Monarch Cove/IGLSD -- Sewer Update
4/01/20

Components:

- Gather and Analysis Existing Data
- Consult with Area and Regional Contractors and Experts
- Develop a Game Plan for going-forward with IGLSD

Key Questions:

- What is the state of MCA sewer system?
- What is the capacity of the MCA sewer systems?
- What rate of discharge should be expected from the MCA sewer lines?
- Are MCA residence inappropriately discharging roof and sump pump discharges into the sewer system?
- What are standard practices for repair of sewer lines?
- What do we know about IGLSD?
- How can MCA be proactive in suggesting allowable discharge levels?
- Are our annual maintenance procedures adequate and, if not, what else should we be doing?

State of Existing Sewer System

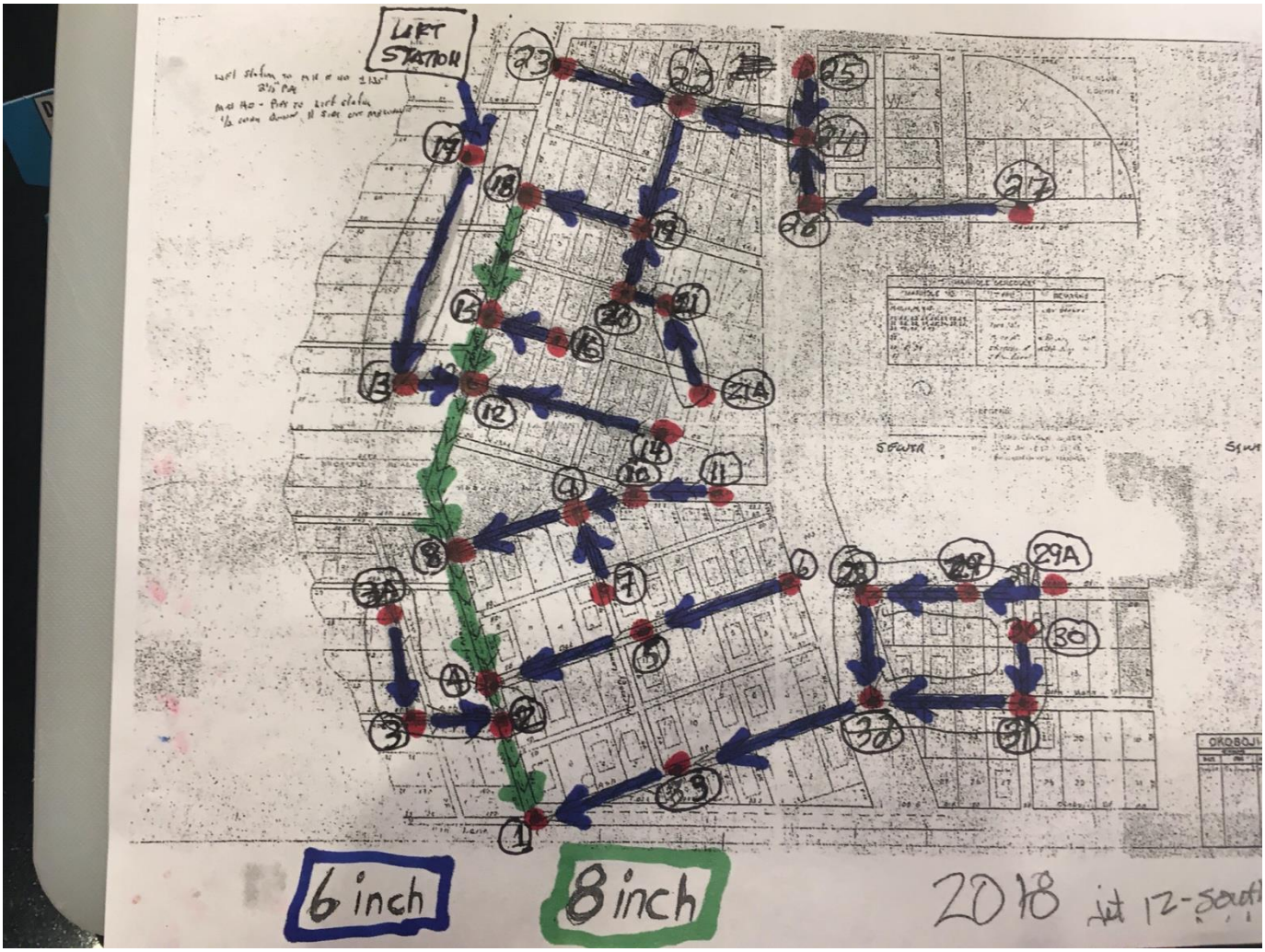
Data Compilation:

- Assembled existing data
    - Howe sketch of sewer system layout (see following page)
        - Only one 8-inch VCP section
            - Owned by IGLSD (per Howe conversation with IGLSD)
            - Don Hemphill could not find easement in MCA records
        - Remaining sections (owned by MCA) are 6-inch VCP
    - Howe 2014 Videos
    - IGLDS Assessments of 2014 Data
    - IGLSD Letters to MCA
    - Data transferred to drop box for sharing

Organized and summarized data:

- Transferred data to drop box for sharing and analysis
- Trunk and Lateral Lines
    - IGLSD Trunk Line – 6 sections / 942 feet
    - Laterals – 30 sections / 4,742 feet
- Reviewed and Summarized IGLSD analysis (see following pages)
    - Numbering system tied to 8-inch inlet manhole
    - Key for defects (MCA / IGLDS #'s)
        - Joint Offsets (28 / 6)
        - Joint Separation (1 / 0)
        - Holes (4 / 0)
        - Broken Pipe (8 / 3)
        - Leaky Pipe (1 / 0)
        - Cracks (6 / 2)
        - Surface Damage (2 / 0)
        - Lateral Break ins (non-factory original tie-ins) (29 / 0)
        - Sags (low spots at installation and/or settling) (35 / 6)
    - Note: Most defects are not likely source of non-sewer inflows
        - Experience of Howe and pipe experts
- Visual inspection of homes for potential inappropriate discharges of roof and/or sump pump into sewer system.
    - Orange dots on map indicate "**potential"** problem sewer discharges.

MCA Sewer System Map Layout (from Howe Sanitation)



Summary of IGLSD analysis of Howe Videos

	New Line Name	Jnt Offset	Jnt Sprtn	Hole	Brkn Pipe	Leaky Pipe	Cracks	Surf Dmg	Lateral Bl's	Sags
1	1.1				1		2		1	0
2	1.2	2							2	0
3	1.E3	1			1				8	2
4	"1.E4	3						1	1	0
5	1.N3	2							1	0
6	1.N4				1	1			2	1
7	1.N5	3							0	0
8	2.1								0	4
9	2.2								2	2
10	4.1	1							3	0
11	4.2	1	1						2	0
12	8.1						1		2	0
13	8.S2	1			1				0	0
14	8.E2								1	0
15	8.E3	4							0	0
16	8.E4								0	0
17	12E.1									
18	12W.1								0	0
19	12W.2	4			1		2		3	1
20	15.1						1	1	1	0
21	18.1	1		3	1				0	0
22	18.S2	1							0	0
23	18.S3	2			1				0	0
24	18.S4	1							0	2
25	18.N2								0	6
26	18.N3W								0	8
27	18.N3E								0	3
28	18.N4EN								0	0
29	18.N4ES			1	1				0	6
30	18.N5ES	1							0	0
	TOTAL	28	1	4	8	1	6	2	29	35

MAIN TRUCK LINE

	New Line Name	Jnt Offset	Jnt Sprtn	Hole	Brkn Pipe	Leaky Pipe	Cracks	Surf Dmg	Lateral Bl's	Sags
1	M1	1	0	0	3	0	2	0	0	2
2	M2	1	0	0	0	0	0	0	0	4
3	M3	4	0	0	0	0	0	0	0	0
4	M4	0	0	0	0	0	0	0	0	0
5	M5	0	0	0	0	0	0	0	0	0
6	M6	0	0	0	0	0	0	0	0	0
	TOTAL	6	0	0	3	0	2	0	0	6

Potential Inappropriate Discharges into Sewer System

Contractor / Pipe Expert Consultation

Comments from Howe Sanitation:

- MCA sewers laterals are generally in good condition, no collapse or other unexpected obstructions observed during annual jetting or root cutting maintenance.
- MCA sewer laterals are in better condition than other IGLSD customers inspected:
    - Templar Park (in very poor condition)
    - Subdivision near McDonalds on Hwy 71 (in need of repair with pipe collapse)
- Howe's experience with the major causes of high flows into sewer systems are:
    - 70-80% chance that it is from inappropriate discharge of sump pumps.
    - 10-20% chance that it is from manholes that need to be grouted.
    - 5-10% chance that the VCP lines are leaking, given that MCA's VCP is in good structural condition.
- If using measurements to assess inflow into the sewer system, two sets would be required, one in the dry season (Nov to Dec) and one in the wet season (Apr to May):
    - NOTE: If one suspects inappropriate sump pump discharges the major cause for high flow rates into the IGLSD system, a first step would be to measure flow rates leaving MCA before and after inappropriate discharges are corrected. If the rate after removal of sump pump discharges is "reasonable" (compared to MCA expected discharges), then no further remediation would be necessary.
    - NOTE: Homeowners who are discharging sump pumps into the sewer lines will be reluctant to eliminate those sewer discharges, even though illegal. Rerouting the sump pump discharge onto street or adjacent drainage ditch would likely require those lines to be heat tape wrapped. This would be necessary as the new lines would be above the ground freeze depth, in which case the line could freeze between periodic sump pump discharges, thus plugging the line, which in turn, would cause the pump to burn out, the sump pump reserve tank to fill, and overflow spilling into homeowner basements.
- Howe Sanitation has the expertise to repair VCP systems (in-situ grouting or liner installation as well as video inspection, smoke testing and limited metering capabilities).
    - NOTE: if in-situ grouting repair required, Howe would need to purchase smaller 6-inch packers.

Comments from the Clay Pipe Industry

- VCP lines can last for more than 100 years
- Most visual defects from videos are likely false positives
- Standard practice for actual VCP defects repair is trenchless in-situ repair rather than replacement
- Quick scan of videos indicate that MCA lines are generally in good condition
- Laterals in need of repair can be identified by comparing estimated vs actual flow rates.

Comments on IGLSD (Howe Sanitation and Paul Stensland)

- IGLSD is expanding flow capacity capabilities (major increase in line sizes) downstream of MCA discharge point. This indicates there has either been a significant increase in development north of Nature Center Road and Lakeshore drive and / or the system coming from the north (MCA area) is undersized, thus necessitating the expansion.
- IGLSD has renewed focus on older subdivisions as they are having to expand their capacity south of MCA connection and upstream of their sewage treatment plant.
- IGLSD probably has metering capabilities, that could be used to identify potential high flow rate MCA laterals.

Comments from All: Sewer Systems Inspection and Repair Costs:

- Small leaks: Joint offset or Separation / Hole / Leak / Crack
    - In-Situ Grouting with AvantiGrout => https://www.youtube.com/watch?v=PQTlXBzLk04&app=desktop
    - Lateral Repair Cost: $6,000 to $12,000
        - Assumes 500 foot lateral, $35 per joint for tool and $20 per joint for chemical and either 4 foot or 2 foot joint lengths.
- Larger Pipe Damage: Pipe Section Split or other Body Defect
    - In-situ Internal Lining with PermaLine System => https://www.youtube.com/watch?v=L80pvqgfn1g
    - Cost: $6,000:
        - Assumes two 4 foot sections per repair per lateral.
- Manhole Grouting Repair
    - Visual inspection of manholes during wet season looking for inflows.
    - Cost: Initial visual inspection for 40 manholes: $1,000
    - Cost: Plus $1,300 to $1,500 per manhole if grouting required
- Visual Inspection and Documentation of Homeowner houses for inappropriate discharges into sewer system:
    - Homes w/ sump pump discharges: $300 per home (photos and documentation)
    - Homes w/o sump pump discharges: $150 minimal documentation
- Smoke Testing
    - Not recommended as it will only identify major breakage, and then only in rare cases for underground systems.
    - Cost: $2,500-$3,000 for MCA's 30 blocks
- Flow measurements
    - Cost: $30,000. Assumes $1,000 per measurement point, and we would need 8-10 measurement points during both the wet and dry season plus $10,000 for mobilization, demobilization, and associate work and documentation.
    - Note: Approximately 80% of measurements would be on IGLSD manholes, so if done on shared cost MCA's share would be $6,000.

Basis for Approaching IGLSD

Background:

- IGLSD is having to significantly expand their flow capacity from Nature Center Road south to their treating plant.
- IGLSD has started focusing on reviewing inflow from subdivision into their system
- We believe IGLSD will not be willing to set flow limits from subdivisions, but instead will try to influence subdivision to review and manage their own systems?
- We suspect IGLSD will be willing to work with subdivisions to develop an acceptable management system that monitors for leaks and acts responsibly to correct leaks.
- Trying to get information on IGLSD on sewer collection system (map, pipe sizing and capacity) upstream and downstream of MCA.

Starting Point:

- What is actual sewer output from MCA and is it reasonable?
- Reasonable discharge rate?
    - 143 homes (3 not MCA residents, 2 Camp homes, but missing Camp itself)
    - 100 gallons per day for person and four persons per household
    - Reasonable = 40 gallons per minute (or 57,600 GPD) (plus Camp?) average the entire day.
- Actual discharge rates?
    - NEED THESES MEASUREMENTS to compare “Reasonable Rate” in both the IGLSD Trunk Line and the MCA laterals.
    - NOTE: It is expected that lower 1-2 inches of the sewer pipe will be standing full of fluid. An 8 inch pipe carrying 48.3 GPM will flow at a depth of 1.6” deep in the pipe (assuming 1% slope, Coef. of Friction of 0.013, and velocity of 2.17 fps)

Suggested MCA / IGLSD Discussion Approach:

- MCA has structurally competent sewer laterals and general good practices for maintaining their system of laterals, but if there are unacceptable inflows, we will work with the IGLSD to identify and correct any defect inflows.
- As a starting point, we request the IGLDA measure the flow rates into and out of the MCA point of discharge. The difference in measurements will allow the calculation of flow rates coming from the MCA inlet.
- If the rate is "reasonable" based on estimated flow rates from a subdivision the size of the MCA subdivision, then no repairs will be necessary.
- If the rates significantly exceed the expected rate, then we will undertake a cooperative study with the IGLSD to locate the source of the high inflows. It is our understanding that the probability for unexpectedly high flow rate sources are"
    - 70-80% chance that it is from inappropriate discharge of sump pumps.
    - 10-20% chance that it is from manholes that need to be grouted.
    - 5-10% chance that the VCP lines are leaking inflow from outside the sewer laterals, given that MCA's VCP is in good structural condition.
- If the rates significantly exceed the estimated flow rates, we will systematically evaluate the three identified sources for the high non-sewer inflows:
    - First, we will hire Howe Sanitation to inspect and document the discharge location for any home with a sump pump, and if the discharge is into the sewer line, we will demand the homeowner correct this inappropriate discharge. Prior to these modifications and during a wet period, we would request IGLSD to measure the flow rates leaving their 8" VCP truck line and entering their main sewer line. We believe that IGSL has the equipment and capability to perform such measurements.
    - Second, if after the first mitigation effort, the rates still significantly exceed the estimated flow rates, MCA will hire Howe Sanitation to inspect the manholes for non-system inflows and repair those manholes shown to be defective. Again, we would request IGLSD to measure the flow rates leaving their 8" VCP truck line and entering their main sewer line, to determine if the second remediation is sufficient.
    - Lastly, if after the above two remediation efforts, the MCA discharge rates still significantly exceed the estimated flow rates, we, with your metering capabilities, will proceed to identify and repair the lateral(s) with excessive inflow, Again, we believe the non-sewer inflows from laterals is de minimis given the good structural condition of the laterals, but we stand ready to correct any significant non-sewer inflows.
- MCA will continue annual sewer line maintenance of jetting and root cutting.

Needed Flow Measurements for Flow Balance

MAIN TRUCK LINE

	New Line Name	# Homes	Manhole (from)	Manhole (to)	Length	Grade	Exp Rate GPM
1	M1	35	2	1	195		9.7
2	M2	12	4	2	42		3.3
3	M3	22	8	4	234		6.1
4	M4	34	12	8	113		9.4
5	M5	5	15	12	179		1.4
6	M6	35	18	15	179		9.7
	TOTAL	143			942		39.7

Measurments

IGLSD Source	MCA Source	Lateral Rate	IGLSD Measure	MCA Measure
MH #2	MH #33	33 = 1 -2	1 & 2	
MH #4	MH #3	3 + 5 = 2 - 4	4	3
MH #8	MH #5	9 = 12 - 8	8	
MH #12	MH #12	13+14=12-15	12	13
MH #15	MH #15	16 = 15-18	15	
MH #18	MH #19	19 = 18	18	

Board Decisions Going Forward

- Recommendation 1: Street renovation project can proceed as in-situ repair methods are available to correct any non-sewer inflows into the MCA sewer system.

- Recommendation 2: Develop an approach for dealing with homeowners who may be inappropriately discharging sump pump into the sewer system. We will likely need to gain access to homes to determine and documents the existence of sump pumps and the point of discharge for interactions with IGLSD.

- Recommendation 3: Proceed to engage IGLSD in discussions to test, identify and correct any inflow defects into our sewer system through a cooperative and multi-year effort.

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March 30, 2020

Engineer's Opinion

Over the last 2-3 weeks I have reviewed the videos. There are two sets of videos (over 75 videos) done by Howe Sanitation in April and November of 2014 (in conjunction with the water replacement project) of the existing Monarch Cove Sewer System that includes 4742 feet of 6" VCP and 942 of 8" VCP (942 ft on 213th St). We have been told that the 8" VCP in 213th St. is owned by the IGLSD. I also reviewed the IGLSD Reports and their defect notes and ratings. See the charts in our report documenting the defects (excluding "roots" listings). Monarch Cove has been removing roots and cleaning the system since 2015.
The Monarch System is typical of sewer systems installed in the 1940 to 1970 era that used vitrified clay pipe sanitary sewer systems. In fact, in Sioux City, where I worked for the past 50 years, has over 350 miles of clay pipe sanitary sewer lines that are still in service after 75-100 years of operation.

In my professional judgement, the Monarch Cove's sewer is in good condition, and if leaks exist, they can be repaired via in-situ methods.

- Videos indicate only a minimal number of defects, 22 defects in 4742 feet of 6" VCP. Further evaluation of these defects will likely indicate that some, if not most of these visual defects, will not require repair as they are not leaking. And those that require repair can be repaired using in-situ repair methods. There is also no indication in the videos, or from the annual maintenance programs observations, that the defects have compromised the structural integrity of the pipe.

- There are also 28 joint deflections defects have likely been there since the pipe was installed. This VCP pipe system was installed circa 1950 and the installation methods likely resulted in the noted defects. Again, if it is found that a joint deflection is leaking, there are in-situ methods available to seal the leak.

- There are 35 sags (or low points in the system), but these sags are not likely defects that need to be corrected unless they have routinely caused sewer line backups, which has not been observed.

I have reviewed the above assessment with Jeff Boschert, P.E., National Clay Pipe Institute engineer (at not cost to Monarch Cove). After reviewing the actual video, he has provided the following comments:

- When it was installed circa 1950, the VCP pipe joint system used joints probably filled with "mortar and tar" in the joints. The cast into the pipe joints, in the pipe from the 1940's to 1970, were <u>not gas-tight or air-tight</u> tested as standard installation procedures. Gas-tight and water-tight clay pipe systems requirements were instituted in the early

1970's, but this requirement was only for new construction testing, and not required as condition of operation after instillation.

- VCP pipe systems are, and were, used all over the country and continue to be used. They last over 100+ years and with minimal maintenance, and they can last another 100 years. Hydrogen Sulfide gas, that exists in all sewage flow, cannot deteriorate the pipe walls on VCP sanitary sewer.

The Monarch Cove's sewer system potential for leaking, in my engineer judgement, is more likely the result of above ground discharges into the sewer system from sump pump discharges and roof run-off by residents rather than sewer line defects. This is not to imply that certain laterals feeding the Sanitation District gathering line might have defects resulting in inflows coming from those defects, but this needs to be assessed from cooperative effort between the Sanitation District and Monarch Cove to measure flows between sections of the Sanitation District's *8" VCP mainline in 213th Street* and Monarch Cove laterals to affirmatively determine which laterals are experiencing a inflow in excess of expected sewage discharge. These measurements would, of course, be performed after testing, inspection and removal of discharges by residents of sump pump or roof discharge into the sewer system.

I recommend the Board consider proceeding with the testing recommendations listed in the suggested MCA practices. After this, testing repairs to the system "without excavation" can be used if the defects are leaking or determined to need repair sewer line inflow from sewer line integrity.

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