Ford Lake Business Assessment

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Introduction

Ford Lake is an approximately one mile long impoundment of the Huron River (Figure 1) located in Ypsilanti Township, Southeast MI. The lake is solely owned and operated by Ypsilanti Township. The outlet dam was built by Henry Ford, and it is still used for hydroelectric power generation. Aside from the power generation, the lake is used for recreation. There are three main parks around the lake: Loonfeather Park, North Bay Park, and Ford Lake Park. Loonfeather and North Bay Park have no boat access ramps, but have docks and other walkways for people to enjoy the lake. Ford Lake Park has boat access and docks. The water quality is generally good during the year, however from July to September algal blooms often cover the surface of the water (see Figure 2). These blooms are very unsightly and have an offensive odor.

Figure 1 – Aerial Photograph of Ford Lake

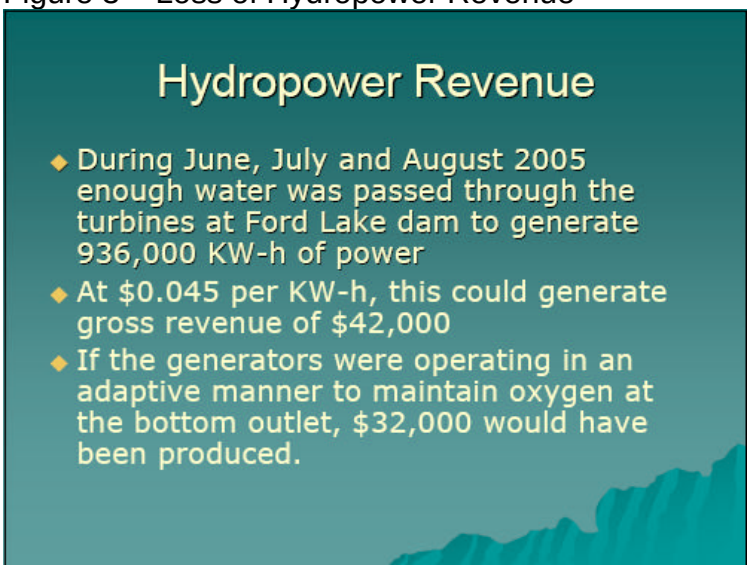
Figure 2 – Unsightly algal blooms

The types of algae that dominate during the late summer months are cyanobacteria (blue green algae) including species of *Aphanizomenon* and toxic strains of *Microcystis*. Several factors contribute to the production of algal blooms, including high temperature and low wind; a large supply of phosphate; a low ratio of nitrogen to phosphorus; and ammonium as a nitrate source. Conventional wisdom and management strategy concerning the nuisance blooms is that they are caused by the large amount of phosphate discharged into the Huron River by the Ann Arbor Wastewater Treatment Plant and other sources upstream. However, the triggering events seem to be not external factors from the Huron River, but rather internal factors that might be managed.

In order to explore this possibility, Ypsilanti Township has granted Professor John T. Lehman the cooperation and permission to conduct experiments on Ford Lake, in the hopes of improving the water quality during the months of July to September. The premise of Professor Lehman's experiment will reduce water flow through the turbines of Ford Dam and divert some of the discharge water through openings deeper underwater. The consequence of this for Ypsilanti Township is lost revenue. The approximate loss of revenue over the course of a year is estimated to be $10,000 (Figure 3). Considering the annual revenue for the dam is $200,000 to $400,000, a loss

of $10,000 is significant for the Township. The remainder of this paper describes the methods, analysis, and recommendations recovering this lost revenue.

Figure 3 – Loss of Hydropower Revenue



Methods

In order to determine if and how Ypsilanti Township could recover lost revenue, a good deal of information had to be collected. The first information needed was background to the water quality problem and the way in which Professor Lehman would attempt to solve it. This background information was necessary in order to understand why the revenue was going to be lost at the dam and the benefits of the improved water quality.

The basic reason why the algal blooms appear during the late summer months is due to an anoxic environment in the deeper portion of the lake. Water in the shallow portion of the lake mixes well and is constantly in contact with the atmosphere. This provides plenty of oxygen. However, in the deeper portions of the lake, there is little to no mixing with the atmosphere because a temperature and water density interface called the thermocline separates deep and shallow water. Moreover, there is not enough light in the deep water for algae to produce oxygen by the process of photosynthesis. This leads to the anoxic environment and promotes the release of fertilizing nutrients from the mud that build up and encourage the growth of bluegreen algae when they finally mix upward during a cold spell or a storm. If conditions worsen to a certain point, bluegreen algae float and concentrate on the surface of the water. This leads to bad odors and an unappealing atmosphere for recreation.

Professor Lehman's experiment will hopefully prevent stagnation in the deeper portions of the lake, partly by passing water through the lower gates of the dam. This will draw new water into the deeper part of the lake, thus increasing the oxygen. This increase in

oxygen will in theory prevent the formation of bluegreen algae in the summer months and result in improved water quality.

Ypsilanti Township granted approval for experiments because they are concerned about water quality and want to ensure an attractive lake for visitors throughout the year. However, they are also concerned with the loss in revenue due to the experiment. After gaining an understanding about the scientific issues, information regarding the operations of the lake and dam were gathered. Several meetings were held with Ms. Joann Brinker, Director of Human Resources. Ms. Brinker has been with Ypsilanti Township for over 30 years and has extensive knowledge about the operations of Ford Dam, Ford Lake and the surrounding facilities. She provided information regarding hydropower revenue, the contract details between the Township and Detroit Edison, park pass statistics, and the number of dwellings bordering Ford Lake. This information was critical in determining the options that Ypsilanti Township has in recovering the lost revenue at the dam.

Along with collecting and analyzing the information provided by Ms. Brinker, weekly meetings were held with Professor Lehman to discuss the status of the investigation. His knowledge of Ford Lake and the study was used to explore issues and the viability of possible solutions. One of the analyses performed regarded the water flows into Ford Lake over the past 20 years. This analysis provided information regarding the revenue potential of Ford Dam as well as any trends in both seasonal flows as well as flashiness. Flashiness in this context would be an increase in rapid runoff from land into the river caused by development and increased impermeable surface (e.g., roofs, roads) in the upstream watershed.

Results

Ford Dam's 2005 Revenue figures (Table 1) contain two main items of note. The first is the overpayments that are being deducted. Detroit Edison overpaid Ypsilanti Township in 2004 through the first quarter of 2005. This was ultimately realized and corrected starting in the second quarter of 2005, resulting in reduced revenue for 2005. These overpayments are tabulated as negative amounts, but they actually represent amounts that would have been paid, but in fact were withheld. As an internal record for Ypsilanti Township the negative amounts are used to illustrate the revenue that was lost for that month. The other item of note is the revenue that was generated: $223,390.37. According to Ms. Brinker, this is a very low revenue figure, which makes the overpayment corrections even more difficult on the Township's budget.

After analyzing the revenue figures for 2005, a complete understanding of how Ypsilanti Township is paid by Detroit Edison was needed. Ms. Brinker provided a breakdown of the payments between the two parties (Table 2). The income for Electric Energy is the amount paid for every KWH (kilowatt-hour), regardless of how many the dam produces. Electric Capacity receipts are determined by a yearly calculation, which will be described below. For 2005, this amount is 743 kW, which means that Detroit Edison will pay the specified amounts for all energy produced up to 743 kW. Kilowatts are calculated as an annual mean by taking annual generation in Kilowatt Hours and

dividing it by the number of hours in a year. The payments are then deducted from these gross receipts. The administration fee goes back to Detroit Edison, while the escrow amount is deposited into a restricted escrow account. These funds belong to the Township, but are not released for 25 years.

Table 1 – 2005 Hydropower Revenue for Ypsilanti Township

	MWH	Revenue	10% to City	Township	YTD Township	YTD Income
Beginning Balance		$ -	$ -	$ -	$ -	$ -
January	855.220	$ 31,755.87	$ 3,175.59	$ 28,580.28	$ 28,580.28	$ 31,755.87
February	836.353	$ 29,396.66	$ 2,939.67	$ 26,456.99	$ 55,037.28	$ 61,152.53
March	1,124.933	$ 32,629.49	$ 3,262.95	$ 29,366.54	$ 84,403.82	$ 93,782.02
April	940.892	$ 29,784.39	$ 2,978.44	$ 26,805.95	$ 111,209.77	$ 123,566.41
May	678.738	$ (24,785.98)	$ -	$ -	$ 111,209.77	$ -
June	290.245	$ (12,847.40)	$ -	$ -	$ 111,209.77	$ -
July	409.735	$ (16,251.87)	$ -	$ -	$ 111,209.77	$ -
August	104.760	$ (3,357.61)	$ -	$ -	$ 111,209.77	$ -
		$ 458.00	$ 45.80	$ 412.20	$ 111,621.97	$ 124,024.41
September	84.238	$ 2,860.77	$ 286.08	$ 2,574.69	$ 114,196.66	$ 126,885.18
October	75.277	$ 2,596.21	$ 259.62	$ 2,336.59	$ 116,533.25	$ 129,481.39
November	491.220	$ 16,392.60	$ 1,639.26	$ 14,753.34	$ 131,286.59	$ 145,873.99
December	590.933	$ 20,273.52	$ 2,027.35	$ 18,246.17	$ 149,532.76	$ 166,147.51
		$ (57,242.86)				
Total	6,482.544	$ 166,147.51				
		$ 223,390.37				
NOTE:	Statement 7/1/05 - Net Overpayment 1/1/04 - 4/31/05				$ 24,785.98	
	Statement 8/31/05 - Net Overpayment 1/1/04 - 4/31/05				$ 12,847.40	
	Statement 9/2/05 - Net Overpayment 1/1/04 - 4/31/05				$ 16,251.87	
	Statement 9/28/05 - Net Overpayment 1/1/04 - 4/31/05				$ 3,357.61	
					$ 57,242.86	

Table 2 – Payment Breakdown for Hydropower

Payments

$0.001 /KWH/Energy = Admin

$0.005 /KWH/Contract Capacity = Escrow

Receipts

$0.0298 /KWH/Capacity

$0.00356 /KWH/O&M

→ Electric Capacity

$0.01297 /KWH/Energy → Electric Energy

The yearly calculation of Electric Capacity is part of the contract that the Township must adhere to. The Electric Capacity must not fall below 800 kW for two consecutive years per the contract (Table 3). This contract energy amount is calculated by taking the 3 year average of the annual average kW. The number is derived by dividing the annual power generation (KWH) by the number of hours in a year. This contract is currently a

significant problem for the Township due to recent low flow years. As mentioned previously, their 2005 contract amount was 743 kW. Ms. Brinker indicated that the newly calculated 2006 figure is 732 kW. Since this is two consecutive years of less than 800 kW output, there has been a breach in the contract. Ypsilanti Township petitioned for an exception to the contract this year, but does not want this to be an ongoing situation.

Table 3 – Contract Energy Agreement

CHARTER TWP. OF YPSILANTI
Average Net Electric Capability Calculation
by Year

Agreement between The Detroit Edison Company and the Charter Township of Ypsilanti dated February 7, 1994 states that:
* Contract Energy = Average Net Electric Capability (Section 1.3)
*Average Net Electric Capability = Capacity generated in the previous three years (Section 1.6)

Performance Criteria: Failure to achieve net electric capability of at least 800 kW for any two consecutive years shall constitute default (Section 8.1.5).

		Generation		
Year	Contract Energy kW	Annual Generation MWH	Hours	Annual Average kW
1991		9606.007	8760	1,097
1992		7373.258	8784	839
1993		8663.967	8760	989
1994	**975**	8140.941	8760	929
1995	**919**	7035.28	8760	803
1996	**907**	9228.549	8784	1,051
1997	**928**	11391.22	8760	1,300
1998	**1,051**	8137.215	8760	929
1999	**1,093**	6076.418	8760	694
2000	**974**	9569.972	8784	1,089
2001	**904**	10854.48	8760	1,239
2002	**1,007**	6690.575	8760	764
2003	**1,031**	4604.281	8760	526
2004	**843**	8255.696	8784	940
2005	**743**			
2006				
2007				
2008				
2009				
2010				

The next revenue source that was analyzed was sale of park passes for the 3 parks on Ford Lake. The reason for analyzing park passes is that better water quality should make people more inclined to use the lake and the parks that surround the lake. There are usage fees involved with both park use and boat use. However**,** the township provides residents with a free annual park pass. This produces no gain for the township. It is recorded as negative revenue to show the City of Ypsilanti that cost to operate the parks is far higher than the lost revenue from park passes. This stems from a historical settlement with the City of Ypsilanti when Ypsilanti Township gained sole ownership over the lake and park land (Table 4).

Table 4 – Season Pass Rebates

2004/05 ANNUAL PARK PASS COMPARISON

Type of Pass	2004 Cost of Pass	2005 Cost of Pass	2004 # of Passes Sold	2005 # of Passes Sold	2004 Rebate Allowed	2005 Rebate Allowed
PARK						
City Resident	$15.00	$15.00	10	17	N/A	N/A
Township Resident	$15.00	$15.00	1838	1434	$ (27,570.00)	$ (21,510.00)
Non Resident	$25.00	$25.00	25	23	N/A	N/A
Senior City Resident	$10.00	$0.00	2	10	N/A	N/A
Senior Township Resident	$0.00	$0.00	6	96	N/A	N/A
Senior Non Resident	$10.00	$10.00	14	15	N/A	N/A
SUBTOTAL			**1895**	**1595**		
BOAT						
City Resident	$30.00	$30.00	9	2	N/A	N/A
Township Resident	$30.00	$30.00	235	160	$ (3,525.00)	N/A
Non Resident	$50.00	$50.00	50	71	N/A	N/A
Senior City Resident	$20.00	$10.00	2	3	N/A	N/A
Senior Township Resident	$10.00	$10.00	25	27	N/A	N/A
Senior Non Resident	$20.00	$20.00	9	13	N/A	N/A
SUBTOTAL			**330**	**276**		
TOTAL			**2225**	**1871**	**$ (31,095.00)**	**$ (21,510.00)**

The only substantial way to recover revenue through park usage fees is through sale of daily and seasonal passes to non-residents. Although the yearly revenue from these day passes is not enormous, better water quality during the late summer may increase park usage and revenue to the Township (Table 5). A sensitivity analysis was performed to determine how much revenue could be recovered if the usage increased from improved water quality (Figure 4). A conservative usage increase for the entire year is roughly 5%, which only yields an annual increase of about $1,750.

Another revenue element that was explored was a special assessment tax applied only to residents who dwell on Ford Lake. The rationale is that lakeshore residents will most benefit from cleaner water. If the lake becomes aesthetically pleasing year round the value of their homes would possibly increase. According to Ms. Brinker there are 2,407 dwelling units on Ford Lake. The required assessment to these residents would be very modest and affordable (Table 6): $4.05 is all that is necessary to recover the projected cost of $10,000. Even if a more generous figure was used to account for overhead and

other costs, a mere $10 assessment to these residents would fully recover the required revenue.

Table 5 – Daily Pass Revenue Summary

	2004 Passes Issued	2005 Passes Issued	2004 Total Revenue	2005 Total Revenue
FLP Daily Park Passes ($5.00)	2,800	2,848	$14,000.00	$14,240.00
NBP & LFP Daily Passes ($3.00)	2,275	2,654	$6,825.00	$7,962.00
Daily Park Pass Upgrade ($2.00)	13	16	$26.00	$32.00
All Parks - Daily Park Passes	**5,088**	**5,518**	**$20,851.00**	**$22,234.00**
FLP Daily Boat Passes ($8.00)	1,684	1,595	**$13,472.00**	**$12,760.00**
FLP season Park Passes	1,087	961	N/A	N/A
NBP & LFP Season Passes	822	673	N/A	N/A
All Parks - Season Park Passes	**1,909**	**1,634**	**N/A**	**N/A**
FLP Season Boat Passes	338	287	N/A	N/A
All Parks - Bus Passes	1	3	**$20.00**	**$60.00**
Daily Gate Revenues	**9,020**	**9,037**	**$34,343.00**	**$35,054.00**

Figure 4 – Revenue Sensitivity to Park Usage

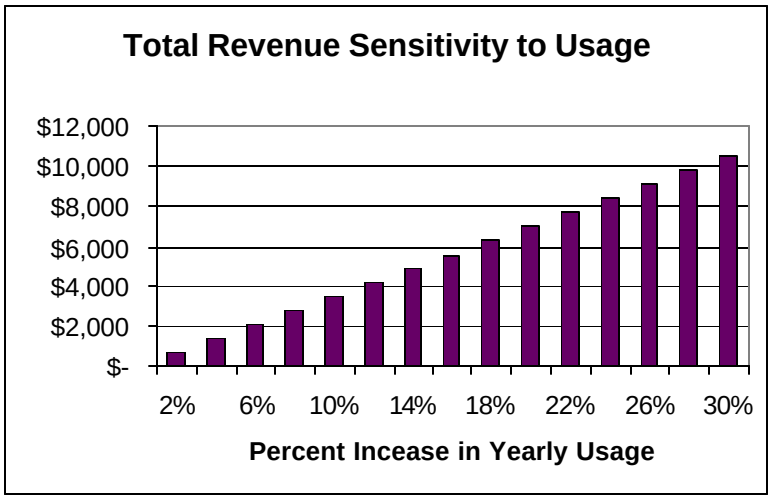


Table 6 – Special Assessment to Ford Lake Residents

Dwelling Units on Ford Lake	Lost Revenue	Necessary Special Assessment Amount	
2,407	$ 10,000.00	$ 4.15	/per unit/per year

Includes single-family home, condominiums, and apartments

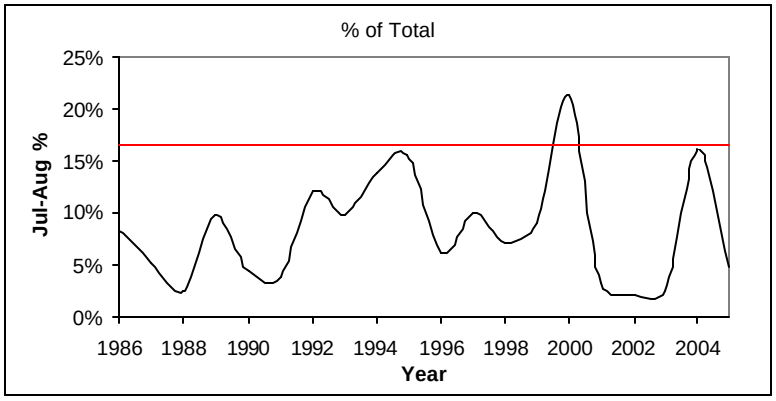
After looking at options to recover the lost revenue, a final analysis was performed in regards to the water flows. There were two thoughts behind this analysis. The first was that the maintenance schedule setup for turbines and generators by the Township would be most cost effective if maintenance was scheduled during periods of low flow. The other thought was to see what trends, if any, there were in flashiness. Flashiness is when there is increased runoff caused by impermeable surfaces, such as concrete. This could lead to lower revenue if the water flow comes episodically in bursts too great for the turbines to handle rather than in a more steady flow. Our hypothesis was that the increasing urbanization of the upstream watershed is leading to increased flashiness over time. This, in turn, might cause bursts of high flow conditions that cannot be effectively channeled into electricity production.

After running the numbers for the amount of revenue that could be earned in a perfectly predictable scenario with a 100% efficient dam, it appeared that the Township could be earning a much larger amount of money (Table 7). It also appeared that July and August were the best months for preventive maintenance because the amount of flow is lower than the rest of the year (Figure 5). However, after speaking with Ms. Brinker about this issue, she indicated that all maintenance was performed at the same time when at all possible. She also indicated that when things break they have to be fixed immediately, but all preventative maintenance is already performed during low flow periods in order to minimize revenue loss. Furthermore, she said that due to leakage in the turbines, the dam was not able to run at 100% efficiency. Thus it seems that the management of the dam is adequate and while it seems in theory they could earn more, in practice they are earning what they can.

Table 7 – Potential Revenue

Year	Total MW-h	Total Revenue
1985	10,878	$489,494
1986	12,081	$543,637
1987	8,139	$366,243
1988	8,863	$398,846
1989	9,805	$441,218
1990	13,085	$588,841
1991	10,439	$469,739
1992	12,531	$563,880
1993	12,663	$569,842
1994	11,208	$504,362
1995	11,445	$515,042
1996	10,339	$465,261
1997	12,929	$581,795
1998	9,417	$423,761
1999	6,442	$289,897
2000	10,539	$474,247
2001	12,077	$543,457
2002	7,945	$357,540
2003	6,094	$274,225
2004	9,841	$442,860
2005	8,242	$370,902
Averages	**10,238**	**$460,719**

Figure 5 – July to August Water Flow as percent of annual. Red line is reference: 2 mo/12 mo



In regards to flashiness, Figures 6 and 7 show the number of days in which the dam was operating at full capacity and the number of days that the dam could not produce any energy due to low flow. The reason for this analysis is that flashiness creates a feast or famine scenario. If there is significant flashiness, there will be more days when flow saturates the generator capacity, but there will also be more days when there is not enough flow to generate any power. There does not appear to be an upward trend in the maximum capacity days, but an argument could be made that the number of days that no power can be produced is increasing. Overall, there does not seem to be any conclusive evidence that suggests flashiness is increasing, and thus inhibiting revenue generation.

Figure 6 – Days of Maximum Capacity

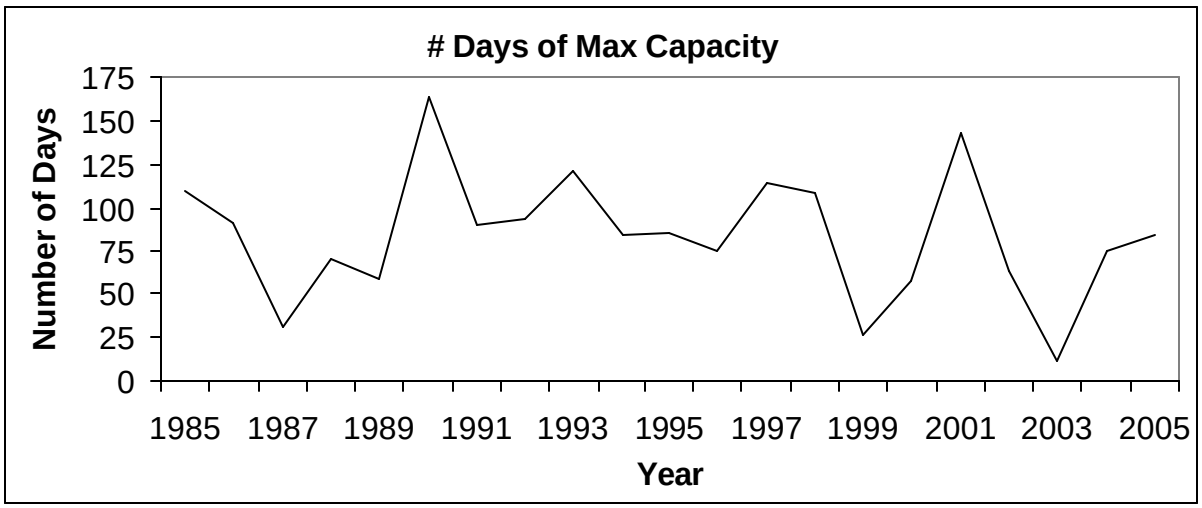
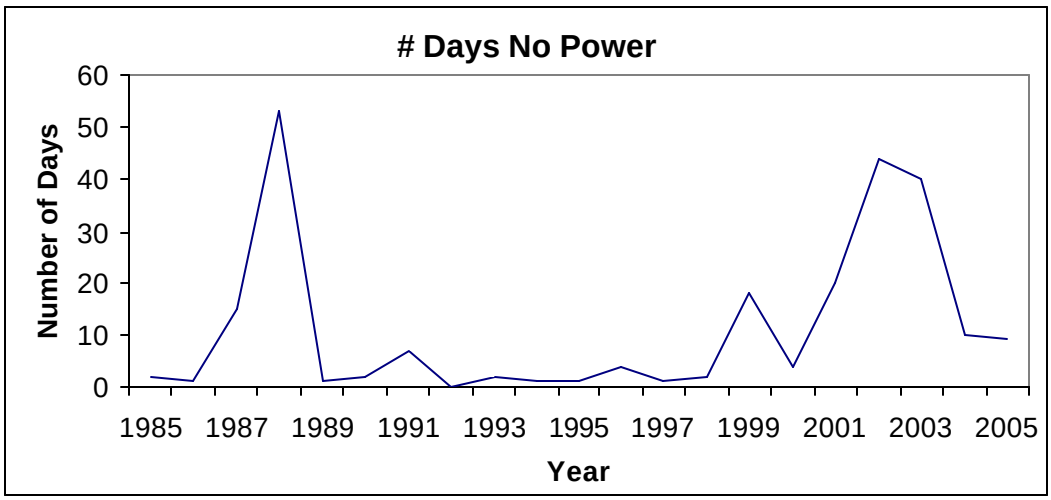


Figure 7 – Days of No Power Generation Due to Lack of Water Flow



Recommendations

In the final analysis there appear to be two viable options for Ypsilanti Township to recover revenue lost from selective withdrawal of water from the bottom of Ford Lake dam in an effort to improve water quality. The first option is the increase usage of the parks surrounding Ford Lake after water quality improves from July to September. In order to notify residents and non-residents of the improved water quality, township officials should promote this clearer, more enjoyable water so as to attract more users. This will hopefully allow the increased usage to climb past the conservative 5% estimate to as high as the 30% figure needed to generate $10,000. Effective marketing of the improved water quality would be essential to the success of this option. While marketing efforts require some funds, the Township should be able to leverage their resources and create a campaign that is cost effective.

The second, and more predictable option, is to create a special assessment tax. This tax would apply only the 2,400 plus residents of Ford Lake and would be inexpensive. Being residents of Ford Lake, these citizens surely would like to see improved water quality for both their enjoyment and the resale value of their home. The cost of this assessment to the residents will be very minimal, with a likely assessment of $10 per household. This assessment would have to be approved by the voters and further steps would be necessary to enact the special assessment. However, this seems to be the most worthwhile option for Ypsilanti Township.

Along with implementing the options outlined above, Ypsilanti Township should also maintain careful monitoring of the dam to ensure that it runs as efficiently as it can. Flashiness does not appear to be a problem over the past 20 years, but increased impermeable surfaces around the lake may cause this to change. Careful monitoring of these values will also ensure that the Township extracts the most value out of the dam.

Finally, the Township must remain abreast of their energy contract and ensure that they can obtain the specified amount of 800 kW. The past two years have shown that breaching the contract is possible and future underperformance may be treated differently by Detroit Edison. A contingency plan should be in place in order to ensure there is no crisis regarding the contract between Ypsilanti Township and Detroit Edison.

If the previous recommendations are implemented, Ford Lake can become a clear and enjoyable lake, with little or no harm to the Township's financials.

References

Interviews with Joann Brinker, Director of Human Resources, Ypsilanti Township
7 February 2006; 9 March 2006

Lehman, John T. Adaptive Strategies to improve the Condition of Ford Lake. Presentation to the Ford Lake Water Conservation Advisory Committee, Township Trustees, and Guests. 14 November 2005 (www.umich.edu/~hrstudy).