**SHED A- VEGETATED SWALE**

**Calculation Table for Determination of Design Imperviousness ($I_{WQ}$)**

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft²)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor(b)</th>
<th>Weighted % Imperviousness(c,d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete</td>
<td>17,053</td>
<td>100</td>
<td>0.673</td>
<td>67</td>
</tr>
<tr>
<td>pavement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roofs</td>
<td>1,075</td>
<td>90</td>
<td>0.042</td>
<td>4</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>7,215</td>
<td>0</td>
<td>0.285</td>
<td>0</td>
</tr>
<tr>
<td>Total Contributing Area(a)</td>
<td>25,342</td>
<td>–</td>
<td>–</td>
<td>71</td>
</tr>
</tbody>
</table>

a. Total contributing area = sum of unit areas  
b. Weighting factor = unit area / total tributary area  
c. Weighted imperviousness = weighting factor x percent imperviousness  
d. Design imperviousness = sum of weighted imperviousness  
e. Variable with product type; assumes porous subsoil and use of underdrains

**Swale Calculations**

- Shed Area: 0.58 ac  
- Intensity: 0.2 in/hr  
- C: 0.50  
- n: 0.2  
- $Q_{\text{design}}$: 0.059 cfs

**Note:**

- swale bottom width: 0.5 ft  
- side slope: 3:1  
- design slope: 0.005 ft/ft  
- Design flow velocity: 0.16 ft/sec from flowmaster  
- Flow Depth: 3.24 in from flowmaster  
- Design Length: 96 ft  
- Length per plan: 96 ft

**Check Swale Length:** Ok

**Notes:**

- Design length calculated using the 10 min. minimum contact  
  Design Length = $T_c \times$ Design Flow Velocity x 60  
- Intensity determined as 2X the 85th percentile hourly  
  Rainfall intensity (City of Woodland rain gauge = 0.10 in/hr)  
- $Q_{\text{design}} = C \times I \times A$  
- Storm Quality Design Flow (SQDF)  
  $C = \text{runoff coefficient} = 0.858 \left( I_{WQ} \right)^3 - 0.78 \left( I_{WQ} \right)^2 + 0.774 \left( I_{WQ} \right) + 0.04$
## Calculation Table for Determination of Design Imperviousness (I\textsubscript{WQ})

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft\textsuperscript{2})</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor\textsuperscript{(b)}</th>
<th>Weighted % Imperviousness\textsuperscript{(c,d)}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>8,304</td>
<td>100</td>
<td>0.603</td>
<td>60</td>
</tr>
<tr>
<td>Gravel pavement</td>
<td>0</td>
<td>40</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Roofs</td>
<td>0</td>
<td>90</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Porous pavement\textsuperscript{(e)}</td>
<td>1,726</td>
<td>35</td>
<td>0.125</td>
<td>4</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>3,737</td>
<td>0</td>
<td>0.271</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Contributing Area\textsuperscript{(a)}</strong></td>
<td><strong>13,767</strong></td>
<td>-</td>
<td>-</td>
<td><strong>65</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>Total contributing area = sum of unit areas</td>
</tr>
<tr>
<td>b.</td>
<td>Weighting factor = unit area / total tributary area</td>
</tr>
<tr>
<td>c.</td>
<td>Weighted imperviousness = weighting factor x percent imperviousness</td>
</tr>
<tr>
<td>d.</td>
<td>Design imperviousness = sum of weighted imperviousness</td>
</tr>
<tr>
<td>e.</td>
<td>Variable with product type; assumes porous subsoil and use of underdrains</td>
</tr>
</tbody>
</table>

### Pervious Pavers:

- **Shed Area:** 0.32 ac
- **C:** 0.45
- **desired capture (for 48 hr storm):** 80%
- **Voids:** 30%

### Calculations:

- \( Vu \) (in) [From graph on page 333 of CASQA BMP Handbook, 48-hr drawdown]
- \( V \) (cf) \( V \) (cf) Design Surface Area (sf) Depth (in) Provided Media Depth (in)
- 0.32 367 1,726 8.51 9

### Notes:

Calculations based on section 5.5 of the California Stormwater BMP Handbook, dated January 2003 per section E.12.e(ii),(c)2 of the State General Permit, dated February 5, 2013.

- \( V \)=Required Capture Volume (cf)
- \( Vu \)=Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)
- \( I_{WQ} \)=Design Imperviousness

\[ C = \text{runoff coefficient}=0.858 \left( I_{WQ} \right)^3 - 0.78 \left( I_{WQ} \right)^2 + 0.774 \left( I_{WQ} \right) + 0.04 \]

storage depth is based on 30% void space
### Calculation Table for Determination of Design Imperviousness ($I_{WQ}$)

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft²)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor&lt;sup&gt;(b)&lt;/sup&gt;</th>
<th>Weighted % Imperviousness&lt;sup&gt;(c,d)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>11,808</td>
<td>100</td>
<td>0.66</td>
<td>66</td>
</tr>
<tr>
<td>Roofs</td>
<td>0</td>
<td>90</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>6,102</td>
<td>0</td>
<td>0.34</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Contributing Area</strong>&lt;sup&gt;(a)&lt;/sup&gt;</td>
<td>17,910</td>
<td>–</td>
<td>–</td>
<td>66</td>
</tr>
</tbody>
</table>

a. Total contributing area = sum of unit areas  
b. Weighting factor = unit area / total tributary area  
c. Weighted imperviousness = weighting factor x percent imperviousness  
d. Design imperviousness = sum of weighted imperviousness

### Rain Garden Calculations

- **Shed Area**: 0.41 ac  
- **C**: 0.46  
- **desired capture (for 48 hr storm)**: 80%

**Vu** (in) [From graph on page 333 of CASQA BMP Handbook, 48-hr drawdown]  
<table>
<thead>
<tr>
<th>Required V (cf)</th>
<th>Design V (cf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.32</td>
<td>478</td>
</tr>
<tr>
<td></td>
<td>487</td>
</tr>
</tbody>
</table>

**Notes:**  
Calculations based on section 5.5 of the California Stormwater BMP Handbook, dated January 2003 per section E.12.e(ii),(c)2 of the State General Permit, dated February 5, 2013.  
V = Required Capture Volume (cf)  
Vu = Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)  
$I_{WQ}$ = Design Imperviousness  
C = runoff coefficient = $0.858 (I_{WQ})^3 - 0.78 (I_{WQ})^2 + 0.774 (I_{WQ}) + 0.04$  
Vu = Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)
## SHED D- PERVIOUS PAVEMENT

### Calculation Table for Determination of Design Imperviousness (IWQ)

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft²)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor(b)</th>
<th>Weighted % Imperviousness(c,d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>19,747</td>
<td>100</td>
<td>0.440</td>
<td>44</td>
</tr>
<tr>
<td>Gravel pavement</td>
<td>492</td>
<td>40</td>
<td>0.011</td>
<td>0</td>
</tr>
<tr>
<td>Roofs</td>
<td>10,310</td>
<td>90</td>
<td>0.230</td>
<td>21</td>
</tr>
<tr>
<td>Porous pavement</td>
<td>6,823</td>
<td>35</td>
<td>0.152</td>
<td>5</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>7,517</td>
<td>0</td>
<td>0.167</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Contributing Area</strong></td>
<td><strong>44,888</strong></td>
<td></td>
<td></td>
<td><strong>70</strong></td>
</tr>
</tbody>
</table>

- **a.** Total contributing area = sum of unit areas
- **b.** Weighting factor = unit area / total tributary area
- **c.** Weighted imperviousness = weighting factor x percent imperviousness
- **d.** Design imperviousness = sum of weighted imperviousness
- **e.** Variable with product type; assumes porous subsoil and use of underdrains

### Pervious Pavers-

- **Shed Area:** 1.03 ac
- **C:** 0.50
- **desired capture (for 48 hr storm):** 80%
- **Voids:** 30%

### Calculation:

\[
Vu = \text{Required Capture Volume (cf)}
\]

\[
Vu = \text{Unit Basin Storage Volume (in)} \quad \text{(from graph on page 333 of CASQA BMP Handbook)}
\]

\[
IWQ = \text{Design Imperviousness}
\]

\[
C = \text{runoff coefficient} = 0.858 (IWQ)^3 - 0.78 (IWQ)^2 + 0.774 (IWQ) + 0.04
\]

**Notes:**
Calculations based on section 5.5 of the California Stormwater BMP Handbook, dated January 2003 per section E.12.e(ii),(c)2 of the State General Permit, dated February 5, 2013.

- **V** = Required Capture Volume (cf)
- **Vu** = Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)
- **IWQ** = Design Imperviousness
- **storage depth is based on 30% void space**
### Calculation Table for Determination of Design Imperviousness ($I_{WQ}$)

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft²)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor (b)</th>
<th>Weighted % Imperviousness (c,d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>19,353</td>
<td>100</td>
<td>0.463</td>
<td>46</td>
</tr>
<tr>
<td>Gravel pavement</td>
<td>799</td>
<td>40</td>
<td>0.019</td>
<td>1</td>
</tr>
<tr>
<td>Roofs</td>
<td>9,294</td>
<td>90</td>
<td>0.222</td>
<td>20</td>
</tr>
<tr>
<td>Porous pavement (e)</td>
<td>4,417</td>
<td>35</td>
<td>0.106</td>
<td>4</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>7,938</td>
<td>0</td>
<td>0.190</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Contributing Area</strong></td>
<td><strong>41,801</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>71</strong></td>
</tr>
</tbody>
</table>

- **a.** Total contributing area = sum of unit areas
- **b.** Weighting factor = unit area / total tributary area
- **c.** Weighted imperviousness = weighting factor x percent imperviousness
- **d.** Design imperviousness = sum of weighted imperviousness
- **e.** Variable with product type; assumes porous subsoil and use of underdrains

#### Pervious Pavers:

- **Shed Area:** 0.96 ac
- **C:** 0.50
- **desired capture (for 48 hr storm):** 80%
- **Voids:** 30%

Vu (in) [From graph on page 333 of CASQA BMP Handbook, 48-hr drawdown]:

<table>
<thead>
<tr>
<th>V (cf)</th>
<th>Design Surface Area (sf)</th>
<th>Required Media Depth (in)</th>
<th>Provided Media Depth (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.36</td>
<td>1,254</td>
<td>4,417</td>
<td>11</td>
</tr>
</tbody>
</table>

**Notes:**

Calculations based on section 5.5 of the California Stormwater BMP Handbook, dated January 2003 per section E.12.e(ii),(c)2 of the State General Permit, dated February 5, 2013.

- **V** = Required Capture Volume (cf)
- **Vu** = Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)
- **I_{WQ}** = Design Imperviousness

C = runoff coefficient = 0.858 ($I_{WQ}$)³ - 0.78 ($I_{WQ}$)² + 0.774 ($I_{WQ}$) + 0.04

**storage depth is based on 30% void space.**
### SHED F- STORMWATER PLANTER

#### Calculation Table for Determination of Design Imperviousness ($I_{WQ}$)

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft²)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor&lt;sup&gt;(b)&lt;/sup&gt;</th>
<th>Weighted % Imperviousness&lt;sup&gt;(c,d)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>11,662</td>
<td>100</td>
<td>0.446</td>
<td>45</td>
</tr>
<tr>
<td>Roofs</td>
<td>0</td>
<td>90</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>14,504</td>
<td>0</td>
<td>0.554</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Contributing Area</strong></td>
<td><strong>26,166</strong></td>
<td>–</td>
<td>–</td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

- **a.** Total contributing area = sum of unit areas
- **b.** Weighting factor = unit area / total tributary area
- **c.** Weighted imperviousness = weighting factor x percent imperviousness
- **d.** Design imperviousness = sum of weighted imperviousness

#### Rain Garden Calculations

- **Shed Area:** 0.60 ac
- **C:** 0.31
- **desired capture (for 48 hr storm):** 80%

\[
Vu \text{ (in) [From graph on page 333 of CASQA BMP Handbook, 48-hr drawdown]} = 0.22 \\
\text{Required V (cf):} 480 \\
\text{Design V (cf):} 505
\]

**Notes:**
- Calculations based on section 5.5 of the California Stormwater BMP Handbook, dated January 2003 per section E.12.e(ii),(c)2 of the State General Permit, dated February 5, 2013.
- $V =$ Required Capture Volume (cf)
- $Vu =$ Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)
- $I_{WQ} =$ Design Imperviousness
- $C = \text{runoff coefficient} = 0.858 (I_{WQ})^3 - 0.78 (I_{WQ})^2 + 0.774 (I_{WQ}) + 0.04$
- $Vu =$ Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)
SHED G- VEGETATED SWALE

Calculation Table for Determination of Design Imperviousness ($I_{WQ}$)

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area ($ft^2$)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Weighted % Imperviousness&lt;sup&gt;c,d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>6,996</td>
<td>100</td>
<td>0.226</td>
<td>23</td>
</tr>
<tr>
<td>Pool</td>
<td>1,856</td>
<td>100</td>
<td>0.060</td>
<td>6</td>
</tr>
<tr>
<td>Roofs</td>
<td>16,933</td>
<td>90</td>
<td>0.547</td>
<td>49</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>5,190</td>
<td>0</td>
<td>0.168</td>
<td>0</td>
</tr>
<tr>
<td>Total Contributing Area&lt;sup&gt;a&lt;/sup&gt;</td>
<td>30,976</td>
<td>–</td>
<td>–</td>
<td>78</td>
</tr>
</tbody>
</table>

a. Total contributing area = sum of unit areas
b. Weighting factor = unit area / total tributary area
c. Weighted imperviousness = weighting factor x percent imperviousness
d. Design imperviousness = sum of weighted imperviousness
e. Variable with product type; assumes porous subsoil and use of underdrains

Swale Calculations

- Shed Area: 0.71 ac
- Intensity: 0.2 in/hr
- $C$: 0.57
- $n$: 0.2
- $Q_{design}$: 0.082 cfs

- Swale bottom width: 1 ft
- Side slope: 3 :1
- Design slope: 0.005 ft/ft
- Design flow velocity: 0.17 ft/sec from flowmaster
- Flow Depth: 3.24 in from flowmaster
- Design Length: 102 ft
- Length per plan: 108 ft

Check Swale Length: Ok

Notes:
Design length calculated using the 10 min. minimum contact
Design Length = $T_c \times$ Design Flow Velocity x 60
Intensity determined as 2X the 85th percentile hourly
Rainfall intensity (City of Woodland rain gauge = 0.10 in/hr)

$Q_{design} = C \times I \times A$

Storm Quality Design Flow (SQDF)
$C = \text{runoff coefficient}=0.858 \left(I_{WQ}\right)^3 - 0.78 \left(I_{WQ}\right)^2 + 0.774 \left(I_{WQ}\right) + 0.04$
### SHED H- VEGETATED SWALE

**Calculation Table for Determination of Design Imperviousness (I_{WQ})**

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft²)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor (b)</th>
<th>Weighted % Imperviousness (c,d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>6,840</td>
<td>100</td>
<td>0.336</td>
<td>34</td>
</tr>
<tr>
<td>Pool</td>
<td>2100</td>
<td>100</td>
<td>0.103</td>
<td>10</td>
</tr>
<tr>
<td>Roofs</td>
<td>7,986</td>
<td>90</td>
<td>0.393</td>
<td>35</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>3,412</td>
<td>0</td>
<td>0.168</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Contributing Area</strong></td>
<td><strong>20,337</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>79</strong></td>
</tr>
</tbody>
</table>

* a. Total contributing area = sum of unit areas
  * b. Weighting factor = unit area / total tributary area
  * c. Weighted imperviousness = weighting factor x percent imperviousness
  * d. Design imperviousness = sum of weighted imperviousness
  * e. Variable with product type; assumes porous subsoil and use of underdrains

### Swale Calculations

- Shed Area: 0.47 ac
- Intensity: 0.2 in/hr
- C: 0.59
- n: 0.2
- Q_{design} = 0.055 cfs

Swale bottom width: 1 ft
side slope: 3 : 1
design slope: 0.005 ft/ft
Design flow velocity: 0.15 ft/sec from flowmaster
Flow Depth: 3.24 in from flowmaster
Design Length: 90 ft
Length per plan: 90 ft

Check Swale Length: Ok

**Notes:**

Design length calculated using the 10 min. minimum contact:

Design Length = Tc x Design Flow Velocity x 60

Intensity determined as 2X the 85th percentile hourly:

Rainfall intensity (City of Woodland rain gauge = 0.10 in/hr)

Q_{design} = C x I x A

Storm Quality Design Flow (SQDF)

C = runoff coefficient=0.858 (I_{WQ})^3 - 0.78 (I_{WQ})^2 + 0.774 (I_{WQ}) + 0.04
### SHED I- STORMWATER PLANTER

#### Calculation Table for Determination of Design Imperviousness ($I_{WQ}$)

<table>
<thead>
<tr>
<th>Site Element</th>
<th>Unit Area (ft²)</th>
<th>Percent Imperviousness</th>
<th>Weighting Factor (b)</th>
<th>Weighted % Imperviousness (c,d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt/concrete pavement</td>
<td>6,260</td>
<td>100</td>
<td>0.200</td>
<td>20</td>
</tr>
<tr>
<td>Roofs</td>
<td>11,664</td>
<td>90</td>
<td>0.373</td>
<td>34</td>
</tr>
<tr>
<td>Lawn/turf</td>
<td>13,384</td>
<td>0</td>
<td>0.427</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total Contributing Area</strong></td>
<td><strong>31,307</strong></td>
<td><strong>-</strong></td>
<td><strong>-</strong></td>
<td><strong>54</strong></td>
</tr>
</tbody>
</table>

a. Total contributing area = sum of unit areas  
b. Weighting factor = unit area / total tributary area  
c. Weighted imperviousness = weighting factor x percent imperviousness  
d. Design imperviousness = sum of weighted imperviousness

#### Rain Garden Calculations

Shed Area: 0.72 ac  
C = 0.36  
desired capture (for 48 hr storm) = 80%

Vu (in) [From graph on page 333 of CASQA BMP Handbook, 48-hr drawdown]  
Required V (cf)  
Design V (cf)  
0.25 652   690

Notes:
Calculations based on section 5.5 of the California Stormwater BMP Handbook, dated January 2003 per section E.12.e(ii),(c)2 of the State General Permit, dated February 5, 2013.

V=Required Capture Volume (cf)  
Vu=Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)  
$I_{WQ}$ =Design Imperviousness

C = runoff coefficient=$0.858 (I_{WQ})^3 - 0.78 (I_{WQ})^2 + 0.774 (I_{WQ}) + 0.04$

Vu=Unit Basin Storage Volume (in) (from graph on page 333 of CASQA BMP Handbook)