Sewer System Evaluation Survey (SSES)

When Infiltration and/or Inflow (I/I) exists in a collection system and treatment plant flow records indicate that the I/I flow exceeds the designated values described in the SRF policy, the applicant may perform an SSES to identify the sources of I/I and determine at what level it is cost effective to treat and/or remove the I/I. If the applicant decides to perform an SSES, the following steps should be taken, at minimum, to complete the study:[1]

I.   Identify Collection System Problems

        A.   Describe the existing system and discuss its history;

        B.   Review and analyze existing flow records such as plant influent data, pump stations data, overflow locations and estimated amounts, etc;

        C.   Divide the collection system into subsystems and identify the key manholes which are located at the outlet of each subsystem;

        D.   Monitor flows to key manholes and compare them to the expected sewer flows from the subsystems. Identify problem subsystems and determine if further study is needed. Discuss and explain the basis for the decision; and

        E.   Determine if the excessive flow problem is due to infiltration or inflow (or both) and decide the appropriate time period of the year to monitor the problem subsystems.

U.S.E.P.A., Guidance For Sewer System Evaluation; March 1974
U.S.E.P.A., Handbook of Sewer System Evaluation and Rehabilitation;
       Publication No. EPA-430/9-75-021; December 1975.[1]
American Society of Civil Engineers/Water Pollution Control Federation, Manual of Practice FD-6;Existing
       Sewer Evaluation Rehabilitation; 1983.

II.   Define Infiltration/Inflow (I/I) Problem

Once the problem subsystems are identified, a physical inspection, rainfall data, and rainfall simulation should be used to further define the I/I problem.

A.   Physical Inspection

Conduct a physical inspection of the subsystem area that includes the following:

1. Inspect all manholes within the identified area. Descend manholes using a lamp system and inspect the manhole walls and floor for weeping water, mineral deposits, and sand/silt deposits. Inspect all construction and pipe materials for misalignment, structural deformities, etc.

2. Prepare a manhole inspection report. A manhole inspection report should contain the manhole number, size, type of pipe, structural condition, amount of deposit, root growth, and other miscellaneous information. The report should also contain a recommendation for the preferred cleaning method for each sewer section.

3. If groundwater infiltration is suspected to be a problem, groundwater gauges should be installed at manholes or at other sites to evaluate the groundwater conditions.

4. Measure early morning flows (between 2 a.m. to 5 a.m.) at key manholes and at upstream manholes to identify infiltration. The domestic flows will be minimal during these hours. Subtract approximated domestic flow from the actual flow measurements to determine infiltration.

B.   Collection of Rainfall Data

Obtain hourly and daily rainfall information by contacting the weather bureau, airports, or water resources agencies. In the event there is no rainfall data available in the immediate vicinity of the study area, rain gauges should be installed at selected sites, either to provide raw data or to establish the basis for a correlating analysis of various adjacent areas that have available rainfall data.

C. Rainfall Simulation

Perform rainfall simulation to identify sewer sections with I/I problems. The use of the following techniques is suggested:

1. Smoke test--A smoke test should be used to identify inflow sources such as catch basins, roof and other drains, crossing connections, manhole covers, and bad joints and leaks.

2. Dye test--A dye test should be used on ditches, streams, or storm sewers located above or crossing the sanitary sewer system.

3. Exfiltration tests (air or water)--An exfiltration test should be used to detect possible leakage in the sewer lines and manholes.

TV inspection may be used by itself or in conjunction with any of the above tests to determine the location, condition, and estimated flow rate of I/I sources.

III.   Prepare Map and Field Report

    A. After all the field work is complete, locate and present all identified problem sewers and manholes on a map. The map should be color coded to identify pipe sizes, joint materials, and estimated quantity of I/I. The direction of sewer flow should also be indicated on the map.

    B. Prepare a field inspection report. The inspection report should compile and analyze all data and information collected in the field. Include all backup information, such as field notes and measurements, a summary of defective manholes and pipes, an estimate of rehabilitation cost, and an estimate of I/I reduction.

IV.   Conduct a Cost-Effectiveness Analysis

After all data and results have been analyzed and summarized, a cost-effective analysis must be conducted to determine the cost of eliminating I/I at various levels. The costs of I/I reduction should then be compared to the total cost of transportation and treatment of I/I flows at the treatment facilities. The total present worth or annual worth analysis shall be used to perform the cost comparison.

For various levels of I/I removal, determine the:

    (1) cost of transporting and treating existing I/I. Include capital costs (modifying transportation system, constructing treatment plant, replacing units, engineering, legal, administration, and contingency costs), operation and maintenance costs;

    (2) cost of I/I reduction. Include rehabilitation, repair, replacement, and engineering costs; and

(3) <u>total</u> cost of transporting, treating, and reduction I/I.

Plot the total costs associated with the various percentages of I/I reduction and determine the *cost-effective cutoff point*, the lowest cost point for I/I reduction (see attached Cost Effective Analysis Curve).

V.   <u>Prepare Survey Recommendations</u>

Propose a rehabilitation program to deal with the cost effective reduction of I/I. Explain the basis for recommendations and include a short term and long term action plan and schedule.

Attachment

Cost-Effective Analysis Curve

Percent Transport and Treatment Capacity for I/I

100   50   0

Cost (Present Worth or Average Annual Equivalent Value)

Total Cost Curve

Cost-Effective Cut-off Point (Minimum Planned Total Cost)

Transport and Treatment Cost Curve

Planned Reduction

Rehabilitation Cost Curve

0   50   100

Percent Infiltration or Inflow Reduction