

# Key Largo Wastewater Treatment District Board of Commissioners Meeting Agenda Item Summary

Meeting Date:  
January 21, 2020

Agenda Item Number: L-1

Agenda Item Type:  
Information / Presentation

Agenda Item Scope:  
Review / Discussion

Recommended Action:  
Discussion

Department:  
Engineering

Sponsor:  
Steve Suggs P.E.

Subject:  
**C905 Blockage & Mitigation Options**

Summary of Discussion:

A blockage occurred on C905 on December 13th 2019. The likely cause was analyzed by WEC staff with KLWTD staff assistance. Several options to prevent or mitigate a future similar incident on C905 were reviewed with KLWTD staff and are presented in the attached memo along with estimated cost.

<u>Reviewed / Approved</u>	<u>Financial Impact</u>	<u>Attachments</u>
Operations: _____	\$	Weiler Memo
Administration: _____		
Finance: _____	Funding Source:	
District Counsel: _____		
District Clerk: _____	Budgeted:	
Engineering: _____	No	

Approved By:   
General Manager

Date: 1-16-2020



## MEMORANDUM

**To:** Peter Rosasco, General Manager  
**Cc:** Mike Dempsey, Field Operations Manager  
**From:** Ed Castle, PE  
**Date:** December 24, 2019  
**Re:** North Transmission Main 6”X4” Reducer Options

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The Field Operations Department received several trouble calls beginning on December 13, 2019 regarding problems with the District-owned grinder pumps associated with the C-905 service area. According to the calls, the pump station, which are located at the homes but owned by KLWTD, were reaching high levels and generating alarms.

On investigation by the Field Operations staff, it was determined that a blockage of the force main had occurred near the transition from the 4” North Transmission Main (NTM) Extension to the 6” C-905 Force Main. The Field Operations crew excavated and determined that the blockage was on the 6” side of the 6”X4” reducer between the two segments of force main. According to the crew, the blockage consisted of approximately 20’ of compacted grit.

The Field Operations Department mobilized the jet rodder trailer and the VacTrons and cleared the blockage, restoring service to the C-905 Area. Due to the length of time that some of the E-One grinder pumps were dead-heading against the blocked 6” Force Main, 10 E-One pumps were damaged and need to be rebuilt. This represents approximately 12% of the C-905 grinder pumps.

The C-905 area provides wastewater collection service to 81 EDUs, each with an E-One grinder pump station. For design, each user is assigned a daily potable water consumption rate of 167 gallons per day. This equates to an Annual Average Daily Flow of 13,527 GPD. Under normal use, with a standard peaking factor of 4.3, the peak flow would be 40 GPM, or 0.089 cubic feet per second. However, after a power outage, all 81 pumps could run simultaneously, generating a peak flow of 810 GPM.

In a 4” force main after a power outage, the velocity would be approximately 21 feet per second, which exceeds the maximum allowable velocity of 10 feet per second. If a 6” force main is used instead of a 4”, the velocity with 81 pumps running would be 9.2 feet per second, which is within the allowable design velocity. A 6” force main was installed on the southern-most 9,000 feet of C-905 for this reason.

CPH Engineers was selected from the District’s library of engineering firms to design the North Transmission Main (NTM) and the NTM Extension in 2007. The design proceeded through 2008. At that time, the District Board was debating options on how, or even if, the District would

provide wastewater service to the 81 users on C-905. It appeared that there was a good likelihood that a force main on C-905 to carry wastewater to the regional WWTP from C-905 and other remote locations would not be constructed. For this reason, CPH Engineers did not include the peak instantaneous flow from the 81 developed properties in the C-905 area in their flow and velocity calculations for the NTM Extension. Without the C-905 flows, the NTM 4" Extension was properly sized.

After much analysis and debate, the Board decided in 2012 to design a force main to collect the wastewater from the 81 users on C-905 and convey it via force mains to the regional WWTP. Weiler Engineering was tasked with designing the C-905 force main and grinder pump collection and transmission system. As demonstrated above, a 6" force main would be required on the southern 9,000 of C-905. The NTM 4" Extension was already designed, permitted, constructed and approved for use at that time.

Since the southern 9,000 feet of the C-905 force main was required to be 6" in diameter, and the receiving NTM 4" Extension was already installed and certified complete, a reducer from 6" to 4" was installed at the connection point between the C-905 force main and the NTM 4" Extension. The 6"X4" reducer had to be installed "backward" from the normal position, creating a potential bottleneck if large balls of debris were to be sent down the line. The risk of this occurring was deemed to be low, since all the wastewater from C-905 was being run through grinder pumps and individual force main laterals with a diameter of 1.25".

The C-905 force main became blocked on December 13<sup>th</sup>, 2019. It was subsequently found that grit had compacted in the 6" C-905 force main just short of the connection to the NTM 4" Extension. The plug consisted of approximately 20' of pipe plugged with impacted grit. The plug was not caused by a large ball of rags. It is apparent that some change in flow regime occurred at that area, allowing the grit to drop out of suspension and accumulate in the pipe.

It is speculated that grit has accumulated over time in the C-905 force main, since under normal use with only a few grinder pumps running simultaneously, the velocity in the force main is less than 2 feet per second, allowing the grit to fall out of suspension. It is further speculated that as the winter season approached, and residents returned to their homes on C=905, the higher use caused the accumulated grit to re-suspend and be moved along the 6" force main up to the connection to the NTM 4" Extension. At that point, the change in flow regime caused the re-suspended grit to drop out of solution and finally completely plug the southern terminus of the 6" force main.

In order to prevent a recurrence of the process that caused the blockage, Weiler Engineering and KLWTD staff examined several possible options for correction of the bottleneck at the NTM 4" Extension connection. These include:

1. Remove and replace the 4,200 feet of NTM 4" Extension
2. Discharge the 6" C-905 force main into a duplex pump station with a 4" discharge, which would re-pump through the existing NTM 4" Extension.
3. Install pressure detectors and flushing ports upstream and downstream of the 6"X4" reducer to track pressure changes, allowing KLWTD staff to flush the lines to move any grit accumulation down the line to the WWTP. The jet rodder and Vactrons could be used for flushing this area when the pressure differential begins to increase.
4. Install flushing ports along the C-905 and NTM Extension force mains to allow for periodic flushing using the jet rodder and Vactrons.

The table below provides cost estimates for the four options described above.

Solution	Estimated Cost	Pros and Cons
Replace 4,200 FL of 4" FM	\$1,069,181	<u>Pros:</u> <ul style="list-style-type: none"> <li>• Corrects design so that acceptable Peak Hourly Flow is maintained when 81 pump stations run on C-905</li> </ul> <u>Cons:</u> <ul style="list-style-type: none"> <li>• Expensive</li> </ul>
Construct Booster Pump Station with 4" Discharge	\$400,703	<u>Pros:</u> <ul style="list-style-type: none"> <li>• Eliminates bottleneck by repumping</li> <li>• Would re-grind any larger balls of debris</li> </ul> <u>Cons:</u> <ul style="list-style-type: none"> <li>• Need to acquire land</li> <li>• Need electrical service installed</li> <li>• Potential for overflow of the new pump station if pumps fail and C-905 keeps pumping</li> </ul>
Install Pressure Monitoring and Two Flushing Ports	\$37,756	<u>Pros:</u> <ul style="list-style-type: none"> <li>• Provides warning prior to full blockage so that Staff can flush line</li> </ul> <u>Cons:</u> <ul style="list-style-type: none"> <li>• Does not correct design velocity issues when 81 pumps run</li> <li>• Requires use of jet rodder, Vactrons &amp; personnel</li> </ul>
Install Flushing Ports on C-905 and NTM 4" Extension	\$342,644	<u>Pros:</u> <ul style="list-style-type: none"> <li>• Allows for periodic flushing of force main segments, preventing accumulation of grit</li> </ul> <u>Cons:</u> <ul style="list-style-type: none"> <li>• Does not correct design velocity issues when 81 pumps run</li> <li>• Requires use of jet rodder, Vactrons &amp; personnel</li> </ul>