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A FIVE-YEAR PLAN
FOR
WATER RESOURCES RESEARCH AND
ASSOCIATED TECHNOLOGY TRANSFER NEEDS

For The

Office of Water Research and Technology
U.S. Department of Interior

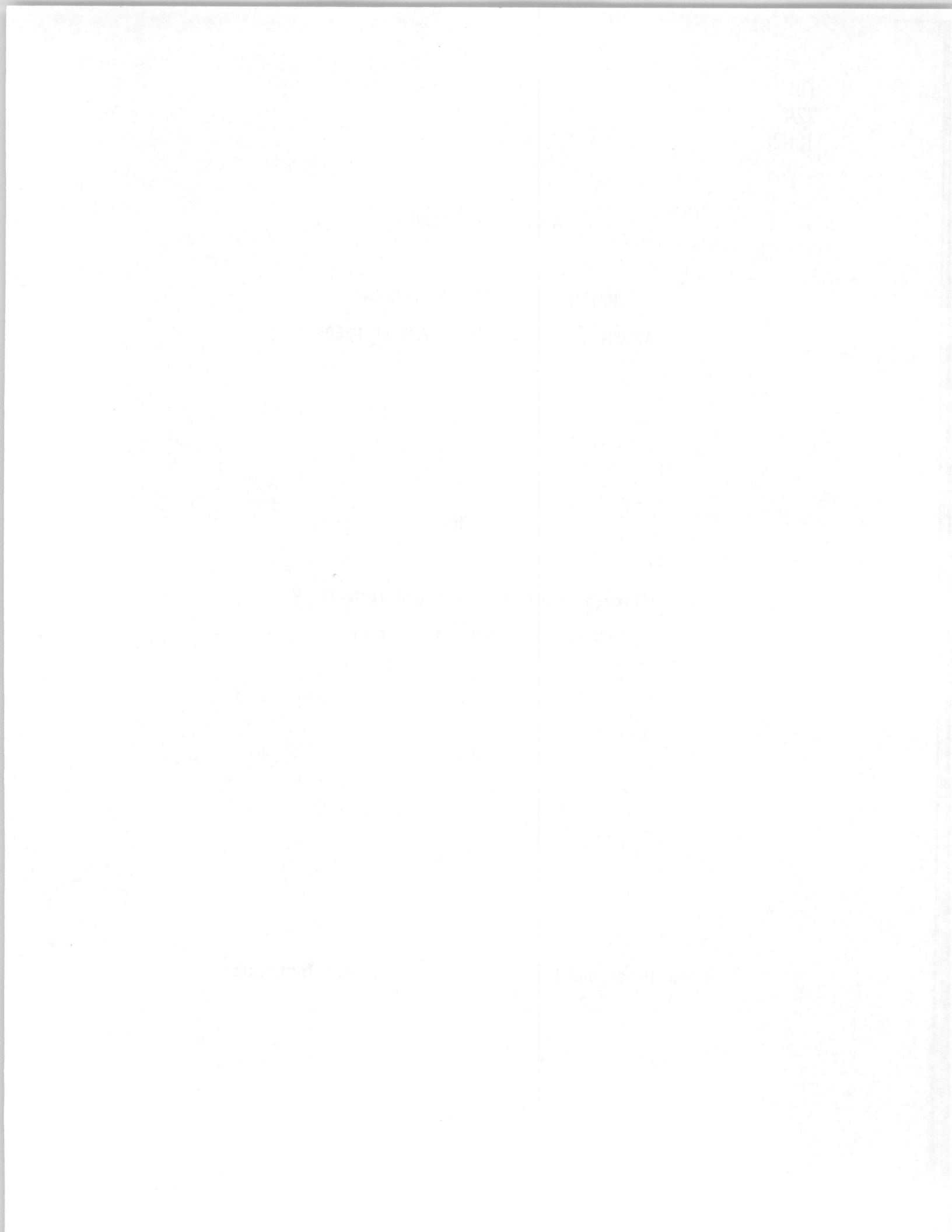
by

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INTRODUCTION AND STATEMENT OF GOALS

This five-year comprehensive plan for conducting research and information dissemination has been prepared to serve the State of Idaho's and the Nation's research needs in the field of water and related land resources. As a part of a national program sponsored by the U.S. Office of Water Research and Technology and an integral part of the University of Idaho's mission it addresses the three-fold purpose of research, instruction and service. The basic objectives of the research plan and the goals of the Institute are as follows:

1. To promote research that is relevant to state and regional needs with emphasis on economic resource development, preservation and enhancement of environmental quality, and social well-being of people with concern for conservation of water and related land resources.
2. To stimulate, coordinate, and provide leadership for research in the established units of the University and in cooperation with sister institutions. Such research should utilize an interdisciplinary approach involving personnel in an efficient manner thereby meeting a goal of performing an educational function by giving opportunity for training of students.
3. To cooperate with and serve local entities, state and federal government agencies in carrying out their responsibilities concerned with water and related land resources and to provide for involvement of the public in identifying research needs.
4. To assist current and potential researchers in proposal preparation, contract negotiations and report writing.
5. To provide for dissemination of the research findings in an expeditious and comprehensible manner to local, state and national users.

6. To seek ways of financing the needed research and program efforts and to encourage cooperation with regional research centers in conducting an efficient and productive research effort.

DEVELOPMENT OF THE CONSIDERATIONS AND RESEARCH NEEDS

The process of inventorying those considerations, ideas, and research needs followed study of relevant reports identifying water problems and research, and compilations of comments from researchers, potential researchers, water managers, and the leaders and professional staff of various entities concerned with water and related land resources. The first step in the inventorying effort was to identify the water resources planning considerations and water use categories that are important to Idaho and the Pacific Northwest region. The Appendix contains two tabular matrices (Table 6 and 7) that were used in making the inventory. The major planning considerations and research needs were arrayed and identified with respect to water uses, economic consideration, and institutional considerations; and a tally was made as to whether the problems were mentioned in recent published reports. The references cited in the Appendix with appropriate numbers are those used in the appraisal.

From this identification of these water resource problems and considerations an evaluation was made as to the timeliness and importance of the problems. These problems were then grouped in five categories each with a common focus and a further screening made of their importance. An example of how response was obtained from outside entities is the agency reply from the Idaho Department of Health and Welfare which is also presented in the Appendix. The final five categories of concern are:

1. Energy
2. Irrigated agriculture
3. Environmental
4. Institutional and social
5. Water conservation

The following are five tables summarizing and cataloging research needs including in many cases needs for technology transfer. From all these interviews, letters and reviews of recent reports the authors have established a listing of priority problems that need our most immediate and urgent attention.

TABLE 1 WATER RELATED RESEARCH AND TECHNOLOGY TRANSFER
NEEDS PERTAINING TO ENERGY.

Evaluate the interrelationship of existing hydropower production and new development of hydropower with alternative energy production from wind, solar, geothermal and biomass in Idaho's small scattered communities and remote locations.

Evaluate specific pumped storage sites; with particular emphasis on environmental considerations and studies of water management problems with revised water delivery schedules.

Evaluate specific hydropower potential in the State of Idaho and examine the practicality of microhydro units developed by private developers including use and testing of centrifugal pumps used as turbines.

Evaluate and develop new technology for utilizing moderate to low temperature geothermal water for heating and other uses. There is need for careful economic and engineering analysis of all kinds of heat exchangers and heat pumps, and control used in realistic situations to insure energy efficiency.

Identify and conduct subsurface and surface geologic, geophysical, and hydrologic studies of occurrence of geothermal waters in order to determine the most efficient methods of developing the resource.

Evaluate the potential of specific offstream and underground storage of water for electrical energy generation in different modes of production, such as peak power, pumped storage and firm power.

Develop new and more sophistication of river and reservoir management models for application to regionally coordinated power generation within a broad multipurpose framework of water use. Research emphasis to be on how reservoir operations and existing water use practices might be changed. Needed is definition of relation between water supply from state and areas of origin and equitable distribution of the flow of benefits from energy production.

Evaluate energy use in irrigated agriculture and in pumping for municipal and industrial use to achieve greater efficiency in the use of electrical energy.

Evaluate water needs and considerations for fossil fuel and nuclear power plants in the broadest application including, water consumption, return flow and siting problems.

Evaluate institutional and attitude problems related to further small scale hydro development in Idaho, particularly the problems in financing, management, ownership and operation of new plants.

Assess energy load management problems particularly as it relates to irrigation pumping, industrial plants and municipal electrical demands.

TABLE 2 WATER RELATED RESEARCH AND TECHNOLOGY TRANSFER
PERTAINING TO IRRIGATED AGRICULTURE.

Evaluate erosion control on both irrigation and dryland farms with emphasis on the study of costs of implementing control practices. Evaluate new methods for on-farm control of erosion.

Evaluate and collect current data for determining irrigation water requirements for all common crops to help in planning, management, and regulation for irrigation use of water.

Evaluate recharging groundwater aquifers in up-gradient areas and in irrigated areas for irrigation use.

Develop cost effective and energy efficient methods of applying and controlling irrigation water at the individual farm operation.

Evaluate irrigation facilities and practices to determine the optimum irrigation water supply distribution and application systems that achieve maximum net returns subject to energy, social, and water restraints.

Develop technology and information transfer programs to facilitate implementation of land management practices which will reduce erosion on agricultural lands and improve water quality in receiving streams.

Evaluate and disseminate information on conjunctive surface-groundwater systems in agricultural use.

Evaluate water stress on plants and deficit water supply for irrigation management and planning including the physical and economic impacts of water shortages.

Evaluate the impact of new energy uses like biofuels production on the economics of irrigated agriculture.

TABLE 3 WATER RELATED RESEARCH AND TECHNOLOGY TRANSFER
PERTAINING TO ENVIRONMENTAL CONSIDERATIONS.

Evaluate specific habitat requirements of aquatic organisms, fish and wildlife including food chains, water quality, water quantity, and flow fluctuation. Evaluate the effect of man-made alterations on the resiliency of the natural systems.

Develop improved watershed, stream, lake and reservoir modeling capabilities for purposes of displaying and understanding ecosystem interactions. Particular research should include sufficient basic data acquisition to make the studies relevant.

Evaluate the impact of volcanic ash fallout from Mt. St. Helens eruption on the watershed, stream and lake systems to determine ways of coping with such catastrophes and to help in any rehabilitation efforts.

Develop improved fish passage facilities at dams which impede fish movement including test facilities to study the problem.

Develop flow needs for migrating fish and study flow changes and dedicated storage for protection and enhancement of resident and migratory fish resources. Include studies on water management schemes to accomplish protection and enhancement.

Develop improved water quality and water quantity controls for fish hatcheries.

Determine practical means of controlling erosion, scour and channel degradation through improved design criteria for water control structures and transportation facilities in and on the river system.

Develop improved techniques for defining instream flow requirements and develop better criteria for relating flow requirements to stream physical characteristics, particularly in areas with minimal streamflow measurement data.

Evaluate ecosystems related to lakes of Idaho. Develop criteria for evaluating the pollution extent and possible corrective measures. Include necessary data acquisition to make a viable evaluation of the problem.

Evaluate the positive and negative effects of public recreation on various types of aquatic environments including the origin and characteristics of user groups to help in management and planning for that aspect of Idaho's water resource.

Evaluate flood problems particularly in urban areas where development is changing runoff behavior and endangering society in a subtle way.

Assess the impact of the resurgence of mining activity throughout the State on water quality and water quantity, particularly dredge mining effects of small scale operations.

Assess the impact of oil and gas exploration and possible development on the fish and wildlife habitat of the overthrust area of Idaho.

Develop improved technology and information transfer to facilitate better management of pollution from non-point sources including erosion, adverse impact of recreation users, forest and range uses of watersheds, and irrigation return flows as well as from domestic waste disposal.

Evaluate present fishery management of anadromous Snake River Salmonids and determine if alternative fishing methods can be developed that allow harvest of abundant stocks but preserve threatened stocks.

Assess the role of diseases found in fish in natural stream compared to fish produced in hatcheries and released in streams and lakes.

TABLE 4 WATER RELATED RESEARCH AND TECHNOLOGY TRANSFER NEEDS
PERTAINING TO INSTITUTIONAL AND SOCIAL CONCERNS.

Evaluate need and ways of consolidating of canal companies and irrigation districts to obtain more efficient management and operation of irrigation systems.

Evaluate current attitudes and incentives for improved methods of irrigation and control of water.

Evaluate water right policies and laws particularly in federal, state, and interstate rights conflicts. Identify possible legal changes in water rights administration that will provide more efficient use of water for economic development, preservation and enhancement of environmental quality and social well being of people.

Evaluate the effectiveness of various administrative units (federal, state, local and private) in obtaining, implementing, and sustaining programs like water saving and water quality control.

Develop methodology for predicting the acceptability of water development plans and programs to government units, to regulatory agencies, and to the public at large.

Determine attitudes of people toward environmental concerns and seek expressions for weighing decisions for management and control of water resources.

Update and improve methodologies for studying the tradeoffs between various uses of water particularly the competition between instream and diversion type uses and relating this to the decision making process. Develop acceptable units for measuring tradeoffs.

Evaluate problems of Indian fishing rights and the management and control of water as it relates to migratory fish.

Assess the potential for and problems concerned with water-based recreation in Idaho particularly as it applies to urban populations.

TABLE 5 WATER RELATED RESEARCH AND TECHNOLOGY TRANSFER NEEDS
PERTAINING TO WATER CONSERVATION CONCERNS

Determine economic and technological potential for controlling water quality and recycling water from food processing, aquaculture, forest product industries to achieve savings in water.

Determine the potential for artificially recharging dry or unsaturated aquifer systems for long time water storage.

Identify and determine legal implications and potential conflicts pertaining to saved water resulting from conservation practices.

Develop improved information transfer program to encourage conservation of water in all diversional uses such as municipal and industrial use and irrigation use.

Evaluate methods of assisting municipalities in planning for domestic and industrial water use that will be conservative of energy and of diversional use of the water.

Evaluate the physical, economic and institutional impacts of alternative water conservation policies particularly studies of changes in the extent of irrigation diversions with different agricultural and reservoir operational practices.

Determine improved methods for predicting irrigation water demands based on climatic, physical and social parameters to enhance water planning and river regulation for achieving better resource use efficiency.

Investigate chemical waste disposal in its broadest connotation as it impacts particularly the surface and ground waters of the State including means of monitoring chemical wastes over long periods of time and over extensive geographic areas.

Determine methods of quantifying water input into areas where precipitation measurement and stream gaging is minimal, particularly as it relates to urban areas where water control for storm runoff is critical.

Develop improved technology for studying the ground water resources of the state, including methods for extraction of the water and ways of determining the safe and economical limits of that development.

PRIORITIES AND ALTERNATIVES

Limited faculty time and funding are constraints which demand placing priorities on the various problems that need to be addressed. Concurrently it must be recognized that the talents of reserchers cannot change markedly and alternatives for study must be available to develop realistic programs. Discussion on various inputs for the plan indicate the following are priority research consideration that should be approached at the University of Idaho.

Update and improve methodologies for studying tradeoffs between various uses of water particularly the competition between in-stream and diversion type uses and relating this to the decision making process. Develop acceptable units for measuring tradeoffs.

Develop new and more sophistication of river and reservoir management models for operational studies of power generation within a broad framework of multiple purpose uses of water and define relation between the water supply and an equitable flow of the benefits.

Evaluate water stress on plants and deficit water supply for irrigation management and planning including the physical, economic, and social impacts of water shortages.

Develop improved technology and information transfer programs to facilitate management of pollution from non-point sources including erosion, adverse impact of recreation users, forest and range uses of watersheds, and irrigation return flow as well as domestic waste disposal.

Develop improved technology for studying the ground water resources of the State including methods for extraction of the water and ways of determining the safe and economic limits of that development.

Develop improved techniques for defining instream flow requirements and develop better criteria for relating flow requirements to stream physical characteristics particularly in areas with minimal stream-flow measurement data.

Evaluate the impact of volcanic ash fallout from Mt. St. Helens eruption on the watershed, stream and lake systems to determine ways of coping with such catastrophies and to help in rehabilitation efforts.

Evaluate the physical, economic and institutional impacts of alternative water conservation policies particularly studies of changes in the extent of irrigation diversions with different agricultural and reservoir operational practices.

Evaluate water right policies and laws particularly in federal, state, and interstate conflicts. Identify possible legal changes in water rights administration that will provide more efficient use of water for economic development, preservation and enhancement of environmental quality and social well being of people.

Evaluate institutional and attitude problems related to further small scale hydro development in Idaho. Particularly problems of financing, management, ownership and operation of new plants.

Investigate chemical waste disposal in its broadest connotation as it impacts particularly the surface and groundwaters of the State including means of monitoring chemical wastes over long periods of time and over extensive geographic areas.

IMPLEMENTATION OF PLAN AND RECOMMENDATIONS

A plan must always be flexible to meet changes in conditions and availability and interests of researchers. In reviewing all new proposals applicability and approach should be weighed against the objectives that the research have emphasis on economic resource development, preservation of environmental quality and concern for the social well being of people. A balanced mix of these objectives has been sought in listing the priority research problems. Hopefully, a more committed thrust will be a concerted effort for studies of ways to achieve conservation of water and related land resources.

The plan suggests a continuation of research being conducted within the traditional departments of the University, recognizing that several projects have evidenced extensive cooperation in an interdisciplinary sense between different departments. Future studies will be encouraged to be undertaken in an interdisciplinary manner. Present discussions on campus tend to favor linking water research with energy research in a more organized way.

Research has in the past been undertaken by Ph.D. and Master Degree students providing an excellent training for people to find useful roles in industry, in municipalities and in federal and state organizations that function in planning, management and control of water as a resource. Continued stress on involving graduate students is anticipated and will be encouraged.

The faculty and staff of sister institutions will continue to be invited to participate in the research and information dissemination functions of the Institute. More use of the affiliate faculty provisions should be fostered in the graduate program that is well established at the University of Idaho. The cooperation of staff engineers and scientists working for federal research laboratories and for state government agencies has through the affiliate faculty program enriched the offerings and output of trained people at the University of Idaho. This should be continued and encouragement given to enlargement.

In the realm of extending cooperation and in serving local entities, state and federal agencies, there has been in the past informal study teams functioning in water quality and surface water primarily under the sponsorship of the Idaho Department of Water Resources when it was developing the Idaho State Water Plan. It is recommended that these study teams be reactivated and if necessary sponsored by the Institute to foster more cooperation with agencies. Active representation at Idaho Water Board meetings is another recommendation

as well as active staff participation in such groups as the Idaho Water Users Association. Past State Water Conferences have been jointly sponsored by the Institute and other water organizations. This should be encouraged and actively pursued as a means of disseminating information on water research.

A newsletter has been a means of providing information transfer. The possible closer integration of this as a publication with the Cooperative Extension Service and other news media activities of the University of Idaho should be encouraged.

In conclusion the Institute's research program should be, "problem oriented" and place emphasis on developing criteria, methodologies or principles and in accumulating data which the practitioner can apply. Relevancy should be measured against the defined goals of the Institute of research, teaching, and service. Perhaps the greatest value of the Water and Energy Resources Research Institute to Idaho is serving as a catalyst among state, local and private sectors for identifying water and related problems and issues. At all times the Institute leadership and faculty should use its utmost in ingenuity and efforts to solve problems in a timely manner.

APPENDIX

CONSIDERATIONS AND RESEARCH NEEDS
CITED IN DOCUMENTS AND REPORTS

REFERENCES CITED

EXAMPLE RESPONSE FROM COOPERATING ENTITIES

TABLE 6.

MAJOR WATER RESOURCE PLANNING CONSIDERATIONS
CITED IN RECOGNIZED DOCUMENTS AND REPORTS

Major Planning Considerations	Reference Document: Consult List of Reference for Detail					
	13, 14, 15	10	11	2	5	6
1 Economic Tradeoffs		X		X	X	
2 Energy Alternative	X	X	X	X	X	X
3 Environment Natural and Cultural	X	X		X	X	X
4 Fish and Wildlife	X	X		X	X	
5 Flood Damage Reduction	X			X	X	X
6 Instream Flow Requirements	X		X	X	X	X
7 Irrigated Agriculture	X	X	X	X	X	X
8 Land Management, includes Erosion Sedimentation	X	X		X	X	X
9 Legal and Institutional		X		X	X	
10 Municipal and Industrial Water Supply	X	X		X	X	X
11 Navigation	X			X		
12 Water Based Recreation	X	X	X	X	X	X
13 Water Conservation	X	X		X	X	X
14 Water Quality	X			X	X	X
15 Weather Modification				X		X

TABLE 7

WATER RESOURCES RESEARCH NEEDS
CITED BY RECOGNIZED PLANNING DOCUMENTS

Research need	Reference Documents: Consult: List of Reference for Detail									
	17	9	2	7 & 8	6	12				
1 Economic Tradeoffs		X			X	X				
2 Energy Alternatives		X	X	X	X	X				
3 Environment (Natural and Cultural)		X		X		X				
4 Fish and Wildlife	X	X		X	X	X				
5 Flood Damage Reduction										
6 Instream Flow Requirements	X	X	X	X		X				
7 Irrigated Agriculture	X	X	X	X	X	X				
8 Land Management, Includes Erosion Sedimentation		X		X	X					
9 Legal and Institutional		X	X	X	X					
10 Municipal and Industrial Water Supply	X			X		X				
11 Navigation										
12 Water Based Recreation	X	X		X						
13 Water Conservation			X	X	X	X				
14 Water Quality	X		X	X	X					
15 Weather Modification			X							

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STATE OF IDAHO

DEPARTMENT OF HEALTH
AND WELFARE

DIVISION OF ENVIRONMENT
Statehouse
Boise, Idaho 83720

September 29, 1980

Warren Reynolds
Rt. 2
Kuna, ID 83634

Dear Warren:

I have assembled a list of potential research projects, as you requested. The projects are listed below with the name of a contact person in our Bureau who you can get more information from. If some of these projects are not the type you were looking for, feel free to eliminate them.

The projects are:

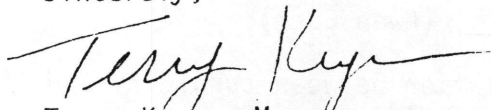
1. Development of a method to produce sediment rating curves for use with the State's Water Quality Standards. (Gwen Burr)
2. The effectiveness of diel versus daily water quality sampling for Idaho streams. (Gwen Burr)
3. Correlation between turbidity and other light penetration parameters. (Gwen Burr)
4. The monetary benefits from cleaning up Idaho streams. (Susan Lowman)
5. The overall water quality impacts of implementing agricultural best management practices. (Susan Lowman)
6. The effects on groundwater quality of agricultural injection wells. (Susan Lowman)
7. The extent of water quality problems from silviculture in Idaho. (Susan Lowman)
8. The effects of leakage from tailings ponds on groundwater quality. (Susan Lowman)
9. The effects of dredging on salmonoid spawning. (Susan Lowman)
10. The environmental effects of oil and gas exploration in the overthrust belt of eastern Idaho. (Susan Lowman)

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11. The synergistic effects of various toxics on water quality. (Mike Smith)
12. Establishment of the natural radiation levels for groundwater in Idaho. (Mike McSorley)
13. Development of methods to produce accurate nonpoint source pollution assessments. (Steve Bauer)
14. Application of biological water quality monitoring methods to water quality management. (Steve Bauer)
15. Development of a model which would allow the establishment of density limitations for subsurface sewage disposal systems. (Dennis Gray)
16. Establishment of levels of exfiltration from sewage treatment lagoons that can be allowed without affecting groundwater quality. (Bob Braun)
17. Determination of the effects of stormwater runoff from major urban areas of the state on receiving waters. (Terry Keyes)

Each of the contact people I have listed can be reached at 334-4250. If you need any further information, give me a call.

Sincerely,



Terry Keyes, Manager
Water Quality Management Section

TK/nc

ACKNOWLEDGEMENT

This document was prepared pursuant to a request from the Office of Water Research and Technology of the U.S. Department of Interior to develop a five-year plan for research and information dissemination for the State of Idaho. The process of preparing this plan involved interviews, draft document reviews and advisory committee evaluation trying to come up with a critical appraisal of the important problems that need to be studied. This involved the cooperation of the following entities:

Idaho Department of Lands	Idaho Department of Water Resources
Idaho Department of Parks and Recreation	Idaho Department of Health and Welfare
Idaho Wildlife Federation	Idaho Department of Fish and Game
Idaho League of Women Voters	Idaho Department of Energy
Idaho Power Company	Idaho Pumpers Association
Marsden Williams, Idaho Senate Resources Committee	Morrison-Knudsen, Inc.
Public Policy Research Center, Idaho State University	Idaho Water Users Association
Idaho Cooperative Extension Service, Boise	Department of Geology
Snake River Conservation Research Center	Boise State University
U.S.D.A.	N.W. Watershed Research Center,
U.S. Corps of Engineers, Walla Walla Dist.	U.S.D.A.
U.S. Soil Conservation Service	U.S. Bureau of Land Management
U.S. Forest Service, Intermountain Forest and Range	U.S. Water and Power Service
Pacific Northwest River Basins Commission	U.S. Fish and Wildlife Service
	U.S. Geological Service
	U.S. Department of Energy
	Lyman Wilbur, Consulting Engineer
	Crookham Seed Company

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1. Dr. John S. Gladwell former Director of the Institute who organized the original outline of the document.
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