Collection system operation and maintenance is the essential element of a Capacity Management, Operation and Maintenance (CMOM) Program, which is required for any permittee by the Wisconsin Department of Natural Resources. Failure is inevitable to any asset without regular maintenance and repairs.

Sewer cleaning is one of the many operation and maintenance activities detailed and required as part of the City of Superior CMOM program. The purpose of sewer cleaning is to maintain continuous service to customers and mitigate the likelihood of sanitary sewer overflows and basement backups. Accumulation of debris, roots and grease over time may cause a blockage and an interruption of conveyance in the sewer. An interruption of conveyance may result in sanitary sewer overflows and backups of sewage into basements.

Sewer cleaning is detailed and tracked through a Work Order (WO) system, which utilizes ArcGIS, Microsoft Access and paper documentation. This document will detail the types of WOs, the procedure for the creation of the WOs, and documentation of completed WOs.

1. Work Order Categories

There are currently four different categories of work orders currently used for sewer cleaning in the City of Superior. These work orders are differentiated based on frequency of cleaning, and in some cases type of debris expected while cleaning.

1. Routine Cleaning

Routine Cleaning WOs are detailed for all sanitary sewers less than or equal to 42 inches in effective diameter. These WOs are created by Sewer District and are completed on a rotating basis. The current rotation for sewer cleaning WOs by sewer district is:

District 08

District 07

District 3A

District 05

District 3B

District 02

District 04

District 09

District 06

District 01

As of the end of 2021, the City has completed an average of 30.1 miles of sewer cleaned annually, or an approximate return cycle of 4.2 years.

1. Root Cut

Root Cut WOs are detailed for sanitary sewers with known root intrusion issues. These WOs are completed in the fall (except RA1 which is completed in the spring) and are separated into three subcategories: work orders to be completed annually (RA), work orders to be completed in even numbered years (RB), and work orders to be completed annually and by easement jetting (RE).

1. Grease Cut

Grease Cut WOs are detailed for sanitary sewers with known grease debris issues. These work orders are completed twice per year, in the spring and fall.

1. Run List

The City maintains a separate listing of sewers that need to be checked on a more frequent basis called the “Run List.” The frequency at which these sewers are checked vary from weekly to quarterly. The procedure for creating WOs for the Run List is separate from the other types of cleaning WOs.

1. Routine Cleaning Work Orders

The basis for Routine Cleaning WO has been in use since the early 2000s and is separated into smaller, geographically concise work groups. Each work group is designated by three numbers: sewer district, section and work order number. The work group for each sewer main section is housed in the Microsoft Access database *Work Order Record.accdb* located at [\\ESDFILESERVER\Working Foreman\Database](file:///\\ESDFILESERVER\Working%20Foreman\Database) in the table “DIS\_SEC\_WO\_RELATION.” This table includes the work group designation (i.e. 2-1-1) as well as the Root Cut work group and Grease Cut work group.

1. Work Group Verification

Once the sewer district to be cleaned has been determined, the work groups for the sewer district need to be verified as current and accurate based on the up-to-date sanitary sewer ArcGIS database. Work groups need to be manually adjusted to match current infrastructure and workable/printable maps. This is a manual process that can be completed within the Access database via query or visually in ArcMap. Additionally, abandoned or renamed sewer mains that are in the “DIS\_SEC\_WO\_RELATION” table need to be removed from the work group in order to prevent the records for those mains from appearing on the printed work order text. **NOTE**: mains that have been renamed will no longer have cleaning data associated with the “old” name appear under the record for the “new” name.

1. Map Creation

Once the work groups have been verified and updated, as applicable, printed maps need to be created for all work orders. This is done by work group, with the geographical area to be cleaned zoomed in and centered as best possible. Data frames should be used for areas where there needs to be zoomed in view of the infrastructure. The procedure for creating the maps follows.

1. The “DIS\_SEC\_WO\_RELATION” table in the Access database needs to be Joined with “ESD.DBO.UTIL\_COS\_scollect\_arc” by FACILITY\_ID; preference is to have this Join be its own layer in the basemap.
2. Use the Definition Query within the layer to only display one work group. An example of this is *"DIS\_SEC\_WO" LIKE '2-12-1'*
3. The following items need to be visible/active in the basemap for printing:
   1. Labels for joined work group layer
   2. Layer “Toilet Blown” (currently working with Paul to get this as its own geodatabase – right now is a Join between an Excel spreadsheet and the Parcels layer).
   3. City Parcels
   4. Road Centerlines with labels
   5. Sanitary sewers “ESD.DBO.UTIL\_COS\_scollect\_arc”
   6. Sanitary structures “ESD.DBO.UTIL\_COS\_scollect\_node” with labels
   7. Current aerial image
4. Layout needs to include a compass rose in the lower right hand corner of the printed page and the work group number in the upper right corner. Page size needs to be 8.5”x11” (letter size paper).
5. After all information is readable in the printed layout, export the map to PDF.
6. Repeat with remaining work groups in the sewer district.
7. Work Order Text Creation

After creating the maps, text details for the work group need to be created. These details include: sewer main details (facility ID, diameter, length), all information needed for work order tracking (staff, equipment used, length cleaned, etc.), and cleaning history by sewer main segment. The procedure for creating the work order text follows.

* 1. Open the Report “routine\_jetting\_report\_new” in the Access database *Work Order Record.accdb*.
  2. When prompted, enter the work group name you would like printed (i.e. 2-2-1) and select “OK” or press enter.
  3. After verifying the correct work group is in the report, print the report to PDF.
  4. Open the PDF of the work order text. Verify there is only one entry per sewer main segment (FACILITY\_ID); sewer mains in ArcGIS may have multiple OBJECTID per FACILITY\_ID and these separate OBJECTID need to be combined into one entry on the work order text report. If there is more than one entry per sewer main segment complete the following procedure:
     1. Save the PDF as a Word document.
     2. Open the Word document and locate the multiple entries. Total the length for all entries per FACILITY\_ID. Note the DIA info for each entry.
     3. Edit the Length value on one of the entries per FACILITY\_ID. In the same entry, edit the DIA value if necessary.
     4. Delete all other entries for that FACILITY\_ID.
     5. Repeat Steps i-iv as necessary.
     6. Print edited Word document to PDF.
  5. Repeat with remaining work groups in the sewer district.
  6. Verify the Work Order maps and Work Order text contain the same sewer main segments (FACILITY\_ID). Edit/adjust any that do not match.

1. Print Work Orders

Print all maps and work order text for the sewer district once complete, with the map following the work order text report by work group. Do not print the work order documents on both sides of the paper. Deliver the printed work orders to the Collections Working Foreman.

1. Root Cut and Grease Cut Work Orders

Like Routine Cleaning Work Orders, the work group for Root Cut and Grease Cut work orders are housed in the Microsoft Access database *Work Order Record.accdb* located at [\\ESDFILESERVER\Working Foreman\Database](file:///\\ESDFILESERVER\Working%20Foreman\Database) in the table “DIS\_SEC\_WO\_RELATION.” Maps for these work orders do not need to be created each time the work needs to be completed as these sewer mains (in general) do not change between cleaning cycles. The work order text will need to be created each time in order to include details from the last time the cleaning was completed. The text can be generated by running the report “routine\_rootcut\_report” or “routine\_greasecut\_report” as applicable.

1. Run List Work Orders

The “Run List” is a list of sewers that need to be checked and potentially cleaned on a more frequent basis, from weekly to quarterly. The information on the sewers to be checked and the frequency at which they are checked is housed in the Access database *Run List.mdb* located at [\\ESDFILESERVER\Working Foreman\Database\100RunList](file:///\\ESDFILESERVER\Working%20Foreman\Database\100RunList). The table “RunListFacility” contains all information on active, and inactive, Run List locations. These sewers are defined by the facility ID of the manhole that needs to be checked instead of the sewer main facility ID. Maps are not created for these work orders.

The weekly schedule for the Run List is detailed in the table “RunListWeekSchedule.” Each FACILITY\_ID is assigned a FREQUENCY\_GROUP based on how often the location needs to be checked, attempting to evenly distribute locations to be checked each week. Each FACILITY\_ID is assigned a RUN\_ORDER value that places the location in a logical order geographically to maximize efficiency in physically checking the locations.

The Run List Work Order is completed weekly, based on the week of the year corresponding with the Run List number. The work order details are generated using the report “CurrentRunList” in the Access database *Run List.mdb.* The staff assigned to complete this work order will first check all locations on the work order; the locations are assigned a condition of “Good,” “Grease,” or “Debris.” Any locations assigned the condition of “Grease” or “Debris” are then addressed appropriately. A corrective action of “Jet,” “Flush,” or “Vactor” is marked for each of those locations.

Periodically, the completed Run List work orders are entered into the *Run List.mdb* Access database. The only information tracked in the “RunListRecord” table is whether or not the location required action for the particular week; the type of corrective action is immaterial to whether or not these locations continue to need more frequent inspections and cleaning. Twice per year, the active locations are reviewed to verify the necessity of continuing the inspections at the currently listed locations and to modify frequency of inspection if necessary.

1. Completed Work Order Entry

ESD Collections staff are given the paper copy of the work order by the Working Foreman as needed during the year. The ESD Collections staff are responsible for accurately writing details on cleaning activities on the paper form. Once the work order has been completed, the paper form is turned in to the Working Foreman. The Working Foreman then enters all the information from the paper form in to the Access database *Work Order Record.accdb.* The paper forms are turned in to the ESD Collection Systems Engineering and Operations Manager for review and closing out the work order. Finally, the paper work orders are scanned and filed in the appropriate folder on the network by the ESD Staff Assistants. Details on this process are not included in this document.