Drinking Water Protection
Water, Water
Everywhere...
Your very own body of water

The average human body is composed of about 55% water. The average adult male is about 60% water, the average adult female about 50% water.*

How much water is that?

An average adult male with a weight of 80 kg (about 176 lbs) and a water content of 60%, would contain 48 kg or 48 L of water, equal to eight cases of standard-size bottled water.**

Where is all of that water?

All parts of the body contain some water. Here are some of the more “watery” parts.

- Lungs: 90% water
- Blood: 82%
- Skin: 80%
- Muscle: 75%
- Brain: 70%
- Bones: 22%

* Muscle contains more water than fat does. Males generally have higher muscle content than females.

** 1 litre of water weighs 1 kilogram. A standard size container of bottled water is 500 mL.
WATERSHEDS
The Great Lakes Watershed

...the only place like this on the Earth!
The Watershed

Groundwater

Courtesy of MWEA
The Great Lakes containing 21% of the world's surface fresh water. The total surface is 94,250 square miles, and the total volume (measured at the low water datum) is 5,439 cubic miles.
**Michigan Groundwater Statistics**

Estimated Groundwater Usage in Michigan (in million gallons per day)

- **Private Household Wells** 239 mgd (31%)
- **Public Water Supplies** 247 mgd (32%)
- **Irrigation - Agriculture** 135 mgd (18%)
- **Irrigation - Golf Courses** 20.6 mgd (2.7%)
- **Livestock** 10.2 mgd (1.3%)
- **Industrial** 110 mgd (14%)
Figure 1. Total water withdrawals by source

- Great Lakes: 87%
- Ground water: 7%
- Inland lakes and streams: 6%
Figure 2. Total water withdrawals by major user category.
Table 2. Water withdrawals by major user categories in Michigan, 2004, million gallons per day.

<table>
<thead>
<tr>
<th>Type of use</th>
<th>Great Lakes</th>
<th>Inland Lakes and Streams</th>
<th>Ground Water</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public supply</td>
<td>879.2</td>
<td>17.8</td>
<td>247.3</td>
<td>1,144.3</td>
</tr>
<tr>
<td>Industrial</td>
<td>426.6</td>
<td>113.0</td>
<td>89.1</td>
<td>628.7</td>
</tr>
<tr>
<td>Irrigation</td>
<td>5.0</td>
<td>98.3</td>
<td>187.0</td>
<td>290.3</td>
</tr>
<tr>
<td>Thermoelectric power</td>
<td>8,404.2</td>
<td>476.7</td>
<td>4.1</td>
<td>8,885.0</td>
</tr>
<tr>
<td>Domestic</td>
<td>-</td>
<td>-</td>
<td>250.3</td>
<td>250.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9,715.0</strong></td>
<td><strong>705.8</strong></td>
<td><strong>777.8</strong></td>
<td><strong>11,198.6</strong></td>
</tr>
</tbody>
</table>

Source: Data reported in or calculated based on MDEG (2006).

Table 3. Total consumptive use by major user category, 2004, million gallons per day.

<table>
<thead>
<tr>
<th>Type of use</th>
<th>Total withdrawals</th>
<th>Consumptive-use coefficient (percent)</th>
<th>Total consumptive use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public supply</td>
<td>1,144.2</td>
<td>12</td>
<td>137.3</td>
</tr>
<tr>
<td>Industrial</td>
<td>628.8</td>
<td>10</td>
<td>62.9</td>
</tr>
<tr>
<td>Irrigation</td>
<td>290.3</td>
<td>90</td>
<td>261.3</td>
</tr>
<tr>
<td>Thermoelectric power</td>
<td>8,885.0</td>
<td>2</td>
<td>177.7</td>
</tr>
<tr>
<td>Domestic</td>
<td>250.3</td>
<td>12</td>
<td>30.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,198.6</strong></td>
<td></td>
<td><strong>669.2</strong></td>
</tr>
</tbody>
</table>
Water Consumptive Use

Thermoelec. 27%
Irrigation 39%
Public Supply 21%
Industry 9%
Domestic 4%
Source Water Protection

Wellhead Protection

Surface Water Intake Protection
Wellhead Protection Program

- Protect Public Water Supply Wells through proactive land-use planning and management
- State program was developed by the Michigan Department of Natural Resources (MDNR) & Michigan Department of Public Health (MDPH)
- Submitted to the U.S. Environmental Protection Agency in 1994
Participation in Michigan’s WHP is voluntary.

Most, if not all of the other States have mandatory participation in WHP.

Level of activity varies by State.
Goal of a Source Water Protection Program

Safeguard public water supply systems from potential sources of contamination
Wellhead Protection

- Since 1994, we have approved Wellhead Protection Plans for over 200 public water supplies
  - 23 programs have been updated since original approval, 12 of those in the last three years
Contributing Area
Wellhead Protection Area (WHPA)

The surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or wellfield

WHPA = 10 year time-of-travel
Wellhead Protection

• Since 1992, we have approved over 250 wellhead protection area delineations of public water supplies in Michigan
Wellhead Protection in Michigan

- 208 Approved Programs
- 257 Water Supplies w/Approved Wellhead Area Delineations
- ~92% of the population on municipal groundwater system
- ~67% of municipal groundwater systems
MGMT

Michigan Groundwater Management Tool

(formerly MIGWWP)
MGMT
A tool for analyzing groundwater flow using existing data

Delineating WHPAs
Contaminant migration
Groundwater flow direction
Abandoned Wells
Source Water Protection

Wellhead Protection

Surface Water Intake Protection
Watersheds in Michigan Public Water Supply Source Water Assessment Areas

Explanation
- Public Water-Supply Location
- Inland River Source-water Area
- Great Lakes Connecting Channels Source-water Area
- Great Lakes Source-water Area

State of Michigan
Department of Environmental Quality

USGS
science for a changing world
Surface Water Intake Protection

- Seven Surface Water Intake Protection Plans have been approved for public water supplies in Michigan.
  - These are a combination of Great Lakes and inland river sources.
The Source Water Protection Area is usually the entire watershed.
Contaminant Source Inventory
Source Water Protection

- Grant Program

32 communities will receive shares of a $423,000 wellhead protection grant
National Water Quality Initiative

- Conservation program to provide financial assistance to agricultural producers to improve water quality in impaired streams.
- Qualified producers will receive assistance for installing conservation practices such as cover crops, filter strips and terraces.
You can't be a real country unless you have a beer and an airline. It helps if you have some kind of a football team, or some nuclear weapons, but at the very least you need a beer.

Frank Zappa