 cu ft = 2 cu y

Value Box

6' x 6.5' x 8' / 27 = 1.5 cu y

Vol Soil = 96 - 2 - 1.5 = 82.5 cu y

3. Determine volume of soil from pipe removal

Assume lines 7' deep and three 3' wide

Assume 100 yd lines

100 yd / 1560 = 0.06 yd

V = 200 ft x 7' x 3' / 27 = 11.8 cu y

Net total volume of pipe
4) Total volume of soil to be handled:

\[ 608 + 82.5 + 7.6 = 784 \text{ yd}^3 \]

Assume 2.0\% expansion:

\[ 784 \times 1.02 = 800 \text{ yd}^3 \]

5) Estimate number of bags:

Each bag has volume of 258 ft\(^3\) and 2400 lb limit. Based on unit weight of soil = 111 lb/ft\(^3\).

Capacity of bag = \( \frac{Vol \text{ bag}}{bag \text{ wgt}} \)

\[ \frac{2400 \times 111}{258} = 924 \text{ ft}^3/\text{bag} \]

\[ \frac{924}{27} = 34 \text{cy/bag} \]

\[ \frac{1016}{924} = 1.1 \text{cy/bag} \]

\[ \frac{127}{44} \text{ bags of soil} \]

So, estimate no of bags for piping.
Assume volume of pipe is 80 cf and that pipe takes up 10 times the space of its volume:

\[ 10 \times 80 = 800 \text{ cf} \]

\[ \frac{800}{27} = 29.63 \text{ cy} \]

Assume each bag can only be filled to 45 cy:

\[ \frac{29.63}{45} = 0.66 \text{ bags} \]

Assume 7 bags of pipe:

\[ \text{Total bags} = 7 \times 122.645 = 858.52 \]

7. Determine storage area for bags:

Assume stack 1 high:

Area of each bag = 52.4 sq ft

\[ \frac{134}{2} \times 52.4 = 3511 \text{ sq ft} \]

Space available:

5300 sq ft which allows for bag expansion.

Discussion:

Total soil volume = 1016 cy
Total bags = 122.645 bags 84%
Soil container capacity 8 cf/bag → 85% capacity
Storage area required 40 x 80 = 3200 sq ft
3600 sq ft
There is the potential that gravel road base within the AOC and laydown areas could become contaminated and require bagging for disposal.

**Drum Storage**

\[ 1' \times 3000 \text{ sq ft} \times \frac{1}{27} = 111 \text{ cy} \]

**Hi-Volume Storage**

\[ \frac{0' \times (53 \times 53) \times \left(\frac{53+15}{2} \times 45\right)}{27} = 161 \text{ cy} \]

**Offsite Access Rd**

\[ \frac{1}{2} \times 12 \times 113 \times \frac{1}{27} = 25 \text{ cy} \]

\[ + \frac{1}{2} \times 20 \times 255 \times \frac{1}{27} = 94 \text{ cy} \]

**Other Road Areas**

\[ \frac{1}{2} \times 15 \times 703 + \left(\frac{1}{2} \times 23 \times 105\right) + \left(\frac{1}{2} \times 23 \times 45\right) \times \frac{1}{27} = 83 \text{ cy} \]

**Total = 474 cy or**

**Approx 59 Days**
<table>
<thead>
<tr>
<th>Rev #:</th>
<th>Date:</th>
<th>Revision:</th>
<th>Calculated by:</th>
<th>Checked by:</th>
<th>Approved:</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAA</td>
<td>4/11/01</td>
<td>60%</td>
<td>R. Ederer</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>RAB</td>
<td>6/1/01</td>
<td>90%</td>
<td>R. Ederer</td>
<td>D. Bennecke</td>
<td>B. Keshian</td>
</tr>
<tr>
<td>RAC</td>
<td>6/27/01</td>
<td>90% Polish</td>
<td>D. Brennecke</td>
<td>B. Keshian</td>
<td>B. Keshian</td>
</tr>
<tr>
<td>RAD</td>
<td>9/27/01</td>
<td>Draft Final</td>
<td>D. Brennecke</td>
<td>B. Keshian</td>
<td></td>
</tr>
</tbody>
</table>
Problem Statement:
Evaluate the lifting requirements of the V-1, 2, 3, and V-9 tanks. Consider lifting of shipping casks, concrete rad-vault, and soil bags.

Method of Solution:
1. Estimate the tank surface area.
2. Estimate thickness of the steel.
3. Estimate the tank weight.

Assumptions:
1. The tanks are stainless steel (type 304 for this analysis)
2. The V-1, 2, 3 tanks are 10 ft diameter and 19.5 ft long.
3. The V-9 tanks is 3.5 ft diameter by 5.5 ft to top of cone section, cone is 1.75' long.

Sources of Formulas and References:
- Grove Hydraulic Crane Product literature
- Design Drawings
- Duratek shipping container and vault literature
- “Lift Liner” system product literature

Calculation:

A. Calculate the expected weight of V-1, V-2, and V-3 tanks

1. Determine the surface area of the tanks.

\[
\text{Area}_{\text{surface}} := 
\left( \text{Dia}_{\text{tank}} \times \text{L}_{\text{tank}} \right) + 2 \times \frac{\text{ Dia}_{\text{tank}}^2}{4}
\]

Assume the tank thickness:

\[
\text{t}_{\text{shell}} := \frac{0.25}{12}
\]

2. Determine the tank weight

Steel volume is:

\[
\text{Vol}_{\text{sst}} := \text{t}_{\text{shell}} \times \text{Area}_{\text{surface}}
\]

Assume the density of Type 304 stainless steel is:

\[
\text{sg}_{\text{sst}} := 8.04 \quad \rho_{\text{sst}} := 62.4 \quad \rho_{\text{sst}} := 501.7 \text{ pcf}
\]

\[
\text{Vol}_{\text{sst}} := 16.35 \text{ cf}
\]
The tank weight is:

\[ W_{\text{tank}} = \rho_{\text{sst}} \cdot V_{\text{sst}} \quad \text{W}_{\text{tank}} = 8203 \quad \text{lbs} \]

Assume approximately 2" of liquid or sludge left in the tank when lifted.

\[ s := \frac{2}{12} \quad r := 5 \quad \alpha := \frac{s}{r} \quad \alpha = 0.033 \]

\[ W_{\text{liquid}} := \left(0.5 \cdot r^2 \cdot \alpha - \sin(\alpha)\right) \cdot L_{\text{tank}} \cdot (62.4 \cdot 1.2) \quad W = 601 \quad \text{lbs} \]

Adjust tank weight for fittings, flanges, and miscellaneous piping (1,000 lbs).

\[ W_{\text{tank}} := (W_{\text{tank}} + W_{\text{liquid}} + 1000) \quad W_{\text{tank}} := 9804 \quad \text{lbs} \]

B. Estimate the weight of the V-9 tank. To be conservative and simplify the calculation, assume the cone section is a cylinder.

\[ \text{Dia}_{\text{tank.v9}} := 4 \quad \text{L}_{\text{tank.v9}} := 5 + 1.5 \]

\[ \text{Area}_{\text{surface.v9}} := \ \left(\text{Dia}_{\text{tank.v9}} \cdot \frac{\pi}{2}\right) + \text{L} \cdot \pi \cdot \text{Dia}_{\text{tank.v9}} \quad \text{area} := 101.71 \quad \text{sf} \]

Assume the tank thickness:

\[ t_{\text{shell}} := \frac{0.25}{12} \]

2. Determine the tank weight

Steel volume is:

\[ \text{Vol}_{\text{sst.v9}} := t_{\text{shell}} \cdot \text{Area}_{\text{surface.v9}} \quad \text{Vol}_{\text{sst.v9}} = 2.11 \quad \text{cf} \]

Assume the density of Type 304 stainless steel is:

\[ s_{g_{\text{sst}}} := 8.04 \quad \rho_{\text{sst}} := s_{g_{\text{sst}}} \cdot 62.4 \quad \rho_{\text{sst}} := 501.7 \quad \text{pcf} \]

The tank weight is:

\[ W_{\text{tank.v9}} := \rho_{\text{sst}} \cdot \text{Vol}_{\text{sst.v9}} \quad W_{\text{tank.v9}} = 1063 \quad \text{lbs} \]

Adjust tank weight for fittings, flanges, and miscellaneous piping (500 lbs).

\[ W_{\text{tank.v9}} := W_{\text{tank.v9}} + 500 \quad 1563 \quad \text{lbs} \]
C. Evaluate the lifting requirements for the tanks. Design lifting for V-1, 2, & 3 tanks

1. In summary, the weight of each tanks is:

- V-1, V-2, and V-3 (each): \( W_{\text{tank}} = 9804 \text{ lbs} \)
- V-9: \( W_{\text{tank,v9}} = 1563 \text{ lbs} \)

2. Assume the tanks are placed in granular fill material (cohesion = 0), with no groundwater therefore neglect the suction required to overcome the capillary forces.

\[
c := 0 \quad c_a := c \cdot 0.9
\]

3. Add the force to overcome soil friction. Assume the soil rises to the springline of the tank (5').

a. Determine the active soil force on the tank

\[
\gamma_{\text{soil}} := 111 \text{ pcf} \quad H := 5 \quad \phi := 32-\text{deg}
\]

\[
K_a := \frac{1 - \sin(\phi)}{1 + \sin(\phi)} \quad K_a = 0.307
\]

\[
P_{\text{vertical}} := \gamma_{\text{soil}} H = 555
\]

\[
P_{\text{active}} := K_a P_{\text{vertical}} \quad P_{\text{active}} = 172 \text{ psf}
\]

b. Determine the skin friction coefficient on the tank.

\[
\delta := 17-\text{deg} \quad C_a := 0.9 \quad f_o := c_a + P_{\text{active}} \cdot \tan(\delta) \quad f_n = 53.5 \text{ psf}
\]

c. Estimate the surface area of the tank in contact with soil.

\[
A_{\text{tank}} = \frac{(19.5 \times 10^2) \times 1}{2} \quad A_{\text{tank}} = 306 \text{ sf}
\]

d. Estimate the breaking force to overcome the soil friction

\[
P_{\text{break}} := f_o A_{\text{tank}} \quad P_{\text{break}} = 14,387 \text{ lbs}
\]

4. Estimate the lifting requirement for removing the largest tank.

\[
\text{Lift capacity} := (W_{\text{tank}} + P_{\text{break}}) \cdot 1 \quad \text{Lift capacity} = 26191 \text{ lbs or 13.1 tons}
\]

\[9804 + 16387\]
Discussion

Summary of calculations:

- Weight of each V-1, V-2, and V-3 tanks (tons): \( W_{\text{ea.\ tank}} = 4.9 \) tons
- Weight of V-9 tank (tons): \( W_{\text{tank.\ v9}} = 0.781 \) tons
- Tank lifting capacity required (tons): \( \text{Lift capacity} = 13.1 \) tons

Select a Grove RT650E Series Rough Terrain Hydraulic Crane or equal. A cut sheet is included as Attachment 1. This crane will be adequate for other lifting requirements on the job such as the "Rad Vault 8-120" with loaded HIC (66,700 lbs + 7,500 lbs = 74,200 lbs), DURATEK CNS 8-120B Type B shipping casks (49,300 lbs, empty; 63,980 lbs w/maximum payload) and soil bags (24,000 lbs).
ROUGH TERRAIN HYDRAULIC CRANE
Note: ( ) Reference dimensions in mm
## RT650E Rated Lifting Capacities in Pounds
### 33 Ft. - 105 Ft. Boom
### On Outriggers Fully Extended - 360°

<table>
<thead>
<tr>
<th>Radius in Feet</th>
<th>Main Boom Length in Feet</th>
<th>#0001</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>100,000 (69.5)</td>
<td>80,550 (73.5)</td>
</tr>
<tr>
<td>40</td>
<td>79,150 (70.5)</td>
<td>64,200 (75)</td>
</tr>
<tr>
<td>50</td>
<td>69,550 (65.5)</td>
<td>59,950 (71)</td>
</tr>
<tr>
<td>60</td>
<td>51,800 (69.5)</td>
<td>45,200 (75)</td>
</tr>
<tr>
<td>70</td>
<td>38,550 (64.5)</td>
<td>34,450 (75.5)</td>
</tr>
<tr>
<td>80</td>
<td>36,050 (62.5)</td>
<td>31,400 (77.5)</td>
</tr>
<tr>
<td>90</td>
<td>30,700 (58.5)</td>
<td>26,350 (71)</td>
</tr>
<tr>
<td>100</td>
<td>25,450 (52.5)</td>
<td>21,000 (73.5)</td>
</tr>
<tr>
<td>110</td>
<td>20,850 (46)</td>
<td>17,300 (68.5)</td>
</tr>
<tr>
<td>120</td>
<td>17,100 (41.5)</td>
<td>14,650 (65.5)</td>
</tr>
<tr>
<td>130</td>
<td>13,950 (38)</td>
<td>11,900 (59)</td>
</tr>
<tr>
<td>140</td>
<td>9,730 (26)</td>
<td>10,100 (55.5)</td>
</tr>
<tr>
<td>150</td>
<td>0,200 (23)</td>
<td>6,290 (35.5)</td>
</tr>
<tr>
<td>160</td>
<td>6,960 (24.5)</td>
<td>4,720 (35)</td>
</tr>
<tr>
<td>170</td>
<td>6,080 (31)</td>
<td>4,020 (29)</td>
</tr>
<tr>
<td>180</td>
<td>5,130 (23)</td>
<td>3,400 (21.5)</td>
</tr>
</tbody>
</table>

Minimum boom angle (*) for indicated length (no load)

Maximum boom length (ft.) at 0° boom angle (no load) 105

---

### Lifting Capacities at Zero Degree Boom Angle
### On Outriggers Fully Extended - 360°

<table>
<thead>
<tr>
<th>Boom Angle</th>
<th>Main Boom Length in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0°</td>
<td>16,250 (28.2)</td>
</tr>
<tr>
<td>10°</td>
<td>12,600 (35)</td>
</tr>
<tr>
<td>20°</td>
<td>8,780 (45)</td>
</tr>
<tr>
<td>30°</td>
<td>6,290 (55)</td>
</tr>
<tr>
<td>40°</td>
<td>4,510 (65)</td>
</tr>
<tr>
<td>50°</td>
<td>3,160 (75)</td>
</tr>
<tr>
<td>60°</td>
<td>2,110 (85)</td>
</tr>
<tr>
<td>70°</td>
<td>1,260 (95)</td>
</tr>
</tbody>
</table>

NOTE: (*) Boom angles are in degrees.

#LMI operating code. Refer to LMI manual for operating instructions.

*This capacity is based on maximum boom angle.
### RT600E SERIES ON RUBBER CAPACITIES

#### STATIONARY CAPACITIES
**360°**

<table>
<thead>
<tr>
<th>Radius in Feet</th>
<th>#9005</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>38,550 (69.5)</td>
</tr>
<tr>
<td>40</td>
<td>38,550 (73.5)</td>
</tr>
<tr>
<td>50</td>
<td>32,550 (65.5)</td>
</tr>
<tr>
<td>60</td>
<td>32,550 (70.5)</td>
</tr>
<tr>
<td>70</td>
<td>23,700 (59.5)</td>
</tr>
<tr>
<td>80</td>
<td>23,700 (65.5)</td>
</tr>
<tr>
<td>90</td>
<td>23,700 (71.5)</td>
</tr>
<tr>
<td>100</td>
<td>23,700 (75.5)</td>
</tr>
</tbody>
</table>

#### STATIONARY CAPACITIES
**DEFINED ARC OVER FRONT (See Note 3)**

<table>
<thead>
<tr>
<th>Radius in Feet</th>
<th>#9005</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>14,450 (47.5)</td>
</tr>
<tr>
<td>40</td>
<td>14,450 (57.5)</td>
</tr>
<tr>
<td>50</td>
<td>9,640 (32)</td>
</tr>
<tr>
<td>60</td>
<td>9,640 (47)</td>
</tr>
<tr>
<td>70</td>
<td>6,840 (34.5)</td>
</tr>
<tr>
<td>80</td>
<td>6,840 (50)</td>
</tr>
<tr>
<td>90</td>
<td>6,840 (50)</td>
</tr>
<tr>
<td>100</td>
<td>4,850 (59)</td>
</tr>
<tr>
<td>110</td>
<td>4,850 (64.5)</td>
</tr>
<tr>
<td>120</td>
<td>4,850 (70)</td>
</tr>
<tr>
<td>130</td>
<td>4,850 (73.5)</td>
</tr>
</tbody>
</table>

#### Lifting Capacities at Zero Degree Boom Angle
**On Rubber - 360°**

<table>
<thead>
<tr>
<th>Boom Angle</th>
<th>Main Boom Length in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>7,580 (28.2)</td>
</tr>
<tr>
<td>40</td>
<td>4,850 (35)</td>
</tr>
<tr>
<td>50</td>
<td>2,410 (45)</td>
</tr>
</tbody>
</table>

### Lifting Capacities at Zero Degree Boom Angle
**On Rubber - Defined Arc Over Front**

<table>
<thead>
<tr>
<th>Boom Angle</th>
<th>Main Boom Length in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>14,550 (28.2)</td>
</tr>
<tr>
<td>40</td>
<td>10,050 (35)</td>
</tr>
<tr>
<td>50</td>
<td>6,290 (45)</td>
</tr>
<tr>
<td>60</td>
<td>5,050 (55)</td>
</tr>
<tr>
<td>70</td>
<td>4,060 (65)</td>
</tr>
</tbody>
</table>

**NOTE:** ( ) Boom angles are in degrees.

#LMI operating code. Refer to LMI manual for operating instructions.

( ) Reference radii in feet.

A6-829-100836A

A6-829-100835A
<table>
<thead>
<tr>
<th>Rev #</th>
<th>Date</th>
<th>Revision</th>
<th>Calculated by</th>
<th>Checked by</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAA</td>
<td></td>
<td>60%</td>
<td>R. Ederer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAB</td>
<td>5/31/01</td>
<td>90%</td>
<td>R. Ederer</td>
<td>B. Keshian</td>
<td>B. Keshian</td>
</tr>
<tr>
<td>RAC</td>
<td>6/29/01</td>
<td>90% Polish</td>
<td>D. Brennecke</td>
<td>B. Keshian</td>
<td>B. Keshian</td>
</tr>
<tr>
<td>RAD</td>
<td>9/27/01</td>
<td>Draft Final</td>
<td>D. Brennecke</td>
<td>B. Keshian</td>
<td>Jim Lockhart</td>
</tr>
<tr>
<td>RAE</td>
<td>10/23/01</td>
<td>Draft Final Polish</td>
<td>D. Brennecke</td>
<td>B. Keshian</td>
<td>Jim Lockhart</td>
</tr>
</tbody>
</table>

Subject: Drum Storage/Water Storage/Decontamination Area Secondary Containment Requirements

Work Order Number: 12393.002.001

Number of Sheets: 10/8
Problem Statement:

Estimate the containment area required for storing of contaminated liquids. Secondary containment.

Method of Solution:

1. Determine the area needed for containers.
2. Determine the volume needed for a 25yr/24 hr storm.
3. Determine volume of liquids in containers.
4. Design containment berm with a capacity to contain the volume of contaminated liquids & 25yr/24 hr storm.

Sources of Information:

- Design Drawings
- Design information from Bartlett, INEEL and BBNU

Assumptions:

\[
C_I = 79
\]

\[
S = \frac{1000}{C_I} - 10
\]

\[
Q = \frac{(P - 0.25)^2}{(P + 0.85)}
\]
# Determination of Water Sources

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources of water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V-1</td>
<td>1164</td>
<td>gallons</td>
</tr>
<tr>
<td>V-2</td>
<td>1076</td>
<td>gallons</td>
</tr>
<tr>
<td>V-3</td>
<td>7648</td>
<td>gallons</td>
</tr>
<tr>
<td>V-9</td>
<td>70</td>
<td>gallons</td>
</tr>
<tr>
<td>Decon</td>
<td>2000</td>
<td>gallons</td>
</tr>
<tr>
<td>Runoff</td>
<td>15000</td>
<td>gallons</td>
</tr>
<tr>
<td>Rinse</td>
<td>500</td>
<td>gallons</td>
</tr>
<tr>
<td>Total water volume</td>
<td>27458</td>
<td>gallons</td>
</tr>
</tbody>
</table>
Assumptions. Can't

- Contain 100% volume of the largest container or 10% of total storage volume plus volume of 25 yr 24 hr storm per 40 CFR 264.17563

- Total storage volume:
  Decon, Runoff, Rinse, Tank water ≈ 30,000 gallons

- Largest container will be 10,000 gal water tank
  (12' φ x 14' high) Area req'd = πL² = 113 SF/tank

- Estimated area of containment area from drawings
  \[ 2 \times 6,000 \text{ SF} \times \frac{\text{m}^2}{(5280 \text{ ft/m})^2} = 0.000215 \text{ m}^2 \]
Calculations:

Volume of Stormwater from within containment area

\[ V = Q \times A \times 53 \times 33 \text{ ft}^3 \]

\[ A = \text{Area in mi}^2 \]

\[ Q = \frac{(P_{25} - 0.28)}{(P + 0.85)} \]

\[ S = \frac{1000}{C_N - 10} \Rightarrow S = \frac{1000}{79} - 10 = 8.66 \]

\[ P_{25} = 2.0 \]

\[ Q = 0.522 \text{ in} \]

\[ V = 0.522 \times 0.000215 \text{ mi}^2 \times 53.33 \]

\[ = 0.005985 \text{ ac-ft} \times \frac{43,560 \text{ SF}}{\text{AC}} = 260.7 \text{ CF} \]

\[ = 260.7 \text{ CF} \times 7.48 \text{ ga} = 1950 \text{ GAL} \]

Storage Volume Req'd

\[ \text{Vol} = \text{Tank} + 25 \text{ yr 24 HR storm} \]

\[ = 10,000 \text{ GAL} + 1950 \text{ GAL} \]

\[ = 11,950 \text{ GAL} \]
ASSUMPTIONS

- Drums are moved directly to interim storage area after filling
- No more than 10 drums are stored in drum storage area at one time

- Drum storage area is 25 ft²/Drum

- 10,000 gal H₂O storage tanks (12") require 11.6 ft² = 1135 gal/tank

- 3% additional area reqd for logistics

- 10,975 gal of secondary containment storage is reqd (10,000 gal + 10% = 10,975) assuming 3.0% (area occupied by water) calculates area needed

CALCULATE AREA REQ'D

Drums 25 ft²/Drum x 10 drums = 250 ft²

10,975 gal water storage (10,000 gal + 10%)

1135 ft²/tank x 3 tanks = 3405 ft²

875 ft²/tank x 10 tanks = 8750 ft²

+ 3% logistics

132 ft²

Access road area

750 ft²

480 ft²

240 ft²

CALCULATE MIN AREA REQ'D assuming minimum storage depth

of 1 foot

10,975 gal x 1 ft²

7.48 ft²

176 ft²

14.6 ft²

MIN AREA REQ'D

1100 ft²

⇒ minimum dimensions of area = √1100 ft² = 33.2 ft

⇒ MAKE AREA 50 ft x 60 ft TO ACCOMMODATE