Got Almonds?

Kit Kat Club
March 15, 2016

Warren W. Tyler

Got Almonds?

It Takes a Gallon of Water to Grow One Almond!

The Environmental Protection Agency's regulatory scheme, at core, is the protection of raw water sources. The hazardous and solid wastes rules, the rules governing air emissions, the protection of ground and surface water are designed to work in concert to ensure that we have clean (safe) water.

The first line of defense is the quality of our raw water from both surface and groundwater sources. The second line of defense is water processing and filtration of home systems (wells) and municipal water treatment plants. The last defense is the quality of our water distribution infrastructure. The age and maintenance of the distribution system is a major factor affecting drinking water quality.

Athens, Ohio

The Athens service director was on the bubble. He presented operating and capital budgets that were three times higher than any water and sewer spending plan in memory. The mayor and city council were concerned and began to question the director's competence. The State was asked to help. An analysis of the city's water plant and distribution systems confirmed that approximately 34% of the city's finished water was leaking between the plant and the end user's meter. The fix would be a huge expense to the city.

The problem is common throughout the United States and the world. Poor system maintenance equals an unlegislated tax and introduces health risks.

The New York City water system leaks 36 million gallons of finished drinking water a day.

Flint, Michigan

As is now common knowledge, residents of Flint have a problem. The water is making their kids sick. In 2014 the city changed their drinking water source from Lake Huron to the Flint River to save money.

For decades, industrial waste was discharged into the river. Residents are now experiencing high levels of lead and other contaminants in their tap water. The long term costs and health effects associated with drinking contaminated water is hard to predict. What is known is that blood tests show that children in Flint now have elevated levels of lead in their systems.

The problem is further complicated by an old and poorly maintained distribution infrastructure: a national problem. The fix will be costly. Passing out bottles of water is not a solution.

More than 25% of bottled water comes from a municipal water plant.

Columbus, Ohio

Columbus grew from 91 square miles in 1960 to 196 square miles in 1990. More growth than any other city in Ohio. EPA was asked … "Is the region's raw water sources adequate to support future growth?" In short, the answer was no.

Agency personnel suggested that time be set aside at the next Chamber Board meeting to present findings. "How much time do you need?" "20 minutes." "I can only give you ten minutes" "It would help if mangers thought like owners: for the long term." It takes a long time to figure out water." Quote, Chuck Lazarus.

Flushing the toilet is the biggest water user in your home unless you like to take a bath/about 70 gallons.

The average American uses about 100 gallons of water a day. Europeans use about 50 gallons a day and sub-Saharan Africans use about 2-4 gallons a day. 400 billion gallons of water are used by people in the US every day.

Like people the earth is 70% water.

97% of our water is salt water. The other 3% is fresh water. 30 % of the 3% is groundwater. One third of the groundwater is hard to get because it is locked away in aquifers, some more than a half mile below the surface. Another 2% is stuck away in ice caps and glaciers, at least for now.

Lakes hold 40 times more water than rivers and streams. More than 20% of the fresh surface water in the world is in the Great Lakes.

Some History - John Wesley Powell

John Wesley Powell (Lake Powell) born in 1834 lived in Chillicothe in his youth. As a Union officer he lost his lower right arm at the battle of Shiloh.

Powell explored the Mississippi and Colorado River basins and the Grand Canyon and became famous as an explorer and expert on the geography of the west.

Powell understood the need for water. In a shocking address to Congress in 1874 he reported that the entire western region of the United States was too arid for farming without irrigation and maybe too arid for farming **with** irrigation!

At the time, the public believed that the west would get enough rain to make farming and ranching in the region economically viable. The public was wrong. Powell was right then and he's right now.

Powell saw an opportunity and became the hero of water storage and irrigation for the west after authoring the influential **"Report on the Arid Land of the Arid Region of the United States."**

Southwestern states, on average, get less than 7 inches of rain a year. Not enough.

Powell justified his efforts in the west and his support of the small farmer by arguing that "captured water" (dams) would support more than a million small farmers and they would cultivate more than a 100 million acres of western cropland. Not true, but it was a really good pitch and it worked.

Under the Reclamation Act the Reclamation Service sold public land. The proceeds were used to fund irrigation projects for "small" farmers. Small farms were defined as a family farm of 160 acres or less. The big farmers and ranchers found ways to directly benefit from the government's investment in subsidized water! A century later they still get (cheap) federally subsidized water and hydroelectric power.

Powell was appointed the United States irrigation czar. The heavyweight champ of federally financed water storage projects (dams) to irrigate the west. He dammed and/or redirected every free flowing water body he could find and finance it with public money.

Notwithstanding the generous federal water subsidies to small farmers (ten year interest deferment and easy repayments terms), more than 60% of the farmers defaulted on their loans.

Before his death Powell had the satisfaction of seeing his irrigation ideas memorialized by the enactment of the 1902 Reclamation Act and the creation U.S. Bureau of Reclamation. The act was pushed by Teddy Roosevelt who became President following the assassination of President McKinley.

Teddy Roosevelt liked Powell and liked his water ideas. The head Roughrider was in love with the west. Meanwhile there was talk of digging a big ditch to connect the Atlantic and the Pacific thereby making the west much more accessible. Sounded like a good idea to Teddy.

The Panama Canal completed in 1914. It was, at the time, the grandest water engineering project in history!

The western "agribusiness establishment" never liked small family farms (and still don't) nor did they like Powell. They lobbied to remove him and succeeded.

With Powell gone, the wealthy farmers, ranchers and land investors stepped in. They were/are ultimately the beneficiaries of the defaulted farm loans on now irrigated land. The big farmers and ranchers got bigger. Land owners became richer and the richer they became the more powerful they became and they still are.

Commerce Secretary Herbert Hoover, an engineer, became president in 1929. Soon after taking office he began work on Boulder Dam which created America's largest reservoir, Lake Mead. Franklin Roosevelt dedicated the dam in 1935 which was placed into service in 1936. It took only five years to build.

Hoover Dam so impressed FDR that it convinced him of the benefits of **big** public works projects. It was the early 30's and unemployment was 25%. By the late 1930s the six largest structures on earth were under construction. All were in the west. All were dams.

Hoover Dam/Lake Mead on the Colorado River
The Grand Coulee Dam/Lake Roosevelt on the **mighty** Columbia River
Bonneville on the Columbia River
Glen Canyon / Lake Powell on the Columbia River
Shasta on the Sacramento River, and
Fort Peck on the Missouri River

Three months after dedicating Hoover Dam FDR signed off on The Central Valley Project. The water flows are much bigger than **all** the dams that converted the Imperial Valley and the Central Valley from a desert to the richest and most productive farmland in the world.

Ranchers and farmers are more politically powerful than any other well defined interest group in America! As a group they are known as the Water Nobility. Publicly subsided irrigation and hydroelectric power made the Water Nobility wealthy and keeps them wealthy. Without public money many of these farmers and ranchers would be out of business and broke.

For example, California's Central Valley is 450 miles long and 50 miles wide. The Central Valley Project water delivery network supported 140,000 farming operations cultivating 10 million acres in 2013. The **estimated** public subsidy is $12,000 per acre. More than the market value of the land.

The Central Valley Project began delivering irrigation water to the Central Valley in 1940. The water users started repaying the capital costs of the project in 1986. The project is now due to be paid off in 2030. Ninety years.

There are 36 major dams controlling the Columbia River and its tributaries. All were built between 1933 and 1973. Almost one dam per year. The Columbia River provides 40% of America's total hydroelectric power.

The Colorado River has 19 large dams capable of managing four times the annual flow of the Colorado River system.

The Bureau of Reclamation built 70,000 dams between 1902 and 1970. Almost three dams a day! There are 500,000 dams, reservoirs and canals, big and small, controlling America's surface waters. All were built with your money. The biggest, best and most costly systems are in the west with the possible exception of the Tennessee Valley Authority water management network.

Our thanks goes out to the likes of Barry Goldwater, the champion of free markets and hater in chief of all things welfare. He was, however, the head cheerleader for western water welfare.

House majority leader Kevin McCarthy is the new head cheerleader for water welfare for the Water Nobility. He's pushing for the construction of two new dams which he thinks will solve the **current water crisis.** The cost estimate is $3 billion each.

If work started today neither dam would store or deliver a drop of water until 2040; that's assuming there is enough water to fill the dams 25 years from now.

McCarthy reminds me of Philadelphia Mayor Frank Rizzo. Rizzo wanted to issue 40 year general obligation bonds to solve a current year operating deficit.

Thirty years ago the southwestern congressional delegations got together to push legislation to get the US government to pay for the construction of a 2,000 mile pipeline to transport fresh water from the Great Lakes to the southwest.

The Great Lakes Governors' Association didn't like the idea and got in their way! The western delegations are still quietly working on the pipeline. The governors are still in their way.

There are very few **good** dam sites remaining. The **walls** of Grand Coulee Canyon creates the Grand Coulee Dam. Today, because of the drought conditions, some in the west think the Grand Canyon would be a **great** place to build a big new dam. Not going to happen!

Farmers, Ranchers and the Rest of Us

In California's Central/Imperial Valleys the farmers and ranchers are in charge. The water crisis, however, is now more urgent than most of them are willing to admit. Again irrigated agriculture accounts for most of **all** of the water consumed in the southwest. More than half of the irrigation water is provided by and paid for by tax payers.

There are fewer than 450 ranches/farms in California's Imperial Valley. Four of every five California farms/ranches are over a 1,000 acres. 75% of California's entire agricultural output comes from 10% of those farms.

Alfalfa (hay) is the forth largest crop produced in the US behind corn, wheat and soybeans. Alfalfa cultivation requires 15% of California's water. Four times more water than it takes to grow wheat. Alfalfa is a low margin crop. More than half of the hay production is exported to Asia.

Eight acre-feet of water is needed to grow three tons of alfalfa on one acre. At a price of $100 per ton hay generates about $60 of revenue. One acre-foot of water used in the semiconductor industry generates almost $1 million of revenue. California growers consume 85% of the state's water but contributes only 2% to the state's gross product.

An acre-foot is 12 inches of water covering 1 acre, 326,000 gallons. Lake Mead (Hoover Dam) covers 158,500 acres with the capacity to hold 28,945,000 acre-feet of water.

California is the leading producer of walnuts, avocados, broccoli, cauliflower, grapes, lettuce, milk, onions, spinach, tomatoes and almonds. California produces one third of America's vegetables and two thirds of our fruits and nuts.

Like California, Arizona, Colorado, New Mexico, Kansas, Nevada, Nebraska, North Dakota, South Dakota, Idaho and Texas use most of their available water for livestock and irrigation. People use less than 10% of the water in in the southwest.

Got Almonds? Again, it takes one gallon of water to produce one almond. 80% of the world's almonds, 940,000 cultivated acres, comes from California. Almond cultivation requires 10% of California's total available water. That's 1.1 trillion gallons of water per year or 4 acre-feet per acre. Almonds deliver the highest net revenue of any crop.

One large avocado requires 220 gallons of water to produce, 500 gallons for one stick of butter and 5,000 gallons to produce a pound of beef. If we want to eat we need ranchers and farmers and they need water…but where are we going to get the water and who's going to pay?

The public money supporting the southwestern agribusiness economic model is now, politically, difficult to get. Too many demands; more objections to western water welfare and no one with the courage to deal with our current crop subsidies and tax policies.

The western United States and all of California is struggling to survive the most severe drought in a thousand years. Lake Mead, the largest reservoir in the US, is half empty. All the reservoirs in the west are at record lows.

In April 2015 Governor Brown mandated a 25% statewide reduction in water use. Farmers and ranchers were exempt. The governor's water conservation policy may not help because relatively little water is used by people.

The average faucet flows at 2 gallons per minute and a running toilet can waste 200 gallons of water a day. Taking a five minute shower uses about 25 gallons of water.

The west is the fastest growing region in the US. One third of our population lives in the West. Workers aged 25 to 34 are moving to the west. Corporations are moving to the west. In the last 20 years 50 fortune 400 companies moved to Texas. During the same period New York lost 50 fortune 400 companies.

Seven of the ten largest cities in America are west of the Mississippi River. Between 1970 and 2001 California's population grew 60%. As of 2010, 4 of the 6 largest counties in the US are in the West: Maricopa County added 563,000 new residents from 2000 to 2005. From 2010 to 2013 another 200,000 people moved to Maricopa County. But is there enough water?

The Colorado River provides water for 40 million people. The majority live in cities such as Los Angeles, San Diego, Denver, Salt Lake City, Phoenix and Las Vegas. None of these cities are on the river.

The Las Vegas population is projected to double in 3 decades. The century old Southwest Water Sharing Agreement allocates 300,000 acre-feet of water per year to southern Nevada from Lake Mead. Not enough water to support Vegas' current needs nor the expected future demand. Las Vegas' 300,000 acre-feet compares to 4.4 million acre-feet **guaranteed** to California from Lake Mead. Las Vegas has not identified an alternative raw water source. A problem.

San Diego, facing the same problem as Las Vegas, is investing more than $1 billon to construct the Carlsbad Desalination Plant. It's the largest desalination plant in the western hemisphere. The plant is expected to provide for the future drinking water needs of San Diego and San Diego County. The plant will be placed in service this year. Desalination is not an option for Las Vegas.

The Bureau of Reclamation projects that there is a 54% probability that Lake Mead's water level will go below 1,075 feet in 2017. The Lake was 1,080 feet in August 2015. It is at 1,079 feet today. If the lake goes below 1,075 feet mandatory rationing goes into effect! More bad news for Las Vegas.

Today, Lake Mead is at 38% of capacity and Lake Powell is only 57% full. Unlike Lake Mead, Lake Powell, Glen Canyon Dam, does not provide irrigation water for farms and ranches. It was built to generate **subsidized** hydroelectric power.

The Bureau of Reclamation has authorized the release of eleven billion gallons of water a day from Lake Powell to help maintain Lake Mead water levels.

Lake Powell evaporates at the rate of 860,000 acre-feet per year. Lake Mead evaporates at 800,000 acre-feet per year. **Climate change?** 860,000 acre feet is enough water to supply Los Angeles' **drinking** water demand for almost two years.

The western drought is in its 15th year. If the drought continues and water users don't adopt measures to reduce their water use, much of the water will run out, perhaps in your lifetime.

Groundwater

35% of Ohioans use groundwater as their primary source of drinking water.

Surface water is the "preferred" and safer raw water source. Surface water, however, is not enough. We also need groundwater.

In the early 1930's we figured out that there was a lot of water underground. It was hard to get because we lacked the technical know-how to pump water from aquifers and the costs associated with pumping was uneconomic. In the late 1930's pumps were developed that were capable of "lifting" the water.

Water is heavy. A gallon of water weighs 8.34 pounds. 20%more than a gallon of oil.

The Ogallala aquifer is under Nebraska, Kansas, Oklahoma, Texas, South Dakota, Wyoming, Colorado and New Mexico. The pockets of fresh water in the Ogallala is equal to the water in Lake Huron, 3.3 billion acre-feet, or more than 235 years of flow of the Colorado River. Two thirds of the Ogallala is under Nebraska.

The Ogallala aquifer accounted for one fifth of total US irrigated farming in the 1970's. The annual ground water withdrawal quadrupled between 1950 and 1980. Irrigated acreage during the period was 14 million acres.

Water withdrawal from the Ogallala is 10 times faster than the aquifer can recharge. Overdraft in 2000 totaled 200 million acre-feet or the annual flow 14 Colorado Rivers. It took a thousand years of rain and snow melt to fill a large part of the aquifer which is now being depleted as a result of over pumping since 1950. It's projected that 70% of the Ogallala will be gone in 50 years at current rate of withdrawal. 30% of the aquifer is already gone.

The question is how long will the remaining groundwater last. Texas and Kansas are projected to run out of Ogallala groundwater between 2020 and 2030. Water shortage is a proxy for inept public goverence and uninformed or lazy management practice.

We now pump 90 billion gallons of groundwater a day, 30% of our national water supply. 50% of Americans rely on ground water as their primary source of drinking water. We use 45 trillion gallons of groundwater a year. Groundwater is no longer a renewable resource.

Saudi Arabia purchased 15 square miles of farm land north of Phoenix, Arizona to grow alfalfa as did the United Arab Emirates.

The Saudis ran out of groundwater at home but needed feed for their livestock. The hay is bundled and shipped by sea to Saudi Arabia. The Saudis are spending petrodollar surpluses to import food for their livestock. Imagine, a virtual water pipeline from Arizona to middle east!

Perhaps this something my main man Kevin McCarthy should do something about!

Arizona does not have regulations covering this form of water export. California does not have any regulations governing the pumping or "export" of groundwater.

The Middle East is the first region in the modern world to run out of water. Jordan ran out of water in the 1960's and Egypt in the late 1970's. Keep an eye on Saudi Arabia, the United Arab Emirates and the rest of the region.

Libya's Gaddafi used his petrodollar wealth to mine groundwater in the southern Sahara desert. A 2000-mile network of tunnels, called the **Great Manmade River,** transfers water to the coast where most of Libya's 6 million people live. The water bearing structures under the desert contains 50 billion acre-feet of water, the largest know fossil water deposit on earth. The problem is Gaddafi is dead. There is a leadership vacuum in the region. Egypt, Chad and the Sudan think it's their water too.

So What to Do?

Farmers and ranchers must become more efficient in the way they use water and expand their conservation practices. Flood irrigation is not best practice! Drip irrigation is the solution and produces higher crop yields. Our ranchers are doing it the old way to their peril. They can and must do better.

Australia and Singapore have taken the long view on water planning and use which is helping them avoid water shortages. For each the key is conservation and **full cost pricing** for any and all water used.

The poster child for water planning, sourcing, conservation, and distribution is Israel. No country in the world has made fresh water management a higher priority than Israel.

60% of Israel is desert and the rest is semiarid. Since it's founding in 1948 Israel has nurtured a "water respecting culture" because there is so little water.

In Israel water is owned, managed and its use is measured by the State. Water is **not** private property! Groundwater, surface water and even rainwater is a public asset. Drilling for water anywhere in the country, even on private land, is prohibited unless you hold a state issued permit. No permit; you may not drill for water anywhere nor are you permitted to "move" water without the states permission.

Any and all water distribution is metered and users pay the full market price for all the water used. Not so in the US. In the US water is viewed by the Water Nobility as an entitlement that should be available at no charge.

David Ben-Gurion, the first Prime Minister of Israel, realized that if his small nation was to grow, prosper and provide a homeland for Jews migrating from Hitler's Europe, water would be the linchpin. Ben-Gurion was right.

Today, Israel's finished water loss between the plant and the meter in less than 11%. Policy makers see this as unacceptable. Arid Israel has a fresh water surplus!

In the movie, The Big Short, adapted from Michael Lewis' book of the same name, Scion Asset Management founder Dr. Michael Burry took a large short position in sub-prime mortgage bonds. He made almost a billion dollars. Since 2010 he has been investing almost all of his capital in one commodity: Water!

3/6/2016 final draft

Sources

Unquenchable: America's Water Crisis and What To Do About It
Robert Glennon 2009 Island Press / Shearwater Books

Water: The Epic Struggle For Wealth, Power, And Civilization
Steven Solomon 2010 Harper Collins Publishers

The Age Of Sustainable Development
Jeffrey D. Sachs 2015 Columbia University Press

Cadillac Desert: The American West And Its Disappearing Water
Marc Reisner 1986 Penguin Books

Deadbeat Dams: Why We Should Abolish the U.S. Bureau of Reclamation and Tear Down Glen Canyon Dam Daniel P. Beard 2015 Johnson Books, Big Earth Publishing

Let There Be Water: Israel's Solution for a Water-Starved World
Seth M. Siegel 2015 Thomas Dunne Books

The New Yorker: May 2015

Drinking Water: U.S. Environmental Protection Agency

When Your Kids Move Out West: Bloomberg Business April 2015

Save California Farmers From Themselves: Bloomberg View April 2015

Desalination by the Numbers: Report From Global Water Intelligence

Protecting Drinking Water is Costly: Columbus Dispatch/Associated Press

Columbus Comprehensive Annual Financial Report 2014:
Auditor Hugh Dorrian

Arizona Department of Water Resources

California Water Foundation

Global Water Security Calls for Leadership, Intelligence Assessment: The Wilson Center's Environmental Change and Security Program

As Their Wells Run, California Residents Blame Thirsty Farms: npr/KQED News

U.S. Bureau of Reclamation/ U.S. Department of Interior

U.S. Geological Survey/ The USGS Water Science School: Land Subsidence in the United States