

# **Clam Lake Watercraft Carrying Capacity Study**

## **Friends of Clam Lake**

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Data collection by  
Volunteers from the  
Friends of Clam Lake

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## Executive Summary

On Saturday, July 26, 2008, volunteers from the Friends of Clam Lake conducted a watercraft carrying capacity study on Clam Lake. The purpose of the study was to establish a factual baseline of watercraft traffic on Clam Lake during a typical summer day, not the extremes like July 4<sup>th</sup> or Labor Day.

As discussed in the section “History and Reality of Carrying Capacity Studies”, there is no one universally recognized or legally accepted methodology to conducting a Watercraft Carrying Capacity Study. This does not negate or diminish the importance of this study’s findings since the data is in fact, real and accurate using the described methodology.

Since Clam Lake is part of the Chain-of-Lakes and somewhat unique in its use by the general public and riparian owners, the actual study was specifically designed for Clam Lake. Data was captured in three components:

1. Average Boat Loading Study: Establish how many watercraft are on the lake at any point in time. Data was collected for the afternoon and shows that the average boat loading for Clam Lake is 37.75 watercraft. The largest category of boats was the “Runabout/Bowrider/Cruiser” followed by “Pontoon”, “Jet-Ski”, “Fishing” and “Non-Motorized” in that order. No boats moored at docks along the lake were counted.
2. Boat Traffic Study: A count of the number and types of boats going into and out of Clam Lake at both the Clam River Bridge (from land) and the Grass River (from boat or land). Data was collected between 10:00 am and 5:00 pm. At Clam River, the total traffic for the study period showed 219 watercraft entering Clam Lake and 267 watercraft exiting Clam Lake. At the Grass River, there were 83 watercraft entering Clam Lake and 86 watercraft exiting Clam Lake at the Grass River.
3. DNR Boat Launch Site: Count the number and type of parked boat trailers. Data was collected for the afternoon and shows that there were 26 boat trailers, on the average, parked at the DNR site.

This report will make no statements or conclusions on how crowded Clam Lake is. It only presents the data using the described methodology. It is then up to the readers, government officials, lawyers, courts and other interested groups and individuals to make their own conclusions, using the data and other studies’ analyses and recommendations on boating densities.

At this time there are no major issues regarding the use of Clam Lake. For the future though, if an issue comes up on watercraft loading, no-wake zones, launching site expansions, commercial ventures, etc., we will now have a base point for evaluations, comparisons and negotiations.

As we look to the future, our recommendation is for everyone to stay vigilant and knowledgeable about all that takes place under, on, and above Clam Lake. If an issue arises, another watercraft carrying capacity study using the identical methodology will add powerful information to the “discussion” when compared to the July 26, 2008 study.

We welcome all comments.

Our thanks again to all those volunteers who made this study a success.

## **Acknowledgement:**

The Friends of Clam Lake (FoCL) Board of Directors would like to recognize the volunteers who participated in the 2008 Clam Lake Watercraft Carrying Capacity Study:

Jerry & Terrie Ash  
Dave & Sharon Brooks  
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Art & Carol Hoadley  
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Bob Hockenberger  
Jackie & Steve Kline  
Dave & Maureen Latanick  
Bob & Arlene Manzardo  
Jim & Mary Ann Marling  
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Kimberly Sak  
Paul & Lori Sak  
Bill & Marian Seidenstucker  
Joan & Bob Sell  
Fred & Susan Sittel  
John & Nancy Tisch  
Cottie & Tom Volle

We would also like to thank Mr. William Boik from the Waterways Unit of the DNR - Parks and Recreation for his insight and cooperation.

## **Section 1: Purpose & Background**

During its efforts with the Michigan Department of Environmental Quality (DEQ) in 2007, the Friends of Clam Lake (FoCL) realized that in addition to public involvement and comments, realistic and factual data, photos, plats, etc. were crucial in presenting our concerns over the safe public and private use of Clam Lake.

To that end, FoCL's Board of Directors authorized two studies for 2008: Shoreline Greenbelt Survey and Watercraft Carrying Capacity Study. For both of these studies, the primary purpose was to establish a baseline status and then disseminate this information to all concerned about the continued quality of Clam Lake and Antrim County's Chain-of-Lakes.

Specifically for the Watercraft Carrying Capacity Study, there was a need to establish a factual starting point concerning watercraft traffic on Clam Lake. It's recognized that on major holidays like July 4<sup>th</sup> and Labor Day, the activity on Clam Lake can be sometimes overwhelming. Although it may be helpful to do a similar study on one of these holidays to establish an "extreme case" baseline, the decision was made to target a more average and typical summer day to arrive at a baseline. With that in mind, the initial study was targeted for Saturday, July 19, 2008, but never completed. The weather on that Saturday was very overcast, cool and rainy with periods of heavy downpours and extreme winds. A complete study was then done the following Saturday, July 26, 2008, which turned out to be a more average and typical summer day "Up North".

## Section 2: Clam Lake Overview

Clam Lake is part of the Antrim County (Michigan) Chain-of-Lakes, covering a 500 square mile watershed with fourteen lakes, interconnecting rivers and 247 tributaries. From a navigation point, the chain is split between the Upper Chain and the Lower Chain by the Bellaire Dam. All waters from the Chain flow into Lake Michigan at Elk Rapids where the Elk Rapids Dam prevents direct access to and from Lake Michigan.

Clam Lake is the smallest of the Lower Chain, which consists of Lake Bellaire, Clam Lake, Torch Lake, Skegemog Lake, and Elk Lake.

Lake	Surface Area (acres)	Shoreline Length (miles)	Deepest Point (feet)	Average Depth (feet)	Public Access Parcels	Public Boat Launch Ramps	Private Boat Launch Ramps
Lake Bellaire	1,793	11.5	95.1	41.6	11	2	1 <sup>1</sup>
Clam Lake	439	8.5	27	13.1	5	2 <sup>2</sup>	1 <sup>2</sup>
Torch Lake	18,473	41.4	330	139.7	48	5 <sup>3</sup>	2 <sup>3</sup>
Skegemog Lake	2,755	11	29	11.2	4	3	0
Elk Lake	8,088	26	192	67.2	15	5 <sup>4</sup>	1 <sup>4</sup>

Notes:

- 1 - Includes Intermediate River
- 2 - Includes Clam River
- 3 - Includes Torch River
- 4 - Includes Elk River

Clam Lake is located in both Helena Township and Forest Home Township.

From the general information above, along with the actual use of Clam Lake, some interesting facts and realities surface that describe the importance of Clam Lake and the corresponding impact on its boating traffic, carrying capacity, safety and overall “quality of life”:

- Clam Lake is both a destination and a means to an end:
  - Boaters come to Clam Lake for fishing, skiing, tubing, wakeboarding and sightseeing.
  - To get to the Grass River, Grass River Natural Area and Lake Bellaire, boaters from Torch, Skegemog and Elk Lakes must use Clam Lake.
  - Boaters from Lake Bellaire and the Grass River must use Clam Lake to get to Torch Lake and its popular sandbar.
- Clam Lake is a “safe haven” lake. When the winds pick up on Torch Lake, Clam Lake is where boaters go for fishing, tubing, wakeboarding and skiing.
- Because of its size and calmer waters, Clam Lake is the preference for those trying skiing or wakeboarding for the first time. Without the waves and almost constant “chop” of Torch Lake, it’s also preferred by the more experienced skier or wakeboarder.
- With its warmer waters, Clam Lake is used earlier in the season than the other lakes.
- The surface area of Clam Lake is approximately 439 acres. As some studies do, when you determine the actual area available for boating, eliminating the 100 foot buffer zone from the shoreline or dock/raft, as well as the no-wake zones, the useful surface area is approximately 335 acres.
- Clam Lake is a long narrow lake with actual width varying from 450 - 1050 feet. Excessive noise from “off-shore” boats with above water exhaust systems, ski/wakeboarding boats with tower mounted mega-bass speakers and jet-skis are a major problem and nuisance.

- Since both entrances to Clam Lake (Grass River and Clam River/marina area) are no-wake zones, the tendency for those passing through is to get up on plane and speed through the lake since they've "wasted time" just coming from a no-wake area.
- For its size, based on surface area, Clam Lake offers more boating access (trailer launch ramps) for the general public than any of the lower Chain-of-Lakes.

Lake	Actual Launch Ramps	Lake Surface Area per Launch Ramp (acres)	Theoretical Launch Ramps to Match Clam Lake's Ratio
Lake Bellaire	3	598	12
Clam Lake	3	146	N/A
Torch Lake	7	2639	127
Skegemog Lake	3	918	19
Elk Lake	6	1348	55

## Section 3: History and Reality of Carrying Capacity Studies

Initial research for this project was conducted by reading past carrying Capacity Studies and reviews dating from 1971 through 2005. Appendix A lists the studies that were reviewed. These studies are all available on the Internet. If the reader would like a relatively quick overview of Capacity Studies, “**Techniques for Estimating Boating Carrying Capacity: A Literature Review**” by Holly E. Bosley<sup>1</sup> is recommended.

The Michigan Department of Environmental Quality (DEQ) and Department of Natural Resources (DNR) were contacted to determine what methodologies were used at the state level. Our contacts at the DEQ were unaware of any official methodology. William Boik from the Waterways Unit of DNR - Parks and Recreation was very helpful, especially in providing information on what the DNR uses when considering development of boat launching facilities.

The final document reviewed was a legal one involving the final determination on a case brought to the DEQ Office of Administrative Hearings:

Petition of Vandercook Lake Improvement Association on the permit issued to John Dobben, 1999

File No. 96-13-0079

<http://www.deq.state.mi.us/oah/VanderCook.htm>

The **key finding** from all this research was:

**There is no one universally recognized or legally accepted methodology to conducting a Watercraft Carrying Capacity Study.**

Mr. Boik from the DNR reaffirmed this in his email correspondence with us:

“There is no formula that fits all lakes and the “carrying capacity” for any lake. There have been many attempts at developing a formula by consultants and universities around the country, but all have failed due to the vast number of variants that lakes have to offer. A few years back, there was a study done at MSU of all the studies claiming carrying capacity and the conclusions affirmed that a formula does not exist. The study further concluded that a formula could not be achieved that could factor in the totality of variances within natural waterbodies and direct or indirect influences.”

One may then ask, “Why conduct a Carrying Capacity Study?”

The answer starts with the fact that there **can be** a valid formula or methodology for conducting a **Clam Lake** Watercraft Carrying Capacity Study. This methodology and the interpretation of results should only be used for Clam Lake. The methodology becomes more powerful if and when another study is conducted using the exact same methodology. Finally, it will become **truly valid** at that point in time when an issue arises and the interested parties, lawyers, state agencies and/or judges sit down to evaluate, make comparisons and negotiate the issue at hand.

A summary of other key points learned from our research and used in the design and execution of the study are as follows:

- The design of the study should take into account the lake's specific physical characteristics and use characteristics.
- The study should capture activity at several points in time to provide the most accurate picture of actual usage.
- Volunteers should be consistently instructed on how to conduct the survey.
- All forms and other aids used for counting and tabulating should be consistent and easy to use.
- Keep it simple. Many of the studies added variables like type, length, and horsepower of watercraft. Others captured the exact uses of the watercraft on the lake: fishing, tubing, skiing, wakeboarding,



cruising and sailing. Some studies added variables like shallowness ratios, shoreline development factors, and other theoretical calculations for their analyses. While these factors may add interest, generate hours of further discussion and qualify as a doctoral dissertation, they also add to the overall length, weight and cost of the report. We kept it simple but consistent.

- Some of the other studies' results are shown below.<sup>1,2</sup>

Source	Suggested Density	Boating Uses
Ashton (1971)	5 to 9 acres/boat	All uses combined in Cass Lake
	4 to 9 acres/boat	All uses combined in Orchard Lake
	6 to 11 acres/boat	All uses combined in Union Lake
Kusler (1972)	40 acres/boat	Waterskiing - All uses combined
	20 acres/boat	Waterskiing
	15 acres/boat	Coordinated waterskiing
Jaakson <i>et al.</i> (1989)	20 acres/boat	Waterskiing and motorboat cruising
	10 acres/boat	Fishing
	8 acres/boat	Canoeing, kayaking, sailing
	10 acres/boat	All uses combined
Wagner (1991)	25 acres/boat	All recreational activities
Warbach <i>et al.</i> (1994)	30 acres/boat	All motorized (>5 HP) uses
PAE (2001)	10 - 15 acres/boat	All uses

- An interesting guidebook developed by the U. S. Department of Agriculture's Forest Service was highlighted in the "Ririe Reservoir Recreation Carrying Capacity Study" <sup>1D</sup>. The complete guidebook can be found at <http://www.usbr.gov/pmts/planning/wros/>. An excerpt from the "Techniques for Estimating Boating Carrying Capacity: A Literature Review"<sup>1</sup> adds some interesting analysis:

#### "Water Recreation Opportunity Spectrum (WROS)

A second table of interest provided in the Ririe Reservoir study deals with the Water Recreation Opportunity Spectrum (WROS). The original Recreation Opportunity Spectrum (ROS) was developed by the U.S. Department of Agriculture's Forest Service as a response to increased demand for a variety of outdoor recreation opportunity settings (Clark & Stankey, 1979). Recently, however, the ROS has been translated to water-based recreation activities.

There are six WROS classes: urban, suburban, rural developed, rural natural, semi primitive, and primitive. The Water Recreation Opportunity Spectrum Users' Guidebook offers the following ranges of reasonable boating capacity coefficients (i.e., boating densities) for the six WROS classes:

**Table 3**  
**Boating Density Ranges for Six WROS Classes**

WROS Class	Range of Boating Coefficients (boating density)	
	Low end of range	High end of range
Urban	1 acre/boat	10 acres/boat
Suburban	10 acres/boat	20 acres/boat
Rural developed	20 acres/boat	50 acres/boat
Rural natural	50 acres/boat	110 acres/boat
Semi-primitive	110 acres/boat	480 acres/boat
Primitive	480 acres/boat	3,200 acres/boat

## Section 4 - DNR Boat Launch

In addition to the Carrying Capacity Study done on Clam Lake, we also took this opportunity to track the actual usage at the DNR boat launch located on the northern shore of Clam lake in Forest Home Township.

Mr. William Boik from the DNR provided us with this insight into how the DNR evaluates boat launching facilities. This is from an email he sent:

“Our evaluations are based on the lake attributes and provides us with a range of impact that helps us in the development of a boat launching facility. For instance, we look at local populations, roads, density of shoreline development, nearby lakes, access points on the lake, types of recreation available on the lake, and various other measures we use in getting to a fair number for shared use of the public waters.

For DNR purposes, our calculations provide us with a number of boats we could allow access on a particular waterbody. This number is for the non-riparian public's access to the water. Our development goal is determined in lake surface acres per boat at the public access site. The normal goal is from 15 acres per boat density to 6 acres per boat density. Typically, we use the 15 acres per boat number in our development. This provides the most space for all users.

You must remember the 15 acres per boat is only for the number of non-riparian boats we will allow from our boat launch site. This is in addition to the riparian owners boats already on the lake. The 15 acres per boat ratio is for a fully developed shoreline with maximum riparian density. The reason we normally use this number as our boat launch development goal, is that it allows for a lake's shoreline development to continue to add riparians to the lake without the public facility to be downsized in the future.”

This information was also documented in one of the studies:

“Current guidelines used by the Department of Natural Resources in sizing access sites require one car/trailer space for each 15 acres of lake surface area (on lakes up to 1,000 acres).”<sup>2</sup>

## **Section 5 - Clam Lake Study**

### **Section 5A - Approach:**

Since Clam Lake is both a destination and a passageway on the Chain-of-Lakes, it was determined that an indicator of “carrying capacity/boating density/congestion” must take into account both of those characteristics. We designed a study with three components to accomplish this.

#### **1. Average Boat Loading Study**

From a point on land or from an anchored boat, a team of two people took a “snapshot” count of the number and types of watercraft in use, once each hour. Clam Lake was divided into six zones so that each team did their count in that zone at the top of each hour. Each zone was laid out so that each team could easily see the boating activity in that zone. Specific landmarks were designated on both the north and south shores to help identify the zone boundaries. Counts from each team were added together for each hour and these hourly counts averaged to determine an average boat loading for Clam Lake. These counts were done at the top of each hour: 2:00 pm, 3:00 pm, 4:00 pm, and 5:00 pm. Volunteers were asked to use a cell phone to determine the exact time for the “snapshot” count”.

#### **2. Boat Traffic Study**

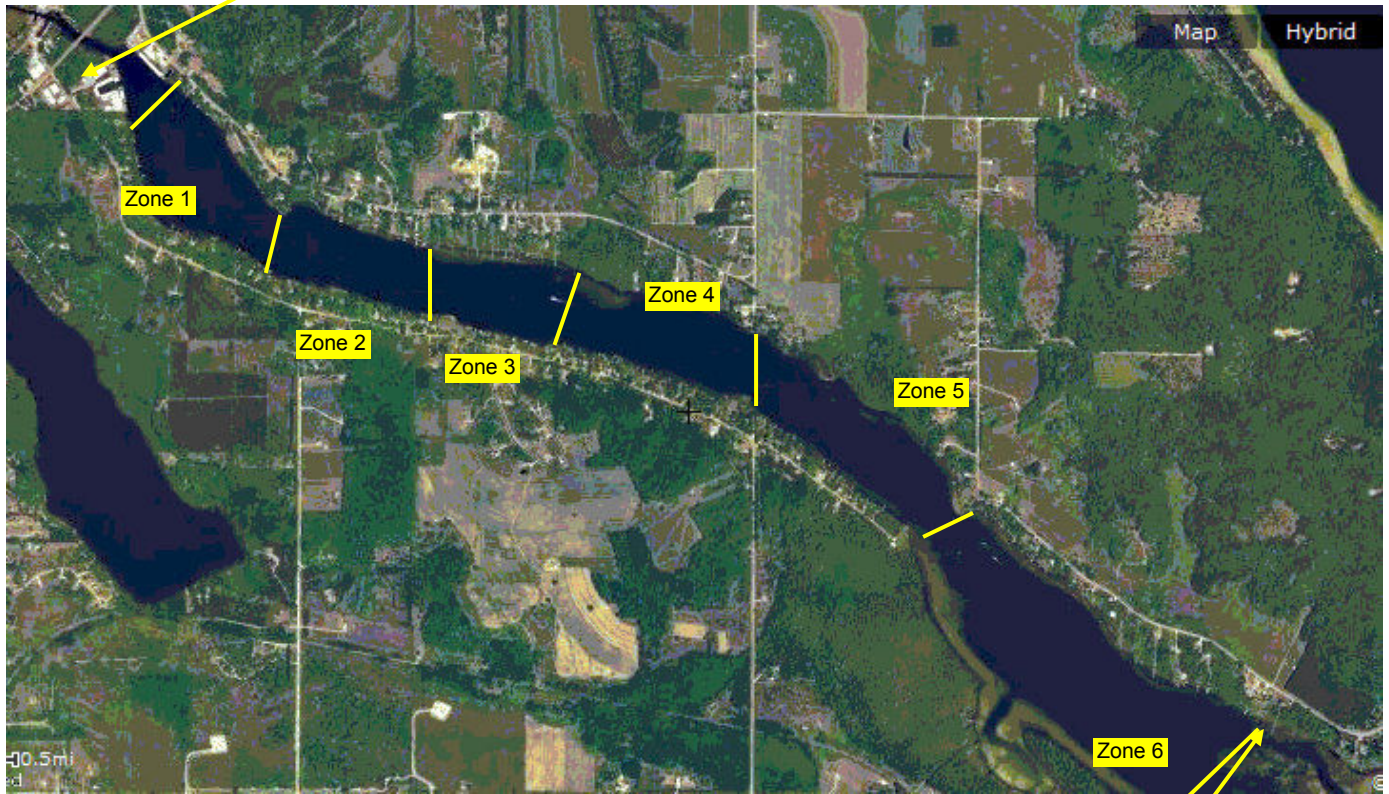
Teams of two people counted the number and types of boats going into and out of Clam Lake at both the Clam River Bridge (from land) and the Grass River (from boat or land). Each team was assigned to a one, two or three hour time slot. The continuous counts were done in assigned time slots of 10:00 am - Noon, Noon - 2:00 pm, 2:00 pm - 5:00 pm.

#### **3. DNR Boat Launch Site**

At the DNR site, a count was made of the number and type of parked boat trailers. These counts were done at the top of each hour: 2:00 pm, 3:00 pm, 4:00 pm, and 5:00 pm.

The overall layout of the zones and traffic study locations can be seen below in Figure 1 - Boat Loading Zones & Traffic Locations.

Clam River Traffic in/out of Clam Lake (@ Ferris home 6249 Crystal Springs Rd)



Grass River Traffic in/out (@ Grass River entrance)

Figure 1- Boat Loading Zones & Traffic Locations

### Section 5B - Training:

During the week prior to the study, a formal training session for volunteers was held. The Purpose & Background, Approach, Forms, Visual Aids and Schedule were reviewed. Those volunteers unable to attend the formal training were trained one-on-one by Paul Sak, using the same materials and agenda. Those volunteers doing the Average Boat Loading count were asked to visually preview their assigned zone boundaries prior to the actual survey date.

## Section 5C - Forms:

The following forms (see Appendix C) were used by all volunteers to collect the study data:

- Clam Lake Average Boat Loading Study
- Clam Lake Boating Traffic Study
- Clam Lake Average DNR Site Trailer Study

## Section 5D - Visual Aids:

The following aids were used by all volunteers:

- Sample filled out forms as shown in Appendix C
- Cell phones and binoculars when necessary
- Photographs of each Zone used in the Average Boat Loading Study. See Appendix B Figures.

## Section 5E - Schedule:

The following schedule was used to organize all participants.

### Clam Lake Carrying Capacity Study July 26, 2008 Schedule

Boating Traffic			
Clam River (at Ferris's Home)	10:00 am – Noon 10:00 – 11:00 am	Duane & Doris Ferris Bob Hockenberger	Contact Phone Numbers were provided but are not shown in this report.
	Noon – 2:00 pm	Jerry & Terrie Ash	
	2:00 pm – 5:00 pm	Lori & Kim Sak	
Grass River	10:00 am – Noon	Art & Steve Hoadley	
	Noon – 2:00 pm	Dave & Maureen Latanick	
(7695 Cottage Drive)	2:00 pm – 5:00 pm	Fred & Susan Sittel	
Average Boat Loading			
Zone 1	Kline's Dock	Jackie & Steve Kline	
Zone 2	Volle's Dock	Cottie & Tom Volle	
Zone 3	Seidenstucker's Dock	Bill & Marian Seidenstucker	
Zone 4	Boat	Paul Sak	
Zone 5	Boat or Koop's	Bob & Arlene Manzardo	
Zone 6	Sittel's Dock	Fred & Susan Sittel	
DNR Boat Launch	Car	John Tisch	

Notes:

1. Weather – Paul Sak will call participants if canceled in morning or during the day.
2. Bring forms, 2 -3 pencils, sunscreen, water/liquids, binoculars if needed.
3. Average Boat Loading zones – check them out before Saturday. Call Paul if questions – use Home #.
4. If have cell phone, use it to determine exact time. Otherwise, check your watch against some established clock.
5. Get to location 10 minutes early. If next person is not there, call them to find out issue. If they can't make it and you can't stay, that's okay. Call Paul.
6. Each person/team keeps their own tally and drops it off at Paul & Lori's home. Please drop tally sheets off by Sunday evening.
7. HAVE FUN & THANKS!!!!

## Section 5F - Results:

Summary tables for each of the three components to the Clam Lake Watercraft Carrying Capacity Study are shown below. Original data forms are stored in the Friends of Clam Lake files.

Table 1 - Average Boat Loading Study

Table 2A - Boat Traffic Study @ Clam River

Table 2B - Boat Traffic Study @ Grass River

Table 3 - DNR Boat Launch Site

There is a lot of information in these tables which can be interpreted, summarized and charted. Although this report will highlight some of the results and make some observations, it will make no statements or conclusions on how crowded Clam Lake is. It will only present the data using the described methodology. It is then up to the readers, government officials, lawyers, courts and other interested groups and individuals to make their own conclusions, using the data and other studies' analyses and recommendations on boating densities.

### Highlights & Observations:

- Weather during the study was close to an average July/August Saturday "Up North". Appendix D captures the observed weather as reported by [www.intellicast.com](http://www.intellicast.com).
- Watercraft classifications were the same for both of the "Boat" studies with the exception that "Off-Shore" or above-water exhaust boats were able to be identified and counted in the "Boat Traffic Study". Any "Off-Shore" boats that were possibly on the lake for the "Average Boat Loading Study" are included in that report's "Runabout/Bowrider/Cruiser" category.
- **Average Boat Loading** on Clam Lake for the four "snapshots" taken between 2:00 pm and 5:00 pm is **37.75 watercraft**. The largest category of boats was the "Runabout/Bowrider/Cruiser" followed by "Pontoon", "Jet-Ski", "Fishing" and "Non-Motorized" in that order. No boats moored at docks along the lake were counted.
- The surface area targeted for the "Average Boat Loading Study" did not include the no-wake zone by Dewitt Marine or the very shallow arm on the south side of the eastern portion of the lake. As noted in Section 2 - Clam Lake Overview, the surface area for any analysis of Clam Lake can be calculated to vary between 335 - 439 acres, depending on what type of study and the assumptions made. Since certain areas of the lake were specifically not included, we would estimate that the **surface area for this study would vary between 335 - 400 acres**.
- Between the hours of 10:00 am and 5:00 pm, there were 219 watercraft entering Clam Lake and 267 watercraft exiting Clam Lake at the Clam River. During the same hours, there were 83 watercraft entering Clam Lake and 86 watercraft exiting Clam Lake at the Grass River. Although some may want to interpret and analyze this data to prove some point, it should be noted that these numbers **do not include**:
  - watercraft leaving Dewitt Marine and going into Clam Lake and then returning to the marina

- watercraft launched at the DNR boat launch which stayed in Clam Lake
- riparian owners who stayed in Clam Lake

The “Boating Traffic Study” is just **a count of traffic** at each river, at each end of Clam Lake. The usefulness of this data will come when another identical study can be done and comparisons of growth or decline can be made.

- **Average Trailer Count** at the DNR site was **26 trailers**. As noted in Section 4 - DNR Boat Launch, a design target is to have a launch ramp site sized for approximately **15 lake surface acres/boat (trailer)**.



Table 1 - Average Boat Loading						Date: July 26, 2008	
2:00 PM Zone	Runabout Bowrider Cruiser	Fishing	Pontoon	Jet Ski	Non-Motorized	Zone Sub-Total	Lake Total
1	7					7	
2	2					2	
3	3					3	
4	3	1			1	5	
5	5					5	
6	8		2			10	
Type Sub-Total	28	1	2	0	1		32
3:00 PM Zone	Runabout Bowrider Cruiser	Fishing	Pontoon	Jet Ski	Non-Motorized	Zone Sub-Total	Lake Total
1	3		3			6	
2	2		1			3	
3	3		1			4	
4	3	1	1			5	
5	7					7	
6	12	1		1	1	15	
Type Sub-Total	30	2	6	1	1		40
4:00 PM Zone	Runabout Bowrider Cruiser	Fishing	Pontoon	Jet Ski	Non-Motorized	Zone Sub-Total	Lake Total
1	4		2			6	
2	1					1	
3	5		1	2		8	
4	3	1	2			6	
5	4		1			5	
6	9			3		12	
Type Sub-Total	26	1	6	5	0		38
5:00 PM Zone	Runabout Bowrider Cruiser	Fishing	Pontoon	Jet Ski	Non-Motorized	Zone Sub-Total	Lake Total
1	7		2			9	
2	2					2	
3	5		2	2		9	
4	8		1			9	
5	4			1		5	
6	6		1			7	
Type Sub-Total	32	0	6	3	0		41
Average Boat Loading:							37.75



Table 2A - Boating Traffic Study @ Clam River								Date: July 26, 2008							
IN	10:00 AM - 11:00 AM							OUT	10:00 AM - 11:00 AM						
Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total		Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total	
6		1			2	9		12			4			16	
IN	11:00 AM - Noon							OUT	11:00 AM - Noon						
Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total		Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total	
6			1		2	9		13		1	5			19	
IN	Noon - 1:00 PM							OUT	Noon - 1:00 PM						
Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total		Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total	
20		2	3	3		28		31	3	2	9		4	49	
IN	1:00 PM - 2:00 PM							OUT	1:00 PM - 2:00 PM						
Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total		Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total	
17			3	3		23		35	5		5	6		51	
IN	2:00 PM - 3:00 PM							OUT	2:00 PM - 3:00 PM						
Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total		Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total	
32			6	2		40		38	5	1	6		5	55	
IN	3:00 PM - 4:00 PM							OUT	3:00 PM - 4:00 PM						
Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total		Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total	
31	3	1	5	4		44		25	1		3	8		37	
IN	4:00 PM - 5:00 PM							OUT	11:00 AM - Noon						
Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total		Runabout Bowrider Cruiser	"Off-Shore"	Fishing	Pontoon	Jet Ski	Non-Motorized	Total	
50	1	3	8	4		66		30		2	6	2		40	
				Total IN		219						Total OUT		267	

Table 2B - Boating Traffic Study @ Grass River							Date: July 26, 2008							
IN	10:00 AM - 11:00 AM						OUT	10:00 AM - 11:00 AM						
Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	
3		3	1			7	3						3	
IN	11:00 AM - Noon						OUT	11:00 AM - Noon						
Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	
2			3		2	7	7		1				8	
IN	Noon - 1:00 PM						OUT	Noon - 1:00 PM						
Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	
5		1	3		2	11	10			3			13	
IN	1:00 PM - 2:00 PM						OUT	1:00 PM - 2:00 PM						
Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	
3			2		2	7	8			3			11	
IN	2:00 PM - 3:00 PM						OUT	2:00 PM - 3:00 PM						
Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	
15			2		3	20	12			1	1		14	
IN	3:00 PM - 4:00 PM						OUT	3:00 PM - 4:00 PM						
Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	
8			5	5		18	15			4		1	20	
IN	4:00 PM - 5:00 PM						OUT	11:00 AM - Noon						
Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	Runabout Bowrider Cruiser	"Off- Shore"	Fishing	Pontoon	Jet Ski	Non- Motorized	Total	
11			2			13	9		1	3	4		17	
			Total IN			83				Total OUT			86	

Table 3 - DNR Boat Launch Site				Date: July 26, 2008		
Time	Standard Boat Pontoon Trailer	Jet Ski Trailer - Single	Jet Ski Trailer - Double	Car Top Carrier - Single	Car Top Carrier - Double	Site Total
2:00 PM	28	1				29
3:00 PM	25	1				26
4:00 PM	25					25
5:00 PM	24					24
		Average Trailer Count:				26

## Section 6 - Conclusion & Recommendations

Using a consistent methodology with ample documentation of the process and results, this report is submitted to our members and other readers, government officials, lawyers, courts and any other interested groups.

When the Friends of Clam Lake undertook this study, we had no hidden agenda in trying to prove or disprove anything. Now, with the writing of this report a year later, after a delay due only to the time constraints of the author's, we still have no hidden agenda.

The data is accurate and captures a summer day on Clam Lake. This data and report provides one baseline for further discussion centered on the goal of our organization:

***Protection of the water quality, safety, environment, wildlife and quality of life of all who live and play on Clam Lake through the dissemination of information and taking action on issues which impact Clam Lake.***

As we look to the future, our recommendation is for everyone to stay vigilant and knowledgeable about all that takes place under, on, and above Clam Lake. If an issue arises, another watercraft carrying capacity study using the identical methodology will add powerful information to the "discussion" when compared to the July 26, 2008 study.

We welcome all comments.

Our thanks again to all those volunteers who made this study a success.

## Appendix A - Carrying Capacity Studies & Reviews

### <sup>1</sup>Techniques for Estimating Boating Carrying Capacity:

#### A Literature Review

##### Prepared for:

Catawba-Wataeree Relicensing Coalition

##### Prepared by:

Holly E. Bosley

North Carolina State University

Department of Parks, Recreation & Tourism Management

August, 2005

<http://www.cwrc.info/boatcarryingcapacity.pdf>

The above review covers the following studies:

#### <sup>1A</sup>Carrying Capacity and Lake Recreation Planning, Parts I & II

Study Area: North-Central Saskatchewan, Canada

Authors: Jaakson, Buszynski, and Botting (1989, 1990)

#### <sup>1B</sup>Deep Creek Lake (Maryland) Boating and Commercial Use Carrying Capacity Study

Authors: ERM 1988, 1989)

#### <sup>1C</sup>Visitor Carrying Capacity Guidelines

Authors: Florida Department of Environmental Protection, Division of Recreation and Parks

#### <sup>1D</sup>Ririe Reservoir Recreation Carrying Capacity Study, Idaho

Authors: EDAW (2004b)

#### <sup>1E</sup>Reservoir Boating; Final; R-7; Oroville Facilities Relicensing, FERC Project No. 2100

Study Area: Lake Oroville, CA

Authors: EDAW (2004a)

#### <sup>1F</sup>Recreational Boating on Delaware's Inland Bays: Implications for Social and Environmental Carrying Capacity

Authors: Falk, Graefe, Drogin, Confer, & Chandler (1992)

### <sup>2</sup>Four Township Recreational Carrying Capacity Study: Pine Lake, Upper Crooked Lake, Gull Lake, Sherman Lake (Michigan)

Authors: PAE May, 2001

<http://www.kbs.msu.edu/ftwrc/publications/Carryingcapacity.pdf>

<http://www.ftwrc.org/publications/Carryingcapacity.pdf>

### <sup>3</sup>Recreational Carrying Capacity in Lakes:

#### How much is too much?

Author: Sheela Doshi Summer, 2006

Indiana State University

School of Public and Environmental Affairs

<http://www.indiana.edu/~clp/documents/WATER%20COL%20V18,%20N2.pdf>

**<sup>4</sup>REGULATING KEYHOLE DEVELOPMENT: CARRYING CAPACITY ANALYSIS & ORDINANCES  
PROVIDING LAKE ACCESS REGULATIONS**

**Author:** John D. Warbach, Ph.D & Mark A. Wyckoff, AICPO   November 1994

[http://www.pzcenter.com/Regulating\\_Keyhole\\_Develop\\_Report.pdf](http://www.pzcenter.com/Regulating_Keyhole_Develop_Report.pdf)

## Appendix B

Zone 1 - No Wake Zone at Dewitts east to point at Sell's (north) across to Ballard's (south) (green boat hoist covers)



West Boundary – across no wake sign



South:



North:

East Boundary – Ballard's green boat hoist covers to point at Sell's



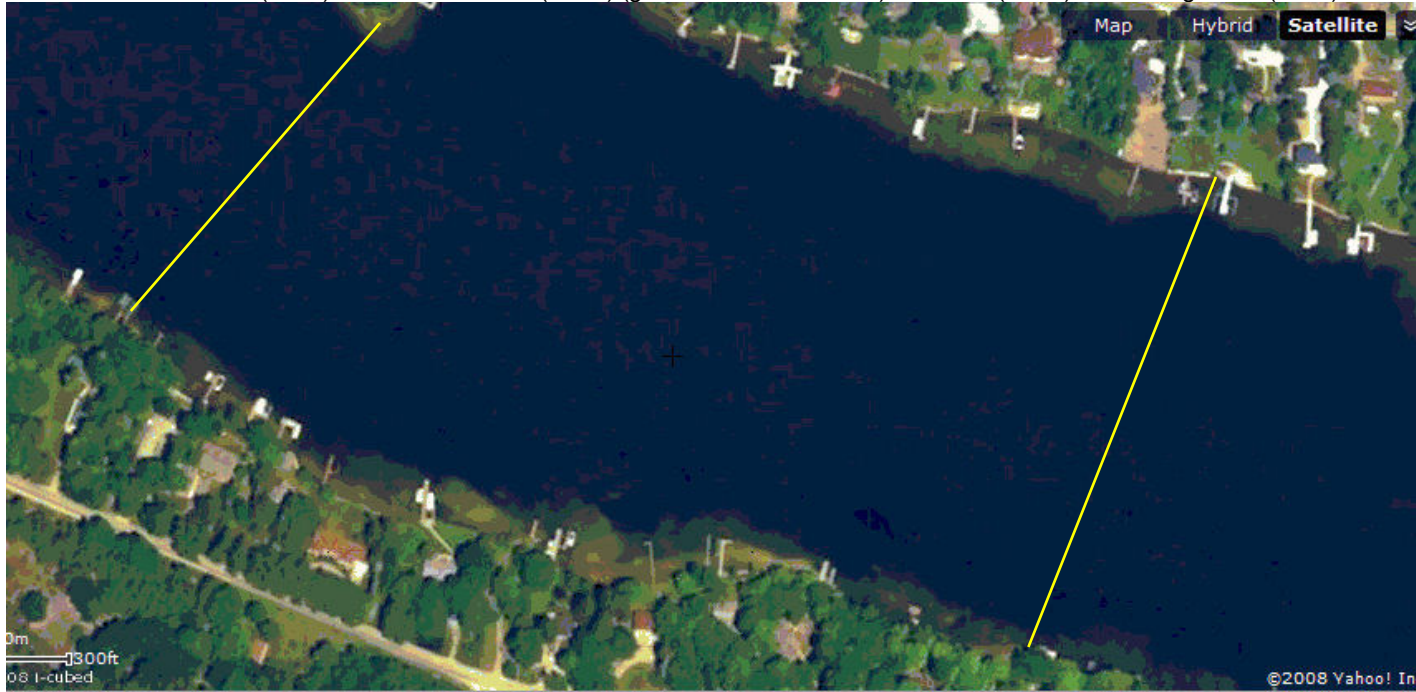
South:



North:



Zone 2 – Point at Sell's (north) across to Ballard's (south) (green boat hoist covers) to Volle's (south) across to gazebo (north)



West Boundary – Ballard's green boat hoist covers to point at Sell's



South:



North:

East Boundary – Volle's red striped boat hoist cover across to gazebo



South:



North:



Zone 3 – Volle’s (south) across to gazebo (north) to white/cream “new” boat house with new yellow swim raft (south) across to metal boat house with 2 green pontoons to the west (north)



West Boundary – Volle’s red striped boat hoist cover across to gazebo



South:



North:

East Boundary – White/cream “new” boat house with new yellow swim raft (south) across to metal boat house with 2 green pontoons to the west (north)



South:



North:



Zone 4 - White/cream “new” boat house with new yellow swim raft (south) across to metal boat house with 2 green pontoons to the west (north) to point by Crystal Springs access (south) across to DNR boat launch (north)



West Boundary – White/cream “new” boat house with new yellow swim raft (south) across to metal boat house with 2 green pontoons to the west (north)



South:



North:

East Boundary – Point by Crystal Springs access (south) across to DNR boat launch (north)



South:



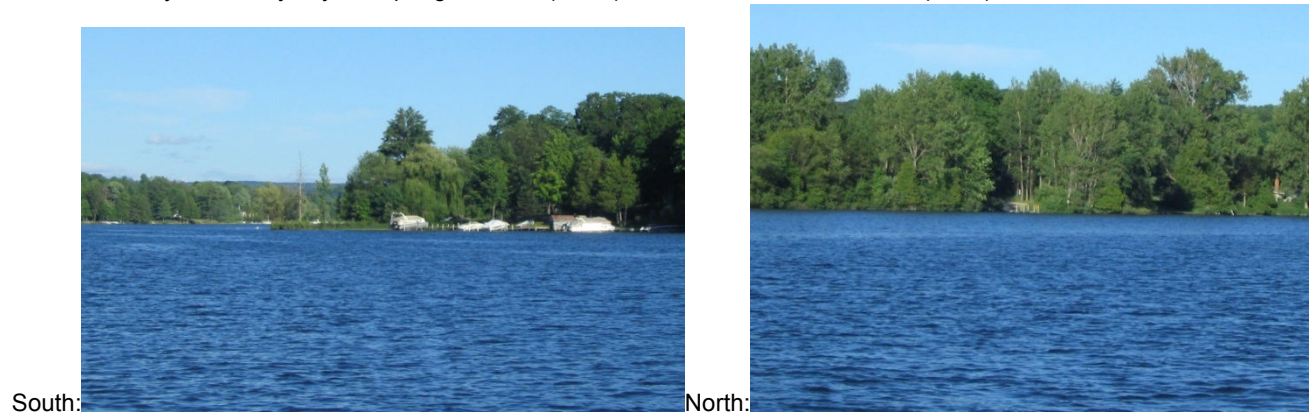
North:



Zone 5 - Point by Crystal Springs access (south) across to DNR boat launch (north) to last house on Green St. (south) across narrows to stone house with orange buoys (north)



West Boundary – Point by Crystal Springs access (south) across to DNR boat launch (north)



East Boundary – Last house on Green St. (south) across narrows to stone house with orange buoys (north)





Zone 6 - Last house on Green St. (south) across narrows to stone house with orange buoys (north) to Grass River entrance



West Boundary – Last house on Green St. (south) across narrows to stone house with orange buoys (north)



South:



North:



East Boundary – Grass River entrance

## Appendix C - Forms

SAMPLE

### Clam Lake Average Boat Loading Study

Zone: 6 Participants: Pam + Lori Sak Date: 7/19/08

Time: 2:00 pm	Types of Watercraft			
Runabouts, Bowrider, Cruiser, Ski, "Cigarette"	Fishing	Pontoon/Houseboat	Jet Skis	Non-Motorized: Row, Kayak, Canoe, Sail
/// 1	2	1	3	—
Hour Count: <u>6</u>	Hour Count: <u>2</u>	Hour Count: <u>1</u>	Hour Count: <u>3</u>	Hour Count: <u>0</u>
Time: 3:00 pm	Types of Watercraft			
Runabouts, Bowrider, Cruiser, Ski, "Cigarette"	Fishing	Pontoon/Houseboat	Jet Skis	Non-Motorized: Row, Kayak, Canoe, Sail
2	3	3	1	2
Hour Count: <u>2</u>	Hour Count: <u>3</u>	Hour Count: <u>3</u>	Hour Count: <u>1</u>	Hour Count: <u>2</u>
Time: 4:00 pm	Types of Watercraft			
Runabouts, Bowrider, Cruiser, Ski, "Cigarette"	Fishing	Pontoon/Houseboat	Jet Skis	Non-Motorized: Row, Kayak, Canoe, Sail
///	//	////	/// ///	///
Hour Count: <u>3</u>	Hour Count: <u>2</u>	Hour Count: <u>4</u>	Hour Count: <u>10</u>	Hour Count: <u>3</u>
Time: 5:00 pm	Types of Watercraft			
Runabouts, Bowrider, Cruiser, Ski, "Cigarette"	Fishing	Pontoon/Houseboat	Jet Skis	Non-Motorized: Row, Kayak, Canoe, Sail
4	—	—	5	—
Hour Count: <u>4</u>	Hour Count: <u>0</u>	Hour Count: <u>0</u>	Hour Count: <u>5</u>	Hour Count: <u>0</u>

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SAMPLE

# Clam Lake Boating Traffic Study

Location: Grass River  
or Clam River

Participants: The Leon Ranger

Date: 7/19/08

Time: 3-4 PM		Types of Watercraft			Non-Motorized: Row, Kayak, Canoe, Sail
Runabouts, Bowrider, Cruiser, Ski, "Cigarette"		Fishing	Pontoon/Houseboat	Jet Skis	
IN:	-    -     		-	-    -    -	
Cigarette					
OUT:	-1			-	
Cigarette					
Time: 4-5 PM		Types of Watercraft			Non-Motorized: Row, Kayak, Canoe, Sail
Runabouts, Bowrider, Cruiser, Ski, "Cigarette"		Fishing	Pontoon/Houseboat	Jet Skis	
IN:	-    -    -    -     				1
OUT:		-    -    -			

# Clam Lake Average DNR Site Trailer Study

SAMPLE  
Date: 7/17/08

DNR Site

Participants:

PAUL SAK

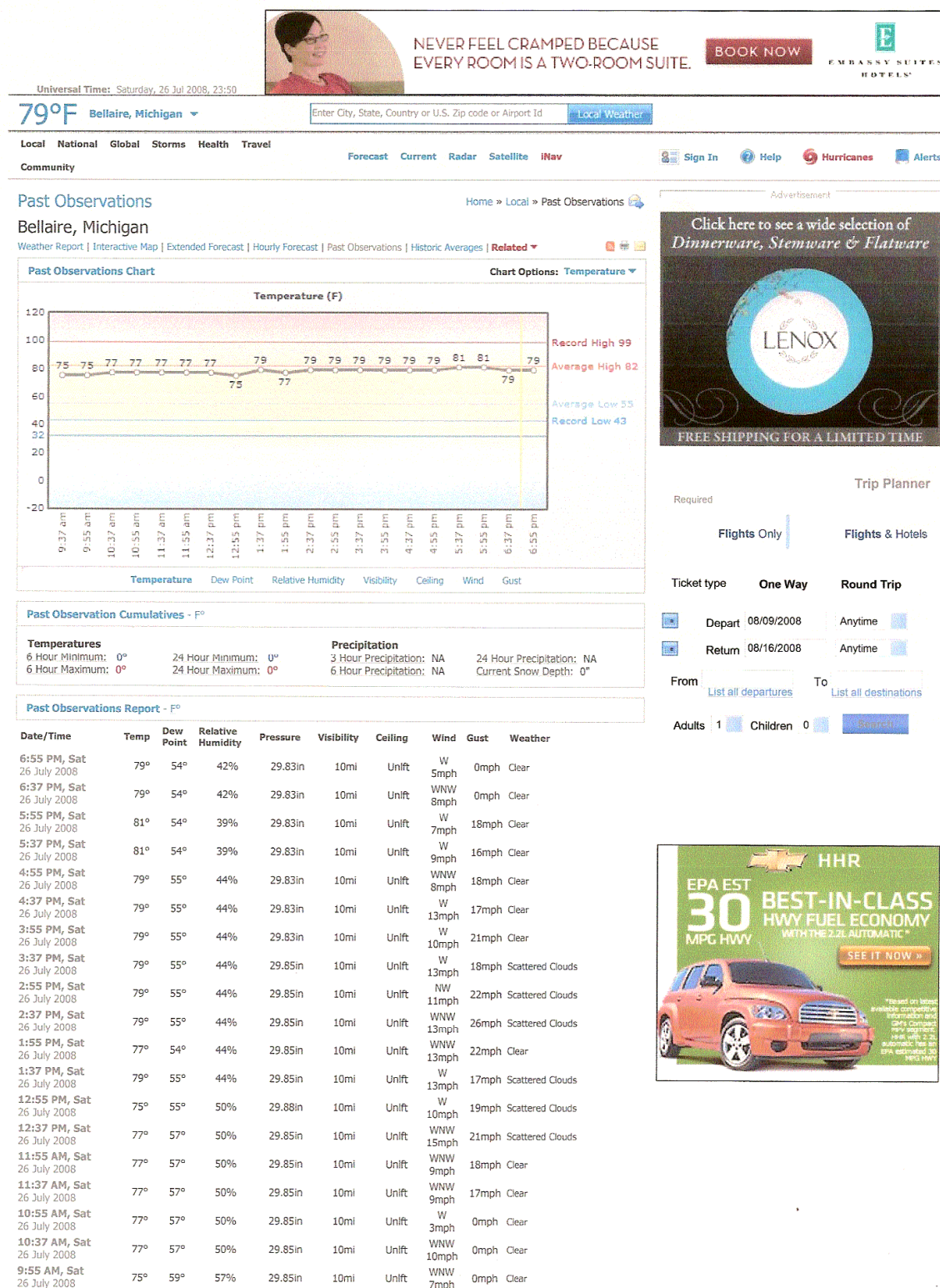
Time: 2:00 pm		Types of Trailers		
Standard Boat or Pontoon Trailer	Jet Ski Trailer - Single	Jet Ski Trailer - Double	Car Top Carrier - Single	Car Top Carrier - Double
 1	1	0	0	0
Hour Count: 11	Hour Count: 1	Hour Count: 0	Hour Count: 0	Hour Count: 0
Time: 3:00 pm		Types of Trailers		
Standard Boat or Pontoon Trailer	Jet Ski Trailer - Single	Jet Ski Trailer - Double	Car Top Carrier - Single	Car Top Carrier - Double
       	11	0	0	11
Hour Count: 15	Hour Count: 2	Hour Count: 0	Hour Count: 0	Hour Count: 2
Time: 4:00 pm		Types of Trailers		
Standard Boat or Pontoon Trailer	Jet Ski Trailer - Single	Jet Ski Trailer - Double	Car Top Carrier - Single	Car Top Carrier - Double
       	1	0	0	0
Hour Count: 13	Hour Count: 1	Hour Count: 0	Hour Count: 0	Hour Count: 0
Time: 5:00 pm		Types of Trailers		
Standard Boat or Pontoon Trailer	Jet Ski Trailer - Single	Jet Ski Trailer - Double	Car Top Carrier - Single	Car Top Carrier - Double
 	0	0	1	0
Hour Count: 8	Hour Count: 0	Hour Count: 0	Hour Count: 1	Hour Count: 0



# Appendix D - Weather

Intellicast - Bellaire Past Weather Observations in Michigan (49615)

Page 1 of 3



http://www.intellicast.com/Local/Observation.aspx?location=USMI0069

7/26/2008