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An example citation:

2010 Piermont Hydrologic Data (finalized) courtesy of the Hudson River Environmental Conditions Observing System (<http://www.hrecos.org>)

**Entry Verification:**

Since December 2009, data collection and verification have been performed according to the HRECOS Quality Management Plan and the HRECOS Estuary Stations Quality Assurance Project. Both are available at [www.hrecos.org](http://www.hrecos.org). This station is quality level B; the data are verified once per quarter.

Previous to December, 2009, data were collected according to the manufacturer's instructions only. Deployment dates and post calibration values were not recorded and data were not verified.

**Site Location and Character:**

The Piermont Pier sampling station, in Piermont NY (41° 2' 35.0226"N 73° 53' 45.891"W), is situated on the end of a mile long pier stretching into the Hudson River. The pier is open to the public and regularly used for recreational purposes. It is located just north of the NERRS Piermont Marsh, a tidal salt marsh dominated by the invasive reed *Phragmites australis*, where approximately 30 MGD of secondarily treated sewage is discharged from Orangetown and Rockland County. The local tidal range varies between 3 and 5 feet and the river bottom is characterized by thick mud and rocks. A submersible YSI 6600 multi-probe sonde is deployed in a perforated PVC tube encasing mounted to the pier. The installed sensors monitor Chlorophyll, Dissolved Oxygen, Salinity, Turbidity, Water Temperature, Water Level and pH. Data is transmitted to a geostationary satellite via a Sutron Satlink2 transmission system located on a nearby utility building.

Based on sampling on December 1, 2011, the river cross-section at this location showed greater variability in turbidity and conductivity across both distance and time than other HRECOS sites examined. Due to a dysfunctional sonde at the station, a comparison of longer term patterns was not possible. On the day of sampling there was a strong West to East gradient in turbidity which (if general) means the fixed HRECOS site will overestimate turbidity of the main channel at this location. There was no conclusive evidence of an effect of the wastewater outfall or Sparkill Creek on conditions observed at the fixed HRECOS site. The full report of this analysis is given as appendix A.

Piermont hydrological station is located on Piermont Pier, owned and operated by the village of Piermont. Permission for research work can be obtained through Mayor Christopher Sanders (csanders898@optonline.net).

**Data collection period:**

Sampling at the Piermont Hydrological Station began on April 22, 2008. Sampling is continuous year round unless noted in Other Remarks/Notes (section IIe).

A YSI 6600 Extended Deployment System (EDS) sonde was purchased for Piermont Hydrological in December 2009. Previous to this, the station was using available YSI sondes on loan from the Hudson River National Estuarine Research Reserve. The YSI 6600 sonde was first deployed on 4/30/2010.

Dates and times for site deployments and retrievals:

*Deployment and Retrieval dates prior to 4/30/2010 were not recorded.*

Deployment	Retrieval	YSI sonde type
04/30/2010	05/28/2010	6600
06/10/2010	07/10/2010	6600
07/10/2010	08/14/2010	6600
08/14/2010	09/02/2010	6600
09/28/2010	11/09/2010	6600
11/17/2010	01/06/2011	6600
01/06/2011	02/07/2010	6600
02/07/2010	03/20/2010	6600
03/20/2010	04/30/2010	6600
04/30/2010	06/10/2010	6600
06/10/2010	07/10/2010	6600
07/10/2010	08/14/2010	6600
08/14/2010	09/28/2010	6600
09/28/2010	11/17/2010	6600
11/17/2010	12/29/2010	6600
12/29/2010	02/04/2011	6600
02/07/2011	02/12/2011	6600
02/12/2011	04/18/2011	6600
04/18/2011	05/17/2011	6600
05/17/2011	06/08/2011	6600
06/08/2011	07/14/2011	6600
07/14/2011		6600

## Post deployment information

Deployment <i>expected values</i>	DO 100% <i>100%</i>	SpCond <i>10 mS/cm</i> <i>* 1 mS/cm</i>	pH <i>7</i>	Turb <i>0 NTU</i>
4/30/2010	101.1	9.93	7.25	2.7*
06/10/2010	102.1	9.69	7.10	-0.6
07/10/2010	98.5	10.12	6.96	1.2*
08/14/2010	100.6	9.90	7.44*	4.5*
09/28/2010	101.0	*0.969	7.13	-0.4
11/17/2010	101.2	*1.025	7.13	-0.4
01/06/2011	97.6	9.971	7.03	3.1*
02/07/2010	98.9	10.14	7.08	0
03/20/2010	100.4	9.86	7.04	1.3*
04/30/2010	101.1	9.93	7.25	2.7*
06/10/2010	102.1	9.69	7.10	-0.6
07/10/2010	98.5	10.12	6.96	-1.2*
08/14/2010	100.6	9.90	7.44*	4.5*
09/28/2010	101.0	0.969	12.79*	-0.2
11/17/2010	101.2	1.025	7.13	-0.4
12/29/2010	sonde was completely dead on 2/4/2011			
02/07/2011	98.9	10.14	7.08	0
02/12/2011	106.6*	10.04	7.06	0.3
04/18/2011	98.7	1.01	7.05	4.4*
05/17/2011	103.2	**	7.04	-4.5*
06/08/2011				

\* Indicates post deployment values exceeded alarm levels as defined by the HRECOS Estuary Station Quality Assurance Project Plan

\*\* Error during calibration: value was not recorded.

### Other remarks / notes:

- 01/06/2011 The sonde deployed from 1/6/2011 to 2/7/2011 failed during deployment. All data from this deployment was lost.
- 02/07/2011 The dissolved oxygen probe failed for the duration of the 2/7/11 – 2/12/11 deployment.

## Sensor Specifications

General Information	Date first operational	6/16/08
	Date of first transmission	7/1/08
	Data Logger Model	YSI 6600 V2/4
	Data Transmitter	Sutron Model #SL2-G312-1 geo-stationary satellite data transmitter
	Vented to Atmosphere?	vented
	Collection Interval	15 min
Temperature	Units	Celsius (°C)
	Sensor type	Thermistor
	Model #	YSI 6560
	Range	-5 to 45 °C
	Accuracy	+/-0.15 °C
	Resolution	0.01 °C
Conductivity	Units	mS/cm
	Sensor type	4-electrode cell with autoranging
	Model #	YSI 6560
	Range	0 to 100 mS/cm
	Accuracy	+/-0.5% of reading + 0.001 mS/cm
	Resolution	0.001 mS/cm to 0.1 mS/cm (range dependent)
Salinity	Units	parts per thousand (ppt)
	Sensor type	Calculated from conductivity and temperature
	Range	0 to 70 ppt
	Accuracy	+/- 1.0% of reading or 0.1 ppt, whichever is greater
	Resolution	0.01 ppt
	Dissolved Oxygen % Saturation	Units
Sensor type		Optical probe w/ mechanical cleaning
Model #		YSI 6150 ROX
Range		0 to 500% air saturation
Accuracy		0-200% air saturation: +/- 1% of the reading or 1% air saturation, whichever is greater 200-500% air saturation: +/- 15% or reading
Resolution		0.1% air saturation

Dissolved Oxygen mg/L	Units	milligrams/Liter (mg/L)
	Sensor type	Calculated from % air saturation, temperature, and salinity
	Model #	YSI 6150 ROX
	Range	
	Accuracy	0-20 mg/L: +/-0.1 mg/l or 1% of the reading, whichever is greater; 20 to 50 mg/L: +/-15% of the reading
	Resolution	0.01 mg/L
	Water Level (shallow depth)	Units
Sensor type		Stainless steel strain gauge
Vented to Atmosphere		vented
Range		0 to 30 ft (9.1 m)
Accuracy		0-10 ft: +/- 0.01 ft (0.003 m); 10-30 ft: +/- 0.06 ft (0.018 m)
Resolution		0.001 ft (0.001 m)
pH		Units
	Sensor type	Glass combination electrode
	Model #	YSI 6561 Flat Glass
	Range	0 to 14 units
	Accuracy	+/- 0.2 units
	Resolution	0.01 units
Turbidity	Units	nephelometric turbidity units (NTU)
	Sensor type	Optical, 90 ° scatter, with mechanical cleaning
	Model #	YSI 6136
	Range	0 to 1000 NTU
	Accuracy	+/- 2 % of reading or 0.3 NTU (whichever is greater)
	Resolution	0.1 NTU
Chlorophyll	Units	micrograms/Liter (ug/L)
	Sensor type	optical fluorescence sensor
	Model #	6025
	Range	0 to 400 ug/L chl a; 0 to 100 RFU
	Detection Limit	~ 0.1 ug/L
	Resolution	0.1 ug/L chl a, 0.1% FS

**QAQC flag definitions:**

	Flag	Description
Automatic Data Flags	0	Acceptable data
	5	Data that demonstrate a dramatic increase or decrease from the previous value. This flag will be applied to all parameters except chlorophyll, radiation, rainfall, wind direction, and wind direction standard deviation where dramatic increases and decreases are expected. The boundaries for these flags are: <ul style="list-style-type: none"> <li>○ <math>x &gt; 3(\text{previous value})</math> for Acidity, Dissolved Oxygen, Water Level, Water Temperature, Barometric Pressure, and Absolute Pressure.</li> <li>○ <math>x &lt; 1/3(\text{previous value})</math> for Specific Conductivity, Salinity, and Relative Humidity.</li> <li>○ <math>x &gt; 10 + 3(\text{previous value})</math> for Turbidity, Wind Gusts, and Wind Speed.</li> <li>○ <math> x  &gt; 10 + 3(\text{previous value})</math> for Air Temperature</li> </ul>
	6	Flat lined data (20 or more repeated records of the same value). This flag will be applied to all parameters except specific conductivity, chlorophyll, radiation, and rainfall where flat lined data is expected. For the same reason, this flag will not be applied to salinity data from Norrie Point.
	30	Hydrological data outside three standard deviations of the seasonal mean. The seasons will be defined by the solstices and equinoxes.
	40	Hydrological data outside four standard deviations of the seasonal mean. The seasons will be defined by the solstices and equinoxes.
	100	Data outside the range of the instrument.
Added by Site Manager	0	Data determined to be acceptable after a final review by the site manager.
	10,000	Suspicious data according to a final review by the site manager
	20,000	Corrected Data
	500,000	Rejected data according to a final review by the site manager.
Added by HRECOS Coordinator	5,000	Data from instruments that exceed the post-deployment warning level as defined by the HRECOS quality management plan
	9,000	Data from instruments that exceed the post-deployment alarm level as defined by the HRECOS quality management plan

**QAQC Comment Code definitions:**

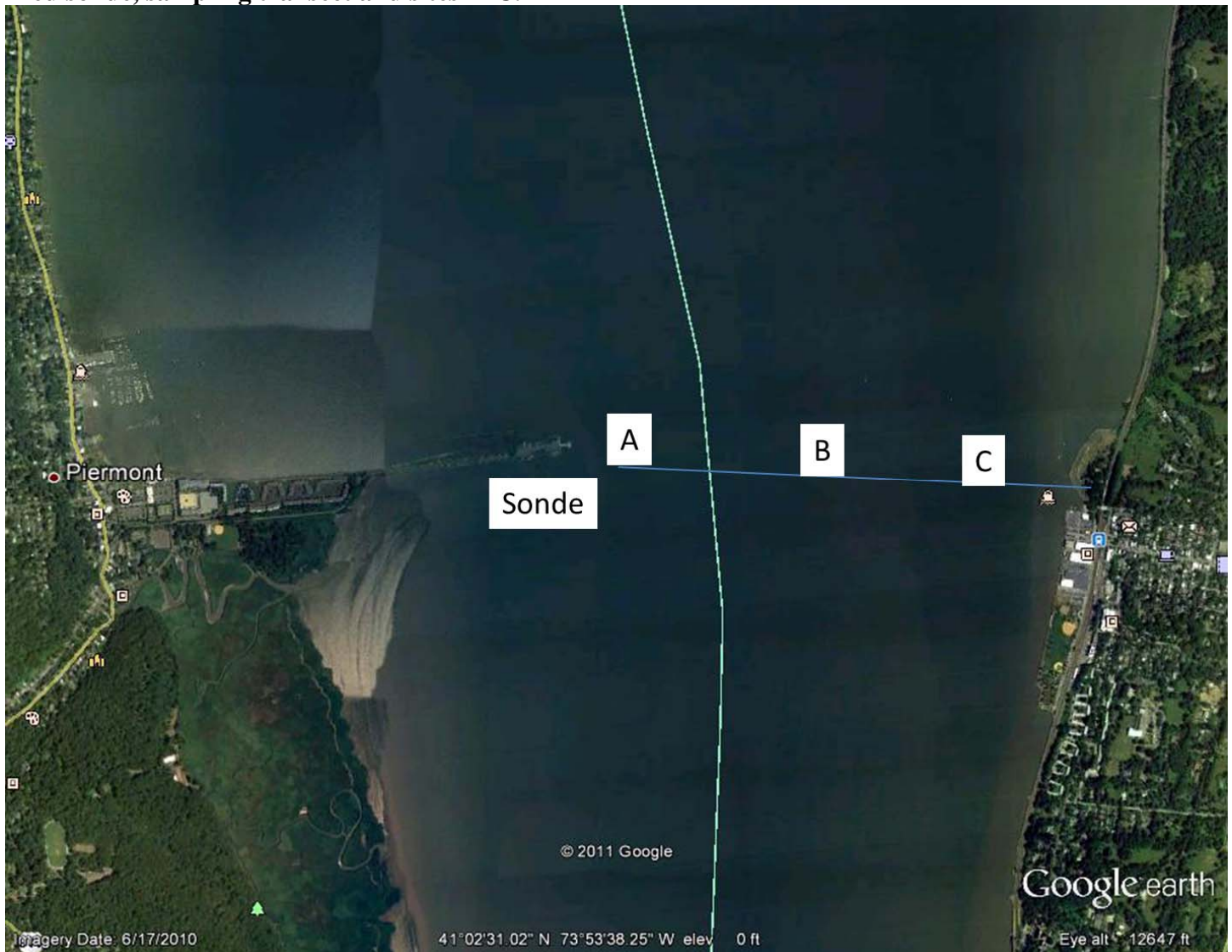
Comment Codes Added By Site Managers	General Errors	Hyd + Met	[GIM]	instrument malfunction	[GPF]	power failure/low battery	
			[GIT]	instrument recording error, recovered telemetry data	[GQR]	rejected due to QAQC checks	
			[GMC]	no instrument deployed due to maintenance/calibration	[GSM]	see metadata	
		Hyd	[GIC]	no instrument deployed due to ice	[GOW]	out of water event	
			[GNF]	deployment tube clogged/no flow			
		Met	[GMT]	instrument maintenance	[GIM]	program reload	
			[GPD]	power down			
		Sensor Errors	Hyd	[SBO]	blocked optic	[SPC]	post calibration out of range
				[STF]	catastrophic temperature sensor failure	[SSDN]	sensor drift, record not corrected
	[SCF]			conductivity sensor failure	[SSDC]	sensor drift, record corrected	
	[SDF]			depth port frozen	[SSM]	sensor malfunction	
	[SDP]			DO membrane puncture	[SOW]	sensor out of water	
	[SDO]			DO suspect	[SSR]	sensor removed (not deployed)	
	[SIC]			incorrect calibration/contaminated standard	[STS]	turbidity spike	
	[SNV]			negative value	[SWM]	wiper malfunction/loss	
	Met		[SIC]	incorrect calibration constant, multiplier or offset	[SOC]	out of calibration	
			[SNV]	negative value	[SSM]	sensor malfunction	
			[SSN]	not a number/unknown value	[SSR]	sensor removed	
	Comments	Hyd		acceptable calibration/accuracy error of sensor	[CRE]	significant rain event	
			[CAF]		[CRE]	significant rain event	
			[CBF]	biofouling	[CSM]	see metadata	
			[CCU]	cause unknown	[CTS]	turbidity spike	
			[CDA]	DO hypoxia <28 percent saturation	[CWD]	data collected at wrong depth	
			[CDB]	disturbed bottom	[CAP]	depth sensor in water, affected by atmospheric pressure	
			[CDF]	data appear to fit conditions	[CAB]	algal bloom	
			[CFK]	fish kill	[CVT]	possible vandalism/tampering	
			[CIP]	surface ice present at sample station	[CMC]	in field maintenance/cleaning	
			[CLT]	low tide	[CMD]	mud in probe guard	
		[CND]	new deployment begins				
		Met		acceptable calibration/accuracy error of sensor	[CSM]	see metadata	
			[CAF]		[CSM]	see metadata	
			[CDF]	data appear to fit conditions	[CVT]	possible vandalism/tampering	
[CRE]			significant rain event				

**Final Report**  
**Characterizing cross-channel variability at the Piermont HRECOS site.**  
**Prepared by:**  
**Stuart Findlay**  
**Cary Institute of Ecosystem Studies**  
**Millbrook, NY**

**Transmitted to Alene Onion, HRECOS Coordinator on December 30, 2011**

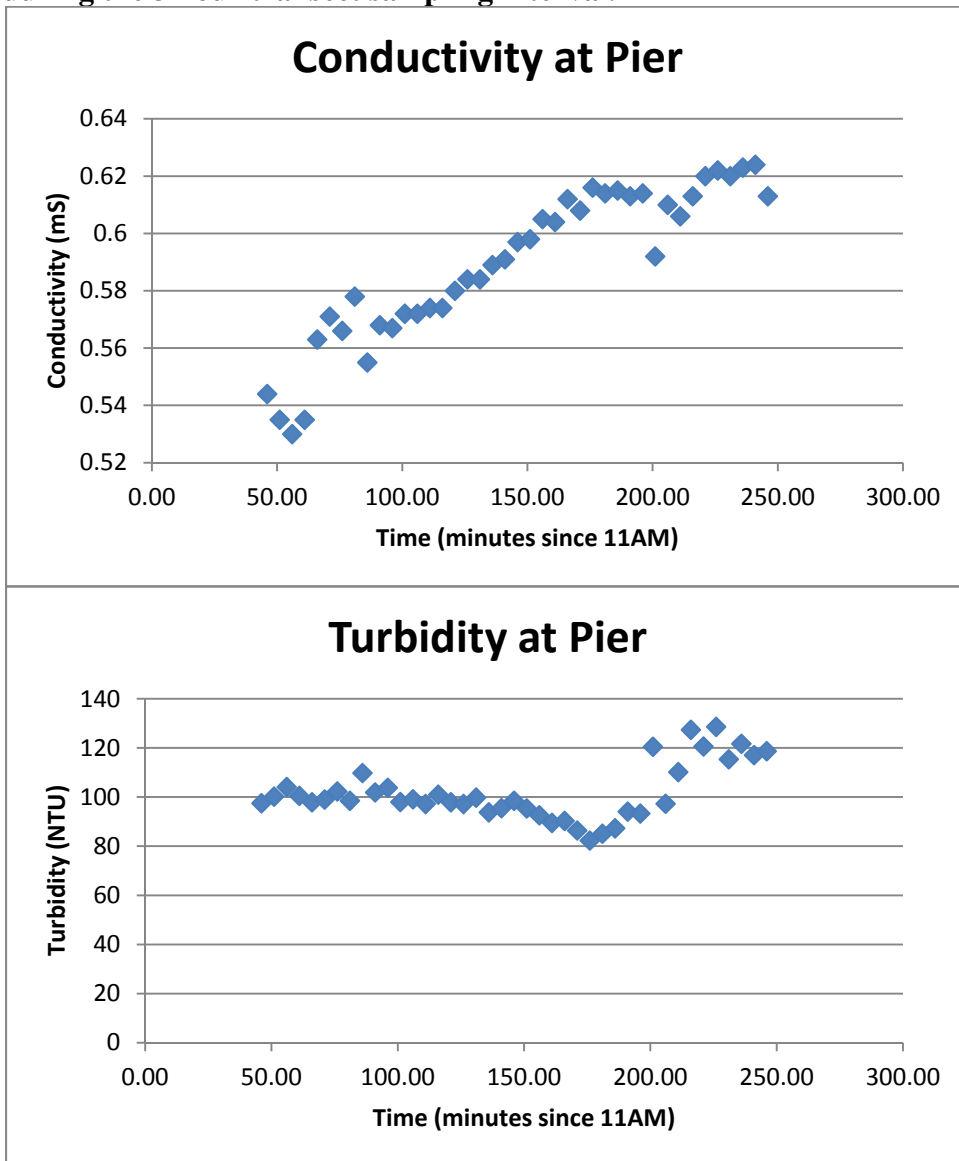
On December 1, 2011 we conducted a survey of cross-channel variability adjacent to the Piermont Pier HRECOS deployment. The HRECOS sonde is located in a pipe on the southern side of the pier in approximately 4 m water depth. Due to concern about the condition of the existing HRECOS sonde we attached a newly-calibrated sonde at the same location as the existing sonde. This sonde was programmed to log every 5 minutes for the interval of our field sampling. To assess how well this location represents conditions across the channel we conducted two sampling transects each including three locations (Fig. 1) where we conducted vertical sampling. Following established procedures we towed a YSI Water Quality sonde approximately 1 m sub-surface across the transect with logging set for 30 sec intervals. Due to the width of the Hudson at this location it required nearly an hour to traverse the channel. Sampling occurred between Noon and 3 PM (EST) during a flooding tide since the main concern at this site was the possible influence of a wastewater outfall and the Sparkill Creek both located south of the Pier. At Locations A,B,C along the transect the sonde and a sampling tube connected to a peristaltic pump were lowered to 1 and 5 m (and 10 m in the navigation channel (Site C)) to collect observations and an actual water sample from these depths. All sonde calibration and suspended matter determinations followed established procedures.

**Fig. 1: Google Earth image of Piermont reach of the Hudson River showing approximate locations of the fixed sonde, sampling transect and sites A-C.**



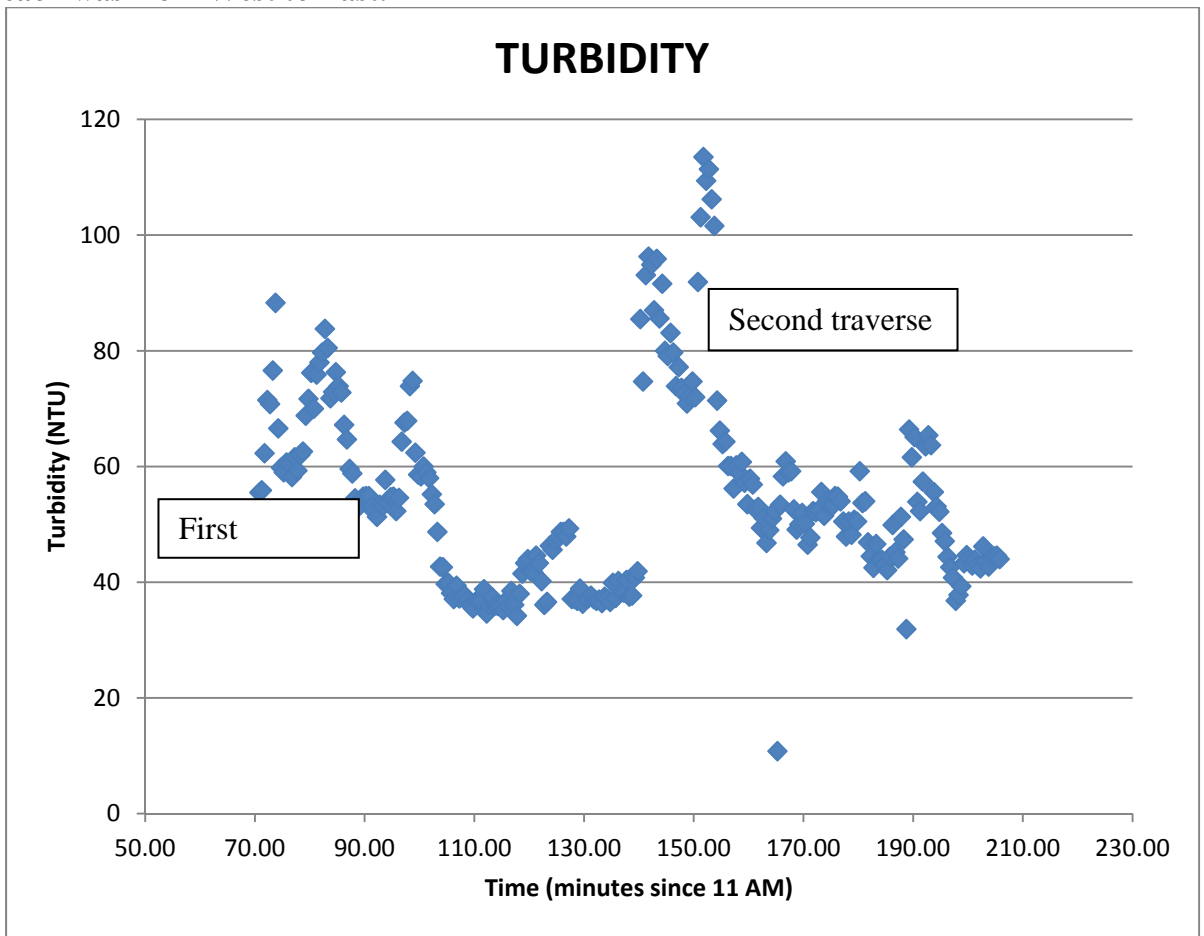
Both conductivity and turbidity records at the Pier showed increases during the three hour period of flooding tide. Conductivity is likely simply due to an upriver flow of higher salinity water. The turbidity increase could be due to either local resuspension or upriver movement of a water mass with higher turbidity.

**Fig. 2: Changes in conductivity and turbidity recorded by the temporary sonde attached to the pier during the 3 hour transect sampling interval.**

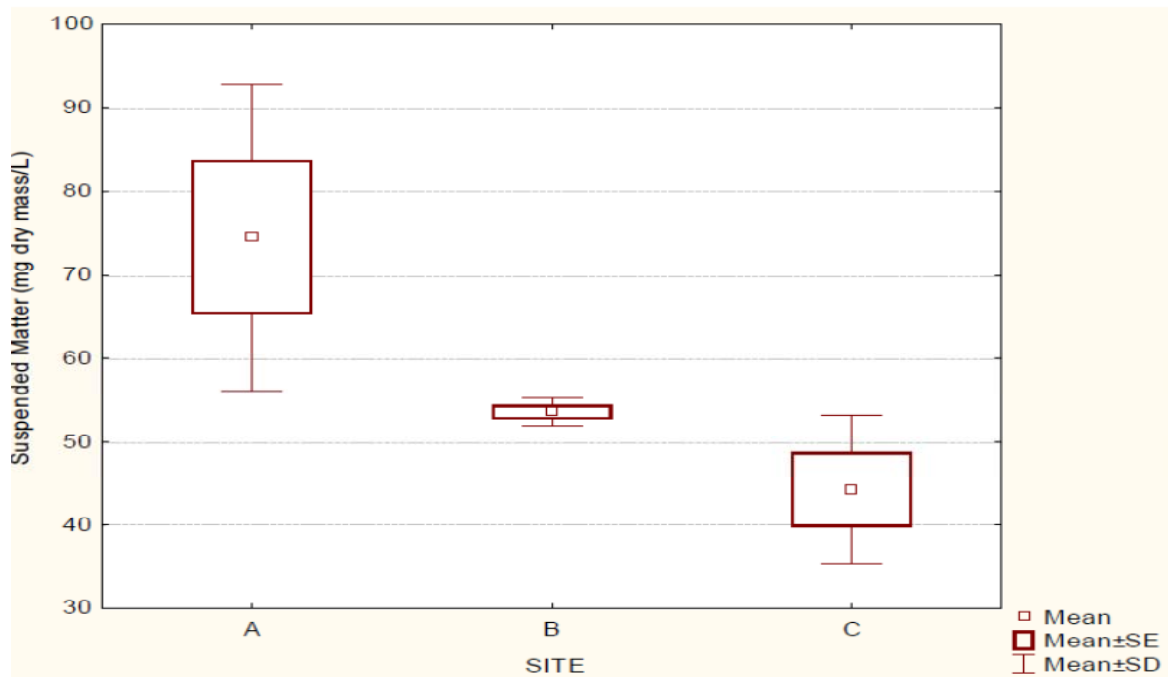


Sampling across the channel revealed large and distinct differences in turbidity with highest values on the west side of the channel, decreasing towards the east during both traverses (Fig. 3). Higher values occurring at ~ 80 and 120 minutes represent times the sonde was lowered for vertical profiles (see below). Samples of suspended matter showed distinct differences among locations with values at Location “A” nearly two-fold higher than Location “C” in the navigation channel (Fig. 4).

**Fig. 3: Cross-channel variation in turbidity as recorded by the towed YSI Sonde. The X-axis is in minutes since 11 AM for ease of comparison with the fixed (pier) sonde. Two traverses were carried out, the first lasting from roughly 70 to 130 minutes past 11AM and the second from 140 to 210 minutes and each was from West to East.**

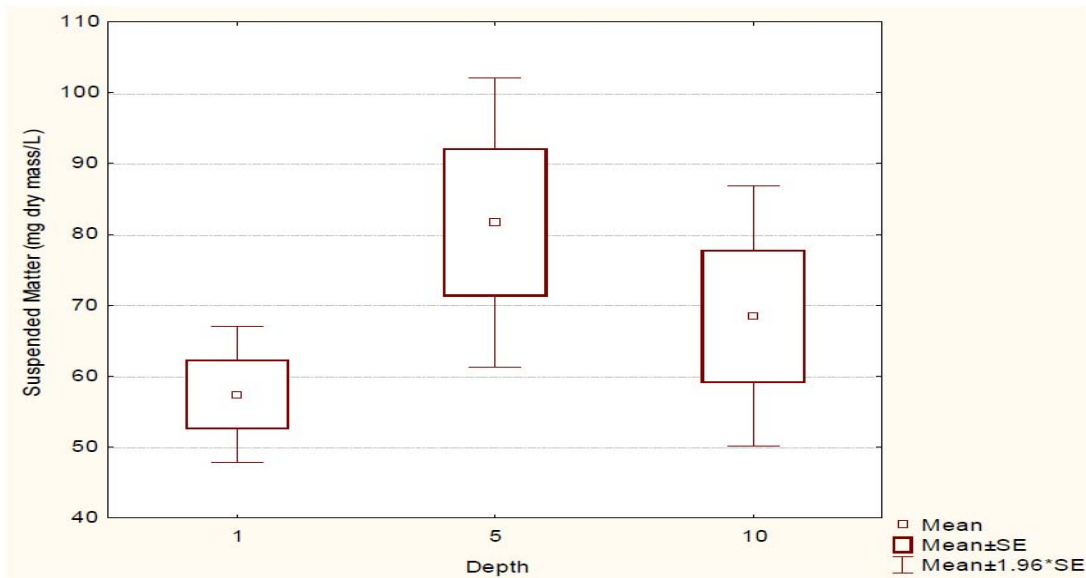


**Fig. 4: Variation in suspended matter in shallow water (depth = 1 m) samples collected at locations A-C (West to East) across the transect.**

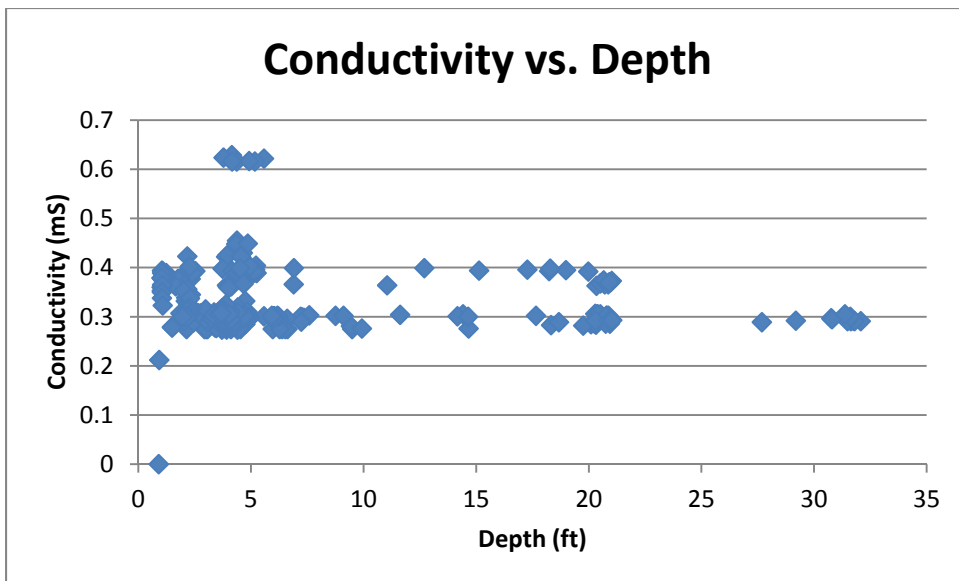


Samples for suspended matter collected along vertical profiles showed higher values at depths 5 and 10 (Fig. 5) although statistical analysis was equivocal since only “Location “C” was deep enough to allow sampling at 10 m.

**Fig. 5: Depth variation in suspended matter. Locations “A & B” were sampled at 1 and 5 m while Location “C” was sampled at 1,5 and 10 m.**



There were slight West to East gradients in conductivity with a range of less than 0.1 mS (not shown) but little evidence of strong vertical variation in conductivity. Dissolved oxygen and pH showed no variation across the transects. The average dissolved oxygen was 11.2 mg/L with a standard deviation of only 0.1 mg/L. Mean pH was 7.9 pH units.



**Fig. 6: Variation in conductivity across sampling depth showing no consistent stratification (higher conductivity at depth) during this three hour period.**

### Conclusions

1. On the date of sampling the Piermont cross-section showed greater variability in turbidity and conductivity across both distance and time than other HRECOS sites examined.
2. Lack of a functional fixed sonde makes comparison of the particular sampling dates to longer term patterns impossible.
3. On the day of sampling there was a strong West to East gradient in turbidity which (if general) means the fixed HRECOS site will overestimate turbidity of the main channel at this location.
4. There was no conclusive evidence of an effect of the wastewater outfall or Sparkill Creek on conditions observed at the fixed HRECOS site.