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SEALED ENGINEER CERTIFICATION

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December 12, 2012

Mr. F. Thomas Lubozynski, P.E.
Waste Program Administrator
Florida Department of Environmental Protection ("Department")
3319 Maguire Blvd., Suite 232
Orlando, FL 32803-3767

Subject: **FDEP Application for Extended Period Renewal of Operations Permit for a Solid Waste Disposal Facility- FDEP Permit No. SO64-0078767-023 Tomoka Farms Road Landfill (TFRLF) North Cell Class I Disposal Area Volusia County Solid Waste Division**

Dear Mr. Lubozynski:

On behalf of the Volusia County Solid Waste Division, we are submitting four (4) copies of an FDEP Application, engineering report and supporting documents to renew the FDEP Solid Waste Facility Operations Permit for the North Cell Class I disposal area in TFRLF. We request the permit duration to be twenty (20) years of operations for the approximate 90.9-acre contiguous North Cell Class I solid waste disposal area.

The North Cell Class I solid waste disposal area is comprised of the original North Cell covering 43.2 acres, the 26-acre Phase I expansion, and the 21.7-acre Phase II expansion. Currently, the original cell and the Phase I expansion are in operation, and Phase II expansion is under construction. The construction of Phase-II expansion is anticipated to be completed by 2015. This long-term Operations Permit application is prepared to cover the existing and future solid waste disposal operations for the entire North Cell predicated on acceptance of certification of completion of construction for the Phase II by FDEP. It is requested that the fill operations of the Phase II expansion area be included in the long-term Operations Permit for the North Cell Class I solid waste disposal area.

The Department has recently renewed the sequential closure permit for the North Cell covering three (3) phases of closing construction as final permitted elevations are achieved. It is requested that the general and specific conditions of the North Cell closing construction permit be consolidated into the long-term Operations Permit. Based on the results of the October 22, 2012 pre-application discussions, the County will notify the Department prior to construction of a sequential closing and will submit the certification of completion of construction after each construction event.

In addition, based on the result of our discussion at the pre-application meeting, we are submitting the North Cell landfill gas master plan for future expansion and improvements of the LFG management and control system. We request that the LFG master plan be integrated into the long-term Operations Permit. The County will notify the Department prior to construction of each landfill gas collection system expansion and will submit the certification of completion of construction after each construction event.

VI. CERTIFICATION BY ENGINEER

This is to certify that the Cost Estimates pertaining to the engineering features of this solid waste management facility have been examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, the Cost Estimates are a true, correct and complete representation of the financial liabilities for closing and/or long-term care of the facility and comply with the requirements of Rule 62-701.630 F.A.C. and all other Department of Environmental Protection rules, and statutes of the State of Florida. It is understood that the Cost Estimates shall be submitted to the Department annually, revised or adjusted as required by Rule 62-701.630(4), F.A.C.

Signature	200 W. Forsyth St., Ste. 800 Mailing Address
Carlo Lebron, Project Manager Name and Title (please type)	Jacksonville, FL 32202-4321 City, State, Zip Code
9/12 Date	Carlo.Lebron@hdrinc.com E-Mail address (if available)
60815 Florida Registration Number (In case affix seal)	(904)-598-8900 Telephone Number

VII. SIGNATURE BY OWNER/OPERATOR

Signature of Applicant	3151 East New York Avenue Mailing Address
Leonard Marion, Director Name and Title (please type)	DeLand, FL 32724 City, State, Zip Code
lmarion@co.volusia.fl.us E-Mail address (if available)	(386)-943-7889 Telephone Number

ATTACHMENT F

Updated North Cell Class I Landfill Closure and Long-Term Estimate

Print Form | Reset Form

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

DEP Form # 62-701.900(28), F.A.C.
Form Title: Closure Cost Estimating Form For Solid Waste Facilities
Effective Date: January 6, 2010
Incorporated in Rule 62-701.630(3), F.A.C.

CLOSURE COST ESTIMATING FORM FOR SOLID WASTE FACILITIES

Date of DEP Approval: _____

I. GENERAL INFORMATION:

Facility Name: Tomoka Farms Road Landfill-North Cell, Phase I, Class I WACS ID: 27540
Permit Application or Consent Order No.: SF64-0078767-028 Expiration Date: 03/19/2017
Facility Address: 1990 Tomoka Farms Road, Daytona Beach, Florida
Permittee or Owner/Operator: Volusia County Solid Waste Division
Mailing Address: 3151 East New York Avenue, DeLand, Florida 32724

Latitude: 29 ° 07 ' 50 " Longitude: 81 ° 06 ' 02 "
Coordinate Method: AutoCAD/GPS Datum: NAD 1983/90 (east)
Collected by: J.E. Zapert Company/Affiliation: Sliger & Associates, Inc.

Solid Waste Disposal Units Included in Estimate:

Phase / Cell	Acres	Date Unit Began Accepting Waste	Active Life of Unit From Date of Initial Receipt of Waste	If active: Remaining life of unit	If closed: Date last waste received	If closed: Official date of closing
North Cell	65.65	June 1999	13.5 years	5.0 years	NA	NA

Total disposal unit acreage included in this estimate: Closure: 65.65 Long-Term Care: 65.65

Facility type: (Check all that apply) ☒ Class I ☐ Class III ☐ C&D Debris Disposal ☐ Other: _____

II. TYPE OF FINANCIAL ASSURANCE DOCUMENT (Check type)

☐ Letter of Credit* ☐ Insurance Certificate ☒ Escrow Account
☐ Performance Bond* ☐ Financial Test ☐ Form 29 (FA Deferral)
☐ Guarantee Bond* ☐ Trust Fund Agreement

* - Indicates mechanisms that require the use of a Standby Trust Fund Agreement

Northwest District
160 Government Center
Pensacola, FL 32502-5794
850-595-8360

Northeast District
7825 Baymeadows Way, Ste. B200
Jacksonville, FL 32256-7590
904-807-3300

Central District
3319 Maguire Blvd., Ste. 232
Orlando, FL 32803-3767
407-894-7555

Southwest District
13051 N. Telecom Pky.
Temple Terrace, FL 33637
813-632-7600

South District
2295 Victoria Ave., Ste. 364
Fort Myers, FL 33901-3881
239-332-6975

Southeast District
400 N. Congress Ave., Ste. 200
West Palm Beach, FL 33401
561-681-6600

III. ESTIMATE ADJUSTMENT

CFR Part 264 Subpart H as adopted by reference in Rule 62-701.630, Florida Administrative Code, (F.A.C.) sets forth the method of annual cost estimate adjustment. Cost estimates may be adjusted by using an inflation factor or by recalculating the maximum costs of closure in current dollars. Select one of the methods of cost estimate ajustment below.

☐ **(a) Inflation Factor Adjustment** ☒ **(b) Recalculated or New Cost Estimates**

Inflation adjustment using an inflation factor may only be made when a Department approved closure cost estimate exists and no changes have occurred in the facility operation which would necessitate modification to the closure plan. The inflation factor is derived from the most recent Implicit Price Deflator for Gross National Product published by the U.S. Department of Commerce in its survey of Current Business. The inflation factor is the result of dividing the latest published annual Deflatory by the Deflator for the previous year. The inflation factor may also be obtained from the Solid Waste website www.dep.state.fl.us/waste/categories/swfr or call the Financial Coordinator at (850) 245-8706.

This adjustment is based on the Department approved closing cost estimate dated: _____

Latest Department Approved **Closing Cost** Estimate:		Current Year Inflation Factor, ***e.g. 1.02***		Inflation Adjusted Closing Cost Estimate:
_____	×	_____	=	_____

This adjustment is based on the Department approved long-term care cost estimate dated: _____

Latest Department Approved Annual **Long-Term Care** Cost Estimate:		Current Year Inflation Factor, ***e.g. 1.02***		Inflation Adjusted Annual Long-Term Care Cost Estimate:
_____	×	_____	=	_____

Number of Years of Long Term Care Remaining: × _____

Inflation Adjusted Long-Term Care Cost Estimate: = _____

Signature by: ☒ **Owner/Operator** ☒ **Engineer** (check what applies)

Signature	200 W Forsyth St, Ste 800 Address
Carlo Lebron, Project Manager Name & Title	Jacksonville, FL 32202 City, State, Zip Code
12/7/12 Date	Carlo.Lebron@hdrinc.com E-Mail Address
(904) 598-8900 Telephone Number	

IV. ESTIMATED CLOSING COST (check what applies)

☒ **Recalculated Cost Estimate** ☐ **New Facility Cost Estimate**

Notes: 1. Cost estimates for the time period when the extent and manner of landfill operation makes closing most exp
2. Cost estimate must be certified by a professional engineer.
3. Cost estimates based on third party suppliers of material, equipment and labor at fair market value.
4. In some cases, a price quote in support of individual item estimates may be required.

Description	Unit	Number of Units	Cost / Unit	Total Cost
1. Proposed Monitoring Wells	**(Do not include wells already in existence.)**			
	EA			
			Subtotal Proposed Monitoring Wells:	
2. Slope and Fill (bedding layer between waste and barrier layer):				
Excavation	CY			
Placement and Spreading	CY			
Compaction	CY			
Off-Site Material	CY			
Delivery	CY			
			Subtotal Slope and Fill:	
3. Cover Material (Barrier Layer):				
Off-Site Clay	CY	175,086	$13.50	$2,363,661.00
Synthetics - 40 mil	SY	346,837	$3.81	$1,321,448.97
Synthetics - GCL	SY			
Synthetics - Geonet	SY			
Synthetics - Other (explain)	SY	346,837	$5.55	$1,924,945.35
Double Sided Geocomposite			Subtotal Cover Material:	$5,610,055.32
4. Top Soil Cover:				
Off-Site Material	CY	58,362	$14.00	$817,068.00
Delivery	CY			
Spread	CY			
			Subtotal Top Soil Cover:	$817,068.00
5. Vegetative Layer				
Sodding	SY	307,333	$1.82	$559,346.06
Hydroseeding	AC	5.41	$2,833.33	$15,328.32
Fertilizer	AC			
Mulch	AC			
Other (explain)				
			Subtotal Vegetative Layer:	$574,674.38
6. Stormwater Control System:				
Earthwork	CY			
Grading	SY			
Piping	LF	6,778	$20.97	$142,134.66
Ditches	LF			
Berms	LF			
Control Structures	EA	12	$3,366.67	$40,400.04
Other (explain)	LS	1	$372,590.00	$372,590.00
See Attachment R-2			Subtotal Stormwater Control System:	$555,124.70

Description	Unit	Number of Units	Cost / Unit	Total Cost
7. Passive Gas Control:				
Wells	EA			
Pipe and Fittings	LF			
Monitoring Probes	EA			
NSPS/Title V requirements	LS	1		
			Subtotal Passive Gas Control:	
8. Active Gas Extraction Control:				
Traps	EA			
Sumps	EA			
Flare Assembly	EA			
Flame Arrestor	EA			
Mist Eliminator	EA			
Flow Meter	EA			
Blowers	EA			
Collection System	LF			
Other (explain)	LS	1	$434,187.88	$434,187.88
See Attachment R-3			Subtotal Active Gas Extraction Control:	$434,187.88
9. Security System:				
Fencing	LF	1	$2,000.00	$2,000.00
Gate(s)	EA			
Sign(s)	EA			
			Subtotal Security System:	$2,000.00
10. Engineering:				
Closure Plan Report	LS	1	$50,000.00	$50,000.00
Certified Engineering Drawings	LS	1	$25,000.00	$25,000.00
NSPS/Title V Air Permit	LS	1	$20,000.00	$20,000.00
Final Survey	LS	1	$25,000.00	$25,000.00
Certification of Closure	LS	1	$50,000.00	$50,000.00
Other (explain)				
			Subtotal Engineering:	$170,000.00

Description	Hours	Cost / Hour	Hours	Cost / Hour	Total Cost
11. Professional Services					
	Contract Management		Quality Assurance		
P.E. Supervisor	160	$130.0(	80	$130.0(	$31,200.00
On-Site Engineer	300	$100.0(	180	$100.0(	$48,000.00
Office Engineer	200	$100.0(	144	$100.0(	$34,400.00
On-Site Technician			2,992	$65.00	$194,480.00
Other (explain)			1	$50,00(	$50,000.00
Lump Sump Amount					

Description	Unit	Number of Units	Cost / Unit	Total Cost
Quality Assurance Testing	LS	1	$50,000.00	$50,000.00
			Subtotal Professional Services:	$408,080.00

		Subtotal of 1-11 Above:	$8,571,190.28
12. Contingency	10 % of Subtotal of 1-11 Above		$857,119.03
		Subtotal Contingency:	$857,119.03
		Estimated Closing Cost Subtotal:	$9,428,309.30

Description	**Total Cost**
13. Site Specific Costs	
Mobilization	$428,559.51
Waste Tire Facility	
Materials Recovery Facility	
Special Wastes	
Leachate Management System Modification	
Other (explain) _____	
_____ Subtotal Site Specific Costs:	$428,559.51

TOTAL ESTIMATED CLOSING COSTS ($): $9,856,868.81

V. ANNUAL COST FOR LONG-TERM CARE

See 62-701.600(1)a.1., 62-701.620(1), 62-701.630(3)a. and 62-701.730(11)b. F.A.C. for required term length. For landfills certified closed and Department accepted, enter the remaining long-term care length as "Other" and provide years remaining.

(Check Term Length) ☐ 5 Years ☐ 20 Years ☒ 30 Years ☐ Other, ___ Years

Notes: 1. Cost estimates must be certified by a professional engineer.

2. Cost estimates based on third party suppliers of material, equipment and labor at fair market value.

3. In some cases, a price quote in support of individual item estimates may be required.

All items must be addressed. Attach a detailed explanation for all entries left blank.

Description	Sampling Frequency (Events / Year)	Number of Wells	(Cost / Well) / Event	Annual Cost
1. Groundwater Monitoring [62-701.510(6), and (8)(a)]				
Monthly	12			
Quarterly	4			
Semi-Annually	2			
Annually	1			
			Subtotal Groundwater Monitoring:	
2. Surface Water Monitoring [62-701.510(4), and (8)(b)]				
Monthly	12			
Quarterly	4			
Semi-Annually	2	7	$426.36	$5,969.04
Annually	1			
			Subtotal Surface Water Monitoring:	$5,969.04
3. Gas Monitoring [62-701.400(10)]				
Monthly	12			
Quarterly	4	1	$2,035.50	$8,142.00
Semi-Annually	2			
Annually	1			
			Subtotal Gas Monitoring:	$8,142.00
4. Leachate Monitoring [62-701.510(5), (6)(b) and 62-701.510(8)c]				
Monthly	12			
Quarterly	4			
Semi-Annually	2			
Annually	1			
Other (explain) _____	_____			
_____			Subtotal Leachate Monitoring:	

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
5. Leachate Collection/Treatment Systems Maintenance				
Maintenance				
Collection Pipes	LF			
Sumps, Traps	EA			
Lift Stations	EA			
Cleaning	LS	1	$2,000.00	$2,000.00
Tanks	EA			

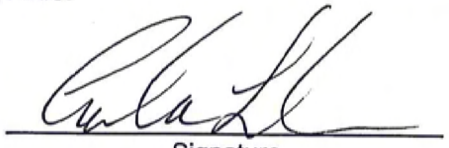
Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
5. (continued)				
Impoundments				
Liner Repair	SY	20	$9.00	$180.00
Sludge Removal	CY			
Aeration Systems				
Floating Aerators	EA			
Spray Aerators	EA			
Disposal				
Off-site (Includes transportation and disposal)	1000 gallon	1,000	$30.00	$30,000.00
			Subtotal Leachate Collection / Treatment Systems Maintenance:	$32,180.00
6. Groundwater Monitoring Well Maintenance				
Monitoring Wells	LF	1	$500.00	$500.00
Replacement	EA			
Abandonment	EA			
			Subtotal Groundwater Monitoring Well Maintenance:	$500.00
7. Gas System Maintenance				
Piping, Vents	LF	1	$5,000.00	$5,000.00
Blowers	EA	1	$1,200.00	$1,200.00
Flaring Units	EA	1	$400.00	$400.00
Meters, Valves	EA	1	$500.00	$500.00
Compressors	EA			
Flame Arrestors	EA	1	$1,200.00	$1,200.00
Operation	LS	1	$24,840.00	$24,840.00
			Subtotal Gas System Maintenance:	$33,140.00
8. Landscape Maintenance				
Mowing	AC	65.65	$290.00	$19,038.50
Fertilizer	AC			
			Subtotal Landscape Maintenance:	$19,038.50
9. Erosion Control and Cover Maintenance				
Sodding	SY	7,164	$1.82	$13,038.48
Regrading	AC			
Liner Repair	SY	1,194	$9.00	$10,746.00
Clay	CY	796	$14.00	$11,144.00
			Subtotal Erosion Control and Cover Maintenance:	$34,928.48
10. Storm Water Management System Maintenance				
Conveyance Maintenance	LS	1	$5,000.00	$5,000.00
			Subtotal Storm Water Management System Maintenance:	$5,000.00
11. Security System Maintenance				
Fences	LS	1	$500.00	$500.00
Gate(s)	EA			
Sign(s)	EA			
			Subtotal Security System Maintenance:	$500.00

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
12. Utilities	LS	1	$1,800.00	$1,800.00
			Subtotal Utilities:	$1,800.00
13. Leachate Collection/Treatment Systems Operation				
Operation				
P.E. Supervisor	HR			
On-Site Engineer	HR			
Office Engineer	HR			
OnSite Technician	HR	104	$65.00	$6,760.00
Materials	LS	1		
	Subtotal Leachate Collection/Treatment Systems Operation:			$6,760.00
14. Administrative				
P.E. Supervisor	HR	30	$135.00	$4,050.00
On-Site Engineer	HR	48	$75.00	$3,600.00
Office Engineer	HR	60	$75.00	$4,500.00
OnSite Technician	HR			
Other	HR	30	$35.00	$1,050.00
Administrative Assistant			Subtotal Administrative:	$13,200.00
			Subtotal of 1-14 Above:	$161,158.02
15. Contingency	10	% of Subtotal of 1-14 Above		$16,115.80
			Subtotal Contingency:	$16,115.80

Description	Unit	Number of Units / Year	Cost / Unit	Annual Cost
16. Site Specific Costs				
			Subtotal Site Specific Costs:	
			ANNUAL LONG-TERM CARE COST ($ / YEAR):	$177,273.82
			Number of Years of Long-Term Care:	30
			TOTAL LONG-TERM CARE COST ($):	$5,318,214.66

VI. CERTIFICATION BY ENGINEER

This is to certify that the Cost Estimates pertaining to the engineering features of this solid waste management facility have been examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, the Cost Estimates are a true, correct and complete representation of the financial liabilities for closing and/or long-term care of the facility and comply with the requirements of Rule 62-701.630 F.A.C. and all other Department of Environmental Protection rules, and statutes of the State of Florida. It is understood that the Cost Estimates shall be submitted to the Department annually, revised or adjusted as required by Rule 62-701.630(4), F.A.C.



Signature

Carlo Lebron, Project Manager
Name and Title (please type)

12/7/12
Date

60815
Florida Registration Number
(please affix seal)

200 W. Forsyth St., Ste. 800
Mailing Address

Jacksonville, FL 32202-4321
City, State, Zip Code

Carlo.Lebron@hdrinc.com
E-Mail address (if available)

(904)-598-8900
Telephone Number

VII. SIGNATURE BY OWNER/OPERATOR

Signature of Applicant

Leonard Marion, Director
Name and Title (please type)

lmarion@co.volusia.fl.us
E-Mail address (if available)

3151 East New York Avenue
Mailing Address

DeLand, FL 32724
City, State, Zip Code

(386)-943-7889
Telephone Number

Financial Assurance Responsibility
Closure and Long-term Care Cost Estimates
Tomoka Farms Road Landfill North Cell, Phase I
Volusia County, Florida
December 2012

Closure and long-term care cost estimates for the Tomoka Farms Road Landfill North Cell, excluding Phase II, are being re-calculated according to 62-701.630(3)(a), FAC. The basis for cost estimates include current pricing, closure design and regulations contained in Chapter 62-701 of the Florida Administrative Code (FAC).

The updated FDEP Form 62-701.900(28) is provided in Attachment R-1. Quotes from third-party sources are provided in Attachment R-2. The 2012 RSMeans Heavy Construction Cost Data 26th Annual Edition was used to estimate some unit costs. In order to correct the costs to region specific, a city factor provided by RSMeans in the manual is used. The Daytona Beach city factor of 0.979 was applied to all unit costs from RSMeans. The page has been provided in Attachment R-2.

CLOSURE COSTS

Monitoring Wells (Item 1)

Monitoring wells were installed during the construction of Phase I of the North Cell and therefore and not included as part of the closure construction estimate.

Slope and Fill (Item 2)

As a part of on-going landfill operations a 12-inch bedding layer will be installed over compacted waste once the intermediate cover grades are achieved. The associated cost of placing this layer is not included in this cost estimate.

Cover Material (Item 3)

The proposed final cover consists of either 40-mil textured LLDPE & double sided geocomposite, and 18" layer of cover soil. The geosynthetic quantities have been adjusted by 4% to account for seams, destructive testing, wastage, anchoring, toe of slope run-out, and booting. The cover soil has been increased by 5% to account for soil bulking and other losses. A slope factor of 1.054 has been accounted in the side slope area for 3:1 side-slope.

Waste Footprint = 65.65 AC
Total Surface Area = Side Slope Area + Top Flat Area
Side Slope Area = 2,766,001 ft^2 (obtained from AutoCAD Civil 3D)
Top Area = 235,476 ft^2 (obtained from AutoCAD Civil 3D)
Total Surface Area = 3,001,477 ft^2

(a) Cover Soil:
Volume of Cover Soil in 18" layer= (3,001,477 ft^2 × 1.5 ft × 1.05/ 27) = 175,086 CY

Please note that the unit price of installed cover soil is based on an average of two quotes from third-party installers. Quotations are provided in Attachment R-2.

(b) Synthetics:
Area of Geosynthetics = (3,001,477 ft^2 × 1.04 / 9) = 346,837 yd^2

Please note that the unit prices of installed geomembrane and geocomposite are based on an average of three quotes from third-party installers. Quotations are provided in Attachment R-2.

Top Soil Cover (Item 4)

The top soil cover consists of 6" layer over the entire closure area. Top soil has been increased by 5% to account for soil bulking and other losses.

Volume of Cover Soil in 6" layer= (3,001,477 ft^2 × 0.5 ft × 1.05/ 27) = 58,362 CY

Please note that the unit price of installed top soil is based on an average of two quotes from third-party installers. Quotations are provided in Attachment R-2.

Vegetation (Item 5)

Sod will be installed on a side slopes for the entire closure area. The top surface closure area will be vegetated by Hydroseeding.

Quantity of sod required = 2,766,001 ft^2 = 307,333 SY

Area of Hydroseeding required = 235,476 ft^2 = 5.41 AC

Please note that the unit prices for installed sod and Hydroseeding are based on an average of three quotes from third-party installers. Quotations are provided in Attachment R-2.

Stormwater Control System (Item 6)

No separate earthwork, grading and ditches are considered as part of North Cell closure as it will be covered in items 2 through 4. Also, the installation of the perimeter ditch and berm installation are part of the landfill's on-going operations and therefore, not included in this updated cost estimate.

- Piping*:
  Total length of 18" downdrain piping required for drainage = 5,222 LF
  Unit Cost of 18" downdrain pipe = $20.50 per LF x 0.979 (City Factor) = $20.07

  Total length of 24" downdrain piping required for drainage = 1,556 LF
  Unit Cost of 24" downdrain pipe = $24.50 per LF x 0.979 (City Factor) = $24.00

  Total length of downdrain pipe = 6,778 LF
  Average Unit cost of downdrain pipe = $20.97 per LF

  Please refer to Attachment R-2 for unit price of downdrain piping.

- Control Structures*:
  Number of control structures, i.e., Baffled Endwall FDOT No. 261= 12

Please refer to Attachment R-2 for unit price of control structures.

- Others*:
  Number of inlets = 42
  Cost per Inlet = $5,745.00
  Total cost of Inlets = $241,290.00

  Assume $2,000 per AC for Sedimentation and Erosion Control.
  Total for Sedimentation and Erosion Control = $2,000 x 65.65 AC = $131,300.00

  Total "Others" Cost = $372,590.00

*Note that quantities are based on FDEP approved cost estimates included as part of the North Cell Closure Permit Renewal Application dated December 6, 2011.

Passive Gas Control (Item 7)
No passive gas control system is proposed as a part of the North Cell closure.

Active Gas Extraction Control (Item 8)
Active gas extraction control will be part of the North Cell closure. The quantities associated with the active gas extraction system required for the North Cell closure were identified in the FDEP approved cost estimates included as part of the North Cell Closure Permit Renewal Application dated December 6, 2011. It should be noted that existing gas extraction system was expanded from December 2011 through April 2012 by installing several vertical wells, associated piping, condensate sumps etc. Out of the installed items, the following items can be considered as part of the active gas extraction system required for North Cell closure.

- 3 vertical wells (275 ft total depth)
- 3 vertical wells required benching
- 3 well heads
- 3 pipe boots
- 1,611 ft of 18-inch header pipe
- 596 ft of 16-inch header pipe
- 399 ft of 4-inch lateral pipe
- 5 condensate sumps
- 7 access points
- One 18-inch and one 16-inch header isolation valve

The active gas extraction system quantities have been updated by taking into account the above listed quantities of the items recently installed. A detailed breakdown of the costs associated with the gas extraction system installation at closure is included in Appendix R-2.

Security System (Item 9)
Perimeter fencing, gates and signs already exists at the facility. A $2,000 lump sum is allocated for additional signs as part of the closure costs.

Closure Permit, Contracts, CQA and Certification (Items 10 & 11)
Professional engineering services will be needed during three phases of the closure process: permitting, construction and certification. The fee for certification of closure includes a professional engineer's time spent at the landfill reviewing test data and submitting the certification report to the FDEP.

Contingency (Item 12)
A 10% of total closure cost will be allocated as a contingency.

Site Specific Costs (Item 13)
The mobilization fee has been estimated to be 5% of Items 1 through 11.

LONG-TERM CARE COSTS

Total long-term care area = 65.65 AC

Ground Water Monitoring (Item 1)
Per previous correspondence with FDEP, the long-term care costs for groundwater monitoring at the facility are included wholly in the long-term care financial assurance for the South Cell.

Surface Water Monitoring (Item 2)

There are seven surface water monitoring locations associated with the North Cell, and all the locations are monitored on a semi-annual basis.

It is estimated that it takes four hours to sample, travel to the site and submit results to FDEP. Lab analysis costs are based upon the facility's master agreement with the lab. Applicable pages from the master agreement are included in Appendix R-2. A detailed cost breakup is provided below:

- Cost Associated with Ammonia as N, Hardness as CaCO3, Organic Carbon, TDS, TSS, BOD, COD, Nitrogen as N, Nitrate as N, Phosphates, Chlorophyll A, and Fecal Coliform = $182.00
- Cost Associated with Iron, Mercury, and Sodium = $31.50
- Cost Associated with 40 CFR Part 258 Appendix I Parameters = $190.00
- Assuming 4 hours of sampling @ $40 per hour
- Total Cost per semi-annual monitoring event = 7 ($182.00 + $31.50 + $190.00) + 40×4 = $2,984.50

Gas Monitoring (Item 3)

There are 8 gas monitoring probes as well as surface monitoring for the North Cell long-term care and all the locations are monitored on a quarterly basis.

It is estimated that it takes approximately 2 days (10 hours per day) to perform monitoring, travel to the site and submit results to the FDEP for both probe monitoring and surface monitoring. The field technician charge is estimated to be $65/hour. Equipment rental for a GEM2000 monitor is $100/day and $60/day for a RKI Eagle Multi Gas Detector (see quotes from AJAX Environmental and Safety Supply in Attachment R-2) and miscellaneous expenses are estimated to be $250. A 15% profit and contingency fee was added to the sum. Assuming monitoring will be performed in 2 days (10 hours per day), the cost estimate per quarterly monitoring event is $2035.50 =115% * ($60*20 + $100*2 + $60*2 + $250).

Leachate Monitoring (Item 4)

Per Chapter 62-701 of the Florida Administrative Code (FAC), annual leachate monitoring is no longer required and therefore, no included as part of this long-term care cost estimates.

Leachate Collection & Treatment System (Item 5)

Maintenance:

- Assume lump sum allocation of $500/year for repairs to piping, valves, etc.

- Jet cleaning of leachate collection system is performed every 5 years for the North Cell @ $7,500 (refer to Attachment R-2).
- Therefore, annual maintenance cost = $2,000.

Impoundments and Aeration Systems: It is assumed that 20 SY of liner repairs will be required every year @ $9 per SY.

Offsite Disposal: The cost is based on average annual generation of 1,000,000 gallons of leachate and $30 per 1,000 gallons of total disposal cost for leachate (disposal cost per Volusia County).

Groundwater Monitoring Well Maintenance (Item 6)
Assume a lump sum amount of $500 per year for well maintenance and replacement.

Gas System Maintenance (Item 7)
To estimate the cost of maintaining the active gas collection system, maintenance of the well field and flare station were taken into consideration. Routine maintenance includes replacing the thermocouples in the flare stack every few months, inspecting and cleaning of the flare arrestor and replacing the bearings on the blower. Installation of replacement collection wells, especially in the years immediately after closure, was budgeted in addition to replacement of the blower every fifteen years. It was assumed a field technician would be needed for two days per month (20 hours @ $65 per hour, $500 misc expenses, and 15% profit and contingency fee) to monitor the collection wells, perform well field adjustments and document readings.

Landscaping (Item 8)
It is anticipated the landfill cap will need landscaping/mowing four times a year.

Unit cost of mowing from 2012 RS Means= $1.70 per 1000 SF × 0.979 = $1.66 per 1000 SF = $72.50 per AC (refer to Attachment R-2)

Total annual mowing cost = $72.50 per AC * 4 = $290.00 per AC

Erosion Control and Cover Maintenance (Item 9)

To account for erosion control and cover maintenance in the post closure care period, reconstruction of the final cover (including sod, liner and soil fill material) and re-grading were considered. An annual average soil loss of 796 CY was calculated using the United Soil Loss Equation (USLE). This is a conservative assumption since it is assumed that 60% of the ground is covered by vegetation. Please refer to Attachment R-3 for further explanation of the USLE equation.

For financial assurance estimation, it is assumed that soil will erode in channels that will cut an average of six inches deep into the final cover.

- Sodding: 7,164 SY = 796 CY * 27 CF/CY * 150% machinery disturbance / (0.5 FT average depth)
- Liner Repair: 1,194 SY = 796 CY * 27 CF/CY * 25% / 0.5 FT
- Soil: 796 CY

Please refer to Attachment R-2 for unit price of sodding.

It was assumed that 25% of the disturbed area will require liner repairs. Replacement soil will include cover soil and top soil. As the unit price of installed top soil is higher, the unit cost of replacement soil was assumed similar to that of top soil. See Item 4 of the closure cost for installed replacement soil.

Stormwater Maintenance (Item 10)
A lump sum amount of $5,000 has been allocated for annual storm water management system maintenance.

Security System Maintenance (Item 11)
A lump sum amount of $500 is assumed as cost associated with fence repairs and other security management.

Utilities (Item 12)
Estimated power requirement for site equipment = $150/month = $1,800/year

Leachate Collection/Treatment Systems Operation (Item 13)
It is assumed that a technician will be needed for an average of eight hours every four weeks to monitor, inspect, and maintain the system.

Administrative Costs (Item 14)
Professional engineering services expected during the long-term care period include semiannual water quality monitoring, water quality technical reports, ten-year long-term care permit renewal applications, stabilization reports and other miscellaneous reporting requirements. Time was added for inspections of the stormwater and landfill cap systems.

Attachment R-1
FDEP Form 62-701.900(28)

Attachment R-2
Third Party Quotes

Tomoka Farms Road Landfill - North Cell
Class I Financial Assurance Closure Cost
Average of Quotations

Item NO.	Description	Unit	Unit Cost			
			ERC	Comanco	Southeast Environmental	Average
1	18" Cover Soil Layer (See Note 1)	CY	$7.50	$13.00	$14.00	$13.50
2	6" Top Vegetative Soil Layer (See Note 1)	CY	$8.50	$13.00	$15.00	$14.00
3	Textured 40-mil LLDPE	SY	$2.88	$4.05	$4.50	$3.81
4	Double Sided Geo-Composite	SY	$4.05	$4.50	$8.10	$5.55
5	Sodding	SY	$1.85	$1.80	$1.80	$1.82
6	Hydroseeding	AC	$2,500.00	$3,500.00	$2,500.00	$2,833.33

Notes:
1. For calculating average cover soil and top soil costs, ERC unit costs were neglected as the unit costs seem low per HDR experience.

Albers, Jonathan

To: Beben, David
Subject: RE: Volusia County - Cost Estimates

AMServiceURLStr: https://Slingshot.hdrinc.com:443/CFSS/control?view=services/FTService

---

From: Beben, David
Sent: Monday, November 26, 2012 1:10 PM
To: Albers, Jonathan
Subject: FW: Volusia County - Cost Estimates

From: Jerry L. Pinder [mailto:jerry.pinder@ercflorida.com]
Sent: Monday, November 26, 2012 12:21 PM
To: Beben, David
Subject: RE: Volusia County - Cost Estimates

THESE cost should be close.

Jerry L. Pinder, President

ERC General Contracting Services, Inc.
890 Carter Road, Suite 170
Winter Garden FL 34787
Phone (407) 656-3900
Fax (407) 656-2128
Mobile (407) 468-1046
WWW.ERCFLORIDA.COM

From: Beben, David [mailto:David.Beben@hdrinc.com]
Sent: Monday, November 26, 2012 12:10 PM
To: Jerry L. Pinder
Cc: Albers, Jonathan
Subject: Volusia County - Cost Estimates

Hi Jerry:

I have a favor to ask. We are collecting cost quotes for the Tomoka Farms Road Landfill in Daytona. It will be for a FDEP regulatory submittal for future closure of their North Cell. A table below is provided with the cost estimates that are needed. Please complete the unit cost for the six items to the best of your knowledge. There is an upcoming closure project in Volusia that we expect to occur in the next couple of months. We'll keep you informed.

Item	Quantity	Unit	Unit Cost	Comments
18" Cover soil Layer (**off-site material**)	221,281	CY	7.50	Installed unit cost including materials, hauling and installation costs.
6" Top vegetative soil (**off-site materials**)	73,760	CY	8.50	Installed unit cost including materials, hauling and installation costs.
Textured 40-mil LLDPE	460,264	SF	.32	Installed unit cost including materials and installation costs.
Double sided geocomposite	460,264	SF	.45	Installed unit cost including materials and installation costs.
Sodding	387,175	SY	1.85	Installed unit cost including materials and installation costs.
Hydro seeding	11.44	AC	2,500	

Thanks,
David

DAVID BEBEN
PE

HDR Engineering, Inc.
Project Engineer

200 West Forsyth St. Suite 800 | Jacksonville, FL 32202
904.598.8923 | f:904.598.8988
david.beben@hdrinc.com | hdrinc.com

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Albers, Jonathan

From: David Scherbaty [dscherbaty@comanco.com]
Sent: Friday, November 30, 2012 8:31 AM
To: Albers, Jonathan
Cc: John Jacobs
Subject: RE: Request for Unit Cost Data for Tomoka Farms Road Landfill

Jonathan,

Please see below. As for the Erosion Control, I wasn't able to get a number for it without knowing what exact type of erosion control you are referring to. Please let me know if you have any questions.

Thanks,

David Scherbaty
Estimator
COMANCO Environmental Corporation
4301 Sterling Commerce Drive
Plant City, Florida 33566-7372
Office: (813) 988-8829
Fax: (813)-386-7364
Email: dscherbaty@comanco.com
Web: www.comanco.com

From: Albers, Jonathan [mailto:Jonathan.Albers@hdrinc.com]
Sent: Tuesday, November 27, 2012 8:50 AM
To: David Scherbaty
Subject: Request for Unit Cost Data for Tomoka Farms Road Landfill

David,

The Tomoka Farms Road Landfill in Volusia County, FL is required per FDEP to provide 3rd party quotes for items in their upcoming closure cost estimate. We would appreciate it if you could provide quotes for the following items on a unit price basis based on:

- Assume off-site borrow source for cover soil and top soil. Estimate typical off-site haul distance, if necessary.
- All costs shall include material, transportation, and installation.
- The costs shall be based on current (2012) prices

Closure Item	Approximate Quantity	Unit
18" Cover Soil	175,000	CY $13.00
6" Top Soil	58,500	CY $13.00
Textured 40-mil Geomembrane	350,000	SY $4.05
Double-Sided 300-mil Geocomposite	350,000	SY $4.50
Turf Sodding	324,000	SY $1.80
Hydroseeding	5.40	AC $3,500.00
Erosion Control	65.0	AC Type?

Any information you might be able to provide would be appreciated. If you have any questions or would like to discuss, please give me a call at 904-598-8916 or email me at jonathan.albers@hdrinc.com.

JONATHAN ALBERS, PE

HDR Engineering, Inc.
Solid Waste Engineer

200 W. Forsyth Street, Suite 800 | Jacksonville, FL 32202
904.598.8916 | c: 806.773.8765
jonathan.albers@hdrinc.com | hdrinc.com

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Albers, Jonathan

From: Earl Holmes [secontracting@windstream.net]
Sent: Wednesday, November 28, 2012 4:27 PM
To: Albers, Jonathan
Subject: Re: Request for Unit Cost Data for Tomoka Farms Road Landfill

Please see the attached estimate.

Closure Item	Approximate Quantity	Unit	Cost	Extension
18" Cover Soil	175,000	CY	$14.00	$2,450,000.00
6" Top Soil	58,500	CY	$15.00	$877,500.00
Textured 40-mil Geomembrane	350,000	SY	$4.50	$1,575,000.00
Double-Sided 300-mil Geocomposite	350,000	SY	$8.10	$2,835,000.00
Turf Sodding	324,000	SY	$1.80	$583,200.00
Hydroseeding	5.40	AC	$2,500.00	$13,500.00
Erosion Control	65.00	AC	?	$0.00
			Total	**$8,334,200.00**

Earl Holmes
President
Southeast Environmental Contracting, Inc.
229-794-3330 Fax 229-794-3332
www.southeastenvironmental.com

From: Albers, Jonathan
Sent: Monday, November 26, 2012 11:30 AM
To: mailto:earl@southeastenvironmental.com
Subject: FW: Request for Unit Cost Data for Tomoka Farms Road Landfill

Mr. Holmes,

I sent this request to your general information email address this morning, but wanted to send it directly to you as well. Thanks.

JONATHAN ALBERS, PE
HDR Engineering, Inc.
Solid Waste Engineer

200 W. Forsyth Street, Suite 800 | Jacksonville, FL 32202
904.598.8916 | c: 806.773.8765
jonathan.albers@hdrinc.com | hdrinc.com

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From: Albers, Jonathan
Sent: Monday, November 26, 2012 8:55 AM
To: 'info@southeastenvironmental.com'
Subject: Request for Unit Cost Data for Tomoka Farms Road Landfill

The Tomoka Farms Road Landfill in Volusia County, FL is required per FDEP to provide 3rd party quotes for items in their upcoming closure cost estimate. We would appreciate it if you could provide quotes for the following items on a unit price basis based on:

- Assume off-site borrow source for cover soil and top soil. Estimate typical off-site haul distance, if necessary.
- All costs shall include material, transportation, and installation.
- The costs shall be based on current (2012) prices

Closure Item	Approximate Quantity	Unit
18" Cover Soil	175,000	CY
6" Top Soil	58,500	CY
Textured 40-mil Geomembrane	350,000	SY
Double-Sided 300-mil Geocomposite	350,000	SY
Turf Sodding	324,000	SY
Hydroseeding	5.40	AC
Erosion Control	65.0	AC

Thanks for any help you may be able to provide. If you have any questions or would like to discuss, please give me a call at 904-598-8916 or email me at jonathan.albers@hdrinc.com.

JONATHAN ALBERS, PE

HDR Engineering, Inc.
Solid Waste Engineer

200 W. Forsyth Street, Suite 800 | Jacksonville, FL 32202
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RSMeans Heavy Construction Cost Data

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015433	CONTRACTOR EQUIPMENT		96.5	96.5		100.4	100.4		100.4	100.4		100.4	100.4		100.9	100.9		100.4	100.4
0241, 31 - 34	SITE & INFRASTRUCTURE, DEMOLITION	123.6	95.0	103.9	111.8	103.3	105.9	111.0	103.3	105.7	103.6	103.3	103.4	109.2	104.0	105.6	111.2	103.3	105.7
0310	Concrete Forming & Accessories	110.1	79.2	83.3	99.3	121.7	118.8	99.3	121.6	118.7	97.3	121.6	118.4	99.0	121.6	118.6	99.6	121.6	118.7
0320	Concrete Reinforcing	104.3	80.7	92.4	103.6	128.8	116.3	103.6	128.8	116.3	103.6	128.8	116.3	103.6	128.8	116.3	103.6	128.8	116.3
0330	Cast-in-Place Concrete	114.1	81.4	101.2	107.8	125.0	114.6	101.0	125.0	110.4	107.0	125.0	114.1	97.1	125.0	108.1	102.6	125.0	111.4
03	CONCRETE	111.5	80.4	96.3	110.6	124.0	117.1	107.1	123.9	115.3	110.0	123.9	116.8	105.2	123.9	114.3	108.0	123.9	115.7
04	MASONRY	134.8	75.6	98.7	104.1	129.8	119.8	96.7	129.8	116.9	97.2	129.8	117.1	95.3	129.8	116.7	98.0	129.8	117.4
05	METALS	94.6	82.4	90.6	99.1	125.2	107.7	99.1	125.0	107.7	103.9	125.0	110.9	96.5	125.0	105.9	95.7	125.0	105.4
06	WOOD, PLASTICS & COMPOSITES	96.5	82.4	88.3	98.6	120.3	111.1	98.6	120.3	111.1	97.1	120.3	110.5	98.6	120.3	111.1	98.6	120.3	111.1
07	THERMAL & MOISTURE PROTECTION	105.0	81.9	95.6	101.2	126.6	111.6	101.3	123.7	110.4	102.6	123.7	111.2	101.3	123.7	110.4	101.3	123.7	110.4
08	OPENINGS	95.7	83.7	92.7	102.4	130.1	109.4	102.4	130.1	109.4	103.1	130.1	109.9	105.1	130.1	111.4	102.4	130.1	109.4
0920	Plaster & Gypsum Board	81.2	81.8	81.6	97.8	120.3	113.8	97.8	120.3	113.8	95.9	120.3	113.3	99.6	120.3	114.4	97.8	120.3	113.8
0950, 0980	Ceilings & Acoustic Treatment	108.8	81.8	90.9	102.0	120.3	114.1	102.0	120.3	114.1	100.2	120.3	113.5	106.3	120.3	115.5	102.0	120.3	114.1
0960	Flooring	119.1	47.5	98.1	94.5	134.4	106.2	94.5	134.4	106.2	94.5	134.4	106.2	94.5	134.4	106.2	94.5	134.4	106.2
0970, 0990	Wall Finishes & Painting/Coating	107.9	24.9	56.7	90.1	117.5	107.0	90.1	117.5	107.0	90.1	117.5	107.0	90.1	117.5	107.0	90.1	117.5	107.0
09	FINISHES	107.9	67.7	85.5	101.7	123.2	113.7	101.8	123.2	113.7	99.9	123.2	112.9	102.9	123.2	114.2	101.8	123.2	113.7
COVERS	DIVS. 10 - 14, 25, 28, 41, 43, 44, 46	100.0	91.0	98.2	100.0	108.6	101.7	100.0	108.6	101.7	100.0	108.6	101.7	100.0	108.6	101.7	100.0	108.6	101.7
21, 22, 23	FIRE SUPPRESSION, PLUMBING & HVAC	94.1	74.6	86.2	100.0	114.7	106.0	100.0	114.7	106.0	100.1	114.7	106.0	94.1	114.7	102.4	100.0	114.7	106.0
26, 27, 3370	ELECTRICAL, COMMUNICATIONS & UTIL.	95.1	75.1	84.8	102.2	109.9	106.2	102.2	109.6	106.0	99.2	110.5	105.1	102.1	109.6	106.0	102.3	109.6	106.1
MF2010	WEIGHTED AVERAGE	101.3	78.3	91.2	102.2	118.7	109.5	101.5	118.6	109.0	102.0	118.7	109.4	99.7	118.6	108.0	101.1	118.6	108.8

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0310	Concrete Forming & Accessories	99.0	121.6	118.6	99.0	121.6	118.6	99.3	122.1	119.1	99.3	122.1	119.1	99.3	121.6	118.7	99.3	121.5	118.6
0320	Concrete Reinforcing	103.6	128.8	116.3	81.2	128.8	105.2	103.6	129.0	116.4	103.6	129.0	116.4	103.6	128.8	116.3	103.6	128.8	116.3
0330	Cast-in-Place Concrete	104.4	125.0	112.5	88.9	125.0	103.1	106.0	126.5	114.1	107.8	126.5	115.2	107.8	125.0	114.6	100.7	124.9	110.2
03	CONCRETE	123.2	123.9	123.5	94.7	123.9	108.9	109.7	124.7	117.0	110.6	124.7	117.4	110.6	123.9	117.0	107.0	123.8	115.2
04	MASONRY	96.9	129.8	117.0	95.3	129.8	116.3	96.4	131.3	117.7	97.2	131.3	118.0	97.2	129.8	117.1	96.5	129.8	116.8
0	METALS	95.9	125.0	105.5	95.6	125.0	105.3	99.1	125.7	107.9	99.1	125.7	107.9	99.1	125.0	107.7	98.9	124.9	107.5
0	WOOD, PLASTICS & COMPOSITES	98.6	120.3	111.1	98.6	120.3	111.1	98.6	120.3	111.1	98.6	120.3	111.1	98.6	120.3	111.1	98.6	120.3	111.1
07	THERMAL & MOISTURE PROTECTION	101.4	123.6	110.4	101.3	123.7	110.4	101.4	127.3	111.9	101.3	127.3	111.9	101.3	123.6	110.4	101.5	123.3	110.4
08	OPENINGS	102.4	130.1	109.4	105.6	130.1	111.8	102.4	130.1	109.4	102.4	130.1	109.4	102.4	130.1	109.4	105.6	130.1	111.8
0920	Plaster & Gypsum Board	97.8	120.3	113.8	97.8	120.3	113.8	97.8	120.3	113.8	97.8	120.3	113.8	97.8	120.3	113.8	97.8	120.3	113.8
0950, 0980	Ceilings & Acoustic Treatment	102.0	120.3	114.1	100.0	120.3	113.4	102.0	120.3	114.1	102.0	120.3	114.1	102.0	120.3	114.1	100.0	120.3	113.4
0960	Flooring	94.5	134.4	106.2	94.5	134.4	106.2	94.5	134.4	106.2	94.5	134.4	106.2	94.5	134.4	106.2	94.5	119.7	101.9
0970, 0990	Wall Finishes & Painting/Coating	90.1	117.5	107.0	90.1	117.5	107.0	90.1	117.5	107.0	90.1	117.5	107.0	90.1	117.5	107.0	90.1	117.5	107.0
09	FINISHES	101.8	123.2	113.7	100.6	123.2	113.2	101.8	123.2	113.7	101.9	123.2	113.7	101.6	123.2	113.6	101.5	120.7	112.2
COVERS	DIVS. 10 - 14, 25, 28, 41, 43, 44, 46	100.0	108.6	101.7	100.0	108.6	101.7	100.0	108.8	101.7	100.0	108.8	101.7	100.0	108.6	101.7	100.0	108.6	101.7
21, 22, 23	FIRE SUPPRESSION, PLUMBING & HVAC	100.0	114.7	106.0	94.1	114.7	102.4	100.0	114.8	106.0	100.0	114.8	106.0	100.0	114.7	106.0	100.0	114.7	106.0
26, 27, 3370	ELECTRICAL, COMMUNICATIONS & UTIL.	102.1	109.6	106.0	98.7	109.6	104.3	102.2	162.3	133.2	102.2	162.3	133.2	101.6	109.9	105.9	102.2	110.5	106.5
MF2010	WEIGHTED AVERAGE	102.8	118.6	109.8	97.6	118.6	106.9	101.8	126.3	112.6	101.9	126.3	112.7	101.8	118.6	109.2	101.7	118.4	109.1

DIVISION		D.C.			DELAWARE									FLORIDA					
		WASHINGTON			DOVER			NEWARK			WILMINGTON			DAYTONA BEACH			FORT LAUDERDALE		
		200 - 205			199			197			198			321			333		
		MAT.	INST.	TOTAL	MAT.	INST.	TOTAL	MAT.	INST.	TOTAL	MAT.	INST.	TOTAL	MAT.	INST.	TOTAL	MAT.	INST.	TOTAL
015433	CONTRACTOR EQUIPMENT		103.2	103.2		116.9	116.9		116.9	116.9		117.0	117.0		98.0	98.0		90.9	90.9
0241, 31 - 34	SITE & INFRASTRUCTURE, DEMOLITION	109.6	92.6	97.9	98.2	111.9	107.6	98.6	111.9	107.8	88.8	112.2	104.9	116.5	89.6	97.9	99.7	77.9	84.6
0310	Concrete Forming & Accessories	97.4	81.1	83.2	98.3	102.7	102.1	100.4	102.7	102.4	101.4	102.7	102.5	95.7	72.1	75.3	95.3	72.8	75.7
0320	Concrete Reinforcing	98.5	89.7	94.1	96.0	102.1	99.1	96.8	102.1	99.5	96.8	102.1	99.5	96.3	77.0	86.6	96.3	76.7	86.4
0330	Cast-in-Place Concrete	129.8	90.0	114.1	95.5	101.9	98.0	85.8	101.9	92.2	92.6	101.9	96.3	91.8	73.9	84.7	96.2	81.0	90.2
03	CONCRETE	115.7	87.0	101.7	97.3	103.2	100.2	92.7	103.2	97.8	95.2	103.2	99.6	91.6	74.8	83.4	93.8	77.5	85.8
04	MASONRY	101.4	81.4	89.2	103.8	96							1.2	93.6	69.4	78.8	93.9	72.2	80.6
05	METALS	96.5	106.6	99.8	103.9	116							5.1	96.1	92.2	94.8	96.0	93.1	95.1
06	WOOD, PLASTICS & COMPOSITES	101.9	79.9	89.2	97.2	102							2.5	100.0	73.6	84.7	95.9	71.4	81.8
07	THERMAL & MOISTURE PROTECTION	100.2	84.9	94.0	97.9	112							4.1	95.1	77.8	88.1	95.1	85.4	91.2
08	OPENINGS	103.0	88.8	99.4	95.6	110.4	99.3	95.6	110.4	99.3	95.3	110.4	99.1	100.2	70.5	92.7	97.9	69.5	90.7
0920	Plaster & Gypsum Board	108.6	79.3	87.7	105.9	102.5	103.5	107.3	102.5	103.9	107.8	102.5	104.0	93.2	73.2	78.9	92.3	71.0	77.1
0950, 0980	Ceilings & Acoustic Treatment	105.8	79.3	88.3	104.2	102.5	103.1	104.2	102.5	103.1	99.5	102.5	101.5	95.8	73.2	80.9	95.8	71.0	79.4
0960	Flooring	115.0	97.2	109.8	97.1	107.6	100.1	97.3	107.6	100.3	96.9	107.6	100.0	117.7	77.1	105.8	117.7	72.6	104.5
0970, 0990	Wall Finishes & Painting/Coating	121.0	86.6	99.8	98.1	102.8	101.0	98.1	102.8	101.0	98.1	102.8	101.0	111.2	78.1	90.8	105.7	74.0	86.2
09	FINISHES	107.0	83.9	94.1	100.1	103.1	101.8	100.6	103.1	102.0	99.4	103.1	101.5	107.1	73.4	88.3	103.9	72.1	87.0
COVERS	DIVS. 10 - 14, 25, 28, 41, 43, 44, 46	100.0	99.4	99.9	100.0	93.7	98.7	100.0	93.7	98.7	100.0	93.7	98.7	100.0	78.3	95.7	100.0	84.8	93.1
21	FIRE SUPPRESSION, PLUMBING & HVAC	100.2	94.2	97.7	99.9	113.4	105.4	100.0	113.4	105.5	100.1	113.4	105.5	99.9	77.0	90.6	99.9	70.6	85.5
2	70 ELECTRICAL, COMMUNICATIONS & UTIL.	98.8	106.0	102.5	96.4	110.1	103.5	100.3	110.1	105.3	98.6	110.1	104.5	98.0	58.4	77.6	98.0	74.3	88.3
M	WEIGHTED AVERAGE	102.4	92.8	98.2	99.5	107.9	103.2	99.4	107.9	103.2	99.1	108.0	103.0	98.8	75.2	88.4	98.1	75.9	88.3

Daytona Beach City Factor = 0.979

33 41 Storm Utility Drainage Piping

33 41 13 – Public Storm Utility Drainage Piping

	33 41 13.40 Piping, Storm Drainage, Corrugated Metal	Crew	Daily Output	Labor-Hours	Unit	2012 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
2860	24" diameter				Ea.	21			21	23.50
2865	30" diameter					24			24	26.50
2870	36" diameter					26.50			26.50	29
2875	48" diameter					35			35	38.50
2880	60" diameter					53			53	58.50
2885	72" diameter				▼	70			70	77
	33 41 13.50 Piping, Drainage & Sewage, Corrug. HDPE Type S									
0010	**PIPING, DRAINAGE & SEWAGE, CORRUGATED HDPE TYPE S**									
0020	Not including excavation & backfill, bell & spigot									
1000	With gaskets, 4" diameter	B-20	425	.056	L.F.	.85	2.21		3.06	4.35
1010	6" diameter		400	.060		2	2.35		4.35	5.85
1020	8" diameter		380	.063		4.15	2.48		6.63	8.40
1030	10" diameter		370	.065		6	2.54		8.54	10.50
1040	12" diameter		340	.071		6.70	2.77		9.47	11.60
1050	15" diameter	▼	300	.080		7.95	3.14		11.09	13.60
1060	18" diameter	B-21	275	.102		12.65	4.12	.48	17.25	20.50
1070	24" diameter		250	.112		15.55	4.53	.53	20.61	24.50
1080	30" diameter		200	.140		22	5.65	.66	28.31	33.50
1090	36" diameter		180	.156		29.50	6.30	.74	36.54	43
1100	42" diameter		175	.160		39.50	6.45	.76	46.71	54.50
1110	48" diameter		170	.165		47	6.65	.78	54.43	62.50
1120	54" diameter		160	.175		88	7.10	.83	95.93	109
1130	60" diameter	▼	150	.187	▼	115	7.55	.88	123.43	140
1135	Add 15% to material pipe cost for water tight connection bell & spigot									
1140	HDPE type S, elbows 12" diameter	B-20	11	2.182	Ea.	61	85.50		146.50	199
1150	15" diameter	"	9	2.667		93	105		198	263
1160	18" diameter	B-21	9	3.111		153	126	14.70	293.70	375
1170	24" diameter		9	3.111		325	126	14.70	465.70	565
1180	30" diameter		8	3.500		515	142	16.55	673.55	800
1190	36" diameter	▼	8	3.500		660	142	16.55	818.55	960
1240	HDPE type S, Tee 12" diameter	B-20	7	3.429		104	134		238	320
1260	15" diameter	"	6	4		155	157		312	415
1280	18" diameter	B-21	6	4.667		218	189	22	429	555
1300	24" diameter		5	5.600		298	226	26.50	550.50	710
1320	30" diameter		5	5.600		595	226	26.50	847.50	1,025
1340	36" diameter		4	7		670	283	33	986	1,200
1360	42" diameter		4	7		735	283	33	1,051	1,275
1380	48" diameter	▼	4	7	▼	1,250	283	33	1,566	1,850
1400	Add to basic installation cost for each split coupling joint									
1402	HDPE type S, split coupling, 12" diameter	B-20	17	1.412	Ea.	7.35	55.50		62.85	93.50
1420	15" diameter		15	1.600		12.25	62.50		74.75	110
1440	18" diameter		13	1.846		21	72.50		93.50	135
1460	24" diameter		12	2		31	78.50		109.50	155
1480	30" diameter		10	2.400		68.50	94		162.50	221
1500	36" diameter		9	2.667		95.50	105		200.50	266
1520	42" diameter		8	3		107	118		225	298
1540	48" diameter	▼	8	3	▼	138	118		256	335
	33 41 13.60 Sewage/Drainage Collection, Concrete Pipe									
0010	**SEWAGE/DRAINAGE COLLECTION, CONCRETE PIPE**									
0020	Not including excavation or backfill									
0050	Box culvert, cast in place, 6' x 6'	C-15	16	4.500	L.F.	206	187		393	510
0060	8' x 8'	▼	14	5.143	▼	300	213		513	655

Florida Department of Transportation
Item Average Unit Cost
From 2011/11/01 to 2012/10/31

Contract Type: CC STATEWIDE
Displaying: VALID ITEMS WITH HITS
From: 0102 1 To: 9999999

Item	No. of Conts	Weighted Average	Total Amount	Total Quantity	Unit Meas	Obs?	Description
0430610223	1	$1,025.00	$1,025.00	1.000	EA	N	U-ENDWALL,STD 261,1:3 SLP, 15"
0430610225	2	$1,030.24	$3,090.73	3.000	EA	N	U-ENDWALL,STD 261,1:3 SLP, 18"
0430610233	1	$3,350.00	$3,350.00	1.000	EA	N	U-ENDWALL,STD 261,1:3 SLP, 30"
0430610329	1	$1,190.00	$1,190.00	1.000	EA	N	U-ENDWALL,STD 261,1:2 SLP, 24"
0430611125	4	$1,211.00	$7,266.00	6.000	EA	N	U-ENDWALL, BAFFLES,STD 261,1:4 SLP, 18"
0430611225	1	$2,716.47	$5,432.94	2.000	EA	N	U-ENDWALL, BAFFLES, STD 261,1:3 SLP,18"
0430611233	2	$2,415.44	$16,908.08	7.000	EA	N	U-ENDWALL,STD 261,BAFFLES,1:3 SLP, 30"
0430611323	1	$1,000.00	$5,000.00	5.000	EA	N	U-ENDWALL, BAFFLES, STD 261,1:2 SLP,15"
0430611325	2	$3,366.67	$10,100.00	3.000	EA	N	U-ENDWALL, BAFFLES, STD 261,1:2 SLP,18"
0430822 25	1	$1,500.00	$1,500.00	1.000	EA	N	CLEANING & SEALING EXIST PIPE JNT,18" CD
0430830	15	$198.82	$443,024.18	2,228.300	CY	N	PIPE FILLING AND PLUGGING
0430950	10	$70.92	$141,921.81	2,001.100	CY	N	DESILTING CONCRETE BOX CULVERT,
0430963 1	3	$22.87	$1,189.04	52.000	LF	N	PVC PIPE FOR BACK OF SIDEWALK, 4"
0430963 2	4	$33.43	$3,108.80	93.000	LF	N	PVC PIPE FOR BACK OF SIDEWALK, NON STAND
0430982121	2	$545.48	$1,090.96	2.000	EA	N	MITERED END SECT, OPTIONAL RD, 12" CD
0430982123	13	$810.44	$20,261.08	25.000	EA	N	MITERED END SECT, OPTIONAL RD, 15" CD
0430982125	32	$965.90	$154,544.50	160.000	EA	N	MITERED END SECT, OPTIONAL RD, 18" CD
0430982129	31	$1,009.83	$115,120.23	114.000	EA	N	MITERED END SECT, OPTIONAL RD, 24" CD
0430982133	15	$1,328.00	$54,447.82	41.000	EA	N	MITERED END SECT, OPTIONAL RD, 30" CD
0430982138	15	$1,771.03	$51,359.77	29.000	EA	N	MITERED END SECT, OPTIONAL RD, 36" CD
0430982140	4	$2,789.66	$13,948.31	5.000	EA	N	MITERED END SECT, OPTIONAL RD, 42" CD
0430982141	4	$3,213.14	$19,278.82	6.000	EA	N	MITERED END SECT, OPTIONAL RD, 48" CD
0430982142	5	$4,582.38	$27,494.26	6.000	EA	N	MITERED END SECT, OPTIONAL RD, 54" CD
0430982143	4	$4,221.00	$16,884.00	4.000	EA	N	MITERED END SECT, OPTIONAL RD, 60" CD
0430982144	1	$5,100.00	$5,100.00	1.000	EA	N	MITERED END SECT, OPTIONAL RD, 66" CD
0430982145	1	$4,913.10	$4,913.10	1.000	EA	N	MITERED END SECT, OPTIONAL RD, 72" CD
0430982625	9	$802.35	$33,698.87	42.000	EA	N	MITERED END SECT, OPT - OTHER, 18" CD
0430982629	3	$1,000.00	$9,000.00	9.000	EA	N	MITERED END SECT, OPT - OTHER, 24" CD
0430982633	5	$1,451.28	$8,707.69	6.000	EA	N	MITERED END SECT, OPT - OTHER, 30" CD
0430982638	2	$2,745.00	$5,490.00	2.000	EA	N	MITERED END SECT, OPT - OTHER, 36" CD
0430982640	2	$2,518.00	$7,554.00	3.000	EA	N	MITERED END SECT, OPT - OTHER, 42" CD
0430982641	2	$6,084.00	$30,420.00	5.000	EA	N	MITERED END SECT, OPT - OTHER, 48" CD
0430982642	2	$4,593.33	$13,780.00	3.000	EA	N	MITERED END SECT, OPT - OTHER, 54" CD
0430982643	2	$3,971.10	$15,884.38	4.000	EA	N	MITERED END SECT, OPT - OTHER, 60" CD
0430984121	1	$1,000.00	$1,000.00	1.000	EA	N	MITERED END SECT, OPTIONAL RD, 12" SD

33 41 Storm Utility Drainage Piping

33 41 13 – Public Storm Utility Drainage Piping

		Crew	Daily Output	Labor-Hours	Unit	2012 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
33 41 13.40	**Piping, Storm Drainage, Corrugated Metal**									
2860	24" diameter				Ea.	21			21	23.50
2865	30" diameter					24			24	26.50
2870	36" diameter					26.50			26.50	29
2875	48" diameter					35			35	38.50
2880	60" diameter					53			53	58.50
2885	72" diameter					70			70	77
33 41 13.50	**Piping, Drainage & Sewage, Corrug. HDPE Type S**									
0010	**PIPING, DRAINAGE & SEWAGE, CORRUGATED HDPE TYPE S**									
0020	Not including excavation & backfill, bell & spigot									
1000	With gaskets, 4" diameter	B-20	425	.056	L.F.	.85	2.21		3.06	4.35
1010	6" diameter		400	.060		2	2.35		4.35	5.85
1020	8" diameter		380	.063		4.15	2.48		6.63	8.40
1030	10" diameter		370	.065		6	2.54		8.54	10.50
1040	12" diameter		340	.071		6.70	2.77		9.47	11.60
1050	15" diameter		300	.080		7.95	3.14		11.09	13.60
1060	18" diameter	B-21	275	.102		12.65	4.12	.48	17.25	20.50
1070	24" diameter		250	.112		15.55	4.53	.53	20.61	24.50
1080	30" diameter		200	.140		22	5.65	.66	28.31	33.50
1090	36" diameter		180	.156		29.50	6.30	.74	36.54	43
1100	42" diameter		175	.160		39.50	6.45	.76	46.71	54.50
1110	48" diameter		170	.165		47	6.65	.78	54.43	62.50
1120	54" diameter		160	.175		88	7.10	.83	95.93	109
1130	60" diameter		150	.187		115	7.55	.88	123.43	140
1135	Add 15% to material pipe cost for water tight connection bell & spigot									
1140	HDPE type S, elbows 12" diameter	B-20	11	2.182	Ea.	61	85.50		146.50	199
1150	15" diameter	"	9	2.667		93	105		198	263
1160	18" diameter	B-21	9	3.111		153	126	14.70	293.70	375
1170	24" diameter		9	3.111		325	126	14.70	465.70	565
1180	30" diameter		8	3.500		515	142	16.55	673.55	800
1190	36" diameter		8	3.500		660	142	16.55	818.55	960
1240	HDPE type S, Tee 12" diameter	B-20	7	3.429		104	134		238	320
1260	15" diameter	"	6	4		155	157		312	415
1280	18" diameter	B-21	6	4.667		218	189	22	429	555
1300	24" diameter		5	5.600		298	226	26.50	550.50	710
1320	30" diameter		5	5.600		595	226	26.50	847.50	1,025
1340	36" diameter		4	7		670	283	33	986	1,200
1360	42" diameter									1,275
1380	48" diameter									1,850
1400	Add to basic installation cost for each split									93.50
1402	HDPE type S, split coupling, 12" diam									110
1420	15" diameter									135
1440	18" diameter									155
1460	24" diameter									221
1480	30" diameter									266
1500	36" diameter									298
1520	42" diameter									335
1540	48" diameter									
33 41 13.60	**Sewage/Drainage Coll**									
0010	**SEWAGE/DRAINAGE COLLECTION, C**									
0020	Not including excavation or backfill									
0050	Box culvert, cast in place, 6' x 6'	C-15	16	4.500	L.F.	206	187		393	510
0060	8' x 8'		14	5.143		300	213		513	655

RS Means 2012 Inlet Cost:

A single inlet includes a tee and 45 degree elbow along with an approximately 50 SY concrete pad.

City Factor = 0.979

Total Cost for Two Inlets = 2 * 0.979 * ($375+$555)*1.15 = $2,095
Total Cost of Concrete (from FDOT) = 50 * $73 = $3,650

Total Cost of Double Inlet = **$5,745**

Florida Department of Transportation
Item Average Unit Cost
From 2011/11/01 to 2012/10/31

Contract Type: CC STATEWIDE
Displaying: VALID ITEMS WITH HITS
From: 0102 1 To: 9999999

Item	No. of Conts	Weighted Average	Total Amount	Total Quantity	Unit Meas	Obs?	Description
0334 1 14	15	$83.34	$5,474,794.67	65,694.700	TN	N	SUPERPAVE ASPHALTIC CONC, TRAFFIC D
0334 1 15	1	$78.15	$39,223.49	501.900	TN	N	SUPERPAVE ASPHALTIC CONC, TRAFFIC E
0334 1 22	16	$88.70	$11,614,267.82	130,944.300	TN	N	SUPERPAVE ASPH CONC, TRAF B, PG76-22
0334 1 23	28	$92.55	$35,834,707.41	387,205.170	TN	N	SUPERPAVE ASPH CONC, TRAF C, PG76-22
0334 1 24	21	$92.22	$22,430,430.88	243,240.360	TN	N	SUPERPAVE ASPH CONC, TRAF D, PG76-22
0334 1 25	6	$85.00	$16,057,507.70	188,913.700	TN	N	SUPERPAVE ASPH CONC, TRAF E, PG76-22
0337 7 5	21	$121.21	$13,455,440.68	111,008.360	TN	N	ASPH CONC FC, INC BIT/RUBBER, FC-5
0337 7 22	37	$116.34	$30,243,196.72	259,950.300	TN	N	ASPH CONC FC,INC BIT,FC-5,PG76-22
0337 7 30	7	$98.59	$1,566,758.71	15,891.200	TN	N	ASPH CONC FC,TRAFFIC B,FC-9.5,RUBBER
0337 7 31	6	$119.81	$1,750,022.61	14,607.130	TN	N	ASPH CONC FC,TRAFFIC B,FC-12.5,RUBBER
0337 7 32	22	$110.23	$8,965,706.42	81,335.440	TN	N	ASPH CONC FC,TRAFFIC C,FC-9.5,RUBBER
0337 7 33	31	$102.21	$17,648,981.64	172,668.783	TN	N	ASPH CONC FC,TRAFFIC C,FC-12.5,RUBBER
0337 7 35	1	$86.89	$389,458.36	4,482.200	TN	N	ASPH CONC FC,TRAFFIC D,FC-12.5,RUBBER
0337 7 40	12	$97.51	$4,994,639.31	51,220.300	TN	N	ASPH CONC FC,TRAFFIC B,FC-9.5,PG 76-22
0337 7 41	2	$104.63	$2,016,250.10	19,270.700	TN	N	ASPH CONC FC,TRAFFIC B,FC-12.5,PG 76-22
0337 7 42	12	$100.84	$7,504,748.72	74,421.740	TN	N	ASPH CONC FC,TRAFFIC C,FC-9.5,PG 76-22
0337 7 43	15	$93.94	$10,529,603.25	112,084.700	TN	N	ASPH CONC FC,TRAFFIC C,FC-12.5,PG 76-22
0337 7 45	9	$92.34	$5,482,009.62	59,369.100	TN	N	ASPH CONC FC,TRAFFIC D,FC-12.5,PG 76-22
0337 7 58	1	$91.45	$316,801.09	3,464.200	TN	N	ASPH CONC FC,TRAFFIC D,FC-12.5,PG 82-22
0339 1	83	$138.20	$3,549,157.91	25,681.470	TN	N	MISCELLANEOUS ASPHALT PAVEMENT
0341 70	2	$5.14	$250,452.15	48,723.000	SY	N	ASPHALT RUBBER MEMBRANE INTERLAYER
0350 1 1	1	$35.00	$19,915.00	569.000	SY	N	PLAIN CEMENT CONC PAVT, 6"
0350 1 3	1	$72.90	$9,404.10	129.000	SY	N	PLAIN CEMENT CONC PAVT, 8"
0350 1 4	1	$63.00	$1,380,015.00	21,905.000	SY	N	PLAIN CEMENT CONC PAVT, 9"
0350 1 5	1	$55.00	$720,445.00	13,099.000	SY	N	PLAIN CEMENT CONC PAVT, 10"
0350 2 10	1	$336.00	$19,152.00	57.000	SY	N	CEMENT CONC PAVT REINFORCED,12"
0350 72	3	$1.79	$419,625.42	234,325.000	LF	N	CLEANING & RESEALING JOINTS - CONC PVMT
0350 78	2	$2.04	$21,890.40	10,740.000	LF	N	CLEANING & SEALING RAN CRACKS CONC PVMT
0352 70	3	$4.85	$772,009.00	159,099.000	SY	N	GRINDING CONCRETE PAVT
0353 70	1	$395.00	$2,363,285.00	5,983.000	CY	N	CONC PAVT SLAB REPLACEMENT
0400 0 11	30	$448.21	$4,078,890.56	9,100.486	CY	N	CONC CLASS NS, GRAVITY WALL
0400 1 2	44	$839.90	$525,119.40	625.220	CY	N	CONC CLASS I, ENDWALLS
0400 1 11	6	$441.14	$304,826.18	691.000	CY	N	CONC CLASS I, RETAINING WALLS
0400 2 1	5	$1,085.30	$107,227.86	98.800	CY	N	CONC CLASS II, CULVERTS
0400 2 2	4	$1,656.00	$146,887.00	88.700	CY	N	CONC CLASS II, ENDWALLS

Tomoka Farms Road Landfill - North Cell
Class I Financial Assurance Closure Cost
Estimates Landfill Gas Collection System

Item NO.	Description	Quantity	Unit	Unit Cost				2011 Total Cost	2012 Total Cost [2]
				Shaw Environmental	Comanco	SCS Field Services	Average		
1	Mobilization/Demobilization	1	LS	$12,400.00	$5,500.00	$15,000.00	$10,966.67	$10,966.67	$11,186.00
2	Wellhead Assembly	17	EA	$500.00	$700.00	$620.00	$606.67	$10,313.33	$10,519.60
3	Drilling of 36" borehole and completion of Vertical Well (0'-274')	274	LF	$131.00	$185.00	$140.00	$152.00	$41,648.00	$42,480.96
4	Drilling of 36" borehole and completion of Vertical Well (275'-549')	275	LF	$93.00	$135.00	$120.00	$116.00	$31,900.00	$32,538.00
5	Drilling of 36" Borehole and Completion of Vertical Well (550' - 999')	450	LF	$78.50	$120.00	$100.00	$99.50	$44,775.00	$45,670.50
6	Drilling of 36" Borehole and Completion of Vertical Well (1,000'+)	878	LF	$76.00	$100.00	$98.00	$91.33	$80,190.67	$81,794.48
7	Benching	14	EA	$400.00	$250.00	$350.00	$333.33	$4,666.67	$4,760.00
8	18" HDPE SDR 17 Header Pipe (0'-499)	318	LF	$52.00	$80.00	$66.00	$66.00	$20,988.00	$21,407.76
9	16" HDPE SDR 17 Header Pipe (0'-499')	349	LF	$50.00	$72.00	$61.00	$61.00	$21,289.00	$21,714.78
10	6" HDPE SDR 11 Lateral Pipe (0'-499')	499	LF	$20.00	$17.00	$26.00	$21.00	$10,479.00	$10,688.58
11	6" HDPE SDR 11 Lateral Pipe (500'-1,499')	1000	LF	$18.00	$15.00	$25.00	$19.33	$19,333.33	$19,720.00
12	6" HDPE SDR 11 Lateral Pipe (1,500'+)	1177	LF	$17.00	$14.00	$24.00	$18.33	$21,578.33	$22,009.90
13	4" HDPE SDR 11 Lateral Pipe (0'-499')	499	LF	$15.00	$21.00	$29.00	$21.67	$10,811.67	$11,027.90
14	4" HDPE SDR 11 Lateral Pipe (500'-1,499')	1000	LF	$14.00	$20.00	$25.00	$19.67	$19,666.67	$20,060.00
15	4" HDPE SDR 11 Lateral Pipe (1,500'+)	584	LF	$13.00	$19.00	$24.00	$18.67	$10,901.33	$11,119.36
16	Header/Condensate Access Point	3	EA	$2,300.00	$5,000.00	$3,700.00	$3,666.67	$11,000.00	$11,220.00
17	Condensate Sump	2	EA	$16,000.00	$28,000.00	$29,400.00	$24,466.67	$48,933.33	$49,912.00
18	Pipe Boot	17	EA	-	$500.00	$600.00	$366.67	$6,233.39	$6,358.06
								TOTAL =	$434,187.88

Notes:
1. Unit Prices are based on the bids received from Shawn Environmental, Comanco, and SCS Field Services for "Landfill Gas Collection System Installation" Project at Tomoka Farms Road Landfill (June 2011)
2. Inflation Factor of 1.020 Sourced from link Below
http://www.dep.state.fl.us/waste/categories/swfr/pages/CostEstimates.htm

09-B-76KW

ATTACHMENT A
REVISION 1

SOLID WASTE DIVISION

Organics	Price Per Test	*Metals*	Price Per Test
Lindane	$25.00	Aluminum	$7.00
Endrin	$25.00	Antimony	$7.00
Methoxychlor	$25.00	Arsenic	$7.00
Toxaphene	$25.00	Barium	$7.00
2, 4-D	$25.00	Beryllium	$7.00
2, 4, 5-TP (silvex)	$25.00	Cadmium	$7.00
Ethylene Dibromide	$25.00	Calcium	$7.00
Vinyl Chloride	$5.00	Chromium	$7.00
1, 2-Dichloroethane	$5.00	Copper	$7.00
1, 1, 1-Trichloroethane	$5.00	Cobalt	$7.00
Trichloroethene	$5.00	Iron	$7.00
Tetrachloroethene	$5.00	Lead	$7.00
Benzene	$5.00	Magnesium	$7.00
Carbon Tetrachloride	$5.00	Manganese	$7.00
1,3-Dichlorobenzene	$5.00	Mercury	$17.50
Tolune	$5.00	Nickel	$7.00
Xylenes (total)	$5.00	Potassium	$7.00
1,2,4-Trichlorobenzene	$5.00	Selenium	$7.00
1,4-Dichlorobenzene	$5.00	Silver	$7.00
1,2-Dichlorobenzene	$5.00	Sodium	$7.00
Chlorobenzene	$5.00	Thallium	$7.00
1,1-Dichloroethylene	$5.00	Tin	$7.00
cis-1,2-Dichloroethylene	$5.00	Vanadium	$7.00
1,2-Dichloropropane	$5.00	Zinc	$7.00
Ethylbenzene	$5.00	Toxicity Characteristic Leaching Procedure (TCLP)	$75.00
Styrene	$5.00	Arsenic	$7.00
Trans-1,2-Dichloroethylene	$5.00	Barium	$7.00
Dichloromethane	$5.00	Cadmium	$7.00
1,1,2-Trichloroethane	$5.00	Chromium	$7.00
Trihalomethane	$35.00	Lead	$7.00
Chlorinated Phenols	$150.00	Mercury	$17.50
Purgable Halocarbons 601/8260	$75.00	Selenium	$7.00
Purgable Volitals	$75.00	Silver	$7.00
Purgable Aromatics 602/8260	$40.00	TCPL Organics – Price includes extraction plus methods 8260,8270,8151,8081	$625.00
Total Organic Halogens	$120.00	***Orangic & Demands***	**Price Per Test**
Total Recovery Hydrocarbon/FLPRO	$65.00	Biochemical Oxygen Demand	$20.00
Polynuclear Aromatic Hydrocarbs	$90.00	Chemical Oxygen Demand	$15.00
Organic Toxic Pollutants – VOC	$75.00	Oil & Grease	$45.00
Organic Toxic Pollutants – BNA	$150.00	Phenols, Total	$20.00
Organic Toxic Pollutants – Pesticides	$125.00	Total Organic Carbon	$15.00
Organic Toxic Pollutants – VOC	$75.00	Total Inorganic Carbon	$15.00

Pages from Volusia County's Master Agreement

09-B-76KW

ATTACHMENT A

REVISION 1

Nutrients	Price Per Test	*Groups*	Price Per Test
Ammonia Nitrogen	$15.00	**Hazardous Waste Characterization**	
Ammonium	$15.00	Reactive Cyanide	$50.00
Kjeldahl Nitrogen, Total	$17.00	Reactive Sulfide	$50.00
Nitrate Nitrogen	$8.00	**Metals**	Price Per Test
Nitrite Nitrogen	$8.00	RCRA Metals (8)	$56.00
Nitrogen, Total	$30.00	Priortiy Pollutant Metals (13)	$85.00
Organic Nitrogen	$32.00	TAL Metals	$125.00
Mircobiological	Price Per Test	**Semi-Volatile Organics**	Price Per Test
Fecal Coliform	15	PAH's by EPA 625 or 8270C	90
Total Coliform	15	Base/Neutrals by EPA 625 or 8270C, PP or TCL list	$125.00
Residue/Solids	Price Per Test	Base/Neutrals and Acid Extractables by EPA 625 or 8270C, PP or TCL List	$150.00
Total Dissolved Solids	$10.00	BNA RCRA List with TCLP extraction (EPA 1311 & 8270C)	$200.00
Total Suspended Solids	$10.00	STARS PAH's by EPA 8270C	$90.00
Percent Solids	$5.00	PCB's by EPA 8082	$70.00
Field Test	Price Per Test	Pesticides by EPA 8081	$100.00
Total Well Depth	$0.00	Pesticides & PCB's by EPA 8081/8082	$150.00
Water Elevation	$0.00	Herbicides-WATER by EPA 8151 or 515.1	$135.00
Temperature	$0.00	Herbicides-SOIL by EPA 8151	$175.00
Specific Conductance	$0.00	**Toxicity Characteristic Leaching Procedure (TCLP)**	Price Per Test
Dissolved Oxygen	$0.00	TCLP Metals	$66.50
pH	$0.00	TCLP Volatile Organics	$75.00
Turbidity	$0.00	TCLP Pesticides	$100.00
Miscellaneous	Price Per Test	TCLP Herbicides	135
Bicarbonates as HCO_3	$10.00	Full TCLP	675
Calcium Hardness as $CaCO_3$	$7.00	AHE Extraction	75
Chloride	$8.00	SPLP Extraction	50
Color	$5.00	**Volitile Organics**	Price Per Test
Cyanide	$20.00	BTEX + MTBE by EPA 624 or 8260B	40
Corrosivity	$20.00	VOHs by EPA 624 or 8260B	75
Flouride	$8.00	VOC's by EPA 624 or 8260B (chlorinated and aromatic compounds)	75
Hydrogen Sulfide	$20.00	VOC's by EPA 8021 (chlorinated and aromatic compounds)	90
Odor	$5.00	VOC's by GC/MS EPA 624 or 8260B	75
pH	$5.00	NYSDEC STARS List VOC's by EPA 8260B	75
Sulfate	$8.00	**Miscellaneous**	Price Per Test
Total Alkalinity	$10.00	40 CFR Part 258 Appendix I	$190.00
Total Hardness as $CaCO_3$	$7.00	40 CFR Part 258 Appendix II	$750.00
Total Phosphorus	$15.00	Primary Metals 62-550.310(1)(a)	$94.50
Total Phosphate	$15.00	Primary VOC 62-550.310(2)(C)	$75.00
Chlorophyll A	$35.00	Full Primary Drinking Water Scan 62-550.310	$1,000.00
		Secondary Drinking Water Scan 62-550.320(1)	$135.00
		Field Parameters	0
Hourly Rate for time in field during regular working hours (8:00 a.m. to 5:00 p.m. Monday through Friday			40
Hourly Rate for time in field after regular working hours (nights, weekends and county recognized holidays			75
		GRAND TOTAL	$17,475.80

09-B-76KW

ATTACHMENT A

REVISION 1

Definitions			
BNA = Base, Neutral, Acid extractable organics			
BTEX = Benzene, Toluene, Ethylbenzene, Xylenes			
CFR = Code of Federal Regulations			
MTBE = Methyl Tert-Butyl Ether			
PAHs = Polynuclear Aromatic Hydrocarbons			
PCBs = Polychlorinated Biphenyls			
RCRA = Resource Conservation and Recovery Act			
SPLP = Synthetic Precipitation Leaching Procedure			
TAL = Target Analyte List			
TCLP = Toxicity Characteristic Leaching Procedure			
TRPH = Total Recoverable Petroleum Hydrocarbons			
VOAs = Volatile Organic Aromatics			
VOCs = Volatile Organic Compunds			
VOHs - Volatile Organic Halogens			

Pace Analytical Services, Inc.
8 East Tower Circle
Ormond Beach, FL 32174
386.672.5668
fax 386.673.4001

Pace Quote No.: 10-0241

Date: 7/14/10

To: Volusia County Solid Waste
1990 Tomoka Farms Rd.
Port Orange, FL 32128
Attn: Jennifer Stirk
Email: jstirk@co.volusia.fl.us
Project Name: Additional Parameters
Start Date: as required

Duration: as required
Samples Per Day: NA
Report Results: NA
Deliverable: Florida
Surcharge: NA
Turnaround: 10 business days
TAT Surcharge: NA

Phone: 386-947-2952
Fax:
P.O. Number:
Qualifiers: NA
Special Analytes: NA
Shipping: NA
Shipping Charges: NA
Client generated from
EDD: PacePort
Primary Lab: Ormond Beach
Sampling Org.: Pace/client
Hourly Rate: NA
Pace Contact:
Paul Jackson
813.731.1595
Paul.Jackson@pacelabs.com

Qty	Matrix	Test Description	Method	Unit Price	Total
NA	water	Ethane/Ethene	Microseeps SOP-AM20GAx	$96.00	NA
NA	water	2-Butanone	8260	$75.00	NA
NA	water	Mercury, Low-level (field QC samples are invoiced at the same unit price)	1631E	$85.00	NA
NA	water	Solids, Total Volatile	160.4	$20.00	NA
NA	water	Molybdenum (when run with >3 other 200.7/6010 analytes	200.7/6010	$7.00	NA
NA	water	Organophosphorus Pesticides	8141	$145.00	NA
				Estimated Project Total	NA

To: Volusia County Solid Waste
Attn: Jennifer Stirk

Pace Quote No.: 10-0241
Pace Contact: Paul R. Jackson

Notes:

Please write Pace quotation number on chain of custody.
Terms and conditions as follows unless superceded by existing MSA or contract.

We appreciate the opportunity to be of service to you.
Please call Paul Jackson at 813.731.1595 for questions concerning this quotation.

Request a Catalog

Rental Products A-Z

AquiStar DL-2
Bios Dry Cell Calibrator
GeoTech GeoPump
HACH DR 820
Horiba U-22XD
Innov-X XRF Anylyzer
In-Situ Level Troll 500
In-Situ Level Troll 700
In-Situ Rugged Reader
INW PS-9800
LaMotte 2020 Turbidity Meter
Landtec GEM 2000 Landfill Gas Monitor
Ludlum NORM Meter
Magellan Handheld GPS
Masterflex Peristaltic Pump
Myron Ultrameter II 6P
Pipehorn Magnetic Pipe Locator
PROACTIVE MEGA-MONSOON™
PROACTIVE MEGA-TYPHOON™
PROACTIVE MONSOON™
PROACTIVE SS Hurricane™
PROACTIVE SS MEGA-TYPHOON™
PROACTIVE SS MONSOON™
QED 12 Volt Compressor
QED MP10 Controller
QED Sample Pro
Quest Noise Dosimeter
RAE MiniRAE 2000
RAE MultiRAE Plus PID
RAE PGM-7200
RKI Eagle 4 Gas Monitor
RKI Single Gas Monitor
SKC Air Sampling Pump
Soil Sampling Kit
Thermo 580B 10.6 Lamp
Thermo 580B 11.8 Lamp
Thermo DataRam PDR Series
Thermo Foxboro TVA 1000
Thermo Foxboro TVA 1000 PID/FID
Thermo GasTech GT-402
Trimble GeoExplorer 2005
Trimble Hurricane Antenna
TSI Q-Trak
YSI 55
YSI 600XL
YSI 600XLM
YSI 6820
YSI 6920

Supplies A-Z

Alconox/Liquinox
Calibration Gasses
Calibration Solutions
Drum Labels
Dust Masks/Respirators
EcoBailers
EcoPlug Well Caps
Ear Plugs
Eyewash Station
Filters
First-Aid Kits

GEM 2000 Landfill Gas Monitor CH4/CO2/O2

Rent for:	$100-Day	$350-Week	$1,400-Month

Rental Information:
Call 1-877-386-2480
e-mail sales@ajaxrentals.com
Submit A Quick Online Rentals Reservation

The GEM2000 portable instrument is designed for analyzing Landfill Gas (LFG) composition and calculating flow. The GEM2000 combines the capabilities of the now discontinued GA-90 for monitoring gas migration probes and the GEM-500 for monitoring gas extraction systems. The GEM2000 is certified Intrinsically Safe and offers improved speed and accuracy. It also measures and displays Btu content, temperature (with optional Temperature Probe) relative and atmospheric pressures as well as CH4 LEL (Lower Explosive Limit).

Landtek_Gem_2000_Manual.pdf
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LANDTEC

Click for Larger Image
Manufacturers Website

Features

- Measures % CH4, CO2 and O2Volume, static pressure and differential pressure
- Calculates balance gas, flow (SCFM) and calorific value (KW or BTU)
- Displays % LEL of CH4, and user-defined comments
- Records site and well conditions
- Extended operation (10 - 14 hrs use from one charge)
- Certified intrinsically safe for landfill use
- Dual Mode Two instruments in one (GA and GEM mode)

Benefits

- Designed specifically for use on landfills to monitor landfill gas (LFG) extraction systems, flares, and migration control systems.
- No need to take more than one instrument to site.
- Can be used for routine sub-surface migration monitoring of landfill site perimeter probes.
- Measures gas composition, pressure and flow in gas extraction systems.
- The user is able to set up comments and questions to record information at site and at each sample point.
- Ensures consistent collection of data for better analysis.
- Allows balancing of gas extraction systems.

Request a Catalog

Rental Products A-Z

AquiStar DL-2
Bios Dry Cell Calibrator
GeoTech GeoPump
HACH DR 820
Horiba U-22XD
Innov-X XRF Anylyzer
In-Situ Level Troll 500
In-Situ Level Troll 700
In-Situ Rugged Reader
INW PS-9800
LaMotte 2020 Turbidity Meter
Landtec GEM 2000 Landfill Gas Monitor
Ludlum NORM Meter
Magellan Handheld GPS
Masterflex Peristaltic Pump
Myron Ultrameter II 6P
Pipehorn Magnetic Pipe Locator
PROACTIVE MEGA-MONSOON™
PROACTIVE MEGA-TYPHOON™
PROACTIVE MONSOON™
PROACTIVE SS Hurricane™
PROACTIVE SS MEGA-TYPHOON™
PROACTIVE SS MONSOON™
QED 12 Volt Compressor
QED MP10 Controller
QED Sample Pro
Quest Noise Dosimeter
RAE MiniRAE 2000
RAE MultiRAE Plus PID
RAE PGM-7200
RKI Eagle 4 Gas Monitor
RKI Single Gas Monitor
SKC Air Sampling Pump
Soil Sampling Kit
Thermo 580B 10.6 Lamp
Thermo 580B 11.8 Lamp
Thermo DataRam PDR Series
Thermo Foxboro TVA 1000
Thermo Foxboro TVA 1000 PID/FID
Thermo GasTech GT-402
Trimble GeoExplorer 2005
Trimble Hurricane Antenna
TSI Q-Trak

RKI Eagle 1 to 6 Gas Meter

Rent 2 Gas LEL/02 for:	$50-Day	$180-Week	$550-month
Rent 4 Gas LEL/O2/H2S/CO for:	$60-Day	$220-Week	$660-month

Rental Information:
Call 1-877-386-2480
e-mail sales@ajaxrentals.com
Submit A Quick Online Rentals Reservation

The EAGLE's ergonomic design offers easy access to controls such as autocalibration, alarm silence, demand zero, peak hold and a wide variety of other features. Each channel has 2 alarm levels plus TWA and STEL alarms for toxic channels. Alarm levels are adjustable and can be latching or self resetting.

RKI_Eagle_Manual.pdf
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Eagle_Datasheet.pdf
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Click for Larger Image

Manufacturers Website

Standard features on the EAGLE are not available on most other competitive units such as ppm/LEL hydrocarbon detection (5 ppm resolution) and a methane elimination switch for environmental applications. For quick response and recovery, the EAGLE has a strong internal pump which can draw samples from over 125 feet. The EAGLE will continuously operate for over 30 hours on alkaline batteries or 18 hours on Ni-Cads. Many accessories such as long hoses, special probes, datalogging, continuous operation adapters, remote alarms and strobes, dilution fittings, inter-nal hydrophobic filter, etc, are available to help satisfy almost any application. Rugged, weather resistant, easy to operate and maintain, the EAGLE is the industry's answer to portable gas detection in many applications, including land surey.

Features

- Simultaneous detection of up to 6 different gases
- Wide variety of field proven gas sensors available
- IR Sensors available for CO2, %LEL CH4, and 0-100% volume CH4
- Transformer testing version available

FLORIDA JETCLEAN

HIGH PRESSURE WATER JETTING – EXPLOSION PROOF INSPECTION
PIPE LOCATING – NO DIG REPAIRS – VACUUM TRUCK SERVICES

7538 Dunbridge Drive
Odessa, FL 33556
www.floridajetclean.com

TEL : 813-792-7876
800-226-8013
FAX : 813-926-4616

PROPOSAL

DATE : 12/4/12
TO : Jonathan Albers – HDR
FROM : Ralph Calistri (floridajetclean@yahoo.com)
SUBJECT : 2012 Volusia County Landfill LCS Maintenance Proposal

Thank you for your inquiry. We confirm our capability and interest in providing the required leachate collection system services for HDR at the Volusia County landfill.

Based on prior work at the project location we quote as follows:

High-pressure water-jetting of roughly 10,000' of existing landfill HDPE leachate collection piping at the above location $ 7,500.00

Subject to:

- An adequate no charge on site water for jetcleaning.
- Exposed and opened cleanouts/manholes at ground level.
- Continuity of access allowing work to be carried out on a single mobilization
- Standby time chargeable at $200.00 per hour should delays not of our making delay progress e.g. bad weather, access problems, high leachate flow levels etc.
- Payment : net 30 days

Please call with questions or to schedule service.

Thank you.

Ralph Calistri - Florida Jetclean - 800-226-8013

32 01 30 – Operation and Maintenance of Site Improvements

32 01 30.10 Site Maintenance

		Crew	Daily Output	Labor-Hours	Unit	2012 Bare Costs Material	Labor	Equipment	Total	Total Incl O&P
	Spray after mulch	1 Clab	48	.167	M.S.F.		5.85		5.85	9
6370	Tree maintenance									
7100	Clear and grub trees, see Section 31 11 10.10									
7140	Cutting and piling trees, see Section 31 13 13.20									
7160	Fertilize, tablets, slow release, 30 gram/tree	1 Clab	100	.080	Ea.	.52	2.81		3.33	4.89
7200	Guying, including stakes, guy wire & wrap, see Section 32 94 50.10									
7280	Planting, trees, Deciduous, in prep. beds, see Section 32 93 43.20									
7300	Removal, trees see Section 32 96 43.20									
7400	Pest control, spray	1 Clab	24	.333	Ea.	23.50	11.70		35.20	44
7420	Systemic	"	48	.167	"	24	5.85		29.85	35.50
7430										

32 01 90 – Operation and Maintenance of Planting

32 01 90.13 Fertilizing

0010	FERTILIZING									
0100	Dry granular, 4#/M.S.F., hand spread	1 Clab	24	.333	M.S.F.	2.59	11.70		14.29	21
0110	Push rotary		140	.057	"	2.59	2.01		4.60	5.95
0112	Push rotary, per 1076 feet squared		130	.062	Ea.	2.59	2.16		4.75	6.15
0120	Tractor towed spreader, 8'	B-66	500	.016	M.S.F.	2.59	.72	.49	3.80	4.47
0130	12' spread		800	.010		2.59	.45	.31	3.35	3.87
0140	Truck whirlwind spreader		1200	.007		2.59	.30	.21	3.10	3.53
0180	Water soluable, hydro spread, 1.5#/M.S.F.	B-64	600	.027		2.66	.93	.59	4.18	4.99
0190	Add for weed control					.45			.45	.50

32 01 90.19 Mowing

0010	MOWING									
1650	Mowing brush, tractor with rotary mower									
1660	Light density	B-84	22	.364	M.S.F.		16.95	15.60	32.55	42.50
1670	Medium density		13	.615			28.50	26.50	55	72
1680	Heavy density		9	.889			41.50	38	79.50	105
2000	Mowing, brush/grass, tractor, rotary mower, highway/airport median		13	.615			28.50	26.50	55	72
2010	Traffic safety flashing truck for highway/airport median mowing	A-2B	1	8	Day		275	211	486	645
4050	Lawn mowing, power mower, 18" - 22"	1 Clab	65	.123	M.S.F.		4.32		4.32	6.65
4100	22" - 30"		110	.073			2.55		2.55	3.93
4150	30" - 32"		140	.057			2.01		2.01	3.09
4160	Riding mower, 36" - 44"	B-66	300	.027			1.19	.82	2.01	2.71
4170	48" - 58"	"	480	.017			.75	.52	1.27	1.70
4175	Mowing with tractor & attachments									
4180	3 gang reel, 7'	B-66	930	.009	M.S.F.		.38	.27	.65	.87
4190	5 gang reel, 12'		1200	.007			.30	.21	.51	.68
4200	Cutter or sickle-bar, 5', rough terrain		210	.038			1.71	1.18	2.89	3.87
4210	Cutter or sickle-bar, 5', smooth terrain		340	.024			1.05	.73	1.78	2.39
4220	Drainage channel, 5' sickle bar		5	1.600	Mile		71.50	49.50	121	163
4250	Lawnmower, rotary type, sharpen (all sizes)	1 Clab	10	.800	Ea.		28		28	43
4260	Repair or replace part		7	1.143	"		40		40	61.50
5000	Edge trimming with weed whacker		5760	.001	L.F.		.05		.05	.08

32 01 90.23 Pruning

0010	PRUNING									
0020	1-1/2" caliper	1 Clab	84	.095	Ea.		3.34		3.34	5.15
0030	2" caliper		70	.114			4.01		4.01	6.15
0040	2-1/2" caliper		50	.160			5.60		5.60	8.65
0050	3" caliper		30	.267			9.35		9.35	14.40
0060	4" caliper, by hand	2 Clab	21	.762			26.50		26.50	41
0070	Aerial lift equipment	B-85	38	1.053			39.50	24.50	64	87
0100	6" caliper, by hand	2 Clab	12	1.333			47		47	72

Attachment R-3
USLE Calculation

Volusia County- Tomoka Farms Road Landfill
December 2012

Soil Erosion using the Universal Soil Loss Equation (USLE)

The Universal Soil Loss Equation A (tons/AC/year) = R * K * LS * C * P

Name	Value	Reference*
Rainfall Factor		
R =	400	Figure 1 of USDA "Predicting Rainfall Loss Handbook"

Soil Erodibility Factor

K = 0.08 Figure 3 of USDA "Predicting Rainfall Loss Handbook"; assuming 10% silt and very fine sand (.15 to .075 mm), 90% sand (0.1 to 2 mm), 2% organic matter, fine granular structure, and moderate permeability

Topographic Factor (North Cell)

LS = 11.57 Table 3 USDA "Predicting Rainfall Loss Handbook"; 150 ft slope, 33% slope

Topographic Factor (South Cell)

LS = 5.77 Table 3 USDA "Predicting Rainfall Loss Handbook"; 200 ft slope, 20% slope

Cover and Management Factor

C = 0.042 Assuming 60% of the ground is covered by vegetation.

Support Practice Factor

P = 1 support practice factor (ranges 0 to 1), assumed for slope with no farming

Assumptions:

density	95	lb/ft^3	dry density for silty sand
acreage	65.65	acres	North Cell Landfill area

Table of Soil Loss

	C	A (tons/AC/year)	tons/ year	CF/ year	CY/ year
North Cell	0.042	15.55	1,021	21,492	796

reference United States Department of Agriculture. "Predicting Rainfall Erosion Losses." Agriculture Handbook No. 537, December 1978.

AH537/12/78

PREDICTING RAINFALL EROSION LOSSES

A GUIDE TO CONSERVATION PLANNING

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURE HANDBOOK NUMBER 537

PREPARED BY SCIENCE AND EDUCATION ADMINISTRATION

site as the product of six major factors whose most likely values at a particular location can be expressed numerically. Erosion variables reflected by these factors vary considerably about their means from storm to storm, but effects of the random fluctuations tend to average out over extended periods. Because of the unpredictable short-time fluctuations in the levels of influential variables, however, present soil loss equations are substantially less accurate for prediction of specific events than for prediction of longtime averages.

The soil loss equation is

$$A = R K L S C P \qquad (1)$$

where

A is the computed soil loss per unit area, expressed in the units selected for **K** and for the period selected for **R**. In practice, these are usually so selected that they compute **A** in tons per acre per year, but other units can be selected.

R, the rainfall and runoff factor, is the number of rainfall erosion index units, plus a factor for runoff from snowmelt or applied water where such runoff is significant.

K, the soil erodibility factor, is the soil loss rate per erosion index unit for a specified soil as measured on a unit plot, which is defined as a 72.6-ft length of uniform 9-percent slope continuously in clean-tilled fallow.

L, the slope-length factor, is the ratio of soil loss from the field slope length to that from a 72.6-ft length under identical conditions.

S, the slope-steepness factor, is the ratio of soil loss from the field slope gradient to that from a 9-percent slope under otherwise identical conditions.

C, the cover and management factor, is the ratio of soil loss from an area with specified cover and management to that from an identical area in tilled continuous fallow.

P, the support practice factor, is the ratio of soil loss with a support practice like contouring, stripcropping, or terracing to that with straight-row farming up and down the slope.

The soil loss equation and factor evaluation charts were initially developed in terms of the English units commonly used in the United States. The factor definitions are interdependent, and direct conversion of acres, tons, inches, and feet to metric units would not produce the kind of integers that would be desirable for an expression of the equation in that system. Therefore, only the English units are used in the initial presentation of the equation and factor evaluation materials, and their counterparts in metric units are given in the Appendix under **Conversion to Metric System.**

Numerical values for each of the six factors were derived from analyses of the assembled research data and from National Weather Service precipitation records. For most conditions in the United States, the approximate values of the factors for any particular site may be obtained from charts and tables in this handbook. Localities or countries where the rainfall characteristics, soil types, topographic features, or farm practices are substantially beyond the range of present U.S. data will find these charts and tables incomplete and perhaps inaccurate for their conditions. However, they will provide guidelines that can reduce the amount of local research needed to develop comparable charts and tables for their conditions.

The subsection on **Predicting Cropland Soil Losses**, page 40 illustrates how to select factor values from the tables and charts. Readers who have had no experience with the soil loss equation may wish to read that section first. After they have referred to the tables and figures and located the values used in the sample, they may move readily to the intervening detailed discussions of the equation's factors.

The soil loss prediction procedure is more valuable as a guide for selection of practices if the user has a general knowledge of the principles and factor interrelations on which the equation is based. Therefore, the significance of each factor is discussed before presenting the reference table or chart from which local values may be obtained. Limitations of the data available for evaluation of some of the factors are also pointed out.

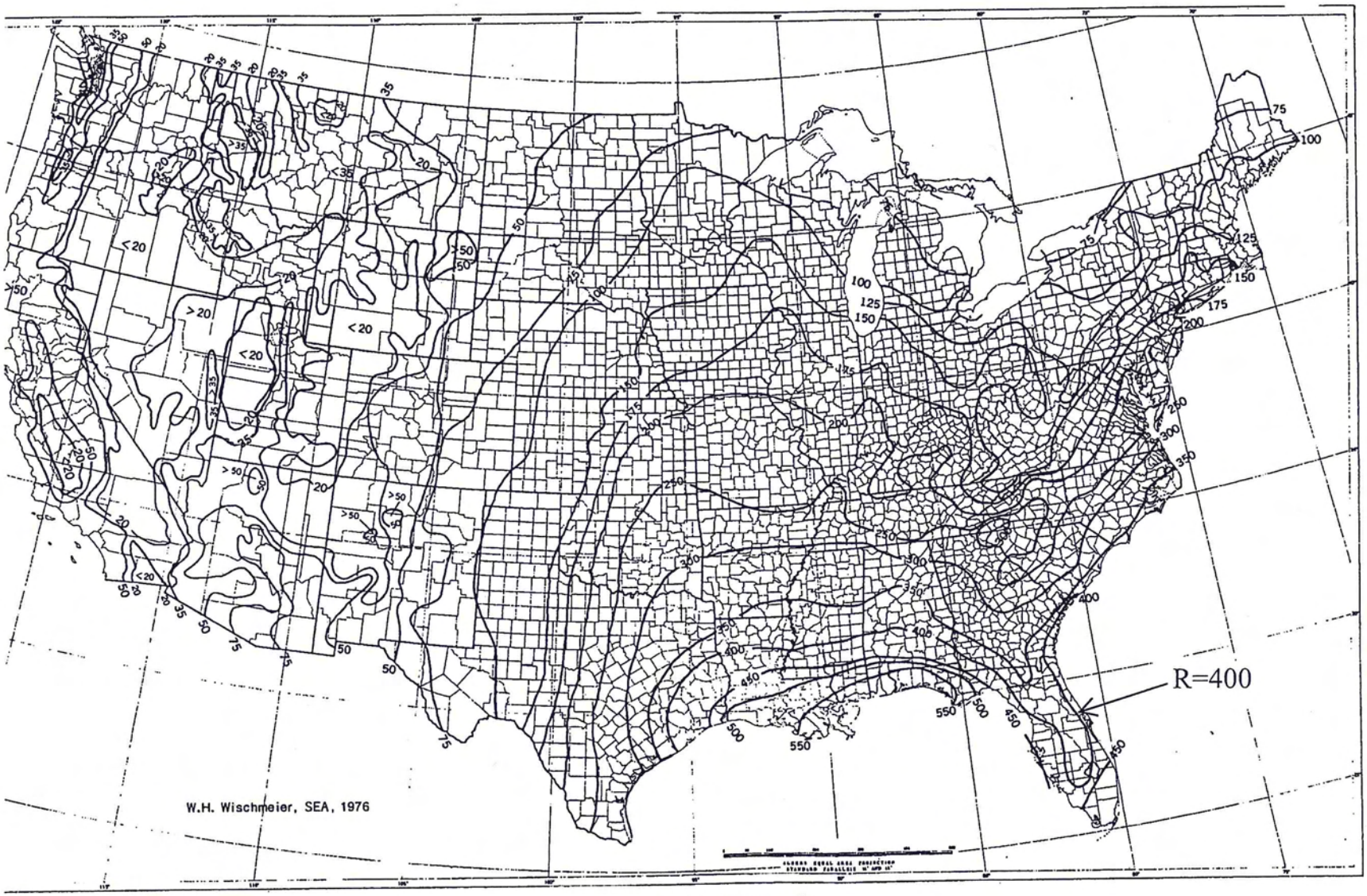

FIGURE 1.—Average annual values of the rainfall erosion index.

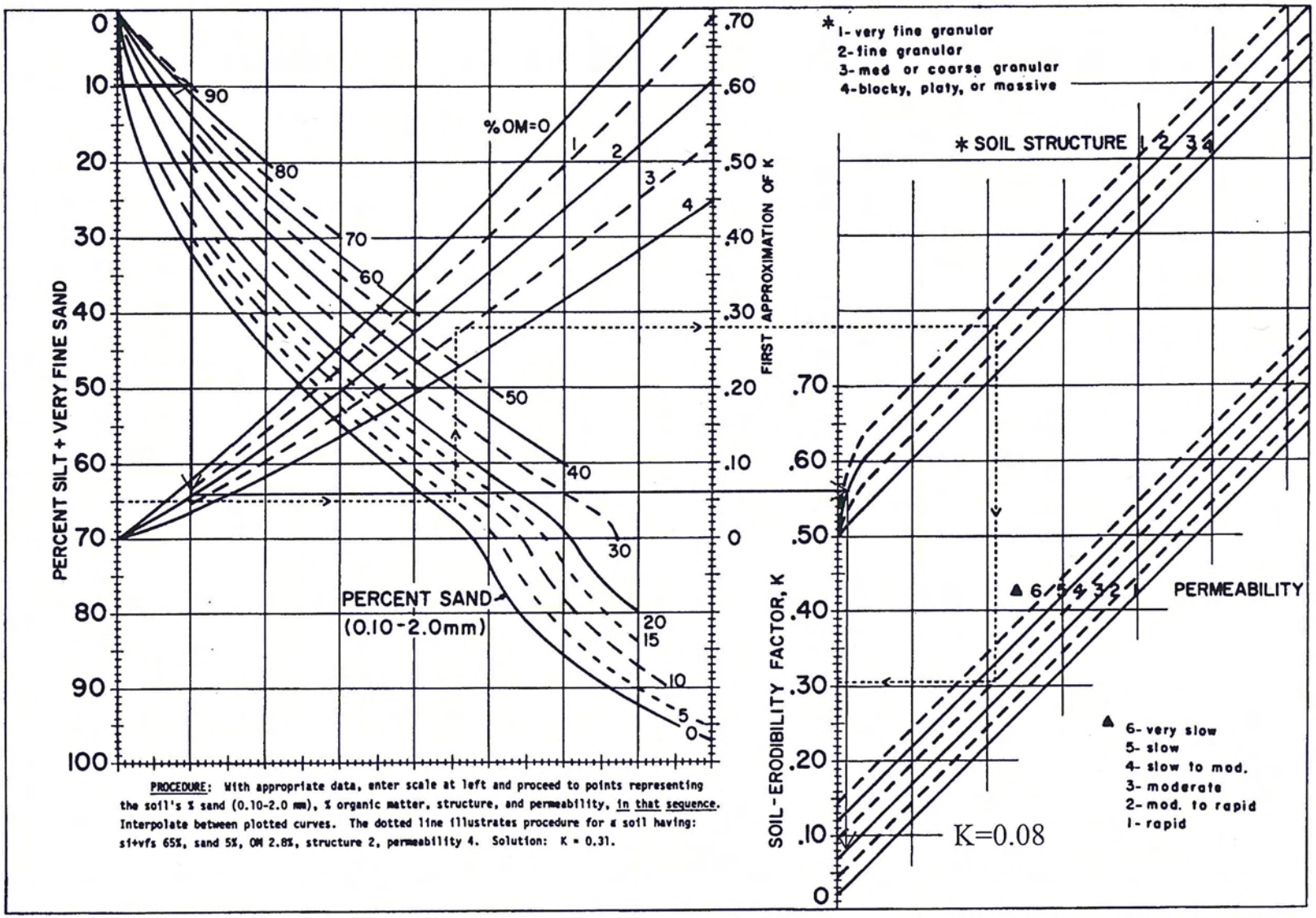

FIGURE 3.—The soil-erodibility nomograph. Where the silt fraction does not exceed 70 percent, the equation is $100\ K = 2.1\ M^{1.14}\ (10^{-4})\ (12 - a) + 3.25\ (b - 2) + 2.5\ (c - 3)$ where M = (percent si + vfs) (100 — percent c), a = percent organic matter, b = structure code, and c = profile permeability class.

TOPOGRAPHIC FACTOR (LS)

Both the length and the steepness of the land slope substantially affect the rate of soil erosion by water. The two effects have been evaluated separately in research and are represented in the soil loss equation by **L** and **S**, respectively. In field applications, however, considering the two as a single topographic factor, **LS**, is more convenient.

Slope-Effect Chart

LS is the expected ratio of soil loss per unit area from a field slope to that from a 72.6-ft length of uniform 9-percent slope under otherwise identical conditions. This ratio for specified combinations of field slope length and uniform gradient may be obtained directly from the slope-effect chart (fig. 4). Enter on the horizontal axis with the field slope length, move vertically to the appropriate percent-slope curve, and read **LS** on the scale at the left. For example, the **LS** factor for a 300-ft length of 10-percent slope is 2.4. Those who prefer a table may use table 3 and interpolate between listed values.

To compute soil loss from slopes that are appreciably convex, concave, or complex, the chart **LS** values need to be adjusted as indicated in the section **LS Values for Irregular Slopes.** Figure 4 and table 3 assume slopes that have essentially uniform gradient. The chart and table were derived by the equation

$$LS = (\lambda/72.6)^m \ (65.41 \ \sin^2 \theta + 4.56 \ \sin \theta + 0.065) \quad (4)$$

where λ = slope length in feet;
θ = angle of slope; and
m = 0.5 if the percent slope is 5 or more, 0.4 on slopes of 3.5 to 4.5 percent, 0.3 on slopes of 1 to 3 percent, and 0.2 on uniform gradients of less than 1 percent.

The basis for this equation is given in the subsection discussing the individual effects of slope length and steepness. However, the relationships expressed by the equation were derived from data obtained on cropland, under natural rainfall, on slopes ranging from 3 to 18 percent in steepness and about 30 to 300 ft in length. How far beyond these ranges in slope characteristics the relationships derived from the data continue to be accurate has not been determined by direct soil loss measurements.

The Palouse Region of the Northwest represents

TABLE 3.—*Values of the topographic factor,* **LS**, *for specific combinations of slope length and steepness*[1]

Percent slope	Slope length (feet)											
	25	50	75	100	150	200	300	400	500	600	800	1,000
0.2	0.060	0.069	0.075	0.080	0.086	0.092	0.099	0.105	0.110	0.114	0.121	0.126
0.5	.073	.083	.090	.096	.104	.110	.119	.126	.132	.137	.145	.152
0.8	.086	.098	.107	.113	.123	.130	.141	.149	.156	.162	.171	.179
2	.133	.163	.185	.201	.227	.248	.280	.305	.326	.344	.376	.402
3	.190	.233	.264	.287	.325	.354	.400	.437	.466	.492	.536	.573
4	.230	.303	.357	.400	.471	.528	.621	.697	.762	.820	.920	1.01
5	.268	.379	.464	.536	.656	.758	.928	1.07	1.20	1.31	1.52	1.69
6	.336	.476	.583	.673	.824	.952	1.17	1.35	1.50	1.65	1.90	2.13
8	.496	.701	.859	.992	1.21	1.41	1.72	1.98	2.22	2.43	2.81	3.14
10	.685	.968	1.19	1.37	1.68	1.94	2.37	2.74	3.06	3.36	3.87	4.33
12	.903	1.28	1.56	1.80	2.21	2.55	3.13	3.61	4.04	4.42	5.11	5.71
14	1.15	1.62	1.99	2.30	2.81	3.25	3.98	4.59	5.13	5.62	6.49	7.26
16	1.42	2.01	2.46	2.84	3.48	4.01	4.92	5.68	6.35	6.95	8.03	8.98
18	1.72	2.43	2.97	3.43	4.21	3.86	5.95	6.87	7.68	8.41	9.71	10.9
20	2.04	2.88	3.53	4.08	5.00	5.77	7.07	8.16	9.12	10.0	11.5	12.9

[1] $LS = (\lambda/72.6)^m \ (65.41 \ \sin^2 \theta + 4.56 \ \sin \theta + 0.065)$ where λ = slope length in feet; m = 0.2 for gradients < 1 percent, 0.3 for 1 to 3 percent slopes, 0.4 for 3.5 to 4.5 percent slopes, 0.5 for 5 percent slopes and steeper; and θ = angle of slope. (For other combinations of length and gradient, interpolate between adjacent values or see fig. 4.)

tion and developmental areas can be obtained from table 5 if good judgment is exercised in comparing the surface conditions with those of agricultural conditions specified in lines of the table. Time intervals analogous to cropstage periods will be defined to begin and end with successive construction or management activities that appreciably change the surface conditions. The procedure is then similar to that described for cropland.

Establishing vegetation on the denuded areas as quickly as possible is highly important. A good sod has a **C** value of 0.01 or less (table 5-B), but such a low **C** value can be obtained quickly only by laying sod on the area, at a substantial cost. When grass or small grain is started from seed, the probable soil loss for the period while cover is developing can be computed by the procedure outlined for estimating cropstage-period soil losses. If the seeding is on topsoil, without a mulch, the soil loss ratios given in line 141 of table 5 are appropriate for cropstage **C** values. If the seeding is on a desurfaced area, where residual effects of prior vegetation are no longer significant, the ratios for periods SB, 1 and 2 are 1.0, 0.75 and 0.50, respectively, and line 141 applies for cropstage 3. When the seedbed is protected by a mulch, the pertinent mulch factor from the upper curve of figure 6 or table 9 is applicable until good canopy cover is attained. The combined effects of vegetative mulch and low-growing canopy are given in figure 7. When grass is established in small grain, it can usually be evaluated as established meadow about 2 mo after the grain is cut.

C Values for Pasture, Range, and Idle Land

Factor **C** for a specific combination of cover conditions on these types of land may be obtained from table 10 (57). The cover characteristics that must be appraised before consulting this table are defined in the table and its footnotes. Cropstage periods and **EI** monthly distribution data are generally not necessary where perennial vegetation has become established and there is no mechanical disturbance of the soil.

Available soil loss data from undisturbed land were not sufficient to derive table 10 by direct comparison of measured soil loss rates, as was done for development of table 5. However, analyses of the assembled erosion data showed that the research information on values of **C** can be extended to completely different situations by combining subfactors that evaluate three separate and distinct, but interrelated, zones of influence: (a) vegetative cover in direct contact with the soil surface, (b) canopy cover, and (c) residual and tillage effects.

Subfactors for various percentages of surface cover by mulch are given by the upper curve of

TABLE 10.—*Factor* **C** *for permanent pasture, range, and idle land*[1]

Vegetative canopy		Cover that contacts the soil surface						
Type and height[2]	Percent cover[3]	Type[4]	Percent ground cover					
			0	20	40	60	80	95+
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	.45	.24	.15	.091	.043	.011
Tall weeds or short brush with average drop fall height of 20 in	25	G	.36	.17	.09	.038	.013	.003
		W	.36	.20	.13	.083	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.076	.039	.011
	75	G	.17	.10	.06	.032	.011	.003
		W	.17	.12	.09	.068	.038	.011
Appreciable brush or bushes, with average drop fall height of 6½ ft	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.087	.042	.011
	50	G	.34	.16	.08	.038	.012	.003
		W	.34	.19	.13	.082	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.078	.040	.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.089	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.087	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.084	.041	.011

[1] The listed C values assume that the vegetation and mulch are randomly distributed over the entire area.

[2] Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible if fall height exceeds 33 ft.

[3] Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's-eye view).

[4] G: cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 in deep.
W: cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

TABLE 12.—*Factor C for mechanically prepared woodland sites*

Site preparation	Mulch cover[1]	Soil condition[2] and weed cover[3]							
		Excellent		Good		Fair		Poor	
		NC	WC	NC	WC	NC	WC	NC	WC
	Percent								
Disked, raked, or bedded[4]	None	0.52	0.20	0.72	0.27	0.85	0.32	0.94	0.36
	10	.33	.15	.46	.20	.54	.24	.60	.26
	20	.24	.12	.34	.17	.40	.20	.44	.22
	40	.17	.11	.23	.14	.27	.17	.30	.19
	60	.11	.08	.15	.11	.18	.14	.20	.15
	80	.05	.04	.07	.06	.09	.08	.10	.09
Burned[5]	None	.25	.10	.26	.10	.31	.12	.45	.17
	10	.23	.10	.24	.10	.26	.11	.36	.16
	20	.19	.10	.19	.10	.21	.11	.27	.14
	40	.14	.09	.14	.09	.15	.09	.17	.11
	60	.08	.06	.09	.07	.10	.08	.11	.08
	80	.04	.04	.05	.04	.05	.04	.06	.05
Drum chopped[5]	None	.16	.07	.17	.07	.20	.08	.29	.11
	10	.15	.07	.16	.07	.17	.08	.23	.10
	20	.12	.06	.12	.06	.14	.07	.18	.09
	40	.09	.06	.09	.06	.10	.06	.11	.07
	60	.06	.05	.06	.05	.07	.05	.07	.05
	80	.03	.03	.03	.03	.03	.03	.04	.04

[1] Percentage of surface covered by residue in contact with the soil.

[2] *Excellent* soil condition—Highly stable soil aggregates in topsoil with fine tree roots and litter mixed in.

Good—Moderately stable soil aggregates in topsoil or highly stable aggregates in subsoil (topsoil removed during raking), only traces of litter mixed in.

Fair—Highly unstable soil aggregates in topsoil or moderately stable aggregates in subsoil, no litter mixed in.

Poor—No topsoil, highly erodible soil aggregates in subsoil, no litter mixed in.

[3] NC—No live vegetation.

WC—75 percent cover of grass and weeds having an average drop fall height of 20 in. For intermediate percentages of cover, interpolate between columns.

[4] Modify the listed C values as follows to account for effects of surface roughness and aging:

First year after treatment: multiply listed C values by 0.40 for rough surface (depressions >6 in); by 0.65 for moderately rough; and by 0.90 for smooth (depressions <2 in).

For 1 to 4 years after treatment: multiply listed factors by 0.7.

For 4+ to 8 years: use table 6.

More than 8 years: use table 7.

[5] For first 3 years: use C values as listed.

For 3+ to 8 years after treatment: use table 6.

More than 8 years after treatment: use table 7.

meadow, the selected seedbed soil loss ratio is multiplied by a factor from table 5-D. If mulch is applied, a subfactor read from the upper curve of figure 6 is multiplied by the residual subfactor to obtain **C**. When canopy develops, a canopy subfactor from figure 5 is also included.

SUPPORT PRACTICE FACTOR (P)

In general, whenever sloping soil is to be cultivated and exposed to erosive rains, the protection offered by sod or close-growing crops in the system needs to be supported by practices that will slow the runoff water and thus reduce the amount of soil it can carry. The most important of these supporting cropland practices are contour tillage, stripcropping on the contour, and terrace systems. Stabilized waterways for the disposal of excess rainfall are a necessary part of each of these practices.

By definition, factor **P** in the USLE is the ratio of soil loss with a specific support practice to the corresponding loss with up-and-down-slope culture. Improved tillage practices, sod-based rotations, fertility treatments, and greater quantities of crop residues left on the field contribute materially to erosion control and frequently provide the major control in a farmer's field. However, these are considered conservation cropping and management practices, and the benefits derived from them are included in **C**.

Contouring

The practice of tillage and planting on the contour, in general, has been effective in reducing erosion. In limited field studies, the practice provided almost complete protection against erosion from storms of moderate to low intensity, but it provided little or no protection against the occasional severe storms that caused extensive breakovers of the contoured rows. Contouring appears to be the most effective on slopes in the 3- to 8-percent range. As land slope decreases, it approaches equality with contour row slope, and the soil loss ratio approaches 1.0. As slope increases, contour row capacity decreases and the soil loss ratio again approaches 1.0.