MARINE SCIENCES RESEARCH CENTER
STATE UNIVERSITY of NEW YORK
STONY BROOK, N.Y.

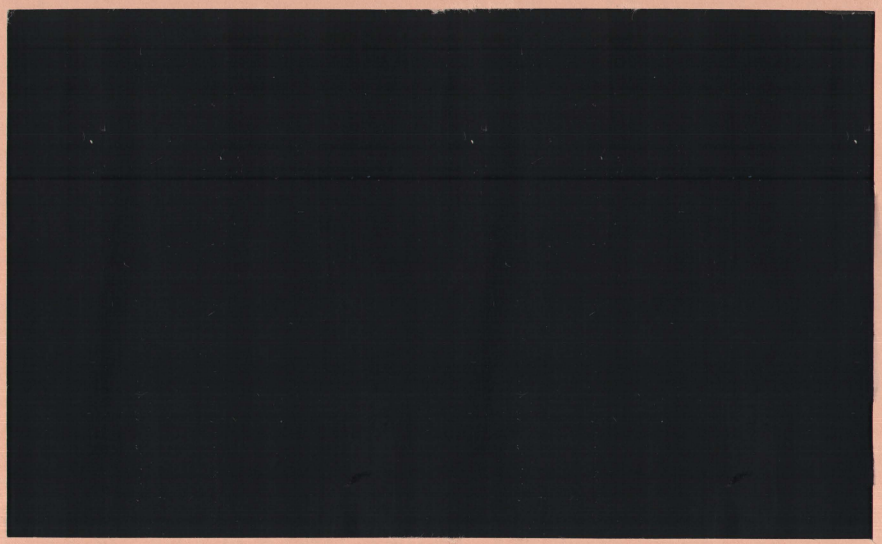
THE DELAWARE ESTUARY PROGRAM

Informal Report of A Workshop
Held 30-31 March 1990

to Identify

Uses and Values for the Delaware Estuary in 2020

J.R. Schubel
William M. Eichbaum
Susan E. Schubel



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COAST Institute
of the
Marine Sciences Research Center
The University at Stony Brook

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This report was prepared through the Coastal Ocean Action Strategies (COAST) Institute of the Marine Sciences Research Center.

"The voice is Jacob's voice, but the hands are the hands of Esau."
Genesis 27:22

PREFACE

The views expressed in this report are intended to be those of the participants in the 30-31 March 1990 workshop. Our task was to record them, to synthesize them, to look for connections and to weave the views of the participants into a story -- a story consistent with the views of the majority of the workshop participants. The participants came from diverse backgrounds, had diverse interests and represent diverse and, in some cases, conflicting constituencies. Where there was not agreement, we have tried to make that clear also.

This report is an informal report of the first of two workshops. It is intended primarily to be input to the second workshop. While we do not intend to print a revised version of this report, comments and suggestions are welcomed. Comments received in time (10 May 1990) for the second workshop (18-19 May 1990) will be incorporated into a supplemental statement which will be provided to all participants. Comments received after 10 May 1990 will be considered in preparing the final report -- an integrated report to be based on the proceedings of the two workshops and other materials.

INTRODUCTION

On 30-31 March 1990 a workshop was held at the University of Delaware's conference center in Newark, Delaware. The workshop was the first of two workshops conducted by J.R. Schubel and William M. Eichbaum in the continuing series of workshops to shape the Delaware Estuary Program.

One of the lessons to be learned from other bay programs is the need to formulate goals and objectives for the program early in the study. These should guide the research that is done and the management plans that are designed and implemented. The users, the citizens, the public -- you -- should decide what uses you want for the Delaware Estuary, what values you cherish and want conserved and, if appropriate, rehabilitated and restored. Those should be the driving force behind the goals. Specific objectives should be formulated to achieve -- or at least approach -- these goals. These program objectives should guide the development of the research agenda to produce the information needed to achieve the management goals and objectives.

If the Delaware Estuary Program is to make a fundamental contribution to achieving the Delaware Estuary that the people want in the year 2020 specific objectives and goals need to be formulated NOW. They must be comprehensible, measurable and achievable. They should be stated in societal terms; in uses and values that the public wants. The goals and objectives should be stated unambiguously and publicly along with the plans on how to achieve them. Progress toward achieving the goals and objectives should be monitored and reported on a regular basis to the public.

In February 1989, 7 public workshops were held in Delaware, New Jersey and Pennsylvania during which citizens were invited to identify:

(1) "What they value most about the Delaware Estuary,
(2) What problems of the Delaware Estuary concern them most, and
(3) What they think needs to be done to improve the estuary."

Four major questions were asked at each of the seven workshops to focus the discussion. The four questions were:

(1) What are the most important uses and values of the Delaware Estuary?

(2) What are the major environmental problems facing the Delaware Estuary?

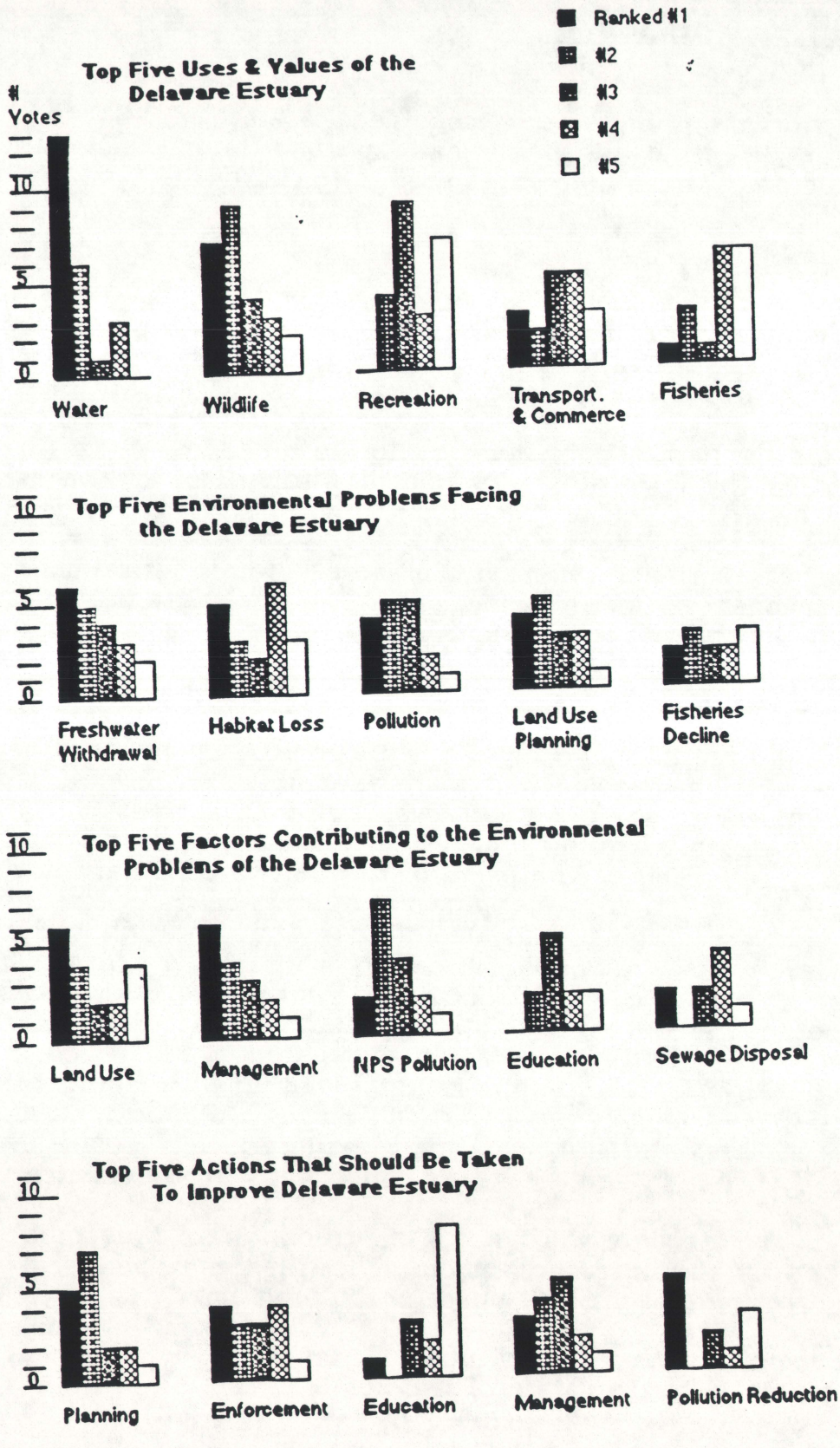
(3) What factors do you believe are contributing to the environmental problems?

(4) What do you believe needs to be done to improve the Delaware Estuary, both in the long and short-term?

These questions were asked again at this workshop and the answers are summarized in Figure 1. A summary of the answers to these questions for the seven earlier workshops is included in Appendix C. The goals of this (the March 1990) workshop and of the May 1990 workshop sponsored by the Scientific and Technical Advisory Committee of the Delaware Estuary Program are reproduced below. This statement is a very slightly modified version of the statement prepared by Jonathan Sharp and was sent to each of the March 1990 workshop participants.

FIGURE 1

RESULTS OF THE POLLS TAKEN AT THE DELAWARE ESTUARY WORKSHOP, 30-31 MARCH, 1990



Goals of STAC Workshops*

Two workshops have been scheduled for March 30-31 and May 18-19, 1990 by the Scientific and Technical Advisory Committee of the Delaware Estuary Program. This statement is written to clarify the expectations of these workshops.

PURPOSE

The two separate sessions are scheduled as a two-part process. For the first workshop, the invitation list includes primarily individuals who could be considered users of the Delaware River and Bay. They are diverse, ranging from environmental artists and bird watchers to waterfront developers and industrial dischargers. The major question to be addressed to this assembled group involves the current and projected future uses of the estuary. The second workshop will have scientists, engineers, resource managers, and regulators as its major invitation group. They will be charged with the question of what further information is needed as a background for rational present and future management of the estuarine resources. Central to this question are the uses identified by the first workshop.

EXPECTED RESULTS

The Delaware Estuary Program is in the five-year phase of developing the Comprehensive Conservation and Management Plan. Several rather routine considerations (e.g. toxic substances, living resources, etc.) have been identified as areas of public concern. However, it is felt that a clearer delineation is needed from the users of the Delaware Estuary of the values of this aquatic system. Therefore, a group of users is being assembled in this first workshop that are much broader in interests than the public who responded last year in the original planning sessions for the program. This clearer delineation of estuarine uses is needed to formulate information needs for management. The following are expected results.

From the first workshop, a list of uses with some priorities and delineation of key locations to support those uses; identification of present and potential conflicts; and a preliminary exploration of strategies to reduce conflicts to "acceptable" levels -- levels consistent with the desired uses.

From the second workshop, identification of information gaps for management that aid in research planning for the immediate fiscal year and the following three years of the first phase of the program.

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*This statement is a very slightly modified version of the statement prepared by Jonathan H. Sharp on March 16, 1990.

J.R. Schubel pointed out to the workshop participants that to achieve the goals for the two workshops the questions listed below would have to be answered. He indicated that the first workshop would concentrate on the first two questions but that the views of the participants in the first workshop were also sought on the other three questions.

Some Important Questions to Address

1. What uses and qualities does society want for the Delaware Estuary in the year 2020?

2. How different is the vision of the estuary of the future from the existing estuary?

3. Do we have the information and understanding needed to formulate effective and efficient management policies and practices -- policies and practices that will achieve the desired results with acceptable levels of uncertainty and at acceptable and predictable cost?

4. What new areas of research are required to provide the information needed to develop management strategies appropriate to societal goals?

5. Based upon existing information, what new management policies and practices -- strategies -- are needed to ensure the uses and qualities desired for the estuary of the future?

The workshop was organized around the following issues identified in the earlier (1989) set of workshops:

A. Resource uses of estuary and drainage basin including: fisheries, and aquaculture, wildlife needs, agriculture, forestry...

B. Urban waterfront and residential development.

C. Shipping, transportation and port development.

D. Recreation and aesthetic enjoyment: boating, birding, photography, hunting, beachcombing, swimming.

E. Industrial uses and freshwater supply.

Because of the modest number of participants (35) in the March 1990 workshop, we chose to combine issues C and E.

The agenda for the workshop is reproduced in Appendix A of this report. The participants and their affiliations are listed in Appendix B.

Following the opening plenary session in which W. M. Eichbaum and J.R. Schubel presented the goals and objectives of the workshop and a statement of the scope of the anticipated products, the groups broke into four concurrent working sessions, each built around one of the major issues (themes) identified by the seven previous workshops and listed above. The four working groups, their issues, facilitators, rapporteurs, scientific resource people and participants are summarized in Table1. Participants were assigned to the various working groups, but were given the option to join another.

Each working group was instructed to explore their issues and to formulate the strongest statements for which they could gain a consensus in support of the uses and values they wanted for the Delaware Estuary in 2020.

Summary statements were presented by the facilitators to the entire group for discussion. They are summarized --as presented-- in Exhibits A-D. More complete statements of the working groups are contained in the appendices. Initial discussion led to an identification of areas of broad agreement among the majority of participants (Exhibit E) and identification of areas of conflict -- real or perceived (Exhibit F). The two categories of issues -- those for which there was broad agreement and those for which there was conflict or the potential for conflict -- were presented to the entire group by J.R. Schubel and W.M. Eichbaum during the opening plenary session on the second day of the workshop for the group's reaction to our interpretation of the previous day's discussions. Some slight adjustments were made. The issues of conflict became the topics for further group discussion.

TABLE 1

Summary of Topics and Compositions of Initial Working Groups

Issue	Facilitator	Rapporteur	Participants
A. Natural Resources	Mary D. Gastrich	Susan Schubel	Grace P. Beck Joanne Denworth Lloyd Falk Penrose Hallowell Harold Haskin Bob Morgan Mrs. Morgan Clyde Roberts
B. Urban Waterfront & Residential Development	John Campanelli	Ajit Subramanian	Hal Bickings Stephanie Craighead Stephen Kehs John Kraeuter Ian McHarg Alfred Stango Victor Yarnell
C/E. Shipping, Port Development, Industry & Freshwater Supply	Sam Glasscock	Doreen Monteleone	John Balletto Judy Brackin Robert L. Chester Roy E. Denmark Henry Gunther Peggy Haskin Bill Lowe Alfred Pagano Jonathan Sharp
D. Recreation	Marjorie Crofts	Trudy Bell	Joanna Biggs Bruce Hargreaves H. Dale Parsons David Pollison Marion Stewart

EXHIBITS A - D

STATEMENTS FROM THE WORKING GROUPS (see Table 1)

EXHIBIT A. NATURAL RESOURCES

To conserve the natural resources of the Delaware Estuary both now and in the future, we need to:

- Produce an integrated regional plan for land use and drainage basin management.
- Characterize, assess and maintain productive wetland habitats. Strive for No Net Loss of Function.
- Enhance and maintain balanced and diversified fish stocks.
- Maintain biodiversity of wildlife and vegetation.
- Continue and improve pollution control (point and nonpoint source controls) and, as a result, continue to improve water quality.

EXHIBIT B. URBAN WATERFRONT and RESIDENTIAL DEVELOPMENT

The Delaware Estuary can be divided by function into 3 zones:

I.	Trenton	-> Wilmington:	industrial, urban and suburban
II.	Wilmington	-> Delaware City:	mixed usage
III.	Delaware City	-> Lewes:	agricultural, residential and recreational

- A regionwide plan of development should be formed using these zones as a framework.
- Economic incentives are necessary for preserving wetlands and other sensitive lands.
- Make best use of land/water interface by giving priority to water-dependent activities, especially in Zone I.
- When possible use existing infrastructure.
- Erosion control, waste disposal and recreation will continue to be important issues in 2020; increased population is a factor.

EXHIBIT C/E. SHIPPING, PORT DEVELOPMENT, AND FRESHWATER INDUSTRY

In the interests of maintaining its position as a leading port and industrial center:

- The potential effects and benefits of a deepwater port and oil pipeline should be assessed.
- Continued maintenance of the channel to Philadelphia is necessary. Creative uses for dredged material should be sought.
- A unified emergency response plan for oil spills should be implemented, coordinated by the U.S. Coast Guard.
- Present water quality is good now for industrial use, but potable water is limited. Increased collection, storage and conservation of freshwater should be stressed.
- Wetlands should be assessed and conserved, but not by shutting out industry completely. With proper planning and management, industry can coexist with wildlife.
- A unified port authority would enhance the Delaware Bay ports' position on a world scale.

EXHIBIT D. RECREATION

Uses, values and conflicts were identified. In 2020. . .

- To enhance people's awareness of the bay there should be greater access to it. More beach access, boating access, hunting areas, greenways. . .
- Increase the number of parks (with active and passive recreation) to keep pace with the population.
- Water throughout the system should be SWIMMABLE and FISHABLE.
- Recreational fishing should be improved by maintaining habitat and water quality and stocking if necessary.
- Environmental and responsible user education (e.g., for small boat operators) should be stressed in schools and for the public.

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EXHIBIT D cont.

- Local economic benefits of tourism and low impact recreation such as birding should not be overlooked.
- Wise land use planning is critical -- fragmentary habitat may not serve its function as a breeding/nursery/living space for a species.
- Increased development and a lack of funding are most likely to inhibit increased recreational use of the estuary.

The primary goal of the workshop was to form a vision of the Delaware Estuary for the year 2020 which was shared by a diversity of people representing the users of the estuary. At the end of day 1 the following points were identified by JRS and WME as points of agreement.

EXHIBIT E

SOME MAJOR POINTS OF AGREEMENT

- The Delaware Estuary -- particularly the upper estuary and tidal reaches of the river -- has shown dramatic improvement in water quality and dissolved O_2 over the past 1-2 decades.
- The lower Bay is generally in pretty good condition and probably always has been.
- Efforts to reduce inputs of contaminants and nutrients from point sources have been effective, but non-point source control needs to be addressed.
- "Maintain & Conserve" are two guiding principles for the estuary of 2020 ...to stay even means we must do better in most categories.
- The existing pattern of uses of the estuary are amenable to zoning the estuary into three zones...each clustered around the predominant uses...and used as the mechanism to guide development along the estuary between now and 2020. The proposed system of zoning is consistent with the natural features of the system and with existing uses and would facilitate management consistent with general economic and environmental goals.

Zone I Trenton -> Wilmington
Zone II Wilmington -> Delaware City
Zone III Delaware City -> Mouth of Bay

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EXHIBIT E cont.

- Within Zone I priority for waterfront development should be given to water-dependent uses.

- Within Zones II and III, the agricultural "base" should be stabilized with controls on inputs/outputs. (The concept of "base" was discussed and there was general agreement that it was used in the context of overall production and not acreage under cultivation. The observation was made that perhaps more land under cultivation with less intensive agriculture would have environmental benefits.)

- Productive wetland habitats should be maintained. They need to be inventoried, evaluated, and ranked in importance to the estuary and its living resources, including birds and mammals. The goal should be to strive for no net loss of wetland function.

- A well balanced, carefully managed regional land use/ watershed program needs to be developed, implemented and monitored carefully. Local regulatory controls should be guided by and be consistent with this regional plan.

- Fish stocks should be enhanced and stabilized to produce balance and diversity.

- Biodiversity in the system (land/water) should be maintained. This will require management.

- Pollution control measures/practices for point and non-point sources should be maintained. This will require management.

- Fish caught throughout the system in 2020 should meet all FDA and state criteria (e.g. for PCBs) for consumption.

- A good environment is good for business.

- The "Delaware" is a major shipping route/port. Its leadership position should be maintained, but not at the expense of the ecosystem or other uses of the system. Periodic dredging of channels and slips will be required. Creative/beneficial uses should be developed for uncontaminated dredged materials. One potential use may be wetland enhancement.

- A comprehensive emergency response system for spills of oil and other hazardous materials should be developed. It should be coordinated by the U.S. Coast Guard, but a local, rapid clean-up capability is essential to minimize damage from spills. The first few hours are critical.

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EXHIBIT E cont.

- Demands for freshwater will be greater in 2020 than in 1990. Storage capacity should be increased; criteria for allocation developed; and conservation promoted.

- The recreational "system" based on the environment (boating, birding, bathing, etc.) in the lower estuary should be expanded by 2020. Greater opportunities for diverse recreational activities should be provided to more people. This will require greater access, but it must be consistent with protecting sensitive habitats and living resources.

- A new, expanded, enriched educational and cultural focus on the Delaware River and Estuary should be developed: education, museums, aquariums, walks, school curriculum, etc.

- An appropriate goal for 2020 is to make the entire system swimmable and fishable.

During the plenary discussion of working group findings, a number of issues were identified that needed further discussion. These are summarized in Exhibit F.

EXHIBIT F

POINTS WHICH NEED FURTHER DISCUSSION; ISSUES OF CONFLICT -- EXISTING AND POTENTIAL

- The role of **tributaries** and sub-tributaries in 2020. Is their development being properly managed?

  What roles should tributaries and sub-tributaries play in 2020?

  Is their development being managed properly?

  What's the future of barging on the tributaries/sub-tributaries?

- The benefits of **zoning** of the estuary, its margins and the drainage basin.

  The River/Estuary

  Should the river/estuary be zoned into the three zones proposed?

  To make it work, the different sections (zones) would require greater control of local zoning within sections (zones) and a system for zoning to meet the needs of the region i.e. a local and regional perspective.

  In the Drainage Basin

  Achieving and sustaining a proper balance among development -- residential, industrial -- agriculture, forestry, etc.

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EXHIBIT F cont.

- **Freshwater** collection and storage, allocation and conservation.

  Freshwater demand will increase.

  What criteria should control the allocation of freshwater in 2020?

  Will more storage be needed?

  What role could conservation play?

- Disposal and beneficial uses of **dredged materials.**

  Is it an underutilized resource?

  What role could it play in wetland maintenance?

  Does disposal outside of the aquatic system make sense?

- **Port unification**; channel deepening; the oil pipeline issue-- an alternative to lightering and shipping oil up estuary by barge.

  How deep is deep enough?

  Should the oil pipeline question be revisited? (You do have a deepwater oil port with all the risks and few of the benefits of local control.)

  Unified port?

- **Fisheries** and **aquaculture**: striking an appropriate balance between commercial and recreational; enhancing and managing stocks

  What's the role for aquaculture in 2020?

  What could/should be done to enhance it?

  What's the proper balance between recreational and commercial fisheries?

  What steps should be taken to achieve and sustain that balance?

  Is maintaining the present level of fish stocks (and landings) an appropriate goal?

  What would it take?

- Can you have too much of a "**green thing**"? What are the possible consequences of the recommended emphasis on wetland preservation and greenways?

  With the recommended emphasis on birding, fishing, greenways. . . do you run the risk (have the opportunity) of converting the mid-to-lower Bay into a public/private nature preserve dotted with quaint little towns?

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EXHIBIT F cont.

- o Effects of a changing **population**: changes in the total population in the drainage basin and changes in its distribution; suburbanization in the north; tourism and second homes in the south.
  - Will it increase?
  - Will its distribution change?
  - Will per capita water consumption continue to increase?
  - Will lawn fertilizers continue to increase?

Groups were formed around these issues for further discussion. The summary conclusions and recommendations resulting from these more extended discussions are summarized in Exhibits G-N. More detailed comments are contained in the appendices.

The statements which follow represent consensus views of the participants.

EXHIBITS G-N

Clarification of Issues of Conflict--Existing and Potential

EXHIBIT G

Tributaries

- o Each tributary has a unique effect on the estuary. Each has value to the system. The development of each should be guided by and be consistent with the zoning of the estuary.
- o Techniques of conflict resolution might be helpful in reducing and resolving conflicts.
- o Special emphasis should be placed on tributaries and sub-tributaries in the Delaware Estuary Program. The existing data and information on tributaries have not been synthesized, analyzed and interpreted. This effort is needed to formulate an appropriate research effort.
- o In studying tributaries, the largest tributary -- the Delaware River -- should not continue to be overlooked.

EXHIBIT H

Zoning

- o The proposed zoning of the Bay into 3 zones is a legitimate concept. It was proposed that the lower (seaward) limit of Zone I be redefined to the Delaware Memorial Bridge.
- o The characteristics of Zones II and III have been the subject of more intense study and are, therefore, better understood than Zone I. More emphasis needs to be placed on studies of Zone I.
- o Consideration should be given to reestablishment of wetlands in Zone I.

EXHIBIT I

Freshwater

- o The demand for freshwater will be greater in 2020 than at present even if there is no increase in population. The redistribution of the population from inner cities to suburbs increases water use for lawns and other

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EXHIBIT I cont.

domestic activities. In addition, if the rate of rise of sea level accelerates, more freshwater will be needed -- more river discharge -- to maintain the present salinity distribution in the Bay.

- The general consensus was that the Delaware River Basin Commission (DRBC) has a good allocation plan out to 2000 and that it needs to be updated to 2020. New DRBC regulations for low flow toilets in all new construction after 1991 and for all retrofitting of buildings is an important step.

- Public education is needed to raise the level of consciousness about the need for water conservation.

- Storage capacity will need to be increased and a program to control allocations of freshwater for maximum benefit to all.

EXHIBIT J

Dredged Materials

- To a first order approximation, the character of dredged materials coincides with the three zones. Sediments dredged from Zone I are predominantly fine-grained and contaminated. Sediments dredged from Zone II are predominantly fine-grained and uncontaminated. Sediments dredged from Zone III are predominantly clean sand. At present all fine-grained dredged material is disposed of in diked upland areas bordering the estuary.

- Uncontaminated fine-grained sediments dredged from Zones I and II are a potential resource which should be evaluated. The potential beneficial uses include landfill cover and wetland nourishment. As sea level continues to rise, there will be a net loss in wetlands area unless wetlands can migrate landward or accrete upward at the same rate sea level rises. This requires an increase in the sedimentation rate and probably in the rate of supply of sediment to the wetlands. Fine-grained dredged material is a potential source of sediment. Evaluation of the practicability of doing this is a subject for research.

EXHIBIT K

Port

- Port unification might be a good idea. It would be beneficial for world competition, but it is not likely to happen because of internal competition. As a minimum, a unified port concept could be developed

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EXHIBIT K cont.

for marketing.

- o The whole system must be looked at when considering deepening of channels and the Chesapeake and Delaware canal. Port infrastructure and bridge clearances may already impose controls on vessel size. The environmental effects of channel dredging should be assessed. Changes in channel geometry may alter the salinity distribution, the vertical stratification and the residual circulation. All can have effects on the ecology. Larger ships may pose larger threats. The present proposal to dredge to 45' would not infringe significantly on the aquifer and would not require rock blasting. Dredging to 55' might have unacceptable impacts on the aquifer.

- o Impacts and benefits -- both short-term and long term -- of a pipeline should be critically assessed. At various times a pipeline has been proposed as an alternative to lightering and barging of oil up the estuary. The alternative should be evaluated; options should not be foreclosed. The assessment needs to consider impacts and benefits to the entire system.

- o All foreign flag vessels should be required to meet the safety standards of U.S. flag vessels by 2020.

EXHIBIT L

Fisheries and Aquaculture

- o A comprehensive aquaculture plan is needed to formulate desired goals for 2020 and to outline the strategies to attain these goals. Participants were reluctant to state specific goals.

- o Hybrids should be investigated to fill voids and supplement stock (e.g. MSX-resistant oysters) to meet market demands, but care must be taken not to negatively impact natural populations.

- o Enforcement on all levels needs to be increased as different fisheries impact one another.

- o A salt water license could serve as a source of revenue for research and habitat enhancement. If a license is proposed, it should state explicitly that revenues will be dedicated to these activities.

- o Aquaculture can be used as a means to enhance stock (more popular) or to provide food for market.

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EXHIBIT L cont.

- o Recreational and commercial fisheries must achieve a balance; many fear that by 2020 recreational fishing will put commercial fishing out of business.
- o By 2020 oyster harvests should be stabilized at one million bushels/year.
- o All fish and shellfish caught should be edible.

EXHIBIT M

A Green Thing: Can You Have Too Much of it?

- o It is not so much "too much of a green thing" as a lack of other colors. The area -- the lower estuary -- must be shared among a variety of user groups.
- o The "green" should be maximized by establishment of greenways along the coastal margin. The appropriate width of the greenway is dependent on natural features and on its function rather than on an arbitrary measure. The greenway will vary in width along the margin of the Bay. The system needs a green zone, a buffer zone and a zone for appropriate development.
- o Residential development needs to be carefully managed in the Lower Bay area.
- o The "carrying capacity" of the Lower Bay for different uses needs to be determined.

EXHIBIT N

Population

- o Assessments need to be made of the change in total population in the drainage basin over the past several decades, as well as population projections out to 2020. In addition, assessments need to be made of changes of the distribution of population within the drainage basin over the past several decades and projections of changes in distribution out to 2020. Population in the drainage basin allegedly has increased only slightly in the past decade, but there have been major redistributions with suburban areas gaining and inner city areas, particularly Philadelphia, losing. In addition, assessments need to be made to determine if the projected changes are consistent with desired uses and values of the estuary for 2020 and, if not, what strategies should be

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EXHIBIT N cont.

pursued to ensure a better match. A number of these questions will be answered by the 1990 census and by Dr. Ruth Patrick's forthcoming book.

- One should expect increasing pressure for some kind of development within the coastal zone. The statement was made that population in the Bay region had increased two-fold in the past few decades but it was low to begin with. Not all development is bad. For example, second homes can provide significant economic benefits to communities with little demand for services and little impact on the environment.

In addition to the conclusions and recommendations contained in the previous exhibits, there were a number of other important conclusions and recommendations that did not fit neatly into any of the major working group categories. These are summarized in Exhibit O.

EXHIBIT O

A Bouillabaise of Other Important Conclusions and Recommendations

- Efforts should be continued to reduce inputs of contaminants through pre-treatment and other strategies to control point and non-point sources of contaminants.

- The present electric generating capacity within the region may not be adequate to meet the energy demands in 2020. A combination of new capacity and conservation may be needed. It is unclear how large a role cogeneration will play in 2020.

- To some extent improvement in water quality within the system is a result of the loss of industry particularly from Philadelphia, Trenton and Wilmington.

- In searching for solutions to problems within the system, it is important to scale the problem to the appropriate segment of the total system. In some cases this may be the entire drainage basin; in others only a very restricted segment of the Bay or its drainage area.

- 70% of the oil that enters the East Coast of the U.S. enters through the Delaware.

- Comprehensive management plans are needed for each important species of finfish and shellfish. For some species these plans will have to be regional in scope because of their migratory behavior.

- Privately-owned ecological preserves need to be mapped far better than at present.

- A regional environmental data-information center needs to be established which has a major focus on the Delaware River system -- river, estuary, drainage basin. The Center should be responsible not only for collecting, storing and assuring the quality of data, but also for a periodically analyzing, synthesizing and interpreting the data and for converting data into information useful to decision makers and the general public. Academic institutions should play a major role in such an effort.

- The vision for the Delaware Bay of 2020 calls for a combination of preservation, conservation, maintenance, enhancement and rehabilitation. The Delaware Estuary Program could be the vehicle to formulate and articulate that vision.

APPENDICES

APPENDIX A

DELAWARE ESTUARY PROGRAM

Project: On the Development of a Users Manual for the Future

WORKSHOP

An Identification and Ranking of Uses and Potential Conflicts

30-31 March 1990
University of Delaware
Conference Center

Day 1

0800-0900 **Registration**

0900-1100 **Session A -- Plenary**

o	Welcome and introductions.	J. Sharp, et al.
o	An overview of what we intend to achieve during the workshop.	J.R. Schubel
o	A preliminary identification of the classes of uses desired for the "estuary of the future" and the qualities needed to sustain those uses. Results of previous workshops will be used as the point of departure.	W.M. Eichbaum
o	A preliminary assessment by the participants of how closely the "estuary of the future" matches the "estuary of the present."	W.M. Eichbaum
o	Summary and charges to working groups to clarify desired uses and qualities and perceived threats to those uses and qualities.	J.R. Schubel

1100-1200 **Session B -- Working Groups**

A. Resource uses of estuary and drainage basin including: fisheries,

and aquaculture, wildlife needs agriculture, forestry...

B. Urban, waterfront and residential development.

C. Shipping, transportation and port development.

D. Recreation and aesthetic enjoyment: boating, birding, photography, re-creation.

E. Industrial uses and freshwater supply.

1200-1330 **Lunch and address by The Honorable Thomas R. Carper, U.S. House of Representatives, Delaware**

1330-1530 **Working Groups**

1530-1600 **Break**

1600-1700 **Session C -- Plenary**

- o Working groups report on their findings. — W.M. Eichbaum

1700-1800

- o A preliminary search for the golden thread, for unifying themes, for rallying points and for conflicts and barriers. — J.R. Schubel

1830-2030 **Dinner and film about the Delaware**

By the end of day 1, we should have

(1) Identified the classes of uses and the qualities people want for the estuary of the future.

(2) Determined how closely the present estuary meets those expectations.

(3) Determined conflicts -- real and perceived -- among uses and users now and in the future.

(4) Identified management policies and practices that may not be consistent with future expectations.

(5) Raised the level of political commitment to the "estuary of the future."

(6) Raised the consciousness of different stakeholders to the importance of the Delaware Bay Estuary.

Day 2

0830-0930 **Session A -- Plenary**

- o A brief recap and clarification of objectives and an exploration of how the previous evening's address affected the group's thinking. — J.R. Schubel, W.M. Eichbaum

0930-1200 **Session B -- New Working Groups**

- o Pairing of working groups of users that perceive they have the greatest conflicts: a search for common ground by clarifying purposes.

1200-1330 **Lunch and address by The Honorable Vincent Fuomo, Pennsylvania State Senator**

1300-1530 **Session C -- Plenary**

- o Reaching consensus on a summary statement. — W.M. Eichbaum, J.R. Schubel

1530 **Adjourn**

APPENDIX B

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APPENDIX C

Poll Results from Past Workshops

Most Important Uses and Values of the Delaware Estuary:

- *Habitat for fish and wildlife
- *Recreation
- *Water Supply
- *Commerce

Major Environmental Problems facing the Delaware Estuary:

- *Poor Water Quality/Pollution
- *Habitat Loss
- *Poor Land Use Practices
- *Threatened Water Supply

Factors Contributing to the Environmental Problems:

- *Inadequacy and Enforcement of Laws and Regulations
- *Management and Institutional Factors
- *Increased Population and Development Demands
- *Lack of Land Use Planning
- *Pollution
- *Lack of Public Awareness

Things that Need to be Done to Improve the Delaware Estuary:

- *Enforcement
- *Management
- *Public Education/Awareness
- *Planning

APPENDIX D

Natural Resources

In 2020 it is hoped that productive **wetland** habitats will be maintained. Wetlands throughout the estuary should be assessed as to their **quality**, based on productivity, biodiversity, size, sediment toxicity, and water quality. Some wetlands formed on dredged materials are subject to *Phragmites* intrusion - reducing the biodiversity and quality of the area. Wetlands are also created on diked farmland that is not maintained, and abandoned industrial sites. High quality wetlands should be preserved, and lower quality ones improved - the goal is for no net loss of function. Some felt that by rating wetlands they were being placed in danger; lower quality areas would be allocated for other uses and gradually more and more would be lost.

To maintain **wetlands** water conservation (withdrawal) needs to be monitored to keep salinity and flow at acceptable levels. Sea level rise will drown some existing habitat which could be replaced with clean dredge or wetlands could be allowed to naturally move inland where buffer zones are provided. There have been large areas of destruction due to Snow Geese (but perhaps that's part of the system?).

A well managed **land use plan** should be developed for the estuary and its drainage basin. It should be a regional plan adhered to and implemented by each municipality. Resources in each area would be assessed and environmentally sensitive areas recognized. Agricultural and forested lands are important for aquifer recharging and should be kept open.

Over the past twenty years competition with foreign markets has made it more difficult for farmers to stay in business. One solution may be to purchase **development rights** and lease the land back to the farmer for use. Under this system the land is kept open and the town does not lose tax revenue. As the freshwater supply decreases it will be ever more costly to grow crops; the use of effluent for **irrigation** of nonfood crops should be considered. To reduce the use of **chemicals** used in agriculture perhaps a lower yield/acre should be accepted and more land cultivated. (Don't just blame the farmer however - many chemicals are from homeowners using pesticides, herbicides and fertilizers to beautify their lawns.)

In 2020 we hope to have enhanced the estuary's diverse **fish stocks**. Habitat requirements and limiting factors should be assessed and improvements in water quality, fish ladders, etc. made as necessary. The effects of nuclear plant cooling systems should be assessed.

Recreational fishing and commercial fishing should strike a balance so that both are maintained. Fish numbers will have to increase to keep pace with the growing numbers of fisherpeople. Regulations should be thoughtfully developed, based on the resource, and strictly enforced. Since fish migrate

and state laws vary it may be difficult to effect a change without a regional plan. All fish and shellfish caught in the estuary should meet **FDA standards** for safe consumption.

Aquaculture is probably not a priority for Delaware Estuary, except as a supplement to natural stocks. Land values and labor costs are too high to compete with foreign markets; and in the case of oysters, natural bed oysters preempt the market for aquaculture ones. Supplementing the wild population with MSX-resistant (a PARASITE) individuals is important. Some fear that developing closed aquaculture systems may divert money away from estuary preservation.

Water quality must be maintained; withdrawals and export of freshwater from the **watershed** should be reduced. Public awareness and pressure on legislating bodies is effective - education should be stressed.

APPENDIX E

Urban Waterfront and Residential Development

The group identified the following **uses** for the waterfront over the entire estuary for the present and agreed that these would continue to exist in 2020:

- o Industrial use of the waterfront including for transportation & commerce (port facilities, docks, channels etc.); factories and/or intake pipes for cooling systems.
- o Residential use of the waterfront.
- o Recreational use of the waterfront including beaches, parks, greenways with paths, boat ramps, marinas etc.
- o Research and Development
- o Education
- o Wetlands and natural habitat preserves
- o Erosion control measures such as jetties, groins, dunes etc.
- o Waste disposal facilities including outfalls for combined sewers.
- o Military bases.

It is recognized that the waterfront and its usage on the Delaware Estuary is very varied and what is good or desirable for one part is not for another. For example, Philadelphia and Cape Lewes have entirely different plans for development and growth. The estuary was divided into three **zones** based on use: Zone I from Trenton to Wilmington, Zone II from Wilmington to Delaware City and Zone III from Delaware City to Lewes.

Zone I traditionally has been **industrial** but is changing now due to the demise of shipbuilding, steel industries etc. The waterfront is slowly being replaced by residential and recreational users. The industrial pollution load on the estuary has reduced due to recession and stricter environmental regulations in place. It is also recognized that the new industries replacing the older ones are more high tech and more environmentally sensitive. The possibility of movement of refineries to lower Delaware Bay or even off shore was discussed and although no predictions were made, townships in the Lower Bay may not be in favor of development of this kind.

A more mixed use is envisioned for the year 2020. Priority should be given to **water dependent uses** but not limited to it. "Swimmable/ fishable" water is a goal for zone I in 2020. A storm water sewage authority is needed with tighter regulation on combined sewer overflows. Air quality should be linked to water quality while considering industrial licenses . The possibility of privatizing sewage plants was discussed.

Zone II usage has been traditionally **mixed** with some port facilities and light industries along with residential developments and some of the biggest natural habitat areas. The second largest marsh in Delaware is located just south of Delaware City and another large area is across the river around Salem. These habitats have remained relatively pristine and undisturbed - as measured by the population of animals in these areas - despite the industrial activity. Agricultural usage of the waterfront also occurs in this zone.

In the year 2020, the biggest goal is **"no net loss of wetlands"**. The use of land remaining after an industry moved out was discussed. This land is probably not be desired by developers for residential or recreational development as it is in the middle of an industrial zone. But it may not be incompatible with use as wildlife habitat. The land abandoned by Star Enterprises (Texaco refineries) was discussed. Maintenance of high quality natural habitats in the year 2020 is stressed. Changes in use of waterfront for agriculture is envisioned due to factors such as salt intrusion, rising sea level, reduced water allocation etc. But tighter regulations on non point runoff is emphasized. The agricultural output of the area should be stabilized. Green ways and buffer zone are to be established.

Zone III usage has been mostly that of **natural habitats** and **agriculture** with a bit of residential and recreational development. The largest marsh in Delaware lies around Lewes. Seventeen percent of Cumberland County in New Jersey (80,000 acres) is covered by wetlands. There are numerous state and federal refuges in this zone. The Coastal Area Facilities regulation (CAFR) deals with the development of waterfront in this zone.

In the year 2020, more **fishing**, **recreation** and **tourism** is envisioned for this zone. Mariculture should be used. High quality natural habitat is to be maintained. Growth and development should be controlled. Better erosion control mechanisms should be adopted.

The **costs of not developing**, i.e. turning green was discussed for all three zones. The direction of development for zone I, i.e. an urban area, is different from that of zone III. In Lewes, the choice is between a clam factory and a boat ramp or between being a coal port and a residentially developed "second home" town. The cost of taking land off tax rolls for a small township is prohibitive and the township usually has no say in the matter. A township with a lot of state or federally owned land is punished twice - once by the reduced number of tax payers (the cost of services remains the same) and then again as the high tax rate drives away new business and developers. On a local basis, if one township restricts development, it is recognized that the developers will move to another and create the problems anyway. A need for a region wide development plan is emphasized. The plan has to tie zoning and licensing practices to a "carrying capacity" of each township/area. Residential development in zone III is not desirable since the cost of providing services is higher than the income from taxes. In urban areas the infrastructure already exists and development is encouraged. In their visions for the future, Philadelphia wants to grow while small townships like Lewes do not. In some

instances, however, development is tied to jobs rather than ratables. A boat ramp is less desirable than a clam factory in terms of supporting the local economy.

Economic incentives are required for preserving sensitive land. Since the land is being protected for the "good of all", individual owners or local towns people should not bear the burden of support alone. Innovative measures like those taken in Cumberland County need to be widely adopted - Cumberland County which has some of the most environmentally sensitive land and some of the most economically depressed areas, declared enterprise zones in some areas. In the enterprise zones, the existing tax structure is altered to encourage development and offset income lost by maintaining natural habitats. A large portion of land is preserved in a pristine condition, other portions are developed and the cost is borne by the entire state. (DOES THIS WORK??!)

Conflicts were identified between the following classes of users:

- o industrial & recreational, residential, environmental
- o recreational & residential, environmental
- o residential & environmental

Industrial and residential users prevent **public access** for recreational use. Development permits are being bargained for public access in Philadelphia. It is recognized that industrial and luxury residential developments are the highest ratables.

Zoning regulations on waterfront usage should meet the criteria of making **best use of land-water interface**, making use of its uniqueness. Characterization of locale, protection of property value, knowledge of tolerance of the area for that particular use are also to be considered in resolving conflicts. Market demand and advocacy are the principal causes of zoning changes and these changes are driven more by use than need.

In the vision for 2020, widening the choices on usage may be more effective in conflict resolution, i.e. planning alternatives for communities to consider may be more effective than predicting conflicts in usage.

APPENDIX F

Shipping, Port Development, Freshwater and Industry

The Delaware Estuary holds a number of major ports (Wilmington, ports of Philadelphia, Glouster, Camden, Trenton, Philadelphia Navy Yard) and overall has a large and varied cargo of shipments. There is little room for expansion in the larger ports; although land-based transportation is also a limiting factor for port capacity.

Of the total bulk tonnage - 80 to 85% is oil. Seventy-five percent of the U.S.'s imported oil comes in to the east coast (crude to Delaware and refined to New York). Considering the great traffic of oil-carrying ships it is lucky that there have been no large and devastating spills. Large ships are lightered to decrease draft and allow passage up to Philadelphia.

It was felt by this group that the costs and benefits of a **pipeline** should be assessed. Short-term impacts are significant and the capital required for construction is large, but in the long-run it could reduce the risk of oil spills and be cost-effective. The pipeline would be a pipe within a pipe, have a leak detection system and could possibly be connected into existing pipelines; a user fee could be used to pay for maintenance. The operation run by a consortium (as in Alaska) would be more efficient than government owned.

A plan and 24 hour **response team** is needed in case **oil spills** do occur. This effort could be organized by the U.S. Coast Guard or supported by $ collected as a user fee.

A deepwater port is not accepted by the public, but the industry wants **dredging** of the channel to 45 feet to stimulate shipping. Wetlands are created on deposited dredge materials, thus closing that disposal area to further sediments. It was recommended that special provision be made to maintain dredge disposal sites and creative uses be found for dredged materials.

Maintaining the flow of **freshwater** into the estuary is important for a variety of reasons - the moving salt line, parasites which cannot survive well in freshwater, etc. There is a limited supply of potable water, so conservation is a high priority. Most industrially used water is returned to the system but treatments can have negative effects. Pumps can be used to recirculate water but cost is high for refitting - this could be balanced by a user fee based on amount of water used. At Salem high velocity water flow is used so chlorination is not necessary to prevent fouling. The Frances E. Walter Reservoir should be expanded

Water quality upriver has improved and minimal improvements in industry would probably not change conditions much. Further improvement in water quality would increase dissolved oxygen and therefore corrosion, and may

not improve the quality of life. Poorly functioning CSO's and NPS pollution are the major sources of pollution now.

It is felt that industrial development is being hindered by wetland and coastal resource regulations. Non water-dependent facilities should move inland, leaving coastal areas for water-dependent industries.

APPENDIX G

Recreation

The following activities and priorities were identified by the group:

-fishing
-open space (greenways, access)
-active and passive parks
-swimming/ beach enjoyment
-boating
-tourism
-hunting and trapping
-birding
-whale watching
-education and nature study
-tubing
-photography
-aesthetics
-recreational vehicles

It is hoped that recreation in all forms will be enhanced by 2020 to allow more people greater access to the estuary and thereby increase their appreciation of it. Recreation is not necessarily low-impact and must be managed carefully. Channels for access should be provided; people should not be allowed to "rec it" indiscriminately. The idea of use vs. preservation should be addressed.

Recreational fishing is a popular activity in the estuary. Enhancement of the sport is based on increased access and enhancement of the fish stocks. Threats to fishes come in large part from loss of habitat or change in habitat quality (water quality, dissolved oxygen, salinity, toxics, turbidity, sewage, etc.) but also from overfishing and a lack of law enforcement. Regulations vary between states and since fish migrate, it is difficult to effect a change locally; regional planning is more appropriate. The threats posed by impingement and entrainment need to be researched.

To create an aware and caring public the issue of **education** should be addressed. A variety of educational programs exist at present (Audubon classes, DE Nature Society, Schooner CLYDE PHILIPS, WHSRN, Camden Aquarium, etc.) but it is hoped that the number will grow and that environmental education will be incorporated into school curricula. Lack of funding and political support, apathy, and a lack of training are the biggest obstacles.

Open space requirements very between zones, but it is felt that there should be access to the estuary throughout all three zones. As the population increases there will be increased threats of development for residences and second homes. A lack of funding and political support makes it difficult to buy and maintain land, but greenways and protected habitats are desired. Natural areas and wetlands should be preserved at today's acreage as a minimum and designed to provide vital pathways in fragmented areas for wildlife movement. The minimum size of such pieces should be assessed based on species' needs. Impacts by illegal dumping and recreational vehicles should be minimized.

Boating activities available to the public include: commercial party boats, historic tours, the Cape May -> Lewes ferry, whale watches, fishing trips, and private boat operation. It is hoped that boating activity will be enhanced through greater access; more boat ramps and marinas. Conflicts with commercial shipping could be reduced with increased education for small boaters -- possibly the introduction of a required license. As boat traffic increases it will become increasingly more important for recreational boaters to learn boater safety and the "rules of the road" to lessen accidents. Competition for space in the tributaries could be a problem.

Tourism is important as a source of revenue and an avenue through which people may enjoy the area and learn more about it. State parks, seaside towns, wildlife refuges, museums, aquariums, fishing tournaments, and birding trips are some of the more popular forms of tourism. It is imperative to manage these so that resources will not be overused, community character is not lost, and people do not miss what they came to see.

Birding is a fairly low-impact recreation which brings money into a number of small communities. The Cape May Bird Observatory estimated that $5.5 million is spent each year by birders in Cape May County alone. This financial contribution should not be overlooked and could provide extra incentive to preserve vital habitat for migrating shorebirds, endangered species and others. Threats to birdwatching are really threats to the birdlife - and are ever increasing as the human population increases. Predation by domestic animals, raccoons, rats, etc. and disturbance by humans endangers nesting birds. Oil spills, plastic garbage, and loss of habitat threaten the hundreds of thousands of shorebirds which use the Delaware Estuary as an important migration rest stop.

APPENDIX H

Tributaries

Tributaries and sub-tributaries are important subbasins in the Delaware Estuary system. Their bank development is consistent with the three recognized zones of development (Zone I: Industrial; Zone II: Mixed; Zone III: Nonurban). Although the volume of water may be low, each tributary has **unique values**, **uses**, and **chemical impacts** on the estuary.

Tributaries often have high **sediment** loads and low oxygen; some have high metal levels in the sediment. The mouths of many tributaries will be silted in by 2020 and may need dredging. They are worth maintaining and protecting because of their role as sub-basins and flood plains.

A **regional plan** for greenways, access and development should be developed so that individual township's decisions will not negatively impact other townships downstream. Present local control often leads to emotion driven decisions by a caring but unknowledgeable public. Scientists cannot solve competing use problems, but they can supply necessary information for the decision-making process. People often react to "unacceptable" situations without knowing the facts.

A **mechanism** is needed to determine priorities for the tributary. The Schuykill has such a mechanism. When the railroad was abandoned, the river opened up for recreational use and gained public attention. **Access** is critical for public support -- people don't care about things they can't see. Education and monitoring are done by a River Keeper, and Greenway Association.

APPENDIX I

Zoning

The **three region** approach is appropriate when addressing development, especially on the land/water interface. Zone I should be amended to extend from Trenton to the Delaware Memorial Bridge area; state boundaries need to be considered.

A strong emphasis should be placed on gathering data in **Zone I** and on its relation to Zones II and III. The Upper Bay needs **improvements** in its natural environments, public and industrial areas -- these should be studied. Money is no longer available to make significant changes in treatment plants; requirements of the estuary and inhabitants should be assessed. Scientific committees should work with industries whenever possible. **Wetlands** should be emphasized in Zone I -- creation or reclamation from abandoned industrial land.

A central repository for existing and future data is needed (perhaps DRBC), but more than that **synthesis** of the data is necessary. Some think that putting all data in one large system compounds the difficulty of removing it. Unfortunately little money is available for non-original research -- for the reworking of others' data, but funding should be sought from industry.

The maintenance of a biodiverse ecosystem which efficiently transfers nutrients and energy should be our goal as we seek **balance** with development. Industry and natural areas can coexist, particularly if a partnership is formed in which industry helps to fund research and improvement. Licensing and training of developers, enforcement of regulations, public and estuary-user education can help to reduce negative impacts. **Planning**, **research**, **monitoring**, and **implementation of regulatory measures** will help us reach desired goals.

APPENDIX J

Freshwater

Freshwater is probably the most critically limited resource for human life in the Delaware Estuary region. Actions must be taken now to conserve water and plan for future allocation and use. The DRBC's present plan covers many of the key issues, but not everyone agrees it is enough. The group recommends that the plan be revisited, especially for longer-range considerations after the year 2000. Farther is fuzzier, but it may be beneficial to grope around in the dark rather than do nothing. Conservation, increased collection and storage facilities, and maintaining an adequate flow for the ecosystem are prime considerations.

The DRBC regulated that in 1991 all new construction and refitting will be equipped with **low consumption plumbing**. Other strict conservation measures that should be taken (and in some cases have been) are **leak detection**, **metering of water usage**, and **withdrawal charges**. **Education** is an important part of the conservation process. Most water is obtained from a public water supply (cities or towns) but individuals using private wells can also be monitored and charged a user fee if necessary. To expand existing reservoirs funding from a user fee is essential.

Water, air, and land form a system that should be managed as such. **Multimedia** regulations need to be developed. Presently there seems to be confusion about who regulates what -- coordination of **local and regional** governing bodies (EPA, states, municipalities) is needed to avert power struggles and a lack of action.

Another problem faced by the freshwater system includes **saltwater intrusion** due to a decreased flow of fresh and rising sea level; further diversions of freshwater (F.E. Walter Reservoir, Prompton) need to be carefully considered. Dredging the C&D Canal may after the exchange of water between the Delaware and Chesapeake Bays and therefore the salinity regime in the Upper Delaware.

Cooling towers and basins constitute a major depletive use of freshwater through evaporation. It would be less wasteful to recirculate cooling water but refitting of factories is expensive and regulations complicate the issue. In many cases it is felt that REGULATIONS and CONSERVATION are not complimentary. Water used in cooling systems is often shock-treated with chlorine and has a chemical impact on the system as well, the extent of which is not known but is being studied by the NJDEP.

There is also evaporative loss through **irrigation**. Use of gray water would cut freshwater use, as would high user fees. (Water is removed without charge from the Salem Canal now for agriculture use.) Farmers feel that their crops

will be driven off the market by foreign competition that has free water, cheap labor, and a more liberal use of chemicals.

Allocation of freshwater must be regionally planned. Voluntary conservation is the first step, but effective contingencies for drought conditions need to be put in place before such time. In times of drought, New York City will cut back by 35% on consumption, but residents of the estuary region may also need cutbacks. Local enforcement based on fines has been effective in California. Additional allocation to farmland may be necessary.

Can problems be fixed by **education** or are they determined by **economics**? The knowledge that conservation is important may not change actions as readily as a high user fee which puts a monetary value on the resource.

received by making the Delaware "port" more competitive worldwide. Small specialty ports could be developed.

To help support the estuary system **benefits** of port development and commerce should be linked to the environment.

APPENDIX M

Fisheries and Aquaculture

There will be increased emphasis on **aquaculture** in the year 2020. Although present laws impede aquaculture, it will become important by necessity as the human population increases -- a comprehensive plan is needed to reach desired goals.

Presently most Fish and Wildlife fisheries in the U.S. are supported by aquaculture (for stream stocking). Delaware stocks Striped Bass; brood stocks of rockfish. There are forty clam farms in New Jersey, but none in Delaware as the habitat is less suitable (too shallow). These forms of **enhancing natural stock** are more acceptable than culturing in ponds - a costly and less profitable venture. Aquaculture requires a large volume of water and suitable habitat; it is difficult and expensive but will become more cost effective as the demand for fish increases.

In some cases **hybrid species** which mature rapidly are released. Time until harvest is shorter, but stocking must be maintained as the fish are often sterile. In some cases (e.g. salmon) there is the possibility of cultured fish overwhelming the natural populations. As in any introduction program, it must be carefully researched before implementation, and cautiously approached.

In 1950 1 million bushels of **oysters** per year were collected. After a decline and the introduction of MSX, the catch was down to 2 to 300,000 bushels/year. MSX-resistant oysters can provide backup to wild populations that are being decimated by the MSX parasite, but money is needed to support a large hatchery for them. Oysters survive best in fresher areas which afford them some protection from MSX. Water **withdrawal** upstream affects the flow available to oysters; they need to be considered during allocation time. Oyster culturing structures may cause problems in intertidal zones; tributaries could serve as more protected sites.

Present **regulations** favor recreational fisherpeople over commercial. Out on the Bay there are problems as recreational boaters follow commercial boats to the catch. Enforcement should be tightened and impacts on non-target species (e.g. fingerlings caught in shrimp nets) reduced. Regional planning is essential to migratory fish (if they all get killed down the block a locally strict regulation is worthless). Mid-Atlantic Marine Fisheries and Fish & Wildlife have input into regional planning.

Anadramous stocks are increasing now. Should habitat be "improved" or will it cause as yet unrecognized problems for them and for other species?

There are three groups of fish users in the Bay to be accommodated: recreational fishers, commercial fishers, and consumers wanting to buy fish. The **yield** of fish landed should be optimized in 2020.

The **salt water license** issue should be revisited. Stocks could be more easily assessed using data collected from license-holders and revenue from the license could go toward maintaining the resource; presented in this way there might be more support for the idea.

APPENDIX N

A Green Thing: Can You Have Too Much Of It?

It became apparent that while you couldn't really have too much of a green thing, you could be lacking in some other colors. Available space must be distributed for a variety of uses, so that valuable resources are not lost. Over the past ten years areas of the Lower Bay (e.g. Lewes, DE) have experienced dramatic change and growth. In general the area below Wilmington has little industry but residential development is increasing. Homes and recreation facilities are not always low-impact.

Preservation of a **coastal buffer zone** in which water-dependent industry and development are limited, but not eliminated was most acceptable. This must be recognized and conserved before the land is lost. **Width** of the zone is dependent on environmental features rather than simple measurement. (In the past it was designated as the distance one could see from a canoe.) There are many advantages for this - marshes will be allowed to move inland as sea level rises and buffers serve as excellent protection for the land against flood and storm. Much of this land is held privately and already set aside for preservation; mapping of these and other sensitive areas could help guide the formation of a buffer zone. New Jersey has a greenway manual which could be consulted. A permit is required now by the N.J. Coastal Resource Group to build within 500 feet of the river. Tributary shores perhaps should also be included so that they will not become highways for inland development.

The group felt that the risks of the **pipeline** to the Lower Bay outweighed any advantages it might supply for the Upper Bay. The pipeline could change the character of the Lower Bay and encourage industrialization to tap in. The cost is high and short-term effects are great. Lightering has been going well and a pipeline would attract larger ships which pose greater hazards. Unloading from ships in Zone I is actually more dangerous than the present Lower Bay operations.

Zone II is a transitional zone developmentally and may serve as an ecological barrier due to high turbidity. **Zone III** (from Artificial Island south) has mainly residential use forms of industry and hopes to continue with a limited amount of clean industry; mostly inland. It would be economically wise to encourage recreation and tourism. Allowing for growth of tourism while maintaining quaintness and character of an area can be tricky. The carrying capacity of areas should be assessed and not exceeded.

APPENDIX O

Population

The **population** of the Delaware Estuary region appears to be increasing as well as redistributing within the area. The Pocono area is growing rapidly. Buck, Montgomery, and Chester counties are growing faster than Philadelphia.

A holistic approach to determine the **carrying capacity** of areas should be used; environmental, social, economic and transportation issues should be considered. A regional plan based on carrying capacities would limit growth to acceptable levels and close areas to development when they reach capacity. Second homes provide tax revenue for towns in return for a relatively low output of services, but do require new construction and use of land.

Cities have an existing infrastructure to support large populations with less impact. A long range vision is to **stem the migration** from cities using short-term measures. Champions for the vision -- political and business leaders and private citizens -- should be chosen and educated to sell the vision. Economic incentives to keep businesses in, revitalizing cities economically and visually to make them more appealing. Industry moves from the cities to the suburbs, taking workers with it. New people attracted to the cities are often unskilled workers with less money to spend.

An increasing population puts increased pressures on available resources such as **freshwater**. Should new dams be built to collect water? It is important to maintain the flow of freshwater from the river and tributaries to push the salt wedge back and keep habitats sound. The system is already stressed -- in Buck's County the drought flow of water is mostly sewage.

Overpopulation is a problem worldwide and an issue that should be included in any discussion on the environment. All humans are resource users and waste producers -- Americans excel by producing 30 % of the waste, by using 30% of the resources while only comprising 5% of the population.