SANITARY SEWER REPORT

MILLER ROAD RESIDENTIAL SUBDIVISION

JULY 3, 2018

Prepared For:

Vincent Riggi / V&R LLC
41 Old Gick Road
Saratoga Springs, NY 12866

Prepared By:

LANSING ENGINEERING
2452 State Route 9, Suite 301
Malta, New York 12020

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Appendices

I. PROJECT DESCRIPTION

The proposed sewer installation and improvements discussed in this report will provide public sewer service to future residents of the Miller Road Residential Subdivision to be owned and maintained by Saratoga County Sewer District #1. The sewer extension will provide service to seventy-nine (79) single family unit homes via individual grinder pumps and low pressure forcemain sewer.

II. SITE DESCRIPTION

The Miller Road Residential Subdivision is situated on three parcels having a total area of approximately 106.44 acres. Parcel 1 with tax map number 270-2-51.2, is approximately 0.71 acres and located at Miller Road, Clifton Park, New York 12065. Parcel 2 with tax map number 270-2-32.112, is approximately 68.68 acres and located at NYS Route 146, Clifton Park, New York 12065. Parcel 3 with tax map number 270-2-38.12, is approximately 37.05 acres and located at Miller Road, Clifton Park, New York 12065. The applicant is proposing to subdivide the parcel for the construction of seventy-nine (79) single family homes.

The Soil Survey of Saratoga County, New York prepared by the National Resources Conservation Service (NRCS) indicates the site is mantled with eight (8) distinct soil units. These units consist of Burdett Silt Loam (BxB), Chenango Silt Loam (ChB/ChC), Ilion Silt Loam (In), Madalin Mucky Silty Clay Loam (Ma), Nunda Silt Loam (NuB/NuC), Raynham Silt Loam (Ra), Rhinebeck Silt Loam (RhA/RhB), and Scio Silt Loam (SeB). The majority of the site is somewhat poorly drained with some areas of well drained moderately well drained soils.

The site topography can be considered to be undulating and generally sloping from the north to the south within the northern portion and sloping from the south to the north within the southern portion with the low area containing wetlands and streams located within the center of the project area. Slopes range between 0 and 30 percent.

Access to the project are will be provided by two (2) curb cuts made along Miller Road, one (1) connection to Tisdale Lane, and one (1) connection to Gloucester Street. Construction of the project will progress in several phases to limit the total disturbance at one time to less than five (5) acres. The properties will be cleared to allow roadway construction and installation of all necessary utilities. Following the general infrastructure installation, construction will then begin on the individual homes.

III. ALTERNATIVE SELECTION

Selection of this alternative is based on engineering analysis of the proposed site. The surrounding sites have been analyzed based on the likelihood of growth that may potentially result in an increased burden on the proposed wastewater system.

IV. ENGINEERING CRITERIA

As outlined in 11.24 of the "Recommended Standards for Wastewater Facilities" published by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental

Managers, 2014 Edition, all wastewater conveyance piping has been sized to accommodate the peak hourly flow from the proposed residential subdivision and the potential surrounding area.

Pursuant to the design standards set forth in Chapter 30 of the "Recommended Standards for Wastewater Facilities", the capacity of all sewer conveyance piping shall be designed to accommodate the ultimate tributary population. The sewer piping will be sized to accommodate the design peak hourly flow. All low pressure forcemain sewer piping will be 2 or 3-inches in diameter.

The proposed network will utilize gravity collection/conveyance to the greatest extent possible. Due to topography constraints individual grinder pumps will be required for all lots to convey wastewater to the gravity sewer.

Individually owned external grinder pumps manufactured by Environment One (E-One) pumps will be used on all lots. Wastewater flow from these external grinder pumps will flow through low pressure forcemain to closest gravity manhole for collection. The exterior grinder pump shall be DH071-93 by E-One or equivalent.

A hydraulic analysis was performed by E-One using their model DH071-93 grinder pump and DR-11 forcemain. The forcemain system was broken down into 18 "zones" which illustrate the hydraulic characteristics of all sections of the system during the occurrence of maximum contribution of flow into the system. The analysis shows that 2" & 3" DR-11 forcemain will be installed within the system. The analysis is included in Appendix C.

For forcemain sewage conveyance, a cleansing velocity of at least 2 feet per second must be maintained. Air and vacuum relief valves must be installed on all force main piping to relieve negative pressures where necessary. In addition, all pipe materials must be of sufficient strength for use as a water main.

All sewage piping shall be installed to minimize damage to the piping and all joints. Trenches shall be dug and pipe shall be laid to minimize any bending. According to 33.82 (b) of the Recommended Standards, rocks, boulders and large stones will be removed to provide minimum clearance of 4 inches on all sides of the pipe.

V. EXISTING SANITARY SEWER CONVEYANCE SYSTEM

An existing 10" sanitary sewer gravity main exists along the north side of NYS Route 146 and is owned and operated by the Saratoga County Sewer District #1. Forty six (46) lots from the northern section of the Miller Road Residential Subdivision will be serviced by the connection to the existing 10" gravity main via an insertion manhole to be constructed along the northside of NYS Route 146.

An existing gravity sewer line is located along Gloucester Street. Thirty three (33) lots from the southern section of the Miller Road Residential Subdivision will be serviced by the connection to the gravity sewer via an insertion manhole. An existing 8" sanitary sewer gravity main exists along the west side of Vischers Ferry Road and is owned and operated by the Saratoga County Sewer District #1. Flows from the existing lines connect to the Vischers Ferry Road sanitary sewer.

The peak hour flow from the northern portion of the project represents 9.35% of the capacity of the receiving 8" main. Initial discussions with the Saratoga County Sewer District #1 have indicated that there are existing capacity issues within the receiving NYS Route 146 8" gravity sewer. A flow study of the main as it passes through the intersection of NYS Route 146 and 146A has been requested by the

SCSD#1. The flow study was performed by Corrosion Products and Equipment. The results of the flow study indicate a maximum flow of 99.816 gpm. The maximum flow from the northern portion of the project is 66 gpm per the low pressure sewer analysis by E-One, Appendix C. The total required flow of 161.82 gpm is 22.92% of the capacity the existing line through the intersection. Therefore, sufficient capacity exists for the additional flow. See Appendix B for calculations.

The peak hour flow from the southern portion of the project is 66 gpm per low pressure sewer analysis by E-One, Appendix C. The peak hour flow from the southern portion of the project, 66 gpm and the additional contributing area, 95 gpm, results in a total peak hour flow of 160 gpm or 28.52% of the capacity of the existing 8" diameter pipe. Therefore, sufficient capacity exists for the additional flow. See Appendix B for calculations.

All sewage waste is ultimately conveyed and treated at the SCSD #1 treatment plant located in Halfmoon, New York.

VI. Environmental Review

The sewer network for the proposed development has been carefully designed to minimize any potential impacts associated with wastewater conveyance. All joints and piping will be inspected and tested prior to use using the appropriate ASTM standards to ensure the network will limit infiltration and contamination of surface water bodies as well as ground water. Performing a hydrostatic test will ensure the infiltration and exfiltration rates do not exceed required limits. Air tests will conform to ASTM C-924 for concrete pipe and ASTM F-1417 for plastic pipe.

According to the "Recommended Standards for Wastewater Facilities", all sewers must be placed at least 10 feet in the horizontal direction from all existing and proposed water mains. A vertical distance of 18" must be maintained between sewer lines and existing or proposed water mains. Pipe joints in both the water and sewer mains will be installed so the water and sewer joints will be "equidistant and as far as possible from the water main joints." (Recommended Standards for Wastewater Facilities pg. 30-11).

VII. Summary

This sewer report, submitted on behalf of the proposed Miller Road Residential Subdivision outlines the expected wastewater contribution anticipated for the proposed subdivision. The calculations illustrated in the text of this report and in the appendices confirm the site conditions are favorable for the addition of sewer lines to service the proposed subdivision. The size and location of the sewer line conforms with the "Recommended Standards for Wastewater Facilities, 2014 Edition", published by the Great Lakes – Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers and all provisions set forth by the New York State Department of Environmental Conservation.

Appendix A:
Maps

SITE LOCATION MAP

SCALE: 1"=2000'

PRELIMINARY / NOT FOR CONSTRUCTION

MILLER ROAD RESIDENTIAL SUBDIVISION

MILLER ROAD, TOWN OF CLIFTON PARK, SARATOGA COUNTY, NEW YORK

LANSING ENGINEERING
2492 STATE ROUTE 9, SUITE 301
MALTA, NY 12020
(518) 899-5243

SITE LOCATION MAP

PROJ. NO: 803.00
SCALE: AS SHOWN
DATE: 02/05/18

SHEET 1 OF 1

Appendix B:
Hydraulic Capacity Calculations

Hydraulic Capacity Calculations

Wastewater Flow Contributors

Miller Road Residential Subdivision – The network includes the proposed 79 single family residential units.

Population = (79 single family residences) x (2.5 residents/unit) = 198 residents
Design Average Daily Wastewater Flow = (198) x (100 gpd/resident) = 19,800 gpd

Wastewater System Configuration

The sanitary sewer network within the Miller Road Residential Subdivision collects the wastewater flow from the residents by means of individual grinder pumps which connect to 1.5", 2" or 3" low pressure forcemain. The subdivision is split into two distinct sections, a northern and southern section. The northern section shall convey wastewater by low pressure forcemain to the existing 10" gravity sewer system along the north side of NYS Route 146. The southern section shall convey wastewater by low pressure forcemain to the existing 8" gravity sewer system along Gloucester Street. An insertion or "doghouse" type manhole will be utilized at both the northern and southern points of connection. The collected wastewater will ultimately be conveyed to and treated at the Saratoga County Sewer District No.1 Wastewater Treatment Plant located in the Town of Halfmoon, Saratoga County, New York.

Wastewater System Capacity Design

Miller Road Residential Subdivision - North – The network includes the proposed 46 single family residential units.

Population = 115 residents

Cumulative Design Average Daily Wastewater Flow

= (Population) x (100 gpd/residents)
= (115) x (100 gpd/household)
= 11,500 gpd = 8 gpm

Peak Hour Factor (P = population in thousands)

$$= \frac{(18 + P^{1/2})}{(4 + P^{1/2})} = \frac{(18 + 0.115^{1/2})}{(4 + 0.115^{1/2})} = 4.23$$

PHF = 4.23

Cumulative Peak Hour Wastewater Flow

= (Average Daily Wastewater Flow) x (Peak Hour Factor)
= (11,500 gpd) x (4.23)
= 48,604 gpd
= 34 gpm (calculated design flow, required flow)

Miller Road Residential Subdivision - South – The network includes the proposed 33 single family residential units.

Population = 83 residents

Cumulative Design Average Daily Wastewater Flow

= (Population) x (100 gpd/residents)
= (83) x (100 gpd/household)
= 8,300 gpd = 6 gpm

Peak Hour Factor (P = population in thousands)

$$= \frac{(18 + P^{1/2})}{(4 + P^{1/2})} = \frac{(18 + 0.083^{1/2})}{(4 + 0.083^{1/2})} = 4.26$$

PHF = 4.26

Cumulative Peak Hour Wastewater Flow

= (Average Daily Wastewater Flow) x (Peak Hour Factor)
= (8,300 gpd) x (4.26)
= 35,398 gpd
= 25 gpm (calculated design flow, required flow)

Downstream Analysis

Based on conversations with SCSD#1, there was report of an issue in the line as it travelled from west to east under the intersection of NYS Route 146A and Route 146. At the request of SCSD#1 a flow analysis was performed by Corrosion Products & Equipment, Inc. from 5/19/2008 through 6/14/2018. A flow meter was installed at the sewer manhole located in the northeast quadrant of the intersection of Route 146 and 146A. The flow analysis indicated a maximum flow rate on 5/18/2018 of 95.816 gpm. The results of the analysis may be found within Appendix X

Southern Analysis

3" Forcemain – This line will contribute to the gravity sewer system that starts at the sanitary manhole at 1267 NYS Route 146 at Vista Subdivision (West).

3" Diameter SDR 21 Forcemain

Area	= 0.05 SF
Velocity	= 2.0 FPS minimum
Flow	= 0.1 CFS minimum
	= 45 gpm minimum

Maximum flow = 66 gpm (E-One Pressure Sewer Analysis, Zone 8)

Vista Subdivision (West) – The Vista Subdivision (West) is located on the north side of NYS Route 146 and contains 13 double family units (26 units total). SCSD #1 has confirmed a reserve capacity of 5,566 gpd

Average daily wastewater flow = 5,566 gpd = 3.87 gpm

Vista Subdivision (East) / Sterling Heights – The Vista Subdivision (East) / Sterling Heights is located on the north side of NYS Route 146 and contains 54 single family units.

Average daily wastewater flow = (54 single family units) x (2.5 residents/unit) x (100 gpcpd)
Average daily wastewater flow = 13,500 gpd = 9.38 gpm

Brookhaven Subdivision (Tisdale Ln) – The Brookhaven Subdivision (Tisdale Ln) is located on the south side of NYS Route 146 and contains 24 single family units.

Average daily wastewater flow = (24 single family units) x (2.5 residents/unit) x (100 gpcpd)
Average daily wastewater flow = 6,000 gpd = 4.17 gpm

Honey Hallow Subdivision – The Honey Hallow Subdivision is located on the south side of NYS Route 146 and contains 33 single family units.

Average daily wastewater flow = (33 single family units) x (2.5 residents/unit) x (100 gpcpd)
Average daily wastewater flow = 8,250 gpd = 5.73 gpm

Peak Hour Factor (P = population in thousands of contributing area (137 units x 2.5 residents/unit))

$$= \frac{(18 + P^{1/2})}{(4 + P^{1/2})} = \frac{(18 + 0.343^{1/2})}{(4 + 0.343^{1/2})} = 4.05$$

PHF = 4.05

Cumulative Peak Hour Wastewater Flow

= (Average Daily Wastewater Flow) x (Peak Hour Factor)
= (33,316 gpd) x (4.05)
= 134,930 gpd
= 94 gpm (calculated design flow, required flow)

Southern Downstream Analysis - The following represents an isolated local analysis of the receiving lines to determine the percentage of increase in flows to the existing 8" gravity main that the southern portion of the project will be conveying all wastewater flows to.

Existing Pipe size = 8"
Pipe Slope = 0.005 ft/ft minimum
Full Velocity = 3.55 fps
Full Capacity = 1.25 cfs = 561 gpm

561 gpm (design capacity) > 160 gpm (required capacity)
160 gpm ≈ 28.52% of the capacity of the existing 8" Diameter Pipe

Therefore, 8" Diameter Pipe Adequate to Handle Flows

<u>Northern Analysis</u>

3" Forcemain – This line contributes to the gravity sewer system that exists along the northern side of Route 146.

3" Diameter SDR 21 Forcemain

Area	= 0.05 SF
Velocity	= 2.0 FPS minimum
Flow	= 0.1 CFS minimum
	= 45 gpm minimum

Maximum flow = 66 gpm (E-One Pressure Sewer Analysis, Zone 18)

Downstream Analysis - The following represents an isolated local analysis of the receiving lines to determine the percentage of increase in flows to the existing 8" gravity main that the project will be conveying all wastewater flows to. The existing 8" gravity main along Route 146 flows from west to east, towards the intersection of Route 146 and Route 146A. The existing gravity main was directionally drilled under said intersection with 8" HDPE pipe. An analysis of the 8" HDPE pipe is first shown to ensure adequate capacity as this pipe has a smaller inner diameter of approximately 6.593".

Existing Pipe size = 8"
Pipe Slope = 1.96% (per as-built drawings provided by SCSD#1)
Full Velocity = 6.76 fps
Full Capacity = 1.572 cfs = 705.56 gpm

706 gpm (design capacity) > 161.82 gpm (required capacity = 99.816 gpm + 66 gpm)
161.82 gpm ≈ 22.92% of the capacity of the existing 8" HDPE Diameter Pipe

Therefore, 8" HDPE Pipe Adequate to Handle Flows

Per the as-built drawings provided by the SCSD#1, the minimum slope in the run between the point of connection and where it connects to a 10" trunk line is 0.46%. An analysis of the capacity of this line is shown to ensure adequate capacity exists within this line.

Existing Pipe size = 8"
Pipe Slope = 0.0046 ft/ft minimum
Full Velocity = 3.71 fps
Full Capacity = 1.286 cfs = 577.20 gpm

577.20 gpm (design capacity) > 161.82 gpm (required capacity = 99.816 gpm + 66 gpm)
161.82 gpm ≈ 28.04% of the capacity of the existing 8" Diameter Pipe

Therefore, 8" Diameter Pipe Adequate to Handle Flows

Appendix C:
Environment One Corporation
Pressure Sewer Preliminary Cost and Design Analysis

SEWER SYSTEMS

Environment One Corporation

Pressure Sewer Preliminary Cost and Design Analysis For Riggi Subdivision Rev1

Prepared For:
Lansing Engineering
2452 State Route 9, Suite 301
Malta NY 12020 USA
Tel: 518-899-5243
Fax: 518-899-5245
Prepared By: M. Crowley

April 6, 2018

Riggi Subdivision
Rev1

Prepared by : M. Crowley **On:** April 6, 2018

Notes :
Analysis based upon drawings and data provided. Station recommendations are preliminary.

GPD values impact retention times only, not line sizing or hydraulics.

Length, tie in pressure, static head provided by the engineer.

<<<<< E N D O F N O T E S >>>>>

April 6, 2018

Budgetary Low Pressure Sewer System Costs

Riggi Subdivision
Rev1

	Quantity	Description	Unit Cost	Installation	Sub Total
Valves	4	Air/Vacuum Release Valve	$0.00	0.00	$0.00
	12	Clean Out	$0.00	0.00	$0.00
					$0.00
Pumps	79	DH071-93	$0.00	0.00	$0.00
	79	Lateral (Boundary) Installation	$0.00	0.00	$0.00
	79	Pump/Panel Installation	$0.00	0.00	$0.00
	79	Lateral Kits (Includes Ball\Check Valve Assembly)	$0.00	0.00	$0.00
	3,950	LF of 1.25" Lateral Pipe	$0.00	0.00	$0.00
					$0.00
Piping	1,939	2.00" Pipe	$0.00	0.00	$0.00
	4,186	3.00" Pipe	$0.00	0.00	$0.00
					$0.00

Number of Connections	79			
Total Per Connection	$0.00	**Total (w/o other)**	>>>>>>>>>>>>	**$0.00**
Grand Total Per Connection	$0.00	**Grand Total (including other)**	>>>>>>>>>>>>	**$0.00**

Note: The System Costs above are based on piping sized for, and Grinder Pumps manufactured by Environment One Corporation.

Prepared By:
M. Crowley

PRELIMINARY PRESSURE SEWER- PIPE SIZING AND BRANCH ANALYSIS
Riggi Subdivision
Rev1

April 6, 2018

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Fric Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE											Friction loss calculations were based on a Constant for inside roughness "C" of: 150						
1.00	2.00	3	3	250	11.00	2	22.00	2.00	2.38	150.00	1.19	1.78	31.54	382.00	352.00	30.00	61.54
2.00	3.00	6	9	250	11.00	3	33.00	2.00	3.57	356.00	2.52	8.97	29.76	382.00	366.00	16.00	45.76
3.00	4.00	9	18	250	11.00	4	44.00	3.00	2.19	528.00	0.65	3.43	20.79	364.00	364.00	0.00	20.79
4.00	8.00	2	20	250	11.00	5	55.00	3.00	2.74	324.00	0.98	3.18	17.36	358.00	358.00	0.00	17.36
5.00	6.00	3	3	250	11.00	2	22.00	2.00	2.38	160.00	1.19	1.90	24.14	379.00	379.00	0.00	24.14
6.00	7.00	6	9	250	11.00	3	33.00	2.00	3.57	285.00	2.52	7.18	22.24	358.00	358.00	0.00	22.24
7.00	8.00	2	11	250	11.00	4	44.00	3.00	2.19	135.00	0.65	0.88	15.06	357.00	357.00	0.00	15.06
8.00	8.00	2	33	250	11.00	6	66.00	3.00	3.29	1,030.00	1.38	14.18	14.18	352.00	352.00	0.00	14.18
9.00	10.00	3	3	250	11.00	2	22.00	2.00	2.38	183.00	1.19	2.18	28.58	364.00	347.00	17.00	45.58
10.00	11.00	6	9	250	11.00	3	33.00	2.00	3.57	429.00	2.52	10.81	26.40	364.00	345.00	19.00	45.40
11.00	18.00	6	15	250	11.00	4	44.00	3.00	2.19	365.00	0.65	2.37	15.59	364.00	336.00	28.00	43.59
14.00	15.00	3	3	250	11.00	2	22.00	2.00	2.38	170.00	1.19	2.02	27.58	374.00	354.00	20.00	47.58
15.00	16.00	6	9	250	11.00	3	33.00	2.00	3.57	206.00	2.52	5.19	25.56	374.00	366.00	8.00	33.56
16.00	17.00	9	18	250	11.00	4	44.00	3.00	2.19	344.00	0.65	2.24	20.37	365.00	365.00	0.00	20.37
17.00	18.00	11	29	250	11.00	5	55.00	3.00	2.74	500.00	0.98	4.91	18.13	364.00	343.00	21.00	39.13
18.00	18.00	2	46	250	11.00	6	66.00	3.00	3.29	960.00	1.38	13.22	13.22	364.00	364.00	0.00	13.22

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

Prepared By:
M. Crowley

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME(HR)

Riggi Subdivision

Rev1

April 6, 2018

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE								Gals per Day per Dwelling		250
1.00	2.00	3	2.00	15.40	150.00	23.10	750	32.46	0.74	3.79
2.00	3.00	9	2.00	15.40	356.00	54.83	2,250	41.03	0.58	3.05
3.00	4.00	18	3.00	33.47	528.00	176.70	4,500	25.47	0.94	2.47
4.00	8.00	20	3.00	33.47	324.00	108.43	5,000	46.11	0.52	1.52
5.00	6.00	3	2.00	15.40	160.00	24.64	750	30.43	0.79	2.65
6.00	7.00	9	2.00	15.40	285.00	43.90	2,250	51.26	0.47	1.87
7.00	8.00	11	3.00	33.47	135.00	45.18	2,750	60.87	0.39	1.40
8.00	8.00	33	3.00	33.47	1,030.00	344.70	8,250	23.93	1.00	1.00
9.00	10.00	3	2.00	15.40	183.00	28.19	750	26.61	0.90	3.06
10.00	11.00	9	2.00	15.40	429.00	66.08	2,250	34.05	0.70	2.16
11.00	18.00	15	3.00	33.47	365.00	122.15	3,750	30.70	0.78	1.45
14.00	15.00	3	2.00	15.40	170.00	26.18	750	28.64	0.84	3.01
15.00	16.00	9	2.00	15.40	206.00	31.73	2,250	70.91	0.34	2.18
16.00	17.00	18	3.00	33.47	344.00	115.12	4,500	39.09	0.61	1.84
17.00	18.00	29	3.00	33.47	500.00	167.33	7,250	43.33	0.55	1.22
18.00	18.00	46	3.00	33.47	960.00	321.28	11,500	35.79	0.67	0.67

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

Appendix D:
CME Flow Study

CPE
SERVICE SYSTEMS SOLUTIONS

June 19, 2018

Michael Robertson
Lansing Engineering
2452 State Route 9
Suite 301
Malta, NY 12020

Ref: Clifton Park Flow Monitoring

Dear Mr. Robertson:

Corrosion Products and Equipment was tasked to install a flow meter in Clifton Park. The location was determined to be suitable for flow monitoring per a site visit conducted by Colton Zepka of CPE. The flow study began on May 18th, 2018 and through June 14th, 2018. Data was collected using the ISCO 2150 area –velocity flow meter. The ISCO 2150 operates off of the doppler ultrasonic principle and further information on the units can be found on the attached document regarding the type of technology used.

On the following pages please find the following:

1. ISCO 2150 Area Velocity Data Sheet
2. Data for each site
3. Picture of the sites

In a separate file you will find the flow rates for each location in 'CSV" format.

Any questions regarding the data should be addressed to the undersigned.

Very truly yours,

Michael Ademovic

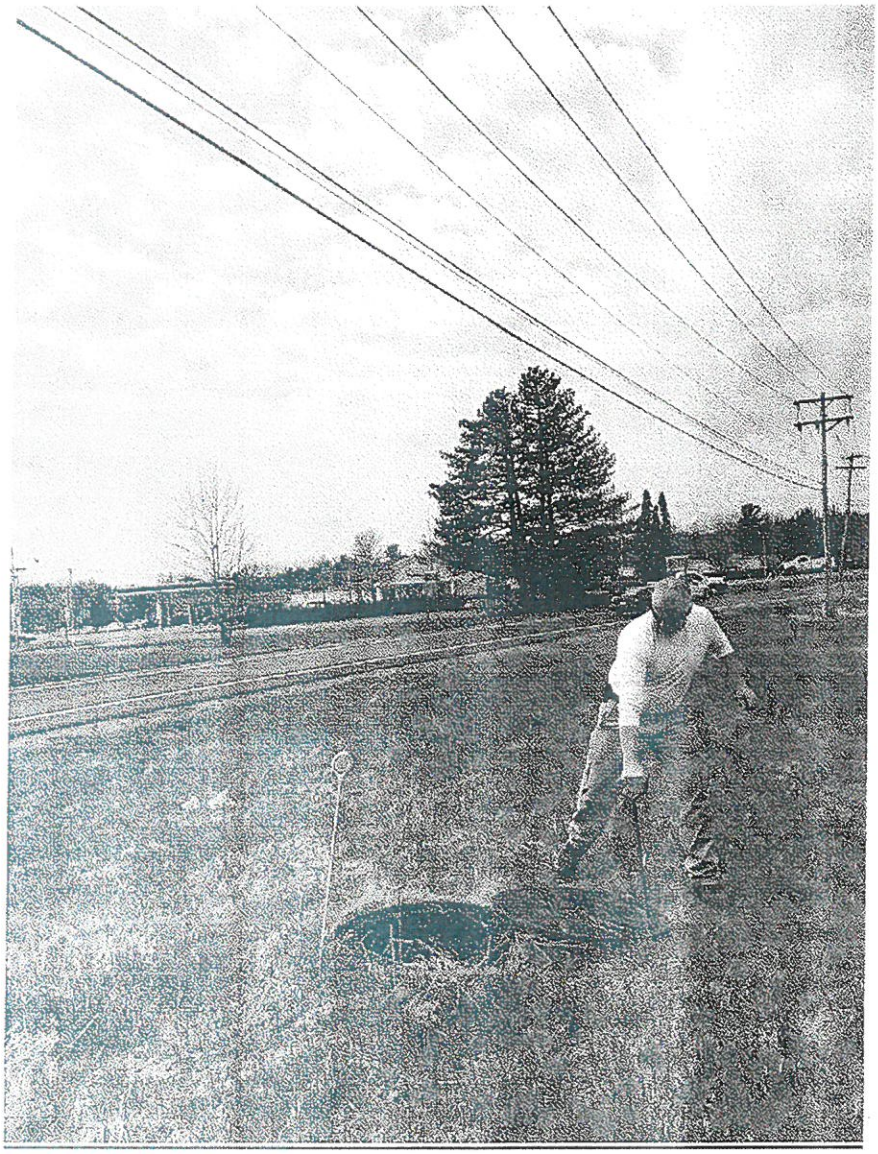
Flow Study Project Manager
CPE
Work: 585-247-3030
Fax: 585-247-7268
ademovic@corrosion-products.com

CPC

SERVICE SYSTEMS SOLUTIONS

MH#1: 8" Diameter Pipe

Clifton Park, NY



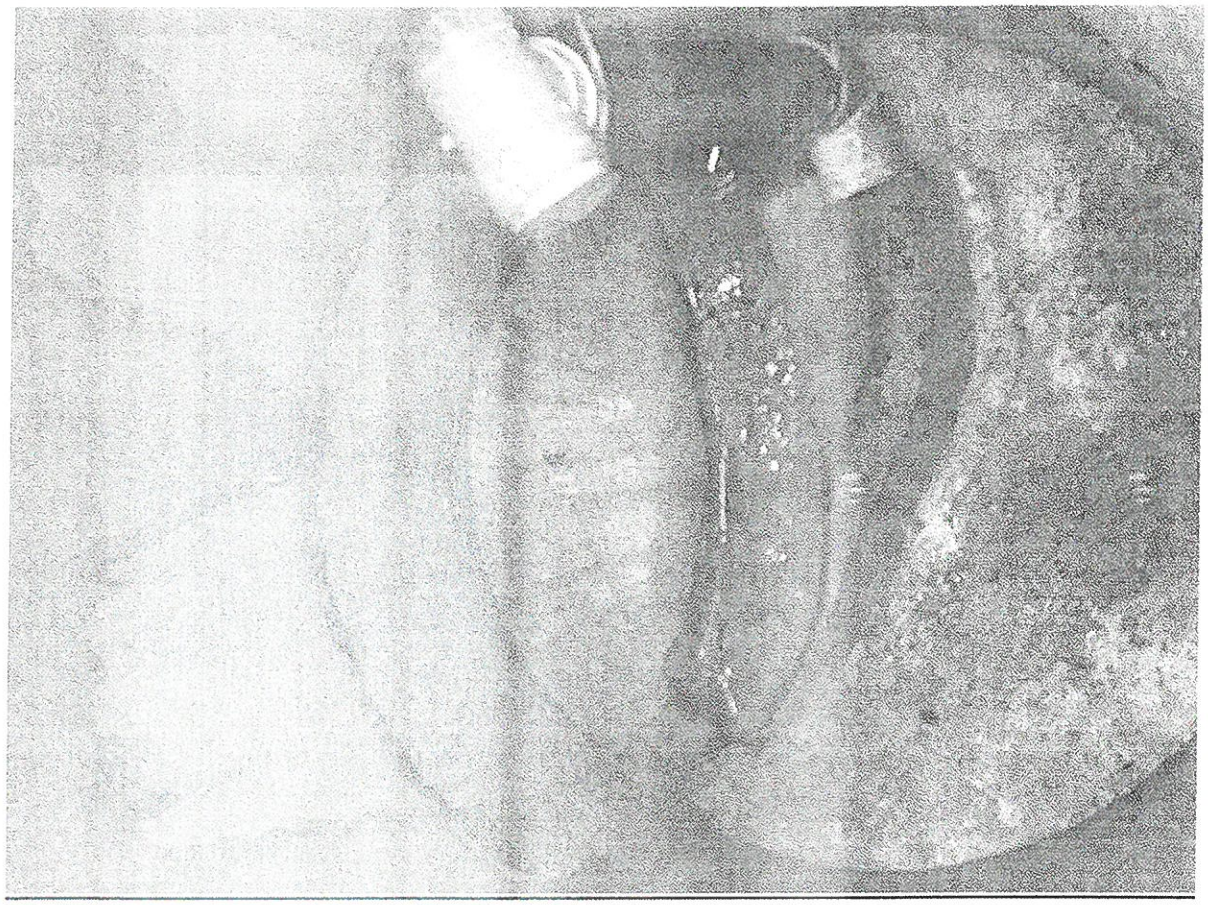
ROCHESTER
110 Elmgrove Park
Rochester, NY 14624
585.247.2030
585.247.7268

ALBANY
35 Maplewood Avenue
Albany, NY 12205
518.458.7252
518.458.7259

CARIBBEAN
43 Main Street, Mandeville
Manchester, Jamaica W.I.
876.962.6592
876.963.8144

CPC

SERVICE SYSTEMS SOLUTIONS



ROCHESTER
110 Elmgrove Park
Rochester, NY 14624
585.247.3030
585.247.7268

ALBANY
35 Maplewood Avenue
Albany, NY 12205
518.458.7252
518.458.7259

CARIBBEAN
43 Main Street, Mandeville
Manchester, Jamaica W.I.
876.962.6592
876.963.8144

Isco Product Data

Isco 2150 Area Velocity Flow Module

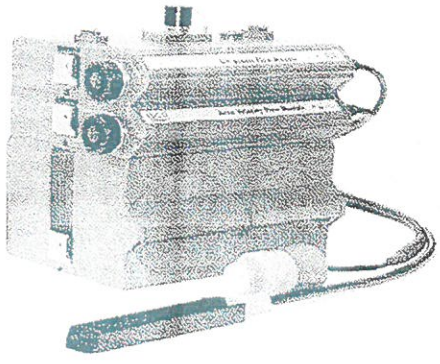
The 2150 Flow Module uses continuous wave Doppler technology to measure mean velocity. The sensor transmits a continuous ultrasonic wave, then measures the frequency shift of returned echoes reflected by air bubbles or particles in the flow.

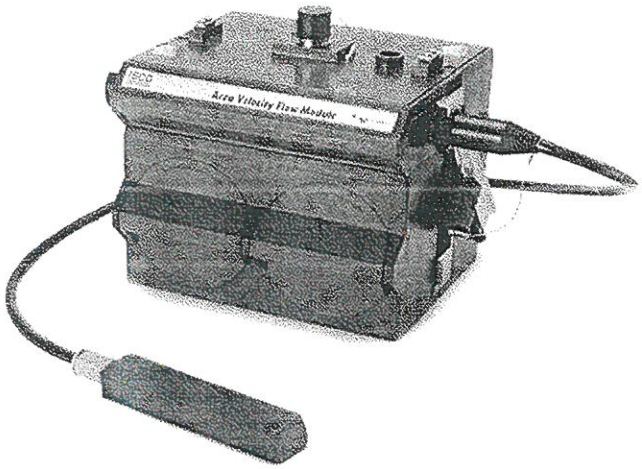
The 2150's "smart" area velocity probe is built on digital electronics, so the analog level is digitized in the sensor itself to overcome electromagnetic interference. The probe is also factory-calibrated for 10-foot (3 meter) span at different temperatures. This built-in calibration eliminates drift in the level signal, providing long-term level stability that reduces recalibration frequency and completely eliminates span recalibration.

In field use, the 2150 is typically powered either by two alkaline, or Isco Rechargeable Lead-acid batteries, within a 2191 Battery Module. Highly efficient power management extends battery life up to 15 months at 15-minute data storage intervals. Other power options (including solar) are available.

Applications

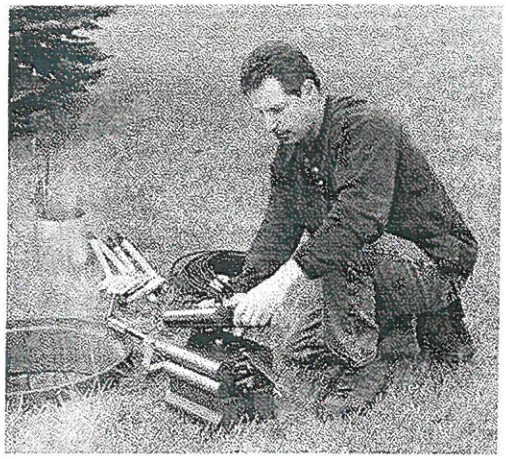
- Portable and permanent-site AV flow monitoring for inflow and infiltration, capacity assessment, sewer overflow, and other sewer studies.
- Measuring shallow flows in small pipes. Our low-profile area velocity sensor minimizes flow stream obstruction and senses velocity in flows down to 1 inch (25 mm) in depth.





Standard Features

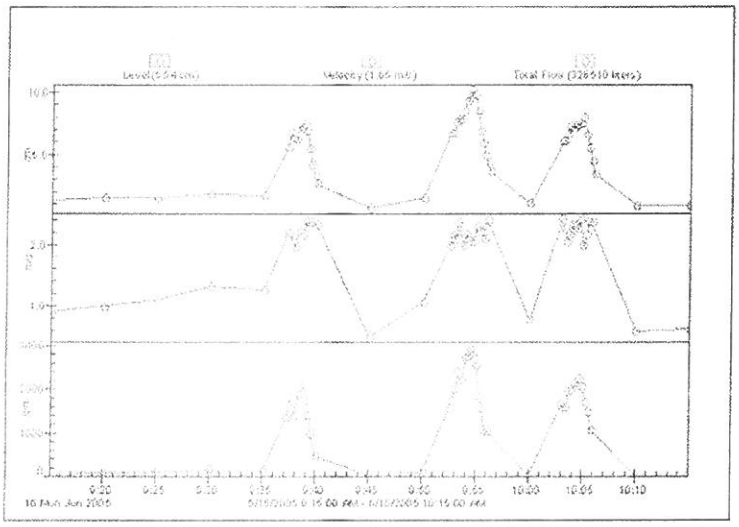
- Rugged, submersible enclosure meets NEMA 4X, 6P (IP68) environmental specs.
- Chemically resistant epoxy-encapsulated sensor withstands abuse, resists oil and grease fouling, and eliminates the need for frequent cleaning.
- Replaceable high-capacity internal desiccant cartridge and hydrophobic filter protect sensor reference from water entry and internal moisture.
- Pressure transducer vent system automatically compensates for atmospheric pressure changes to maintain accuracy.
- The quick-connect sensor can be easily removed and interchanged in the field without requiring recalibration.
- Up to four 2100 Series flow modules can be networked by stacking and/or extension cables.



Above left: Additional modules can be added for redundant or multi-stream measuring (Isco 2110 Ultrasonic Module shown).
Right: Optional mounting rings provide quick, secure sensor installation in round pipes from 6 to 80 inches (150 to 2000 mm).

Software Features

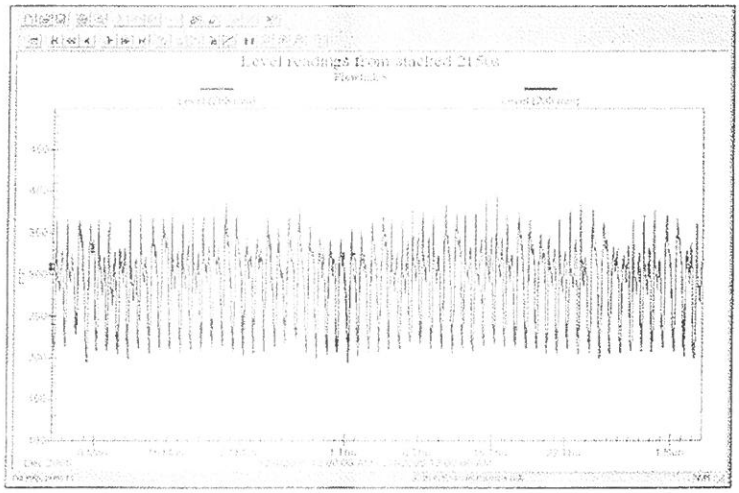
- Secure data storage. All data are continuously stored in flash memory to protect against loss in case of power failure
- Easy to upgrade. New operating software can be downloaded into non-volatile flash memory, without affecting stored program and data.
- Records and stores input voltage and temperature data.
- Variable rate data storage lets you change the data storage interval when programmed conditions occur. This feature assures maximum information about an exceptional event – such as an overflow – while conserving power and data capacity during normal conditions.
- 38,400 bps communication provides speedy setup and data retrieval.



Variable rate data storage

The 2150 flow module has the ability to automatically switch data storage rates based on varying conditions.

In the example at left, the 5-minute data storage rate automatically changed to 30 seconds when the flow rose above a programmed level.



Level stability

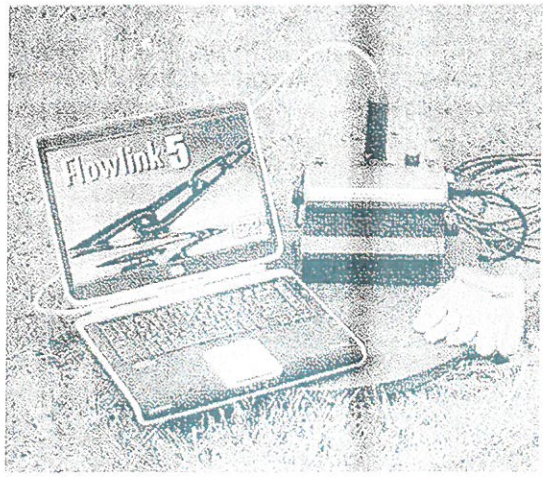
Frequent multipoint level recalibration is a requirement with other area velocity flow meters. Isco's exclusive "smart" sensor design in the area velocity probe yields exceptionally low drift in the level signal.

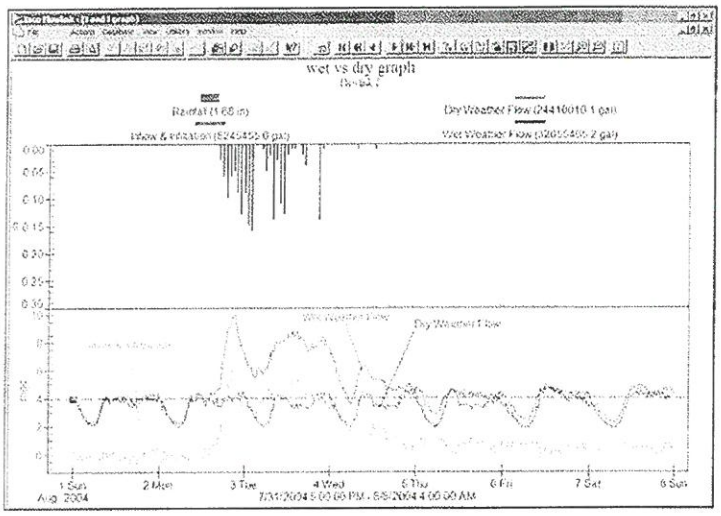
The 2150's factory-calibrated 3-meter span totally eliminates the need for cumbersome span recalibration in the field.

In the example at left, two area velocity probes were installed at the same site. The level readings from both sensors track closely without any drift, over an 8-week period.

Flowlink® Data Analysis

Isco Flowlink® Software is a powerful tool for analyzing flow and water quality data. It provides site setup, data retrieval, and comprehensive data analysis, as well as advanced reporting and graphing. See separate datasheets for details on Flowlink and Flowlink Pro software.





The Flowlink screen shown above gives a comparison of dry and wet weather flows, plus rainfall typical of an inflow & infiltration study

Information Delivery

Isco 2100 Series Flow Modules offer a wide variety of communication and retrieval options, to minimize the need for expensive on-site visits and confined space entry. These include:

Isco 2103 Land-line Modem Module
Reliable two-way dial-up communication between down-hole 2100 Flow Modules and your desktop computer, equipped with Isco Flowlink Software. A dial-out feature enables the system to transmit a text message alarm to your digital cell phone or pager.

Isco 2103c Cellular Modem Module
All the features of the 2103 Modem with the convenience of cell phone access. And the 2103c can automatically send data via the Internet to a designated server running Flowlink Pro software, using economical 1xRTT packet-switched data transmission.

Isco 2108 Analog Output Module
Provides current outputs for use with Isco 2100 Series Area Velocity and Ultrasonic Flow Modules. It allows easy interface with SCADA/DCS or other secondary instrument systems.

Modbus
2100 Series Flow Modules provide digital RS 232 Modbus output that can be used to interface with external communication modules, SCADA systems, or other devices.

On-site Data Retrieval

Isco Flowlink Software
Download and process data on-site. Enjoy unmatched data management capability, advanced data editing and analysis, powerful reporting and presentation choices, and a variety of downloading and data handling options.

Isco 2101 Field Wizard
A durable, weatherproof module for on-site data retrieval. Don't risk damage to your fragile notebook PC. The 2101 Field Wizard provides on-site display of current readings, information about stored data, diagnostics, and more.

Interrogate all 2100 Series Flow Modules in the stack at one time, and store more than 14 days' data from up to 20 modules!

Isco 2102 Communication Module
Connect with your Isco 2100 Series Flow Modules from the safety and convenience of your vehicle.

Digital spread-spectrum radio signals enable "drive-up" data retrieval, system configuration, and level calibration, with minimum power consumption. "Plug and Play" setup – no interfacing needed.

Specifications

2150 Flow Module	
Size (HxWxD):	2.9 x 11.3 x 7.5 in (74 x 287 x 191 mm)
Weight:	2.0 lb (0.9 kg)
Materials of construction:	High-impact polystyrene, stainless steel
Enclosure (self-certified):	NEMA 4X, 6P (IP68)
Temperature Range:	-40° to 140° F (-40° to 60° C) operating and storage
Power Required:	12 VDC nominal (7.0 to 16.6 VDC), 100 mA typical, 1 mA standby
Power Source:	Typically, an Isco 2191 Battery Module, containing 2 alkaline or 2 rechargeable lead-acid batteries. (Other power options are available; ask for details.)
Typical Battery Life:	Using 15-minute data storage interval Energizer® Model 529 alkaline - 15 months Isco rechargeable lead-acid - 2.5 months
Program Memory:	Non-volatile programmable flash; can be updated using PC without opening enclosure; retains user program after updating.
Built-in Conversions	
Flow Rate Conversions:	Up to 2 independent level-to-area conversions and/or level-to-flow rate conversions.
Level-to-Area Conversions:	Channel Shapes - round, U-shaped, rectangular, trapezoidal, elliptical, with slit correction. Data Points - Up to 50 level-area points.
Level-to-Flow Conversions:	Most common weirs and flumes; Manning Formula; Data Points (up to 50 level-flow points); 2-term polynomial equation
Total Flow Calculations:	Up to 2 independent, net, positive or negative, based on either flow rate conversion
Data Handling and Communications	
Data Storage:	Non-volatile flash; retains stored data during program updates. Capacity 395,000 bytes (up to 79,000 readings, equal to over 270 days of level and velocity readings at 15-minute intervals, plus total flow and input voltage readings at 24-hour intervals)
Data Types:	Level, velocity, flow rate 1, flow rate 2, total flow 1, total flow 2, input voltage, temperature
Storage Mode:	Rollover. 5 bytes per reading.
Storage Interval:	15 or 30 seconds; 1, 2, 5, 15, or 30 minutes; or 1, 2, 4, 12, or 24 hours Storage rate variable based on level, velocity, flow rate, total flow, or input voltage
Data Retrieval:	Serial connection to PC or optional 2101 Field Wizard module; optional modules for spread spectrum radio; land-line or cellular modem; 1xRTT. Modbus and 4-20 mA analog available.
Software:	Isco Flowlink for setup, data retrieval, editing, analysis, and reporting
Multi-module networking:	Up to four 2100 Series Flow Modules, stacked and/or remotely connected. Max distance between modules 3300 ft (1000 m).
Serial Communication Speed:	38,400 bps

2150 Area Velocity Sensor	
Size (HxWxD):	0.75 x 1.3 x 6.0 in (19 x 33 x 152 mm)
Cable (Length x Diameter):	25 ft x 0.37 in (7.6 m x 9 mm) standard. Custom lengths available on request.
Weight (including cable):	2.2 lbs (1 kg)
Materials of construction:	Sensor - Epoxy, chlorinated polyvinyl chloride (CPVC), stainless steel Cable - Polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC)
Operating Temperature:	32° to 140° F (0° to 60° C)
Level Measurement:	Method - Submerged pressure transducer mounted in the flow stream Transducer Type - Differential linear integrated circuit pressure transducer Range (standard) 0.033 to 10 ft (0.010 to 3.05 m); (optional) up to 30 ft (9.15 m). Maximum Allowable Level 34 ft (10.5 m) Accuracy ±0.01 ft from 0.033 to 10 ft, (±0.003 m from 0.01 to 3.05 m,) Long-Term Stability ±0.023 ft/yr (±0.007 m/yr) Compensated Range 32° to 122°F (0° to 50°C)
Velocity Measurement:	Method - Doppler ultrasonic, frequency 500 kHz Typical Minimum Depth 0.08 ft (25 mm) Range -5 to +20 ft/s (-1.5 to +6.1 m/s) Accuracy (in water with uniform velocity profile, speed of sound = 4850 ft/s, for indicated velocity range) ±0.1 ft/s from -5 to 5 ft/s (±0.03 m/s from -1.5 to +1.5 m/s) ±2% of reading from 5 to 20 ft/s (1.5 to 6.1 m/s)
Temperature Measurement:	Accuracy ±3.6° F (±2° C)
2191 Battery Module	
Size (HxWxD):	6.0 x 9.6 x 7.6 in (152 x 244 x 193 mm)
Weight (without batteries):	3.2 lb (1.4 kg)
Materials of construction:	High-impact polystyrene, stainless steel
Enclosure (self certified):	NEMA 4X, 6P, (IP68)
Batteries:	Two 6-volt Energizer Model 529* alkaline (25 Ahrs capacity) or Isco Rechargeable Lead-acid (5 Ahrs capacity) recommended. *Note – Energizer 529 ER does not give specified life.

2150 Ordering Information

Contact your Teledyne Isco representative for complete ordering details and information on other 2100 Series Modules.

Description	Part No.
2150 with AV sensor, 2191 Battery Module, and Handle	68-2050-002
2150 Module with AV sensor (only)	68-2050-001
Isco Flowlink® 5 Software	68-2540-200
Energizer® Model 529 Alkaline Lantern Battery (2 required)	340-2006-02
Isco Rechargeable Lead-acid Battery (2 required)	60-2004-041
Charger for Lead-acid Batteries (holds 2 batteries)	60-2004-040

ISCO®

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Teledyne Isco, Inc.
4700 Superior Street
Lincoln NE 68504 USA
Tel: (402) 464-0231
USA and Canada: (800) 228-4373
Fax: (402) 465-3022
E-Mail: iscoinfo@teledyne.com
Internet: www.isco.com

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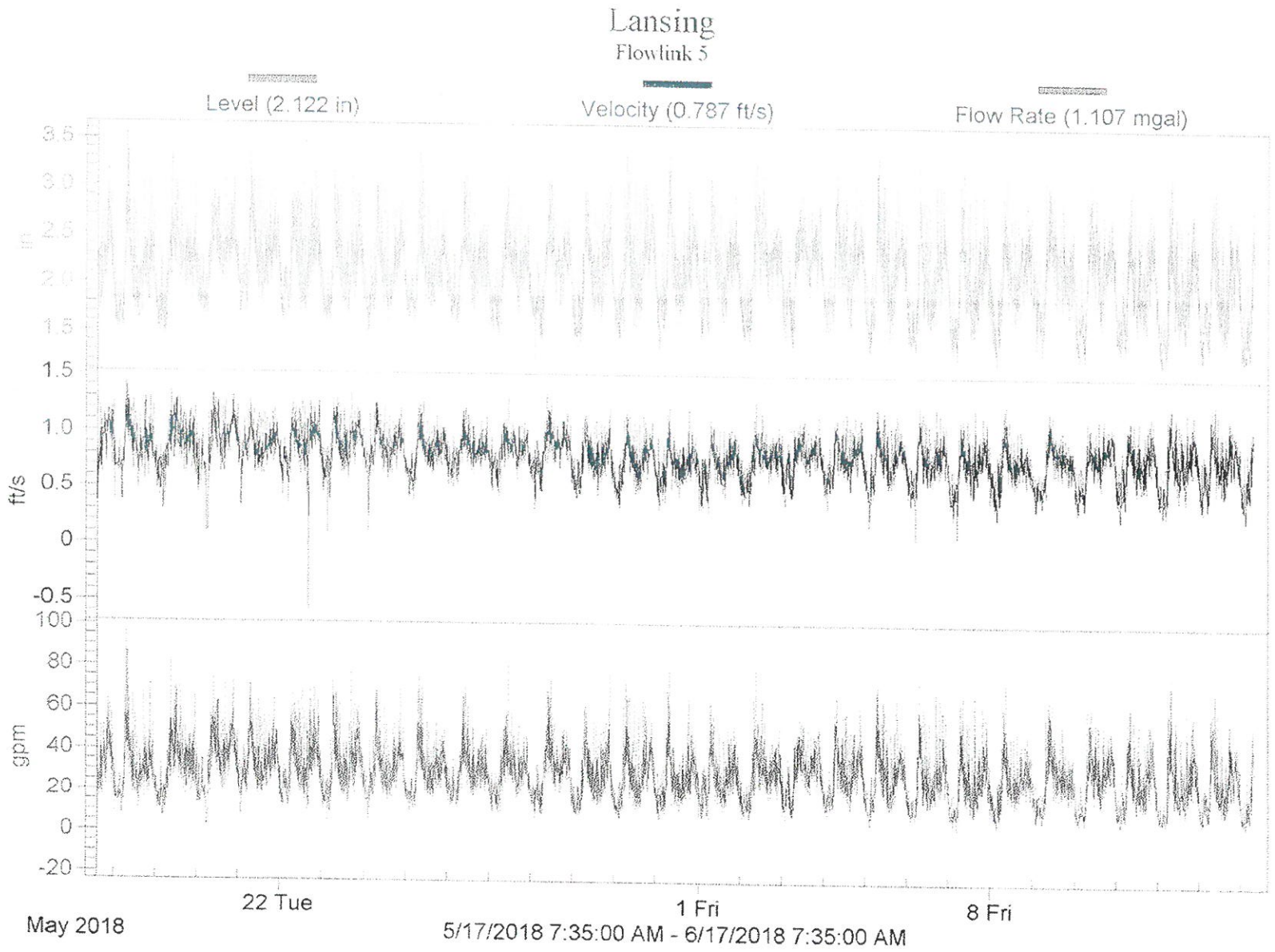
Lansing
Flowlink 5
Level (2.122 in)
Velocity (0.787 ft/s)
Flow Rate (1.107 mgal)
3.5
3.0
2.5
2.0
1.5
1.5
1.0
0.5
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-0.5
ft/s
100
80
60
40
20
0
-20
gpm
22 Tue
1 Fri
8 Fri
May 2018
5/17/2018 7:35:00 AM - 6/17/2018 7:35:00 AM

Lansing

Flowlink 5

Date/Time	Level (in)	Velocity (ft/s)	Flow Rate (gpm)
	Average	Average	Average
5/19/2018 9:00:00 AM	2.011	0.810	26.010
5/20/2018 9:00:00 AM	2.214	0.847	31.225
5/21/2018 9:00:00 AM	2.355	0.937	37.148
5/22/2018 9:00:00 AM	2.224	0.832	30.740
5/23/2018 9:00:00 AM	2.169	0.859	31.056
5/24/2018 9:00:00 AM	2.150	0.880	31.140
5/25/2018 9:00:00 AM	2.126	0.813	28.271
5/26/2018 9:00:00 AM	2.118	0.818	27.992
5/27/2018 9:00:00 AM	2.125	0.819	28.420
5/28/2018 9:00:00 AM	2.100	0.816	27.885
5/29/2018 9:00:00 AM	2.163	0.843	30.604
5/30/2018 9:00:00 AM	2.126	0.742	26.234
5/31/2018 9:00:00 AM	2.190	0.744	27.447
6/1/2018 9:00:00 AM	2.190	0.719	26.227
6/2/2018 9:00:00 AM	2.085	0.706	24.106
6/3/2018 9:00:00 AM	2.204	0.780	28.663
6/4/2018 9:00:00 AM	2.270	0.810	30.858
6/5/2018 9:00:00 AM	2.155	0.775	28.072
6/6/2018 9:00:00 AM	2.090	0.753	26.387
6/7/2018 9:00:00 AM	2.043	0.725	24.626
6/8/2018 9:00:00 AM	2.019	0.738	24.548
6/9/2018 9:00:00 AM	2.093	0.685	23.420
6/10/2018 9:00:00 AM	2.081	0.744	25.853
6/11/2018 9:00:00 AM	2.112	0.780	27.575
6/12/2018 9:00:00 AM	1.958	0.726	23.557

Date/Time	Level (in)	Velocity (ft/s)	Flow Rate (gpm)
6/13/2018 9:00:00 AM	1.950	0.755	24.019
6/14/2018 7:45:00 AM	1.935	0.735	23.387
	Average Level 2.121 (in)	Average Velocity 0.785 (ft/s)	
			Total 1.072 mgal