Hamilton

UTILIZATION OF ZOOM CAMERA TECHNOLOGY IN MUNICIPAL SEWER SYSTEM MAINTENANCE

2008 Infra Conference
Quebec City, Quebec
November 17-19, 2008

Zoom

Camera

Inspection

CITY OF HAMILTON

- Is a port city on the western end of Lake Ontario.
- population of 504,559
- Part of the Golden Horseshoe and the Quebec City-Windsor Corridor.
- Traditionally, the local economy has been led by the steel and heavy manufacturing industries. Within the last decade, there has been a shift towards the service sector, particularly health sciences.

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Why Inspect?

- Assess Condition – Structural and Service
- Schedule flushing and cleaning programs
- Exercise due diligence – Reduce risks

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How Often Should You Inspect?

Every 5 Years

More often in problem spots

Customer Complaints

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To Zoom

or

Not to Zoom?

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What is Zoom Camera Technology?

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What is typically found

missing bricks
offset second section
crack
crack
broken rungs
water table
infiltration
360°
roots
infiltration around pipe
105°
Section A-A'
collapsed pipe
Section B-B'
defective
joint with roots
circular crack
A
A'
broken joint
longitudinal crack
B
B'
infiltration at joint
offset joint
open joint

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Zoom Camera

Set up

2004

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2008

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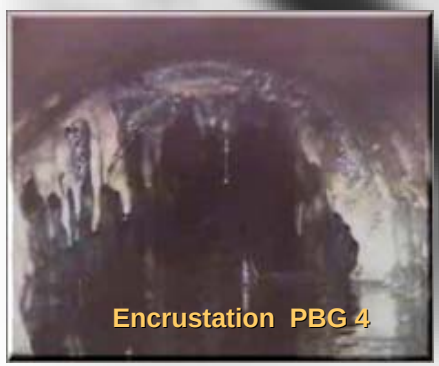
Structural and Service Grades for Pipes

I - Internal Structural Condition Grade (ISCG)

Longitudinal crack, infiltration seeper, ISCG 2

Broken pipe ISCG 4

II - Potential for Blockage Grade (PBG)


Encrustation PBG 4

Grease PBG 4

Heavy Roots PBG 4

2004

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Structural and Service Grades for Maintenance Holes

I - Condition Grade (CG)

II - Safety Grade (SG)

III – Potential for Blockage Grade (PBG)

Critics View

- Zoom cameras are limited in their capability of inspecting the entire length of typical sewers
- Distance of defects from manhole cannot not be accurately determined

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City of Hamilton's Asset Management Report

- Average zoom inspection distance of 30 meters (98 ft) from manhole
- On average 59.44% of defects are found within 20 meters (66 ft) of manholes and 76.12% are found within 30 meters (98 ft) of manholes.

Zoom

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- 838 km / 521miles of inspection
- 59 % of defects within 20 m (66 feet) of MH
- 76 % of defects within 30 m (98 feet) of MH

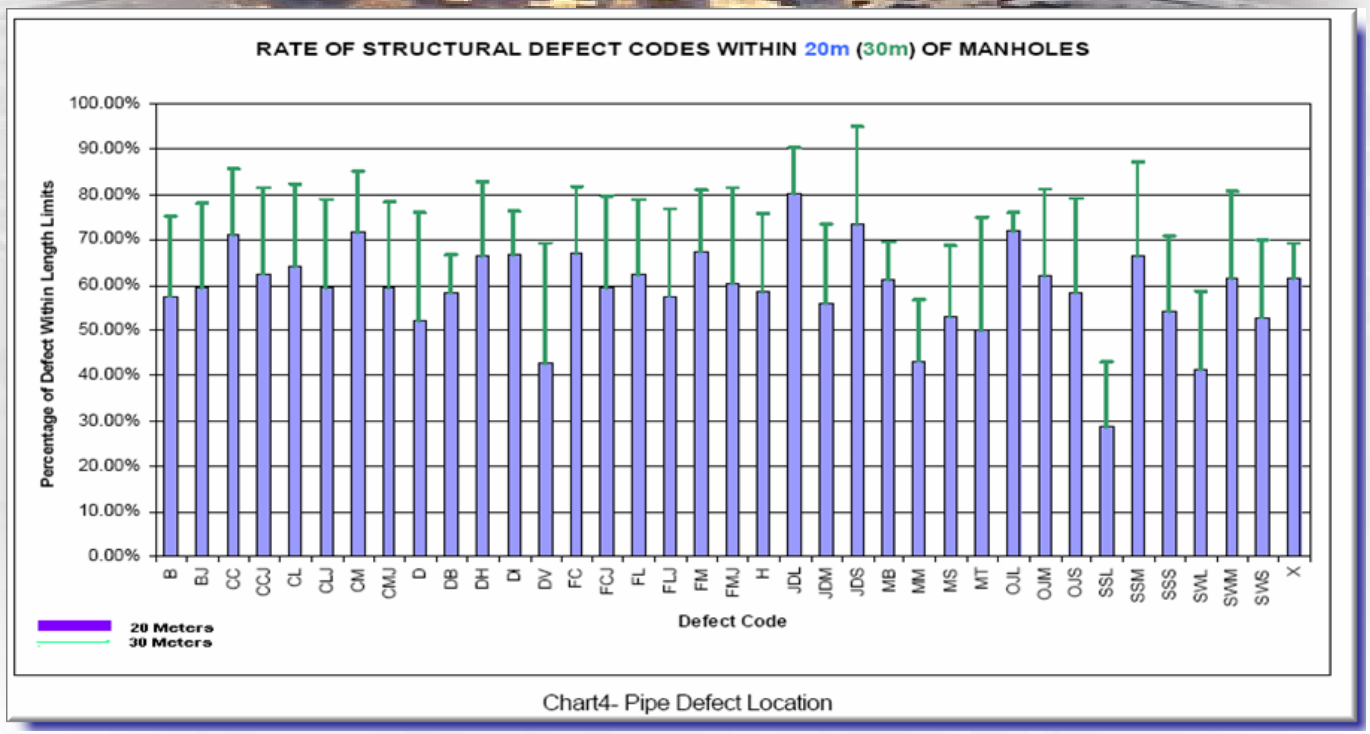

Chart4- Pipe Defect Location

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In 1996 the City of Hamilton developed a 5 year maintenance program with the Zoom Camera technology as its primary tool to identify it's maintenance needs

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Aqua Cad Canalis Software

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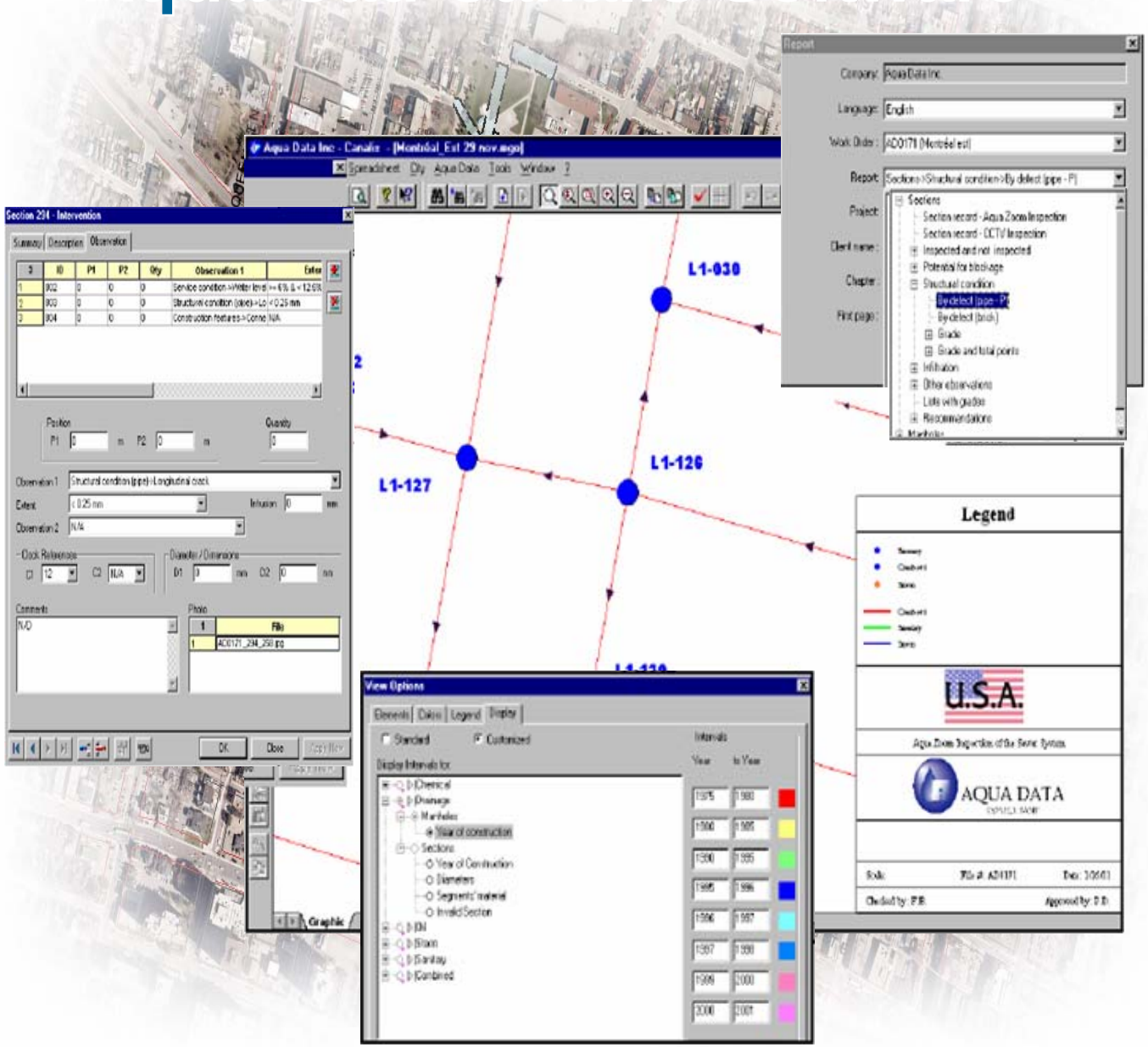

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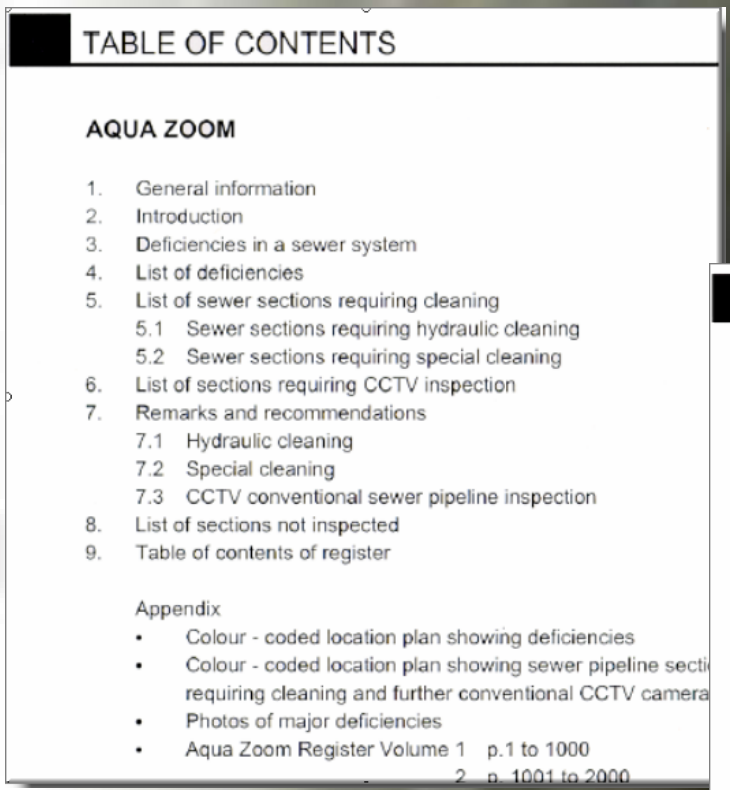
Zoom

Camera

Inspection



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AQUA ZOOM

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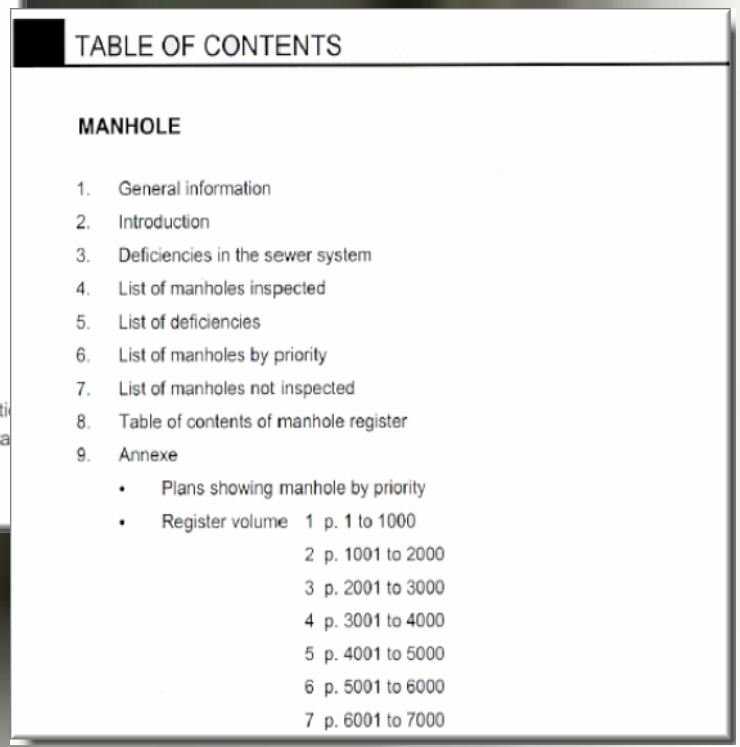
6. List of sections requiring CCTV inspection
7. Remarks and recommendations
   - 7.1 Hydraulic cleaning
   - 7.2 Special cleaning
   - 7.3 CCTV conventional sewer pipeline inspection
8. List of sections not inspected
9. Table of contents of register

Appendix

- Colour - coded location plan showing deficiencies
- Colour - coded location plan showing sewer pipeline secti requiring cleaning and further conventional CCTV camera
- Photos of major deficiencies
- Aqua Zoom Register Volume 1 p.1 to 1000
  2 p. 1001 to 2000



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MANHOLE

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6. List of manholes by priority
7. List of manholes not inspected
8. Table of contents of manhole register
9. Annexe
   - Plans showing manhole by priority
   - Register volume 1 p. 1 to 1000
     2 p. 1001 to 2000
     3 p. 2001 to 3000
     4 p. 3001 to 4000
     5 p. 4001 to 5000
     6 p. 5001 to 6000
     7 p. 6001 to 7000

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Aqua Zoom Inspection Register

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Register - Aqua Zoom inspection

GENERAL INFORMATION

Section:	HQ10B131 ==> HQ10B135	Flow direction:	==>
Street name:	SUNRISE DR.	Material:	Reinforced concrete
Location:	HAMILTON-WENTWORTH	Shape:	Circular
Job number:	AD97-40202-009	Diameter:	525 mm
Sewer type:	Storm	Measured length:	104.00 m
Comment:			

INSPECTION

Inspection:	HQ10B131 <== HQ10B135	Tape number:	18
Inverts: (m)	3.25 3.49	VTR index:	0H24M42 - 0H25M58
Inspection date:	98-07-05 07:52:31	Climatic condition:	Clear sky
Inspection quality:	Good		
Comment:			

NUM.	DESCRIPTION	REMARKS
	NO DEFICIENCY FOUND	

INSPECTION

Inspection:	HQ10B131 ==> HQ10B135	Tape number:	18
Inverts: (m)	3.25 3.49	VTR index:	0H26M53 - 0H28M12
Inspection date:	98-07-05 08:03:06	Climatic condition:	Clear sky
Inspection quality:	Good		
Comment:			

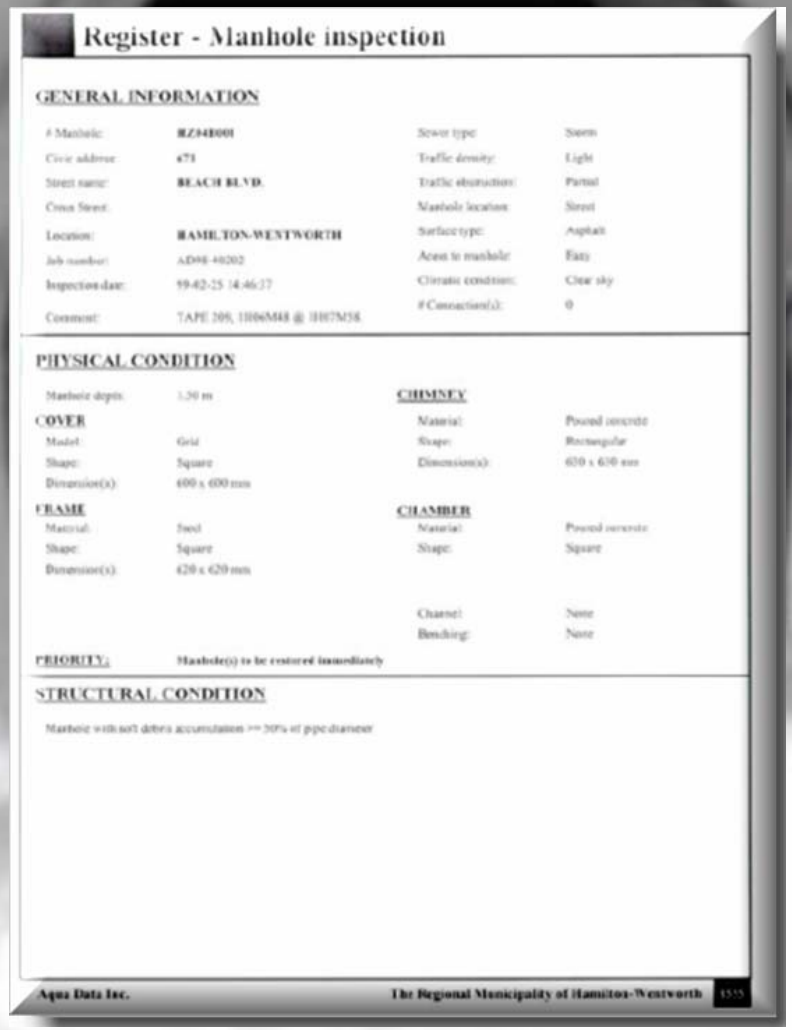
NUM.	DESCRIPTION	REMARKS
1	Encrustation (calcite build up) >= 6% & < 12.5% of pipe diameter	

Maintenance Hole Inspection Register

Zoom

Camera

Inspection



Register - Manhole inspection

GENERAL INFORMATION

# Manhole:	HZ04B001	Sewer type:	Storm
Civic address:	671	Traffic density:	Light
Street name:	BEACH BLVD.	Traffic obstruction:	Partial
Cross Street:		Manhole location:	Street
Location:	HAMILTON-WESTWORTH	Surface type:	Asphalt
Job number:	AD98-40202	Access to manhole:	Easy
Inspection date:	99-02-25 14:46:27	Climatic condition:	Clear sky
Comment:	TAPE 209, 1106M48 @ 1107M58.	# Connection(s):	0

PHYSICAL CONDITION

Manhole depth: 1.50 m

COVER

Model:	Grid
Shape:	Square
Dimension(s):	600 x 600 mm

FRAME

Material:	Steel
Shape:	Square
Dimension(s):	620 x 620 mm

CHIMNEY

Material:	Poured concrete
Shape:	Rectangular
Dimension(s):	600 x 600 mm

CHAMBER

Material:	Poured concrete
Shape:	Square

Channel:	None
Benching:	None

PRIORITY: Manhole(s) to be restored immediately

STRUCTURAL CONDITION

Manhole without debris accumulation >= 30% of pipe diameter

Aqua Data Inc. The Regional Municipality of Hamilton-Wentworth 5555

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Sewer Deficiencies List

Zoom

Camera

Inspection

List by deficiencies (Sewer)

Joint offset >= 12.5% & < 25% of pipe diameter

STREET NAME	INSPECTION	
QUEENSTON RD.	HP10E014	<==
ROXBOROUGH AVE.	HM09E046	==>
SELWAY CT.	HQ12B042	<==
SHERMAN AVE. N.	HK08E126	==>
SHYNAL AVE.	HP06E050	<==
SPADINA AVE.	HK09E105	<==

Joint offset >= 25% & < 37.5% of pipe diameter

STREET NAME	INSPECTION	
HOLTON AVE. S.	HJ10E081	<==
MORLEY ST.	HP06B063	==>
PARKDALE AVE. N.	HP09E005	==>
PRINCESS ST.	HK07E091	==>

Joint offset >= 37.5% & < 50% of pipe diameter

STREET NAME	INSPECTION	
MOUNT ALBION RD.	HP12B027	<==
OWEN PL.	HR11A053	<==

Sewer Section Recommendations

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5.2 Sewer sections requiring special cleaning

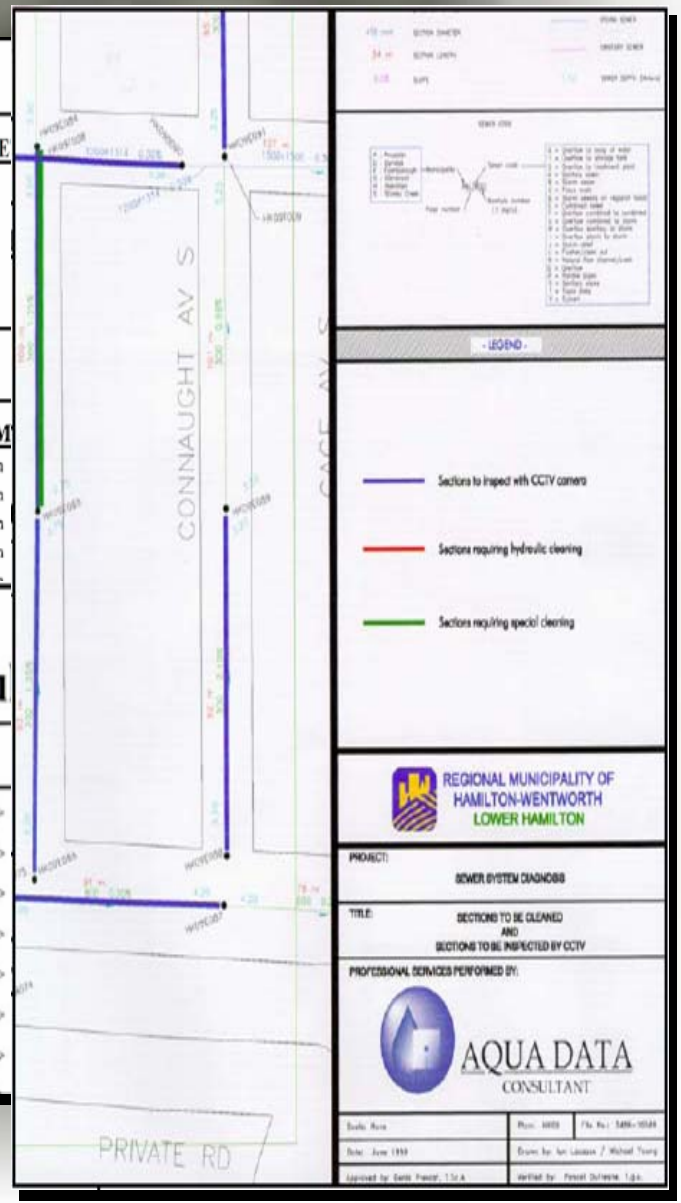
STREET NAME	SEWER			DIAME
WILSON ST.	HI08B019	==>	HI08E001	375 mm
WILSON ST.	HI08E020	==>	HI08B019	375 mm
WILSON ST.	HJ08E068	==>	HJ08E053	450 mm
WILSON ST. E.	HH08E055	==>	HH08E053	300 mm
WINDERMERE RD.	HP04B014	==>	HP04T001	450 mm

List of sections requiring CCTV inspection

STREET NAME	SEWER			DIAM
CANNON ST. E.	HM08E001	==>	HL08E082	600 mm
CANNON ST. E.	HM08E023	==>	HM08E002	600 mm
CANNON ST. E.	HM08E026	==>	HM08E100	450 mm
CANNON ST. E.	HM08E028	==>	HM08E099	375 mm

5.1 Sewer sections requiring hydrau

STREET NAME	SEWER	
NATIONAL DR.	HR13A032	==>
NATIONAL DR.	HR13A090	==>
NATIONAL DR.	HR13B064	==>
NATIONAL DR.	HR13B091	==>
NEWARK AVE.	HQ11B041	==>
NIAGARA ST.	HJ04E001	==>
NIAGARA ST.	HJ05E006	==>



Maintenance Holes Deficiencies

Zoom

Camera

Inspection

4 List of manholes inspected

# MANHOLE	LOCALISATION	MANHOLE
HQ07E026	BRUNSWICK ST.	3.45
HQ07E027	BRUNSWICK ST.	4.51
HQ07E028	WALMER RD.	5.17
HQ07E02		
HQ07E03		
HQ07E03		
HQ07E03		
HQ07E03		
HQ07E03		
HQ07E03		

5 List of deficiencies (Manhole)

Chimney with evidence of previous active infiltration (staining)

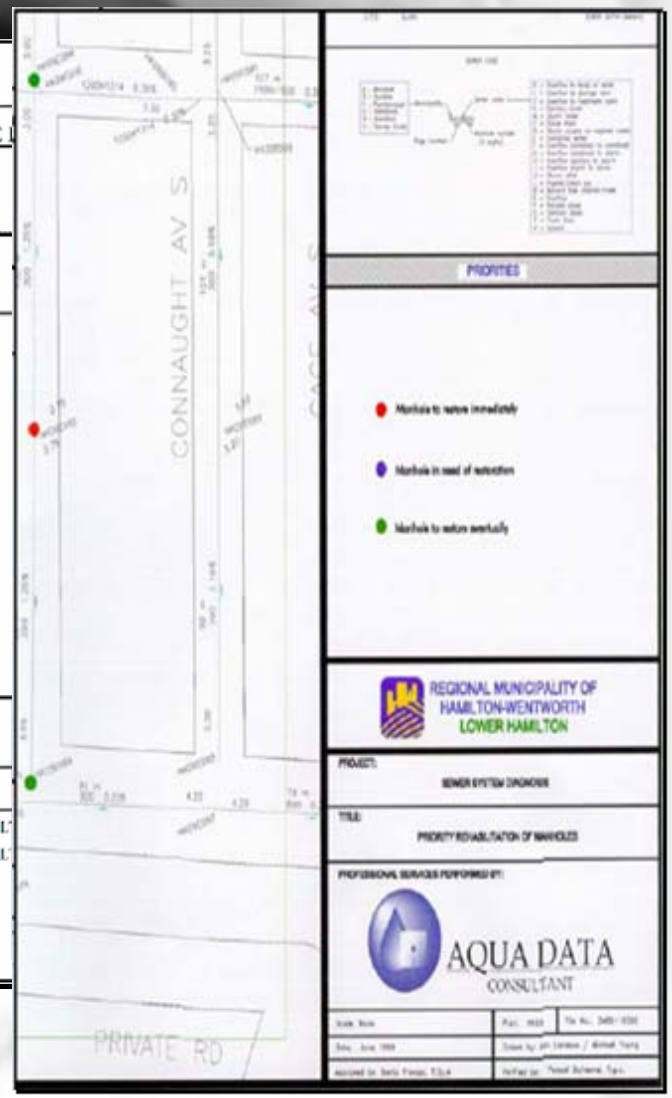
# MANHOLE	STREET NAME
HQ15A025	GREENHILL AVE.
HR12A045	PAVAROTTI CT.
HR13A030	NATIONAL DR.
HR13A042	NATIONAL DR.
HR13A096	DEREK AVE.
HT07A038	BROCKLEY DR.
HT07A040	BROCKLEY DR.

Chimney with active infiltration < 6ml/min

# MANHOLE	STREET NAME

8 List of sections unable to be inspected

SEWER			COMMENT
HG11E083	<==	HG11E094	UNABLE TO INSPECT, MANHOLE HG11E094 COVERED WITH ASPHAL
HG11E095	<==	HG11E094	UNABLE TO INSPECT, MANHOLE HG11E094 COVERED WITH ASPHAL
HG11E114	==>	HG11E113	UNABLE TO INSPECT, MANHOLE HG11E114 IS NOT VISIBLE
HG11E116	-->	HG10E074	UNABLE TO INSPECT, THE PIPE IS TOO OFFSET.
HG11E121	<==	HG11E122	UNABLE TO INSPECT, THE MANHOLE HG11E122 IS NOT VISIBLE.
HG11E122	-->	HG11E123	UNABLE TO INSPECT, THE MANHOLE HG11E122 IS NOT VISIBLE.



Pipe Deficiencies

Zoom

Camera

Inspection

PHOTO #2

GLENGROVE AVE.

HP09E079 → HP09E080

Joint offset ≥ 12,5% & < 25%

HQ07E022 → HQ07E024

Longitudinal crack
≥ 1,5mm & < 10 mm

PHOTO #33

HUNTER ST. E

HH10B004 → HH10B172

Water level ≥ 50%

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Pipe Deficiencies

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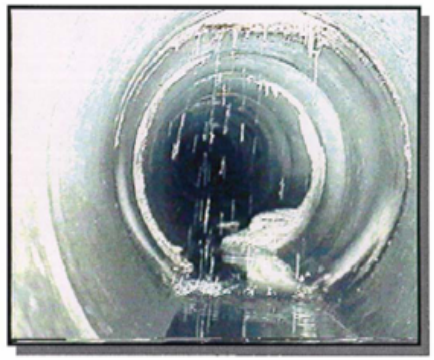
PHOTO #17

MONTMORENCY DR.

HP13B103 → HP13B091

Active infiltration ≥ 500ml & < 10L



HP13B065 → HP13B067

Hard debris ≥ 37,5% ? <50%

PHOTO #26

QUIGLEY RD

HQ12A082 → HQ12A068

Special debris with major obstruction

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1996

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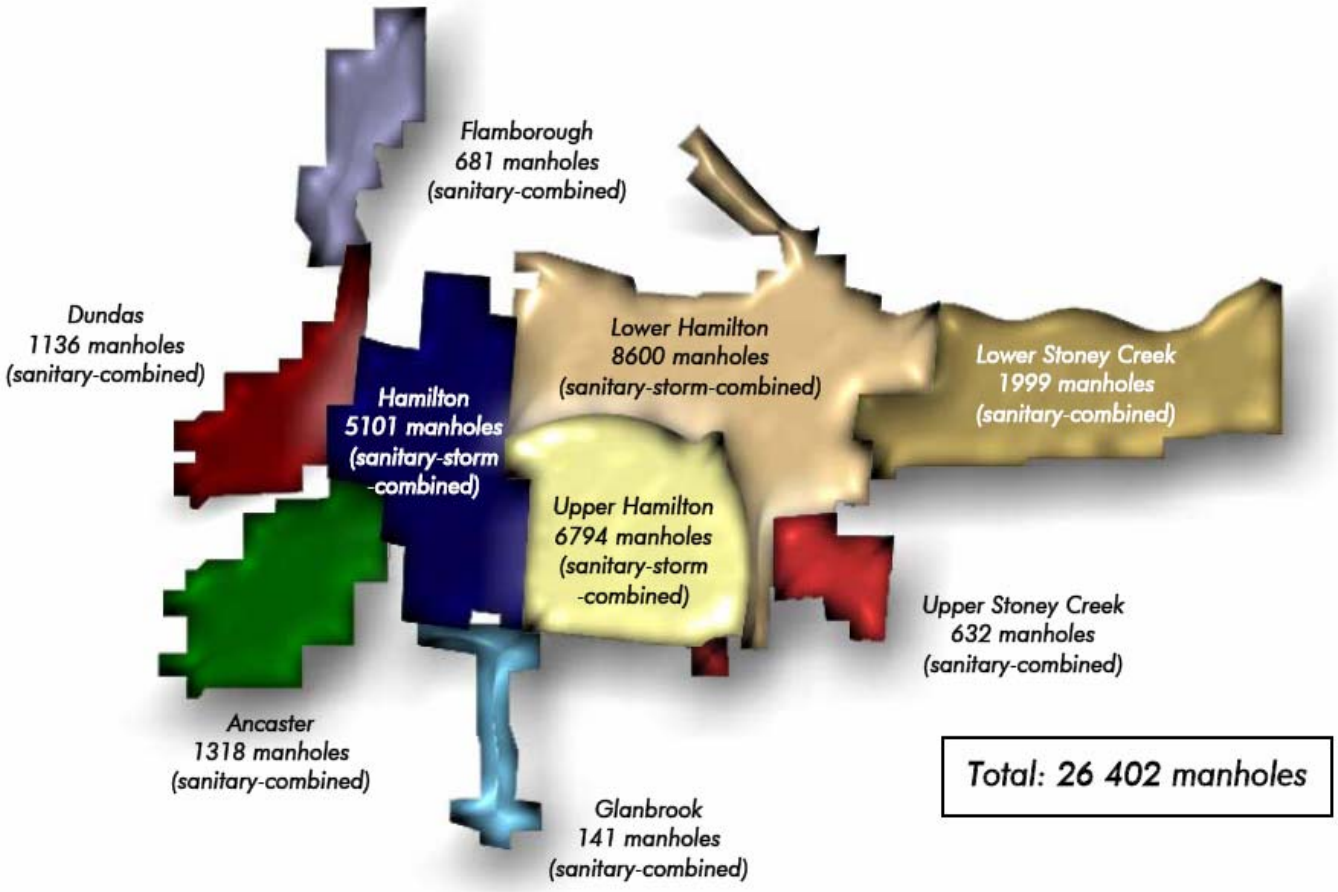
1999

26,402 Manhole Inspections



1996

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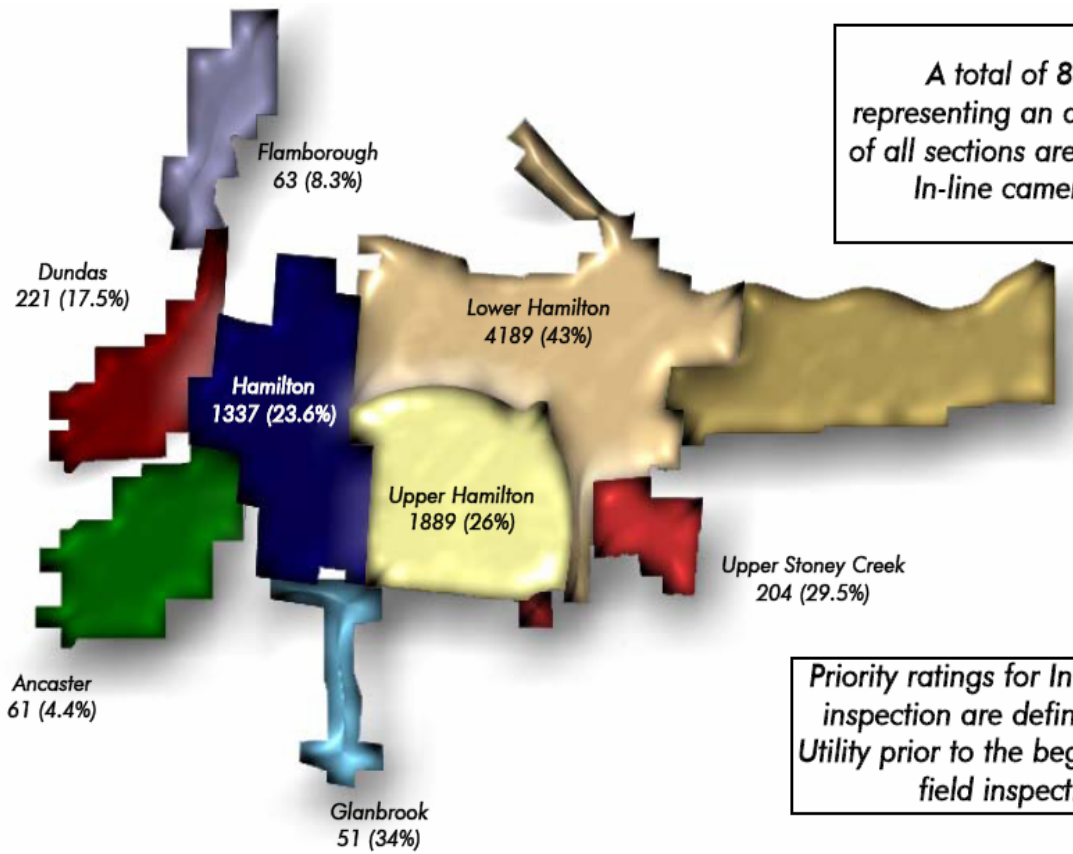
Inspection

1999

8889 In-line Camera Recommendations



A total of 8829 sections representing an average of 24.88% of all sections are recommended for In-line camera inspections

Priority ratings for In-line camera inspection are defined with the Utility prior to the beginning of the field inspections

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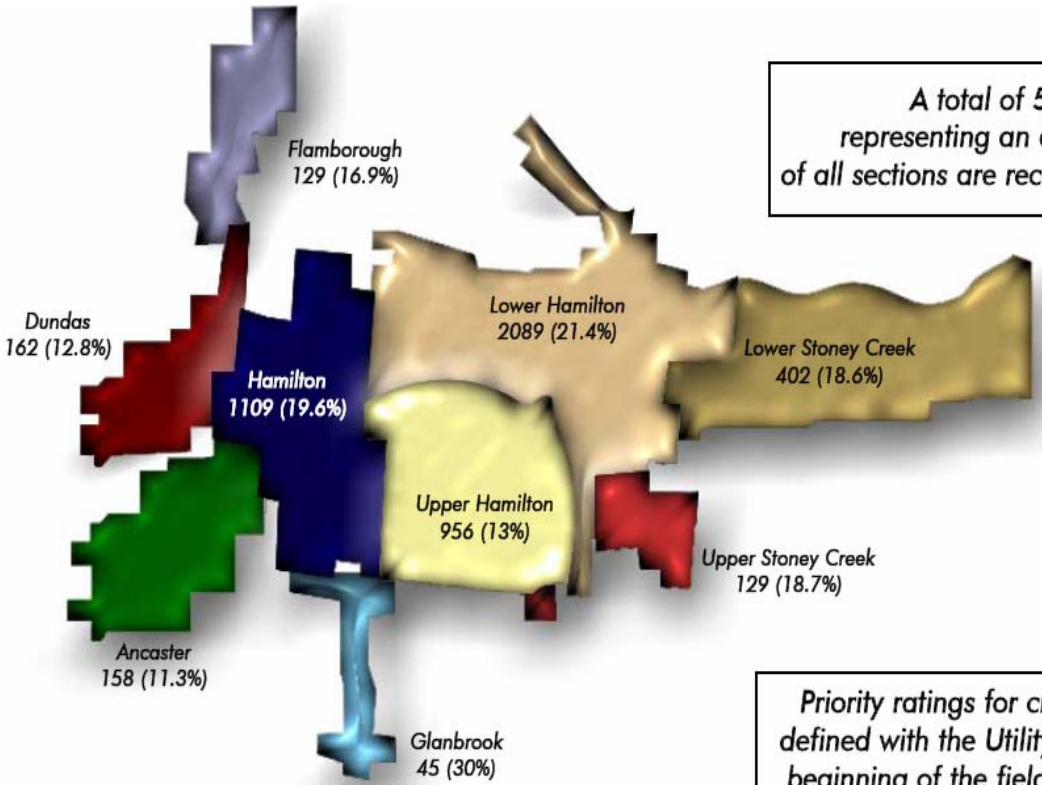
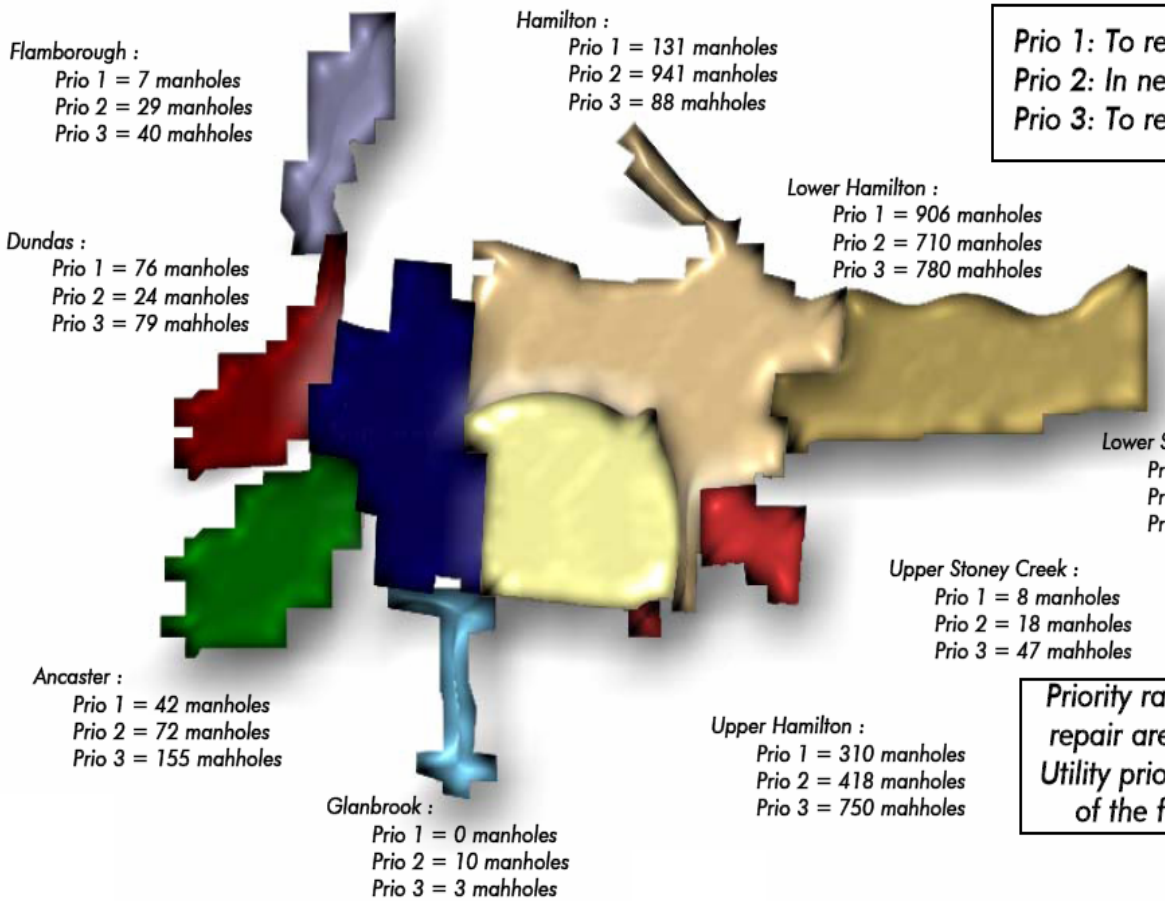
5179 Cleaning Recommendations



A total of 5179 sections representing an average of 18.03% of all sections are recommended for cleaning

Priority ratings for cleaning are defined with the Utility prior to the beginning of the field inspections

Manhole Priority Rating



Flamborough :
Prio 1 = 7 manholes
Prio 2 = 29 manholes
Prio 3 = 40 mahholes

Hamilton :
Prio 1 = 131 manholes
Prio 2 = 941 manholes
Prio 3 = 88 mahholes

Dundas :
Prio 1 = 76 manholes
Prio 2 = 24 manholes
Prio 3 = 79 mahholes

Lower Hamilton :
Prio 1 = 906 manholes
Prio 2 = 710 manholes
Prio 3 = 780 mahholes

Lower Stoney Creek :
Prio 1 = 40 manholes
Prio 2 = 145 manholes
Prio 3 = 155 mahholes

Upper Stoney Creek :
Prio 1 = 8 manholes
Prio 2 = 18 manholes
Prio 3 = 47 mahholes

Ancaster :
Prio 1 = 42 manholes
Prio 2 = 72 manholes
Prio 3 = 155 mahholes

Upper Hamilton :
Prio 1 = 310 manholes
Prio 2 = 418 manholes
Prio 3 = 750 mahholes

Glanbrook :
Prio 1 = 0 manholes
Prio 2 = 10 manholes
Prio 3 = 3 mahholes

Prio 1: To restore immediately
Prio 2: In need of restoration
Prio 3: To restore eventually

Priority ratings for manhole repair are defined with the Utility prior to the beginning of the field inspections

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Follow-up Maintenance

Hydraulic Cleaning Tendered

Special Cleaning Tendered

CCTV assigned to Annual Contract

Emergency Repairs Quoted

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2nd Go Around

2001 Asset Management (AM) section established to manage and co-ordinate capital works for water/wastewater road and bridge infrastructures

The Zoom Camera Technology's WRc defect coding for manholes and pipes provides AM an alternative tool for structural condition rating of the system where historic CCTV records did not exist.

The Zoom Camera program was therefore also turned to focus not only on the identification of O & M issues, but also on CPI management issues.

WRc Coding Added to Deficiencies

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Structural Rating

ID	CODE	WRc	OBSERVATION	EXTENT	ISCG	PBG
92	PD	D	Structural condition (pipe)->Deformed	25%	5	
92	PD	D	Structural condition (pipe)->Deformed	30%	5	
92	PD	D	Structural condition (pipe)->Deformed	35%	5	
92	PD	D	Structural condition (pipe)->Deformed	40%	5	
92	PD	D	Structural condition (pipe)->Deformed	45%	5	
93	PX	X	Structural condition (pipe)->Collapsed	100%	5	5
	PX	X	Structural condition (pipe)->Collapsed	40%	5	
	PX	X	Structural condition (pipe)->Collapsed	50%	5	
PX		X	Structural condition (pipe)->Collapsed	60%	5	5
93	PX	X	Structural condition (pipe)->Collapsed	70%	5	5
93	PX	X	Structural condition (pipe)->Collapsed	80%	5	5
93	PX	X	Structural condition (pipe)->Collapsed	90%	5	5
94	PJDL	JDL	Structural condition (pipe)->Joint displaced	Large	3	3
94	PJDM	JDM	Structural condition (pipe)->Joint displaced	Medium	2	2
94	PJDS		Structural condition (pipe)->Joint displaced	Slight	1	1
95	POJL	OJL	Structural condition (pipe)->Open joint	Large	3	
95	POJM	OJM	Structural condition (pipe)->Open joint	Medium	2	
95	POJS		Structural condition (pipe)->Open joint	Slight	1	

Code WRc OBSERVATION ICSG PBG

Service Rating

ID	CODE	WRc	OBSERVATION	EXTENT	ISCG	PBG
125	SDES	DES	Service condition->Debris - silt	30%		4
125	SDES	DES	Service condition->Debris - silt	35%		4
125	SDES	DES	Service condition->Debris - silt	40%		4
125	SDES	DES	Service condition->Debris - silt	45%		4
125	SDES	DES	Service condition->Debris - silt	50%		5
125	SDES	DES	Service condition->Debris - silt	55%		5
125	SDES	DES	Service condition->Debris - silt	60%		5
125	SDES	DES	Service condition->Debris - silt	65%		5
125	SDES	DES	Service condition->Debris - silt	70%		5
	SDES	DES	Service condition->Debris - silt	75%		5
125	SDES	DES	Service condition->Debris - silt	80%		5
125	SDES	DES	Service condition->Debris - silt	85%		5
125	SDES	DES	Service condition->Debris - silt	90%		5
125	SDES	DES	Service condition->Debris - silt	95%		5
126	SDEG	DEG	Service condition->Debris - grease	=< 5%		2
126	SDEG	DEG	Service condition->Debris - grease	10%		2
126	SDEG	DEG	Service condition->Debris - grease	100%		5
126	SDEG	DEG	Service condition->Debris - grease	15%		3
126	SDEG	DEG	Service condition->Debris - grease	20%		3
126	SDEG	DEG	Service condition->Debris - grease	25%		4

Code WRc OBSERVATION ICSG PBG

Weekly Maintenance Report and Recommendations

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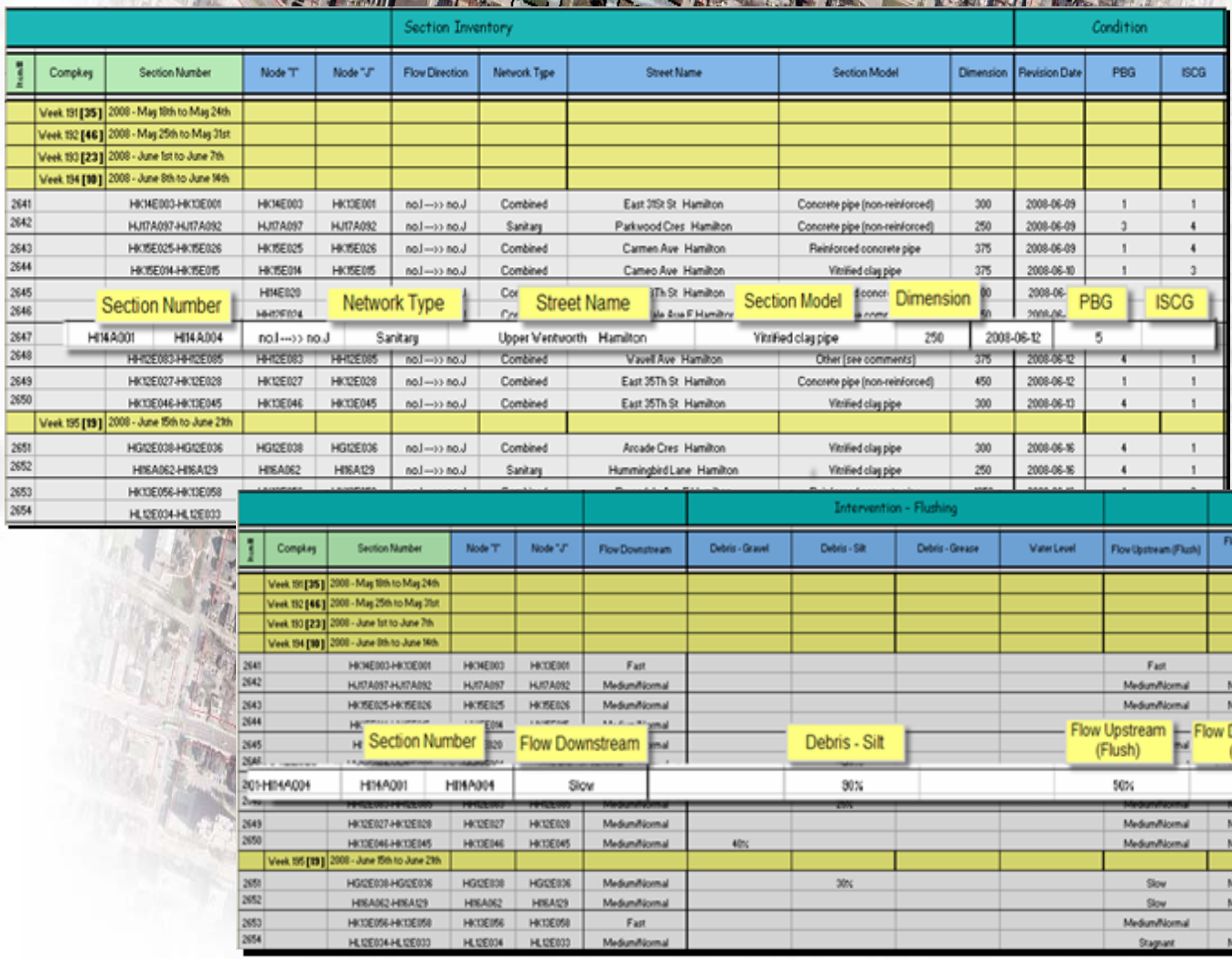

Section Inventory

Compkey	Section Number	Node "I"	Node "J"	Flow Direction	Network Type	Street Name	Section Model	Dimension	Revision Date	PBG	ISCG
Week 191 [35]	2008 - May 18th to May 24th										
Week 192 [46]	2008 - May 25th to May 31st										
Week 193 [23]	2008 - June 1st to June 7th										
Week 194 [18]	2008 - June 8th to June 14th										
2641	HK14E003-HK13E001	HK14E003	HK13E001	no.I ---›› no.J	Combined	East 31St St Hamilton	Concrete pipe (non-reinforced)	300	2008-06-09	1	1
2642	HJ17A097-HJ17A092	HJ17A097	HJ17A092	no.I ---›› no.J	Sanitary	Parkwood Cres Hamilton	Concrete pipe (non-reinforced)	250	2008-06-09	3	4
2643	HK15E025-HK15E026	HK15E025	HK15E026	no.I ---›› no.J	Combined	Carmen Ave Hamilton	Reinforced concrete pipe	375	2008-06-09	1	4
2644	HK15E014-HK15E015	HK15E014	HK15E015	no.I ---›› no.J	Combined	Cameo Ave Hamilton	Vitrified clay pipe	375	2008-06-10	1	3
2645		HI14E020		Co		Th St Hamilton		30	2008-06-		
2646		HH15F014		Cre		ale Ave E Hamilton		30	2008-06-		
2647	HI14A001-HI14A004			no.I ---›› no.J	Sanitary	Upper Wentworth Hamilton	Vitrified clay pipe	250	2008-06-12	5	
2648	HH12E083-HH12E085	HH12E083	HH12E085	no.I ---›› no.J	Combined	Wavell Ave Hamilton	Other (see comments)	375	2008-06-12	4	1
2649	HK12E027-HK12E028	HK12E027	HK12E028	no.I ---›› no.J	Combined	East 35Th St Hamilton	Concrete pipe (non-reinforced)	450	2008-06-12	1	1
2650	HK13E046-HK13E045	HK13E046	HK13E045	no.I ---›› no.J	Combined	East 35Th St Hamilton	Vitrified clay pipe	300	2008-06-13	4	1
Week 195 [19]	2008 - June 15th to June 21th										
2651	HG12E038-HG12E036	HG12E038	HG12E036	no.I ---›› no.J	Combined	Arcade Cres Hamilton	Vitrified clay pipe	300	2008-06-16	4	1
2652	HI16A062-HI16A129	HI16A062	HI16A129	no.I ---›› no.J	Sanitary	Hummingbird Lane Hamilton	Vitrified clay pipe	250	2008-06-16	4	1
2653	HK13E056-HK13E058										
2654	HL12E034-HL12E033										

Intervention - Flushing

Compkey	Section Number	Node "I"	Node "J"	Flow Downstream	Debris - Gravel	Debris - Silt	Debris - Grease	Water Level	Flow Upstream (Flush)	Flow Downstream (Flush)
Week 191 [35]	2008 - May 18th to May 24th									
Week 192 [46]	2008 - May 25th to May 31st									
Week 193 [23]	2008 - June 1st to June 7th									
Week 194 [18]	2008 - June 8th to June 14th									
2641	HK14E003-HK13E001	HK14E003	HK13E001	Fast					Fast	Fast
2642	HJ17A097-HJ17A092	HJ17A097	HJ17A092	Medium/Normal					Medium/Normal	Medium/Normal
2643	HK15E025-HK15E026	HK15E025	HK15E026	Medium/Normal					Medium/Normal	Medium/Normal
2644	HK15E014-HK15E015	HK15E014	HK15E015	Medium/Normal					Medium/Normal	Medium/Normal
2645		HI14E020								
2646		HH15F014								
2647	HI14A001-HI14A004	HI14A001	HI14A004	Slow		90%			50%	No water
2648	HH12E083-HH12E085	HH12E083	HH12E085	Medium/Normal					Medium/Normal	Medium/Normal
2649	HK12E027-HK12E028	HK12E027	HK12E028	Medium/Normal					Medium/Normal	Medium/Normal
2650	HK13E046-HK13E045	HK13E046	HK13E045	Medium/Normal	40%				Medium/Normal	Medium/Normal
Week 195 [19]	2008 - June 15th to June 21th									
2651	HG12E038-HG12E036	HG12E038	HG12E036	Medium/Normal		30%			Slow	Medium/Normal
2652	HI16A062-HI16A129	HI16A062	HI16A129	Medium/Normal					Slow	Medium/Normal
2653	HK13E056-HK13E058	HK13E056	HK13E058	Fast					Medium/Normal	Fast
2654	HL12E034-HL12E033	HL12E034	HL12E033	Medium/Normal					Stagnant	Medium/Normal

2004

Zoom

Camera

Inspection

2009

Monthly Reports

Progress Payment QA/QC

UNITID	COMPKEY	INSPNO	WONO	PROJ	PROJN	STARTDTTM	CREW	DEBRIS	WHEATHE	PCG	PBG	SG	COMPDTTM	REVIEW_DTTM	COMPBY
FL19B090	311716	1592948	1478828	C11-2904		377; 29/06/2004 3:06:00 PM	P.P.	N	Dry (1)	3	1	1	30/4 1:50:23 PM	30/4 1:09:23 PM	F.B.
FK24B030	618338	1592949	1478829	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	1	1	1	30/4 9:53:31 AM	3/4 11:07:07 AM	G.P.
FK24B029	618337	1592950	1478830	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Showers (4	3	1	4	3/4 10:42:06 AM	3/4 11:35:45 AM	G.P.
FL22A019	307378	1592953	1478833	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	3	2	1	30/4 8:25:10 AM	30/4 3:53:38 PM	G.P.
FL22A003	307360	1592954	1478834	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	2	2	1	30/4 12:39:33 PM	30/4 3:47:20 PM	G.P.
FK24B043	618354	1592965	1478835	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	2	1	1	3/4 11:29:09 AM	30/4 1:27:20 PM	G.P.
FK24B027	618335	1592956	1478836	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	2	1	1	3/4 11:53:15 AM	30/4 1:42:33 PM	G.P.
FL22A021	307393	1592957	1478837	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	2	2	1	30/4 9:48:32 AM	30/4 9:47:14 AM	G.P.
FL22A018	307377	1592958	1478838	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Light rain (3	2	2	2	30/4 4:23:03 PM	30/4 7:30:48 AM	G.P.
FL22A005	307362	1592959	1478839	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	1	2	1	30/4 8:06:13 AM	3/4 10:30:42 AM	G.P.
FL22A006	307368	1592960	1478840	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	1	2	1	30/4 8:04:42 AM	30/4 8:04:42 AM	G.P.
FL22A015	307365	1592962	1478842	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	1	1	1	30/4 9:02:40 AM	30/4 9:02:40 AM	G.P.
FL22A015	307374	1592965	1478845	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	3	1	1	30/4 3:12:29 PM	30/4 1:53:26 PM	G.P.
FL22A022	307394	1592967	1478847	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	2	1	1	3/4 10:30:37 AM	30/4 9:18:56 AM	G.P.
FL22A002	307359	1592968	1478848	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	2	1	1	3/4 11:10:42 AM	30/4 3:25:25 PM	G.P.
FM21A003	307745	1592969	1478849	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	3	1	1	30/4 4:01:32 PM	30/4 9:34:08 AM	G.P.
FL22A017	307376	1592970	1478850	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Light rain (3	1	2	1	30/4 3:21:49 PM	30/4 7:53:24 AM	G.P.
FL22A004	307361	1592971	1478851	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	2	1	3	30/4 8:07:18 AM	30/4 8:13:29 AM	G.P.
FL22A006	307363	1592973	1478853	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	1	2	1	30/4 8:18:11 AM	3/4 10:43:15 AM	G.P.
FK24A024	307529	1592974	1478854	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	1	1	2	30/4 9:11:55 AM	3/4 10:36:19 AM	G.P.
FL22A011	307369	1592975	1478855	C11-2904		377; 29/06/2004 3:06:00 PM	P.D.	N	Dry (1)	1	1	2	3/4 11:26:35 AM	30/4 7:31:41 AM	G.P.

Unit ID

Work Order

PCG

PBG

SG

Hamilton

2004 Zoom Camera Inspection 2009

Aqua Data

Hamilton

298 $168,927

Manhole Repairs

2000 $380,000

CCTV Investigations

Over 5000 work

2312 $655,000

Hydraulic Cleanings

260 $123,000

Special Cleanings

to date

15 $4,604

Main Repairs

2004

Zoom

Camera

Inspection

2009

Hamilton

Zoom Inspections to Date

29,500 Manholes – 4 years

76% of entire system

2,212 km (36,875 sections)

$2,150,000 Zoom

$1,200,000 CCTV/Cleaning

$3,350,000

$ 1.50 per meter

2004

Zoom

Camera

Inspection

2009

Hamilton

CCTV & Clean

2212 km

$2.69 per meter

$5,950,000

2004 Zoom Camera Inspection 2009

The last few years Severe Rainfalls have increased in numbers resulting in hydraulic overloading on the sewer systems and increased sewer back-ups.

Property Owners were incensed and Politicians demanded answers as to why newer systems could not handle the flow.

Zoom Inspections provided an audit of the system to ensure that there were no defects present to contribute to the flooding much quicker than in-line camera inspections could have.

Hamilton

Questions