

## WATER RESOURCES INFRASTRUCTURE REVIEW\*

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This paper reviews the three reports forming the basis for the U.S. National Council on Public Works Improvement water resources infrastructure related findings. It also reviews the soon to be published proceedings of a NATO Advanced Research workshop on Urban Water Infrastructure. The purpose of the review is to provide a consolidated background for future consideration of Water Resources Infrastructure needs. It was prepared for the 1990 ASCE Fort Worth Water Resources Infrastructure Symposium and has been reprinted here with minor modifications with ASCE consent.

The U.S. National Council on Public Works Improvement was created in 1984 to assess the state of the U.S. infrastructure. The Council was to specifically analyze: age and condition changes, methods of finance, trends in financing methods, maintenance needs, and expenditures needed for improvement. Water resources is one of nine infrastructure categories examined by the Council. The categories are: streets, roads, highways and bridges, airports, mass transit, solid waste facilities, hazardous waste facilities, intermodal transit and three categories of water infrastructure: waste-water treatment, water supply, and water resources. Waste water and water supply were separated from the rest of water resources primarily because of differing financing and regulatory considerations for infrastructure in these categories. The water resources infrastructure category reviews navigation, flood control, urban drainage, dam safety, navigation, flood control, urban drainage, dam safety, irrigation, agricultural drainage, erosion, hydropower, recreation, and fish and wildlife needs.

The water resources category received not only the highest grade for the three water categories, but the highest of all infrastructure categories examined by the council. Still physical and financial

water resources needs exist for both new works and improved management of old works. New works with Federal participation are likely to be smaller in number and size. A primary concern is also to develop and improve forums for intergovernmental planning, financing and coordination, including technology transfer. Improving user pay and beneficiary identification practices is a basic theme along with increasing the efficiency of existing projects. Specific functional areas meriting special concern are: urban stormwater management, exacerbated by pending stormwater quality discharge regulations; safety of non-Federal dams, levees, and floodwalls, due to current under-investment and institutional fragmentation; and shore line erosion, an emerging problem which is also related to climate change. Water supply system needs are dominated by evolving requirements to meet new safe drinking water standards. With regard to water supply, small water supply systems are a particular problem with 86.5 % of maximum contaminant level violations occurring in these systems. Capital costs for facilities to meet standards are disproportionately higher in these systems and ability to successfully operate less certain. It appears questionable as to whether the same level of operational efficiency achieved in large systems can ever be expected of small systems, leading to further questions of the economic wisdom of capital investment policies based on the same standards. With regard to wastewater, the massive U.S. water quality program has been a success in that overall the nation's waters have not deteriorated over the past two decades despite increasing population, and in many instances, a marked improvement exists. More improvement is needed but, currently wastewater systems improvements are marked by declining economic efficiencies. From 1978 to 1986, the total value of wastewater facilities rose 25 % to \$138 billion, while the volume of treated effluent increased only

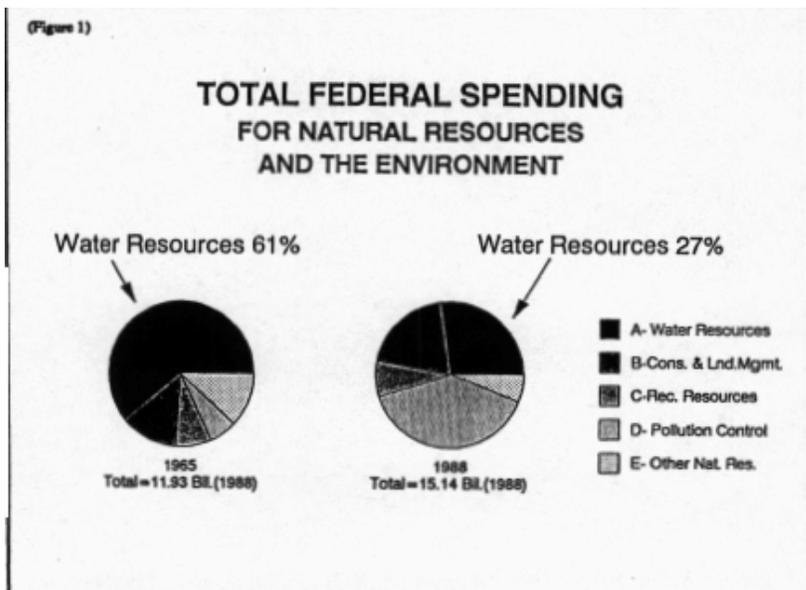
6 %. Yet, one-third of all plants are not now being operated to meet existing standards. The non-Federal responsibility for funding improvements to meet standards will be increasing in the future due to reduced Federal funding. This is expected to increase pressure for more cost efficient design and operation.

Capital spending for all levels of government for public works has remained roughly the same in constant dollars from 1960 through 1985 and is equally split between non-Federal and Federal levels of government. However, spending for operations and maintenance has tripled in the same time period with most of the increased cost borne by non-Federal levels of government. At the same time, the relative share of all government spending for public works has declined from about 20 % in 1950 to less than 7 % in 1984. Other priorities for spending have also shifted slightly, probably reflecting increased environmental sensitivity and regulation. The water resources share of Federal spending for natural resources and the environment has declined from 61 % in 1965 to 27 % in 1988 (see Figure 1), offset predominantly by increases in spending for conservation and pollution control. Much of the pollution control emphasis has been directed to wastewater management mandated by P.L. 92-500 with non-Federal financial emphasis

also shifting accordingly.

In summary, the water resources category was judged by the Council to have met past and current needs more successfully than other infrastructure categories. However, the study still recommends both development and management improvements focusing on improving inter-governmental coordination, financing, and user pay issues as well as several functional areas of special concern. The wastewater and water supply studies also identified both new development and management needs, but received slightly lower ratings by the Council. Recommendations in these categories identify improved financial management and full cost pricing, regional and integrated water quality/quantity planning and management, more flexible regulation recognizing cost, and research and technology transfer improvements to varying degrees as common themes.

An over-riding common theme to U.S. water related infrastructure concerns reflected in the Council's report is cost and efficiency. The report recommendations reflect the two different models which have dominated past implementation practice: regulatory with fixed standards for wastewater and water supply environmental concerns, and benefit-cost for most other aspects of water resources. The regulatory approach has been most strenuously applied only within the last two decades, reflecting the importance of non-monetary environmental concerns. Increased spending has accompanied this shift in emphasis and significant environmental gains have been achieved. Recent evidence of decreasing cost effectiveness, however, is probably the principal reason the Council scored wastewater and water supply infrastructure categories slightly lower than other water resources functions. The benefit-cost model applied to most other aspects of water resources probably contributed heavily to a higher score. Given the high future costs forecast for wastewater and water supply cate-



gories, the inability to operate to meet standards in some systems and the lack of ability to adjust standards for appropriate site specific conditions, some pressure to achieve future savings through a more flexible approach incorporating benefit-cost analysis might be expected in the future. Overall, more explicit management attention might also be expected for improving the operation of existing systems and developing complementary institutional cost efficiency decision-making structures.

The NATO Advanced Research Workshop was organized under a NATO grant to enhance scientific cooperation made as a result of an application through the Urban Water Resources Research Council of the American Society of Civil Engineers. The Water Research Center in the United Kingdom cosponsored the workshop, and managed the on-site arrangements.

The proceedings represent the contributions of thirty-five participants selected for their personal expertise from sixteen countries.

The areas of broadest consensus for follow-up policy research emerging from workshop deliberations are:

- + Improved asset management and capital budgeting processes;
- + Demand management and water conservation practice along with user pay and pricing principles;
- + Comparative analysis of regulatory and cost efficiency processes and appropriate methodologies for the conduct of national assessments.

Improved asset management and capital budgeting discussion indicated that future work might include: reasons that public systems often

experience more short-falls than private systems, priority setting and value for money, need for systems approaches, problems of small systems, worker/organizational effectiveness, and need for performance or level of service standards.

Similarly, demand management, conservation, user pay and pricing future work might include, among other issues: effects of cost sharing and subsidies, best practice techniques, response to the “green” movement, demand modeling, improved beneficiary identification, and institutional arrangements to assess costs.

With regard to comparing regulatory and cost efficiency processes and conducting national assessments, discussion would indicate inclusion of: benefit evaluation and presentation; comparison of differing regulatory approaches; centralized versus decentralized approaches; cross referencing air, land, and water standards to reflect costs; scientific and health risk confirmation for standards; operating standards and benefits; approaches; and international training and exchange programs.

## References

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