CHAPTER 2

SEWER MAPPING

FIGURES

INTRODUCTION

An accurate record of the location, size, depth and type of sanitary sewers and their appurtenances is essential for effective sewer operations and maintenance. The best way to maintain these records is with detailed sewer maps. If not already available, sewer system maps should be developed, and kept updated, before any organized maintenance activities can be planned.

MAP TYPES

There are several types of mapping systems that have been used effectively by many communities. An area map is a map of the entire system. It is scaled in such a way that is shows how the entire area is served by the system and what the general patterns of the system are. Only the major items of concern are outlined on area maps, such as separate sewer areas, combined sewer areas, major trunk line connection points to other systems, pumping stations, diversion structures, overflows, treatment plants, and major roads.

At a much larger scale than area maps are section maps. These are drawn at a scale which allows for even more detail of the sewers, manholes, appurtenances, and their surroundings, such as property lines, buildings, and even trees and bushes. The size of section maps should be practical for use in the field. The number of section maps required to represent a sewer system depends on the size of the area. Ample space should be left on the maps to allow for pipe identification numbers, footages, pipe material, and pipe sizes. Section maps are necessary for planning specific maintenance tasks and for the field crews performing maintenance on the system. A set of properly prepared section maps will summarize data in one location from volumes of sewer system records normally kept by sewer system operation and maintenance personnel. Once developed, a comprehensive set of sewer system section maps will save time organizing and implementing a long-term operation and maintenance program because pertinent sewer system data will be centrally located and readily available.

Assessor's maps are also suitable for field use. These maps are usually drawn on individual pages and bound into books. They are very detailed and contain street names, street widths, property identification numbers and property sizes. Assessor's maps are usually obtainable from real estate or assessor departments.

Finally, grid coordinate maps can be used. These are developed by surveying crews and are based on a coordinate system developed by the state. This type of mapping system is very effective because the coordinate system will never change. It should be possible to locate the sewers at any time. All utility agencies can identify the location of all the important points of their underground facilities on the same grid system. This would make many jobs such as excavation much easier for sewer collection system personnel.

MAPPING DATA

When organizing a long-term operation and maintenance program it is essential to develop an accurate area map and set of section maps. Generally, the more data that is included on each type of map, the easier it will be to set up and implement a sewer maintenance program. Mapping data can be stored in a computer system's database so that computerized maps can be generated or revised quickly.

Area Maps

As a minimum, area maps should include the following sewer system data:

1. Background information including the community/agency boundary, major roadways, waterways, the boundaries of the 100-year floodplain, and any other pertinent landmarks.

2. The entire sanitary sewer collection system with the exception of the individual service connections.

   This includes:

   a. All sewer mains and local interceptors.

   b. Wastewater lift stations.

   c. Diversion structures.

d. Inverted Siphons

e. Overflows or bypasses.

f. Other major appurtenances.

3. Differentiate between areas in the community/agency which are served by separate sewers from those areas served by combined sewers.

4. In communities/agencies served by more than one MSDGC treatment plant, indicate the boundaries of the sewer areas served by each MSDGC facility and label each area appropriately.

5. Mark and label all locations where the separate sanitary sewers of the community/agency are connected to the MSDGC interceptor sewer system, local combined sewer systems, or sewer systems of other communities/agencies.

6. An area on the map should be reserved for tabulating the population equivalent served by each connection point to the receiving sewer system.

7. The scale at which the map is drawn.

8. A north arrow.

9. Date of latest map revision.

A basic example of an area map with typical useful data is included as Figure 2-1.

Section Maps

The data included on section maps needs to be in much greater detail than the general sewer system data included on a typical area map. Useful section maps should include the following data:

1. Location of sewers, manholes, and other appurtenances relative to the centerline of streets, property lines and benchmarks.

2. Building sewer connections located by their distance from the nearest manhole.

3. Sewer line data such as:

a. Sewer pipe diameter.

b. Sewer pipe material.

c. Sewer age.

d. Invert elevations shown at each manhole.

e. Wastewater flow direction designated by an arrow.

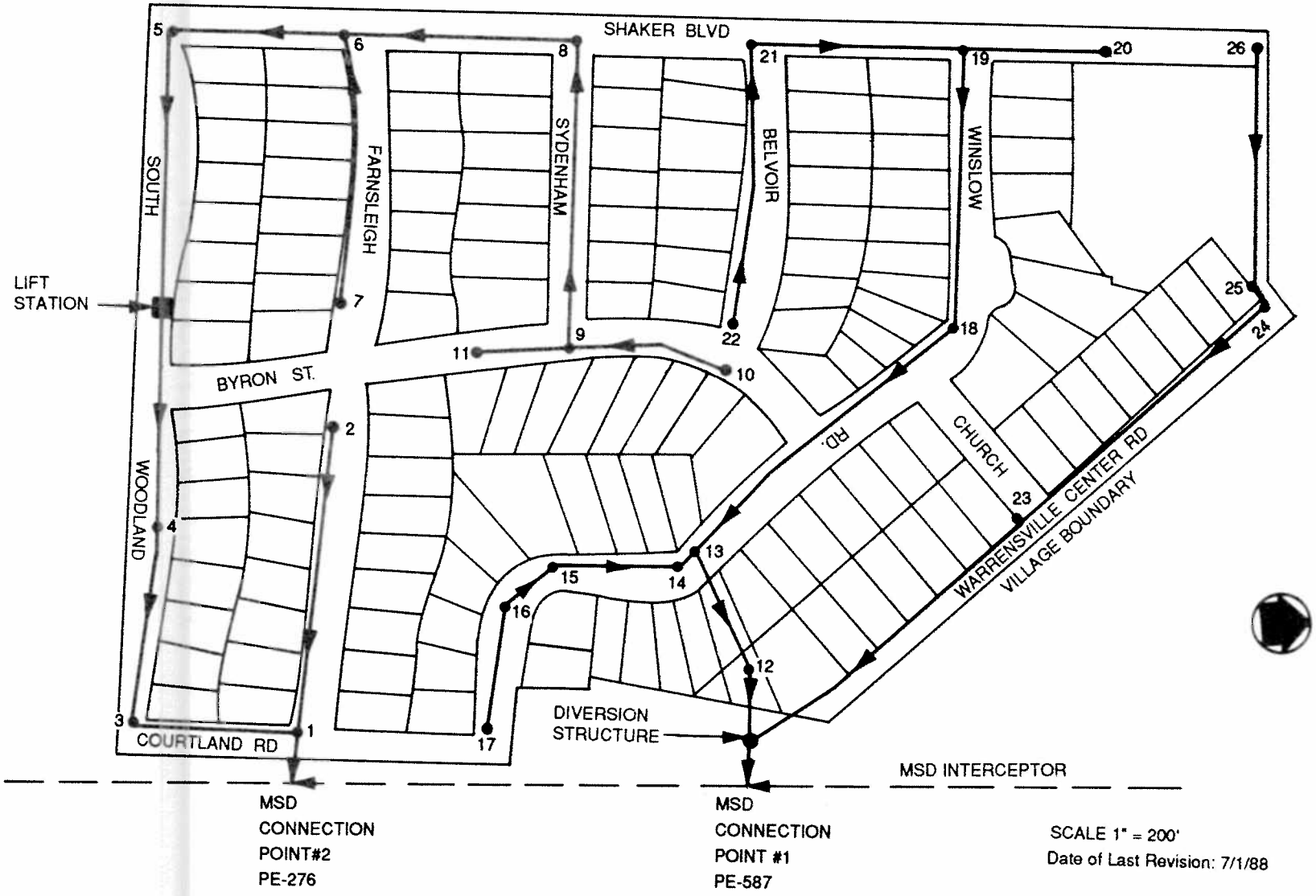

FIGURE 2-1. EXAMPLE AREA MAP

f. Differentiation between gravity mains and force mains.

g. Sewer lengths between manholes.

h. Location of flushing branches.

4. Manhole data such as:

   a. Rim elevations.

   b. Type of manhole construction.

   c. Manhole diameter.

5. Lift stations.

6. System overflows.

7. System bypasses.

8. Other utilities including:

   a. Storm sewers.

   b. Combined sewers.

   c. MSDGC interceptors and connection points.

   d. Water mains.

   e. Gas mains.

   f. Buried electrical cables.

   g. Buried telephone lines, etc.

9. Location of building service lateral cleanouts.

10. Invert elevations of building service laterals at the property line.

11. Miscellaneous data including:

    a. Width of streets.

    b. Right-of-way locations.

    c. Easement locations.

    d. Lot boundaries.

    e. Community/agency boundaries.

12. The scale at which the map is drawn.

13. A north arrow.

14. Legend defining all symbols and abbreviations used.

15. Date of latest map revision.

A basic example of a section map showing typical data is included as Figure 2-2.

Labeling Map Components

Each component of the sanitary sewer collection system shown on any sewer map must have a unique identification number. The number a sewer system component has been assigned must never be changed. Manholes that may be added later must be given new identification numbers. A length of sewer can be identified by indicating the numbers of the two manholes or other terminating structures which it connects. The service laterals can be identified by the street address or lot number which it serves. Connection points to the MSDGC system or other receiving systems must be identified and labeled.

MAP DEVELOPMENT

For communities/agencies that do not have a set of usable sewer maps, it is essential for proper operation and maintenance that useful sewer maps be developed. The development of sewer maps requires combining a variety of sewer system records. If a computerized mapping system is chosen for generating the sewer maps, the sewer system records can be used to create a database consisting of the critical information needed on the sewer system maps. Frequently the records are used to develop a base map along with a series of overlays. Base maps commonly include background information such as roads, waterways, buildings, property lines, basements, and other relatively permanent landmarks. Each overlay commonly represents a specific set of data traced onto a blank reproducible sheet which overlays the base map. Typical overlays for properly maintaining and operating the sanitary sewer system would include:

1. An overlay consisting of the sanitary sewer collection system.

2. An overlay including all utilities other than the sanitary sewer system.

3. An overlay with groundwater contours on it.

4. An overlay with ground surface contours on it.

Obtaining Map Data

Obtaining data to incorporate on sewer maps can be achieved by reviewing available records and/or by conducting field inspections. The following list indicates the common types of records that can be reviewed and field inspections that can be done to obtain the most important sewer map data:

1. Review as-built construction drawings and contract specifications. As-built drawings and specifications can provide information regarding the age of the system, pipe materials used, type of manholes installed, rim elevations of manholes, location and size of lift stations and other system appurtenance.

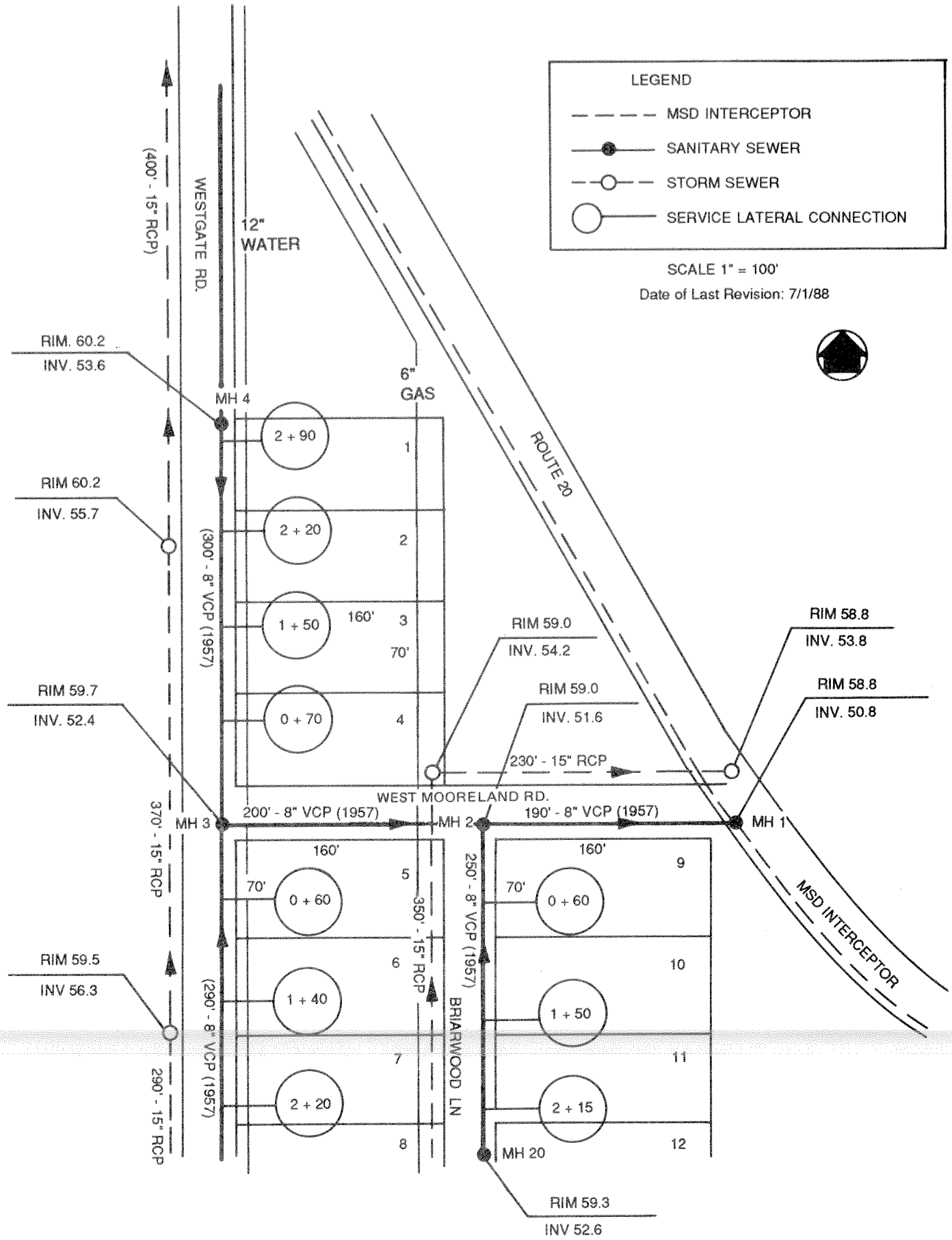

FIGURE 2-2. EXAMPLE SECTION MAP

2. Review Sewerage System Permits to verify the locations of connection points to the MSDGC interceptor system.

3. Review surveys of private property for identifying property lines and permanent easements.

4. Review maps provided by utility companies for accurately determining the location of all utilities in the sewer area.

5. If information regarding the direction of flow in the sanitary sewer system is not available, flow tests can be completed in the field. The tests are done by putting either a uniquely visible floating object into the sanitary sewer system or introducing a dye solution into the sewer system. The floating object or dye bracer is then followed through the sewer system as they are observed passing through downstream manholes.

6. Smoke testing can be done quickly and relatively inexpensively to determine the location of the sanitary sewer system. Smoke is blown through the system at a specific manhole. The smoke will surface at other system manholes located near the manhole in which the smoke was introduced.

7. Additional data for developing a sewer system map may be obtained by interviewing people familiar with the system. These people may include the director of public works, sewer maintenance personnel, the community/agency engineer, or contractors that constructed the system or have maintained it.

Map Scale and Size

The scale of each type of map should be clearly identified on each map sheet. The scale on an area map is dependent on the community/agency size. The area map scale should be determined so that the data presented on the map is clearly shown and at the same time presented on a sheet size which is easy to handle.

Section maps are typically developed at a scale between 1 inch = 100 feet and 1 inch = 200 feet. Again the actual scale chosen must be adequate for clearly representing the data typically included on section maps.

The size of the maps depends on who will be handling them. Office copies and originals of the section maps may be on standard 24" x 36" sheets. Reduced size sets for easier handling in the field should be considered for map use at the operational and maintenance level.

MAP UPDATING

Sewer system maps are only as useful as they are accurate. Any errors found in the maps or changes made to the system should be corrected or recorded as soon as they occur. This can be done with bracing overlays, or by attaching changes to the maps. The mapping personnel must be adequately trained and possess good drafting skills. It is the responsibility of the management, however, to make sure that all changes to the maps are recorded as soon as possible. Field workers can also assist in the maintenance of accurate

maps by reporting any discrepancies they encounter between maps and the actual system and by participating in a regularly scheduled field checking program. It is important for the updated maps to be reprinted periodically. This updating is critical for proper maintenance of the system even though it is tedious, time consuming, and cumbersome.

One person should be assigned the responsibility of updating the sewer maps. All map update data should be given to this person so that it can be incorporated onto the reproducible map sheets. Typical items that would require periodic updating include:

1. New sewer extensions and the appropriate new appurtenances. New map components must be given new identification numbers.

2. Sewer line changes resulting from the rehabilitation of existing sewers including pipe diameter, pipe material, sewer elevations, and sewer location.

3. Buried manholes not shown on the mapping system that are located in the field.

4. Change in manhole rim elevations due to sewer system rehabilitation or other construction projects in the area of the manholes.

5. Corrections to sewer map errors noted by field maintenance crews.

6. Addition of new utilities as they are constructed.

COMPUTERIZED MAPPING

Although still a new area of mapping technology, many communities are beginning to use a computerized system to maintain their maps. A database is generated, including locations, sizes, lengths, types of material, and ages of system elements.

The advantages of a computerized mapping system are numerous. It allows for a visual checklist of land parcels connected to the system and simplifies the billing process. The sections of pipe that require replacement can be easily identified when a parameter such as age of pipe is one replacement criteria. Inflow/infiltration studies can also be simplified, as well as map updating. This previously slow and error-inducing process can be made quick and accurate through the use of computers. Although the initial cost of implementing such a system may be high, it can minimize costs in the future by reducing the time required to locate system elements, to make decisions, and to update the maps. Also, information required for the system can be input to the computer by the collection system staff.

Because the computer system's database is very extensive, combining information from perhaps hundreds of other maps and records, most communities that have implemented computerized mapping programs have contracted the job to consultants experienced in this area. The consultant is able to tailor the system to the needs of the collection system facility.

The computer system can be expanded, once the database is compiled, to include programs for generating reports, calculating costs of alternative rehabilitation procedures, or drawing maps.