

4.0 MANHOLE INSPECTIONS

Manhole inspections were performed in Catchment Areas 1, 3, 4, and 7 to determine the condition of the key components of the manholes and to observe and document any defects. These catchment areas were designated as priority inflow/infiltration (I/I) contributors in the Phase 1 Part 1 CSO Control Plan report. A total of 408 manholes in the priority sewer catchment areas were inspected. This total includes 20 manhole inspections that were performed on the Thames Street Interceptor as part of Phase 1 Part 1.

Manhole Inspection Results

Of the 388 manholes inspected as part of the Phase 1 Part 2 field work, 290 revealed defects and in need of some rehabilitation. Of the 290 manholes requiring rehabilitation, many of them have multiple defects. Therefore, to quantify the necessary work, some manholes have been counted more than once below:

- 141 manholes have cracks in the asphalt surrounding their covers which may lead to inflow into the manhole through the manhole's frame, corbel and walls.
- 55 manholes are either set too high or too low to the surrounding pavement causing damage to the manhole by vehicle tires striking the frame at odd angles introducing problems to the rest of the manhole structure. During winter weather, manholes often are struck by snow plows causing chips and cracks in the manhole's frame/cover therefore increasing the likelihood of infiltration to a manhole.
- 16 manholes were found to have the wrong cover; (i.e., storm drain), cracks in the cover and frame, and manholes that are located in gutter lanes with ponding issues.
- 12 manholes had frames that were either offset, badly chipped or have pieces missing from them, (i.e., badly damaged). Frames that are missing pieces and/or are offset present a significant source of inflow into the system and should be repaired or replaced as soon as possible.

- 42 manholes were found with covers that have more than 4 lift holes in them, which may result in significant inflow during a wet weather event, especially when the manhole is located in the gutter line or in/near areas with ponding conditions.
- 65 corbels were found to be in a steady state of decay with bricks/mortar missing, cracks and deterioration associated with hydrogen sulfide gases that introduce structural weakness to the corbel and other parts of the manhole. Infiltration/inflow from this part of the manhole can be significant and rehabilitation is recommended. Of the damaged corbels, all are either totally comprised of bricks or brick with parged block that typically degrade with time and often need rehabilitation to remain functional.
- 7 manholes had walls that were leaking at the time of the inspections producing approximately 6,050 gallons per day (gpd) of infiltration. Sealing of the manholes with an appropriate grout or a cementitious lining will eliminate this source of infiltration. Also, 23 manholes had significant damage to their walls including missing bricks/mortar, root intrusion, cracking and hydrogen sulfide corrosion. The first three pose immediate sources of I/I, while the latter can be dangerous as the manhole can become structurally unsound due to the weakened state of the mortar and bricks.
- 30 floors of the manholes inspected had defects ranging from breaks/cracks and debris to improperly shaped bottoms:
 - 7 floors were either under water and couldn't be fully inspected or were covered with debris from surcharging
 - 7 manholes had mineral deposits which could point to sources of infiltration
 - 6 had defects such as v-shaped bottoms, gaps and missing mortar/bricks
 - 10 Inverts were under water or surcharged and couldn't be inspected
- When inspecting the inverts of the manholes, 26 will require repairs because of v-shaped bottoms, broken pipe inlets/outlets or surcharging.

- 30 manholes had surcharge marks on the walls of the manhole. This occurs because of low capacity in the system, high flow during an event, or a blockage in the system from large debris and roots.
- During inspection, 5 manholes were found to be surcharged and could not be inspected fully.
- 123 manholes were observed to have steps in various stages of disrepair. Since manholes in the system tend to be made of brick, the steps are also made of brick and are no longer the recommended material to be used in this application.
 - 90 manholes had steps that were found to be unacceptable by the City's current standards.
 - 20 were found to have steps that were broken and unusable
 - 13 manholes had steps that were metal and severely rusted and/or missing

Conclusions and Recommendations

Based on the amount of infiltration that was observed during the manhole inspections (approximately 6,500 gpd), it does not appear that a full scale manhole rehabilitation program is warranted to reduce infiltration. Although the amount of infiltration observed is minimal, the large number of defects found indicates that more problems exist that allow infiltration/inflow that cannot be quantified as presently there is no mechanism for verification. These flows are likely to be significant and must be addressed. The information gained from these inspections provides the City with a comprehensive database of manhole defects. It is recommended that rehabilitation of the manholes be established as a priority as part of the routine maintenance of the sewer system.

Earth Tech received a contract amendment in December 2006 to perform the recommended manhole rehabilitation work as part of Phase 1 Part 3. The design work to rehabilitate the manholes is currently underway.

A detailed description of the manhole inspections including procedures, results, evaluation of manhole defect found, recommendations, and conclusions is presented in the following

Technical Memorandum. The location of each of the defective conditions cited above is identified in the Technical Memorandum.