Case Study: 12” Force Main, sub-aqueous crossing, inspected using Remote Field Technology, summer 2008

During the summer of 2008 a new electromagnetic inspection tool was used to inspect an abandoned 12” force main for Pinellas County Utilities in Florida.

Location:	**Indian Rocks Beach**
Material Type:	**Cast Iron in two thicknesses**
Liner:	**Cement mortar**
Coating:	**Coal Tar Enamel**
Diameter:	**12”**
Thickness (grade):	**Class 23 and Class ??(“River Crossing Pipe”)**
Length:	**940’**
Age:	**Approximately 40 years**
Depth of cover:	**Buried below the channel at a depth of approximately 36”, with partially exposed pipe at ends of crossing**
Reason for inspection:	**The eastern upland section of the line had a history of repeated failures which were linked to corrosive soils and graphitization from the outside of the pipe. The crossing is the same age as the upland sections, but has not exhibited the same failure history. Testing of the crossing was conducted using the available technology, ultrasound, visual inspection, which did not provide conclusive condition information. Choosing not to wait for pipe failure, and in the absence of proven technology, Pinellas County Utilities decided to replace the crossing with drilled HDPE pipe. The County has several other such force mains crossing waterways and wanted to use this line, with verified defects, as a test for a new tool from PICA Pipeline Integrity and Condition Analysis Inc..**
Technology Description:	**The new Tool uses low frequency electromagnetic energy which travels through the wall of the pipeline as a sinusoidal wave. The pipe material acts as a waveguide for this signal which is detected by an array of electromagnetic sensors, which are positioned approximately 3 diameters away from the emitter where the direct, internal field has attenuated to near-zero. The “time of flight” and “amplitude” of this signal are measured and compared to reference standards. Remaining wall thickness is computed from these measurements. The electronics, sensors, batteries and memory are housed within stainless steel pressure housings, joined together by flexible joints which allow**

the tool to negotiate bends. The Tool is positioned within the pipe by centralizers, and has a clearance approaching 2", allowing for the liner thickness plus some internal deposits. The technology is sensitive to wall-thickness changes caused by pitting, graphitization, cracking and erosion.

Case Study:

Prior to the inspection, a length of pipe was removed by a civil contractor and reference defects were machined into it. These are necessary to create a "Calibration Standard" against which defect signals are compared and sized. The pipe section removed also had natural graphitized through-wall corrosion which was detected by the Tool during a baseline scan (i.e. before machining), and confirmed visually after encrustations and graphite was removed. After the calibration pipe had been manufactured the civil contractor cleaned the pipeline with one run of a foam cleaning pig, and then videotaped part of the pipeline with a remote CCTV system. The CCTV video showed roots growing through a crack in the line located in the tidal area near the east end of the line. Water was flowing into the line at this location. No other defects were observed.

The Civil contractor left a wire rope in the pipeline which was used to pull the PICA Tool through. Note: the PICA Tool is a self-contained, free-swimming Tool that can travel many miles through a pipeline system; however, since this pipeline was out of service, and large amounts of water would have been required to push the tool through with water, it made sense to winch the tool back and forth across the waterway.

The inspection took approximately two hours to winch the Tool across and back while data was gathered in both directions. The data was downloaded to a P.C. and the analysis process began. The following day a preliminary report was given to the customer which reported that the line had considerable wall loss in several discreet pipes, with corroded areas at both sides of the crossing in the tidal area and on shore. Included in this damage was a 6' long through wall crack that was spiraling down the pipe on the east end, in the tidal area where the roots had been seen by CCTV.

The heavier walled pipe in the middle of the channel had less corrosion damage.

Subsequent to the inspection, an "excavate and confirm program" was initiated to provide correlation between the tool and the ground truth. This work is continuing at the time of writing; however, in other inspections, the correlation between actual location and depth of corrosion has been excellent.

Photos of the job and screen captures of the data follow:

Fig-1: (above) 12" PICA Tool being loaded into launch tray

Fig-2: Wire rope being attached to Tool

Fig-3: Winch unit being used to pull tool

Fig-4: Pre-cleaning the line (cleaning and sizing pig is winched through)

Fig-5: shows no damage on the sizing plates (that are slightly larger than the actual inspection Tool)

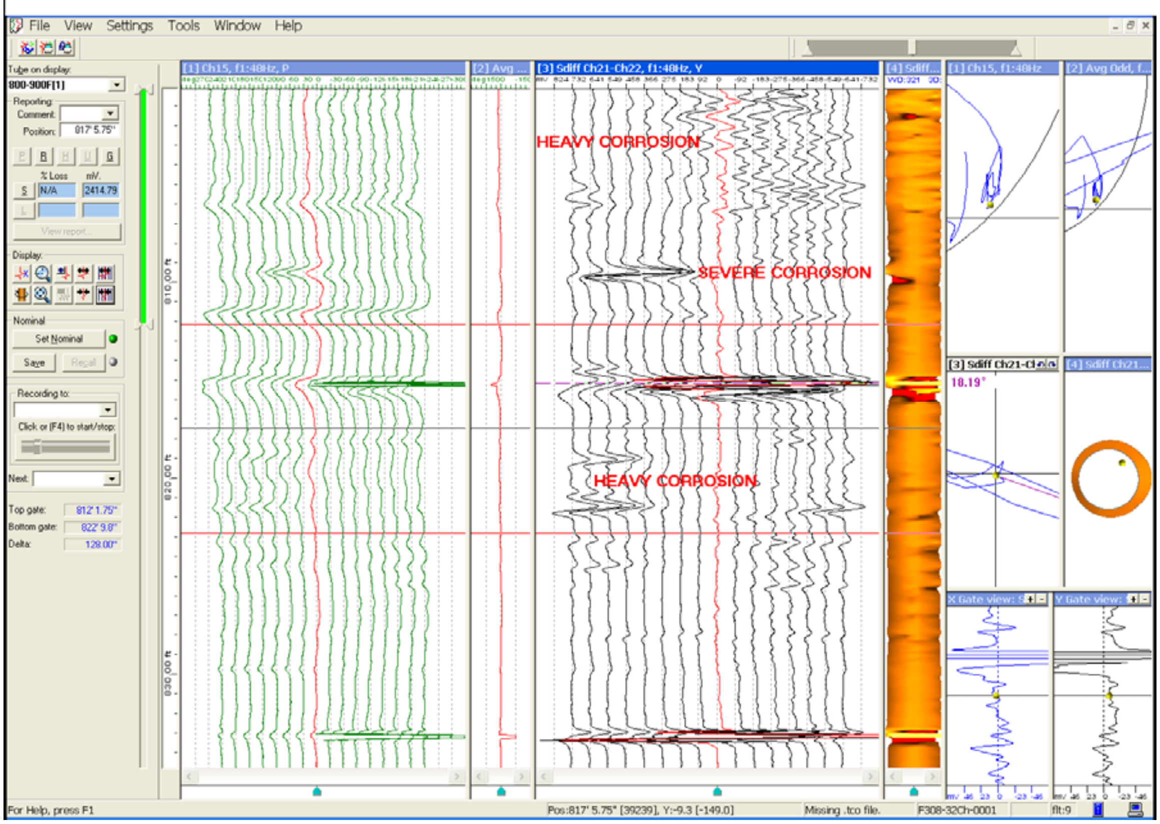

Fig-6: Data showing severe corrosion signals