FINAL REPORT

HUDSON RIVER FLOW REGULATION BENEFIT STUDY

Prepared for:

HUDSON RIVER-BLACK RIVER REGULATING DISTRICT

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1.0 Introduction

The Hudson River-Black River Regulating District (District) is a public benefit corporation organized and operating in accordance with Title 21 of Article 15 of the New York State Conservation Law. It was formed in 1959 when the former Hudson River and Black River Regulating Districts were merged. The District operates two reservoirs, Great Sacandaga Lake and Indian Lake, in the Hudson River Basin. Great Sacandaga Lake was created in 1930 by the construction of the Conklingville Dam on the Sacandaga River, about six miles above its confluence with the Hudson River. At the time of its construction, its intended purpose was to reduce floods and increase the low water flow of the Sacandaga and Hudson Rivers for hydroelectric power generation. Since its construction, other benefits have been realized.

As part of the Upper Hudson/Sacandaga River Offer of Settlement Agreement, the District agreed to conduct a headwater benefit analysis to identify potential beneficiaries and the relative magnitude of the benefits they receive from flow regulation provided by Great Sacandaga Lake. This study was completed as part of the District commitments under the settlement agreement.

1.1 Project Operations

Great Sacandaga Lake is a 25,940 acre impoundment. The emergency spillway crest elevation is 771 MSL. The District's current operating policy is based on the Upper Hudson/Sacandaga River Offer of Settlement Agreement. That policy balances the needs of flood control, low flow augmentation for waste assimilation and fish habitat, hydroelectric power generation, lake recreation, whitewater recreation and navigation.

Historically (prior to the Upper Hudson/Sacandaga Offer of Settlement Agreement, March 27, 2000-see Appendix A), Great Sacandaga Lake was regulated to provide a flow of 3000 cfs in the Hudson River downstream of the confluence of the Sacandaga River, from Monday to Saturday from May 1 through Labor Day. On Sundays and holidays, the flow was less than 1000 cfs. This was accomplished by filling Great Sacandaga Lake to elevation 768 in late spring by not allowing any flow releases for approximately three weeks. The purpose of this was to avoid or reduce spring flooding and to collect water in storage to augment summer flows. As the summer progressed, the water level of Great Sacandaga Lake was then drawn down to provide releases for downstream users while maintaining a lake level above 756 during the period May 1 through Labor Day. During fall and winter, the District continued to draw down the lake to provide storage for rainy periods in November-December and for spring runoff. By the middle of March, the average reservoir level was elevation 744.

Following the Upper Hudson/Sacandaga Offer of Settlement Agreement, regulation of Great Sacandaga Lake was changed to provide higher lake elevations between Labor Day and Columbus Day for fall lake recreation and to provide base flows in the Sacandaga River year-round by increasing the winter drawdown elevation. The new regulation is to be phased in over 20 years.

The first operation scenario was scheduled from license issuance to June 1, 2010 and is targeted to achieve a maximum winter drawdown elevation of 748 by mid-March in anticipation of snowmelt and spring flows. The District will maintain this low level until mid-April when it will begin to refill the reservoir to an elevation of 768 in the first week of June. Once the reservoir is filled, the District will maintain an average flow in the Hudson River below the confluence with the Sacandaga River of 1760 cfs. At the same time, the District will also maintain a lake level above 760 from May 1 to Columbus Day. The reservoir will continue to be drawn down through fall and winter from elevation 760 to a maximum drawdown in mid-March at elevation 748.

The second operation scenario scheduled from June 2, 2010 to June 1, 2020 is targeted to achieve a maximum winter drawdown elevation of 749. The District will maintain this low level until mid-April when it will begin to refill the reservoir to an elevation of 768 in the first week of June. Once the reservoir is filled, starting in 2013, the District will maintain a base flow in the Sacandaga River between 300 and 350 cfs depending on the reservoir elevation and an average flow in the Hudson River below the confluence with the Sacandaga River of 1760 cfs. At the same time, the District will also maintain a lake level above 760 from May 1 to Columbus Day. The reservoir will continue to be drawn down through fall and winter from elevation 760 to a maximum drawdown in mid-March at elevation 749.

The final operation scenario scheduled from June 2, 2020 to FERC license expiration is targeted to achieve a maximum winter drawdown elevation of 750. The District will maintain this low level until mid-April when it will begin to refill the reservoir to an elevation of 768 in the first week of June. Once the reservoir is filled, the District will maintain a base flow in the Sacandaga River between 300 and 350 cfs depending on the reservoir elevation and an average flow in the Hudson River below the confluence with the Sacandaga River of 1760 cfs. At the same time, the District will also maintain a lake level above 760 from May 1 to Columbus Day. The reservoir will continue to be drawn down through fall and winter from elevation 760 to a maximum drawdown in mid-March at elevation 750.

1.2 Statutory Authority to Assess Beneficiaries

Title 21 of Article 15 of the New York State Environmental Conservation Law requires that the cost of operation of the District's reservoirs be apportioned upon any public corporation or parcel of real estate benefited. The cost to individual beneficiaries is to be proportioned based on the benefits received. Therefore, any corporation, individual property owners, municipalities, counties, and the State of New York can be assessed for benefits derived from operation of the Great Sacandaga Lake. Presently, benefits are assessed for industry (hydropower) and flood protection. An annual apportionment schedule allocating the District's expenses is determined every 3 years. Benefits as defined in Article 15-2101.3 include "benefits to real estate, public or private, to municipal water supply, to navigation, to agriculture and to industrial and general welfare. The list of potential benefits is described in Section 2 of this report.

2.0 Hudson River Flow Regulation Benefits

The benefits created by construction of the Conklingville Dam and Great Sacandaga Lake are numerous. A list of these benefits includes:

- Increased Real Estate Values for Lakeshore Property
- Lake Recreation
- Hydroelectric Power Generation
- Flood Protection
- Waste Assimilation
- Whitewater Recreation
- Water Supply
- Downstream Water Recreation
- Downstream Fisheries Enhancement
- Navigation

As discussed below, the economic benefits to water supply, downstream water recreation, downstream fisheries enhancement and navigation are very small when compared to the other categories.

3.0 Methodology to Evaluate Benefits

In order to develop an assessment schedule, all the significant economic benefits should be quantified and summed. The percentage of the total benefits allocated to each benefit category can then be calculated. The benefit derived by individual beneficiaries can then be calculated by the portion of the total benefit category they receive. With these numbers in hand, the cost of operation of Great Sacandaga Lake can then be calculated for each benefit category and for each beneficiary. The addition of the benefit values requires that each benefit be quantified in the same units, dollars. Therefore, all benefits have been calculated on an annual basis as June 2001 dollars. Unfortunately, at this time we are not able to quantify one major benefit on an annual basis - increased real estate values for lakeshore property. The reasons are discussed below.

Based on initial investigations, it was evident that the benefit study should focus on those uses that derive the most benefit from Hudson River flow regulation and which have not been previously quantified. Lake recreation, navigation, and water supply benefits that have already been quantified previously into dollars have been indexed using the Consumer Price Index to June 2001. Downstream water recreation and downstream fisheries benefits have not been studied in detail because their economic value is much smaller compared to the major benefits.

3.1 Increased Real Estate Values for Lakeshore Property

One of the biggest benefits of Great Sacandaga Lake is the creation of 125 miles of lakeshore property. The increased real estate benefits derived from the Great Sacandaga Lake would be the difference between current property values and property values without the reservoir. A literature search yielded very little information to quantify this benefit.

The Great Sacandaga Lake region is defined as those townships, which share a piece of the approximately 125 miles of lake shoreline. The townships include Northampton, Mayfield, and Broadalbin, which are located in Fulton County; and the townships of Edinburg, Day, and Providence, which are located in Saratoga County. According to the deSeve report (1984), the 1984 market value of seasonal lake property (from a survey of 2,000 seasonal residences) was $117 million. This survey also reported that there were a total of 9,841 total housing units in the Great Sacandaga Lake Region but did not give their dollar value. The market value of the total housing units (9,841) is expected to be greater than $117 million since there are almost 5 times as many properties compared to the sample size (2000) and they are expected to have more amenities since many are inhabited year-round.

A previous real estate appraisal for the District's reservoir lands in the Town of Northhampton can provide some information on current lakefront property values if Great Sacandaga Lake did not exist. The appraisal by the NYS Division of Equalization and Assessment, conducted in 1992, was performed to determine the without project value of District reservoir lands[1] in the Town of Northampton. The NYS report reviewed historical records, aerial maps, topography and geology maps to determine the land use of each of the 380 parcels prior to reservoir construction. Then a map of probable Adirondack Park Agency (APA) zoning for the inundated reservoir area was developed based on APA zoning for the Sacandaga River north of the reservoir and the Hudson River between North Creek and Lake Luzerne. The probable APA zoning for each parcel was determined based on likely physical attributes, location, access, and likely public amenities. Market values for each type of APA zoning/land use were determined using a Sales Comparison Approach. Property values ($/ac) for each zoning/land use were determined from comparable locations in 4 other counties in the

[1] The District owns all land below water elevation 778 (7 feet above spillway crest)

Adirondack Park for riverfront and non-riverfront property. The land values from the NYS appraisal could be applied to properties adjoining Great Sacandaga Lake to determine their real estate value if Great Sacandaga Lake did not exist (i.e. Conklingville Dam had not been constructed).

The current real estate value for properties around the perimeter of Great Sacandaga Lake could be determined from property tax information. The increased real estate benefit of flow regulation would be the difference between the real estate value of properties with and without the presence of Great Sacandaga Lake. However, this analysis, while potentially representing a significant benefit attributable to the existence of Great Sacandaga Lake, was beyond the scope of this report.

3.2 Lake Recreation

Lake recreation includes boating, swimming, fishing, and sunbathing. According to the Upper Hudson/Sacandaga River Offer of Settlement Agreement, Great Sacandaga Lake will be managed for lake recreation from Memorial Day weekend to Columbus Day weekend. The value determined by deSeve (1984) for lake recreation, $16.8 million/year was indexed to June 2001. This cost was composed of day use ($2.3 million), seasonal residents ($11.1 million), boaters ($0.9 million), property taxes by seasonal residents ($1.9 million), and property maintenance costs of seasonal residents ($0.6 million). This computation was based on user-days of seasonal and non-residents, and did not include permanent residents. In addition, the lake recreation benefit did not include a value associated with shoreline real estate.

3.3 Hydroelectric Power Generation

In order to quantify flow related benefits, a HEC5P operations model of the Great Sacandaga Lake/Upper Hudson River system was used. This model was initially developed by Erie Boulevard Hydropower as part of the FERC relicensing negotiations associated with several of the Upper Hudson River projects. During negotiations, the HEC5P model was used for evaluating impacts associated with flow regulation in terms of hydroelectric power generation, and flood/low flow magnitude and frequency.

The HEC5P model originally developed by Erie Boulevard Hydropower terminated at the Hudson Falls hydroelectric project. For this study, the model was extended downstream to encompass all hydroelectric projects and river basin hydrology down to the Green Island Hydroelectric Project (Troy Lock and Dam). Table 1 lists all of the hydroelectric projects on the mainstem of the upper Hudson River by FERC license number, licensee, project name, station capacity and river mile and Figure 1 shows the location of each hydroelectric project. FERC licenses to construct the Northumberland and Waterford Projects at existing dams were issued; however, construction has not commenced.

Once the extension of the HEC5P model was completed, it was executed for two scenarios. The first scenario reflected the operational conditions set forth in the settlement agreement for the Upper Hudson/Sacandaga River Offer of Settlement Agreement[2]. The second scenario reflected run-of-river operation at Great Sacandaga Lake.

For hydroelectric power generation computations at a particular project, HEC5P uses the basic power equation:

[2] The settlement agreement stipulates that the targeted elevations for winter maximum drawdown will be 748 feet from license issuance to 6/1/2010, 749 feet from 6/2/2010 through 6/1/2020, and 750 feet from 6/2/2020 through license expiration.

$$P = \frac{Q H_{net} \Sigma_{sys}}{11.8}$$

Where: P= Power (kW)

Q= Turbine Discharge (cfs)

H_{net}= Net Head (ft), which is equals the headwater minus tailwater minus headlosses

Σ_{sys}= Station Efficiency (%)

11.8= Constant for English/Metric conversion

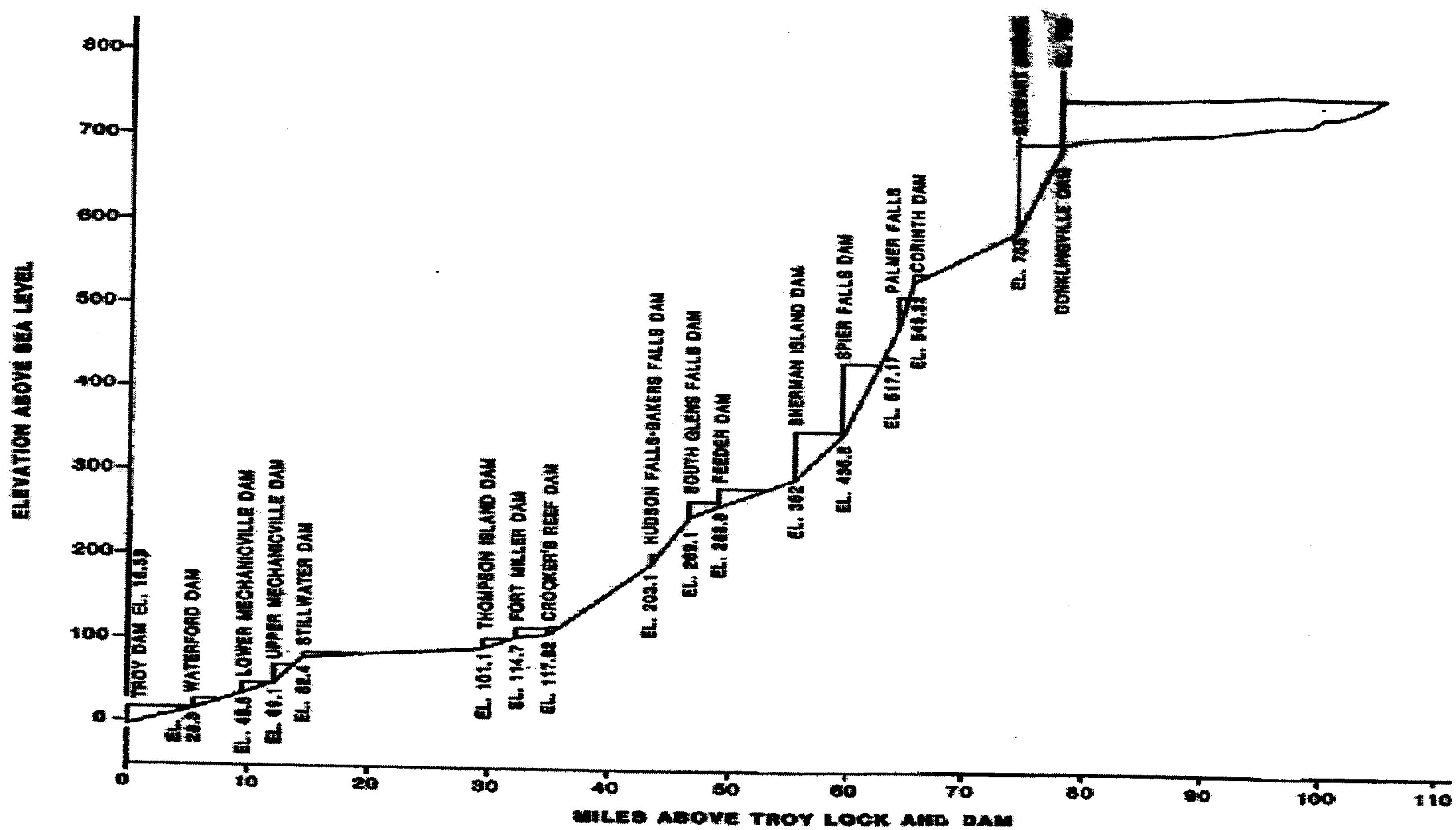
The monthly average energy generated at each hydroelectric project was calculated for peak and non-peak periods based on the hydrologic period of record from 1922 to 1995 for each operational scenario (see Appendix B). This information allowed for a computation in MWH of the net monthly benefit each hydroelectric project receives from flow regulation.

Table 1: Hydroelectric Stations in the Upper Hudson River Watershed

FERC No.	Project Licensee	Project Name	Capacity (MW)	River Mile
2318	Erie Boulevard Hydropower	E.J. West	20	(Sacandaga River) 6
2047	Erie Boulevard Hydropower	Stewarts Bridge	30	3
2609	Curtis/Palmer Hydroelectric	Curtis Station	10.8	(Hudson River) 218
2609	Curtis/Palmer Hydroelectric	Palmer Falls	48	218
2482	Erie Boulevard Hydropower	Spier Falls	51	213
2482	Erie Boulevard Hydropower	Sherman Island	30	209
2554	Erie Boulevard Hydropower	Feeder Dam	6	202
2385	Finch Pruyn	Glen Falls	12	200
5461	Adirondack Hydro	South Glen Falls	15.7	200
5276	Adirondack Hydro	Hudson Falls	36.1	198
4226	Mercer Companies, Inc.	Fort Miller	4.8	187
4244	Northumberland Hydro Partners	Northumberland	NA	184
4684	Stillwater Hydro Partners	Stillwater Hydro	3.5	168
2934	NYSEG	Mechanicville Upper	18.5	166
6032	Fourth Branch Associates	Mechanicville Lower	4.5	164
10648	Adirondack Hydro	Waterford	NA	160
13	Green Island Power Authority	Green Island	6	154

The monthly benefits for each project were summed for conditions with and without flow regulation. The difference in monthly energy generation was converted to dollars by multiplying the energy generated by the price of peak and nonpeak energy. There is some difficulty in predicting these prices as the energy generation and distribution system is in the early years of conversion from a regulated to a deregulated market. For this reason, hydroelectric energy values were converted to dollars by multiplying the monthly energy generation values by the cost paid by the Independent System Operators for the 12 month period June 2000-May 2001 as reported by the New York State Public Service Commission for the Capitol region of the state (see Appendix C).

Figure 1: Profile of Upper Hudson and Sacandaga Rivers Troy Lock and Dam to Great Sacandaga Reservoir (Source: Stetson-Dale, 1986).



3.4 Flood Protection

The cities of Troy, Albany, Rensselaer Watervliet, and Green Island currently are assessed headwater benefit charges from the District. To determine the annual flood benefits associated with Great Sacandaga Lake it was necessary to combine a flood frequency analysis with a stage versus discharge analysis and a stage versus damage (dollars) analysis to compute a damage frequency curve at various locations. Integrating under the resulting damage frequency curve gave an estimate of the average annual damages (see Figure 2). As described below, the flood frequency and stage versus discharge relationships were calculated at various locations. The District contracted with the NYSDEC to conduct a stage damage assessment for the 2, 10, 50 and 100 year flood events with and without regulation by Great Sacandaga Lake.

To determine the net flood frequency at various locations on the Upper Hudson River, peak annual average daily flow values (for each downstream dam) were output from the HEC5P model under the 750-foot winter maximum drawdown settlement scenario (settlement scenario with least amount of storage) and run-of-river operation. Using the peak annual flows, a Log-Pearson Type III flood frequency analysis was completed to determine the 2, 10, 50, and 100 year flood events at each downstream dam.

Elevations for each flood recurrence interval were then determined using individual rating curves associated with each dam. The resulting elevations reflected the predicted maximum water stage of each impoundment under the two operating scenarios. The difference in flood elevation between the two operating scenarios was computed. Table 2 reports the flow and elevation for flow regulation and run-of-river conditions for different flood events and the difference in flood stages resulting from the two conditions.

Downstream of the Troy Dam to the tidal gage in Albany, water surface elevations during floods are not a function of discharge alone, but a complex function of discharge, flood volume, tide levels and wind effects. Rather than attempt to treat these factors separately, an analysis to establish a peak elevation-frequency relationship was used to treat their combined effect. Annual peak stage data from 1910-1977 at the tidal gage (no. 01359139) in Albany, provided by the Troy, New York office of the USCOE, was obtained. A frequency analysis of annual peak stages was conducted for flow regulation and run-of-river conditions. The period of record 1910-1929 represented run-of-river conditions and the period of record 1930 to 1977 represented flow regulation conditions.

This information as well as data from FEMA Flood Insurance Studies was used to calculate elevations downstream to the southern corporate limits-Towns of Schodack/Coeymans, the most downstream location where flood stages were predicted. The elevation for the 2 year flood event with flow regulation at the southern corporate limits–Town of Schodack/Coeymans was determined using a linear regression analysis of the 10, 50 and 100 year flood stages, which were reported in the FEMA Flood Insurance Studies. The elevations for the run-of-river operation at the southern corporate limits–Town of Schodack/Coeymans were estimated from the relationship of run-of-river and flow regulation flood stages at the Albany tidal gage and the flood stages for flow regulation at the southern corporate limit-Towns of Schodack/Coeymans. The accuracy of predicted flood stages for the 13 mile river segment between the Albany gage and the southern corporate limits-Towns of Schodack/Coeymans is not as accurate as the other 82 miles studied. The tidal flood stages for different storm events are shown in Table 2.

The District contracted with the NYSDEC to complete a preliminary estimate of the benefit of flow regulation for the 100 year flood event (Appendix D). The preliminary analysis extended downstream just south of the Dunn Memorial Bridge in the cities of Albany and Rensselaer, NY. Subsequently, additional work was completed to extend the analysis to the southern corporate limits-Towns of Schodack/Coeymans and for other storm events using the same methodology. The computed damages resulting from the 100 year storm for run-of-river and flow regulation scenarios in the 2002 NYSDEC report (Appendix D) differ from those reported recently for two reasons. First, an additional 13 miles of stream was added to the analysis. Second, a review of the previous analysis indicated that several commercial properties were erroneously excluded. For a discussion of the NYSDEC GIS methodology to compute flood damages based of the predicted flood elevations and real property values, please refer to Appendix D.

Flood damages within the study area were then calculated for the 2, 10, 50, and 100 year flood events for both regulated and unregulated conditions. The average annual flood damage for each case is equal to the area under the damage probability curve. The annual flood protection benefit (i.e. damage reduction) is the difference in the annual flood damages determined with and without flow regulation.

The flood analysis encompassed the following communities: City of Albany, City of Cohoes, City of Mechanicville, City of Rensselaer, City of Troy, City of Watervliet, Town of Bethlehem, Town of Coeymans, Town of Colonie, Town of Corinth, Town of East Greenbush, Town of Easton, Town of Fort Edward, Town of Greenwich, Town of Hadley, Town of Halfmoon, Town of Moreau, Town of New Baltimore, Town of North Greenbush, Town of Northumberland, Town of Queensbury, Town of Saratoga, Town of Schaghticoke, Town of Schodack, Town of Stillwater, Town of Stuyvesant, Town of Waterford, Village o Castleton-on-Hudson, Village of Corinth, Village of Fort Edward, Village of Green Island, Village of Hudson Falls, Village of Menands, Village of Schuylerville, Village of South Glens Falls, Village of Stillwater, and the Village of Waterford.

Information used in the analysis included elevations and flows from the HEC5P model and from a stage frequency analysis of the tidal gage at Albany; and existing topographic, aerial and tax property mapping. Structural and contents damages resulting from each flood event were based on depth damage curves developed by the USCOE for residential and commercial properties.

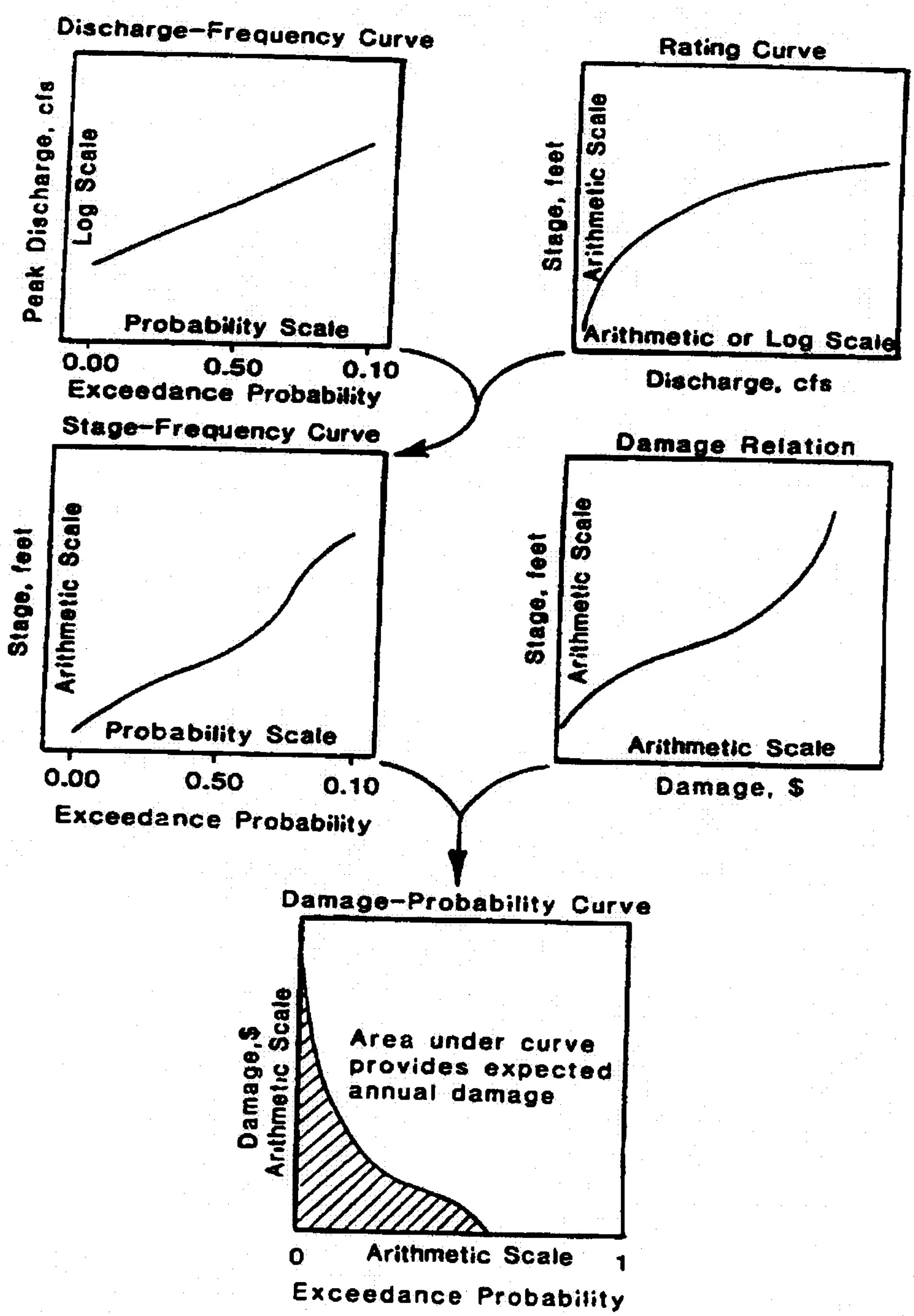
Table 2: Hudson River Flows and Elevations for 2, 10, 50, and 100 Year Flood Events for Flow Regulation and Run-of-River Operation

Location	Drainage Area (sq. mi.)	Recurrence Interval	Flow Regulation[3] Flow (cfs)	Flow Regulation[3] Elevation (ft)	Run-of-River Flow (cfs)	Run-of-River Elevation (ft)	Difference (ft)
Curtis (Corinth)	2760	100	45,568	553.4	76,749	555.4	2.0
		50	41,921	553.1	71,552	555.1	2.0
		10	32,632	552.4	57,466	554.2	1.8
		2	21,625	551.4	39,784	553.0	1.5
Palmer Falls)	2760	100	45,568	531.9	76,749	536.4	4.4
(Corinth		50	41,902	531.3	71,517	535.7	4.3
		10	32,625	529.7	57,438	533.7	4.0
		2	21,626	527.6	39,770	531.0	3.4
Spiers Falls	2779	100	45,585	443.4	76,749	446.8	3.4
		50	41,940	442.9	71,554	446.2	3.3
		10	32,654	441.7	57,467	444.8	3.1
		2	21,644	440.0	39,790	442.7	2.7
Sherman	2810	100	46,019	359.4	77,352	362.3	2.9
		50	42,379	359.0	72,002	361.8	2.9
		10	33,064	357.9	57,498	360.5	2.6
		2	21,959	356.5	39,745	358.7	2.2
Feeder Dam	2811	100	45,983	291.6	77,312	295.1	3.5
		50	42,351	291.1	71,973	294.5	3.4
		10	33,054	289.9	57,495	293.0	3.1
		2	21,944	288.2	39,741	290.8	2.6
South Glens Falls	2807[4]	100	45,967	274.4	77,296	277.0	2.6
/Finch Pruyn		50	42,334	274.0	71,956	276.6	2.6
		10	33,038	273.1	57,478	275.4	2.3
		2	21,927	271.8	39,724	273.8	2.0
Hudson Falls	2821	100	46,180	213.3	77,513	216.5	3.2
		50	42,532	212.9	72,157	216.0	3.1
		10	33,190	211.8	57,636	214.6	2.8
		2	22,029	210.2	39,833	212.6	2.4
Fort Miller	2980	100	48,609	121.7	80,029	124.7	3.0
		50	44,721	121.3	74,437	124.2	2.9
		10	34,815	120.2	59,280	122.8	2.6
		2	23,087	118.7	40,900	120.9	2.2
Stillwater	3773	100	60,046	89.5	91,963	92.0	2.6
		50	55,112	89.0	85,210	91.5	2.5
		10	42,790	87.9	67,077	90.1	2.2
		2	28,376	86.3	45,883	88.2	1.8

[3] Flow regulation conditions were those for the 750-foot winter maximum drawdown settlement scenario (settlement scenario with least amount of storage).
[4] Drainage area decreases due to diversion to Glens Falls Feeder Canal.

Location	Drainage Area (sq. mi.)	Recurrence Interval	Flow Regulation[3]		Run-of-River		
			Flow (cfs)	Elevation (ft)	Flow (cfs)	Elevation (ft)	Difference (ft)
Upper	4500	100	71,976	81.7	103,283	84.6	2.9
Mechanicville		50	65,751	81.0	95,420	83.9	2.9
		10	50,707	79.4	74,577	81.9	2.6
		2	33,575	77.2	50,664	79.4	2.2
Lower	4572	100	73,233	53.9	104,381	55.9	2.0
Mechanicville		50	66,877	53.4	96,432	55.4	2.0
		10	51,537	52.2	75,362	54.0	1.8
		2	34,103	50.7	51,176	52.2	1.5
Waterford	4611	100	73,922	35.4	104,980	37.6	2.3
		50	67,495	34.8	96,983	37.1	2.2
		10	51,992	33.6	75,788	35.5	1.9
		2	34,391	31.9	51,454	33.5	1.6
Green Island	8090	100	152,901	27.9	192,829	30.3	2.4
(Troy)		50	140,831	27.2	176,937	29.4	2.2
		10	110,862	25.2	135,613	26.8	1.7
		2	75,012	22	90,668	23.7	1.2
Albany	8090	100	NA	20.1	NA	22.2	2.1
		50	NA	17.8	NA	20.6	2.8
		10	NA	13.1	NA	16.8	3.7
		2	NA	8.8	NA	12.4	3.6
Southern Corporate	----	100	NA	16.4	NA	18.0	1.6
Limits-Towns of		50	NA	14.6	NA	16.8	2.2
Schodack/Coeymans		10	NA	11.0	NA	13.8	2.8
		2	NA	7.7	NA	10.4	2.7

Figure 2: Derivation of Damage CDF from Discharge CDF, Rating Function, and Elevation-Damage Function (Source: ASCE Handbook of Hydrology).



3.5 Waste Assimilation

Flow releases from Great Sacandaga Lake during the summer months provide the majority of flows necessary for waste assimilation. The flow that is commonly used in determining wastewater treatment needs to maintain water quality (i.e. permit wastewater dischargers) is the minimum average 7 consecutive day low flow with a 10-year recurrence interval (MA7CD10). The NYSDEC's Upper Hudson River Waste Assimilative Model, which is used to permit wastewater discharges, is based on a flow of 1760 cfs at Hadley Falls. The flows used by the NYSDEC in its Upper Hudson River Waste Assimilation Model are the sum of an average of the 5-day weekday flow plus the historically 2-day low flow weekend period. The HEC-5P operations model was used to determine the MA7CD10 flow in the Hudson River at different locations for run-of-river operation. The wastewater treatment plants on the Upper Hudson River, downstream of Great Sacandaga Lake, would have to provide additional treatment to meet water quality standards under this lower flow if Great Sacandaga Lake did not exist.

Table 3 compares the flows used by the NYSDEC in their waste assimilative model with the MA7CD10 computed by the HEC-5P model for run-of-river conditions at different locations along the Hudson River.

Table 3: Waste Assimilative Design Flows for Existing Flow Regulation and Run-of River Operation

Location	Drainage Area	Existing Regulation (NYSDEC Regulatory Flow)	Run-of-River (MA7CD10)
Hadley Falls	2,719	1,760	470
Fort Miller	2,980	1,764	524
Upper Mechanicville	4,500	1,952	863
Green Island	8,032	3,013	1,846

This information was provided to the NYSDEC who then used it with their Upper Hudson River Waste Assimilative Model to predict what the new pollutant permit loadings would be at each treatment plant based on the lower streamflows for run-of-river operation (see Appendix E). The additional cost to maintain stream standards between regulated flows and run-of-river flows is the flow regulation benefit for waste assimilation.

DEC's waste assimilative model is divided into 3 segments. Segment 1 is from Palmer Falls Dam (mile point 218) to Stillwater Dam (mile point 168). Segment 2 is from Stillwater Dam (mile point 168) to Troy Lock (mile point 154). Segment 3 is from Troy Lock (mile point 154) to mile point 123, the location of the next dissolved oxygen sag.

In order to maintain the same existing water quality under run-of-river conditions with respect to dissolved oxygen, existing permit loads for biochemical oxygen demand (BOD) and nitrogenous oxygen demand (NOD) would have to be reduced 60% in segment 1, 35% in segment 2, and 25 % in segment 3. Table 4 lists the major wastewater dischargers of BOD and NOD, their permitted and actual discharges, their permitted and actual BOD and NOD loadings, and their reduced BOD and NOD loadings for run-of-river operation.

To calculate the expected pollutant loadings for dischargers who operate below permit discharges, it was necessary to prorate the past year's effluent loadings by the ratio of the maximum permitted discharge and actual discharge. This is considered a conservative assumption for BOD and NOD because it is likely that pollutant loadings would actually be higher at higher discharges because removal efficiency rates would decrease. Based on these assumptions, each wastewater discharger was evaluated to see if additional treatment was needed to reduce pollutants for run-of-river conditions.

DEC regulatory permit personnel were interviewed to identify the existing treatment processes employed at each wastewater treatment plant. Table 4 lists those wastewater discharges that would require additional treatment to maintain existing water quality for run-of-river conditions and the pollutants whose loadings would need to be reduced.

If additional treatment was necessary, the capital and operation and maintenance costs were calculated from EPA cost curves for all of the treatment processes. The costs on the EPA cost curves are a function of discharge and do not take into account influent or effluent pollutant concentrations, removal efficiencies, redundancies in a treatment plant, etc. The EPA cost curves are intended for planning or comparison purposes and are not meant to be the absolute answer.

It was assumed that additional BOD treatment would be provided by a biotower and additional NOD treatment by providing a separate activated sludge chamber for nitrification.

3.6 Whitewater Recreation

The benefit of whitewater recreation was determined by the unit day value method. The annual benefit of flow regulation was based on the number of whitewater trips and the average willingness to pay of whitewater users for the Sacandaga River whitewater experience.

In the Stewarts Bridge license application, the Niagara Mohawk River Power Corporation[5] (NMPC) published the number of commercial whitewater boating trips for the years 1993-1996. The Whitewater River Manager was contacted to update the number of boating trips for 1997-1999. A review of this data indicated that the number of commercial whitewater trips is fairly constant, around 30,000 boating trips per year. In previous reports, estimates of the number of private whitewater trips per year have varied anywhere between 1,000 and 10,000 trips per year.

In the NMPC Response to the FERC Additional Information Request Item No. 13 for the E.J. West Project on Whitewater Recreation (1993), it was estimated that the direct expenditures on whitewater recreation on the Sacandaga River of a commercial trip including the rafting trip fee, lodging/camping, food, transportation, and souvenirs (e.g. photos, tee shirts, etc.) was $35 per day and for a private trip was $20 per day. These values have been updated to 2001 by using the CPI. Based on this method, the economic benefit in 2001 for whitewater recreation in the Sacandaga River is $43 /day for a commercial trip and $25/ day for a private trip.

[5] Predecessor to Erie Boulevard Hydropower.

Table 4: Hudson River Sewage Treatment Plant Discharges and BOD and NOD Loadings for Flow Regulation and Run-of-River Operation

Discharge	STP Flow (MGD)	Actual Flow* (MGD)	Permit BOD (#/day)	Effluent BOD (#/day)	Reduced BOD (for ROR #/day)	Expected BOD (#/day)	Permit NOD (#/day)	Effluent NOD (#/day)	Reduced NOD for ROR (#/day)	Expected NOD (#/day)	Notes
Trans-Canada	10.3	6	16127	5256	6450	9022	0	0	0		BOD reduction needed
Corinth (V)	0.6	0.61	300	174	120	174	450	0	180	no data	BOD reduction needed
Finch Pruyn	17.5	18.2	67502	18425	27801	18425	24432	12109	9773	12109	NOD reduction needed
Encore Paper	2.2	2.03	10810	6178	4324	6695	0	0	0	0	BOD reduction needed
Glens Falls (C)	9.5	5.1	3150	302	1260	563	9600	719	3840	1340	
GE Ft. Edward	0.216	0.162	500	16	200	21.3	48	13.7	19.2	18.3	
Irving Tissue (Scott Paper)	3.2	0.64	6400	1400	2560	7000	0	0	0	0	BOD reduction needed
Washington Co. SD #2	2.5	2.3	934	374	374	407	1870	1036	748	1126	BOD & NOD reduction needed
H&V Easton Mill (Paper Mill)	1.9	2.3	590	187	236	187	0	0	0	0	
Schuylerville (V)	0.25	0.367	100	38.6	40	38.6	190	no data	76	no data	
Stillwater (V)	0.301	0.3	112	17	73	17	225	94	146	94	
Saratoga Co. SD #1	21.3	10.4	8000	1328	5200	2720	15900	3255	10335	6666	
GE Waterford	30.0	30.6	10000	1665	6500	1665	0	475	0	475	NOD removal needed
Albany North	35.0	22.7	10946	663	8210	1022	20277	4338	15208	6689	
Albany South	25.0	21.6	7819	1063	5864	1231	14674	1938	11006	2295	
Rensselaer Co. SD #1	24.0	19.3	7506	1611	5629	2003	14636	5959	10977	7410	
East Greenbush	2.5	1.9	938	428	704	563	1906	1126	1430	1481	NOD removal needed
Bethlehem	4.9	4.5	1839	270	1379	294	3735	274	2801	299	

*Discharge and effluent loadings for period 4/00 to 3/01

4.0 Results

4.1 Increased Real Estate Values for Lakeshore Property

A real estate appraisal of lakeshore property values is necessary to determine the flow regulation benefit.

4.2 Lake Recreation

According to deSeve report (1984), the total direct lake related expenditures by day users, seasonal residents, and boaters are $16.8 million/year. Based on the CPI, this figure in 2001 dollars is $28.7 million/year.

4.3 Hydroelectric Power Generation

The benefit of hydroelectric generation was evaluated using the HEC-5P operations model. The amount of generated electricity is converted into dollars by multiplying the monthly MWh by the price per MWh. Table 5 shows the difference in annual average energy generation in MWh for peak and non-peak periods. The benefit of flow regulation is the difference in the energy produced under flow regulation and by run-of-river operation. The hydroelectric benefit of flow regulation by project owner, in 2001 dollars, is also shown in Table 5. The total hydroelectric benefit for all projects combined is $ 15.1 million/year.

Table 5: Difference in Annual Power Generation for Flow Regulation and Run-of-River Operation

Owner	Difference in Peak Energy (MWH)	Difference in Off-Peak Energy (MWH)	Total Annual Replacement Cost ($)
Erie Boulevard Hydropower	(114,239)	(23,363)	($8,224,557)
Curtis/Palmer Hydroelectric	(30,387)	(29,524)	($3,019,307)
Finch Pruyn	(5,314)	(5,127)	($522,231)
Adirondack Hydro	(23,018)	(22,237)	($2,268,108)
Mercer Companies	(2,616)	(2,508)	($256,979)
Stillwater Hydro	(965)	(925)	($96,016)
NYSEG	(5,075)	(4,899)	($482,962)
Fourth Branch Associates	(1,241)	(1,199)	($125,952)
Green Island Power Authority	(1,439)	(1,380)	($134,617)
Total	**(184,294)**	**(91,162)**	**($15,130,729)**

4.4 Flood Protection

Flood control was the major impetus for the original construction of Great Sacandaga Lake. The District contracted with the NYSDEC to calculate the flood damages for the 2, 10, 50, and 100 year flood events (see Table 6). The average annual flood damage for each case is equal to the area under the damage probability curve. The annual flood protection benefit (i.e. damage reduction) is the difference in the annual flood damages determined with and without flow regulation.

Table 6: Flood Damages for Entire Study Area under Flow Regulation and Run-of-River Operation

Flood Event	Flood Damages (Flow Regulation)	Flood Damages (Run-of-River Operation)
2-year	$84,406,588	$173,974,737
10-year	$105,978,378	$261,522,836
50-year	$133,026,270	$305,549,654
100-year	$145,055,264	$339,763,812

The average annual flood damages under flow regulation and run-of-river operation are $49,027,587 and $113,008,981, respectively. For all municipalities analyzed, the total annual flood protection benefit is $63,981,395 in 2001 dollars. The annual flood protection benefit by municipality is listed in Table 7.

Table 7: Annual Flood Protection Benefit by Municipality

Municipality	Annual Flood Protection Benefit
City of Albany	$8,768,385
City of Cohoes	$207,426
City of Mechanicville	$243,149
City of Rensselaer	$2,552,199
City of Troy	$727,424
City of Watervliet	$23,369
Town of Bethlehem	$31,486,852[6]
Town of Coeymans	$219,326
Town of Colonie	$81,594
Town of Corinth	$60,329
Town of East Greenbush	$663,864
Town of Easton	$4,964
Town of Fort Edward	$9,555
Town of Greenwich	$62,539
Town of Hadley	$142,107
Town of Halfmoon	$982,474
Town of Moreau	$85,445
Town of New Baltimore	$257,766
Town of North Greenbush	$826,804
Town of Northumberland	$3,867
Town of Queensbury	$223,799
Town of Saratoga	$101,363
Town of Schaghticoke	$174,390
Town of Schodack	$133,051
Town of Stillwater	$234,114
Town of Stuyvesant	$18,744
Town of Waterford	$1,352,139
Village o Castleton-on-Hudson	$1,392,484
Village of Corinth	$2,733,982
Village of Fort Edward	$162
Village of Green Island	$29,779
Village of Hudson Falls	$0
Village of Menands	$5,666,464
Village of Schuylerville	$459,284
Village of South Glens Falls	$1,252,286
Village of Stillwater	$2,658,402
Village of Waterford	$141,516
Total	**$63,981,395**

[6] The Town of Bethlehem accounts for approximately 49% of annual flood protection benefits due principally to flood benefits received at a Niagara Mohawk fossil fuel generating station, which is valued at $267 million.

4.5 Waste Assimilation

Flow releases from Great Sacandaga Lake during the summer months provide the majority of flows necessary for waste assimilation.

Table 8 shows the incremental capital cost and annual operating and maintenance cost for additional wastewater treatment to maintain existing water quality between run-of-river operation and existing flow regulation. The capital cost to reduce BOD and NOD loadings in the Hudson River in 2001 dollars is $56.3 million, which amortized assuming a 20-year useful life and 5% bond rate for municipal plants and a 10-year useful life and 8% interest rate for industrial plants, is an annual cost of $7.7 million. The operations and maintenance cost to reduce BOD and NOD loadings is $1.4 million. Therefore, the annual cost to reduce BOD and NOD is $9.1 million/year in 2001 dollars.

Table 8: Cost of Additional Biological Wastewater Treatment for Run-of-River Conditions to Reduce BOD and NOD

Discharge	Pollutants to be Removed	Treatment Processes	Capital Cost	Annualized Capital Cost	Annual O & M Cost	Total Annual Cost
Trans-Canada	BOD, phenols	biotower	$12,762,538	$1,901,618	$335,627	$2,237,245
Corinth	BOD	biotower	$1,491,430	$119,762	$32,522	$152,284
Finch Pruyn	NOD, phenols	nitrification	$10,568,921	$1,574,769	$70,957	$1,645,726
Encore Paper	BOD	biotower	$2,914,549	$434,268	$74,150	$508,418
Irving Tissue	BOD	biotower	$4,298,960	$640,545	$105,371	$745,916
Washington County S.D. #2	BOD	biotower	$3,169,397	$254,503	$83,256	$337,759
Washington County S.D. #2	NOD	nitrification	$2,536,541	$203,684	$107,977	$311,661
General Electric - Waterford	NOD	nitrification	$16,064,760	$2,393,649	$462,760	$2,856,409
East Greenbush	NOD	nitrification	$2,536,541	$203,684	$107,977	$311,661
Total			$56,343,637	$7,726,482	$1,380,597	**$9,107,079**

Note: Capital cost for municipal plants amortized assuming 5% bond rate and 20-year return period. Capital cost for industrial plants amortized assuming 8% interest rate and 10-year return period.

4.6 Whitewater Recreation

Without Great Sacandaga Lake, it is unlikely that there would be whitewater recreation in the Sacandaga River in any season other than the spring. The Reservoir provides the majority of the streamflow in the popular summer season on a predictable schedule. Without the Reservoir, summer streamflows would be on the order of 300 cfs (the median August unregulated flow would be 294 cfs). The optimum whitewater flow according to studies by NMPC (1993) for relicensing is 4000 cfs.

Based on the annual number of daily Sacandaga River whitewater boating trips and the economic benefit per trip, the annual benefit of commercial whitewater recreation is $1,050,000 and the annual benefit of private whitewater recreation can vary between $25,000 and $250,000. Therefore, the total benefit, in 2001 dollars is $1,075,000/year to $1,300,000/year.

4.7 Water Supply

Although summer flow releases from Great Sacandaga Lake improve downstream water quality and, therefore, are a benefit to water supply treatment, the benefit is much smaller than other benefits to be studied. Decreased summer flow under a natural flow regime would result in increased treatment costs for coagulation/sedimentation, sludge handling, chlorination, and chloride removal.

The Malcolm Pirnie Report (1984) estimated that the costs for these increased processes for a reduction in the MA7CD10 flow of 260 cfs to be $16,100. Assuming that we saw a fivefold decrease in the MA7CD10 flow of approximately 1290 cfs (this is the difference at Hadley between 1760 cfs for existing regulation and 470 cfs for run-of-river operation), the 1984 cost would be approximately $80,500. Escalated by the CPI, the 2001 cost would be $137,524/year. The benefit of avoiding this cost is small compared to some of the more significant benefits.

4.8 Downstream Water Recreation

The benefit of flow regulation on downstream water recreation is unclear for several reasons. First, it would be difficult to quantify the differences in water recreation use. Although flows in the river would be less in the summer for run-of-river operation as compared to flow regulation, there would still be water in the river and the impoundments behind the existing dams would still be present. To be consistent with the analysis of waste assimilation benefits, it is assumed that existing water quality would be maintained for run-of-river operation and be suitable for water-based recreation. Therefore, assuming water depths were suitable for boating and water quality was suitable for swimming and fishing, recreation use is not expected to be significantly different for run-of-river operation than flow regulation.

4.9 Downstream Fisheries Enhancement

The economic benefit of fisheries enhancement in the Sacandaga and Hudson Rivers is believed to be small and may be offset by negative effects to fisheries created by other beneficiaries' uses such as hydroelectric power generation and whitewater boating. Therefore, this economic benefit has not been quantified in this report.

4.10 Navigation

Navigation benefits from flow regulation are considered small when compared to the other benefits. By law, the NYSDOT has first priority for Hudson River flows up to a monthly average of 150 cfs to be diverted to the Glens Falls Feeder Canal. This flow augments lockage water for the Champlain Canal from April to December. About 25 % of diverted water returns to the Hudson River (Malcolm Pirnie, 1984).

"The actual average amount of diversion is about 100 cfs" (Malcolm Pirnie, 1984). Unregulated flows in the Hudson River would exceed the 150 cfs diversion requirement. Therefore, no benefit is derived from regulation of Great Sacandaga Lake.

The only navigation benefit derived from the Great Sacandaga Lake is that it improves the sediment transport of the Hudson River by increasing the quantity of summer flows. This has the effect of decreasing the maintenance dredging requirements of the Champlain Canal which functions with diverted Hudson River flows. M-P estimated in 1984 that the annual increased dredging cost to remove 600 cubic yards of sediment due to lower flows would be $12,000. This value updated to 2001 by the CPI is $20,524/year. The benefit of avoiding this cost due to releases from Sacandaga River is small compared to other benefits.

5.0 Summary

The most significant benefits due to regulation of Hudson River flows are increased real estate values for lakeshore property, flood protection, lake recreation, hydroelectric power generation, wastewater assimilation, and whitewater recreation. Water supply, downstream recreation, fisheries enhancement, and navigation are relatively small benefits compared to the significant benefits. Table 9 summarizes the annual dollar value of the benefits we have identified.

Table 9: Summary of Annual Benefits of Flow Regulation from Great Sacandaga Lake

Benefit	Annual Value
Increased Real Estate Values for Lakeshore Property	***Further Study Required***
Flood Protection	$64.0 million
Lake Recreation	$28.7 million
Hydroelectric Power Generation	$15.1 million
Waste Assimilation (for BOD and NOD)	$9.1 million
Whitewater Recreation	$1.1-1.3 million
Water Supply	$0.1 million
Downstream Water Recreation	-
Downstream Fisheries Enhancement	-
Navigation	$0.02 million

6.0 Benefit Apportionment Schedule for Hudson River Flow Regulation

The District's present assessment schedule allocates 95% of their costs to hydroelectric generation beneficiaries and 5% to municipalities for flood control benefits.

The following apportionment schedule in Table 10 is based on the benefits that have been quantified to date. This schedule will change if the benefits for increased real estate values are quantified.

Table 10: Benefit Apportionment Schedule

Benefit Category	Annual Value	Percentage
Flood Protection	$64.0 million	54.14%
Lake Recreation	$28.7 million	24.28%
Hydroelectric Power Generation	$15.1 million	12.77%
Waste Assimilation (for BOD and NOD)	$9.1 million	7.70%
Whitewater Recreation	$1.2 million	1.02%
Water Supply	$0.1 million	0.08%
Downstream Water Recreation	-	
Downstream Fisheries Enhancement	-	
Navigation	$0.02 million	0.02%
Total Benefits	**$118.2 million**	100.00%

The information in Table 10 was apportioned further by the individual beneficiaries within each benefit category. This analysis was completed for the lake recreation, flood protection, hydroelectric power generation, waste assimilation, and whitewater recreation benefit categories. The analysis was not conducted for water supply and navigation, as these benefits are relatively minor. The purpose of the analysis was to determine each individual beneficiary's payment percentage.

For lake recreation, the benefit associated with this category was apportioned between Fulton and Saratoga Counties, which surround Great Sacandaga Lake. The apportionment was based on a ratio of lake surface area between the two counties. Flood protection benefits were apportioned by municipality based on the estimated damage that would have occurred (Table 7). Hydroelectric generation benefits were apportioned by project owner based on the percentage of annual replacement costs (see Table 5). For waste assimilation, the benefits were apportioned by discharger based on the annual cost of additional biological wastewater treatment to reduce BOD and NOD. Whitewater recreation benefits were apportioned between commercial (30,000 user-days) and private (10,000 user-days) use based on user-days (see Section 3.6). Table 11 illustrates the results of this analysis.

Table 11: Apportionment Schedule for Individual Beneficiaries

Benefit Category	Individual Beneficiary within Category	% by Benefit Category (see Table 10)	% of Benefit within Category	% of Total Payment from Individual Beneficiary
Flood Protection	City of Albany	54.14%	13.70%	7.42%
	City of Cohoes		0.32%	0.18%
	City of Mechanicville		0.38%	0.21%
	City of Rensselaer		3.99%	2.16%
	City of Troy		1.14%	0.62%
	City of Watervliet		0.04%	0.02%
	Town of Bethlehem		49.21%	26.64%
	Town of Coeymans		0.34%	0.19%
	Town of Colonie		0.13%	0.07%
	Town of Corinth		0.09%	0.05%
	Town of East Greenbush		1.04%	0.56%
	Town of Easton		0.01%	0.00%
	Town of Fort Edward		0.01%	0.01%
	Town of Greenwich		0.10%	0.05%
	Town of Hadley		0.22%	0.12%
	Town of Halfmoon		1.54%	0.83%
	Town of Moreau		0.13%	0.07%
	Town of New Baltimore		0.40%	0.22%
	Town of North Greenbush		1.29%	0.70%
	Town of Northumberland		0.01%	0.00%
	Town of Queensbury		0.35%	0.19%
	Town of Saratoga		0.16%	0.09%
	Town of Schaghticoke		0.27%	0.15%
	Town of Schodack		0.21%	0.11%
	Town of Stillwater		0.37%	0.20%
	Town of Stuyvesant		0.03%	0.02%
	Town of Waterford		2.11%	1.14%
	Village o Castleton-on-Hudson		2.18%	1.18%

Benefit Category	Individual Beneficiary within Category	% by Benefit Category (see Table 10)	% of Benefit within Category	% of Total Payment from Individual Beneficiary
	Village of Corinth		4.27%	2.31%
	Village of Fort Edward		0.00%	0.00%
	Village of Green Island		0.05%	0.03%
	Village of Hudson Falls		0.00%	0.00%
	Village of Menands		8.86%	4.79%
	Village of Schuylerville		0.72%	0.39%
	Village of South Glens Falls		1.96%	1.06%
	Village of Stillwater		4.15%	2.25%
	Village of Waterford		0.22%	0.12%
Lake Recreation	Saratoga County	24.28%	30.24%	7.34%
	Fulton County		69.76%	16.94%
Hydroelectric Generation	Erie Boulevard Hydropower	12.77%	54.81%	7.00%
	Curtis/Palmer Hydroelectric		20.12%	2.57%
	Finch Pruyn		3.48%	0.44%
	Adirondack Hydro		15.12%	1.93%
	Mercer Companies		1.71%	0.22%
	Stillwater Hydro		0.64%	0.08%
	NYSEG		3.22%	0.41%
	Four Branch Associates		0.84%	0.11%
	Green Island Power Authority		0.90%	0.11%
Waste Assimilation	Trans-Canada	7.70%	24.57%	1.89%
	Corinth		1.67%	0.13%
	Finch Pruyn		18.07%	1.39%
	Encore Paper		5.58%	0.43%
	Irving Tissue		8.19%	0.63%
	Washington County S.D. #2		7.13%	0.55%
	General Electric - Waterford		31.36%	2.41%
	East Greenbush		3.42%	0.26%
Whitewater Recreation	Commercial	1.02%	75.00%	0.76%
	Private		25.00%	0.25%
Total		**100%**		**100%**

7.0 Recommendations

The benefits of increased real estate values for lakeshore property and waste assimilation are significant enough to warrant further study prior to revising the District's assessment schedule of benefits. Although, the District charges access permit fees[7] for properties around Great Sacandaga Lake, these mostly cover the administrative cost of the program and not the benefit of flow regulation. We recommend that the District contract with New York State's Division of Equalization and Assessment Department or a real estate appraisal firm to determine the benefit of increased real estate values. The most comprehensive level of study would be to compile a list of all the lakefront properties and their assessed values from the tax records of local municipalities or counties. In order to calculate the benefit of the reservoir's presence, the value of these lakefront properties would be compared to similar type properties in nearby areas that are not located on a lake. The difference between the real estate value of property with and without Great Sacandaga Lake frontage would be the net benefit. The level of effort required for this type of study is extensive.

A lower level of effort might be to study 5 or 6 types of property in one community to see the difference between property values with and without the reservoir. These results could then be applied to properties in the other communities as well. The drawback to this approach is that it uses a much smaller sample size than the first alternative and may be more subject to criticism.

The waste assimilative benefits appear to be a large benefit that warrants further study if the District wishes to assess the beneficiaries. The analysis conducted for the waste assimilative benefit was at a planning level, particularly in the case of toxics. Additional study, if pursued, should refine and make more site-specific the EPA cost curves used to determine the removal of pollutants.

[7] The District owns all land up to approximately elevation 778 (7 feet above spillway crest). Permit holders are people who own land adjacent to the lake who use the lake by access to the District's land with a permit.

REFERENCES

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USEPA. Handbook Remedial Action at Waste Disposal Sites, EPA/625/6-85/006.

Upper Hudson/Sacandaga River Offer of Settlement Agreement. March 27,2000.

Appendix A-Excerpts from the Upper Hudson/Sacandaga River Offer of Settlement

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Erie Boulevard	)	Project Nos. 2318, 2047
Hydropower, LP	)	2482 and 2554

UPPER HUDSON/SACANDAGA RIVER OFFER OF SETTLEMENT

MARCH 27, 2000

3.0 OPERATION OF GREAT SACANDAGA LAKE

3.1 Introduction

The Parties have agreed to a plan for the operation of Great Sacandaga Lake (GSL) that is based on maintaining certain maximum and minimum lake elevations, and to following an annual guide curve for lake levels that is intended to meet a number of resource objectives in consideration of the storage capacity of the lake.

The operation of GSL except as provided in Section 3.9 below will begin upon issuance to and acceptance of a license by the Regulating District. Table 3.0-1 provides a summary of the operational enhancements to be provided by the Regulating District for Great Sacandaga Lake.

3.2 Operating Objectives for Great Sacandaga Lake

The Regulating District will operate the Great Sacandaga Lake to achieve the following objectives while maintaining the goal of controlling floods on the Hudson River:

- Maintaining the lake at the targeted elevations during the late winter consistent with the use of storage for flow augmentation;
- Providing flows in the Hudson River to maintain water quality and fish habitat;
- Targeting higher than current lake elevations to enhance fall lake recreation;
- Minimizing energy losses to affected hydro projects by the aggressive use of storage while maintaining the other objectives;
- Enhancement of whitewater recreation on the Sacandaga River.
- Providing base flows in the Sacandaga River.

Table 3.0-1
Summary of Settlement Offer Measures for Great Sacandaga Lake

Issue	Description	Time Frame for Implementation
Winter Drawdowns	748 feet	From License Issuance and Acceptance to 06/01/10
	749 feet	06/02/10 to 06/01/20
	750 feet	06/02/20 to License expiration
Operation to Target Flow Augmentation Needs on the Upper Hudson River Just Below the Confluence with the Sacandaga River	In accordance with Table B (p. 38)	From License Issuance and Acceptance to 06/01 / 13
	In accordance with Table C (p. 38)	From 06/02/13 to License Expiration
Targeted Maximum Flows in Hudson River Below the Confluence with the Sacandaga River for Aggressive Use of Storage	In accordance with Table D (p. 39)	From License Issuance and Acceptance to License Expiration

When flows are being released from Great Sacandaga Lake, the Regulating District will ensure that releases from Great Sacandaga Lake will allow Erie to provide a base flow and whitewater flows below the Stewarts Bridge Project, a minimum average daily flow below the confluence of the Hudson and Sacandaga Rivers, and a base flow below the Feeder Dam Project.

3.2.1 Level Curves

Four level curves have been developed to express the annual constraints on lake elevations in Great Sacandaga Lake. The four Level Curves are designated as follows:

- Level Curve 1 is considered the bottom of available storage; Great Sacandaga Lake may be drawn below this Level Curve only under circumstances detailed in this agreement; Level Curve 1 is defined as elevation 756 from May I through Labor Day, then linearly interpolated to 740 on October 15 and maintained at 740 feet through March31 of the next year, and then linearly interpolated back to 756 on May 1;

- Level Curve 2 represents the top of buffer storage; buffer storage between Level Curves I and 2 is primarily reserved to augment flows on the Hudson and Sacandaga Rivers for water quality, and to provide whitewater flows;

- Level Curve 3 represents the annual Guide Curve the Regulating District will follow over the course of any given year, subject to balancing inflow to Great Sacandaga Lake with other operating constraints. Level Curve 3 represents the top of conservation storage. Storage between Level Curves 2 and 3 is used to augment flows on the Hudson and Sacandaga Rivers for water quality and power generation, as well as to provide white water flows.

- Level Curve 4 represents the top of the flood pool and is set at elevation 773 throughout the year; lake levels will approach this elevation only in accordance with the Regulating District's responsibility to utilize the storage capability of the lake to control flooding on the Hudson River.

The Settlement allows for a transition in Level Curve 3 from a targeted elevation for maximum winter drawdown of 748 at the time of license issuance, elevation 749 starting on June 2, 2010, and elevation 750 starting on June 2, 2020. Figures A through C show the Level Curves for each of the three time periods in the transition period.

Shown in Appendix E is a look-up table that shows the relationship between lake Level Curves and USGS datum for Great Sacandaga Lake elevations, including intermediate levels 1.2, 1.5, 2.5, etc., which pertain to operating guidelines herein.

3.3 Winter Drawdowns

During the winter, the maximum drawdown of Great Sacandaga Lake occurs typically in late March or April and the targeted elevations for maximum winter drawdown for Level Curve 3 are shown in Table A (p. 37). Under certain circumstances, the Regulating District will be allowed to operate Great Sacandaga Lake below the targeted elevation for maximum winter drawdown as described further below.

In all cases, drawdowns below the targeted elevation for maximum winter drawdown will be for the minimum duration necessary and the lake elevation will be restored above the target level as soon as possible after the circumstances requiring the drawdown have passed.

Under the following circumstances, prior notification to the NYSDEC will not be required for drawdowns below the targeted elevation for winter drawdown:

- Any emergency situations related to dam safety, human life and property, or rescue activities;

- The need for flow augmentation objectives as described in Subsection 3.4.

3.3.1 Consultation Requirements Prior to Drawdowns Below the Targeted Elevation for Maximum Winter Drawdowns

Under the following circumstances, consultation with NYSDEC will be required prior to drawdowns below the targeted elevation for winter drawdown:

- Maintenance, repair or reconstruction of the Conklingville Dam, for which NYSDEC approval will be required;

- Existence of a water equivalent of 8.6 inches at the first March snow survey may warrant the provision of more storage for flood control purposes. In the event that the water equivalent trigger is met, the Regulating District will consult, in advance of drawing the lake below the target elevation, with NYSDEC Regional Director for Region 5.

The Regulating District is required to implement the following notification and consultation steps prior to drawdowns below the targeted elevation for maximum winter drawdowns if circumstances described above warrant:

- The Regulating District must consult in advance with appropriate NYSDEC Region 5 staff, Fulton and Saratoga County stag and Erie's staff regarding the need for drawdowns below the targeted elevation for maximum winter drawdowns for flood protection purposes, describing the need for the drawdown, the approximate drawdown level needed, and the approximate duration of the drawdown. It will be the responsibility of the NYSDEC to notify the USFWS and APA of the request. To the extent possible, the decision on drawdown level will be determined by consensus of these parties. Documentation of consultation among the Regulating District, NYSDEC, Fulton and Saratoga Counties and Erie on the justification for the drawdown will be prepared and maintained on file by the Regulating District and NYSDEC, with a copy supplied to Erie and Fulton and Saratoga Counties within 30 days of the occurrence. In the absence of consensus, the Regulating District and NYSDEC will make the final determination on the level of drawdown.

- Advanced notification and consultation with appropriate NYSDEC, Fulton and Saratoga Counties and Erie staff will not be deemed necessary if it would impair the Regulating District's ability to address immediate dangers relating to dam safety, human life and property, or rescue activities. However, NYSDEC, Fulton and Saratoga Counties and Erie will be notified within 24 hours of the commencement of the drawdown and the related emergency. This notification will be followed within the subsequent 24 hours by submission to NYSDEC of a description of the need for the drawdown, any related emergency actions and the reasons why the situation is an emergency. Documentation of the notification will be maintained on file by the Regulating District and NYSDEC, with a copy, supplied to Erie and Fulton and Saratoga Counties within 30 days of the occurrence.

3.4 Operation for Flow Augmentation

The Regulating District will allocate sufficient daily water volume releases from Great Sacandaga Lake to meet minimum average daily flow requirements on the Hudson River just below the confluence with the Sacandaga River and to help meet the 1,500 cfs instantaneous Hudson River base flow requirement below Feeder Dam. The Regulating District will use the minimum average daily flows shown in Tables B (p. 38) or C (p. 38), as adjusted in Section 3.4.2, to help meet these objectives.

3.4.1 Drawdown Exceptions to Level Curve 1

The Regulating District may draw Great Sacandaga Lake below Level Curve 1 only in accordance with the exceptions described herein. In all cases, drawdowns below Level Curve 1 will be for the minimum duration necessary and the lake elevation will be restored above Level Curve 1 as soon as possible after the circumstances requiring drawdown have passed. As soon as Great Sacandaga Lake rises above Level 1, Hudson River flows shall be restored per Table B or C and subsection 3.4.2, below, as applicable. Reasons for drawing below Level Curve 1 may include, but not necessarily be limited to the following:

- Maintenance, repair or reconstruction of the Conklingville Dam;

- Any emergency situations related to dam safety, human life and property, or rescue activities;

- The need for flow augmentation because of critical low flows in the Hudson River which adversely affect water quality conditions' (see subsection 3.4.3 below for consultation procedures for drawdowns below Level Curve 1 for flow augmentation).

3.4.2 Drawdown Exceptions during the Champlain Canal Navigation Season

During the Champlain Canal Navigation Season (approximately May 1 through mid-November), if the elevation of Great Sacandaga Lake drops below level 1.2 (interpolated between Level Curves 1 and 2) and an interim minimum average daily flow has not been invoked per subsection 3.4.3 (see below), the minimum average daily flow on the Hudson River just below the confluence with the Sacandaga River (see row I of Table B or C, p. 38) shall be increased by the flow being diverted from the Hudson River to the Feeder Canal. The resulting minimum average daily flow will remain in effect until either Great Sacandaga Lake rises above level 1.2 or an interim minimum average daily flow is established per subsection 3.4.3.

3.4.3 Consultation on Drawdown Exceptions for Flow Augmentation

If the elevation of the Great Sacandaga Lake reaches Level 1.2 (interpolated between Level Curves I and 2) at any time and the lake elevation is continuing to drop, the Regulating District will, within 48 hours of the lake reaching Level 1.2, noti& the NYSDEC. At any time between Memorial Day and Labor Day, the Regulating District shall also provide general, public notification in the event an emergency occurs that will require Great Sacandaga Lake to be drawn below level 1.2. Notification shall be provided within 48 hours following commencement of the emergency drawdown. Within seven working days of the lake reaching level 1.2, the NYSDEC and Regulating District will consult with Erie, the USFWS, the APA and Fulton and Saratoga Counties to establish an interim minimum average daily flow that will be invoked should the lake actually reach Level 1.0. To the extent possible, the decision on an interim minimum average daily flow shall be determined by consensus among the participants. In the absence of consensus, the NYSDEC will, within the seven-day period described above, make the final determination on the minimum average daily flow that will be invoked should the lake actually reach Level 1.0. As soon as the Lake rises above Level 1.0, the minimum average daily flow shall be restored as per Table B or C (p. 38), as applicable.

The NYSDEC, The Regulating District, and the consulted Parties shall consider the following factors in establishing the interim minimum average daily flow:

- The goal of minimizing the extent and duration of lake drawdown below Level Curve 1;
- Water quality conditions on the Hudson River at the time;
- Natural inflow to Great Sacandaga Lake
- Natural flow in the Hudson River above Hadley;
- Minimum base flow in the Sacandaga River;
- The quantity of flow being diverted from the Hudson River to the Feeder Canal;
- Other meteorological circumstances (e.g., precipitation and temperature).

In the event an interim minimum average daily flow is implemented that may take Great Sacandaga Lake below Level Curve 1, periodic consultation shall occur thereafter for NYSDEC to determine whether changes in conditions warrant raising or lowering the interim minimum average daily flow. Consultation shall continue until Great Sacandaga Lake elevation is restored to above level 1.2.

3.5 Operation for Fall Recreation

To facilitate lake recreation through Columbus Day, the Regulating District will regulate Great Sacandaga Lake in accordance with Level Curve 3. A minimum lake elevation of 760 feet on October 15 as shown on Level Curve 3 is considered a target elevation, and the Regulating District may operate Great Sacandaga Lake below elevation 760 feet under the following conditions:

- to maintain flow augmentation needs on the Hudson River as a daily average of 1,760 cfs below Feeder Dam and an instantaneous flow of no less thanl,500 cfs below Feeder Dam using the target flows shown on Tables B and C and the provisions of Subsection 3.4.2;

- to maintain Sacandaga River Base Flows;

- to maintain the whitewater demand schedule.

- to address other conditions as requested by NYSDEC.

3.6 Operation for Aggressive Use of Storage

For the purpose of minimizing energy losses to affected downstream hydroelectric projects, the Regulating District will make every reasonable attempt to limit water releases from the Great Sacandaga Lake to not exceed the target maximum flows in the Hudson River below the confluence with the Sacandaga River, based on the relationship shown in Table D.

3.6.1 Exceptions to Operation for Aggressive Use of Storage

In cases where exceedance of the target maximum flows on the Hudson River is needed, the Regulating District will restore the Hudson River to below the maximum flows as soon as possible after circumstances requiring the exceedance have passed. Reasons for exceeding the maximum flows shown in Table D include, but are not limited to, the following:

- Maintenance, repair or reconstruction of the Conklingville Dam;

- Observation of lake elevations rising above elevation 771 and anticipation of unusual meteorological conditions that may result in flooding around Great Sacandaga Lake above Level Curve 4;

- Any emergency situations related to dam safety, human life and property, or rescue activities.

3.6.2 Consultation to Implement Exceptions to Operation for Aggressive Use of Storage

The following notification and consultation provisions for exceedance of target maximum flows in the Hudson River will be undertaken as circumstances warrant:

- The Regulating District will consult with appropriate NYSDEC Region 5 staff and Fulton and Saratoga Counties and downstream hydroelectric project owners and municipalities regarding the need to exceed the maximum flows shown on Table D. Consultation will include the need for the exceedance, estimation of the consequences to downstream properties and hydro facilities as a result of the exceedance, and an estimation of the approximate duration of the exceedance. Documentation of the consultation will be maintained on file by the Regulating District, with copies to NYSDEC, Fulton and Saratoga Counties, Erie and affected downstream entities within 30 days.

- Consultation with NYSDEC, Fulton and Saratoga Counties and downstream hydroelectric project owners and municipalities will not be deemed necessary where consultation would impair the Regulating District's ability to address immediate dangers relating to dam safety, human life and property, or rescue activities. However, NYSDEC, Fulton and Saratoga Counties and affected downstream entities will be notified as soon as possible of the emergency situation and its expected duration. In such emergency circumstances, the Regulating District will prepare a report discussing the rationale and circumstances for exceeding the target flows. The report will be maintained on file by the Regulating District and copies will be provided to NYSDEC, Fulton and

- Saratoga Counties, Erie and affected downstream hydroelectric project owners and municipalities within 30 days of the occurrence.

3.7 Operation for Whitewater Recreation

For the purpose of enhancing whitewater recreation, the Regulating District will operate the Great Sacandaga Lake to provide the daily volume of water, if available, needed to sustain the whitewater demand flow in the Sacandaga River below Stewarts Bridge dam as provided in Section 5.5.1.4 of this settlement document.

3.8 Operation for Base Flows in the Sacandaga River

The Regulating District shall provide sufficient flow volumes to facilitate the release of an instantaneous base flow, beginning in 2013, to the Sacandaga River below the Stewarts Bridge Project as described in Section 5.3 below. In the event neither of the two turbine/generator units at the E.J. West Project are operating, the Regulating District and Erie will cooperate to insure that base flows are maintained in the Sacandaga River without violating impoundment fluctuation restrictions at the Stewarts Bridge Project.

3.9 Interim Measures

Until the new license is issued and accepted, the Regulating District shall maintain status quo operation of the Great Sacandaga Lake with the exception of the following interim measures.

The Regulating District shall provide the following interim measures for a period not to exceed two years from the date this Settlement Offer is executed and filed with the FERC, and thereafter once a license has been issued and accepted.

3.9.1 Interim Operation of Great Sacandaga Lake for Fall Recreation

For interim enhancement to fall recreation, the Regulating District will strive to keep the Great Sacandaga Lake level at or above elevation 760 through October 15.

3.9.2 Interim Operation of Great Sacandaga Lake for Aggressive Use of Storage

To the extent practicable, the Regulating District will limit water releases from the Great Sacandaga Lake, to approach but not exceed the targeted maximum flows on the Hudson River below the confluence with the Sacandaga River based on the relationship shown in Table D.

Table A: Great Sacandaga Lake Target Elevation for Winter Maximum Drawdown	
Implementation Schedule	Targeted Elevation for Maximum Drawdown
From License Issuance and Acceptance' to June 1,2010	748 feet
From June 2,2010 through June 1, 2020	749 feet
From June 2, 2020 through License Expiration	750 feet

Table B: Operation of Great Sacandaga Lake to Target Flow Augmentation Needs on the Hudson River Just Below the Confluence with the Sacandaga River (from License Issuance to June 1,2013)	
Great Sacandaga Level	Minimum average daily flow target on the Hudson River just below the confluence with the Sacandaga River (cfs)
1.00- 1.19[1]	1,500[4]
1.20 1.50 [2,3]	1,760
2.50-3.00[3]	2,250
3.50[3]	3,000
4.00[3]	4,000

Table C: Operation of Great Sacandaga Lake to Target Flow Augmentation Needs on the Hudson River Just Below the Confluence with the Sacandaga River (from June 2, 2013 to License Expiration) Great Sacandaga Level Minimum average daily flow on the Hudson River just below the confluence with the Sacandaga River (cfs)	
Great Sacandaga Level	Minimum average daily flow target on the Hudson River just below the confluence with the Sacandaga River (cfs)
1.00- 1.19[1]	1,500[4]
1.20 1.50 [3]	1,760
2.50-3.00[3]	2,000
3.50[3]	3,000
4.00[3]	4,000

[1] NYSDEC and the Regulating District will confer in accordance with Section 3.4.2 to detennine the appropriate flow that will be provided below Level Curve 1.00.

[2] Levels above 1.50, the corresponding minimum average daily flow targets on the Hudson River exceed the 1,760 cfs required for water quality. The flow targets shown are designed to increase hydro operating efficiency at Hudson River hydro projects (i.e., generation).

[3] Flows between specified ranges are to be interpolated.

[4]See exception at subsection 3.4.2.

Table D: Targeted Maximum Hudson River flow Below the Confluence with the Sacandaga River	
Great Sacandaga Lake Elevation (feet)	Targeted Maximum Flow on the iludson River below the confluence with the Sacandaga River (cfs)
735.00-755.00	6,000
755.01-769.00	8,000
769.99	10,000
770.00	20,000
773.00	26,000
776.0 and above	32,000
Note: For those GSL elevations not shown above, the targeted maximum allowable flow should be linearly interpolated.	

Appendix B-Summaries of Monthly Energy Generation from HEC5P Operations Model

TABLE B-1

DIFFERENCE IN ENERGY PRODUCED BY FLOW REGULATION IN COMPLIANCE WITH THE UPPER HUDSON/SACANDAGA RIVER OFFER OF SETTLEMENT AGREEMENT AND BY RUN-OF-RIVER OPERATION

DIFFERENCE IN TOTAL ENERGY GENERATION

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	(3,167)	(7,934)	(1,846)	(5,845)	(5,171)	(4,116)	(860)	(1,322)	(1,474)	(4,414)	(632)	(172)	(1,274)	(112)	(247)	(38,586)
February	(2,397)	(6,777)	(1,501)	(4,646)	(4,015)	(3,153)	(728)	(1,041)	(1,137)	(3,440)	(508)	(136)	(1,000)	(89)	(191)	(30,759)
March	2,235	1,095	(974)	(2,148)	(1,287)	(1,327)	(298)	(329)	(361)	(1,498)	(251)	(67)	(419)	(38)	(134)	(5,802)
April	7,622	13,220	(506)	45	586	83	150	285	192	76	16	(20)	56	(1)	(41)	21,760
May	(1,174)	(2,139)	(54)	(964)	(1,642)	(1,193)	5	(347)	(542)	(1,132)	(23)	39	(418)	4	(2)	(9,582)
June	(2,691)	(4,053)	(465)	(2,379)	(1,935)	(1,533)	(362)	(534)	(614)	(1,658)	(224)	(94)	(500)	(154)	(152)	(17,348)
July	(4,234)	(6,637)	(1,212)	(5,999)	(4,429)	(3,725)	(964)	(1,387)	(1,409)	(3,931)	(678)	(327)	(1,196)	(557)	(466)	(37,152)
August	(4,333)	(7,008)	(1,405)	(6,580)	(4,796)	(4,054)	(1,134)	(1,529)	(1,520)	(4,311)	(782)	(382)	(1,308)	(622)	(533)	(40,296)
September	(3,057)	(5,167)	(941)	(4,427)	(3,118)	(2,680)	(802)	(1,027)	(1,007)	(2,924)	(538)	(266)	(879)	(428)	(372)	(27,632)
October	(2,441)	(4,552)	(900)	(3,878)	(2,871)	(2,425)	(607)	(877)	(899)	(2,672)	(437)	(184)	(769)	(271)	(267)	(24,050)
November	(1,679)	(4,065)	(1,014)	(3,704)	(3,027)	(2,681)	(470)	(843)	(950)	(2,892)	(386)	(114)	(817)	(96)	(174)	(22,914)
December	(3,776)	(8,408)	(2,027)	(6,540)	(5,955)	(4,681)	(867)	(1,489)	(1,688)	(5,049)	(682)	(167)	(1,451)	(78)	(240)	(43,096)
Annual	(19,091)	(42,426)	(12,845)	(47,065)	(37,660)	(31,486)	(6,940)	(10,441)	(11,408)	(33,847)	(5,123)	(1,890)	(9,974)	(2,440)	(2,819)	(275,455)

DIFFERENCE IN PEAK ENERGY GENERATION

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	(1,717)	(5,140)	(831)	(1,977)	(1,423)	(1,710)	(352)	(402)	(425)	(1,484)	(267)	(176)	(597)	(56)	(351)	(16,908)
February	(1,295)	(4,370)	(643)	(1,600)	(1,296)	(1,613)	(304)	(339)	(329)	(1,153)	(231)	(150)	(453)	(45)	(345)	(14,166)
March	(947)	(3,841)	(1,273)	(3,971)	(3,202)	(3,087)	(590)	(934)	(1,015)	(3,011)	(472)	(14)	(1,179)	(18)	(112)	(23,667)
April	(817)	(2,077)	(1,496)	(6,952)	(5,880)	(4,625)	(912)	(1,893)	(2,230)	(5,778)	(704)	40	(2,247)	(0)	(93)	(35,664)
May	(2,823)	(4,865)	(1,010)	(5,211)	(4,596)	(3,389)	(657)	(1,400)	(1,670)	(4,353)	(511)	(14)	(1,564)	1	(92)	(32,155)
June	(1,883)	(2,676)	(488)	(1,243)	(1,912)	(1,206)	(252)	(250)	(250)	(811)	(150)	(118)	(135)	(78)	(155)	(11,610)
July	(2,672)	(4,068)	(206)	(435)	(1,269)	(981)	(183)	(51)	(5)	(108)	(59)	(91)	237	(286)	(9)	(10,184)
August	(2,197)	(3,575)	196	881	42	81	22	293	376	967	101	(32)	662	(317)	232	(2,269)
September	(543)	(1,002)	1,003	3,684	2,803	2,133	464	1,033	1,203	3,178	419	73	1,683	(218)	453	16,364
October	(1,550)	(3,078)	1	(105)	(360)	(439)	(24)	71	123	209	(11)	(109)	160	(139)	(99)	(5,350)
November	(2,563)	(5,619)	(923)	(3,050)	(2,581)	(2,263)	(398)	(667)	(744)	(2,260)	(328)	(177)	(839)	(48)	(401)	(22,861)
December	(2,481)	(6,456)	(1,152)	(3,586)	(2,781)	(2,757)	(487)	(774)	(839)	(2,609)	(402)	(196)	(803)	(37)	(466)	(25,824)
Annual	(21,487)	(46,766)	(6,823)	(23,564)	(22,455)	(19,857)	(3,674)	(5,314)	(5,805)	(17,213)	(2,616)	(965)	(5,075)	(1,241)	(1,439)	(184,293)

DIFFERENCE IN OFF-PEAK ENERGY GENERATION

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	(1,451)	(2,794)	(1,016)	(3,868)	(3,748)	(2,406)	(508)	(919)	(1,049)	(2,930)	(365)	4	(677)	(55)	104	(21,678)
February	(1,102)	(2,407)	(858)	(3,046)	(2,720)	(1,539)	(425)	(701)	(808)	(2,287)	(277)	14	(547)	(44)	154	(16,593)
March	3,182	4,935	299	1,823	1,915	1,761	292	604	655	1,512	221	(53)	760	(19)	(21)	17,865
April	8,439	15,296	990	6,997	6,466	4,708	1,061	2,178	2,422	5,854	720	(61)	2,303	(0)	52	57,425
May	1,650	2,726	956	4,247	2,954	2,197	662	1,053	1,129	3,221	488	53	1,147	3	90	22,574
June	(808)	(1,377)	23	(1,137)	(23)	(327)	(109)	(284)	(363)	(847)	(73)	24	(364)	(75)	3	(5,738)
July	(1,562)	(2,570)	(1,006)	(5,564)	(3,161)	(2,744)	(782)	(1,336)	(1,404)	(3,822)	(620)	(236)	(1,433)	(272)	(457)	(26,968)
August	(2,135)	(3,432)	(1,601)	(7,461)	(4,838)	(4,135)	(1,156)	(1,822)	(1,896)	(5,279)	(883)	(350)	(1,970)	(304)	(766)	(38,028)
September	(2,514)	(4,165)	(1,944)	(8,111)	(5,920)	(4,814)	(1,266)	(2,060)	(2,209)	(6,102)	(956)	(338)	(2,562)	(210)	(825)	(43,996)
October	(891)	(1,474)	(901)	(3,774)	(2,511)	(1,986)	(583)	(948)	(1,023)	(2,881)	(426)	(75)	(928)	(132)	(168)	(18,700)
November	884	1,554	(91)	(654)	(446)	(419)	(72)	(176)	(206)	(633)	(58)	62	22	(48)	227	(53)
December	(1,295)	(1,952)	(874)	(2,954)	(3,173)	(1,925)	(380)	(715)	(850)	(2,441)	(280)	30	(648)	(41)	227	(17,272)
Annual	2,396	4,340	(6,022)	(23,502)	(15,204)	(11,629)	(3,266)	(5,127)	(5,603)	(16,634)	(2,508)	(925)	(4,899)	(1,199)	(1,380)	(91,162)

TABLE B-2
ENERGY GENERATION UNDER SETTLEMENT 748 CONDITIONS

TOTAL ENERGY GENERATION-SETTLEMENT 748 CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	6,688	13,775	5,513	22,839	21,513	16,245	3,007	5,688	5,860	17,710	2,791	1,484	8,182	3,323	4,581	139,198
February	4,998	11,357	4,578	19,194	17,872	13,520	2,546	4,777	4,856	14,821	2,389	1,318	7,102	3,022	4,139	116,491
March	4,462	10,651	5,905	24,362	23,436	17,067	3,168	6,131	6,390	19,035	2,943	1,111	9,074	3,325	3,984	141,043
April	4,824	9,207	7,136	30,815	32,523	22,533	3,908	8,178	8,948	24,863	3,479	1,030	11,364	3,239	4,012	176,057
May	8,895	14,870	6,448	28,493	29,705	20,922	3,559	7,481	8,142	22,916	3,226	1,209	10,490	3,328	4,198	173,882
June	5,309	8,488	3,816	17,901	17,168	12,836	2,281	4,500	4,584	13,803	2,166	1,276	6,697	3,165	3,910	107,899
July	5,504	9,014	2,905	15,044	14,046	10,554	1,851	3,733	3,681	11,307	1,809	1,151	5,470	3,166	3,445	92,682
August	4,768	8,088	2,499	13,559	12,366	9,350	1,656	3,328	3,197	10,000	1,652	1,105	4,911	3,142	3,227	82,849
September	4,272	7,520	2,497	13,421	12,313	9,293	1,635	3,301	3,194	9,939	1,626	1,076	4,842	3,042	3,230	81,202
October	5,255	9,381	3,679	17,496	16,434	12,342	2,188	4,327	4,344	13,238	2,097	1,253	6,287	3,242	3,820	105,383
November	7,044	12,624	5,498	23,392	22,335	16,838	2,948	5,788	6,049	18,091	2,751	1,431	8,214	3,205	4,402	140,610
December	8,181	15,395	6,280	25,625	24,390	18,381	3,298	6,302	6,572	19,736	3,041	1,540	8,862	3,327	4,775	155,704
Annual	**70,201**	**130,369**	**56,754**	**252,140**	**244,100**	**179,881**	**32,048**	**63,532**	**65,817**	**195,460**	**29,969**	**14,984**	**91,494**	**38,528**	**47,723**	**1,513,000**

PEAK ENERGY GENERATION-SETTLEMENT 748 CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	4,145	9,479	3,315	11,426	13,669	9,566	1,542	2,863	2,950	8,915	1,407	748	4,122	1,666	2,302	78,114
February	3,196	7,927	2,795	9,596	11,727	8,314	1,316	2,408	2,449	7,471	1,207	666	3,583	1,516	2,081	66,251
March	2,947	7,573	3,399	12,185	14,005	10,040	1,613	3,077	3,207	9,556	1,479	558	4,559	1,665	1,997	77,862
April	2,796	5,631	3,673	15,404	16,906	11,672	1,958	4,089	4,474	12,432	1,739	515	5,680	1,619	2,005	90,595
May	5,090	8,717	3,403	14,281	16,357	10,950	1,798	3,755	4,087	11,504	1,620	606	5,261	1,666	2,105	91,201
June	3,805	6,181	2,420	8,943	12,060	7,824	1,195	2,267	2,310	6,955	1,095	644	3,375	1,591	1,977	62,643
July	4,247	6,997	1,930	7,526	10,902	7,110	1,018	1,903	1,880	5,768	927	587	2,784	1,601	1,758	56,938
August	3,921	6,686	1,765	6,781	10,299	6,561	922	1,702	1,639	5,119	850	565	2,509	1,591	1,651	52,560
September	3,477	6,210	1,723	6,715	10,029	6,441	908	1,686	1,635	5,081	835	550	2,473	1,540	1,653	50,955
October	3,829	7,144	2,330	8,741	11,706	7,851	1,172	2,187	2,197	6,694	1,064	635	3,178	1,634	1,933	62,296
November	4,644	9,117	3,242	11,690	13,852	9,536	1,511	2,903	3,034	9,075	1,382	719	4,126	1,608	2,211	78,650
December	4,904	10,442	3,663	12,833	14,672	10,410	1,678	3,166	3,302	9,914	1,529	774	4,458	1,667	2,398	85,810
Annual	**47,002**	**92,103**	**33,657**	**126,124**	**156,185**	**106,276**	**16,630**	**32,005**	**33,165**	**98,483**	**15,132**	**7,567**	**46,109**	**19,365**	**24,072**	**853,875**

OFF-PEAK ENERGY GENERATION-SETTLEMENT 748 CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	2,543	4,296	2,198	11,412	7,844	6,679	1,466	2,825	2,910	8,795	1,384	736	4,059	1,657	2,279	61,084
February	1,802	3,430	1,784	9,598	6,145	5,206	1,230	2,369	2,407	7,350	1,182	653	3,520	1,506	2,058	50,240
March	1,516	3,077	2,506	12,177	9,431	7,027	1,555	3,054	3,183	9,479	1,464	552	4,515	1,660	1,987	63,181
April	2,027	3,576	3,463	15,410	15,616	10,860	1,950	4,089	4,474	12,431	1,740	515	5,683	1,620	2,007	85,462
May	3,805	6,153	3,044	14,211	13,348	9,972	1,761	3,726	4,054	11,413	1,606	603	5,229	1,663	2,093	82,681
June	1,503	2,307	1,397	8,957	5,109	5,012	1,086	2,232	2,274	6,848	1,071	632	3,322	1,574	1,933	45,256
July	1,258	2,017	975	7,518	3,144	3,444	833	1,830	1,802	5,539	882	564	2,686	1,565	1,687	35,744
August	848	1,402	734	6,777	2,067	2,789	734	1,626	1,558	4,881	803	540	2,402	1,551	1,576	30,288
September	795	1,311	774	6,706	2,284	2,852	728	1,615	1,559	4,859	791	526	2,368	1,503	1,577	30,248
October	1,426	2,237	1,350	8,755	4,728	4,491	1,016	2,140	2,147	6,544	1,033	618	3,108	1,608	1,887	43,087
November	2,400	3,507	2,256	11,702	8,483	7,302	1,437	2,884	3,015	9,016	1,370	711	4,088	1,597	2,190	61,959
December	3,276	4,953	2,617	12,791	9,718	7,971	1,621	3,137	3,270	9,822	1,512	766	4,404	1,660	2,377	69,894
Annual	**23,199**	**38,266**	**23,097**	**126,016**	**87,915**	**73,605**	**15,417**	**31,527**	**32,653**	**96,977**	**14,837**	**7,417**	**45,385**	**19,163**	**23,651**	**659,125**

TABLE B-3
ENERGY GENERATION UNDER SETTLEMENT 749A CONDITIONS

TOTAL ENERGY GENERATION-SETTLEMENT 749A CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	6,554	13,434	5,399	22,538	21,220	16,021	2,957	5,614	5,781	17,477	2,749	1,469	8,113	3,321	4,566	137,211
February	4,823	10,802	4,395	18,688	17,388	13,154	2,469	4,657	4,726	14,434	2,325	1,300	6,988	3,020	4,118	113,289
March	4,450	10,379	5,800	24,079	23,177	16,869	3,126	6,065	6,321	18,820	2,907	1,104	9,014	3,324	3,975	139,409
April	5,082	9,653	7,119	30,849	32,592	22,586	3,912	8,198	8,973	24,904	3,480	1,030	11,379	3,239	4,013	177,008
May	9,012	15,104	6,464	28,585	29,809	20,998	3,571	7,508	8,174	22,995	3,234	1,210	10,516	3,329	4,202	174,711
June	5,335	8,524	3,826	17,933	17,200	12,859	2,289	4,508	4,593	13,829	2,170	1,277	6,704	3,167	3,912	108,124
July	5,512	9,025	2,909	15,064	14,056	10,560	1,856	3,735	3,684	11,315	1,811	1,152	5,472	3,168	3,446	92,767
August	4,777	8,101	2,503	13,573	12,377	9,359	1,662	3,331	3,201	10,010	1,654	1,106	4,914	3,144	3,228	82,940
September	4,278	7,530	2,500	13,430	12,321	9,299	1,640	3,303	3,197	9,947	1,627	1,077	4,844	3,044	3,231	81,268
October	5,264	9,396	3,684	17,509	16,446	12,351	2,192	4,330	4,347	13,248	2,098	1,254	6,290	3,243	3,821	105,472
November	7,050	12,636	5,500	23,403	22,345	16,845	2,951	5,790	6,052	18,099	2,753	1,431	8,216	3,205	4,402	140,677
December	8,181	15,395	6,280	25,625	24,390	18,381	3,298	6,302	6,572	19,736	3,041	1,540	8,862	3,327	4,775	155,704
Annual	**70,319**	**129,978**	**56,379**	**251,275**	**243,319**	**179,282**	**31,922**	**63,343**	**65,620**	**194,813**	**29,848**	**14,949**	**91,312**	**38,531**	**47,689**	**1,508,580**

PEAK ENERGY GENERATION-SETTLEMENT 749A CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	4,056	9,239	3,232	11,274	13,497	9,509	1,520	2,827	2,912	8,802	1,387	741	4,089	1,665	2,295	77,044
February	3,096	7,564	2,672	9,341	11,491	8,181	1,282	2,350	2,386	7,283	1,176	657	3,527	1,516	2,071	64,592
March	2,959	7,411	3,336	12,048	13,893	9,965	1,596	3,046	3,175	9,455	1,462	555	4,530	1,665	1,993	77,089
April	2,919	5,833	3,661	15,416	16,936	11,671	1,960	4,098	4,485	12,448	1,739	515	5,687	1,619	2,005	90,992
May	5,155	8,843	3,406	14,324	16,383	10,981	1,803	3,767	4,102	11,539	1,624	607	5,273	1,666	2,107	91,580
June	3,823	6,209	2,425	8,960	12,076	7,836	1,199	2,272	2,315	6,969	1,097	645	3,379	1,592	1,979	62,775
July	4,254	7,006	1,932	7,535	10,911	7,128	1,022	1,904	1,881	5,773	928	588	2,786	1,602	1,759	57,008
August	3,928	6,697	1,768	6,789	10,310	6,572	925	1,704	1,641	5,124	851	565	2,511	1,592	1,652	52,629
September	3,482	6,217	1,725	6,720	10,037	6,450	910	1,687	1,636	5,085	835	550	2,474	1,541	1,653	51,002
October	3,835	7,154	2,332	8,748	11,713	7,860	1,174	2,189	2,199	6,700	1,065	635	3,180	1,635	1,934	62,353
November	4,646	9,120	3,243	11,692	13,854	9,536	1,511	2,904	3,035	9,077	1,382	719	4,126	1,608	2,211	78,665
December	4,904	10,442	3,663	12,833	14,672	10,410	1,678	3,166	3,302	9,914	1,529	774	4,458	1,667	2,398	85,810
Annual	**47,058**	**91,736**	**33,396**	**125,680**	**155,771**	**106,099**	**16,579**	**31,913**	**33,068**	**98,168**	**15,074**	**7,551**	**46,021**	**19,368**	**24,056**	**851,539**

OFF-PEAK ENERGY GENERATION-SETTLEMENT 749A CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	2,498	4,194	2,167	11,264	7,723	6,512	1,436	2,787	2,869	8,675	1,363	728	4,024	1,656	2,271	60,167
February	1,727	3,238	1,723	9,347	5,898	4,974	1,187	2,307	2,340	7,151	1,149	643	3,460	1,504	2,048	48,696
March	1,491	2,967	2,464	12,031	9,284	6,904	1,530	3,019	3,146	9,365	1,445	549	4,483	1,659	1,983	62,320
April	2,163	3,820	3,458	15,432	15,656	10,915	1,952	4,101	4,488	12,456	1,740	515	5,692	1,620	2,007	86,017
May	3,857	6,261	3,058	14,261	13,426	10,017	1,768	3,741	4,072	11,455	1,610	603	5,243	1,663	2,095	83,131
June	1,512	2,315	1,401	8,972	5,124	5,022	1,090	2,236	2,278	6,859	1,073	632	3,326	1,575	1,933	45,349
July	1,259	2,019	977	7,529	3,144	3,433	834	1,831	1,803	5,542	883	564	2,687	1,566	1,688	35,759
August	849	1,404	735	6,784	2,067	2,787	736	1,628	1,560	4,886	804	541	2,403	1,552	1,576	30,311
September	796	1,312	775	6,711	2,285	2,849	730	1,616	1,560	4,862	792	527	2,369	1,503	1,577	30,266
October	1,428	2,242	1,352	8,760	4,733	4,490	1,018	2,141	2,148	6,549	1,034	618	3,110	1,608	1,887	43,118
November	2,404	3,516	2,257	11,710	8,490	7,309	1,440	2,886	3,017	9,022	1,371	712	4,090	1,597	2,191	62,012
December	3,276	4,953	2,617	12,791	9,718	7,971	1,621	3,137	3,270	9,822	1,512	766	4,404	1,660	2,377	69,894
Annual	**23,261**	**38,242**	**22,983**	**125,595**	**87,548**	**73,183**	**15,342**	**31,430**	**32,552**	**96,644**	**14,774**	**7,398**	**45,292**	**19,163**	**23,633**	**657,040**

TABLE B-4
ENERGY GENERATION UNDER SETTLEMENT 749B CONDITIONS

TOTAL ENERGY GENERATION-SETTLEMENT 749B CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	6,478	12,603	5,355	22,415	21,118	15,938	2,935	5,585	5,749	17,384	2,732	1,463	8,083	3,307	4,555	135,701
February	4,771	9,969	4,360	18,596	17,314	13,090	2,445	4,633	4,700	14,357	2,309	1,293	6,963	3,010	4,106	111,916
March	4,492	9,604	5,802	24,100	23,215	16,891	3,123	6,071	6,327	18,834	2,905	1,102	9,012	3,322	3,973	138,773
April	5,219	9,043	7,150	30,954	32,709	22,666	3,925	8,225	9,001	24,986	3,490	1,030	11,402	3,239	4,014	177,051
May	9,062	14,510	6,508	28,688	29,889	21,068	3,577	7,530	8,194	23,066	3,250	1,215	10,537	3,324	4,206	174,626
June	5,402	7,659	3,881	18,061	17,328	12,966	2,271	4,540	4,626	13,924	2,192	1,288	6,733	3,162	3,924	107,955
July	5,640	8,287	3,013	15,310	14,280	10,726	1,876	3,792	3,745	11,494	1,848	1,166	5,527	3,168	3,469	93,340
August	4,933	7,411	2,623	13,874	12,671	9,587	1,699	3,408	3,283	10,250	1,700	1,126	4,991	3,155	3,259	83,971
September	4,144	6,307	2,457	13,279	12,196	9,216	1,519	3,268	3,157	9,836	1,609	1,069	4,812	3,022	3,215	79,106
October	4,856	7,679	3,480	16,898	15,893	11,945	1,922	4,178	4,181	12,765	2,015	1,222	6,142	3,204	3,763	100,144
November	7,048	11,969	5,500	23,403	22,361	16,862	2,885	5,788	6,051	18,098	2,748	1,428	8,214	3,187	4,396	139,938
December	8,166	14,821	6,279	25,613	24,380	18,373	3,289	6,299	6,567	19,725	3,040	1,540	8,858	3,322	4,774	155,043
Annual	**70,210**	**119,863**	**56,408**	**251,191**	**243,353**	**179,327**	**31,465**	**63,317**	**65,582**	**194,718**	**29,839**	**14,942**	**91,275**	**38,422**	**47,652**	**1,497,564**

PEAK ENERGY GENERATION-SETTLEMENT 749B CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	3,996	8,651	3,196	11,207	13,402	9,429	1,505	2,810	2,892	8,745	1,376	737	4,071	1,657	2,288	75,962
February	3,057	6,944	2,641	9,294	11,398	8,088	1,264	2,335	2,370	7,236	1,166	653	3,512	1,510	2,064	63,531
March	2,991	6,842	3,333	12,058	13,890	9,903	1,595	3,047	3,176	9,456	1,460	554	4,528	1,664	1,991	76,488
April	3,070	5,430	3,676	15,469	16,979	11,698	1,965	4,111	4,499	12,489	1,744	515	5,698	1,619	2,006	90,969
May	5,210	8,460	3,445	14,371	16,447	10,976	1,814	3,777	4,111	11,572	1,631	609	5,283	1,663	2,109	91,477
June	3,907	5,546	2,488	9,028	12,197	7,765	1,196	2,285	2,328	7,009	1,107	650	3,391	1,588	1,983	62,468
July	4,374	6,413	2,026	7,659	11,094	7,054	1,027	1,932	1,911	5,860	946	595	2,812	1,599	1,770	57,072
August	4,073	6,133	1,877	6,943	10,547	6,543	942	1,742	1,682	5,244	873	575	2,549	1,595	1,667	52,987
September	3,388	5,224	1,698	6,646	9,917	6,206	845	1,665	1,612	5,016	824	545	2,454	1,527	1,644	49,213
October	3,540	5,846	2,180	8,444	11,278	7,398	1,042	2,105	2,107	6,432	1,018	617	3,099	1,612	1,901	58,619
November	4,632	8,708	3,233	11,697	13,809	9,414	1,479	2,900	3,032	9,068	1,378	717	4,123	1,597	2,207	77,994
December	4,888	10,134	3,663	12,826	14,658	10,388	1,674	3,163	3,299	9,906	1,528	774	4,455	1,664	2,397	85,418
Annual	**47,124**	**84,331**	**33,457**	**125,643**	**155,617**	**104,863**	**16,351**	**31,873**	**33,020**	**98,032**	**15,052**	**7,541**	**45,974**	**19,295**	**24,026**	**842,198**

OFF-PEAK ENERGY GENERATION-SETTLEMENT 749B CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	2,482	3,953	2,159	11,208	7,715	6,509	1,429	2,776	2,856	8,639	1,356	726	4,012	1,650	2,267	59,739
February	1,715	3,025	1,719	9,302	5,916	5,002	1,180	2,298	2,330	7,121	1,143	640	3,451	1,500	2,042	48,385
March	1,501	2,762	2,469	12,042	9,325	6,988	1,528	3,023	3,152	9,378	1,445	548	4,484	1,658	1,981	62,285
April	2,148	3,613	3,473	15,485	15,729	10,968	1,959	4,114	4,502	12,497	1,746	515	5,703	1,620	2,008	86,082
May	3,852	6,051	3,062	14,317	13,442	10,093	1,764	3,753	4,083	11,495	1,619	606	5,255	1,661	2,098	83,149
June	1,496	2,113	1,393	9,033	5,130	5,200	1,075	2,255	2,298	6,915	1,085	638	3,342	1,573	1,940	45,487
July	1,266	1,874	987	7,650	3,186	3,672	849	1,860	1,834	5,634	901	572	2,715	1,568	1,699	36,268
August	860	1,277	746	6,931	2,124	3,044	757	1,666	1,601	5,006	826	551	2,442	1,560	1,592	30,984
September	756	1,083	760	6,633	2,279	3,010	673	1,603	1,545	4,820	785	524	2,358	1,495	1,571	29,894
October	1,316	1,833	1,300	8,455	4,615	4,546	879	2,074	2,074	6,333	997	605	3,044	1,592	1,861	41,525
November	2,416	3,261	2,267	11,707	8,552	7,448	1,405	2,888	3,019	9,030	1,370	711	4,092	1,590	2,189	61,944
December	3,278	4,687	2,616	12,786	9,721	7,984	1,615	3,136	3,268	9,819	1,512	766	4,403	1,657	2,377	69,625
Annual	**23,086**	**35,532**	**22,952**	**125,548**	**87,736**	**74,464**	**15,114**	**31,444**	**32,563**	**96,687**	**14,786**	**7,401**	**45,300**	**19,127**	**23,626**	**655,366**

TABLE B-5
ENERGY GENERATION UNDER SETTLEMENT 750 CONDITIONS

TOTAL ENERGY GENERATION-SETTLEMENT 750 CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	6,346	12,231	5,243	22,113	20,830	15,719	2,879	5,512	5,669	17,150	2,690	1,448	8,015	3,302	4,538	133,685
February	4,562	9,290	4,152	18,025	16,780	12,689	2,336	4,498	4,554	13,923	2,236	1,270	6,835	3,001	4,080	108,231
March	4,493	9,346	5,696	23,846	22,992	16,721	3,068	6,012	6,267	18,641	2,869	1,093	8,957	3,318	3,963	137,283
April	5,475	9,531	7,136	31,009	32,797	22,745	3,929	8,250	9,033	25,047	3,492	1,029	11,423	3,239	4,015	178,151
May	9,170	14,764	6,522	28,774	29,994	21,150	3,581	7,557	8,228	23,143	3,257	1,215	10,563	3,322	4,209	175,449
June	5,400	7,648	3,876	18,043	17,319	12,967	2,258	4,537	4,624	13,917	2,190	1,286	6,731	3,158	3,922	107,874
July	5,653	8,305	3,011	15,305	14,298	10,748	1,876	3,798	3,751	11,506	1,850	1,168	5,532	3,170	3,471	93,442
August	4,932	7,405	2,621	13,869	12,667	9,585	1,701	3,407	3,282	10,248	1,699	1,126	4,991	3,154	3,258	83,946
September	4,108	6,227	2,433	13,213	12,134	9,185	1,486	3,254	3,143	9,793	1,602	1,065	4,800	3,013	3,209	78,664
October	4,857	7,662	3,472	16,879	15,875	11,954	1,879	4,167	4,173	12,736	2,010	1,217	6,134	3,188	3,756	99,960
November	7,099	12,055	5,523	23,478	22,432	16,922	2,886	5,804	6,070	18,151	2,757	1,429	8,230	3,182	4,399	140,419
December	8,188	14,861	6,291	25,644	24,410	18,398	3,295	6,307	6,575	19,749	3,044	1,541	8,866	3,323	4,776	155,268
Annual	**70,285**	**119,326**	**55,977**	**250,196**	**242,527**	**178,782**	**31,176**	**63,104**	**65,369**	**194,004**	**29,697**	**14,888**	**91,074**	**38,371**	**47,597**	**1,492,372**

PEAK ENERGY GENERATION-SETTLEMENT 750 CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	3,904	8,385	3,112	11,053	13,214	9,337	1,478	2,772	2,852	8,627	1,355	729	4,036	1,655	2,280	74,790
February	2,935	6,496	2,503	9,009	11,107	7,877	1,210	2,267	2,296	7,017	1,129	641	3,448	1,506	2,051	61,491
March	3,000	6,660	3,261	11,931	13,767	9,796	1,568	3,018	3,146	9,361	1,442	550	4,500	1,662	1,987	75,649
April	3,192	5,673	3,664	15,501	17,032	11,703	1,968	4,125	4,517	12,524	1,745	515	5,710	1,619	2,007	91,495
May	5,264	8,584	3,443	14,416	16,473	10,990	1,813	3,791	4,129	11,612	1,635	609	5,296	1,662	2,110	91,827
June	3,901	5,532	2,481	9,019	12,177	7,718	1,186	2,284	2,327	7,005	1,106	649	3,389	1,586	1,982	62,342
July	4,384	6,427	2,026	7,656	11,109	7,059	1,027	1,935	1,914	5,866	947	596	2,814	1,600	1,771	57,131
August	4,073	6,129	1,876	6,941	10,542	6,531	944	1,742	1,682	5,243	873	575	2,549	1,594	1,667	52,960
September	3,358	5,156	1,677	6,613	9,852	6,072	819	1,657	1,604	4,992	820	543	2,447	1,522	1,640	48,773
October	3,536	5,824	2,167	8,438	11,220	7,232	1,001	2,099	2,103	6,417	1,015	614	3,094	1,603	1,897	58,262
November	4,666	8,771	3,250	11,734	13,839	9,398	1,472	2,908	3,041	9,093	1,382	717	4,130	1,594	2,209	78,204
December	4,905	10,166	3,674	12,843	14,685	10,388	1,674	3,168	3,303	9,919	1,530	775	4,459	1,665	2,398	85,552
Annual	**47,118**	**83,803**	**33,134**	**125,156**	**155,017**	**104,101**	**16,160**	**31,766**	**32,914**	**97,674**	**14,981**	**7,513**	**45,874**	**19,268**	**23,998**	**838,475**

OFF-PEAK ENERGY GENERATION-SETTLEMENT 750 CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	2,442	3,846	2,131	11,060	7,616	6,381	1,401	2,739	2,817	8,524	1,335	718	3,978	1,647	2,259	58,895
February	1,626	2,794	1,650	9,016	5,673	4,812	1,125	2,231	2,258	6,906	1,107	629	3,387	1,496	2,030	46,739
March	1,493	2,686	2,435	11,915	9,225	6,925	1,500	2,994	3,121	9,281	1,427	544	4,457	1,656	1,977	61,634
April	2,284	3,858	3,472	15,507	15,765	11,042	1,961	4,125	4,516	12,523	1,746	515	5,713	1,620	2,008	86,656
May	3,906	6,180	3,079	14,358	13,521	10,160	1,768	3,766	4,099	11,531	1,622	606	5,267	1,660	2,099	83,623
June	1,499	2,116	1,395	9,023	5,142	5,249	1,072	2,254	2,297	6,912	1,084	637	3,341	1,572	1,939	45,532
July	1,269	1,878	985	7,649	3,188	3,689	849	1,863	1,837	5,641	903	573	2,717	1,570	1,700	36,312
August	860	1,276	745	6,928	2,125	3,054	758	1,665	1,600	5,004	826	551	2,441	1,560	1,592	30,986
September	750	1,071	756	6,600	2,282	3,113	667	1,596	1,539	4,801	782	522	2,353	1,491	1,569	29,891
October	1,321	1,838	1,305	8,442	4,655	4,722	878	2,068	2,070	6,319	995	602	3,040	1,585	1,858	41,698
November	2,433	3,285	2,273	11,744	8,592	7,525	1,414	2,897	3,029	9,058	1,375	712	4,100	1,588	2,191	62,215
December	3,283	4,696	2,617	12,800	9,726	8,009	1,621	3,139	3,272	9,830	1,514	767	4,407	1,658	2,378	69,716
Annual	**23,167**	**35,522**	**22,843**	**125,041**	**87,509**	**74,682**	**15,015**	**31,338**	**32,455**	**96,330**	**14,716**	**7,375**	**45,200**	**19,103**	**23,600**	**653,896**

TABLE B-6
ENERGY GENERATION UNDER RUN-OF-RIVER CONDITIONS

TOTAL ENERGY GENERATION-ROR CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	3,349	5,077	3,531	16,632	15,999	11,865	2,084	4,278	4,291	13,016	2,109	1,294	6,825	3,202	4,313	97,863
February	2,392	3,577	2,871	13,980	13,323	9,961	1,721	3,601	3,572	10,944	1,807	1,159	5,972	2,925	3,920	81,723
March	6,709	11,089	4,827	21,948	21,918	15,560	2,823	5,740	5,966	17,334	2,655	1,035	8,595	3,285	3,840	133,325
April	12,772	22,578	6,629	30,951	33,241	22,715	4,068	8,498	9,181	25,026	3,501	1,009	11,447	3,238	3,972	198,827
May	7,861	12,673	6,432	27,671	28,207	19,842	3,577	7,172	7,643	21,898	3,219	1,251	10,109	3,329	4,202	165,085
June	2,670	4,027	3,384	15,605	15,319	11,374	1,913	3,987	3,993	12,210	1,956	1,188	6,216	3,009	3,765	90,615
July	1,343	2,021	1,747	9,182	9,741	6,922	901	2,378	2,306	7,475	1,151	833	4,304	2,611	2,992	55,906
August	520	743	1,157	7,138	7,724	5,416	545	1,840	1,721	5,816	894	734	3,644	2,527	2,710	43,130
September	1,144	1,729	1,531	8,909	9,124	6,568	768	2,254	2,166	6,954	1,079	806	3,945	2,603	2,849	52,429
October	2,617	3,978	2,679	13,317	13,291	9,723	1,438	3,373	3,362	10,325	1,618	1,052	5,444	2,948	3,523	78,690
November	5,381	8,256	4,491	19,715	19,341	14,185	2,447	4,949	5,105	15,217	2,367	1,315	7,402	3,099	4,226	117,497
December	4,403	6,710	4,256	19,087	18,438	13,702	2,428	4,814	4,883	14,687	2,359	1,374	7,411	3,246	4,535	112,334
Annual	51,163	82,458	43,534	204,135	205,665	147,832	24,713	52,883	54,189	160,903	24,715	13,051	81,315	36,023	44,846	1,227,424

PEAK ENERGY GENERATION-ROR CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	2,309	3,799	2,383	9,263	12,022	7,750	1,159	2,415	2,477	7,288	1,114	563	3,483	1,604	1,940	59,569
February	1,776	2,862	2,009	7,710	10,135	6,502	965	2,001	2,046	6,099	939	504	3,064	1,467	1,722	49,801
March	2,027	3,281	2,059	8,085	10,687	6,839	1,003	2,113	2,161	6,446	989	540	3,350	1,646	1,879	53,105
April	2,178	3,565	2,173	8,496	11,083	7,061	1,051	2,212	2,264	6,695	1,038	555	3,447	1,619	1,913	55,348
May	2,356	3,786	2,415	9,137	11,819	7,585	1,149	2,373	2,437	7,204	1,117	594	3,714	1,665	2,016	59,366
June	1,976	3,191	1,965	7,745	10,215	6,579	942	2,027	2,070	6,173	951	529	3,248	1,511	1,825	50,947
July	1,643	2,643	1,772	7,159	9,736	6,107	841	1,868	1,891	5,708	878	501	3,036	1,315	1,755	46,853
August	1,802	2,836	2,017	7,744	10,466	6,633	955	2,015	2,037	6,150	963	538	3,192	1,276	1,892	50,515
September	2,883	4,700	2,708	10,357	12,762	8,426	1,334	2,707	2,825	8,221	1,247	619	4,145	1,315	2,100	66,350
October	2,136	3,414	2,253	8,488	11,119	7,146	1,073	2,216	2,275	6,769	1,029	516	3,297	1,482	1,817	55,032
November	2,083	3,309	2,319	8,654	11,257	7,208	1,095	2,236	2,292	6,818	1,053	541	3,288	1,554	1,809	55,518
December	2,420	3,840	2,513	9,248	11,891	7,643	1,189	2,392	2,463	7,305	1,127	578	3,655	1,629	1,931	59,823
Annual	25,588	41,228	26,588	102,087	133,192	85,478	12,757	26,575	27,237	80,877	12,444	6,578	40,919	18,082	22,599	662,229

OFF-PEAK ENERGY GENERATION-ROR CONDITIONS

	Sacandaga	Stewarts Bridge	Curtis	Palmer Falls	Spier Falls	Sherman	Feeder Dam	Finch Pruyn	South Glen Falls	Hudson Falls	Fort Miller	Stillwater	Upper Mechanicville	Lower Mechanicville	Green Island	All Projects
January	1,041	1,278	1,148	7,369	3,977	4,115	925	1,863	1,814	5,728	995	731	3,341	1,597	2,373	38,293
February	615	715	861	6,270	3,188	3,459	756	1,600	1,526	4,845	868	655	2,907	1,458	2,198	31,922
March	4,682	7,808	2,767	13,864	11,231	8,722	1,820	3,627	3,805	10,888	1,666	495	5,245	1,639	1,961	80,220
April	10,594	19,013	4,456	22,456	22,158	15,654	3,017	6,285	6,917	18,331	2,463	454	8,001	1,620	2,060	143,479
May	5,505	8,887	4,017	18,534	16,388	12,257	2,427	4,799	5,206	14,695	2,102	657	6,395	1,665	2,186	105,720
June	694	836	1,419	7,860	5,103	4,794	971	1,960	1,924	6,037	1,005	658	2,969	1,498	1,940	39,668
July	(299)	(623)	(25)	2,022	5	815	60	510	415	1,767	273	332	1,268	1,296	1,237	9,052
August	(1,281)	(2,093)	(860)	(606)	(2,742)	(1,216)	(410)	(175)	(316)	(334)	(69)	196	452	1,251	818	(7,385)
September	(1,739)	(2,971)	(1,178)	(1,449)	(3,638)	(1,858)	(566)	(453)	(658)	(1,267)	(169)	187	(200)	1,288	749	(13,921)
October	482	564	426	4,829	2,172	2,576	365	1,157	1,087	3,556	589	536	2,147	1,466	1,706	23,657
November	3,298	4,947	2,173	11,062	8,083	6,977	1,352	2,713	2,813	8,399	1,314	774	4,114	1,545	2,417	61,979
December	1,983	2,870	1,742	9,838	6,547	6,059	1,239	2,422	2,420	7,382	1,233	796	3,756	1,618	2,604	52,510
Annual	25,574	41,228	26,588	102,087	133,192	85,478	12,757	26,575	27,237	80,877	12,444	6,578	40,919	17,940	22,599	662,073

Appendix C-Electricity Prices

STATE OF NEW YORK
DEPARTMENT OF PUBLIC SERVICE

INTEROFFICE MEMORANDUM

June 5, 2001

TO: Directors

FROM: Office of Regulatory Economics

SUBJECT: Market Prices of Electricity: May 2001

Attached to this monthly memo are tables[8] containing recent market prices for electricity. As described below, there are two tables, Actual Price of Electricity and Price of Electric Futures, and a chart, Weekly Peak Period Energy Prices, followed by two tables, Monthly Electric Forward Prices and Annual Electric Forward Electric Prices. Note that these prices are energy prices, i.e., they do not reflect any cost of capacity or ancillary services.

Actual Price of Electricity

We report energy prices for four NYISO market zones: Western NY, Capital Region, Hudson Valley, and New York City. For comparison purposes, we also report energy prices from two of New York State's neighboring power markets, PJM and New England.

PJM Spot: The average of hourly energy prices reported by the PJM ISO for the "NY West" interconnection.

NYISO NY West: The average of hourly location based marginal price (LBMP) of energy in the NYISO Day-Ahead market for the NY West zone.

NYISO Capital: The average of hourly LBMP of energy in the NYISO Day-Ahead market for the NY Capital zone.

NYISO Hudson: The average of hourly LBMP of energy in the NYISO Day-Ahead market for the Hudson Valley zone.

NYISO NYC: The average of hourly LBMP of energy in the NYISO Day-Ahead market for New York City zone.

NEPOOL Market: The average of hourly energy prices reported by the New England ISO.

[8]All of the prices in the above memo and the attached tables are simple averages for the respective periods. That is, they represent the price per MWH a 100% load factor wholesale buyer would pay (ignoring applicable losses, ancillary services and other uplift). A typical customer that demands more on peak than off peak would pay a higher average price. More detailed data are available for anyone who wishes to price out a different load shape.

Prices of Electric Futures

The New York Mercantile Exchange (NYMEX) facilitates the trading of a few standardized futures contracts for the 5x16 peak period (Monday through Friday, 16 hours per day) for future months and reports the results of these trades. Because off-peak prices do not vary much, we also calculate an "around the clock" (ATC) average energy price for PJM by including the previous 12 months of off-peak actual prices (as a rough forecast of future off-peak prices) in this ATC average. The tables reflect the settlement price on the last trading day of the latest month.

PJM: The PJM service area includes all or part of Pennsylvania, New Jersey, Maryland, Delaware, Virginia and the District of Columbia.

Cinergy: The Cinergy system is in central and southern Indiana, southwestern Ohio, and northern Kentucky.

Entergy: The Entergy transmission system is in Louisiana, Arkansas, Mississippi, and Texas.

Weekly Peak Period Energy Prices

The graph shows the weekly average of the peak period prices for the last eight weeks for the five markets described in the above section, except the Hudson Valley zone.

Monthly and Annual Electric Forward Prices

Natsource, Inc. facilitates the trading of standardized forward contracts for the 5x16 peak period (Monday through Friday, 16 hours per day) and for the 5x8, 2x24 off-peak period (Monday through Friday, 8 hours per day and Saturday through Sunday, 24 hours per day). The tables reflect the average of daily bid and ask prices for the month.

Attachment

Actual Price of Electricity - Energy Market

Office of Regulatory Economics

(unit in $/mWh)

Month	*On Peak*							*Around the Clock*						
	PJMNY	*WEST*	*CAPITAL*	*HUDSON*	*NYC*	*NE ISO*	*Hours*	*PJMNY*	*WEST*	*CAPITAL*	*HUDSON*	*NYC*	*NE ISO*	*Hours*
2000.05	41.87	38.39	49.59	50.54	52.34	123.69	352	28.64	29.12	40.36	39.97	41.83	72.78	744
2000.06	29.95	47.41	96.37	92.86	95.86	47.74	352	24.51	35.69	65.86	64.03	67.11	39.45	720
2000.07	34.02	36.04	61.69	62.12	64.44	44.83	336	23.96	27.21	44.94	44.81	47.16	37.14	744
2000.08	41.20	46.07	70.67	75.61	79.44	50.02	368	29.28	34.64	51.66	54.67	58.73	42.23	744
2000.09	34.55	46.45	56.72	56.33	61.12	48.60	336	27.20	38.71	46.01	46.11	50.17	43.15	720
2000.10	43.64	51.58	60.80	60.73	63.90	55.94	352	31.61	44.67	52.68	51.86	54.83	50.33	744
2000.11	44.69	46.42	58.47	58.60	60.57	52.59	336	32.93	42.33	52.46	52.35	53.68	49.30	720
2000.12	58.79	60.98	69.79	72.05	79.43	70.13	320	46.71	50.32	58.12	59.24	64.44	62.59	744
2001.01	47.03	52.02	66.57	66.53	69.18	69.64	352	37.40	44.97	55.93	55.91	57.72	62.69	744
2001.02	38.63	39.40	49.82	49.48	55.03	47.74	320	31.55	34.24	43.26	42.59	46.09	43.01	672
2001.03	43.85	44.91	56.61	58.02	61.07	56.24	352	35.63	38.20	47.64	47.65	52.40	50.18	744
2001.04	46.41	46.73	53.47	55.60	67.62	44.67	336	34.82	37.35	43.13	44.07	51.71	36.29	720
2001.05	41.25	44.30	53.43	58.43	64.56	51.70	352	31.28	36.27	44.85	47.26	51.27	41.28	744
Twelve-M	42.00	46.86	62.87	63.86	68.52	53.32	343	32.24	38.71	50.54	50.88	54.61	46.47	730

Appendix D-Upper Hudson River Preliminary Flood Impact Economic Analysis
August 2002

UPPER HUDSON RIVER
PRELIMINARY FLOOD IMPACT ECONOMIC ANALYSIS

(AUGUST 2002)

PURPOSE

The purpose of this study was to make a preliminary determination of the economic impact of the Hudson River's flood waters on the surrounding areas within Saratoga, Warren, Washington, Rensselaer, and Albany counties. The flood events studied included the 100 year event (1% annual chance flood) with the influence of the Great Sacandaga Lake and the 100 year event without the influence of the Great Sacandaga Lake.

STUDY AREA

The study area included a stretch of the Hudson River beginning at Lake Luzerne, in the towns of Hadley and Lake Luzerne, NY; and ending just south of the Dunn Memorial Bridge in the cities of Albany and Rensselaer, NY (see Figure 1.) The total length of the Hudson River studied was 131,162 meters, or approximate 81.5 miles. Fifteen sites along this stretch of the river provided flow data in cubic feet per second, and elevations in feet.

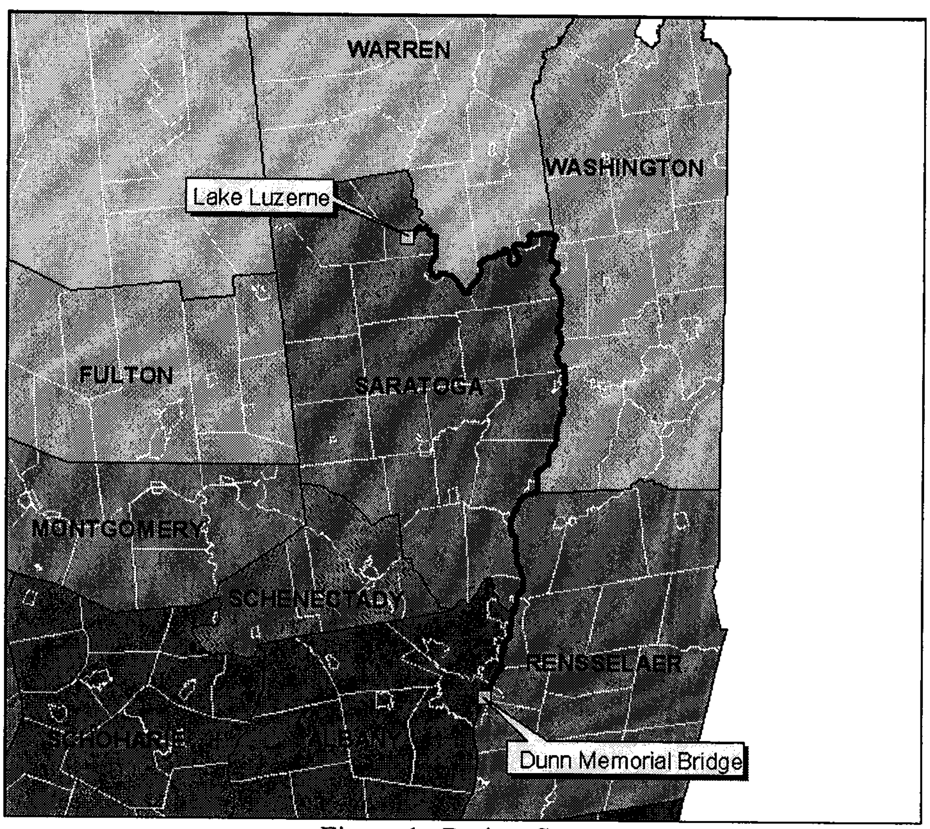

Figure 1. Project Scope

SOFTWARE

The majority of the analysis performed in this study was done using geographic information systems (GIS) software. Specifically, ESRI©'s ArcView v.3.2 software package was used, with the addition of ESRI©'s Spatial Analyst v.1.1 extension. Digital data for this study can be found in one of the following formats: ArcView shapefile; ESRI© Grid; or MrSID image.

DATA

A variety of pre-existing and newly developed data sets were used in this study. Below is a list of those data sets, with a description of their development and usage. The projection used in this study was Universal Transverse Mercator (UTM) zone 18. The horizontal datum was NAD83, GRS80 spheroid.

Color Balanced Ortho-imagery

The ortho-imagery depicts ground conditions as shown on aerial imagery taken within the period 1994 through 1999. The original digital ortho-imagery was produced under the federal Digital Ortho-Photography Quarter Quadrangle Program and New York State Department of Environmental Conservation. Department of State enhanced the ortho-imagery as part of New York State's Y2K preparedness planning effort. The imagery was used as the base map.

For more information: http://www.nysgis.state.ny.us/gis3/data/dos.doqq_orthos.html

Hudson River Hydrography

The source of this data was the 1:24000 statewide hydrography. The hydrography is a single line representing the channel. The data was manually modified to align with the ortho-imagery. After cleaning the channel's topology, left and right banks were calculated, along with a perimeter. These data sets were used in both the GIS and Engineering Methodologies for determining the flood extents. These methodologies are described later in this report.

10 meter Digital Elevation Models (DEMs)

A DEM is a collection of data that consist of points arrayed in a grid over a particular geographic extent. Each point in a DEM will always contain an X, Y, and Z value. The 10 meter DEMs are at a scale of 1:24000 and have a horizontal spacing of 10 meters, and a vertical accuracy (for the study area) of approximately +/- 2 meters(+/- 6 feet).

The10 meter digital elevation models were joined together to form one elevation model for the entire study area. A hillshade model was calculated from the elevation model. The elevation data was used in determining the flood extents.

Office of Real Property Parcel Centroids

This data set contains point features and attributes for real property tax parcels by county. These points represent the visual center of the parcel on a tax map. The points and associated attributes were extracted from local government assessment rolls. The data is developed by local governments for assessing real property tax parcels. The points represent a spatial address that can be used for mapping and analysis. Although the data is developed for the purpose of real property tax administration, the ability to map parcel centroids along with the associated assessment information creates the opportunity to use the data for many other purposes.

For more information: http://www.nysgis.state.ny.us/gis3/data/orps.rpsdata00.html

The data used for the study was for the year 2000. There were 6,655 parcel centroids in the general study area. From these centroids, there were 119 unique property classifications. It was necessary to reclassify the data in order to simplify it for the economic analysis. The final classifications used in the study included:

- Single story, residential
- Split level, residential
- Two story, residential
- Mobile, residential
- Commercial
- Converted residence
- Warehouse
- Agriculture

Additional fields were added to the database to facilitate the re-classification.

The ORPS centroids acted as the main input for the economic analysis. The data set contains a field with a dollar value, determined by the municipality, for the land and for the land and structure. From these two fields, a third was added, representing strictly the structure value. Figure 2 is a graphical representation of the spatial distribution of the structure value of all those properties included in the flood extents.

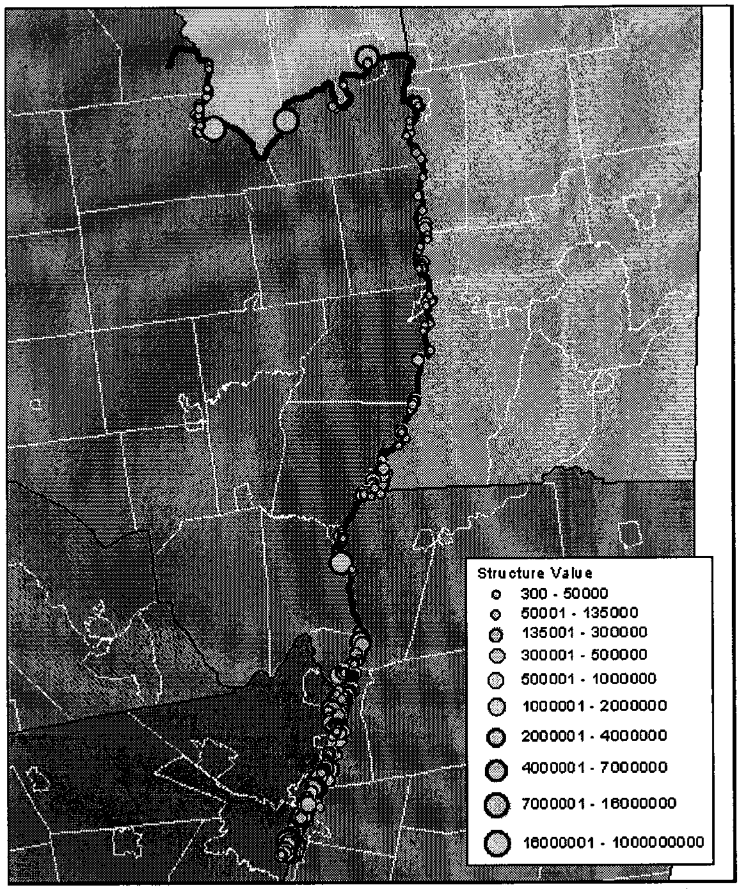

Figure 2. Structure Values in Flood Extent

It is important to note that the centroids were not spatially corrected to represent the location of the structure. There may be cases where a property was included in the study, but the structure that resides on that property actually fell outside the flood extent. Alternatively, there may be cases where a property was excluded from the study, but the structure that resides on that property actually fell inside the flood extent.

Dams

The fifteen dams used in the study were extracted from NY State Department of Environmental Conservation's Water Division, Dam Safety section's statewide dam database. The dams were then spatially re-oriented to match the ortho-imagery and the DEMs.

FLOOD EXTENT DETERMINATION

Two flood extents were calculated for the study area. The first was the 100 year flood event (1% annual chance flood) with the influence of the Great Sacandaga Lake and the 100 year event without the influence of the Great Sacandaga Lake.

Table 1 shows the discharge and elevation data used for the 100 year flood event with and without Great Sacandaga Lake provided by the District for the flood extent determination. Flood discharges and elevations for the 100 year event for with and without Great Sacandaga Lake were predicted from the HEC5P operations model developed by the District.

Table 1
Discharge and Elevation Data at each Dam

DAM	Drainage Area (sq.mi.)	With Great Sacandaga Lake (Settlement 750) Z50_FLOW Flow (cfs)	Z50_ELEV Elev.(ft.)	Without Great Sacandaga Lake (Run-of-River) ROR_FLOW Flow (cfs)	ROR_ELEV Elev.(ft.)
Hadley (Lake Luzerne)	2719	44661		75889	
Curtis (Corinth)	2760	45568	553.37	76749	555.37
Palmer Falls (Corinth)	2760	45568	531.94	76749	536.38
Spiers Falls	2779	45585	443.38	76749	446.76
Sherman	2810	46019	359.36	77352	362.31
Feeder Dam	2811	45983	291.59	77312	295.1
South Glens Falls/ Finch Pruyn	2807	45967	274.38	77296	277.02
Hudson Falls	2821	46180	213.34	77513	216.52
Fort Miller	2980	48609	121.74	80029	124.72
Stillwater (Stillwater)	3773	60046	89.46	91963	92.02
Upper Mechanicville	4500	71976	81.68	103283	84.61
Lower Mechanicville	4572	73233	53.86	104381	55.90
Waterford	4611	73922	35.35	104980	37.62
Green Island (Troy)	8090	152901	27.94	192829	30.33
Albany Estuary (estimate)	0	0	20.1	0	22.2

Both flood extents were calculated using the following **GIS Methodology**. This methodology consisted of using the change in elevation values to fill the DEM.

1. Map panels were created for each one of the dam sites. Each map panel would contain the dam, and extend upstream to just beyond the next dam. (Figure 3.)

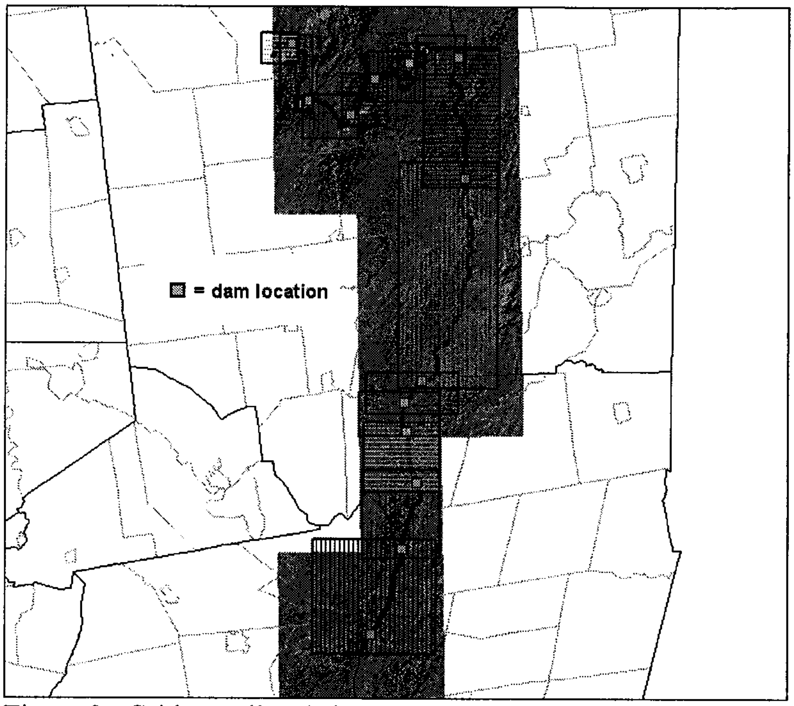

Figure 3. Grid Paneling Scheme

2. Using the panels, individual elevation grids were extracted from the master merged grid.
3. For each dam, the normal surface water elevation was calculated and populated into the [ELEVFT] field. This value was then subtracted from the surface water elevations in the [Z50_FLOW] and [ROR_FLOW] field. The results were converted to meters, and stored in the [Z50_DIF_M] and [ROR_DIF_M] fields.
4. For each elevation grid extract made in step 3., two grid-filling operations were performed. One for each value in ([Z50_DIF_M] + [ADDMETER]) and ([ROR_DIF_M] + [ADDMETER]). The [ADDMETER] field represents the +/- 2 meter vertical accuracy of the 10 meter DEM. An optimal value was chosen from this range to reflect the real world elevation. The programming code used to fill the grid can be found in Appendix II of this study.
5. The grid filling output for each panel of a particular flood event was merged together. The end product was two polygon flood extents, one for With Great Sacandaga Lake and one for Without Great Sacandaga Lake.
6. To clean the flood extents they were buffered out by 300 feet and then back in by 300 feet. For a more involved discussion on the buffering technique, see Appendix III.

FLOOD EXTENT DETERMINATION METHODOLOGY QUALITY ASSURANCE

Approximately 40 miles of river was studied using a standard **engineering backwater methodology**. The purpose of this analysis was to use the output flood extent data as a quality assurance for the above described GIS Methodology.

The flood extents were developed using the Army Corps of Engineer's HEC – RAS (River Analysis System) v.2.2 software package. The modeling parameter and geometry were derived using GIS techniques and data sets. Cross section elevations were extracted from the 10 meter DEMs. The spacing between each cross section was set to 600 feet. Roughness factors (Manning's 'n') used in the model were obtained using semi-automated methods supported by GIS techniques. The 30 meter multi-resolution land cover (MRLC) data produced by EPA was used to estimate the roughness factors for the over-bank areas of the floodplain. The discharge values for each dam along the river are shown in Table 1. The effects of hydraulic obstructions, such as bridges and culverts, along the stream were not taken into consideration due to a lack of structure data.

The output of the engineering backwater methodology was compared to the output of the GIS methodology for the With Great Sacandaga Lake. For each extent, any area that exceeded that of the other extent was extracted. These two extractions were merged into one polygon. The extents themselves were then merged into a single polygon. The merged flood extent's total square miles was equal to 1.86709. The merged exceeding data's total square miles was equal to 0.24716. 86.77% of the flood extent area calculated using both methodologies was shared, while 13.23% was not. See Figure 4.

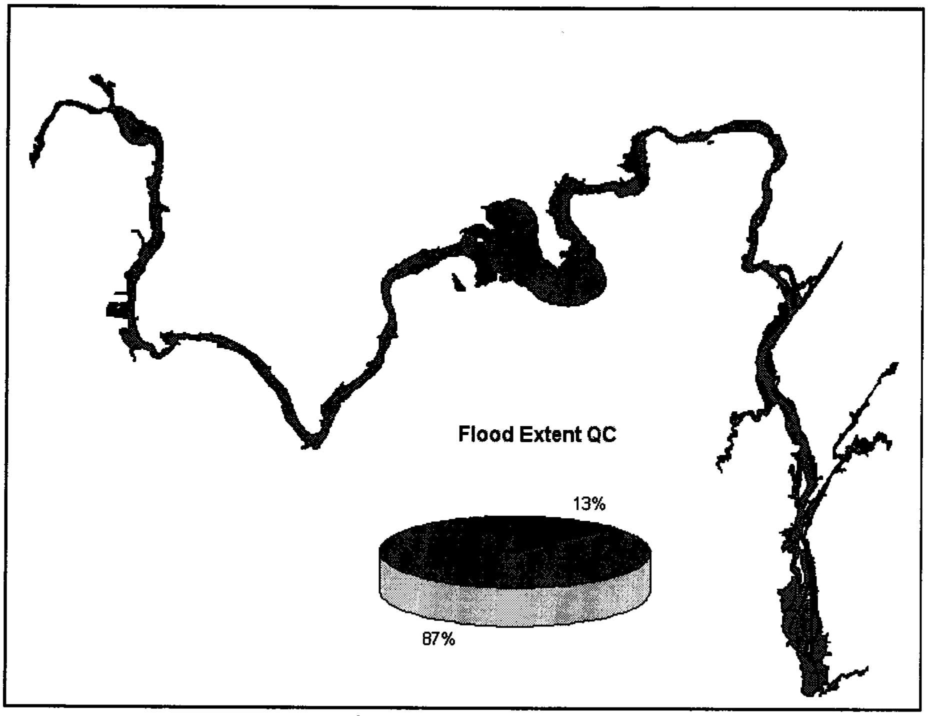

Figure 4. QC Output

ECONOMIC ANALYSIS

The economic analysis was performed in two parts. The first part consisted of applying a **structure** damage percentage to the structure value of all properties that fell within the flood extents. The second part consisted of applying a **content** damage percentage to the structure value of *only* residential properties that fell within the flood extents.

For the case With Great Sacandaga Lake, all properties that fell within the flood extent were assumed to have an average flood depth of 2 feet. For the case Without Great Sacandaga Lake, all properties that fell within the With Great Sacandaga Lake flood extent were assumed to have an average flood depth of 4 feet. The remaining properties that fell outside the With Great Sacandaga Lake extent but within the Without Great Sacandaga extent were assumed to have a flood depth value of 2 feet.

The flood depth percentages used came from a study done by the Army Corps of Engineers, Institute for Water Resources, titled *Depth-Damage Functions for Corps of Engineers Flood Damage Reduction Studies* (2001). The depth damage percentages in that study were statistically validated for residential structures without basements. The following depth damage tables are from the *Depth-Damage Functions for Corps of Engineers Flood Damage Reduction Studies* (2001) report.

Table 2
Damage for One Story, No Basement

Structure Damage:

Depth	Damage	Comments
-2	0%	No structure damage.
-1	2.5%	Some damage to garage, occasional foundation damage, damage to porches and decks.
0	13.4%	Damage to floors, carpets, buckled tile, and floor molding.
1	23.3%	The first four feet of drywall need replacement and the insulation and lower cabinets are damaged. Doors need replacement.
2	32.1%	Additional cabinet damage, plumbing fixtures are damaged.
3	40.1%	Reaches the top of the cabinet level.
4	47.1%	Reaches second layer of drywall.

Content Damage:

Depth	Damage	Comments
-2	0.0%	
-1	2.4%	Some damage to items in garage, or on the porch.
0	8.1%	Rugs ruined, furniture damage begins.
1	13.3%	Appliances are damaged.
2	17.9%	Much of the furniture is damaged.
3	22.0%	Clothes in the closet are damaged.
4	25.7%	Damage to items on countertops.

Table 3
Damage for Two Story, No Basement

Structure Damage:

Depth	Damage	Comments
-2	0%	
-1	3.0%	
0	9.3%	
1	15.2%	
2	20.9%	
3	26.3%	
4	31.4%	

Content Damage:

Depth	Damage	Comments
-2	0.0%	
-1	1.0%	
0	5.0%	
1	8.7%	
2	12.2%	
3	15.5%	
4	18.5%	

Table 4
Damage for Split Level, No Basement

Structure Damage:

Depth	Damage	Comments
-2	0%	
-1	6.4%	
0	7.2%	
1	9.4%	
2	12.9%	
3	17.4%	
4	22.8%	

Content Damage:

Depth	Damage	Comments
-2	0.0%	
-1	2.2%	
0	2.9%	
1	4.7%	
2	7.5%	
3	11.1%	
4	15.3%	

The average depths used in the study take into account the fact that depth damage percentages provided by the Corps account for structures without basements. This lowers the damage estimate, since a significant number of structures within the flood extent probably have basements, particularly those that are residential. The lowered estimate is balanced by the fact that first floor elevations were not considered.

Using the classifications listed in the ORPS data discussion, the most reasonable associations between classification type and damage percentage were made.

This study's property classifications and associated flood damage percentages can be seen in the Table 5 for **structure** damage, and Table 6 for **content** damage.

Table 5
Structure Damage

Property Class	**Depth Damage Source Table (Structure)**	**2 Foot Damage %**	**4 Foot Damage %**
Single story, residential	One Story, No Basement	32.10	47.10
Split level, residential	Split Level, No Basement	12.90	22.80
Two story, residential	Two Story, No Basement	20.90	31.40
Mobile, residential	One Story, No Basement	32.10	47.10
Commercial	One Story, No Basement (minus 1 ft)*	23.30	40.10
Converted residence	One Story, No Basement	32.10	47.10
Warehouse	One Story, No Basement (minus 2 ft)*	13.40	32.10
Agriculture	One Story, No Basement (minus 2 ft)*	13.40	32.10

* the "minus *n* ft" value was an adjustment made based on the property class. For example, the One Story, No Basement depth damage source table was used for the "Commercial" property class. However, it was decided that the structural damage would not be as high as that found in an actual residential property. As such, the 2 Foot Damage Percentage used is actually the equivalent to the 1 Foot Damage Percentage found in the original One Story, No Basement depth damage source table.

Table 6
Contents Damage

Property Class	Depth Damage Source Table (Content)	2 Foot Damage %	4 Foot Damage %
Single story, residential	One Story, No Basement	17.9	25.7
Split level, residential	Split Level, No Basement	7.5	15.3
Two story, residential	Two Story, No Basement	12.2	18.5
Mobile, residential	One Story, No Basement	17.9	25.7
Commercial	One Story, No Basement (minus 1 ft)*	13.3	22
Converted residence	One Story, No Basement	17.9	25.7
Warehouse	One Story, No Basement (minus 2 ft)*	8.1	17.9
Agriculture	One Story, No Basement (minus 2 ft)*	8.1	17.9

RESULTS

Table 7 shows the number of each property type that are flooded by the 100 year event with and without Great Sacandaga Lake.

Table 7
Property Type Count Flooded by the 100 Year Event
With and Without Great Sacandaga Lake

	With Great Sacandaga Lake	Without Great Sacandaga Lake
PROPERTY TYPE	COUNT	COUNT
Two story, residential	499	499
Agriculture	0	1
Commercial	234	332
Converted residence	4	9
Mobile, residential	51	54
Single story, residential	35	79
Split level, residential	4	6
Warehouse	52	504

(See Chart 1.1 and Chart 1.2 in Appendix IV)

Structure Damage Analysis

The **structure damage** values (in dollars) to the properties listed in Table 7 were calculated for the 100 year event for With and Without Great Sacandaga Lake. They are shown in Table 8.

Table 8
Structure Property Damage for With and Without Great Sacandaga Lake
For the 100 Year Event

	With Great Sacandaga Lake	**Without Great Sacandaga Lake**
Total	$25,480,531.76	$58,526,612.51
Number of properties	874	1554
Mean value	$29,153.93	$37,661.91
Maximum value	$3,041,861.60	$5,235,135.20
Minimum value	$0.00	$0.00

Content Damage Analysis

The content damage listed in Table 9 is that to **residential** properties for the 100 year event for With and Without Great Sacandaga Lake. Content damage analysis was only calculated for residential structures. Commercial structures were not included. The contents damage due to flooding of commercial structures could be significant.

Table 9
Structure Property Damage for With and Without Great Sacandaga Lake
For the 100 Year Event

	With Great Sacandaga Lake	**Without Great Sacandaga Lake**
Total	$2,456,087.51	$3,707,816.05
Number of properties	589	1142
Mean value	$4169.93	$4,611.42
Maximum value	$59658.00	$90,465.00
Minimum value	$53.70	$77.10

Total Damage Analysis

The combined damages (structure and content) for With Great Sacandaga Lake is:

27,936,619.27 Dollars US.

The combined damages (structure and content*) for Without Great Sacandaga Lake is:

62,234,428.56 Dollars US.

The difference between the two studies is the flood protection benefit for the 100 year event of Great Sacandaga Lake and is:

34,297,809.29 Dollars US.

The computed damages resulting from the 100 year storm for run-of-river and flow regulation scenarios in the August 2002 NYSDEC report differ from those reported in June 2003 for several reasons. An additional 13 miles of stream was added to the analysis. A review of the previous analysis indicated that several commercial properties were erroneously excluded. Contents damages for commercial properties were not included previously.

A breakdown by municipality of the flood damages reported as part of the revised June 2003 analysis for the 2, 10, 50, and 100 year events is shown on the following pages.

2 Year Flood-Flow Regulation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	41	$2,299,441	$1,385,829	$3,685,270
City of Cohoes	17	$154,277	$90,943	$245,220
City of Mechanicville	20	$339,151	$195,080	$534,231
City of Rensselaer	80	$497,945	$293,986	$791,931
City of Troy	52	$313,991	$184,553	$498,543
City of Watervliet	1	$13,899	$8,113	$22,012
Town of Bethlehem	12	$34,292,398	$20,724,503	$55,016,901
Town of Coeymans	16	$260,657	$153,781	$414,437
Town of Colonie	1	$16,590	$10,028	$26,619
Town of Corinth	21	$120,873	$69,392	$190,265
Town of East Greenbush	18	$715,204	$430,517	$1,145,722
Town of Easton	19	$5,184	$2,911	$8,095
Town of Fort Edward	3	$8,769	$5,118	$13,887
Town of Greenwich	8	$100,557	$58,509	$159,066
Town of Hadley	13	$213,181	$118,876	$332,057
Town of Halfmoon	5	$1,050,952	$634,468	$1,685,420
Town of Moreau	42	$233,589	$131,859	$365,448
Town of New Baltimore	7	$282,767	$167,336	$450,103
Town of North Greenbush	2	$16,201	$9,457	$25,659
Town of Northumberland	1	$0	$0	$0
Town of Queensbury	35	$395,237	$224,349	$619,585
Town of Saratoga	21	$272,246	$153,966	$426,213
Town of Schaghticoke	47	$309,090	$177,446	$486,536
Town of Schodack	42	$204,865	$120,282	$325,147
Town of Stillwater	22	$404,380	$231,792	$636,172
Town of Stuyvesant	3	$0	$0	$0
Town of Waterford	3	$42,972	$24,090	$67,062
Village o Castleton-on-Hudson	9	$1,360,458	$821,352	$2,181,810
Village of Corinth	5	$2,919,679	$1,764,546	$4,684,225
Village of Green Island	1	$1,193	$697	$1,890
Village of Hudson Falls	1	$0	$0	$0
Village of Menands	2	$31,623	$19,115	$50,738
Village of Schuylerville	17	$624,648	$369,073	$993,721
Village of South Glens Falls	3	$1,397,804	$844,941	$2,242,745
Village of Stillwater	138	$3,838,505	$2,241,352	$6,079,856
SUM	728	$52,738,324	$31,668,264	$84,406,588

2 Year Flood-Run of River Operation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	83	$9,283,200	$3,761,134	$13,044,334
City of Cohoes	26	$337,972	$134,176	$472,148
City of Mechanicville	19	$517,872	$206,357	$724,229
City of Rensselaer	173	$1,391,113	$555,312	$1,946,425
City of Troy	156	$1,029,396	$468,270	$1,497,666
City of Watervliet	1	$20,882	$8,113	$28,995
Town of Bethlehem	26	$82,856,563	$21,250,010	$104,106,574
Town of Coeymans	22	$530,096	$194,065	$724,161
Town of Colonie	1	$39,742	$10,028	$49,771
Town of Corinth	22	$189,151	$71,501	$260,652
Town of East Greenbush	19	$1,716,000	$463,232	$2,179,232
Town of Easton	19	$8,021	$2,911	$10,932
Town of Fort Edward	3	$17,392	$5,118	$22,510
Town of Greenwich	8	$150,821	$58,509	$209,331
Town of Hadley	20	$409,056	$173,626	$582,682
Town of Halfmoon	5	$2,490,092	$634,468	$3,124,560
Town of Moreau	44	$366,643	$141,338	$507,981
Town of New Baltimore	9	$626,948	$183,156	$810,104
Town of North Greenbush	2	$24,341	$9,457	$33,798
Town of Northumberland	1	$0	$0	$0
Town of Queensbury	43	$711,488	$292,670	$1,004,159
Town of Saratoga	21	$405,512	$153,966	$559,478
Town of Schaghticoke	50	$487,071	$192,478	$679,548
Town of Schodack	48	$390,361	$129,964	$520,325
Town of Stillwater	22	$601,812	$231,792	$833,604
Town of Stuyvesant	4	$22,982	$13,415	$36,397
Town of Waterford	10	$856,579	$502,072	$1,358,651
Village o Castleton-on-Hudson	37	$3,411,273	$929,975	$4,341,248
Village of Corinth	13	$7,113,487	$1,845,096	$8,958,583
Village of Green Island	3	$30,640	$18,134	$48,774
Village of Hudson Falls	1	$0	$0	$0
Village of Menands	6	$6,143,329	$3,658,607	$9,801,937
Village of Schuylerville	17	$1,307,770	$369,073	$1,676,844
Village of South Glens Falls	4	$3,348,470	$844,941	$4,193,411
Village of Stillwater	138	$7,191,371	$2,241,352	$9,432,722
Village of Waterford	23	$122,351	$70,622	$192,973
SUM	1099	$134,149,796	$39,824,941	$173,974,736

10 Year Flood-Flow Regulation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	83	$6,245,468	$3,761,134	$10,006,602
City of Cohoes	26	$227,264	$134,176	$361,440
City of Mechanicville	19	$361,894	$206,357	$568,251
City of Rensselaer	173	$941,666	$555,312	$1,496,978
City of Troy	156	$796,662	$468,270	$1,264,932
City of Watervliet	1	$13,899	$8,113	$22,012
Town of Bethlehem	26	$35,179,424	$21,250,010	$56,429,435
Town of Coeymans	22	$329,098	$194,065	$523,163
Town of Colonie	1	$16,590	$10,028	$26,619
Town of Corinth	22	$124,485	$71,501	$195,986
Town of East Greenbush	19	$769,325	$463,232	$1,232,557
Town of Easton	19	$5,184	$2,911	$8,095
Town of Fort Edward	3	$8,769	$5,118	$13,887
Town of Greenwich	8	$100,557	$58,509	$159,066
Town of Hadley	20	$309,439	$173,626	$483,064
Town of Halfmoon	5	$1,050,952	$634,468	$1,685,420
Town of Moreau	41	$230,734	$130,267	$361,001
Town of New Baltimore	9	$309,868	$183,156	$493,024
Town of North Greenbush	2	$16,201	$9,457	$25,659
Town of Northumberland	1	$0	$0	$0
Town of Queensbury	35	$395,237	$224,349	$619,585
Town of Saratoga	21	$272,246	$153,966	$426,213
Town of Schaghticoke	50	$335,190	$192,478	$527,668
Town of Schodack	48	$221,552	$129,964	$351,516
Town of Stillwater	22	$404,380	$231,792	$636,172
Town of Stuyvesant	4	$22,982	$13,415	$36,397
Town of Waterford	10	$836,327	$502,072	$1,338,399
Village o Castleton-on-Hudson	37	$1,541,507	$929,975	$2,471,482
Village of Corinth	13	$3,053,386	$1,845,096	$4,898,482
Village of Green Island	3	$30,040	$18,134	$48,174
Village of Hudson Falls	1	$0	$0	$0
Village of Menands	6	$6,099,199	$3,658,607	$9,757,806
Village of Schuylerville	17	$624,648	$369,073	$993,721
Village of South Glens Falls	4	$1,397,804	$844,941	$2,242,745
Village of Stillwater	138	$3,838,505	$2,241,352	$6,079,856
Village of Waterford	23	$122,351	$70,622	$192,973
SUM	1088	$66,232,832	$39,745,547	$105,978,379

10 Year Flood-Run of River Operation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	134	$20,690,539	$11,807,988	$32,498,527
City of Cohoes	36	$576,082	$329,890	$905,972
City of Mechanicville	36	$824,120	$468,775	$1,292,894
City of Rensselaer	293	$5,385,294	$3,181,691	$8,566,985
City of Troy	254	$1,940,783	$1,106,855	$3,047,638
City of Watervliet	2	$30,387	$17,852	$48,239
Town of Bethlehem	34	$84,153,116	$46,951,004	$131,104,121
Town of Coeymans	28	$682,837	$394,809	$1,077,646
Town of Colonie	3	$72,784	$40,967	$113,751
Town of Corinth	22	$190,966	$108,857	$299,822
Town of East Greenbush	21	$1,800,528	$1,005,478	$2,806,006
Town of Easton	30	$15,568	$8,693	$24,261
Town of Fort Edward	6	$24,350	$13,658	$38,008
Town of Greenwich	13	$220,569	$127,997	$348,566
Town of Hadley	20	$455,479	$251,219	$706,698
Town of Halfmoon	13	$2,618,544	$1,463,895	$4,082,439
Town of Moreau	43	$358,692	$199,484	$558,176
Town of New Baltimore	14	$718,865	$402,739	$1,121,604
Town of North Greenbush	3	$1,699,033	$1,026,655	$2,725,687
Town of Northumberland	3	$8,829	$5,154	$13,983
Town of Queensbury	43	$711,488	$400,066	$1,111,555
Town of Saratoga	23	$441,785	$247,105	$688,890
Town of Schaghticoke	64	$617,811	$354,430	$972,241
Town of Schodack	54	$429,576	$244,708	$674,284
Town of Stillwater	34	$853,230	$486,091	$1,339,321
Town of Stuyvesant	5	$48,934	$28,752	$77,686
Town of Waterford	23	$3,175,912	$1,829,296	$5,005,207
Village o Castleton-on-Hudson	52	$3,704,219	$2,070,371	$5,774,590
Village of Corinth	13	$7,288,306	$4,065,583	$11,353,889
Village of Green Island	6	$72,526	$40,544	$113,070
Village of Hudson Falls	1	$0	$0	$0
Village of Menands	12	$14,111,408	$7,966,963	$22,078,370
Village of Schuylerville	21	$1,356,134	$755,633	$2,111,767
Village of South Glens Falls	4	$3,348,470	$1,867,215	$5,215,685
Village of Stillwater	199	$8,365,064	$4,707,442	$13,072,506
Village of Waterford	60	$350,329	$202,424	$552,753
SUM	1622	$167,342,555	$94,180,282	$261,522,836

50 Year Flood-Flow Regulation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	134	$12,382,456	$7,445,197	$19,827,653
City of Cohoes	36	$374,410	$220,119	$594,530
City of Mechanicville	36	$632,363	$363,319	$995,681
City of Rensselaer	293	$4,558,199	$2,732,085	$7,290,284
City of Troy	254	$1,234,102	$726,694	$1,960,796
City of Watervliet	2	$23,404	$13,662	$37,066
Town of Bethlehem	34	$35,487,355	$21,433,699	$56,921,054
Town of Coeymans	28	$433,135	$254,997	$688,131
Town of Colonie	3	$49,632	$28,834	$78,466
Town of Corinth	22	$124,488	$71,501	$195,989
Town of East Greenbush	21	$778,325	$468,591	$1,246,917
Town of Easton	30	$12,729	$7,215	$19,945
Town of Fort Edward	6	$15,727	$9,146	$24,873
Town of Greenwich	13	$171,705	$98,949	$270,654
Town of Hadley	20	$309,442	$173,626	$483,068
Town of Halfmoon	5	$1,050,953	$634,468	$1,685,421
Town of Moreau	43	$246,083	$138,824	$384,907
Town of New Baltimore	14	$388,170	$228,027	$616,197
Town of North Greenbush	3	$1,690,893	$1,021,771	$2,712,664
Town of Northumberland	3	$8,829	$5,154	$13,983
Town of Queensbury	43	$515,827	$292,670	$808,497
Town of Saratoga	23	$308,520	$174,734	$483,254
Town of Schaghticoke	63	$439,879	$252,078	$691,957
Town of Schodack	54	$252,465	$147,716	$400,181
Town of Stillwater	34	$655,799	$373,730	$1,029,529
Town of Stuyvesant	5	$37,388	$21,824	$59,212
Town of Waterford	23	$2,099,841	$1,263,782	$3,363,623
Village o Castleton-on-Hudson	52	$1,616,978	$974,386	$2,591,363
Village of Corinth	13	$3,053,387	$1,845,096	$4,898,483
Village of Green Island	6	$31,670	$19,088	$50,758
Village of Hudson Falls	1	$0	$0	$0
Village of Menands	12	$6,814,826	$4,091,188	$10,906,014
Village of Schuylerville	21	$673,010	$396,367	$1,069,377
Village of South Glens Falls	4	$1,397,804	$844,941	$2,242,745
Village of Stillwater	199	$5,012,202	$2,916,063	$7,928,265
Village of Waterford	60	$288,180	$166,552	$454,732
SUM	1613	$83,170,477	$49,856,092	$133,026,270

50 Year Flood-Run of River Operation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	209	$31,115,439	$17,449,526	$48,564,964
City of Cohoes	36	$681,442	$388,258	$1,069,699
City of Mechanicville	42	$1,030,322	$590,066	$1,620,388
City of Rensselaer	358	$12,448,587	$7,078,793	$19,527,380
City of Troy	262	$2,358,049	$1,333,293	$3,691,342
City of Watervliet	15	$160,486	$93,872	$254,358
Town of Bethlehem	39	$84,650,018	$47,222,183	$131,872,202
Town of Coeymans	28	$743,861	$430,384	$1,174,245
Town of Colonie	4	$772,170	$447,803	$1,219,973
Town of Corinth	54	$395,714	$226,891	$622,605
Town of East Greenbush	23	$1,821,566	$1,017,057	$2,838,622
Town of Easton	30	$19,439	$10,833	$30,272
Town of Fort Edward	6	$27,801	$15,680	$43,480
Town of Greenwich	13	$256,246	$147,838	$404,084
Town of Hadley	43	$802,523	$446,742	$1,249,265
Town of Halfmoon	13	$2,618,544	$1,463,895	$4,082,439
Town of Moreau	43	$367,970	$204,308	$572,279
Town of New Baltimore	17	$845,268	$475,949	$1,321,217
Town of North Greenbush	2	$4,011,762	$2,237,088	$6,248,850
Town of Northumberland	3	$13,265	$7,816	$21,081
Town of Queensbury	49	$886,704	$498,038	$1,384,742
Town of Saratoga	23	$459,462	$257,129	$716,591
Town of Schaghticoke	82	$801,017	$458,850	$1,259,866
Town of Schodack	60	$466,702	$266,209	$732,911
Town of Stillwater	34	$988,872	$558,087	$1,546,960
Town of Stuyvesant	6	$56,885	$33,493	$90,378
Town of Waterford	23	$4,877,395	$2,722,601	$7,599,996
Village o Castleton-on-Hudson	65	$3,817,575	$2,134,392	$5,951,967
Village of Corinth	31	$7,377,421	$4,117,311	$11,494,732
Village of Green Island	9	$78,490	$43,996	$122,486
Village of Hudson Falls	1	$0	$0	$0
Village of Menands	27	$16,641,431	$9,401,483	$26,042,914
Village of Schuylerville	21	$1,385,170	$770,771	$2,155,941
Village of South Glens Falls	4	$3,348,470	$1,867,215	$5,215,685
Village of Stillwater	199	$9,038,799	$5,081,330	$14,120,129
Village of Waterford	60	$434,323	$251,287	$685,610
SUM	1934	$195,799,187	$109,750,467	$305,549,654

100 Year Flood-Flow Regulation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	209	$14,766,419	$8,875,287	$23,641,707
City of Cohoes	36	$374,410	$220,119	$594,530
City of Mechanicville	36	$632,363	$363,319	$995,681
City of Rensselaer	358	$6,896,703	$4,142,525	$11,039,228
City of Troy	262	$1,261,976	$742,303	$2,004,279
City of Watervliet	15	$148,728	$86,817	$235,545
Town of Bethlehem	39	$35,632,217	$21,518,259	$57,150,476
Town of Coeymans	28	$433,135	$254,997	$688,131
Town of Colonie	4	$726,036	$423,673	$1,149,709
Town of Corinth	22	$124,488	$71,501	$195,989
Town of East Greenbush	23	$790,329	$475,285	$1,265,614
Town of Easton	30	$12,729	$7,215	$19,945
Town of Fort Edward	6	$15,727	$9,146	$24,873
Town of Greenwich	13	$171,705	$98,949	$270,654
Town of Hadley	20	$309,442	$173,626	$483,068
Town of Halfmoon	13	$1,179,405	$708,800	$1,888,205
Town of Moreau	43	$246,083	$138,824	$384,907
Town of New Baltimore	17	$476,358	$279,506	$755,864
Town of North Greenbush	2	$1,674,692	$1,012,314	$2,687,006
Town of Northumberland	3	$8,829	$5,154	$13,983
Town of Queensbury	43	$515,827	$292,670	$808,497
Town of Saratoga	23	$308,520	$174,734	$483,254
Town of Schaghticoke	64	$450,652	$258,366	$709,018
Town of Schodack	60	$274,454	$160,552	$435,005
Town of Stillwater	34	$655,799	$373,730	$1,029,529
Town of Stuyvesant	6	$38,101	$22,223	$60,324
Town of Waterford	23	$2,099,841	$1,263,782	$3,363,623
Village o Castleton-on-Hudson	65	$1,670,914	$1,005,561	$2,676,475
Village of Corinth	13	$3,053,387	$1,845,096	$4,898,483
Village of Green Island	9	$36,239	$21,789	$58,028
Village of Hudson Falls	1	$0	$0	$0
Village of Menands	27	$8,346,177	$5,002,339	$13,348,516
Village of Schuylerville	21	$673,010	$396,367	$1,069,377
Village of South Glens Falls	4	$1,397,804	$844,941	$2,242,745
Village of Stillwater	199	$5,012,202	$2,916,063	$7,928,265
Village of Waterford	60	$288,180	$166,552	$454,732
SUM	1831	$90,702,882	$54,352,383	$145,055,264

100 Year Flood-Run of River Operation

Municipality	Number of Properties	Structural Damage	Content Damage	Total Damages
City of Albany	320	$41,353,417	$23,354,543	$64,707,960
City of Cohoes	62	$1,634,095	$954,484	$2,588,579
City of Mechanicville	42	$1,030,322	$590,066	$1,620,388
City of Rensselaer	379	$16,516,762	$9,288,249	$25,805,011
City of Troy	549	$4,044,995	$2,334,384	$6,379,379
City of Watervliet	63	$892,733	$522,814	$1,415,547
Town of Bethlehem	39	$84,722,796	$47,265,850	$131,988,646
Town of Coeymans	28	$743,861	$430,384	$1,174,245
Town of Colonie	11	$1,315,219	$771,350	$2,086,569
Town of Corinth	54	$395,714	$226,891	$622,605
Town of East Greenbush	23	$1,827,175	$1,019,974	$2,847,149
Town of Easton	30	$19,439	$10,833	$30,272
Town of Fort Edward	16	$168,862	$96,765	$265,628
Town of Greenwich	16	$299,167	$171,772	$470,940
Town of Hadley	43	$802,523	$446,742	$1,249,265
Town of Halfmoon	13	$2,685,004	$1,502,400	$4,187,404
Town of Moreau	50	$399,406	$222,497	$621,902
Town of New Baltimore	17	$889,573	$502,532	$1,392,105
Town of North Greenbush	5	$4,040,975	$2,254,141	$6,295,116
Town of Northumberland	6	$33,010	$19,219	$52,229
Town of Queensbury	49	$886,704	$498,038	$1,384,742
Town of Saratoga	23	$459,462	$257,129	$716,591
Town of Schaghticoke	98	$900,354	$515,359	$1,415,713
Town of Schodack	60	$477,750	$272,837	$750,587
Town of Stillwater	34	$988,872	$558,087	$1,546,960
Town of Stuyvesant	6	$57,219	$33,666	$90,884
Town of Waterford	56	$5,127,597	$2,866,094	$7,993,691
Village o Castleton-on-Hudson	65	$3,849,062	$2,152,058	$6,001,120
Village of Corinth	31	$7,377,421	$4,117,311	$11,494,732
Village of Fort Edward	2	$20,796	$11,596	$32,392
Village of Green Island	159	$239,951	$137,910	$377,862
Village of Hudson Falls	1	$0	$0.0	$0
Village of Menands	31	$18,563,631	$10,410,620	$28,974,251
Village of Schuylerville	21	$1,385,170	$770,771	$2,155,941
Village of South Glens Falls	4	$3,348,470	$1,867,215	$5,215,685
Village of Stillwater	199	$9,038,799	$5,081,330	$14,120,129
Village of Waterford	166	$1,073,317	$618,277	$1,691,594
SUM	2771	$217,609,623	$122,154,190	$339,763,813

Appendix E-Wastewater information from DEC

Determination of Benefit Due to Flow Regulation on the Upper Hudson River

1. Organic Loads

Segment 1 : Upper Hudson River - Palmer Falls Dam (MP 218) to Stillwater Dam (MP 168)

- The Upper Hudson Dissolved Oxygen (DO) was run using current flow (regulated) and permit loadings. The river dissolved oxygen at the DO sag point was determined to be 4.62 mg/l.
- The model was then run under unregulated flow conditions. It was determined that a 60% load reduction (BODu + NOD) would be necessary to achieve a sag point DO of 4.62 mg/l under the reduced flow conditions.
- The existing permit loads were multiplied by 60% to determine the total BOD_u and NOD load reductions needed to meet the established DO sag point criteria.
- Fine tuning of the individual discharge responsibility at the DO sag point can be accomplished by performing a unit response analysis.
- The sag point DO unit responses for the BODu and NOD components for each individual discharge were determined.
- The sum of the DO unit responses (BODu + NOD) were totaled (Σ = 2.73 mg/l).
- The sum of the DO unit responses due to the BODu components were totaled (Σ = 1.785 mg/l).
- The percentage of the total DO deficit due to the BODu component was determined (65.4 %).
- The sum of the DO unit responses due to the NOD components were totaled (Σ = 0.945 mg/l).
- The percentage of the total DO deficit due to the NOD component was determined (34.6 %).
- The percentage that each individual discharge contributes to the BODu and NOD component deficits was calculated by dividing the BODu and NOD unit response for each discharge by the total segment DO deficit.
- The required reduction in individual BODu and NOD loads needed to meet the 60% overall reduction was derived by multiplying total segment reduction by the percent the discharge contributes to the total deficit.
- The required reduction was subtracted from the existing discharge load to determine the allowable load under unregulated flow conditions.

Example : Develop limits for Finch Pruyn under unregulated flow conditions.

- **Regulated Flow Conditions** (1760 cfs@ Corinth)
  - DO @ Sag Point (upstream of Stillwater Dam MP 168) : 4.62 mg/l
  - Discharge Load : 143,003 #/d

BODu	106,413 #/d
NOD	36,590 #/d

- **Unregulated Flow Conditions** (653 cfs@ Corinth)
  - DO @ Sag Point (upstream of Stillwater Dam MP 168) : 4.62 mg/l
  - Required Load Reduction to Maintain DO @ Sag Point : 60 %

- BODu 63,848 #/d (Required reduction)
- NOD 21,954 #/d (Required reduction)
- Allowable Discharge Load : 57,201 #/d
  - BODu 42,565 #/d
  - NOD 14,636 #/d

- A 60 % reduction can be assigned to all discharges. This approach does not account for the non-conservative nature of the organic based discharges. A different way to assign benefit value to the various discharges is to evaluate the DO unit response at the segment sag point for each individual discharge. The unit response was developed for both the carbonaceous and nitrogenous components separately since they have different stream reaction rates.

  - Finch Pruyn existing permit load :
    - BODu 67502 #/d
    - NOD 24432 #/d

  - Sag point DO unit response :
    - BODu 1.18 mg/l
    - NOD 0.64 mg/l
  - Total segment DO deficit @ the sag point : 2.73 mg/l
  - Segment DO deficit due to BODu component of discharge : 1.785 mg/l
  - % of DO deficit due to BODu : 1.785 mg/l / 2.73 mg/l = 65.4 %
  - segment DO deficit due to NOD component of discharge : 0.945 mg/l
  - % of DO deficit due to NOD : 0.945 mg/l / 2.73 mg/l = 34.6 %
  - Finch Pruyn contribution to total deficit :
    - BODu 1.18 mg/l / 2.73 mg/l = 43.2 %
    - NOD 0.64 mg/l / 2.73 mg/l = 23.4 %
    - Total = 66.7 %
  - Finch Pruyn BODu required reduction : (43.2% / 65.4 %) x 63,848 = 42,208 #/d
  - Finch Pruyn NOD required reduction : (23.4% / 34.6 %) x 21,954 = 14,868 #/d
  - Finch Pruyn BODu allowable load : 67,502 #/d - 42,208 #/d = 25,294 #/d
  - Finch Pruyn NOD allowable load : 24,432 #/d - 14,868 #/d = 9,564 #/d

- **Results : Unit Response Analysis - Required Percent Reductions**
  - International Paper 44 %
  - Corinth (V) 39 %
  - Finch Pruyn 62 %
  - Encore Paper 63 %
  - Glens Falls (C) 62 %
  - GE Hudson Falls 65 %
  - Scott Paper 61 %
  - Washington SD #2 67 %
  - Hollingsworth & Vose, Easton Mill 61 %
  - Schuylerville (V) 0 %

Segment 2 : Upper Hudson River - Stillwater Dam (MP 168) to Troy Lock (MP 154)

- An identical procedure was followed for this segment. The results indicate an overall load reduction of 35 % is necessary to maintain current minimum DO level in the segment.
- **Results : Unit Response Analysis - Required Percent Reductions**
  - Stillwater (V) 39 %
  - Saratoga Co. SD # 1 38 %
  - GE Waterford 29 %

Segment 3 : Lower Hudson River - Troy Lock (MP 154) to MP 123

- An identical procedure was followed for this segment. The results indicate an overall load reduction of 25 % is necessary to maintain current minimum DO level in the segment.
- **Results : Unit Response Analysis - Required Percent Reductions**
  - Albany North 25 %
  - Albany South 25 %
  - Rensselaer Co. SD # 1 25 %
  - East Greenbush 25 %
  - Bethlehem 25 %

Allowable Loads At Current and Unregulated Flows

SEGMENT 1

CURRENT RIVER FLOWS

INDUSTRY @ TBL

MUNICIPAL STP's @ SECONDARY LIMITS

SOURCE	REACH	FLOW	BODu	NOD
		MGD	#/D	#/D
International Paper	1	10.3	16127	0
Corinth (V)	1	0.6	300	450
Reach Total	1	10.9	16427	450
Finch Pruyn	4	17.5	67502	24432
Encore Paper	4	2.2	10810	0
Glens Falls (C)	4	9.5	3150	9600
Reach Total	4	29.2	81462	34032
GE Hudson Falls	5	0.216	500	48
Scott Paper	6	3.2	6400	0
Washington Co. SD #2	6	2.5	934	1870
Reach Total	6	5.7	7334	1870
H&V Easton Mill	10	1.9	590	0
Schuylerville (V)	10	0.25	100	190
Reach Total	10	2.15	690	190
Totals			106413	36590
Totals				143003

UNREGULATED RIVER FLOWS

At the unregulated flow condition a 60 % load reduction is needed to meet the current (regulated flowcondition) DO of 4.62 mg/l at MP 168 =

REACH	FLOW	BODu	NOD	% Reduction
	MGD	#/D	#/D	
1	10.3	8973	0	44
1	0.6	121	334	39
1	10.9	9094	334	
4	17.5	25294	9564	62
4	2.2	4014	0	63
4	9.5	1004	3792	62
4	29.2	30312	13356	
5	0.216	142	48	65
6	3.2	2465	0	61
6	2.5	219	708	67
6	5.7	2684	708	
10	1.9	232	0	61
10	0.25	100	190	0
10	2.15	332	190	
Totals		42564	14636	
Totals			57200	60

SEGMENT 2

CURRENT RIVER FLOWS

INDUSTRY @ TBL

MUNICIPAL STP's @ SECONDARY LIMITS

SOURCE	REACH	FLOW	BODu	NOD
		MGD	#/D	#/D
Stillwater (V)	11	0.301	112	225
Saratoga Co. SD #1	13	21.3	8000	15900
GE Waterford	14	7	10000	0
Totals			18112	16125
Totals				34237

UNREGULATED RIVER FLOWS

At the unregulated flow condition a 35 % load reduction is needed to meet the current (regulated flow condition) DO of 4.62 mg/l at MP 168 =

REACH	FLOW	BODu	NOD	% Reduction
	MGD	#/D	#/D	
11	0.301	112	94	39
13	21.3	4542	10388	38
14	7	7119	0	29
Totals		11773	10482	
Totals			22255	35

SEGMENT 3

CURRENT RIVER FLOWS

EXISTING PERMIT LIMITS

SOURCE	REACH	FLOW	BODu	NOD
		MGD	#/D	#/D
Albany North	17	35	10946	20277
Albany South	17	25	7819	14674
Rensselaer Co. SD #1	17	24	7506	14636
East Greenbush	17	2.5	938	1906
Bethlehem	17	4.9	1839	3735
	Totals		29048	55228
	Totals			84276

UNREGULATED RIVER FLOWS

At the unregulated flow condition a 25 % load reduction is needed to meet the current (regulated flowcondition)

DO of 4.62 mg/l at MP 168 =

REACH	FLOW	BODu	NOD	% Reduction
	MGD	#/D	#/D	
17	35	8244	15256	25
17	25	5792	11013	25
17	24	5648	10975	25
17	2.5	769	1383	25
17	4.9	1332	2794	25
Totals		21785	41421	
	Totals		63206	25

Upper Hudson STP Treatment and Loadings

Segment 1 : Upper Hudson River - MP 218 to MP 168

Discharge	SPDES Permit #	DEC Permit Engineer	STP Flow mgd	Type of Treatment			Influent BODu	Influent NOD	Effluent BODu	Effluent NOD	Actual Flow
International Paper	0004405	Cheryle Merkley 518-402-8115	10.3	Screening, settling, trickling filter			No data available	NA	5256 #/d BODu (average load for period 4/00 to 3/01)	NA	6.0 mgd average flow (4/00 to 3/01)
Corinth (V)	0020397	Region 518-623-3671	0.6	Covered synthetic media trickling filter			224 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 134 mg/l (based on strength of influent BOD5).	34.2 mg/l BODu (average concentration for period 4/00 to 3/01)	No data available	0.61 mgd (4/00 to 3/01)
Finch Pruyn	0005525	Cheryle Merkley 518-402-8115	17.5	Primary settling, activated sludge, settling			No data available	No data available	18425 #/d BODu (average load for period 4/00 to 3/01)	12109 #/d NOD (average load for period 4/00 to 3/01)	18.2 mgd average flow (4/00 to 3/01)
Encore Paper	0007226	Cheryle Merkley 518-402-8115	2.2	Activated sludge + dissolved air flotation			No data available	NA	6178 #/d BODu (average load for period 4/00 to 3/01)	NA	2.03 mgd average flow (4/00 to 3/01)
Glens Falls (C)	0029050	Doug Clark 518-402-8113	9.5	Extended aeration, conventional activated sludge. Treatment units can be operated in either mode.			234 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 140 mg/l (based on strength of influent BOD5).	7.1 mg/l BODu (average concentration for period 4/00 to 3/01)	16.9 mg/l NOD (average concentration for period 6/00 to 3/01)	5.1 mgd average flow (4/00 to 3/01)
GE Ft. Edward	0007048	Brian Baker 518-402-8124	0.216	Carbon absorption tower + multi-media filter			No data available	No data available	16 #/d BODu (average load for period 4/00 to 3/01)	13.7 #/d NOD (average load for period 4/00 to 3/01)	0.162 mgd average flow (4/00 to 3/01)
Irving Tissue (Scott Paper)	0006050	Cheryle Merkley 518-402-8115	3.2	Dissolved air flotation			No data available	NA	1400 #/d BODu (average load for period 4/00 to 3/01)	NA	0.64 mgd average flow (4/00 to 3/01)
Washington Co. SD #2	0183695	Cheryle Merkley 518-402-8115	2.5	Plug flow activated sludge			170 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 102 mg/l (based on strength of influent BOD5).	19.5 mg/l BODu (average concentration for period 4/00 to 3/01)	54 mg/l NOD (average concentration for period 6/00 to 3/01)	2.3 mgd (4/00 to 3/01)
H&V Easton Mill (Paper Mill)	0006807	Cheryle Merkley 518-402-8115	1.9	Aerated lagoon			No data available	NA	187 #/d BODu (average concentration for period 4/00 to 3/01)	NA	2.3 mgd (4/00 to 3/01)
Schuylerville (V)	0031941	Region 518-623-3671	0.25	Sequencing batch reactor (2 units operating in sequence. As #1fills, aerates, settles,empties, #2 stores incoming flow. Units then reverse roles.Essentially an extented air plant).			209 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 125 mg/l (based on strength of influent BOD5).	12.6 mg/l BODu (average concentration for period 4/00 to 3/01)	No data available	0.367 mgd (4/00 to 3/01)

Segment 2 : Upper Hudson River - MP 168 to MP 154

Discharge	SPDES Permit #	DEC Permit Engineer	STP Flow mgd	Type of Treatment	Influent BODu	Influent NOD	Effluent BODu	Effluent NOD	Actual Flow
Stillwater (V)	0093637	Region 518-623-3671	0.301	Extented aeration	219 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 131 mg/l (based on strength of influent BOD5).	6.8 mg/l BODu (average concentration for period 4/00 to 3/01)	No data available	0.3 mgd (4/00 to 3/01)
Saratoga Co. SD #1	0028240	Bill Schaff 518-402-8116	21.3	Conventional activated sludge, step aeration activated sludge. STP can be operated in either mode	306 mg/l BODu (average concentration for period 4/00 to 3/01)	143 mg/l NOD (ave. maximum concentration for period 4/00 to 3/01)	15.3 mg/l BODu (average concentration for period 4/00 to 3/01)	37.5 mg/l NOD (ave. maximum concentration for period 6/00 to 3/01)	10.4 mgd (4/00 to 3/01)
GE Waterford	0008605	Brian Baker 518-402-8124	30.0	Activated sludge + air stripper +muti-media filters + carbon absorption tower.	No data available	NA	1665 #/d BODu (average load for period 4/00 to 3/01)	475 #/d NOD (average load for period 4/00 to 3/01)	30.6 mgd (4/00 to 3/01) Includes process + Noncontact cooling water + stormwater.

Segment 3 : Lower Hudson River - MP 154 to MP 123

Discharge	SPDES Permit #	DEC Permit Engineer	STP Flow mgd	Type of Treatment	Influent BODu	Influent NOD	Effluent BODu	Effluent NOD	Actual Flow
Albany North	0026875	Cheryle Merkley 518-402-8115	35	Contact stabilization, conventional activated sludge, step aeration activated sludge. STP can be operated in either mode	244 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 146 mg/l (based on strength of influent BOD5).	3.5 mg/l BODu (average concentration for period 4/00 to 3/01)	22.9 mg/l NOD (average concentration for period 6/00 to 3/01)	22.7 mgd (4/00 to 3/01)
Albany South	0026867	Cheryle Merkley 518-402-8115	25	Contact stabilization, conventional activated sludge, step aeration activated sludge. STP can be operated in either mode	112 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 67 mg/l (based on strength of influent BOD5).	5.9 mg/l BODu (average concentration for period 4/00 to 3/01)	11 mg/l NOD (average concentration for period 4/00 to 3/01)	21.6 mgd (4/00 to 3/01)
Rensselaer Co. SD #1	0087971	Cheryle Merkley 518-402-8115	24	Step aeration activated sludge	131 mg/l BODu (average concentration for period 4/00 to 3/01)	No data. Assume 78 mg/l (based on strength of influent BOD5).	10 mg/l BODu (average concentration for period 4/00 to 3/01)	37 mg/l NOD (average concentration for period 4/00 to 3/01)	19.3 mgd (4/00 to 3/01)
East Greenbush	0026034	Not currently assigned to a specific engineer	2.5	Conventional activated sludge	406 mg/l BODu (average concentration for period 4/00 to 3/01)	137 mg/l NOD (average concentration for period 4/00 to 3/01)	27 mg/l BODu (average concentration for period 4/00 to 3/01)	71 mg/l NOD (average concentration for period 4/00 to 3/01)	1.9 mgd (4/00 to 3/01)
Bethlehem	0025739	Not currently assigned to a specific engineer	4.9	Step aeration activated sludge	165 mg/l BODu (average concentration for period 4/00 to 3/01)	161 mg/l NOD (average concentration for period 4/00 to 3/01)	7.2 mg/l BODu (average concentration for period 4/00 to 3/01)	7.3 mg/l NOD (average concentration for period 4/00 to 3/01)	4.5 mgd (4/00 to 3/01)

Calculation of Unit Response to Decreased Flow

File Name : Unit

SEGMENT 1

Wasteload levels : Industry @ TBL
Municipal @ secondary limits

SOURCE	REACH	FLOW MGD	BODu #/D	NOD #/D	Unit Response to DO mg/l Due To BODu	NOD	TOTAL	% of total BODu	NOD	TOTAL	Required Reduction BODu	NOD		Allowable Discharge	
International Paper	1	10.3	16127	0	0.2	0	0.2	7.3%	0.0%	7.3%	7154	0	7154	8973	0
Corinth (V)	1	0.6	300	450	0.005	0.005	0.01	0.2%	0.2%	0.4%	179	116	295	121	334
Reach Total	1	10.9	16427	450											
Finch Pruyn	4	17.5	67502	24432	1.18	0.64	1.82	43.2%	23.4%	66.7%	42208	14868	57076	25294	9564
Encore Paper	4	2.2	10810	0	0.19	0	0.19	7.0%	0.0%	7.0%	6796	0	6796	4014	0
Glens Falls (C)	4	9.5	3150	9600	0.06	0.25	0.31	2.2%	9.2%	11.4%	2146	5808	7954	1004	3792
Reach Total	4	29.2	81462	34032											
GE Hudson Falls	5	0.216	500	48	0.01	0	0.01	0.4%	0.0%	0.4%	358	0	358	142	48
Scott Paper	6	3.2	6400	0	0.11	0	0.11	4.0%	0.0%	4.0%	3935	0	3935	2465	0
Washington Co. SD #2	6	2.5	934	1870	0.02	0.05	0.07	0.7%	1.8%	2.6%	715	1162	1877	219	708
Reach Total	6	5.7	7334	1870											
H&V Easton Mill	10	1.9	590	0	0.01	0	0.01	0.4%	0.0%	0.4%	358	0	358	232	0
Schuylerville (V)	10	0.25	100	190	0	0	0	0.0%	0.0%	0.0%	0	0	0	100	190
Reach Total	10	2.15	690	190											
Totals			106413	36590	1.785	0.945	2.73	65.4%	34.6%	100.0%	63848	21954	85802	42565	14636

At the unregulated flow condition a 60 %

BODu Reduction	63848	BODu Allowable	42565	#/d
NOD Reduction	21954	NOD Allowable	14636	#/d
Total	85802	Total	57201	

SEGMENT 2

SOURCE	REACH	FLOW MGD	BODu #/D	NOD #/D	Unit Response to DO mg/l Due To BODu	NOD	TOTAL	% of total BODu	NOD	TOTAL	Required Reduction BODu	NOD		Allowable Discharge	
Stillwater (V)	11	0.301	112	225	0	0.005	0.005	0.0%	1.5%	1.5%	0	131	131	112	94
Saratoga Co. SD #1	13	21.3	8000	15900	0.06	0.21	0.27	18.5%	64.6%	83.1%	3458	5513	8970	4542	10388
GE Waterford	14	7	10000	0	0.05	0	0.05	15.4%	0.0%	15.4%	2881	0	2881	7119	0
Totals			18112	16125	0.11	0.215	0.325	34%	66%	100%	6339	5644	11983	11773	10481

At the unregulated flow condition a 35 %

BODu Reduction	6339	BODu Allowable	11773	#/d
NOD Reduction	5644	NOD Allowable	10481	#/d
Total	11983	Total	22254	

SEGMENT 3

SOURCE	REACH	FLOW MGD	BODu #/D	NOD #/D	Unit Response to DO mg/l Due To BODu	NOD	TOTAL	% of total BODu	NOD	TOTAL	Required Reduction BODu	NOD		Allowable Discharge	
Albany North	17	35	10946	20277	0.16	0.48	0.64	9.1%	27.4%	36.6%	2702	5021	7723	8244	15256
Albany South	17	25	7819	14674	0.12	0.35	0.47	6.9%	20.0%	26.9%	2027	3661	5688	5792	11013
Rensselaer Co. SD #1	17	24	7506	14636	0.11	0.35	0.46	6.3%	20.0%	26.3%	1858	3661	5519	5648	10975
East Greenbush	17	2.5	938	1906	0.01	0.05	0.06	0.6%	2.9%	3.4%	169	523	692	769	1383
Bethlehem	17	4.9	1839	3735	0.03	0.09	0.12	1.7%	5.1%	6.9%	507	941	1448	1332	2794
Totals			29048	55228	0.43	1.32	1.75	25%	75%	100%	7262	13807	21069	21786	41421

At the unregulated flow condition a 25 %

BODu Reduction	7262	BODu Allowable	21786	#/d
NOD Reduction	13807	NOD Allowable	41421	#/d
Total	21069	Total	63207	

Toxic Discharges **No influent data available**

Parameter	Discharge	Current Permit Limit	Existing Effluent Discharge	Comments
		#/d	#/d	
Copper	International Paper	4.14	4.30	
	Finch Pruyn	3.40	4.78	
	Encore Paper	1.60	0.69	
	Glens Falls	4.60	6.12	
	Ciba Geigy	No Data. Plant closed. Site is undergoing reclaimation and is being capped. There is essentially no discharge at this time. Eventually site will have only a stormwater permit.		
	GE Fort Edward	1.00	0.27	
	Chase Bag	0.04	No data available	
	Irving Tissue (Scott Paper)	Copper not contained in current permit. Remove from table.		
	Washington Co. SD	0.50	0.58	
	Saratoga Co. SD	8.10	8.30	
	Katzenbach & Warren	Copper not contained in current permit. Remove from table.		
	GE Waterford	63.20	7.93	
	Albany North	11.00	3.52	
	Albany South	6.00	2.89	
	Rensselaer Co. SD	15.40	3.34	
	East Greenbush	0.80	1.69	Added to inventory
Cyanide	Finch Pruyn	15.50	9.40	Cyanide amenable to chlorination
	Encore Paper	3.70	0.40	Total cyanide
	Glens Falls	3.00	1.05	Cyanide amenable to chlorination
	Ciba Geigy	No Data. Plant closed. Site is undergoing reclaimation and is being capped. There is essentially no discharge at this time. Eventually site will have only a stormwater permit.		Total cyanide
	GE Waterford	0.50	0.46	Total cyanide
	Albany North	Cyanide not contained in current permit. Remove from table.		
	Albany South	Cyanide not contained in current permit. Remove from table.		
	Rensselaer Co. SD	Monitor	1.97	Total cyanide
	East Greenbush	Monitor	0.17	Added to inventory. Total cyanide

Lead	Glens Falls	7.10	1.24	
	Ciba Geigy	No Data. Plant closed. Site is undergoing reclaimation and is being capped. There is essentially no discharge at this time. Eventually site will have only a stormwater permit.		
	GE Fort Edward	0.07	0.01	
	Chase Bag	0.05	No data available	
	Saratoga Co. SD	3.00	0.88	
	GE Waterford	0.006 mg/l	2.24	
Phenols	International Paper	5.10	1.90	
	Finch Pruyn	3.60	3.00	Does not include 11/00 measurement of 49.1 #/d
	Encore Paper	3.30	0.80	
	GE Fort Edward	Phenols not contained in current permit. Remove from table.		
	Chase Bag	0.01	No data available	
	GE Waterford	6.00	1.56	
	Albany North	Phenols not contained in current permit. Remove from table.		
	Albany South	Phenols not contained in current permit. Remove from table.		
	Rensselaer Co. SD	6.00	1.70	
	East Greenbush	0.40	0.14	Added to inventory
Tetrachloro-ethylene	GE Hudson Falls Encore Paper Chase Bag Scott Paper Saratoga Co. SD	The toxics inventory for tetrachloroethylene carried a load of 2.1 #/d for Encore Paper. Further investigation shows this parameter has been removed from the Encore permit. Tetrachloroethylene is no longer a water quality limiting substance in the Upper H		

Upper Hudson River : Unregulated Flow Impact on Toxic Discharges

Parameter	Evaluation
Metals	
Aluminum	No impact
Antimony	No impact
Arsenic	No impact
Barium	No impact
Beryllium	No impact
Boron	No impact
Bromide	No impact
Cadmium	No impact
Chromium	No impact
Chromium $^{+6}$	No impact
Copper	Upper Hudson River discharges - reduce current loads by 48% International Paper; Chase Bag Finch Pruyn; Scott Paper Encore Paper; Washington Co. SD Glens Falls; Saratoga Co. SD Ciba Geigy; Katzenbach & Warren GE Hudson Falls; GE Waterford Lower Hudson River discharges - reduce current loads by 17% Albany North; Rensselaer Co. SD Albany South
Cyanide	Upper and Lower Hudson River discharges - reduce current loads by 30% Finch Pruyn; GE Waterford Encore Paper; Albany North Glens Falls; Albany South Ciba Geigy; Rensselaer Co. SD
Fluoride	No impact
Iron	No impact
Lead	Upper Hudson River discharges - reduce current loads by 49% Glens Falls; Chase Bag Ciba Geigy; Saratoga Co. SD GE Hudson Falls; GE Waterford Lower Hudson River discharges - No impact
Magnesium	No impact
Manganese	No impact
Mercury	No measurable impact
Nickel	No impact
Selenium	No impact
Silver	No impact
Thallium	No impact
Zinc	No impact

Parameter	Evaluation
Organics	
Benzene	No impact
Bis (2ethyl-hexyl) phthalate	No impact
Bromodichloromethane	No impact
Buyyl Benzyl Phthalate	No impact
Carbon Tetrachloride	No impact
Chlorobenzene	No impact
Chloroform	No impact
Dichlorobenzene	No impact
PCB	No impact
1,1 Dichloroethane	No impact
1,2 Dichloroethane	No impact
1,1 Dichloroethene	No impact
1,2 trans Dichloroethene	No impact
Diethyl Phthalate	No impact
Dimethyl Phthalate	No impact
Di-n-butyl Phthalate	No impact
Ethylbenzene	No impact
Methylene Chloride	No impact
Phenanthrene	No impact
Phenols	Upper Hudson River discharges - reduce current loads by 45% International Paper; GE Hudson Falls Finch Pruyn; Chase Bag Encore Paper; GE Waterford Lower Hudson River discharges - reduce current loads by 26% Albany North; Rensselaer Co. SD Albany South
Sulfides	No impact
Sulfite	No impact
Tetrachloroethylene	Upper Hudson River discharges - reduce current loads by 11% GE Hudson Falls; Scott Paper Encore Paper; Saratoga Co. SD Chase Bag Lower Hudson River discharges - No impact
Toluene	No impact
1,1,1 Trichloroethane	No impact
Trichloroethylene	No impact
Vinyl Chloride	No impact
Xylene	No impact