Keynote Address Delivered at Opening Session of Cities of the Future 2010 / Urban River Restoration 2010 on Monday, March 8, 2010

Cities of the Future: Improving the Machine and Tending the Garden

Paul R. Brown, Executive Vice President, CDM

March 8, 2010

I would like to add my welcome to those we have already heard – especially on behalf of the IWA Cities of the Future Steering Committee, which I co-chair with Dr. Kala Vairavamoorthy of Birmingham University in the UK. I also want say how enthusiastic I am about holding this specialty conference together with the Urban River Restoration 2010 conference. It is both fortuitous and significant that this joint conference brings together two communities that are striving towards shared goals from slightly different initial perspectives.

Because many of the topics and issues we will be discussing are uniquely associated with specific geographies and cultures, I should say that most of my experience as a water resources planner has been focused on the arid and rapidly-growing Southwestern United States. I live in Southern California. So please consider my remarks in that context – for better or for worse.

In spite of any differences between our local conditions and situations, however, we have much in common. Most of us believe that water is the central organizing element of a healthy and sustainable urban ecosystem. And while we all know that adequate supplies of high-quality water are essential for life itself, we are seeing its importance to the health of the urban environment as a whole – beyond our needs as individuals. The sustaining life-blood of the urban ecosystem is water. And our emerging understanding regarding the health and sustainability of cities as ecosystems presents significant challenges to our thinking, our expectations, and our roles in the development and protection of the urban environment.

In this context, many cities are fundamentally redefining the function and purpose of their water infrastructure. My colleague Vladimir Novotny argues that an entirely new model or paradigm of urban water management is emerging as a response to these needs.

In the preface to our book "Cities of the future: Towards integrated sustainable water and landscape management," we address the emergence of a fundamental change in our conceptual model of how water should be managed in cities:

> “. . . the fifth paradigm of urban water management . . . adopts a holistic, systems approach to the urban watershed, rather than a functionally discrete focus on individual components (drinking water, sewage, stormwater) characteristic of earlier models.
>
> “This . . . will evolve from . . . the total hydrologic water and mass balance where all the components of water supply, stormwater, and wastewater will be managed in a closed loop.
>
> “One of the goals of the fifth paradigm is to develop an urban landscape that mimics but not necessarily reproduces the processes and structures present in a predevelopment natural system …relying on reduction of imperviousness, increased infiltration, surface storage and use of plants that retain water.…interconnected green [spaces] . . . around urban water resources…[and] storage-oriented drainage with less reliance on underground conduits and more surface storage, infiltration and flow retardation.”

There is a growing belief that urban water infrastructure should be doing something very different from what it has done in the past.

Broadly stated, the natural and built environment within urban watersheds is being reconfigured to restore hydrological and ecological functions, provide for the water needs of the community, and maintain the health of people and habitat – with less reliance on energy-intensive, ecologically damaging imported supplies or exported surpluses and waste products that use water for carriage. These system-level changes, which comprise greater levels of integration and far-greater operational complexity, are emerging in various forms throughout the world.

At the same time, technology breakthroughs in both water and energy are providing radical improvements in the efficiency and flexibility of the mechanical components available to us. Advances are occurring on many fronts. Some of the most noteworthy are taking place in treatment processes that employ membranes and nanotechnologies in lower-cost, more energy-efficient ways. The progress is extraordinary and promises life-changing benefits for the world. But the high-tech improvements in water quality are not the only new frontier.

Green infrastructure that is based on landscape design and the restoration of ecological functions in urban spaces reflects a counter-point to the advanced hardware of water treatment. Together, the combinations of functional landscape and flexible treatment technologies allow for an almost infinite combination of cost-effective approaches to restoring the integrity of urban ecosystems.

The pursuit of technological innovation is generally narrow and deep. It literally looks through a microscope at the molecular level. When we gather to discuss “cities of the future” on the

other hand, we are putting away the microscope, stepping out of the research laboratory, and rising to a higher level perspective.

We are asking ourselves, "How will these innovations be applied in the world?" Technology breakthroughs can take us down more than one path: either a high-performance version of "business as usual" – much improved "machines." Or, they can contribute to a transforming vision of an emerging new paradigm.

We should not take for granted how the new technology being developed around us will be employed in the future. It can either extend the status quo or open new possibilities. I thought that this choice was well articulated in an article in the *New York Times Magazine* several years ago. Written by Elizabeth Royte, it described her visit to the Groundwater Replenishment System facilities in Orange County California, a project that is designed to treat 70 million gallons per day of secondary treated wastewater to above drinking water standards, and uses it to both recharge the county's potable groundwater supply as well as maintaining a groundwater barrier against salt water intrusion from the Pacific Ocean. This project was designed by CDM, and I served as our firm's principal-in-charge. So needless to say, I was pretty interested in what she had to say. In her concluding remarks, she offered the following observation:

> "You could argue that in coming to terms with wastewater as a resource, we'll take better care of our water. At long last, the "everything is connected" message, the bedrock of the environmental movement, will hit home. In this view, once a community is forced to process and drink its toilet water, those who must drink it will rise up and change their ways. Floor moppers will switch to biodegradable cleaning products. Industry will use nontoxic material. Factory farms will cut their use of antibiotics. Maybe we'll even stop building homes in the desert.
>
> "But these situations are not very likely. No one wants to think too hard about where our water comes from. It's more likely that the virtuosity of water technology will let polluters off the hook: why bother to reduce noxious discharges if the treatment plant can remove just about anything? The technology, far from making us aware of the consequences of our behavior, may give us license to continue doing what we've always done."

Well that's the question: will we "continue to do what we've always done?" The two paths presented by Royte are evident in our own professional activities. We look for ways that new technology can make old solutions more efficient and durable – and that is valuable and appropriate. At the same time, we catch glimpses of the fundamental change that could result from combining innovative technological tools to achieve entirely new design objectives.

Furthermore, we are inspired by the thought that changes in behavior, values, institutions, legal systems, regulations, professional disciplines, and academic curriculum could significantly improve the quality of life and environment within an urbanizing world. Our aspirations are transformational and far-reaching and involve fundamental change to traditional models. We aspire to do more than simply "improve the machine."

"Cities of the future" is an agenda that explores that second path. That strives to make significant progress towards reshaping cities by addressing the dynamic processes that steer development and eliminating the barriers that prevent change over the long run.

So let me pause briefly and expand on the concept of "urban process," an idea that is well described by Spiro Kostof in his book "The City Shaped: Urban Patterns and Meanings through History." He explains it in the following terms:

> "The tendency all too often is to see urban form as a finite thing, a closed thing, a complicated object. I want to stress what we know instead to be the case – that a city, however perfect its initial shape, is never complete, never at rest. Thousands of witting and unwitting acts every day alter its lines in ways that are perceptible only over a certain stretch of time. City walls are pulled down and filled in; once rational grids are slowly obscured; a slashing diagonal is run through close-grained residential neighborhoods; railroad tracks usurp cemeteries and water-fronts; wars, fires, and freeway connectors annihilate city cores."

While we are rapidly improving the performance of those finite objects that are the component parts of cities (better buildings and more efficient hardware), we are not spending enough time on the processes that drive the behavior, adaptive capacity, and the long-term resilience of the whole. Cities evolve as a result of the collaboration and conflicts that exist among citizens, elected officials, local authorities, regulators, developers, businesses, and institutions – the long list of interests and stakeholders active in every community. This community of interests and hopes and needs is not a machine. It is itself a fundamentally natural system supported by a built environment and made up of people, vegetation, animal life, and the natural resources of water, air, and energy that sustain them.

Furthermore, cities function as more than human habitat. They are where people are born, live, learn, work, shop, play, create, compete, pray, and are finally laid to rest. Cities support every level of human need, aspiration, and potentiality – from the most basic need for potable water to the lofty goals of spiritual fulfillment. To expect that our cities will subordinate all of these aspirations in order to create an optimal urban ecosystem with a perfectly balanced water cycle would be naïve at best.

And yet, how foolish would it be to continue enforcing standards established in the nineteenth and twentieth centuries, if change could improve the sustainable functioning of natural systems within the built environment. This is especially true since we know that we can shorten the distance between where we obtain water and where we reuse it, we can reduce or eliminate the runoff originating from buildings and paved surfaces, we can minimize the waste created and introduced into the environment, reduce the energy consumed in making all of this happen, and introduce renewable energy sources into our lives and economies. We can do these things. In many places, we are doing these things. When they become institutionalized practices in government, industry, and academia, we will have gone a long way towards achieving our vision of a sustainable world.

Let me close with three observations regarding: (1) how we address urban process, (2) the relationship between land-use and water resources planning and development, and (3) the pace of change.

First, in my view Spiro Kostof is right, it is fundamentally wrong to think of an existing city, in its entirety, as something we can design, control or perfect – we can only control the pieces and parts, and only as long as they are in our hands. So, if we need fundamental changes in the way things work in order to conserve and protect resources for the future, we must talk about how to guide urban development so that the sum of the decisions made results in what we would like to see tomorrow, not what we learned from the Romans.

Of course not all cities develop in a purely spontaneous, geomorphic manner. Well planned and thoughtful eco-cities are being designed and developed in Asia, the Middle East, and elsewhere. You will hear about some of these initiatives at this conference. They represent bold and important experiments in sustainable urban design. But they are the exceptions, and they will only be perfect in their initial concepts, forms and shapes.

Most of us live in cities that are much more organic and spontaneous in their growth and development – the result of both "witting and unwitting acts." At the same time, we are seeing massive growth in mega-cities that combine dramatic economic expansion with the proliferation of under-served informal settlements which consume very little by way of water and energy but which are unsustainable in the face of health risks and the extreme events which threaten their low-lying and largely coastal locations.

So what are reasonable objectives for those of us working together under the rubric "cities of the future"? If we agree that cities, as a whole, are not designed objects like buildings, bridges, and water treatment plants, then to influence their shape and performance through time, we need to reach out and encourage a dialogue that engages the many actors and enablers who influence urban process – the building commissioners, real estate developers, business

interests, fire marshals, academic institutions, religious groups, and most importantly the citizens and residents who shape the growth and development of our cities and communities.

We need to share insights from many different perspectives and disciplines focused on urban infrastructure and the environment, searching for ways those future cities can achieve all of their complex functions while being less dependent on external resources, energy, and remote locations to dispose of waste – cities with healthier metabolisms, stronger, more resilient, more self-sufficient in the world.

Second topic: let me speak briefly to the differences between land use planning and development – on the one hand, and water resources planning and development on the other. I have been interested for some time in the inherent distinctions between these two co-existing urban activities. I gained some insight from a description of the differences between how natural systems generally work and how human-designed systems function contained in a book by Steven Vogel entitled, *Cats' Paws and Catapults: Mechanical Worlds of Nature and People,* published in 1998.

> "Natural and human technologies differ extensively and pervasively. We build dry and stiff structures; nature mostly makes hers wet and flexible. We build of metals; nature never does. Our hinges mainly slide; hers mostly bend. We do wonders with wheels and rotary motion; nature makes fully competent boats, aircraft, and terrestrial vehicles that lack them entirely. Our engines expand or spin; hers contract or slide. We fabricate large devices directly; nature's large things are cunning proliferations of tiny components."

Vogel's description clarified for me the challenge of integrating our existing structural solutions with functioning natural systems in an urban environment. It also highlighted to me the fundamental differences between those of us focused on water resources planning and our colleagues in land use.

In the spirit of Vogel's elegant comparison, let's contrast the differences between land and water when it comes to planning and development. They are so basic that they frequently inhibit communications among individuals and institutions that share common goals and values, but work in worlds organized by these fundamentally different intellectual frameworks.

Land-use planning is about establishing the ownership, location, and uses of solid property; water resource planning is about managing the movement and use of a fluid through the liquid phase of the water cycle. Land use planning is essentially dry; water resources are wet. Land is largely fixed and finite; water is generally moving and renewable. Developed land has many flat, hard surfaces, straight lines, and right angles; water wants to flow downhill on curving paths that follow natural topography, often disappearing below grade and reappearing somewhere

else. People bring land to life through the application of civil engineering. Nature brings life to land through the medium of water.

I could go on at length regarding the historical and economic drivers that have perpetuated these differences between those of us who develop land and those that manage water. Suffice it to say that we must learn from each other and integrate our understanding of what we want to accomplish together in the future if our common goals are to be successfully achieved.

Finally, the topic of time and the pace of change that we would like to see happen – particularly given the urgency we all feel about achieving radical, resilient, and lasting improvements to our urban environment and the quality of community life. I often close talks like this by challenging our industry to produce transformational changes similar to those resulting from the worldwide adoption of wireless communications technology. But I have concluded that there is a flaw in that analogy, and it has to do with the increasingly long time-scales that apply to changes taking place in technology, business, infrastructure, governments, culture, and nature. If you are interested in pursuing this concept further, I would point you to Stewart Brand's 1999 book entitled, *The Clock of the Long Now: Time and Responsibility*. As he points out, the advances we continue to see in information technology are proceeding at a pace described by Gordon Moore and memorialized as "Moore's Law," which predicted the continuous doubling of the number of components that could be put onto a computer chip.

To quote Brand:

> "The pace of Moore's Law has become the pacesetter for human events. According to the rule of thumb among engineers, any tenfold quantitative change is a qualitative change, a fundamentally new situation rather than a simple extrapolation. Moore's Law brings such tenfold structural changes every three years or so, thus three revolutions every decade, for five decades straight."

But Brand also points out that human families, government institutions, social norms, culturally-driven behaviors, and natural systems grow and change productively over much longer periods of time. We can improve machines rapidly; in fact we can improve them at a blinding speed that is increasing exponentially. Healthy urban forests aren't on that curve. Functional natural systems in our cities need communities that tend to their care over the long run. If those communities don't exist, we will be forced to rely on large-scale, rigid centralized systems that adopt a command-and-control strategy forever.

We can design technologies, tools, and processes that make it easier and more efficient to manage our natural assets – but that will not be enough. Those technological solutions need to be in the hands of people and communities who will continuously choose to tend to and invest

in their health and welfare – if our natural system solutions are going to succeed. We have a lot to learn from each other regarding how to make that happen.

So to conclude: what should we focus on?

> **institutional reforms** in places where water management responsibilities remain divided among semi-independent water, wastewater, stormwater, and flood control agencies;
>
> **advanced systems modeling** that improves understanding of the complex inter-relationships that exist within urban environments at various spatial and temporal scales (as an aside, at CDM we have opened the Neysadurai Centre in Singapore to focus on developing those tools);
>
> **examination of zoning, building codes and ordinances** that influence the shape and form of the built environment;
>
> **increased emphasis on both the energy** demand and generation opportunities of water infrastructure;
>
> **continued research into the health-effects** and mitigation of persistent micro-contaminants in the water supply;
>
> **greater consensus regarding the appropriate scale of decentralized, closed-loop systems** within urban watersheds; and finally (maybe most importantly)
>
> **increased citizen involvement and behavioral change** in achieving healthy urban communities and environments.

We can do this work, and I believe we will. Again, it is especially appropriate are here together: those of us who are dedicated to new models for urban water infrastructure, and those of us who are succeeding in restoring and revitalizing the urban rivers that bring cities to life. I know from the agenda that this conference is rich with many inspiring examples of places where we have both improved the machine and inspired people to tend the urban garden that nurtures community health and well-being. I appreciate the opportunity to participate in this important joint conference, and I thank you all of you for being here today.