BISCAYNE BAY AND ITS ENVIRONS

AN ANALYSIS OF ITS PRESENT AND FUTURE USES FOR METROPOLITAN DADE COUNTY

Thomas W. Bilhorn
Resource Management Consultant

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Information Services
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University of Miami
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An Analysis of its Present and Future Uses
For Metropolitan Dade County

By
Thomas W. Bilhorn
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September, 1975

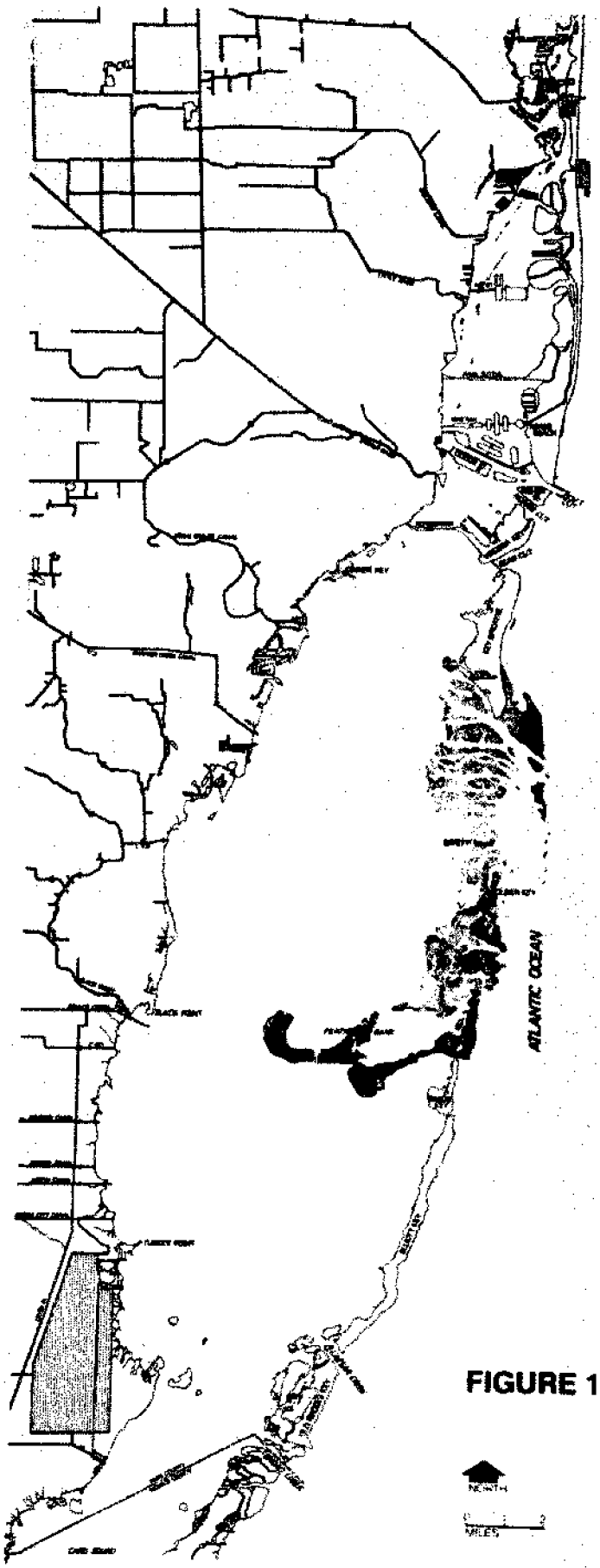

FIGURE 1: STUDY AREA LOCATION

field operations division

September, 1975

Mr. R. Ray Goode
County Manager
Metropolitan Dade County
911 Couthouse
Miami, Florida

Dear Mr. Goode:

I am pleased to submit herein my report, "Biscayne Bay and Its Environs, An Analysis of Its Present and Future Uses." This report concludes my consultant services contracted by the County.

The findings of the report conclude that: the Bay is, and can remain, an extremely valuable asset to the region, and County government will play a decisive role in directing this action. Some of the actions are already underway and some significant ones are believed not difficult to undertake.

The natural and social diversity of the Bay offers solution to the many expressions of concern. To the individuals and groups that have given me their thoughts and time, I express my thanks. It is hoped that the set of recommendations presented here, reasonably represent a balance of these interests.

Sincerely,

Thomas W. Bilhorn

Thomas W. Bilhorn

general oceanics, inc., 5535 n.w. 7th avenue, miami, florida 33127

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SUMMARY

Biscayne Bay defines the eastern limit for the total length of Dade County. This 225 square mile water body is the single large open space immediately available to the 1½ million residents of the metropolitan area. It is also the single large protected bay within the continental United States with a subtropical environment — allowing year-round usage for resident and winter tourists.

Because of a mixture of natural and man-made features, *the Bay divides into two units — North and South.* There is a strong diversity of present use and future possibilities between these two areas. A fundamental principle of good business practice, urban design or resource planning is the provision of diversity. The recommendations given in this summary and throughout the body of the report attempt to capitalize on the diversity the Bay region provides the County and its municipalities.

As any body of water, the Bay's internal circulation transfers the impact at one point to the remaining areas — sometimes rapidly, sometimes slowly. It is therefore a system in itself on a technical basis, and options for its use must recognize the natural factors as constraints.

The major findings and recommendations are primarily two: 1) the north Bay management package and 2) the south Bay management package (mid and southern Bay).

NORTH BAY RECOMMENDATIONS

The North Bay, from Rickenbacker Causeway to Dumfoundling Bay is for the most part a fully developed, urbanized area. Essentially all of the shoreline and Bay bottom has been modified. Water quality declined to a low in the early 1950's but has improved and reached an apparently steady condition since the construction of major waste treatment plants.

Over 90 percent of the present landside use of the Bay is for viewing from single family and multifamily and commercial high rise buildings. On the water, the North Bay is used for boat transit (from dock to ocean or South Bay) and commercial maritime industry.

The existing Bay quality is satisfactory for this majority of uses. Based on the limited data available, however, the north Bay is believed uncertain in meeting the health standards for water contact recreation such as swimming and water skiing. The quality is probably marginally sufficient for safe consumption of cooked fish taken here, but not for shellfish.

Public access, either for viewing or swimming areas, or fishing from shore is extremely limited — approximately 5 percent of the total shoreline. The one swimming area is Rickenbacker Causeway, an area not originally planned for recreation, but intensely used for this purpose.

Future options for North Biscayne Bay are:

1) *Maintain the present passive, non-contact shoreline usage and the present water quality,* providing additional public access at well shaded parks — and causeways if possible. Marinas, particularly private, and mainly for power boats, be encouraged to locate in this area rather than mid or south Bay. A few larger marinas (over a hundred boats) could be accommodated plus numerous smaller dockage (20-50 boats.) They would best be located where bottom and shore have been more deeply dredged and filled. Use of piers and piles rather than solid fill is strongly recommended.

   Any proposed construction in the Bay should be reviewed for its effects upon circulation since further solid fill will undoubtedly interfere with the present critically sluggish circulation.

2) *Improve water quality to clearly safe and desirable swimming standards and provide additional beach access.* Present water quality data indicates, but does not unquestionably prove, that north Bay is marginal for swimming. A short, but *thorough* bacterial and toxic metal monitoring study should be undertaken to prove or disprove the interpretation made in this report and before any action is taken towards increasing water contact usage.

Because of the present minimal water contact usage it makes little sense to undertake a water quality improvement program without a parallel effort in providing additional beach — of a type which improves on the Rickenbacker Causeway example.

Upgrading of water quality requires improvement in circulation and cut back in point and non-point contaminating sources — broken or old sanitary sewer lines and poorly operating septic tanks and storm drains. Both improvements in circulation and further control of discharge are high cost efforts. Filled causeways, McArthur and Julia Tuttle, would have to be pierced with major channels.

Deepening or widening of Baker's Haulover would, in all probability, interfere with coastal sand transport needed to maintain the ocean beach.

The first of the above two options is recommended as it satisfies nearly all present and future uses of the north Bay area. With limited governmental resources of manpower and capital funds, the south Bay is believed to provide the greater potential benefit with greater return for dollars spent.

SOUTH BAY RECOMMENDATIONS

The South Bay, extending from Rickenbacker Causeway to the Card Sound bridge is the water recreation area for the County. In contrast to the urban character and small water area of the north Bay, the most southern section provides the feeling of remoteness with broad water areas and naturally vegetated shorelines. The barrier islands and flats provide calmer waters than the ocean and protected anchorages for swimming, overnighting and exploring. The ample dimensions work well to satisfy cruising, racing, fishing and to spread out fast and slow boats. The upper half is presently the most heavily used by the day sailor, the southern half by the overnighters and faster power boats.

Present shoreside development is primarily single family residential viewing, but most of the Bay shore is yet undeveloped, either held as private or County lands.

The critical needs for diverse water recreation are:

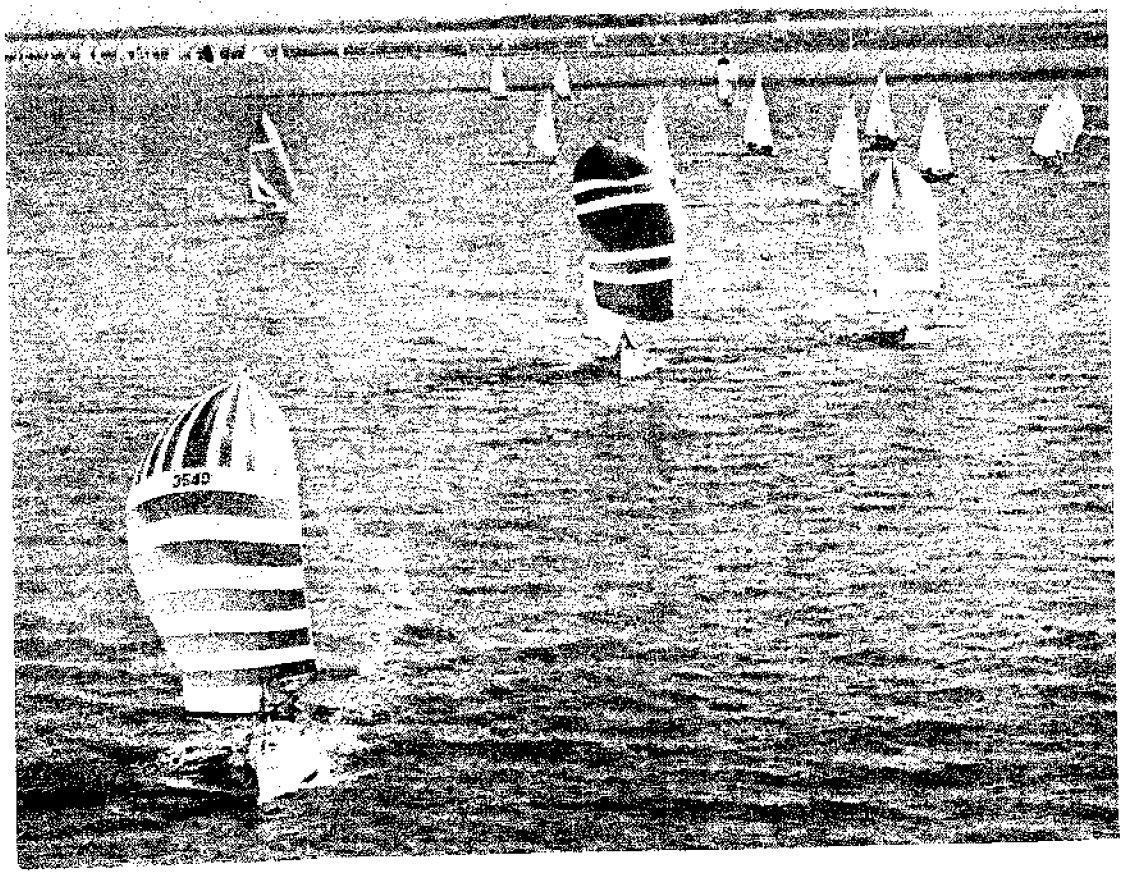
1) Openness and ample size
2) Fishing areas
3) Protected anchorages with clear water and clean, shallow bottom
4) A character of undisturbed naturalness
5) Access

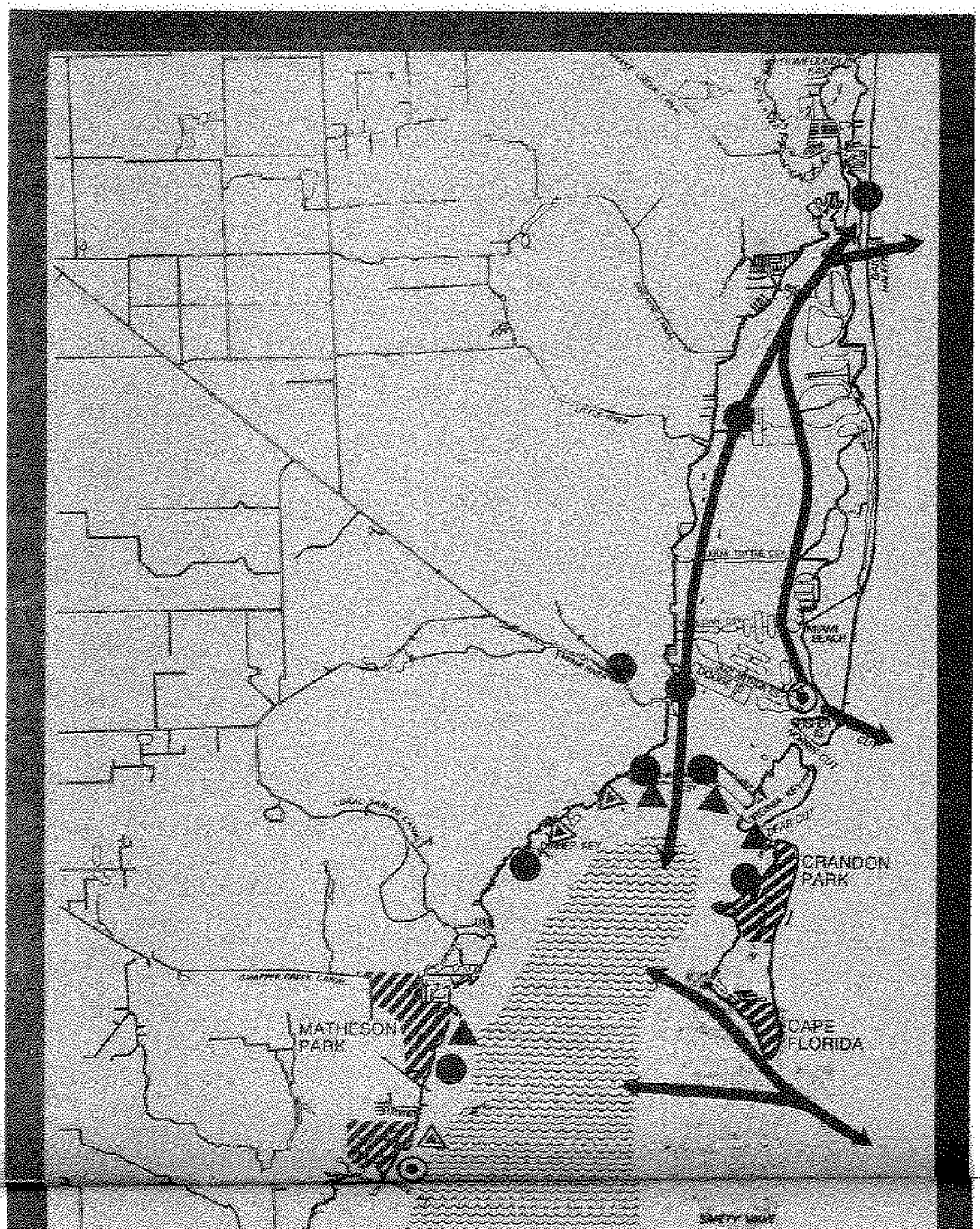
The south Bay presently provides all of these needs except access. The Biscayne National Monument serves to provide anchorage areas and maintenance of marine life within its boundaries. The County, because of the extremely fortunate siting of its five park areas, holds the key to access. Within its land use and waste treatment authorities, it further controls the future water quality of the south Bay.

Six recommendations are made:

1) Expend the major effort on the south Bay as a recreational resource for the County.
2) Through the County Park system greatly expand overall Bay access by boat launching, dockage, rental, charter and excursion facilities.
3) Beach areas in the Bay could be trebled or quadrupled by construction of shaded, near shore, parallel island beaches connected to the shore by piling supported piers.
4) Protect dense marine grass bed areas by careful selection of channel locations.
5) At the existing parks and on private bayfrontage lands, encourage by all possible mechanisms, a zone of vegetation for collection and uptake of chemicals and silt contained in land runoff and shelter for land and marine life.
6) In the immediately adjacent upland areas encourage use of seepage pit systems for all runoff waters excepting the intense storm

Racing in central Biscayne Bay. (Credit: Miami-Metro Department of Publicity and Tourism).




CRANDON
PARK
CAPE
FLORIDA
MATHESON
PARK
CHAPPER CREEK CANAL
CORAL GABLES CANAL
BISCAYNE BAY

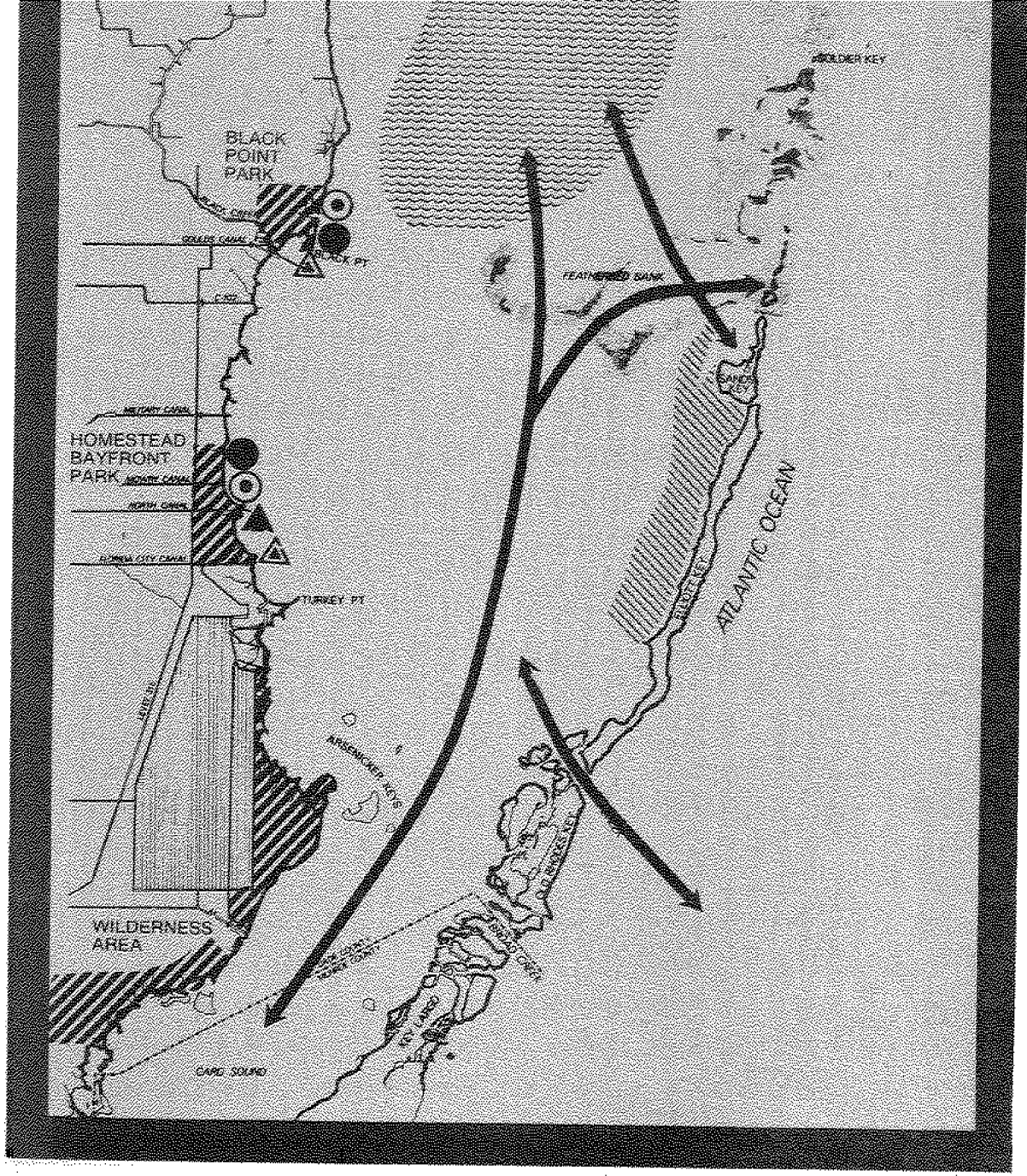
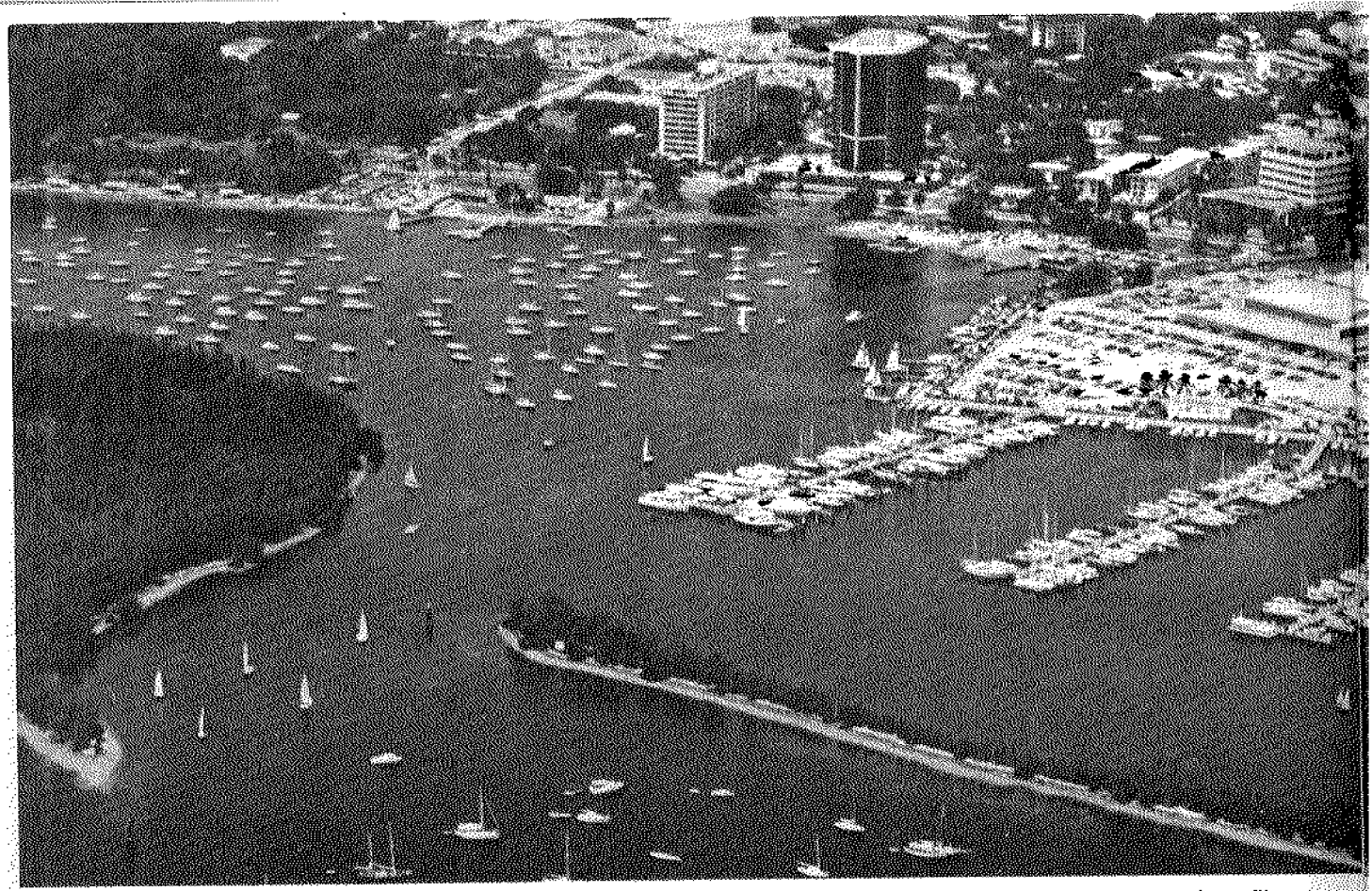


FIGURE 2: PROPOSED FIRST PRIORITIES.

- EXISTING PUBLIC LANDS
- MAJOR BOATING WAYS
- EXISTING PUBLIC MARINA
- PROPOSED PUBLIC MARINA
- EXISTING PUBLIC BEACH
- PROPOSED PUBLIC BEACH
- PREFERRED ANCHORAGE



Miami's Dinner Key Marina, a public facility.

INTRODUCTION

The water and adjacent lands of Biscayne Bay lie almost totally within the boundaries of Dade County, considering reasonable physical boundaries to be Dumfoundling Bay on the north and Card Sound on the south. The perimeter shoreline of the Bay is approximately 138 linear miles, almost equal to the linear distance between Miami and Fort Myers.

This report addresses the uses, natural constraints and future options of the Bay and how well it serves the present interests and the mechanisms for managing its future success.

Problems are occuring due to conflicting uses of the Bay. For example, the poor quality of storm runoff and domestic waste waters disposed of into the Bay are in conflict with the needed high quality for contact sports. Low clearance bridges back up vehicular traffic and boat traffic as well, particularly on weekend recreational days.

What problems exist and their resolution depend on which use is considered and what rank of importance it has over others in the minds of the community at large. The body of this report describes each of the major Bay uses which range from wilderness areas to commercial ports, their location and quality needs, and the impact of one use upon another. To this point, the report attempts objectivity. There are some uncertainties in such an evaluation, however, because of lack of either environmental quality data or the scientific certainty of cause and effect. The final sections of this report present conclusions based upon the writer's judgment and his understanding of natural environmental processes and the limits to which they constrain and direct management options.

Staff members of the University of Miami, particularly its Sea Grant Program, have provided searches and summaries of Bay data and two reports are now available to the public. One of these gives a broad description of the natural and social systems which have created the present Bay.[1] The second

report lists and describes the information available on the Bay. [2] For those who are interested, titles and addresses are provided in the appendix. These reports and the *"Comprehensive Development Master Plan, Part 2 — Proposed Environmental Protection Guide, Metropolitan Dade County,"* (see pages 144-152) give sufficient background which is not repeated here.

Why This Study Was Undertaken

On April 2, 1974, the Board of County Commissioners adopted Ordinance No. 74-13. It declared Biscayne Bay and its environs an aquatic park and conservation area. Authorization was given to the County Manager to develop a plan for the protection of the aquatic park including the start and coordination of appropriate research and analysis.

In the year preceding April, 1974, there were several public committees actively concerned with Bay matters, and members of the then composed Board of County Commissioners participated. The prominent issue at that time was the news-worthy fish kills in the south Bay adjacent to several canals and the catching of diseased fish in north Bay near the Miami River and Virginia Key. Two other persistent problems also dominated the discussions — the apparently insufficient capability at all levels of government to even monitor those actions that require permits. Secondly, the complexity of the permit process itself was an issue. The principal criticisms of the permit process were:

1. Too many agencies are directly and indirectly involved.
2. The many reviews require a great amount of time and effort.
3. There is a strong uncertainty of what is and is not acceptable at the outset, causing much wasted effort.

One of the very few points upon which there is general agreement is the desirability for clearer guidelines, such as regulations telling what can and cannot be done, where and under what conditions.

THE BAY AS A RECREATIONAL RESOURCE

The north Bay offers views of city skylines, homes and cruise ships either from shore or land. It is an urbanized area, used for passive viewing and maritime commerce. The south Bay, measuring from Rickenbacker Causeway to Card Sound, offers thirty three miles of protected water. The four to seven mile width, with the extensive length, are excellent dimensions for spreading slow and fast boats and those who are out briefly from those who wish solitude. The southern keys provide extremely clear and calm water for swimming and diving. There is no other bay in the continental United States which provides this diversity and size in a year-round climate.

For the resident and visitor to Dade County, the alternatives for outdoor recreation are few. The Everglades and undeveloped interior lands are available but the appeal is limited, because of the difficulties of the terrain and climate.

Although the offshore reefs and Gulfstream waters are an enviable asset to the region, most boaters correctly perceive that regular use of these open waters requires a significant step upwards in boating skill, boat size, and costs. This offshore area therefore is available to only a small public while the protected Bay can be used by far more.

THE PRESENT CONDITION

Recognizing that the use must be first considered, a summary of the Bay's present condition is given in the following paragraphs. In describing the existing condition the severe lack of data leaves some conclusions open to question. Predicting future trends becomes far more difficult. It is deeply disappointing that some level of government had not been encouraged five or ten years ago to begin a program of routinely sampling Bay quality. Without this data it is hard to judge the success of past efforts to improve the Bay and perhaps the arguments now over the future quality trend and needed action could have been avoided.

In the north Bay (Rickenbacker Causeway to Dumfoundling Bay) bacterial levels have exceeded specified State and County standards some time in the past three years at thirty seven of the forty County measuring stations (the measurements exceed 1000 coliform). [3] Actually, the standards specify levels based on monthly averages of at least ten samples per month. The County sampling program measures only once a month and technically one cannot say if these waters are legally polluted or not.

There are a number of problems in interpretation of coliform data and some judgment is necessary. Based on the number of times the 1000 level has been exceeded and the highest numbers reported (2000 to 5000) the conclusion reached is that the north Bay is marginal in meeting the Class III Recreation standards. With this doubt as to quality, the *recommendation made is that a special monitoring survey be undertaken to establish the present safety of the north Bay.* No subregion is considered obviously acceptable as high coliform values are reported at Interama and Baker's Haulover Park, the east and west sides at the 79th Street Causeway, and the north side of Rickenbacker Causeway. As the Class II standards (shellfish harvesting) are far more stringent than Class III, it is quite clear that the north Bay does not allow this use.

The bacterial source is questionable. The Indian Creek area gives the highest values and the Miami River discharges near the southern measurement station with a high reading. Within these two sources there are probably poor operating septic tanks and some undiscovered faulty sanitary

sewer mains.

Of the approximately 70 miles of shoreline in the north Bay:

45 miles (66%) is used for private viewing

3 miles (4%) is used for public parks with view access only

1 mile (1.5%), the north sides of Rickenbacker Causeway, is public beach

5 miles (7.5%) is developed for commercial marine uses such as the Port, the Coast Guard base and the Chalk terminal.

14-15 miles (21%) the remainder, is mixed between unusable because they are right-of-ways such as McArthur Causeway and yet undeveloped shorelines.

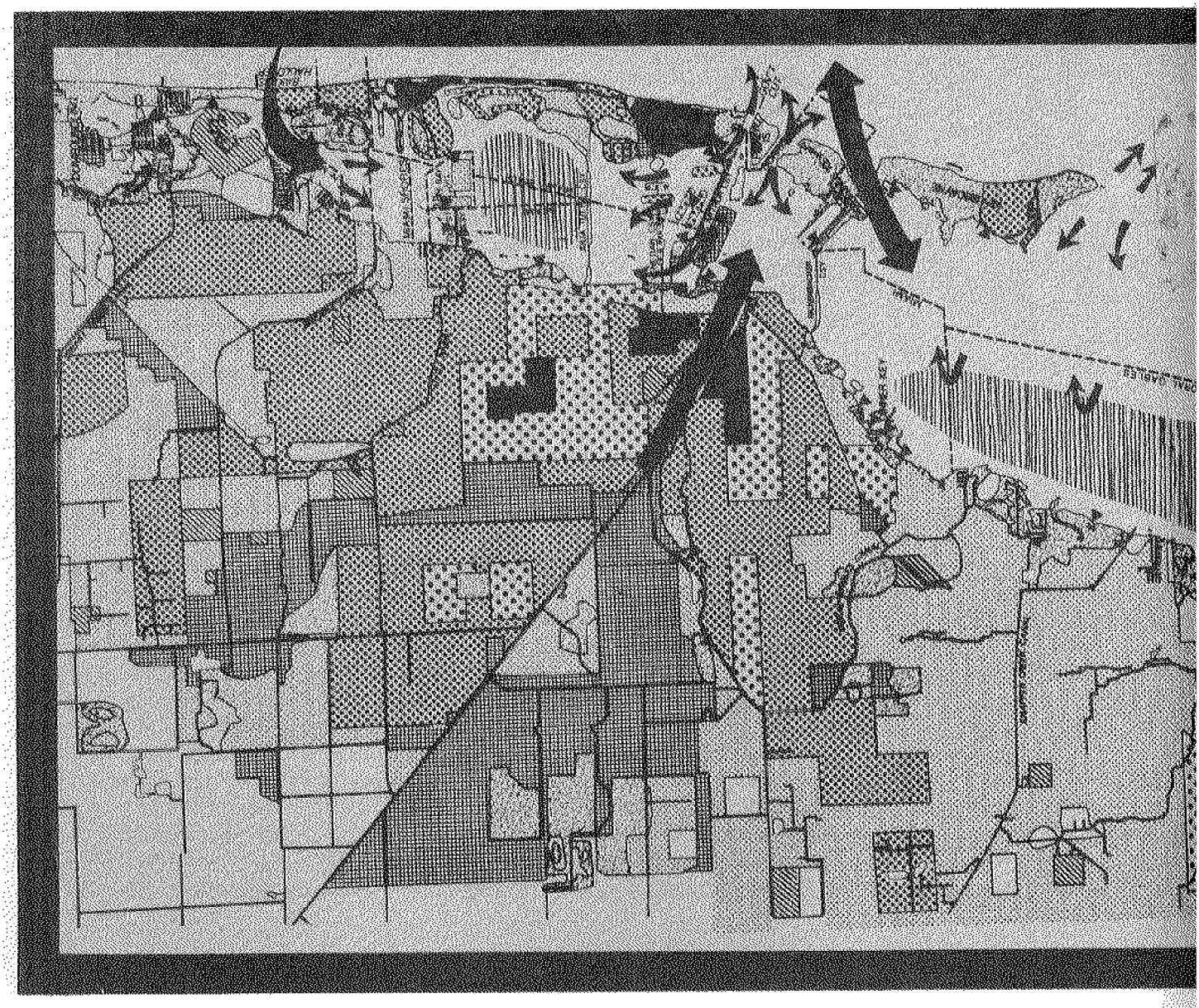
The largest parcels in this latter category are the Interama tract, Virginia Key and Fisher Island. If, by closer monitoring the waters surrounding Julia Tuttle Causeway are found to be acceptable for water contact, this right-of-way might be considered usable. It represents about 4% of the shore edge, four times that now in beach use in the north Bay.

As more than 98% of the north Bay is used for non-contact purposes, the existing water quality satisfies practically all the present uses. By bacterial standards and judgments of the color and transparency it is inferior to the mid and southern Bay areas and has obviously declined in quality from the early 1900's; it reached its lowest quality prior to 1955. In that year the Virginia Key treatment plant was placed in operation and discharges in the Miami River and the Bay were reduced. Dr. J. K. McNulty made the only systematic study of Bay pollution that documented the before and after effects of the plants operation.[4] The comparisons spanned different periods depending on the characteristic considered. For coliform bacteria, 1959 data showed decreases by factors of three to as much as 10,000 (24,000 to 7,000, 11 million to 1,300) when compared to 1949. Phosphate levels dropped by one half to one quarter. Plankton, small organisms which in sufficient quantities cause loss of clarity and give a greenish cast to the water, dropped to about one half the old concentration in the central part of the north Bay but did not change in the area near the Miami River. Other biological comparisons were made, but Hurricane Donna occurred during the study period and complicated interpretation.

The County measurements referred to earlier, give some insight on the conditions over the past three years. They are taken at too infrequent intervals for indications of trends for that three year period, but when compared to the 1960 data, indicate little change in bacterial concentrations.

Based on these data and general completion of the development of the surounding land, *the conclusion is the north Bay is probably stabilized at its present quality levels.*

Where we stand in the south Bay is even more difficult to describe factually. *There have been no continuous water quality monitoring stations in this region, and there is no present data network.* Some bacterial measurements are taken at Dinner Key, at the swimming atoll at Homestead Bayfront and at a yacht club. For research purposes, salinity and temperature have been repeatedly measured and can be used to give a clue as to what might occur. Turbidity has been measured broadly twice, but this very important characteristic is highly variable and must be measured frequently to allow interpretation. The writer is not ignoring the excellent and serious work of a number of scientists who have studied biological and physical processes and made inventories of the biology of portions of the Bay. However, unless the areas are revisited, carefully using the same techniques — and revisited at frequent and regular intervals, no trend can be projected. This has not



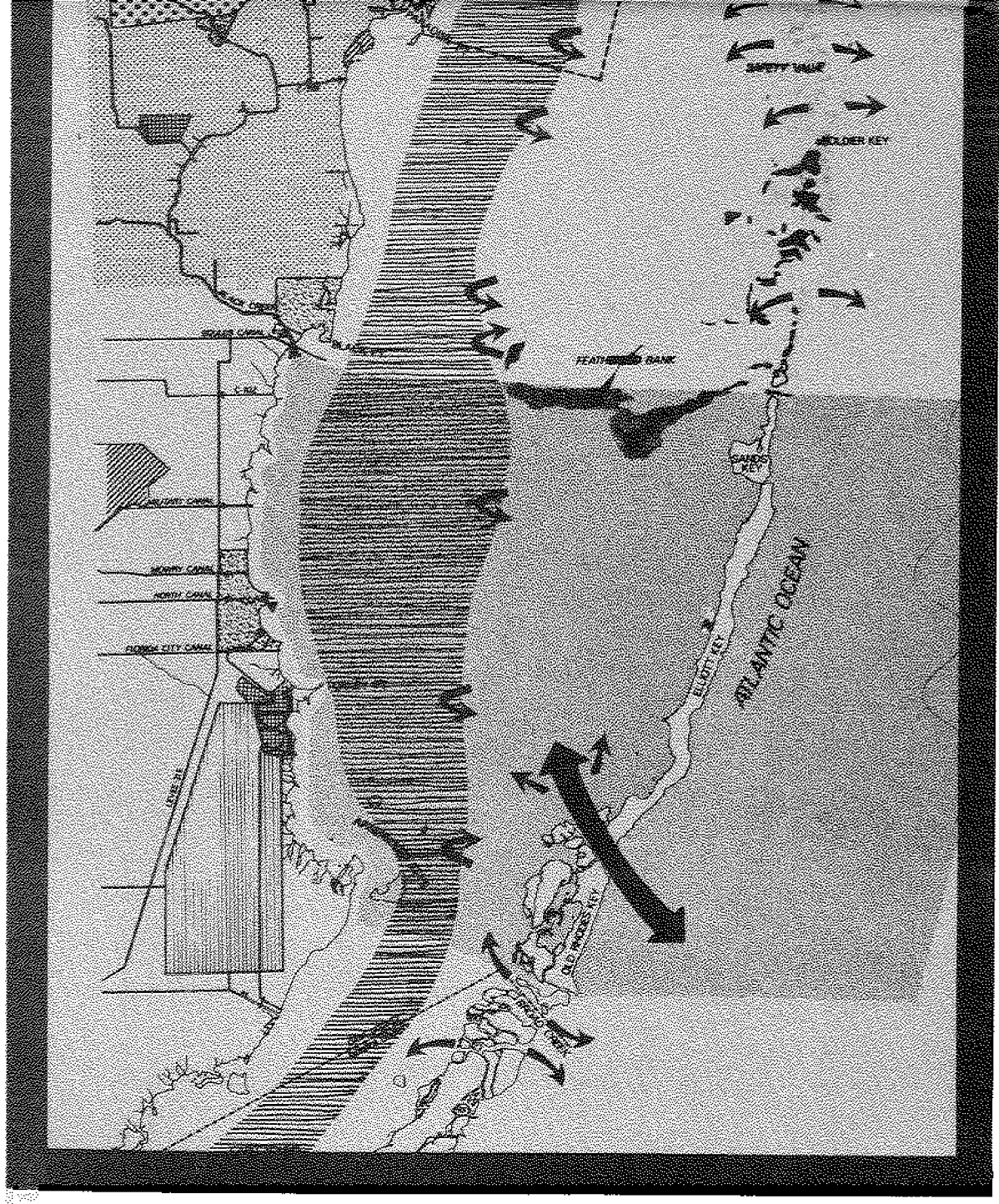


FIGURE 3: EXISTING LAND USE AND BAY CIRCULATION

RESIDENTIAL [people/sq. mi.]

- 15,000
- 5,000 10,000
- 10,000 15,000
- 5,000
- COMMERCIAL and INDUSTRIAL
- INSTITUTIONAL
- AGRICULTURE, OPEN LAND
- RECREATIONAL
- BISCAYNE NATIONAL MONUMENT
- MARINA, LAUNCHING RAMP
- MAJOR FLOW
- MINIMUM EXCHANGE AREA (Residence time = 3 months)

been done.

Considering water contact sports and fishing to be the favored uses, the writer's judgment based upon review of the scant data and his site inspection, is the southern Bay remains in satisfactory condition. The mid Bay is marginally acceptable. The principal criteria used is turbidity, color and denseness of bottom vegetation. If water quality data were available for the past five or so years, it could be compared with growth patterns and, more importantly, changing practices in waste treatment and development design along the water's edge. From this comparison, some reasonable forecasts of the future could be given. Failing that, the following is the writer's estimates of the future of the south Bay.

1. If land use should be one of high density development and the shoreline bulkheaded at the currently projected mean high water line (probably removing almost all coastal vegetation) the south Bay will have the same overall characteristics as now exist in the north Bay. The waters of the western shore will approximate the quality of the most turbid waters of the north Bay. The west side of the south Bay has very poor circulation; particles of chemicals take 2 to 3 months to leave the area of their source, thus building up high concentrations.

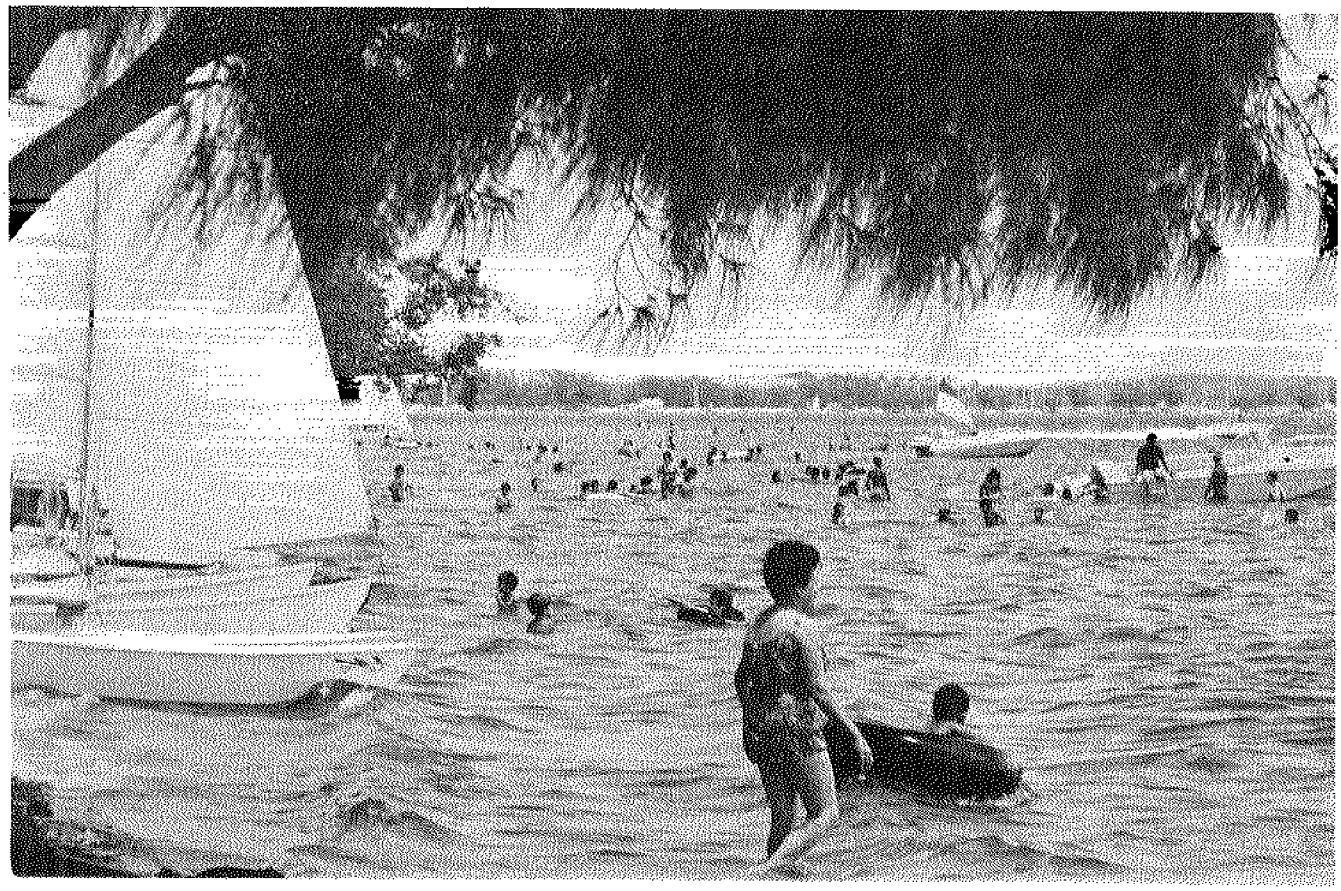
2. If developed no further than the present lands under construction, with minimal pollution loading, leaving shore edge vegetation for at least 100 yards inland, *Bay quality will improve over present conditions*. The improvement would be primarily due to the continued implementation of the area wide waste treatment plan.

3. What has not been predicted is the Bay's response to the likely middle ground between these two management extremes. The writer does not believe anyone, using the present body of knowledge, can accurately predict the outcome of the development alternatives possible within this middle range. With very careful control of density, provision of buffering vegetation, normal (less than 10 year storm) runoff to seepage pits, swales and very limited canal and basin excavation, these southern portions of Biscayne Bay can possibly be maintained at its present quality level.

WHAT FURTHER COULD BE DONE

In December of 1974, recommendations on immediate actions were given by the writer to the County Manager's Office. In making those recommendations, the writer then believed the greatest concern should be for water quality and fish and wildlife productivity in the south Bay. Four subject areas were proposed: (1) Development of a fringe plan; (2) Undertake a comprehensive survey and engineering study, possibly funded by an EPA 208 Act application; (3) Study of chemical loadings and residence times in the Bay; and (4) A resource economics survey. Of the four, the County is beginning the resource survey in support of the design for the expansion of the County park and marina sites, it has requested and been approved as the area agency for the EPA 208 non-point source pollution management program, and mapping of the Bay bottom and shore erge, the first step of a fringe plan, is planned to provide review of channel and coastal sites. Study of the loadings and residence times (the concentration in time and space of materials entering the Bay) is less certain since federal funds have not been definitely provided.

In light of these actions and because the waste treatment program is progressing the recommendations *now* made on future opportunities emphasize recreational access as the priority subject area.



The Rickenbacker Causeway provides recreation access to the Bay.

Interama Tract: In the decisions on what finally is to be done with the Interama Tract, consideration should initially include boat launching ramps, fishing from shore, a water skiing area, a marine park with paths to the water with shaded areas and leaving parcels of undistributed vegetation for wildlife support. More careful water quality tests may possibly find the area suitable for contact sports and fishing. If not, shore edge public viewing, launching and dockage could still give Bay access.

Julia Tuttle Causeway: The two long shorelines could be opened to public access. Provide for the uses seen at Rickenbacker Causeway in a more controlled and designed manner, particularly contact sports, but water quality tests are needed to determine health safety.

Virginia Key: As the landfill operation is completed and the digestion tanks are covered, the Bay side could be used as an area to beach small boats, wade, picnic. If highway congestion is serious, access should be limited to boats. Perhaps access to a point such as this and other islands could be by a public excursion ferry. Such a ferry might be a part of a high speed transit system or a slower Bay excusion system.

Fisher Island: Besides the above, this island is virtually the only other major undeveloped land acreage in the north or mid Bay. Protecting the channel on the south side, (Norris Cut) is mandatory for exchanging Bay

waters with the ocean. The present flow should in no way be restricted. A slight deepening could be beneficial. Development on Fisher Island, irrespective of the issues of access, should receive careful consideration of runoff, treatment of the south shore edge and perhaps some ocean side public access. By a mechanism such as transfer of development rights, the island conceivably could be devoted to a marine park of service to a broader community.

North Bay Dockage: As a possibility to relieve the demand for dockage, applications could be considered for private or public docks in areas which have already been substantially disturbed by dredging and bulkheading. A number of small facilities could be acommodated if designed for good water circulation, *using piers rather than solid fill.* Particularly favor those which could provide hurricane refuge.

Mid Bay: On the western shore several public parks exist from the vicinity of Dinner Key northward to Rickenbacker Causeway. They are presently vertically bulkheaded but could include swimming facilities if bulkheads were removed and sand and shade trees provided.

Ragged Keys: This chain of small islands is privately held and claim is also made for ownership of considerable surrounding Bay bottom lands. The area itself has a high use for anchoring, swimming and beachcombing. Immediately south, the Sands Key and Elliot Key portions of Biscayne National Monument are influenced strongly by the tidal currents which flow through the Ragged Keys. *The recreational and natural resource value of this region are the highest for the entire Bay.* Minimal alteration is recommended, leaving no question of reduced circulation, increased turbidity or disturbance of fishing and diving grounds. Public acquisitions should be considered if no other means can be found to protect the present qualities and public use.

Marine Parks in County Lands of Mid and South Bay: The greatest opportunity for meeting the water recreation demand is additional access to the shore and water areas. Demand is so great that doubling or tripling launching and dockage capacities would not exceed demand nor compete with existing private and public facilities. As a complex, consisting of marinas, parks, swimming areas and nature habitats, marine parks in south Bay play the dominant role in maintaining the recreational values of the south Bay and providing access to it.

Additional swimming and wading areas in the south Bay are particularly hard to provide and should not be done at the expense of existing vegetative shorelines. The only means the writer can suggest would be by the construction of island beaches, offshore but parallel to the shoreline of the county park sites. To maintain satisfactory resource qualities, both for the bathing areas and the south Bay region, will require dealing with a number of severe environmental constraints. Water circulation and exchange must not be reduced. Marine grass beds should be avoided, and in construction and after completion siltation will have to be most carefully controlled. Parking and access to the proposed island beaches should not infringe on the dense coastal vegetation band.

The proposed islands might be several hundred yards long, 100 yards wide and planted their entire length with native shade trees. They should be at least 100 yards offshore of the existing shoreline with access by a walkway supported on pilings. Only a few are suggested, as any continuing stretch of beach would severely interfere with water exchange and the movement of marine life, nutrients and runoff.

These public marine facilities, particularly marina access, should receive

the highest priority in the County's Bay activities. The design and operation should be carefully coordinated with Biscayne National Monument plans and the State Biscayne Bay Aquatic Preserve Act. The opportunity, perhaps requirement, exists for an exemplary design for resource maintenance and public use.

The above list of recommendations addresses specific areas and uses. Throughout this report it has been stated and implied that lack of regular monitoring of water and biological characteristics leaves many conclusions tentative. To reduce the uncertainty of present conditions and to measure the effect of abatement programs and population growth, *it is recommended that a monitoring program be implemented in the three basic areas of the Bay — north, mid and southern.* Its functions would be:

1. To establish the bacterial level in the north bay. Is it clearly safe for contact sports and consumption of fin and shell fish? What are the pollution sources?
2. To measure the concentrations in all basins of nutrients, (particularly nitrogen compounds) herbicides, persistent pesticides and the toxic metals and determine if these materials exceed known safe levels and are increasing or decreasing in the different bay areas, locate the source and determine if the various quality improvement programs such as domestic and industrial waste treatment are showing the expected results.

Approximately twenty-five stations would be sufficient, spaced to sample near canal discharges and ocean inlets. This number is less than the County's existing network. Twice a month rather than once per month sampling is recommended however to better recognize variability. Far better interpretation can be made if the time of measurement is kept in phase with the tidal stage. Following normal solar time causes gradually different water masses to be measured and unless sampled at much more frequent intervals will give trends related to some confused mixture of tides and discharges. Finally, it is imporant to standardize the locations and sampling techniques and collect corollary data on rainfall, winds and wave condition from the National Weather Service and canal discharges from the Floor Control District and U.S. Geological Survey. The program should be considered to have an indefinite length, and be a part of the County's management program. A research program is not proposed, but monitoring as a part of or additional to that expected in the Environmental Protection Agencies 208 program grant. The results should be used to keep track of water quality and safety and to provide warning and assurance of the future.

It unrealistic now to launch a comprehensive research program as there are too few management options left open and the time delay required would cause substantial social and economic penalties. Using informed, present best judgements, as a basis for resource decisions seems the best hope.

MANAGEMENT ALTERNATIVES

Over the past two years, much of the attention given to the bay has been on the subject of a bay management system. A portion of this contract effort has been spent in appraising management programs in other bays throughout the country. It is appreciated that there are many factors to weigh in addition to strictly technical arguments of management. The alternatives proposed and the recommendation made, however, are limited to technical and legal consideration as the consultant has not tried to view the priority of the bay problems in a perspective that includes all of the other regional needs which the County, municipalities and the State must also face.

Three alternatives are presented:

1. The present system (which has had changes as recent as July, 1975)
2. An intergovernment Task Group, and
3. A permanent Bay Commission.

In evaluating these or any other management approach, the body of this report provides the kinds of problems and goals to be met. Who legally has the power to act has been the subject of reports more lengthly than this. The writer concludes that more important than who owns the bay is who controls the shoreline and interior lands. By state and federal delegation, the County, the municipalities and the Flood Control District have the key authority. Secondly, there are many laws and authorities in existence, particularly in environmental management. The prime example is the Refuse Act of the 1890's — the basic authority now more broadly interpreted and applied. Rather than a matter of a new system of law, the question is a matter of *focus* of interest and authority.

This report recommends an intergovernmental Task Group. The group would review the actions and programs recommended here and seek others. It should make regular public reports on progress — providing the focus now missing. The County should provide the major manpower commitment.

The ultimate difficulty in making these final recommendations as well as those throughout this report is judgment of the priority to be placed on the bay and the value and cost of further delay. Other bay areas with far less value than Biscayne Bay have had millions of dollars spent on their study. But this region has other pressing environmental problems, particularly the safe supply of drinking water and protection from flooding. It is believed a middle ground approach is a realistic solution and not an ineffectual compromise.

THE PRESENT MANAGEMENT SYSTEM

The present management system is basically composed of Metro-Dade Government, particularly its Department of Environmental Resource Management, and the several municipalities — for lands above the mean high water line. The Flood Control District has broad powers for water supply and water quality in the canal system and aquifer. The state reorganization of July, 1975 now places the bay waters and bottom lands under the authority of the Departments of Natural Resources and Environmental Regulation respectively. The Army Corps of Engineers is the most immediately significant federal agency.

Both the recent County and State reorganizations combine prior functions in the interest of improving efficiency. The complaint of confusion and slow processing of permit applications may be resolved by these actions. Those who will now work with these new groups will have to make the appraisal.

In comparing the roles of these groups and the actions recommended, it is believed plausible, but unlikely, that all could be reviewed and imple-

mented if the Board of County Commissioners, Commissioner of Municipal Governments and the State Environmental Regulation Department each made informal cooperative commitments. The south bay programs can be implemented by the County with the normal State approvals.

INTERGOVERNMENTAL TASK GROUP

An Intergovernmental Task Group would be a temporary group composed of appointed representatives of municipal, County and State governments which would review and recommend a set of ordinances and projects for accomplishing a set of objectives such as given in this report. Citizens and technical ad hoc advisory boards would be used in evaluating goals and strategies. *The Task Group's principal actions would be in recommending priorities and specific projects to be implemented.* Resource monitoring and permitting would remain the function of existing agencies. Once the projects are completed by the assigned departments, the Group's work would be finished and should be disbanded. The Task Group's function would be to see projects implemented, not just studied.

A BAY COMMISSION

A permanent Bay Commission is a form of limited authority regional government. It supersedes other governments gaining its powers by delegation, usually from the State. In a different, but very important sense, it provides a center of focus. The San Francisco Bay Conservation and Development Commission (BCDC) has been frequently mentioned as an example of what might be implemented here. The success of that agency — in accomplishing its goals, and in the broad support it received, is remarkable. Two aspects, however, make their approach somewhat inappropriate for this area. In the San Francisco Bay area there was and is no regional government. Secondly, the BCDC has limited powers with respect to the bay itself. Their task is to control the filling of the bay and the use of the shore edge. They have no authority over water quality. They then have a simpler problem, measuring success by the number of acres not filled. It is surprising to those who are not familiar with that area to find that proportionately, much of San Francisco Bay is not yet developed. Most of BCDC's early work was the design and implementation of a coastal development plan. Their present efforts are to begin a second round of refinement of that plan. They do not monitor the bay, but do have permitting and hearing powers.

In meetings with the BCDC staff, the point of a more restricted goal was emphasized. This greatly simplified the organizational structure and support. It was also mentioned recently that serious thought is being given to forming a metropolitan form of government. Metro-Dade County is looked at as a possible example.

The principal virtue of a bay authority would be the centralizing of all permitting, monitoring and funding. San Francisco is not an example of this. To the BCDC staff's and the writer's knowledge, there is not such a bay authority in existence.

A permanent Commission could direct the preparation of a bay management plan which sets out the specific uses for all of the shore edge and waters and details their design criteria. Continuing functions for handling development review, appeal and environmental monitoring would also have to be covered. If such a plan were prepared, it could be submitted to the State and Federal government, under the Federal Coastal Zone Management Act. If ultimately approved, this detailed coastal plan would bind all agencies, *at all government levels*, to its specifications.

The above approach is the only way known to centralize all of the per-

mitting functions of a coastal area. It clearly requires, however, a minimum period of several years in order to make it operational. During that time, all coastal development would have to be delayed to varying degrees. If Biscayne Bay presently was at the stage of development of the late 1950's, a commission form of management would be strongly recommended. It seems less necessary now as limited decisions remain and a metropolitan form of government has been created.

USES OF THE BAY AND CONFLICTS

The section summarizes the overall analysis of the Bay, its present uses and the potential and existing conflicts. Of the several approaches to analyzing a resource, the method applied here was selected to define uses of the Bay by environmental quality requirements and location desirability. Uses are grouped by proximity to the water.

The three major groupings are:

Near Coast	not fronting on the water, but from the coastal wetlands inward to the point where drainage to the bay no longer occurs
Water Edge	one boundary is the actual edge of the bay waters
On or in the Water	physically located in the bay waters

THE NEAR COAST

Near Coast uses include urban centers, suburban developments, agriculture and wildlife habitats. The major consideration for location and site preparation for these Near Coast uses (excepting wildlife areas) is that South Florida's extremely low land elevations require extensive land alteration for protection from flooding and storm tides. The Bay map included in this report and the Flood Project Map of the Central and South Florida Flood Control District clearly show the major extent of the drainage canal system for excess storm water discharge into the Bay. This system of canals and companion levees works to provide land drainage and flood protection. Salinity control structures at the coastal canals are provided in an attempt to control salt water instrusion into the fresh water aquifer.

The use of the Bay for these near coast activities is primarily as a receptacle for excess waste waters. Bay water quality is not a consideration for such use, although suburban areas traversed by a canal connected to the Bay do place requirements on the quality of the canal waters. Minimum desirable characteristics of canal waters are freedom from undesirable nuisances such as algal growths, strong odors and excess litter. The most desirable use of the canals would be swimming. However, this water sport requires fair clarity with safe bacterial and viral concentrations. Canals in Dade County are erratic in quality and it is still generally advised that many canals not be used for body contact because of health considerations and the lack of safely sloping sides.

Canals passing through urban areas of the County have been used extensively as receivers of point and non-point discharges creating high bacterial and toxic chemical concentrations. Efforts to control point sources such as sewerage discharge have made headway and projects such as the Miami River restoration have made some progress in removing visible pollution. Water at the mouth of the river, however, is far from the goal of having no negative impact on the Bay. Hydrocarbon compounds and heavy metals, in addition to silt and other suspended solids, are still reported to exist in high concentrations.[5]

Canals which drain agricultural lands carry large amounts of materials harmful to water quality. Agricultural chemicals (fungicides, pesticides, herbicides and fertilizers) unfortunately serve no further useful purpose to the environment after they leave the fields either by percolation into ground waters or surface runoff. Some individual or combination of agricultural chemicals are highly suspect as causing the sporadic fish kills in the south bay. DDT levels in fish tissue have been found to exceed federal standards

— though the number of such analyses are small as yet.[6]

Coastal canals have salinity structures which maintain the fresh water level above that of the bay, however, there is continual leakage. During the rainy season, the canals intermittently discharge into the bay and it is not surprising to find diseased or dead fish on both sides of the structures.

The near coast uses, *because of their need for drainage, and because of past and some existing practices of handling point and non-point sources, have had a negative effect upon most of the Bay's recreational uses and commercial fishing.*

THE WATER'S EDGE

At *Water's Edge* most of the shoreline is taken up for residential use and is most concentrated in North Bay. Only a modest number of either high density apartments or single family homes have a beach or boat dockage thus limiting the utilization of the bay to private shoreline viewing. As the distance from the water increases, horizontally or vertically, clarity and color of Bay waters quickly become less important to the view. Objectionable, but again decreasingly with distance, are floating debris, scums and floating algal mats. For those interested in only viewing the Bay, the milky blue-green color seen in the area near the Rickenbacker Causeway and Norris and Bear Cuts is pleasant. This color, however, is due to suspended silt and plankton and the water is roughly three times more turbid than that of the South Bay near Elliot Key (the bottom can be seen at about three or four feet in the North Bay and at about 10 to 14 feet in the South Bay). Further, viewing from the shore has little demand for biological health of the Bay. It would be pleasant to spot a manatee or a large jumping tarpon but from the 14th floor this is hardly noticeable.

Two types of conflicts result from private shoreline viewing as a use: (1) conversion of natural landscape to dense development, and (2) the competition for physical space.

The *first* is the impact of converting a tract of waterfront land to a dense development. The previous wetland, with slow drainage and a balanced and relatively mild input to bay waters is changed into an urbanized area with a rapid runoff of waters of a very different chemistry which quickly overload the natural system. Dade County and the City of Miami have building ordinances requiring provision of collection fields with soakage pits for high density developments. This design requirement helps to alleviate potential runoff problems of new construction but does not duplicate the natural condition.

For the single family residential development, the control of runoff, other than for the purpose of protection of the homes and access roads from flooding, is a very recent consideration. Most existing bayfront residential areas are drained by culverts and pipes leading immediately to the Bay. The Venetian Causeway islands are only one example. Runoff waters carry excess fertilizers, weed killers and pesticides. Federal law now requires the change from persistent to non-persistent pesticides. Biological damage may therefore be reduced, but time and space are required for these and other materials to be converted or neutralized before entering the bay or canal. This is one of the principal arguments of the report in support of the recommendation for the need to preserve and maintain a shore edge vegetation buffer.

Some new developments now being proposed make efforts to provide shore side vegetation and reduce runoff rates and amounts. *There is no existing, inclusive set of ordinances or regulations, however, for guidance*

in development on the water's edge.

The *second* conflict brought about by private viewing is the competition for physical space. The map included with this report displays existing land and water use locations. In the north bay, practically the entire eastern shoreline is devoted to private use. No public access is possible except at Baker's Haulover Park located east of the Interama Tract. On the western shore of the Bay some public viewing access is provided, principally in downtown Miami.

In the south bay, existing development is more varied as to use, but public access is highly limited. On Key Biscayne, Cape Florida State Park offers the longest stretch of public viewing access. Vertical bulkheading, however, prevents water contact. Crandon Park offers a minimum amount of Bay viewing and swimming beach immediately south of Bear Cut. The remaining bayside property of Crandon Park is left in natural, dense mangrove stands.

On the western shore, from Rickenbacker Causeway south to the City of Coral Gables southern limits at Paradise Point, uses are divided between private residential viewing, mostly inaccessible vegetated shorelines of the two county park areas and the Dinner Key Marina complex. Vertical bulkheading of the short sections occupied by the City of Miami public parks prohibits swimming or small boat launching.

Southward from the city limits of Coral Gables to Florida Power and Light's Turkey Point facility, exists the greatest stretch of yet undeveloped shoreline. In the northern part of this 16 miles long strip, tracts such as Coco Plum and Saga Bay are in early stages of development for private residential use. Together they include almost 3 miles of Bay front and are generally typical of the expected style of development. Depending upon the type of controls put upon the Bay front, the location of the mean high water line, and the cooperation of landowners, the private development throughout this south bay area could have a minor impact as far as increased chemical and fresh water loads on the bay. However, if most coastal vegetation is stripped and storm drainage and bulkheading designs follow past practices, future development of south bay would significantly lower water qualities.

But, if natural shoreline vegetation is left intact, this southern portion of the Bay will have limited private or public viewing. The shore would be classified as wildlife conservation and buffer zone, with limited areas for recreation access by usual designs.

Marine Industrial use of the water's edge commonly makes up a major segment of a bay's activities. In Biscayne Bay, however, industrial usage is limited to Dodge Island, Lummus Island (in the future), a small portion of Fisher Island and portions of the Miami River. Light marine industry and small boat yards are also located on the Miami River, Little River and Dinner Key. Public and private marinas are not included in this category but are reviewed separately below.

The environmental demands of maritime uses are minimal, but their impact may be significant. Biscayne Bay is shallow (4-12 feet), with few natural channels; bottom vegetation is sensitive to sedimentation and water cloudiness (turbidity). However, deep channels (30-45 feet) with widths suitable for maneuvering room and mild currents are the principal needs of the marine industry. For the small craft boat works protection from wave action is important.

Over all, it should therefore be concluded that Biscayne Bay has limited available space for major maritime activities. The Port of Miami operations can expand from Dodge Island to Lummus Island. The small boat industry is

principally located at Dinner Key and the Miami River, with a small segment in the Little River, Oleta River, and Dumfoundling Bay. Competition for the limited physical space exists, mainly with uses such as high rise buildings which can give, in the short term, a higher rate of return on the land investment. Within the marine industry, the general opinion is that present land allocations are marginally sufficient to meet the *present* volume of recreational and commercial vessels. Meeting future growth needs will aggravate the competition, especially in the Miami River.

The commercial port (Port of Miami at Dodge Island) does not handle bulk cargoes and therefore environmental conflicts are not great. Careful operating procedures regarding bilge pumping, fuel transfer, and sanitation holding tanks appear sufficient to have reduced problems, but the potential exists if monitoring is not a continuing part of the Port's Management Program. The present dredging operation to deepen the commercial harbor at Dodge Island has produced a siltation problem in the bay area adjacent to Virginia Key Beach. Nourishment of this beach area was accomplished by using dredged spoils. Unfortunately, these spoils contain a large volume of silt forming material which is producing turbidity as wave action carries the material from the beach into the bay. More careful investigations need to be conducted by those responsible agencies to determine the suitability of spoil and the monitoring of the product produced. Blame cannot be placed on the dredging contractor.

Turbidity *(i.e.* loss of water clarity due to suspended or dissolved materials introduced to the water) is concluded to be one of the significant impacts which reoccurs in the Bay and which must be more carefully managed to protect bay interests. The production of turbidity in the bay waters has impact on all recreational uses and commercial fishing. *As discussed in the Present Condition section, increase in turbidity is the most obvious quality decline occurring in the Bay. Its many impacts on the natural system and the resulting impacts on the social values of the Bay make turbidity the most important single quality characteristic.*

Shore edge wading and swimming in Dade County has been provided in the ocean beaches of Miami Beach and Crandon and Cape Florida Parks on Key Biscayne. Within the north bay no deliberate provision of bathing area exists. Most of this area is vertically bulkheaded, and only a few people are seen occasionally along the few nonbulkheaded rights-of-way.

Rickenbacker Causeway, a right-of-way not designed as a beach area, ironically supports a remarkable high density recreation usage. Spill over from Cape Florida Park and Crandon Park facilities are only partial explanations for the dense use of the Causeway area. The true reason is the lack of public Bay facilities throughout the County. Neither of the two park areas provides the combination of close parking to the water, shade, and the ability to launch light sail boats. Shade at the beach edge is the strong preferential requirement as crowd densities thin rapidly on the eastern poorly shaded side of the causeway draw bridge. A second strong preference apparently is for a protected place to beach a small boat, and allow at one time the combination of boating, picnicking and swimming.

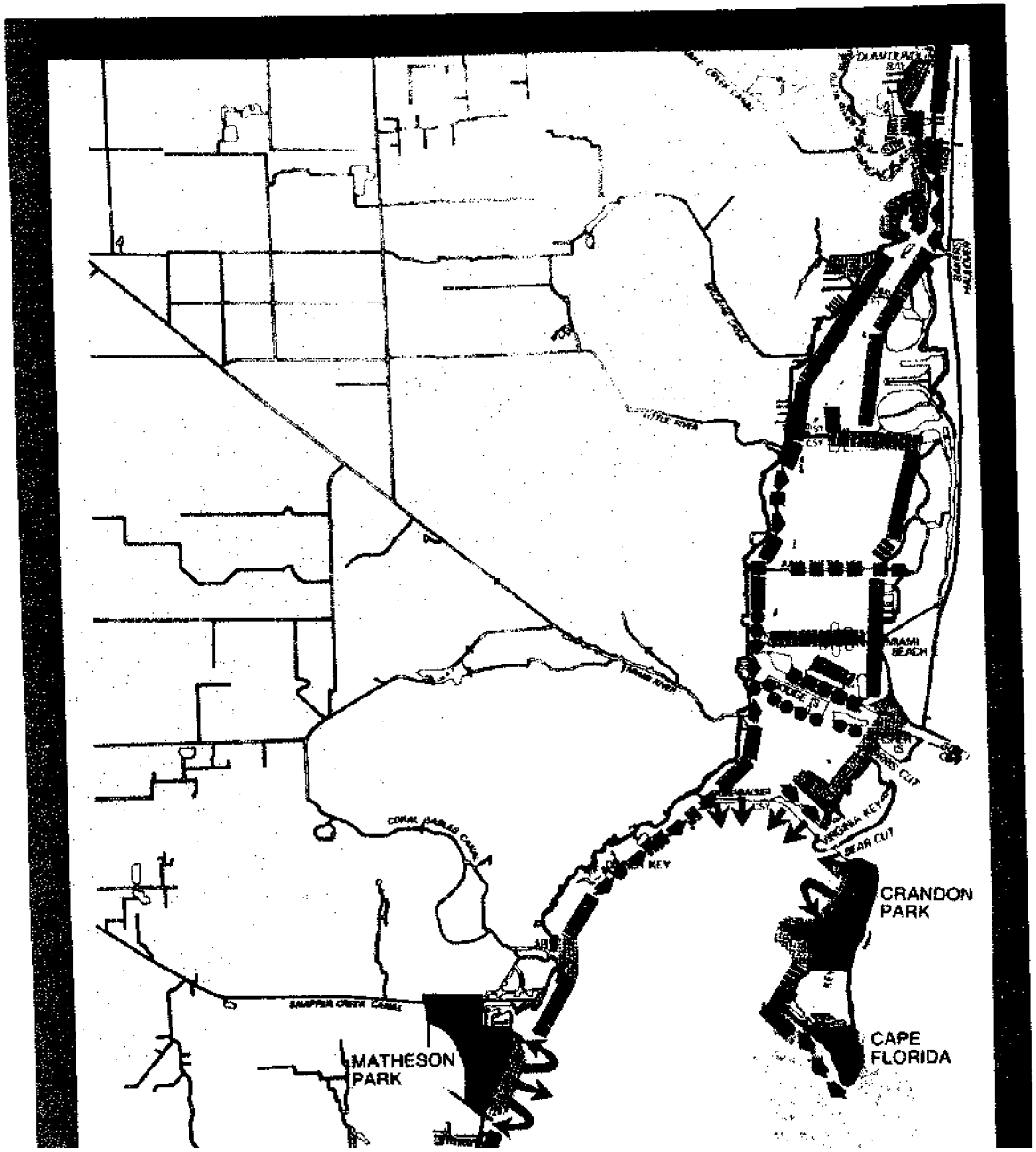
These physical characteristics of the Causeway are so appealing that people are willing to accept the extreme crowding and traffic problems, and the use of a beach and water area that generally would be considered of poor quality. While recognized traffic and transportation improvements are needed to this area, spending money only for vehicle access is contrary to good comprehensive planning. A County-wide water recreation plan is needed, with implementation and funding to match Dade's rapid growth by

TABLE ONE:

WATER QUALITY CLASSIFICATION

Summary of Criteria Significant to Biscayne Bay
from Rules, Department of Pollution Control, State of Florida, Chapter 17-3

	Class II Waters	**Class III Waters**
Use classification	Shellfish Harvesting	Recreation — propagation and management of fish and wildlife.
Bacteriological Quality, Coliform Group	*Median coliform* number cannot exceed *70 per 100 milliliters*, and *not more than 10% of samples ordinarily exceed a most probable number of 230*, in those areas most probably exposed to fecal contamination during most unfavorable hydrographic and pollutional conditions.	*Fecal coliform* shall not exceed a monthly average of 200 per 100 milliliters nor 400 fecal coliform per 100 milliliters in 10% of the samples, nor exceed 800 on any one day, nor exceed a *total coliform* count of 1,000 per 100 millilters as a monthly average, nor exceed 1,000 per 100 milliliters in more than 20% of samples examined during any one month, nor exceed 2,400 per 100 milliliters on any day. Monthly averages to be based on a minimum of 10 samples taken over a 30 day period.
Sewerage, Industrial Wastes or Other Wastes	Any industrial wastes or other wastes shall be effectively treated by the latest modern technological advances as *approved by the regulatory agency*.	Same
Dissolved Oxygen	Average not less than 5 milligrams per liter in a 24 hour period and never less than 4 milligrams per liter.	Same
Toxic Substances	"Free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations, which are harmful to humans, animals or aquatic life"	Same


MATHESON
PARK
CRANDON
PARK
CAPE
FLORIDA
VIRGINIA KEY
BEAR CUT
CORAL GABLES CANAL
MIAMI
BEACH

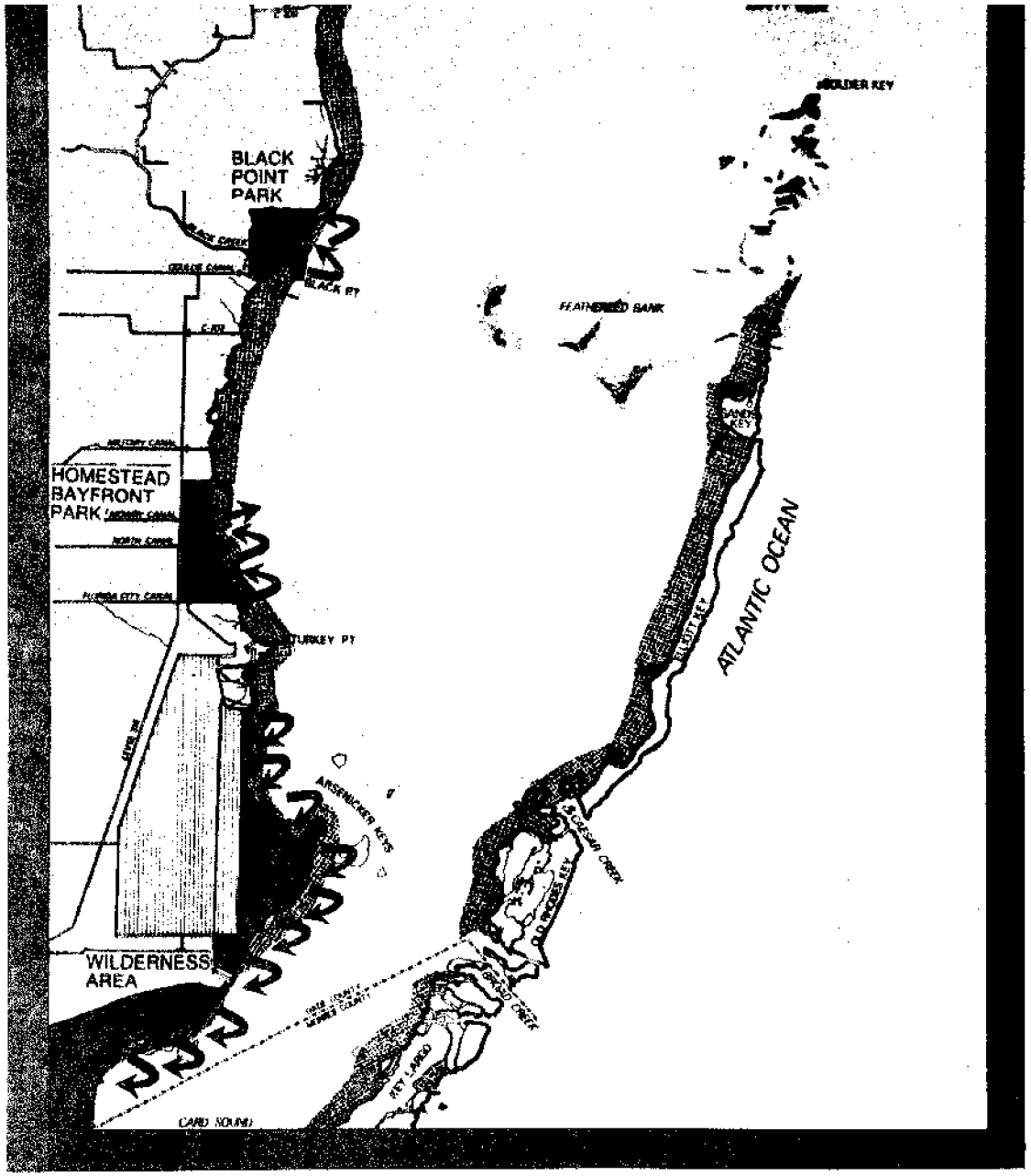


FIGURE 4: EXISTING 1975 WATER EDGE USE

- EXISTING PUBLIC LANDS
- PRIVATE (VIEWING)
- VEGETATED SHORELINE
- SEMI-PUBLIC ACCESS
- PUBLIC (VIEWING)
- PUBLIC BEACH ACCESS
- PUBLIC NON-ACCESS
- PUBLIC NON-USEABLE

providing more recreation areas throughout the County and particularly at the water's edge.

In the south bay three additional areas have been available for public swimming and wading. Homestead Bayfront Park has a heavily used man-made "atoll" type wading and swimming area as does Matheson Hammock Park. Matheson also has some limited beach area. Tahiti Beach has been the one remaining public beach in the south bay. Its future public access is presently uncertain since plans for residential use of the land are being considered by the owners.

For swimming use, there are very specific water quality regulations by state and local governments. These regulations concern health factors and specify "Class III" waters (See Table I) for use for recreation and propagation of fish and wildlife. The principal distinction between classes is in allowable coliform bacterial concentrations. Coliforms are crude indicators of the occurrence of raw domestic sewage which can carry numerous bacterial and viral diseases.

Other recreational standards usually used to evaluate water bodies cover specific chemicals and "aesthetic" factors such as floating debris, odor and scums. The chemical compounds are only problems in heavy industry areas. The aesthetic factors, however, are so vague they give little guidance to objective judgment of suitability for this use. The Rickenbacker area demonstrates the wide range of acceptability for water quality and aesthetics. The high use of this area is perhaps more out of desperation than preference of its users.

For the existing shore edge swimming areas, water quality is acceptable in the south bay and somewhat doubtful at Rickenbacker. The few coliform measurements taken there and reviewed by the writer, show instances of counts above the safe State and County standard. Without closer monitoring, the source is speculative although the Miami River is believed the major source.

Any new opportunities for public swimming access are extremely limited by the scarcity of the remaining public land and the conflicts between this use and use as a buffer and wildlife refuge zone. The north bay presents an additional problem in safe water quality.

Marinas are the principal corridors to the bay. They serve two broad purposes: dockage for boats staying in the water (wet storage) and launching access for the trailable boat user. The first serves resident owners and the transient visitor. Live aboard facilities are desired by the transient and by a usually small, but ardent permanent community. The trailable boat facility requires minimal dockage and piers, but demands more parking space (for trailers) than the wet storage marina. Increasing provision of dry storage space at the marina is common, and should be promoted by the County. For conserving space, vertical storage systems are an effective solution.

An additional important distinction is that between a "working" marina and providing dockage only. The working marina supplies boat servicing and supply, particularly haul-out facilities either by sling or marine railways. Sail and power boats commonly occupy the same marina, but within Biscayne Bay, the many bridges cause a strong preference for sailboat dockage south of Rickenbacker Causeway. Further, as the central and south bay are the preferred cruising grounds, the slower sailboat desires a shorter travel time to this area.

Although most marinas satisfy some combination of uses, no one location and design can possibly satisfy all the boating uses described. For example, the non-working marina can operate satisfactorily for larger transient boats,

but the required dockage fees become too high for the year-round rental unless some other source of revenue is available. Public marinas should not be of a standard design, but vary according to the need and suitability of the immediate area. The County, with its six existing and planned marina facilities has an excellent opportunity to design an integrated system. Public use marinas exist at the Dinner Key complex, Crandon Park, Homestead Bayfront, Matheson Hammock and Black Point — all in the central and south bay. Miamarina, Pelican Harbor and Baker's Haulover are the only public operated marinas in the north bay. There are additional privately operated marinas located in the rivers and canals of the western shore. It is believed only one small privately operated launching and dockage facility for public use presently exists on the Miami Beach side of the bay. However, a substantial marina complex is planned for the south beach area, opposite the Coast Guard base.

Because marinas, particularly those which handle trailable boats, offer a substantial means for the inland public to gain access to the Bay, Dade County Parks and Recreation Department is planning expansion of these facilities in the South Bay. There are no existing compilations of the number of available slips, launching ramp capacity or total boats using the bay. Strong evidence for needed additional capacity comes from the long waiting lists for slips, the long lines at launch ramps, and use of unimproved right-of-ways. Space for the transient winter tourists is highly limited, particularly in comparison to the Ft. Lauderdale area.

The potential impacts of a marina include the alteration of the immediate area and the addition of heavy metals, PCB's (polychlorinated biphenyls) and fuels into the surrounding waters. There are three site selection options for reducing the impact of the marine facility upon the Bay:

1. A location where *prior construction has deepened and altered the bay bottom* and shoreline — north bay is typically so altered.
2. A location where the *bay bottom is sparsely vegetated and rocky rather than silt covered* — the southwestern shoreline is irregular in vegetative growth and possible locations may be found.
3. A location landward of the shoreline in *areas of altered or poorly productive land* — Homestead Bayfront and Kings Bay are two examples.

Loading of the bay waters with heavy metal compounds, PCB's (polychlorinated biphenyls), fuels and debris occur far more from the landside operation of the marina than from piers and moored vessels. This gives the opportunity for wise design of catch basins, percolating drains and swales to minimize discharge into the bay.

Becaus slip rental space is in high demand, it is possible to use this circumstance to encourage the tenant to exercise care in controlling discharges. Southern California marinas quickly cancel rental agreements if the tenant is found to be careless.

There is present strong concern over PCB levels in marine organisms by federal agencies. Extremely low concentrations (a few parts per billion) have been found sufficient to cause death or interference with species reproduction. One of the principal sources is paints. Copper compounds have also been questioned.[7] It seems very likely that landside discharges are a far greater contributor than the slow leaching from bottom paint of boats in the water. Landside control is the key.

Wildlife habitats are the remaining shore edge use of the bay discussed here. The objective in holding some lands in their natural state is to *at least maintain the variety of marine and animal life native to the area*. This is a somewhat easier goal to set than one which specifies some number of

individuals for each species. Variety is not hard to measure, but numbers are. The major difficulty, however, is in judging how much land must be set aside. Both a percentage of the total shoreline and the size of the individual parcel must be decided. Some birdlife is amazingly tolerant of suburbanization. Catle egrets are not an uncommon sight in residential areas. Other species require a buffer zone of at least several miles between their habitat and a populated area.

Only one wilderness area specifically designated for wildlife maintenance (at Turkey Point) exists in north or south Biscayne Bay. The Interama tract, with its fairly extensive vegetation presently plays the sole habitat role for the northern Biscayne Bay area. In the central and south bay, the most northerly habitat location is Crandon Park on Key Biscayne. The total County property, 898 acres, includes both the ocean beach and bay sides. Roughly half of this parcel presently serves, in varying degrees, as a habitat area.

Four additional major tracks along the south bay mainland are County property. The Matheson Hammock property contains 561 acres; Chapman Field, 566 acres; Black Point, roughly 500 by next year; and Homestead Bayfront, 850 acres. These areas are not intended as preserves, but represent the public owned park lands north of the Turkey Point power plant. Perhaps 1,200 of the total 2,477 acres of these blocks could be considered potential habitat preserves.

Two thousand, five hundred and five (2,505) acres (approximately four square miles) of lands immediately east and south of the Florida Power and Light Co. Turkey Point cooling canals were deeded to the State in 1974. These are now included in the State's wilderness system to be preserved in their present condition. For reasons of environmental monitoring, certain access is permitted to the Florida Power and Light Company.

On the ocean side, Elliot and Sands Keys provide refuge areas. The Ragged Keys and Soldier Key are too small to qualify as land refuge areas. Their private ownership and usage also eliminate thought on such use, however, their values for marine life propagation and as recreation areas are very high.

Presently the lands bordering the Turkey Point facility to the north and south are undeveloped and serve as wildlife areas. Zoned for low density and difficulty to develop because of the potential hurricane surge height, they may remain largely intact.

The *County's 1975 Comprehensive Development Master Plan* provides for a southern coastal preservation subzone which includes the southwest bay margin. The plan implies acceptable usages to include hunting, fishing, passive recreation, camping or wildlife habitat.

The Master Plan assumes, as have many individuals, that the public/private property boundary, established at the mean high water line, would act to automatically preserve the dense coastal vegetative strip. The first actual survey of such a line approved by the State does not bear out this assumption. This survey excludes virtually all of the tidal mangrove areas from the public domain. However, private coastal developments now under review are reflecting substantially greater allocation of lands to be left in an at least partially natural state.

The writer believes the three possible sources of shore edge habitat areas: County lands, State lands, and private land allocations, combine to produce what could be a satisfactory quantity of land for maintenance of the existing variety of wildlife. *But the lack of any presnt specific designation of land parcels for this purpose creates a major and important uncertainty affecting the maintenance of a semi-natural environment as well as sport and commer-*

cial fishing interests. The social diversity which the Bay now provides could be sharply reduced.

ON OR IN THE BAY WATERS

On or In the Water uses of Biscayne Bay are primarily recreational. The commercial activity which the port of Miami represents has been discussed above.

Commercial fishing within the bay is nearly limited to the taking of live bait shrimp. Use of gill nets (fingerlings pass safely through such a net) is allowed in the south bay for food fish but restricted to bait fish in the north bay. Both of these industries are relatively small.

Retail value of the bait shrimp industry is approximately 1¼ million dollars yearly. Live shrimp are a strongly preferred bait for sport fishing and any loss in availability would impact strongly upon this larger tourist industry.

The State Department of Natural Resources (DNR) monitors the industry, requiring licensing and inspection of gear annually. They monitor the actual fishing operation, checking several boats a week, on the average.

Questions reoccur on the environmental harm of dragging the bay bottom for shrimp. Although it is common practice to drag nets in most shrimp fisheries, this is specifically not allowed in Biscayne Bay. The Department has established the requiremnt for the use of a roller net. At least three specified studies have been conducted by the State, the University of Miami, and the National Marine Fisheries Service on the impact of harvest amounts and the effect of roller trawls on marine grasses. The grass areas of the bay *are* extremely important. They help to stabilize the fine bottom sediments and act as traps for incoming silt. Controlling turbidity in the Bay requires maintenance of these grasses. Additionally, they are the major source of organic carbon, fundamentally necessary to the biological productivity of the Bay.

The studies conclude that use of the roller trawls and the harvested amounts are not damaging to the other uses of the Bay and the industry is an overall benefit to the region.

Although they do not support an industry, edible species of oysters exist in both the north and south bay. The State does not allow commercial harvesting of oysters because of insufficient water quality in the Bay. A commercial shell fish harvesting area has the most stringent water quality requirements because the animal feeds by filtering a large volume of water and thereby concentrates bacteria, chemicals and viruses in its organs. Unfortunately, oysters are taken in the bay to supplement the diet of low income families. They are collected at publicly accessible points which are the canal mouths — the places most likely to have high bacterial and toxic metal concentrations. The health hazard is sufficiently great to this unfortunate group to recommend some additional action. More careful monitoring may indicate some safe areas. Identification of these and the unsafe areas would be a useful service.

Recreational on-the-water use is divided into *water contact*, *non-contact*, and *sport fishing* activities. The three have considerably different requirements. Non-water contact includes *cruising* in the larger sail and power boats, *viewing*, *racing*, and *transit* from the dock to the cruising area. Satisfaction of these uses is not so demanding of water quality characteristics such as color and clarity. Floating scums, oil and heavy debris are the major detractors. Bays such as the Chesapeake and Galveston support large racing and cruising fleets in waters with less clarity and muddier color than any portion of Biscayne Bay. No area of the Bay then, has qualities so

deteriorated as to exclude these uses. The requirement for sufficient distances for easy maneuvering — long tacks and relaxed pilotage, make the central bay most popular.

The principal requirement *of boating transit, as a use,* is short travel time. Congestion, as seen on the Intracoastal Waterway between Baker's Haulover and Ft. Lauderdale leads to greater speed and resultant danger and damage from boat wakes. For the sailboat, bridge clearances of less than 60 or 65 feet hinder transit. Less than 25 foot clearances require opening for the larger power boat. The number of spans in the north bay and the distance, make transit times unappealing and create a preference for dockage as close to the south bay as possible. The automotive congestion caused by bridge openings also suggests that transit paths should be close to or in the south bay. Unfortunately, sailboat access to the ocean is only possible at Port Everglades and at Government Cut. The proposed marina site at the south end of Miami Beach offers a good solution to the problems of marine use of the shoreline and easy transit to the preferred cruising areas. It will be possible to use the channel between Lummus and Dodge Island and pass only through Rickenbacker Causeway or leave through Government Cut and enter the south bay at Cape Florida.

A further non-water contact recreational use is viewing of the shore edge. Diversity, in itself, has a strong appeal. The south bay gives views of a natural environment. The north bay gives views of urban and residential areas. Night time viewing in the north bay is sometimes overlooked as a worthwhile experience. Either viewing or transit at night requires well lighted markers in the north bay and in the south bay at the "Stiltsville" or Safety Valve area and Feathered Banks. Some feel that boating safety and night usage would increase if additional lighted markers were provided.

Weekending, overnighting and day anchoring are a major part of boating recreation. A mixture of non-contact and contact uses, the major requirement is for a safe and pleasant lee shore. The most popular area is within Biscayne National Monument at Sands and Elliot Keys. This area provides both an excellent anchorage and the clearest waters of the bay. Smaller anchorages are possible at Soldiers Key and the Ragged Keys. Both of these areas, however, are privately owned and, in the past year, have been posted with no trespassing signs. No Name Harbor, the small cove on the bay side of Cape Florida Park, is a densely used area comparable to Rickenbacker Causeway. Overnight anchorage at the cove adjacent to the Rusty Pelican Restaurant, a rarity two years ago, is now common. Removal of the Presidential Security Area at Key Biscayne has returned this area to public use which includes overnighting.

Water contact uses on the bay include diving, water skiing, swimming from the boat and "wet sailing" — sailing of small dorys and the fast catamarans where overturning is frequent and part of the sport. As a minimum, all require Class III water standards which state that coliform bacteria counts must not exceed 1,000 total per 100 milliliters. Swimming preferences are for areas where the bottom is visible. Diving requires high visibility and some marine plant and animal life.

Visual examination shows that water skiers prefer either side of Rickenbacker Causeway, along Key Biscayne and along the shores of the Ragged Keys and Elliot Key. Some skiing also takes place in the north bay area on the Miami Beach side and in the area of the Interama site. Diving, swimming from an anchorage and water skiing each require calm waters and are therefore in potential conflict. If density is high and boat operators careless, it may become necessary to designate areas and monitor the activity. San

Diego was forced to this some years ago. It is not believed this is a critical problem on the Bay. An attempt to encourage safe practices by public information and Marine Patrol warnings is an easy first, and perhaps sufficient, step.

Sport fishing is the last of the use categories considered. The launching ramps and slips of the bay serve both the bay and offshore sport fisheries. In combination, they represent a nationally recognized attraction. Bay fishing is heaviest in the area of the channels running through the Safety Valve (Stiltsville), Bear Cut and the grass beds and flats southward to the Featherbed Banks. The bridges over Bear Cut and at Rickenbacker Causeway provide non-boaters access to bay fishing. Fishing is either for species that inhabit channels, migrating from the ocean or stationing themselves there for the flow of food, or those that inhabit the grass and mangrove areas of the bay.

A small amount of fishing from boats and bulkheads occurs in north bay. Though not a highly productive area, it still supports marine life of limited variety and shelters some schools of migrating fishes. Any decline in a sports fishery has to be dramatic before it is recognized. Statistics on the landings made by individual sports fishermen in Biscayne Bay have not been kept, although commercial fishermen have told fisheries scientists that they have observed a decline. Also, such popular species as Spanish makerel are not native to the bay and their abundance is influenced by foreign and unknown factors. This also applies to the Florida lobster.

To support the present abundance of sport fish, grass beds as well as shore edge vegetation must remain intact. The major threat is any increase in turbidity that would decrease the light available for grass growth. There is argument on the relative importance and needed amounts of shore and bottom vegetation. The writer agrees with the conclusions of those who consider the marine grasses most critical, with shore edge vegetation serving to buffer runoff and wave action.

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