

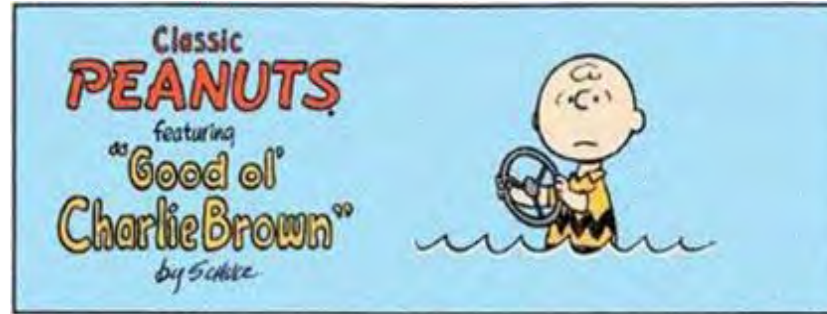


**Lake Levels –**  
**How Ups and Downs**  
**Affect Everything**  
**We Littorians**  
**Do With Our Lakes**

**Dr. Stacy Leroy Daniels**  
**Michigan Inland Lakes Convention**  
**Boyne Mountain Resort,**  
**30 APR 2016**



# Secret of Living on a Lake



# **Littorians: On the Level**

- **The Littoral (Littorian) Zone**
- **What Affects Lake Levels<sup>3</sup>**
- **How Lakes Affect Littorians**
- **How Littorians Affect Lakes**
- **Perspectives for Littorians**

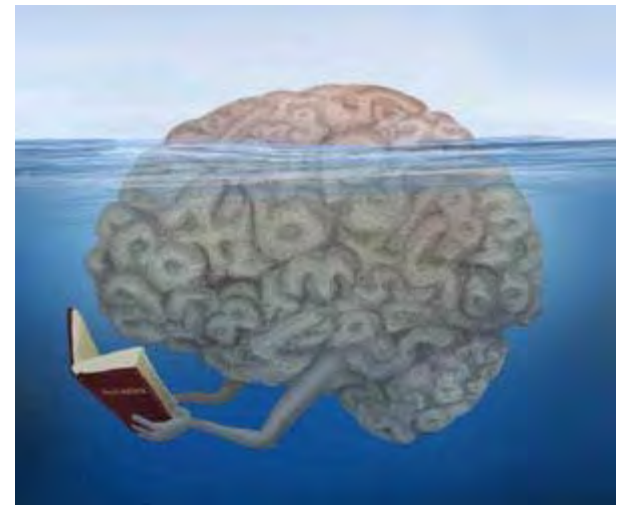
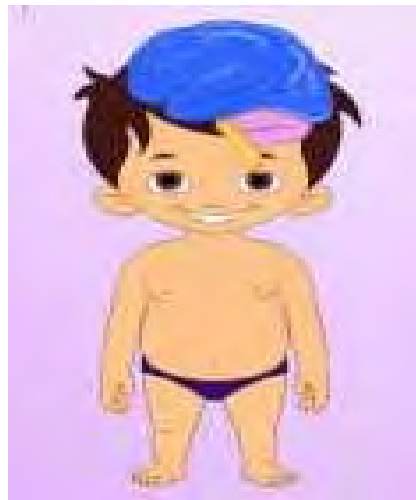
**(\*) SLD, Crystal Lake - Commonality and Uniquity: A Century of "Ups & Downs" in Lake Level, ML&SA, 01 May 2015.**

# **Quiz: “On The Level” ???**

- 1. How many of you live on a lake ?**
  - 2. Is your lake really level ?**
  - 3. Do you know the level of your lake ?**
  - 4. Does your lake have a “normal” (legal) level ?**
  - 5. Is your lake too high, too low, or just right ?**
  - 6. Would you “pull the plug”/ “put it back in” ?**
  - 7. How do you and your lake affect each other ?**
  - 8. Do you consider yourself a “littorian”?**
- It all depends ... Right ?**

# Confucius Say:

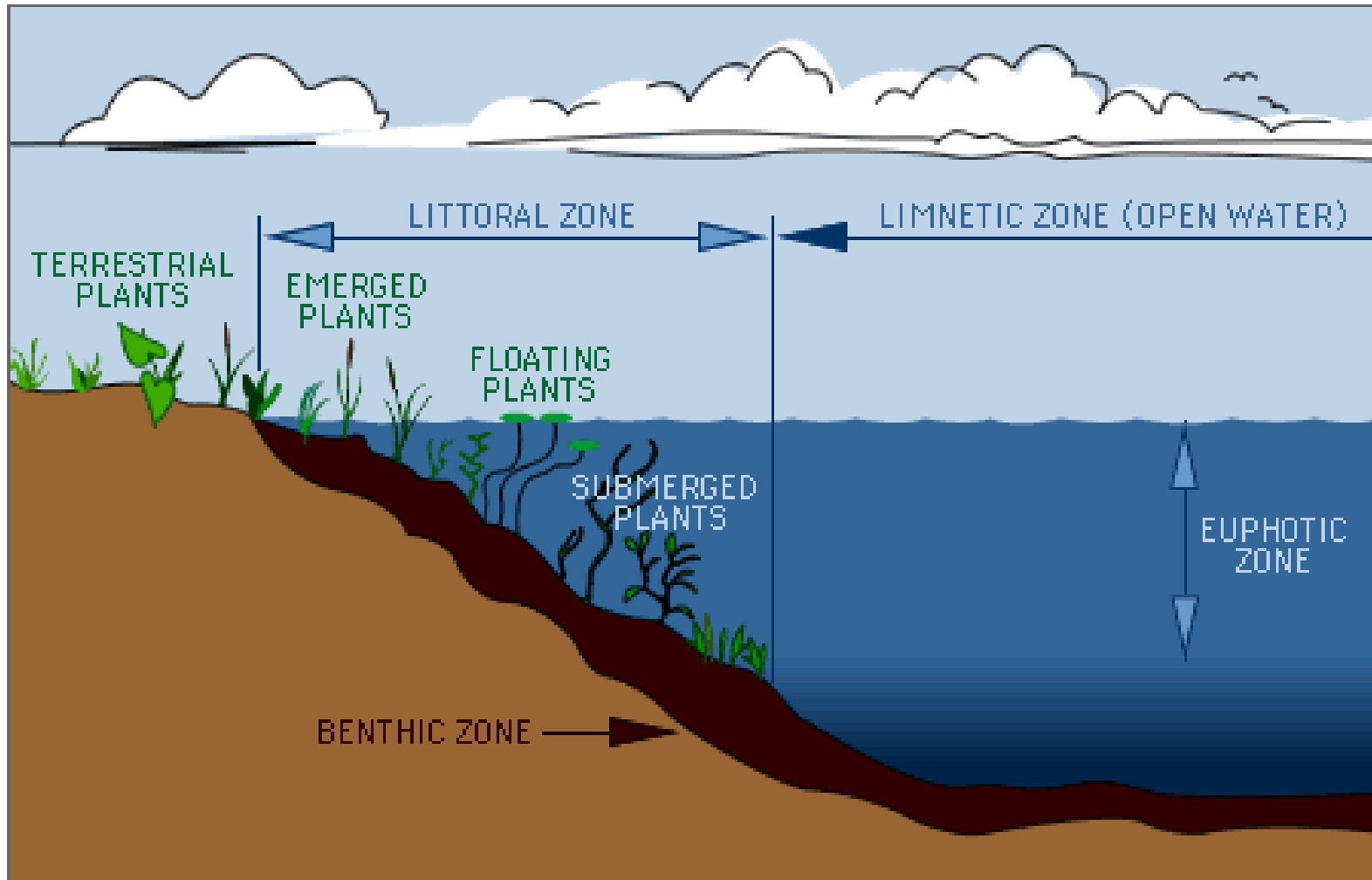
“Man who have water on brain,  
have lake in mind, or mind in lake.”



# “Littorian” or “Riparian” ?

- A “Littorian” : Someone who inhabits or frequents the edges of large freshwater lakes and rivers.
- A “Riparian“ : someone who is associated with the interface between land and a river or stream.
- The difference ? Being “high-and-dry” vs. “low-and-wet”.
- Your humble “littorian lives beside, not on a lake, or by a river.
- (A littoral zone littered with *Littorina littorea* (Periwinkle snails))
- Heaven save us from the “*literal littering littorian*”, who, having a concern for a specific issue involving a lake, creates a character, assumes attributes, and plays a role, spreading the word.

# Littoral Zone: Tween Land & Lake



<http://www.lakeaccess.org/ecology/art/lakezones.gif>

# How Many are True/False !/?

- **Watching lake level rise and fall is boring.**
- **In the past, there was little concern about surveying, and regulating, “natural” lake levels.**
- **Changing lake levels affect shoreline, water quality and quantity; animal and plant life; recreational uses; zoning; property values; environment; ... and littorians.**
- **Engineered structures are needed control floods; improve rivers, lakes, and harbors; drain and irrigate land; and store and supply drinking water.**
- **Littorians and lake levels affect each other.**
- **Lake level is the most controversial issue for littorians.**



# Biblical Level Control



# **“Normal Lake Level ?”**

**“It seems to me that the matter of defining or arbitrarily determining the normal lake level is very nearly of the same order as determining a normal stream flow. I don’t believe anyone can do it.”**

**“It would be possible within certain limits to fix lake levels, but we could not be arbitrary beyond factors which are entirely beyond man’s control. So let us not think we can by any legal device determine a normal lake level.”**

**-- Robert Letts McNamee, 28 Jan 1944(\*)**

(\*) Boardman, Harry, Water in Its Relation to Inland Lake Level Control, Michigan’s Water Problems, Water Conservation Conference, MI State Planning Commission, MI Dept. Cons., MSC, and UM, Lansing, MI, 28 Jan 1944, pp 81-92.

# Lake Level: Stopping the “Tide”



**King Canute demonstrates the futility of "trying to stop the tide" of an inexorable event explaining that secular power is vain compared to the supreme power of God.**

[http://www.telegraph.co.uk/content/dam/Travel/leadAssets/34/47/canute3\\_3447545a-large.jpg](http://www.telegraph.co.uk/content/dam/Travel/leadAssets/34/47/canute3_3447545a-large.jpg)

# What Is a “Normal Level” ?

Given the uncertainties of an engineering interpretation of a parameter with natural variability, it took time to reach consensus of a usable term that could be legally defined for regulatory purposes.

The Inland Lake Levels Act (ILLA), [Act 451, Part 307, amended (1994)], gave the Water Resources Commissioner the responsibility to establish and maintain normal lake levels in MI.

“Normal level” is now currently defined in the ILLA as:

“(T)he level or levels of the water of an inland lake

- that provide the most benefit to the public;
- that best protect the public health, safety, and welfare;
- that best preserve the natural resources of the state; and
- that best preserve and protect the value of property around the lake.”

(All the parameters that comprise classic social dilemmas.)

# Legal Actions for the Times

## River & Harbor Improvements

Legal requirements for the formation of companies to construct canals or harbors, and improve the same, were first approved for the State of Michigan in 1861 and revised in 1871.

(The Benzie Co. River Improvement Co. was formed in 1873.)

## Natural Lake Levels

A subsequent State action authorized boards of supervisors to determine the natural level of the waters in navigable inland lakes, to maintain the level, and to build dams and embankments (1911).

(The natural level of Crystal Lake was also determined in 1911.)



# Lakes: Matters of Perspective

- Lake levels have “ups and downs”.
- The levels of other parameters may rise or fall independently.
- Certain parameters can act as environmental “stressors”.



*"This lake looked a whole lot bigger  
on the map!"*

# Level-Headed

- The level of the water is the surface of the lake
- Relative to some benchmark (e.g. sea level, legal level)
- Symptomatic of what's right, or wrong, with other "levels":
- More water = more, or less, of everything else.
- More people = more activity = more environmental stress.

**"Today's water in the lake, is tomorrow's water over the dam."**

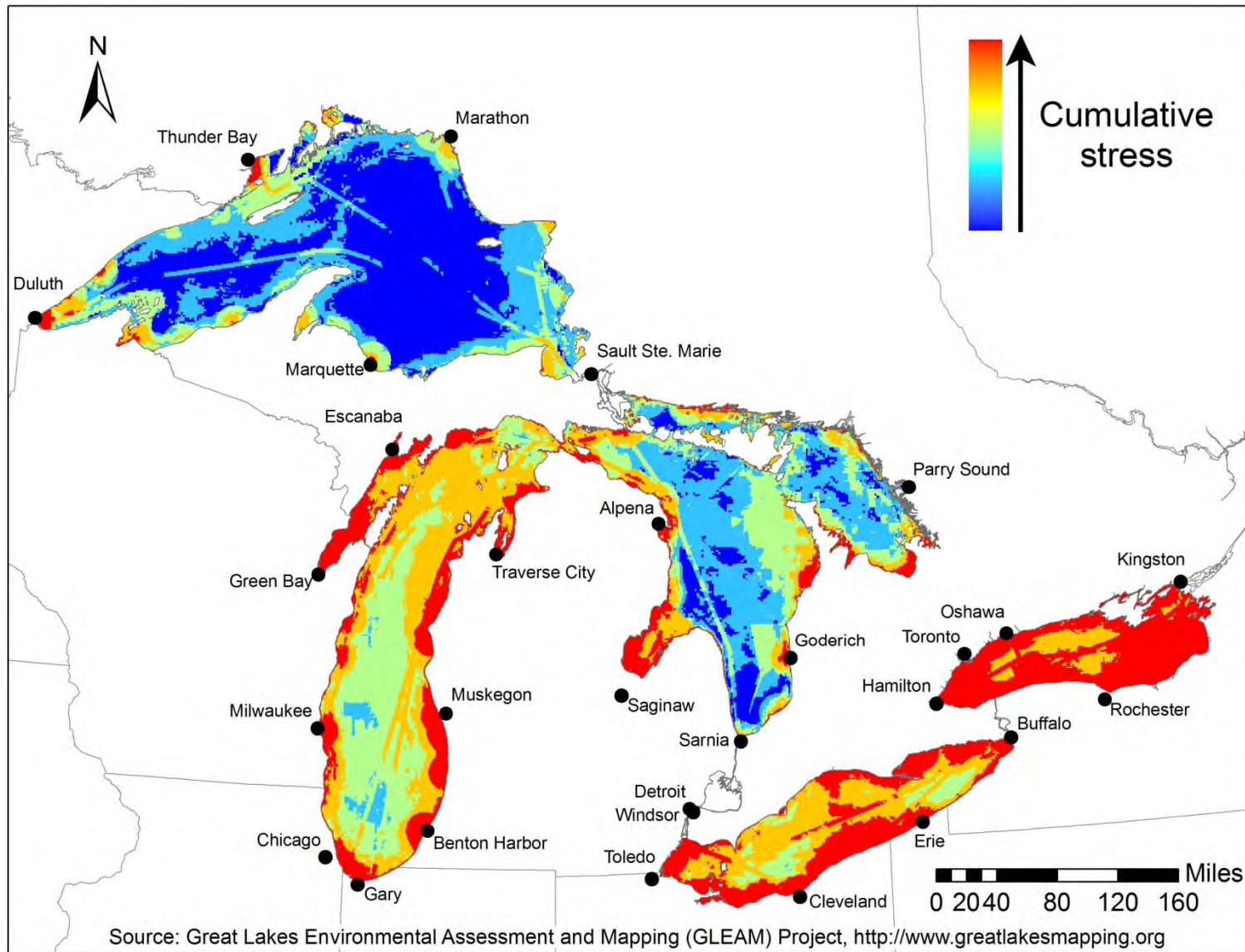
**-- Archibald Jones ("A.J.")**

# Environmental Stressors (34)

<b><u>Habitat</u></b>	<b><u>Development</u></b>	<b><u>Invasives</u></b>	<b><u>Pollution</u></b>
Hypoxia	Coastal	Ballast	CSOs
Ports	Mines	Gobies	Nitrogen
Lights	Power plants	Mussels	Phosphorus
Marinas	Recreation	Phragmites	Sediments
Shipping	Roads	Lamprey	
Hardening		Fish Disease*	<b>Chemicals</b>
Piers	<b><u>Fisheries</u></b>	Algae*	AOCs
Dams	Aquaculture	Plankton*	Hg
Dredging*	Commercial		Cu
Pipelines*	Stocking(native)	<b><u>Climate</u></b>	PCBs
	Stocking(other)	Water level	New Toxics*
<b><u>Withdrawals</u></b>	Recreational*	Ice Cover	Drugs*
Inland Lakes*	Food Chain*	Temperature	Pesticides*
Great Lakes*			

(\*) Not weighted. <http://www.pnas.org/content/110/1/372.full.pdf>

# Environmental Stressors



# Goldilocks Principle for Lakes

Lakes are either:

too high or too low;

too wet or too dry;

too cold or too hot; with

too many boats; and too few fish; and have

too many invasive aquatic, or

too few desirable native species; and the beach is

too rocky or too muddy;

and those lakes that are

too good to be true; are

too far away

to give a too(t) !



Very few lakes are “just right” all around, all of the time, for all the littorian owners, and all the visitors.

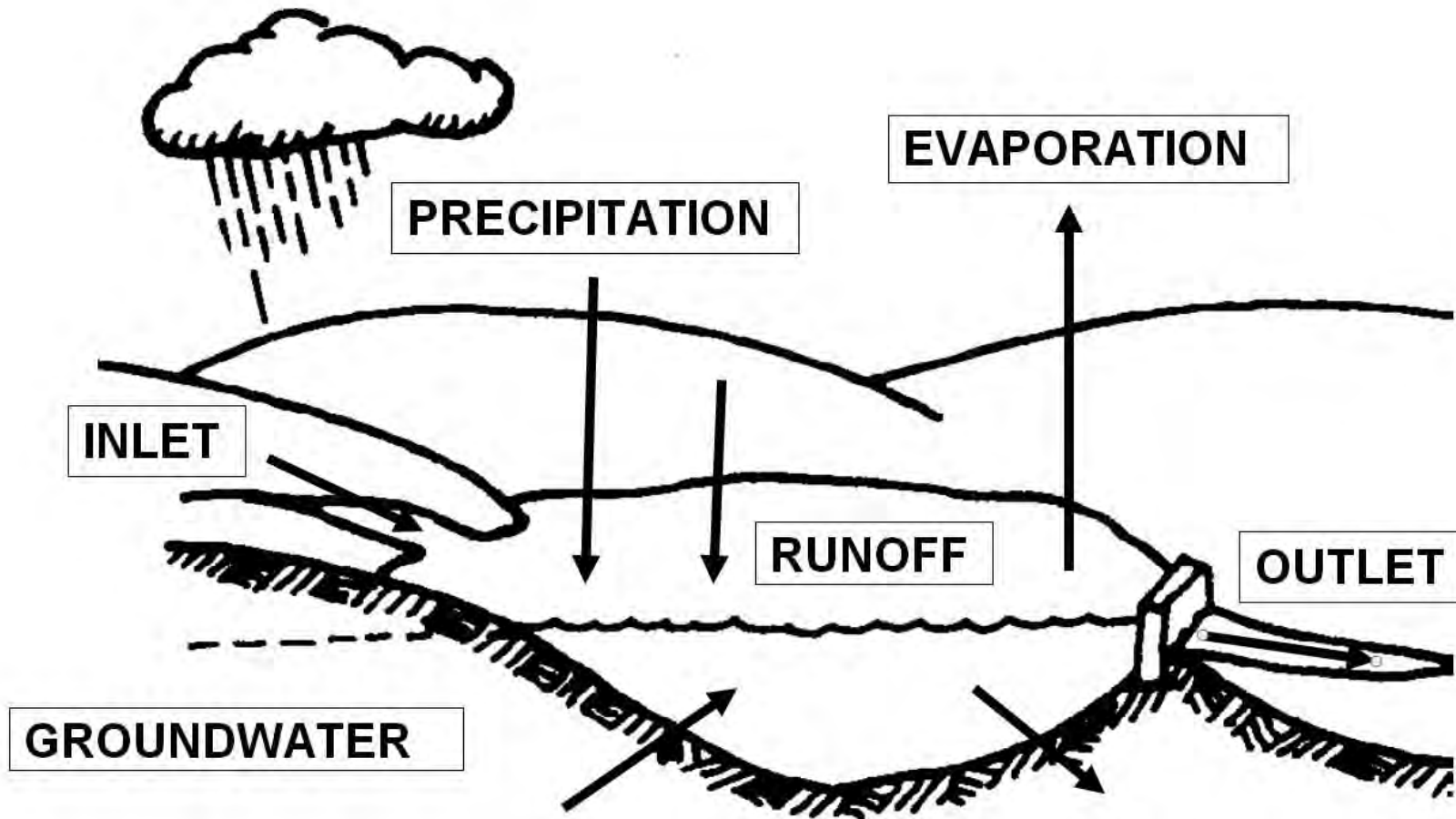


# ***Lakes Likely Leak***

- I *like* lakes, you *like* lakes, ... ,
- but lakes are *likely* to leak, and most do,
- when Mother Nature – or the errant hand of Man
- – suddenly decides to pull the plug.
- with little or lack of warning, you take your licks,
- for then there is a lot less to *like*.
- (and you're *likely* out of luck with less lake).



# Inputs & Outflows: A Groundwater Drainage Lake



# **“Who Pulled the Plug on My Lake?”**

- **“Artificially maintaining lake levels is not an area where one can exercise “self-help.” The proper legal procedures must be utilized.**
- **Anyone who attempts to dam an outlet or install a lake pump (or in the reverse situation, create an outlet or clean out or widen an outlet to increase water outflow) on their own could incur civil and even criminal penalties.**
- **Since a lake is like a common highway and the waters are owned by and held in trust for the people of the state of Michigan, no private individual can simply artificially alter lake levels.”**

**-- Clifford H. Bloom, 2002.**

# Pulling the Plug

When should littorians be put in an old-folks home ?

Fill up their lake. Offer a teaspoon, teacup, and bucket.



Ask them to empty their lake.

A normal littorian would use the bucket.

It's bigger than the spoon or the teacup. Right ?

No. A normal littorian would just pull the plug !

Do you want a bed near a window overlooking the lake ?

# The Level of Crystal Lake ?



**Still only comes half-way up a merganser duck's back !**



# More on the Level

**“In regard to the question of lake level, I personally do not feel that it will work out practically to have the level dropped a portion of the year with any dependence upon its being satisfactory the remaining portion of the year, for what is everybody’s business is nobody’s business, and it would not be properly attended to, and, if it should be placed in reliable hands, who knows whether the season is going to be wet or dry, and what dependence can be placed upon the sluiceway, or whatever means is used to drop the level, being closed in time to bring it up to the desired point to maintain the level at its present height ...”**

**-- Frank E. Herdman, Resident engineer and overseer of the 1911 Crystal Lake Dam construction, 10 Aug 1916.**

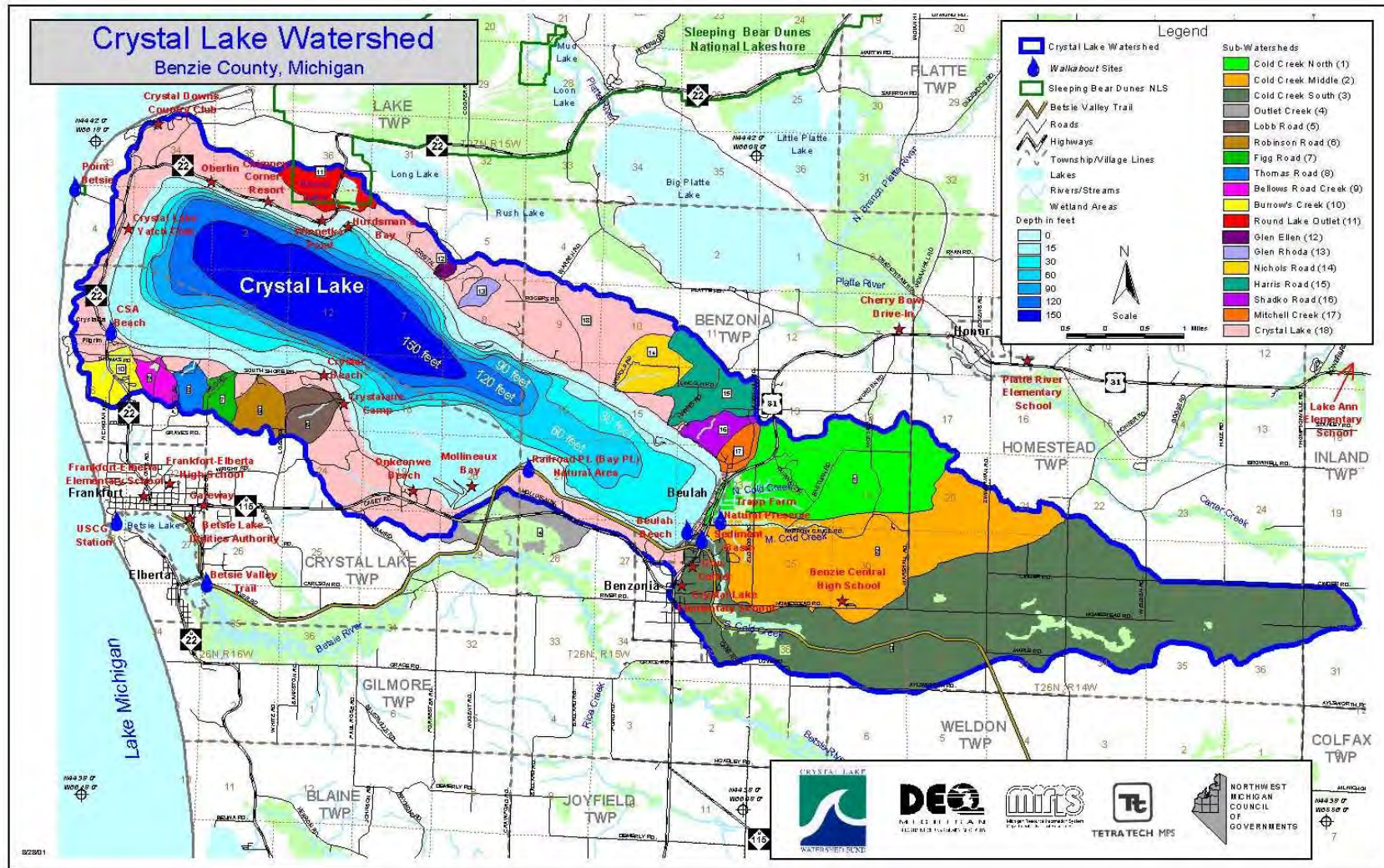
# Crystal Lake & Environs



Photograph® by Marge Beaver, Photography Plus, 2005. 25



# Crystal Lake Watershed

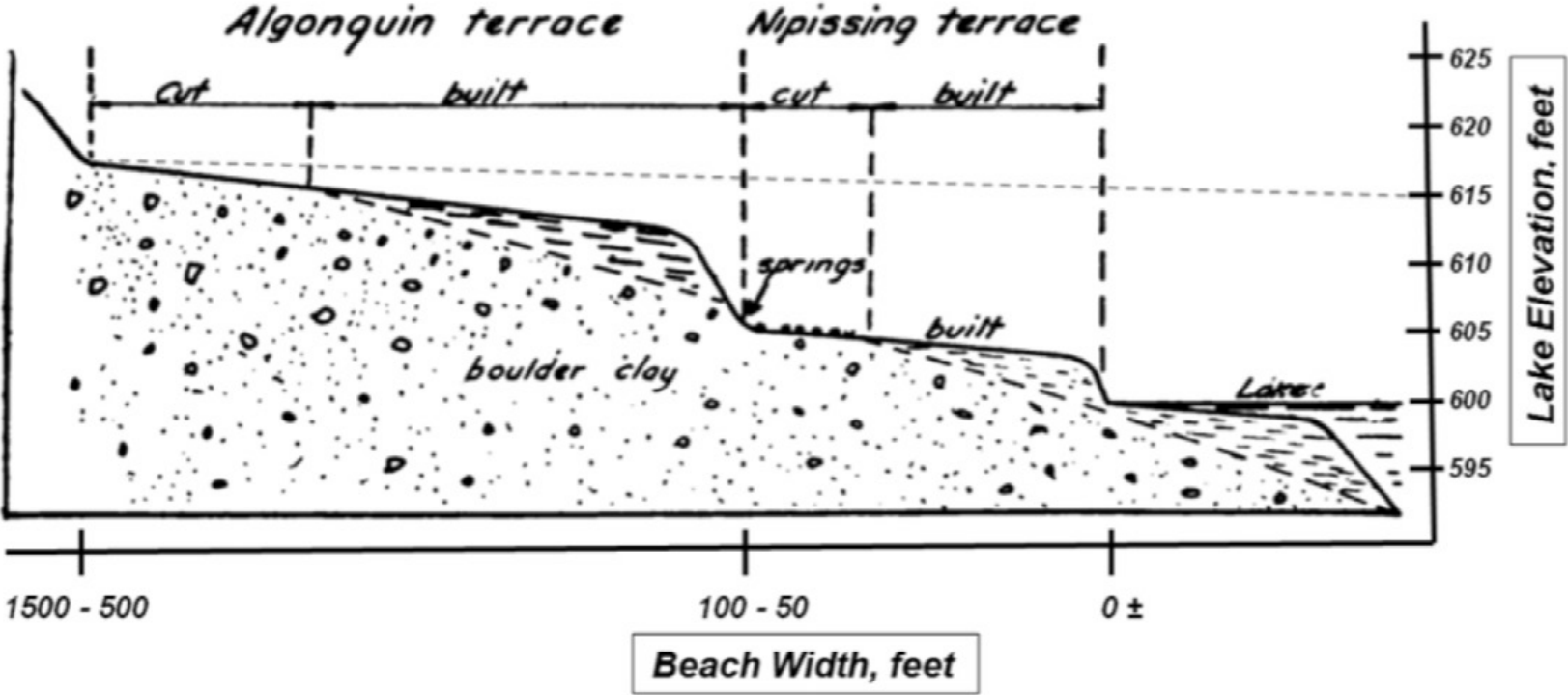




# Digital Elevation Model



# Crystal Lake – Its Many Levels





**“MAP SHOWING SOURCES & COURSES of the PLATTE & BETSEY RIVERS, BENZIE COUNTY, MICH., Together With Some of the Obstructions and Proposed Improvements, DRAWN for the BENZIE COUNTY RIVER IMPROVEMENT COMPANY, DRAWN by B.S. Hubbell, DRAFTSMAN, BENZONIA, MICHIGAN” (ca. 1873)**







**High & Wet  
10 Apr 2013**



**Just Right  
10 Apr 2013**



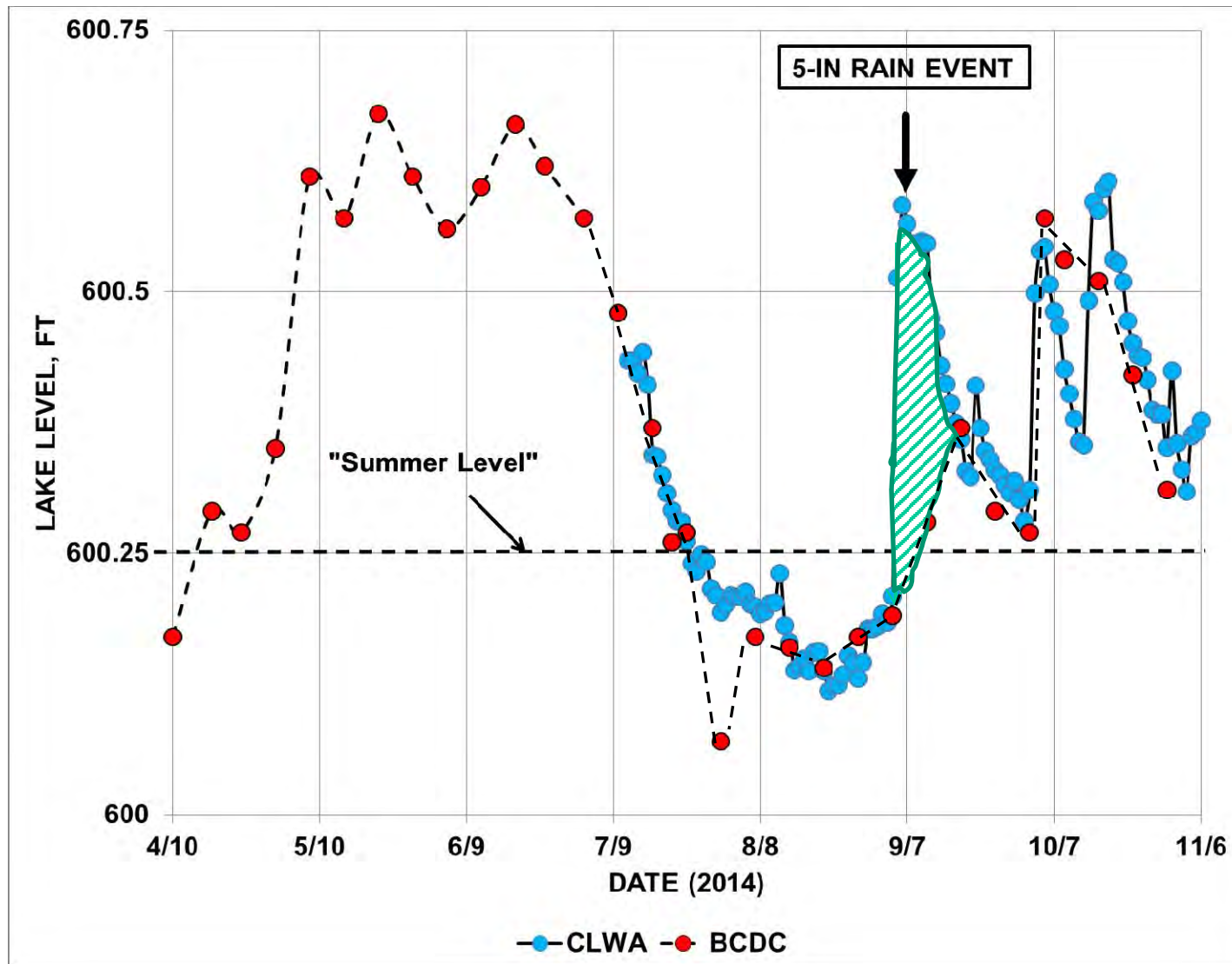
**Low & Dry  
14 Oct 2013**

# Automatic Lake Level Monitoring

- Gauge submerged below ice
- Level, temperature, solar
- 15 min intervals; 24/7/365
- Level rise/fall events due to:
  - Wind & wave
  - Precipitation (rain, .snow)
  - Seiches (tides)
  - Ice in/out
  - Adjusting of dam spillway



# Automatic & Manual Lake Levels



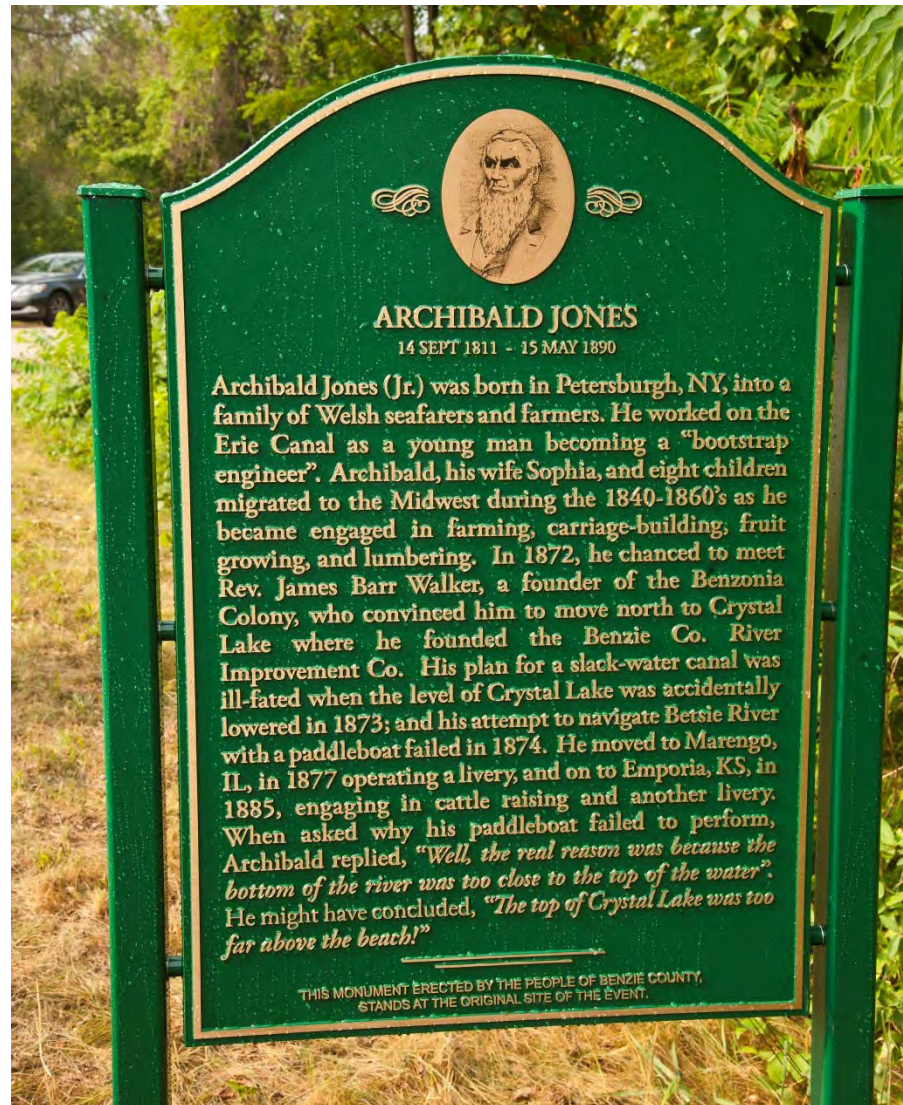
The 100-yr rain event = 1,300,000,000 gal.

# Crystal Lake, Benzie Co., MI

- The past century: a classic social dilemma embroiling littorians and local government in setting a high level in summer for recreation, and a low level in winter for erosion control, while controlling discharge from the outlet dam affecting downstream sediment transport.
- A “natural level” was set in 1909
- A permanent dam built in 1911
- A two-tiered system set in 1980:      600 ft +/- 0.5 ft
  - Summer:      (01 May – 31 Oct)      600.25 ft
  - Winter:      (01 Nov – 30 Apr)      599.75 ft
- Levels; “high and wet” to “just right” to “low and dry”
- Continuous lake level monitoring (2014+)
- Bottom line: need to implement better control

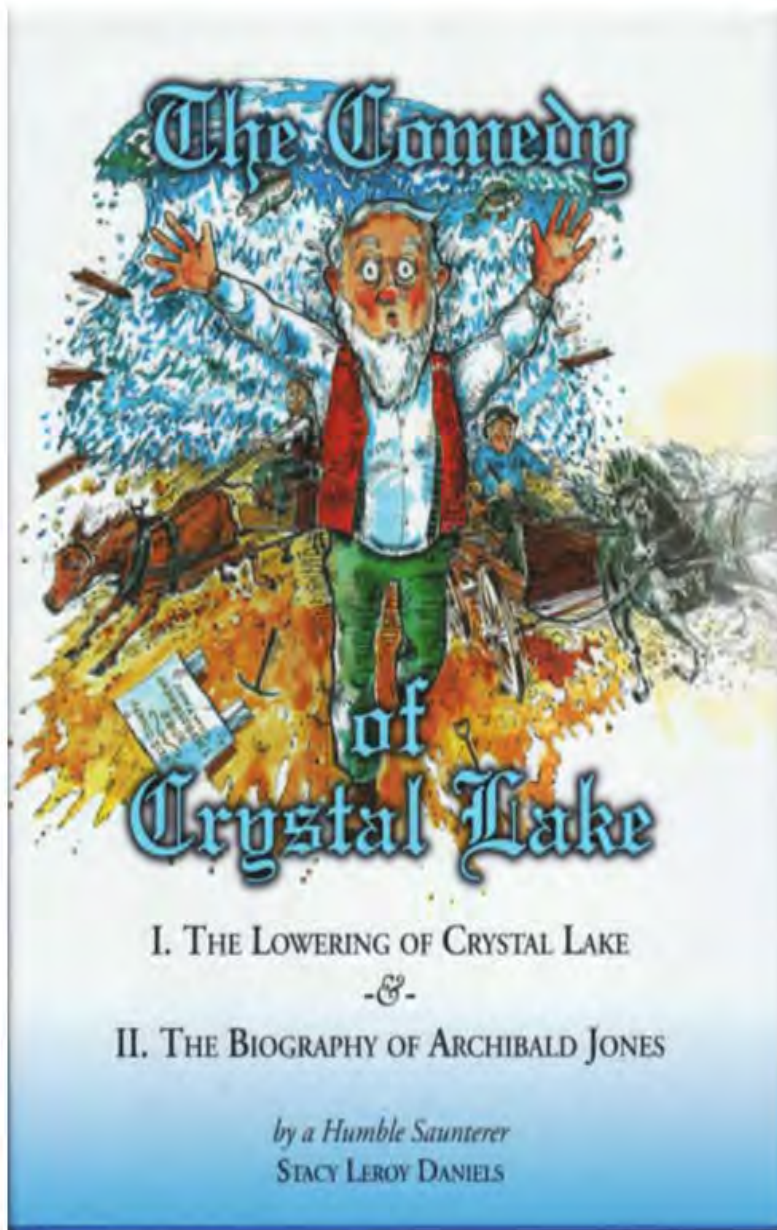


# Local Historical Marker



Dedicated 22 Aug 2016 at the Crystal Lake Outlet





## The Comedy of Crystal Lake

Stacy Leroy Daniels

ISBN 978-0-692-21715-3

\$49.95 (\*) | Hardcover | 9 x 12

496 pages with over 200 illustrations

Flushed With Pride Press

P.O. Box 281, Frankfort, MI 49635

<http://www.ComedyCrystalLake.com>

A sequel to the classic booklet, "*The Tragedy of Crystal Lake*" (1922), being a summary chronicle with many more sidelights, of a tale written in two parts, describing a seemingly ill-fated historical event, so epochal in its nature as to have had a permanent bearing upon the development and future of Benzie Co., Northwest Lower Michigan, together with myriad viewpoints of its diverse characters and sundry locales, &c, &c.

The real-life story of the attempt by Archibald Jones to build a slack-water canal from Crystal Lake to Lake Michigan in 1873 has elements of tragedy and comedy - a serious beginning and a happy ending - with foibles of human nature and consequences of bold venture: the dramatic lowering of a very large inland lake and the creation of a long sandy beach. Net proceeds from direct sales to local nonprofit organizations on request. (\*) Plus Sales tax (6%) and postage of \$5, if applicable.)



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