UNITED STATES DISTRICT COURT
DISTRICT OF CONNECTICUT

UNITED STATES OF AMERICA and STATE OF CONNECTICUT, Plaintiffs, v. THE METROPOLITAN DISTRICT OF HARTFORD, CONNECTICUT Defendant.	)	CIVIL ACTION NO.

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CONSENT DECREE

WHEREAS, The Metropolitan District of Hartford, Connecticut ("MDC" or "Defendant") discharges pollutants into waters of the United States from Sanitary Sewer Overflow outfalls without authorization under any National Pollutant Discharge Elimination System ("NPDES") Permit; and

WHEREAS, the plaintiffs, United States of America, on behalf of the United States Environmental Protection Agency ("EPA") and the State of Connecticut ("State") have filed complaints ("Complaints") simultaneously herewith, alleging that the MDC has violated Section 301(a) of the Clean Water Act ("CWA"), 33 U.S.C. § 1311(a); and

WHEREAS, the Parties agree, without adjudication or admission of facts or law, that settlement of this matter is in the public interest and that entry of this Consent Decree without further litigation is an appropriate resolution of the dispute, and the Parties consent to the entry of this Consent Decree;

NOW, THEREFORE, it is hereby ordered, adjudged, and decreed as follows:

I. STATEMENT OF CLAIM

A. The Complaints filed in this action state claims upon which relief can be granted against the Defendant pursuant to Section 309 of the CWA, 33 U.S.C. § 1319. The State's Complaint also states claims upon which relief can be granted pursuant to applicable State law.

II. JURISDICTION AND VENUE

A. This Court has jurisdiction over the subject matter of this action pursuant to Section 309(b) of the CWA, 33 U.S.C. § 1319(b), and 28 U.S.C. §§ 1331, 1345, and 1355. This Court has personal jurisdiction over the Parties to this Consent Decree. Venue properly lies in this district pursuant to Section 309(b) of the CWA, 33 U.S.C. § 1319(b), 28 U.S.C. §§ 1391(b) and (c), and 28 U.S.C. § 1395. The MDC waives all objections it might have raised to such jurisdiction or venue.

III. BINDING EFFECT

A. The provisions of this Consent Decree shall apply to, and be binding on, the MDC, its officers, directors, employees, agents, servants, successors and assigns, and all persons, firms and corporations in active concert or participation with the MDC or its officers, directors, agents, employees, successors and assigns, and upon the United States and the State.

B. Effective from the Date of Entry of this Consent Decree until its termination, the MDC shall give written notice of this Consent Decree to any person or entity to whom the MDC transfers ownership or operation of its wastewater treatment facilities, its Sanitary Collection System or any other portion of its wastewater treatment facilities or Sanitary Collection System and shall provide a copy of this Consent Decree to any such person or entity. The MDC shall

notify EPA and the United States Department of Justice in writing of any successor in interest at least 30 days prior to any such transfer. Any sale or transfer of the MDC's interests in or operating role with respect to the MDC's wastewater treatment facilities or Sanitary Collection System shall not in any manner relieve the MDC of its responsibilities in meeting the terms and conditions of this Consent Decree.

C. The MDC shall provide a copy of this Consent Decree to each engineering and consulting and contracting firm that is retained to perform the work or any portion thereof required by this Consent Decree upon execution of any contract relating to such work, and shall provide a copy to each engineering and consulting and contracting firm already retained no later than 30 days after the Date of Entry of this Consent Decree. Any action taken by any contractor or consultant retained by the MDC to implement the MDC's duties under this Consent Decree shall be considered an action of the MDC for purposes of determining compliance with this Consent Decree. In an action to enforce this Consent Decree, the MDC shall not assert as a defense against an action by EPA or the State any act or failure to act by any of its officers, directors, employees, agents, servants, consultants, engineering firms, contractors, successors and assigns. However, the MDC retains any rights it may have against such officers, directors, employees, agents, servants, consultants, engineering firms, contractors, successors and assigns.

IV. PURPOSE

A. It is the express purpose of the Parties in entering into this Consent Decree to have the MDC take all measures necessary to fulfill the objectives of the CWA and to achieve and maintain compliance with the CWA, including the regulations promulgated thereunder, Connecticut water pollution control laws, the regulations promulgated under such laws, the

MDC's NPDES permits, any NPDES permits that may be issued to the MDC in the future, and to eliminate all SSOs from its Sanitary Collection System.

B. Engineering designs and analyses required to be performed pursuant to this Consent Decree shall be conducted using sound engineering practices, and, as applicable, consistent with: (a) EPA's Handbook: Sewer System Infrastructure Analysis and Rehabilitation, EPA/625/6-91/030, Oct. 1991; (b) EPA's Handbook for Sewer System Evaluation and Rehabilitation, EPA 430/9-75-021, Dec. 1975; (c) Existing Sewer Evaluation and Rehabilitation, WEF MOP FD-6, 1994; (d) A Guide to Short Term Flow Surveys of Sewer Systems, WRc Engineering (Undated); (e) the National Association of Sewer Service Companies (NASSCO) "Manual of Practice"; and, (f) the currently effective edition of "TR 16: Guides for the Design of Wastewater Treatment Works."

V. DEFINITIONS

A. Unless otherwise expressly provided herein, terms used in this Consent Decree that are defined in the CWA or in regulations promulgated under the CWA shall have the meaning ascribed to them in the CWA or in the regulations promulgated thereunder. Whenever the terms listed below are used in this Consent Decree, the following definitions shall apply:

1. "Building/Private Property Backup" shall mean any release of wastewater from the MDC's Sanitary Sewer System into buildings or onto private property, except a release that: (1) is the result of blockages, flow conditions, or malfunctions of a building lateral or other piping/conveyance system that is not owned or operationally controlled by the MDC, or (2) is the result of overland, surface flooding not emanating from the MDC's Sanitary Sewer System.

2. "Calendar Quarter" shall mean a three-month period ending on March 31st,

June 30th, September 30th, or December 31st.

3. "Capacity-Related SSO" shall mean any discharge or release from any part of the MDC's Sanitary Collection System, not including the combined sewer areas in Hartford and West Hartford, that is the result of the inability of that portion of the Sanitary Collection System or portions of the Sanitary Collection System downstream of that portion, to convey peak flows to a treatment plant when operating as designed.

4. "Collection System" shall mean the sewage collection and transmission system (including all pipes, Force Mains, gravity sewer lines, lift stations, Pumping Stations, manholes, and appurtenances thereto) owned or operated by the MDC and designed to convey wastewater to any wastewater treatment facility ("WWTF") or to one or more points of discharge.

5. "Consent Decree" or "Decree" shall mean this Consent Decree and all appendices attached hereto. In the event of conflict between this Decree and any appendix, this Decree shall control.

6. "Date of Entry" shall mean the date this Consent Decree is approved and signed by a United States District Court Judge for the District of Connecticut.

7. "Date of Lodging" shall mean the date this Consent Decree is filed for lodging with the Clerk of the Court for the United States District Court for the District of Connecticut.

8. The terms "day" or "days" as used herein shall mean a calendar day or calendar days. In computing any period of time under this Consent Decree, where the last day would fall on a Saturday, Sunday, federal or state holiday, the period shall run until the close of

the next business day.

9. "Excessive Inflow/Infiltration" or "Excessive I/I" shall mean the Infiltration/Inflow ("I/I") that can be cost-effectively eliminated as determined by a cost-effectiveness analysis that compares the costs of eliminating the I/I with the total costs for transportation and treatment of the I/I (including capital costs of increasing sewage facilities capacity and treatment and its resulting operating costs).

10. "Flow" shall mean all wastewaters conveyed by any portion of the Collection System.

11. "Force Main" shall mean any pipe that receives and conveys, under pressure, wastewater from the discharge side of a pump. A Force Main is intended to convey wastewater under pressure.

12. "Infiltration" shall mean water that enters a sewer system (including sewer service connections and foundation drains) from the ground through such means as defective pipes, pipe joints, connections, or manholes.

13. "Inflow" shall mean water that enters a sewer system (including sewer service connections) from sources such as, but not limited to, roof leaders, cellar drains, yard drains, area drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm waters, surface runoff, street wash waters, or drainage.

14. "Inflow/Infiltration" ("I/I") shall mean the total quantity of water from Inflow, Infiltration, and Rainfall-Induced Infiltration without distinguishing the source.

15. "Minisystem" shall mean a subsystem of the Sanitary Collection System in

which a key manhole located at the outlet of the subsystem can be used to measure the I/I that occurs within the subsystem.

16. "Parties" shall mean EPA, the State of Connecticut, and the MDC.

17. "Pumping Station" shall mean facilities comprised of pumps that lift wastewater to a higher hydraulic elevation, including all related electrical, mechanical, and structural systems necessary to the operation of that Pumping Station.

18. "Rainfall-Induced Infiltration" ("RII") is Infiltration that behaves similarly to Inflow. Like Inflow, RII occurs as a result of rainfall. RII is the result of rainfall percolating through the soils into defects in collection systems which generally lie near the surface.

19. "Sanitary Collection System" shall mean the separate wastewater collection, storage, and transmission system (including all pipes, Force Mains, gravity sewer lines, lift stations, Pumping Stations, manholes, and appurtenances thereto) intended to carry only sewage from residences, commercial buildings, industrial buildings and institutions, which is owned or operated by the MDC.

20. "Sanitary Sewer Overflow," "SSO," and "Overflow" shall mean an overflow, spill, diversion, or release of wastewater from, or caused by, the MDC's Sanitary Collection System. This term shall include discharges to waters of the State or United States from the MDC's Sanitary Collection System, as well as any release of wastewater from the MDC's Sanitary Collection System to public or private property that does not reach waters of the United States or the State, including Building/Private Property Backups.

21. "Sewershed" shall mean a major portion of the Sanitary Collection System that drains to one, or a limited number of, major sewers.

22. "Structural SSO Outfalls" shall mean those SSO outfalls at the following locations:

-the Hartford Avenue Siphon Overflow Chamber in Newington

-the Goff Brook Overflow Chamber in Rocky Hill

-the Church Street Overflow in Wethersfield

-the Elm Street Overflow Chamber in Wethersfield

-the Hillcrest Overflow Chamber in West Hartford

-the Center Trunk Overflow to Trout Brook (CTS-2) in West Hartford

-the Center Trunk Overflow at Talcott Street (CTS-3) in West Hartford

-the Windsor Interceptor Overflow Chamber (NM-1) in Hartford.

23. "Surface Waters" shall mean waters of the State and United States as defined by 40 C.F.R. § 122.2.

24. The phrase "approval by EPA and CTDEP," shall mean the MDC's receipt of one joint, written approval document from both EPA and the Connecticut Department of Environmental Protection ("CTDEP"), or a written approval from each, EPA and CTDEP.

VI. SUBMISSIONS REQUIRING REVIEW AND APPROVAL BY EPA AND CTDEP

A. **EPA /CTDEP Review**

After review of any plan, report or other item that the MDC is required to submit to EPA and CTDEP for approval pursuant to this Consent Decree, EPA and CTDEP shall: (a) approve the submission, in whole or in part; (b) approve the submission with specified conditions; (c) disapprove, in whole or in part, the submission, directing the MDC to modify the submission; or (d) any combination of the above. If EPA or CTDEP disapproves the submission, in whole or in

part, EPA or CTDEP shall notify the MDC in writing of those portions of the submission that EPA or CTDEP disapproves.

B. **The MDC's Obligations upon EPA and CTDEP Approval**

In the event of approval, or approval with conditions by EPA and CTDEP, the MDC shall proceed to take any action required by the plan, report or other item as approved by EPA and CTDEP.

C. **The MDC's Obligations upon EPA or CTDEP Disapproval**

Upon receipt of notice of disapproval pursuant to Sub-Section VI.A above, the MDC shall, within 45 days correct the deficiencies in the plan, report or other item and resubmit the plan, report or other item for approval. Notwithstanding the receipt of a disapproval notice pursuant to Sub-Section VI.A above, the MDC shall proceed, at the direction of EPA or CTDEP, to take any action required by any non-deficient portion of the submission.

D. **Procedures for Resubmitted Plans**

In the event that EPA or CTDEP disapproves a resubmitted plan, report or other item, or portion thereof, EPA or CTDEP may again require the MDC to correct the deficiencies within 30 days or EPA or CTDEP may modify the submittal. The MDC shall, within 15 days, either accept the decision of EPA or CTDEP to modify the submittal or initiate the dispute resolution provisions of this Consent Decree, starting with petitioning the Court pursuant to Section XV (Dispute Resolution). If the Court upholds EPA's or CTDEP's modification or disapproval, stipulated penalties shall accrue for such violation from the date on which the initial submission was originally required.

E. **Enforceability of Modifications**

All plans, reports, and other items required to be submitted to EPA and CTDEP under this Consent Decree shall, upon approval or modification by EPA and CTDEP, be enforceable under this Consent Decree. In the event EPA and CTDEP approves or modifies a portion of a plan, report or other item required to be submitted to EPA and CTDEP under this Consent Decree, the approved or modified portion shall be enforceable under this Consent Decree.

VII. CWA REMEDIAL MEASURES

A. **Capacity, Management, Operation and Maintenance (CMOM) Program**

Within 180 days of the Date of Entry, the MDC shall submit to EPA and CTDEP for approval, a CMOM Program Self-Assessment of its Collection System maintenance programs, in accordance with the attached guidance document in Appendix A to ensure that the MDC has a CMOM Program in place that is effective at eliminating SSOs from the Collection System. The CMOM Program Self-Assessment shall be accompanied by a CMOM Corrective Action Plan to address any deficiencies noted during the CMOM Program Self-Assessment and a schedule for its implementation (the "CMOM Program Corrective Action Schedule"). Upon EPA's and CTDEP's approval of the CMOM Program Self-Assessment and CMOM Program Corrective Action Plan, the MDC shall implement the corrective actions in accordance with the CMOM Program Corrective Action Schedule whereupon the MDC shall continuously implement its modified CMOM Program.

B. **Long-Term Preventative Maintenance Program**

Within 180 days of the Date of Entry, the MDC shall submit to EPA and CTDEP for approval, a plan for a Long-Term Preventative Maintenance Program ("the Preventative

Maintenance Program") that incorporates the findings of the CMOM Program (Self-Assessment and Corrective Action Plan). The Preventative Maintenance Program shall include, but need not be limited to, the following:

1. Physical inspection and testing procedures to be used to routinely inspect and maintain the MDC's Collection System including, but not limited to, all Pumping Stations, Force Mains, siphons, emergency generators, alarms, telemetry equipment, interceptor and lateral sewers, and to be used to identify and correct any structural, electrical, mechanical, or operational problems that may result in SSOs;

2. Preventative and routine maintenance schedules and procedures, including, but not limited to, specific maintenance plans for those areas of the Collection System prone to vandalism, electrical or mechanical failures, grease and silt deposits and root penetration, as well as those areas that have been the source of SSOs in the past;

3. A tracking system for all maintenance activities, including, at a minimum, the use of Collection System maintenance software designed to catalog the maintenance history of the Collection System and to plan and schedule future Collection System maintenance activities;

4. Staffing, organization, and resource commitments;

5. A plan and schedule for priority and routine maintenance cleaning of the Collection System to maintain the Collection System's capacity, to prevent Collection System blockages, to prevent Building/Private Property Backups, and to prevent SSOs;

6. A description of all activities, including procedures, equipment, resources to be used and the frequency of the activity;

7. A proposed budget for implementation of the Preventative Maintenance Program; and

8. A five-year preventative maintenance expenditure plan for the Collection System.

The MDC shall implement the Preventative Maintenance Program upon approval or conditional approval by EPA and CTDEP.

C. **Hydraulic Model and Model Report**

Within 270 days of the Date of Entry, the MDC shall develop a model(s) (the "Model") and submit to EPA and CT DEP a Modeling Report of the MDC's Sanitary Collection System using a hydraulic modeling software package. This Model shall evaluate portions of the Sanitary Collection System that include the contiguous interceptor sewers, 12-inch and greater, that are within the limits, both upstream and downstream, of all Structural SSO Outfalls. Isolated surcharges shall be addressed under the Sewer System Evaluation Survey that will be prepared pursuant to Section VII.H of this Decree. The MDC shall use the Model to: 1) assess the hydraulic capacity of each Sewershed that is tributary to, or which contributes to, a Capacity-Related SSO including all Structural SSO Outfalls identified in Sub-Section V.A.22; 2) identify the appropriate remedial measures to address all capacity limitations identified in the Sanitary Collection System; and, 3) provide a detailed understanding of the response of its Sanitary Collection System to wet-weather events and an evaluation of the impacts of the proposed remedial measures and removal of extraneous flows.

1. The MDC shall configure the Model to accurately represent each of the MDC's Sewersheds that is tributary to, or which contributes to, Capacity-Related SSOs in

accordance with currently accepted engineering practice. The MDC may model its Sanitary Collection System in different levels of detail and with different types of models, as necessary, to identify the causes of all known Overflows and to assess proposed remedial measures to eliminate those Overflows.

2. The MDC shall configure the Model using adequate, accurate, and sufficiently current physical data (including, but not limited to invert and ground elevations, pipe diameters, slopes, pipe run lengths, Manning roughness factors, manhole sizes and configurations, and Pumping Station performance factors) for its Sanitary Collection System. In particular, the MDC shall sufficiently field verify physical data to allow calibration and verification of the Model.

3. The MDC shall calibrate and verify the Model using appropriate rainfall data, actual hydrographs and Sanitary Collection System flow data. The MDC shall use an approved data set(s) for calibration and verification. As part of the calibration process, the MDC shall either use existing sensitivity analyses for the selected Model, or carry out its own sensitivity analyses, such that calibration effectiveness is maximized.

4. The Hydraulic Modeling Report submitted pursuant to this Section shall include the following:

a. a description of the Model;

b. specific attributes, characteristics, and limitations of the Hydraulic Model;

c. identification of all input parameters, constants, assumed values, and expected outputs;

d. digitized map(s) and schematics that identify and characterize the portions (including the specific gravity sewer lines) of the Sanitary Collection System that shall be included in the Model;

e. identification of input data to be used;

f. configuration of the Model;

g. procedures and protocols for performance of sensitivity analyses (i.e., how the Model responds to changes in input parameters and variables);

h. procedures for calibrating the Model to account for values representative of the Sanitary Collection System actual system data (e.g., flow data); and

i procedures to verify the Model's performance using additional, independent actual system and WWTF data (e.g., flow data).

D. **Sanitary Collection System Capacity Assessment**

Within 180 days of EPA and CTDEP approval of the Modeling Report, the MDC shall submit to EPA and CTDEP a professional engineering evaluation of the conveyance capacity of all Sewersheds that are tributary to, or contribute to, Capacity-Related SSOs (the "Capacity Assessment"). The Capacity Assessment shall utilize the Model developed pursuant to Sub-Section VII.C and shall include an evaluation of all interceptor sewers, Pumping Stations, Force Mains and siphons, known areas of Sanitary Collection System surcharges, known Overflow points and areas with known Building/Private Property Backups, and any other portions of the Sanitary Collection System that must be assessed so as to allow for a technically-sound evaluation of the causes of all SSOs. It shall also:

1. identify, at a minimum, the hydraulic capacities of the portions of the

Sanitary Collection System upstream and downstream of all Capacity-Related SSOs, and compare those capacities to existing and future projected wet-weather flows. The Capacity Assessment shall identify, within the aforementioned portions of the MDC's Sanitary Collection System, those portions of the Sanitary Collection System that have caused, or are expected to cause or contribute to, Capacity-Related SSOs, and/or Building/Private Property Backups under existing and future peak wet-weather flows, and the degree to which those portions experience or cause, under current or projected future conditions, Capacity-Related SSOs;

2. consider local rainfall data and the impact of an appropriate range of rainfall events, based on return frequency and duration, on peak wet-weather flows within those portions of the MDC's Sanitary Collection System that are tributary to, or contribute to, all Capacity-Related SSOs;

3. characterize the Sanitary Collection System performance by identifying, for each condition considered, each pipe segment operating in surcharged condition, each manhole or structure at which an SSO might be expected to occur; and

4. include a breakdown of the length, size and cost of the facilities that are required to eliminate each Capacity-Related SSO assuming various levels of extraneous flow removal. The analyses shall also include a map noting the location of any potential relief or replacement sewers and size of all downstream interceptors and Pumping Stations.

E. **Assessment of Voluntary I/I Removal Incentive Programs**

Within 180 days of the Date of Entry of the Consent Decree, the MDC shall submit to EPA and CTDEP a report assessing the participation rates and effectiveness of the MDC's voluntary private Inflow source removal program ("Voluntary Private Inflow Source Removal

Program Assessment"). The Voluntary Private Inflow Source Removal Program Assessment shall note each instance in which a voluntary removal occurred, summarize the work that was performed, and include an estimate of the cost of the work. It shall also describe the results of any follow-up inspections and post-removal flow monitoring conducted by the MDC to assess the effectiveness of the Voluntary Private Inflow Source Removal Program. The MDC shall canvass a representative sample of property owners that did not participate in the program to determine why they did not participate in the program and describe the results of this survey.

F. **Implementation of Prior I/I Remediation Recommendations**

Within 120 days of the Date of Entry of the Consent Decree, the MDC shall review the recommendations contained in prior I/I flow investigation reports since January 1, 1995, which were conducted in any Sewershed that is tributary to, or contributes to, a Capacity-Related SSO and shall submit to EPA and CT DEP for approval a consolidated plan (the "Initial Extraneous Flow Remedial Plan"), which includes a schedule for implementation of each of the remaining report recommendations (the "Initial Extraneous Flow Remedial Plan Implementation Schedule"). If the MDC does not plan to implement a specific recommendation of a report, the Initial Extraneous Flow Remedial Plan must provide the rationale for the decision not to implement the recommendation. Upon EPA's and CT DEP's approval of the Initial Extraneous Flow Remedial Plan, the MDC shall implement the Initial Extraneous Flow Remedial Plan in accordance with the Initial Extraneous Flow Remedial Plan Implementation Schedule.

G. **Additional Extraneous Flow Investigations**

Within 120 days of the Date of Entry of the Consent Decree, the MDC shall submit to EPA and CTDEP a report delineating the results of the additional I/I investigations that are

necessary to identify and quantify those sources of extraneous flow within the Sewersheds that are tributary to, or contribute to, all Capacity-Related SSOs (the "Additional Extraneous Flow Investigations Report"). The Additional Extraneous Flow Investigations Report(s) shall include separate sections describing the Sewersheds that are tributary to, or contribute to, a Capacity-Related SSO, and shall:

1. Include the MDC's rationale for excluding additional I/I investigations in any portion of any Sewershed that is tributary to, or contributes to, a Capacity-Related SSO;

2. Quantify groundwater and Rainfall-Induced Infiltration and the Inflow components of extraneous flow during periods of high groundwater for each Sewershed;

3. Identify and quantify the level of peak Rainfall-Induced Infiltration by evaluating continuous flow monitoring records for the period beginning no earlier than 12 hours after the end of a 1.00" or greater storm event measured during a 24-hour period, and ending no later than 24 hours following the same event;

4. Include the following information for each Sewershed:

a. a map of the Sewershed that delineates all minisystems, streets, water courses, the location of all key manholes where the MDC conducted flow monitoring during the investigations, all major branch, trunk, and interceptor sewers, siphons, Pumping Stations, Force Mains, Overflow points, and wastewater treatment facilities. The map(s) must also differentiate Force Mains from gravity sewers, provide the direction of flow and indicate the size of all interceptor sewers. The boundaries of each minisystem being investigated must be indicated;

b. an evaluation of the ability of the Sewershed to convey current and

expected flows to the tributary wastewater treatment facilities; and,

c. recommendations for additional investigations of those minisystems determined to contain Excessive I/I, including, but not limited to, identification and quantification of both public and private sources of groundwater Infiltration and Rainfall-Induced Infiltration and Inflow. The recommendations and schedule for the implementation of the additional investigations shall form the basis of the Sewer System Evaluation Survey Scope of Work ("the SSES SOW") and the SSES Implementation Schedule for each Sewershed, which shall constitute a separate section within the Additional Extraneous Flow Investigations Report.

H. **Submission of Sewer System Evaluation Survey Report**

Upon approval by EPA and CTDEP of the Additional Extraneous Flow Investigations Report, the MDC shall implement the SSES SOW in accordance with the SSES Implementation Schedule including, but not limited to, submittal of a Sewer System Evaluation Survey Report (the "SSES Report") to EPA and CT DEP for approval.

I. **Contents of SSES Report**

The SSES Report shall be organized into separate sections, corresponding to those presented in the "Additional Extraneous Flow Investigations Report," which include the Sewersheds that are tributary to, or contribute to, a Capacity-Related SSO. In addition to identifying those sources of extraneous flow that are cost effective to remove, it shall also itemize the specific measures that must be implemented to eliminate each Capacity-Related SSO and include a schedule for the implementation of the required measures. It shall include, but shall not be limited to, the following information:

Infiltration/Inflow - Public Sources

1. A listing of all public sources of I/I identified during the SSES in the Sewersheds that are tributary to, or contribute to, any Capacity-Related SSOs;

2. A listing of all public sources of I/I that were determined to be excessive in the Sewersheds that are tributary to, or contribute to, any Capacity-Related SSOs;

3. Cost-effectiveness analyses that determine which public sources of I/I are more cost-effective to remediate than to transport and treat, and a narrative description of the bases of the analyses;

4. Proposals for rehabilitating or replacing each deficient component of the Sewershed identified during the SSES, and a schedule for implementing the recommended rehabilitation/replacement measures, including engineering design and construction;

5. Proposals for rehabilitating each public source of Excessive I/I in the Sewersheds that contribute to any Capacity-Related SSOs, and a schedule for implementing the proposals, including engineering design and construction;

Infiltration/Inflow - Private Sources

6. A listing of all private sources of I/I identified during the SSES in the Sewersheds that contribute to any Capacity-Related SSOs;

7. A listing of all private sources of I/I that were determined to be excessive in Sewersheds that contribute to any Capacity-Related SSOs;

8. Identification of each minisystem in the Sewersheds that are tributary to, or contribute to any Capacity-Related SSO in which excessive Inflow or Rainfall-Induced Infiltration is determined to exist. For each minisystem in the Sewershed that is tributary to, or contributes to a Capacity-Related SSO in which excessive Inflow or Rainfall-Induced Infiltration

is determined to exist pursuant to the procedures detailed above, the SSES Report shall include, but shall not be limited to, the following information:

a. a summary of the results of the building surveys conducted by the MDC, or agents of the MDC, including an address listing of those buildings that have been surveyed, an address listing of those buildings with identified sources of Inflow and Rainfall-Induced Infiltration, and a listing of those addresses where Inflow and Rainfall-Induced Infiltration sources are recommended to be rehabilitated and the recommended methods of rehabilitation;

b. a plan and schedule for surveying those buildings that have not been previously surveyed;

c. a map of each Sewershed that delineates the location of all properties within the Sewershed and identifies each property that is an actual or potential source of extraneous flow to the Sanitary Collection System that was identified during the SSES as well as any of the MDC's prior investigations. The map shall note the properties where private sources of Inflow and Rainfall-Induced Infiltration have been determined to be excessive, as well as the extent of each member community's storm water collection system in areas of excessive Inflow and Rainfall-Induced Infiltration. It shall also note those properties that availed themselves of the MDC's Voluntary Private Property Extraneous Flow Removal Program, the type of remedial measure that was implemented and shall identify those properties that the MDC has yet to inspect due to refused entry or lack of response;

d. a determination of whether it is cost-effective to redirect identified private sources of extraneous Inflow or Rainfall-Induced Infiltration or to expand the Sanitary

Collection System to convey the extraneous flow to the tributary wastewater treatment facility. The analysis shall include, but shall not be limited to:

(1) a generalized/schematic level assessment of whether conditions permit redirection of the identified sources to the ground and the range of homeowner costs associated with this type of remedial measure;

(2) an assessment of whether the storm sewer system(s) has sufficient capacity and can be extended to eliminate the identified sources and the range of homeowner costs associated with this type of remedial measure, including, but not limited to the costs of redirecting extraneous flow sources to a storm sewer system;

(3) an assessment of whether off-line storage within the sanitary Sewershed can be used to eliminate Capacity-Related SSOs; and

(4) an assessment of the cost of conveying the extraneous flow to the WWTF without exacerbating down-stream Overflows. Such assessment shall also assess consistency with the Long Term CSO Control Plan where appropriate.

e. recommendations regarding the disposition of each identified private source of extraneous flow that is determined to be excessive;

f. the framework of a public education plan to promote the elimination of private sources of excessive Rainfall-Induced Infiltration and Inflow and a schedule for the plan's implementation;

g. an evaluation of whether any changes in the MDC's ordinances or by-laws are necessary to implement or facilitate the planned remedial measures. If the MDC determines that any changes in the MDC's ordinances or by-laws, or ordinance(s) of member

towns, are necessary to implement or facilitate the planned remedial measures, the MDC shall submit to EPA and CTDEP a proposed schedule for implementing said MDC ordinances or by-laws, and the MDC shall notify the member towns in writing of the changes requested of their ordinances; and,

h. a schedule to implement the private extraneous source reduction recommendations of the SSES (the "SSES Private Source Remediation Schedule") including an implementation plan; and,

9. If the conclusion of the SSES is that it is more cost-effective to allow individual sources of extraneous flow to remain in the Sanitary Collection System rather than to redirect the sources or to implement other sewer system rehabilitation measures, the SSES shall include a separate section that describes the recommended measures that must be implemented to expand the existing Sanitary Collection System to eliminate Structural SSO Outfalls and a schedule for their implementation.

J. **SSES Report Implementation Schedule**

Upon EPA's and CTDEP's approval of the SSES Report, the MDC shall implement the recommendations of the SSES Report in accordance with the schedules included in the SSES Report, as amended by EPA or CTDEP.

K. **Elimination of Discharges from Structural SSO Outfalls**

1. **Windsor, Wethersfield, and Rocky Hill.** All Structural SSO outfall discharges from the MDC's Collection System serving Windsor, Wethersfield and Rocky Hill (i.e., Elm Street Overflow Chamber, Church Street Overflow, Goff Brook Overflow Chamber, and Windsor Interceptor Overflow Chamber (NM-1)) shall be eliminated no later than **five years**

from the date of EPA's and CTDEP's approval of the SSES Report Implementation Schedule as required in Section VII.J.

2. **Newington and West Hartford.** All Structural SSO outfall discharges from the MDC's Collection System serving Newington and West Hartford (i.e., Hartford Avenue Siphon Overflow Chamber, Hillcrest Overflow Chamber, Center Trunk Overflow to Trout Brook (CTS-2), and Center Trunk Overflow at Talcott Street (CTS-3)) shall be eliminated no later than **10 years** from the date of EPA's and CTDEP's approval of the SSES Report Implementation Schedule as required in Section VII.J.

3. **Newington and West Hartford Alternate Measures SSO Plan.** The MDC shall submit to EPA and CTDEP in conjunction with the Sewer System Evaluation Survey Report required pursuant to Sub-Section VII.I, an engineering report (the "Newington and West Hartford Alternate Measures SSO Plan") that evaluates the feasibility of restoring CSO S-4 to interim operation during wet-weather peak flow events until the Park River Auxiliary Conduit is operational. The Newington and West Hartford Interim Measures SSO Plan shall evaluate the interim operation of CSO S-4 as a temporary means of eliminating the Structural SSO outfall discharges from the Sanitary Collection System that serves Newington and West Hartford. The Report shall include, but shall not be limited to the following:

a. an analysis of the hydraulic impact of peak flows from the Newington Trunk Sewer and the Center Trunk Sewer on the New Southwest Branch Interceptor and connecting sub areas assuming various removal rates of public and private Infiltration and Inflow within the tributary Sewersheds.

b. an assessment of the environmental benefits and costs associated

with temporarily opening CSO S-4 versus continuing SSO discharges from the Hartford Avenue Siphon Overflow Chamber, the Hillcrest Overflow Chamber, the Center Trunk Overflow to Trout Brook and the Center Trunk Sewer Overflow at Talcott Street assuming various removal rates of public and private Infiltration and Inflow within the tributary Sewersheds.

c. recommendations regarding the temporary reopening of CSO S-4 as an alternate means of eliminating the discharges from the Structural SSO Outfalls from the Sanitary Collection System serving Newington and West Hartford and any schedules for their implementation (the "Newington and West Hartford Alternate Measures SSO Plan Implementation Schedule"). Any proposed schedules shall specifically relate to milestones established for the removal of public and private sources of Infiltration and Inflow pursuant to Sub-Section VII.J of this Consent Decree.

d. Upon EPA's and CT DEP's approval of the Newington and West Hartford Alternate Measures SSO Plan, the MDC shall implement it in accordance with the Newington and West Hartford Alternate Measures SSO Plan Implementation Schedule.

VIII. EMERGENCY RESPONSE PLAN

A. Within 120 days following the Date of Entry, the MDC shall develop an Emergency Response Plan and shall submit a copy of the plan to EPA and CTDEP for approval. The Emergency Response Plan shall be designed to ensure that, should an SSO occur, the volume of untreated wastewater discharged to the environment and the impact of the discharge on the environment and public health will be minimized. The Emergency Response Plan shall result in: 1) all SSOs being responded to and halted as rapidly as possible; 2) mitigation being employed whenever appropriate; 3) appropriate measures being implemented to prevent SSO

recurrence; and 4) appropriate measures being implemented to respond to and in preventing Building/Private Property Backups. The Emergency Response Plan shall provide procedures for responding to SSOs, including Building/Private Property Backups to minimize the environmental impact and potential human health risk of SSOs. The Emergency Response Plan shall include, at a minimum:

1. Procedures and public notice requirements to limit public access to and contact with areas affected by SSOs;

2. Procedures to provide timely notice to EPA, CTDEP, and local public health officials of SSOs;

3. Procedures to make the public aware of SSOs, including but not limited to, providing the public with a telephone number which can be used by the public to report SSOs;

4. A review to ensure that the MDC has available the equipment necessary to respond to SSOs and to implement the Emergency Response Plan;

5. Procedures to ensure the rapid dispatch of personnel and equipment to correct or repair the condition causing or contributing to any SSO;

6. Procedures to ensure the preparedness, including responsiveness training, of the MDC's employees and contractors necessary for effective implementation of the Emergency Response Plan;

7. A system to track SSO reports and other complaints and related repairs, and to investigate the causes of any SSOs;

8. Safety training for all Collection System personnel;

9. Procedures to ensure that SSOs are immediately contained, and eliminated in a timely manner;

10. Procedures, if any, to provide relief to residents experiencing Building/Private Property Backups resulting from the Sanitary Collection System;

11. Procedures for investigating and documenting the causes of Building/Private Property Backups;

12. Measures to clean up Building/Private Property Backups as required by the MDC Claims Policy regarding such backups; and,

13. Measures to eliminate Building/Private Property Backups, and in cases where measures included in Section VII (CWA Remedial Measures) will not completely eliminate the Building/Private Property Backups until some date in the future, measures to mitigate Building/Private Property Backups.

B. Within 90 days following the Date of Entry the MDC shall provide a list of all known Building/Private Property Backup incidents within the past five years. This listing shall include the date of the Building/Private Property Backup incident, the location by address, source of notification, the cause(s) of the Building/Private Property Backup and actions taken by the MDC to halt, mitigate, and prevent future incidents.

C. The MDC shall immediately and continuously implement the Emergency Response Plan upon approval or conditional approval by EPA and CTDEP.

D. As soon as practicable, but no later than two (2) hours of learning of any SSO, the MDC shall also provide an oral report to EPA by calling Michael Fedak at (617) 918-1766 and to CTDEP by calling Iliana Ayala, during regular business hours, at (860) 424-3758 or CT DEP's

Municipal Facilities Section at (860) 424-3704. If the MDC learns of an SSO at any other time than normal business hours, the MDC also shall notify EPA at the above phone number and CTDEP's Emergency Response Unit by calling (860) 424-3338. The oral report must identify the location, estimated volume and receiving water(s), if any, of the SSO(s). The MDC shall also, within 24 hours of learning of such SSO(s), send a facsimile report to EPA, to the attention of Michael Fedak, at (617) 918-1809 and to CT DEP, to the attention of Iliana Ayala at (860) 424-4067. The facsimile reports shall be submitted in the form attached as Appendix B and shall include the following information:

1. The date, time and location of the SSO, including a description of the sewer system component from which the release occurred (e.g., manhole, constructed Overflow pipe, crack in pipe);

2. The circumstances that led to the SSO;

3. The estimated volume of the SSO;

4. Whether the SSO reached navigable waters of the State or United States and, if so, the identity of the receiving waters and the estimated volume of the SSO that reached those waters;

5. Steps taken (or the steps to be taken) to mitigate the impact(s) of the SSO, including treatment of any of the discharge, and when those steps were (or will be) taken;

6. If any of the SSO was treated, the volume of the SSO treated and the volume of treated SSO that reached receiving waters;

7. The steps taken (or the steps to be taken) to eliminate and prevent reoccurrence of the SSO and when those steps were (or will be) taken; and

8. A description of the cleanup efforts taken or intended to be taken.

EPA and CTDEP will advise the MDC in writing in the event of any change in personnel to whom oral and facsimile reports should be made.

E. The reporting requirements set forth in this section do not relieve the MDC of its obligation to submit any other reports or information as required by state, federal or local law.

IX. DEMONSTRATION OF ELIMINATION OF CAPACITY-RELATED SSOs

A. Following completion of the remedial measures required by Sub-Sections VII.A-K, in accordance with the approved schedules, the MDC shall demonstrate for one year that Capacity-Related SSOs have been eliminated to EPA's and CTDEP's satisfaction.

B. If following completion of the measures required by Sub-Sections VII.A-K, the MDC experiences Capacity-Related SSOs, then the MDC shall by no later than 90 days after the triggering storm event, submit a Capacity Assurance Plan to EPA and CTDEP for approval that shall include provisions for eliminating all Capacity-Related SSOs. The Capacity Assurance Plan shall include a schedule for completing the additional measures proposed therein. After completion of the remedial projects in the Capacity Assurance Plan, the demonstration provisions of this Section shall again apply.

C. If following completion of the measures required by Sub-Sections VII.A-K, the MDC experiences SSOs that are not Capacity-Related SSOs, then the MDC shall by no later than 60 days after the non-Capacity-related discharge event, submit revisions to the CMOM Corrective Action Plan and CMOM Corrective Action Schedule (as described in Sub-Section VII.A) to EPA and CTDEP for approval that shall include provisions for preventing similar O&M-related SSOs.

X. REPORTING

A. Beginning with the first quarter following the Date of Entry of this Consent Decree and each quarter thereafter for a four-year period until termination of the Decree, the MDC shall submit on the thirtieth day of each month following the end of the quarter, a written report to EPA and CTDEP regarding the status of its compliance with Section VII (CWA Remedial Measures) of this Decree. After the four-year period, written reports shall be required semi-annually, within 30 days of June 30th and December 31st, until termination of the Decree. The report shall contain a summary of the status and progress of all projects and programs required by Section VII (CWA Remedial Measures) of this Decree, including but not limited to:

1. A summary listing of all SSOs including Building/Private Property Backups that have occurred in the past quarter. This tabular listing should be organized chronologically by municipality and Sewershed and shall include the date of the SSO or Building/Private Property Backup incident, the location by address, source of notification (e.g., property owner, field crew, etc.), and the cause(s) of the Building/Private Property Backup.

2. A description of the activities undertaken during the reporting period directed at achieving compliance with this Consent Decree. A separate listing of all public and private Infiltration/Inflow sources, organized by municipality and Sewershed, that were eliminated during the quarter, the date that they were eliminated, and the mechanism that was used to eliminate the source shall also be included in each quarterly report;

3. Identification of all plans, reports, and other deliverables required by this Consent Decree that the MDC completed and submitted during the reporting period, or failed to complete; and

4. A description of the expected activities to be taken during the next reporting period in order to achieve compliance with this Consent Decree.

B. By January 30, 2007, and every 12 months thereafter until termination of this Decree, the MDC shall submit to EPA and CTDEP an Annual Report. The last quarterly report and semi-annual report required in Sub-Section X.A may be combined with the Annual Report. The Annual Report shall contain a summary of compliance with and activities related to the projects scheduled under Section VII (CWA Remedial Measures) of this Decree and also:

1. A summary of Emergency Response Plan activities, including, but not limited to, the number of responses to Overflows and bypasses, the response times for each discharge and actions taken to clean and disinfect the discharge site.

2. A summary of the preventive maintenance activities undertaken by the MDC. This shall include information identifying the length of pipe segments that were inspected, cleaned, repaired or replaced and a summary of all Pumping Station and Force Main preventive maintenance activities for the year. Where available, maps shall be submitted documenting the information provided in the report.

3. The reporting requirements of Sub-Section X.A.

C. All reports required to be submitted in this section shall contain a certification signed by a duly authorized representative of the MDC. The certification shall read as described in Sub-Section XVII.B.

D. The reporting requirements set forth in this section do not relieve the MDC of its obligation to submit any other reports or information as required by state, federal or local law.

XI. RECORDS RETENTION

The MDC shall retain copies of all data collected and all documents and reports generated pursuant to this Decree for the pendency of this Decree.

XII. CIVIL PENALTY

A. The MDC shall pay a civil penalty in the amount of EIGHT-HUNDRED AND FIFTY THOUSAND DOLLARS ($850,000) in satisfaction of the claim for civil penalties alleged in the United States' and the State of Connecticut's Complaints.

1. The MDC shall pay a civil penalty in satisfaction of the United States' claims in the amount of FOUR-HUNDRED AND TWENTY-FIVE THOUSAND DOLLARS ($425,000). The MDC shall make payment by electronic funds transfer in accordance with written instructions to be provided by the United States Attorney's Office, Financial Litigation Unit, New Haven, Connecticut. The costs of such electronic funds transfer shall be the responsibility of the MDC. The MDC shall send a copy of the electronic funds transfer authorization form, the electronic funds transfer transaction record, and the transmittal letter to EPA and the United States Department of Justice as specified in Section XVII (Form of Notice). Payment of the civil penalty shall be made within 15 days after the MDC receives notice of entry of the Consent Decree. If the MDC fails to tender payment within 15 days of receiving notice of entry of this Consent Decree, then interest shall accrue on the debt to the United States, from the date of entry of this Consent Decree, at the rate provided for in 28 U.S.C. § 1961.

2. The MDC shall pay a civil penalty in satisfaction of the State of Connecticut's claims in the amount of FOUR-HUNDRED AND TWENTY-FIVE THOUSAND DOLLARS ($425,000). This amount shall be deposited into the "Central Connecticut Regional

SEP Account" in accordance with Conn. Gen. Stat. 22a-16a, to fund various environmental projects in the greater Hartford area as selected by CT DEP consistent with its February 15, 1996 "Policy on Supplemental Environmental Projects," including but not limited to water quality planning, assessment and restoration, and greenway enhancements which will benefit water quality and habitat. The MDC shall make payment by electronic funds transfer to the Office of the Connecticut Attorney General, in accordance with written instructions to be provided by the Office of the Connecticut Attorney General. The costs of such electronic funds transfer shall be the responsibility of the MDC. The MDC shall send a copy of the electronic funds transfer authorization form, the electronic funds transfer transaction record, and the transmittal letter to CTDEP and the Office of the Connecticut Attorney General as specified in Section XVII (Form of Notice). Payment of the civil penalty shall be made within 15 days after the MDC receives notice of entry of the Consent Decree. If the MDC fails to tender payment within 15 days of receiving notice of entry of this Consent Decree, then interest shall accrue on the debt to the State of Connecticut, from the date of entry of this Consent Decree, at the rate provided for in 28 U.S.C. § 1961.

XIII. STIPULATED PENALTIES

A. **Failure to Submit Timely and Complete Documents**

The MDC shall pay to the United States and the State stipulated penalties, as set forth below, for each day the MDC fails to submit and/or complete any plans, reports or other submittals required under this Decree by the specified due dates or to make the changes to those documents per EPA's or CTDEP's comments within the required time frames. All plans, upon submission and approval, shall be incorporated herein as part of this Decree. The stipulated

penalties for failure to meet each document submission date shall be as follows:

Period of Noncompliance	**Penalty per Day per Violation**
1st to 10th day	$500
11th to 20th day	$1,000
21st day and beyond	$2,000

B. **Remedial Requirements**

The MDC shall pay to the United States stipulated civil penalties as set forth below for each day the MDC fails to satisfy any of the remedial requirements of Section VII (CWA Remedial Measures) of this Decree. The stipulated penalties for failure to meet each such requirement shall be as follows:

Period of Noncompliance	**Penalty per Day per Violation**
1st to 10th day	$500
11th to 20th day	$1,000
21st day and beyond	$2,000

C. **Unpermitted Discharges**

For each Capacity-Related SSO, the MDC shall pay a stipulated penalty of $5,000. Notwithstanding the foregoing, the MDC shall not be liable for such a stipulated penalty if all of the following conditions are met: (i) The MDC stopped the discharges from the SSO outfall as soon as reasonably practicable; (ii) The MDC is in full compliance with the schedules and requirements set forth pursuant to Section VII (CWA Remedial Measures) of this Consent Decree; and, (iii) The MDC has complied with all reporting requirements related to such discharges from its SSO outfalls, including those set forth in this Consent Decree.

D. **Delay in Payment of Penalty**

The MDC shall pay to the United States and/or the State, as applicable, a stipulated penalty of $2,000 for each day that the MDC is late in paying the civil penalty required under Section XII.

E. **All Other Violations**

The MDC shall pay a stipulated penalty of $1,000 per violation per day for any violation of the Consent Decree that is not specified in this Section.

F. **Payment of Stipulated Penalties**

Stipulated penalties shall automatically begin to accrue on the first day the MDC fails either to meet any of the schedules of performance required by this Consent Decree or to satisfy any obligation or requirement of this Consent Decree and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity, but need not be paid except as provided in Sub-Section G below. Payment of stipulated penalties as set forth above shall be in addition to any other rights or remedies which may be available to the United States or the State by reason of the MDC's failure to comply with requirements of this Consent Decree, and any applicable federal, state or local laws, regulations, NPDES Permits and all other applicable permits.

G. **Written Demand for Payment of Stipulated Penalties**

Stipulated penalties shall be paid within 30 days of EPA's or CTDEP's written demand for payment of stipulated penalties. Stipulated penalties shall be paid to the United States and the State in accordance with the payment procedures detail above. Copies of any checks and the transmittal letters shall be sent simultaneously to U.S. DOJ, EPA, and the State.

XIV. FORCE MAJEURE

A. "Force Majeure," for purposes of this Consent Decree, is defined as any event arising from causes entirely beyond the control of the MDC, including its contractors and subcontractors, which delays or prevents the timely performance of any obligation under this Consent Decree notwithstanding the MDC's best efforts to avoid the delay. Stipulated penalties shall not be due for the number of days of noncompliance caused by a Force Majeure event as defined in this Section, provided that the MDC complies with the terms of this Section. Examples of events which may constitute Force Majeure events include natural disasters, national emergencies, and delays in obtaining any required approvals or permits despite the MDC's complete and timely submission of requests for approval and applications for required permits and any supplemental information that may be requested. Examples of events that are not Force Majeure events include, but are not limited to, normal inclement weather, unanticipated or increased costs or expenses of work, the financial difficulty of the MDC to perform such work, acts or omissions attributable to the MDC's contractors or representatives, and the failure of the MDC or the MDC's contractors or representatives to make complete and timely application of any required approval or permit.

B. If any event occurs that may delay or prevent the performance of any obligation under this Consent Decree, whether or not caused by a Force Majeure event, the MDC shall notify EPA and CTDEP within 48 hours after the MDC first knew or should have known that the event might cause a delay. Within five working days thereafter, the MDC shall provide to EPA and CTDEP, at the addresses specified in Section XVII (Form of Notice), a written explanation of the cause(s) of any actual or expected delay or noncompliance, the anticipated

duration of any delay, the measure(s) taken and to be taken by the MDC to prevent or minimize the delay, a proposed schedule for the implementation of such measures, and a statement as to whether, in the opinion of the MDC, such event may cause or contribute to an endangerment to public health, welfare, or the environment. Notwithstanding the foregoing, the MDC shall notify EPA and CTDEP orally or via fax within 24 hours of becoming aware of any event which presents an imminent threat to the public health or welfare or the environment and provide written notice to EPA and CTDEP within 72 hours. Failure to give timely and complete notice in accordance with this Sub-Section shall constitute a waiver of any claim of Force Majeure with respect to the event in question.

C. If the Parties agree that a delay or anticipated delay is attributable to Force Majeure, the time for performance of the obligations under this Consent Decree that are affected by the Force Majeure event shall be extended by mutual agreement of the Parties for a period of time as may be necessary to allow performance of such obligations to the extent the delay was caused by a Force Majeure event.

D. If the Parties are unable to agree as to whether a delay or anticipated delay is attributable to Force Majeure, or on the number of days of noncompliance caused by such event, the MDC may initiate the Dispute Resolution process set forth in Section XV (Dispute Resolution) below. If the MDC does not initiate the Dispute Resolution process set forth in Section XV below within 14 days of receiving written notice that EPA and CTDEP disagree as to whether a delay or anticipated delay is attributable to Force Majeure, or on the number of days of noncompliance caused by such circumstances, then the MDC shall be deemed to have waived any Force Majeure claims or any rights to initiate Dispute Resolution with regard to such claims.

E. Delay in performance of any obligation under this Consent Decree shall not automatically justify or excuse delay in complying with any subsequent obligation or requirement of this Decree.

F. Failure of the MDC to obtain any state or federal grants or loans shall not be considered a Force Majeure event under this Consent Decree.

XV. DISPUTE RESOLUTION

A. Unless otherwise expressly provided for in this Consent Decree, the dispute resolution procedures of this Section shall be the exclusive mechanism to resolve disputes arising under or with respect to this Consent Decree. However, the procedures set forth in this Section shall not apply to actions by the United States or the State to enforce obligations that the MDC has not disputed in accordance with this Section.

B. If the MDC objects to disapproval or conditions in an approval of a plan, report, or other item required to be submitted to EPA and CTDEP under this Consent Decree, or if the Parties are unable to agree as to whether a delay or anticipated delay is attributable to Force Majeure, or the number of days of noncompliance caused by such event, or on the amount of Stipulated Penalties due, the MDC may initiate informal, good faith negotiations between the Parties to the dispute for a period of up to 30 days from the time the MDC gives notice of the existence of the dispute to EPA and CTDEP. The period for negotiations may be extended by agreement of the Parties.

C. In the event that the Parties cannot resolve any such dispute by informal negotiations under the preceding Sub-Section, then the position advanced by EPA and CTDEP shall be considered binding unless, within 15 days of the end of the informal negotiation period,

the MDC files a petition with this Court setting forth the matter in dispute, the efforts of the Parties to resolve it, and the relief requested. EPA and/or CTDEP shall then have 30 days to respond to any such petition.

D. In proceedings on any dispute regarding a delay in performance as set forth in this Section, the MDC shall have the burden of proving: (1) that the delay or noncompliance is or was caused by a Force Majeure event, and (2) that the amount of additional time requested is necessary to compensate for that event. In no event shall the time for performance be extended for a period longer than the actual delay resulting from the Force Majeure event.

E. Notwithstanding the previous Sub-Section, in all disputes under this Section, the MDC shall have the burden of proving, based upon an administrative record, that the United States' and CTDEP's position is arbitrary and capricious, an abuse of discretion or otherwise not in accordance with law. EPA or CTDEP shall maintain the administrative record of the dispute, which shall contain all statements of the Parties, including supporting documentation, submitted pursuant to this Section.

XVI. RIGHT OF ENTRY

A. EPA and CTDEP and their contractors, consultants, and attorneys shall have authority to enter any property and/or facility covered by this Consent Decree at any time, upon proper identification, for the purposes of monitoring the progress of activity required by this Consent Decree, verifying any data or information submitted to EPA and CTDEP under this Consent Decree, and assessing the MDC's compliance with this Consent Decree. This requirement is in addition to, and does not limit, the authority of EPA or CTDEP pursuant to the CWA or any other provision of state or federal law.

XVII. FORM OF NOTICE

A. Submissions required by this Consent Decree shall be made in writing to the following respective addresses, unless written notice is given that another individual has been designated to receive the submissions:

As to the Department of Justice

Bruce Gelber, Chief
Environmental Enforcement Section
Environment & Natural Resources Division
United States Department of Justice
P.O. Box 7611 - Ben Franklin Station
Washington, D.C. 20044

As to the United States Attorney

Lisa E. Perkins
Assistant United States Attorney
U.S. Attorney's Office
Hartford Office
450 Main Street, Room 328
Hartford, Connecticut 06103

As to EPA

Michael Fedak
Environmental Engineer
Water Technical Unit (SEW)
U.S. Environmental Protection Agency, Region I
One Congress Street
Boston, MA 02114-2023

Jeffrey Kopf
Enforcement Counsel
Office of Environmental Stewardship (SEL)
U.S. Environmental Protection Agency, Region I
One Congress Street
Boston, MA 02114-2023

Reports and plans required to be submitted by the MDC to EPA shall be submitted to Michael Fedak, with a copy of the transmittal letter only to Jeffrey Kopf. The MDC shall provide complete copies to both Mike Fedak and Jeffrey Kopf of all other submissions required to be made by the MDC to EPA pursuant to this Decree.

As to the Connecticut DEP

William Hogan
Connecticut Department of Environmental Protection
Bureau of Water Management
79 Elm Street
Hartford, CT 06106-5127

As to the Connecticut Attorney General

John Looney, Assistant Attorney General
Office of the Attorney General
55 Elm Street
Hartford, CT 06106

Reports and plans required to be submitted by the MDC to CTDEP shall be submitted to William Hogan with a copy of the transmittal letter only to John Looney. The MDC shall provide complete copies to both William Hogan and John Looney of all other submissions required to be made by the MDC to CTDEP pursuant to this Decree.

As to the MDC of Hartford, Connecticut

Charles P. Sheehan, Chief Executive Officer
Metropolitan District of Hartford, Connecticut
555 Main Street
P.O. Box 800
Hartford, CT 06142-0800

B. All written notices, reports or any other submissions required by this Consent Decree shall contain the following certification by a duly authorized representative of the MDC:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

XVIII. EFFECT OF SETTLEMENT

A. This Consent Decree is neither a permit nor a modification of existing permits under any federal, state, or local law and in no way relieves the MDC of its responsibilities to comply with all applicable federal, state, and local laws and regulations, nor shall it be construed to constitute EPA approval of any equipment or technology installed by the MDC under the terms of this Consent Decree.

B. This Consent Decree does not limit any rights or remedies available to the United States or the State for any violation by the MDC of the CWA and associated regulations or permit conditions other than those civil violations alleged in the Complaints through the Date of Entry. This Consent Decree does not limit any rights or remedies available to the United States or the State for any criminal violations. This Consent Decree does not limit the standing of any person under Section 505 of the CWA to sue for any future violation of the CWA not addressed by this Decree. The United States and the State expressly reserve all rights and remedies, legal and equitable, available to each of them for all violations of the CWA or other applicable law where such violations are not alleged in their respective Complaints, and reserve all rights and remedies, legal and equitable, available to enforce the provisions of this Consent Decree.

Nothing herein shall be construed to limit the power of the United States or Connecticut, consistent with its respective authority, to undertake any action against any person, in response to conditions which may present an imminent and substantial endangerment to the public's health or welfare, or the environment.

C. Neither the United States nor the State, by consent to the entry of this Consent Decree, warrant or aver in any manner that the MDC's compliance with this Consent Decree will result in compliance with the CWA, Connecticut state laws, or any regulations or permits issued thereunder.

XIX. COSTS

A. Each party shall bear its own costs and attorney's fees in this action, except that the MDC shall be responsible for all expenses incurred by the United States in collecting any outstanding penalties due under Sections XII and XIII of this Consent Decree and in enforcing the requirements of this Consent Decree, unless the MDC prevails before a court in any dispute resolution brought pursuant to Section XV (Dispute Resolution). In no event shall the United States or the State be responsible for any expenses, costs or attorney's fees incurred by the MDC.

XX. RETENTION OF JURISDICTION

A. The Court shall retain jurisdiction to modify and enforce the terms and conditions of this Consent Decree and to resolve disputes arising hereunder as may be necessary or appropriate for the construction or execution of this Consent Decree and to assess any stipulated penalties that may have accrued during the term of the Decree. This paragraph does not constitute a waiver of the bar to judicial review of administrative decisions, including, but not limited to, approval of plans and other submissions, and permitting decisions.

XXI. MODIFICATION

A. Any material modification to the terms of this Consent Decree shall be by written agreement of the Parties and approval of the Court. Any nonmaterial modifications to the terms of this Consent Decree, such as approval of modifications to submissions to EPA and CTDEP, shall be effective upon approval by EPA and CTDEP.

XXII. CONTINGENT LIABILITY OF THE STATE OF CONNECTICUT

A. This Consent Decree does not resolve the contingent liability of the State of Connecticut under Section 309(e) of the Clean Water Act, 33 U.S.C. § 1319(e). The United States specifically reserves its claims against the State, and the State specifically reserves all defenses to any such claims, including that State law does not prevent the MDC from raising revenues needed to comply with such judgment.

XXIII. FUNDING

A. Performance of the terms of this Consent Decree by the MDC is not conditioned on the receipt of any federal or state grant funds or loans. In addition, performance is not excused by the lack of any federal or state grant funds or loans.

XXIV. SEVERABILITY PROVISION

A. The provisions of this Consent Decree shall be severable, and should any provisions be declared by a court of competent jurisdiction to be unenforceable, the remaining provisions shall remain in full force and effect.

XXV. TERMINATION

A. This Decree shall not terminate until the MDC has completed all the remedial measures required by Section VII (CWA Remedial Measures) of the Decree and achieved and

has maintained compliance with all provisions of this Decree for twelve consecutive months. The Decree shall not terminate thereafter until each of the following occurs:

1. The MDC has demonstrated for one year that Capacity-Related SSOs have been eliminated to EPA's and CTDEP's satisfaction, as provided in Sub-Section IX.A;

2. The MDC has paid all penalties due under this Decree;

3. The MDC has certified in writing to the Court and to the United States compliance with each provision of the Decree; and

4. The MDC and the United States jointly move the Court for termination of the Decree.

XXVI. FINAL JUDGMENT

A. Entry of this Consent Decree constitutes Final Judgment under Rule 54 of the Federal Rules of Civil Procedure.

XXVII. WAIVER OF SERVICE OF SUMMONS AND COMPLAINT

A. The MDC hereby acknowledges receipt of the Complaint and waives service of the summons pursuant to Rule 4 of the Federal Rules of Civil Procedure.

XXVIII. PUBLIC COMMENT

A. This Consent Decree shall be lodged with the Court for a period of not less than 30 days, for public notice and comment in accordance with the provisions of 28 C.F.R. § 50.7. Plaintiffs reserve the right to withdraw or withhold their consent if the comments received disclose facts or considerations which indicate that the Consent Decree is inappropriate, improper or inadequate. Defendant hereby agrees not to withdraw from, oppose entry of, or to challenge any provision of this Consent Decree, unless the United States has notified Defendant

in writing that it no longer supports entry of the Consent Decree.

Judgment is hereby entered in accordance with the foregoing Consent Decree this _____ day of _____.

_____

UNITED STATES DISTRICT JUDGE

United States and State of Connecticut v. The Metropolitan District of Hartford, Connecticut
United States District Court
District of Connecticut
Consent Decree

The following Parties hereby consent to the entry of this Consent Decree:

For Plaintiff UNITED STATES OF AMERICA

Sue Ellen Wooldridge
Assistant Attorney General
Environment & Natural Resources Division
United States Department of Justice

DATE

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For the UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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04/05/2006
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Stephen S. Perkins
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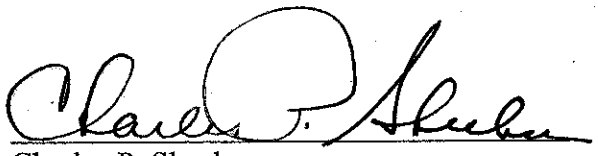
For Defendant, The Metropolitan District of Hartford, CONNECTICUT



MARCH 23, 2006
DATE

Charles P. Sheehan
Chief Executive Officer
The Metropolitan District
555 Main Street
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Hartford, CT 06142-0800

Appendix A

GUIDE FOR EVALUATING CAPACITY, MANAGEMENT, OPERATION, AND MAINTENANCE (CMOM) PROGRAMS AT SANITARY SEWER COLLECTION SYSTEMS

United States
Environmental Protection
Agency

Office of Enforcement and
Compliance Assurance (2224A)

EPA 305-B-05-002

www.epa.gov

January 2005

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CHAPTER 1. INTRODUCTION

1.1 Purpose of this Guide

This guide identifies some of the criteria used by EPA to evaluate a collection system's management, operation, and maintenance (CMOM) program activities. The guide is intended for use by EPA and state inspectors as well as the regulated community – owners or operators of sewer systems collecting domestic sewage as well as consultants or other third-party evaluators or compliance assistance providers. Collection system owners or operators can review their own systems by following the checklist in Chapter 3 to reduce the occurrence of sewer overflows and improve or maintain compliance. The guidance herein may also be taken a step further. If a federal or state reviewer observes a practice that does not effectively meet the elements of a CMOM program, he or she may make recommendations to educate the operator, inspector, case developer, or those involved in a settlement agreement. Additionally, having key board members (policy makers) read this guide will also allow them to better understand the benefits of investing in good CMOM programs.

The guide is applicable to small, medium, and large systems; both publicly and privately owned systems; and both regional and satellite collection systems. Regardless of size, each owner or operator will have an organization and practices unique to its collection system. While these specific characteristics will vary among systems, the CMOM concepts and best management practices are likely to apply to all types of systems. Where appropriate, this document provides guidance on the differences.

This document does not, however, substitute for the CWA or EPA's regulations, nor is it a regulation itself. Thus, the document does not and cannot impose legally binding requirements upon these circumstances. EPA and state decision-makers retain the discretion to adopt approaches on a case-by-case basis that differ from this guidance where appropriate. EPA may change this guidance in the future.

Individuals reviewing a collection system are strongly encouraged to read the guidance portion of this document prior to conducting a review. Reviewers should use the checklist in Chapter 3 as the primary tool for questions during the paperwork and/or onsite review of the collection system.

While some sections or topics may not appear to relate directly to environmental performance, taken as a whole, they provide an indication of how well the utility is run.

1.2 Terminology

To provide a more user-friendly guidance and for clarification, the terminology for several terms has been modified. The following paragraphs list these terms and reasoning for the modifications.

Frequently, the term "COLLECTION SYSTEM OWNER OR OPERATOR", abbreviated as "OWNER OR OPERATOR," is used in this guide and refers to the entities responsible for the administration and oversight of the sewer system and its associated staff (in either a municipal or industrial context); capacity evaluation, management, operation, and maintenance programs; equipment; and facilities. The owner and operator may be two different entities. For example, the owner may own the infrastructure and be responsible for its maintenance while it designates responsibility for the day to day operation of

the system to the operator. It should be noted that the term used in EPA's CMOM Program Self Assessment Checklist is "MUNICIPAL WASTEWATER UTILITY OPERATORS" or "UTILITY" rather than "collection system owner or operator." Both refer to the same individual(s).
The term "REVIEW" is used in this document in place of "INSPECTION" or "AUDIT." Because "inspection" often refers to an evaluation conducted by the regulatory authority and "audit" has been used to refer to an evaluation with very specific requirements, "review" is more appropriately used to capture the wider universe of evaluations (e.g., those conducted by a regulatory authority, the system itself, and/or by a third-party).

Similarly, the term used to describe the person conducting the CMOM review is the "REVIEWER" – this could be either an inspector, a third party reviewer hired by the owner or operator, or personnel of the owner or operator performing a self-evaluation of the collection system.

The term "FACILITY" is used in this document to refer to the components of the collection system (e.g., pump stations, sewer lines).

1.3 How to Use the Guide

The guide and checklist provide a three-tiered approach to the CMOM review:

- Evaluation of the CMOM program, based on interviews with management and field personnel, as well as observation of routine activities and functions
- Review of pertinent records and information management systems
- Evaluation based on field/site review

Chapter 2 provides a breakdown and overview of each CMOM concept and what to look for when reviewing the system, defines the CMOM elements for the reviewer, and follows through with a discussion of the indicators or other clues about which the reviewer should be aware. Chapters 2 and 3 present detailed information on conducting reviews of collection systems. Chapter 3 contains the comprehensive reviewer checklist, supported by the information in Chapter 2. Appendix A presents a Collection System Performance Indicator Data Collection Form which provides examples of the types of information a reviewer should attempt to obtain while on-site.

The "one size does not fit all" approach to reviewing CMOM programs cannot be overstated. The principles covered in this guide are applicable to all wastewater collection systems, however, these principles may be implemented through different means depending on the system. Larger systems may have the resources and the need to implement more costly and complex means of meeting the CMOM program elements. In occasional cases a CMOM feature may not be implemented at all, due to characteristics of the system. A reviewer should be able to look at the system as a whole and determine whether certain key elements are present or should be present and to what extent the system incorporates the CMOM principles.

Reviewers will also find that the location or names of some documents, logs, or reports may vary from system to system. This guide tries to provide a general description of the materials the reviewer should request.

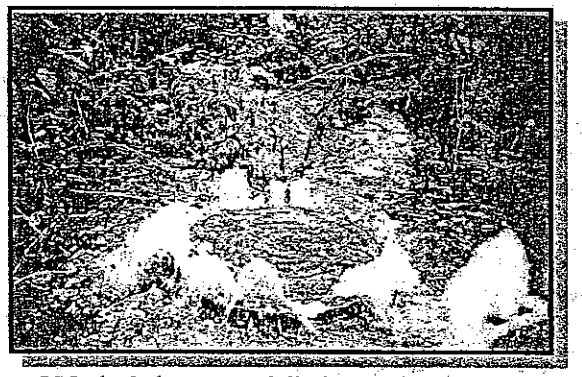
Although use of this guide cannot guarantee a collection system will avoid permit violations or discharge violations, generally, when owners or operators adequately practice the principles laid out in the guide, they should experience fewer problems and, therefore, fewer instances of noncompliance.

1.4 Overview of the Underlying Issues

Sanitary sewer collection systems are designed to remove wastewater from homes and other buildings and convey it to a wastewater treatment plant. The collection system is a critical element in the successful performance of the wastewater treatment process. EPA estimates that collection systems in the U.S. have a total replacement value between $1 to $2 trillion. Under certain conditions, poorly designed, built, managed, operated, and/or maintained systems can pose risks to public health, the environment, or both. These risks arise from sanitary sewer overflows (SSOs) from the collection system or by compromised performance of the wastewater treatment plant. Effective and continuous management, operation, and maintenance, as well as ensuring adequate capacity and rehabilitation when necessary, are critical to maintaining collection system capacity and performance while extending the life of the system.

EPA believes that every sanitary sewer system has the capacity to have an SSO. This may be due to a number of factors including, but not limited to:

- Blockages
- Structural, mechanical, or electrical failures
- Collapsed or broken sewer pipes
- Insufficient conveyance capacity
- Vandalism



SSOs include untreated discharges from sanitary sewer systems that reach waters of the United States (photo: US EPA).

Additionally, high levels of inflow and infiltration (I/I) during wet weather can cause SSOs. Many collection systems that were designed according to industry standards experience wet weather SSOs because levels of I/I may exceed levels originally expected; prevention of I/I has proven more difficult and costly than anticipated; or the capacity of the system has become inadequate due to an increase in service population without corresponding system upgrades (EPA 2004).

SSOs can cause or contribute to environmental and human health impacts (e.g., water quality standards violations, contamination of drinking water supplies, beach closures, etc.) which, in addition to flooded basements and overloaded wastewater treatment plants, are some symptoms of collection systems with inadequate capacity and improper management, operation, and maintenance. These problems create the need for both the owner or operator and the regulatory authority to conduct more thorough evaluations of sanitary sewer collection systems.

1.5 Purpose of CMOM Programs

CMOM programs incorporate many of the standard operation and maintenance activities that are routinely implemented by the owner or operator with a new set of information management requirements in order to:

- Better manage, operate, and maintain collection systems
- Investigate capacity constrained areas of the collection system
- Proactively prevent SSOs
- Respond to SSO events

The CMOM approach helps the owner or operator provide a high level of service to customers and reduce regulatory noncompliance. CMOM can help utilities optimize use of human and material resources by shifting maintenance activities from "reactive" to "proactive"–often leading to savings through avoided costs due to overtime, reduced emergency construction costs, lower insurance premiums, changes in financial performance goals, and fewer lawsuits. CMOM programs can also help improve communication relations with the public, other municipal works and regional planning organizations, and regulators.

It is important to note that the collection system board members or equivalent entity should ensure that the CMOM program is established as a matter of policy. The program should not be micro-managed, but an understanding of the resources required of the operating staff to implement and maintain the program is necessary.

In CMOM planning, the owner or operator selects performance goal targets, and designs CMOM activities to meet the goals. The CMOM planning framework covers operation and maintenance (O&M) planning, capacity assessment and assurance, capital improvement planning, and financial management planning. Information collection and management practices are used to track how the elements of the CMOM program are meeting performance goals, and whether overall system efficiency is improving.

On an periodic basis, utility activities should be reviewed and adjusted to better meet the performance goals. Once the long-term goal of the CMOM program is established, interim goals may be set. For instance, an initial goal may be to develop a geographic information system (GIS) of the system. Once the GIS is complete, a new goal might be to use the GIS to track emergency calls and use the information to improve maintenance planning.

An important component of a successful CMOM program is periodically collecting information on current systems and activities to develop a "snapshot-in-time" analysis. From this analysis, the owner or operator evaluates its performance and plans its CMOM program activities.

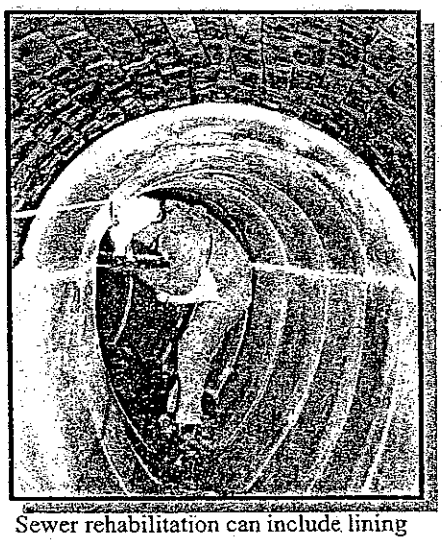
Maintaining the value of the investment is also important. Collection systems represent major capital investments for communities and are one of the communities' major capital assets. Equipment and facilities will deteriorate through normal use and age. Maintaining value of the capital asset is a major goal of the CMOM program. The infrastructure is what produces sales and service. Proper reinvestment in capital facilities maintains the ability to provide service and generate sales at the least cost possible and helps ensure compliance with environmental requirements. As a capital asset, this will result in the

need for ongoing investment in the collection system and treatment plant to ensure design capacity while maintaining existing facilities and equipment as well as extending the life of the system.

The performance of wastewater collection systems is directly linked to the effectiveness of its CMOM program. Performance characteristics of a system with an inadequate CMOM program include frequent blockages resulting in overflows and backups. Other major performance indicators include pump station reliability, equipment availability, and avoidance of catastrophic system failures such as a collapsed pipe.

A CMOM program is what an owner or operator should use to manage its assets; in this case, the collection system itself. The CMOM program consists of a set of best management practices that have been developed by the industry and are applied over the entire life cycle of the collection system and treatment plant. These practices include:

- Designing and constructing for O&M
- Knowing what comprises the system (inventory and physical attributes)
- Knowing where the system is (maps and location)
- Knowing the condition of the system (assessment)
- Planning and scheduling work based on condition and performance
- Repairing, replacing, and rehabilitating system components based on condition and performance
- Managing timely, relevant information to establish and prioritize appropriate CMOM activities
- Training of personnel



Sewer rehabilitation can include lining aging sewers (photo: NJ Department of Environmental Protection).

1.6 National Pollutant Discharge Elimination System Regulatory Requirement

The National Pollutant Discharge Elimination System (NPDES) program prohibits discharges of pollutants from any point source into the nation's waters except as authorized under an NPDES permit. EPA and state NPDES inspectors evaluate collection systems and treatment plants to determine compliance with permit conditions including proper O&M. Among others, these permit conditions are based on regulation in 40 CFR 122.41(e): "The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit."

When violations occur, the collection system or wastewater treatment plant owner or operator can face fines and requirements to implement programs to compensate residents and restore the environment. For example, in June 2004, the U.S. District Court for the Southern District of Ohio entered a consent decree resolving CSO, SSO, and wastewater treatment plant violations at the Hamilton County sewer system in Cincinnati, Ohio. In addition to a $1.2 million civil penalty, the settlement included programs to clean up residents' basements, compensate residents, and implement measures to prevent further basement backups. The settlement also includes over $5.3 million in supplemental environmental projects.

1.7 EPA Region 4 MOM Programs Project

EPA Region 4 created the "Publicly Owned Treatment Works MOM Programs Project" under which the Region invites permitted owners or operators, and contributing satellite systems, in watersheds it selects to perform a detailed self-assessment of the management, operation, and maintenance (MOM) programs associated with their collection system. Participants provide a report which includes the results of the review, any improvements that should be made, and schedules to make those improvements. Participants that identify and report a history of unpermitted discharges from their collection system, and a schedule for the necessary improvements, can be eligible for smaller civil penalties while under a remediation schedule.

EPA's Office of Compliance coordinated with EPA Region 4 on the development of this CMOM Guide. This guide is based in part on material obtained from the Region 4 MOM Programs Project. Some of the more specific items of the Region 4 program have been omitted in order to provide a more streamlined review framework. The fundamental concepts behind CMOM have been maintained in this guide. By combining elements of the Region's program with existing NPDES inspection guidance, this CMOM Guide provides a comprehensive framework for reviewers and regulated communities to evaluate the effectiveness of O&M throughout the collection system.

CHAPTER 2. COLLECTION SYSTEM CAPACITY, MANAGEMENT, OPERATION, AND MAINTENANCE PROGRAMS

This chapter provides an overview of the CMOM program elements. The information will help evaluate wastewater collection system operation and maintenance (O&M) practices. The key elements of the CMOM program, which are presented in detail in the following sections, include:

- Collection System Management
- Collection System Operation
- Collection System Maintenance
- Collection System Capacity Evaluation

In addition to this overview, there are several areas (e.g., 2.1.3 Internal Communications, 2.1.4 Customer Service, etc.) in this guide that go into greater depth regarding the operation and maintenance of a collection system. The intent of this detail is not only to provide the owner or operator with suggestions as to what to look for in their own program, but to provide the reviewer a complete overview of good operations, in general, regardless of a particular item resulting in poor performance or a violation.

For EPA and state inspectors or other reviewers, conducting an evaluation of collection system CMOM programs shares many similarities with other types of compliance reviews. Overall, the reviewer would examine records, interview staff and conduct field investigations, generally in that order although tailored, if necessary, to meet site-specific needs. Prior to performing the on-site interviews and evaluations, preliminary information may be requested that will provide an overall understanding of the organization to allow for a more focused approach for the review. This information also provides a basis for more detailed data gathering during on site activities. The information typically requested prior to the review should include a schematic map of the collection system (could be as-built drawings) and any written operations or maintenance procedures. Depending on the volume of information, the collection system owner or operator may need ample lead time to gather and copy these documents. Alternatively, the reviewer may offer to examine the documents and bring them back when doing the on-site review so that extra copies are not necessary. No matter which method is used, the importance of up-front preparation cannot be overemphasized. With the exception of pump stations and manholes, much of the collection system is not visible. Therefore, the more complete the reviewer's understanding of the system is prior to the review, the more successful the assessment will be.

The reviewer would then proceed with the on-site activities. Guidance for conducting compliance reviews is provided in the *NPDES Compliance Inspection Manual* (EPA 2004). The manual provides the general procedures for performing compliance reviews and is a valuable source of information on such topics as entry, legal authority, and responsibilities of the reviewer. Although CMOM evaluations are not specifically addressed in the manual, the general

review procedures can be applied to CMOM reviews. Another good reference for general review information is the *Multi-Media Investigations Manual, NEIC* (EPA 1992). Some issues with entry are specific to CMOM reviews. Some facilities may be on private property and the reviewer may need property owner consent for entry.

Documents to Review On-site Include:

- Organization chart(s)
- Staffing plans
- Job descriptions
- Sewer use ordinance
- Overall map of system showing facilities such as pump stations, treatment plants, major gravity sewers, and force mains
- O&M budget with cost centers[1] for wastewater collection
- Performance measures for inspections, cleaning, repair, and rehabilitation
- Recent annual report, if available
- Routine reports regarding system O&M activities
- Collection system master plan
- Capital improvement projects (CIP) plan
- Flow records or monitoring
- Safety manual
- Emergency response plan
- Management policies and procedures
- Detailed maps/schematics of the collection system and pump stations
- Work order management system
- O&M manuals
- Materials management program
- Vehicle management and maintenance records
- Procurement process
- Training plan for employees
- Employee work schedules
- Public complaint log
- Rate ordinance or resolution
- Financial report ("notes" section)
- As built plans
- Discharge monitoring reports (DMRs)

The above list is not all inclusive nor will all utilities necessarily have formal, written documentation for each of the items listed. The *Collection System Performance Indicator Data Collection Form*, included as Appendix A, provides examples of the types of information a reviewer should attempt to obtain while on-site.

Reviewer - Point to Note
A schedule should be established by the reviewer for the staff interviews and field assessments.

Interviews are generally conducted with line managers and supervisors who are responsible for the various O&M activities

[1] A cost center is any unit of activity, group of employees, line of products, etc., isolated or arranged in order to allocate and assign costs more easily.

and support services staff from engineering, construction, human resources, and purchasing, where appropriate. Appendix B presents an example agenda and schedule that would be used for a large collection system owner or operator. The collection system's size and physical characteristics will determine the length of time needed for the review. A guideline for the time required, given a two person review team, would be two days for a small system, and a week or more for large systems.

Field reviews are typically conducted after interviews. The following is a list of typical field sites the team should visit:

- Mechanical and electrical maintenance shop(s)
- Fleet maintenance facilities (vehicles and other rolling stock)
- Materials management facilities (warehouse, outside storage yards)
- Field maintenance equipment storage locations (i.e., crew trucks, mechanical and hydraulic cleaning equipment, construction and repair equipment, and television inspection equipment)
- Safety equipment storage locations
- Pump stations
- Dispatch and supervisory control and data acquisition (SCADA) systems
- Crew and training facilities
- Chemical application equipment and chemical storage areas (use of chemicals for root and grease control, hydrogen sulfide control [odors, corrosion])
- Site of SSOs, if applicable
- A small, but representative, selection of manholes

Collection system operators typically assist with manhole cover removal and other physical activities. The inspector should refrain from entering confined spaces. A confined space is defined by the Occupational Safety and Health Administration (OSHA) as a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work; and (2) has limited or restricted means for entry or exit; and (3) is not designed for continuous employee occupancy [29 CFR 1910.146(b)]. A "permit-required confined space (permit space)" is a confined space that has one or more of the following characteristics: (1) contains or has a potential to contain a hazardous atmosphere; (2) contains a material that has the potential for engulfing an entrant; (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or (4) contains any other recognized serious safety or health hazard [29 CFR 1910.146(b)].

Though OSHA has promulgated standards for confined spaces, those standards do not apply directly to municipalities, except in those states that have approved plans and have asserted jurisdiction under Section 18 of the OSHA Act. Contract operators and private facilities do have to comply with the OSHA requirements and the inspector may find that some municipalities elect to do so voluntarily. In sewer collection systems, the two most common confined spaces are the underground pumping station and manholes. The underground pumping station is typically entered through a relatively narrow metal or concrete shaft via a fixed ladder. Inspectors conducting the field evaluation component of the CMOM audit should be able to identify and

avoid permit-required confined spaces. Although most confined spaces are unmarked, confined spaces that may have signage posted near their entry containing the following language:

DANGER–PERMIT REQUIRED–CONFINED SPACE
AUTHORIZED PERSONNEL ONLY

If confined space entry is absolutely necessary, inspectors should consult with the collection system owner or operator first, have appropriate training on confined space entry, and use the proper hazard detection and personal safety equipment. More information on confined space entry can be found in *Operation and Maintenance of Wastewater Collection Systems Volumes I and II* (California State University (CSU) Sacramento 1996; CSU Sacramento 1998).

2.1 Collection System Management

Collection system management activities form the backbone for operation and effective maintenance activities. The goals of a management program should include:

- Protection of public health and prevention of unnecessary property damage
- Minimization of infiltration, inflow and exfiltration, and maximum conveyance of wastewater to the wastewater treatment plant
- Provision of prompt response to service interruptions
- Efficient use of allocated funds
- Identification of and remedy solutions to design, construction, and operational deficiencies
- Performance of all activities in a safe manner to avoid injuries

Management Documents to Review

- Organization chart(s)
- Staffing plans–Number of people and classifications
- Job descriptions for each classification
- Sewer use ordinance
- Safety manual
- Training program documentation
- Notes to financial reports

Without the proper procedures, management and training systems, O&M activities may lack organization and precision, resulting in a potential risk to human health and environmental contamination of surrounding water bodies, lands, dwellings, or groundwater. The following sections discuss the common elements of a robust collection system management program.

2.1.1 Organizational Structure

Well-established organizational structure, which delineates responsibilities and authority for each position, is an important component of a CMOM program for a collection system. This information may take the form of an organizational chart or narrative description of roles and

responsibilities, or both. The organizational chart should show the overall personnel structure, including operation and maintenance staff. Additionally, up-to-date job descriptions should be available. Job descriptions should include the nature of the work performed, the minimum requirements for the position, the necessary special qualifications or certifications, examples of the types work, lists of licences required for the position, performance measures or promotion potential. Other items to note in regard to the organizational structure are the percent of staff positions currently vacant, on average, the length of time positions remain vacant, and the percent of collection system work that is contracted out.

> **Reviewer - Point to Note**
> The reviewer may want to note the turnover rate and current levels of staffing (i.e., how many vacant positions exist and for how long they have been vacant). This may provide some indication of potential understaffing, which can create response problems.

Reviewers should evaluate specific qualifications of personnel and determine if the tasks designated to individuals, crews, or teams match the job descriptions and training requirements spelled out in the organizational structure. From an evaluation standpoint, the reviewer might try to determine what type of work is performed by outside contractors and what specific work is reserved for collection system personnel. If much of the work is contracted, it is appropriate to review the contract and to look at the contractor's capabilities. If the contractor handles emergency response, the reviewer should examine the contract with the owner or operator to determine if the emergency response procedures and requirements are outlined.

The inclusion of job descriptions in the organizational structure ensures that all employees know their specific job responsibilities and have the proper credentials. Additionally, it is useful in the course of interviews to discuss staff management. The reviewer should note whether staff receive a satisfactory explanation of their job descriptions and responsibilities. In addition, when evaluating the CMOM program, job descriptions will help a reviewer determine who should be interviewed.

> **Reviewer - Point to Note**
> A reviewer should look for indications that responsibilities are understood by employees. Such indications may include training programs, meetings between management and staff, or policies and procedures.

When evaluating the organizational structure, the reviewer should look for the following:

- Except in very small systems, operation and maintenance personnel ideally should report to the same supervisor or director. The supervisor or director should have overall responsibility for the collection system.

- In some systems, maintenance may be carried out by a city-wide maintenance

organization, which may also be responsible for such diverse activities as road repair and maintenance of the water distribution system. This can be an effective approach, but only if adequate lines of responsibility and communication are established.

- In general, one supervisor should manage a team of individuals small enough that is safe and effective. However, the individuals on the team may have additional employees reporting to them. This prevents the top supervisors from having to track too many individuals. The employee-supervisor ratio at individual collection systems will vary depending on their need for supervisors.

In a utility with well-established organizational structure, staff and management should be able to articulate their job and position responsibilities. Personnel should be trained to deal with constantly changing situations and requirements, both regulatory and operational.

The system's personnel requirements vary in relation to the overall size and complexity of the collection system. In very small systems, these responsibilities may include operation of the treatment plant as well as the collection system. In many systems, collection system personnel are responsible for the stormwater as well as wastewater collection system. References providing staff guidelines or recommendations are available to help the reviewer determine if staffing is adequate for the collection system being reviewed. Following is a list of available references:

- *Manpower Requirements for Wastewater Collection Systems in Cities of 150,000 to 500,000 Population* (EPA 1974)
- *Manpower Requirements for Wastewater Collection Systems in Cities and Towns of up to 150,000 Population* (EPA 1973)
- *Operation and Maintenance of Wastewater Collection Systems*, Volume II (California State University (CSU) Sacramento 1998)

Volumes I and II of *Operations and Maintenance of Wastewater Collection Systems* can be obtained through:

Office of Water Programs
California State University Sacramento
6000 J Street
Sacramento, CA 95819-6025
phone: 916/278-6142
www.owp.csus.edu

The following tables have been taken from the two EPA documents listed above to provide the reviewer with guidance. However, these documents may not take into account technological advances that have occurred since their publication date that might reduce staffing requirements. For instance, advances in remote data acquisition and telemetry have likely reduced the number

of field inspection staff needed for systems with several pump stations. Other system-specific characteristics should also be accounted for when using these tables. An example of this might be collection systems that are not primarily constructed of brick will not require the masons the tables specify.

STAFF COMPLEMENTS FOR WASTEWATER COLLECTION SYSTEM MAINTENANCE
POPULATION SIZE
(Estimated Number of Personnel)

Occupational Title	5,000		10,000		25,000		50,000		100,000	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Superintendent	1	5	1	10	1	20	1	40	1	40
Assistant Superintendent										
Maintenance Supervisor							1	40	2	80
Foreman	1	15	1	20	1	20	1	40	1	40
Maintenance Man II	1	15	1	20	1	20	1	40	1	40
Maintenance Man I	1	15	1	20	2	60	3	120	5	200
Mason II							1	40	1	40
Mason I									1	40
Maint. Equipment Personnel					1	40	2	80	3	120
Construction Equipment Personnel	1	15	1	20	1	20	1	40	1	40
Auto. Equipment Personnel									1	40
Photo. Inspection Technician									1	40
Laborer	1	15	1	20	2	40	2	80	5	200
Dispatcher							1	40	2	80
Clerk Typist							1	20	1	20
Stock Clerk							1	40	1	40
Sewer Maint. Staff	6	80	6	110	9	220	16	620	27	1,060
Maintenance Mechanic II	see comment (c) below									
Maintenance Mechanic I	see comment (d) below									
Maintenance Mechanic Helper	see comment (d) below									
Construction Inspection Supervisor	see comments (e) and (f) below									
Total Staff										

(a) Estimated number of personnel.
(b) Estimated total man-hours per week.
(c) Multiply number of lift stations maintained by 8/3.
(d) Multiply number of lift station visits per week by 1.
(e) Multiply estimated construction site visits per week by 8/3.
(f) Determined by the number of Construction Inspectors employed and developed on a judgmental basis.

Unit processes included in this staffing table are:

1. Maintenance of sanitary sewer main lines & appurtenances (laterals not included).
2. Maintenance of storm sewer main lines.
3. Maintenance of lift stations.
4. Inspection of newly constructed sewer main lines and appurtenances.

(U.S. EPA 1973)

STAFF COMPLEMENTS FOR WASTEWATER COLLECTION SYSTEM MAINTENANCE
POPULATION SIZE
(Estimated Number of Personnel)

Occupational Title	150,000	200,000	300,000	400,000	500,000
Superintendent	1	1	1	1	1
Assistant Superintendent	1	1	1	1	1
Maintenance Supervisor II	1	1	1	1	1
Maintenance Supervisor I	1	2	2	3	3
Equipment Supervisor	1	1	1	1	1
TV Technician II	1	2	2	3	3
TV Technician I	1	2	2	3	3
Foreman	2	3	4	5	6
Maintenance Man II	3	5	6	8	9
Maintenance Man I	11	17	22	29	33
Mason II	1	2	2	3	3
Mason I	1	2	2	3	3
Maintenance Equipment Personnel	6	8	12	15	18
Construction Equipment Personnel	3	4	6	8	9
Auto. Equipment Personnel	2	3	4	5	6
Laborer	7	10	14	18	22
Dispatcher	2	2	2	3	3
Stock Clerk	1	2	2	3	3
Clerk Typist	2	2	2	3	3
Sewer Maintenance Staff	48	70	88	116	131
Maintenance Mechanic II	see comment (a) below				
Maintenance Mechanic I	see comment (b) below				
Maintenance Mechanic Helper	see comment (b) below				
Electrician	see comment (c) below				
Construction Inspector Supervisor	see comment (d) below				
Construction Inspector	see comment (e) below				
Total Staff					

(a) Divide number of lift stations maintained by 15.
(b) Divide number of lift station visits per week by 40
(c) Divide number of lift stations maintained by 15.
(d) Determined by the number of Construction Inspectors employed and developed on a judgmental basis.
(e) Divide estimated daily construction site visits by 2.

Unit processes included in this staffing table are:

1. Maintenance of sanitary sewer main lines & appurtenances (laterals not included).
2. Maintenance of storm sewer main lines.
3. Maintenance of lift stations.
4. Inspection of newly constructed main lines and appurtenances.

(U.S. EPA 1974)

2.1.2 Training

The commitment of management to training is key to a successful program. It is important to recognize training as a budget expense item. A guideline for the typical amount of funding for training is three to five percent of the gross budget for the collection system. However, in large collection systems or those undergoing extensive construction this percentage may be considerably lower, and, in systems with a high turnover, training costs may be higher due to orienting new employees. Other changes, such as incorporation of new technology, will have a short-term impact on training costs. Although training is not explicitly required under current regulations, a collection system with untrained or poorly trained collection system personnel runs a greater risk of experiencing noncompliance.

The following elements are essential for an effective training program:

- Fundamental mission, goals, and policies of the collection system are addressed
- Mandatory training requirements are identified for key employees
- On-the-job training progress and performance are measured
- Effectiveness of the training is assessed including periodic testing, drills, or demonstrations
- New employees receive training

The owner or operator should generally provide training in the following areas:

- Routine line maintenance (may be on-the-job training only)
- Safety during confined space entry (every system should also have a strict policy and permit program)
- Traffic control (where applicable)
- Record keeping
- Pump station O&M
- Electrical and instrumentation (may be a combination of formal and on-the-job training)
- Public relations and customer service
- SSO/Emergency response
- Pump station operations and maintenance
- Pipe repair; bursting or cured in place pipe (CIPP); or closed circuit TV and trench/shoring (where these activities are not outsourced)

Sources of Training

Training is required to safely perform inspections, follow replacement procedures, and lubricate and clean parts and equipment. Following are the many sources of maintenance training:

- Manufacturer
- In-house
- On-the-job (OJT)
- Industry-wide (e.g., consultants, regulatory authorities, professional associations, or educational institutions)

The training program should identify the types of training required and offered. Types of training vary, but may include general environmental awareness, specific equipment, policies and

procedures, and conducting maintenance activities. If the owner or operator is carrying out its own training, the reviewer should evaluate one or more examples of training materials to answer the following questions: are the materials appropriate to the training topic and the level of those being trained; and are they likely to accomplish the intended goal?

> **Owner or Operator - Point to Note**
> The owner or operator should routinely assess the effectiveness of training through periodic testing, drills, demonstrations, or informal reviews, and improve training based on this assessment.

2.1.3 Internal Communication

Communication is essential to ensuring that collection systems run efficiently and effectively. It is especially important that an effective communication link exists between wastewater treatment plant operators and collection system crews as well as with other municipal departments.

Effective communication requires the top-down, bottom-up, and lateral exchange of information amongst staff. Examples of top-down communication are bulletin board posters, paycheck inserts, regular staff meetings, e-mail or informal brown-bag lunch discussions. Examples of bottom-up communication may include the establishing environmental committees, confidential hotlines, e-mail, or direct open discussions. Collection system owners or operators may also offer incentives to employees for performance, and encourage them to submit suggestions for ways to improve the performance of the collection system. "Front line" employees are often an excellent source of ideas, issues, and information about how to improve performance at the work site. In this context, the reviewer can check for morale-boosting activities or reward programs, such as "Employee of the Month" and "Employee of the Year."

The reviewer should attempt to determine lines of internal communication to ensure all employees receive information and have an appropriate forum to provide feedback. The reviewer should assess the level of communication by interviewing several levels of staff or by simply observing collection system teams on work assignments. The owner or operator should have procedures and be able to demonstrate internal communication between the various levels and functions of the collection system regarding its management, operation, and maintenance programs.

2.1.4 Customer Service

The community often knows very little about the wastewater treatment and collection services performed for them. The community may only be aware of the collection system and its owner or operator through articles in local newspapers, public radio and television announcements, or only when there is an SSO. Collection system representatives should talk to schools and universities, make presentations to local officials and businesses about the wastewater field. Formal presentations can also be given to citizens, building inspectors, public utility officials,

and members of the media.

An effective customer service and public relations program ensures that the owner or operator addresses all incoming inquiries, requests, and complaints in a timely fashion. From this information, owners or operators may further develop or revise programs to better address areas of concern. The reviewer should examine customer service records for the following:

- Personnel who received the complaint or request
- Date and nature of the complaint or request
- Location of the problem
- Name, address, and telephone number of the customer
- Cause of the problem
- To whom the follow-up action was assigned
- The initial date of the follow-up action
- Date the complaint or request was resolved
- Total days to end the problem
- Feedback to the customer

Awareness of past issues, population served, compliance history, and other elements help a reviewer determine whether the amount and types of inquiries, requests, or complaints are increasing or decreasing. For example, there may have been many complaints during only a certain week. The reviewer can examine those records to determine if there were specific circumstances (e.g., a large precipitation event) that caused the increase in inquiries or complaints.

Reviewer - Point to Note
To fully understand the context of customer inquiries, requests, or complaints, a reviewer should understand the history, topography, boundaries, and demographics of the collection system's jurisdiction before site evaluations are conducted.

Employees who handle customer service should be specifically trained to handle complaints, requests, or inquiries. These employees should be provided with sample correspondence, Q/A's, or "scripts" to help guide them through written or oral responses to customers. The reviewer should look for procedures on how to answer the telephone, e-mail, and other communication used by personnel. A reviewer may evaluate staff telephone responses by evaluating:

- The number of persons available to answer calls
- The number of repeat callers
- The average length of calls
- The volume of calls per day

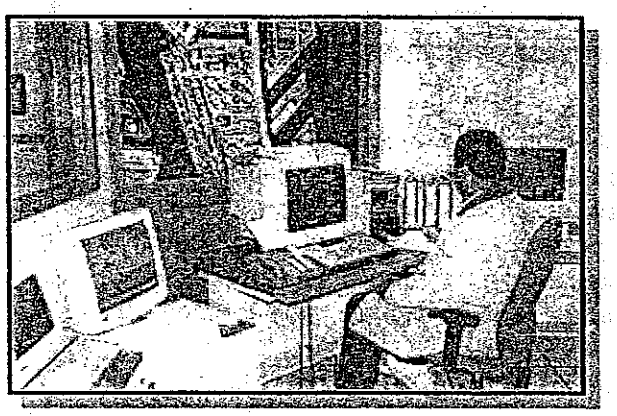
Collection system field crews and their activities are the most visible segment of any wastewater treatment organization. Workers project a public image for their system on city and town streets. For this reason, personnel need to be trained in what to expect in public situations. For example,

collection system supervisory staff should be familiar with the areas around public rights-of-way and easements to which their field crews must gain access to service facilities. Additionally, crew leaders should know how to deal with the public when approached.

Collection systems field crews influence the public's confidence in the collection system owner or operator. Reviewers should observe whether personnel wear uniforms or not, and if vehicles and equipment are identifiable as utility property and kept in good working order. Vehicles should be equipped with adequate emergency lighting and flashers, traffic control signs and barriers, etc. Before major construction or maintenance work begins, owners or operators should notify homeowners where properties may be affected. Methods of notification may include door hangers, newspaper notices, fliers, signs, or public radio or television announcements. Information should also be provided to residents on cleanup and safety procedures following basement backups and other overflows.

2.1.5 Management Information Systems

The ability of the owner or operator to effectively manage its collection system is directly related to its ability to maintain access to the most current information concerning the facilities. Maintenance of this current information is an effort involving all members of the collection system from the staff answering the telephone to the worker in the street. Operational information informs and clarifies financial information. This will make the financial information more useful for the policy makers, leading to better decisions. A satisfactory management information system should provide the owner or operator with the following advantages:



A growing number of sewer systems have shifted to computer-based collection system management [photo: Milwaukee Metropolitan Sewerage District (MMSD)].

- Maintain preventive maintenance and inspection schedules
- Offer budgetary justification
- Track repairs and work orders
- Organize capital replacement plans
- Manage tools and equipment inventories
- Create purchase orders
- Record customer service inquiries, complaints, or requests
- Provide measurement of effectiveness of program and O&M activities

Owners and operators have been shifting to computer-based systems to manage data. Only the smaller collection system owners or operators may still rely on paper management systems.

Computer-based Maintenance Management Systems (CMMSs) are designed to manage the data needed to track the collection system's O&M performance. Geographic Information Systems (GIS) are used to map and locate facilities and because of computer-based compatibility, can often easily be integrated with a CMMS. The computer-based system however, can only be as accurate as the data used to develop it, which was most likely paper files.

Types of Management Information Tracking

- Customer service
- Safety incident
- Emergency response
- Process change
- Inspection scheduling and tracking
- Monitoring and/or sampling schedules
- Compliance
- Planned maintenance (schedules and work orders)
- Parts inventory

Regardless of the information management style chosen, the collection system should have written instructions regarding the use of the management information systems. These procedures may include operating the system, upgrading the system, accessing data and information, and generating and printing reports. The system should be kept current with accurate information. Work reports from the field crews should be complete, accurate, and legible.

The reviewer may select some number of complaints and see how well they can be tracked through the system to an ultimate conclusion. Work reports generated by the field crew should be randomly chosen and scanned for legibility and completeness. The reviewer should do a random check of the timeliness and accuracy of data entry. Additionally, the reviewer should obtain selected original data sources (such as field reports) and compare them to the appropriate database output to determine how long entry takes. This will provide a check on how current the database is and what data entry backlog exists.

2.1.6 SSO Notification Program

The owner or operator should maintain a written procedure indicating the entities, (e.g., drinking water purveyors, the public, public health officials, and the regulatory authority) that should be notified in the event of an SSO. The procedure should clearly indicate the chain of communication used to notify the proper personnel of an SSO event for reporting and remediation. The procedure should include the names, titles, phone numbers, and responsibility of all personnel involved. The reviewer should verify that the personnel listed in the procedure are still in the position listed and are aware of their responsibilities.

Reviewer - Point to Note
To verify the effectiveness of the notification program, the reviewer should walk an overflow occurrence report through the chain of events that would occur from the time of initial notification.

The procedure may allow for different levels of response for different types of SSOs. For example, the regulatory authority may request that SSOs due to sewer line obstructions be

reported on a monthly basis. Therefore, the procedure may simply be to gather this information from the maintenance information system and have the appropriate personnel put together a reporting form. A chronic SSO at a pump station that discharges when overloaded during wet weather may require a more complex notification procedure, including immediate telephone notification to specified authorities.

To verify the effectiveness of the notification program, the reviewer should walk an overflow occurrence report through the chain of events that would occur from the time of initial notification. This can be done by choosing several random overflow events from the complaint records and observing whether they are handled as procedures dictate. The minimum information that should be reported for an SSO includes the date, time, location, cause, volume of the overflow (which may be estimated), how it was stopped, and any remediation methods taken. The reviewer should not only verify that the SSO notification procedures are appropriate, but also verify that the owner or operator has reliable methods for the detection of overflows and a phone number or hotline for the public to report observed overflow events.

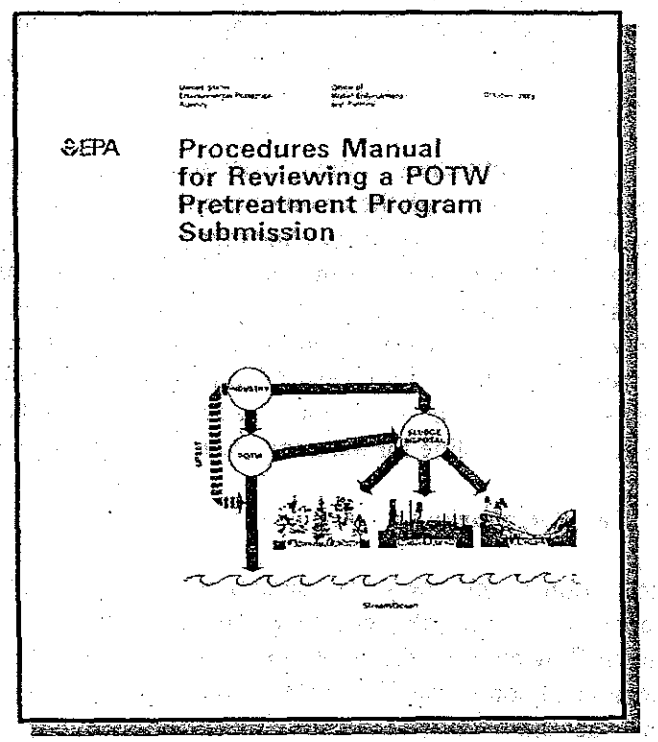
2.1.7 Legal Authority

The collection system owner or operator should select and enforce the legal authority necessary to regulate the volume of flow entering the collection system, including residential and commercial customers, satellite communities and industrial users. The legal authority may take the form of sewer use ordinances, contracts, service agreements, and other legally binding documents.

> **A satellite community** is a collection systems which does not own the treatment facility to which it discharges.

The pretreatment program seeks to prevent the discharge of materials into the sewer system (by non-domestic users) that interfere with proper operation of the wastewater treatment plant or may pass through the plant untreated. At the time the operator of a wastewater treatment plant submits its pretreatment program to the regulatory authority for approval, the plant operator must include a statement from the city solicitor or other legal authority that the plant has the authority to carry out the program [40 CFR 403.9(a)(1)]. The reviewer should verify the existence of this statement and inquire as to whether any significant changes have occurred in the program such that the legal authority may need further review. Additionally, some owners or operators may have a pretreatment program approved by the state, through which discharge permits are issued to industrial users and enforcement is conducted. Further information on legal authority under the pretreatment program may be found in *Procedures Manual for Reviewing a POTW Pretreatment Program Submission* (EPA 1983).

The owner or operator should have the authority to ensure that new and rehabilitated sewers and connections have been properly designed, constructed, and tested before being put into service. This authority could take the form of design and performance specifications in a sewer use ordinance or other legal document such as a statute or series of contracts or joint powers agreements. The ordinance or legal document should contain, at a minimum, general prohibitions, adequate grease control requirements and measures, prohibitions on stormwater inflow, infiltration from laterals, and new construction standards.



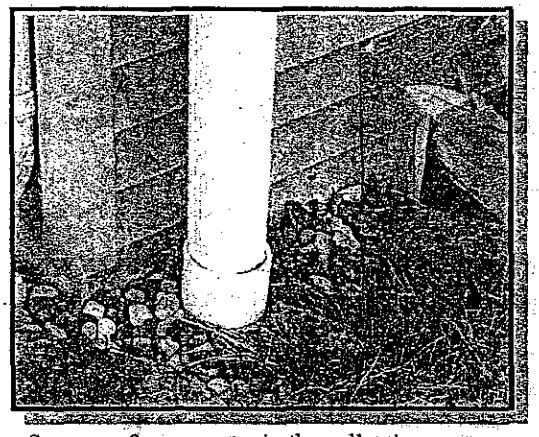
The grease control section of the document should contain the requirement to install grease traps at appropriate facilities (e.g., restaurants). Additionally, these facilities should be required to properly maintain the grease traps and pump them out on a regular basis. The document should also address periodic inspections of grease traps by collection system personnel and the ability to enforce (i.e., levy fines on persistent offenders).

General Prohibitions

- Fire and explosion hazards
- Corrosive and obstructive materials
- Material which may cause interference at the wastewater treatment plant
- Heat which may inhibit biological activity at the wastewater treatment plant
- Oils or petroleum products which may cause interference or pass through the wastewater treatment plant

The owner or operator should maintain strict control over the connection of private sewer laterals to sewer mains. These connections have significant potential as sources of infiltration. Standards for new connections should be clearly specified. The sewer use ordinance should contain provisions for inspection, approval of new connections, and a program to implement the requirements. A method to maintain control over existing connections is to require an inspection of the lateral prior to sale of a property. It is important to note that implementing this type of program may require a change to the local ordinance or code.

The owner or operator should also have the legal authority to prohibit stormwater connections to the sanitary sewer. Stormwater connections may include catch basins; roof, cellar and yard drains; sump pumps; direct connections between the storm and sanitary sewers; leaking manhole covers; uncapped cleanouts; and the direct entrance of streams into the collection system. This practice is now discouraged. Direct stormwater connections to a separate sanitary sewer system are known as inflow. Inflow can severely impact the ability of the collection system to transport flows to the treatment plant during wet weather, leading to overflows and noncompliance with the wastewater treatment plant's NPDES permit.



Sources of stormwater in the collection system may include building downspouts connected directly to the system (photo: MMSD).

Satellite communities should not be allowed to contribute excessive flows that cause or contribute to overflows, flooding, or noncompliance at the wastewater treatment plant. Should any of these situations exist, it is not sufficient for the owner or operator to charge the satellite community for the excess flow. The owner or operator must be able to prohibit the contribution of the excess flow. This may be done through a legal inter-jurisdictional agreement between the wastewater treatment plant owner or operator and the satellite community that addresses allowable flows and sets requirements. The reviewer should examine all contracts between systems and their satellites (unless too numerous, then select representative contracts). Contracts should have a date of termination and allow for renewal under renegotiated terms. Contracts should limit flow from satellite communities and limit peak wet weather flow rates.

Owner or Operator - Point to Note
The owner or operator should have a comprehensive program which addresses flows from satellite communities.

2.2 Collection System Operation

Collection systems have little of what is traditionally referred to as "operability" as compared to a wastewater treatment plant (i.e., the number of ways to route the wastewater is typically limited). However, the design of some collection systems does allow flow to be diverted or routed from one pipe to another or even to different treatment plants. This can be accomplished by redirecting flow at a pump station from one discharge point to another or opening and closing valves on gravity sewers and force mains.

Owner or Operator - Point to Note
There should be detailed, written procedures available to guide owners or operators through flow routing activities. Also, there should be operating procedures for mechanical equipment such as pump station pump on/off and service rotation settings or in-line grit removal (grit trap) operations.

There are many reasons why the owner or operator may want to divert flows; among them, to relieve overloading on a system of piping or the wastewater treatment plant or to add more flow to piping serving an area not yet fully developed to maintain a cleansing velocity.

2.2.1 Budgeting

The budget is one of the most important variables in the CMOM program. Although an adequate budget is not a guarantee of a well operated collection system, an inadequate budget will make attaining this goal difficult. Funding can come from a variety of sources, including user fees or appropriations from the state or local government.

> **Reviewer - Point to Note**
> Reviewers need to determine the source of the funding for the collection system and who controls it. Reviewers should also request budget documents, summaries, or pie charts to learn more about the systems' budget.

A key element of the operation budget program is the tracking of costs in order to have accurate records each time the annual operating budget is developed. Having an annual baseline provides documentation for future budget considerations and provides justification for future rate increases. Collection system management should be aware of the procedures for calculating user rates and for recommending and making user rate changes.

Collection system and wastewater treatment plant costs may be combined into one budget, or budget line items may be divided into each of two individual budgets. For example, electrical and mechanical maintenance work performed by plant staff on a pump station may be carried as an O&M cost in the treatment plant budget, although pumping stations are generally considered to be a collection system component.

The cost of preventive and corrective maintenance and major collection system repairs and alterations are key items in the annual operating budget. The collection system owner or operator should keep adequate records of all maintenance costs, both in-house and contracted, plus the costs for spare parts. This will assist in the preparation of the following year's budget. In general, there should be an annual (12-month cycle) budget of discretionary and non-discretionary items. There may also be a Capital Improvement Plan (CIP) which may encompass small projects (one to two year cycles) or larger projects (three to five year cycles). Larger projects may include items such as equipment, labor, training, or root cause failure analysis.

> **Examples of O&M Budget Items**
>
> - Labor (usually at least 50% of total budget)
> - Utilities
> - Capital
> - Maintenance materials and supplies
> - Chemicals
> - Motor vehicles
> - Contracted services

The major categories of operating costs are labor, utilities, and supplies. Cost accounting for

these categories should include information on unit costs, total costs, and the amount and/or quantities used. The reviewer should evaluate the current and proposed budget, and current year balance sheets. In examining current and proposed expenditure levels, the reviewer should consider:

- Whether the budgets include contributions to capital reserve (sinking) funds. These funds are savings for replacement of system components once they reach their service life.
- Whether all income from water and sewer billings supports those functions, or if it goes into the general fund.
- Whether raising user fees is a feasible option to meet budget needs based on recent expenditure history.

2.2.2 Monitoring

The collection system owner or operator may be responsible for fulfilling some water quality or other monitoring requirements. Responsibilities may include:

- Monitoring discharges into the collection system from industrial users
- Monitoring to determine the effects of SSOs on receiving waters
- Monitoring required as part of an NPDES permit, a 308 letter, administrative order, or consent decree

The owner or operator should maintain written procedures to ensure that sampling is carried out in a safe, effective, and consistent manner. The procedures should specify, at a minimum the following:

- Sampling location(s)
- Sample volumes, preservatives, and holding times
- Instructions for the operation of any automatic sampling and/or field monitoring (e.g., pH or dissolved oxygen) equipment
- Sampling frequency
- Sampling and analytical methodologies
- Laboratory QA/QC

Records should be maintained of sampling events. These records should at a minimum include the following:

- Date, time, and location of sampling
- Sample parameters
- Date shipped or delivered to the laboratory

2.2.3 Hydrogen Sulfide Monitoring and Control

The collection system owner or operator should have a program under which they monitor areas of the collection system which may be vulnerable to the adverse effects of hydrogen sulfide. It may be possible to perform visual inspections of these areas. The records should note such items as the condition of metal components, the presence of exposed rebar (metal reinforcement in concrete), copper sulfate coating on copper pipes and electrical components, and loss of concrete from the pipe crown or walls.

Areas Subject to Generation of Hydrogen Sulfide:

- Sewers with low velocity conditions and/or long detention times
- Sewers subject to solids deposition
- Pump stations
- Turbulent areas, such as drop manholes or force main discharge points
- Inverted siphon discharges

As mentioned in Section 2.4.2, the collection system owner or operator should be carrying out routine manhole inspections. The hydrogen sulfide readings generated as a result of these inspections should be added to the records of potential areas of corrosion. A quick check of the pH of the pipe crown or structure enables early indication of potential hydrogen sulfide corrosion. A pH of less than four indicates further investigation is warranted. "Coupons" may be installed in structures or pipelines believed to be potentially subject to corrosion. Coupons are small pieces of steel inserted into the area and measured periodically to determine whether corrosion is occurring.

Reviewer - Point to Note
The reviewer should be aware that a system in which infiltration and inflow (I/I) has successfully been reduced may actually face an increased risk of corrosion. The reviewer should pay particular attention to the hydrogen sulfide monitoring program in these systems.

The reduction of flow through the pipes allows room for hydrogen sulfide gases to rise into the airway portion of the sewer pipe and react with the bacteria and moisture on the pipe walls to form sulfuric acid. Sulfuric acid corrodes ferrous metals and concrete.

There are several methods to prevent or control hydrogen sulfide corrosion. The first is proper design. Design considerations are beyond the scope of this manual but may be found in the *Design Manual: Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants* (EPA 1985). The level of dissolved sulfide in the wastewater may also be reduced by chemical or physical means such as aeration, or the addition of chlorine, hydrogen peroxide, potassium permanganate, iron salts, or sodium hydroxide. Whenever chemical control agents are used, the owner or operator should have procedures for their application and maintain records of the dosages of the various chemicals. Alternatively, sewer cleaning to remove deposited solids reduces hydrogen sulfide generation. Also, air relief valves may be installed at the high points of the force main system. The valve allows air to exit thus avoiding air space at the crown of the pipe where acid can form. The reviewer should examine the records to see that these valves are

receiving periodic maintenance.

Collection systems vary widely in their vulnerability to hydrogen sulfide corrosion. Vitrified clay and plastic pipes are very resistant to hydrogen sulfide corrosion while concrete, steel, and iron pipes are more susceptible. The physical aspects of the collection system are also important. Sewage in pipes on a decline that moves the wastewater at a higher velocity will have less hydrogen sulfide than sewage in pipes where the wastewater may experience longer detention times. Therefore, some systems may need a more comprehensive corrosion control program while some might limit observations to vulnerable points.

2.2.4 Safety

The reasons for development of a safety program should be obvious for any collection system owner or operator. The purpose of the program is to define the principles under which the work is to be accomplished, to make the employees aware of safe working procedures, and to establish and enforce specific regulations and procedures. The program should be in writing (e.g., procedures, policies, and training courses) and training should be well documented.

> **Point to Note**
> Although a safety program may not be explicitly required under current NPDES regulations, an excessive injury rate among personnel increases the likelihood of collection system noncompliance with other requirements. Furthermore, when good safety practices are not followed, there may be a risk to the public or to collection system workers.

The purpose of safety training is to stress the importance of safety to employees. Safety training can be accomplished through the use of manuals, meetings, posters, and a safety suggestion program. One of the most common reasons for injury and fatalities in wastewater collection systems is the failure of victims to recognize hazards. Safety training cuts across all job descriptions and should emphasize the need to recognize and address hazardous situations. Safety programs should be in place for the following areas:

- Confined spaces
- Chemical handling
- Trenching and excavations
- Material Safety Data Sheets (MSDS)
- Biological hazards in wastewater
- Traffic control and work site safety
- Lockout/Tagout
- Electrical and mechanical safety
- Pneumatic or hydraulic systems safety

The collection system owner or operator should have written procedures which address all of the

above issues and are made available to employees. In addition to training, safety programs should incorporate procedures to enforce the program. For example, this could include periodic tests or "pop" quizzes to monitor performance and/or compliance and follow-up on safety related incidents.

> **Reviewer - Point to Note**
> The reviewer should, in the course of interviewing personnel, determine their familiarity with health and safety procedures according to their job description.

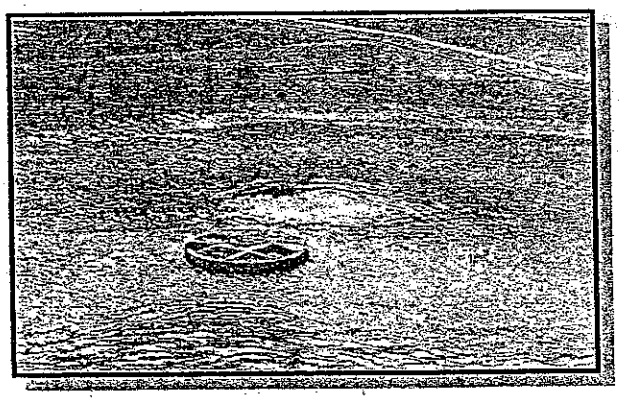
The owner or operator should maintain all of the safety equipment necessary for system staff to perform their daily activities and also undertake any emergency repairs. This equipment should include, at minimum:

- Atmospheric gas testing equipment
- Respirators and/or self-contained breathing apparatus
- Full body harness
- Tripods or non-entry rescue equipment
- Hard hats
- Safety glasses
- Rubber boots
- Rubber and/or disposable gloves
- Antibacterial soap
- First aid kit
- Protective clothing
- Confined space ventilation equipment
- Traffic and/or public access control equipment
- Hazardous gas meter

Each field crew vehicle should have adequate health and safety supplies. If the reviewer has access to the municipal vehicle storage area, he or she might choose to check actual vehicle stocks, not just supplies in storage.

2.2.5 Emergency Preparedness and Response

The collection system owner or operator should have a comprehensive plan in place for dealing with both routine and catastrophic emergencies. Routine emergencies include situations such as overflowing manholes, line breaks, localized electrical failure, and power outages at pump stations. Catastrophic emergencies include floods, tornados, earthquakes, other natural events, serious chemical spills, or widespread electrical



SSOs can include overflows out of manholes onto city streets, sidewalks, and surrounding areas (photo: U.S. EPA).

failure. Ideally, this plan is written, reviewed, and adjusted as needed at periodic intervals.

The reviewer should determine if the emergency response plan generally follows the guidelines described below. The location where the plan is housed may vary but, in general, such a document should be available in the yard office or other building commonly accessible to and frequented by collection system personnel. The emergency preparedness and response procedures may be contained in the collection system's O&M manual, or may be reflected in the descriptions of equipment and unit operations. Putting emergency procedures in a stand-alone document, rather than combining it with other information in the O&M manual, makes it easier for collection system personnel to find information.

The plan should utilize the most current information on the collection system. For larger systems, a structured analysis, or *risk assessment*, should be made of the collection system, treatment plant, and the community. The risk assessment should identify areas where the collection system is vulnerable to failure and determine the effect and relative severity to collection systems operations, equipment and public safety, and health of such a failure. The risk assessment should concentrate on such factors as topography, weather, sewer system size, and other site-specific factors which reflect the unique characteristics of the system. Once the areas of vulnerability are known, the collection system owner or operator should have appropriate plans in place to ensure collection system operations continue for the duration of the emergency.

The plans must clearly identify the steps staff should take in the event of emergency situations. Plans should include information on when it is appropriate to initiate and cease emergency operations. The plans should be very specific as to the collection system or repair equipment involved. Instructions should be available which explain how to operate equipment or systems during an emergency event when they are not functioning as intended but are not fully inoperable. The plan should also include specific procedures for reporting events that result in an overflow or other noncompliance event to the appropriate authorities.

The owner or operator should track emergency situations to become better prepared for future emergencies and to assist with reporting and maintaining compliance with emergency-related requirements. Typical components of an emergency program may include:

- General information regarding emergencies, such as telephone numbers of collection system personnel, fire department, and ambulance.
- Identification of hazards (e.g., chlorine storage areas) and use of universal classification system for hazards: combustible material, flammable liquids, energized electrical circuits, and hazardous materials.
- Vulnerability analysis that identifies the various types of emergencies that could occur, such as natural disasters, power outages, or equipment failures.
- Emergency response procedures.
- Methods to reduce risk of emergencies.
- Responsibilities of staff and management.

- Continuous training.

Procedures for emergency response plans should be understood and practiced by all personnel in order to ensure safety of the public and the collection system personnel responding. Procedures should be specific to the type of emergency that could occur. It is important to keep detailed records of all past emergencies in order to constantly improve response training, as well as the method and timing of future responses. The ability to deal with emergencies depends on the knowledge and skill of the responding crews, in addition to availability of equipment. The crew should be able to rapidly diagnose problems in the field under stress and select the right equipment needed to correct the problem. If resources are limited, consideration should be given to contracting other departments or private industries to respond to some emergency situations, for example, those rare emergencies that would exceed the capacity of staff.

2.2.6 Modeling

Computer programs (modeling programs) are available that are capable of simulating the different flows within the collection system. The purpose of modeling is to determine system capacity requirements with respect to sewer design and structural conditions. Therefore the input of accurate data on sizes, location, elevation, and condition of sewer system components such as pipes, manholes, and pump stations is necessary. When possible, flow monitoring data should be used to calibrate the model.

Reviewer - Point to Note
The reviewer should determine whether a model used by the owner or operator:

- Has user support
- Has adequate documentation such as a user's manual that describes data input requirements, output to be expected, model capabilities and limitations, and hardware

Modeling is also useful in examining effects before and after rehabilitation. For example, models can be applied to "before" and "after" scenarios to estimate the effects of repairs. If a collection system is not experiencing any capacity related issues (i.e., overflows, bypasses, basement backups, street flooding, hydraulic overload at the treatment plant, etc.) then maintenance of a model may be optional for that system, although most medium and large systems should maintain a model of the larger diameter portion of their system. If any of the mentioned conditions are occurring then development and maintenance of a model is essential to performing a capacity assessment in the problem areas.

Computer modeling is a specialized and complex subject. The reviewer may not have a comprehensive knowledge of modeling. If this is the case the he or she should obtain the following basic information:

- Is the owner or operator using a model?
- What areas of the collection system are being modeled and why?
- What model (including the version) is being used? Who developed the model and when?

- How are the modeling results being used?

2.2.7 Mapping

The importance of maintaining accurate, current maps of the collection system cannot be overstated. Efficient collection system maintenance 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. The collection system maps should contain information on the following:

- Main, trunk and interceptor sewers
- Building/house laterals
- Manholes
- Cleanouts
- Force mains
- Pump stations
- Service area boundaries
- Other landmarks (roads, water bodies, etc.)

Collection system maps should have a numbering system which uniquely identifies all manholes and sewer cleanouts. The system should be simple and easy to understand. Manholes and sewer cleanouts should have permanently assigned numbers and never be renumbered. Maps should also indicate the property served and reference its cleanout.

Sewer line maps 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. Other information that should be included on maps are access and overflow points, a scale, and a north arrow. All maps should have the date the map was drafted and the date of the last revision. Although optional, maps often include materials of pipe construction. 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.

Geographic Information System (GIS) technology have 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

Key Design Characteristics

- Line locations, grades, depths, and capacities
- Maximum manhole spacing and size
- Minimum pipe size
- Pumping Station dimensions and capacities
- Drop manholes
- Flow velocities and calculations (peak flow and low-flow)
- Accessibility features
- Other technical specifications (e.g., materials, equipment)

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 the owner or operator's management program.

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 engineering endeavors.

2.2.8 New Construction

The owner or operator should maintain strict control over the introduction of flows into the system from new construction. 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). Quality sanitary sewer designs keep costs and problems associated with operations, maintenance, and construction to a minimum. Design flaws are 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. Reviewers should examine construction inspection records and be able to answer the following:

- Does the volume of records seem reasonable given system size?
- Do records reflect that the public works inspectors are complying with procedures?

The state or other regulatory authority may also maintain standards for new construction. The standards held by the owner or operator should be at least as stringent. Start-up and testing should be in accordance with the manufacturers' recommendation where applicable and with recognized industry practices. Each step of the review, start-up, testing, and approval procedures should be documented.

The owner or operator approval procedure should reflect future ease of maintenance concerns. After construction is complete, a procedure for construction testing and inspection should be used. Construction supervision should be provided by qualified personnel such as a registered professional engineer.

2.2.9 Pump Stations

Proper operation, maintenance, and repair of pump stations typically requires special electrical, hydraulic, and mechanical knowledge. Pump station failure may damage equipment, the environment, or endanger public health. Variation in equipment types, pump station

configuration, and geographical factors determine pump station design and O&M requirements.

The reviewer should verify that the O&M manual contains procedures in writing for the following:

- Are pumps rotated manually or automatically? If manually, how frequently?
- Are wet well operating levels set to limit pump starts and stops?
- Is there a procedure for manipulating pump operations (manually or automatically) during wet weather to increase in-line storage of wet weather flows?
- Is flow monitoring provided? How is the data collected used?
- Does the pump station have capacity-related overflows? Maintenance related overflows? Is overflow monitoring provided?
- Is there a history of power outages? Is there a source of emergency power? If the emergency power source is a generator, is it regularly exercised under load?

2.3 Equipment and Collection System Maintenance

Every collection system owner or operator should have a well-planned, systematic, and comprehensive maintenance program. The goals of a maintenance program should include:

- Prevention of overflows
- Maximization of service and system reliability at minimum cost
- Assurance of infrastructure sustainability (i.e., ensure all components reach their service life)

There should then be procedures which describe the maintenance approach for various systems. In addition, there should be detailed instructions for the maintenance and repair of individual facilities. These instructions should provide a level of detail such that any qualified collection system personnel or repair technician could perform the repair or maintenance activity.

Maintenance may be planned or unplanned. There are essentially two types of planned maintenance; predictive and preventive. Predictive maintenance is a method that tries to look for early warning signs of equipment failure such that emergency maintenance is avoided. Preventive maintenance consists of scheduled maintenance activities performed on a regular basis. There are two types of unplanned maintenance, corrective and emergency. Corrective maintenance consists of scheduled repairs to problems identified under planned or predictive maintenance. Emergency maintenance are activities (typically repairs) performed in response to a serious equipment or line failure where action must be taken immediately. The goal of every owner or operator should be to reduce corrective and emergency maintenance through the use of planned and predictive maintenance. The reviewer should evaluate the progress of the owner or operator in achieving that goal. The goals of the reviewer in assessment of the maintenance program are:

- Identify SSOs caused by inadequate maintenance
- Determine maintenance trends (i.e., frequent emergency maintenance performed as opposed to predictive maintenance)
- Identify sustainability issues (i.e., inadequate maintenance to allow system components to reach service life and/or many components nearing or at service life)

2.3.1 Maintenance Budgeting

The cost of a maintenance program is a significant part of the annual operating budget. The collection system owner or operator should track all maintenance costs incurred throughout the year, both by internal staff and contractors, to ensure that the budget is based on representative costs from past years. Budgets should be developed from past cost records which usually are categorized according to preventive maintenance, corrective maintenance, and projected and actual major repair requirements. Annual costs should be compared to the budget periodically to control maintenance expenditures.

The reviewer should evaluate the maintenance budget keeping in mind the system's characteristics, such as age. Costs for emergency repairs should be a relatively small percentage of the budget; five to ten percent would not be considered excessive. The establishment of an "emergency reserve" may also be included as part of the maintenance budget. This is especially useful where full replacement is not funded. The budget should also be considered in light of maintenance work order backlog. The labor budget should be evaluated for consistency with local pay rates and staffing needs and the reviewer should compare local pay rates and staffing needs according to the tables in Section 2.1.1.

2.3.2 Planned and Unplanned Maintenance

A planned maintenance program is a systematic approach to performing maintenance activities so that equipment failure is avoided. Planned maintenance is composed of predictive and preventive maintenance. In the end, a good planned maintenance program should reduce material and capital repair and replacement costs, improve personnel utilization and morale, reduce SSOs, and sustain public confidence.

Examples of predictive maintenance includes monitoring equipment for early warning signs of impending failure, such as excess vibration, heat, dirty oil, and leakage. Assessment and inspection activities can be classified as predictive maintenance. Vibration and lubrication analyses, thermography, and ultrasonics are among the more common predictive maintenance tools. Predictive maintenance also takes into account historical information about the system as all systems will deteriorate over time. A predictive maintenance program strives to identify potential problem areas and

Reviewer - Point to Note
The reviewer should inquire as to whether tools such as vibration and lubrication analysis, thermography, or ultrasonics are used, and obtain information on the extent of the programs.

uncover trends that could affect equipment performance. Predictive maintenance offers an early warning. It allows collection system personnel to detect early signs of increasing rates of wear and therefore failure, and thus shift a "corrective" task into a "planned" task. To be truly effective predictive, however, maintenance should not spur personnel into doing the work too soon and wasting useful life and value of the equipment in question.

The basis of a good predictive maintenance program is recordkeeping. Only with accurate recordkeeping can baseline conditions be established, problem areas identified, and a proactive approach taken to repairs and replacement.

Effective preventive maintenance minimizes system costs and environmental impacts by reducing breakdowns and thus the need for corrective or emergency maintenance, improves reliability by minimizing the time equipment is out of service, increases the useful life of equipment thus avoiding costly premature replacement, and avoids potential noncompliance situations. An effective preventive maintenance program includes:

- Trained personnel
- Scheduling based on system specific knowledge
- Detailed instructions related to the maintenance of various pieces of equipment
- A system for recordkeeping
- System knowledge in the form of maps, historical knowledge and records

An effective preventive maintenance program builds on the inspection activities and predictive maintenance described in Sections 2.4.1 to 2.4.4, and includes a well thought-out schedule for these activities.

Lubrication

Lubrication is probably one of the most important maintenance activities for mechanical systems, such as pumps and motors. Frequency of lubrication, choice of lubricant and lubrication procedure are all important factors in this activity. These items should closely follow manufacturer instructions, but may be modified to fit site-specific conditions and particular equipment applications.

The basis of the schedule for mechanical equipment maintenance (i.e., pump station components) should be the manufacturers' recommended activities and frequencies. This schedule may then be augmented by the knowledge and experience of collection system personnel to reflect the site-specific requirements. The schedule for sewer line cleaning, inspection, root removal, and repair activities should be based on periodic inspection data. In most systems, uniform frequencies for sewer line cleaning, inspection, and root removal are not necessary and inefficient. In many systems, a relatively small percentage of the pipe generates most of the problems. Efficient use of inspection data allows the owner or operator to implement a schedule in the most constructive manner. In rare cases it may be appropriate to reduce maintenance frequency for a particular piece of equipment. An example of a scheduling code and maintenance schedule for a pump is shown below:

Rotary Pump Maintenance Schedule	
Frequency	**Maintenance Required**
D	Check packing gland assembly
D	Check discharge pressure
S	Inspect and lubricate bearings
A	Flush bearings and replace lubricant

D = Daily A = Annually
S = Semiannually

Typically, there is a maintenance card or record for each piece of equipment within the collection system. These records should contain maintenance recommendations, schedule, and instructions on conducting the specific maintenance activity. The records should include documentation regarding any maintenance activities conducted to date and other observations related to that piece of equipment or system. Maintenance records are generally kept where maintenance personnel have easy access to them. The reviewer should examine the full series of periodic work orders (i.e. weekly, monthly, semiannually, and annually) for a selection of system components (e.g., a few pump stations, several line segments). The reviewer should then compare the recommended maintenance frequency to that which is actually performed. He or she should also look at the backlog of work; not focusing solely on the number of backlogged work orders, but on what that number represents in time. A very large system can have a hundred orders backlogged and only be one week behind. In a computerized system, a listing of all open work orders is usually very simple for collection system personnel to generate. The owner or operator should be able to explain their system for prioritizing work orders.

The reviewer needs to clearly understand the following:

- How the maintenance data management system works
- How work orders are generated and distributed
- How field crews use the work orders
- How data from the field is collected and returned
- How and on whose authority work orders are closed out

The reviewer should check to see if data entry is timely and up to date.

Unplanned maintenance is that which takes place in response to equipment breakdowns or emergencies. Unplanned maintenance may be corrective or emergency maintenance. Corrective maintenance could occur as a result of preventive or predictive maintenance activities which identified a problem situation. A work order should be issued so that the request for corrective maintenance is directed to the proper personnel. An example of non-emergency corrective maintenance could be a broken belt on a belt driven pump. The worn belt was not detected and

replaced through preventive maintenance and therefore the pump is out of service until corrective maintenance can be performed. Although the pump station may function with one pump out of service, should another pump fail, the situation may become critical during peak flow periods.

If the information can be easily generated the reviewer should select a sampling of work orders and compare them to the corrective maintenance database to determine if repairs are being made in a timely manner. Reviewers should note the current backlog of corrective maintenance work orders. A corrective maintenance backlog of two weeks or less would indicate an owner or operator in control of corrective maintenance. The owner or operator should be able to explain corrective maintenance work orders that have not been completed within six months.

Corrective maintenance takes resources away from predictive and preventive maintenance. When corrective maintenance becomes a predominant activity, personnel may not be able to perform planned maintenance, thus leading to more corrective maintenance and emergency situations. Emergency maintenance occurs when a piece of equipment or system fails, creating a threat to public health, the environment, or associated equipment. This type of maintenance involves repairs, on short notice, of malfunctioning equipment or sewers. A broken force main, totally non-functional pump station, and street cave-ins are all examples of emergency situations.

Types of Portable Emergency Equipment

- Bypass pumps
- Portable generator
- Air compressor, trailer-mounted
- Manhole lifters and gas testing equipment
- Sewer rodder and/or flushing machine
- Portable lights and hand tools
- Chemical spray units (for insects and rodent control)
- Truck (1-ton) and trailers
- Vacuum truck
- Repair equipment for excavation (backhoe, shoring equipment, concrete mixers, gasoline operated saws, traffic control equipment, etc.)
- Confined space entry gear

Emergency crews should be geared to a 24-hour-a-day, year-round operation. Most large systems have staffed 24-hour crews; many small systems have an "on-call" system. The owner or operator should be able to produce written procedures which spell out the type of action to take in a particular type of emergency and the equipment and personnel requirements necessary to carry out the action. The crews should have copies of these procedures and be familiar with them. Equipment must be located in an easily accessible area and be ready to move in a short period of time. Vehicles and equipment must be ready to perform, under extreme climatic conditions if necessary. The emergency crew

Reviewer - Point to Note
The reviewer should note the presence of supplies during the review of the yard where equipment and spare parts are maintained and personnel are dispatched.

may need materials such as piping, pipe fittings, bedding materials and concrete. The owner or operator should have supplies on hand to allow for two point (i.e. segment, fitting, or appurtenance) repairs of any part of its system.

Pump stations should be subject to inspection and preventive maintenance on a regular schedule. The frequency of inspection may vary from once a week, for a reliable pump station equipped with a telemetry system, to continuous staffing at a large pump station. The basic inspection should include verification that alarm systems are operating properly, wet well levels are properly set, all indicator lights and voltage readings are within acceptable limits, suction and discharge pressures are within normal limits, that the pumps are running without excessive heat or vibration and have the required amount of lubrication, and that the emergency generator is ready if needed. Less frequent inspections may include such items as vibration analysis and internal inspection of pump components.

Owner or Operator - Point to Note
Occasionally a supervisor should perform an unscheduled inspection to confirm that tasks have been performed as expected.

Observations and tasks performed should be recorded in a log book or on a checklist at the pump station. It is important to note how this data returns to the central maintenance data management system. At the time of the inspection, collection system personnel may perform minor repairs if necessary. If non-emergency repairs are required that are beyond the staff's training, it will probably be necessary to prepare a work order which routs a request though the proper channels to initiate the repair action. During the review the reviewer should check a random number of work orders to see how they move through the system. The reviewer should note whether repairs are being carried out promptly. In pump stations, for critical equipment (pumps, drives, power equipment, and control equipment), there should not be much backlog, unless the staff is waiting for parts.

During the review, the reviewer should also make on-site observations of a representative pump stations. The reviewer should plan at least half an hour to look at the simplest two-pump prefabricated station, and one to two hours to look at a larger station. In large systems, drive time between stations may be significant. The reviewer should strive to see a range of pump station sizes and types (i.e., the largest, smallest, most remote and any that review of work orders has indicated might be problematic).

Overall, the pump station should be clean, in good structural condition and exhibit minimal odor. The reviewer should note the settings of the pumps (i.e., which are operating, which are on stand-by, and which are not operating and why). The operating pumps should be observed for noise, heat, and excessive vibration. The settings in the wet well should be noted (as indicated on the controls, as direct observation of the reviewer in the wet well is not recommended) and the presence of any flashing alarm lights. The reviewer is reminded of the atmospheric hazards in a pump station (make sure ventilation has been running prior to arrival) and to avoid confined

space entry. If the pump station has an overflow its outlet should be observed, if possible, for signs of any recent overflows such as floatable materials or toilet paper. The reviewer should check the log book and/or checklist kept at the pump station to ensure that records are current and all maintenance activities have been performed. Below is a listing of items that indicate inadequate maintenance:

- Overall poor housekeeping and cleanliness
- Excessive grease accumulation in wet well
- Excessive corrosion on railings, ladders, and other metal components
- Sagging, worn, improperly sized, or inadequate belts
- Excessive equipment out of service for repair or any equipment for which repair has not been ordered (i.e., a work order issued)
- Pumps running with excessive heat, vibration, or noise
- Peeling paint and/or dirty equipment (the care given to equipment's outer surfaces often, but not always, mirrors internal condition)
- Check valves not closing when pumps shut off
- Inoperative instrumentation, alarms, and recording equipment
- "Jury-rigged" repairs (i.e., "temporary" repairs using inappropriate materials)
- Leakage from pumps, piping, or valves (some types of pump seals are designed to "leak" seal water)
- Inadequate lighting or ineffective/inoperative ventilation equipment

2.3.3 Sewer Cleaning

The purpose of sewer cleaning is to remove accumulated material from the sewer. Cleaning helps to prevent blockages and is also used to prepare the sewer for inspections. Stoppages 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. 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 solids that eventually block the sewer. If the flow is less than approximately 1.0 to 1.4 feet per second, grit and solids can accumulate leading to a potential blockage.

Results of Various Flow Velocities

Velocity	Result
2.0 ft/sec	Very little material buildup in pipe
1.4-2.0 ft/sec	Heavier grit (sand and gravel) begin to accumulate
1.0-1.4 ft/sec	Inorganic grit and solids accumulate
Below 1.0 ft/sec	Significant amounts of organic and inorganic solids accumulate

(EPA 1974)

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 material from the sewer. Chemical cleaning can facilitate the control of odors, grease buildup, root growth, corrosion, and insect and rodent infestation. For additional information on sewer cleaning methods refer to Volumes I and II of *Operation and Maintenance of Wastewater Collection Systems* (CSU Sacramento 1996 and 1998).

Sewer Cleaning Records

- Date, time, and location of stoppage or routine cleaning activity
- Method of cleaning used
- Cause of stoppage
- Identity of cleaning crew
- Further actions necessary and/or initiated
- Weather conditions

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 of the collection system susceptible to stoppages such that all portions of the system can be on an appropriate schedule. The reviewer should examine the records for legibility and completeness. He or she should then review the database to determine if entry of the field notes is current and accurate.

Root and grease buildup can cause blockages in a sewer system [photo: North Carolina Department of Natural Research (NCDNR)].

Sewers vary widely in their need for preventive cleaning. The collection system in a restaurant district may require cleaning every six months in order to prevent grease blockages. An area of the sewer system with new PVC piping and no significant grease contribution with reasonable and consistent slopes (i.e., no sags) may be able to go five years with no problems.

The owner or operator should be able to identify problem collection system areas, preferably on a map. Potential problem areas 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. 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 grease producing activities, etc).

2.3.4 Parts and Equipment Inventory

An inventory of spare parts, equipment, and supplies should be maintained by the collection system owner or operator. The inventory should be based on equipment manufacturer's recommendations, supplemented by historical experience with maintenance and equipment problems. Without such an inventory, the collection system may experience long down times or periods of inefficient operation in the event of a breakdown or malfunction.

Basic Equipment Inventory

- Type, age, and description of the equipment
- Manufacturer
- Fuel type and other special requirements
- Operating costs and repair history

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 always has adequate tools. Tools should be subject to sign out procedures to provide accountability. Tools and equipment should be replaced at the end of their useful life. The reviewer should inquire as to how this is determined and how funds are made available to ensure this is the case. In addition, the reviewer should look at the tools and note their condition.

The owner or operator should maintain a yard where equipment, supplies, and spare parts are maintained and personnel are dispatched. Very large systems may maintain more than one yard. In this case, the reviewer should perform a visual survey at the main yard. In small to medium size systems, collection system operations may share the yard with the department of public works, water department, or other municipal agencies. In this case the reviewer should determine what percentage is being allotted for collection system items. The most important features of the yard are convenience and accessibility.

The reviewer should observe a random sampling of inspection and maintenance crew vehicles for equipment as described above. A review of the equipment and manufacturer's manuals aids in determining what spare parts should be maintained. The owner or operator should then consider the frequency of usage of the part, how critical the part is, and finally how difficult the part is to obtain when determining how many of the part to keep in stock. Spare parts should be kept in a clean, well-protected stock room. Critical parts are those which are essential to the operation of the collection system. Similar to equipment and tools management, a tracking system should be in place, including procedures on logging out materials, when maintenance personnel must use them. The owner or operator should be able to produce the spare parts inventory and clearly identify those parts deemed critical. The reviewer should evaluate the inventory and selected items in the stockroom to determine whether the specified number of these parts are being maintained.

Owner or Operator - Point to Note
The owner or operator should have a procedure for determining which spare parts are critical.

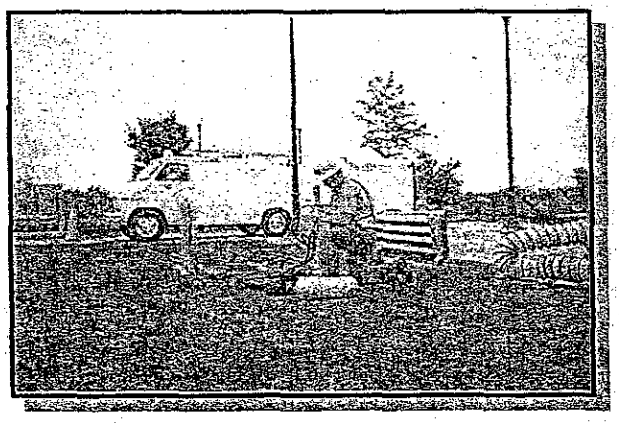
2.4 Sewer System Capacity Evaluation - Testing and Inspection

The collection system owner or operator should have a program in place to periodically evaluate the capacity of the sewer system in both wet and dry weather flows and ensure the capacity is maintained as it was designed. 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 system components. The inventory should include the following basic information about the system:

- Population served
- Total system size (feet or miles)
- Inventory of pipe length, size, material and age, and interior and exterior condition as available
- Inventory of appurtenances such as bypasses, siphons, diversions, pump stations, tide or flood gates and manholes, etc., including size or capacity, material and age, and condition as available
- Force main locations, length, size and materials, and condition as available
- Pipe slopes and inverts
- Location of house laterals - both upper and lower

The system then undergoes general inspection (described below in Sections 2.4.1 to 2.4.4) which serves to continuously update and add to the inventory information.

The next step in the capacity evaluation is to identify the location of wet weather related SSOs, 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. The reviewer should determine that the capacity evaluation includes an estimate peak flows experienced in the system, an estimate of the capacity of key system components, and identifies the major sources of I/I that contribute to hydraulic overloading events. The capacity evaluation should also make use of a hydraulic model, if any, to identify areas with hydraulic limitations and evaluate alternatives to alleviate capacity limitations. 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 (photo: N.J. Department of Environmental Protection).

2.4.1 Flow Monitoring

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 I/I. Flow measurement may also be performed for billing purposes, to assess the need for new sewers in a certain area, or to calibrate a model. There are three techniques commonly used for monitoring flow rates: (1) permanent and long-term, (2) temporary, and (3) instantaneous. Permanent installations are done at key points in the collection system such as the discharge point of a satellite collection system, pump stations, and key junctions. Temporary monitoring consists of flow meters typically installed for 30-90 days. Instantaneous flow metering is performed by collection system personnel, one reading is taken and then the measuring device is removed. The collection system owner or operator should have a flow monitoring plan that describes their flow monitoring strategy or should at least be able to provide the following information:

- Purpose of the flow monitoring
- Location of all flow meters
- Type of flow meters
- Flow meter inspection and calibration frequency

A flow monitoring plan 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.

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 I/I component. Infiltration is the seepage of groundwater into pipes or manholes through defects such as cracks, broken joints, etc. Inflow 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. Many collection system owners or operators add a third classification: rainfall induced infiltration (RII). RII is stormwater that enters the collection system through defects that lie so close to the ground surface that they are easily reached. Although not from piped sources, RII tends to act more like inflow than infiltration.

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 excessive I/I. 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.

The owner or operator should have in place a program for the efficient identification of excessive I/I. 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. The reviewer should evaluate the program including procedures and records associated with the flow monitoring plan. 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 inspection and rehabilitation activities.

2.4.2 Sewer System Testing

Sewer system testing techniques are often used to identify leaks which allow unwanted infiltration into the sewer system and determine the location of illicit connections and other sources of stormwater inflow. Two commonly implemented techniques include smoke testing and dyed water testing. 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. The reviewer should also evaluate any public relations program and assess how the owner or operator communicates with the public during these tests (i.e., when there is a possibility of smoke entering a home or building).

Smoke testing 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. 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, usually via a manhole. Sources of inflow can then be identified when smoke escapes through them.

Areas Usually Smoke Tested

- Drainage paths
- Ponding areas
- Roof leaders
- Cellars
- Yard and area drains
- Fountain drains
- Abandoned building sewers
- Faulty service connections

If the collection system owner or operator implements a regular program of smoke testing, the program should include a public notification procedure. The owner or operator should also have procedures to define:

- How line segments are isolated
- The maximum amount of line to be smoked at one time
- The weather conditions in which smoke testing is conducted (i.e., no rain or snow, little wind and daylight only)

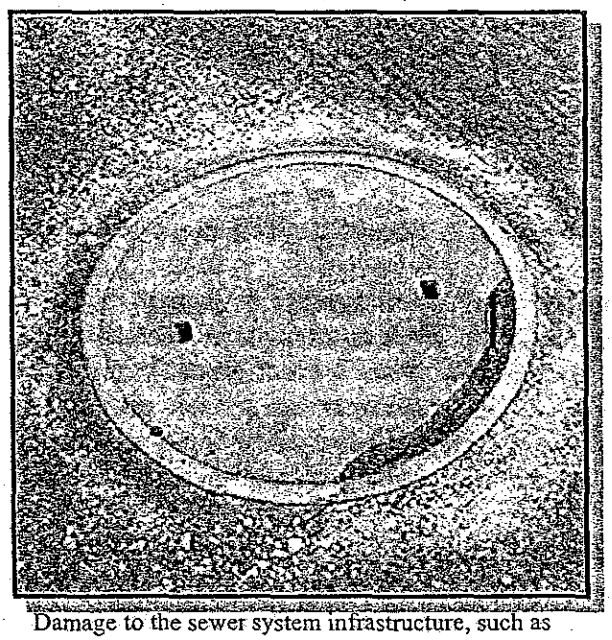
The results of positive smoke tests should be documented with carefully labeled photographs. Building inspections are sometimes conducted as part of a smoke testing program and, in some cases, may be the only way to find illegal connections. If properly connected to the sanitary sewer system, smoke should exit the vent stacks of the surrounding properties. If traces of the

smoke or its odor enter the building, it is an indication that gases from the sewer system may also be entering. Building inspections can be labor intensive and require advanced preparation and communication with the public.

Dyed water testing may be used to establish the connection of a fixture or appurtenance 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. Dyed water testing 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/corbel, and walls of the manhole.

2.4.3 Sewer System Inspection

Visual inspection of manholes and pipelines are the first line of defense in the identification of existing or potential problem areas. 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 degree of I/I problems, and the physical state-of-repair of the system. By observing the manhole directly and the incoming and outgoing lines with a mirror, it is possible to determine structural condition, the presence of roots, condition of joints, depth of debris in the line, and depth of flow. The reviewer should examine the records of visual inspections to ensure that the following information is recorded:



Damage to the sewer system infrastructure, such as this broken manhole cover allows stormwater into the sewer system (photo: Limno-Tech, Inc.)

- Manhole identification number and location
- Cracks or breaks in the manhole or pipe (inspection sheets and/or logs should record details on defects)
- Accumulations of grease, debris, or grit
- Wastewater flow characteristics (e.g., flowing freely or backed up)
- Inflow
- Infiltration (presence of clear water in or flowing through the manhole)
- Presence of corrosion
- Offsets or misalignments
- Condition of the frame
- Evidence of surcharge
- Atmospheric hazard measurements (especially hydrogen sulfide)
- If repair is necessary, a notation as to whether a work order has been issued

Manholes should undergo routine inspection typically every one to five years. There should be a baseline for manhole inspections (e.g., once every two years) with problematic manholes being inspected more frequently. The reviewer should conduct visual observation at a small but representative number of manholes for the items listed above.

There are various pipeline inspection techniques, the most common include: lamping, camera inspection, sonar, and CCTV. These will be explained further in the following sections.

2.4.3.1 Sewer System Inspection Techniques

Sewer inspection 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 a inspection program includes frequency and schedule of inspections and procedures to record the results. Sewer system cleaning should always be considered before inspection is performed in order to provide adequate clearance and inspection results. Additionally, a reviewer should evaluate records maintained for inspection activities including if information is maintained on standardized logs and should include:

- Location and identification of line being inspected
- Pipe size and type
- Name of personnel performing inspection
- Distance inspected
- Cleanliness of the line
- Condition of the manhole with pipe defects identified by footage from the starting manhole
- Results of inspection, including estimates of I/I

Lamping 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 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 confined space entry and little equipment and set-up time is required.

Camera inspection is more comprehensive then lamping 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. This technique is often employed in larger lines where access points are far apart. Similarly to lamping, portions of the pipe may still be missed using this technique. Obviously, there also must be flow in the pipe for the raft to float. This technique also does not fully capture the invert of the pipe and its condition.

Sonar is a newer technology deployed similarly to CCTV cameras, described in more detail below. The sonar emits a pulse which bounces off the walls of the sewer. The time it takes for

this pulse to bounce back provides data providing 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.

Sewer scanner and evaluation is an experimental technology where a 360 degree scanner produces a full digital picture 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 CCTV, but not all types of sewer defects may be identified as readily (i.e., infiltration, corrosion).

Closed Circuit Television (CCTV) inspections are a helpful tool for early detection of potential problems. 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. CCTV inspections 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. CCTV, however, eliminates the hazards associated with confined space entry. The output is displayed on a monitor and videotaped. A benefit of CCTV inspection is that a permanent visual record is captured for subsequent reviews.

2.5 Sewer System Rehabilitation

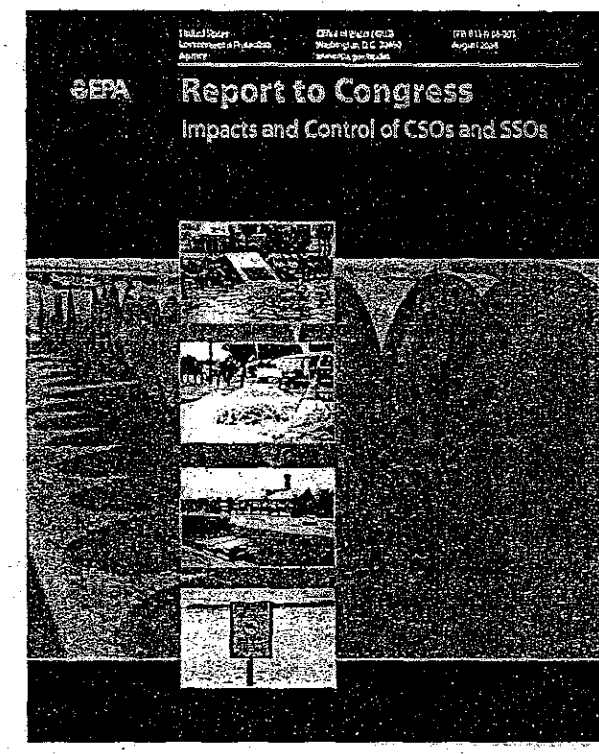
The collection system owner or operator should have a sewer rehabilitation program. The objective of sewer rehabilitation is to maintain the overall viability of a collection system. This is done in three ways: (1) ensuring its structural integrity; (2) limiting the loss of conveyance and wastewater treatment capacity due to excessive I/I; and (3) limiting the potential for groundwater contamination by controlling exfiltration from the pipe network. The rehabilitation program should build on information obtained as a result of all forms of maintenance and observations made as part of the capacity evaluation and asset inventory 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 prioritorized. Priorities may be stated in the written program or may be determined through interviews with system personnel.

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

Structural repairs 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).

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. An reviewer who wants further guidance on methods of rehabilitation may consult:

- Technology Description from 2004 Report to Congress (EPA 2004)
- *Operation and Maintenance of Wastewater Collection Systems,* Volumes I and II (CSU Sacramento 1996 and 1998)
- *Existing Sewer Evaluation and Rehabilitation* (WEF 1994)



The reviewer should determine the owner's or operator's policies regarding service lateral rehabilitation since service laterals can constitute a serious source of I/I. Manholes should not be neglected in the rehabilitation program. Manhole covers can allow significant inflow to enter the system because they are often located in the path of surface runoff. Manholes themselves can also be a significant source of infiltration 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. The reviewer should compare the rehabilitation accomplished with that recommended by the capacity evaluation program. When examining the collection system rehabilitation program, the reviewer should be able to answer the following questions:

- Is rehabilitation taking place before it becomes emergency maintenance?
- Are recommendations made as a result of the previously described inspections?
- Does the rehabilitation program take into account the age and condition of the sewers?

CHAPTER 3. CHECKLIST FOR CONDUCTING EVALUATIONS OF WASTEWATER COLLECTION SYSTEM CAPACITY, MANAGEMENT, OPERATION, AND MAINTENANCE (CMOM) PROGRAMS

The following is a comprehensive checklist available for use in the review process. The checklist consists of a series of questions organized by major categories and sub-categories. The major category is followed by a brief statement describing the category. Following the sub-category is a brief clarifying statement. References are then given.

Questions are provided in a table format that includes the question, response, and documentation available.

Response is completed by using information and data acquired from the data and information request, onsite interviews, and site reviews. An alternative to this process is to transmit the entire checklist to the collection system owner or operator to complete and return electronically.

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I. General Information - Collection System Description

Question	Response	Documentation Available	
		Yes	No
Size of service area (acres).			
Population of service area.			
Number of pump stations.			
Feet (or miles) of sewer.			
Age of system (e.g., 30% over 30 years, 20% over 50 years, etc.).			

Comments:

II. Continuing Sewer Assessment Plan

Question	Response	Documentation Available	
		Yes	No
Does the collection system experience problems related to I/I? How do these problems manifest themselves? (Manhole overflows, basement flooding, structure, SSOs)			
How does the owner or operator prioritize investigation, repairs and rehabilitation related to I/I?			
What methods are considered to remedy hydraulic deficiencies?			
Does the plan include a schedule for investigative activities?			
Is the plan regularly updated?			

Comments:

III. A. Collection System Management: Organizational Structure

Question	Response	Documentation Available	
		Yes	No
Is an organizational chart available that shows the overall personnel structure for the collection system, including operation and maintenance staff?			
Are there organizational charts that show functional groups and classifications?			
Are up to date job descriptions available that delineate responsibilities and authority for each position?			
Are the following items discussed in the job descriptions: ☐ nature of work to be performed, ☐ minimum requirements for the position, ☐ necessary special qualifications or certifications, ☐ examples of the types of work, ☐ list of licences required for the position, ☐ performance measures or promotional potential?			
Does the organizational chart indicate how many positions are budgeted as opposed to actually filled?			
On average, how long do positions remain vacant?			
Are collection system staff responsible for any other duties, (e.g., road repair or maintenance, O&M of the storm water collection system)?			

Comments:

III. B. Collection System Management: Training

Question	Response	Documentation Available	
		Yes	No
Is there a documented formal training program?			
Does the training program address the fundamental mission, goals, and policies of the collection system owner or operator?			
Does the owner or operator provide training in the following areas: ☐ safety, ☐ routine line maintenance, ☐ confined space entry, ☐ traffic control, ☐ record keeping, ☐ electrical and instrumentation, ☐ pipe repair, ☐ bursting CIPP, ☐ public relations, ☐ SSO/emergency response, ☐ pump station operations and maintenance, ☐ CCTV and trench/shoring, ☐ other?			
Which of these programs have formal curriculums?			
Does On-the-Job (OJT) training use Standard Operating and Standard Maintenance Procedures (SOPs & SMPs)?			
Is OJT progress and performance measured?			
Does the owner or operator have mandatory training requirements identified for key employees?			
What percentage of employees met or exceeded their annual training goals during the past year?			
Which of the following methods are used to assess the effectiveness of the training: ☐ periodic testing, ☐ drills, ☐ demonstration, ☐ none?			
What percentage of the training offered by the owner or operator is in the form of the following: manufacturer training, on-the-job training, in-house classroom training, industry-wide training?			

Comments:

III. C. Collection System Management: Communication and Customer Service

Question	Response	Documentation Available	
		Yes	No
What type of public education/outreach programs does the owner or operator have about user rates?			
Do these programs include communication with groups such as local governments, community groups, the media, schools, youth organizations, senior citizens? List applicable groups.			
Is there a public relations program in place?			
Are the employees of the collection system trained in public relations?			
Are there sample correspondence or "scripts" to help guide staff through written or oral responses to customers?			
What methods are used to notify the public of major construction or maintenance work: ☐ door hangers, ☐ newspaper, ☐ fliers, ☐ signs, ☐ other, ☐ none?			
Is the homeowner notified prior to construction that his/her property may be affected?			
Is information provided to residents on cleanup procedures following basement backups and overflows from manholes when they occur?			
Which of the following methods are used to communicate with system staff: ☐ regular meetings, ☐ bulletin boards, ☐ e-mail, ☐ other?			
How often are staff meetings held (e.g., daily, weekly, monthly)?			
Are incentives offered to employees for performance improvements?			
Does the owner or operator have an "Employee of the Month/Quarter/Year" program?			

Question	Response	Documentation Available	
		Yes	No
How often are performance reviews conducted (e.g., semi-annually, annually, etc.)?			
Does the owner or operator regularly communicate with other municipal departments?			
Does the owner or operator have a formal procedure in place to evaluate and respond to complaints?			
What are the common complaints received?			
Does the owner or operator have a process for customer evaluation of the services provided?			
Do customer service records include the following information: ☐ personnel who received the complaint or request, ☐ nature of complaint or request, ☐ to whom the follow-up action was assigned, ☐ date of the complaint or request, ☐ date the complaint or request was resolved, ☐ customer contact information, ☐ location of the problem, ☐ date the follow-up action was assigned, ☐ cause of the problem, ☐ feedback to customer?			
Does the owner or operator have a goal for how quickly customer complaints (or emergency calls) are resolved?			
What percentage of customer complaints (or emergency calls) are resolved within the timeline goals?			
How are complaint records maintained? (i.e., computerized) Is this information used as the basis for other activities such as routine preventative maintenance?			

Comments:

III. D. Collection System Management: Management Information Systems

Question	Response	Documentation Available	
		Yes	No
What types of work reports are prepared by the O&M Staff?			
Do the work reports include enough information? (See example report forms)			
How are records kept?			
Are records maintained for a period of at least three years?			
Are the records able to distinguish activities taken in response to an overflow event?			
Does the owner or operator use computer technology for its management information system? (Computer Based Maintenance Management Systems, spreadsheets, data bases, SCADA, etc). If so, what type of system(s) is used?			
Are there written instructions for managing and tracking the following information: ☐ complaint work orders, ☐ scheduled work orders, ☐ customer service, ☐ scheduled preventative maintenance, ☐ scheduled inspections, ☐ sewer system inventory, ☐ safety incidents, ☐ scheduled monitoring/sampling, ☐ compliance/overflow tracking, ☐ equipment/tools tracking, ☐ parts inventory?			
Do the written instructions for tracking procedures include the following information: ☐ accessing data and information, ☐ instructions for using the tracking system, ☐ updating the MIS, ☐ developing and printing reports?			
How often is the management information system updated (immediately, within one week of the incident, monthly as time permits)?			

Comments:

III. E. Collection System Management: SSO Notification Program

Question	Response	Documentation Available	
		Yes	No.
Does the owner or operator have standard procedures for notifying state agencies, health agencies, the regulatory authority, and the drinking water purveyor of overflow events?			
Are above notification procedures dependent on the size or location of the overflow? If so, describe this procedure.			
Is there a Standard form for recording overflow events? Does it include location, type, receiving water, estimated volume, cause?			
Are chronic SSO locations posted?			

Comments:

III. F. Collection System Management: Legal Authority

Question	Response	Documentation Available	
		Yes	No
Does the collection system receive flow from satellite communities?			
What is the total area from satellite communities that contribute flow to the collection system (acres or square miles)?			
Does the owner or operator require satellite communities to enter into an agreement?			
Does the agreement include the requirements listed in the sewer use ordinance (SUO)?			
Do the agreements have a date of termination and allow for renewal under different terms?			
Does the owner or operator maintain the legal authority to control the maximum flow introduced into the collection system from satellite communities?			
Are standards, inspections, and approval for new connections clearly documented in a SUO?			
Does the SUO require satellite communities to adopt the same industrial and commercial regulator discharge limits as the owner or operator?			
Does the SUO require satellite communities to adopt the same inspection and sampling schedules as required by the pretreatment ordinance?			
Does the SUO require the satellite communities or the owner or operator to issue control permits for significant industrial users?			
Does the SUO contain provisions for addressing overstrength wastewater from satellite communities?			
Does the SUO contain procedures for the following: inspection standards, pretreatment requirements, building/sewer permit issues?			

Does the SUO contain general prohibitions of the following materials: ☐ fire and explosion hazards, ☐ oils or petroleum, ☐ corrosive materials, ☐ materials which may cause interference at the wastewater treatment plant, ☐ obstructive materials?			
Does the SUO contain procedures and enforcement actions for the following: ☐ fats, oils, and grease (FOG); ☐ I/I; building structures over the sewer lines; ☐ storm water connections to sanitary lines; ☐ defects in service laterals located on private property; ☐ sump pumps, air conditioner?			

Comments:

IV. A. Collection System Operation: Budgeting

Question	Response	Documentation Available	
		Yes	No
What are the owner or operator's current rates?			
What is the average annual fee for residential users?			
How are user rates calculated?			
How often are user charges evaluated and adjusted based on that evaluation?			
How many rate changes have there been in the last 10 years and what were they?			
Does the owner or operator receive sufficient funding from its revenues?			
Are collection system enterprise funds used for non-enterprise fund activities?			
Is there a budget for annual operating costs?			
Does the budget provide sufficient line item detail for labor, materials and equipment?			
Are costs for collection system O&M separated from other utility services, i.e., water, storm water and treatment plants?			
Do O&M managers have current O&M budget data?			
What is the collection system's average annual O&M budget?			
What percentage of the collection system's overall budget is allocated to maintenance of the collection system?			
Does the owner or operator have a Capital Improvement Plan (CIP) that provides for system repair/replacement on a prioritized basis?			
What is the collection system's average annual CIP budget?			

Question	Response	Documentation Available	
		Yes	No
What percentage of the maintenance budget is allotted to the following maintenance: Predictive maintenance (tracking design, life span, and scheduled parts replacement), preventative maintenance (identifying and fixing system weakness which, if left unaddressed, could lead to overflows), corrective maintenance (fixing system components that are functioning but not at 100% capacity/efficiency), emergency maintenance (reactive maintenance, overflows, equipment breakdowns).			
Does the owner or operator have a budgeted program for the replacement of under-capacity pipes?			
Does the owner or operator have a budgeted program for the replacement of over-capacity pipes?			
Are O&M staff involved in O&M budget preparation?			
How are priorities determined for budgeting for O&M during the budget process?			
Does the owner or operator maintain a fund for future equipment and infrastructure replacement?			
How is new work typically financed?			

Comments:

IV. B. Collection System Operation: Compliance

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have inter-jurisdictional or inter-municipal agreements?	Already asked		
Is there a sewer-use and a grease ordinance?			
Is there a process in place for enforcing sewer and grease ordinances?			
Are all grease traps inspected regularly?			
How does the owner or operator learn of new or existing unknown grease traps?			
Who is responsible for enforcing the sewer ordinance and grease ordinance? Does this party communicate with the utility department on a regular basis?			
Are there any significant industrial dischargers to the system?			
Is there a pretreatment program in place? If so, please describe.			
Is there an ordinance dealing with private service laterals?			
Is there an ordinance dealing with storm water connections or requirements to remove storm water connections?			

Comments:

IV. C. Collection System Operation: Water Quality Monitoring

Question	Response	Documentation Available	
		Yes	No
Is there a water quality monitoring program in the service areas?			
If so, who performs the monitoring?			
How many locations are monitored?			
What parameters are monitored and how often?			
Is water quality monitored after an SSO event?			
Are there written standard sampling procedures available?			
Is analysis performed in-house or by a contract laboratory?			
Are chain-of-custody forms used?			

Comments:

IV. D. Collection System Operation: Hydrogen Sulfide Monitoring and Control

Question	Response	Documentation Available	
		Yes	No
Are odors a frequent source of complaints? How many?			
Are the locations of the frequent odor complaints documented?			
What is the typical sewer slope? Does the owner or operator take hydrogen sulfide corrosion into consideration when designing sewers?			
Does the collection system owner or operator have a hydrogen sulfide problem, and if so, does it have in place corrosion control programs? What are the major elements of the program?			
Does the owner or operator have written procedures for the application of chemical dosages?			
Are chemical dosages, dates, and locations documented?			
Does the owner or operator have a program in place for renewing or replacing severely corroded sewer lines to prevent collapse?			
Are the following methods used for hydrogen sulfide control: ☐ aeration, ☐ iron salts, ☐ enzymes, ☐ activated charcoal canisters, ☐ chlorine, ☐ sodium hydroxide, ☐ hydrogen peroxide, ☐ potassium permanganate, ☐ biofiltration, ☐ others?			
Does the system contain air relief valves at the high points of the force main system?			
How often are th valves maintained and inspected (weekly, monthly, etc.)?			
Does the owner or operator enforce pretreatment requirements?			

Comments:

IV. E. Collection System Operation: Safety

Question	Response	Documentation Available	
		Yes	No
Is there a documented safety program supported by the top administration official?			
Is there a Safety Department that provides training, equipment, and an evaluation of procedures?			
If not, who provides safety training?			
Does the owner or operator have written procedures for the following: ☐ lockout/tagout, ☐ MSDS, ☐ chemical handling, ☐ confined spaces permit program, ☐ trenching and excavations, ☐ biological hazards in wastewater, ☐ traffic control and work site safety, ☐ electrical and mechanical systems, ☐ pneumatic and hydraulic systems safety?			
What is the agency's lost-time injury rate(percent or in hours)?			
Is there a permit required confined space entry procedure for manholes, wetwells, etc.? Are confined spaces clearly marked?			
Are the following equipment items available and in adequate supply: ☐ rubber/disposable gloves; ☐ confined space ventilation equipment; ☐ hard hats, ☐ safety glasses, ☐ rubber boots; ☐ antibacterial soap and first aid kit; ☐ tripods or non-entry rescue equipment; ☐ fire extinguishers; ☐ equipment to enter manholes; ☐ portable crane/hoist; ☐ atmospheric testing equipment and gas detectors; ☐ oxygen sensors; ☐ H_2S monitors; ☐ full body harness; ☐ protective clothing; ☐ traffic/public access control equipment; ☐ 5-minute escape breathing devices; ☐ life preservers for lagoons; ☐ safety buoy at activated sludge plants; ☐ fiberglass or wooden ladders for electrical work; ☐ respirators and/or self-contained breathing apparatus; ☐ methane gas or OVA analyzer; ☐ LEL metering?			
Are safety monitors clearly identified?			
How often are safety procedures reviewed and revised?			

Question	Response	Documentation Available	
		Yes	No
Are workplace accidents investigated?			
How does the Administration communicate with field personnel on safety procedures; memo, direct communication, video, etc.?			
Is there a Safety Committee with participation by O&M staff? How often does it meet?			
Is there a formal Safety Training Program? Are records of training maintained?			

Comments:

IV. F. Collection System Operation: Emergency Preparedness and Response

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have an emergency response plan? A contingency plan?			
How often is the plan reviewed and updated? What was the date it was last updated?			
Does the plan take into consideration vulnerable points in the system, severe natural events, failure of critical system components, vandalism or other third party events, and a root cause analysis protocol?			
Are staff trained and drilled to respond to emergency situations? Are responsibilities detailed for all personnel who respond to emergencies?			
Are there emergency operation procedures for equipment and processes?			
Does the owner or operator have standard procedures for notifying state agencies, local health departments, the regulatory authority, and drinking water authorities of significant overflow events?			
Does the procedure include an up-to-date list of the names, titles, phone numbers, and responsibilities of all personnel involved?			
Do work crews have immediate access to tools and equipment during emergencies?			
Is there a public notification plan? If so, does it cover both regular business hours and off-hours?			
Does the owner or operator have procedures to limit public access to and contact with areas affected with SSOs?			
Does the owner or operator use containment techniques to protect the storm drainage systems?			

Do the overflow records include the following information: ☐ date and time, ☐ cause(s), ☐ names of affected receiving water(s), ☐ location, ☐ how it was stopped, ☐ any remediation efforts, ☐ estimated flow/volume discharged, ☐ duration of overflow?			
Does the owner or operator have signage to keep public from affected area?			
Is there a hazard classification system? Where is it located?			
Does the owner or operator conduct vulnerability analyses?			
Are risk assessments performed? How often?			

Comments:

IV. G. Collection System Operation: Modeling

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a hydraulic model of the collection system including pump stations? What model is used?			
What uses does the model serve (predicting flow capacity, peak flows, force main pressures, etc.)?			
Does the model produce results consistent with observed conditions?			
Is the model kept up to date with respect to new construction and repairs that may affect hydraulic capacity?			

Comments:

IV. H. Collection System Operation: Engineering - System Mapping and As-built Plans (Record Drawings)

Question	Response	Documentation Available	
		Yes	No
What type of mapping/inventory system is used?			
Is the mapping tied to a GPS system?			
Are "as-built" plans (record drawings) or maps available for use by field crews in the office and in the field?			
Do field crews record changes or inaccuracies and is there a process in place to update "as built" plans (record drawings)?			
Do the maps show the date the map was drafted and the date of the last revision?			
Do the sewer line maps include the following: ☐ scale; ☐ north arrow; ☐ date the map was drafted; ☐ date of the last revision; ☐ service area boundaries; ☐ property lines; ☐ other landmarks; ☐ manhole and other access points; ☐ location of building laterals; ☐ street names; ☐ SSOs/CSOs; ☐ flow monitors; ☐ force mains; ☐ pump stations; ☐ lined sewers; ☐ main, trunk, and interceptor sewers; ☐ easement lines and dimensions; ☐ pipe material; ☐ pipe diameter; ☐ pipe diameter; ☐ installation date; ☐ slope; ☐ manhole rim elevation; ☐ manhole coordinates; ☐ manhole invert elevation; ☐ distance between manholes?			
Are the following sewer attributes recorded: ☐ size, ☐ shape, ☐ invert elevation, ☐ material, ☐ separate/combined sewer, ☐ installation date?			
Are the following manhole attributes recorded: ☐ shape, ☐ type, ☐ depth, ☐ age, ☐ material?			
Is there a systematic numbering and identification method/system established to identify sewer system manhole, sewer lines, and other items (pump stations, etc.)?			

Comments:

IV. I. Collection System Operation: Engineering - Design

Question	Response	Documentation Available	
		Yes	No
Is there a document which details design criteria and standard construction details?			
Is life cycle cost analysis performed as part of the design process?			
Is there a document that describes the procedures that the owner or operator follows in conducting design review? Are there any standard forms that are used as a guide?			
Are O&M staff involved in the design review process?			
Does the owner or operator have documentation on private service lateral design and inspection standards?			
Does the owner or operator attempt to standardize equipment and sewer system components?			

Comments:

IV. J. Collection System Operation: Engineering - Capacity

Question	Response	Documentation Available	
		Yes	No
What procedures are used in determining whether the capacity of existing gravity sewer system, pump stations and force mains are adequate for new connections?			
Is any metering of flow performed prior to allowing new connections?			
Is there a hydraulic model of the system used to predict the effects of new connections?			
Is there any certification as to the adequacy of the sewer system to carry additional flow from new connections required?			

Comments:

IV. K. Collection System Operation: Engineering - Construction

Question	Response	Documentation Available	
		Yes	No
Who constructs new sewers? If other than the owner or operator, does the owner or operator review and approve the design?			
Is there a document that describes the procedures that the owner or operator follows in conducting their construction inspection and testing program?			
Are there any standard forms that guide the owner or operator in conducting their construction inspection and testing program?			
Is new construction inspected by the owner or operator or others?			
What are the qualifications of the inspector(s)?			
What percentage of time is a construction inspector on site?			
Is inspection supervision provided by a registered professional engineer?			
How is the new gravity sewer construction tested? (Air, water, weirs, etc.)			
Are new manholes tested for inflow and infiltration?			
Are new gravity sewers televised?			
What tests are performed on pump stations?			
What tests are performed on force mains?			
Is new construction built to standard specifications established by the owner or operator and/or the State?			
Is there a warranty for new construction? If so, is there a warranty inspection done at the end of this period?			

Comments:

IV. L. Collection System Operation: Pump Station Operation

Question	Response	Documentation Available	
		Yes	No
How many pump stations are in the system? How many have backup power sources?			
Are enough trained personnel assigned to properly maintain pump stations?			
Are these personnel assigned full-time or part-time to pump station duties?			
Are there manned and un-manned pump stations in the system? How many of each?			
Is there a procedure for manipulating pump operations (manually or automatically during wet weather to increase in-line storage of wet weather flows?			
Are well-operating levels set to limit pump start/stops?			
Are the lead, lag, and backup pumps rotated regularly?			

Comments:

IV. L. 1. Collection System Operation: Pump Stations - Inspection

Question	Response	Documentation Available	
		Yes	No
How often are pump stations inspected?			
What work is accomplished during inspections?			
Is there a checklist?			
Are records maintained for each inspection?			
What are the average annual labor hours spent on pump station inspections?			
Are there Standard Operating Procedures (SOPs) and Standard Maintenance Procedures (SMPs) for each station?			
What are the critical operating characteristics maintained for each station? Are the stations maintained within these criteria?			

Comments:

IV. L. 2. Collection System Operation: Pump Stations - Emergencies

Question	Response	Documentation Available	
		Yes	No
Is there an Emergency Operating Procedure for each pump station?			
Is there sufficient redundancy of equipment in all pump stations?			
Who responds to lift station failures and overflows? How are they notified?			
How is loss of power at a station dealt with? (i.e. on-site electrical generators, alternate power source, portable electric generator(s))			
What equipment is available for pump station bypass?			
What process is used to investigate the cause of pump station failure and take necessary action to prevent future failures?			

Comments:

IV. L. 3. Collection System Operation: Pump Stations - Emergency Response and Monitoring

Question	Response	Documentation Available	
		Yes	No
How are lift stations monitored?			
If a SCADA system is used, what parameters are monitored?			

Comments:

IV. L. 4. Collection System Operation: Pump Stations - Recordkeeping

Question	Response	Documentation Available	
		Yes	No
Are operations logs maintained for all pump stations?			
Are manufacturer's specifications and equipment manuals available for all equipment?			
Are pump run times maintained for all pumps?			
Are elapsed time meters used to assess performance?			

Comments:

IV. L. 5. Collection System Operation: Pump Stations - Force Mains and Air/Vacuum Valves

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator regularly inspect the route of force mains?			
Does the owner or operator have a program to regularly assess force main condition?			
Is there a process in place to investigate the cause of force main failures?			
Does the owner or operator have a regular maintenance/inspection program for air/vacuum valves?			
Have force main failures been caused by water hammer?			

Comments:

V. A. Equipment and Collection System Maintenance: Maintenance Budgeting

Question	Response	Documentation Available	
		Yes	No
How does the collection system owner or operator track yearly maintenance costs?			
Is there a maintenance cost control system?			
Are maintenance costs developed from past cost records?			
How does the owner or operator categorize costs? Preventive? Corrective? Projected Costs? Projected Repair?			
How does the owner or operator control expenditures?			

Comments:

V. B. Equipment and Collection System Maintenance: Planned Maintenance

Question	Response	Documentation Available	
		Yes	No
Are preventive maintenance tasks and frequencies established for all pump stations and equipment?			
How were preventive maintenance frequencies established?			
What percentage of the operator's time is devoted to planned as opposed to unplanned maintenance?			
What predictive maintenance techniques are used as part of PM program?			
Is there a formal procedure to repair or replace pump stations and equipment when useful life is reached?			
Has an energy audit been performed on pump station electrical usage?			
Is an adequate parts inventory maintained for all equipment?			
Is there a sufficient number of trained personnel to properly maintain all stations?			
Who performs mechanical and electrical maintenance?			
Are there Standard Maintenance Procedures (SMPs) for each station?			

Comments:

V. C. Equipment and Collection System Maintenance: Maintenance Scheduling

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator plan and schedule preventive and corrective maintenance activities?			
Is there an established priority system? Who sets priorities for maintenance?			
Is a maintenance card or record kept for each piece of mechanical equipment within the collection system?			
Do equipment maintenance records include the following information: ☐ maintenance recommendations, ☐ instructions on conducting the specific maintenance activity, ☐ other observations on the equipment, ☐ maintenance schedule, ☐ a record of maintenance on the equipment to date.			
Are dated tags used to show out-of-service equipment?			
Is maintenance backlog tracked?			
How is O&M performance tracked and measured?			
What percent of repair finds are spent on emergency repairs?			
Are corrective repair work orders backlogged more than six months?			
Is maintenance performed for other public works divisions?			
How are priorities determined for this work?			
How is this work funded?			
Are maintenance logs maintained for all pump stations?			

Comments:

V. D. Equipment and Collection System Maintenance: Maintenance Right-of-Way

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator perform scheduled maintenance on Rights-of-Way and Easements?			
Does the owner or operator monitor street paving projects?			
Does the owner or operator have a program to locate and raise manholes (air valves, etc) as needed?			
How are priorities determined?			
How is the effectiveness of the maintenance schedule measured?			

Comments:

V. E. Equipment and Collection System Maintenance: Sewer Cleaning

Question	Response	Documentation Available	
		Yes	No
Is there a routine schedule for cleaning sewer lines on a system wide basis, *e.g.*, at the rate of once every seven to twelve years or a rate of between 8% and 14% per year?			
What is the owner or operator's goals for annual system cleaning?			
What percent of the sewer lines are cleaned, even high/repeat cleaning trouble spots, during the past year?			
Is there a program to identify sewer line segments that have chronic problems and should be cleaned on a more frequent schedule?			
What is the average number of stoppages experienced per mile of sewer pipe per year?			
Has the number of stoppages increased, decreased, or stayed the same over the past five years?			
Are stoppages diagnosed to determine the cause?			
Are stoppages plotted on maps and correlated with other data such as pipe size and material, or location?			
Do the sewer cleaning records include the following information: ☐ date and time, ☐ cause of stoppage, ☐ method of cleaning, location of stoppage or routine cleaning activity, ☐ identity of cleaning crew, ☐ further actions necessary/initiated?			
If sewer cleaning is done by a contractor are videos taken of before and after cleaning?			

Comments:

V. E. 1. Equipment and Collection System Maintenance: Sewer Cleaning - Cleaning Equipment

Question	Response	Documentation Available	
		Yes	No
What type of cleaning equipment does the owner or operator use?			
How many cleaning units of each type does the owner or operator have? What is the age of each?			
How many cleaning crews and shifts does the owner or operator employ?			
How many cleaning crews are dedicated to preventive maintenance cleaning?			
How many cleaning crews are dedicated to corrective maintenance cleaning?			
What has the owner or operator's experience been regarding pipe damage caused by mechanical equipment?			
Where is the equipment stationed?			

Comments:

V. E. 2. Equipment and Collection System Maintenance: Sewer Cleaning - Chemical Cleaning and Root Removal

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a root control program?			
Does the owner or operator have a FOG program?			
Are chemical cleaners used?			
What types of chemical cleaners are used?			
How often are they applied?			
How are the chemical cleaners applied?			
What results are achieved through the use of chemical cleaners?			

Comments:

V. F. Equipment and Collection System Maintenance: Parts Inventory

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a central location for the storage of spare parts?			
Have critical spare parts been identified?			
Are adequate supplies on hand to allow for two point repairs in any part if the system?			
Is there a parts standardization policy in place?			
Does the owner or operator maintain a stock of spare parts on its maintenance vehicles?			
What method(s) does the owner or operator employ to keep track of the location, usage, and ordering of spare parts? Are parts logged out when taken by maintenance personnel for use?			
Does the owner or operator salvage specific equipment parts when equipment is placed out-of-service and not replaced?			
How often does the owner or operator conduct a check of the inventory of parts to ensure that their tracking system is working?			
Who has the responsibility of tracking the inventory?			
For those parts which are not kept in inventory, does the owner or operator have a readily available source or supplier?			

Comments:

V. G. Equipment and Collection System Maintenance: Equipment and Tools Management

Question	Response	Documentation Available	
		Yes	No
Is there a list of equipment and tools used for operation and maintenance?			
Do personnel feel they have access to the necessary equipment and tools to do all aspects of operation and maintenance of the collection system?			
Is there access to suitable equipment if the owner or operator's equipment is down for repair?			
Does the owner or operator own or have access to portable generators?			
Where does the owner or operator store its equipment?			
Is a detailed equipment maintenance log kept?			
Are written equipment maintenance procedures available?			
What is the procedure for equipment replacement?			
Are the services of an in-house vehicle and equipment maintenance services used?			
What is the typical turnaround time for equipment and vehicle maintenance?			

Comments:

VI. Management Information Systems: Performance Indicators

Question	Response	Documentation Available	
		Yes	No
How many sanitary sewer overflows (SSOs) have occurred in the last 5 years? How many less than 1,000 gallons?			
Does the owner or operator document and report all SSOs regardless of size?			
Does the owner or operator document basement backups?			
Are there areas that experience basement or street flooding?			
How many SSOs have reached "Waters of the US"? Is there a record?			
Approximately, what percent of SSOs discharge were from each of the following in the last 5 years: manholes, pump stations, main and trunk sewers, lateral and branch sewers, structural bypasses?			
What is the per capita wastewater flow for the maximum month and maximum week or day?			
What is average annual influent BOD?			
What is the ratio of maximum wet weather flow to average dry weather flow?			
Approximately, what percent of SSO discharge were caused by the following in the last 5 years: debris buildup, collapsed pipe, root intrusion, capacity limitations, excessive infiltration and inflow, FOG, vandalism?			
What percent of SSOs were released to: soil; surface water; basements; paved areas; coastal, ocean, or beach areas; rivers, lakes or streams?			
For surface water releases, what percent are to surface waters that could affect: contact recreation, shellfish growing areas, drinking water sources?			
How many chronic SSO locations are in the collection system?			

Are pipes with chronic SSOs being monitored for sufficient capacity and/or structural condition?			
Prior to collapse, are structurally deteriorating pipelines being monitored for renewal or replacement?			
What is the annual number of mainline sewer cave-ins? What was the cause (i.e. pipe corrosion, leaks, etc.)			
What other types of performance indicators does the owner or operator use?			

Comments:

VII. A. Sewer System Capacity Evaluation (SSES): Internal TV Inspection

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator use internal T.V. inspection? If so please describe the program.			
Do the internal TV record logs include the following: ☐ pipe size, type, length, and joint spacing; ☐ distance recorded by internal TV; ☐ results of the internal TV inspection; ☐ internal TV operator name; ☐ cleanliness of the line; ☐ location and identification of line being televised by manholes?			
Is a rating system used to determine the severity of the defects found during the inspection process?			
Is there documentation explaining the codes used for internal TV results reporting?			
Approximately what percent of the total defects determined by TV inspection during the past 5 years were the following:			
Are main line and lateral repairs checked by internal TV inspection after the repair(s) have been made?			

Comments:

VII. B. SSES: Survey and Rehabilitation (general)

Question	Response	Documentation Available	
		Yes	No
Have SSES's been performed in the past? If so, is documentation available?			
Has any sewer rehabilitation work been done in the past 15 years? If so, please describe?			
Does the owner or operator have standard procedures for performing SSES work?			
Do the SSES reports include recommendations for rehabilitation, replacement, and repair?			
Were defects identified in the SSES repaired?			
Does the owner or operator have a multi-year Capital Improvements Program that includes rehabilitation, replacement, and repair?			
How are priorities established for rehabilitation, replacement, and repair?			
Has the owner or operator established schedules for performing recommended rehabilitation, both short term and long term?			
Has funding been approved for the recommended rehabilitation?			
Is post rehabilitation flow monitoring used to assess the success of the rehabilitation?			

Comments:

VII. C. SSES: Sewer Cleaning Related to I/I Reduction

Question	Response	Documentation Available	
		Yes	No
Are sewers cleaned prior to flow monitoring?			
Are sewers cleaned prior to internal T.V. inspection?			
When cleaning, is debris removed from the system?			

Comments:

VII. D. SSES: Flow Monitoring

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a flow monitoring program? If so, please describe.			
Does the owner or operator have a comprehensive capacity assessment and planning program?			
Are flows measured prior to allowing new connections?			
Number of permanent meters? Number of temporary meters?			
What type(s) of meters are used?			
Number of rain gauges?			
How frequently are flow meters checked?			
Do the flow meter checks include: ☐ independent water level, ☐ checking the desiccant, ☐ velocity reading, ☐ cleaning away debris, ☐ downloading data, ☐ battery condition?			
Are records maintained for each inspection?			
Do the flow monitoring records include: ☐ descriptive location of flow meter, ☐ type of flow meter, ☐ frequency of flow meter inspection, ☐ frequency of flow meter calibration?			
Are flow data used for billing, capacity analysis, and/or I/I investigations?			
What is the ratio of peak wet weather flow to average dry weather flow at the wastewater treatment plant?			
Does the owner or operator have any wet weather capacity problems?			
Are low points or flood-plain areas monitored during rain events?			
Does the owner or operator have any dry weather capacity problems?			

VII. E. SSES: Smoke Testing and Dyed Water Flooding

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a smoke testing program to identify sources of inflow and infiltration into the system including private service laterals and illegal connections? If so please describe.			
Are there written procedures for the frequency and schedule of smoke testing?			
Is there a documented procedure for isolating line segments?			
Is there a documented procedure for notifying local residents that smoke testing will be conducted in the area?			
What is the guideline for the maximum amount of line to be tested at one time?			
Are there guidelines for the weather conditions under which smoke testing should be conducted?			
Do the written records contain location, address, and description of the smoking element that produced a positive result?			
What follow-up occurs as a result of positive results for smoke or dye testing?			
Is there a goal for the percent of the system smoke tested each year?			
What percent of the system has been smoke tested over the past year?			
Does the owner or operator have a dyed water flooding program If so please describe.			
Is there a goal for the percent of the system dye tested each year?			
What percent of the system has been dye tested over the past year?			
Does the owner or operator share smoke and dye testing equipment with another owner or operator?			

Comments:

VII. F. SSES: Manhole Inspection

Question	Response	Documentation Available	
		Yes	No
Does the owner or operator have a routine manhole inspection and assessment program?			
What is the purpose of the inspection program?			
Does the owner or operator have a goal for the number of manholes inspected annually?			
How many manholes were inspected during the past year?			
Do the records for manhole/pipe inspection include the following: ☐ conditions of the frame and cover; ☐ evidence of surcharge; offsets or misalignments; ☐ atmospheric hazards measurements; ☐ details on the root cause of cracks or breaks in the manhole or pope including blockages; ☐ recording conditions of corbel, walls, bench, trough, and pipe seals; ☐ presence of corrosion, if repair is necessary; ☐ manhole identifying number/location; wastewater flow characteristics; ☐ accumulations of grease, debris, or grit; ☐ presence of infiltration, location, and estimated quantity; ☐ inflow from manhole covers?			
Are manholes susceptible to inflow identified and inspected on a regular frequency?			
Is there a data management system for tracking manhole inspection activities?			
What triggers whether a manhole needs rehabilitation?			
Does the owner or operator have a multi-year Capital Improvements Program that includes rehabilitation, replacement, and repair of manholes?			
How are priorities established for rehabilitation, replacement, and repair of manholes?			
Has the owner or operator established schedules for performing rehabilitation, both short term and long term of manholes?			

Question	Response	Documentation Available	
		Yes	No
Has funding been approved for the rehabilitation of manholes?			
Does the owner or operator have a grouting program?			

Comments:

VIII. A. Rehabilitation: Manhole Repairs

Question	Response	Documentation Available	
		Yes	No
What rehabilitation techniques are used for manhole repairs?			
How are priorities determined for manhole repairs?			
What type of documentation is kept?			
Does the owner or operator use manhole inserts?			
Are they used system wide or only on low lying manholes?			

Comments:

VIII. B. Rehabilitation: Mainline Sewers

Question	Response	Documentation Available	
		Yes	No
What type of main line repairs has the owner or operator used in the past?			
Does the owner or operator currently use any of above techniques for main line repairs? What other techniques is the owner or operator presently using?			
How are priorities established for main line repairs?			
What type of follow-up is performed after the repair (e.g., CCTV)?			

Comments:

Appendix A

EXAMPLE
COLLECTION SYSTEM PERFORMANCE
INDICATOR DATA
COLLECTION FORM

EXAMPLE
COLLECTION SYSTEM PERFORMANCE INDICATOR DATA COLLECTION FORM

I. General Information

A. Agency Name _____

B. Agency Address

Street _____

City _____ State _____ Zip _____

C. Contact Person _____

D. Telephone: Voice _____ Fax _____ Email _____

E. Data provided for latest fiscal/calendar year, 20___

II. Collection System Description

A. Service Area _____ Square miles

B. Population Served _____

C. System Inventory

Miles of gravity sewer	Miles of force main	Number of maintenance access structures	Number of pump stations	Number of siphons	Number of air, vacuum, or air/vacuum relief valves

D. Number of Service Connections:

Residential _____ Commercial _____ Industrial _____ Total _____

E. Lateral Responsibility (check one)

1. At main line connection only _____
2. From main line to property line or easement/cleanout _____
3. Beyond property line/cleanout _____
4. Other _____

F. System combined (storm and sanitary)? Yes ___ No ___ If yes, % combined ____

G. Average Annual Precipitation _____ inches

H. System Flow Characteristics (total for service area)

Peak Dry Weather Flow (MGD)	Peak Wet Weather Flow (MGD)	Average Daily Flow (MGD)

III. Special Conditions

A. Indicate local conditions that are accounted for during design, construction, operation, and maintenance of the collection system.

1. Precipitation: Yes ____ No _____ If yes, provide brief explanation _____
_____
_____

2. Terrain: Yes ____ No _____ If yes, provide brief explanation_____
_____

3. Soils: Yes ____ No _____ If yes, provide brief explanation _____
_____

4. Temperature: Yes ____ No _____ If yes, provide brief explanation _____
_____

5. Groundwater: Yes _____ No _____ If yes, provide brief explanation _____
_____

6. Geology: Yes ____ No _____ If yes, provide brief explanation _____
_____

7. Other: _____
_____

B. Is corrosion a significant problem? Yes ____ No ____
- Is there a corrosion control program in place? Yes ____ No ____

C. Is odor a significant problem? Yes ____ No ____
- Is there an odor control program in place? Yes ____ No ____

D. Is grease a significant problem? Yes ____ No ____
- Is there a grease control program in place? Yes ____ No ____

E. Are roots a significant problem? Yes ____ No ____
- Is there a root control program in place? Yes ____ No ____

IV. Age Distribution of Collection System

Age	Gravity Sewer, miles	Force Mains, miles or feet	Number of Pump Stations
0 - 25 years			
26 - 50 years			
51 - 75 years			
> 76 years			

V. Size Distribution of Collection System

Diameter in inches	Gravity Sewer, miles	Force Mains, miles or feet
8 inches or less		
9 - 18 inches		
19 - 36 inches		
> 36 inches		

VI. Distribution of Gravity Sewer By Material

A. Vitrified Clay Pipe (VCP) _____ Miles
B. Reinforced Concrete Pipe (RCP) _____ Miles
C. Unreinforced Concrete Pipe (CP) _____ Miles
D. Plastic (all types) _____ Miles
E. Brick _____ Miles
F. Other _____ Miles
G. Other _____ Miles
H. Other _____ Miles

VII. Distribution of Force Mains By Material

(circle one)

A. Reinforced Concrete Pipe (RCP) _____ miles or feet
B. Prestressed Concrete Cylinder Pipe (PCCP) _____ miles or feet
C. Asbestos Cement Pipe (ACP) _____ miles or feet
D. Polyvinyl Chloride (PVC) _____ miles or feet
E. Steel _____ miles or feet
F. Ductile Iron _____ miles or feet
G. Cast Iron _____ miles or feet
H. Techite (RPMP) _____ miles or feet
I. High Density Polyethylene (HDPE) _____ miles or feet
J. Fiberglass Reinforced Plastic (FRP) _____ miles or feet
K. Other _____ miles or feet

VIII. Preventive Maintenance of System

A. Physical Inspection of Collection System, Preventive Maintenance

Inspection Activity	Total Annual Labor Hours Expended for This Activity	Total Completed (Miles of Pipe or Manholes Inspected Annually)	Crew Size (s)
CCTV			
Visual Manhole Inspection, Surface Only			
Visual Manhole Inspection, Remove Cover			
Visual Gravity Line Inspection, Surface Only			
Visual Force Main Inspection, Surface Only			
Other (Sonar, etc.)			

B. Mechanical and Hydraulic Cleaning, Preventive Maintenance

Cleaning Activity	Total Annual Labor Hours Expended for This Activity	Total Annual Labor Hours Expended for Scheduled PM	Total Miles Cleaned Annually	Crew Size (s)	Range of Pipe Diameters Cleaned
Hydraulic Jet					
Bails, Kites, Scooters					
Combination Machines					
Rod Machines					
Hand Rodding					
Bucket Machines					
Chemical Root Control					
Chemical or Biological Grease Control					

IX. Dry Weather Stoppages

A. Number of stoppages, annually _____
B. Average time to clear stoppage _____
C. Number of stoppages resulting in overflows and/or backups annually _____
D. Total quantity of overflow(s) _____
E. Is there an established procedure for problem diagnosis? Yes ____ No ____
F. Are future preventive measures initiated based on diagnosis? Yes ____ No ____
G. What equipment is available for emergency response? _____

X. Repairs and Rehabilitation, Proactive

A. Number of annual spot repairs identified _____
B. Number of annual spot repairs completed _____
C. Percent of spot repairs contracted _____
D. Number of manholes identified for rehabilitation _____
E. Number of manholes rehabilitated annually _____
F. Percent of manhole repairs contracted _____
G. Feet of main line needing rehabilitation _____
H. Feet of main line rehabilitated _____
I. Percent of main line rehabilitation contracted _____
J. Number of manholes scheduled for rehabilitation under Capital Improvement Program (s) _____
K. Feet of main line scheduled for rehabilitation under Capital Improvement Program (s) _____

XI. Repairs and Rehabilitation, Reactive

A. Number of annual line features _____
B. Number of line repairs _____

XII. Pump Stations

A. Number of pump stations inspected _____
- Frequency of inspections _____ (daily, every other day, weekly)

B. Number of inpsection crews _____
C. Crew size _____
D. Number of pump stations with pump capacity redundancy _____
E. Number of pump stations with backup power sources _____
F. Number of pump stations with dry weather capacity limitations _____
G. Number of pump stations with wet weather capacity limitations _____
H. Number of pump stations calibrated annually _____
I. Number of pump stations with permanent flowmeters _____
J. Number of pump stations with remote status monitoring _____
K. Number of pump stations with running time meters _____
L. Number of mechanical maintenance staff assigned to mechanical maintenance _____
M. Number of electrical maintenance staff assigned to electrical maintenance _____
N. Total labor hours scheduled annually for electrical and mechanical PM tasks _____
O. Total labor hours expended annually for electrical and mechanical PM tasks _____

XIII. Pump Station Failures, Dry Weather

A. Number of failures resulting in overflows/bypass or backup, annually _____
B. Total quantity of overflow/bypass _____ Gallons or MG
C. Average time to restore operational capability _____ hours
D. Total labor hours expended for electrical and mechanical corrective maintenance tasks _____
E. Is failure mode and effect diagnosed? Yes ___ No ___
F. Are future preventive measures initiated based on diagnosis? Yes ___ No ___
G. What equipment is available for emergency response? _____

XIV. Force Mains

A. Force mains inspected annually _____ miles or feet (visual surface inspection of alignment)

B. Force mains monitored annually _____ miles or feet (pressure profile, capacity)

C. Number of force main failures annually _____

D. Cause(s) of force main failures _____

_____

XV. Air Relief/Vacuum Valves

A. What is frequency of valve inspections? _____

B. What is frequency of PM (backflushing, etc)? _____

C. Number of annual valve failures _____

D. Cause(s) of valve failures _____

_____

XVI. System Operation and Maintenance Efficiency

A. Total full time or full time equivalent staff assigned to O & M (excluding administration staff but including line managers, supervisors) _____

B. Total estimated labor hours actually expended for active O & M tasks (this is the total above less hours for sick, vacation, holidays, training, breaks, etc., not directly related to performing O & M tasks) _____

XVII. Level of Service

A. Average annual rate for residential users _____

B. Rate based on: water consumption _____ Flat rate _____ Other _____

C. Number of complaints annually _____

D. Number of complaints that are agency responsibility _____

E. Number of public health or other warnings issued annually _____

F. Number of claims for damages due to backups annually _____

G. Total cost of claims settled annually _____

XVIII. Financial

A. Total annual revenue received from wastewater _____

1. % of revenue for long-term debt _____
2. % of revenue for treatment and disposal _____
3. % of revenue for collection and conveyance _____

B. Current value of collection system assets _____

C. Annual O & M expenditure _____

D. Annual CIP expenditure for repair, replacement, or rehabilitation _____

E. Annual O & M training budget _____

F. Total number of O & M personnel (including administrative in O & M department) _____

G. Number of personnel with collection system certification _____

H. Number of personnel qualified for collection system certification _____

I. Amount of O & M budget allocated for contracted services _____

J. Hydroflush cost per foot _____

K. Rodding cost per foot _____

L. Bucketing cost per foot _____

M. CCTV cost per foot _____

N. Spot repairs, cost each _____

XIX. Safety

A. Total labor hours assigned to O & M _____

B. Number of lost time injuries _____

C. Total lost time days _____

D. Total cost of lost time injuries _____

XX. Regulatory

A. Total number of violations issued annually _____

B. Total cost of fines paid annually _____

C. What is minimum reportable quantity in gallons? _____

D. What is time reporting requirement? _____

E. Number of annual WWTP upsets due to wet weather flow _____

XXI. General

A. Has SSES been performed on system? Yes _____ No _____

B. Total O & M positions currently budgetd _____

C. Total O & M positions currently filled _____

D. Is computerized maintenance management system (s) used for O & M managing? Yes ____ No ___

E. Is GIS system used for O & M managing? Yes _____ No _____

XXII. Procedures or Other Documentation Available

A. Overflow, bypass and containment Yes _____ No _____

B. Problem evaluation and solution Yes _____ No _____

C. Cleanup procedure Yes _____ No _____

D. Failure mode and effect procedure Yes _____ No _____

E. O & M budget process Yes _____ No _____

F. O & M budget with line item detail Yes _____ No _____

G. Long-range CIP planning for system expansion, rehabilitation, and replacement Yes _____ No ____

H. Is there a written procedure for cleanup to mitigate effect of overflow? Yes _____ No _____

I. Is there a written procedure for containing overflows and bypasses? Yes _____ No _____

J. Is there an established procedure for containing overflows and bypasses? Yes _____ No _____

K. Is there an established procedure for problem evaluation and solution? Yes _____ No _____

L. Is there an established procedure for cleanup to mitigate effect of overflow? Yes _____ No _____

M. Is there a grease control program? Yes _____ No _____

N. Is there a pretreatment program? Yes _____ No _____

O. Is there a private source I/I reduction program? Yes _____ No _____

P. Do you have chronic O & M problems that are designed into your system? Yes _____ No _____

If yes, provide brief description _____

_____

Q. Do you have chronic O & M problems that are constructed into your system? Yes _____ No ____

If yes, provide brief description _____

_____

R. How would you rate your construction inspection program?

Very effective _____ Needs improvement _____ Poor _____

XXIII. Definitions/Clarifications

A. Maintenance access structures, most commonly manholes, in your system that are incorporated into your O & M program.

B. Pump capacity redundancy is the ability to maintain pumping at design capacity with the largest pump out of service.

C. Remote status monitoring is any remote monitoring system such as alarm telemetry or SCADA that provides remote pump station status information.

D. You will notice that in the section on stoppages and pump station failures, we are asking for dry weather incidents only. Dry weather system performance is a good indicator or effectiveness of O & M program. If you have wet weather information that you wish to provide also, please do.

E. Under the Special Conditions sections we are identifying conditions that are present in your system that require consideration during design, construction, and O & M of your system.

F. Any of the questions dealing with labor hours are designed to determine total labor hours irrespective of crew size or crews that are only assigned to cleaning, for example, less than full time.

G. Our goal is to obtain data that can be or are standardized and that are accurate. We also realize that some data may not be available; however, data can be accurately estimated. If you estimate data please follow with an (E).

H. If data is not available please indicate "NA." If data does not apply to your system, please indicate by "DNA."

I. Failure mode and effect refers to any established procedure you have to diagnose system failures to determine the cause and effect of the failure. This can apply to crews clearing stoppages or to pump station failures.

J. Pump station inspection (XII) means scheduled inspection by operators to verify station operation and perform PM.. It excludes electrical or mechanical craft maintenance.

K. Stoppage in section IX refers only to stoppages other than pump stations. Pump stations are covered in Section XIII. Backup in this case refers to a basement or other structure backup as opposed to main line sewer backup.

XXIV. Additional Comments

Appendix B

EXAMPLE INTERVIEW SCHEDULE AND TOPICS

EXAMPLE INTERVIEW SCHEDULE AND TOPICS

Days 1 and 2 Interviews

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Senior Management	Discuss project expectations, report review and comment process. Overview of organizational structure and "culture". Identify sensitive issues and how to approach. Schedule			
Project Kick off Meeting	Overview and purpose of project. Interview and field assessment process. Report content and review process. Questions and answers	None		
Physical Inspection and Testing – Gravity sewer system	Visual Inspection, pipe alignment. CCTV Smoke and Dye Testing Other	Reports, inspection forms, performance data, inspection strategy, crew assignments and schedules, equipment available, current expenditures and budgeted amounts, area maps, Standard Operating Procedures, field maps.		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Preventive Maintenance - Mechanical and hydraulic cleaning	High velocity jets and combination machines. Other hydraulic methods Rodding Machines Bucket Machines	Reports, performance data, preventive maintenance cleaning strategy, crew assignments and schedules, equipment available, current and budgeted, problem areas, Standard Operating Procedures, Standard Maintenance Procedures, problem diagnosis		
Chemical and biological cleaning	Root control Grease control Odor control Corrosion control	Grease control ordinance, enforcement, odor and corrosion control strategy, root control program, design for O&M considerations, materials used (MSDS), reports, performance data, preventive maintenance cleaning strategy, crew assignments and schedules, equipment available, current and budgeted, problem areas, Standard Operating Procedures, Standard Maintenance Procedures, problem diagnosis, public education, enforcement		
Pump Stations	Routine inspection Electrical and mechanical maintenance SCADA Standby/emergency systems Valves Forcemains	Logs, inspection sheets, Standard Maintenance Procedures, Standard Operating procedures, pump station inventory and attribute data base, spares inventory, Reports, performance data, preventive maintenance strategy, crew assignments and schedules, equipment available, current and budgeted, critical pump stations, Standard Operating Procedures, Standard Maintenance Procedures, problem diagnosis, preventive and predictive maintenance methods, maintenance tasks and frequencies, O&M manuals, capacity issues		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Training and Certification	Training program, technical, supervisory and management. Certification program	Knowledge, skills and abilities, basic skills, career paths, minimum qualifications, certification, educational assistance program, internal and external training, OJT, training budget		
Work Management	Planning and scheduling work Materials management Priority Backlog management Procurement Manual or Computer Maintenance Management System (CMMS)	Complaints and emergencies normal hours and after hours. Corrective, preventive and predictive maintenance work orders, work backlog, labor utilization, reports,		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Safety	Safety committee Safety meetings Safety enforcement Documentation of comprehensive safety training Compliance with safety regulations Documentation of effectiveness of safety program (e.g., reduction of accidents) Documentation of attendance and learning at safety training sessions	Policy and procedures for trenching, confined space, lockout tagout, PPE. Safety manual, formal training, tracking, accident investigation		
Financial	Annual O&M Budget Rates CIP for rehabilitation/rehab Non-enterprise fund allocations	O&M budget process, line item accounts, five year CIP plan, repair, rehabilitation, replacement strategy for pipes and pump stations		

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time, and Location
Construction and Repair	Emergency repair Spot repairs, gravity system Rehabilitation Lateral installation Inspection New Construction Testing	Reports, inspection forms, performance data, inspection strategy, crew assignments and schedules, equipment available, current and budgeted, area maps, Standard Operating Procedures, field maps,		
Fleet Management	Maintenance Replacement Availability Budgeting	Inventory, repair and replacement process, maintenance turn around time, preventive maintenance, Standard Operating Procedures, Standard Maintenance Procedures, CMMS,		

Day 3 - Field

Pump Stations

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time and Location
Pump Station Maintenance	Submersible Cast in place wet well dry well Prefabricated Grinder/Low Pressure System	Logs, O&M manuals, on-site procedures, vehicles and equipment, SCADA, Supervisory controls, electrical systems, flow meters, HVAC, variable speed systems, chronic problems, pumps and hydraulic systems.		

Day 4 – Field

Facilities and Crews

Work Practice or Maintenance Function	Description	Examples of Discussion Topics and Supporting Documents	Name	Interview Date, Time and Location
Facilities	Electrical and mechanical repair shops and equipment Warehouse and equipment storage areas Vehicle maintenance shops Crew areas; locker rooms, training areas, dispatch areas	Logs, O&M manuals, on-site procedures, vehicles and equipment, SCADA, Supervisory controls, electrical systems, flow meters, HVAC, variable speed systems, chronic problems, pumps and hydraulic systems,		
Crews Exit Interview	CCTV Cleaning Construction Repair Overview of findings for week	N/A None		

Appendix C

INFORMATION SOURCES

REFERENCES

California State University (CSU) Sacramento.1996. Operation and Maintenance of Wastewater Collection Systems. Volume I, Fifth Ed. Prepared for EPA, Office of Water Programs Operations. Sacramento, CA: California State University, Sacramento Foundation.

California State University (CSU) Sacramento. 1998. Operation and Maintenance of Wastewater Collection Systems. Volume II, Fifth Ed. Prepared for EPA, Office of Water Programs Operations. Sacramento, CA: California State University, Sacramento Foundation.

U.S. EPA National Enforcement Investigations Center (NEIC). 1992. Multi-media Investigations Manual. EPA-330/9-89-003-R.

U.S. Environmental Protection Agency. 1974. "Process Design Manual for Sulfide Control in Sanitary Sewerage Systems." Prepared for the Technology Transfer Office of the U.S. Environmental Protection Agency. EPA 625/1-74-005. pg. 3-27.

U.S. EPA Office of Water. 1973. *Manpower Requirements for Wastewater Collection Systems in Cities and Towns of up to 150,000 Population.* EPA-832-R-73-104.

U. S. EPA Office of Water. 1974. *Manpower Requirements for Wastewater Collection Systems in Cities of 150,000 to 500,000 Population.* EPA-832-R-74-102.

U.S. EPA Office of Water. 1983. *Procedures Manual for Reviewing a POTW Pretreatment Program Submission. EPA*-833-B-83-200.

U.S. EPA Office of Water. 1985. *Design Manual: Odor and Corrosion Control in Sanitary Sewerage Systems and Treatment Plants.* EPA-625-1-85-018.

U.S. EPA Office of Water. 2004. NPDES Compliance Inspection Manual. EPA-305-X-03-004.

U.S. EPA Office of Water. 2004. *Report to Congress: Impacts and Controls on CSOs and SSOs.* EPA-833-R-04-001.

Water Environment Federation. 1994. *Existing Sewer Evaluation & Rehabilitation*: WEF Manual of Practice FD-6, ASCE Manuals and Reports on Engineering Practice No. 62. Alexandria, VA: WEF.

Appendix B

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
WATER MANAGEMENT BUREAU

SSO REPORTING FORM

City or Town: _____

Type of SSO

____ Raw Sewage
____ Chlorinated Raw Sewage
____ Sludge Spill
____ Other:_____
_____

Cause of SSO

____ Mechanical Equipment Failure
____ Electric Utility Failure
____ Electrical Equipment Failure
Blockage of Sewer Line:
Grease ____, Roots ____, Other: ____
____ Approved Shutdown
____ Other:_____

Date and Time SSO was Discovered: _____/_____/_____ ____/____ AM/PM

Date and Time SSO was Stopped: _____/_____/_____ ____/____ AM/PM

Exact Location of SSO: _____
_____

How SSO was Discovered: _____
_____

Quantity/Volume of SSO: _____

How Quantity/Volume was Determined: _____
_____

If Equipment Failure, date of last inspection, maintenance or repairs: _____/_____/_____

Receiving Waters (If Applicable)_____

Steps taken to minimize volume and duration of SSO:_____
_____

Action taken to eliminate SSO:_____
_____

Steps Taken to prevent recurrence of SSO:_____
_____

Was area of SSO cleaned of debris? _____ Yes _____ No

Method Used:_____

Date of Last SSO at this location: _____/_____/_____