Value Engineering Study
Sponsored By
U.S. Army Engineer District, Omaha

VALUE ENGINEERING STUDY REPORT
ON THE FULTZ LANDFILL
SUPERFUND SITE

BYESVILLE, OHIO

Office, Chief of Engineers
Value Engineering Study Team

O V E S T

March 1994
Value Engineering Team Study Report On The
FULTZ LANDFILL SUPERFUND SITE
BYESVILLE, OHIO
MARCH 1994

VALUE ENGINEERING STUDY TEAM LEAD BY:
OVEST / U. S. Army Corps of Engineers
P.O. Box 889, Savannah, Georgia 31402-0889

VALUE ENGINEERING STUDY TEAM LEADER:
Fred McAuley, Telephone: 912-652-5715

VALUE ENGINEERING TEAM MEMBERS:

<table>
<thead>
<tr>
<th>NAME</th>
<th>DISCIPLINE</th>
<th>TELEPHONE NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fred McAuley</td>
<td>General Engineer/OVEST</td>
<td>912-652-5715</td>
</tr>
<tr>
<td>Ronald Lanier</td>
<td>Civil Engineer/OVEST</td>
<td>912-652-5449</td>
</tr>
<tr>
<td>Charles Claghorn</td>
<td>Civil Engineer/OVEST</td>
<td>912-652-5173</td>
</tr>
<tr>
<td>Carl Canicatti</td>
<td>General Engineer/OVEST</td>
<td>912-652-5172</td>
</tr>
<tr>
<td>Steven Moore</td>
<td>Civil Engineer/CEMRO</td>
<td>402-221-3929</td>
</tr>
<tr>
<td>Kurk Inglebart</td>
<td>PM/CEMRO</td>
<td>402-221-7830</td>
</tr>
<tr>
<td>Mike Steffensmeier</td>
<td>Technical PM/CEMRO</td>
<td>402-221-7163</td>
</tr>
<tr>
<td>Donald Moses</td>
<td>Geotechnical/CEMRO</td>
<td>402-221-3177</td>
</tr>
<tr>
<td>Robert Saari</td>
<td>Environmental/CEMRO</td>
<td>402-221-4424</td>
</tr>
<tr>
<td>Greg Mellema</td>
<td>Geotechnical/CEMRO</td>
<td>402-221-4707</td>
</tr>
<tr>
<td>Larry Boardman</td>
<td>Geotechnical/CEMRO</td>
<td>402-221-4706</td>
</tr>
<tr>
<td>Thomas Bloom</td>
<td>RPM, EPA - Region 5</td>
<td>312-886-1967</td>
</tr>
<tr>
<td>Raj Rajaram</td>
<td>PRC Environmental Management</td>
<td>708-225-4166</td>
</tr>
</tbody>
</table>
# VALUE ENGINEERING TEAM STUDY

## TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover</td>
<td>1</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>2</td>
</tr>
<tr>
<td>Project Description and Background</td>
<td>3</td>
</tr>
<tr>
<td>Executive Summary</td>
<td>6</td>
</tr>
<tr>
<td>Summary of Recommendations</td>
<td>7</td>
</tr>
<tr>
<td><strong>Proposals:</strong></td>
<td></td>
</tr>
<tr>
<td>Proposal No. 1 - Revise Landfill Cap Design Using a Composite Geotextile Fabric and Drainage Net/ Geomembrane/Geocomposite Clay Liner</td>
<td>8</td>
</tr>
<tr>
<td>Proposal No. 2 - Eliminate Northeast and Northwest Retaining Wall Systems and Slope Toe to Grade</td>
<td>14</td>
</tr>
<tr>
<td>Proposal No. 3 - Eliminate Northeast and Northwest Retaining Wall Systems and Use a Gabion Retaining Wall</td>
<td>19</td>
</tr>
<tr>
<td>Proposal No. 4 - Use Two Separate Storage Tanks for Leachate and Shallow Aquifer Storage</td>
<td>24</td>
</tr>
<tr>
<td>Proposal No. 5 - Modify Gas Collection Extraction System</td>
<td>28</td>
</tr>
<tr>
<td>VE Study Team Comments</td>
<td>33</td>
</tr>
<tr>
<td><strong>Supporting Documents:</strong></td>
<td></td>
</tr>
<tr>
<td>Contact Directory -- VE Team List</td>
<td></td>
</tr>
<tr>
<td>F.A.S.T. Diagram</td>
<td></td>
</tr>
<tr>
<td>Cost Models -- Total Project and Landfill Cover</td>
<td></td>
</tr>
<tr>
<td>Speculation List</td>
<td></td>
</tr>
<tr>
<td>Appendix A -- Composite Geotextile Fabric Drainage Net Data</td>
<td></td>
</tr>
<tr>
<td>Appendix B -- Underwater Silicate Grout Mix Data</td>
<td></td>
</tr>
</tbody>
</table>
The Fultz Landfill Site Record of Decision was issued by the Environmental Protection Agency, Region V, in September 1991. The Selected Remedy, chosen in compliance with the CERCLA-1980 and SARA-1986, was concurred with by the Ohio EPA. A description of major components of the Selected Remedy follows:

- Institutional controls to reduce exposure to contaminants through legal restrictions.
- Site fence to reduce direct exposure to contamination.
- Alternate water supply for downgradient wells if unacceptable risk is attributed to site.
- Long term monitoring of air, surface and ground water, leachate and sediments.
- Subsurface structural supports for mine voids to prevent cap damage and reduce bedrock fracturing between landfill and deep aquifer.
- Surface water and sediment controls
- Berm and multi-layer cap to reduce infiltration, prevent erosion, and reduce risk from direct contact with contaminants.
- Leachate collection system (2-gallons per minute).
- Extraction well system intercepting contaminated groundwater in shallow aquifer migrating into deep coal mine aquifer.
- On-site water treatment to economically treat 6 million gallons of contaminated groundwater annually and leachate seepage.
- Discharge treated water to surface with NPDES permit.
- Wetland replacement plan to restore ponds and habitat disturbed by remedial action.

The plan is intended to reduce risk to the public by direct contact and by exposure to contaminated water sources at an estimated present worth cost over 30-year life of $19,480,700 (based on $15,759,700 first cost and $218,000 O&M cost at a 5% interest rate).
THE FULTZ LANDFILL SUPERFUND PROJECT'S PRELIMINARY REMEDIAL DESIGN DRAFT REPORT DEFINES THE CONCEPTUAL LEVEL WORK FEATURES REQUIRED TO REMEDY CONTAMINATED GROUND AND SURFACE WATER AT THE 30-ACRE LANDFILL SITE IN BYESVILLE, OHIO. THE MAJOR COMPONENTS OF THE PROJECT CONSISTS OF THE FOLLOWING ITEMS: (1) A MULTI-LAYER RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) SUBTITLE C-COMPATIBLE LANDFILL CAP (MODIFIED), (2) STABILIZATION OF THE MINE VOIDS UNDERLYING THE SOUTHERN PORTION OF THE SITE (CAP DESIGNED FOR SUBSIDENCE), AND (3) A GAS VENTING SYSTEM, LEACHATE AND
groundwater extraction and treatment system (treatment requirement will be determined by monitoring of stored groundwater and leachate seepage. If required, treatment will occur at existing municipal facility (by hauling or piping contaminants). The results of the Contract Laboratory Program’s (CLP’s) analysis of groundwater contaminate levels which will define treatment requirements will be available during February 1994. The Remedial Design (RD) plan also provides fencing, placing deed restrictions and monitoring to ensure the remedy is effective. The preliminary capital cost is estimated at $8.2 million.

The Preliminary RD has made some significant redefinition of project features while maintaining technical compliance with the ROD. The VE Team has provided comments concerning the refinements in the Preliminary RD which are intended to lend support to effectively addressed design evolutions. The reader is encouraged to review these comments which follow the VE study proposal recommendations.
EXECUTIVE SUMMARY

PROJECT TITLE: FULTZ LANDFILL SUPERFUND SITE
PROJECT LOCATION: Byesville, Ohio

The Value Engineering study was started during the initial VE working conference conducted at the Omaha District during February 7th through 9th, 1994. The study was based on the Preliminary Remedial Design Draft Report, dated January 1994, prepared by PRC Environmental Management, Inc. The study team was comprised of representatives of the Omaha District, EPA Region V, PRC Environmental Management, Inc. and was lead by a representative of the Corps' Value Engineering Team / OVEST. A site visit was conducted on 7 February 1994 to see the site conditions and relationships of constructability issues.

The project was studied using the Corps of Engineers' standard value engineering (VE) methodology, consisting of five phases:
- Information Phase
- Speculation Phase
- Analysis Phase
- Development Phase
- Presentation Phase

During the information phase, the team studied the drawings, specifications and cost estimates to fully understand the work to be performed and the functions to be achieved. Programming issues and user functions were discussed fully. Cost models were prepared to determine areas of relative high cost to ensure that the team focused on those parts of the project which offered the most potential for cost savings.

The team speculated by conducting brainstorming sessions to generate ideas for alternative designs. All team members were encouraged to contribute ideas and critical analysis of the ideas was discouraged.

Following Speculation the team analyzed these ideas and ranked them by priority for development. Ideas which did not survive critical analysis were deleted.

The most feasible ideas were initially developed during an intensive technical development period by the full VE study team. The full development of proposals which are presented in this Value Engineering Team Study Report was continued and coordinated by OVEST. VE Team Comments are included for items of special interest which were not developed as technical proposals, but offer support to the project.

Formal Presentation of the VE study recommendations will be made at the Project Review conference in EPA Region V in March 1994. The summary of the VE recommendations is given on the following page.
# VALUE ENGINEERING TEAM STUDY

## SUMMARY OF VE RECOMMENDATIONS

**PROJECT TITLE:** FULTZ LANDFILL SUPERFUND SITE  
**PROJECT LOCATION:** Byesville, Ohio

<table>
<thead>
<tr>
<th>PROPOSAL NUMBER</th>
<th>RECOMMENDATION</th>
<th>SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Revise Landfill Cap Design Using a Composite Geotextile Fabric and Drainage Net/Geomembrane/Geocomposite Clay Liner*</td>
<td>$1,661,954</td>
</tr>
<tr>
<td>1B</td>
<td>Revise Landfill Cap Design Using a Composite Double Geotextile Fabric and Drainage Net/Textured VLDPE Geomembrane/Geocomposite Clay Liner*</td>
<td>$1,258,470</td>
</tr>
<tr>
<td>2</td>
<td>Eliminate Northeast and Northwest Retaining Wall Systems and Slope Toe to Grade*</td>
<td>$ 438,081</td>
</tr>
<tr>
<td>3</td>
<td>Eliminate Northeast and Northwest Retaining Wall Systems and Use a Gabion Retaining Wall*</td>
<td>$ 511,815</td>
</tr>
<tr>
<td>4</td>
<td>Use Two Separate Storage Tanks for Leachate and Shallow Aquifer Storage</td>
<td>$ 19,403</td>
</tr>
<tr>
<td>5</td>
<td>Modify Gas Collection Extraction System</td>
<td>$ 45,807</td>
</tr>
</tbody>
</table>

**Total Savings**  
$2,238,979

* Total Savings uses Proposal No. 1A with savings for the single fabric composite drain net estimated at $1,661,954. Two options are given for the elimination sheetpile retaining walls - either Proposal Nos. 2 or 3. Proposal No. 3 is used in the Total Savings amount.

**Total Savings of $2,238,979 are based on acceptance of Proposals Nos. 1A, 3, 4, and 5.
VALUE ENGINEERING PROPOSAL

PROPOSAL NO.: 1  PAGE NO.: 1 OF 6
DESCRIPTION: Revise Landfill Cap Design Using a Composite Geotextile Fabric and Drainage Net/Geomembrane/Geocomposite Clay Liner

CRITERIA CHALLENGE: No  CRITERIA NO.:___

ORIGINAL DESIGN: The current design provides an approximately 5-foot thick cap section covering the 21 acre landfill site. The cap consists of a 6-inch top soil layer, a 2-foot select fill layer, followed by a filter fabric separation, a gravel drainage layer, a 40 mil VLDPE membrane, a geocomposite clay liner on a 6-inch engineered fill, a second filter fabric, and an 8-inch thick granular fill for both leachate and gas. There is also some random fill on top of the land fill waste to grade the site for cap construction.

PROPOSED CHANGE: This proposal recommends that the cap section be revised to use a composite geotextile fabric layer bonded to a polyethylene drainage net, which is placed on a geomembrane liner (40 Mil VLDPE), with a geocomposite clay liner. The latter two layers remain as provided in the original design.

The use of the open weave geodrainage net is more hydraulically efficient than the gravel drainage layer. A geotextile fabric layer is bonded over the drainage net to form the composite drainage layer. The center gravel drainage layer is thereby deleted. This new material combined with a geocomposite clay liner allows reduction of the 36-inch freeze-thaw zone as these materials are not likely to degrade as would a natural clay earth layer. It is recommended that the 2-foot thick select fill section be reduced to 18-inches. The cap will also be covered with a 6-inch top soil layer for a total 2-foot thick earth cover above the new liner.

Below the geocomposite clay liner, the 6-inch Engineered fill layer and filter fabric is deleted as the liner is competent for placement directly over the 8-inch granular layer. The random fill on top of the existing land fill is still required to regrade the existing surface.

The initially proposed single fabric composite drainage cap section is estimated as 1A. An alternate for the proposed system recommends a similar cap section; however, a double geotextile fabric faced drainage net is placed on a two sided textured 40-mil VLDPE. This substitution will make the cap more structurally stable for the sloped site. This alternative is estimated as 1B.

This proposed liner section will result in an approximately 3-foot thick cap section. (Reductions in retaining wall height is covered under Proposal Nos. 2 and 3.)
ADVANTAGES/DISADVANTAGES/PROPOSAL JUSTIFICATION

PROPOSAL NO.: 1 PAGE NO.: 2 OF 6

ADVANTAGES:
1. Reduces costs and construction time while providing an equal or superior cap.
2. Less stress on public infrastructure due to reduced material hauling.
3. Reduces cap loading and results in less landfill settlement.
4. Less susceptible to construction damage — gravel placement is not directly over geomembrane.
5. Reduced material exposure to atmosphere during construction.
7. Provides an equally effective cap as has been used in similar regional areas including Pennsylvania and Virginia.
8. Geonet is a more effective drainage medium. (Less head build-up, less potential for leachate, and better site stability).
9. More structurally stable on slopes (further improved as described in option 1B featuring double fabric drain composite on two sided textured VLDPE).

DISADVANTAGES: Slightly encroaches into a frost zone, but has been used in similar region projects including Pennsylvania.

JUSTIFICATION: This proposal will provide an equal to or superior cap for the Fultz Landfill Site at a reduced cost. The proposed cap, using less materials, weighs less and will result in reduced settlement and subsidence. The 6-inch top soil and 18-inch select fill meets EPA final cover criteria, and provides adequate thickness to protect the underlaying geosynthetic materials. The composite fabric/drainage net provides superior drainage compared to the gravel drainage layer. The leachate/gas collection layer serves as bedding layer for the geocomposite clay and VLDPE liners. HELP modeling has shown that the GCL is equally effective as the engineered fill sections. Because the engineered fill is deleted, one layer of Geotextile fabric is eliminated. The GCL has its own external separator. Similar composite geosynthetic liners have been used at other EPA jobs, such as Delaware Sand and Gravel, Kane and Lombard, New Lyme, Welsh Road and Blosenski Landfills. Savings are $1,661,954 for single fabric composite drain net and $1,258,470 for the double fabric composite drain net on textured VLDPE liner. (Appendix A provides documentation supporting this proposal)
FULTZ LANDFILL SITE -- PROPOSED CAP CROSS-SECTION

PROPOSED DESIGN DRAWING/SKETCH

PROPOSAL NO.: 1

PAGE NO.: 4 OF 6
## Cost Estimating Worksheet

**Proposal No.: 1A (One Geotex Fabric Layer) Page No.: 5 of 6**

### Original Design

<table>
<thead>
<tr>
<th>Item</th>
<th>U/M</th>
<th>QTY</th>
<th>Cost</th>
<th>Unit Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DELETE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel Drain Layer</td>
<td>CY</td>
<td>33,800</td>
<td>$19.00</td>
<td>$642,200</td>
</tr>
<tr>
<td>2-Ft Select Fill</td>
<td>CY</td>
<td>67,600</td>
<td>12.00</td>
<td>811,200</td>
</tr>
<tr>
<td>Geotex Fab, 2-layers</td>
<td>SY</td>
<td>203,200</td>
<td>2.50</td>
<td>508,000</td>
</tr>
<tr>
<td>Engr Fill Layer, 6-In</td>
<td>CY</td>
<td>16,900</td>
<td>12.00</td>
<td>202,800</td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$2,164,200</td>
</tr>
</tbody>
</table>

### Proposed Change

<table>
<thead>
<tr>
<th>Item</th>
<th>U/M</th>
<th>QTY</th>
<th>Cost</th>
<th>Unit Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADD:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geodrain Net</td>
<td>SY</td>
<td>101,600</td>
<td>$1.98</td>
<td>$201,168</td>
</tr>
<tr>
<td>Geotex Fab, 1-layer</td>
<td>SY</td>
<td>101,600</td>
<td>2.50</td>
<td>254,000</td>
</tr>
<tr>
<td>Select Fill, 18-In</td>
<td>CY</td>
<td>50,700</td>
<td>12.00</td>
<td>608,400</td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$1,063,568</td>
</tr>
</tbody>
</table>

**Net Savings**

- **$1,100,632**
- **Mark-Ups (51.00%)**
- **$561,322**
- **Total Savings**

**$1,661,954**

Geodrain Net - Unit Cost $1.98, National Seal Co.

(Mark-Up Calculation: Total Capital Cost $8,176,000 / Estimated Project Cost $5,414,400 = 1.5100 or 51.00%)
## COST ESTIMATING WORKSHEET

**PROPOSAL NO.: 1B (Two Geotex Fabric Layers) PAGE NO.: 6 OF 6**

### ORIGINAL DESIGN

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DELETE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravel Drain Layer</td>
<td>CY</td>
<td>33,800</td>
<td>$19.00</td>
<td>$ 642,200</td>
</tr>
<tr>
<td>2-Ft Select Fill</td>
<td>CY</td>
<td>67,600</td>
<td>12.00</td>
<td>811,200</td>
</tr>
<tr>
<td>Geotex Fab, 2-layers</td>
<td>SY</td>
<td>203,200</td>
<td>2.50</td>
<td>508,000</td>
</tr>
<tr>
<td>Engr Fill Layer, 6-In</td>
<td>CY</td>
<td>16,900</td>
<td>12.00</td>
<td>202,800</td>
</tr>
<tr>
<td>VLPDE Liner</td>
<td>SY</td>
<td>101,600</td>
<td>4.00</td>
<td>406,400</td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$2,570,600</td>
</tr>
</tbody>
</table>

### PROPOSED CHANGE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADD:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite -</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geodrain Net with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geotex Fab, 2-layers</td>
<td>SY</td>
<td>101,600</td>
<td>6.98</td>
<td>709,168</td>
</tr>
<tr>
<td>Textured VLDPE Liner</td>
<td>SY</td>
<td>101,600</td>
<td>4.13</td>
<td>419,608</td>
</tr>
<tr>
<td>Select Fill, 18-In</td>
<td>CY</td>
<td>50,700</td>
<td>12.00</td>
<td>608,400</td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$1,737,176</td>
</tr>
</tbody>
</table>

**NET SAVINGS**  
$ 833,424  
**MARK-UPS (51.00%)**  
$ 425,046  
**TOTAL SAVINGS**  
$1,258,470

June 92 - Welsh Road Landfill VLDPE Liner Unit Cost $4.13

(Mark-Up Calculation: Total Capital Cost $8,176,000 / Estimated Project Cost $5,414,400 = 1.5100 or 51.00%)
VALUE ENGINEERING PROPOSAL

PROPOSAL NO.: 2
DESCRIPTION: Eliminate Northeast and Northwest Retaining Wall Systems and Slope Toe to Grade

CRITERIA CHALLENGE: No

ORIGINAL DESIGN: The current design provides an approximately 5-foot high steel sheetpile retaining wall system for approximately 550 LF along the northeast and 400 LF along the northwest portions of the Fultz Landfill site. The retaining walls are intended to contain the nearly 5-foot thick landfill cap addition, and avoid construction encroachment into the wetland areas to the northeast and the residential area to the northwest. The sheetpile sections are assumed at 30 feet high (allowing for temporary 10-foot high wall during excavation of unsuitable material, with 5-foot backfill to slope to grade, and 20-foot buried depth).

The preliminary RD estimate reflected quantities for a full 1,600 LF steel sheetpile retaining wall (48,000 SF) along the entire north landfill boundary; however, the preliminary design plan has reduced the amount where adequate grades were found to slope the toe into existing grade. Approximately 650 LF has been omitted from the proposed preliminary site plan (The VE proposal reflects this change and no claim for savings is made by this proposal.)

PROPOSED DESIGN: This proposal recommends elimination of the northeast and northwest steel sheetpile retaining wall systems and sloping the toe to existing grade where adequate site conditions will permit. The proposal considers the original 5-foot thick cap is to be modified to approximately 3 feet as describe in Proposal No. 1. Some removal of landfill debris may be required to redefine the cap perimeter. A Gabion toe protection is provided with the landfill liner turned down to end the cap construction. An allowance is made for approximately 150 LF along the northeast of the site where the landfill is in closest proximity of the existing pond number 2. This area should be provided with some wall system to avoid encroachment into the pond side slope. A Gabion U-channel as described in the attached detail is recommended for approximately 150 LF at pond 2.
ADVANTAGES/DISADVANTAGES/PROPOSAL JUSTIFICATION

PROPOSAL NO.: 2

PAGE NO.: 2 OF 5

ADVANTAGES:

1. The proposed toe tie-in eliminates use of steel sheetpiles thereby addressing driveability issues for on-site soils with cobbles and rock outcrops noted present on the surface.

2. The toe may use the cap liner materials trenched and turned down for a cut-off wall if required.

3. The Gabion toe and Gabion channel details follow previously established details from the Blosenski Landfill cap.

4. The natural looking toe tie-in has aesthetically pleasing appearance at less cost to the project.

DISADVANTAGES:

1. The proposed details must be developed for this site.

2. Some removal of landfill debris may be required to redefine the cap perimeter.

JUSTIFICATION: The modified thinner landfill cap permits sloping the cap toe into the existing or slightly modified adjoining site. The tightest area noted was northeast at pond 2. Use of the Gabion toe and the Gabion channel will serve as both grade tie and the latter will channel runoff at the steeper grades at pond 2. Savings are estimated to be $438,081.
FULTZ LANDFILL SITE PLAN (NOTED AS MODIFIED)
FULTZ LANDFILL SITE — ORIGINAL CROSS-SECTION AND PROPOSED SECTION DETAILS

**TOE DRAIN DETAIL**

**GABION CHANNEL DETAIL**

*NOTE:*
Upstream End Will be Sealed with a 3'x3' Gabion Box Headwall.
## COST ESTIMATING WORKSHEET

**PROPOSAL NO.: 2**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DELETE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel Sheetpile Wall</td>
<td>SF</td>
<td>28,500</td>
<td>$14.00</td>
<td>$399,000</td>
</tr>
<tr>
<td><strong>ORIGINAL DESIGN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$399,000</td>
<td></td>
</tr>
<tr>
<td><strong>ADD:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gabion Channel</td>
<td>LF</td>
<td>150</td>
<td>$152.00</td>
<td>$22,800</td>
</tr>
<tr>
<td>Gabion Toe</td>
<td>LF</td>
<td>800</td>
<td>85.60</td>
<td>68,480</td>
</tr>
<tr>
<td>Seeding</td>
<td>MSF</td>
<td>15.5</td>
<td>50.00</td>
<td>800</td>
</tr>
<tr>
<td>Topsoil</td>
<td>CY</td>
<td>300</td>
<td>20.00</td>
<td>6,000</td>
</tr>
<tr>
<td>Select Fill</td>
<td>CY</td>
<td>800</td>
<td>12.00</td>
<td>9,600</td>
</tr>
<tr>
<td>Removal of Landfill</td>
<td>LS</td>
<td>1</td>
<td>1,200.00</td>
<td>1,200</td>
</tr>
<tr>
<td><strong>PROPOSED CHANGE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$108,880</td>
<td></td>
</tr>
<tr>
<td><strong>NET SAVINGS</strong></td>
<td></td>
<td></td>
<td>$290,120</td>
<td></td>
</tr>
<tr>
<td><strong>MARK-UPS (51.00%)</strong></td>
<td></td>
<td></td>
<td>147,961</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL SAVINGS</strong></td>
<td></td>
<td></td>
<td>$438,081</td>
<td></td>
</tr>
</tbody>
</table>

(Mark-Up Calculation: Total Capital Cost $8,176,000 / Estimated Project Cost $5,414,400 = 1.5100 or 51.00%)
VALUE ENGINEERING PROPOSAL

PROPOSAL NO.: 3 PAGE NO.: 1 OF 5
DESCRIPTION: Eliminate Northeast and Northwest Retaining Wall Systems and Use a Gabion Retaining Wall
CRITERIA CHALLENGE: No CRITERIA NO.:___

ORIGINAL DESIGN: The current design provides an approximately 5-foot high steel sheetpile retaining wall system for approximately 550 LF along the northeast and 400 LF along the northwest portions of the Fultz Landfill site. The retaining walls are intended to contain the nearly 5-foot thick landfill cap addition, and avoid construction encroachment into the wetland areas to the northeast and the residential area to the northwest. The sheetpile sections are assumed at 30 feet high (allowing for temporary 10-foot high wall during excavation of unsuitable material, with 5-foot backfill to slope to grade, and 20-foot buried depth).

The preliminary RD estimate reflected quantities for a full 1,600 LF steel sheetpile retaining wall (48,000 SF) along the entire north landfill boundary; however, the preliminary design plan has reduced the amount where adequate grades were found to slope the toe into existing grade. Approximately 650 LF has been omitted from the proposed preliminary site plan (The VE proposal reflects this change and no claim for savings is made by this proposal.)

PROPOSED DESIGN: This proposal recommends elimination of the 950 LF of steel sheetpile retaining wall systems and recommends use of a Gabion retaining wall where adequate site conditions will permit. The proposal considers the original 5-foot thick cap is to be modified to approximately 3 feet as describe in Proposal No. 1. Some removal of landfill debris may be required to redefine the cap perimeter. A Gabion wall is provided with the landfill liner turned down to end the cap construction. Use of a Gabion U-channel, as described in Proposal No. 2’s detail, is optional for approximately 150 LF where the landfill is in closest proximity of the existing pond number 2 to avoid encroachment into the pond’s side slope.
ADVANTAGES:

1. The proposed Gabion walls eliminate use of steel sheetpile thereby addressing driveability issues for on-site soils with cobbles and rock outcrops noted present on the surface.

2. The wall system may use the cap liner materials trenched and turned down for a cut-off wall if required.

3. The Gabion details generally follow previously established details from the Blosenski Landfill cap.

4. The Gabion wall has aesthetically pleasing appearance and performs equally well at less cost to the project.

DISADVANTAGES:

1. The proposed details must be developed for this site.

2. Some removal of landfill debris may be required to redefine the cap perimeter.

JUSTIFICATION: The modified thinner landfill cap permits sloping the cap toe into the reduced height walls and use of Gabion walls has been previously been used on similar projects. The tightest area noted was northeast at pond 2. Use of the Gabion wall or the Gabion channel will serve as perimeter retaining walls and the latter will channel runoff at the steeper grades at pond 2 if selected. Savings are estimated to be $511,815 using the Simpler Gabion walls.
ORIGINAL DESIGN DRAWING/SKETCH

PROPOSAL NO.: 3  PAGE NO.: 3 OF 5

FULTZ LANDFILL SITE PLAN (NOTED AS MODIFIED)
ORIGINAL DESIGN DRAWING/SKETCH

PROPOSAL NO.: 3  PAGE NO.: 4 OF 5

FULTZ LANDFILL SITE — ORIGINAL CROSS-SECTION AND PROPOSED GABION WALL SECTION DETAIL

DETAILED CAP CROSS-SECTION WITH LEACHATE SEEP COLLECTION SYSTEM
COST ESTIMATING WORKSHEET

PROPOSAL NO.: 3

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELETE:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel Sheetpile Wall</td>
<td>SF</td>
<td>28,500</td>
<td>$14.00</td>
<td>$ 399,000</td>
</tr>
<tr>
<td>SUBTOTAL</td>
<td></td>
<td></td>
<td></td>
<td>$ 399,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROPOSED CHANGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADD:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gabion Wall - 5’ X 3’</td>
<td>LF</td>
<td>950</td>
<td>$55.00</td>
<td>$ 52,250</td>
</tr>
<tr>
<td>Select Fill</td>
<td>CY</td>
<td>550</td>
<td>12.00</td>
<td>6,600</td>
</tr>
<tr>
<td>Removal of Landfill Materials</td>
<td>LS</td>
<td>1</td>
<td>1,200.00</td>
<td>1,200</td>
</tr>
<tr>
<td>SUBTOTAL</td>
<td></td>
<td></td>
<td></td>
<td>$ 60,050</td>
</tr>
</tbody>
</table>

NET SAVINGS $ 338,950
MARK-UPS (51.00%) $ 172,865
TOTAL SAVINGS $ 511,815

(Mark-Up Calculation: Total Capital Cost $8,176,000 / Estimated Project Cost $5,414,400 = 1.51 or 51.00%)
DESCRIPTION: Use Two Separate Storage Tanks for Leachate and Shallow Aquifer Storage

CRITERIA CHALLENGE: No  CRITERIA NO.:___

ORIGINAL DESIGN: The existing design calls for the use of a single 20,000 gallon tank to store both the leachate and the dewatering of the shallow aquifer. The stored water will be tested for compliance with WQBELs and will be discharged into nearby ponds if treatment is not required. The need for treatment will continue to be evaluated during February 1994 upon receipt of CPL laboratory data. Treatment will likely involve transfer of contaminated stored water to an off-site treatment facility such as the Byesville Sewerage Treatment Plant. The preliminary RD estimate allows for either an above ground or underground tank to be located in the uncapped area. (See Drawing No. 1)

PROPOSED CHANGE: This proposal recommends use two separate storage tanks one for leachate and one for shallow aquifer storage. This proposal further defines the location, establishes approximate sizes, and acquisition of the tanks. Furthermore, since the majority of dewatering and leaching removal will occur in the initial stages of construction, this proposal recommends leasing two larger tanks (say one-15,000 gallon and one-5,000 gallon). This initial leachate and dewatering process can develop more intensely in the initial phases of construction and diminish after the cap has been installed. Two smaller permanent tanks (one for dewatering at, say 5,000 gallons, and one for leachate at, say 1,000 gallons) are installed above ground near the north perimeter of the landfill.

Another variation could be the phasing of the dewatering ahead of schedule to induce early settlement within the landfill which may benefit the construction phase. An early contract prior to the main contract to perform the initial dewatering is possible, or the contractor may be directed to begin dewatering say 3 months prior to start of cap placement.
ADVANTAGES:

1. Reduces the size of the permanent tanks.

2. Separates leachate from dewatering - thereby reducing the amount of contaminant that may require hauling and/or treatment.

3. Separate leachate and dewatering tanks will also allow the discerning of the contaminant source as the shallow aquifer or the leachate seepage.

4. Above ground installation improves leakage detection, response and prevention.

DISADVANTAGES: Access by tanker trucks to haul contaminated water may require continual maintenance for roadway to north side of the landfill site

JUSTIFICATION: Low volume flows justify smaller tank sizes once the site is capped. Savings are estimated at $19,403 for tanks alone. Undefined savings through construction benefits may result from early dewatering efforts.
FULTZ LANDFILL SITE -- STORAGE TANKS
<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELETE:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20,000 Gal Stor Tank</td>
<td>LS</td>
<td>1</td>
<td>$25,000</td>
<td>$ 25,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROPOSED CHANGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADD:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15,000 Gal Leased Tank</td>
<td>Month</td>
<td>3</td>
<td>$250</td>
<td>$ 750</td>
</tr>
<tr>
<td>5,000 Gal Leased Tank</td>
<td>Month</td>
<td>3</td>
<td>$200</td>
<td>$ 600</td>
</tr>
<tr>
<td>5,000 Gal Perm Tank</td>
<td>LS</td>
<td>1</td>
<td>8,100</td>
<td>8,100</td>
</tr>
<tr>
<td>1,000 Gal Perm Tank</td>
<td>LS</td>
<td>1</td>
<td>2,700</td>
<td>2,700</td>
</tr>
</tbody>
</table>

| NET SAVINGS          | $ 12,850|
| MARK-UPS (51.00%)    | $ 6,553 |
| TOTAL SAVINGS        | $ 19,403|

(Mark-Up Calculation: Total Capital Cost $8,176,000 / Estimated Project Cost $5,414,400 = 1.5100 or 51.00%)
ORIGINAL DESIGN: The current gas extraction system consists of an 8-inch thick granular gas collection layer with 6-inch perforated HDPE gas collection pipe located approximately at 400-feet intervals to convey gas to surface vents spaced approximately at one per acre. The gas extraction is a passive venting system emitting low levels of methane gas from the landfill materials and from the mine voids. See the Pultz Landfill Site Plan -- Gas Extraction System and Gas Extraction Cross-Section for locations and details.

PROPOSED DESIGN: This proposal recommends the gas piping be reduced to 4-inch diameter perforated HDPE and the selected sections of the pipe be eliminated. The areas selected for elimination are approximately 1,200 LF and are generally end lines going toward the outside of the landfill cap. Adequate collection piping will remain to fully emit methane gas. It is questioned that the highly perforated HDPE piped loops could be converted to an active venting system with vacuum maintained to the ends of the lines. It is also recommended that the vent pipe be modified from 8-inch ductile iron to 6-inch UV resistant HDPE or PVC. Use of HDPE pipe boots are recommended for pipe penetrations.
ADVANTAGES: 

1. The proposed system is suggested to maintain methane gas extraction at a reduced cost to the project.

2. The HDPE or PVC vent pipe is resistant to methane gas induced corrosion.

3. The landfill age or cycle of gas generation may be peaked to allow use of the passive gas extraction system for the full life of the project.

DISADVANTAGES:

1. The proposed system will not be easily converted to an active gas extraction system if required in the future. It is questioned that the existing system with highly perforated pipes can be effectively converted also.

2. Conversion to an active system may require gas wells, condensate collection and removal, and modified lateral and feeder pipe design and additional construction.

JUSTIFICATION:

1. The 8-inch granular blanket and 4-inch gravity piped gas extraction system is adequate to passive gas flows. The material change and reduced vent pipe size are considered adequate for a passive system. Savings are estimated to be $45,807.
FULTZ LANDFILL SITE PLAN -- GAS EXTRACTION SYSTEM
(NOTED AS MODIFIED)
ORIGINAL DESIGN DRAWING/SKETCH

PROPOSAL NO.: 5

PAGE NO.: 4 OF 5

FULTZ LANDFILL SITE -- GAS EXTRACTION CROSS-SECTION
(NOTED AS MODIFIED)

REVISE 8-INCH DUCTILE IRON GAS VENTS TO
4-INCH HDPE (UV RESISTANT) OR PVC

REVISE GAS COLLECTION PIPE TO 4-INCH
PERFORATED HDPE

ORIGINAL DESIGN DRAWING/SKETCH

PROPOSAL NO.: 5

PAGE NO.: 4 OF 5

FULTZ LANDFILL SITE -- GAS EXTRACTION CROSS-SECTION
(NOTED AS MODIFIED)
## Cost Estimating Worksheet

### Proposal No.: 5

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DELETE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-In HDPE Pipe</td>
<td>LF</td>
<td>10,000</td>
<td>12.00</td>
<td>$120,000</td>
</tr>
<tr>
<td>8-In Ductile Iron</td>
<td>LF</td>
<td>1,000</td>
<td>15.00</td>
<td>15,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$135,000</td>
</tr>
</tbody>
</table>

### Proposed Change

<table>
<thead>
<tr>
<th>ITEM</th>
<th>U/M</th>
<th>QTY</th>
<th>COST</th>
<th>UNIT TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADD:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-In HDPE Pipe</td>
<td>LF</td>
<td>8,800</td>
<td>10.53</td>
<td>$92,664</td>
</tr>
<tr>
<td>6-In Vent Pipe</td>
<td>LF</td>
<td>1,000</td>
<td>12.00</td>
<td>12,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td></td>
<td></td>
<td></td>
<td>$104,664</td>
</tr>
</tbody>
</table>

**NET SAVINGS**            | $30,336  |
**MARK-UPS (51.00%)**      | $15,471  |
**TOTAL SAVINGS**           | $45,807  |
1. VE Study Team conclusions of the Project's Record of Decision and Preliminary Remedial Design -- The Fultz Landfill's scope of work and project objectives were well defined by the Record of Decision (ROD) as described in the Project Description and Background of this report. It is commendable that the preliminary design process has incorporated features to enhance the technical compliance of the design by means that address specific project functional needs, and to provide opportunities which are also more cost effective. The following specific project features were noteworthy for comments by the VE Team:

a. Modifications to the landfill cap were made in the preliminary design to introduce a geosynthetic clay liner (GCL). This material is recognized to perform better than a 24-inch compacted clay layer with considerable other benefits. GCL incorporates a durable polypropylene geotextile for shear strength and slope stability. Permeability, typically $1 \times 10^{-9}$ cm/sec, is better than the $1 \times 10^{-7}$ for clay. Constructibility is much simpler with the light weight GCL (rolls are placed in 15-foot widths and 125-foot lengths). Material hauling and equipment applications are reduced for the GCL. The GCL is not subject to freeze-thaw degradation as is the clay liner. The VE team sees further opportunities for the cap design as are described in Proposals 1A and 1B. The combination of the design and the VE study results in the most proficient cap design with substantial reductions in material dimensions and weights while providing a superior cap.

b. The preliminary design strategy in addressing mine stabilization was well received by the VE team. Allowance for limited subsidence (approximately 2.5 feet) as was described in the report offers overall the most favorable direction for the project. This allows for minimizing effects by subsidence to the cap by design/materials selection (GCL and VLDPE) and groundwater extraction to reduce head acting on the mine aquifer. The proposed 3-foot (thinner, lighter weight) VE cap section compliments this option. Most importantly, it does not threaten water quality of the mine aquifer as does the use of grouting or hydraulic flushing. The aquifer remains critical to Byesville's drinking water supply. Concerns with grout dissolving and leaching into the aquifer may require exhaustive mix design investigations, or use of a totally cementitious mix and column leaching test (TCLP - toxicity characteristic leaching procedures) and compliance with State MCL requirements. Furthermore, cost for special grout mixtures may spiral if a silicate cement grout is used as is described in Appendix B. Cost for this method of silicate-grout mix placement is estimated at nearly $200 per cubic yard to $4,500 per cubic yard, potentially raising project costs by $5 to $10 million (for 26,000 to 52,000 cu. yds.). Contingency planning for a mix design and mobilization plan may be appropriate for emergency repairs if ever required.

c. On-site/off-site Treatment issues will be further resolved after laboratory test data is disseminated.
2. The following issues are provided to address project enhancements or possible constructibility issues:

a. Consider construction sequencing or phased construction contracts for early dewatering of the landfill. This may be accomplished with temporary storage tanks and allows for site settlement (say 3 to 4 months) prior to cap construction.

b. Provide contract allowances for additional geo-erosion control materials, including temporary bio-degradable erosion mats, for more rapid establishment of grassing on landfill sloped areas to enhance nearby wet areas.

c. Extend perforated HDPE leachate collection pipe around toe of the cap for hydrostatic relief for the cap. Increased first cost may avoid future higher repair cost.

d. Provide the allowance for temporary construction encroaching into wetlands with reestablishment of damaged areas by the contractor. It may be quicker and less expensive to reestablish damaged areas than to fully prevent all possibilities of impact during construction.

e. Continue to address relocation of landfill materials from the west near the frontage road to meet local drainage and road shoulder safety. Also this issue supports power line relocation further discussed in comment 3.

3. Revisit Power Line Relocation — The existing design depicts a 12,470 Volt aerial power line traversing the landfill along the west frontage road. The design indicates capping the landfill will necessitate relocating the power line. The plans do not show the planned relocated line; however, a direct cost of $100,000 has been allocated in the estimate for this effort. An estimated direct cost for this relocation has been developed after informal telephone conversations with the Ohio Power Co. ranging to $25,000. (See Drawing No. 1.)

This discussion attempts to define the power line relocation by offering three options:

**OPTION 1:** One option is to try to retain the line in its existing location. The existing poles belong to General Telephone. The power lines on those poles belong to Ohio Power. At the VE study, the A/E indicated that additional borings or site investigations would be made to determine whether the narrow strip (about 30 ft) on the west side of the site requires capping. If the results are positive, capping will not be required under the power line, also the line may not need relocating. This option will offset costs for further site investigations by about $25,000 for the power line and savings of approximately $66,000, at $46 per SY, by not capping this area.
3. Revisit Power Line Relocation (Continued) —

**OPTION 2:** This option suggests skirting the perimeter of the cap on the west side. Relocating poles off of the caps and clear of the drainage ditch must be field verified. The location of the poles in the drawings are approximate, and are subject to the exact placement of the cap and the drainage ditch. Again the relocation will range to $25,000.

**OPTION 3:** This option attempts to relocate the power line off the site; thereby avoiding interference with the cap and the construction activities. There is a concern with the steep slope on the west side of the road. In addition, the representative of Ohio Power indicates that there is a slip condition in the 40-foot road cut leading down hill to the Interstate Highway (shown in Drawing No. 1). Whether the option can be exercised rests with the power company and General Telephone. About $25,000 of Direct costs are added to relocate.

All three options are technically feasible, but each requires further development and field investigations. The direct cost of the power line effort could be about $20,000 - $25,000 if contracted directly between the Government and GTE/Ohio Power rather than through a construction contractor. An adjustment to the Preliminary RD estimate may be made and justification for more field investigation is apparent.
FULTZ LANDFILL SITE -- POWER LINE RELOCATION

CONCEPT ONLY

EXISTING POWERLINE

OEU BOUNDARY

NOTE: LOCATION OF POLES SUBJECT TO FIELD VERIFICATION/INVESTIGATION

EXISTING POLE & LINE

RELOCATED POLE & LINE

O (GEN TELE POLES, OHIO PWR LINE)

SCALE: 1 = 1000

[Diagram showing various options for power line relocation]
VALUE ENGINEERING TEAM STUDY

SUPPORTING DOCUMENTS

1. Contact Directory -- VE Team List
2. F.A.S.T. Diagram
3. Cost Models
4. Speculation List
5. Appendix A - Composite Geotextile Fabric Drainage Net Data
6. Appendix B - Underwater Silicate Grout Mix Data
# VALUE ENGINEERING TEAM STUDY

## CONTACT DIRECTORY

**VALUE ENGINEERING STUDY TEAM FOR THE**
**FULTZ LANDFILL SUPERFUND SITE**
**BYESVILLE, OHIO**
Omaha District, Omaha, NE
8 - 9 February 1994

<table>
<thead>
<tr>
<th>NAME</th>
<th>ORGANIZATION</th>
<th>TELEPHONE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fred McAuley</td>
<td>General Engineer/OVEST</td>
<td>912-652-5715</td>
</tr>
<tr>
<td>Ronald Lanier</td>
<td>Civil Engineer/OVEST</td>
<td>912-652-5449</td>
</tr>
<tr>
<td>Charles Claghorn</td>
<td>Civil Engineer/OVEST</td>
<td>912-652-5173</td>
</tr>
<tr>
<td>Carl Canicatti</td>
<td>General Engineer/OVEST</td>
<td>912-652-5172</td>
</tr>
<tr>
<td>Steven Moore</td>
<td>Civil Engineer/CEMRO</td>
<td>402-221-3929</td>
</tr>
<tr>
<td>Kurk Inglebart</td>
<td>PM/CEMRO</td>
<td>402-221-7830</td>
</tr>
<tr>
<td>Mike Steffensmeier</td>
<td>Technical PM/CEMRO</td>
<td>402-221-7163</td>
</tr>
<tr>
<td>Donald Moses</td>
<td>Geotechnical/CEMRO</td>
<td>402-221-3177</td>
</tr>
<tr>
<td>Robert Saari</td>
<td>Environmental/CEMRO</td>
<td>402-221-4424</td>
</tr>
<tr>
<td>Greg Mellema</td>
<td>Geotechnical/CEMRO</td>
<td>402-221-4707</td>
</tr>
<tr>
<td>Larry Boardman</td>
<td>Geotechnical/CEMRO</td>
<td>402-221-4706</td>
</tr>
<tr>
<td>Thomas Bloom</td>
<td>RPM, EPA - Region 5</td>
<td>312-886-1967</td>
</tr>
<tr>
<td>Raj Rajaram</td>
<td>PRC Environmental Management</td>
<td>708-225-4166</td>
</tr>
</tbody>
</table>
FULTZ LANDFILL SUPERFUND SITE

DESIGN OBJECTIVES
- ASSESS RISKS
- ISOLATE CONTAMINATES
- MONITOR AIR/WATER/LEACHATE
- ASSURE MCL WATER SOURCES
- MEET NPDES PERMIT
- TREAT GROUNDWATER
- AVOID IMPACTING WETLANDS

FUNCTIONS THAT HAPPEN ALL THE TIME
- INSURE SAFETY
- REDUCE/ELIMINATE RISKS TO PUBLIC
- COMPLIANCE WITH STATUTORY PROVISIONS

HOW?

FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM

WHY?

INSTITUTE REMEDIAL ACTIONS
- CONTROL/MONITOR SYSTEMS
- STORE LEACHATE/SHALLOW GROUNDWATER
- MEET NPDES
- COLLECT LEACHATE
- COLLECT SHALLOW GROUNDWATER
- COLLECT METHANE GAS
- CONTAIN LANDFILL CONTAMINATES
- PREVENT ACQUIFER CONTAMINATION
- PROTECT GROUNDWATER
- PROTECT DIRECT EXPOSURE
- PROTECT HUMAN HEALTH/ENVIRONMENT
COST MODEL
TOTAL PROJECT

MAJOR COST ITEMS

- LANDFILL COVER CONSTRUCTION: $7.094
- BONDS AND INSURANCE: $0.265
- GROUNDWATER EXTRACTION SYSTEM: $0.242
- LANDFILL GAS VENTING SYSTEM: $0.204
- POWER LINE RELOCATION: $0.151
- STORM WATER DRAINAGE: $0.144
- GROUNDWATER STORAGE: $0.061
- CLEARING AND GRUBBING: $0.038

TOTAL = $8,200,000
COST MODEL
LANDFILL COVER CONSTRUCTION

MAJOR COST ITEMS

- SELECT FILL $1.229
- SHEET PILING $1.018
- DRAINAGE LAYER $0.973
- GCL $0.923
- GEOTEXTILE FABRIC $0.769
- GAS COLLECTION LAYER $0.647
- VLDPE LINER $0.615
- TOP SOIL/VEGETATION LAYER $0.512
- ENGINEERED SOIL BASE $0.307
- SEEDING $0.069
- CUT AND FILL $0.032

TOTAL = $7,094,130
VALUE ENGINEERING TEAM STUDY

SPECULATION LIST (Annotated)

✓ = Idea for Development  X = Idea Deleted
? = Idea Requires Investigation  CMT = Comment
P = Priority Item  Appropriate

X 1. Collapse Mine Shafts

? 2. Revisit westside of landfill (relocate some or all [and fill materials]).

X 3. In-fill pond #2.

? 4. Move west material to main landfill (see 2).

? 5. Make west area wetland mitigation area (see 2 and 4).

? 6. Put west material on top to achieve minimum slope (see 4 and 5).

P✓ 7. Use gabions for vertical walls (for one or both sheet pile walls).

P✓ 8. Use conc. "T" or "L" wall, slope toe of cap, or other systems (see 7 — choose one).

P✓ 9. Move storage tank down hill, reduce pumping. (Easements for access issue, improved roads needed for construction and maintenance.)

P✓ 10. Use above-ground storage tank.

P✓ 11. New cap section --
   a. 6" cover
      18" select Filter Fab
      Geonet 40 mill VLDPE
      Geocomposit 12" Gravel/Leachate/Gas
      (Reduce Pipe sizes/gas maybe, but water is design driven by flows)
   b. 6" cover
      18" select Filter Fab
      Geonet 40 mill VLDPE
      Geocomposit Other 8" or 10"
      (driven by pipe size)


P✓ 13. Address extraction well and subsidence issue (use telescoping pipe).
<table>
<thead>
<tr>
<th>Idea</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>Use horizontal well drilling (construction sequencing — de-watering).</td>
</tr>
<tr>
<td>☑</td>
<td>Use 2&quot; or 3&quot; pipe to storage tanks; being done in design.</td>
</tr>
<tr>
<td>✗</td>
<td>Delete cap and flush site.</td>
</tr>
<tr>
<td>☑</td>
<td>Use cold-rolled steel pile.</td>
</tr>
<tr>
<td>✗</td>
<td>Use slurry wall.</td>
</tr>
<tr>
<td>✗</td>
<td>Use fiberglass sheet pile.</td>
</tr>
<tr>
<td>☑</td>
<td>Use 4&quot; gas pipe (also investigate loops). (See new cap design.)</td>
</tr>
<tr>
<td>☑</td>
<td>Revisit power line relocation.</td>
</tr>
<tr>
<td>✓</td>
<td>Use vents, delete or reduce pipe (see 20).</td>
</tr>
<tr>
<td>☑</td>
<td>Put construction easements in for wetland construction (re-establish any damaged wetland areas impacted during construction).</td>
</tr>
<tr>
<td>☑</td>
<td>Revisit grout stabilization versus subsidence. (Address work scope ROD and RD. Discuss design and cost avoidance.)</td>
</tr>
<tr>
<td>☑</td>
<td>Reduce north-west portion of sheet pile wall (tie with other wall proposals).</td>
</tr>
<tr>
<td>☑</td>
<td>Extend leachate collection to provide hydrological relief for cap. (Cost growth — technically required to avoid blow out.)</td>
</tr>
<tr>
<td>✗</td>
<td>Relocate road to avoid relocation of waste materials on small west area.</td>
</tr>
<tr>
<td>☑</td>
<td>Consider geotextile versus rip rap for surface drainage (lined ditches).</td>
</tr>
<tr>
<td>✗</td>
<td>Use soil at underdeveloped center area for borrow source.</td>
</tr>
</tbody>
</table>
### VALUE ENGINEERING TEAM STUDY

**SPECULATION LIST (Annotated) (con't)**

| ✓ | 30. Use bio-erosion control mat (also use on landfill cap). (Small increased cost — rapid establishment of erosion protection.) |
| X | 31. Do nothing, do less to site. |
| ✓ | 32. Construction sequencing — de-water before applying cap. (Tie with other proposals; use existing walls for de-watering. Two contracts.) |
| ✓ | 33. Tech revision ROD (PRC to develop full support!). |
| ✓ | 34. Commentaries on design changes from original scope. |
| ✓ | 35. Temporary tanks/leased tanks (mobile) (Econo tanks). |
APPENDIX A: Composite Geotextile Fabric Drainage Net Data
Geotextile replacement saves Corps $1 million

There's a relatively new twist on the traditional method of restoring landfills. Old-fashioned as it seems, "bagging your trash" has turned out to be the best way to deal with garbage, according to a recent engineering review of a project to cap two trash dumps at one of the largest installation restoration projects in the country.

The $11 million project, to cap two abandoned landfills containing hazardous and toxic material at Fort Eustis, Va., calls for more than 80,000 dump truck loads and as many as 600 round trips per day. It will take the contractor, Laidlaw Environmental Services of Burlington, N.C., more than a year to complete. It is the largest installation restoration project in North Atlantic Division (NAD), according to Jack Pickett, the Installation Restoration Program Manager at NAD.

Patrick Devereux, Project Engineer for Norfolk District's Southern Virginia Area Office, explained that one of the keys to the successful clean-up of a landfill project is the final cap which keeps surface water such as rain away from the trash layer, reducing leaching into surrounding soil and water.

Originally, the contract called for the surface cap to be a nearly impermeable layer of clay. "But under the value engineering clause of our contract, Laidlaw submitted an alternate design," Devereaux said. "The design uses manmade materials of very low density polyethylene which is more impervious than the clay and should give a better cap."

It will also save the government the $1 million it would cost to haul the extra two-and-a-half feet of clay and sand.

At first glance, the polyethylene looks like a shiny black kitchen trashbag, only thicker. Two more layers complete the design. A waffle-like drainage grid diverts runoff to the gravel beds encircling the landfill. Next in the three-layer sandwich comes a filter cloth that keeps the perforated drainage grid unlogged.

On top of the three layers of manmade materials goes two feet of topsoil. The final touch calls for replanting vegetation to stabilize the area and further reduce erosion.

Three layers replace the clay-and-sand cap — polyethylene fabric seals the site; a waffle-like drainage grid diverts runoff to gravel beds, and a filter cloth keeps the grid clean.

Geotextiles that resemble plastic bags replace four feet of expensive truck-hauled clay at the largest installation restoration project in North Atlantic Division.

The project actually calls for restoring two sites. The first and oldest is a 53-acre tract along the Warwick River. It was used by the post from 1951 through 1972 to dispose of all types of household and post refuse, including paint, oil, pesticide and herbicide containers, and construction debris.

At 23 acres, the second site is only half as large as the older location. Sitting on a bluff above Bailey's Creek, it operated from 1972 through 1988. It also contains the same types of trash.

The capping also caps years of study of the two sites to ensure the best cleanup strategy. Since the late 1970s, agencies looking at the project have included the Environmental Protection Agency, the Virginia State Department of Waste Management and Department of Environmental Quality, and representatives from the Corps of Engineers and Fort Eustis.

"The change in design provides two advantages," Devereaux said. "We get a better project and save money."

Construction began March 8 and is expected to be finished next July. However, ground and surface water monitoring, including quarterly tests for contaminants, will continue for at least the next five years. According to Corps and post officials, other remedial steps will be taken should monitoring show the need for additional measures.
The Right Choice

The following table shows the flow requirement for a retaining wall and compares those requirements to the flow provided by Tensar DC 1101. These flows are shown for a variety of ground pressures. As you can see, crush-resistant Tensar DC is the choice for maximum reliability, even at high confining pressures.

<table>
<thead>
<tr>
<th>TENSAR Drainage Composite</th>
<th>Flow Rate vs. Confining Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confining Pressure (KPSF)</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>Flow Rate (GPM/FT)</td>
<td>0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>DCF100</td>
<td>Sand</td>
</tr>
<tr>
<td>DC1101</td>
<td>Wall Height</td>
</tr>
</tbody>
</table>

DCF100, our premium product for retaining and foundation walls, is designed for use where waterproofing is critical. DCF100 has a geotextile on one side and an impermeable film on the other, to provide the highest level of protection against seepage or leaks. The film mounts against your waterproofing surface.

DC1101 has a geotextile bonded to one side. It is designed for use with the net side against a waterproofed surface and is used where the top line protection of DCF100 is not needed.

Specify the Best

Tensar Drainage Composites are the ones to choose because they:
- Meet flow requirements in specified applications,
- Provide reliable, long-term flow, and
- Are easy to install, lightweight, and competitively priced

With Tensar Drainage Composites you can specify the flow you need with confidence.

The Engineered Advantage

Please see brochure cover for illustration of other primary applications.

For More Information

TENSAR Geogrids are distributed throughout the United States by Contech Construction Products Inc. For more information on TENSAR design and applications, contact your Contech Construction Products office nearest you.

Contech Construction Products Inc.
Dept. 8067
P.O. Box 800
Middletown, Ohio 45042
1-800-336-1122

Regional Offices are in the following cities

Atlas, P.O. Box 49526
Atlanta, GA 30359
317/525-1014

Contech Construction Products Inc.
317/842-7788

317/842-7788

Memphis, TN 38117
Oak Brook, IL 60521
Palmerton, MA 01068
Raleigh, NC 27609
San Bernardino, CA 92408
Topeka, KS 66614
Wheat Ridge, CO 80033

404/225-0814
505/220-1028
708/63-1110
413/928-7611
71/878-1840
913/923-5950
303/431-8989

Sales Offices are in principal cities.

Tensar is a registered trademark.

©1990 Tensar Earth Technologies, Inc.
MADE IN U.S.A.

The information contained herein has been carefully compiled by Tensar Earth Technologies, Inc., and to the best of our knowledge, accurately represents Tensar product use in the applications which are illustrated. Final determination of the suitability of any information is measured to the user and not the sole responsibility of the user.
VALUE ENGINEERING TEAM STUDY

APPENDIX B: Underwater Silicate Grout Mix Data
Mix halts flowing water in seconds

Additive has been around a long time, but it's becoming sophisticated.

Super fast-setting grout has been making some new marks for stopping water flows and now is in for a major underwater test. A silicate additive causes the cement grout to set in as little as three seconds, even in rushing water.

The mix has been used to stem reservoir leaks, shore up a failing breakwater, and add die properties of Portland cement mixes, according to one producer of the material, The PQ Corp., Valley Forge, Pa.

Light control. What is new is sophisticated application procedures, says Hugh C. Carr, president of The Judy Company, an engineering and construction firm based in Kansas City, Kan. It is a major user of the grout. "In recent years we have developed a placement system which accurately controls the mix of sodium silicate and cement grout and consequently their behavior," says Carr. "When dealing with initial set times of 3 to 50 seconds, accurate control is essential.

It is not really a material, it is a process that allows you to modify any conventional grout," says Richard Reifsnyder, a PQ senior technical service representative.

The silicate forms a semipermeable gel around the grout so that it does not become overly diluted and can achieve maximum strength. According to Reifsnyder, the additive increases compressive strength and lowers permeability while enhancing structural integrity and durability.

The Judy company used the material to restore a crumbling breakwater in Mineral Wells, Texas. (ENR 6/9/88, p. 24). There are voids between the internal walls and there is no base slab. The cracked upstream toe was, he says. "We would have had to do a lot of excavation. The grout really did the job for us."

When workers drilled into the fractured concrete they encountered up to 600 gpm of water flowing under the dam and along its axis in foundation rock. "It's not really a material, it's a process that allows you to modify any conventional grout," says Richard Reifsnyder, a PQ senior technical service representative.

The deep demonstration would test a nozzle that PQ developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.

The material then would form a column with a steep angle of repose (see drawing). According to PQ, that will cost less than one-tenth as much as pumping cement grout into foundation rock. The demonstration would test a nozzle that was developed recently. It delivers cement through a tube surrounded by an annular passage carrying silicate. The two mix at the mouth of the nozzle, preventing clogging.