Memo

To: Hollywood Monitoring File

From: Don Deis, PBS&J

Date: February 13, 2003

Re: COMMENTS ON: A Professional Jury Report on the Biological Impacts of Submarine Fiber Optic Cables on Shallow Reefs off Hollywood, Florida. A report by Public Employees for Environmental Responsibility

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The following review provides comments following page and paragraph of the report.

Page 1 - Title page

The term jury used in the title implies that this group of individuals has somehow been selected to review all of the evidence and give a "professional" opinion in a trial or contest. This report is not a full review and is more a small independent study. In addition, limited peer review occurred or the obvious discrepancies that were identified in this response would have been identified. A trial or contest is not occurring; however, the release of this document on the date of the Board of Trustees of the Internal Improvement Trust fund meeting on the rulemaking for fiber optic cables does seem to imply that this document is meant to influence the process. The connotation of a jury report should be removed.

Page 3 – first full paragraph

This paragraph attempts to place the "routing of submarine telecommunication cables" in the same context as beach restoration projects. Cable installation does not involve dredging or filling near the reefs. In addition, all of the studies and reports cited are on the impacts of beach restoration projects and all of them are more than 10 years old. Beach restoration projects have progressed and review has become more stringent so that impacts have been reduced and mitigation and compensation is required.

The same evolution in permitting has occurred in a very short time period with submerged fiber optic cables. When Columbus III and Americas II were laid, laying cable on the bottom, even hard bottom, was and still is exempt from permitting in Florida. The work performed by PBS&J on that project was a post-deployment damage assessment. PBS&J has assisted the industry in developing Standard Operating Procedures (SOPs) for laying the cables over hard bottom areas for subsequent installations. The SOPs have resulted in less damage than occurred in the installation of the earlier cables.

Page 3 - paragraphs 2 and 3 – *Reefs and reef growth*

This section wanders through several reef processes that, in reality, have very little to do with potential impacts of fiber optic cables on hard bottom areas. Geologically, as expressed in the last paragraph in the next section on this page, these reef processes were important on these reefs in these areas. The growth process built the structure on which the hard bottom (or live bottom) assemblage currently exists. Carbon-14 dating has been done on representative reef building corals taken from the hard bottom structure after the *USS Memphis* grounding. The youngest date for *Acropora palmata* (see below) is 6,000 years old meaning that these reefs have not demonstrated active accretion, as described in the PEER report, for at least 6,000 years (Precht *et al*., 2001).

The current community existing offshore southeastern Florida is not a "healthy" or "unhealthy" reef system (see Kojis and Quinn, 1994; Aronson and Precht, 2001). It is a hard bottom community on which hard corals, soft corals, sponges, and other benthic are attached. The average size of a hard coral on this community is about 35 cm (about 14 inches) in diameter and 25 cm (10 inches) in height. The corals at this site are a part of the attached benthic community, not the coral reef community described in paragraph 2. Our assessment (PBS&J, 1999d) and countywide studies by NOVA University and Broward County Department of Planning and Environmental Protection (DPEP) (summarized in Gilliam *et al*., 2002) have shown that coral cover in this hard bottom community is on the order of 2-3%.

Done *et al.* (1996) did not include fiber optic cable installation among the anthropogenic impacts that may change benthic species composition in coral communities. An excellent review of the current understating of impacts on coral reef systems is found in Szmant (2002). She concludes that, while nutrient enrichment may be a the major factor for the decline in a few reefs, it appears to mostly play a secondary role compared to those of sedimentation (mainly from deforestation in developing countries), overfishing, and global warming. Jackson *et al*. (2001) demonstrate the importance of overfishing through time on the collapse of coastal ecosystems including coral reefs. The loss of herbivores (urchins and fish) and the presence of nutrients from inlet discharges and sewage outfalls visibly affect the hard bottom communities at the Hollywood, Florida cable landing site. The result is algal overgrowth that competes for space for growth and recruitment on the hard bottom surface.

Page 3 - Paragraph 4 – *Ft. Lauderdale Relict Reefs*

The multiple reef tracts described in this paragraph are relict reef systems (Lightly, 1977). The second and third reefs, the northern extension of the "tropical" reefs, extend north to the Jupiter area in northern Palm Beach County. The first reef, a nearshore rock outcrop, extends north to the Cape Canaveral area, although it does not have corals growing on it beyond approximately the northern Palm Beach County area (after Jaap and Hallock, 1992).

It is interesting to note that *Acropora cervicornis*, staghorn coral, a reef building species as its congener *A. palmata*, elkhorn coral, is actually expanding northward in growth on the 2nd reef tract (Gillam *et al*., 2002; Vargas-Angel and Thomas, 2002)(see below). We have found new colonies growing throughout that reef tract. The colony depicted below was smaller when the cable was laid. Cable deployment did not affect the colony and the colony is beginning to grow around the cable.

Photograph 1: *Acropora cervicornis* growing around the Maya I cable.

Page 4 – Paragraph 3 – *Threats to South Florida's coral communities*

Several years ago, we changed our name from Post, Buckley, Schuh, and Jernigan, Inc. to *PBS&J*.

As described above, the Columbus III and Americas II cable were laid prior to the development of the mitigation program; however, the mitigation program consisted of three elements.

1. Restoration, promptly after the cable was laid, via divers freeing by hand any soft corals pinned under the cables and moving the cable to the extent possible off any stony corals.
2. Restoration via divers cementing to the bottom any stony corals that may have been dislodged by cable placement.
3. Compensation for impacts that could not be restored or remediated (such as where the cable cannot be moved off of a stony coral and, subsequently, shades or touches a portion of that coral), via placement of artificial reef modules at an artificial reef site permitted subsequent to the *USS Memphis* grounding.

The monitoring program is designed to directly answer the question of survivorship of the restored corals. The program also investigates the survivorship of the corals compared to reference corals on the reefs, between reefs, and between cables. In addition, the program is tracking the colonization of the artificial reef modules by fishes and benthic species.

Page 5 – Paragraph 1 – *Threats to South Florida's coral communities*

In reality, we have always kept in mind that this hard bottom community is composed of more than just hard corals. Data on benthic coverage of hard corals, soft corals, sponges, and algae on the reefs in Dade and Broward Counties are found in Blair and Flynn (1989). These data were used in the calculation of preliminary Habitat Equivalency Analyses (HEAs) for the ARCOS - 1 project in Sunny Isles, Dade County, Florida.

Page 5 – Paragraph 3 – *Field Methods*

It is very difficult to determine what was actually done in this study. *Field Methods* refer to "Sixteen replicates of two fifty meter belt transects" (page 5). The RESULTS contain a description of the locations of fourteen replicates (page 7). The DISCUSSION refers to "For this study, the sample area, or defined impact area, was 0.5 m on either side of 400 linear feet of the fiber optic cables" (page 10). In the DISCUSSION, an "impact area" of 400 m^2 is used (page 10). So the length of cable examined was either 800 m (16 replicates of 50 m), 400 m, 400 ft. To make matters more confusing, calculation of densities, such as 18.2 damaged gorgonians per square meter (page 10), involve dividing the total count of gorgonians on Table 1 (page 8) by 16 m^2 of total area observed, which suggests that all observations were within a single use of a 1-m^2 quadrat on each transect. If, as we suspect, these counts are from 50-meter belt transects that are 1 meter in width, the mean number of damaged gorgonians per meter square would be 0.36 rather than the 18,2 as reported.

Page 6 – Paragraph 6 and Paragraphs 1 through 4 on Page 7 – RESULTS

To clarify the confusion expressed by the PEER report, the cables from north to south are Columbus III (labeled C), Americas II (labeled A), MAC 1 (labeled M1), MAC2 (labeled M2), and Maya I (labeled M3). The cables were stationed for reference from 0+000 starting at the west (shoreward) end of the cable through past the west (waterward) side of the third reef. Station markers were placed at 250-foot intervals along each cable (see Photographs 2 and 3, below for examples). Marker M2 0+250 would indicate that the marker identified in paragraph 6 on page 6, as M2 +250, was 250 feet east of the beginning (shoreward end as the cable intersected the 2nd reef) of the MAC 2 cable. Marker M1 1+000, as identified in paragraph 2 on page 7 as M1 + 1000, was 1000 feet east of the beginning (shoreward end as the cable intersected the 2nd reef) of the MAC 1 cable. Marker A1+250, indicated as A1+25 in paragraph 3 on page 7, was 250 feet east of the beginning (shoreward end as the cable intersected the 2nd reef) of the Americas II cable. Marker C1+250, indicated as such in paragraph 3 on page 7, was 1,250 feet east of the beginning (shoreward end as the cable intersected the 2nd reef) of the Columbus III cable.

Photographs 2: Marker A1+250 on the Americas II cable.

Photographs 3: Marker C0+750 on the Columbus III cable.

Restoration stations (restored hard corals) were numbered along each cable. Restoration of corals occurred in three separate time periods as described in PBS&J 1999b, 1999e, and 1999g. Restoration stations along the Columbus III and Americas II cables occurred at 45 stations along the cables (1-36 along Americas II and 37-45 along Columbus III). Restoration stations along the MAC1, MAC2, and Maya I cables were numbered M1-X, M2-X, or M3-X with X being a number starting with 1. MAC 1 (M1) has five restoration stations along its length over hard bottom; MAC 2 (M2), three stations; and Maya I (M3), eight stations. We have developed a Geographic Information System (GIS) file using ArcInfo of the post-lay cables and stationed the restoration stations along the cable using a computer assisted drawing program (MicroStation). This drawing was the source of some of the original reported coordinates for restoration stations. We have been continually refining the Differential Global Positioning System (DGPS) coordinates in the field as we visit the stations for monitoring.

We have reviewed the post-lay video for the MAC 1, MAC 2, and Maya I cables to understand the confusion indicated in paragraph 4 on page 7 (i.e., “To further confuse the issue, both cable(sic) were labeled with survey markers with the prefix ‘M3.(sic)’”). All of those cables are marked as indicated above with no error.

Page 7 – Paragraph 5 – RESULTS

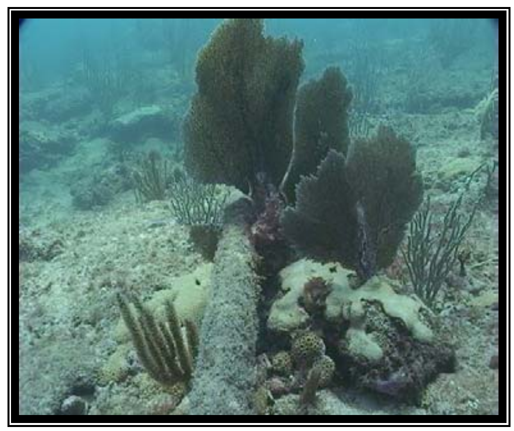
As indicated above, the methods description requires further clarification. This paragraph indicates that 800 m^2 of hard bottom was examined for “damaged epifauna”. It appears from this description that the belt transects were subsampled, possibly by surveying 25, 1-meter square quadrats along each of the 16 belt transects, for a total of 400 m^2 along each transect and a total of 800 square meters for each pair of transects. These numbers coincide with the results table (Table1, page 8, in the PEER report).

A nonparametric comparison of paired quadrats along the belt transects was appropriate for the paired sampling described. However, the Mann-Whitney U test (also referred to as Wilcoxen Rank Sum) is not a paired test – we believe the correct test would have been the Wilcoxen Signed Rank test. Using the Wilcoxen Signed Rank for paired comparisons, there is a significant difference between damaged quadrats and quadrats three meters away, the sampling program as described, for corals and sponges, but not gorgonians ($P<0.05$). If the total number of damaged quadrats in the transect along the cable is compared with the total number of damaged quadrats in the transect three meters from the cable, the Mann Whitney U test would be appropriate.

Page 10 – Paragraph 1 – DISCUSSION

It is not surprising to see some damage to sponges and soft corals even after three years. As mentioned above, we used data on all of the major components of the hard bottom community for calculation of preliminary HEAs for the ARCOS – 1 project. For those HEAs, we used a ten-year recovery period for soft corals and a five-year recovery period for sponges. What is surprising is that PEER did not note the recovery of soft corals and sponges along the cables as noted in photographs 4 through 8.

Photograph 4: Soft coral attaching itself to the cable.



Photograph 5: Sea fans and soft coral growing around the cable.

Photograph 6: Sponge growing on the cable.

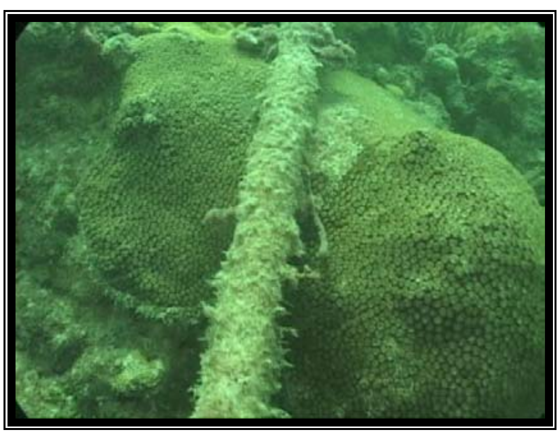
Photograph 7: Barrel sponge, at Year 2 monitoring, split by cable at installation regrown around the cable.

Photograph 8: Barrel sponge that was impacted by cable installation growing over the cable.

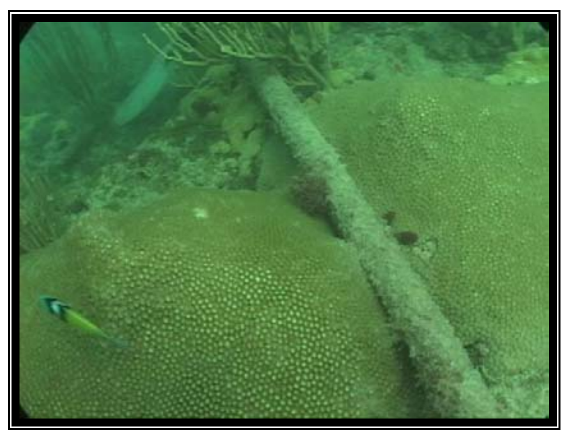
Photograph 9: Anchor on the cable. No cable movement was noted around the anchor.

We have noted very little evidence of movement of the cable after installation. Photograph 10 shows the one area where we have noted active scraping at the Year 2 monitoring. This scraping occurs at the eastern (shoreward) side of the 2nd reef after the cable rises five to six feet vertically up a ledge creating a local suspension in the cable at that point. A few inches of movement has occurred at that point. Photograph 11, however, shows the next affected corals to the west. The cable touches these corals, but the corals show no movement or abrasion.

In order to closely investigate the potential for movement of the cable, we installed stainless steel pins at each 250-foot interval along the Columbus III and Americas II cables and connected the cable to the pin with a cable-tie. Photograph 2 shows the pin and cable-tie at A1+250. We have noted no breakage of the cable-ties along these cables. This is in the presence of large storm events including a 20-year storm event (waves greater than 15 feet) recorded in March 2001.

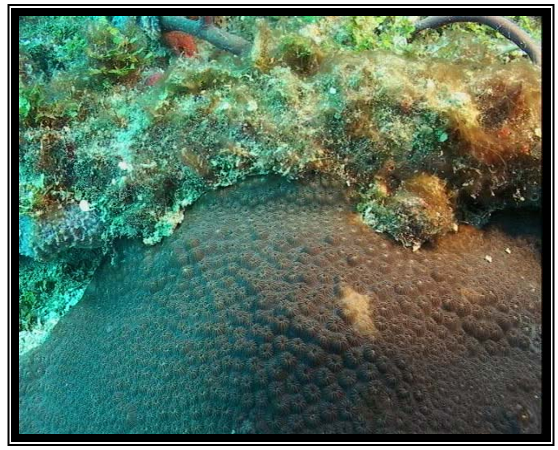


Photograph 10: Evidence of minor cable movement on Americas II cable at the east end of the 2nd reef.



Photograph 11: Two corals immediately west of the coral in Photograph 11 showing no cable movement.

Photograph 12: Staghorn coral growing around the cable.



Photograph 13: *Montastrea annularis* (complex) growing onto the cable.

Photographs 7 and 8 showing barrel sponges healing around the cable and Photographs 12 and 13 showing corals growing around and on the cable are further evidence that the cable has not moved since installation. We have found anchors that must have been snagged on the cable and left as indicated in Photograph 9; however, we have not noted movement of the cable associated with these anchors. We usually find these anchors on the third reef because the discharge of the sewage outfall, located immediately south of the cables at the eastern side of the 3rd reef, is a popular fishing location.

Page 10 – Paragraph 2 through Page 11 – Paragraph 3 – DISCUSSION

PEER attempts to calculate an area affected by the cables (starting on page 10). There are several flaws in this methodology. The areas investigated are presumably a paired (impact and control) series of randomly placed 50 m2 (50 m X 1 m) quadrats. Without a formal randomization process, such as those provided by computer programs or random number tables, the results of the sampling cannot be assumed to be representative of the larger area. Theoretically, without formal randomization the investigators could consciously or subconsciously select the sites to be examined and bias the results. The whole method for estimating the area affected assumes that the results of sampling are representative of the transects. But, the field methods do not indicate that such a randomization process was used or that replicates were allocated along the 50-m transects, so that the results of sampling cannot be assumed to be representative of the transects.

To estimate the affected area, PEER defines affected in terms of a maximum percent of organisms damaged (10 percent, see page 10) and then calculates the amount of unaffected area that would have to be added to the area examined along the cables so that the calculated percent of organisms damaged equals their selected acceptable percent of impact within an affected area. For gorgonians, they calculate that an area 6 times the examined area along the cable would be required to reduce the average density of organisms affected to 10 percent. Since the area examined along the cable extends 0.5 m on either side of the cable, their affected area extends 0.5 m x 6 = 3 m on either side of the cable. But the control area is 3 m from the cable (page 5), so that their conclusion indicates that the affected area and the control area include the same physical area.

The results are even more self-contradictory for sponges and hard corals. For sponges PEER calculates that the affected area is 315 times the area examined along the cable. In other words, the affected area spreads out 0.5 m x 315 = 157.5 m to either side of the cables, even though their own control areas start only 3 m from the cables. For hard coral, their method indicates that the affected area spreads out infinitely, even though all of the damage on which they base the calculations is 16 m^2 that lies within 0.5 m on either side of the cable (page 10).

The problem with the PEER analysis is that including unaffected area just to decrease the average density of organisms affected is a mathematical device that does not provide a true estimate of area affected. Regardless of the percent of organisms affected, if the damage occurs within some distance, say within 10 cm of the cable, manipulating the mathematical calculation of average density does not change the fact that the area actually affected is 10 cm (= 0.1 m) times the distance that the sampling program represents (say 50 m). The problem that should be addressed is to estimate where the damage actually occurs. This would be accomplished by sampling at various distances from the cables and examining organisms injured as a function of distance from the cable. The sampling performed by the PEER was not designed to provide such information and so cannot be used to estimate affected area. Therefore sampling design used by the PEER does not allow the estimation of the affected area, but does show that the maximum area affected must be less than that indicated in any of their analyses. The current design does presume that the impact of the cables is within 0.5 m on each side of the cable.

Page 12 – Paragraph 3 – *Off-site mitigation for irreparable impacts to hard corals*

The PEER report implies that HEA is not applicable to hard bottom; however, several government agencies have accepted and used HEA in past incidences of hard bottom impacts. At least five examples of the use of HEA in hard bottom injuries exist. Julius *et al*. (1995) uses HEA for the damage assessment of the grounding of the M/V *Miss Beholden* at Western Sambo Reef in the Florida Keys. Banks *et al*. (1998) used a Habitat Equivalency Model (HEM) in the impact assessment of the grounding of the nuclear submarine *USS Memphis* off Dania Beach, Florida north of the cable site. PBS&J used HEA as a guide in the assessment and restoration of the grounding site of the containership *Houston* in the Florida Keys. The National Park Service in Biscayne National Park also performed HEAs for the groundings of the *M/V Igloo Moon* and the *Allie B*.

The unique difference between grounding cases on hard bottom and in seagrasses and the installation of fiber optic cables is that cable installation does not destroy the foundation of the community. Grounding cases usually result in the crushing and removal of the hard bottom foundation of the reef or the removal of sediment from the seagrass bed resulting in a protracted natural recovery (Precht *et al.*, 2001).

Page 13 – Paragraphs 2 and 3 - Page 14 – Paragraphs 1 – *Off-site mitigation for irreparable impacts to hard corals*

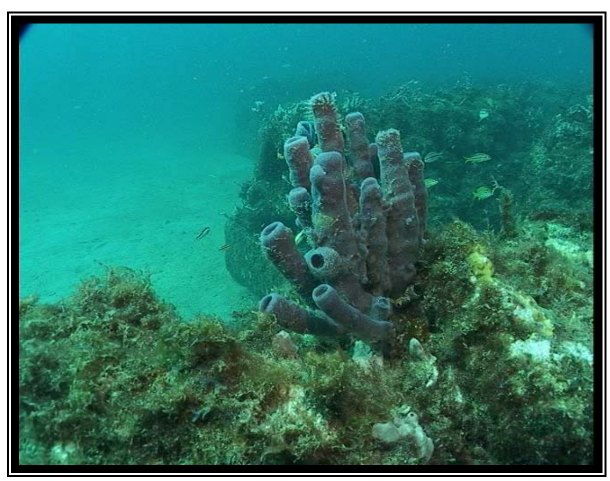
The PEER report claims that the criterion of sufficient data presents difficulty in applying HEA to the second coral reef off Hollywood, and that the problem is defining a metric that captures all of the ecological services lost due to cable impacts. It says that the problem is that the metric is based on a single taxon, when the potentially affected community has many taxa.

Their argument implicitly assumes that the mitigation only mitigates for the taxon used in the metric. Use of percent coverage of the bottom by hard corals was chosen to be representative of the whole community (PBS&J, 1999c). The mitigation method, addition of substrate that could be colonized by hard corals, also provides additional substrate for the other members of the community. Some community members may be better suited and some worse suited to colonize the additional substrate, but that observation does not invalidate the use of a representative group in the metric.

One important fact needs to be factored into this discussion. The HEA only described the necessity for one DERM module as mitigation for each cable. AT&T authorized the design and placement of 30 modules at the mitigation site. This allowed the creation of a unique wave stable design of five sets of six modules. This design is a spur and groove effect of the waterward side of natural reef system. Of course, more modules means more surface area for attachment by organisms.

The reef modules used as compensation for the AT&T project were perceived by Broward County Department of Planning and Environmental Protection (BCDPEP) to be recipient surfaces for corals found naturally dislodged due to bioerosion on the reefs in Broward County. The sixteen modules not used for monitoring over the five years after installation have been used for that purpose. These modules currently hold almost 200 hard corals that have been relocated from the surrounding hard bottom areas.

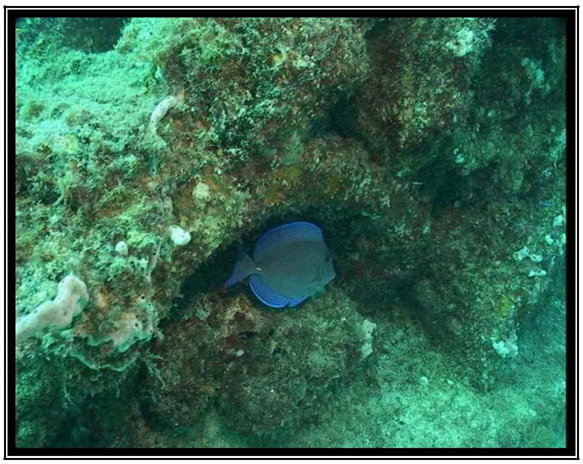
Photograph 14: *Diploria labyrinthiformis* transplanted onto a module.



Photograph 15: Sponge growth on the modules at Year 3.

Photograph 16: *Porites astreoides* recruit on a module.

Photograph 17: *Diploria clivosa* recruit on a module.



Photograph 18: Blue tang on a module.

Photograph 19: Scrawled filefish and other fishes on modules.

In addition, recruitment of attached benthic species has been noted on the modules. Photographs 15, 16, and 17 show some of the sponge and hard corals that have recruited onto the modules in the first three years since deployment. The modules also formed immediate habitat for many fish species of which some are represented in Photographs 18 and 19. The modules are now a regularly monitored site by volunteers with the REEF Environmental Education Foundation. The results of their monitoring can be found at www.reef.org with the data at geographic zone 33010203 (Derm Modules/Coral Nursery).

Page 14 – Paragraph 2 – *Off-site mitigation for irreparable impacts to hard corals*

The PEER report incorrectly states that hard coral coverage at the Hollywood cable landing site is 7.8%. Actually, the percent hard coral coverage reported in the Mitigation Plan from the actual assessment of the hard bottom area crossed by the reef was much lower than 7.8% (see table below). The numbers in the table below compare with the hard corals per square meter and percent coverage presented in Banks, et al. (1998) for the *USS Memphis* grounding site and reported by Gilliam *et al.* (2002) for the reefs off Broward County. The estimate at the *USS Memphis* grounding site on the second reef was 1.9 hard corals per square meter and a hard coral areal coverage of 1.97%. For further comparison, Banks, *et al*. (1998) provided values averaged from two transects on the second reef offshore of Hollywood and Hallandale, Florida. In this area, the number of corals per square meter was higher at 4.9 and the areal coverage was greater at 2.66%. Gilliam *et al.* (2002) reports an average hard coral coverage of 2–3%.

ESTIMATE OF THE NUMBER OF HARD CORALS PER SQUARE METER OF HARD BOTTOM AND THE AREAL COVERAGE (%) OF HARD CORALS WITHIN EACH REEF SEGMENT (PBS&J, 1999c)				
Reef Segment	**Number of Corals per Square Meter**		**Areal Coverage of Hard Corals (%)**	
	Americas II	**Columbus III**	**Americas II**	**Columbus III**
Second Reef - Segment 1	1.9	2.6	2.39	1.77
Second Reef - Segment 2	0.9	1.1	0.60	0.69
Third Reef – Segment 1	1.2	0.9	0.44	0.57
Third Reef – Segment 2	0.7	0.8	0.53	0.52

Page 14 – **(1) Will the sponges, gorgonians, and hard corals grow in the same relative abundance on the artificial reef as on the impacted natural reef?**

Don Deis, the project manager with PBS&J for the AT&T Hollywood restoration, mitigation, and monitoring, had been on the team that worked with Steve Blair, Dade County Department of Environmental Resources Management (DERM), that designed and installed the artificial reefs in compensation for damages done to hard bottom resources in the 1988 Sunny Isles beach restoration project (see Blair and Flynn, 1988). Several designs and surface treatments were tested at Sunny Isles and the team learned from that exercise through the five-year monitoring program that followed (see G. M. Shelby & Associates, Inc., 1995). Some of the designs were conceived to simulate structure in the reef community to quickly attract mobile members (fish and invertebrates) of the reef community. The design selected for the artificial reefs for the Hollywood projects was based on lessons learned from the Sunny Isles project. As Steve Blair commented in the PEER report, what was learned from that study was that we can design and build artificial substrates that will eventually attract any species of attached benthic organism which sufficiently disperses itself. Our problem has become that we do not fully understand how some species disperse.

[Note: We do not understand the reference "As of 1993" (page 14, paragraph 3). As indicated, the monitoring report by G.M. Shelby & Associates, Inc. (1995) contains data from the 1995 monitoring event, the fourth year of the monitoring program. Data from 1993 would be from year two of the monitoring.]

Some of the problems mentioned in the PEER report are merely design and placement problems. We could place flatter artificial substrates in deeper water and either transplant barrel sponges to those surfaces or wait for larval dispersion to the surfaces. The type, angle, and texture (among other factors) affect the species of benthic organisms that settle upon them.

Study continues on some of the more frustrating aspects of larval dispersion of hard bottom associated species (see Aronson and Precht, 2001). Particular examples include the most common hard coral species found on the nearshore reefs off Hollywood, *Montastrea cavernosa* (Photograph 20). This species has been seen producing gametes at locations in southeastern Florida; however, little is known of the ultimate larval dispersal of the species. This coral is among the species that broadcast gametes and fertilization occurs in the water column. At present, coral recruitment is limited, throughout Florida, with broadcast species, in general, showing the least recruitment. Brooding species, species that brood gametes and release planula larvae, e.g., *Agaricia agaricites* and *Porites* spp., have been more successful at recruitment and are among the species that we see recruiting on the artificial reef modules (Aronson and Precht, 2001; Szmant, 1986).

Photograph 20: *Montastrea cavernosa* transplanted onto a DERM module at the AT&T artificial reef site.

As has been mentioned already in this response, soft corals and sponges do grow onto or recolonize both the artificial reefs and the cables (see Photographs 4, 6, and 15). Barrel sponges recover after cable laying impacts (see Photographs 7 and 8). The PEER survey was performed at year three after deployment of the cables and artificial reefs at the AT&T Hollywood site and year one of the ARCOS – 1 site in Sunny Isles. In developing HEAs for these sites, we used 35 years as recovery for all types of hard coral impacts (AT&T and ARCOS – 1 sites), ten years for recovery of soft coral impacts (ARCOS – 1 site), seven years for recovery of sponge impacts (ARCOS – 1 site), and two years for recovery of algae impacts (ARCOS – 1 site). These levels of recovery time must be realized when analyzing impact recovery or artificial reef colonization.

Page 15 – **(2) Will the sponges, gorgonians, and hard corals that colonize the artificial reef modules be of sufficient size to provide the same shelter and other services as those on the natural reef?**

Much of the information addressing this question has been already presented in this memorandum. Again, these artificial reef modules were designed to immediately provide some of the services that are provided by the reef community, in particular shelter. The success of the artificial reef modules in providing shelter is demonstrated by the number and kinds of motile fish and invertebrates attracted to them. These services were provided at seven times the level of mitigation estimated by HEA at the AT&T Hollywood site and 26 times, at the ARCOS-1 site. This expanded level of mitigation allows for much more area for colonization by attached flora and fauna. As indicated above and as we already know, some community members may be better suited and some worse suited to colonize the additional substrate; however, the artificial reef program used at these sites provides a great deal of hard bottom substrate for colonization. Sponges, gorgonians, and hard corals will eventually colonize this hard bottom substrate.

Page 16 – *Sunny Isles cable, Miami-Dade County, Florida*

The characterization that "hundreds of hard corals were damaged" is an exaggeration. Two hundred and twenty-three (223) hard corals, in total, were impacted by cable deployment. One hundred and forty-two (142), 63.7%, were Type 1 corals that were impacted by the cable passing over them, i.e., not touching, but shading the corals. The following is a summary of impact categories identified and measured during the post-installation assessment.

Type 1, cable over coral, where the cable is located over but not touching the coral;
Type 2, cable touching coral, where the cable has been laid over a coral and is touching the coral;
Type 3, cable abrading coral, where the cable is laying on a coral and has abraded the coral;
Type 4, coral abraded but not currently being abraded, where the coral has been abraded during the installation process but the cable is not currently abrading the coral; and
Type 5, dislocated corals, where the coral has been dislocated from the hard bottom.
Type 5 corals were measured for any other type of damage and repaired by reattaching them to the hard bottom surface. The number of corals impacted in each of the other impact categories is listed below.

NUMBER OF CORALS IN EACH IMPACT CATEGORY ALONG EACH CABLE (PBS&J, 2001a)		
Impact Category	**North Cable**	**South Cable**
1	67	75
2	34	23
3	3	6
4	5	10

Subsequent monitoring has shown no mortality of corals in the Type 1 coral category and limited local impacts in the other categories. The corals at this site were small. The average size of coral at the north cable was 8.82 inches in diameter and 4.26 inches in height; on the south cable, 6.7 inches in diameter and 3.25 inches in height. The actual impact area of all of the impact categories was 2.3 square feet on the north cable and 1.76 square feet on the south cable. All impacts were compensated through the HEA.

The permitting agencies preferred a limestone boulder reef for this project and provided the location for placement of the reef. The actual artificial reef occupies a footprint of over 2,000 square feet and is a multiple stack of 3 to 5 foot diameter boulders.

Page 17 – CONCLUSIONS

As has been discussed in this response, thought and action has already occurred towards reducing the severity of impacts that occurred in the deployment of the Americas II cable. We have been able to comment and modify the Standard Operating Procedures (SOPs) used during cable deployment. The result has been slower, gentler deployment techniques used over hard bottom areas (see Photograph 21). These techniques have resulted in less damage to the hard bottom community because of less movement of the cable during the deployment process.

Photograph 21:Deployment of one of the ARCOS-1 cables. The cable was suspended by floats across the hard bottom areas. The float lines were sequentially released allowing the cable to lay gently onto, while preventing the cable from being pulled across, the hard bottom surface.

We have had anchor fouling on the cable, but have not experienced movement of the cables resulting from the fouling. We have seen impacts from recreational boat anchors within the cable study area. Perhaps a more positive approach to this concern is to address the problem of impacts from recreational boat anchors by constructing permanent mooring locations. Broward County DPEP has an active permanent mooring program south of Port Everglades. Construction of permanent moorings within the cable corridor area could be a part of the mitigation package required during the permitting process.

We have discussed anchoring the cables to the hard bottom surface. The process could be done using the same cement used to reattach the corals to the hard bottom surface. Again, we have not seen significant movement in the cable after deployment. The impacts of anchoring would certainly be greater than the impacts that we have seen from movement. The cable naturally toes and disappears into the sediment between the hard bottom areas developing a natural anchoring system across the hard bottom.

The misconceptions of the PEER concerning HEA have been discussed in this response. The hard bottom substrate is an important component of this community. Providing more hard bottom substrate is a valid mitigation technique. For the most part, this is not a static community, as evident from the small average size of the hard corals (see Aronson and Precht 2001; Kojis *et al*., 1994. The HEA recovery projections used were conservative for this community.

We have discussed the current knowledge of artificial reef creation. As stated, we can design and build artificial substrates that will eventually attract any species of attached benthic organism, which sufficiently disperses itself. We can transplant representatives of species that do not disperse well to substrates. The companies doing these cable projects have shown their willingness to provide adequate mitigation for proposed projects. We have taken the approach of mitigating by expanding the ongoing county artificial reef programs. Perhaps a more positive approach for PEER is to input into the permitting process by recommending the types or locations of artificial reefs that may be used for mitigation or recommending target species for recruitment or transplantation.

The *Oculina* reefs located in deeper water off of the east coast of Florida have been the focus of research by NOAA and have resulted in the creation of Marine Protection Areas in the offshore areas south of Cape Canaveral. These areas are outside of State jurisdiction. The use of replacement hard bottom as mitigation for damage to these reefs is being attempted (Reed, 2002).

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