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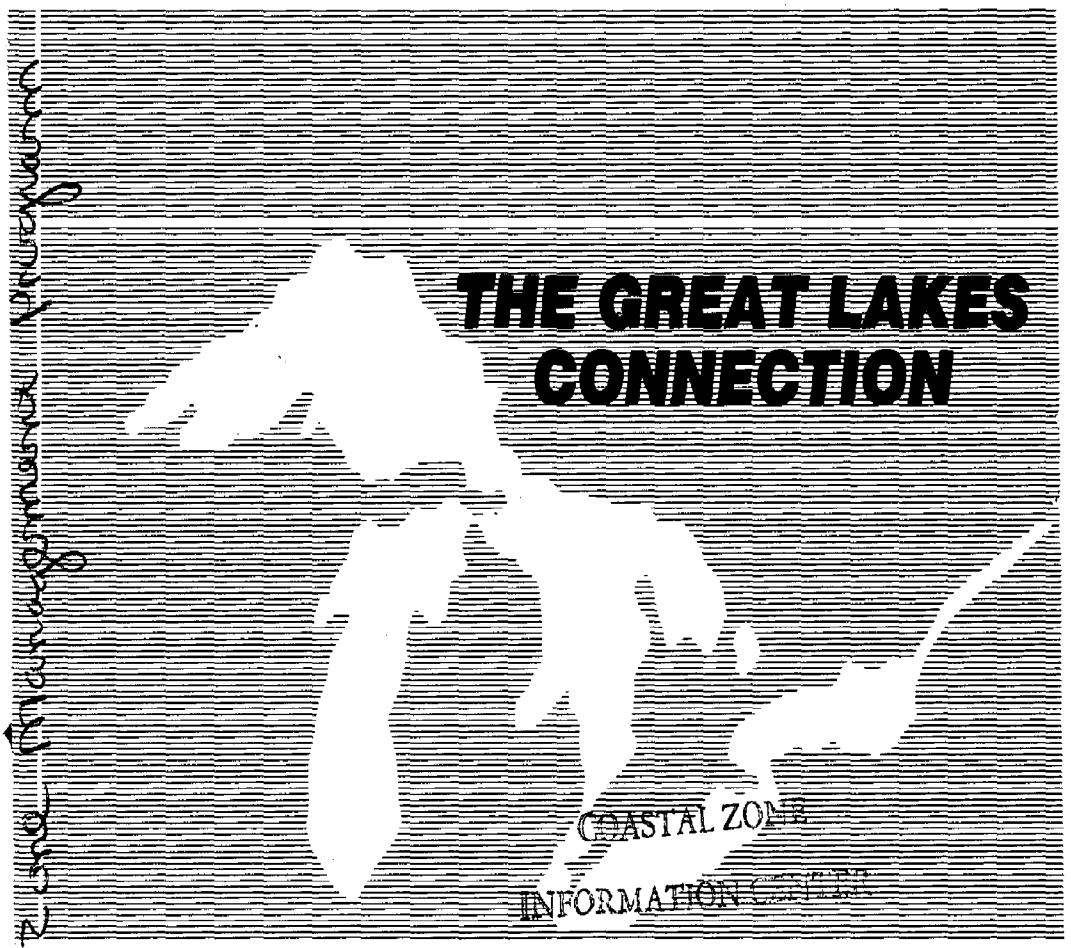
THE INTERBASIN TRANSFER OF WATER...



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May 10 and 11, 1982
Milwaukee, WI

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THE INTERBASIN TRANSFER OF WATER
. . THE GREAT LAKES CONNECTIONS

MAY 1982

Chandler McKelvey, Conference Chairman
Allen H. Miller, Program Manager, Wisconsin Coastal Management Program
Georgia Wagner, Conference Coordinator
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On May 10 and 11 1982, The Wisconsin Coastal Management Council sponsored a Conference on the Interbasin Transfer of Water. The Conference was co-sponsored by the Freshwater Foundation and Society, the Coastal States Organization, the Upper Great Lakes Governors' Council and the Great Lakes Governors' of the Midwestern Governors' Association. These Proceedings are an Edited Transcript of presentations made at the conference.

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CONFERENCE INTRODUCTION

Chandler McKelvey

Conference Chairman

Last week I had occassion to fly east (of Wisconsin) which took us over Lake Michigan which is just five blocks from here and I think that is a good way to get an appreciation of the subject of this Conference. The fact is that 95% of the fresh surface water on this continent is contained in the Great Lakes. That is a statistic that gives a little bit of a feel for the enormity of our water resource when you see it all at one time.

Our objective for the next two days is to learn about the implications of having all that water. There are well established laws and traditions in the water poor parts of this country relating to use and diversion of water. Here in the water rich areas we have never developed a real awareness of these issues and that is why we are here. It seems clear to me that the one thing that we know for sure about water diversion questions is that they will become more urgent and more contenious in the very near future. At this point in history, we see the junction of three very powerful and very basic forces; social, natural and economic. The first of those is regionalism. This is an issue which is worldwide in scope. We see it in one form or another in almost every part of the world. I think a very good example is what is happening just to the north of us in Canada where a very serious debate is taking place as to what that country is going to look like in the future and whether it is really going to be one country or more than one. Those issues have not come down to this country in quite the same force yet, but certainly we have the seeds of all of them here. I think in this country when we talk about things like the new federalism; when we see the increasing importance of severence taxes on energy resources that threaten to turn this country into a group of haves and a group of have nots; that regionalism is very much on our agenda and will be over the next period of years.

You take regionalism and combine it with the increasing concern about the difficulty of obtaining sufficient water to maintain our economic and social activity and you have the makings for an extremely devisive issue that will become more and more to the forefront in the future. This Conference is important and in my opinion it is not only important, it is very timely. If we had held this Conference a few years ago, most people would have wondered what we were about and why we were having such a conference. I think that if we had delayed a few years to have this conference that we would already be embroiled in the matters that we are going to be discussing here and would wish that we had had this conference earlier than we did. I think that this conference is going to be a good one; and we have a good audience. We have a knowledgeable diverse group of people; the participants are all leaders in their fields and I think that we will find that during the course of this event we have many different points of view. We are going to hear from people who are truly knowledgeable and leaders in their field.

KEYNOTE ADDRESS

Lee Sherman Dreyfus

Governor: The State of Wisconsin

I would like to share my most sincere thanks and appreciation to Al Miller and his Coastal Management people and the organizations co-sponsoring these two days. It is a truly remarkable gathering of national, international experts in the field.

The second thing that I would like to say is that the time is now to address the issue of our water resource. The future is far too important to put off until tomorrow. I see legislators in the group and one thing that I have learned about legislative bodies in Washington is that they tend not to deal with the problem until it is a problem, not until they have a pile of mail and a pile of calls from constituents and lobbiests and hired guns leaning on them. Here is a chance to move now, before this is decided and out from under us.

You are in the City of Milwaukee; renowned as a beer capitol. The key component of a beer capitol is good water. It is that simple. I come from a city that has good beer, Stevens Point. If you have every tried a Blue Bullet then you know why it's good beer. It's good beer because the water comes right out of the ground, its put in a pipe and we get to drink it as it is; and that is happening less and less in other parts of the world and parts of this state. I said half facetiously that we have water out here that belongs to us in this basin called the Great Lakes; and would be glad to sell anybody any amount they want as long as it comes mixed in cans with malt, beer, hops and barley.

There are those that said, well, we can't deal with it on that level. That is true. I know some of the conclusions that you have already drawn. It is not going to be economically feasible in great quantity to move water to the other parts of the county. I would remind you that Ransom E. Olds was told, at the turn of the century, that his idea of producing a replacement for the horse in quantity would mean by calculation that if a person traveled five miles a day, which most people didn't do with a horse, that you would be talking about somewhere close to 1800 miles traveled in a year by an individual; and that the cost of ownership could rise as high as $1,000 just to own and operate that; and that the economics of that meant that the horse was here to stay and we were never going to see the thing that Mr. Olds was talking about. So if you don't mind before you have all kinds of water versions of Reo trucks and Oldsmobiles all over our back, the time to deal with the issue of diversion is now rather than come to the conclusion that this is going to be too costly. I've lived through a period of life where nothing is too costly. It is just silly to even talk in those terms. I now find out you spend $10,000 to buy a car that used to fit into the trunk of a car you use to be able

to buy for $2,000. That has to tell you something, so please don't let these numbers get carried away and say there isn't a problem. I worry how strongly you to hold that conclusion.

There are 65 trillion gallons of water sitting out here in the Great Lakes and according to our Coastal people and those who keep the data that is over 90% of all the fresh water available in the 48 continguous states. That is enough water to cover the entire continential United States to a depth of 8 feet. We are sitting on the edge of the largest well of fresh water by any definition and I think because we are it is too easy to forget that we are the exception not the rule. There is over 1/4 of this country right now chronically short of water and that's the beginning, from there it goes up. Now occasionally we get maligned as the snow belt. Sometimes we get the nomenclature as the star of the snow belt and that is fine. Just smile when they say that because remember that snow melts and we are truly the water belt. Sun may be fine but it doesn't melt, all they've got is sand. Most areas of the United States would rather see a rain cloud than a rainbow and you and I just happen to live in a part of the country where we are fortunate to be able to enjoy rainbows and that is when the water deluge has ended.

In the past our country was divided, by probably the most critical line in our history, the Mason-Dixon Line. I carry the name Lee and Sherman and I'm very concious of that line since my mother obviously went for honorifics to strattle, in the process of producing her last child. If you add that to Dreyfus, it gives me LSD for initials and they were not great when I was a university president. I will tell you right now the most significant line within this continential United States is going to be the 100th meridian. There isn't any question in my mind about that. If you haven't taken a look at the 100th meridian you ought to get your maps out and start looking it. It will come down from central North Dakota right straight through the Texas-Mexican border on a north-south line. It separates the arid from the humid. Quite frankly its not by chance that Arizona sounds like arid zone and it is in more ways than one. The water scarcity is beginning to shake the American west. Sixty percent of the land in the United States is in the western region and it only receives 25% of the precipitation. Sooner or later once this land became utilized by some significant quantity of human beings water was sooner rather than later to become a significant fact of the geographics. The Colorado River was mentioned. It is a powerful river, it literally carved out the Grand Canyon. I am sure everybody in this room must remember some of the pictures of Bobby Kennedy and his family rafting in the whitewater of the mightly Colorado. To think that that literally that river is used; that every single drop is taken out of it and that it no longer reaches the Gulf of California and the Pacific Ocean. It no longer travels as far as it did.

In the last 30 years there have been declines of that kind. Groundwater in an area of some 4500 square miles, that includes 120 miles just southeast of Phoenix, Arizona, has already caused that land to sink an average of 7 feet. Somebody has got to start worrying about those numbers out there. I know they worry in California as to whether Sacramento is going to have

riparian rights in the next few years. That may occur with the San Andres Fault. The Ogallala Aquafer, which I am sure has been involved in discussions up to this point, is a primary source of water for the Southwest. It is being drawn down now at an estimated rate of 10 to 14 times faster than it is being replenished. It doesn't take a lot of genius to figure what is going to happen in the long run. Despite this water limit problem, the greatest increases of population are occurring in the West and Southwest. Those are our fastest growing states. Arizona is up 50%, Texas up 27%. In fact, 8 of the 10 fastest growing states of the 70's were in the west. The west continues to grow despite their increasing water depletion rates. Federal investment has helped to make that water available; and by the way, that number is $180 billion in this century. Federal tax dollars that have been spent in various water dam reservoir projects and so on literally make that water available and thus allow people to move so they didn't have to move where water was naturally available as in the case of the Middle West and the Great Lakes. There is a darn good reason why this area was the primary population center. The key reason out there happens to be sitting in that water basin.

A resident of Sun City, Arizona, despite the fact we have to put all these taxes into producing that water availability, actually pays less for water than a resident of Milwaukee, Wisconsin. To add insult to injury the average person in Laraedo, Texas, uses twice as much water as a citizen in the City of Milwaukee, but pays less. This frivilous price arrangement clearly cannot last. These is a large dust cloud on the horizon and due to the drop in water levels and skyrocketing energy prices estimates indicate that pumping water from the Ogallala could actually make agriculture in the southen plains uneconomical within this century. Something is going to happen one way or the other. People are going to stop moving or start moving back; or we are going to pump the water out there where they are or they are going to give up agriculture which will increase the value of the agricultural base here in the middle west. For your information 20% of the land in agriculture is in this middle western states area. That 20% produces 58% of all of the agricultural products of these United States. That is the kind of numbers that we are playing with and in the long run, though we may be an energy poor depleted state for the long run, food and water are absolutely going to take precedence over energy. Energy is going to be the thing that the human mind will solve within this century.

Water has been called the "Time Bomb of the West". I think that is an accurate statement. West of that 100th meridian their water problems loom almost as large as our water resources. That is a fact that has not escaped the attention of the people who at least are now looking at those resources and trying to make some judgements. It is not a fact that is met the attention of the average person going about his daily life. If you don't think that those who are responsible aren't casting a coveting glance at our water then you are not paying attention. You heard earlier that the Governor of South Dakota has already negotiated the sale of a portion of its water rights for the next 50 years. Look at the Governor of Iowa and the Governor

of Nebraska; they are wondering how much of the water that South Dakota is taking out of the ground in Dakota is being taken out of the fundamental basic aquafer that supplies Nebraska and Iowa and they will, in fact, begin to go to the courts.

Diversion is not a new idea. You know that. The Romans, in fact, moved water 400 miles in aquaducts before the birth of Christ. Some of those aquaducts are still in existence. Hundreds of interbasin transfers already are moving water to water deficient areas. One out of five people today in the United States is served by water that is imported at distance greater than 100 miles. One out of five American citizens has water available to him or to her that comes from a distance of greater than 100 miles. We have already built through the federal government over 2 million dams and diverted over 3/4 of all the major and secondary rivers in this country. Even in our own region, Illinois is already diverting 2 billion gallons per day from the Lake Michigan basin. Well, out of 65 trillion what's a couple of billion. You know its like Washington's money. Billion here, billion there and pretty soon it adds up to real money. The situation is going to be just as true in water. In a single year that diversion quantity exceeds the amount of water contained in Lake Winnebago which is the second largest inland fresh water body in the continential United States, the first being in Florida.

Our water will prove to be our most valuable resource in the future. It represents the true opportunity for our future. But to reverse an old saying; with each great opportunity, there lies an equally great challenge and it will undoubtedly have an impact on national and regional opportunity and may directly influence population distribution in the years ahead.

While the focus has been on quantity, water has little value without adequate quality. I think we are fortunate to have our water quality still quite high in Wisconsin. We have been working at that. I think sane and clear heads have been doing it, and doing it, at a reasonable rate without destroying the entire society or economy in the process. You do have people who will shout that the end of the world is coming, but that has always been true. Remember, over a decade ago when we had environmental groups that argued that Lake Erie was forever gone; totally irretrievable, never to be reversed and that it was now destroyed. We know that Lake Erie has come back, in fact, surprisingly faster than predicted. You will always have those who shout the end of the world. That is a good thing to shout because when it doesn't happen nobody is really hacked at you and very few point out that you were wrong. In this area of the nation we have had a good common constant involvement in the quality of the water which continues to improve. In this state we are pressing for water quality and are now moving to non-point source pollution.

How ready are we to respond when the thirsty come to the Great Lakes well? The answer today is that we are not ready because the issue is a tangle of laws, regional interests, economic and moral implications. You are informational, you are trying to make some predications of what will or

won't happen, but the issue now is to take whats happening here and keep the momentum pushing us forward. I will be meeting at Mackinac Island next month with other Great Lakes' Governors and Provincial Premiers of Ontario and Quebec. Quebec is not on the Great Lakes, well it is on the St. Lawrence and it happens to be a major factor in the Great Lakes. What ever comes out of the Great Lakes passes by Quebec. Frankly, I am looking at both Ontario and Quebec as being a couple of buried aces in the blind in this sheepshead game that is coming up with the federal government because they don't have control over those two cards in the deck.

I will assert now that I believe that because the Great Lakes and the St. Lawrence totally lie within the borders of eight states and two and provinces is, in fact, the fundamental property of those states and those provinces. No Canadian or U.S. federal territory is involved here. We have been drawing our maps of Wisconsin all wrong. The line between Wisconsin is out there between Michigan and Wisconsin. The lines between Ontario and Minnesota extend through the lake and between Ontario and Michigan and between Ontario and Ohio and Pennsylvania and New York. All those borders are out there in the water. There is no federally assigned area either to Ottawa or Washington, DC. Wisconsin's interests lie with the concerned efforts of all of our neighbors and I am talking about our state and provincial neighbors to deal with the issues of our common resource. The water is in and within our territory. I submit, the water is the property of the people of those states and those provinces. I would argue that that is just as true of that water as is the gas, oil and coal that exists within the property, both private and public, of the states in the rest of this continent. There is no distinction. I do not deny the question of navigability as it relates to interstate commerce does come under Ottawa and Washington, DC. I do not deny the issue of water pollution and water quality as being of a national interest in which both Washington, DC, and Ottawa have something at stake because, again, it is interstate. I do deny the notion of property ownership and right, therefore, to take water out and move water to some other province or some other state. The issue will not be provincial because Canada has a good deal of water in its provinces. It is the United States that will become the key issue. In Wisconsin we will also evaluate the adequacy of our existing governmental institutions and perhaps a new vehicle is needed, whether it is a Water Planning Board or whatever, but something that will have to carried forward in formal agreement with other Great Lakes' states and with the two provinces. I think it is advisable to form and interstate and interprovincial compact and notice I do not say and international compact. I know I begin to start coming off as the George Wallace of the water set, but I feel very strongly about this issue based on where those boundary lines and the fact that all my life I always thought that Wisconsin ended out here at the shore of Lake Michigan; and I now know clearly it does not.

It is important now to form and interstate and provincial compact to address these issues on the water ownership question. You have heard the economics of transfer are not good and I understand that. You are dealing

with the economics today and I particularly say to those of you who are young, my age never believed they were going to be looking at cars for $10,000 or talking about house at $80,000 or $90,000. Joyce and I bought our first home at $11,200 which my parents thought was a ridiculous price. It was twice what they thought of paying for a home in their lifetime and then I got gouged at 4% by the bankers, so please don't take what is today and make judgments about what is going to happen by the end of the century in terms of the numbers. I think that is a very dangerous path to tread and those who have the best part of a half century under their belt know full well the kinds of changes that can occur within a period of time. Economics are important, but they are not the sole determinent. If money can make water flow uphill, rest assured that under the right conditions, politics can make is gush uphill. Don't lose sight of that. Wisconsin must be on its guard and frankly will shout to be heard when making a decision that is so basic and so important.

I will simply conclude now by reminding you that over 200 years ago Ben Franklin said, "We know not what the well is worth until it runs dry". We in Wisconsin, Minnesota, Ontario, Illinois, Indiana, Ohio, Michigan, Pennsylvania, Quebec, New York must now look to our well. God and the glacier may have created the Great Lakes but Ottawa and Washington, DC, will try to claim it. If we don't stand together now and protect and perserve that which by historical chance belongs to the people within who's state and provincial borders these lakes exist; then I say we will be letting loose the greatest resource ever given to any people on this continent. Time will yet bear those predictions out and with a little luck I will live long enough to see that not only were they born out but starting at this conference and what takes place subsequently we did something about it.

WARREN VIESSMAN, JR.
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LUNCHEON ADDRESS

WATER CRISIS: A PHYSICAL REALTIY OR AN INSTITUTIONAL SPECTER

*Warren Viessman, Jr.**

During the last 100 years there has been a parade of analyses, plans, projects, legislative hearings, confrontations, and hung decisions relative to matters concerning the Nation's water resources. The first 80 years were mostly a period of development, but the last 20 have broken the pattern and an antagonism toward almost every type of development, and certainly water resources development, has effectively altered the earlier precedent. It is interesting to observe the disproportionate share of blame for inefficiency, "pork barreling", and environmental destructiveness which as been assigned to water projects and programs. For when measured in dollars, the total level of expenditures constitutes only about one percent of the entire federal budget (FY 1983). Perhaps it is because water projects are scrutinized so intensively. The lengthy reviews they are given are not typical of those imposed on most other programs, some of which involve expenditures measured not in billions, but in hundreds of billions of dollars.

Perception of water problems, acceptance of ways for dealing with them, political maneuvering to get water projects, definition of beneficial uses of water, and administrative procedures for dealing with water supply and wastewater disposal have all undergone rapid change since the 1960s. The environmental movement took shape, sweeping legislation on water quality control was passed, and citizens began looking more critically at the tradeoffs between water programs and those related to education, crime and social services.

The once powerful political blocks of western Congressmen were weakened under the fire of eastern coalitions which felt that they were not being fairly treated regarding location and type of water resources investments. And the list continues. In fact, during all of this time, the only constant has been the resource itself. Floods, droughts, and pollution have marched on as always. What *did* change radically was the focus. It shifted from the technical issues of hydrologic systems—physical, biological, and chemical features of water bodies—to issues of human behavior, those associated with the presence of man and his activities.

Historically, water resources development has been project oriented. A local constituency identifies a need for flood control, drinking water supply,

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*The views expressed are those of the author and do not necessarily reflect those of the Library of Congress or any member of Congress.

irrigation water, etc. This desire is then translated into political action, and if the necessary support can be gained, a project usually results. Although the trend has been for such projects to be multipurpose in nature, they are often conceived with little concern for how they relate to other elements of the overall water resources system of which they are a part. Such practice was not particularly troublesome in days when projects were few and their effects could be considered local. But as time went on, it became clear that inter-dependencies, whether considered or not, did exist for many water management activities. Ground water pumpers were interfering with surface water users and with one another. Industrial and other waste dischargers were driving water treatment costs up for downstream users. Upstream storages for irrigation were conflicting with downstream navigation flows. The examples are endless.

As the need to recognize regional relationships became more pronounced, a variety of area-wide planning programs was established. Unfortunately, many of these were administered by loose, voluntary types of organizations, and few of them had any authority to plan objectively, or more importantly, to see their plans through to completion. The trouble with most such efforts was that the actors involved were usually representative of some level of government, or a particular agency or interest group. As a result, they carried the flag of their organization and were reluctant to even consider alternatives which would cast their interests in a negative light. Plans that unfolded out of such consensus-seeking efforts were mostly collections of projects, packaged so that all partners were appeased. Little effort usually went into addressing questions of priority or into assessing the implications of pursuing the courses of action proposed. The vague and costly nature of such plans was by itself good reason for their rejection by members of the Congress, state legislatures, or other decision-makers. The usual detachment of most such planning groups from agencies responsible for carrying out water management programs was a further constraint on implementation.

Today the need for objective planning and management is more apparent than ever before. The question is how to pull it off. It is not a matter of technology, it is a matter of human . . . agency . . . government . . . interest-group interrelationships. And, it is symptomatic of a larger institutional problem which is at the bottom of all water issues. Even a casual observer of water resources planning and management recognizes that competent, authoritative mechanisms are needed to assure wise decisions and long-term reliability for meeting the Nation's water needs. The trouble is that many of those who participate in such processes are jealous of their local kingdoms and are suspicious of any overlying authority that might dilute their voices. Why they cannot recognize that many of the problems they face are due to their already dilute positions is hard to understand. The greatly fragmented power systems which must be dealt with—state, federal, local—legislative, executive, judicial—present more of a challenge than most care to accept.

Isolationalism in dealing with water resources issues, localized influences of laws and regulations, political boundaries, agency missions, financial barriers, social customs, and the belief that water is free for the taking have all interacted to create a "water crisis" aura. It is unfortunate that these human aspects of water management are so sensitive that politicians and others avoid addressing them, with the hope that if left alone, they will eventually go away. Instead, as the situation deteriorates, technological refinements and evaluation procedures are argued about because they generate controversy of little real scale, and can be made the scapegoat for indecision and inaction. The lessons of history never seem to be learned.

Now I don't want to convey the notion that there are not problems of water shortage or water quality degradation, or that there is no technical role to be played. There is and it is a powerful one. The point I am trying to make, however, is that in many, and I believe most cases, water is physically available but locked out of use by laws, regulations, historic traditions, imperceptions, and/or other institutional mechanisms. The challenge of the future is to take on these dragons and bring them to bay. If this is not done, local water shortages will be widespread and their correction will be costly and time-consuming.

The institutional elements of concern to water management are varied, but they all have a common human thread which drives them, not by logic, but by emotion. It is this feature with which you and I must contend if we are going to use our talents in the most effective manner to assure that future generations will be able to enjoy their environment, have ample food, produce the things necessary for achieving desired goals and maintain a healthful standard of living. Our present levels of technological understanding are already sufficient to allow us to present viable alternatives capable of getting at some of the tough water-related issues; our shortcoming is in our ability to implement the solutions suggested. The voices of those who strongly oppose any form of water development must be reckoned with and listened to. These militant groups press for curtailment of water use, emphasize non-structural approaches, play on the selfishness of local constituencies, and are masters at creating negativism and delay. The trouble is that an organized and informed counterforce to bring the dimension of objectivity into the arena is usually lacking. The intensity of opposition to water resources programs by conservationists, preservationists, environmentalists, and others has created an era in which both the layman and the professional almost rush to postponement of difficult decisions in their desire to achieve short-run objectives. But someday the "piper will have to be paid". Our tendency to avoid or minimize the issues now will exact a substantial price.

If the world's water problems could be solved without concern for political boundaries, social customs, in-place organizations, existing laws, regulations, and local politics, technical solutions would be the order of the day. But reality dictates that technology be exercised within institutional limits. This means that only those technical solutions which are politically feasible,

socially acceptable, and legally permissible will have any chance at implementation, short of lifting some or all of the constraining influences. Planners, developers, and managers must identify the institutional constraints affecting their missions, and with this understanding, proceed to develop alternatives which are feasible. To seek "best" technical solutions without regard for their viability within institutional settings is to invite delay, added cost, or even total failure.

Although the technologist must learn to operate within the context of prevailing institutional systems, he does not have to accept that these systems are fixed forever. There is an important role to play in providing factual analyses of the impact of existing constraints on addressing water issues. If the benfits to society can be clearly determined to increase as the result of modifying laws, changing regulations, developing new organizations, etc., then prospects for eventual reform will be enhanced. Politicians are very sensitive to costs and rewards, and where they can be convinced that revised or new directions will have payoff, they will listen. The technologist's approach should be to offer options which include both constrained and unconstrained solutions, documenting the benefits of each. In this way, options requiring institutuional change can be weighed against those which do not and the choice can at least be informed one. Scientists and engineers have always taken pride in their objectivity in attacking problems, and that is what is needed now. Unfortunately, this objectivity has been undermined by political and social pressures. An easy route has been taken, but it is one with grave consequences for the future. Dr. Abel Wolman's statement that . . . "one can discern a long, evolving manifestation of intimidation of professional objectivity" . . . says it very well.

We as a Nation are technologically rich, and our level of accomplishment is high and very sophisticated. But we as a human system are floundering at an elementary level, with perplexing interpersonal, intergovernmental, interagency, and related problems which drive and mold our decisons and which seem at times to eliminate all options for achievement except those created in a scene of crisis. This is not an easy society to live in. The rate of change in its technological dimensions has been swift and mind boggling, and these changes are accelerating. Many of the institutional elements, on the other hand, are old, have not kept pace with other shifts, and are tied to policies of days gone by. The tug of war this creates is intense and debilitating. It must be resolved, however, if our future is not to be one of shortage and suffering. I believe we know what to do, but unfortunately are too often inhibited in our actions out of fear of the short-run consequences.

Furthermore, it seems to me that we have generally been approaching the problems we face in the wrong way, or at least in a way which minimizes our chances of success. For years it was recognized that some type of regional planning was needed to bring about a cohesive type of development. Unfortunately, the failures of regional organizations which were created to do this job are legion. The lesson is that needed changes are not going to occur unless there is strong incentive for them. Most reforms will require

compromise at best, and loss for some of those involved at worst. Few panels will ever recommend a course of action which is detrimental to any of its members. What is needed, is a mechanism by which objectivity can be brought into decision-making processes on a sustained basis. Most politicians are able to understand, and actively seek factual information about issues of concern to them. If a good case can be made for an issue, and if its pros and cons are documented, decision-makers will review them. If a payoff related to change can be presented in hard terms, the likelihood of program implementation is high. But it must also be recognized that decision-makers have heavy demands on their time and they often must deal with a variety of issues during a few days or hours. The resources and time they have for study are limited. If they are to react to truth, it must be presented at the right moment and in understandable fashion. There are several ways in which this can be accomplished. Independent commissions or boards, such as the National Water Commission, could be created. Similar structures could also be devised at other levels of government. What strikes me as a broader way to get at this is through an intensive educational process.

The planners and managers of tomorrow must be of a new breed. Being well grounded in technology is not enough. The strict technologist looks for the best technical way out of a problem, he does not always stop to determine if that particular approach goes counter to local traditions, cannot be accommodated within a prevailing legal system, or would negate some other desired activity. To be effective, we must learn to design, manage, and plan within the context of existing physical and institutuional dimensions. Otherwise, our proposals will fare poorly and we will risk the loss of even a step-wise solution. On the other hand, we must take every opportunity to show the gains which might be achieved by lifting some or all of the constraining influences. Information of this type, laid out in simple terms is sorely needed. If it is presented often enough, and done well, it will eventually be listened to by those who can modify laws, form or change organizations, or otherwise change troublesome institutional elements. Given the pressures to provide water for an expanding population, increased industrial activity, energy development, food and fiber production, fish and wildlife preservation, recreation, and other purposes, and given that there are strong social pressures to do all of this with minimal structural undertakings, and in a way unlike that before, an exciting opportunity exists for imaginative management, operating outside of the narrow perspectives of agencies, interest groups, and others. The tools of diagnosis and evaluation at our disposal permit prompt, in-depth evaluations of many courses of action. It is time we started to objectively examine systems already in place to see if they can be operated more efficiently and, if so, what changes would be needed to bring this about. Some exciting things along this line are already in progress. For example, analysts at Johns Hopkins University have found a way to forestall the need for additional water storage facilities in the Potomac River Basin until well into the next century by optimizing the releases from existing reservoirs. Imaginative studies such as this have great promise for taking on problems all over the U.S. But to undertake

such efforts, we will have to consider the total dimensions of the systems to be dealt with—physical and institutional—otherwise the solutions recommended will only be library-bound.

In the final analysis, it seems to me that the severity of environmental and other crises we may face as a Nation will depend in part upon our ability to be "society wise" as well as "technology wise". If we can do this, our creativity, imagination, and strong technical underpinning will find a way to unlock the constraining mechanisms that force us to operate at a level of efficiency far beneath that for which we are capable. This is perhaps the only hope we have for unraveling the years of tradition, laws, regulations, and other institutions which must be tampered with to permit us to use the great pool of knowledge that has been accumulated.

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Mr. Lord is President of Policy and Sciences Associates, a non-profit research corporation specializing in applied social science research in the public policy area. Mr. Lord's experience includes teaching natural resource economics at the University of Colorado; Research Associate at the Institute of Behavioral Science at the University of Colorado; Technical Assistance Expert to the United Nations Office of Technical Cooperation, Kaul, Afghanistan; and Representative in Mexico for Resources for the Future, Inc.

Mr. Lord has extensive publications on the subject of water planning which include 'Municipal Water Supply Restrictions as Urban Growth Constraints', 'Institutional Aspects of Water Allocation in the Upper Colorado', 'Water Resources Planning: Conflict Management', and 'Unified River Basin Management in Retrospect and Prospect' (to be published). Mr. Lord holds a B.S. Degree from the University of Michigan, M.S. Degress from the University of Michigan and the University of Wisconsin, and a Ph.D. Degree from the University of Michigan.

EXECUTIVE SUMMARY

THE INTERBASIN TRANSFER OF WATER: *THE GREAT LAKES CONNECTION*

Prepared by: *William B. Lord*

Diversions of water from the western Great Lakes have been proposed as a response to declining water supplies in the Ogallala aquifer and as a source of water for energy development in the western coal fields. Such proposals quite naturally arouse interest and concern in the Great Lakes states. This conference was called in order to explore the prospects, the problems, and the politics of interbasin transfers of water from the Great Lakes, and to pave the way for multistate consideration of possible responses.

It is common knowledge that use of the fresh surface and ground water resources of North America is increasing, while the availability of those resources remains unchanged at best. Given the fixed supply of water, increased competition is inevitable and absolute shortage a clear possibility. Indeed, the U.S. Water Resources Council has predicted regional water shortages in the Lower Colorado River and Rio Grande regions by the end of the century, and growing demands everywhere.

Forecasts of growing demands and increasing competition must be placed in context, however. That context is one of plentiful supplies of both surface and ground water on an overall national basis and modest economic cost in most places for access to additional water supplies. As competition increases in the future, those costs of access will rise, and rising costs, as always, will dampen the growth of demand.

For most users, the cost of access to additional water supplies will rise slowly and will pose no great economic problems. Municipalities and other domestic users, together with most industries, are capable of sustaining somewhat higher water costs without undue hardship. The same cannot be said for irrigated agriculture, which accounts for 80 percent of the nation's annual consumption of fresh water and which is highly sensitive to the costs of water. Increasing competition for water, therefore, will be marked by reductions in irrigation use as supplies are diverted to meet the demands of industries and municipalities.

The adjustments required in the agricultural sector will pose severe problems for some farmers already punished by a depressed agricultural economy. Those who rely on the declining Ogallala aquifer which underlies parts of the high plains will be especially hard hit. However, farmers in the humid regions will benefit as excess crop production is reduced and prices rise. Irrigators in the energy-producing areas of the West will also feel the pinch of competition for water, but they will often profit as they are able to

sell water rights at prices above the value of water in agricultural production.

There will be proposals for water transfer schemes to relieve the pressure on declining supplies of irrigation water. Few, if any, of those proposals will be economically feasible. The cost of transporting water alone is likely to be several times the value of such water to agriculture. Environmental costs of water transfer technology and the initial value of the water itself will raise the bill even farther above the ability of irrigators to pay. A presently unforeseeable and immensely powerful political coalition will be required to impose the massive costs of such projects upon the rest of the nation, already stuggling as it is with an unyielding federal deficit.

Energy development, on the other hand, presents a more credible stimulus to water transfers. Even in this case, however, the acquisition of irrigation water rights in the vicinity of the development sites, or reliance upon presently untapped ground and surface water supplies, promises to be far cheaper than expensive water transport projects. Then too, the water requirements for energy development are both modest in relation to irrigation requirements and characterized by great flexibility. There will undoubtedly be additional, energy-related water transfers, like that recently negotiated by the State of South Dakota, but they will rarely involve very large volumes of water.

The prospect of large-scale interbasin transfers of water from the Great Lakes is unlikely, although not impossible, in this century. Such transfer proposals as may be realized are likely to be small ones; more in keeping with past diversions into and out of the lakes than with the grandiose schemes which arouse axiety within the region. It is well to remember that water diversions are not new to the Great Lakes. They date back to the construction of the Erie Canal in the nineteenth century, and currently much more water is diverted into the Great Lakes than is diverted out of them.

Even modest interbasin transfers of water out of the Great Lakes do impose costs upon regional interests. The greatest of these costs is the reduction in revenues from hydroelectric power production in the eastern part of the region. Additional losses are due to reductions in tonnages transported by water-borne commerce as water levels fall. Conversely, some recreational benefits can be attributed to lower water levels, as can reductions in losses due to winter storm damages.

The environmental costs of fluctuating water levels, due to the creation of largely sterile littoral zones, have always been a matter of concern. This raises the intriguing possibility that transbasin diversions of water out of the Great Lakes might be beneficial if they could be restricted to high water years, perhaps coupled with ground water recharge at the destination.

On balance, the opportunity costs of exporting modest amounts of Great Lakes water to water-short regions are likely to be less than the value of such water at its destination. This is almost certainly true of the consequent reductions in hydroelectric power and navigation benefits incurred within the Great Lakes region. It is, instead, the large economic, and possibly environmental, costs of accomplishing such transfers which promise to limit their implementation. If and when such obstacles are overcome, however, it would behoove the governmental entities of the region to be prepared to ensure that they are fully compensated for any losses suffered within the region and, additionally, for the scarcity value of the water itself. Furthermore, the region's governments must have settled upon the terms and limits applicable to such transfers, so that unacceptable and irreversible damages to the natural and social systems of the region are avoided. Indeed, it should be an established prerequisite that any interbasin transfers redound to the net benefit of the region and not to its detriment.

As usual, it is not the technical aspects of interbasin transfers of water which are the most problematical, but rather their social aspects. The states and provinces of the Great Lakes region confront the prospects of interbasin transfers without the social institutions in place to deal adequately with that prospect. These institutional inadequacies are most imposing in the two areas of water law and intergovernmental cooperation.

The water laws of the eastern United States were based originally upon the riparian doctrine of English common law. This doctrine in its pure form fails to achieve either workable settlements of water use conflicts or efficient use of scarce water supplies. In essence, it states that water rights inhere only in the ownership or riparian lands, and that even such owners are restricted to those water uses which do not interfere with the water uses of other riparians. The practical result is to bar any controversial use of water.

All states have modified riparian doctrine to make it more workable, and some states have replaced it altogether with modern permit systems. But even these vastly superior permit systems fail, almost always to fully recognize the principle that water is increasingly a scarce good, that scarcity creates value on its own account, and that the scarcity value of water creates the possibility of unearned increments, or windfall gains. Our social institutions for allocating water supplies, and especially our state water laws, treat water as if it were a free good. Water users customarily pay only the costs of developing, treating, and delivering the water they use. Recently, a laudable trend to inclusion of the external or third-party costs, most often attributable to environmental quality concerns, has emerged. Still to come, however, is recognition that any scarce good can be treated as a free good only at the risk of encouraging excessive consumption and windfall gains. If those windfalls are not captured by government, whether through water charges, user fees, or taxes, they will encourage speculative water grabs, wasteful water use, and political pressures for excessive water resource development. The history of water allocation and use in the western states provides abundant examples of this pathology.

The Great Lakes states will be in a weak position to control proposed interbasin transfers of water and to claim their rightful share of the benefits arising fom such transfers until they modernize their water laws. These laws provide the means by which water uses can be controlled within each state and they set an influential precedent for consideration of interstate transfers of water.

If the possibilities for settling intrastate water conflicts are uncertain under riparian doctrine, they are even more ambiguous at the interstate level. States possess three broad options for resolving interstate water conflicts. They may attempt to act unilaterally, through imposing water export bans and/or sales of interstate waters, as in the recent South Dakota example. They may resort to litigation, which is a likely consequence of unilateral action as well. Finally, they may seek to resolve matters through interstate cooperation and bargaining, perhaps eventually resulting in an interstate compact.

The ultimate authority of the United States government to settle interstate conflicts, whether by court action or by legislation, is well established but only reluctantly invoked. In the case of the Great Lakes, both the United States and Canada share that authority under treaty, as exercised by the International Joint Commission. Any substantial change in the levels of any of the Great Lakes, as might be produced by very large water exports, would require the assent of the IJC, and consequently of both national governments. How the IJC might rule on any massive water transfer proposal, or how the U.S. Supreme Court might rule on an interstate conflict surrounding any water transfer proposal, or how the U.S. Congress might decide on any proposed interstate compact to govern one or more such projects, is presently indeterminate.

The ultimate authority of the federal government to regulate interstate water conflicts and to protect the broader national interest in the process of doing so is well established. Still, it is preferable on all counts for the affected states to achieve as much agreement as is possible and to leave as little as possible for subsequent resolution at the federal level, whether in the courts or in the Congress. Ironically, the existing institutuions for interstate and intergovernmental planning and coordinated decision making are being dismantled or weakened through federal action at a time when the need for such institutions is growing. It will be more difficult to create new ad hoc institutions or to adapt existing ones to perform these functions than it would have been to strengthen and improve the Great Lakes Basin Commission. These steps must be taken, however, because the need for effective planning, management, and decision making will only be accentuated by the emergence of new and often conflicting proposals for using the interstate and international water resources of the Great Lakes.

Regional institutions are needed to systematically and objectively explore the many facets, not only of interbasin transfers, but of all the problems which make the Great Lakes states and provinces interdependent with

each other and with other regions. Such institutions can and must produce better information about options and implications; information which will raise the level of public understanding and public discourse about the problems and opportunities associated with the use of the Great Lakes. Democratic decision making demands no less.

Among the kinds of information which should be better developed and disseminated is that concerning who gains and who loses, and how, as a consequence of interbasin transfers and other water allocation decisions. Too often decisions are made without the full illumination of such matters. These decisions are likely to be poor ones, leading eventually to resentment and retribution as history inevitably brings prior omissions to light. The end result is a kind of destructive parochialism in which state is pitted against state and interest against interest, to the point that common values and common purposes are obscured.

In the case of Great Lakes water diversions, better information about the extent and incidence of propsective gains and losses would permit the bargaining between states which could ensure that there were no losers; that the benefits of such transfers were equitably shared between all affected parties, after all prospective costs were fully compensated. Of course, the achievement of such an ideal outcome requires not only full information but also an institutional structure within which bargaining can occur and the arrangements for appropriate payments can be made and carried out. Existing institutions are not adequately structured to perform these functions. New ones must be created, and there must be a prior period of investigation and discussion to develop their outlines.

In conclusion, it appears that interbasin transfers of water are among the lesser dangers confronting the Great Lakes. The most important problem now, as in all recent years, is the maintenance and protection of water quality. But the agenda for adressing this and other problems, interbasin transfers among them, is headed by the requirement for institutional change. The need for improved planning and management, for public education and involvement, for better information about the extent and incidence of gains and losses, and for institutions which facilitate and encourage the bargaining processes through which parochial concerns ae resolved and the common interest discovered, is great. The challenge now is to convert people's fears and suspicions concerning interbasin transfers into an informed public dialogue which will lead eventually to improvement in the governmental institutions through which common values are articulated, conflicts are equitably resolved, efficient resource use is achieved, and environmental quality is maintained; in short, through which a true community is created.

THE DEMAND FOR WATER NATIONWIDE

Moderator: *Lee Botts*
Speakers: *Joseph Rossillon*
Dennis Geary
Harvey Banks

LEE BOTTS
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Ms. Botts is currently serving as Co-director of a newly established Environmental Policy Program at the Center for Urban Affairs and Policy Research at Northwestern University. Prior to her current position, Ms. Botts was Chairperson of the Great Lakes Basin Commission, a regional planning agency responsible for coordinating water and related land policies for eight states and twelve federal agencies.

Ms. Botts has held positions with the Environmental Protection Agency, the Ford Foundation Energy Policy Project, and the Lake Michigan Federation.

THE DEMAND FOR WATER

INTRODUCTION

Lee Botts

I have been accused of having started the fuss over water diversion in the Great Lakes because of a newsletter of the Great Lakes Basin Commission. It discussed the issue of diversion and consumptive use and called attention to the fact that certain places elsewhere in the country were beginning to think that they had a God-given right to the Great Lakes. I happen to disagree with that view, but I do think it is important to address the diversion issue.

The sooner the Great Lakes' states and this region join together in preparing to answer any attempts to divert water from the Great Lakes, the sooner we can get on to the real issue. The issue is, how we are going to keep the Great Lakes clean so that we can better use them in this region in order to rebuild the economy and to restore the quality of life which we have enjoyed and which is the reason this region become great in the first place. So I was delighted when the State of Wisconsin took the initiative to invite persons from the other states and to invite all of us here today to talk about this diversion issue. It is especially good that some of our Canadian neighbors are participating. One of the things we have to make the people in the West and the Southwest understand is that the Great Lakes do not belong just to the United States. Not only do we share them with Canada but they are a world resource. Safeguarding their future is important not just for those of us who enjoy them here in the region but for the future of the food production capacity of our country and especially for the eight states that border on the Great Lakes.

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Dr. Rossillon serves as Executive Director of the Freshwater Foundation, as is a former teacher with graduate degrees in the area of speech/communication specializing in the psychology of communication. Dr. Rossillon assisted in the planning and building of Southwest Minnesota State College, now Southwest State University, and served in the capacity of Assistant to the President for eight years.

Dr. Rossillon has served as Vice President of an agri-business marketing and management firm and as Executive Director of the Minnesota Agri-Growth Council.

INTERBASIN TRANSFER OF WATER: AN OVERVIEW

Dr. Joseph P. Rossillon

We are supposed to discuss Interbasin Transfer of Great Lakes water and I am to present an overview. When we think of water transfer, it is usually for industrial related purposes and the water in question is considered surplus water "That's going to go to waste anyway".

I attended a conference sponsored by the Joyce Foundation two months ago in Chicago, programmed to discuss land and water; rural; urban; regional issues and implications. My section spent the whole first day discussing potable water needs - water for human consumption.

At the review at the end of the third day of the conference, it become very clear that all the sections, land, water, urban, region and rural, ended up with discussions of the same issue, potable water for human consumption. That is an important point to understand because, historically, when we look at water we always think of it as an environmental issue. Environmental issues are never of the highest priority. They are always something "we ought to do if we can get around to it". We are now beginning to realize "potable water" is the number one issue. Potable water is not an environmental issue, its a "people issue" and people issues are always a number one priority.

So before we start looking for nice general environmental based solutions to complex people issues let's keep in mind that we are talking about providing water for people to consume not surplus water as an economic base, or "who gets how much for what purpose".

I used to have a boss who said "people who have all the answers usually don't know the questions". With water, we are just beginning to realize that we don't know the questions.

There was a time when there was plenty of water for everybody to do everything they wanted to do whenever they wanted to. Two things have happened since then. We have put people where there isn't water and we have produced more people. The water is the same amount. We just happen to have more folks now and we have more people at places where there isn't enough water. As a result, we no longer have the luxury of saying, "there's plenty of water for everything".

Before we start looking for answers, let's begin by establishing some of the things we do know. We do know, for example, there is no new water. We have the same stuff we have always had, and we are using it over and over again. The total volume of usable fresh water is only 2,000 gallons per day per man, woman and child in the world. In the United States today, we are nearing a daily use of 2,500 gallons per day per man, woman and child;

which means we are using more than our fair share of the global fresh water supply. That is why pressures are occurring on our supply that weren't there before.

It is important to know that there are not new supplies. One of the errors we make in redistribution is to mask our problems. We give the impression that we have found some new water and we haven't; it has just been moved. It is part of someone else's supply that got moved from someplace else.

Another important thing to keep in mind is that water is a "closed loop". We can't change the system. We can't alter it. We can try to manipulate it, but it always comes back to its prior form; sometimes with very negative results.

A second thing we have learned is that water does not necessarily reclaim or recharge a supply - an old truism. The San Joaquin Valley in California has sunk 30 feet because of a depleted aquifer and it isn't going to recharge. The Ogallala Aquifer, which supplies 1/3 of the produce in the United States is being pumped down as much as three feet a year in some places in Texas. They are running out of water pressure in some areas of western Kansas, West Texas and Oklahoma. We have now found out that the Ogallala is "glacial" water afterall. It isn't recharging. What we are really doing is "mining" a restricted resource.

Many coastal states have had such a tremendous drain on their aquifers that the pressure from the ocean is causing salt water encroachment. Those aquifers are not going to be able to reclaim themselves. They are now becoming salt water aquifers.

Even the Colorado River, which is sixty percent oversubscribed, is used to such a degree for irrigation that it becomes saline it won't grow anything toward the end of it channel. The U.S. is being forced to build a multi-million dollar desalination plant to "desalt" the Colorado River to comply with a "water treaty" with Mexico.

So don't assume that if you leave the water alone it will put itself back in the condition it was before. That is not necessarily the case.

A third thing we need to keep in mind is that water is not a free resource. Water is only free if you are catching rainwater in a cup. Pumping, cleaning, transporting, reclaiming - all of those things cost money. Most of these real costs are not built into our water supply system. They are subsidized and built into the national debt. Because "use" costs are not built in, we create the misconception that water is really not a very valuable resource. If we begin figuring the cost of preparing for use, water in the Great Lakes becomes priceless.

The fourth thing we are learning about water is that we don't have a lot of water problems in the United States - we have only one. *That is overstress.*

We have people using more water for more things than the total water system can absorb without damage. What we are really seeing across the country is all kinds of different manifestations of one single problem, overstress.

There is a direct connection between the sink hole in Florida, the contaminated ground water in Michigan, the increased flooding in Houston, the collapse of the San Joaquin Valley in California, the pump down of the Ogallala and the contamination of the Great Lakes. They are manifestations of a single problem; we are overloading the system.

The one thing we forgot while managing our water supplies for maximum use is "water is Mother Nature's sewer system". Everything in our universe ends up in water. We should not think about water as something clean, we should think of it as a universal septic tank. A septic tank that only works if it is kept in balance.

The three things that will put a septic tank out of balance is to overload it, to kill the bacteria, or introduce something that the bacteria don't recognize. The exact same things occur in all of our water.

What we do in Minneapolis-St. Paul, Chicago, Cleveland and New York is compile people and materials and we overload. Then, to avoid contamination, we kill "the bad" bacteria; ignoring the fact that only 10% of the bacteria are the "bad guys" and many of the "good guys" get killed in the process, creating an imbalance. We further complicate our water supplies by introducing new materials that Mother Nature doesn't recognize (not biodegradable) which stay there forever and they make a supply of water unusable.

What does all of this mean? It means we can no longer do things the old way. When a community was only a few people living on a stream, they could carry their water supply in a bucket. But each new generation and new technology has taken us a long way from that and we have not adequately adjusted. We have lived with the assumption that we can always adjust water to suit our purpose. As a result, we are overstressing the delicate balance of nature and must now consider adjusting our systems to better fit the natural water system.

Impossible? No! Painful? Perhaps. We are making adjustments with energy now, and it is less painful than we anticipated. The changes that we have made since 1975 in regard to energy are indicative of the fact that we can change very quickly. We started looking at alternate energy sources, different sources and different levels of heat for our homes, different modes of transportation, even different lifestyles dictated by energy use. We have adjusted to energy shortages and we are going to have to make similar adjustments with water.

The current condition of our water supplies reminds us that the question is no longer "how much water is there"? The real question is "how much water is available, in a usable form, at an affordable price"? The real issue is whether the water supply is in a condition that is usable for us in the way we need to use it and in the manner that we can afford.

The condition of our fresh water means that from now on, **potable water must come first.** World Health Organization states that 70% of the people in the world do not have acceptable drinking water and that percentage is going up. And the E.P.A. states that 49% of the municipal water supplies in the United States do not meet minimal standards. A new study by Cornell University points out that 60% of rural water supplies, wells, are contaminated.

At the conference in Chicago, William Marks from the Water Management Planning Task Force, of Michigan said, "I'm not about to say that the ground water for the State of Michigan is totally contaminated, but I'm willing to predict that within 5 years the states' entire water supply will come from the Great Lakes". What an awesome statement when you think of all the water underneath the ground that may not be usable for human consumption.

Don't think Michigan is unique. If Michigan has ground water problems, so does New York, Ohio, New Jersey and Pennsylvania. The EPA states that in the United States today there are 204 confirmed "love canal" type situations that are going to break out and contaminate our water supplies. If that is the case, if Michigan's problems are symptomatic of the other 11 states and provinces around the Great Lakes, and if the 8 1/2 million population in a 300 mile radius of the Great Lakes are going to have to take their water from the Great Lakes, the annual use in volume would be equivalent to 3/4 of all the water in Lake Erie.

If that kind of change occurs, it may take all of our efforts just to keep Great Lake's water usable without worrying about selling "surplus" water to other parts of continental North America.

What may be needed? I think what is needed is some kind of a regional planning group, or a super structure that looks at the total picture of the Great Lakes, ties everything together and presents a total perspective of our combined needs and uses to make sure that we know the "plus" and "minuses" of all recommendations. I'm not saying that we shouldn't use the water, I'm not even saying that we shouldn't sell it or transfer it. I'm suggesting that those decisions ought to be made in perspective with the total picture. Before we nickel/dime our future away, I think it very important that we look at it in the total perspective. If we don't, I'm afraid that we will end up just like we did with the energy crisis of overusing our supplies without the alternatives and escape valves that we had with the energy crisis.

In summation, here are the points that I would like to have remembered:

1. Water is Mother Nature's sewer system. It must be allowed to work in balance to clean itself. We aren't rich enough, smart enough or good enough to artifically clean our entire water supply.

2. Our water problems are not "different" problems. Every state in the nation has some kind of water problem that are all manifestations of one single problem - an overload or stressing of the total water system.

3. The issue today is not "Great Lakes water". The issue is the U.S. water supply, a shortage of usable water across the United States and the role that the Great Lakes water plays in that picture.

4. Man doesn't "change" water systems, he "intervenes into" those systems. The question is not "what can we do with our water", but, "what will be the impact of our intervention".

Let's be careful what we decide. We can no longer afford very many or any large mistakes.

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THE DEMAND FOR WATER IN POWER GENERATION

Dennis Geary

People in the power industry aren't always the most well received at gatherings like this, so perhaps I can present some information here that will put us in a little better light. What I plan to do is discuss the demand for water in power generation and attempt to put it into the context of interbasin transfer. I think I'll begin by considering relative water usage on a nationwide basis.

In the US about 24% of available stream flow is withdrawn for various uses and about a third of that is consumed or not returned. I'm going to limit my discussion to stream flow and not consider groundwater here. With regard to consumption, I'm referring specifically to offstream consumption, which is the water withdrawn from a stream or a lake and not put back. This definition eliminates structures like hydrodams that affect the evaporative consumption but don't really withdraw the water from the stream.

Major use categories, are agricultural, industrial and mining, public water supply and steam electric generation. The steam electric generation category includes the power plants which you are used to seeing which burn coal, oil, natural gas, to produce steam to run a turbine, the classic power plant. What I have shown are data for 1975 and projections to the year 2000. What you see as the total consumption for 1975 was a little less than 120 million gallons per day and of this, that very little red piece of the pie you see on the lefthand side, is steam electric generation which was about 14.4 million gallons per day or only 1.23% of the total. Overall it is a pretty small piece. That big yellow chunk that was alluded to by our previous speaker is agricultural consumption. This is actual consumption primarily from irrigation which was just under 85% of the total consumption of surface water for 1975. The projections to year 2000 don't really show a significant amount of differences, as the total consumption increases to just under 150 million gallons per day. When these projections were made, the Water Resources Council projected a seven-fold increase in steam electric consumption to just under 11,000 million gallons per day. Personally, I think that is an over estimate because of some factors that existed then that don't exist now which I will discuss a little later. Agriculture will obviously remain the single largest consumer in 2000 at 73% of the total.

Obviously, nationwide consumption doesn't mean much when considering real water supply problems. You have to look at things on a narrower basis. So I have shown the regions that the Water Resources Council looked at and I picked some of these somewhat arbitrarily, I guess. Since we are in Wisconsin and I live in Wisconsin, I am going to show you some numbers from the two regions, the Great Lakes and the Upper Mississippi that together encompass the State of Wisconsin. Also we want to look at the Lower Colorado which is representative of an arid region where there are

some obvious water supply problems. This region is basically comprised of the State of Arizona. We should also consider California region for reasons which will become obvious I want to illustrate here is the regionalism of water consumption, the term that Mr. McKelvey used earlier, which I think is an extremely important concept. If everything were distributed equally, we wouldn't be here talking about transferring resources across basin boundaries. What you see in the Great Lakes region, which a heavily industrialized area, is that the total consumption is only about two percent of the total, which is really pretty small. We are talking about dividing up a very small piece of the pie. The industry and mining category (62% of the total) is obviously the largest consumer of water in this region. This is somewhat unique within the US, and I think this is the highest percentage that existed in any region. Another characteristic of an industrialized area with adequate rainfall is the low agricultural consumption of about 8% of the total for the Great Lakes.

Looking at the Upper Mississippi, you see an even smaller percentage consumption for that region, only about 1% of the total for the US. This region is also somewhat unique in the balance of its major consumers. There is usually considerable disparity between uses, and I think that this is the only region that was examined at by the Water Resources Council where this sort of balance between users existed. Agriculture was highest at 36% and steam electric the lowest at 11%.

Now when you consider Lower Colorado and California, you see that the green line seems to have grown considerably. This represents the agricultural consumption which is primarily irrigation. Colorado doesn't really use that much water relatively speaking if you want to look at it that way, about 4% of the US consumption. Of that the agricultural portion was about 90%, and the steam electric portion was only about 1%. Power plants are not really using a lot of water in those areas. The lower Colorado is interesting in that it is one of two regions, the Rio Grande being the other, in which consumption exceeds supply and must be met through imports.

California is very similar to Colorado, with 92% agricultural usage and only about .1% for steam electric. Of course this doesn't include the coastal plants that are using salt water, we are just talking about fresh water resources here. The thing that strikes me about California is that their consumption in 1975 was 24% of the total U.S. consumption. So you are looking at one state whose consumptive usage is about 1/4 of that for the entire country. Obviously, something which you should pay particular attention to.

The next slide shows the same categories projected to year 2000. The patterns are pretty much the same as for 1975. California is still projected to consume over 20% of the total for the nation and nearly 90% of it for agricultural consumption. The predictions indicate that the relative consumptive use of the four major users within the regions will not change

greatly; although, the steam electric consumption in the Upper Mississippi is projected to reach 40% for that region.

Before I go on I will make a few comments on what I feel is the significance of these sorts of data. Particularly, I want to underline the regionalism of water resources within the United States as well as the relative significance of major consumptive uses of water in both water rich and water poor regions of the country. It is very apparent to me that the relatively arid regions with limited surface water supplies are major consumers of water and that most of that consumption is related to agricultural practices, particularly irrigation. It is equally apparent that the consumption of water for steam electric power generation is very small when viewed on a countrywide scale. Obviously, a large reduction in percentage of consumption, lets say in the 30 to 40 percent range, in consumptive use of power plants would mean very little to total available water resources. However, the withdrawal and consumption requirements for central station power generation may be very important on a localized basis particularly in water poor areas. Any meaningful statement regarding the physical availability of water for a specific project requires a hyrdologic analysis tailored to the specific need. I know as well as you do how big power plants are and on a local basis, they can certainly have a significant effect; and with this in mind it is useful to consider more carefully the needs and requirements for water at various energy facilities. This is where I can give you some of our industry information that you may not be so familiar with.

The next slide highlights the steam electric category which I have been discussing most specifically. You will see that these numbers are awfully hard to relate to in terms of their relative magnitude. They are expressed in acre feet which is pretty easy to understand. It is the volume of water contained in a one acre pond that is one foot deep. It is equivalent to just under 326,000 gallons. The other unit, which is one thousand quadrillion BTU's of product, is something I don't really have a handle on, but for the purposes of this slide it serves to put all of these technologies and processes on an equal footing. Just say per common energy unit if you want to look at it that way; it is a common denominator. Now you can see that for nuclear and fossil fuel we are talking about 600 acre feet per unit for nuclear and 400 acre feet for unit for cooling for fossil fuel plants, and the difference is because of the thermal efficiency of these plants. Nuclear plants are about 31% efficient; fossil fuel plants 38%. What that means is that in the steam cycle somewhere in the range of 62 to 69% of the heat that is generated has to be dissipated or rejected. It is just not usable under this technology in the steam cycle. This in very simple terms, is why you need a lot of cooling water for power plants. Some of the waste heat, obviously is rejected in flue gas. It goes up the stack. But this is very very small. Nearly all of it is rejected through condensors. As the steam is run through heat exchangers containing cold water in adjacent tubes, it condenses according to the applicable laws of thermodynamics and rejects a tremendous amount of BTU's to the cooling water. This is why you see or

have seen in the past, power plants built on very large bodies of water, and using as much of that water as they needed.

Now we come to cooling. The categories are the following: (1) Once-through or open cycle cooling where the water is pumped in from a river or a lake, passes through the condensors, and is discharged with a certain elevation in temperature. (2) Cooling ponds which are constructed at a station for the purpose of providing an off-stream source of cooling water. Cooling lakes are also within this subcategory, and they are sometimes an on-stream reservoir-type situation. (3) Wet cooling towers of various types, such as the natural draft wet cooling towers that have become the symbol of the nuclear industry. They can be at any other kind of power plant as well. Since there are two of them on Three Mile Island they have become the symbol of that industry even though they represent a cooling technology that can exist at any power plant. (4) The last is a dry cooling tower that exchanges heat with air. These are used in some of the arid regions for so called zero discharge plants.

I am going to skip a lot of the detail on cooling technologies and to try to get to the significance of each type in terms of withdrawal requirement, the consumption requirement and then the energy penalty. This is the price you pay at the plant for using these sorts of cooling technologies. The sources are a reduction in plant efficiency due to the energy needed for fans and pumps, or a loss on thermodynamic efficiency caused by higher cooling water temperatures. The slide clearly shows the once-through situation where the consumption is not so high and then off-stream cooling such as cooling ponds and wet cooling towers which have a much reduced withdrawal requirement. As such they don't have to be sited on very large bodies of water, but they pretty much evaporate all the water they do withdraw.

This is the reason I want to get back to an earlier statement about why I think the projections that were made in 1975 for steam electric consumption may have been overestimated. That was a time when it looked very unlikely that once through plants would be built any more, and that the variances to build these would be very difficult to acquire. The regulatory atmosphere right now seems to be a little more receptive to once through cooling now that so called thermal pollution is not the issue it once was relative to some of the environmental problems caused by cooling towers and the land requirements of cooling lakes. I think that there will be more once through than maybe was projected then and I don't think that the water consumption will be so high as the Water Resources Council might have thought in 1975.

The key is the energy penalty particularly for dry towers. When you are siting a plant in an arid region, you are going to derate it significantly. For a thousand megawatt plant, the average energy penalty for operating dry towers is 7% or 70,000 kilowatts. The situation could, of course, be much worse on the hottest days of the year, which is also when maximum plant

capacity is usually needed to meet peak loads. It is obvious that to reduce water consumption significantly at power plants inflicts a potentially severe energy cost.

On the next slide you can see the various types of synfuel technologies, coal, gassification, oil shell conversion, coal liquefaction and their water requirements which are in the 50 to 100 acre per unit range. These figures represent the production-phase requirement and do not include any water consumption requirement at a power generation site.

The problem that I encountered with synfuels was trying to figure out where the projects are going. Things have changed a lot since the Carter Administration, and I found the prospects very difficult to assess even on a day-to-day basis. Several large projects, such as the $3.5 billion Wy Coal Gas project and the $6 billion Colony Oil shale project, have been dropped in recent weeks. Occidental Petroleum has totally withdrawn from synfuels projects, citing high interest rates and soft oil prices as the culprits. Such projects, if completed, would certainly have profound effects on the balance of energy and water resoureces in the U.S., but the uncertainties involved do not allow a valid assessment.

A topic that I think is fairly significant to this group is that of coal slurry pipelines. As you can see from the slide the actual water requirement for transporting coal with first generation coal slurries is relatively low. In first generation coal slurry pipelines, the optimum ratio by volume is 52 to 48 of coal to water or very nearly one to one. What this means is that 12 1/2 million tons of coal per year requires 8500 acre feet of water. To put this into a little perspective, the 8500 acre feet of water is equivalent to the annual supply of a city of 75,000 people. Whereas the 12 1/2 million tons of coal will supply six 500 megawatt power plants which will produce the electricity to supply 1 1/2 to 2 million people. This is a fairly significant difference in terms of the population equivalent.

While I am discussing coal slurry pipelines, which are transportation modes I think I should put them into perspective with other types of energy transport. The next slide compares slurry pipelines to unit trains which are the most common way of moving coal from the west to the midwest, and with EHV DC transmission lines. What you see are very similar numbers (4.6 & 4.2%) for the coal slurry pipeline and unit trains in terms of the energy penalty to move the equivalent amount of fuel a 1000 miles. The extra high voltable DC transmission line—has a significantly higher penalty of 6 1/2%, which really doesn't make the coal by wire philosophy look too attractive.

My presentation so far has been a rather unrealistic consideration of energy and water resources. I would like to acknowledge reality and at least mention, what I call my non-energy considerations. These are a multitude of factors which continually affect the viability of all water and energy projects. Certainly, any consideration of interbasin transfer of

water or energy would be significantly affected by some of all of the following: 1) legal factors, such as western water law, interstate routing, eminent domain which is certainly a significant topic in discussing the prospects of slurry pipelines, and Indian rights; 2) environmental considerations which would include more than I could even list; 3) political factors such as protectionism that individual states may feel in giving up any of their resources and the pork barrel attitudes of a lot of our politicians; they want a project whether it is going to do them any good or not; 4) socio-economic factors such as conversion of non-energy to energy uses of water, and the ghost town syndrome—what happens to areas economically when major energy projects are terminated. Even at the planning stage the demise of the Colony project affected a lot of the ancilliary projects that would have been associated with it. Now that I have mentioned these things, I would like to forget them and go back to the simplistic unreal world and maybe pose a couple possibilities tying some of these ideas together.

First, the concept of regionalism. We obviously have energy rich and water poor areas such as the State of Wyoming. And there are energy poor and water rich regions such as the State of Wisconsin which really has no native energy resources (if you discount peat) but certainly has abundant surface water supplies. If we combine the concept of regionality with that of reciprocity perhaps it is possible to, in an equivalent way, rectify the imbalance with acceptable transfers of resources. With this in mind, I would like to pose what I think is a feasible, if simplistic scenario, for interbasin transfer. It is transferring via water pipeline high quality water from Lake Superior to a water poor state such as Wyoming, and I certainly don't want to infer that this water would be used for a coal slurry pipeline. That would be ridiculous because of the quality consideration. Lake Superior water is at or near potable quality and certainly could be used for domestic supplies or other high quality uses with little or no treatment. The coal from Wyoming could then be transported east by a slurry pipeline using low quality water such as wastewater or irrigation return flow, provided there are no salinity limitations. The efficiency of the pipeline is similar to a unit train, and this idealized scenario would redistribute the natural resources and eliminate the regional imbalances.

The idealized scheme which I described was not meant to endorse slurry pipelines nor does it represent my company's policy. I personally feel that eventually there are going to be critical shortages of both enery and water in different areas. I think that the concept of reciprocal interbasin transfer is not one that should be dismissed as a priority, but when conditions become serious enough it should be given serious consideration.

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Mr. Banks has forty-six years' experience in land and water resources management, and environmental work on the federal, state, and local levels both in public agencies and private practice. Mr. Banks was the last State Engineer and the first Director of Water Resources for the State of California. He directed the final formulation of the California Water Plan. In addition to his work in California, Mr. Banks has served on the Texas Water Development Board which prepared a long range water plan for Texas, worked on the master water development plan for the State of New York, served as a member of the Board of Consultants to the National Water Commission, worked with the Bureau of Reclamation on a U.S. Western Water Plan, as well as international service with the United Nations. Mr. Banks was Project Director on the $6 million Six State High Plains-Ogallala Aquifer Study. Mr. Banks is a Registered Professional Engineer in the States of California, Texas, Nevada, Arizona, Nebraska, and Washington.

FUTURE WATER DEMANDS IN THE UNITED STATES

Harvey O. Banks

INTRODUCTION

I am pleased to have been invited to discuss what has become to a large extent an emotional and political issue. The economic aspects appear to have been forgotten by many people.

I must admit that I know little about the water resources or the water problems in the Great Lakes' states. I have had no experience in these states except in New York and that was some years ago.

I agree with many of the principal points that Dr. Rossillon made. We continue to grossly misuse and abuse our water resources. We have long continued to regard water as a **free** good in the source to be developed and used for the direct benefit of those who can assert some claim to use of the resources with minor exceptions. It is true that when one plays a water bill it costs money. When Wisconsin Power Company develops a water supply for cooling purposes, it costs the utility. But the payment of utility bills by customers do not pay for the resources, water in the source. It reimburses the utility, for example, for the costs of the intake structures, pumping plants, dams, reservoirs, pipelines, wells, treatment plants and other physical facilities, for management and administrative costs, and for profit. It does **not** reimburse the proper owner for the resource—the citizens of Wisconsin—for the value of the resource used to them. It does **not** provide any funds to the State of Wisconsin to manage the resource in the overall interests of the citizens of Wisconsin. The State does not charge the water users for that. We do not, with minor exceptions, ever regard water as a valuable resource in the source. Those exceptions are mostly local agencies, particularly in California.

Water problems are nationwide. Problems and shortages are not confined to the arid and semi-arid areas, but are found throughout the country. Most of those in the East and in parts of the West are due to pollution, inadequate or deteriorated systems, lack of planning, lack of corrective action before the time that the problem reaches crisis proportions, lack of funding, or other causes not directly related to the regional availability of naturally occuring water resources. It often happens that ample resources are available on a regional basis but for one reason or another, frequently political, the necessary facilities have not been constructed in time to prevent shortages. Examples may be found in Texas, Massachusetts and California.

The problem of funding for water and related resources planning and development, and for system improvements is now acute,, and will worsen as

the Federal Government continues to retreat from the water resources field.

Interbasin transfers, the subject for discussion today, are not a new concept. The Romans made interbasin transfers. Ancient peoples made interbasin transfers. In the later part of the 19th century, New York went to the Catskills and more recently to the Upper Delaware River Basin. In 1913, the City of Los Angeles diverted water in the Owens Valley and transported it some 230 miles to the growing metropolitan area of southern California. It is interesting to note, incidentally, in connection with that interbasin transfer, that the City did exactly what many economists are saying should be done today. The City bought agricultural water rights. That is one of the favorite proposals today; transfer agricultural uses to higher value uses such as municipal and industrial. It is also interesting to note, however, that after the farmers of Owens Valley had received payment for their water rights back in the early 1900's, they began to regret it and they have regretted it ever since. It has become a hot political issue in California.

Metropolitan Water District of Southern California began importing water from the Lower Colorado River Basin in 1941.

There is beginning to be some thought given to international transfers. Several plans have been developed and are being actively discussed.

Interbasin transfers including interstate interbasin transfers have been a fact of life in this country for decades. It is by no means a new idea. However, there are two things that need to be considered now; technology for the better use of water minimizing the need for more water, the cost of interbasin transfers and the lack of funding. I will discuss later the High Plains - Ogallala Aquifer Regional Resources Study which has recently been completed. That Study illustrates some of the problems involved and some of the aspects to be considered before we embark on large scale interbasin transfers. I was project director for that Study.

FUTURE WATER DEMAND

Any projection of demand made today may be outdated next week, perhaps tomorrow. As Mr. Geary has said, abandonment of the Colony Oil Shale Project changes the demand for water for energy production at least for the near future. The demand for water for irrigation depends on the future demand for agricultural products which in turn depends on the federal agricultural policy of which there is none as regards expansion of irrigation. If the export demand for agricultural products grows as the U.S. Department of Agriculture projects, the demand for irrigation water may increase. As this time, it would be difficult to sell very much water for irrigation because of the current price-cost squeeze.

The terms used in discussion of this subject must be defined carefully. Of course, the term "water resources" is self-explanatory. It means the naturally occurring waters that nature provides which vary from year to year, from decade to decade, but in general as far as we can foresee, on an average basis, water is a renewable resource providing we don't spoil it in the interium. However, when we speak of demand, that is different. There have been volumes of literature written on the definition of demand. The term is sometimes used synonymously with requirements, sometimes synonymously with need. I am not speaking only of the "need" for potable water but include the uses of water for such purposes as irrigation, hydropower generation, energy production, navigation, recreation, and fish and wildlife habitat.

The term "requirements" is often used to mean, in the case of agriculture, for example, the water required to provide a full supply for irrigation of every irrigable acre in a particular state or region. That would take a lot of water and probably would not be justified under any circumstance. "Needs" are frequently wishful thinking. Wouldn't it be nice if we had X million gallons or hundreds of millions of gallons or trillion gallons for this particular purpose?

"Demand" is used here in an economic sense, i.e. as determined by the values derived from the uses of water. This does not rule out the proper demand for environmental purposes, fish and wildlife, riparian habitat, quality control and other non-quantifiable but socially valuable uses. But demand is to a considerable extent dependent on economics. The demand for water in irrigation, for instance, is very sensitive to the cost of water to the farmer. If the farmer is subsidized, as under the Federal Reclamation Program, more water will be used than if the full cost were charged. Under the cost sharing principles proposed by the current Administration, the demand for irrigation water from new federal projects will be significantly less than in the past.

The Second National Assessment of the Nation's Water Resources made by the U.S. Water Resources Council 1975 to 1978 is the **only** overall assessment that we have of recent time. There may not be another one, at least in the forseeable future because the Water Resources Planning Act of 1965 has expired. The Water Resources Council as we have known it will cease to exist on September 30, 1982. Concerning what the new water policy group under Secretary of the Interior Watt will or will not do we can only speculate at this time.

The projections of water uses to the year 2000 as given in the Second National Assessment are largely expressions of desire or needs, not necessarily as might be dictated by economics or limitations of funding. In other words, these are gross values. The Assessment identified only three water resource regions in the United States with deficiencies in resources as related to the anticipated or projected uses: the Lower Colorado River Region below Lee Ferry, the Great Basin Region located mainly in Nevada and

Western Utah, and Rio Grande Region in southern Colorado, central New Mexico and western Texas. For the other 15 regions in the United States, the regional resources were projected to exceed to some degree the anticipated regional needs.

A gross regional approach masks some serious problems as identified in the Second National Assessment for subregions. There are areas of deficiency within water resource regions with indicated excesses, of which the High Plains-Ogallala Aquifer area is probably the predominant one. It masks the fact that in the San Joaquin Valley of California there is presently about a million and a half acre feet per year overdraft on the ground water. The southern California metropolitan area will be short unless more water is imported. There are sufficient water resources within the State of California, mostly in Northern California, to provide for future demands provided we can overcome our emotional and political problems, and provided we do objective planning and development and get away from wishful thinking. California does not need water from the Columbia River or from the Great Lakes.

Another example of shortage is southern Georgia where irrigation is expanding resulting in severe reductions in both ground water levels and stream base flows. Proper planning and development of the resources would have avoided shortage. Indiana faces some problems due to expanding irrigation in certain river basins. Arizona is frequently listed as a severely water short area. There is something in the order of a two and a half million acre feet overdraft on the ground water at present, largely due to irrigation. However, under the new Comprehensive Groundwater Management Act of Arizona which was passed in 1980, it is the intent to gradually phase out most irrigation in the Salt River Valley. If that is done, coupled with the Central Arizona Project which will go into operation in 1985 supply may be brought into balance with demand by 2025. I doubt that Arizona will ever need any water from the Great Lakes. Denver is another area for which shortage in the near future is projected. The Denver Water Board has asked the U.S. Army Corps of Engineers to make a massive study of alternatives including additional interbasin transfers from the Upper Colorado River Basin or as conventionally known, the West Slope of Colorado. The possibility of tapping the Great Lakes has not been mentioned.

We can not evaluate resources vs. demand on a gross national or even regional basis but rather it must be done on a specific subregional basis.

What are the uncertainties in projecting water demands? There is the effect of price to be charged for water used, particularly true for agriculture. To some extent it is true in industrial use as Mr. Lord has pointed out in a recent paper. It is for true to some extent in energy production. Another question is the degree of conservation that we can reasonably expect to achieve in existing uses and how will that affect future uses? What are reasonably cost effective levels of unit uses?

Unfortunately, we know very little about what is needed to maintain an adequate habitat for fish and wildlife. How much water do we need for navigation? What will be the future demand for energy production and energy generation? What will be the cost of energy for pumping groundwater or surface water, a major factor in projecting the demand for irrigation water in places such as the High Plains-Ogallala Aquifer area? What are the possibilities for reallocation of existing supplies, particularly those used for irrigation, to higher uses, municipal, industrial and energy? This is going on today in Colorado and Utah. Finally, what increases in water use efficiences may be achievable through technological research? To summarize, water demands are highly dynamic. Projections made at any given time must be considered as subject to major changes in the future.

THE HIGH PLAINS-OGALLALA AQUIFER AREA

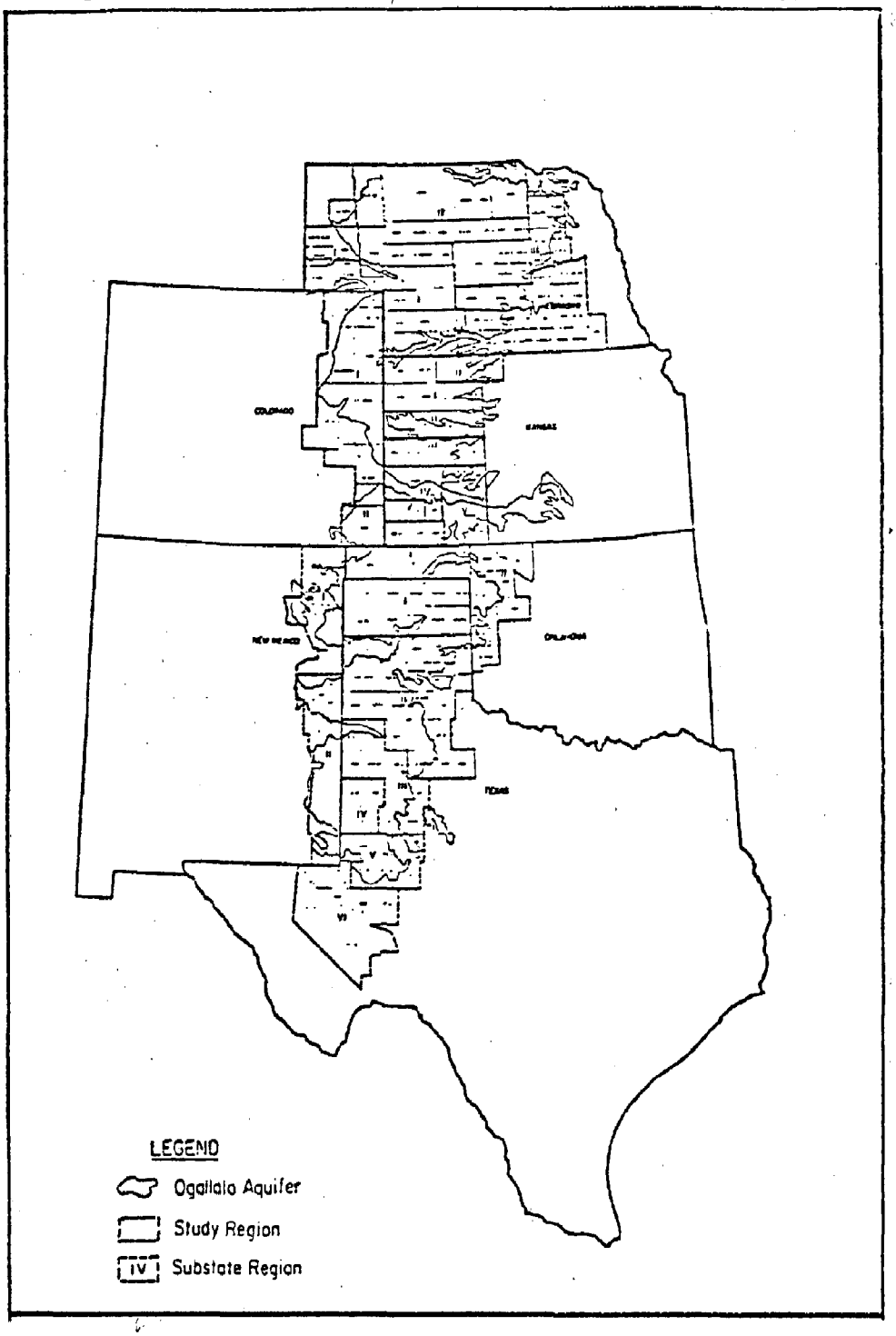
Results of the $6 million six-state High Plains-Ogallala Aquifer Regional Resources Study, authorized and funded by the Congress, and completed in March 1982 under my direction, may provide a better insight into shortage problems and the possibilities for action other than interbasin transfers. Possible interbasin transfers from "adjacent areas" as specified by the Congress in the authorizing legislation, were investigated by the U.S. Army Corps of Engineers as an element of the overall study.

The Study was undertaken because of the concern of the Congress over the continuing depletion of the Aquifer and the prospective effects on the regional economy and on the food supply of the Nation. The Congress was also concerned about the economic impacts of the depletion of the oil and gas reserves. The energy sector is an important element of the regional economy. The Congress felt that something should be done or at least studied that might indicate how the regional economy and vitality might be maintained.

The Ogallala Aquifer and the Study area are shown on Figure 1. The Study area encompasses those counties which partly or wholly overly the Ogallala Aquifer and which depend on the Ogallala and associated aquifers for irrigation water supplies. Economic/demographic data are available on a county basis. It is an area of 220,000 square miles comprising 180 counties in west Texas, eastern New Mexico, the Panhandle of Oklahoma, western Kansas, eastern Nebraska and western and central Nebraska. There are about 40,000,000 acres of irrigable land, much of which is prime land—class one and class two. About 15,000,000 acres were irrigated in 1980 comprising about 20% of the irrigated acreage in the United States, producing much of the feed grains, corn, sorghums and wheat, and cotton grown in the United States. Forty percent of the fed beef we eat, is fattened and gotten ready for slaughter on the High Plains, fed primarily by the feed grains produced there. The Ogallala is primarily of teriary age. Recharge is limited but a real variable. In west Texas, for instance, the recharge is less than one inch per year, whereas it may be six inches per year in the Ne-

FIGURE 1

HIGH PLAINS STUDY AREA–OGALLALA AQUIFER AND COLORADO, KANSAS, NEBRASKA, NEW MEXICO, OKLAHOMA AND TEXAS SUB-REGIONS OF THE HIGH PLAINS REGION



braska sand hills. It is being mined. Water levels are dropping much faster in places where the Aquifer is thin and the recharge lower than in Nebraska where which has tremendous amounts of water remaining in storage in the Aquifer. Some areas have already reverted to dryland farming or have been abandoned because of physical or economic exhaustion of the underlying groundwater particularly in the south High Plains of west Texas. It is not what might be termed a homogenous region. Nor is the Aquifer itself homogenous or uniform.

Six water management strategies were analyzed:

- A "Baseline" trend projection of expansion in use of currently available water conservation and use technology and practices already in use to some extent, with no new purposeful public policy to intervene with action programs for altering the course of irrigation water consumption. (The Baseline or "no action" alternative)

- A water demand management strategy which would stimulate voluntary action to reduce water demands though research, education, demonstration programs and incentives, using technology and practices either not considered in the Baseline analysis or reflected at rates which would be purposefully accelerated. (Management Strategy One)

- A second demand management strategy which assumes Strategy One policies and programs, and in addition projects further water demand reduction by mandatory programs of a regulatory nature to control water use. (Management Strategy Two)

- A water supply augmentation strategy to add local agumentation actions to demand reduction efforts. These actions could include local practices such as cloud-seeding, local storage, groundwater recharge, desalination, and snowpack and vegetation management. (Management Strategy Three)

- A supply augmentation strategy of intra-state surface water interbasin transfers, importing water into the High Plains Region in accordance with State Water Plans of the six High Plains states. (Management Strategy Four)

- A supply augmentation strategy of interstate surface water transfers, importing water from sources in areas adjacent to the Ogallala Region by means of large-scale federal-state or federal projects to store and maintain irrigation of the acreage that would have reverted to dryland farming by 2020 under Strategy One or Two. (Management Strategy Five)

Even under the Baseline case of no new actions, the farmers throughout the High Plains region will increasingly use water more efficiently. In fact, in

west Texas and eastern New Mexico and the Panhandle of Oklahoma because of the cost of pumping, the use for irrigation is now very efficient and efficiency will continue to increase to some extent.

With no new action, some 4.6 million acres of presently irrigated land will have gone out of irrigated production by about the year 2020 but new lands will have been put under irrigation resulting in a net gain of 3,760,000 acres under irrigation, 1977-2020. The overall regional economy will still be strong assuming that all agriculture doesn't suffer a complete disaster as now seems possible with the present price-cost squeeze. But assuming a reasonably good future for agriculture in the United States and continuation of the growth in export demand as the U.S. Department of Agriculture projects there will be no major economic disaster. In other words, the economic roof is not going to collapse for the High Plains by the year 2020. The water supply situation will worsen rapidly thereafter, however.

The provision of incentives to stimulate earlier and more widespread voluntary adoption of conservation techniques - Management Strategy One -will result in some 945,000 acres additional under irrigation in 2020 with only a reduction of 3,100,000 acre feet remaining in underground storage as compared to the Baseline. The regional economy will be slightly stronger. Under Management Strategy Two - mandatory controls on ground water use - the number of acres under irrigation in 2020 will be about the same as under Baseline conditions while the amount of water remaining in underground storage will be greater by about 123,700,000 acre feet or 5.4 percent. However, the overall regional economy; the total value added by all economic sectors, will be less by $1 billion per year in 2020 as compared to Baseline. In other words, mandatory controls on groundwater use will result in economic detriment.

There appears to be little opportunity for significant additional local water supply augmentation. The local districts and the farmers are already conserving local runoff to a great extent. Little surface water remains to be conserved.

The State of Oklahoma has plans for intrastate interbasin transfers of water from sources in eastern Oklahoma to the central and western areas of the State. The Legislature is considering a surcharge on oil and gas production in the State to provide funds for such water resource developments.

With respect to interstate interbasin transfers, the legislation authorizing the Study limited the investigation of possible interbasin transfers to sources in "adjacent areas". The congress specifically indicated its intent that the U.S. Army Corps of Engineers was not to consider either the Columbia River Basin or the lower Mississippi River Basin. That limited the possible sources to the Missouri River and to the streams in Arkansas. These are all interstate streams, and all have federal projects already in existence with committments of water and storage to flood control, inbasin irrigation, inbasin M & I use, navigation and power generation.

The sources and conveyance routings to terminal storages studied by the Corps are shown on Figure 2. All of the terminal storage reservoirs are much higher in elevation - ranging from 1745 to 3618 feet higher - than the points of diversion at the sources, requiring very large amounts of energy for pumping.

Total investment costs and unit costs per acre foot, exclusive of costs of distribution from terminal storage to farm headgate, are shown on Figures 3 and 4 respectively. These costs are far beyond the farmers ability to pay. Massive federal and/or state subsidies would be required.

The principal findings from the Corps studies regarding the availability of water for transfer are:

- From the Missouri River, at Fort Randall Dam just upstream of the South Dakota-Nebraska stateline, after allowance for present committments and for future inbasin uses, there is no surplus water that could be exported by an interbasin transfer. If there were to be such an interbasin trasfer, it would involve tradeoffs with navigation downstream and with lessened hydrogeneration. The environment for fish and wildlife and the riparian habitat would be seriously affected. Stream morphology would be affected even more than it has been altered already. Some surplus water might be diverted and exported from the Missouri River near St. Joseph, Missouri. The amount available after allowing for present committments and future inbasin needs would be far less than that needed by the High Plains-Ogallala Aquifer area.

- Diversions from the streams in Arkansas would seriously affect Louisiana. There may be limited amounts of surplus water after provision for present committments and future in-basin needs.

- The Missouri River Basin states and the State of Arkansas are opposed to exportation from the Missouri or Arkansas streams, at least with the present status of planning.

It appears that the only implementable water management strategy to alleviate the stress on the Ogallala Aquifer to some degree is greater emphasis on conservation and increased efficiency of use by the farmers themselves within economic limits, at least for the next several years. The provision of incentives to stimulate earlier and more widespread adoption of such measures will help.

Increasing amounts of land will revert to dryland framing or be abandoned some already has reverted. New lands will be put under irrigation where the soils are suitable and groundwater is available. By 2020 that water will be exhausted either physically or water levels will have been drawn down below economic pumping limits in much of west Texas, eastern New Mexico, the Panhandle of Oklahoma, some of western Kansas, some of eastern Col-

FIGURE 2

: MANAGEMENT STRATEGY FIVE (MS-5)—INTERSTATE WATER TRANSFER ROUTE ALTERNATIVES ASSESSED BY THE CORPS OF ENGINEERS

Source: Adapted from Figure 5, Review Draft, Water Transfer Elements of High Plains-Ogallala Aquifer Study, January 1982, U.S. Army Corps of Engineers

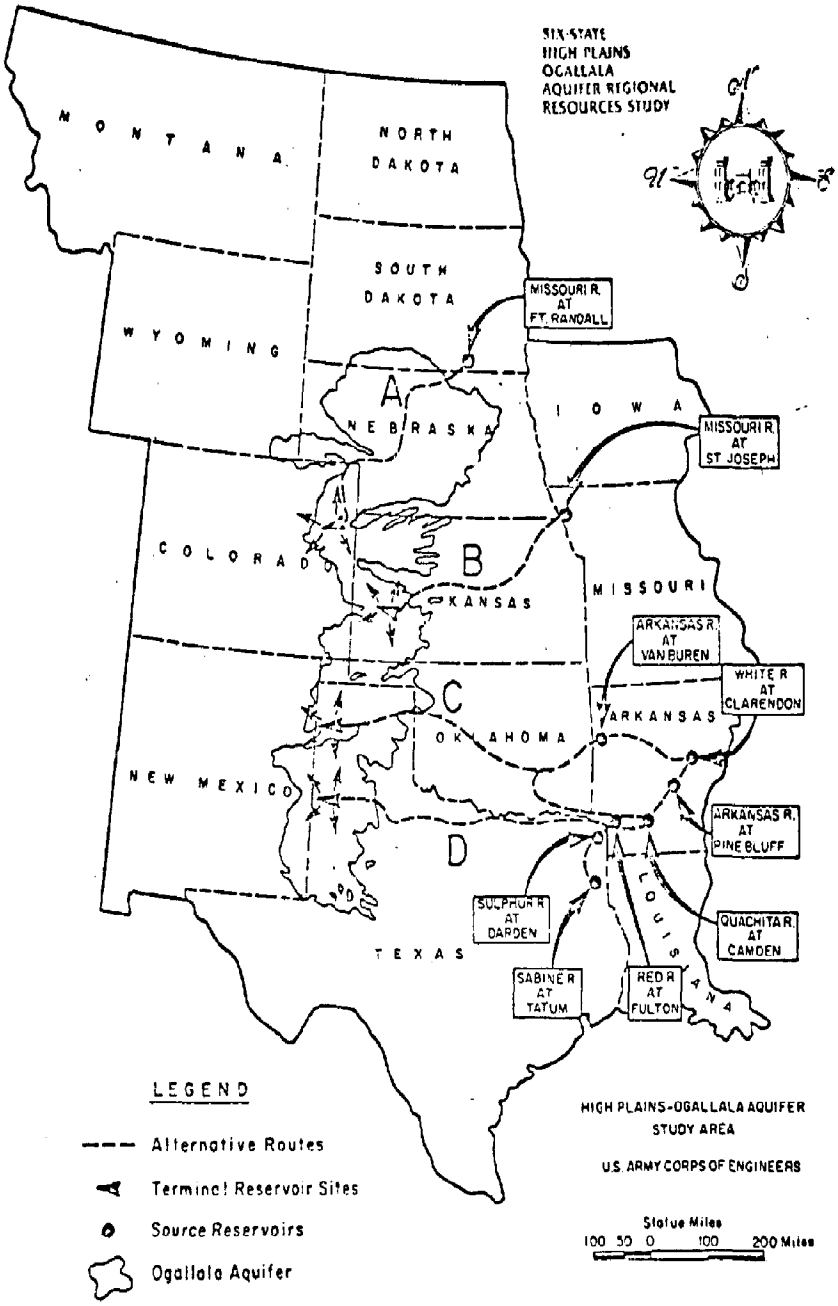
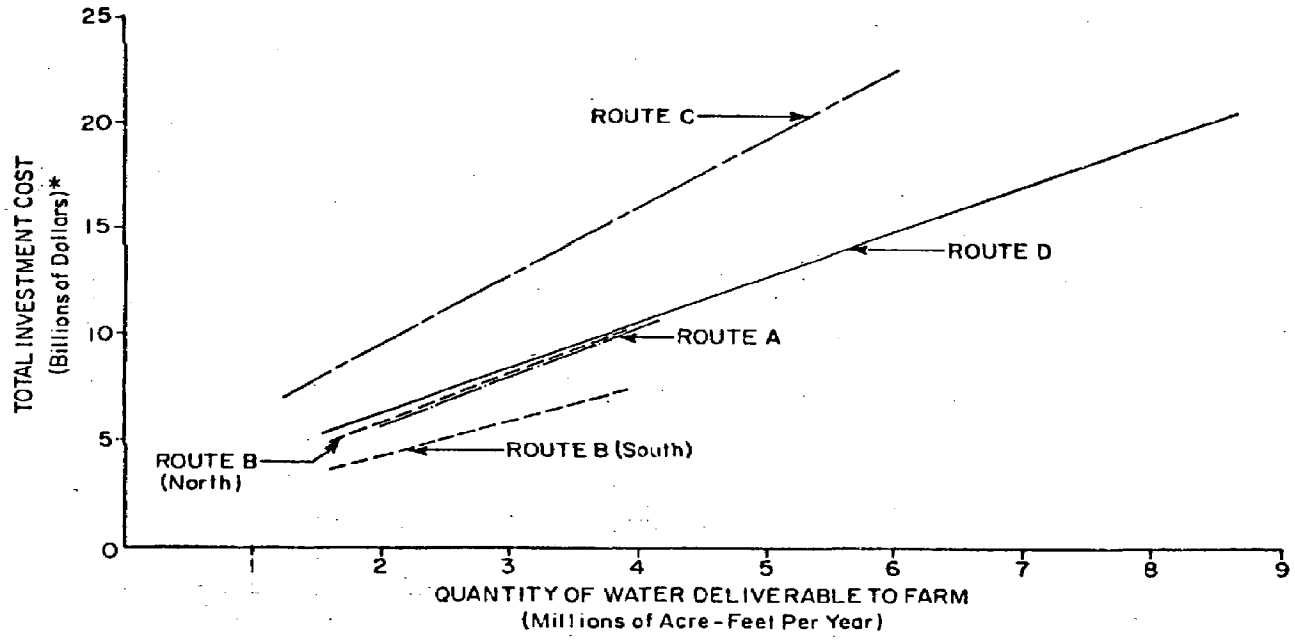


FIGURE 3

MANAGEMENT STRATEGY FIVE (MS-5)—COMPARATIVE TOTAL COST CURVES, ALTERNATIVE WATER TRANSFER ROUTES—U.S. ARMY CORPS OF ENGINEERS

Source: Adapted from Figure 17, Review Draft, Water Transfer Elements of High Plains-Ogallala Aquifer Study, January 1982, U.S. Army Corps of Engineers

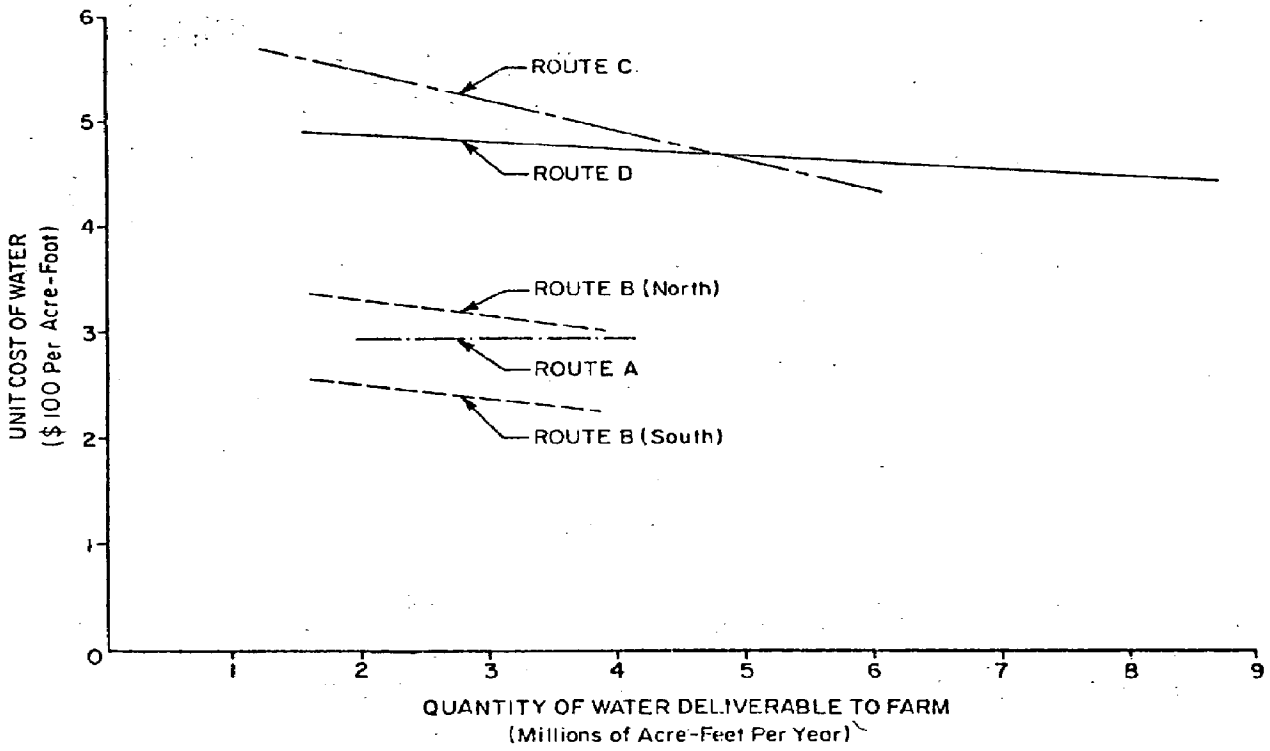


* Cost does not include cost of distribution of imported water from terminal reservoirs to farm headgates.

FIGURE 4

MANAGEMENT STRATEGY FIVE (MS-5)—COMPARATIVE UNIT WATER COST CURVES, ALTERNATIVE WATER TRANSFER ROUTES—U.S. ARMY CORPS OF ENGINEERS

Source: Adapted from Figure 19, Review Draft, Water Transfer Elements of High Plains-Ogallala Aquifer Study, January 1982, U.S. Army Corps of Engineers



orado and certain spots in Nebraska. By 2050, the water situation will be much worse unless major new supplies are provided.

Adjustments to the reversion from irrigated to dryland farming are already being made, particularly in the South High Plains of west Texas. The attitudes of farmers regarding the reversions already in progress or the prospect of reversion were investigated. The general attitude seems to be: we will irrigate as long as the water is available and we can use it economically. We will make the necessary adjustments when required. We don't anticipate any major problem in making the adjustment if it occurs gradually.

THE NEW JERSEY - DELAWARE - PENNSYLVANIA COASTAL PLAN

The principal problems here encompass excessive localized stresses of the aquifers resulting in deep cones of depression, 60 to 100 feet below sea level, in vicinity of the Cities of Camden, New Jersey, and Wilmington and Dover, Delaware; saline water intrusion into the aquifers and in the Delaware Estuary; and increasing groundwater pollution from surface sources.

The Delaware River Basin Commission, acting under provisions of the federal-interstate Delaware River Basin Compact, is developing a groundwater management plan for the area within the Commission's jurisdiction outlined on Figure 5.

The Delaware River has sufficient surface water resources, if properly developed, distributed and used, to mitigate the problems of groundwater overdraft and saline water intrusion. One may ask why the problems have been allowed to expand to their present severity. The answer seems to be that there has been extensive opposition to any new dams and reservoirs in the Delaware River Basin and to certain jurisdictional controversies.

A serious and more difficult problem to solve from both the technical and funding standpoints is mitigation of contamination of the groundwater resources from surface sources some of which are shown on Figure 5. Until very recently, the disposal of solid, toxic and hazardous wates in landfills was unregulated. Many wells now show at least traces of organic pollution; some have been abandoned.

The voters of New Jersey last year voted $365 million in bonds for water resource development and management in that state. A comprehensive body of water law has been enacted.

CONCLUSIONS

It is highly doubtful that any new large-scale interstate interbasin transfers are necessary and justified in the near future or will be undertaken for many years becuase of the costs involved, lack of adequate studies and planning,

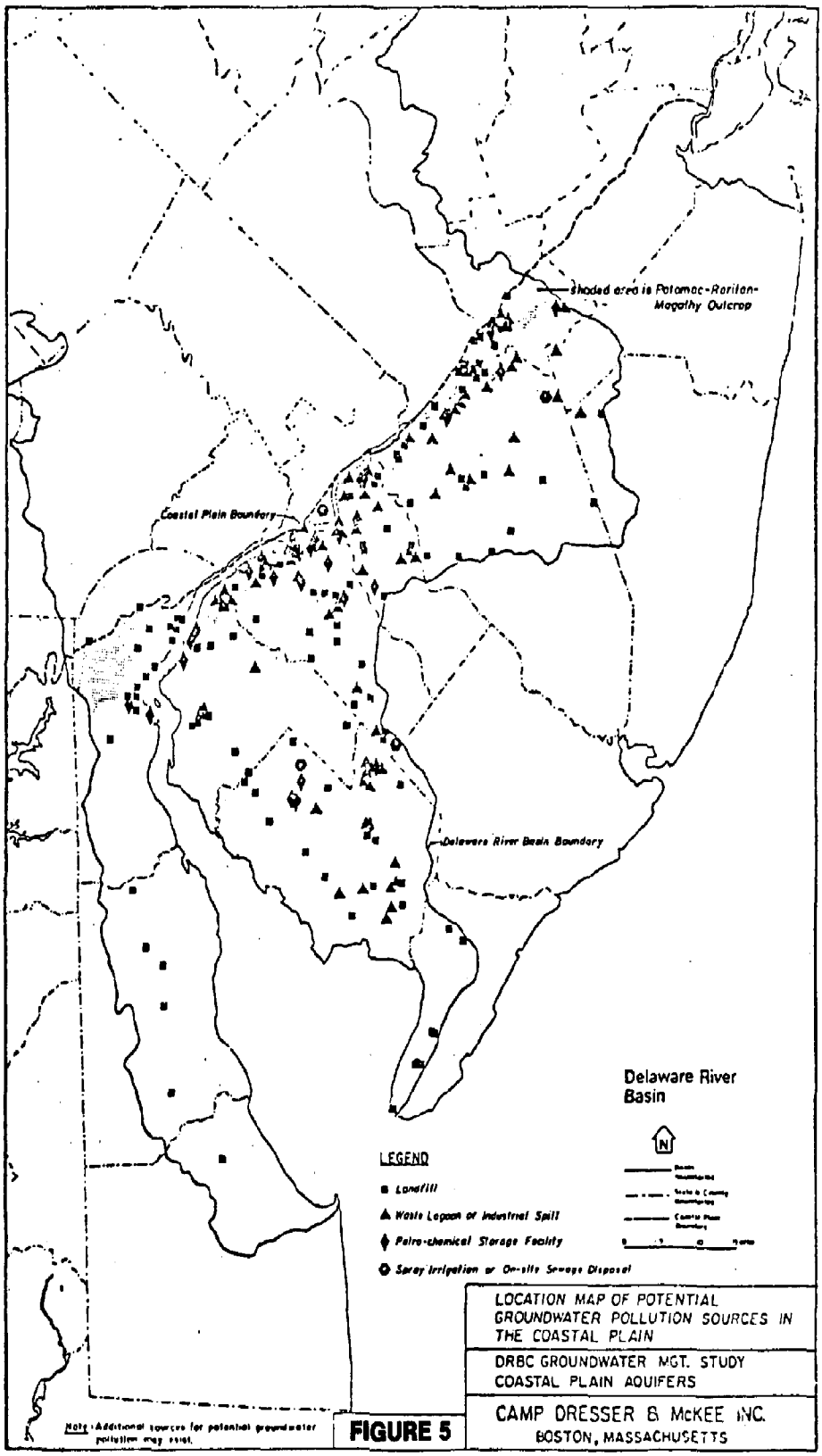


FIGURE 5

LOCATION MAP OF POTENTIAL GROUNDWATER POLLUTION SOURCES IN THE COASTAL PLAIN

DRBC GROUNDWATER MGT. STUDY
COASTAL PLAIN AQUIFERS

CAMP DRESSER & McKEE INC.
BOSTON, MASSACHUSETTS

and opposition by the states and basins of origin. Some smaller transfers to provide water for the energy industry may be proposed.

RECOMMENDATIONS

The Great Lakes States should concentrate their funds and efforts on effective internal management and protection of their water resources. Should interstate interbasin transfers be proposed, the Great Lakes States should follow the lead of South Dakota in acting on the ETSI proposal to export water from Oahe Reservoir to Wymoing, and impose charges on the water exported or derive other benefits therefrom.

QUESTIONS AND ANSWERS

Question: Is is cheaper to move water to people or people to water?

Banks—That question in it various forms is posed everytime I speak and I am going to give you an illustration for an answer. In California, my home state, we have that megalopolis in southern California of some 12 or 13 million people now supported entirely by imported water from Colorado, Owens Valley, and northern California. The Water Resources of California concentrated primarily in northern California north of the latitude of Sacramento and much of that is a highly environmentally insensitive area. If we were to put 13 million people in the Sacramento Valley and the north coast where all the water resources are it would be, in my opionion, an environmental disaster of the first magnitude. In my opinion, people are going to go where they want to go and secondly, before we propose that everybody be moved to the area of surplus resources, we had better look at what would be needed and what would happen if that were done.

Even here in a water rich state you are going to need water development if you are going to support industry. It isn't just a matter of going out and dipping a pump in a stream. You are going to need dams, reservoirs, intakes, etc. etc. I am not opposing or saying you shouldn't have development here but what I am saying is this concept of moving people to water is not as simple as it might sound.

Question: What is the role of the federal government and if there is a role what should it be?

Rossillion—We live in a democracy, therefore the federal government is a democracy of the people and of course there is a role. It is not the government's job nor is it the people's job but I think the role is for us to accept this as a collective issue, as a total issue and not look at it with the simplicity and say well let's have the federal government solve it. They don't solve anything for us. All they do is step in and do something with something we dump in their laps. By the same token dumping it back to individual states and saying solve your problems unilaterially without respect for anyone else is equally absurd. What we are saying is the role is for us collectively to accept this as a principal primary issue and one that has to be addressed and one that is not going to go away. I agree with and appreciate the answer about which is cheaper, moving people or water. That may not be the question. Maybe the answer is yes to both of them, or maybe all we are saying is be more sensitive about both halves of that question instead of just saying do whichever one is the easiest, or whichever one is the cheapest, or which one seems the best idea at the moment. We are saying it is a complex question that is going to require all involvement.

Banks—I would like to comment on that if I may. In the first place there never has been a federal water policy, that is comprehensive coherent policy. I think there should be. Irrigation, for instance, for agricultural production by and large is largely dependent on national objectives, national policies; particularly with respect to export of foodstuffs, balance of payments and likes. The federal government does have an interest in this issue. On interstate steams the development in one state has third party effects on other states. There is a federal role in attempting to see that the proper balance is maintained. Fish and wildlife, for instance, by and large on many steams is an interstate problem in which there should be a distinct federal interest. I could go down the line, there is a federal interest in much of the water resources of this country, how they are developed, how they are used or abused. I regret very much to see the federal government retreating rapidly from any degree of interest or responsibility, except possibly in navigation, in our water resources and how they are used and treated.

Question: Has a comparative study been done on the cost of desalinization versus interbasin water transfer?

Banks—The answer is no, unfortunately. Of course, the relative economics of that would depend on several things; the relative expenditure and requirements for energy, the availability of energy for both, the distance, the amount and so forth. My own personal opinion, and I have not made a study of this, but I think that for the Los Angeles metropolitian area, probably in the long run the reclaimation or the reuse of waste water supplemented by some desalinization of sea water might prove economically competitive with moving water from northern California to southern California over the mountains. I am not sure, but I wish it had been looked at, it has not.

Question: Why isn't the issue of interbasin transfer of water being addressed directly by the panel members?

Banks—This is a conference on interstate problems. Interbasin, interstate possible potential for transfers. What I want to repeat is that the possibilities of major interstate, interbasin transfers for most uses such as agriculture, which is the largest user, is remote. I think it is quite conceivable that the energy industry of various ramifications may look to your area as they already have but I think their requirements compared to what agriculture might demand are relatively small. In addition to this matter of potential interbasin transfers, you had better look also at your own problems right here and how you are going to solve your own problems of quality control, providing M & I water, providing as in Indiana water for irrigation. You have got local regional problems here as well as looking to Wyoming or the Ogallala or elsewhere for problems.

Question: What is the level of surcharge on oil and gas production in Oklahoma and will that tax be used for the water supply?

Banks—I can't give you an answer to the first part of that question because it is still being debated in the Legislature there and no decisions or even a range has been suggested. I can give you an idea of what would be involved in the Oklahoma Water Plan in terms of 1978 dollars. The initial investment would be $7.8 billion which is a sizable amount. Whether it is justified or not, the people in Oklahoma believe it is, but it would have to be grossly subsidized as far as agriculture is concerned in Oklahoma. Oklahoma agriculture can't afford to pay that kind of resultant true cost per acre foot for water with an investment of that magnitude. Now your other question which is real relevant, certainly subsidized water tends to decrease the deficiency of use or results in lower efficieny of use shall I say. To give you an example, in the San Joaquin Valley of California, the Bureau of Reclamation under the Reclamation Program is still selling water to the farmers at $3.50 per acre foot delivered to farm headgate. The efficieny of use on individual farms is relatively low because it is cheaper for the farmer to buy water at that price than it is to hire the labor and make the investment so it would be necessary to achieve a higher efficiency of use. Under the State Water Project of California which I initiated, the farmers are charged the true cost and the efficiency of use is much higher. The efficiency of use in west Texas due to the economics of pumping is quite high. Maybe in a rambling way that answers your question.

Question: How Mr. Geary would you address the entrainment and entrapment issues that we now have with withdrawal of water for cooling.

Geary—I had an answer already until you said particularly for existing power plants. I guess what I would say for existing plants is that they have all been subject to section 316B of the Clean Water Act and should have provided a study demonstrating exactly what the impingement entrainment impacts of their intakes are and either they were approved by the state agency if they have primacy or the EPA Region they happen to be in or they were disapproved. If they were disapproved there should have been some sort of retrofitting of either alternative cooling or backfitting of some sort or probably fixed screening device at the intake to reduce impingement entrainment to what within their context would be acceptable levels. That is the best answer I can give you; that all of the existing plants should have been subject to that particular scrutiny and analysis.

Question: Mr. Geary, could you comment on the projections for energy production in the future and the accuracy of those projections?

Geary—I am glad you asked because it is a significant factor that load forecasts have been reduced nearly everywhere. Certainly they have in Wisconsin and the projected power plants have been significantly reduced

from what they were just because the demand is not going to be there. Everyone is aware in this state that the advanced plans have been modified considerably in terms of what we had anticipated in terms of new power plants within Wisconsin and most of the Midwest is very similar. I think that is a very significant factor in altering that projection. And one thing to clarify what you said, I really wasn't predicting a change in legislation or rules per se, I don't think Section 316 of the Clean Water Act is going to be changed. I just think that the atmosphere within the regulatory and enforcement community is a little more receptive to open cycle or once through than they were and that the new source performance standard doesn't necessarily require close cycle cooling as was required in the early to mid 70's.

Banks—It isn't my intent to have the last word it is just the fact that I forgot to mention one thought that I want to leave with you. As I said, we have always regarded water as a free good in the source. I suggest that you seriously consider that if water is to be divered from the Great Lakes and taken elsewhere that you place a charge on that water in the source, get away from this concept of free good. Put that revenue into a fund to solve your own intrastate or regional problems. There is no reason, in my opinion, why water should continue to be considered as a free good, anybody that wants to come and take it within the framework of the laws controlling.

LEGAL ASPECTS OF WATER TRANSFER

Moderator: *Bronson LaFollette*
Speakers: *Karen Langland*
James MacDonald
Edward M. Parsons

BRONSON C. LA FOLLETTE
Attorney General
State of Wisconsin
Madison, Wisconsin

Mr. LaFollette is currently serving his fourth term as Attorney General for the State of Wisconsin. Mr. LaFollette has served as Assistant U.S. Attorney General for the Western District of Wisconsin and was engaged in private law practice until elected Attorney General in 1974. He has served as Chairman of the President's Consumer Advisory Council, and was elected to the Board of Directors of Consumers Union.

Mr. LaFollette holds a Backelors Degree in Political Science and a Law Degree, both from the University of Wisconsin.

LEGAL ASPECTS OF WATER TRANSFER

INTRODUCTION

Bronson C. LaFollette

Thank you very much and welcome to this panel. I just want to say one thing about the comments I heard about the session this morning. Everyone said they didn't seem to think that there was any problem, but I just wanted to report to you on that request for a legal opinion that you gave our office several months ago concerning the question of Indian water rights. Our opinion is going to come out and say that the Indians own all the water in the State of Wisconsin. So, the other people may not have any problems but we certainly have problems here.

Unfortunately, one of our panelists at the last minute could not be here and furthermore, unfortunately, he didn't let anyone know about it until Friday afternoon. We would have enjoyed hearing some of his comments from the perspective as the legal advisor to the International Joint Commission and I am sure that he could have added a lot to the substance of this session this afternoon. We aren't going to forgive him for not being here. I don't think it was his fault, he was advised by his superiors that they did not think it would be appropriate for him to be here. Why that is, I don't know, but let's direct our feeling against whoever his superiors are and hopefully someone will send them a nasty letter for not letting us know. But that means that we do have some additional time for the three remaining panel members, one of whom is an old law professor of mine.

There are two observations that I would like to make before the panel begins and that is if there is any speciality in the law that would seem to be a built in area for a young lawyer to get into, it is this area. It sounds like a full employment scheme for lawyers.

Secondly, I had the opportunity to participate as Attorney General in two of the proceedings of the Chicago Water Diversion Case. The first in 1966 and another phase of that case was just completed within the last two years. I am surprised that wasn't mentioned yet, but that is probably the longest case that has been pending in the United States Supreme Court. The first phase of the case came up around 1902 or 1906. Another hearing was held in 1922, the Court retained jurisdiction and we had another phase of the case in 1966 which was just completed. As an example of diversion of water from one basin to another, this diversion is probably the primary example because in the wisdom of the City Fathers of Chicago before the turn of the century, the city engineers devised a scheme whereby they reversed the flow of the Illinois River. The Illinois River used to flow into Lake Michigan. They reversed the flow of the Illinois River to turn it around and flow it downstream and into the Mississippi River and thereby, they could float all

their raw sewage down the Mississippi instead of putting it in the river in which they liked to swim and play. That is the reason for the diversion of the Illinois River.

Arising out of that case as we were preparing to challenge the plan that Chicago had for remeasuring the amount of diversion from one spot to another, they wanted to change the measuring point from downstream at Lockport to almost at the mouth of Lake Michigan, we found out that their principal scheme there was that they would not be taking any more water according to the amount that they were allowed in the 1966 decision which was 3,200 cfs. but because of the way it would have been measured, they would have been taking far more than 3,200 cfs. In the process of preparing for the case and it relates to the question of whether there is a need for what is going on here, we also discovered that they main reason that they wanted to take more was there are 27 different communities in Illinois that take their water for their local use by tapping the deep aquifer that runs between the southern part of Wisconsin, in fact starting out here west of Milwaukee and all the way through Racine and Kenosha underground, tapping that aquifer for their domestic use and depleting it. They weren't just tapping it, they were mining it and they are mining it today to the tune of about 15 feet per year. It is just a matter of charting it on a timetable before those wells will have run that aquafer dry or will have run it so deep that it will be no longer economically feasible to take water that way. That is what that case was all about.

Right now, Illinois has gone to a system of taking water for domestic use that is causing 15 feet per year to be lowered in an aquafer that is used up here in Wisconsin as well as in Illinois and there is some question about what legal aspects or what legal remedy, if any, we have against those cities and as everyone has said before, we don't seem to act in this area until we are faced with an absolute crisis.

KAREN LANGLAND
Policy Research Office
State of Nebraska
Lincoln, Nebraska

Ms. Langland serves as the Natural Resources and Agriculture Specialist for the State of Nebraska's Policy and Research Office. Ms. Langland acts as legal counsel to the Governor's Interagency Water Coordinating Committee, and is an appointed member of the Nebraska Natural Resources Development Fund Advisory Board; the Nebraska Natural Resources Commission Data Bank Advisory Board; and the Governor's Rural Development Task Force. Prior to her current position, Ms. Langland was on the staff of U.S. Senator Carl Curtis in Washington, D.C.

Ms. Langland holds a B.S. Degree in Business Administration and a Law Degree, both from the University of Nebraska.

WATER: A WESTERN PERSPECTIVE

Karen Langland

The State of Nebraska conjures up a lot of different images in people's minds. The Great American Desert is one. But Nebraska is much more than that. I think Mr. Banks demonstrated on his map that we have a lot of water there. Nebraska is lush, green, corn fields, but its also dry barren plains. We have rolling sandhills—a lot of flat land. I don't know if any of you have ever headed west on I-80, but that is all you see for 463 miles—flatlands. We also have rushing rivers and, unfortunately, an increasing number of small trickling streams. All of these images are real, but very different from the Great Lakes Region. These images illustrate the diversity of Nebraska and they relate to Nebraska's greatest natural resource, its water.

The word Nebraska is the approximate Omaha Indian equivalent for flat water. These are words which best describe the Platte River, also known as the Great Platte River Road, which was followed by the Mormons heading west in the 1800's. However, the Platte is only one small portion of the vast amount of water resources Nebraska is fortunate to possess. We have the Missouri on the east, to the north the Niobrara, which provides some of the best canoeing area in the nation. We have the Platte, the North Platte and South Platte on the west and to the south. Additionally, as you all become familiar with the term Ogallala Aquifer you know that we have the lion's share of that great water body.

The Ogallala Aquifer was described to me when I was a little girl as the great underground Nebraska ocean. It was very confusing to me because I never saw it, I couldn't figure out where all that water was, but I am beginning to realize that it is there and it is leaving very quickly. Given this description of all of the water in Nebraska, the state hardly sounds like an area where water shortages should be a matter of concern, and up until the last decade they haven't been. New technology, the population shifts to the west and southwestern areas of the nation, increased industrialization, and development of energy resources have begun to strain our abundant water supply.

Nebraska's economy is based on agriculture and that shouldn't come as a surprise to any of you here. Today, much of our agriculture is sustained by underground water, but it is projected that in less than 40 years underground water will no longer be available in some parts of the state and indeed that is already happening now. I can relay to you numerous stories of farmers calling the Governor's office saying, "we have to do something, I am pumping air, I don't have any more water". If farming is to continue in these parts of Nebraska, the diversion of large amounts of water from some source will be necessary to replenish the aquifers. Nebraska's interest, though, doesn't lie only in maintaining the productivity of lands that are now irrigated. There are many reasons including the increased demand from

foreign markets for agricultural commodities and the overtillage of erodable soils (which seems to be now a major interest at the federal levels), that the irrigation of additional Nebraska land will be required. In fact it is probable that any farmland expansion will require additional direct surface irrigation or aquifer regeneration. Where, then, are we going to get this water?

I would like to expand a little bit on the use of water for irrigated agriculture. We have seen diagrams that illustrate dramatically how much water is used for agriculture in the nation. From 1975 to 1980, the irrigated area in Nebraska increased from 5,400,000 acres to 7,200,000 acres. This is an average increase of 360,000 acres per year and that is a lot of land. The rate of development in irrigation hasn't been uniform. In 1860 surface water was the only means of irrigating crop land. Most of the private development using surface water as a source was completed by 1902 when the Federal Reclamation Act was passed. As a result of that Act, a number of storage reservoirs were constructed on the Platte River system to the west of Nebraska. More recently the number of irrigated acres has increased as the result of groundwater development. With the advent of the centerpivot irrigation system in the late 1950's and early 60's, areas which were previously considered to be unproductive land, have turned into marvelously productive crop land. These systems and that land are supplied primarily by groundwater. However, the use of these systems has lead to the severe depletion of groundwater. Nebraska's share is in far better condition than that of our neighbors to the south, Kansas, Oklahoma and Texas.

Irrigation in Nebraska is by far the largest user of ground and surface water. The total use for irrigation is 8 times greater than the use of water for power plant cooling which is the second largest consumer, and 25 times as large as the amount used for municipalities and other public water supplies. Nebraska has a total population of about 1.5 million. You can see that the water would not be going for largely domestic uses. About 90% of the water consumed in Nebraska is used for irrigation, and it is estimated that there still remain over 10 million acres which could be developed. As such, it is obvious that water for irrigation is going to retain its first place ranking as a water use in Nebraska.

Energy and energy development—we have heard a little bit about that today. These very likely deserve a second place if not a first place ranking with respect to the uses of water in Nebraska. There is an adage that is being used more frequently now which goes something like this, "water runs uphill to money". I will defer to Bob Neufeld to tell a little more about money and water on the economics panel which follows.

The question of interstate diversion of groundwater for energy in Nebraska arose in the context of a dispute between South Dakota, Wyoming and Nebraska over a proprosal to take groundwater from the Madison formation which underlies parts of all three states for use in a coal slurry delivery system.

The State of Wyoming issued a water permit to Energy Transportation Systems, Inc. known as ETSI, for water to be used in the operation of a coal slurry transportation project which would move coal from mines in Wyoming to power plants in Oklahoma, Arkansas and Louisiana. The Federal Environmental Impact Statement on that proposed project identified the several areas of controversy involved. They included the possible groundwater impacts to present and future users of Madison Aquifer water and the transportation of water from an area where readily available water is relatively scarce to an area where it is abundant. It was for this reason that Nebraska was very concerned about the prospects of this project becoming a reality. Groundwater has proven to be a most beneficial natural resource, particularly for western states like Nebraska. The extensive use of groundwater, however, has caused substantial declines in the amount of water stored under the State of Nebraska. Some of the effects of excessive withdrawals are reduced stream flows, reduced pressure in the aquifers which cause springs to dry up, a lowering of the water table and a consequent reduced discharge to streams, lakes and subirrigated areas. Increased costs for pumping from irrigation wells has also become a matter of great concern in the state.

A number of states which share common interstate aquifers similar to those overlying the Madison are becoming concerned about the possibility that these resources will ultimately be depleted. Another fear is that a more populous or more economically advantaged state may take all the waters of an interstate aquifer because they got to it first. The nature of underground water only intensifies this fear.

Back to the ETSI story. In 1981 Nebraska's fears about development on its western border transferred to the eastern border when the State of South Dakota announced that it intended to enter into an agreement with ETSI whereby 50,000 acre feet of water per year would be withdrawn from the Missouri River for use in the coal slurry project. The source was to be the Oahe Reservoir which is located in about the middle of the state near Pierre which is the capitol. The Missouri River doesn't sound like a very dry river—it is known as Big Muddy and a lot of things take place on it: Nebraska relies on the Missouri River for barge transportation for one, we move heavy commodities on the Missouri River and we are hoping to develop the Missouri River further for navigation. We also use the Missouri River to generate electricity from the main stem dams and to provide municipal and industrial water to the towns and cities in the eastern part of the state. As such, any withdrawal of water from the Missouri could have a detrimental impact on the State of Nebraska. Now 50,000 acre feet is not a lot of water; it is a drop in the bucket and this was raised to us when we started complaining about the ETSI sale. However we are concerned about the precedent it sets. That kind of a withdrawal has never been made before. How is Nebraska going to prevent others from coming in and taking additional water out of the Missouri, which we feel is so essential to Nebraska's economic well-being?

Nebraska views the proposal as a means to facilitate the sale of water as a cash commodity on a first come, first served basis. It will be exported entirely outside of the basin and will not return to the basin of origin.

Within Nebraska, the Constitution declares water to be a public want. Water is dedicated to the people of the state for beneficial purposes. In Nebraska, no right or title may be acquired to the water itself—any right to the water is a right of use only. For irrigation, the water must be applied to the underlying land and it may not be traded or sold. In Nebraska, water is not an article of commerce.

South Dakota's transfer in comparison, is seen as a fundamental departure from present practices, which are to recognize appropriations by states for their internal use. Furthermore, it is not the only transfer looming on the horizon.

Oil shale development was mentioned this morning. It can't take place without major volumes of water. Given the national policy of enlarging domestic energy sources, it goes without saying that this resource will be developed in the future on a much larger scale than is presently ongoing. Within the last two weeks, Exxon did shut down the development they had going in Colorado, but I fear that this is only a temporary state of affairs and we will see that development started up again. One corporation has estimated what when the oil shale industry reaches a level of production of 15 million barrels of oil per year, it will require 1.7 million acre feet of Missouri River water per year. It is estimated that approximately 21 million acre feet of water flows by South Souix City annually in the Missouri. 1.7 million acre feet is not a whole lot of water but things start to add up; coal slurry, oil shale.

While Nebraska appreciates the need to develop our energy resources, we feel that these demands must be considered in light of the equally important demands of irrigated agriculture.

As I mentioned earlier, rapid population growth in the southwest and the west has also produced a competitor for Nebraska's water. The drying up of the Ogallala Aquifer has received an increasing amount of attention in the national media, although the aquifer has been used throughout the last three decades for irrigated agriculture. The National Geographic, The Wall Street Journal and the May 10, 1982 issue of Time Magazine all have had articles on the Ogallala Aquifer. It becomes rapidly apparent then that all of us have to become better educated on what the drying-up of that aquifer means.

Mr. Banks told you a little bit about the High Plains Ogallala Aquifer Study. He is far better equipped than I to talk about that, this was his project. However, I will elaborate on it just a bit. In 1976, the High Plains Study was authorized by Congress. The study directed several agencies of the federal government, along with state and local agencies and private sector repre-

sentatives to study the depletion of the natural resources of those regions of the states of Colorado, Kansas, Nebraska, New Mexico, Oklahoma and Texas which presently utilize the declining water resources of the Ogallala Aquifer and to develop plans to increase water supplies in the area and report to Congress. The legislation states that the reasons for the study are to insure an adequate supply of food to the nation and to promote the economic vitality of the region. Food. . .economics. . . you have to have both to make a nation work. In order to increase water supplies, particularly in the high plains of Texas where the most serious declines have taken place, water importation schemes were studied. One of the schemes would call for the withdrawal of up to 8 million acre feet of water per year from the Fort Randall area which Mr. Banks talked about earlier. That water would be transported across a number of midwestern states and be deposited to recharge the aquifer in Texas and Oklahoma, where they can no longer afford to pump water or they don't have any water at all for irrigated agriculture.

The costs for such a transfer would understandably be great. When you consider the development that has taken place in that area I find it very difficult to perceive moving those people out of that area. The concept of moving the people to the water—I don't believe will take place. The economics will work out one way or another to get the water to them. This withdrawal provides another competitor for Nebraska's water. We have the need for irrigation for agriculture, coal slurry wants it, oil shale wants it, other states want it.

Next, I'll talk a little bit about the protection of wildlife and the demands that wildlife place on Nebraska's water resouces. Of particular importance in Nebraska is a stretch of the Platte River that is heavily used by migratory waterfowl, wading birds and raptors. The habitat of the Big Bend area of the Platte River which is an 80 mile strech from Overton, Nebraska to Chapman, Nebraska—about smack dab in the middle of the state—is critical to migrating sandhill cranes and the endangered whooping crane. A smaller area between North Platte and Sutherland, Nebraska, is also suitable as crane habitat. Concern has been expressed that flow depletions in the Platte River would adversely effect crane habitat in this area. Now sandhill cranes prefer habitats of shallow submerged unvegatated sandbars in broad stretches of river with wet meadows. Corn and milo stubble and alfalfa fields are needed for feeding. The presently occurring peak flood discharges and ice jams cause a continual shifting and scouring of the river bottom inhibiting the encroachment of vegatation which makes it a great place for wildlife. Reduction in stream flow of the river, however, would permit the growth of vegatation on these sandbars and also reduces the amount of wet meadow adjacent to the river.

Currently in the State of Nebraska the establishment of minimum instream flows is a topic of great controversy. There is no question, however, that some of Nebraska's water will have to be dedicated to the preservation of

certain recognized stream reaches, such as those which I have described to you.

Thus far I have described some specific examples of water demands in Nebraska. Nebraska like other states has always guarded its water very jealously. It is this attitude which is for the most part responsible for the conflict that exists when trying to resolve and balance these competing demands for our water.

I will briefly give you an overview of three methods available to Nebraska for resolving the conflicts that have been produced: adjudication, interstate compacts, and legislative bars to water exportation. The adjudication or litigation of the relative rights of two or more states normally occurs in the United States Supreme Court. This course of action has been used in the past to resolve interstate water disputes. There are a number of factors, time and money not the least of which, which may make litigation a very unattractive alternative, particularly in the state and lower federal courts. Its availability as a last resort, however, gives this method of resolving interstate disputes a coersive value in encouraging state to try to resolve their disputes on their own. The threat of suits between two states in the United States Supreme Court is a very serious matter. While the longest opinion may have involved an interstate water dispute, in the scheme of things there are not a lot of U.S. Supreme Court decisions involving interstate water disputes.

What do you do if you don't go to court? You try to cooperate and that's the interstate compact. Interstate cooperation in resolving disputes between interstate water allocation is something that is dealt with quite frequently on an interstate compact basis. The purpose of a compact is to equitably apportion the water of interstate streams among the states along the interstate river system. The interstate compact is a legal instrument which combines the characteristics of a contract and a state statute into a composite legal and administrative mechanism. It is usually enacted by a state legislature in much the same manner as other legislation. It would be something available to the Great Lakes states. It also possesses the basic attributes of a contract by conferring rights and obligations on the parties to it. The state and its citizens and the federal government in some cases all may become involved. An administrative commission is frequently utilized given the responsibility to implement the compact provisions. Right now the State of Nebraska and the other Missouri Basin states are involved in the Missouri Basin States Association. It is hoped that Missouri Basin conflicts will be resolved through an interstate compact formed as a result of the Commission's activities. The interstate compact has been viewed as the most desirable means to affect solutions to interstate water disputes particularly in the west. Water allocation compacts have been prevalent among western states including Nebraska.

I was talking at lunch about the South Platte River Compact. It was put on the books in 1923 and nothing happened for a long period of time. Last

month, however, we had the first meeting of the administrators of the South Platte River Compact. We haven't had a problem—now we do. There is a possibility that a dam will be constructed on the South Platte River in Colorado which would have a substantial impact on the flows of the Platte River coming into the State of Nebraska. Times have changed.

Most of the interstate compacts seek to accomplish an equitable apportionment of the water of an interstate stream as I said before. Foremost, the interstate compact is based on a voluntary agreement of the states involved. This is not a fighting type of situation and therefore makes it a very attractive method for handling interstate water problems.

Finally, I will talk a little bit about legislative bars to water exportation. These kind of mechanisms generally fall into three categories. The first allows the exportation of water but only upon legislative approval; Wyoming has something that goes like that. The second allows the exportation of water but only upon a reciprocal basis and this is the case in Nebraska. The third attempts to create an absolute ban against the interstate transportation of water; New Mexico has that statute. Both the Nebraska and New Mexico statutues have been challenged on constitutional grounds very recently. In fact, Nebraska's statute was the subject of a U.S. Supreme Court case within the last two months; a decision should be handed down sometime during the summer. I will tell you a little bit about it.

Two farmers, Sporhase and Moss, owned adjoining tracts of land in Colorado and Nebraska. No water to irrigate their Colorado land could be had in Colorado so they put their well in Nebraska. That was back in 1978 or so. Well, they didn't bother to check to see whether they needed a permit. Under the Nebraska statute the only way they could have would have been if Colorado had an arrangement whereby Colorado water could be pumped into Nebraska. Colorado doesn't have any reciprocity with Nebraska. Our Attorney General shut them down in 1978; they couldn't pump any more. Well, Sporhase and Moss obviously didn't like that. They felt that water should be considered an article of commerce; that it should be freely transferable among the states and that Nebraska's reciprocity statute was unconstitutional. The essential issue raised in that case is the power of a state legislature to manage its own water resources in accordance with its own priorities and wisdom, unfeddered by the commerce clause.

As I mentioned earlier, Nebraska doesn't view water as an article of commerce. The outcome of this case should be a matter of concern to any state which is dependent upon water for its agricultural or industrial economy or the maintenance of its muncipalities and population centers.

The topics I have already discussed—increased need and use for water in the foreseeable future and the demands that are now beginning to be placed upon it by traditional as well as non-traditional users and the schemes for the diversions of water to support these various uses makes the continued recognition of state's soverignty in the allocation and use of

water within its borders a most crucial issue for the states in the coming decades. I am sure that I am not in agreement with everybody in this room on that point.

The demands on Nebraska's water resources are diverse and many in number. This afternoon I have only outlined a few of those with a couple of possible remedies. Water is truly a unique commodity; it is essential to the life itself. Water is different from other natural resources such as oil, gas, fish and wildlife. As such it should be treated differently by the government in its policy and law. Hopefully, Nebraska, with its wealth of water won't squander it. Hopefully, Nebraska will be in the forefront in providing balance among the competing uses for this valuable resource.

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THE INTERBASIN TRANSFER OF WATER—THE GREAT LAKES CONNECTION

Prof. James B. MacDonald

The allocation of responsiblity of the members of this panel on interbasin transfer of water is that Karen Langland will deal primarily with Nebraska's attitude toward South Dakota's sale of Missouri River water, Ed Parsons will deal mainly with state administrative bodies and their responsibilities in water transfer and my tight, little subject is everything else.

I will be talking about what law applies and how it apples to the interbasin transfer of water and that is easy to describe. It takes only a few words—**nobody knows with certainty**. However, we do know that there are a number of laws that may be applied. We do know the levels of government that have an interest and presently have authority over interbasin transfer. Our framework for discussion is a proposal to use Lake Superior water for a pipeline to transport Wyoming coal to Superior, Wisconsin, for shipment to power plants along the Great Lakes.

Unfortunately, laws aren't there waiting to be used. Laws are created by people; they are created by people after a problem is perceived to be of sufficient magnitude that rules of regulation are sought. Legislators adopt statutes; they adopt those statutes at a time when a majority of their constituents are aware that a problem exists and believe a solution is needed and when those constituents view the proposed solution as not so unpalatable that they will vote against the supporting legislators at the next election.

Courts don't produce law until they have cases to decide. It is only as litigation comes to a court that the court tells us what rules apply and thus expands the common law. We are now starting this process of evolution in the law of interbasin transfer of water.

What levels of government have an interest and what are some of the known rules? Lake Superior is an international body of water. Several states and a province are concerned. Two countries, the United States and Canada, have interests. In 1909 a treaty was signed by the United States and Great Britain, at that time representing Canada. The treaty was called "A Treaty Relating to the Boundary Waters and Questions Arising Between the United States and Canada". One important provision in that treaty was the creation of an administrative body called the International Joint Commission, the IJC. The treaty specifically provides in Article III that "no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line affecting the natural level or flow of the boundary waters on the other side of the line shall be made except by authority of the United States or the Dominion of Canada

within their respective jurisdictions and with the approval as herinafter provided of the International Joint Commission". Any diversion that will affect the level of Lake Superior requires a permit from the International Joint Commission and prior approval of that body.

How much water has to be taken from Lake Superior before the water level is affected? I suppose a thimbleful. How much has to be taken before the level is significantly affected or affected to the point where the IJC believes that they have a responsibility? That is one of many unanswered questions. What standards are the IJC going to use as they determine whether water may be taken from the Great Lakes and shipped to the United States rather than shipped to Canada? I thought that before this conference concluded, I might have an answer to these questions because a representative of the IJC was going to be on this panel. He might have made some predictions of, or at least have commented on, what the IJC thinks of interbasin transfer and what their jurisdiction empowers them to do. Inasmuch as we learned this morning that this individual would not be coming and that no substitute would be sent for him, it appears that the IJC does not view this as an opportunity to send word to the public about the position they will take when a petition is filed. So we know what government level is involved—international; we know what may be required—a permit; we don't know much more that but after the first permit application is made, the law will begin to evolve.

We know that the United States government under this treaty would have to approve a transfer and we also know on the basis of many cases that the United States government may exercise supreme power over the allocation of water in the United States. There are western states that view this as a radical statement. But clearly under the Interstate Commerce Clause the federal government has control over navigable waters. Under the Supremacy Clause, when there is a conflict between state and federal regulations regarding an item in which the federal government has authority, the federal government always wins. In two cases within the last two years in the U.S. Supreme Court, one involving the Stanislaus River in California[1] and the other the Gila National Forest in New Mexico,[2] the majority held that from now on the intent of the federal government to establish exclusive authority must be made clear in all legislation. The federal government must state explicitly the authority that it is going to exercise. The court is going to be much more hesitant to find that federal government authority is established through implication in broad language in legislation.

In the past the federal government has been hesitant to take responsibility for allocation of water from specific projects to users within the United States. Thus it is not likely that a majority of Congress is going to agree very soon to any interbasin transfer of water from Lake Superior to Wyoming. It is my belief that Congress has the authority to do so. It is also my belief that this is very unlikely to happen. Certainly the Congressional delegations of many states would object to the adoption of legislation exercising such authority by the federal government.

But does the federal government presently have any requirements that limit interbasin transfer? The answer is yes. The Rivers and Harbors Act of 1899, Section 10,[3] requires that when any facilities or structures are built on the bed of a navigable water, there must be prior approval by the Corps of Engineers. It seems hard to believe that any major water diversion could be made from Lake Superior without first building a physical structure for which approval would be necessary. Similar Corps approval is required for each crossing of navigable water by a pipeline through which the diversion would be accomplished.

When the federal government fails to act, as it usually does, in the area of water allocation, states control. Do states want water transferred? For example, does Wisconsin want water tranferred from Lake Superior to Wyoming for use in a coal slurry pipeline? One would guess that there is wide divergence of opinion within the state but let us assume that the vast majority of the people want it. Does Wisconsin presently have state authority to do this? My reaction is no, we do not have that authority without new state legislation. South Dakota is a dry state, especially that part west of the Missouri River. South Dakota recently sold to Energy Transportation Systems, Inc. 50,000 acre feet of water per year from the Oahe Reservoir on the Missouri River to be used in the ETSI pipeline from Wyoming south. Did this require legislation? Certainly legislation was enacted. A special session of the legislature was called and in that session a number of laws were adopted and then signed by Governor William Janklow. One gave the state authority to transfer title to the water to the ETSI Pipeline Company. Another aided ETSI in financing the project. The State of South Dakota will float a major bond issue. The interest paid on these bonds will not be subject to federal income tax and therefore financing will be less costly than borrowing through a private corporation. The state also authorized the expenditure of a large amount of money to bring law suits in an effort to settle legal difficulties.

Why do most people in South Dakota support the sale to ETSI? The answer is that they have much to gain from the sale. They will be selling 50,000 acre feet of water per year from the river for which there will be several benefits. First, they will get money—South Dakota will receive millions of dollars in direct payments from ETSI.

Secondly, the pipeline will be larger in capacity than would be necessary to move the water to Wyoming. Water will be drawn without charge from the pipeline for use by municipalities in South Dakota. Also, ETSI earlier secured the right to drill deep wells in Wyoming that would take water from the Madison aquifer. That aquifer slants down as it goes west toward Wyoming; its water charge area is in South Dakota. In Wyoming the aquifer is 3000 feet below the surface and contains poor quality water but in South Dakota it contains good quality water and is relied on by many people. The impact statement at the time of the study of this deep well proposal indicated that if ETSI pumped sufficient water for the pipeline from those wells, the water table in South Dakota might fall by 200 or 300 feet, substantially

increasing the cost of providing water in South Dakota or possibly making it impossible to reach water in certain places in South Dakota.

Thirdly, a provision of the South Dakota contract requires ETSI to shift its priorities and instead of drawing first from deep wells on the Madison aquifer, to fill its needs from the Oahe Reservoir to the extent possible thus conserving South Dakota groundwater. It is not difficult to understand what there is major support for this contract in the State of South Dakota. Whether there would be similar support in Wisconsin for such a sale from Lake Superior is a different issue and hopefully those who speak later in this program on the political implications of such a sale will discuss that question.

The State of South Dakota has taken these actions. Do they know whether their actions are legal? No. They know that they have started a major law suit to adjudicate all water rights in the Missouri River in South Dakota. The state hopes to prove that there is sufficient surplus, unallocated water in the Missouri River at the Oahe Dam to fulfill the contract without infringing on anyone's water rights in South Dakota. This is a major adjudication. It includes the rights of individuals, of the federal government and the rights of many Indian nations. Several groups of Sioux are actively opposing the concept that there is any surplus water. Let us digress to discuss federal rights in water and Indian rights in water. Land owned by the federal government as part of the public domain can be withdrawn by the federal government for a specified use: for a national forest, for a national park, for a military reserve, for an Indian reservation. The law provides that withdrawal of land carries with it the right to enough water to carry out the purpose for which the withdrawal was made even though the quantity is not specifically stated in the withdrawal. Since the recent Supreme Court decisions mentioned earlier, more specific language may be required in the future than in the past. Indian reservations have a right to enough water to carry out the purpose of the reservation. The Winters Doctrine comes from a case in Montana[4] at the turn of the century involving the Fort Belknap Indian Reservation in which the flowery language of the treaty and withdrawal spoke of settling this band of Indians and enabling them to lead 'a pastoral and civilized life'. The issue was how much water is needed to lead a pastoral and civilized life and does it include water for irrigation. The answer was that it does include water for irrigation, even that which is started long after the reservation was created. Does it include water for a coal slurry pipeline? The court hasn't faced that question yet. In the present litigation the Sioux Indians are saying they have a right not just to their apportioned share of the Missouri River but to a fractional share in each drop of water in the Missouri River. The Sioux believe there is no surplus water. If they have a right to 2% of the water in the Missouri River, they also have a right to 2% of what the state is selling to ETSI. Are they right? The courts have not faced this issue before. Will we know eventually? Yes. How soon? I don't know.

Could Wisconsin enter into a similar contract with a pipeline company to ship water to Wyoming? Of course the answer is yes. If there was sufficient support in the legislature and if the governor felt this was desirable, the State of Wisconsin could make a similar contract. Would it be valid? Time will tell. Time will tell in South Dakota; time will tell in Wisconsin. In Wisconsin there is an additional difficulty—in fact, several additional difficulties—but the major one is what is called the Trust Doctrine. Wisconsin's Trust Doctrine for the protection of the navigable waters of the state is stronger than that in any of the other 49 states. It comes from the old Northwest Ordinance and was adopted word for word in the Wisconsin Constitution. Its authority and meaning have been steadily broadened by the courts ever since so that a duty of the state to preserve the water of the state for the benefit of its citizens has evolved.

Before the turn of the century the state legislature authorized an individual to drain a lake and conveyed title to the lake bottom to him. An action was brought before the Wisconsin Supreme Court. The court in the Priewe case[5] held the legislature's action unconstitutional, the legislature lacking authority to transfer the state's rights to the lake because the state holds the lake in trust for its citizens. The sale by the state of 50,000 acre feet from Lake Superior is much different than the conveyance of a small lake in southeastern Wisconsin but how different is it? Is it enough different? This is another issue that will surely be litigated in the event the state decides to sell.

The state may decide it doesn't want to be the actual seller but would rather leave the sale to individual citizens. Can an individual citizen in Wisconsin sell water from Lake Superior to a pipeline company? With state permission? Without state permission? If not, why not? There are a lot of why nots.

Wisconsin has what is called the Riparian Doctrine, meaning that anyone who owns land along the shore of navigable water has a right to share in the use of that water along with all other riparians. This doctrine goes back to English law and is based on a theory that there is plenty of water, there is never going to be a shortage and all we need are rules for the reasonable division of the bounteous supply. As water supply becomes less bounteous, states under the Riparian Doctrine tend to put more limits on uses and eventually to shift to a permit system. Minnesota has shifted to a permit system from a riparian system. South Dakota has always had a permit system with prior appropriation.

Wisconsin says, "Riparians share water equally. Put the pipe in the water. You can take the water out if you own the shorelines unless . . ." Unless what? "Unless you are going to use the water for irrigation and then you must get a permit from the Department of Natural Resources under Section 30.18 of the Wisconsin Statutes." Or "unless you are going to use it for mining purposes and then you must get a permit from DNR under Section 107.05". So, what is water for pipelines? It that mining? No, that is trans-

portation. Another question to litigate. And there seems to be no doubt that the state can add permit requirements for new uses and will likely continue to until finally Wisconsin is totally on a permit system. If the legislature is opposed to someone who happens to own land on Lake Superior selling the water to a pipeline company, the state can broaden our permit system to inlcude all water for pipelines, all water for interbasin transfer, all water to go outside the state or any number of additional limitations that will force user or seller to ask for a permit. This requires legislation but if there is enough public pressure, there will undoubtedly be legislation.

Suppose Wisconsin says, "No one may ship water out of the state". What is the law? Is a statute that says none of our water may go out of the state legal? Illegal? Nobody knows. The federal courts have considered two cases on the subject. One around 1900 involved a water company in New Jersey that intended to take water out of the Passaic River and pipe it to Staten Island. The State of New Jersye adopted legislation prohibiting the transfer to New York City. The case went to the U.S. Supreme Court[6] where the legislation was held valid, the court saying that New Jersey can preserve its resources. Twenty or thirty years later the city of Altas, Oklahoma, made a contract to buy groundwater coming from a well in Texas. Texas passed a statute prohibiting shipment of water out of state. The case went to federal court[7] where the holding was that well water, at least well water in Texas, is just like oil and gas. It is an underground resource and the Interstate Commerce Clause provides that it cannot be prevented from going outside the state. That case says it's illegal and unconstitutional to prevent out-of-state shipment. So what is the answer? We don't know. But in this period of evolution we are soon going to know because Nebraska argued this issue before the U.S. Supreme Court within the last two months[8]. In all likelihood within a month or so we will have the answer to at least that one question.

Suppose Wisconsin says that we don't want to sell it as a state but will let individuals sell it. However, we do want some money from the sale so we will levy a tax. Taxes on removal of natural resources are called 'severance taxes' and if Montana could levy a 30% severance tax on coal shipped out-of-state, why can't Wisconsin put a tax on water being shipped out of Lake Superior? Who knows? The Montana decision was a split decision.[9] It got enough votes in the U.S. Supreme Court to be held valid only because of one concurring opinion that indicated Montana had pressed as close as possible to the limits of its authority and yet have its action considered constitutional. The court developed a several point test requiring among other things that there must be sufficient connection with the state. If the pipe goes into Lake Superior from Wisconsin, that likely comprises sufficient connection with the State of Wisconsin. Also the tax must be generally fair; it must be equally applied. It would seem that if Wisconsin were going to tax water taken from Lake Superior going out of state, we should tax water taken from Lake Superior that is being used inside the state just as Montana coal bought for use instate is not tax exempt. Then any municipality that gets its water from Lake Superior would be paying the same tax. An

alternative would be to establish a maximum amount that would be tax exempt for each (the amount our largest municipal user needs) and say all water in excess of that maximum would be subject to taxation. Those who have studied this question say the approval of the Montana severance tax was close to a denial; that if pushed farther, the court is going to say no.

Who owns the Montana coal? It was in the State of Montana but on federal land. Who owns the water in the Oahe Reservoir that has just been sold by South Dakota? The water is located in South Dakota but in the Oahe Reservoir that was built by the Corps of Engineers with federal tax dollars. Who owns Lake Superior? It can be claimed that Wisconsin owns Lake Superior at least as much as Montana owns the coal or South Dakota owns the Missouri River water. But that question too will have to be litigated and it surely will be.

In what other ways could we recover the value of the resource? The problem is that the State of Wisconsin may discover tht it isn't the one selling the water. If someone looked at a map and discovered that water could be taken out at Duluth, Minnesota, instead of Superior, Wisconsin, he would realize that one less state would have to be dealt with. Water taken from Wisconsin would have to be shipped across Minnesota but water taken from Minnesota would not have to be shipped across Wisconsin to send it to Wyoming. A good bargainer would buy it from Minnesota not Wisconsin, all else being equal. How do we avoid a sale by Minnesota or some other state? A number of relevant cases have been decided by the Supreme Court since 1900. All were by downstream states against upstream states alleging that residents of the upstream states were taking more than their rightful share of the water of a river. The early cases were against the State of Colorado because Colorado happens to be a high point in the Rocky Mountains where many major rivers start, giving that state the first opportunity to take water before the rivers flow on to downstream states. Both Kansas[10] and Wyoming[11] sued the State of Colorado before the U.S. Supreme Court. The court applied the rule of equitable sharing but that rule has very few standards. Decisions tended to approve what had happened up to the time of the trial and included a stern warning to the upstream state not to take any more than their just share in the future. Nebraska and other downstream states are now seriously considering such an action against South Dakota. And if they begin an action, more law will evolve.

Another possibility for regulation of interbasin transfer is an interstate compact where all involved states agree on a contract, every state passes exactly the same law that is then passed by Congress and becomes an enforceable contract. Seemingly only in times of total crisis are states willing to come to agreement. Perhaps the sale to ETSI by South Dakota will be considered such a crisis and the states will agree to enter into a compact. Then in absence of a compact law suits seem inevitable.

One other old, tried and true rule that might be applied by one state trying to stop the activity of another is a law based on nuisance, another doctrine which comes to us from England. Basically the law says that one should use one's own property in such a way as not to harm one's neighbor unreasonably. This old rule fell into disuse until about 20 years ago when the environmental movement dusted it off. It is now broadly used across the country in many situations. During the last 20 years this concept has evolved as a federal common law of nuisance as well as a state rule. A familiar case is Illinois' suit against the Milwaukee Metropolitan Sewage System, which went to the U.S. Supreme Court twice.[12] The first time the Supreme Court agreed that there is such a rule and directed the parties to begin their action again but in the proper federal court. The court indicated that the federal common law of nuisance would be in effect until Congress filled the gap through federal legislation. The court dismissed the case the second time, saying that the 1978 amendments to the Federal Water Pollution Control Act had filled the gap and so replaced the federal common law of nuisance on issues of water quality. But because we do not have federal legislation on water allocation, Congress has not preempted the field and any state can sue any other state under the federal common law of nuisance if it believes itself damaged because another state is taking an inequitable share of water from a common source.

And what are our conclusions? We have no shortage of rules. We do not know exactly how these will be fit together or how the gaps will be filled as litigation continues, as it surely will. If we are to have interbasin transfer of water, initial legislation will be needed by states. That legislation will be followed by litigation until the rules are fully developed. Existing limitations that cannot be ignored are the approval authority of the International Joint Commission under the treaty with Canada and the authority of the federal government to direct interbasin transfer through Congressional action.

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[1] California v. United States, 438 U.S. 645, (1978)

[2] United States v. New Mexico, 438 U.S. 696, (1978)

[3] 33 USC 3404

[4] Winters v. United States, 207 U.S. 564, (1908).

[5] Wisconsin Constitution, Art. IX, 31 (1908)
Priewe v. Wisconsin State Land and Improvement Co. 103 Wis. 537, 79 N.W. 780 (1899)

[6] Hudson County Water Co. v. McCarter, 209 U.S. 349 (1908).

[7] City of Altus Oklahoma V. Carr, 255 F. Sup 828, (W.D. Tex. 1966), aff'd per curiam, 385 U.S. 35 (1966).

[8] State ex rel Douglass v. Sporhaw, (U S Supreme Court Docket No. 81-613)

[9] Commwealth Edison V Montana, 453 U.S. 607 (1981).

[10] Kansas v. Colorado, 206 U.S. 46 (1907)

[11] Wyoming v. Colorado, 259 U.S. 419 (1922)

[12] Illinois v. City of Milwaukee, 406 U.S. 91 (1972, (1981)

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STATE REGULATION OF THE WATER RESOURCE

Edward M. Parsons

When I was asked to appear on this panel this afternoon and later received some the conference material relating to this conference, I noted that all of the panel participants on this panel were lawyers and that the moderator is a lawyer, I knew that you as conference participants were in trouble. I am mindful of a visit I had with one of the prominent labor leaders in Wisconsin a few months ago. I entered his fairly large office with a lot of memorabilia, a picture with Harry Truman, a picture with President Johnson, a picture with President Kennedy, this tells you something of his political bent; notwithstanding all of these little momentos in his office, there was one sign he had on the wall that dwarfed everything else. The sign said, "The first thing we have to do is get rid of all the lawyers". So I want you to know that my comments today are from the perspective of my role now as an ex-regulator not so much as a lawyer. When I realized today that I was going to follow Professor MacDonald I knew that it would be difficult to follow such a distinguished scholar in the area of water rights. I was also mindful as I thought back to some of the painful decisions that I was required to make when I was sitting as Commissioner of the Wisconsin Public Service Commission. A number of these decisions involved the approval of new wells and pumping facilities and water treatment facilities for Wisconsin municipalities whose old facilities had deteriorated to the point that environmental standards were not being met. The usual scenario went something like this, and I know there are Department of Natural Resources personnel here in the audience so I am going to tread softly here; but the scenario was something like this.

The DNR in Wisconsin becomes aware of water quality problems either through its in-house surveillance procedures or through citizen complaints. After investigation and analysis, DNR requires corrections of any deficiencies. The next step is something like the following:

- The Wisconsin Department of Natural Resources becomes aware of water quality problems either through its inhouse surveillance procedure or through citizen complaints.

- After investigation and analysis, DNR requires correction of any deficiencies.

- If economic analysis showed new facilities were required then a system is designed and presented to area residents for recommendation usually through a referendum. If referendum action is favorable or approval obtained by municipal council action, then application for the new facility is made to the PSC including notice of the fact that DNR was requiring the facilities and that area residents approve of its construction.

The bottom line of all of this is that the Wisconsin PSC ultimately approved construction of the facilities and set the rates to recover the investment and other costs associated with running the facilities. This is where the pain came in. The rates that were approved were quite significant in magnitude.

The federal requirements, the DNR and PSC requirements and the desires of local interests all played a role in the ultimate costs of providing services. The rates also represented a direct reflection by all sectors of our society of a conscious disregard or an inattentiveness to the environmental, economic and social concerns relative to water quality and use. There are many problems regarding water use and distribution. Regulation should and probably will play an important role in the ultimate solution to these problems. So I am pleased to be here today to share some of my thoughts with you.

I am sorry that I was unable to attend this morning's session on demand for water nationwide for I am sure there was an excellent briefing and discussion of some historical perspectives of water transfer issues. There is some data, in fact, I would like to present that hopefully will not be repetitive of this morning's discussion.

The focal point of our increasing water problem seems not to be that this country lacks sufficient water supply but that our water resources are geographically out of balance. There are regional shortages in the northeast and southwest while the northwest and midwest appear to have a more abundant water supply. This country's vast underground reserves of water have been seriously depleted in the last few decades. Between 1950 and 1980 the amount of water taken from these reserves more than doubled from 12 trillion gallons yearly to an excess of 25 trillion gallons. Each day 21 billion more gallons flow out of these underground networks than are deposited.

Other problems are more identifed with water quality such as acid rain which is killing our lakes and drinking water being contaminated by PCBs and other chemical substances. Groundwater contamination is occuring in almost all regions posing serious public health hazards resulting from runoff, agricultural pesticides and herbicides, industrial discharge of contaminents into lake and rivers as well as toxic waste and landfill runoff into groundwater. All the forces impacting on water use and quality are creating an atmosphere of regional parochialism and an intense competition for the use of water is developing at an ever increasing rate. In discussions earlier, of Montana and Wyoming, I am mindful of the millions of dollars Wisconsin rate payers are being subjected to because of the coal severence taxes coming out of these two states.

The rising cost of electricity that has occurred since the Arab oil embargo in 1973 has had a substantial economic impact on the cost of pumping water for irrigation. A special report in the February 23, 1981, issue of Newsweek entitled the "Browning of America", states that begining with the water that

irrigates the corn that is fed to the steer, a single steak from the steer might account for 3500 gallons of water. Imagine the total amount of water involved in marketing a 1,000 pound steer. It is estimated that it takes 14,395 gallons of water to grow a bushel of wheat and to put a single egg on the breakfast table. . .120 gallons of water are required.

Effective water resource management has been thwarted by such institutional barriers as artifically low water prices which discourage conservation and helps create shortages, lack of effective coordination between federal and state governments relative to surface water management and water quality and quantity management, and conflicts between the executive and legislative branches of the federal government which have caused delays in federal water project authorizations.

Where does Wisconsin stand in this moras of political, legal and economic entanglements? Although Wisconsin has maintained an explorary record in this management of water resources, at this date it stands ill prepared to address the many public interests concerns associated with the interbasin transfer of water from our precious water resources.

What is needed? Just as Wisconsin has been required in recent years to address issues associated with a sound nuclear waste management policy mostly as a result of federal government ineptness and procrastination, Wisconsin must begin **now** to formulate a sound interbasin water tranfer policy together with other affected Midwest states and associated provinces of the Canada.

What are the main ingredients of an effective interbasin water transfer policy? In my view and effective policy must assure that any water transfer program is technically and environmentally feasible, it must be politically palatable and finally, it must be socially responsible so as to protect the interests of future generations.

Why a statewide policy? The need to develop a statewide policy regarding interbasin water transfer is paramount for several reasons. The most obvious is that an effective policy in this area is essential if Wisconsin citizens are to continue to enjoy the quality of life that has been fundamental throughout the history of this great state. As important is the requirement that the Wisconsin industrial and commercial sectors continue to be viable partners and strong contributors to the growth and economy of this state. A statewide policy, if clearly articulated and affirmatively expressed in a non-discriminatory manner, can also be an effective deterrent against federal intrustion by preempting state action in the regulation and management of any major water diversion efforts effecting the state. A strong definition of what constitutes the "public interests" is a requirement in meeting legal challenges to positions taken by the state in addressing water diversion issues.

What about the role of regulation in developing a statewide water diversion policy? Regulations can play an important role in the development and implementation of a sound state water transfer policy. First, the Wisconsin Department of Natural Resources and the Wisconsin Public Service Commission have explorary records of regulating in the "public interest" throughout the history of its existence. The expertise founded in these two agencies can be of substantial benefit in the review and formulation of water transfer policy.

In addition, the economic value of water in the marketplace is in the formative stages of determination. Regulation has historically played an instrumental role in representing the public interest in a monopoly environment. Just as forecasts and associated planning to meet Wisconsin's energy needs takes place in the regulated environment ten to fifteen years in advance of the construction of a facilities, it would appear that Wisconsin can and should follow a similar path in regard to issues associated with water transfer or diversion.

How do we in Wisconsin accomplish the task we have before us? First we must have strong commitment from the state's Chief Executive Officer to represent and protect the state's resources and environoment. In addition, the Legislature should begin to review and direct its efforts toward achieving a sound overall state policy. As I noted earlier in my discussion as successful state water transfer program must address three requirements; namely, technically and environmentally feasible, politically palatable, and socially responsible. Although it appears that any technical problems with interbasin tranfer can be overcome, environmental questions must be addressed leading to a judicious assessment of the water transfer impacts on our environment. Politically palatable—the development of a satisfactory water transfer policy and program requires the creation of an administrative and organizational structure within our state government capable of providing the competence, preception and authority that the resolution of problems of this magnitude and importance will require. As to socially responsible—any program to transfer water must be managed so as to protect current and future generations. This must be the foremost criterion for any interbasin water transfer program. This is minimum demanded by our society.

QUESTIONS AND ANSWERS

Question: Given the fact that this morning the statement was made that farmers will be able to adapt to a declining aquifers, declining water tables, why is it we are going to need additional water and secondly, given that interbasin transfers are now economically infeasible, what are we going to do to supply that water?

Langland—The first question, the fact that farmers can use water more efficiently is good. Whether they will or not is the question. In Nebraska to tell a farmer how many inches per year he can put on his corn is like finding out if I can get on the next space shuttle. You can't do it politically. I wouldn't want to be the one proposing that bill in the next session of the Legislature and I really don't think in all good conscience I could suggest it to the Governor or I might be out on the soupline very quickly. The economic feasiblity of interbasin transfers from the Great Lakes is something with which I am not familiar. I do believe, though, it will be economically feasible to move water within the Missouri River basin to supply those needs in Nebraska. That is also to be distinguished from moving the water to the High Plains of Texas talking proximity, pumping costs, and all sorts of things like that; but I do believe that we will be able to move the Missouri River as a supplemental irrigation source in the near future for the agricultural needs of Nebraska.

Question: How does the State of Nebraska regulate water in times of shortage and are there interbasin water transfers in Nebraska?

Langland—We have in the State of Nebraska a system of natural resource districts which are delineated based on the sub-basins within the state; there are 24 of those, each is run by a local board of directors and there is within the state a system called the Groundwater Management Act. That allows the natural resource district to petition the State Department of Water Resources for what is called control area designation. Control area designation is something that may be given to a natural resource district if there are serious declines in the water supply and those can be proven by the NRD. There are currently three in the State of Nebraska. If an NRD is granted control area authority, the natural resource district, can impose controls on the water used within the district boundaries. Controls may consist of well spacing requirements, well drilling moratoriums, allocation of water and a number of other tools to deal with the decline.

The second question with respect to intrabasin transfers of water in the State of Nebraska. Up until two years ago interstate transfers of water within the basins of Nebraska was illegal. There is a currently a case in the Nebraska Supreme Court which would allow for diversion from the Platte River to the Blue River basin. Curiously enough within the last two weeks, Little Blue, the Little Blue area is a control area, was given the authority to impose controls to take care of the water they do have on a decreasing

basis. Two weeks ago that natural resource district decided not to impose any controls for two years even though the state has jumped through all the hoops to give them the control area designation. They couldn't get the local people together on the board to decide what those controls are going to be and when you have the banker, the farmer, the equipment dealer, etc. all sitting on the NRD Board it is pretty tough to shutdown your neighbor and put him out of business. That is also the same NRD that is asking for more water from the Platte River and it struck me as very curious that an area that won't even take care of what it has is asking for more. I don't think the Nebraska Supreme Court is going to look very kindly on that decision.

Question: Would legislation be required to transfer water from one basin to another within Wisconsin?

MacDonald—What I am about to say isn't going to add much knowledge. Although Wisconsin has no court decisions on the subject, it is presumed that in most riparian states interbasin transfer of water is prohibited. If you want to know the answer, start the law suit! My guess is that the answer will be that you won't be able to transfer from one basin to another without authorizing legislation. We do have Section 30.18 of the Wisconsin Statutes providing that surplus water may be transferred from one lake to another. It was adopted during the drought in the 30's when there were resorts in northern Wisconsin with neither tourists nor water. It was adopted to permit someone with a dry lake to bring in water from another district if there was surplus water elsewhere. I doubt that it is applicable; I think you would have to go to court.

ECONOMIC ASPECTS OF WATER TRANSFER

Moderator: ***William Marks***
Speakers: ***Tom Kalitowski***
Paul Nickel
Bruce DenUyl
Warren Neufeld

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Mr. Marks serves as the Assistant Chief for the Bureau of Environmental Protection in the State of Michigan's Department of Natural Resources. The Bureau is responsible for water quality, air quality, resource recovery, and International Joint Commission Liaison. Mr. Marks also serves on the Winter Navigation Board; National Shoreline Erosion Advisory Panel; International Joint Commission Panel on Great Lakes Diversions; and the International Water Quality Agreement Negotiation Team. Prior to holding his present position, Mr. Marks was Chief of the Michigan Water Development Services Division and Assistant Chief to the Michigan Water Resources Commission.

Mr. Marks holds a Bachelors Degree in Land and Water Conservation and a Masters Degree in Resource Development, both from Michigan State University.

ECONOMIC ASPECTS OF WATER TRANSFER

INTRODUCTION

William D. Marks

Good afternoon, it is nice to be with you. Coming from the only state (Michigan) in the Great Lakes basin that can't divert water from the Great Lakes on our own volition, I'm a little suspicious of the nature of this conference. I am also a little confused with the preoccupation of that aquifer in the west and its repeated discussion here today. Putting aside by suspicions and confusion, I think it is interesting to remember that the economy of the Great Lakes, the development of the Great Lakes really began with interbasin transfers of water. The first major interbasin transfer was that through the Erie Canal. The Erie Canal, the Ohio Canals and the Illinois Waterway all really opened up the Great Lakes for the development that we have here today so that I suspect that there will be some ramifications and linkages to the future as well as the past as far as interbasin transfers are concerned.

THOMAS J. KALITOWSKI
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Mr. Kalitowski is currently Chairman of the Minnesota Water Planning Board, a position he has held for the past four years. Prior to his work with the Board, Mr. Kalitowski served as Assistant Commissioner for the Minnesota Department of Agriculture. Mr. Kalitowski has also served as an Assistant Attorney General for the State of Minnesota.

Mr. Kalitowski holds a Bachelors Degree in Political Science and a Law Degree, both from the University of Minnesota.

ECONOMIC PARAMETERS ASSOCIATED WITH WATER FROM A PLANNING PERSPECTIVE

Thomas J. Kalitowski

I have been asked to address **Economic Aspects of Water Transfers** and the conference planners will be glad to know I will stick to the topic assigned. However, my remarks should **not** be construed as an indication that the State of Minnesota is primarily concerned with economics when examining the issue of interbasin transfers of water. In fact in the comming year my agency, the Minnesota Water Planning Board, will be studying all facets of the issue including those being addressed in the conference: water demand, engineering feasibility, legality, political ramifications, and economics. In addition, we will be paying close attention to an issue **not** specifically covered by a session of the conference: namely, environmental concerns which of course can raise a host of issues ranging from esthetics and "quality of life" to the economic costs of EIS or the even greater costs of environmental mitigation. But as I stated initially, I am not going to deal with these other pieces of the larger picture but will confine my remarks to the economic parameters associated with water from a planning perspective.

Specifically, I want to talk about work which has taken place in Minnesota as part of the Water Planning Board's development of a state water plan concerning the general issue of "The Value of Water". Let me begin by putting Minnesota's concern with the economics of interbasin transfers in perspective.

In September 1979, Theodore Schad of the Commission on Natural Resources for the National Research Council told a symposium on western water resources: "No state will be willing sell its water 'birthright' unless the consideration is so high as to increase the cost of the project to such an extent that it would not be economically justified".

As you all know, barely two years later, in December 1981, the State of South Dakota signed an agreement with Energy Transporation Systems, Inc. to sell 16.3 billion gallons of Missouri River water annually for 50 years.

Minnesota—and other states—took note. Even before the South Dakota agreement was finalized, the Midwestern Governors' Conference created a special task force to explore ways in which the region's water resources might be used to enhance economic growth.

Given Minnesota's general interest in the topic, what do we do next? In a way, Minnesota is fortunate in that it has somewhat of a head start in its effort to address this emerging issue. In 1977, our state water planning process began to give some thought to a basic issue: namely, the economic value of water to Minnesota. We had just been through one of the

four worst droughts recorded in the state. Nearly 60 communities had experienced substantial water supply problems and irrigated acreage was doubling and redoubling. While we had a ground and surface water appropriation permit system and a set of priorities for water appropriation adopted by the Legislature, we began to ask ourselves whether we were really making the best use of our resources. One part of that question was whether we were making economically efficient use of our water resources.

I want to emphasize here that this was just one part of the question. "Socially" optimal allocation of water resources depends on how allocation decisions affect the whole range of goals we have set, of which economic efficiency is only one. It is a question for elected decision-makers to weigh public desires and to decide where our greatest interest lies.

To answer this question we began with an examination of legal restraints on economically efficient use.

As you probably know, Minnesota follows the American Reasonable Use Doctrine of Riparian Rights for surface waters and the Correlative Doctrine for ground waters.

We concluded that both the Riparian Rights and Correlative Doctrines pose formidable obstacles to economically efficient water allocation. This is due to the fact that water resources are not evenly distributed and that court and policy decisions generally discourage the sale of water from a riparian to a non-riparian. Interestingly, in Minnesota there is an 1889 State Supreme Court decision, **St. Anthony Falls Water and Power Co. v. City of Minneapolis,** which upheld the right of a riparian to allow a non-riparian to draw water across his land. However, current Department of Natural Resources policy prohibits such transfers. Thus, we found it is left somewhat to chance that the distribution of water resources will coincide with the distribution of uses in which it would be most productive.

Faced with a growing interest in the role of water resources in economic development—the 1976 drought cost the state nearly $1 billion—the state water planning effort began to look more closely at the value of water to the state. I would like to generally discuss our work in this area.

The value of water to individual Minnesotans—that is, its relative importance or utility—is only tangentially related to the cost of acquiring it. In paying a water utility bill a person is really paying for the pumps, drilling, treatment, storage and distribution system—and little or nothing for the resource itself.

Historically, Minnesota's water was first valued by French voyageurs and their successors as an avenue of commerce for the fur trade. From the mid-19th century until the early 1900's, millions of board-feet of lumber were

floated down the Mississippi and St. Croix Rivers from northern Minnesota forests. About the same time, water took on great worth to the flour milling industry which spawned the growth of Minneapolis-St. Paul. The development of the Iron Range of northern Minnesota toward the end of the 19th century assigned a new value of water in the region. As the state's population grew during the 20th century, water took on new and expanded values for domestic agricultural and industrial growth. However, importantly the vastness of available resources allowed this development to occur without converting value into monetary terms.

When water resources are ample to meet all present and projected future needs—as they generally are in Minnesota—the failure to equate value and actual price is not a major cause for concern in terms of resource allocation. But in specific cases this imbalance can become a greater concern.

Thus, as part of the (1978-79) state water planning effort, we began to evaluate the economic impacts on the state of severe water shortages.

For example, a drought of 1976 severity, which reduced surface water supplies by around 30 percent, produced estimated agricultural crop losses of about $1.45 billion dollars, or about $75 per planted acre. Thus, in a very rough sense, you could say that the value of an "average" precipitation season to Minnesota farmers is $75 per planted acre.

As another example, we have found that Minnesota industries with large water requirements, such as food processing and pulp and paper manufacturing, are extremely sensitive to changes in the cost of intake water. If the price of intake water were to rise by $3.05 per thousand gallons, the profit of a typical vegetable canner in Minnesota would be wiped out unless the increased cost could be passed on to the consumers, or water use could be reduced.

Having offered these general comments on the value of water, I would like to describe our more detailed work in the area. In trying to get a better idea of how to value our water realistically, we found that there are several possible ways you can look at "values" of water. I would like to discuss three of these approaches: First, value as the cost of producing the resource; second, value as the cost of providing alternative supplies if the resource were not there; and third, value as determined in terms of a value added to a product by the availability of water to the process.

First, value as the cost of producing the resource.

As I have noted, assigning a price based on cost of producing or supplying the resource generally does **not** attach any value to the resource itself and therefore, undervalues the resource. We in Minnesota actually "value" most of our water resources this way. For instance, a municpal water customer gets a bill for water service, but this reflects only the costs of secur-

ing, pumping, treating, and distributing the resource which has a market value of "zero". For the record, a survey of 26 Minnesota water utilities with single block rates found an average rate of $175 per acre-foot, with a range of $98-$407 acre-foot. This, of course, is for treated, drinking-water quality water and not for "raw" water.

Similarly, the "water cost" for an irrigator using ground water in west-central Minnesota, will be influenced by equipment costs and interest rates, fuel prices, and depth to the water table, but **not** by any charge for the water itself. Annual costs per acre irrigated range from 75 to 90 dollars (including both capital and operating costs).

In some cases, the price a buyer pays for water does not even cover the cost of producing the resource, much less any intrinsic value for the water. Large-scale water diversion and delivery projects, especialy those supported by the federal government, rarely recover costs if those costs are calculated comprehensively. Price to customers is generally calculated based on ability to pay.

For example, charges to irrigators for older Bureau of Reclamation projects in North and South Dakota are on the order of $2.50 per acre-foot. The cost of providing that water can easily be tenfold greater. An economic analysis of the O'Neill Unit in Nebraska (a component, currently under study, of the Pick-Sloan Program) finds that benefitting irrigators will pay only about 5 to 10 percent of the total project cost. In terms of actual values, the prices to be charged to irrigators for O'Neill Unit water, based on ability to pay, is to be on the order of $20/acre-foot. Costs of delivery, based on Bureau of Reclamation cost estimation procedures, are approximately $200/acre-foot, although independent analysts feel that actual costs could be twice that high. Of course, there are other benefits to downstream users, such as flood control and improved navigation, which are a major objective of the Pick-Sloan project, and which argue against assigning all of the costs to benefitting irrigators.

A second possible way to "value" water is to treat the value as the cost of providing alternative supplies.

A primary example of the sometimes exorbitant costs of providing an alternative to an existing resource is the Ogallala Aquifer situation. The Army Corps of Engineers component of the High Plains Study evaluates six proposals to replace depleted ground water supplies with large-scale surface water diversions from basins with more abundant supplies. Costs of providing this alternative supply are estimated to be in the range of $350 to $800 per acre-foot.

A less dramatic example is taking place in western Minnesota, where ground and surface water supplies are less abundant than elsewhere in the state, and where ground water quality is often too poor for human and live-

stock consumption. In these areas, several rural water supply systems are planned or operating. The systems are financed through loans and grants from the Farmers Home Administration; users are assessed for capital costs and pay volume charges for water delivered. Users of existing systems are paying $2-3 per 1000 gallons—which translates into $650 to $1000 per acre-foot. This indicates how valuable Minnesota's water can be to areas that do not have it.

A third approach to valuing water might be to look at value in terms of value added.

Determining the value for water based on the value added or price increase to the product can be easily understood by looking at irrigation: it is the difference between the value of the product with and without additional water.

A 1981 University of Minnesota/Ag Extension study of the economic impact of irrigation in Swift County (in west-central Minnesota) measures increase in profits (that is, increased sales less operating costs) due to application of irrigation water in normal and dry years. On Class One and Two soils, additional receipts generated from irrigation of field corn were about $165 per acre-foot of water applied.

The North Dakota State Water Commission, as part of the West River Study in 1975, also evaluated water for irrigation. The value of water was assumed to be the difference in net profit between dryland and irrigated agriculture. Three different levels of crop prices were assumed. Under low, medium, and high crop price assumptions (1972-73) the "value added" of water per acre foot was calculated at $17.06, $53.67, and $94.62, respectively. Of course, as the sale price of crops increased, the "value" of the water applied increased more rapidly.

In attempting to value water for industrial uses the West River Study used a similar approach, a "residual imputation approach". The value of water was estimated to be the sales value of the product minus associated production costs. For a 500 megawatt steam electric generating plant, the value of water was based on the net profits of generating, and ranged from $309 to $415 per acre-foot, with the higher value representing more efficient water use.

A 1958 study in New Mexico reviewed the relative economic benefits of different patterns of water use, including a mixture of irrigation, industry, and recreation. The study found that the value added, per acre-foot, was $44-51 for agriculture, $212-307 for recreation, and $3040-4000 for industry The differences between returns for agricultural and industrial water uses for a given input of water is striking, especially in view of the priority generally given to agricultural uses. The authors comment that the prior appropriation doctrine in effect in New Mexico does not lead to efficient

allocation of water. They recommend that a policy be implemented of introducing flexibility into patterns of water use, so that less economically efficient uses can give way to more efficient uses as the area develops.

Finally, I would like to briefly discuss a recent situation in Minnesota in which a state agency was called upon to determine how water should be valued. In the summer of 1981, the Minnesota Department of Natural Resources received a request from a Red River Valley farmer to pump water from a gravel pit on state trust fund lands, which the DNR manages. The resulting lease was unique in that it was the first instance of the state selling rights to an individual to appropriate water from trust fund lands. In the process of negotiating the lease, the DNR consulted with the Water Planning Board about possible pricing policies for the water.

Although the quantities of water involved were small, the staff of both agencies were concerned about setting a precedent for future pricing decisions. Neither wanted to perpetuate the view that water had no value, and therefore felt that a charge at some level above the "cost of producing", which was practically nil, should be assessed. Ultimately, the DNR decided upon an "alternative cost" approach: the irrigator was charged a fixed percentage of the cost of developing an alternative supply—which in this case was about $15,000 for the installation of a well. (8 percent was the figure used since this was the standard percentage used by DNR in other types of commercial leases). At this rate, the cost to the irrigator for the lease is $1200 a year. The irrigator expected to withdraw 16" of water annually on 350 acres.

As a check for reasonableness, DNR compared the cost with a range of others and found that it approximated the $2.50 an acre-foot average being paid by Northern Great Plains irrigators for Bureau of Reclamation water.

In conclusion, the basic message of this talk is that our planning process in Minnesota has given us a little better understanding of the value of our water. However, we know much less about what price we could, would or should charge for it. And referring back to the other apects of the issue, we definitely aren't sure if the transfer or sale of water is something we want to do. Our current state policy is clear. Minnesota law discourages the interstate transfer of water and further discourages transfers between basins within the state. These were value choices made by our legislators. While they were choices made in different times and without real consideration of economic values, they were made in the context of the goals for the state as a whole—its environmental desires, its social needs, and its economic wants. Any review of the earlier choice must be made in the same context. It is our hope that some of the work we have done on the economic perspectives will contribute to this decision making process.

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Dr. Nickel is currently Chairman of the Department of Resource Development at Michigan State University. Prior to his present position, Dr. Nickel was Planning Director for the Great Lakes Basin Commission. Dr. Nickel has had extensive teaching experience as well as acting as a consultant. His consulting experience includes work with the Premier's Planning and Priorities Committee of Cabinet for the Government of Manitoba; a Benefit-Cost Analysis on Air Pollution for the National T.B. and Respiratory Disease Association; and work with the Council of State Governments on ways state governments might assist cities in resolving their economic problems.

Dr. Nickel holds Ph.D. in Economics from Michigan State University.

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Mr. DenUyl currently heads the consulting firm of R. B. DenUyl & Associates. He is also serving on the Governor's Water Task Force for the State of Michigan. As a consultant, Mr. DenUyl has done an economic evaluation of water transportation on the Great Lakes, a study of the economic impact of hazardous waste management and resource recovery in the Great Lakes Region, and acted as a consultant to the Great Lakes Basin Commission on water, environmental and transportation issues.

Mr. DenUyl holds a B.A. Degree from Lawrence University and Masters in Resource Economics from the University of Michigan.

ECONOMIC ASPECTS OF INTERBASIN WATER TRANSFERS FROM THE GREAT LAKES

R. Bruce DenUyl and Paul Nickel

Introduction

We have been asked to address the issue of the economics of interbasin transfers of water from the Great Lakes. This is a difficult topic, since the only major diversion is at Chicago, which is not intended to benefit the water-poor regions of the west. Information on the benefits of other diversions that have been undertaken is mainly qualitative in nature. Furthermore, estimates of the economic impacts associated with interbasin transfers have been confined primarily to power losses. The only useful economic data that is available for most projects is the cost of constructing and operating the transfer system. Within the Great Lakes Region there have been a few proposals for transferring water out of the region (such as a coal slurry pipeline using water from Lake Superior), but not detailed cost and engineering studies that we are aware of.

A lack of solid economic data has always been an economist's nemesis, but it has never stopped most practitioners from making a variety of colorful projections. In keeping with that tradition, we will not allow the lack of a few numbers to prevent us from discussing the economics of interbasin water transfers from the Great Lakes. However, instead of giving you estimates of net benefits to the second decimal place, we will provide an outline of how one proceeds in evaluating the economics of such projects, and present estimates which indicate whether transfers might be economically feasible for such uses as irrigation or energy production.

We should point out that criteria other than economic ones will be important in any decision concerning interbasin transfer. The fundamental question of who controls or has a right to divert water from the Great Lakes is as yet unclear. Political and environmental considerations will likely be strong components of any decision. Since other speakers will address these non-economic issues, we will consider them only as they impact economic issues.

Uses of Water Diverted From the Great Lakes

If water was diverted from the Great Lakes, its most likely direction would be west or southwest, where the prospect of future water deficits are most likely, and if it was transferred to the west, its most likely use would be for irrigation purposes. On a national basis over 80 percent of all water is consumed by agriculture, and this proportion is probably higher in the west.

Energy production is another strong possibility, particularly if synfuel plants or coal slurry pipelines become numerous. Outside residential and industrial uses are less likely, unless water could not be diverted away from low value agricultural uses.

Economic Criteria for Interbasin Transfers

There are two conditions which must be met if an interbasin transfer is to be justified on economic grounds. First, the primary and secondary benefits to the importing region and the region through which the water is being diverted must exceed the primary and secondary costs to the exporting region, plus the secondary cost to regions where output is displaced by production in the importing region, plus the cost of the transfer syste. Since that may not be immediately absolutely clear, we will elaborate that. The second condition is that the cost of the proposed system must be less than that of the best alternative.

It may be apparent that the criteria just stated is from the perspective of the national economy. All water projects undertaken by the federal government are evaluated on this basis. If the benefits to the importing region exceed the costs to the exporting region, including construction costs, then the nation as a whole is made better off. Unless there is some means of compenstaing the region that is suffereing an economic loss, then clearly that region will lose at the expense of other areas of the country.

We raised this issue of national versus regional accounting stances because it is of some concern to many in the Great Lakes region at this time. Many of the states in this region are losing jobs to the sunbelt; more federal tax dollars are taken from the region than are sent back, and the current administration in Washington is perceived as being more sympathetic to western concerns. However, it may be advantageous to consider interbasin transfers from a national standpoint even if one is opposed to any transfers from the Great Lakes. One of the historical effects of investment in water projects has been to displace agricultural production in other regions of the country as more western land was irrigated. A national accounting stance will consider those costs to other regions in the economic evaluaton. If the analysis was conducted on the basis of the exporting region versus the importing region, such costs would be missed.

Economic Cost of Interbasin Transfers

There are several costs associated with an interbasin transfer. The most obvious, and the most easily quantifiable is the cost of constucting and operating the system. Although there are no specific projects from which we can derive estimates of these costs, they will certainly be in the billions of dollars (Banks quoted at $400-$800).

Although construction and operation costs are likely to be the major proportion of the cost of transferring water out of the region, there are secondary costs that may be quite significant. One of these costs is the displacement of agricultural production in other regions that occurs when new irrigated acreage (or increase yields on existing acreage) is brought into production. During the period from 1944 to 1964, an additional 3.3 million acres were irrigated by the Bureau of Reclamation. It is estimated that the increased production on this acreage replaced 5 to 18 million acres elsewhere, primarily in the south and the north. This represents from 8 to 43 precent of acreage diverted under annual commodity programs during the 1960s. In some cases, Bureau of Reclamation irrigation displaced production within the same state. Although it is difficult to assign values to this diverted acreage, one example will indicate the magnitude of the impact. In 1964 and 1965, potato acreage served by reclamation irrigation increased 40,000 acres. The increased production on these acres accounted for an estimated decline in the value of the potato crop of between $69 million and $173 million. The increased output on the irrigated acres was worth only $2.9 million.

Another impact of reclamation irrigation are costs borne by the public of payments made under the annual commodity programs, which pay farmers to withhold acreage from production and provide price supports. Only 42 percent of the irrigated acreage was planted in crops that are supported by these programs, but the annual cost to the public between 1944 and 1964 was between $83 million and $179 million.

Overall the, the indirect costs associated with the expansion of irrigation in the west are quite substantial and often not considered in the economic evaluation of water diversions. The examples used are somewhat dated, but the impact would be even greater today.

Another potentially significant cost that has to be included in the benefit-cost calculus is the economic impact on the Great Lakes region. Specifically, we will address the economic impact of any change in water levels that would occur as a result of an interbasin transfer. Our economic impact projections are based on the results of a study recently completed by the International Joint Commission, entitled: "Great Lakes Diversion and Consumptive Uses Study". This report examined the effects of regulating the levels of the Great Lakes by increasing or decreasing outflows at existing diversions such as Chicago or the Welland Canal. The report did not study the effects of an interbasin transfer, but by assigning the impacts of increased outflows reported in the study to a hypothetical interbasin transfer, we can analyze the effects and possible consequences.

For example, one of the scenarios called for an increase in the outflow at Chicago from 3200 CFS to 8700 CFS, with inflows to Lake Superior and outflows at the Welland Canal remaining at current levels. For the purpose of this discussion, the increased outflow is equivalent to an interbasin transfer out of Lake Michigan of 5500 CFS with diversions at all of the regu-

latory works remaining at current levels. The effect of a diversion of this magnitude would be to lower the mean level of the Great Lakes from three-quarters of an inch on Lake Superior to a little over two inches on Lakes Michigan and Huron.

The economic impact of a decrease in lake levels of this magnitude was estimated by the study to be slightly less than $44 million per year. The majority of the impacts were related to a decrease in peak power load-meeting capability at hydroelectric power facilities in the United States and Canada. The estimated opportunity cost of this loss of power of approximately $41 million per year. The second most significant loss was attributed to increased costs for navigation. A lowering of lake levels requires ships to carry less cargo per load, thus increasing the number of necessary trips. The cost to navigation of a diversion of 5500 CFS is slightly less than $6 million per year. There is also a small cost to recreational boating and benefits to shoreline property owners of $3.5 million per year. However, the total cost of $44 million is net of the coastal benefits (reduced shoreline erosion).

To put this hypothetical diversion in perspective, 5500 CFS works out to 10,890 acre-feet per day, or slightly less than 4 million acre-feet per year. Since the economic cost associated with lower lake levels is approximately $44 million per year, the economic cost is about $11 per acre-foot. Under the worst scenario considered in the study, the cost per acre-foot would be $17.48. The only difference between this worst-case scenario and the one just discussed is that there would be no diversion of water into Lake Superior at Long Lac/Ogoki.

We should note that the costs just presented are based on changes from current lake levels. The IJC study has made projections of consumptive uses into the future, based on population changes and other factors. The projections suggest that lake levels will be lowered by consumptive uses within the region. Therefore, if an interbasin transfer occurred in the future, the impact on power and navigation losses would be somewhat greater than $11 to $17 per acre-foot. However, we do think the consumptive use projections are somewhat overstated.

There are also external costs that must be evaluated to assess the true cost of an interbasin transfer. External costs refer to the losses associated with any environmental impacts that may occur. There are likely to be some environmental impacts in the exporting and importing region, as well as the region through which the transfer is being made. The IJC report suggested that impacts associated with lowering of Great Lakes' levels by a few inches exist, but they would be minor. Although it is difficult to assess the dollar value associated with environmental impacts, these costs should be considered in any evaluation of an interbasin transfer.

The final cost component that should be considered is the "option value" of a resource. The option value is the future net present value of an opportu-

nity that will be foregone as a result of consumption today. If an interbasin transfer were to permanently divert a given amount of water to another region, the Great Lakes would be precluded from utilizing that water for other purposes in the future. The future is, of course, uncertain, but perhaps we should not assume that the Great Lakes regions' current difficulties will long continue. A revitilzation of the region in the future would increase the value of Great Lakes water, and suggest higher costs associated with any diversion.

Economic Benefits of Interbasin Transfers

The economic benefit that will be generated by an interbasin transfer of water is the increase in value associated with the new production stemming from the increased application of water. The most obvious example is the value of new or increased crop yields as acreage is irrigated.

Earlier we stated that agriculture would be the most likely recipient of water from an interbasin transfer, at least in terms of probable need. To determine whether a diversion to agriculture is the west would be economically justified, we need to assess the benefits of increasing crop yields as more irrigated acreage is brought into production. A number of studies were conducted during the 1960s that estimated the direct and secondary benefits of irrigation in the west. The direct benefits are the increased value of the crops, and the secondary benefits are generated by any economic expansion in related industries. There are a fairly wide range of benefits, depending on the type of crop, soil conditions, and other factors. The studies indicated that this range of direct and secondary benefits could be as great as $30 to $50 per acre-foot of water. Of course, inflation may have increased these benefits since the time these studies were undertaken, but this provides a ball-park estimate of the magnitude of the benefits.

We also mentioned that an interbasin transfer for purposes of energy development were also a real possibility. South Dakota recently sold the right to 50,000 acre-feet of water from the Oahe Reservoir for $180 per acre-foot to Energy Transportation Systems, Inc. This water will be used to move coal in a slurry pipeline from Gillette, Wyoming to Louisiana. The price of $180 does not include the cost of the system to transport the water from South Dakota to Wyoming. I'm sure our next speaker will provide much more detail on this transaction. However, this example indicates significantly the willingness to pay or place a high value on water for energy purposes. Early studies of synfuel plants in the Northern Great Plains also suggested that companies would be willing to pay a significant amount of money for assured supplies of water.

The value of water for residential and industrial uses is also likely to be much higher than for agricultural purposes. Residents of Milwaukee are currently paying in exess of $37 per acre-foot for water (not including sewerage fees), and the rate is almost twice as great in Minneapolis. In Gary,

Indiana, the rate for the first 1,000 cubic feet is over $100 per acre-foot. Thus, as you may have expected, the value of water for residential and industrial use is much greater than for agriculture.

The benefits associated with an interbasin transfer of water raises an interesting question concerning the distribution of benefits. For federal projects, the net benefits are not redistributed to those made worse off by the project. However, suppose Wisconsin made a sale similar to that of South Dakota. Would they be willing to compensate the other states bordering on the lakes, or for that matter Canada? If the Great Lakes states were to become the OPEC of water, it would be interesting to see how they shared the spoils.

Alternatives to Interbasin Water Transfers

We would be remiss if we did not point our some of the alternatives to an interbasin transfer. There is room for improvements in the efficiency of irrigation systems. It is estimated that an improvement in efficiency of 7 percent in U.S. agricultural water consumption would provide for a doubling of all other consumptive uses in the west. Conservation of water, both in agriculture and other uses, has been set back by the relatively low subsidized prices paid in the west. This is changing, but more realistic pricing is needed. Other alternatives, such as additional surface water development, wastewater reclamation, groundwater development and recharge, and transfers of water from low to high valued uses should be considered.

Conclusion

What can we conclude from all of the foregoing? We have not been able to determine all of the costs and benefits associated with an interbasin transfer from the Great Lakes, in part because no specific proposals have been studied. However, we have been able to provide estimates for some of the possible costs and benefits, and from these we can derive one significant conclusion: **It seems highly unlikely that an interbasin transfer of water from the Great Lakes for the purpose of supplying irrigation water to the west could be justified by any economic criteria.** The benefits to agriculture are not much greater than the impacts associated with a minor lowering of Great Lakes water levels, let alone the costs of construction and operation of the transfer system, and the displacement of agricultural production in other regions of the country. **Furthermore, if water could be transferred from low to high value uses in the west, there would be no need to transfer water from the Great Lakes for energy development or industrial purposes, even if they were willing to pay the cost.** Of course, this last point raises a congeries of political and legal issues that we will leave to those better informed.

WARREN R NEUFELD
Secretary, Department of Water and Natural Resources
Pierre, South Dakota

Mr. Neufeld is currently Secretary of the South Dakota Department of Water and Natural Resources. In this position, Mr. Neufeld was actively involved in the sale of water from the Oahe Reservoir to Energy Transportation System, Inc., a private coal slurry company. Prior to serving in his present position, Mr. Neufeld was engaged in the private practice of law in South Dakota. Mr. Neufeld holds a Bachelors Degree in Chemical Engineering and a Law Degree from the University of South Dakota.

THE ECONOMICS OF SELLING WATER: THE SOUTH DAKOTA PERSPECTIVE

Warren Neufeld

Thank you Bill. We are going to have a little show and tell this afternoon. I am here to talk about the economics of interbasin transfers. I am sure you have all heard the story (if you haven't you are going to hear it now and if you have you are going to hear it again) of the boss who said all he really wanted was a one-handed economist because everytime he talked to his economists they always said, "Well, on the one hand it could be this but on the other hand it could also be that." He wanted just a simple story. Your closing statement about simple two-handed economists is really much more complicated than it seems.

All I can say about the economics of interbasin transfer with respect to ETSI is that we sat down at the bargaining table with those people and we had certain economic and political cards in our hand and they had certain economic and political cards in their hand. Everytime they made an offer we just kept saying "no" until we got afraid that they were going to walk away from the table and then we said "yes". It was just a very straight business deal with each side holding certain advantages over the other. Perhaps if we go through some of the material that I brought, you will understand the background of what brought about the ETSI deal in South Dakota. It is, from our standpoint in South Dakota, probably one of the most politically popular things that has happened in the State of South Dakota, I would say, in the last 25 or 30 years. It has created quite a stir nationwide which is why I am here. It is an interesting process, and I would like to lead you through it a little bit at a time.

First of all, what is coal slurry. For those of you who don't know, the coal is ground up at a point near Gillette, Wyoming, in the case of ETSI and is mixed with an equal amount of water by volume to be shipped through a pipe. The coal remains in suspension with the water until it reaches the point of delivery, and it is then separated from the water by centrifuges. The water is either put in the power plants where the coal is burned and used for cooling, or it is treated and discharged to streams depending upon local water quality requirements and, basically, political and social considerations. Why coal slurry? Let me quote to you some remarks made by the mayor of San Antonio in May of 1980 with respect to the problems they had changing from natural gas to coal in order to keep pace with air pollution requirements and some of the policies of the federal administrations to become energy independent in this country. The mayor said at this address to the American Public Power Association, "When we were looking for coal leases . . . the railroad at the point of origin quoted us a price of $7.90 a ton for hauling the coal some 1630 miles from Wyoming to Texas by unit train with the city public service facility furnishing some $30 million worth of

coal cars. That is the train was just pulling the coal, it was the city's coal and the city's coal cars. Subsequently when the commitment was made to the Cordero Mine where the coal originated [the railroad] withdrew its offer and began quoting prices as high as $16 a ton up from $7.90. When no agreement could be reached and we were ready to stockpile, we petitioned the Interstate Commerce Commission to set a rate and they did so in October of 1976 and they did so of $10.93 per ton. In the next two years several rate increases were granted until the rate reached $12.42 per ton. It become apparent the railroad lobbist were hard at work. Then on December 1, 1978, the ICC granted a rate increase to $16.12 per ton. Eight additional freight races since that time have driven the freight rate to $20.25 per ton. There have been five increases since October 1 of last year." (This address was given on May 7, 1980 so between May of 1980 and October 1, there were five increases in that time, and the price went from nearly $8 a ton up to somewhere near $21 a ton for freight rates.)

How does coal slurry fit into this vis a vis the railroads? This is graph (Figure I) taken from a presentation made by Mr. Frank Odasz of ETSI at the Interstate Oil Compact Commission Conference in 1980 in Wyoming. The dotted lines represent a comparison of costs between railroad and pipeline at the 1979 level of inflation as measured by the Gross National Product Deflator which was then 5%. The solid line represents the 1975 level of inflation at a 3.3% Gross National Product Deflator. The reason for this is that coal slurry lines are highly capitol intensive and have a low ratio of operating costs and railroads are just the other way around. In fact, slurry lines variable costs amount to about 30% of their initial operating costs and their fixed costs are about 70% of their initial operating costs. Railroads, on the other hand, are about 85% variable and 15% fixed. You can see as inflation raises railroad costs the high weight of fixed costs in coal slurry pipelines gives them a very real economic advantage. Considering the remarks of the Mayor of San Antonio, other mayors, and other consumers in the country, the people who really know what coal slurry pipelines are all about felt that there was a tremendous advantage to be had over present means of transporation. ETSI decided to enter the market for transporting coal. The coal is not owned by ETSI just as it is not owned by the railroad. Some railroads do own the coal but by and large the coal is owned by a mining company and is contracted for by the utility or the consumer and the railroads and ETSI are in the market for competing for the business of hauling the coal from the mine to its place of comsumption.

Why Missouri River water? This is a map (Figure II) of the Missouri River Basin and right in the middle there is South Dakota. It covers about 1/6 of the land area of the United States and where the Missouri River leaves South Dakota and enters Iowa the average annual flow based on 1970 levels of depletion which have remained fairly constant up to this time is about 21 million acre feet of water a year. At the mouth of the Missouri River where the water leaves the Missouri River Basin and enters the Mississippi River the annual flow is about 54 million acre feet of water a year. So it more than doubles its flow on an average basis between Sioux City

FIGURE I

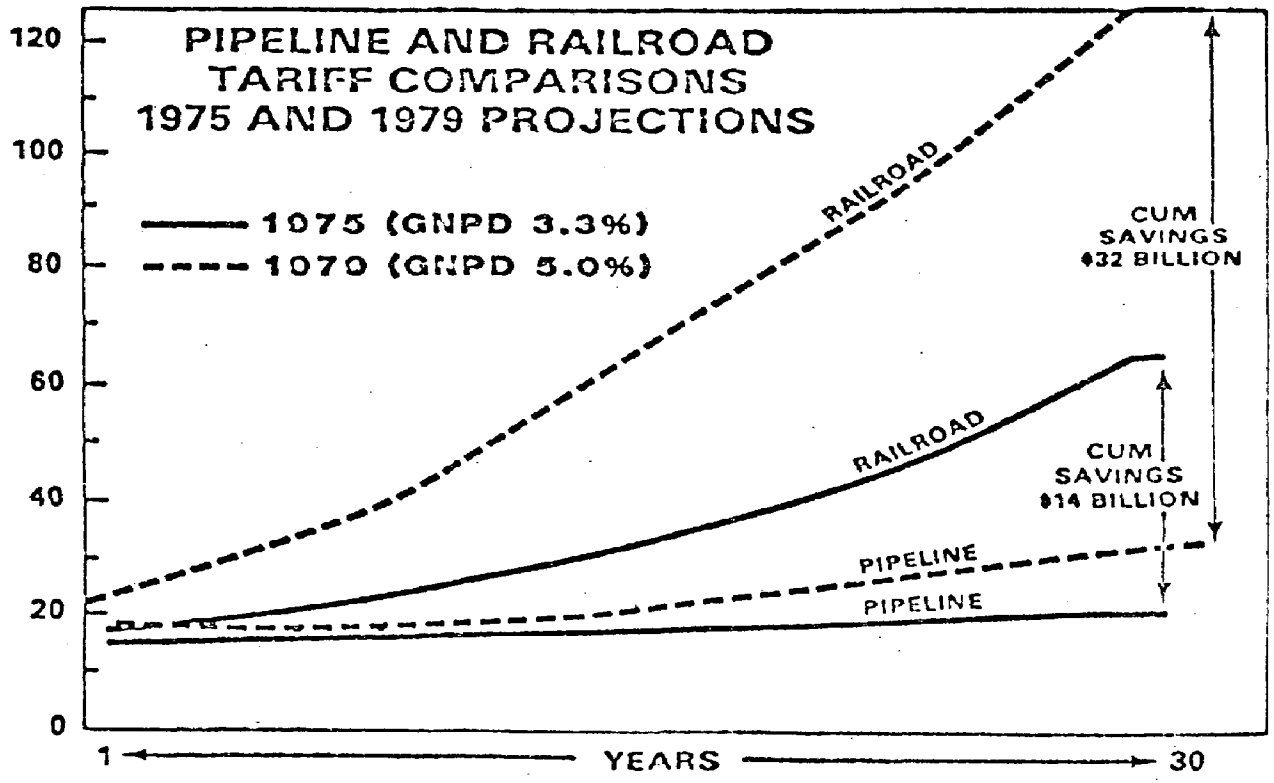
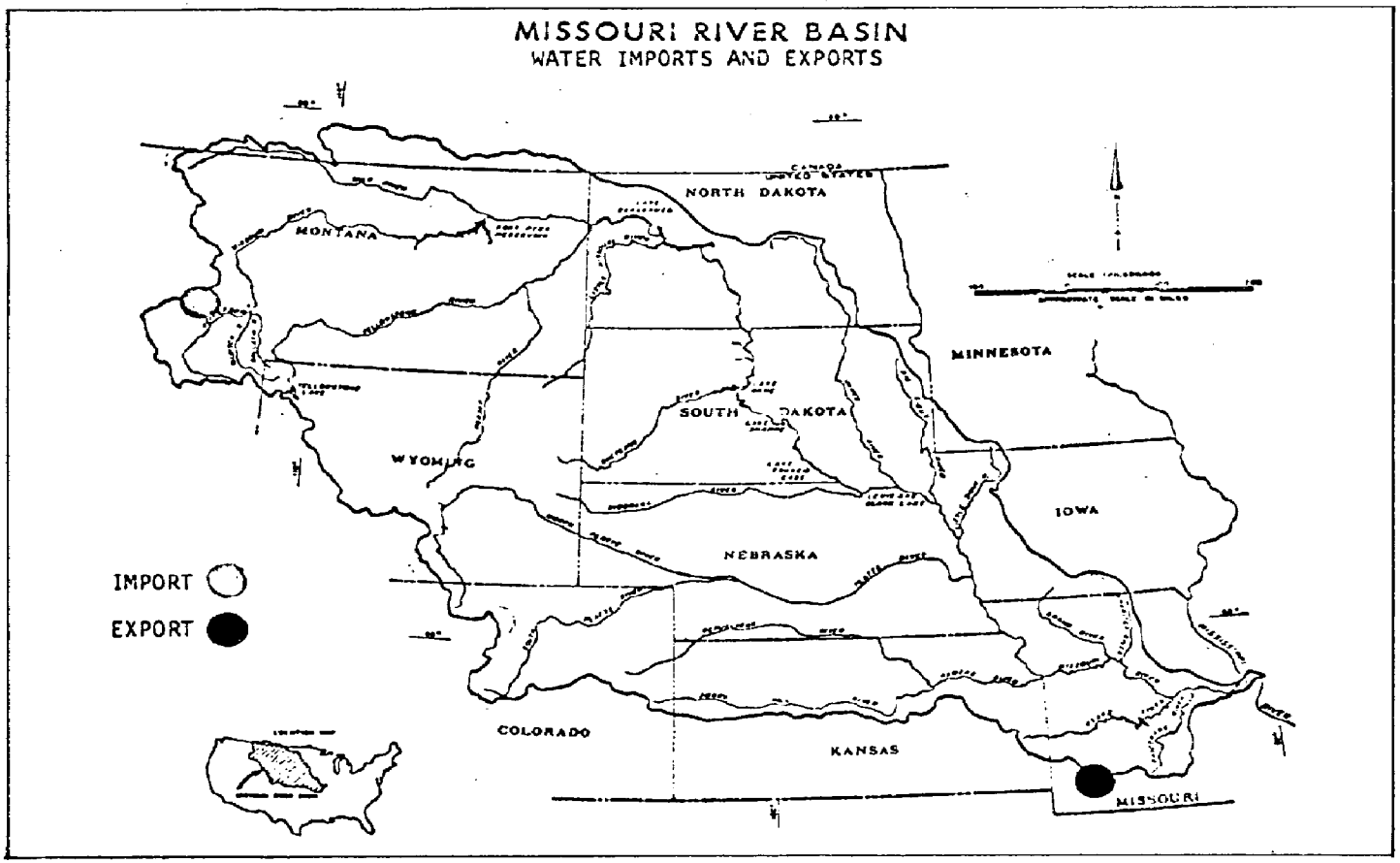

PIPELINE AND RAILROAD
TARIFF COMPARISONS
1975 AND 1979 PROJECTIONS
1975 (GNPD 3.3%)
1979 (GNPD 5.0%)
RAILROAD
RAILROAD
PIPELINE
PIPELINE
CUM
SAVINGS
$32 BILLION
CUM
SAVINGS
$14 BILLION
120
100
80
60
40
20
0
1
YEARS
30

FIGURE II


MISSOURI RIVER BASIN
WATER IMPORTS AND EXPORTS
NORTH DAKOTA
MONTANA
MINNESOTA
SOUTH DAKOTA
WYOMING
IOWA
NEBRASKA
IMPORT
EXPORT
COLORADO
KANSAS
MISSOURI

and the mouth. Traditionally, Sioux City has been considered the dividing line between upper basin and lower basin interests on the Missouri River. As a bit of background, there are four dams on the Missouri River in the State of South Dakota, one in Montana and one in North Dakota. These were dams developed under the Pick Sloan Plan which was authorized by the Flood Control Act of 1944. This act authorized large development works on the Missouri River—basically navigation and flood works downstream, irrigation works up stream and power generation for the entire basin.

What these dams end up doing is providing storage in the Missouri River. Now that is the total storage, the middle line on the chart (Figure III) just where the colored lines start represents March 1982 and each line forward or backward represents a month. The total storage capacity in the main stem reservoirs is about 72 million acre feet of water. In other words, above Sioux City we normally contain somewhere near three years annual flow of the Missouri River in the dams. The Oahe Reservoir in South Dakota alone holds 22 million acre feet of water in conservation storage. That is how much water is stored. The top colored line represents what they expect to see the storage to be in the future if we receive the top tenth percentile of runoff in future months. The green line represents what the storage will accumlate to if it is the top quartile of runoff. The blue line represents a median projection; the purple line the bottom quartile and the orange line a lower 10% of runoff. So that is basically the storage that the reservoirs provide.

The effect they have on the flows downstream is shown here. This is a chart (Figure IV) of the Missouri River flows at SiouxCity. This is from 1975. The actual flows are represented by the little squiggly line that doesn't go way up and down. It is fairly level, climbs across the chart and levels out on the right. The unregulated flows, flows that would have been in the river had the Missouri River not had dams constructed, is represented by the lines that go all over the place. You will note that the second line from the bottom, 100,000 cubic feet per second, represents flood flows at Sioux City. You will note that those floods did not take place in 1975 and in fact, the water was stored in the reserviors and released at a later time to provide higher flows through August, September, October, and November for navigation purposes in the later part of 1975. As a matter of fact, that water could have been stored two or three years prior to that time since we have a three year supply in the reservoir. So that is the regulating effect that the dams have on the river.

The Pick-Sloan Plan also provides power generation. Between 10 to 14 billion kilowatt hours of electricity are generated each year. 1978 as you will note was not the highest power generation year but it was the highest water flow year in a long period of time ever since the dams have been closed. The reason power generation has gone down or the energy generation has gone down is that the dams are mainly operated to meet peak capacity needs rather than a firm energy requirement. So some effect is from low

FIGURE III

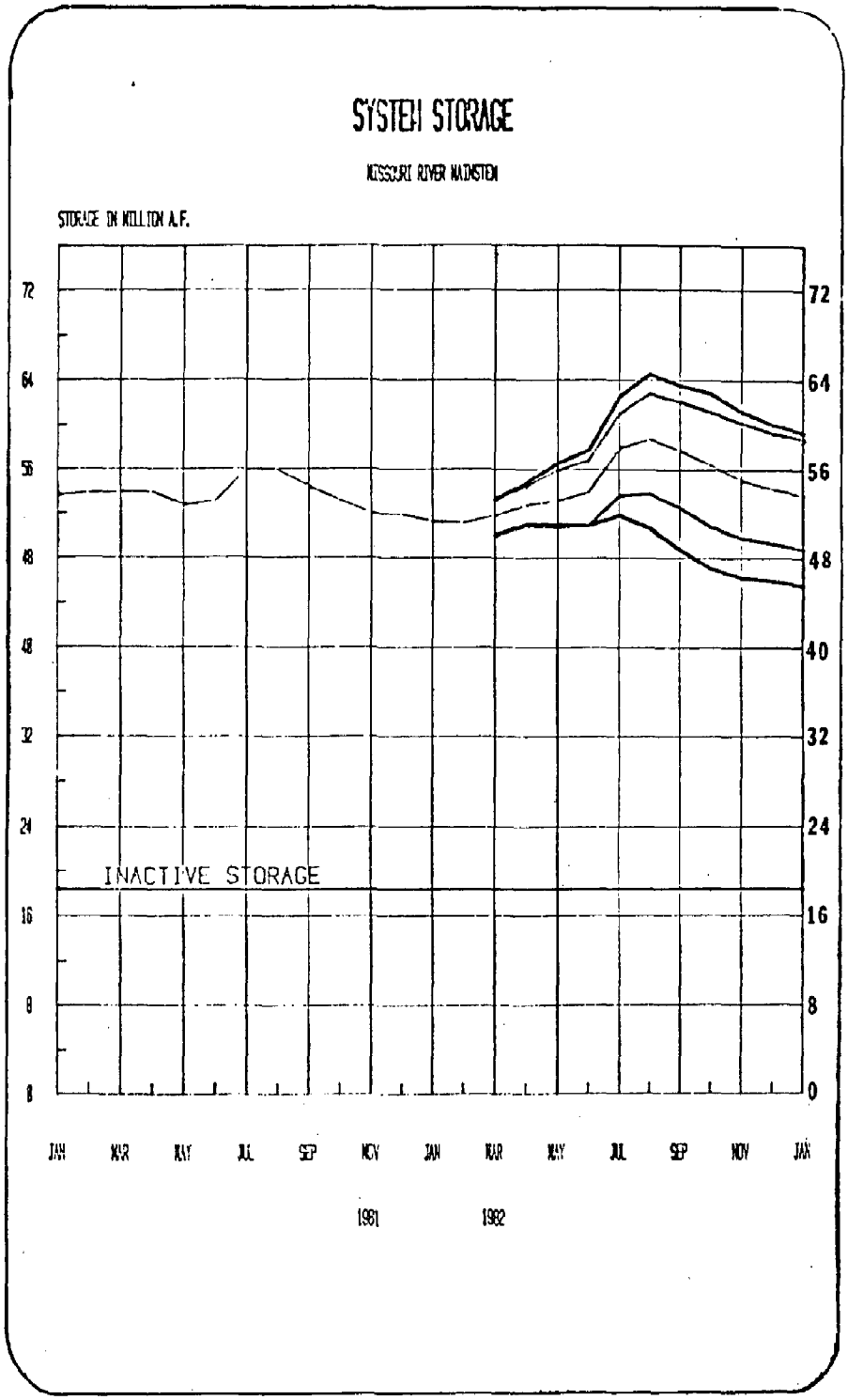
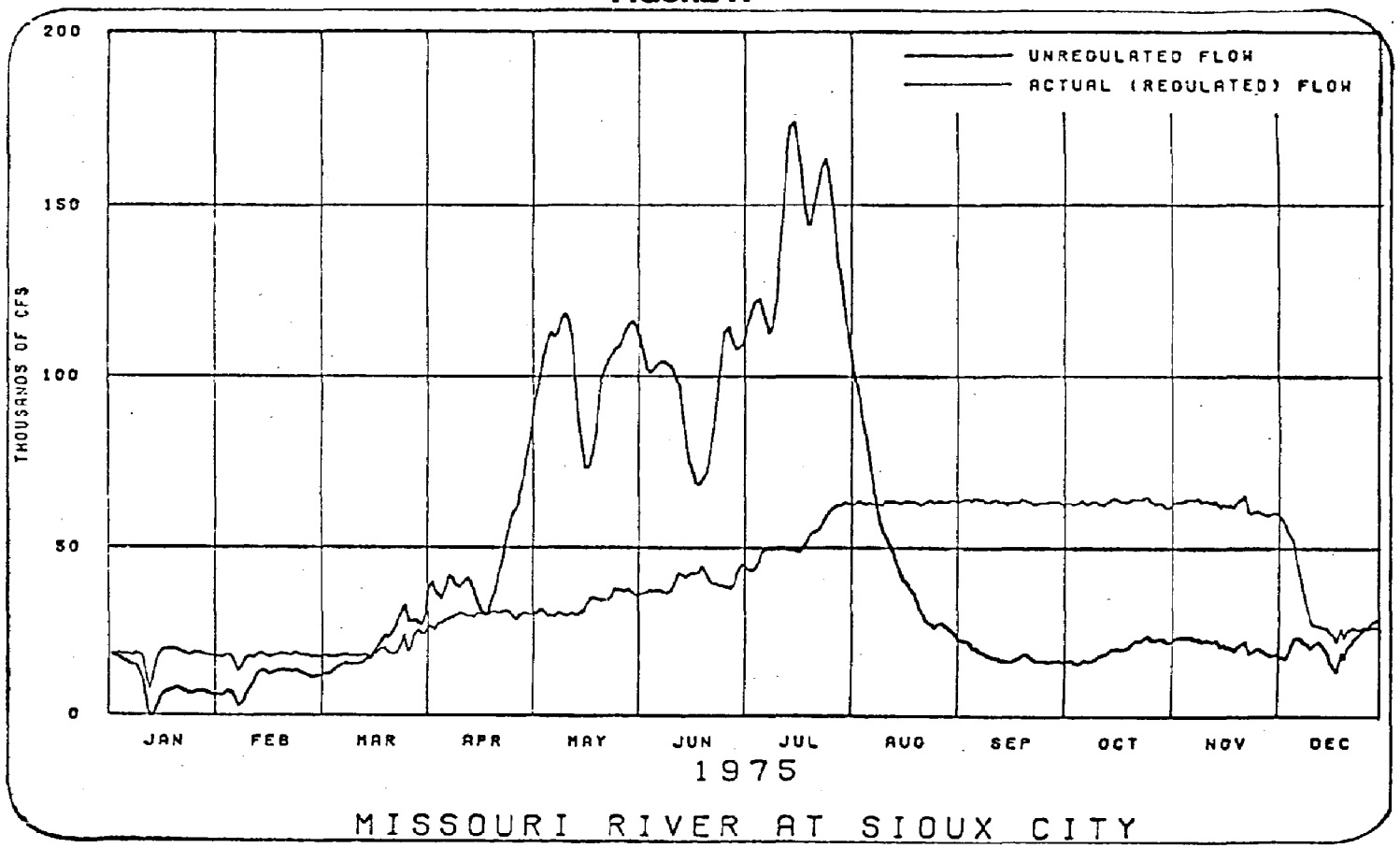

SYSTEM STORAGE
MISSOURI RIVER MAINSTEM
STORAGE IN MILLION A.F.
72
64
56
48
40
32
24
16
8
0
INACTIVE STORAGE
JAN
MAR
MAY
JUL
SEP
NOV
JAN
MAR
MAY
JUL
SEP
NOV
JAN
1981
1982

FIGURE IV


UNREGULATED FLOW
ACTUAL (REGULATED) FLOW
THOUSANDS OF CFS
200
150
100
50
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
1975
MISSOURI RIVER AT SIOUX CITY

water flows in recent years and some is from a change in the operating procedure of the dams.

This chart (Figure V)represents flood damages avoided by the construction of the dams since the first one was built. The Army Corps of Engineers estimates that floods that have not occurred have saved damages in the neighborhood of over $1.5 billion. The result is that the flood control allocation in the reservoirs is something slightly over a billion or a billion four hundred million dollars. So we have saved more money in flood damages than it cost to build that portion of the reservoirs allocated to flood control, $450 million alone in 1978. That was the great non-flood of 1978 as we in South Dakota like to call it and remind our neighbors in Nebraska who are dry while we have 537,000 acres of land under water.

It also provides navigation. In 1980 it was 3 million tons, not a great deal of navigation but it does provide some benefit to those downstream states. It was a little lower in 1981 based on an estimate.

Why do I bring all this up? Well these things are what was put in the '44 Flood Control Act: power generation, flood control, navigation. We never did get all the irrigation benefits that we were supposed to receive in return for flooding land in North and South Dakota to provide this type of control downstream. There was, however, written into the 1944 Flood Control Act this language called the O'Mahoney-Milliken Amendment. O'Mahoney was from Colorado and Milliken was from Wyoming or maybe it was the other way around. They were two senators in the U.S. Senate, and they said they were going to protect western states' interests in the use and allocation of water to be sure that 50 years from now some guy doesn't decide he wants to take our irrigation water and use it for floating his barges down by St. Louis. It says very simply, "the use for navigation in connection with the operation and maintenance of such works herein authorized for construction of waters arising in states lying wholly or partly west of the 98th meridian shall be only such use as does not conflict with any beneficial consumptive use present or future in states lying wholly or partly west of the 98th meridian of such waters for domestic, municipal stockwater, irrigation, mining or industrial purposes." We feel that 98th meridian runs 20 or 30 miles west of Sioux City and runs north and south. We feel that under federal law we are, in fact, protected in allocating the water of the Missouri River under state law. As a matter of fact, ETSI hired one of the top water lawyers in the country, a fellow from Salt Lake City, and his opinion was that they could not divert from the Missouri River without a state permit.

That is the background on the Missouri River. This is the background on ETSI and this chart (Figure VI) is very difficult to read but where you see those black splotches in the middle on the right hand side that represents an outline generally of the Black Hills of South Dakota. Where all of those concentric rings converge is where ETSI has its Madison Formation well field located; right on the Wyoming, South Dakota border. Those concentric rings represent the drawn down that would have been experienced in

FIGURE V

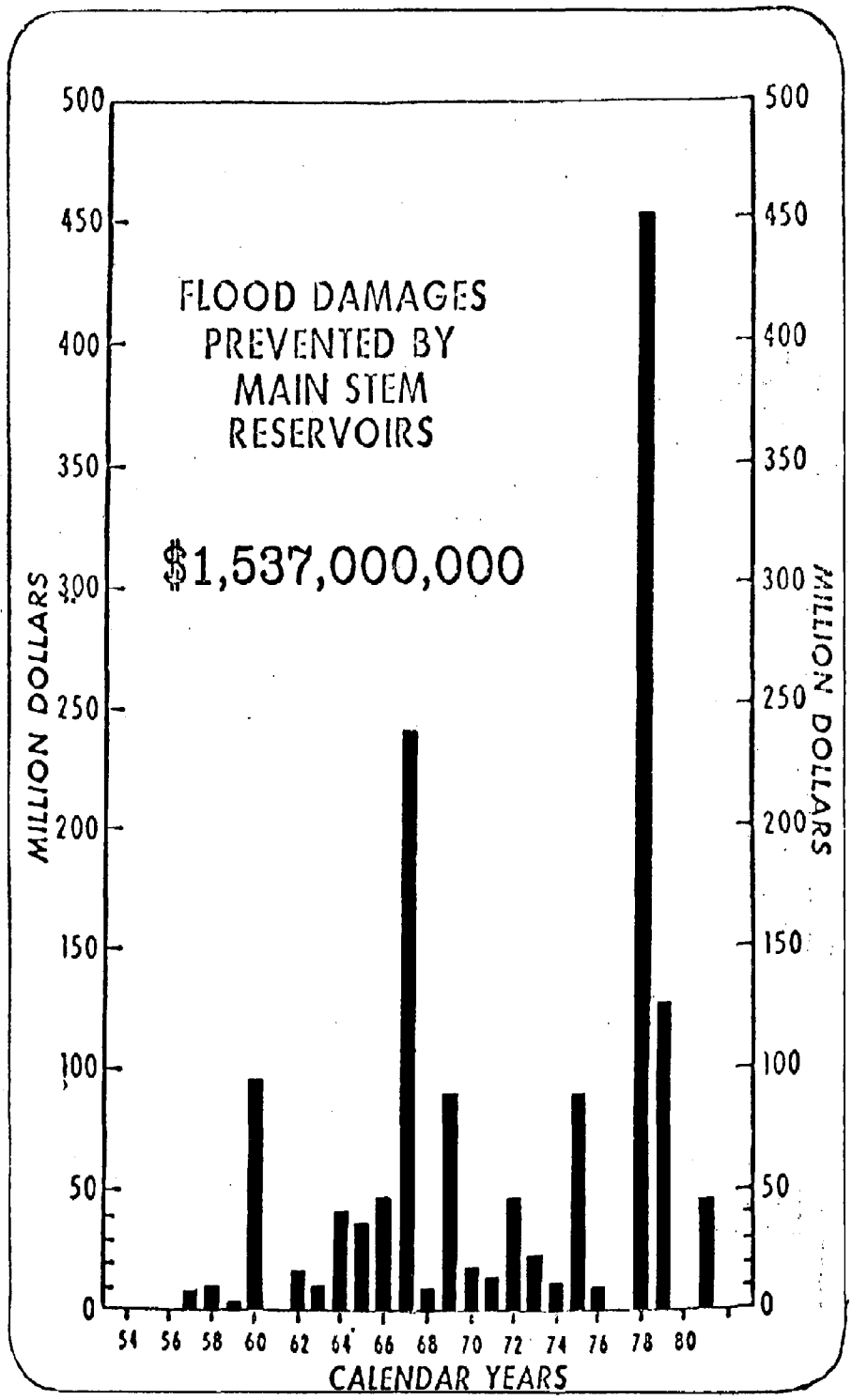
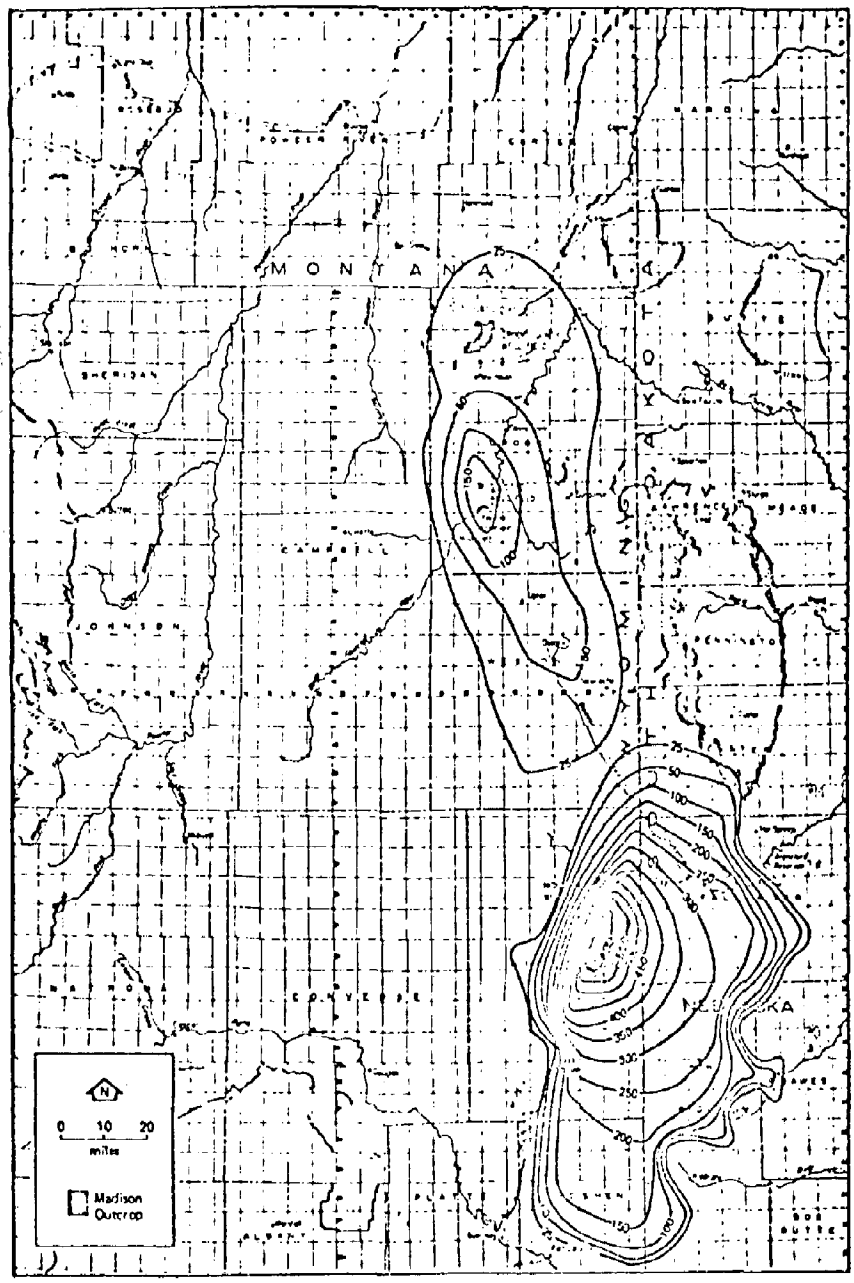

FLOOD DAMAGES
PREVENTED BY
MAIN STEM
RESERVOIRS
$1,537,000,000
MILLION DOLLARS
500
450
400
350
300
250
200
150
100
50
0
54 56 58 60 62 64 66 68 70 72 74 76 78 80
CALENDAR YEARS

FIGURE VI



Map 5-2. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING BY EXISTING AND PLANNED MADISON USERS, WITH ETSI PUMPING FROM NIOBRARA COUNTY WELL FIELD ONLY (PLAN 1)

Madison Formation wells as a result of ETSI's pumping somewhere in the neighborhood of 15,000 acre feet of water a year from the Madison Formation. This would have been a reduction in artisian pressure of the formation and by and large most of the water users in the Southern Black Hills would have had to drill new wells in order to get their intake structure deep enough to bring water to the surface for their use. It is very good water, in fact it is better quality that what you would find in the Missouri River. The only problem is is that it is the only feasible supply and existing supply source for those people living there now. The Town of Edgemount, South Dakota, would have experienced somewhere in the neighborhood of 250 to 300 feet of wellhead pressure drawdown over the 50 years of the life of the project. Interestingly enough the majority of that draw down would have been felt in the first five to ten years of the existence of the project. For those of you who are wondering, the blue marks on the map represent areas that the U.S. Geological Survey has identified as likely areas for future withdrawal of water from the ground for future energy production. I use this slide for another purpose but it fits our purpose here. So we had available to ETSI a large supply of water in the Missouri River, 21,000 million acre feet a year at Sioux City. We were experiencing a very real threat to existing water supplies in the southwestern part of the state. Now there are probably more sheep and cattle than people out in that area, but they were very excited. It was a very real issue to those people and a very political issue in the rest of the state. We didn't like the idea of somebody setting their wellfield right on the border and getting a permit from the State of Wyoming and feeling that they could effect the wells in South Dakata 50 or 60 miles away in a very real and dramatic manner.

In addition, the area between the Missouri River and Wyoming in South Dakota, except for the Black Hills, is very short of water and is very short of quality water. The Federal Safe Drinking Water Standard for radium in water is somewhere around 5 picocurries per liter, if I remember correctly. Water analyses from several of the towns enroute along the ETSI water aquaduct will show levels as high as 150 picocurries per liter of radium, and that is just the stuff you can't taste. The stuff you can taste makes it seem even worse, but it is not necessarily as harmful. We have that combination of a threat to existing water supplies, an opportunity to have private industry subsidize water delivery to communities that badly need new water supplies and an abundant source that made the ingredients go together to make the ETSI deal. In addition, we carried out the customary threats of law suits as they are being carried out against us these days. We told ETSI that over our dead bodies would they ever withdraw water from the Madison Formation and we were deadly serious about it. We would have taken the matter to court and we still may some day if they don't take the water out of the Missouri River instead.

Our negotiations with ETSI carried on for a period of four to five years. They were in the state legislature in 1977 trying to get a Missouri River water permit as a backup to Madison water supply and the governor at that time vetoed it. We conducted renewed negotiations again in 1979 and 1980 and

again they wanted a Missouri River water right as a backup supply to the Madison formation. Again, we told them they could take their business elsewhere. In May of 1981, it became apparent to them, I suspect for hydrological reasons and for also political and legal reasons, that the Madison water supply was not the best of all possible worlds for ETSI. So they started negotiations again with us, and it became very apparent that they were willing to come to the Missouri River as a primary source and use the Madison only as a backup which was a reversal of their prior position. We entered into negotiations about the 1st of June, 1981, finished the preliminary negotiation and went to the state legislature in a special session at the end of September of 1981.

What ETSI will do for South Dakota: ETSI will pay $2 million when the water permit is granted, that money has been received and is in the bank and the check did not bounce; ETSI will pay $2 million more when the water permit has received final governmental action, that means confirmed by the South Dakota Supreme Court. An appeal on the issuance of the water right is taking place now and we do expect to see a resolution of that in the South Dakota Supreme Court sometime this year. On each anniversary of the permit until construction starts on the coal slurry line they will pay us $3 million a year not to exceed 10 years.

In addition, when construction starts on the pipeline and for 50 years which is the term of the contract (this is the presentation that was made to the legislature and some of these terms we renegotiation slightly in the final contract negotiations but these are substantially correct) $9 million for 50 years indexed upward at 1/2 of the Fixed Weighted Price Index for the Gross National Product. They do intend to start construction sometime in 1983 or 1984. If they determine that there is another water source available for other reasons other than the Madison Formation water and other than the Missouri River, simply for the insult if you will, they will pay us $45 million or $9 million for five years. We deserve something for calling a special session of the legislature.

Finally, if by July 1, 1984, the West River Aqueduct, as we call it, which runs from the Oahe Reservoir to Gillette, Wyoming, is not operational they will pay us $1.5 million to start working on other solutions to the water quality problems in those communities.

They will not use the Madison Aquifer as a primary source so long as the Oahe water is available which is why we are somewhat concerned about law suits from downstream states. If it is determined that we do not have the legal right to issue this kind of a permit, ETSI does have the right under the contract to go back to the Madison Aquafer and Wyoming, South Dakota, and Nebraska will all be in the same hassle they were in before we entered the into contract with ETSI. The pipeline will deliver 4300 to 6700 acre feet of water per year along the pipeline to local communities in South Dakota; the higher number represents what would have to be available in order to qualify the pipeline for tax exempt financing under the Internal Revenue

Code. They are going to build, own and pay for the aqueduct system. In fact, they will be paying property taxes on it to the counties in South Dakota and, in addition, but not in the contract, they have publicly offered to provide $200,000 worth of engineering assistance to western communities that are not able to get water from the pipeline because of distance and other costs.

What do we have to do for ETSI? 1) 50,000 acre feet of water per year and allow them 10 years to develop. We assume that at least the first 20,000 acre foot increment which will be their first slurry pipeline will be built within the 10 years. What happens to the next 30,000 acre feet we are not sure. If they do not have facilities to use that within 10 years, that portion which they have not used at the end of 10 years will, in fact, be forfeited back to the state without any reduction in payments. 2) A legally approved water permit by January 1, 1982. We slightly missed that deadline but they haven't cancelled the contract. 3) Assistance in least cost financing. That means tax exempt financing, if ETSI determines to use it, much in the same manner that I am sure the states here have housing authorities that issue tax exempt bonds for housing development. There is a similar provision under the Internal Revenue Code for public water supplies and by making 25% of the facility available to public use in South Dakota there is a possibility that we could qualify for tax exempt financing. 4) Completion of government processes by January 1, 1982. That has been renegotiated to October 1, 1982, which means the Supreme Court confirmation of the water right.

What did it do for South Dakota? It stopped the Madison use and brought water to western South Dakota communities that needed it very badly and it put money in the state treasury. It is here where I think that we have managed, at least in some form, to stay within some sort of public trust doctrine, Professor MacDonald, in that the money is, in fact, going back into a public trust fund to provide funds for developing other water resources in the State of South Dakota. There is an old legal term about converting the trust or exchanging the corpus of the trust from one type of asset to another. I think maybe we have done that here. We will see how that stands up. Also, free technical assistance for South Dakota communities with water quality problems, plus all the jobs we get for construction of the pipeline in a badly depressed economy. South Dakota now sits as the lowest state in the nation in per capita income, and we can use anything we can get.

Ramifications. How much water does it represent? This is a chart (Figure VIII) of releases from the Oahe Dam at Pierre, South Dakota, based on the average discharge on January 1, 1980, was 24,700 cubic feet per second. I found this interesting in that ETSI's 50,000 acre-feet per year amounts to 69 cubic feet per second or about .28% of this discharge of the Oahe Reservoir. On an annual basis, it will be about .27% of discharge. The figures over on the right—most stream gauges that you can put on a stream the size of the Missouri River have a margin of error of plus or minus 5%. So

FIGURE VII

1980

MONTH	AVERAGE DISCHARGE* (CFS)	ETSI WITHDRAWAL (CFS)	ETSI WITHDRAWAL % OF AV. DISCHARGE	COMPARISON DISCHARGES 2% (CFS)	COMPARISON DISCHARGES 5% (CFS)
JAN.	24,700	69.0	.28	494	1235
FEB.	19,600	69.0	.35	392	980
MAR.	21,700	69.0	.32	434	1085
APR.	21,100	69.0	.33	422	1055
MAY	28,300	69.0	.24	566	1415
JUNE	27,900	69.0	.25	558	1395
JULY	32,000	69.0	.25	640	1600
AUG.	36,100	69.0	.19	722	805
SEPT.	29,500	69.0	.23	590	1475
OCT.	24,800	69.0	.28	496	1240
NOV.	25,900	69.0	.27	518	1295
DEC.	15,200	69.0	.45	304	760
ANNUAL	25,600	69.0	.27	512	1280

* MISSOURI RIVER AT OAHE PUMPING PLANT-FROM U.S. ARMY CORPS OF ENGINEERS

what this means is that anybody measuring the water supply in the Missouri River will never be able to techniquely detect the fact that ETSI is taking water out of the river. They won't be able to measure it. In addition to how much water there is, and I was interested in Mr. Banks comment that they determined there was no surplus water available at the Fort Randall Reservoir, which from the aspect of the High Plains Study was very comforting to me, but, on the other hand the Missouri River Basin Commission which is now defunct ran a study in the mid 1970's in which the Corps of Engineers, the Bureau of Reclamation, the State of Iowa and the Chairman of the Missouri River Basin Commission served on a special investigating commission to determine the projected future needs of water in the Missouri River Basin, and, in addition, all of the states in the Missouri River Basin Commission sat as a watchdog over this ad hoc committee and finally approved the final report which indicated that within the next 50 years, I believe was the time frame they looked at, there was somewhere in the neighborhood of 3,000,000 acre feet of water available, over and above projected total irrigation development, navigation needs, and other needs, available for coal development in the west.

A waster of water. Well, some people are saying that it is a waste of water. I don't agree. If you look at the increased releases in the Missouri River that were released for navigation flows, that is normally the last dam on the river will release flows of 15,000 cubic feet per second. Normal navigation releases are about 32,000 to 35,000 cubic feet per second. If you look at that difference over the 240 day normal 8 month navigation season and the 1980 navigation tonnage, the 3,000,000 tons per year it works out to somewhere in the neighborhood of .37 of a ton of produce shipped for every acre foot of water sent down the river. Coal slurry, on the other hand, will use 1875 tons of coal shipped for every acre foot of water. That is an increase by a factor of about 5,000 in the efficiency of the use of water. I don't consider it a waste.

Interbasin transfer. We thought we were setting a precedent, but we didn't know what all these other states were doing when we got into it. Those dots on this chart represent interbasin transfers in the Missouri River Basin. The blue one at the top of the map is from the St. Marys River which drains into Canada, and about 150,000 acre feet of water a year are brought into the basin. The red one is for the City of Butte, Montana, 13,800 acre feet of water per year are shipped out of the basin. The next one is a blue one in Wyoming, and we are not sure exactly what it is for but there are 7,800 acre feet. The next one is for the City of Denver and its environs, 505,400 acre feet of water shipped into the basin per year from the west slope. The next one is from the Arkansas River Basin, it is not very large but it amounts to 12,560 acre feet of water per year. And, by golley, way down there at the bottom of the map is the City of Independence, Missouri. All within its city limits it takes water out of the Little Sac River which feeds the Big Sac River which feeds another river which feeds the Missouri River and runs it through its municipal system and discharges through its sewer outfall into the Arkansas River Basin across the divide all within the city limits. Seem-

ingly innocent, 16,800 acre feet of water a year diverted out of the Missouri River Basin. As my boss is often quite fond of saying, we thought we were setting a precedent but then we got to looking at things and saw what the other states were doing and we thought we would try it out for ourselves. The net flow is that there is a gain of about 645,000 acre feet of water per year into the Missouri River Basin. Interbasin transfers are not new, and I am not actually sure that what we are doing is, in its strictest sense, an interbasin transfer. The water is taken from the Oahe Reservoir, sent to Wyoming and mixed with coal that is mined within the Missouri River Basin and for 500 miles of its trip it stays within the Missouri River Basin before it finally crosses the basin boundary. There is a substantial argument, I would think, maybe it is somewhat technical that the beneficial use of the water is, in fact, made within the Missouri River Basin. It is a point that is not all that important because I have been unable to determine why it is that interbasin transfers have this aura of sin cast about them. Man has never followed natural boundaries for other purposes as the state borders on that map will testify, and I haven't been able to figure out why a water basin or water shed could create any more of a boundary than other natural boundaries have created for man in the past. But for some reason, and I think it is a holdover from the New Deal Era and the concept of national planning, water shed basins hold some sort of mystical significance for those of us in the water field.

In addition, the water is going to be expensive for ETSI. They couldn't tell us exactly how much profit they were going to make. I think it was one of the most closely kept secrets in the bowels of the ETSI organization, but they did tell us that based on present day interests costs that water is going to cost them, delivered to Wyoming, $5,000 an acre foot or about $15 per thousand gallons. I pay somewhere in the neighborhood of $1.50 to $2.00 per thousand gallons for my household water in Pierre, South Dakota. But for political and social reasons it was the only water available to ETSI, and it was the only water that had no impact on other users of the resource. There was water present in Wyoming, and there was water present in Montana. Wyoming required, however, that they receive legislative approval before you could ship water out of state and Wyoming was trying desperately to find a way to repeal the legislative approval it had already given ETSI in 1974. Montana took a different approach, they just simply said that use of water for coal slurry pipelines is not a beneficial use of water within the confines of the law of the State of Montana. It took a special session in South Dakota to get approval of the statutory authority necessary to implement this.

I have something to read here, this is from a colleague of Professor MacDonalds and his name Frank Trelease who spoke in Rapid City, South Dakota, in 1979. He had this to say about parochial attitudes by states who like to keep the water to themselves and don't want to share with their neighbors as if somehow a South Dakota resident is more deserving of water than a Wyoming resident or an Arkansas resident. He said this, "the states have been very jealous of their water laws and very resentful of fed-

eral encroachment into this area, yet when they deny water to a coal slurry pipeline they maybe inviting exactly the federal intervention they fear. There is a real danger that the Congress will simply override their laws, that the federal government will supercede state law with federal project law. The nation has an energy crisis and might seek a national solution. The federal project might solve the pipeline company's problem by supplying water to it with a complete disregard for state water law, state water policy, state coal development policy, and state land use plans. Far away in Washington there are national officials who take a broader view, who see a real need for coal in Houston and the Midwest and who believe that slurry pipelines offer coal transportation on a better and cheaper basis than do the railroads. Rumors have come to me of recent statements by two highly placed federal officials in the Department of Interior and of Energy that if the states do not take the lead the federal government will step in. I think that there is no way that a state can deny to a federal instrumentality the water needed to accomplish the federal purpose."

In this particular case, the economics in my mind, were not as important as the legal and the social impediments much along the lines of the address that was given to us this noon. In getting together, ETSI and the State of South Dakota showed that business and government can cooperate. In this case we (1) averted the threat to the Madison Aquifer, (2) provided a new water supply to towns and ranches that are dangerously short of quality water, (3) provided money to develop other South Dakota water resources, and (4) opened the door for new competition in the national coal transportation market. Most importantly, and in my mind very importantly, it was done in a manner that proves to the federal government that state control of water resources can, in fact, operate in the national interest and that the federal government will serve all of us best if it continues to respect the prerogatives of the states in allocating water resources.

We have talked today about a retreat of the federal government from state water policy in the water arena in recent years. I hope it is a retreat that continues, but I am not sure it will continue past this present administration. To a westerner this policy means a great deal and as you folks in the water rich midwest begin to face water allocation decisions in the future, I am confident that it is a policy that will serve very well also.

QUESTIONS AND ANSWERS

Question—Should a national policy for water diversion be developed?

Nickel—I guess that I would make two responses. One is that I would ask Bruce DenUyl to also respond. My own personal prejudice is that we like in soverign states and that as an admirer of Warren here I would say that the decision should be made at the state level. Americans are anarchists, they never admit this but we are a nation of anarchists and I like the decisions made at the levels we most closely control and I would like to see more decisions made at those levels. That is a prejudice.

DenUyl—I think what Paul was talking about in his speech was that it you look at only the state costs you are going miss some of the more national issues and I think when you deal with an interbasin or interstate system that you can't just pit states against each other.

Neufeld—If I can add just a little bit to the question. My perspective has been that, indeed, decisions are best made when they are made at the level of lowest accountability, but you do run into situations and one situation we had was when the 1944 Flood Control Act was enacted when states can't get along and they can't resolve the differences between themselves. At that point you have to elevate the decision to a higher authority but I think you have to be aware of the consequences that have to be faced. To tell you the truth, I am scared to death of having some Senator from New Jersey vote on water allocation decisions in South Dakota. I just don't think he understands and would have the insite or the understanding of the problem. And one reason I really like the ETSI proposal is that it works within a type of a free market proposal in which the federal government didn't come in and force it upon us. We got private enterprise willing to pay the cost, if you will, for political and social approval of something that had never been done before and so the state was able to work it out without elevating it into an arena where it could have been taken out of context.

Question—In the South Dakota negotiations with ETSI, did you include a mechanism in times of low water or drought to not allow ETSI their quota of water?

Neufeld—In the history of the Missouri River recorded flows which goes back to almost 1890, I think the lowest recorded flow ever has been 14,000,000 acre feet of water which is still a substantial quantity compared to that necessary to meet ETSI's demand. In addition, the reservoirs, and ETSI has contracted with the federal government to store its water—to purchase storage space in those reservoirs, as I said, provide three years annual flow of the river in storage. The chances of a long term drought providing the opportunity in which we have to make a choice between ETSI and other water uses in South Dakota or downstream are non existent in my mind. There really is no failsafe from South Dakota's standpoint in the

contract. As a matter of fact it provides that if the water is not available, if the dam should go out and there is an earthquake or something of that nature, or the U.S. Supreme Court would rule that we could not do this, ETSI can in fact go back to the Madison Formation.

Question—Mr Neufeld, do you feel the downstream states have an argument to make over the allocation of the Missouri in regard to the ETSI negotiations? Maybe they should share in the sale.

Neufeld—Absolutely not. You have to live in the basin and experience the argument between upstream and downstream states. That whole litany that I went through about the power generation and Pick Sloan Plan; 17% of the power generated in South Dakota is consumed in South Dakota. The rest goes to Nebraska, Minnesota and Iowa. We have a Congressman from Iowa that is attempting to deauthorize some of our unbuilt irrigation projects in South Dakota mainly because he knows that when those projects are built they are entitled under law to divert some of that electricty from the dams for operation of the irrigation projects. The flood control benefits that have been provided downstream were all at the expense of not necessarily totally productive acres but a good 537,000 acres of land in South Dakota. We felt that the deal had been struck in 1944 with the O'Mahoney-Milliken Amendments that it was permissible under state law to do whatever was necessary to allocate the waters of the Missouri River upstream. Frankly, we thought the downstream states had received enough from the Pick Sloan Plan. This is the first time I have ever had an opportunity to speak after Nebraska on this subject, but I am leaving tonight so she can get back at me tomorrow.

IMPACTS OF WATER TRANSFER ON THE GREAT LAKES

Moderator: *Carroll Besadny*
Speakers: *William Fetter*
David C. Campbell
Donald Munton

CARROLL D BESADNY
Secretary, Wisconsin Department of Natural Resources
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Mr. Besadny serves as Chief Executive Officer of the Wisconsin Department of Natural Resources. The WDNR administers traditional state conservation programs in fisheries, wildlife, forestry, recreation, as well as environmental programs relating to water quality and quantity planning, pollution control, air quality, solid waste management, shoreland and floodplain management, and environmental enforcement. Mr. Besadny has served the Wisconsin Department of Natural Resources in other capacities including Administrator for the Division of Resource Management and Director of the Bureau of Environmental Impact.

Mr. Besadny holds both a B.S. Degree in Biology and a M.S. Degree in Wildlife Management from the University of Wisconsin.

IMPACT OF WATER TRANSFERS ON THE GREAT LAKES

Carroll D. Besadny

It is great to see each of you here in the City of Milwaukee. Like each of you I am very concerned about water resources—water conservation, water management and water use. I believe as time goes on each of us will be even more apprehensive as we read the papers to know what is happening to our waters with acid rain in the northern states, with some of the country's large aquifers drying up, and with continuing water pollution problems. That is a concern to those of us that have grown up and lived in the snow belt, that have survived the long winters, that have watched the droughts in summer, and that have watched our neighbors move as they retired to the southwest. Now our neighbors are looking back at us not for the cold that we endured, but for the high quality water that we still have here. I suspect that a few of you have sampled the water in Milwaukee last night, the water that came from bottles and cans. You all know what Milwaukee is famous for. In discussing water resources I'm sure that you will find there is a lot of conflict, a lot of concern and each of us is looking very hungrily at the other person who has water or who needs water. I recall the story about two young boys growing up in England. They watched each other grow up and they became very competitive. Each wanted to get ahead of the other. One young fellow eventually became an admiral in Her Majesty's Navy, a very proud person indeed. The other person become a Cardinal in the Catholic Church, another very prestigious job. Again there was this conflict or competition between these two people, one seemingly getting ahead of the other. One day they met at a train station in London. Here was the Cardinal decked out in his beautiful robes and, over time he had put on a little weight. He looked across the train station and there he saw the Admiral in his parade uniform, decked out with campaign ribbons, waiting for the train. The Cardinal could not resist. He walked up to the Admiral and said, "Pardon me porter when does the next train leave for Glouchester." The Admiral looked at the Cardinal and said, "Madame in your condition you shouldn't be traveling." You know, I think that is how we all feel sometime.

We have a panel of experts this morning and you know what an expert is. An expert is a person who is far away from home and uses slides. This morning we have a person from Canada and we have a person who has slides so I think we can say we have highly qualified experts. Our panel is going to concentrate on the Great Lakes impacts of water transfer.

DAVID C. CAMPBELL
National Wildlife Federation
Washington, D.C.

Dr. Campbell is Staff Economist and Research Specialist in the Water Resources Program of the National Wildlife Federation. Dr. Campbell has also served as the Senior Economist with the U.S. Water Resources Council, taught economics at American University, the University of Idaho, and Golden State University.

Dr. Campbell holds a Ph.D. in Natural Resources Economics from the University of California at Berkley. He has authored papers on the economics of environmental policy and is active in several professional organizations.

THE CRITICAL ZONE WITH RESPECT TO THE GREAT LAKES

David C. Campbell

Introduction

The National Wildlife Federation is the nation's leading conservation organization with over four million members and supporters. The Federation has a longstanding interest in interbasin water diversions. Such diversions could create adverse impacts on fish and wildlife habitat, through changes in existing instream flows, water temperatures, or lake levels. Introduction of new species of plants, microorganisms, or fish into the receiving body of water could upset an existing ecosystem. For example, ecologists have argued against a sea-level canal in the Panama Isthmus because they predict catastrophic consequences from the mixing of the waters of the Atlantic and Pacific Oceans. The introduction of the lamprey eel into the Great Lakes resulted in serious declines in the populations of several species. The NWF urges caution in the merging or intermingling of different hydrologic or aquatic systems.

The federation adopted a strong resolution against diversions of water from the Great Lakes at its March 1982 meeting here in Milwaukee. The resolution states, "it is opposed to any plan to divert additional water from the Great Lakes watershed to points outside the Great Lakes for any purpose".

Other resolutions of NWF recommend caution with respect to interbasin transfers. In 1969, the members resolved that, "no water should be diverted from the Columbia River system into other watersheds". In 1979, the delegates resolved that, "construction of new interbasin water transfer facilities or new operating procedures should not be commenced until the full impacts could be determined". The 1982 resolution on coal slurry pipelines asked for "a careful analysis of both environmental and economic benefits and costs of the use of water in coal slurry transportation on a case-by-case basis". The Federation has also filed as a Friend of the Court on behalf of Nebraska in the Sporhase case which has been discussed in depth at this conference. Nebraska argues that a state has the right to regulate transfers of water from the state. In summary, the National Wild Life Federation has taken a strong stand against almost all interbasin transfers but has left the gates open for acceptance of reasonable diversion which are both economically sound and environmentally benign.

There are four statements which I wish to make concerning the subject of interbasin transfers of water from the Great Lakes.

1. The economic health of the Great Lakes region is not threatened by impending diversions.

2. The environmental health of the Great Lakes could be threatened by human actions, including possible diversion, affecting the Lakes.

3. Potential adverse environmental impacts can be prevented if proper actions are taken **before** the "critical zone" is reached.

4. Social institutions must be strengthened and given adequate authority in order to protect and enhance the economic and environmental health of the Great Lakes region.

The economic health of the Great Lakes is not threatened by impending diversions of water.

I belive that part of the reason why this conference was organized and why many of you are here is because the current recession has hit the Great Lakes region more severely than the rest of the nation. This economic decline has resulted in a protective feeling for the region's resources. Of course, major diversions of water from the Great Lakes could reduce economic outputs from navigation, hydropower, and other sectors. However, the present economic decline in the region is not caused by a shortage of water. A certain amount of regional competition may be healthy, but other factors have a stronger relationship to the current economic health of the region than does the water level of the Great Lakes. Emotional parochial concerns about possible water diversion should be avoided.

In preparing for this conference, the Wisconsin Coastal Program prepared a package of relevant materials on the issue of interbasin transfers. One of the items in the package was a copy of a March 8th article from the Milwaukee Journal by Daniel Bromley of the University of Wisconsin. He argues that the issue of interbasin water transfers from the Great Lakes is being used as a political smoke screen to obscure other issues.

If you are concerned about water resources and the economic health of the Great Lakes region, I suggest that you attempt to halt the immense federal investment in water projects in other areas of the nation. Taxes paid from this region are used to develop water resources in areas where water shortages have, sometimes, been constraints to economic development. For example, that "clone of the Mississippi River," the Tennessee-Tombigbee Waterway, could capture waterway traffic from the Great Lakes. The U.S. Army Corps of Engineers drains bottomland hardwoods in the South in order to create more farmland. Citizens from this region pay for such projects twice—in their taxes and when the prices of your farm products fall as the result of increases in crop production from Federal projects. Yet, the Congressional delegation from the Great Lakes region supports many Federal water projects which the National Wildlife Federation feels are unwise economic investments with adverse environmental effects.

The NWF staff prepared a map to illustrate the regional distortions of recent Federal investment in water. We drew the size of the states relative to their share of the Federal investment in water projects. Of course, the states in the South and the West appeared huge and the states in the Midwest and the Northeast were very tiny.

A speaker at this conference described the Pick-Sloan Program for the Missouri River Basin in positive terms. This program of more than 15 water projects was audited recently by the accounting firm of Price-Waterhouse. One of their findings was that less than a third of the reimbursable portion of this multibillion dollar program of irrigation, flood damage, hydroelectric, and navigation projects will be paid for one hundred years from now.

I don't believe that you should be nervous about possible Great Lakes water diversion because major diversions plans will prove to be uneconomic unless the real costs of these interbasin transfers are hidden under the cloud of Federal subsidies. The cost of moving water uphill is high. I would like to warn opinion leaders in the Great Lakes region to be careful of any Federal scheme to divert water from the Great Lakes. Carefully weigh the costs and the benefits of each proposal. Total costs include construction and operating costs, environmental costs, and opportunity costs. One estimate of opportunity cots of water transfers was provided to us yesterday. The speaker described a study which estimated that a diversion of water from the Great Lakes of 1/2 inch to 2 inches would result in losses in the production of hydropower worth $44 million. It was pointed out that as the level of diversion increased and the level of the lakes fell, those costs would rise at an increasing rate. The study estimated that the hydropower losses from a small diversion would be $11 per acre foot of water. The Federal Government sells its water to irrigators for as little as $3.50 per acre-foot. Should the Great Lakes states participate in diversion projects which transfer water from a use worth $11 per acre-foot to one worth $3.50?

The environmental health of the Great Lakes could be threatened by human actions, including possible diversions.

Another reason for reducing the rhetoric relating regional economic conditions and water diversions is to allow your concerns to return to protecting the environmental amenities of the Great Lakes system. The ecosystem could be impacted by interbasin water diversion, but I believe that it is more likely to be harmed by further deteriorations in water quality, shoreline amenities, and scenic resources.

Potential adverse environmental effects can be prevented if proper action is taken before the critical zone is reached.

The Great Lakes region should adopt policies and programs, based upon continuing research, which avoid the "critical zones" of the ecological, cultural, and aesthetic properties of the resources of the Lakes. The critical

zone is a range of use rates or resource property deterioration which is incapable of being reversed. Reversals of resource depletion are impossible, either because of technical or economic constraints. The critical zone entails immoderate social losses. The critical zone implies irreversibilities.

The critical zone is analogous to an endangered species. The descriptive classifications for plants and animals are (1) healthy and reproductive, (2) declining, (3) threatened, (4) endangered, and (5) extinct. If we wish to avoid the extinction of a species, we must determine the relationships between human actions and the decline of a species in order to take appropriate action **before** the species is endanagered. By definition, if the properties of a resource reach the critical zone, it is too late to take action.

The cost of avoiding the critical zone is usually small in relation to the immoderate losses that could result. The strategy is to monitor the direction and rates of change in the resource, identify the threatened resources and the causes, and develop low-cost actions to prevent further deterioration.

The question here is, "Is there a critical zone for water diversion?" Is there a point at which the adverse effects of diversions could not be reversed? Because the water in the Lakes is a newnewable resource, I don't believe that the critical zone is likely to be reached through diversions—in the economic or the technical sense. However, political decisions may be difficult to reverse. One of the speakers here yesterday, speaking in defense of the Pick-Sloan Program said, "a social contract was made in 1944. . . " No matter how poor the program is, we don't have the ability or the nerve to stop it because two Federal agencies struck a deal in the dead of the night and called it a "social contract".

A study of the possible effects of diversion should be done. At this conference, we are learning that we have as much misinformation as information. For example, we discovered that, contrary to our pre-conceived beliefs, more water is being diverted into the Great Lakes than from them.

Effective regional institutions must be developed and strengthened.

If you wish to carry out the research, develop policies, and outline actions to avoid the critical zone, you must strengthen the social institutions that are concerned with the Great Lakes. It is unfortunate that the Reagan Administration has abolished the Great Lakes Basin Commission, because Federal involvement is needed to negotiate international problems, protect Federal interests, and contribute expertise.

In spite of the loss of Federal support, the various entities in the region should attempt to create a stronger Great Lakes Commission. This commission must confine itself to the tasks of a second-level social institution as defined by Ciriacy-Wantrup.

"Social institutions may be conceptualized as decision systems on the second level of a three-level hierarchy of decision systems. On the first level, the lowest, decision-making relates to the control of inputs, outputs, and the host of similar decisions made by the operating sectors of the economy, namely, firms, industries, and public opeating agencies such as water projects and irrigation districts. This level of decision systems may be called the operating level. The decision systems on the next higher level, the second, comprise the institutuional framework of decision-making on the first level. One may call this level of decision systems the institutional level. On the next higher, the third, changes of institutions on the second level are the subject of decision-making. This level of decision systems may be called the policy level."

The states and provinces, cities and counties, ports and hydropower commissions, associations, and other interested parties must set up the Commission and prescribe its responsibilities, functions, and authority. But once this social institution is operating, its actions with respect to the operating units at the first level must be generally accepted. You in this region must decide whether or not you have common problems and common objectives relating to the economic and environmental used of the Great Lakes which will make it profitable to relinquish your individual and local autonomy for the common good.

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Dr. Fetter is currently Program Manager of Law Engineering Testing Company's Marietta, Georgia, offices. Dr. Fetter is on leave from the Geology Department of the University of Wisconsin-Oshkosh, where he holds the rank of Professor. From 1977 to 1980, Dr. Fetter was the senior expert witness for the Wisconsin Department of Justice in Wisconsin, et al. v. Illinois, et al.; one of the longest running cases on the U.S. Supreme Court docket. Dr. Fetter made a number of studies on the impacts of the Lake Michigan Diversion at Chicago. He also evaluated the interstate impacts of groundwater pumpage in southeastern Wisconsin and northeastern Illinois.

Dr. Fetter has 15 years of experience as a hydrogeologist and is the author of Applied Hydrogeology, an extensively used textbook. Dr. Fetter holds a Masters Degree in Geology and a Ph.D. in Hydrology, both from Indiana University.

GREAT LAKES WATER DIVERSIONS HYDROLOGIC IMPACTS

Dr. C. W. Fetter, Jr.

The Great Lakes contain enough water to fill the Grand Canyon 178 times. The bottom of the deepest lake, Superior, is 730 feet below sea level. If the Sears Tower were built on the bottom of Lake Superior, only the television tower would protrude above the surface. The water surface of the Great Lakes, 95,000 square miles, is the same as the area of West Germany. The average annual discharge from the Great Lakes is 238,000 cubic feet per second or 14,000 gallons per year for every person on the globe. Should we be concerned with diversions which represent only a small fraction of this amount?

The Great Lakes consist of four separate pools. Lake Superior is at the highest elevation, 600 feet. It flows through the St. Mary's River to Lake Huron. A control structure on the St. Mary's River regulates the level of Lake Superior. Lakes Michigan and Huron stand at the same elevation, 576.8 feet, being connected at the Straights of Mackinac. Their elevation is unregulated. Water from Lake Huron flows through the St. Clair River, Lake St. Clair, and the Detroit River to Lake Erie, elevation 568.2 feet, the most shallow of the Great Lakes. From Lake Erie, water can enter Lake Ontario either through the Welland Canal, or through the Niagara River. The level of Lake Ontario, 242.8 feet, is regulated by a control structure on the St. Lawrence River.

The levels of the Great Lakes are subject to natural fluctuations due to variations in seasonal and annual amounts of runoff, precipitation and evaporation. For example, in Lakes Michigan and Huron, the range of lake stage fluctuations from 1900 to 1967 was 6.6 feet with a mean annual seasonal change of 1.1 feet. In addition to long-term and seasonal changes, waves and seiches concentrate energy on shorelines by creating very rapid level changes.

The first diversion of water from the Great Lakes Basin commenced with the construction of the Erie Canal in 1825. Water was diverted from Buffalo on Lake Erie to Albany on the Hudson River, although the volume was and continues to be insignificant. The Illinois and Michigan Canal was completed in 1848 and connected Lake Michigan with the Illinois River at Chicago. About 500 c.f.s. were diverted by this precursor of the present Lake Michigan diversion.

In 1900 the Chicago Sanitary and Ship Canal was completed. This reversed the flow of the Chicago River and was constructed primarily for sewage disposal and secondarily for navigation. In 1922 the Calumet-Sag channel was constructed which diverted industrial wastes from the Calumet River

into the Sanitary and Ship Canal. The Lake Michigan Diversion System was constructed to protect the quality of Lake Michigan as a drinking water source for Chicago; however, an additional result was the fouling the water supply of users of Illinois River water.

By 1928 the Lake Michigan diversion was averaging 10,000 c.f.s. This diversion has been the subject of numerous law suits between the states of Wisconsin and Illinois, starting in 1922. A 1925 Supreme Court decree limited the diversion to 8500 c.f.s. plus domestic pumpage. A 1930 decree established gradual reduction in pumpage so that by 1938 it averaged 3100 c.f.s. A 1967 decree permitted a total diversion of 3200 c.f.s. but established stringent limitations on how the average amount was computed. Finally a 1980 decree left the diversion at an annual average of 3200 cubic feet ser second but gave Illinois much greater latitude in the time over which the flows could be averaged.

The Welland Canal, originally constructed in 1829, permits navigation from Lake Erie to Ontario. The current flow of 7500 c.f.s. provides for both navigation and power generation. It is not a transfer of water into or out of the total Great Lakes Basin area, but does affect lake levels of Erie and Michigan-Huron.

There are two diversions of water into the Great Lakes Basin; both divert water from the Albany River Basin, a tributary of Hudson Bay, into Lake Superior.

Water from the Ogoki diversion flows through Lake Nipigon and then the Nipigon River into Lake Superior. Lake Nipigon is regulated to control hydroelectric power generation in the Nipigon River.

The Long Lac diversion connects the headwaters of the Kenogami River with the Aguasabon River, a tributary of Lake Superior. The diverted water is used for both power generation and log driving.

The Long Lac diversion began in 1941 and the Ogoki in 1943. The average flow to Lake Superior via these diversions has been 5,600 c.f.s.

A final diversion is consumptive use, or water withdrawn from the lakes and then either evaporated or transported from the Great Lakes Basin in a product. In 1975 the net consumptive use in the basin was 4,900 c.f.s This amount is projected to increase substantially, especially for thermal power plant cooling.

The average water level of the Great Lakes is impacted by diversions, control structures and channel changes. Because the lakes are interconnected, changes in the level of one lake can impact other lakes. For example, the Welland Canal lowers the level of Lake Erie which influences the St. Clair River-Detroit River System, thus lowering the level of Lake Michigan-

Huron. Let us look at one lake, Michigan-Huron, in detail to see how average levels are impacted.

The level of Lake Michigan-Huron has been impacted by a number of events. The Long Lac/Ogoki Diversion has raised its level by 0.37 feet. Other events have acted in concert to lower lake levels. These include the Lake Michigan Diversion, 0.23 feet, the Welland Canal, 0.10 feet, and consumptive uses, 0.10 feet. Dredging of the St. Clair and Detroit Rivers for navigation as well as gravel has resulted in a net lowering of 0.9 feet. The overall change in the level of Lake Michigan-Huron has been a reduction of 0.95 feet.

Changes in lake levels and outflows have environmental and economic impacts which may be competing. Diversions into the lakes and high lake levels favor power generation. High lake levels favor shipping and boating as the draft in shallow areas is improved. Low lake levels reduce shoreline erosion and create larger beaches producing benefits for coastal interests. Rapidly changing water levels are probably more harmful to coastal ecosystems than either high or low water levels.

A study was authorized by Congress in 1976 to evaluate whether increased diversions from Lake Michigan during high water periods could reduce damages to coastal areas on Lake Michigan-Huron. A diversion of up to 10,000 c.f.s. was authorized for purposes of the study. Due to budgetary restraints and opposition from downstream riparian interests, computer simulations were made rather than actual releases.

This study found that the maximum average annual flow which could be diverted through the Chicago Sanitary and Ship Canal, without flooding downstream areas, was 8400 c.f.s. This increased diversion would provide improved water quality in the upper reaches of the Illinois Waterway, increase navigation during low-flow periods on the Mississippi River and increase power generation at Lockport. There would also be some adverse downstream impacts, such as increased flood potential and channel scour.

Any increase in the Lake Michigan Diversion would result in the decrease in the level of Lake Michigan. Maximum potential increased diversion would lower the maximum stage of Lake Michigan-Huron by about one-quarter of a foot, with lesser impacts on the downstream lakes. This would benefit coastal interests by about $3.25 million a year. This amount is insignificant compared with a loss of $6 million annually to navigation and $40 million for hydropower generation. The conclusions of this study were that the increased diversion was not economically justified.

The major dangers facing the Great Lakes today are water quality issues rather than level and flow problems. For example, coal slurry pipelines running from the west into the Great Lakes would carry low-quality, highly mineralized water from western sources. This water is much poorer in quality than that in the Great Lakes Basin and could reduce the pristine nature of

lakes such as Superior and Huron. Should major transfers of water out of the Great Lakes occur, greatest economic losses would be sustained by navigation and hydropower interest, especially during periods of low water levels.

At the present time there are no major diversions planned either into or out of the Great Lakes. This picture could change with economic development or more arid regions of the United States. Minor diversions especially for coal slurry pipelines, are a possibility.

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Dr. Munton serves as the Director of Research for the Canadian Institute of International Affairs. Dr. Munton is also a Senior Fellow in Trinity College at the University of Toronto. Dr. Munton has a large number of publications to his credit including 'Great Lakes Water Quality: At Study in Environmental Politics and Diplomacy', 'Global Problems for Canadians: Forecasts and Speculation', and 'Simulating Canadian-American Negotiations: A Boundary Waters Example'. Dr. Munton has done commentary on national and local radio and television and served as a consultant to the Canadian Government.

Dr. Munton hold B.A. and M.A. Degree's from the University of British Columbia in Political Science and a Ph.D. from Ohio State University in Political Science.

WATER—A CANADIAN'S VIEW

Donald Munton

I should begin, because I sometimes forget to say this, by explaining the Canadian Institute of International Affairs, the acronym for which is CIIA. (We are eternally grateful for that other organization not calling itself the Central International Intelligence Agency.) The CIIA is a private, non-partisian organization with its national office in Toronto. The Institute does not take positions on issues; its concern is educational—broadening understanding about international issues. Therefore, the views that I am going to express are my own. I might also add that I am not a permanent staff member of the Institute; I am on leave for a few years from the Department of Political Science at Dalhousie University in Halifax, Nova Scotia.

Despite my Ohio State background and the fact that various Canadians occasionally detect a slight trace of Ohia Twang in my voice, I must confess that I systematically fail the American Citizenship-Customs Test as you come into this country. All I have to say is that I am going "oot" to Milwaukee to attend a conference "aboot" water and they have me every time.

I must also confess that I was a little reluctant to present myself as any kind of authority on interbasin transfers of water in such expert company. Then I looked at the program and realized that on a panel with some real water experts, following the lawyers and following the economists, someone with a sense of humor had squeezed in a Political Scientist. And for real comic relief he is a Canadian as well. I don't whether that alone makes the Wisconsin Coastal Management Program an equal opportunity conference organizer, but perhaps so.

As a political scientist I naturally have a bias that political perspectives should at least get equal opportunity. I also believe that the political process generally works rather well in settling the conflicts that we have in modern society and in resolving the competing interests that we invariably find. I think the political process—and this is, of course a bias—works as well as the marketplace in the economic system and works as well as the courts in the legal system. Political scientists often find that this point isn't made and thus I would like to try and underscore it here.

We tend to feel that economists assume away politics and, I might add, assume away almost everything else and then argue that what is left can be explained in economic terms and resolved by market mechanisms. Lawyers, on the other hand, do talk about politics, but they tend to subsume it and almost everything else under this mystical thing they call "the law". Most if not all is explained in terms of legal principles and most conflicts, lawyers seem to suggest, can be reconciled through litigation and court action. Let me hasten to add that present company should be excepted.

Those tendencies I found considerably repressed by the speakers yesterday.

We did hear it said though that the problems we are discussing here were at root economic, were at root legal and were at root or at the most basic level, institutional. Thankfully, we also heard that the economic problems were uncertain, the legal principles were fuzzy, and the institutions were weak. Thus, if only by the process of elimination, it seems to me it is appropriate to look at the politics. I think it could also be fairly argued, and I will argue, that the final decision on the kinds of matters we are discussing here these days will be political.

Before I do that I want to begin by playing an old psychology game with you. Some of you may recognize it. If you do, please don't tell your neighbors the point of the game. While I am talking I would like you to imagine your dream house, I would like you to imagine your dream house and picture its location under the assumption that money, job, commuting, etc. is no object.

Now, in talking today, I probably should distinguish two different things. The first of these is the Canadian position on Great Lakes water exports—and I put that in quotations, "the Canadian position" on export of water from the Great Lakes. The second thing it seems to me we are talking about is what I suppose I might call the Canadian perspective or the perspective which a Canadian might offer to the position that the Great Lakes' states themselves would have on the export of water from the lakes. It seems to me that those are two really quite different things.

First of all, what about the "Canadian position"? It seems to me that it has to be emphasized first that there is no single Canadian position or no single Canadian perspective. Diversion issues like so many other issues in Canadian-American relations tend not to pit Canadians versus Americans in any sort of monolythic sense. They usually, much more often, pit some Canadians and some Americans versus some Canadians and some Americans. The long battle over the St. Lawrence Seaway would be a classic example of this pattern. The Great Lakes' states had a strong ally in Ontario, particularly Ontario Hydro, and eastern seaboard states who opposed the St. Lawrence Seaway had a strong ally in the Atlantic provinces in Canada who saw themselves losing out as shipping ports.

To go into a bit of political history on water diversions, there was the massive North American Water and Power Alliance (NAWAPA) Project proposed in the early and mid 1960s. There were also various schemes to divert northern rivers that, in some people's minds, were flowing uselessly into Hudson Bay, to divert them instead into the Great Lakes and then divert that extra water out of the Great Lakes. Some of the schemes, I would emphasize, were proposed by Canadians. The Canadian Government, however, when pressed by the American Government in 1964 to engage in some studies or at least to agree on a "reference" (as it is called) for the

International Joint Commission to look at the question of Great Lakes' levels including the question of diversion, quite strongly resisted those pressures. They were resisted, at least within The Department of External Affairs which was primarily responsible for the position the Canadian Government took, not because there were concrete development plans on the Canadian side which would be jeopardized by diversions, not because anybody in those days was thinking particularly about the environmental problems, but certainly initially because of basic sovereignty concerns. The Canadian Government tended to view such studies as an implict internationalization of what they regarded as Canadian waters—not the Great Lakes, but those rivers that were flowing "uselessly" into Hudson Bay.

Another consideration certainly would have become a factor if it wasn't initially is that the Canadian provinces which have control over lands and some waters within their territories were opposed to diversion at least in part, though not entirely, because they didn't want the Canadian Federal Government involved in the management of those resources. So there was some domestic politics involved as well.

That, I think, is a good illustration of what the Canadian position would be on diversions from the Great Lakes in the 1980s. It seems to me as one who would emphasize the politics of this that we can ask a very basic question along the lines of "who loses and who benefits"? And it would seem, I think, to almost any Canadian government that Canadian interests broadly defined would be harmed and that benefits would accrue. It seems to me entirely unlikely that Canada would be compensated for any water that was diverted out of the Great Lakes. Thus, my hunch is that the Canadian Government would oppose these kinds of plans, probably quite strongly, given the opposition that the Canadian government has traditionally and very consistently exercised, to the point of sending diplomatic notes to Washington about, for example, plans to enlarge the Chicago diversion, and given the same kinds of sentiments, it seems to me, that are involved in Senator Jackson and the State of Washington opposing diversions from the Columbia, or I gather from yesterday, the State of Nebraska opposing diversions in South Dakota. It seems to me that this opposition could only be expected.

Perhaps I might elaborate for a couple of minutes on the discussion yesterday that Professor MacDonald gave us about the role of the International Joint Commission. The International Joint Commission is, under the Boundary Waters Treaty, responsible for deciding on diversions that would affect levels or flows in the Great Lakes. It is important to note at the same time, though, that private applications by particular companies or by individuals for diversions, necessarily, under the Boundary Waters Treaty, have to be passed on to the IJC through the governments and by the governments. It is also very explicit in the Boundary Waters' Treaty that the governments can, if they so desire, bypass the International Joint Commission by making some sort of separate agreement. In theory only one government has to request the Commission to decide on an application but in

practice it has always been two. I think there would be a great deal of reluctance to violate that practice.

Suppose the IJC were given this particular issue (of diversions). What I would emphasize in short—probably to the horror of at least some of you who regard the IJC as a very independent agency—is that the IJC can be a very highly political agency. It seems to me inconceivable, if it came to a difference of view between the Canadian and American governments, that the American section of the IJC would approve in the face of Canadian opposition to a diversion of this sort. In other words, if it got to the IJC and the Canadian and American governments were on opposite sides, it would be an issue, it seems to me, that the IJC could not handle.

To understand the opposition perhaps in a slightly different sense, it is important to understand that the large amounts of water involved, the size of the Great Lakes, is really an illusion. The notion of there being excess water in the Great Lakes, I would argue, is something of a political mirage. As Dr. Fetter has explained very well the level of the Great Lakes is a very delicate balance. The lakes are partly regulated by man but also naturally regulated and very depended on precipitation levels. It is also important, I think, to note that the lakes do tend to vary in level and have in history varied on a somewhat cyclical basis. I wouldn't emphasis the cyclical pattern too stongly but there have been highs and there have been lows. There were record lows in 1964, the last time there were serious proposals about diverting water into and out of the Great Lakes. And there were record highs in the early 1970's when the IJC report on low lake levels was finally delivered. (Some people argue that that is an example of the IJC's inefficiency. I would argue that that is an example of the IJC's absolutely brilliant political tactics—to finally come out with a report which says that nothing really can be done at a time when everybody agrees that nothing should be done. If they had come out with that report in a year or two years after the original reference, which they could probably have done, they would have been in a lot of trouble.)

The affected interests, as we were told yesterday, are quite clear—and these aren't Canadian interests they are Great Lakes interests; power generation, navigation, riparian interests, and general environmental quality. The prospect that the current reasonably high levels in the Great Lakes would not last forever and we might go through another period of very low levels, would, it seems to me, be enough to arouse very strong opposition from at least some of these interests.

I might just say as an aside that I personally get a little concerned about arguments such as we heard yesterday that the individual state or, I might add, the individual province, knows best. I am frankly sorry the South Dakota contingent here seems to have gone because I wish I could make this argument to them. It seems to me that the notion that the individual, the father or whoever, knows what is best is only the case for that individual for himself. The notion that father knows best isn't the case necessarily for the

family let alone for his neighbor. There is an old, and I think, wisely discredited doctrine called the Harmon Doctrine the gist of which is that the upstream state can do what it likes to waters while they are within its own territory. I would hope that most water issues between Canadian provinces or between American states or between countries were settled with somewhat greater consideration than seems to have been given by South Dakota for downstream effects in the case we heard about yesterday.

Possibly, but it seems to me not necessarily, the whole question of the politics of possible Great Lakes diversions is a moot one if as we heard yesterday there really is no economic advantage involved, that any such diversions would be almost certainly uneconomical. The only caveat I suppose I would add to that is that the final decision will be political. It is always possible for politics to override economics.

Now, if the planned diversions from the Great Lakes were very minor ones, it is entirely possible that the Canadian government, while making a bit of fuss, would accept them. The Great Lakes, after all, are already diverted—as we have heard this morning. If the principle is established, what we are arguing about is the amount and the price. The Powder River Pipeline proposal, as much as I know about it, which is very little, is by my estimation a trickle compared to the Chicago diversion which in itself is not that substantial a diversion. The opposition to a minor diversion would probably be less, particularly if the economic returns would not only cover treating the water that was used in the pipeline itself, but also perhaps provide a fund for water quality improvement, for example, around Duluth or some other of the effected parts of Lake Superior.

As a final point, I can perhaps in one case forsee the Canadian government approving a major diversion. That would be if some enterprising engineer came up with a scheme that involved hooking a pipe up to the end of the American side of the Niagara River and piping all that is in it out to the west to carry coal or whatever.

Now, what about the Canadian perspective on the position of the Great Lakes' states? Here, I would come down even harder and emphasize what I would call the political in the broadest sense. I mean political in the sense of the need for and the process of developing a concensus on the nature of the community in which we live. And that seems to me necessarily to be emphasizing in the broadest sense the values which are involved, not just the short term cash returns. I think it is important to note that water is probably in this context more like land than it is like gas, oil or other nonrenewable resources. Selling water or having it taken is an issue of rock bottom fundamental human importance. To try to illustrate this let me just ask, going back to my suggestion that you imagine your dream house and its dream location, if anyone imagined something that didn't involve water. Either that dream house was by the ocean or by a waterfall or by a stream or by a lake. I have found very few people that ever imagined a dream house that isn't in one of those locations. It seems to me that the whole

question of water is fundamental to what any of us would regard as a livable community—not only in terms of jobs but also much more basically and perhaps in the future, much more importantly, in terms of quality of life.

Water was, is, and will be a key for the Great Lakes area. Sending water on a large scale west even for almost any conceivable price that could be agreed to would be sending economic development, sending jobs and sending quality of life with it. Given that the law and economics render diversions unlikely, but recognizing that the final decision would be political, it seems to me important that we recognize the choice being made between values—values of short term economic gain versus a long term investment. Perhaps I can just paraphrase a Prince Edward Island farmer taking about the measures the government of Prince Edward Island has taken regarding restricting land purchases by non- Prince Edward Islanders. To paraphrase what he said: water is not something we inherit from our ancestors, it is something we borrow from our children.

Let me give you four brief conclusions. First of all, amidst the economics and the legalities, I would urge you not to forget the politics. Second, I would urge that the basic political question be asked and recognized—that is, who gains and who loses? Third, I would suggest, although this is only my personal predication, that the Canadian government's response to major diversions in the Great Lakes is almost certainly to be opposition. This opposition would be based very simply on a perception that Canadian interests would lose. Fourth, I would urge that the question about diversions focus on water quality questions as well as water quantity questions and that the Great Lakes' states position should be political in the broadest sense of the values involved. As was mentioned yesterday there is the philosophy of "take your money and run". Instead, I would suggest the philosophy of refusing short term economic gains and instead accepting the challenges of reconciling economic, energy and environmental problems in way that might be a model for all of those who are yet to face those challenges quite as severely as has the Great Lakes area.

QUESTIONS AND ANSWERS

Question—What would the Canadian government lose?

Munton—I think the Canadian government would either hear from or anticipate strong opposition from the interests that I mentioned. All of whom in one way or another, it seems to me, would perceive losses. The interests would include the interests of power generation, navigation interests that given the nature of the connecting channels in the Great Lakes, in particular the various locks and canals our shipping interests are extremely sensitive to changing levels. It would be of concern to people who own homes along the lakes that diversions would exascerbate the problems evident the in early and mid-1960s when the lake levels were very low. My hunch is that those kinds of expectations would be much more important than the arguments that diversions would not be an important factor on lake levels most of the time and indeed would be a beneficial factor when lake levels were high. What people would be more worried about would be extensive diversions and certainly the precedent of extensive diversions when the lake levels would be low.

POLITICAL IMPLICATIONS OF WATER TRANSFERS

Moderator: *Sharon Metz*
Speakers: *Carlisle Runge*
James Fish
Ned Carroll
Sheehan Donoghue

SHARON K. METZ
Representative, Wisconsin State Legislature
Green Bay, Wisconsin

Representative Metz is serving her fourth term in the Wisconsin State Assembly. Ms. Metz has served as the first Chairperson of the Assembly Energy Committee, and was the first woman in the history of Wisconsin Legislature to be appointed to the Joint Finance Committee.

Ms. Metz has received numerous honors while serving in the State Legislature including 'Legislator of the Year' award from the Wisconsin Wildlife Federation.

POLITICAL IMPLICATIONS OF WATER TRANSFER

Sharon K. Metz

Over and over again in the last day and a half no matter what the individual was speaking to that ultimately all of these questions, the questions of water diversion comes down to political decisions when one gets to the end of road no matter what the legal, economic or enviornmental issues. Those issues will ultimately be resolved in a political way and we have finally reached that point of the program where we are going to find out about those political decisions. I think concern for water and how it gets to where it is needed has been a political concern throughout the entire history of our country. It has been a concern for entire regions of the country for many many decades and it is sure to be a concern for each one of our Great Lakes' states and Canada in the future. The purpose of this panel is to give us some insight into the past, present and future of water in the political arena.

CARLISLE RUNGE
Brule, Wisconsin

Dr. Runge, until his retirement, served as Director of the Center for Public Policy and Administration; Professor of Law and Regional Planning; and was associated with the Institute of Environmental Studies at the University of Wisconsin at Madison. Dr. Runge has served with the United Nations Development Program as Project Director of a Yugoslavian Adriatic Environmental Study. He also served as Assistant Secretary of Defense for Manpower.

Dr. Runge holds a Law Degree from the University of Wisconsin and Ph.D. in American Institutions from the University of Wisconsin. Dr. Runge has published numerous works including Analysis of Water-Related Research Requirements in the Great Lakes Region, New Directions in Regionalism: A Case Study of Intergovernmental Relations in Northwestern Wisconsin, and An Analysis of the International Great Lakes Levels Board Report on Regulation of Great Lakes Water Levels.

THE EVOLUTION OF WATER POLICY IN THE UNITED STATES

Carlisle Runge

First of all, and what essentially I will try to deal with is the evolution of water policy in the United States and the institutions designed to execute that policy and the overall relationship to this immediate diversion issue concerning mid-western waters. However, now that I live in rural Wisconsin ten miles from Lake Superior, I feel compelled to have a word on the policy in sub-regional and parochial terms. I was amazed to hear a comment yesterday that in terms of energy resources that it would cost more to ship slurried coal through the pipeline than it would to haul it by rail to a point of destination! Does this diversion really make any sense as a substitute for an existing system? Is it worth serious consideration? It maybe on the part of the oil and coal companies that are pushing this sort of thing, but for the citizenry at large and state government and national government it is questionable. We have existing rail, we have a very elaborate and efficient coal port in Superior, Wisconsin. We have ships that can haul that coal anywhere in the Great Lakes Basin and to Western Europe. I raise the question as to whether all the existing infra-structure and all the jobs that go with it should be abandoned in the interests of running Lake Superior waters west and coal in slurry form back to the eastern consumers.

Secondly, let us look at Lake Superior's place in the system. (Dr. Fetter did an excellent job in laying out the Great Lakes system in hydrologic terms.) Lake Superior is the holding body, it is at the head of the system and it is controlled at the Soo with respect to water levels. In high regimes you hold back waters in Lake Superior in order to protect, if you please, downstream installations and structures. In times of water shortage, you must pass more water through the system in order to accomodate downstream needs. So just a little natural variation gets compounded at times in Lake Superior in order to support the rest of the Lake system. I think it is a more delicate relationship than the massive amounts of water involved would suggest. There is an impact on riparians, harbors, ports, hydro-electric systems, and the environment. (At least the Chicago diversion is being employed in the interest of a major metropolitan area within our own region if I again may be parochial.) I think that cash payments are no substitute for sound public policy with respect to the interests of the Great Lakes' states and particularly northwestern Wisconsin and northeastern Minnesota. Then too, let us note that Professor Bromley of UW-Madison has suggested that water diversion is not the most significant water issue of our times in the Great Lakes region. The legitimate issue is water quality and, let me suggest by way of example the problems and costs associated with non-point waste and sewage disposal in the Greater Milwaukee area.

I plan to track the national evolution of water policy and institutions and to note where Wisconsin in the past has had substantial development interests. I will observe that while in recent times Wisconsin has elected to reject the completion of a substantial public works project, namely the Kickapoo Dam, in our past Wisconsin has not been above being consumed with public works expenditures for water projects. We spent fifty years or more in the nineteenth century fussing with the Fox-Wisconsin Improvement! Obviously we were concerned early on with the works at the Soo that made Lake Superior broadly navigable by means of locks relating Lake Superior to the rest of the system. We are interested in river or port and harbor dredging. We were very interested and continue to be in the St. Lawrence Seaway, which is I believe the only major water resource improvement in the United States that was not wholly paid for by federal appropriations. The only way the Seaway received approval, and I will admit it came after thirty years of trying, was to make it self-supporting. Now I believe the interest payments are waived on the Seaway debt, but still we have the substantial tolls in the system in order to pay for the basic costs.

We started off nationally in immediate post-revoluntary times, in the Articles of Confederation era, and in the early years under the Constitution, to be concerned with water resources and related public works all in the interest of development. The first major planning was done by Treasury Secretary Albert Gallitan for President Thomas Jefferson and that basic study layed the plan for public works respecting roads and waters for the next fifty years. John C. Calhoun picked up the cudgels in his time as did Henry Clay the advocate of the American system. The early years were repleat with activity of a planning nature and some modest construction but there was always a nagging constitutional question about spending federal money for internal improvements. At least of the question of basic authority over navigable waters, not necessarily the question of financing was determined in the classic case of **Gibbons versus Odgen** when Chief Justice John Marshall, writing for the Supreme Court, concluded that a license from the State of New York to Robert Livingston for a boat operation stood in second place to a license for coasting issued by the United States government. Navigation was deemed commerce and commerce, if interstate, was the business of the United States per the Commerce Clause of the Constitution. Through administrative practice and congressional action and in a certain number of cases beyond **Gibbons versus Ogden**, it was established that the United States government was paramount in the water resource domain. (It is this that Professor MacDonald spoke of yesterday with respect to broad navigable waters authority and the authority to spend money on related works of improvement.)

Spend money we did in mixed forms. A great deal of money was spent indirectly through land grants. We invested public money in private water resource operations. Through a series of actions all of this evolved into a process of survey and investigation done by the Corps of Engineers followed by public works bills appropriating billions of dollars over the years to construct facilities and works at national expense. In addition to con-

struction the United States imposed various types of regulation over uses of navigable waters. U.S. dominance in the field was institutionalized through the course of the 19th Century.

With the turn of the century water resource development took on another substantial dimension. The Reclamation Act of 1902 moved us into the era of major multi-purpose water resource projects. Big dams were constructed providing hydropower, usually flood control; sometimes navigational improvements and reservoirs of water that could be piped around "to make the dessert bloom" through irrigation. In the New Deal period, TVA was authorized very early on—the most completely integrated regional multi-purpose operation that we have ever launched and with a singular institutional form, namely a government corporation responsible the operations. We eventually built the St. Lawrence Seaway and by the 60's and 70's we were moving into the other major dimension of water resource concern, namely water quality. The Congress passed in one year the single largest non-defense financial authorization in American history. Billions of dollars were appropriated to assist the states and communities with sewage treatment plant construction and related programs.

Also in the 60's, following a classic joint executive-senate policy statement, Senate Document No. 97, we enacted in 1965 the water planning legislation which established the Water Resources Council, an interagency council with a permanent staff and policy formulation responsibilities. The Council did the National Water Assessments generated policy implementing regulations and worked with the multi-state federal basin commissions. Wisconsin was a member of the Great Lakes Basin Commission. On the other side of our watershed Wisconsin was also a member of the Upper Mississippi River Basin Commission. Over the 200 year period of national existence, we have evolved national responsibility, authority, policies, and plans for major fiscal participation in water resource improvements and development and national regulation of navigable waters where deemed necessary. And eventually during these past twenty years, a set of institutions were designed to require careful analysis and more rigorous planning of water programs. Consultation on a regional basis with the states was a part of this process. While not an ideal process, nonetheless it was a substantial effort with promise. The Administration's reaction these past two years has not been to reform or strengthen this structure and process, but rather to abandon it. We no longer have a Great Lakes Basin Commission. We will not have a Water Resources Council after August and so we have eliminated effectively not all, but most of the institutional structure designed, we had believed, to provide rational long range plans generated regionally in federal-state forums. The Water Resources Council is going to the exact route of the National Resources Planning Board near the end of World War II! We might not have an International Joint Commission except that it is provided for by treaty with Canada.

How does Wisconsin and neighboring states stand in all of this in terms of political participation and leadership? Certainly, as a generalization, one

can say that the dominate national leadership in the water resource area these past 30 or 40 years has been Southern and Western in origin. Major figures like Senator Robert Kerr of Oklahoma, who in his own way helped to make Tulsa a seaport, Senator Clinton Anderson of New Mexico and currently Senator Henry Jackson from Washington and Senator John Stennis of Mississippi, have played major roles in water program policy and planning. We have provided from the Upper Midwest some excellent leadership but not typically in the kind of classical Southern and Western multi-purpose development mold. Wisconsin's former Senator, Gaylord Nelson, was certainly one of the effective environmentalist of the past decade. Representative John Blatnik of Minnesota, who combined really both developmental and environmental interests, was Chairman of the House Public Works Committee and from that vantage point authored the major water pollution abatement legislation of the 1960's; and somewhat earlier Senator Alexander Wiley, who preceded Gaylord Nelson, was the gallant advocate of the St. Lawrence Seaway and carried the unequal fight with the eastern port and railroad interests for the benefit of the Great Lakes region. However, I see no contemporary national leader in water resource matters from the Upper Midwest's Congressional delegations (with the possible exception of Representative James Oberstar of Minnesota).

I submit that this matter of moving lake waters to the west to bring coal back to the midwest and east has obvious problems associated with it, not the least of which is institutional. What may I ask is indicated with respect to our broad political action role? What is the State of Wisconsin's role, what should we try to do? First of all to use that delightful Canadian term, we should maintain a "watching brief" over the entire situation and I think this kind of conference is a part of that informed observation. Our Coastal Management Council is attempting to respond at the state level in institutional terms to this and related issues. At least we are opening the matter for general public attention and expert consideration. I think that we should try, through all of this, to inform, educate and pursuade our Senators and Representatives from the Lake states with respect to this and related issues. We should not passively allow all of the key roles in the national water forum to be held by the Westerners and Southerners. This may suggest from time to time that someone from our delegation seek a position on one of the pertinent Congressional committees. This isn't just a Wisconsin concern, rather it is the mutual concern of the Upper Great Lakes' states. We should attempt to renew or substitute ad hoc institutions for the ones that have been deliberately eliminated these past two years and to use to the maximum extent possible the formal institutions that remain. Namely, the Great Lakes Commission which has been duly approved by the Congress under the Compact Clause and the International Joint Commission.

However, let us not be carried away in a relative sense with the diversion issue compared to other major water issues, for example, the one I mentioned, the problems in metropolitan Milwaukee. In development terms, I think that Wisconsin can properly emphasize its available resources of am-

ple water quality and water quantity of high quality. After all, we are the "land of western water". If the matter of diversions should develop into a more legitimate national issue, then Wisconsin as a state in association with the upper Great Lakes' states should attempt to deal with it in a statesman like manner and not wholly in sectional terms. We should approach it from a basis of informed analysis and sophisticated planning—working out the most reasonable bargain and arrangements we can, consistent with the states' and nation's interests.

JAMES FISH
Executive Director, Great Lakes Commission
Ann Arbor, Michigan

Mr. Fish serves as Executive Director of the Great Lakes Commission; an interstate compact commission serving the eight states which border the Great Lakes. The Commission pursues solutions to water resource and associated land use problems. Prior to joining the Commission, Mr. Fish was associated with a consulting firm specializing in intergovernmental affairs at all levels of government.

Mr. Fish attended Macalester College where he majored in Political Science and Economics.

POLITICAL IMPLICATIONS OF WATER DIVERSION

James Fish

I would point out as an early disclaimer, I am expressing a set of views today and some observations that may not necessarily be the views of the individual commissioners nor the full Great Lakes Commission nor necessarily the other staff. I say that because six of the eight state members have been present at this meeting, there are a number of advisors, one commissioner who also serves as a committee chairman and less there be any mistakes I want the disclaimer early.

Because a number of you might not deal directly with the Great Lakes Commission I will take a few moments to describe that organization. It was formed in 1955 by action of five of the eight states bordering the Great Lakes. Pennsylvania, New York and Ohio joined later. In 1968 the Congress granted their consent to the compact. The generic purposes of this compact are three-fold; to facilitate interstate communication on issues of common concern between the Great Lakes' states, to serve as a mechanism for coordination of views between these states on issues which they choose, and third, when there is an agreement to serve as an advocate for those views, generally speaking to the federal government.

The Commission committees are Natural Resources Management with sub-committees on land and air and a sub-committee on water and a committee on Transportation and Economic Development with sub-committees on Great Lakes Seaway and Related Transportation and Economic Development and Promotion. Through these committees and sub-committees the Commission can cover a broad spectrum of issues or problems which effect the Great Lakes. The Commission staff is very small, we have now moved from having a staff of four to having a staff of six and hopefully seven with the transfer of some bonds. We rely almost totally on our eight member states' commissioners and their advisors to identify and develop issues. It is, in fact, a state commission.

We were, as a Commission, recently designated by the states as the successor organization to the federally chartered Great Lakes Basin Commission, which as Dr. Runge mentioned was terminated last fall by Presidental Executive Order. I might say, as an aside, that that was an element of disappointment for a number of our commissioners even though we ended up as the successor organization. I think the Great Lakes Commission have probably offered more testimony on behalf of strengthening and enhancing the basin commissions and the parent organization, the U.S. Water Resources Council, than any other organization over the past three or four years. Our Commission had taken a strong stand initially in creating the Water Resources Council in the basin commissions and subsequently in trying to facilitate their improvement.

Before I go into any of the specific political observations on implications, I think that it might serve to reemphasize a few facts that we have heard before or that we should now. One is that fact that was mentioned earlier is that there is the same amount of water on the earth and its environments as there always has been, no more, no less. I guess to paraphrase a Will Rogers statement on the land, they aren't making any more of that, it is a compound to be protected. Secondly, lest we forget, water is the second most important compound in the maintenance of human and other animal life and plant life. Oxygen is the most important, without air we die in three to five minutes; without water in four to six days; without food in 50 to 80 days. It is a critical commodity. I emphasize these because I think they may help as we move along to keep those in mind as we move into full consideration of what we do with this water.

Yesterday we heard Bob Neufeld from South Dakota make some comments about .28% of the flow of the Missouri River being diverted, it was so small that, in fact, you couldn't measure it on standard gauges. I would point out that we are dealing here with a much larger body of water than they are. We are dealing with, as the figures given to me by Research Director, Al Ballard, something on the order of 5400 cubic miles of water and compared to the 21 million acre feet that Bob Neufeld mentioned as outflow, based on the average flows of the St. Lawrence, it is 172 million plus acre feet flowing out each year. I point that out because I think with those large numbers we might be lulled into a sense and for that matter with all due respect to our political representatives whether in Washington or in some of our state capitols who might be lulled into a sense that there is a great plenty. There is plenty to go around and little bit by little bit diversion might not make any difference. Indeed, it might not, but those numbers become so astronomical that we don't see any impact and I think that is something to keep in mind. It is a fragile system; it has fragile wetlands near it and I don't think we can afford even with those large numbers a sense of necessarily security about it.

Donald Munton in his earlier remarks covered a number of things that I might have otherwise have covered. The session on the demand for water, the session on legal aspects, on economic aspects and the impacts, those are all political issues they all have political implications in them. For example, demand; it is a political decision where we encourage industries to locate, how we zone, where we encourage people to go. It was a political decision to encourage people to move west and to develop the water. We wanted that land settled, we said we will give that land away under the Dessert Lands Act and under the Homestead Acts. That was a politicial decision. We made the demand for water grow. I heard Professor MacDonald speaking about the courts will determine this, the courts will determine that. I get very nervous about the courts determining it all. I would much rather have the legislature write the law and we start with that rather than leaving it all up to the courts. I say that with all due respect for the lawyers and the courts. I think we have a better chance. I am saying that the political system in that way has a better opportunity to arrive at a decision which

is going to be good, socially responsible, politically acceptable than necessarily the courts who are appointed for the most part.

I would like to point out that the question of diversions, the question of how we use our water is changing a great deal. Four weeks ago we had an Executive Committee meeting of the Great Lakes Commission and I was asked under what conditions did I think water might be diverted from the Great Lakes in significant new quantities. I said two things. Point one; if our elected representatives in Washington again lose their collective minds over something, they might permit that. Point two; it might be a national emergency of such order of magnitude that there is no question that we will do it. I can't give you a specific example but certainly we have had those cases where in the national interest we will go ahead and do these things. I would add that after hearing Bob Neufeld's presentation and rethinking the budgets of our respective states, if the price is right, yes, that might be another issue. I hadn't really thought about that in those terms. I would also point out that for practically anybody I know in the water business if they had been asked two years ago what will happen if the Governor of South Dakota proposed to the Legislature and the people of South Dakota that 50,000 acre feet of water be diverted to a coal slurry pipeline to flow down to Louisiana I would have told you that was political suicide. I think every other one of the water people I know would have told you that it is probably political suicide for a Governor of South Dakota to do that. Today it is not. I would say that times are changing, the economy has changed and the perception has changed. I think we need to look very carefully at some of the things that we didn't think would ever happen and say, yes they might.

When we look at the political questions we have a tremendous number of interests groups. They have been identified before with the whole recreational, boating, swimming, fishing and the astetic concerns, commerical fishing on the lakes, navigation. We have a program for recreational boating on the water and we have a program for navigation and we have a program for clean water and then we have a program for agricultural water permitting. I would like to suggest that it is hard to split that drop of water. Management and our political system ought to consider water as a multi-use commodity which can go in anyone of those directions and we ought to plan those things together. I would suggest that probably our biggest problem with some of the federal agency programs is that they have not been intergrated, they have been segregated. There has been window shopping for the best deals for the states and the local communities which has caused chaos within our states. We really need to think about planning for water as a total commodity not as a segrated drop of water, if you will. I have a lot of respect for the Indians who said 2% of each drop, I believe that was mentioned yesterday. That may be a conceptual way to put that together.

I would point out that, as out earlier speaker Mr. Munton did, we have a number of political entities here and as we go through this process we have

the International Joint Commission, we have eight states and two or three provinces, we have the federal agencies, cities, and counties. There are insitutional needs to be considered. How to put these things together and who is going to make those decisions. I don't think it is going to be easy. I think that law suit that might generate out of a diversion of Great Lakes' waters might make the Nebraska—South Dakota and other surrounding states' law suits look kind of puny and it might even make the Chicago diversion look small in comparison.

I would point out one other thing and then leave time for questions. Dr. Runge mentioned our payments to the west and the south, if you will, for development. Yes, we did make some decisions. Our elected representatives made political decisions to transfer money from our region to other regions. I would suggest to you that historically that was an excellent political decision because that gave us an opportunity in those times to see new development in the south, new development in the west, and for that matter, overseas and those people then bought our automobiles, bought our refrigerators, bought our heavy equipment and we made money. Lord help us, I hope we get back to that point so we can make that political decision again. I believe we will, but I think at that time it was a good political decision. It is a little tight right now, but I think that when we look at transfer of payments, we can't be totally critical of those because for at the time they were made. Maybe those decisions need to be changed now. They were benefical for this region and they in fact helped us to utilize the natural resources we have and the water we have.

NED CARROLL
Legislative Assistant
Washington, D.C.

Mr. Carroll is a Legislative Assistant to Congressman Berkley Bedell, 6th District, Iowa. Congressman Bedell has recently introduced legislation prohibiting the sale of water between states for use outside the state unless all other states in the drainage basin consent to the sale.

CURRENT FEDERAL LEGISLATION

Ned Carroll

On behalf of Congressman Bedell I thank you very much for the opportunity to be before you today to take part in this very important and timely conference. Mr. Bedell sincerely regrets not being able to attend; but this being the season of blossoming May flowers and federal deficits he feels he must remain in Washington to take part in the drafting of the First Budget Resolution for FY 1983.

As a long time advocate of efforts to halt excessive and wasteful spending on pork barrel water projects as well as efforts to promote the conservation of water, he is especially pleased that this conference is being held to generate attention on what some have termed "our next resource crisis"—water.

We should be grateful for this attention. We need to continue to determine our national water priorities, and answer the difficult water questions we are encountering and will continue to encounter as demand for this critical resource intensifies. This demand comes from a variety of sources and locations using several techniques to obtain the water, one of which is diversion. Although Congressman Bedell believes it is generally accepted that each State has the authority to determine water use within its own borders, he believes that recent developments have given rise to the need for the Federal Government to clarify the limit of each States' power to divert water resources for use outside of the State and, more importantly, outside of the drainage basin. To this end he has introduced legislation, HR 5278, along with 16 of his colleagues from the Missouri River Basin. The language of the legislation is straightforward. The bill prohibits any state from selling or otherwise tranferring interstate water flowing through its boundaries for use outside of the state unless there is in place a compact between the drainage basin States and the sale is approved by all of them.

Now looking at the options, a compact seems to be the most desirable and feasible means to resolve conflict, both current and potential, even though compacts are neither easy to form nor to implement. HR 5278 provides a framework for resolution of this conflict. It does not provide for heavy handed federal involvement nor does it provide for federal solutions to these problems. What is does provide is an opportunity to find these solutions and protects the interests of all concerned. It promotes conciliation rather than confrontation. Incidentially, if this bill would have been enacted, South Dakota and the Madison Formation would have been protected.

The bill was introduced because of the critical concern that such a sale, approved without the consent of the adjoining basin States, will set a dangerous precedent for future situations—in effect, putting a large, perhaps

irrepairable crack in a reservoir of water problem solutions. The fear is that these sales approved without this consent will serve short term parochial interests at the expense of other States and our national welfare. States would be pitted against each other for this precious commodity. Condoning such sales would, perhaps, open a Pandora Box of troubles, evolving into a situation where States would be acting for short-term economic reasons over prudent, wide ranging actions serving the general good of our nation.

A precedent would be set which could escalate into full scale bidding wars between differing interests for the available water. Eventually, the water would be allocated to the user with the greater financial resources, rather than reserved for practices which may be more responsible. In this instance, allocation by the marketplace may not be sound, and would pervert what would otherwise be the reasonable distribution of our water resources. Now under this scenario, water is treated as a commercial commodity, an economic good. We found out yesterday that this treatment is generally not the accepted practice right now.

However, by enacting the proposal that Members of Congress from Missouri to Montana have introduced and since co-sponsored by members from the Eastern half of the country, we might avoid the intolerable situation where one or two interests dictate the distribution of this essential and rather finite resource. At the same time, we would be pursuing a cautious and more responsible course in shaping of future water policies, taking into consideration our needs and sources and quantity of supply.

Many unanswered questions exist with regard to our water policies such as ownership or claims and rights of competing interests, and these matters should be resolved before States are allowed to sell water outside their borders in an unrestricted fashion.

Now I should give you an update on the bill. It was introduced in December 1981 and was referred to and is pending in the House Interior Committee. No hearings have been scheduled at this time. However, the House Public Works Subcommittee on Surface Transportation recently considered and marked up the Coal Pipeline Act. We were able to have H.R. 5278 offered as an amendment to the Act and we were surprised that it lost barely on tie, 15-15 vote. Hopefully, it will be successful by one more vote when it is marked up in the full committee.

SHEEHAN DONOGHUE
Representative, Wisconsin State Legislature
Merrill, Wisconsin

Representative Donoghue represents the 35th Assembly District in the State Legislature. Ms. Donoghue was elected to her first term in 1972. Prior to her election to the State Assembly, Ms. Donoghue worked as a Research Assistant for the Republican National Committee in Washington, D.C., and was named an Assistant Coordinator for the White House Conference on Food, Nutrition, and Health.

During her tenure in the Wisconsin Legislature, Ms. Donoghue has served on numerous committees including Natural Resources, Municipalities, State Affairs, and Revenue. Ms. Donoghue is currently serving on the Revenue Committee, Local Affairs Committee, the Criminal Justice and Public Safety Committee and the Urban Affairs and Housing Committee. In addition, Ms. Donoghue was appointed to the Goveror's Blue Ribbon Tax Reform Commission.

Representative Donoghue holds a Bachelor of Science Degree from the University of Wisconsin in Political Science.

WATER: A STATE PERSPECTIVE

Sheehan Donoghue

The first time I was elected, I found it fascinating that we were called out-state legislators. This some what startled me to hear that terminology when referring to a part of the state that I felt had a good deal more than many other parts of the state.

I have written down a number of points which I will try to touch on briefly, and then leave time for you to let the members of this panel know what your concerns are regarding state policy and state legislation.

I guess I would like to start first with the federal law versus state law and who controls the water. It was my understanding that there was a 1963 Supreme Court decision that gave Congress the power to order the transfer of water from one state to another. That's an interesting concept, and one that we in Wisconsin should keep very aware of in the future. The reason I say that is that it really makes one pause to consider when you take a look at what Montana did in applying a 30% severence tax to coal at the same time that Wisconsin was considering a new tax policy for zinc and copper. You know those kinds of wars ought not to be set up between states. Better than 200 years ago we bonded together because we felt there was strength in joining together for mutual needs and to provide for the common defense and to help each other. . .not to go to war with each other over these differences that we might have specifically.

I also bring to this discussion a certain amount of interest. My parents live in the state of Arizona and have for 14 years. I went out with them as a child in 1953 and I have been able to see the changes that have occurred there. It is absolutely mind boggling. I think what is even more mind boggling is that they think nothing in Arizona about creating a big Tidal Wave in the middle of the desert. That not only is a waste of water, but it is indicative of the lack of planning for their water needs that many of the dry western states have exhibited in the past.

If ever I have seen a waste of water and energy that is it. The western states had better start taking a very good hard look at their zoning practices and at their planning practices. It is not necessary for everyone in an arid climate or what is basically a desert climate to have a swimming pool in their backyard. They should be clustering their homes around a central swimming pool rather than building one in every backyard. That is a poor plan for resources. It is not necessary for people to have watered green lawn in their yards. My first year in college I went to the University of Colorado at Boulder. I was flabbergasted to discover that they had irrigation ducts right alongside the sidewalks and they flooded the campus every morning. Those are the kinds of things that people should be taking a good hard look

at within their own states before they start turning to us to provide water for them.

Then when you think about the kinds of energy needs. Now our state is going to have to provide energy needs and alternate forms of energy other than nuclear energy. That has been one of the big battles and it will be one of the big battles for the future. Hydroelectric power! The Wisconsin Valley Improvement Corporation is part of the water basin for the Great Lakes. The Wisconsin Valley Improvement Corporation was founded by paper mills to provide hydroelectric power to provide a steady amount of power for the mills along the River. There were other companies like that formed, at the same time, for instance, over in Chippewa Falls. These corporations provided flood control and created lots of lakes for the tourism industry. That was a side product. I'm not sure that it was anticipated that those lakes would become as important to the economy of the north as they have become. But it is something that I think we have to, from somewhat of a parochial, but also from a statewide impact kind of thing, take into consideration. You will see an increasing desire for alternatives to nuclear energy and you are going to have to look not only at solar but you are also going to have to look at hydroelectric and you are going to have to look at another thing which I have been deeply involved in and that is groundwater. Reinjection wells for groundwater heat pumps. That is something that I think is terribly important for this state and other states to address.

When you talk about groundwater, you talk about the quality of the water that we drink and the level of that water. You talk about the pollution questions, you talk about quality of water whether it is in the Great Lakes or the area served by the Great Lakes and I happen to have some of the areas that had their groundwater polluted by things like aldicarb. When they start talking about taking water from our area and taking it west, there are some state decisions that we are going to have to make in terms of: is our water quality going to be so drastically affected within our groundwater in the future. Who owns it? That is another state question. Who controls the groundwater? Is it the farmer who has the high capacity well on his land? Is it the individual who says that their tables are kept high because of the Great Lakes being nearby for instance up in Douglas County or some county such as that along Lake Superior or of the counties along Lake Michigan? That is a question that we as a state are going to have to continue to face. We are facing those questions right now. We are facing the quality questions, we are facing the reinjection wells for groundwater, for heat pumps. We are facing pollution questions, we are facing the ownership questions of groundwater. We are facing ownership questions of the Great Lakes, who really owns them. Do we own them? Does Canada own them? Does the United States own them or do they belong to the people forever? That is the question.

Historically, all of the great civilizations have been located near water. They have been located on major river systems. The great cities, London and the cities in Russia and in Germany and Egypt, can you imagine an Egypt with-

out the Nile River for the Egyptian civilization. All of those things are part and parcel of the water question whether it is the Upper Great Lakes, the Lower Great Lakes or any part of it because water is critical, absolutely critical for life.

I guess one of the other things that I am going to just touch on is the state's role in terms of the business needs for water. Are we going to sell the water or are we going to tax the sale of water or are we going to adjust our tax policies in such a manner that businesses that use large amounts of water will be encouraged to settle in Wisconsin rather than other states? For instance, Texas is supposedly one of the great states to attract business because of their tax qualities and because they have a nice year around climate for industry. Maybe we should be continuing to encourage in a better manner businesses that use large quantities of water to settle in Wisconsin. The paper mills need the water and they need the trees. They need to be close to their source of product and power, but I cannot imagine many paper mills in the desert of Arizonia. I think that is one of the things we have to consider as a state in terms of tax incentatives that are needed.

Another major question for us, directly connected to the Great Lakes, (and, these are all questions that as a state government we are going to have to address) is the question of court decisions affecting water quality. What happens to our state when we have to make a decision as we just did, in terms of helping the City of Milwaukee to cope with a $3 billion sewage problem. This problem came about as a result of a law suit brought by the City of Chicago against the City of Milwaukee and the water that was being polluted, the Great Lakes water that was being polluted, was supposedly being polluted by the City of Milwaukee. We had to address that problem and that is an expensive proposition for the people who live in Milwaukee, and for the people who have to deal and pay for those problems in the Metropolitan Milwaukee area. It is also a statewide responsibility. Because we are a state that is concerned both about Milwaukee and about the north, or I would hope that we would be. I think that before we go too far in terms of thinking about selling water such as you sell oil or natural gas we ought to start thinking about the consequences of the other states' laws that may set up an adversary relationship. I think we may, in the end, unless we are very careful with the way in which we approach this, both as the State of Wisconsin and in conjunction with other states that ring the Great Lakes, set up a situation in which we could do great damage to the union that is called the United States.

Now I have just touched briefly on some of the issues that we face, I obviously haven't hit all of them. I don't hold myself out as an expert on this subject but I certainly would like to try to respond to questions in terms of legislative initiative within the State of Wisconsin. I think one of the first and most important questions that must be resolved is who controls, does the federal government or the State of Wisconsin, And if so, in what manner do they control, and what particular part of the water resource do they control? Do they control only the Great Lakes? Do they control the basins that

drain into and out of the Great Lakes? I think that is a critical question particularly when you talk about diversions from the Mississippi River and the Wisconsin River and some of the major water systems that are part of the basin of the Great Lakes.

QUESTIONS ND ANSWERS

Question: In relation to water quality, is there any chance that the phosphate ban will be continued?

Representative Metz—I hope that we can include it on a special session before the ban is discontinued and again address that problem. I don't know if that will happen but that is my hope.

Representative Donaghue—Sharon and I have opposite positions on this legislation. I voted against the original phosphate ban, I voted for the lifting of the phosphate ban at this point. I am not convinced that it has appreciably effected the water quality in the Great Lakes or within the lake system or the water system in the State of Wisconsin. I know that is has done some damage to some basic things such as the manufacture of washing machines and things like that. I do know that people who live in my district have contacted me specifically about opposition to that legislation and as long as I am convinced that the water quality is not adversely affected, I will continue to oppose the legislation at this time. I doubt that it will be placed on the call.

Question: With regard to the Great Lakes Basin Compact enabling legislation for the Great Lakes Commission, how could the states' use it on questions of diversion?

Fish—A compact is a consultative organization. It could provide the vehicle for discussion of the issue for joint recommendations between the states, the development of common policy and for that matter, if there is a federal presence involved for the states as a unified group go forward to the federal government. If you go back to the Chicago diversion, the Commission served as a vehicle for some discussion on that as it went through the courts in the early 60's but that was more of a very low level discussion because it was already in adjudication and each of the states were represented in that court process so they did not take a specific position with that case.

Question: In the agricultural use of the water is there a negative tax impact or a tax subsidy?

Representative Donoghue—Let me rephrase the question and make sure I understand it correctly. Are you asking that would it be in the interest of the State of Wisconsin to restrict the agricultural use of water thus leading to a reduction in the agriculture output that would reflect in a higher price for those products. Since I am only a legislator in Wisconsin, I think that is more a federal type of question in one sense. From another sense, since others do not necessarily collect tax from water at this time in Wisconsin we would really have no control over that. I'm not an agricultural economist, I guess the best I could say is that we have a big dairy industry and I'm not

sure that restricting the application or use of the water in the dairy industry would appreciably effect the price of dairy products. I think that it is a function of a different nature, basically in terms of price controls and supplies.

Fish—I think maybe part of the answer to that question is do we continue to encourage or permit the development of opening of new western lands for agriculture which require subsidized water. My personal feeling on that is no, however, I would point out that one of the best arguments that I heard for a new irrigation project, federally supported, was last year in some appropriations testimony by some people from Oregon. What they said was, we are not asking you for new land per se we are simply replacing the agricultural production which is being lost because areas are being urbanized and eating our prime farmland. I stopped and thought about that and I said that is one of the best arguments I have heard for the long term. I do think that we ought to bring the price of water delivered by the federal government to agricultural lands more in line with the cost of delivery. I think in that way we begin to bring some of these things into balance and we may in fact begin to see some better pricing for some of the agricultural products.

Carroll—I would like to point out that during the last 10 to 20 years new reclamation projects generally carried a ban in their authorizing legislation to prohibit use of subsidized irrigation water to grow crops designated as being in surplus. The ban extended ten years from the authorization. The purpose of the ban is to pervent the situation where the right hand of the federal government didn't know what the left hand was doing in that first you provide subsidized water to grow certain crops and then turn around during surplus times and subsidize incentives not to grow these crops. The problem with the ban is that projects just don't get done in 10 years, much less started. Therefore, the ban is meaningless. During recent consideration of the Reclamation Act Amendments, Mr. Bedell offered clarifying language, which was accepted, to preserve the intent of the ban by applying it 10 years from the date water is first made available for the project. However, this ban will only apply to new projects authorized after the enactment of the legislation.

Question: What definition is given in Congressman Bedell's bill to the states who were affected by the legislation?

Carroll—The bill defines affected States as those States within a drainage basin of an interstate body of water, such as, for example, the Missouri River Basin. You raise a good point with regard to Canada, and we should consider the international implications in interbasin transfers. As I said, hearings haven't been held yet, and hopefully, when they are held a lot of the unforeseen implications will be aired. We can correct the legislation.

Question: In Congressman Bedell's bill what definition is given to the use of water is it for a specific purpose or could it be water than has already been used for another purpose such a navigation?

Carroll—There hasn't been any attempt to define the water for specific purposes. It is the use of interstate flowing water outside of the boundary of the state.

Question: What can we do from a state, local or interstate perspective to address the questions of water as it relates to economics of our region?

Representative Donaghue—First let me go back to what I had said in my speech originally. As far as the State of Wisconsin goes and I think this should also be true for the other states that border, particularly the midwestern states, on the Great Lakes since many of us are experiencing some acute financial problems at this time. We have got to take a good hard look at our tax policies in the state and what they are doing to industries that are dependent upon large amounts of water. Are we, in fact, driving those industries out simply because of our tax policies and are they seeking alternative states where their tax policies are not as restrictive? I think that is one of the areas that we have got to address whether it is in relationship to the paper mills or some other industry. Now you have to understand that water quality is a major concern of legislators including myself. Water quality not just the quantity, but the water quality is extremely important when you take a look at both the federal and state decisions as they pertain to the cleaning up of the water and to the improvement of the water quality. The dollar consequences to the paper mills and the businesses and the cities along the rivers of the State of Wisconsin and the Great Lakes are important. I'm not saying it shouldn't be done; I'm saying it should be done. What I'm also saying is that you have to look at the consequences and that should be part of the equation when you are drafting public policies at least for the State of Wisconsin and I think it ought to be a consideration for the other states. There are dollar effects. I have, for instance, four paper mills in my Assembly district. Sharon, I am sure, has several in the Fox River Valley. One of those paper mills in Rhinelander happens to be the major employer for the community. It is struggling to keep its head above water because it is an aging industry, it is an older factory, the machinery is going down, it manufactures a very technical kind of paper called Glasseen. They are trying to expand into other markets so that they can develop a different product to sell. They can't do it fast enough and at the same time that they are putting millions and millions of dollars into the improvement of the river. Now they have improved tremendously and companies have to recognize that it is to their advantage to clean the rivers in the area and be responsible about it. Quite often they can determine a way in which they can make a usable, saleable product from the waste. To give you an example, that particular mill which is hanging on barely by its fingernails at this point is under some heavy air and water orders right now that could very well be the straw that breaks the camels back. Now if we lose 900 jobs in the City of Rhinelander right when we are already experiencing 15% unemployment in the City of Merrill, you have a major problem. In effect right now there is 25% unemployment because they don't count persons who ran out of unemployment compensation a year ago. When I am looking at the tax consequences on people in my district, those are the things that we have to be

thinking about. We aren't doing enough thinking about it in this state or any of the other ones.

Question: In light of the problems experienced in other states, specifically Colorado, why are we looking at a compact as one the structures we are using rather than an alternative structure.

Runge—I think one of the advantages of the compact is that the states if they so choose can initiate it. And it becomes then a matter of Congressional approval of the states initiative; that is probably its greatest advantage. The complications, of course, are to get all the states in the basin to get the necessary agreements to go ahead with the operation and I think Ned would probably agree with that. But it is more in the nature of an act of desperation and the legislation that the Congressman has introduced is attempting to plug a hole, if you please, in the dam. It is running to try to block this sort of behavior on the part of a given state. It is all part of this chaos that has been created by the effectively eliminating such modest institutional apparatus as we had put into place in allowing a single state to contract with the coal company which is owned by the oil companies I'm sure. And I site this compact thing, the legislation, the points I made earlier and I learned on Friday, from staff in the Department of Interior, Office of Land and Water, that the Corps of Engineers has either concluded that they will not issue the permit to withdraw the water from the reservoir on the Missouri or are planning to take such action. (This was telephone information, I don't want to speak too positively on the point.) Here again we have an element of the chaos to which I have referred. The Missouri River was dammed and the reservoir was built with federal money by the Corps under Corps plans. The Corps' position is, as I understand it, if you draw down from this reservoir it may have adverse impact on navigational interests down river on the Mississippi. So there are complex questions and while they have an immediate regional focus, they impact on the next region and quickly take on a national significance.

Carroll—Ditto! First of all, as I said earlier a compact would be difficult to form and implement; there are difficulties with this concept. But the alternatives or the consequences of not trying to form a compact make this concept seem much more palatable. It is an attempt to allow the people involved in an affected area to work out their own problems without bringing in outside forces, for example, the court or the federal government. It is a framework, it is a vehicle for them to work out their problems while protecting everyone's interests, particularly the downstream states, but also the upstream states as well. Montana, for example, has objected to the ETSI sale.

Question: What process would unfold at the state, national and international levels if a major diversion were to take place? What would we have to do institutionally first?

Runge—Professor MacDonald's remarks yesterday lays the framework for all of this in terms of where the legal authority is found. My own belief is that the State of Wisconsin has limited authority because of the United State's paramount posture in the field, and that the State of Wisconsin would be limited to playing its own political role in national councils rather than taking definitive actions. Mind you, this is putting aside all of the litigation that can ensue both in the state courts or federal courts testing various propositions along the way. Let me limit myself to the political and administrative process. We have institutionally the role of the multi-state Great Lakes Commission which I think is not authoritative but does allow Great Lakes' states to provide briefs, to provide positions, to lobby a position one way or another at the various levels.

Certainly the existing U.S. structure involved would come into action, particularly the Corps. As the long time operators of the water level activities they would be heard from and I think would have to issue appropriate permits for American actions. Other federal agencies would be involved, more particularly, some of the environmental agencies, E.P.A., Fish and Wildlife Service, etc., but I think more in the way of expressing a position rather than having any power to block.

Then we come, of course, to the International Joint Commission. Since Elihu Root and Lord Bryce signed that agreement in 1909, the Commission has handled matters of this kind and have been responsible for the water level policy on the lake system. Certainly the IJC would subject this matter to their most deliberate process!

Fish—In my last comment I was assuming that the water, if you please, that would be piped out of Lake Superior "belongs" to the United States or is subject to its control. That is why I down played the role of the State of Wisconsin. On the other hand, if it were concluded that those waters "belonged" to the State of Wisconsin, then, of course the full operation of the state legislature, the Governor and our custodian of waters, the Department of Natural Resources would become fully involved.

Representative Metz—Before we conclude, I would like to just add one comment of my own. I would seem to me that one thing Congress ought to be able to agree on or at least most of the states ought to be able to agree on is to urge Congress to adopt would be that before the application or approval of any water transfers that state requesting the transfer must demonstrate maximum self-help in terms of pricing, conservation, recycling and desalination where that is appropriate. That would make the states look at themselves in the mirror and see if they have practiced maximum self-help before requesting water transfers and might be something the Congress could adopt in the interim.

ADDENDUM

ENVIRONMENTAL PROBLEMS ASSOCIATED WITH COAL SLURRY PIPELINE TRANSPORT

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Edited By Barbara Murdock

Introduction

Oil and gas have been transferred through pipelines for years. Now proposals are in the works to transport coal in pipelines as well. These proposals may mean trouble for water quality.

Transporting coal this way requires crushing it to a fine powder and mixing it with water to produce a slurry that is approximately half coal and half water by weight. Hence coal slurry transport will call for a plentiful supply of water. A pipeline transporting 5 million tons of coal each year will require at least 1300 million gallons of water. And although high quality water need not be used, there are certain restrictions. Marine or brackish water is unsatisfactory because the salt will lower the heat output of the coal when it is burned, will increase the tendency for chemicals in the coal to dissolve or leach into the water, and will cause more corrosion during burning at the power plant.

Whatever the nature of the water used in the slurry pipeline, it becomes considerably degraded during the transport of the coal, compared to normal surface waters. It can become considerably more acid, increase in alkalinity, have higher levels of such toxic elements as arsenic, selenium, mercury and lead, and gain higher levels of organic material that can serve as nutrient for the growth of microorganisms and algae.

Currently, only one commercial slurry pipeline is in operation, running from the Black Mesa, Arizona, coal mine to a power plant at Mohave, Nevada. This pipeline, 275 miles long, has been operated successfully since 1970 and transports approximately 5 million tons of coal annually.

Degradation of water quality in the Black Mesa pipeline has not been adequately studied because there the slurry water is normally used to supplement the power plant cooling water. Furthermore, the climate is hot and dry, so spent water from the pipeline and other power plant processes can be evaporated in large holding ponds and not released to a waterway.

A new pipeline proposal, however, the Powder River Pipeline for transporting coal from Wyoming to Duluth, Minnesota, poses water quality problems for two reasons. First, the volume of water and coal to be transported is great: 4000 million gallons of water and 15 million tons of coal each year. Second, because the Upper Midwest has a colder, more humid climate than

Nevada, and has a low average annual evaporation rate, these large volumes of water cannot simply be left to evaporate in holding ponds. Eventually, they will have to be discharged into Lake Superior, either with or without treatment, or they will have to be recycled in a return pipeline, one that has been proposed to carry Great Lakes water to the mine in Wyoming.

Recycling in the return pipeline, though an attractive proposition, would be severely limited by the fact that as the water is used and reused, it will become more acid, contain more dissolved mineral and organic material, and will eventually cause the deterioration of the coal carried in the pipeline. Minerals may be redeposited on the coal, making it harder to burn.

Coal Slurry Pipelines

A typical mine to power plant pipeline transports coal as a finely crushed and ground powder suspended in water. To keep the particles suspended in the water, the particles must be very small and the flow of water fairly fast. The Black Mesa pipeline specifications call for coal particles to range from the size of a sugar granule (2 mm) to the size of a particle of flour or less (0.05 mm). The mix of 50 percent coal to 50 percent water by weight flows along the pipeline at more than 3 feet per second; otherwise even these fine particles will settle out and clog the pipe.

The small particle size, although an advantage in transporting the coal through the pipeline, is a disadvantage in removing the water from the coal at the plant. The slurry is sent through a series of centrifuges and spun so that the heavy coal particles sink to the bottom. Still, even efficient certrifugation leaves some coal dust in the water and leaves about 30 to 40 percent water by weight in the coal.

If there is a large volume of water left after coal transport, as at the proposed Powder River pipeline from Wyoming to Duluth, Minnesota, the water must eventually be discharged into an existing waterway.

The use of coal slurry pipelines, then, poses significant water quality problems independent of the water supply problem. These problems could include: catastrophic pipeline breakage over or under waterways, which would release large amounts of finely divided coal into the water, the discharge of spent pipeline water into existing waters, leakage of pipeline water into streams and aquifers, and the impact of treated water discharged into the environment.

Coal-Water Interactions: Impacts From Pipeline Spills

When coal and water are mixed to form a slurry, chemicals leach out of the coal and pollute the water to such an extent that direct discharge of water that has been used in a coal slurry will probably not be permitted even into

large bodies of water. An accident, such as a pipeline rupture into a lake, river or aquifer, would have a severe environmental impact, though it would be of short duration and limited in area. The environmental effects of depositing coal from a pipeline into a waterway or onto a land surface have not been fully explored, but there is considerable data on the environmental impacts of water runoff from waste coal piles. These data show that the long term weathering of coal produces acid runoff waters, high in sulfuric acid from the combining of oxygen from the air with sulfur compounds, mainly iron pyrite, or fool's gold, in the coal. On top of this, toxic metals such as iron, chromium, arsenic, mercury, lead and zinc leach out of the coal piles, sometimes in concentrations toxic to all organisms in the water but algae. These toxic metals are in time carried into the rivers, where they get into the sediments. There, some, for example, mercury, are taken up by bacteria and bottom feeding organisms and eventually move up the food chain. Mercury is converted by bacterial processes to a toxic compound that tends to be concentrated in fatty tissues. The bacteria are eaten by bottom feeding worms and other invertebrates, which in turn are eaten by fish. Humans and other mammals then eat the fish and get the load of mercury compound from the fatty tissues of the fish.

Coal-Water Interactions: Impacts From Waste Water Discharge

If the waste water from the pipeline is not used for cooling or other processes at the power plant and if it cannot be disposed of through evaporation, then it will have to be discharged into a lake or river. Discharging spent slurry waters into the natural waterways will have a significant impact on the environment. Recycling or treatment will be necessary.

The major effects that finely ground coal will have on the water transporting it will be: discoloration from the presence of coal dust and dissolved organic material, increased water hardness and acidity from minerals and inorganic salts dissolving out of the coal, and the presence of dissolved organic compounds.

Coal Dusts

Coal dusts and fine sediments still remain in the water after the slurry has been centrifuged at the power plant. Decaying organic material, like the decaying vegetation that causes streams leaving peat bogs to look brown, also dissolves into the water from the coal. Both of these, although they do not pose a significant problem in themselves, cause the water to have an unappealing brown color.

Inorganic Salts

Inorganic salts and other minerals that leach from the coal are of greater concern. Because many small particles expose much more surface area to

the water than large pieces of coal do, leaching takes place more readily in a coal slurry.

The major minerals that leach from the coal during transport are carbonates, or chemicals like limestone, and sulfates, sulfur containing compounds that can produce sulfuric acid. Chloride containing compounds, like table salt, will also leach from the coal.

The amounts of these compounds that leach from the coal will vary according to the kind of coal and the place of origin, but overall the effects will be an increase in acidity, an increase in dissolved solids, an increased in the sulfate content of the water—which also increases acidity—and an increase in water hardness from the dissolving of calcium and iron carbonates and calcium sulfate compounds. The increased acid and water hardness eventually translate into corrosion and boiler scale in industrial pipes and corroded, scaly pipes in household plumbing. These effects are less health hazards than technological problems. Two recent studies (2, 3) have shown that these effects occur under simulated pipeline conditions and that water treatment to correct them will be necessary.

In addition, when the water is more acid, more minerals dissolve into the water, increasing both its hardness and releasing more of the minor constituents of coal, such as mercury and lead, into the water. In time, the discharge of acid waters into lakes can cause them to become more acid, which affects fish populations.

Toxic elements, such as mercury, antimony, lead, cadium, selenium, and arsenic, usually occur in coal as sulfur compounds that do not dissolve readily and that should not, therefore, be leached to any great extent during transport in the pipeline. Nevertheless, the minerals that contain these elements may become more soluble either by combining with oxygen from the atmosphere or from being ground to small particle size. Oxidation, or the combining of a chemical with oxygen, may take place more easily when the coal has been ground to fine particles or exposed to air, water and microorganisms, conditions that are likely to occur in stored coal awaiting slurrying.

Dissolved Organic Matter

Although simulated pipeline studies have shown that organic, or carbon containing compounds to dissolve into the water, no one knows exactly which organic compounds dissolve from coal in a pipeline slurry. Coal mine drainage, however, contains the compounds listed in the table below:

Compounds Identified in Coal Mine Drainage

methylene chloride	chloroform
benzene	dibutyl phthelate
toluene	1,,1,1-trichloroethane
1,1,2,2-tetrachloroethane	ethylbenzene
1,2-dichloroethane	anthracene
phenanthrene	2,6-dinitrotoluene
chlorobenzene	

and it is reasonable to suppose they would leach into pipeline water as well. Of these, benzene, phenanthrene and anthracene are know as carcinogens.

In addition,, coal contains a great number of organic compounds that can be selectively leached by organic solvents, chemicals like cleaning fluid. Although most of these compounds are not very soluble in water, additives, such as anticorrosive agents or detergents added to keep the coal particles from clogging the pipes, may cause them to dissolve more readily. Some of these compounds, such as benzene, are toxic in very low concentrations. Some hydrocarbons may be converted to more toxic forms, such as chloroform, by chlorination during water treatment. Still others, the highly toxic polynuclear aromatic hydrocarbons—the naphthalenes, phenanthrene, pyrene, fluorene, anthracene, and chrysene—are all potent carcinogens. They are produced from coal during burning, surviving the burning to escape with the fly ash. But they may also be leached from coal into water, where their fate is not well known. They are not degraded during biological water treatment and would therefore be discharged into the environment. Thus, coal slurry waste waters are likely to require special water treatment such as tertiary treatment-solids separation, biotreatment and active carbon filtration.

Research Needs

As we can see from the above discussion, there are a number of water quality problems associated with coal slurry pipelines. Before such pipelines are built, then, we need more research to answer the following questions:

1. What are the leaching rates of inorganic chemicals for Western coals under simulated pipeline conditions?

2. To what extent will organic compounds dissolve into pipeline water? What are the effects of such additives as anti-corrosion agents and detergents on the leaching of organic compounds?

3. How effectively can large scale waste water treatment processes remove the inorganic and organic constituents of coal slurry waste waters?

4. What are the public health impacts of accidental discharges of waste waters to rivers or aquifers?

There has been little information of this kind derived from existing pipelines, but priority should be given to the study of operating systems rather than laboratory systems. With proper design and a better understanding of how coal and water interact, appropriate technology to solve most of the environmental problems exists. It may, however, be expensive.

Conclusions

Construction of coal slurry pipelines will pose problems of water quality which must be considered before such pipelines are built. The major water quality problems are degradation from dissolved organic compounds. Appropriate large scale water treatment plants will be needed to bring coal slurry waste waters to acceptable federal and state criteria.

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