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Keynote Address

Enabling Innovation in Water Management

Paul R. Brown, AICP

President

Paul Redvers Brown Inc.

Carlsbad, California

It's a pleasure to speak here today as part of Metropolitan's Foundational Actions Funding Program and the 2015 update to its Integrated Resources Plan. As Deven [Upadhyay] mentioned, I worked on Metropolitan's first IRP published in 1996. I checked, and that IRP had a planning horizon of 2020 – which seemed a long way off at the time. So frankly, I am grateful to be here at all.

Back in the 1990s, as a planner, I was enthusiastic about the chance to evaluate resource strategies that could reliably meet Southern California's water demands, and be presented on so-called "exceedance curves" (still in use of course) that specifically quantified both the frequency and extent of future water supply shortages and surpluses. It offered board members information to make confident decisions regarding the level of service that Metropolitan would attain, and the amount of revenue that would be needed to do it.

Unfortunately, we can't make those promises today with anything like the level of certainty we claimed in the 1990s; and we can't deliver future water supplies without collaboration and partnerships that reach well beyond traditional institutional boundaries.

Why is this the case? Because, in my view, we're confronted with the convergence of two forces that are game changers in our industry – one is the deep uncertainty of climate change, and the other is the extreme complexity of our radical transition to one-water-solutions – and all this while trying to maintain aging and outdated infrastructure.

When Metropolitan developed the concept of "foundational actions," as part of its 2010 IRP update, I was genuinely impressed. It demonstrated a willingness to invest in

research, technical studies, and pilot projects specifically focused on reducing the barriers to future water supply from all sources, at every scale.

That includes the renewal and repurposing of larger-scale centralized and decentralized infrastructure on one hand; and the micro-scale re-invention of urban landscape, stormwater management, and the built environment – one tiny change at a time – on the other. Helping bridge this apparent divide between the large-scale top-down and the micro-scale bottom-up worlds of innovation is one of the important reasons you're here today.

I spoke on this topic at the WaterSmart Innovations Conference in Las Vegas last October, addressing how we might unify our vision and speed up the adoption of both the top-down and the bottom-up simultaneously. And I want to share with you a couple of the points raised at that conference.

But first, let me provide a brief definition of “innovation” – one that I particularly like. It's taken from a book entitled *The Innovator's Way* written by Peter Denning and Robert Dunham. And in it they state:

Most thinking about innovation is dominated by invention. . . What if the supposition that invention causes innovation is wrong? What if our low innovation success rate is tied to our lack of clear distinction between invention and innovation? . . . Since the acid test of innovation is adoption, we have defined innovation . . . as "new practice **adopted** by a community." (Denning and Dunham 2010)

That focus on adoption resonates with me because I feel that we have been witnessing the rapid development of technological **inventions** in water for some time. And the availability of new technologies is not the central problem confronting us – rather, it's the slow adoption of these technologies that stands as our biggest challenge.

And so, let's focus on the adoption of new practices (including those developed in the Foundational Actions Funding program) and address the question: How we can accelerate that process? In answer to that, I have three propositions I want to discuss:

The Optimization Trap

The first relates to avoiding what I'll call the “optimization trap.” It involves relaxing an expectation that the sum of everything we do must fit into an integrated, top-down, cost-effective, fully-prioritized, capital plan that drives a series of synchronized investments, delivered just before they're needed. That expectation is based on the **false** belief that every solution to a problem can be optimized, and the somewhat **self-defeating** conclusion that no action should be taken until it has been.

Consider this alternative to the “optimization trap” published by two researchers at the MIT Senseable City Laboratory, Carlo Ratti and Matthew Claudel, in their book *The City of Tomorrow: Sensors, Networks, Hackers, and the Future of Urban Life*:

A merger of top-down and bottom-up systems can invite wide spread engagement and mean effective implementation of solutions, ideally resulting in livable urban spaces. Pure optimization quickly becomes obsolete, but a hybrid model with a measure of chaos may be a more sustainable form of efficiency."

They go on to say:

Allowing citizen participation requires vulnerability, slackened control, and the possibility of failure. But if hacking catches on, the productive integration of top-down and bottom-up urban paradigms may yet realize tomorrow's city . . . (Ratti and Claudel 2016)

Is this an optimal expenditure of public resources? Well, there is no optimal in this context. Realizing tomorrow's cities presents so called “wicked problems,” that is problems that “[defy] complete definition, for which there can be no final solution, since the resolution generates further issues, and where solutions are not true or false or good or bad, but the best that can be done at the time.” (Brown, Harris, and Russell 2010) And there is no such thing as an optimal solution to a wicked problem. Local engagement should be encouraged and understood to be intrinsically chaotic but fundamental to shaping sustainable urban environments.

Optimization (which is enormously useful in the design of mechanical systems) requires a finite number of known variables with sufficient stationarity to allow for reasonable forecasts of their future behavior. Of course, in the water management arena stationarity (as it applies to expected future weather conditions) has been pronounced “dead” (Milly et al. 2008). And consequently, we should be a little suspect when it comes to relying upon the long-term forecasts that generally support our decision-making, optimization studies, and selection of winning technology solutions.

Picking winners and losers is much harder to do these days, and it's important that Metropolitan's foundational actions continue to promote and fund many promising ideas and approaches. These are actions that may win sometime in the future (or maybe not) but they need to be nurtured in the present.

Standardization and Restraints on Change

And that brings me to my second point relating to standardization, regulations, ordinances, licensing requirements and other institutional restraints. They generally derive from important public health and environmental protection goals, but can present both temporal and financial impediments to innovation. Of course, we are an

industry that is fundamentally conservative and deliberately skeptical in its adoption of institutional, technological, and regulatory change.

From something as simple as a curb-cut to redirect street runoff into an infiltration basin, to something as complicated as applications of biological membrane systems to produce drinking water, there is a prudently deliberate process of study and demonstration built into decisions, including broad and necessary involvement of diverse and multi-disciplined stakeholders.

In that context, since it's likely we cannot (and probably should not) speed that process up too much, then we must consider embarking on more innovative actions simultaneously, encouraging apparently redundant efforts to accelerate adoption in the hopes of producing sufficient numbers of acknowledged successes to meet our needs – investing in many **real options** for a deeply uncertain future.

Again, it's not the optimal solution. It's the optimist's solution – someone who believes in the transformational power of disruptive innovations when they're allowed to exist.

We should re-plumb and repurpose the big innovations of the past, while we encourage the viral change of individual and community-based initiatives and programs. Both may require enabling legislation and new regulations that redefine current restraints. Restraints that are designed to prevent both hazards and new technologies from ever surprising us.

Re-engagement of Individual Citizens

And finally, I want to close on a less obvious proposition, the re-engagement of individual citizens in the process – the reconnection of people (including ourselves as water users) to the technologies we have been kept apart from for decades.

We have a long tradition of what could be described as “utility invisibility.” “We'll take care of you.” “Don't worry about it, just pay your water bill.” And for many of us living in urban settings no individual initiative was called for at all. We were freed from the technology and natural systems that had for centuries been a daily worry – and for most of the world's population still is.

The solutions that have the greatest potential of making us sustainable are the ones that re-connect people (all people) with the natural and technological systems that sustain everyone. Not just spectators, free riders on this spaceship earth, but caring, engaged crew, participating in the real business of living on a blue planet.

That means better apps, more sensors, greater dependence on crowd-sourced solutions, smaller more intimate infrastructure that is outside your back door and beside your porch, knowingly using water that might have passed through your plumbing once

before, that you understand the source of, the value of, and the personal importance of every single day.

As you all know, it goes well beyond seeing things in terms of “demand management,” which is an expression that reflects the perspective of a large utility manager. When I am removing my lawn and adding solar panels to my home, my purpose is to provide for my own well-being, not eliminate my demands on the power grid or various water utilities. I am doing something affirmative. I am engaging with technologies not withdrawing my demands. I am making change happen not making something go away. We are here today to make things happen.

So, let me close by re-iterating that this pursuit of innovation in times of uncertainty may seem like a redundant, and sometimes chaotic, process to anyone trained as an engineer, scientist, mathematician or planner.

We all need to rely a little more on the right brain. Some creativity, imagination and a holistic sense of the continuity of all our efforts is essential to making change happen. We will never discover **the** optimal winning solution, because a single technological breakthrough will never emerge that can sustain us in a rapidly changing and unpredictable world. We need to promote an adaptive culture of collaboration, supporting the efforts of everyone who is attempting to achieve the values and goals of a sustainable water future.

Let’s encourage and foster a growing multitude of good ideas at every scale, allowing them to co-exist and emerge from all directions and many diverse communities, as the best response to a future of rapid change and extreme uncertainty. I applaud Metropolitan on its commitment to spend resources on making that happen. And just as important, I congratulate you on your commitment and effort in support of Metropolitan's foundational actions program. What we are observing here today is tangible proof that these innovative concepts and approaches can be made a reality.

Thank you all very much.

Works Cited

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