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**ANALYSIS OF
ADDITIONAL STABILIZATION ALTERNATIVES
FOR THE
FLORIDA TIRE RECYCLING, INC WASTE TIRE SITE**

Prepared for
The Florida Department of Environmental Protection

by
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DEPARTMENT OF ENVIRONMENTAL REGULATION**

OBJECTIVE

The Florida Tire Recycling, Inc. Waste Tire Site has been estimated to contain approximately 5,734,000 passenger tire equivalents (PTE) as of March 11, 1993. The site represents a serious public health risk. The Florida Department of Environmental Protection (DEP) requested analysis of additional questions related to stabilization of the site. The following sections summarize the methodology and results of this analysis.

CURRENT ON-SITE QUANTITIES

The Florida Tire Recycling, Inc (Florida Tire) Site is an active operation, so site conditions are subject to continuous change. Since Florida Tire has denied site access to DEP, previous on-site quantity estimates can't be accurately updated to reflect interim site changes. However, the site was overflowed on September 19, 1993 to view current site conditions. Appendix A contains a site schematic reflecting the following major site alterations since the March 11, 1993 visit:

- (1) Piles T-2 and T-4 containing whole passenger tires have been removed.
- (2) Two narrow (approximately 8 feet wide) fire lanes were being cut through the main shred pile. The shorter east-west fire lane was apparently being widened by an additional estimated 8 feet.
- (3) Significant quantities of shreds have been added to the top of existing shred pile segments. Additional ramps have been created since March 11, 1993 to facilitate shred movement to the top of these piles.
- (4) Significant quantities of shreds have also been used to raise the level of internal and perimeter roadways.
- (5) Additional whole off-road and truck tires have been stored in the area south of the central access roadway and trailers.

Although quantity estimates can't be accurately updated without on-site height measurements, analysis of aerial photographs and observations indicate that the on-site quantity has not been significantly reduced since March 11, 1993. The current quantity may actually be greater than previously estimated. A revised comprehensive estimate must be completed before DEP establishes a detailed budget for site stabilization.

ON-SITE STORAGE CAPACITY

Shredded tires can be moved into piles conforming to DEP waste tire storage rules. However, DEP does not generally reconfigure shred piles within a site for the following reasons:

- (1) Efficient shred movement at large sites like Florida Tire requires loading into trucks. Once loaded, shred removal to an ultimate disposal location can be accomplished as rapidly as on-site shred relocation if adequate transport equipment is used.
- (2) Shreds can be reprocessed and removed as rapidly as they can be relocated on-site if adequate shredding capacity is used.
- (3) Double-handling of shreds caused by on-site relocation ultimately doubles shred loading costs and increases processing costs due to additional soil contamination resulting from each loading sequence.
- (4) If adequate equipment is used, shred reprocessing/removal can be accomplished as rapidly as pile reconfiguration. On-site shred relocation simply allows the site operator to defer, and avoid if possible, costs associated with proper ultimate shred disposal.

Within this perspective, DEP requested evaluation of an on-site shred storage alternative in anticipation of such a proposal from Florida Tire. Therefore, Appendix B contains a schematic shred pile reconfiguration for the Florida Tire Site based on dimensions from the professional aerial photograph taken in early September, 1993 and an approximated Florida Power and Light right-of-way boundary.

The schematic depicts 24 piles with ground level dimensions of 200 feet by 50 feet, the maximum size allowed by DEP rules. Two additional piles approximately one-half this size are also shown, so an effective total of 25 full-size piles can potentially be reconfigured on-site. The piles closely bordering the central access roadway could obstruct movement of fire fighting equipment if they become involved in a fire. Piles close to the railroad spur bearing rail cars containing chlorine gas and other hazardous materials increase the probability of chemical release from these cars during a fire. It would be logical to consider a central access roadway as a perimeter boundary subject to a 50-foot clearance and to increase separation from chemical storage areas to at least 100 feet. However, these shred pile locations appear to be permissible under existing DEP rules and have been included to maximize on-site storage capacity. This scenario requires

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processing and removal of all whole tires to create space for the shred piles. The northeast portion of the site has been left vacant to serve as a required processing area.

Assuming a pile height of 15 feet (maximum allowed under DEP regulations) and an angle of repose of 60 degrees, each pile will contain approximately 4,350 cubic yards. Coarse shreds similar to those present in the main shred pile typically have density of 600-700 pound/cubic yard (22-26 pounds/cubic foot) in an uncompacted pile. Higher densities can be achieved by compression with heavy equipment (as in the existing shred piles), but such compaction greatly increases the probability of internal heating resulting in pyrolytic reactions that can generate high temperatures and oils during long term storage. This phenomenon is known to have occurred in shred piles in Oregon, Washington, Texas, Maryland and Pennsylvania and may have occurred in other locations. Due to potentially severe environmental consequences associated with permeation of pyrolytic oils (containing potentially carcinogenic chemicals) into the underlying aquifer, the new piles should not be intentionally compacted.

Assuming a maximum density of 700 pounds/cubic yard, each pile can contain an estimated 1,522 tons of shreds. Therefore, total on-site shred storage capacity in 25 piles is estimated to be 38,050 tons. Relocation of this quantity at Florida Tire's projected rate of 200 tons/day would require 190 days or 38 weeks if operations were conducted 5 days/week, 32 weeks at 6 days/week and 27 weeks at 7 days/week. Detailed calculations of pile volumes and quantities are contained in Appendix C.

REQUIRED WASTE TIRE/SHRED REMOVAL

The Florida Tire Site was estimated to contain 8,490 tons of whole tires and 48,850 tons of shreds as of March 11, 1993, representing an on-site total of 57,340 tons. Aerial observation on September 19, 1993 confirmed removal of whole passenger tire piles T-2 and T-4 containing an estimated total of 940 tons. It has been assumed that these tires were removed from the site rather than being shredded and added to existing shred piles. As a result, total on-site quantity has been adjusted to 7,550 tons of whole tires and 48,850 tons of shreds representing a total of 56,400 tons for subsequent analysis.

The actual on-site volume is probably greater than this estimate. Aerial observation on September 19, 1993 showed additional whole tire accumulations in the area south of the trailers, but the actual quantity cannot be estimated without

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ground-level measurements. In addition, analysis of the professional aerial photograph indicates that the surface area and resulting volume occupied by the main shred pile may be greater than initially estimated from our lower-level aerial photographs. The on-site quantity may also have increased if additional incoming tires have been shredded and added to the piles. Photographic evidence clearly indicates that shreds have been added to the top of existing piles since March 11, 1993.

Although the actual on-site quantity may be even greater, the site is estimated to contain at least 56,400 tons of waste tires and shreds. If site stabilization is achieved by reconfiguring 38,050 tons of shreds into on-site storage piles, a minimum of 18,350 tons (including 7,550 tons of whole tires and 10,800 tons of shreds) must still be removed from the site.

Florida Tire has proposed that they remove material from the site at a rate equal to 125% of incoming quantities stated to be approximately 100 tons/day or 500 tons/week. This would result in a net removal rate of 25 tons/day or 125 tons/week. At this rate, removal of the required 18,350 tons would be projected to take over 146 weeks or almost 3 years before the site is even stabilized.

WHOLE TIRE PROCESSING RATES

In order to implement the above plan, all whole tires must be processed and/or removed from the site. Based upon previous estimates, the site contained 2,940 tons of off-road tires, 3,340 tons of truck tires, and 2,210 tons of passenger tires representing a total of 8,490 tons as of March 11, 1993. If the quantity of passenger tires is reduced by 940 tons to reflect removal of piles T-2 and T-4, the revised passenger tire and total whole tire quantities become 1,270 tons and 7,550 tons, respectively. Based on aerial observation, the actual quantity as of September 19, 1993 is probably greater due to additional new storage areas behind the trailers.

Off-road tires are generally not shredded in the type of equipment owned by Florida Tire due to equipment limitations and maintenance impact. At other sites, DEP has used a LaBounty-type shear to cut off-road tires into at least 8 pieces to reduce volume prior to disposal in an approved landfill. Based on DEP's historical experience with a LaBounty-type shear, normal processing rates are approximately 30 tons/day or 150 tons per 5 day week. At this rate, processing and removal of the estimated 2,940 tons of off-road tires will require almost 20 weeks. A massive dual-powered tub grinder has reportedly been used recently to shred off-

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road tires prior to landfill disposal. Use of this equipment may represent an alternative if analysis of historical experience and economics indicates advantages versus traditional use of a shear.

Processing rates for passenger and truck tires are dependent upon shredding equipment availability, condition, and products produced. Mr. Jack Wilson of Florida Tire indicated at the ARA Conference in April, 1993 that he owned two shredders manufactured by Columbus McKinnon (CM). These machines, if properly operated and maintained, have historically been able to produce coarse shreds at a rate of 9 tons/hour, flowable chips at 6 tons/hour and 1 inch nominal TDF at 3 tons/hour on a sustained 40 hours/week operating basis. In addition, Florida Tire owns two older Triple S shredders, one of which is equipped with a recycling trommel allowing production of flowable chips (or TDF if the trommel screen size was reduced). The trommel can be removed or bypassed to allow coarse shred production. The other Triple S shredder is only capable of coarse shred production. These two Triple S machines could be used independently to produce coarse shreds or placed in series to produce flowable chips or TDF. Their combined production capacity would roughly approximate one of the CM machines due to their age and condition. Florida Tire indicated a lower production rate of 30 tons/day (3.75 tons/hour for an 8 hour day), assumed to represent production of coarse shreds from the Triple S shredder without a trommel. As a result, it may be necessary to improve handling procedures, equipment maintenance, or operating hours to allow their two Triple S shredders to achieve projected rates equal to one CM shredder. Table 1 summarizes the time required to process 4,610 tons of whole truck and passenger tires as a function of the number of machines used and product type.

These whole tire shredding rates do not contain allowances for adverse weather conditions or equipment downtime resulting from major component failure. Actual elapsed time would increase proportionately if either of these factors impact operations.

The required elapsed processing and removal time will be dependent on the type and number of machines that Florida Tire dedicates to processing of whole tire piles currently present on their site. One CM shredder is reportedly committed to off-site contract operations at Florida landfills and is not available for on-site processing. Florida Tire's proposed plan states that one machine, assumed to be a Triple S unit, must be moved to their unpermitted Lakeland location. Therefore, only two shredders (one CM and one Triple S) will remain on-site. The combined projected maximum capacity (producing coarse shreds) of these two units is approximately 500-540 tons/week. This on-site capacity will be

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consumed in processing their projected incoming whole tire flow of 100 tons/day or 500 tons/week. Since the CM shredder is currently set up to produce flowable chips at a reduced rate, there is a serious question about Florida Tire's ability to even process incoming flow with their proposed deployment of existing equipment. This scenario does not allow dedication of one machine to processing of existing whole tire piles at their projected rate of 150 tons/week.

TABLE 1

Required Whole Passenger/Truck Tire Processing Time				
Shred Type	Weekly Rate (tons/shredder)	Required weeks		
		1 shredder*	2 shredders*	3 shredders*
Coarse	360	12.8	6.4	4.3
Flowable	240	19.2	9.6	6.4
TDF	120	38.4	19.2	12.8

* A shredder represents one Columbus-McKinnon machine or two combined Triple S machines

PROJECTED SITE STABILIZATION SCHEDULE

The preceding sections have outlined a series of activities required to implement this site stabilization scenario. Since some of these activities can be implemented concurrently, Table 2 provides a projected optimum schedule for implementation of combined site stabilization activities.

As illustrated in Table 2, all activities can potentially be conducted concurrently with the exception of shred movement into reconfigured on-site storage piles. Since whole tires present in planned storage areas must first be processed and removed, a

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minimum delay of 6 weeks (as proposed in their initial plan) has been projected before initiation of this operation. Concurrent operation as depicted in Table 2 assumes that whole tire piles will be processed/removed at their projected rate and availability of adequate loading and transport equipment to support all on-going activities. If Florida Tire does not have or obtain such equipment, the total elapsed time requirement would increase even further.

TABLE 2
PROJECTED SITE STABILIZATION SCHEDULE

ACTIVITY	TIME (WEEKS)							
	0	20	40	60	80	100	120	140
Shred Tires								
Off-road	_____							
Passenger/ truck *	_____							
Shred Removal	_____							
Shred Movement**	_____							

* Assumes use of 1 shredder

** Assumes operation 5 days/week

Even assuming required equipment availability and cooperative weather conditions, this optimized schedule requires almost 3 years to achieve site stabilization at Florida Tire's suggested net shred removal rate of 125 tons/week.

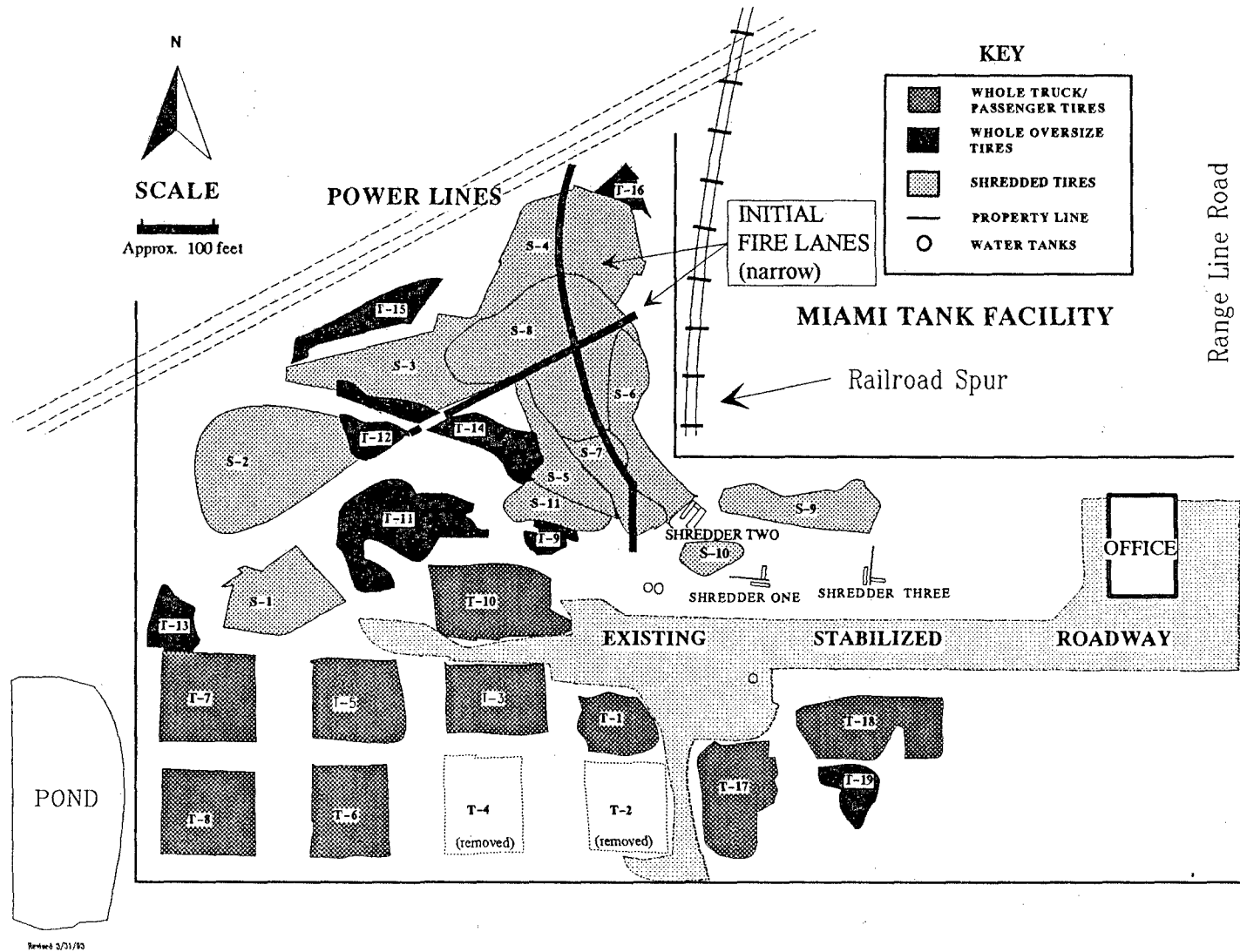
One major public risk associated with this site is the large quantity of combustible tire shreds located in close proximity to major transmission lines conveying electrical power to South

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Florida. Approximately 70% of the shreds, or 34,195 tons, are currently stored within Florida Power and Light's right-of-way. Even if all of these shreds were preferentially moved to other on-site storage piles at Florida Tire's projected rate of 1,000 tons/week (200 tons/day, 5 days/week), approximately 40 weeks (6 weeks to clear whole tires from initial storage areas and 34 weeks for actual shred movement) would be required to remove all shreds and tires from this area.

During this 40 week operating period, only 5,000 tons of shreds would be removed from the site at Florida Tire's projected rate of 125 tons/week. Since 7,550 tons of processed whole tires would be generated during this period and only 5,000 tons would be removed from the site, the remaining 2,550 tons would have to be added to the original shred pile area bordering the right-of-way and the railroad spur (with cars containing hazardous chemicals). This remaining main pile segment adjacent to the right-of-way would still exceed DEP's size requirements under this scenario. This remaining pile segment would contain 17,205 tons (the equivalent of 1,720,500 passenger tires) in close proximity to the power lines and rail cars and with no fire lanes. Since Florida Power and Light has indicated that dense smoke like that generated from waste tire/shred fires can result in failure of high voltage lines, the public risk of power interruption will continue until all waste tires and shreds are far enough away from the lines to prevent failure under all reasonable weather conditions.

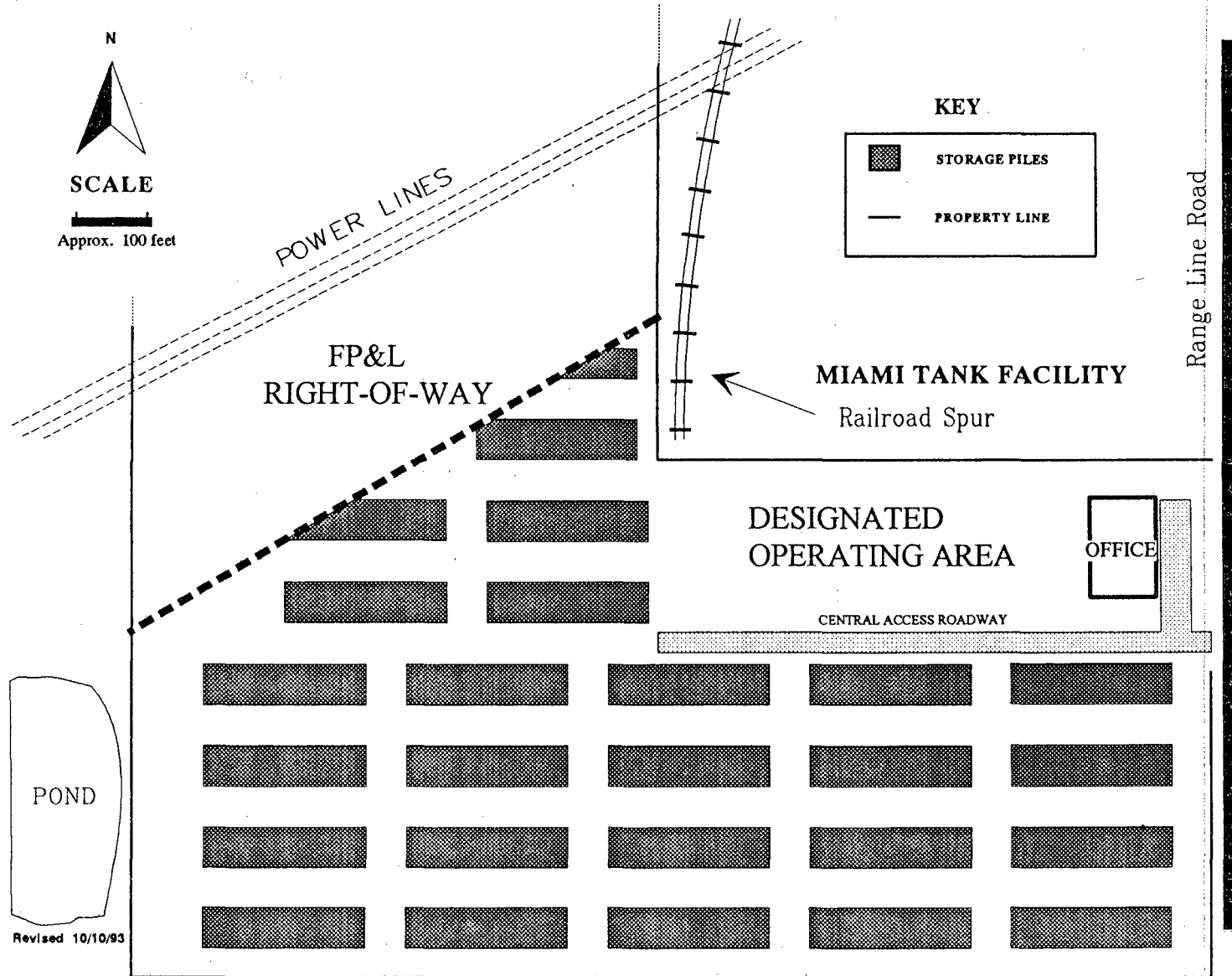
APPENDIX A - FLORIDA TIRE RECYCLING, INC. - SITE SCHEMATIC



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APPENDIX B - FLORIDA TIRE RECYCLING, INC. - STORAGE PILE SCHEMATIC

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ALTERNATIVE SITE STABILIZATION SUMMARY

ESTIMATED ON-SITE QUANTITIES		
TYPE	AS OF 3/11/93	ADJUSTED 9/11/93
Shreds	48,850 tons	48,850 tons
Whole tires		
Off-road	2,940 tons	2,940 tons
Truck	3,340 tons	3,340 tons
Passenger	2,210 tons	1,270 tons
Subtotal	8,490 tons	7,550 tons
TOTAL	57,340 tons	56,400 tons

MAXIMUM ON-SITE STORAGE
25 piles (200' X 50' X 15') @ 1,522 tons/pile = 38,050 tons

IMPLEMENTATION REQUIREMENTS			
ACTIVITY	QUANTITY (tons)	RATE (tons/week)	TIME (weeks)
Shred Tires			
Off-road	2,940	150	20
Truck/pass	4,610	150	31
Shred Movement	38,050	1,000	38
Shred Removal	18,350	125	146
MINIMUM ELAPSED TIME WITH CONCURRENT OPERATIONS 146 WEEKS			