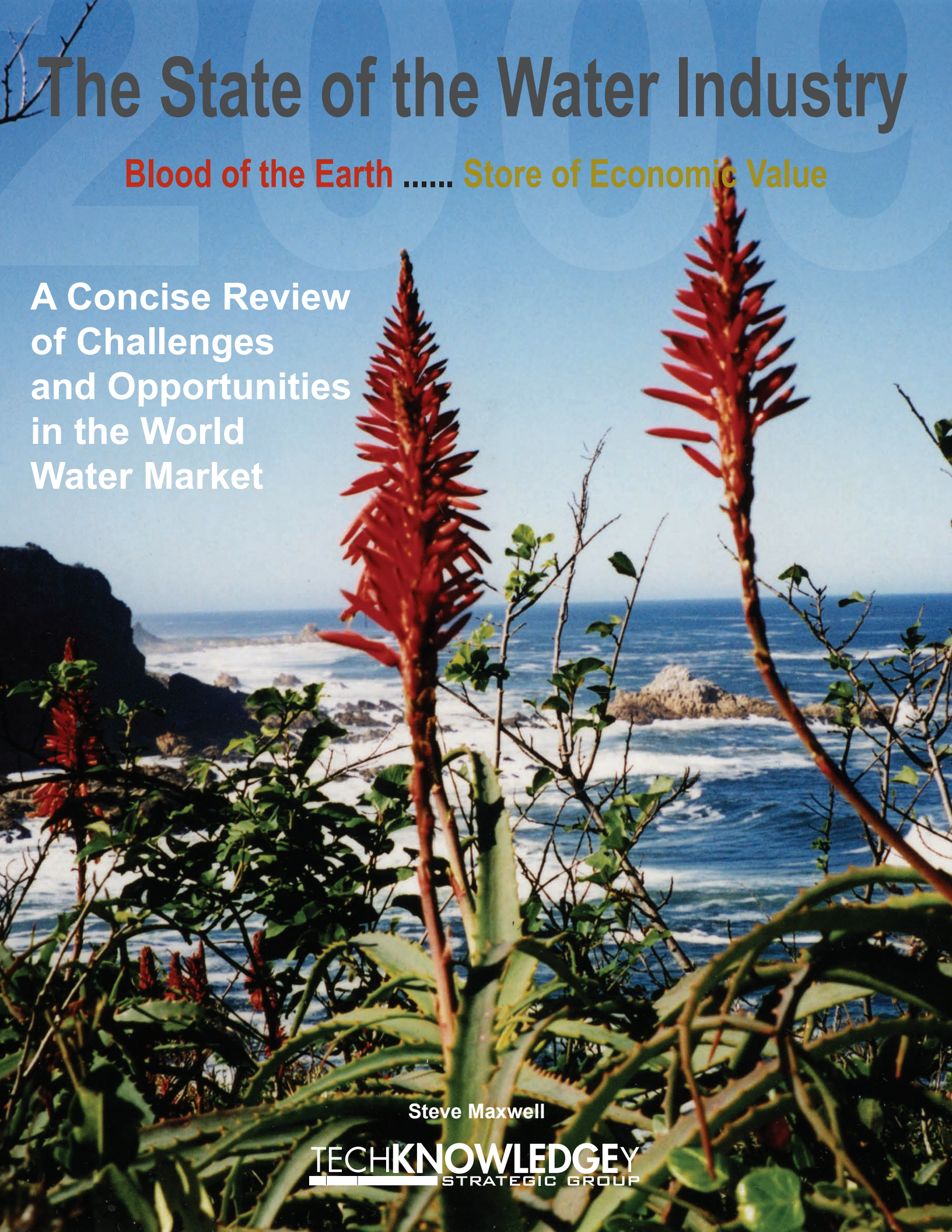
The State of the Water Industry

Blood of the Earth ..... Store of Economic Value

A Concise Review of Challenges and Opportunities in the World Water Market



Steve Maxwell

TECHKNOWLEDGEY STRATEGIC GROUP

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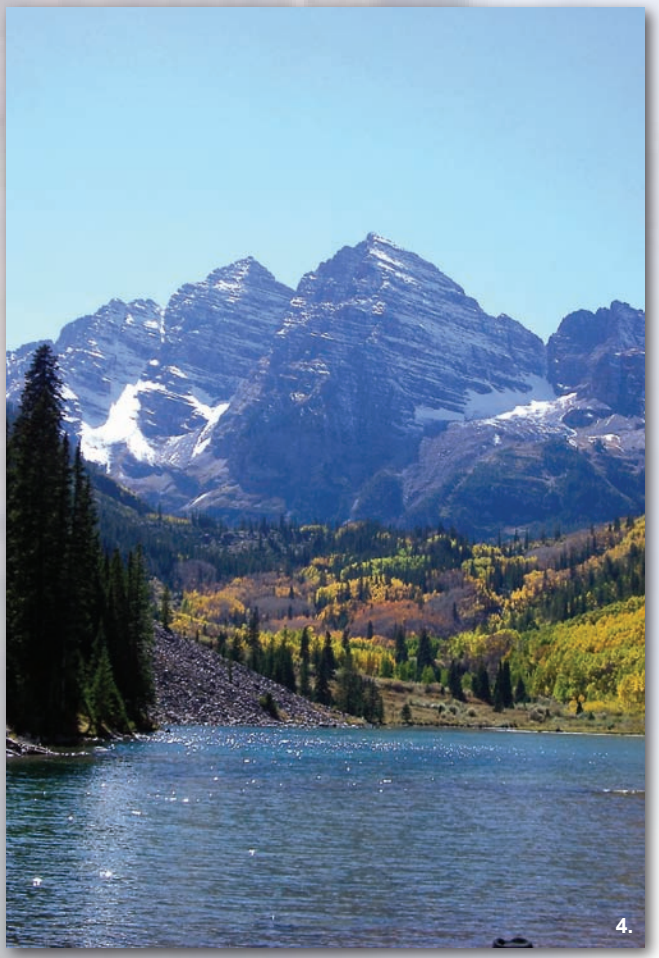

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I. Introduction

Decades from now, it seems likely that historians will look back on the 2008 - 2009 timeframe as a turning point - with a global financial crisis the likes of which has not been seen in decades, an historic changing of the guard in American politics, and exploding interest in environmental and energy policies. Less dramatic perhaps, but likely to be just as significant over the longer term is the growing recognition and appreciation of the critical role that water plays, not only in the functioning of industry, international politics, and the biological health of the planet, but also the value it can imply and create in the global *financial* infrastructure. As our financial system teeters near collapse, the significance of water in the world economy continues to grow. Water is not only a vital prerequisite of all life - the blood of the earth, as the ancient Chinese called it - but in various forms, it is also and increasingly recognized as a true store of economic value in troubled times.

There is no substance more critical to life than water; we cannot live without it for more than a few days. Even though it is abundant in some areas, it is hardly surprising that water should eventually begin to take on more economic recognition and financial value. Modern water treatment technology and distribution infrastructure have allowed us to conquer disease, to build advanced industrial economies, and to dramatically increase standards of living for many of the world's people. In conjunction with advances in plant genetics and modern agriculture, improving irrigation techniques have made it possible to feed a rapidly growing world population, to turn deserts into productive farmland and to quench the thirst of sprawling metropolises - a harsh rebuke to the predictions of Malthus.

But it may be only a temporary rebuke. We continue to deplete our groundwater resources and pollute our surface rivers and streams at an alarming rate - and we steadfastly look the other way while our water infrastructure crumbles. Because water is artificially cheap, most of us use it less efficiently than we easily could, and we blithely assume that it will always flow when we turn on the tap. But there is gathering evidence that we are converging towards a point where many of us will no longer have sufficient clean water to support our current lifestyles. Half of the world's population is expected to suffer from severe water shortages by the year 2050. A report just issued at the 2009 Davos World Economic Forum warns that the world is quickly headed towards "water bankruptcy" and rates this as one of the world's most pressing problems.

Many still seem to believe that water simply falls out of the sky and that it should be basically free, forgetting that it costs money - hundreds of billions of dollars a year - to collect, clean, store and distribute water. In the United States, many of our treatment plants, reservoirs, and distribution pipelines were built fifty to a hundred years ago and are rapidly decaying, with leakage rates as high as fifty percent in some of our older cities. More ominously, many of our underground aquifers and surface water sources are irreversibly contaminated, or are drying up from decades of overuse. The problems are everywhere, and are plain to see for those willing to take a look. Nonetheless, political leaders are rewarded for minimizing public spending in the short term rather than insuring that their constituents will have vital water resources in the future. City councils are loath to raise water rates, even though large percentage increases would amount to only a few dollars a month for most Americans. Indeed, as I will reemphasize throughout this report, one of the biggest challenges in water is improving public understanding and awareness of these vexing problems - and what we can each do to begin solving them.

At a fundamental level, the main reason for this nonchalance and indifference is that water remains *absurdly* cheap relative to its real value. Americans today pay an average of a quarter of a penny per gallon for the clean drinking water that seems to magically flow out of our taps, or only about $25 to $30 a month for the typical family. One simply cannot find another product whose real value so far exceeds its price - or for that matter, one whose price is often so unrelated to its true cost of delivery. But as time goes by, we will all eventually bear the costs of correcting the water pollution problems that we have created, and rebuilding the infrastructure that we have allowed to decay. Higher water prices will eventually force us to pay more attention to this problem on both an individual and a collective basis.

Last year we referred to the "flood of challenges" and the "sea of opportunities" presented by the world water industry, and the events of the past year have served to underline and emphasize both of these critical and countervailing perspectives. Now that we find ourselves staring into the abyss of more immediate economic and financial crises, some issues surrounding water and environmental stewardship may have to be pushed to the back of the political agenda for awhile longer, and we will have to hold back this flood of challenges. But the opportunities also continue to grow, and water itself seems to be increasingly considered as a store of value - maybe not yet quite as valuable on a unit basis as gold or silver, but a store of value nonetheless. The water industry will continue to be one sector of the overall economy that is absolutely critical to economic vitality and human health, and increasingly one where investment dollars are more likely to retain their value. Indeed, in many ways, water stocks - particularly water utility stocks - may represent the ultimate defensive and recession-resistant investment. In tough times, consumers may cut back on a lot of things, but water is probably not one of them, especially when it remains so cheap relative to all others goods and services.

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In an earlier report, I compared the global water problem to a huge asteroid hurtling directly towards the earth - an imminent and life-threatening crisis that could only be solved if all the people of the earth quickly put their differences aside, focused on the problem and began working together to find a solution. As each year passes, the world's water problems grow in terms of geographic extent, scientific complexity and human impact - and our collective ability to understand and correct these problems is stretched thinner and thinner. The twin challenges of water quantity and water quality represent an inexorable crisis - one that is not going away, and one that will ultimately overshadow shorter-term geopolitical, financial, and even energy crises that typically attract far more attention. Now more than ever, we need to develop an urgent focus and cooperative international approach to really begin solving our water problems.

II. Recent Trends and Highlights

Since our review of the water business a year ago, a number of new issues and trends have emerged. Below, I mention just a few of the more critical recent highlights.

• **Water Investments Gain Attention as Economy Falters:** Last year at this time I noted the impending turmoil in world financial markets, but took a pass on prognosticating about the longer-term future - saying that it was too early to make predictions about the longer term economic impact on the water industry. However, it can now obviously be said with certainty that 2008 saw some of the most ominous economic circumstances in at least two generations. The financial crisis and deep recession in which we now find ourselves seems likely to have a significant and lasting impact on stock valuations across the board, including the water industry. (It has been many years since the black bars on the right-hand side of our Stock Value table on page 8 have been so short). A similar impact will be felt by private companies and in smaller transactions as well. Although the negative impact of the financial crisis on publicly-traded water stocks and the overall water business is clear, I again emphasize that water is beginning to be recognized and emerge as an alternative store of value in recessionary times - a good place to save money for a rainy day. Water investments will not be as dramatically impacted by the current financial crisis as most investments will.

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- ***The Less Glamorous Side of the Business, Where Most of the Dollars will be Spent***
- ***The Growing Role of Private Equity in the Water Industry***
- ***Sources of Financing for Your Water Business***
- ***Strategic Planning in the Water Industry: Making It a Truly Useful Process***
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- ***The Paradox of Water Dollars***
- ***How Big is the Water Industry, Anyway?***
- ***Monitoring and Testing: A Critical and Growing Sector of the Water Industry***

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The credit crunch and equity collapse has predictably caused a virtual shutdown of the initial public offering market, and a distinct slowdown in private equity investments across the economy. There were a couple of notable new stock issues in early 2008 or late 2007 - Cascal, ERI and American Water Works - but by the beginning of the third quarter of 2008, the IPO market was effectively closed. Indeed, there was not a single new major exchange IPO in the fourth quarter in any industry in the United States. Likewise, as it has become more difficult or impossible to borrow capital, private equity buyers (who like to leverage their investments) have backed off from the torrid pace of acquisitions seen between 2005 and the early part of 2008. In addition, beyond the current financial circumstances, there simply are not many significantly sized private companies in the water industry that are attractive to the typical private equity investor.

Water is not only a vital prerequisite of all life - the blood of the earth as the ancient Chinese called it - but it is also and increasingly recognized as a true economic store of value in troubled times.

Some observers have noted that most privately-owned players in the domestic water industry find themselves inconveniently located somewhere in between the "sweet spots" of *either* the private equity *or* the traditional venture capital investor - i.e., there aren't many private companies large and profitable enough to attract the private equity community, nor are there many start-up or early state companies with the cutting edge technology and the high potential returns needed to excite the venture capital community.

All of these factors have combined to bring water company stock values and deal valuations back down from their recently stratospheric heights to more realistic and more sustainable levels. And we will likely experience a longer-term and secular adjustment in the valuation of water companies - values are not going to bounce back up again the near-term. Finally, in terms of merger and acquisition activity, industry buyers will eventually get back into the game, but for the moment even the largest strategic buyers are sitting on the sidelines, preserving their cash.

However, things are by no means bleak in the water industry. It is important to look beyond the current crisis and recognize that even with this (perhaps needed) adjustment, the value of most water stocks will inexorably continue to grow over time. As I will discuss in more detail below, many market sages believe that water stocks - and water utility stocks in particular - will begin to de-couple or deviate from the pack, and represent the kind of fundamental value-based proposition that few other industries will be able to match. This has often happened in the past during broader bear markets, and it is almost certain to happen again this time.

• **Renewed Focus on the Environment:** There is great anticipation and heightened expectations in the water and broader environmental community regarding the new Obama administration, and what impact the proposed stimulus packages - as well as a dramatically different environmental and energy per-

spective - will have on the water business over the next few years. However, past experience has shown that such administration changes and philosophical shifts take considerable time before any real impact trickles down to project spending in the day to day marketplace. Despite the national momentum towards a "New Deal"-like focus on public projects and infrastructure spending, and the likelihood of increased funding for various loan programs, most observers do not expect to see a dramatic impact on the water and wastewater treatment infrastructure. The Obama administration seems certain to take a more environmentally friendly and sustainability oriented outlook to many social and industrial issues, but the direct impact upon the water industry will most likely be gradual and muted.

• **The Intertwining Aspects of Water and Global Food Production:** The efficiency and sheer volume of agricultural water consumption - including large-scale irrigation and its impact on underground water resources - is receiving more attention and analysis. Food prices have been rising rapidly around the world, and with this has come a closer look at our water efficiency planet-wide - and trying to grow the right kinds of crops in the most logical regions. World per-capita food demands are also undergoing rapid change. The Chinese now consume 110 pounds of meat per capita per year, more than double the 44 pounds they consumed in 1985 - and it takes a lot of water to produce a pound of beef. And as prices for commodity crops like wheat and corn reach all-time highs, the impact on the price of all downstream food products has risen accordingly. According to the Earth Policy Institute, at the end of 2007 in the U.S., the price of bread was 12 percent higher than a year before, eggs were up 36 percent and milk was up 29 percent. This did not get as much media attention in the United States as it did in many less developed parts of the world, where most people spend a much higher percentage of disposable income on food. These trends will quickly translate into greater food scarcities in the poorer and more under-nourished areas of the world. Massive plans to develop ethanol as an alternative fuel may also turn out to be a strategic mistake, both in terms of water consumption, and the impact on food prices - this is a "cure" that may turn out to be worse than the disease. These competing demands will lead to further price increases in both food and water, and will complicate water policy decisions even more.

• **Water to Make Oil, Oil to Make Water:** There are likewise serious challenges emerging at the intersection of energy and water. It takes lots of water to produce energy, but it also takes lots of energy to treat and move water around - and the demand for one could soon cripple our use of the other. As Michael Webber put it in the October 2008 edition of *Scientific American*, ".... many people are concerned about the perils of peak oil - running out of cheap oil. A few are voicing concerns about peak water. But almost no one is addressing the tension between the two: water restrictions are hampering solutions for generating more energy, and energy problems, particularly rising prices, are curtailing efforts to supply more clean water …… the situation should be considered a crisis, but the public has not yet grasped the urgency."

There are intriguing questions here - questions such as how much water it will take to produce a barrel of oil from the Canadian tar sands, and what to do with the resulting contaminated process water? Or, on the other side of the globe, how many barrels of oil will it take in Saudi Arabia to produce a barrel of desalinized drinking water? The on-going modernization of Saudi Arabia and the arid Gulf States rests upon the consumption of a large portion of their natural energy reserves to "manufacture" water for their people. In water-rich Canada, huge amounts of water are needed to enable domestic energy security. A side issue here is the emerging idea that so-called "produced waters" from deep energy extraction operations may start to be viewed not as a by-product waste, but as a potential new source of raw water - changing the economics of energy, and confounding existing legal and regulatory systems.

Almost twenty percent of California's total energy consumption goes to moving water around the state; a similar figure for the nation as a whole is about six percent. China is preparing to spend almost $100 billion to create large-scale diversions of

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40 Publicly Traded Companies With Interests in the Water Industry

Company	Symbol	Revenues $ mils.	Income $ mils.	Market Cap. $ mils.
American States	awr	309	25	634
Ameron	amn	668	59	491
Aqua America	wtr	616	97	2799
Badger Meter	bmi	280	25	441
Calgon Carbon	ccc	393	31	814
California Water	cwt	396	40	917
Cascal NV	hoo	165	19	121
Clarcor	clc	1060	96	1611
Clean Harbors	clh	1040	56	1236
Clorox	clx	5450	472	7225
Danaher	dhr	12700	1320	17929
Dionex	dnex	394	57	896
Energy Recovery	erii	44	6.1	321
FlowServe	fls	4410	424	3007
Fluor	flr	20970	790	7648
Franklin Electric	fele	747	46	596
Gorman-Rupp	grc	326	28	367
Insituform Tech.	insu	530	23	387
Itron	itri	1960	28	1971
ITT Corporation	itt	11690	775	7783
Layne Christenson	layn	1000	47	360
Lindsay Mfg.	lnn	512	41	356
Metpro	mpr	108	11	173
Middlesex Water	msex	91	12.7	217
Millipore	mil	1610	158	3381
Mueller Water	mwa	1810	-356	362
Nalco Holding	nlc	4210	-342	1606
Northwest Pipe	nwpx	428	29	303
Pall	pll	2590	224	3228
Pentair	pnr	3350	256	2431
Polypore	ppo	610	41	275
Robbins & Myers	rbn	792	91	638
SJW Corporation	sjw	218	21	520
Southwest Water	swwc	222	-8	141
Tetra Tech	ttek	1250	61	1499
Thermo Fisher	tmo	10500	989	16687
URS	urs	9120	201	2876
Valmont Industries	vmi	1800	127	1067
Veolia Environne.	ve	44230	1270	10708
Watts Water Tech.	wts	1460	72	732

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water from the south to the northern part of the country. As Webber says, "Some day we might look back with a curious nostalgia at the days when profligate homeowners wastefully sprayed their lawns with liquid gold to make the grass grow, just so they could then burn black gold to cut it down on the weekends. Our children and grandchildren may wonder why we were so dumb."

• **Growing Concerns About Global Climate Change:** As more and more evidence piles up to suggest that climate change is indeed real, it is becoming ominously clear that this will affect the hydrologic cycle, rainfall patterns and general water resource availability in numerous and complex ways. Although we are a long way from understanding these complex interacting factors, one thing is clear - increasing temperatures will complicate and exacerbate an already dire water situation. Vast new storage and transmission infrastructure to accommodate shifting weather and precipitation patterns may come first - but shifting population trends and large-scale human migrations could well be the ultimate result decades from now. It may sound like heresy today, but from a very long-term perspective, it seems inevitable that the huge capital and energy costs of moving water to supply booming desert oases such as Las Vegas will one day reverse, and we will see the large-scale movement of people back to areas of more abundant water.

• **The Bottled Water Craze Cools Off:** At the same time that many parts of the world face crippling water shortages, it is outrageous to many observers to witness the way the bottled water craze continues to captivate wealthier regions. Hollywood starlets still pitch all manner of natural spring waters, vitamin waters, energy waters, smart waters, holy waters and various other so-called specialty beverages right up to "Bling H2O" - which proudly calls itself the most expensive bottled water available - all now available at a cost of only a few hundred to a thousand times the price of the tap water from which they are virtually indistinguishable. "Liquid OM" is, according to *Newsweek*, a "super-purified bottled water containing vibrations that promote a positive outlook …. The water purportedly possesses an energy field made by striking a giant gong and Tibetan bowls in the vicinity of the water. The good energy can be felt not just after you drink the water but also when you're just holding the bottle." What can possibly be next? It calls to my mind the famous quote from H.L. Mencken that "no one ever went bankrupt under-estimating the intelligence of the American public."

But the fad may be moderating - some upscale restaurants are now promoting the virtues of tap water. Late last year, Pepsi laid off some 3,300 people, attributing it to a slowdown in its bottled water business. And no less a water authority than the National Association of Evangelicals has said, "Spending $15 billion a year on bottled water is a testimony to our conspicuous consumption, our culture of indulgence…. drinking bottled water may not be a sin, but it sure is a choice." With the economic hardships that appear to be coming, there will definitely be a change in the appetite of the American public to pay such high prices for essentially the same thing that comes out of their taps virtually free.

To be fair, there is no doubt that bottled water supplies can be

The Water Business in a Nutshell

Key Drivers
water quality *and* water scarcity problems are reaching crisis proportions worldwide
awareness of water problems is gradually increasing – but public education and more attention is critical
regulation and enforcement levels are increasing, and new policies and approaches are emerging
huge economic (and human) capital investments are required – much more focus is needed
Key Trends and Developments
more regulation and government oversight of water issues and markets seems inevitable
our dilapidated and crumbling infrastructure cries out for more attention and investment dollars, now
conservation of water and more efficient use of water will allow us to extend our existing resource base
as water becomes more dear, recycling and re-use will become more common, and more accepted
better monitoring and metering of water consumption will also help us become more efficient
residential consumers are becoming more proactive about the quality of the water in their homes
there has been a surge of financial interest – from all types of investors – in the water business
consolidation and rearrangement of asset ownership in the water industry is on-going
we may also see broader consolidation of municipal water and wastewater utilities in the future
the controversy over privatization, out-sourcing and the role of private companies in water rages on
many paradoxes in the pricing, conservation, and financial of water continue to confound the industry
Possible Solutions
increasing water prices are inevitable and needed – and will help us better manage this scarce resource
we must devise water policy at the global level, but strive for individual solutions at the local level
there is much we can all do, in our day to day lives, to conserve water and use it more efficiently
technology can help, but we should not rely on a technological fix to solve all our water problems
we must strive to develop better laws and public policies, to address complex water problems

Source: Tech*KNOWLEDGE*y Strategic Group

of critical help in short-term emergencies, or where the safety of public water systems has been temporarily compromised, and in many parts of the developing world where public tap water is not nearly as safe as it is in the United States. But, as I will repeat numerous times throughout this report, better public education programs are needed in the water industry, both on this issue and many others, to help people better understand what is truly at stake in water.

• **New Policies and New Ways of Thinking About Water:** As water problems become increasingly serious in certain regions of the world, we are beginning to see the development of new resource management approaches, and creative market mechanisms to help preserve and allocate water resources more efficiently. We as a society need to allocate much more of our talent to this area and work to promote more creative thinking, but at least there is some progress being made. For obvious reasons, new approaches and more creative policies tend to emerge earliest in those regions that are suffering the most - like the southeastern corner of Australia, where a severe drought is now in its seventh year, and where significant sectors of the economy are truly threatened by water shortages. New systems for owning and trading water rights are beginning to be developed; other regions are experimenting with tradable pollution rights, similar to what we have seen in certain air-shed regions in the past - to try to insure that pollution will be minimized or at least occur in regions where it has the least impact. This development is at a very early stage, but as more sophisticated management, allocation and trading systems evolve, they will hopefully provide stronger incentives and means for everyone to use water more wisely.

Water investments will not be as dramatically impacted by the current financial crisis as most investments will.

• **Public Versus Private Ownership:** There are many contentious issues in the water market, but none are as divisive and polarizing as the debate over the appropriate role of the private sector. Controversies about privatization, out-sourcing and the role of private companies are frequent and widespread, and they only seem to intensify as the years roll by. For example, in mid-2008, *The Economist* sponsored a widely attended on-line debate directed at this issue - and more specifically at how water should be priced. The viewpoint on one end of this spectrum seems to propose that the water business would be better off if it were entirely privatized, while those at the far opposite end fervently believe that there should be no role for private industry in water whatsoever.

From the broader perspective, some argue that water should be viewed simply as a basic human right, often with the implication that clean water should somehow be equally and freely available to all. Others suggest that we need to move towards viewing water as a simple commodity - just like any other commodity such as wheat, corn, copper or oil - and allow natural market forces to more efficiently set its price and govern its allocation. Unfortunately, the angry participants in these debates often talk past each other; indeed, such forums typically serve as little more than soapboxes for airing the same old arguments between the advocates and opponents of privatization.

These aren't simple questions - they are very complex issues, and simply spouting one extremist view or the other sheds little light on the problem. The truth behind all of these rigidly black and white arguments lies somewhere in between - and it is time to move beyond the fruitless rhetoric occupying either end of this spectrum. These are complex "gray" issues, on which reasonable people can disagree but where we must carefully examine alternatives, and work towards the most effective balance between extreme points of view.

Access to clean drinking water obviously has to be viewed as an inalienable human right. And poorer people, particularly in the developing world, should not and can not be denied the right to water simply because they may be unable to afford to pay for it. Subsidies or other types of government involvement in markets must clearly protect those at the bottom end of the income scale. I don't know of any serious industry observer who would argue with that. However, we also have to be practical and remember that clean drinking water costs hundreds of billions a year worldwide to store, treat and distribute - and that we as a society somehow have to pay those bills. Despite what some uninformed observers may claim, clean water certainly isn't - and can never be - free. The fact that access to water should be viewed as a fundamental human right does not imply that private capital and private companies shouldn't be involved in water.

Indeed, as I highlight in more detail in later sections of the report, sometimes privatization or out-sourcing may represent the best alternative to solve a complex water challenge. Of course, at other times they may not. The fact is, there are a number of fundamental economic drivers which support greater privatization in the water industry. Few municipalities enjoy over-flowing coffers, and public officials who wish to be re-elected try to avoid large tax increases on their watch. Most public works managers find themselves between a rock and a hard place - technical requirements, regulatory complexities and overall utility costs continue to increase. Yet the general public is typically resistant to any increase in user fees, even though in the case of water such proposed rate increases are usually small. In some cases, one solution to this dilemma may be to turn to private companies and/or private capital to finance, build and operate the water or wastewater system.

The anti-privatization proponents tend to forget that a private *operator* has no control of or influence over water pricing - that remains the responsibility of the city council or governing entity to which they are simply a contractor. And in the case where a private utility *owner* does have authority over pricing, it is subject to strict regulatory control from the local Public Utility Commission. Indeed, private water utilities are far more closely regulated in terms of rate-setting and consumer price rates than are municipally-owned utilities. Private participation in the water industry is not the "greed gone wild" scenario of evil corporations jacking up prices and flagrantly gouging the poor, although its opponents often try to portray it that way.

At the same time, it must be acknowledged that there are well-known examples where privatization and out-sourcing has not worked very well - for example, in the city of Atlanta. Privatization of the drinking water systems in certain cities in South America led to widespread protests and riots when prices were raised above the local population's ability to pay. Most larger and well-financed cities are perfectly capable of running efficient and fiscally profitable water and wastewater systems without private assistance. Again, it seems neither logical nor

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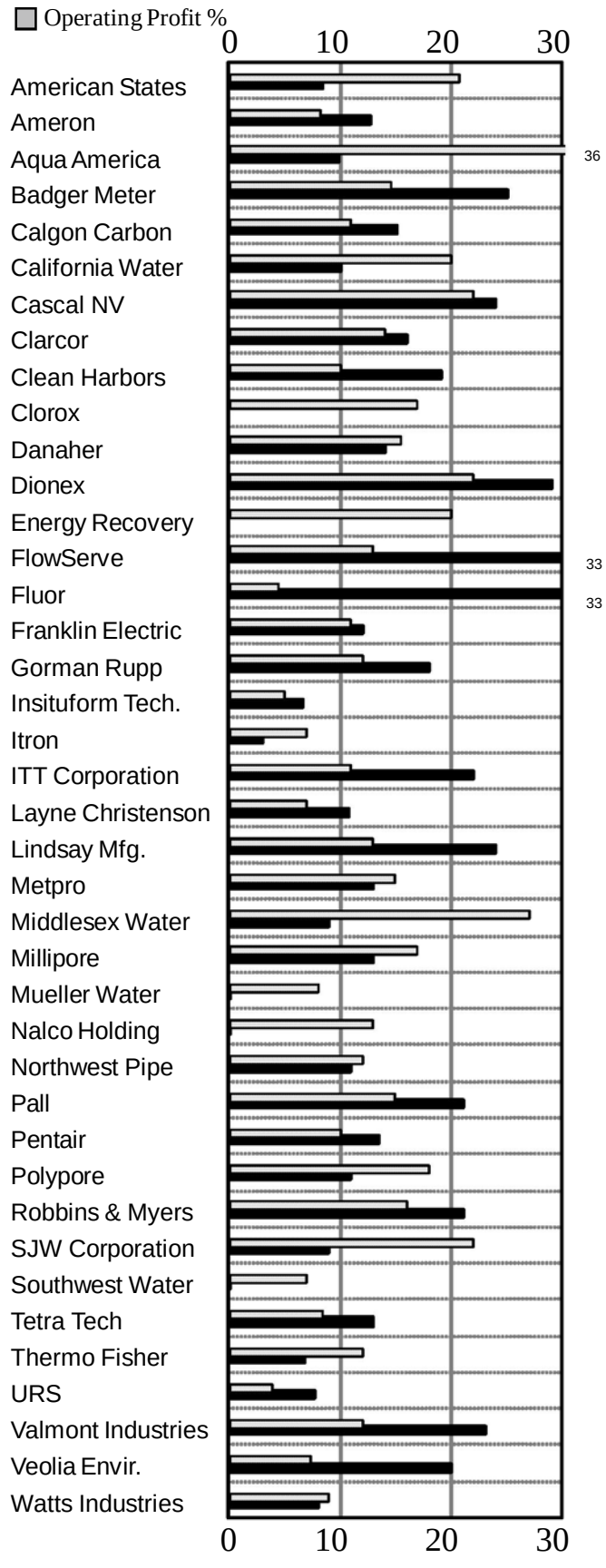
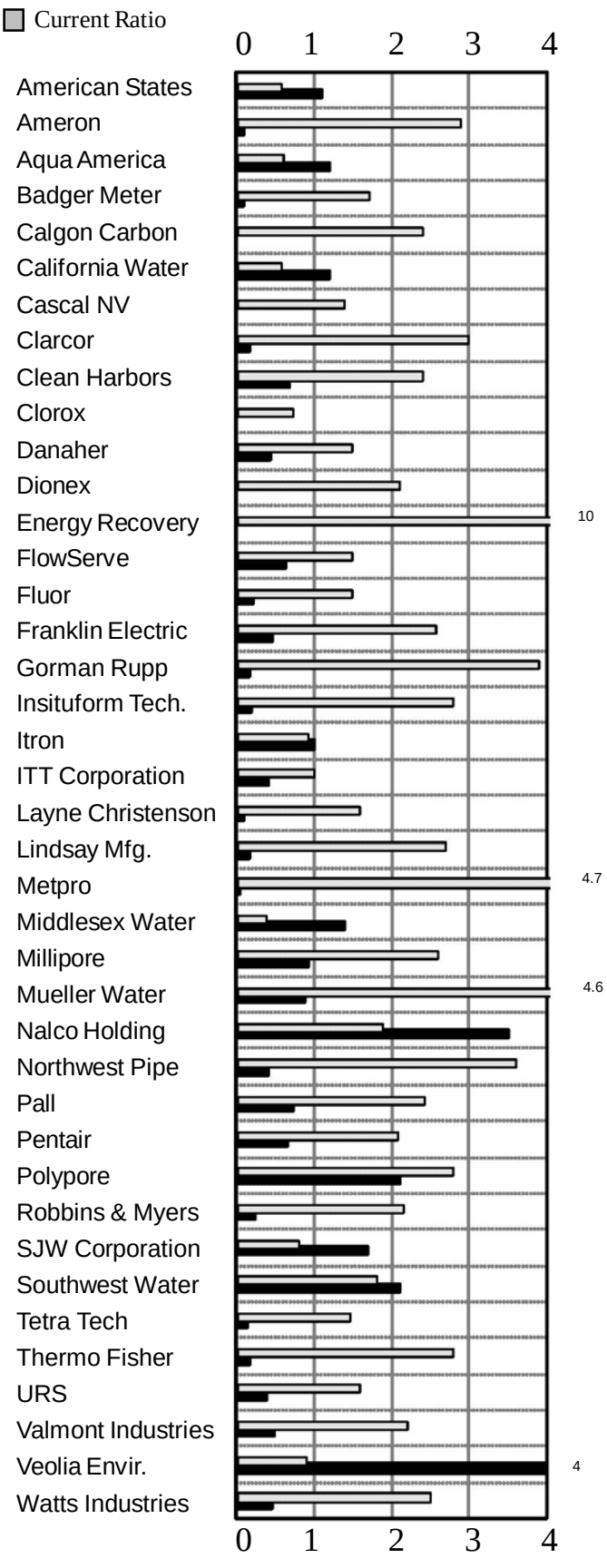
Profitability & Performance



Note: Where there is no bar, the number is zero or has a negative value.

Balance Sheet Information



Financial Performance of Water Companies

(Note: The data used to construct the charts and analysis on pages 6 through 8 are from late February, 2009; sources and definition of the various data utilized herein are summarized in the legend on page 9.)

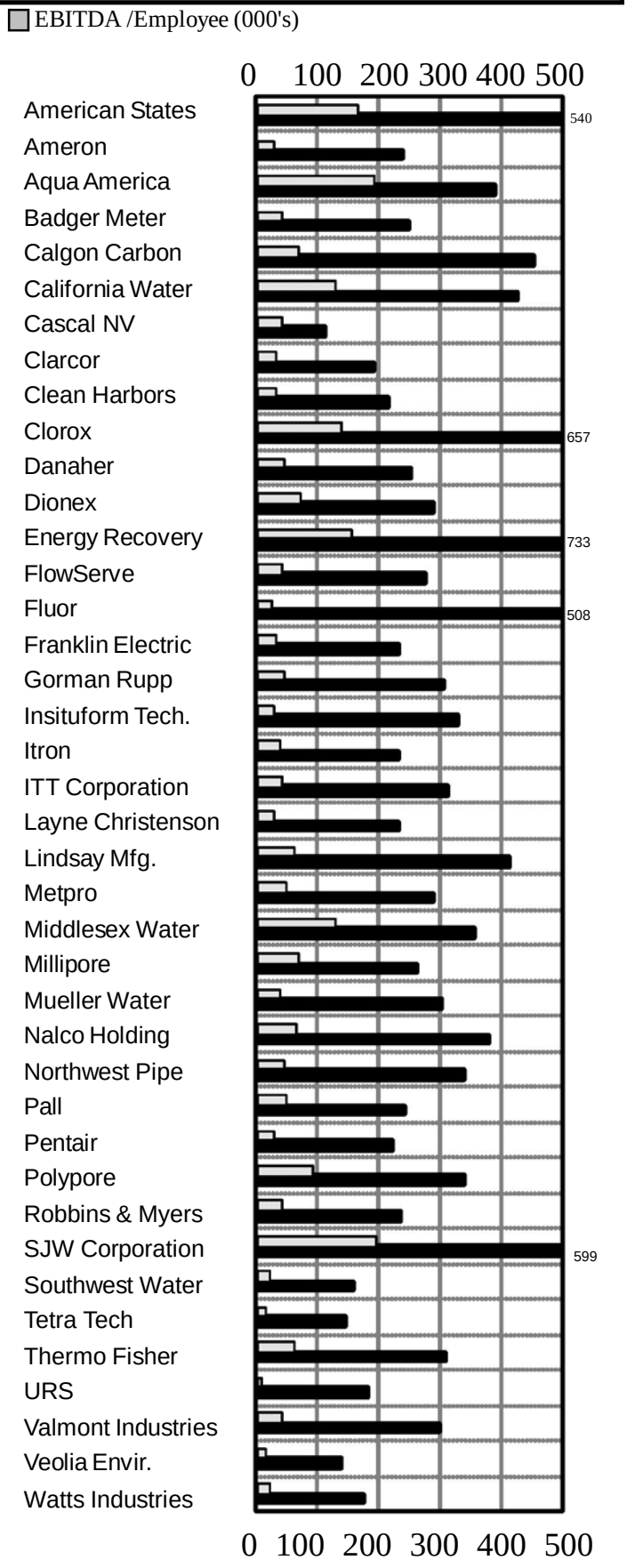
The consolidation craze in the water industry is finally winding down - or at least being put on hold through the on-going economic upheaval. Evidence for this can be found in the fact that not a single company in our portfolio of forty publicly-traded firms has disappeared through consolidation since last year. However, we have made a few changes in our list, to reflect current industry conditions and trends.

We have removed several small companies from the list, including Artesian Resources, Basin Water and Vermont Pure Holdings, and have replaced those with the following three new companies. Cascal NV, publicly traded for just over a year now, is based in the United Kingdom, and provides water and wastewater services to homes and businesses in the United Kingdom, South Africa, Indonesia, China, Chile, Panama, and the Philippines. The company collects raw water from surface and groundwater sources, treats the water to meet the required quality standards, and then provides the treated water through a distribution network to third-party customers. Cascal's stock is down significantly from its initial offering price. Energy Recovery, Inc. manufactures and markets efficient energy production and recovery devices, specifically for use in the burgeoning seawater desalination marketplace. The Company is also new to the public markets in the last year or so, and has seen its market value erode in concert with the rest of the market. Polypore, a filtration technology company, is engaged in the development, manufacture, and marketing of specialized micro-porous membranes used in separation and filtration processes. Although only a small fraction of the Company's current revenues are attributable to water, it is building up that part of its business.

There is one additional change in our listing of companies this year. In the past, we have followed the financial performance of the giant French infrastructural services company Suez. During the past year, and as a result of the merger between Suez and Gaz de France, the water and infrastructure portion of Suez was spun out as a stand-alone company to shareholders, and is now called Suez Environment. Unfortunately, detailed financial data on the new public entity are not yet available, and so for this year, we have included one additional company - Clean Harbors. Clean Harbors is more of a hazardous waste management firm, but it is increasingly involved with the treatment and disposal of hazardous and non-hazardous wastewaters as well, and more observers are beginning to include it under the category of water and wastewater firms. Finally, because of similar financial reporting constraints, we have had to use slightly out-of-date data for some of the Veolia Environnement financial figures as well.

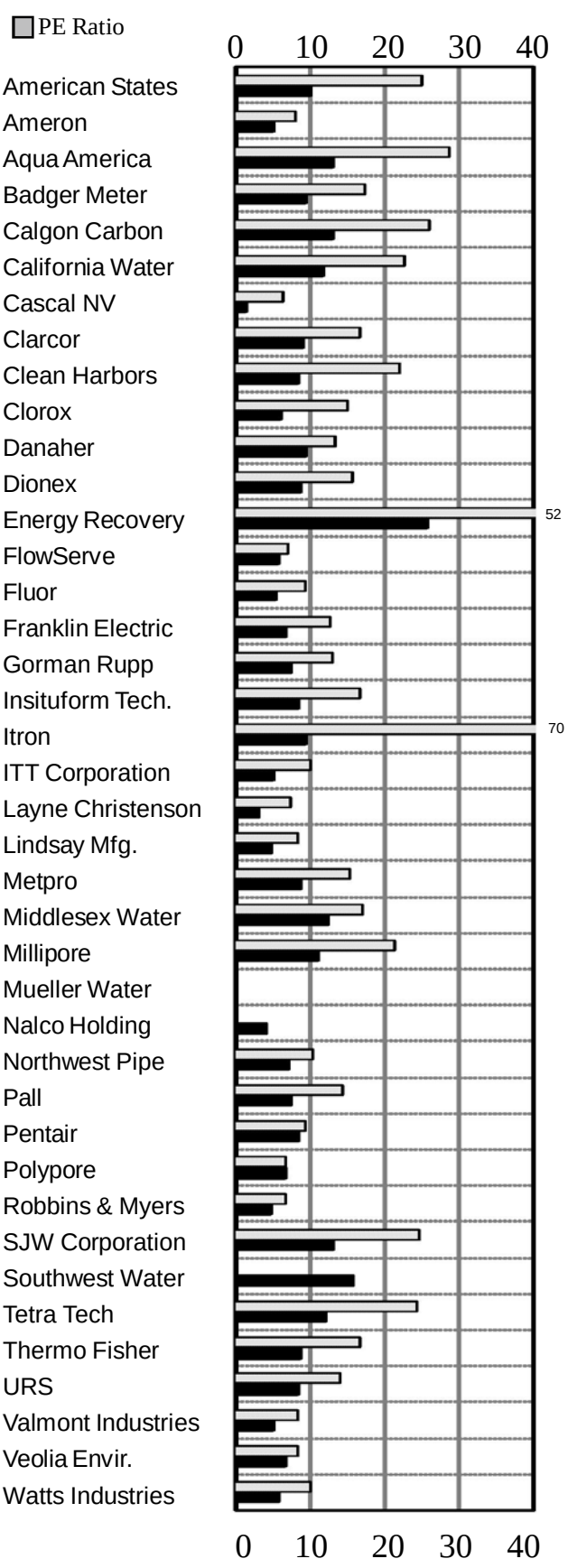
The right-hand table on page 8 is a dramatic illustration of just how far stocks have fallen - across the board and in the water industry. The left-hand table on page 8 is also a reflection of the price of the individual company's stock, and serves to underline the point, made elsewhere in this issue, that different sectors of the water "industry" have very different characteristics - including different valuation levels as measured by the public markets.

Productivity Measures



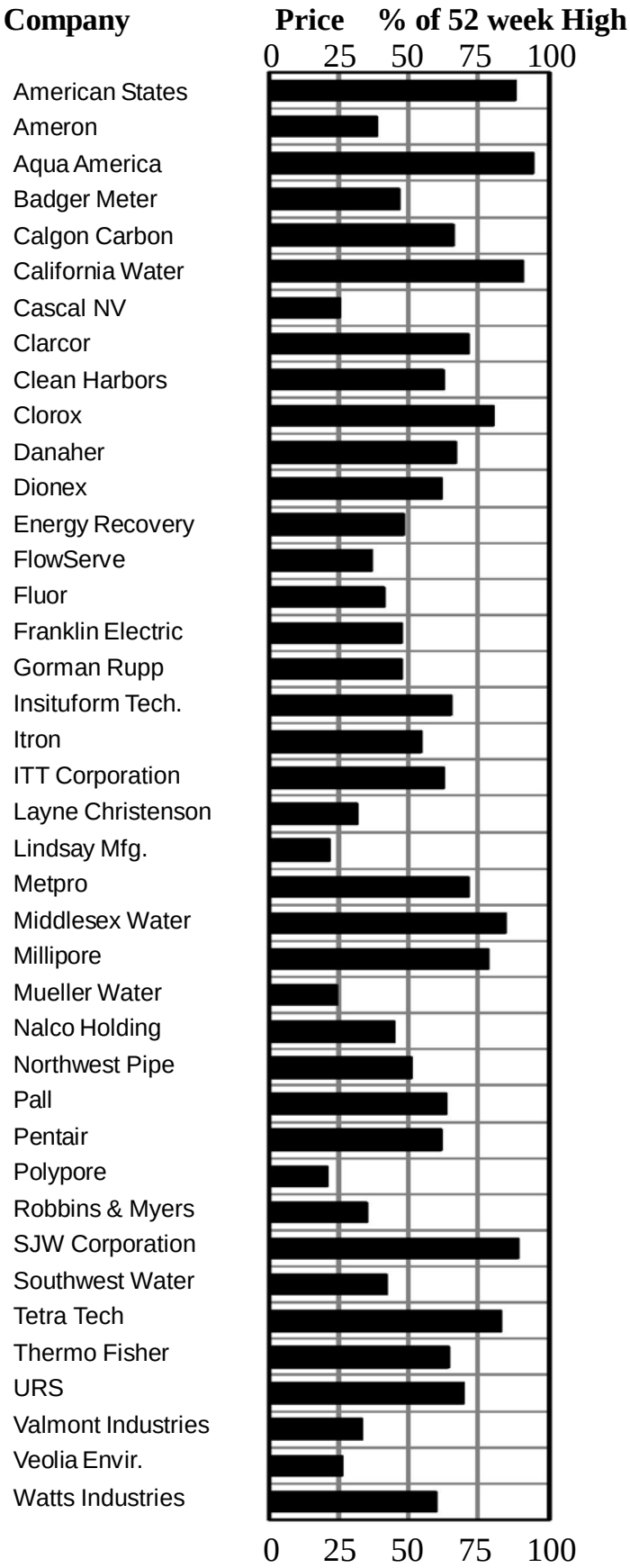
Note: Where there is no bar, the number is zero or has a negative value.

Equity Valuations



Note: Where there is no bar, the number is zero or has a negative value.

Stock Price Performance



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productive to take an extreme stance on either side of these issues. The key is evaluating each individual circumstance, and striving for an appropriate mix between public and private participation in order to bring people the clean water they need.

…. as water becomes scarcer and more valuable, one of our most immediate solutions is to not lose so much of the water which we already have in the system.

We need to avoid arguing and wasting time debating these ideological extremes - the problems are pressing, and the time is short. Water must be provided at a reasonable cost to all, but a more market-oriented approach might go a long way to making that possible. Privatization should not be viewed as the answer to all problems, nor should it be viewed as the enemy in helping clean water to flow for all. In the end, it should not matter whether the water provider is a private or public entity - what matters is that people have access to water, that the quality of that water is acceptable, that natural hydrological systems are preserved for future generations to use, and that prices and profit levels are reasonable.

In summary, challenges and threats to global water availability and water security continue to grow around the world. This will translate into more and better opportunities for commercial water product and service companies to provide new and innovative solutions. Prices will inexorably rise, and as a result, we will all become more attentive and more efficient in our water usage. These trends, and the broad forces that are shaping the future of the commercial water industry, are the focus of this report. From a broader and longer-term perspective - despite the recent turmoil in world financial markets - the water business is booming, and there is no doubt that it will continue to show strong and consistent growth in the future.

In the following pages, this comprehensive annual overview of trends and developments in the water industry is updated, and new information and facts are presented. I will attempt to delineate and make sense out of all of the rapid and sometimes paradoxical developments in the water business - to distill the key opportunities and drivers which characterize this $400 billion market, and to succinctly highlight the critical issues which will shape the future of the world water business. The Table on page 4 summarizes key drivers and trends in today's commercial market, along the lines of the organization of the report.

III. The World Water Challenge: How Bad Is It?

Widespread recognition and understanding of the human and industrial impact on the earth's natural hydrologic cycle has been

(Continued on Page 10)

HOW TO READ THE ACCOMPANYING TABLES

Please note that with the exception of page 3 and the stock price on page 8, all of the tables herein show two different financial statistics which are measured on different scales; the metric listed at the top of the table is shown as the top bar in the chart, and is measured against the scale shown on the top of the table. Likewise, the metric listed at the bottom is shown as the lower bar and is measured against the scale shown at the bottom of the table. Where this is no bar, the calculated number is zero or has a negative value. Where the bar extends off of the scale, the actual value is shown in type.

The financial data and statistics utilized in this report are provided by Market Guide, Inc. through various financial websites. The data utilized in constructing the charts herein are typically from a date two to three weeks prior to the time the subscriber receives the publication in his or her mailbox. Specific definitions of certain data contained herein follow:

- number of shares includes all shares outstanding, less the shares held in treasury
- price to earnings ratio is calculated using earnings *before* extraordinary items and accounting changes over the past four quarters
- EBITDA equals earnings before interest, taxes, depreciation and amortization
- net earnings used to calculate return on equity is calculated as income after taxes plus minority interest and equity in affiliates plus preferred dividends and U.S. GAAP adjustments.
- return on equity is calculated as net earnings available to common shareholders divided by average common equity over the most recent five quarters
- debt to equity ratio is total debt for the most recent quarter divided by total shareholder equity for the same period
- cash includes actual cash as well as short-term investments on the balance sheet
- enterprise value equals market capitalization plus long-term debt less cash (as defined above)
- Per employee statistics shown on page 7 are based upon headcount reported in the most recent 10-K filing to the Securities and Exchange Commission, which is only published annually. For companies which have grown substantially within the past year via acquisition, financial data may be published and updated prior to the availability of new employee data. Hence, these per employee statistics may be overstated for a few quarters.

For further information or any questions regarding the financial data and comparisons herein, please contact Tech*KNOWLEDGE*y Strategic Group at (303) 442-4800.

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slow to develop. However, the past decade has seen a plethora of new reports, books and "doomsday" forecasts about future water availability from the federal government, trade associations, and international think tanks. The level of awareness continues to increase, while the general prognosis for the future seems to worsen. A recent World Bank report suggested that India will essentially run out of usable water within two decades. In 2005, the EPA produced a widely cited study in terms of the U.S. situation - the Drinking Water Infrastructure Needs Survey and Assessment - which called for the investment of $277 billion over the next twenty years, simply to *maintain* our drinking water infrastructure at acceptable levels. The Agency pegged wastewater infrastructure requirements for the same period at $203 billion.

The fact is that human activities have severely altered and damaged the earth's natural hydrologic cycle and processes for centuries, but the impact has only started to become broadly evident during the last few decades. Today's water dilemma results from centuries and centuries of unfettered industrial expansion, exploding population *growth*, population *shifts* - often to more arid regions - and perhaps worst of all, a nonchalant belief that our standard of living can continue to improve, with Mother Earth somehow absorbing all the environmental insults that we create.

Degradation of water resources comes from all corners of our modern society - our industrial economy has caused extensive and often irreversible chemical pollution of many of the world's major waterways and aquifers; tens of thousands of dams have changed the whole course of natural rivers for flood control and irrigation purposes; poor resource management practices and over-grazing have allowed the growth of deserts; and double-cropping practices to maximize agricultural yield have drawn down natural aquifers at accelerated rates. Perhaps most significantly, the increasing combustion of fossil fuels seems to be leading to a gradual warming of the planet - and we are only beginning to understand the potential long-run effects of climate change on the hydrologic cycle and other natural systems.

A few facts and figures quickly serve to illustrate the breadth, and underline the magnitude of the world's water problems:

• many of the world's largest cities still dump the untreated sewage of millions of inhabitants directly into natural waterways or oceans. A visit to sprawling coastal mega-cities such as Lagos, Sao Paolo or Shanghai is shocking in this regard, and indeed makes one marvel at the natural treatment capacity of our oceans. Given the amount of raw sewage that is directly discharged, it is remarkable that our oceans are still relatively clean in many areas.

• the United Nations estimates that more than 10 million people a year die as a result of drinking dirty water. This is obviously a difficult statistic to accurately measure, since so many diseases are water-borne. In reality the figure is probably higher.

• two and a half billion people have no access to basic sanitation - toilets and clean running water. This is almost 40 percent of the world's total population.

• despite water shortages around the world, we still tolerate massive losses of water as a result of dilapidated infrastructure and decaying pipes. According to the EPA, about 17 percent of treated water in the United States is lost due to leaky pipes; Boston loses 30 percent of its water, while it is estimated that London loses almost 50 percent. As mentioned, estimates suggest that it will take something on the order of $600 billion to update the water, wastewater, and storm water infrastructural systems in this country, and a similar estimate puts the required worldwide expenditure at $41 trillion! And of course, many developing parts of the world don't enjoy *any* kind of water or wastewater distribution and transmission infrastructure.

• forty percent of American rivers are categorized as heavily polluted, while more than 75 percent of Chinese rivers are so designated, according to the United Nations.

• the emerging problem of endocrine disrupting chemicals received considerably greater attention early in 2008 with broad media reports on the microscopic but nearly universal presence of these man-made products in the natural waterways. This assorted group of compounds, referred to as "xenobiotics" - including cancer treatment drugs, mood stabilizers, sex hormones, antibiotics, and a whole range of modern health, beauty and medical compounds - can have deleterious but as yet poorly understood effects on the endocrine and reproductive systems of humans and other organisms. Modern wastewater treatment plants were not designed for, and are not capable of treating these types of ultra-low level contaminants, but their eventual and collective impact on human health is potentially staggering.

Although we are a long way from understanding these complex interacting factors, one thing is clear - increasing temperatures will complicate and exacerbate an already dire water situation.

• 45,000 large dams around the world are estimated to have displaced some 80 million people around the world in the last seventy-five years. The vast recent dam constructions in China are only the most visible such projects; new projects to create major water diversions to the northern part of China are on the drawing boards now as well. The ecological or social impacts of these large dams can be long-lasting, while - as we are recognizing in the case of major Federal water projects in the American Southwest - their economically useful lives may be relatively short due to sediment infill.

• there are some 79,000 dams in the U.S. which are categorized as "large," and many of these are no longer functional or safe. It is increasingly realized that it will be cheaper to remove these rather than to try to fix them. However, dam decommissioning and removal is an infant field - only some 500, mostly much smaller, dams have actually been removed.

• natural wetlands - ecologically designed by nature to regulate and clean our surface waterways - are being lost at a record rate.

• underground aquifers around the world are being depleted or "mined" at a vastly higher rate than natural processes can replenish them. The Ogallala Aquifer, which underlies some 250,000 square miles of the "bread-basket" central region of the United States, is being drawn down at unsustainable rates - and the long-term impact for agriculture and world food supplies is potentially catastrophic. Many rapidly growing metropolitan areas, such as the southern tier of Denver suburbs and the city of Albuquerque, have been exhausting irreplaceable deep aquifers for decades, and now find themselves struggling to locate and acquire new source waters to insure a viable future.

• there are also numerous secondary effects of growing water shortages. For example, as aquifers deplete, not only do the inhabitants above run out of water, but the ground they live on may also begin to collapse. This is becoming a significant

problem in certain areas - Mexico City has seen substantial subsidence in recent decades. Not only do leaky pipes cause water losses, they may also cause geotechnical instability and erosion.

• finally, as a grim summary of the various types of issues listed above, it is now widely predicted that half of the world's population will live with chronic water shortages by the year 2050. In short, we are rapidly creating a situation of severe "water stress" in many parts of the world.

Water stress will inevitably lead to political stress. Political conflict over water is not some sort of phenomenon waiting to happen in the future; water conflicts have been going on for hundreds if not thousands of years already. There are a number of "hot spots" around the world that could explode today. For example, India has strained relations with both its eastern and western neighbors - Bangladesh and Pakistan - over the two key rivers that flow between those countries, the Ganges and the Indus. The Jordan River arises on the Syrian-Lebanese border and is used by Jordan, Israel, and the Palestinian territories - not much more needs to be said in that regard. Water issues have contributed to shaping the current crisis in the Darfur region of Sudan. Nine often contentious countries depend upon the Nile River for most of their water.

Perhaps the biggest unanswered - and maybe unanswerable at the moment - question is how incipient global climate change will affect the world water situation. We have all heard the old saying - "everyone is always complaining about the weather, but no one ever does anything about it." It now appears that indeed we *are* doing something about the weather - we're making it warmer. While we don't yet fully understand the breadth and severity of the impacts of potential global warming on the hydrologic cycle, if global warming does continue, we face a whole range of challenging and potentially catastrophic new challenges. Witness the following handful of rather dire quotes from the Executive Summary of the recent report from the U.N.'s Intergovernmental Panel on Climate Change - a group of the world's leading meteorologists and climate scientists:

• …. observed warming over several decades has been linked to changes in the large-scale hydrological cycle…
• ….. (scientific models project) precipitation increases in high latitudes and parts of the tropics, and decreases in some sub-tropical and lower mid-latitude regions…
• ….. annual average river runoff and water availability are projected to increase as a result of climate change at high latitudes….
• ….. increased precipitation intensity and variability are projected to increase the risk of flooding and drought…
• ….. water supplies stored in glaciers and snow cover are projected to decline over the course of this century…
• ….. higher water temperatures … are projected to affect water quality and exacerbate many forms of water pollution…
• ….. changes in water quantity and quality due to climate change are expected to affect food availability, stability, access and utilization …
• ….. climate change affects the function and operations of existing water infrastructure - including hydropower, structural flood defenses, drainage and irrigation systems, as well as water management practices; and
• ….. climate change challenges the traditional assumption that past hydrological experience provides a good guide to future conditions.

This is scary stuff, and one is not relieved by the closing quote acknowledging that "several gaps in knowledge exist in terms of observations and research needs related to climate change and water." It is becoming clearer and clearer that the potential impact of climate change on our existing water infrastructure could be dramatic. The potential of global warming to shift the *predictability, timing, and extent* of natural rainfall patterns around the world could truly wreak havoc in terms of water availability, agricultural productivity, and food supplies. This impact could, as they say, "change everything." While scientists are parsing the potential long-term effects of global warming, water policy-makers and economists are just starting to think about the potential economic and social effects.

So, students of the water business are increasingly wondering if the human race is finally facing the real "revenge of Malthus." This is a question that American society seems to revisit at least once every generation, and each time the evidence seems to be more overwhelming. It certainly is this time. Perhaps the last time so many people worried so visibly about the sustainability of the human race was in the 1970s, when the infamous Club of Rome report *The Limits to Growth* was published. This report drew the world's attention to the issues of depleting natural resources, particularly oil and base metals, and caused a huge international furor - yet it hardly even mentioned water.

And in many regards, water is different from any other commodity or resource. The quantity of water on the earth is basically fixed (although we can contaminate some water so much that it is no longer usable, and we can clean some sources of water, like seawater, such that they become more usable). However, in many parts of the world, we're hitting ourselves with a "double whammy" - by decreasing the quality, we are effectively decreasing the quantity too.

In this brief summary, we haven't really tried to touch on the potentially vast political and social impacts of growing water shortages - and the fact that the poor are often forced to pay the most for their water, while the rich sometimes pay next to nothing. (According to the Earth Policy Institute the 120,000 gallons per year typically used by an American family costs about $350, whereas buying the same amount of water from a vendor in the slums of Guatemala City would cost about $1700.) Disparities in water availability around the world could quickly become a recipe for social and political turmoil in the future.

To be fair, as a wise person once said "it is difficult to make predictions, especially about the future." There may be room for disagreement about the timing or eventual extent of some of these problems, but its hard to deny that they are hurtling towards us at an increasing velocity. As the world's population continues to grow, and as we continue to pollute and disrupt the earth's natural water systems, it seems pretty easy to predict that we are headed towards a true global water crisis. The only issue is when. Many of the issues mentioned above are inevitably going to reach a boil in the future - some perhaps in the quite near future - and therefore they must rapidly become top policy priorities for governments around the world.

IV. Defining the Water Industry

a. A Disparate Business: Although we casually talk about the "water industry," strictly speaking there is really no such

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thing as the water industry. What there is instead is a balkanized and teeming "bazaar" of fundamentally quite different businesses - all of which have something to do with delivery of clean water, but which can't all be quite accurately classified under any single heading. As most observers loosely use the term, the "water industry" includes a very broad array of sectors: steel and concrete pipe manufacturers; specialty chemical producers; measurement, monitoring and testing firms; tank manufacturers; all kinds of treatment equipment manufacturers; new technology developers of all stripes; manufacturer's representatives who sell all of these things to different end users; engineers and consultants; contract operators of water plants, and many others - companies which may be quite different, and whose only real similarity is that they are somehow involved in the process of providing clean water. A detailed look through one of the numerous manufacturers' directories serving the water business conveys the true breadth of "the water industry."

A diffuse and fragmented industry such as the water business is therefore very difficult to classify and analyze. Obviously, when it is difficult to define an industry accurately, it is even more difficult - if not impossible - to accurately estimate its size, growth characteristics and other market attributes. And, there is a real paucity of reliable market research and intelligence in the water business. Nonetheless, there *are* some conventional wisdoms and at least rough market statistics for the overall water-related business. The size of the domestic U.S. water and wastewater industry is generally estimated at around $120 billion per year, as summarized in the Table below.

The U.S. Water Industry
(Revenues in Millions)

Business Segment	2007 Revenue	'08 - '10 Growth
Water Treatment	$10,719	6% - 8%
Delivery Equipment	$13,090	5% - 6%
Chemicals	$4,760	2% - 3%
Contract Operations	$4,760	5% - 6%
Consulting/Engineering	$8,330	5% - 6%
Instruments and Testing	$1,785	5% - 7%
Wastewater Utilities	$39,270	4% - 5%
Drinking Water Utilities	$38,080	3% - 5%
Total U.S. Water	**~$120,000**	**6% - 7%**

Modified from the Environmental Business Journal, 2008

An analysis of these summary figures, and the more detailed data behind them, reveals some interesting insights. First, note that the fees that individuals and businesses pay to utility organizations (either municipal or investor-owned) for primary drinking water and sewage services comprise almost two-thirds of total annual spending on water in this country. It is also important to understand that the vast majority of these revenues pass through municipal and public agencies - some 55,000 water utilities and about 16,000 wastewater utilities - not private companies. Hence, these dollars are not really "industry" revenues, and are not generally available to private companies and providers. (This split between private and public utilities is discussed in more detail later.)

Notice also that the right-hand column of this table underlines the sectoral variability just discussed: projected longer-term growth rates for different sectors of the overall water-related industries show considerable variation. Certain specific "sub-niche" areas that are not broken out in the Table above may be growing at much higher rates. A recent UBS report, for example, estimated the following more detailed growth rates for various treatment technology sub-sectors: activated carbon treatment was estimated to be growing at 5.5 percent annually, ozonation at 8 percent, reverse osmosis treatment at 10 percent, ultraviolet radiation disinfection at 13 percent, microfiltration and ultrafiltration membrane treatment at 15 percent, and membrane bioreactors at 20 percent.

In addition, the growth rates of individual sectors are themselves experiencing slow but perceptible change. For example, even though water treatment chemicals comprise a very large market, the average growth rate of this sector is widely assumed to be slowly declining. Similarly, it appears likely that recent growth of the contract operations business will slow somewhat as that sector matures, particularly if public opposition to privatization increases.

On the other hand, growth rates in traditionally less glamorous infrastructure sectors such as pipe rehabilitation are likely to increase in the future, as more and more capital is inevitably poured into maintaining and upgrading the nation's infrastructure. A high percentage of future infrastructural spending will be going into things such as steel and concrete pipe, pumps and valves and storage tanks. Most of the economic stimulus dollars being currently planned will pour money, if anywhere, into this sector of the water business. This may not be the "sexy" side of the business, and the companies in this sector are not yet attracting as much attention from Wall Street analysts - but there is little doubt that this is where many of the dollars will be spent. A recent study suggested that trenchless pipe renovation will likely grow to $5 billion annually within the next several years - a growth of 500 percent from current levels.

If data for the U.S. market is sparse, then information for most of the rest of the world is truly speculative. While the U.S. is clearly the world's largest individual market, it is increasingly clear that opportunities abound for water companies in the rest of the world. Many of these markets are growing at much higher rates than the U.S. market. Conventional wisdom suggests that the world market is about four times the size of the U.S. market. Several reputable parties have pegged the level of world business at around this level. The English publication *Global Water Intelligence (GWI)* recently presented a set of assumptions and analysis that put the global market at $420 billion per year.

b. Emergence of New Sectors: Even though the water industry is already a hodge-podge of different products and services, new sectors or new opportunities continue to emerge as well. New companies continue to develop, and older pre-existing companies continue to refashion themselves as water players. New treatment technologies continue to be developed, and existing technologies continue to be applied for the first time to water treatment applications. A review of start-up and "venture capital" technology companies in this industry can make the head spin - such things as electro-coagulation, ozonation, electro-deionization, electrodialysis reversal, and multi-stage bubble aeration. As will be discussed later, few of

these new technologies are expected to revolutionize the industry. Nonetheless, promoters of "better mousetraps" - as well as snake oil salesmen - are pervasive across the industry. Early-stage venture investments continue to be made regularly in the water treatment technologies.

Water "loss management" services and control technologies seem to be one emerging sector of the market - products and services geared at locating, measuring and repairing the vast water losses that occur due to decaying underground infrastructure. The types of products in this emerging sector include surface leak detection systems, robotic and video pipeline monitoring technologies, high-precision flow monitoring and metering technologies, and pipeline rehabilitation systems. Several companies have focused their strategic growth plans in this area - on the assumption that as water becomes scarcer and more valuable, one of our most immediate solutions is to not lose so much of the water that is already in the system. The Miya Water Group was set up recently in Israel to deal with exactly these sorts of problems around the world. Several of the other conglomerates working to build an international presence in the water business, such as Idex Corporation, are also moving to provide solutions in this area.

Innovative irrigation systems and technologies for measuring and implementing more efficient agricultural water usage are also starting to coalesce into a more specific - and increasingly critical - sub-sector of the water industry. The reasons behind growing interest in this sector are pretty clear: in many more arid parts of the world, agriculture is responsible for a high percentage of total water consumption, 80 percent or more in many arid western states. Hence, better conservation and small percentage efficiency gains here can free up water which can, in turn, result in large percentage increases available for municipal and industrial usage. While firms such as Lindsay Manufacturing and Valmont (see pages 6 through 8) have long been publicly-traded companies active in the manufacture of center-pivot and other agricultural irrigation systems, they are now being joined by a bevy of new companies looking at innovative new means of conserving agricultural water use.

Companies that were scarcely thought of as water firms a few years ago - such as the Toro Corporation - are more and more being classified as water industry players. The heavy agricultural equipment manufacturer John Deere has made several significant acquisitions in this area in the last few years, and clearly has designs on becoming a leading player in the irrigation marketplace. Not surprisingly, due to their very arid climate, Israeli companies are amongst the leaders in this emerging sector as well. And it is not just more efficient treatment or application systems that are of interest here - better monitoring and measurement capabilities are critical as well. Real-time and wireless types of micro-level soil moisture monitoring can improve agricultural productivity, save energy, reduce fertilizer usage, and at the same, cut waste and free up scarce water for other uses.

Another area that is emerging and beginning to distill into a specific investment area or sector of the market place has to do with the ownership, trading and marketing of actual water rights - particularly in the western United States, and in other regions where scarce water consumption or usage rights are starting to be allocated by various types of market mechanisms. The ownership and trading of water rights has, to date, generally been restricted to the more arid Great Plains and southwestern regions of the country where the "prior appropriation" doctrine of water ownership is employed. Most of the business transacted in water rights ownership has been between farmers or mining enterprises - who originally held the historical water right - and municipal agencies, which desperately need that water today.

Private companies and investment groups are increasingly getting involved in this area - in essence attempting to bring private capital to bear in the development of public water supply and management projects. There is a handful of public companies that are focused on acquiring and developing water rights - Cadiz, PureCycle, and the Vidler division of Pico Holdings are three, albeit small examples. There are also some companies that have tried and failed to get into this aspect of the water business in earlier years, including a formerly public company called Western Water that filed for bankruptcy in 2005. Likewise, the Bass Brothers of Texas engaged in an unsuccessful effort to buy and develop water rights in southern California several years ago. Some of these efforts may have been ahead of their time in trying to capitalize on water as a long-term store of value. There is no doubt that this area is fraught with more market and political uncertainties, and is subject to the whole controversy (detailed later) at the intersection of public and private approaches to water resource management. Nonetheless, more and more investors are taking a look at the possible opportunities here.

c. A Growing and a Coalescing Industry: Many analysts have airily predicted exploding growth for the water industry in the near-term future. However, at least in most sectors of the business, the real situation has been more one of lower but very consistent growth - a sort of "tortoise" rather than a "hare" situation. There can be no doubt that fundamental supply and demand considerations insure continuing - and probably somewhat accelerating - growth into the long-term future. Indeed, it is very difficult to construct any kind of reasonable future scenario in which this industry will be characterized by anything *other than* very steady and sustained growth. However, would-be investors in this business need to understand that very few sectors are growing at the 15 percent to 20 percent annual rates that are often bandied about. The growth of the overall "business" will probably continue in the neighborhood of five to seven percent a year - or, generally speaking, a little in excess of GNP or population growth rates. For strategic planning and analytical purposes, it is more meaningful to talk about the growth and profitability characteristics of individual market sectors than to try to peg growth rates in the overall "industry."

…. it is estimated that on some of the major river systems in the United States, water is used and re-used in this fashion up to twenty times as it travels to the sea - the discharge waters from one wastewater treatment plant essentially comprising the raw water intake at a primary drinking water plant a few miles downstream.

Certain conventional wisdoms have taken hold within the industry, but it is difficult to document growth rates or market size estimates with solid market data. Many studies have tried, but even when all of these individual sectors are precisely defined and carefully totaled up, we still don't have a very good

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idea of just how big this total pie really is. Suffice it to say, the world water market is huge, and in the final analysis, debating or trying to pin down the actual figure is probably not very productive. For most firms, rough estimates of specific end markets in certain geographical areas are much more meaningful - and thus more useful in terms of good business planning. Perhaps more important to recognize is the fact that many of the key geographic markets, such as China, are at an earlier and much more rapid stage of growth than is the United States. With a total market that is agreed to be somewhere in the range of hundreds of billions of dollars per year, and given the truly critical underlying human needs and factors which are driving this market, individual firms don't really need to worry whether the world market is $400 billion or $500 billion a year.

As water resource challenges are more broadly recognized and understood, and as more and more companies position to provide goods and services to help solve critical water needs, there is anecdotal but increasing evidence that this balkanized "industry" will begin to consolidate or coalesce into a more distinct and more definable whole. As that happens, and as more and more researchers, scholars and policy-makers turn their attentions towards water, better market information should eventually become available.

V. Key Drivers Behind the Water Business

Several key factors - economic forces, social forces, and political realities - are responsible for driving the overall expansion and evolution of the broader water industry. These drivers can be reduced to the following:

• **Water Quality and Scarcity Problems Are Reaching Crisis Proportions:** This may sound self-evident in a report about water, but for the sake of thoroughness it is useful to start at the beginning. Water quality and scarcity problems are the main concerns and drivers behind the challenges, the regulations, all of the commercial business opportunities and ultimately, the projected growth for the water business over the coming decades.

Clearly, the world has both significant water quantity and water quality problems, but the quantity aspect of this equation - the absolute scarcity of water - is beginning to take on an even greater urgency in many regions. As mentioned above, dozens of reports and studies have pinpointed the fundamental lack of clean water as one of the most serious long-term threats facing mankind. One can scarcely pick up a news magazine or the daily newspaper without seeing an article about water problems. The United Nations Millennium Development Goals identified access to clean drinking water as one of the primary international objectives of this century, asserting that the world should "halve by 2015 the proportion of people without sustainable access to safe drinking water" - a goal that few expect to be achieved.

Here in the United States, it used to be conventional wisdom to highlight water *quality* problems in the older and more industrialized east, while focusing on water *quantity* issues in the drier and less populated west. Now, we have both quantity and quality challenges across the country. More humid cities in the east, such as Atlanta, are running short of water - with the state of Georgia trying to redraw its historical border with Tennessee for the purposes of appropriating some 500 million gallons of water per day. And on the other side of the country, we see large California aquifers becoming unusable because they are contaminated with perchlorates derived from the defense industry. In short, both quantity and quality problems are becoming more pervasive, and they are getting worse. Although it has become commonplace, and lately somewhat trite, to describe water as "the oil of the 21st century" in terms of its global economic and political significance - it may well turn out to be true.

• **Public Awareness And Understanding of Water Problems is Increasing:** As water scarcity and quality problems have become more serious and more apparent, the public has gradually become better informed - and increasingly concerned about the range of water problems that may be passed on to future generations. Again, one needs only to look at the front pages of the popular media to see how broad and widespread - though often over-simplified - this recognition is becoming. And as the general populace becomes more aware and concerned about water, public perceptions and public demands gradually become more important drivers of public policy and legislation. (A clear, if somewhat misinformed, reflection of this growing concern is the explosive growth of the bottled water industry over the past few years.) Although, as discussed at the outset, additional and massive public education programs are sorely needed around the world to inform the public of the real nature of our water quality and quantity problems, water issues *are* gradually gaining attention.

• **Regulation and Enforcement Will Continue to Intensify:** As public awareness and concern about water issues continue to grow, they translate one way or another into greater government review, oversight, legislation, regulatory control, and enforcement. Sadly, it is often said about the water industry - as well as other public infrastructure businesses - that the only thing which brings about real change in policy is a catastrophe. The bridge collapse in Minnesota a couple of years ago is often cited as a driver behind greater awareness, and greater activity, in terms of both evaluating and repairing the nation's transportation infrastructure. Localized water "catastrophes" - like those experienced by the cities of Milwaukee and Des Moines several years ago, and which continue to occur on a smaller scale across the country - are credited with the issuance of new water quality rules and combined sewer overflow regulations. Many skeptics continue to believe that real change - a thorough-going assessment of and new funding for the nation's water infrastructure needs - will only come about when we experience a public health catastrophe or infrastructure failure of massive dimensions. However, in contrast to other general areas of environmental legislation - where public interest, regulation and enforcement have waxed and waned during the past couple of decades - the American public seems insistent upon ever-stronger and broader regulatory protection when it comes to their drinking water.

• **Huge Economic (and Human) Capital Investments are Required in the Water Industry:** Finally, in order for municipalities and industry to comply with all these expanding regulations - and for the country to maintain and expand the necessary infrastructure - huge capital expenditures will be required, beginning now and continuing into the long-term future. Numerous studies have predicted how large this collective expenditure must be - it is certainly in the range of hundreds of billions of dollars over the next two decades. The so-called "spend-

ing gap" - the shortfall between the current level of water infrastructure spending, and the spending levels that will be required to really sustain our infrastructure into the longer-term future - continues to increase. Where the capital resources to address these issues will actually come from is a conundrum. A related resource constraint that generally gets far less attention is the aging of the workforce in the water utility industry, and the fact that the industry may also be facing a shortage of trained *human* resources in the near future as well.

The impending question of *how*, not if, we should fund these required capital expenditures is going to turn into a larger and more contentious policy debate in coming years - and it will be a debate fraught with challenging political and social factors. For example, the large metropolitan centers that often have the oldest and most run-down infrastructure with the greatest capital needs, are the very same areas with shrinking center-city populations and a declining tax base; the city of Detroit comes to mind. It seems likely that the federal government will eventually have to step in, although it may require the kind of catastrophe or major public health crisis alluded to above before that happens. The investment shortfall represents a huge and unresolved future challenge for the United States - but it also constitutes a great opportunity for firms serving the water and wastewater treatment industry.

VI. Industry Trends and Key Issues

These interlocking industry drivers in turn give rise to a number of critical trends in the water business - with respect to supply, demand, market and competitive conditions, and in terms of how we manage and utilize our increasingly precious water resources. Some of these key trends are highlighted on the next several pages.

a. Increasing Regulation and Government Oversight: A huge volume of new regulations has been issued by federal and state agencies over the past couple of decades. Regulatory controls are becoming stronger in almost every other region of the globe as well. Public agencies and private companies struggle just to understand, let alone comply with, this rapidly expanding and ever more complex regulatory machinery - and it has become a major cost to water and wastewater utilities. Many smaller utility districts have great difficulties just staying current with the morass of existing regulations and the steady stream of new requirements. And it has become increasingly frustrating to water utilities that one compliance requirement may sometimes be at odds against another. The *Journal of the AWWA* has described water regulations as an "immense regulatory maze and administrative superstructure that …. may be at risk of collapsing under its own weight." However, it is these regulations which really drive the day-to-day activities, spending levels, and commercial developments in the water industry.

Despite this extensive *existing* body of laws and compliance requirements, it seems likely that the extent and reach of regulatory controls will continue to expand. Even in the economically most advanced and most highly regulated countries like the United States, water pollution problems continue to grow. New contaminants continue to be unleashed and discovered. One recent study - the Environmental Working Group's *National Assessment of Tap Water Quality* - found that "tap water in 42 states is contaminated with more than 140 unregulated chemicals that lack safety standards," and suggested that EPA should be doing a far more thorough job of regulating drinking water - above and beyond the vast regulatory and control infrastructure that we already have in place. (The xenobiotic contaminants mentioned above have only recently been detectable at all. As our understanding of the chemistry of water contamination expands, and as analytical technologies improve, we are likely to discover more compounds of potential concern to human health and well-being - and this is in turn likely to lead to more regulation and more controls.)

Compounding all of these traditionally regulated areas is a growing concern about potentially "introduced" compounds in water distribution systems - a polite way of referring to potential terrorist activities - and other security concerns regarding the potential contamination of primary drinking water supplies - issues which have largely arisen since 9/11.

This has raised the visibility of another key concern in the water utility industry, and an area of new opportunity for monitoring and testing companies. Despite all of the advances in clean water that have been accomplished over the last fifty years, and the numerous regulatory controls which drinking water must meet, there is still essentially no monitoring of that clean water once it leaves the treatment plant and runs into more than a million miles of underground distribution system piping. This area of post-treatment monitoring of drinking water quality will probably be the subject of considerable new regulation in the coming years, and represents a significant commercial opportunity for testing and monitoring firms.

To summarize, water treatment regulations may be extensive, confusing and conflicting today, but they are only likely to increase in volume and complexity in the future.

Many skeptics continue to believe that real change - a thorough-going assessment of and new funding for the nation's water infrastructure needs - will only come about when we experience a catastrophe or infrastructure failure of massive dimensions.

b. Our Dilapidated Infrastructure: During the past several years, numerous studies and observers have drawn attention to the woeful and dilapidated state of the American water and wastewater treatment infrastructure. The American Society of Civil Engineers has just come out with its annual Report Card, and has once again assigned a grade of D minus to both drinking water and wastewater - the lowest grades in their assessment of the nation's overall infrastructure situation. The report points out that we lose almost 7 billion gallons of clean water *a day* through leakage, and that we should be spending an additional $11 billion per year, simply to *maintain* the existing infrastructure.

In terms of the likely scale of future spending requirements, one can almost pick a number and find some study to support it. However, perhaps the most widely cited studies are those coming out of the Environmental Protection Agency. As mentioned, the most recent assessment from the EPA pin-pointed a spending requirement on the drinking water side of the business of $277 billion over the next twenty years, the bulk of which is directed towards the transmission and storage areas. Recently, the EPA suggested that $203 billion would be required over the same period in terms of *waste*water infrastructure -

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including treatment facilities, sewer overflows, and storm water management systems.

In industry circles, these EPA estimates are often considered to be somewhat conservative. The key trade associations representing the water and the wastewater sectors of the business - respectively, the American Water Works Association, and the Water Environment Federation - have issued studies with higher projected spending needs. Other Congressional and Federal agency studies have put the combined water and wastewater infrastructure spending requirement over that same twenty year period at close to a trillion dollars. Regardless of the study you pick, all of them predict strong future growth in the industry, particularly in the transmission, distribution and storage sectors.

As mentioned, concerns about the impact of impending climate change will only intensify this trend - and will likely tend to gradually increase the amount of money that society has to spend on moving water around and storing it. As the magnitude of these looming expenditures becomes clearer, we will also see more creative solutions to many of these challenges. For example, water can be stored in underground aquifers rather than expensive surface impoundments and reservoirs that not only cost millions to construct, but also disrupt the environment and allow significant amounts of the water to evaporate anyway. Innovative technologies to rehabilitate existing underground transmission piping will also grow - studies suggest that it can cost up to five times more to rebuild an underground water main than to rehabilitate it in place. In the future, expect more dollars to be spent, in more creative ways, to maintain and upgrade the water and wastewater infrastructure.

c. Conservation and Efficiency: More efficient and more sustainable use of our existing water resources is increasingly viewed as a new "source" of water - reducing demand to "increase" supply. Supply and demand are indeed two sides of the same coin, and better conservation and utilization practices are perhaps the best and most immediate opportunities we have to extend the overall availability of water. And despite solid improvement and increasing attention to this area during the last several years, there are still easy improvements to be made, in terms of more efficient conservation, use, and re-use of our water resources.

For example, even today, many water distribution systems incur leakage of as much as 20 percent to 40 percent of their treated drinking water. Loss rates in the main distribution systems - referred to as "non-revenue water" - are as high as 50% in many parts of England and France where water mains may be over a hundred years old. This is one of the first areas that should be addressed. It clearly makes more sense, and is more sound environmentally to fix *existing* water infrastructure first, rather than building new dams, reservoirs, or seeking other new sources of supply - half of which would also go to waste. This consideration again points to the expansive growth which the infrastructure equipment sector of the marketplace - pipes, valves, meters, pumps and tanks - is likely to enjoy in the coming years.

Several years of significant droughts across the western United States (and in other areas of the world, such as southeastern Australia) have dramatically illustrated just how much water we waste. Conversely, they have also demonstrated how much water we can save, once we are forced to confront the issue. In some regards, droughts may be a good thing - just like $4 gasoline was a good thing - in that they force us to sit up and pay attention, and get smarter about conservation, re-use, recycling, and better allocation systems. The truth is, most of us could be far more efficient and miserly in our use of clean water, without making major sacrifices. Greater public awareness of conservation issues and opportunities, and successful local conservation programs have begun to show good results in many cities, such as Denver and Las Vegas. (As discussed later in this report, an interesting but problematical paradox is beginning to emerge in this regard. As consumers try harder and work smarter to use less water, the total revenues paid to the municipality or water agency in some regions have fallen sharply. This leads to an unintended consequence - declining revenues, at a time when major new expenditures are required.)

Perhaps crying out loudest for efficiency improvement is the area of agricultural irrigation. Almost 80 percent of our total water usage in more arid regions goes to agricultural irrigation, and almost half of our food supply now comes from artificially irrigated lands. As the researcher Sandra Postel says, in her review of irrigation practices, *Pillar of Sand*, "irrigation unleashed a profound transformation in human development, and created a new foundation from which civilizations sprung and blossomed." However, irrigation as it is often practiced can be hugely wasteful of water. Furthermore, it can lead to salt build-up and gradually less fertile soils if not managed properly. Some sources estimate that 30 percent of irrigated land has already been rendered infertile because of careless irrigation practices. New and more efficient technologies for the use of water in irrigation, through such practices as drip irrigation - "more crop per drop" - and enhanced soil moisture monitoring offer great promise.

Temporary shortages and droughts also force us to rethink our agricultural priorities, and to carefully examine the principles of virtual water - the concept that measures the amount of water necessary to produce a given commodity or product. For example, as water becomes scarcer, it may no longer make sense to grow highly water-intensive crops, such as cotton and alfalfa, in the central valley of California. Similar water allocation adjustments have led drought-stricken Australia to reorient its agricultural industry. Once one of the world's largest exporters of water-intensive rice, Australia has now refocused its scarce water resources to other less water-intensive and/or more valuable crops such as grapes and citrus fruits. More efficient water application, better drainage systems, and increasing use of certain types of wastewater for agricultural irrigation, should all be important policy objectives, and can collectively add up to constitute an important new "source" of water.

Conservation habits and more efficient water allocation are inextricably tied to water prices, and those regions where water tends to be less expensive naturally tend to focus less on efficiency, conservation and recycling. We will return constantly to this theme - how higher water prices will eventually force all of us to be much more careful and conservative in our individual and collective water usage. Most people don't pay a lot of attention to conservation and recycling of water at the moment, but they increasingly will when it begins to hit them squarely in the pocketbook. Most western European countries pay considerably more for their water than we do in the United States; most of the population there is far more cognizant of the value of water, and per capital usage is far lower. A report

a few years ago from *The Economist* reported that not only are water prices in the United States among the lowest in the world, but that we are also the most wasteful nation on earth in terms of water usage. As prices increase, we will pay more attention and become more efficient.

In a broader sense, more efficient water usage is perhaps best reflected by the growing interest in water re-use and recycling - a sector that many experts believe to be one of the most exciting growth opportunities in the entire water business. As the boundary between "water" and "wastewater" continues to fade - as wastewater increasingly comes to be viewed as just another source of primary water - there are strong economic reasons to recycle and re-use wastewater. This arena of potential new business opportunity is described in more detail next.

d. Focus on Recycling and Re-use: Water "re-use" in all of its varied forms remains one of the most robust sectors of the overall water business. Water "recycling" initiatives, from the individual residence to the large municipality or major industrial installation, are rapidly gathering steam. Because these terms are often used rather vaguely or interchangeably, some definitions and clarifications are in order.

The vast majority of the 130 gallons per person per day could be recovered and treated for a variety of other uses without anyone ever having to drink directly "recycled" wastewater.

Most wastewater can be recycled and cleaned to levels where it can be re-used for potable purposes - and this can occur in both what are referred to as direct and indirect manners. The distinction between these two terms is critical. *Indirect* re-use of treated wastewater - i.e., after it has been treated, discharged into and then withdrawn from a river, or pumped into and then out of an underground aquifer - has clearly been practiced one way or another since the dawn of history. For example, it is estimated that on some of the major river systems in the United States, water is used and re-used in this fashion up to twenty times as it travels to the sea - the discharged water from one wastewater treatment plant essentially comprising the raw water intake at a primary drinking water plant a few miles downstream. Indeed, it is interesting to note that, as a result of forty years of steady progress under the Clean Water Act, the treated effluent from wastewater treatment plants is sometimes cleaner than the supposedly "natural" rivers and streams into which they flow. (And of course after they flow downstream to the sea, those same water molecules are evaporated from the oceans, condense to form clouds and fall on land as rain, to begin the same cycle all over again.)

What is usually meant by the term water re-use today, however, and what generates considerably more controversy, is the *direct* re-use of water - without that intervening and supposedly purifying effect of "nature" and the hydrologic cycle - i.e., more immediate and direct recycling of wastewater for primary use purposes. Although direct re-use of wastewater has been feasible for years, any widespread direct re-use for drinking purposes still seems to be a long ways in the future - and this is due to social rather than technological reasons. Putting a "black box" on the outside of a home to treat sewage and recycle it directly back into the tap - often referred to as "toilet to tap" in the popular media - is clearly suspicious and unacceptable to most people. Scare stories in the press tend to reinforce this reticence, even though from a technological perspective, it is fairly straightforward to recycle wastewater to drinking water standards. Today, such direct re-use for drinking water purposes is only commercially practiced in a very few and very arid locations around the world. However, it can be confidently projected that direct re-use will increase in the future out of sheer necessity.

There is one very critical statistic to consider when evaluating the potential impact of re-use as a means of extending our water resources - a factor which should eventually make direct re-use much more feasible on a wide scale. *Only a tiny percentage of our primary water supply is actually used for drinking.* Out of the roughly 130 gallons of water per capita per day that we currently treat to drinking water standards, most individuals drink less than a gallon a day. Even if we also consider the proportion of our water that we use to cook and clean with - which we might also wish to be treated to high-level drinking water regulatory standards - it is still a small percentage of total water consumption. Most of the rest of that water is used for flushing toilets, watering lawns, washing cars, fighting fires and the like - applications where the water doesn't have to be treated to highly exacting drinking water standards. In other words, much of our current consumption could be recovered and treated for a variety of other secondary uses *without anyone ever having to drink directly "recycled" wastewater.* Hence, even if only small incremental gains could be made in terms of *non-potable* water re-use, overall water availability concerns could be substantially impacted.

Public resistance to broader use of directly recycled wastewater is, at the base level, another prime example of poor public understanding about water. These worries basically ignore the fact that all drinking water has indeed already been recycled many times. Wider public acceptance of direct wastewater re-use is a major public education challenge, but eventually more and more direct re-use seems certain to happen, particularly with the intervening, if minor, impact of "nature." Cities and municipalities in the arid west are already paying top dollar for access to wastewater effluent streams - both as a means to recharge aquifers or augment surface stream flows, as well as for direct source waters. A recent landmark transaction in Prescott Valley, Arizona saw the rights to a wastewater effluent change hands at almost $25,000 per acre-foot - a transaction valued at $70 million. Carefully planned and efficient re-use systems will increasingly be recognized as a far cheaper source of additional water supply than huge new reservoirs, massive pipeline projects or desalination plants.

One thing is certain: as water prices continue to rise, there will be ever-increasing incentives for more careful recycling and re-use. With greater economic incentives, individuals and households will begin to use and re-use water more carefully, and industrial companies will re-think their approaches and re-tool their manufacturing systems, to utilize less water and to better recycle their wastewater streams.

e. Better Measurement and Monitoring: There is an old adage: "what you can not measure, you can not manage." This certainly applies to today's complex water industry. Better and quicker information is critical to the sustenance of natural ecosystems and to the maintenance of public health. The ability to monitor and track - and more importantly, to understand the implications of - the physical and chemical composition of water is becoming more and more important. The treatment, storage

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and distribution infrastructure increasingly depends upon a plethora of monitoring data and analytical information in order to function efficiently. As a more informed public demands better information about their drinking water, as more comprehensive regulatory controls evolve, and as new contaminant effects and the potential for harmful interactions are better understood, it seems certain that testing and monitoring requirements will only continue to grow.

The monitoring of source waters is the critical first step in the water delivery process, whether that source be glacial, snowmelt, surface rivers and streams, or underground aquifers. Water quality parameters may change, depending upon recent weather conditions, time of year, seasonal biological activity, upstream human activities and so on. It is important to understand the physical and chemical quality of that incoming source water, in order to anticipate problems and maintain optimal conditions in the primary drinking water treatment plant.

Monitoring of key operational parameters improves productivity and cost control in both the drinking water plant, and later in the wastewater treatment works. Understanding the step-by-step quality and physical characteristics of the water as it flows through the treatment system enables the operator to maximize efficiency - saving on chemical costs for filtration and sedimentation, electrical power costs for aeration and mixing, and so on. This type of productivity-driven information has to be almost real-time in order to be useful.

Within the past decade or two, advanced real-time monitoring processes, and dependable remote and field-deployable instruments and monitors have begun to be used on a wide scale. In earlier times, a manufacturer only knew it had water quality problems when it began to produce an off-spec product. The water utility only knew it had problems after the local emergency room began to fill up. Today, both industrial users and utilities monitor in-coming source waters and treated discharge waters on a much more real-time basis, such that they can anticipate issues or problems rather than simply reacting to them after the fact.

Extensive monitoring and testing is of course conducted at various stages during the drinking water treatment process, and particularly at the point where fully treated water is discharged into the distribution system. A large array of parameters must be measured on a regular basis in order to comply with the Safe Drinking Water Act regulations, and in order to protect the broader human health. Consumer Confidence Reports, which by regulation have to be sent to all consumers of public water utility systems once each year, report observed levels of about 100 potential water contaminants. Although this requirement to measure and report has become a significant regulatory and cost burden on drinking water utilities, many critics believe that dozens more potential contaminants should also be tested and monitored.

As mentioned above, one area of drinking water testing which has received considerably more attention during the past few years is post-treatment plant distribution system monitoring of the quality of water - *after* it leaves the treatment plant and runs out into the underground distribution system. Although drinking water is very heavily regulated and tested at the point of discharge from the treatment plant, it seems remarkable that there is almost no monitoring of its quality once it is discharged into the distribution system which carries it to our homes and businesses. Particularly given emerging concerns about aging pipelines, contaminant infiltration, and chlorine disinfection by-products, it seems likely that distribution system monitoring will be more heavily regulated in the future.

Water *quantity* monitoring is also becoming much more important in the overall picture. This business comprises a wide variety of instruments, equipment and systems geared toward more accurate and efficient tracking of water volumes, consumption and conservation habits - for example, broader use of water meters on individual homes. In source water applications, ultrasonic devices are increasingly used to measure flow rates in rivers and streams, so that users downstream can know what to expect. In agricultural applications, more precise measurement of soil moisture, or flow rates in irrigation ditches or center-pivot irrigation systems can be critical; small percentage efficiency improvements here can free up massive amounts of water for municipal use.

As the above discussion makes clear, there are numerous points in the water resource management cycle, and in wastewater treatment processes, where massive amounts of data are collected on either an occasional basis, or on a continuous and real-time basis. Gathering, transmitting, and analyzing all of this information - turning these veritable mountains of data in to actionable intelligence upon which the customer can make decisions - is a huge undertaking. In many cases, this data may only be useful if one has an efficient data automation and process control system, often referred to in the water industry as a SCADA (supervisory control and data acquisition system). These are systems which collect data from various sensors on a continuous basis, and automatically process the information to monitor, manage and optimize an overall process on a real-time basis. Systems to manage, transmit and evaluate the data are just as critical in the overall scheme of things as are the sensors and instruments which initially collect it.

f. Technological Solutions: Few observers believe that there are any truly revolutionary technological breakthroughs just around the corner which have the potential to radically transform the water industry overnight. However, incremental technological advance is ubiquitous across all of the water industry. Thousands of technology developers are actively working on developing and commercializing better "mousetraps," and there is a steady march of innovation in many different technological sectors.

Perhaps the most significant and well-known example of this incremental but steady technological advance is the improvement in efficiency which has been achieved over the past couple of decades in reverse osmosis - one of the primary technologies behind seawater desalination, as well as water treatment and wastewater recycling. The rapidly declining cost and increasing efficiency of reverse osmosis, despite its high energy costs, have made membrane treatment of raw water and desalination of seawater economically feasible in many parts of the world today, where it never would have been economical a couple of decades ago. Likewise, rapid advances in water testing and analysis are both helping us to become more efficient in our usage of water, but are also exposing new problems which we must find new ways of dealing with.

Innovations are occurring not just in terms of new equipment and better hardware, but also in terms of improved approaches,

systems, and enhanced application and combination of existing technologies. For example, as discussed elsewhere in this report, we are seeing consistent advances in the use and application of existing agricultural irrigation technologies - an end use where small percentage gains can free up massive new "sources" of water for alternative municipal or industrial uses, particularly in arid regions. Historical irrigation practices have been notoriously inefficient - for example, simple and occasional flooding of furrows is often employed when far less moisture is sufficient to sustain the crop. Advances in soil moisture monitoring, remotely controlled center pivot systems, and application of reduced water flows at the optimal time of day are all contributing to more efficient irrigation.

All across water treatment technology, incremental enhancements to existing technology and continual cost reductions are on-going. A look at the agenda for any technology conference in this industry quickly suggests the breadth of technological approaches which are being applied to water treatment. Beyond the more widely known techniques such as membrane filtration, UV radiation, chlorination, ion exchange, chemical treatment, flocculation and settling, and so on, there is a bewildering array of newer and developing technologies - such things as electro-coagulation, sonication, cavitation, demineralization, ozonation, electro-deionization, biocidal disinfection, electrodialysis reversal, multi-stage bubble aeration, and various alternative chemical treatments. All manner of new nano-technology treatment businesses have been developed and financed over the past few years.

There is also an emerging focus on bio-mimicry - systems that promote and enhance natural water treatment methods, such as natural attenuation and constructed wetlands development. In the water treatment arena - just as in the medical equipment and other advanced technology fields - there is a growing recognition that better understanding and imitation of nature can often lead to new treatment approaches - and simpler, more elegant technologies.

The proper application of all of these improving technologies - separately or in combination with each other - can help to solve many of the world's water problems and challenges. But the real solution to the problem in many areas - particularly around the less economically developed parts of the world - is not technology as much as it is money. Indeed, many observers of the global water crisis believe that the simpler and "lower tech" approaches - sand filtration and enhanced natural wetland treatment rather than much more expensive reverse osmosis and the like - will be more logical, easier to implement, and cheaper. Simpler technologies are ultimately likely to play a more significant role in solving the vast majority of the world's water shortages.

In summary, we should not be lulled into thinking that if things get really bad, new technologies will automatically spring up to save the day. But despite this lack of any obvious "silver bullets," existing technologies appropriately funded and applied can go a long way towards solving many of the world's water problems.

g. Residential Water Consumption: As the general public has become more aware and concerned about water, individual consumer preferences and demands have become more significant factors of the business. The most critical trend or consideration here is the growing concern amongst consumers, particularly the more affluent, that tap water may not be safe to drink. Remarkably, the Metropolitan Water District of Southern California reported several years ago that almost *two-thirds* of their customers no longer thought it advisable to drink the water coming out of their taps. Primarily because utilities have not effectively marketed the true value of their product - and partly because real quality problems do occasionally occur - many consumers now believe they need to either buy bottled water or further treat the tap water coming into their homes. Right or wrong, this is a key driver behind several important trends in the water business.

The tap water quality issue is becoming a great controversy between the water utility industry - the 55,000 agencies providing drinking water, most of which are municipally or government-owned - and the residential treatment companies. The former group suggests that public tap water is truly one of the great economic bargains of all time. The latter group - which includes POE/POU (point of entry/point of use) equipment manufacturers as well as bottled water suppliers - cautions that the only way you can *really* ever be sure your water is safe is to treat it within the confines of your own home or drink it out of a pre-packaged bottle. Here again, the truth obviously lies somewhere in between - both sides of the debate can point to arguments which support their case. Although the ultimate outcome of this debate is still in question, the shorter-term effect has clearly been to strengthen the markets both for bottled water and for POE/POU home treatment products. In addition, new markets are beginning to emerge in areas such as residential water monitoring and testing services.

Nonetheless, the explosive growth of the bottled water industry over the past few years is a spectacular example of how customer perceptions - rightly or wrongly - can create and drive new markets. The extent of this phenomenon is staggering - it is now the second-largest beverage category in the United States, and it is estimated that Americans consumed over 7 billion gallons in 2005, an 11percent increase over 2004 - or 26 gallons per person - more than $10 billion worth in total. According to the Beverage Marketing Corporation, the reasons are clear - bottled water is "a healthy, safe, ready-to-drink commercial beverage, which is becoming increasingly affordable - a great beverage alternative." Providers continue to market bottled water by promoting it as something completely different than tap water - a concept which apparently sells to a large swath of the American public.

The truth is: (a) there is generally scant evidence that most bottled water is much different from, or safer than tap water; (b) the bottled water industry is not as closely regulated as the tap water business, and in many cases may be far less regulated; and (c) the "transportability" of water is easily accomplished by keeping a couple of empty bottles around. Nonetheless, the bottled water business continues to boom - at a price of hundreds to thousands of times higher than tap water. However, with the economic downturn of 2008, bottled water is likely to be extravagance which many consumers find they can cut back on relatively easily - and the industry is preparing for a sharp decline in sales.

The more substantive and serious question which arises out of the whole tap water safety debate has to do with point-of-use treatment, and larger policy questions about the efficiency of centralized water treatment versus "decentralized" or "distrib-

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uted" treatment of water. This issue ties back to a very key fact mentioned above - *very little of our treated municipal water is actually used for drinking.* Put simply, if we only drink one percent or less of all the water that is treated to our very stringent regulatory standards, does it make any sense from a broader perspective to treat all of our water to those exacting standards? Wouldn't it make more sense to treat water to lower standards at centralized facilities, at considerably less expense, and gradually develop an infrastructure where individuals treated water at the point of use for the specific intended purpose? In other words, would it make sense to save a lot of money in the construction of such sophisticated central facilities, and have each home and business treat the very small amount of water that they drink, cook with or bathe in, at the point where it is actually consumed?

The true cost of delivering clean water - as well as the average price of water - does continue to creep slowly upwards in most localities, but it appears that prices are not rising at the kind of rates which will be necessary if we are going to upgrade and maintain our infrastructure on a truly sustainable basis.

This would obviously require a massive re-thinking and re-building of the entire water infrastructure system in the country - and hence it is not likely to happen any time soon. However, over time, we may indeed see more and more consumers taking matters into their own hands, and treating or re-treating water to their own specifications at the point of use. The residential water treatment business is one of the more rapidly growing parts of the overall water business, and probably will accelerate in the future. Indeed, some utilities in California have already tried to bridge this gap, and are offering to provide POE treatment devices to their users to avoid the expense of investing in centralized treatment upgrades. This issue of decentralized treatment will represent another major policy debate in the future.

h. A Surge of Investment in the Industry: As the widespread recognition of water problems has increased, and as a corporate consolidation of the water industry has developed, hundreds of strategic and financial buyers have swarmed into the industry in an attempt to establish a foot-hold. First and foremost, this has included a large array of industrial consolidators and strategic buyers looking to expand existing water businesses, or to establish a platform in an industry which they rightly believe is certain to show long-term growth. These industrial buyers and recent industry consolidation trends are discussed in the next section of this report.

The water business has also attracted many other types of investors. For example, there are literally hundreds of private equity (PE) firms looking to establish a position in the water equipment industry. As other popular investment opportunities have faded, and as the amount of dollars in private equity funds has exploded, there has been a head-long rush into water-related businesses over the past several years. Despite the growing economic uncertainties of the past year, the total amount of capital sitting in private equity funds still remains near its all-time peak, and as a result PE managers find themselves today with huge amounts of capital which they still need to invest quickly. The water business is one attractive sector in which to explore for good investment opportunities.

The water industry is attractive to private equity firms for several reasons. First, it represents a strong and very consistent growth opportunity over the long-term future - virtually no one expects the water industry to shrink. Many sectors of the business offer the allure of high profitability at the same time. It is still a relatively fragmented industry, ripe for consolidation. This offers PE firms the opportunity to consolidate various businesses together to build larger and more valuable companies - although experience is showing that many PE firms over-estimate the simplicity of implementing this type of industry growth plan. The relative long-term stability and predictability of water businesses are key factors behind the high level of interest in infrastructure-related water businesses. The only significant drawback from the PE perspective is the huge premiums that, at least until recently, have been paid for companies in this sector - valuations which financial buyers often have not been able to justify.

There have been several large transactions involving PE investors over the past few years, including Water Pik, Utilities Inc., Nalco, Culligan Water and - more recently - several of the British water utilities. During the past few years, the biggest and most talked about example has been MacQuarie's purchase of Thames Water for approximately $15 billion, following the break-up of RWE's ill-fated water business. Despite the obvious slowdown in activity during the financial turmoil of late 2008, it seems likely that we will see continued PE interest in the water industry. A listing of some key private equity investments to date is shown in the Table below.

Major Private Equity Deals in the Water Industry

Seller	Buyer
Anglian Water	Consortium of PE Investors
Bridgepoint/Alcontrol	Candover Partners
East Surrey Water	Terra Firma Partners
Norit	Doughty Hanson (U.K.)
Nuon/Utilities, Inc.	AIG Highstar Capital
RWE/Ashbrook Simon Hartley	Blue Sage Capital
RWE/F.B. Leopold	PNC Equity
RWE/Thames Water	MacQuarie
Severn Trent Laboratories	HIG Capital
Suez/Nalco Chemical	Blackstone, Apollo, Goldman Sachs,
Suez/Northumbrian	Aquavit Partners
US Filter/Culligan	Clayton, Dubilier & Rice
US Filter/Waterworks	Thomas Lee, J.P. Morgan, et.al.
Water Pik Technologies	Carlyle Group, Zodiac

Nor is this surge of investment interest in water just an industrial consolidation or a private equity phenomenon. There is also a greater interest in water investments on the part of the broader public as well. Existing publicly-traded water stocks, though relatively few in number in the United States, continue to be highly sought after by individual investors, as evidenced by continuing high valuations, even in the tumultuous equities environment of late 2008. (See pages 6 to 8 for a listing of key publicly traded U.S. firms.) Water-related hedge funds, exchange-traded funds, and other types of investment vehicles have proliferated during the past few years, though all are similarly hampered by the paucity of public traded U.S. water in-

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The Essential Thesis of Water Investing

by John Dickerson

The disparity between the supply and demand of clean water is a critical and growing problem. Growing demand for uninterrupted supply makes water by far the most stable of all commodities - unaffected by the cyclical influences and demand swings which constantly badger other commodities. This theme of insufficient water supply and unrelenting global demand - along with all the related trends and subsidiary opportunities it has spawned - continues to benefit the future prospects of a broad range of publicly traded water companies. Hence, the global water business offers a diverse set of investment opportunities - making it potentially more rewarding, broader in scope and less susceptible to cyclical influences, than almost any other investment sector.

Historically, the U.S. water utilities have represented the core of most water investment portfolios - for the simple reason that they have, over the course of many years, out-performed all of the major market indices by a wide margin. A striking illustration of this fact is that in any random five or ten year period over the last 25 years, water utilities dominate the list of the best performing industry groups in the U.S. stock market on a total return basis. Why? The simple answer is that water utilities have always done well in good times and bad - people continue to use the same amount of water during recessionary times, and hence water utilities perform just as well in weak economies as in robust economies. When compared to virtually any other industry, water utilities have a more compelling business model - with the most sustained and persistent demand, and probably the most predictable future. In addition, regular dividend increases are a hallmark of the water utility group - and indeed are perhaps the best indicator of the quality and stability of any enterprise.

Below is a table comparing nine of the remaining investor-owned water utilities in the U.S. to a list of standard market indices and popular investment icons. This table clearly shows that few sectors have offered as good a return to shareholders over the long-term as has the water utility business.

However, at the same time, investors should keep in mind that water utilities are actually only a small part of the potential global investment universe. Indeed, in the Summit Global Management water stock universe of about 380 companies, only a small percentage of our potential targets are water utilities. The non-utility majority of companies on our list are comprised of basic water industrial stocks - companies involved with pumps, pipes, valves, filters, testing, instrumentation, engineering, and construction of water systems. Water utilities may be the highly visible "point of the spear" in the water industry, but the water industrial stocks are the "shaft" of that spear - and one group cannot function without the other.

It is also critical to note that only about a quarter of the companies in our listing of water companies are U.S. companies. Indeed, despite the huge investment interest of the past few years, the United States markets suffer from a paucity of relatively pure-play publicly traded water companies. That may change in the future, but nonetheless, water investments should be selected on the basis of the best values available - not on the basis of location. Water is truly a global industry, even though it still doesn't seem to be perceived that way by many investors.

During the economic chaos of the last six months, water stocks have by no means been immune to the general downturn in world markets. Many stocks sit today at 50% to 60% of the market price they enjoyed a year ago. As has always happened in the past however, water utilities in particular and all water stocks more generally, will start to de-couple from overall recessionary trends, and will likely show stronger performance during the current recession. This will occur for the very reasons discussed above - people tend to use the same amount of water regardless of external economic conditions. For these reasons, many are beginning to view water as a store of economic value - maybe not quite as valuable yet as gold or silver, but a true store of value nevertheless. All of these facts make the present time look like an excellent buying opportunity for many water stocks.

		1998-2008	
Symbol	Name	Total Return	Annualized
SJW	**SJW Corp**	**300.54%**	**14.89%**
YORW	**York Water Co**	**171.96%**	**10.52%**
XOM	Exxon Mobil Corp	170.98%	10.48%
AWR	**American States Water Co**	**155.38%**	**9.83%**
PNNW	**Pennichuck Corp**	**133.28%**	**8.84%**
WTR	**Aqua America Inc**	**131.88%**	**8.77%**
CWT	**California Water Service**	**116.84%**	**8.05%**
MSEX	**Middlesex Water Co**	**107.96%**	**7.60%**
ARTNA	**Artesian Resources Corp**	**99.05%**	**7.13%**
MCD	McDonald's Corp	90.72%	6.67%
CTWS	**Connecticut Water Serv**	**85.64%**	**6.38%**
JNJ	Johnson & Johnson	71.69%	5.55%
K	Kellogg co	70.44%	5.48%
PG	Procter & Gamble	65.79%	5.19%
WMT	Wal-Mart Stores Inc	51.99%	4.28%
INDU	Dow Jones Indus. Avg	18.10%	1.68%
IBM	Intl Business Machines Corp	-0.02%	0.00%
SPX	S&P 500 Index	-13.00%	-1.38%
DIS	Walt Disney Co	-15.23%	-1.64%
KO	Coca-Cola Co	-17.13%	-1.86%
CCMP	Nasdaq Composite Index	-24.04%	-2.71%

Source: Bloomberg Analytics - All returns are with dividends reinvested

In summary, the global water industry combines an excellent underlying business model with probably the most sustainable and inexorable future demand characteristics of any industry - and this fundamental fact is not likely to change. Indeed, we believe that the water industry has more wind in its sails than any other global industry - period. Obviously, learning how to choose the best stocks from within this select universe further is a fine art, and can considerably enhance potential returns. But, in our view, if one concentrates wholly on a stock universe that represents the highest quality and most dominant investor-owned water stocks in the world, and if one constantly monitors this universe for the best values, the chances for investment success are very good and the odds for unsatisfactory performance are quite low.

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vestment vehicles. Not surprisingly, almost all have been down during the last six months, but most have nevertheless outperformed general market indices.

Although the market for initial public offerings in the water sector has not been as active as one might expect over the past few years, there have been a few new companies coming on to the public markets. Recent IPOs have included American Water Works (the largest investor-owned utility in the country, which was publicly traded prior to its acquisition several years ago by RWE), Cascal Inc., Energy Recovery, Inc., Heckmann Corporation, and Polypore. In addition, several existing public companies successfully completed secondary stock offerings, including PureCycle, Layne Christenson, and Clean Harbors. Finally, there were also numerous private financial placements and underwritings (in companies such as Miox, Purfresh, NanoH2O, and Seven Seas). Venture-type investments in smaller and newer start-up companies have also been widespread.

The global economic crisis will clearly impact the volume and rate of investment going into the water industry in 2009 - and probably well beyond. However, in a broad sense, water companies - particularly water utilities - are more recession-resistant than almost any other type of companies. If there is one thing that we don't cut back on during tough economic times, it is probably the water that comes out of our taps. And, in turn, the product and service firms which sell things to water utilities are also likely to be buffered from sharp economic downturns as well. Particularly given the urgency of water challenges in many parts of the world, and the generally dilapidated state of water infrastructure, it seems a safe overall bet that the water business will remain a vital industry irrespective of external economic conditions.

i. Ownership Changes and Consolidation: One impact of the exploding investment interest in the water industry has been a trend towards consolidation amongst the key suppliers and vendors, and an on-going rearrangement of ownership of key industrial assets. At times, this has almost resembled a game of "musical chairs" - with major international companies seeking to strategically position themselves to exploit future opportunities offered by the water business.

First, it may be interesting to review a little recent history. The widely discussed "foreign invasion" of the U.S. water industry occurred in the mid-1990s, when British, French and German companies bought up many of the larger suppliers in the U.S. water business. These buyers were generally driven by the belief that the U.S. water utility business was on the verge of a wave of privatization - and they bought a range of U.S. product and service companies to take advantage of this projected bonanza. However, this supposed trend to widespread privatization did not, and has not happened. As a result, many of these acquisitions were either strategically misguided, ill-timed or over-priced - or all of the above. Hence, this cycle of European investment began to reverse direction in the early part of this decade.

As a result, major assets owned by these earlier foreign consolidators began to change hands again, and many were purchased by major U.S. industrial corporations. Veolia, Suez, RWE, and most of the other major European water companies retreated back to their infrastructure service businesses, and have now exited most if not all of their equipment businesses in the United States. Global industrial firms such as General Electric, Siemens, Danaher, ITT, Pentair and 3M have emerged as new diversified water service and equipment companies. General Electric's rapid-fire acquisition of Ionics, Osmonics and Zenon - at very high valuations - is the most often-cited example of this trend. Today, Severn Trent is the only major foreign water utility that still has a strong equipment business in the States.

There have been fewer "block-buster" deals during the past two or three years - more because of a dearth of pure-play acquisition opportunities than a lull in strategic interest levels. Unfortunately, one fall-out of the high prices that GE, Danaher, and other large consolidators have recently paid for water companies is that they helped to drive average valuations up, and left in their wake an unrealistic set of value expectations for hundreds of smaller technology developers, inventors, and tinkerers - who now all think their "better mouse-traps" should also be worth twelve to fifteen times EBITDA. However, this is another trend which will probably be "corrected" by the current economic downturn.

Although the number of large deals has declined over the past couple of years, smaller deals have continued apace across the global industry. Pentair, Watts, Danaher and many others continue to make smaller acquisitions. Siemens continues its strategy of adding pieces to fill out and complete its already broadly diversified equipment and service offerings. And new buyers continue to emerge all the time - such as Home Depot (which entered the business a few years ago, and then abruptly exited), Ashland, and Axel Johnson. Numerous other industrial companies, such as Idex, Roper and John Deere seem to be interested in expanding their platform and holdings in the broad water business. (See the Chart on the insert page for a detailed listing of key water transactions over the past several years.) And consolidation activity in Western Europe and other parts of the world continues at an often feverish pace. Numerous infrastructure players in the United Kingdom and Europe have bought and sold very significant assets during the past year or two, with perhaps the biggest deal being the merger between Suez and Gaz de France, and the subsequent spin-off of Suez Environment.

With so many major industry assets changing hands so quickly, the competitive situation in the water industry has been very fluid. The picture is gradually becoming clearer, but it is still not clear exactly who the primary players will be in this industry. Most observers are betting on the various diversified companies mentioned above - ITT, General Electric, Pentair, Siemens, or perhaps a few others who have not yet made their intentions clear. But several larger strategic questions remain: how can companies like RWE that were such committed buyers a few short years ago turn into such eager sellers? What was wrong with their strategies? Will the new owners of these assets have sounder strategies? And most importantly, what will be the ultimate impact of this large-scale ownership rearrangement on employees, shareholders, and customers?

As the new economic era unfolds, it is still an open question as to what will happen with merger and acquisition activity, and investment activity in the water industry more generally. As the credit markets have tightened, more highly-leveraged players have had a harder time securing financing, and many transactions on the books or in the planning stages have fallen apart.

Many strategic industry buyers have decided to sit on their cash, and wait for the general economic picture to clarify. Although many PE firms may have the necessary equity to continue acquiring, their ability to leverage transactions has obviously also been severely curtailed. Smaller deals do seem to be proceeding ahead - often with the implicit assumption on the buyer's part that more leverage can be applied against the target company sometime in the future. However, it is already apparent that M&A and investment activity in this industry will subside considerably - and there will almost definitely be a more permanent downwards adjustment in terms of typical multiples being paid for water companies - at least until the current recession is over.

j. Consolidation in the Public Sector? When we talk about industry consolidation, it is usually within the context of the private sector - private companies merging with or buying each other, in the *commercial* side of the business. However, with the efficiencies and economies of scale of larger water and wastewater operations continuing to grow, it seems increasingly possible - indeed it seems necessary - that consolidation within the *public* sector, or the municipal utility business, will begin to occur as well. As observers are increasingly pointing out, it just makes too much sense for it *not* to happen.

Water and wastewater treatment are both very capital-intensive businesses, and there is no doubt that scale can convey distinct operating, technical and financial advantages. Yet, the municipal side of the business is primarily made up of very small local players - almost 85 percent of all municipal drinking water systems are categorized as "small" or serving less than 3,300 people. As regulatory requirements pile up, and as the business becomes more technologically complex and expensive to run, it seems logical that some of these smaller utility operations would find a way to combine forces and take advantage of these scale efficiencies. There has been some consolidation amongst *private* investor-owned utilities - but, as we point out elsewhere, privately-owned utility companies only represent a small fraction of the overall infrastructure. A major policy debate is emerging around the challenges and the potential benefits of combining smaller public water and wastewater utility operations.

….. advancing technology can be a strong partner in solving global water problems, but it must be exploited in combination with more careful and conservation-minded attitudes, greater efficiency in use, and smarter policies and management approaches. Technology alone cannot be relied upon to solve this problem.

Trying to combine or "merge" municipally or governmentally-owned systems is far more difficult financially, and is obviously fraught with a whole range of sensitive political and fiscal challenges. However, such mergers or combinations could definitely make good economic and operational sense. Many industry observers believe that we must figure out some politically workable and acceptable means of consolidating small and local water municipal utilities, The alternative, they say, will simply be increasing non-compliance with key regulations, and even bankruptcy, as these small utilities will no longer be able to keep up in an increasingly complex business environment.

There are other broader and more vexing policy questions in terms of this potential consolidation of smaller and local utilities into larger "super-regional" utilities. How would a consolidation of the public water utility business affect the delivery of water and provision of sewerage services? Would such combinations also include other municipal services, such as solid waste and highway management, or would they be restricted to water and wastewater? Could such super-regional utilities privatize themselves, or even consider floating public stock? Or, would it make sense to facilitate the merger of water and hydro-based power utilities, to more effectively utilize their common resource - water? Despite all of these unknowns, it seems likely that we will see more consideration of public utility consolidation in coming years.

k. Controversy Over Privatization and Out-Sourcing: As described at the outset, the whole arena of privatization, outsourcing, and the employment of private capital in public water projects remains a very controversial set of issues. Any discussion at the local level involving private sector involvement in water provision can be potentially and sometimes shockingly divisive. The current lingo of "public-private partnerships" must also become the true operating philosophy in order for any such ventures to be successful - and even this approach is subject to great controversy. Regardless of what it is called, the involvement of private companies in water and wastewater operations constitutes one of the more controversial aspects of the water industry today.

In the United States, roughly 12 percent of the population is provided water by private organizations of one sort or another - publicly owned systems that are either *operated* by private contractors, or systems that are actually *owned* by private companies. The comparable figure for wastewater services is around two percent. Privatization of water systems began to spread in the early 1990s, but soon stumbled. The highly publicized misfortunes of several high-visibility privatization projects - notably the experiences of United Water in Atlanta - combined with an active and growing opposition movement, have forced a reassessment of water and wastewater privatization in the U.S. As might be expected, the public tends to get a negative slant on this issue in the popular press, and hence, privatization of drinking water and wastewater utilities, at least large ones, faces an uphill battle in the United States at the moment.

It is worth contemplating that in many parts of the world, the private operation of drinking water systems is taken for granted, and in fact is the operational norm. The French, and more recently the British, are the world's major players in terms of private water management and operation. And privatization and contract water operations are significant and growing in many other parts of the world. *Global Water Intelligence* reports that about ten percent of the world's population is currently served by private operators - a figure that is expected to grow to 16 percent by 2015. More than 45 percent of the population in Western Europe is now served by private operators, with rapid growth occurring in the Mediterranean and North African regions.

It seems quite ironic therefore that here in the United States, which many like to consider the home of free enterprise and democratic capitalism, we have such a resistance to private water systems, while in European countries that we tend to think of

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as marginally socialist, private water systems are common and widely accepted. One European report accuses the United States of maintaining a "bunker mentality" in terms of being open-minded to privatization, and the possible solutions it could bring to a variety of water infrastructure problems.

The basic arguments *against* privatization of water assets revolve around concerns about the motives of private, for-profit firms - and the philosophical sense that access to clean water, as a basic human right, should be equitably priced and provided to all. Within such broad confines, there is plenty of room for reasonable people to debate and disagree. Many people simply believe that water resources are a part of our natural heritage which should never be entrusted to private companies to own, manage and disburse. Given the isolationist attitudes that have evolved in this country since 9/11, the fact that many of these contract operators are foreign-owned companies has only led to further concern and suspicion. However, the situation is not the "greed gone wild" scenario of faceless, evil corporations jacking up prices and flagrantly gouging the poor - the scenario that is, unfortunately, often portrayed by privatization opponents. Typically unmentioned is the fact that, as natural monopolies, all private water utilities fall under extensive and strict regulatory control from the local Public Utility Commission. Indeed, they are far more closely regulated in terms of price increases than are municipally-owned utilities.

On the other hand, there are a number of fundamental and compelling economic drivers which tend to *support* the consideration of greater privatization in the water industry. Most municipalities enjoy over-flowing coffers, and few public officials who wish to be re-elected want large user fee or tax increases on their watch. Hence, public works managers are between a rock and a hard place - technical requirements, regulatory complexities and overall utility costs continue to increase, but the general public remains very resistant to increasing taxes and users fees. Oftentimes, one solution to this dilemma may be to turn to private companies and/or private capital to finance, build and operate the water or wastewater system under long-term contract. As mentioned, the private operator has no influence over water pricing - that remains the responsibility of the city council or governing entity.

In summary, despite the cries and concerns of labor organizations and various public interest groups, the urgency of infrastructural needs and the political difficulties of increasing taxes or fees make it likely that privatization - under various names - will become a more important factor in the water business. Although the growth rate of out-sourcing has slowed a bit over the last few years, the fundamental drivers behind privatization and consolidation - huge capital needs, technological and operational synergies, limited public funds and a widespread aversion to higher taxation - remain strong. At the same time, it is clear that private operators are going to be judged by a very demanding and critical public.

An early driver of the water privatization movement was the desire to improve productivity and efficiency in municipal agencies - organizations that are sometimes viewed as bloated and sleepy. It is worth noting that, after a decade or more living under the "threat" of privatization, many public agencies and utilities have made substantial progress in terms of undertaking needed productivity improvements and cost reductions - a sort of "de facto" privatization. One way or another, water and wastewater agencies are gradually becoming more competitive and efficient.

l. Paradoxes in the Water Market: The water business seems increasingly confused by a few emerging ironies or paradoxes which are briefly touched on here.

• Although the pressing need for vast infrastructure expenditures is becoming clearer, it seems to be simultaneously less obvious where the funding for these investments will come from. Almost all local agencies and municipalities continue to suffer from greater fiscal constraints, and the Federal government, at least at this point in time, shows no inclination to get involved. Projections about the limitless future of spending in the water business are beginning to be tempered by the reality of national fiscal constraints. In short, there are huge capital investment needs but few proposed capital sources. Even with all the current discussions regarding massive infrastructure spending and the economic stimulus package, it appears that only moderate funding will trickle down to the water business. As noted previously, it may eventually take a series of public health calamities - resulting one way or another from the decaying water infrastructure - to finally cause people to wake up, and force Federal attention to this problem.

On the other hand - at the same time as we hear about all these pressing needs - the water industry has never been "hotter" from an investment and financial opportunity and investment perspective. As described above, there is a huge reservoir of investment funds seeking to find a home in the water industry. And it often seems like a stampede of investors chasing relatively few real investment vehicles. This situation represents a major paradox and dilemma for the water industry. On one side, hungry investors are complaining about the lack of good investment opportunities, and on the other, the public is clamoring for the rebuilding and expansion of a dilapidated water system.

... the real question is - does our whole legal system, as it pertains to water, need to be revamped to fit our modern industrial economy and today demographics - instead of the largely uninhabited country when these systems and laws were first devised?

Given the urgency of the world's water problems, this is a situation which virtually cries out for new and more innovative approaches - for more creative financial vehicles and mechanisms which will allow private investors to put their money to work for the public good, and concurrently be able to earn a competitive rate of return on those monies in the process. There is a huge interest in water investment, and we clearly have huge needs - we must figure out better mechanisms and investment vehicles to connect this *supply* of "water dollars" with the obvious *demand* for water dollars.

• In another somewhat counter-intuitive development, the drive to create better water conservation measures in many parts of the country - particularly more arid areas - has begun to show some real results. Many southwestern cities like Albuquerque and Las Vegas have seen per capital daily consumption drop from around 200 gallons into the neighborhood of 120 or even 100 gallons. Following the drought of 2002, Denver was able to lower its overall daily water production by almost twenty

percent. However, the resulting lower water usage has translated into lower revenues for these municipalities, at a time when additional funds are generally badly needed to invest in new infrastructure. So, by "doing the right thing" and conserving water, consumers have created a greater, rather than a lesser, financial burden for the water authority. In many areas it looks as if responsible customers must be told to both use fewer gallons *and* pay more for the gallons they *do* use - not very palatable to either the water supplier or the customer.

Difficult situations and challenging problems usually don't have simple answers, and frequently the outcome is not what was expected. Sometimes, an apparent solution may in fact create a new and unforeseen problem. This was dramatically illustrated a few years ago when it was recommended that Washington, D.C. eliminate dangerous trihalomethane by-products in its water system by replacing its chlorine disinfection system with alternative chloramine disinfection. As it turned out, the use of the environmentally-friendlier chloramines unexpectedly began to leach lead out of Washington's ancient water mains and into the drinking water. In effect, the "solution" created a worse problem than the initial one, resulting in a major public hue and cry. These types of quandaries, difficult choices, and counter-intuitive results are likely to continue to plague water providers and water users in the future.

VII. Moving Towards a Solution

Several important conclusions and lessons emerge from a more detailed study and review of the water industry. When one more fully understands the array of pressing challenges here, it becomes more feasible to think through strategic alternatives and begin to propose potential solutions. There are obviously many studies, scholarly reports and policy analyses available which discuss the urgency of the world water challenge - many of them putting forth an urgent "Chicken Little" type of doomsday warning. In this report we have tried to focus on the facts and figures, and the broader context of the world water challenge - while at the same time pointing out the criticality and the many very real urgencies of the situation. But none of this is very helpful or productive unless solutions and ideas for improvement are also proposed.

….. we suffer not so much from an absolute shortage of water as from an inability to properly manage and allocate that water that we do have……

Fortunately, the impending world water crisis lends itself to small and incremental improvements. Across the board in the water industry, there are many solutions or steps - some of them perhaps baby steps - that can be taken immediately. There are simple things which can be done individually and collectively to address and reverse some of the more problematic trends - to begin to move in the right direction. All of these actions can be undertaken voluntarily, but they will all gather considerably more momentum as water prices rise, and as our "water behavior" begins to have a bigger and bigger impact on our pocketbooks. In this concluding section, I will wrap up our review and analysis of the water business by proposing some perspectives and approaches that might help us move towards solutions to the global water challenge.

a. Rising Prices: First and foremost - as I have emphasized repeatedly throughout this report - water prices simply must rise for many of the necessary changes in thinking, policies and practice to really begin to occur. If there is one single and inescapable conclusion resulting from any review and discussion of the water business, it must surely be the inevitability of continuously rising water prices over the longer-term - indeed, the *urgent need* for rapidly rising water prices in many parts of the globe. Water has traditionally been priced so low that most users simply don't have any serious economic incentive to conserve it or use it wisely. People naturally don't pay much attention or conserve a commodity if they tend to view it as virtually free - and until recently, that is exactly the way in which a lot of people viewed water. (Indeed, there are still those today who suggest that water should be provided free to everyone - demonstrating a remarkable lack of understanding of both the hydrologic cycle and the water infrastructure system.)

The true *cost* of delivering clean water - as well as the average *price* of water - is continuing to creep slowly upwards in many localities, but in most areas, prices are not rising at the kind of rates which will be necessary if we are going to upgrade and maintain our infrastructure on a truly sustainable basis. Almost all water utilization decisions and resource management issues would be far more efficient and solutions would begin to emerge more quickly if water prices were higher. As prices rise, decisions about water usage will inevitably begin to take on greater significance in the overall economy, and many of the incipient trends discussed above will gather steam - greater reliance on re-use and recovery, more emphasis on conservation, a continuing trend towards more private-public partnerships, and more rapid advances in technology.

There is no doubt that higher water prices will gradually force more logical and sustainable decision-making in our use and allocation of water. As prices rise, water usage naturally will be more carefully measured and monitored, in turn reinforcing even better usage and allocation habits. However, higher water prices also inevitably raise the issue of a variable "ability to pay" across society, and the question of whether or not subsidies should be provided to certain groups. This is an issue which may not be adequately addressed by market mechanisms, and which must receive careful attention from Federal and local policy makers.

The key policy question here is whether prices should simply be allowed to rise gradually and naturally due to the market forces, weak though they are, or if they should be increased more sharply by some sort of well-reasoned political mandates and policies. Short of more reasoned approaches, there is always the looming possibility that water prices will skyrocket in certain areas as a result of haphazard responses to water dislocations or public health catastrophes. At the end of the day, the issue of higher water prices reduces to a massive public education initiative - those of us in the water industry must help to build a better understanding, and to promote broader public acceptance of the fact that water is valuable, and that it is simply going to cost more in the future.

Many observers have pointed out that we suffer not so much from an absolute shortage of water as from an inability to properly manage and allocate that water that we *do* have. This is a good perspective to keep in mind. An authoritative special report a few years ago from the *Economist*, concisely concluded

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that water is "ill-governed and colossally under-priced" around the world. Or, as Peter Gleick of the Pacific Institute put it in a recent report, "there is a vast amount of water on the planet - but we are facing a crisis of running out of sustainably managed water." In short, increasing prices will naturally help to improve the allocation of water, but they must be combined with smarter policies and more innovative management approaches.

Finally, as a point of reference, water prices around the world have increased over the past year by an average of about seven percent, according to Global Water Intelligence (GWI). Averages can be deceiving - some areas have seen water prices increase by as much as 50 percent a year, while others continue to enjoy free water. In one of its reviews of water pricing around the world, GWI asserted that "there is no correlation between....water scarcity and water price." The report also observed that there is no other product whose price to the consumer is so totally unrelated to its cost - an observation that seems to often go unnoticed or ignored in most economic and political debates. We still don't recognize the true value of water - and few of us currently have to pay anywhere near what it is really worth to us (see "Water is Cheap, Ridiculously Cheap" *TEBS*, Winter 2006). Indeed, to paraphrase Benjamin Franklin's observations of over 200 years ago - "we only recognize the true value of water when the well runs dry."

b. Global Perspectives, Local Actions: Pondering how to deal with the world's water problems increasingly brings to mind the old political bumper-sticker - "Think Globally, Act Locally." While technologies, conceptual solutions, and broad policy approaches may be similar and applicable around the globe, implementation of those policies and approaches need to be much more location-specific. We need to increasingly look at water challenges and issues from two perspectives - the global and the local. Perhaps said another way, we need to view challenges and evaluate solutions from both the policy level and the implementation level.

As opposed to other broad environmental problems - such as air pollution and global climate change - water challenges and solutions tend to be regional or even local in nature, and in many cases are specific to the individual watershed basin. If China burns less coal, air pollution problems in Japan may improve; however, better water conservation practices in Arizona aren't going to help alleviate water shortages in southern India. Some areas don't yet have serious water problems, while others face severe and immediate water availability or water quality challenges. More arid regions generally face nearer-term and more serious supply issues - though that is not always reflected in current pricing today. Water quality issues may vary extensively from one basin to another, based upon levels of industrial activity, historical population patterns, and so on. Technological solutions such as desalination may be economically feasible in one area but not another, depending upon alternative supply sources, local energy costs, or distance to the sea.

This "local" perspective is most likely to reflect the form of a single river basin area, or watershed region. Within a river basin, all users tend to have a common problem or set of circumstances, and hopefully a similar set of objectives in water resource usage and management. Within an individual watershed region, all users should be willing to address, and pay for certain water quality and water availability, whereas they may be far less concerned about quality or quantity issues in the neighboring watershed basin. We must strive to reform political and social institutions to take account of this more regional or local nature of water problems - systems which will work to coordinate national or international policies with regional decision-making bodies and localized solutions. It is critical to note that there are some 260 "major" river basins in the world that cross 145 national boundaries. Some 60 percent of the world's population lives within those 260 basins. This fact alone makes it clear that we are facing serious political problems in the water arena in the future.

Although practical solutions for many water problems may be more regional in nature, price increases are likely to occur across the board. The supply and demand characteristics of water may vary from place to place - and the allocation and distribution of water may be more dysfunctional in one area than another. However, in the final analysis, we are all going to have to treat water as a bigger expense item in our individual budgets, no matter where we live.

c. Promoting Greater Efficiency: Even without the "iron hammer" of higher prices forcing us to make more rational decisions, we can all do much more to conserve water and improve efficiency, both in how we produce and how we consume water. As we have discussed, there remains much "low-hanging fruit," and governments, businesses and individuals must all work to exploit these potential savings. Most significantly, there are numerous means by which we could begin to conserve and use agricultural water more efficiently. Better soil moisture monitoring and smart irrigation are just two obvious ways that we could save on some of this vast volume of water usage. Storing water in underground aquifers instead of in surface reservoirs to eliminate loss through evaporation, and the lining of earthen irrigation ditches could also save large amounts of water. When one considers that in many arid states over 80 percent of total water consumption is attributable to agriculture, it is clear that small percentage gains here can free up massive percentage gains for potential municipal and industrial usage.

At the level of the individual user, low-flow toilets and showerheads, xeriscaping or wiser lawn watering practices, and other home conservation techniques have already begun to show considerable per-capita usage declines. Some newer areas are encouraging housing and construction codes which allow the collection of used household water to irrigate lawns or outside plants. As mentioned, rapidly growing southwestern cities such as Denver and Albuquerque have shown that it is fairly easy to cut individual water consumption by as much as half without severe hardship. There seems to be no reason why other parts of the country can't begin to do the same thing, even though droughts or high prices are not yet forcing the issue.

In many regards, the potential for improved efficiency and greater conservation also reduces down to a public education challenge. Higher prices will eventually force more attention, but better public understanding of the water resource challenge and what we can all do to contribute, will also help to spur smarter use. Some regions and individual cities have shown good progress in conservation and efficiency via extensive public outreach and education programs, but unfortunately too many cities and towns still don't care or recognize the magnitude of the challenge.

d. Virtual Water Concepts: Where it makes comprehensive sense - and there are many areas where it does - we need to start incorporating the concept of virtual water into our trade and commerce patterns. Here again, higher water prices will help to force smarter and more logical regional allocation of scarce water, but in the absence of higher prices, there is progress that can be made. An international system to promote export of more water-intensive foodstuffs such as rice, to relatively drier countries, can free up water there for other more critical uses - and perhaps create a more stable political situation in the process. The liberalization of agricultural trade policies and tariffs is obviously a vexing political challenge, but progress here could well contribute to better production decisions, and ultimately to the individual competitive advantage of nations.

Rising food prices are a harbinger of the growing water crisis. Many food experts believe that the world faces a real risk of widespread famine in coming years, and the regional variability of water resources is a critical consideration in the equation. Although there has been a brief respite in the last few months, the prices of such food staples as rice, wheat and milk rose to record levels in 2008. A report by the British think tank Chatham House early in 2009 said that "long-term resource scarcity trends, notably climate change, energy security and falling water availability" will put increasing pressure on food prices and production.

At the same time, the concept of virtual water has serious limitations, and may in some cases conflict with other trade or consumer objectives. Because food requires so much more water than most industrial products, international trade patterns in virtual water are essentially a reflection of trade patterns in agricultural commodities. Stronger industrial countries without as much agriculture will obviously tend to be net importers of water in the form of food, whereas less industrialized and more agrarian countries will tend to be agricultural (and water) exporters - regardless of their natural water resources. As a recent issue of *GWI* put it "you cannot tell peasant farmers in North Africa or India that they should give up their land and become advertising executives or bank clerks because those professions use the least water." The article added that "perverse" virtual water flows are here to stay, and that what really needs to be addressed - as we emphasized above - is the efficiency of that water use where it is most scarce.

Unfortunately, one seemingly logical approach or attempt to practice more sustainable behavior may often be at odds with another. For example, the emerging "buy local" consumer trend that is emerging in many parts of the United States - as a means of promoting local agriculture and reducing the carbon footprint of large-scale food transportation around the world - may often be in direct conflict with the concept of virtual water. If one looks around many of the major and growing cities in the world, there simply isn't sufficient water or the appropriate climate to locally grow all the food that may be needed. In summary, one idea or approach may appear very logical or elegant when viewed in isolation, but when it is viewed from a more holistic and integrated perspective, it becomes clear that many different approaches and objectives have to be balanced.

e. Technological Fixes: As discussed, there don't seem to be many "silver bullets" out there ready to miraculously solve all our water problems. However, technological advance *is* ubiquitous, and we *can* do much better in terms of applying advanced technology and new scientific understanding and breakthroughs to manage and utilize our scarce water resources more efficiently. Just as we have mentioned in each of the last several sections, the broader application of new and advanced technologies also depends on higher prices - as water continues to become more scarce and more expensive, new treatment, distribution and consumption technologies will inevitably emerge.

For example, advances in soil moisture monitoring and new smarter irrigation techniques will contribute to important savings in agricultural water usage. More advanced and widespread residential metering technologies will help us all to be more careful and smarter about the way we use water. Improved infrastructure, and techniques for in-situ enhancement and extension of existing infrastructure will mean less water loss and wastage - and more water to be put to efficient use. New desalination technologies could provide virtually limitless new sources of clean water, but energy and environmental questions, and geographic limitations imply that this technology will only be practicable in certain fairly restricted areas. Mobile sea-going desalination plants may be able to address some of these environmental questions, and provide emergency supplies to population centers that are experiencing droughts or short-term breakdown in infrastructure. In summary, advancing technology can be a strong partner in solving global water problems, but it must be exploited in combination with more careful and conservation-minded attitudes, greater efficiency of use, and smarter policies and management approaches. Technology alone cannot be relied upon to solve our water problems.

f. Smarter Laws and Policies: Finally, we must begin to critically refashion long-standing policies, regulations and laws - indeed, our whole way of thinking about water. Some of the current regulatory structure, while well-intended, may create conflicts or unnecessary hardships, and may actually not protect us against many of the contaminants and health risks it was designed to avoid. Government subsidies, major Federally-funded dams, and interstate water distribution programs over the past hundred years were all undertaken for sound political or economic reasons at the time. However, they have also seriously distorted the workings of local market systems, and have led to usage and allocation decisions that may not be in the best interests of the country now. The whole arena of water resource ownership - the legal framework of both the prior appropriation and riparian water rights doctrines - is coming more and more to the forefront of water resource usage and management, particularly in the west.

If there is one single and inescapable conclusion resulting from all of this review and discussion, it must surely be the inevitability of continuously rising water prices over the longer-term future - indeed, the urgent need for rapidly rising water prices in most parts of the globe.

Although I have emphasized the local nature of water solutions, there are many broader and over-arching policy questions which we must begin to address in more of a holistic manner at the national and international level.

- Does our "command and control" type of regulatory approach protect water resource and human health in the most thorough and cost-effective manner?

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- Do our current approaches to water usage in the west - "first in time, first in right" - still make sense today, or do they as many critics argue, lead to inefficiency and wasting of scarce water resources? In much of the world, we are moving from an era of *water development* to an era of *water allocation*, and again the real debates and issues are often very localized.
- Do the interstate and intra-state compacts that were largely devised in the early part of the 20th century need to be revised? Are these compact agreements still reasonable and equitable many decades later - after vast technological and demographic changes. The political wrath and potential explosiveness of this issue was clearly illustrated when John McCain made an apparently offhand comment during the recent Presidential elections about reopening the terms of the 1922 Colorado River Compact.
- Does our whole legal system, as it pertains to water, need to be revamped to fit our modern industrial economy and today's demographics - instead of the largely uninhabited rural nation that existed when these laws were first devised?
- How will these issues be impacted by the potential impacts of climate change?
- Is there any practicable political way to make these sorts of changes possible?

This type of broader policy and legal review must be done at the federal level, or even at the international level. However, at the moment, the sheer number of different federal agencies involved one way or another with water tends to make policy coordination or change an almost impossible challenge. Presently, there are more than twenty federal agencies and entities that have authority over water issues - six cabinet departments, directed by thirteen congressional committees with some twenty-three subcommittees and five appropriations subcommittees that are in one way or another responsible for water-resource management. Hence, it is no wonder that federal water regulations and policies are sometimes confusing or contradictory. Consolidation of these responsibilities into some sort of coordinated department or commission would make the job of managing water resources easier. Most politicians say such consolidation of power and control is unlikely - but at some point it is going to become critical. A more likely approach might involve White House coordination of partnerships between federal agencies, and coordination with state and local agencies to create integrated water policies as part of a national framework.

Many other institutions, agencies and astute observers have put forth creative ideas and proposals in terms of concrete steps for dealing with water policy and legislation. For example, the Pacific Institute's Peter Gleick has made a series of recommendations to President Obama, including the development of a coordinated national water policy and the creation of a national bipartisan Water Commission - to review, update and coordinate water policies and regulations, and to promote new and creative vehicles to expand infrastructural investment. Gleick also draws attention to the impact of water-related issues on national security, the growing consequences of global warming, and the scientific and foreign aid role which the U.S. should strive to play in the deepening global water crisis.

Along a similar vein, the Office of Water in the Environmental Protection Agency has been promoting its "four pillar" approach to a more sustainable water infrastructure and system; better water management techniques, full-cost pricing of water, greater efficiency in terms of water production and usage, and more reliance on watershed-wide approaches to policy. Most of the proposed solutions to the world water challenge reduce down to similar conclusions and types of approaches.

g. Conclusion: Yes, water frequently falls out of the sky. Yes, three-quarters of our planet is covered with water. And yes, fresh water is abundant in many parts of the globe. But all that water is not always clean, it's often not where we need it, and it costs the world hundreds of billions of dollars a year to collect it, clean it, and move it around. The world's population has increased four-fold over the last hundred years, but we don't have a single drop of new water. These are the simple facts - but they are not yet recognized or understood by the majority of people, and they are typically not reflected in consumer water prices; hence, inefficient use and profligate waste continues. This status quo can not go on indefinitely.

To start thinking about water in a more holistic way, we need to look at our planet like the NASA astronauts were able to do - and view the earth as a self-contained and solar-powered desalination unit quietly floating through space. We need to better understand and respect the natural hydrologic cycle, and remember that we are a closed system - we can neither create nor destroy water. Sure, we can desalinate increasing volumes of salty sea water at high expense and marginally increase the amount of freshwater available for human consumption. And, on the other hand, we can and do continue to over-pollute and deplete some sources of freshwater to the extent that they are virtually unusable. But in the big picture - as viewed by those astronauts - the earth is a closed system. We need to get smarter about water usage, and we need to do it in a hurry.

Water prices *will* rise, and over time water *will* come to be viewed more and more as a true economic commodity - one that can be bought, sold, moved around like other commodities. At the same time, the "commoditization" of water obviously has to be balanced by equity and fairness concerns - everyone needs water to live, and there will always be some who will have difficulty affording it. Finding the right balance to this dilemma - *water as an economic commodity versus water as a human right* - will be one of the great economic and political challenges of this century. And we must develop new and more creative financial mechanisms which will allow hungry investors to put their money to work for the public good - better ways to connect growing investment interest with the huge capital requirements which are staring us in the face.

The facts are simple - water is an essential prerequisite of life, to sustain and improve our standard of living and our modern industrial economy - and *we are not going to find a substitute for water*. As the global water crisis intensifies, we face numerous and daunting political and economic challenges. The flip side of this coin represents virtually limitless opportunities for creative and innovative firms to help provide those needed solutions.

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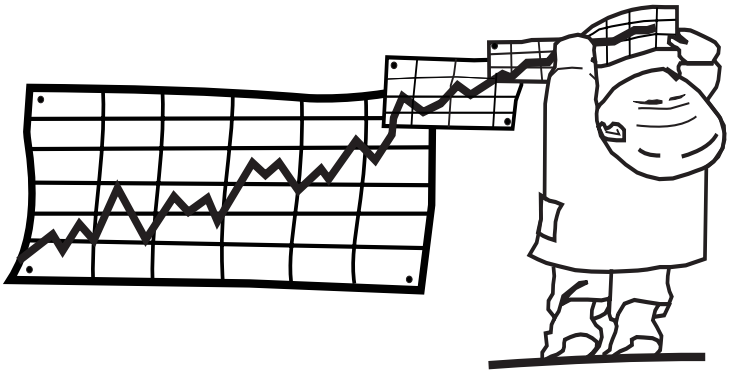

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ACCUTEST Laboratories

has acquired

Evergreen Analytical Laboratory, Inc.

We acted as Advisor to the Buyer

December, 2008

YSI

has sold its
Precision Temperature Group to

measurement SPECIALTIES

We acted as Advisor to the Seller.

March, 2006

ARCADIS

has acquired

Finkbeiner, Pettis & Strout, Inc.

We acted as Advisor to the Buyer.

June, 2003

GCAL

has been acquired by

3Stone Advisors LLC
(an affiliate of Stonehenge Partners)

We acted as Advisor to the Seller.

January, 2007

Lindsay Goldberg & Bessemer

has made a majority investment in

RECON Remedial Construction Services, L.P.

We assisted the Buyer in the Transaction.

May, 2008

water is...

Photo Captions

Front Page: South Atlantic Ocean, Western Cape Province, South Africa

Inside Cover: 1 – Yellowstone Falls, Wyoming; 2 – Pinnacle Rock, Galapagos Islands; 3 – Seattle Harbor; 4 – Maroon Bells, Aspen, Colorado; 5 – Mendenhall Glacier, Alaska

Back Page: 6 – Thirsty Children in the Turkhana Region of Northern Kenya; 7 – Terraced Rice Paddies, Indonesia; 8 – Hoover Dam, Nevada-Arizona Border; 9 – Canal System in Amsterdam, The Netherlands; 10 – Bellagio Fountains, Las Vegas; 11 – Thompson Lake, Maine; 12 – Water Lily, Island of Bali.

All photographs by Steve and Susan Maxwell

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