Registration Form

COLLECTIONS OPERATIONS AND MAINTENANCE
CEU TRAINING COURSE $100.00
48 HOUR RUSH ORDER PROCESSING FEE ADDITIONAL $50.00

Start and finish dates: _____
You will have 90 days from this date in order to complete this course

List number of hours worked on assignment must match State Requirement. _____

Name_____Signature_____
I have read and understood the disclaimer notice on page 2. Digitally sign XXX

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Please circle/check which certification you are applying the course CEU's.

Collection___ Wastewater Treatment ___ Other _____

Your certificate will be emailed to you in about two weeks unless you pay for the rush service.

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I understand that it is my responsibility to ensure that this CEU course is either approved or accepted in my State for CEU credit. I understand State laws and rules change on a frequent basis and I believe this course is currently accepted in my State for CEU or contact hour credit, if it is not, I will not hold Technical Learning College responsible. I fully understand that this type of study program deals with dangerous, changing conditions and various laws and that I will not hold Technical Learning College, Technical Learning Consultants, Inc. (TLC) liable in any fashion for any errors, omissions, advice, suggestions or neglect contained in this CEU education training course or for any violation or injury, death, neglect, damage or loss of your license or certification caused in any fashion by this CEU education training or course material suggestion or error or my lack of submitting paperwork. It is my responsibility to call or contact TLC if I need help or assistance and double-check to ensure my registration page and assignment has been received and graded. It is my responsibility to ensure all information is correct and to abide with all rules and regulations.

Professional Engineers; Most states will accept our courses for credit but we do not officially list the States or Agencies. Please check your State for approval.

You can obtain a printed version of the course manual from TLC for an additional $69.95 plus shipping charges.

AFFIDAVIT OF EXAM COMPLETION

I affirm that I personally completed the entire text of the course. I also affirm that I completed the exam without assistance from any outside source. I understand that it is my responsibility to file or maintain my certificate of completion as required by the state or by the designation organization.

Grading Information

In order to maintain the integrity of our courses we do not distribute test scores, percentages or questions missed. Our exams are based upon pass/fail criteria with the benchmark for successful completion set at 70%. Once you pass the exam, your record will reflect a successful completion and a certificate will be issued to you.

For security purposes, please fax or e-mail a copy of your driver's license and always call us to confirm we've received your assignment and to confirm your identity.

Many States and employers require the final exam to be proctored.

Do not solely depend on TLC's Approval list for it may be outdated.

A second certificate of completion for a second State Agency $50 processing fee.

All downloads are electronically tracked and monitored for security purposes.

Collections Operations and Maintenance Answer Key

Name_____

Phone# _____

You are solely responsible to ensure that this course is accepted for credit by your State. <u>No refunds.</u> Did you check with your State agency to ensure this course is accepted for credit?

Method of Course acceptance confirmation. Please fill this section
Do not solely depend on TLC's Approval list for it may be outdated.

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Did you receive the approval number, if applicable? _____

What is the course approval number, if applicable? _____

You are responsible to ensure that TLC receives the Assignment and Registration Key. Please call us to ensure that we received it.

You can also fill this assignment out electronically in Adobe Acrobat DC

Please circle, underline, bold or X only one correct answer

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This course contains general EPA's CWA federal rule requirements. Please be aware that each state implements wastewater/safety/environmental /building regulations that may be more stringent than EPA's regulations. Check with your state environmental/health agency for more information. These rules change frequently and are often difficult to interpret and follow. Be careful to not be in non-compliance and do not follow this course for proper compliance.

Please fax the answer key to TLC
(928) 272-0747

Rush Grading Service

If you need this assignment graded and the results mailed to you within a 48-hour period, prepare to pay an additional rush service handling fee of $50.00. This fee may not cover postage costs. If you need this service, simply write RUSH on the top of your Registration Form. We will place you in the front of the grading and processing line. Thank you…

COLLECTIONS OPERATIONS AND MAINTENANCE
CEU TRAINING COURSE

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1. Please rate the difficulty of your course.
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Collections Operations and Maintenance CEU Training Course Assignment

The Assignment (Exam) is also available in Word on the Internet for your Convenience, please visit www.ABCTLC.com and download the assignment and e- mail it back to TLC.

You'll have 90 days from the start of this course to complete in order to receive your Professional Development Hours (**PDHs**) or Continuing Education Unit (**CEU**). A score of 70 % is necessary to pass this course. We prefer if this exam is proctored. No intentional trick questions. If you should need any assistance, please email all concerns and the completed manual to info@tlch2o.com.

We would prefer that you utilize the enclosed answer sheet in the front, but if you are unable to do so, type out your own answer key. Please include your name and address on your manual and make copy for yourself. You can e-mail or fax your Answer Key along with the Registration Form to TLC. **(S) Means answer may be plural or singular**. **Multiple Choice Section, One answer per question and please use the answer key.**

Infiltration and Inflow
What is Infiltration/Inflow (I/I)?

1. This term occurs when groundwater enters the sewer system through cracks, holes, faulty connections, or other openings.

A. Grease producing activities
B. Problem collection system areas
C. Infiltration
D. Maximum flow capacity of wastewater
E. Breakdown or malfunction
F. None of the Above

2. This term occurs when surface water such as storm water enters the sewer system through roof downspout connections, holes in manhole covers, illegal plumbing connections, or other defects.

A. Both infiltration and inflow or I/I
B. Inflow
C. Potential problem areas
D. General I/I source areas
E. Equipment problems
F. None of the Above

3. The sanitary sewer collection system and treatment plants have a _____ that can be handled. I/I, which is essentially clean water, takes up this capacity and can result in sewer overflows into streets and waterways, sewer backups in homes, and unnecessary costs for treatment of this water.

A. Grease producing activities
B. Problem collection system areas
C. Infiltration
D. Maximum flow capacity of wastewater
E. Breakdown or malfunction
F. None of the Above

Determining I/I

4. Flow monitoring and flow modeling provide measurements and data used to determine estimates of_____. Flow meters are placed at varying locations throughout the sewer collection system to take measurements and identify general I/I source areas.

A. Both infiltration and inflow or I/I
B. I/I
C. Potential problem areas
D. General I/I source areas
E. Equipment problems
F. None of the Above

5. Measurements taken before and after a precipitation event indicate the extent that _____ is increasing total flow.

A. Grease producing activities
B. Problem collection system areas
C. Infiltration
D. Maximum flow capacity of wastewater
E. I/I
F. None of the Above

6. Both _____increase with precipitation. Infiltration increases when groundwater rises from precipitation, and inflow is mainly stormwater and rainwater. Rainfall monitoring is also performed to correlate this data.

A. Infiltration and inflow
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Illegal plumbing, drains, and roof downspouts
F. None of the Above

Identifying sources of I/I

7. A Sewer System Evaluation Survey (SSES) involves inspection of the sewer system using several methods to identify sources of I/I: Visual inspection - accessible pipes, gutter and plumbing connections, and manholes are visually inspected for _____.

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Sewer system testing techniques
E. Faults
F. None of the Above

8. Smoke testing – smoke is pumped into sewer pipes. Its reappearance aboveground indicates points of this term. These points can be on public property such as along street cracks or around manholes, or on private property such as along house foundations or in yards where sewer pipes lay underground.

A. I/I
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Illegal plumbing, drains, and roof downspouts
F. None of the Above

9. TV inspection – camera equipment is used to do _____. The City will usually have one 2-3 person crew that can perform TV inspection on over 20 miles of sewer pipe per year.

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Sewer system testing techniques
E. Faults
F. None of the Above

10. Dye testing – Dye is used at suspected _____ sources. The source is confirmed if the dye appears in the sewer system.

A. I/I
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Illegal plumbing, drains, and roof downspouts
F. None of the Above

11. This term is also sometimes identified when sewer backups or overflows bring attention to that part of the system. The purpose of the SSES is to reduce these incidences by finding sources before they cause a problem.

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Sewer system testing techniques
E. Faults
F. None of the Above

Repairing I/I Sources

12. Repair techniques include manhole wall spraying, Insituform pipe relining, manhole frame and lid replacement, and disconnecting this term.

A. I/I
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Illegal plumbing, drains, and roof downspouts
F. None of the Above

13. The owner or operator should have in place a program for the efficient identification of this term. The program should look at the wastewater treatment plant, pump stations, permanent meter flows, and rainfall data to characterize peaking factors for the whole system and major drainage basins.

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Sewer system testing techniques
E. Faults
F. None of the Above

14. Temporary meters should be used on a "roving" basis to identify areas with high wet weather flows. Areas with high wet weather flows should then be subject to this term.

A. I/I
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Inspection and rehabilitation activities
F. None of the Above

Sewer System Testing

15. Sewer system testing techniques are often used to identify leaks which allow _____into the sewer system and determine the location of illicit connections and other sources of stormwater inflow.

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Unwanted infiltration
E. Faults
F. None of the Above

16. Two commonly implemented techniques include_____. Regardless of the program(s) implemented by the owner or operator, the reviewer should evaluate any procedures and records that have been established for these programs.

A. I/I
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Illegal plumbing, drains, and roof downspouts
F. None of the Above

17. This term is a relatively inexpensive and quick method of detecting sources of inflow in sewer systems, such as down spouts, or driveway and yard drains, and works best suited for detecting cross connections and point source inflow leaks.

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Sewer system testing techniques
E. Smoke testing
F. None of the Above

18. Smoke testing is not typically used on a routine basis, but rather when evidence of excessive I/I already exists. With each end of the sewer of interest plugged, smoke is introduced into the test section, Guide for Evaluating CMOM Programs at Sanitary Sewer Collection Systems usually via a manhole. _____can then be identified when smoke escapes through them.

A. I/I
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Sources of inflow
F. None of the Above

19. The weather conditions in which _____is conducted (i.e., no rain or snow, little wind and daylight only)

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Sewer system testing techniques
E. Smoke testing
F. None of the Above

20. The results of positive smoke tests should be documented with carefully labeled photographs. Building inspections are sometimes conducted as part of a smoke testing program and, in some cases, may be the only way to find this term.

A. I/I
B. High wet weather flows
C. Stormwater and rainwater
D. Smoke testing and dyed water testing
E. Illegal connections
F. None of the Above

21. If properly connected to the sanitary sewer system, smoke should exit the vent stacks of the surrounding properties. If traces of the smoke or its odor enter the building, it is an indication that _____may also be entering.

A. Smoke
B. Excessive I/I
C. Sources of I/I
D. Gases from the sewer system
E. Faults
F. None of the Above

Dye Testing

22. Dyed water testing may be used to establish the _____to the sewer. It is often used to confirm smoke testing or to test fixtures that did not smoke. As is the case with smoke testing, it is not used on a routine basis, but rather in areas that have displayed high wet weather flows.

A. Smoke testing
B. Potential problem areas
C. I/I problems
D. Presence of roots
E. Connection of a fixture or appurtenance
F. None of the Above

23. This missing term can be used to identify structurally damaged manholes that might create potential I/I problems. This is accomplished by flooding the area close to the suspected manholes with dyed water and checking for entry of dyed water at the frame-chimney area, cone or corbel, and walls of the manhole.

A. Smoke testing
B. Potential problem areas
C. I/I problems
D. The presence of roots
E. Dyed water testing
F. None of the Above

Sewer System Inspection

24. This term and pipelines are the first line of defense in the identification of existing or potential problem areas.

A. Smoke testing
B. Potential problem areas
C. Visual inspection of manholes
D. The presence of roots
E. Dyed water testing
F. None of the Above

25. Visual inspections should take place on both a scheduled basis and as part of any preventive or corrective maintenance activity. Visual inspections provide additional information concerning the accuracy of system mapping, the presence and_____, and the physical state-of-repair of the system.

A. Smoke testing
B. Potential problem areas
C. I/I problems
D. The presence of roots
E. Degree of I/I problems
F. None of the Above

26. By observing the manhole directly and the incoming and outgoing lines with a _____, it is possible to determine structural condition, the presence of roots, condition of joints, depth of debris in the line, and depth of flow.

A. Smoke testing
B. Potential problem areas
C. I/I problems
D. The presence of roots
E. Dyed water testing
F. None of the Above

Sewer System Inspection Techniques

27. This term is an important component of any maintenance program. There are a number of inspection techniques that may be employed to inspect a sewer system. The reviewer should determine if an inspection program includes frequency and schedule of inspections and procedures to record the results.

A. Lamping
B. Camera inspection
C. Sonar
D. Sewer inspection
E. Sewer scanner and evaluation
F. None of the Above

28. Sewer system cleaning should always be considered before _____is performed in order to provide adequate clearance and inspection results.

A. Sewer system cleaning
B. Capacity evaluation
C. Inspection
D. Closed Circuit Television (CCTV) inspections
E. Confined space entry
F. None of the Above

Camera Inspection

29. This term involves lowering a still camera into a manhole. The camera is lined up with the centerline of the junction of the manhole frame and sewer. A picture is the taken down the pipe with a strobe-like flash.

A. Lamping
B. Camera inspection
C. Sonar
D. Procedures to record the results
E. Sewer scanner and evaluation
F. None of the Above

30. A disadvantage of this technique is that only the first 10-12 feet of the pipe can be inspected upstream and downstream of the access point. Additionally, it has limited use in small diameter sewers. The benefits of this technique include not requiring _____ and little equipment and set-up time is required.

A. Sewer system cleaning
B. Capacity evaluation
C. Trenchless technologies
D. Closed Circuit Television (CCTV) inspections
E. Confined space entry
F. None of the Above

31. Camera inspection is more comprehensive than _____ in that more of the sewer can be viewed. A still camera is mounted on a floatable raft and released into a pipe. The camera takes pictures with a strobe-like flash as it floats through the sewer pipe.

A. Lamping
B. Camera inspection
C. Sonar
D. Procedures to record the results
E. Sewer scanner and evaluation
F. None of the Above

32. This technique also does not fully capture the invert of the pipe and its condition. Sonar is a newer technology deployed similarly to this term.

A. Lamping
B. Camera inspection
C. Sonar
D. CCTV cameras
E. Sewer scanner and evaluation
F. None of the Above

33. This term emits a pulse which bounces off the walls of the sewer. The time it takes for this pulse to bounce back provides data and an image of the interior of the pipe, including its structural condition. A benefit of this technique is that it can be used in flooded or inaccessible sections of the sewer. The drawback is that the technique requires heavy and expensive equipment.

A. Sonar
B. Capacity evaluation
C. Trenchless technologies
D. Closed Circuit Television (CCTV) inspections
E. Confined space entry
F. None of the Above

34. Sewer scanner and evaluation is an experimental technology where a 360 degree scanner produces a full digital photograph of the interior of the pipe. This technique is similar to sonar in that a more complete image of a pipe can be made than with_____, but not all types of sewer defects may be identified as readily (i.e., infiltration, corrosion).

A. Lamping
B. Camera inspection
C. Sonar
D. CCTV
E. Sewer scanner and evaluation
F. None of the Above

Closed Circuit Television (CCTV) Inspections

35. This term a helpful tool for early detection of potential problems.

A. Sewer system cleaning
B. Capacity evaluation
C. Trenchless technologies
D. Closed Circuit Television (CCTV) inspections
E. Confined space entry
F. None of the Above

36. This technique involves a closed-circuit camera with a light which is self-propelled or pulled down the pipe. As it moves it records the interior of the pipe. _____may be done on a routine basis as part of the preventive maintenance program, as well as part of an investigation into the cause of I/I.

A. Lamping
B. Camera inspection
C. Sonar
D. CCTV inspections
E. Sewer scanner and evaluation
F. None of the Above

37. CCTV, however, eliminates the hazards associated with confined space entry. The output is displayed on a monitor and videotaped. A benefit of _____is that a permanent visual record is captured for subsequent reviews.

A. Sewer system cleaning
B. Capacity evaluation
C. Trenchless technologies
D. CCTV inspection
E. Confined space entry
F. None of the Above

Most sewer lines are inspected using one or more of the following techniques:

38. This term is the most frequently used most cost efficient in the long term, and most effective method to inspect the internal condition of a sewer.

A. Inspection technique(s)
B. CCTV inspection(s)
C. Inspection program(s)
D. Television (TV) inspections
E. Polaroid still photographs
F. None of the Above

39. This term recommended for sewer lines with diameters of 0.1-1.2 m (4 - 48 inches.) The CCTV camera must be assembled to keep the lens as close as possible to the center of the pipe.

A. Sanitary sewer overflow(s)
B. Rehabilitation
C. CCTV inspection(s)
D. Check with the local authorities
E. Education and pollution prevention
F. None of the Above

40. In larger sewers, the _____, which is floated through the sewer from one manhole to the next. To see details of the sewer walls, the camera and lights swivel both vertically and horizontally.
A. Inspection technique(s) D. Visibility of manholes and other structures
B. CCTV inspection(s) E. Polaroid still photographs
C. Inspection program(s) F. None of the Above

41. In smaller sewers, _____ are attached to a sled, to which a parachute or droge is attached and floated from one manhole to the next. Documentation of inspections is very critical to a successful operation and maintenance (O&M) program.
A. Documentation of inspections D. Cleaning and inspecting sewer lines
B. CCTV inspection(s) E. The cable and camera
C. Visual inspection(s) F. None of the Above

42. _____ produce a video record of the inspection that can be used for future reference.
A. Inspection technique(s) D. Visibility of manholes and other structures
B. CCTV inspection(s) E. Polaroid still photographs
C. Inspection program(s) F. None of the Above

43. _____ are vital in fully understanding the condition of a sewer system. Visual inspections of manholes and pipelines are comprised of surface and internal inspections. Operators should pay specific attention to sunken areas in the groundcover above a sewer line and areas with ponding water.
A. Documentation of inspections D. Cleaning and inspecting sewer lines
B. CCTV inspection(s) E. Operator to enter a manhole
C. Visual inspection(s) F. None of the Above

44. Inspectors should thoroughly check the _____of stream crossings, the conditions of manhole frames and covers or any exposed brickwork, and the visibility of manholes and other structures.
A. Inspection technique(s) D. Visibility of manholes and other structures
B. CCTV inspection(s) E. Physical conditions
C. Inspection program(s) F. None of the Above

45. For large sewer lines, a walk-through or this missing term is recommended. This inspection requires the operator to enter a manhole, the channel, and the pipeline, and assess the condition of the manhole frame, cover, and chimney, and the sewer walls above the flow line.
A. Documentation of inspections D. Cleaning and inspecting sewer lines
B. CCTV inspection(s) E. Internal inspection
C. Visual inspection(s) F. None of the Above

46. If entering the manhole is not feasible, this missing term can be used.
A. Documentation of inspections D. Cleaning and inspecting sewer lines
B. Mirrors E. Operator to enter a manhole
C. Visual inspection(s) F. None of the Above

47. Several specialized _____ have been recently developed worldwide.
A. Inspection technique(s) D. Visibility of manholes and other structures
B. CCTV inspection(s) E. Polaroid still photographs
C. Inspection program(s) F. None of the Above

48. Light-line based and _____equipment that measures the internal cross-sectional profile of sewer systems.
A. Documentation of inspections D. Cleaning and inspecting sewer lines
B. CCTV inspection(s) E. Operator to enter a manhole
C. Sonar-based F. None of the Above

Understanding Gravity Sanitary Sewers

49. Sanitary sewers are designed to transport the wastewater by utilizing the _____provided by the natural elevation of the earth resulting in a downstream flow. This energy, if not designed properly, can cause losses due to free falls, turbulent junctions, and sharp bends.
A. Potential energy D. Flow velocities and design depths of flow
B. Peak flow of population E. SSO
C. Wastewater F. None of the Above

50. Sewer systems are designed to maintain proper flow velocities with_____.
A. Design flow(s) D. Both wet and dry weather flows
B. Stormwater inflow E. Minimum head loss
C. I/I F. None of the Above

51. _____may find it necessary to dissipate excess potential energy.
A. I/I D. Flow velocities and design depths of flow
B. Peak flow of population E. Higher elevations in the system
C. Wastewater F. None of the Above

52. Design flows are based on the quantity of wastewater to be transported. _____is determined largely by population served, density of population, and water consumption.
A. Design flow(s) D. Both wet and dry weather flows
B. Stormwater inflow E. Low pressure in the sewer system
C. Flow F. None of the Above

53. Sanitary sewers should be designed for _____.
A. I/I D. Flow velocities and design depths of flow
B. Peak flow of population E. SSOs, surcharged lines, basement backups
C. Wastewater F. None of the Above

54. _____ is highly discouraged and should be designed separate from the sanitary system.
A. Design flow(s) D. Both wet and dry weather flows
B. Stormwater inflow E. Low pressure in the sewer system
C. I/I F. None of the Above

(s) means the answer may be plural or singular in nature.

55. Gravity-flow sanitary sewers are usually designed to follow the topography of the land and to flow full or nearly full at peak rates of flow and partly full at lesser flows. Most of the time the flow surface is exposed to the atmosphere within the sewer and it functions as_____.

A. I/I
B. Peak flow of population
C. An open channel
D. Flow velocities and design depths of flow
E. SSOs, surcharged lines, basement backups
F. None of the Above

56. At extreme peak flows the wastewater will surcharge back into the manholes. _____ produces low pressure in the sewer system.

A. This surcharge
B. Stormwater inflow
C. I/I
D. Both wet and dry weather flows
E. Low pressure in the sewer system
F. None of the Above

57. In order to design a sewer system, many factors are considered. The purpose of this topic is to aid in the understanding of _____. The ultimate goal for our industry is to protect the health of the customers we serve. This is achieved by prevention of sewer manhole overflows.

A. I/I
B. Peak flow of population
C. Wastewater
D. Flow velocities and design depths of flow
E. SSOs, surcharged lines, basement backups
F. None of the Above

Sewer System Capacity Evaluation - Testing and Inspection

58. The collection system owner or operator should have a program in place to periodically evaluate the _____in both wet and dry weather flows and ensure the capacity is maintained as it was designed.

A. Design flow(s)
B. Stormwater inflow
C. I/I
D. Capacity of the sewer system
E. Low pressure in the sewer system
F. None of the Above

59. The capacity evaluation program builds upon ongoing activities and the everyday preventive maintenance that takes place in a system. The capacity evaluation begins with an inventory and characterization of the_____.

A. I/I
B. System components
C. Wastewater
D. Flow velocities and design depths of flow
E. SSOs, surcharged lines, basement backups
F. None of the Above

60. The system then undergoes general inspection which serves to continuously update and add to the_____.

A. Design flow(s)
B. Stormwater inflow
C. I/I
D. Inventory information
E. Low pressure in the sewer system
F. None of the Above

Capacity Limitations

61. The next step in the capacity evaluation is to identify the location of wet weather related_____, surcharged lines, basement backups, and any other areas of known capacity limitations. These areas warrant further investigation in the form of flow and rainfall monitoring and inspection procedures to identify and quantify the problem.

A. I/I
B. Peak flow of population
C. Wastewater
D. Flow velocities and design depths of flow
E. SSOs
F. None of the Above

62. The reviewer should determine that the capacity evaluation includes an estimate peak flows experienced in the system, an estimate of the capacity of_____, and identifies the major sources of I/I that contribute to hydraulic overloading events.

A. Design flow(s)
B. Stormwater inflow
C. I/I
D. Both wet and dry weather flows
E. Key system components
F. None of the Above

63. The capacity evaluation should also make use of a hydraulic model. This model will help identify areas that need to alleviate_____.

A. I/I
B. Peak flow of population
C. Capacity limitations
D. Flow velocities and design depths of flow
E. SSOs, surcharged lines, basement backups
F. None of the Above

64. Short and long term alternatives to address hydraulic deficiencies should be identified, prioritized, and scheduled for implementation. A sewer inspection is an important part of a sewer system capacity evaluation and determining your _____.

A. Design flow(s)
B. Stormwater inflow
C. I/I
D. Both wet and dry weather flows
E. Low pressure in the sewer system
F. None of the Above

Flow Monitoring

65. Fundamental information about the collection system is obtained by flow monitoring. Flow monitoring provides information on dry weather flows as well as areas of the collection system potentially affected by _____.

A. I/I
B. Peak flow of population
C. Wastewater
D. Flow velocities and design depths of flow
E. SSOs, surcharged lines, basement backups
F. None of the Above

66. _____may also be performed for billing purposes, to assess the need for new sewers in a certain area, or to calibrate a model.

A. Design flow(s)
B. Stormwater inflow
C. I/I
D. Both wet and dry weather flows
E. Flow measurement
F. None of the Above

Flow Monitoring Plan

67. _____should provide for routine inspection, service, and calibration checks (as opposed to actual calibration). In some cases, the data is calibrated rather than the flow meter. Checks should include taking independent water level (and ideally velocity readings), cleaning accumulated debris and silt from the flow meter area, downloading data (sometimes only once per month), and checking the desiccant and battery state. Records of each inspection should be maintained.

A. Velocity
B. Infiltration
C. RII
D. A flow monitoring plan
E. Sewer cleaning
F. None of the Above

(s) means the answer may be plural or singular in nature.

Flow Measurements

68. Flow measurements performed for the purpose of quantifying I/I are typically separated into three components: base flow, infiltration, and inflow. Base flow is generally taken to mean the wastewater generated without any _____.

A. Stoppages
B. Deposition of solids
C. Infiltration
D. Inflow
E. Any I/I component
F. None of the Above

69. _____ is the seepage of groundwater into pipes or manholes through defects such as cracks, broken joints, etc.

A. Velocity
B. Infiltration
C. RII
D. Blockage(s)
E. Sewer cleaning
F. None of the Above

70. _____ is the water which enters the sewer through direct connections such as roof leaders, direct connections from storm drains or yard, area, and foundation drains, the holes in and around the rim of manhole covers, etc.

A. Stoppages
B. Deposition of solids
C. Infiltration
D. Inflow
E. Any I/I component
F. None of the Above

71. Many collection system owners or operators add a third classification: rainfall induced infiltration (RII). RII is _____that enters the collection system through defects that lie so close to the ground surface that they are easily reached.

A. Velocity
B. Infiltration
C. Stormwater
D. Blockage(s)
E. Sewer cleaning
F. None of the Above

72. Although not from piped sources, _____tends to act more like inflow than infiltration.

A. Stoppages
B. Deposition of solids
C. Infiltration
D. Inflow
E. RII
F. None of the Above

73. In addition to the use of flow meters, which may be expensive for a small owner or operator, other methods of inspecting flows may be employed, such as visually monitoring manholes during low-flow periods to determine areas with_____. For a very small system, this technique may be an effective and low-cost means of identifying problem areas in the system which require further investigation.

A. Velocity
B. Infiltration
C. RII
D. Blockage(s)
E. Excessive I/I
F. None of the Above

Flow Capacity

74. Most sewers are designed with the capacity to flow half full for less than 15 inches in diameter; larger sewers are designed to flow at three-fourths flow. The velocity is based on calculated peak flow, which is commonly considered to be twice the_____.

A. Average daily flow
B. Deposition of solids
C. Infiltration
D. Inflow
E. Any I/I component
F. None of the Above

75. A velocity in excess of 3.5 m/sec (10 fps) can be tolerated with proper consideration of pipe material, abrasive characteristics of the wastewater, _____, and thrust at changes of direction.

A. Velocity
B. Infiltration
C. RII
D. Blockage(s)
E. Sewer cleaning
F. None of the Above

76. The minimum velocity is necessary to prevent the _____.

A. Stoppages
B. Deposition of solids
C. Infiltration
D. Inflow
E. Any I/I component
F. None of the Above

Sewer Cleaning

77. The purpose of sewer cleaning is to remove accumulated material from the sewer. Cleaning helps to prevent _____ and is also used to prepare the sewer for inspections.

A. Velocity
B. Infiltration
C. RII
D. Blockage(s)
E. Sewer cleaning
F. None of the Above

78. _____ in gravity sewers are usually caused by a structural defect, poor design, poor construction, an accumulation of material in the pipe (especially grease), or root intrusion.

A. Stoppages
B. Deposition of solids
C. Infiltration
D. Inflow
E. Any I/I component
F. None of the Above

79. Protruding traps (lateral sewer connections incorrectly installed so that they protrude into the main sewer) may catch debris, which then causes a further buildup of _____that eventually block the sewer.

A. Velocity
B. Infiltration
C. RII
D. Blockage(s)
E. Solids
F. None of the Above

Sewer Cleaning Methods

80. There are three major methods of sewer cleaning: hydraulic, mechanical, and chemical. Hydraulic cleaning (also referred to as flushing) refers to any application of water to clean the pipe. Mechanical cleaning uses physical devices to scrape, cut, or pull_____.

A. Velocity
B. Infiltration
C. Material from the sewer
D. Blockage(s)
E. Sewer cleaning
F. None of the Above

81. Chemical cleaning can facilitate the control of odors, grease buildup, root growth, corrosion, and insect and_____.

A. Stoppages
B. Deposition of solids
C. Infiltration
D. Inflow
E. Rodent infestation
F. None of the Above

(s) means the answer may be plural or singular in nature.

Sewer Cleaning Records

82. The backbone of an effective sewer cleaning program is accurate recordkeeping. Accurate recordkeeping provides the collection system owner or operator with information on the areas. The owner or operator should be able to identify _____, preferably on a map.

A. Grease producing activities
B. Problem collection system areas
C. Infiltration
D. Maximum flow capacity of wastewater
E. Breakdown or malfunction
F. None of the Above

83. _____ identified should include those due to grease or industrial discharges, hydraulic bottlenecks in the collection system, areas of poor design (e.g., insufficiently sloped sewers), areas prone to root intrusion, sags, and displacements. The connection between problem areas in the collection system and the preventive maintenance cleaning schedule should be clear.

A. Both infiltration and inflow or I/I
B. Inflow
C. Potential problem areas
D. General I/I source areas
E. Equipment problems
F. None of the Above

84. The owner or operator should also be able to identify the number of stoppages experienced per mile of sewer pipe. If the system is experiencing a steady increase in stoppages, the reviewer should try to determine the cause (i.e., lack of preventive maintenance funding, deterioration of the sewers due to age, an increase in_____, etc.).

A. Grease producing activities
B. Problem collection system areas
C. Infiltration
D. Maximum flow capacity of wastewater
E. Breakdown or malfunction
F. None of the Above

Parts and Equipment Inventory

85. An inventory of spare parts, equipment, and supplies should be maintained by the collection system owner or operator. The inventory should be based on the equipment manufacturer's recommendations, supplemented by historical experience with _____.

A. Both infiltration and inflow or I/I
B. Inflow
C. Potential problem areas
D. Maintenance and equipment problems
E. Equipment problems
F. None of the Above

86. Without such an inventory, the collection system may experience long down times or periods of inefficient operation in the event of a _____. Files should be maintained on all pieces of equipment and major tools. The owner or operator should have a system to assure that each crew member has adequate and correct tools for the job.

A. Grease producing activities
B. Problem collection system areas
C. Infiltration
D. Maximum flow capacity of wastewater
E. Breakdown or malfunction
F. None of the Above

Sewer System Rehabilitation

87. The collection system owner or operator should have a _____program. The objective of sewer rehabilitation is to maintain the overall viability of a collection system. This is done in three ways: (1) ensuring its structural integrity; (2) limiting the loss of conveyance and wastewater treatment capacity due to excessive I/I; and (3) limiting the potential for groundwater contamination by controlling exfiltration from the pipe network.

A. Sewer system cleaning
B. Capacity evaluation
C. Trenchless technologies
D. Sewer rehabilitation
E. Confined space entry
F. None of the Above

88. The rehabilitation program should build on information obtained as a result of all forms of maintenance and observations made as part of the _____to assure the continued ability of the system to provide sales and service at the least cost. The reviewer should try to gain a sense of how rehabilitation is prioritized. Priorities may be stated in the written program or may be determined through interviews with system personnel.

A. Sewer system cleaning
B. Capacity evaluation
C. Trenchless technologies
D. Closed Circuit Television (CCTV) inspections
E. Capacity evaluation and asset inventory
F. None of the Above

89. There are many rehabilitation methods; the choice of methods depends on pipe size, type, location, dimensional changes, sewer flow, material deposition, surface conditions, _____, and other physical factors. Non-structural repairs typically involve the sealing of leaking joints in otherwise sound pipe.

A. A significant source of infiltration
B. A serious source of I/I
C. Non-structural repairs
D. Warm, moist, nutrient rich atmosphere
E. Severity of I/I
F. None of the Above

90. _____involve either the replacement of all or a portion of a sewer line, or the lining of the sewer. These repairs can be carried out by excavating, usually for repairs limited to one or two pipe segments (these are known as point repairs) or by trenchless technologies (in which repair is carried out via existing manholes or a limited number of access excavations).

A. Sanitary sewer service line
B. Debris discharged
C. Rehabilitation program
D. Structural repairs
E. Cracks or loose joints in the sewer pipe
F. None of the Above

91. The rehabilitation program should identify the methods that have been used in the past, their success rating, and methods to be used in the future. A reviewer who wants further guidance on methods of rehabilitation may consult the owner's or operator's policies regarding service lateral rehabilitation, since service laterals can constitute _____.

A. A significant source of infiltration
B. A serious source of I/I
C. Non-structural repairs
D. Warm, moist, nutrient rich atmosphere
E. Severity of I/I
F. None of the Above

92. Manholes should not be neglected in the _____ program.

A. Sanitary sewer service line
B. Debris discharged
C. Rehabilitation
D. Exert considerable pressure
E. Cracks or loose joints in the sewer pipe
F. None of the Above

93. Manhole covers can allow significant inflow to enter the system because they are often located in the_____.

A. Sanitary sewer service line
B. Debris discharged
C. Rehabilitation program
D. Path of surface runoff
E. Cracks or loose joints in the sewer pipe
F. None of the Above

94. Manholes themselves can also be _____ from cracks in the barrel of the manhole. The owner or operator should be able to produce documentation on the location and methods used for sewer rehabilitation.

A. A significant source of infiltration
B. A serious source of I/I
C. Non-structural repairs
D. Warm, moist, nutrient rich atmosphere
E. Severity of I/I
F. None of the Above

Tree Roots vs. Sanitary Sewer Lines
Root Growth in Pipes

95. Roots require oxygen to grow, they do not grow in _____or where high ground water conditions prevail.

A. Sanitary sewer service line
B. Debris discharged
C. Pipes that are full of water
D. Exert considerable pressure
E. Cracks or loose joints in the sewer pipe
F. None of the Above

96. Roots thrive in the warm, moist, nutrient rich atmosphere above the water surface inside sanitary sewers. The flow of warm water inside the sanitary sewer service pipe causes water _____surrounding the pipe.

A. A significant source of infiltration
B. A serious source of I/I
C. Non-structural repairs
D. Vapor to escape to the cold soil
E. Severity of I/I
F. None of the Above

97. Tree roots are attracted to the water vapor leaving the pipe and they follow the vapor trail to the source of the moisture, which are usually _____ in the sewer pipe.

A. Sanitary sewer service line
B. Debris discharged
C. Rehabilitation program
D. Exert considerable pressure
E. Cracks or loose joints
F. None of the Above

98. Upon reaching the crack or pipe joint, _____will penetrate the opening to reach the nutrients and moisture inside the pipe. This phenomenon continues in winter even though trees appear to be dormant.

A. A significant source of infiltration
B. A serious source of I/I
C. Non-structural repairs
D. Tree roots
E. Severity of I/I
F. None of the Above

Problems Caused by Roots Inside Sewers

99. Once inside the pipe, roots will continue to grow, and if not disturbed, they will completely fill the pipe with multiple hair-like root masses at each point of entry. The root mass inside the _____ becomes matted with grease, tissue paper, and other debris discharged from the residence or business.

A. Sanitary sewer service line
B. Debris discharged
C. Rehabilitation program
D. Exert considerable pressure
E. Cracks or loose joints in the sewer pipe
F. None of the Above

100. Homeowners will notice the first signs of a _____by hearing gurgling noises from toilet bowls and observing wet areas around floor drains after completing the laundry.

A. A significant source of infiltration
B. A serious source of I/I
C. Non-structural repairs
D. Slow flowing drainage system
E. Severity of I/I
F. None of the Above

101. A complete blockage will occur if no remedial action is taken to remove the roots/blockage. As roots continue to grow, they expand and exert considerable pressure _____where they entered the pipe.

A. Sanitary sewer service line
B. Debris discharged
C. Rehabilitation program
D. At the crack or joint
E. Cracks or loose joints in the sewer pipe
F. None of the Above

102. The force exerted by the root growth will break the pipe and may result in total collapse of the pipe. _____and pipes that are structurally damaged will require replacement.

A. A significant source of infiltration
B. A serious source of I/I
C. Non-structural repairs
D. Severe root intrusion
E. Severity of I/I
F. None of the Above

Tree Roots in Sewer

103. Tree roots growing inside sewer pipes are generally the most expensive sewer maintenance item experienced by City residents. Roots from trees growing on private property and on parkways throughout the City are responsible for many of the sanitary sewer service backups and_____.

A. Root intrusion
B. Drought conditions
C. Inflow and infiltration (I&I)
D. Sanitary sewer service backup(s)
E. Damaged sewer pipes
F. None of the Above

104. Homeowners should be aware of the location of their sewer service and refrain from planting certain types of trees and hedges near the sewer lines. The replacement cost of a sanitary sewer service line as a result of _____may be very expensive.

A. Root intrusion
B. Damage from tree roots
C. Tree roots
D. Copper sulfate and sodium hydroxide
E. The common method of removing roots
F. None of the Above

Pipes Susceptible to Root Damage

105. Some pipe material is more resistant to root intrusion than others. Clay tile pipe that was commonly installed by developers and private contractors until the late 1980's is easily penetrated and_____.

A. Root intrusion
B. Drought conditions
C. Inflow and infiltration (I&I)
D. Sanitary sewer service backup(s)
E. Damaged by tree roots
F. None of the Above

106. Concrete pipe and PVC pipe may also allow root intrusions, but to a lesser extent than clay tile pipe. PVC pipe is more resistant to root intrusion because it usually has fewer joints. The tightly fitting PVC joints are less likely to _____as a result of settlement of backfill around the pipe.

A. Root intrusion
B. Sewer service
C. Tree roots
D. Leak
E. The common method of removing roots
F. None of the Above

Root Spread

107. During drought conditions and in winter, tree roots travel long distances in search of moisture. As a general rule, tree roots will extend up to 2.5 times the height of the tree, and some species of trees may have roots extending _____.

A. Root intrusion
B. Drought conditions
C. Inflow and infiltration (I&I)
D. Sanitary sewer service backup(s)
E. Roots removed by auguring
F. None of the Above

(s) means the answer may be plural or singular in nature.

Root Growth Control

108. The common method of removing roots from _____involves the use of augers, root saws, and high pressure flushers. These tools are useful in releasing blockages in an emergency, however, cutting and tearing of roots encourages new growth. The effect is the same as pruning a hedge to promote faster, thicker, and stronger regrowth.

A. Root intrusion
B. Sewer service
C. Sanitary sewer service pipes
D. Sanitary sewer service backup(s)
E. The common method of removing roots
F. None of the Above

109. Roots removed by auguring are normally just a small fraction of the roots inside the pipe. To augment the cutting and auguring methods, there are products available commercially that will kill the roots inside the pipe without_____.

A. Root intrusion
B. Drought conditions
C. Inflow and infiltration (I&I)
D. Sanitary sewer service backup(s)
E. Roots removed by auguring
F. None of the Above

110. The use of products such as copper sulfate and sodium hydroxide are not recommended because of negative environmental impacts on the_____. Also, these products may kill the roots but they do not inhibit regrowth.

A. Root intrusion
B. Sewer service
C. Tree roots
D. Downstream receiving water
E. Method of removing roots
F. None of the Above

Smoking out Sewer Leaks

111. Used extensively for over 40 years, smoke testing has proven to be a vital ingredient of successful inflow and infiltration (I&I) studies. It is as important now as it has ever been, as growing municipalities increase demands on aging, often deteriorating collection systems. In addition, programs such as the EPA's new CMOM (capacity, maintenance, operations, and maintenance) emphasize a focus on proactive, _____practices.

A. Preventive maintenance
B. Smoke testing
C. Dye
D. Video inspection
E. Inflow
F. None of the Above

112. _____ is an effective method of documenting sources of inflow and should be part of any CMOM program.

A. Smoke
B. Smoke testing
C. CFM
D. Video inspection and other techniques
E. Sources of inflow
F. None of the Above

113. _____ is a relatively simple process, which consists of blowing smoke mixed with larger volumes of air into the sanitary sewer line, usually induced through the manhole.

A. Smoke
B. Smoke testing
C. Dye
D. Video inspection
E. Inflow
F. None of the Above

114. The smoke travels the path of least resistance and quickly shows up at sites that allow_____.

A. Smoke
B. Surface water inflow
C. CFM
D. Video inspection and other techniques
E. Sources of inflow
F. None of the Above

115. _____will identify broken manholes, illegal connections (including roof drains, sump pumps, yard drains and more), uncapped lines, and will even shows cracked mains and laterals providing there is a passageway for the smoke to travel to the surface.
A. Smoke D. Video inspection
B. Smoke testing E. Inflow
C. Dye F. None of the Above

116. Although video inspection and other techniques are certainly important components of _____, research has shown that approximately 65% of all extraneous stormwater inflow enters the system from somewhere other than the main line.
A. An I&I survey D. Video inspection and other techniques
B. Smoke testing E. Sources of inflow
C. CFM F. None of the Above

117. Smoke testing is an excellent method of inspecting both the mainlines, laterals and more. _____ travels throughout the system, identifying problems in all connected lines, even sections of line that were not known to exist, or thought to be independent or unconnected. Best results are obtained during dry weather, which allows smoke better opportunity to travel to the surface.
A. Smoke D. Video inspection
B. Smoke testing E. Inflow
C. Dye F. None of the Above

Necessary Equipment
118. Blowers; Most engineering specifications for smoke testing _____able to provide 1750 cfm (cubic feet of air per minute), however in today's world it seems to be the mindset that bigger is better.
A. Smoke D. Video inspection and other techniques
B. Smoke testing E. Sources of inflow
C. CFM F. None of the Above

119. Moving the air very quickly is useless if the blower does not have the static pressure to push that air/smoke through the lines. If you've used _____and found that smoke frequently backs up to the surface, this may be your problem.
A. High CFM blowers D. Video inspection
B. Smoke testing E. Inflow
C. Dye F. None of the Above

Blowers
120. There are two types of blowers available for smoke testing sewers: squirrel cage and direct drive propeller. In general, squirrel cage blowers are usually larger in size, but can provide more static pressure in relation to _____.
A. Smoke D. Video inspection and other techniques
B. Smoke testing E. Sources of inflow
C. CFM F. None of the Above

121. The output of the _____ is usually adjustable by alternating pulleys and belts to meet the demands of the job. Propeller style blowers are usually more compact and generally offer approx. 3,200 CFM. Other than reducing the engine throttle, the output is not adjustable since the fan blade is attached directly to the engine shaft.

A. Smoke
B. Smoke testing
C. Dye
D. Video inspection
E. Inflow
F. None of the Above

122. Smoke Types; There are two types of smoke currently offered for smoke testing sewers, classic smoke candles and_____.

A. Smoke fluids
B. Smoke testing
C. Dye
D. Video inspection
E. Smoke candles
F. None of the Above

123. _____ were first used for testing sewers when the process began its popularity back in 1961, and continue to be the most widely used. They are used by simply placing a smoke candle on the fresh air intake side of the blower.

A. Smoke fluids
B. Smoke testing
C. Dye
D. Video inspection
E. Smoke candles
F. None of the Above

124. Once ignited, the exiting smoke is drawn in with the fresh air and blown down into the manhole and throughout the_____.

A. Manhole
B. Smoke fluid system
C. Heating chamber
D. Blocking off sections of line
E. System
F. None of the Above

125. _____ are available in various sizes that can be used singularly or in combination to meet any need. This type of smoke is formed by a chemical reaction, creating a smoke which contains a high content of atmospheric moisture. It is very visible even at low concentrations, and extremely effective at finding leaks.

A. Smoke fluids
B. Smoke testing
C. Dye
D. Video inspection
E. Smoke candles
F. None of the Above

126. Another available source of smoke is a smoke fluid system. Although they have just recently been more aggressively marketed, _____ became available for sewer testing shortly after smoke candles, some 30 years ago. They can certainly be used effectively, but it is important to understand how they work.

A. Smoke fluids
B. Smoke testing
C. Dye
D. Video inspection
E. Smoke candles
F. None of the Above

127. This system involves injecting a _____ (usually a petroleum based product) into the hot exhaust stream of the engine where it is heated within the muffler (or heating chamber) and exhausted into the air intake side of the blower.

A. Smoke fluid
B. Smoke testing
C. Dye
D. Video inspection
E. Smoke candles
F. None of the Above

128. One gallon of smoke fluid is generally less expensive than_____, however smoke fluids do not consistently provide the same quality of smoke. When using smoke fluid, it is important to understand that as fluid is injected into the heating chamber (or muffler) it immediately begins to cool the unit.

A. Smoke fluid
B. Smoke testing
C. Dye
D. One dozen smoke candles
E. Smoke candles
F. None of the Above

129. The heating chamber will eventually reach a point where it is not hot enough to completely convert all the_____, thus creating thin/wet smoke. This can actually happen quickly, depending on the rate of fluid flow. If the smoke has become thin it can be especially difficult to see at greater distances.

A. Smoke testing
B. Rate of fluid flow
C. Smoke candle(s)
D. Fluid to smoke
E. Leaks
F. None of the Above

130. Blocking off sections of line is usually a good idea with any type of smoke, but becomes almost a necessity when using _____. Some manufactures have taken steps to address this issue, and now offer better flow control, fluid distribution, and most importantly insulated heating chambers to help maintain necessary temperatures.

A. Smoke fluid
B. Smoke testing
C. Dye
D. One dozen smoke candles
E. Smoke candles
F. None of the Above

131. Safety; Maybe one of the more talked about, yet least understood aspects of smoke testing is the use and safety of these products. As manufacturers have become more competitive, some marketing programs and advertisements have implied danger in the use of competitive types of_____.

A. Smoke testing
B. Smoke products
C. Smoke candle(s)
D. Hot exhaust stream
E. Leaks
F. None of the Above

More on Manholes

132. When designing a wastewater system, the design engineer begins by first determining the types and quantities of sewage to be handled. This is accomplished through a careful study of _____.

A. Design flow
B. Peak flow factor
C. A typical value
D. Water per person in the area to be served
E. A typical infiltration allowance
F. None of the Above

133. The design engineer bases his design on the average daily use of water per person in the area to be served. _____ is 100 gallons per person per day. But, the use of water is not constant.

A. Design flow
B. Peak flow factor
C. A typical value
D. Water per person in the area to be served
E. A typical infiltration allowance
F. None of the Above

134. Use is greater in the summer than in the winter and greater during the morning and evening than it is in the middle of the day or at night. Therefore, the average daily flow (based on the average utilization) is multiplied by a peak flow factor to obtain the _____.

A. Design flow
B. Peak flow factor
C. A typical value
D. Water per person in the area to be served
E. A typical infiltration allowance
F. None of the Above

135. _____factors range from 4 to 6 for small areas down to 1.5 to 2.5 for larger areas. An allowance for unavoidable infiltration of surface and subsurface water into the lines is sometimes added to the peak flow to obtain the design flow.

A. Design flow
B. Peak flow factor
C. A typical value
D. Typical peak flow
E. A typical infiltration allowance
F. None of the Above

136. A typical _____is 500 gallons per inch of pipe diameter per mile of sewer per day. From the types of sewage and the estimated design flow, the engineer can then tentatively select the types, sizes, slopes, and distances below grade of the piping to be used for the system.

A. Design flow
B. Peak flow factor
C. A typical value
D. Water per person in the area to be served
E. Infiltration allowance
F. None of the Above

Low Pressure System Description and Operation
Vacuum Sewers

137. Wastewater from one or more homes flows by gravity to a holding tank known as the valve pit. When the wastewater level reaches a certain level, sensors within the holding tank open a _____that allows the contents of the tank to be sucked into the network of collection piping.

A. Vacuum sewer system(s)
B. Vacuum main(s)
C. Interface valve
D. Vacuum collection and transportation systems
E. Vacuum valve
F. None of the Above

138. There are no manholes with a vacuum system; instead, access can be obtained at each valve pit. The vacuum or draw within the system is created at a vacuum station. _____are small buildings that house a large storage tank and a system of vacuum pumps.

A. Conventional gravity sewers
B. Interface valve
C. Vacuum stations
D. Vacuum system
E. Vacuum within the vacuum mains
F. None of the Above

139. _____ are limited to an extent by elevation changes of the land. Rolling terrain with small elevation changes can be accommodated, yet steep terrain would require the addition of lift stations like those used for conventional sewer systems. It is generally recommended that there be at least 75 properties per pump station for the use of a vacuum sewer system to be cost effective.

A. Vacuum sewer system(s)
B. Vacuum main(s)
C. Interface valve
D. Vacuum collection and transportation systems
E. Network of collection piping
F. None of the Above

140. This minimum property requirement tends to make vacuum sewers most conducive for small communities with a relatively high density of properties per acre. The maintenance and operation of this system requires a full-time system operator with the necessary training. This can make the operation and maintenance costs of _____exceed those of other systems.

A. Conventional gravity sewers
B. Vacuum sewers
C. Manholes
D. Vacuum system
E. Vacuum within the vacuum mains
F. None of the Above

Applications

141. Vacuum collection and transportation systems can provide significant capital and ongoing operating cost advantages over_____, particularly in flat terrain, high water table, or hard rock areas.

A. Vacuum sewer system(s)
B. Vacuum main(s)
C. Interface valve
D. Conventional gravity systems
E. Network of collection piping
F. None of the Above

142. This term is installed at shallow depths, significantly reducing excavation, shoring and restoration requirements, and minimizing the disruption to the community.

A. Vacuum sewer system(s)
B. Vacuum main(s)
C. Interface valve
D. Vacuum collection and transportation systems
E. Network of collection piping
F. None of the Above

143. The alignment of _____is extremely flexible, without the need for manholes at changes in grade or direction.

A. Conventional gravity sewers
B. Interface valve
C. Manholes
D. Vacuum system
E. Vacuum mains
F. None of the Above

144. Vacuum sewer mains can skip over and around other services or obstacles and can be used to achieve uphill flow. Turbulent velocities of 5 to 6m/sec are developed as the sewage and air passes through the _____. This disintegrates solids and reduces the risks of sewer blockages which are unknown in a correctly designed and constructed vacuum system.

A. Vacuum sewer system(s)
B. Vacuum main(s)
C. Interface valve
D. Vacuum collection and transportation systems
E. Network of collection piping
F. None of the Above

145. No electricity is required at the _____, enabling the system to be installed in virtually any location.

A. Conventional gravity sewers
B. Interface valve
C. Manholes
D. Vacuum system
E. Vacuum within the vacuum mains
F. None of the Above

146. Fractures in _____may go undetected for a long time. A leak in a vacuum main will raise an alarm within minutes of the break. The mains have to be repaired for sewage transport to continue, ensuring up to date maintenance and eliminating deterioration and infiltration.

A. Vacuum sewer system(s)
B. Vacuum main(s)
C. Gravity systems
D. Vacuum collection and transportation systems
E. Network of collection piping
F. None of the Above

147. Due to the shallow depth of the installation, additional connections can be quickly and simply made by a small construction crew, thus reducing the disruption and restoration work normally required for _____.

A. Conventional gravity sewers
B. Interface valve
C. Manholes
D. Vacuum system
E. Vacuum within the vacuum mains
F. None of the Above

148. _____ and transport systems have many applications in industry for collecting all forms of liquid waste, including toxic and radioactive fluids. Collection pipes may be installed above ground, overhead or in utility ducts.

A. Vacuum sewer system(s)
B. Vacuum main(s)
C. Interface valve
D. Vacuum collection
E. Network of collection piping
F. None of the Above

Vacuum Interface Valves

149. Interface between the vacuum within the vacuum mains and the atmospheric pressure within the_____. When sewage is entering the system from a source and the sewage level in the chamber rises, it pressurizes air in the 63mm sensor line.

A. Conventional gravity sewers
B. Interface valve
C. Vacuum interface chamber
D. Vacuum system
E. Vacuum within the vacuum mains
F. None of the Above

150. This air pressure is transmitted by a hose to the controller/sensor unit, which opens the valve and the wastewater is rapidly drawn into the_____. This suction of the sewer creates a vortex in the sump and air is drawn into the sewer with the sewage.

A. Collection tank
B. Collection sump
C. Vacuum in the sewer
D. Controller/sensor unit
E. Vacuum main
F. None of the Above

151. As the valve opens, a pneumatic timer in the _____ starts a pre-set time cycle. The timer holds the valve open for sufficient time to draw all the sewage out of the sump and allows a designated amount of air to enter the system.

A. Collection tank
B. Collection sump
C. Vortex
D. Controller/sensor unit
E. Vacuum interface valve
F. None of the Above

152. This term is capable of serving at least four equivalent tenements, and multiple valve chambers may be installed to serve higher flow rates.

A. Collection tank
B. Collection sump
C. Vacuum in the sewer
D. Controller/sensor unit
E. Interface valve
F. None of the Above

153. No electricity is required at the_____. The vacuum valve is automatically operated by the pressure generated with the rising sewage level and the pneumatic timer, and actuated by the vacuum in the sewer.

A. Collection tank
B. Collection sump
C. Valve chamber
D. Controller/sensor unit
E. Vacuum interface valve
F. None of the Above

154. Differential air pressure is the driving force in vacuum sewer systems. The vacuum sewer lines are under a vacuum of 16"-20" Hg (-0.5 to -0.7 bar) created by _____located at the vacuum station.

A. Collection tank
B. Collection sump
C. Vacuum in the sewer
D. Controller/sensor unit
E. Vacuum pumps
F. None of the Above

155. The pressure differential between the atmospheric pressure and the vacuum in the sewer lines of 7 to 10 psi (0.5 - 0.7 bar) provides the energy required to open the vacuum interface valves and to transport the sewage. Sewage flows by gravity from homes into a _____.

A. Collection tank
B. Collection sump
C. Vacuum in the sewer
D. Controller/sensor unit
E. Interface valve
F. None of the Above

156. When 10 gallons (40 liters) accumulates in the sump, the located above the sump automatically opens and differential air pressure propels the sewage through the valve and into the_____.

A. Collection tank
B. Collection sump
C. Vacuum main
D. Controller/sensor unit
E. Vacuum interface valve
F. None of the Above

157. Sewage flows through the vacuum lines and into the collection tank at the vacuum station. Sewage pumps transfer the sewage from the _____ to the wastewater treatment facility or nearby gravity manhole. There are no electrical connections required at the home. Power is necessary only at the vacuum station.

A. Collection tank
B. Collection sump
C. Vacuum in the sewer
D. Controller/sensor unit
E. Interface valve
F. None of the Above

Valve Pit Package

158. The Valve Pit Package connects the homes to the vacuum sewer system. _____ flows by gravity from up to four homes into a sealed fiberglass sump. Located above the sewage sump and surrounded by a fiberglass valve pit is a 3" (90 mm) vacuum interface valve, which is pneumatically controlled and operated.

A. Raw sewage
B. Solids
C. High scouring velocity
D. Potential vacuum loss
E. Vacuum pump(s)
F. None of the Above

159. Vacuum from the _____opens the valve and outside air from a breather pipe closes it.

A. Vacuum sewer system(s)
B. Lift station
C. Sewer line
D. Vacuum pump(s)
E. Vacuum service line
F. None of the Above

160. Sewage level sensing is remarkably simple. As the sewage level rises, air trapped in the empty 2" (50 mm) diameter sensor pipe pushes on a diaphragm in the valve's controller/sensor unit, signaling the valve to open. When ten gallons of sewage accumulates in the sump the valve automatically opens. The _____propels the sewage at velocities of 15-18 feet per second (4.5 - 5.5 m/s), disintegrating solids while being transported to the vacuum station.

A. Raw sewage
B. Differential air pressure
C. High scouring velocity
D. Potential vacuum loss
E. Vacuum pump(s)
F. None of the Above

Vacuum Lines

161. _____are installed in narrow trenches in a saw tooth profile for grade and uphill transport. Vacuum lines follow grade for downhill transport.

A. Vacuum sewer system(s)
B. Lift station
C. Downhill transport
D. Vacuum pump(s)
E. Vacuum service lines
F. None of the Above

162. Vacuum lines are slightly sloped (0.2%) towards the collection station. Unlike gravity sewers that must be laid at a minimum slope to obtain a 2 ft./sec. (0.6 m/s) scouring velocity, vacuum has a flatter slope since a high scouring velocity is a feature of _____transport.

A. Raw sewage
B. Vacuum sewage
C. High scouring velocity
D. Potential vacuum loss
E. Vacuum pump(s)
F. None of the Above

Line Sizes

163. The vacuum service line from the _____to the main in the street is 3" diameter (90 mm). The vacuum mains are 4", 6", 8" and 10" diameter (110 mm to 250 mm) schedule 40 or SDR 21 gasketed PVC pipe.

A. Vacuum sewer system(s)
B. Lift station
C. Valve
D. Vacuum pump(s)
E. Vacuum service line
F. None of the Above

164. PE pipe can also be used. In general, a potential vacuum loss is associated with every lift. This limits the length of each vacuum line to about 2 to 3 miles (3 to 5 km) in flat terrain. _____can extend or reduce this range. Longer distances are possible depending on local topography.

A. Raw sewage
B. Elevation changes
C. High scouring velocity
D. Potential vacuum loss
E. Vacuum pump(s)
F. None of the Above

Vacuum Station

165. The vacuum station is similar in function to a lift station in a gravity sewer system. Sewage pumps transfer the sewage from the_____, through a force main, to the treatment plant. Unlike a lift station, the vacuum station has two vacuum pumps that create vacuum in the sewer lines and an enclosed collection tank.

A. Vacuum sewer system(s)
B. Lift station
C. Collection tank
D. Vacuum pump(s)
E. Vacuum service line
F. None of the Above

Vacuum Pumps

166. The vacuum pumps maintain the system vacuum in the 16" to 20" mercury vacuum (-0.5 to -0.7 bar) operating range. _____ typically run 2 to 3 hours each per day (4 to 6 hours total) and don't need to run continuously since the vacuum interface valves are normally closed.

A. Raw sewage
B. Solids
C. High scouring velocity
D. Potential vacuum loss
E. Vacuum pump(s)
F. None of the Above

167. As sewage enters the system, driven by air at atmospheric pressure, the system vacuum will slowly decrease from 20" to 16" Hg. The _____ are sized to increase the system vacuum from 16" to 20" Hg in three minutes or less.

A. Vacuum sewer system(s)
B. Lift station
C. Downhill transport
D. Vacuum pump(s)
E. Vacuum service line
F. None of the Above

168. Typical _____ sizes are 10, 15, and 25 horsepower (7.5, 11 and 18.6 kw). Busch rotary vane vacuum pumps are standard. The two non-clog sewage pumps are each sized for peak flow. The collection tank is steel or fiberglass and is sized according to flow, with typical sizes ranging from 1,000 to 4,000 gallons (3.8 to 15 cubic meters).

A. Raw sewage
B. Solids
C. High scouring velocity
D. Potential vacuum loss
E. Vacuum pump(s)
F. None of the Above

169. _____ connect individually to the collection tank, effectively dividing the system into zones. A stand-by generator keeps the vacuum sewer system in operation during extended power outages. An automatic telephone dialer alerts the operator to alarm conditions.

A. Vacuum sewer system(s)
B. Lift station
C. The incoming vacuum lines
D. Vacuum pump(s)
E. Vacuum service line
F. None of the Above

Review

Pressure Sewers

170. Instead of relying on gravity, pressure sewers utilize the force supplied by pumps, which deliver the wastewater to the system from each property. Since _____ do not rely on gravity, the system's network of piping can be laid in very shallow trenches that follow the contour of the land.

A. Gravity system
B. Grinder pump(s)
C. Pressure sewers
D. Two kinds of pressure sewer systems
E. Both the STEP and grinder systems
F. None of the Above

171. There are two kinds of_____, based upon the type of pump used to provide the pressure.

A. Gravity system
B. Grinder pump(s)
C. Pressure sewers
D. STEP and grinder systems
E. Pressure sewer systems
F. None of the Above

172. Systems that use a _____combination are referred to as STEP pressure sewers.

A. Gravity system
B. Grinder pump(s)
C. Pressure sewers
D. Two kinds of pressure sewer systems
E. Septic tank/effluent pump
F. None of the Above

173. Like the small diameter, _____ pressure sewers utilize septic tanks to settle out the solids; this allows for the use of piping that is extremely narrow in diameter. The effluent pump delivers the wastewater to the sewer pipes and provides the necessary pressure to move it through the system. The other type of pressure sewer uses a grinder pump.

A. Gravity system
B. Grinder pump(s)
C. Pressure sewers
D. STEP
E. Two kinds of pressure sewer systems
F. None of the Above

174. Wastewater from each property goes to a tank containing a pump with grinder blades that shred the solids into tiny particles. Both solids and liquids are then pumped into the sewer system. Because the effluent contains a mixture of solids as well as liquids, the diameter of the pipes must be slightly larger. However, _____eliminate the need to periodically pump the septic tanks for all the properties connected to the system.

A. Gravity system
B. Grinder pump(s)
C. Pressure sewers
D. Two kinds of pressure sewer systems
E. Both the STEP and grinder systems
F. None of the Above

175. Both the STEP and _____are installed with high water alarms. Because of the addition of the pumps, pressure sewers tend to require more operation and maintenance than small diameter gravity sewers.

A. Gravity system
B. Grinder pump(s)
C. Pressure sewers
D. Grinder systems
E. Two kinds of pressure sewer systems
F. None of the Above

176. Operators can usually be hired on a part time basis, as long as someone is on call at all times. Operators will need training on both the plumbing and_____.

A. Gravity system
B. Grinder pump(s)
C. Pressure sewers
D. Two kinds of pressure sewer systems
E. Electrical aspects of the system
F. None of the Above

Sewer Line Mapping

177. The importance of maintaining accurate, current maps of the collection system cannot be overstated. _____and repairs are unlikely if mapping is not adequate. Collection system maps should clearly indicate the information that personnel need to carry out their assignments.

A. Overflow points
B. Introduction of flows
C. Inspection
D. Owner or operator's management program
E. Efficient collection system maintenance
F. None of the Above

178. Collection system maps should have a numbering system which uniquely identifies all manholes and _____. The system should be simple and easy to understand.

A. Engineering endeavors
B. Sewer line maps
C. Sewer cleanouts
D. Quality sanitary sewer designs
E. Numbering system
F. None of the Above

179. This term should have permanently assigned numbers and never be renumbered. Maps should also indicate the property served and reference its cleanout.

A. Overflow points
B. Introduction of flows
C. Inspection
D. Owner or operator's management program
E. Manholes and sewer cleanouts
F. None of the Above

180. This term should indicate the diameter, the length between the centers of manholes, and the slope or direction of flow. The dimensions of easements and property lines should be included on the maps.
A. Engineering endeavors D. Quality sanitary sewer designs
B. Sewer line maps E. Numbering system
C. Sewer cleanouts F. None of the Above

181. Other information that should be included on maps are access and overflow points, a scale, and a north arrow. All maps should have the _____was drafted and the date of the last revision.
A. Overflow points D. Date the map
B. Introduction of flows E. Manholes and sewer cleanouts
C. Inspection F. None of the Above

182. Although optional, maps often include_____. Maps may come in different sizes and scales to be used for different purposes. Detailed local maps may be used by maintenance or repair crews to perform the duties. However, these detailed local maps should be keyed to one overall map that shows the entire system.
A. Engineering endeavors D. Quality sanitary sewer designs
B. Sewer line maps E. Materials of pipe construction
C. Sewer cleanouts F. None of the Above

Geographic Information System (GIS)
183. GIS technology has made the mapping and map updating process considerably more efficient. GIS is a computerized mapping program capable of combining mapping with detailed information about the physical structures within the collection system. If a GIS program is being used by the owner or operator, the reviewer should ask if the program is capable of accepting information from this term.
A. Overflow points D. Owner or operator's management program
B. Introduction of flows E. Manholes and sewer cleanouts
C. Inspection F. None of the Above

184. Specific procedures should be established for correction of errors and updating maps and drawings. Field personnel should be properly trained to recognize discrepancies between field conditions and map data and record changes necessary to correct the existing mapping system. Reviewers should check to see that maps and plans are available to the personnel in the office and to field personnel or contractors involved in all _____.
A. Engineering endeavors D. Quality sanitary sewer designs
B. Sewer line maps E. Numbering system
C. Sewer cleanouts F. None of the Above

New Sewer Construction
185. The owner or operator should maintain strict control over the introduction of flows into the system from new construction. _____ may be public (i.e., an expansion of the collection system) or private (i.e., a developer constructing sewers for a new development).
A. Overflow points D. Owner or operator's management program
B. Introduction of flows E. Manholes and sewer cleanouts
C. Inspection F. None of the Above

186. This term keep costs and problems associated with operations, maintenance, and construction to a minimum.

A. Engineering endeavors
B. Sewer line maps
C. Sewer cleanouts
D. Sanitary sewer designs
E. Numbering system
F. None of the Above

187. This term is difficult to correct once construction is complete. The reviewer should be aware that this has historically not been adequately addressed in some collection systems. The owner or operator should have standards for new construction, procedures for reviewing designs and protocols for inspection, start-up, testing, and approval of new construction. The procedures should provide documentation of all activities, especially inspection.

A. Overflow points
B. Introduction of flows
C. Inspection
D. Design flaws
E. Manholes and sewer cleanouts
F. None of the Above

Grease

188. If left unmanaged, grease can cause interference in wastewater collection, transmission, and treatment systems. _____ due to grease build-up are a common cause of sanitary sewer overflows, and grease accumulation at treatment facilities can lead to pass-through of contaminants.

A. Grease interceptor(s)
B. POTW
C. Notice of Violation
D. Pass-through of contaminants
E. Blockages
F. None of the Above

189. Proactive municipal governments have a grease ordinance which provides them legal authority to require that grease generators have devices to catch the grease before it enters the public wastewater system. These devices are often referred to as "_____."

A. POTW(s)
B. Local ordinance
C. Grease interceptor(s)
D. International Plumbing Code
E. Grease traps
F. None of the Above

190. Proactive municipal governments also have in place _____program to ensure grease generators clean the traps on an appropriate schedule and in a proper manner.

A. Grease interceptor(s)
B. POTW
C. Notice of Violation
D. Pass-through of contaminants
E. An inspection and enforcement
F. None of the Above

191. Failure to do so incurs a penalty levied by the municipality, so there is incentive to correct problems before they result in sanitary sewer overflows, interference, or pass-through. _____often have public education programs to ensure non-commercial contributions of grease to the wastewater system are minimized.

A. Proactive municipalities
B. Local ordinance
C. Grease interceptor(s)
D. International Plumbing Code
E. POTW inspectors
F. None of the Above

Grease Interceptors

192. This term use grease interceptors which are larger than the traps and are installed underground, outside of a facility. Grease is actually "intercepted" in these concrete or fiberglass tanks before it reaches the sewer main.

A. Grease interceptor(s)
B. High-volume or new establishments
C. Notice of Violation
D. Pass-through of contaminants
E. An inspection and enforcement program
F. None of the Above

193. This term should be accessible by three manhole covers, and a sample box. Interceptors and traps cause the flow of water to slow down, allowing the grease to naturally float to the top of the tank for easy removal.

A. POTW(s)
B. Local ordinance
C. Grease interceptor(s)
D. International Plumbing Code
E. POTW inspectors
F. None of the Above

Plan Checks and Inspections

194. All plans for new commercial food establishments (including new construction remodels and retrofits) should receive a plan review from the _____. This review assures that appropriate grease-removal equipment is installed during construction.

A. Grease interceptor(s)
B. POTW
C. Notice of Violation
D. Pass-through of contaminants
E. An inspection and enforcement program
F. None of the Above

Grease Blockages

195. Shortly after sewer-spills caused by grease are reported, _____investigate facilities within the immediate area. A determination is made as to which commercial facilities contributed to the blockage, and more in-depth inspections are conducted at those facilities. Where appropriate, additional requirements and/or procedures are put in place.

A. POTW(s)
B. Local ordinance
C. Grease interceptor(s)
D. International Plumbing Code
E. POTW inspectors
F. None of the Above

196. When requirements are made for additional grease-removal equipment, the facility is given a due date to comply. A Notice of Violation, with_____, is issued once a facility has passed its final due date. Administrative hearings, permit revocation, and ultimately, termination of sewer service may occur for those facilities that remain out of compliance.

A. Grease interceptor(s)
B. POTW
C. An administrative fee
D. Pass-through of contaminants
E. An inspection and enforcement program
F. None of the Above

Regular Grease Inspection

197. Regular inspection and maintenance is essential to the proper operation of a grease removal device. This term should require a minimum cleaning frequency of once every six months.

A. POTW(s)
B. Local ordinance
C. Grease interceptor(s)
D. International Plumbing Code
E. POTW inspectors
F. None of the Above

198. Regular cleaning at the appropriate interval is necessary to maintain the rated efficiency of the device. Equipment that is not regularly maintained puts the food service facility at risk of violating the_____ , and this may not be known until an overflow and violation have occurred.

A. Grease interceptor(s)
B. POTW
C. Notice of Violation
D. Pass-through of contaminants
E. Sewer use ordinance
F. None of the Above

199. This term suggest businesses start with quarterly cleanings and should be done when 75 percent of the retention capacity of the unit is 75 percent full of accumulated grease. A large measuring stick and/or a clear piece of conduit may be used to determine the depth of the grease accumulation. You should require that restaurants contract with a licensed grease hauler to remove it from your premises for appropriate disposal.

A. POTW(s)
B. Local ordinance
C. Grease interceptor(s)
D. International Plumbing Code
E. POTW inspectors
F. None of the Above

Collection Systems O&M Section
Sewer Cleaning and Inspection

200. As sewer system networks age, the risk of deterioration, _____, and collapses becomes a major concern. As a result, municipalities worldwide are taking proactive measures to improve performance levels of their sewer systems.

A. Sanitary sewer overflow(s)
B. Rehabilitation
C. Blockages
D. Check with the local authorities
E. Education and pollution prevention
F. None of the Above