THE INTERSTATE COMMISSION ON THE DELAWARE RIVER BASIN

AN ANALYSIS

OF ITS ORGANIZATION; OPERATIONS; FUTURE PROGRAMS

by

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March, 1941

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The Interstate Commission on
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Gentlemen:

In accordance with your request for consultation, I have spent considerable time in studying the work and methods of your organization. I have had extensive discussions and conferences with members of your office staff and of your advisory committees, and have given deliberate consideration to the questions which you have directed to my attention. To carry out this study has necessarily required broad consideration of Incodel's program and facilities.

The present review of Incodel activities is intended to cover the field of water control. While it is recognized that watershed boundaries have especial significance in this respect, they do not necessarily have the same significance in connection with regional planning for the use of other natural resources. However, it is most important to note that the use of water is inextricably tied up with that of other natural resources; and planning for the one can be complete or satisfactory only in the degree to which it takes proper account of the others.

My contacts with members of the Advisory Committee on Planning, and on Information and Research, lead me to believe that invaluable contributions in general planning for the Basin can be made through the cooperative efforts of these Committees, especially through the expert counsel and advice available through the individual members.

This report is designed to cover not only the specific inquiries outlined in my assignment, but as well such other features of the Incodel program as are directly related to these questions.

I wish to express my appreciation of the active assistance of your staff, and of the helpful discussions with members of your Commission and your advisory committees. This generous cooperation has made the review a pleasant task.

Sincerely yours,

Carl A. Bock
Consulting Engineer

TABLE OF CONTENTS

I.

FINDINGS AND RECOMMENDATIONS

General Policies and Objectives

The stated functions and objectives of your Commission are to promote and assist in the formulation and execution of policies and programs for the wise use, development and control of the natural resources of the Delaware River Basin.

I believe these functions are a fundamental right and responsibility of the several interested states. I believe the states can effectively, economically, and democratically exercise these functions and accomplish these objectives by means of interstate cooperation through a pooling of their interests, facilities, and efforts.

For such interstate action Incodel, as the coordinating agency of the states, with its technical advisory committees to guide and supervise its programs, is a practical and effective form of organization.

Progress and Accomplishments

Since its creation in 1936, Incodel has made remarkable progress towards its primary objective, and has produced most valuable results, demonstrating clearly the soundness, economy, and effectiveness of its methods.

Incodel has performed a valuable service in attacking and directing attention to specific regional problems. This attack has resulted in the determination of guiding principles and policies which are important and essential to orderly development.

The plan devised and adopted for the correction and control of water pollution is a notable achievement. Incodel should urge its complete ratification by the additional requisite legislation, and should study procedures for making its operation continuously effective.

The principles and rules evolved for the control of water supply diversions are sound and equitable, and furnish a satisfactory foundation for future water supply planning. After a reasonable period for review by members of its advisory committees, they should be formally adopted by Incodel, and every effort should be made to secure suitable legislative ratification.

The present programs and facilities for collecting hydrologic data, by existing federal and state agencies, are in general satisfactory and adequate. Studies of specific water problems may indicate from time to time further needs for particular purposes.

Incodel should continue its present policy of study and analysis of basic data and the usefulness of this data.

Incodel has issued a number of printed publications dealing with major water problems. These are attractive, dependable in content, and timely in making available the significant information regarding such problems, and in presenting policies and procedures designed for their solution. This is a valuable service.

My review has convinced me that Incodel has made a wise and effective approach to its problems. It is my considered opinion that a so-called comprehensive plan is not a pre-requisite to individual and current determinations as undertaken by your organization. These determinations, together with results of the work of various other agencies, have developed many of the essential elements of a general plan and program. To this extent a regional plan has been shaped and is in existence.

Future Program

The study of actual needs and opportunities which are of regional significance is a direct and effective method for determining workable and practical programs for the use, development and contol of the natural resources of the Delaware River Basin.

It is recommended that Incodel, by this method, make a study of the most promising possibility of multiple purpose development of regional significance. This will require thorough study of major possibilities of use such as water supply, recreation, and power, and should result in the development of policies, controls, and general plans for inclusion in the recommended basin program.

I believe that one of the most important opportunities of Incodel is that of providing a clearing house, liaison channel, and an information center for interested state and federal agencies. A study should be made to determine possibilities of making these services still more useful.

While there appears to be no special or urgent need for hydrologic research in the Basin, it is a proper function of Incodel to promote and stimulate practical technical research by agencies qualified and equipped for this work. It should study and analyze the results of some of the numerous special studies or experimental research projects completed or under way elsewhere.

Adopted policies and programs are important only as they become effective through proper application and practical use. It is recommended that Incodel make a study to develop administrative procedures for operating the adopted policies and programs.

II.

INCODEL'S PURPOSES AND METHODS

The importance and value of our natural resources are now well known; planning for their conservation and wise use needs no defense. The manner of planning, by whom it should be done, and how the plans may become operative, are matters still open to question. Water problems are not limited by state boundaries, nor by the watershed area. This fact has given rise to many interstate controversies regarding the use of interstate waters. The recent Delaware River Case in the United States Supreme Court amply evidences the interest of contending states in the interstate waters of the Delaware River, and to some extent has established and defined their respective rights and responsibilities. The decision in this case furthermore established a new principle as the basis for determining rights and responsibilities in the use of interstate water resources--the basis of reasonable need and beneficial use. This decision leaves no doubt as to the need for effective planning. Such planning, in my opinion, is an important responsibility of the states concerned, and it is their problem to develop the most effective means for its accomplishment.

Cooperative Interest of States

Methods of control and management of interstate river systems are still somewhat in the experimental stage. Various approaches have been made to the problem. One expedient has been the use of interstate

compact commissions, not overly popular because of the usually slow, cumbersome and rather unpredictable progress. Another is the resort to interstate litigation, but this too is slow and in some cases has been very costly.

Partial solution of interstate water problems has been sought through the federal jurisdiction of navigable streams, and federal control in recent years has been greatly extended through various federal flood control acts; by a series of interpretations through the Supreme Court of the United States under which the commerce clause of the constitution has been informally amended; and by the fairly recent establishment of federal corporate "authorities". In some cases, (in the Tennessee Valley and in the Pacific Northwest) the federal authority, through special legislation, has been extended to extreme limits, permitting the imposition of plans by regional federal agencies without state or local participation. This recent and rapid extension of federal powers, spurred by the ability to get federal appropriations, has encouraged numerous federal agencies to enter the field of water control planning, even to the point of surveying the smallest headwater streams and the individual private lands on which they originate.

A serious disadvantage of regional federal authorities, in my opinion, is the tendency and the power to expand such authorities into what amounts to a duplication of the functions and facilities of federal, state, and local governments. Miniature countries within the country result, and if this practice were engaged in extensively, as contemplated in proposed federal legislation to blanket the nation with seven additional regional federal authorities, it would result in inestimable duplication, confusion, and waste. Recent evidence of this tendency in support of further federal

control is the decision of the United States Supreme Court in the New River Case, which indicates federal interest in a wide variety of water problems. In this connection it is interesting to recall that the most detailed and exhaustive study ever made of the Delaware River, that of the United States Army Engineers, published in 1934, concludes that "Federal participation in any project for the comprehensive use of the water resources of the river above Trenton is not warranted."

A new and most promising approach to unified water resources control on interstate streams is the use of a cooperative interstate organization, such as the Interstate Commission on the Delaware River Basin. While unprecedented in its plan to organize and coordinate interstate action and controls, along with federal programs, its aim to utilize such cooperative effort is similar to that of earlier intrastate organizations such as the Miami Conservancy District in Ohio, which aimed to effect intrastate cooperation within a specified area. This approach has the advantage of recognizing local responsibility and requiring local participation in the initiation and execution of plans. It insures suitable consideration of states' rights and interests; it makes direct use of the skill, experience, and information available from state and local agencies; it permits full cooperation with agencies of the federal government without undue duplication or waste.

A discussion of the relative merits and disadvantages of these various expedients for dealing with interstate water problems would fill volumes.

In the case of the Delaware River, my own opinion, based on extensive experience with these various expedients, and on my previous study and present review, is that a cooperative interstate organization such as Incodel offers the most satisfactory, the most effective, and the most economical means yet devised for meeting the interstate water problems of the Delaware River Basin.

Organization and General Methods

Continuous, correlated, advisory planning is necessary to the wise use of our natural resources. The Incodel form of organization is admirably adapted to render such service for it is, essentially, a service organization, which does not seek to usurp legislative, administrative or executive functions of existing state agencies.

The present organization comprises:

1. The Commission, comprised of one State Senator, one member of the House of Representatives, one administrative appointee of the Governor, and an official from the State Planning Board in each of the participating states.
2. Technical Advisory Committees, composed of experts in their respective fields, on:
   - Information and Research
   - Planning
   - Quality of Water
   - Quantity of Water
3. A central staff of seven persons, conveniently located in Philadelphia.

The staff provides for definite continuity and correlation of planning; a most important function in dealing with long-range, forward-looking plans. It discloses opportunities for cooperative effort, and provides a planning nucleus for correlating and utilizing existing information and facilities without conflict or duplication.

The Advisory Committees are composed of members of the State Planing Boards in the area and a member of the National Resources Planning Board; the Chief Engineers of the State Departments of Health; officials representing the responsible water supply agencies of each state, representatives from educational institutions in the region, and technicians from federal and state agencies. The planning and engineering skill and experience represented by this membership comprises an advisory service of the highest type.

Working under the general guidance and inspiration of the Commission, the organization has access to the combined planning facilities and technical resources of the several states, and, in a more limited sense, to federal agencies operating within the region. This form of organization permits sufficient elasticity to adapt itself to changing conditions.

III.

INCODEL'S PROGRESS

Accomplishments Through Cooperation

The work of Incodel is concerned with that of many state and federal departments and agencies as well as that of many private interests. The numerous agencies engaged in the collection of hydrologic data, and in water control studies and planning, have excellent facilities and experienced personnel for this work and are getting good results. Obviously with so many agencies active, in closely related and overlapping fields, some duplication is unavoidable. The National Resources Planning Board has made an important contribution in correcting such duplication by promoting cooperation and by directing planning efforts towards comprehensive accomplishments. In view of this general situation the methods by which Incodel has undertaken its unique and difficult task of correlating these extensive planning resources, should be gratifying to the various groups interested in the Delaware River Basin.

One approach might have been to embark immediately on a survey of the entire Delaware River Basin for all purposes, spending great sums of money and duplicating or setting aside much valuable work previously done by other competent agencies, on the theory that the completion of an all-inclusive plan is a pre-requisite to a satisfactory solution of major problems regardless of their importance and urgency. Such a survey, in time, would have indicated important conclusions, previously well established,

such as the paramount importance of water supply, the critical effects of water pollution, the lack of navigation problems, the limitations of flood control work, and the conflicts between water power and other uses.

Instead of such a blanket survey, Incodel chose to make a direct attack on obvious, important and pressing problems of regional significance and to consider such problems in relation to multiple purpose possibilities. The valuable results achieved by this method, at a remarkably small expense, can leave little room for doubt as to its wisdom.

The outstanding achievement of Incodel, I believe, is its success in bringing together, for the first time, representatives of interested state agencies as well as those of federal agencies, in a concerted attack on interstate water problems. This undertaking has been aided by the compilation and timely publication of valuable data for the presentation of major problems of the Basin. An important result of this achievement, in my opinion, is the progress which has been made in substituting arbitration methods for litigation in water controversies. This seems particularly significant because of the large expenditures of public funds spent by these states, in the past, for litigation, and because it exemplifies one of the primary objectives of Incodel. Another notable accomplishment is the substantial and consistent progress that is being made towards functioning as a clearing house for information, as a coordinator in fact-finding activities, and as a sponsor for cooperative action among the several states and their departments in developing policies, practices, and legislation important to each of the states in the Delaware River Basin.

The plan developed and adopted for water pollution abatement and control may well be taken as a model for similar situations elsewhere. It is compre-

hensive in scope and is designed to permit optimum utilization of the water resources of the Delaware River Basin for all purposes. It provides standards of water quality for the main stream which have been formally adopted by the several State Departments of Health and are now embodied in statutory form. The spur provided by this action to the interested states and municipalities to cease pollution and to provide necessary collection and treatment facilities, in my opinion, more than justifies the entire expense of Incodel to date.

A more recent study, under the supervision of the Incodel Advisory Committee on Quantity, of the effect of diversions of water for domestic water supply purposes has established important basic principles which furnish the fundamental controls within which water uses may proceed in the best interests of all concerned. This work represents the essence of long-range, regional planning. In this same connection, an incidental study of salinity data has produced valuable results.

The results here indicated present conclusive evidence of what can be accomplished with a small force when backed by competent organizations and sound methods. The quantity and quality of these results cannot be measured by the competence of the staff alone. They reflect also the combined experience, skill and judgment of individual committee members, and the leadership and guidance of the members of the Commission.

The possibilities of this form of organization are far-reaching. Through proper organization channels, the technical skill, experience, and accumulated information of such agencies as the state health boards, water and conservation departments, and planning boards are made available. By correlating the efforts of such agencies and by bringing them to bear cooperatively on the major problems of the Basin, Incodel, in my opinion, can

render greater service to its member states than by attempting, through a greatly enlarged organization of its staff and its work program, an invasion of the fields of these various existing agencies.

Approach Through Present Problems

Your Commission, its advisory committees and its staff, have been planning for an orderly water control program in the Delaware River Basin. The procedure followed has been to explore specific problems for the purpose of developing guiding principles and methods of control in the development and use of water resources, and to test these principles and methods by application to proposed projects. While these studies have been directed mainly towards water supply needs, they have approached the problem on the basis of a broad inquiry into all uses and related water problems, and the results not only will be useful but in fact are a component part of a comprehensive program of water control.

I have reviewed much of the work done and now under way, and am of the opinion that the procedure followed by your Commission in this respect is sound and effective and will result in economical, constructive progress. It follows the procedure taken by the United States Supreme Court in the Delaware River Case in 1930, which adjudicated a specific, urgent, but partial development, even though a comprehensive plan for complete development was not available.

I believe that the procedure of your Commission should be determined by the facts, rather than by general theory. There appear to be no issues, present or potential, which would require a general re-casting of a total plan. Any effort to envisage problems which are not now in evidence, which are remote and highly speculative, would inevitably tend to destroy the

realism of the present approach, and add nothing to the useful knowledge of the situation. The facts are largely available, and direct attack on known, urgent problems of regional import, with incidental attention to those having only local significance, will continue to give good results.

Development of Guiding Principles and Policies

The current work of your Advisory Committee on Quantity of Water, in testing principles for controlling diversions or takings of water, and provisions for compensation release, is essential to the formulation of a comprehensive water plan. The work is urgent, it is of regional importance, and its results will be immediately useful. The New York diversion project is now under construction. If the findings of the Committee are to have application to this construction they must be available soon.

I have reviewed this work in considerable detail and my suggestions have been incorporated in its final presentation. The resulting report on Rules Governing Diversions of Delaware River Waters has been prepared with care, and at the expense of considerable time and study by the members of your Committee. It should be noted that the basic principles established under the decision of the United States Supreme Court in the Delaware River Case (283 U.S. 336) relating to the use and diversion of waters of the Delaware River Basin are not questioned nor changed by the findings of this report, but are confirmed, clarified and strengthened. The proposed modifications of the application of these principles represent great improvements. By placing the control at the point of development, the control is made positive, quick, simple, and independent of the

effects of other developments. By a modification of the distribution of amounts of compensating water released, a greater quantity of water is released during periods of extreme low flow, when it results in the greatest amount of benefit.

In my opinion, the principles recommended in this report of the Advisory Committee on Quantity of Water are sound and afford a satisfactory foundation for future planning and execution of water supply projects in this basin. I recommend that they be adopted by your Commission. They are as equitable as can be devised on the basis of a survey of past experience, and further effort in this connection should be limited and directed to such steps as may facilitate formal state ratification.

IV.

THE COMPREHENSIVE PLAN

Basic Data

The competence of any plan is judged first by the data on which it is based. The great quantity of basic data available in the Delaware River Basin, on hydrologic as well as physical, social, and economic features; the numerous agencies engaged in collecting and classifying it; and the intensive study to which it has been subjected in recent years suggests that this part of a plan is largely accomplished. Closer study will doubtless disclose additions or revisions that may be desirable, but the information in general is ample and is readily available.

Hydrologic Data

Summary statements of the extent and availability of information on precipitation, run-off, evaporation, ground water, and infiltration are included in a supplement to this report.

The New Jersey State Water Policy Commission has recommended that the standard gages now being operated by the Weather Bureau at Newton, Belvidere, Pemberton, and Bridgeton should be replaced by stations equipped with automatic recording devices. In 1936, Incodel recommended a program for the installation of 23 new stream gaging stations, and the improvement of six existing stations; eight of these installations have since been completed. I believe these are desirable recommendations and Incodel should support the states in their efforts to carry them into effect.

I believe that information on ground water can be extended to advantage, particularly in areas where it is extensively used as a source of water supply. Incodel should not undertake projects for this purpose, but should keep actively in touch with ground water surveys conducted within its area and should undertake some study of their results, as an independent research project to develop a better basis of judgment as to the value and applicability of such results to specific localities.

Other Data

Incodel has performed a valuable service in the orderly collection and filing of significant reports and publications, maps and charts, and a useful bibliography covering the literature of the Delaware River Basin. It already has on hand a mass of original data developed in its own office, as well as certain documents and information not available elsewhere. Its operation as a central clearing house of significant data is becoming an important function.

Progress Towards A Comprehensive Plan

One of the stated purposes of Incodel is planning for the wise use, of the waters of the Delaware River Basin--it was the recognized need for such planning, in fact, which resulted in its organization. In attempting to carry out such a planning program, however, some confusion seems to have developed regarding just what work should be done, what methods and procedures should be used, and what sequence should be followed in approaching the regional water problems that demand attention. It is believed that this confusion results not so much from differences of opinion on actual water problems and the procedures to be used in their solution, but rather from a lack of definition or common understanding of the term "comprehensive plan".

Present planning cannot envision all future developments, much less provide detail drawings and specifications for them. The kind of planning that Incodel should undertake is that which will provide useful fundamental policies, principles, controls, legislation, and administrative practices to afford a solid framework within which specific regional projects can be accomplished as they are needed. It should devise methods for interstate cooperation in the appraisal of natural resources and in their balanced development and use for the greatest total benefit. It must make a living plan, adaptable to changing conditions and needs.

A vast amount of study has been devoted to the water problems of the Delaware River Basin. While such study admittedly has not achieved complete nor final solutions to these problems, it has nevertheless supplied many of the essential elements for orderly regional development. The basic data is adequate; well considered studies and surveys of major problems have been made from time to time; suitable legal machinery and administrative controls are being provided; important water policies have been developed; current problems and programs are being studied.

For example, New York made intensive studies for a proposal to use certain upstream tributaries for water supply, giving incidental consideration to the effects of such development on other possible uses or developments. Before a disposition was made of this proposal the entire water resources of the Delaware River Basin were subjected to study from all standpoints and searching inquiry was made into many possibilities of use.

Other surveys and studies have been made since that time by federal as well as by state agencies. The "308" report of the U. S. Army Engi-

neers and the Salinity Survey by the State of Pennsylvania may be cited as examples. Such studies and surveys have developed much of the information that is necessary to establish an orderly water control program.

Much progress has been made in establishing suitable legal and administrative machinery for the satisfactory development and execution of regional water plans. In addition to the usual legally constituted state boards of health, water policy and control commissions, planning boards, and metropolitan water boards, the Basin is now equipped with its own Incodel, a regional organization created as a part of the governmental machinery of the cooperating states for the formulation and execution of a unified plan for the use and control of the waters of the Delaware Basin.

Policies and practices have been in the making for years past. For example, the New York State Conservation Commission was created in 1911, an organization which has continued up to the present, and has engaged in the exploration of policies for the development and control of water resources. New Jersey created its Water Supply Commission in 1907. As early as 1915, the Pennsylvania Water Supply Commission published a statement of policy for the unified control of water resources, and a continuous program of study, planning, and control has been maintained since that time. Further steps were taken toward the development of policies for the Delaware River Basin in the interstate compact negotiations of 1925 and 1927, and outstanding accomplishments resulted from the Delaware River Case in the United States Supreme Court decision in 1930. The recent creation of Incodel itself is an important policy-making step, and represents a notable advance in integrated planning.

Any well considered plan must provide some appraisal of the needs and problems involved, and should indicate some program for their solution. Considerable progress has been made in such appraisals. For instance, it has been definitely established that use for water supply is paramount. Pollution would come next. There are no special navigation problems. Irrigation and drainage are not regionally important. Opportunities for flood control are limited. Recreation is exceedingly important. A more complete discussion of navigation, soil conservation, flood control, and water supply is contained in a supplement to this report.

I am convinced that the progress just reviewed has developed many controlling elements of a total plan, and that it furnishes Incodel with reasonably accurate knowledge of the best program of use for the river.

It is recommended that Incodel, as a part of its program during the next two years, undertake the compilation of the existing features of a regional plan into an orderly, authoritative statement of a program for the use and control of the water resources of the Delaware River Basin. This should be prepared in form for publication. A tentative outline for undertaking such a compilation is attached to this report as Appendix B.

V.

RECOMMENDED FUTURE PROGRAMS

Multiple Purpose Developments

An important function of regional water control planning, which recently has been emphasized with persistence, is to discover and resolve possibilities of multiple purpose development. While the number of such possibilities of regional significance in the Delaware River Basin may be quite limited, they are of sufficient importance to warrant earnest consideration.

I believe that the next logical step for Incodel is to undertake a study of the most promising possibility for multiple purpose development. This would require consideration of all possibilities of conflict or use. The choice of project, or particular combination of developments to be considered, would comprise a preliminary part of the study.

Various reports issued in past years have proposed the construction of dams and reservoirs on the Delaware River for multiple purpose use. The most comprehensive and authoritative of these is the "308" Report of the United States Army Engineers, published in 1934. It recognizes the importance of water supply, calling attention to the fact that other uses must be subordinated to it. It presents the following conclusions:

1. The Delaware River is of great value as a source of water supply.
2. Existing and potential hydro-electric values are substantial.
3. Power developments may be combined advantageously with the storage and regulation for municipal water supply projects.
4. Federal participation in any present or proposed project above Trenton, New Jersey, does not appear justifiable.

These conclusions are supported by detailed data in the report, and it is probable that additional data have since been developed by the Army Engineers which would have bearing on these problems.

The study should not be limited to proposals in this report, but should use them as a basis for starting the investigation. All possibilities of use should be considered. It should provide estimates of cost or damages, and estimates of benefits, and should allocate these estimates to various features, such as water supply, industrial use, sanitation, power, recreation, navigation, flood control, salinity, shellfish industry, and other features, so as to permit definitive evaluations or conclusions with respect to these features. Such appraisals are difficult to make, and this difficulty constitutes one of the chief barriers to the development of long range plans in terms of specific projects. I believe, however, that Incodel, by drawing on the experience and extensive information developed by federal, state and other agencies, may be able to make a valuable contribution by developing effective methods for making such evaluations. In any case, the aim of this study should be to make its findings authoritative.

In addition to the examination of combined-purpose possibilities and their potential benefits and conflict, the study should seek to develop

general policies and methods for the protection of future possibilities of interstate development, as has been done in the case of pollution and water supply diversions.

It is recommended that this investigation be conducted as a preliminary study, using information now in existence. It should be so organized and prosecuted as to make full use of the expert counsel and guidance available from the Advisory Committees, it should avail itself of all opportunities of advisory service, information, or cooperative work on the part of federal agencies and state agencies. By enlisting the aid and advice of such experts as state engineers, state geologists, public health officers and others, it is believed that an effective study can be brought to bear on the problems involved.

The study should be planned for completion in a period of two years; and to prosecute it effectively will require some increase in the present staff. A tentative outline for initiating this study is attached to this report as Appendix A.

The limitations of such a preliminary study by a small force should be recognized; it will be in the nature of a preliminary survey which will not be conclusive in all respects. For instance, it might disclose possibilities in an interstate project for combined power, water supply, and recreation so important as to demand more detailed surveys, and to warrant protective controls in the meantime. On the other hand, it might show quite conclusively that recreation would be damaged instead of improved by such a combination, and that conflicts between power and water supply developments are so great as to make any further consideration unnecessary. In any case, this method of direct attack on specific problems will assure

results of great value to the several states, and will provide an important step forward in regional planning for the Basin.

Public Relations

I believe that one of the greatest opportunities of Incodel lies in expanded service as a clearing house, a liaison channel, and an information center for interested states and federal agencies. The great resources of information and capacities for getting things done, which are available in these numerous agencies, can only be capitalized for cooperative action to the best advantage by supplying the best kinds of contact and coordination. Incodel is in an excellent position to make effective use of these facilities by maintaining suitable contacts.

Excellent work has been done in this respect by your Executive Secretary and your Engineer. They should be provided with sufficient assistance and support to enable them to continue the remarkable progress that has been made in bringing together representatives of state, regional, and federal agencies for cooperative attack on interstate water problems. I recommend that more of their time be made available for this important work.

Incodel should also assume the responsibility of making a definitive statement of a coordinated regional water control plan, insofar as such a plan is available, and of interpreting this plan to the public. By making available more of the time of your secretary and engineer, greater progress can be made on this important work.

Research

Various projects for hydrologic research have been proposed from time to time. Doubtless most of these would have merit in extending

our field of knowledge, but there appears to be no special or urgent need for hydrologic research in the Basin at this time. However, it is a proper function of Incodel to promote and stimulate technical research of value to its program, to be undertaken by agencies qualified and equipped for this kind of work. Federal agencies, such as the Weather Bureau, the Geological Survey, the Forest, Park, and Soil Conservation services, and others, are especially well situated to do effective work in the collection and study of basic data. Numerous special investigations and research projects have been undertaken for the study of hydrologic phenomena, in the effort to provide a sounder foundation for study of water problems.

I believe that critical examination of the results of some of the numerous special investigations or research projects completed, or under way elsewhere, would be helpful in furnishing a better basis of judgment for appraising the value of such work. An example of how this might be done to advantage is the recent work of your engineer in examining the results of salinity investigations, which has produced some valuable results. This work should be followed up by a review of the forthcoming report of the Army Engineers on their study of salinity data.

Further collection of ground water data, particularly in areas where ground water is extensively used as a source of water supply, can be undertaken to advantage to extend knowledge of ground water conditions. This can best be done by such agencies as the U. S. Geological Survey, in cooperation with interested state agencies. Incodel, however, should keep in close touch with the work and from time to

time should undertake to study the results with a view to appraising their value for application to the solution of regional water problems.

Another field is the study of allocation of the waters of the Delaware River Basin, not for specific quantitative determination, but for determining basic principles and controls for their equitable use.

Other items which may profitably be subjected to some study are:

Infiltration, factors affecting it, and its effect on run-off.

Quality of Water as affecting oyster and fish life.

Amounts of water which have been carried by the Delaware and Raritan Canal and its feeder.

Problems other than those of water control are important. I am of the opinion that recreation, not only as it may be incidentally tied up with water control projects, but as an end by itself, is a most important consideration in regional planning. While there may be no compelling reason for relating it to drainage basin boundaries, there may be important opportunities for correlated effort in the Delaware River Basin. I suggest that a small sub-committee of the Advisory Committee on Planning be created to direct an active investigation of the possibilities of preserving and developing recreational resources of the Basin.

Considerable attention and expense has been devoted to the possibilities of soil conservation districts, and to soil conservation demonstration projects operated by the U. S. Department of Agriculture. Analysis of the results of this work and their evaluation is suggested as another opportunity for research.

Administrative Procedures

Adopted policies and programs can become effective only as they have practical application to actual needs. While the execution of plans is not deemed a primary function of Incodel, this organization is in a position to render a valuable service in developing administrative procedures for executing and operating the adopted policies and programs. The individual states are amply equipped with administrative machinery for ordinary needs. The cooperative administration of interstate water projects requires some practical means for coordinating these existing facilities. New York doubtless will provide ample facilities for operating its diversions from the Delaware River in accordance with adopted rules and policies, and will provide detailed records of this operation. The other states, however, are entitled to current and continuing information with respect to this operation,and Incodel affords a logical channel for making this impartially available. Likewise in respect to the adopted pollution control program information as to progress and to the status of the operations should be currently available to the interested states. Occasional or periodical inspection of, or contact with, actual project operation might furnish an authoritative basis for keeping suitable records and making these available to the individual states.

Operation of projects and the execution of adopted controls and policies will from time to time develop questions of interpretation and problems regarding the practical application of guiding principles to particular situations, which must be reasonably resolved if the operation is to be successful. By establishing procedures for receiving information or complaints, or applications for action; by making impartial analysis

and reviews; and by submitting formal findings and recommendations in such cases, Incodel could perform a most valuable administrative service without encroaching on established functions and responsibilities of the individual states.

Incodel should make a study to develop suitable administrative procedures. This can be done without increase of its present personnel. Information from such operating organizations as the nearby Hudson River Regulating District, or from some of the intrastate conservancy districts such as the Miami or Muskingum districts of Ohio, might be helpful.

Summary Statement of Recommended Program

As I have previously indicated in this report, two widely divergent policies might be pursued by Incodel. One would be to attempt an appropriation of half a million dollars and embark on a comprehensive survey of the Basin for all purposes. In my opinion, this would result in considerable duplication of effort. However, it would be spectacular; it would develop useful information quickly; it would unquestionably strengthen Incodel's prestige; it would doubtless establish the organization as the undisputed authority on water control problems in the Basin, and would assure it of a commanding position in the case of proposals for regional, multiple-purpose developments.

The alternative would be to continue as at present with a small organization largely as a correlating agency, to progress more slowly by making full use of the facilities of existing planning agencies, both federal and state, and the information and advisory service at the command of these agencies. By attacking urgent and major problems directly, Incodel will, in time, establish itself as the ultimate

authority, and by its economy of operation, its actual accomplishments, and the sheer value of services rendered, should commend itself to the states which it serves. I prefer this approach.

It is my further opinion that Incodel's present policy of functioning primarily as a correlating agency by means of a small, compact, centrally located staff, will best serve the needs of the immediate future. Beyond this general estimate, a long-range program for Incodel and a budget for its accomplishment will depend somewhat on future contingencies as well as on the results achieved. I cannot forecast these developments with sufficient accuracy to warrant estimating a definitive budget for a long-term future period.

Five major activities are recommended for the next two-year period, with respect to the development of water control plans for the Delaware River Basin, as indicated in preceding sections of this report:

I. Interstate Coordination and Information Service

A. Clearing house service for federal, state and local agencies, disseminating general information and advice on the Basin and its problems.

B. Correlation of policies and procedures of federal and state agencies in particular reference to the specific problems outlined in this and other sections.

C. Correlation of the work-programs of federal and state departments, boards, bureaus, and commissions through an expansion of the Commission's advisory committee pattern of organization, where such is required by the progress of the Incodel program.

D. Continuance of the Incodel series of publications both general and technical.

E. Afford opportunity to the Executive Secretary and the Engineer to expand a moderate public relations program.

II. Adoption and Ratification of the Water Pollution and Water Supply Diversion Policies

A. Press for legislative enactment of the Incodel Pollution Law by the States of Delaware and Pennsylvania, to complement the concurrent statute approved by New Jersey and New York.

B. Determine a policy for crystallizing the principles agreed upon by the Quantity Committee for water supply diversions in some definite administrative or legislative form or document.

III. Study of Multiple Purpose Possibilities

A. A preliminary survey designed to estimate the possibilities of a combined-purpose development in the Delaware River Basin by determinations as to:

1. Run-off and yields at a selected group of possible dam and reservoir sites.

2. General design features of such dams and reservoirs.

3. Construction costs for such dams and reservoirs, and other works.

B. Based upon the above determinations an effort should be made to arrive at a reasonable allocation of cost to various features and an appraisal of the value of the multiple purpose projects for various uses, as outlined in Appendix A, including water supply, recreation, sanitation, navigation, flood control, industrial water supplies, fish and fisheries.

IV. Research and Study Projects

A. A critical examination of the results of some of the numerous investigations or research projects completed, or in progress, including such items as:

1. Salinity

2. Ground Water

3. Allocation of water

4. Quality of Water

5. Infiltration

6. Recreation

7. Soil Conservation

V. Development of Administrative Procedures

A. The development of administrative procedures and the drafting of appropriate record forms to supply current and continuing information to each of the states in the Delaware River Basin in regard to:

1. The actual operation of specific projects such as the New York City water supply diversion, possessed of interstate interest;

2. Interstate rules, procedures and policies which are now guiding individual state departments, or which may in the future be devised for particular situations.

APPENDIX A

OUTLINE OF A SUGGESTED PROGRAM FOR A STUDY OF MULTIPLE PURPOSE POSSIBILITIES

Several reports advocating the construction of dams and reservoirs on the Delaware River for multiple purpose use have been advanced in the past. At least one of these was concerned primarily with the development for municipal water supply; others feature the development of hydro-electrical power. Probably most prominent of such reports are: "A Program for the Regulation and Conservation of the Delaware River" prepared for the City of Trenton, New Jersey, in 1929 by Robert E. Horton, Consulting Hydraulic Engineer; and "U. S. House Document No. 179, 73d Congress, 2d Session," prepared by the Army Engineers and published in 1932.

Since it has been definitely established that the highest use of the waters of the Delaware River is for municipal water supply purposes, any study or program of multiple purpose developments must give first consideration to this item.

Horton's Report

Horton's report deals primarily with power and gives practically no consideration to water supply problems. His program was offered in evidence in the Delaware River Diversion Case. The Master hearing the case concluded that while the program probably could be constructed from an engineering standpoint (provided legal imitations were removed) he was not convinced that the development of water power would be financially remunerative.

The "308" Report

The Army Engineers "308" Report is comprehensive. It recognizes the importance of water supply, calling attention to the fact that other uses must be subordinated to it. It presents the following conclusions:

1. The Delaware River is of great value as a source of water supply.
2. Existing and potential hydro-electric values are substantial.
3. Power developments may be combined advantageously with the storage and regulation for municipal water supply projects.
4. Federal participation in any present or proposed project above Trenton, New Jersey, does not appear justifiable.

Suggested Procedure

The Army Engineers "308" Report considers three groups of projects which are designated Project Groups No. 1, No. 2, and No. 3. Project Group No. 1 represents the first stage in the progressive development of the ultimate program conceived by the Engineers Office; Project Group No. 2 represents the program claimed to be most attractive for the development of power; and project Group No. 3 includes all of the more favorable sites necessary to justify dual development of power and of water supply needs in 1980.

For the prospective initial investigation, Project Group No. 1, comprising reservoirs at Tocks Island, Belvidere, and Chestnut Hill, should be selected for examination. It should be assumed that this project could utilize the entire flow of the Delaware River except the 440 million gallons a day which has been authorized for the New York City water supply and also that the New York City project would be operated under such conditions governing diversions as would be mutually satisfactory to the states of New Jersey, Pennsylvania, and New York.

Among the determinations regarding items to be investigated would be the following:

1. Determination of the yields at each of the dam sites on the basis of the presently available stream flow records. These would cover the severe drought which occurred during 1930 to 1932. The study would reflect the effect of the operation of the New York City water supply project.

2. Determination of the general design features for the necessary dams. As an aid in this work, Appendix 2 of the "308" Report giving a description of the selected project sites considered in that study should be consulted.

3. Determination of the estimated construction costs for the dams and reservoirs for the purpose of comparing with those used in the "308" study.

4. Determination of power production estimates for comparison with the figures used in the "308" study.

5. Determination of construction costs for power houses, equipment, and accessories.

Items (1), (2) and (3) undoubtedly have been reexamined by the U. S. Engineer Office, and advantage should be taken of work done by this agency.

Assistance in the work involved in items (4) and (5) probably could be obtained from federal, state, municipal and private agencies

Upon the completion of the above determinations, efforts next should be directed toward allocating the costs to various features and appraising the value of the multiple purpose projects for various uses. Among others, these would include:

1. Value of the project for municipal water supply purposes.

2. Value of the project for the development of power.

3. Value of the project for recreational purposes. This work probably could be done by or in conjunction with the state planning agencies, and U. S. Park and Forest Services.

4. Value of project for sanitation. This work would be done in conjunction with representatives of the State Departments of Health.

5. Value of the project for navigation. It was found by the Army Engineers in the "308" Report that the project has relatively little value for navigation.

6. Value of the project for flood control. This was also investigated by the Army Engineers in the "308" study. It was found that flood control is not a serious problem in the Delaware River and the project would have no considerable value for this purpose.

7. Value of project for private industrial water supplies, including particularly the problem of salinity in the tidal basin below Philadelphia.

8. Value of project for oyster and shellfish industries.

9. Value of the project for other uses.

APPENDIX B

THE DELAWARE RIVER BASIN AND ITS WATER RESOURCES

Skeleton Outline of a Water Plan

I. Introduction and Summary

II. Resources of the Basin

- A. Physical Characteristics of the Basin
- B. Social and economic data and trends
- C. Hydrologic Data
- D. Maps

III. Water Problems

- A. Water Control
- B. Water utilization
- C. Regional problems

IV. Development of Regional Controls and Facilities

- A. Studies, surveys and research
- B. Legislation and adjudication
- C. Policies and practices

V. The Basin Water Plan

- A. Basic Data
- B. Research
- C. Planning and construction of projects
- D. Operation of projects
- E. Administration of policies and projects

THE DELAWARE RIVER BASIN AND ITS WATER RESOURCES

Being a statement of the essential elements of a plan for promoting the optimum development, use and control of the waters of the Basin.

I. INTRODUCTION AND SUMMARY

A. Purposes, scope, character

B. Need for planning - objectives

C. Procedure, controls, assumptions

D. Definitions

F. Summary

Unified development is taken to mean development for all purposes in optimum relationship and balance. Its objectives are the comprehensive, integrated development, control and use of the waters of the basin for the greatest total public benefits.

II. RESOURCES OF THE BASIN (Inventory, analysis, appraisal)

Indicating current programs and deficiencies; recommended additions or improvements; estimates of time and cost.

A. Physical Characteristics of the Basin

Description - location - relation to adjacent basins
Area - extent - topography - geology - minerals
Soils - waters - climate

B. Social and Economic Data and Trends

1. Population (Character, density, rates, trends)

2. Land Use

a. Agriculture, forestry
b. Industry, commerce
c. Mining
d. Transportation, communications
e. Utilities, public works

3. Social Facilities and Trends

a. Education and recreation
b. Health and Safety
c. Unemployment and relief
d. Finance
e. Government

C. Hydrologic Data

1. Precipitation

2. Evaporation

3. Ground water

4. Stream flow

5. Quality of Water

D. Maps

1. Control surveys

2. Planimetric - topographic - geologic - soil maps (Local and regional)

3. Photographic maps

III. WATER PROBLEMS

Including statement of problem; cases or examples; regional significance; appraisal of needs, benefits, cost; plans and programs, present and recommended.

A. Water Control

1. Erosion and siltation

a. Soil conservation
b. Land use and land management
c. Beach erosion

2. Floods and drainage

3. Drought

4. Pollution

5. Malaria Control

6. Salinity

7. Low flow control

B. Water Utilization

1. Water supply (public, domestic, industrial, irrigation)

2. Navigation

3. Power

4. Recreation and wild life conservation

5. Fish and shellfish

C. Regional Problems

1. Water Supply

2. Pollution abatement and control

3. Recreation

4. Power

5. Low flow control

6. Multiple Purpose Projects

7. Incidental considerations (national defense, unemployment)

IV. DEVELOPMENT OF REGIONAL CONTROLS & FACILITIES (Historical)

A. Studies, surveys and research

1. Local and municipal

2. State agencies

3. War Department

4. Department of Agriculture

5. Department of Interior

6. Laboratories

7. Private agencies

B. Legislation and Adjudication

1. State and municipal

a. Creation of state and local agencies

2. Acts of Congress

3. Court decisions

C. Policies and Practices

1. Development of planning and construction functions

a. Local and municipal
b. State and federal
c. Incodel

2. Administration and Operation

V. THE BASIN WATER PLAN (Statement of policies and programs)

A. Basic Data

1. Adopted policies and programs

a. Agencies to do work
b. Controls and limitiations

2. Items requiring further study

a. Ground water

B. Research

1. Adopted policies and programs

2. Items requiring further study

a. Runoff relationships (at reservoir sites)

C. Planning and Construction of Projects

1. Adopted policies and programs

2. Items requiring further study

a. Allocation of water
b. Appraisal of benefits and allocation of costs
c. Evaluation of reservoir sites

D. Operation of Projects

1. Adopted policies

2. Items requiring further study

E. Administration of Policies and Projects

1. Recommended practices

2. Items requiring further study