Response to NYSDEC Request for Hudson River Flux Calculations Near Piermont Marsh and Reporting of BOD Concentrations for East River WPCPs Used in SWEM Simulations of the Long Island Sound Nitrogen TMDL

August 27, 2010

In response to NYSDEC's requests for additional information, CBOD concentrations for the East River treatment plants have been tabulated and an additional SWEM simulation has been conducted to calculate the fluxes of nutrients across the HEP waters northern boundary on the Hudson River at Piermont. The CBOD concentrations for the East River treatment plants are tabulated in Table 1, and represent a 10% reduction to the loads in the Long Island Sound TMDL model baseline condition, reflective of assumptions included in the modeling work supporting the development of the Long Island Sound Nitrogen TMDL. The calculation of the requested total nitrogen (TN) fluxes required an additional SWEM run.

To calculate the fluxes of TN at Piermont the model was run saving net fluxes in each layer and for each state variable crossing the interface between model grid cells across the Hudson River at Piermont. The fluxes saved included both advective fluxes (fluxes as a result of flow), and dispersive fluxes (fluxes as a result of concentration gradients), as well as a correction for numerical dispersion. Monthly outputs were summarized into both annual and overall average values for both TN and total organic carbon (TOC). TOC was included because the information was saved for all variables, and TOC reductions are also being targeted by the Harbor TMDL. TN fluxes at Piermont were 67310 lbs/day, 90963 lbs/day, and 79108 lbs/day for 1988 hydrodynamic conditions, 1989 hydrodynamic conditions, and overall respectively. TOC fluxes at Piermont were 253302 lbs/day, 390454 lbs/day, and 321714 lbs/day for 1988 hydrodynamic conditions, 1989 hydrodynamic conditions, and overall respectively.

The monthly fluxes for both TN and TOC are plotted on Figures 1 and 2. These plots show the seasonal variation in fluxes with the majority of the annual flux passing Piermont in the spring months with an additional elevated period in the fall, consistent with the general pattern of the Hudson River hydrograph. The plots also include the annual and overall summary values at the far right.

Figures 3 and 4 are plots of the fluxes of TN and TOC along with the other loads entering the Hudson and Upper Bay reaches of the HEP waters averaged over 1988 and 1989 hydrodynamic conditions. On the bottom half of the Figures, the vertical distribution of the flux at Piermont is presented for the 10 model layers in lighter blue. The next bar on the diagram moving up from the bottom is the total flux at Piermont summed over all layers in the darker blue. The top half of the plot presents the loads entering the HEP

waters from Piermont to the Verrazano Narrows in tan with the sum of the loads for this reach in orange just above the total flux. The Draft TMDL Sub-Regional Plan SWEM simulation loads are plotted as solid bars, and the Revised Planned Improvement SWEM simulation loads are plotted as open maroon bars. Each of the bars representing SWEM calculated fluxes in the Hudson River near Piermont and the individual loadings used in the Draft TMDL Plan SWEM simulation are labeled with the value of the load. Only the total load bar is labeled for the SWEM Planned Improvements simulation loads to prevent over-plotting of the numbers on the diagrams.

Based on the results of the flux analysis, the total nitrogen flux at Piermont is equal to 64% of the total loads to the Hudson River and Upper Bay reaches under Planned Improvements conditions and 86% of the total loads under Draft TMDL Plan SWEM simulation conditions. For organic carbon, the flux from the upstream Hudson River exceeds the total loads to the Hudson River and Upper Bay reaches. For organic carbon, the flux is 1.8 times greater than the total loads to these reaches under Planned Improvements conditions and 3.9 times greater than the total loads under Draft TMDL Plan SWEM simulation conditions.

These results suggest that the total nitrogen and total organic carbon fluxes entering the HEP waters at the northern boundary may be significant when compared to the HEP loads entering this region directly; however, the magnitude of the fluxes are related to the magnitude of the Hudson River flow rather than large concentrations. The Hudson River watershed is 13,400 square miles most of which drains to the River above Piermont. A very simplified dilution calculation (flux+load)/flux suggests that the Draft TMDL Plan SWEM simulation loadings would double the Hudson River ambient total nitrogen concentration due to the flux from upstream at Piermont and would increase the carbon concentration produced from the upstream flux by 25% in this reach of the Hudson River and Upper Bay.

Note that the analysis completed was strictly for the flux into the Hudson River at the northern extent of HEP waters. The analysis did not quantify the fluxes of nitrogen and carbon between the Hudson River and: Harlem River, East River, Lower Bay, and Kill van Kull. The fluxes of nitrogen and carbon at these other boundaries may be sources, sinks, or some combination of sources and sinks of nitrogen and carbon for the Hudson River and Upper Bay reaches of the HEP waters. Such calculations may be performed for the Draft TMDL Plan and/or Planned Improvements SWEM simulation conditions upon EPA's authorization.

Table 1. East River, Planned Improvements,
Wastewater Treatment Plant CBOD Concentrations

PLANT ID.	NAME	Month	LIS TMDL+C CBOD5 (mg-BOD/L)
NY0026158	BOWERY BAY	January	9.0
NY0026158	BOWERY BAY	February	12.6
NY0026158	BOWERY BAY	March	11.7
NY0026158	BOWERY BAY	April	9.9
NY0026158	BOWERY BAY	May	6.3
NY0026158	BOWERY BAY	June	8.1
NY0026158	BOWERY BAY	July	6.3
NY0026158	BOWERY BAY	August	4.5
NY0026158	BOWERY BAY	September	4.5
NY0026158	BOWERY BAY	October	5.4
NY0026158	BOWERY BAY	November	6.3
NY0026158	BOWERY BAY	December	6.3
NY0026191	HUNT'S POINT	January	8.1
NY0026191	HUNT'S POINT	February	9.9
NY0026191	HUNT'S POINT	March	9.0
NY0026191	HUNT'S POINT	April	8.1
NY0026191	HUNT'S POINT	May	9.0
NY0026191	HUNT'S POINT	June	8.1
NY0026191	HUNT'S POINT	July	7.2
NY0026191	HUNT'S POINT	August	5.4
NY0026191	HUNT'S POINT	September	6.3
NY0026191	HUNT'S POINT	October	6.3
NY0026191	HUNT'S POINT	November	7.2
NY0026191	HUNT'S POINT	December	9.0
NY0026204	NEWTOWN CREEK	January	13.5
NY0026204	NEWTOWN CREEK	February	13.5
NY0026204	NEWTOWN CREEK	March	13.5
NY0026204	NEWTOWN CREEK	April	13.5
NY0026204	NEWTOWN CREEK	May	13.5
NY0026204	NEWTOWN CREEK	June	13.5
NY0026204	NEWTOWN CREEK	July	13.5
NY0026204	NEWTOWN CREEK	August	13.5
NY0026204	NEWTOWN CREEK	September	13.5
NY0026204	NEWTOWN CREEK	October	13.5
NY0026204	NEWTOWN CREEK	November	13.5
NY0026204	NEWTOWN CREEK	December	13.5

Table 1 (Continued). East River, Planned Improvements,
Wastewater Treatment Plant CBOD Concentrations

PLANT ID.	NAME	Month	LIS TMDL+C CBOD5 (mg-BOD/L)
NY0027073	RED HOOK	January	9.0
NY0027073	RED HOOK	February	8.1
NY0027073	RED HOOK	March	2.7
NY0027073	RED HOOK	April	4.5
NY0027073	RED HOOK	May	7.2
NY0027073	RED HOOK	June	4.5
NY0027073	RED HOOK	July	7.2
NY0027073	RED HOOK	August	9.0
NY0027073	RED HOOK	September	6.3
NY0027073	RED HOOK	October	4.5
NY0027073	RED HOOK	November	7.2
NY0027073	RED HOOK	December	9.9
NY0026239	TALLMAN ISLAND	January	4.5
NY0026239	TALLMAN ISLAND	February	9.9
NY0026239	TALLMAN ISLAND	March	9.0
NY0026239	TALLMAN ISLAND	April	8.1
NY0026239	TALLMAN ISLAND	May	9.9
NY0026239	TALLMAN ISLAND	June	5.4
NY0026239	TALLMAN ISLAND	July	7.2
NY0026239	TALLMAN ISLAND	August	4.5
NY0026239	TALLMAN ISLAND	September	9.9
NY0026239	TALLMAN ISLAND	October	3.6
NY0026239	TALLMAN ISLAND	November	2.7
NY0026239	TALLMAN ISLAND	December	3.6
NY0026131	WARDS ISLAND	January	9.9
NY0026131	WARDS ISLAND	February	10.8
NY0026131	WARDS ISLAND	March	9.9
NY0026131	WARDS ISLAND	April	8.1
NY0026131	WARDS ISLAND	May	10.8
NY0026131	WARDS ISLAND	June	9.0
NY0026131	WARDS ISLAND	July	9.9
NY0026131	WARDS ISLAND	August	6.3
NY0026131	WARDS ISLAND	September	7.2
NY0026131	WARDS ISLAND	October	8.1
NY0026131	WARDS ISLAND	November	8.1
NY0026131	WARDS ISLAND	December	8.1

Figure 1. Hudson River at Piermont, Monthly TN Flux for Plan Run Conditions

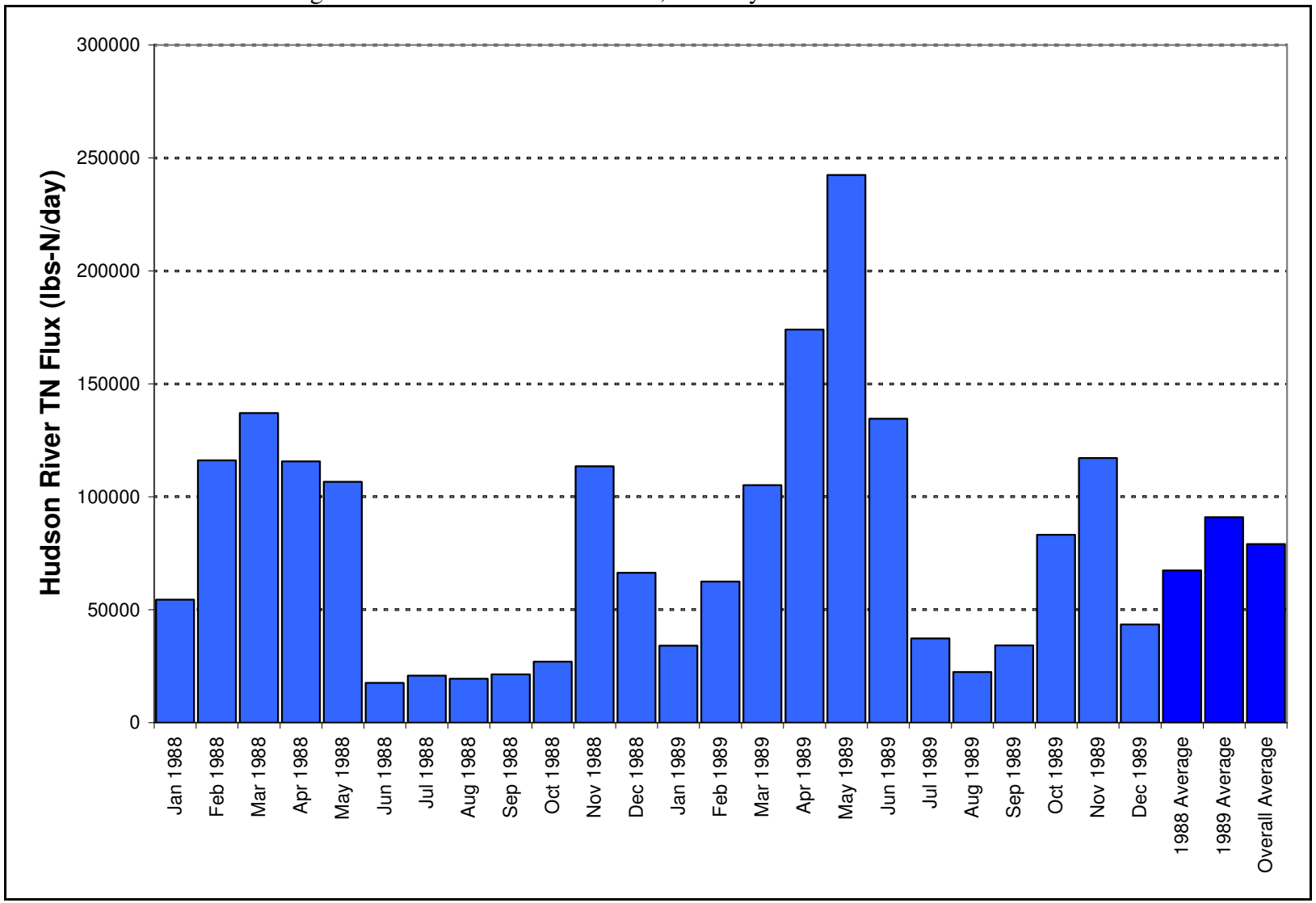

Figure 2. Hudson River at Piermont, Monthly TOC Flux for Plan Run Conditions

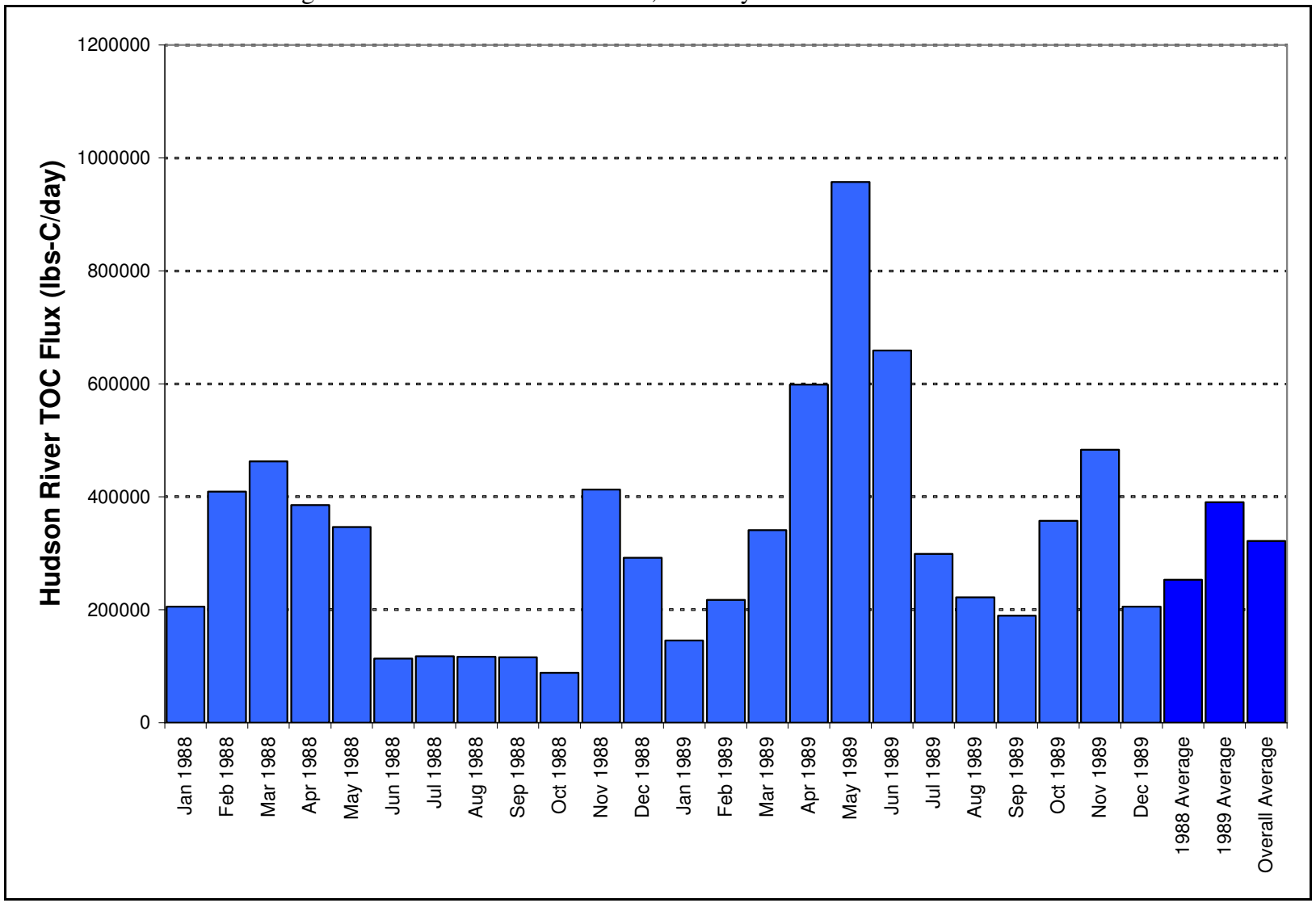

Figure 3. Hudson River at Piermont, Average TN Flux for Plan Run Conditions with internal HEP Loads

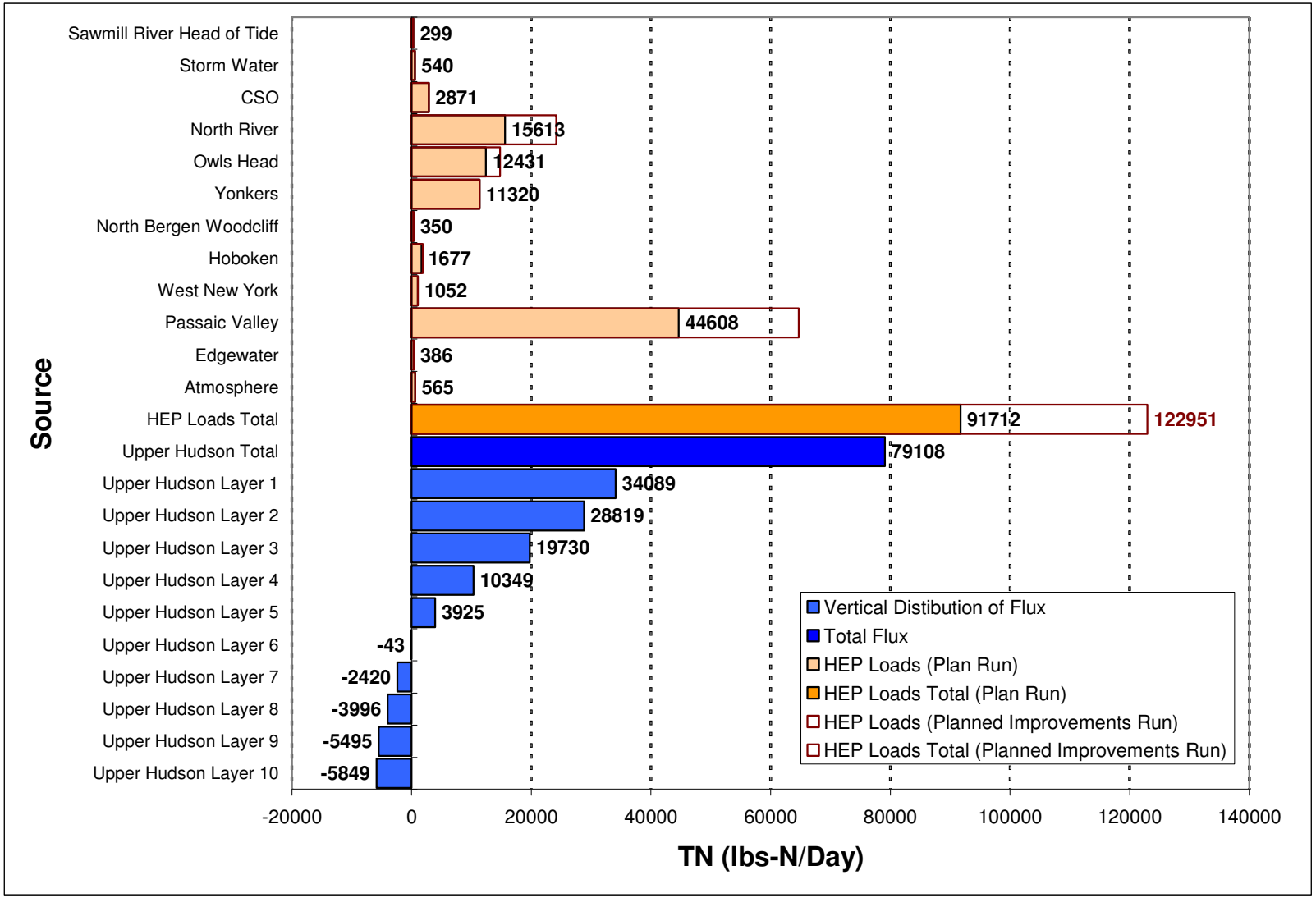

Figure 4. Hudson River at Piermont, Average TOC Flux for Plan Run Conditions with internal HEP Loads