

## MIAMI-DADE LATERAL PILOT PROGRAM

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### ABSTRACT

Since 1994 the Miami-Dade Water and Sewer Department (WASD) has been engaged in an extensive sanitary sewer system evaluation and rehabilitation program in an effort to reduce system infiltration, exfiltration and inflow (I/E/I). Under the I/E/I Program, the entire sanitary sewer collection system, which represents approximately 3,930 km (12.9 million feet) of gravity sewer lines and 58,000 man-holes was evaluated by July, 1997. The Program sewer evaluation consisted of cleaning and televising 100 percent of the gravity lines, the visual inspection of each manhole and the smoke testing of the entire system to identify defects. A total of 32,194 defects were identified and repaired.

The I/E/I Program has been highly successful with system flows to the regional treatment facilities reduced by approximately 100 mgd. Although the system-wide infiltration was greatly reduced, Rainfall Dependent Infiltration/Inflow (RDII) and the various pump station force main improvements have continued to increase the peak flows to the treatment facilities during heavy rainfall events. Since the mainline sewer components were fully investigated and laterals from the main sewer to the house (house lateral) have only been evaluated in close proximity to the mainline sewer, the sewer house laterals have been identified as the only system component not fully investigated.

The house laterals above the normal water table were, therefore, considered the source of the RDII. In 1999, WASD initiated an Initial Lateral Pilot Program to determine if house laterals could be the cause of the RDII and to quantify the effectiveness and cost of a lateral evaluation and repair program.

Three collection basins were selected for the initial pilot program. Although all main sewers were repaired under the I/E/I Program, all basin main sewers were re-televised and smoke tested and all man-holes were again visually inspected for defects. The identified repairs were completed and the manholes were sealed to reduce system inflow. After a significant rain event, rainfall dependent infiltration/inflow hydrograph signatures were obtained for the "before" baseline flow. Each basin lateral, both public and private sides, were then pressure tested for leaks and the defects were identified and repaired. Figures 1, 2 and 3 illustrate the effectiveness of the program where the RDII signature is reduced after repairs are made.

Figure 1 – Pump Station 116

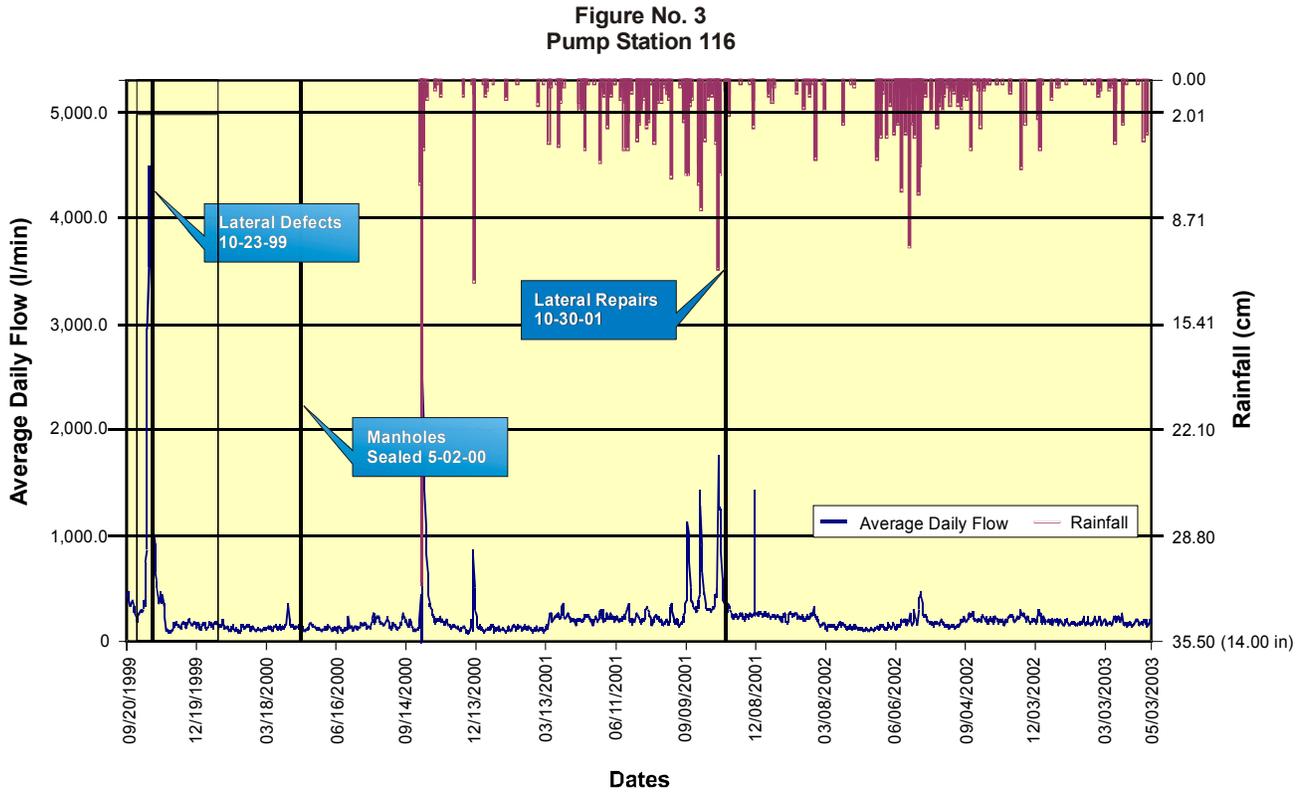
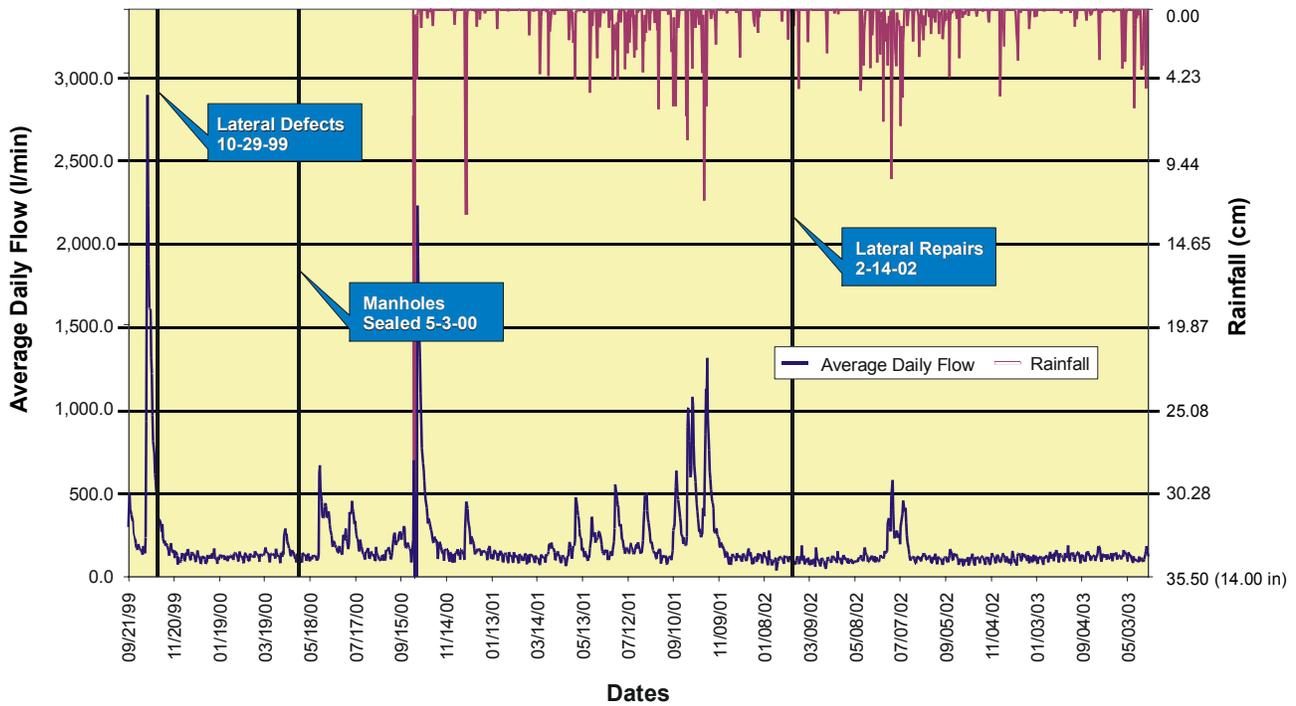
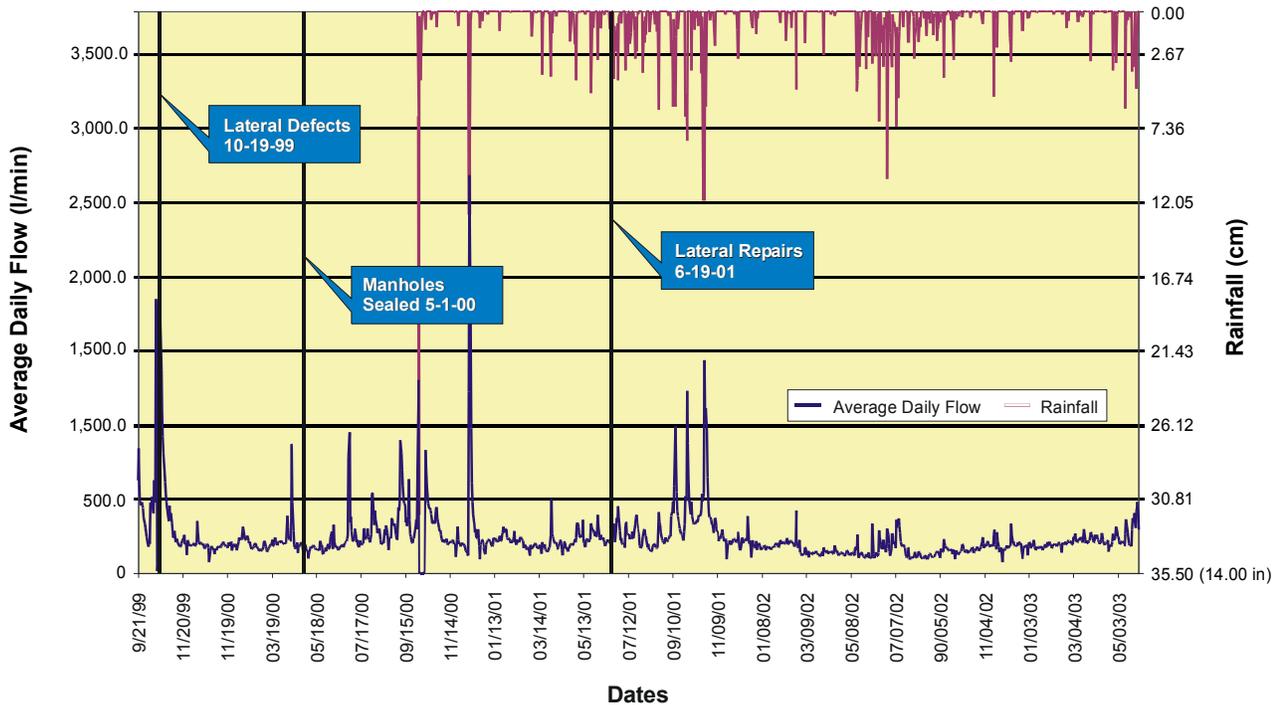


Figure 2 – Pump Station 91



**Figure 3 – Pump Station 203**



As a result of the initial pilot program, the Department decided to expand the program to include thirty (30) additional basins. The new Lateral Pilot Program will, once again, evaluate the effectiveness of the lateral repairs and determine the feasibility of expanding the Program to the remaining 500 basins which exhibit RDII signatures.

To date the 30 basins have been selected, the mainline sewer repairs have been identified and repaired, the manholes have been sealed and RDII signatures have been obtained. The Department is presently in the process of obtaining competitive bids from contractors to evaluate the house laterals and perform repairs.

The paper reviews Program protocols for the basin selection process, preparing the basins for the evaluation, testing the house laterals and repairing the laterals using conventional and trenchless technologies.

## **KEYWORDS**

Infiltration, Inflow, Rainfall Dependent Infiltration/Inflow, House Lateral, Program Protocols

## **PROGRAM PROTOCOLS**

A number of protocols were developed for the Lateral Pilot Program. These include the basin selection, basin preparation, and lateral evaluation criteria. Each procedure is described below.

### **Basin Selection**

WASD operates and maintains 960 sewage pump stations which serve Miami-Dade County, Florida. The purpose of the basin selection protocol was to identify 30 collection basins which exhibit excessive RDII and represent a cross section of the County collection system.

Flow data for the stations was collected for a September 2001 storm which approximated a 2-year storm event. The stations were categorized according to stations having RDII signatures, stations with little or no RDII signature and stations with insufficient SCADA data to determine the RDII signature. The data from an October 2001 storm event was also used to classify the stations. Approximately 500 stations were considered RDII stations.

The stations were then ordered according to highest RDII signatures and the high RDII stations were ordered by the size of the collection system. High RDII stations with under 4,570 m (15,000 feet) of collection system sewers were selected for the Program in order to reduce Program repair costs. The selection criteria also included terminal basins (non-cascading systems) without other basin flows pumping to the system, and constant speed stations discharging to gravity sewers to facilitate flow calculations. The following data were collected for each selected basin:

- RDII Signature
- Night Flow
- Land Use
- Repair Status
- Last Survey Data
- Sewer Component Materials
- Number of Laterals
- Location in County
- Proximity to Surface Water
- Future Development Potential
- Number of Repairs to Date

Although the Program will evaluate laterals in 30 basins, a total of 51 basins have been selected since some basins may not exhibit RDII signatures after the mainline repairs are complete. Typical basins, along with selective data, are listed in Table 1.

### **Basin Preparation**

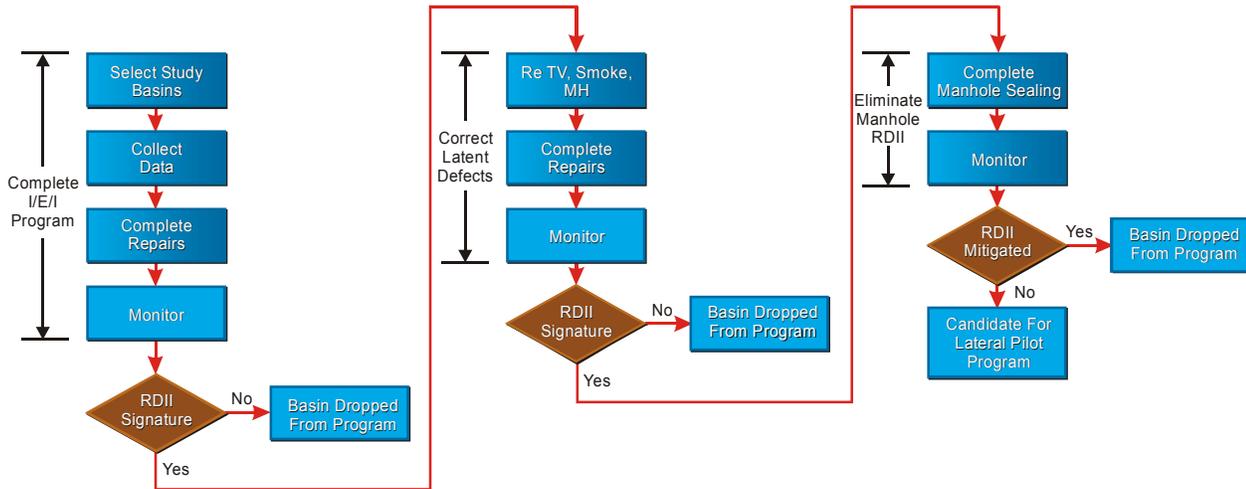
Figure 4 is a flow chart of the Program procedure for assuring that mainline sewers and manholes were not contributing to the RDII signature. All I/E/I Program repair items were initially completed under the previous program and a RDII signature was documented. Each basin was then subjected to an additional SSES program to correct any latent defects since the I/E/I Program and the RDII signature was confirmed. The basin manholes were then sealed and a third RDII signature was documented. This serves as the “before” lateral repair signature. The stations were then candidates for the Lateral Pilot Program, if the RDII signature continued. These remaining stations had no outstanding mainline repairs and rainwater was not entering through the manhole covers. Each basin lateral would then be evaluated and any defects repaired to determine if the RDII signature could be reduced.

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**Table No. 1  
Initial Basin Selection**

BASIN DATA																I/I DATA - SEPT. STORM						REPAIR HISTORY						
Basin Number	Basin Footage	Number of Laterals	Pump Station Atlas Page	LAND USE							SEWER MATERIAL (FT)							Dry NF (gpm)	Peak NF (gpm)	RDII (MG)	Duration (days)	Signature GW	Signature W/ Storms	Total No of repairs	I/I Rate (gpm)	Number of Incomplete repair	Incomplete I/I rate (gpm)	Last 100% TV Date
				Location	Multi-family	Single-Family	Commercial	Industrial	Hotel	School	PVC/LINER	Clay	Concrete	Iron	Unknown	Surface water												
106	6659	2	L13	Central-East			17.41	0.09	20.61			0	5748	0	911	0	Y	50	150	0.36	5	y	y	20	126	10	23.2	14-Mar-98
111	4589	28	P14	Central-East			54.25					1173	2480	0	936	0	N					y	y	12	68	7	38	04-Jun-97
116	1537	8	Q13	Central-West		0.09	11.08	14.11				0	1751	0	96	0	Y	40	150	0.9504	6	y	y	20	64.5	2	3	04-Jun-97
118	2722	9	P10	North			27.92	10.40				0	2642	0	80	0	N	50	200	0.864	4	y	y	16	41.5	11	38.5	12-Mar-97
119	4416	13	Q13	Central-West			8.79	22.25				0	4163	0	253	0	Y	100	500		6	y	y	40	83.1	30	83.1	21-Sep-98
128	1870	12	S14	Central-West	6.64		1.48					1561	309	0	0	0	N	25		0.792	10	y	y	2	1	1	1	28-Sep-98
140	8166	33	P13	Central-East								399	7173	0	594	0	N	100	300	1.08	5	y	y	27	54.9	4	6.5	04-Nov-94
191	7050	60	H9	North		2.23	10.37	16.72				0	6466	0	584	0	N	50	250	0.864	4	y	y	8	24.1	0	0	05-Oct-98
203	5536	32	P13	Central-East			32.41	9.01				0	4938	0	598	0	N	200		1.152	4	y	y	10	71.75	4	23	03-Mar-98
342	1513	11	A1	North	14.83		0.74					0	1513	0	0	0	N	60		-7E+307	3	y	y	11	154.78	10	55.78	03-Nov-97
394	5746	23	C2	North	14.23	8.21	5.84	0.01			9.04	2007	2799	0	940	0	Y	50	125	0.432	4	y	y	46	53.94	23	14.74	08-Apr-98
447	1733	16	F1	North	15.23	0.01	0.92					0	1651	0	82	0	Y	60	450	1.728	5	y	y	13	23.75	5	13	19-Oct-97
539	5349	86	R15	Central-West	14.17	0.64	14.87					1215	3771	0	363	0	N					y	y					24-Jan-99
604	7162	62	S28	South		28.72						1557	4911	0	694	0	N					y	y	10	4.7	0	0	18-Oct-94
635	1654	93	Q18	Central-West	9.99	0.08	21.17					0	1654	0	0	0	N	2	45	0.28224	7	y	y	6	6.5	0	0	10-Apr-95
763	5601	40	P19	Central-East	35.97		10.17					0	5227	0	374	0	Y	100	500	1.296	3	y	y	31	78.55	22	56.4	20-Apr-98
795	6937	20	N19	Central-East	41.26		3.46					0	6823	0	114	0	Y	200		1.728	3	y	y	51	92.03	34	55.93	22-Apr-98
825	3227	17	S21	Central-West	25.38		10.68					1709	1329	0	189	0	N	60	300	0.2592	2	y	y	12	26	8	23	18-May-98
835	4039	61	S21	Central-West	0.03	18.77	3.59					0	3999	0	40	0	N					y	y	59	185	53	177	19-Aug-98
867	2882	10	T20	Central-West	6.35	1.48	11.83					380	1970	0	552	0	N					y	y	6	200	2	0	16-Nov-97
1015	5551	45	V30	South	14.31	0.74	1.35			0.39		1073	4454	0	24	0	N	100	500	1.728	4	y	y	23	395.72	13	24.22	25-Sep-97

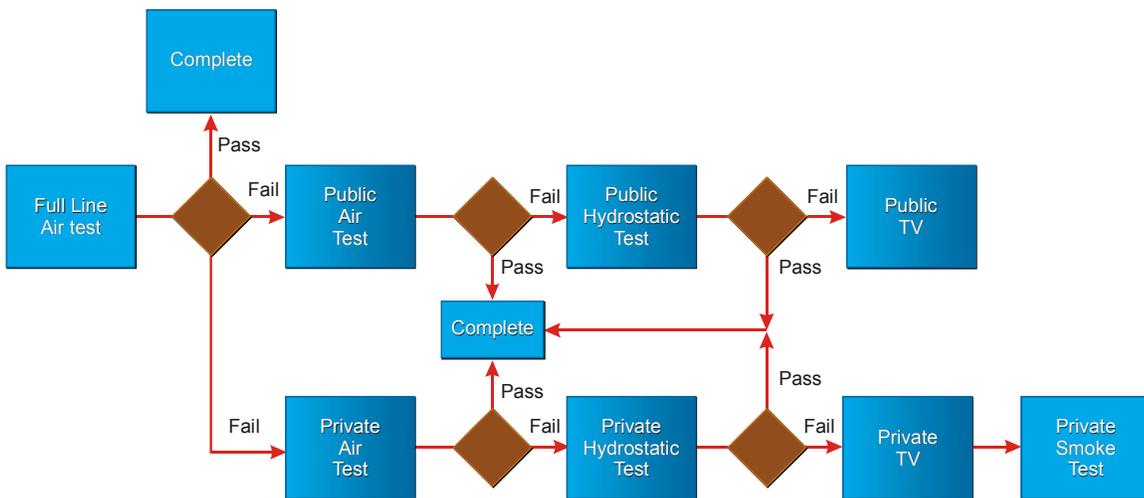
**Figure 4 – Lateral Pilot Program Protocol**



**Lateral Evaluation**

Once contractors are identified, all laterals in each basin will be subjected to an air pressure test. In some instances the air tests will be supplemented by hydrostatic tests and/or smoke tests, followed by video inspection. Figure 5 shows the lateral pressure test program protocol. Each lateral will first be pressure tested from the main sewer to the No. 1 cleanout at the house. Laterals which pass the test are then considered acceptable with no further work required. Laterals which fail the initial full line pressure test will be divided and the public side from the street to the property line and the private side from the property line to the house will be individually tested. If the public side fails the air test, a hydrostatic test will be performed to confirm the air test findings. If the line fails the hydrostatic test, the line will be video televised to locate defects. The private side is also air tested and hydrostatically tested if the air test fails. If the hydrostatic test confirms the air test results, the line will be televised and smoke tested to locate the defects. All the field data will then be evaluated and defect repairs identified.

**Figure 5 – Lateral Pilot Program Air Test Protocol**



## Lateral Repairs

Separate contracts will be let for the removal and replacement or repair of house laterals found to be defective during the lateral evaluation phase. Contracts will be awarded by four basic groups utilizing different technologies as follows:

- Group A: Excavated Point Repairs and Full Service Lateral Replacement
- Group B: Cured-in-Place Liners
- Group C: Cured-in-Place Main Line/Lateral Repair System
- Group D: Full Service Lateral Replacement by Pipe Bursting

A repair protocol has been established based on the type, location, and repair cost of the identified defects. Each video CD from the CCTV performed during the evaluation phase will be reviewed, and a repair/replacement technology will be matched with each defect, following the summarized criteria described below.

Excavated Point Repairs and Full Service Lateral Replacement – Used when trenchless technologies are inappropriate – for collapsed pipe, severe offset joints, dropped pipe and medium to heavy root intrusion. The excavated point repair replaces up to 10 feet of pipe and is sometimes used in conjunction with a liner. The full service lateral replacement will include the Y-connection and pipe up to Cleanout No. 1.

Cured-in-Place Liners – Used for structural damage where excavated point repair or full lateral replacement exceeds liner costs. Depending on the location, amount and severity of breaks or defects, three types of liners may be installed: 1) Standard CIP liner, 2) Standard CIP liner with mainline connection, and 3) Standard CIP liner with mainline connection and full circle mainline sectional.

Cured-in Place Mainline/Lateral Repair System – Same as the CIP liner system except the mainline/lateral liner is a one piece installation and not a three component repair (CIP liner, mainline connection and mainline sectional). This repair technology is basically a monolithic liner with a mainline connection to a full circle mainline sectional. It is used for structural damage where excavated point repair, full lateral replacement or cured-in-place liner component costs exceed the liner system costs.

Full Service Lateral Replacement by Pipe Bursting – Used for replacing in kind or with larger diameter pipe and, when open cut (pipe replacement) is prohibitive or restoration is excessive)

The Program will be completed in February 2006. A Program report will contain cost data to allow the Department to determine if a full scale house lateral repair program will be cost effective for the remaining 470 collection basins