

**TRAIL RIDGE LANDFILL**  
**MITIGATION MONITORING REPORT NO. 4**  
**DER PERMITS 161821182 AND SC16-184444**

**30 September 1994**

**PREPARED FOR:**

**Mr. Scott McCallister**  
**Trail Ridge Landfill**  
**Waste Management of North America, Inc.**  
**Post Office Box 548**  
**5110 U.S. 301**  
**Baldwin, Florida 32234**

**PREPARED BY:**

**Mitigation Services, Inc.**  
**8711 Perimeter Park Boulevard, Suite 11**  
**Jacksonville, Florida 32257**

MITIGATION MONITORING REPORT NO. 4  
FOR  
TRAIL RIDGE LANDFILL

A. INTRODUCTION

On 1 September 1994, Mitigation Services, Inc. conducted the fourth monitoring of the forested wetland creation effort located at the Trail Ridge Landfill site in Duval County (see Drawing 1). Pursuant to Conditions 6, 11, 12 13 and 14 of Permit # 12-031-055 (see Appendix A) this evaluation was undertaken to document the success of the creation area at the end of its second growing season. This report will discuss the status of the project in terms of the following:

- Percent survival and density of planted species
- Recruitment density and composition
- Percent cover of herbaceous species
- Recorded growth via established parameters for trees and shrubs
- Hydrological conditions
- Wildlife utilization

The earthwork phase of construction was completed during the summer of 1992. The mitigation area was over-excavated approximately 0.5 foot below the existing grade of the adjacent wetlands. The area was then backfilled with mulch consisting of the upper soil layer from impacted wetlands on-site to promote natural revegetation by herbaceous recruits. Planting of the forested creation area was completed on 16 November 1992. A mixture of 3-gallon trees and 1-gallon shrubs were planted on 10-foot centers throughout the mitigation area. A total of 2,095 native wetland trees and 125 native wetland shrubs were installed. A completion report of the species planted was submitted on 10 December 1992. Planted tree and shrub species included:

Native Wetland Trees

<u>Species</u>	<u>Size</u>	<u>Number</u>
Bald cypress ( <u>Taxodium distichum</u> )	3-gallon	419
Red Maple ( <u>Acer rubrum</u> )	3-gallon	419
Sweetgum ( <u>Liquidambar styraciflua</u> )	3-gallon	419
Black gum ( <u>Nyssa sylvatica</u> var. <u>biflora</u> )	3-gallon	95
Sweet bay ( <u>Magnolia virginiana</u> )	3-gallon	295
Water Tupelo ( <u>Nyssa aquatica</u> )	3-gallon	448

### Native Wetland Shrubs

<u>Species</u>	<u>Size</u>	<u>Number</u>
Wax myrtle ( <u>Myrica cerifera</u> )	1-gallon	31
Fetterbush ( <u>Lyonia lucida</u> )	1-gallon	46
Buttonbush ( <u>Cephalanthus occidentalis</u> )	1-gallon	31
Virginia willow ( <u>Itea virginica</u> )	1-gallon	17

#### B. ANALYTICAL TECHNIQUES

A total of eight (8) permanent belt transects were established within the forested mitigation area (Figure 2) and marked with 4-foot PVC stakes for reference. Four transects were orientated north-south, and four were orientated east-west to capture a uniform cross-section of the entire creation area. Each transect is 10 feet in width. All tree specimens within each transect were counted, and the health of each specimen was observed by noting new twig and leaf growth.

A total of ten (10) square meter plots were also permanently installed at each point of intersection between the various transects. The herbaceous density and growth parameters were noted by visual estimation. Recruitment of nuisance and non-nuisance species were noted throughout the mitigation area. Any observed wildlife in the vicinity of the mitigation area was also noted.

The methodology used in assessing growth and survivorship of planted trees and shrubs was as follows:

1. **Survivorship.** All trees and shrubs growing within each transect were counted. This number was divided by the total number of trees or shrubs originally planted within that belt transect to obtain the percent survivorship of planted species.
2. **Growth.** Two (2) trees in each transect were permanently marked with an identifying numbered tag.
  - a. **Caliper.** The width of tree trunks was measured six (6) inches from the ground.
3. **Recruitment.** The natural recruitment of wetland trees, shrubs and herbs in each transect was determined by visual assessment.

The methodology used in assessing growth and coverage of herbaceous vegetation was as follows:

- a. **Growth and Coverage.** The percent cover by wetland species of the total area of each square meter plot was determined and recorded.
- b. **Recruitment.** The natural recruitment of herbaceous wetland species within each plot was determined by visual assessment. Any recruited herbs observed throughout the mitigation area were also noted.

## C. RESULTS

**Survivorship.** The creation area at Trail Ridge has shown excellent survivorship since it was initially planted. The overall survivorship for all of the transects fell one percent since the spring iteration to approximately 95 percent. This is a very good indicator of the entire area being very healthy and a viable ecosystem. All of the trees and shrubs were exhibiting new twig and leaf growth. No signs of stress were observed and all specimens appeared healthy. Please refer to Table 1 for the data on the survivorship.

**Growth.** The marked trees were measured for changes in diameter at a height of 6 inches above ground level. All but two specimens exhibited an increase in diameter since the previous iteration. One tagged tree in T6 was dead upon inspection. Growth data are also provided in Table 1.

**Coverage.** The coverage of the mitigation area by natural recruits has given the area a natural appearance. The percent coverage by the recruits in the area has increased to approximately 65 percent. This also is a very good indicator of the overall success of the creation area. The herbaceous species are starting to reproduce rapidly, thus creating their own seed source. Data from the sample quadrats are provided in Table 2.

**Recruitment.** A large variety of herbaceous species have naturally recruited into the mitigation area, contributing to the formation of a diverse and thickly vegetated community. Notable recruits include beak rushes (Rhynchospora spp.), sphagnum moss (Sphagnum sp.), various sedges (Cyperus sp.), rush (Juncus sp.), pennywort (Hydrocotyle umbellata), bamboo briar (Smilax laurifolia), spikerush (Eleocharis sp.), red root (Lachnanthes caroliniana), low panicum (Panicum sp.), St. Johns wort (Hypericum fasciculatum), yellow-eyed grass (Xyris sp.), blue maidencane (Amphicarpum muhlenbergianum), red ludwigia (Ludwigia repens) and fetterbush. Several tree species have also started to recruit into the creation area. These include Red maple, Sweetgum, Loblolly bay (Gordonia lasianthus), and Tupelo. The adjacent wetland system is apparently providing the seeds for these specimens.

**Nuisance Species.** No nuisance species were observed within the mitigation area. Historically tenacious nuisance species such as cattails (Typha sp.) were notably absent from the area.



**Hydrologic Conditions.** The data collected from the piezometers revealed that the water table was unusually low. Levels ranged from water at the surface to 2.5 feet below the surface. The previous months of July and August had rainfall amounts below the normal as calculated by NOAA (National Oceanic and Atmospheric Administration). Rain gauge data from Trail Ridge Landfill show that 4.1 inches of rain fell in July, which is only 66 percent of the normal 6.2 inches. August had a total of 4.6 inches of rain, which is 63 percent of the normal 7.2 inches. Although the Jacksonville area is approximately 3.1 inches above normal for the year as of September 1, 1994; the below normal rainfall for July and August may account for the deep water table. All piezometer data are provided in Table 3.

**Wildlife Utilization.** During the site visit various species of minnows (Fundulus sp.), mosquito fish (Gambusia sp.), frogs and tadpoles were observed in the areas of standing water within the creation area. These organisms represent pioneer species which would be expected to colonize developing wetlands, indicating the emergence of a stable ecosystem. Evidence of armadillo (Dasypus novemcinctus) and deer (Odocoileus virginianus) were also observed. Crayfish burrows were observed indicating inundation and saturation at the surface since the previous inundation.

#### D. CONCLUSION

The wetland creation area at the Trail Ridge Landfill is continuing to exhibit signs of success at the end of its second growing season. Planted trees and shrubs appear to be healthy and growing as evidenced by new leaf and twig growth. Percent cover by herbaceous species has been excellent thus far, with herbaceous natural recruits accounting for approximately 65 percent coverage of the creation area. No nuisance species have been observed within the project site. Evidence of proper hydrology and the presence of pioneer faunal species indicate the early successional development of a healthy, viable wetland ecosystem.

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Attachments

**TABLE 1**  
**Percent Survival & Growth Data of Planted Trees**

Transect Number	No of Planted Trees	No. of Trees Living						Percent Survival						Tree Number - Species	Spring 1993 Caliper (Inches)	Fall 1993 Caliper (Inches)	Spring 1994 Caliper (Inches)	Fall 1994 Caliper (Inches)	Spring 1995 Caliper (Inches)	Fall 1995 Caliper (Inches)
		M <sup>1</sup>	M <sup>2</sup>	M <sup>3</sup>	M <sup>4</sup>	M <sup>5</sup>	M <sup>6</sup>	M <sup>1</sup>	M <sup>2</sup>	M <sup>3</sup>	M <sup>4</sup>	M <sup>5</sup>	M <sup>6</sup>							
1	37	37	36	35	35			*	97	95	95			T1-1 ( <i>Taxodium distichum</i> ) T1-2 ( <i>Liquidambar styraciflua</i> )	0.4 0.5	0.4 0.5	0.5 0.5	0.9 0.6		
2	40	40	37	37	36			*	93	93	90			T2-1 ( <i>Taxodium distichum</i> ) T2-2 ( <i>Nyssa sylvatica</i> var. <i>biflora</i> )	0.5 0.3	0.6 0.4	0.6 0.5	1.0 0.5		
3	45	45	44	44	44			*	98	98	98			T3-1 ( <i>Taxodium distichum</i> ) T3-2 ( <i>Magnolia virginiana</i> )	0.6 0.5	0.6 0.5	0.7 0.7	0.9 0.7		
4	31	31	31	31	30			*	100	100	97			T4-1 ( <i>Acer rubrum</i> ) T4-2 ( <i>Acer rubrum</i> )	0.5 0.3	0.5 0.4	0.6 0.4	0.7 0.6		
5	91	91	91	91	88			*	100	100	97			T5-1 ( <i>Acer rubrum</i> ) T5-2 ( <i>Acer rubrum</i> )	0.4 0.5	0.4 0.5	0.4 0.5	0.7 0.7		
6	80	80	80	79	78			*	100	99	98			T6-1 ( <i>Magnolia virginiana</i> ) T6-2 ( <i>Magnolia virginiana</i> )	0.7 0.8	0.8 0.8	0.8 0.9	0.8 **		
7	46	46	46	46	46			*	100	100	100			T7-1 ( <i>Acer rubrum</i> ) T7-2 ( <i>Liquidambar styraciflua</i> )	0.4 0.6	0.6 0.6	0.6 0.7	0.8 0.8		
8	44	44	36	36	36			*	82	82	82			T8-1 ( <i>Acer rubrum</i> ) T8-2 ( <i>Taxodium distichum</i> )	0.4 0.7	0.5 0.7	0.5 0.7	0.7 1.0		

Note: M<sup>1</sup> designates the first monitoring iteration, M<sup>2</sup> the second, etc.

\* Since no previous survivorship data has been taken, data from the first iteration will serve as background for future comparison.

\*\* Dead.

**TABLE 2**  
**Data From Sample Quadrats at Trail Ridge Landfill**

Quadrat #	Species	Percent Coverage					
		M1	M2	M3	M4	M5	M6
Q-1	<u>Eleocharis</u> sp. <u>Panicum</u> sp. <u>Lachnanthes caroliniana</u> <u>Rhynchospora</u> spp.	3	15 5	30 15	15 15 10 5		
Q-2	<u>Panicum</u> sp. <u>Rhynchospora</u> sp. <u>Iris virginica</u> <u>Ludwigia repens</u> <u>Hypericum fasciculatum</u> <u>Lachnanthes caroliniana</u> <u>Eleocharis</u> sp.	3 5 3 4 5 40	2 5  2 5 40	50 10 5   	35 10  1 10 20		
Q-3	<u>Panicum</u> sp. <u>Eleocharis</u> sp. <u>Rhynchospora</u> sp.	40 30 10	50 20 10	70 10 10	70 8 8		
Q-4	<u>Panicum</u> sp. <u>Eleocharis</u> sp. <u>Rhynchospora</u> sp. <u>Xyris</u> sp. <u>Lachnanthes caroliniana</u> <u>Ludwigia repens</u> <u>N. sylvatica</u> v. <u>biflora</u>	20 60 5   5	10 80 5 2 2	40 35 5 2  	35 25 10 5 8 2		
Q-5	<u>Rhynchospora</u> sp. <u>Iris virginica</u> <u>Ludwigia repens</u> <u>Panicum</u> spp.	  2	  	2 1	5  10		
Q-6	<u>Panicum</u> sp. <u>Eleocharis</u> sp. <u>Andropogon virginicus</u> <u>Rhynchospora</u> spp.		2	8 10 5	10 5 2 3		
Q-7	<u>Panicum</u> sp. <u>Eleocharis</u> sp. <u>Rhynchospora</u> sp. <u>Juncus elliotii</u>	5	20 20	25 20 20	25 15 25 10		
Q-8	<u>Panicum</u> sp. <u>Rhynchospora</u> sp. <u>Eleocharis</u> sp.	20 20 30	5 35 35	30 40	30 20 20		

TABLE 2 (Continued)  
Data From Sample Quadrats at Trail Ridge Landfill

Quadrat #	Species	Percent Coverage					
		M1	M2	M3	M4	M5	M6
Q-9	<u>Panicum</u> sp.	10	5	10	15		
	<u>Eleocharis</u> sp.	60	60	35	30		
	<u>Rhynchospora</u> sp.			5	5		
	<u>Cyperus</u> spp.	5	5				
	<u>Fuirena squarrosa</u>				5		
Q-10	<u>Panicum</u> sp.	10	20	50	40		
	<u>Rhynchospora</u> sp.	10	5	35	15		
	<u>Eleocharis</u> sp.	55	50	3	10		
	<u>Iris virginica</u>			2			
	<u>Juncus effusus</u>	10	15				
	<u>Juncus elliotii</u>				20		
	<u>Lachnanthes caroliniana</u>				10		

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**TABLE 3: Piezometer Data (in feet) from Creation Area**

Piez. #	Fall 1993	Spring 1994	Fall 1994
1	-3.0	-1.3	-2.5
2	-1.3	-1.7	-1.2
3	-1.1	-0.6	-0.5
4	-1.5	-1.1	-1.7
5	0.0	0.0	-1.1
6	-1.0	-1.0	-1.3
7	-1.7	-1.7	-2.3
8	-2.5	-0.5	-1.7
9	0.2	0.0	-2.1
10	-0.9	0.4	0.0
11	*	-0.5	-1.6

Note : \* indicates no record.

## APPENDIX A

### PROJECT INFORMATION

Date: 14 September 1994	
Project Name: Trail Ridge Landfill	Project No: 91-297.3
Monitoring Period: Fall 1994	Monitoring Rep: 4 of 6
<p>Permit No: <u>161821182 and SC16-184444</u></p> <p>Total Wetlands Created: <u>± 4.76 acres</u></p> <p>Monitoring Conditions: <u>Permit No. 161821182 - Specific Conditions 6, 11, 12, 13 and 14 (46, 51, 52, 53 and 54 for Permit No. SC16-184444).</u></p> <p>6(46).      The mitigation plan, "Trail Ridge Landfill Wetland Impacts and Mitigation Plan," submitted on June 18, 1990, shall be appended as a Specific Condition of this permit. Any specific condition requirements listed herein, shall supersede or modify any requirements contained in the appended mitigation plan.</p> <p>11(51).     The permittee shall furnish the Department with monitoring reports on the wetland creation areas describing:</p> <ul style="list-style-type: none"> <li>a.      Percent survival and diversity of planted species within each stratum;</li> <li>b.      Recruitment density and composition within each stratum;</li> <li>c.      Recorded growth via established parameters for planted trees and shrubs;</li> <li>d.      Percent cover of herbaceous species;</li> <li>e.      Surface water elevations referenced to N.G.V.D., or if surface water is not present, groundwater elevation referenced to N.G.V.D.</li> </ul> <p>The first monitoring year shall start as of the planting date and data shall be collected and submitted in accordance with Specific Condition Number 6. Reports to the Department must also include photographs, descriptions of problems encountered and solutions undertaken.</p>	

**Monitoring Conditions 6, 11, 12, 13 and 14 (46, 51, 52, 53 and 54) Continued**

- 12(52). Within the wetland creation areas, non-native vegetation and nuisance vegetation such as Typha sp. shall be controlled by hand clearing or other methods approved by the Department so that they constitute no more than 10% of the areal cover at any monitoring period.
- 13(53). Successful establishment of the wetland creation shall occur when:
- a. On an annual basis at least 80 percent of the planted individuals in each stratum have survived and are showing signs of normal annual growth, based on standard growth parameters such as height and base diameter, or canopy circumference; and
  - b. The above criteria has been achieved and maintained for a three (3) year period following initial planting.
- 14(54). In the event that the success criteria as stated in Specific Condition Number 13 are not achieved by the expiration date of this permit, the permittee shall enter into a long term agreement with the Department so as to insure the success of the mitigation plan.

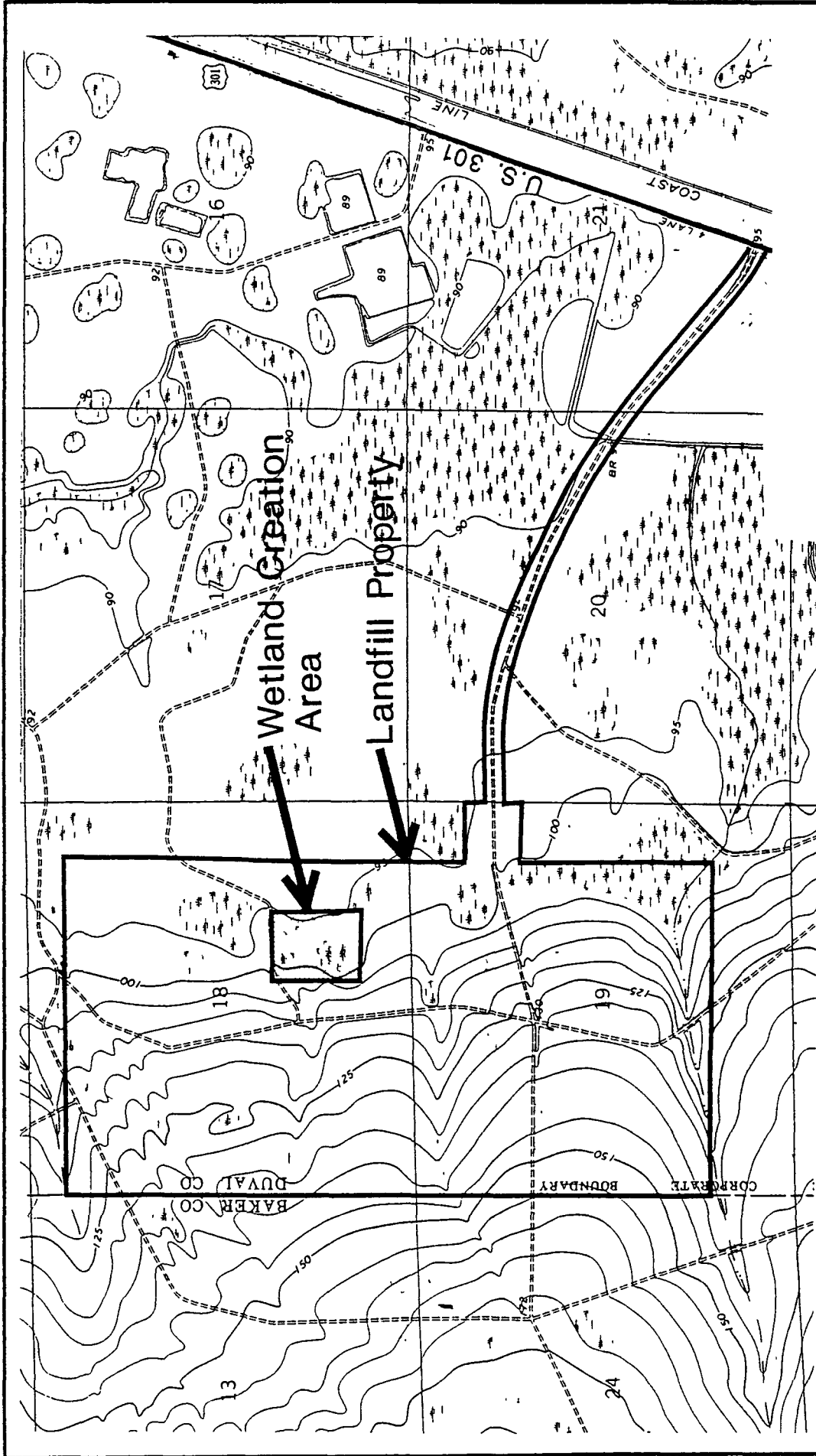


Figure 1  
Location Map

Source: U.S.G.S. Topographical Survey,  
Maxville, FL., Quadrangle. (1970)

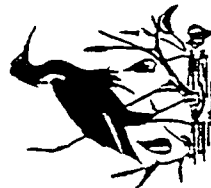
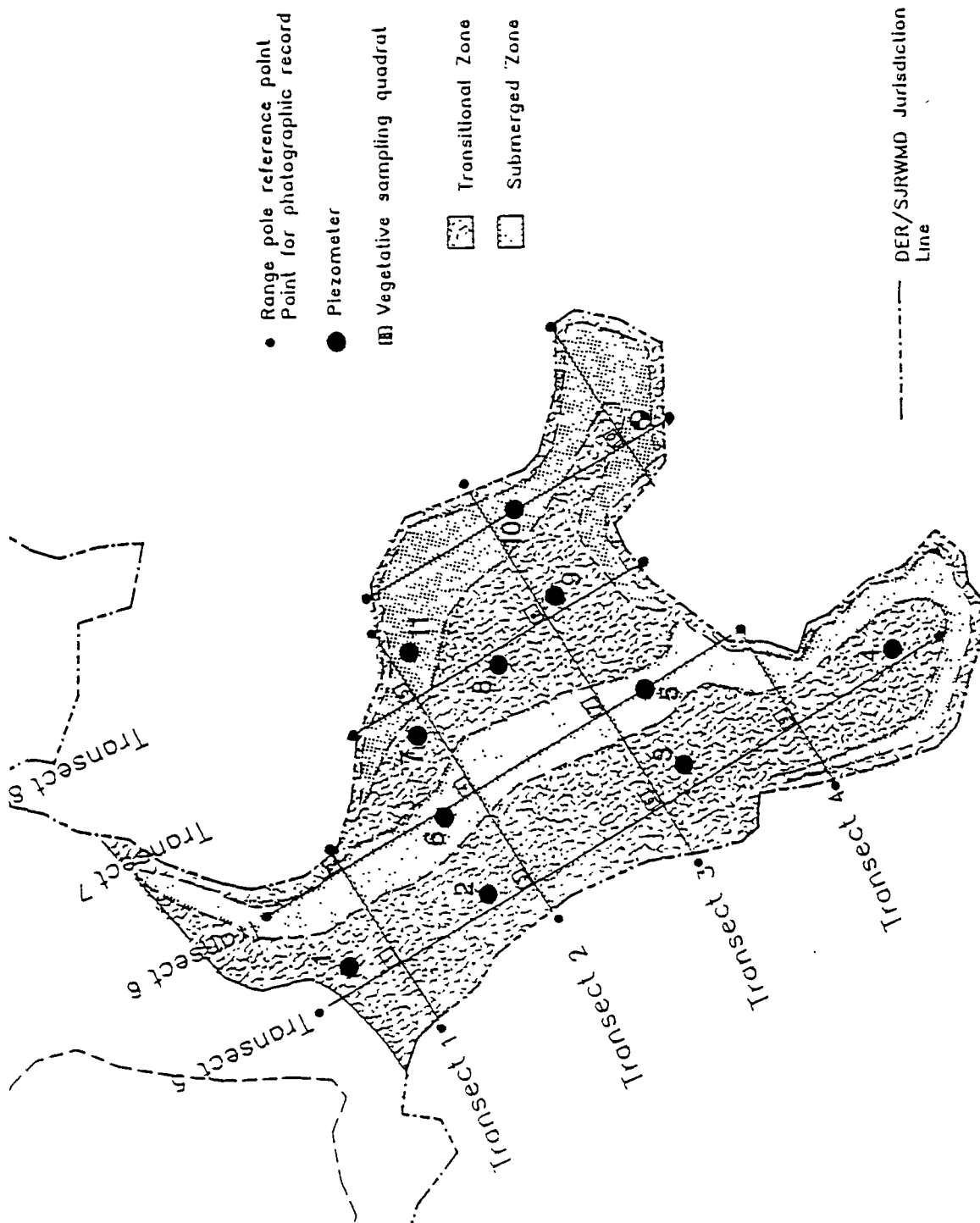


ENVIRONMENTAL  
SERVICES, INC.

# Trail Ridge Landfill Mitigation Monitoring

Project No.	91-297.3
Date	5/26/93
Scale	1"=2000'
Drawing No.	1 of 2





ENVIRONMENTAL  
SERVICES, INC.

# Trail Ridge Landfill Mitigation Plan 4.76 Acres

Project No.	91-297.3
Date	5/26/93
Scale	1"=150'
Drawing No.	2 of 2

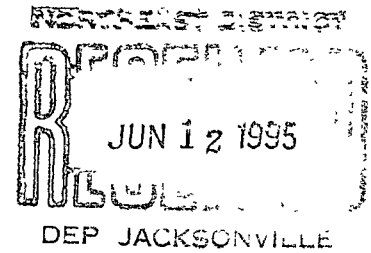
Trail Ridge Landfill, Inc.  
5110 U.S. Highway 301  
P.O. Box 548  
Baldwin, Florida 32234  
904/289-9100



A Waste Management Company

June 8, 1995

Mrs. Lisa Adams  
Florida Department of Environmental Protection  
7825 Baymeadows Way, Suite B200  
Jacksonville, Florida 32257



Re: **Trail Ridge Landfill  
Wetland Mitigation Monitoring Report**

Dear Mrs. Adams:

Enclosed is a copy of Report No. 5 for the wetland mitigation area at Trail Ridge Landfill. This report was prepared by Environmental Services, Inc. and concludes that the mitigation area is doing well.

Should you have any questions, please give me a call, or feel free to contact ESI directly.

Sincerely,

Scott W. McCallister, P.G.  
Senior Environmental Engineer

SWM:lh

cc: Greg Mathes

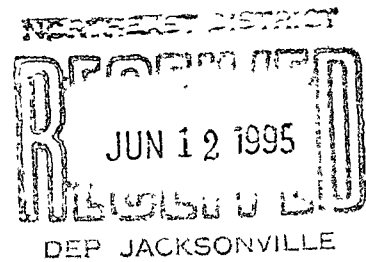
Enclosure

C:\WPDOCS\SCOTT\1995\ADAMS

MITIGATION SERVICES, INC  
8711 PERIMETER PARK BOULEVARD, SUITE 11  
JACKSONVILLE, FLORIDA 32216

(904) 645-9900

30 September 1994



Mr. Scott McCallister  
Trail Ridge Landfill  
Waste Management of North America, Inc.  
Post Office Box 548  
5110 U.S. 301  
Baldwin, Florida 32234

**RE: Trail Ridge Landfill Mitigation Monitoring  
Permits No. 161821182 and SC16-184444**

Dear Scott:

Enclosed please find the fourth monitoring report for the wetland creation area at the Trail Ridge Landfill site. The site appears to be doing well regarding tree survivorship and herbaceous recruitment.

If this report meets with your approval, please forward a copy to the local DEP office to the attention of Mrs. Lisa Adams.

Should you have any questions, please call Byron Peacock or me.

Sincerely yours,

MITIGATION SERVICES, INC.

Nancy C. Zyski  
President

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Attachments



**TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994**



Transect 1 - Northeast Direction



Transect 1 - Southwest Direction



**TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
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Transect 2 - Southwest Direction



Transect 2 - Northeast Direction



**TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994**



Transect 3 - Southwest Direction



Transect 3 - Northeast Direction



**TRAIL RIDGE LANDFILL  
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Transect 4 - Northeast Direction



Transect 4 - Northeast Direction



**TRAIL RIDGE LANDFILL  
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FALL 1994**



Transect 5 - Northwest Direction



Transect 5 - Southeast Direction



**TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994**



Transect 6 - Northwest Direction



Transect 6 - Southeast Direction



**TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994**



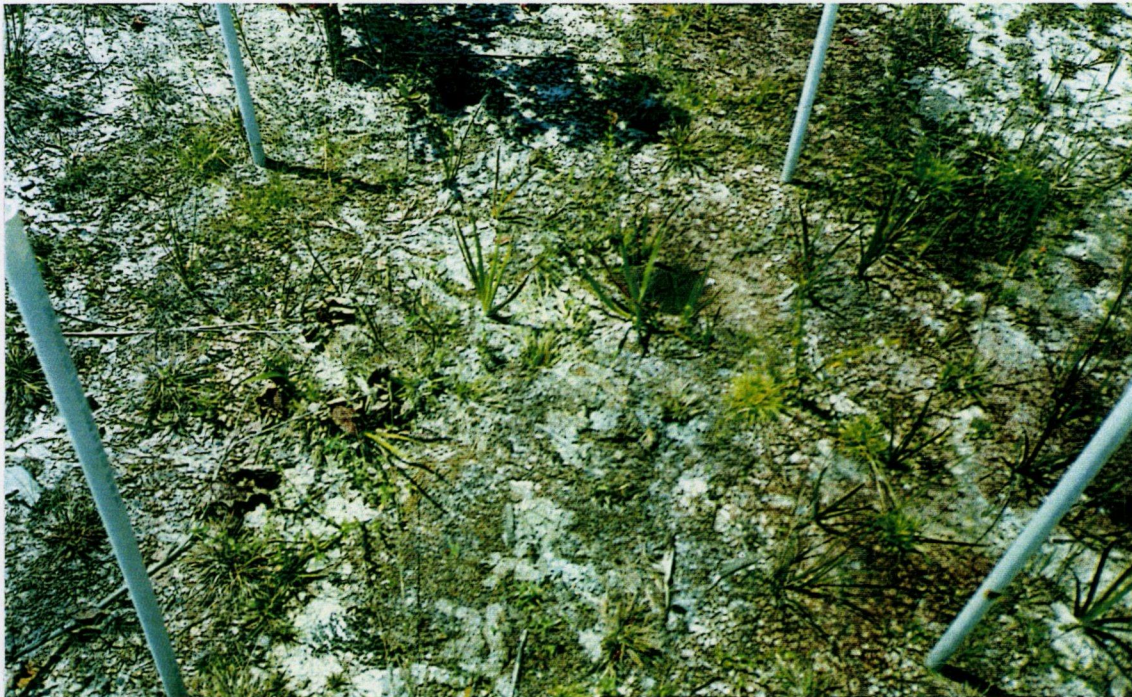
Transect 7 - Northwest Direction



Transect 8 - Northwest Direction



TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994



Sample Quadrat 1



Sample Quadrat 2



TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994



Sample Quadrat 3



Sample Quadrat 4



TRAIL RIDGE LANDFILL  
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FALL 1994



Sample Quadrat 5



Sample Quadrat 6



TRAIL RIDGE LANDFILL  
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Sample Quadrat 7



Sample Quadrat 8



TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994



Sample Quadrat 9



Sample Quadrat 10



TRAIL RIDGE LANDFILL  
MITIGATION MONITORING REPORT #4  
FALL 1994



Crawfish Burrow - Evidence of Inundation



Ponded Water in Depositional Area