

**Worksheet CEW-01: FORMAT FOR THE ESTIMATION OF CLOSURE COSTS**

**City of Bristol SWP 498 Landfill, Closure Financial Assurance Estimate**

Where specific costs are not available, engineers judgement has been used to assign costs based on other projects and construction.

**Soil Cap Components**

	For reshaping of site	Calculation or Conversion	
<b>I. Slope &amp; Fill</b>			
a. Area to be capped	12.4 acres	x 4,840yd <sup>2</sup> /ac	60,016 yd <sup>2</sup>
b. Depth of soil needed for slope and fill	12 inches	x 1yd/36in	0.33 yd
c. Quantity of soil needed		a x b	20,005 yd <sup>3</sup>
d. Percentage of soil from off-site	100%		
e. Purchase unit cost for off-site material	\$20.00 /yd <sup>3</sup>		
f. Percentage of soil from on-site		(1 - d)	0%
g. Excavation unit cost (on-site material)	\$8.00 /yd <sup>3</sup>		0
h. Total soil unit cost		(d x e) + (f x g)	\$20.00 /yd <sup>3</sup>
i. Hauling, Placement and Spreading unit cost	\$15.00 /yd <sup>3</sup>		0
j. Compaction unit cost		Included above	
k. Total soil unit cost		h + i + j	\$35.00 /yd <sup>3</sup>
l. Soil subtotal		k x b	\$700,187
m. Percent compaction		Included above	
<b>Total Slope &amp; Fill Cost</b>		l x (1 + m)	<b>\$700,187</b>
<b>II. Infiltration Layer Soil</b>			
<i>Infiltration Soil Cost</i>			
a. Area to be capped	0 acres	x 4,840yd <sup>2</sup> /ac	0 yd <sup>2</sup>
b. Depth of infiltration soil needed		x 1yd/36in	0.00 yd
c. Quantity of infiltration soil needed		a x b	0 yd <sup>3</sup>
d. Percentage of soil from off-site			
e. Purchase unit cost for off-site material			
f. Percentage of soil from on-site		(1 - d)	100%
g. Excavation unit cost (on-site material)			
h. Total infiltration soil unit cost		(d x e) + (f x g)	\$0.00 /yd <sup>3</sup>
i. Hauling, Placement and Spreading unit cost			
j. Compaction unit cost			
k. Total infiltration soil unit cost		h + i + j	\$0.00 /yd <sup>3</sup>
l. Infiltration soil subtotal		k x b	\$0
m. Percent compaction			
n. <i>Subtotal Infiltration Soil Cost</i>		l x (1 + m)	\$0
<i>Soil Admixture Cost</i>			
o. Area to be capped	0 acres	x 4,840yd <sup>2</sup> /ac	0 yd <sup>2</sup>
p. Soil admixture unit cost			
q. <i>Subtotal admixture cost</i>		a x b	\$0
<i>Soil Testing</i>			
r. Area to be capped	0 acres		
s. Testing unit cost			
t. <i>Subtotal soil testing cost</i>		a x b	\$0
<b>Total Infiltration Soil Cost (soil, admixtures, and testing)</b>		n + q + t	<b>\$0</b>
<b>III. Erosion Control / Protective Cover Soil</b>			
a. Area to be capped	12.4 acres	x 4,840yd <sup>2</sup> /ac	60,016 yd <sup>2</sup>
b. Depth of soil needed	18 inches	x 1yd/36in	0.50 yd
c. Quantity of soil needed		a x b	30,008 yd <sup>3</sup>
d. Percentage of soil from off-site	100%		

e. Purchase unit cost for off-site material	<input type="text" value="\$0.00"/>	/yd <sup>3</sup>		
f. Percentage of soil from on-site			(1 - d)	0%
g. Excavation unit cost (on-site material)	<input type="text" value="\$8.00"/>	/yd <sup>3</sup>		
h. Total erosion/protective soil unit cost			(d x e) + (f x g)	\$0.00 /yd <sup>3</sup>
i. Hauling, Placement and Spreading unit cost	<input type="text" value="\$34.53"/>	/yd <sup>3</sup>		
j. Compaction unit cost	<input type="text" value=""/>	/yd <sup>3</sup>		
k. Total soil unit cost			h + i + j	\$34.53 /yd <sup>3</sup>
l. Erosion/Protective soil subtotal			k x b	\$1,036,176
m. Percent compaction	<input type="text" value="0%"/>			
<b>Total Erosion Control/Protective Cover Soil Cost</b>			l x (1 + m)	<b>\$1,036,176</b>

#### IV. Vegetative support soil (Topsoil)

a. Area to be capped	<input type="text" value="12.4"/>	acres	x 4,840yd <sup>2</sup> /ac	60,016 yd <sup>2</sup>
b. Depth of topsoil needed	<input type="text" value="6"/>	inches	x 1yd/36in	0.17 yd
c. Quantity of topsoil needed			a x b	10,003 yd <sup>3</sup>
d. Percentage of topsoil from off-site	<input type="text" value="100%"/>			
e. Purchase unit cost for off-site material	<input type="text" value="\$20.00"/>	/yd <sup>3</sup>		
f. Percentage of topsoil from on-site			(1 - d)	0%
g. Excavation unit cost (on-site material)	<input type="text" value="\$8.00"/>	/yd <sup>3</sup>		
h. Total topsoil unit cost			(d x e) + (f x g)	\$20.00 /yd <sup>3</sup>
i. Hauling, Placement and Spreading unit cost	<input type="text" value="\$21.00"/>	/yd <sup>3</sup>		
j. Total soil unit cost			h + i	\$41.00 /yd <sup>3</sup>
<b>Total Topsoil Cost</b>			c x j	<b>\$410,120</b>

#### V. Vegetative Cover

a. Area to be vegetated	<input type="text" value="13"/>	acres		
b. Vegetative cover (seeding) unit cost	<input type="text" value="\$10,000"/>	/acre		
c. Erosion control matting unit cost	<input type="text" value="\$12,778"/>	/acre		
d. Erosion Control matting acreage	<input type="text" value="3"/>	acres		
<b>Total Vegetative Cover Cost</b>			(a x b) + (c x d)	<b>\$168,332.80</b>

**Soil Cap Component Subtotal (I + II + III + IV + V): \$2,314,816**

### Geosynthetic Barrier & Infiltration Layers

#### VI. Flexible Membrane Liner

a. Quantity of FML needed	<input type="text" value="12.4"/>	acres	Calculation or Conversion x 43,560ft <sup>2</sup> /ac	540,144 ft <sup>2</sup>
b. Purchase unit cost	<input type="text" value="\$0.75"/>	/ft <sup>2</sup>		
c. Installation unit cost	<input type="text" value="\$0.33"/>	/ft <sup>2</sup>		
d. Total FML unit cost			b + c	\$1.08
<b>Total FML cost</b>			a x d	<b>\$583,356</b>

#### VII. Geosynthetic Clay Liner

a. Quantity of GCL needed	<input type="text" value="0"/>	acres	x 43,560ft <sup>2</sup> /ac	0 ft <sup>2</sup>
b. Purchase unit cost	<input type="text" value=""/>	/ft <sup>2</sup>		
c. Installation unit cost	<input type="text" value=""/>	/ft <sup>2</sup>		
d. Total GCL unit cost			b + c	\$0.00 /ft <sup>2</sup>
<b>Total GCL Cost</b>			a x d	<b>\$0</b>

**Geosynthetic Layers Subtotal (VI + VII): \$583,356**

### Drainage Components

#### VIII. Sand or Gravel Drainage

a. Area to be capped	<input type="text" value="0"/>	acres	Calculation or Conversion x 4,840yd <sup>2</sup> /ac	0 yd <sup>2</sup>
b. Depth of sand or gravel needed	<input type="text" value=""/>	inches	x 1yd/36in	0.00 yd
c. Quantity of drainage material needed			a x b	0 yd <sup>3</sup>
d. Percentage of media from off-site	<input type="text" value=""/>			

e.	Purchase unit cost for off-site material	<input type="text"/>	/yd3		
f.	Percentage of material from on-site			(1 - d)	100%
g.	Excavation unit cost (on-site material)	<input type="text"/>	/yd3		
h.	Total drainage material unit cost			(d x e) + (f x g)	\$0.00 /yd3
i.	Hauling, Placement and Spreading unit cost	<input type="text"/>	/yd3		
j.	Compaction unit cost	<input type="text"/>	/yd3		
k.	Total drainage material unit cost			h + i + j	\$0.00 /yd3
l.	Drainage material subtotal			k x b	\$0.00
m.	Percent compaction	<input type="text"/>			
	<b>Total drainage material cost</b>			l x (1 + m)	<b>\$0</b>

**IX. Geotextile**

a.	Quantity of geotextile needed	<input type="text"/>	0 acres	x 43,560ft2/ac	0 ft2
b.	Purchase unit cost	<input type="text"/>	/ft2		
c.	Installation unit cost	<input type="text"/>	/ft2		
d.	Total geotextile unit cost			b + c	\$0.00 /ft2
	<b>Total Geotextile Cost</b>			a x d	<b>\$0</b>

**X. Drainage Geocomposite**

a.	Quantity of geonet composite needed	<input type="text"/>	12.4 acres	x 43,560ft2/ac	540,144 ft2
b.	Purchase unit cost	<input type="text"/>	\$0.99/ft2		
c.	Installation unit cost	<input type="text"/>	\$0.20/ft2		
d.	Total geonet composite unit cost			b + c	\$1.19 /ft2
	<b>Total Geonet Composite Cost</b>			a x d	<b>\$642,771</b>

**XI. Anchor Trench**

a.	Length of trench	<input type="text"/>	3,000 LF		
b.	Trenching and backfilling cost	<input type="text"/>	\$3.00/LF		
c.	Total trench unit cost			b	\$3.00 /LF
	<b>Total Anchor Trench Cost</b>			a x b	<b>\$9,000</b>

**XII. Stormwater Controls**

*Diversion Berms*

a.	Total Length of Diversion Berms	<input type="text"/>	2,057 LF		
b.	Diversion berm unit cost	<input type="text"/>	\$26.00/LF		
c.	<i>Subtotal Diversion berm cost</i>			a x b	\$53,482

*Flexamat Stormwater Channels/Downchutes*

d.	Quantity of Flexamat needed	<input type="text"/>	5956 /yd2		
e.	Flexamat Unit Cost	<input type="text"/>	\$65.00 /yd2		
f.	<i>Subtotal flexamat cost</i>			d x e	\$387,111

*Storm Sewer System*

g.	Length of stormsewer pipes	<input type="text"/>	0 yd3		
h.	Stormsewer pipe unit cost	<input type="text"/>	/yd3		
i.	Subtotal stormwater pipe cost			g x h	\$0

*Riprap Inlet/Outlet Protection*

j.	Total Area of riprap	<input type="text"/>	0 ft2		
k.	Riprap unit cost	<input type="text"/>	/ft2		
l.	Subtotal riprap cost			j x k	\$0

**Total Stormwater Control** c + f + i + l **\$440,593**

**Drainage Components Subtotal (VIII + IX + X + XI+ XII): \$1,092,364**

## Landfill Gas and Groundwater Features

### XIII. Landfill Gas Monitoring & Control Components

Calculation

#### Landfill Perimeter System

a. Number of probes to be installed	<input type="text" value="0"/>	probes	Not required	
b. LFG probe unit cost	<input type="text"/>	/probe		
c. <b>Subtotal LFG probe cost</b>			a x b	\$0

#### Landfill Control Systems

d. Area to be closed	<input type="text" value="12.4"/>	acres		
e. Estimated total length of <b>horizontal collectors</b>	<input type="text" value="2201"/>	LF		
f. LFG horizontal collector unit cost	<input type="text" value="\$204"/>	/LF		
g. <b>Subtotal LFG collector cost</b>			d x e x f	\$449,004.00
h. Length of header pipe needed	<input type="text" value="2,000"/>	LF		
i. Header pipe unit cost	<input type="text" value="\$10.00"/>	/LF		
j. Header pipe installation cost	<input type="text" value="\$60.00"/>	/LF		
k. Wellhead and Vertical Riser Cost	<input type="text" value="\$45,000.00"/>	total	6 wellheads/risers x \$7500 each	
l. Isolation Valves	<input type="text" value="\$10,000.00"/>			
m. Drainage Pits	<input type="text" value="\$9,000.00"/>		6 x \$1500 each	
l. 4" FM and 2" Air in Common Trench	<input type="text" value="\$288,000.00"/>		2400ft x \$120 per ft	
m. <b>Subtotal LFG active well hook-up</b>			[h x (i+j)]+k+l+m+l.	\$492,000
<b>Total Landfill Gas Management Cost</b>			c + g + l	\$941,004

### XIV. Groundwater Monitoring Components

Previously Installed

a. Hydrogeologic study cost	<input type="text"/>			
b. Number of wells to be installed	<input type="text"/>	wells		
c. GW Monitoring Well unit cost	<input type="text"/>	/well		
d. Number of wells > 50 ft length	<input type="text"/>	wells		
e. Additional well length over 50 ft	<input type="text"/>	LF/well		
f. Unit cost for additional well length	<input type="text"/>	/LF		
<b>Total Groundwater Monitoring Well Cost</b>			a + (b x c) + (d x e x f)	\$0

**Landfill Gas & Groundwater Features Subtotal (XIII + XIV): \$941,004**

## Miscellaneous

### XV. Removal and Disposal of Stockpiled Material

Calculation

a. Quantity of stockpiled materials	<input type="text"/>	yd3	None associated with landfill	
b. Loading and Hauling unit cost	<input type="text"/>	/yd3		
c. Disposal unit cost	<input type="text"/>	/yd3		
d. <b>Total Removal/Disposal Cost</b>			a x (b + c)	\$0

### XVI. Erosion/Sediment Control

a. Quantity of silt fence needed	<input type="text" value="4,000"/>	LF		
b. Silt Fence unit cost	<input type="text" value="\$4.00"/>	/LF		
<b>Total Silt Fence Cost</b>			a x b	\$16,000

### XVII. Landfill Access Road

Internal and perimeter road improvements

a. Size of LF access road	<input type="text" value="5,000"/>	yd2		45,000 ft2
b. Depth of gravel needed	<input type="text" value="6"/>	inches	x 1yd/36in	833.3 yd3
c. Depth of structural fill needed, average	<input type="text" value="6"/>	inches	x 1yd/36in	833.3 yd3
d. Total material needed			a x (b + c)	1,667 yd3
e. Gravel material unit cost	<input type="text" value="\$71.12"/>	/yd3		
f. Structural fill soil Placement/Spreading unit cost	<input type="text" value="\$15.00"/>	/yd3		
g. Road Geotextile	<input type="text" value="\$0.65"/>	/ft2		
<b>Total access road cost</b>			b x e + c x f + g x a	\$101,015

**XVIII. Site Security**

*Fencing*

a. Length of fencing needed	<input type="text" value="-"/>	ft		
b. Fence unit cost	<input type="text"/>	/ft		
c. <i>Subtotal fencing cost</i>			a x b	\$0

*Gate or Barrier*

d. Number of gates required	<input type="text" value="-"/>			
e. Gate unit cost	<input type="text"/>	/gate		
f. <i>Subtotal gate cost</i>			d x e	\$0

*Closed Sign*

g. Number of signs required	<input type="text" value="1"/>			
h. Sign unit cost	<input type="text" value="\$2,000.00"/>	/sign		
i. <i>Subtotal sign cost</i>			g x h	\$2,000
<b><i>Total site security cost</i></b>			c + f + i	<b>\$2,000</b>

**XIX. Mobilization / Demobilization**

a. Cost for mobilization/demobilization	<input type="text"/>			
<b><i>Total mobilization/demobilization cost</i></b>				<b>\$0</b>

See Below

**Miscellaneous Subtotal (XV + ... + XIX): \$119,015**

**Closure Cost Subtotal (CCS):** (I + ... + XIX) \$5,050,555

**Mobilization / Demobilization (5%):** CCS x 0.05 \$252,528

**Contingency (10%):** CCS x 0.10 \$505,055

**Engineering & Documentation:**

Construction QA/QC (15%) CCS x 0.15 \$757,583

Closure Certification and CQA Report (1%) CCS x 0.01 \$50,506

Survey and as-builts (4%) CCS x 0.04 \$202,022

Cost for survey and deed notation

***Total Engineering & Documentation Costs*** **\$1,016,611**

**Total Closure Cost:** CCS + Contingency + Engineering **\$6,824,749**