ENVIRONMENTAL ANALYSIS AND DECISION ON THE NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT (EIS)

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EXECUTIVE SUMMARY

Wisconsin Department of Natural Resources has the authority under Chapter 30.12(2) Wisconsin Statutes to require permits for the placement of solid/crib piers, groins and jetties in navigable waters of the state. The permit process for these structures requires the applicant to publish a class I notice in the local newspaper in order to allow the public and other property owners the opportunity to object to the placement of the structure under section 30.02 Wisconsin Statutes. The Department is also required to review these proposals for their environmental impacts under NR 150 Wisconsin Administrative Code.

In late 1995 and 1996 12 applications for these solid structures were applied for to be constructed on the bed of Green Bay in Door and Kewaunee Counties. During the notice period numerous objections and concerns were expressed from the public and Department staff regarding these projects. Objections and concerns raised were impacts on fish habitat, natural scenic beauty, property values, taking of public lakebed for private purposes, water quality, erosion, accretion and user conflicts resulting from these structures. As a result of these concerns the Department determined that an Environmental Assessment, under provisions of NR 150 on these proposals along the Green Bay shoreline in Door, Brown and Kewaunee counties should be completed. Further processing of the applications was suspended pending completion of the environmental assessment.

During EA development, the Department solicited public and peer involvement in the process. A scoping meeting with interested parties was held to identify significant concerns and issues. These were affects on fish and wildlife habitat, natural scenic beauty, property values, water quality, riparian rights, user conflicts, erosion, accretion and navigation potentially caused by solid structures.

The data imported into the EA were mainly based on a literature search of studies related to biological and physical changes occurring as a result of solid structures. Time and resources did not allow for in-depth surveys to be completed by expert staff. DNR pilots supplied aerial photographs of the Green Bay shoreline from Northport Ferry Dock to the end of Brown county on the west shore of Green Bay. These were used to determine the numbers and types of structures present and their relative impact on near shore areas.

Review of the current scientific literature affirms there are biological impacts to the near shore area of the shoreline where these solid structures are placed. This near shore area is called the littoral zone. Species which use the near shore area are not allowed to follow the drift or currents which naturally occur in that zone. Literature also affirms that these solid structures do impact erosion and accretion on adjacent properties and for distances along the shoreline. The aerial photos were an excellent visual representation of this. Cumulative impacts of numerous structures along the shoreline are a definite concern. Consider if every property owner placed a solid pier every 100 - 200 feet along the shoreline, the littoral zone would be severely affected. Based on the 1997 aerial photos there are presently 309 solid structures, 40 marinas and 529 temporary or flow through structures on the bed of Green Bay along the shoreline in Brown, Door and Kewaunee Counties.
As riparians, permit applicants feel they have a right to create whatever they need for safe mooring and recreation. Yet the public objectors feel the riparians are taking lakebed which belongs to all citizens of the state.

Natural scenic beauty is a major concern of many who use the Green Bay shoreline. Some property owners purchased the shoreline for the natural view of the bay and the sun set. Yet others purchased the shoreline property so they could build a pier for their recreation. The solid piers are assessed as real property and the riparian owner pays taxes on that structure.

Conclusions reached from the EA do indicate that water quality and near shore species are impacted by the obstruction of the littoral drift created by these solid piers. Accretion and erosion is increased on adjacent properties as a result of these structures. Natural scenic beauty is altered, as a structure which is man made is not natural. These structures do impact and consume a large amount of lakebed for private purposes.

Riparian property owners do have alternatives. Some areas along the Green Bay shoreline just are not feasible for safe harbors. Marinas or mooring areas should be considered. In some areas the shoreline is conducive to conditions which will allow access by a portable or flow through pier. Engineering designs which allow for the littoral drift to move naturally is an option. Design can also address erosion, accretion and wave refraction problems. Many of the issues are subjective and therefore must be resolved through legal processes including decisions of administrative law judges, establishing rules, and creating appropriate legislation.

INTRODUCTION

The primary impetus for the Department of Natural Resources' (DNR, or the Department) preparation of this study is to address the increasing number of permit applications for the placement of permanent solid dock structures and specifically to address the corresponding increase in public opposition to the permitting of these structures in Door County in particular. While most of the current applications are from Door County, the study area includes Door, Brown and Kewaunee counties because of similar past applications, similar physical forces, and similar biological and public concern (Figure 1).

The magnitude of the complaints/opposition to permit requests required the Department's Water management staff to assess the CUMULATIVE impacts of the solid pier structures. Consequently; effective January 1, 1997, all pending applications (12 of them initially) were put on hold until completion of this Environmental Assessment (EA).

WEPA requires the DNR and all state agencies to consider the environmental effects of their actions to the extent possible under their other statutory authorities. (Wisconsin State Statute 1.1).

The purpose of this Environmental Assessment (EA) is to provide information to the public on the CUMULATIVE PHYSICAL, BIOLOGICAL, SOCIO-ECONOMIC, AND AESTHETIC IMPACTS OF PERMANENT SOLID PIER STRUCTURES ON THE BED OF GREEN BAY. This EA pertains only to private solid permanent structures. It does not include public marinas or public docking areas.

Definition of "Solid Permanent Structures"

The Department has defined "solid permanent structures" as structures, primarily docks and piers, which are permanent (as opposed to temporary docks which are typically removed during the winter months.) These solid structures do not "allow for the free, flow of water beneath them" (Chapter NR 326, "Piers and Boat Shelters in Navigable Waterways," August, 1991.)

Private piers are those constructed for the personal use of the owner. Public piers are those owned and operated by an individual but must be open to the public for a reasonable fee, be advertized annually, and for which a waiting list is maintained.

The Public Trust Doctrine and Riparian Rights: Statutory History and Discussion

Public Trust Doctrine

Under Wisconsin's Constitution, Article IX, Section 1, the navigable waters in the State of Wisconsin are declared to be public waters to be held as "common highways and forever free" to the citizens of the State and the United States. From this constitutional provision there has grown a body of law referred to as the "Public Trust Doctrine".

The precepts which form the basis for this doctrine are outlined well in the case of Diana Shooting Club v. Husting, 156 Wis. 261(1914), where the Wisconsin Supreme Court stated:

> Navigable waters are public waters and as such they should inure to the benefit of the public. They should be free to all for commerce, for travel, for recreation, and also for hunting and fishing, which are now mainly certain forms of recreation. Only by so construing the provisions of our organic laws can the people reap the full benefit of the grant secured to them therein. This grant was made to them before the state had any title to convey to private parties, and it became a trustee of the people charged with the faithful execution of the trust created for their benefit. Riparian owners, therefore, took title to lands under navigable waters with notice of such trust and subject to the burdens created by it. It was intended that navigable waters should be public navigable waters, and only by giving members of the public equal rights thereon so far as navigation and its incidents are concerned can they said to be truly public. at p. 505.

Public rights have been broadly defined by the Wisconsin Supreme Court. In Muensch v. Public Service Commission, 261 Wis. 492 (1951), a landmark case which contains a lengthy discussion of the public trust doctrine relating to navigable waters in Wisconsin, the Court stated:

> Indeed, the courts have recognized, and now more than ever before recognize, the public's interest in pleasure and sports as a measure of public health . . .
>
> Many of the meandered lakes and streams of this state, navigable in law, have ceased to be navigable for pecuniary gain. They are still navigable in law, that is, subject to the use of the public for all the incidents of navigable waters. As population increases, these waters are used by the people for sailing, rowing, canoeing, bathing, fishing, hunting, skating, and other public purposes . . . .
>
> . . . . the enjoyment of scenic beauty is a public right to be considered . . . . at p. 507-508 (Emphasis in the original).

Under the Wisconsin Constitution, the statutes discussed below, and the common law as articulated by Wisconsin courts, the State of Wisconsin has a responsibility to assess the impacts of activities of private riparian owners on the "public rights" in our navigable waters. This is one of the underlying reasons the Department is conducting the environmental assessment in this instance.

In carrying out its responsibilities under the public trust doctrine, the courts have recognized the importance of considering the cumulative impacts of these projects. While individual structures may appear to have little impact, cumulatively, the impacts can be significant.

In the recent case of Sterlingworth v. DNR, 205 Wis. 2d 702(Ct. App., 1996), the Court of Appeals stated:

> Although nine additional boat slips may seem inconsequential to a proprietor such as Sterlingworth, we approach it differently. Whether it is one, nine or ninety boat slips, each slip allows one more boat which inevitably risks further damage to the environment and impairs the public's interest in the lakes. The potential ecological impacts include direct impacts on water quality and sediment quality alteration, as well as direct and indirect influences on flora and fauna. For this very reason, the consideration of "cumulative impact" must be taken into account. As was explained by the Supreme Court:
>
> > A little fill here and there may seem to be nothing to become excited about. But one fill, though comparatively inconsequential, may lead to another, and another, and before long a great body of water may be eaten away until it may no longer exist. Our navigable waters are a precious natural heritage; once gone they disappear forever.... Hixon v. PSC, 1966.
>
> In our opinion, the DNR, in limiting Sterlingworth's permit to twenty-five boat slips, carried out its assigned duty as protector of the overall public interest in maintaining one of Wisconsin's most important natural resources.

The Department must, in view of these concepts, consider the cumulative impacts of these discrete projects on our navigable waters.

Riparian Rights: Relevant Court Cases

Under Wisconsin law, riparian proprietors do have certain rights to utilize their shoreline properties. Those rights are limited by the statutory limitations adopted by the Legislature in Chapter 30, Stats., discussed below, and by the public trust doctrine.

> It is axiomatic under Wisconsin law that rights of a riparian owner are qualified, subordinate and subject to the paramount interest of the state and the paramount rights of the public in navigable waters. State v. Bleck, 114 Wis. 2d at 467; Mayer v. Grueber, 29 Wis. 2d 168, 173-74 (1965). As clearly and repeatedly as the courts have asserted the conditional nature of riparian rights, so the courts have "jealously guarded the navigable waters of this state and the rights of the public to use and enjoy them." Delta Fish and Fur Farms v. Pierce, 203 Wis. 519, 523 (1931). No person, including a riparian owner, may destroy or impair navigable waters. State v. Adelmeyer, 221 Wis. 246, 256 (1936).
>
> The rights of a riparian are also impacted by the concept of "reasonable use".
> This concept first appeared in Wisconsin law in the context of riparian rights in Timm v. Bear, 29 Wis. 254, 265 (1871), where the Court stated:
>
> > "What constitutes reasonable use depends upon circumstances of each particular case and no positive rule of law can be laid down to define and regulate such use with entire precision ... In determining this question, regard must be had that the subject matter of the use, the occasion and the manner of its application, its object, extent and necessity for it, to the previous usage, and so also upon the size of the stream, the fall of water, its volume, velocity and prospective rise and fall are important elements to be considered."
>
> This concept is again discussed in State ex rel. Chain O'Lakes P. Assoc.v. Moses, 53 Wis. 2d 579, 582 (1971) as follows:
>
> > "The established rule of the common law was that every riparian owner of stream or lakeshore property had an equal right to the use of it for all reasonable and beneficial purposes, and it was this rule that early became the law in Wisconsin. The right of reasonable use of water was one of the rights assured owners adjacent to lakes and streams, others including the rights to accretions, relictions, pierages and wharfages. What constitutes a reasonable use, under the common-law test, is a factual determination, varying from case to case, and subject to a trust doctrine concept that sees all natural resources in this state as impressed with a trust for usage and conservation as a state resource."
>
> As indicated in these cases, what constitutes a reasonable riparian use will vary from case to case. It is clear, however, that at some point a riparian use can adversely affect not only the rights of other riparians but also the rights of the public guaranteed by the public trust doctrine. This affect is not based solely on the physical obstruction to navigation and its

incidents resulting from the placement of the structures, although that certainly is a factor. It is also based on the cumulative impacts occurring when riparians intensively use relatively small amounts of riparian frontage.

These are the issues which must be explored and resolved in the cases which are the subject of this environmental assessment.

Statutory History

It was the departments' and its predecessor agencies' opinion that it was not prohibited to build structures in navigable waters prior to the enactment of section 30.02(l)(b) by Chapter 455, Laws of 1933. Prior to this time the legislature and municipalities had the authority to authorize these activities.

Section 30.02(l)(b) read as follows: "It shall be unlawful to deposit any material or to place any structures upon the bed of any navigable water where no shore line has been established or beyond such shore line where the same has been established." The total prohibition of structures in navigable waters resulting from the enactment of this section created a dichotomy in the law. The common law rights of riparian owners to place certain structures such as piers in navigable waters were clearly established by the courts; yet, this new law seemed to prohibit any structure even if it was intended as an aid to navigation.

To handle this apparent conflict, the Railroad and Public Service Commission interpreted the statutes referring to structures and obstructions in navigable waters as referring to unlawful structures that actually interfered with navigation and the rights incident to navigation or was contrary to the trust doctrine.

When section 30.02 was amended by Chapter 335, Laws of 1949, providing for the Public Service Commission to authorize structures, the commission adopted the same policy. This amendment continued the general prohibition of placing structures in navigable waters but created a mechanism for approving them by adding the following language: "...provided, however, that the Public Service Commission may grant to any riparian owner the right to build a structure, or to maintain a structure already built and now existing, for his own use, if the same does not materially obstruct navigation." After this amendment, permits were issued for structures if they did not materially obstruct navigation.

In 1951, Section 30.02(l)(b) was modified by Chapter 712, Laws of 1951. This modification included the addition of the following two standards: "...or reduce the effective flood flow capacity of the stream or is not detrimental to the public interest."

In 1959, Chapter 441, Laws of 1959 created Chapters 30 and 31 Statutes in the form we have today. At this time, section 30,02(l)(b) was renumbered as 30.12(2)(a) and section 30.02(l)(ba) was renumbered as section 30.12(2)(b). For the first time, the common law rights of riparian landowners to build wharves and piers was recognized through this chapter and section 30.13 of the Statutes it created.

Since 1959, the statutory criteria that must be met in order for a permit to be granted are as follows:

A. A permit can only be granted if the applicant is a riparian owner.
B. A permit may be granted if the structure does not materially obstruct navigation.
C. A permit may be granted if the structure does not reduce the effective flood flow capacityof a stream
D. A permit may be granted if the structure is not detrimental to the public interest.

Standards A through C above are quite straightforward and very specific, however; the public interest standard is much broader. The courts require that many factors be considered when reviewing the impacts on public rights and public interest in our navigable waters.

1. Natural scenic beauty.
2. Potential for disruption of fish or wildlife habitat.
3. Impacts on wetlands or endangered -resources.
4. Effects on water quality.
5. Adequacy of design, including potential for failure.
6. Reasonable use, including consideration of alternatives.
7. Compatibility with the trust doctrine.
8. Cumulative impacts.
9. Impacts on the ability of the public to exercise the incidents of navigation, including such things as canoeing, kayaking, fishing, waterskiing, snowmobiling, hiking and swimming.

Wisconsin Administrative Code NR 326 specifically applies to the construction of piers in navigable waters. This code was promulgated to provide consistency in application of Sections 30.12 and 30.13 Wisconsin Statutes to the construction of piers and structures in navigable waters as aids to navigation.

Authorities and Approval

The following twelve projects are regulated under sections 30.12(2) 30.20 Wisconsin Statutes and NR 326 & 340 Wisconsin Administrative Codes; therefore, permits are required from the State. Permits and approvals are also required from the U.S. Army Corps of Engineers and some local units of government.

Each applicant's project proposal will be evaluated on an individual basis. This EA was completed to bring together a group of experts to throughly review the individual and cumulative effects of these structures.

Applicant Information and Site Description

This section identifies the name and address of each applicant, the location and description of each project, and the purpose and need of each structure.

1. 3-LM-96-5779 578 & 579

   John Carpenter, 4555 W Schroeder Drive, Suite 100, Milwaukee, WI 53223-1470

   Located at 723 Little Sister Road in the Village of Sister Bay, in the NW1/4, SW1/4, in section 6, T3 1 N, R28E, Door County on the bed of Green Bay. There is a deck at this site which will have to be removed as it is a deck below the ordinary high water mark of Green Bay. This site is a small bluff on Green Bay with a bedrock substrate. The lawn is dispersed with birch and cedar trees. There are other piers in the area but most of the shoreline development is camoflauged by the vegetation.

   This project is to construct an "L" shaped solid pier. The pier will be 115 feet long by 26 feet wide at the base and 14 feet wide on the top, with a 56 feet long by 26 feet wide "L" extension. The main portion will be constructed of steel sheet piling filled with rock. The out side of the pier will be protected with a layer of rock rip rap. Dredging will be needed in an area 70 feet long by 26 feet wide and an area 30 feet wide by 50 feet long. The foot print of the structure will affect 6,234 square feet of lakebed.

   The purpose and need of the structure is for recreation.

2. 3-LM-96-428 & 429

Ralph & Sue Gerhardt, 735 Little Sister Road, Sister Bay, WI 54234

Located at 735 Little Sister Road in the Village of Sister Bay, in the NW1/4, SW1/4, in - section 6, T3 IN, R28E, Door County on the bed of Green Bay. There is an existing deck at this site which will have to be removed as it is a deck below the ordinary high water mark of Green Bay. The shoreline is a small ledge of bedrock. There are cedar trees along the shoreline. Most of the developed areas are camoflauged by the vegetation. A few solid piers exist along the shoreline.

This project is to construct a crib type pier. The length of the pier will be 106 feet long by 12 feet wide on the top. Rock rip rap will face the outer end and the last 52 feet on the south of the pier. This structure will use 888 square feet of lakebed.

The purpose and need of the structure is for family recreation and a safe mooring area.

3. 3-LM-05-513

Randy & Deborah Rose, 220 S Gore Avenue, St. Louis, Missouri, 63119

Located at 7017 Bayshore Drive in the Town of Egg Harbor, in the SWI/4, SEI/4, in section 4, T29N, R26E, Door County on the bed of Green Bay. This site is a bluff on Green Bay with bedrock substrate. The shoreline is vegetated with cedar and birch trees. There are some boathouses along the shoreline but most of the residences are camoflauged by the vegetation.

This project is to construct a steel sheet filled solid pier 100 feet long by 40 feet wide at the bottom, with a 120 feet long by 40 feet wide at the bottom "L" extension. Rock rip rap will face the outward side of the steel sheeting. A 80 feet long by 25 feet wide at the bottom breakwater will be constructed to the south of the main structure to create a harbor area. This structure will use 11,200 square feet of lakebed.

The purpose of this structure is to provide safe dockage for boats.

4. 3-LM-95-628
   Greg Grewe, 4400 Oak Ridge Court, DePere, WI 54115

   Located on Lady Slipper Lane in the Town of Egg Harbor, in the NWI/4, of the NW I/4, in section 29, T29N, R26E, Door County on the bed of Green Bay. This site is located on a cobble shoreline. There is not a residence on the property. The shoreline is heavily vegetated with red osier dogwood, cedar and birch. There is a hug old concrete, steel rock pier to the south of this site. Large homes are visible along the shoreline. There are no other solid piers in the area other than the old one described above.

   This project is to construct a solid pier of rock 190 feet long by 30 feet wide at the bottom with a 100 feet long by 30 feet wide at the bottom "L" extension. A steel boat lift will be anchored to the pier. An area will be dredged on the inside of the "L". This area will be 35 feet wide by 40 feet long and 15 feet wide by 20 feet long to a depth of 8 feet. This structure and dredging will use 10,400 square feet of lakebed.

   The purpose of this structure is to provide safe and calm waters for a 40 feet long boat.

5. 3-LM-96-417, 418 & 419

Steve Orser, 675 Riley lane, Lake Zurich, IL 60047

Located at 6091 Bayshore Drive in the Town of Egg Harbor, in the SEI/4 of the SW1/4, in section 20, T29N, R26E, Door County on the bed of Green Bay. This site is a bluff along the shoreline with a bedrock substrate. There are no solid piers visible in this area. Cedar and birch are the dominant vegetation. There are a few boathouses visible but most of the residences are partially camoflauged by the trees.

This project is to construct a solid pier of steel sheeting with rock rip rap. The pier will be 115 feet long by 26 feet wide at the bottom and 14 feet wide at the top, with an "L" extension 46 feet long by 26 feet wide at the base. An area in the "L" of the pier will be dredged. This area is 75 feet long by 30 feet wide and 20 feet wide by 50 feet long. This proposal will use 6,184 square feet of lakebed.

The purpose and need of this proposal is for recreation.

6. 3-LM-96-481 & 482

Thomas Knab, 510 Oak St, Manitowoc, WI 54220 and Charles DeGrange, Suite 400, 2300

North Barrington Road, Hoffman Estates, IL 60195

Located at 7087 County “B” in the Town of Egg Harbor, in the NW1/4, of the SWI/4, in section 3, T26N, R26E, Door County on the bed of Green Bay. This site is a cobble area on the bed of Green Bay. A solid pier exists to the south of the site and Murphy Park solid pier to the north. The lawn is visible along with cedar and birch trees. Homes are visible along this area of the shoreline.

This project is to construct a solid steel sheeting pier with rock rip rap. The pier will be 150 feet long and 26 feet wide at the base with a 126 feet long "L" extension to the north. A rock breakwater will be constructed to the north of the main structure. This breakwater will be 90 . feet long by 10 feet wide at the base. An area in the harbor will be dredged. This area will be 80 feet wide by 100 feet long and 30 feet wide by 35 feet long. A finger pier will be attached to the main pier in the harbor. This finger pier will be 30 feet long by 4-5 feet wide. This proposal will use 9,056 square feet of lakebed.

The purpose and need of this proposal is for recreation.

7. 3-LM-96-514

Richard Kosmoski, 1270 Main Street, Green Bay, WI 54302

Located at N9455 Highway 57 in the Town of Red River, in the NW1/4, SEI/4, in section 6, T25N, R23E, Kewaunee County on the bed of Green Bay. This site is located south of Red River. The lakebed is sand and gravel. There is a turf lawn at the residence along with cottonwood and willow trees. This area is highly developed and most of the dwellings, piers, and seawalls are visible.

This project is to construct a solid pier 145 feet long by 38 feet wide at the bottom with a slight "L" extension 55 feet long by 38 feet wide. This proposal will use 7,410 square feet of lakebed.

The purpose of this structure is to provide safe dockage and enhance access to the water.

8. 3-LM-96-426 & 427

Rudolph Peterson, 8007 White Cliff Road, Egg harbor, WI 54209

Located at 8007 White Cliff Road in the Village of Egg Harbor, in the NW1/4 of the NE 1/4, in section 24, T30N, R26E, Door County on the bed of Green Bay. This site is on the north edge of the Village of Egg Harbor. There are many solid piers to the south of this site. Most residences have lawns with cottonwood, willow and cedar trees. The houses are visible from the shoreline. The substrate at this site is rock , rubble and cobble.

This project is to construct a solid pier 46 feet long by 12 feet wide with a 30 feet long by 12 feet wide "L" extension. This will be of cedar crib construction with rock facing the outside portions. This proposal will use 1,428 square feet of lakebed.

The purpose of this structure is for family recreation and safe mooring.

9. 3-LM-96-169 & 170
Bradford Shaw, 837 Larchmont Lane, Lake Forest, IL 60045

Located at 8011 White Cliff Road in the Village of Egg Harbor, in the NW1/4 of the NEI/4, in section 24, T30N, R25E, Door County on the bed of Green Bay. This site is located at the northern edge of the Village of Egg Harbor. There are solid piers to the south of this project and temporary piers to the north. The area is vegetated with lawns, cottonwood, willow and cedar trees. Development is visible along the shoreline. The substrate at this site is rock, rubble and cobble.

This project is to construct a solid pier of steel sheeting, rock and concrete. The pier will be 90 feet long by 20 feet wide at the base with a 70 feet long by 20 feet wide "L" extension and . a small extension off of the "L" 30 feet long by 20 feet wide. An area is to be dredged. This area is 80 feet wide by 90 feet long. This project will use 11,200 square feet of lakebed.

This project is to provide a tie up for a boat and protect the shoreline from erosion.

10. 3-LM-96-360
Tom Herlache, PO Box 9, Sturgeon Bay, WI 54235

Located at 3879 County "B" in the Town of Sevastopol, in the SEI/4 of the NW1/4, in section 3 1, T28N, R26E, Door County on the bed of Green Bay. This site is in an area with few solid piers. The shoreline is highly developed. Vegetation consists of lawns, oak, willow and cottonwood trees with some shrubs. Visible from the lake are residences, boathouses, retaining walls and temporary piers. The area substrate is partially rubble with sand.

This project is to construct a rock, rubble mound solid pier . The pier will be 250 feet long by 25 feet wide at the base, with a 50 feet long by 25 feet wide "L" extension. The top of the pier will be 6 feet wide. This structure will use 7,500 square feet of lakebed.

The purpose of this structure is to provide a safe harbor, help prevent shoreline erosion and build on existing break wall to eliminate a hazard to navigation.

11. 3-LM-96-503
Jeff Slavik, 1325 N 3rd, Sturgeon Bay, WI 54235

Located at 1325 N 3rd in the City of Sturgeon Bay, in the NW1/4 of the SEI/4, in section 31, T28N, R26E, Door County on the bed of Green Bay. This site is highly visible as the shoreline is developed. There are lawns, residences, boathouses, temporary piers and a jettie along this shoreline. The area is vegetated with willow, cottonwoods, oaks and shrubs. The substrate is sand.

This project is to construct a rock rubble mound breakwater which will be 265 feet long by 25 feet wide at the base. This project will use 6,625 square feet of lakebed.

The purpose of this structure is to provide a safe harbor and help prevent shoreline erosion.

12. 3-LM-96-5309 531 & 532

Warren Davis Jr., 80 Inverness Court, Lake Bluff, IL 60044

Located at 10383 North Shore Road in the Village of Ephraim in the NW1/4 of the SWI/4, in section 12, T3 IN, R27E, Door County on the bed of Green Bay. This is a bluff area along the shoreline with a bedrock substrate. A deck exists on the property which is below the ordinary high water mark. There is little evidence of development as the homes along this stretch are camoflauged with cedar and birch trees. There are a few solid piers in the area.

This project is to construct a steel sheeting with rock rip rap solid pier. The pier will be 64 feet long by 26 feet wide at the base with a 56 feet long by 26 feet wide “L” extension. The top of the pier will be 12 feet wide. An area to be dredged will be 60 feet long by 20 feet wide and 30 feet wide by 25 feet long. This project will use 4,644 square feet of lakebed.

The purpose of this project is for recreation.

The above applications include dimensions of lakebed which will be filled and dredged only. These calculations do not include erosion to properties along shoreline or distances boats must cross to access their harbor/pier.

Estimated Costs and Funding

The proposals are funded by private individuals. The proposals range from approximately $22,000 to $200,000 in materials and labor.

Past Public Involvement/Public Comments

On May 5th, 1997, the Department sponsored a Public Meeting at the Public Library in Sturgeon Bay to (1) inform the public of this EA process and (2) to give the public an opportunity to comment on the issue. A copy of the minutes of this meeting is attached in Appendix I . Based on this informational meeting, and numerous comments and letters sent to DNR from the public, the following list of issues was developed to be addressed in this EA:

1. Natural scenic beauty/disruption of view scape for neighboring property owners.

2. Creation of "safe harbor" by constructing these solid structures. (Definition of "safe harbor" needs to be clarified.)

3. Concern about an increase in boating.

4. Protection of shoreline.

5. Erosion of shoreline.

6. Effects on property values/local tax base.

7. Effects on water quality; e.g., trapping of debris, dead fish, etc. near shore (in swimming area.)

8. Effects on fish and wildlife habitat.

9. Safety issues; e.g., increase boat traffic in neighbors' swimming area and navigational issues such as large dock structures forcing small watercraft (canoes) away from shore into deeper water.

10. Perceived violations of the "Public Trust Doctrine"; i.e., " encroachment of private property into the public's domain."

11. Riparian owners' "right of reasonable access."

12. Effect on local economy in terms of solid dock construction creating local jobs for contractors, etc.

13. Clarification of private vs. commercial docks; e.g., condos, marinas. (Some of this is a local zoning issue.)

14. Structures should be properly designed, substantially constructed, and adequately maintained; e.g, complaints about damaged and demolished structures creating a hazard to navigation and depositing debris along the shore.

15. Effects on littoral drift/beach processes (accretion vs. starvation).

PURPOSE OF STUDY

The purpose of this Environmental Assessment (EA) is to provide information to the public on the SUMULATIVE PHYSICAL, BIOLOGICAL, SOCIO-ECONOMIC AND AESTHETIC IMPACTS OF PERMANENT SOLID PIER STRUCTURES ON THE BED OF GREEN BAY.

This EA is not a process to block future shoreline developments. It is the Department's responsibility thrugh NR 150 to address concerns raised by the public. The Department has the responsiblity to review and evaluate the impacts of alterations to public waterways. The physical, biological, and cultural affects of these alteratios must be reviewed in light of the Department's responsibility to uphold the public trust doctrine. It is the cumulative impact of multiple structures that this EA addresses.

Study Area and Description of the Bay of Green Bay

While most of the current applications are from Door County, the study area includes Door, Brown and Kewaunee counties because of past similar requests and applications and similar physical forces, biological importance of the littoral zone and public concern (Figure 1).

The Department pilots flew the shoreline of Green Bay from Brown County to the tip of Door County in the summer of 1997 (Appendix G). These aerial photos depict the development along the shoreline, and can be compared to earlier photos to show the increased rate of development. Many solid structures exist in the northern part of Door County, more so than along the rest of the Green Bay shoreline. The aerial photos (Appendix G) from this recent flight depict the physical (e.g., affects on beach forming processes deposition vs. starvation) and aesthetic ("unnatural" impacts to scenic beauty) impacts of these structures.

The Department also took photographs from the water looking landward, including some at the applicants' sites (Appendix H). In addition, photos were taken from a boat for the natural scenic beauty computer imaging exercise.

Existing Physical Conditions

The bay of Green Bay, Lake Michigan, is an elongated fresh water estuary, bordering northeast Wisconsin and the upper peninsula of Michigan. Lying in a NNE-SSW orientation, the water body is 120 miles in length, has an average width of 23 miles, and average depth of 65 feet. The bay extends from the city of Green Bay at it's southwesterly limit to Little and Big Bay de Noc in Delta County Michigan at it's northeasterly limit. It is bordered by five Wisconsin Counties (Door, Kewaunee, Brown, Acantha, and Marinette) and Delta and Me nominee counties in the State of Michigan.

The total watershed drains approximately 15,500 square miles, or roughly one third of the Lake Michigan drainage basin. There are four Wisconsin river systems draining into the Bay of major importance (the Fox, Acantha, Peshtigo, and Me nominee rivers) (Figure 2). These major drainages are found on the south and west shores of the Bay. Of these four river systems, the Fox has the most influence on the waters of Green Bay because of the quality and volume of the water it discharges to the bay. The drainages on the east shore of the Bay include much smaller watersheds and are therefore not as significant as the west shore rivers.

The land surface of the two shorelines of Green Bay are in stark contrast to each other even though the bedrock materials are quite similar. The east shore is dominated by very steep, exposed rock ledges of Niagara Dolomite. The cliff faces range from a few feet of exposed escarpment to as much as 60 feet. In contrast, the west shoreline is bordered by very gradual topographic change where extensive wetland communities dominate the landscape.

The bottom materials of the Bay are a diverse mixture somewhat reflecting the major drainage ways emptying into the Bay. Bed materials include sand, silt, mud, gravel, cobble, rubble and bedrock. The Fox River drains extensive areas of clay and silt soils; therefore, these soil types dominate the southern and southwestern portions of the Bay. These sediments in turn influence the water quality and clarity of the southern end of the Bay. The western shore has bed materials of a sandy character, similar to the loads of materials carried in by the western rivers. The northeast shoreline has the majority of the rock, gravel, cobble and bedrock substrate. Again, this is influenced by: the small watersheds feeding this side of the bay with their relatively small sediment loads; the nature of the land features in the area; the dominant water currents of the Bay; and the strength of wave energy to this shoreline.

The average elevation of the Bay of Green Bay is the same as that of Lake Michigan. The average over the last century has been about 580 feet above International Great Lakes

Datum, 1985 (IGLD85). Water levels vary in this system by as much as 6.5 feet with the all time high recorded in October 1986 at 582.35 feet and the record low recorded in March 1964 at 576.05 feet. Seasonal, daily, and hourly fluctuating water levels raise concerns for shoreline property owners and other users of the system due to heavy erosion and property damage during high water periods and limited navigation during low water periods. In general, water level over the last 25 years have been higher than the long term recorded averages. For a typical boating season of May through October, this historic range is slightly reduced to 5.9 feet between the record high elevation of 582.35 feet, IGLD85 set in October 1986 and the record low elevation of 576.44 feet, IGLD85 set in March 1964.

Water elevations of the bay are further influenced by seiches. Seiches are back-and-forth or rocking like movements of the water body influenced by wind direction and strength, atmospheric pressure, water currents, etc. As evidence of the extent of these movements, the Fox River reverses its flow as far upstream as the De Pere dam which is seven miles upstream from the mouth of the river at the Bay of Green Bay. These localized movements can result in elevation changes of up to several feet in as little as one hour.

In addition to seiche movements, the Bay has a general circulation pattern in a counter clockwise direction (Figure 3). It is this circulation pattern that has a major influence on bottom sediment patterns and littoral drift movements in the near shore area. Eventually all of the water discharged into the Bay from its tributaries flows into Lake Michigan; however, the total discharge from thetributaries is small in comparison to water movements associated with seiches and circulation patterns. In spring and fall, with weather dominated by winds out of the northeast, large volumes of Lake Michigan water enter the Bay. This southerly moving water generally follows the west shore to southern Green Bay and then turns north following the east shore. Water entering the Bay from the Fox River flows north and east and follows the east shore.

Water quality and clarity generally improves as you move from the southern end of the Bay, near the city of Green Bay, to the northern portion of Door County. This is primarily due to the quantity and quality of discharge from the Fox River to the southern end of the Bay. The southern end of the bay has very poor water clarity and degraded water quality as the result of runoff from industrial, urban, and agricultural lands in the Fox/Wolf basin.

High nutrient loads and sediments that are added to the system and continuously suspended are the main problems of this area. These water clarity conditions improve dramatically heading north. The recent introduction of zebra mussels has had the effect of improving water clarity in some locations of the southern half of the bay all the way to Ellison Bay.

The Littoral Zone and Biological Characteristics

Most direct impacts from these solid dock structures - physical, biological, and aesthetic - will be in the area of the "littoral zone. The Littoral Zone, or Littoral Region, is defined as the "zone of shallow water and the accompanying bottom above the depth at which photosynthesis cannot be supported in lakes" (Henderson 1995). In beach terminology, the littoral zone is "an indefinite zone extending seaward from the shoreline to just beyond the breaker zone." (SPM 1984) More specifically the littoral zone along the Green Bay shoreline can be defined as the area from the shoreline out to water depths of about eight feet. *(Personal communication /w Phil Keillor)*

Littoral zones comprise shallow water communities between the open water areas of a lake and the surrounding land. Technically, littoral zones begin on land where the water table lies only a foot or two below the soil surface, and extend to the maximum depth where rooted aquatic plants grow. The size of the littoral zone obviously depends on the characteristics of the water body. However, an expansive littoral zone could begin with a riparian wetland community and extend far from shore in a shallow water body.

The maximum depth of rooted aquatic plant growth usually defines the outermost edge of the littoral zone from shore. Plant growth is limited by either light penetration or one atmosphere of hydrostatic pressure. Growth of macrophytic vegetation (large aquatic plants), and the accompanying macro invertebrate and zooplankton and phytoplankton communities, is often restricted to shallower depths due to natural lake fertility or cultural eutrophication.

While the maximum rooting depth can vary greatly from one lake to the next, the shallow water area encompassing three feet or less (the littoral zone) is the more crucial habitat affecting lake productivity and biodiversity. These shallow water areas provide important spawning , nursery and life sustaining functions for a myriad of fish, water fowl, and other aquatic organisms.

Scores of minute plants (phytoplankton) and animals (zooplankton) utilize rooted aquatic plant beds during all or part of their life cycles. "Invisible" but important residents of the littoral zone and components the lake food web include attached algae, sponges, mollusks, crustaceans, microcrustaceans, insects, and forage fish such as darters which use bottom material in the littoral zone during their life historics. Nearshore areas link terrestrial and aquatic ecosystems and are crucial for sustaining amphibian and reptile populations.

As higher demands are placed on lake front property, development activities can compromise wetland and vital littoral zone functions. Extensive pier and seawall construction destroys and fragments aquatic plant communities along with beneficial life cycle and food producing habitats. Cumulative effects of many individual near shore modifications reduce fish production, herptile populations, biodiversity, and water quality,

Social and Economic Characteristics of Study Area

The social and economic character of the Bay area is almost as diverse as the physical characteristics and the biology of the Bay. The southern end of the Bay is dominated by the city of Green Bay. This is an industrial/commercial/urban center of northeastern Wisconsin. Established as a fort in the early history of the area, the current dominant industries center around paper production. As you move north from the city of Green Bay, the landscape reflects a more rural and rural residential pattern of development. The shoreline of Green Bay, north of the city, is in a transition from being used as sites for seasonal recreation and summer cottages, to being used for year round homes and retirement homes. Larger communities and industries are found at Sturgeon Bay on Green Bay's east shore, and Acantha and Marionette on Green Bay's west shore. A number of still smaller communities are supported by residents who commute to larger cities, or by the tourist industry as exemplified by small communities north of Sturgeon Bay. North of the city of Green Bay, agricultural production, dairy product production, fruit growing, cash cropping, forestry, and other open space uses are found on the interior of Door, Kewaunee, and Brown counties. With extensive marshes and wetlands on the west shore, there is less commercial use or development potential for some of these shoreland areas. Agricultural production, forestry, and, where available, shoreline cottage and home development are seen in upland areas along the west shore.

The waters of the Bay of Green Bay are important to the economies of these two regions. The port of Green Bay is a major commercial shipping center in the area. In addition, the population center in this region makes extensive recreational use of the waterway. The northern end of the Bay supports the tourist industry of Door, Marionette and Acantha counties. The draw to these areas has been the natural scenic beauty of this water body and the varied recreational opportunities this waterway provides.

CUMULATIVE IMPACTS OF SOLID PIER STRUCTURES

PHYSICAL IMPACTS

Hydrogeological Impacts of Blasting to the Littoral Zone

Solid Structures are built upon bedrock by blasting or "peeling," not usually by driving pylons. Bedrock structural damage (fracturing) caused by blasting adjacent to existing springs or seeps may potentially open up new discharge spring outlets.

In addition, blasting may crack well casings which will require maintenance and may allow suspended sediments into the well.

However, information from DNR hydrogeologist revealed that blasting in these situations should not cause adverse impacts to groundwater quantity or quality for the following reasons:

- Springs are fed from areas of higher hydraulic head upland from these shoreland areas. Delivery to the discharge area (spring) is via fractured rock (Sturgeon Bay, - Red River Watershed Report p. 24, 1994). Door County is a groundwater watershed, primarily internally drained via these numerous fractures to discharge to Green Bay or Lake Michigan (WDNR 1987).

- Increased groundwater drawdown in upland areas is unlikely due to these few additional potential spring openings especially when viewed relative to clusters of groundwater pumping discharges by private or agricultural wells of 5 - 70 gpm (gallons per minute) (Systestad 1985).

- Water wells in Door County are required to be constructed with 100 - 170 feet of casing below land surface grade. The water table typically is about 40' below grade (Door County casing advisories and construction reports).

- Shoreland wells adjacent to the blasted area should not be affected since local springs should be recharged from upgradient upland areas and local production wells, if properly constructed, should be drawing from significantly beneath the spring discharge zone. Therefore no water shortage should be incurred by local production wells. In addition, as groundwater recharge events fade, many unfed springs could begin to fill back in with sediment as discharge flow is reduced.

- Spring water discharging to the bay or lake should be at temperatures of approximately 55°F. The addition of these more temperate waters may provide additional habitat areas for new plant communities. Although it may be undesirable to alter stable indigenous plant communities, these minute spring location sizes do not likely constitute an overall adverse effect due to minimal water temperature changes (*Personal communication Tim Rasman, WDNR).*

Door County bedrock is highly fractured in nearly all localities where it meets the Bay of Green Bay or Lake Michigan. Erosion and surface weathering is more rapid along these defects. This is evidenced by the shape of some land forms and the presence of Karst features. To achieve the highest structural stability of any permanent solid structure erected along the shoreline, that structure should be anchored independently to the shoreland bottom and not tied in any structurally dependent way to the adjacent shoreland. Thus, the failing of a shoreland tied structure causing any associated shoreland alteration is averted.

According to the Just vs Marionette court case, a property owner does not have the inherent right to alter the natural environment of a parcel. In areas of bedrock, dock structures are associated with blasting and dredging, which has an increased adverse impact to the shallow water habitat.

Physical Impacts of Solid Piers to the Aquatic Environment

For the purposes of this EA, a generic recreational solid pier is defined as up to 300 feet lakeward from shore, with widths up to 30 feet and base widths up to 40 feet (these dimensions are variable), and may be in the form of a straight, T, L, or semi enclosed pier. These piers are not commercial harbor piers and jetties which may extend lakeward a thousand feet or more from shore. The scales of these piers are similar to large groins (groynes) used for shore and beach stabilization and the environmental/physical effects are similar. Consequently, the literature review used in this study often references groins. A *groin* is a shore protection structure designed to trap longshore drift; it is typically constructed perpendicular to the shoreline. It is assumed that the piers discussed in this study typically have vertical sides and are highly wave-reflective. (Boats are difficult to fender from sloping sides, and wave reflection is a necessity for sheltering docked boats from waves.) Most of the applications propose rock rip rap on the wind ward side of the structure to break up wave and ice action. Due to the size and mass of these solid structures, they often inadvertently function as groins or jetties.

A U.S. Army Corps of Engineers (USACE) engineering manual summarizes environmental impacts of breakwaters and jetties (USACE 1986).

The twelve applications request approval for a diverse set of solid pier typesincluding: eight L-shaped piers, one straight pier, one breakwater, one L-shaped pier with breakwater and one L-shaped pier with an extension. At least half of these structures are filled, steel sheet pile piers. At least two of them are rock filled timber cribs. Three of them are rock rubble mound structures. Lengths vary from 46 to 265 feet. The diversity seems to mirror the diversity of present solid piers in Green Bay waters in these counties (Appendix A).

Table 1 shows that the 12 pending applications for solid piers would add slightly more than 10 to the present number of solid piers along Wisconsin shores of Green Bay, all but one in Door County.

Table 1 was prepared by David Hart, AICP, UW-Madison Land Information and Computer Graphics Facility from reports by Niedzwiedz (1995). The counts of solid piers for Door County include the Town of Liberty Grove which extends around the tip of the Door Peninsula and 2.5 miles along the Lake Michigan coast from the Northport Dock (in 1978) in the Porte des Morts Passage between Green Bay and Lake Michigan. Niedzwiedz counted shoreline structures on aerial photos taken by the U.S. Army Corps of Engineers in 1978 and 1992. His counts and identifications by type have not been independently verified in the field or on photos.

Table 1 - *Constructed solid piers and groins along Wisconsin shores of Green Bay.*

County	Groins, 1978	Groins, 1992	Solid piers, 1978	Solid piers, 1992
Brown	2	2	1	0
Door*	21	25	60	111
Kewaunee	0	1	0	0
Marionette	0	0	0	0
Acantha	2	3	0	0
Total in G.B.	25	31	61	111

Source: David Hart (1997), using data from Niedzwiedz (1995).

Limitations of a Literature Review

There is not an abundant supply of literature on the environmental impacts of shoreline structures. Most of the literature I have seen applies to low groins which sediment can pass over and around, jetties at the mouths of streams on the ocean coast and seawalls which protrude modestly into the water. I have seen few studies which evaluate long-term impacts (year 3 to multiple decades). The aerial photos included in the draft assessment show solid piers on coastline segments which do not have beaches. Nevertheless, some impacts of solid piers in Green Bay can be predicted by analogy as well as by the investigations of existing solid piers which have been done.

Some Definitions (SPM 1984):

Downdrift: “The direction of predominant movement of littoral materials.”(USACE Shore Protection Manual, Vol. III, 1997.)

Littoral zone: "An indefinite zone extending seaward from the shoreline to just beyond the breaker zone."

Littoral drift: "The sedimentary material moved in the littoral zone under the influence of waves and currents."

Littoral Transport: "The movement of littoral drift in the littoral zone by waves and currents. Includes movement parallel (longshore transport) and perpendicular (on-offshore transport) to the shore."

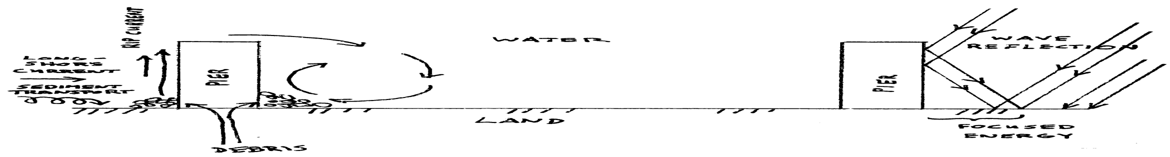
Longshore current: "The littoral current in the breaker zone moving essentially parallel to the shore, usually generated by waves breaking at an angle to the shoreline."

Shoaling: “(1) To become shallow gradually. (2) To *cause* to become shallow. (3) To *proceed*
from a greater to a lesser depth of water (USACE Shore Protection Manual, Vol. III, 1997.)

Updrift: “The direction opposite that of the predominant movement of the littoral materials” (USACE, Vol. III, 1997.)

Effect of Solid Piers on the Longshore Current and Littoral Transport

The requirement of solid piers for adequate water depths is opposite to the requirement of shore perpendicular shore protection structures for adequate water depths. Groins extend just



Some possible physical, environmental effects of solid piers.

far enough into the water to trap some of the sediment moving alongshore without blocking all of the sediment moving along the coast. Seawalls and revetments intentional intrusion into the water is done to provide armored stone at the toe to protect the structures. Tait and Griggs (1991) drew this conclusion about seawalls:

> "...a wall built out to the water's edge will have many opportunities to interact with the waves and may frequently project into the surf zone to block *littoral drift*...... One of the most critical factors controlling the impact of a seawall on the beach is its position on the beach profile relative to the surf zone. All other things being equal, the further seaward the wall is, the more often and more energetically it can interact with the waves".

This statement is much more true of solid piers. Solid piers pose a greater impact on physical nearshore processes (sediment and water movement) than do shore protection structures (Figure 4 & 7).

Figure 4 . *Some possible physical, environmental effects of solid piers. Drawing by Keillor (1997)*

Solid pier structures in Green Bay will always interact with the nearshore waves and will project beyond the common surf zones, blocking most, if not all, of the littoral transport of sediment and the longshore current within their zone of influence.

Table 2 shows the water depths needed to dock boats at piers. The Environmental Assessment does not mention the sizes of boats for which the piers are to be built. Pleasure boats up to 100 feet in length are no longer rare in the Great Lakes. Klancnik (1994) suggested typical dredging depths of 15 feet below mean low water (Low Water Datum, or Chart Datum, in the Great Lakes) for *maxi-boats* (power and sail). Half of the applications require dredging to be done, indicating that the water depths adjacent to the proposed piers are too shallow for the intended boats. Design water depths at the piers are also not stated in the EA. Hopefully the applicants are aware of the storm wave conditions and historic ranges of water levels on Green Bay as well as the large storm surges which occasionally occur along the embankments within Green Bay. If the littoral zone for physical processes of wave breaking, sediment transport and lakebed erosion is used, solid piers will completely block this zone if built for sailboats or power boats 30 feet or more in length because of the need for the piers to extend into water depths greater than eight feet for safe navigation.

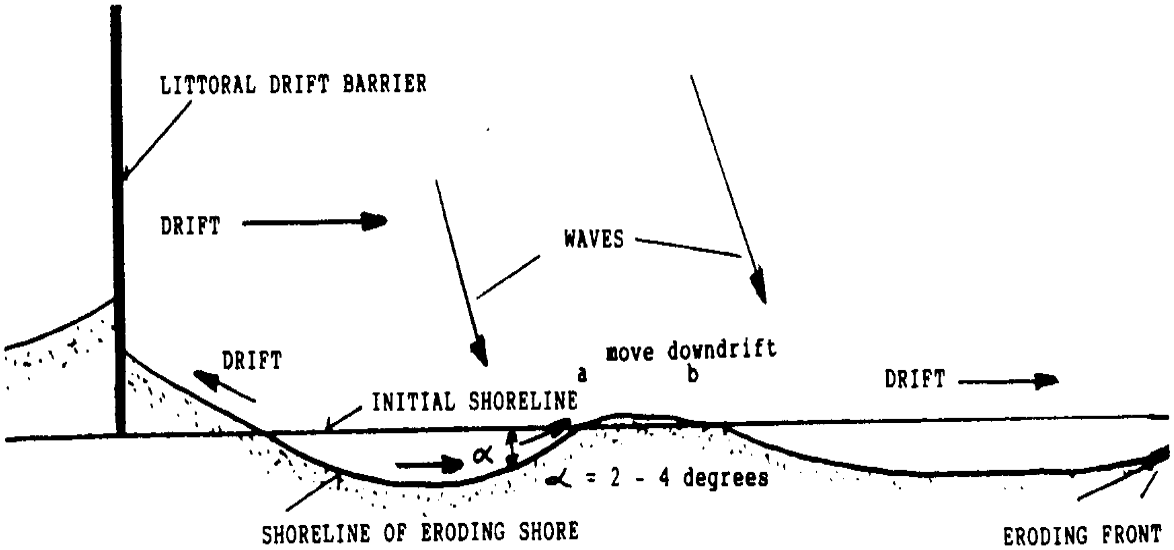
Piers extending into water depths greater than seven feet will intercept most of the surf zone and piers extending into water depths of 10 feet and greater will intercept all of the surf zone in which the longshore current and littoral transport takes place along Green Bay shores.

Because of limited over-water distances and shoaling, nearshore waves on Green Bay are typically one to six feet in height. Waves in Green Bay tend to break in water depths greater than breaking wave heights (water depths up to twice the wave heights) because of relatively short wavelengths (Goda 1985). This would be the case for common nearshore bottom slopes not as steep as 1:20 (vertical: horizontal). For example, common waves on the bay, four feet in height, tend to break in water depths of slightly more than four feet to seven feet.

Table *2.Minimum recommended water depth in marinas. From Tobiasson and Kollmeyer (1991)*

Boat Length (feet)	Power Boats (feet)	Sail Boats (feet)
minimum values	4	4
30	7	9
35	8	10
40	8	11
45	8	12
50	8.5	13
55	8.5	14
60	8.5	14.5
65	9	15.5

Significance of Blocking Longshore Currents and Littoral Drift



Decreased sediment transport and sediment accumulation against solid piers are potential consequences of blocking longshore currents and littoral drift. If protective beaches are robbed of their sediment supply, the beaches erode and the land behind the beaches may erode (Figure 6). The aerial photographs of solid piers in the EA give some indication of the extent of sediment accumulation that occurs because of these littoral barriers (Appendix G).

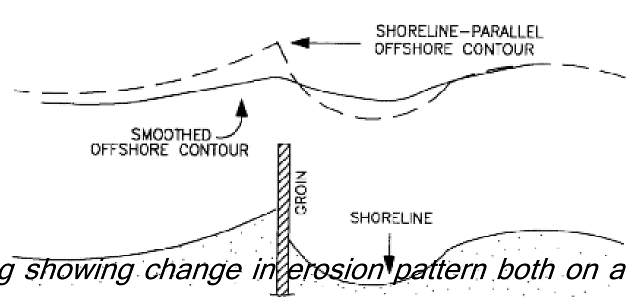


Figure 6. *Drawing showing change in erosion pattern both on and off shore from a structure (CERC89-19 1977).*

Figure 9 . *The development of downdrift erosion downdrift of a groin (Bruun 1995).*

The aerial photos in the EA show accretion of sediment at the following locations (Appendix G):

- Chaudoir's Dock. The accumulation of sediment only on the northeast side suggests that the L-shaped pier had been present for years and that the on-going construction was either reconstruction, or construction of the breakwater on the southwest side of this harbor.

- Solid piers north of Sister Bay (2 photos). Some structures have accretion on both sides as occurs with littoral barriers in areas with no net littoral transport dominating in either direction along the shore (Komar et al 1976). The relative amount of accretion seems to depend on the distance from the nearest littoral barrier: some obviously-solid piers have little accretion where they are in close proximity (less than a pier length) from a neighboring solid pier. Lack of accretion may also indicate recent construction. There are too many solid piers, too closely spaced, to see any signs of starvation in the photo (i.e. erosion "downdrift" of a pier). Several piers have accretion along most of their length.

- Solid structures north of Anderson's dock, Village of Ephraim, Door County. Several piers have accretion along most of their length. Some piers appear to have dredged or blasted underwater approach channels three or four times the pier lengths. Such channels can be temporary depositional basins for littoral debris or sand and gravel.

- Village of Sister Bay in Door County (2 photos). Some piers north of the village breakwater show sediment accretion filets on the north sides only of the piers, but the many littoral barriers south of these piers prevents any conclusions about what the prevailing littoral transport would be if there were no barriers.

The blockage of littoral transport caused by solid piers in the aerial photos is not obvious in some cases either because: a) a pier was placed between several existing littoral barriers or b) the pier was installed recently or c) there was little littoral transport along that part of the coast.

Solid piers on sandy, gravelly shores present major barriers to littoral drift and can cause downdrift erosion for distances many times the length of the piers in proportion to the magnitude of the littoral transport.

Cobblestone is not stationary and is subject to littoral drift forces. Most, if not all of Green Bay lakebed is composed of various sized materials and detritus. While cobble may predominate in many areas, it only means the area is starved of smaller sized particles and hence, the increasing importance of the limited amount of this material. Where solid structures have been placed, photographic evidence shows accumulation of littoral sands in areas that are predominantly cobble.

The significance of blocking littoral transport is best seen with the Michigan Island dock example since it is the only littoral barrier on that island coast. The photographs of the Michigan Island pier included in the DEA show a large filet of sand and gravel that has accumulated on the “updrift”, northeastern side of the dock, but not on the southwestern side of the dock (Figure 5a and b). Barriers to longshore transport can have large and distant negative effects on unprotected shorelines. A conversation with National Park Service staff suggest that the dock's obvious interference with the littoral transport has robbed the spit at the southwestern end of the island of sediment and worsened erosion of the bluff where the spit joins the highland, one mile westward along the coast from the pier.

Brunn (1995) mentioned adverse effects of downdrift erosion spreading 10 or 20 kilometers (6 or 12 miles) along the Atlantic Coast because of jetties at Jupiter Inlet in Florida, and 40 to 50 kilometers (25 to 31 miles) because of a huge barrier to massive longshore transport rates on the coast at Lagos, Nigeria. Bruun lists 16 ocean locations where littoral barriers have caused a short-term migration rate of erosional activity to be 0.2 to one kilometer per year (700 feet to 0. 6 mile per year) and a long-term migration rate of 1.2 to 1. 5 kilometers per year (0. 8 to 0.9 miles per year).

The longshore extent of the erosional effect of a solid pier will be generally limited to the distance to the next littoral barrier (Everts 1983).

Everts (1983) stated that constructed littoral barriers act like small headlands. He developed a simple model for predicting the shape of the shoreline downdrift of such barriers and gave examples of such shoreline shaping on the New Jersey shore downdrift of inlet jetties.

Wave Reflection from Solid Piers

The first photo in the EA shows the embayment within the Village of Sister Bay. Construction of solid piers and sheetpile bulkheads in the southern half of this embayment caused wave reflection into sheltered waters within the northern half of the embayment. Behind the old village breakwater, these reflected waves created an untenable dockage situation for boats and led to the addition of a new breakwater to shelter these docks.

Wave reflection off of vertical sheetpile piers perpendicular to the shore will as much as double the wave energy that reaches the shore within a distance along the shore equal to about 70 percent of the length of the pier lakeward from the water's edge. Most of this energy will be within a longshore distance equal to about 50 percent of the pier length lakeward from the waters edge.

As waves shoal and "feel" the lakebed, their paths tend to become more perpendicular to the lakebed contours. Where the lakebed contours are roughly parallel to the shore, the wave paths will tend to become more perpendicular to shore the closer that waves get to shore. It would be uncommon for large waves getting into shallow water (less than 10 or 15 feet deep) to be approaching at right angles greater than 45 degrees from a perpendicular to such shores. A more typical approach angle would be 25 degrees or less. Since waves reflecting from straight vertical surfaces (like sheetpile walls) have reflection angles equal to approaching angles, this means that the shoreline length adjacent to these reflecting walls which receives this reflected wave energy is equal to the tangent of the angle times the water length of the pier perpendicular to the shore.

Waves approaching verticle walls with very small angles (less than 15 degrees) may form Mach-Stem waves with heights higher than the approaching wave heights. These higher waves roll along the wall and collapse on or near the shore, concentrating their energy within a short distance of shoreline adjacent to the pier wall. This distance is less than 30 percent of the water length of the verticle wall.

Erosion of a shore adjoining a groin or solid pier is only partly due to interference with the longshore transport of sediment. Waves reflecting from the groin or pier will cause a focusing of wave energy on the shoreland adjacent to the groin or pier on the windward side of the groin or pier (Figure 4). Where there is focused wave energy, there is greater potential for erosion or damage to shoreland structures than there is with unfocused waves.

For a vertical wall with crown above water, the reflected wave is 70 to 100 percent of the height of the incoming wave. Therefore, 50 to 100 percent of the energy is reflected (Goda, 1985).

For a rubble stone slope (1:2 to 1:3 slope): the reflected wave is 30 to 90 percent of the height of the incoming wave. Therefore, 9-36 percent of the energy is reflected (Goda, 1985).

For a natural beach (of unstated slope, but most likely 1:10 to 1:100 slope) the reflected wave is 5 to 20 percent of the height of the incoming wave. Therefore 2.5 to 4 percent of the energy is reflected (Goda, 1985).

The amount of wave energy reflected is dependent on the wave conditions (more long period wave energy reflected than short period wave energy) and on the rock size, void size, and depth of the rubble structure. Goda (1985) cites Seeling and Ahrens (1981) for empirical formulas to estimate reflection coefficients for beaches, revetments and rubble mound breakwaters exposed to regular and irregular (like we have in nature) waves.

Wave diffraction around the lakeward end of a groin or pier can have the opposite effect; dispersing or spreading wave energy on the shoreland along the opposite (leeward) side of the groin or pier. The Shore Protection Manual (1984) is a primary reference for wave reflection and wave diffraction at solid structures.

Proper design and use of rip rap can be utilized to help mitigate increased wave energy due to reflection but will not completely negate it.

The aerial photos in the EA show some solid piers less than a pier length from a neighboring pier. These closely-spaced piers likely cause some wave reflection into the intended shelter for boats docked at the neighbor's pier. Riprap placed outside of pier walls and reaching at least as high as the water surface will absorb much of the reflected wave energy and reduce damage caused by reflected waves to adjoining shorelines (Appendix G).

Changes to Lakebed Depths

The presence of a groin or solid pier can alter the lakebed, creating shallower areas and creating deeper areas through scour by reflected waves and diverted currents (Figure 8). Perlin and Dean (1985) studied the subject

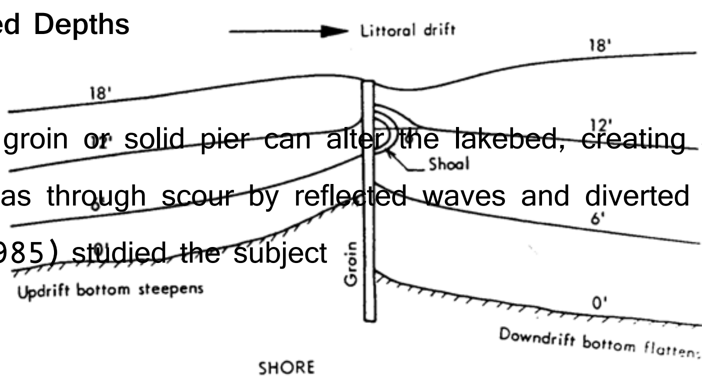


Figure 8 . *Drawing from Bruun (1995) showing changes in lakebed depths.*

If one were to consider normal current patterns, one would expect accretion on the south side of docks. However, as clearly depicted on the photographs from the Sister Bay area, accretion in Door county occurs on the northerly side of permanent structures. We believe this to be principally the result of the nature of the bottom material, that is the dolomitic limestone beach cobble. This material is not subject to normal downdrift as one would find with sand particles. Rather, beach cobblestone moves in response to storm action. The long fetch for storm action is from the northwest and it is those winds and waves that are creating accretion on the north side of docks. It can be determined from the photograph that the extent of this accretion can be significant. As such, great care must be taken to protect neighboring property owners from accretion activities caused by solid structures.

There are of course notable exceptions in certain of the bays whereby sand particles are trapped by large structures. Certainly the Murphy Park Dock at Horseshoe Bay would be a classic example (*Sautebin pers. comm 1997*).

Summary of Physical Impacts of Solid Piers to the Aquatic Environment

Solid piers along the Green Bay shore are effective littoral barriers to longshore currents and efficient traps of floating debris. Where they are not sited close to other barriers, they trap sand and gravel that would otherwise disperse along the minimal beaches common to the area. Solid piers also reflect waves on to adjoining shores and into the sheltered waters behind adjacent piers unless riprap is placed to absorb wave energy arriving at such piers. Based on complaints from adjacent riparians, debris does accumulate on the updrift side of solid structures creating an area of stagnant, foul smelling water.

SCUBA Dive Observations on Existing and Proposed Solid Structures (Sites)

On May 2, and August 18, 1997, the Department NE Region Dive Team staff conducted underwater observations to compare physical, chemical, and biological conditions existing in areas with and without solid piers. Underwater photography was used to document the conditions. Three study areas were chosen and each represented one of the following dominate substrates: sand, cobble, or bedrock. Within each of the three areas, two study sites were chosen; one site was located within an existing solid structure and the other was located outside and adjacent to the first site. In addition to the three pairs of sites, two additional sites with existing structures were also studied (Bayshore Park and Eagles Nest). Therefore a total of eight sites were studied.

Physical

Inside the **O'Brien** solid pier and breakwall, which is located just south of the Murphy Park, sediment had accumulated creating a berm against the man made solid structures (Figure 10). The solid structure on the **Standish** property showed evidence of recent extensive renovation. Some detritus along with silt was observed in the corner of the "L" extension or where the end of the structure forms an "L" to the south. Pictures of the area and structure are attached. This area was a bedrock substrate with cobble on top of the bedrock (Figure 11, 12 & 13).

The final solid structure **Lama Wama** was located just north of the Sturgeon Bay channel. This structure is a jetty on sand substrate. Due to the littoral drift, sand, detritus and dead clams had accumulated on the upwind side of the structure. The downwind side of the structure had an accumulation of detritus covering soft sediment and muck.

Photographs from the survey show floating and dead fish inside some of these structures.

Chemical

The accompanying chart (Figure 15) shows the depth, temperature, dissolved oxygen level, saturation and conductivity taken at the dive sites as well as at **Bayshore Park** and **Eagles Nest.** These chemistries were taken on two separate dates, May 2, 1997 and on August 18, 1997.

No dissolved oxygen concentrations below 5 mg/l were measured during the survey. Though dissolved oxygen differences did exist inside and outside of the structures. Dissolved oxygen below 5 mg/l is violation of state statute.

Conductivity (specific conductance) is a measure of the total dissolved inorganic chemicals in the water. Measurements were taken inside and outside of the structures to see if there was nay difference.

O'Brien site -The chart shows almost no change in dissolved oxygen, temperature and conductivity inside or outside of the structure.

Standish site - The chart shows the dissolved oxygen and temperature were higher on the inside of the structure, likely from the growth of plant material and lack of water exchange.

Lama Wama site- Conductivity was the same on both sides of the jetty. Dissolved oxygen was super saturated due to a combination of wind and wave action creating some aeration in the shallows. The presence of plant material produced oxygen from photosynthesis, as well.

Bayshore Park site - Water temperature, dissolved oxygen, and conductivity were almost the same inside and outside of the structures at Bayshore park. Secchi disk transparency was almost the same, 0.9M outside the structure and 0.8M inside the structure.

Eagles Nest site - The chart shows the readings were almost the same inside and outside of the structure. Dissolved oxygen was 1 mg/l lower inside the structure, likely due to the lack of water exchange. The water stagnates producing higher oxygen demand. Water clarity, measured by the standard secchi disk was only 0.6M inside and outside of the structure. Our trophic scale indicates some improvement when secchi disk transparency is 1.5M or greater. A heavy green color due to algae production was apparent inside and outside, as well.

Biological

O'Brien site - On May 2, 1997 aquatic life consisted of zebra mussels on cobble and rubble. The sandy area did not have any obvious growth. The bottom material was not examined for additional aquatic life such as periphyton or invertebrates. Some zooplankton was observed inside and outside of the structures. On August 18, 1997 the most noticeable difference was a growth of Myriophyllum spicatum (Eurasian milfoil) in several clumps inside of the structure. This growth was present on the sand. There was also an accumulation of dead organic matter or detritus in and around the milfoil plants. No rooted plant growth was observed outside of the structure within 50 yards.

Standish site - On the inside of the structure the May 5, 1997 observations included zebra mussels on cobble, rubble and gravel. On August 18, 1997 on the inside of the structure, Myriophyllum spicatum (Eurasian milfoil) and filamentous algae were growing with the zebra mussels. Filamentous algae and zebra mussels were growing on the outside of the structure (Figure 12 and13).

Lama Wama site - On May 5, 1997 rooted and floating aquatic vegetation was observed. On the August 18, 1997 dive, clasping leaf pondweed, coontail, eurasian milfoil, wild celery and elodea were observed, with filamentous algae covering these plants (Figure 14). The outside of the structure contained zebra mussels, snails and clams on the sand, gravel and rocks adjacent and part of the structure. In water depths greater than 6.2 feet, eurasain milfoil, elodea, coontail and wild celery were evident. Filamentous algae was also present in the area but not abundant. There were open areas, primarily sand, where no aquatic life was observed.

Bayshore Park site - Inside of the structures the rooted vegetation consisted of coontail and elodea.

Terrestrial Manipulation/Impacts

Temporary roads have been used to construct the docks and to gain access to the area to be dredged and to back fill. While these are mostly removed, without proper oversight, some substrate will either be removed, or part of the road fill may be left. “Erosion from these temporary roads contribute to siltation at and near the site, potentially for years”.

There may be disturbance of adjacent upland by equipment to access the construction site. This would be particularly detrimental in the bluff areas. Shoreline/upland interface will be altered in the process of constructing the solid structure and "connecting" it to the upland, particularly if proper erosion control/stabilization measures are not implemented during and after construction.

"Rebuilding / resurfacing of piers often lead to deposition of concrete, blacktop etc. in and around the pier in the disguise of "fill, rip rap," or fines are just shoved into the water. (No solid pier, no problems). "

BIOLOGICAL IMPACTS

General Fisheries

Due to dredging, littoral drift, and the loss of lakebed (bay bed) and subsequent aquatic habitat caused by these solid structures, the fish community will be negatively affected by the direct loss of natural spawning, nursery and food production areas in the littoral zone. Many game and forage species spawn in the shallow waters of the littoral zone. Loss of spawning substrate will reduce potential spawning success. Both adult and young life stages of many fish species rely on invertebrates found in the littoral zone as a food source. Because a decrease in macro invertebrate populations is possible, the carrying capacity of the fisheries community could be diminished.

Fish surveys with seines conducted by WDNR staff at selected sites along the west shore of Door County from Sturgeon Bay to Ellison Bay during August and September, 1995-1997, indicated that more than 20 different species make use of the area from shore to an average depth of about four feet over a variety of bottom materials (Table 3). The most common type of bottom material was rock rubble of various sizes, often interspersed with sand. The most abundant group of fish captured were various species and ages of minnows, a key element in the fish predator-prey food chain of Green Bay. Also, present was a variety of juvenile fish of various other species that were probably using these littoral waters as a nursery area, prior to moving offshore as they grow and mature. Some will return seasonally to use these same shallow areas for spawning.

At some of the sites, solid structures may benefit fish communities. Rock crib structures have been shown to contribute to increased diversity of fish species and toward providing refuge and cover areas for some young life stages of fish (Beauchamp et al. 1994). These types of structures, with proper design, may mitigate, in part, the substrate lost in construction of the projects. The benefits derived from such structures will be proportionally less in areas with abundance of natural habitat than in areas where the natural system has been degraded.

In addition to the direct loss of habitat, there will also be indirect losses. While no direct physical changes to the substrate may occur from construction, except for that buried under the structure, the portion of the littoral zone enclosed by solid structures may change in biological functioning. Spawning fish may no longer utilize the area because the enclosed area will be cut off from the adjacent shoreline. For species which may still be attracted to the enclosed areas, water quality changes may make successful reproduction unlikely. High use in the area by water craft could disturb fish during the spawning period and affect the viability of deposited eggs through increased turbidity and sedimentation. The discharge of fill material to construct the structures within the water typically contains a large amount of fines that can be seen leaving the area. In addition, the

Table 3.- *Summary of fish species caught, by location and bottom type, during shoreline seine surveys conducted during August and September, 1995 - 1997, at various sites along the western shore of Door County. Each site was sampled 1-2 times per year with 1-4 seine hauls per site. Definitions of bottom types: R - rock rubble; S - sand; C - clay; M - silt; V - vegetation.*

LOCATION	STURGEON BAY		STONE QUARRY		MURPHY PARK			EGG HARBOR			FISH CREEK			WEBORG POINT	NICOLET BAY		TENNISON BAY		EPHRAIM	SISTER BAY	ELLISON BAY
YEAR	96	97	96	97	95	96	97	95	96	97	95	96	97	96	95	97	95	96	96	96	96
BOTTOM TYPE	RS	RS	R	R	RS	RSV	SV	SC	RSV	RS	SM V	SV	S	RSMV	R	R	RS	R	SV	RS	RS
Yellow perch *Perca flavescens*					2	5	20	4	1		22			21			55				
Walleye *Stizostedion vitreum*									6											1	
Johnny darter *Etheostoma nigrum*	1					2								1							
Minnow spp. *Cyprinidae*	1					9		1			101	20			60				100		
Longnose dace *Rhinichthys cataractae*						15					3						2	3			
Spottail shiner *Notropis hudsonius*					1370	648	150	400	2500		125	200	300	2			85	800	600	1000	1200
Blacknose shiner *Notropis heterolepis*											4										
Bluntnose minnow *Pimephales notatus*						80				6											
Golden shiner *Notemigonus crysoleucas*									3												
Common shiner *Notropis cornutus*												100							400	1000	300
Carp *Cyprinus carpio*									1												

Table 3. *Continued.*

LOCATION	STURGEON BAY		STONE QUARRY		MURPHY PARK			EGG HARBOR			FISH CREEK			WEBORG POINT	NICOLET BAY		TENNISON BAY		EPHRAIM	SISTER BAY	ELLISON BAY
YEAR	96	97	96	97	95	96	97	95	96	97	95	96	97	96	95	97	95	96	96	96	96
BOTTOM TYPE	RS	RS	R	R	RS	RSV	SV	SC	RSV	RS	SMV	SV	S	RSMV	R	R	RS	R	SV	RS	RS
Smallmouth bass *Micropterus dolomieui*	78	4	126	4	3	16	3	9	14		24			29	6		74	4	1		1
Largemouth bass *Micropterus salmoides*																	1				
Rock bass *Ambloplites rupestris*											3			9							
White sucker *Catostomus commersoni*																	1				
Sculpin spp. *Cottidae*						1															
Round whitefish *Prosopium cylindraceum*									1												
Channel catfish *Ictalurus punctatus*									1					1							
Northern pike *Esox lucius*														6							
Stickleback spp. *Gasterosteidae*														1							

White perch *Morone americana*					250	686	135 5	8	7		26	25	20 0			3			100		
Alewife *Alosa pseudoharengus*				200		32	40			100				1							

disruption of the lakebed during construction stirs up the bottom and can release sediments into the water column. (Appendix G - Chaudoir's photo). These fines or disrupted bottom materials may be deposited over fish eggs and reduce a hatch within a particular area. Spilled petroleum and engine exhaust products also trapped in enclosures degrade water quality.

Additional adverse impacts from these projects include the disruption to the natural shoreline and lakebed, the result of littoral drift interacting with the structure. An area of sand accretion can be expected on the updrift side of the structure with a concomitant scouring and removal of materials on the downdrift side. This shift in sediment composition can cause changes in species distribution, diversity, and numbers of benthic organisms. By changing the nature of the near shore bottom material, the zones affected by the structure could see the elimination of valuable spawning habitat for a variety of fish species. Also, newly hatched fish are dependent on water currents for movement. Even at later larval stages, they are often weak swimmers. Interference with the longshore current and changes in water circulation between the pier and the shore created by the structure could sweep weak swimming fish away from the protection of the shoreline and its food resources out into deeper waters where either environmental factors or predation could decrease their survival (Stockley 1974).

Smallmouth Bass

Smallmouth Bass depend on shallow nearshore areas for spawning (May-mid July). Spawning habitat varies anywhere from soft to hard substrate, but gravel to rubble areas are preferred. Bulrush areas are extensively used and are extremely important to protect. Nests are most commonly built in 3 to 8 feet of water, but will utilize deeper water. Building permanent structures on these substrates will, of course, permanently destroy part of existing historical spawning areas. However, at the same time, small mouth bass do use manmade structures (the base of bulkheads at corners) to locate nests. The permanent loss of spawning areas are not mitigated by the adoptive nature of bass to use these structures to build nests.

Young of the year (YOY) smallmouth bass become pelagic and leave the nests. Many will move to very shallow areas ranging in depths from 6 inches to 4 feet of water, while others may seek out submerged vegetation for protection. Rock rip-rap, often placed at the water shoreline interface to prevent erosion could be used by YOY for refuge. All age fish may utilize these structures sometime from mid-April to October, depending upon water temperatures. Large mature fish will more likely to concentrate near structures with rip-rap early in the year, searching for spawning areas; whereas, immature fish would be common from June through August. In general, these areas may concentrate bass leading to ever increasing fishing pressure on these populations.

The major impact to smallmouth bass is the cumulative effects over time to spawning fish. Although smallmouth bass will adapt to other substrates for spawning (I. e. deeper water, zebra mussel encrusted boulders), this is not beneficial or an acceptable alternative. The seasonal inshore movement and dispersal of spawning smallmouth bass could be affected by the continual construction of permanent piers. However, the main concern is the cumulative effect of lost natural spawning areas available to smallmouth bass as a result of the construction of solid structures. Smallmouth bass populations have demonstrated they are capable of maintaining themselves with the natural habitat available along the Door County shoreline. There are still many questions regarding the long term effects on these populations caused by replacing the natural habitat with artificial solid structures.

Summary of Aquatic Biological Impacts

The cumulative effect of repeated projects along the shoreline would significantly affect the biological community in the littoral zone (Schulz). There now is the potential for similar projects at intervals as close as 100 feet. All of the physical impacts previously described would be compounded and their environmental effects would be magnified. Near shore substrates would be altered by changes in longshore drift. This could devastate individual species within the benthic community whose preferred bottom types would be eliminated. The change to the benthic community's structure and diversity could have significant implications to the fisheries' community, which relies on the richness and diversity of the benthic community. Spawning conditions would be permanently altered. Under this scenario some species would be favored while others would be put under a severe disadvantage. The same could be said for those nearshore spawning species whose fry survive changes in water circulation patterns. Given many structures along Green Bay and sufficient time, both the species composition and the relative abundance of those species could be significantly altered.

Water Quality

Water quality impacts have been known to exist with past permitted structures. These impacts are associated with: 1) Impacts from additional boat activities in the area. 2) Impacts due to lack of water circulation within the dock structures. 3) Impacts to the near shore littoral drift movement which increases sedimentation within the docks, adding to macrophyte and algae populations adjacent to the structures. Increased sedimentation also adds to increased nutrient levels in the area.

The nearshore or littoral area of the Bay is the area of greatest productivity. However, it represents a very small percent of the surface area of the Bay.

Habitat needs in the littoral area of the Bay are provided by aquatic plants, rock rubble and other material formed over the past 10,000 years. The aquatic life has adapted to it. The pelagic or open water area depends on the littoral area. It provides a critical need for the entire food web of the Bay.

The entire littoral area is sensitive to any changes. The mini environment created by solid structures prevents normal water exchange, increases water temperatures, and increases oxygen demand. The overall impact is reduced water quality.

Finally, littoral disturbances can increase the potential for invasions of exotic plant species, such as Eurasian watermilfoil. This aggressive exotic plant has created severe water quality and nuisance conditions throughout North America and Wisconsin. Millions of dollars have been spent on attempts to control this undesirable exotic.

Wildlife

Waterfowl

Geese, puddle ducks, diving ducks, and mergansers frequently use solid structures associated with the harbors of Green bay as feeding and resting areas. Recent colonization of solid structures and the lake bottom by zebra mussels has provided a food source that diving ducks utilize frequently. Mallards and gulls have adapted to living within close proximity to humans and benefit by protection from natural predation and use artificial food sources provided by humans. Mergansers and gulls feed on small fish which may concentrate around artificial structures. All waterfowl species take advantage of piers and breakwalls as refuge from heavy wave action. In the absence of piers or breakwalls, waterfowl would find other protected areas such as natural bays.

Colonial Waterbirds

Gulls, cormorants, and herons all utilize structures in Green Bay as roosting and feeding areas. Herring and ring-billed gulls have adapted well to human modifications of the landscape and are not negatively affected by high amounts of human activity in their roosting and feeding areas. They actually are drawn to these areas, and as their numbers increase, they can be considered to be a nuisance. In areas where human disturbance is minimal, double-crested cormorants and several species of herons roost on piers and other artificial structures. These birds may create nuisance situations for some property owners.

Shorebirds

Many species of shorebirds utilize habitat along the shores of Green Bay during spring and fall migrations. Most species require mudflat and/or beach habitat, but a few prefer rock substrates. Harbors and their associated structures are attractive to shorebirds where these conditions exist. The construction of solid piers will create habitat for mudflat and beach dependent shorebirds where sediment deposition is caused by the piers. Rock loving shorebirds may benefit by the creation of habitat where rip rap and boulders are used to protect piers. However, most shorebirds will not remain in areas where human disturbance is frequent.

The accumulation of debris consisting of injured or dead fish will attract shorebirds in areas where the littoral drift is obstructed.

Mammals

Raccoons, mink, and other small mammals frequent shorelines when foraging for food. The construction of solid piers may add to the foraging habitat of these animals by attracting prey species like insects, crayfish, mice, reptiles, amphibians and human created food sources. Nuisance situations may occur when animals enter boats in search of food. In urban areas, problems have been documented where Norway rats colonize rip rap.

Herptiles

Several species of reptiles and amphibians will use artificial structures as habitat. Pier construction perpendicular to the shore should have no effect on amphibian migration between land and water.

Mollusks

Several species of mollusks are documented in the waters off of Door County, and colonies could be significantly damaged by construction of solid piers and/or dredging.

Summary of Wildlife Impacts:

The construction of solid piers on the bed of Green Bay will have detrimental effects on wildlife only where colonies of endangered or threatened mollusks occur, or where existing unique habitat pockets like coastal wetlands or sandbars are modified or destroyed to facilitate establishment of the pier, or where these habitats are destroyed as a result of changes in current, wave action, and sediment deposition caused by the pier. Most wildlife species in the study area may benefit from the creation of solid piers. However, these benefits are insignificant when compared to the available comparable habitat in the bay of Green Bay.

The fragmentation of the littoral zone by perpendicular solid structures create discontinuities in communities of organisms living along the shoreline, from microscopic organisms to crayfish. Their ecological niche is disrupted. Furthermore, as silting occurs on one side of the dock, and scouring occurs on the other due to wave action, their environment is further compromised (*Burton pers. comm*).

CULTURAL

Economic

Aerial photographs taken in 1997 determined that 309 solid structures, 40 marina complexes and 529 temporary flow through piers currently exist along the Green Bay shoreline in Door, Kewaunee, and Brown counties (Purentin).

The economic impacts of solid dock structures can be summarized as follows:

♦ Some large structures may provide additional tax base for the community in which they are located if the tax assessor chooses to tax them (although these additional tax dollars are not significant in view of the property taxes generated by near-shore property owners.) Structures may increase property values for some riparian owners but may destroy monetary values for neighboring riparians. Of what value are these piers when they deteriorate and become useless (Nebel)? Should economics play a role in the decision making process when the natural resources may be impacted?

♦ Should the construction of these types of individual private solid structures be limited, existing
private piers would become even more valuable. Then again , the permanent alteration of a shoreline by a solid pier will limit its use by future property owners. For example, a non-boating property owner would be "stuck" with a previously constructed solid structure and its impact to the shoreline. Alternatively, temporary piers allow the option of use to remain flexible (Purentin).

♦ Capacity in the present public marinas may need to be expanded to replace the need for private solid structures. This would both add to the tax base and generate greater income to marinas owned by local government. Some increased development could be expected within the area of the larger marinas. While boating congestion is increased in marina areas, the public is aware of, and expects the resulting increased traffic, pollution, and safety concerns.

♦ Construction and maintenance of solid structures provide jobs for local dock construction companies (although so would the construction of public marinas). The use of temporary piers provide jobs for those who manufacture and annually install and remove temporary piers. Is it the departments charge to find employment for citizens of the state?

♦ The business areas and smaller incorporated areas that provide public marinas and boat launch sites may be more active if there is area to expand the present marinas to make up for the lack of private individual marina areas.

♦ Pressure to develop more dockominiums could present problems for adjacent property owners. This may require some rezoning in certain areas. While docominiums may provide needed berthing space for some boaters, by law, lakebed cannot be sold. Only riparians can place a pier along their shoreline on lakebed.

Social

The construction and proliferation of large solid structures increases or reduces the amount of useable near shore fishing opportunities utilized by a different socioeconomic group than those who are typically building these structures. Also, the construction of structures which create a partial enclosure of navigable waters has in the past created the illusion and perception of private ownership of these waters of the State. This has created user conflicts between the owners of the structures and persons wishing to navigate on the waters enclosed by them. For example, many small boats troll the near shore area which becomes interrupted by solid structures.

<u>Safety</u>

A risk to the public can be created by these structures. These risks are created when navigators (e.g., boaters, kayakers, canoeists, snowmobilers, cross-country skiers) are forced farther off shore to get around such structures. The increased risk with such off shore circumnavigation occurs during both the open water season and when the waters are frozen. Because the piers are an obstruction to others (walkers, canoeists, skiers etc.) access over the structures should be provided. Small craft which are forced farther off shore to get around these structures may encounter wind or wave conditions which exceed the safe operating capabilities of these small craft (e.g., canoes paddling close to shore).

Solid structures have been helpful in situations where boats have ceased to maneuver. Boats are able to moor at these piers under some weather conditions. However, wind and weather conditions can be violent enough that boats are safer further away from shore. Green Bay waters are such that there are times when no mooring situation is safe.

During the winter months, water currents under the ice can create dangerously thin ice conditions near the off shore ends of solid structures. Snowmobilers operating on frozen ice, wishing to stay close to shore to enjoy scenery or for safety purposes, may not be aware of these dangerous conditions and encounter unsafe ice close to the structures, even though ice conditions elsewhere may be relatively safe.

Unused, unsafe, and deteriorating structures also create a navigation hazard.

Many applicants have stated they need the solid pier to provide a "safe harbor" for their personal watercraft as well as to aid boaters in navigation during inclement weather. The bay of Green Bay can produce conditions such that a "safe harbor" in some areas is not possible; in fact, remaining in open water may be safer than on shore. The U.S. Coast Guard defined "safe harbor" as "harbor of safe refuge." This term is used extensively in passenger vessel regulations and is defined in 46 Code of federal regulations (CRF) 175.400 as: "a port, inlet, or other body of water normally sheltered from heavy seas by land and in which a vessel can navigate and safely moor. Suitability as a harbor of safe refuge is determined by the Officer in Charge of Marine Inspection and varies for each vessel dependent upon a vessel's size, maneuverability and mooring gear".

The Officer in Charge of Marine Inspection who is responsible for east/northeastern Wisconsin says that the proposed structures do not meet the Coast guard definition of "harbor of safe refuge" (Appendix D) . This response was based on the individual applications which are proposed. The Coast Guard comments are relevant to recreational boats as they are to passenger vessels and freighters. The scale of the required space for safe entry and departure is different for the class of vessel, but the general criteria are the same.

Archeological/Historical

The Wisconsin State Historical Society was notified regarding all of the proposed structures. Society staff responded that the White Cliff Road area in Egg Harbor has copper artifacts along the bluff face. However, the artifacts are not likely to be affected by solid structures in the water.

They also revealed that four ship wrecks are located along the shoreline in the Town of Egg Harbor where some of the structures are proposed. The wrecks may be further lakeward than the proposed solid structures and therefore unaffected by the structures.

Society staff also directed that "Should any archeological materials, including submerged features, artifacts or structural materials be encountered, construction activities should be halted and reported to the State Underwater Archeologist. In addition, should human bone be discovered, the Burial Sites Preservation Office must be contacted " (Appendix E).

Natural Scenic Beauty General

It is often said that beauty is in the eye of the beholder. Through Muench v. Public Service Commission, 261 Wis. 492 (1952) , the public right to enjoy natural scenic beauty, and the Department's responsibility to protect this right, is firmly established. In addition, by virtue of the Public Trust Doctrine, the Department of Natural Resources has the duty to protect this public right.

Many riparian landowners state that they purchased their shoreline property for the view, landward looking lakeward. A solid pier adjacent to their property will affect their natural scenic view of the waterway. The Department evaluates natural scenic beauty as viewed from the water, looking landward.

Development along the shoreline is regulated under local zoning ordinances to" further the maintenance of safe and healthful conditions; prevent and control water pollution; protect spawning grounds, fish and aquatic life; control building sites, placement of structure and land uses; and reserve shore cover and natural scenic beauty" (NR 1 15.01(2)).

The Department, and many others, believe that natural scenic beauty will be adversely impacted by the increased construction of solid structures along the States' waterways. These solid structures are not invisible; they do impact the natural shoreline from a visual standpoint. The impacts to natural scenic beauty are also affected by the fluctuating water levels on Green Bay. For example: in years of high water levels the solid piers are less visible and in years of low water levels are highly visible. Seasonal temporary structures also impact natural scenic beauty, but to a lesser extent since these are removed for a portion of the year and are typically smaller in size. The number and size of docks constructed is continually increasing, but our shoreline, of course, is not.

Shoreland zoning requires structures to be set back from the Ordinary High Water Mark to reduce impacts on natural scenic beauty, water quality, and to protect life and property. Docks are exempt from these requirements since they obviously must be built in the water. However, it may be argued that the adverse impacts to natural scenic beauty may be greater than what has been protected by the zoning requirements.

Local shoreland zoning regulates removal of vegetation along the shoreline, yet, the Department can grant a permit for placement of a solid pier where the adjacent riparian can view the pier and non-essential accessories placed on the pier which otherwise would be prohibited by local shoreland zoning regulations (Sautebin pers.comm).

In its analysis of natural scenic beauty, the Department views the landscape from the water. A solid pier or a flow through pier is not natural. Often times the intended use of a solid pier is altered from the berthing of a boat to the storage of canoes, jet skies, tables, chairs, umbrellas, flag poles, bird houses and boat lifts. Viewing this from the water is not natural . Again, the term "reasonable" is what needs to be addressed, clarified, and if possible, quantified.

Roads to gain access to the site usually require the removal of shoreline cover. While this usually is less than that allowed under county zoning, it adds a negative impact to natural scenic beauty of the shoreline and has the potential to increase erosion into surface waters.

Computer Imaging

The affected shoreline is a regionally important scenic resource that is protected under the Public Trust doctrine in Article IX of the Wisconsin Constitution and under Chapter 30, Wis. Statutes.

Literature Review Regarding Perception of Natural Scenic Beauty

There has been a great deal of literature in recent years providing analysis of human perceptions of visual environments. For example, literature searches at the University of Wisconsin's Department of Landscape Architecture have identified over 1700 articles or reports on landscape aesthetics research (Chenoweth et al 1995).

One of the central questions of much of the aesthetics research has been whether perceptions of natural scenic beauty are commonly shared by most people. This is a critical question for the administration of the public policy of the publics right to the enjoyment of natural scenic beauty along navigable waters under the Public Trust Doctrine. What has been found is that there is substantial public agreement on what is and what is not perceived to be naturally scenically beautiful. For example, Daniel and Boster (1979) found that subject groups in different occupations, different economic strata, different education levels, and different genders largely agreed on their scenic beauty estimates for forested landscape scenes.

The remainder of this literature review is largely gleaned from a review done by Chenoweth (1995).

A common observation in much of the aesthetics research has been that perceived naturalness is a strong predictor of natural scenic beauty. Man-made (or "cultural") elements are often seen as detractions to the perception of natural scenic beauty (Kaplan 1972, Brush

1979, and Anderson 1976), and landscape preferences tend to decrease with increasing levels of human development (Carls 1974).

Related to this in developed environments is the concept of visual compatibility between cultural developments and the natural environment. Gobster (1982) found that aesthetic values in shore land areas can be degraded by developments brought about by the people who were originally attracted to the area by those values. Shore land residential structures were found to be more compatible with their environment when they were less noticeable, due to not being size-intrusive, having low color contrast with the surroundings, and having more intact shore land vegetation. Macbeth (1988) in a study of the visual effects of shore land zoning found that vegetative screening tended to protect lake shoreline aesthetic qualities.

Chenoweth (1995) looked at the effect of shore protection measures - including riprap on natural scenic beauty. He found that scenes with less development were preferred, and that more noticeable or less screened developments detracted from preference scores. Some of the detracting elements were visible boats, piers, boat launches, and boat houses.

Potential Impacts on Natural Scenic Beauty

It is clear from the literature that large, color-contrasting, and unscreened developments like the proposed solid piers will generally detract from the natural scenic beauty of shore land areas. In areas that are already partially developed, the effect may be relatively less dramatic than in largely undeveloped areas, but the existing degree of natural scenic beauty will still be diminished. This negative effect is a concern to many Door County property owners as per letters received from the public.

The Department is largely concerned with the view of the shoreline from the water since it is this perspective most commonly protected by the Public Trust Doctrine. However, some riparian land owners are also concerned about the view of the water that they enjoy from their properties. Their large property investments in the enjoyment of the natural scenic beauty of the bay is threatened by the proposed piers.

A series of simulations were prepared and analyzed by the Department in order to characterize the nature and degree of impact of the proposed structures on the natural scenic beauty of the affected environment. The simulations can be found in Appendix C.

The effects of the development of solid pier structures does not vary much between the three substrate environments, (sand, cobble and bedrock). There is a difference in effect depending on the existing level of visible development. In areas with little or no obvious development, the construction of a large pier in the near shore area brings about a dramatic change in the visual character of the area. Areas that seemed remote or sparsely populated and dominated by the natural environment become with the pier(s) developed, populated, and culturally dominated in character. With some pier designs - those with exposed sheet pile, boat lifts, etc. - a nearly industrial look is created. The piers cause a significant loss of visibility of shoreline when viewed from the water, and of the lake and horizon when viewed from shore. These changes are also evident in areas currently displaying obvious development, although the effect is somewhat less pronounced owing to a less dramatic change in visual character of those environments.

Site Simulations of Potential Impacts on Natural Scenic Beauty

METHODS

General

There are many techniques for identifying the visual impacts of proposed developments. For this analysis we used computer imaging technology to produce photo-accurate simulations of representative pier developments This methodology allows all concerned parties to have a common impression of what proposed developments will look like, and the degree to which they will alter the natural scenic beauty existing at each site.

Photographs were taken from the bay looking shoreward of the proposed sites. Sites were photographed from various angles and distances. Several other areas along the bay shoreline of the peninsula were also photographed, including many existing piers of various kinds and sizes. Photographs of the proposed Grewe pier were also taken from the shore on the adjacent property looking waterward (Appendix H).

Photographs were taken on June 23 and 24, 1997 between approximately 10:00 a.m. and 4:00 p.m. A 35 mm single lens reflex camera, 55 mm lens, and 200 ASA color print film were used. All images were printed to 4 X 6 inch glossy prints. In all, 187 photographs were successfully taken and printed.

One site was selected to represent each of the three kinds of substrate environments. There was insufficient time to produce a simulation of each proposed pier. Each selected photograph was relatively close to the shoreline (approximately 200 to 500 feet from shore) and taken looking at the site in such a way that the updrift side of the simulated pier was shown. A photograph of an undeveloped shoreline was also selected as a generic example for cumulative visual effects. Visual scale was approximated by using representative pier images at similar distances from shore as is evident in the site photographs.

The simulations were produced using a Dell 466/ME Intel-based computer, Adobe Photoshop software, a Microtek ScanMaker E3 color flat bed scanner, and an Epson Stylus Color 800 color ink jet printer. Representative site photographs and photographs of representative piers were scanned at 300 dots per inch resolution at their existing 4 X 6 inch scale, and corrected for brightness, contrast, and sharpness. Portions of the representative pier images were combined as appropriate in order to match as accurately as possible the piers proposed for each site, as described in the permit applications. Several images of whole existing piers were used in the cumulative effects example simulation. Prints of the sites and simulations were made on photo-glossy paper at a resolution of 1440 by 720 dots per inch. These prints were reproduced for the EA document using a digital color photocopier.

Each simulation was examined to determine the nature and degree of visible effect each pier had on each site.

<u>Image Specific Methods For Sites</u> (Appendix C)

The **Rose** site was chosen to represent the bedrock/cobble substrate environment sites. The other site in this kind of environment is the Grewe site. The base photo chosen was film role #3, exposure #6, taken on 6/23/97 between 1:09 p.m. and 2:02 p.m. It provides a near view of the Rose site from the south side looking obliquely along the shoreline north. The photograph was taken looking approximately eastward.

The simulated pier and breakwall proposed for this site were composited from portions of piers and breakwalls. in the following photographs: film roll #2, exposure #'s 1, 2 and 16, and film role #3, exposure #25. The simulation was done in an attempt to accurately represent the proposed 100 feet long riprapped and sheet pile pier with 120 feet long "L" extension, concrete deck, and 80 feet long breakwall, as shown in the permit application.

The **Herlache** site was chosen to represent the sand/gravel/cobble substrate environment sites. The other sites in this kind of environment are the Kosmoski and Slavik sites. The base photo chosen for this site was film roll #4, exposure #34, taken on 6/23/97 between 2:02 p.m. and 2:42 p.m. It provides a near view of the Herlache site from the east side looking north.

The simulated pier was based on the pier image in film roll #8, exposure #l. The simulation was done in an attempt to accurately represent the proposed 250 feet long rock pier with 50 feet long "L" extension, as shown in the permit application.

The **Davis** site was chosen to represent sites occurring in the large cobble\bedrock dominated environment sites. Other sites in this kind of environment are the: Carpenter, Gerhardt, Orser, Knab, Peterson, and Shaw sites. The base photograph chosen for the Davis site was film roll #7, exposure #1 , taken on 6/24/97 at 10:44 a.m. It provides a near view of the Davis site from the south side looking approximately northeast.

The simulated pier was based on the pier image in film roll #2, exposure #9, and the pier's steel sheetpile came from film roll #3, exposure 25. The simulation was done in an attempt to accurately represent the proposed 65 feet long riprapped and sheet pile pier with 56 feet long "L" extension, as shown in the permit application.

In order to analyze effects on the from-shore view, a photograph of the proposed Grewe site (bedrock substrate environment) taken from the adjacent property was chosen. The photo chosen was film roll #3, exposure #30, taken on 6/23/97 between 1:09 p.m. and 2:02 p.m. -This photograph was taken from the base of the Standish pier located next to the Grewe site. The photo was taken looking approximately north.

The simulated pier was based on an image of the Standish pier in film roll #3, exposure #34, with riprap added from film roll #2, exposure #'s 2 and 16. The simulation was done in an attempt to accurately represent the proposed 190 feet long riprapped Grewe pier with 100 feet long "L" extension, as shown in the permit application.

The cumulative effect of multiple pier developments along the same reach of shoreline was done using a base photo of an undeveloped shoreline. The photograph selected was film roll #3, exposure #16, taken on 6/23/97 between 1:09 p.m. and 2:02 p.m. This photograph was taken looking easterly along the shoreline located to the north of the Grewe site. The Grewe site is not visible in the photo.

The simulation was done using existing pier images chosen from: film roll #2, exposure #'s 11, 17, and 18. These pier images were used in an unchanged condition, except that two pier images were lengthened slightly in order to provide a diversity, of pier sizes. The pier designs chosen are all fairly simple. No additional breakwalls are shown. The pier images were placed into the base photo image at approximately equal distances from each other. Given the scale of the base photograph, this simulation represents roughly one pier for every three property parcels along the visible shoreline. No associated developments such as houses were simulated in order to focus the analysis on the piers alone.

RESULTS AND DISCUSSION

Simulation Images

Please refer to the print of each photo pair for each named site located in Appendix C .

Rose simulation - In the base photo for the **Rose** site, some development is evident along the shoreline, consisting of some turf lawn areas, houses partially screened by vegetation, a boat house and a row boat on shore. There are no piers existing in this area or depicted in this photograph.

The simulation shows the Rose's proposed pier from the side showing the interior of the protected harbor the pier would create. This proposed pier is large, and dominates the view at this distance. In the simulation, a huge length of relatively undisturbed shoreline is hidden by the pier. The pier also is different in character from the shoreline cliff, and therefore changes the visual character of the area.

Herlache simulation - Considerable shore land development is evident in the base photograph of the Herlache site, including: a house, a large boat house, decks, temporary piers, lawn furniture, riprap and wooden sea walls, and turf lawn areas. A large radio antenna is also clearly visible. The simulation shows the Herlache's proposed pier from the side showing the interior of the protected harbor the pier would create. This is a very long pier. The riprap is similar in character with the riprapped shoreline. The pier is one of several dominant cultural elements in this scene. At the viewing angle shown, the pier seems to make the shoreline much closer than it is, because the view of so much water surface is no longer visible.

Davis simulation - Existing development in the Davis site base photo is very subtle. A couple of earthtone decks and some shoreline riprap are all that is visible at the shoreline. The top of a house at the hill crest is visible but mostly screened. It too is dark brown, and blends fairly well with the dark wooded understory.

In the simulation, the presence of development becomes prominent. Although this pier is relatively small, it changes the character of the view from decidedly rural to nearly industrial. The effect would be slightly less dramatic if the flag pole and steel sheetpile were not present. The simulation again shows this proposed pier from the south side showing the interior of the protected harbor the pier would create.

Grewe simulation - The base photo of the Grewe site provides an example of the from-shore view. From this vantage point no development is visible other than in the foreground (the Standish pier). The simulation shows a dramatically changed view. When viewed from an adjacent property like this, a pier of this size dominates the view and eliminates the sense of. remoteness present in the base photo. The plane of the horizon is also interrupted.

The base photo for the cumulative effects analysis shows no development of any kind. In the simulation, four piers of various sizes and configurations are shown. Here, nearly all of the shoreline's cobble beach becomes hidden behind the structures. The remoteness of the base scene is diminished to a populated developed character.

General Visual Effects

The effects of the development of solid pier structures does not vary much between the three substrate environments. There is a difference in effect depending on the existing level of visible development. However, in areas with little or no obvious development, the construction of a solid pier in the near shore area brings about a dramatic change in the visual character of the area. Areas that seemed remote or sparsely populated and dominated by the natural environment become with the pier(s) developed, populated, and culturally dominated in character. With some pier designs - those with exposed sheet pile, boat lifts, etc. - a nearly industrial look is created. There is a significant loss of visibility of shoreline when viewed from the water, and of the lake and horizon when viewed from shore. These changes are also evident in areas currently displaying obvious development, although the effect is somewhat less pronounced owing to a less dramatic change in visual character of those environments.

The cumulative effect of several piers being constructed in close proximity along a shoreline is of the same nature as from a single pier at one site, but the effect is much more dramatic. The Department has received about 300 solid pier permit requests since 1975. If the obvious degradation of natural scenic beauty can not effectively be used to control the level of pier development, then a continuous degradation of one of Wisconsin's uniquely beautiful shorelines will occur.

ALTERNATIVES

Alternatives to the construction of private solid piers along the shoreline do exist.

♦ Many riparians use temporary flow through piers which are put in and taken out annually. There are times that these temporary piers have to be retrieved after inclement weather and there are times when water craft break away from them. In many areas along the shoreline these piers seem to work satisfactorily. However, watercraft can break away from solid piers also.

♦ Floating piers and wave attenuation systems may be viable alternatives in some locations depending on site specific conditions including expected ice and wave conditions.

♦ Mooring a boat is another alternative. A mooring buoy is required in order to do this. The riparian would then have to access the moored boat with a smaller boat or raft.

♦ Renting a space at a marina is another option. (The Department has been informed that there are waiting lists for berthing spaces at the public marinas in Door County.) More marinas are planned for future construction; the law of supply and demand will be a factor here.

♦ A riparian has the alternative of tailoring and launching and landing his/her boat as the boat is needed for use. This alternative may obviously not be suited for very large watercraft.

♦ Another alternative is to winch the boat up to the shoreline via a track system and hoist which cradles the vessel out of the water.

♦ Michigan's Official Position on Solid Structures.

The state of Michigan, Department of Environmental Quality, in order to protect public lakebottom as well as lakefront, no longer allows solid piers (*Spencer pers. comm.*) Open pile piers are permitted where ice shoves are not a problem. Crib piers with properly spaced flow throughs are permitted only when bedrock prohibits the placement of open pile piers. The state of Michigan does not require permits for temporary or seasonal piers. In Michigan, long shore revetments are used for shore protection (*Spencer pers. comm*). They must be low profile and located far enough from property lines as to protect adjacent properties from impacts.

Department Alternatives

The Department has the following options. We could approve all twelve permit requests, approve some and deny some, or deny all twelve permit requests. The existing level of natural scenic beauty will not be diminished at any site where a pier is denied. In permitting any of the requests we could ask for modifications to mitigate, at least to a small degree, mitigate negative effects. For example, dark colored riprap contrasts less with the natural environment and therefore presents slightly less visual impact. Restrict boat lifts which allow boats to be placed above the pier. Enforce uses of the pier. For example, piers are permitted for the berthing/mooring of a boat and for loading and unloading cargo and passengers (ref). Piers are not to be used as a deck, to hold lawn furniture, jet skies, or other recreational toys.

SUMMARY OF COMMENTS FROM DRAFT ENVIRONMENTAL ASSESSMENT

Comments

Comments received in response to the DRAFT EA include concerns regarding water quality, natural scenic beauty, fish and wildlife habitat, property values, taking of public lakebed for private use, user conflicts, and navigation.

The following comments were received, reviewed and modified in the EA. The person who commented is listed by name. The information following the name are comments the Department considered. Following each comment is a the word "modified" or "unmodified"and the page where the comment has been addressed in the EA.

Dave Wentland, Coastal Planning:
The applicant should be responsible to show need, type of design, reason for choice, expected service life, maintenance and regional cumulative impacts of the solid structure. Applicant should be required to submit the EA addressing the above issues (unmodified).

Dave Sautebin, Door County Planning and Zoning Department:
First full paragraph on page 11 is missing a portion (modified page 18).
"Just vs. Marionette" case decision which states there is no inherent right to alter the natural environment for a purpose for which that environment is naturally unsuited. Blasting of bedrock to achieve greater water depths should not be allowed (modified page 23).
Blasting affects water quality by suspending sediments and cracks casings (modified page 22). Experience shows old cribs withstand ice better than steel sheeting (unmodified).

Study did not show a good example of a structure becoming useless through accretion (unmodified). Beach cobble is not subject to littoral drift but responds to wave and storm surges from the northwest, which deposits cobble on north side of structures instead of south side. Creating accretion on adjacent properties (modified pages 30 & 33).

Structural integrity is an issue (unmodified as already addressed on page 43).

Temporary road building to construct solid piers is contradictory to NR 115. Cutting vegetation along the shoreline for these temporary roads (modified page 36).

A work force could be created to install and take out temporary flow through piers on an annual basis. Dockominiums could alleviate some of the pressures for mooring spaces. DNR does not allow selling of lakebed to a non riparian owner (modified page 42).

Navigation in summer is more detrimental than ice cover during winter months (modified page 43). Zoning regulates natural scenic beauty and fish and wildlife habitat by restrictions in shoreline cutting as well as structures. A pier is for the loading and unloading of passengers and cargo and a berthing place for the watercraft. The decking is not to be used for other leisure activities which accrue lawn furniture and such (modified page 44).

Rudolph Peterson, applicant:

Correct dimensions of Peterson proposal (modified page 13).

Applicant states need for proposal is shore protection not berthing place. Unmodified as the DNR can reconsider for shore protection.

Zoning regulates from land looking waterward, DNR regulates from water looking landward (modified page 44).

Richard Nebel II, Nebel Construction Inc.:

States his proposals do not allow wave refraction (modified pages 23, 24 & 31).

Coast Guard looked at these proposals from a commercial view (modified page 42).

Chaudoirs is being constructed as a safe harbor. Unmodified as Chaudoirs is for public use, not private.

Law states a riparian has the right of "reasonable access" to use the water, not a right of improved access (modified page8).

Depending on the situation and the weather conditions a solid pier can be of assistance but can also be hazard. Temporary piers, marinas and mooring buoys can also provide safe mooring as conditions allow (modified page 43).

Additional berthing for tourists during peak summer months (modified page 42).

Rocks provide fish habitat (modified pages 37 & 38).

Improved access for riparian (modified page 8).

Increased shoreline protection. Unmodified as applications state purpose and need as recreation and mooring of boats.

Property values and taxes (modified pages 41 & 42).

Revenues for local boat yards and marine contractors. Unmodified as DNR is responsible to protect the natural resources of the state page 42.

Piers add to the culture and character of waterfront communities (modified pages 20 & 21).

Brad Seymour, citizen:

Marinas are full (modified page 43).

Disruption of the near shore area by various users and aquatic species (modified pages 19, 20, 23 & 31).

Need a summary of negative and positive impacts. Modified in conclusions based on comments.

Bradford Shaw, applicant:

This proposal will create a safe harbor and safe swimming area (modified page 42).

Richard Purentin, Washington Island Ferry:

Natural scenic beauty is in the eye of the beholder (modified pages 8 & 58).

Engineering designs can be addressed to meet Department concerns (modified page 58).

Property values increase and taxes increase with construction of solid piers (modified page 41).

<u>Kurt Pagel</u>, citizen:

Define “public” vs “private” (modified page 7).

Areas of proposed solid piers and dredged area are calculated in the foot print (modified page 15).

Public interest has changed to include more uses of the near shore area (modified pages 8, 9 & 43).

Incomplete paragraph (modified page 18).

Natural wave, wind and water conditions on solid piers allow erosion and pollution of the waters (modified pages 20 & 36).

Temporary road to access building sites of these structures (modified pages 36, 38 & 39).

Mallards, gulls and mergansers (modified page 40).

Derelict piers become hazards to navigation (modified page 43).

<u>Robert Merline</u>, Gibraltar Preservation Council:

Further studies are necessary. Unmodified, listed in conclusion s to comments.

<u>Gary Antoniewicz</u>, WIB Inc.:

The DNR has to consider natural scenic beauty (modified pages 8 & 58).

DNR is creating policy (modified page 17).

DNR is substituting EA for rule making (unmodified page 17).

<u>William Malkasian</u>, WRA:

Private taking of public lakebed for private use (unmodified page 8).

Applications are being scheduled for individual contested case hearings (modified page 10).

Not enough berthing places and user conflicts (modified page 43).

<u>**Fred Hankwitz**</u>, Water Resources Coalition:

The 12 applications do not meet criteria in NR 150 (modified page 7).

The EA does meet criteria for NR 150 (unmodified page 7).

No proposals in Brown and 1 in Kewaunee counties. This is not relevant to study (modified page 7).

Most of the shoreline has a cobble bottom. This cannot move (modified pages 30 & 33).

No analysis is made of potential beneficial effects of accretion and erosion (unmodified as addressed on pages 23- 33).

The piers allow for the flow of water, thus they are flow through piers (unmodified as these solid piers are not flow through piers by definition, page 7).

Clarify "public interest" (modified page 8).

Protection of shoreline (unmodified as applications show purpose is for recreation and mooring of boats).

Property values and tax base (modified pages 41 & 42).

Fisheries and fishing (modified pages 36-38).

Groin analogy is not valid. There are no tides or currents along this shoreline (modified page 23).

Structures in this study do not have vertical sides and therefore no wave reflection (modified page 24).

Aesthetic impacts can be reduced by the use of rock rip rap and other design features (modified pages 44-47).

These structures improve the fish habitat and therefore the fishing in the vicinity (modified pages 36-38).

The safety benefit of the structure far out weighs any risk to persons reasonably using all types of watercraft (modified page 42).

"Safe Harbor" (unmodified as peer review from U.S. Coast Guard requested and gathered).

Conclusions (modified in summary).

"Truly extraordinary" (modified page 45).

No bibliography in DRAFT EA (modified end of EA).

Applications and plans submitted for permits must include all work to be done as DNR can only permit what is shown on the application (modified Appendix A).

Paul Burton, Village of Ephraim:

Fragmentation of the littoral zone (modified pages 39 & 41).

Alternatives (modified page 52).

Robert Graef, citizen:

Detrimental to the public interest (modified page 8*).

Contractors benefit economically, how does the public benefit? (Modified pages 41 & 42).

George Krall, citizen:

Riparian rights vs. Public rights (modified page 8).

Steven Spencer, Michigan Department of Environmental Quality:

Alternatives to solid piers (modified page 53).

Alternatives to shore protection (modified page 53).

Phil Keillor, University of Wisconsin Sea Grant:

Physical Impacts to the littoral zone (modified pages 23-34).

Alternatives to solid pier proposals (modified page 53 "Safe Harbor"; modified page 43).

Jerry Viste, Door County Environmental Council:

Necessity, not personal wishes should determine if a solid pier is needed (modified page 53).

Terry Zielke, citizen:

Comparing data from Pacific and Atlantic coasts is not relevant to Green Bay shoreline (modified page 25).

Carl Schulz, citizen:

The cumulative impacts of the solid piers will eliminate the littoral community. Solid piers should not be allowed (modified pages 36-38).

Joe Schmelzer, citizen:

These structures affect the natural scenic beauty, water quality and fish habitat. What will be left for future generations? (Modified pages 36-39, 45-47).

Helen's Sweeping Beauties, citizen:

More studies need to be done to address scenic beauty and littoral zone (modified pages 36-39 & 45-47).

CONCLUSIONS

The following conclusions were based on the literature search, data compiled, expertise, and public input:

1. The littoral zone is disturbed by construction of a solid structure. Accretion and erosion take place on adjacent shorelines. Aquatic species which use and depend on the near shore area are disturbed, displaced, or buried. Survivors are forced to move elsewhere, sometimes into deeper water, while some may remain in the vicinity of the structure. Studies of the species which use this near shore area are needed.

2. Engineering designs of these solid piers, which address the Department's concerns for disturbance in this near shore area, can be addressed. Riprap will not alter wave refraction and riprap can reduce but not eliminate wave reflection. Spanning portions of the littoral zone to allow for constant water flow can partially compensate for the blockage of the littoral transport, considering the fluctuating water levels. Structural integrity can be required by using a licensed PE to design the solid structures.

3. Natural scenic beauty will be adverserly impated by the construction of solid structures along Green Bay. Fluctuating water levels will alter the natural scenic beauty as the solid piers can be almost hidden in years of high water but high, dry and visible in years of low water levels.

4. Reasonable access/use needs to be defined. The issue here is taking of public lakebed for private individuals personal use.

5. Solid piers, which are rocked with rip rap, do provide habitat for smallmouth bass. The piers also create areas to fish from. At the same time, near shore trolling is

obstructed by the solid pier. The fishing “magnet”, these structures create may have an impact on the bass population. Further studies need to be completed.

6. There are user conflicts in the near shore area. Skiers, snowmobilers, canoers, kayakers, fishermen, swimmers and waders are forced into deeper water to get around the solid piers.

7. Blasting is used to remove bottom bedrock to increase water depths. Studies need to be done to see if there are impacts to the lakebed flora, fauna and water quality.

8. There is a demand for berthing/mooring of boats.

9. The solid structures provide habitat for water snakes, as well as loafing and resting areas for gulls and shorebirds.

10. These structures would be taxed and would create temporary jobs for contractors.

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