2017 Manitoba Envirothon
Provincial Field Test
Agricultural Soil and Water Conservation Stewardship

2017 MANITOBA ENVIROTHON FIELD TEST
Turtle Mountain Meadow Trail

STOP 1

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 1

1) What does the acronym TEK stand for? (0.5 pt)

2) What method is generally used to transfer or pass along TEK? (0.5 pt)

3) *Review the following statements. Circle the correct option to indicate if each statement is a characteristic of TEK, Western Science (WS), or Both.* (1 pt - 0.5 pt each)

TEK	WS	BOTH	Emphasis on application of practical skills and knowledge used in daily life.
TEK	WS	BOTH	Knowledge of plant and animal behavior, life cycles, and habitat needs.

Answer:
1) Traditional Ecological Knowledge (0.5 pt)
2) oral tradition (also accept stories, songs, legends, traditions) (0.5 pt)
3) TEK, BOTH (1 pt - 0.5 pt each)

Reference:
1) Traditional Ecological Knowledge, p 1
2) Traditional Ecological Knowledge, p 9
3) Traditional Ecological Knowledge, p 2

SOILS AND LAND USE (2 pts) – STOP 1
This question requires BOTH features and materials found at stop.

1) Look at the soil pit at the stop.

a) What is the depth of the LFH horizon? (0.5 pt)

b) Using the Munsell colour chart, determine the colour of the A horizon. (0.5 pt)

2) Would you expect the colour of the A horizon in a typical grassland soil to be lighter or darker than the A horizon of this soil? Explain why. (1 pt)

Answer:
1a) TBD (0.5 pt)
1b) TBD (0.5 pt)
2) darker (0.5 pt)
Any 1 of the following: in grassland soils more organic matter is below the soil surface resulting in a darker colour; in forest soils more organic matter is found on the soil surface resulting in a lighter colour; acids from forest organic matter leach the colour out of the A horizon (0.5 pt)

Reference:
1a) Soil Management Guide, p 18
1b) Training; Think Trees TV Let's Get the Dirt on Soil
2) Soil Management Guide, p 10

THEME (2 pts) – STOP 1

1) Name two (2) organizations that you can partner with if you are an agricultural producer who is looking into preserving and protecting the wetland acres you have on your agricultural land. (1 pt)

2) *Indicate whether each statement is true (T) or false (F) by circling the correct answer.* (1 pt - 0.5 pts each)

T F Landowners can get information about possible BMPs to implement on their land from both government and non-government sources.
T F Landowners can apply for funding assistance to implement BMPs on their land from both government and non-government organizations.

Answer:
1) Any 2 of the following: Ducks Unlimited, MB Habitat Heritage Corporation, Conservation Districts (1 pt - 0.5 pt each)
2) T, T (1 pt - 0.5 pt each)

Reference:
1)-2) Theme Training Powerpoint, p 5

WATER AND AQUATIC ECOLOGY (10 pts) – STOP 1

This question requires materials provided at stop.

1) Follow the directions below for the water quality test to determine the concentration of phosphate of the sample water in bucket A-A.

Directions*:*
Remove your sunglasses and put on the safety goggles and gloves. If you are wearing prescription glasses, you do not need to wear the safety goggles.

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As discussed in training, obtain your sample of water from the bucket labeled A-A. Follow the instruction on the laminated card labeled Phosphate to perform the water quality test.

Continue with questions 2) to 4) while waiting for the test to complete.

Use the colour chart on the reverse side of the laminated card to determine the concentration of phosphate in your sample. If the colour of your test result is between colours on the chart, report your result halfway between the numbers given on the chart. Record your result below.

Concentration of phosphate in sample A-A is _____ ppm. (3 pts)

2) State one (1) reason the measurement of phosphorus should be included in a water quality monitoring program. (1pt)

3) Changes will occur in a lake that receives excessive amounts of phosphorus. For each parameter listed below, indicate whether there will be an increase (I), decrease (D) or no change (NC) when subjected to excess phosphorus. *Circle the correct answers.* (4 pts - 1pt each)

I D NC Occurrences of noxious or toxic algal blooms
I D NC Occurrences of spring turnover
I D NC Secchi depth
I D NC Concentration of dissolved oxygen

4) A scientific experiment was done at South Tobacco Creek, MB, to determine the effects on water quality of converting to conservation tillage. The graph below shows the results from the experiment. Answer the following questions about dissolved phosphorus. (2 pts)

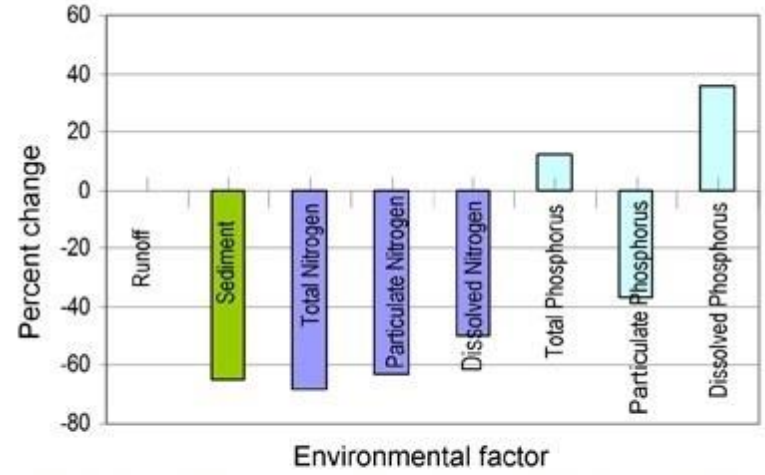

Fig 3. Percent change in sediment and nutrient export after conversion to conservation tillage.

a) Did export of dissolved phosphorus increase or decrease? (0.5 pt)

b) What is the approximate amount of change in dissolved phosphorus? (0.5 pt)

c) Briefly explain one (1) reason for this unexpected change. (1 pt)

Answer:
1) TBD (3 pts)
Partial marks: TBD (1 pt for having a close answer)
2) Any 1 of the following: P is essential for life; algae and plants need P for growth; excess amounts of P cause algal blooms; P contributes to productivity; high P indicates eutrophication; determines the health of the water body; shows if there is pollution. (1 pt)
3) I, NC, D, D (4 pts - 1pt each)
4a) increase (0.5 pt)
4b) any value between 33% and 38% (0.5 pt)
4c) Any 1 of the following: P is released from the crop residue left on the fields during the freeze/thaw cycle; P from fertilizing accumulates in the soil surface and is never mixed down during tilling. (1 pt)

Reference:
1) Provincial training; ability to read and follow instructions
2) Water Quality, p 17; Lake Ecology, p 34-35; able to synthesize information from many sources
3) Lake Ecology, p 35
4) Ability to interpret graph; Nutrient Cycles, P-cycle; Lake Ecology, p 13-14; Theme-South Tobacco Creek BMP, Fact Sheet #4.

WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 1

This question requires materials provided at stop.

Identify the organs in the specimen indicated by the pins flagged W-A, W-B, W-C and W-D . (2 pts - 0.5 pt each)

W-A _____

W-B _____

W-C _____

W-D _____

Answer:
W-A: Liver (0.5 pt)
W-B: Lung (0.5 pt)

W-C: Stomach (0.5 pt)
W-D: Kidney (0.5 pt)

Reference:
Wildlife Document, p 13-16

STOP 2

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 2

List four (4) advantages of de-limbing trees at the stump during a timber harvesting operation. (2 pts)

Answer:
No large debris piles at landing leading to loss of productive land; Maintenance of coarse woody debris on site; Increase in the amount of cone bearing smash for the promotion of natural regeneration; Promotion of soil fertility. Other answers as appropriate. (2 pts - 0.5 pt each)

Reference:
Biomass Management, p 2

SOILS AND LAND USE (2 pts) – STOP 2

This question requires features found at stop.

At this site, you may notice that the streambank shows some signs of erosion and slumping/undercutting. Briefly describe two (2) specific practices that may reduce or eliminate this erosion. (2 pts)

Answer:
Any 2 of the following: maintaining a protective cover on the soil (vegetation, riprap, etc), creating a barrier to the water, modifying the landscape to control runoff amounts and rates, shortening the length and reducing the steepness of slopes, increasing water infiltration, improving aggregate stability, or any example of the above. (2 pts - 1pt each)

Reference:
Erosion (Soil Quality Resource Concerns)

THEME (10 pts) – STOP 2

Landowners can play a critical role by holding back water on their land. An Integrated Watershed Management Plan (IWMP) was completed for your watershed and identified potential water storage sites throughout the area. You are very concerned about downstream flooding and would

like to help out your downstream neighbours. You notice that the IWMP identifies an area on your property as a suitable water storage site.

1) You are interested in constructing an earthen dam to hold back water.

a) Who should you contact to discuss the IWMP and inquire about receiving assistance? (1 pt)

b) Name one (1) other organization or person you should speak with before you begin construction of the dam. (1 pt)

2) List two (2) factors that the IWMP would have considered when identifying water storage sites throughout the watershed. (1 pt)

3) When constructing an earthen dam, a landowner must consider sources of dam failure and how to prevent damage. Two significant sources of failure are vegetation and animals.

a) What general type of vegetation can be a source of dam failure. (0.5 pt)

b) Name (1) kind of animal that can be a source of dam failure. (0.5 pt)

c) Develop a monitoring plan to mitigate the consequences of dam failure due to the animal you named in b). (5 pts)

4) List two (2) benefits other than flood protection that may result from the construction of the earthen dam. (1 pt)

Answer:
1a) Conservation District (1 pt)
1b) Any 1 of the following: Province of Manitoba – Sustainable Development to inquire about licensing requirements, an engineer, local RM (1 pt)
2) Any 2 of the following: topography, land use, soil type, the magnitude of downstream flooding and the magnitude of downstream erosion (1 pt - 0.5 pt each)
3a) woody plants, or trees and shrubs (0.5 pt)
3b) Any 1 of the following: Muskrat, Beaver, Woodchuck, Pocket Gopher, North American Badger, Prairie Dog, Ground Squirrel, Livestock (cow, sheep, horse, pig and wild pig), Crayfish, Coyote, Moles and Voles, River Otter, Gopher Tortoise, Red Fox and Gray Fox, Canada Goose, Ants (0.5 pt)
Vegetation/plants - trees, woody plants (1 pt - 0.5 pt each)
3c) Explanation of monitoring plan to mitigate against dam failure must include the following components (5 pts total)
Problem: List problem animal (beaver, muskrat, ground hogs, fox, coyote) (no points since animal named in b))
Indicator(s): Wildlife damage observation, such as burrows, dens, beaver dam, etc. (1 pt)
Collection of Data: Species identification, wildlife behavior, burrow location preferences (1 pt)

Mitigation Activities: Appropriate repairs to the dam would be made once a dam owner identifies the damage and the species responsible, including trapping and hunting. They may indicate that they should contact the Wildlife Branch (agency) or a local trapper. (1.5 pts)
Long term maintenance: Regular dam inspections, identifying what could go wrong if wildlife damage is left unchecked, continued maintenance for upkeep of the dam (1.5 pts)
4) Any 2 of the following: reduction in peak flows, reduction in the export of sediment, reduction in the export of total N and total P, source of irrigation water, storage capacity for livestock watering sources, groundwater recharge and habitat creation

Reference:
1a) Storing Water on the Land
1b) Small Earth Filled Dams, p 1
2) Storing Water on the Land
3a) Dam Owners Guide to Plant Impacts on Earthen Dams, p 6, 8, 9
3b) Dam Owners Guide to Animal Impacts on Earthen Dams, p 5
3c) Small Earth Filled Dams, p 4; Dam Owners Guide to Plant Impacts on Earthen Dams, p 10, 12, 13; Dam Owners Guide to Animal Impacts on Earthen Dams , p 10-18
4) WEBS Fact Sheet - page 3, 4

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 2

This question requires features found at stop.

Note the nearby stream, which flows out of Lake Udall and continues down through the woods to another small lake. Although the stream water comes from Lake Udall, the stream water may differ from the lake water. Landscape features along the stream can affect both physical and chemical properties of the stream water.

1) Briefly explain how a small waterfall on the stream may affect a chemical property of the stream water that is important for aquatic organisms living in the water. (1 pt)

2) Briefly explain why flowing through a wooded area can affect a physical property of the water, which then may affect the same chemical property referred to in question 1? (1 pt)

Answer:
1) Tumbling over a waterfall will expose the stream water to more air, thereby raising concentrations of dissolved oxygen and other gases from the air. (1 pt)
2) Flowing through the woods will shade the stream water from direct sunlight, thereby moderating or cooling the water temperature on hot summer days and enabling the water to retain dissolved gases including oxygen. (1 pt)
Partial marks: flowing through the woods will shade the stream water from direct sunlight, thereby moderating or cooling the water temperature (i.e., no mention of dissolved gases) (0.5 pt).

Reference:
1) Basics of Stream Ecology, p 1
2) Basics of Stream Ecology, p 1-2

WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 2

This question requires materials provided at stop.

Look at the specimen in the jar labelled W-A.

1) What is the common name of this lizard? (1 pt)

2) Briefly describe the adaptation this lizard has to help it avoid predation. (0.5 pt)

3) How does this lizard overcome the thermal limitations of living in an northern climate? (0.5 pt)

Answer:
1) Northern Prairie Skink (1 pt)
2) When pursued by a predator, the skink will use its tail as a "decoy" by detaching it. The tail will continue to twitch distracting the predator while the skink scurries for cover. (0.5 pt)
3) Skinks hibernate in sandy soil below the frostline. (0.5 pt)

Reference:
1)-3) Herpetology Guide, p 26

STOP 3

MULTI-DISCIPLINARY (20 pts) – STOP 3

This question requires BOTH features and materials found at stop.

A healthy riparian zone is essential for the health of the stream, the land that surrounds it, and downstream waterbodies. A Riparian Health Assessment helps provide a complete picture of riparian function because it knits together eleven key health indicators, which include vegetative and physical features. You will conduct a partial Riparian Health Assessment of Udall Stream by evaluating 3 of the 11 riparian health indicators. Then you will answer some riparian theory questions. Make sure you work together as a team to answer this multidisciplinary question, and pay attention to directions about flagging tape colour.

1) The outer edge of the riparian area is delineated by BLUE FLAGS. Briefly describe two (2) characteristics that are used to distinguish a riparian area from an upland. (2 pts)

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2) Riparian Health Indicator 7: Streambank Root Mass Protection

The streambank on this side of the stream is indicated by PINK FLAGS. The plant species marked with ORANGE FLAGGING TAPE have deep binding roots that hold the streambank together. More of these plants can be found along the streambank. Walk around the area outlined by the PINK FLAGS. Determine how much of the streambank is covered by these species. Use Diagram M-A: Percent Cover Diagram to help you.

a) Approximately what percentage of the streambank within the PINK FLAGS on this side of the stream is covered by plants that have a deep, binding root mass? *Circle the best answer.* (2 pts)

A More than 85% of the streambank has a deep, binding root mass
B 65- 85% of the streambank has a deep, binding root mass
C 35-65% of the streambank has a deep, binding root mass
D Less than 35% of the streambank has a deep, binding root mass

b) Without crossing the stream, take a look at the bank on the opposite side. Compared to this side, is there more, an equivalent amount, or less deep binding root mass on the other side? (1 pt)

3) Riparian Health Indicator 8: Human Caused Bare Ground

Any alterations caused directly or indirectly by land-use management (e.g. overgrazing) are considered to be human-caused. Recently deposited soils along the bank due to high water are a natural stream process and therefore not considered human-caused. Walk around the area confined by the BLUE FLAGS ON THIS SIDE OF THE STREAM. Determine how much of the riparian area has human-caused bare soil. Use Diagram M-A: Percent Cover Diagram to help you.

a) How much of the designated riparian area ON THIS SIDE OF THE STREAM has human-caused bare ground? *Circle the best answer*. (2 pts)

A Less than 1% of the reach is human-caused bare ground
B 1-5% of the reach is human-caused bare ground
C 5-15% of the reach is human-caused bare ground
D More than 15% of the reach is human-caused bare ground

b) Without crossing the stream, take a look at the riparian area on the opposite side. Compared to this side, is there more, an equivalent amount, or less bare soil on the other side? (1 pt)

4) Riparian Health Indicator 11: Stream Channel Incisement (Vertical Stability)

The Rosgen Incisement Stages (Diagram M-B) reflect how historical stream flow has shaped the stream channel and floodplain.

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Stand at the ORANGE FLAG, and look towards the second ORANGE FLAG across the stream. Using Diagram M-B: Rosgen Incisement Stages, select the profile which most closely resembles the stream cross-section between the two markers. *Circle the best answer.* (2 pts)

A Stage 1a
B Stage1b
C Stage 1c
D Stage 2
E Stage 3
F Stage 4a
G Stage 4b

5) The following questions require you to use your general knowledge of riparian theory.

a) Name two (2) shallow rooted exotic plant species that do not contribute to deep binding root mass of streambanks. (1 pt)

b) Name two (2) human causes of bare ground, other than overgrazing, that may be found in a riparian area. (1 pt)

c) Briefly describe two (2) ways bare soil in the riparian area can impact aquatic organisms. (1 pt)

d) Briefly describe one (1) negative consequence if water cannot access a large floodplain. (1 pt)

e) Briefly describe how stream channel incisement (downcutting) changes the vegetation on a floodplain. (1 pt)

f) Name one (1) key ecological function of a healthy riparian zone that supports agricultural use of this area or the surrounding upland. (1 pt)

g) List two (2) key ecological functions of a healthy riparian zone that support stream water quality. (2 pts)

6) If managed properly with proper stocking rates and a rotational grazing system that controls the timing and duration of cattle access, riparian health can be maintained even though the land is being grazed. Look at the photographs labelled M-C, M-D and M-E which show possible fencing designs for a pasture near a riparian area.

a) Which photograph (M-C, M-D, or M-E) represents the most compatible fencing design for a rotational grazing system that would conserve the health of the riparian areas next to a lake or stream? (1 pt)

b) Give one (1) reason why mid-to-late summer grazing is the best time to graze the riparian pasture. (1 pt)

Answer:

1) Any 2 of the following: Presence of water either on surface, or close to surface, Vegetation that requires and survives well in abundant water, Soils modified or deposited by water and stream processes, Within the transitional zone from wet to dry landscape, or Floodplain where water periodically escapes from channel (2 pts - 1 pt each)
2a) TBD (2 pts)
Partial marks: =/- one letter (1 pt)
2b) TBD (1 pt)
3a) TBD (2 pts)
Partial marks: =/- one letter (1 pt)
3b) TBD (1 pt)
4) TBD (2 pts)
Partial marks: =/- one letter (1 pt)
5a) Any 2 of the following: rose, hawthorn, bromegrass, timothy, Canada Thistle, leafy spurge (others accepted) (1 pt - 0.5 pt each)
5b) Any 2 of the following: ATV use, trails from humans, heavy equipment work, artificial beaches (others accepted) (1 pt - 0.5 pt each)
5c) Any 2 of the following: lack of vegetation causing high water temperatures, lack of shade over water, erosion increasing water sedimentation, decreasing water quality, less cover and protection for aquatic species in the water's shallow edge (1 pt - 0.5 pt each)
5d) Any 1 of the following: Increased speed of water, increased erosivity of water system, less recharging of groundwater, drying out of riparian soil which changes desirable riparian species to disturbance or noxious / less desirable and less productive species, more stream bank erosion, more in-channel erosion and sediment load. (1 pt)
5e) Dries out the soil by lowering the water table. This causes a shift in vegetation to less productive disturbance/upland species which have shallow roots. Encourages the introduction of noxious weeds. (1 pt)
5f) Any 1 of the following: Creates primary production, recharges the aquifer, maintains biodiversity, supports pollinators (1 pt)
5g) Any 2 of the following: filters and buffers water, traps sediment, create primary production (2 pts - 1 pt each)
6a) Photograph M-C (1 pt)
6b) Any 1 of the following: Early spring is not good because the soil is too wet, and susceptible to damage from hoof action; late summer to early fall not a good time as deep rooted shrubs are most sensitive to browsing which decreased the root reserves (1 pt)

Reference:

1) Managing the Water's Edge, p 22
2) Managing the Water's Edge, p 53
3) Managing the Water's Edge, p 57
4) Managing the Water's Edge, p 62-69
5a) Managing the Water's Edge, p 83-89

5b) Managing the Water's Edge, p 57; Caring for the Green Zone, p 17
5c) Managing the Water's Edge, p 10-13; Caring for the Green Zone, p 20
5d) Managing the Water's Edge, p 62
5e) Managing the Water's Edge, p 62-69
5f) Managing the Water's Edge, p 10-11
5g) Managing the Water's Edge, p 10-11
6a)-b) Riparian Grazing strategies/ Improving Bank Stability

STOP 4

NATIVE PLANTS AND FORESTRY (10 pts) – STOP 4

This question requires materials provided at stop.

Refer to the map labelled F-A to answer the following questions.

1) What direction is it from point C to point E? (1 pt

2) How many meters is the red line at D? (1 pt)

3) What species is dominant at Point C? (1 pt)

4) What point has the highest terrain elevation? (1 pt)

5) Which trees are taller? The trees around point F or the trees around point K? (1 pt)

6) Which white square (square H or square J) has more successful regeneration? (1 pt)

7) Is the regeneration in square J planted or has it been naturally regenerated? (1 pt)

8) Are the trees around point K coniferous or deciduous? (1 pt)

9) Identify the feature around point L? (1 pt)

10) How many Waldos are there on the map? (1 pt)

Answer:
1) East
2) 300 meters
3) Black Spruce
4) E
5) F
6) J
7) planted
8) coniferous

9) lowland or pooled water
10) 5

Reference:
1)-10) Remote Sensing, GIS and Forestry, p 1-4

SOILS AND LAND USE (2 pts) – STOP 4

This question requires BOTH features and materials found at stop.

A clinometer and two wooden markers are provided for you to determine the slope of the hill. Use the % scale and the top of the markers to determine slope. Your observations will address Land Capability Subclass T, for topographical considerations.

1) Which slope class does this soil belong to? *Circle the best answer.* (0.5 pt)

x = 0 - 0.5% (level)
b = 0.5 - 2% (nearly level)
c = 2 - 5% (very gently sloping)
d = 5 - 9% (gently sloping)
e = 9 - 15% (moderately sloping)
f = 15 - 30% (strongly sloping)
g = 30 - 45% (very strongly sloping)
h = 45 - 70% (extremely sloping)

2) According to the table labelled S-A, which Dryland Agricultural Capability Class does this land fall into? (0.5 pt)

3) Name one (1) direct consequence of using this land for annual crop farming. (0.5 pt)

4) Name one (1) land use or management practice that can be used to conserve soil and water in this landscape. (0.5 pt)

Answer:
1) TBD (g or h) (0.5 pt)
2) TBD (5 or 6 or 7) (0.5 pt)
3) Any 1 of the following: erosion; sedimentation ; nutrient runoff (0.5 pt)
4) Any 1 of the following: incorporate fertilizers into the soil (not on surface); plant buffer strips to catch sediment or nutrients; plant forages (or perennial vegetation, pasture) only; adopt conservation tillage practices (zero till); do not break if unbroken (0.5 pt)

Reference:
1) Soil Management Guide, p 23
2) Soil Management Guide, p 31-37
3) Soil Management Guide, p 52-54, 89-94

4) Soil Management Guide, p 52-54, 89-94, 98-102

THEME (2 pts) – STOP 4

Manitoba has limited area with soils appropriate for agriculture. It is important for both the economy and the ecology of the province to manage soil sustainably, and to minimize the impact of agriculture and industry on pollution of water resources.

***Multiple choice**: Which of the choices is correct? Circle the best response.* (1 pt - 0.5 pt each)

1) Manitoba's total surface area is 65 million hectares. How much of Manitoba's surface area has potential for agriculture?

a) 2.7 million hectares
b) 7.7 million hectares
c) 15.7 million hectares
d) 25.7 million hectares

2) Which of the following is NOT a factor in the degradation of potential agricultural land in Manitoba?

a) urbanization
b) erosion
c) salinity
d) compaction
e) deforestation

3) The Environmental Farm Plan process involves identifying "sensitive areas" of farms that present an increased risk to groundwater or surface water through leaching, runoff or erosion.

***True/False**: Indicate whether the statement is true (T) or false (F) by circling the correct answer.* (1 pt - 0.5 pt each)

T F "Sensitive areas" of farms provide excellent yields and high economic returns.
T F Participation in the Environmental Farm Plan process is mandatory.

Answer:
1) b (0.5 pt)
2) e (0.5 pt)
3) F, F (1 pt - 0.5 pt each)

Reference:
1)-2) MB Soil Management Guide, p 6
3) MB Soil Management Guide, p 114, 116

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WATER AND AQUATIC ECOLOGY (2 pts) – STOP 4

This question requires materials provided at stop.

Document A-A contains images (labeled A to D) of four (4) different invasive species currently found in some aquatic ecosystems in Manitoba. Write the name of each species (common or scientific) next to its corresponding letter below. (2 pts - 0.5 pt each)

A _____

B _____

C _____

D _____

Answer:
A: purple loosestrife (Lythrum salicaria) (0.5 pt)
B: rusty crayfish (Orconectes rusticus (0.5 pt)
C: Spiny waterflea (Bythotrephes longimanus) (0.5 pt)
D: Zebra mussel (Dreissena polymorpha) (0.5 pt)

Reference:
Aquatic Invasive Species, p 3-4, 11-12, 9-10, 13-14

WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 4

An old growth coniferous forest undergoes a forest fire, destroying almost all of the trees and leaving the landscape bare. Over time, the ash is replaced with grasses and flowering plants, then by shrubs, bushes and willows. These are followed by deciduous trees which are eventually replaced with the same type of coniferous forest that was present before the fire.

1) What is this process called? (0.5 pt)

2) Briefly describe three (3) changes in the wildlife that might happen in the area in the years after the fire. (1.5 pts)

Answer:
1) Succession (0.5 pt)
2) Any 3 of the following: The fire will destroy habitat used by some species causing them to move, the first species to come back will be species that eat grasses and small shrubs, nectar-eating species will come back once the flowers are blooming, species that like open spaces will come to the newly open area, herbivores will come first, the herbivores entering the area will in turn attract carnivores, as the trees grow, or any other answer that makes sense. (1.5 pts - 0.5 pt each)

Reference:
Wildlife Document, p 7

STOP 5

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 5

1) What are the two reservoirs that most strongly influenced the mass of CO_2 in the atmosphere over the time scale of decades to centuries? (1 pt)

2) ***Fill in the blank****: Complete the sentence with the most appropriate range of temperatures.* (1 pt - 0.5 pt each)

> Climate change will have a major impact on Manitoba's forests. Northern latitudes are projected to feel the heat of climate change more than other regions of the globe. Winters are expected to be _____°C warmer, whereas summer averages will increase by _____°C.

Answer:
1) The surface ocean, the terrestrial biosphere (plants and soils) (1 pt - 0.5 pt each)
2) 6-12, 2-6 (1 pt - 0.5 pt each)

Reference:
1) What Trees can do to Reduce CO_2, p 4
2) Climate Change Connection, p 1

SOILS AND LAND USE (2 pts) – STOP 5

This question requires materials provided at stop.

Manitoba's Provincial Soil will be recognized on June 17, 2017, at the community on Highway 16 for which the soil was named. A kiosk will be unveiled giving details of the soil, the history of agriculture in the area, and Manitoba Soil Survey.

1) Name the community after which the notable clay loam was named. (0.5 pt)

2) Look at the photo of the soil profile labelled Provincial Soil of Manitoba.

a) What is the Order of this soil?(0.5 pt)

b) What is the Great Group of this orthic soil? (0.5 pt)

3) This soil has an average field capacity of 29% soil moisture content and an average permanent wilting point of 12% soil moisture content. What is its available water content? (0.5 pt)

Answer:
1) Newdale (0.5pt)
2a) Chernozem (0.5pt)
2b) Black (0.5pt)
3) 17% (must include percent symbol for marks) (0.5 pt)

Reference:
1)-2) Manitoba Soil Management Guide, p 40, 41
3) Manitoba Soil Management Guide, p 42, 43

THEME (2 pts) – STOP 5

This question requires features found at stop.

Observe the landscape features both on and surrounding this site. Cattle farmer Dustin Reid is planning on expanding his herd and wants to use this field for pasture.

1) What is the main water quality concern for Dustin if he allows his cattle to graze this field? (0.5 pt)

2) List three (3) BMPs that would reduce this concern. (1.5 pts)

Answer:
1) Increased nutrients in the lake OR eutrophication (0.5 pt)
2) Any 3 of the following: holding pond to capture runoff; fencing cattle out of the lake/riparian area; providing alternative water sources; upkeep/improvement of riparian area. Other answers may be acceptable. (1.5 pts - 0.5 pt each)

Reference:
1) South Tobacco Creek BMP Catalogue, p13
2) South Tobacco Creek BMP Catalogue, p13; GAEGS BMP Document, p 4-5

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 5

1) List two (2) methods used to clean up oil spills. (1 pt)

2) List two (2) environmental parameters that should be monitored after an oil spill to assess ecosystem health. (1 pt)

Answer:
1) Any 2 of the following: Absorbent booms, mechanical skimming (or skimming), herding agents, burning (1 pt - 0.5 pt each)
2) Any 2 of the following: Concentrations of oil in water, Concentrations of oil in soil, in vitro tests (in the lab) (1 pt - 0.5 pt each)

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Reference:
Crude Oil and Aquatic Ecosystems, p 3

WILDLIFE AND WILDLIFE MANAGEMENT (10 pts) – STOP 5

1) Match the letter of each definition with the corresponding term. Write the letter of the definition in the box beside the term. (5 pts - 0.5 pt each)

	Interspecific competition
	Mutualism
	Commensalism
	Ecology
	Amensalism
	Neutral interactions
	Predation
	Parasitism
	Intraspecific competition
	Ecosystem

A	relationship in which there is no effect on individuals or populations
B	relationship that involves the killing and consumption of prey
C	relationship in which one population or individual is negatively affected while the other remains unaffected
D	interaction that benefits both individuals or populations involved
E	community of living things interacting with each other and the physical environment.
F	interaction in which one (usually small) organism lives on or in another (the host) from which it obtains nutrients
G	study of the inter-relationships among and between organisms and all the aspects (living and non-living) of the environment
H	negative interaction between two individuals of the same species.
I	negative interaction between two different species.
J	relationship in which one individual or population is benefited while the other is neither benefited nor harmed

2) All living things require certain basic needs to survive.

a) List the five (5) basic habitat needs of all living things. (2.5 pts)

b) A short supply of any of these needs will affect the number and distribution of wildlife and is called a _____. (0.5 pt)

c) Give an example of an environmental factor that can cause a short supply of a basic need. (1 pt)

d) The number of animals that an area can support without damage to the habitat or animals is called the _____. (0.5 pt)

e) What basic need normally determines the uppermost limit on the size of a population? (0.5 pt)

Answer:
1) I, D, J, G, C, A, B, F, H, E (5 pts - 0.5 pt each)
2a) Food, water, cover (shelter), space, arrangement (2.5 pts - 0.5 pts each)
2b) Limiting Factor (0.5 pt)
2c) Any suitable example (ie. competition, disease, drought, flood, fire, overcrowding) (1 pt)
2d) Carrying Capacity (0.5 pt)
2e) the availability of food (0.5 pt)

Reference:
1) Wildlife Document, p 4-5
2a) Wildlife Document, p 5-6
2b) Wildlife Document, p 6
2c) Wildlife Document, p 6
2d) Wildlife Document, p 6-7

STOP 6

MULTI-DISCIPLINARY (20 pts) – STOP 6

This question requires features found at stop.

On Earth, the element carbon is found in bodies of water, air, rocks and soil as well as in all living things. Carbon moves around the planet, from one of these reservoirs to another, as part of the carbon cycle. For example, an atom of carbon found in carbon dioxide is absorbed from the air into ocean water. There, it is used by floating plankton during photosynthesis to get the nutrition the plankton need. This carbon atom may become part of the plankton's skeleton, or a part of the skeleton of an animal that eats the plankton. Eventually, it may become part of a sedimentary rock when the living things die and only the skeletons are left behind.

Carbon that is part of rocks and fossil fuels, like oil, coal, and natural gas, or part of plant material used for construction lumber and incorporated into buildings may be held away from the rest of the carbon cycle for a long time. These long-term storage places are called "sinks". When

fossil fuels are burned, carbon that had been underground is sent into the air as carbon dioxide, one of the greenhouse gases.

Over time, people have caused these biogeochemical cycles to change. When we grow food, cut down forests without replacing them, operate factories that emit pollution, use vehicles that burn fossil fuels, the way that carbon moves around Earth changes. These changes add more greenhouse gases in our atmosphere, causing climate change. And climate changes leads to changes to our vital ecosystems.
(Source: UCAR Centre for Science Education)

Beneficial Management Practices (BMP) have been developed with the hope of reducing carbon emissions generated by human use of the resources covered in four core Envirothon topics: Native Plants & Forestry, Soils & Land Use, Water & Aquatic Ecosystems and Wildlife & Wildlife Management.

Look around this site. Identify two (2) BMPs for each of the four core topics which could improve carbon storage in the surrounding ecosystems. The BMPs might turn a source of carbon dioxide into a sink, or improve an existing carbon sink. For each BMP, briefly describe one (1) pro and one (1) con of its application. Write your answers in the tables that follow. (20 pts, as shown).

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Native Plants & Forestry

BMP	Pros	Cons
(0.5 pt)	(1 pt)	(1 pt)
(0.5 pt)	(1 pt)	(1 pt)

Soils & Land Use

BMP	Pros	Cons
(0.5 pt)	(1 pt)	(1 pt)
(0.5 pt)	(1 pt)	(1 pt)

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Water & Aquatic Ecosystems

BMP	Pros	Cons
(0.5 pt)	(1 pt)	(1 pt)
(0.5 pt)	(1 pt)	(1 pt)

Wildlife & Wildlife Management

BMP	Pros	Cons
(0.5 pt)	(1 pt)	(1 pt)
(0.5 pt)	(1 pt)	(1 pt)

Answer:
Other answers may be accepted

NATIVE PLANTS AND FORESTRY
Any 2 of the following BMPs: plant trees, prevent land use changes, maintain and enhance natural areas, improve lake buffer (1 pt - 0.5 each)
Any 1 of the corresponding pros for each BMP (2 pts - 1 each)
PLANT TREES: longer term C balance, young growth better as sink
PREVENT LAND USE CHANGES: continues C balance
MAINTAIN/ENHANCE NATURAL AREAS: improve ecological function of natural areas, promote wildlife habitat/corridors/biodiversity, increase C storage through plant growth/death cycle, store water and reduce flooding, reduce soil erosion
IMPROVE LAKE BUFFER: better sink if healthy and diverse
Any 1 of the corresponding cons for each BMP (2 pts - 1 each)
PLANT TREES: species choice compounded by climate change and species migration
PREVENT LAND USE CHANGES: alternate use may not be a sink
MAINTAIN/ENHANCE NATURAL AREAS: potential loss of land for production by not clearing, cost of sustainable harvesting
IMPROVE LAKE BUFFER: increased wildlife and browse activity may limit C sink

SOILS AND LAND USE
Any 2 of the following BMPs: continue hay production, use rotational grazing, set aside riparian areas, set proper stocking rates, manage livestock distribution for even use of vegetation, avoid grazing in sensitive areas at sensitive times, provide adequate rest after grazing for recovery (1 pt - 0.5 each)
Any 1 of the corresponding pros for each BMP (2 pts - 1 each)
CONTINUE HAY PRODUCTION: perennial vegetation is better C sink; avoids tillage and reduces risk of erosion of topsoil containing C
USE ROTATIONAL GRAZING: more even use of pasture improves plant production, more control over where and when cattle access sensitive areas improves plant production, built in rest periods for land improves plant production, stimulation of root growth and death cycles sequesters C, topsoil containing C not exposed to erosion
SET ASIDE RIPARIAN AREAS: more control over where and when cattle access sensitive areas improves plant production, built in rest periods for land improves plant production, stimulation of root growth and death cycles, topsoil containing C not exposed to erosion
SET PROPER STOCKING RATES: amount of vegetation taken is controlled, plants aren't repeatedly grazed and weakened, adequate vegetation is left to cover soil
MANAGE LIVESTOCK DISTRIBUTION: enough biomass remains for quick recovery, topsoil containing C not exposed to erosion
AVOID GRAZING SENSITIVE AREAS/TIMES: topsoil containing C not exposed to erosion, wildlife can use for nesting and forage
PROVIDE ADEQUATE REST: plants can grow and photosynthesize and sequester C while resting, stimulation of root growth and death cycles sequesters C, wildlife can use for nesting and forage
Any 1 of the corresponding cons for each BMP (2 pts - 1 each)

CONTINUE HAY PRODUCTION: hay requires fertilizer and occasional replanting to stay productive, chemical application may be required to control weeds and brush encroachment, equipment used to harvest hay may dislodge surface soil or residue
USE ROTATIONAL GRAZING: cost of fencing and water supply, cost of labour to move cattle, grass less palatable if rotation doesn't keep up with rapid spring growth
SET ASIDE RIPARIAN AREAS: cost of fencing and water supply, cost of labour to move cattle
SET PROPER STOCKING RATES: cost of fencing and water supply, cost of labour to move cattle, forage may be perceived as wasted if sustainable amount left, need to keep stable numbers of cattle may not balance with variations in forage productivity
MANAGE LIVESTOCK DISTRIBUTION: cost of fencing and water supply, cost of labour to move cattle
AVOID GRAZING SENSITIVE AREAS/TIMES: cost of fencing and water supply, cost of labour to move cattle, grass less palatable if rotation doesn't keep up with rapid spring growth
PROVIDE ADEQUATE REST: cost of fencing and water supply, cost of labour to move cattle

WATER AND AQUATIC ECOSYSTEMS
Any 2 of the following BMPs: increase lake size, improve lake buffer, restore wetland (1 pt - 0.5 each)
Any 1 of the corresponding pros for each BMP (2 pts - 1 each)
INCREASE LAKE SIZE: water is good C sink
IMPROVE LAKE BUFFER: better sink if healthy and diverse
RESTORE WETLAND: reduce surface runoff and provide water storage, improve water quality, reduce soil erosion, improve wildlife habitat, increase C storage through plant growth and trapped sediment
Any 1 of the corresponding cons for each BMP (2 pts - 1 each)
INCREASE LAKE SIZE: reduced riparian vegetation; decay will be a source of C
IMPROVE LAKE BUFFER: increased wildlife and browse activity may limit C capture
RESTORE WETLAND: cost of construction, cost of planting, potential loss of land for production, can lead to nutrient loss if not managed

WILDLIFE AND WILDLIFE MANAGEMENT
Any 2 of the following BMPs: control invasive species, control predators (1 pt - 0.5 each)
Any 1 of the corresponding pros for each BMP (2 pts - 1 each)
CONTROL INVASIVE SPECIES: reduces tree and shrub loss so increases C balance
CONTROL PREDATORS: balanced food chain is C sink
Any 1 of the corresponding cons for each BMP (2 pts - 1 each)
CONTROL INVASIVE SPECIES: once established may be difficult to remove, some species are good C sinks
CONTROL PREDATORS: allows grazers to overpopulate and reduce C balance

Reference:
NATIVE PLANTS AND FORESTRY: Theme Training PowerPoint; The Carbon Cycle and Canada's Forests
SOILS AND LAND USE: Theme Training PowerPoint; Climate Change and Agriculture

WATER AND AQUATIC ECOSYSTEMS: Theme Training PowerPoint; Aquatics Climate Change Impacts; Climate Change and Agriculture
WILDLIFE AND WILDLIFE MANAGEMENT: Theme Training PowerPoint; Animals May Play Significant Role in Carbon Cycling

STOP 7

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 7

1) *Indicate whether the statement is true (T) or false (F) by circling the correct answer.* (0.5 pt)

T F Sustainable Harvest Level is the minimum amount of forest harvested in order to make a business profitable.

2) Canada is a member of The Montreal Process. What is The Montreal Process? *Circle the best response.* (0.5 pt)

a) An international treaty to help reduce greenhouse gas emissions.
b) A framework to monitor, assess, and report progress toward sustainable forest management.
c) A policy developed in Quebec to reduce the use of pesticides in forestry operations.

3) What is forest certification? (1 pt)

Answer:
1) F (0.5 pt)
2) b (0.5 pt)
3) Forest certification is an independent (third party) assessment of a company to ensure that it is operating legally (laws, regulations, policies) and complying with internationally accepted standards for sustainable forest management (1 pt).

Reference:
1) Forest Certification in Canada, p 13
2) Sustainable Forest Management in Canada, p 2
3) Sustainable Forest Management in Canada, p 3

SOILS AND LAND USE (2 pts) – STOP 7

This question requires BOTH features and materials found at stop.

Cattle farmer Dustin Reed wants to apply manure to the field directly west of this stop.

1) What is the length of the buffer strip between the lake and the field, to the nearest meter? (0.5 pt)

2) Dustin decides to broadcast his manure without incorporation. Using Table S-A: Summary of manure management practices required for Special Management Areas (SMAs), answer the following questions.

a) Is Dustin legally allowed to apply manure on this field with the current buffer strip in place? (0.5 pt)

b) What is the total minimum setback width required for this case? (0.5 pt)

3) ***Fill in the blank****: Complete the sentence with the most appropriate word(s).* (0.5 pt)

In Manitoba, most vegetative buffer strips are ineffective at reducing phosphorus runoff, because losses are most likely to occur during _____.

Answer:
1) TBD (0.5 pt)
2a) TBD (0.5 pt)
2b) 30 m (0.5 pt)
3) snowmelt (0.5 pt)

Reference:
1) ability to measure distance
2) ability to interpret information
3) Soil Management Guide, p 54

THEME (2 pts) – STOP 7

Phosphorus is a necessary nutrient for plant and animal life. However, excessive levels of phosphorus can cause problems in aquatic ecosystems. Beneficial management practices are used to reduce the flow of phosphorus to surface water.

1) Name the two (2) forms in which phosphorus can move in the environment. (1 pt)

2) ***True/False****: Indicate whether each statement is true (T) or false (F) by circling the correct answer.* (1 pt - 0.5 pt each)

T F Phosphorus is more mobile than nitrogen in the soil.
T F Conservation tillage can lead to the accumulation of phosphorus near the soil surface and increase the flow of phosphorus to surface water.

Answer:
1) dissolved, particulate (1 pt - 0.5 pt each)
2) F, T (1 pt - 0.5 pt each)

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Reference:
1) MB Soil Management Guide, p 53
2) Agri-Environmental Bulletin, p 1

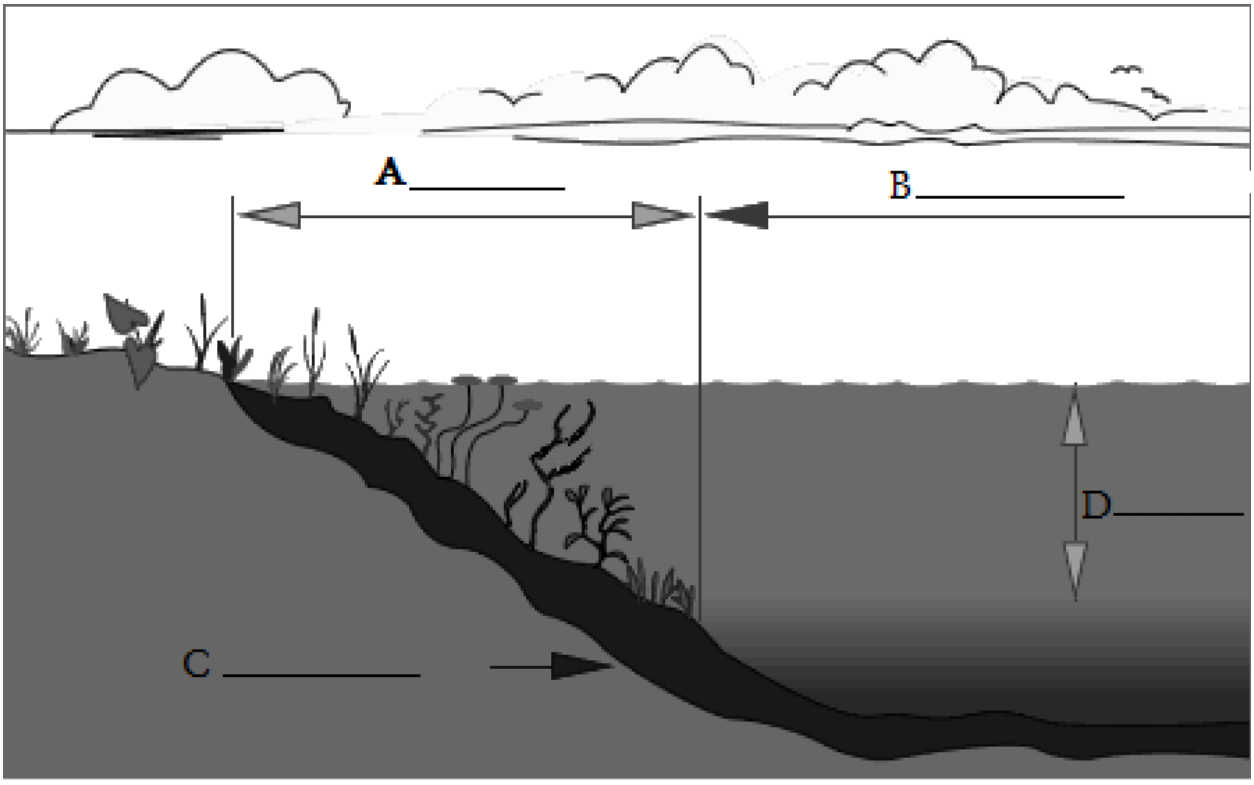
WATER AND AQUATIC ECOLOGY (10 pts) – STOP 7

This question requires materials provided at stop.

1) Use the Key to Manitoba Sport Fish to identify the species of the fish labeled A-A. (1pt)

2) What species was named the provincial fish of Manitoba in 2014? (1pt)

3) The diagram below shows the zones of a lake.



a) Label the zones of a lake indicated by letters A to D on the diagram. (2 pt - 0.5 pt each)

b) Which lake zone is defined by the presence of macrophytes? (1 pt)

4) Look at the invertebrate specimen labelled A-B.

a) Use the Guide to Freshwater Invertebrates to identify invertebrate A-B. (1 pt)

b) In which lake zone would you be most likely to find this organism? (1 pt)

5) Lakes are often classified by their trophic state.

a) Name two (2) of these trophic states. (1 pt)

b) List one (1) defining feature of each trophic state you listed in part a). (2 pts)

Answer:
1a) TBD (1 pt)
2) walleye (1 pt)
3a) A - littoral zone (0.5 pt); B - limnetic zone (or open water) (0.5) ; C - benthic zone (0.5 pt); D - euphotic zone (0.5 pt)
3b) littoral zone (1 pt)
4a) TBD (1 pt)
4b) benthic zone (1 pt)
Partial marks: littoral zone (0.5 pt)
5a) Any 2 of the following: oligotrophic, mesotrophic, eutrophic (1 pt - 0.5 pt each)
b) Any 1 feature from 2 of the following categories (must match the trophic states given in 3a) (2 pts - 1 pt each)
EUTROPHIC: A very biologically productive type of lake due to relatively high rates of nutrient input; low oxygen; fish kills; high phosphorus; minimal light penetration
OLIGOTROPHIC: Very unproductive; lakes low in nutrients and algae, usually very transparent with abundant hypolimnetic oxygen if stratified.
MESOTROPHIC: Moderately productive; relating to the moderate fertility of a lake in terms of its algal biomass

Reference:
1) Ability to use key
2) livestream training
3a) Lake Ecology, p19
3b) Lake Ecology, p 26
4a) Ability to use key
4b) Lake Ecology, p 19
5a) Lake Ecology, p 34
5b) Lake Ecology, p 45, 49, 50

WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 7

This question requires BOTH features and materials found at stop.

Using the binoculars and field guide provided, identify the birds in the distance. (2 pts - 0.5 pt each)

W-A _____

W-B _____

W-C _____

W-D _____

Answer:
W-A: Loggerhead Shrike (0.5 pt)
W-B: Pintail (0.5 pt)
W-C: Black Duck (0.5 pt)
W-D: Peregrine Falcon (0.5 pt)

Reference:
Birds of Manitoba, p 3-6, 15, 20; ability to use field guide

STOP 8

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 8

Match each tree species with its preferred silvicultural habitat features by writing the letter in the apppropriate blank. (2 pts – 0.5 pt each)

A Red Pine
B Black Spruce
C Jack Pine
D White Spruce

_____ Dry to moist site with sandy soils and little competition
_____ Well drained moist loam or clay soil, can tolerate hardwood or shrub competition
_____ Wet site with deep organic soil profile
_____ Dry sites with sandy soils, generally planted along roadways or where aesthetic values are paramount or planted as a preferred species in Dwarf Mistletoe infested areas

Answer:
C, D, B, A (2 pts - 0.5 pt each)

Reference:
Field Guide to the Native Trees of Manitoba, p 26, 22, 20, 24; Clear cutting in Manitoba, p 11; Forest Practices Guidebooks: Training

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SOILS AND LAND USE (10 pts) – STOP 8

This question requires materials provided at stop.

1) Where can you find the First (or Principal) Meridian, which is used as a basis for the Dominion Land Survey? *Circle the best response.* (0.5 pt)

a) longitudinally, near the westernmost point in Canada (Dawson City, Yukon Territory)
b) along the 49th parallel of latitude (southern border of Western Canada)
c) longitudinally, through Greenwich, England
d) longitudinally, though a location near Winnipeg, Manitoba

2) Find SE24-3-20 in the Soils of the Boissevain - Melita Area Survey and answer the following questions.

a) Is this a detailed or reconnaissance map? (0.5 pt)

b) What information on the map leads you to that answer? (0.5 pt)

3) Find the dominant soil series in the polygon.

a) What is the full name of the soil series? (1 pt)

b) Look at Table 4.2 (p 112) in the report. *Complete the sentence with the most appropriate word(s) or term(s).*

The other symbol on the map unit means the that soil series has _____ slopes, _____ topography and a slope of _____%. (1.5 pt - 0.5 pt each)

c) What is the soil texture of the soil series? (0.5 pt)

d) What is the subgroup of the soil series? (1 pt)

e) Look at Table 3.5 (p 45) in the report. Define the term SOIL ASSOCIATION (also known as a CATENA). (1.5 pt)

f) To which association does the soil series belong? (0.5 pt)

4) Half of the town of Boissevain would like to transform this site into a camping area with play structures, picnic areas and hiking trails. The other half would like to expand their growing town's septic field. Use Table 4.14 (p 156) and Table 4.16 (p 185) in the report to answer the following questions.

a) As a land use planner, and considering only the dominant soil series, which use would you recommend? (0.5 pt)

b) Provide a reason for your answer that explains the severity and the type of soil limitations for both uses. (2 pts)

Answer:
1) d) (0.5 pt)
2a) detailed (0.5 pt)
2b) the scale is 1:20000 (0.5 pt)
3a) Montgomery (1 pt)
Partial marks: My (0.5 pt)
3b) multiple, complex, 0-5 (1.5 pts - 0.5 pt each)
3c) loam (0.5 pt)
3d) Gleyed Carbonated Rego Black (1 pt)
Partial marks: any part (0.5 pt)
3e) sequence of related soils (0.5 pt) located adjacent to one another (0.5pt) under different landscape positions (hilltop to depression) (0.5 pt) (1.5 pts total)
3f) Waskada (0.5 pt)
4a) camping area (0.5 pt)
4b) camping area has none or slight limitations (0.5 pt), including imperfect drainage (0.5 pt); septic field has moderate limitations (0.5 pt), including moderately slow permeability of the substrate materials. (0.5 pt) (2 pts total)

Reference:
1) The Dominion Land Survey: Mapping Western Canada
2) ability to interpret map; Soil Management Guide, p 28
3a)-3d) ability to interpret map; The Dominion Land Survey: Mapping Western Canada
3e)-3f) Soil Management Guide, p 22; ability to interpret map
4) ability to interpret map

THEME (2 pts) – STOP 8

This question requires materials provided at stop.

The map labelled T-A shows a section of farmland (259 ha; 640 ac). Mel Singer, a mixed farmer (livestock + crops), has been waiting her whole life to add this neighboring section of farmland to her operations. It even comes with a 10 year old house to live in, nestled in the southeast corner of the property! Seeing that the section is too steep and light textured for annual cropping, she wants to use it for cattle production instead. She is having a tough time deciding among four areas to put her livestock wintering site.

1) Study the map of the section and the descriptions of four areas in the section below. Which livestock wintering site is most likely to conserve soil and water quality? *Circle the letter of the best answer.* (0.5 pt)

A Allowing the cattle to use almost all of the open area near A (64 ha; 160 ac) will spread out the manure pack, and we won't have to move it from another area if we want to fertilize this field. Fencing out the stream will prevent cattle from directly accessing it, and we'll still have a lot of ground left for feeding. We'll need to invest in off-site water systems so that the cattle have drinking water.

B This area will shelter the cattle from winter winds. It is close to the house so that it has easy access to stored hay and silage. Someone will be close by to keep an eye on the health of the cattle. Surface water is easily accessible.

C There is no need to use all of the open area in the north half of this property. We should save some for spring calving pasture or summer pasture. Confining them to the northeastern part will be enough. Additionally this area is close to the road for easy access to bring in feed, to check on their health, and to add new cattle into the property or to move them somewhere else.

D This site is close to both the yard and the road for easy access to check on cattle and deliver feed. Groundwater is close enough to the surface that we can dig a shallow well at least 30 m away from the feeding area to get water for the cattle so that they won't need to access the surface water.

2) *Select one (1) of the remaining areas and circle your choice*. Explain why it is not ideal for wintering livestock. (0.5 pt)

A B C D

3) Briefly describe two (2) risks to soil and water resulting from overusing any one area for livestock wintering or grazing. (1 pt)

Answer:
1) A (0.5 pt)
2) Any 1 of the following for the appropriate choice of area (0.5 pt):
B: very close to a natural surface water body OR small area will exceed nutrient holding capacity over multiple years of use OR possibly very close to ground water so will result in contamination
C: clearly there is surface water drainage going through the site (contamination risk) OR site is likely close to groundwater (contamination risk) OR small area will exceed nutrient holding capacity over multiple years of use
D: very close to groundwater and coarse textured = contamination OR very close to a natural surface water body OR small area will exceed nutrient holding capacity over multiple years of use
3) descriptions which address 2 of the following (1 pt - 0.5 pt each)
soil erosion, soil compaction, sediment transport, sediment accumulation, nutrient concentration in soils, surface water contamination, ground water contamination, alteration of plant

community, alteration of faunal populations or communities, increase of pathogens, release of pathogens

Reference:
Sustainable Livestock Wintering factsheet

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 8

This question requires BOTH features and materials found at stop.

Document A-A contains two figures. Use these figures to answer the questions.

The upper figure is an aerial photo of Lake Udall, which is visible from this stop. Bathymetric contour lines illustrating the water depth at intervals of 1 meter are superimposed on the lake surface. The outermost contour delineates a depth of 1 m. Four different locations in the lake are identified by the letters A, B, C and D.

The lower figure is a graph of water temperature versus depth measured in this lake at depth intervals of 0.5 meters. This graph shows two separate profiles, F and G, taken in two different months of the year.

1) At which one of the four indicated locations were these temperature profiles obtained? *Circle the best response.* (0.5 pt)

A B C D

2) In which month would Profile F have been obtained? *Circle the best response*. (0.5 pt)

December June September

3) In which month would Profile G have been obtained? *Circle the best response*. (0.5 pt)

March July October

4) Why is the water temperature 4 degrees Celsius at the bottom of profile F? (0.5 pt)

Answer:
1) A (0.5 pt)
2) December (0.5 pt)
3) July (0.5 pt)
4) Water at 4.0 degrees C is at maximum density and sinks to the lake bottom (0.5 pt)

Reference:
1) How to Read a Topographic Map and Delineate a Watershed, p 1
2)-4) Lake Ecology, p 8-9

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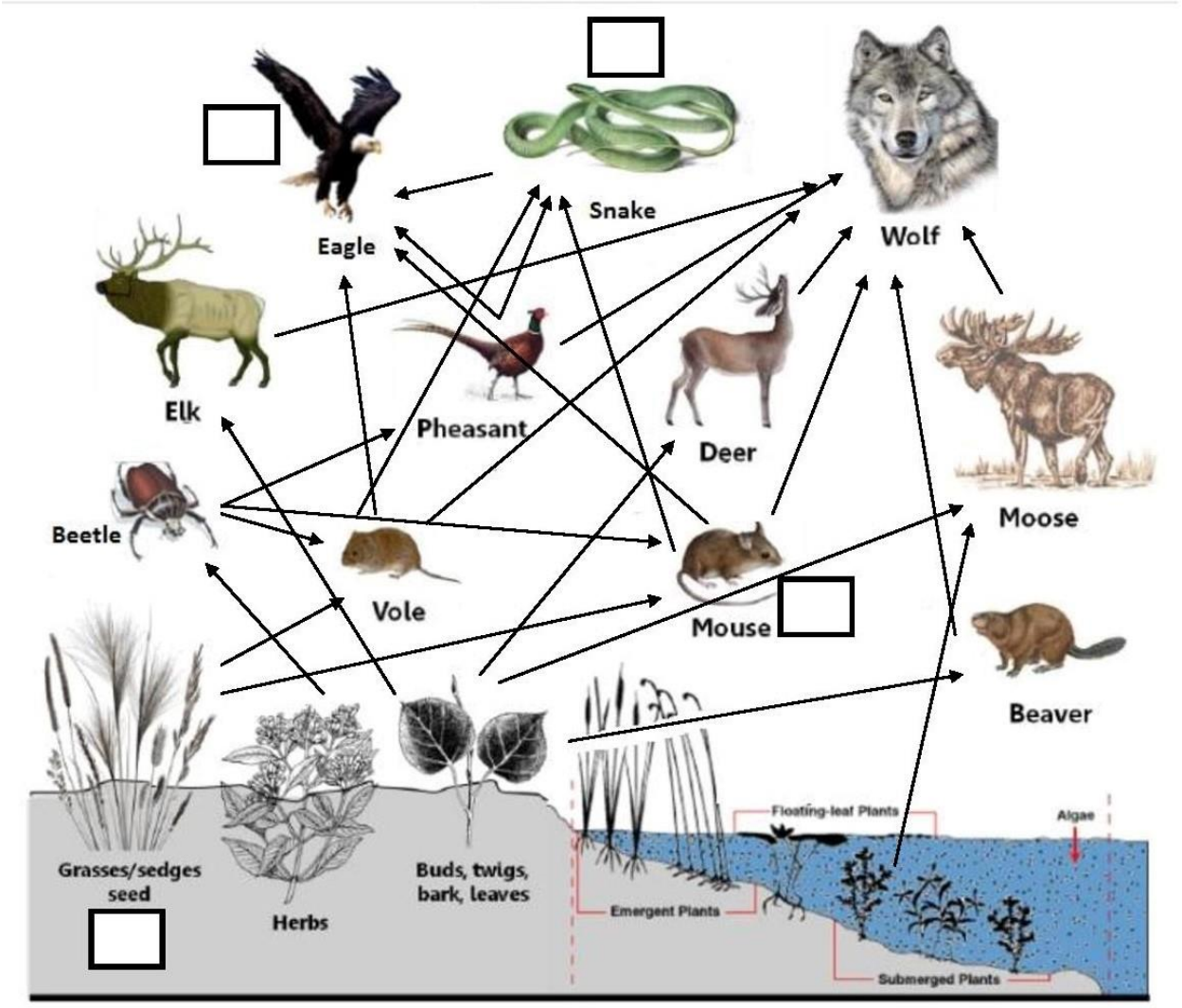
WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 8

In the diagram of a food web below, four organisms have boxes beside them. *Arrange the letters A, B, C and D in the boxes in the best possible way to indicate the trophic levels of those organisms.* (2 pts - 0.5 pt each)

A Autotroph
B Quaternary Consumer
C Herbivore
D Secondary Consumer



Answer:
grasses/sedges: A; mouse: C; snake: D; eagle: B
Reference:
Wildlife Document, p 29-31

STOP 9

MULTI-DISCIPLINARY (20 pts) – STOP 9

This question requires BOTH features and materials found at stop.

The site you are standing on has been selected for a new educational hiking trail. Your group has been given the task of observing the site and recording everything you see. The committee in charge of creating the interpretive signs will use your notes to decide what site characteristics the new signs should include. Your notes need to be thorough and accurate, and must include all species, habitat features and general site characteristics that you can see and identify.

Using your own senses and the equipment that is provided, study this site and record all of your observations on the Field Notes sheet provided at the stop. Keep in mind the four core Envirothon topics (Native Plants & Forestry, Soils & Land Use, Water & Aquatic Ecosystems and Wildlife & Wildlife Management) when you are studying the site, and make sure you work as a team to maximize your observational skills. (20 points)

Answer:
See Field Notes Marking Sheet and Marking Guide for the possible observations and mark breakdown.

Reference:
MB Recreational Fish Key; Aquatic Sampling Techniques, p 8; Aquatic Training Session
Field Guide To The Native Trees Of MB; Forestry Equipment Techniques, p 4; Tree Physiology, p 6
Soils & Land Use Document, p 6; Soil Management Guide, p 8; Soils Training Session
Mammals of MB; Birds of MB; Wildlife Training Session; Wildlife Document, p 47
Ability to observe and organize data

STOP 10

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 10

True/False*: Indicate whether the statement is true (T) or false (f) by circling the correct answer*. (2 pts - 0.5 pt each)

T F Invasive alien species are considered the second biggest threat to biodiversity.

T F Most North American ash tree species are resistant to emerald ash borer.

T F Mountain pine beetle could be brought into Manitoba through firewood.

T F It is only illegal to bring elm firewood into Canada from the U.S.A.

Answer:
T, F, T, F (2 pts - 0.5 pt each)

Reference:
Alien Forest Pests, p 10; Emerald Ash Borer, p 1; Don't Move Firewood - Provincial, p 1-22

SOILS AND LAND USE (10 pts) – STOP 10

This question requires BOTH features and materials found at stop.

1) The name of the soil on this site is shown on the sign by the soil pit.

a) What soil order does the soil belong to? (0.5 pt)

b) What soil great group does it belong to? (0.5 pt)

2) A dilute hydrochloric acid solution is used to find the top of the C horizon in Prairie soils.

a) Use the dilute HCl provided to find the top of C horizon. Write down the approximate depth to the C-horizon (in cm). (0.5 pt)

b) What is the acid reacting to when it encounters soil from the C horizon? (0.5 pt)

c) Name one (1) soil forming process that has occurred in the C horizon. Describe briefly what happened in this soil. (1 pt)

3) How would you describe the structure of the A horizon? *Circle the best answer*. (0.5 pt)

a) amorphous
b) platy
c) angular blocky
d) granular

4) How is structure related to soil water? (1 pt)

5) What colour would the soil have if you found it to be poorly drained or saturated with water? (0.5 pt)

6) The richness and depth of this soil profile is not as well developed as the soil that is at the bottom of the slope. Name one (1) of the five soil forming factors that has limited this soil's development. Briefly explain how it was limiting. (1 pt)
7) Remove a handful of soil from the C horizon. Try to form a ball. If it is too dry, add water. Use both the soil texturing flow chart and textural triangle to determine the percentages of clay and silt in the sample. Which of the following combinations is the best answer? (1 pt)

a) 60% clay and 20% silt
b) 40% clay and 10% silt
c) 30% clay and 35% silt
d) 10% clay and 20% silt

8) What is the parent material and origin for this soil? *Circle the best answer*. (1 pt)

a) Organic deposit from accumulated dead vegetation
b) Lacustrine deposit from Glacial Lake Agassiz
c) Aeolian deposit originating from beach sand
d) Morainal deposit from limestone and shale pulverized by a glacier

9) Although you likely saw a lot of annual cropping on your way to Envirothon, it is actually rare in this area.

a) Name one (1) specific agricultural capability limitation of soils and land in this area (0.5 pt)

b) List three (3) land uses that are more suited for the soils of this area. (1.5 pt)

Answer:
1a) Soil Order TBD (0.5 pt)
1b) Soil Great Group TBD (0.5 pt)
2a) C Horizon Depth TBD (0.5 pt; up to 5 cm of deviation from our answer is acceptable)
2b) Calcium carbonate and/or magnesium carbonate (0.5 pt)
2c) TRANSLOCATION: calcium carbonate is moved from from the A and B horizons into the C horizon (1 pt - 0.5 pt for process, and 0.5 pt for the description)
3) TBD (0.5 pt)
4) structure contributes to pore space (0.5 pt) for water flow or storage (0.5 pt) (1 pt total)
5) Any of the following: dull gray, bluish gray, mottles with oxide flecks (0.5 pt)
6) Any 1 of the following (0.5 pt for factor, 0.5 pt for explanation) (total 1 pt)
TOPOGRAPH/RELIEF - water sheds here and accumulates down there
CLIMATE - exposure to elements (wind, sun, less water infiltration); the soil down there is more sheltered
ORGANISMS - there is less vegetation up here because of exposure to elements (wind, sun, less water infiltration)
(NOT parent material or time)
7) soil texture of C horizon TBD (1 pt)

8) d (1 pt)
9a) T Topography - steep slopes (0.5 pt)
9b) Any 3 of the following: pasture; recreation (e.g. camping, hiking); residential or urban development; hunting or trapping; set-aside (preserve); forest harvest; wildcraft (collecting plants for food, materials, or medicine) (1.5 pts - 0.5 pt each)

Reference:
1) Canadian System of Soil Classification, p A.9
2) Training, Soils and Land Use Document, p 19-20; Soil Management Guide, p 16-17, Think Trees TV: Let's Get the Dirt on Soil
3)-5) Soil Management Guide p 13-15
6) From the Surface Down: Section 3 - What are the Soil Forming Processes?
7) Training, Soil Management Guide, p 148
8) Soils and Land Use Document, p 8-9; From the Surface Down, p 11-13; Soils and Land Use Document, p 25-26
9) Soil Management Guide, p 33

THEME (2 pts) – STOP 10

This question requires features found at stop.

1) Describe how wind and water erosion are similar to each other. (0.5 pt)

2) Describe how wind and water erosion are different from tillage erosion. (0.5 pt)

3) For agricultural land that will be annually cropped for a number of years, what is one (1) practice that can be applied to minimize the risk of wind, water and tillage erosion? (0.5 pt)

4) How would the conversion of annual cropland to perennial pasture reduce wind and water erosion risk? (0.5 pt)

Answer:
1) they both carry soil particles away (0.5 pt)
2) Any 1 of the following, must demonstrate the CONTRAST: tillage erosion can happen only when tilling - wind and water erosion may happen any time there is weather; tillage erosion leaves soil on the field (but redistributed) - no soil is lost from the site like what may happen with wind and water erosion (0.5 pt)
3) Any 1 of the following: establish grassed waterways in steeply sloped parts of the field; adopt minimal tillage; adopt cropping systems that leave plenty of plant residue to protect the soil; avoid row crops; plant cover crops; plant buffer strips; plant shelterbelts; reduce tillage frequency; reduce depth and speed (intensity); reduce size of tillage equipment; till along the contour of land (or perpendicular to slope); use a plow that can switch the sides of the furrow so that the material is always deposited on the upslope side; other reasonable answers (0.5 pt)
4) permanent vegetation cover (0.5 pt)

Reference:
Soil Management Guide, Ch 7

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 10

Each of the sentences below describes one process of the hydrologic cycle. Name each process.

1) Water vapour cools and becomes liquid or solid on tiny particles of dust in the air. (0.5 pt)

2) Water is heated by the sun and surface molecules become sufficiently energized to break free. (0.5 pt)

3) Vapour is emitted from plant leaves. (0.5 pt)

4) Precipitation and snowmelt moves downward through cracks and joins in soil and rocks. (0.5 pt)

Answer:
1) Condensation or desublimation (0.5 pt)
2) Evaporation (0.5 pt)
3) Transpiration (0.5 pt)
4) Percolation (0.5 pt)
(Any version of root is acceptable)

Reference:
Aquatic Ecology Document, p 4

WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 10

This question requires materials provided at stop.

Look at the skull labelled W-A.

1) Calculate the dental formula for the skull W-A. (1 pt)

2) Using the skull plates and dental formula sheets provided, identify what species the skull belongs to. (1 pt)

Answer:
1) I 3/3 C 1/1 P 4/3 M 1/2 (0.5 pt); = 36 (0.5 pt)
2) Lutra (River Otter) (1 pt)

Reference:
1) Wildlife Document, p 16-20
2) Training Session; Dental Formula; ability to use field guides

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STOP 11

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 11

This question requires BOTH features and materials found at stop.

1) Using the Field Guide to the Native Trees of Manitoba, identify the specimens labeled F-A, F-B, and F-C. State the full common or scientific name. (1.5 pts - 0.5 pt each)

F-A _____

F-B _____

F-C _____

2) Which one of these native tree species in under threat from an invasive insect pest? (0.5 pt)

Answer:
1) F-A: TBD (0.5 pt); F-B: TBD (0.5 pt); F-C: TBD (0.5 pt)
2) Green Ash (as ID'd above)

Reference:
Field Guide to Native Trees of Manitoba, p 11-13; Provincial / Regional Training

SOILS AND LAND USE (2 pts) – STOP 11

This question requires features found at stop.

The rate of water infiltration into the soil is largely dependent on soil texture, but other factors also impact infiltration. Choose your answers to the questions from the list below. *Write the letter of your choice.*

A High water table
B Freeze-thaw cycle effects on heavy clay soils
C Use of perennial crops in rotation
D Presence of sodium salts in B horizon
E Soil compaction
F Soil cultivation
G Incorporation of compost or manure
H The population of night crawlers and earthworms

1) Which is the most visible sign of poor infiltration on this site? (0.5 pt)

2) What three (3) factors could be used to improve water infiltration on this site? (1.5 pts)

Answer:
1) E (0.5 pt)
2) Any 3 of: C, F, G, H (1.5 pts - 0.5 pt each)

Reference:
1)-2) Soil Quality Indicators: Infiltration and Soil Management Guide, p 46

THEME (10 pts) – STOP 11

This question requires materials provided at stop.

1) Soil surveys describe the characteristics of soils in an area and plot the soil types on a map. Soil survey maps are produced at a variety of scales, which can be given as a ratio, e.g. 1:50 000. This means 1 unit of measurement on the map represents 50 000 of those units on the ground. The scale of a map determines the amount of detail the map shows.

Identify one (1) potential purpose for a soil survey map at each scale listed.

a) 1:1 000 000 (1 pt)

b) 1:125 000 (1 pt)

c) 1: 20 000 (1 pt)

2) Use the map "Soils in the Rural Municipality of Killarney - Turtle Mountain, Manitoba" to answer the next two questions.

a) What is the range of soil textures in the furthest southwest corner of the mapped area (Section 6)? (1 pt)

b) The furthest southwest corner of the map is only 12 km away from your current location in the International Peace Gardens. Since the mapped area is so nearby, can you use this map to predict how well-drained the soils are in the International Peace Gardens? Explain why or why not. (2 pts)

3) Soil survey reports give information that can be used to help identify the risk of soil erosion. List two (2) soil characteristics in a soil report or map that would help you assess the soil's susceptibility to erosion. (2 pts)

4) Name three (3) mechanisms of soil erosion. For each mechanism, identify one (1) method used in agriculture to mitigate this type of erosion. (3 pts)

Answer:
1a) Any 1 of the following: provincial overview, general soil comparisons, national scope (1 pt)

1b) Any 1 of the following: general soils awareness, general soil comparisons, national scope, starting point for more detailed data collection (1 pt)
1c) Any 1 of of the following: on-farm decisions, municipal decisions, field-scale comparisons, watershed management, land use assessment, irrigation assessment, nutrient management (1 pt)
2a) Loam to clay loam (1 pt)
2b) No (1 pt); Any 1 of the following: soils can vary over short distances, soil drainage varies widely even in the area shown, physical characteristics (e.g. bedrock geology, topography, etc.) of this area and the International Peace Gardens area might be different (1 pt)
3) Any 2 of the following: texture, agricultural capability subclass E (erosion limitation), degree of erosion in soil code, agricultural capability subclass T (slope limitation), slope class in soil code, "rapid surface runoff" in description (2 pts - 1 pt each)
4) Wind (0.5 pt) AND any 1 of the following: maintain crop residue over, establish cover crops, emergency tillage, addition of crop residue, addition of manure, addition of water to moisten soil (0.5 pt)
Water (0.5 pt) AND any 1 of the following: crop management, buffer strips, riparian management, establish grassed waterways, conservation tillage, establish permanent cover (0.5 pt)
Tillage (0.5 pt) AND any 1 of the following: reduce tillage frequency, reduce tillage intensity, reduce variability in tillage speed and depth, reduce size of tillage implements, use contour tillage, use reversible moldboard plow (0.5 pt)

Reference:
1a)-1c) MB Soil Management Guide, p 28
2a) Ability to interpret map
2b) Reasoning skills; MB Soil Management Guide, p 30
3) MB Soil Management Guide, p 85, 89, 94, 95
4) MB Soil Management Guide, p 84, 87-91, 95, 96

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 11

This question requires features found at stop.

Note the small area of wetland habitat where water from Lake Udall flows out into the stream passing under the bridge.

1) Which wetland habitat type best describes this small system? (0.5 pt)

2) Name two (2) characteristic types of emergent vegetation commonly found in this kind of wetland habitat. (1 pt)

3) Name one (1) important function this wetland provides that improves the water quality in the stream flowing out of Lake Udall? (0.5 pt)

Answer:
1) marsh (0.5 pt)

2) Any 2 of the following: reeds, rushes, cattails, sedges (1 pt - 0.5 pt each)
3) Any 1 of the following: water filtration, contaminant removal, suspended particle removal, excessive nutrient removal. (0.5 pt)

Reference:
1)-2) Aquatic Ecology: Wetlands, Habitat Types, p 23
3) Aquatic Ecology: Wetlands, Wetland Functions and Values, p 21

WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 11

This question requires BOTH features and materials found at stop.

As you are hiking through the woods you notice the scene before you. Using the tracks, scats and other wildlife signs, determine the four (4) wildlife species that have been here. (2 pts - 0.5 pt each)

Answer:
In no particular order: Coyote (0.5 pt); Eastern Cottontail (0.5 pt); Badger (0.5 pt); Cougar (mountain lion) (0.5 pt)

Reference:
Wildlife Signs and Tracks: Animal Tracking and Animal Tracks in Manitoba; Scat Identification; Training; Track Identification Video (if it is out by then)

STOP 12

MULTI-DISCIPLINARY (20 pts) – STOP 12

This question requires BOTH features and materials found at stop.

A healthy riparian zone is essential for the health of the stream, the land that surrounds it, and downstream waterbodies. A Riparian Health Assessment helps provide a complete picture of riparian function because it knits together eleven key health indicators, which include vegetative and physical features. You will conduct a partial Riparian Health Assessment of Udall Stream by evaluating 3 of the 11 riparian health indicators. Then you will answer some riparian theory questions. Make sure you work together as a team to answer this multidisciplinary question, and pay attention to directions about flagging tape colour.

A partially completed Riparian Health Assessment form is found on the next page. As you answer the questions below, you must also complete this form by circling the appropriate scores and recording the values in the "Actual" column (questions 1a+b, 2a, and 3a).

1) Indicator 2: Invasive Plant Species
The outer edge of the riparian area is delineated by BLUE FLAGS. Look at the representative specimens of invasive plant species (noxious weeds) that are marked with ORANGE

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FLAGGING TAPE. Look for these invasive species throughout the riparian area ON THIS SIDE OF THE STREAM ONLY and answer the following questions. Use M-A: Percent cover and Density distribution to help you.

Riparian Health Assessment Form

	Actual	Possible
1. Vegetative Cover of Floodplain and Streambanks	6	6
6 4 2 0		
2. Invasive Plant Species		6
3 2 1 0 (cover)		
3 2 1 0 (density)		
3. Disturbance-increaser Undesirable Herbaceous Species	2	3
3 2 1 0		
4. Preferred Tree and Shrub Establishment and Regeneration		6
6 4 2 0		
5. Utilization of Preferred Trees and Shrubs		3
3 2 1 0		
6. Standing Decadent and Dead Woody Material	3	3
3 2 1 0		
7. Streambank Root Mass Protection	6	6
6 4 2 0		
8. Human-Caused Bare Ground	6	6
6 4 2 0		
9. Streambank Structurally Altered by Human Activity	0	6
6 4 2 0		
10. Pugging, Hummocking and/or Rutting	0	3
3 2 1 0		
11. Stream Channel Incisement (vertical stability)	6	9
9 6 3 0		
Total		57

Pts	17/57	23/57	29/57	32/57	34/57	37/57	40/57	46/57	52/57
%	30	40	51	56	60	65	70	80	91
	Unhealthy				Healthy with Problems			Healthy	

Form adapted from: Managing the Water's Edge. 2004. Riparian Health Assessment for Streams and Small Rivers v1. Winnipeg, Manitoba.

a) Approximately what percentage of the riparian area is covered with these invasive plants? *Choose the best answer below and circle the score in the Riparian Health Assessment form.* (2 pts)

score 3 - No invasive species present
score 2 - invasive species present with total cover less than 1 percent
score 1 - invasive species present with total cover between 1 and 15 percent
score 0 - invasive species are present with total cover more than 15 percent

b) What density/distribution class best characterizes the distribution of invasive species in the riparian area? *Choose the best answer below and circle the score in the Riparian Health Assessment form.* (2 pts)

score 3 - No invasive species present
score 2 - invasive species present with density/distribution class 1, 2, or 3
score 1 - invasive species present with density/distribution class 4, 5, 6, or 7
score 0 - invasive species are present with density/distribution class 8 or higher

2) Indicator 4: Preferred tree and shrub establishment and regeneration

A good indicator of ecological stability is the presence of desirable woody plants in all age classes, especially the younger age classes. In this area, all the shrubs with red bark are desirable species (including willow, saskatoon, chokecherry, and dogwood), whereas rose and hawthorn (shrubs with thorns), and snowberry (very short shrubs with gray stems) are not. Observe the desirable woody species on the slopes near the riparian area ON THIS SIDE OF THE STREAM. Look carefully for seedling and sapling regeneration. Estimate the total area covered by all preferred woody species, regardless of age, and then determine the proportion of that cover that is young (seedling and sapling).

How much of the preferred tree/shrub cover is saplings or seedlings? *Choose the best answer below and record the score in the Riparian Health Assessment form.* (2 pts)

score 6 - More than 15%
score 4 - 5 to 15 %
score 2 - Less than 5%
score 0 - Preferred trees or shrubs are completely absent

3) Indicator 5: Utilization of preferred trees and shrubs (browsing by animals)

a) On the shrub flagged with BLUE FLAGGING TAPE, count the number of twig ends within reach of large herbivores that have been browsed (bitten or chewed off by animals). Compare this to the number of undamaged twigs within reach of large herbivores on the same shrub to determine the browsing percentage. What has been the browsing pressure on the desirable woody

species (represented by the one flagged shrub)? *Choose the best answer below and record the score in the Riparian Health Assessment form*. (2 pts)

score 3 - None (0 to 5% of available twigs are browsed)
score 2 - Light (5 to 25% of available twigs are browsed)
score 1 - Moderate (25 to 50% of available twigs are browsed)
score 0 - Heavy (more than 50% of available twigs are browsed)

b) Observe the browsing on the non-desirable shrub marked with PINK FLAGGING TAPE. What has been the browsing pressure on it? *Circle the best answer below, but do NOT enter it into the Riparian Health Assessment form*. (1 pt)

score 3 - None (0 to 5% of available twigs are browsed)
score 2 - Light (5 to 25% of available twigs are browsed)
score 1 - Moderate (25 to 50% of available twigs are browsed)
score 0 - Heavy (more than 50% of available twigs are browsed)

4) At this point you will have completed your Riparian Health Assessment form. Double check that you have entered values into each blank cell in the "Actual" column, and then add up all values in this column to determine the Total Actual Riparian Health score. Write this total in the empty cell at the bottom of the table. Use this total and the health score chart at the bottom of the table to answer the questions that follow:

a) What is the result of this health assessment? *Circle the best answer*. (1 pt)

i) Unhealthy
ii) Healthy with Problems
iii) Healthy

b) Name the indicator you think is most important to monitor (i.e. assess repeatedly) over the long term for improvement in this riparian area. Give one (1) reason why that indicator is so important. (1 pt)

c) Give two (2) recommendations for managing or improving this riparian area if the main objective is increasing biodiversity. (1 pt)

5) The following questions require you to use your general knowledge of riparian theory.

a) Name one (1) ecological service of this riparian area that relates to the area's recreational values. (0.5 pt)

b) Explain why we are concerned about invasive plant species (noxious weeds) in a riparian area. (1 pt)

c) Browsing on shrubs and other plants suggests the presence of wildlife. Of the eight ecological functions provided by a riparian area, which function is indicated by browsing? (0.5 pt)

d) List two (2) ecological functions of preferred trees and shrubs in the riparian area. (1 pt)

e) List two (2) potential causes of large amounts of dead and decadent wood in riparian zones. (1 pt)

f) This stream has been channelized by human activity. Give one (1) reason would this might have been done at this location. (0.5 pt)

g) Explain how channelization changes a riparian area. (1 pt)

h) Name one (1) effect channelization can have downstream. (0.5 pt)

i) Look at the photo labelled M-B, an aerial photograph of Udall Stream. List two (2) natural sources of sediment and/or nutrients that could flow into the stream from the landscape in the photo. (2 pts)

Answer:
1a) TBD (2 pts)
Partial marks: 1 pt - the answer selected is one step above or below the correct answer
1b) TBD (2 pts)
Partial marks: 1 pt - the answer selected is one step above or below the correct answer
2) TBD (2 pts)
Partial marks: 1 pt - the answer selected is one step above or below the correct answer
3a) TBD (2 pts)
Partial marks: 1 pt - the answer selected is one step above or below the correct answer
3b) TBD (1 pt)
Partial marks: 0.5 pt - the answer selected is one step above or below the correct answer
4a) TBD (1 pt)
Partial marks: 0.5 pt - the answer selected matches the category (unhealthy, healthy, etc.) for their "total" score, even if they have done the health assessment incorrectly
4b) Answer is up to the students to choose and defend. They may choose the lowest scoring parameter, or something they value the most. The right answer will be subjective. Good choices are: vegetation cover; shrub use; regeneration. (1 pt)
4c) Any 2 of the following: Restrict access to the area to allow woody species to grow back; Do not mow; plant more trees; manage vegetation to reduce weeds/disturbance species; burn brome/bluegrass; manage entire stretch of riparian corridor (1 pt - 0.5 pt each)
5a) Any 1 of the following: shade/shelter; enjoyment of healthy ecosystem (aesthetic values); decreased incidence/costs of floods, or other reasonable answers (0.5 pt)
5b) Noxious weeds are aggressive, but shallow rooted. They do not hold the streambank together as well as native riparian species. (1 pt)
5c) maintain biodiversity (0.5 pt)

5d) Any 2 of the following: Maintains biodiversity, Maintains streambanks, trap and store sediment, create primary productivity (1 pt - 0.5 pt each)
5e) Any 2 of the following: Extended flooding, Stream unable to access floodplain due to channel incisement, Lowering of water table, Disease affecting trees and shrubs spreading throughout riparian area (1 pt - 0.5 pt each)
5f) Any 1 of the following: Landscaping purposes, control over water flow, to get more water out of upstream waterbodies (drainage – there is farmland upstream out of the park) (0.5 pt)
5g) Channelization increases water flow and erosion potential, therefore increases erosion, reduces the building of streambanks, may cause channel incisement and down cutting, which decreases the extent of the riparian area. (1 pt)
5h) Any 1 of the following: Sedimentation, decreased water quality, decreased aquatic habitat value (0.5 pt)
5i) Any 2 of the following: decomposition of leaf litter from trees or vegetation, animal droppings, natural erosion along stream, or other reasonable natural sources (2 pts - 1 pt each)

Reference:
1a) Managing the Water's Edge p. 35-40
1b) Managing the Water's Edge p. 38
2) Managing the Water's Edge p. 43-46
3a) Managing the Water's Edge, p 47-49
3b) Managing the Water's Edge, p 47-49
4a) Managing the Water's Edge, p 71-73
4b) ability to reason and provide an argument
4c) ability to reason and think about solutions; general themes from Managing the Water's Edge and Caring for the Green Zone
5a) Caring For the Green Zone, p 8-9
5b) Caring For the Green Zone, p 17
5c) Caring For the Green Zone, p 8-9
5d) Caring For the Green Zone, p 16-19
5e) Caring For the Green Zone p 19
5f) ability to reason; Managing the Water's Edge, p 62-69; Caring for the Green Zone, p 20
5g) Caring for the Green Zone, p 20, 22-23
5h) Caring for the Green Zone, p 22-23
5i) ability to observe and reason

STOP 13

NATIVE PLANTS AND FORESTRY (2 pts) – STOP 13

List four (4) values or considerations that are taken into account during the planning of a future harvest area. (2 pts)

Answer:
Regeneration/silvicultural treatments of the site after harvest; Other non Forest values like wildlife features or high recreational use; Historical or indigenous values; Site damage and operational constraints, winter or summer harvest. Other answers as appropriate. (2 pts - 0.5 pt each)

Reference:
Pre-Harvest Survey; Clearcutting in Manitoba; Protection of Softwood Understory

SOILS AND LAND USE (2 pts) – STOP 13

This question requires materials provided at stop.

A sample of soil was analyzed, but some measurements needed to calculate the bulk density of the sample were forgotten.

1) Using the equipment provided, determine these missing measurements. (1 pt - 0.5 pt each).

NOTE: The empty graduate cylinder and the one containing the soil sample have the same mass. Do NOT move the soil out of the cylinder labelled Soil Sample.

Mass of empty graduated cylinder (grams):
Mass of graduated cylinder + soil (grams):

2) The volume of the soil sample is 98 cm^3. Calculate the bulk density (in g/cm^3) of this soil sample using the information obtained in question 1). (1 pt).

Answer:
1) mass of empty cylinder: TBD (0.5 pt); mass of cylinder + soil: TBD (0.5 pt)
2) (mass of cylinder + soil) - (mass of empty cylinder): TBD (0.5 pt); bulk density = mass of soil/98 cm3: TBD (0.5 pt)

Reference:
Soil Management Guide, p 111

THEME (2 pts) – STOP 13

The quality of a soil, or its capacity to function, is evaluated using inherent and dynamic soil properties.

1) In the context if the above sentence:

a) Define INHERENT. (0.5 pt)

b) Define DYNAMIC. (0.5 pt)

2) Soil electrical conductivity is a soil quality indicator.

a) List one inherent factor that effects electrical conductivity. (0.5 pt)

b) List one dynamic factor that effects electrical conductivity. (0.5 pt)

Answer:
1a) A property that changes very little or not at all with management (0.5 pt)
1b) A property that is affected by human management and natural disturbances over the human time scale. (0.5 pt)
2a) Any 1 of the following: the amount and type of soluble salts in solution, porosity, soil texture, soil moisture, soil temperature (0.5 pt)
2b) Enrichment with organic matter and/or fertilizer (0.5 pt)

Reference:
1) Soil Quality Indicator Sheets - Soil Quality Indicators
2) Soil Quality Indicator Sheets - Soil Electrical Conductivity

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 13

This question requires materials provided at stop.

1) Follow the directions for the water quality test outlined below to determine the turbidity of the water sample provided. (1.5 pt)

Directions*:*
Remove your sunglasses and put on the safety gloves and goggles. If you are wearing prescription glasses, you do not need to use the safety glasses.
Shake the bottle of sample water (2-L plastic bottle labelled A-A) vigorously for 5 seconds to ensure sample is thoroughly mixed.
Pour some sample water into the beaker provided until the beaker is about half-full.
Using the water sample in the beaker, follow the instructions on the laminated card labeled Turbidity.
Record your result below, in JTU. If the sample is between two numbers on the reference card, report your result halfway between the numbers on the reference card.

Turbidity reading _____

2) ***Multiple Choice****: Which of the choices is correct? Circle the best response*. (0.5 pt)

Look at the equipment labeled A-B. What does this equipment measure?

a) Water temperature
b) Stratification of a water body

c) Total dissolved solids
d) Penetration of solar radiation

Answer:
1) TBD (1.5 pt)
Partial marks TBD (0.5 pt)
2) d (1 pt)

Reference:
1) Ability to follow written instructions; Water Quality, p 14-15
2) Aquatic Sampling Techniques, p 1

WILDLIFE AND WILDLIFE MANAGEMENT (10 pts) – STOP 13

This question requires materials provided at stop.

You have been in the field for several days completing a mark recapture survey to determine the estimated population of the Olive-backed pocket mouse found in a 3 km^2 area in Spruce Woods Provincial Park. You are using the Peterson Method. On the first day, you set up a live trap. You returned the next day and found 13 mice inside. You then marked all of these mice with white-out on their foreheads before releasing them back into the wild. You then reset the trap for the next day. The results of next three days' sampling are shown on Diagram W-A. Using the provided information from your subsequent days of sampling, determine the following:

1) Write the formula you will use for the Peterson Method. (1 pt)

2) Determine the estimated population based on Survey Day 2 (2 pts)

3) Determine the estimated population based on Survey Day 3 (2 pts)

4) Determine the estimated population based on Survey Day 4 (2 pts)

5) What is the overall estimated population of Olive-backed pocket mice in the 3 k^{m2} area of Spruce Woods? (2 pts)

6) The survey is only catching a small number of individuals. Write the adjusted formula that corrects for the small sample size. (1 pt)

Answer:
1) N= MC/R (1 pt)
2) (13)(9)/4 (1 pt) = 29.3 (1 pt)
3) (13)(11)/6 (1 pt) = 23.8 (1 pt)
4) (13)(12)/5 (1 pt) = 31.2 (1 pt)
5) (29.3+23.8+31.2)/3 (1 pt) =28.1 (1 pt)
6) Nc= [(M+1) x (C+1))/(R+1)] - 1 (1 pt)

Reference:
Wildlife Document, p 50-53

STOP 14

NATIVE PLANTS AND FORESTRY (10 pts) – STOP 14

This question requires BOTH features and materials found at stop.

This Permanent Sample Plot was established in 2012, and the trees were measured and tagged at that time. Using the equipment provided, measure the marked trees at this location. Record the information in the correct places on the tally sheet provided at the stop, and perform the calculations required. Write your team number on the tally sheet and return the tally sheet with t he rest of your test. (10 pts)

Answer:
TBD
Full marks: +/- 0.5 cm in diameter or m in height
Partial marks: +/- 1.0 cm in diameter or m in height

Reference:
Regional and Provincial training; Livestreaming training; ThinkTrees videos

SOILS AND LAND USE (2 pts) – STOP 14

This question requires features found at stop.

This stop is a popular habitat for fungi. If they are not yet visible at the soil surface, you will just have to trust the writer of this question!

1) List two (2) benefits that fungi provide for the soil ecosystem. (1 pt)

2) List two (2) soil management practices that can maintain and/or increase fungal populations in an agricultural system. (1 pt)

Answer:
1) Any 2 of the following: residue decomposition, infiltration and water storage, nutrient cycling (1 pt - 0.5 pt each)
2) Any 2 of the following: reduction/elimination of tillage, reduction in compaction (lighter machinery, less machinery use under wet conditions), reduction/elimination/appropriate use of pesticides, addition of compost/manure, use of cover crops/crop rotation, leaving cropping residue on the soil surface NOT mixing cropping residue into the soil (1 pt - 0.5 pt each)

Reference:
1)-2) Soil Biodiversity

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THEME (2 pts) – STOP 14

The Watershed Evaluation of BMPs program is a multi-stakeholder effort to verify the environmental and economic benefits of BMPs in real-world situations. The projects take advantage of twin watersheds to contrast conventional (traditional) and recommended beneficial practices.

1) State one (1) way government and academic researchers play a part in the WEBs program. (0.5 pt)

2) State one (1) way government policy makers can use the information from the WEBs program. (0.5 pt)

3) State one (1) way agricultural producers use this information. (0.5 pt)

4) State one (1) way you, as a food consumer, can use this information. (0.5 pt)

Answer:
1) Any 1of the following: gathering scientific evidence about practices; modelling the potential total impacts of conventional and innovative practices on Lake Manitoba and other watersheds; publishing or communicating scientific results of practice comparisons. (0.5 pt)
2) Any 1 of the following: evidence-based land use regulations; evidence-based BMP incentive programming; evidence-based education (0.5 pt)
3) Any 1 of the following: make informed choices about implementing land management practices; use the evidence of sustainability to help market their products (0.5 pt)
4) Any 1 of the following: support farms using beneficial practices by choosing their ag products; communicate with others using an informed opinion about agriculture (0.5 pt)

Reference:
South Tobacco Creek BMP Document, inset and header boxes; Sustainable Food: Public Summary of Policy Document

WATER AND AQUATIC ECOLOGY (2 pts) – STOP 14

Multiple Choice*: Which of the choices is correct? Circle the best response.* (2 pts - 0.5 pt each)

1) Manitoba's Water Strategy identifies six inter-related policy areas. Which one of the following is NOT one of these areas?

a) Water quality
b) Drainage
c) Use & Allocation
d) Disposal

2) What do Manitoba Conservation Districts do?

a) Work at the federal level with provincial representatives to revitalize waterways and manage water control structures.
b) Work at the international level with federal representatives to revitalize waterways and manage water control structures.
c) Work at the local level with all community members to revitalize waterways and manage water control structures.
d) None of the above.

3) Which of the following is NOT an Act in Manitoba?

a) The Dyking Authority Act
b) The Water Power Act
c) The Water Rights Act
d) Pumping and Lift Station Rights Act

4) Which of the following is NOT an activity of the International Joint Commission?

a) Regulating Manitoban fisheries
b) Regulating shared water uses
c) Improving air quality
d) Improving water quality

Answer:
1) d (0.5 pt)
2) c (0.5 pt)
3) d (0.5 pt)
4) a (0.5 pt)

Reference:
1) Water Policy and Legislation, p 7
2) Water Policy and Legislation, p 9
3) Water Policy and Legislation, p 11-13
4) Water Policy and Legislation, p 17-18

WILDLIFE AND WILDLIFE MANAGEMENT (2 pts) – STOP 14

This question requires materials provided at stop.

You are walking in Spruce Woods Provincial Park and you see a large area of prairie that appears to be dug up by an animal, as shown the photo labelled W-A. Looking around, you also see a

skull (labelled W-B) and scat (labelled W-C). You identify the species as wild boar. This species is invasive in Manitoba and therefore can cause negative impacts to the native ecosystem.

Name and briefly describe two (2) wildlife management techniques that could be used in controlling the spread of this species. (2 pts)

Answer:
Any 2 of the following (1 pt - 0.5 pt each) PLUS a description that fits with the technique in relation to wild boars (1 pt - 0.5 pt each)
RESEARCH - estimate of the number of boars, where they are, how big the problem is
MONITORING - estimate and monitor the number of boars present.
SEASONS AND BAG LIMITS (for hunting and harvesting) - unlimited hunting season, no bag limit
HUNTING AND TRAPPING - No licence required to hunt boar
PUBLIC EDUCATION - education of public on how to identify boar and where to find them
COMPLIANCE/LAWS - regulation of agricultural practices

Reference:
Wildlife Document, p 33-35

STOP 15

MULTI-DISCIPLINARY (20 pts) – STOP 15

This question requires BOTH features and materials found at stop.

Stand on the viewing platform and look around at the surrounding landscape. From this vantage point, you can see the results of many Beneficial Management Practices (BMPs) that are used in agriculture for soil and water conservation.

Use the Table MD-A which is provided at the stop to record your answers to the following questions. Hand in your completed table with your test.

1) List five (5) BMPs used in agriculture for soil and water conservation that you can see in action from the viewing platform (2.5 pts - 0.5 pt each)

2) For each BMP, indicate whether it is a Water Management BMP or a Soil Management BMP by circling the appropriate term in the second column. (2.5 pts - 0.5 pt each)

3) For each BMP, briefly explain what the BMP is doing to benefit the landscape. (5 pts - 1 pt each)

4) Agricultural BMPs also affect the resources discussed in the core Envirothon topics (Native Plants & Forestry, Soils & Land Use, Water & Aquatic Ecosystems and Wildlife & Wildlife

Management). For each BMP, briefly explain how one (1) of the benefits to the landscape you discussed in question 3) relates to one (1) of the core Envirothon topics. (5 pts - 1 pt each)

5) For each BMP, briefly describe one (1) potential negative impact on the landscape. (5 pts - 1 pt each)

Answer:
1) Any 5 of the following: Water Retention, Riparian Area Enhancement, Perennial Cover, Natural Area Maintenance & Enhancement, Shelterbelt/Tree Establishment, Zero Tillage/Conservation Tillage, Buffer Establishment. (2.5 pts - 0.5 pt each)

2) Correct answer for the 5 BMPS listed (2.5 pts - 0.5 pt each)
WATER RETENTION: Water Management
RIPARIAN AREA ENHANCEMENT: Water Management
PERENNIAL COVER: Soil Management
NATURAL AREA MAINTENANCE: Soil Management
SHELTERBELT/TREE ESTABLISHMENT: Soil Management
ZERO TILLAGE: Soil Management
BUFFER ESTABLISHMENT: Water Management

3) Any 1 of the corresponding answers for the BMPs listed (5 pts - 1 pt each)
WATER RETENTION: reduce peak flow, reducing nutrient run-off, reduce effects of flooding, store water, improve water quality, improve ecosystem resilience
RIPARIAN AREA ENHANCEMENT: bank stabilization, reduces erosion, wildlife habitat, protect aquatic life, reduce flood energy, maintain water quality, biodiversity corridors
PERENNIAL COVER: reduces wind & water erosion, reduce fertilizer application rates, carbon sequestration
NATURAL AREA MAINTENANCE: wildlife habitat, biodiversity corridors, improve ecological functions, carbon sequestration, reduce soil erosion, store water, reduce flooding
SHELTERBELT/TREE ESTABLISHMENT: wildlife habitat, reduces erosion, improve water conservation, increase crop yields, carbon sequestration, thermal protection for livestock, reduce surface runoff, enhance water quality
ZERO TILLAGE: reduces erosion, increase carbon sequestration
BUFFER ESTABLISHMENT: reduce soil erosion, improve water quality, stabilize stream banks, provides biodiversity and habitat

4) Explanation based on applied knowledge of all resource and training materials of how a benefit to landscape relates to any 1 of the corresponding core topics for the BMPs listed (5 pts - 1 pt each)
For all BMP answers, the explanation will be marked
WATER RETENTION: Aquatics, Soils, Wildlife
RIPARIAN AREA ENHANCEMENT: Soils, Forestry, Wildlife, Aquatics
PERENNIAL COVER: Soils, Wildlife
NATURAL AREA MAINTENANCE: Forestry, Wildlife, Soils
SHELTERBELT/TREE ESTABLISHMENT: Soils, Wildlife

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ZERO TILLAGE: Soils
BUFFER ESTABLISHMENT: Soils, Aquatics, Wildlife

5) Any 1 of the corresponding answers for the BMPs listed (5 pts - 1 pt each)
WATER RETENTION: can cause upstream flooding, periodic increase of nutrient runoff
RIPARIAN AREA ENHANCEMENT: can increase nutrient runoff
PERENNIAL COVER: can increase nutrient runoff
NATURAL AREA MAINTENANCE: can increase nutrient runoff
SHELTERBELT/TREE ESTABLISHMENT: can interrupt grassland biodiversity, can contaminate ponds with leaf litter
ZERO TILLAGE: can increase nutrient runoff, reduced yields in certain crops
BUFFER ESTABLISHMENT: can increase nutrient runoff

Reference:
1) Ability to observe and apply knowledge about BMPs
2) Theme Training Power Point, p 3
3) South Tobacco BMP Document, p 4, 9; GAEGS BMP Catalogue; Managing the Waters Edge, p 10
4) Ability to apply knowledge about BMPs based on all resource and training materials provided.
5) South Tobacco BMP Document, p 4,5; Planning Farm Shelterbelts, p 5