

WATER--ONE OF THE MOST SERIOUS PROBLEMS  
CONFRONTING THIS PART OF THE NATION

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I am especially pleased to participate this evening in the New Mexico Water Conference. You are dealing with one of the most serious problems confronting this part of the nation. But, your accomplishments in the water field will have an impact far beyond the borders of our own Southwest. I say this because the basic knowledge that you gain and the application of that knowledge to achieve practical solutions is applicable to many other areas of this continent and the rest of the world.

Your conference is dedicated to the exchange of information and the cross-pollination of ideas. This process of exchange is fundamental to the advancement of science and technology. Without it, the solution to problems would never come within reach.

Another reason for this conference is to promote cooperation among many professional disciplines because the water problem is so complex that it defies easy assignment to one specialty. And, in the same way, there must be cooperation among the states of a region because the problems involved in water extend beyond state lines.

I think Harold E. Thomas and Luna B. Leopold said this quite clearly in their recent article in "Science." They wrote:

"Water habitually does not subscribe to our efforts at compartmentalization according to special interests in irrigation, industrial use, recreational use, municipal use; or to allocations of fields for the chemist, for the geologist, for the sanitary engineer, for the physicist, for this or that government agency, any more than it does to separation into areas bounded by property lines, county lines, state lines, or even some river basin boundaries. As the areas of heavy demand expand toward each other and the necessity for water management increases, these artificial boundaries and classifications will have to yield more and more to the realities of the hydrologic cycle."

Additionally, the projects which we hope will assure the water essential to water needs are vast enterprises; and if they are to be successful, they require the mutual effort of several states.

<sup>1/</sup> Senator from New Mexico, Speech given at New Mexico Water Conference Banquet.

This is the kind of joining of hands proposed in the Pacific Southwest Water Plan, which is now under review by the Bureau of the Budget. In the words of the Department of the Interior, the plan proposes that "the States of the Pacific Southwest put aside the long and wearisome controversies that have plagued Lower Colorado Basin development for over half a century, and unite in support of a broad regional approach to assure that water as required would be developed and made available to meet all needs within the region wherever they occur."

And those needs grow greater each day. Population of the Pacific Southwest, now in the neighborhood of 11 million, is forecast to multiply threefold by the year 2000. I need not ask: Are we prepared for such a growth? Obviously, we are not; and far-sighted planning and far-reaching action are needed now.

The cost of the portion of the Plan proposed for immediate authorization is estimated to be \$1,704,000,000 of which 92 percent would be fully reimbursable. The total construction cost of the entire initial Plan--to meet just the most immediate needs--is estimated at \$3,126,000,000 of which 95 percent would be fully reimbursable. While these costs may seem high, they are modest in relation to the value of the extensive and diversified economy of the five-state area.

We cloud-watchers in Congress who come from the Southwest must debate long and hard with our friends from the rest of the country over support for reclamation. But, I believe the economic facts favor us.

Soon after the Reclamation Act of 1902 brought the Federal Government full square into the water development picture, the Carlsbad and the Rio Grande projects were authorized. Today, they furnish irrigation for nearly a quarter of a million acres of land and provide municipal and industrial water--as well as some electric energy--for the area. The cumulative gross value of crops grown on these projects over the years amounts to nearly 39 times the cost of construction of the projects. Other returns, in the form of taxes generated by development in the area, and industrial and transportation profits would materially increase that figure. This is wise use of available water.

But the Rio Grande, the San Juan, the Pecos and the Canadian rivers, and our ground-water basins underlying the Mimbres and Roswell areas are very close to--or beyond--full development for appropriation and use. After completion of the San Juan-Chama and Navajo Indian projects, and after the building of Hooker Dam on the Gila River, there will be only a relatively few, relatively small, water projects remaining to be developed in New Mexico.

Incidentally, I understand that a week from today bids will be opened on the contract for construction of Azotea Tunnel, the first

and probably the biggest job of the \$86 million San Juan-Chama project. The Bureau of Reclamation expects to call for bids on a contract for more tunnels in about December, and the one for the final tunnel will in all probability be let next year.

We know that present and impending population growth is rapidly outstripping available water resources. The University of New Mexico's Bureau of Business Research estimates that our population, which grew from 530,000 in 1940 to 960,000 in 1959, will grow about 2-1/4 million by 1980. What does that mean in terms of our water problem? In 1959, State Engineer Steve Reynolds estimated that about 125,000 acre-feet of water was being withdrawn for municipal and industrial uses. With the prospect of population more than doubling by 1980, it is a very conservative view to expect at least a doubling of the 125,000 acre-feet for municipal and industrial use. Those figures, it seems to me, typify New Mexico's water problem. What can we do to get practical solutions?

One of the key recommendations of the Senate Select Committee on National Water Resources was for markedly increased research in all phases of water resources conservation and development. That certainly makes sense in this state. New Mexico's average annual precipitation is about 90 million acre-feet; but the runoff from our watersheds averages only slightly more than 3 million acre-feet per year. We are not getting the greatest possible use out of the 90 million acre-feet of precipitation that we should.

We know, for example, that we have only begun conservation of water lost through evaporation from the surface of reservoirs and from the lands. That loss is estimated at 332,000 acre-feet annually--more than double the withdrawal for municipal and industrial use.

We have only begun to salvage the water lost through nonbeneficial phreatophyte growth in the stream courses and low lands. But we are making some headway. A major program of channelization, carried on by the Bureau of Reclamation since 1951, has saved approximately 700,000 acre-feet of Rio Grande water. Estimates are that when the work is completed about 100,000 acre-feet will be saved annually. Poured into an empty Alamogordo Dam, this amount of water would leave it more than three-quarters full.

We have only begun to conserve the water lost through seepage from the canals and ditches in the valleys. Seepage is a real villain in the water story. Irrigation systems on farms are estimated to deliver only about two-thirds of the water diverted into them, and the application efficiency is rated at anywhere from 65 percent down to 35 percent.

The Senate Select Committee on National Water Resources identified 18 major subjects on which additional research is needed for improved water conservation and utilization. I believe that

such research into every one of those subjects is pertinent in New Mexico.

Let me digress a bit to illustrate why I have confidence in the promise of research. Some years ago, I sponsored legislation to authorize the Department of the Interior to construct and operate saline and brackish water conversion demonstration plants. Some of us in Congress felt that 1960 was not one bit too soon to start acquiring information and competence in the construction and operation of large-scale conversion plants. But there were others who thought that this was unrealistic and visionary.

As you are all aware, about two months ago Cuba shut off the flow of fresh water to the United States Naval Base at Guantanamo. Within 48 hours the Navy arranged to move the Interior Department saline water demonstration plant--built under the 1958 legislation--from near San Diego to Guantanamo. The year of operating the plant showed that not only is it capable of producing the one million gallons of water per day for which it was designed; but that, in fact--by improved operating procedures--the plant is actually capable of producing about 50 percent more than its design capacity. As a consequence of what some people considered was impractical just a few years ago, the Navy will have a saline water plant capable of supplying a substantial part of the fresh water requirement at Guantanamo.

If Congress approves, another demonstration plant will be built at San Diego designed to operate at higher temperatures than any of the other demonstration plants.

While I am on this subject, I will mention that the Interior Department is now giving very active consideration to a research proposal from Dr. N. N. Gunaji of the New Mexico State University. His proposal involves the utilization of solar energy in connection with the brine effluent from the Roswell desalting plant.

In October 1962, here at State University, I joined in the observance of the 100th Anniversary of the establishment of Land Grant Colleges. My remarks to that centennial celebration touched briefly on the past century of the land grant colleges and, at somewhat greater length, looked forward to their next century. The land grant colleges' great contributions to increasing agricultural productivity, I suggested, can be matched in the years ahead by equally great contributions in other resources fields. One of these is water resources.

Toward that end, I sponsored a water resources research act in 1962. This bill was circulated among experts in the field of research and education for their advice and suggestions for perfecting it. Early in 1963, I introduced the improved bill known as S. 2. The bill was passed by the Senate last April. A more limited bill has been reported out of the House Interior Committee. I am hopeful that a measure

will be formulated acceptable to both Houses of Congress and to the President and that action may come early enough to permit at least a modest start in the universities next fall.

Some people ask what university water research will do that is not being done by the eight major Federal agencies engaged in such activity. And they also ask how much larger the total program of water resources research should be. In the year ending June 30, Federal support of water resources research will total about \$71 million, and about \$73 million is requested for next fiscal year.

Isn't that large amount enough? Well, let's do some comparing. The proposed \$73 million for water research is less than 6 percent of the \$1-1/4 billion per year that the Federal Government now spends on national programs of water conservation and development. It is only 7/10ths of one percent of the approximately \$10 billion that is spent each year for Federal, state and local government and private water facilities; about double that rate of annual expenditure for water facilities will have to be made to meet water needs. In contrast, the oil and gas industry annually spends about 3 percent on research and development, in the chemical industry the figure is about 6 percent, and in the automotive industry it is around 12-1/2 percent. Less than one percent for water research is too little.

If water research expenditures were only 3 percent of the present \$10 billion annual expenditure for water facilities, it would be \$300 million, or more than three times the present water research program. It seems to me that water research activities are not by any means overly endowed. If research enables us to improve the efficiency of water conservation and development by only five percent, it could reduce our annual capital investment in water facilities by \$500 million alone.

One major difficulty in expanding water resources research activities, however, is that qualified research people are in short supply. In this matter, universities are eminently well suited to produce the needed research personnel. Universities can do this in the field of water resources in the same way that they have done it in agriculture, or nuclear energy, or the space sciences--by training graduate students through association with the research work of senior faculty scientists.

Even more than the size of the water resources research program, we are concerned with the character of the research. The water research programs of the Federal agencies, in general, are excellent.

There are, however, certain limiting characteristics built into Federal research programs. The research done by Federal agencies, quite properly, is directed to national rather than to local problems. While this provides the technical basis for

national programs, it is not well suited for solving the specific problems that are important to specific localities--the Roswell Basin, or to the Mesilla Valley, or the Estancia Valley, for example. Such specific problems are understood best by research workers who are familiar with the special physical and economic characteristics of the local situation. I believe that many such specific problems can be worked out best by a combination of the broad general research results obtained from nationwide investigations together with their specific application to local areas.

University research can make another important contribution more readily than can most Federal agencies. Increasingly, water resources problems are not just engineering problems or just legal problems, or problems amenable to any one technology or any one scientific discipline. Solution of almost any major water problem now requires a mixture of engineering, biology, hydrology, law, chemistry, economics and other technical subjects. Although the multidisciplinary character of water matters is generally an accepted fact, few, if any, Federal agencies are in a position to deal with them in those terms. This is a limitation that is built into most of the agencies, and not much can be done to modify that aspect of agency organization.

Universities, on the other hand, embrace many disciplines by their very nature. Most universities have on the same campus faculties representing some or all of the elements involved in water problems--engineering, law, the physical, biological, and social sciences, and other branches of knowledge. This makes for an ideal setting for water resources research. At a number of universities there is encouraging evidence that cross-discipline seminars and research teams already are coming to grips with water resources matters.

It seems to me that the water resources research centers to be supported under the proposed legislation would be one of its major accomplishments. Such centers could be influential not only in university research; they should also be influential in orientation of the new crop of water scientists who will receive advanced training in a multidisciplinary climate. Furthermore, through research work under the auspices of those centers, badly needed new research methods intertying various callings should become widely available to others, including the Federal water resources agencies.

A realistic view of the universities in most states reveals that many of them are equipped with faculty competence in less than the full range of subjects that are needed for effective, broad-gauged research. The systems of higher education of many states are geographically dispersed through the state. Generally, there will be several more or less coordinated educational institutions in each state, often with some specialization at each institution. One university will have a strong college of law, another will have

a strong college of medicine, one may be strong in economics and other social sciences, while engineering and physical sciences may be dominant elsewhere.

To a considerable degree this is the situation in a number of the western states, including New Mexico. It will be extremely important that in each state ways be worked out to assure the full participation in the water research program of all the institutions of higher education. That will be necessary in order to conserve and take full advantage of limited resources of competent manpower. I certainly hope that this will be in the pattern in New Mexico.

This brings me to a final comment on water resources research. In addition to stressing the need for more research, the Senate Select Committee on National Water Resources strongly recommended comprehensive river basin planning as essential for full conservation and use of our limited resources. President Kennedy accepted that recommendation and he directed the Federal executive agencies to carry out their responsibilities in that undertaking. Congressional authorization is necessary especially to provide for appropriate participation by the state and local governments. I introduced S. 1111 in this Congress to provide such authorization. It passed the Senate last December, and is now pending before the House of Representatives. I hope that early enactment of the measure will clear the road for vigorous progress in the much needed Federal-State river basin planning work.

The specific point I make in this connection is that effective river basin planning will need to rely heavily on knowledge and understanding of water resources, and that means that there will need to be a considerable involvement of research workers in the planning activities. The water resources research centers at the universities, I am confident, will have an important role in river basin planning.

Some years ago, Dr. Warren Weaver, then vice-president of the Rockefeller Institute, said that science cannot avoid being practical. By that he meant that research that adds to our knowledge and understanding becomes a basis for some applied use--just as theoretical physics became the basis for the great developments in nuclear energy. I am confident that university research, both basic and applied, will make important contributions to solving water resources problems, and I am confident that New Mexico's institutions of higher education will participate fully in this effort. I come here to wish you well in that endeavor.