

Osborne Reef Waste Tire Site Abatement Pilot Project
Project Evaluation
August 22, 2007

Contract number SW224, between Florida Department of Environmental Protection and Broward County requires the submittal of a Project Evaluation Report prior to payment for tasks completed under the project, specifically:

VII. Project Evaluation

The Contractor, in cooperation with project partners, will evaluate diver productivity; tire recovery, and transport techniques; tire recovery, transport and processing costs; level of reef protection and restoration achieved; and will prepare a report on project evaluation findings.

1. Dive Chronology

June 1 2007: Mobile Diving and Salvage Unit (MDSU) Two arrive Ft Lauderdale with 15-man team, three Light Service Support Vehicles (LSSV), one 15-ton truck, two rigid hull inflatable boats (RHIB), one 27' Boston Whaler, one trailer

June 2 2007: weather day

June 3 2007: hyperbaric chamber training for divers

June 4 2007: dive day: 15 MDSU TWO DET SIX, 15 US Army, 6 USCG, 5 US Navy reserve; CWO2 Motley, Officer-in-charge (OIC)

18 dives

Bottom time: 784 min

Total bottom time: 784 min

Water temperature: 78°F

Maximum depth: 78'

Tires removed: 359

Total tires removed: 359

Tires removed per dive: 19.9

Ave. tires removed/dive: 19.9

June 5 2007: dive day

16 dives

Bottom time: 958 min

Total bottom time: 1742 min

Tires removed: 716

Total tires removed: 1075

Tires removed per dive: 44.8

Ave. tires removed/dive: 31.6

June 6 2007: dive day

10 dives

Bottom time: 310 min

Total bottom time: 2052 min

Tires removed: 228

Total tires removed: 1303

Tires removed per dive: 33.4

Ave. tires removed/dive: 45.6

June 7 2007: dive day
10 dives
Bottom time: 288 min
Total bottom time: 3328 min
Tires removed: 188
Tires removed per dive: 37.6
Total tires removed: 1491
Ave. tires removed/dive: 33.9

June 8 2007: dive day
36 dives
Bottom time: 968 min
Total bottom time: 3328 min
Tires removed: 989
Tires removed per dive: 54.9
Total tires removed: 2480
Ave. tires removed/dive: 40

June 9 2007: dive day
10 dives
Bottom time: 231 min
Total bottom time: 3559 min
Tires removed: 226
Tires removed per dive: 37.7
Total tires removed: 2706
Ave. tires removed/dive: 39.8

June 10 2007: no operation

June 11 2007: dive day
8 dives
Bottom time: 190 min
Total bottom time: 3749 min
Tires removed: 161
Tires removed per dive: 40.3
Total tires removed: 2867
Ave. tires removed/dive: 39.8

June 12 2007: dive day
27 dives
Bottom time: 883 min
Total bottom time: 4632 min
Tires removed: 1291
Tires removed per dive: 92.2
Total tires removed: 4158
Ave. tires removed/dive: 48.3

June 13 2007: dive day
35 dives
Bottom time: 1023 min
Total bottom time: 5655 min
Tires removed: 1311
Tires removed per dive: 72.8
Total tires removed: 5533
Ave. tires removed/dive: 53.2

June 14 2007: dive day
14 dives
Bottom time: 466 min

Total bottom time: 6121 min
Tires removed: 477
Tires removed per dive: 53.0

Total tires removed: 6010
Ave. tires removed/dive: 53.2

June 15 2007: dive day

26 dives
Bottom time: 846 min
Total bottom time: 6967 min
Tires removed: 1330
Tires removed per dive: 102.3

Total tires removed: 7340
Ave. tires removed/dive: 58.2

June 16 2007: maintenance day

0 dives
Bottom time: 0 min
Total bottom time: 6967 min
Tires removed: 0
Tires removed per dive: -

Total tires removed: 7340
Ave. tires removed/dive: 58.2

June 17 2007: off day

0 dives
Bottom time: 0 min
Total bottom time: 6967 min
Tires removed: 214
Tires removed per dive: -

Total tires removed: 7340
Ave. tires removed/dive: 58.2

June 18 2007: dive day

32 dives
Bottom time: 1058 min
Total bottom time: 8025 min
Tires removed: 1802
Tires removed per dive: 112.6

Total tires removed: 9142
Ave. tires removed/dive: 64.3

June 19 2007: dive day

27 dives
Bottom time: 861 min
Total bottom time: 8886 min
Tires removed: 1017
Tires removed per dive: 72.6

Total tires removed: 10,159
Ave. tires removed/dive: 65.1

June 20 2007: dive day

10 dives
Bottom time: 332 min
Total bottom time: 9218 min
Tires removed: 214
Tires removed per dive: 42.8

Total tires removed: 10,373
Ave. tires removed/dive: 64.4

2. Observations/recommendations

- a. IRT packages should be submitted earlier to allow all commands involved time to review package and release funds; it has not been determined if

another IRT package is needed for next year, but a letter outlining projects needs will be submitted

- b. Cell phone is preferred method of communications with single channel of communication, i.e., communications with military should be through a single person.
- c. Port Everglades harbormaster interaction was satisfactory.
- d. LCU should be anchored as closely to dive site as possible, without risk of damage to reef, to reduce travel time of tow boats to LCU.
- e. Worst case allowable weather conditions for crane operation is 25kts, no lightning.
- f. All RHIB boats on site should have canopies for sun protection.
- g. 6 dive days per week not conducive to diver welfare (health and attitude); 5 days per week (Monday-Friday) is recommended.
- h. Each lift bag on site should have a fill bottle snapped into the bag so divers do not need to disconnect on the bottom and may easily disconnect on the surface before lifting with the crane.
- i. Recommended lift bag is Subsal, EFP4000; need extra quick-disconnect fittings, repair kits, dump valves, slings; 15 of each recommended.
- j. Clyde winch method found to be unsafe for LCU and crane.
- k. Weather can deteriorate quickly so it is necessary to be prepared to weigh anchors quickly for safety of small vessels.
- l. 730lb SWL and 3000lb SWL snap hooks not strong enough for towing lift bags with tires; hooks should be rated at 5000-6000 lbs or greater.
- m. Tire bundle cables should have swedge fittings for eye (6-8" eye) so tires don't jamb on wire rope clips; cables should be 3/8" wire rope, 50' long.
- n. Tire bundle tow lines should be 1/2" Sampson braid nylon, 100' long (no loop)
- o. Buoys marking the west edge of the outer reef were very helpful for the skipper of the LCU and minimized reef damage risk. Broward County will set and maintain reef edge buoys during subsequent years of the tire removal project.
- p. Transit time for LCU to Port Everglades averaged 1 hour each way which included time to set or retrieve anchors.
- q. Trailers on LCU ideally 45' long with max of 48'; >50' took too long to maneuver onto LCU and may not fit depending on crane size.
- r. The County was required to provide a crane for the pilot project since the LCU was coming from DEEP BLUE and no crane was mounted. The 60-ton crane that was used was sufficient. We could probably use a 40-ton crane if it is not needed to unload LCU; need 80' long boom, regardless of crane size used. The crane footprint coupled with the trailers caused interference items on the LCU deck so this should be a consideration in the future. It is also recommended that a wheeled crane or fix-mounted crane be used instead of a tracked crane. The cost of a crane, if supplied by the County, will significantly cut in to the budget for tire disposal, thus reducing the number of tires that can be removed. It is recommended that Army supply crane for LCU.

- s. Miami-Dade fire/rescue divers requested to participate in salvage project next year, but military divers stated that non-military divers are not allowed to participate.
- t. 'Lacing' of tires during loading to trailers is not recommended by military divers because it reduces tire retrieval rate; lacing may result in occasional overloading of trailer (FDOT limit is 48,000 lb/trailer and one trailer weighed 46,000 lb without tires being laced)
- u. Dive team leaders, to provide more rapid filling of tanks, have recommended a large capacity air compressor on the LCU for SCUBA tank airfills in the future. Space limitations on the LCU should be considered if this is implemented.
- v. In order to remove sufficient tires from priority area 1 and revised priority area 2, an increase in military salvage resources will be needed for a 120-day project period in each of three succeeding years, beginning in 2008. These additional resources would be additional divers and 2 LCUs each year for tire transport to shore.

3. **Equipment list for 2008**

Provided by military:

- a. 5 RHIBs (3 for diving, 2 for towing)
- b. 15 4000-lb pillow lift bags
- c. 15 fill regulators with hoses
- d. 15 single fill bottles with line snapped on
- e. 15 SCUBA tank doubles
- f. 20 regulators with octopus
- g. 5 SCUBA, 100 cu ft, singles for standby divers
- h. 5 compressors (3 on LCU, 2 back-up) or 1 ASRA with 026 diesel compressor and spider whip and 2 small compressors as back-up
- i. One water tank required for cooling SCUBA tanks during fill for each compressor used.
- j. 3 spare O₂ tanks in addition to those in O₂ medical kits
- k. 12 handheld VHF radios (5 for RHIBs, 2 for Z-boats, 2 for command and control (CC), 3 back-up)
- l. 2 Z-boats to supply dive boats
- m. 10 hard hats for deck hands and tire handlers in trailers
- n. Gloves and coveralls
- o. Crane of 60-ton capacity with an 80' long boom. A 40-ton crane can be used if it is not needed to unload LCU equipment. The crane footprint shall not cause interference with safety items on the LCU deck. It is recommended that a wheeled crane or fix-mounted crane be used instead of a tracked crane.

Provided by County/DEP:

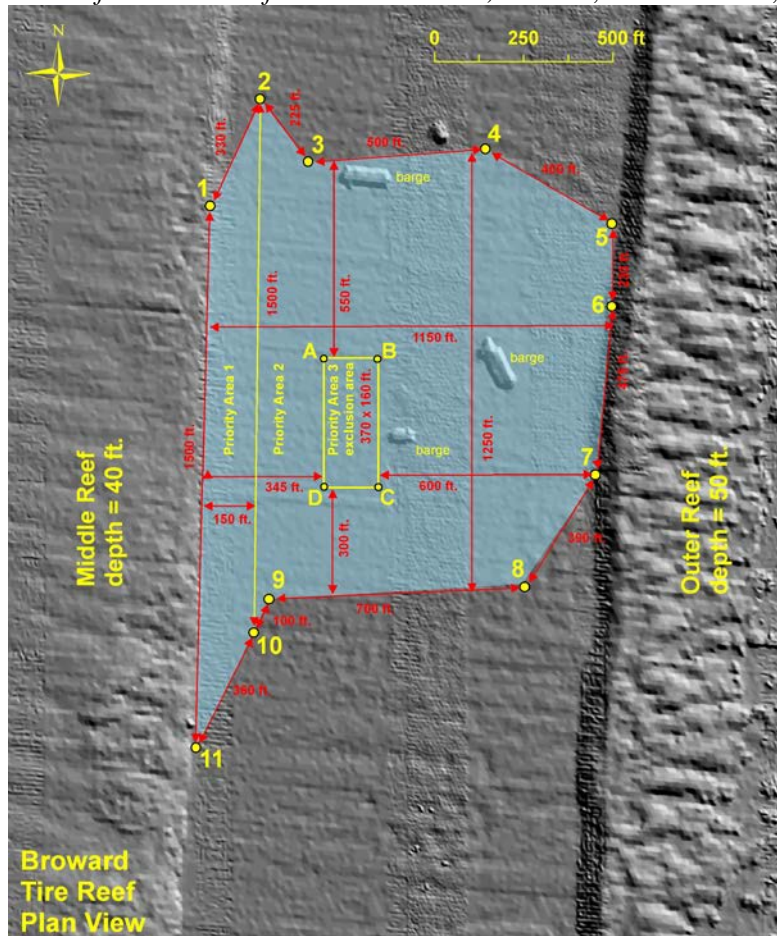
- a. 4 tow lines with snap hooks. Lines shall be ½" Sampson braid nylon, 100 ft long with no loops. Snap hook capacity shall not be less than 5000 - 6000 lbs.
- b. 1 line with snap hook to recover fill bottle from lift bag when alongside LCU

- c. 3/8" wire rope for 15, 50-ft long wire slings. Wire rope shall have swedge fittings for 6-8" eyes at each end.
- d. 100 wire rope clips
- e. 10 buoys with line and clump weights (3 for dive boats, 2 to mark reef, spare for marking lift bags if they have to be sunk)
- f. 20 shackles with 3/4" screw pins
- g. 5 snap hooks (5000-lb SWL or higher) for tow line
- h. 20 snap hooks (750-lb SWL) for fill bottles and fill bottle recovery line

4. Tire Quantity and Removal Time Estimates

The priority tire removal areas (1 and 2) shown in Figure 1 were proposed in the project description, *A Plan for the Recovery of the Artificial Tire Reef in Ft. Lauderdale, Florida*, December 28, 2006. It was estimated that approximately 676,000 PTE (passenger tire equivalent) are present in these priority areas (Table 1).

Figure 1. Locations of priority areas 1, 2, and 3 for tire removal from, *A Plan for the Recovery of the Artificial Tire Reef in Ft. Lauderdale, Florida*, December 28, 2006



Based on the conservative assumption that military divers can remove 1000 PTE/day (40 divers; 1 LCU), monthly tire removal production is estimated to be 20,000 PTE (1000 PTE/day x 5 days/wk x 4 wks/mo). An annual 3-mo project would produce 60,000 PTE, and a 4-mo project would produce 80,000 PTE.

Figure 2 illustrates a revised priority area scheme which combines priority area 1 and subdivides area 2 (a – e). The rationale for this revision is to remove tires from the east face of the affected portion of the middle reef and adjacent areas of sand from which tires are likely to be transported to the middle reef face during storm events. Priority area 1 shall be cleared in a south to north direction first, followed by 2a (south to north), 2b, etc. Priority area 3 is relatively stable and shall only be cleared after areas 1 and 2. The total area of priority area 1 and the revised priority area 2 is approximately 30 acres. Estimated combined tire quantity is 651,565 PTE as presented in Table 1.

Table 1. Summary of estimated tire quantities to be removed in priority areas. Area of priority area 1 differs from that presented in Project Description Report because of method of calculation. Project Description Report value is based on rectangular approximation of area and Table 1 was calculated using the area-of-polygon command in AutoCadd, providing a more accurate estimation.

| Priority Areas | Area (yd ²) | Thickness (yards) | Volume (yd ³) | Density (PTE/yd ³) | Tire Quantity (PTE=-passenger tire equivalent) | |
|----------------|-------------------------|-------------------|---------------------------|--------------------------------|--|-------------|
| | | | | | PTE | Tons |
| 1 | 26,494 | 1.00 | 26,287 | 14.0 | 368,018 | 3680 |
| 2 a | 27,854 | 0.17 | 4653 | 15.0 | 69,797 | 698 |
| 2b | 15,213 | 0.17 | 2586 | 15.0 | 38,790 | 388 |
| 2c | 27,363 | 0.17 | 4652 | 15.0 | 69,780 | 698 |
| 2d | 26,973 | 0.17 | 4585 | 15.0 | 68,775 | 688 |
| 2e | 23,271 | 0.17 | 3956 | 15.0 | 59,340 | 593 |
| TOTAL | | | | | 651,565 | 6745 |

This number still exceeds the capabilities of tire removal in a 3-year project as outlined above. It is therefore necessary that, in order to remove the tires from priority area 1 and revised priority area 2, an increase in military salvage resources be made available with a 120-day project in each of the 3 years. These additional resources would be additional divers and 2 LCUs for tire transport to shore.

Figure 2. Map of priority area 1 and revised priority area 2. Inset map shows area cleared by military divers during pilot project, 2007 and is based on observation by Broward County EPD divers on 25 July 2007.

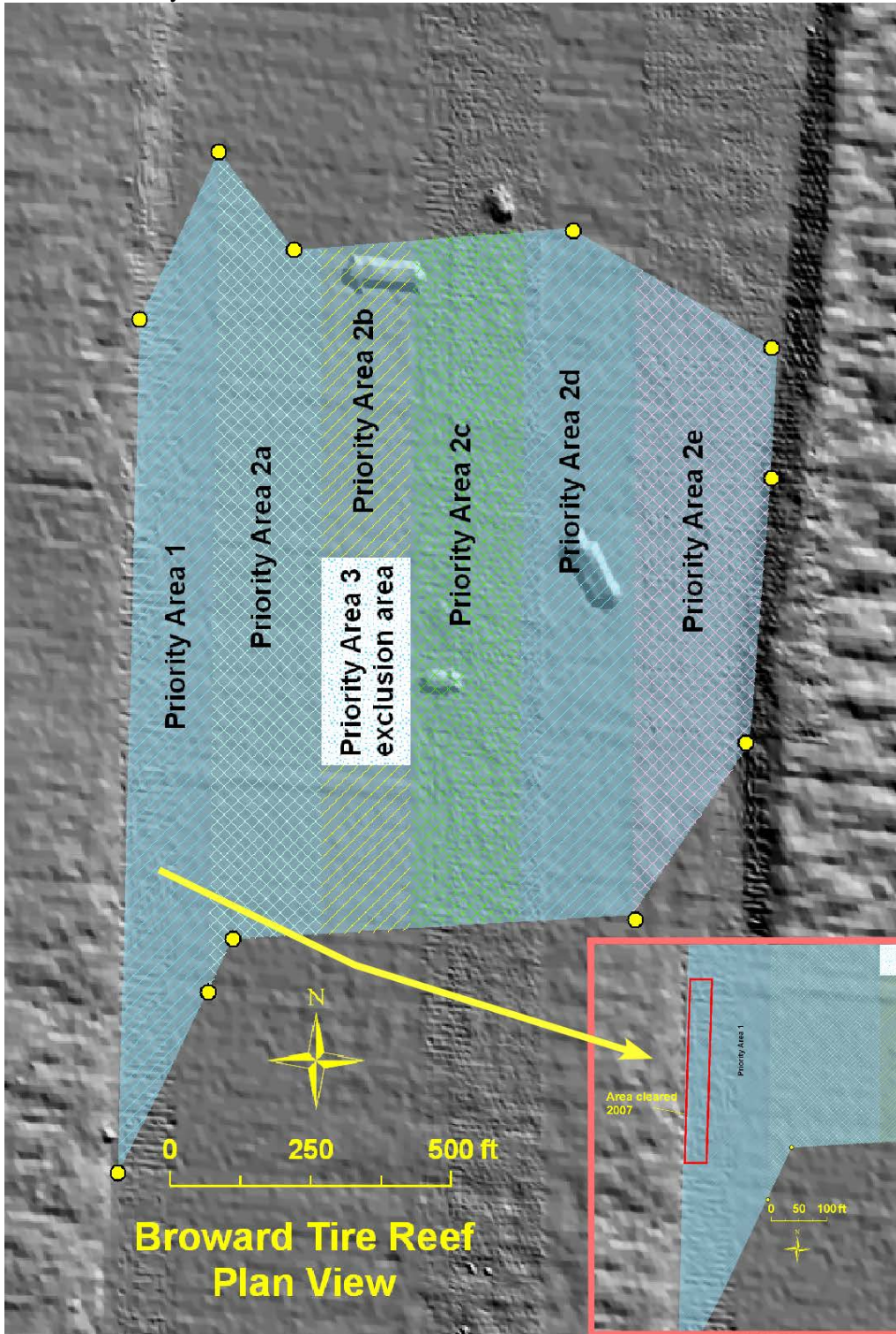


Table 2. Vertices of tire removal priority areas shown in Fig. 2. XY values are Florida State Plane Coordinate System, East Zone, NAD83, US feet. Latitude/longitude are WGS84

| Priority Site | X | Y | Latitude | Longitude | |
|---------------|--------|--------|--------------|--------------|--------------|
| 1 | 957021 | 656749 | N26 08.2537' | W80 04.9783' | |
| | 957060 | 658272 | N26 08.5050' | W80 04.9692' | |
| | 957201 | 658572 | N26 08.5543' | W80 04.9430' | |
| | 957183 | 657071 | N26 08.3067' | W80 04.9482' | |
| 2a | 957183 | 657071 | N26 08.3067' | W80 04.9482' | |
| | 957201 | 658572 | N26 08.5543' | W80 04.9430' | |
| | 957335 | 658396 | N26 08.5251' | W80 04.9188' | |
| | 957385 | 658396 | N26 08.5251' | W80 04.9097' | |
| | 957385 | 657174 | N26 08.3233' | W80 04.9113' | |
| | 957226 | 657166 | N26 08.3222' | W80 04.9403' | |
| | 2b | 957385 | 657846 | N26 08.4343' | W80 04.9104' |
| 957385 | | 658396 | N26 08.5251' | W80 04.9097' | |
| 957545 | | 658411 | N26 08.5273' | W80 04.8804' | |
| 957545 | | 657846 | N26 08.4341' | W80 04.8811' | |
| 957385 | | 657476 | N26 08.3732' | W80 04.9109' | |
| 957545 | | 657476 | N26 08.3730' | W80 04.8816' | |
| 957545 | | 657182 | N26 08.3244' | W80 04.8820' | |
| 957385 | | 657174 | N26 08.3233' | W80 04.9113' | |
| 2c | | 957545 | 657182 | N26 08.3244' | W80 04.8820' |
| | | 957545 | 658411 | N26 08.5273' | W80 04.8804' |
| | 957745 | 658425 | N26 08.5294' | W80 04.8438' | |
| | 957745 | 657191 | N26 08.3258' | W80 04.8454' | |
| 2d | 957745 | 657191 | N26 08.3258' | W80 04.8454' | |
| | 957745 | 658425 | N26 08.5294' | W80 04.8438' | |
| | 957833 | 658431 | N26 08.5303' | W80 04.8277' | |
| | 957945 | 658365 | N26 08.5193' | W80 04.8073' | |
| | 957945 | 657204 | N26 08.3276' | W80 04.8088' | |
| 2e | 957945 | 657191 | N26 08.3256' | W80 04.8088' | |
| | 957945 | 658365 | N26 08.5193' | W80 04.8073' | |
| | 958187 | 658222 | N26 08.4954' | W80 04.7632' | |
| | 958187 | 657989 | N26 08.4570' | W80 04.7635' | |
| | 958141 | 657516 | N26 08.3790' | W80 04.7725' | |
| 3 | 957385 | 657476 | N26 58.0545' | W80 59.7588' | |
| | 957385 | 657846 | N26 58.0545' | W80 59.6906' | |
| | 957545 | 657846 | N26 58.0809' | W80 59.6906' | |
| | 957545 | 657476 | N26 58.0809' | W80 59.7588' | |

5. Major Recommendations

- a. US Army should provide crane for use on LCU
- b. Broward County should continue to provide dockage for the LCU, at no cost to project
- c. Additional dive teams and 2 LCUs should be provided in 2008, 2009 and 2010
- d. Salvage operations should be conducted over a 120-day period each year