EXAMPLE EXAM QUESTIONS

CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL®

EXAMPLE EXAM QUESTIONS

CPESC®
ENVIROCERT

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ENVIROCERT International, Inc.®

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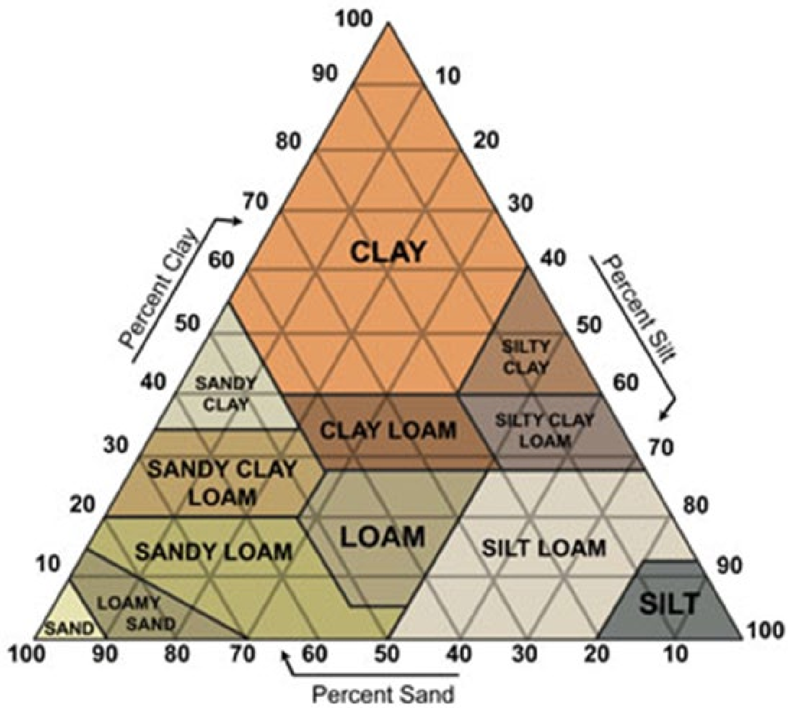
CPESC EXAMPLE EXAM QUESTIONS COMBINED IMPERIAL AND STANDARD INTERNATIONAL VERSION

ECI has provided the following questions as examples as to what to expect on the Certification Exam for CPESC. An answer sheet with a brief explanation is provided after the questions.

Values in italics represent Standard International values. If there are no italics the values are the same in both Imperial and Standard International units.

Example Questions:

Question 1: As a CPESC you have received a soils report with the summary page missing. Within the report you received the following composition of the soil, 48% Sand, 30% Clay, and 22% Silt. Based on the USDA Soil Texture chart below, what is soil type?



a. Clay Loam
b. Loam
c. Sandy Loam
d. Sandy Clay Loam

Question 2: Which of the following soil structures is generally the most erodible?

a. High portions of silt and very fine sand
b. High portion of clay
c. High portion of organic matter
d. High portion of stone

Question 3: All the different modes of sediment transportation by water include:

a. Creep, Saltation, and Suspension
b. Saltation, Suspension, and Solution
c. Traction, Saltation, Suspension, and Solution
d. Crawl, Saltation, Suspension, and Solution

Question 4: Exogenic Forces include:

a. Radioactivity, Rotational, Weathering, and Deposition
b. Weathering, Deposition, Mass Movements, and Erosion
c. Weathering, Heat, Tidal Friction, and Erosion
d. Radioactivity, Mass Movements, Erosion, and Heat

Questions 5 through 16 are based on the following Scenario

You have just purchased a seventy-five (75) acre *(30.35 hectares)* parcel of land to develop as clustered housing.

Site Parameters:

Isoerodent Factor – 125 *(2,127.5)*

Groton Soil – Hydrologic Soil Group A
K factors – A = 0.17 *(0.0224)*, B = 0.17 *(0.0224)*, C = 0.17 *(0.0224)*
Texture – A gr-sl, B gr-sl, C sr-sg

Acton Soil – Hydrologic Soil Group B
K factors – A = 0.20 *(0.0263)*, B = 0.43 *(0.0566)*, C = 0.43 *(0.0566)*
Texture – A fsl, B fsl, C gr-sl

Paxton Soil – Hydrologic Soil Group C

K factors – A = 0.24 *(0.0316)*, B = 0.43 *(0.0566)*, C = 0.17 *(0.0224)*

Texture – A fsl, B fsl, C fsl

Slope Length Factor – LS Factor 1.42 *(1.415)*

0.04 (4.0%) slope, 600 feet *(183 meters)* length

Cover Factor – Small Grain Straw, applied at two (2) tons per acre *(4.94 tonnes per hectare)*. C Factor 0.02 in both imperial and standard international

Practice Factor – Compact and Smooth, except raked with bulldozer or scraper up and down hill. P Factor 1.3 in both imperial and standard international

Estimated Weight of Soil – fsl dry density 80-105 *(1,280-1,680)*

or multiply soil losses in tons by 0.70 *(0.595)*

Isohyetal Value for twenty-four (24) hour storm

2-year storm	3.2 inches	*(8.128 cm)*
10-year storm	5.1 inches	*(12.954 cm)*
100-year storm	7.3 inches	*(18.542 cm)*

Rainfall Distribution – Type 2

RCN Factors –Same in both imperial and standard international

Woods good conditions – A = 30, B = 55, C = 70, D = 77

Meadow – A = 30, B = 58, C = 71, D = 78

Pasture poor condition – A = 68, B = 79, C = 86, D = 89

Farmstead – A = 59, B = 74, C = 82, D = 86

Open Space good condition – A= 39, B = 61, C = 74, D = 80

½ acre Residential *(0.20 hectare Residential)* – A = 54, B = 70, C = 80, D = 85

Newly Graded Areas – A= 77, B = 86, C = 91, D = 94

Impervious – A = 98, B = 98, C = 98, D = 98

Existing Conditions: The site consist of twenty-five (25) acres *(10.12 hectares)* of woods in good condition on Groton soil, twenty (20) acres *(8.09 hectares)* of meadow on Acton Soil, twenty-five (25) acres *(10.12 hectares)* of pasture in poor condition on Paxton soil, and five (5) acres *(2.02 hectares)* of farmstead on Paxton soil.

Proposed Conditions: You will be maintaining the woods and one half (1/2) of the meadow in existing conditions. The remainder of the site will be developed with ten (10) acres *(4.05 hectares)* of open space in good condition on the Acton soil, ten (10) acres *(4.05 hectares)* of open space in good condition on the Paxton soil, with the remaining acreage as one half (1/2) acre *(0.20 hectare)* clustered housing.

Equations

RUSLE – $A = R * K * LS * C * P$

**MUSLE – $T = [95 (V * Q_p)^{0.56}] * K * LS * C * P$, (V = Runoff volume in ac. ft. and Qp = peak runoff in cubic feet per second)

$Y = [89.6 (Q * Q_p)^{0.56} * K * LS * C * P$ *(Q = Runoff volume in cubic meters and Qp = peak runoff rate in cubic meters per second)*

Weighted RCN – Weighted RCN = [Total of each (RCN x area)] / total area

Potential Maximum Retention – $S = (1000 / CN) – 10$

$S = [(1000 / CN) – 10] * 25.4$ (2.54 to convert to centimeters)

Peak Flow Rate – $Q = (P – (0.2 * S))^2 / (P + (0.8 * S))$

Acre-Feet of Runoff = (Q * acres) / 12 inches per foot

*Hectare-Meters = (Q * hectare) / 100*

Slope – Slope = (Rise / Run) then * 100 to get a whole number percentage

Volume – Volume = Length * Width * Depth

Fertilizer – Pounds of Pure Nutrient = (% of Nutrient in mix /100) ∗ Pounds *(kilograms)* of mix

Pure Live Seed (PLS) –Pounds *(kilograms)* of mix ∗ (% Germination / 100) ∗ (% Purity / 100)

**** SEE MUSLE EQUATION SELECTION EXPLANATION AT END OF CPESC EXAMPLE EXAM QUESTIONS ****

Questions

Question 5: Determine the estimated annual soil loss for the open space and clustered housing area during construction.

a. 3,053 tons per year
b. 640 tons per year
c. 3,969 tons per year
d. 76 tons per year

a. 6,845 tonnes per year
b. 1,435 tonnes per year
c. 8,897 tonnes per year
d. 171 tonnes per year

Question 6: Determine the estimated annual soil loss for the open space and clustered housing area if the disturbed area is covered with small grain straw.

a. 79 tons per year
b. 3,96 tons per year
c. 61 tons per year
d. 31 tons per year

a. 71 tonnes per year
b. 357 tonnes per year
c. 55 tonnes per year
d. 27 tonnes per year

Question 7: Determine the estimated cubic yards *(cubic meters)* of soil that will be eroded in a year for the open space and clustered housing acres if the disturbed area is compact and smooth with no cover, except raked with bulldozer or scraper up and down hill. Since there are two (2) methods of converting tons to cubic yards *(cubic meters)*, choose the closest answer (it is an average of the two (2) answers if both methods are used).

a. 2,153 cubic yards per year
b. 3,422 cubic yards per year
c. 3,520 cubic yards per year
d. 2,789 cubic yards per year

a. 1,647 cubic meters per year
b. 2,617 cubic meters per year
c. 2,692 cubic meters per year
d. 2,135 cubic meters per year

Question 8: Determine the estimated sediment yield in tons *(tonnes)* from the construction area for a storm with a Qp = 2.43 cfs *(0.0688 m^3s)* and a runoff of 1.85 inches *(46.99 mm)*.

a. 35 tons from this storm
b. 264 tons from this storm
c. 846 tons from this storm
d. 337 tons from this storm

a. 32 tonnes from this storm
b. 239 tonnes from this storm
c. 769 tonnes from this storm
d. 306 tonnes from this storm

Question 9: Determine the runoff curve number for the site in existing conditions.

a. Weighted RCN = 58
b. Weighted RCN = 60
c. Weighted RCN = 66
d. Weighted RCN = 75

a. Weighted RCN = 58
b. Weighted RCN = 60
c. Weighted RCN = 66
d. Weighted RCN = 75

Question 10: Using the weighted RCN calculated for existing conditions, calculated in Question 9, determine the runoff from the site for the 2-year, 10-year, and 100-year twenty-four (24) hour storms in existing conditions in acre feet *(hectare meters)*.

a. 2-year = 2.56 ac-ft 10-year = 8.50 ac-ft 100-year = 17.63 ac-ft
   2-year = 0.32 hm 10-year = 1.05 hm 100-year = 2.18 hm
b. 2-year = 0.22 ac-ft 10-year = 0.36 ac-ft 100-year = 0.47 ac-ft
   2-year = 3.68 hm 10-year 12.22 hm 100-year = 25.34 hm
c. 2-year = 3.65 ac-ft 10-year = 12.14 ac-ft 100-year = 25.19 ac-ft
   2-year = 0.22 hm 10-year = 0.74 hm 100-year = 1.53 hm.
d. 2-year = 1.79 ac-ft 10-year = 5.95 ac-ft 100-year = 12.34 ac-ft
   2-year = 0.45 hm 10-year = 1.50 hm 100-year = 3.12 hm

Question 11: Determine the runoff curve number for the site in developed conditions.

a. Weighted RCN = 62
b. Weighted RCN = 54
c. Weighted RCN = 60
d. Weighted RCN = 57

a. Weighted RCN = 62
b. Weighted RCN = 54
c. Weighted RCN = 60
d. Weighted RCN = 57

Question 12: Determine the runoff from the site for the 2-year, 10-year, and 100-year storms in proposed conditions in acre feet *(hectare meters)*.

a. 2-year = 2.41 ac-ft 10-year = 9.40 ac-ft 100-year = 19.69 ac-ft
   2-year = 0.30 hm 10-year 0.88 hm 100-year = 2.40 hm
b. 2-year = 0.17 ac-ft 10-year = 0.32 ac-ft 100-year = 0.42 ac-ft
   2-year = 2.72 hm 10-year 10.10 hm 100-year = 21.79 hm
c. 2-year = 1.93 ac-ft 10-year = 7.52 ac-ft 100-year = 15.75 ac-ft
   2-year = 0.24 hm 10-year 0.89 hm 100-year = 1.92 hm
d. 2-year = 1.54 ac-ft 10-year = 6.02 ac-ft 100-year = 12.60 ac-ft
   2-year = 0.19 hm 10-year 0.71 hm 100-year = 1.54 hm

Question 13: Using the slope and length given in the Site Parameters determine the spacing of stone check dams that have a weir height of twelve (12) inches *(30.5 cm)* .

a. 50 feet
b. 40 feet
c. 20 feet
d. 25 feet

a. 15.26 meters
b. 12.21 meters
c. 6.10 meters
d. 7.63 meters

Question 14: In order to connect the sewer system from the site to the nearest public sewer line, the contractor will need to dig a trench two thousand (2,000) feet *(609.6 meters)* long, eight (8) feet *(2.44 meters)* wide, and an average depth of ten (10) feet *(3.05 meters)*. Determine the volume of soil that will be excavated in cubic yards.

a. 5,185 cubic yards
b. 5,926 cubic yards
c. 2,963 cubic yards
d. 6,667 cubic yards

a. 3,970 cubic meters
b. 4,537 cubic meters
c. 2,269 cubic meters
d. 5,104 cubic meters

Question 15: Determine the total amount of fertilizer required for the open space and clustered housing area if the soil test determined the forty-five (45) pounds *(20.41 kilograms)* of nitrogen, fifteen (15) pounds *(6.80 kilograms)* of Phosphorus, and twenty (20) pounds *(9.07 kilograms)* of potassium are required per acre. The available mixes available at the fertilizer plant are 5-0-15, 15-10-0, and 28-0-0.

a. 14,663 pounds
b. 17,762 pounds
c. 13,594 pounds
d. 21,108 pounds

a. 6,654 kilograms
b. 8,060 kilograms
c. 6, 169 kilograms
d. 9,578 kilograms

Question 16: Determine the total pounds *(kilograms)* of pure live seed that are required to plant the open space and clustered housing area, less 25% of the clustered housing area. The seed mix that has been proposed has a germination rate of 85% and a purity of 80%. The Landscape Architect has specified twenty (20) pounds *(9.07 kilograms)* of pure live seed per acre.

a. 1,030 pounds
b. 968 pounds
c. 1,176 pounds
d. 768 pounds

a. 467 kilograms
b. 439 kilograms
c. 533 kilograms
d. 348 kilograms

Question 17: Which of the following is not a consideration when developing a sequence of construction?

a. Runoff conveyance system
b. Building construction
c. Inspection scheduling
d. Surface stabilization

Question 18: Which of the following is a factor that affects runoff from your property?

a. Stormwater conveyance systems
b. Surrounding land uses
c. Duration of construction
d. Antecedent moisture

Question 19: Which of the following is a site planning and management practice?

a. Tree Protection
b. Rolled Erosion Control Product
c. Skimmers
d. Outlet Protection

Question 20: Which of the following is a form of evapotranspiration?

a. Adsorption
b. Sublimation
c. Detachment
d. Weathering

Question 21: You are going to apply straw mulch on a disturbed area at 2,000 pounds per acre *(2,241.70 kilograms per hectare)*. If one bale of straw weighs about 85 pounds *(38.56 kilograms)*, how many bales of straw will you need to order to apply the specified straw mulch the surface of 6 acres *(2.43 hectares)*?

a. 118

b. 134

c. 142

d. 150

Question 22: A drop of 14.2 feet *(4.33 meters)* in elevation over a horizontal distance of 168 feet *(51.21 meters)* represents a slope of:

a. 9.5 percent

b. 8.5 percent

c. 7.6 percent

d. 1.5 percent

Question 23: Three (3.0) tons per acre *(6.73 tonnes per hectare)* are eroded annually from a 2-acre *(0.81 hectare)* field where the surface soil has a bulk density of 94 pounds per cubic foot *(1,505.74 kilograms per cubic meter)*. About how many years will it take for a 0.5-inch *(12.70 millimeter)* thick layer of soil to erode from the field?

Conversion factors - 43,560 square feet per acre
10,000 square meters per hectare
2,000 pounds per ton
1,000 kilograms per tonne

a. 28.4
b. 14.2
c. 42.6
d. 56.8

Question 24: In a direct volume measurement of channel bank erosion, the following field data was gathered: 750 feet *(228.60 meters)* of stream channel over a 20-year period increased in width from 10 feet *(3.05 meters)* to 33 feet *(10.06 meters)*. The average height of the stream banks is 9 feet *(2.74 meters)* and the soils weigh 96 pounds per cubic foot *(1,537.77 kilograms per cubic meter)*.

The average annual channel erosion rate in tons/year *(tonnes/year)* is:

Conversion factors - 2,000 pounds per ton
1,000 kilograms per tonne

a. 663 tons/year	*601 tonnes per year*
b. 745 tons/year	*676 tonnes per year*
c. 186 tons/year	*169 tonnes per year*
d. 373 tons/year	*338 tonnes per year*

Question 25: A storm drops 0.75 inches *(19.05 millimeters)* of rainfall on a 4-acre *(1.62 hectare)* construction site. Two-thirds (67%) of the rainfall infiltrates and one-third (33%) becomes surface runoff which flows to a sediment basin. Approximately how many cubic feet *(cubic meters)* of water flow to the sediment basin?

Conversion factors - 43,560 square feet per acre
10,000 square meters per hectare

a. 3,594 cu. ft. *102 cu. meters*

b. 7,296 cu. ft. *207 cu. meters*

c. 2,586 cu. ft. *73 cu. meters*

d. 5,624 cu. ft. *159 cu. Meters*

Question 26: The engineer has designed a sediment basin to handle a 24-hour storm event having a direct runoff of 0.32 acre-feet *(0.04 hectare meters)*. The contractor has been directing the dewatering pump discharge into the sediment basin. The pump is discharging some sediment into the basin. Considering that one (1) acre foot equals 328,582 +/- gallons *((1) hectare meter equals 10,000,000 liters)*, what is the maximum pump rate that would result in the same particle size removal when there is no rain?

Conversion factors -	43,560 square feet per acre
	10,000 square meters per hectare
	7.48 gallons per cubic foot
	1,000 liters per cubic meter

a. 50 gallons per minute (gpm)	*189 liters per minute (lpm)*
b. 100 gpm	*378 lpm*
c. 70 gpm	*275 lpm*
d. No limit	*no limit*

Question 27: The project landscape architect has determined that an area about 1,000 feet *(304.8 meters)* long by 100 feet *(30.5 meters)* wide will require the use of a rolled erosion control product (RECP). If each RECP is about 10 feet *(3.05 meters)* wide and 90-feet *(27.4 meters)* long. About how many rolls of material will be required to cover this area? Assume an additional 10 inches *(254 millimeters)* of material is required at the top for each roll installed and the overlap for the edge of each blanket will be approximately 8 inches *(203.2 millimeters)*.

a. Less than 110 rolls

b. 150 – 155 rolls

c. 110 – 115 rolls

d. 130 – 135 rolls

Question 28: Prior to grading, silt fence will be placed on the contour on the southeast part of the project to protect Ventura Creek. The graded area is 1,000-feet long *(304.8 meters)* and 50-feet deep *(15.24 meters)*, sloping up from the toe at 50 percent (2:1). The soil is reported to be Hydrologic Soil Group C with a CN of 91. With an effective height of 1.5 feet *(0.46 meters)*, approximately how far from the toe should the fence be placed to contain the runoff from a 3.0-inch *(76.2 millimeter)* rainfall resulting in 2.0 inches *(50.8 millimeters)* of direct runoff and adding 1,000 cubic feet *(28.32 cubic meters)* for sediment storage?

a. 3 feet	0.91 meters
b. 4 feet	1.22 meters
c. 5 feet	1.52 meters
d. 6 feet	1.83 meters

Question 29: A site includes a 400-foot *(122.00 meters)* long fill slope that is 25 feet *(7.62 meters)* high at 16% slope resulting in a LS factor of 7.60 *(7.13)*. The fill soil is reported to be Hydrologic Soil Group B and the K factor of 0.43 *(0.0566)*. The project is an area where the isoerodent map shows a rainfall runoff erosivity factor of 100 *(1,875)*. The fill soil density is 90 pounds per cubic foot *(1,441.00 kilograms per cubic meter)* and costs $25.00 per cubic yard *($32.00 per cubic meter)* to replace.

The following options are being considered to reduce soil losses. Option 1 – Soil is fallow ground (no cover) along with a support practice of compact and smooth, scraped with a bulldozer up and downhill, resulting in a C factor of 1.00 and a P factor of 1.30. Cost installed equals $250.00. Option 2 – Small grain straw mulch is applied at 2 tons per acre *(4.94 tonnes per hectare)* on loose disked soil, resulting in a C factor of 0.02 and a P factor of 1.00. Cost installed equals $1,500.00. Option 3 – Soil is left with a rough irregular surface equipment tracks in all directions and hay applied at 0.5 tons per acre *(1.24 tonnes per hectare)*, resulting in a C factor of 0.25 and a P factor of 0.90. Cost installed equals $,750.00. Option 4 – Soil is compact and smooth, raked with a root rake across the slope with sodding and irrigation, resulting in a C factor of 0.01 and a P factor of 0.90. Cost installed equals $2,000.00.

Using the RUSLE formula (A = R ∗ K ∗ LS ∗ C ∗ P), based on the options above, which of the cover/practice options would cost the most considering the option plus soil replacement at the end of year?

Conversion factors - 43,560 square feet per acre
10,000 square meters per hectare
2,000 pounds per ton
1,000 kilograms per tonne

a. Option 1
b. Option 2
c. Option 3
d. Option 4

Question 30: A site includes a 400-foot *(122.00 meters)* long fill slope that is 25 feet *(7.62 meters)* high at 16% slope resulting in a LS factor of 7.60 *(7.13)*. The fill soil is reported to be Hydrologic Soil Group B and the K factor of 0.43 *(0.0566)*. The project is an area where the isoerodent map shows a rainfall runoff erosivity factor of 100 *(1,875)*. The fill soil density is 90 pounds per cubic foot *(1,441.00 kilograms per cubic meter)* and costs $25.00 per cubic yard *($32.00 per cubic meter)* to replace.

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Using the RUSLE formula ($A = R * K * LS * C * P$), based on the options above, which of the cover/practice options would cost the least considering the option plus soil replacement at the end of year?

Conversion factors -	43,560 square feet per acre
	10,000 square meters per hectare
	2,000 pounds per ton
	1,000 kilograms per tonne

a. Option 1

b. Option 2

c. Option 3

d. Option 4

Photograph 1

Question 31: See Photograph 1. The plan calls for placement of 6-inch (152.00 millimeters) thickness of mulch around the top of a rectangular pond that has a dimension of 350 feet *(106.68 meters)* by 120 feet *(36.58 meters)*. The plan width is noted as 25 feet *(7.62 meters)*. The supplier has noted that the density of mulch will be 75% of what it will be in place after settling. What volume of mulch will need to be ordered?

a. 482 cubic yards *368 cubic meters*
b. 642 cubic yards *490 cubic meters*
c. 362 cubic yards *276 cubic meters*
d. 2,519 cubic yards *961 cubic meters*

**** MUSLE Equation Selection Explanation**

ECI has researched the MUSLE equation and made a comparison of results between the Imperial (US) and Standard International (SI) equations using a direct conversion of 1.016047 US tons to one (1) SI tonne[1]. During our research, several versions of both the US and SI formulas were found.

In example, equations in US units included:

$$T=95(V*Q_p)^{0.56}*K*LS*C*P$$

$$T=12.2(V*Q_p)^{0.56}*K*LS*C*P$$

$$T=1(V*Q_p)^{0.56}*K*LS*C*P$$

Equations in SI included:

$$Y=89.6(Q*Q_p)^{0.56}*K*LS*C*P$$

$$Y=11.8(Q*Q_p)^{0.56}*K*LS*C*P$$

$$Y=1(Q*Q_p)^{0.59}*K*LS*C*P$$

In all cases the K, LS, C, and P factors were the same when conversion factors were used as referenced in either the RUSLE manual[2] or NIST[1] special publication. The main change noticed was that the first constant used in the equation varied depending on the characteristics of the watershed being studied. While the second constant varied slightly in one (1) of the SI equations, also dependent on the characteristics of the watershed, an insignificant change in the results was noted. Calculations were then performed using the two (2) most commonly referenced equations:

US - $T=95(V*Q_p)^{0.56}*K*LS*C*P$

SI - $Y=11.8(Q*Q_p)^{0.56}*K*LS*C*P$

Results varied by a factor of 8.7+/- when applying a direct conversion between the results from the two (2) equations. ECI then compared results from US and SI equations with similar first constants and the results were within 5% +/- when applying a direct conversion of the results. Thus, ECI will continue to use:

$$T=95(V*Q_p)^{0.56}*K*LS*C*P \text{ for US calculations}$$

and will use:

$$Y=89.6(Q*Q_p)^{0.56}*K*LS*C*P \text{ (SI) equation for SI calculations}$$

in these example questions and for the CPESC examination.

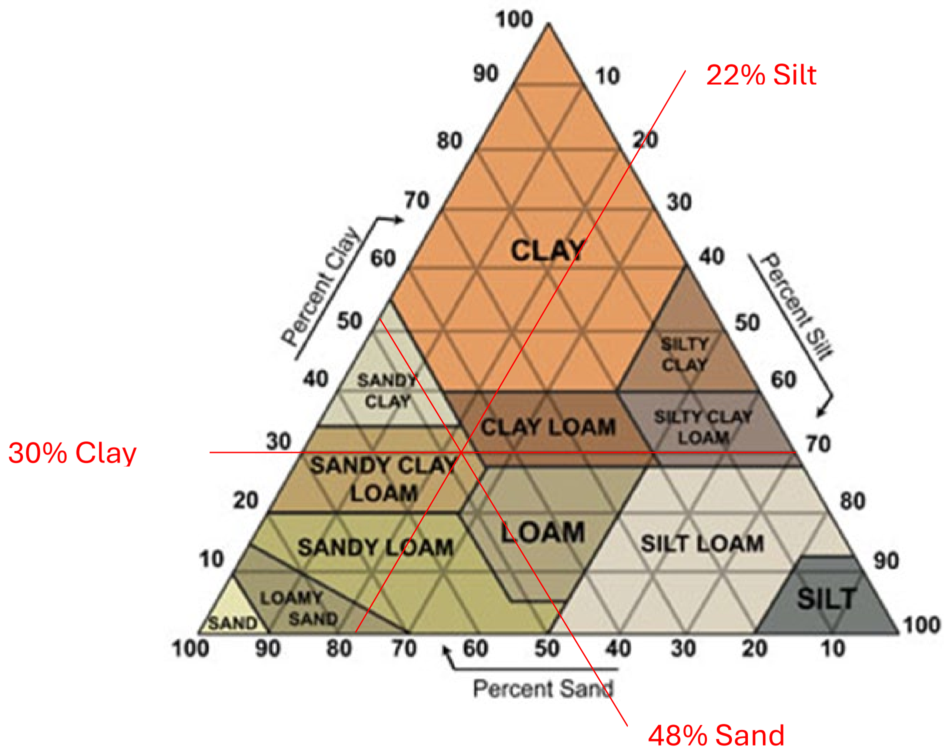
It is up to the professional using the MUSLE equation to verify with the local jurisdiction which values for each constant are to be used for your calculations.

[1]*National Institute of Standards and Technology (NIST) Special Publication 1038, The International System of Units (SI) - Conversion Factors for General Use,* National Institute of Standards and Technology, Technology Administration, 2006

[2]*Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE),* USDA, Agricultural Research Service, Agricultural Handbook Number 703, 1997

CPESC ANSWER SHEET WITH ANNOTATED ANSWERS

Question 1: The correct answer is d. See the USDA Soil Texture chart below.



a. Is incorrect because the percentage of Clay would need to be 55% or more and the percentage of Sand would need to be 45% or less
b. Is incorrect because the percentage of Silt would need to be 28% or more and the percentage of Clay would need to be 28% or less
c. Is incorrect because the percentage of Clay would need to be 48% or less and the percentage of Sand would need to be 52% or more

Question 2: The correct answer is a. A high portion of very fine sands and silts will increase the erodibility of the soil due to lack of cohesive forces within the soil structure.

b. Is incorrect because a high portion of clay generally makes a soil less erodible
c. Is incorrect because a high portion of organic material generally makes a soil less erodible
d. Is incorrect because stone is not typically considered a component of soil and requires greater forces to be dislodged.

Question 3: The correct answer is c. The other three answers are either wind transport, are missing a type of transport, or a combination of water and wind transport methods.

a. Is incorrect because these are the methods of transportation by wind
b. Is incorrect because it does not include Traction in which particles do not become suspended but roll along the bed of the water body
d. Is incorrect because Creep is a type of transportation by wind

Question 4: The correct answer is b. The other three answers contain Endogenic forces.

a. Is incorrect because Radioactivity and Rotational are Endogenic forces
c. Is incorrect because Heat and Tidal Forces are Endogenic forces
d. Is incorrect because Radioactivity and Heat are Endogenic forces

For Questions 5 through 16, the following annotated answers show the required calculation steps performed to achieve the answer. If you calculate a different answer, please verify that you used the proper data as provided in the Site Parameters

Question 5:

You will be using the RUSLE equation, A = R ∗ K ∗ LS ∗ C ∗ P, to determine the answer

Step 1 - Collect the data

Area of calculation - The wooded area, twenty-five (25) acres *(10.12 hectares)* and one half (1/2) of the meadow area, twenty (20 acres / 2 = ten (10) acres) *(8.09 hectares / 2 = 4.04 hectares)*, are to remain as is, reducing the area of the site under consideration by thirty-five (35) acres *(14.16 hectares)*.

Open space area =	10 acres *(4.05 hectares)* Acton soils
Open space area =	10 acres *(4.05 hectares)* Paxton soils
Clustered housing =	20 acres *(8.09 hectares)* Paxton soils
	40 acres *(16.19 hectares)*

R value given	125	*(2,2127.5)*

K value - Since the question states that this is during construction, we assume that the topsoil has been stripped and the B layer has been exposed.

Acton soils B layer=	0.43	*(0.0566)*
Paxton soils B layer =	0.43	*(0.0566)*
LS value given	1.42	*(1.415)*
C value (no description given use)	1.0	
P value (no description given use)	1.0	

Step 2 – Plug data into the RUSLE equation - A = R ∗ K ∗ LS ∗ C ∗ P

A = 125 ∗ 0.43 ∗ 1.42 ∗ 1.0 ∗ 1.0 = 76.33 tons per acre per year

A = 2,127.5 ∗ 0.0566 ∗ 1.415 ∗ 1.0 ∗ 1.0 = 170.39 tonnes per hectare per year

Step 3 – Convert from acre to area under consideration

76.33 ∗ 40 = **3,053 tons per year**

Convert from hectare to area under consideration

170.39 ∗ 16.19 = ***2,759 tonnes per year***

Question 6:

You will be using the RUSLE equation, A = R ∗ K ∗ LS ∗ C ∗ P, to determine the answer

Step 1 - Collect the data

Since this problem is the same with the exception of the C factor all the other data remains the same as in Question 5.

C value 0.02

Step 2 – There are two (2) methods you can use to solve this problem.

Method 1. You can repeat Step 2 and Step 3 as in Question 5

A = 125 ∗ 0.43 ∗ 1.42 ∗ 0.02 ∗ 1.0 = 1.53 tons per acre per year

A = 2,127.5 ∗ 0.0566 ∗ 1.415 ∗ 0.02 ∗ 1.0 = 3.41 tonnes per hectare per year

1.53 ∗ 40 = **61 tons per year**

3.41 ∗ 16.19 = ***55 tonnes per year***

or

Method 2. You can multiply the answer from Question 5 by the factor of change for the C factor (1.0 ∗ 0.02 = 0.02)

3,053 ∗ 0.02 = **61 tons per year**

2,759 ∗ 0.02 = ***55 tonnes per year***

Question 7:

You will be using the RUSLE equation, A = R ∗ K ∗ LS ∗ C ∗ P, and the estimated weight of soil from the Site Parameters to determine the answer.

Step 1 - Collect the data

Since this problem is the same with the exception of the P factor all the other data remains the same as in Question 5.

P value 1.3

Estimated weight of soil	multiply soil losses in tons by 0.70 *(0.60)*
or	fsl dry density 80-105 *(1,280 – 1,680)*

Step 2 – There are two (2) methods you can use to solve this portion of the problem.

Method 1. You can repeat Step 2 and Step 3 as in Question 5

A = 125 ∗ 0.43 ∗ 1.42 ∗ 1.0 ∗ 1.3 = 99.22 tons per acre per year

A = 2,127.5 ∗ 0.0566 ∗ 1.415 ∗ 1.0 ∗ 1.3 = 221.51 tonnes per hectare per year

99.22 ∗ 40 = **3,969 tons per year**

*221.51 ∗ 16.19 = **3,586 tonnes per year***

or

Method 2. You can multiply the answer from Question 5 by the factor of change for the P factor (1.0 ∗ 1.3 = 1.3)

3,053 ∗ 1.3 = **3,969 tons per year**

*2,759 ∗ 1.3 = **3,587 tonnes per year***

Step 3 – There are two (2) methods you can use to solve this portion of the problem.

Method 1. Multiply the tons by the conversion factor provided, 0.70 *(0.69)*

3,969 ∗ 0.70 = **2,778 cubic yards per year**

3,586 ∗ 0.595 = ***2,134 cubic meters per year***

or

Method 2. Since the Acton and Paxton soils are both fsl in the B layer use the air-dry density of 105 *(1,680)*. Typically, you would receive an exact air-dry density weight from the soils report and would use that to perform the calculations.

(3,969 tons) ∗ (2000 lbs./ton) ∗ (ft^3/105 lbs.) ∗ (cy/27 ft^3) = **2,800 cy**

(3,587 tons) ∗ (1000 kg/tonne) ∗ (cm^3/1,680) ∗ (cm/1 m^3) = **2,135 m^3**

Question 8:

You will be using the MUSLE equation, T = [95 (V ∗ Q_p)$^{0.56}$] ∗ K ∗ LS ∗ C ∗ P, (V = Runoff volume in ac. ft. and Qp = peak runoff in cubic feet per second) *Y = [89.6 (Q ∗ Q_p)$^{0.56}$ ∗ K ∗ LS ∗ C ∗ P (Q = Runoff volume in cubic meters and Qp = peak runoff rate in cubic meters per second)* to determine the answer.

Step 1 – Collect the Data

The data remains the same as in Question 5 excepting that you will not be using the R factor but will be using the Q_p and runoff provided in the question.

Q_p value given	2.43 cfs *(0.0688 m^3s)*
V *(Q)* value given	1.85 inches *(46.99 millimeters)*

Step 2 – Calculate the V *(Q)* using the Runoff and disturbed acres for the site.

First convert runoff from inches to feet by either multiplying 1.85 inches ∗ 1/12 or dividing 1.85 inches / by 12

1.85 ∗ 1/12 = 0.1542 or 1.85 / 12 = 0.1542

Then multiply the runoff in feet by the disturbed area of 40 acres

0.1542 x 40 = 6.168-acre feet

First convert the disturbed area of 16.19 hectare to square meters, multiply hectares by 10,000 to get m^2 per hectare, 16.19 ∗ 10,000 = 161,900 square meters

Second convert millimeters to meters, 46.99 / 1,000 = 0.0470 meters

Third multiply square meters by meters, 0.0470 ∗ 161,900 = 7,609 cubic meters of runoff

Step 3 – Plug data into the MUSLE equation - $T = [95 (V * Q_p)^{0.56}] * K * LS * C * P$

Please make sure that you perform the math in the proper mathematical order

$T = [95 * (6.168 * 2.43)^{0.56}] * 0.43 * 1.42 * 1.0 * 1.0$

$T = [95 * (14.988)^{0.56}] * 0.43 * 1.42 * 1.0 * 1.0$

$T = [95 * 4.554] * 0.43 * 1.42 * 1.0 * 1.0$

$T = 432.63 * 0.43 * 1.42 * 1.0 * 1.0$

T = **264 tons from this storm**

Plug data into the MUSLE equation - $T = [11.8 * (Q * Qp)^{0.56}] * K * LS * C * P$

Please make sure that you perform the math in the proper mathematical order

$T = [89.6 * (7,609 * 0.0688)^{0.56}] * 0.0566 * 1.415 * 1.0 * 1.0$

$T = [89.6 * (523.4992)^{0.56}] * 0.0566 * 1.415 * 1.0 * 1.0$

$T = [89.6 * 33.3114] * 0.0566 * 1.415 * 1.0 * 1.0$

$T = 2,984.7014 * 0.0566 * 1.415 * 1.0 * 1.0$

T = ***239 tonnes from this storm***

Question 9:

You will be using the Weighted RCN equation, RCN = [Total of each (RCN x area)] / total area, to determine the answer.

Step 1 – Collect the Data

Determine the area and RCN for each land cover and soil type

Woods in good condition – 25 acres *(10.12 hectares)*,
RCN 30 (Groton = Hydrologic group A)

Meadow – 20 acres *(8.09 hectares)*,
RCN 58 (Acton = Hydrologic group B)

Pasture in poor condition – 25 acres *(10.12 hectares)*,
RCN 86 (Paxton = Hydrologic group C)

Farmstead – 5 acres *(2.02 hectares)*,
RCN 82 (Paxton = Hydrologic group C)

Step 2 – Plug the data into the Weighted RCN equation

Weighted RCN = [Total of each (RCN x area)] / total area

Weighted RCN = [(25 ∗ 30) + (20 ∗ 58) + (25 ∗ 86) + (5 ∗ 82)] / 75

Weighted RCN = [750 + 1,160 + 2,150 + 410] / 75

Weighted RCN = 4,470 / 75

Weighted RCN = 59.6

Rounded to the nearest whole number - **Weighted RCN = 60**

Plug the data into the Weighted RCN equation

Weighted RCN = [Total of each (RCN x area)] / total area

Weighted RCN = [(10.12 ∗ 30) + (8.09 ∗ 58) + (10.12 ∗ 86) + (2.02 ∗ 82)] / 30.35

Weighted RCN = [303.60 + 469.22 + 870.32 + 165.64] / 30.35

Weighted RCN = 1,808.78 / 30.35

Weighted RCN = 59.6

Rounded to the nearest whole number - ***Weighted RCN = 60***

Question 10:

You will be using the Potential Maximum Retention equation, S = (1000 / CN) – 10 *(S = [(1000 / CN) – 10] ∗ 25.4 (2.54 to convert to centimeters))*, the Peak Flow Rate equation, $Q = (P - 0.2S)^2 / (P + 0.8S)$, and the Acre feet of Runoff equation, (Q ∗ acres) / 12 inches per foot *(Hectare-Meters = (Q ∗ hectare) / 100)*, to determine the answers.

Step 1 – Collect the Data

Area of site = 75 acres *(30.35 hectare)*
RCN from Question 9 = 60 *(60)*
2-year 24-hour storm rainfall = 3.2 inches *(8.128 cm)*
10-year 24-hour storm rainfall = 5.1 inches *(12.954 cm)*
100-year 24-hour storm rainfall = 7.3 inches *(18.542 cm)*

Step 2 – Calculate S using the potential maximum retention equation,

S = (1000 / 60) – 10	*S = [(1000 / CN) – 10] ∗ 2.54*
S = 6.67	*S = 16.93*

Step 3 – Calculate the potential maximum retention equation, for each storm using the Peak Flow Rate equation, $Q = (P - 0.2 * S)^2 / (P + 0.8 * S)$ and then determine the acre feet *(hectare meters)* of runoff using the acre-feet of runoff equation *(hectare meter of runoff equation)* acre-feet of runoff= (Q ∗ acres) / 12 inches per foot *(hectare-meters = (Q ∗ hectare) / 100)*

Please make sure that you perform the math in the proper mathematical order

2-year storm

$Q = (3.2 – (0.2 * 6.67))^2 / (3.2 + (0.8 * 6.67))$
Q = (3.482) / (8.536) thus Q = 0.41 inches
Acre-feet of Runoff= (0.41 ∗ 75 acres) / 12 inches per foot
Acre-feet of Runoff= (30.75) / 12 inches per foot
Acre- feet of Runoff= **2.56 acre-feet**

2-year storm

Q = (8.128 – (0.2 ∗ 16.93))^2 / (8.128 + (0.8 ∗ 16.93))

Q = (22.487) / (21.672) thus Q = 1.04 cm

Hectare meters of Runoff= (1.04 ∗ 30.35 hectares) / 100 cm per meter

Hectare meters of Runoff= (31.564) / 100 cm per meter

*Hectare meters of Runoff= **0.316 hectare-meter***

10-year storm

Q = (5.1 – (0.2 ∗ 6.67))^2 / (5.1 + (0.8 ∗ 6.67))

Q = (14.183) / (10.436) thus Q = 1.36 inches

Acre-feet of Runoff= (1.36 ∗ 75 acres) / 12 inches per foot

Acre-feet of Runoff= (102.00) / 12 inches per foot

Acre- feet of Runoff= **8.50 acre-feet**

10-year storm

Q = (12.954.128 – (0.2 ∗ 16.93))^2 / (12.954 + (0.8 ∗ 16.93))

Q = (91.547) / (26.498) thus Q = 3.46 cm

Hectare meters of Runoff= (3.46 ∗ 30.35 hectares) / 100 cm per meter

Hectare meters of Runoff= (105.001) / 100 cm per meter

*Hectare meters of Runoff= **1.050 hectare-meter***

100-year storm

Q = (7.3 – (0.2 ∗ 6.67))^2 / (7.3 + (0.8 ∗ 6.67))

Q = (35.593) / (12.636) thus Q = 2.82 inches

Acre-feet of Runoff= (2.82 ∗ 75 acres) / 12 inches per foot

Acre-feet of Runoff= (211.50) / 12 inches per foot

Acre- feet of Runoff= **17.63 acre-feet**

100-year storm

Q = (18.452 – (0.2 ∗ 16.93))^2 / (18.452 + (0.8 ∗ 16.93))

Q = (229.704) / (31.996) thus Q = 7.18 cm

Hectare meters of Runoff= (7.18 ∗ 30.35 hectares) / 100 cm per meter

Hectare meters of Runoff= (217.841) / 100 cm per meter

*Hectare meters of Runoff= **2.178 hectare-meter***

Question 11:

You will be using the Weighted RCN equation, RCN = [Total of each (RCN * area)] / total area, to determine the answer.

Step 1 – Collect the Data

Determine the acreage and RCN for each land cover and soil type

Woods in good condition – 25 ac *(10.12 hectares)*, RCN 30
(Groton = Hydrologic group A)

Meadow – 10 ac *(4.04 hectares)*, RCN 58
(Acton = Hydrologic group B)

Open Space good Condition – 10 ac (4.04 hectares), RCN 61
(Acton = Hydrologic group B)

Open Space good Condition – 10 ac *(4.04 hectares)*, RCN 74
(Paxton = Hydrologic group C)

1/2 acre Lots – 20 ac (8.09 hectares), RCN 80
(Paxton = Hydrologic group C)

Step 2 – Plug the data into the Weighted RCN equation

Weighted RCN – CN = [Total of each (RCN x area)] / total area

Weighted RCN = [(25 ∗ 30) + (10 ∗ 58) + (10 ∗ 61) + (10 ∗ 74) + (20 ∗ 80)] / 75

Weighted RCN = [750 + 580 + 610 + 740 + 1,600] / 75

Weighted RCN = 4,280 / 75

Weighted RCN = 57.1

Rounded to the nearest whole number - **Weighted RCN = 57**

Plug the data into the Weighted RCN equation

Weighted RCN = [Total of each (RCN x area)] / total area

Weighted RCN = [(10.12 ∗ 30) + (4.04 ∗ 58) + (4.04 ∗ 61) + (4.04 ∗ 74) + (8.09 ∗ 80)] / 30.35

Weighted RCN = [303.60 + 234.32 + 246.44 + 298.96 + 647.20] / 30.35

Weighted RCN = 1,730.52 / 30.35
Weighted RCN =57.021
Rounded to the nearest whole number - ***Weighted RCN = 57***

Question 12:

You will be using the Potential Maximum Retention equation, S = (1000 / CN) – 10 *(S = [(1000 / CN) – 10] ∗ 25.4 (2.54 to convert to centimeters))*, the Peak Flow Rate equation, $Q = (P - 0.2S)^2 / (P + 0.8S)$, and the Acre feet of Runoff equation, (Q ∗ acres) / 12 inches per foot *(Hectare-Meters = (Q ∗ hectare) / 100)*, to determine the answers.

Step 1 – Collect the Data

Area of site = 75 acres *(30.35 hectares)*
RCN from Question 11 = 57 *(57)*
2-year 24-hour storm rainfall = 3.2 inches *(8.128 cm)*
10-year 24-hour storm rainfall = 5.1 inches *(12.954 cm)*
100-year 24-hour storm rainfall = 7.3 inches *(18.542 cm)*

Step 2 – Calculate S using the potential maximum retention equation,

S = (1000 / CN) – 10	*S = [(1000 / CN) – 10] ∗ 2.54*
S = (1000 / 57) – 10	*S = [(1000 / 57) – 10] ∗ 2.54*
S = 7.54	*S = 19.16*

Step 3 - Calculate the potential maximum retention equation, for each storm using the Peak Flow Rate equation, $Q = (P - 0.2 * S)^2 / (P + 0.8 * S)$ and then determine the acre feet *(hectare meters)* of runoff using the acre-feet of runoff equation *(hectare meter of runoff equation)* acre-feet of runoff= (Q ∗ acres) / 12 inches per foot *(hectare-meters = (Q ∗ hectare) / 100)*

Please make sure that you perform the math in the proper mathematical order

<u>2-year storm</u>

$Q = (3.2 – (0.2 * 7.54))^2 / (3.2 + (0.8 * 7.54))$

$Q = (2.863) / (9.232)$ thus $Q = 0.31$ inches

Acre-feet of Runoff= (0.31 ∗ 75 acres) / 12 inches per foot

Acre-feet of Runoff= (23.25) / 12 inches per foot

Acre- feet of Runoff= **1.94 acre-feet**

<u>2-year storm</u>

$Q = (8.128 – (0.2 * 19.16))^2 / (8.128 + (0.8 * 19.16))$

$Q = (18.456) / (23.456)$ *thus* $Q = 0.79$ *cm*

Hectare meters of Runoff= (0.79 ∗ 30.35 hectares) / 100 cm per meter

Hectare meters of Runoff= (23.977) / 100 cm per meter

Hectare meters of Runoff= ***0.240 hectare-meter***

<u>10-year storm</u>

$Q = (5.1 – (0.2 * 7.54))^2 / (5.1 + (0.8 * 7.54))$

$Q = (12.902) / (11.132)$ thus $Q = 1.16$ inches

Acre-feet of Runoff= (1.16 ∗ 75 acres) / 12 inches per foot

Acre-feet of Runoff= (87.00) / 12 inches per foot

Acre- feet of Runoff= **7.25 acre-feet**

<u>10-year storm</u>

$Q = (12.954.128 – (0.2 * 19.16))^2 / (12.954 + (0.8 * 19.16))$

$Q = (83.211) / (28.282)$ *thus* $Q = 2.94$ *cm*

Hectare meters of Runoff= (2.94 ∗ 30.35 hectares) / 100 cm per meter

Hectare meters of Runoff= (89.229) / 100 cm per meter

Hectare meters of Runoff= ***0.892 hectare-meter***

<u>100-year storm</u>

$Q = (7.3 – (0.2 * 7.54))^2 / (7.3 + (0.8 * 7.54))$

$Q = (33.547) / (13.332)$ thus $Q = 2.52$ inches

Acre-feet of Runoff= (2.52 ∗ 75 acres) / 12 inches per foot

Acre-feet of Runoff= (189.00) / 12 inches per foot

Acre- feet of Runoff= **15.75 acre-feet**

100-year storm

Q = (18.452 – (0.2 ∗ 19.16))^2 / (18.452 + (0.8 ∗ 19.16))

Q = (213.744) / (33.780)   thus   Q = 6.33 cm

Hectare meters of Runoff= (6.33 ∗ 30.35 hectares) / 100 cm per meter

Hectare meters of Runoff= (192.116) / 100 cm per meter

Hectare meters of Runoff= ***1.921 hectare-meter***

Question 13

You will be using the slope equation, Slope = (Rise / Run) then ∗ 100, to determine the answer.

Step 1 – Collect the Data

Slope = 4% (0.04)

Length (run) = 600 feet *(183 meters)*

Weir height (rise) = 12 inches *(30.5 cm)*

Step 2 – Convert the rise to feet

12 inches / 12 inches = 1.0 feet

Convert the rise to meters

30.5 centimeters / 100 centimeters per meter = 0.305 meters

Step 3 – Calculate the required run to determine the spacing of the check dams

4 = [(1.0 / run)] ∗ 100

0.04 = 1.0 / run

Run = 1.0 / 0.04

Run = 25 feet

Calculate the required run to determine the spacing of the check dams

4 = [(0.305 / run)] ∗ 100

0.04 = 0.305 / run

Run = 0.305 / 0.04

Run = 7.63 meters

Question 14

You will be using the volume equation, Volume = Length ∗ Width ∗ Depth, to determine the answer.

Step 1 – Collect the Data

Length = 2,000 feet *(609.6 meters)*
Width = 8 feet *(2.44 meters)*
Depth = 10 feet *(3.05 meters)*

Step 2 – Calculate the volume in cubic feet

Volume = 2,000 ∗ 8 * 10
Volume = 160,000 cubic feet
Calculate the volume in cubic feet
*Volume = 609.6 * 2.44 ∗ 3.05*
Volume = ***4,536.64 cubic meters say 4,537 cubic meters***

Step 3 – Imperial Units only - Convert cubic feet to cubic yards

Volume in Cubic Yards = 160,000 cubic feet / 27
Volume in Cubic Yards = **5,926 cubic yards**

Question 15

You will be using the fertilizer equation, Pounds of Pure Nutrient = (% of Nutrient in mix /100) x Pounds of mix, to determine the answer.

Step 1 – Collect the Data

Disturbed acreage (from question 5) –	40 acres *(16.19 hectares)*
Fertilizer Mix #1 -	5-0-15
Fertilizer Mix #2	15-10-0
Fertilizer Mix #3	28-0-0
Required nitrogen per acre *(per hectare)*	45 pounds *(50.45 kg)*
Required phosphorus per acre *(per hectare)*	15 pounds *(16.82 kg)*
Required potassium per acre *(per hectare)*	20 pounds *(22.42 kg)*

Step 2 - Determine the total amount of each nutrient required for the disturbed area;

Nitrogen 40 acres ∗ 45 pounds = 1,800 pounds required
Nitrogen 16.19 hectares ∗ 50.45 kg = 816.78 kg required
Phosphorus 40 acres ∗ 15 pounds = 600 pounds required
Phosphorus 16.19 hectares ∗ 16.82 kg = 272.32 kg required
Potassium 40 acres ∗ 20 pounds = 800 pounds required
Potassium 16.19 hectares ∗ 22.42 kg = 362.98 kg required

Step 3 - Choose either phosphorus or potassium because there is only one mix that provides either of these nutrients. For this calculation we will calculate phosphorus first, Mix #2.

600 pounds = 10% ∗ pounds Mix #2
600 / 0.10 = 6,000 pounds = required pounds of Mix #2 to meet the phosphorus requirement

272.32 kg = 10% ∗ kg Mix #2
272.32 / 0.10 = 2,723.20 kg = required kg of Mix #2 to meet the phosphorus requirement

Step 4 - However, Mix #2 also provides nitrogen. You need to calculate the amount of nitrogen provided in the 6,000 pounds of Mix #2.

Pounds of nitrogen provided = 15% ∗ 6,000 pounds
Pounds of nitrogen provided with Mix #2 = 900 pounds

However, Mix #2 also provides nitrogen. You need to calculate the amount of nitrogen provided in the 2,723.20 kg of Mix #2.

kg of nitrogen provided = 15% ∗ 2,723.20 kg
kgs of nitrogen provided with Mix #2 = 408.48 kg

Step 5 - Reduce the total nitrogen requirement by the amount of nitrogen provided with Mix #2.

1,800 total pounds - 900 pounds provided with Mix#2 = 900 pounds nitrogen still required
NOTE: Failure to reduce the required nitrogen will result in an over application if nitrogen on the site

Reduce the total nitrogen requirement by the amount of nitrogen provided with Mix #2.

816.78 kg required - 408.48 kg provided with Mix#2 = 408.30 kg of nitrogen still required
NOTE: Failure to reduce the required nitrogen will result in an over application if nitrogen on the site

Step 6 - Calculate the pounds of Fertilizer Mix #3 required to meet the total pounds of potassium required.

800 pounds = 15% ∗ pounds Mix #1
5,333 pounds = required ponds of Mix #1 to meet the potassium requirement

Calculate the pounds of Fertilizer Mix #1 required to meet the total pounds of potassium required.

362.98 kg = 15% ∗ kg Mix #1
2,419.87 kg = required kg of Mix #1 to meet the potassium requirement

Step 7 - Again, Mix #1 also provides nitrogen. You need to calculate the amount of nitrogen provided in the 5,333 pounds of Mix #1.

Pounds of nitrogen provided = 5% ∗ 5,333 pounds
Pounds of nitrogen provided with Mix #1 = 267 pounds

Again, Mix #1 also provides nitrogen. You need to calculate the amount of nitrogen provided in the 2,419.87 kg of Mix #1.

kg of nitrogen provided = 5% ∗ 2,419.87 kg
kg of nitrogen provided with Mix #1 = 120.99 kg

Step 8 - Reduce the total nitrogen requirement by the amount of nitrogen provided with Mix #1.

> 900 total pounds - 267 pounds provided with Mix#1 = 633 pounds nitrogen still required
> NOTE: Failure to reduce the required nitrogen will result in an over application if nitrogen on the site

Reduce the total nitrogen requirement by the amount of nitrogen provided with Mix #1.

> *408.30 kg - 120.99 kg provided with Mix#1 = 287.31 kg nitrogen still required*
> *NOTE: Failure to reduce the required nitrogen will result in an over application if nitrogen on the site*

Step 9 - Calculate the pounds of Fertilizer Mix #3 required to meet the remaining total pounds of nitrogen required.

> 633 pounds = 28% ∗ pounds Mix #3
> 2,261 pounds = required pounds of Mix #3 to meet the remaining nitrogen requirement

Calculate the pounds of Fertilizer Mix #3 required to meet the remaining total kg of nitrogen required.

> *287.31 kg = 28% ∗ kgs Mix #3*
> *1,026.11 kg = required kg of Mix #3 to meet the remaining nitrogen requirement*

Step 10 - Calculate the total pounds *(kg)* of fertilizer required for the site, combining the amounts of all three fertilizer mixes required.

Fertilizer Mix #1	5,333 pounds
Fertilizer Mix #2	6,000 pounds
Fertilizer Mix #3	2,261 pounds
Total pounds of fertilizer required	**13,594 pounds**

Calculate the total pounds *(kg)* of fertilizer required for the site, combining the amounts of all three fertilizer mixes required.

Fertilizer Mix #1	*2,419.87 kg*
Fertilizer Mix #2	*2,723.20 kg*
Fertilizer Mix #3	*1,026.11 kg*
Total pounds of fertilizer required	**6,169.18 kg say 6,619 kg**

FOR INFORMATION PURPOSES ONLY

If you just calculated the amount of nitrogen required using only Mix #3 you would have applied 1,167 pounds of nitrogen more than the site required.

Applying too much nitrogen to soil can lead to excessive foliage growth on plants at the expense of flower and fruit production, weaker root systems, increased susceptibility to pests, soil acidification, and potential water contamination through nitrate leaching, ultimately harming both plant health and the environment.

Applying to much phosphorus to the soil can lead to a nutrient imbalance where plants struggle to absorb other essential minerals such as iron and zinc, resulting in a lack of chlorophyll, resulting in stunted growth and yellow or bleached foliage.

Applying too much potassium to soil can lead to a nutrient imbalance causing plants to struggle to absorb other essential minerals like magnesium, calcium, and iron, hindering their growth and potentially reducing yield.

Question 16

You will be using the Pure Live Seed equation, Pounds of Pure Live Seed = (Pounds of mix ∗ (% Germination / 100) ∗ (% Purity / 100), *(kilograms) of mix ∗ (% Germination / 100) ∗ (% Purity / 100)* to determine the answer.

Step 1 – Collect the Data

Open space area =	10 acres *(4.05 hectares)*Acton soils
Open space area =	10 acres *(4.05 hectares)* Paxton soils
Clustered housing area =	20 acres *(8.09 hectares)* Paxton soils
Less 25% Clustered housing area =	- 5 acres *(2.02 hectares)* Paxton soils
	35 acres *(14.17 hectares)* area
Required Pure Live Seed per acre (hectare)	20 pounds *(22.42 kilograms)*
Seed Mix Germination	85%
Seed Mix Purity	80%

Step 2 - Determine the total amount of each Pure Live Seed provided per pound *(kilogram)* of seed mix;

Pure Live Seed per pound of mix = 1 ∗ (85 / 100) ∗ (80 / 100)
Pure Live Seed per pound of mix = 0.68 pounds
Pure Live Seed per kilogram of mix = 1 ∗ (85 / 100) ∗ (80 / 100)
Pure Live Seed per (kilogram) of mix = 0.68 kilograms)

Step 3 - Determine the total amount of seed mix required to obtain the Pure Live Seed required per disturbed area;

(35 acres ∗ 20 pounds per acre) / 0.68 per pound of mix = **1,030 pounds of seed mix required**

(14.17 hectares ∗ 22.42 kilograms per hectare) / 0.68 per kilogram of mix = ***467 kilograms of seed mix required***

Question 17: The correct answer is C. Inspection scheduling is typically part of the permit, not the sequence.

a. Is considered when planning a construction sequence
b. Is considered when planning a construction sequence
c. Is considered when planning a construction sequence

Question 18: The correct answer is D. The existing antecedent moisture condition prior to a precipitation event will affect runoff. The more water contained in the soil, the less water will infiltrate, thus increasing runoff.

a. Stormwater conveyance systems do not affect the amount of runoff from your site. They are designed to move the runoff generated from a precipitation event either offsite or to a management facility in a non-erosive manner
b. Surrounding land uses do not affect the amount of runoff originating on your site
c. Duration of construction does not affect the runoff generated. The site condition during construction at the time of the precipitation event will affect the runoff generated.

Question 19: The correct answer is A. Tree Protection, along with existing vegetation and scheduling and sequencing are site planning and management practices

b. Rolled Erosion Control Product is an erosion management practice
c. Skimmers are a sediment management practice
d. Outlet Protection is a runoff control practice

Question 20: The correct answer is B. Evapotranspiration includes evaporation, transpiration, and sublimation.

a. Adsorption is factor in soil chemistry
c. Detachment is part of the erosion process
d. Weathering is an erosion process

Question 21

Step 1 – Collect the Data

Mulch required =	2,000 lbs per acre	*2,241.70 kg per hectare*
Straw Bale weight =	85 lbs	*38.56 kg*
Area =	6 acres	*2.43 hectares*

Step 2 – Determine total pounds *(kilograms)* of mulch is required

2,000 pounds ∗ 6 acres = 12,000 pounds

2.241.70 kilograms ∗ 2.43 hectares = 5,447.33 kilograms

Step 3 – Calculate the required number of bales required

12,000 pounds required / 85 pounds per bale
141.2 = required number of bales
Since you cannot use a partial bale round up to the next whole bale
142 bales required

5,447.33 kilograms required / 38.56 kilograms per bale
141.3 = required number of bales
Since you cannot use a partial bale round up to the next whole bale
142 bales required

Question 22

You will be using the slope equation, Slope = (Rise / Run) ∗ 100, to determine the answer.

Step 1 – Collect the Data

Drop (rise) = 14.2 feet	*4.33 meters*
Distance (Run) = 168 feet	*51.21 meters*

Step 2 – Calculate the slope

Slope = (Rise / Run) ∗ 100
Slope = (14.2 / 168) ∗ 100
Slope = 0.085 * 100
Slope = 8.5%

Slope = (Rise / Run) ∗ 100
Slope = (4.33 / 51.21) ∗ 100
*Slope = 0.085 * 100*
Slope = 8.5%

Question 23

Step 1 – Collect the Data

Tons *(tonnes)* lost per year per ac *(ha)* =	3 tons	*6.73 tonnes*
Size of field =	2 acres	*0.81 hectares*
Soil bulk density =	94 lbs/ft3	*1,505.74 kg/m3*
Soil loss =	0.5 inches	*12.70 millimeters*

Step 2 – Determine size of the field in square feet (square meters)

43,560 square feet ∗ 2 acres = 87,120 square feet
10,000 square meters ∗ 0.81 hectares = 8,100.00 square meters

Step 3 – Determine total cubic feet *(cubic meters)* of soil loss

(Square feet in field ∗ soil loss thickness) / 12 inches per foot = cubic feet
(87,120 ∗ 0.5) / 12 = cubic feet
43,560 / 12 = cubic feet
3,630 cubic feet

(m^2 in field ∗ soil loss thickness) / 1,000 mm per m = cubic meters
(8,100 ∗ 12.70) / 1,000 = cubic meters
102,870 / 1,000 = cubic meters
102.87 cubic meters

Step 4 – Determine tons per acre *(tonnes per hectare)* in soil thickness layer

(ft^3 ∗ bulk density pounds per ft^3) / pound per ton = tons per field
(3,600 ∗ 94) / 2,000 = tons
341,220 / 2,000 = tons
170.61 tons

(m^3 ∗ bulk density kilograms per m^3) / 1,000 kg per tonne = cubic meters
(102.87 ∗ 1,505.74) / 1,000 = tonnes
154,895.47 / 1,000 = tonnes
154.90 tonnes

Step 5 – Determine the tons eroded per year *(tonnes eroded per year)*

tons eroded per acre per year ∗ acres = tons eroded per year
3 ∗ 2 = tons eroded per year
6 = tons eroded per year

tonnes eroded per year ∗ hectares = tonnes eroded per year
6.73 ∗ 0.81 = tonnes eroded per year
5.45 = tonnes eroded per year

Step 6 – Determine the numbers of years of soil loss

tons lost / tons eroded per year
170.61 / 6 = number of years of soil loss
28.44 = number of years of soil loss

tonnes lost / tonnes per hectare per year
154.90 / 5.45 = number of years of soil loss
28.42 = number of years of soil loss

Question 24

Step 1 – Collect the Data

Length of stream channel =	750 feet	*228.60 meters*
Previous width of stream =	10 feet	*3.05 meters*
Current width of stream =	33 feet	*10.06 meters*
Stream bank height =	9 feet	*2.74 meters*
Years of erosion =	20	*20*
Soil weight =	96 lbs/ ft3	*1,537.77 kg/m3*

Step 2 – Determine the amount of soil lost in cubic feet (cubic meters)

Soil loss = Stream length * (current width - previous width) * bank height
Soil Loss = 750 * (33 - 10) * 9
Soil Loss = 155,250.00 cubic feet

*Soil loss = Stream length * (current width - previous width) * bank height*
*Soil Loss = 228.60 * (10.06 – 3.05) * 2.74*
Soil Loss = 4,396.19 cubic meters

Step 3 – Determine the amount of soil lost per year

Soil loss per year = soil loss from step 2 / number of years
Soil Loss = 155,250 / 20
Soil Loss = 7,762.50 cubic feet per year

Soil loss per year = soil loss from step 2 / number of years
Soil Loss = 4,396.19 / 20
Soil Loss = 219.54 cubic meters per year

Step 4 – Determine the tons (tonnes) of soil lost per year

Tons of soil loss per year = soil weight * soil loss per year / lbs in ton
Tons of soil loss per year = 7,762.50 * 96 / 2000
Tons of soil loss per year = 372.60 tons per year

*Tonnes of soil loss per year = soil weight * soil loss per year / kg in tonne*

Tonnes of soil loss per year = 219.54 ∗ 1,537.77 / 1,000

Tonnes of soil loss per year = 337.60 tonnes per year

Question 25

Step 1 – Collect the Data

Rainfall =	0.75 inches	*19.05 millimeters*
Site =	4 acres	*1.62 hectares*
Infiltration percentage =	67%	*67%*
Runoff percentage =	33%	*33%*

Step 2 – Determine the amount of rainfall in feet (meters)

Rainfall in feet = rainfall in inches / 12 inches per foot
Rainfall in feet = 0.75 / 12
Rainfall in feet = 0.0625

Rainfall in meters = rainfall in inches / 1,000 millimeters per meter
Rainfall in meters = 19.05 / 1,000
Rainfall in meters = 0.0191

Step 3 – Determine the amount of cubic feet (cubic meters) of rainfall

Cubic feet of rainfall = acres of site ∗ feet of rainfall ∗ 43,560 square feet in an acre
Cubic feet of rainfall = 4 ∗ 0.0625 ∗ 43,560
Cubic feet of rainfall = 10,890 cubic feet

Cubic meters of rainfall = hectares of site ∗ meters of rainfall ∗ 10,000 square meters in a hectare
Cubic meters of rainfall = 1.62 ∗ 0.0191 ∗ 10,000
Cubic meters of rainfall = 309 cubic meters

Step 4 – Determine the cubic feet (cubic meters) of runoff

Cubic feet of runoff to basin = cubic feet of rainfall ∗ % of runoff
Cubic feet of runoff to basin = 10,890 ∗ 33%
Cubic feet of runoff to basin = 3,594

Cubic meters of runoff to basin = cubic feet of rainfall ∗ % of runoff
Cubic meters of runoff to basin = 309 ∗ 33%
Cubic meters of runoff to basin = 102

Question 26

Step 1 – Collect the Data

Storm Event =	24 hour	24 hour
Direct Runoff =	*0.32 acre feet*	*0.04 hectare meters*

Step 2 – Convert hours to minutes (conversion in both Imperial Units and Standard International Units is the same)

Number of minutes = number of hours ∗ 60 minutes per hour
Number of minutes = 24 ∗ 60
Number of minutes = 1,440

Step 3 – Determine the number of gallons *(liters)* of direct runoff

Gallons of direct runoff = acres feet of direct runoff ∗ 43,560 square feet in an acre ∗ gallons in cubic foot
Gallons of direct runoff = 0.32 ∗ 43,560 ∗ 7.48
Gallons of direct runoff = 104,265

Liters of direct runoff = hectare meters of direct runoff ∗ 10,000 square meters in a hectare ∗ liters in cubic meter
Liters of direct runoff = 0.04 ∗ 10,000 ∗ 1000
Liters of direct runoff = 400,000

Step 4 – Determine gallons per minute (liters per minute)

Gallons per minute = cubic feet of direct runoff / minutes

Gallons per minute = 104,265 / 1,440

Gallons per minute = 72.4

Liters per minute = cubic meters of direct runoff / minutes

Liters per minute = 400,000 / 1,440

Liters per minute = 277.7

Question 27

Step 1 – Collect the Data

Area size =	1,000 ft. x 100 ft.	*304.8 m x 30.5 m*
Top anchor required =	10 inches	*254.0 millimeters*
Overlap required =	8 inches	203.2 millimeters
Roll width =	10 feet	*3.05 meters*
Roll length =	100 feet	*30.5 meters*

Step 2 – Convert top anchor and overlap required to feet *(meters)*

Top anchor = 10 inches / 12 inches per foot

Top anchor = 0.83 feet

Overlap = 8 inches /12 inches per foot

Overlap = 0.67 feet

Top anchor = 254 millimeters / 1,000 millimeters per meter

Top anchor = 0.25 meters

Overlap = 203.2 millimeters /1,000 millimeters per meter

Overlap = 0.20 meters

Step 3 – Determine the number of rolls need per width

Number of rolls per width = Width / (roll width -overlap)

Number of rolls per width = 100 feet / (10 feet -0.67 feet)

Number of rolls per width = 100 feet / 9.33
Number of rolls per width= 10.71 - say 11

Number of rolls per width = Width / (roll width -overlap)
Number of rolls per width = 30.5 / (3.05 -0.2)
Number of rolls per width = 30.5 / 2.85
Number of rolls per width= 10.71 - say 11

Step 4 – Determine the number of rolls need per width

Number of rolls per length = (length + top anchor) / (roll length -overlap)
Number of rolls per length = (1000 feet + 0.83) / (90 feet -0.67 feet)
Number of rolls per length = 1000.83 feet / 89.33
Number of rolls per length= 11.20 - say 12

Number of rolls per length = (length + top anchor) / (roll length -overlap)
Number of rolls per length = (304.8 + 0.25) / (27.4 -0.20)
Number of rolls per length = 305.05 / 27.20
Number of rolls per length= 11.22 – say 12

Step 5 – Determine the number of rolls needed

Number of rolls required = rolls per width ∗ rolls per length
Number of rolls required = 11 ∗ 12
Number of rolls required = 132

Number of rolls required = rolls per width ∗ rolls per length
Number of rolls required = (304.8 + 0.25) ∗ (27.4 -0.20)
Number of rolls required = 132

Question 28

Step 1 – Collect the Data

Graded area length =	1,000 feet	*304.8 meters*
Graded area depth =	50 feet	*15.24 meters*
Slope grade =	25 %	25%
Curve Number=	91	91
Silt fence effective height =	1.5 feet	*0.46 meters*
Rainfall =	3.0 inches	*76.2 millimeters*
Direct runoff +	2.0 inches	*50.8 millimeters*
Additional storage required +	1,000 cubic feet	*28.32 cubic meters*

Step 2 – Determine square feet *(square meters)* of bare earth

Area of bare earth = graded area length $*$ graded area depth
Area of bare earth = 1,000 feet $*$ 50 feet
Area of bare earth = 50,000 square feet

Area of bare earth = graded area length $*$ graded area depth
Area of bare earth = 304.8 meters $*$ 15.24 meters
Area of bare earth = 4,645.15 square meters

Step 3 – Convert the direct runoff to feet *(meters)*

Direct runoff in feet = direct runoff in inches / 12 inches per foot
Direct runoff in feet = 2.0 inches / 12 inches per foot
Direct runoff in feet = 0.17 feet

Direct runoff in meters = direct runoff in mm / 1,000 mm per meter
Direct runoff in meters = 50.8 millimeters / 1,000 mm per meter
Direct runoff in meters = 0.05 meters

Step 4 – Determine the cubic feet *(cubic meters)* of direct runoff

Cubic feet of direct runoff = area of bare earth $*$ direct runoff in feet
Cubic feet of direct runoff = 50,000 square feet $*$ 0.17 feet

Cubic feet of direct runoff = 8,500.00 cubic feet

Cubic feet of direct runoff = area of bare earth ∗ direct runoff in meters
Cubic feet of direct runoff = 4,645.15 square meters ∗ 0.05 meters
Cubic feet of direct runoff = 232.26 cubic meters

Step 5 – Determine the total volume need behind the silt fence

Total volume = direct runoff + additional storage required
Total volume = 8,500 cubic feet + 1000 cubic feet
Total volume = 9,500 cubic feet

Total volume = direct runoff + additional storage required
Total volume = 232.26 cubic meters + 28.32 cubic meters
Total volume = 260.58 cubic meters

Step 6 – Determine the cross-sectional area behind the silt fence to required contain the volume of sediment calculated

Total cross-sectional area = cubic feet of storage / length of area
Total cross-sectional area = 9,500 cubic feet / 1,000 feet
Total cross-sectional area = 9.5 cubic feet per foot of silt fence

Total cross-sectional area = cubic meters of storage / length of area
Total cross-sectional area = 260.58 cubic meters / *304.80 meters*
Total cross-sectional area = 0.85 cubic meters per meter of silt fence

Step 7 – Determine the distance from the toe of slope to the silt fence to contain the required volume. This is an iterative process. Use the formula distance from toe of slope = (distance ∗ depth of ponding) + (0.5 ∗ (storage depth ∗ (slope ratio per foot *(meter)* ∗ slope depth)))

First try 3 feet *(0.91 meters)*

Volume per foot of silt fence = (3 ∗ 1.5) + (0.5 ∗ (1.5 ∗ (2 * 1.5)))
Volume per foot of silt fence = 4.5 + (0.5 ∗ (1.5 ∗ 3.00))
Volume per foot of silt fence = 4.5 + (0.5 ∗ 4.50)

Volume per foot of silt fence = 4.5 + 2.25
Volume per foot of silt fence = 6.75 cubic feet

This does not meet the requirement of 9.5 cubic feet of storage, try a longer distance

*Volume per meter of silt fence = (0.91 ∗ 0.46) + (0.5 ∗ (0.46 ∗ (2 * 0.46)))*
Volume per meter of silt fence = (0.42) + (0.5 ∗ (0.46 ∗ 0.92))
Volume per meter of silt fence = (0.42) + (0.5 ∗ 0.42)
Volume per meter of silt fence = (0.42) + (0.21)
Volume per meter of silt fence = 0.63 cubic meters

This does not meet the requirement of 0.85 cubic meters of storage, try a longer distance

Next try 4 feet *(1.22 meters)*

Volume per foot of silt fence = (4 ∗ 1.5) + (0.5 ∗ (1.5 ∗ (2 * 1.5)))
Volume per foot of silt fence = 6 + (0.5 ∗ (1.5 ∗ 3.00))
Volume per foot of silt fence = 6 + (0.5 ∗ 4.50)
Volume per foot of silt fence = 6 + 2.25
Volume per foot of silt fence = 8.25 cubic feet

This does not meet the requirement of 9.5 cubic feet of storage, try a longer distance

*Volume per meter of silt fence = (1.22 ∗ 0.46) + (0.5 ∗ (0.46 ∗ (2 * 0.46)))*
Volume per meter of silt fence = 0.56 + (0.5 ∗ (0.46 ∗ 0.92))
Volume per meter of silt fence = 0.56 + (0.5 ∗ 0.42)
Volume per meter of silt fence = 0.56 + 0.21
Volume per meter of silt fence = 0.77 cubic meters

This does not meet the requirement of 0.85 cubic meters of storage, try a longer distance

Next try 5 feet *(1.52 meters)*

Volume per foot of silt fence = (5 ∗ 1.5) + (0.5 ∗ (1.5 ∗ (2 * 1.5)))
Volume per foot of silt fence = 7.5 + (0.5 ∗ (1.5 ∗ 3.00))
Volume per foot of silt fence = 7.5 + (0.5 ∗ 4.50)
Volume per foot of silt fence = 7.5 + 2.25
Volume per foot of silt fence = 9.75 cubic feet

Five (5) feet does meet the requirement of 9.5 cubic feet of storage

*Volume per meter of silt fence = (1.52 ∗ 0.46) + (0.5 ∗ (0.46 ∗ (2 * 0.46)))*
Volume per meter of silt fence = 0.70 + (0.5 ∗ (0.46 ∗ 0.92))
Volume per meter of silt fence = 0.70 + (0.5 ∗ 0.42)
Volume per meter of silt fence = 0.70 + 0.21
Volume per meter of silt fence = 0.91 cubic meters

Five (5) feet does meet the requirement of 0.85 cubic meters of storage

Question 29

Step 1 – Collect the Data

Graded area length =		400 feet	*122.00 meters*	
Graded area depth =		25 feet	*7.62 meters*	
Slope grade =		16 %	*16%*	
R factor=		100	*1,875*	
K factor =		0.43	*0.0566*	
LS factor =		7.60	*7.13*	
	Option 1	Option 2	Option 3	Option 4
C factors +	1.0	0.02	0.25	0.01
P factors	1.3	1.0	0.90	0.90
Soil weight =		90 lbs / cu ft	*1,411.00 kg / cu m*	
Soil Replacement cost =		$25.00 cy	*$32.00 cm*	
	Option 1	Option 2	Option 3	Option 4
Installation costs =	$250.00	$1,500.00	$750.00	$2,000.00

Step 2 – Calculate the area of the slope in acres

Area in acres = (length * height) / 43,560

Area in acres = (400 * 25) /43,560

Area in acres = 10,000 / 43560

Area in acres = 0.23

*Area in hectares = (length * height) / 10,000*

*Area in hectares = (122.00 * 7.62) /10,000*

Area in hectares = 929.64 / 10,000

Area in hectares = 0.09

Step 3 – Calculate the annual soil loss for each Option using RUSLE equation, A = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.23 acres

<u>Option 1</u>

Annual Soil Loss in tons = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.23

Annual Soil Loss in tons = (100 ∗ 0.43 ∗ 7.60 ∗ 1.0 ∗ 1.3) ∗ 0.23

Annual Soil Loss in tons = 424.84 ∗ 0.23

Annual Soil Loss in tons = 97.71

Annual soil loss in tonnes = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.09

Annual soil loss in tonnes = (1875 ∗ 0.0566 ∗ 7.13 ∗ 1.0 ∗ 1.3) ∗ 0.09

Annual soil loss in tonnes = 983.67 ∗ 0.09

Annual soil loss in tonnes = 88.53

<u>Option 2</u>

Annual Soil Loss in tons = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.23

Annual Soil Loss in tons = (100 ∗ 0.43 ∗ 7.60 ∗ 0.02 ∗ 1.0) ∗ 0.23

Annual Soil Loss in tons = 6.54 ∗ 0.23

Annual Soil Loss in tons = 1.50

Annual soil loss in tonnes = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.09

Annual soil loss in tonnes = (1875 ∗ 0.0566 ∗ 7.13 ∗ 0.02 ∗ 1.0) ∗ 0.09

Annual soil loss in tonnes = 15.13 ∗ 0.09

Annual soil loss in tonnes = 1.36

<u>Option 3</u>

Annual Soil Loss in tons = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.23

Annual Soil Loss in tons = (100 ∗ 0.43 ∗ 7.60 ∗ 0.25 ∗ 0.90) ∗ 0.23

Annual Soil Loss in tons = 75.53 ∗ 0.23

Annual Soil Loss in tons = 16.91

Annual soil loss in tonnes = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.09

Annual soil loss in tonnes = (1875 ∗ 0.0566 ∗ 7.13 ∗ 0.25 ∗ 0.90) ∗ 0.09

Annual soil loss in tonnes = 170.25 ∗ 0.09

Annual soil loss in tonnes = 15.32

<u>Option 4</u>

Annual Soil Loss in tons = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.23

Annual Soil Loss in tons = (100 ∗ 0.43 ∗ 7.60 ∗ 0.01 ∗ 0.90) ∗ 0.23

Annual Soil Loss in tons = 2.94 ∗ 0.23

Annual Soil Loss in tons = 0.68

Annual soil loss in tonnes = (R ∗ K ∗ LS ∗ C ∗ P) ∗ 0.09

Annual soil loss in tonnes = (1875 ∗ 0.0566 ∗ 7.13 ∗ 0.01 ∗ 0.90) ∗ 0.09

Annual soil loss in tonnes = 15.13 ∗ 0.09

Annual soil loss in tonnes = 0.65

Step 4 – Determine the cubic yards (cubic meters) of soil lost per year for each option

Option 1

Cubic yards of soil loss per year = (calculated soil loss in tons ∗ 2000 pounds per ton) / (soil density ∗ 27 cubic feet in a cubic yard per cubic yard)

Cubic yards of soil loss per year = (97.71 ∗ 2000) / (90 ∗ 27)

Cubic yards of soil loss per year = 195,420 / 2,430

Cubic yards of soil loss per year = 80.42

*Cubic meters of soil loss per year = (calculated soil loss in tonnes * 1000) / soil density*

*Cubic meters of soil loss per year = (88.53 * 1000) / 1441.00*

Cubic meters of soil loss per year = 88,530 / 1441

Cubic meters of soil loss per year = 61.43

Option 2

Cubic yards of soil loss per year = (calculated soil loss in tons ∗ 2000 pounds per ton) / (soil density ∗ 27 cubic feet in a cubic yard per cubic yard)

Cubic yards of soil loss per year = (1.50 ∗ 2000) / (90 ∗ 27)

Cubic yards of soil loss per year = 3,000 / 2,430

Cubic yards of soil loss per year = 1.23

*Cubic meters of soil loss per year = (calculated soil loss in tonnes * 1000) / soil density*

*Cubic meters of soil loss per year = (1.36 * 1000) / 1441.00*

Cubic meters of soil loss per year = 1,360 / 1441

Cubic meters of soil loss per year = 0.94

Option 3

Cubic yards of soil loss per year = (calculated soil loss in tons ∗ 2000 pounds per ton) / (soil density ∗ 27 cubic feet in a cubic yard per cubic yard)

Cubic yards of soil loss per year = (16.91 ∗ 2000) / (90 ∗ 27)

Cubic yards of soil loss per year = 33,820 / 2,430

Cubic yards of soil loss per year = 13.92

*Cubic meters of soil loss per year = (calculated soil loss in tonnes * 1000) / soil density*

*Cubic meters of soil loss per year = (15.32 * 1000) / 1441.00*

Cubic meters of soil loss per year = 15,320 / 1441

Cubic meters of soil loss per year = 10.63

Option 4

Cubic yards of soil loss per year = (calculated soil loss in tons ∗ 2000 pounds per ton) / (soil density ∗ 27 cubic feet in a cubic yard per cubic yard)

Cubic yards of soil loss per year = (0.68 ∗ 2000) / (90 ∗ 27)

Cubic yards of soil loss per year = 1,360 / 2,430

Cubic yards of soil loss per year = 0.56

*Cubic meters of soil loss per year = (calculated soil loss in tonnes * 1000) / soil density*

*Cubic meters of soil loss per year = (0.65 * 1000) / 1441.00*

Cubic meters of soil loss per year = 650 / 1441

Cubic meters of soil loss per year = 0.45

Step 5 – Determine the cost of soil replace met + installation of measures

Option 1

Cost = (cubic yards ∗ replacement cost) + installation cost

Cost = (80.423 ∗ 25.00) + 250.00

Cost = 2,010.50 + 250.00

Cost = $2,260.50

Cost = (cubic meters ∗ replacement cost) + installation cost

Cost = (61.43 ∗ 32.00) + 250.00

Cost = 1,965.76 + 250.00

Cost = $2,215.76

<u>Option 2</u>

Cost = (1.23 ∗ 25.00) + 1,500.00

Cost = 30.75 + 1,500.00

Cost = $1,530.75

Cost = (0.94 ∗ 32.00) + 1,500.00

Cost = 30.08 + 1,500.00

Cost = $1,530.08

<u>Option 3</u>

Cost = (cubic yards ∗ replacement cost) + installation cost

Cost = (13.92 ∗ 25.00) + 750.00

Cost = 348.00 + 750.00

Cost = $1,098.00

Cost = (cubic meters ∗ replacement cost) + installation cost

Cost = (10.63 ∗ 32.00) + 750.00

Cost = 340.16 + 750.00

Cost = $1,090.16

<u>Option 4</u>

Cost = (cubic yards ∗ replacement cost) + installation cost

Cost = (0.56 ∗ 25.00) + 2,000.00

Cost = 14.00 + 2,000.00

Cost = $2,014.00

Cost = (cubic meters ∗ replacement cost) + installation cost

Cost = (0.45 ∗ 32.00) + 2,000.00

Cost = 14.40 + 2,000.00

Cost = $2,014.40

Step 6 – Compare costs for different options

Option 1 = $2,260.50	*$2,215.76*
Option 2 = $1,530.75	*$1,530.08*
Option 3 = $1,098.00	*$1,090.16*
Option 4 = $2,014.00	*$2,014.40*

The highest cost is Option 1

Question 30

Step 1 – Since this the same problem as Question 29 copy Step 6 of the last problem to determine the least expensive

Option 1 = $2,260.50	*$2,215.76*
Option 2 = $1,530.75	*$1,530.08*
Option 3 = $1,098.00	*$1,090.16*
Option 4 = $2,014.00	*$2,014.40*

The lowest cost is Option 3

Question 31

Step 1 – Collect the Data

Pond top length =	350 feet	*106.68 meters*
Pond top width =	120 feet	*36.58 meters*
Mulch width =	25 feet	*7.62 meters*
Mulch thickness	6 inches	152 millimeters
Settling factor=	75%	*75%*

Step 2 – Determine the outer dimensions of the mulch area

Length in feet = pond top + mulch width
Length in feet = 350 + (25 * 2)
Length in feet = 350 + 50
Length in feet = 400

Length in meters = pond top + mulch width
*Length in meters = 106.68+ (7.62 * 2)*
Length in meters = 106.68 + 15.24
Length in meters = 121.92

Width in feet = pond top + mulch width
Width in feet = 120 + (25 * 2)
Width in feet = 120 + 50
Width in feet = 170

Length in meters = pond top + mulch width
*Length in meters = 36.58+ (7.62 * 2)*
Length in meters = 36.58 + 15.24
Length in meters = 51.28

Step 3 – Calculate the area mulch surrounding the pond

Area of mulch in square feet = (length mulch ∗ width mulch) – (length pond * width pond)
Area of mulch in square feet = (400 ∗ 170) – (350 ∗ 120)
Area of mulch in square feet = 68,000 – 42,000
Area of mulch in square feet = 26,000
Area of mulch in square meters = (length mulch ∗ width mulch) – (length pond * width pond)
Area of mulch in square meters = (121.92 ∗ 51.82) – (106.68 ∗ 36.58)
Area of mulch in square meters = 6,3172.89 – 3,902.35
Area of mulch in square meters = 2,415.54

Step 4 – Determine the volume of mulch to be provided in cubic yards *(cubic meters).*

Volume of mulch in cubic yards = (area of mulch ∗ (thickness of mulch in inches / 12 inches per foot)) / 27 cubic feet in a cubic yard
Volume of mulch in cubic yards = (26,000 ∗ ((6 / 12)) / 27
Volume of mulch in cubic yards = (26,000 * 0.5) / 27
Volume of mulch in cubic yards = 13,000 / 27
Volume of mulch in cubic yards = 481.48

Volume of mulch in cubic meters = (area of mulch ∗ (thickness of mulch in millimeters / 1,000 millimeters per meter))
Volume of mulch in cubic meters = (2,415.54 ∗ (152.00 / 1,000))
Volume of mulch in cubic yards = 2415.54 ∗ 0.152
Volume of mulch in cubic meters = 367.16

Step 5 – Calculate volume of mulch considering settlement

Volume of mulch required in cubic yards = cubic yards of mulch / 0.75 settling factor
Volume of mulch required in cubic yards = 481.48 / 0.75
Volume of mulch required in cubic yards = 641.97 say 642

Volume of mulch required in cubic meters = cubic meters of mulch / 0.75 settling factor
Volume of mulch required in cubic yards = 367.16 / 0.75
Volume of mulch required in cubic yards = 489.54 say 490