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Why a Water Soft Path, and Why Now

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Two roads diverged in a wood, and I took the one less traveled by,
And that has made all the difference.

Robert Frost

Water is essential for all life. An adequate supply of water has been critical to the foundation and success of civilization, from the first agricultural societies more than 5000 years ago to the industrialized mega-cities of today. But water is not always a blessing. Human societies have often been faced with water challenges – often too little and periodically too much. Long-term droughts, in particular, have had major impacts on the development of societies, as shown by some of the myths that pervade ancient literature. Until recently, however, concern about adequacy of the water supply on a *global scale* did not exist.

For the past 2500 years, perhaps longer, the practice of water management has been about the design and construction of an ever-larger and more complex infrastructure for water supply; building dams and reservoirs, digging or drilling wells, building cisterns and extending aqueducts, canals and pipelines to cities, factories and farms. This historical supply-oriented model is highly linear, with water literally flowing through our built infrastructure on a one-way course. At the tail-end of this system millions of litres of waste water are carried away from those cities, farms, factories and generating stations (and not always treated) to flow back into our rivers, lakes and oceans.

There is much to celebrate with the achievement of this approach, including the widely accessible and high-quality drinking water and reliable

sanitation that has allowed communities in middle- and high-income countries around the world to flourish. Vast amounts of clean water have been made available, whether for domestic needs in cities, for agriculture and industry or for more discretionary uses such as municipal gardens and parks, car washes and swimming pools.

Unfortunately, the era of 'endless' fresh water is coming to an end. Contrary to popular perceptions of water availability, less than 1 per cent of global water resources are actually fresh and renewable (Pielou, 1998). Moreover, geographic, geologic and economic considerations put much of that (relatively small) quantity out of our reach. We have already exploited the most easily accessible sources of fresh water and costs to develop additional supplies are increasing every year (Serageldin, 1995). By the turn of the new millennium, several fast-growing regions of the world were already withdrawing two-fifths to three-fifths of all available water (Raskin et al, 1996).

As a consequence, concern is increasing that the availability of water will become the greatest natural resource challenge of the 21st century. Humanity is currently facing the combined effects of a changing climate, ever-increasing urbanization and expanding population with impacts on the environment magnified by the quest for economic growth. Equally important, but less often noted, is the growing recognition that current water management practices are simply unsustainable and cannot continue to deliver the benefits they have in the past.

Take the case of Canada, commonly viewed as one of the most 'water-rich' countries in the world – a country in which most citizens have a strong belief in their entitlement to potable water (Biro, 2007; Sprague, 2007). In reality, even Canada is not exempt from water resource limitations. Much of that nation's fresh water is located in the Great Lakes, a non-renewable relic of melting continental glaciers. Only a small fraction of the total in the lakes is available for use without impairing their capability to provide the ongoing ecological goods and services that are the foundation for the prosperity of the surrounding region.

Approximately 60 per cent of the rest of the water in Canada flows northward toward Hudson's Bay or the Arctic Ocean, well beyond the reach of even the longest currently feasible pipeline (Sprague, 2007). Even if such pipelines *were* possible, the huge investment required to build them, in addition to the ongoing cost of energy to operate them, would make such a project unattractive to investors as well as violating a general societal reluctance to allow inter-basin transfers of water. Times have changed: Not so long ago it was believed that all water flowing to the sea was fully available for our use and, in fact, would be 'wasted' if not used for human benefit. Today, in contrast, a growing proportion of society understands that much of this supposedly available water must be left in place to support crucial ecological services such as waste dilution, habitat protection, flood control (in wetlands) and other ecosystem functions (Millennium Ecosystem Assessment, 2005; Katz, 2006).

Current water management practices are at an impasse and the symptoms of a 'sick' system are everywhere. Rivers that once ran free and clear are now sluggish or brackish. Water tables are falling. Aquatic habitat is no longer able to support the variety of flora and fauna that it once did. It is becoming increasingly common to find potential sources of water that are too polluted for most uses and communities are often forced to rely on water supplies that are unsafe for domestic use. Human society is thus faced with a serious conundrum. Our ability to provide an inexhaustible supply of 'cheap', safe, fresh water can no longer be met using the old methods, yet we are told that the demand for water will continue to grow.

Box 1.1 summarizes the kinds of water supply problems people and governments around the world are facing. The much-quoted statement by Marq de Villiers (1999) – 'The trouble with water is that they are not making any more of it' – is all too true, and its effects are upon us today. Even acknowledging that the global water cycle continues – the same amount of water flows now as in prehistoric times – is of little help when several regions of the world are withdrawing two-fifths to three-fifths of all available water (Raskin et al, 1996).

Going beyond concrete and steel

Peter Gleick was the first person to explicitly put forward the soft path for water as a paradigm shift in water management practice that would focus on demand rather than supply (1998). Since then there have been a number of others, including the majority of authors in this book, who have been promoting the adoption of a whole new approach to management – one that goes beyond simply 'saving water' and emphasizes *reducing demand* rather than *increasing supply*. This approach manages people – not the watersheds that house them – as the priority.

To find a lasting balance between a resilient and prosperous society, and a healthy and productive environment, a 21st-century approach to water management must move from a focus on large centralized reservoirs, higher capacity pumps and longer pipelines towards an emphasis on decentralized, smaller scale built infrastructure, alternative sources, such as rainwater collection, greater reliance on reuse and recycling, pricing and economic incentives and highly improved efficiency in water use, as the starting point.

This type of demand-oriented approach, often called *water demand management*, is a strategy that recognizes limits to the amount of water that can be withdrawn from nature and that searches for cost-effective measures to cut water use. Greater efficiency – 'more crop per drop' in the jargon of irrigation – can reduce the demand for water and save money. Common demand management measures for the home include full-cost pricing keyed to the amount withdrawn or used, water saving appliances, low-flow taps, showerheads and toilets, and drip or sprinkler irrigation. For example, well-designed, low-flow toilets can cut water use by about 75 per cent per flush, with further

Box 1.1 The problem

Peter Gleick

During the industrial revolution and population explosion of the 19th and 20th centuries, tens of thousands of monumental engineering projects were built to manage the natural hydrologic cycle and make water available to hundreds of millions of people. Thanks to improved sewer systems, cholera, typhoid and other water-related diseases, once endemic throughout the world, have largely been conquered in the more industrialized nations. Vast cities, incapable of surviving on local resources, have bloomed in the desert with water brought from hundreds and even thousands of miles away. Food production has kept pace with soaring populations largely because of irrigation systems that now produce 40 per cent of the world's food. Nearly one-fifth of all of our electricity is produced by turbines spun by the power of falling water.

But this supply-based approach has its limitations. As the easy sources of water have been tapped, new projects become more ambitious, intrusive and capital-intensive, and their costs, never small, become more evident. Half the world's population still suffers with water services inferior to those available to the ancient Greeks and Romans. One billion people lack access to clean drinking water; more than two and a half billion people do not have improved sanitation services (World Health Organization, 2008). Preventable water-related diseases still kill an estimated 10,000–20,000 children each day, and the latest evidence suggests that we are falling behind in efforts to solve these problems.

The effects of our water policies extend beyond human health. Tens of millions of people have been displaced from their homes – often with little warning or compensation – to make way for the reservoirs behind dams. Certain irrigation practices degrade soil quality and reduce agricultural productivity, threatening to bring an end to the Green Revolution. Groundwater continues to be pumped faster than it is naturally replenished in both developed and developing nations of the world. And disputes over shared water resources have led to violence and continue to raise local, national and even international tensions (see the 'Water Conflict Chronology' at www.worldwater.org).

Negative impacts on natural habitat are also significant. More than 20 per cent of all freshwater fish species are now threatened or endangered because dams and water withdrawals have destroyed the free-flowing river ecosystems where they thrive (Ricciardi and Rasmussen, 1999). On the Columbia and Snake Rivers in the US, 95 per cent of the juvenile salmon trying to reach the ocean do not survive passage through the numerous dams and reservoirs that block their way. More than 900 dams on rivers in New England and Europe block Atlantic salmon from their spawning grounds, and their populations have fallen to less than 1 per cent of historic levels. Perhaps most infamously, the Aral Sea in central Asia has been devastated because water policies in the former Soviet Union (and largely continued by current governments in the region) cut off most of the inflow. Twenty-four species of fish formerly found in the Aral Sea and nowhere else are now thought to be extinct.

We can no longer look to the past policies as a guide to future sustainable water management.

reductions possible if reclaimed wastewater, rather than drinking water, is used for flushing.

Increasing water costs greatly expand the potential for demand management. In fact, experts believe that cost-effective water savings of 20 to 40 per cent are readily available. A recent study of water use in California by the Pacific Institute (Gleick et al, 2003) and in Canada (Brandes et al, 2007) show that total urban (residential, commercial, institutional and most industrial) water use could comfortably be cut by at least 30 per cent using existing ('off-

the-shelf') technologies that are cheaper than new supplies of water. Equally important, this 'additional water' can be obtained more quickly than any new supply project can be built and brought on stream. The gains are great enough to eliminate the need for any new supply projects for the next several decades, even if California and urban centres in Canada continue to grow at their current rapid pace.

Demand management is, in fact, already used frequently by water system operators, especially in more progressive and integrated organizations but, in general, is usually employed only as a secondary or temporary option until additional supplies are secured. Most people are rarely aware of the need to moderate their water use until, usually in mid-summer, periods of low rainfall deplete reserves or reduce flow in wells, and temporary restrictions are imposed – typically just on lawn watering or washing cars and sidewalks with a hose. Such 'rationing' is almost invariably coupled with demands to build a larger supply system rather than an analysis of ways in which water demand could be reduced to more closely match availability. A striking parallel exists between this approach to water use and that for electricity and gasoline, both of which generally continue to be underpriced, at least in North America.

Demand management can no longer be viewed as a second-best or a temporary option. Moderating demand must become the priority for water managers, with new supply treated as the *back-up option* that is used only when absolutely necessary. In the face of current uncertainty and change, such as looming energy limits, rapidly changing climate and ever-increasing population and urbanization, reducing the demand for water through efficiency and conservation will simply be the best 'source' of 'new' water most communities have.

Travelling along the spectrum of water management

Demand management, as it is commonly practised today, starts from an emphasis on water efficiency and simple technical fixes (eg, low-flow shower heads, fixtures and appliances) and basic economic incentives (eg, volume-based pricing). Demand reductions achieved in this manner can typically be accomplished at less cost, more quickly and with less environmental damage, than any supply alternative. These savings can be characterized as the 'low hanging fruit' of demand management, and they will always have a role to play in any sustainable water management strategy.

These conventional efforts, though relatively simple, have a fundamental limitation. Because they are based on an *anthropocentric view* rather than an *ecosystem perspective*, they focus more on measures for water use efficiency, as defined by short-term cost effectiveness, than on long-term ecological sustainability. Moving towards a new water management paradigm will require society to ensure that there is a balance between water use and ecological sustainability over the longer term. This kind of comprehensive and integrated approach is called the *water soft path* and is the focus of this book.

Whereas 'traditional' water demand management is generally restricted to water efficiency, water soft paths (WSP) encourage *both* water efficiency and water conservation – two terms that are often used interchangeably but that are really different concepts (Brooks, 2005). Briefly, water efficiency focuses on ways to reduce the amount of water used to accomplish a specific task; water conservation focuses on ways to change the task so that use of water is reduced much further or eliminated entirely.

The key distinction between traditional programmes and WSP is highlighted by the core questions they pose. Demand management focuses on questions that begin with *How* – How to accomplish the same thing with less water? The soft path, in contrast, focuses on *Why* – Why use water to do this in the first place?

Why, for example, do we use water to carry away our waste? Demand management would urge low-flow toilets, but waterless or fully integrated resource recovery systems are available – perhaps not for homes (because of the technical requirements and the need for regular maintenance), but certainly for larger buildings, or networked systems that might exist at the neighbourhood scale. Why do we use half the potable water that is piped to a house in the summer for watering lawns and gardens and washing cars (and all too often the sidewalk (pavement))? Demand management would urge more efficient sprinklers with automatic shut-offs, maybe even watering on alternate days. The soft path goes further: recycling water from bathtubs and washing machines or, better yet, planting greenery that is drought resistant and that requires little or no watering once it is established, a technique called xeriscaping.[1]

By focusing on 'why', the soft path greatly increases the number of possible solutions. The approach is, of course, broadly applicable, not just to houses and gardens, but also large buildings, factories and farms – indeed across sectors – to entire cities and even complete watersheds and basins. Soft paths are therefore 'soft' partly because they require less steel, concrete and other resource-intensive inputs, but mainly because they depend on human ingenuity to find ways around current natural resource use patterns without losing the benefits of economic development that have improved the quality of life for so many people. The role of water management changes from just building and maintaining water supply infrastructure to also providing water related services, such as new forms of sanitation, drought-resistant landscapes, urban redesign for conservation and rain-fed ways to grow crops.

The ultimate goal of WSP is to permit economic and social development at rates, and by means, that are compatible with long-term ecological sustainability and democratic decision-making. Instead of relying exclusively on the use of physical infrastructure – pipes and pumps – to manage water demand, it looks at ways in which social engineering can be used to change water consumption patterns. This approach would engage individuals, businesses, communities and governments in a wide-ranging analysis of local water consumption patterns and the environmental impacts (upstream and downstream) associ-

ated with this level of use. The objective is to strike a balance between water consumption and the long-term preservation of the environment.

Widening the audience for water soft paths

This book is designed not only to introduce but also to promote the WSP concept as a viable alternative to the current approach to water management. While the principles involved with the concept are already gaining ground, they have mainly been communicated to niche audiences through articles in professional journals and focused presentations at conferences in Canada, the US and Europe; they have only begun to receive wider attention by more general water management professionals and the public.

The only complete analysis of water soft path options for specific ecological, economic and social settings has been undertaken in Canada, with that study presented in Part II of the book. Despite limited general exposure, the

BOX 1.2 SPECTRUM OF WATER MANAGEMENT

Oliver M. Brandes and David B. Brooks

This box illustrates the differing characteristics of supply management, demand management and soft paths across several key aspects, with Figure 1.1 demonstrating this relationship diagrammatically, revealing the likely water use outcome under each of those patterns of water management. This graphic clearly demonstrates that the soft path approach reaches a potentially sustainable level of water use because it is specifically designed that way from the start – ensuring that our demands on water as a source and the supporting environment as a sink do not exceed the carrying capacity of the ecosystem. How one gets to that position is the major concern of the analysis and, as is suggested (by the two lines) in this graphic, there is no uniquely appropriate soft path from here to there.

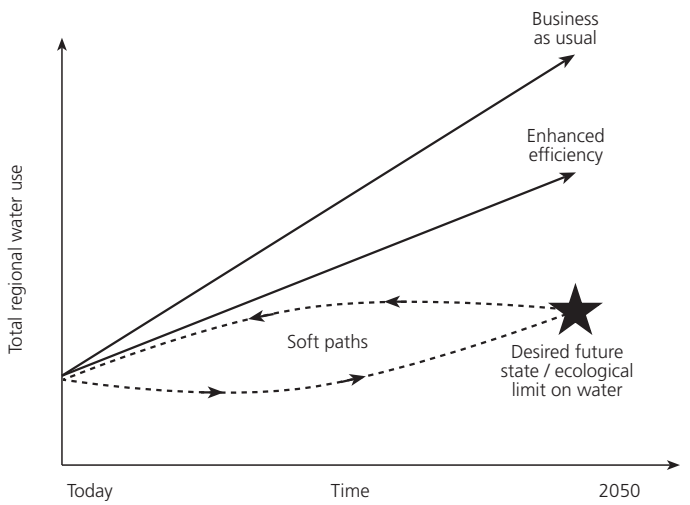

Figure 1.1 *Planning for the future with a soft path approach*

Box 1.2 *continued*

Policy	*Dominant discipline*	*Range of policy choices*	*Fundamental question*	*Planning process*	*Outcome*
Supply management	Engineering	Policies based on presumed need for new infrastructure.	How can we meet projected water needs given current trends in water use and population growth?	Planners extrapolate from current consumption patterns to determine future 'requirements' and then locate and develop new sources of supply to meet this projected demand.	Construction of dams, pipelines, canals, wells, desalination systems, and inter-basin transfers, where necessary.
Demand management	Economics	Policies based on short-term cost–benefit calculations.	How can we reduce needs for water to conserve the resource, save money and reduce environmental impacts?	Planners incorporate efficiency and information programmes together with improved pricing patterns to maximize use of existing infrastructure. Increasing capacity is only one option among others in a least-cost approach.	Efficiency gains through technical fixes and consumer education.
Soft path	Multi-disciplinary	Policies based on stakeholder consultation and political review.	How can we deliver services currently provided by water in ways that recognize the need for economic, social and ecological sustainability?	Planners model a sustainable future state for water use with attention to long-term economic and social prosperity. They then 'backcast' to devise a feasible and desirable path to reach that state. Ecological sustainability is fundamental to all economic, political and socio-cultural choices.	Options to reduce water use through innovation, conservation, water reallocation and changing patterns of use and reuse. More water is left in situ.

Source: Brandes and Brooks, 2007

concept of WSP is gaining momentum. A number of communities, notably those faced with an apparent need for expensive additions to their water supplies, have begun to explore the potential of WSP methodology to defer, perhaps permanently, new construction and to save money, while responding to public demands for environmental protection. Ecological sustainability remains somewhat lower on the list of priorities, but they are nevertheless moving in the right direction to achieve it.

As explored in Chapter 3 (Holtz and Brooks) the soft path for water concept is adapted from the energy field. Amory Lovins coined the term 'soft energy path' in a 1976 *Foreign Affairs* article and went on, in subsequent publications, to develop a whole new approach to energy planning. In fact, Lovins used the same quotation from Robert Frost to head his *Foreign Affairs* article that we have used to head this chapter, as it so appropriately captures the changes that he then wanted for energy, and that we, today, want for fresh water.

Four principles that make soft paths different

Soft path thinking seeks to be as open as possible about the principles on which the concept is based and that drive soft path analysis. Four principles stand out as specifically distinguishing the soft path from conventional water planning and management:

1 treating water as a service rather than an end in itself;
2 making ecological sustainability a fundamental criterion;
3 matching the quality of water delivered to that needed by the use;
4 planning from the future back to the present.

Treating water as a service

Of all the innovations that Lovins brought to the field of energy analysis, perhaps the most significant was his recognition that energy is not needed for itself, but for the services it can provide; that is, that it is an intermediate rather than a final good. The same is true for water, or at least for most water. Instead of being viewed as an end product, most water is the means society uses to accomplish specific tasks, such as carrying away wastes, cooling motors or promoting plant growth. Drinking water is a quantitatively small but obviously critical exception; in that case, water is an end in itself. Changing the concept of energy or water from *ends* to *means* is critical to all soft path thinking, and it recognizes that water has been seen differently, at different times, and by different groups, throughout history (Linton, 2009).

This change of perspective liberates water planners and managers from the constraints of merely supplying more water and permits them to innovate by identifying alternatives to water-based services. One example of this approach would be to ask whether flushing toilets is an objective in itself or whether we are really looking at how to remove human waste. Another would redefine the objective of irrigating crops to one of growing food. If this approach allows us to meet our actual needs using less supplied water, we have the potential to cut costs, protect the environment and enhance local control.

When water is viewed as a service, it becomes easier for managers to expand their focus beyond traditional technologies and infrastructure. They are more likely to innovate and engage broader society by, for example, promoting education and social marketing, urban redesign for conservation

and different modes of farm management. Changing practices and behaviour offers an increased range of options to reduce water use while maintaining desired services.

Ensuring ecological sustainability

Ecosystems are paramount in any discussion of water use but their position is typically ignored because they cannot speak for themselves. Soft paths recognize *ecosystems* as legitimate 'users' of fresh water and aim to include the value of water needed to sustain ecosystems (and indeed all of us) in the overall assessment of water supply costs. The work of the Millennium Ecosystem Assessment (2005) validates this approach. For example, the Assessment looked at the ecosystem services provided by wetlands and attempted to calculate the economic value of unconverted wetlands versus that of converted wetlands. It was found that the *total economic value* of unconverted wetlands is often greater than that of converted wetlands – that is leaving water in its natural state may be more beneficial to society than extracting it for commercial use. It certainly is a superior option for the plants and animals that inhabit that ecosystem.

Conventional cost–benefit analysis is not sufficient to ensure basic ecological resilience and ecosystem health. Therefore, in soft path studies, environmental constraints are built in from the start to limit the amount of water withdrawn from natural sources and to establish conditions on the quality of water returned to nature. Of the many possible soft paths that exist, each is tested for its effects, and any option – be it source or use – that puts environmental sustainability at risk must be rejected. Major inter-basin transfers of water are not considered acceptable; they contradict the objective of living with the water you have. Similarly, if there are water resources that are valued for their beauty or for their cultural or religious significance, they must be placed off-limits for development. Cost–benefit analysis is only employed once a number of viable options are found, to help identify those that would be cheaper to follow or have other advantages.

Conserving quality as well as quantity

Water quality requirements vary with end-use. A contaminant that is toxic for one use may be benign or even beneficial for another. We don't want animal waste in our drinking water, for example, but we eagerly seek it for gardens and farms. Yet, in most of the Western world, we still flush toilets with drinking water and also use it, in many areas, for irrigating gardens and crops. For both economic and physical reasons, it is almost as important to conserve the quality of water as to conserve its quantity. High-quality water (think of it as drinking water) occurs much less frequently in nature and is much more expensive to deliver to users than lower quality water. Fortunately, we only need small quantities of this high-quality water (mainly for households and special industrial tasks), but huge quantities of lower quality water (such as for irrigation on farms and cooling at generating stations and industrial plants).

Soft path options are designed from the start to match the quality of water supplied to the quality required by the specific end-use. The goal is to create circular cascading systems so that wastewater from one use becomes the input for another use – for example, from rainwater capture to the washing machine and then to the garden, or from cooling systems to water for cleaning or other industrial uses, then treated and recirculated.

Looking ahead by working backwards

Soft paths require a set of policy changes and programme plans that will, over time, move society along the road toward water sustainability in patterns that are consistent with economic prosperity and a high quality of life. The way that route is built is another unique characteristic of the soft path approach. Traditional economic or development planning starts from the present and projects forward to the future. Soft path planning does just the opposite. First it defines a sustainable and desirable future state for society, at least as far as water sources and uses are concerned. It then works backward to identify policies and programmes that will connect the future to the present. This technique is called '*backcasting*' in obvious contrast to forecasting, and it is the most important and the most challenging part of soft path analysis and planning.

Backcasting is not so strange an exercise as might first appear. Think of planning a holiday. One does not leave home and wander aimlessly. Rather, you first choose a destination and then plan your itinerary according to a specific set of priorities. Are you interested in travelling on the more scenic routes or do you want to make the trip in the shortest time possible? Are there other travel options that you need to take into account? Backcasting is a similar iterative process. You do it over and over until reasonably satisfied that the goal can be achieved in the most cost-effective and agreeable way possible. Suppose a community decides that no new water sources will be developed before 2050. The desired condition in this case is that all future water needs for population and economic growth will be met through efficiency and conservation. The initial choice sets in motion the strategic thinking needed to implement policy and programme alternatives to ensure that this end result can be met. But the destination and the goal are clear.

By their very nature, soft paths are a long-term approach to water management. They do not ignore the past we have come from, and they allow time for gradual replacement of the existing physical infrastructure, a factor that can be determined, with a reasonable degree of accuracy, by engineering and economic considerations. This longer time horizon also allows for the gradual evolution of new norms of behaviour or forms of social 'infrastructure', neither of which is easy to anticipate when thinking about the future. Due to the long time frame involved, soft path scenarios for water must also allow for the possible impacts of climate change, such as changing precipitation patterns, longer drought periods, and increased rates of evaporation. The process of developing scenarios by working back from the future allows these kinds of

potential impacts to be incorporated in water planning today, but also adjusted over time.

Soft paths and values

The analysis underlying soft path planning does not generally yield a single, best path. Rather there are likely to be a number of paths that vary in the specific social patterns assumed and the specific applications of water use permitted, both of which are of course highly political choices. Notwithstanding the above limitations, soft path analysis has significant benefits. It can be used to identify possible paths, describe their advantages and disadvantages (and, if quantifiable, their benefits and costs), and suggest the likely level of social acceptance and political feasibility associated with each path. It is up to society as a whole, operating through democratic and participatory means, to choose the path most appropriate to its collective values, which is not the task of the analyst.

The strategies that emerge from a soft path plan are explicitly value laden. Supply-based policies are also value laden, but these values are less obvious because they are based on existing policies and status quo approaches. Soft path strategies pay attention to costs but also include ecological sustainability and societal engagement as fundamental criteria. The soft path defines a future, sustainable society in value terms. Implicit in this approach is the assumption that the decisions we make today – identifying new actions, policies and reforms – can, in fact, influence future water consumption patterns and the institutional arrangements that drive them.

As with any strategic plan, soft path planning is not designed to be a one-time event. Rather, it is an iterative process in which assumptions are revisited regularly as new industries arrive, values shift and climate changes. Periodic review (every five or so years) will identify new options and result in policy refinements. However, if the strategy and goals are clear from the start, the smaller adjustments, such as updating demand management technologies or population growth rates, will be relatively easy to accommodate.

Three aspects of soft path thinking

All soft paths, whether for energy, water or any other natural resource, have three key aspects:

1 *human vision* of a different future in which human activity and ecological protection exist in a mutually supportive and sustainable way;
2 *analytical method* for defining and demonstrating the 'feasibility' – a term that itself requires careful definition – of a route between the present and the envisioned future;
3 *planning tool* for water managers, engineers, planners, politicians and community leaders to discuss, design and ultimately implement steps that

will move communities, companies and organizations along the route toward that desired future.

These three aspects provide the organizing structure for this book.

Part I: Water Soft Paths as Human Vision

The vision goes back many millennia. Classical religious texts are highly sensitive to environmental issues, and those originating in the Middle East, as with the Hebrew Bible and the Koran, are particularly so with respect to water. Unfortunately, environmental aspects of the religious vision were neglected for most of the last two millennia. Only in the second half of the 20th century did it again came to the fore, heralded by such seminal works as Aldo Leopold's *A Sand County Almanac*, Rachel Carson's *Silent Spring*, and Jay Forrester's *Limits to Growth*, among others. Because they embody the philosophy of sustainability, soft paths are more than just 'how to'; they are incomplete and likely to be ineffective unless they incorporate the vision that must guide society as it faces the challenges of the 21st century. In a general sense, the vision guiding the water soft path can be seen as the water component of a broader vision of sustainability for a community, a city or a nation. Because soft paths focus on demand, they are inevitably inward looking and focus on a particular jurisdiction or region or watershed. As such, they are equally incomplete and likely to be ineffective if they do not also incorporate important social goals such as full employment and equitable distribution of political and economic power, and attention to issues of governance such as ensuring democratic and participatory decision-making, and community engagement.

This vision aspect of the soft path is captured in Part I of this book which explores the philosophical and theoretical underpinning of soft paths and, in so doing, provides the foundation for the remainder of the book. In Chapter 2, Robert Sandford uses the analogy of a 'perfect storm' to illustrate how human use, overuse and abuse of natural resources are contributing to climate change, and how the resulting ecological effects are likely to work in a vicious circle to magnify the adverse impacts on most life forms, and on our economy in the absence of immediate changes of the type proposed by soft paths. He challenges us to 'follow the water' suggesting its importance in our broader social and ecological systems. The focus turns more directly to the origins of soft path thinking in Chapter 3 where Susan Holtz and David Brooks, who were collaborators on the Canadian soft energy study in the early 1980s, describe how the concept of water soft paths evolved from work on soft energy paths; they go on to review the history of soft energy paths to illustrate some of the opportunities and pitfalls for water soft paths.

Unfortunately, the route toward water soft paths is anything but smooth. In Chapter 4, Peter Gleick identifies a number of misconceptions and misunderstandings about water soft paths, all of which are both widely held and demonstrably wrong. Wrong they may be, but, as he also points out, they continue to inhibit the adoption and impede the implementation of water soft

path policies. In Chapter 5, Oliver Brandes looks at the emerging field of ecological governance and shows why it has much to offer in overcoming persistent institutional and social gridlock as well as in helping to move society towards sustainability. This chapter shows how the development of water soft path strategies can act as a catalyst in this process. The adoption of a sustainable water management model will almost certainly discomfit entrenched interests and will displace workers in some industries, but the inevitable upheaval will only worsen the longer we remain fixated on past practices and status quo options. Finally, with Chapter 6 Susan Holtz concludes the section on the vision aspect of the water soft path by looking at water policy as it is commonly conceived. She suggests that the most crucial institutional reform needed involves the relationship between water management and land use planning which falls under the purview of municipal or rural district levels of government. She notes that senior levels of government must play their part by developing appropriate water use standards, policies and guidelines to support efforts at the lower levels.

Part II: Water Soft Paths as Analytical Method

The analytical method for water soft paths is much younger than the vision. As noted above, it was initially developed for energy in the 1970s. Later, as the concept of sustainable development gained currency in the late 1980s, soft paths became its analytics. The objective of this analysis was to show that the water soft path could move beyond its philosophical roots to practical applications of sustainability on the ground. An Annex to the book provides a step-by-step summary of how soft path studies are undertaken; some readers may prefer to read this annex prior to the more detailed discussions in the chapters that follow.

The first complete application of the general soft path analysis anywhere in the world was undertaken in Canada between 2005 and 2007 for one generalized urban area, one watershed and one province, and this study provides the content for Part II of this book. In effect, the chapters in Part II represent a set of case studies of water soft path analysis at three geographic and administrative levels, each with advantages and disadvantages. Taken together, they show that, despite serious deficiencies in our information about how water is used, it is possible to carry out a meaningful soft path analysis and to derive relevant policy conclusions.

Chapter 7 by David Brooks and Susan Holtz describes the methodology of soft path analysis. The chapter first shows how the principles of water soft path analysis differ from conventional natural resource studies in general and from soft energy analysis in particular. After defining the conceptual differences between soft paths and demand management, the chapter concludes by introducing the Canadian water soft path study. Those who want a brief overview of the Canadian study could read just this section.

Chapter 8 by Carol Maas and Tony Maas provides the first published description of the model developed at the University of Victoria's POLIS

Project to help with urban analysis in several parts of the study. Dubbed 'Scenario Builder', the model facilitates a systematic determination of water savings possible when integrating a range of urban water efficiency and conservation measures into a comprehensive plan. In recent years the Scenario Builder has been expanded to calculate the differences in greenhouse gas emissions associated with each scenario as a further incentive to help drive water conservation (see poliswaterproject.org).

Chapters 9, 10 and 11 present, respectively, the urban, watershed and provincial dimensions of the water soft path study.

- In Chapter 9, Oliver Brandes and Tony Maas at the University of Victoria investigate future water use in an urban centre that grows from a population of 200,000 in 2005 to 300,000 in 2050. Their work is based on a variety of real cases across Canada and is probably applicable to much of the developed world. The study shows that the goal of 'no new water' is achievable, even under conditions of significant population growth. A powerful conclusion can be drawn from this work: Existing urban water use patterns and habits need not dictate the future.
- In Chapter 10, Lisa Isaacman and Graham Daborn at Acadia University look at water use in the Annapolis Valley of Nova Scotia as an illustration of water issues found in rural, agricultural areas of Canada. Located in a maritime region, superficial views suggest that water resources are adequate. However, seasonal rainfall variations and increased demand deplete aquifers and degrade surface water. As shown by their analysis, the application of soft path measures together with better use of rainwater would all but eliminate the prospect of unsustainable water use.
- In Chapter 11, Paul Kay and Elizabeth Hendricks at the University of Waterloo ask whether water soft path planning could enable Ontario, Canada's most industrialized province, to avoid the need for new water sources until, at least, 2031. They found that, even with soft path policies, both the agricultural and the industrial sectors might use more water in 2031 than today. Therefore, to achieve the goal of no new water by 2031, the province would have to induce farms and industrial plants to adopt more water conserving methods or encourage a shift in crop choice and industrial structure.

Part III: Water Soft Paths as Planning Tool

Part III takes up the story of the way in which the vision and the analysis of soft paths can be converted to planning tools, first in urban areas and later elsewhere. Its focus is the practical application and implications of the soft path approach. This section also provides the opportunity to look at soft path thinking in other parts of the world: the US and some other relatively rich countries, as well as a number of developing countries. The point in these chapters is not to look for current formal applications of soft path analysis, but to identify the kinds and sources of emerging thinking that not only contain

aspects of the soft path thinking but could also support future soft path innovations.

In Chapter 12, Sarah Jordaan, Carla Stevens and David Brooks categorize the kinds of institutional barriers that slow down, and in some cases block, policies aimed at promoting efficiency and encouraging conservation. They define barriers as specific impediments that make it difficult or undesirable to implement policies, yet are correctable by appropriate government or institutional action.

In Chapter 13, Sarah Wolfe and Kurtis Elton point out that soft path elements of water management have not received much attention from municipal planners and engineers. In order to investigate this gap, they surveyed specific water management strategies already undertaken by municipalities and the extent to which they fit within a soft path framework. Informed by a theoretical structure based on social capital and the nature of intrinsic knowledge, the responses to the survey indicate that the foundations for a shift toward a soft path do exist in municipal water practitioner networks, and that aspirations for a sustainable future are more widely shared than is apparent.

Chapter 13 is complemented by Chapter 14 in which Andrew Hellebust reviews opportunities for designing and building less water-intensive buildings and neighbourhoods. Even at the one-building scale that characterizes most wastewater reuse projects in Canada, unexpected benefits have become apparent, including reduced life cycle costs, longer life of existing infrastructure and reduced time in the approval process. However, big gains will only come when reuse is employed at the block or even community scale. The water and nutrients contained in wastewater are resources that can benefit agriculture and the environment, but technology has to shift focus from dilution to recovery.

The next three chapters go beyond the specific practical applications of the concept and reveal the extent to which elements of water soft path thinking are taking hold around the globe. Peter Gleick begins with a review in Chapter 15 of water soft path approaches in the US, where an active debate about future water policy is driven by both shortages and environmental concerns. He notes that, for the first time in history, water use in the US is declining – not just in per capita or per dollar terms but in absolute numbers. He also demonstrates the immediate gains available from demand management; for example, the State of California could reduce water use by 30 per cent or more at lower cost and in far less time than building new capacity.

Chapter 16 extends the review globally and contains short reviews of the initial (and typically implicit) elements of water soft path thinking in three OECD countries or regions:

- Gareth Walker reviews recent experience with water privatization in England, and suggests that the government needs to embrace water soft path policies and adapt its regulatory approach to them if privatization is to overcome social and environmental externalities as well as financing problems related to valuing capital and operational costs.

- Simone Klawitter focuses on several aspects of the European Water Directive, currently being implemented across the European Community to achieve a more demand-oriented water policy, and finds that many aspects are indeed conceptually and practically consistent with the approach outlined in this book.
- Henning Bjornland and Geoff Kuehne describe how multi-year drought in Australia is driving innovative solutions such as water markets as part of a broader reform that puts the limits on excessive use of water and protection of aquatic ecosystems in the forefront.

Chapter 17 contains short reviews of the initial (and at this time very limited) elements of water soft path thinking in three developing countries or regions:

- Inga Jacobs and Tony Turton review recent water history in South Africa, and particularly the dominance of irrigation as a form of water use; they find substantial change in the institutions managing water, and wider recognition of the need to protect water in situ, but that more fundamental reforms are still forthcoming.
- Sara Ahmed looks at one region of India where the key issues are equity, both among classes and between sexes. She emphasizes effects that long-standing inequity have had on water productivity, and on the varying effects – mostly good, but some less so – reform will have for women.
- David Brooks writes on the Middle East and North Africa, where water scarcity has been a chronic problem throughout written history; he finds that demand management and participatory irrigation management are gaining ground, but not nearly fast enough to overcome current problems and certainly not fast enough to be described as a water soft path.

Conclusion

The book concludes with a look back and a look forward by David Brooks, Oliver Brandes and Stephen Gurman in which they ask: 'What have we really learned from the concept of water soft paths?', and 'How might the future differ from the past if the soft path approach is adopted?' They emphasize that citizens and their governments must be willing to rethink the ways in which our freshwater resources are supplied, distributed and, most importantly, used, to avoid an arid future of our own making. In their view only the soft path offers a way to guide current water management practice onto a sustainable path for long-term ecological and social prosperity. They recognize, however, that soft paths, which require deeper changes in lifestyles and livelihoods than more conventional demand management approaches, should be applied with great caution in those parts of the world where equity in access to water and democratic decision-making cannot be assured. Though they believe strongly in the potential for water soft paths and ecological governance, they conclude that parallel social and political values, including democratic decision-making,

equity in political and economic power, and broad public participation in decisions about water use and environmental protection, are not just equally important, but inherent components of water soft paths.

Note

1 Sandra Postel (1997, p159) describes xeriscaping as follows: 'From the Greek word *xeros*, meaning dry, Xeriscaping designs draw on a wide variety of attractive indigenous and drought-tolerant plants shrubs and ground cover to replace the thirsty green lawns found in most suburbs. A Xeriscaped yard typically requires 30–80 per cent less water than a conventional one, and can reduce fertilizer and herbicide use as well. One study in Navato, California found the Xeriscaped landscaping cuts water use by 54 per cent, fertilizer use by 61 per cent and herbicide use by 22 per cent.'

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