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Continuing Education Course #171
Design of Sand Filters & Bioretention Systems

1. Urban and rural stormwater can carry which of the following pollutants?
 - a. Suspended solids.
 - b. Nitrogen.
 - c. Phosphorous.
 - d. All of the above.

2. The New Jersey Department of Environmental Protection (NJDEP) defines a major project as any project that increases the potential for stormwater pollutant loading.
 - a. True
 - b. False.

3. The NJDEP assigns equal TSS removal rates to sand filters and bioretention systems.
 - a. True.
 - b. False.

4. If properly designed and constructed a drywell can approximate which of the following stormwater control features?
 - a. A bioretention basin.
 - b. A bioretention swale.
 - c. An infiltration basin.
 - d. A sand filter.

5. Reducing the amount of lawn area on a site will have no impact on the stormwater quality emanating from the site.
 - a. True.
 - b. False.

6. If sand filters are used in areas that have a high volume of sediment then what should be done to protect the sand filter?
 - a. It should be an above-ground sand filter.
 - b. It should be a below ground sand filter.
 - c. It should have some form of a pre-treatment device.
 - d. it should be combined with a bioretention system.

7. Which of the following are components of a sand filter?
 - a. A forebay zone and a sand filter zone.
 - b. An underdrain within the sand filter zone.
 - c. An overflow.
 - d. All of the above.

8. It is generally understood that it is the smaller frequently-occurring storms of low intensity storms flush most pollutants downstream.

- a. True.
- b. False.
9. The NJDEP water quality storm has a duration intensity curve that is roughly linear.
- a. True.
- b. False.
10. Riprap is often required in the forebay of a sand filter. What is the purpose of this riprap?
- a. To prevent erosion & scour.
- b. To direct the water into the sand filter.
- c. To increase the time of concentration within the sand filter.
- d. To remove pathogens.
11. Routine maintenance is required for a sand filter to function properly over a period of years.
- a. True.
- b. False.
12. Which of the following is an obvious place for debris to collect in a subsurface sand filter?
- a. The inflow pipe.
- b. The forebay.
- c. The optional gravel layer.
- d. The outlet pipe.
13. A sand filter must be designed to safely pass large storms without compromising the berm. What is one way this can be accomplished?
- a. Using a perimeter sand filter.
- b. Using a surface sand filter.
- c. Using a subsurface sand filter.
- d. Employing a “flow-splitter” upstream of the sand filter which will route large storms around the sand filter.
14. A bioretention system can take the form of a swale or a basin..
- a. True.
- b. False.
15. Bioretention systems can remove a variety of pollutants including which of the following?
- a. Suspended solids.
- b. Nutrients.
- c. Metals.
- d. All of the above.
16. A forebay within a bioretention basin will accomplish which of the following?
- a. Help trap debris, filter sediments, and increase the time of concentration within the basin.
- b. Help the woody vegetation to become established.
- c. Provide stormwater quantity control for larger storms.
- d. Prevent the berm from becoming overtopped.
17. A bioretention basin can double as a typical detention basin.
- a. True.
- b. False.
18. What materials should comprise the planting bed of a bioretention system?

- a. It should be topsoil.
 - b. It should be a mixture of topsoil and sand.
 - c. it should have 85-95% sand and 2-5% clay.
 - d. It should be 50% sand and 50% clay.
19. The same plantings can be planted throughout a bioretention system.
- a. True.
 - b. False.
20. Native plantings should be used within the bioretention system.
- a. True.
 - b. False.
21. Where can site-tolerant grasses be used in a bioretention system?
- a. In high velocity areas such as inflow channels.
 - b. Within the forebay.
 - c. In lieu of upland woody plantings in the highest zone.
 - d. They can never be used in bioretention systems.
22. How far above the seasonal high water table should the bottom of the bioretention system be?
- a. 1 foot.
 - b. 2 feet.
 - c. 5 feet.
 - d. no separation is required.
23. Which areas of a bioretention basin require maintenance?
- a. Trash racks
 - b. Vegetated areas.
 - c. Structural components.
 - d. All of the above.
24. Which system provides more visual benefit, a sand filter or a bioretention system?
- a. A sand filter.
 - b. A bioretention system.
 - c. Both systems provide significant visual benefit.
 - d. Neither system provides any visual benefit.
25. Both sand filters and bioretention basins can be placed underground.
- a. True.
 - b. False.

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