



## Florida Department of Environmental Protection

Marjory Stoneman Douglas Building  
3900 Commonwealth Boulevard  
Tallahassee, Florida 32399-3000

Rick Scott  
Governor

Carlos Lopez-Cantera  
Lt. Governor

Jonathan P. Steverson  
Secretary

December 31, 2016

The Honorable Rick Scott  
Governor of Florida  
The Capitol  
400 South Monroe Street  
Tallahassee, Florida 32399-0001

The Honorable Joe Negron, President  
Florida Senate  
Room 409, The Capitol  
404 South Monroe Street  
Tallahassee, Florida 32399-1100

The Honorable Richard Corcoran, Speaker  
Florida House of Representatives  
Room 420, The Capitol  
402 South Monroe Street  
Tallahassee, Florida 32399-1300

Dear Governor Scott, President Negron and Speaker Corcoran:

I am pleased to submit the Assessment Report for the Osborne Reef tire removal efforts, as required by 2016-17 General Appropriations Act (Line Item 1674B). The report was prepared in consultation with Broward County.

Osborne Reef is the name of a site off the coast of Broward County where an estimated 1 to 2 million waste tires were placed between two coral reefs in the 1970s for fishery enhancement purposes. It was later realized that tires were becoming loose and posing a threat to the reef and the tire removal project was initiated. Tire removal efforts began in 2007 and continued through 2009 using military divers, and were again restarted in 2015 using contracted private divers. To date, over 150,000 tires have been removed.

In response to the pace of the removal efforts and the continued impacts to the reef, the 2016 Legislature provided Line Item 1674B as a Fixed Capital Outlay appropriation. The appropriation is \$1,800,000 for tire removal efforts. Specific language attached to Line Item 1674B of the 2016-2017 General Appropriations Act reads:

“From the funds in Specific Appropriation 1674B, \$1,800,000 in nonrecurring funds from the Solid Waste Management Trust Fund is provided for the removal of tires from Osborne Reef in Broward County, through the deployment of technologies that will minimize the long-term costs to the state of completing this project while ensuring the protection of the reef system. Priority consideration shall be given to "source control" by complementing the ongoing hand removal of tires from the reef with technologies capable of efficiently and significantly reducing the risk of migration of tires into areas already restored. By December 31, 2016, the department, in consultation with Broward County, shall provide an assessment to determine environmental benefits from the tire removal program and recommendations going forward to the Governor, the President of the Senate, and the Speaker of the House of Representatives.” *Underline added.*

In September 2016, the department initiated an Invitation to Negotiate (ITN No. 2017007C) process to identify contractor(s) to address the proviso language requirements while ensuring the protection of the reef system. The department reviewed their Best and Final Offer and decided to award two contracts; one contract will be for divers retrieving tires in the sensitive areas near the reef with coral benthic habitat and the other will be for a pilot project to determine the effectiveness of using a mechanical concept of deploying trawling vessels for retrieving tires from non-sensitive areas. The department plans to have these contracts in place before the end of the 2017 legislative session.

If you have questions regarding this report, please contact me or Joseph Ullo, Director of DEP’s Division of Waste Management, at (850) 245-8690 or [Joseph.Ullo@dep.state.fl.us](mailto:Joseph.Ullo@dep.state.fl.us).

Sincerely,

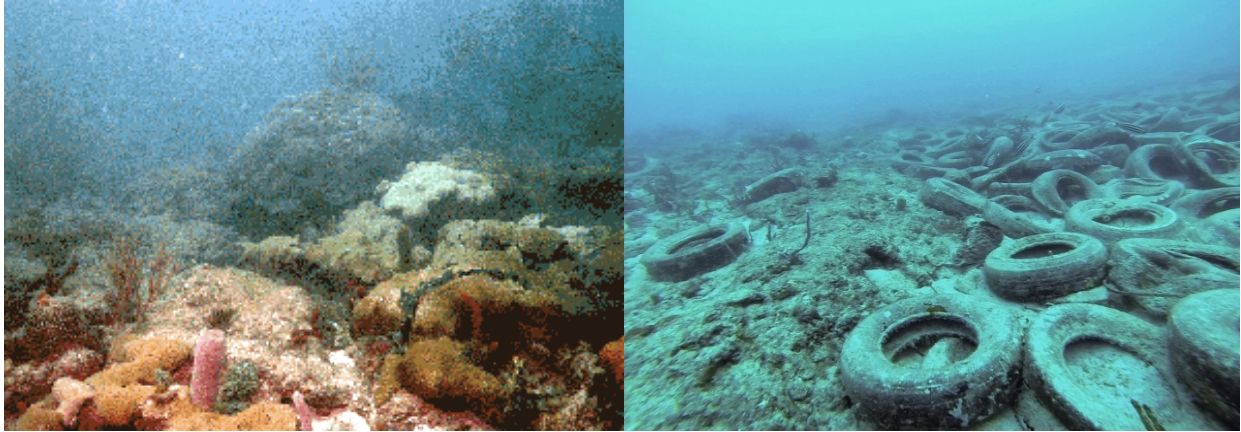


Jonathan P. Steverson  
Secretary

Enclosure

cc: Ryan Matthews, Deputy Secretary for Regulatory Programs, DEP  
Kevin Cleary, Director, Office of Legislative Affairs, DEP  
Joseph Ullo, Director, Division of Waste Management, DEP

# OSBORNE REEF TIRE REMOVAL PROGRAM



This document is prepared by the Department of Environmental Protection (department) in response to proviso language attached to Appropriation Item 1674B of the 2016-17 General Appropriation Act that reads:

1674B GRANTS AND AIDS TO LOCAL GOVERNMENTS AND NONSTATE ENTITIES - FIXED CAPITAL OUTLAY GRANTS AND AIDS - OSBORNE REEF WASTE TIRE REMOVAL - BROWARD COUNTY FROM SOLID WASTE MANAGEMENT TRUST FUND

From the funds in Specific Appropriation 1674B, \$1,800,000 in nonrecurring funds from the Solid Waste Management Trust Fund is provided for the removal of tires from Osborne Reef in Broward County through the deployment of technologies that will minimize the long-term costs to the state of completing this project while ensuring the protection of the reef system. Priority consideration shall be given to "source control" by complementing the ongoing hand removal of tires from the reef with technologies capable of efficiently and significantly reducing the risk of migration of tires into areas already restored. By December 31, 2016, the Florida Department of Environmental Protection, in consultation with Broward County, shall provide an assessment to determine environmental benefits from the tire removal program and recommendations going forward to the Governor, the President of the Senate, and the Speaker of the House of Representatives.

The department acknowledges and appreciates the collaboration of Broward County in the development of this document. The photographs are provided by Broward County Environmental Planning and Community Resilience Division.

## Table of Contents

### Background

- Deployment
- Tire Removal
- Current Project

### Environmental Considerations

- Removal Methods
- Environmental Challenges and Opportunities

### Steps Forward

### References

## **Background**

In the early 1970s, a large number (estimates range between 1 million and 2 million) of waste tires were dumped offshore between the outer two coral reefs in Broward County, Florida, for fishery enhancement purposes. This was done under the auspices of permits issued by the state of Florida and the U.S. Army Corps of Engineers to enhance fish habitat. Reports and studies in the 1960s and early 1970s recommended the use of tires for construction of artificial reefs as the tires were abundant, inexpensive and easy to handle, and there was a great demand for a useful method of tire disposal. Additionally, increasing fishing pressure on commercially important species (e.g., grouper and snapper) was creating a demand for additional habitat where these fish could reproduce and grow.

## **Deployment**

Most of the tires were bundled with plastic strapping to provide some structure to the reef; however, many were deployed singly to the bottom. While records are unavailable for much of the tires deployed, there are reports of tires being placed in groups as large as 50,000 (April 1972) and 190,000 (November 1973) (Stone and Buchanan, 1970). Actual deployment methods ranged from bundles being transported on a barge (Figure 1) and dropped using a clamshell crane to individuals deploying single tires from private vessels (Figure 2). It was reported that many of the strappings broke during the clamshell deployment, and the remaining straps have become loose due to the corrosion of the metal binding clips, resulting in the majority of the tires being loose on the ocean bottom.

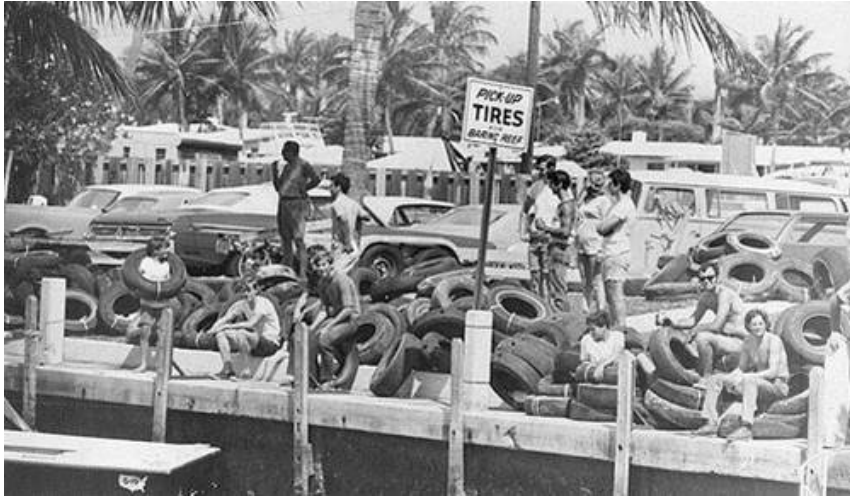
**Figure 1. Most of the tires dumped in the 1970s were placed as bundles.**



**Figure 2. Tires were also deployed singly from private vessels.**



**Figure 3. Tires available for deployment by private participants.**



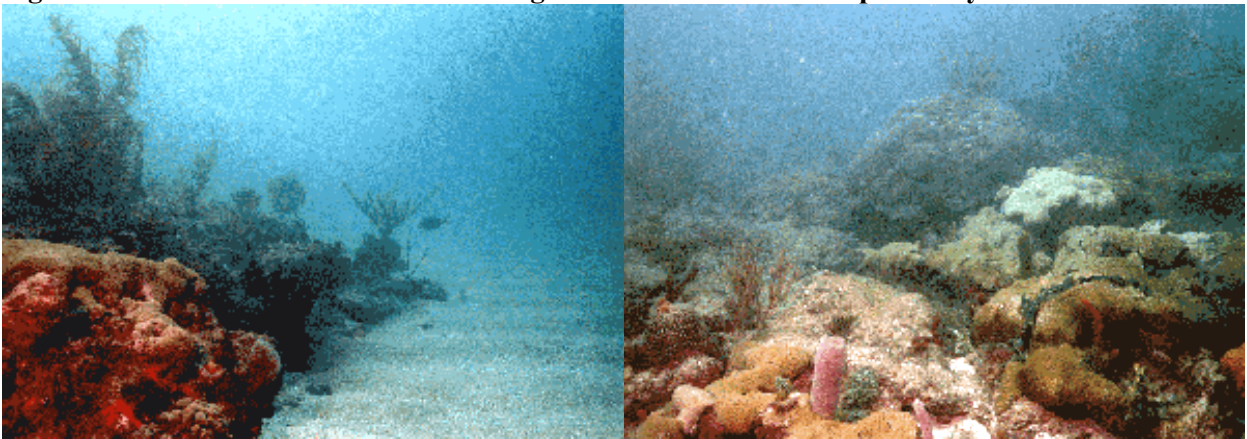
It was later realized that tires were not suitable as an artificial reef in this area, and the project was suspended. Issues associated with the tires included the tendency for single tires to easily be transported away from the intended artificial reef site by surface currents during deployment, and single tires being easily moved outside of the site and onto the surrounding natural reef by high-energy wave action. Scouring action around the tires indicated that the tires would not be a suitable material for sand accretion. Additionally, large commercially important fish species were not found to be inhabiting the tires. In fact, it was found that the total number of fish species and number of fish did not differ from those found on the natural reef (Morley, 2006).

Benthic reef organisms (corals, sponges, etc.) are typically delicate, some with only a thin layer of living tissue surrounding the skeleton, and so are very susceptible to physical damage. Tires that continue to move by wave action onto the reef will have considerable detrimental effects by abrading the living tissue on the benthic organisms, making the organisms more open to disease or predation which could result in total mortality of the organisms over time. Also, tires that settle onto the reef substrate will quickly kill any reef organisms underneath. Tires that are on the reef will typically not stay in that location, but they continue to move by wave action which continues the process of damage and/or mortality to the benthic reef organisms (Figure 4).

**Figure 4. Tires that have been moved from the tire artificial reef site and are now impacting the adjacent natural reef. Benthic organisms (corals, sponges, etc.) can be damaged or killed by tires abrading the living tissue or settling on top of the organism.**



**Figure 5. Conditions of the natural reef edge which have not been impacted by tires.**



The legacy of the decision to place tires there in the 1970s remains with Florida today. High wave and current conditions over the past 40 years have resulted in dispersal of many of these tires onto sensitive reef areas, significantly impacting these resources. Most of the reef organisms



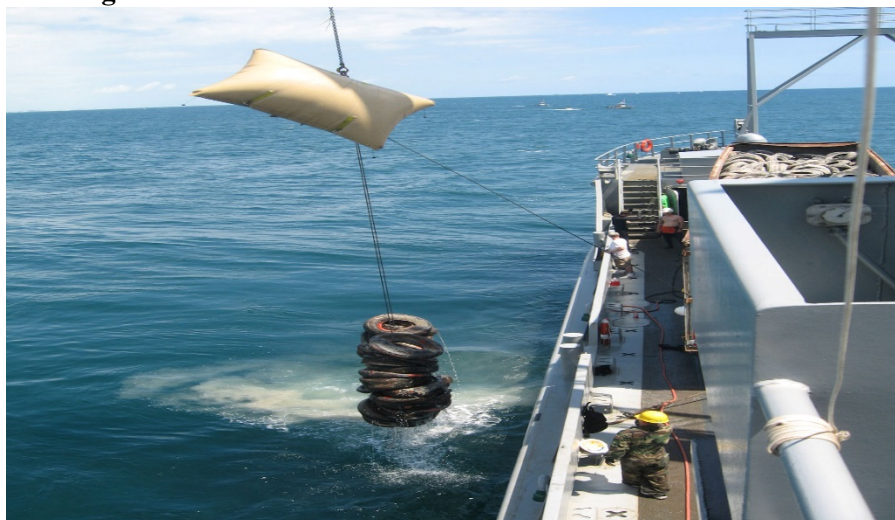
on the middle reef face have been killed, and the original intent of the tire reef as substrate has not been realized because of poor colonization on the tires by reef organisms. It has, thus, become obvious that the loose tires need to be removed.

There are tires embedded in the ocean floor that support benthic activity and production. Avoiding removal of these tires can foster a higher level of protection of the reef system and recognize the benefit of the initial artificial reef construction effort.

### **Tire Removal**

In 2007, 2008 and 2009, DEP, Broward County and NOAA partnered with the U.S. Department of Defense (DoD) through the DoD's Innovative Readiness Training Program to use military assets for the removal of tires as a training opportunity for military personnel (Army, Navy and Coast Guard). During the three missions combined, the military removed over 72,000 tires from an area termed Priority Area 1 (PA1). Dive teams on scuba bundled tires onto wire ropes and used lift bags to send the bundles to the surface, where the bags were taken on board the support ship by crane (Figure 6) before being unloaded into one of two open-top trailers (Figure 7).

**Figure 6. Cable bundle being hoisted aboard the support ship after being brought to the surface by a lift bag.**



**Figure 7. Bundled tires being loaded into an open-top trailer during the military's tire salvage mission.**



Once the trailers were full, the ship would dock in Port Everglades and the trailers would be offloaded and empty trailers reloaded. The tires were then trucked to recycling plants in either Georgia or central Florida.

### **Current project**

In 2015, DEP signed a contract agreement with a South Florida marine salvage contractor using a method similar to the military's, although on a smaller scale. The method typically entails a single diver on the bottom slinging tires into a bundle (Figure 8). The bundle is hoisted onto the surface support vessels using a surface crane or winch. Once the vessel is loaded (approximately 500 tires), the vessel travels to Port Everglades and unloads the tires into an open-top trailer staged on the port property (Figure 9).

**Figure 8. Surface air supplied diver hand bundling tires for transport to the surface by crane.**



From May 7, 2015, through December 9, 2015, 31,965 tires were removed by the current contractor. From January 7, 2016, through November 11, 2016, the contractor has removed 46,208 tires.

**Figure 9. Current commercial tire removal operation using a similar method to that used by the military. Once the support vessel is loaded with approximately 500 tires, the vessel will return to Port Everglades to offload the tires into an open-top container.**



## **Removal methods**

The form of tire removal in the past and currently underway utilizes divers (on scuba or surface air supply) hand picking tires and bundling them on a rope before the bundle is taken to the surface with a lift bag or by crane. This hand-picking method does allow for avoidance techniques and the recognition that some tires are stable and have significant stony coral growth. This method can ensure that any stony corals found on tires can either be removed for transplantation onto the natural reef or simply left in place.

Other advantages of this type of tire removal include ease of permitting, as the method is proven to be minimally impactful to the environment with reduced turbidity in the water and sedimentation onto the natural reef. It is a precise method that allows tires to be removed close to the natural and artificial reefs in the area. The major disadvantages are it is a slow process, limited to good working conditions (winds, wave height and currents), and typically divers in the water are relatively expensive per tire compared to mechanical means. Hand removal is also very labor intensive when tires are even partially buried in the sand. Once the diver moves out of the area where tires are not loose and in multiple layers, productivity could drop to the point where it would not be economically feasible to continue with this removal method.

While no mechanical means (e.g., crane and clamshell bucket or trawling) of removal have been used in this project, it is generally accepted that it could be a more efficient way of removing large numbers of tires. Issues would include obtaining necessary permits and the possible necessity for a barge-mounted crane to anchor over the tire field without damaging natural and artificial habitats. Mechanical methods would still necessitate divers in the water for salvage of stony corals as required by permit. Also, it is not clear how variable weather conditions could affect a mechanical removal operation.

Although a mechanical means of tire removal may prove more efficient than the sole use of divers over most of the field, a significant number of tires are still near the hardbottom edge and the artificial reefs (barges, concrete modules) (Figure 10), which may preclude removal of tires by clamshell or trawl.

**Figure 10. Tires piled up against an artificial reef (steel barge) within the tire field. Close proximity to the barge may prevent the use of mechanical means of tire removal.**



### **Environmental Challenges and Opportunities for the Project**

The tires on the seafloor in Fort Lauderdale, Florida, were placed for the creation of fish habitat and for waste disposal. This well-intentioned project occurred in a time when tire recycling options were limited, and it was expected to have a double net benefit. Although many tires have corals growing on them, too many have become mobile and are destroying living hardbottom habitats. The goal of the project is to remove these tires from the ocean, thus removing the threat to the living hardbottom habitat.

An environmental challenge for the project is to remove the tires while minimizing threats to the habitat. These threats include coral and benthic habitat impacts by suspended sediments and harm to marine species including turtles and fish. Not all resources in and adjacent to the tire field have been destroyed. On a few of the more stable tires, corals have been able to settle and

establish themselves. These living corals are a resource that are required to be protected as the salvage operation continues.

**Figure 11. Tires that have been stable long enough for stony corals to settle and grow. Permit conditions may require that these corals be removed for transplantation onto the nearby natural hardbottom before the tires are salvaged.**



Opportunities to reduce long-term cost to the state include minimization of delays from the regulatory reviews and permitting processes, and avoidance of possible restoration costs for damaged resources. Additionally, concerns of project stakeholders (tourism organizations, recreational diving and fishing interests, marine protection community and local governments) have been taken into account. The benefits of taking less time to remove the tires may be outweighed by these costs.

### **Steps Forward**

The department received a \$1,800,000 appropriation from the 2016 Florida Legislature for the deployment of technologies that will minimize the long-term costs to the state of completing this project while ensuring the protection of the reef system. The appropriation's proviso language also directed priority consideration be given to "source control" by complementing the ongoing hand removal of tires from the reef with technologies capable of efficiently and significantly reducing the risk of migration of tires into areas already restored.

In September 2016, the department initiated an Invitation to Negotiate (ITN No. 2017007C) process to identify contractor(s) to address the proviso language requirements while ensuring the protection of the reef system. Three respondents submitted proposals for consideration. The department reviewed their Best and Final Offer (BAFO) and decided to award two contracts. Both contractors must secure requisite permits and authorizations from local, state, and federal authorities to conduct their work and address the “while ensuring the protection of the reef system” stated in the appropriation’s proviso language.

One contract will be for divers retrieving tires in the sensitive areas near the reef with coral benthic habitat. The other contract will be for a pilot project to determine the effectiveness of using a mechanical concept of deploying trawling vessels and their patented “Gorilla” nets (U.S. Patent No. 08/746,076) for retrieving tires from non-sensitive areas (without coral and benthic habitat). Due to anticipated permitting timelines for the pilot mechanical process and even the possibility of this proposal not being approved by the various permitting agencies, having another vendor onsite retrieving tires during the permitting process will enable the department to continue retrieving tires.

The department plans to have these contracts in place before the end of the 2017 legislative session. The diver contract will be a three-year task assignment contract. The terms of the contract for a pilot project in the non-sensitive area will be determined by the scope of work negotiated with the department. The Secretary looks forward to discussing this project with the Governor and the Legislature.

## **References**

- Morley, M.M. 2009. Environmental Enhancement Gone Awry: Characterization of an Artificial Reef Constructed From Waste Vehicle Tires, M.S. Thesis, Nova Southeastern University Oceanographic Center, 97 pgs.
- Stone, R.B. and C.C. Buchanan. 1970. Old tires make new fishing reefs. In: Underwater Naturalist. *Bulletin of the American Littoral Society*. 6: 24-28.