2741

# CONSTRUCTION QUALITY ASSURANCE FINAL REPORT

## ON-SITE DISPOSAL FACILITY PHASE II CELL 3

**REVISION 0**
**NOVEMBER 1999**
**VOLUME VI**

United States Department of Energy
Fernald Environmental Management Project
Fernald, Ohio


prepared by

GeoSyntec Consultants
Fernald Field Office
7400 Wiley Road, Mail Stop 38
Hamilton, Ohio 45013


under

**Fluor Daniel Fernald**
Subcontract 95PS005028

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# APPENDIX S

# AS-BUILT AND GEOMEMBRANE RECORD DRAWINGS

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# AS-BUILT DRAWINGS

2141

# TOP OF SUBGRADE

GeoSyntec Consultants

# SUBGRADE APPROVAL

**OSDF Phase II Option A – Cell 3**
**Subcontract No. 95PS005028**
**GeoSyntec Project No. GQ0409**

The undersigned have verified the following in accordance with Section 02200 and Section 02225 of the Technical Specifications:

- GeoSyntec CQC personnel witnessed the proofrolling of the subgrade. The subgrade was proofrolled by driving a loaded dump truck (minimum weight of 10 tons per axle and minimum loaded weight of 20 tons) or other pneumatic-tired vehicle, back and forth to confirm the firmness of the subgrade surface. Documentation on the subgrade proofrolling work are presented in the Daily Field Reports, and will be included in the Final CQA Report for Cell 3 lining system construction.

- The subgrade surface has been surveyed and certified by Hirsch & Associates Surveying, Inc. (Hirsch) of Okeana, Ohio. A copy of Hirsch's subgrade certification is attached. The survey certification data have been reviewed by Kwasi Badu-Tweneboah, Ph.D., P.E., of GeoSyntec and found to be within the tolerance of -0.3 ft to +0.1 ft of the grades indicated on the Construction Drawings.

Based on the information presented above, GeoSyntec concludes that the subgrade is acceptable and ready for placement of compacted clay liner. Prior to placement of the first lift of compacted clay liner, the subgrade would have to be scarified to a depth of 2 inches, and all visible rock particles with a maximum dimension larger than 2 inches removed, as required by Part 3.04 of Section 02225.

Collin P. Sukow
CQC Manager

Kwasi Badu-Tweneboah, Ph.D., P.E..
Certifying Resident Engineer
Ohio Registration No. E-55354
7 July 1999

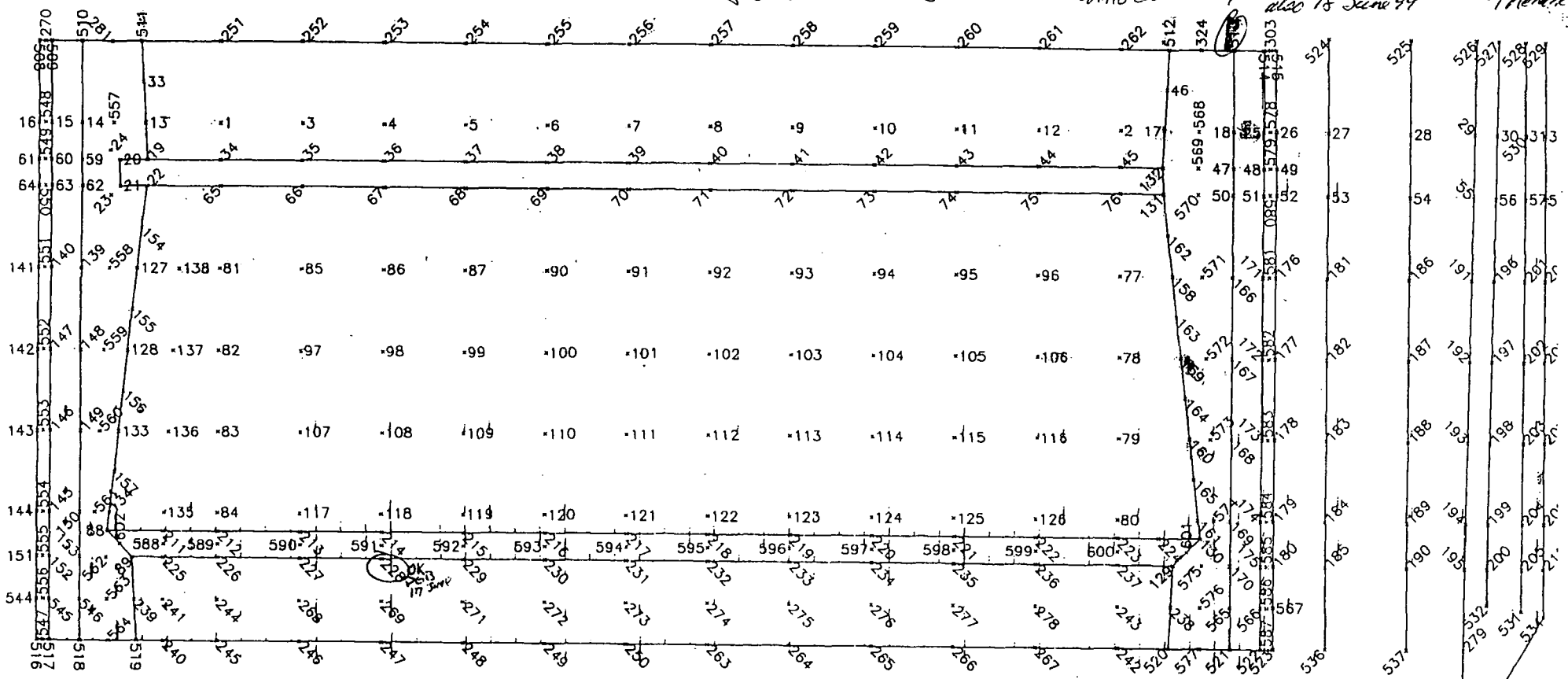
Attachment

Points out of tolerance and unacceptable until corrected, resurveyed and found within tolerance. PBS
Rechecked by EBT 6-28-99, OKay

# Cell 3 Subgrade

TOLERANCE −0.3 ft to +0.1 ft

Points Reviewed by DGB on 3 June 99 and found to be within Tolerance
Points checked by EBT 8-9 June '99 within Tolerance
Points checked by DGB on 17 June 99 and are also 18 June 99



Certify Pts Tolerance @ Proposed Grade
or 0.15' Below Proposed Grade

Points checked by EBT on 28-06-99 and found to be within tolerance. Remaining midpoints outside cell more than 2.0 ft apart.

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HIRSCH & ASSOCIATES SURVEYING, INC.
3610 STATE LINE ROAD
OKEANA, OH 45053
(513) 367-0534
Fax: (513) 367-2935

May 24, 1999

SUBJECT: CERTIFICATION POINTS SUBGRADE CELL 3, FERNALD SITE.

I hereby cetify that the elevations listed on the next 7 pages are the as built elevations of the subgrade for the point numbers listed, along with the date the elevations were taken.

Lynn Edward Hirsch

LYNN EDWARD HIRSCH
REGISTERED OHIO LAND SURVEYOR NO. 5738

file: ferce3sg

STATE OF OHIO
LYNN E. HIRSCH
S-5738
REGISTERED SURVEYOR

All points on the attached pages reviewed and found to be acceptable and within tolerance

Kawai Bodur-Turnbull
7 July 1999

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Prepared by: Hirsch & Associates Surveying, Inc. #CGDS07961
List-Coords/Brg-Azi PET3SG 7/02/98 6:18:07 Factor: 1.0000000

| Pt.No. | Code | North | East | Prop. Elev Elevation | Desc. | As Built Elev | |
|---|---|---|---|---|---|---|---|
| 1 | SG | 482202.28109 | 1350890.51312 | 593.120 | grid point | 593.03 | 5/24/99 |
| 2 | SG | 482195.55312 | 1351440.47197 | 598.620 | grid point | 598.62 | 5/24/99 |
| 3 | SG | 482201.66945 | 1350940.50938 | 593.620 | grid point | 593.59 | 5/24/99 |
| 4 | SG | 482201.05782 | 1350990.50564 | 594.120 | grid point | 594.10 | 5/24/99 |
| 5 | SG | 482200.44619 | 1351040.50190 | 594.620 | grid point | 594.60 | 5/25/99 |
| 6 | SG | 482199.83455 | 1351090.49816 | 595.120 | grid point | 595.12 | 5/24/99 |
| 7 | SG | 482199.22292 | 1351140.49442 | 595.620 | grid point | 595.62 | 5/24/99 |
| 8 | SG | 482198.61129 | 1351190.49068 | 596.120 | grid point | 596.12 | 5/24/99 |
| 9 | SG | 482197.99965 | 1351240.48694 | 596.620 | grid point | 596.62 | 5/24/99 |
| 10 | SG | 482197.38802 | 1351290.48320 | 597.120 | grid point | 597.12 | 5/24/99 |
| 11 | SG | 482196.77639 | 1351340.47946 | 597.620 | grid point | 597.62 | 5/24/99 |
| 12 | SG | 482196.16475 | 1351390.47571 | 598.120 | grid point | 598.12 | 5/24/99 |
| 13 | SG | 482202.84434 | 1350844.47131 | 592.660 | toe slp | 592.63 | 5/24/99 |
| 14 | SG | 482203.31915 | 1350805.65951 | 602.370 | top slp | 602.28 | 6/1/99 |
| 15 | SG | 482203.54816 | 1350786.93950 | 602.740 | toe slp | 602.65 | 6/22/99 |
| 16 | SG | 482203.64346 | 1350779.14946 | 607.940 | top slp | 607.91 | 6/22/99 |
| 17 | SG | 482195.22554 | 1351467.24938 | 598.900 | toe slp | 598.90 | 5/24/99 |
| 18 | SG | 482194.71160 | 1351509.25942 | 609.390 | top slp | 609.39 | 6/4/99 |
| 19 | SG | 482180.26000 | 1350845.28000 | 592.220 | toe slp | 592.07 | 6/8/98 |
| 20 | SG | 482180.46000 | 1350828.56000 | 592.060 | toe slp | 591.93 | 6/8/98 |
| 21 | SG | 482164.46000 | 1350828.36000 | 592.060 | toe slp | 592.03 | 6/8/98 |
| 22 | SG | 482164.26000 | 1350844.63000 | 592.220 | toe slp | 592.19 | 6/8/98 |
| 23 | SG | 482158.89000 | 1350822.71000 | 597.640 | top slp | 597.64 | 6/16/99 |
| 24 | SG | 482186.45000 | 1350822.77000 | 597.920 | top slp | 597.88 | 6/16/99 |
| 25 | SG | 482194.48261 | 1351527.97807 | 609.770 | toe slp | 609.64 | 6/12/99 KFT |
| 26 | SG | 482194.38731 | 1351535.76801 | 614.960 | top slp | 614.95 | 6/15/99 6-28- |
| 27 | SG | 482194.00046 | 1351567.38962 | 609.690 | toe slp | | |
| 28 | SG | 482193.38768 | 1351617.47958 | 606.690 | toe slp | | |
| 29 | SG | 482192.90505 | 1351656.93126 | 600.120 | cl dit | | |
| 30 | SG | 482192.73793 | 1351670.59155 | 604.670 | top slp | | |
| 31 | SG | 482192.51907 | 1351688.48205 | 604.840 | toe slp | | |
| 32 | SG | 482192.37103 | 1351700.58312 | 609.020 | top slp | | |
| 33 | SG | 482227.88601 | 1350843.57462 | 593.150 | toe slp | 593.10 | 5/24/99 |
| 34 | SG | 482179.71010 | 1350890.23700 | 592.670 | grid point | 592.65 | 5/25/99 |
| 35 | SG | 482179.09856 | 1350940.23326 | 593.170 | grid point | 593.17 | 5/25/99 |
| 36 | SG | 482178.48702 | 1350990.22952 | 593.670 | grid point | 593.62 | 5/25/99 |
| 37 | SG | 482177.87549 | 1351040.22578 | 594.170 | grid point | 594.11 | 5/25/99 |
| 38 | SG | 482177.26395 | 1351090.22204 | 594.670 | grid point | 594.58 | 5/25/99 |
| 39 | SG | 482176.65241 | 1351140.21830 | 595.170 | grid point | 595.06 | 5/25/99 |
| 40 | SG | 482176.04087 | 1351190.21456 | 595.670 | grid point | 595.67 | 5/25/99 |
| 41 | SG | 482175.42933 | 1351240.21082 | 596.170 | grid point | 596.09 | 5/25/99 |
| 42 | SG | 482174.81780 | 1351290.20708 | 596.670 | grid point | 596.65 | 5/25/99 |
| 43 | SG | 482174.20626 | 1351340.20334 | 597.170 | grid point | 597.14 | 5/25/99 |
| 44 | SG | 482173.59472 | 1351390.19960 | 597.670 | grid point | 597.57 | 5/25/99 |
| 45 | SG | 482172.98318 | 1351440.19586 | 598.170 | grid point | 598.08 | 5/25/99 |
| 46 | SG | 482220.24145 | 1351468.85685 | 599.410 | toe slp | 599.41 | 5/24/99 |
| 47 | SG | 482172.14179 | 1351508.98379 | 609.220 | top slp | 609.07 | 6/4/99 |
| 48 | SG | 482171.91284 | 1351527.70183 | 609.600 | toe slp | 609.48 | 6/11/99 |
| 49 | SG | 482171.81755 | 1351535.49177 | 614.790 | top slp | 614.74 | 6/15/99 |
| 50 | SG | 482156.14865 | 1351508.78849 | 609.100 | top slp | 609.03 | 6/4/99 |
| 51 | SG | 482155.92005 | 1351527.50609 | 609.480 | toe slp | 609.38 | 6/11/99 |
| 52 | SG | 482155.82491 | 1351535.29603 | 614.670 | top slp | 614.54 | 6/15/99 |
| 53 | SG | 482155.43872 | 1351566.91769 | 609.400 | toe slp | | |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 54 | SG | 482154.82697 | 1351617.00767 | 606.400 | toe slp | | |
| 55 | SG | 482154.35221 | 1351655.88113 | 599.930 | cl dit | | |
| 56 | SG | 482154.18537 | 1351669.54175 | 604.480 | top slp | | |
| 57 | SG | 482153.96062 | 1351687.94402 | 604.660 | toe slp | | |
| 58 | SG | 482153.81015 | 1351700.26465 | 608.890 | top slp | | |
| 59 | SG | 482180.74348 | 1350805.38381 | 602.200 | top slp | 602.12 | 6/16/99 |
| 60 | SG | 482180.96115 | 1350786.66366 | 602.570 | toe slp | 602.45 | 6/22/99 |
| 61 | SG | 482181.05433 | 1350778.87361 | 607.770 | top slp | 607.76 | 6/22/99 |
| 62 | SG | 482164.74484 | 1350805.18844 | 602.080 | top slp | 601.95 | 6/16/99 |
| 63 | SG | 482164.97495 | 1350786.46844 | 602.450 | toe slp | 602.35 | 6/22/99 |
| 64 | SG | 482165.07071 | 1350778.67842 | 607.650 | top slp | 607.54 | 6/18/99 |
| 65 | SG | 482163.70539 | 1350890.04121 | 592.670 | grid pt | 592.67 | 5/25/99 |
| 66 | SG | 482163.09479 | 1350940.03748 | 593.170 | grid pt | 593.17 | 5/25/99 |
| 67 | SG | 482162.48419 | 1350990.03375 | 593.670 | grid pt | 593.67 | 5/25/99 |
| 68 | SG | 482161.87358 | 1351040.03002 | 594.170 | grid pt | 594.09 | 5/25/99 |
| 69 | SG | 482161.26298 | 1351090.02629 | 594.670 | grid pt | 594.58 | 5/25/99 |
| 70 | SG | 482160.65238 | 1351140.02256 | 595.170 | grid pt | 595.11 | 5/25/99 |
| 71 | SG | 482160.04177 | 1351190.01883 | 595.670 | grid pt | 595.67 | 5/25/99 |
| 72 | SG | 482159.43117 | 1351240.01511 | 596.170 | grid pt | 596.12 | 5/25/99 |
| 73 | SG | 482158.82057 | 1351290.01138 | 596.670 | grid pt | 596.64 | 5/25/99 |
| 74 | SG | 482158.20996 | 1351340.00765 | 597.170 | grid pt | 597.05 | 5/25/99 |
| 75 | SG | 482157.59936 | 1351390.00392 | 597.670 | grid pt | 597.67 | 5/25/99 |
| 76 | SG | 482156.98876 | 1351440.00019 | 598.170 | grid pt | 598.03 | 5/25/99 |
| 77 | SG | 482106.99248 | 1351439.38959 | 599.170 | grid pt | 599.15 | 5/27/99 |
| 78 | SG | 482056.99621 | 1351438.77899 | 600.170 | grid pt | 600.15 | 6/3/99 |
| 79 | SG | 482006.99994 | 1351438.16838 | 601.180 | grid pt | 601.17 | 6/3/99 |
| 80 | SG | 481957.00367 | 1351437.55778 | 602.180 | grid pt | 602.18 | 6/3/99 |
| 81 | SG | 482113.70912 | 1350889.43060 | 593.670 | grid pt | 593.67 | 5/27/99 |
| 82 | SG | 482063.71285 | 1350888.82000 | 594.670 | grid pt | 594.67 | 6/3/99 |
| 83 | SG | 482013.71658 | 1350888.20940 | 595.670 | grid pt | 595.66 | 6/3/99 |
| 84 | SG | 481963.72031 | 1350887.59879 | 596.670 | grid pt | 596.57 | 6/3/99 |
| 85 | SG | 482113.09852 | 1350939.42687 | 594.170 | grid pt | 594.16 | 5/27/99 |
| 86 | SG | 482112.48792 | 1350989.42315 | 594.670 | grid pt | 594.64 | 5/27/99 |
| 87 | SG | 482111.87731 | 1351039.41942 | 595.170 | grid pt | 595.17 | 5/27/99 |
| 88 | SG | 481953.45000 | 1350819.72000 | 596.220 | toe slp | 596.20 | 6/3/99 |
| 89 | SG | 481936.90000 | 1350834.78000 | 592.280 | toe slp | 592.25 | 6/9/99 |
| 90 | SG | 482111.26671 | 1351089.41569 | 595.670 | grid pt | 595.66 | 5/27/99 |
| 91 | SG | 482110.65611 | 1351139.41196 | 596.170 | grid pt | 596.15 | 5/27/99 |
| 92 | SG | 482110.04550 | 1351189.40823 | 596.670 | grid pt | 596.59 | 5/27/99 |
| 93 | SG | 482109.43490 | 1351239.40450 | 597.170 | grid pt | 597.13 | 5/27/99 |
| 94 | SG | 482108.82430 | 1351289.40077 | 597.670 | grid pt | 597.64 | 5/27/99 |
| 95 | SG | 482108.21369 | 1351339.39705 | 598.170 | grid pt | 598.14 | 5/27/99 |
| 96 | SG | 482107.60309 | 1351389.39332 | 598.670 | grid pt | 598.67 | 5/27/99 |
| 97 | SG | 482063.10225 | 1350938.81627 | 595.170 | grid pt | 595.17 | 6/3/99 |
| 98 | SG | 482062.49164 | 1350988.81254 | 595.670 | grid pt | 595.66 | 6/3/99 |
| 99 | SG | 482061.88104 | 1351038.80881 | 596.170 | grid pt | 596.16 | 6/3/99 |
| 100 | SG | 482061.27044 | 1351088.80509 | 596.670 | grid pt | 596.67 | 6/3/99 |
| 101 | SG | 482060.65983 | 1351138.80136 | 597.170 | grid pt | 597.17 | 6/3/99 |
| 102 | SG | 482060.04923 | 1351188.79763 | 597.670 | grid pt | 597.66 | 6/3/99 |
| 103 | SG | 482059.43863 | 1351238.79390 | 598.170 | grid pt | 598.13 | 6/3/99 |
| 104 | SG | 482058.82802 | 1351288.79017 | 598.670 | grid pt | 598.67 | 6/3/99 |
| 105 | SG | 482058.21742 | 1351338.78644 | 599.170 | grid pt | 599.15 | 6/3/99 |
| 106 | SG | 482057.60682 | 1351388.78271 | 599.670 | grid pt | 599.67 | 5/24/99 |
| 107 | SG | 482013.10598 | 1350938.20567 | 596.180 | grid pt | 596.18 | 6/3/99 |
| 108 | SG | 482012.49537 | 1350988.20194 | 596.680 | grid pt | 596.66 | 6/3/99 |
| 109 | SG | 482011.88477 | 1351038.19821 | 597.180 | grid pt | 597.16 | 6/3/99 |
| 110 | SG | 482011.27417 | 1351088.19448 | 597.680 | grid pt | 597.64 | 6/3/99 |
| 111 | SG | 482010.66356 | 1351138.19075 | 598.180 | grid pt | 598.18 | 6/3/99 |
| 112 | SG | 482010.05296 | 1351188.18702 | 598.680 | grid pt | 598.67 | 6/3/99 |
| 113 | SG | 482009.44236 | 1351238.18330 | 599.180 | grid pt | 599.13 | 6/3/99 |

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|---|---|---|---|---|---|---|---|---|
| 114 | SG | 482008.83175 | 1351288.17957 | 599.680 | grid | pt | 599.64 | 6/3/99 |
| 115 | SG | 482008.22115 | 1351338.17584 | 600.180 | grid | pt | 600.13 | 6/3/99 |
| 116 | SG | 482007.61055 | 1351388.17211 | 600.680 | grid | pt | 600.62 | 6/3/99 |
| 117 | SG | 481963.10970 | 1350937.59506 | 597.180 | grid | pt | 597.15 | 6/3/99 |
| 118 | SG | 481962.49910 | 1350987.59134 | 597.680 | grid | pt | 597.64 | 6/3/99 |
| 119 | SG | 481961.88850 | 1351037.58761 | 598.180 | grid | pt | 598.17 | 6/3/99 |
| 120 | SG | 481961.27789 | 1351087.58388 | 598.680 | grid | pt | 598.68 | 6/3/99 |
| 121 | SG | 481960.66729 | 1351137.58015 | 599.180 | grid | pt | 599.18 | 6/3/99 |
| 122 | SG | 481960.05669 | 1351187.57642 | 599.680 | grid | pt | 599.68 | 6/3/99 |
| 123 | SG | 481959.44608 | 1351237.57269 | 600.180 | grid | pt | 600.17 | 6/3/99 |
| 124 | SG | 481958.83548 | 1351287.56896 | 600.680 | grid | pt | 600.61 | 6/3/99 |
| 125 | SG | 481958.22488 | 1351337.56524 | 601.180 | grid | pt | 601.13 | 6/3/99 |
| 126 | SG | 481957.61427 | 1351387.56151 | 601.680 | grid | pt | 601.63 | 6/3/99 |
| 127 | SG | 482114.32833 | 1350838.72991 | 593.170 | toe | slp | 593.11 | 6/3/99 |
| 128 | SG | 482064.39666 | 1350832.82982 | 594.120 | toe | slp | 594.12 | 6/3/99 |
| 129 | SG | 481929.12000 | 1351470.97000 | 598.640 | toe | slp | 598.59 | 5/25/99 |
| 130 | SG | 481945.29000 | 1351487.71000 | 602.900 | toe | slp | 602.88 | 5/25/99 |
| 131 | SG | 482156.67000 | 1351466.10000 | 598.430 | toe | slp | 598.43 | 5/24/99 |
| 132 | SG | 482172.67000 | 1351465.80000 | 598.430 | toe | slp | 598.41 | 5/24/99 |
| 133 | SG | 482014.46499 | 1350826.92973 | 595.060 | toe | slp | 594.97 | 6/3/99 |
| 134 | SG | 481964.53332 | 1350821.02964 | 596.010 | toe | slp | 596.01 | 6/3/99 |
| 135 | SG | 481964.12331 | 1350854.60125 | 596.340 | grid | pt | 596.30 | 6/3/99 |
| 136 | SG | 482014.08905 | 1350857.71167 | 595.370 | grid | pt | 595.35 | 6/3/99 |
| 137 | SG | 482064.05479 | 1350860.82209 | 594.390 | grid | pt | 594.36 | 6/3/99 |
| 138 | SG | 482114.01442 | 1350864.43247 | 593.420 | grid | pt | 593.40 | 5/27/99 |
| 139 | SG | 482114.74543 | 1350804.57784 | 601.710 | top | slp | 601.68 | 6/16/99 |
| 140 | SG | 482114.97405 | 1350785.85783 | 602.070 | toe | slp | 602.05 | 6/23/99 |
| 141 | SG | 482115.06919 | 1350778.06781 | 607.280 | top | slp | 607.20 | 6/18/99 |
| 142 | SG | 482065.07292 | 1350777.45727 | 606.900 | top | slp | 606.85 | 6/18/99 |
| 143 | SG | 482015.07665 | 1350776.84673 | 606.530 | top | slp | 606.44 | 6/18/99 |
| 144 | SG | 481965.08038 | 1350776.23619 | 606.150 | top | slp | 606.06 | 6/22/99 |
| 145 | SG | 481964.98524 | 1350784.02616 | 600.950 | toe | slp | 600.83 | 6/22/99 |
| 146 | SG | 482014.98151 | 1350784.63671 | 601.320 | toe | slp | 601.17 | 6/22/99 |
| 147 | SG | 482064.97778 | 1350785.24727 | 601.700 | toe | slp | 601.64 | 6/22/99 |
| 148 | SG | 482064.74916 | 1350803.96729 | 601.330 | top | slp | 601.30 | 6/16/99 |
| 149 | SG | 482014.75288 | 1350803.35673 | 600.960 | top | slp | 600.90 | 6/16/99 |
| 150 | SG | 481964.75661 | 1350802.74618 | 600.580 | top | slp | 600.48 | 6/16/99 |
| 151 | SG | 481937.62004 | 1350775.90086 | 605.940 | top | slp | 605.81 | 6/22/99 |
| 152 | SG | 481937.52477 | 1350783.69081 | 600.740 | toe | slp | 600.60 | 6/7/99 |
| 153 | SG | 481937.29584 | 1350802.41082 | 600.370 | top | slp | 600.29 | 6/16/99 |
| 154 | SG | 482139.43273 | 1350841.69633 | 592.690 | toe | slp | 592.69 | 6/3/99 |
| 155 | SG | 482089.50105 | 1350835.79624 | 593.640 | toe | slp | 593.64 | 6/3/99 |
| 156 | SG | 482039.56938 | 1350829.89615 | 594.590 | toe | slp | 594.53 | 6/3/99 |
| 157 | SG | 481989.63771 | 1350823.99606 | 595.540 | toe | slp | 595.49 | 6/3/99 |
| 158 | SG | 482106.60376 | 1351471.21842 | 599.490 | toe | slp | 599.40 | 6/3/99 |
| 159 | SG | 482056.53752 | 1351476.33684 | 600.550 | toe | slp | 600.46 | 5/24/99 |
| 160 | SG | 482006.47128 | 1351481.45526 | 601.650 | toe | slp | 601.60 | 5/24/99 |
| 161 | SG | 481956.40504 | 1351486.57368 | 602.660 | toe | slp | 602.66 | 6/3/99 |
| 162 | SG | 482131.79963 | 1351468.64257 | 598.960 | toe | slp | 598.85 | 6/3/99 |
| 163 | SG | 482081.73339 | 1351473.76099 | 600.010 | toe | slp | 600.00 | 6/3/99 |
| 164 | SG | 482031.66715 | 1351478.87941 | 601.070 | toe | slp | 601.07 | 6/3/99 |
| 165 | SG | 481981.60091 | 1351483.99783 | 602.130 | toe | slp | 602.04 | 6/3/99 |
| 166 | SG | 482106.15237 | 1351508.17793 | 608.730 | top | slp | 608.70 | 6/4/99 |
| 167 | SG | 482056.15610 | 1351507.56737 | 608.350 | top | slp | 608.20 | 6/4/99 |
| 168 | SG | 482006.15983 | 1351506.95682 | 607.980 | top | slp | 607.92 | 6/4/99 |
| 169 | SG | 481956.16356 | 1351506.34626 | 607.600 | top | slp | 607.57 | 6/4/99 |
| 170 | SG | 481928.69148 | 1351506.01077 | 607.390 | top | slp | 607.39 | 6/4/99 |
| 171 | SG | 482105.92379 | 1351526.89418 | 609.100 | toe | slp | 609.02 | 6/11/99 |
| 172 | SG | 482055.92754 | 1351526.28226 | 608.730 | toe | slp | 608.58 | 6/11/99 |
| 173 | SG | 482005.93128 | 1351525.67035 | 608.350 | toe | slp | 608.35 | 6/15/99 |

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|---|---|---|---|---|---|---|---|---|
| 174 | SG | 481955.93503 | 1351525.05843 | 607.980 | toe | slp | 607.94 | 6/15/99 |
| 175 | SG | 481928.46266 | 1351524.72219 | 607.770 | toe | slp | 607.77 | 6/15/99 |
| 176 | SG | 482105.82865 | 1351534.68411 | 614.290 | top | slp | 614.29 | 6/15/99 |
| 177 | SG | 482055.83240 | 1351534.07220 | 613.920 | top | slp | 613.87 | 6/15/97 |
| 178 | SG | 482005.83614 | 1351533.46028 | 613.540 | top | slp | 613.52 | 6/15/97 |
| 179 | SG | 481955.83989 | 1351532.84837 | 613.170 | top | slp | 613.10 | 6/15/97 |
| 180 | SG | 481928.36740 | 1351532.51212 | 612.960 | top | slp | 612.81 | 6/15/97 |
| 181 | SG | 482105.44246 | 1351566.30583 | 609.030 | toe | slp | | |
| 182 | SG | 482055.44620 | 1351565.69397 | 608.650 | toe | slp | | |
| 183 | SG | 482005.44995 | 1351565.08211 | 608.280 | toe | slp | | |
| 184 | SG | 481955.45369 | 1351564.47025 | 607.910 | toe | slp | | |
| 185 | SG | 481927.98069 | 1351564.13403 | 607.700 | toe | slp | | |
| 186 | SG | 482104.83071 | 1351616.39581 | 606.020 | toe | slp | | |
| 187 | SG | 482054.83446 | 1351615.78395 | 605.650 | toe | slp | | |
| 188 | SG | 482004.83820 | 1351615.17209 | 605.270 | toe | slp | | |
| 189 | SG | 481954.84194 | 1351614.56023 | 604.900 | toe | slp | | |
| 190 | SG | 481927.36814 | 1351614.22400 | 604.690 | toe | slp | | |
| 191 | SG | 482104.36511 | 1351654.51954 | 599.680 | cl | dit | | |
| 192 | SG | 482054.37801 | 1351653.15795 | 599.430 | cl | dit | | |
| 193 | SG | 482004.39091 | 1351651.79636 | 599.180 | cl | dit | | |
| 194 | SG | 481954.40381 | 1351650.43477 | 598.930 | cl | dit | | |
| 195 | SG | 481926.93447 | 1351649.68654 | 598.790 | cl | dit | | |
| 196 | SG | 482104.19827 | 1351668.18058 | 604.230 | top | slp | | |
| 197 | SG | 482054.21116 | 1351666.81941 | 603.980 | top | slp | | |
| 198 | SG | 482004.22406 | 1351665.45825 | 603.730 | top | slp | | |
| 199 | SG | 481954.23695 | 1351664.09708 | 603.480 | top | slp | | |
| 200 | SG | 481926.76739 | 1351663.34907 | 603.340 | top | slp | | |
| 201 | SG | 482103.96541 | 1351687.24640 | 604.420 | toe | slp | | |
| 202 | SG | 482053.97021 | 1351686.54879 | 604.180 | toe | slp | | |
| 203 | SG | 482003.97500 | 1351685.85117 | 603.940 | toe | slp | | |
| 204 | SG | 481953.97979 | 1351685.15355 | 603.690 | toe | slp | | |
| 205 | SG | 481926.50543 | 1351684.77019 | 603.560 | toe | slp | | |
| 206 | SG | 482103.81147 | 1351699.85170 | 608.720 | top | slp | | |
| 207 | SG | 482053.81278 | 1351699.43876 | 608.550 | top | slp | | |
| 208 | SG | 482003.81410 | 1351699.02582 | 608.370 | top | slp | | |
| 209 | SG | 481953.81541 | 1351698.61288 | 608.200 | top | slp | | |
| 210 | SG | 481926.33892 | 1351698.38595 | 608.100 | top | slp | | |
| 211 | SG | 481953.03233 | 1350853.91083 | 596.560 | top | slp | 596.55 | 6/4/99 |
| 212 | SG | 481952.62247 | 1350887.46325 | 596.900 | top | slp | 596.79 | 6/4/99 |
| 213 | SG | 481952.01172 | 1350937.45952 | 597.400 | top | slp | 597.34 | 6/4/99 |
| 214 | SG | 481951.40098 | 1350987.45579 | 597.900 | top | slp | 597.90 | 6/4/99 |
| 215 | SG | 481950.79024 | 1351037.45206 | 598.400 | top | slp | 598.40 | 6/4/99 |
| 216 | SG | 481950.17950 | 1351087.44833 | 598.900 | top | slp | 598.87 | 6/4/99 |
| 217 | SG | 481949.56876 | 1351137.44460 | 599.400 | top | slp | 599.25 | 6/4/99 |
| 218 | SG | 481948.95801 | 1351187.44087 | 599.900 | top | slp | 599.80 | 6/4/99 |
| 219 | SG | 481948.34727 | 1351237.43714 | 600.400 | top | slp | 600.26 | 6/4/99 |
| 220 | SG | 481947.73653 | 1351287.43341 | 600.900 | top | slp | 600.78 | 6/4/99 |
| 221 | SG | 481947.12579 | 1351337.42968 | 601.400 | top | slp | 601.27 | 6/4/99 |
| 222 | SG | 481946.51505 | 1351387.42595 | 601.900 | top | slp | 601.82 | 6/4/99 |
| 223 | SG | 481945.90430 | 1351437.42222 | 602.400 | top | slp | 602.26 | 6/4/99 |
| 224 | SG | 481945.59893 | 1351462.42036 | 602.650 | top | slp | 602.50 | 6/4/99 |
| 225 | SG | 481936.66849 | 1350853.71098 | 592.470 | toe | slp | 592.37 | 6/9/99 |
| 226 | SG | 481936.25818 | 1350887.26340 | 592.810 | toe | slp | 592.80 | 6/9/99 |
| 227 | SG | 481935.64677 | 1350937.25966 | 593.310 | toe | slp | 593.31 | 6/9/99 |
| 228 | SG | 481935.03536 | 1350987.25592 | 593.810 | toe | slp | 593.81 | 6/16/99 |
| 229 | SG | 481934.42396 | 1351037.25218 | 594.310 | toe | slp | 594.21 | 6/4/99 |
| 230 | SG | 481933.81255 | 1351087.24844 | 594.810 | toe | slp | 594.77 | 6/4/99 |
| 231 | SG | 481933.20114 | 1351137.24471 | 595.310 | toe | slp | 595.29 | 6/4/99 |
| 232 | SG | 481932.58974 | 1351187.24097 | 595.810 | toe | slp | 595.78 | 6/4/99 |
| 233 | SG | 481931.97833 | 1351237.23723 | 596.310 | toe | slp | 596.28 | 6/4/99 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 234 | SG | 481931.36692 | 1351287.23349 | 596.810 | toe slp | 596.71 | 6/13/99 |
| 235 | SG | 481930.75552 | 1351337.22975 | 597.310 | toe slp | 597.31 | 6/13/99 |
| 236 | SG | 481930.14411 | 1351387.22601 | 597.810 | toe slp | 597.80 | 6/6/99 |
| 237 | SG | 481929.53270 | 1351437.22228 | 598.310 | toe slp | 598.30 | 6/4/99 |
| 238 | SG | 481903.31332 | 1351469.31021 | 598.110 | toe slp | 598.05 | 6/4/99 |
| 239 | SG | 481911.05673 | 1350835.70994 | 591.780 | toe slp | 591.78 | 6/16/99 |
| 240 | SG | 481885.00923 | 1350853.08006 | 591.430 | grid pt | 591.41 | 6/16/99 |
| 241 | SG | 481910.84059 | 1350853.39554 | 591.950 | grid pt | 591.85 | 6/16/99 |
| 242 | SG | 481877.87930 | 1351436.59143 | 597.270 | grid pt | 597.22 | 6/4/99 |
| 243 | SG | 481903.70933 | 1351436.90690 | 597.790 | grid pt | 597.76 | 6/4/99 |
| 244 | SG | 481910.43053 | 1350886.94797 | 592.290 | grid pt | 592.16 | 6/9/99 |
| 245 | SG | 481884.59947 | 1350886.63249 | 591.770 | grid pt | 591.76 | 6/16/99 |
| 246 | SG | 481883.98890 | 1350936.62876 | 592.270 | grid pt | 592.23 | 6/16/99 |
| 247 | SG | 481883.37833 | 1350986.62503 | 592.770 | grid pt | 592.74 | 6/9/99 |
| 248 | SG | 481882.76775 | 1351036.62131 | 593.270 | grid pt | 593.12 | 6/9/99 |
| 249 | SG | 481882.15718 | 1351086.61758 | 593.770 | grid pt | 593.76 | 6/4/99 |
| 250 | SG | 481881.54661 | 1351136.61385 | 594.270 | grid pt | 594.16 | 6/10/99 |
| 251 | SG | 482252.27735 | 1350891.12476 | 594.120 | grid pt | 594.12 | 5/25/99 |
| 252 | SG | 482251.66571 | 1350941.12102 | 594.620 | grid pt | 594.61 | 5/24/99 |
| 253 | SG | 482251.05408 | 1350991.11728 | 595.120 | grid pt | 594.98 | 5/24/99 |
| 254 | SG | 482250.44245 | 1351041.11354 | 595.620 | grid pt | 595.61 | 5/24/99 |
| 255 | SG | 482249.83081 | 1351091.10979 | 596.120 | grid pt | 596.03 | 5/24/99 |
| 256 | SG | 482249.21918 | 1351141.10605 | 596.620 | grid pt | 596.57 | 5/24/99 |
| 257 | SG | 482248.60755 | 1351191.10231 | 597.120 | grid pt | 597.12 | 5/24/99 |
| 258 | SG | 482247.99591 | 1351241.09857 | 597.620 | grid pt | 597.60 | 5/24/99 |
| 259 | SG | 482247.38428 | 1351291.09483 | 598.120 | grid pt | 598.11 | 5/24/99 |
| 260 | SG | 482246.77265 | 1351341.09109 | 598.620 | grid pt | 598.55 | 5/24/99 |
| 261 | SG | 482246.16101 | 1351391.08735 | 599.120 | grid pt | 599.12 | 5/24/99 |
| 262 | SG | 482245.54938 | 1351441.08361 | 599.620 | grid pt | 599.62 | 5/24/99 |
| 263 | SG | 481880.93604 | 1351186.61012 | 594.770 | grid pt | 594.66 | 6/4/99 |
| 264 | SG | 481880.32546 | 1351236.60639 | 595.270 | grid pt | 595.19 | 6/4/99 |
| 265 | SG | 481879.71489 | 1351286.60267 | 595.770 | grid pt | 595.71 | 6/4/99 |
| 266 | SG | 481879.10432 | 1351336.59894 | 596.270 | grid pt | 596.16 | 6/4/99 |
| 267 | SG | 481878.49374 | 1351386.59521 | 596.770 | grid pt | 596.68 | 6/4/99 |
| 268 | SG | 481909.81951 | 1350936.94423 | 592.790 | grid pt | 592.74 | 6/9/99 |
| 269 | SG | 481909.20850 | 1350986.94050 | 593.290 | grid pt | 593.22 | 6/9/99 |
| 270 | SG | 482253.58994 | 1350783.65968 | 605.720 | mid pt | | |
| 271 | SG | 481908.59748 | 1351036.93676 | 593.790 | grid pt | 593.72 | 6/9/99 |
| 272 | SG | 481907.98646 | 1351086.93303 | 594.290 | grid pt | 594.21 | 6/9/99 |
| 273 | SG | 481907.37544 | 1351136.92930 | 594.790 | grid pt | 594.70 | 6/4/99 |
| 274 | SG | 481906.76442 | 1351186.92556 | 595.290 | grid pt | 595.26 | 6/4/99 |
| 275 | SG | 481906.15340 | 1351236.92183 | 595.790 | grid pt | 595.69 | 6/4/99 |
| 276 | SG | 481905.54239 | 1351286.91810 | 596.290 | grid pt | 596.21 | 6/4/99 |
| 277 | SG | 481904.93137 | 1351336.91436 | 596.790 | grid pt | 596.73 | 6/4/99 |
| 278 | SG | 481904.32035 | 1351386.91063 | 597.290 | grid pt | 597.25 | 6/4/99 |
| 279 | SG | 481875.95745 | 1351648.29799 | 598.530 | cl dit | | |
| 280 | SG | 481825.97598 | 1351646.93655 | 598.280 | cl dit | | |
| 281 | SG | 482253.08996 | 1350824.47867 | 598.190 | mid pt | 598.19 | 6/15/99 |
| 282 | SG | 481775.99452 | 1351645.57512 | 598.030 | cl dit | | |
| 283 | SG | 481695.00650 | 1351627.30525 | 597.600 | cl dit | | |
| 284 | SG | 481669.62273 | 1351585.30011 | 597.350 | cl dit | | |
| 285 | SG | 481662.85881 | 1351528.33247 | 596.770 | cl dit | | |
| 286 | SG | 481657.27763 | 1351478.64495 | 596.220 | cl dit | | |
| 287 | SG | 481651.69644 | 1351428.95742 | 595.680 | cl dit | | |
| 288 | SG | 481646.11526 | 1351379.26989 | 595.140 | cl dit | | |
| 289 | SG | 481622.33610 | 1351311.42410 | 593.880 | cl dit | | |
| 290 | SG | 481578.33600 | 1351289.68108 | 592.880 | cl dit | | |
| 303 | SG | 482244.43495 | 1351532.48974 | 612.750 | mid pt | | |
| 324 | SG | 482244.94996 | 1351490.16854 | 604.850 | mid pt | 604.85 | 6/17/99 |
| 508 | SG | 482253.64000 | 1350779.76000 | 608.310 | top slp | 608.19 | 6/18/99 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 509 | SG | 482253.54000 | 1350787.55000 | 603.120 | toe slp | 603.09 | 6/22/99 | |
| 510 | SG | 482253.31000 | 1350806.27000 | 602.740 | top slp | 602.61 | 6/16/99 | |
| 511 | SG | 482252.87000 | 1350842.68000 | 593.640 | toe slp | 593.60 | 5/25/99 | |
| 512 | SG | 482245.19000 | 1351470.46000 | 599.920 | toe slp | 599.86 | 5/24/99 | |
| 513 | SG | 482244.71000 | 1351509.87000 | 609.770 | top slp | 609.64 | 6/18/99 | EST 6/25 |
| 514 | SG | 482244.48000 | 1351528.59000 | 610.150 | toe slp | 610.10 | 6/18/99 | |
| 515 | SG | 482244.39000 | 1351536.38000 | 615.340 | top slp | 615.26 | 6/15/99 | |
| 516 | SG | 481885.96000 | 1350775.27000 | 605.560 | top slp | 605.46 | 6/23/99 | |
| 517 | SG | 481885.87000 | 1350783.06000 | 600.360 | toe slp | 600.27 | 6/16/99 | |
| 518 | SG | 481885.64000 | 1350801.78000 | 599.990 | top slp | 599.85 | 6/16/99 | |
| 519 | SG | 481885.21000 | 1350836.64000 | 591.270 | toe slp | 591.27 | 6/16/99 | |
| 520 | SG | 481877.50000 | 1351467.65000 | 597.580 | toe slp | 597.50 | 6/4/99 | |
| 521 | SG | 481877.04000 | 1351505.38000 | 607.010 | top slp | 606.97 | 6/4/99 | |
| 522 | SG | 481876.81000 | 1351524.09000 | 607.390 | toe slp | 607.39 | 6/15/99 | |
| 523 | SG | 481876.72000 | 1351531.88000 | 612.580 | top slp | 612.47 | 6/15/99 | |
| 524 | SG | 482251.23000 | 1351568.09000 | 610.120 | toe slp | | | |
| 525 | SG | 482250.62000 | 1351618.18000 | 607.120 | toe slp | | | |
| 526 | SG | 482250.13000 | 1351658.49000 | 600.400 | cl dit | | | |
| 527 | SG | 482249.97000 | 1351672.15000 | 604.960 | top slp | | | |
| 528 | SG | 482249.35000 | 1351688.72000 | 605.120 | toe slp | | | |
| 529 | SG | 482248.90000 | 1351701.05000 | 609.230 | top slp | | | |
| 530 | SG | 482192.03000 | 1351688.48000 | 605.000 | toe slp | | | |
| 531 | SG | 481900.35000 | 1351684.41000 | 603.430 | toe slp | | | |
| 532 | SG | 481904.40000 | 1351662.74000 | 603.230 | top slp | | | |
| 534 | SG | 481896.56000 | 1351698.14000 | 608.000 | top slp | | | |
| 535 | SG | 481844.45000 | 1351666.51000 | 607.910 | top slp | | | |
| 536 | SG | 481876.99000 | 1351563.51000 | 607.320 | toe slp | | | |
| 537 | SG | 481876.38000 | 1351613.60000 | 604.310 | toe slp | | | |
| 538 | SG | 481740.93000 | 1351644.62000 | 597.850 | cl dit | | | |
| 539 | SG | 481668.44000 | 1351578.02000 | 597.310 | cl dit | | | |
| 540 | SG | 481643.47000 | 1351355.72000 | 594.880 | cl dit | | | |
| 541 | SG | 481568.94000 | 1351289.09000 | 592.690 | cl dit | | | |
| 542 | RP | 481742.97124 | 1351569.64778 | | rad pt | | | |
| 543 | RP | 481568.93851 | 1351364.09000 | | rad pt | | | |
| 544 | SG | 481911.79152 | 1350775.58545 | 605.750 | top slp | 605.70 | 6/22/99 | |
| 545 | SG | 481911.69632 | 1350783.37539 | 600.540 | toe slp | 600.40 | 6/18/99 | |
| 546 | SG | 481911.46754 | 1350802.09541 | 600.180 | top slp | 600.16 | 6/16/99 | |
| 547 | SG | 481885.91505 | 1350779.16026 | 602.960 | mid pt | | | |
| 548 | SG | 482203.59576 | 1350783.04915 | 605.340 | mid pt | | | |
| 549 | SG | 482181.00769 | 1350782.77330 | 605.170 | mid pt | | | |
| 550 | SG | 482165.02278 | 1350782.57809 | 605.050 | mid pt | | | |
| 551 | SG | 482115.02157 | 1350781.96748 | 604.670 | mid pt | | | |
| 552 | SG | 482065.02530 | 1350781.35692 | 604.300 | mid pt | | | |
| 553 | SG | 482015.02902 | 1350780.74636 | 603.920 | mid pt | | | |
| 554 | SG | 481965.03275 | 1350780.13581 | 603.550 | mid pt | | | |
| 555 | SG | 481937.57235 | 1350779.80046 | 603.340 | mid pt | | | |
| 556 | SG | 481911.74387 | 1350779.48504 | 603.140 | mid pt | | | |
| 557 | SG | 482203.08178 | 1350825.06276 | 597.520 | mid pt | 597.52 | 6/16/99 | |
| 558 | SG | 482114.53691 | 1350821.65118 | 597.440 | mid pt | 597.43 | 6/16/99 | |
| 559 | SG | 482064.57288 | 1350818.40090 | 597.730 | mid pt | 597.62 | 6/16/99 | |
| 560 | SG | 482014.60897 | 1350815.14061 | 598.010 | mid pt | 598.01 | 6/16/99 | |
| 561 | SG | 481964.64493 | 1350811.89032 | 598.300 | mid pt | 598.26 | 6/16/99 | |
| 562 | SG | 481937.09797 | 1350818.59121 | 596.330 | mid pt | 596.29 | 6/15/99 | |
| 563 | SG | 481911.26215 | 1350818.90119 | 595.980 | mid pt | 595.97 | 6/15/99 | |
| 564 | SG | 481885.42498 | 1350819.21133 | 595.630 | mid pt | 595.63 | 6/16/99 | |
| 565 | SG | 481902.86865 | 1351505.69542 | 607.200 | top slp | 607.18 | 6/7/99 | |
| 566 | SG | 481902.63998 | 1351524.40614 | 607.580 | toe slp | 607.58 | 6/15/99 | |
| 567 | SG | 481902.54477 | 1351532.19608 | 612.770 | top slp | 612.75 | 6/15/99 | |
| 568 | SG | 482194.96853 | 1351488.25780 | 604.150 | mid pt | 604.06 | 6/17/99 | |
| 569 | SG | 482172.40594 | 1351487.38839 | 603.830 | mid pt | 603.82 | 6/18/99 | |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 570 | SG | 482156.40927 | 1351487.44841 | 603.770 | mid | pt | 603.76 | 6/11/99 |
| 571 | SG | 482106.37808 | 1351489.69704 | 604.110 | mid | pt | 604.01 | 6/11/99 |
| 572 | SG | 482056.34677 | 1351491.95567 | 604.450 | mid | pt | 604.40 | 6/11/99 |
| 573 | SG | 482006.31558 | 1351494.20431 | 604.780 | mid | pt | 604.78 | 6/11/99 |
| 574 | SG | 481956.28426 | 1351496.46294 | 605.130 | mid | pt | 605.08 | 6/11/99 |
| 575 | SG | 481928.90576 | 1351488.48869 | 603.020 | mid | pt | 602.95 | 6/9/99 |
| 576 | SG | 481903.09103 | 1351487.49886 | 602.660 | mid | pt | 602.16 | 6/11/99 |
| 577 | SG | 481877.26996 | 1351486.51860 | 602.300 | mid | pt | 602.16 | 6/4/99 |
| 578 | SG | 482194.43490 | 1351531.87778 | 611.990 | mid | pt | | |
| 579 | SG | 482171.86514 | 1351531.60154 | 612.200 | mid | pt | | |
| 580 | SG | 482155.87242 | 1351531.40580 | 612.080 | mid | pt | | |
| 581 | SG | 482105.87617 | 1351530.79389 | 611.700 | mid | pt | | |
| 582 | SG | 482055.87991 | 1351530.18197 | 611.330 | mid | pt | | |
| 583 | SG | 482005.88366 | 1351529.57006 | 610.950 | mid | pt | | |
| 584 | SG | 481955.88740 | 1351528.95814 | 610.580 | mid | pt | | |
| 585 | SG | 481928.41497 | 1351528.62190 | 610.370 | mid | pt | | |
| 586 | SG | 481902.59232 | 1351528.30585 | 610.180 | mid | pt | | |
| 587 | SG | 481876.76495 | 1351527.98974 | 609.990 | mid | pt | | |
| 588 | SG | 481944.84788 | 1350853.81087 | 594.520 | mid | pt | 594.50 | 6/16/99 |
| 589 | SG | 481944.43757 | 1350887.36329 | 594.860 | mid | pt | 594.73 | 6/10/99 |
| 590 | SG | 481943.82616 | 1350937.35955 | 595.360 | mid | pt | 595.34 | 6/10/99 |
| 591 | SG | 481943.21475 | 1350987.35582 | 595.860 | mid | pt | 595.84 | 6/16/99 |
| 592 | SG | 481942.60335 | 1351037.35208 | 596.360 | mid | pt | 596.27 | 6/4/99 |
| 593 | SG | 481941.99194 | 1351087.34834 | 596.860 | mid | pt | 596.79 | 6/4/99 |
| 594 | SG | 481941.38053 | 1351137.34460 | 597.360 | mid | pt | 597.24 | 6/10/99 |
| 595 | SG | 481940.76913 | 1351187.34086 | 597.860 | mid | pt | 597.72 | 6/10/99 |
| 596 | SG | 481940.15772 | 1351237.33712 | 598.360 | mid | pt | 598.26 | 6/10/99 |
| 597 | SG | 481939.54631 | 1351287.33339 | 598.860 | mid | pt | 598.81 | 6/10/99 |
| 598 | SG | 481938.93491 | 1351337.32965 | 599.360 | mid | pt | 599.21 | 6/10/99 |
| 599 | SG | 481938.32350 | 1351387.32591 | 599.860 | mid | pt | 599.86 | 6/10/99 |
| 600 | SG | 481937.71209 | 1351437.32217 | 600.360 | mid | pt | 600.28 | 6/10/99 |
| 601 | SG | 481937.20695 | 1351479.34202 | 600.770 | mid | pt | 600.76 | 6/10/99 |
| 602 | SG | 481945.17631 | 1350827.24881 | 594.250 | mid | pt | 594.17 | 6/16/99 |

Points Reviewed by DGB on 3 June 99 and found to be within Tolerance

Points checked by EBT 8-9 June 99.

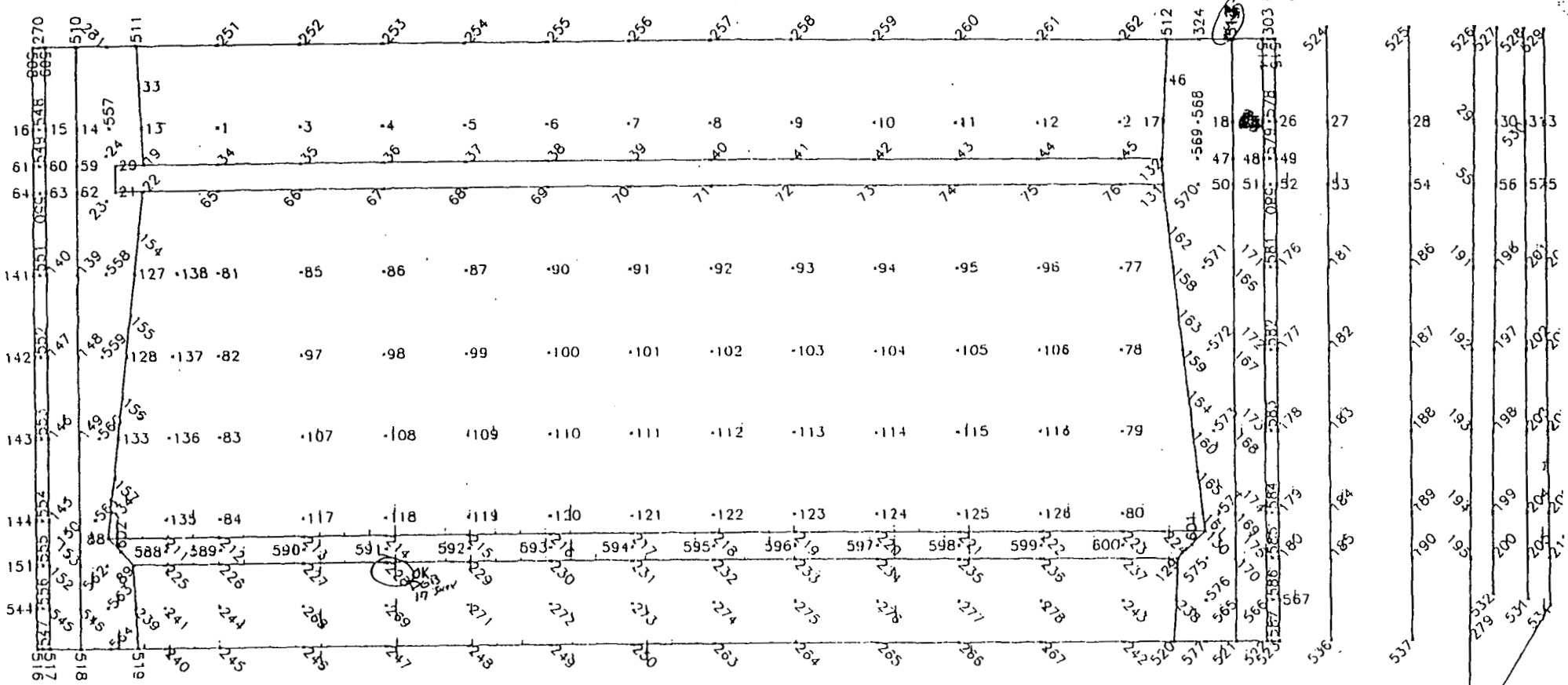
Points checked by DGB on 17 June 99 and are within Tolerance. also 18 June 99

Points [illegible] rected, resurveyed and found within 1st Cell 3 Subgr[illegible]

Cut [illegible]

Ro[illegible] by EBT 6-28-99, Okay

TOLERANCE −0.3 ft to +0.1 ft



Certify Pts Tolerance @ Proposed Grade

or 0.15' Below Proposed Grade

Points checked by EBT on 28-06-99 and found to be within tolerance. Remaining mid points outside are cells than 2 ft apart.

7/7/99

000014

2741

# TRANSMITTAL FORM

2741

DATE June 24, 1999

TO: Bruce Schweitzer
Fluor Daniel Fernald

RE FDF Southern Waste Unit (SWU)/On Site Disposal Facility (OSDF)
Contract No. FSC 614

☐ EXPRESS MAIL

GENTLEMEN:

WE ARE SENDING YOU the following items: (✓) Attached ( ) Under separate cover

| COPIES | DATE | DESCRIPTION |
|---|---|---|
| 2 | 06/23/99 | Survey Field Notes – Cells 3/4 subgrade certification points |
| 2 | 06/22/99 | Summary of Subgrade Certification Points – Cells 3/4 |
| | | |
| | | Reviewed by |
| | | EBT on 6-28-99 |
| | | |
| | | Kwasi Boahen-Gerenhard |
| | | 7-7-99 |
| | | |

THESE ARE TRANSMITTED AS CHECKED BELOW:

( ) For Approval
(✓) For Your Use
( ) For Review & Comment
( ) For Bids Due _____ 19 ____
( ) Approved as Submitted
( ) Approved as Noted
( ) Returned for Corrections
( ) Resubmit ___ Copies for Approval
( ) Submit ___ Copies for Distribution
( ) Return ___ Corrected Prints
( ) _____

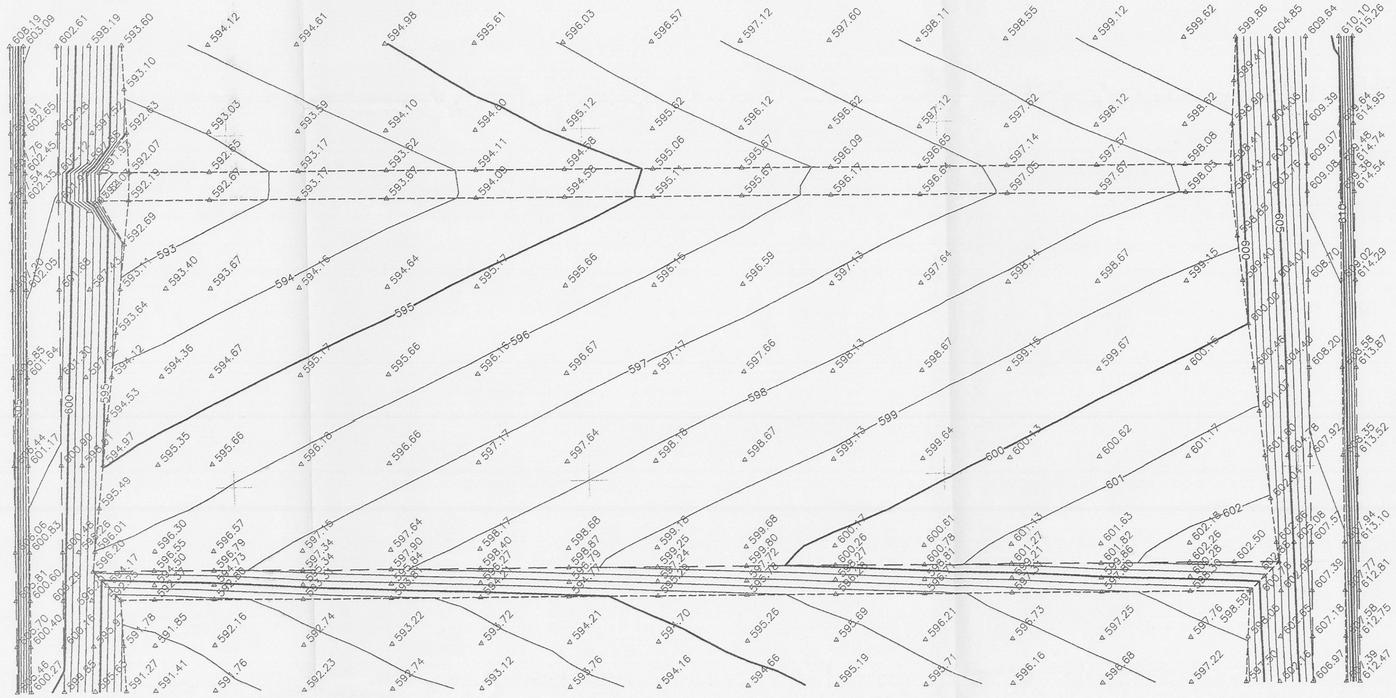
REMARKS

CC: FILE Project No. WC9-021/022
Section 02100 - Field Notes
GeoSyntec – Jim Burnett (OSDF Only)
FDF – Rick McGuire (STP Only)

By: J. Richard Schairbaum

000015

RECEIVED
JUN 24 1999
R Crisman



NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

LEGEND:

| | |
|---|---|
| △ 599.15 | = CERTIFIED POINT |
| ——600—— | INDEX (5 FOOT) ELEVATION CONTOUR LINE |
| ——601—— | ONE FOOT ELEVATION CONTOUR LINE |

INFORMATION ONLY

FIELD SURVEY COMPLETED JULY 6, 1999, APK 12/13/99

GRAPHIC SCALE

40 0 20 40 80 160

( IN FEET )
1 inch = 40 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 12/13/99

DOC. NO.: 20102-OPTA-DWG-016A (REV.#)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | JULY 1, 1999 |
| SCALE: | 1"=40' |
| DRAWN BY: | BJL |
| PRINT DATE: | JULY 1, 1999 |

STATE OF OHIO LYNN E. HIRSCH 16-5741 REGISTERED SURVEYOR

OSDF PHASE 2
AS-BUILT TOP OF SUBGRADE
OSDF CELL 3
06/25/1999

DATE: REVISIONS:

FILE NAME: strc3.dwg

SHEET NO. 1 OF 2

000016

12741

| | | | | |
|---|---|---|---|---|
| 1 | 482202.281090 | 1350890.513120 | 593.030000 | grid point |
| 2 | 482195.553120 | 1351440.471970 | 598.620000 | grid point |
| 3 | 482201.669450 | 1350940.509380 | 593.590000 | grid point |
| 4 | 482201.057820 | 1350990.505640 | 594.100000 | grid point |
| 5 | 482200.446190 | 1351040.501900 | 594.600000 | grid point |
| 6 | 482199.834550 | 1351090.498160 | 595.120000 | grid point |
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| 8 | 482198.611290 | 1351190.490680 | 596.120000 | grid point |
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| 11 | 482196.776390 | 1351340.479460 | 597.620000 | grid point |
| 12 | 482196.164750 | 1351390.475710 | 598.120000 | grid point |
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| 14 | 482203.319150 | 1350805.659510 | 602.280000 | top slp |
| 15 | 482203.548160 | 1350786.939500 | 602.650000 | toe slp |
| 16 | 482203.643460 | 1350779.149460 | 607.910000 | top slp |
| 17 | 482195.225540 | 1351467.249380 | 598.900000 | toe slp |
| 18 | 482194.711600 | 1351509.259420 | 609.390000 | top slp |
| 19 | 482180.260000 | 1350845.280000 | 592.070000 | toe slp |
| 20 | 482180.460000 | 1350828.560000 | 591.930000 | toe slp |
| 21 | 482164.460000 | 1350828.360000 | 592.030000 | toe slp |
| 22 | 482164.260000 | 1350844.630000 | 592.190000 | toe slp |
| 23 | 482158.890000 | 1350822.710000 | 597.640000 | top slp |
| 24 | 482186.450000 | 1350822.770000 | 597.880000 | top slp |
| 25 | 482194.482610 | 1351527.978070 | 609.640000 | toe slp |
| 26 | 482194.387310 | 1351535.768010 | 614.950000 | top slp |
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| 35 | 482179.098560 | 1350940.233260 | 593.170000 | grid point |
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| 37 | 482177.875490 | 1351040.225780 | 594.110000 | grid point |
| 38 | 482177.263950 | 1351090.222040 | 594.580000 | grid point |
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| 40 | 482176.040870 | 1351190.214560 | 595.670000 | grid point |
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| 47 | 482172.141790 | 1351508.983790 | 609.070000 | top slp |
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| 49 | 482171.817550 | 1351535.491770 | 614.740000 | top slp |
| 50 | 482156.148650 | 1351508.788490 | 609.080000 | top slp |
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| 52 | 482155.824910 | 1351535.296030 | 614.540000 | top slp |
| 59 | 482180.743480 | 1350805.383810 | 602.120000 | top slp |
| 60 | 482180.961150 | 1350786.663660 | 602.450000 | toe slp |
| 61 | 482181.054330 | 1350778.873610 | 607.760000 | top slp |
| 62 | 482164.744840 | 1350805.188440 | 601.950000 | top slp |
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| 67 | 482162.484190 | 1350990.033750 | 593.670000 | grid pt |
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| 70 | 482160.652380 | 1351140.022560 | 595.110000 | grid pt |
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| 75 | 482157.599360 | 1351390.003920 | 597.670000 | grid pt |
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| 84 | 481963.720310 | 1350887.598790 | 596.570000 | grid pt |
| 85 | 482113.098520 | 1350939.426870 | 594.160000 | grid pt |
| 86 | 482112.487920 | 1350989.423150 | 594.640000 | grid pt |

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| 130 | 481945.290000 | 1351487.710000 | 602.880000 | toe slp |
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| 156 | 482039.569380 | 1350829.896150 | 594.530000 | toe slp |
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| 159 | 482056.537520 | 1351476.336840 | 600.460000 | toe slp |
| 160 | 482006.471280 | 1351481.455260 | 601.600000 | toe slp |

| | | | | |
|---|---|---|---|---|
| 161 | 481956.405040 | 1351486.573680 | 602.660000 | toe slp |
| 162 | 482131.799630 | 1351468.642570 | 598.850000 | toe slp |
| 163 | 482081.733390 | 1351473.760990 | 600.000000 | toe slp |
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| 230 | 481933.812550 | 1351087.248440 | 594.770000 | toe slp |
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| 264 | 481880.325460 | 1351236.606390 | 595.190000 | grid pt |

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| 272 | 481907.986460 | 1351086.933030 | 594.210000 | grid pt |
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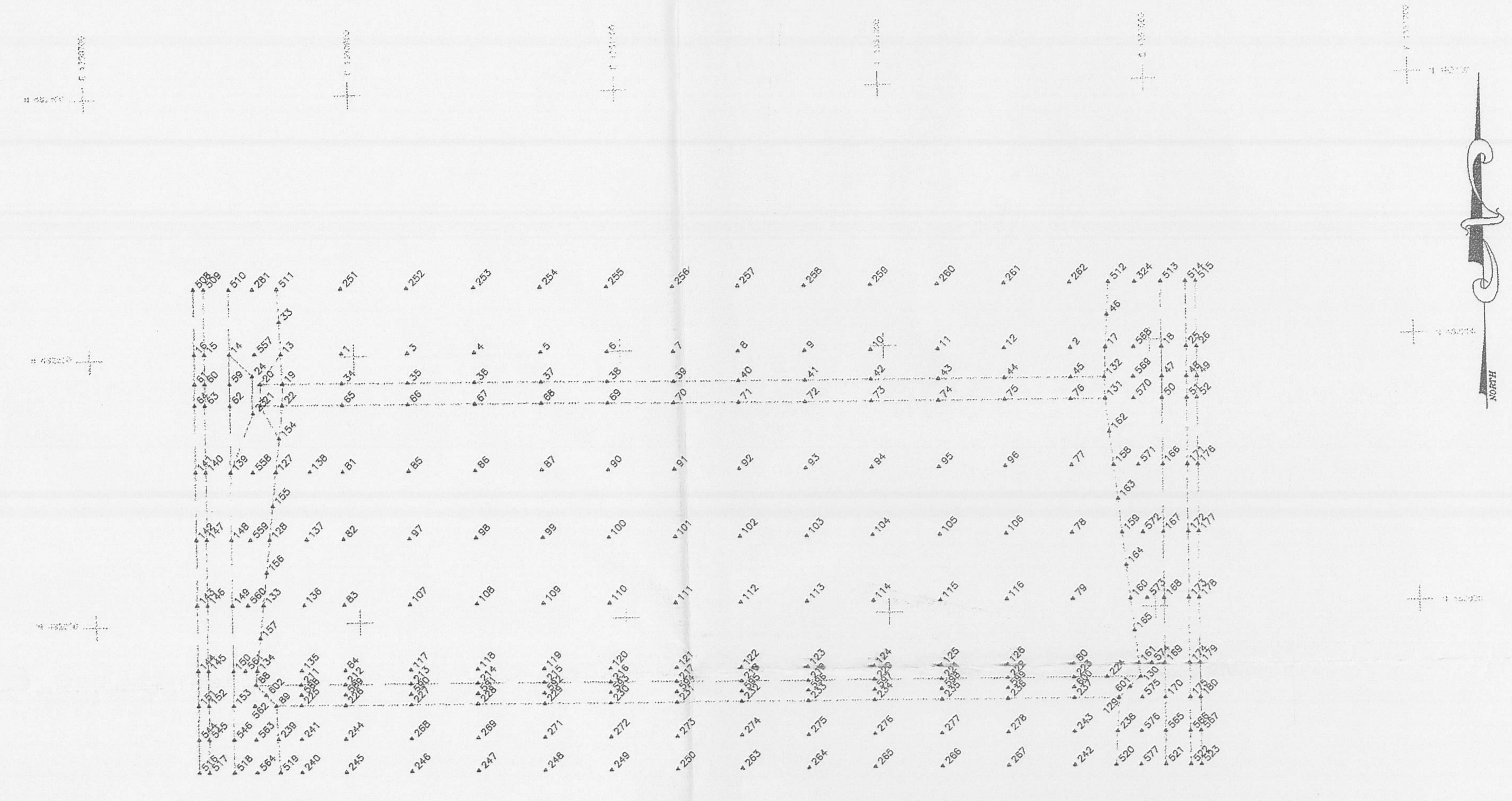
| 510 | 482253.310000 | 1350806.270000 | 602.610000 | top slp |
| 511 | 482252.870000 | 1350842.680000 | 593.600000 | toe slp |
| 512 | 482245.190000 | 1351470.460000 | 599.860000 | toe slp |
| 513 | 482244.710000 | 1351509.870000 | 609.640000 | top slp |
| 514 | 482244.480000 | 1351528.590000 | 610.100000 | toe slp |
| 515 | 482244.390000 | 1351536.380000 | 615.260000 | top slp |
| 516 | 481885.960000 | 1350775.270000 | 605.460000 | top slp |
| 517 | 481885.870000 | 1350783.060000 | 600.270000 | toe slp |
| 518 | 481885.640000 | 1350801.780000 | 599.850000 | top slp |
| 519 | 481885.210000 | 1350836.640000 | 591.270000 | toe slp |
| 520 | 481877.500000 | 1351467.650000 | 597.500000 | toe slp |
| 521 | 481877.040000 | 1351505.380000 | 606.970000 | top slp |
| 522 | 481876.810000 | 1351524.090000 | 607.390000 | toe slp |
| 523 | 481876.720000 | 1351531.880000 | 612.470000 | top slp |
| 544 | 481911.791520 | 1350775.585450 | 605.700000 | top slp |
| 545 | 481911.696320 | 1350783.375390 | 600.400000 | toe slp |
| 546 | 481911.467540 | 1350802.095410 | 600.160000 | top slp |
| 557 | 482203.081780 | 1350825.062760 | 597.520000 | mid pt |
| 558 | 482114.536910 | 1350821.651180 | 597.430000 | mid pt |
| 559 | 482064.572880 | 1350818.400900 | 597.620000 | mid pt |
| 560 | 482014.608970 | 1350815.140610 | 598.010000 | mid pt |
| 561 | 481964.644930 | 1350811.890320 | 598.260000 | mid pt |
| 562 | 481937.097970 | 1350818.591210 | 596.290000 | mid pt |
| 563 | 481911.262150 | 1350818.901190 | 595.970000 | mid pt |
| 564 | 481885.424980 | 1350819.211330 | 595.630000 | mid pt |
| 565 | 481902.868650 | 1351505.695420 | 607.180000 | top slp |
| 566 | 481902.639980 | 1351524.406140 | 607.580000 | toe slp |
| 567 | 481902.544770 | 1351532.196080 | 612.750000 | top slp |
| 568 | 482194.968530 | 1351488.257800 | 604.060000 | mid pt |
| 569 | 482172.405940 | 1351487.388390 | 603.820000 | mid pt |
| 570 | 482156.409270 | 1351487.448410 | 603.760000 | mid pt |
| 571 | 482106.378080 | 1351489.697040 | 604.010000 | mid pt |
| 572 | 482056.346770 | 1351491.955670 | 604.400000 | mid pt |
| 573 | 482006.315580 | 1351494.204310 | 604.780000 | mid pt |
| 574 | 481956.284260 | 1351496.462940 | 605.080000 | mid pt |
| 575 | 481928.905760 | 1351488.488690 | 602.950000 | mid pt |
| 576 | 481903.091030 | 1351487.498860 | 602.650000 | mid pt |
| 577 | 481877.269960 | 1351486.518600 | 602.160000 | mid pt |
| 588 | 481944.847880 | 1350853.810870 | 594.500000 | mid pt |
| 589 | 481944.437570 | 1350887.363290 | 594.730000 | mid pt |
| 590 | 481943.826160 | 1350937.359550 | 595.340000 | mid pt |
| 591 | 481943.214750 | 1350987.355820 | 595.840000 | mid pt |
| 592 | 481942.603350 | 1351037.352080 | 596.270000 | mid pt |
| 593 | 481941.991940 | 1351087.348340 | 596.790000 | mid pt |
| 594 | 481941.380530 | 1351137.344600 | 597.240000 | mid pt |
| 595 | 481940.769130 | 1351187.340860 | 597.720000 | mid pt |
| 596 | 481940.157720 | 1351237.337120 | 598.270000 | mid pt |
| 597 | 481939.546310 | 1351287.333390 | 598.810000 | mid pt |
| 598 | 481938.934910 | 1351337.329650 | 599.210000 | mid pt |
| 599 | 481938.323500 | 1351387.325910 | 599.860000 | mid pt |
| 600 | 481937.712090 | 1351437.322170 | 600.280000 | mid pt |
| 601 | 481937.206950 | 1351479.342020 | 600.760000 | mid pt |
| 602 | 481945.176310 | 1350827.248810 | 594.170000 | mid pt |




KEY MAP

NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD)1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

INFORMATION ONLY

LEGEND:

| | | | | |
|---|---|---|---|---|
| 235 | 481930.755520 | 1351337.229750 | 597.310000 | toe slp |

= CERTIFIED POINT

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 12/14/99

GRAPHIC SCALE

80 0 40 80 160 320

( IN FEET )
1 inch = 80 ft.

20102-OPTA-DWG-016B (REV. 1)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | JULY 1, 1999 |
| SCALE: | 1"=80' |
| DRAWN BY: | BJL |
| PRINT DATE: | JULY 1, 1999 |

STATE OF OHIO
LYNN E. HIRSCH
S-5728
REGISTERED SURVEYOR
[signature] Lynn E. Hirsch

OSDF PHASE 2
AS-BUILT TOP OF SUBGRADE
OSDF CELL 3
06/25/1999

| DATE: | REVISIONS: |
|---|---|

FILE NAME: strc3-C.dwg

2

000017

SHEET NO. 2 OF 2

2741

G:\LAND PROJECTS\990607\0008\DWG\strc3-C.dwg BJL - DECEMBER 04, 1999 - 14:19:54 XREFS:

# TOP OF COMPACTED CLAY LINER

GeoSyntec Consultants

# COMPACTED CLAY LINER EVALUATION

**OSDF Phase II Option A – Cell 3**
**Subcontract No. 95PS005028**
**GeoSyntec Project No. GQ0409**

The undersigned have performed the following evaluation in accordance with Section 02225 and Section 02770 of the Technical Specifications:

- GeoSyntec CQC personnel have completed soil performance testing of compacted lifts of the Cell 3 clay liner in accordance with the requirements of the CQA Plan. The clay liner material was placed and compacted within the acceptable permeability zone (APZ) of each clay liner stockpile in compliance with Section 02225 of the Technical Specifications. Documentation on the compacted clay liner construction and testing are presented in the Test Logs and Daily Field Reports, and will be included in the Final CQA Report for Cell 3 lining system construction.

- The compacted clay liner surface has been surveyed and certified by Hirsch & Associates Surveying, Inc. (Hirsch) of Okeana, Ohio. A copy of Hirsch's compacted clay liner certification is attached. The survey certification data have been reviewed by Kwasi Badu-Tweneboah, Ph.D., P.E., of GeoSyntec and found to be within the tolerance of 0 to +0.3 feet of the thickness and ±0.2 feet of the grades indicated on the Construction Drawings and required by Section 02225 of the Technical Specifications.

Based on the information presented above, GeoSyntec concludes that the as-constructed compacted clay liner for Cell 3 is in compliance with the project specifications. However, clay liner protection and surface preparation and maintenance will have to be performed prior to deployment of the overlying geosynthetics.

Collin P. Sukow
GeoSyntec CQC Manager

Kwasi Badu-Tweneboah, Ph.D., P.E.
GeoSyntec Certifying Engineer
Ohio Registration No. E-55354
12 August 1999

Attachment

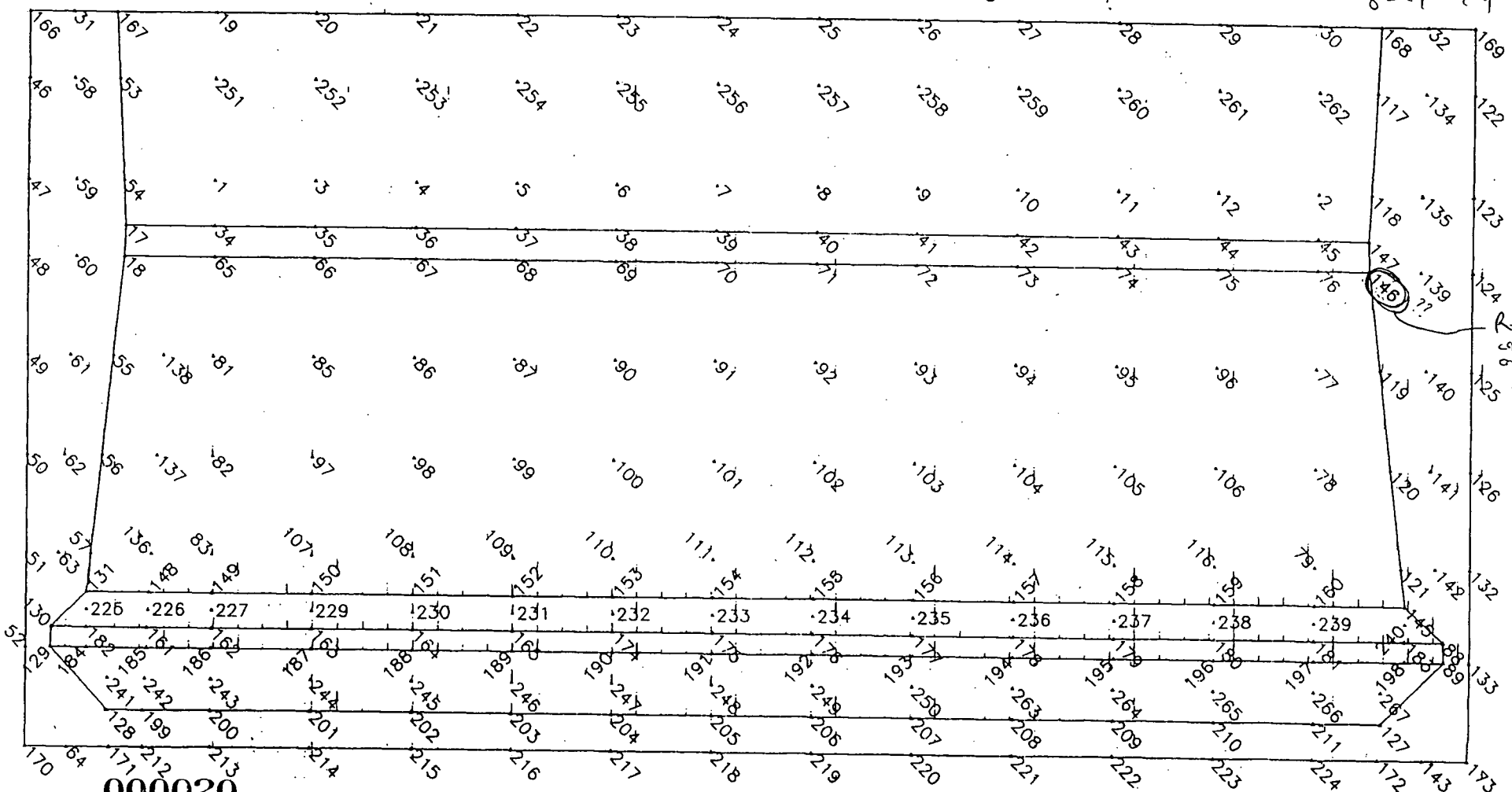
# Cell 3 Top of Clay

TOLERANCE: 0 to +0.3 ft

POINTS CHECKED BY KBT on 8-10-99
ALL POINTS EXCEPT PT. 146 FOUND TO BE WITHIN TOLERANCE.
POINT 146 is +0.5 FT OF REQUIRED ELEVATION.

KBT 8-10-99

Point resurveyed by Hirsch on 8-11-99 and found to be okay (within tolerance)
KBT
8-11-99




Resurveyed on 8-11-99 and found to be ok.
KBT
8-11-

000020

Certify Pts Tolerance @ Proposed Grade
or 0.15' Above Proposed Grade

CELL 3 TOP OF CLAY

2741

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HIRSCH & ASSOCIATES SURVEYING, INC.
3610 STATE LINE ROAD
OKEANA, OH 45053
(513) 367-0534
Fax: (513) 367-2935

August 5, 1999

**SUBJECT: CERTIFICATION POINTS TOP OF CLAY CELL 3. FERNALD SITE.**

I hereby cetify that the elevations listed on the next 5 pages are the as built elevations of the top of clay for the point numbers listed, along with the date the elevations were taken.

Lynn Edward Hirsch

**LYNN EDWARD HIRSCH**
**REGISTERED OHIO LAND SURVEYOR NO. 5738**

file: ferce3tc

STATE OF OHIO
LYNN E. HIRSCH
S-5738
REGISTERED
SURVEYOR

All points on the attached pages checked and found to be acceptable and within tolerance

Kenneth Bodie-Trembath
11 August 1999

Points with a Code of TC Have a Corresponding Subgrade Pt.
Points with a Code of TCO Do Not Have a Corresponding Pt.

Pg 1 of 5

2741

Prepared by: Hirsch & Associates Surveying, Inc. #CGDS07961
List-Coords/Brg-Azi PET3TC 3/24/99 9:45:52 Factor: 1.0000000

| Pt.No. | Code | North | East | As Built S/G Elev | Prop Elev. Elevation | Desc. | As Built Elev |
|---|---|---|---|---|---|---|---|
| 1 | TC | 482202.28109 | 1350890.51312 | 593.03 | 596.120 | grid point | 596.19 8/9/99 (T3.13) |
| 2 | TC | 482195.55312 | 1351440.47197 | 598.62 | 601.620 | grid point | 601.76 8/6/99 (T3.14) |
| 3 | TC | 482201.66945 | 1350940.50938 | 593.59 | 596.620 | grid point | 596.75 8/10/99 (T3.16) |
| 4 | TC | 482201.05782 | 1350990.50564 | 594.10 | 597.120 | grid point | 597.25 8/7/99 (T.3.5) |
| 5 | TC | 482200.44619 | 1351040.50190 | 594.60 | 597.620 | grid point | 597.76 8/7/99 (T.3.16) |
| 6 | TC | 482199.83455 | 1351090.49816 | 595.12 | 598.120 | grid point | 598.24 8/6/99 (T3.12) |
| 7 | TC | 482199.22292 | 1351140.49442 | 595.62 | 598.620 | grid point | 598.77 8/6/99 (T3.15) |
| 8 | TC | 482198.61129 | 1351190.49068 | 596.12 | 599.120 | grid point | 599.23 8/6/99 (T3.11) |
| 9 | TC | 482197.99965 | 1351240.48694 | 596.62 | 599.620 | grid point | 599.75 8/6/99 (T3.13) |
| 10 | TC | 482197.38802 | 1351290.48320 | 597.12 | 600.120 | grid point | 600.25 8/6/99 (T3.13) |
| 11 | TC | 482196.77639 | 1351340.47946 | 597.62 | 600.620 | grid point | 600.74 8/5/99 (T3.12) |
| 12 | TC | 482196.16475 | 1351390.47571 | 598.12 | 601.120 | grid point | 601.19 8/6/99 (T3.17) |
| 17 | TCO | 482180.22000 | 1350845.64000 | | 595.230 | toe slp pt 2017 | 595.31 8/7/99 |
| 18 | TCO | 482164.29000 | 1350844.99000 | | 595.220 | toe slp pt 2018 | 595.33 8/7/99 |
| 19 | TCO | 482285.23249 | 1350891.52792 | | 597.790 | south limit | 597.85 8/9/99 |
| 20 | TCO | 482284.62096 | 1350941.52418 | | 598.290 | south limit | 598.38 8/9/99 |
| 21 | TCO | 482284.00540 | 1350991.52039 | | 598.790 | south limit | 598.84 8/9/99 |
| 22 | TCO | 482283.39387 | 1351041.51665 | | 599.290 | south limit | 599.41 8/9/99 |
| 23 | TCO | 482282.78234 | 1351091.51291 | | 599.790 | south limit | 599.79 8/6/99 |
| 24 | TCO | 482282.17082 | 1351141.50917 | | 600.290 | south limit | 600.32 8/6/99 |
| 25 | TCO | 482281.55929 | 1351191.50543 | | 600.790 | south limit | 600.80 8/6/99 |
| 26 | TCO | 482280.94776 | 1351241.50169 | | 601.290 | south limit | 601.38 8/6/99 |
| 27 | TCO | 482280.33623 | 1351291.49795 | | 601.790 | south limit | 601.79 8/6/99 |
| 28 | TCO | 482279.72470 | 1351341.49421 | | 602.290 | south limit | 602.29 8/5/99 |
| 29 | TCO | 482279.11317 | 1351391.49047 | | 602.790 | south limit | 602.79 8/6/99 |
| 30 | TCO | 482278.50164 | 1351441.48673 | | 603.290 | south limit | 603.34 8/6/99 |
| 31 | TCO | 482286.10498 | 1350820.03161 | | 602.750 | south limit mid pt | 602.75 8/7/99 |
| 32 | TCO | 482277.84502 | 1351495.46825 | | 609.410 | south limit mid pt | 609.44 8/5/99 |
| 34 | TC | 482179.71010 | 1350890.23700 | 592.65 | 595.670 | grid point | 595.75 8/7/99 (T3.10) |
| 35 | TC | 482179.09856 | 1350940.23326 | 593.17 | 596.170 | grid point | 596.24 8/7/99 (T3.07) |
| 36 | TC | 482178.48702 | 1350990.22952 | 593.62 | 596.670 | grid point | 596.77 8/7/99 (T3.15) |
| 37 | TC | 482177.87549 | 1351040.22578 | 594.11 | 597.170 | grid point | 597.29 8/7/99 (T3.17) |
| 38 | TC | 482177.26395 | 1351090.22204 | 594.58 | 597.670 | grid point | 597.80 8/6/99 (T3.22) |
| 39 | TC | 482176.65241 | 1351140.21830 | 595.06 | 598.170 | grid point | 598.31 8/6/99 (T3.25) |
| 40 | TC | 482176.04087 | 1351190.21456 | 595.67 | 598.670 | grid point | 598.80 8/6/99 (T3.13) |
| 41 | TC | 482175.42933 | 1351240.21082 | 596.09 | 599.170 | grid point | 599.27 8/7/99 (T3.18) |
| 42 | TC | 482174.81780 | 1351290.20708 | 596.65 | 599.670 | grid point | 599.79 8/6/99 (T3.14) |
| 43 | TC | 482174.20626 | 1351340.20334 | 571.14 | 600.170 | grid point | 600.21 8/6/99 (T3.07) |
| 44 | TC | 482173.59472 | 1351390.19960 | 597.57 | 600.670 | grid point | 600.72 8/6/99 (T3.15) |
| 45 | TC | 482172.98318 | 1351440.19586 | 598.08 | 601.170 | grid point | 601.26 8/6/99 (T3.18) |
| 46 | TCO | 482253.41907 | 1350797.79756 | | 607.950 | top slp | 608.09 8/7/99 |
| 47 | TCO | 482203.42280 | 1350797.18694 | | 607.570 | top slp | 607.61 8/7/99 |
| 48 | TCO | 482154.84518 | 1350796.71577 | | 607.280 | top slp | 607.34 8/7/99 |
| 49 | TCO | 482114.84890 | 1350796.10515 | | 606.900 | top slp | 606.96 8/7/99 |
| 50 | TCO | 482064.85263 | 1350795.49453 | | 606.530 | top slp | 606.53 8/7/99 |
| 51 | TCO | 482014.85636 | 1350794.88390 | | 606.150 | top slp | 606.16 8/7/99 |
| 52 | TCO | 481967.86194 | 1350794.30994 | | 605.800 | top slp | 605.81 8/9/99 |
| 53 | TCO | 482252.86559 | 1350843.04011 | | 596.650 | toe slp | 596.71 8/7/99 |
| 54 | TCO | 482202.83995 | 1350844.83046 | | 595.670 | toe slp | 595.80 8/7/99 |
| 55 | TCO | 482114.32400 | 1350839.08468 | | 596.170 | toe slp | 596.32 8/7/99 |
| 56 | TCO | 482064.39234 | 1350833.18343 | | 597.120 | toe slp | 597.26 8/7/99 |
| 57 | TCO | 482014.46068 | 1350827.28217 | | 598.070 | toe slp | 598.08 8/7/99 |
| 58 | TCO | 482253.14233 | 1350820.41880 | | 602.300 | mid pt | 602.30 8/7/99 |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 59 | TCO | 482203.13138 | 1350821.00874 | | 601.620 | mid pt | 601.62 | 8/7/99 | | |
| 60 | TCO | 482164.56759 | 1350820.85310 | | 601.250 | mid pt | 601.32 | 8/7/99 | | |
| 61 | TCO | 482114.58645 | 1350817.59479 | | 601.540 | mid pt | 601.56 | 8/7/99 | | |
| 62 | TCO | 482064.62249 | 1350814.33883 | | 601.830 | mid pt | 601.87 | 8/7/99 | | |
| 63 | TCO | 482014.65852 | 1350811.08288 | | 602.110 | mid pt | 602.11 | 8/7/99 | | |
| 64 | TCO | 481918.48000 | 1350814.76011 | | 600.180 | mid pt | 600.33 | 8/9/99 | | |
| 65 | TC | 482163.70539 | 1350890.04121 | 592.67 | 595.670 | grid pt | 595.72 | 8/7/99 | (T3.05) | |
| 66 | TC | 482163.09479 | 1350940.03748 | 593.17 | 596.170 | grid pt | 596.24 | 8/7/99 | (T3.07) | |
| 67 | TC | 482162.48419 | 1350990.03375 | 593.67 | 596.670 | grid pt | 596.69 | 8/7/99 | (T3.02) | |
| 68 | TC | 482161.87358 | 1351040.03002 | 594.09 | 597.170 | grid pt | 597.22 | 8/7/99 | (T3.12) | |
| 69 | TC | 482161.26298 | 1351090.02629 | 594.58 | 597.670 | grid pt | 597.81 | 8/7/99 | (T3.23) | |
| 70 | TC | 482160.65238 | 1351140.02256 | 595.11 | 598.170 | grid pt | 598.17 | 8/6/99 | (T3.06) | |
| 71 | TC | 482160.04177 | 1351190.01883 | 595.67 | 598.670 | grid pt | 598.68 | 8/6/99 | (T3.01) | |
| 72 | TC | 482159.43117 | 1351240.01511 | 596.17 | 599.170 | grid pt | 599.19 | 8/6/99 | (T3.02) | |
| 73 | TC | 482158.82057 | 1351290.01138 | 596.64 | 599.670 | grid pt | 599.79 | 8/6/99 | (T3.15) | |
| 74 | TC | 482158.20996 | 1351340.00765 | 597.05 | 600.170 | grid pt | 600.26 | 8/6/99 | (T3.21) | |
| 75 | TC | 482157.59936 | 1351390.00392 | 597.67 | 600.670 | grid pt | 600.71 | 8/6/99 | (T3.04) | |
| 76 | TC | 482156.98876 | 1351440.00019 | 598.03 | 601.170 | grid pt | 601.29 | 8/6/99 | (T3.26) | |
| 77 | TC | 482106.99248 | 1351439.38959 | 599.15 | 602.170 | grid pt | 602.21 | 8/6/99 | (T3.06) | |
| 78 | TC | 482056.99621 | 1351438.77899 | 600.15 | 603.170 | grid pt | 603.20 | 8/6/99 | (T3.05) | |
| 79 | TC | 482006.99994 | 1351438.16838 | 601.17 | 604.180 | grid pt | 604.20 | 8/6/99 | (T3.03) | |
| 81 | TC | 482113.70912 | 1350889.43060 | 593.67 | 596.670 | grid pt | 596.73 | 8/7/99 | (T3.06) | |
| 82 | TC | 482063.71285 | 1350888.82000 | 594.67 | 597.670 | grid pt | 597.81 | 8/9/99 | (T3.14) | |
| 83 | TC | 482013.71658 | 1350888.20940 | 595.66 | 598.670 | grid pt | 598.74 | 8/9/99 | (T3.08) | |
| 85 | TC | 482113.09852 | 1350939.42687 | 594.16 | 597.170 | grid pt | 597.32 | 8/9/99 | (T3.16) | |
| 86 | TC | 482112.48792 | 1350989.42315 | 594.64 | 597.670 | grid pt | 597.67 | 8/6/99 | (T3.03) | |
| 87 | TC | 482111.87731 | 1351039.41942 | 595.17 | 598.170 | grid pt | 598.29 | 8/6/99 | (T3.12) | |
| 88 | TCO | 481969.22000 | 1351501.94000 | | 609.660 | ed berm pt 2144 | 609.67 | 8/6/99 | | |
| 89 | TCO | 481959.21000 | 1351502.13000 | | 609.660 | ed berm pt 2143 | 609.74 | 8/6/99 | | |
| 90 | TC | 482111.26671 | 1351089.41569 | 595.66 | 598.670 | grid pt | 598.74 | 8/6/99 | (T3.08) | |
| 91 | TC | 482110.65611 | 1351139.41196 | 596.15 | 599.170 | grid pt | 599.27 | 8/6/99 | (T3.12) | |
| 92 | TC | 482110.04550 | 1351189.40823 | 596.59 | 599.670 | grid pt | 599.67 | 8/6/99 | (T3.08) | |
| 93 | TC | 482109.43490 | 1351239.40450 | 597.13 | 600.170 | grid pt | 600.27 | 8/6/99 | (T3.14) | |
| 94 | TC | 482108.82430 | 1351289.40077 | 597.64 | 600.670 | grid pt | 600.78 | 8/6/99 | (3.14) | |
| 95 | TC | 482108.21369 | 1351339.39705 | 598.14 | 601.170 | grid pt | 601.17 | 8/6/99 | (T3.08) | |
| 96 | TC | 482107.60309 | 1351389.39332 | 598.67 | 601.670 | grid pt | 601.68 | 8/6/99 | (T3.01) | |
| 97 | TC | 482063.10225 | 1350938.81627 | 595.17 | 598.170 | grid pt | 598.29 | 8/9/99 | (T3.12) | |
| 98 | TC | 482062.49164 | 1350988.81254 | 595.66 | 598.670 | grid pt | 598.82 | 8/6/99 | (T3.16) | |
| 99 | TC | 482061.88104 | 1351038.80881 | 596.16 | 599.170 | grid pt | 599.29 | 8/6/99 | (T3.13) | |
| 100 | TC | 482061.27044 | 1351088.80509 | 596.67 | 599.670 | grid pt | 599.80 | 8/6/99 | (T3.13) | |
| 101 | TC | 482060.65983 | 1351138.80136 | 597.17 | 600.170 | grid pt | 600.31 | 8/6/99 | (T3.14) | |
| 102 | TC | 482060.04923 | 1351188.79763 | 597.66 | 600.670 | grid pt | 600.69 | 8/6/99 | (T3.03) | |
| 103 | TC | 482059.43863 | 1351238.79390 | 598.13 | 601.170 | grid pt | 601.20 | 8/6/99 | (T3.07) | |
| 104 | TC | 482058.82802 | 1351288.79017 | 598.67 | 601.670 | grid pt | 601.69 | 8/6/99 | (T3.02) | |
| 105 | TC | 482058.21742 | 1351338.78644 | 599.15 | 602.170 | grid pt | 602.17 | 8/6/99 | (T3.02) | |
| 106 | TC | 482057.60682 | 1351388.78271 | 599.67 | 602.670 | grid pt | 602.68 | 8/6/99 | (T3.01) | |
| 107 | TC | 482013.10598 | 1350938.20567 | 596.18 | 599.180 | grid pt | 599.25 | 8/9/99 | (T3.07) | |
| 108 | TC | 482012.49537 | 1350988.20194 | 596.66 | 599.680 | grid pt | 599.80 | 8/9/99 | (T3.14) | |
| 109 | TC | 482011.88477 | 1351038.19821 | 597.16 | 600.180 | grid pt | 600.24 | 8/9/99 | (T3.08) | |
| 110 | TC | 482011.27417 | 1351088.19448 | 597.64 | 600.680 | grid pt | 600.68 | 8/9/99 | (T3.04) | |
| 111 | TC | 482010.66356 | 1351138.19075 | 598.18 | 601.180 | grid pt | 601.19 | 8/9/99 | (T3.01) | |
| 112 | TC | 482010.05296 | 1351188.18702 | 598.67 | 601.680 | grid pt | 601.68 | 8/9/99 | (T3.01) | |
| 113 | TC | 482009.44236 | 1351238.18330 | 599.13 | 602.180 | grid pt | 602.29 | 8/9/99 | (T3.16) | |
| 114 | TC | 482008.83175 | 1351288.17957 | 599.64 | 602.680 | grid pt | 602.69 | 8/9/99 | (T3.05) | |
| 115 | TC | 482008.22115 | 1351338.17584 | 600.13 | 603.180 | grid pt | 603.18 | 8/9/99 | (T3.05) | |
| 116 | TC | 482007.61055 | 1351388.17211 | 600.62 | 603.680 | grid pt | 603.68 | 8/6/99 | (T3.06) | |
| 117 | TCO | 482245.19449 | 1351470.09285 | | 602.920 | toe slp | 602.94 | 8/5/99 | | |
| 118 | TCO | 482195.22986 | 1351466.89620 | | 601.900 | toe slp | 601.92 | 8/5/99 | | |
| 119 | TCO | 482106.60850 | 1351470.83061 | | 602.490 | toe slp | 602.61 | 8/5/99 | | |
| 120 | TCO | 482056.54226 | 1351475.94864 | | 603.550 | toe slp | 603.68 | 8/5/99 | | |

PER DWG NO. 9-2X-635 G-0025

E-2741

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 121 | TCO | 482006.47603 | 1351481.06666 | | 604.610 | toe slp | 604.69 | 8/9/99 |
| | 122 | TCO | 482244.60429 | 1351518.33750 | | 614.980 | top slp | 614.98 | 8/5/99 |
| | 123 | TCO | 482194.60802 | 1351517.72688 | | 614.610 | top slp | 614.66 | 8/5/99 |
| | 124 | TCO | 482156.04523 | 1351517.25590 | | 614.320 | top slp | 614.47 | 8/5/99 |
| | 125 | TCO | 482106.04896 | 1351516.64527 | | 613.950 | top slp | 613.95 | 8/5/99 |
| | 126 | TCO | 482056.05269 | 1351516.03465 | | 613.570 | top slp | 613.69 | 8/5/99 |
| 2142 | 127 | TCO | 481928.73000 | 1351470.56000 | | 601.630 | toe slp pt 2142 | 601.73 | 8/5/99 |
| 2085 | 128 | TCO | 481936.49000 | 1350835.15000 | | 595.270 | toe slp pt 2085 | 595.39 | 8/5/99 |
| 2084 | 129 | TCO | 481967.71000 | 1350806.74000 | | 602.700 | ed berm pt 2084 | 602.85 | 8/9/99 |
| 2083 | 130 | TCO | 481977.71000 | 1350807.15000 | | 602.710 | ed berm pt 2083 | 602.86 | 8/9/99 |
| 2082 | 131 | TCO | 481995.32000 | 1350825.02000 | | 598.430 | toe slp pt 2082 | 598.57 | 8/7/99 |
| | 132 | TCO | 482006.05642 | 1351515.42403 | | 613.190 | top slp | 613.24 | 8/5/99 |
| | 133 | TCO | 481959.05452 | 1351514.84998 | | 612.840 | top slp | 612.92 | 8/9/99 |
| | 134 | TCO | 482244.89939 | 1351494.21504 | | 608.950 | mid pt | 608.95 | 8/5/99 |
| | 135 | TCO | 482194.91894 | 1351492.31130 | | 608.260 | mid pt | 608.29 | 8/5/99 |
| | 136 | TC | 482014.08905 | 1350857.71167 | 595.35 | 598.370 | grid pt | 598.43 | 8/9/99 (T3.08) |
| | 137 | TC | 482064.05479 | 1350860.82209 | 594.36 | 597.390 | grid pt | 597.54 | 8/9/99 (T3.18) |
| | 138 | TC | 482114.01442 | 1350864.43247 | 593.40 | 596.420 | grid pt | 596.46 | 8/9/99 (T3.06) |
| | 139 | TCO | 482156.37262 | 1351491.48292 | | 607.880 | mid pt | 607.88 | 8/5/99 |
| | 140 | TCO | 482106.32873 | 1351493.73790 | | 608.220 | mid pt | 608.24 | 8/5/99 |
| | 141 | TCO | 482056.29748 | 1351495.99164 | | 608.560 | mid pt | 608.71 | 8/5/99 |
| | 142 | TCO | 482006.26622 | 1351498.24538 | | 608.900 | mid pt | 609.01 | 8/5/99 |
| | 143 | TCO | 481910.20500 | 1351491.81981 | | 606.860 | mid pt | 606.87 | 8/5/99 |
| 145 | 145 | TCO | 481987.27000 | 1351483.03000 | | 605.010 | toe slp pt 2145 | 605.07 | 8/10/99 |
| 146 | 146 | TCO | 482156.70000 | 1351465.71000 | | 601.430 | toe slp pt 2146 | 601.53 | 8/11/99 |
| 147 | 147 | TCO | 482172.65000 | 1351465.41000 | | 601.420 | toe slp pt 2147 | 601.48 | 8/5/99 |
| | 148 | TCO | 481994.93464 | 1350856.51929 | | 598.740 | toe slp | 598.76 | 8/4/99 |
| | 149 | TCO | 481994.54981 | 1350887.97531 | | 599.050 | toe slp | 599.09 | 8/4/99 |
| | 150 | TCO | 481993.93817 | 1350937.97157 | | 599.550 | toe slp | 599.57 | 8/4/99 |
| | 151 | TCO | 481993.32652 | 1350987.96783 | | 600.050 | toe slp | 600.09 | 8/4/99 |
| | 152 | TCO | 481992.71487 | 1351037.96409 | | 600.550 | toe slp | 600.58 | 8/4/99 |
| | 153 | TCO | 481992.10323 | 1351087.96035 | | 601.050 | toe slp | 601.14 | 8/4/99 |
| | 154 | TCO | 481991.49158 | 1351137.95661 | | 601.550 | toe slp | 601.55 | 8/4/99 |
| | 155 | TCO | 481990.87993 | 1351187.95286 | | 602.050 | toe slp | 602.06 | 8/4/99 |
| | 156 | TCO | 481990.26828 | 1351237.94912 | | 602.550 | toe slp | 602.55 | 8/4/99 |
| | 157 | TCO | 481989.65664 | 1351287.94538 | | 603.050 | toe slp | 603.07 | 8/4/99 |
| | 158 | TCO | 481989.04499 | 1351337.94164 | | 603.550 | toe slp | 603.56 | 8/4/99 |
| | 159 | TCO | 481988.43334 | 1351387.93790 | | 604.050 | toe slp | 604.05 | 8/4/99 |
| | 160 | TCO | 481987.82170 | 1351437.93416 | | 604.550 | toe slp | 604.58 | 8/4/99 |
| | 161 | TCO | 481977.12254 | 1350855.22537 | | 603.180 | top slp | 603.31 | 8/4/99 |
| | 162 | TCO | 481976.72501 | 1350887.75762 | | 603.510 | top slp | 603.60 | 8/4/99 |
| | 163 | TCO | 481976.11408 | 1350937.75389 | | 604.010 | top slp | 604.08 | 8/4/99 |
| | 164 | TCO | 481975.50315 | 1350987.75015 | | 604.510 | top slp | 604.64 | 8/4/99 |
| | 165 | TCO | 481974.89222 | 1351037.74642 | | 605.010 | top slp | 605.15 | 8/4/99 |
| 66 | 166 | TCO | 482286.37000 | 1350798.20000 | | 608.200 | top slp pt 2166 | 608.28 | 8/7/99 |
| 167 | 167 | TCO | 482285.84000 | 1350841.86000 | | 597.290 | toe slp pt 2167 | 597.32 | 8/7/99 |
| 168 | 168 | TCO | 482278.13000 | 1351472.20000 | | 603.590 | toe slp pt 2168 | 603.69 | 8/9/99 |
| 169 | 169 | TCO | 482277.56000 | 1351518.74000 | | 615.230 | top slp pt 2169 | 615.28 | 8/5/99 |
| 170 | 170 | TCO | 481918.74000 | 1350793.71000 | | 605.440 | south limit pt 2170 | 605.53 | 8/9/99 |
| 171 | 171 | TCO | 481918.22000 | 1350835.81000 | | 594.920 | south limit pt 2171 | 595.07 | 8/9/99 |
| 172 | 172 | TCO | 481910.48000 | 1351469.39000 | | 601.250 | south limit pt 2172 | 601.35 | 8/5/99 |
| 173 | 173 | TCO | 481909.93000 | 1351514.25000 | | 612.470 | south limit pt 2173 | 612.62 | 8/9/99 |
| | 174 | TCO | 481974.28129 | 1351087.74269 | | 605.510 | top slp | 605.66 | 8/4/99 |
| | 175 | TCO | 481973.67036 | 1351137.73896 | | 606.010 | top slp | 606.05 | 8/4/99 |
| | 176 | TCO | 481973.05943 | 1351187.73522 | | 606.510 | top slp | 606.65 | 8/4/99 |
| | 177 | TCO | 481972.44850 | 1351237.73149 | | 607.010 | top slp | 607.11 | 8/4/99 |
| | 178 | TCO | 481971.83757 | 1351287.72776 | | 607.510 | top slp | 607.60 | 8/4/99 |
| | 179 | TCO | 481971.22664 | 1351337.72403 | | 608.010 | top slp | 608.12 | 8/4/99 |
| | 180 | TCO | 481970.61571 | 1351387.72029 | | 608.510 | top slp | 608.51 | 8/4/99 |
| | 181 | TCO | 481970.00478 | 1351437.71656 | | 609.010 | top slp | 609.10 | 8/4/99 |

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 182 | TCO | 481977.49430 | 1350824.80230 | 602.880 | top | slp | 602.90 | 8/4/99 |
| 183 | TCO | 481969.45373 | 1351482.81241 | 609.460 | top | slp | 609.49 | 8/4/99 |
| 184 | TCO | 481967.49071 | 1350824.68012 | 602.880 | top | slp | 602.90 | 8/5/99 |
| 185 | TCO | 481967.11884 | 1350855.10320 | 603.180 | top | slp | 603.21 | 8/4/99 |
| 186 | TCO | 481966.72119 | 1350887.63544 | 603.510 | top | slp | 603.53 | 8/4/99 |
| 187 | TCO | 481966.11006 | 1350937.63171 | 604.010 | top | slp | 604.14 | 8/4/99 |
| 188 | TCO | 481965.49894 | 1350987.62797 | 604.510 | top | slp | 604.66 | 8/4/99 |
| 189 | TCO | 481964.88782 | 1351037.62424 | 605.010 | top | slp | 605.14 | 8/4/99 |
| 190 | TCO | 481964.27670 | 1351087.62050 | 605.510 | top | slp | 605.65 | 8/4/99 |
| 191 | TCO | 481963.66558 | 1351137.61677 | 606.010 | top | slp | 606.15 | 8/4/99 |
| 192 | TCO | 481963.05445 | 1351187.61303 | 606.510 | top | slp | 606.61 | 8/4/99 |
| 193 | TCO | 481962.44333 | 1351237.60930 | 607.010 | top | slp | 607.11 | 8/4/99 |
| 194 | TCO | 481961.83221 | 1351287.60556 | 607.510 | top | slp | 607.64 | 8/4/99 |
| 195 | TCO | 481961.22109 | 1351337.60183 | 608.010 | top | slp | 608.14 | 8/4/99 |
| 196 | TCO | 481960.60996 | 1351387.59809 | 608.510 | top | slp | 608.61 | 8/4/99 |
| 197 | TCO | 481959.99884 | 1351437.59436 | 609.010 | top | slp | 609.06 | 8/4/99 |
| 198 | TCO | 481959.44762 | 1351482.69021 | 609.460 | top | slp | 609.52 | 8/4/99 |
| 199 | TCO | 481936.26977 | 1350853.18281 | 595.450 | toe | slp | 595.46 | 8/5/99 |
| 200 | TCO | 481935.85362 | 1350887.25846 | 595.790 | toe | slp | 595.81 | 8/5/99 |
| 201 | TCO | 481935.24304 | 1350937.25473 | 596.290 | toe | slp | 596.29 | 8/5/99 |
| 202 | TCO | 481934.63245 | 1350987.25100 | 596.790 | toe | slp | 596.79 | 8/5/99 |
| 203 | TCO | 481934.02187 | 1351037.24727 | 597.290 | toe | slp | 597.34 | 8/5/99 |
| 204 | TCO | 481933.41129 | 1351087.24354 | 597.790 | toe | slp | 597.83 | 8/5/99 |
| 205 | TCO | 481932.80070 | 1351137.23982 | 598.290 | toe | slp | 598.29 | 8/5/99 |
| 206 | TCO | 481932.19012 | 1351187.23609 | 598.790 | toe | slp | 598.80 | 8/5/99 |
| 207 | TCO | 481931.57953 | 1351237.23236 | 599.290 | toe | slp | 599.32 | 8/5/99 |
| 208 | TCO | 481930.96895 | 1351287.22863 | 599.790 | toe | slp | 599.84 | 8/5/99 |
| 209 | TCO | 481930.35837 | 1351337.22490 | 600.290 | toe | slp | 600.39 | 8/5/99 |
| 210 | TCO | 481929.74778 | 1351387.22117 | 600.790 | toe | slp | 600.92 | 8/5/99 |
| 211 | TCO | 481929.13720 | 1351437.21745 | 601.290 | toe | slp | 601.29 | 8/5/99 |
| 212 | TCO | 481918.01049 | 1350852.95991 | 595.090 | south | limit | 595.11 | 8/5/99 |
| 213 | TCO | 481917.59421 | 1350887.03546 | 595.430 | south | limit | 595.43 | 8/5/99 |
| 214 | TCO | 481916.98345 | 1350937.03172 | 595.930 | south | limit | 595.97 | 8/5/99 |
| 215 | TCO | 481916.37268 | 1350987.02799 | 596.430 | south | limit | 596.46 | 8/5/99 |
| 216 | TCO | 481915.76191 | 1351037.02426 | 596.930 | south | limit | 596.93 | 8/5/99 |
| 217 | TCO | 481915.15114 | 1351087.02053 | 597.430 | south | limit | 597.43 | 8/5/99 |
| 218 | TCO | 481914.54037 | 1351137.01680 | 597.930 | south | limit | 597.95 | 8/5/99 |
| 219 | TCO | 481913.92960 | 1351187.01307 | 598.430 | south | limit | 598.46 | 8/5/99 |
| 220 | TCO | 481913.31883 | 1351237.00934 | 598.930 | south | limit | 598.99 | 8/5/99 |
| 221 | TCO | 481912.70806 | 1351287.00561 | 599.430 | south | limit | 599.43 | 8/5/99 |
| 222 | TCO | 481912.09729 | 1351337.00188 | 599.930 | south | limit | 599.99 | 8/5/99 |
| 223 | TCO | 481911.48652 | 1351386.99815 | 600.430 | south | limit | 600.45 | 8/5/99 |
| 224 | TCO | 481910.87575 | 1351436.99442 | 600.930 | south | limit | 600.92 | 8/5/99 |
| 225 | TCO | 481986.41056 | 1350824.91119 | 600.660 | mid | pt | 600.72 | 8/4/99 |
| 226 | TCO | 481986.02811 | 1350855.87230 | 600.960 | mid | pt | 601.09 | 8/4/99 |
| 227 | TCO | 481985.64048 | 1350887.86650 | 601.280 | mid | pt | 601.34 | 8/4/99 |
| 229 | TCO | 481985.02883 | 1350937.86276 | 601.780 | mid | pt | 601.91 | 8/4/99 |
| 230 | TCO | 481984.41718 | 1350987.85902 | 602.280 | mid | pt | 602.35 | 8/4/99 |
| 231 | TCO | 481983.80554 | 1351037.85528 | 602.780 | mid | pt | 602.78 | 8/4/99 |
| 232 | TCO | 481983.19389 | 1351087.85154 | 603.280 | mid | pt | 603.30 | 8/4/99 |
| 233 | TCO | 481982.58224 | 1351137.84780 | 603.780 | mid | pt | 603.79 | 8/4/99 |
| 234 | TCO | 481981.97060 | 1351187.84406 | 604.280 | mid | pt | 604.31 | 8/4/99 |
| 235 | TCO | 481981.35895 | 1351237.84031 | 604.780 | mid | pt | 604.78 | 8/4/99 |
| 236 | TCO | 481980.74730 | 1351287.83657 | 605.280 | mid | pt | 605.29 | 8/4/99 |
| 237 | TCO | 481980.13565 | 1351337.83283 | 605.780 | mid | pt | 605.80 | 8/4/99 |
| 238 | TCO | 481979.52401 | 1351387.82909 | 606.280 | mid | pt | 606.29 | 8/4/99 |
| 239 | TCO | 481978.91236 | 1351437.82535 | 606.780 | mid | pt | 606.79 | 8/4/99 |
| 240 | TCO | 481978.36066 | 1351482.92119 | 607.240 | mid | pt | 607.30 | 8/4/99 |
| 241 | TCO | 481951.91885 | 1350835.33843 | 599.130 | mid | pt | 599.16 | 8/5/99 |
| 242 | TCO | 481951.66996 | 1350854.14149 | 599.310 | mid | pt | 599.31 | 8/5/99 |

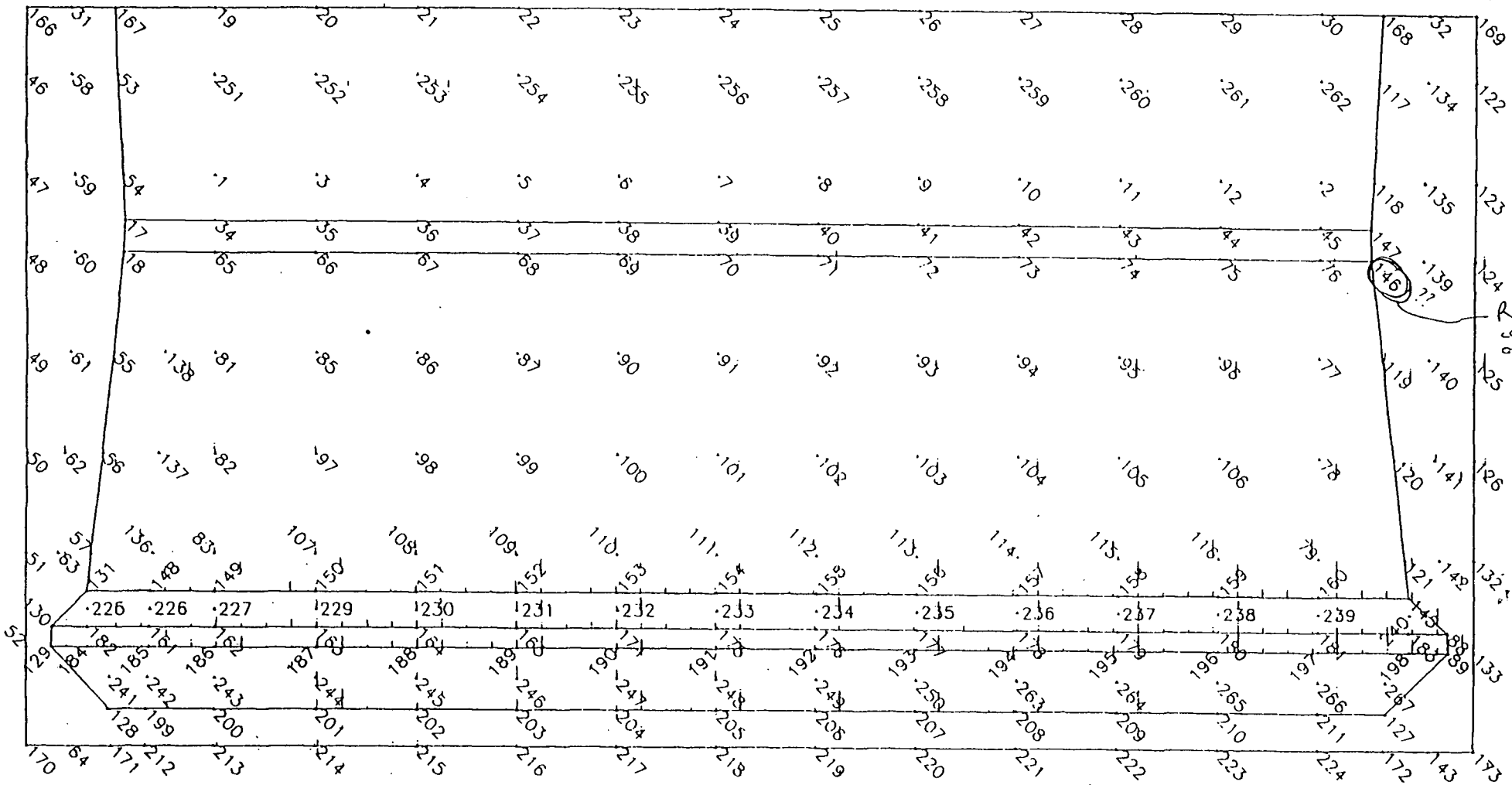
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 243 | TCO | 481951.28247 | 1350887.44689 | | 599.650 | mid pt | 599.28 | 8/5/99 | | |
| 244 | TCO | 481950.67189 | 1350937.44316 | | 600.150 | mid pt | 600.18 | 8/5/99 | | |
| 245 | TCO | 481950.06130 | 1350987.43943 | | 600.650 | mid pt | 600.70 | 8/5/99 | | |
| 246 | TCO | 481949.45072 | 1351037.43570 | | 601.150 | mid pt | 601.25 | 8/5/99 | | |
| ~~247~~ | ~~TCO~~ | ~~481948.84014~~ | ~~1351087.43198~~ | | ~~601.650~~ | ~~mid~~ pt | 601.73 | 8/5/99 | | |
| 248 | TCO | 481948.22955 | 1351137.42825 | | 602.150 | mid pt | 602.30 | 8/5/99 | | |
| ~~249~~ | ~~TCO~~ | ~~481947.61897~~ | ~~1351187.42452~~ | | ~~602.650~~ | ~~mid~~ pt | 602.76 | 8/5/99 | | |
| 250 | TCO | 481947.00838 | 1351237.42079 | | 603.150 | mid pt | 603.15 | 8/5/99 | | |
| 251 | TC | 482252.27735 | 1350891.12476 | 594.12 | 597.120 | grid pt | 597.20 | 8/9/99 | (T3.08) | |
| 252 | TC | 482251.66571 | 1350941.12102 | 594.61 | 597.620 | grid pt | 597.72 | 8/9/99 | (T3.11) | |
| ~~253~~ | ~~TC~~ | ~~482251.05408~~ | ~~1350991.11728~~ | ~~594.98~~ | ~~598.120~~ | grid pt | 598.14 | 8/9/99 | (T3.16) | |
| 254 | TC | 482250.44245 | 1351041.11354 | 595.61 | 598.620 | grid pt | 598.66 | 8/17/99 | (T3.05) | |
| 255 | TC | 482249.83081 | 1351091.10979 | 596.03 | 599.120 | grid pt | 599.18 | 8/6/99 | (T3.15) | |
| 256 | TC | 482249.21918 | 1351141.10605 | 596.57 | 599.620 | grid pt | 599.64 | 8/6/99 | (T3.07) | |
| 257 | TC | 482248.60755 | 1351191.10231 | 597.12 | 600.120 | grid pt | 600.13 | 8/6/99 | (T3.01) | |
| 258 | TC | 482247.99591 | 1351241.09857 | 597.60 | 600.620 | grid pt | 600.62 | 8/6/99 | (T3.02) | |
| 259 | TC | 482247.38428 | 1351291.09483 | 598.11 | 601.120 | grid pt | 601.14 | 8/6/99 | (T3.03) | |
| 260 | TC | 482246.77265 | 1351341.09109 | 598.55 | 601.620 | grid pt | 601.76 | 8/6/99 | (T3.21) | |
| ~~261~~ | ~~TC~~ | ~~482246.16101~~ | ~~1351391.08735~~ | 599.12 | ~~602.120~~ | grid pt | 602.19 | 8/6/99 | (T3.07) | |
| 262 | TC | 482245.54938 | 1351441.08361 | 599.62 | 602.620 | grid pt | 602.66 | 8/6/99 | (T3.04) | |
| ~~263~~ | ~~TCO~~ | ~~481946.39780~~ | 1351287.41706 | | 603.650 | mid pt | 603.79 | 8/5/99 | | |
| 264 | TCO | 481945.78722 | 1351337.41333 | | 604.150 | mid pt | 604.28 | 8/5/99 | | |
| ~~265~~ | TCO | ~~481945.17663~~ | ~~1351387.40961~~ | | 604.650 | mid pt | 604.78 | 8/5/99 | | |
| 266 | TCO | 481944.56605 | 1351437.40588 | | 605.150 | mid pt | 605.15 | 8/5/99 | | |
| ~~267~~ | TCO | 481944.15885 | 1351470.74843 | | 605.490 | mid pt | 605.64 | 8/6/99 | | |

TOLERANCE: 0 to +0.3 ft

POINTS CHECKED BY KBT on 8-10-99
ALL POINTS EXCEPT PT. 146 FOUND TO BE WITHIN TOLERANCE.
POINT 146 is +0.5 FT OF REQUIRED ELEVATION.

KBT 8-10-99

Point resurveyed by Hinch on 8-11-99 and found to be okay (within tolerance)
KBT 8-11-99



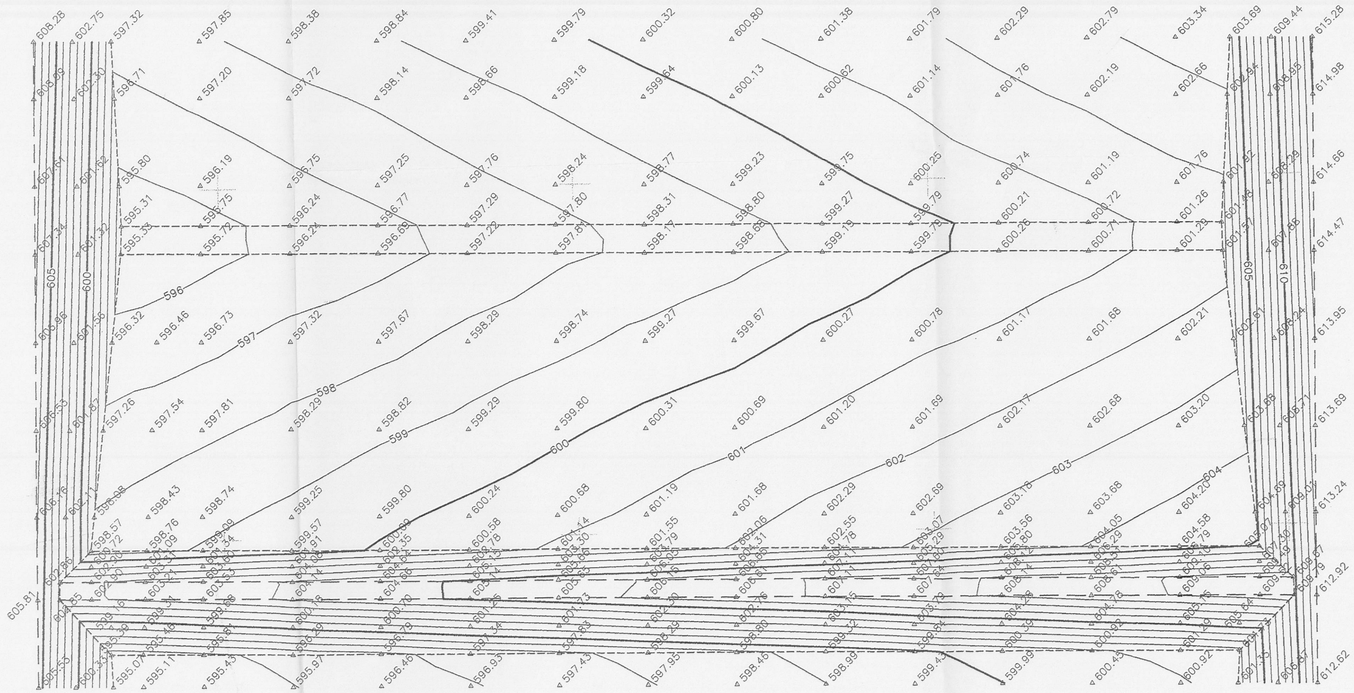

Certify Pts Tolerance @ Proposed Grade or 0.3' Above Proposed Grade

CELL 3 TOP OF CLAY

Kwame Boadu-Twereboah
11 August 1999

E-2741

000027



NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

LEGEND:

| | |
|---|---|
| △ 599.15 | = CERTIFIED POINT |
| ——600—— | INDEX (5 FOOT) ELEVATION CONTOUR LINE |
| ——601—— | ONE FOOT ELEVATION CONTOUR LINE |

INFORMATION ONLY

FIELD SURVEY COMPLETED AUG 10, 1999. ADK 12/13/99

GRAPHIC SCALE

40 0 20 40 80 160

( IN FEET )
1 inch = 40 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 12/13/99

20102 - OPTA - DWG - 01GA (REV. 0)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | JULY 1, 1999 |
| SCALE: | 1"=40' |
| DRAWN BY: | BJL |
| PRINT DATE: | JULY 1, 1999 |

STATE OF OHIO LYNN E. HIRSCH 5738 REGISTERED PROFESSIONAL SURVEYOR

OSDF PHASE 2
AS-BUILT TOP OF CLAY
OSDF CELL 3
08/18/1999

DATE: REVISIONS:

FILE NAME: topclayc3.dwg

1

SHEET NO. 1 OF 2

000028

F-2741

G:\LAND PROJECTS\990907\0001\DWG\topclay3.dwg B&L - DECEMBER 04, 1999 - 13:53:05 JKOPP

| | | | | |
|---|---|---|---|---|
| 1001 | 482202.28109 | 1350890.51312 | 596.19000 | grid point |
| 1002 | 482195.55312 | 1351440.47197 | 601.76000 | grid point |
| 1003 | 482201.66945 | 1350940.50938 | 596.75000 | grid point |
| 1004 | 482201.05782 | 1350990.50564 | 597.25000 | grid point |
| 1005 | 482200.44619 | 1351040.50190 | 597.76000 | grid point |
| 1006 | 482199.83455 | 1351090.49816 | 598.24000 | grid point |
| 1007 | 482199.22292 | 1351140.49442 | 598.77000 | grid point |
| 1008 | 482198.61129 | 1351190.49068 | 599.23000 | grid point |
| 1009 | 482197.99965 | 1351240.48694 | 599.75000 | grid point |
| 1010 | 482197.38802 | 1351290.48320 | 600.25000 | grid point |
| 1011 | 482196.77639 | 1351340.47946 | 600.74000 | grid point |
| 1012 | 482196.16475 | 1351390.47571 | 601.19000 | grid point |
| 1017 | 482180.22000 | 1350845.64000 | 595.31000 | toe slp pt 2017 |
| 1018 | 482164.29000 | 1350844.99000 | 595.33000 | toe slp pt 2018 |
| 1019 | 482285.23249 | 1350891.52792 | 597.85000 | south limit |
| 1020 | 482284.62096 | 1350941.52418 | 598.38000 | south limit |
| 1021 | 482284.00540 | 1350991.52039 | 598.84000 | south limit |
| 1022 | 482283.39387 | 1351041.51665 | 599.41000 | south limit |
| 1023 | 482282.78234 | 1351091.51291 | 599.79000 | south limit |
| 1024 | 482282.17082 | 1351141.50917 | 600.32000 | south limit |
| 1025 | 482281.55929 | 1351191.50543 | 600.80000 | south limit |
| 1026 | 482280.94776 | 1351241.50169 | 601.38000 | south limit |
| 1027 | 482280.33623 | 1351291.49795 | 601.79000 | south limit |
| 1028 | 482279.72470 | 1351341.49421 | 602.29000 | south limit |
| 1029 | 482279.11317 | 1351391.49047 | 602.79000 | south limit |
| 1030 | 482278.50164 | 1351441.48673 | 603.34000 | south limit |
| 1031 | 482286.10498 | 1350820.03161 | 602.75000 | south limit mid pt |
| 1032 | 482277.84502 | 1351495.46825 | 609.44000 | south limit mid pt |
| 1034 | 482179.71010 | 1350890.23700 | 595.75000 | grid point |
| 1035 | 482179.09856 | 1350940.23326 | 596.24000 | grid point |
| 1036 | 482178.48702 | 1350990.22952 | 596.77000 | grid point |
| 1037 | 482177.87549 | 1351040.22578 | 597.29000 | grid point |
| 1038 | 482177.26395 | 1351090.22204 | 597.80000 | grid point |
| 1039 | 482176.65241 | 1351140.21830 | 598.31000 | grid point |
| 1040 | 482176.04087 | 1351190.21456 | 598.80000 | grid point |
| 1041 | 482175.42933 | 1351240.21082 | 599.27000 | grid point |
| 1042 | 482174.81780 | 1351290.20708 | 599.79000 | grid point |
| 1043 | 482174.20626 | 1351340.20334 | 600.21000 | grid point |
| 1044 | 482173.59472 | 1351390.19960 | 600.72000 | grid point |
| 1045 | 482172.98318 | 1351440.19586 | 601.26000 | grid point |
| 1046 | 482253.41907 | 1350797.79756 | 608.09000 | top slp |
| 1047 | 482203.42280 | 1350797.18694 | 607.61000 | top slp |
| 1048 | 482164.84518 | 1350796.71577 | 607.34000 | top slp |
| 1049 | 482114.84890 | 1350796.10515 | 606.96000 | top slp |
| 1050 | 482064.85263 | 1350795.49453 | 606.53000 | top slp |
| 1051 | 482014.85636 | 1350794.88390 | 606.16000 | top slp |
| 1052 | 481967.86194 | 1350794.30994 | 605.81000 | top slp |
| 1053 | 482252.86559 | 1350843.04011 | 596.71000 | toe slp |
| 1054 | 482202.83995 | 1350844.83046 | 595.80000 | toe slp |
| 1055 | 482114.32400 | 1350839.08468 | 596.32000 | toe slp |
| 1056 | 482064.39234 | 1350833.18343 | 597.26000 | toe slp |
| 1057 | 482014.46068 | 1350827.28217 | 598.08000 | toe slp |
| 1058 | 482253.14233 | 1350820.41880 | 602.30000 | mid pt |
| 1059 | 482203.13138 | 1350821.00874 | 601.62000 | mid pt |
| 1060 | 482164.56759 | 1350820.85310 | 601.32000 | mid pt |
| 1061 | 482114.58645 | 1350817.59479 | 601.56000 | mid pt |
| 1062 | 482064.62249 | 1350814.33883 | 601.87000 | mid pt |
| 1063 | 482014.65852 | 1350811.08288 | 602.11000 | mid pt |
| 1064 | 481918.48000 | 1350814.76011 | 600.33000 | mid pt |
| 1065 | 482163.70539 | 1350890.04121 | 595.72000 | grid pt |
| 1066 | 482163.09479 | 1350940.03748 | 596.24000 | grid pt |
| 1067 | 482162.48419 | 1350990.03375 | 596.69000 | grid pt |
| 1068 | 482161.87358 | 1351040.03002 | 597.22000 | grid pt |
| 1069 | 482161.26298 | 1351090.02629 | 597.81000 | grid pt |
| 1070 | 482160.65238 | 1351140.02256 | 598.17000 | grid pt |
| 1071 | 482160.04177 | 1351190.01883 | 598.68000 | grid pt |
| 1072 | 482159.43117 | 1351240.01511 | 599.19000 | grid pt |
| 1073 | 482158.82057 | 1351290.01138 | 599.79000 | grid pt |
| 1074 | 482158.20996 | 1351340.00765 | 600.26000 | grid pt |
| 1075 | 482157.59936 | 1351390.00392 | 600.71000 | grid pt |
| 1076 | 482156.98876 | 1351440.00019 | 601.29000 | grid pt |
| 1077 | 482106.99248 | 1351439.38959 | 602.21000 | grid pt |
| 1078 | 482056.99621 | 1351438.77899 | 603.20000 | grid pt |
| 1079 | 482006.99994 | 1351438.16838 | 604.20000 | grid pt |

| | | | | |
|---|---|---|---|---|
| 1081 | 482113.70912 | 1350889.43060 | 596.73000 | grid pt |
| 1082 | 482063.71285 | 1350888.82000 | 597.81000 | grid pt |
| 1083 | 482013.71658 | 1350888.20940 | 598.74000 | grid pt |
| 1085 | 482113.09852 | 1350939.42687 | 597.32000 | grid pt |
| 1086 | 482112.48792 | 1350989.42315 | 597.67000 | grid pt |
| 1087 | 482111.87731 | 1351039.41942 | 598.29000 | grid pt |
| 1088 | 481969.22000 | 1351501.94000 | 609.67000 | ed berm pt 2144 |
| 1089 | 481959.21000 | 1351502.13000 | 609.79000 | ed berm pt 2143 |
| 1090 | 482111.26671 | 1351089.41569 | 598.74000 | grid pt |
| 1091 | 482110.65611 | 1351139.41196 | 599.27000 | grid pt |
| 1092 | 482110.04550 | 1351189.40823 | 599.67000 | grid pt |
| 1093 | 482109.43490 | 1351239.40450 | 600.27000 | grid pt |
| 1094 | 482108.82430 | 1351289.40077 | 600.78000 | grid pt |
| 1095 | 482108.21369 | 1351339.39705 | 601.17000 | grid pt |
| 1096 | 482107.60309 | 1351389.39332 | 601.68000 | grid pt |
| 1097 | 482063.10225 | 1350938.81627 | 598.29000 | grid pt |
| 1098 | 482062.49164 | 1350988.81254 | 598.82000 | grid pt |
| 1099 | 482061.88104 | 1351038.80881 | 599.29000 | grid pt |
| 1100 | 482061.27044 | 1351088.80509 | 599.80000 | grid pt |
| 1101 | 482060.65983 | 1351138.80136 | 600.31000 | grid pt |
| 1102 | 482060.04923 | 1351188.79763 | 600.69000 | grid pt |
| 1103 | 482059.43863 | 1351238.79390 | 601.20000 | grid pt |
| 1104 | 482058.82802 | 1351288.79017 | 601.69000 | grid pt |
| 1105 | 482058.21742 | 1351338.78644 | 602.17000 | grid pt |
| 1106 | 482057.60682 | 1351388.78271 | 602.68000 | grid pt |
| 1107 | 482013.10598 | 1350938.20567 | 599.25000 | grid pt |
| 1108 | 482012.49537 | 1350988.20194 | 599.80000 | grid pt |
| 1109 | 482011.88477 | 1351038.19821 | 600.24000 | grid pt |
| 1110 | 482011.27417 | 1351088.19448 | 600.68000 | grid pt |
| 1111 | 482010.66356 | 1351138.19075 | 601.19000 | grid pt |
| 1112 | 482010.05296 | 1351188.18702 | 601.68000 | grid pt |
| 1113 | 482009.44236 | 1351238.18330 | 602.29000 | grid pt |
| 1114 | 482008.83175 | 1351288.17957 | 602.69000 | grid pt |
| 1115 | 482008.22115 | 1351338.17584 | 603.18000 | grid pt |
| 1116 | 482007.61055 | 1351388.17211 | 603.68000 | grid pt |
| 1117 | 482245.19449 | 1351470.09285 | 602.94000 | toe slp |
| 1118 | 482195.22986 | 1351466.89620 | 601.92000 | toe slp |
| 1119 | 482106.60850 | 1351470.83061 | 602.61000 | toe slp |
| 1120 | 482056.54226 | 1351475.94864 | 603.68000 | toe slp |
| 1121 | 482006.47603 | 1351481.06666 | 604.69000 | toe slp |
| 1122 | 482244.60429 | 1351518.33750 | 614.98000 | top slp |
| 1123 | 482194.60802 | 1351517.72688 | 614.66000 | top slp |
| 1124 | 482156.04523 | 1351517.25590 | 614.47000 | top slp |
| 1125 | 482106.04896 | 1351516.64527 | 613.95000 | top slp |
| 1126 | 482056.05269 | 1351516.03465 | 613.69000 | top slp |
| 1127 | 481928.73000 | 1351470.56000 | 601.73000 | toe slp pt 2142 |
| 1128 | 481936.49000 | 1350835.15000 | 595.39000 | toe slp pt 2085 |
| 1129 | 481967.71000 | 1350806.74000 | 602.85000 | ed berm pt 2084 |
| 1130 | 481977.71000 | 1350807.15000 | 602.86000 | ed berm pt 2083 |
| 1131 | 481995.32000 | 1350825.02000 | 598.57000 | toe slp pt 2082 |
| 1132 | 482006.05642 | 1351515.42403 | 613.24000 | top slp |
| 1133 | 481959.05452 | 1351514.84998 | 612.92000 | top slp |
| 1134 | 482244.89939 | 1351494.21504 | 608.95000 | mid pt |
| 1135 | 482194.91894 | 1351492.31130 | 608.29000 | mid pt |
| 1136 | 482014.08905 | 1350857.71167 | 598.43000 | grid pt |
| 1137 | 482064.05479 | 1350860.82209 | 597.54000 | grid pt |
| 1138 | 482114.01442 | 1350864.43247 | 596.46000 | grid pt |
| 1139 | 482156.37262 | 1351491.48292 | 607.88000 | mid pt |
| 1140 | 482106.32873 | 1351493.73790 | 608.24000 | mid pt |
| 1141 | 482056.29748 | 1351495.99164 | 608.71000 | mid pt |
| 1142 | 482006.26622 | 1351498.24538 | 609.01000 | mid pt |
| 1143 | 481910.20500 | 1351491.81981 | 606.87000 | mid pt |
| 1145 | 481987.27000 | 1351483.03000 | 605.07000 | toe slp pt 2145 |
| 1146 | 482156.70000 | 1351465.71000 | 601.57000 | toe slp pt 2146 |
| 1147 | 482172.65000 | 1351465.41000 | 601.48000 | toe slp pt 2147 |
| 1148 | 481994.93464 | 1350856.51929 | 598.76000 | toe slp |
| 1149 | 481994.54981 | 1350887.97531 | 599.09000 | toe slp |
| 1150 | 481993.93817 | 1350937.97157 | 599.57000 | toe slp |
| 1151 | 481993.32652 | 1350987.96783 | 600.09000 | toe slp |
| 1152 | 481992.71487 | 1351037.96409 | 600.58000 | toe slp |
| 1153 | 481992.10323 | 1351087.96035 | 601.14000 | toe slp |
| 1154 | 481991.49158 | 1351137.95661 | 601.55000 | toe slp |
| 1155 | 481990.87993 | 1351187.95286 | 602.06000 | toe slp |
| 1156 | 481990.26828 | 1351237.94912 | 602.55000 | toe slp |

| | | | | |
|---|---|---|---|---|
| 1157 | 481989.65664 | 1351287.94538 | 603.07000 | toe slp |
| 1158 | 481989.04499 | 1351337.94164 | 603.56000 | toe slp |
| 1159 | 481988.43334 | 1351387.93790 | 604.05000 | toe slp |
| 1160 | 481987.82170 | 1351437.93416 | 604.58000 | toe slp |
| 1161 | 481977.12254 | 1350855.22537 | 603.31000 | top slp |
| 1162 | 481976.72501 | 1350887.75762 | 603.60000 | top slp |
| 1163 | 481976.11408 | 1350937.75389 | 604.08000 | top slp |
| 1164 | 481975.50315 | 1350987.75015 | 604.64000 | top slp |
| 1165 | 481974.89222 | 1351037.74642 | 605.15000 | top slp |
| 1166 | 482286.37000 | 1350798.20000 | 608.28000 | top slp pt 2166 |
| 1167 | 482285.84000 | 1350841.86000 | 597.32000 | toe slp pt 2167 |
| 1168 | 482278.13000 | 1351472.20000 | 603.69000 | toe slp pt 2168 |
| 1169 | 482277.56000 | 1351518.74000 | 615.28000 | top slp pt 2169 |
| 1170 | 481918.74000 | 1350793.71000 | 605.53000 | south limit pt 2170 |
| 1171 | 481918.22000 | 1350835.81000 | 595.07000 | south limit pt 2171 |
| 1172 | 481910.48000 | 1351469.39000 | 601.35000 | south limit pt 2172 |
| 1173 | 481909.93000 | 1351514.25000 | 612.62000 | south limit pt 2173 |
| 1174 | 481974.28129 | 1351087.74269 | 605.66000 | top slp |
| 1175 | 481973.67036 | 1351137.73896 | 606.05000 | top slp |
| 1176 | 481973.05943 | 1351187.73522 | 606.65000 | top slp |
| 1177 | 481972.44850 | 1351237.73149 | 607.11000 | top slp |
| 1178 | 481971.83757 | 1351287.72776 | 607.60000 | top slp |
| 1179 | 481971.22664 | 1351337.72403 | 608.12000 | top slp |
| 1180 | 481970.61571 | 1351387.72029 | 608.51000 | top slp |
| 1181 | 481970.00478 | 1351437.71656 | 609.10000 | top slp |
| 1182 | 481977.49430 | 1350824.80230 | 602.90000 | top slp |
| 1183 | 481969.45373 | 1351482.81241 | 609.49000 | top slp |
| 1184 | 481967.49071 | 1350824.68012 | 602.90000 | top slp |
| 1185 | 481967.11884 | 1350855.10320 | 603.21000 | top slp |
| 1186 | 481966.72119 | 1350887.63544 | 603.53000 | top slp |
| 1187 | 481966.11006 | 1350937.63171 | 604.14000 | top slp |
| 1188 | 481965.49894 | 1350987.62797 | 604.66000 | top slp |
| 1189 | 481964.88782 | 1351037.62424 | 605.14000 | top slp |
| 1190 | 481964.27670 | 1351087.62050 | 605.65000 | top slp |
| 1191 | 481963.66558 | 1351137.61677 | 606.15000 | top slp |
| 1192 | 481963.05445 | 1351187.61303 | 606.61000 | top slp |
| 1193 | 481962.44333 | 1351237.60930 | 607.11000 | top slp |
| 1194 | 481961.83221 | 1351287.60556 | 607.64000 | top slp |
| 1195 | 481961.22109 | 1351337.60183 | 608.14000 | top slp |
| 1196 | 481960.60996 | 1351387.59809 | 608.61000 | top slp |
| 1197 | 481959.99884 | 1351437.59436 | 609.06000 | top slp |
| 1198 | 481959.44762 | 1351482.69021 | 609.52000 | top slp |
| 1199 | 481936.26977 | 1350853.18281 | 595.46000 | toe slp |
| 1200 | 481935.85362 | 1350887.25846 | 595.81000 | toe slp |
| 1201 | 481935.24304 | 1350937.25473 | 596.29000 | toe slp |
| 1202 | 481934.63245 | 1350987.25100 | 596.79000 | toe slp |
| 1203 | 481934.02187 | 1351037.24727 | 597.34000 | toe slp |
| 1204 | 481933.41129 | 1351087.24354 | 597.83000 | toe slp |
| 1205 | 481932.80070 | 1351137.23982 | 598.29000 | toe slp |
| 1206 | 481932.19012 | 1351187.23609 | 598.80000 | toe slp |
| 1207 | 481931.57953 | 1351237.23236 | 599.32000 | toe slp |
| 1208 | 481930.96895 | 1351287.22863 | 599.84000 | toe slp |
| 1209 | 481930.35837 | 1351337.22490 | 600.39000 | toe slp |
| 1210 | 481929.74778 | 1351387.22117 | 600.92000 | toe slp |
| 1211 | 481929.13720 | 1351437.21745 | 601.29000 | toe slp |
| 1212 | 481918.01049 | 1350852.95981 | 595.11000 | south limit |
| 1213 | 481917.59421 | 1350887.03546 | 595.43000 | south limit |
| 1214 | 481916.98345 | 1350937.03172 | 595.97000 | south limit |
| 1215 | 481916.37268 | 1350987.02799 | 596.46000 | south limit |
| 1216 | 481915.76191 | 1351037.02426 | 596.93000 | south limit |
| 1217 | 481915.15114 | 1351087.02053 | 597.43000 | south limit |
| 1218 | 481914.54037 | 1351137.01680 | 597.95000 | south limit |
| 1219 | 481913.92960 | 1351187.01307 | 598.46000 | south limit |
| 1220 | 481913.31883 | 1351237.00934 | 598.99000 | south limit |
| 1221 | 481912.70806 | 1351287.00561 | 599.43000 | south limit |
| 1222 | 481912.09729 | 1351337.00188 | 599.99000 | south limit |
| 1223 | 481911.48652 | 1351386.99815 | 600.45000 | south limit |
| 1224 | 481910.87575 | 1351436.99442 | 600.92000 | south limit |
| 1225 | 481986.41066 | 1350824.91119 | 600.72000 | mid pt |
| 1226 | 481986.02811 | 1350855.87230 | 601.09000 | mid pt |
| 1227 | 481985.64048 | 1350887.86650 | 601.34000 | mid pt |
| 1229 | 481985.02883 | 1350937.86276 | 601.91000 | mid pt |
| 1230 | 481984.41718 | 1350987.85902 | 602.35000 | mid pt |
| 1231 | 481983.80554 | 1351037.85528 | 602.78000 | mid pt |

| | | | | |
|---|---|---|---|---|
| 1232 | 481983.19389 | 1351087.85154 | 603.30000 | mid pt |
| 1233 | 481982.58224 | 1351137.84780 | 603.79000 | mid pt |
| 1234 | 481981.97060 | 1351187.84406 | 604.31000 | mid pt |
| 1235 | 481981.35895 | 1351237.84031 | 604.78000 | mid pt |
| 1236 | 481980.74730 | 1351287.83657 | 605.29000 | mid pt |
| 1237 | 481980.13565 | 1351337.83283 | 605.80000 | mid pt |
| 1238 | 481979.52401 | 1351387.82909 | 606.29000 | mid pt |
| 1239 | 481978.91236 | 1351437.82535 | 606.79000 | mid pt |
| 1240 | 481978.36066 | 1351482.92119 | 607.30000 | mid pt |
| 1241 | 481951.91885 | 1350835.33843 | 599.16000 | mid pt |
| 1242 | 481951.66996 | 1350854.14149 | 599.31000 | mid pt |
| 1243 | 481951.28247 | 1350887.44689 | 599.68000 | mid pt |
| 1244 | 481950.67189 | 1350937.44316 | 600.18000 | mid pt |
| 1245 | 481950.06130 | 1350987.43943 | 600.70000 | mid pt |
| 1246 | 481949.45072 | 1351037.43570 | 601.25000 | mid pt |
| 1247 | 481948.84014 | 1351087.43198 | 601.73000 | mid pt |
| 1248 | 481948.22955 | 1351137.42825 | 602.30000 | mid pt |
| 1249 | 481947.61897 | 1351187.42452 | 602.76000 | mid pt |
| 1250 | 481947.00838 | 1351237.42079 | 603.15000 | mid pt |
| 1251 | 482252.27735 | 1350891.12476 | 597.20000 | grid pt |
| 1252 | 482251.66571 | 1350941.12102 | 597.72000 | grid pt |
| 1253 | 482251.05408 | 1350991.11728 | 598.14000 | grid pt |
| 1254 | 482250.44245 | 1351041.11354 | 598.66000 | grid pt |
| 1255 | 482249.83081 | 1351091.10979 | 599.18000 | grid pt |
| 1256 | 482249.21918 | 1351141.10605 | 599.64000 | grid pt |
| 1257 | 482248.60755 | 1351191.10231 | 600.13000 | grid pt |
| 1258 | 482247.99591 | 1351241.09857 | 600.62000 | grid pt |
| 1259 | 482247.38428 | 1351291.09483 | 601.14000 | grid pt |
| 1260 | 482246.77265 | 1351341.09109 | 601.76000 | grid pt |
| 1261 | 482246.16101 | 1351391.08735 | 602.19000 | grid pt |
| 1262 | 482245.54938 | 1351441.08361 | 602.66000 | grid pt |
| 1263 | 481946.39780 | 1351287.41706 | 603.79000 | mid pt |
| 1264 | 481945.78722 | 1351337.41333 | 604.28000 | mid pt |
| 1265 | 481945.17663 | 1351387.40961 | 604.78000 | mid pt |
| 1266 | 481944.56605 | 1351437.40588 | 605.15000 | mid pt |
| 1267 | 481944.15885 | 1351470.74843 | 605.64000 | mid pt |

KEY MAP

NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD)1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

LEGEND:

INFORMATION ONLY

| | | | | |
|---|---|---|---|---|
| 235 | 481930.755520 | 1351337.229750 | 597.310000 | toe slp |

= CERTIFIED POINT

GRAPHIC SCALE

80 0 40 80 160 320

( IN FEET )
1 inch = 80 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 12/13/99

20102-OPTA-DWG-018B (REV. 0)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | JULY 1, 1999 |
| SCALE: | 1"=80' |
| DRAWN BY: | BJL |
| PRINT DATE: | JULY 1, 1999 |

STATE OF OHIO
LYNN E. HIRSCH
S-5738
REGISTERED SURVEYOR

OSDF PHASE 2
AS-BUILT TOP OF CLAY
OSDF CELL 3
08/18/1999

| DATE: | REVISIONS: |
|---|---|

FILE NAME: topclayc3-C.dwg

2

000029

SHEET NO. 2 OF 2

2741

G:\LAND PROJECTS\990607\0008\DWG\topclayc3-C.dwg BJL - DECEMBER 04, 1999 - 13:54:29 XREFS:

# TOP OF LEAK DETECTION LAYER

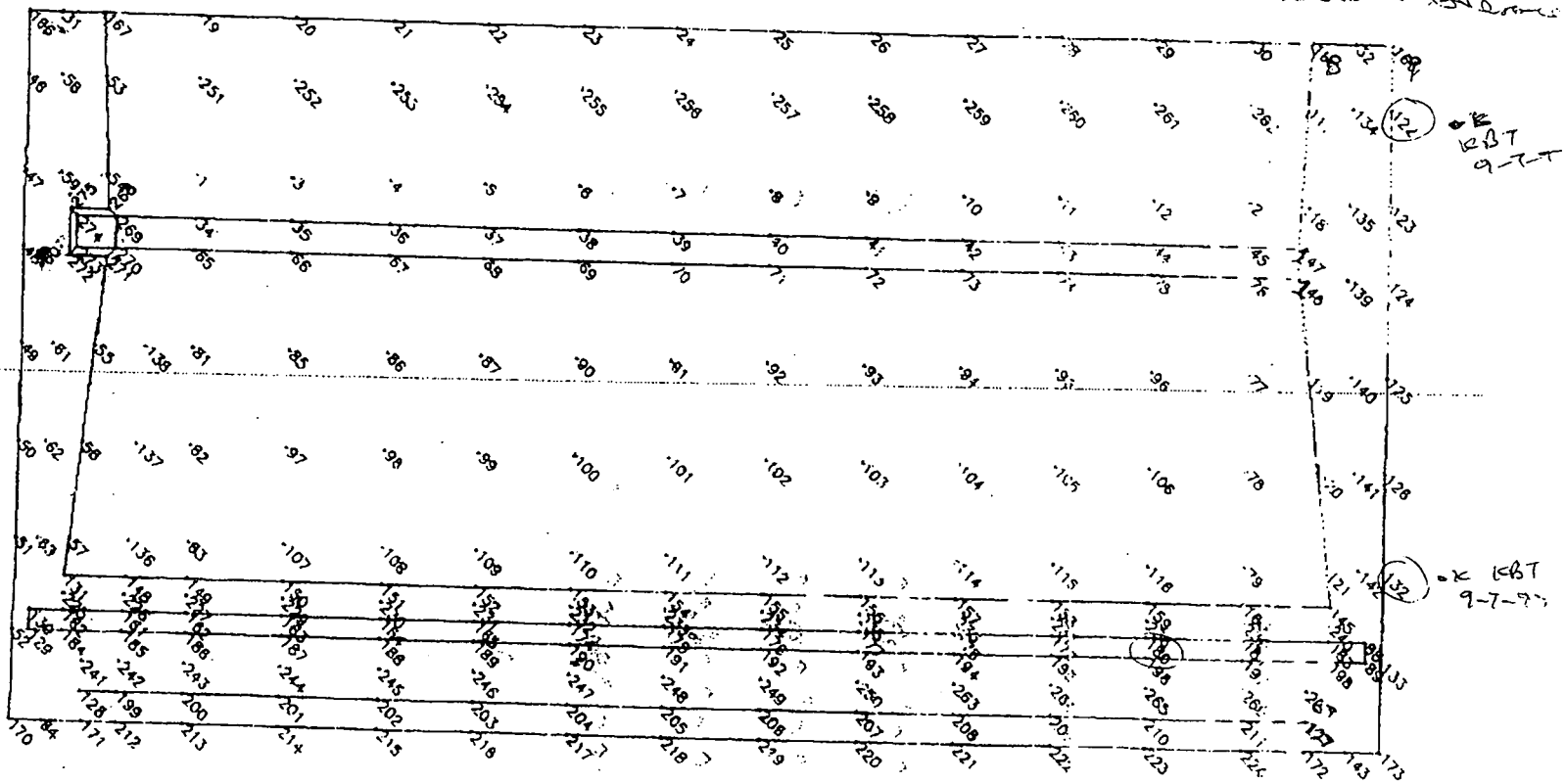
PETRO-FERNALD
HIRSCH SURVEYING INC

09/07/1999 07:22 5136483407
08/18/1999 13:50 5133672935

Tolerances: Elevation -0.1 to +0.3 ft
Thickness 0.0 to +0.1 ft.

on 9-7 and found to be within elevation tolerances.

Points checked by KBT on 9-9-99 and found to be within tolerances




Points checked by KBT on 9-10-99 and found to be within elevation tolerances.

Points checked by KBT on 9-14-99 and found to be within elevation tolerances.

Points checked by KBT on 9-16-99 and found to be within elevation tolerances.

TOP OF LDS LAYER
FILE : PET3LD .CRD

Points checked on 9/20/99 and found to be within elevation tolerances

Points on liner penetration bumps checked on 9/24/99 and field verified to be within elevation tolerances. KBT.

2741

HIRSCH & ASSOCIATES SURVEYING, INC.
3610 STATE LINE ROAD
OKEANA, OH 45053
(513) 367-0534
Fax: (513) 367-2935

August 30, 1999

**SUBJECT: CERTIFICATION POINTS TOP OF LDS LAYER CELL 3, FERNALD SITE.**

I hereby cetify that the elevations listed on the next 5 pages are the as built elevations of the top of LDS layer for the point numbers listed, along with the date the elevations were taken.

Lynn Edward Hirsch

**LYNN EDWARD HIRSCH**
**REGISTERED OHIO LAND SURVEYOR NO. 5738**

file: ferce3lds

STATE OF OHIO
LYNN
E.
HIRSCH
S-5738
REGISTERED
SURVEYOR

Note: Code of LDS Has a Corresponding Point From top Clay file
Code of LDSO Has No Corresponding Point From Top Clay file

Prepared by: Hirsch & Associates Surveying, Inc. #CGDS07961 Pg 1 of 5
List-Coords/Brg-Azi PET3LD 8/18/99 13:55:41 Factor: 1.0000000.

E-2741

| Pt.No. | Code | North | East | | Elev. Determined From As Built Top of Clay Elevation | Desc. | | |
|---|---|---|---|---|---|---|---|---|
| 1 | LDS | 482202.28109 | 1350890.51312 | 596.19 | 597.190 | grid point | 597.20 | 9/16/99 (T1.01) |
| 2 | LDS | 482195.55312 | 1351440.47197 | 601.76 | 602.760 | grid point | 602.76 | 8/30/99 (T1.00) |
| 3 | LDS | 482201.66945 | 1350940.50938 | 596.75 | 597.750 | grid point | 597.75 | 9/16/99 (T1.00) |
| 4 | LDS | 482201.05782 | 1350990.50564 | 597.25 | 598.250 | grid point | 598.26 | 9/16/99 (T1.01) |
| 5 | LDS | 482200.44619 | 1351040.50190 | 597.76 | 598.760 | grid point | 598.80 | 9/16/99 (T1.04) |
| 6 | LDS | 482199.83455 | 1351090.49816 | 598.24 | 599.240 | grid point | 599.25 | 9/8/99 (T1.01) |
| 7 | LDS | 482199.22292 | 1351140.49442 | 598.77 | 599.770 | grid point | 599.77 | 9/8/99 (T1.00) |
| 8 | LDS | 482198.61129 | 1351190.49068 | 599.23 | 600.230 | grid point | 600.25 | 9/8/99 (T1.02) |
| 9 | LDS | 482197.99965 | 1351240.48694 | 599.75 | 600.750 | grid point | 600.75 | 9/8/99 (T1.00) |
| 10 | LDS | 482197.38802 | 1351290.48320 | 600.25 | 601.250 | grid point | 601.27 | 8/30/99 (T1.02 |
| 11 | LDS | 482196.77639 | 1351340.47946 | 600.74 | 601.740 | grid point | 601.76 | 8/30/99 (T1.02 |
| 12 | LDS | 482196.16475 | 1351390.47571 | 601.19 | 602.190 | grid point | 602.24 | 8/30/99 (T1.05 |
| 19 | LDS | 482285.23249 | 1350891.52792 | 597.85 | 598.850 | south limit | 598.99 | 9/13/99 (T1.1 |
| 20 | LDS | 482284.62096 | 1350941.52418 | 598.38 | 599.380 | south limit | 599.39 | 9/13/99 (T1.0 |
| 21 | LDS | 482284.00540 | 1350991.52039 | 598.84 | 599.840 | south limit | 599.88 | 9/13/99 (T1.0 |
| 22 | LDS | 482283.39387 | 1351041.51665 | 599.41 | 600.410 | south limit | 600.46 | 9/13/99 (T1.05 |
| 23 | LDS | 482282.78234 | 1351091.51291 | 599.79 | 600.790 | south limit | 600.91 | 9/13/99 (T1.1 |
| 24 | LDS | 482282.17082 | 1351141.50917 | 600.32 | 601.320 | south limit | 601.47 | 9/13/99 (T1.15 |
| 25 | LDS | 482281.55929 | 1351191.50543 | 600.80 | 601.800 | south limit | 601.84 | 9/13/99 (T1.04 |
| 26 | LDS | 482280.94776 | 1351241.50169 | 601.38 | 602.380 | south limit | 602.40 | 9/13/99 (T1.02 |
| 27 | LDS | 482280.33623 | 1351291.49795 | 601.79 | 602.790 | south limit | 602.79 | 9/8/99 (T1.00) |
| 28 | LDS | 482279.72470 | 1351341.49421 | 602.29 | 603.290 | south limit | 603.33 | 9/8/99 (T1.04) |
| 29 | LDS | 482279.11317 | 1351391.49047 | 602.79 | 603.790 | south limit | 603.88 | 9/8/99 (T1.09 |
| 30 | LDS | 482278.50164 | 1351441.48673 | 603.34 | 604.340 | south limit | 604.39 | 9/8/99 (T1.05) |
| 31 | LDS | 482286.10498 | 1350820.03161 | 602.75 | 603.780 | south limit mid pt | 603.80 | 9/16/99 (1.05 |
| 32 | LDS | 482277.84502 | 1351495.46825 | 609.44 | 610.470 | 9/1/13 south limit mid pt | 610.62 | 9/8/99 |
| 34 | LDS | 482179.71010 | 1350890.23700 | 595.75 | 596.750 | grid point | 596.87 | 9/16/99 (1.12) |
| 35 | LDS | 482179.09856 | 1350940.23326 | 596.24 | 597.240 | grid point | 597.26 | 9/16/99 (1.02) |
| 36 | LDS | 482178.48702 | 1350990.22952 | 596.77 | 597.770 | grid point | 597.92 | 9/16/99 (1.15) |
| 37 | LDS | 482177.87549 | 1351040.22578 | 597.29 | 598.290 | grid point | 598.36 | 9/16/99 (1.07) |
| 38 | LDS | 482177.26395 | 1351090.22204 | 597.80 | 598.800 | grid point | 598.91 | 9/14/99 (T1.11) |
| 39 | LDS | 482176.65241 | 1351140.21830 | 598.31 | 599.310 | grid point | 599.33 | 9/14/99 (T1.04) |
| 40 | LDS | 482176.04087 | 1351190.21456 | 598.80 | 599.800 | grid point | 599.83 | 9/8/99 (T1.03 |
| 41 | LDS | 482175.42933 | 1351240.21082 | 599.27 | 600.270 | grid point | 600.28 | 9/8/99 (T1.01) |
| 42 | LDS | 482174.81780 | 1351290.20708 | 599.79 | 600.790 | grid point | 600.87 | 9/8/99 (T1.08) |
| 43 | LDS | 482174.20626 | 1351340.20334 | 600.21 | 601.210 | grid point | 601.30 | 9/8/99 (T1.09) |
| 44 | LDS | 482173.59472 | 1351390.19960 | 600.72 | 601.720 | grid point | 601.85 | 9/8/99 (T1.13) |
| 45 | LDS | 482172.98318 | 1351440.19586 | 601.26 | 602.260 | grid point | 602.34 | 9/8/99 (T1.08) |
| 46 | LDSO | 482253.36867 | 1350801.91725 | | 608.090 | top slp | 608.22 | |
| 47 | LDSO | 482203.37240 | 1350801.30663 | | 607.610 | top slp | 607.74 | 9/18/99 — |
| 48 | LDSO | 482164.79780 | 1350800.83550 | | 607.340 | top slp | 607.48 | 9/18/99 — |
| 49 | LDSO | 482114.79859 | 1350800.22484 | | 606.960 | top slp | 607.07 | 9/18/99 — |
| 50 | LDSO | 482064.80232 | 1350799.61422 | | 606.530 | top slp | 606.67 | 9/18/99 — |
| 51 | LDSO | 482014.80605 | 1350799.00360 | | 606.160 | top slp | 606.24 | 9/18/99 — |
| 52 | LDSO | 481967.81158 | 1350798.42964 | | 605.810 | top slp | 605.89 | 9/18/99 — |
| 53 | LDS | 482252.86415 | 1350843.15836 | 596.71 | 597.740 | toe slp | 597.84 | 9/16/99 (1.13) |
| 54 | LDS | 482202.83854 | 1350844.94607 | 595.80 | 596.830 | toe slp | 596.90 | 9/16/99 (T1.10) |
| 55 | LDS | 482114.32253 | 1350839.20468 | 596.82 | 597.350 | toe slp | 597.46 | 9/18/99 (T1.14) |
| 56 | LDS | 482064.39087 | 1350833.30342 | 597.26 | 598.290 | toe slp | 598.30 | 9/18/99 (T1.04) |
| 57 | LDS | 482014.45922 | 1350827.40216 | 598.08 | 599.110 | toe slp | 599.25 | 9/18/99 (T1.17) |
| 58 | LDS | 482253.14233 | 1350820.41880 | 602.36 | 603.330 | mid pt | 603.43 | 9/16/99 (1.13) |
| 59 | LDS | 482203.13138 | 1350821.00874 | 601.62 | 602.650 | mid pt | 602.73 | 9/18/99 (T1.11) |
| 60 | LDS | 482164.56759 | 1350820.85310 | 601.32 | 602.350 | mid pt | 602.42 | 9/23/99 (T1.10) |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 61 | LDS | 482114.58645 | 1350817.59479 | 601.56 | 602.590 | mid pt | 602.74 | 9/18/99 | (T1.18) |
| 62 | LDS | 482064.62249 | 1350814.33883 | 601.87 | 602.900 | mid pt | 602.90 | 9/18/99 | (T1.03) |
| 63 | LDS | 482014.65852 | 1350811.08288 | 602.61 | 603.140 | mid pt | 603.15 | 9/18/99 | (T1.03) |
| 64 | LDS | 481921.47977 | 1350814.79674 | 600.33 | 601.380 | mid pt | 601.40 | 9/18/99 | (T1.07) |
| 65 | LDS | 482163.70539 | 1350890.04121 | 595.72 | 596.720 | grid pt | 596.84 | 9/16/99 | (T1.12) |
| 66 | LDS | 482163.09479 | 1350940.03748 | 596.24 | 597.240 | grid pt | 597.32 | 9/16/99 | (T1.08) |
| 67 | LDS | 482162.48419 | 1350990.03375 | 596.69 | 597.690 | grid pt | 597.78 | 9/16/99 | (T1.09) |
| 68 | LDS | 482161.87358 | 1351040.03002 | 597.22 | 598.220 | grid pt | 598.36 | 9/16/99 | (T1.14) |
| 69 | LDS | 482161.26298 | 1351090.02629 | 597.86 | 598.810 | grid pt | 598.94 | 9/14/99 | (T1.13) |
| 70 | LDS | 482160.65238 | 1351140.02256 | 598.17 | 599.170 | grid pt | 599.32 | 9/14/99 | (T1.15) |
| 71 | LDS | 482160.04177 | 1351190.01883 | 598.68 | 599.680 | grid pt | 599.81 | 9/8/99 | (T1.13) |
| 72 | LDS | 482159.43117 | 1351240.01511 | 599.19 | 600.190 | grid pt | 600.33 | 9/8/99 | (T1.19) |
| 73 | LDS | 482158.82057 | 1351290.01138 | 599.79 | 600.790 | grid pt | 600.85 | 9/8/99 | (T1.06) |
| 74 | LDS | 482158.20996 | 1351340.00765 | 600.26 | 601.260 | grid pt | 601.28 | 9/8/99 | (T1.02) |
| 75 | LDS | 482157.59936 | 1351390.00392 | 600.71 | 601.710 | grid pt | 601.81 | 9/8/99 | (T1.10) |
| 76 | LDS | 482156.98876 | 1351440.00019 | 601.29 | 602.290 | grid pt | 602.29 | 9/8/99 | (T1.00) |
| 77 | LDS | 482106.99248 | 1351439.38959 | 602.21 | 603.210 | grid pt | 603.33 | 8/30/99 | (T1.12) |
| 78 | LDS | 482056.99621 | 1351438.77899 | 603.20 | 604.200 | grid pt | 604.28 | 8/28/99 | (T1.08) |
| 79 | LDS | 482006.99994 | 1351438.16838 | 604.20 | 605.200 | grid pt | 605.33 | 8/28/99 | (T-1.13) |
| 81 | LDS | 482113.70912 | 1350889.43060 | 596.73 | 597.730 | grid pt | 597.88 | 9/18/99 | (T1.15) |
| 82 | LDS | 482063.71285 | 1350888.82000 | 597.81 | 598.810 | grid pt | 598.91 | 9/18/99 | (T1.10) |
| 83 | LDS | 482013.71658 | 1350888.20940 | 598.74 | 599.740 | grid pt | 599.89 | 9/18/99 | (T1.15) |
| 85 | LDS | 482113.09852 | 1350939.42687 | 597.32 | 598.320 | grid pt | 598.45 | 9/18/99 | (T1.13) |
| 86 | LDS | 482112.48792 | 1350989.42315 | 597.67 | 598.670 | grid pt | 598.78 | 9/18/99 | (T1.11) |
| 87 | LDS | 482111.87731 | 1351039.41942 | 598.29 | 599.290 | grid pt | 599.38 | 9/18/99 | (T1.09) |
| 88 | LDS | 481969.33998 | 1351501.93772 | 609.67 | 610.700 | ed berm | 610.80 | 8/28/99 | (T-1.13) |
| 89 | LDS | 481959.09002 | 1351502.13228 | 609.79 | 610.820 | ed berm | 610.94 | 8/28/99 | (T-1.15) |
| 90 | LDS | 482111.26671 | 1351089.41569 | 598.74 | 599.740 | grid pt | 599.77 | 9/8/99 | (T1.03) |
| 91 | LDS | 482110.65611 | 1351139.41196 | 599.27 | 600.270 | grid pt | 600.28 | 9/8/99 | (T1.01) |
| 92 | LDS | 482110.04550 | 1351189.40823 | 599.67 | 600.670 | grid pt | 600.77 | 9/8/99 | (T1.10) |
| 93 | LDS | 482109.43490 | 1351239.40450 | 600.27 | 601.270 | grid pt | 601.37 | 9/8/99 | (T1.10) |
| 94 | LDS | 482108.82430 | 1351289.40077 | 600.78 | 601.780 | grid pt | 601.86 | 9/8/99 | (T1.08) |
| 95 | LDS | 482108.21369 | 1351339.39705 | 601.17 | 602.170 | grid pt | 602.29 | 8/30/99 | (T1.12) |
| 96 | LDS | 482107.60309 | 1351389.39332 | 601.68 | 602.680 | grid pt | 602.83 | 8/30/99 | (T1.15) |
| 97 | LDS | 482063.10225 | 1350938.81627 | 598.29 | 599.290 | grid pt | 599.40 | 9/18/99 | (T1.11) |
| 98 | LDS | 482062.49164 | 1350988.81254 | 598.82 | 599.820 | grid pt | 599.90 | 9/18/99 | (T1.08) |
| 99 | LDS | 482061.88104 | 1351038.80881 | 599.29 | 600.290 | grid pt | 600.36 | 9/18/99 | (T1.07) |
| 100 | LDS | 482061.27044 | 1351088.80509 | 599.80 | 600.800 | grid pt | 600.80 | 9/9/99 | (T1.00) |
| 101 | LDS | 482060.65983 | 1351138.80136 | 600.31 | 601.310 | grid pt | 601.33 | 9/8/99 | (T1.02) |
| 102 | LDS | 482060.04923 | 1351188.79763 | 600.49 | 601.690 | grid pt | 601.84 | 9/8/99 | (T1.15) |
| 103 | LDS | 482059.43863 | 1351238.79390 | 601.20 | 602.200 | grid pt | 602.33 | 9/8/99 | (T1.13) |
| 104 | LDS | 482058.82802 | 1351288.79017 | 601.69 | 602.690 | grid pt | 602.76 | 8/30/99 | (T1.08) |
| 105 | LDS | 482058.21742 | 1351338.78644 | 602.17 | 603.170 | grid pt | 603.22 | 8/31/99 | (T1.03) |
| 106 | LDS | 482057.60682 | 1351388.78271 | 602.68 | 603.680 | grid pt | 603.81 | 8/28/99 | (T1.13) |
| 107 | LDS | 482013.10598 | 1350938.20567 | 599.25 | 600.250 | grid pt | 600.38 | 9/18/99 | (T1.13) |
| 108 | LDS | 482012.49537 | 1350988.20194 | 599.80 | 600.800 | grid pt | 600.83 | 9/18/99 | (T1.03) |
| 109 | LDS | 482011.88477 | 1351038.19821 | 600.24 | 601.240 | grid pt | 601.38 | 9/18/99 | (T1.14) |
| 110 | LDS | 482011.27417 | 1351088.19448 | 600.68 | 601.680 | grid pt | 601.71 | 9/9/99 | (T1.03) |
| 111 | LDS | 482010.66356 | 1351138.19075 | 601.19 | 602.190 | grid pt | 602.31 | 9/9/99 | (T1.12) |
| 112 | LDS | 482010.05296 | 1351188.18702 | 601.68 | 602.680 | grid pt | 602.83 | 9/9/99 | (T1.15) |
| 113 | LDS | 482009.44236 | 1351238.18330 | 602.29 | 603.290 | grid pt | 603.30 | 9/9/99 | (T1.01) |
| 114 | LDS | 482008.83175 | 1351288.17957 | 602.69 | 603.690 | grid pt | 603.71 | 8/28/99 | (T1.02) |
| 115 | LDS | 482008.22115 | 1351338.17584 | 603.18 | 604.180 | grid pt | 604.33 | 8/28/99 | (T-1.15) |
| 116 | LDS | 482007.61055 | 1351388.17211 | 603.68 | 604.680 | grid pt | 604.81 | 8/28/99 | (T-1.13) |
| 117 | LDS | 482245.19596 | 1351469.97286 | 602.94 | 603.970 | toe slp | 603.97 | 8/30/99 | (T1.03) |
| 118 | LDS | 482195.23122 | 1351466.78494 | 601.92 | 602.950 | toe slp | 603.07 | 8/30/99 | (T1.15) |
| 119 | LDS | 482106.60996 | 1351470.71062 | 602.61 | 603.640 | toe slp | 603.65 | 8/28/99 | (T-1.04) |
| 120 | LDS | 482056.54373 | 1351475.82864 | 603.68 | 604.710 | toe slp | 604.86 | 8/30/99 | (T1.18) |
| 121 | LDS | 482006.47749 | 1351480.94667 | 604.69 | 605.720 | toe slp | 605.81 | 8/30/99 | (T1.12) |
| 122 | LDSO | 482244.65469 | 1351514.21781 | | 614.980 | top slp | 615.07 | 8/30/99 | |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 123 | LDSO | 482194.65841 | 1351513.60719 | | 614.660 | top slp | 614.24 | 8/30/99 | |
| 124 | LDSO | 482156.09756 | 1351513.13623 | | 614.470 | top slp | 614.54 | 8/30/99 | |
| 125 | LDSO | 482106.09928 | 1351512.52558 | | 613.950 | top slp | 614.02 | 8/30/99 | |
| 126 | LDSO | 482056.10301 | 1351511.91496 | | 613.690 | top slp | 613.76 | 8/30/99 | |
| 127 | LDS | 481928.61001 | 1351470.55853 | 601.73 | 602.760 | toe slp | 602.89 | 8/28/99 | (T1.16) |
| 128 | LDS | 481936.37001 | 1350835.14853 | 595.39 | 596.420 | toe slp | 596.55 | 9/18/99 | (T1.16) |
| 129 | LDS | 481967.59010 | 1350806.73508 | 602.85 | 603.880 | ed berm | 603.95 | 9/18/99 | (T1.10) |
| 130 | LDS | 481977.82990 | 1350807.15492 | 602.86 | 603.900 | ed berm | 604.00 | 9/18/99 | (T1.14) |
| 131 | LDS | 481995.43999 | 1350825.02147 | 598.57 | 599.600 | toe slp | 599.72 | 9/18/99 | (T1.15) |
| 132 | LDSO | 482006.10673 | 1351511.30433 | | 613.240 | top slp | 613.31 | 8/28/99 | |
| 133 | LDSO | 481959.10488 | 1351510.73028 | | 612.920 | top slp | 612.99 | 8/28/99 | |
| 134 | LDS | 482244.89939 | 1351494.21504 | 608.95 | 609.980 | mid pt | 610.10 | 8/30/99 | (T1.03) |
| 135 | LDS | 482194.91894 | 1351492.31130 | 608.29 | 609.320 | mid pt | 609.43 | 8/30/99 | (T-1.14) |
| 136 | LDS | 482014.08905 | 1350857.71167 | 598.43 | 599.430 | grid pt | 599.54 | 9/18/99 | (T1.11) |
| 137 | LDS | 482064.05479 | 1350860.82209 | 597.54 | 598.540 | grid pt | 598.65 | 9/18/99 | (T1.11) |
| 138 | LDS | 482114.01442 | 1350864.43247 | 596.46 | 597.460 | grid pt | 597.51 | 9/18/99 | (T1.05) |
| 139 | LDS | 482156.37262 | 1351491.48292 | 607.88 | 608.910 | mid pt | 609.08 | 8/30/99 | (1.19) |
| 140 | LDS | 482106.32873 | 1351493.73790 | 608.24 | 609.270 | mid pt | 609.42 | 8/30/99 | (T1.18) |
| 141 | LDS | 482056.29748 | 1351495.99164 | 608.71 | 609.740 | mid pt | 609.88 | 8/30/99 | (T1.17) |
| 142 | LDS | 482006.26622 | 1351498.24538 | 609.01 | 610.040 | mid pt | 610.17 | 8/28/99 | (T-1.16) |
| 143 | LDSO | 481913.20478 | 1351491.85645 | | 607.890 | mid pt | 607.94 | 8/28/99 | |
| 145 | LDS | 481987.38999 | 1351483.03147 | 605.07 | 606.100 | toe slp pt | 606.22 | 8/28/99 | (T-1.15) |
| 146 | LDS | 482156.70135 | 1351465.59001 | 601.57 | 602.600 | toe slp | 602.73 | 9/18/99 | (T1.16) |
| 147 | LDS | 482172.65159 | 1351465.29001 | 601.49 | 602.510 | toe slp | 602.66 | 9/18/99 | (T1.18) |
| 148 | LDS | 481995.05433 | 1350856.52798 | 598.76 | 599.790 | toe slp | 599.90 | 9/18/99 | (T1.14) |
| 149 | LDS | 481994.66980 | 1350887.97678 | 599.09 | 600.120 | toe slp | 600.14 | 9/18/99 | (T1.05) |
| 150 | LDS | 481994.05816 | 1350937.97304 | 599.57 | 600.600 | toe slp | 600.71 | 9/18/99 | (T1.14) |
| 151 | LDS | 481993.44651 | 1350987.96930 | 600.09 | 601.120 | toe slp | 601.17 | 9/18/99 | (T1.08) |
| 152 | LDS | 481992.83486 | 1351037.96555 | 600.58 | 601.610 | toe slp | 601.72 | 9/18/99 | (T1.14) |
| 153 | LDS | 481992.22322 | 1351087.96181 | 601.14 | 602.170 | toe slp | 602.28 | 9/9/99 | (T1.09) |
| 154 | LDS | 481991.61157 | 1351137.95807 | 601.55 | 602.580 | toe slp | 602.72 | 9/9/99 | (T-1.17) |
| 155 | LDS | 481990.99992 | 1351187.95433 | 602.06 | 603.090 | toe slp | 603.22 | 9/9/99 | (T1.18) |
| 156 | LDS | 481990.38828 | 1351237.95059 | 602.55 | 603.580 | toe slp | 603.68 | 9/9/99 | (T1.13) |
| 157 | LDS | 481989.77663 | 1351287.94685 | 603.07 | 604.100 | toe slp | 604.23 | 8/28/99 | (T-1.16) |
| 158 | LDS | 481989.16498 | 1351337.94311 | 603.56 | 604.590 | toe slp | 604.64 | 8/28/99 | (T1.08) |
| 159 | LDS | 481988.55333 | 1351387.93937 | 604.05 | 605.080 | toe slp | 605.20 | 8/28/99 | (T1.15) |
| 160 | LDS | 481987.94169 | 1351437.93562 | 604.58 | 605.610 | toe slp | 605.76 | 8/28/99 | (T1.18) |
| 161 | LDS | 481977.24253 | 1350855.22684 | 603.31 | 604.340 | top slp | 604.39 | 9/18/99 | (T1.08) |
| 162 | LDS | 481976.84500 | 1350887.75908 | 603.60 | 604.630 | top slp | 604.76 | 9/18/99 | (T1.16) |
| 163 | LDS | 481976.23407 | 1350937.75535 | 604.08 | 605.110 | top slp | 605.22 | 9/18/99 | (T1.14) |
| 164 | LDS | 481975.62314 | 1350987.75162 | 604.64 | 605.670 | top slp | 605.70 | 9/18/99 | (T1.06) |
| 165 | LDS | 481975.01221 | 1351037.74789 | 605.15 | 606.180 | top slp | 606.26 | 9/18/99 | (T1.11) |
| 166 | LDSO | 482286.31999 | 1350802.31970 | | 608.280 | top slp | 608.42 | 9/13/99 | — |
| 167 | LDS | 482285.83854 | 1350841.97999 | 597.32 | 598.350 | toe slp pt 2167 | 598.50 | 9/13/99 | (T1.1 |
| 168 | LDS | 482278.13147 | 1351472.08001 | 603.69 | 604.720 | toe slp | 604.77 | 9/18/99 | (T1.08) |
| 169 | LDSO | 482277.61046 | 1351514.62031 | 615.28 | 615.280 | top slp | 615.28 | 9/8/99 | |
| 170 | LDSO | 481921.68889 | 1350797.86632 | 605.53 | 605.550 | south limit | 605.65 | 9/18/99 | — |
| 171 | LDSO | 481921.21806 | 1350835.70170 | | 596.130 | south limit | 596.28 | 9/18/99 | — |
| 172 | LDSO | 481913.47385 | 1351469.58193 | | 602.410 | south limit pt 2172 | 602.56 | 8/28/99 | |
| 173 | LDS | 481912.98029 | 1351510.16695 | | 612.640 | south limit pt 2173 | 612.76 | 8/28/99 | |
| 174 | LDS | 481974.40128 | 1351087.74415 | 605.66 | 606.690 | top slp | 606.79 | 9/9/99 | (T1.13) |
| 175 | LDS | 481973.79035 | 1351137.74042 | 606.05 | 607.080 | top slp | 607.22 | 9/9/99 | (T1.17) |
| 176 | LDS | 481973.17942 | 1351187.73669 | 606.65 | 607.680 | top slp | 607.71 | 9/9/99 | (T1.06) |
| 177 | LDS | 481972.56849 | 1351237.73296 | 607.11 | 608.140 | top slp | 608.20 | 9/9/99 | (T1.09) |
| 178 | LDS | 481971.95756 | 1351287.72922 | 607.60 | 608.630 | top slp | 608.67 | 8/28/99 | (T1.07) |
| 179 | LDS | 481971.34663 | 1351337.72549 | 608.12 | 609.150 | top slp | 609.15 | 8/28/99 | (T1.03) |
| 180 | LDS | 481970.73570 | 1351387.72176 | 608.51 | 609.540 | top slp | 609.63 | 8/28/99 | (T1.12) |
| 181 | LDS | 481970.12477 | 1351437.71803 | 609.10 | 610.130 | top slp | 610.20 | 8/28/99 | (T1.10) |
| 182 | LDS | 481977.61429 | 1350824.80376 | 602.80 | 603.930 | top slp | 604.08 | 8/18/99 | (T1.18) |
| 183 | LDS | 481969.57372 | 1351482.81388 | 609.49 | 610.520 | top slp | 610.60 | 8/28/99 | (T1.11) |

E-2741 As Built Top of Cby Pg 4 of 2

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 184 | LDS | 481967.37072 | 1350824.67856 | 602.90 | 603.930 | top slp | 603.96 | 9/18/99 | (T1.06) |
| 185 | LDS | 481966.99885 | 1350855.10173 | 603.21 | 604.240 | top slp | 604.34 | 9/18/99 | (T1.13) |
| 186 | LDS | 481966.60120 | 1350887.63398 | 603.53 | 604.560 | top slp | 604.64 | 9/18/99 | (T1.09) |
| 187 | LDS | 481965.99007 | 1350937.63024 | 604.14 | 605.170 | top slp | 605.22 | 9/18/99 | (T1.08) |
| 188 | LDS | 481965.37895 | 1350987.62651 | 604.66 | 605.690 | top slp | 605.70 | 9/18/99 | (T1.04) |
| 189 | LDS | 481964.76783 | 1351037.62277 | 605.14 | 606.170 | top slp | 606.32 | 9/19/99 | (T1.18) |
| 190 | LDS | 481964.15671 | 1351087.61904 | 605.65 | 606.680 | top slp | 606.83 | 9/19/99 | (T1.18) |
| 191 | LDS | 481963.54558 | 1351137.61530 | 606.15 | 607.180 | top slp | 607.26 | 9/19/99 | (T1.11) |
| 192 | LDS | 481962.93446 | 1351187.61157 | 606.61 | 607.640 | top slp | 607.68 | 9/19/99 | (T1.07) |
| 193 | LDS | 481962.32334 | 1351237.60783 | 607.11 | 608.140 | top slp | 608.14 | 9/19/99 | (T1.03) |
| 194 | LDS | 481961.71222 | 1351287.60410 | 607.64 | 608.670 | top slp | 608.75 | 8/28/99 | (T1.11) |
| 195 | LDS | 481961.10110 | 1351337.60036 | 608.14 | 609.170 | top slp | 609.17 | 8/28/99 | (T1.03) |
| 196 | LDS | 481960.48997 | 1351387.59663 | 608.61 | 609.640 | top slp | 609.69 | 8/28/99 | (T1.07) |
| 197 | LDS | 481959.87885 | 1351437.59289 | 609.06 | 610.090 | top slp | 610.12 | 8/28/99 | (T1.06) |
| 198 | LDS | 481959.32763 | 1351482.68874 | 609.52 | 610.550 | top slp | 610.61 | 8/28/99 | (T1.09) |
| 199 | LDS | 481936.15000 | 1350853.17536 | 595.46 | 596.490 | toe slp | 596.49 | 9/18/99 | (T1.03) |
| 200 | LDS | 481935.73363 | 1350887.25699 | 595.81 | 596.840 | toe slp | 596.98 | 9/18/99 | (T1.17) |
| 201 | LDS | 481935.12305 | 1350937.25326 | 596.29 | 597.320 | toe slp | 597.41 | 9/18/99 | (T1.12) |
| 202 | LDS | 481934.51246 | 1350987.24953 | 596.79 | 597.820 | toe slp | 597.88 | 9/18/99 | (T1.09) |
| 203 | LDS | 481933.90188 | 1351037.24581 | 597.34 | 598.370 | toe slp | 598.52 | 9/18/99 | (T1.18) |
| 204 | LDS | 481933.29129 | 1351087.24208 | 597.83 | 598.860 | toe slp | 598.92 | 9/19/99 | (T1.09) |
| 205 | LDS | 481932.68071 | 1351137.23835 | 598.29 | 599.320 | toe slp | 599.47 | 9/19/99 | (T1.18) |
| 206 | LDS | 481932.07013 | 1351187.23462 | 598.80 | 599.830 | toe slp | 599.95 | 9/19/99 | (T1.15) |
| 207 | LDS | 481931.45954 | 1351237.23089 | 599.32 | 600.350 | toe slp | 600.47 | 9/19/99 | (T1.15) |
| 208 | LDS | 481930.84896 | 1351287.22717 | 599.84 | 600.870 | toe slp | 600.94 | 8/28/99 | (T1.10) |
| 209 | LDS | 481930.23838 | 1351337.22344 | 600.39 | 601.420 | toe slp | 601.54 | 8/28/99 | (T1.15) |
| 210 | LDS | 481929.62779 | 1351387.21971 | 600.92 | 601.950 | toe slp | 602.07 | 8/28/99 | (T1.15) |
| 211 | LDS | 481929.01721 | 1351437.21598 | 601.29 | 602.320 | toe slp | 602.42 | 8/28/99 | (T1.13) |
| 212 | LDSO | 481921.01027 | 1350852.99645 | | 596.170 | south limit | 596.31 | 9/18/99 | - |
| 213 | LDSO | 481920.59399 | 1350887.07209 | | 596.490 | south limit | 596.61 | 9/18/99 | - |
| 214 | LDSO | 481919.98322 | 1350937.06836 | | 579.030 | south limit | 597.17 | 9/18/99 | - |
| 215 | LDSO | 481919.37245 | 1350987.06463 | | 597.520 | south limit | 597.53 | 9/18/99 | - |
| 216 | LDSO | 481918.76168 | 1351037.06090 | | 597.990 | south limit | 598.14 | 9/18/99 | - |
| 217 | LDSO | 481918.15091 | 1351087.05717 | | 598.490 | south limit | 598.62 | 9/19/99 | - |
| 218 | LDSO | 481917.54015 | 1351137.05344 | | 599.010 | south limit | 599.08 | 9/19/99 | - |
| 219 | LDSO | 481916.92938 | 1351187.04971 | | 599.520 | south limit | 599.57 | 9/19/99 | - |
| 220 | LDSO | 481916.31861 | 1351237.04598 | | 600.050 | south limit | 600.13 | 9/19/99 | - |
| 221 | LDSO | 481915.70784 | 1351287.04225 | | 600.490 | south limit | 600.49 | 8/28/99 | - |
| 222 | LDSO | 481915.09707 | 1351337.03852 | | 601.050 | south limit | 601.09 | 8/28/99 | - |
| 223 | LDSO | 481914.48630 | 1351387.03479 | | 601.510 | south limit | 601.53 | 8/28/99 | - |
| 224 | LDSO | 481913.87553 | 1351437.03106 | | 601.980 | south limit | 601.99 | 8/28/99 | - |
| 225 | LDS | 481986.41066 | 1350824.91119 | 600.72 | 601.750 | mid pt | 601.89 | 9/18/99 | (T1.17) |
| 226 | LDS | 481986.02811 | 1350855.87230 | 601.09 | 602.120 | mid pt | 602.27 | 9/18/99 | (T1.18) |
| 227 | LDS | 481985.64048 | 1350887.86650 | 601.34 | 602.370 | mid pt | 602.42 | 9/18/99 | (T1.08) |
| 229 | LDS | 481985.02883 | 1350937.86276 | 601.91 | 602.940 | mid pt | 603.07 | 9/18/99 | (T1.15) |
| 230 | LDS | 481984.41718 | 1350987.85902 | 602.35 | 603.380 | mid pt | 603.52 | 9/18/99 | (T1.17) |
| 231 | LDS | 481983.80554 | 1351037.85528 | 602.78 | 603.810 | mid pt | 603.91 | 9/18/99 | (T1.13) |
| 232 | LDS | 481983.19389 | 1351087.85154 | 603.30 | 604.330 | mid pt | 604.36 | 9/19/99 | (T1.06) |
| 233 | LDS | 481982.58224 | 1351137.84780 | 603.79 | 604.820 | mid pt | 604.82 | 9/19/99 | (T1.04) |
| 234 | LDS | 481981.97060 | 1351187.84406 | 604.31 | 605.340 | mid pt | 605.39 | 9/19/99 | (T1.08) |
| 235 | LDS | 481981.35895 | 1351237.84031 | 604.78 | 605.810 | mid pt | 605.85 | 9/19/99 | (T1.07) |
| 236 | LDS | 481980.74730 | 1351287.83657 | 605.29 | 606.320 | mid pt | 606.40 | 8/28/99 | (T1.11) |
| 237 | LDS | 481980.13565 | 1351337.83283 | 605.80 | 606.830 | mid pt | 606.91 | 8/28/99 | (T1.11) |
| 238 | LDS | 481979.52401 | 1351387.82909 | 606.29 | 607.320 | mid pt | 607.37 | 8/28/99 | (T1.08) |
| 239 | LDS | 481978.91236 | 1351437.82535 | 606.79 | 607.820 | mid pt | 607.89 | 8/28/99 | (T1.10) |
| 240 | LDS | 481978.36066 | 1351482.92119 | 607.30 | 608.330 | mid pt | 608.44 | 8/28/99 | (T1.14) |
| 241 | LDS | 481951.91885 | 1350835.33843 | 599.16 | 600.190 | mid pt | 600.33 | 9/18/99 | (T1.17) |
| 242 | LDS | 481951.66996 | 1350854.14149 | 599.31 | 600.340 | mid pt | 600.49 | 9/18/99 | (T1.18) |
| 243 | LDS | 481951.28247 | 1350887.44689 | 599.58 | 600.710 | mid pt | 600.74 | 9/18/99 | (T1.06) |
| 244 | LDS | 481950.67189 | 1350937.44316 | 600.18 | 601.210 | mid pt | 601.34 | 9/18/99 | (T1.16) |

2741

As Built Top of Cay

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 245 | LDS | 481950.06130 | 1350987.43943 | 600.70 | 601.730 | mid pt | 601.83 | 9/18/99 | (T1.13) |
| 246 | LDS | 481949.45072 | 1351037.43570 | 601.25 | 602.280 | mid pt | 602.38 | 9/18/99 | (T 1.13) |
| 247 | LDS | 481948.84014 | 1351087.43198 | 601.73 | 602.760 | mid pt | 602.90 | 9/9/99 | (T1.17) |
| 248 | LDS | 481948.22955 | 1351137.42825 | 602.30 | 603.330 | mid pt | 603.34 | 9/9/99 | (T1.04) |
| 249 | LDS | 481947.61897 | 1351187.42452 | 602.76 | 603.790 | mid pt | 603.83 | 9/9/99 | (T1.07) |
| 250 | LDS | 481947.00838 | 1351237.42079 | 603.15 | 604.180 | mid pt | 604.20 | 9/9/99 | (T1.05) |
| 251 | LDS | 482252.27735 | 1350891.12476 | 597.20 | 598.200 | grid pt | 598.32 | 9/13/99 | (T1.12) |
| 252 | LDS | 482251.66571 | 1350941.12102 | 597.72 | 598.720 | grid pt | 598.72 | 9/13/99 | (T1.00) |
| 253 | LDS | 482251.05408 | 1350991.11728 | 598.14 | 599.140 | grid pt | 599.17 | 9/13/99 | (T1.03) |
| 254 | LDS | 482250.44245 | 1351041.11354 | 598.66 | 599.660 | grid pt | 599.72 | 9/8/99 | (T1.06) |
| 255 | LDS | 482249.83081 | 1351091.10979 | 599.18 | 600.180 | grid pt | 600.21 | 9/8/99 | (T1.03) |
| 256 | LDS | 482249.21918 | 1351141.10605 | 599.64 | 600.640 | grid pt | 600.74 | 9/8/99 | (T1.10) |
| 257 | LDS | 482248.60755 | 1351191.10231 | 600.13 | 601.130 | grid pt | 601.23 | 9/8/99 | (T1.10) |
| 258 | LDS | 482247.99591 | 1351241.09857 | 600.62 | 601.620 | grid pt | 601.76 | 8/30/99 | (T1.14) |
| 259 | LDS | 482247.38428 | 1351291.09483 | 601.14 | 602.140 | grid pt | 602.24 | 8/30/99 | (T1.10) |
| 260 | LDS | 482246.77265 | 1351341.09109 | 601.76 | 602.760 | grid pt | 602.76 | 8/30/99 | (T1.00) |
| 261 | LDS | 482246.16101 | 1351391.08735 | 602.19 | 603.190 | grid pt | 603.26 | 8/30/99 | (T.1.07) |
| 262 | LDS | 482245.54938 | 1351441.08361 | 602.66 | 603.660 | grid pt | 603.67 | 8/30/99 | (T.1.01) |
| 263 | LDS | 481946.39780 | 1351287.41706 | 603.78 | 604.820 | mid pt | 604.82 | 8/28/99 | (T.1.03) |
| 264 | LDS | 481945.78722 | 1351337.41333 | 604.28 | 605.310 | mid pt | 605.40 | 8/28/99 | (T.1.12) |
| 265 | LDS | 481945.17663 | 1351387.40961 | 604.78 | 605.810 | mid pt | 605.94 | 8/28/99 | (T.1.16) |
| 266 | LDS | 481944.56605 | 1351437.40588 | 605.15 | 606.180 | mid pt | 606.32 | 8/28/99 | (T 1.17) |
| 267 | LDS | 481944.15885 | 1351470.74843 | 605.64 | 606.670 | mid pt | 606.73 | 8/28/99 | (T.1.09) |
| 268 | LDSO | 482183.98000 | 1350845.62000 | | 596.300 | pt #3028 | 596.40 | 9/16/99 | - |
| 269 | LDSO | 482180.17000 | 1350849.49000 | | 596.270 | pt #3029 | 596.29 | 9/16/99 | - |
| 270 | LDSO | 482164.25000 | 1350849.30000 | | 596.270 | pt #3030 | 596.37 | 9/16/99 | - |
| 271 | LDSO | 482159.81000 | 1350844.57000 | | 596.310 | pt #3031 | 596.46 | 9/16/99 | - |
| 272 | LDSO | 482160.05000 | 1350824.75000 | | 601.270 | pt #3032 | 601.29 | 9/23/99 | - |
| 273 | LDSO | 482164.49000 | 1350829.30000 | | 601.270 | pt #3033 | 601.31 | 9/23/99 | - |
| 274 | LDSO | 482180.41000 | 1350829.49000 | | 601.270 | pt #3034 | 601.28 | 9/23/99 | - |
| 275 | LDSO | 482184.23000 | 1350825.77000 | | 601.270 | pt #3027 | 601.27 | 9/23/99 | - |

NN EDWARD HIRSCH
EGISTERED SURVEYOR
RSCH & ASSOCIATES SURVEYING, INC.
10 STATE LINE ROAD
EANA, OH 45053
[redacted]0534
x ([redacted]) 367-2935

98.05
↑ 5.29

2741

(PET STP. 1)

Sheet No. 1 Of 2
Calc. by _____ Date _____
Checked by _____ Date 9/23/99

STP - GRADE CHECK

| PT# | GND. ELEV. | C/F | PROP | PT# | GRND. ELEV. | C/F | PROP |
|---|---|---|---|---|---|---|---|
| 3 | 577.70 | C-1.70 | 576 | 444 | 576.85 | C-0.85 | 576 |
| 2 | 578.31 | C-2.31 | 576 | 704 | 590.02 | F-0.98 | 591 |
| 7 | 577.86 | C-1.86 | 576 | 140 | 592.56 | C-0.56 | 592 |
| 6 | 578.45 | C-2.45 | 576 | 699 | 576.81 | C-0.81 | 576 |
| 07 | | | 583 | 151 | | | 586 |
| 08 | | | 580 | 21 | 594.74 | C-4.74 | 590 |
| 09 | 589.96 | C-0.96 | 589 | 24 | 589.73 | F-0.27 | 590 |
| 01 | 590.76 | F-1.24 | 592 | | | | |
| 02 | 590.16 | F-1.84 | 592 | | | | |
| 03 | 591.87 | F-0.13 | 592 | | | | |
| 05 | 591.09 | F-0.91 | 592 | | | | |
| [redacted] | | | 591 | | | | |
| 4 | | | 580 | | | | |
| 3 | | | 580 | | | | |
| 5 | | | 580 | | | | |
| 6 | | | 580 | | | | |
| 10 | | | 596 | | | | |
| 11 | | | 596 | | | | |
| 81 | | | 598 | | | | |
| 82 | | | 598 | | | | |
| 12 | | | 592 | | | | |
| 13 | | | 592 | | | | |
| 14 | | | 585 | | | | |
| 15 | | | 587 | | | | |
| 04 | 592.07 | C-0.07 | 592 | | | | |
| [redacted] | 594.01 | C-5.01 | 589 | | | | |
| 17 | 588.67 | F-0.33 | 589 | | | | |
| 18 | 586.89 | F-1.11 | 588 | | | | |
| 19 | 586.91 | F-0.09 | 587 | | | | |

CELL III/IV CERTIFICATION

| PT# | GND ELEV | C/F | PROP |
|---|---|---|---|
| 60 | 602.42 | C-0.07 | 602.35 |
| 272 | 601.29 | C-0.02 | 601.27 |
| 273 | 601.31 | C-0.04 | 601.27 |
| 274 | 601.28 | C-0.01 | 601.27 |
| 275 | 601.27 | GRADE | 601.27 |

NN EDWARD HIRSCH
EGISTERED SURVEYOR
RSCH & ASSOCIATES SURVEYING, INC.
10 STATE LINE ROAD
KEANA, OH 45053
-0534
x (513) 367-2935

(PETSTP.1)

2741

Sheet No. 2 Of 2

Calc. by _____ Date _____

Checked by _____ Date _____

STP - GRADE CHECK

| PT # | GND. ELEV. | C/F | PROP. |
|---|---|---|---|
| 432 | 585.32 | F-0.68 | 586 |
| 34 | 586.95 | C-0.95 | 586 |
| 33 | 587.04 | C-1.04 | 586 |
| 86 | 586.32 | C-1.32 | 585 |
| 40 | 582.80 | F-0.20 | 583 |
| 41 | 584.15 | C-1.15 | 583 |
| 82 | | | |
| 84 | | | 582 |
| 28 | | | |
| 29 | | | |
| 31 | | | |
| 17 | | | |
| 18 | | | |
| 20 | | | |
| 19 | | | |
| 13 | | | |
| 14 | | | |
| 16 | | | |
| 15 | | | |

YNN EDWARD HIRSCH
EGISTERED SURVEYOR
IRSCH & ASSOCIATES SURVEYING, INC.
610 STATE LINE ROAD
KEANA, OH 45053

1[redacted]7-0534
[redacted] 367-2935

Sheet No. 27411 Of

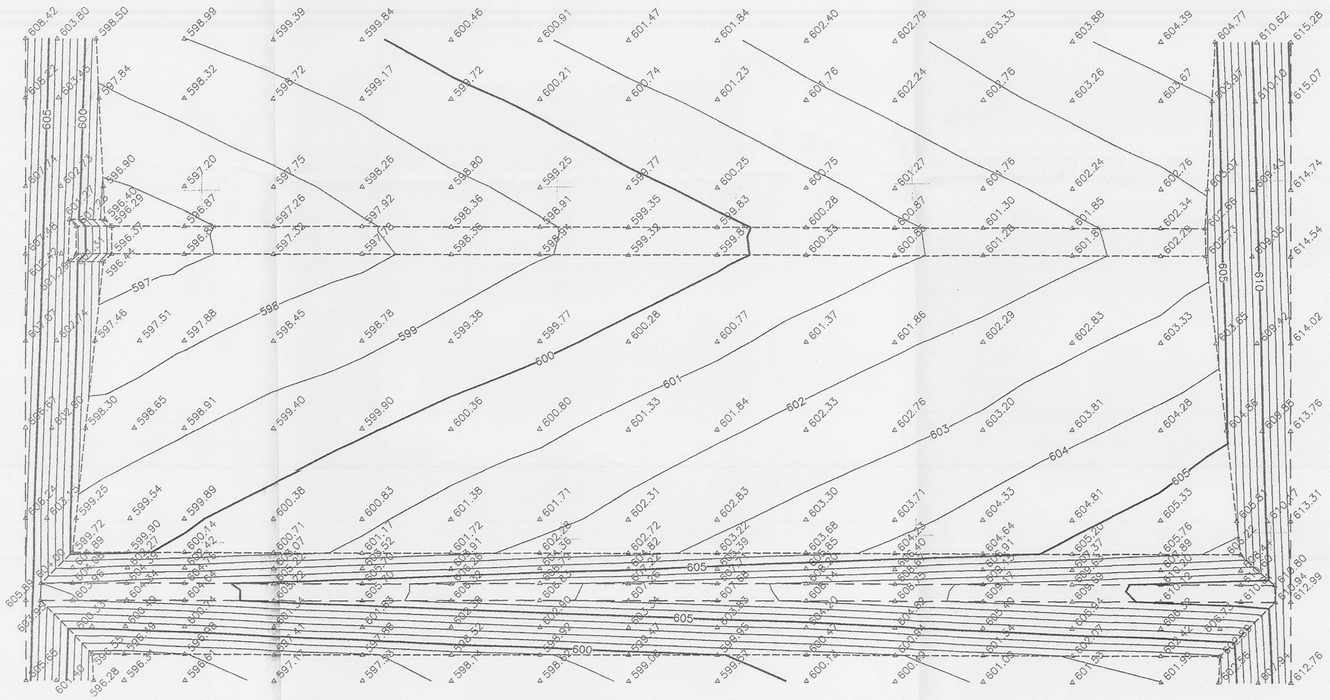
Calc. by Date

Checked by Date 9/23/99

PET 3 LP

CERTIFICATION TOP/ROCK L.D.S. LAYER

| PT# | TOP/ROCK | C/F | PROP |
|---|---|---|---|
| 00 | 602.42 | C-0.07 | 602.35 |
| 272 | 601.29 | C-0.02 | 601.27 |
| 273 | 601.31 | C-0.04 | 601.27 |
| 274 | 601.28 | C-0.01 | 601.27 |
| 375 | 601.27 | GRADE | 601.27 |



NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

LEGEND:

| | |
|---|---|
| △ 599.15 | = CERTIFIED POINT |
| ——600—— | INDEX (5 FOOT) ELEVATION CONTOUR LINE |
| ——601—— | ONE FOOT ELEVATION CONTOUR LINE |

INFORMATION ONLY

FIELD SURVEY COMPLETED SEPT 23, 1999. AJK 12/13/99

GRAPHIC SCALE

40 0 20 40 80 160

( IN FEET )
1 inch = 40 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: Date: 12/13/99

20102 - OPTA - DWG - 0020A (REV. 0)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | SEPT. 29, 1999 |
| SCALE: | 1"=40' |
| DRAWN BY: | BJL |
| PRINT DATE: | SEPT. 29, 1999 |

STATE OF OHIO LYNN E. HIRSCH 5-5200 REGISTERED SURVEYOR

OSDF PHASE 2
AS-BUILT
LDS DRAINAGE LAYER
OSDF CELL 3 08/18/1999

DATE: REVISIONS:

FILE NAME: LDSc3.dwg

1

000041

SHEET NO. 1 OF 2

F-2741

| | | | | |
|---|---|---|---|---|
| 2001 | 482202.28109 | 1350890.51312 | 597.200 | grid point |
| 2002 | 482195.55312 | 1351440.47197 | 602.760 | grid point |
| 2003 | 482201.66945 | 1350940.50938 | 597.750 | grid point |
| 2004 | 482201.05782 | 1350990.50564 | 598.260 | grid point |
| 2005 | 482200.44619 | 1351040.50190 | 598.800 | grid point |
| 2006 | 482199.83455 | 1351090.49816 | 599.250 | grid point |
| 2007 | 482199.22292 | 1351140.49442 | 599.770 | grid point |
| 2008 | 482198.61129 | 1351190.49068 | 600.250 | grid point |
| 2009 | 482197.99965 | 1351240.48694 | 600.750 | grid point |
| 2010 | 482197.38802 | 1351290.48320 | 601.270 | grid point |
| 2011 | 482196.77639 | 1351340.47946 | 601.760 | grid point |
| 2012 | 482196.16475 | 1351390.47571 | 602.240 | grid point |
| 2019 | 482285.23249 | 1350891.52792 | 598.990 | south limit |
| 2020 | 482284.62096 | 1350941.52418 | 599.390 | south limit |
| 2021 | 482284.00540 | 1350991.52039 | 599.840 | south limit |
| 2022 | 482283.39387 | 1351041.51665 | 600.460 | south limit |
| 2023 | 482282.78234 | 1351091.51291 | 600.910 | south limit |
| 2024 | 482282.17082 | 1351141.50917 | 601.470 | south limit |
| 2025 | 482281.55929 | 1351191.50543 | 601.840 | south limit |
| 2026 | 482280.94776 | 1351241.50169 | 602.400 | south limit |
| 2027 | 482280.33623 | 1351291.49795 | 602.790 | south limit |
| 2028 | 482279.72470 | 1351341.49421 | 603.330 | south limit |
| 2029 | 482279.11317 | 1351391.49047 | 603.880 | south limit |
| 2030 | 482278.50164 | 1351441.48673 | 604.390 | south limit |
| 2031 | 482286.10498 | 1350820.03161 | 603.800 | south limit mid pt |
| 2032 | 482277.84502 | 1351495.46825 | 610.620 | south limit mid pt |
| 2034 | 482179.71010 | 1350890.23700 | 596.870 | grid point |
| 2035 | 482179.09856 | 1350940.23326 | 597.260 | grid point |
| 2036 | 482178.48702 | 1350990.22952 | 597.920 | grid point |
| 2037 | 482177.87549 | 1351040.22578 | 598.360 | grid point |
| 2038 | 482177.26395 | 1351090.22204 | 598.910 | grid point |
| 2039 | 482176.65241 | 1351140.21830 | 599.350 | grid point |
| 2040 | 482176.04087 | 1351190.21456 | 599.830 | grid point |
| 2041 | 482175.42933 | 1351240.21082 | 600.280 | grid point |
| 2042 | 482174.81780 | 1351290.20708 | 600.870 | grid point |
| 2043 | 482174.20626 | 1351340.20334 | 601.300 | grid point |
| 2044 | 482173.59472 | 1351390.19960 | 601.850 | grid point |
| 2045 | 482172.98318 | 1351440.19586 | 602.340 | grid point |
| 2046 | 482253.36867 | 1350801.91725 | 608.220 | top slp |
| 2047 | 482203.37240 | 1350801.30663 | 607.740 | top slp |
| 2048 | 482164.79780 | 1350800.83550 | 607.480 | top slp |
| 2049 | 482114.79859 | 1350800.22484 | 607.070 | top slp |
| 2050 | 482064.80232 | 1350799.61422 | 606.670 | top slp |
| 2051 | 482014.80605 | 1350799.00360 | 606.240 | top slp |
| 2052 | 481967.81158 | 1350798.42964 | 605.890 | top slp |
| 2053 | 482252.86415 | 1350843.15836 | 597.840 | toe slp |
| 2054 | 482202.83854 | 1350844.94607 | 596.900 | toe slp |
| 2055 | 482114.32253 | 1350839.20468 | 597.460 | toe slp |
| 2056 | 482064.39087 | 1350833.30342 | 598.300 | toe slp |
| 2057 | 482014.45922 | 1350827.40216 | 599.250 | toe slp |
| 2058 | 482253.14233 | 1350820.41880 | 603.430 | mid pt |
| 2059 | 482203.13138 | 1350821.00874 | 602.730 | mid pt |
| 2060 | 482164.56759 | 1350820.85310 | 602.420 | mid pt |
| 2061 | 482114.58645 | 1350817.59479 | 602.740 | mid pt |
| 2062 | 482064.62249 | 1350814.33883 | 602.900 | mid pt |
| 2063 | 482014.65852 | 1350811.08288 | 603.150 | mid pt |
| 2064 | 481921.47977 | 1350814.79674 | 601.400 | mid pt |
| 2065 | 482163.70539 | 1350890.04121 | 596.840 | grid pt |
| 2066 | 482163.09479 | 1350940.03748 | 597.320 | grid pt |
| 2067 | 482162.48419 | 1350990.03375 | 597.780 | grid pt |
| 2068 | 482161.87358 | 1351040.03002 | 598.360 | grid pt |
| 2069 | 482161.26298 | 1351090.02629 | 598.940 | grid pt |
| 2070 | 482160.65238 | 1351140.02256 | 599.320 | grid pt |
| 2071 | 482160.04177 | 1351190.01883 | 599.810 | grid pt |
| 2072 | 482159.43117 | 1351240.01511 | 600.330 | grid pt |
| 2073 | 482158.82057 | 1351290.01138 | 600.850 | grid pt |
| 2074 | 482158.20996 | 1351340.00765 | 601.280 | grid pt |
| 2075 | 482157.59936 | 1351390.00392 | 601.810 | grid pt |
| 2076 | 482156.98876 | 1351440.00019 | 602.290 | grid pt |
| 2077 | 482106.99248 | 1351439.38959 | 603.330 | grid pt |
| 2078 | 482056.99621 | 1351438.77899 | 604.280 | grid pt |
| 2079 | 482006.99994 | 1351438.16838 | 605.330 | grid pt |
| 2081 | 482113.70912 | 1350889.43060 | 597.880 | grid pt |
| 2082 | 482063.71285 | 1350888.82000 | 598.910 | grid pt |

| | | | | |
|---|---|---|---|---|
| 2083 | 482013.71658 | 1350888.20940 | 599.890 | grid pt |
| 2085 | 482113.09852 | 1350939.42687 | 598.450 | grid pt |
| 2086 | 482112.48792 | 1350989.42315 | 598.780 | grid pt |
| 2087 | 482111.87731 | 1351039.41942 | 599.380 | grid pt |
| 2088 | 481969.33998 | 1351501.93772 | 610.800 | ed berm |
| 2089 | 481959.09002 | 1351502.13228 | 610.940 | ed berm |
| 2090 | 482111.26671 | 1351089.41569 | 599.770 | grid pt |
| 2091 | 482110.65611 | 1351139.41196 | 600.280 | grid pt |
| 2092 | 482110.04550 | 1351189.40823 | 600.770 | grid pt |
| 2093 | 482109.43490 | 1351239.40450 | 601.370 | grid pt |
| 2094 | 482108.82430 | 1351289.40077 | 601.860 | grid pt |
| 2095 | 482108.21369 | 1351339.39705 | 602.290 | grid pt |
| 2096 | 482107.60309 | 1351389.39332 | 602.830 | grid pt |
| 2097 | 482063.10225 | 1350938.81627 | 599.400 | grid pt |
| 2098 | 482062.49164 | 1350988.81254 | 599.900 | grid pt |
| 2099 | 482061.88104 | 1351038.80881 | 600.360 | grid pt |
| 2100 | 482061.27044 | 1351088.80509 | 600.800 | grid pt |
| 2101 | 482060.65983 | 1351138.80136 | 601.330 | grid pt |
| 2102 | 482060.04923 | 1351188.79763 | 601.840 | grid pt |
| 2103 | 482059.43863 | 1351238.79390 | 602.330 | grid pt |
| 2104 | 482058.82802 | 1351288.79017 | 602.760 | grid pt |
| 2105 | 482058.21742 | 1351338.78644 | 603.200 | grid pt |
| 2106 | 482057.60682 | 1351388.78271 | 603.810 | grid pt |
| 2107 | 482013.10598 | 1350938.20567 | 600.380 | grid pt |
| 2108 | 482012.49537 | 1350988.20194 | 600.830 | grid pt |
| 2109 | 482011.88477 | 1351038.19821 | 601.380 | grid pt |
| 2110 | 482011.27417 | 1351088.19448 | 601.710 | grid pt |
| 2111 | 482010.66356 | 1351138.19075 | 602.310 | grid pt |
| 2112 | 482010.05296 | 1351188.18702 | 602.830 | grid pt |
| 2113 | 482009.44236 | 1351238.18330 | 603.300 | grid pt |
| 2114 | 482008.83175 | 1351288.17957 | 603.710 | grid pt |
| 2115 | 482008.22115 | 1351338.17584 | 604.330 | grid pt |
| 2116 | 482007.61055 | 1351388.17211 | 604.810 | grid pt |
| 2117 | 482245.19596 | 1351469.97286 | 603.970 | toe slp |
| 2118 | 482195.23122 | 1351466.78494 | 603.070 | toe slp |
| 2119 | 482106.60996 | 1351470.71062 | 603.650 | toe slp |
| 2120 | 482056.54373 | 1351475.82864 | 604.860 | toe slp |
| 2121 | 482006.47749 | 1351480.94667 | 605.810 | toe slp |
| 2122 | 482244.65469 | 1351514.21781 | 615.070 | top slp |
| 2123 | 482194.65841 | 1351513.60719 | 614.740 | top slp |
| 2124 | 482156.09756 | 1351513.13623 | 614.540 | top slp |
| 2125 | 482106.09928 | 1351512.52558 | 614.020 | top slp |
| 2126 | 482056.10301 | 1351511.91496 | 613.760 | top slp |
| 2127 | 481928.61001 | 1351470.55853 | 602.890 | toe slp |
| 2128 | 481936.37001 | 1350835.14853 | 596.550 | toe slp |
| 2129 | 481967.59010 | 1350806.73508 | 603.950 | ed berm |
| 2130 | 481977.82990 | 1350807.15492 | 604.000 | ed berm |
| 2131 | 481995.43999 | 1350825.02147 | 599.720 | toe slp |
| 2132 | 482006.10673 | 1351511.30433 | 613.310 | top slp |
| 2133 | 481959.10488 | 1351510.73028 | 612.990 | top slp |
| 2134 | 482244.89939 | 1351494.21504 | 610.100 | mid pt |
| 2135 | 482194.91894 | 1351492.31130 | 609.430 | mid pt |
| 2136 | 482014.08905 | 1350857.71167 | 599.540 | grid pt |
| 2137 | 482064.05479 | 1350860.82209 | 598.650 | grid pt |
| 2138 | 482114.01442 | 1350864.43247 | 597.510 | grid pt |
| 2139 | 482156.37262 | 1351491.48292 | 609.050 | mid pt |
| 2140 | 482106.32873 | 1351493.73790 | 609.420 | mid pt |
| 2141 | 482056.29748 | 1351495.99164 | 609.880 | mid pt |
| 2142 | 482006.26622 | 1351498.24538 | 610.170 | mid pt |
| 2143 | 481913.20478 | 1351491.85645 | 607.940 | mid pt |
| 2145 | 481987.38999 | 1351483.03147 | 606.220 | toe slp pt |
| 2146 | 482156.70135 | 1351465.59001 | 602.730 | toe slp |
| 2147 | 482172.65159 | 1351465.29001 | 602.660 | toe slp |
| 2148 | 481995.05433 | 1350856.52798 | 599.900 | toe slp |
| 2149 | 481994.66980 | 1350887.97678 | 600.140 | toe slp |
| 2150 | 481994.05816 | 1350937.97304 | 600.710 | toe slp |
| 2151 | 481993.44651 | 1350987.96930 | 601.170 | toe slp |
| 2152 | 481992.83486 | 1351037.96555 | 601.720 | toe slp |
| 2153 | 481992.22322 | 1351087.96181 | 602.280 | toe slp |
| 2154 | 481991.61157 | 1351137.95807 | 602.720 | toe slp |
| 2155 | 481990.99992 | 1351187.95433 | 603.220 | toe slp |
| 2156 | 481990.38828 | 1351237.95059 | 603.680 | toe slp |
| 2157 | 481989.77663 | 1351287.94685 | 604.230 | toe slp |
| 2158 | 481989.16498 | 1351337.94311 | 604.640 | toe slp |

| | | | | |
|---|---|---|---|---|
| 2159 | 481988.55333 | 1351387.93937 | 605.200 | toe slp |
| 2160 | 481987.94169 | 1351437.93562 | 605.760 | toe slp |
| 2161 | 481977.24253 | 1350855.22684 | 604.390 | top slp |
| 2162 | 481976.84500 | 1350887.75908 | 604.760 | top slp |
| 2163 | 481976.23407 | 1350937.75535 | 605.220 | top slp |
| 2164 | 481975.62314 | 1350987.75162 | 605.700 | top slp |
| 2165 | 481975.01221 | 1351037.74789 | 606.260 | top slp |
| 2166 | 482286.31999 | 1350802.31970 | 608.420 | top slp |
| 2167 | 482285.83854 | 1350841.97999 | 598.500 | toe slp pt 2167 |
| 2168 | 482278.13147 | 1351472.08001 | 604.770 | toe slp |
| 2169 | 482277.61046 | 1351514.62031 | 615.280 | top slp |
| 2170 | 481921.68889 | 1350797.86632 | 605.650 | south limit |
| 2171 | 481921.21806 | 1350835.70170 | 596.280 | south limit |
| 2172 | 481913.47385 | 1351469.58193 | 602.560 | south limit pt 2172 |
| 2173 | 481912.98029 | 1351510.16695 | 612.760 | south limit pt 2173 |
| 2174 | 481974.40128 | 1351087.74415 | 606.790 | top slp |
| 2175 | 481973.79035 | 1351137.74042 | 607.220 | top slp |
| 2176 | 481973.17942 | 1351187.73669 | 607.710 | top slp |
| 2177 | 481972.56849 | 1351237.73296 | 608.200 | top slp |
| 2178 | 481971.95756 | 1351287.72922 | 608.670 | top slp |
| 2179 | 481971.34663 | 1351337.72549 | 609.150 | top slp |
| 2180 | 481970.73570 | 1351387.72176 | 609.630 | top slp |
| 2181 | 481970.12477 | 1351437.71803 | 610.200 | top slp |
| 2182 | 481977.61429 | 1350824.80376 | 604.080 | top slp |
| 2183 | 481969.57372 | 1351482.81388 | 610.600 | top slp |
| 2184 | 481967.37072 | 1350824.67866 | 603.960 | top slp |
| 2185 | 481966.99885 | 1350855.10173 | 604.340 | top slp |
| 2186 | 481966.60120 | 1350887.63398 | 604.640 | top slp |
| 2187 | 481965.99007 | 1350937.63024 | 605.220 | top slp |
| 2188 | 481965.37895 | 1350987.62651 | 605.700 | top slp |
| 2189 | 481964.76783 | 1351037.62277 | 606.320 | top slp |
| 2190 | 481964.15671 | 1351087.61904 | 606.830 | top slp |
| 2191 | 481963.54558 | 1351137.61530 | 607.260 | top slp |
| 2192 | 481962.93446 | 1351187.61157 | 607.680 | top slp |
| 2193 | 481962.32334 | 1351237.60783 | 608.140 | top slp |
| 2194 | 481961.71222 | 1351287.60410 | 608.750 | top slp |
| 2195 | 481961.10110 | 1351337.60036 | 609.170 | top slp |
| 2196 | 481960.48997 | 1351387.59663 | 609.690 | top slp |
| 2197 | 481959.87885 | 1351437.59289 | 610.120 | top slp |
| 2198 | 481959.32763 | 1351482.68874 | 610.610 | top slp |
| 2199 | 481936.15000 | 1350853.17536 | 596.490 | toe slp |
| 2200 | 481935.73363 | 1350887.25699 | 596.980 | toe slp |
| 2201 | 481935.12305 | 1350937.25326 | 597.410 | toe slp |
| 2202 | 481934.51246 | 1350987.24953 | 597.880 | toe slp |
| 2203 | 481933.90188 | 1351037.24581 | 598.520 | toe slp |
| 2204 | 481933.29129 | 1351087.24208 | 598.920 | toe slp |
| 2205 | 481932.68071 | 1351137.23835 | 599.470 | toe slp |
| 2206 | 481932.07013 | 1351187.23462 | 599.950 | toe slp |
| 2207 | 481931.45954 | 1351237.23089 | 600.470 | toe slp |
| 2208 | 481930.84896 | 1351287.22717 | 600.940 | toe slp |
| 2209 | 481930.23838 | 1351337.22344 | 601.540 | toe slp |
| 2210 | 481929.62779 | 1351387.21971 | 602.070 | toe slp |
| 2211 | 481929.01721 | 1351437.21598 | 602.420 | toe slp |
| 2212 | 481921.01027 | 1350852.99645 | 596.310 | south limit |
| 2213 | 481920.59399 | 1350887.07209 | 596.610 | south limit |
| 2214 | 481919.98322 | 1350937.06836 | 597.170 | south limit |
| 2215 | 481919.37245 | 1350987.06463 | 597.530 | south limit |
| 2216 | 481918.76168 | 1351037.06090 | 598.140 | south limit |
| 2217 | 481918.15091 | 1351087.05717 | 598.620 | south limit |
| 2218 | 481917.54015 | 1351137.05344 | 599.080 | south limit |
| 2219 | 481916.92938 | 1351187.04971 | 599.570 | south limit |
| 2220 | 481916.31861 | 1351237.04598 | 600.130 | south limit |
| 2221 | 481915.70784 | 1351287.04225 | 600.490 | south limit |
| 2222 | 481915.09707 | 1351337.03852 | 601.090 | south limit |
| 2223 | 481914.48630 | 1351387.03479 | 601.530 | south limit |
| 2224 | 481913.87553 | 1351437.03106 | 601.990 | south limit |
| 2225 | 481986.41066 | 1350824.91119 | 601.890 | mid pt |
| 2226 | 481986.02811 | 1350855.87230 | 602.270 | mid pt |
| 2227 | 481985.64048 | 1350887.86650 | 602.420 | mid pt |
| 2229 | 481985.02883 | 1350937.86276 | 603.070 | mid pt |
| 2230 | 481984.41718 | 1350987.85902 | 603.520 | mid pt |
| 2231 | 481983.80554 | 1351037.85528 | 603.910 | mid pt |
| 2232 | 481983.19389 | 1351087.85154 | 604.360 | mid pt |
| 2233 | 481982.58224 | 1351137.84780 | 604.820 | mid pt |

| | | | | |
|---|---|---|---|---|
| 2234 | 481981.97060 | 1351187.84406 | 605.390 | mid pt |
| 2235 | 481981.35895 | 1351237.84031 | 605.850 | mid pt |
| 2236 | 481980.74730 | 1351287.83657 | 606.400 | mid pt |
| 2237 | 481980.13565 | 1351337.83283 | 606.910 | mid pt |
| 2238 | 481979.52401 | 1351387.82909 | 607.370 | mid pt |
| 2239 | 481978.91236 | 1351437.82535 | 607.890 | mid pt |
| 2240 | 481978.36066 | 1351482.92119 | 608.440 | mid pt |
| 2241 | 481951.91885 | 1350835.33843 | 600.330 | mid pt |
| 2242 | 481951.66996 | 1350854.14149 | 600.490 | mid pt |
| 2243 | 481951.28247 | 1350887.44689 | 600.740 | mid pt |
| 2244 | 481950.67189 | 1350937.44316 | 601.340 | mid pt |
| 2245 | 481950.06130 | 1350987.43943 | 601.830 | mid pt |
| 2246 | 481949.45072 | 1351037.43570 | 602.380 | mid pt |
| 2247 | 481948.84014 | 1351087.43198 | 602.900 | mid pt |
| 2248 | 481948.22955 | 1351137.42825 | 603.340 | mid pt |
| 2249 | 481947.61897 | 1351187.42452 | 603.830 | mid pt |
| 2250 | 481947.00838 | 1351237.42079 | 604.200 | mid pt |
| 2251 | 482252.27735 | 1350891.12476 | 598.320 | grid pt |
| 2252 | 482251.66571 | 1350941.12102 | 598.720 | grid pt |
| 2253 | 482251.05408 | 1350991.11728 | 599.170 | grid pt |
| 2254 | 482250.44245 | 1351041.11354 | 599.720 | grid pt |
| 2255 | 482249.83081 | 1351091.10979 | 600.210 | grid pt |
| 2256 | 482249.21918 | 1351141.10605 | 600.740 | grid pt |
| 2257 | 482248.60755 | 1351191.10231 | 601.230 | grid pt |
| 2258 | 482247.99591 | 1351241.09857 | 601.760 | grid pt |
| 2259 | 482247.38428 | 1351291.09483 | 602.240 | grid pt |
| 2260 | 482246.77265 | 1351341.09109 | 602.760 | grid pt |
| 2261 | 482246.16101 | 1351391.08735 | 603.260 | grid pt |
| 2262 | 482245.54938 | 1351441.08361 | 603.670 | grid pt |
| 2263 | 481946.39780 | 1351287.41706 | 604.820 | mid pt |
| 2264 | 481945.78722 | 1351337.41333 | 605.400 | mid pt |
| 2265 | 481945.17663 | 1351387.40961 | 605.940 | mid pt |
| 2266 | 481944.56605 | 1351437.40588 | 606.320 | mid pt |
| 2267 | 481944.15885 | 1351470.74843 | 606.730 | mid pt |
| 2268 | 482183.98000 | 1350845.62000 | 596.400 | pt #3028 |
| 2269 | 482180.17000 | 1350849.49000 | 596.290 | pt #3029 |
| 2270 | 482164.25000 | 1350849.30000 | 596.370 | pt #3030 |
| 2271 | 482159.81000 | 1350844.57000 | 596.440 | pt #3031 |
| 2272 | 482160.05000 | 1350824.75000 | 601.290 | pt #3032 |
| 2273 | 482164.49000 | 1350829.30000 | 601.310 | pt #3033 |
| 2274 | 482180.41000 | 1350829.49000 | 601.280 | pt #3034 |
| 2275 | 482184.23000 | 1350825.77000 | 601.270 | pt #3027 |

KEY MAP

NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

INFORMATION ONLY

LEGEND:

| 235 | 481930.755520 | 1351337.229750 | 597.310000 | toe slp | = CERTIFIED POINT |
|---|---|---|---|---|---|

GRAPHIC SCALE

80 0 40 80 160 320

( IN FEET )
1 inch = 80 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 12/13/99

20102-OPTA-DWG-020B (REV. 0)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

STATE OF OHIO
LYNN E. HIRSCH
S-5736
REGISTERED SURVEYOR

OSDF PHASE 2
AS-BUILT
LDS DRAINAGE LAYER
OSDF CELL 3 06/25/1999

DATE: REVISIONS:

JOB NO. 20102
DATE: SEPT. 29, 1999
SCALE: 1"=80'
DRAWN BY: BJL
PRINT DATE: SEPT. 29, 1999

FILE NAME: LDSc3-C.dwg

2

000042

SHEET NO. 2 OF 2

2741

G:\LAND PROJECTS\990607\0008\DWG\LDSc3-C.dwg BJL - DECEMBER 04, 1999 - 14:24:15 XREFS:

F-2741

# TOP OF LEACHATE COLLECTION LAYER

# Cell 3 - Top of LCS Drainage Layer

Points checked by KBT and found to be within elevation tolerances. 9/22/99

Points checked by VB and found to be within elevation tolerance 09/28/99

Points checked by KBT on 10-8-99 and found to be within elevation tolerances.

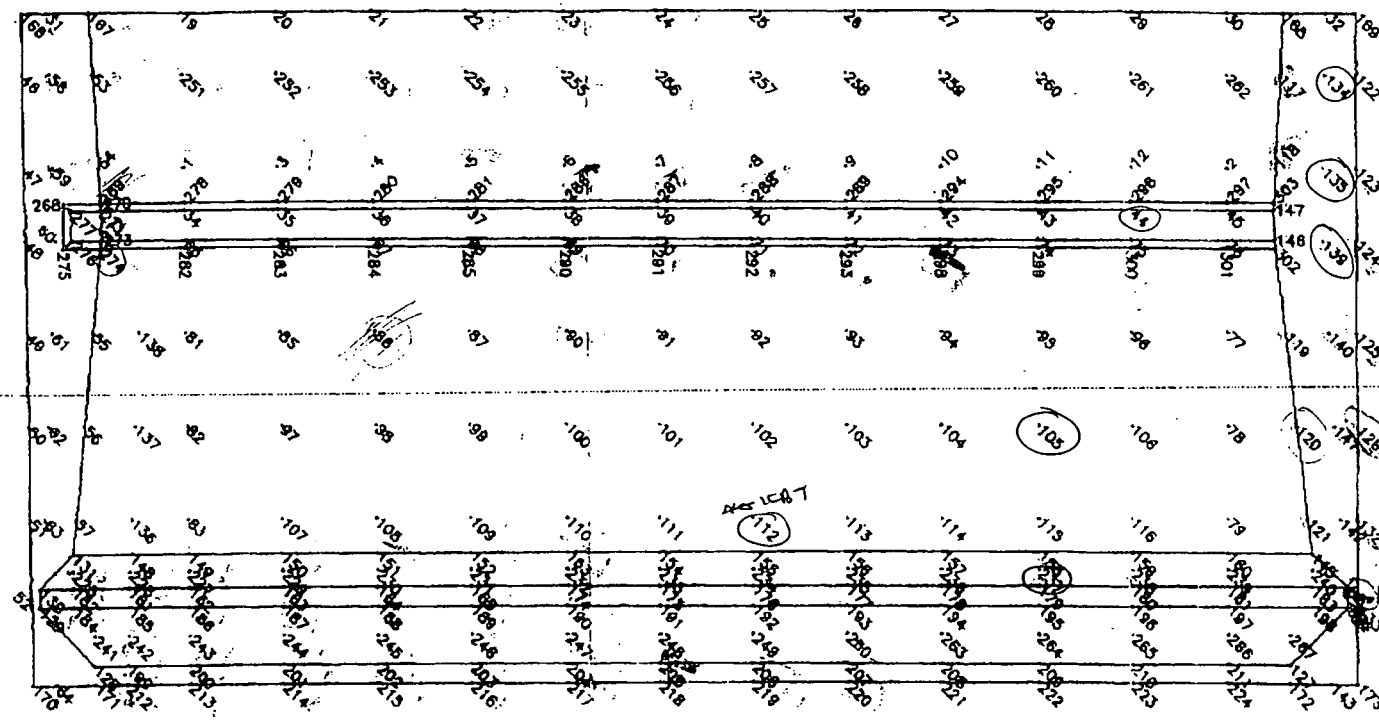
Remaining points checked by KBT on 10-11-99 and found to be within elevation tolerance


PAGE 08

PETRO-FERNALD
HIRSCH SURVEYING INC

09/27/1999 06:48 5136483407
09/24/1999 19:19 5133672935

4:1 slope
T = 0.97 ft
H = 1.03 ft
with +0.1 tolerance for thickness
H = 1.134 ft



Points checked by KBT on 10-1-99 and found to be within elevation tolerance.

Points checked by KBT on 10-4-99 and found to be within elevation tolerance.

Points checked by KBT on 10-6-99 and found to be within elevation tolerance.

Points checked by KBT on 10-7-99 and found to be within elevation tolerance.

There are [illegible] points [illegible] 89.

T-2741

PET3LC.CRD

CELL 3 LCS LAYE

000044

2741

HIRSCH & ASSOCIATES SURVEYING, INC.
3610 STATE LINE ROAD
OKEANA, OH 45053
(513) 367-0534
Fax: (513) 367-2935

September 20, 1999

**SUBJECT: CERTIFICATION POINTS TOP OF LCS LAYER CELL 3, FERNALD SITE.**

I hereby cetify that the elevations listed on the next 6 pages are the as built elevations of the top of LCS layer for the point numbers listed, along with the date the elevations were taken.

Lynn Edward Hirsch

**LYNN EDWARD HIRSCH**
**REGISTERED OHIO LAND SURVEYOR NO. 5738**

file: ferce3lcs

STATE OF OHIO
LYNN
E.
HIRSCH
S-5738
REGISTERED
SURVEYOR

Code of LCSO Has No Corresponding Point From top of LDS file

2741

epared by: Hirsch & Associates Surveying, Inc. #CGDS07961

Coords/Brg-Azi PET3LC 9/24/99 15:16:51 Factor: 1.0000000 Pg 1 of 5

Elev Determined From As Built LDS file

| No. | Code | North | East | | Elevation | Desc. | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | LCS | 482202.28109 | 1350890.51312 | 597.28 | 598.230 | grid point | 598.33 | 10/5/99 | (T1.18) |
| 2 | LCS | 482195.55312 | 1351440.47197 | 602.76 | 603.760 | grid point | 603.78 | 9/24/99 | (T1.02) |
| 3 | LCS | 482201.66945 | 1350940.50938 | 597.75 | 598.750 | grid point | 598.80 | 10/5/99 | (T1.05) |
| 4 | LCS | 482201.05782 | 1350990.50564 | 598.26 | 599.260 | grid point | 599.37 | 10/5/99 | (T1.11) |
| 5 | LCS | 482200.44619 | 1351040.50190 | 598.80 | 599.800 | grid point | 599.88 | 10/5/99 | (T1.08) |
| 6 | LCS | 482199.83455 | 1351090.49816 | 599.25 | 600.250 | grid point | 600.32 | 9/30/99 | (T1.07) |
| 7 | LCS | 482199.22292 | 1351140.49442 | 599.77 | 600.770 | grid point | 600.77 | 9/30/99 | (T1.00) |
| 8 | LCS | 482198.61129 | 1351190.49068 | 600.25 | 601.250 | grid point | 601.26 | 9/30/99 | (T1.01) |
| 9 | LCS | 482197.99965 | 1351240.48694 | 600.75 | 601.750 | grid point | 601.76 | 9/30/99 | (T1.01) |
| 10 | LCS | 482197.38802 | 1351290.48320 | 601.27 | 602.270 | grid point | 602.41 | 9/28/99 | (T1.14) |
| 11 | LCS | 482196.77639 | 1351340.47946 | 601.76 | 602.760 | grid point | 602.76 | 9/24/99 | (T1.00) |
| 12 | LCS | 482196.16475 | 1351390.47571 | 602.24 | 603.240 | grid point | 603.24 | 9/24/99 | (T1.00) |
| 19 | LCS | 482285.23249 | 1350891.52792 | 598.99 | 600.020 | south limit | 600.06 | 10/5/99 | (T1.08) |
| 20 | LCS | 482284.62096 | 1350941.52418 | 599.39 | 600.390 | south limit | 600.54 | 10/5/99 | (T1.15) |
| 21 | LCS | 482284.00540 | 1350991.52039 | 599.84 | 600.840 | south limit | 600.90 | 10/5/99 | (T1.06) |
| 22 | LCS | 482283.39387 | 1351041.51665 | 600.46 | 601.460 | south limit | 601.52 | 10/5/99 | (T1.06) |
| 23 | LCS | 482282.78234 | 1351091.51291 | 600.91 | 601.910 | south limit | 601.97 | 10/5/99 | (T1.06) |
| 24 | LCS | 482282.17082 | 1351141.50917 | 601.47 | 602.470 | south limit | 602.52 | 10/5/99 | (T1.05) |
| 25 | LCS | 482281.55929 | 1351191.50543 | 601.84 | 602.840 | south limit | 602.90 | 9/30/99 | (T1.06) |
| 26 | LCS | 482280.94776 | 1351241.50169 | 602.40 | 603.400 | south limit | 603.42 | 9/30/99 | (T1.02) |
| 27 | LCS | 482280.33623 | 1351291.49795 | 602.79 | 603.790 | south limit | 603.82 | 9/24/99 | (T1.03) |
| [illegible] | LCS | 482279.72470 | 1351341.49421 | 603.33 | 604.330 | south limit | 604.44 | 9/24/99 | (T1.11) |
| [illegible] | LCS | 482279.11317 | 1351391.49047 | 603.88 | 604.880 | south limit | 604.95 | 9/30/99 | (T1.07) |
| 30 | LCS | 482278.50164 | 1351441.48673 | 604.39 | 605.390 | south limit | 605.42 | 9/30/99 | (T1.03) |
| 31 | LCS | 482286.10498 | 1350820.03161 | 603.80 | 604.830 | south limit mid pt | 604.94 | 10/5/99 | (T1.14) |
| 32 | LCS | 482277.84502 | 1351495.46825 | 610.62 | 611.650 (T1.18) | south limit mid pt | 611.80 | 9/24/99 | |
| 34 | LCS | 482179.71010 | 1350890.23700 | 597.87 | 598.870 | grid point | 598.93 | 10/7/99 | (T1.06) |
| 35 | LCS | 482179.09856 | 1350940.23326 | 598.26 | 599.260 | grid point | 599.40 | 10/7/99 | (T1.14) |
| 36 | LCS | 482178.48702 | 1350990.22952 | 598.92 | 599.920 | grid point | 599.93 | 10/7/99 | (T1.01) |
| 37 | LCS | 482177.87549 | 1351040.22578 | 599.36 | 600.360 | grid point | 600.44 | 10/7/99 | (T1.08) |
| 38 | LCS | 482177.26395 | 1351090.22204 | 599.91 | 600.910 | grid point | 600.91 | 10/4/99 | (T1.00) |
| 39 | LCS | 482176.65241 | 1351140.21830 | 600.35 | 601.350 | grid point | 601.43 | 10/4/99 | (T1.08) |
| 40 | LCS | 482176.04087 | 1351190.21456 | 600.83 | 601.830 | grid point | 601.95 | 10/4/99 | (T1.12) |
| 41 | LCS | 482175.42933 | 1351240.21082 | 601.28 | 602.280 | grid point | 602.32 | 10/4/99 | (T1.04) |
| 42 | LCS | 482174.81780 | 1351290.20708 | 600.87 | 602.870 | grid point | 602.87 | 9/28/99 | (T-2.00) |
| 43 | LCS | 482174.20626 | 1351340.20334 | 601.30 | 603.300 | grid point | 603.40 | 9/28/99 | (2.10) |
| 44 | LCS | 482173.59472 | 1351390.19960 | 601.85 | 603.850 | grid point | 604.00 | 9/28/99 | (2.15) |
| 45 | LCS | 482172.98318 | 1351440.19586 | 607.34 | 604.340 | grid point | 604.38 | 9/28/99 | (T2.04) |
| 46 | LCSO | 482253.31828 | 1350806.03694 | | 608.220 | top slp | 608.32 | 10/5/99 | — |
| 47 | LCSO | 482203.32200 | 1350805.42632 | | 607.740 | top slp | 607.81 | 10/5/99 | — |
| 48 | LCSO | 482164.75042 | 1350804.95523 | | 607.480 | top slp | 607.63 | 10/7/99 | — |
| 49 | LCSO | 482114.74828 | 1350804.34454 | | 607.070 | top slp | 607.10 | 10/7/99 | — |
| 50 | LCSO | 482064.75201 | 1350803.73391 | | 606.670 | top slp | 606.71 | 10/7/99 | — |
| 51 | LCSO | 482014.75573 | 1350803.12329 | | 606.240 | top slp | 606.29 | 10/8/99 | — |
| 52 | LCSO | 481967.70175 | 1350802.54817 | | 605.890 | top slp | 606.01 | 10/8/99 | — |
| 53 | LCS | 482252.86268 | 1350843.27835 | 597.84 | 598.840 | toe slp | 598.97 | 10/5/99 | (T1.13) |
| 54 | LCS | 482202.83707 | 1350845.06606 | 596.90 | 597.900 | toe slp | 597.97 | 10/5/99 | (T1.07) |
| [illegible] | LCS | 482114.32107 | 1350839.32467 | 597.46 | 598.460 | toe slp | 598.55 | 10/7/99 | (T1.09) |
| 56 | LCS | 482064.38941 | 1350833.42341 | 598.36 | 599.300 | toe slp | 599.44 | 10/7/99 | (T1.14) |
| 57 | LCS | 482014.45775 | 1350827.52216 | 599.25 | 600.250 | toe slp | 600.36 | 10/8/99 | (T1.11) |
| 58 | LCS | 482253.14233 | 1350820.41880 | 603.93 | 604.460 | mid pt | 604.61 | 10/5/99 | (T1.18) |
| 59 | LCS | 482203.13138 | 1350821.00874 | 602.73 | 603.760 | mid pt | 603.91 | 10/5/99 | (T1.18) |
| 60 | LCS | 482164.56759 | 1350820.85310 | 602.42 | 603.450 | mid pt | 603.56 | 10/7/99 | (T1.14) |

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 61 | LCS | 482114.58645 | 1350817.59479 | 602.74 | 603.770 | mid pt | 603.92 | 10/7/99 | (T1.18) |
| 62 | LCS | 482064.62249 | 1350814.33883 | 602.90 | 603.930 | mid pt | 603.98 | 10/7/99 | (T1.08) |
| 63 | LCS | 482014.65852 | 1350811.08288 | 603.15 | 604.180 | mid pt | 604.31 | 10/8/99 | (T1.16) |
| 64 | LCSO | 481926.47581 | 1350814.59761 | | 602.460 | mid pt | 602.48 | 10/8/99 | |
| 65 | LCS | 482163.70539 | 1350890.04121 | 597.84 | 598.840 | grid pt | 598.87 | 10/7/99 | (T1.03) |
| 66 | LCS | 482163.09479 | 1350940.03748 | 598.32 | 599.320 | grid pt | 599.41 | 10/7/99 | (T1.09) |
| 67 | LCS | 482162.48419 | 1350990.03375 | 598.78 | 599.780 | grid pt | 599.92 | 10/7/99 | (T1.14) |
| 68 | LCS | 482161.87358 | 1351040.03002 | 599.36 | 600.360 | grid pt | 600.48 | 10/7/99 | (T1.12) |
| 69 | LCS | 482161.26298 | 1351090.02629 | 599.94 | 600.940 | grid pt | 601.08 | 10/6/99 | (T1.14) |
| 70 | LCS | 482160.65238 | 1351140.02256 | 600.32 | 601.320 | grid pt | 601.39 | 10/6/99 | (T1.07) |
| 71 | LCS | 482160.04177 | 1351190.01883 | 600.81 | 601.810 | grid pt | 601.81 | 10/6/99 | (T1.00) |
| 72 | LCS | 482159.43117 | 1351240.01511 | 601.33 | 602.330 | grid pt | 602.33 | 10/6/99 | (T1.00) |
| 73 | LCS | 482158.82057 | 1351290.01138 | 600.85 | 602.850 | grid pt | 602.85 | 9/28/99 | (T2.00) |
| 74 | LCS | 482158.20996 | 1351340.00765 | 601.28 | 603.280 | grid pt | 603.29 | 9/28/99 | (T2.01) |
| 75 | LCS | 482157.59936 | 1351390.00392 | 601.81 | 603.810 | grid pt | 603.91 | 9/28/99 | (T2.10) |
| 76 | LCS | 482156.98876 | 1351440.00019 | 602.29 | 604.290 | grid pt | 604.37 | 9/28/99 | (T2.08) |
| 77 | LCS | 482106.99248 | 1351439.38959 | 603.33 | 604.330 | grid pt | 604.37 | 9/24/99 | (T1.04) |
| 78 | LCS | 482056.99621 | 1351438.77899 | 604.28 | 605.280 | grid pt | 605.39 | 9/24/99 | (T1.11) |
| 79 | LCS | 482006.99994 | 1351438.16838 | 605.33 | 606.330 | grid pt | 606.40 | 9/24/99 | (T1.07) |
| 81 | LCS | 482113.70912 | 1350889.43060 | 597.88 | 598.880 | grid pt | 598.94 | 10/6/99 | (T1.06) |
| 82 | LCS | 482063.71285 | 1350888.82000 | 598.91 | 599.910 | grid pt | 600.06 | 10/6/99 | (T1.15) |
| 83 | LCS | 482013.71658 | 1350888.20940 | 599.89 | 600.890 | grid pt | 601.00 | 10/6/99 | (T1.11) |
| 85 | LCS | 482113.09852 | 1350939.42687 | 598.45 | 599.450 | grid pt | 599.56 | 10/6/99 | (T1.11) |
| 86 | LCS | 482112.48792 | 1350989.42315 | 598.78 | 599.780 | grid pt | 599.78 | 10/8/99 | (T1.00) |
| 87 | LCS | 482111.87731 | 1351039.41942 | 599.38 | 600.380 | grid pt | 600.42 | 10/7/99 | (T1.04) |
| 88 | LCS | 481969.45996 | 1351501.93545 | 610.80 | 611.800 | ed berm | 611.95 | 9/27/99 | (T1.15) |
| 89 | LCS | 481958.97004 | 1351502.13455 | 610.94 | 611.940 | ed berm | 611.95 | 9/27/99 | (T1.01) |
| 90 | LCS | 482111.26671 | 1351089.41569 | 599.77 | 600.770 | grid pt | 600.80 | 10/5/99 | (T1.03) |
| 91 | LCS | 482110.65611 | 1351139.41196 | 600.28 | 601.280 | grid pt | 601.36 | 10/1/99 | (T1.08) |
| 92 | LCS | 482110.04550 | 1351189.40823 | 600.77 | 601.770 | grid pt | 601.82 | 10/1/99 | (T1.05) |
| 93 | LCS | 482109.43490 | 1351239.40450 | 601.37 | 602.370 | grid pt | 602.39 | 10/1/99 | (T1.02) |
| 94 | LCS | 482108.82430 | 1351289.40077 | 601.86 | 602.860 | grid pt | 602.87 | 9/24/99 | (T1.01) |
| 95 | LCS | 482108.21369 | 1351339.39705 | 602.29 | 603.290 | grid pt | 603.30 | 9/24/99 | (T1.01) |
| 96 | LCS | 482107.60309 | 1351389.39332 | 602.83 | 603.830 | grid pt | 603.84 | 9/24/99 | (T1.01) |
| 97 | LCS | 482063.10225 | 1350938.81627 | 599.40 | 600.400 | grid pt | 600.51 | 10/6/99 | (T1.11) |
| 98 | LCS | 482062.49164 | 1350988.81254 | 599.90 | 600.900 | grid pt | 601.02 | 10/6/99 | (T1.12) |
| 99 | LCS | 482061.88104 | 1351038.80881 | 600.36 | 601.360 | grid pt | 601.39 | 10/8/99 | (T1.03) |
| 100 | LCS | 482061.27044 | 1351088.80509 | 600.80 | 601.800 | grid pt | 601.86 | 10/5/99 | (T1.06) |
| 101 | LCS | 482060.65983 | 1351138.80136 | 601.33 | 602.330 | grid pt | 602.34 | 10/1/99 | (T1.01) |
| 102 | LCS | 482060.04923 | 1351188.79763 | 601.84 | 602.840 | grid pt | 602.84 | 10/1/99 | (T1.00) |
| 103 | LCS | 482059.43863 | 1351238.79390 | 602.33 | 603.330 | grid pt | 603.38 | 10/1/99 | (T1.05) |
| 104 | LCS | 482058.82802 | 1351288.79017 | 602.76 | 603.760 | grid pt | 603.86 | 9/24/99 | (T1.10) |
| 105 | LCS | 482058.21742 | 1351338.78644 | 603.20 | 604.200 | grid pt | 604.35 | 9/24/99 | (T1.15) |
| 106 | LCS | 482057.60682 | 1351388.78271 | 603.81 | 604.810 | grid pt | 604.83 | 9/24/99 | (T1.02) |
| 107 | LCS | 482013.10598 | 1350938.20567 | 600.38 | 601.380 | grid pt | 601.47 | 10/6/99 | (T1.09) |
| 108 | LCS | 482012.49537 | 1350988.20194 | 600.83 | 601.830 | grid pt | 601.95 | 10/6/99 | (T1.12) |
| 109 | LCS | 482011.88477 | 1351038.19821 | 601.38 | 602.380 | grid pt | 602.39 | 10/8/99 | (T1.01) |
| 110 | LCS | 482011.27417 | 1351088.19448 | 601.71 | 602.710 | grid pt | 602.76 | 10/5/99 | (T1.05) |
| 111 | LCS | 482010.66356 | 1351138.19075 | 602.31 | 603.310 | grid pt | 603.33 | 10/1/99 | (T1.02) |
| 112 | LCS | 482010.05296 | 1351188.18702 | 602.83 | 603.830 | grid pt | 603.86 | 10/1/99 | (T1.03) |
| 113 | LCS | 482009.44236 | 1351238.18330 | 603.30 | 604.300 | grid pt | 604.34 | 10/1/99 | (T1.04) |
| 114 | LCS | 482008.83175 | 1351288.17957 | 603.71 | 604.710 | grid pt | 604.81 | 9/24/99 | (T1.10) |
| 115 | LCS | 482008.22115 | 1351338.17584 | 604.33 | 605.330 | grid pt | 605.39 | 9/24/99 | (T1.06) |
| 116 | LCS | 482007.61055 | 1351388.17211 | 604.81 | 605.810 | grid pt | 605.84 | 9/24/99 | (T1.03) |
| 117 | LCS | 482245.19743 | 1351469.85287 | 603.97 | 604.970 | toe slp | 605.11 | 9/27/99 | (T1.19) |
| 118 | LCS | 482195.23269 | 1351466.66495 | 603.07 | 604.070 | toe slp | 604.07 | 9/27/99 | (T1.00) |
| 119 | LCS | 482106.61143 | 1351470.59063 | 603.65 | 604.650 | toe slp | 604.66 | 9/27/99 | (T1.01) |
| 120 | LCS | 482056.54519 | 1351475.70865 | 604.86 | 605.860 | toe slp | 606.01 | 9/27/99 | (T1.15) |
| 121 | LCS | 482006.47896 | 1351480.82668 | 605.81 | 606.810 | toe slp | 606.92 | 9/27/99 | (T1.11) |
| 122 | LCSO | 482244.70508 | 1351510.09812 | | 615.070 | top slp | 615.09 | 9/27/99 | |

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As Built L.O.S. file

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|---|---|---|---|---|---|---|---|---|---|---|
| 123 | LCSO | 482194.70881 | 1351509.48749 | | 614.740 | top slp | 614.74 | 9/27/99 | | |
| 124 | LCSO | 482156.14989 | 1351509.01656 | | 614.540 | top slp | 614.63 | 9/27/99 | | |
| 125 | LCSO | 482106.14959 | 1351508.40589 | | 614.020 | top slp | 614.15 | 9/27/99 | | |
| 126 | LCSO | 482056.15332 | 1351507.79526 | | 613.760 | top slp | 613.91 | 9/27/99 | | |
| 127 | LCS | 481928.49026 | 1351470.55081 | 602.89 | 603.890 | toe slp | 604.04 | 9/28/99 | (T1.15) | |
| 128 | LCS | 481936.25009 | 1350835.15291 | 596.55 | 597.550 | toe slp | 597.69 | 10/8/99 | (T1.14) | |
| 129 | LCS | 481967.47020 | 1350806.73017 | 603.95 | 604.950 | ed berm | 605.09 | 10/8/99 | (T1.16) | |
| 130 | LCS | 481977.94980 | 1350807.15983 | 604.00 | 605.000 | ed berm | 605.15 | 10/8/99 | (T1.15) | |
| 131 | LCS | 481995.57744 | 1350825.15885 | 599.72 | 600.720 | toe slp | 600.84 | 10/8/99 | (T1.12) | |
| 132 | LCSO | 482006.15705 | 1351507.18464 | | 613.310 | top slp | 613.38 | 9/27/99 | — | |
| 133 | LCSO | 481959.09776 | 1351506.61029 | | 612.990 | top slp | 612.99 | 9/28/99 | — | |
| 134 | LCS | 482244.89939 | 1351494.21504 | 610.10 | 611.130 | mid pt | 611.27 | 9/24/99 | (T1.19) | |
| 135 | LCS | 482194.91894 | 1351492.31130 | 609.43 | 610.460 | mid pt | 610.61 | 9/24/99 | (T1.18) | |
| 136 | LCS | 482014.08905 | 1350857.71167 | 599.54 | 600.540 | grid pt | 600.56 | 10/6/99 | (T1.02) | |
| 137 | LCS | 482064.05479 | 1350860.82209 | 598.65 | 599.650 | grid pt | 599.77 | 10/6/99 | (T1.12) | |
| 138 | LCS | 482114.01442 | 1350864.43247 | 597.51 | 598.510 | grid pt | 598.64 | 10/6/99 | (T1.13) | |
| 139 | LCS | 482156.37262 | 1351491.48292 | 609.05 | 610.080 | mid pt | 610.22 | 9/27/99 | (T1.19) | |
| 140 | LCS | 482106.32873 | 1351493.73790 | 609.42 | 610.450 | mid pt | 610.55 | 9/27/99 | (T1.13) | |
| 141 | LCS | 482056.29748 | 1351495.99164 | 609.88 | 610.910 | mid pt | 610.99 | 9/27/99 | (T1.11) | |
| 142 | LCS | 482006.26622 | 1351498.24538 | 610.17 | 611.200 | mid pt | 611.21 | 9/27/99 | (T1.04) | |
| 143 | LCSO | 481918.19440 | 1351492.17839 | | 609.040 | mid pt | 609.17 | 9/28/99 | | |
| 145 | LCS | 481987.51145 | 1351482.91294 | 606.22 | 607.220 | toe slp pt | 607.26 | 9/27/99 | (T1.04) | |
| 146 | LCS | 482156.70270 | 1351465.47002 | 602.73 | 604.730 | toe slp | 604.86 | 9/27/99 | (T2.13) | |
| 147 | LCS | 482172.65317 | 1351465.17002 | 602.66 | 604.660 | toe slp | 604.76 | 9/27/99 | (T2.10) | |
| 148 | LCS | 481995.17410 | 1350856.53543 | 599.90 | 600.900 | toe slp | 600.97 | 10/8/99 | (T1.07) | |
| 149 | LCS | 481994.78980 | 1350887.97824 | 600.14 | 601.140 | toe slp | 601.22 | 10/8/99 | (T1.08) | |
| 150 | LCS | 481994.17815 | 1350937.97450 | 600.71 | 601.710 | toe slp | 601.71 | 10/8/99 | (T1.00) | |
| 151 | LCS | 481993.56650 | 1350987.97076 | 601.17 | 602.170 | toe slp | 602.30 | 10/8/99 | (T1.13) | |
| 152 | LCS | 481992.95485 | 1351037.96702 | 601.72 | 602.720 | toe slp | 602.81 | 10/8/99 | (T1.09) | |
| 153 | LCS | 481992.34321 | 1351087.96328 | 602.28 | 603.280 | toe slp | 603.39 | 10/8/99 | (T1.11) | |
| 154 | LCS | 481991.73156 | 1351137.95954 | 602.72 | 603.720 | toe slp | 603.79 | 10/1/99 | (T1.07) | |
| 155 | LCS | 481991.11991 | 1351187.95580 | 603.22 | 604.220 | toe slp | 604.29 | 10/1/99 | (T1.07) | |
| 156 | LCS | 481990.50827 | 1351237.95205 | 603.68 | 604.680 | toe slp | 604.82 | 10/1/99 | (T1.14) | |
| 157 | LCS | 481989.89662 | 1351287.94831 | 604.23 | 605.230 | toe slp | 605.27 | 9/24/99 | (T1.04) | |
| 158 | LCS | 481989.28497 | 1351337.94457 | 604.64 | 605.640 | toe slp | 605.77 | 9/24/99 | (T1.13) | |
| 159 | LCS | 481988.67333 | 1351387.94083 | 605.20 | 606.200 | toe slp | 606.30 | 9/24/99 | (T1.14) | |
| 160 | LCS | 481988.06168 | 1351437.93709 | 605.76 | 606.760 | toe slp | 606.77 | 9/24/99 | (T1.01) | |
| 161 | LCS | 481977.36221 | 1350855.23558 | 604.39 | 605.390 | top slp | 605.49 | 10/8/99 | (T1.10) | |
| 162 | LCS | 481976.96500 | 1350887.76055 | 604.76 | 605.760 | top slp | 605.91 | 10/8/99 | (T1.15) | |
| 163 | LCS | 481976.35407 | 1350937.75682 | 605.22 | 606.220 | top slp | 606.32 | 10/8/99 | (T1.10) | |
| 164 | LCS | 481975.74313 | 1350987.75308 | 605.70 | 606.700 | top slp | 606.71 | 10/8/99 | (T1.01) | |
| 165 | LCS | 481975.13220 | 1351037.74935 | 606.26 | 607.260 | top slp | 607.31 | 10/8/99 | (T1.05) | |
| 166 | LCSO | 482286.26998 | 1350806.43939 | | 608.420 | top slp | 608.47 | 10/5/99 | | |
| 167 | LCS | 482285.83708 | 1350842.09998 | 598.50 | 599.500 | toe slp pt | 2167 | 599.65 | 10/5/99 | (T1.15) |
| 168 | LCS | 482278.13292 | 1351471.96002 | 604.77 | 605.770 | toe slp | 605.82 | 9/30/99 | (T1.05) | |
| 169 | LCSO | 482277.66091 | 1351510.50062 | | 615.280 | top slp | 615.30 | 9/30/99 | — | |
| 170 | LCSO | 481926.63764 | 1350802.04702 | | 605.680 | south limit | 605.73 | 10/8/99 | — | |
| 171 | LCSO | 481926.21473 | 1350835.51928 | | 597.380 | south limit | 597.54 | 10/8/99 | — | |
| 172 | LCSO | 481918.46348 | 1351469.90387 | | 603.660 | south limit | 603.79 | 9/28/99 | | |
| 173 | LCSO | 481918.02887 | 1351506.10830 | | 612.790 | outh limit | 612.80 | 9/28/99 | | |
| 174 | LCS | 481974.52127 | 1351087.74562 | 606.79 | 607.790 | top slp | 607.80 | 10/8/99 | (T1.01) | |
| 175 | LCS | 481973.91034 | 1351137.74189 | 607.22 | 608.220 | top slp | 608.36 | 10/1/99 | (T1.14) | |
| 176 | LCS | 481973.29941 | 1351187.73815 | 607.71 | 608.710 | top slp | 608.86 | 10/1/99 | (T1.15) | |
| 177 | LCS | 481972.68848 | 1351237.73442 | 608.20 | 609.200 | top slp | 609.32 | 10/1/99 | (T1.12) | |
| 178 | LCS | 481972.07755 | 1351287.73069 | 608.67 | 609.670 | top slp | 609.70 | 9/28/99 | (T1.03) | |
| 179 | LCS | 481971.46662 | 1351337.72696 | 609.15 | 610.150 | top slp | 610.22 | 9/28/99 | (T1.07) | |
| 180 | LCS | 481970.85569 | 1351387.72322 | 609.63 | 610.630 | top slp | 610.74 | 9/28/99 | (T1.11) | |
| 181 | LCS | 481970.24476 | 1351437.71949 | 610.29 | 611.200 | top slp | 611.20 | 9/24/99 | (T1.00) | |
| 182 | LCS | 481977.73428 | 1350824.80523 | 604.08 | 605.080 | top slp | 605.08 | 10/8/99 | (T1.00) | |
| 183 | LCS | 481969.69371 | 1351482.81534 | 610.60 | 611.600 | top slp | 611.62 | 9/24/99 | (T1.02) | |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 184 | LCS | 481967.25073 | 1350824.67719 | | 604.960 | top | slp | | | |
| 185 | LCS | 481966.87908 | 1350855.09423 | 604.34 | 605.340 | top | slp | 605.34 | 10/8/99 | (T1.00) |
| 186 | LCS | 481966.48120 | 1350887.63251 | 604.64 | 605.640 | top | slp | 605.66 | 10/8/99 | (T1.02) |
| 187 | LCS | 481965.87008 | 1350937.62878 | 605.22 | 606.220 | top | slp | 606.22 | 10/8/99 | (T1.00) |
| 188 | LCS | 481965.25896 | 1350987.62504 | 605.70 | 606.700 | top | slp | 606.71 | 10/8/99 | (T1.01) |
| 189 | LCS | 481964.64784 | 1351037.62131 | 606.32 | 607.320 | top | slp | 607.36 | 10/8/99 | (T1.04) |
| 190 | LCS | 481964.03672 | 1351087.61757 | 606.83 | 607.830 | top | slp | 607.86 | 10/8/99 | (T1.03) |
| 191 | LCS | 481963.42559 | 1351137.61384 | 607.26 | 608.260 | top | slp | 608.41 | 10/1/99 | (T1.15) |
| 192 | LCS | 481962.81447 | 1351187.61010 | 607.68 | 608.680 | top | slp | 608.69 | 10/1/99 | (T1.01) |
| 193 | LCS | 481962.20335 | 1351237.60637 | 608.14 | 609.140 | top | slp | 609.16 | 10/1/99 | (T1.02) |
| 194 | LCS | 481961.59223 | 1351287.60263 | 608.75 | 609.750 | top | slp | 609.88 | 9/28/99 | (T1.13) |
| 195 | LCS | 481960.98110 | 1351337.59890 | 609.17 | 610.170 | top | slp | 610.32 | 9/28/99 | (T1.15) |
| 196 | LCS | 481960.36998 | 1351387.59516 | 609.69 | 610.690 | top | slp | 610.76 | 9/28/99 | (T1.07) |
| 197 | LCS | 481959.75886 | 1351437.59143 | 610.12 | 611.120 | top | slp | 611.13 | 9/28/99 | (T1.01) |
| 198 | LCS | 481959.20764 | 1351482.68727 | 610.61 | 611.610 | top | slp | 611.66 | 9/28/99 | (T1.05) |
| 199 | LCS | 481936.03001 | 1350853.17394 | 596.49 | 597.490 | toe | slp | 597.64 | 10/8/99 | (T1.15) |
| 200 | LCS | 481935.61364 | 1350887.25553 | 596.98 | 597.980 | toe | slp | 597.98 | 10/8/99 | (T1.00) |
| 201 | LCS | 481935.00305 | 1350937.25180 | 597.41 | 598.410 | toe | slp | 598.57 | 10/8/99 | (T1.15) |
| 202 | LCS | 481934.39247 | 1350987.24807 | 597.88 | 598.880 | toe | slp | 599.01 | 10/8/99 | (T1.13) |
| 203 | LCS | 481933.78189 | 1351037.24434 | 598.52 | 599.520 | toe | slp | 599.66 | 10/8/99 | (T1.14) |
| 204 | LCS | 481933.17130 | 1351087.24061 | 598.92 | 599.920 | toe | slp | 600.06 | 10/8/99 | (T1.14) |
| 205 | LCS | 481932.56072 | 1351137.23688 | 599.47 | 600.470 | toe | slp | 600.59 | 10/5/99 | (T1.12) |
| 206 | LCS | 481931.95014 | 1351187.23316 | 599.95 | 600.950 | toe | slp | 601.10 | 10/5/99 | (T1.13) |
| 207 | LCS | 481931.33955 | 1351237.22943 | 600.47 | 601.470 | toe | slp | 601.62 | 10/5/99 | (T1.19) |
| 208 | LCS | 481930.72897 | 1351287.22570 | 600.94 | 601.940 | toe | slp | 602.04 | 9/28/99 | (T1.10) |
| 209 | LCS | 481930.11838 | 1351337.22197 | 601.54 | 602.540 | toe | slp | 602.54 | 9/28/99 | (T1.00) |
| 210 | LCS | 481929.50780 | 1351387.21824 | 602.07 | 603.070 | toe | slp | 603.18 | 9/28/99 | (T1.11) |
| 211 | LCS | 481928.89722 | 1351437.21452 | 602.42 | 603.420 | toe | slp | 603.57 | 9/28/99 | (T1.15) |
| 212 | LCSO | 481926.00992 | 1350853.05553 | ____ | 597.410 | south | limit | 599.42 | 10/8/99 | - |
| 213 | LCSO | 481925.59362 | 1350887.13315 | ____ | 597.710 | south | limit | 597.85 | 10/8/99 | - |
| 214 | LCSO | 481924.98285 | 1350937.12942 | ____ | 598.270 | south | limit | 598.42 | 10/8/99 | - |
| 215 | LCSO | 481924.37208 | 1350987.12569 | ____ | 598.630 | south | limit | 598.70 | 10/8/99 | - |
| 216 | LCSO | 481923.76131 | 1351037.12196 | ____ | 599.240 | south | limit | 599.34 | 10/8/99 | - |
| 217 | LCSO | 481923.15054 | 1351087.11823 | ____ | 599.720 | south | limit | 599.86 | 10/8/99 | - |
| 218 | LCSO | 481922.53977 | 1351137.11450 | ____ | 600.180 | south | limit | 600.25 | 10/5/99 | - |
| 219 | LCSO | 481921.92900 | 1351187.11077 | ____ | 600.670 | south | limit | 600.81 | 10/5/99 | - |
| 220 | LCSO | 481921.31823 | 1351237.10704 | ____ | 601.230 | south | limit | 601.36 | 10/5/99 | - |
| 221 | LCSO | 481920.70746 | 1351287.10331 | ____ | 601.590 | south | limit | 601.72 | 9/28/99 | - |
| 222 | LCSO | 481920.09670 | 1351337.09958 | ____ | 602.190 | south | limit | 602.28 | 9/28/99 | - |
| 223 | LCSO | 481919.48593 | 1351387.09585 | ____ | 602.630 | south | limit | 602.75 | 9/28/99 | - |
| 224 | LCSO | 481918.87516 | 1351437.09212 | ____ | 603.020 | south | limit | 603.06 | 9/28/99 | - |
| 225 | LCS | 481986.41066 | 1350824.91119 | 601.89 | 602.920 | mid | pt | 603.00 | 10/8/99 | (T1.11) |
| 226 | LCS | 481986.02811 | 1350855.87230 | 602.27 | 603.300 | mid | pt | 603.38 | 10/8/99 | (T1.11) |
| 227 | LCS | 481985.64048 | 1350887.86650 | 602.92 | 603.450 | mid | pt | 603.46 | 10/8/99 | (T1.04) |
| 229 | LCS | 481985.02883 | 1350937.86276 | 603.07 | 604.100 | mid | pt | 604.12 | 10/8/99 | (T1.05) |
| 230 | LCS | 481984.41718 | 1350987.85902 | 603.52 | 604.550 | mid | pt | 604.58 | 10/8/99 | (T1.06) |
| 231 | LCS | 481983.80554 | 1351037.85528 | 603.91 | 604.940 | mid | pt | 605.07 | 10/8/99 | (T1.16) |
| 232 | LCS | 481983.19389 | 1351087.85154 | 604.36 | 605.390 | mid | pt | 605.54 | 10/8/99 | (T1.18) |
| 233 | LCS | 481982.58224 | 1351137.84780 | 604.82 | 605.850 | mid | pt | 605.98 | 10/1/99 | (T1.16) |
| 234 | LCS | 481981.97060 | 1351187.84406 | 605.39 | 606.420 | mid | pt | 606.54 | 10/1/99 | (T1.15) |
| 235 | LCS | 481981.35895 | 1351237.84031 | 605.85 | 606.880 | mid | pt | 606.88 | 10/1/99 | (T1.03) |
| 236 | LCS | 481980.74730 | 1351287.83657 | 606.40 | 607.430 | mid | pt | 607.58 | 9/28/99 | (T1.18) |
| 237 | LCS | 481980.13565 | 1351337.83283 | 606.91 | 607.940 | mid | pt | 608.06 | 9/24/99 | (T1.15) |
| 238 | LCS | 481979.52401 | 1351387.82909 | 607.37 | 608.400 | mid | pt | 608.43 | 9/24/99 | (T1.06) |
| 239 | LCS | 481978.91236 | 1351437.82535 | 607.89 | 608.920 | mid | pt | 608.94 | 9/24/99 | (T1.05) |
| 240 | LCS | 481978.36066 | 1351482.92119 | 608.44 | 609.470 | mid | pt | 609.56 | 9/24/99 | (T1.12) |
| 241 | LCS | 481951.91885 | 1350835.33843 | 600.33 | 601.360 | mid | pt | 601.40 | 10/8/99 | (T1.07) |
| 242 | LCS | 481951.66996 | 1350854.14149 | 600.49 | 601.520 | mid | pt | 601.54 | 10/8/99 | (T1.05) |
| 243 | LCS | 481951.28247 | 1350887.44689 | 600.74 | 601.770 | mid | pt | 601.78 | 10/8/99 | (T1.04) |
| 244 | LCS | 481950.67189 | 1350937.44316 | 601.34 | 602.370 | mid | pt | 602.50 | 10/8/99 | (T1.16) |

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 245 | LCS | 481950.06130 | 1350987.43943 | 601.83 | 602.860 | mid pt | 603.00 | 10/8/99 | (T1.12) |
| 246 | LCS | 481949.45072 | 1351037.43570 | 602.38 | 603.410 | mid pt | 603.53 | 10/8/99 | (T1.15) |
| 247 | LCS | 481948.84014 | 1351087.43198 | 602.90 | 603.930 | mid pt | 603.97 | 10/8/99 | (T1.07) |
| 248 | LCS | 481948.22955 | 1351137.42825 | 603.34 | 604.370 | mid pt | 604.38 | 10/1/99 | (T1.04) |
| 249 | LCS | 481947.61897 | 1351187.42452 | 603.83 | 604.860 | mid pt | 604.90 | 10/1/99 | (T1.07) |
| 250 | LCS | 481947.00838 | 1351237.42079 | 604.20 | 605.230 | mid pt | 605.38 | 10/1/99 | (T1.18) |
| 251 | LCS | 482252.27735 | 1350891.12476 | 598.38 | 599.350 | grid pt | 599.39 | 10/5/99 | (T1.07) |
| 252 | LCS | 482251.66571 | 1350941.12102 | 598.72 | 599.720 | grid pt | 599.80 | 10/5/99 | (T1.08) |
| 253 | LCS | 482251.05408 | 1350991.11728 | 599.17 | 600.170 | grid pt | 600.30 | 10/5/99 | (T1.13) |
| 254 | LCS | 482250.44245 | 1351041.11354 | 599.72 | 600.720 | grid pt | 600.81 | 10/5/99 | (T1.09) |
| 255 | LCS | 482249.83081 | 1351091.10979 | 600.21 | 601.210 | grid pt | 601.30 | 10/5/99 | (T1.09) |
| 256 | LCS | 482249.21918 | 1351141.10605 | 600.74 | 601.740 | grid pt | 601.85 | 10/5/99 | (T1.11) |
| 257 | LCS | 482248.60755 | 1351191.10231 | 601.23 | 602.230 | grid pt | 602.38 | 9/30/99 | (T1.15) |
| 258 | LCS | 482247.99591 | 1351241.09857 | 601.76 | 602.760 | grid pt | 602.76 | 9/30/99 | (T1.00) |
| 259 | LCS | 482247.38428 | 1351291.09483 | 602.29 | 603.240 | grid pt | 603.30 | 9/24/99 | (T1.06) |
| 260 | LCS | 482246.77265 | 1351341.09109 | 602.76 | 603.760 | grid pt | 603.76 | 9/24/99 | (T-1.00) |
| 261 | LCS | 482246.16101 | 1351391.08735 | 603.29 | 604.260 | grid pt | 604.28 | 9/28/99 | (T1.02) |
| 262 | LCS | 482245.54938 | 1351441.08361 | 603.67 | 604.670 | grid pt | 604.79 | 9/24/99 | (T1.12) |
| 263 | LCS | 481946.39780 | 1351287.41706 | 604.82 | 605.850 | mid pt | 605.89 | 9/28/99 | (T1.07) |
| 264 | LCS | 481945.78722 | 1351337.41333 | 605.40 | 606.430 | mid pt | 606.53 | 9/28/99 | (T1.13) |
| 265 | LCS | 481945.17663 | 1351387.40961 | 605.94 | 606.970 | mid pt | 607.03 | 9/28/99 | (T1.09) |
| 266 | LCS | 481944.56605 | 1351437.40588 | 606.32 | 607.350 | mid pt | 607.41 | 9/28/99 | (T1.09) |
| 267 | LCS | 481944.15885 | 1351470.74843 | 606.73 | 607.760 | mid pt | 607.84 | 9/28/99 | (T1.11) |
| 268 | LCS0 | 482184.20000 | 1350825.89000 | | 602.260 | pt #4021 | 602.34 | 10/7/99 | - |
| 269 | LCS0 | 482183.96000 | 1350845.74000 | | 597.300 | pt #4022 | 597.30 | 10/7/99 | - |
| 270 | LCS0 | 482183.89000 | 1350845.81000 | | 597.300 | pt #4023 | 597.31 | 10/7/99 | - |
| 271 | LCS0 | 482180.19000 | 1350845.76000 | | 598.230 | pt #4024 | 598.37 | 10/7/99 | - |
| 272 | LCS0 | 482164.31000 | 1350845.57000 | | 598.230 | pt #4025 | 598.33 | 10/7/99 | - |
| 273 | LCS0 | 482160.61000 | 1350845.53000 | | 597.300 | pt #4026 | 597.45 | 10/7/99 | - |
| 274 | LCS0 | 482159.83000 | 1350844.69000 | | 597.310 | pt #4027 | 597.45 | 10/8/99 | - |
| 275 | LCS0 | 482160.07000 | 1350824.87000 | | 602.260 | pt #4028 | 602.41 | 10/7/99 | - |
| 276 | LCS0 | 482164.51000 | 1350829.42000 | | 602.260 | pt #4029 | 602.29 | 10/7/99 | - |
| 277 | LCS0 | 482180.39000 | 1350829.62000 | | 602.260 | pt #4030 | 602.38 | 10/7/99 | - |
| 278 | LCS0 | 482183.70980 | 1350890.28593 | | 597.950 | toe slp | 597.97 | 10/7/99 | - |
| 279 | LCS0 | 482183.09826 | 1350940.28219 | | 598.340 | toe slp | 598.48 | 10/7/99 | - |
| 280 | LCS0 | 482182.48673 | 1350990.27845 | | 599.000 | toe slp | 599.02 | 10/7/99 | - |
| 281 | LCS0 | 482181.87519 | 1351040.27471 | | 599.440 | toe slp | 599.50 | 10/7/99 | - |
| 282 | LCS0 | 482159.70569 | 1350889.99236 | | 597.920 | toe slp | 597.95 | 10/7/99 | - |
| 283 | LCS0 | 482159.09509 | 1350939.98863 | | 598.400 | toe slp | 598.44 | 10/7/99 | - |
| 284 | LCS0 | 482158.48449 | 1350989.98490 | | 598.860 | toe slp | 598.93 | 10/7/99 | - |
| 285 | LCS0 | 482157.87388 | 1351039.98117 | | 599.440 | toe slp | 599.46 | 10/7/99 | - |
| 286 | LCS0 | 482181.26365 | 1351090.27097 | | 599.990 | toe slp | 600.12 | 10/5/99 | - |
| 287 | LCS0 | 482180.65211 | 1351140.26723 | | 600.430 | toe slp | 600.54 | 10/5/99 | - |
| 288 | LCS0 | 482180.04057 | 1351190.26349 | | 600.910 | toe slp | 601.01 | 10/5/99 | - |
| 289 | LCS0 | 482179.42903 | 1351240.25975 | | 601.360 | toe slp | 601.50 | 9/30/99 | - |
| 290 | LCS0 | 482157.26328 | 1351089.97744 | | 600.020 | toe slp | 600.04 | 10/5/99 | |
| 291 | LCS0 | 482156.65268 | 1351139.97372 | | 600.400 | toe slp | 600.52 | 10/5/99 | - |
| 292 | LCS0 | 482156.04207 | 1351189.96999 | | 600.890 | toe slp | 601.04 | 10/5/99 | - |
| 293 | LCS0 | 482155.43147 | 1351239.96626 | | 601.410 | toe slp | 601.50 | 10/5/99 | - |
| 294 | LCS0 | 482178.81750 | 1351290.25601 | | 601.950 | toe slp | 602.05 | 9/28/99 | - |
| 295 | LCS0 | 482178.20596 | 1351340.25227 | | 602.380 | toe slp | 602.51 | 9/28/99 | - |
| 296 | LCS0 | 482177.59442 | 1351390.24853 | | 602.930 | toe slp | 603.06 | 9/28/99 | - |
| 297 | LCS0 | 482176.98288 | 1351440.24479 | | 603.420 | toe slp | 603.50 | 9/28/99 | - |
| 298 | LCS0 | 482154.82086 | 1351289.96253 | | 601.930 | toe slp | 602.01 | 10/5/99 | - |
| 299 | LCS0 | 482154.21026 | 1351339.95880 | | 602.360 | toe slp | 602.50 | 9/28/99 | - |
| 300 | LCS0 | 482153.59966 | 1351389.95507 | | 602.890 | toe slp | 602.89 | 9/28/99 | - |
| 301 | LCS0 | 482152.98905 | 1351439.95134 | | 603.370 | toe slp | 603.38 | 9/28/99 | - |
| 302 | LCS0 | 482152.67236 | 1351465.88202 | | 603.620 | toe slp | 603.77 | 9/28/99 | - |
| 303 | LCS0 | 482176.67475 | 1351465.43628 | | 603.670 | toe slp | 603.82 | 9/27/99 | - |

NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

LEGEND:

| | |
|---|---|
| △ 599.15 | = CERTIFIED POINT |
| ——600—— | INDEX (5 FOOT) ELEVATION CONTOUR LINE |
| ——601—— | ONE FOOT ELEVATION CONTOUR LINE |

INFORMATION ONLY

FIELD SURVEY COMPLETED OCT 18, 1999.
APR 12/13/99

GRAPHIC SCALE

40 0 20 40 80 160

( IN FEET )
1 inch = 40 ft.

X A - Conforms to the Subcontract Requirements
( ) B - Minor Comment - Incorporate and Resubmit
( ) C - Major Comment
Sig: [signature] Date: 12/13/99

20102 - OPTA - DWG - 019A (REV. 0)

| | |
|---|---|
| PETRO ENVIRONMENTAL TECHNOLOGIES, INC.<br>FEMP<br>FERNALD ENVIRONMENTAL MANAGEMENT PROJECT | JOB NO. 20102<br>DATE: SEPT. 29, 1999<br>SCALE: 1"=40'<br>DRAWN BY: BJL<br>PRINT DATE: SEPT. 29, 1999 |
| HIRSCH & ASSOC. SURVEYING INC.<br>3610 STATELINE RD., OKEANA, OHIO 45053<br>(513) 367-0534 | |
| STATE OF OHIO LYNN E. HIRSCH 6545 REGISTERED SURVEYOR | OSDF PHASE 2<br>AS-BUILT<br>LCS DRAINAGE LAYER<br>OSDF CELL 3 08/18/1999<br>DATE: REVISIONS: |
| | FILE NAME: LCSc3.dwg<br>1<br>000051<br>SHEET NO. 1 OF 2 |

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Z:\LAND PROJECTS\PROJECT\2020\DWG\LCSc3.dwg BJL - DECEMBER 04, 1999 - 14:25:21 JOB:

| | | | | |
|---|---|---|---|---|
| 3001 | 482202.28109 | 1350890.51312 | 598.33000 | grid point |
| 3002 | 482195.55312 | 1351440.47197 | 603.78000 | grid point |
| 3003 | 482201.66945 | 1350940.50938 | 598.80000 | grid point |
| 3004 | 482201.05782 | 1350990.50564 | 599.37000 | grid point |
| 3005 | 482200.44619 | 1351040.50190 | 599.88000 | grid point |
| 3006 | 482199.83455 | 1351090.49816 | 600.32000 | grid point |
| 3007 | 482199.22292 | 1351140.49442 | 600.77000 | grid point |
| 3008 | 482198.61129 | 1351190.49068 | 601.26000 | grid point |
| 3009 | 482197.99965 | 1351240.48694 | 601.76000 | grid point |
| 3010 | 482197.38802 | 1351290.48320 | 602.41000 | grid point |
| 3011 | 482196.77639 | 1351340.47946 | 602.76000 | grid point |
| 3012 | 482196.16475 | 1351390.47571 | 603.24000 | grid point |
| 3019 | 482285.23249 | 1350891.52792 | 600.06000 | south limit |
| 3020 | 482284.62096 | 1350941.52418 | 600.54000 | south limit |
| 3021 | 482284.00540 | 1350991.52039 | 600.90000 | south limit |
| 3022 | 482283.39387 | 1351041.51665 | 601.52000 | south limit |
| 3023 | 482282.78234 | 1351091.51291 | 601.97000 | south limit |
| 3024 | 482282.17082 | 1351141.50917 | 602.52000 | south limit |
| 3025 | 482281.55929 | 1351191.50543 | 602.90000 | south limit |
| 3026 | 482280.94776 | 1351241.50169 | 603.42000 | south limit |
| 3027 | 482280.33623 | 1351291.49795 | 603.82000 | south limit |
| 3028 | 482279.72470 | 1351341.49421 | 604.44000 | south limit |
| 3029 | 482279.11317 | 1351391.49047 | 604.95000 | south limit |
| 3030 | 482278.50164 | 1351441.48673 | 605.42000 | south limit |
| 3031 | 482286.10498 | 1350820.03161 | 604.94000 | south limit mid pt |
| 3032 | 482277.84502 | 1351495.46825 | 611.80000 | south limit mid pt |
| 3034 | 482179.71010 | 1350890.23700 | 598.93000 | grid point |
| 3035 | 482179.09856 | 1350940.23326 | 599.40000 | grid point |
| 3036 | 482178.48702 | 1350990.22952 | 599.93000 | grid point |
| 3037 | 482177.87549 | 1351040.22578 | 600.44000 | grid point |
| 3038 | 482177.26395 | 1351090.22204 | 600.91000 | grid point |
| 3039 | 482176.65241 | 1351140.21830 | 601.43000 | grid point |
| 3040 | 482176.04087 | 1351190.21456 | 601.95000 | grid point |
| 3041 | 482175.42933 | 1351240.21082 | 602.32000 | grid point |
| 3042 | 482174.81780 | 1351290.20708 | 602.87000 | grid point |
| 3043 | 482174.20626 | 1351340.20334 | 603.40000 | grid point |
| 3044 | 482173.59472 | 1351390.19960 | 604.00000 | grid point |
| 3045 | 482172.98318 | 1351440.19586 | 604.38000 | grid point |
| 3046 | 482253.31828 | 1350806.03694 | 608.32000 | top slp |
| 3047 | 482203.32200 | 1350805.42632 | 607.81000 | top slp |
| 3048 | 482164.75042 | 1350804.95523 | 607.63000 | top slp |
| 3049 | 482114.74828 | 1350804.34454 | 607.10000 | top slp |
| 3050 | 482064.75201 | 1350803.73391 | 606.71000 | top slp |
| 3051 | 482014.75573 | 1350803.12329 | 606.29000 | top slp |
| 3052 | 481967.70175 | 1350802.54817 | 606.01000 | top slp |
| 3053 | 482252.86268 | 1350843.27835 | 598.97000 | toe slp |
| 3054 | 482202.83707 | 1350845.06606 | 597.97000 | toe slp |
| 3055 | 482114.32107 | 1350839.32467 | 598.55000 | toe slp |
| 3056 | 482064.38941 | 1350833.42341 | 599.44000 | toe slp |
| 3057 | 482014.45775 | 1350827.52216 | 600.36000 | toe slp |
| 3058 | 482253.14233 | 1350820.41880 | 604.61000 | mid pt |
| 3059 | 482203.13138 | 1350821.00874 | 603.93000 | mid pt |
| 3060 | 482164.56759 | 1350820.85310 | 603.56000 | mid pt |
| 3061 | 482114.58645 | 1350817.59479 | 603.92000 | mid pt |
| 3062 | 482064.62249 | 1350814.33883 | 603.98000 | mid pt |
| 3063 | 482014.65852 | 1350811.08288 | 604.31000 | mid pt |
| 3064 | 481926.47581 | 1350814.59761 | 602.48000 | mid pt |
| 3065 | 482163.70539 | 1350890.04121 | 598.87000 | grid pt |
| 3066 | 482163.09479 | 1350940.03748 | 599.41000 | grid pt |
| 3067 | 482162.48419 | 1350990.03375 | 599.92000 | grid pt |
| 3068 | 482161.87358 | 1351040.03002 | 600.48000 | grid pt |
| 3069 | 482161.26298 | 1351090.02629 | 601.08000 | grid pt |
| 3070 | 482160.65238 | 1351140.02256 | 601.39000 | grid pt |
| 3071 | 482160.04177 | 1351190.01883 | 601.81000 | grid pt |
| 3072 | 482159.43117 | 1351240.01511 | 602.33000 | grid pt |
| 3073 | 482158.82057 | 1351290.01138 | 602.85000 | grid pt |
| 3074 | 482158.20996 | 1351340.00765 | 603.29000 | grid pt |
| 3075 | 482157.59936 | 1351390.00392 | 603.91000 | grid pt |
| 3076 | 482156.98876 | 1351440.00019 | 604.37000 | grid pt |
| 3077 | 482106.99248 | 1351439.38959 | 604.37000 | grid pt |
| 3078 | 482056.99621 | 1351438.77899 | 605.39000 | grid pt |
| 3079 | 482006.99994 | 1351438.16838 | 606.40000 | grid pt |
| 3081 | 482113.70912 | 1350889.43060 | 598.94000 | grid pt |
| 3082 | 482063.71285 | 1350888.82000 | 600.06000 | grid pt |

| | | | | |
|---|---|---|---|---|
| 3083 | 482013.71658 | 1350888.20940 | 601.00000 | grid pt |
| 3085 | 482113.09852 | 1350939.42687 | 599.56000 | grid pt |
| 3086 | 482112.48792 | 1350989.42315 | 599.78000 | grid pt |
| 3087 | 482111.87731 | 1351039.41942 | 600.42000 | grid pt |
| 3088 | 481969.45996 | 1351501.93545 | 611.95000 | ed berm |
| 3089 | 481958.97004 | 1351502.13455 | 611.95000 | ed berm |
| 3090 | 482111.26671 | 1351089.41569 | 600.80000 | grid pt |
| 3091 | 482110.65611 | 1351139.41196 | 601.36000 | grid pt |
| 3092 | 482110.04550 | 1351189.40823 | 601.82000 | grid pt |
| 3093 | 482109.43490 | 1351239.40450 | 602.39000 | grid pt |
| 3094 | 482108.82430 | 1351289.40077 | 602.87000 | grid pt |
| 3095 | 482108.21369 | 1351339.39705 | 603.30000 | grid pt |
| 3096 | 482107.60309 | 1351389.39332 | 603.84000 | grid pt |
| 3097 | 482063.10225 | 1350938.81627 | 600.51000 | grid pt |
| 3098 | 482062.49164 | 1350988.81254 | 601.02000 | grid pt |
| 3099 | 482061.88104 | 1351038.80881 | 601.39000 | grid pt |
| 3100 | 482061.27044 | 1351088.80509 | 601.86000 | grid pt |
| 3101 | 482060.65983 | 1351138.80136 | 602.34000 | grid pt |
| 3102 | 482060.04923 | 1351188.79763 | 602.84000 | grid pt |
| 3103 | 482059.43863 | 1351238.79390 | 603.38000 | grid pt |
| 3104 | 482058.82802 | 1351288.79017 | 603.86000 | grid pt |
| 3105 | 482058.21742 | 1351338.78644 | 604.35000 | grid pt |
| 3106 | 482057.60682 | 1351388.78271 | 604.83000 | grid pt |
| 3107 | 482013.10598 | 1350938.20567 | 601.47000 | grid pt |
| 3108 | 482012.49537 | 1350988.20194 | 601.95000 | grid pt |
| 3109 | 482011.88477 | 1351038.19821 | 602.39000 | grid pt |
| 3110 | 482011.27417 | 1351088.19448 | 602.76000 | grid pt |
| 3111 | 482010.66356 | 1351138.19075 | 603.33000 | grid pt |
| 3112 | 482010.05296 | 1351188.18702 | 603.86000 | grid pt |
| 3113 | 482009.44236 | 1351238.18330 | 604.34000 | grid pt |
| 3114 | 482008.83175 | 1351288.17957 | 604.81000 | grid pt |
| 3115 | 482008.22115 | 1351338.17584 | 605.39000 | grid pt |
| 3116 | 482007.61055 | 1351388.17211 | 605.84000 | grid pt |
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| 3119 | 482106.61143 | 1351470.59063 | 604.66000 | toe slp |
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| 3121 | 482006.47896 | 1351480.82668 | 606.92000 | toe slp |
| 3122 | 482244.70508 | 1351510.09812 | 615.09000 | top slp |
| 3123 | 482194.70881 | 1351509.48749 | 614.74000 | top slp |
| 3124 | 482156.14989 | 1351509.01656 | 614.63000 | top slp |
| 3125 | 482106.14959 | 1351508.40589 | 614.15000 | top slp |
| 3126 | 482056.15332 | 1351507.79526 | 613.91000 | top slp |
| 3127 | 481928.49026 | 1351470.55081 | 604.04000 | toe slp |
| 3128 | 481936.25009 | 1350835.15291 | 597.69000 | toe slp |
| 3129 | 481967.47020 | 1350806.73017 | 605.09000 | ed berm |
| 3130 | 481977.94980 | 1350807.15983 | 605.15000 | ed berm |
| 3131 | 481995.57744 | 1350825.15885 | 600.84000 | toe slp |
| 3132 | 482006.15705 | 1351507.18464 | 613.38000 | top slp |
| 3133 | 481959.09776 | 1351506.61029 | 612.99000 | top slp |
| 3134 | 482244.89939 | 1351494.21504 | 611.27000 | mid pt |
| 3135 | 482194.91894 | 1351492.31130 | 610.61000 | mid pt |
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| 3140 | 482106.32873 | 1351493.73790 | 610.55000 | mid pt |
| 3141 | 482056.29748 | 1351495.99164 | 610.99000 | mid pt |
| 3142 | 482006.26622 | 1351498.24538 | 611.21000 | mid pt |
| 3143 | 481918.19440 | 1351492.17839 | 609.17000 | mid pt |
| 3145 | 481987.51145 | 1351482.91294 | 607.26000 | toe slp pt |
| 3146 | 482156.70270 | 1351465.47002 | 604.86000 | toe slp |
| 3147 | 482172.65317 | 1351465.17002 | 604.76000 | toe slp |
| 3148 | 481995.17410 | 1350856.53543 | 600.97000 | toe slp |
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| 3150 | 481994.17815 | 1350937.97450 | 601.71000 | toe slp |
| 3151 | 481993.56650 | 1350987.97076 | 602.30000 | toe slp |
| 3152 | 481992.95485 | 1351037.96702 | 602.81000 | toe slp |
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| 3154 | 481991.73156 | 1351137.95954 | 603.79000 | toe slp |
| 3155 | 481991.11991 | 1351187.95580 | 604.29000 | toe slp |
| 3156 | 481990.50827 | 1351237.95205 | 604.82000 | toe slp |
| 3157 | 481989.89662 | 1351287.94831 | 605.27000 | toe slp |
| 3158 | 481989.28497 | 1351337.94457 | 605.77000 | toe slp |

| | | | | |
|---|---|---|---|---|
| 3159 | 481988.67333 | 1351387.94083 | 606.30000 | toe slp |
| 3160 | 481988.06168 | 1351437.93709 | 606.77000 | toe slp |
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| 3162 | 481976.96500 | 1350887.76055 | 605.91000 | top slp |
| 3163 | 481976.35407 | 1350937.75682 | 606.32000 | top slp |
| 3164 | 481975.74313 | 1350987.75308 | 606.71000 | top slp |
| 3165 | 481975.13220 | 1351037.74935 | 607.31000 | top slp |
| 3166 | 482286.26998 | 1350806.43939 | 608.47000 | top slp |
| 3167 | 482285.83708 | 1350842.09998 | 599.65000 | toe slp pt 2167 |
| 3168 | 482278.13292 | 1351471.96002 | 605.82000 | toe slp |
| 3169 | 482277.66091 | 1351510.50062 | 615.30000 | top slp |
| 3170 | 481926.63764 | 1350802.04702 | 605.73000 | south limit |
| 3171 | 481926.21473 | 1350835.51928 | 597.54000 | south limit |
| 3172 | 481918.46348 | 1351469.90387 | 603.79000 | south limit |
| 3173 | 481918.02887 | 1351506.10830 | 612.80000 | outh limit |
| 3174 | 481974.52127 | 1351087.74562 | 607.80000 | top slp |
| 3175 | 481973.91034 | 1351137.74189 | 608.36000 | top slp |
| 3176 | 481973.29941 | 1351187.73815 | 608.86000 | top slp |
| 3177 | 481972.68848 | 1351237.73442 | 609.32000 | top slp |
| 3178 | 481972.07755 | 1351287.73069 | 609.70000 | top slp |
| 3179 | 481971.46662 | 1351337.72696 | 610.22000 | top slp |
| 3180 | 481970.85569 | 1351387.72322 | 610.74000 | top slp |
| 3181 | 481970.24476 | 1351437.71949 | 611.20000 | top slp |
| 3182 | 481977.73428 | 1350824.80523 | 605.08000 | top slp |
| 3183 | 481969.69371 | 1351482.81534 | 611.62000 | top slp |
| 3184 | 481967.25073 | 1350824.67719 | 604.96000 | top slp |
| 3185 | 481966.87908 | 1350855.09423 | 605.34000 | top slp |
| 3186 | 481966.48120 | 1350887.63251 | 605.66000 | top slp |
| 3187 | 481965.87008 | 1350937.62878 | 606.22000 | top slp |
| 3188 | 481965.25896 | 1350987.62504 | 606.71000 | top slp |
| 3189 | 481964.64784 | 1351037.62131 | 607.36000 | top slp |
| 3190 | 481964.03672 | 1351087.61757 | 607.86000 | top slp |
| 3191 | 481963.42559 | 1351137.61384 | 608.41000 | top slp |
| 3192 | 481962.81447 | 1351187.61010 | 608.69000 | top slp |
| 3193 | 481962.20335 | 1351237.60637 | 609.16000 | top slp |
| 3194 | 481961.59223 | 1351287.60263 | 609.88000 | top slp |
| 3195 | 481960.98110 | 1351337.59890 | 610.32000 | top slp |
| 3196 | 481960.36998 | 1351387.59516 | 610.76000 | top slp |
| 3197 | 481959.75886 | 1351437.59143 | 611.13000 | top slp |
| 3198 | 481959.20764 | 1351482.68727 | 611.66000 | top slp |
| 3199 | 481936.03001 | 1350853.17394 | 597.64000 | toe slp |
| 3200 | 481935.61364 | 1350887.25553 | 597.98000 | toe slp |
| 3201 | 481935.00305 | 1350937.25180 | 598.57000 | toe slp |
| 3202 | 481934.39247 | 1350987.24807 | 599.01000 | toe slp |
| 3203 | 481933.78189 | 1351037.24434 | 599.66000 | toe slp |
| 3204 | 481933.17130 | 1351087.24061 | 600.06000 | toe slp |
| 3205 | 481932.56072 | 1351137.23688 | 600.59000 | toe slp |
| 3206 | 481931.95014 | 1351187.23316 | 601.10000 | toe slp |
| 3207 | 481931.33955 | 1351237.22943 | 601.62000 | toe slp |
| 3208 | 481930.72897 | 1351287.22570 | 602.04000 | toe slp |
| 3209 | 481930.11838 | 1351337.22197 | 602.54000 | toe slp |
| 3210 | 481929.50780 | 1351387.21824 | 603.18000 | toe slp |
| 3211 | 481928.89722 | 1351437.21452 | 603.57000 | toe slp |
| 3212 | 481926.00992 | 1350853.05553 | 597.42000 | south limit |
| 3213 | 481925.59362 | 1350887.13315 | 597.85000 | south limit |
| 3214 | 481924.98285 | 1350937.12942 | 598.42000 | south limit |
| 3215 | 481924.37208 | 1350987.12569 | 598.70000 | south limit |
| 3216 | 481923.76131 | 1351037.12196 | 599.34000 | south limit |
| 3217 | 481923.15054 | 1351087.11823 | 599.86000 | south limit |
| 3218 | 481922.53977 | 1351137.11450 | 600.25000 | south limit |
| 3219 | 481921.92900 | 1351187.11077 | 600.81000 | south limit |
| 3220 | 481921.31823 | 1351237.10704 | 601.36000 | south limit |
| 3221 | 481920.70746 | 1351287.10331 | 601.72000 | south limit |
| 3222 | 481920.09670 | 1351337.09958 | 602.28000 | south limit |
| 3223 | 481919.48593 | 1351387.09585 | 602.75000 | south limit |
| 3224 | 481918.87516 | 1351437.09212 | 603.06000 | south limit |
| 3225 | 481986.41066 | 1350824.91119 | 603.00000 | mid pt |
| 3226 | 481986.02811 | 1350855.87230 | 603.38000 | mid pt |
| 3227 | 481985.64048 | 1350887.86650 | 603.46000 | mid pt |
| 3229 | 481985.02883 | 1350937.86276 | 604.12000 | mid pt |
| 3230 | 481984.41718 | 1350987.85902 | 604.58000 | mid pt |
| 3231 | 481983.80554 | 1351037.85528 | 605.07000 | mid pt |
| 3232 | 481983.19389 | 1351087.85154 | 605.54000 | mid pt |
| 3233 | 481982.58224 | 1351137.84780 | 605.98000 | mid pt |

| | | | | |
|---|---|---|---|---|
| 3234 | 481981.97060 | 1351187.84406 | 606.54000 | mid pt |
| 3235 | 481981.35895 | 1351237.84031 | 606.88000 | mid pt |
| 3236 | 481980.74730 | 1351287.83657 | 607.58000 | mid pt |
| 3237 | 481980.13565 | 1351337.83283 | 608.06000 | mid pt |
| 3238 | 481979.52401 | 1351387.82909 | 608.43000 | mid pt |
| 3239 | 481978.91236 | 1351437.82535 | 608.94000 | mid pt |
| 3240 | 481978.36066 | 1351482.92119 | 609.56000 | mid pt |
| 3241 | 481951.91885 | 1350835.33843 | 601.40000 | mid pt |
| 3242 | 481951.66996 | 1350854.14149 | 601.54000 | mid pt |
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| 3245 | 481950.06130 | 1350987.43943 | 603.00000 | mid pt |
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| 3251 | 482252.27735 | 1350891.12476 | 599.39000 | grid pt |
| 3252 | 482251.66571 | 1350941.12102 | 599.80000 | grid pt |
| 3253 | 482251.05408 | 1350991.11728 | 600.30000 | grid pt |
| 3254 | 482250.44245 | 1351041.11354 | 600.81000 | grid pt |
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| 3262 | 482245.54938 | 1351441.08361 | 604.79000 | grid pt |
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| 3264 | 481945.78722 | 1351337.41333 | 606.53000 | mid pt |
| 3265 | 481945.17663 | 1351387.40961 | 607.03000 | mid pt |
| 3266 | 481944.56605 | 1351437.40588 | 607.41000 | mid pt |
| 3267 | 481944.15885 | 1351470.74843 | 607.84000 | mid pt |
| 3268 | 482184.20000 | 1350825.89000 | 602.34000 | pt #4021 |
| 3269 | 482183.96000 | 1350845.74000 | 597.30000 | pt #4022 |
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| 3271 | 482180.19000 | 1350845.76000 | 598.37000 | pt #4024 |
| 3272 | 482164.31000 | 1350845.57000 | 598.33000 | pt #4025 |
| 3273 | 482160.61000 | 1350845.53000 | 597.45000 | pt #4026 |
| 3274 | 482159.83000 | 1350844.69000 | 597.45000 | pt #4027 |
| 3275 | 482160.07000 | 1350824.87000 | 602.41000 | pt #4028 |
| 3276 | 482164.51000 | 1350829.42000 | 602.29000 | pt #4029 |
| 3277 | 482180.39000 | 1350829.62000 | 602.38000 | pt #4030 |
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| 3279 | 482183.09826 | 1350940.28219 | 598.48000 | toe slp |
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| 3293 | 482155.43147 | 1351239.96626 | 601.50000 | toe slp |
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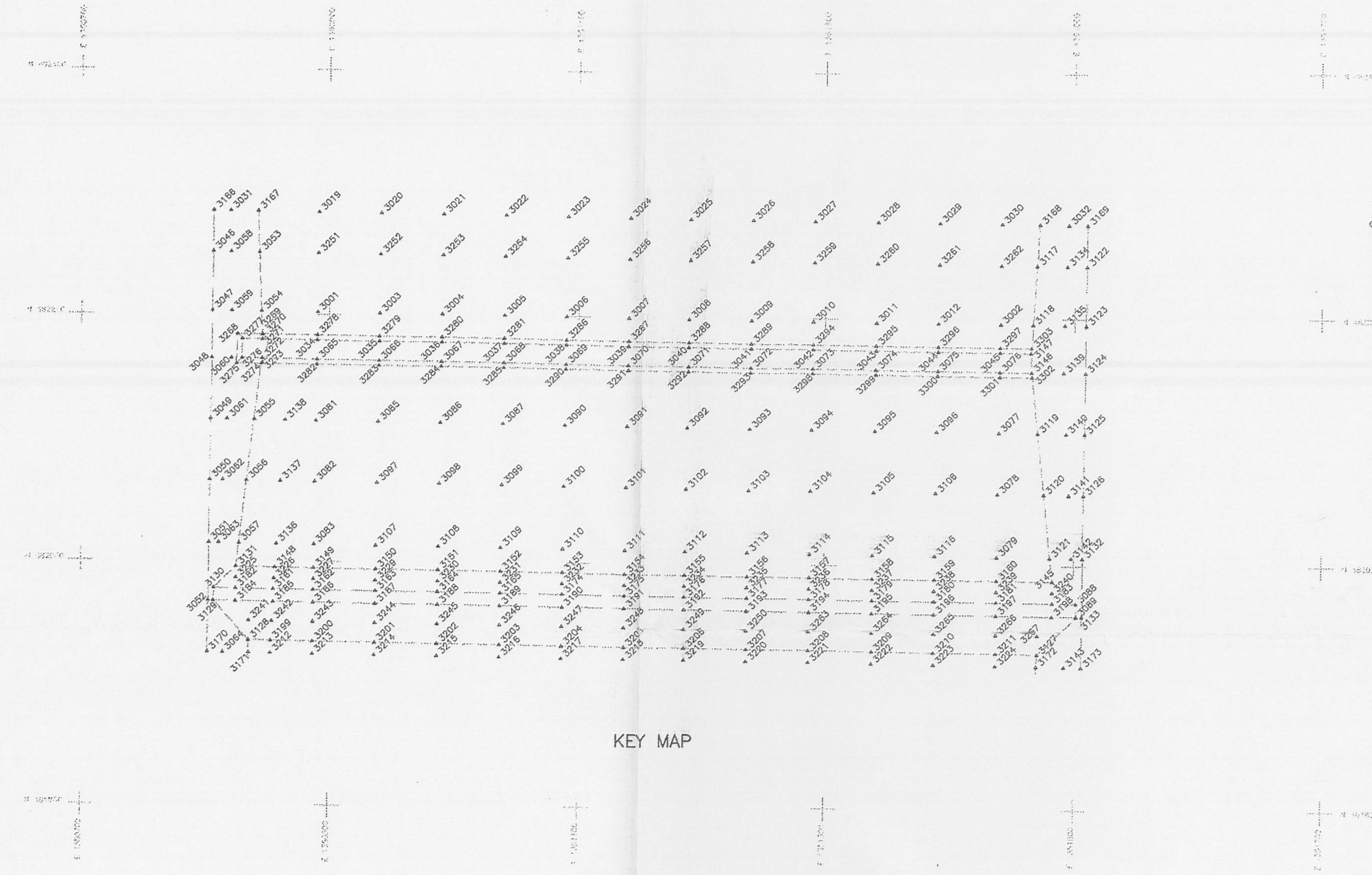
| 3299 | 482154.21026 | 1351339.95880 | 602.50000 | toe slp |
| 3300 | 482153.59966 | 1351389.95507 | 602.89000 | toe slp |
| 3301 | 482152.98905 | 1351439.95134 | 603.38000 | toe slp |
| 3302 | 482152.67236 | 1351465.88202 | 603.77000 | toe slp |
| 3303 | 482176.67475 | 1351465.43628 | 603.82000 | toe slp |



KEY MAP

NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

INFORMATION ONLY

LEGEND:

| | | | | | |
|---|---|---|---|---|---|
| 235 | 481930.755520 | 1351337.229750 | 597.310000 | toe slp | = CERTIFIED POINT |

GRAPHIC SCALE

80 0 40 80 160 320

( IN FEET )
1 inch = 80 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 12/13/99

20102 - OPTA - DWG - 019B (REV. 0)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | SEPT. 29, 1999 |
| SCALE: | 1"=80' |
| DRAWN BY: | BJL |
| PRINT DATE: | SEPT. 29, 1999 |

STATE OF OHIO — LYNN E. HIRSCH S-5728 — REGISTERED SURVEYOR [signature]

OSDF PHASE 2
AS-BUILT
LCS DRAINAGE LAYER
OSDF CELL 3 06/25/1999

| DATE: | REVISIONS: |
|---|---|

FILE NAME: LDSc3-C.dwg

2

000052

SHEET NO. 2 OF 2

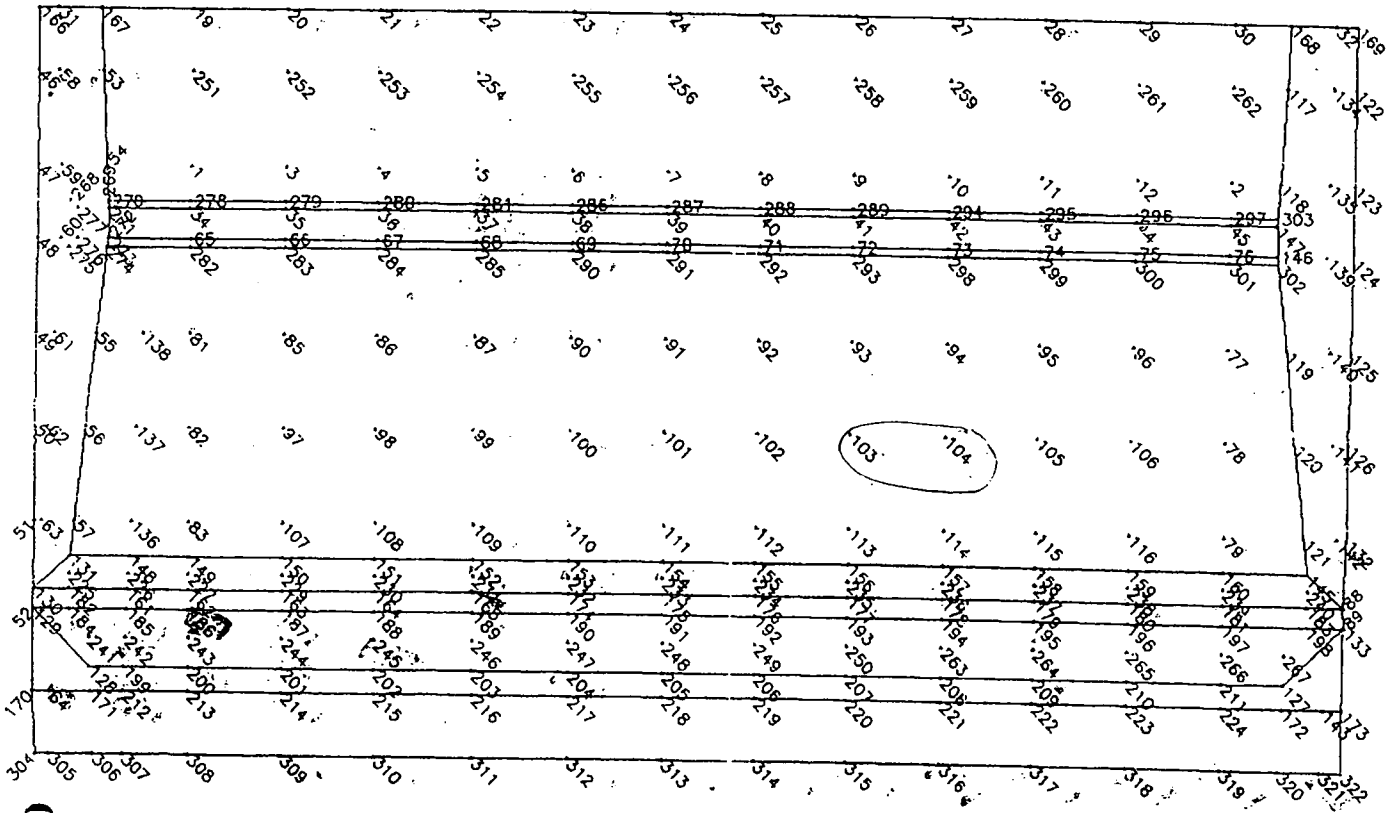
F-2741

G:\LAND PROJECTS\990607\0008\DWG\LCSc3-C.dwg BJL - DECEMBER 04, 1999 - 14:26:17 XREFS:

# TOP OF PROTECTIVE LAYER

CELL 3 - TOP OF PROTECTIVE LAYER

Elevation Tolerance -0.1 to +0.2 ft
Thickness Tolerance 0.0 to +0.1 ft



Points checked by KBT on 10/15/99 and 10/18/99 and found to be within elevation tolerances

Points checked by KBT on 10/20/99 and found to be within elevation tolerance.

Points checked by KBT on 10/21/99 and found to be within elevation tolerance.

Points checked by KBT on 10/27/99 and found to be within elevation tolerance.

Points checked by KBT on 11-4-99 and found to be within elevation tolerances. (new checkplane).

Points checked by KBT on 11-8-99 [illegible] found to be within elevation tolerance.

Points checked by KBT on 11-8-99 and found to be within elevation tolerance.

Points checked by KBT on 11-9-99 and found to be within elevation tolerance.

PETRO-FERNALD

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PET3PRO.CRD

TOP OF PROTECTIVE LAYE

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F-2741

2741

HIRSCH & ASSOCIATES SURVEYING, INC.
3610 STATE LINE ROAD
OKEANA, OH 45053
(513) 367-0534
Fax: (513) 367-2935

October 18, 1999

**SUBJECT: CERTIFICATION POINTS TOP OF PROTECTIVE LAYER CELL 3, FERNALD SITE.**

I hereby cetify that the elevations listed on the next 6 pages are the as built elevations of the top of PROTECTIVE layer for the point numbers listed, along with the date the elevations were taken.

Lynn Edward Hirsch

**LYNN EDWARD HIRSCH**
**REGISTERED OHIO LAND SURVEYOR NO. 5738**

file: ferce3PRO

STATE OF OHIO
LYNN
E.
HIRSCH
S-5738
REGISTERED
SURVEYOR

Note: Code of PRO Has a Corresponding Point from top of LCS file
Code of PROO Has No Corresponding Point from top of LCS file

2741

Prepared by: Hirsch & Associates Surveying, Inc. #CGDS07961
List-Coords/Brg-Azi PET3PRO 10/18/99 7:21:55 Factor: 1.0000000 Pg 1 of 6

| Pt.No. | Code | North | East | Elev. Determined from As Built LCS file | Elevation | Desc. | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PRO | 482202.28109 | 1350890.51312 | 598.33 | 599.330 | grid point | 599.43 | 10/21/99 | (T1.10) |
| 2 | PRO | 482195.55312 | 1351440.47197 | 603.78 | 604.780 | grid point | 604.97 | 11/1/99 | (T1.19) |
| 3 | PRO | 482201.66945 | 1350940.50938 | 598.80 | 599.800 | grid point | 599.93 | 10/15/99 | (T1.13) |
| 4 | PRO | 482201.05782 | 1350990.50564 | 599.37 | 600.370 | grid point | 600.47 | 10/15/99 | (T1.10) |
| 5 | PRO | 482200.44619 | 1351040.50190 | 599.88 | 600.880 | grid point | 600.93 | 11/5/99 | (T1.05) |
| 6 | PRO | 482199.83455 | 1351090.49816 | 600.32 | 601.320 | grid point | 601.43 | 11/5/99 | (T1.11) |
| 7 | PRO | 482199.22292 | 1351140.49442 | 600.77 | 601.770 | grid point | 601.97 | 11/1/99 | (T1.20) |
| 8 | PRO | 482198.61129 | 1351190.49068 | 601.26 | 602.260 | grid point | 602.37 | 11/1/99 | (T1.11) |
| 9 | PRO | 482197.99965 | 1351240.48694 | 601.76 | 602.760 | grid point | 602.92 | 11/1/99 | (T1.16) |
| 10 | PRO | 482197.38802 | 1351290.48320 | 602.41 | 603.410 | grid point | 603.46 | 11/1/99 | (T1.03) |
| 11 | PRO | 482196.77639 | 1351340.47946 | 602.76 | 603.760 | grid point | 603.80 | 11/1/99 | (T1.04) |
| 12 | PRO | 482196.16475 | 1351390.47571 | 603.24 | 604.240 | grid point | 604.30 | 11/1/99 | (T1.06) |
| 19 | PRO | 482285.23249 | 1350891.52792 | 600.06 | 601.060 | south limit | 601.22 | 11/5/99 | (T1.16) |
| 20 | PRO | 482284.62096 | 1350941.52418 | 600.54 | 601.540 | south limit | 601.72 | 11/5/99 | (T1.18) |
| 21 | PRO | 482284.00540 | 1350991.52039 | 600.90 | 601.900 | south limit | 602.09 | 11/5/99 | (T1.19) |
| 22 | PRO | 482283.39387 | 1351041.51665 | 601.52 | 602.520 | south limit | 602.66 | 11/5/99 | (T1.14) |
| 23 | PRO | 482282.78234 | 1351091.51291 | 601.97 | 602.970 | south limit | 603.03 | 11/5/99 | (T1.06) |
| 24 | PRO | 482282.17082 | 1351141.50917 | 602.52 | 603.520 | south limit | 603.32 | 11/1/99 | (T1.00) |
| 25 | PRO | 482281.55929 | 1351191.50543 | 602.90 | 603.900 | south limit | 603.93 | 11/1/99 | (T1.03) |
| 26 | PRO | 482280.94776 | 1351241.50169 | 603.42 | 604.420 | south limit | 604.51 | 11/1/99 | (T1.09) |
| 27 | PRO | 482280.33623 | 1351291.49795 | 603.82 | 604.820 | south limit | 605.01 | 11/1/99 | (T1.18) |
| 28 | PRO | 482279.72470 | 1351341.49421 | 604.94 | 605.440 | south limit | 605.47 | 11/1/99 | (T1.03) |
| 29 | PRO | 482279.11317 | 1351391.49047 | 604.95 | 605.950 | south limit | 606.08 | 11/1/99 | (T1.03) |
| 30 | PRO | 482278.50164 | 1351441.48673 | 605.42 | 606.420 | south limit | 606.52 | 11/1/99 | (T1.11) |
| 31 | PRO | 482286.10498 | 1350820.03161 | 604.94 | 605.970 | south limit | mid pt | 605.99 | 11/5/99 (T1.0 |
| 32 | PRO | 482277.84502 | 1351495.46825 | 611.50 | 612.830 | south limit | mid pt | 613.02 | 11/5/99 (T1.2 |
| 34 | PRO | 482179.83009 | 1350890.23847 | 598.93 | 599.930 | grid point | 599.95 | 10/21/99 | (T1.02) |
| 35 | PRO | 482179.21855 | 1350940.23473 | 599.40 | 600.400 | grid point | 600.44 | 10/15/99 | (T1.06) |
| 36 | PRO | 482178.60702 | 1350990.23099 | 599.93 | 600.930 | grid point | 600.95 | 10/15/99 | (T1.02) |
| 37 | PRO | 482177.99548 | 1351040.22725 | 600.44 | 601.440 | grid point | 601.51 | 11/5/99 | (T1.07) |
| 38 | PRO | 482177.38394 | 1351090.22351 | 600.91 | 601.910 | grid point | 602.07 | 11/5/99 | (T1.15) |
| 39 | PRO | 482176.77240 | 1351140.21977 | 601.43 | 602.430 | grid point | 602.59 | 11/1/99 | (T1.16) |
| 40 | PRO | 482176.16086 | 1351190.21603 | 601.95 | 602.950 | grid point | 603.05 | 11/1/99 | (T1.19) |
| 41 | PRO | 482175.54932 | 1351240.21229 | 602.32 | 603.320 | grid point | 603.49 | 11/1/99 | (T1.17) |
| 42 | PRO | 482174.93779 | 1351290.20855 | 602.87 | 603.870 | grid point | 604.05 | 11/1/99 | (T1.18) |
| 43 | PRO | 482174.32625 | 1351340.20481 | 603.40 | 604.400 | grid point | 604.47 | 11/1/99 | (T1.07) |
| 44 | PRO | 482173.71471 | 1351390.20107 | 604.00 | 605.000 | grid point | 605.02 | 11/1/99 | (T1.02) |
| 45 | PRO | 482173.10317 | 1351440.19733 | 604.38 | 605.380 | grid point | 605.50 | 11/1/99 | (T1.12) |
| 46 | PROO | 482253.26788 | 1350810.15663 | | 608.320 | top slp | 608.34 | 10/26/99 | — |
| 47 | PROO | 482203.27161 | 1350809.54601 | | 607.810 | top slp | 607.93 | 10/21/99 | — |
| 48 | PROO | 482164.70304 | 1350809.07496 | | 607.630 | top slp | 607.77 | 10/21/99 | — |
| 49 | PROO | 482114.69796 | 1350808.46423 | | 607.100 | top slp | 607.16 | 10/21/99 | — |
| 50 | PROO | 482064.70169 | 1350807.85361 | | 606.710 | top slp | 606.73 | 10/15/99 | — |
| 51 | PROO | 482014.70542 | 1350807.24298 | | 606.290 | top slp | 606.39 | 10/15/99 | — |
| 52 | PROO | 481967.47398 | 1350806.66187 | | 607.010 | top slp | 607.11 | 10/21/99 | — |
| 53 | PRO | 482252.86121 | 1350843.39834 | 598.97 | 599.970 | toe slp | 600.14 | 11/5/99 | (T1.17) |
| 54 | PRO | 482202.83560 | 1350845.18605 | 597.97 | 598.970 | toe slp | 599.06 | 10/21/99 | (T1.07) |
| 55 | PRO | 482114.31960 | 1350839.44466 | 598.55 | 599.550 | toe slp | 599.67 | 10/21/99 | (T1.12) |
| 56 | PRO | 482064.38794 | 1350833.54340 | 599.44 | 600.440 | toe slp | 600.59 | 10/21/99 | (T1.15) |
| 57 | PRO | 482014.45629 | 1350827.64215 | 600.36 | 601.360 | toe slp | 601.42 | 10/21/99 | (T1.08) |
| 58 | PRO | 482253.14233 | 1350820.41880 | 604.61 | 605.640 | mid pt | 605.66 | 11/5/99 | (T1.05) |
| 59 | PRO | 482203.13138 | 1350821.00874 | 603.91 | 604.940 | mid pt | 604.98 | 10/20/99 | (T1.07) |
| 60 | PRO | 482164.56759 | 1350820.85310 | 604.56 | 604.590 | mid pt | 604.72 | 10/21/99 | (T1.06) |

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Elev Determined from As Built Lcs file

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| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 61 | PRO | 482114.58645 | 1350817.59479 | 603.92 | 604.950 | mid pt | 604.95 | 10/21/99 | (T1.03) |
| 62 | PRO | 482064.62249 | 1350814.33883 | 603.98 | 605.010 | mid pt | 605.05 | 10/21/99 | (T1.03) |
| 63 | PRO | 482014.65852 | 1350811.08288 | 604.34 | 605.340 | mid pt | 605.34 | 11/1/99 | (T1.03) |
| 64 | PROO | 481923.47787 | 1350814.70882 | 602.45 | 603.480 | mid pt | top slp | 603.60 | (T1.15) |
| 65 | PRO | 482163.58540 | 1350890.03974 | 598.87 | 599.870 | grid pt | 599.87 | 10/21/99 | (T1.00) |
| 66 | PRO | 482162.97480 | 1350940.03601 | 599.41 | 600.410 | grid pt | 600.41 | 10/15/99 | (T1.00) |
| 67 | PRO | 482162.36420 | 1350990.03228 | 599.93 | 600.920 | grid pt | 600.93 | 10/15/99 | (T1.01) |
| 68 | PRO | 482161.75359 | 1351040.02855 | 600.48 | 601.480 | grid pt | 601.54 | 11/5/99 | (T1.06) |
| 69 | PRO | 482161.14299 | 1351090.02483 | 601.08 | 602.080 | grid pt | 602.09 | 11/5/99 | (T1.01) |
| 70 | PRO | 482160.53239 | 1351140.02110 | 601.39 | 602.390 | grid pt | 602.44 | 11/1/99 | (T1.05) |
| 71 | PRO | 482159.92178 | 1351190.01737 | 601.81 | 602.810 | grid pt | 602.85 | 11/1/99 | (T1.04) |
| 72 | PRO | 482159.31118 | 1351240.01364 | 602.33 | 603.330 | grid pt | 603.48 | 11/1/99 | (T1.15) |
| 73 | PRO | 482158.70058 | 1351290.00991 | 602.85 | 603.850 | grid pt | 604.04 | 11/1/99 | (T1.19) |
| 74 | PRO | 482158.08997 | 1351340.00618 | 603.29 | 604.290 | grid pt | 604.47 | 11/1/99 | (T1.18) |
| 75 | PRO | 482157.47937 | 1351390.00246 | 603.91 | 604.910 | grid pt | 605.10 | 11/1/99 | (T1.19) |
| 76 | PRO | 482156.86877 | 1351439.99873 | 604.37 | 605.370 | grid pt | 605.54 | 11/1/99 | (T1.17) |
| 77 | PRO | 482106.99248 | 1351439.38959 | 604.37 | 605.370 | grid pt | 605.51 | 11/3/99 | (T1.14) |
| 78 | PRO | 482056.99621 | 1351438.77899 | 605.39 | 606.390 | grid pt | 606.52 | 11/3/99 | (T1.13) |
| 79 | PRO | 482006.99994 | 1351438.16838 | 606.40 | 607.400 | grid pt | 607.51 | 11/3/99 | (T1.11) |
| 81 | PRO | 482113.70912 | 1350889.43060 | 598.94 | 599.940 | grid pt | 599.96 | 10/21/99 | (T1.02) |
| 82 | PRO | 482063.71285 | 1350888.82000 | 600.06 | 601.060 | grid pt | 601.09 | 10/21/99 | (T1.03) |
| 83 | PRO | 482013.71658 | 1350888.20940 | 601.00 | 602.000 | grid pt | 602.01 | 10/15/99 | (T1.01) |
| 85 | PRO | 482113.09852 | 1350939.42687 | 599.56 | 600.560 | grid pt | 600.57 | 10/15/99 | (T1.01) |
| 86 | PRO | 482112.48792 | 1350989.42315 | 599.78 | 600.780 | grid pt | 600.90 | 10/21/99 | (T1.12) |
| 87 | PRO | 482111.87731 | 1351039.41942 | 600.42 | 601.420 | grid pt | 601.44 | 11/5/99 | (T1.02) |
| 88 | PRO | 481969.57995 | 1351501.93691 | 611.95 | 612.950 | ed berm | 612.96 | 10/15/99 | (T1.01) |
| 89 | PRO | 481958.85005 | 1351502.13309 | 611.95 | 612.950 | ed berm | 613.06 | 10/15/99 | (T.11) |
| 90 | PRO | 482111.26671 | 1351089.41569 | 600.80 | 601.800 | grid pt | 601.89 | 11/5/99 | (T1.09) |
| 91 | PRO | 482110.65611 | 1351139.41196 | 601.36 | 602.360 | grid pt | 602.38 | 11/1/99 | (T1.02) |
| 92 | PRO | 482110.04550 | 1351189.40823 | 601.82 | 602.820 | grid pt | 602.94 | 11/1/99 | (T1.12) |
| 93 | PRO | 482109.43490 | 1351239.40450 | 603.39 | 604.390 | grid pt | 604.39 | 11/1/99 | (T1.00) |
| 94 | PRO | 482108.82430 | 1351289.40077 | 602.87 | 603.870 | grid pt | 603.88 | 11/1/99 | (T1.01) |
| 95 | PRO | 482108.21369 | 1351339.39705 | 603.30 | 604.300 | grid pt | 604.47 | 11/3/99 | (T1.17) |
| 96 | PRO | 482107.60309 | 1351389.39332 | 603.84 | 604.840 | grid pt | 604.84 | 11/3/99 | (T1.00) |
| 97 | PRO | 482063.10225 | 1350938.81627 | 600.51 | 601.510 | grid pt | 601.53 | 10/21/99 | (T1.02) |
| 98 | PRO | 482062.49164 | 1350988.81254 | 601.02 | 602.020 | grid pt | 602.05 | 10/15/99 | (T1.03) |
| 99 | PRO | 482061.88104 | 1351038.80881 | 601.39 | 602.390 | grid pt | 602.42 | 11/5/99 | (T1.03) |
| 100 | PRO | 482061.27044 | 1351088.80509 | 601.86 | 602.860 | grid pt | 602.92 | 11/5/99 | (T1.06) |
| 101 | PRO | 482060.65983 | 1351138.80136 | 602.34 | 603.340 | grid pt | 603.39 | 11/1/99 | (T1.05) |
| 102 | PRO | 482060.04923 | 1351188.79763 | 602.84 | 603.840 | grid pt | 603.92 | 11/1/99 | (T1.08) |
| 103 | PRO | 482059.43863 | 1351238.79390 | 603.38 | 604.380 | grid pt | 604.51 | 11/5/99 | (T1.13) |
| 104 | PRO | 482058.82802 | 1351288.79017 | 603.86 | 604.860 | grid pt | 605.01 | 11/5/99 | (T1.15) |
| 105 | PRO | 482058.21742 | 1351338.78644 | 604.35 | 605.350 | grid pt | 605.54 | 11/3/99 | (T1.19) |
| 106 | PRO | 482057.60682 | 1351388.78271 | 604.83 | 605.830 | grid pt | 605.97 | 11/3/99 | (T1.14) |
| 107 | PRO | 482013.10598 | 1350938.20567 | 601.47 | 602.470 | grid pt | 602.47 | 10/15/99 | (T1.00) |
| 108 | PRO | 482012.49537 | 1350988.20194 | 601.95 | 602.950 | grid pt | 602.96 | 10/15/99 | (T1.01) |
| 109 | PRO | 482011.88477 | 1351038.19821 | 602.39 | 603.390 | grid pt | 603.40 | 11/5/99 | (T1.01) |
| 110 | PRO | 482011.27417 | 1351088.19448 | 602.76 | 603.760 | grid pt | 603.88 | 11/5/99 | (T1.12) |
| 111 | PRO | 482010.66356 | 1351138.19075 | 603.33 | 604.330 | grid pt | 604.43 | 11/5/99 | (T1.10) |
| 112 | PRO | 482010.05296 | 1351188.18702 | 603.86 | 604.860 | grid pt | 604.94 | 11/5/99 | (T1.08) |
| 113 | PRO | 482009.44236 | 1351238.18330 | 604.34 | 605.340 | grid pt | 605.48 | 11/3/99 | (T1.14) |
| 114 | PRO | 482008.83175 | 1351288.17957 | 604.81 | 605.810 | grid pt | 605.95 | 11/3/99 | (T1.14) |
| 115 | PRO | 482008.22115 | 1351338.17584 | 605.39 | 606.390 | grid pt | 606.51 | 11/3/99 | (T1.12) |
| 116 | PRO | 482007.61055 | 1351388.17211 | 605.84 | 606.840 | grid pt | 606.86 | 11/3/99 | (T1.02) |
| 117 | PRO | 482245.19890 | 1351469.73287 | 605.11 | 606.110 | toe slp | 606.29 | 11/1/99 | (T1.18) |
| 118 | PRO | 482195.23415 | 1351466.54495 | 604.07 | 605.070 | toe slp | 605.27 | 11/1/99 | (T1.20) |
| 119 | PRO | 482106.61289 | 1351470.47064 | 604.66 | 605.660 | toe slp | 605.86 | 11/3/99 | (T1.20) |
| 120 | PRO | 482056.54666 | 1351475.58866 | 606.01 | 607.010 | toe slp | 607.21 | 11/3/99 | (T1.20) |
| 121 | PRO | 482006.48042 | 1351480.70669 | 606.92 | 607.920 | toe slp | 608.11 | 11/3/99 | (T1.19) |
| 122 | PROO | 482244.75548 | 1351505.97842 | | 615.090 | top slp | 615.29 | 11/8/99 | — |

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Elev determined from As Built LCS file

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 123 | PROO | 482194.75921 | 1351505.36780 | | 614.740 | top | slp | 610.93 | 11/18/99 | — |
| 124 | PROO | 482156.20223 | 1351504.89689 | | 614.630 | top | slp | 614.77 | 11/8/199 | — |
| 125 | PROO | 482106.19990 | 1351504.28619 | | 614.150 | top | slp | 614.19 | 11/8/199 | — |
| 126 | PROO | 482056.20363 | 1351503.67557 | | 613.910 | top | slp | 610.06 | 11/8/199 | — |
| 127 | PRO | 481928.37027 | 1351470.54929 | 604.04 | 605.040 | toe | slp | 605.19 | 10/20/99 | (T1.15) |
| 128 | PROO | 481936.13010 | 1350835.15149 | | 598.690 | toe | slp | 598.73 | 10/20/99 | — |
| 129 | PRO | 481967.35030 | 1350806.72525 | 605.09 | 606.090 | ed | berm | 606.14 | 10/20/99 | (T1.05) |
| 130 | PRO | 481978.06970 | 1350807.16475 | 605.15 | 606.150 | ed | berm | 606.15 | 10/21/99 | (T1.00) |
| 131 | PRO | 481995.69585 | 1350825.28208 | 600.84 | 601.840 | toe | slp | 601.87 | 10/21/99 | (T1.03) |
| 132 | PROO | 482006.20736 | 1351503.06495 | | 613.380 | top | slp | 613.50 | 11/8/99 | — |
| 133 | PROO | 481958.98024 | 1351502.49197 | | 612.990 | top | slp | 613.04 | 10/15/99 | — |
| 134 | PRO | 482244.89939 | 1351494.21504 | 611.30 | 612.300 | mid | pt | 612.48 | 11/5/99 | (T1.18) |
| 135 | PRO | 482194.91894 | 1351492.31130 | 610.61 | 611.640 | mid | pt | 611.83 | 11/3/99 | (T1.22) |
| 136 | PRO | 482014.08905 | 1350857.71167 | 600.56 | 601.560 | grid | pt | 601.68 | 10/21/99 | (T1.12) |
| 137 | PRO | 482064.05479 | 1350860.82209 | 599.77 | 600.770 | grid | pt | 600.85 | 10/21/99 | (T1.08) |
| 138 | PRO | 482114.01442 | 1350864.43247 | 598.64 | 599.640 | grid | pt | 599.72 | 10/21/99 | (T1.08) |
| 139 | PRO | 482156.37262 | 1351491.48292 | 610.22 | 611.250 | mid | pt | 611.45 | 11/3/199 | (T1.23) |
| 140 | PRO | 482106.32873 | 1351493.73790 | 610.58 | 611.580 | mid | pt | 611.59 | 11/5/99 | (T1.04) |
| 141 | PRO | 482056.29748 | 1351495.99164 | 611.99 | 612.020 | mid | pt | 612.06 | 11/5/99 | (T1.09) |
| 142 | PRO | 482006.26622 | 1351498.24538 | 612.21 | 612.240 | mid | pt | 612.43 | 11/5/199 | (T1.22) |
| 143 | PROO | 481915.19858 | 1351492.02007 | | 610.110 | mid | pt | top slp | 610.11 | 10/15/99 — |
| 145 | PRO | 481987.63292 | 1351482.79284 | 607.26 | 608.260 | toe | slp | pt 608.40 | 11/3/199 | (T1.14) |
| 146 | PRO | 482156.70348 | 1351465.35002 | 604.86 | 605.860 | toe | slp | 605.87 | 11/1/99 | (T1.01) |
| 147 | PRO | 482172.65533 | 1351465.05004 | 604.76 | 605.760 | toe | slp | 605.76 | 11/1/99 | (T1.00) |
| 148 | PRO | 481995.29378 | 1350856.54411 | 600.97 | 601.970 | toe | slp | 602.05 | 10/21/99 | (T1.08) |
| 149 | PRO | 481994.90979 | 1350887.97971 | 601.22 | 602.220 | toe | slp | 602.25 | 10/15/99 | (T1.03) |
| 150 | PRO | 481994.29814 | 1350937.97597 | 601.71 | 602.710 | toe | slp | 602.79 | 10/15/99 | (T1.08) |
| 151 | PRO | 481993.68649 | 1350987.97223 | 602.30 | 603.300 | toe | slp | 603.32 | 10/15/99 | (T1.02) |
| 152 | PRO | 481993.07485 | 1351037.96848 | 602.81 | 603.810 | toe | slp | 603.83 | 11/5/99 | (T1.02) |
| 153 | PRO | 481992.46320 | 1351087.96474 | 603.39 | 604.390 | toe | slp | 604.40 | 11/5/99 | (T1.01) |
| 154 | PRO | 481991.85155 | 1351137.96100 | 603.79 | 604.790 | toe | slp | 604.83 | 11/5/99 | (T1.04) |
| 155 | PRO | 481991.23990 | 1351187.95726 | 604.29 | 605.290 | toe | slp | 605.42 | 11/5/99 | (T1.13) |
| 156 | PRO | 481990.62826 | 1351237.95352 | 604.82 | 605.820 | toe | slp | 606.00 | 11/4/99 | (T1.18) |
| 157 | PRO | 481990.01661 | 1351287.94978 | 605.27 | 606.270 | toe | slp | 606.47 | 11/3/199 | (T1.20) |
| 158 | PRO | 481989.40496 | 1351337.94604 | 605.77 | 606.770 | toe | slp | 606.96 | 11/3/199 | (T1.19) |
| 159 | PRO | 481988.79332 | 1351387.94230 | 606.30 | 607.300 | toe | slp | 607.50 | 11/3/99 | (T1.20) |
| 160 | PRO | 481988.18167 | 1351437.93856 | 606.77 | 607.770 | toe | slp | 607.82 | 11/3/199 | (T1.05) |
| 161 | PRO | 481977.48220 | 1350855.23720 | 605.49 | 606.490 | top | slp | 606.59 | 10/21/99 | (T1.10) |
| 162 | PRO | 481977.08499 | 1350887.76201 | 605.91 | 606.910 | top | slp | 606.97 | 10/21/99 | (T1.06) |
| 163 | PRO | 481976.47406 | 1350937.75828 | 606.32 | 607.320 | top | slp | 607.36 | 10/15/99 | (T1.04) |
| 164 | PRO | 481975.86313 | 1350987.75455 | 606.71 | 607.710 | top | slp | 607.83 | 10/15/99 | (T1.12) |
| 165 | PRO | 481975.25220 | 1351037.75082 | 607.31 | 608.310 | top | slp | 608.40 | 10/21/99 | (T1.09) |
| 166 | PROO | 482286.21997 | 1350810.55909 | | 608.470 | top | slp | 608.60 | 10/26/99 | — |
| 167 | PRO | 482285.83562 | 1350842.21997 | 599.65 | 600.650 | toe | slp | 600.79 | 11/5/99 | (T1.14) |
| 168 | PRO | 482278.13437 | 1351471.84003 | 605.82 | 606.820 | toe | slp | 607.01 | 11/1/99 | (T1.19) |
| 169 | PROO | 482277.71137 | 1351506.38093 | | 615.300 | top | slp | 615.48 | 11/8/99 | — |
| 170 | PROO | 481923.58508 | 1350806.10854 | | 605.730 | top | slp | 605.85 | 10/20/99 | — |
| 171 | PROO | 481923.21679 | 1350835.63048 | | 598.540 | top | slp | 598.64 | 10/21/99 | — |
| 172 | PROO | 481915.46370 | 1351469.86723 | | 604.730 | top | slp | 604.79 | 10/20/99 | — |
| 173 | PROO | 481915.08201 | 1351501.83027 | | 612.800 | top | slp | 612.81 | 10/15/99 | — |
| 174 | PRO | 481974.64127 | 1351087.74708 | 607.80 | 608.800 | top | slp | 608.85 | 10/21/99 | (T1.05) |
| 175 | PRO | 481974.03033 | 1351137.74335 | 608.36 | 609.360 | top | slp | 609.37 | 10/20/99 | (T1.01) |
| 176 | PRO | 481973.41940 | 1351187.73962 | 608.86 | 609.860 | top | slp | 609.96 | 10/20/99 | (T1.10) |
| 177 | PRO | 481972.80847 | 1351237.73589 | 609.37 | 610.320 | top | slp | 610.33 | 10/15/99 | (T1.01) |
| 178 | PRO | 481972.19754 | 1351287.73215 | 609.70 | 610.700 | top | slp | 610.86 | 10/15/99 | (T1.16) |
| 179 | PRO | 481971.58661 | 1351337.72842 | 610.22 | 611.220 | top | slp | 611.27 | 10/15/99 | (T1.05) |
| 180 | PRO | 481970.97568 | 1351387.72469 | 610.74 | 611.740 | top | slp | 611.76 | 10/15/99 | (T1.02) |
| 181 | PRO | 481970.36475 | 1351437.72096 | 611.20 | 612.200 | top | slp | 612.40 | 10/15/99 | (T1.20) |
| 182 | PRO | 481977.85427 | 1350824.80669 | 605.08 | 606.080 | top | slp | 606.11 | 10/15/99 | (T1.03) |
| 183 | PRO | 481969.81370 | 1351482.81681 | 611.62 | 612.620 | top | slp | 612.64 | 10/15/99 | (T1.02) |

Elev Determined from As Built LCS file

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 184 | PRO | 481967.13074 | 1350824.67573 | 604.97 | 605.970 | top | slp | 606.16 | 10/20/99 | (T1.19) |
| 185 | PRO | 481966.75909 | 1350855.09261 | 605.34 | 606.340 | top | slp | 606.37 | 10/20/99 | (T1.03) |
| 186 | PRO | 481966.36121 | 1350887.63105 | 605.66 | 606.660 | top | slp | 606.66 | 11/8/99 | (T1.00) |
| 187 | PRO | 481965.75009 | 1350937.62731 | 606.22 | 607.220 | top | slp | 607.41 | 10/20/99 | (T1.19) |
| 188 | PRO | 481965.13897 | 1350987.62358 | 606.71 | 607.710 | top | slp | 607.89 | 10/20/99 | (T1.18) |
| 189 | PRO | 481964.52785 | 1351037.61984 | 607.36 | 608.360 | top | slp | 608.44 | 10/21/99 | (T1.08) |
| 190 | PRO | 481963.91672 | 1351087.61611 | 607.86 | 608.860 | top | slp | 608.88 | 10/21/99 | (T1.02) |
| 191 | PRO | 481963.30560 | 1351137.61237 | 608.41 | 609.410 | top | slp | 609.50 | 10/20/99 | (T1.09) |
| 192 | PRO | 481962.69448 | 1351187.60864 | 608.66 | 609.690 | top | slp | 609.87 | 10/20/99 | (T1.22) |
| 193 | PRO | 481962.08336 | 1351237.60490 | 609.16 | 610.160 | top | slp | 610.34 | 10/15/99 | (T1.18) |
| 194 | PRO | 481961.47224 | 1351287.60117 | 609.88 | 610.880 | top | slp | 610.90 | 10/15/99 | (T1.02) |
| 195 | PRO | 481960.86111 | 1351337.59743 | 610.32 | 611.320 | top | slp | 611.44 | 10/15/99 | (T1.12) |
| 196 | PRO | 481960.24999 | 1351387.59370 | 610.76 | 611.760 | top | slp | 611.77 | 10/15/99 | (T1.01) |
| 197 | PRO | 481959.63887 | 1351437.58996 | 611.13 | 612.130 | top | slp | 612.28 | 10/15/99 | (T1.15) |
| 198 | PRO | 481959.08765 | 1351482.68581 | 611.66 | 612.660 | top | slp | 612.67 | 10/15/99 | (T1.01) |
| 199 | PRO | 481935.91002 | 1350853.17252 | 597.64 | 598.640 | toe | slp | 598.69 | 10/20/99 | (T1.05) |
| 200 | PRO | 481935.49365 | 1350887.25406 | 597.98 | 598.980 | toe | slp | 599.13 | 10/20/99 | (T1.16) |
| 201 | PRO | 481934.88306 | 1350937.25033 | 598.57 | 599.570 | toe | slp | 599.61 | 10/20/99 | (T1.04) |
| 202 | PRO | 481934.27248 | 1350987.24660 | 599.01 | 600.010 | toe | slp | 600.08 | 10/20/99 | (T1.07) |
| 203 | PRO | 481933.66190 | 1351037.24288 | 599.66 | 600.660 | toe | slp | 600.70 | 10/20/99 | (T1.06) |
| 204 | PRO | 481933.05131 | 1351087.23915 | 600.06 | 601.060 | toe | slp | 601.25 | 11/8/99 | (T1.19) |
| 205 | PRO | 481932.44073 | 1351137.23542 | 600.59 | 601.590 | toe | slp | 601.78 | 10/20/99 | (T1.19) |
| 206 | PRO | 481931.83014 | 1351187.23169 | 601.10 | 602.100 | toe | slp | 602.30 | 10/20/99 | (T1.20) |
| 207 | PRO | 481931.21956 | 1351237.22796 | 601.62 | 602.620 | toe | slp | 602.81 | 10/20/99 | (T1.19) |
| 208 | PRO | 481930.60898 | 1351287.22423 | 602.04 | 603.040 | toe | slp | 603.24 | 10/20/99 | (T1.20) |
| 209 | PRO | 481929.99839 | 1351337.22051 | 602.54 | 603.540 | toe | slp | 603.74 | 10/13/99 | (1.20) |
| 210 | PRO | 481929.38781 | 1351387.21678 | 603.18 | 604.180 | toe | slp | 604.37 | 10/15/99 | (1.19) |
| 211 | PRO | 481928.77723 | 1351437.21305 | 603.57 | 604.570 | toe | slp | 604.77 | 10/15/99 | (T1.20) |
| 212 | PROO | 481923.01557 | 1350852.87143 | | 598.350 | top | slp | 598.49 | 10/20/99 | — |
| 213 | PROO | 481922.59384 | 1350887.09652 | | 598.790 | top | slp | 598.85 | 10/20/99 | — |
| 214 | PROO | 481921.98307 | 1350937.09279 | | 599.600 | top | slp | 599.74 | 10/21/99 | — |
| 215 | PROO | 481921.37230 | 1350987.08905 | | 599.640 | top | slp | 599.75 | 10/20/99 | — |
| 216 | PROO | 481920.76153 | 1351037.08532 | | 601.120 | top | slp | 601.15 | 10/21/99 | — |
| 217 | PROO | 481920.15077 | 1351087.08159 | | 600.800 | top | slp | 600.82 | 10/21/99 | — |
| 218 | PROO | 481919.54000 | 1351137.07786 | | 601.190 | top | slp | 601.36 | 10/20/99 | — |
| 219 | PROO | 481918.92923 | 1351187.07413 | | 601.750 | top | slp | 601.92 | 10/20/99 | — |
| 220 | PROO | 481918.31846 | 1351237.07040 | | 602.300 | top | slp | 602.50 | 10/15/99 | — |
| 221 | PROO | 481917.70769 | 1351287.06667 | | 602.660 | top | slp | 602.75 | 10/15/99 | — |
| 222 | PROO | 481917.09692 | 1351337.06294 | | 603.220 | top | slp | 603.39 | 10/15/99 | — |
| 223 | PROO | 481916.48615 | 1351387.05921 | | 603.690 | top | slp | 603.86 | 10/15/99 | — |
| 224 | PROO | 481915.87538 | 1351437.05548 | | 604.000 | top | slp | 604.19 | 10/15/99 | — |
| 225 | PRO | 481986.41066 | 1350824.91119 | 603.00 | 604.030 | mid | pt | 604.03 | 10/15/99 | (T1.03) |
| 226 | PRO | 481986.02811 | 1350855.87230 | 603.38 | 604.410 | mid | pt | 604.43 | 10/21/99 | (T1.05) |
| 227 | PRO | 481985.64048 | 1350887.86650 | 603.46 | 604.490 | mid | pt | 604.53 | 10/21/99 | (T1.07) |
| 229 | PRO | 481985.02883 | 1350937.86276 | 604.12 | 605.150 | mid | pt | 605.15 | 10/15/99 | (T1.03) |
| 230 | PRO | 481984.41718 | 1350987.85902 | 604.58 | 605.610 | mid | pt | 605.70 | 10/21/99 | (T1.12) |
| 231 | PRO | 481983.80554 | 1351037.85528 | 605.07 | 606.100 | mid | pt | 606.22 | 11/5/99 | (T1.15) |
| 232 | PRO | 481983.19389 | 1351087.85154 | 605.54 | 606.570 | mid | pt | 606.70 | 11/5/99 | (T1.16) |
| 233 | PRO | 481982.58224 | 1351137.84780 | 606.01 | 607.010 | mid | pt | 607.21 | 11/5/99 | (T1.20) |
| 234 | PRO | 481981.97060 | 1351187.84406 | 606.54 | 607.570 | mid | pt | 607.76 | 11/5/99 | (T1.22) |
| 235 | PRO | 481981.35895 | 1351237.84031 | 606.88 | 607.910 | mid | pt | 607.93 | 11/3/99 | (T1.05) |
| 236 | PRO | 481980.74730 | 1351287.83657 | 607.58 | 608.610 | mid | pt | 608.62 | 11/3/99 | (T1.04) |
| 237 | PRO | 481980.13565 | 1351337.83283 | 608.06 | 609.090 | mid | pt | 609.11 | 11/3/99 | (T1.03) |
| 238 | PRO | 481979.52401 | 1351387.82909 | 608.43 | 609.460 | mid | pt | 609.46 | 11/3/99 | (T1.03) |
| 239 | PRO | 481978.91236 | 1351437.82535 | 608.94 | 609.970 | mid | pt | 609.99 | 11/3/99 | (T1.05) |
| 240 | ~~PRO~~ PRO | 481978.36066 | 1351482.92119 | 609.56 | 610.590 | mid | pt | 610.78 | 11/3/99 | (T1.22) |
| 241 | PRO | 481951.91885 | 1350835.33843 | 601.40 | 602.430 | mid | pt | 602.35 | 10/20/99 | (T1.15) |
| 242 | PRO | 481951.66996 | 1350854.14149 | 601.54 | 602.570 | mid | pt | 602.69 | 10/20/99 | (T1.15) |
| 243 | PRO | 481951.28247 | 1350887.44689 | 601.78 | 602.810 | mid | pt | 602.92 | 10/20/99 | (T1.14) |
| 244 | PRO | 481950.67189 | 1350937.44316 | 603.50 | 603.530 | mid | pt | 603.54 | 10/21/99 | (T1.04) |

Elev Determined from As Built LCS file

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| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 245 | PRO | 481950.06130 | 1350987.43943 | 603.00 | 604.030 | mid pt | 604.23 | 11/8/99 | (T1.23) |
| 246 | PRO | 481949.45072 | 1351037.43570 | 603.53 | 604.560 | mid pt | 604.66 | 10/21/99 | (T1.13) |
| 247 | PRO | 481948.84014 | 1351087.43198 | 603.97 | 605.000 | mid pt | 605.01 | 10/21/99 | (T1.00) |
| 248 | PRO | 481948.22955 | 1351137.42825 | 604.38 | 605.410 | mid pt | 605.26 | 10/20/99 | (T1.18) |
| 249 | PRO | 481947.61897 | 1351187.42452 | 604.90 | 605.930 | mid pt | 606.23 | 10/20/99 | (T1.23) |
| 250 | PRO | 481947.00838 | 1351237.42079 | 605.38 | 606.410 | mid pt | 606.43 | 10/15/99 | (T1.05) |
| 251 | PRO | 482252.27735 | 1350891.12476 | 599.39 | 600.390 | grid pt | 600.59 | 11/5/99 | (T1.20) |
| 252 | PRO | 482251.66571 | 1350941.12102 | 599.80 | 600.800 | grid pt | 600.99 | 11/5/99 | (T1.19) |
| 253 | PRO | 482251.05408 | 1350991.11728 | 600.30 | 601.300 | grid pt | 601.49 | 11/5/99 | (T1.19) |
| 254 | PRO | 482250.44245 | 1351041.11354 | 600.81 | 601.810 | grid pt | 602.01 | 11/5/99 | (T1.20) |
| 255 | PRO | 482249.83081 | 1351091.10979 | 601.30 | 602.300 | grid pt | 602.48 | 11/9/99 | (T1.18) |
| 256 | PRO | 482249.21918 | 1351141.10605 | 601.85 | 602.850 | grid pt | 602.91 | 11/1/99 | (1.06) |
| 257 | PRO | 482248.60755 | 1351191.10231 | 602.38 | 603.380 | grid pt | 603.45 | 11/1/99 | (T1.07) |
| 258 | PRO | 482247.99591 | 1351241.09857 | 602.76 | 603.760 | grid pt | 603.79 | 11/1/99 | (T1.03) |
| 259 | PRO | 482247.38428 | 1351291.09483 | 603.30 | 604.300 | grid pt | 604.46 | 11/1/99 | (T1.16) |
| 260 | PRO | 482246.77265 | 1351341.09109 | 603.76 | 604.760 | grid pt | 604.94 | 11/1/99 | (T1.18) |
| 261 | PRO | 482246.16101 | 1351391.08735 | 604.28 | 605.280 | grid pt | 605.46 | 11/1/99 | (T1.18) |
| 262 | PRO | 482245.54938 | 1351441.08361 | 604.79 | 605.790 | grid pt | 605.97 | 11/1/99 | (T1.18) |
| 263 | PRO | 481946.39780 | 1351287.41706 | 605.89 | 606.910 | mid pt | 607.02 | 10/15/99 | (T1.13) |
| 264 | PRO | 481945.78722 | 1351337.41333 | 606.53 | 607.560 | mid pt | 607.73 | 11/8/99 | (T1.20) |
| 265 | PRO | 481945.17663 | 1351387.40961 | 607.03 | 608.060 | mid pt | 608.06 | 10/15/99 | (T1.03) |
| 266 | PRO | 481944.56605 | 1351437.40588 | 607.41 | 608.440 | mid pt | 608.44 | 10/15/99 | (T1.03) |
| 267 | PRO | 481944.15885 | 1351470.74843 | 607.84 | 608.870 | mid pt | 608.89 | 10/15/99 | (T1.05) |
| 268 | PRO | 482184.20000 | 1350825.89000 | 603.29 | 603.320 | pt on slp | 603.46 | 10/21/99 | (T1.17) |
| 269 | PRO | 482183.95853 | 1350845.85999 | 597.30 | 598.300 | toe slp | 598.33 | 10/21/99 | (T1.03) |
| 270 | PRO | 482183.88853 | 1350845.92999 | 597.31 | 598.310 | toe slp | 598.45 | 10/21/99 | (T1.14) |
| 271 | PRO | 482180.18853 | 1350845.87999 | 598.37 | 599.370 | toe slp | 599.48 | 10/21/99 | (T1.11) |
| 272 | PRO | 482164.30853 | 1350845.68999 | 598.33 | 599.330 | toe slp | 599.44 | 10/21/99 | (T1.11) |
| 273 | PRO | 482160.60853 | 1350845.64999 | 597.45 | 598.450 | toe slp | 598.58 | 10/21/99 | (T1.13) |
| 274 | PRO | 482159.82853 | 1350844.80999 | 597.45 | 598.450 | toe slp | 598.46 | 10/21/99 | (T1.01) |
| 275 | PRO | 482160.07000 | 1350824.87000 | 602.41 | 603.440 | pt on slp | 603.57 | 11/4/99 | (T1.16) |
| 276 | PRO | 482164.51000 | 1350829.42000 | 603.29 | 603.320 | pt on slp | 603.43 | 10/21/99 | (T1.14) |
| 277 | PRO | 482180.39000 | 1350829.62000 | 603.38 | 603.410 | pt on slp | 603.46 | 10/21/99 | (T1.08) |
| 278 | PRO | 482183.82979 | 1350890.28740 | 597.64 | 598.970 | toe slp | 599.06 | 10/21/99 | (T1.02) |
| 279 | PRO | 482183.21825 | 1350940.28366 | 598.48 | 599.480 | toe slp | 599.63 | 10/15/99 | (T1.15) |
| 280 | PRO | 482182.60672 | 1350990.27992 | 599.02 | 600.020 | toe slp | 600.17 | 10/15/99 | (T1.15) |
| 281 | PRO | 482181.99518 | 1351040.27618 | 599.50 | 600.500 | toe slp | 600.63 | 11/5/99 | (T1.13) |
| 282 | PRO | 482159.58570 | 1350889.99089 | 597.95 | 598.950 | toe slp | 599.06 | 10/21/99 | (T1.11) |
| 283 | PRO | 482158.97510 | 1350939.98716 | 598.94 | 599.440 | toe slp | 599.45 | 10/15/99 | (T1.01) |
| 284 | PRO | 482158.36449 | 1350989.98344 | 598.93 | 599.930 | toe slp | 600.07 | 10/15/99 | (T1.14) |
| 285 | PRO | 482157.75389 | 1351039.97971 | 599.46 | 600.460 | toe slp | 600.57 | 11/5/99 | (T1.11) |
| 286 | PRO | 482181.38364 | 1351090.27244 | 600.12 | 601.120 | toe slp | 601.12 | 11/5/99 | (T1.00) |
| 287 | PRO | 482180.77210 | 1351140.26870 | 600.54 | 601.540 | toe slp | 601.73 | 11/1/99 | (T1.19) |
| 288 | PRO | 482180.16056 | 1351190.26496 | 601.01 | 602.010 | toe slp | 602.01 | 11/1/99 | (T1.00) |
| 289 | PRO | 482179.54903 | 1351240.26122 | 601.50 | 602.500 | toe slp | 602.56 | 11/1/99 | (T1.06) |
| 290 | PRO | 482157.14329 | 1351089.97598 | 600.04 | 601.040 | toe slp | 601.06 | 11/5/99 | (T1.02) |
| 291 | PRO | 482156.53268 | 1351139.97225 | 600.52 | 601.520 | toe slp | 601.59 | 11/1/99 | (T1.04) |
| 292 | PRO | 482155.92208 | 1351189.96852 | 601.04 | 602.040 | toe slp | 602.06 | 11/4/99 | (T1.02) |
| 293 | PRO | 482155.31148 | 1351239.96479 | 601.50 | 602.500 | toe slp | 602.51 | 11/1/99 | (T1.01) |
| 294 | PRO | 482178.93749 | 1351290.25748 | 602.05 | 603.050 | toe slp | 603.12 | 11/1/99 | (T1.07) |
| 295 | PRO | 482178.32595 | 1351340.25374 | 602.51 | 603.510 | toe slp | 603.63 | 11/1/99 | (T1.12) |
| 296 | PRO | 482177.71441 | 1351390.25000 | 603.06 | 604.060 | toe slp | 604.26 | 11/1/99 | (T1.20) |
| 297 | PRO | 482177.10287 | 1351440.24626 | 603.50 | 604.500 | toe slp | 604.55 | 11/1/99 | (T1.05) |
| 298 | PRO | 482154.70087 | 1351289.96106 | 602.01 | 603.010 | toe slp | 603.17 | 11/1/99 | (T1.16) |
| 299 | PRO | 482154.09027 | 1351339.95734 | 602.50 | 603.500 | toe slp | 603.69 | 11/1/99 | (T1.19) |
| 300 | PRO | 482153.47967 | 1351389.95361 | 602.89 | 603.890 | toe slp | 604.02 | 11/1/99 | (T1.13) |
| 301 | PRO | 482152.86906 | 1351439.94988 | 603.38 | 604.380 | toe slp | 604.56 | 11/1/99 | (T1.18) |
| 302 | PRO | 482152.67327 | 1351465.76202 | 603.77 | 604.770 | toe slp | 604.96 | 11/1/99 | (T1.19) |
| 303 | PRO | 482176.67679 | 1351465.31630 | 603.82 | 604.820 | toe slp | 604.98 | 11/1/99 | (T1.16) |
| 304 | PROO | 481890.60776 | 1350807.33175 | | | top slp | Not used | | |

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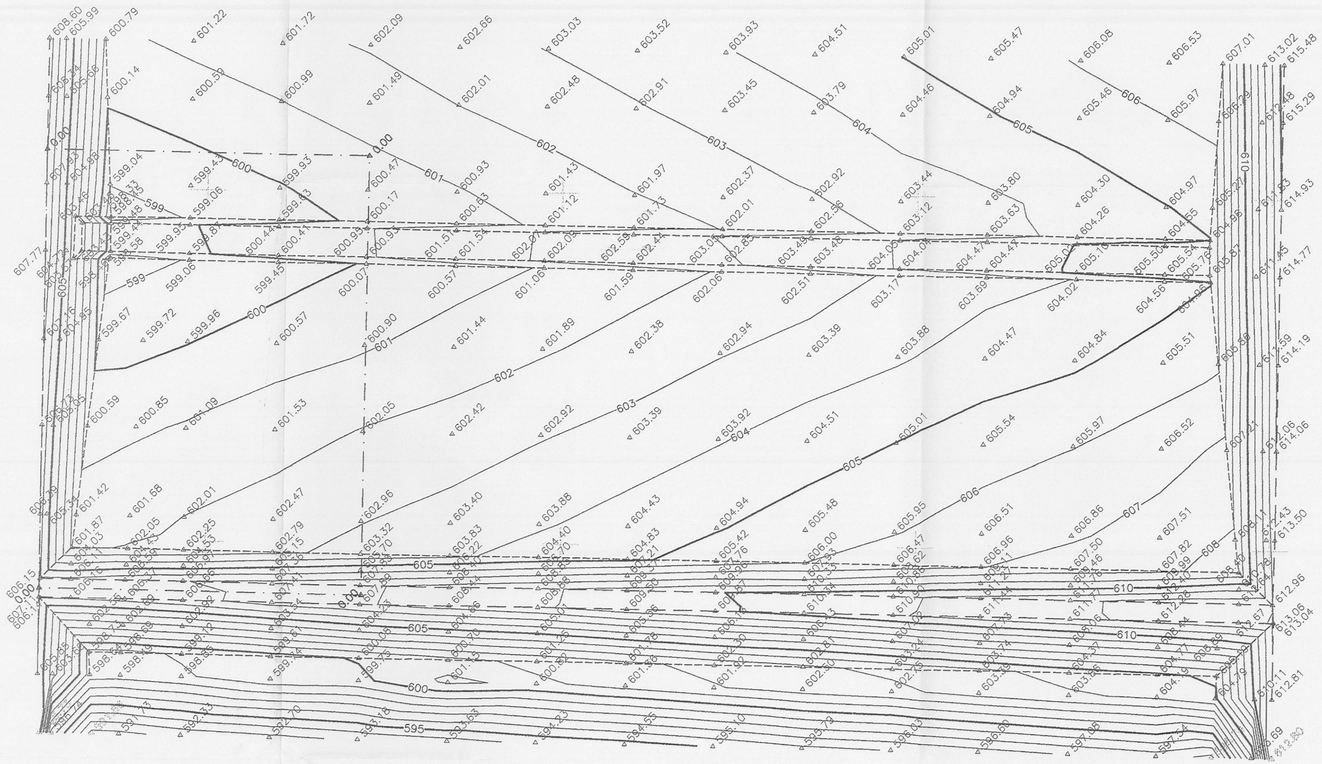
Elev determined from As Built LCS file

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 305 | PROO | 481890.48686 | 1350813.93846 | 596.740 | toe | slp | | |
| 306 | PROO | 481890.23947 | 1350836.85370 | 591.660 | toe | slp | | |
| 307 | PROO | 481890.02457 | 1350852.10107 | 591.700 | toe | slp | 591.73 | 11/8/99 – |
| 308 | PROO | 481889.59630 | 1350886.69352 | 592.130 | toe | slp | 592.33 | 11/8/99 – |
| 309 | PROO | 481888.98553 | 1350936.68979 | 592.700 | toe | slp | 592.70 | 10/21/99 – |
| 310 | PROO | 481888.37476 | 1350986.68606 | 592.980 | toe | slp | 593.18 | 10/21/99 – |
| 311 | PROO | 481887.76400 | 1351036.68233 | 593.620 | toe | slp | 593.63 | 10/21/99 – |
| 312 | PROO | 481887.15323 | 1351086.67860 | 594.140 | toe | slp | 594.23 | 10/21/99 – |
| 313 | PROO | 481886.54246 | 1351136.67486 | 594.530 | toe | slp | 594.55 | 10/21/99 – |
| 314 | PROO | 481885.93169 | 1351186.67113 | 595.090 | toe | slp | 595.10 | 10/21/99 – |
| 315 | PROO | 481885.32092 | 1351236.66740 | 595.640 | toe | slp | 595.79 | 10/21/99 – |
| 316 | PROO | 481884.71015 | 1351286.66367 | 596.000 | toe | slp | 596.03 | 10/21/99 – |
| 317 | PROO | 481884.09938 | 1351336.65994 | 596.560 | toe | slp | 596.60 | 10/21/99 – |
| 318 | PROO | 481883.48861 | 1351386.65621 | 597.030 | toe | slp | 597.08 | 10/21/99 – |
| 319 | PROO | 481882.87784 | 1351436.65248 | 597.340 | toe | slp | 597.54 | 10/21/99 – |
| 320 | PROO | 481882.50969 | 1351468.12575 | 596.740 | toe | slp | | |
| 321 | PROO | 481882.24456 | 1351490.27858 | 603.450 | toe | slp | 603.69 | 10/21/99 – |
| 322 | PROO | 481882.08207 | 1351501.76570 | | top | slp | Not used | |



NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

LEGEND:

| | |
|---|---|
| ▲ 618.65 | = CERTIFIED POINT |
| ▲ 618.65 | = NON CERTIFIED POINT |
| ▲ 0.00 | = CATCHMENT AREA POINT |
| ——600—— | INDEX (5 FOOT) ELEVATION CONTOUR LINE |
| ——601—— | ONE FOOT ELEVATION CONTOUR LINE |
| — · — · — · — | CATCHMENT AREA |

INFORMATION ONLY

FIELD SURVEY COMPLETED NOV 9, 1999. ADK 12/13/99

GRAPHIC SCALE

40 0 20 40 80 160

( IN FEET )
1 inch = 40 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Please Resubmit
Sig: [signature] Date: 12/13/99

20102-OPTA-DWG-021A (REV. 0)

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | NOV. 15, 1999 |
| SCALE: | 1"=40' |
| DRAWN BY: | BJL |
| PRINT DATE: | NOV. 15, 1999 |

STATE OF OHIO LYNN E. HIRSCH E-5394 REGISTERED SURVEYOR

OSDF PHASE 2
AS-BUILT
PROTECTIVE LAYER
OSDF CELL 3 08/18/1999

DATE: REVISIONS:

FILE NAME: PRCc3.dwg

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000062

SHEET NO. 1 OF 2

F-2741

G:\LAND PROJECTS\20102\OPTA\DWG\PRCc3.dwg BJL - DECEMBER 04, 1999 - 14:36:21 (PRES)

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| 4002 | 482195.55312 | 1351440.47197 | 604.97000 | grid point |
| 4003 | 482201.66945 | 1350940.50938 | 599.93000 | grid point |
| 4004 | 482201.05782 | 1350990.50564 | 600.47000 | grid point |
| 4005 | 482200.44619 | 1351040.50190 | 600.93000 | grid point |
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| 4008 | 482198.61129 | 1351190.49068 | 602.37000 | grid point |
| 4009 | 482197.99965 | 1351240.48694 | 602.92000 | grid point |
| 4010 | 482197.38802 | 1351290.48320 | 603.44000 | grid point |
| 4011 | 482196.77639 | 1351340.47946 | 603.80000 | grid point |
| 4012 | 482196.16475 | 1351390.47571 | 604.30000 | grid point |
| 4019 | 482285.23249 | 1350891.52792 | 601.22000 | south limit |
| 4020 | 482284.62096 | 1350941.52418 | 601.72000 | south limit |
| 4021 | 482284.00540 | 1350991.52039 | 602.09000 | south limit |
| 4022 | 482283.39387 | 1351041.51665 | 602.66000 | south limit |
| 4023 | 482282.78234 | 1351091.51291 | 603.03000 | south limit |
| 4024 | 482282.17082 | 1351141.50917 | 603.52000 | south limit |
| 4025 | 482281.55929 | 1351191.50543 | 603.93000 | south limit |
| 4026 | 482280.94776 | 1351241.50169 | 604.51000 | south limit |
| 4027 | 482280.33623 | 1351291.49795 | 605.01000 | south limit |
| 4028 | 482279.72470 | 1351341.49421 | 605.47000 | south limit |
| 4029 | 482279.11317 | 1351391.49047 | 606.08000 | south limit |
| 4030 | 482278.50164 | 1351441.48673 | 606.53000 | south limit |
| 4031 | 482286.10498 | 1350820.03161 | 605.99000 | south limit mid pt |
| 4032 | 482277.84502 | 1351495.46825 | 613.02000 | south limit mid pt |
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| 4082 | 482063.71285 | 1350888.82000 | 601.09000 | grid pt |

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| 4158 | 481989.40496 | 1351337.94604 | 606.96000 | toe slp |

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| 4233 | 481982.58224 | 1351137.84780 | 607.21000 | mid pt |

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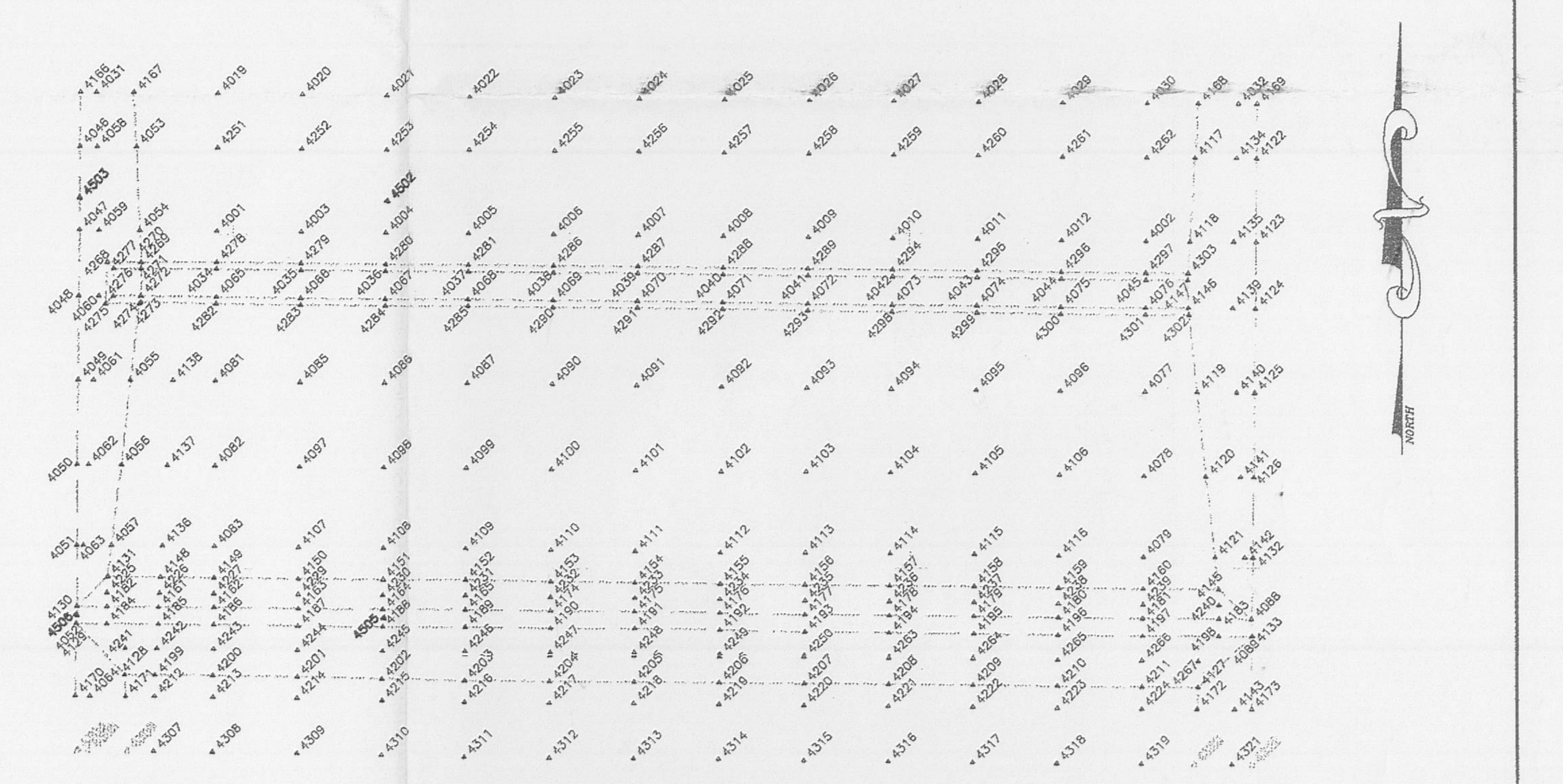
| 4289 | 482179.54903 | 1351240.26122 | 602.56000 | toe slp |
| 4290 | 482157.14329 | 1351089.97598 | 601.06000 | toe slp |
| 4291 | 482156.53268 | 1351139.97225 | 601.59000 | toe slp |
| 4292 | 482155.92208 | 1351189.96852 | 602.06000 | toe slp |
| 4293 | 482155.31148 | 1351239.96479 | 602.51000 | toe slp |
| 4294 | 482178.93749 | 1351290.25748 | 603.12000 | toe slp |
| 4295 | 482178.32595 | 1351340.25374 | 603.63000 | toe slp |
| 4296 | 482177.71441 | 1351390.25000 | 604.26000 | toe slp |
| 4297 | 482177.10287 | 1351440.24626 | 604.55000 | toe slp |
| 4298 | 482154.70087 | 1351289.96106 | 603.17000 | toe slp |
| 4299 | 482154.09027 | 1351339.95734 | 603.69000 | toe slp |
| 4300 | 482153.47967 | 1351389.95361 | 604.02000 | toe slp |
| 4301 | 482152.86906 | 1351439.94988 | 604.56000 | toe slp |
| 4302 | 482152.67327 | 1351465.76202 | 604.96000 | toe slp |
| 4303 | 482176.67679 | 1351465.31630 | 604.98000 | toe slp |
| 4304 | 481880.60778 | 1350807.33175 | 605.73000 | toe slp not certifie |
| 4305 | 481890.48058 | 1350813.93846 | 598.74000 | toe slp not certifie |
| 4306 | 481890.23947 | 1350838.85370 | 591.66000 | toe slp not certifie |
| 4307 | 481890.02457 | 1350852.10107 | 591.73000 | toe slp |

| | | | | |
|---|---|---|---|---|
| 4308 | 481889.59630 | 1350886.69352 | 592.33000 | toe slp |
| 4309 | 481888.98553 | 1350936.68979 | 592.70000 | toe slp |
| 4310 | 481888.37476 | 1350986.68606 | 593.18000 | toe slp |
| 4311 | 481887.76400 | 1351036.68233 | 593.63000 | toe slp |
| 4312 | 481887.15323 | 1351086.67860 | 594.23000 | toe slp |
| 4313 | 481886.54246 | 1351136.67486 | 594.55000 | toe slp |
| 4314 | 481885.93169 | 1351186.67113 | 595.10000 | toe slp |
| 4315 | 481885.32092 | 1351236.66740 | 595.79000 | toe slp |
| 4316 | 481884.71015 | 1351286.66367 | 596.03000 | toe slp |
| 4317 | 481884.09938 | 1351336.65994 | 596.60000 | toe slp |
| 4318 | 481883.48861 | 1351386.65621 | 597.08000 | toe slp |
| 4319 | 481882.87784 | 1351436.65248 | 597.54000 | toe slp |
| 4320 | 481882.58961 | 1351466.12575 | 598.74000 | toe slp not certifie |
| 4321 | 481882.24456 | 1351490.27858 | 603.69000 | toe slp |
| 4322 | 481882.08207 | 1351501.78578 | 612.89000 | toe slp not certifie |
| **4502** | **482220.47580** | **1350991.36961** | **0.00000** | **catchment area** |
| **4503** | **482222.69725** | **1350809.78326** | **0.00000** | **catchment area** |
| **4505** | **481970.49444** | **1350988.31660** | **0.00000** | **catchment area** |
| **4506** | **481972.71590** | **1350806.73015** | **0.00000** | **catchment area** |



KEY MAP

INFORMATION ONLY

GRAPHIC SCALE

80 0 40 80 160 320

( IN FEET )
1 inch = 80 ft.

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 12/13/99

20102-OPTA-DWG-021B (REV. 0)

## NOTES:

1.) ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929).

2.) GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.

## LEGEND:

| | | | | | |
|---|---|---|---|---|---|
| 235 | 481930.755520 | 1351337.229750 | 597.310000 | toe slp | = CERTIFIED POINT |
| 235 | 481930.755520 | 1351337.229750 | 597.310000 | toe slp | = NONCERTIFIED POINT |
| **235** | **481930.755520** | **1351337.229750** | **597.310000** | **toe slp** | = CATCHMENT AREA POINT |

PETRO ENVIRONMENTAL TECHNOLOGIES, INC.
FEMP
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

HIRSCH & ASSOC. SURVEYING INC.
3610 STATELINE RD., OKEANA, OHIO 45053
(513) 367-0534

STATE OF OHIO
LYNN E. HIRSCH
S-5738
REGISTERED SURVEYOR
[signature]

OSDF PHASE 2
AS-BUILT
PROTECTIVE LAYER
OSDF CELL 3 06/25/1999

DATE: REVISIONS:

| | |
|---|---|
| JOB NO. | 20102 |
| DATE: | NOV. 15, 1999 |
| SCALE: | 1"=80' |
| DRAWN BY: | BJL |
| PRINT DATE: | NOV. 15, 1999 |

FILE NAME: PRCc3-C.dwg

2

000063

SHEET NO. 2 OF 2

-2741

G:\LAND PROJECTS\990607\0008\DWG\PRCc3-C.dwg BJL - DECEMBER 04, 1999 - 14:35:09 XREFS:

2741

# GEOMEMBRANE RECORD DRAWINGS

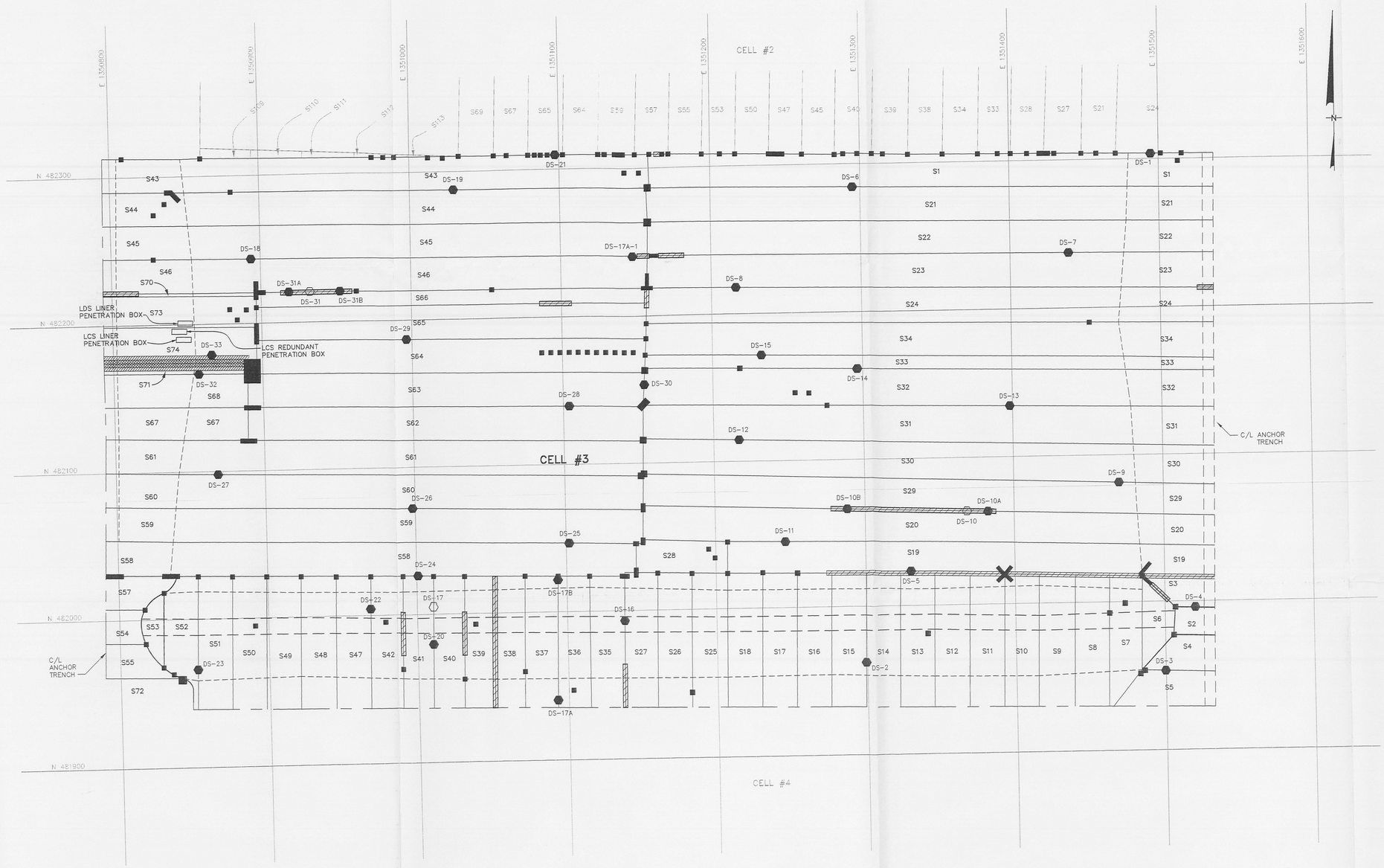
2741

SECONDARY

F-2741

# PRIMARY

000066A




## LEGEND

| | |
|---|---|
| S11 | GEOMEMBRANE PANEL NUMBER |
| DS-5 | DESTRUCTIVE TEST-PASS |
| DS-1 | DESTRUCTIVE TEST-FAIL |
| | PATCH REPAIR LOCATION |
| | PIPE PENETRATION |
| | ℄ TOE OF SLOPE |
| | CREST OF SLOPE |
| | ℄ ANCHOR TRENCH |
| | TOP OF BERM |
| | EXTRUSION WELD |
| | CAPPED SEAM |
| | FUSION WELD |

NOTES:

1. PANEL LOCATIONS ARE IN GENERAL ACCORDANCE WITH SURVEY INFORMATION PROVIDED BY ISTRE COMPANY, INC., HIRSCH AND ASSOCIATES SURVEYING, INC., AND FIELD MEASUREMENTS SHOWN ON THE SEAM AND PANEL REPAIR LOCATION LOGS (SEE APPENDIX P).
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD] OF 1929).
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. MAJOR GEOMEMBRANE REPAIRS ARE SHOWN. FOR MINOR REPAIRS REFER TO APPENDIX P (SEAM AND REPAIR LOCATION LOGS).

30 15 0 30 60
SCALE IN FEET

| REV. NO. | DATE | DESCRIPTION | DES. BY | DR. BY | CHK. BY | RVW. BY | APP. BY |
|---|---|---|---|---|---|---|---|

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE II

TITLE:
CELL 3 - SECONDARY LINER GEOMEMBRANE PANEL LAYOUT

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
15 Dec '99
DATE

SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

| | |
|---|---|
| FDF PROJECT NO.: | 20102 |
| FDF SUBCONTRACT NO.: | 95P5005028 |
| FDF DRAWING NO.: | 90X-6000-G-00230 |
| GEOSYNTEC PROJECT NO.: | GG0573-04 |
| GEOSYNTEC DOCUMENT NO.: | 0573-002 |
| SHEET NO.: | 2 |
| REVISION NO.: | A |

000066

-2741

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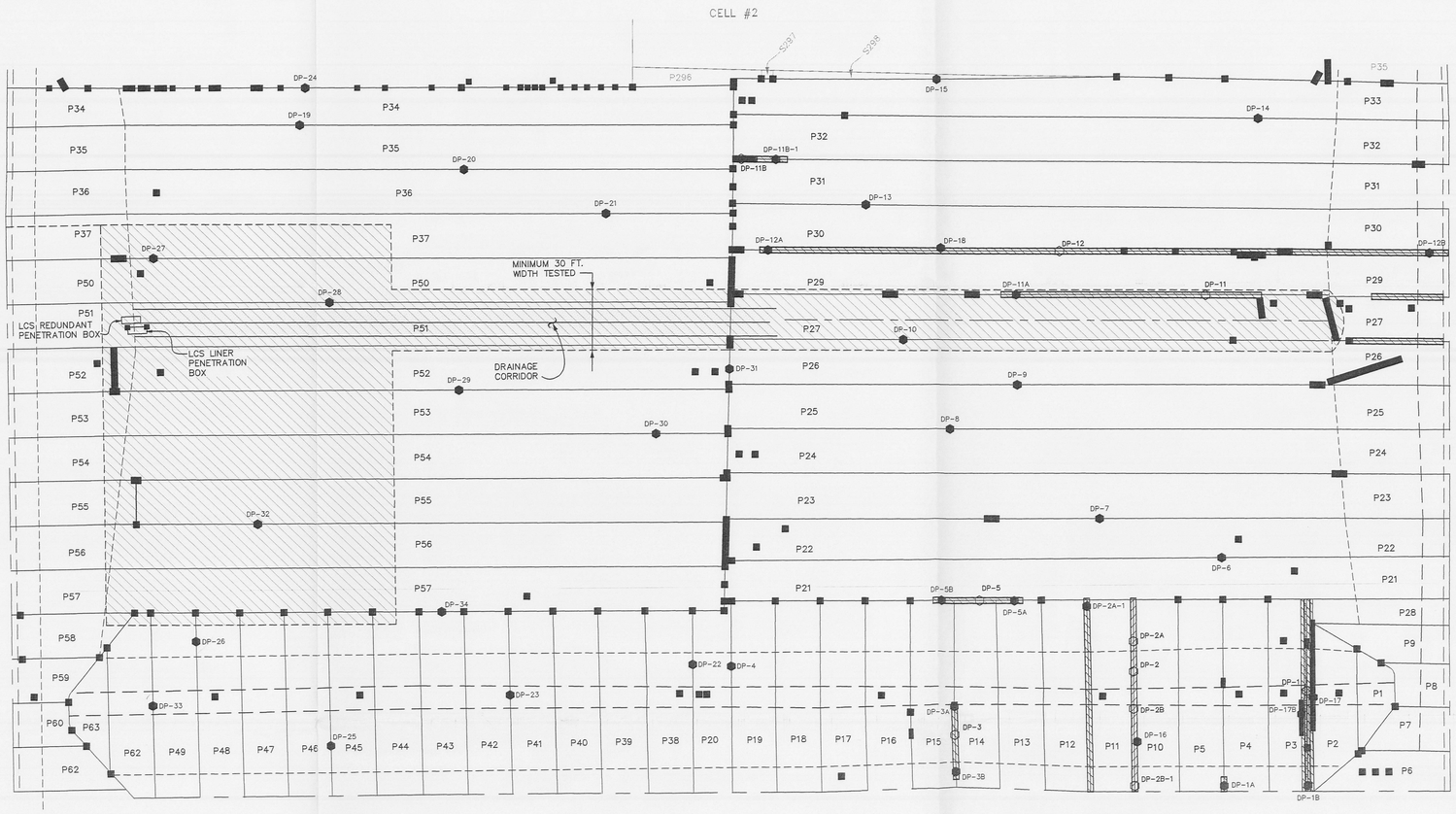


## LEGEND

| | |
|---|---|
| S11 | GEOMEMBRANE PANEL NUMBER |
| DS-34 | DESTRUCTIVE TEST–PASS |
| DS-1 | DESTRUCTIVE TEST–FAIL |
| | PATCH REPAIR LOCATION |
| | PIPE PENETRATION |
| | ℄ TOE OF SLOPE |
| | CREST OF SLOPE |
| | ℄ ANCHOR TRENCH |
| | TOP OF BERM |
| | EXTRUSION WELD |
| | CAPPED SEAM |
| | FUSION WELD |
| | AREA TESTED USING DEMONSTRATION TECHNIQUE FOR ELECTRICAL LEAK DETECTION. |

NOTES:

1. PANEL LOCATIONS ARE IN GENERAL ACCORDANCE WITH SURVEY INFORMATION PROVIDED BY ISTRE COMPANY, INC., HIRSCH AND ASSOCIATES SURVEYING, INC., AND FIELD MEASUREMENTS SHOWN ON THE SEAM AND PANEL REPAIR LOCATION LOGS (SEE APPENDIX P).
2. ELEVATIONS ARE IN FEET ABOVE SEA LEVEL DATUM. (NOTE: "SEA LEVEL DATUM" REFERS TO THE NATIONAL GEODETIC VERTICAL DATUM [NGVD] OF 1929).
3. GRID COORDINATE SYSTEM CORRESPONDS TO STATE PLANAR NORTH AMERICAN DATUM (NAD) 1983 OHIO SOUTH.
4. MAJOR GEOMEMBRANE REPAIRS ARE SHOWN. FOR MINOR REPAIRS REFER TO APPENDIX P (SEAM AND REPAIR LOCATION LOGS).

30 15 0 30 60
SCALE IN FEET

| REV. NO. | DATE | DESCRIPTION | DES. BY | DR. BY | CHK. BY | RVW. BY | APP. BY |
|---|---|---|---|---|---|---|---|

OWNER/FACILITY:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR DANIEL FERNALD

PROJECT:
ON-SITE DISPOSAL FACILITY – PHASE II

TITLE:
CELL 3 – PRIMARY LINER GEOMEMBRANE PANEL LAYOUT

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE
15 Dec 99
DATE
SEAL

GEOSYNTEC CONSULTANTS
1100 LAKE HEARN DRIVE
ATLANTA, GEORGIA 30342 USA

| | |
|---|---|
| FDF PROJECT NO.: | 20102 |
| FDF SUBCONTRACT NO.: | 95PS005028 |
| FDF DRAWING NO.: | 90X-6000-G-00230 |
| GEOSYNTEC PROJECT NO.: | 000573-04 |
| GEOSYNTEC DOCUMENT NO.: | 0573-001 |
| SHEET NO.: | 1 |
| REVISION NO.: | A |

E-2741

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# APPENDIX T

# REQUESTS FOR CLARIFICATION OF INFORMATION (RCIs)

RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2) S/C NO.: 614 | (5) Pg 1 OF 2 KBT | (6) DATE 3/2/99 |
| (3)S/C TITLE: Southern Waste Unit Excavation / On Site Disposal Facility Phase II Project | F-2741 | (11) RCI NO.: RCI-20102-045R | |
| RESPONSIBLE DISCIPLINE: E [ ] M [ ] C [X] OTHER [ ] | (4A) RCI/DCN/TITLE: Waiver of Liner Installer Approval Letter | (11) DCN NO.: | |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| Technical Specifications | 20102-TS-0001 | 0 | 02770-1.04.A |

(9) [X] RCI - INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [ ] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Paragraph 1.04.A of Technical Specification Section 02770 states that the Contractor is to submit a copy of the Installer's letter of approval or license by the geomembrane manufacturer. Due to the way the contract is structured, FDF selects the manufacturer to provide geosynthetics for this project, while the Contractor is free to select the Installer of its' choice. The Installer selected by the Contractor may or may not be previously approved by FDF's selected geosynthetics manufacturer, thus such approval would have to be garnered in order to meet the requirements of this contractual submittal requirement. Additionally, the manufacturer of the geosynthetics provides a warranty for that material while the Installer (or Petro Environmental) provides the warranty to cover geosynthetics installation. In this fashion, both warranties are independent of each other, therefore, the requirement to have the Installer approved by the manufacturer to install their products is not a necessity. Therefore, Petro Environmental is requesting that this submittal requirement be waived.

INFORMATION ONLY

J. Richard Schairbaum

| (10) REQUESTER: | COMPANY: | DATE: | (12) FCE / PE | DATE: |
|---|---|---|---|---|
| J. Richard Schairbaum | Petro Environmental Technologies, Inc. | 3/2/99 | J.C. JENKINS J.C. Jenkins | 5/11/99 |

(13) RESPONSE FOR RCI, IS A DCN REQ'D [X] NO [ ] YES (14) FOR DCN: [ ] APPROVED [ ] APPROVED AS NOTED [ ] DISAPPROVED

See page 2 of 2 for response

7/8/99

GEOSYNTEC RCI - DCN ACCEPTANCE

| | |
|---|---|
| (15) DESIGN ORGANIZATION APPROVAL: DATE: [illegible] [ ] FIT [X] FORM [ ] FUNCTION | (20) CHARGE NO. FOR CAD SERVICES TO INCORPORATE |

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEW ARE COMPLETE: (DCN ONLY) DATE:

000069

PERFORMANCE GRADE: (17) _____

| | |
|---|---|
| (18) CONSTRUCTION CONCURRENCE: Bill Zebrak 7/26/99 DATE: | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| PURCHASE REQUISITION REQUIRED: [ ] YES [X] NO (19) | ORIGINAL |

F-4259 (2/16/98)

**Response to RCI-20102-045R**
**Dated 3/2/99**
**(Page 2 of 2)**

The purpose of the approval and/or license of the Installer by the geomembrane Manufacturer is to enable the Installer obtain technical support from the Manufacturer to address problems that may be encountered during installation. For example, in the event repetitive destructive seam test failures are encountered, the geomembrane Manufacturer technical support team may be able assist the Installer to troubleshoot the welding (or seaming) problems. Different geomembrane manufacturers (e.g., GSE, NSC, Serrot, etc.) use resins from different sources (e.g., Mobil, Chevron, etc.) to produce geomembrane rolls and welding rods. The geomembrane Manufacturer may be helpful to confirm compatibility of welding equipment with the resin used to produce geomembrane rolls and welding rods.

Many geomembrane manufacturers would void their material warranty if an approved Installer did not install them. This may become an issue in the event of problems with the material after installation.

Therefore, approval or license of the Installer by the geomembrane Manufacturer is necessary to ensure smooth installation of the geomembrane liner for the Cell 3 project. It is suggested that FDF assist Petro in obtaining the approval or license for the Installer (The Istre Company) from GSE (the geomembrane Manufacturer).

8 July 1999

RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| | | | |
|---|---|---|---|
| WP / WO NO.: 20102 | (2) S/C NO.: 614 | (5) Pg 1 OF 1 | (6) DATE 3/2/99 |
| S/C TITLE: Southern Waste Unit Excavation / On Site Disposal Facility Phase II Project | 2741 | (11) RCI NO.: RCI-20102-046R | |
| ESPONSIBLE DISCIPLINE: E [ ] M [ ] C [X] OTHER [ ] | (4A) RCI/DCN/TITLE: Modification to Clay Liner Compaction Equipment | (11) DCN NO.: | |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| chnical Specifications | 20102-TS-0001 | 0 | 02225-2.02.G |

[X] RCI - INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [ ] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

ragraph 2.02.G of Technical Specification Section 02225 requires that a Caterpillar 815B compactor (or equal) be used for compacting clay liner/cap material. Petro Environmental is requesting permission to use any of the following: Cat 815 Compactor, Cat 825 mpactor, or the Cat CP-563C padded drum vibratory soil compactor. Performance advantages of the Cat 825 and Cat CP-563C over Cat 815 are as follows: heavier operating weight for the Cat 825 (69,828 lbs.) for use on the cell floor and lighter operating weight for Cat 563 (25,700 lbs.) making it more stable during slope construction; compactive force of the Cat 825 is 69,828 lbs. (static loading) d the compactive effort generated by the Cat 563 is 75,700 lbs. (50,000 lbs. centrifugal force plus the operational weight); and approx-ate effective ground pressure of the Cat 825 is 130 psi, while the ground pressure for the Cat 563 is 300 psi.

summary, use of the Cat 825 and Cat 563 exceeds the compactive effort produced by the Cat 815B Compactor. Petro Environmental equesting that a DCN be issued to permit the use of any of these pieces of equipment during construction of the clay liner/cap. The uipment specifications for each of these are attached.

| REQUESTER: | COMPANY: | DATE: | (12) FCE / PE | DATE: |
|---|---|---|---|---|
| Richard Schairbaum | Petro Environmental Technologies, Inc. | 3/2/99 | Don Guetze / James C. Jenkins | 3/3/99 |

RESPONSE FOR RCI, IS A DCN REQ'D [X] NO [ ] YES (14) FOR DCN: [ ] APPROVED [ ] APPROVED AS NOTED [ ] DISAPPROVED

See Page 4 for response

INFORMATION ONLY

GEOSYNTEC RCI - DCN ACCEPTANCE

| | | |
|---|---|---|
| DESIGN ORGANIZATION APPROVAL: Daniel Bodine [ ] FIT [X] FORM [ ] FUNCTION | DATE: 6 March 1999 | (20) CHARGE NO. FOR CAD SERVICES TO INCORPORATE |

FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEW ARE COMPLETE: (DCN ONLY) DATE:

RMANCE GRADE: (17) _____

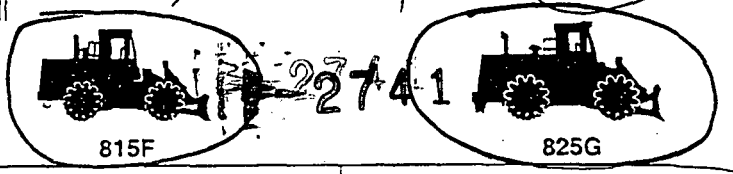
000071

| | | |
|---|---|---|
| CONSTRUCTION CONCURRENCE: | DATE: 03/31/99 | (21) WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| CHASE REQUISITION REQUIRED: [ ] YES [X] NO (19) | | |

A259 (2/16/98)

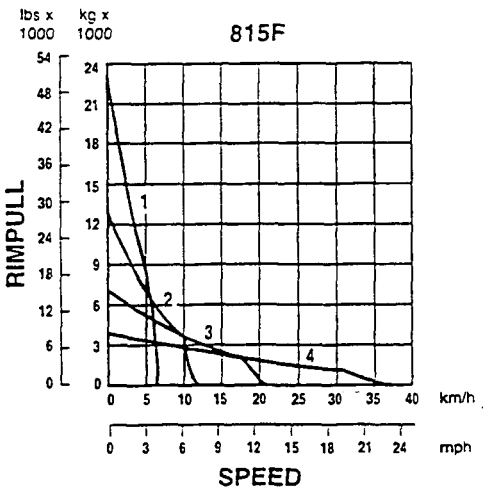
RCI-20102-046R Page 2 of 4 (US)

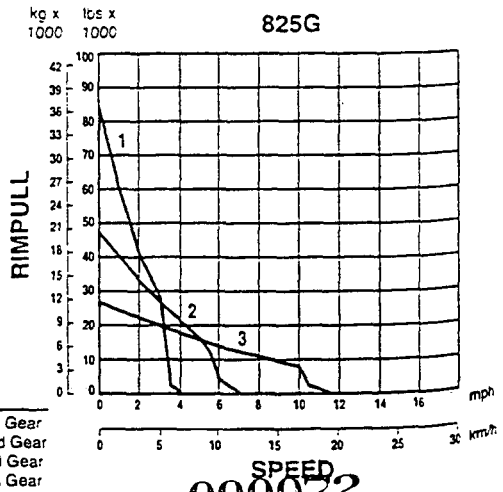





| MODEL | 815F | | 825G | |
|---|---|---|---|---|
| Flywheel Power | 164 kW | 220 hp | 235 kW | 315 hp |
| Operating Weight* | 20 879 kg | 45,934 lb | 31 740 kg | 69,828 lb |
| Engine Model | 3306 DITA | | 3406C DITA | |
| Rated Engine RPM | 2200 | | 2100 | |
| No. Cylinders | 6 | | 6 | |
| Displacement | 10.5 L | 638 in³ | 14.6 L | 893 in³ |
| Speeds: | | | | |
| Forward | 4 | | 3 | |
| Reverse | 4 | | 3 | |
| Turning Circle with Blade | 12.6 m | 41'5" | 14.6 m | 48'0" |
| Fuel Tank Refill Capacity | 464 L | 122.6 U.S. gal | 630 L | 166.5 U.S. gal |
| TAMPING FOOT WHEELS: | | | | |
| Each Drum Width | 978 mm | 38.5" | 1125 mm | 44.3" |
| Diameters, over feet | 1.42 m | 55.9" | 1.68 m | 66" |
| over drum | 1.03 m | 40.5" | 1.29 m | 51" |
| Feet per Wheel | 60 | | 65 | |
| Feet per Row | 12 | | 13 | |
| Rows of Feet | 5 | | 5 | |
| Foot Length | 198 mm | 7.8" | 203 mm | 8" |
| End Area Per Foot | 116 cm² | 18 in² | 183 cm² | 28.4 in² |
| Width of Two Pass Coverage | 4.35 m | 14'3" | 4.88 m | 16'0" |
| GENERAL DIMENSIONS: | | | | |
| Height (top of ROPS) | 3.34 m | 11'0" | 3.74 m | 12'3" |
| Height (stripped top)** | 2.39 m | 7'10" | 2.65 m | 8'8" |
| Wheel Base | 3.35 m | 11'0" | 3.70 m | 12'2" |
| Overall Length with Dozer | 6.82 m | 22'5" | 8.24 m | 27'1" |
| Width over Drums | 3.24 m | 10'8" | 3.65 m | 12'0" |
| Ground Clearance | 423 mm | 1'5" | 355 mm | 1'2" |
| STRAIGHT BULLDOZER: | | | | |
| Width | 3.76 m | 12'4" | 4.41 m | 14'5" |
| Height | 860 mm | 2'10" | 1.03 m | 3'5" |

*Operating Weight includes coolant, lubricants, bulldozer, hydraulics, ROPS canopy, full fuel tank and operator.
**Height (stripped top) — without ROPS, exhaust, seat back or other easily removed encumbrances.




KEY
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear

000072

RCI-20102-046R
Page 2/3 of 4 JB

27A1

Specifications | Padded Drum Vibratory Soil Compactors

| MODEL | CP-433C | | CP-533C* | | CP-563C | |
|---|---|---|---|---|---|---|
| Flywheel Power | 80 kW | 107 hp | 108 kW | 145 hp | 108 kW | 145 hp |
| Rated Engine RPM | 2500 | | 2200 | | 2200 | |
| No. Cylinders | 4 | | 6 | | 6 | |
| Displacement | 4.0 L | 243 in³ | 6.6 L | 403 in³ | 6.6 L | 403 in³ |
| Engine Model | 3054T | | 3116T | | 3116T | |
| Speeds: | | | | | | |
| Forward | 2 | | 2 | | 2 | |
| Reverse | 2 | | 2 | | 2 | |
| Max. Speed (For./Rev.) | 13.3 km/h | 0-8 mph | 12.8 km/h | 0-8 mph | 12.8 km/h | 0-8 mph |
| Operating Weight | 6912 kg | 15,225 lb | 10 760 kg | 23,700 lb | 11 670 kg | 25,700 lb |
| Shipping Weight | 6628 kg | 14,600 lb | 10 646 kg | 23,450 lb | 11 360 kg | 25,000 lb |
| Drive | Drum/rear wheel | | Drum/rear wheel | | Drum/rear wheel | |
| Steering: | | | | | | |
| Inside radius | 3008 mm | 9'10" | 3912 mm | 12'10" | 3912 mm | 12'10" |
| Outside radius | 4684 mm | 15'4" | 6325 mm | 20'9" | 6325 mm | 20'9" |
| Steering angle | ±37° | | ±30° | | ±30° | |
| Vibratory System: | | | | | | |
| Ecc. Weight Drive | Hydraulic | | Hydraulic | | Hydraulic | |
| Frequency | 30 Hz | 1800 vpm | 30 Hz | 1800 rpm | 30 Hz | 1800 vpm |
| Amplitude Settings | 2 | | 2 | | 2 | |
| Centrifugal Force | | | | | | |
| Low amplitude | 6273 kg | 13,800 lb | 22 680 kg | 50,000 lb | 22 680 kg | 50,000 lb |
| High amplitude | 12 727 kg | 28,000 lb | 11 360 kg | 25,000 lb | 11 360 kg | 25,000 lb |
| General Dimensions: | | | | | | |
| Overall width w/blade | 1981 mm | 6'6" | 2740 mm | 9'0" | 2740 mm | 9'0" |
| Overall width w/o blade | 1905 mm | 6'3" | 2440 mm | 8'0" | 2440 mm | 8'0" |
| Drum width | 1680 mm | 5'6" | 2130 mm | 7'0" | 2130 mm | 7'0" |
| Drum diameter over pads | 1220 mm | 4'0" | 1549 mm | 5'1" | 1549 mm | 5'1" |
| Tires | 14.9" × 24" 6-ply | | 23.1" × 26" 8-ply | | 23.1" × 26" 8-ply | |
| Overall height | 2900 mm | 9'6" | 2667 mm | 8'9" | 2997 mm | 9'10" |
| Wheel to drum | 2583 mm | 8'6" | 2740 mm | 9'10" | 2740 mm | 9'0" |
| Overall length | 4825 mm | 15'10" | 5258 mm | 17'3" | 5258 mm | 17'3" |
| Curb clearance | 380 mm | 15" | 483 mm | 19" | 483 mm | 19" |
| Service Refill Capacities: | | | | | | |
| Fuel tank | 167 L | 44 U.S. gal | 254 L | 67 U.S. gal | 254 L | 67 U.S. gal |
| Crankcase | 6.8 L | 1.8 U.S. gal | 15.1 L | 4 U.S. gal | 15.1 L | 4 U.S. gal |
| Hydraulic fluid | 71 L | 18.7 U.S. gal | 132 L | 35 U.S. gal | 132 L | 35 U.S. gal |

*Not offered in United States.

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000073

**Response to RCI –20102-046R**
**(Dated 03/02/99, Page 4 of 4)**

Because the Caterpillar 825 soil compactor is of the same type design and heavier than the Caterpillar 815 soil compactor it is approved as equal to or better than the Caterpillar 815 soil compactor. No DCN is required.

Use of the Caterpillar CP-563C vibratory compactor cannot be approved without another Test Pad Program demonstrating that this equipment is equal to or better than a Cat 815 soil compactor. Loose lift thickness and minimum number of compactor passes would be determined in this Test Pad Program. In addition the affects of compactor vibration on subgrade groundwater at the toe of the slope is a concern. Shutting off the vibration would not be an acceptable option.

As a technical note for the reader's information, the total dynamic force produced by the CP-563C vibratory compactor in the low amplitude mode is not 75,700 lbs. as indicated in the RCI.

Jon Burnett
6 March 1999
Daniel Boden
6 March 1999

RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| | | | |
|---|---|---|---|
| )WP / WO NO.: 20102 | (2) S/C NO.: 614 | (5) Pg 1 OF 1 3 gcg | (6) DATE 3/24/99 |
| )S/C TITLE: Southern Waste Unit Excavation / On Site Disposal Facility Phase II Project 2741 | | (11) RCI NO.: RCI-20102-048R | |
| SPONSIBLE DISCIPLINE: E [ ] M [ ] C [X] OTHER [ ] | (4A) RCI/DCN/TITLE: Equipment Wash Pad Relocation Plan | (11) DCN NO.: | |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| onstruction Drawings | 90X-6000-G-00086 | 0 | Detail 32 and Section B |

) [X] RCI - INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [ ] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

etro Environmental proposes to construct an 8-in. thick reinforced concrete pad at the OSDF Equipment Wash Facility. The pad will be oped to divert water directly into the sump, as opposed to the current drainage scheme which has water percolating through a gravel bed id into a perforated drain pipe. The current design makes it difficult to maintain an area relatively free of debris and mud during wheel ashing and decontamination activities. Please review the attached sketches and provide comments.

MAR 31 1999

INFORMATION ONLY

J. Richard Schairbaum

| | | | | |
|---|---|---|---|---|
| ) REQUESTER: Richard Schairbaum | COMPANY: Petro Environmental Technologies, Inc. | DATE: 3/24/99 | (12) FCE / PE JAMES C. JENKINS | DATE: 3/24 |

) RESPONSE FOR RCI, IS A DCN REQ'D [X] NO [ ] YES (14) FOR DCN: [ ] APPROVED [ ] APPROVED AS NOTED [X] DISAPPROVED

This RCI is disapproved. Revise sketches per comments and comments from previous submittal. New RCI must be written following corrections

GeoSonTec Consultants

RCI - DCN ACCEPTANCE

| | | |
|---|---|---|
| ) DESIGN ORGANIZATION APPROVAL: Jim Burnett / Jim Burnett [ ] FIT [ ] FORM [ ] FUNCTION | DATE: 19 April 1999 | (20) CHARGE NO. FOR CAD SERVICES TO INCORPORATE |

) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEW ARE COMPLETE: (DCN ONLY) DATE:

RMANCE GRADE: (17) N.A.

| | | |
|---|---|---|
| , CONSTRUCTION CONCURRENCE: Bruce A Schwartz | DATE: 4/28/99 | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| RCHASE REQUISITION REQUIRED: [ ] YES [X] NO (19) | | |

000075

F-4259 (2/16/98) ORIGINAL

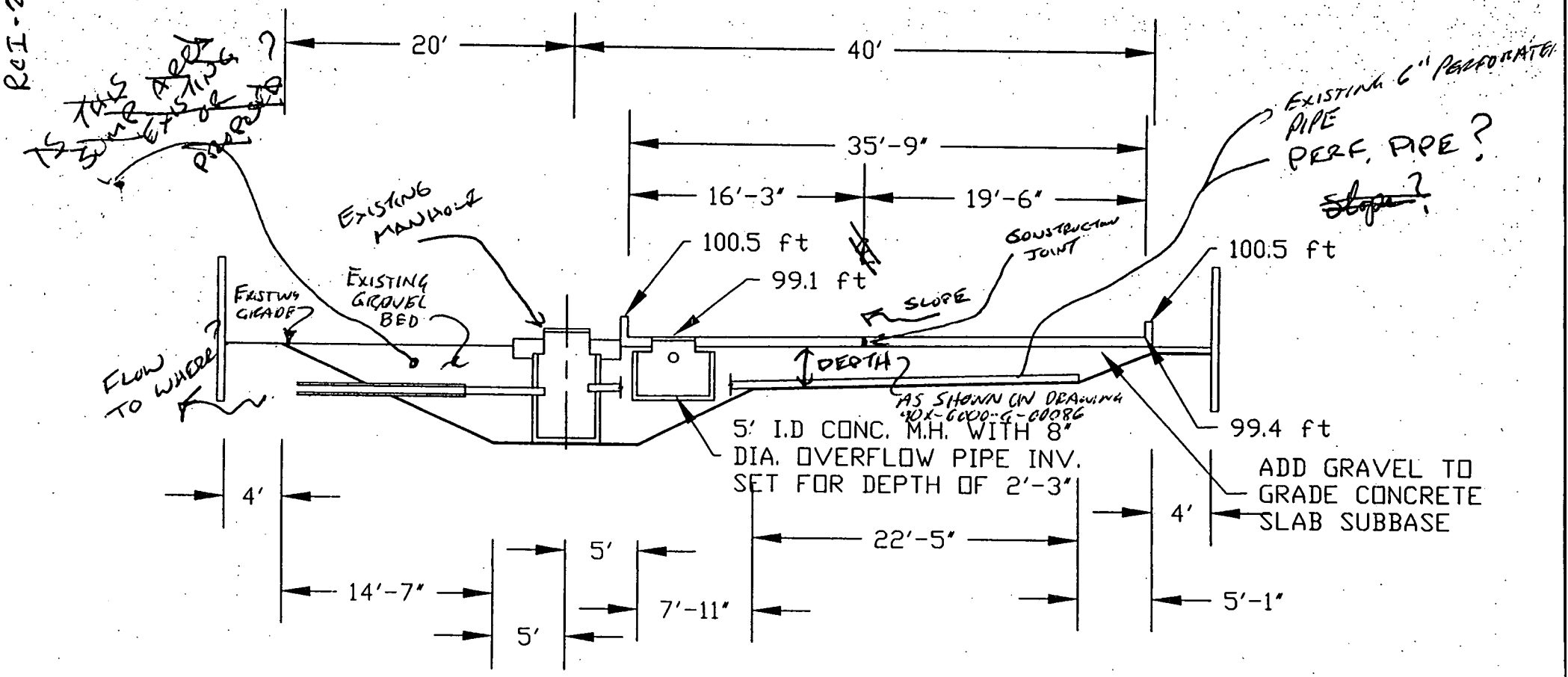
RCI-20102-048R

2 OF 3

2741

000076

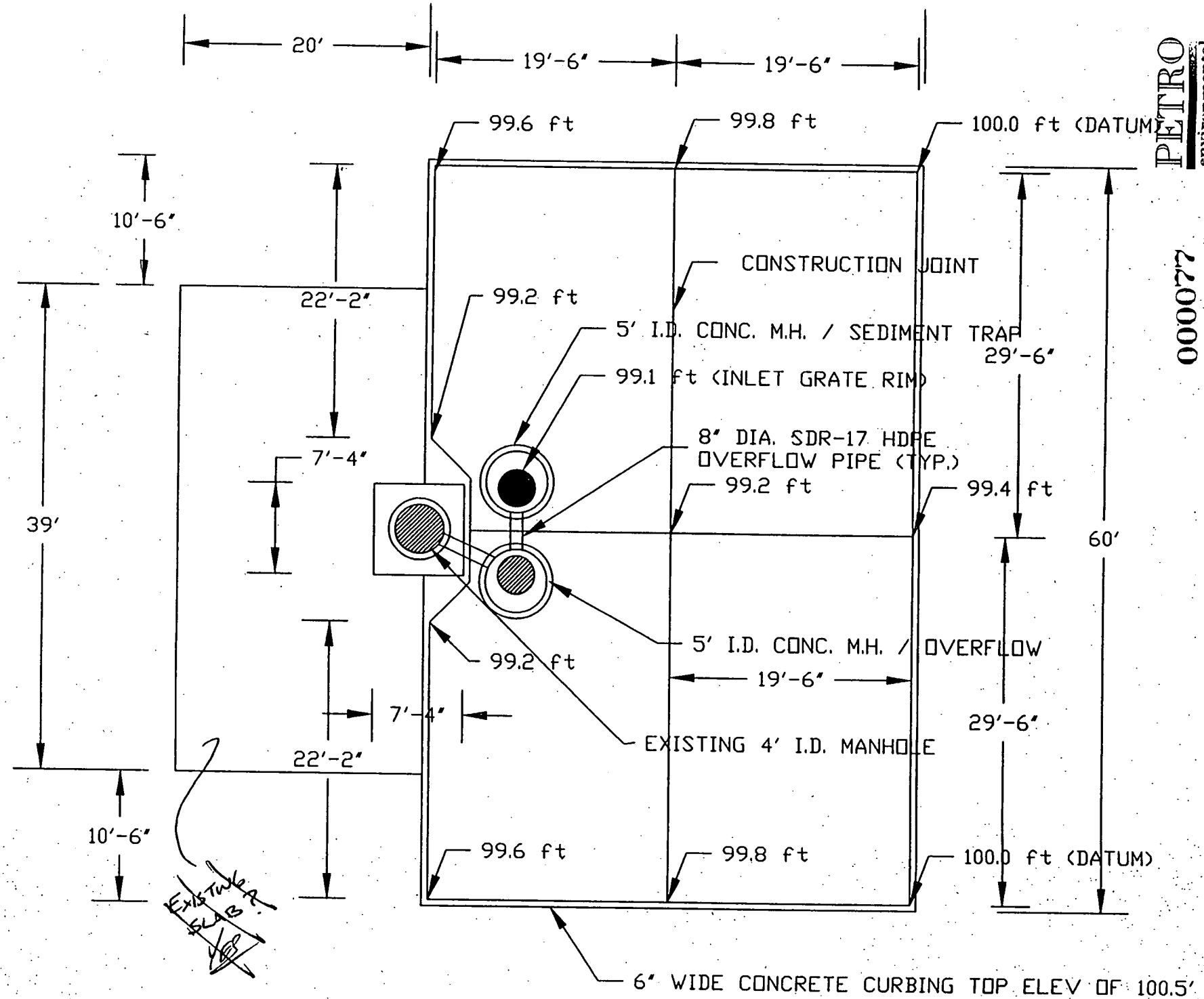
PETRO environmental technologies




NEED MANHOLE DETAIL WITH INVERT ELEVATIONS AND INLET GRATE DIMENSIONS.

RCI-20102-048R
3 OF 3

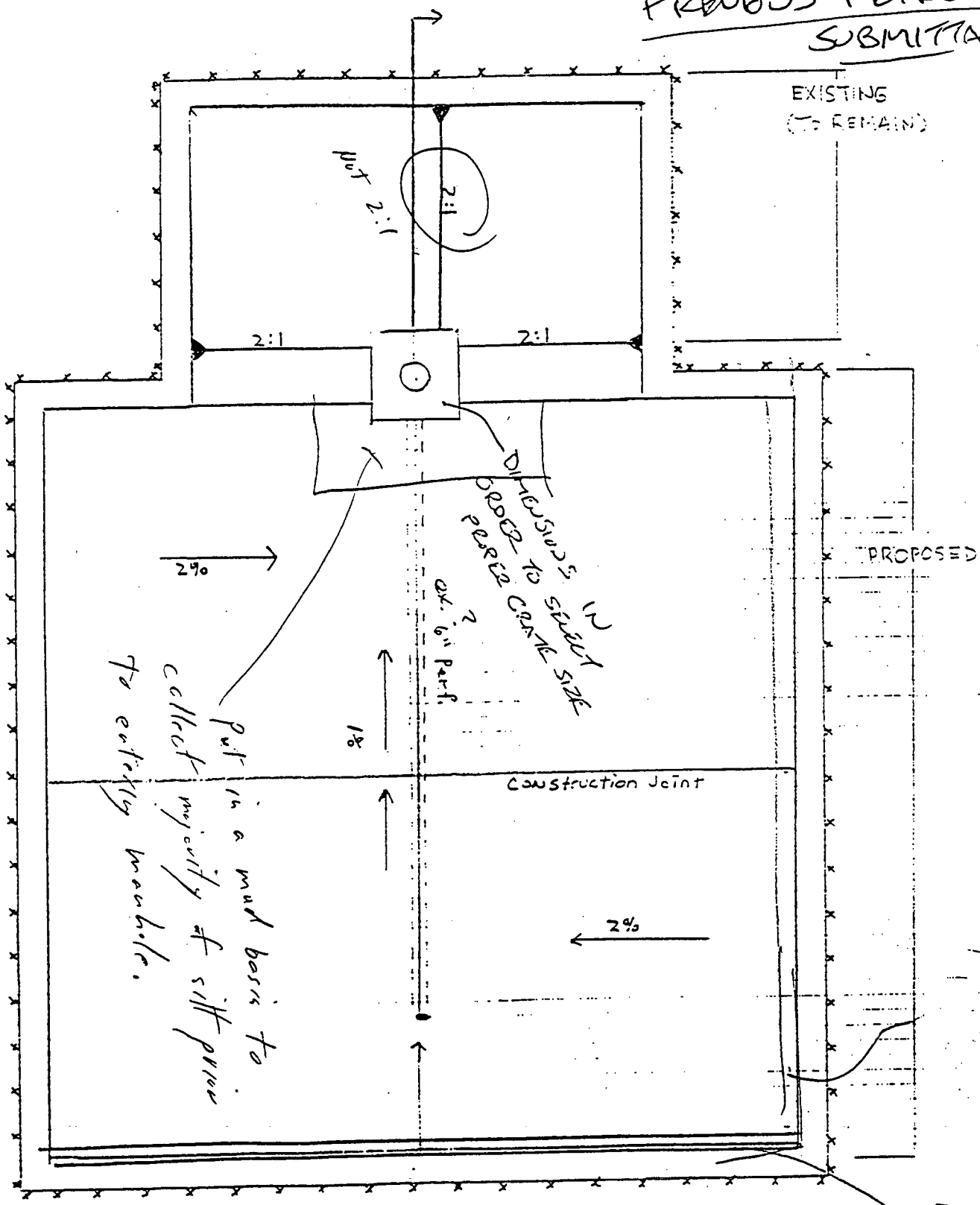
-2741




PETRO environmental technologies

000077

PREVIOUS PETRO SUBMITTAL




SHOW SPOT ELEVATIONS ON CONCRETE AT CORNERS

NOT TO SCALE

PETRO 2741
environmental technologies
7851 Palace Drive
Cincinnati, Ohio 45249-9895

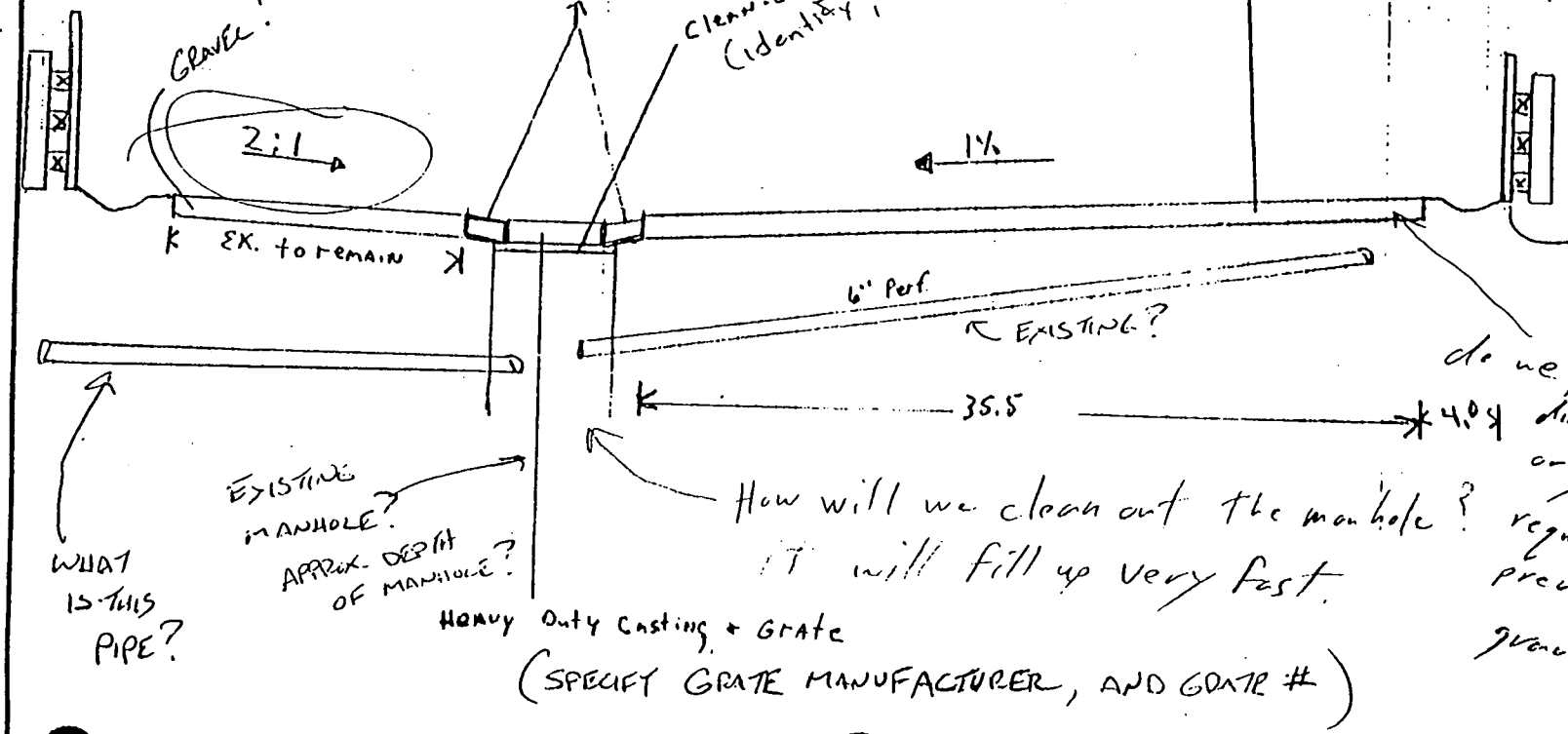
PROJECT No. _____
PAGE _____ OF _____
SUBJECT _____
CLIENT _____

Please clarify drawing,
- existing and proposed structures
- show details of new components

PREVIOUS PETRO SUBMITTAL

Note: concrete to be minimum 4000 PSI w/ 4% to 7% air entrainment
28-day strength of

000079




NOT TO SCALE

RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2) S/C NO.: 614 | (5) Pg 1 OF ~~4~~ KBT 5 | (6) DATE 4/27/99 |
| (3)S/C TITLE: Southern Waste Unit Excavation / On Site Disposal Facility Phase II Project —2741 | | (11) RCI NO.: RCI-20102-049R | |
| RESPONSIBLE DISCIPLINE: E [ ] M [ ] C [X] OTHER [ ] | (4A) RCI/DCN/TITLE: Proposed Alternate Ramping Scheme | (11) DCN NO.: | |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| Construction Drawings | 90X-6000-G-00222 | 0 | |
| | 90X-6000-G-00232 | 2 | Section E |
| | 90X-6000-G-00224 | 0 | Detail 45 |
| | 90X-6000-G-00203 | 2 | Note 1 |

(8) [X] RCI - INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [ ] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Petro Environmental is proposing an alternate ramping scheme involving the existing western ramps entering Cell 1 and Cell 2. Petro Environmental's proposed alternate ramping scheme and description of work is attached.

INFORMATION ONLY

| | | | |
|---|---|---|---|
| (10) REQUESTER: Richard Schairbaum | COMPANY: Petro Environmental Technologies, Inc. | DATE: 4/27/99 | (12) FCE / PE: JAMES C. JENKINS DATE: 5/10/99 |

(13) RESPONSE FOR RCI, IS A DCN REQ'D [X] NO [ ] YES (14) FOR DCN: [ ] APPROVED [ ] APPROVED AS NOTED [ ] DISAPPROVED

See Response on Page 5 of 5

~~JUNE~~ MAY (PAS) 13 ~~JULY~~ 1999

GEOSYNTEC KWASI BADU-TWEREBOAH RCI-DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL: 13 ~~JULY~~ JUNE 1999 DATE: (20) CHARGE NO. FOR CAD SERVICES TO INCORPORATE

KWASI BADU-TWEREBOAH [ ] FIT [ ] FORM [ ] FUNCTION

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEW ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17) N.A. MAY PAS

| | | |
|---|---|---|
| CONSTRUCTION CONCURRENCE: Bruce A. Schmitz DATE: 6/11/99 | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: | |
| PURCHASE REQUISITION REQUIRED: [ ] YES [X] NO (19) | 000080 | |

F-4259 (2/16/98)

Kim N

**Proposed Alternate Ramping Scheme**
**and Description of Work**
**OSDF (Phase II) Project, Option A.**

2741

*RCI-20102-049R*

Petro Environmental proposes to construct an access ramp and associated culvert along the Intercell Berm between OSDF Cells 1 and 2. The ramp will be constructed over existing Phase II structures, such as the protective clay layer (wedge) along the perimeter of the cell and the previously placed layer of select impacted material. The attached detail drawing (derived from Detail 45 of Construction Drawing No. 90X-6000-G-00224) illustrates the construction of the proposed access ramp. The construction sequence of the proposed access ramp will be as follows:

A. A 16 oz. per square yard non-woven geotextile cushion will be placed over the existing sacrificial geomembrane covering the protective clay wedge. The geotextile cushion will be temporarily anchored with sandbags as needed during construction.

B. Using an excavator, piles of access ramp construction material (ODOT 304) will be placed at regular intervals along the alignment of the culvert.

C. Once the piles have been placed, the access ramp construction material (ODOT 304) will be placed to a minimum six (6) inch thickness to provide bedding for the proposed culvert.

D. Using the excavator, thirty (30) inch diameter SDR-32.5 HDPE pipe culvert segments will be placed along the alignment of the proposed culvert. The ends of the pipe segments will be properly joined to create a continuous culvert approximately one hundred (100) feet in length. The culvert will be placed with a minimum flow gradient of 0.8% (1 foot / 125 feet).

E. Using haul trucks, piles of access ramp construction material (ODOT 304) will be placed at regular intervals along the outside of the protective clay layer (wedge). Using a dozer, this material will be placed over the protective clay layer (wedge) to a minimum thickness of eighteen (18) inches and a maximum finished surface grade of 10.0% (1 foot / 10 feet).

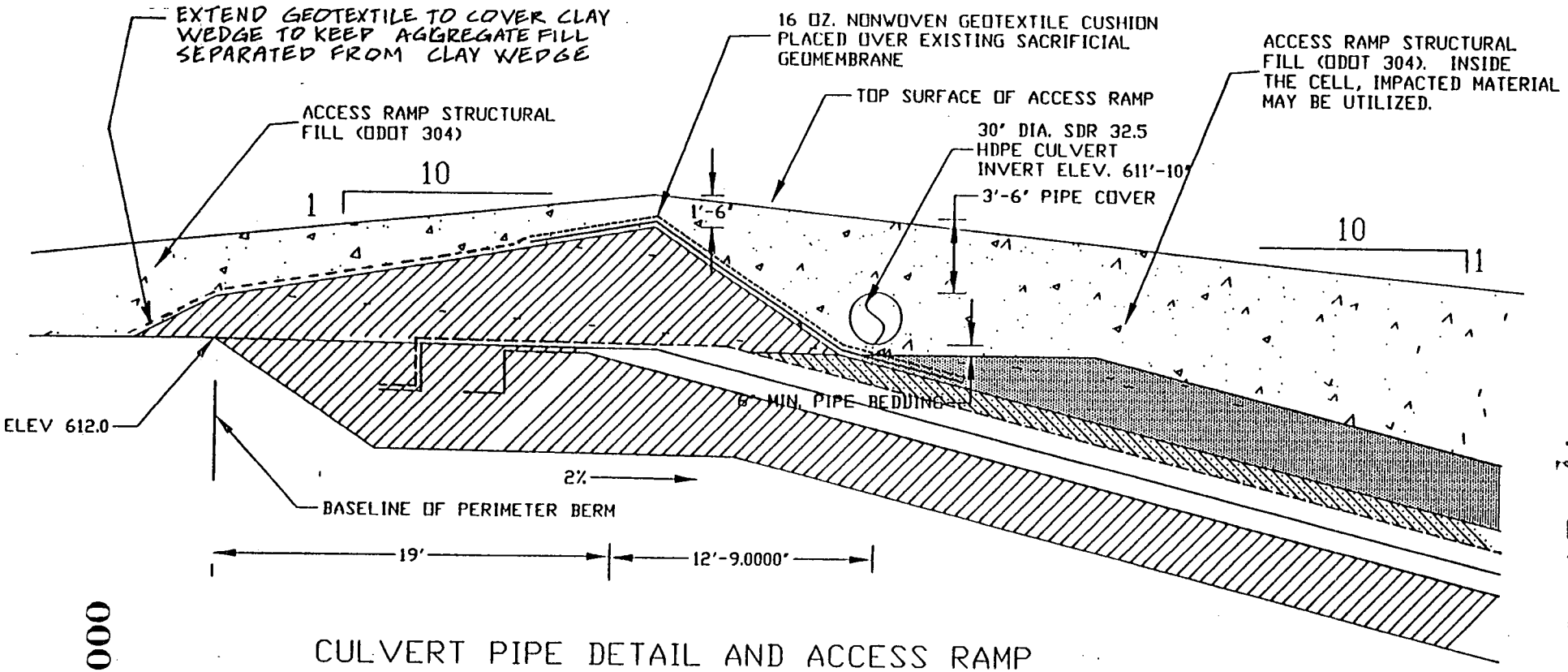
F. Continued dozer operation inside the protective clay layer (wedge) and within the cell area will place additional access ramp construction material (ODOT 304) to a minimum thickness over the culvert of forty-two (42) inches and a maximum finished grade of 10.0% (1 foot / 10 feet). This placement operation will continue over the existing select impacted material layer down to the floor of the cell with a maximum finished grade of 10.0% (1 foot / 10 feet) along an alignment which ensures safety and ease of access into the cell.

G. Culvert maintenance will be performed by Petro personnel on an as-needed basis. Physical inspections of the culvert will be performed at least once per week and after rainfall events greater than 0.5 inches. Minimum cover over the clay wedge (18") and culvert (42") will be inspected at least once per week and maintained as directed by the CM.

H. Proposed northings, eastings and invert elevations of the proposed culvert will be transmitted to FDF for review/approval prior to construction of the access ramp. The grades of the top surface of the access ramp will be surveyed at 50 feet intervals along the centerline and shoulders of the ramp. Final as-built survey information showing the northings, eastings and invert elevations of the top of the access ramp will be transmitted to FDF for review/approval prior to utilization of the access ramp.

I. The access ramp and culvert pipe will be removed as required during Cell 1 capping activities or during Cell 2 placement activities when the access ramp is no longer necessary.

J. Erosion control measures will be implemented as required at the outlet of the 30" culvert.

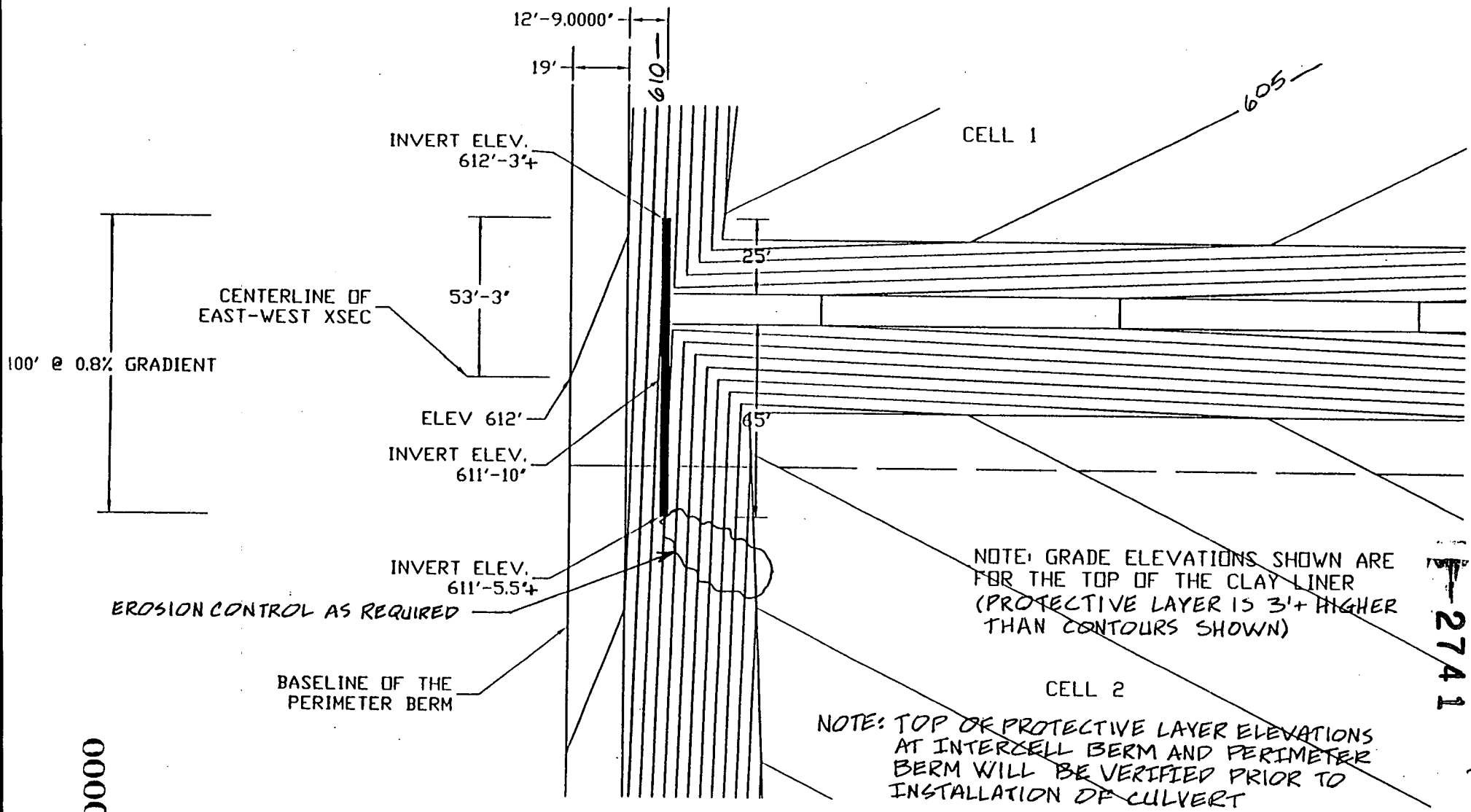



CULVERT PIPE DETAIL AND ACCESS RAMP
EAST-WEST CROSS SECTION
(DRAFT - NOT PLOTTED TO A SCALE)

280000

1-2741

Page 3 of 5
5/13/97




CULVERT PIPE DETAIL AND ACCESS RAMP
PLAN VIEW (DRAFT - NOT PLOTTED TO A SCALE)

T-2741

page 4 of 5
KBT
5/19/9

000083

**Response to RCI –20102-049R**
**(Dated 04/27/99, Page 5 of 5)**

Note 1 on Drawing No. 90X-6000-G-00203 and Note 1 on Drawing No. 90X-6000-G-00224 permit construction of Petro's proposed alternate ramping scheme. As such no DCN is required. However, if structural fill (ODOT 304) is used to construct the access ramp inside the Cell, as indicated on Petro's cross section (page 3 of 5), this material would have to be removed at a later date in order to comply with the requirements of the Impacted Material Placement Plan (IMP Plan). Should Petro elect to use the ODOT 304 material, which is non-impacted material, it is recommended that a geotextile separator be placed on top of the select impacted material layer prior to construction of the access ramp. In addition, as built survey information should be provided to help in future removal of the non-impacted material inside the cell area.

If impacted material is used to construct the access ramp inside the cell area, the material must be manifested and placed in accordance with the IMP Plan.

5/13/99

RCI/DCN FORM

2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: 99SC001440 and -1441 | (5)Pg 1 OF 2 | (6)DATE 05/13/99 |
| (3)S/C TITLE: Procurement Contracts for Purchase of Geosynthetic Clay Liner, Geomembrane Liner, and Geotextiles | | | (11)RCI NO.: 20102-051R |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: Clariifcation of Terminology Relating to Sampling of Geosynthetics Materials | | (11)DCN NO.: |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV. | (8)OTHER |
|---|---|---|---|
| PHII Procurement Specification Section 02714P, Geotextiles | Spec. 02714P | 2 | Para. 2.02.A. |
| PHII Procurement Specification Section 02770P, Geomembrane Liner | Spec. 02770P | 3 | Paras. 2.03.B.5, 2.03.B.7 |
| PHII Procurement Specification Section 02772P, Geosynthetic Clay Liner | Spec 02772P | 2 | Paras. 2.01.G.1, 2.02.A. (applies also to 1.04.B) |

(9) ☒ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9) ☐ DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

The referenced specifications state that Manufacturing Quality Control is to be performed "at a maximum interval of one test for each 'X' square feet manufactured," where 'X' may equal 40,000, 50,000, 100,000, or 400,000 square foot intervals] This entails the following (where a 40,000 square foot interval is used as an example):

(1) Rolls that are missing (i.e., scrapped or sent elsewhere) count as part of the 40,000 square feet as manufactured, though they will not count as part of the product received. For example: if Rolls 1 - 40 (at 2,500 square feet each) are produced, but rolls 5-10 are sold else-where, the first sample must be taken from roll 16 or before (but may not be taken from Rolls 5-10, because they were not supplied to FDF).

(2) A test may "cover" rolls ahead or rolls behind, or both, but may not cover more than its prescribed interval. For example, a 70,000 square foot production run requires two tests, not just one.

(3) A break between lots constitutes a break in "as manufactured." In other words, if a test sample is taken, and 10,000 square feet later a new lot is started, then a new interval is started at the lot break. [A sample may also need to be cut from the final 10,000 square feet, if required by (2) above] If applicable, breaks in production longer than 24 hours (for holiday, maintenance, etc.) are also considered as breaks in "as manufactured."

| | | | |
|---|---|---|---|
| (10)REQUESTOR: JAMES T. TURNER | COMPANY: Fluor Daniel Fernald | DATE: 05/13/99 | (12)CE / PE JAMES C. JENKINS DATE: 5/21/99 |
| (13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒NO ☐YES | | | (14) FOR DCN: ☐APPROVED ☐APPROVED AS NOTED ☐DISAPPROVED |

See attached Response on Page 2 of 2

KWASI BADU-TWENEBOAH

5/20/99 RCI - DCN ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: GEOSYNTEC DATE: 5/20/99 ☐FIT ☐FORM ☐FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
| (16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 5/21/99 | |
| PERFORMANCE GRADE: (17) 4 | |
| (18)CONSTRUCTION CONCURRENCE: DATE: 05/21/99 | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| PURCHASE REQUISITION REQUIRED: ☐YES ☒NO (19) | |

INFORMATION ONLY

FS-F-4259
REV. 4: 02/16/98

ORIGINAL

000085

**Response to RCI –20102-051R**
**(Dated 05/13/99, Page 2 of 2)**

Parts 2.02A.1 and 2.02A.2 of Section 02714P:Geotextiles state that: "...All tested rolls of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted..."

Part 2.03B.5 of Section 02770P: Geomembrane Liner states that: "...All tested rolls of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted..."

Part 2.02A of Section 02772P: Geosynthetic Clay Liner states that: "...All tested rolls of material used to certify compliance shall be delivered to the site. Test data for rolls not delivered to the site will not be accepted..."

Also, each of the geosynthetics procurement specifications requires at least 100,000 $ft^2$ of each type to be manufactured and supplied for this project from each resin (or bentonite in the case of GCL) lot used, unless a smaller quantity is approved by FDF.

The above clearly indicates that each geosynthetic manufacturer must provide test data meeting the specified frequency for the rolls of geosynthetic to be delivered to the site. For those rolls that test data are provided to certify compliance with the Technical Specifications they must definitely be included in the rolls delivered to the site. Responses to the illustrative example are presented below:

(1) Missing rolls do not count as part of the manufacturing quality control testing frequency. The frequency applies to the rolls delivered to the site. Note also that they are supposed to manufacture and supply a minimum 100,000 $ft^2$ of each geosynthetic type from each resin lot used. This is also to minimize the number of conformance samples to be taken by FDF and GeoSyntec CQC.

(2) The testing frequency shall be as specified in the Technical Specifications. Therefore, a 70,000-$ft^2$ production run would require two tests if a testing frequency of one per 40,000 $ft^2$ is required.

(3) Testing frequency shall be as explained above and shall apply to each lot of geosynthetic manufactured. Any break in production due to holidays, maintenance, etc. could be considered as "breaks in as manufacturing" as long as information on production dates is available.

5/20/99

RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| | | | |
|---|---|---|---|
| (1) WP / WO NO.: 20102 | (2) S/C NO.: 614 | (5) Pg 1 OF 1 | (6) DATE 6/8/99 |
| (3) S/C TITLE: Southern Waste Unit Excavation / On Site Disposal Facility Phase II Project | 2741 | (11) RCI NO.: RCI-20102-052R | |
| RESPONSIBLE DISCIPLINE: E [ ] M [ ] C [X] OTHER [ ] | (4A) RCI/DCN/TITLE: Modification to Clay Liner Compaction Equipment | (11) DCN NO.: | |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| Technical Specifications | 20102-TS-0001 | 0 | 02225-2.02.G |

(9) [X] RCI - INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [ ] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Paragraph 2.02.G of Technical Specification Section 02225 requires that a Caterpillar 815B compactor (or equal) be used for compacting the clay liner/cap material. Petro Environmental is requesting permission to use any of the following: Cat 815 Compactor, Cat 825 Compactor, or the Cat CP-563C padded drum vibratory soil compactor. Performance advantages of the Cat 825 and Cat CP-563C over the Cat 815 are as follows: heavier operating weight for the Cat 825 (69,828 lbs.) for use on the cell floor and lighter operating weight for the Cat 563 (25,700 lbs.) making it more stable during slope construction; compactive force of the Cat 825 is 69,828 lbs. (static loading) and the compactive effort generated by the Cat 563 is 75,700 lbs. (50,000 lbs. centrifugal force plus the operational weight); and approximate effective ground pressure of the Cat 825 is 130 psi, while the ground pressure for the Cat 563 is 300 psi.

In summary, use of the Cat 825 and Cat 563 exceeds the compactive effort produced by the Cat 815B Compactor. Petro Environmental is requesting that a DCN be issued to permit the use of any of these pieces of equipment during construction of the clay liner/cap. The equipment specifications for each of these are attached.

FERMCO OU2 JUN 9 9:36 AM '99

J. Richard Schairbaum

| (10) REQUESTER: | COMPANY: | DATE: | (12) FCE / PE | DATE: |
|---|---|---|---|---|
| J. Richard Schairbaum | Petro Environmental Technologies, Inc. | 6/8/99 | | |

(13) RESPONSE FOR RCI, IS A DCN REQ'D [X] NO [ ] YES (14) FOR DCN: [ ] APPROVED [ ] APPROVED AS NOTED [ ] DISAPPROVED

See page 5 for response.

RCI - DCN ACCEPTANCE

| | | |
|---|---|---|
| (15) DESIGN ORGANIZATION APPROVAL: GeoSyntec Consultants — Jim Burnett — Jim Burnett — [ ] FIT [X] FORM [ ] FUNCTION | DATE: 10 August 1999 | (20) CHARGE NO. FOR CAD SERVICES TO INCORPORATE |

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEW ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17) _____

| | | |
|---|---|---|
| (18) CONSTRUCTION CONCURRENCE: | DATE: | (21) WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| PURCHASE REQUISITION REQUIRED: [ ] YES [ ] NO (19) | | 000087 |

S-F-4259 (2/16/98)

RCI-20102-052R Page 2 of 5

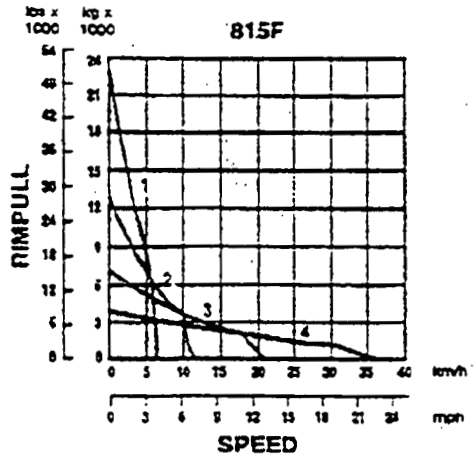
-2741

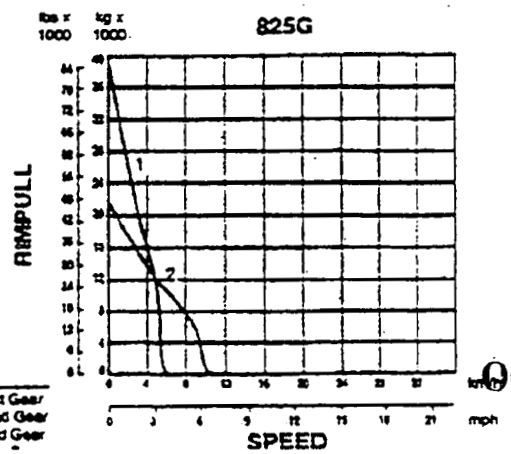
## Soil Compactors

### Specifications
- Rimpull

| MODEL | 815F | | 825G | |
|---|---|---|---|---|
| Flywheel Power | 164 kW | 220 hp | 235 kW | 315 hp |
| Operating Weight* | 20 879 kg | 45,934 lb | 31 740 kg | 69,828 lb * |
| Engine Model | 3306 DITA | | 3406C DITA | |
| Rated Engine RPM | 2200 | | 2100 | |
| No. Cylinders | 6 | | 6 | |
| Displacement | 10.5 L | 638 in³ | 14.6 L | 893 in³ |
| Speeds: | | | | |
| Forward | 4 | | 2 | |
| Reverse | 4 | | 2 | |
| Turning Circle with Blade | 12.6 m | 41'5" | 14.6 m | 48'0" |
| Fuel Tank Refill Capacity | 464 L | 122.6 U.S. gal | 630 L | 166.5 U.S. gal |
| TAMPING FOOT WHEELS: | | | | |
| Each Drum Width | 978 mm | 38.5" | 1125 mm | 44.3" * |
| Diameters, over feet | 1.42 m | 55.9" | 1.68 m | 66" |
| over drum | 1.03 m | 40.5" | 1.29 m | 51" |
| Feet per Wheel | 60 | | 65 | |
| Feet per Row | 12 | | 13 | |
| Rows of Feet | 5 | | 5 | |
| Foot Length | 198 mm | 7.8" | 220 mm | 8.7" |
| End Area Per Foot | 116 cm² | 18 in² | 183 cm² | 28.4 in² |
| Width of Two Pass Coverage | 4.35 m | 14'3" | 4.88 m | 16'0" |
| GENERAL DIMENSIONS: | | | | |
| Height (top of ROPS) | 3.34 m | 11'0" | 3.74 m | 12'3" |
| Height (stripped top)** | 2.39 m | 7'10" | 2.65 m | 8'8" |
| Wheel Base | 3.35 m | 11'0" | 3.70 m | 12'2" |
| Overall Length with Dozer | 6.82 m | 22'5" | 8.24 m | 27'1" |
| Width over Drums | 3.24 m | 10'8" | 3.65 m | 12'0" |
| Ground Clearance | 423 mm | 1'5" | 355 mm | 1'2" |
| STRAIGHT BULLDOZER: | | | | |
| Width | 3.76 m | 12'4" | 4.61 m | 15'2" |
| Height | 8.60 m | 2'10" | 0.99 m | 3'3" |

*Operating Weight includes coolant, lubricants, bulldozer, hydraulics, ROPS canopy, full fuel tank and operator.
**Height (stripped top) — without ROPS, exhaust, seat-back or other easily removed encumbrances.




KEY
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear

COMPACT

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Definition
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RCI - 20102-052R
Page 3 of 5

2741

Specifications | Padded Drum Vibratory Soil Compactors

| MODEL | CP-433C | | CP-533C* | | CP-563C | |
|---|---|---|---|---|---|---|
| Flywheel Power | 80 kW | 107 hp | 108 kW | 145 hp | 108 kW | 145 hp |
| Rated Engine RPM | 2500 | | 2200 | | 2200 | |
| No. Cylinders | 4 | | 6 | | 6 | |
| Displacement | 4.0 L | 243 in³ | 6.6 L | 403 in³ | 6.6 L | 403 in³ |
| Engine Model | 3054T | | 3116T | | 3116T | |
| Speeds: | | | | | | |
| Forward | 2 | | 2 | | 2 | |
| Reverse | 2 | | 2 | | 2 | |
| Max. Speed (For./Rev.) | 13.3 km/h | 0-8 mph | 12.8 km/h | 0-8 mph | 12.5 km/h | 0-8 mph |
| Operating Weight | 6912 kg | 15,225 lb | 10 760 kg | 23,700 lb | 11 570 kg | 25,700 lb * |
| Shipping Weight | 6525 kg | 14,800 lb | 10 648 kg | 23,450 lb | 11 360 kg | 25,000 lb |
| Drive | Drum/rear wheel | | Drum/rear wheel | | Drum/rear wheel | |
| Steering: | | | | | | |
| Inside radius | 3008 mm | 9'10" | 3912 mm | 12'10" | 3912 mm | 12'10" |
| Outside radius | 4684 mm | 15'4" | 6325 mm | 20'9" | 6325 mm | 20'9" |
| Steering angle | ±37° | | ±30° | | ±30° | |
| Vibratory System: | | | | | | |
| Ecc. Weight Drive | Hydraulic | | Hydraulic | | Hydraulic | |
| Frequency | 30 Hz | 1800 vpm | 30 Hz | 1800 rpm | 30 Hz | 1800 vpm |
| Amplitude Settings | 2 | | 2 | | 2 | |
| Centrifugal Force | | | | | | |
| Low amplitude | 6273 kg | 13,800 lb | 22 680 kg | 50,000 lb | 22 680 kg | 50,000 lb * |
| High amplitude | 12 727 kg | 28,000 lb | 11 360 kg | 25,000 lb | 11 360 kg | 25,000 lb |
| General Dimensions: | | | | | | |
| Overall width w/blade | 1981 mm | 6'6" | 2740 mm | 9'0" | 2740 mm | 9'0" |
| Overall width w/o blade | 1905 mm | 6'3" | 2440 mm | 8'0" | 2440 mm | 8'0" |
| Drum width | 1680 mm | 5'6" | 2130 mm | 7'0" | 2130 mm | 7'0" * |
| Drum diameter over pads | 1220 mm | 4'0" | 1549 mm | 5'1" | 1549 mm | 5'1" |
| Tires | 14.9" × 24" 6-ply | | 23.1" × 26" 8-ply | | 23.1" × 26" 8-ply | |
| Overall height | 2900 mm | 9'6" | 2687 mm | 8'6" | 2997 mm | 9'10" |
| Wheel to drum | 2583 mm | 8'6" | 2740 mm | 9'10" | 2740 mm | 9'0" |
| Overall length | 4825 mm | 15'10" | 5258 mm | 17'3" | 5258 mm | 17'3" |
| Curb clearance | 380 mm | 15" | 483 mm | 19" | 483 mm | 19" |
| Service Refill Capacities: | | | | | | |
| Fuel tank | 167 L | 44 U.S. gal | 254 L | 67 U.S. gal | 254 L | 67 U.S. gal |
| Crankcase | 6.8 L | 1.8 U.S. gal | 15.1 L | 4 U.S. gal | 15.1 L | 4 U.S. gal |
| Hydraulic fluid | 71 L | 18.7 U.S. gal | 132 L | 35 U.S. gal | 132 L | 35 U.S. gal |

*Not offered in United States.

75

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RCI - 20102-052R
Page 4 of 5
2741

Author: Tony Klimek at FNST-02
Date: 6/4/99 12:26 PM
Priority: Normal
To: Uday Kumthekar, Bill Zebick
CC: Tony Klimek, Terence Hagen at FNST-06, Chuck Vanarsdale at FNST-05, James Jenkins, Don Goetz at FNST-03
Subject: Compactors for Clay Liner on 3H:1V Side-slopes

---------- Message Contents ----------

There was a brief meeting on Friday, June 4, 1999 regarding the compactor for the clay liner on the 3H:1V slopes on the sides of the cell. the following were in attendance:

- Tony Klimek
- Terry Hagen
- Bill Zebick
- Jim Burnett

Petro has informally requested approval to use a 563 compactor on the clay liner side-slopes instead of the 815. The 815 is a sheepsfoot, static compactor; the 563 is a lighter sheepsfoot vibratory compactor. According to Petro, the 563 will be more efficient to place the clay and provide acceptable results. However, the test pad did not address this type of compactor and some type of test pad or field demonstration must be performed before a change can be made.

ACTION:

1. Petro will write an RCI requesting the use of the 563.

2. GeoSyntec will respond to the RCI with the minimum requirements for a field demonstration. If an acceptable field demonstration can be agreed to by all parties, it must be performed in a timely manner and the results must demonstrate that the liner will meet performance requirements with the 563 before it can be approved for use.

Use of the Caterpillar 825 soil compactor was approved in RCI 20102-046R dated 2 March 1999.

On 8 June 1999, the FDF Construction Manager stated that the use of Caterpillar CP-563C padded drum vibratory soil compactor would be considered for construction of the 3-ft thick clay liner on the cell 4H:1V sideslipes only; and only if this proposed alternative equipment is demonstrated to be functionally equivalent, in all aspects, to the specified Caterpillar 815B soil compactor.

Between 9 and 17 June, draft plans were prepared concerning construction and testing of a Caterpillar CP-563C compactor demonstration clay liner on a 4H:1V slope; and the demonstration clay liner construction start date was tentatively scheduled for 28 June. However, due to time constraints, FDF put this project on indefinite hold on 18 June 1999.

Jim Burnett
10 August 1999

RCI/DCN FORM — 2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: FSC-614 | (5)Pg 1 OF 3 | (6)DATE 28 July 1999 |
| (3)S/C TITLE: OSDF Phase II | | | (11)RCI NO.: 20102-054R |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☐ OTHER ☐ | (4A)RCI/DCN TITLE: Use of Clay Stockpile 99-4 | | (11)DCN NO.: |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV | (8)OTHER |
|---|---|---|---|
| 20102-TS-0001 Section 02225<br>DCN 20102-079 | Part 2.01 | 1 | |

(9) RCI - INQUIRY USQD SCREENING BY PROJECT ENGINEER

Clay stockpile 99-4 has been extensively tested to determine its possible use as acceptable clay liner or cap material. Seven (7) individual samples, 4 composite hydraulic conductivity samples and 4 FDF core samples have been taken. Table 1 summarizes the seven individual sample results and results of the hydraulic conductivity on all samples tested. Figure 1 plots the hydraulic conductivity results and the APZ. The two initial composite hydraulic conductivity test results were tested at degrees of saturation < 90 %, but within the APZ (DCN 20102-079). The hydraulic conductivity values were $2.0 \times 10^{-7}$ and $3.0 \times 10^{-7}$ cm/s; these exceed the maximum $1 \times 10^{-7}$ cm/s specification requirement. Two additional tests from the same sample were tested at higher degrees of saturation (≥90%) and had hydraulic conductivity values of $2.3 \times 10^{-8}$ and $2.5 \times 10^{-8}$ cm/s. These results are less than the specified value, and therefore are acceptable.

Hydraulic conductivity results for the FDF core samples (Tests Nos. LP III-111, LP III-112, LP III-113 and LP III-114), tested at degrees of saturation of <<90%, but within the new APZ, were between $1.0 \times 10^{-6}$ and $2.6 \times 10^{-6}$ cm/s. These and the test results mentioned above indicate a trend of lower hydraulic conductivity with higher degrees of saturation. This is to be expected.

Clay Stockpile 99-4 is silty and has low, but acceptable plasticity indices and clay contents. Based on evaluation of the test results, use of the stockpile for clay liner and cap material can only be allowed with an APZ restriction. This restriction, for Stockpile 99-4 only, is to move the left boundary of the APZ to the 90% degree of saturation line, which was the approved boundary used for Cells 1 and 2. Based on verbal discussions with FDF Engineering, QA, OEPA and the Construction Manager this APZ restriction for Clay Stockpile 99-4 is acceptable to FDF and OEPA. The restricted APZ lies within the currently approved APZ and, therefore, a design change notice is not necessary. Anthony P. Klimek 8/5/99

| (10)REQUESTOR: | COMPANY: | DATE: | (12)CE / PE | DATE: |
|---|---|---|---|---|
| Collin Sukow<br>Dan Bodine, P.E. Collin P. Sukow | GeoSyntec | 29 July 1999 | ANTHONY P. KLIMEK<br>DON GOETZ | 08/05/99 |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES (14) FOR DCN: ☐ APPROVED ☐APPROVED AS NOTED ☐ DISAPPROVED

K Badu-Tweneboah 8/5/99

RCI - DCN ACCEPTANCE

| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: DATE: | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
|---|---|
| K Badu-Tweneboah 5 August 1999<br>Kwasi Badu-Tweneboah ☐ FIT ☒ FORM ☐ FUNCTION | |

16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

17) PERFORMANCE GRADE: ___

| 18)CONSTRUCTION CONCURRENCE:DATE: | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
|---|---|
| Bill Zebich 8/5/99<br>BILL ZEBICH<br>PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO | INFORMATION ONLY |

000092

S-F-4259 (2/16/98) ORIGINAL

NRI

TABLE 1
STOCKPILE 99-4

| le No. | Frequency (Yds.) | STD. | MOD. | LL/PL/PI | #200 %PASS | HYD. COND. | % CLAY |
|---|---|---|---|---|---|---|---|
| LPIII-42 | 33,000 | 119.6@13.9<br>120.4@13.6 | —<br>— | 32/18/14 | 74.2 | — | 19.5 |
| LPIII-43 | 34,500 | 122.4@12.5<br>123.4@12.2 | 132.8@8.9<br>133.7@8.7 | 29/16/13 | 69.4 | $7.6 \times 10^{-8}$ | 18.2 |
| LPIII-44 | 36,000 | 125.0@11.6<br>125.9@11.3 | —<br>— | 27/15/12 | 68.6 | — | 16.7 |
| LPIII-46 | 37,500 | 122.5@11.9<br>123.4@11.6 | 129.1@10.1<br>129.9@9.9 | 30/14/16 | 68.1 | $2.1 \times 10^{-8}$ | 17.6 |
| LPIII-47 | 39,000 | 122.4@11.9<br>123.8@12.1 | —<br>— | 32/15/17 | 68.7 | — | 19.2 |
| LPIII-48 | 40,500 | 121.0@13.0<br>122.2@12.6 | 134.9@8.8<br>135.8@8.6 | 27/15/12 | 67.4 | — | 16.1 |
| ll-49 | 42,000 | 119.8@12.5<br>120.7@12.2 | —<br>— | 28/15/13 | 69.7 | — | 17.3 |

Average Corrected Standard = 122.8 @ 12.2

Average Corrected Modified = 133.1 @ 9.1

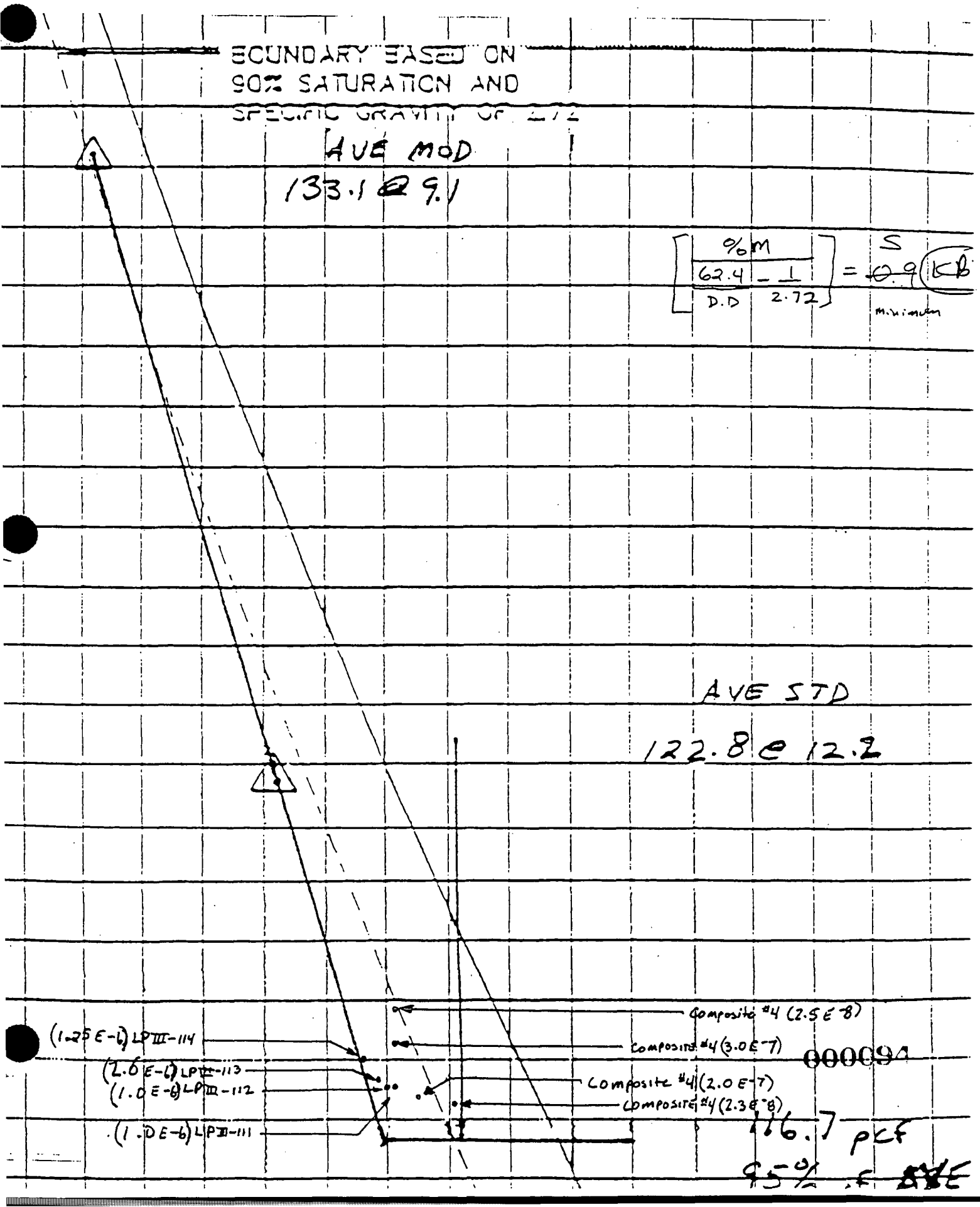
Reported Tons = 15,634 @ 10% = 14,212

Estimated Total Yardage = 8,559

Cumulative Yardage = 37,582

**Final Composite Hydraulic Conductivity** = $2.3 \times 10^{-8}$ and $2.5 \times 10^{-8}$ cm/sec, remolded to the 90% saturation curve which was used as the APZ for Cells 1 and 2. The first two Composite #4 points were remolded to less than the 90% saturation curve within the line of optimums APZ and were $2.0 \times 10^{-7}$ and $3.0 \times 10^{-7}$ cm/sec. The core samples LP III-111 through 114 (see Fig 1) were remolded close to the line of optimums APZ.

2741 KB


ECUNDARY BASED ON
90% SATURATION AND
SPECIFIC GRAVITY OF 2.72
AVE MOD
133.1 @ 9.1
$\left[\frac{\%M}{\frac{62.4}{D.D} - \frac{1}{2.72}}\right] = S$
~~0.9~~ KB
Minimum
AVE STD
122.8 @ 12.2
Composite #4 (2.5E-8)
Composite #4 (3.0E-7)
Composite #4 (2.0E-7)
Composite #4 (2.3E-8)
(1.25E-6) LPIII-114
(2.6E-6) LPIII-113
(1.0E-6) LPIII-112
(1.0E-6) LPIII-111
000094
116.7 pcf
95% ~~AVE~~

F-2741

| Post-it® Fax Note 7671 | Date | # of pages ▶ |
|---|---|---|
| To JD Chiou | From OEPA | |
| Co./Dept. | Co. | |
| Phone # | Phone # | |
| Fax # 4 5731 | Fax # | |

MEMORANDUM

To: J.D. Chiou, FDF , SDFP Manager
From: Tom Ontko, Ohio EPA
Re: DCN 20102-096
RCI 20102-056R
Date: 11/16/99

RCI-056R clarifies the meaning of the phrase "center of the cell" as it is used in Section 8.4.1 of the Impacted Materials Placement Plan. The IMPP states that highly compressible materials (Category 3) are to be placed toward the center of the cell. The RCI defines 'outside edge' as the areas within 50 feet (horizontally) from the bottom of the select layer in the final cover system. The center of the cell is interpreted to mean the areas inside the outside edge. The Ohio EPA concurs with this interpretation.

DCN-096 allows use of a hydraulic mulch/mulch binder mixture in lieu of pine sap emulsion for dust suppression in the OSDF. This product is supposed to be easier to handle, mix, apply and clean up than the pine sap product. It is comparable in performance based on observations made within the OSDF. The Ohio EPA has observed areas in the STP excavation after application of a mulch/mulch binder mixture. The product appeared to be effective several weeks after application and after a 0.7 inch rain. The product adhered to moderate slopes in the deep areas of excavation and also looked more robust to light vehicle traffic. The Ohio EPA concurs with this DCN.

NOV 16

cc: Kwasi Badu-Tweneboah
Collin Sukow
Scott Quammen

C:\TONTKO\OSDF\DCN096.WPD

# RCI/DCN FORM

2741

## REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| (1) PROJECT/CWO/RES NO.: | (2) S/C NO.: | (5) Pg 1 Of 2 | (6) DATE |
|---|---|---|---|
| 20102 | FSC 614 | | 10/22/99 |

| (3) S/C TITLE: | (11) RCI NO.: |
|---|---|
| Southern Waste Units/ OSDF Phase II Excavation | RCI-20102-056R |

| (4) RESPONSIBLE DISCIPLINE: | (4A) RCI/DCN TITLE: | (11) DCN NO.: |
|---|---|---|
| E ☐ M ☐ C ☐ OTHER ☐ | Request for Clarification on Placement of Category 3 Material | |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| Impacted Material Placement Plan | 20100-PL-0007 | 0 | |

(9) ☒ RCI-INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9) ☐ DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

☐ REQUIRED ☒ NOT REQUIRED

Section 8.4.1 of the Impacted Material Placement (IMP) Plan states that Category 3 Material is to be placed toward the "center" of the cell and not in the same horizon with more compressible materials such as Category 4 and Category 5 materials. The center of the cell is understood to mean all areas except those in the outside edges on the east and west sides of each cell, the outside edge on the north side of Cell 1, and the outside edge on the south side of the most southern cell of the OSDF. The outside edges shall not to be used for placement of Category 3 material. Clarification is needed to define the limits of the outside edges.

| (10) REQUESTOR: | COMPANY: | DATE: | (12) CE / PE | DATE: |
|---|---|---|---|---|
| Kevin Harbin | FDF | 10/22/99 | Anthony P. Klimiec | 10/26/99 |

(13) RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES (14) FOR DCN: ☐ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

The outside edge shall be defined as the areas within 50 feet (horizontally) from the bottom of the select layer in the final cover system. Category 3 material shall not be placed within this 50 foot outside edge. Category 3 material may be placed within the cells between the limits defined by the 50-ft outside edge distance. In the case of Lift 5 (i.e., after the 1-ft thick protective layer and 3-ft thick select layer have been placed), Category 3 material may be placed in all grids except the C and J grids on the west and east ends, respectively of a cell. For subsequent lifts, the minimum 50 feet horizontal distance shall be maintained from the bottom of the select layer in the final cover system. Note also that the IMP Plan requires horizons of Category 3 materials to be separated by at least 4-ft thick intervening horizon of Category 1 material. Kwasi Badu-Tweneboah / GeoSyntec

### RCI - DCN ACCEPTANCE

| | (20) CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
|---|---|
| K Badu-Tweneboah 10/27/99<br>☐ FIT ☒ FORM ☐ FUNCTION<br>Kwasi Badu-Tweneboah, GeoSyntec | |

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17)

| (18) CONSTRUCTION CONCURRENCE DATE: | (21) FIELD WORK COMPLETED: |
|---|---|
| Bill Zebrek 10/28/99<br>PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO (19) | (SIGNOFF BY CE OR PE) DATE: |

FS-F-4259
REV. 5: 10/01/99

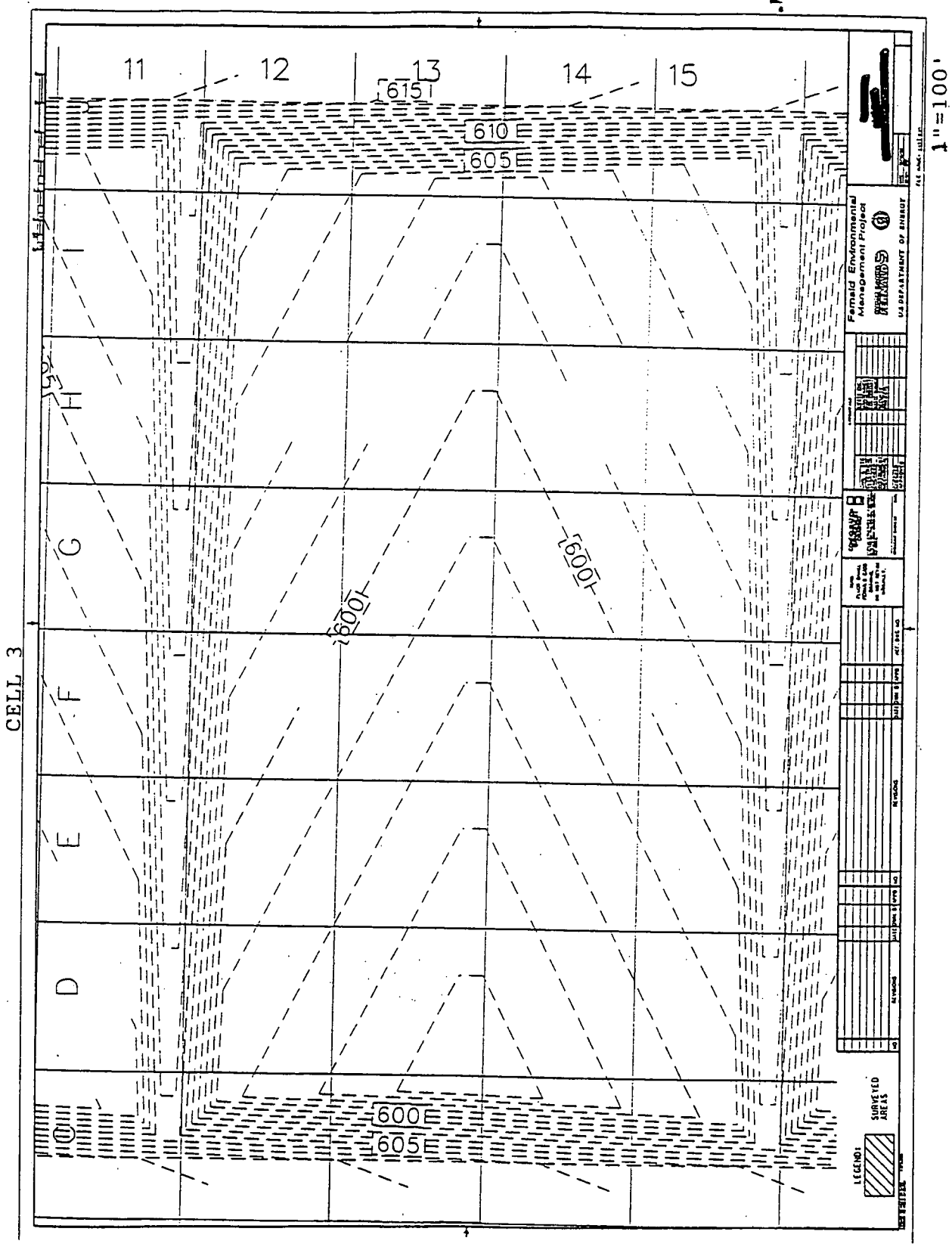
ORIGINAL

INFORMATION ONLY

RCI-20102-056R

Page 2 of 2
KBT

F-2741

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| Post-it® Fax Note 7671 | Date | # of pages ▶ |
|---|---|---|
| To JD Chiou | From OEPA | |
| Co./Dept. | Co. | |
| Phone # | Phone # | |
| Fax # 5131 | Fax # | |

MEMORANDUM

To: J.D. Chiou, FDF, SDFP Manager
From: Tom Ontko, Ohio EPA
Re: OSDF RCI 20102-057R
RCI 20102-058R
Date: 11/5/99

F-2741

RCI 20102-057R clarifies the physical size criteria for numerous pieces of deck plate that were D&D'ed prior to the development of the Impacted Material Placement Plan and the WAC Attainment Plan. The deck plate sheets are ½ inch to 3/4 inch plate that has been folded over once or twice. The plates are generally no more than 10 feet long and up to 10 feet wide. They meet the thickness requirements of Cat 2 material. The Ohio EPA concurs with the interpretation that these objects are consistent with the Impacted Materials Placement

RCI 20102-058R clarifies that the 100 foot separation distance between Category 3 materials and more compressible materials (IMPP Section 8.4.1) applies to grids located diagonally as well as grids located laterally to the Cat 3 grid. The Ohio EPA concurs with this interpretation.

ONTKO plan to work
on Sat. We need
to call him before we start.

Per J.D. Chiou

RECEIVED
NOV 08 1999
1515 hrs EBT

RCI/DCN FORM — 2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| (1) PROJECT/CWO/RES NO.: | (2) S/C NO.: | (5) Pg 1 Of 2 KBT | (6) DATE |
|---|---|---|---|
| 20102 | FSC 614 | | 10/26/99 |

| (3) S/C TITLE: | (11) RCI NO.: |
|---|---|
| Southern Waste Units/OSDF Phase II Excavation | RCI-20102-057R |

| (4) RESPONSIBLE DISCIPLINE: | (4A) RCI/DCN TITLE: | (11) DCN NO.: |
|---|---|---|
| E [X] M [ ] C [ ] OTHER [ ] | Deck Plating to be placed as Category 2 Material | |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| Impacted Material Placement Plan | 20100-PL-0007 | 0 | |
| | | | |
| | | | |
| | | | |
| | | | |

(9) [X] RCI-INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [ ] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

[ ] REQUIRED [ ] NOT REQUIRED

Section 4.3 of the Impacted Material Placement Plan describes the Physical Criteria applied to material destined for the OSDF. During the D&D process, numerous pieces of "deck plate" material which ranges from ½" to 1 ¾" thick was removed from the buildings. These pieces range from 10' long and 4' wide to 10'x10'. Material is configured in a rolled and folded condition. Material is to fit in an 18" to 24" Category 2 lift. Clarification is requested for placement of this material as Category 2 material.

| (10) REQUESTOR: | COMPANY: | DATE: | (12) CE / PE | DATE: |
|---|---|---|---|---|
| Kevin Harbin | FDF | 10/26/99 | Anthony P. Klimek | 10/27/99 |

(13) RESPONSE: FOR RCI, IS A DCN REQ'D? [X] NO [ ] YES (14) FOR DCN: [ ] APPROVED [ ] APPROVED AS NOTED [ ] DISAPPROVED

See attached RCI Response on page 2 of 2

KWASI BADU-TWENEBOAH

## RCI - DCN ACCEPTANCE

| (15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 10/29/99 | (20) CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
|---|---|
| Kwasi Badu-Tweneboah<br>[ ] FIT [X] FORM [ ] FUNCTION | |

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17)

| (18) CONSTRUCTION CONCURRENCE DATE: | (21) FIELD WORK COMPLETED: |
|---|---|
| PURCHASE REQUISITION REQUIRED: [ ] YES [ ] NO (19) | (SIGNOFF BY CE OR PE) DATE: |

-F-4259
REV. 5: 10/01/99

**Response to RCI-20102-057R**
**Dated 10/26/99**
**(Page 2 of 2)**

Section 5.2 (page 5-1) of the Impacted Material Placement (IMP) Plan indicates that Category 2 materials include "...irregularly shaped materials or other components of the superstructure or substructure with a maximum length of 10 ft. (3 m) and a maximum thickness of 18 in. (450 mm) which can be transported, placed, spread, and compacted *en masse*." Category 2 materials are also to be placed in the OSDF in loose lifts not exceeding 21 in. (530 mm) in thickness. The total compacted thickness of a Category 2 material lift, including the Category 1 material used to mix and spread over the Category 2 material, shall be approximately 24 in. (610 mm).

The dimensions of the "deck plate" material described in Item (9) of this RCI meet the length and thickness requirements of Category 2 material. Therefore, as long as the material can be placed to fit in a Category 2 lift without any protruding parts, it can be placed as Category 2 material. Attempts should be made to flatten the material as much as practicable prior to loading for transport to the OSDF. This was agreed to between representatives from Fluor Daniel Fernald (FDF) Construction and GeoSyntec Consultants during a 26 October 1999 visit to the material stockpile in Plant 4. This would avoid creating voids in the lift since Category 2 material should be mixed with Category 1 material as much as practicable during placement activities.

10/29/99

Author: Jyh-Dong Chiou at FNST-02
Date: 11/5/99 3:37 PM
Normal

2741

Vern B Taylor at FNST-03, Scott Osborn at FNST-04
Warren Hooper, Bill Zebick, Susan Lorenz at FNST-06, Dennis Carr,
Carlos Tellez at FNST-03, Robert Nichols at FNST-03, Johnny Reising at FNST-06,
Rob Janke at FNST-06, Jay Jalovec at FNST-06, John Trygier at FNST-06,
John Sattler at FNST-06, Jyh-Dong Chiou
Subject: Approval For "Deck Plate" Placement
---------- Message Contents

Hello,

We have received OEPA's written approval and US EPA's verbal approval for OSDF RCI-20102-057R regarding Plant 4 "deck plate" for OSDF placement. There is no 4-foot width limitation on these material. The 10-foot length and 18-inch thickness limits still apply. The RCI also requires attemps be made to flatten the material as mush as practicable prior to loading. Please proceed safely with loading and placement of these material according to the approved RCI.

OEPA will be on site to observe the placement process at OSDF next week.

J.D.

RCI/DCN FORM — 2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: FSC-614 | (5)Pg 1 OF 1 | (6)DATE 01 Nov '99 |
| (3)S/C TITLE: OSDF Phase II | | (11)RCI NO.: 20102-058R | |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: Clarification on the Category 3 Material Placement Restrictions | (11)DCN NO.: | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV | (8)OTHER |
|---|---|---|---|
| Impacted Material Placement Plan (20100-PL-007) | 20100-PL-007 | 1 | |

(9) RCI - INQUIRY USQD SCREENING BY PROJECT ENGINEER

Section 8.4.1, paragraph 4 (page 8-4) of the Impacted Material Placement (IMP) Plan states that "...the Category 3 items should be placed toward the center of the cell and not in the same horizontal elevation within 100 ft. (30.5 m) laterally of more compressible materials (i.e., Category 4 materials, and sludges and double-bagged asbestos of Category 5 materials)". Clarification is being provided on what "100 ft laterally" means.

(10)REQUESTOR: COMPANY: GeoSyntec DATE: 01 Nov 1999
Kwasi Badu-Tweneboah

(12)CE / PE DATE:

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES (14) FOR DCN: ☐ APPROVED ☐APPROVED AS NOTED ☐ DISAPPROVED

The "100 ft laterally" means a 100-ft separation distance from all directions (north-south, east-west, diagonally) of placed Category 3 material. In other words if a Category 3 material is placed in a grid of 100-ft by 100-ft at Elevation X, Category 4 and 5 materials can only be placed in a grid, separated by another grid in all directions (100 ft minimum), at Elevation X.

RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: DATE: 11/22/99
Kwasi Badu-Tweneboah ☐ FIT ☒ FORM ☐ FUNCTION

(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE:

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

(17) PERFORMANCE GRADE:

(18)CONSTRUCTION CONCURRENCE:DATE:

(19) PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO

(21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE:



FS-F-4259 (2/16/98)

# APPENDIX U

# DESIGN CHANGE NOTICES (DCNs)

2741

RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: FSC-614 | (5)Pg 1 OF 1 | (6)DATE 11 Feb. 99 |
| (3)S/C TITLE: OSDF Phase II | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: HDPE Textured Geomembrane | (11)DCN NO.: 20102-78 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV | (8)OTHER |
|---|---|---|---|
| Technical Specification 02770P | Page 02770P-4 | 3 | |

A clarification concerning the required HDPE textured geomembrane has been requested. It is understood that textured geomembrane is textured on both sides unless otherwise indicated. However, the following design change is made to clarify any misunderstanding.

Change Specification 02770P Part 2.02 A. to read as follows: "HDPE textured (both sides) and HDPE smooth geomembrane will have properties that comply with the required values shown in Table 02770P-1."

| (10)REQUESTOR: | COMPANY: | DATE: | (12)CE / PE | DATE: |
|---|---|---|---|---|
| Daniel Bodine | GeoSyntec | 11 Feb. 1999 | BILL ZEBICH<br>JAMES C. JENKINS | 2/12/99<br>2/11/99 |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14) FOR DCN: ☒ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

RCI – DCN ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: Daniel Bodine 11 Feb.1999 ☐ FIT ☒ FORM ☐ FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
| (16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 2/12/99 | |
| (17) PERFORMANCE GRADE: 5 | |
| (18)CONSTRUCTION CONCURRENCE: DATE: 2/12/99 | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| (19) PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO | |

ORIGINAL

ECDC CONTROLLED COPY NO. 000104

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FS-F-4259 (2/16/98)

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RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: FSC-614 | (5)Pg. 1 OF 1 | (6)DATE 1 Feb. 1999 |
| (3)S/C TITLE: OSDF Phase II | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ ☐ OTHER ☐ | (4A)RCI/DCN TITLE: Modification of APZ Criteria | (11)DCN NO.: 20102-079 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV | (8)OTHER |
|---|---|---|---|
| Test Pad Program Final Report - Addendum No. 1 | | 0 | |
| Technical Specification 20102-Section 02225, Parts 2.01 C, 3.02 C, 3.03 A and 3.04 A. | Pages 02225- 5 & 6 | 1 | |

(9) RCI - INQUIRY USQD SCREENING BY PROJECT ENGINEER

Changes to Technical Specification Section 02225, Parts 2.01 C, 3.02 B, 3.03 A and 3.04 A are being made to comply with requirements presented in the referenced Test Pad Program Final Report – Addendum No. 1. The acceptable permeability zone (APZ) change will modify one of the three criteria that determine the left boundary of the APZ. The soil screening, moisture conditioning and soil stockpiling requirements are improvements to equipment and stockpiling procedures that have already been implemented by the contractor, except for approximate stockpile size.

For Part 2.01 C, replace the first sentence to read as follows: "Identify screened and moisture conditioned stockpiles as sources for clay liner and cap material at least 15 calendar days prior to use to allow for conformance testing by the CQC Consultant and to assure adequate time for hydration of screened soil."

For Part 3.04 A, add the words "moisture condition" after the word "screen,".

(9) DCN – JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

For Part 3.02 C, in the first sentence, change "5,000 cubic yards" to "5,000 to 10,000 cubic yards". Add the following two sentences after the first. "The clay soil shall be moisture conditioned prior to stockpiling to within approximately 2 percentage points of the compaction moisture content. Maintain stockpile moisture condition by sealing, wetting, drying and/or discing, as necessary."

For Part 3.03 A, change criteria " (i) moisture content that results in a degree of soil saturation of at least 90 percent; " to read as follows:

" (i) moisture content that is on or to the right of the line of optimums determined by connecting the optimum moisture contents from the standard and modified Proctor tests (ASTM D 698 and ASTM D 1557, respectively);"

CQC testing protocols that will be used by the CQC Consultant are described in the Test Pad Program Final Report – Addendum No. 1.

| (10)REQUESTOR: | COMPANY: | DATE: | (12)CE / PE | DATE: |
|---|---|---|---|---|
| Daniel Bodine | GeoSyntec | 12 February 1999 | Bill Zebrek | 2/25/99 |
| Daniel Bodine | | | JAMES C. JENKINS J.C. Jenkins | 2/16/99 |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14) FOR DCN: ☒ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

CDC CONTROLLED COPY NO. C011

## RCI – DCN ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: DATE: Daniel Bodine 12 Feb. 1999 ☐ FIT ☒ FORM ☐ FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
| (16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) James C. Jenkins DATE: 2/25/99 | |
| (17) PERFORMANCE GRADE: 5 | |
| (18)CONSTRUCTION CONCURRENCE: Bill Zebrek DATE: 2/25/99 | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| PURCHASE REQUISITION REQUIRED: ☐ YES ☒ NO | |

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FS-F-4259 (2/16/98)

FLUOR DANIEL FERNALD
P.O. Box 538704 Cincinnati, Ohio 45253-8704 (513) 648-3000

—2741 cc: Kwasi
Collin
File

RECEIVED
MAY 18 1999
J. Burnett

Takes the place of DCN No. 20102-80. B. Schweitzer said cannot write a DCN against a plan.

May 18, 1999

Fernald Environmental Management Project
Letter No. C:SWP:(OSDF):99-0018

Mr. Mark Mather
Petro Environmental Technologies, Inc.
7851 Palace Drive
Cincinnati, OH 45259

Dear Mr. Mather:

FSC 614, SWU EXCAVATION/ OSDF PHASE II, CHANGES TO CQA PLAN

This is to advise Petro Environmental Technologies, Inc. (Petro) of a change to the test frequency for clay liner material. Refer to the "Construction Quality Assurance Plan", 20100-PL-006. Table 6-1 of the referenced Construction Quality Assurance Plan (CQA Plan) presents conformance test frequencies for OSDF Liner system components. In this table, hydraulic Conductivity ASTM D 5084 minimum test frequency for clay liner material is given at 1 test per 10,000 $yd^3$ with Footnote 3. Footnote 3 states the following: "For Phase I, the frequency shall be 1 test per 1,500 $yd^3$. This frequency shall be evaluated for modification during later phases." GeoSyntec has evaluated this frequency and per the approved Test-Pad Program Final Report Addendum No. 1, Table 6-1, Compacted Clay Liner Hydraulic Conductivity/ASTM D 5084, the test frequency is revised to read as follows: "1 test per clay stockpile or 1 test per 10,000 $yd^3$, whichever is a greater frequency."

Sincerely,

William A. Zebick
William A. Zebick
OSDF Construction Manager

c: J. Burnett, GeoSyntec, MS38
F.L. Flack, FDF, MS60
R.A. Holbrook, FDF, MS64
D.W. Hooper, FDF, MS 52-0
U.A. Kumthekar, FDF, MS64
L.E. McDaniel, FDF, MS60
L.R. Wehlitz, FDF, MS64
ECDC
OSDF File Station

RCI/DCN FORM E-2741

# REQUESCT FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| VP / WO NO.: 20102 | (2)S/C NO.: FSC-614 | (5)Pg. 1 OF 1 | (6)DATE 13 Feb. 99 |
| (3)S/C TITLE: OSDF Phase II | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: Hydraulic Conductivity Test Frequency | (11)DCN NO. 20102-080 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV | (8)OTHER |
|---|---|---|---|
| Construction Quality Assurance Plan-20100-PL-006 | Table 6-1 | 0 | |
| Letter Report to Mr. Michael J. Hickey from GeoSyntec Consultants, Dated 10 July 1998, Titled, Evaluation of Hydraulic Conductivity Testing Results for Phase 1 Construction. | | | |

(9) RCI - INQUIRY USQD SCREENING BY PROJECT ENGINEER

Table 6-1 of the referenced Construction Quality Assurance Plan (CQA Plan) presents conformance test frequencies for OSDF liner system components. The Hydraulic Conductivity (ASTM D 5084) maximum test frequency for clay liner material is given at 1 test per 10,000 yd$^3$ (remolded sample)(3). Note 3 states the following: "For Phase 1 the frequency shall be 1 test per 1,500 yd$^3$. This frequency shall be evaluated for modification during later phases."

The referenced letter report, dated 10 July 1998 (Attached),

(9) DCN – JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

presents an evaluation of the Phase 1 hydraulic conductivity testing. The report recommends changing the test frequency for future construction phases to one test per clay stockpile or one test per 10,000 yd$^3$, whichever produces the greater number of samples. Therefore, a change to the CQA Plan is now being made. Change CQA Plan, Table 6-1, Compacted Clay Liner Hydraulic Conductivity/ASTM D 5084, test frequency to read as follows: " 1 test per clay stockpile or 1 test per 10,000 yd $^3$, whichever is greater". Please note that this test frequency does not apply to clay cap material.

| (10)REQUESTOR: | COMPANY: | DATE: | (12)CE / PE | DATE: |
|---|---|---|---|---|
| Daniel Bodine | GeoSyntec | 15 Feb. 1999 | | |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☒ NO ☐ YES (14) FOR DCN: ☒ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

RCI – DCN ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL:DATE: Daniel Bodine 15 Feb.1999 ☐ FIT ☒ FORM ☐ FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
| (16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: | |
| (17) PERFORMANCE GRADE: | |
| (18)CONSTRUCTION CONCURRENCE: DATE: | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO | |

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FS-F-4259 (2/16/98)

GEOSYNTEC CONSULTANTS

1100 Lake Hearn Drive • Suite 200
Atlanta, Georgia 30342-1523 • USA
Tel. (404) 705-9500 • Fax (404) 705-9400

2741

10 July 1998

Mr. Michael J. Hickey
Fluor Daniel Fernald
MS: 64
7400 Willey Road
Hamilton, Ohio 45013-9402

Subject: Evaluation of Hydraulic Conductivity Testing Results for Phase I Construction

Dear Mr. Hickey:

This letter report is to provide GeoSyntec Consultants' (GeoSyntec) evaluation of hydraulic conductivity testing results for Phase I construction, as required by Table 6-1 of the Construction Quality Assurance (CQA) Plan (GeoSyntec, 1997). The remainder of this report is organized to: (i) provide background information; (ii) evaluate testing results from Phase I construction; (iii) provide recommendations for Phase II construction; and (iv) provide closure.

## BACKGROUND

The approved source of compacted clay liner and cap material for the On-Site Disposal Facility (OSDF) of the Fernald Environmental Management Project (FEMP) is a local brown till material that will be obtained from excavation for the base of the OSDF and from the on-site East Field Borrow Area. The results of a test pad program reported in the Test Pad Program Final Report (TPPFR) (GeoSyntec, 1997) verify that material used in construction of the test pads meets the applicable or relevant and appropriate requirements (ARARs) presented in the approved Design Criteria Package (DCP) (GeoSyntec, 1996). The approved CQA Plan, Table 6-1 (Attachment A to this letter), specifies a testing frequency for hydraulic conductivity of remolded samples per ASTM D 5084 and provides for an evaluation of the frequency after Phase I construction.

The purpose of this letter report is to present an evaluation of Phase I hydraulic conductivity testing results and to provide a recommendation for modification of the testing frequency for Phase II construction. As requested by Fluor Daniel Fernald (FDF) (see telephone memorandum at Attachment B), GeoSyntec will continue testing at the frequency specified for Phase I construction until the recommendations included in this report are reviewed and approved by FDF.

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GQ0409-01/F9830026

## PHASE I HYDRAULIC CONDUCTIVITY TESTING RESULTS

Construction quality control (CQC) and construction quality assurance (CQA) monitoring and testing results for Phase I construction were reported in a CQA Final Report (GeoSyntec, 1998). Table 4-2 (Attachment C to this letter report) of the CQA Final Report is the Phase I Compacted Clay Liner Properties Summary. During Phase I construction, seventy-three (73) hydraulic conductivity tests (ASTM D 5084) were conducted with four test results having reported hydraulic conductivity greater than $1 \times 10^{-7}$ cm/sec (i.e., unsatisfactory results). A detailed listing of individual test results is presented in Appendix F of the CQA Final Report. Sixty-nine satisfactory tests out of seventy-three total tests represents satisfactory hydraulic conductivity results for 95 percent of the samples. Two of the unsatisfactory tests (initial samples for LP-01 and LP-02) were incorrectly remolded in the laboratory and did not fall within the approved acceptable permeability zone (APZ). They were remolded to within the APZ and retested exhibiting satisfactory results. Therefore, only two tests (LP-07 and LP-34) exhibited unsatisfactory samples based on hydraulic conductivity.

Samples LP-07 and LP-34 indicated unsatisfactory hydraulic conductivity. Both these tests also exhibited clay contents below acceptable levels (i.e., 12.3 % clay for LP-07 and 14.8 % for LP-34 versus a minimum requirement of 15 % clay). Materials represented by these samples were removed from the stockpile and new samples exhibiting satisfactory testing results were obtained in the stockpile location after removal of the unsatisfactory material.

Data presented herein and in the CQA Final Report confirm that the brown till used in Phase I construction consistently produces satisfactory low hydraulic conductivity when compacted within the APZ recommended in the approved TPPFR.

## RECOMMENDATIONS FOR PHASE II CONSTRUCTION

Hydraulic conductivity testing frequency specified in the ARARs and in the CQA Plan is one test per 10,000 $yd^3$ for remolded material. As noted in the CQA Plan, Phase I construction hydraulic conductivity testing frequency was specified as one test per 1,500 $yd^3$, and to be evaluated at the end of Phase I. Analysis of the Phase I data revealed that 97 percent of all samples

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within the APZ meet the project hydraulic conductivity requirement. The two samples which did not meet the project requirements for hydraulic conductivity were also identified as not meeting the requirements for percent clay. Therefore, these two samples would be rejected even if the hydraulic conductivity tests were not performed. Based on the confidence developed during Phase I construction (97 percent of all samples within the APZ passed), GeoSyntec recommends that the testing frequency for Phase II construction be specified as one test per clay stockpile or one test per 10,000 $yd^3$, whichever produces the greater number of samples.

## CLOSURE

GeoSyntec is pleased to provide Title III Engineering Services to FDF for the OSDF project. Your approval to implement recommendations for Phase II construction is requested. Please do not hesitate to contact either of the undersigned for additional information.

Sincerely,

David K. Phillips, P.E.
Senior Project Engineer

J.F. Beech, Ph.D., P.E.
Principal

Enclosure

Copy to: Rick A. Holbrook, FDF
Uday Kumthekar, FDF
Dan Bodine, GeoSyntec

# TABLE 6-1
# MINIMUM CONFORMANCE TESTING FREQUENCIES FOR OSDF LINER SYSTEM COMPONENTS

| TEST NAME/TEST METHOD | SOIL TYPE | | | |
|---|---|---|---|---|
| | COMPACTED FILL | COMPACTED CLAY LINER | GRANULAR DRAINAGE MATERIAL | EMBEDMENT FILL |
| SPECIFICATION SECTION | 02200 | 02225 | 02710 | 02215 |
| Particle Size Analysis/ASTM D 422 (sieve only) | 1 test per 5,000 $yd^3$ | 1 test per 1,500 $yd^3$ (1) | N/A | N/A |
| Particle Size Analysis/ASTM C 136 | N/A | N/A | 1 test per 3,000 $yd^3$ | 1 test per 1,000 $yd^3$ |
| Atterberg Limits/ASTM D 4318 | 1 test per 5,000 $yd^3$ | 1 test per 1,500 $yd^3$ | N/A | N/A |
| Moisture Content/ASTM D 2216 or ASTM D 4643 | 1 test per 5,000 $yd^3$ | 1 test per 1,500 $yd^3$ | N/A | |
| Soil Classification/ASTM D 2487 | 1 test per 5,000 $yd^3$ | 1 test per 1,500 $yd^3$ | 1 test per 3,000 $yd^3$ | 1 test per 1,000 $yd^3$ |
| Standard Proctor/ASTM D 698 | 1 test per 5,000 $yd^3$ | 1 test per 1,500 $yd^3$ | N/A | N/A |
| Hydraulic Conductivity/ASTM D 5084 | N/A | 1 test per 10,000 $yd^3$ (remold sample)(2) | N/A | N/A |
| Hydraulic Conductivity/ASTM D 2434 | N/A | N/A | 1 test per 3,000 $yd^3$ | N/A |
| Carbonate Content/ASTM D 3042(3) | N/A | N/A | 1 test per 5,000 $yd^3$ | N/A |
| Organic Content/ASTM D 2974 | N/A | N/A | N/A | N/A |

NA = Not Applicable

NOTE: 1. Also perform hydrometer analysis once every tenth test.

2. Sample to be tested at pH of 4.

3. For Phase I, the frequency shall be 1 test per 1,500 $yd^3$. This frequency shall be evaluated for modification during later phases.

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**GeoSyntec Consultants**
1100 Lake Hearn Drive, NE, Suite 200, Atlanta, GA 30342-1523

**Record of Telephone Conversation**
Attachments: ☐ Yes ☒ No

## TITLE III SERVICES, FERNALD ON-SITE DISPOSAL FACILITY

Contact Made By: Dave Phillips  Date: 9 July 1998  Time: 10:15 a.m

Person Contacted: Mike Hickey  Title: OSDF Project Manager

Address: FDF  Phone Number: (513) 648-5971

Summary: Mr. Hickey called (Uday Kumthekar and Kwasi Badu-Tweneboah were with him) to discuss hydraulic conductivity testing frequency for compacted clay liner (reference Table 6-1, CQA Plan, Revision 0). FDF believes the regulators will intrepret Table 6-1 to require test frequency of one test per 1,500 yd$^3$ (Phase I requirement) until GeoSyntec produces an evaluation to show that a frequency of one test per 10,000 yd$^3$ (ARAR requirement) is acceptable/appropriate. Mr Hickey instructed GeoSyntec to continue using a frequency of one test per 1500 yd$^3$ until GeoSyntec's evaluation is prepared and approved by FDF.

GeoSyntec will prepare evaluation referencing Phase I hydraulic conductivity data for FDF approval.

— end of conversation —

Telephone Contact: ☐ Initiated ☒ Received

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Action Needed: ☒ Yes ☐ No

By Whom: GeoSyntec

What Is Needed: Maintain test frequency of one/1500 yd$^3$ and prepare evaluation.

Date of Draft to Fluor Daniel Fernald (FDF): 9 July 1998

Copies To:
Mike Hickey, FDF
Uday Kumthekar, FDF
Rick Holbrook, FDF
Kwasi Badu-Tweneboah, GeoSyntec
Jung Beech, GeoSyntec
Project File, GeoSyntec

# TABLE 4-2

## PHASE I COMPACTED CLAY LINER PROPERTIES SUMMARY

| DESCRIPTION | TEST STANDARD | PROJECT(1) SPECIFICATIONS | TEST FREQUENCY ($yd^3$) | APPROXIMATE NUMBER OF TESTS REQUIRED(2) | NUMBER OF TEST PERFORMED (FAILURES) |
|---|---|---|---|---|---|
| LABORATORY TEST | | | | | |
| Particle Size: | ASTM D 422 | | 1 per 1,500 | 63 | |
| Sieve | | | | | |
| Percent Finer than 2.0 in. | | 100% | | | 79 |
| Percent Finer than .075 in. | | ≥90% | | | (5) |
| Hydrometer | | | | | |
| Percent Finer than #200 | ASTM D 1140 | ≥50% | | | 71 |
| Percent Finer than .002 mm | | ≥15% | | | (5) |
| Compaction | ASTM D 698 | — | 1 per 1,500/ as required | 63 | 70 |
| Moisture | ASTM D 2216<br>ASTM D 4643 | — | 1 per 1,500/ as required | 63 | 241<br>197 |
| Soil Classification | ASTM D 2487 | CL or CH | 1 per 1,500 | 63 | 69 |
| Atterberg Limits | ASTM D 4318 | 10 ≤ PI ≤ 40 | 1 per 1,500 | 63 | 73<br>(3) |
| Hydraulic Conductivity: | ASTM D 5084 | | 1 per 1,500 | 63 | 73 |
| Source | | | | | (4) |
| Remold | | ≤ 1 x $10^{-7}$ cm/sec | | | |
| FIELD TEST | | | | | |
| Sand Cone: | | — | 1 per 25 passing density tests | 10 | 21 |
| Soil density | ASTM D 1556 | | | | |
| Soil moisture | ASTM D 2216 | | | | |
| Nuclear Gauge: | | Within APZ and | 5/acre/lift | 240 | 980 |
| Soil density | ASTM D 2922 | ≥95% | | | (370) |
| Soil moisture | ASTM D 3017 | M.C. ≤ + 3% O.M.C. | | | |
| Depth Verification Survey | — | — | — | — | — |

NOTES: (1) Reference Section 02225 of the Specification and Section 6 of the CQA Plan for further details.
(2) The approximate number of tests required is based on a stockpile volume of 93,700 $yd^3$ for the Phase I construction.

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RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: FSC-614 | (5)Pg 1 OF 1 | (6)DATE 5/13/99 |
| (3)S/C TITLE: OSDF Phase II | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: Relocation of Survey Monument OSDF-4 | (11)DCN NO.: 20102-084 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV. | (8)OTHER |
|---|---|---|---|
| Master FEMP Benchmark Location Plan | 00X-5500-G-01846 | 3 | |
| Site Development Plan I - Base Bid | 90X-6000-G-00202 | 0 | |
| Site Development Plan I - Option A | 90X-6000-G-00203 | 2 | |
| Site Development Plan I - Option C | 90X-6000-G-00221 | 2 | |

(9) ☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER (9) ☒ DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Abandon survey monument OSDF-4 and create OSDF-4a approximately 20 ft to the west of current location of OSDF-4. Wetlands Project working in area and need to place approximately 5 ft of fill over current OSDF-4.

Existing bollards surrounding OSDF-4 to be salvaged and placed around new OSDF-4a.

New location of OSDF-4a monument to be as-built and information submitted to GeoSyntec and FDF Engineering for incorporation into applicable site documents.

| | |
|---|---|
| (10)REQUESTOR: MAUREEN RICHARD COMPANY: FDF DATE: 5/13/99 | (12)CE / PE DON GOETZ 05/25/99 JAMES C. JENKINS 5/13/99 DATE: |
| (13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☐YES | (14) FOR DCN: ☒APPROVED ☐APPROVED AS NOTED ☐DISAPPROVED |

GEOSYNTEC RCI - DCN ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: Jim Burnett 25 May 1999 DATE: ☒FIT ☐FORM ☐FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
| (16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) James C. Jenkins DATE: 5/26/99 | |
| PERFORMANCE GRADE: (17) 4 | |
| (18)CONSTRUCTION CONCURRENCE: 05/28/99 DATE: PURCHASE REQUISITION REQUIRED: ☒YES ☐NO (19) | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |

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REV. 4: 02/16/98


Instruction for form completion are provided

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RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

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|---|---|---|---|
| (1)WP / WO NO.:20102 | (2)S/C NO.: FSC-614 | (5)Pg 1 OF ~~1~~ 2 JB | (6)DATE 02 Jun 99 |
| (3)S/C TITLE: OSDF Phase II | | | (11)RCI NO.: NA |
| (4) RESPONSIBLE DISCIPLINE: E ☒ M ☐ C ☐ OTHER ☐ | (4A)RCI/DCN TITLE: Butt Fusion Welding at Penetration Boxes | | (11)DCN NO.:20102-85 |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV. | (8)OTHER |
|---|---|---|---|
| Technical Drawings | 90X-6000-G-00206<br>90X-6000-G-00217<br>90X-6000-G-00218 | 0<br>~~1~~ 0<br>~~1~~ 2 | Sheet No. G-9B<br>Sheet No. G-24B<br>Sheet No. G-25B |
| Technical Specifications | 20102-TS-0001 | 1 | Section 13005 |

(9) ☒ DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

A. Delete the following five electrofusion couplers at the penetration boxes in Cell 3 and replace with butt fusion welded connections.

1. LDS pipe - Down gradient of penetration box between penetration box and Manhole #3 - one
2. Redundant LCS pipe - Down gradient of penetration boxes between penetration box and Manhole #3 - one
3. Redundant LCS pipe - Between penetration boxes in series - one
4. LCS pipe - Down gradient of penetration boxes between penetration box and Manhole #3 - one
5. LCS pipe - Between penetration boxes in series - one

The above changes are being made because of improved performance of butt fusion welds over electrofusion couplers. The locations of the butt fusion welds will be determined in the field.

B. On the upstream ends of penetration boxes on LDS, Redundant LCS, and LCS pipes, use electrofusion couplers or butt fusion welds - three locations

C. To improve tie-in connection between penetration boxes and GML in the field, an 80 mil piece of HDPE may be welded to the upstream end of the penetration boxes prior to installation. This material shall be provided by FDF from approved liner material. This material shall be welded to the penetration boxes by the Contractor and shall be tested in accordance with the CQA plan.

| | |
|---|---|
| (10)REQUESTOR: Anthony P. Klimek COMPANY: FDF DATE: 6/02/99 | (12)CE / PE: Don Goetz 6/03/99 JAMES C. JENKINS James Jenkins 6/02/99 DATE: |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☐YES

(14) FOR DCN: ☐APPROVED ☒APPROVED AS NOTED ☐DISAPPROVED

See attached response on Page 2 of 2

GeoSyntec Consultants RCI - DCN ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: Jim Burnett 06/02/99 Jim Burnett ☐FIT ☒FORM ☐FUNCTION DATE: | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 6/3/99

(17) PERFORMANCE GRADE: 4 James C. Jenkins

| | |
|---|---|
| (18)CONSTRUCTION CONCURRENCE: 06/03/99 DATE: | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| (19) PURCHASE REQUISITION REQUIRED: ☒YES ☐NO | ECDC CONTROLLED COPY NO. C011 |

FS-F-4259
REV. 4: 02/1[illegible]/99

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Page 1 of 1

Instructions for form completion are provided

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**GeoSyntec Consultants**
**Response to DCN - 20102-085**
**(Dated 5/25/99, Page 2 of 2)**

Part 3.04F of Section 02605: High Density Polyethylene (HDPE) Pipes and Fittings indicates that thermal butt-fusion joints or Electrofusion adapters (or couplings) are the approved methods of joining HDPE pipes. In addition, as indicated in the report titled "Evaluation of Leachate Transmission System On-Site Disposal Facility Fernald Environmental Management Project", Revision B, April 1999, prepared by GeoSyntec Consultants, electrofusion coupling is a recommended alternate procedure for joining pipe, especially in cases where pipe ends cannot be brought together. Recommended procedures for joining pipe using electrofusion coupling methods were presented in Appendix I of the above-referenced report.

Butt-fusion welded connections shall be used at the five locations listed in paragraph 9A of DCN No. 20102-085 unless actual field conditions prevent proper utilization of butt-fusion techniques. Prior to utilization of electrofusion couplings at any of the five locations specified, the contractor shall prepare a written request with a detailed description of the conditions that prevent utilization of butt-fusion welding techniques. Contractor shall receive written authorization from the FDF Construction Manager prior to the installation of any electrofusion couplings. All joints must be constructed, and pressure tested, in strict accordance with the Technical Specifications.

2 June 1999

FILE w/ DCN-20102-3

F-2741 CC: OSDF FILE
ECDC -
KLIMEK
ZEBICK
KWASI-GERMAC

MEMORANDUM

To: J.D. Chiou, FDF , SDFP Manager
From: Tom Ontko, Ohio EPA Tom Ontko
Re: OSDF DCN 20102-088

This DCN incorporate current changes to ASTM methods for testing GCL materials. The Ohio EPA approves these changes.

Post-it™ brand fax transmittal memo 7671 | # of pages ▸ 3

| | |
|---|---|
| To J D Chiou | From Tom Ontko |
| Co. | Co |
| Dept. | Phone # 937-285-6023 |
| Fax # 513 ~~280~~ 642-5131 | Fax # |

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RCI/DCN FORM 2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: FSC-614 99SC001440 & 1441 | (5)Pg 1 OF 1 | (6)DATE 02 July 99 |
| (3)S/C TITLE: OSDF Phase II | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: Changes to GCL Test Methods | (11)DCN NO.: 20102-088 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV | (8)OTHER |
|---|---|---|---|
| 20102-TS-0001 Section 02772<br>20102-TS-0001 Section 02772P | Table 02772-1<br>Table 02772P-1<br>Part 1.03A<br>Part 2.02A | 1<br>2<br>2<br>2 | |

(9) RCI - INQUIRY USQD SCREENING BY PROJECT ENGINEER

Changes to Section 02772 and Section 02772P are being made to incorporate current changes to GCL test methods.

Replace "ASTM D 5261" on Part 2.02A (page 02772P-7), Table 02772P-1 (page 02772P-9) and Table 02772-1 (page 02772-7) with "ASTM D 5993".

Add the following to Part 1.03A (page 02772-2 and page 02772P-2):

(9) DCN – JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

17. ASTM D 5993 Standard Test Method for Measuring Mass Per Unit Area of Geosynthetic Clay Liner.

Since ASTM D 5084 is referenced in Table 02772P-1 (page 02772-10), add the following to Part 1.03A (page 02772P-2):

18. ASTM D 5084 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.

7/6/99

| (10)REQUESTOR: | COMPANY: | DATE: | (12)CE / PE | DATE: |
|---|---|---|---|---|
| Kwasi Badu-Tweneboah | GeoSyntec | 02 July 1999 | James C. Jenkins | 7/6/99 |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14) FOR DCN: ☒ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

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COPY NO. C011

RCI – DCN

ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: DATE: 7/2/99<br>Kwasi Badu-Tweneboah ☐ FIT ☒ FORM ☐ FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
| (16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 7/8/99 | |
| (17) PERFORMANCE GRADE: | |
| (18)CONSTRUCTION CONCURRENCE: DATE: 7/6/99<br>(19) PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |

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FS-F-4259 (2/16/98)

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RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.:20102 | (2)S/C NO.: FSC-614 | (5)Pg. 1 OF 1 | (6)DATE 01 Sep 99 |
| (3)S/C TITLE: OSDF Phase II, Option A | | (11)RCI NO.: NA | |
| (4) RESPONSIBLE DISCIPLINE: E ☒ M ☐ C ☐ OTHER ☐ | (4A)RCI/DCN TITLE: Relocate the Cell 3 Primary Liner Penetration Boxes | (11)DCN NO.:20102-091 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV. | (8)OTHER |
|---|---|---|---|
| Technical Drawings | 90X-6000-G-00206<br>90X-6000-G-00217<br>90X-6000-G-00218 | 0<br>0<br>2 | Sheet No. G-9B<br>Sheet No. G-24B<br>Sheet No. G-25B |
| Technical Specifications | 20102-TS-0001 | 1 | Section 13005 |

(9) X DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

DCN 20102-085 requires butt fusion welded connections in the area of the liner penetration boxes at Cell 3 in lieu of electro-fusion couplers. The location of the two boxes on the primary liner shall be moved to provide room to use butt fusion welding equipment. The locations of the three boxes on the secondary liner shall be as shown on the original design.

Butt fusion welded connections shall be used on the Cell 3 Redundant LCS pipe line and the LCS pipe line between the two liner penetration boxes located on each line. The liner penetration boxes on the primary liner must be moved in an easterly direction so that butt fusion welding equipment can be used between the liner penetration boxes in each line. The boxes on the primary liner (Type IV on Redundant LCS line and Type III on LCS line) shall be moved a maximum of 24"inches into the cell (in an easterly direction) and located in line with the existing pipe lines. Material around the penetration boxes shall be graded to conform to the new locations while maintaining existing minimum thickness and drainage requirements. Contractor shall provide as-built survey data on the locations (horizontal and vertical) of the boxes and butt fusion welded connections within 10 calendar days after installation and testing of the boxes.

| | | | |
|---|---|---|---|
| (10)REQUESTOR: 9/2/99 | COMPANY: | DATE: | (12)CE / PE: DATE: |
| Anthony P. Klimek | FDF | 9/1/99 | Don Goetz --FDF 09/02/99 9/1/99 |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☐YES

(14) FOR DCN: ☐APPROVED ☒APPROVED AS NOTED ☐DISAPPROVED

All butt-fusion welds and other welds shall be tested at the test pressures in Part 3-05B, Section 02605 of the Technical Specifications and any applicable DCNs.

KWASI BADU-TWENEBOAH / GERWYNTEX

## RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL:DA 09/02/99
Kwasi Badu-Tweneboah ☐FIT ☒FORM ☐FUNCTION

(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE:

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 9/2/99

(17) PERFORMANCE GRADE: 4

(18)CONSTRUCTION CONCURRENCE: DATE: 09/02/99

(19) PURCHASE REQUISITION REQUIRED: ☐YES ☒NO

(21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE:

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|---|---|
| To JD Chiou | From [redacted] |
| Co. | Co. Ohio EPA |
| Dept. | Phone # 937-285-6073 |
| Fax # 513-648-5131 | Fax # |

MEMORANDUM

To: J.D. Chiou, FDF , SDFP Manager
From: Tom Ontko, Ohio EPA
Re: OSDF DCNs 20102-085
20102-091
20102-092

2741

DCN-085 part A removed the existing electro-fusion couplings between MH-3 and the Cell 3 and replaced them with butt-fused welds. We approve of this replacement.
DCN-085 part B allows electro-fusion couplings upstream (that is, within the cell) of the liner penetration boxes. We approve of the use of electro-fusion couplings to connect lengths of perforated pipes within the drainage corridor. We do not approve of the use of electro-fusion couplings for the LCS pipe or redundant LCS pipe where these pipes penetrate the LDS drainage layers. Leaks of leachate thru joints in the LDS drainage layer would be interpreted as a failure of the primary liner system.
DCN-085 part C allows an 80-mil HDPE panel to be welded to the penetration boxes prior to their placement. We approve this change.

DCN-091 moves the primary liner penetration boxes for the LCS and redundant LCS pipes to the east so that enough clearance is available to butt-fuse the LCS (and redundant LCS) pipe between the two penetration boxes. It is my understanding that this move will in effect make the primary liner slope at the west berm shallower. The LDS drainage layer will be three feet thick at the bottom and taper to the original one foot thickness at the top. We approve this change since it is necessary to eliminate the electro-fusion coupling in the LDS drainage layer

DCN-092 establishes test pressures for hydrostatic testing of SDR-11 carrier pipes (120 psi) and container pipes (15 psi) and allows pneumatic testing at 15 psi as an alternative to hydrostatic testing for containment pipes only. We approve this change.

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SEP 13 1999
KBZ @ 3:55 pm

cc: Jim Burnett

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RCI/DCN FORM

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 20102 | (2)S/C NO.: FSC-614 | (5)Pg 1 OF 10 | (6)DATE 02 Sep 99 |
| (3)S/C TITLE: OSDF Phase II | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E ☐ M ☐ C ☒ OTHER ☐ | (4A)RCI/DCN TITLE: HDPE Pipe and Fittings Pressure Testing | (11)DCN NO. 20102-092 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV | (8)OTHER |
|---|---|---|---|
| Technical Specifications 20102-TS-0001 | Section 02605 | 0 | |

(9) RCI - INQUIRY USQD SCREENING BY PROJECT ENGINEER

☒ DCN

Parts 3.05B and 3.05C (page 02605-8) of Technical Specifications Section 02605 provide pressure testing procedures, including test pressures, for the HDPE pipes and fittings. DCN No. 20102-010 allowed, upon written approval by the Construction Manager, the use of air pressure testing at a minimum 15-psig test pressure for testing the installed HDPE solid wall carrier pipe between the Cell and LCS/LDS Manholes. This DCN No. 20102-092, which supersedes DCN No. 20102-010, incorporates some of the lessons learned from the leak investigation studies on the leachate transmission system (LTS).

Test pressures for hydrostatic testing shall be 120 psi and 15 psi for SDR-11 HDPE carrier and containment pipes, respectively.

The pneumatic test procedure for carrier pipes shall be used for preliminary tests only at a maximum 15-psi test pressure. For containment pipes, pneumatic testing at 15 psi-test pressure may be used as an alternate test. The pipes shall be tested in accordance with the attached dual-containment pipe test procedures.

Replace the second sentence on Parts 3.05B.2 and 3 with the following: "Test pipes in accordance with the attached hydrostatic pipe test procedure for dual-containment pipes".

Replace the second sentence on Part 3.0C with the following: "Testing shall be in accordance with the attached pneumatic pipe test procedure for dual-containment pipes".

9/2/99 DON GOETZ 09/02/99

| (10)REQUESTOR: | COMPANY: | DATE: | (12)CE / PE | DATE: |
|---|---|---|---|---|
| Kwasi Badu-Tweneboah | GeoSyntec | 02 Sep 1999 | ANTHONY P. KLIMEK | 9/2/99 |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐ NO ☐ YES (14) FOR DCN: ☒ APPROVED ☐ APPROVED AS NOTED ☐ DISAPPROVED

ECDC CONTROLLED COPY NO. C011

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|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: DATE: 09/02/99 Kwasi Badu-Tweneboah ☐ FIT ☒ FORM ☐ FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: |
| (16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) ANTHONY P. KLIMEK (17) PERFORMANCE GRADE: 4 | DATE: 9/2/99 |
| (18)CONSTRUCTION CONCURRENCE: DATE: 09/02/99 (19) PURCHASE REQUISITION REQUIRED: ☐ YES ☐ NO | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |

FS-F-4259 (2/16/98) ORIGINAL

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DCN NO. 20142-092

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# HYDROSTATIC PIPE TEST PROCEDURE
# HDPE PIPES AND FITTINGS
# ON-SITE DISPOSAL FACILITY
# FERNALD, OHIO

The following procedures are intended to supplement the requirements of Section 02605: High Density Polyethylene (HDPE) Pipes and Fittings of the Technical Specifications for the OSDF project. The procedures are applicable to the currently used SDR-11 HDPE solid wall pipes and fittings components of the OSDF. If a different SDR pipe is used in subsequent phases of work, the applicability and appropriateness of these procedures need to be reviewed. Refer to Part 3.05.B and Part 3.05.C of Section 02605 of the Technical Specifications [OSDF PHII-SPEC-REV 0] and any applicable DCNs. The procedures are to be reviewed and accepted by the pipe supplier prior to implementation. Bring any conflicts between the following procedures and Section 02605 and any applicable DCN, to the immediate attention of the Construction Manager.

## Carrier Pipe

The steps to be followed during hydrostatic pressure testing of the 6-in. diameter solid-wall carrier pipes between the Cell and LCS/LDS manholes of the OSDF are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, etc.) are to be followed. Each step is to be checked off as it is performed.

- Remove all blind flanges from cleanouts of the section of carrier pipe to be tested.

- Attach all necessary blind flanges, low-point drain valve, high-point drain valve, pressure gauge and fill hose connections to the section of carrier pipe to be tested. Low-point refers to the end of pipe section being tested with the lowest elevation; while high-point refers to the end with the highest elevation. Note that the pressure gauge must be installed upgradient of the low-point drain valve. Position the pressure gauge such that it is in full view of the testing operator when the valve is being turned on or off.



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- Attach a fill hose to the low-point of the drain valve.

- Slowly fill the carrier pipe with water until water flows from the high-point drain valve and over top the cleanouts.

- Make sure any air in the pipe is completely vented, by shaking or tapping pipes gently. When all air is out of the system, shut-off high-point drain valve, replace the cleanout blind flanges, close the low-point drain valve, shut-off water source at low-point drain valve, and remove fill hose.

- Open any low-point drain valves or weep holes in the containment pipe to allow visual leak detection monitoring during the carrier pipe testing.

- Attach pressure source to the low-point drain valve of the carrier pipe, and open low-point drain valve.

- Gradually increase pressure to the 120-psi test pressure. This test pressure applies to SDR-11 HDPE pipes only. The 120-psi pressure is the maximum pressure applied as measured at the low-point drain-valve and includes the pressure due to the hydrostatic head of water in the pipe. Close low-point valve and remove pressure source connection.

- Allow the pipe to stand without makeup pressure until equalization is reached (approximately 2 to 3 hours). Equalization is achieved if there is <u>no</u> further change in pressure over a one-hour period.

- After completion of stabilization period, repressurize the pipe to 120 psi and perform test for one hour if the pipe is not buried, and 3 hours if the pipe is buried. If a pressure decrease occurs, add makeup water to return the pipe pressure to 120 psi. A passing test is considered to require less makeup water than established from Table 1.

- Slowly relieve pressure by opening the high-point drain valve.

- If test was successful (i.e. passed) and testing of containment pipe is not desired at this time, connect a drain hose to the low-point drain valve and drain the system to an appropriate location (e.g., tank, storm sewer, etc.).

**Containment Pipe**

The steps to be followed during hydrostatic pressure testing of the 10-in. diameter containment pipe are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, etc.) are to be followed. Each step is to be checked off as it is performed.

- Remove vent plugs from fixed end seals at all cleanouts of the section to be tested. Drill holes in any fixed-end seals which do not have vent plugs. Tap the hole for subsequent installation of a vent plug.

- Attach all necessary blind flanges, low-point drain valve, high-point drain valve, pressure gauge and fill hose connections to the section of containment pipe to be tested. Low-point refers to the end of pipe section being tested with the lowest elevation; while high-point refers to the end with the highest elevation. Note that the pressure gauge must be installed upgradient of the low-point drain valve. Position the pressure gauge such that it is in full view of the testing operator when the valve is being turned on or off.

- Open all high-point vent valves of the containment piping system.

- Attach a fill hose to the low-point drain valve.

- Slowly fill the containment pipe with water until water flows from the high-point drain valve and over top the cleanouts.

- Make sure that any air in the pipe is completely vented, by shaking or tapping the pipe gently. When all air is out of the system, shut-off high-point drain valve, replace the vent plugs at the cleanout location, close the low-point drain valve, shut-off water source at low-point drain valve, and remove fill hose.

- Fill carrier pipe and pressurize to 15 psi according to the procedures described previously for the carrier pipe.

- Attach pressure source to the low-point drain valve of the containment pipe, and open the containment low-point drain valve.

- Gradually increase pressure to the 15-psi test pressure. This test pressure is the maximum pressure applied to the containment pipe as measured at the low-point drain valve and includes the pressure due to the hydrostatic head in the pipe.

- Visually inspect containment pipe welds, joints, and fittings as pressure is applied. Inspect other pipe sections for any signs of water. Apply soap to welds, joints, or fittings as needed.

- Close low-point valve and remove pressure source connection.

- Allow the pipe to stand without makeup pressure until equalization is reached (approximately 2 to 3 hours). Equalization is achieved if there is no further change in pressure over a one-hour period.

- After completion of stabilization period, repressurize the pipe to 15 psi and perform test for one hour if the pipe is not buried, and 3 hours if the pipe is buried. If a pressure decrease occurs, add makeup water to return the pipe pressure to 15 psi. A passing test is considered to require less makeup water than established from Table 1.

- Slowly relieve pressure by opening the high-point drain valve of the containment system. Note, always release pressure from the containment pipe before releasing pressure from carrier pipe.

- Open the carrier system high-point vent valve and slowly relieve the pressure from the system.

- If test was successful (i.e. passed) and testing of carrier pipe is not desired at this time, connect a drain hose to the low-point drain valve and drain the system to an appropriate location (e.g., tank, storm sewer, etc.).

DCN No. 20102-092

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# TABLE 1: ALLOWANCE FOR EXPANSION UNDER TEST PRESSURE*

**Allowance for Expansion (U.S. Gallons / 100 Fee of Pipe)**

| Nominal Pipe Size (Inches) | 1 Hour Test | 2 Hour Test | 3 Hour Test |
|---|---|---|---|
| 3 | 0.10 | 0.15 | 0.25 |
| 4 | 0.13 | 0.25 | 0.40 |
| 6 | 0.30 | 0.60 | 0.90 |
| 8 | 0.50 | 1.0 | 1.5 |
| 10 | 0.75 | 1.30 | 2.10 |
| 11 | 1.0 | 2.0 | 3.0 |
| 12 | 1.1 | 2.3 | 3.4 |
| 14 | 1.4 | 2.8 | 3.2 |
| 16 | 1.7 | 3.3 | 5.0 |
| 18 | 2.2 | 4.3 | 6.5 |
| 20 | 2.8 | 5.5 | 8.0 |
| 22 | 3.5 | 7.0 | 10.5 |
| 24 | 4.5 | 8.8 | 13.3 |
| 28 | 5.5 | 11.1 | 16.8 |
| 32 | 7.0 | 14.3 | 21.5 |
| 36 | 9.0 | 18.0 | 27.0 |
| 40 | 11.0 | 22.0 | 33.0 |
| 48 | 15.0 | 27.0 | 43.0 |

* These allowances only apply to the test period and not to the initial expansion phase.

# PNEUMATIC PIPE TEST PROCEDURE
# HDPE PIPES AND FITTINGS
# ON-SITE DISPOSAL FACILITY
# FERNALD, OHIO

Hydrostatic testing is the approved testing procedure for the piping systems. However, if approved in writing by the Construction Manager as indicated in Section 02605, Part 3.05.C, a pneumatic test procedure may be used as an alternative or as a preliminary test for the pipes. Regardless of the approval of the Construction Manager the proposed test pressure(s) to be applied to a specific pipe are to be reviewed and accepted by the pipe supplier prior to implementation. Review and acceptance of proposed test pressure(s) by the pipe supplier only involve assessing if proposed test pressure(s) may be detrimental to the pipe (i.e., does NOT include assessing safety issues).

## Carrier Pipe

The steps to be followed during pneumatic pressure testing of the 6-in. diameter solid-wall carrier pipes between the Cell and LCS/LDS manholes of the OSDF are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, danger zones, etc.) are to be followed. FDF Construction, Safety, and Quality Assurance shall verify all site safety protocols are being followed. Extra care shall be exercised when performing this test since compressed air (or the pressurized gas used as the test medium) may present hazards to workers in the vicinity of the pipelines being tested. The test medium shall be nonflammable and nontoxic. For an approved test at Fernald, the test medium shall be air.

- Install blind flanges at cleanouts along the section of carrier pipe to be tested.
- Attach all necessary blind flanges, low-point drain valve, high-point drain valve, pressure gauge and fill hose connections to the section of carrier pipe to be tested. Low-point refers to the end of pipe section being tested with the lowest elevation, while high-point refers to the end with the highest elevation. Note that the pressure gauge must be installed upgradient of the low-point drain

valve. Position the pressure gauge such that it is in full view of the testing operator when the valve is being turned on or off.

- Close all high-point drain valves and low-point drain valves of both the carrier and containment piping systems. Make sure these valves are definitely closed.

- Attach a pneumatic pressure source (i.e., air compressor with pressure regulator valve) to the overall low-point drain valve of the carrier pipe.

- Turn on the pneumatic pressure source and open the carrier pipe low-point drain valve to the pressure source. Allow the pressure to rise in a gradual, step-wise manner.

- Apply a 10-psi pressure as a preliminary test to detect any possible major leaks. Detect leaks by means of soap bubble or monitoring of test gauge as described below.

- Gradually increase the pressure to one-half of the full pneumatic test pressure The test pressure must not exceed the pneumatic test pressure of any component (e.g., valve, blind flange, etc.) of the piping system. Pause to allow the pipe strains to become somewhat equalized and to detect any possible major leaks.

- For testing of the carrier pipe, gradually increase the pressure to the full pneumatic test pressure. Pause at 5-psi below the full test pressure to allow the pipe strains to become somewhat equalized and to detect any possible leaks. Close the low-point valve once the full test pressure is reached.

- For a preliminary test, hold the pressure for a minimum of 10 minutes.

- For an alternate test, hold the pressure for one hour.

- If the internal gauge pressure of the carrier pipe does not drop below the full pneumatic test pressure, and no leaks are detected, the carrier pipe is considered to have passed the pressure/leak test.

- At the completion of the test verify the low-point drain valve is closed and disconnect the pressure source from the low-point drain valve.

- Open the high-point vent valve and slowly allow the pressure to be reduced to atmospheric pressure.

**Containment Pipe**

The steps to be followed during pneumatic pressure testing of the 10-in. diameter solid-wall SDR-11 HDPE containment pipes between the Cell and LCS/LDS manholes of the OSDF are presented below. In addition, all FDF, Contractor, and OSHA safety protocols (e.g., trench stability, pipe supports, equipment verifications, valve opening/closing warning, worker protection, danger zones, etc.) are to be followed. FDF Construction, Safety, and Quality Assurance shall verify all site safety protocols are followed. Extra care shall be exercised when performing this test since compressed air (or the pressurized gas used as the test medium) may present hazards to workers in the vicinity of the pipelines being tested. The test medium shall be nonflammable and nontoxic. For an approved test at Fernald, the test medium shall be air. Each step is to be checked off as it is performed.

- Pressurize the carrier pipe to 15 psi according to the procedures described previously for the carrier pipe.

- Close the carrier pipe system low-point drain valve, and remove the pressure source to the low-point drain valve. Note that the carrier pipe system is now a closed system, filled with compressible gas (i.e., air), under the same pressure that the containment pipe will be pneumatically tested.

- Recheck all high-point vent valves and low-point drain valves of the containment piping system. Low-point refers to the end of the pipe section being tested with the lowest elevation, while high-point refers to the end with the highest elevation. Make sure that these valves are definitely closed. Close all vent plugs at the cleanouts along the section of pipe to be tested.

- Attach a source of pneumatic pressure (i.e., air compressor with pressure regulator valve) to the overall low-point drain valve of the containment pipe.

- Turn on the pneumatic pressure source and open the containment pipe low-point drain valve to the pressure source. Allow the pressure to rise in a gradual, step-wise manner.

- Raise the pressure in increments of 5 psi in a slow, gradual manner. Allow the pipe strains to become somewhat equalized between increments. Apply soapy solution to each weld, joint, or flange to detect bubbles if there are any leaks.

- Close the containment system low-point valve once the full pneumatic test pressure of 15 psi is reached.

- For a preliminary test, hold the pressure for 10 minutes.

- For alternative tests, hold the pressure for one hour.

- If the internal gauge pressure of the carrier pipe does not drop below the full pneumatic test pressure, and no leaks are detected using soap bubble, the containment pipe would have passed the pressure/leak valve.

- When the test is complete, verify the low-point drain valve is closed and disconnect the pressure source from the low-point drain valve.

- Open the containment system high-point vent valve and slowly allow the pressure to be reduced to atmospheric pressure. Note, always release pressure from the containment pipe before releasing pressure from carrier pipe.

- Open the carrier system high-point vent valve and carefully allow the pressure to be reduced to atmospheric pressure.

2741

| Post-it® Fax Note 7671 | Date | # of pages ▸ |
|---|---|---|
| To JD Chiou | From OEPA | |
| Co./Dept | Co | |
| Phone # | Phone # | |
| Fax # Y 5131 | Fax # | |

MEMORANDUM

To: J.D. Chiou, FDF , SDFP Manager
From: Tom Ontko, Ohio EPA
Re: DCN 20102-096
RCI 20102-056R
Date: 11/16/99

RCI-056R clarifies the meaning of the phrase "center of the cell" as it is used in Section 8.4.1 of the Impacted Materials Placement Plan. The IMPP states that highly compressible materials (Category 3) are to be placed toward the center of the cell. The RCI defines 'outside edge' as the areas within 50 feet (horizontally) from the bottom of the select layer in the final cover system. The center of the cell is interpreted to mean the areas inside the outside edge. The Ohio EPA concurs with this interpretation.

DCN-096 allows use of a hydraulic mulch/mulch binder mixture in lieu of pine sap emulsion for dust suppression in the OSDF. This product is supposed to be easier to handle, mix, apply and clean up than the pine sap product. It is comparable in performance based on observations made within the OSDF. The Ohio EPA has observed areas in the STP excavation after application of a mulch/mulch binder mixture. The product appeared to be effective several weeks after application and after a 0.7 inch rain. The product adhered to moderate slopes in the deep areas of excavation and also looked more robust to light vehicle traffic. The Ohio EPA concurs with this DCN.

NOV 16

cc: Kwasi Badu-Tweneboah
Collin Sukow
Scott Quammen

C:\TONTKO\OSDF\DCN096.WPD

# RCI/DCN FORM

2741

## REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| (1) PROJECT/CWO/RES NO.: | (2) S/C NO.: | (5) Pg | Of | (6) DATE |
|---|---|---|---|---|
| 20102 | FSC-614 | 1 | 5 | 10/25/99 |

(3) S/C TITLE: On Site Disposal Facility Phase II Project

(11) RCI NO.: N/A

(4) RESPONSIBLE DISCIPLINE: E [ ] M [ ] C [X] OTHER [ ]

(4A) RCI/DCN TITLE: Alternate Dust Supressent/Crusting Agent within the OSDF.

(11) DCN NO.: 20102-096

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| Technical Specification Section 13010, Impacted Material Placement | 20102-TS-0001 | 1 | 13010-2.01D |

(9) [ ] RCI-INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [X] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

[ ] REQUIRED [X] NOT REQUIRED

Paragraph 2.01.D of Technical Specification Section 13010 states in part, that the dust suppressant/crusting agent shall be a pine sap emulsion product. Petro Environmental has proposed (see RCI 20102-044R dated 2/24/99) to use an alternate dust suppressant/crusting agent method which entails the use of a mixture of Conwed Fiber's Enviroblend hydraulic mulch and Finn Corporation's A-500 Hydro-Stik tacking agent (mulch binder). RCI 20102-044R stated that this mixture would be applied via the Finn HydroSeeder onto exposed surfaces requiring a dust suppressant/crusting agent at the following proposed rates: 1,000 lbs/ac on flat surfaces and 1,125 lbs/ac on slopes greater than 3:1. Concerning the mixture rate or each product, the following application rates are proposed: Hydraulic mulch: 1,000 lbs/ac on flat surfaces and 1,125 lbs/ac on slopes greater than 3:1; HydroStik mulch binder: 20 lbs/ac on flat surfaces and 30 lbs/ac on slopes greater than 3:1.

Based on observations of areas within the OSDF that were previously separately test treated, the hydraulic mulch/mulch binder appears to provide equal dust suppressant/crusting agent capabilities as the pine sap emulsion. The hydraulic mulch/mulch binder is easier to handle, mix, apply and clean up.

Note that DCN 20402-073 dated 12/9/98 approved the use of hydraulic mulch/mulch binder at the SWU in lieu of pine sap emulsion for dust suppressant/crusting agent. 10/27/99

(10) REQUESTOR: Jim Burnett (Jim Burnett) COMPANY: GeoSyntec Consultants DATE: 26 Oct 1999

(12) CE / PE ANTHONY R KLIMEK DATE: 10/26/99

10/26/99

(13) RESPONSE: FOR RCI, IS A DCN REQ'D? [ ] NO [ ] YES (14) FOR DCN: [ ] APPROVED [X] APPROVED AS NOTED [ ] DISAPPROVED

The attached documentation indicates that hydraulic mulch/mulch binder is compatable with the OSDF liner system.

The FDF Construction Manager will decide which areas within the OSDF are to be treated with pine sap emulsion or hydraulic mulch/mulch binder dust suppressant/crusting agent.

ECDC CONTROLLED COPY NO. 011

GeoSyntec Consultants

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 10/27/99

KWASI BADU-TWEMASAH

[ ] FIT [X] FORM [ ] FUNCTION

(20) CHARGE NO. FOR CADD SERVICES TO INCORPORATE:

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17)

(18) CONSTRUCTION CONCURRENCE DATE: 10/26/99

Bill Zebrak

PURCHASE REQUISITION REQUIRED: [ ] YES [X] NO (19)

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

000132

10/27/99

ORIGINAL

FS-F-4259
REV. 5: 10/01/99

DCN 20102-096
Page 2 of 5

CWS
Cincinnati Wholesale Supply

-2741

| Post-it® Fax Note 7671 | Date 8/25/98 # of pages ▸ 3 |
|---|---|
| To Craig Straub | From John Imm |
| Co./Dept. | Co. CWS |
| Phone # | Phone # 671-4150 |
| Fax # 608-5273 | Fax # 671-4151 |

August 25, 1998

DEAR RICK AND CRAIG:

PLEASE SEE THE ENCLOSED INORMATION IN RESPONSE TO SECTION 029000 SEEDING FOR PHASE II.

THE CONWED BRAND HYDRAULIC MULCH DOES MEET THE SPECIFICATIONS OUTLINED AS TO THE WATER HOLDING CAPACITY OF 500% MINIMUM. CONWED ENVIROBLEND HYDRAULIC MULCH IS AT A 800% WATER HOLDING CAPACITY BASED ON DRY WEIGHT. ADDITIONAL INFORMATION IS ENCLOSED.

ADDITIONALLY, THE PINE SAP EMULSION IS A DUST CONTROL AGENT AND IS NOT USED AS A TACKIFIER FOR HYDRAULIC MULCH ADDLIED IN HYDROSEEDING SLURRIES. I WOULD RECOMMEND A GUAR BASED PRODUCT THAT IS VEGTABLE BASED. HYDRO-STIK IS A GUAR BASED PRODUCT THAT HAS BEEN USED AT THE SITE PREVIOUSLY AND THE CERTIFICATION LETTER IS ALSO ENCLOSED.

SHOULD YOU REQUIRE ANY ADDITIONAL INFORMATION REGUARDING THESE PRODUCTS PLEASE CONTACT ME AT 671-4150.

Sincerely,

JOHN IMM
MANAGER

[Click here and type slogan]

000133

190 Container Place • Cincinnati, OH 45246 • (513) 671-4150

DCN 20102-096
Page 3 of 5
-2741

FINN
CORPORATION

Finn Corporation certifies that A-500 Hydro-Stik has been tested and meets the requirements of a tacking agent, and complies with ASTM D 977 and ASTM D 2028, as outlined in section 02935 of the specifications. This statement is based on rain laboratory models, field test and on the job testing.

Finn A-500 Hydro-Stik is a blend of high quality, cold water dispersible gum and special crosslinking additives.

Finn A-500 Hydro-Stik is a granular powder for use as a mulch stabilizer, a slurry lubricant, for straw and hay tacking, and for temporary stabilization of soil and sand.

Finn A-500 Hydro-Stik contains no germination or growth inhibiting materials and is non-toxic to fish or other wildlife when used as directed.

Al Schrand
Consumable Product Manager
August 25, 1998



9281 LeSaint Drive • Fairfield, OH 45014 U.S.A. • (513) 874-2818 • 800-543-7166 • FAX (513) 874-2914

DCN 20102-096
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## DESCRIPTION

Hydraulic mulching shall consist of the mixing of recycled wood and paper fiber mulch, grass seed, fertilizer and/or other agriculture approved additives with water. It shall be mixed in standard hydraulic mulching equipment to form a homogeneous slurry. The slurry shall be sprayed, under pressure, uniformly over the soil surface at the material application rate recommended by the equipment manufacturer. The hydraulic mulching equipment shall contain a motorized continuous agitation system that blends all materials in uniform suspension throughout the mixing and distribution spray cycles.

## MIXED PAPER/WOOD MULCH SPECIFICATION

Mulch materials shall consist of mixed organic materials recycled from post consumer sources or post commercial user sources. Mulch fibers shall be free of abrasive or hard contaminant's which would inhibit hydraulic pumping. The mulch fibers must maintain uniform suspension in water under agitation and shall blend with grass seed, fertilizer and other additives to form a homogeneous slurry. Upon application, the mulch material shall form a blotter-like mat covering the ground. This mat shall have the characteristics of water absorption and percolation and shall cover and bond grass seed in contact with the soil.

The wood fiber mulch shall be dyed green to aid visual metering during application. The dye shall be biodegradable and not inhibit plant growth.

The wood fiber mulch shall conform to the following specifications:

- Percent moisture content (maximum) ..... 12.5% + 3.0%
- Percent organic matter:
  Wood Fiber ..... Minimum 70.0% + 0.8% O. D. Basis
  Paper Fiber ..... Maximum 30.0% + 0.8% O.D. Basis
- Percent ash content ..... 1.0% + 0.2% O.D. Basis
- PH ..... 4.8 + 0.5
- Water holding capacity (minimum) (grams of water per 100 grams of fiber) ..... 800 + 800 (X) NET DRY WEIGHT

The wood fiber mulch shall be packaged in units not exceeding 100 lbs. and suitable for outdoor storage up to six months. The package shall contain on current labels, the manufacturer's name and address, net weight, and customer service telephone number.

## APPLICATION

Using standard hydraulic mulching equipment, fiber mulch, seed and fertilizer slurry shall be applied evenly over the soil surface in a one-step operation.

| TERRAIN | BLENDED WOOD / PAPER MULCH APPLICATION RATE |
|---|---|
| Flat soil surfaces (minimum) | 1,500 lbs. per acre |
| Slopes 3 to 1 or less | 2,000 lbs. per acre |
| Critical areas* | Not Recommended |

000135

*Potential slope instability, extreme low moisture conditions, or probability of high intensity rainfall within 30 days after use.

DCN 20102-096
Page 5 of 5

2741

FINN CORPORATION

August 31, 1999

Mr. Chris Tucker
Petro Environmental Tech. Inc.
Fluor Daniel Fernald
P O Box 249
Ross, Ohio 45061

Re: OSDF Phase II
Dust Suppression Chemicals

Mr. Tucker,

Finn Corporation understands that Petro Environmental Technologies, Inc. intends to use Finn A-500 HydroStik in conjuction with wood fiber mulch as a dust suppressant during construction activities at the onsite disposal facility(OSDF). Finn HydroStik may come into contact with liner materials. Finn Corporation certifies that HydroStik is compatible with, and is bio-degradable, and will not have any adverse impacts on polypropylene geotextile or high density polyethylene geomembrane. If you have additional questions please contact me at 513-874-2818.

Sincerely,

Al Schrand
Consumable Product Manager

000136

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2741

# MEMO

NOV 17

**TO:** J.D. Chiou

**FROM:** Joe Bartoszek

**DATE:** November 15, 1999

**SUBJECT:** **DCN 20102-097** for *OSDF Seed Mix Change*

cc: Kwasi Boahu-Twenebo
Collin Sukow

This DCN changes spec 2900 by deleting the permanent seed mix requirement and changing the interim seed and fertilizer requirement. Ohio EPA approves these changes for the OSDF cell 3 berm and associated soil stockpiles disturbed this construction season as we discussed.

Bill Z

| Post-it® Fax Note 7671 | Date | # of pages ▶ |
|---|---|---|
| To JD Chiou | From OEPA | |
| Co./Dept. | Co. | |
| Phone # | Phone # | |
| Fax # Y 5131 | Fax # | |

RCI/DCN FORM — 2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

| (1) PROJECT/CWO/RES NO.: 20102 | (2) S/C NO.: FSC-614 | (5) Pg 1 Of 2 | (6) DATE 11/9/1999 |
|---|---|---|---|
| (3) S/C TITLE: OSDF Phase II | | | (11) RCI NO.: |
| (4) RESPONSIBLE DISCIPLINE: E [ ] M [ ] C [X] OTHER [ ] | (4A) RCI/DCN TITLE: OSDF Seed Mix Change | | (11) DCN NO.: 20102-097 |

| (7) DOCUMENTS AFFECTED | (7) DOCUMENT NOS. | (7) REV. | (8) OTHER |
|---|---|---|---|
| DCN 20102-040<br>DCN 20102-052 KBT 11-10-99<br>SPEC SECTION 2900 | 20102-TS-001 | 0 | SPEC 2900 CREATED BY DCN 20102-040 AND MODIFIED BY DCN 20102-052 |

(9) [ ] RCI-INQUIRY [ ] USQD SCREENING BY PROJECT ENGINEER (9) [X] DCN-JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

[ ] REQUIRED [ ] NOT REQUIRED

Delete permanent seed mix requirements and change interim seed requirements to: 50 lbs per acre, annual rye; 50 lbs per acre winter wheat; 20 lbs per acre, winter rye. Change fertilizer mix to 30-0-18, sulfur coated, slow release; 100 lbs per acre. See attached page 2 of 2.

| (10) REQUESTOR: | COMPANY: | DATE: | (12) CE / PE ANTHONY R. ICLUPEK | DATE: |
|---|---|---|---|---|
| Don Goetz | FDF | 11/9/1999 | Anthony R. Iclupek | 11/10/99 |

(13) RESPONSE: FOR RCI, IS A DCN REQ'D? [ ] NO [ ] YES (14) FOR DCN: [ ] APPROVED [X] APPROVED AS NOTED [ ] DISAPPROVED

The permanent seed mix requirements can only be deleted for areas that may be disturbed in future, such as outside slopes of perimeter berms due to final cover construction. Permanent seed mix shall be used for final restoration areas. K Badu-Tweneboah 11/10/99

## RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: KWASI BADU-TWENEBOAH / GeoSyntec / 11-10-99

[ ] FIT [X] FORM [ ] FUNCTION K Badu-Tweneboah

(20) CHARGE NO. FOR CADD SERVICES TO INCORPORATE:

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE:

PERFORMANCE GRADE: (17)

(18) CONSTRUCTION CONCURRENCE DATE:

PURCHASE REQUISITION REQUIRED: [ ] YES [ ] NO (19)

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

FDF-4259
REV. 5: 10/01/99

CLIENT FDF Attn: Mike Geaches PROJECT No. _____

SUBJECT Revised Seeding Specs. PAGE 1 OF 1

PETRO environmental technologies

7851 Pierce Drive Cincinnati, Ohio 45249-9895

DCN 20102-097
page 2 of 2

FERTILIZER 30-0-18

NITROGEN ..... 30 %

15 % UREA NITROGEN
15 % SULFUR COATED UREA

PHOSPHORUS ..... 0 %
($P_2O_5$)

POTASH ..... 18 %
(KCl)
FROM MURIATE OF POTASH

DISTRIBUTED BY:
FOREST LYTLE & SONS
740 W. GALBRAITH RD
CINCINNATI, OH
521-1464

MANUFACTURED BY:
HARVEST LAND CO-OP
SEVEN MILE, OH

Author: Craig Straub at FNST-04
Date: 11/5/99 9:21 AM
Normal
TO: Mike Godber
Subject: Re: INTERIM SEEDING FOR OSDF PH II
---------- Message Contents

2741

Mike,

The seed mix is fine to allow this years completion of seeding. Another interim seed specification will be necessary to address areas which will be in limbo regarding final land-use. The current seed mixture proposed by PETRO would be very difficult to convert to restored status. As I understand it, the decision for areas seeded with the proposed seed mix is to excavate. In the future, an interim seed spec which meets the requirements of stabilization (quick cover) and restoration (quick cover with declining 3 year life cycle to minimize competition with warm season grasses and forbs) should be written and implemented.

Please call with questions.

Thanks,
Craig (x5298)

---------- Reply Separator ----------
Subject: INTERIM SEEDING FOR OSDF PH II
Author: Mike Godber at FNST-04
Date: 11/4/99 2:56 PM

DEAR TEAM

Today PETRO Environmental called to give me a status on their proposed seed mixture and fertilizer type for interim seeding. The contractor told me the regreen seed is no longer on stock and supplies will not be available till February 1999. As an alternative the seeding contractor proposed the follow seed and fertilizer mixture:

50 LBS/acre Annual Rye
50 LBS/acre Winter Wheat
20 LBS/acre Winter Rye
Fertilizer: 30-0-18, sulfur coated, slow release,
100 LBS/acre

Information on the fertilizer will be submitted and will be forwarded to you as soon as possible. If you have any comments call me and I will forward the information to our contractor.

Mike Godber

RCI/DCN FORM

2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.:1700 | (2)S/C NO.20110-599-426-3.89-01C: | (5)Pg 1 OF1 | (6)DATE 8/09/99 |
| (3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E☒ M☐ C☐ OTHER☐ | (4A)RCI/DCN TITLE: M.H. 3 SLAB DEMO & PIPE REPAIR | (11)DCN NO.:1700-095 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV. | (8)OTHER |
|---|---|---|---|
| SPECIFICATIONS | 20110-TS-0002 | 0 | |
| HDPE MANHOLES PIPE AND FITTINGS | SEC. 02605,ART.2.04& 2.05 | 0 | |
| DESIGN CRITERIA PACKAGE ,OSDF,~~OCT. 1996~~ May 1997 JJ 8-10 | SEC.2.5 LEACHATE MGMT. 20100-~~DB~~-0001 | ~~0~~ 0 | |

(9) ☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER

(9) ☒ DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

. REPAIR OF LCS/LDS MANHOLE NO.3 INCLUDES REPLACING PIPING FROM THE MH TOWARD THE CELL WITH SDR 11 PIPE INCLUDING ELIMINATION OF THE ELECTROFUSION COUPLINGS. APPROX. 30 FT. TOWARD THE CELL.

.. THE 3"/8" PIPING BETWEEN LDS/LCS IS ALSO BEING REPLACED AND COUPLINGS ELIMINATED.

. THE TOP M.H. SLAB IS BEING PARTIALLY REMOVED TO PROVIDE ACCESSS TO THE PIPING.

JAMES C. JENKINS,FDF James C. Jenkins 8/09/99 | (12)CE / P E JAMES C JENKINS J. C. Jenkins 8/09/99 DATE:

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☐YES

(14) FOR DCN: ☐APPROVED ☒APPROVED AS NOTED ☐DISAPPROVED

Proposed repairs are consistent with DCN 1700-093 and DCN 20102-85.

E Bachmann 8/9/99 QCDS-INTEC

## RCI - DCN ACCEPTANCE

(15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: E Bachmann DATE: 8/9/99 KWASI BADU-TWEH ☐FIT ☒FORM ☐FUNCTION

(20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 2DSU3

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) James C. Jenkins DATE: 8/9/99

PERFORMANCE GRADE: (17) 5

(18)CONSTRUCTION CONCURRENCE: B Edmond DATE: 8/9/99

(21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE:

PURCHASE REQUISITION REQUIRED: ☒YES ☐NO (19)

ECDC CONTROLLED COPY NO. C011

ORIGINAL



Kwasi

RCI/DCN FORM

2741

# REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE -

| | | | |
|---|---|---|---|
| (1)WP / WO NO.: 1700 | (2)S/C NO.: | (5)Pg 1 OF 1 KBT | (6)DATE 8/13/99 |
| (3)S/C TITLE: LEACHATE CONVEYANCE SYSTEM | | (11)RCI NO.: | |
| (4) RESPONSIBLE DISCIPLINE: E☐ M☐ C☐ OTHER X | (4A)RCI/DCN TITLE: VICTAULIC FITTING ON LDS PIPING | (11)DCN NO.: 1700-096 | |

| (7)DOCUMENTS AFFECTED | (7)DOCUMENT NOS. | (7)REV. | (8)OTHER |
|---|---|---|---|
| LEACHATE TRANSMISSION SYSTEM GRAVITY AND MANHOLE DETAILS | 90-X-6000-M-00065 | 0 | |
| | | | |
| | | | |

(9) ☐ RCI - INQUIRY ☐ USQD SCREENING BY PROJECT ENGINEER

(9) ☐ DCN - JUSTIFICATION, EXISTING CONDITION & REQUESTED/PROPOSED CHANGE

Reference: FERMCO Drawing #90-X-6000-M-00065, Revision 0, Detail A, which shows a 6-inch LDS pipe to be running inside a primary containment vessel of a manhole and turning 90 degrees at the discharge point. Because the clearance between the pipe discharge and containment vessel wall is very tight, a plug can not be placed on the end of the pipe for pressure testing. Requesting cutting the LDS outlet pipe inside the primary containment vessel and coupling a test flange on the end of this pipe section. The pipe will be tested at 120 psi for a period of 3 hours after stabilization. After approval of the test, the test flange will be removed and replaced with the section of pipe that was cut out. This section of pipe will be coupled with a victaulic coupling. Since the victaulic fitting will be located within the primary containment of manhole 3, the function, fit, and form of the Leachate Conveyance System will not be affected.

ECDC CONTROLLED COPY NO. C011

| | | | |
|---|---|---|---|
| (10)REQUESTOR: Michael Moller | COMPANY: | DATE: 8/16/99 | (12)CE / PE: JAMES C. JENKINS | DATE: 8/16/99 |

(13)RESPONSE: FOR RCI, IS A DCN REQ'D? ☐NO ☐YES

(14) FOR DCN: ☐APPROVED ☒APPROVED AS NOTED ☐DISAPPROVED

THIS DESIGN CHANGE IS FOR MH-3 LDS OUTLET PIPE IN PRIMARY CONTAINMENT VESSEL ONLY. DOCUMENT LOCATION OF VICTAULIC FITTING FOR FUTURE REPLACEMENT, IF POSSIBLE.

RCI - DCN ACCEPTANCE

| | |
|---|---|
| (15)DESIGN ORGANIZATION APPROVAL/DISAPPROVAL: KWASI BADU-TWEREBOAH DATE: 8/17/99 ☒FIT ☐FORM ☐FUNCTION | (20)CHARGE NO. FOR CADD SERVICES TO INCORPORATE: 2DSU3 |

(16)FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 8/17/99

PERFORMANCE GRADE: (17) 5 James C. Jenkins

| | |
|---|---|
| (18)CONSTRUCTION CONCURRENCE: DATE: 8/18/99 | (21)WORK COMPLETED: (SIGNOFF BY CE OR PE) DATE: |
| PURCHASE REQUISITION REQUIRED: ☐YES ☐NO (19) | |

000142

ORIGINAL

FS-F-4259
REV. 4: 02/16/98



Instruction for form completion are provided

210-648-5767

DCn 1700-096 2/4

LEE SUPPLY CO. INC.

• DIVERSIFIED PIPE & PUMP SYSTEMS
• INDUSTRIAL • MINING • ENVIRONMENTAL PRODUCTS — 2741 KBT

*Mailing Address:* Box 35, Charleroi, PA 15022 *Shipping Address:* 1st & Lincoln Avenue, Charleroi, PA 15022
• *Phone:* (724) 483-3543 • 1-800-353-3747 • *Fax:* (724) 483-0577

# Fax Transmission Sheet

TO: Thor Daniel Gernald

ATTENTION: Mike Godber

FROM: Cindy Teets

DATE: 8-16-99

NUMBER OF SHEETS (Including Cover): 3

RECEIVED AUG 16 1999

REMARKS: KBT @ 3pm

000143

DIN 1700-096 3/4



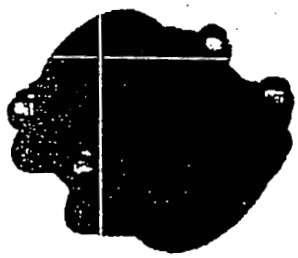
Victaulic®

An ISO 9001 certified company

2741

# Style 995 Coupling for HDP Pipe

## PRODUCT DESCRIPTION



Sizes 3 - 12"

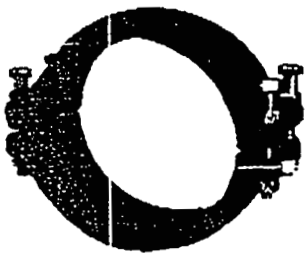
FM

Contact Victaulic for details.

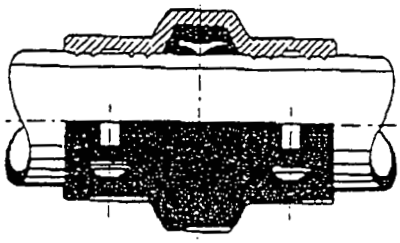
Victaulic Style 995 HDP coupling has sharp gripping teeth on both sides of the coupling which grip into the HDP pipe around the circumference. As housings are tightened pad-to-pad, the four bolts (two on 2"/50 mm sizes) force the teeth to engage into the pipe wall. This design permits direct joining of HDP pipe without fusing equipment.

The new 14" (350 mm) size features the "easy torque" bolts which act as a turnbuckle to ease assembly and provide a mechanical advantage for engaging coupling teeth into pipe.

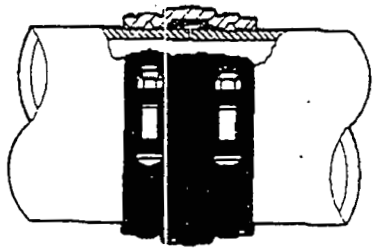
*Exaggerated for clarity*



14" Size

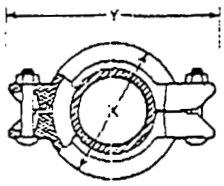


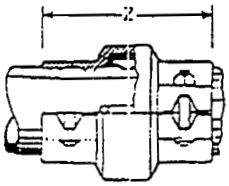
3 - 12" (80 - 300 mm) sizes
(2"/50 mm has one bolt)



14" (350 mm) size

## DIMENSIONS




| Pipe inches millimeters | | Dimensions inches millimeters | | | Approximate Weight Each Lbs. kg |
|---|---|---|---|---|---|
| Nominal Size | Actual Size | X | Y | Z | |
| 2<br>50 | 2.375<br>60.3 | 3.63<br>92 | 5.81<br>148 | 3.63<br>92 | 3.5<br>1.6 |
| 3<br>80 | 3.500<br>88.9 | 4.63<br>118 | 6.81<br>173 | 4.58<br>116 | 7.7<br>3.5 |
| 4<br>100 | 4.500<br>114.3 | 5.88<br>149 | 7.75<br>197 | 5.75<br>146 | 11.6<br>5.3 |
| 5<br>125 | 5.563<br>141.3 | 6.94<br>176 | 9.51<br>242 | 5.87<br>149 | 15.0<br>6.8 |
| 6<br>150 | 6.625<br>168.3 | 8.00<br>203 | 10.50<br>267 | 5.88<br>149 | 16.4<br>7.4 |
| 8<br>200 | 8.625<br>219.1 | 10.19<br>259 | 13.00<br>330 | 6.00<br>152 | 24.9<br>11.3 |
| 10<br>250 | 10.750<br>273.0 | 12.38<br>314 | 15.81<br>402 | 6.50<br>165 | 37.4<br>17.0 |
| 12<br>300 | 12.750<br>323.9 | 14.38<br>365 | 17.75<br>451 | 7.00<br>178 | 49.0<br>22.2 |
| 14<br>350 | 14.000<br>355.6 | 16.25<br>413 | 21.00<br>533 | 7.75<br>197 | 81.0<br>36.7 |

See notes under Performance on page 19.02-2

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DCn 1700-096

2741 4/45 KBT

## PERFORMANCE

Victaulic HDP products are designed to mechanically join HDP (*high density polyethylene/polybutylene conforming to ASTM D-2447, D-3000, D-3035 or D-714, at ambient temperatures) pipe of wall thicknesses from SDR 35 to 7.3. Victaulic HDP products have integral rows of gripping teeth in each side of the housing which bite into HDP pipe around the entire circumference. This eliminates special heat fusion, solvent joining or special adapters.

**Victaulic HDP products are not intended for use on PVC pipe or other materials.** Victaulic lubricant should not be used with HDP pipe.

HDP pipe brands we have tested indicate that the working pressure of Victaulic HDP products are dictated by the working pressure of the pipe. The pipe manufacturers listing is dependent upon wall thicknesses, pipe composition and temperature. Pipe tolerances shown in the charts are *at +70°F (+21°C) and for rigid pipe with SDR of 20 or lower.

*At ambient temperatures

- **Victaulic Style 995 products are qualified for use on HDP ONLY. These products should not be used on other plastic materials.**
- **Failure to follow this instruction could result in personal injury, improper installation, leakage or joint separation.**

| Pipe Inches/millimeters | | Dimensions Inches/millimeters | | |
|---|---|---|---|---|
| | | Outside Diameter | | Maximum Out of Round Tolerance * |
| Nominal Size | Actual Size | Size | Tolerance * | |
| 2<br>50 | 2.375<br>60.3 | 2.375<br>60.3 | ± 0.006<br>0.152 | ± 0.004<br>1.016 |
| 3<br>80 | 3.500<br>88.9 | 3.500<br>88.9 | ± 0.016<br>0.406 | ± 0.040<br>1.016 |
| 4<br>100 | 4.500<br>114.3 | 4.500<br>114.3 | ± 0.020<br>0.508 | ± 0.040<br>1.016 |
| 5<br>125 | 5.563<br>141.3 | 5.563<br>141.3 | ± 0.025<br>0.635 | ± 0.050<br>1.270 |
| 6<br>150 | 6.625<br>168.3 | 6.625<br>168.3 | ± 0.030<br>0.762 | ± 0.050<br>1.270 |
| 8<br>200 | 8.625<br>219.1 | 8.625<br>219.1 | ± 0.039<br>0.990 | ± 0.075<br>1.905 |
| 10<br>250 | 10.750<br>273.0 | 10.750<br>273.0 | ± 0.048<br>1.219 | ± 0.075<br>1.905 |
| 12<br>300 | 12.750<br>323.9 | 12.750<br>323.9 | ± 0.057<br>1.448 | ± 0.075<br>1.905 |
| 14<br>350 | 14.000<br>355.6 | 14.000<br>355.6 | ± 0.063<br>1.600 | ± 0.075<br>1.905 |

*At ambient temperatures.

## MATERIAL SPECIFICATIONS

**Housing:** Ductile iron conforming to ASTM A-536

☐ **Optional:** Zinc electroplated

**Gasket:** (specify choice*)

☐ **Grade "E" EPDM**
EPDM (Green color code). Temperature range -30°F to +230°F (-34°C to +110°C). Recommended for cold and hot water service within the specified temperature range plus a variety of dilute acids, oil-free air and many chemical services. NOT RECOMMENDED FOR PETROLEUM SERVICES.

☐ **Grade "T" nitrile**
Nitrile (Orange color code). Temperature range -20°F to +180°F (-29°C to +82°C). Recommended for petroleum products, air with oil vapors, vegetable and mineral oils within the specified temperature range. Not recommended for hot water services over +150°F (+66°C) or for hot dry air over +140°F (+60°C).

*Services listed are General Service Recommendations only. It should be noted that there are services for which these gaskets are not recommended. Reference should always be made to the latest Victaulic Gasket Selection Guide for specific gasket service recommendations and for a listing of services which are not recommended.

**Bolts/Nuts:** Heat treated carbon steel, plated, track-head conforming to physical properties of ASTM A-183 minimum tensile 110,000 PSI (758340 kPa).

☐ **Optional:** Type 304 or 316 stainless steel.

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DCN 1700-96
Page 5 of 5

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# OhioEPA

State of Ohio Environmental Protection Agency

**Southwest District Office**
401 E. Fifth Street
Dayton, Ohio 45402-2911
(937) 285-6357
FAX (937) 285-6249

Bob Taft
Governor
Maureen O'Connor
Lt. Governor

## FAX TRANSMISSION COVER SHEET

Date: 8/18/99

To: Jim Jenkins

Company/Department: FDF

FAX #: 513-648-4029

From: Tom Ontko

Office/Division: OhioEPA

Telephone: 937-285-6073

Number of pages including cover page: 1

Message: Jim - This fax provides approval of DCN 1700-096. This change allows for cutting out the 6-in LDS pipe within the 1° containment vessle of MH-3. This will enable placement of a blind flange for pressure testing. After testing, the removed section will be re-attached via victaulic fitting

# APPENDIX V

# NONCONFORMANCE REPORTS (NCRs)

2741

# GEOSYNTEC CONSULTANTS

FIGURE 1

2741

GeoSyntec Consultants



# CONSTRUCTION NONCONFORMANCE REPORT

| RIGINATOR: | 2. TITLE/ORGANIZATION: | 3. NCR NUMBER: | 4. DATE DISCOVERED: |
|---|---|---|---|
| Collin Sukow | QC Manager | 20102-18 | 12 MAY 1999 |

| ESPONSIBLE ORGANIZATION/PROJECT: | 6. ASSESSMENT ACTIVITY: | 7. HOLD TAG: |
|---|---|---|
| GeoSyntec Consultants/ Petro Environmental | Construction quality control | ( ) YES (X) NO |
| | | 8. REMOVED (Initial/Date): |

EQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

.01. B .... Fill material shall classify as GC, SC, SM, ML, CL, or CH according to the unified Soil Classification System (ASTM D2487)

08. H .... Compact ... each lift to at least 95% of its standard proctor maximum dry density (ASTM D698)

09. A .... Clayey rockfill ... shall be compacted with an 815 B compactor and a minimum 4 passes.

IONCONFORMANCE TYPE: Construction Nonconformance (X) Material Deviation (X)

IONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

Material used for the temporary access ramps outside of Cell #2, both east and west, were rtially constructed with "dirty 78" stone. The "dirty 78" stone was created from cell #3 fine g and the 78 stone left over from cell #2 construction stockpiled in the area. Sieve nalysis revealed the material as a clayey gravel (GC) of a gravel with clay (GP). While ing loaded approximately 6" to 12" of the brown till under the stone stockpiles were added, further rying the material. As a result, the material was toovaried to run a proctor for density test mparrison to field density tests and was compacted with a smooth drum roller and oof rolled with a loaded Volvo truck.

| RIGINATOR'S SIGNATURE: | 13. DATE PROVIDED TO RESPONSIBLE MANAGER: |
|---|---|
| Collin P. Sukow | 8 June 1999 |

ESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is (X) Reject ( ) Other ( ) Repair ( ) Rework ( )

The amount of material used for these temporary amps sums upto approximately 2000 to 3000 cys. The materials consistant variation made btaining a representative sample improbable, if not impossible. Considering the temporary cture of these ramps and the positive proof rolling results the ramps should be used as is.

ESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION): RESIDENT ENGINEER

By Collin P. Sukow KWASI BADU-TWENEBOAH, GEOSYNTEC

| ESPONSIBLE MANAGER'S SIGNATURE: | 17. PROPOSED COMPLETION DATE: | 18. DATE FORWARDED TO APPROVAL AUTHORITY: |
|---|---|---|
| [signature] | 6/8/99 | |

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GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase II DATE: 16 day MAY month 1999 year

MATERIAL TYPE: Compacted fill (dirty 78's) SAMPLE NO.: RA-02

## SOIL SAMPLE SIZE

| APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams) | SAND | FINE GRAIN |
|---|---|---|
| | 115 | 65 |

| | | BEFORE WASH | AFTER WASH |
|---|---|---|---|
| TARE NO. | | BT | BT |
| WT. OF DRY SAMPLE PLUS TARE | (grams) | 4300.5 | 4067.2 |
| WT. OF TARE | (grams) | 952.6 | 952.6 |
| WT. OF DRY SAMPLE | (grams) | 3347.9 | 3114.6 |

## SIEVE ANALYSIS

QA ID: CA

| SIEVE NO. | DIAMETER (mm) | WT. RETAINED (grams) | % RETAINED | % FINER | PROJECT SPECIFICATIONS |
|---|---|---|---|---|---|
| 1" | 25.0 | Ø | Ø | 100 | |
| 3/4" | 19.0 | 78.8 | 2.4 | 97.6 | |
| 1/2" | 12.5 | 563.1 | 16.8 | 83.2 | |
| 3/8" | 9.5 | 1043.2 | 31.2 | 68.8 | |
| #4 | 4.75 | 1698.4 | 50.7 | 49.3 | |
| 10 | 2.00 | 2108.9 | 63.0 | 37.0 | |
| 20 | 0.85 | 2339.4 | 69.9 | 30.1 | |
| 40 | 0.425 | 2585.9 | 77.2 | 22.8 | |
| 60 | 0.250 | 2778.3 | 83.0 | 17.0 | |
| 100 | 0.150 | 2902.1 | 86.7 | 13.3 | |
| 200 | 0.075 | 3046.6 | 91.0 | 9.0 | |
| PAN | | 3114.2 | — | — | |

000150

%FINER = 100 − Σ% RETAINED

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PARTICLE SIZE DISTRIBUTION AND SOIL CLASSIFICATION TEST RESULTS

(ASTM C 136/D 422) (ASTM D 2487)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

PROJECT NO.: GQ0409 TASK NO.: 04-1

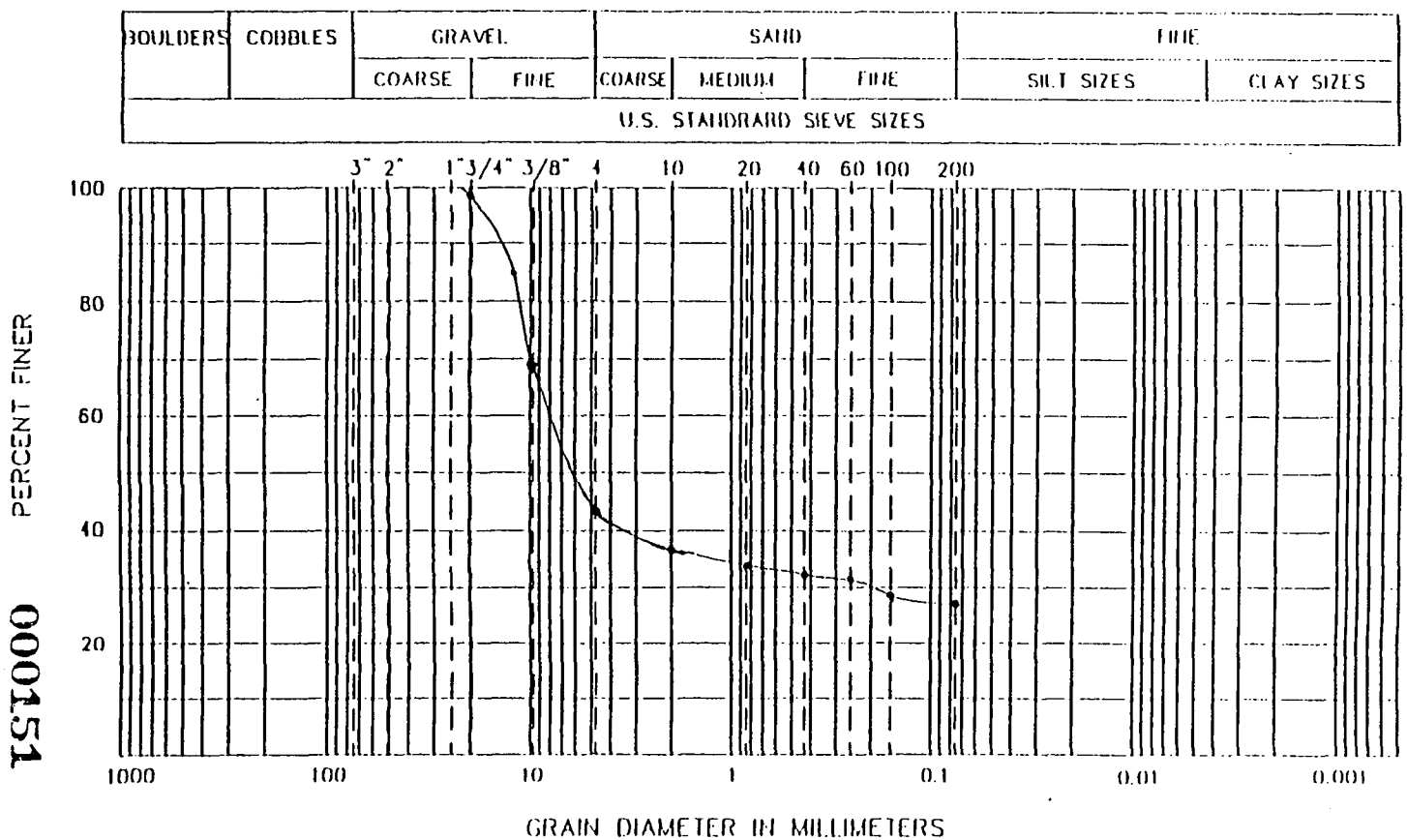
DESCRIPTION: Phase II

DATE: 14 day MAY month 1999 year

MATERIAL TYPE: Compacted Fill (dirty 78'S)

SAMPLE NO.: RA-01 QA ID: CL

CURVE COEFFICIENTS: ($C_u$) ($C_c$)




ATTERBERG LIMITS

(LL)

(PL)

(PI)

SIEVE RESULTS

| SIEVE SIZE | % FINER |
|---|---|
| 3-in. | 100 |
| 2-in. | 100 |
| 1 1/2-in. | 100 |
| 1-in. | 100 |
| 3/4-in. | ~~93~~ 98.7 |
| 1/2-in. | 85.5 |
| 3/8-in. | 69.7 |
| NO. 4 | 43.7 |
| NO. 10 | 36.9 |
| NO. 20 | 34.3 |
| NO. 40 | 32.6 |
| NO. 60 | 31.1 |
| NO. 100 | 29.4 |
| NO. 200 | 27.2 |

HYDROMETER RESULTS

| PARTICLE DIA. | % FINER |
|---|---|
| | |

SOIL CLASSIFICATION (ASTM D 2487): GC - clayey gravel

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GEOSYNTEC CONSULTANTS

2741

FLUOR DANIEL FERNALD

# PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04

DESCRIPTION: Phase II DATE: 14 day MAY month 1998 year

MATERIAL TYPE: Compacted Fill (dirty 78's) SAMPLE NO.: PA-01

## SOIL SAMPLE SIZE

| APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams) | SAND | FINE GRAIN |
|---|---|---|
| | 115 | 65 |

| | | BEFORE WASH | AFTER WASH |
|---|---|---|---|
| TARE NO. | | BT | BT |
| WT. OF DRY SAMPLE PLUS TARE | (grams) | 3950.9 | 3165.4 |
| WT. OF TARE | (grams) | 952.6 | 952.6 |
| WT. OF DRY SAMPLE | (grams) | 2998.3 | 2212.8 |

## SIEVE ANALYSIS

QA ID: [illegible]

| SIEVE NO. | DIAMETER (mm) | WT. RETAINED (grams) | % RETAINED | % FINER | PROJECT SPECIFICATIONS |
|---|---|---|---|---|---|
| 1" | 25.0 | Ø | 0 | 100 | |
| 3/4" | 19.0 | 38.4 | 1.3 | 98.7 | |
| 1/2" | 12.5 | 433.5 | 14.5 | 85.5 | |
| 3/8" | 9.5 | 909.6 | 30.3 | 69.7 | |
| #4 | 4.75 | 1689.2 | 56.3 | 43.7 | |
| #10 | 2.00 | 1891.7 | 63.1 | 36.9 | |
| #20 | 0.85 | 1968.3 | 65.6 | 34.3 | |
| #40 | 0.425 | 2022.1 | 67.4 | 32.6 | |
| #60 | 0.250 | 2066.3 | 68.9 | 31.1 | |
| #100 | 0.150 | 2116.1 | 70.6 | 29.4 | |
| #200 | 0.075 | 2183.0 | 72.8 | 27.2 | |
| PAN | | 2212.3 | – | – | |

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%FINER = 100 − Σ% RETAINED

©GEO SYNTEC CONSULTANTS FILE NO. 2-14-PMS CHECKED BY: [illegible]

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PARTICLE SIZE DISTRIBUTION AND SOIL CLASSIFICATION TEST RESULTS

(ASTM C 136/D 422) (ASTM D 2487)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

PROJECT NO.: GQ0409 TASK NO.: 04.1

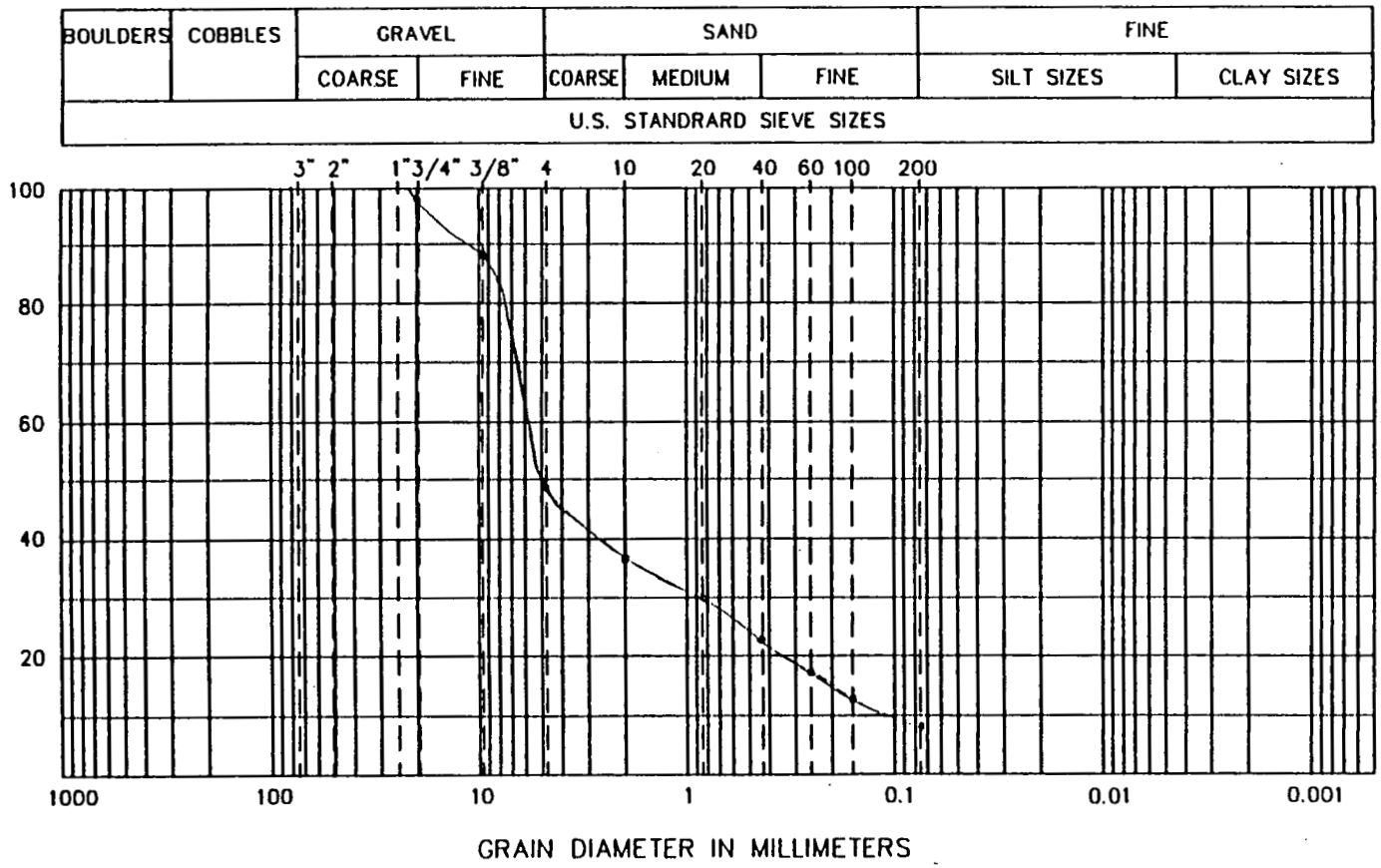
DESCRIPTION: Phase II

DATE: 16 day MAY month 1999 year

MATERIAL TYPE: Compacted Fill (dirty 78's)

SAMPLE NO.: RA-02 QA ID: CS

CURVE COEFFICIENTS: ($C_u$) ..... ($C_c$) .....




ATTERBERG LIMITS

(LL) .....

(PL) .....

(PI) .....

SIEVE RESULTS

| SIEVE SIZE | % FINER |
|---|---|
| 3-in. | 100 |
| 2-in. | 100 |
| 1 1/2-in. | 100 |
| 1-in. | 100 |
| 3/4-in. | 97.6 |
| 1/2-in. | 83.2 |
| 3/8-in. | 68.8 |
| NO. 4 | 49.3 |
| NO. 10 | 37.0 |
| NO. 20 | 30.1 |
| NO. 40 | 22.8 |
| NO. 60 | 17.0 |
| NO. 100 | 13.3 |
| NO. 200 | 9.0 |

HYDROMETER RESULTS

| PARTICLE DIA. | % FINER |
|---|---|
| | |

SOIL CLASSIFICATION (ASTM D 2487): GP-~~GM~~ GC Poorly graded gravel with clay

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CHECKED BY: _____

SHEET NO. _____ OF _____

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T-2741

# FIGURE 1

**GeoSyntec Consultants**

2741



## CONSTRUCTION NONCONFORMANCE REPORT

| 1. ORIGINATOR: | 2. TITLE/ORGANIZATION: | 3. NCR NUMBER: | 4. DATE DISCOVERED: |
|---|---|---|---|
| Collin P. Sukow | CQC Site Manager | 20102-021 | 27 August 1999 |

| 5. RESPONSIBLE ORGANIZATION/PROJECT: | 6. ASSESSMENT ACTIVITY: | 7. HOLD TAG: |
|---|---|---|
| Petro Environmental Technologies/OSDF Phase II | Construction Quality Control | ( ) YES ( ) NO |
| | | 8. REMOVED (Initial/Date): |

9. REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

**02710.1.04 Submittals:** For each source of granular filter material, submit the following to the construction manager within 60 days from notice to proceed for review. 1. The source of the granular filter material along with certification from the supplier that the granular filter material meets the requirements of this section including the test results from ASTM C-136 and ASTM D-2487 on granular filter material. 2. 50-lb. sample of the granular filter material. **02710.3.01 Placement** A: Do not place granular filter material until CQC consultant has completed conformance evaluation of the granular filter material and performance evaluation of previous work. **20100-PL-006 Rev 0** 6.2: 1-ft. of granular LDS layer and corridor having a hydraulic conductivity of $1 \times 10^{-1}$ cm/sec and 10 cm/sec, respectively.....

10. NONCONFORMANCE TYPE: Construction Nonconformance (X) Material Deviation (X)

11. NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

Submittal samples from alternative sources for #57 stone were delivered by Petro during the week of 9 August 1999. Petro began hauling #57 stone on site from Martin Marietta during the week of 16 August 1999. It was determined that the alternative sources did not meet the project specifications. After three loads of #57 stone had been delivered from Martin Marietta it was concluded that this source could not meet volume demand. Also, the Martin Marietta #57 stone did not meet permeability requirements. The Hill Top Quarry was selected as the alternative source and conformance samples were collected. Petro placed the #57 stone from Hill Top prior to the completion of conformance test results and placed the failing #57 stone from Martin Marietta in the Cell 3 drainage corridor.

| 12. ORIGINATOR'S SIGNATURE: | 13. DATE PROVIDED TO RESPONSIBLE MANAGER: |
|---|---|
| Collin P. Sukow | 28 Aug 1999 |

14. RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( ) Reject (X) Other ( ) Repair ( ) Rework (X)

Remove.

15. RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

Collin P. Sukow, GeoSyntec, CQC Manager

| 16. RESPONSIBLE MANAGER'S SIGNATURE: | 17. PROPOSED COMPLETION DATE: | 18. DATE FORWARDED TO APPROVAL AUTHORITY: |
|---|---|---|
| Collin P. Sukow | 1 SEPT 1999 | 28 Aug 1999 |

000154

FIGURE 1

GeoSyntec Consultants

2741



# CONSTRUCTION NONCONFORMANCE REPORT

| 1. ORIGINATOR: | 2. TITLE/ORGANIZATION: | 3. NCR NUMBER: | 4. DATE DISCOVERED |
|---|---|---|---|
| Byran York | Sr. Eng. Technician/GeoSyntec | 20102-022 | 12 October 1999 |

| 5. RESPONSIBLE ORGANIZATION/PROJECT: | 6. ASSESSMENT ACTIVITY: | 7. HOLD TAG: |
|---|---|---|
| FDF Construction, Petro/OSDF Phase II | Construction Quality Control | ( ) YES (☒) NO |
| | | 8. REMOVED (Initial/Date): |

9. REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

Technical Specifications, Phase II, Section 02714 (page 02714-3)

Part 3.01 D – After unwrapping the geotextiles from its opaque cover, do not leave them exposed for a period in excess of 10 calendar days.

10. NONCONFORMANCE TYPE: Construction Nonconformance ( X ) Material Deviation ( )

11. NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

The placement of the geotextile filter on top of the LCS drainage layer began on 01 October 1999. The placement started on the Cell 3/Cell 4 intercell berm in the southeast corner of Cell 3 and continued to the Cell 3/Cell 2 tie-in point. The east half of Cell 3, including the intercell berm and side slopes were covered with the 7-oz/yd$^2$ geotextile filter on 01, 04, and 08 October 1999. As of 12 October 1999, portions of the installed geotextile filter had been exposed for a period greater than 10 calendar days. It is presently not known when the remaining geotextile would be covered with the protective layer.

| 12. ORIGINATOR'S SIGNATURE: | 13. DATE PROVIDED TO RESPONSIBLE MANAGER: |
|---|---|
| Byran York | 13 October 1999 |

14. RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( ) Reject ( ) Other ( × ) Repair ( ) Rework ( )

During the 16 August 1999 preparatory meeting on geosynthetics installation, Petro indicated that the geotextiles would not be exposed more than 10 calendar days (see attached relevant pages from meeting minutes). GeoSyntec also expressed concern on meeting the 10-day exposure limit for the LCS geotextile filter at the 05 October 1999 OSDF construction meeting.

*(cont'd in Block 27)*

15. RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

Kwasi Badu-Tweneboah, Certifying Engineer, GeoSyntec

| 16. RESPONSIBLE MANAGER'S SIGNATURE: | 17. PROPOSED COMPLETION DATE: | 18. DATE FORWARDED TO APPROVAL AUTHORITY: |
|---|---|---|
| KBadu-Tweneboah | As soon as practicable | 21 OCT 1999 |

FIGURE 2

GeoSyntec Consultants

2741



# CONSTRUCTION NONCONFORMANCE REPORT

19. EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (X) Reject ( )
Comments ( ) LETTER FROM MANUFACTURER IS ATTACHED. THE LETTER INDICATES THAT IF MATERIAL IS EXPOSED FOR MORE THAN 30 DAYS, IT MAY DETERIORATE NO MORE THAN 15%. MATERIAL WILL NOT BE EXPOSED FOR ~~THERE~~ APPROX MORE THAN 30 DAYS. SAMPLES OF THE MATERIAL WERE COLLECTED AND TESTED FOR MAXIMUM GRAB STRENGTH; TEST RESULTS ARE ATTACHED. ALL 4 GRAB STRENGTH TESTS (BY ASTM 4632) EXCEED MINIMUM STRENGTH SPECIFIED OF 180 lbs -(SEE ATTACHED)

20. APPROVAL AUTHORITY SIGNATURE: Bill Zebick / Anthony P. Klimek FDF
BILL ZEBICK, FDF CONST / ANTHONY P. KLIMEK ENG

21. DATE: 10/21/99

22. VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):
SEE ATTACHED LETTER FROM "ENGINEERED SYNTHETIC PRODUCTS INC." TO THE A/E (GEOSYNTEC)
SEE ATTACHED TEST RESULTS WHICH ARE GREATER THAN 180 lbs.
JBS 10-21-99

23. VERIFIER'S SIGNATURE: Frank Thompson

24. DATE: 10-21-99

25. APPROVAL AUTHORITY SIGNATURE: [signature]

26. DATE CLOSED: 10/21/99

27. CONTINUATION FROM BLOCK _14_:

The exposed geotextile filter on the crest and southside of the intercell berm was covered with the protective layer on the 12 and 13 October 1999. The remaining section is still exposed as of 14 October 1999. In accordance with the specification requirements, FDF Construction and Petro should provide a timetable for completion of protective layer placement over the exposed geotextile. Also, provide documentation including geotextile manufacturer's written acceptance and/or confirmatory test results that portions of the geotextiles exposed longer than 10 days would retain the specified properties.

4. roll number; and
5. roll dimensions.

D. Geotextile rolls not labeled in accordance with this Section or on which labels are illegible shall be rejected and replaced. The Contractor shall notify the Construction Manager of any rolls not labeled in accordance with the Section.

## 2.03 ACCEPTANCE, HANDLING AND STORAGE

A. Within 45 days of Authorization to Mobilize, Contractor shall inspect and inventory the geotextile material and the manner in which it is being stored. Contractor shall provide letter of acceptance within 45 days to the Construction Manager if material is acceptable for installation. Contractor shall also notify the Construction Manager in writing within 45 days of any geotextile material that is not acceptable for installation.

B. Maintain a program for protection and preservation of geotextile to include, but not be limited to:
   1. protection from sunlight, moisture, excessive heat or cold, puncture, mud, dirt, and dust or other damaging or deleterious conditions; follow all geotextile manufacturer recommendations for handling and storage; Manufacturer recommendations will be provided by the Construction Manager; and
   2. storage of rolls on palates or other elevated structures; do not store rolls directly on the ground.

# PART 3 EXECUTION

## 3.01 PLACEMENT

A. Do not commence geotextile installation until the CQC Consultant completes performance evaluation of previous work, including evaluation of Contractor's survey results for previous work.

B. Handle geotextiles so as to ensure they are not damaged in any way.

C. Take precautions to prevent damage to underlying layers including rutting during placement of the geotextiles.

D. After unwrapping the geotextiles from its opaque cover, do not leave them exposed for a period in excess of 10 calendar days.

SWU EXCAVATION/OSDF (PHASE II) PROJECT
Petro Environmental Technologies, Inc.

2741

PREPARATORY PHASE MEETING MINUTES

Date: August 16, 1999

**Definable Work Feature:** Installation of geotextile, HDPE liner, geosynthetic clay liner, and liner penetration boxes in Cell 2.

**Personnel Present:**

| | | | | | |
|---|---|---|---|---|---|
| Bill Zebick | Gregg Johnson | Michael Waller | Don Goetz | Tony Klimek | Collin Sukow |
| Muriel Vigus | Ron Scott | Jeff Browning | Pete Bolig | Jerry Istre | Byron York |
| Charles Van Arsdale | | J. Richard Schairbaum | | Kwasi Badu-Tweneboah | |

**Review of Applicable Sections (list):**

02714 - Geotextiles
02770 - Geomembrane Liner and Cap
02772 - Geosynthetic Clay Liner and Cap
13005 - Liner Penetration Boxes

**Review of Contract Plans:** ✓ (✓)

**Material and Equipment Submittals Complete and Approved (list):**

Installation Layout Drawings: Doc. No. 20102-DWG-007A, Rev. 0 Action Code; A
Cold Weather Deployment Seaming Methods: Doc. No. PET-058F; Rev. 0 Action Code; A
Certificates of Tensiometer Calibration: Doc. No. - Not Yet Submitted (1999))
Certificates of Calibration for Vacuum/Air Testing Gauges: Doc. No. - Not Yet Submitted (1999)

**Testing/Inspections/Controls Required (Describe):**

CQC Testing:

The CQC Consultant (GeoSyntec) shall perform conformance sampling of the geotextile, HDPE liner, and GCL in accordance with contract specifications and their approved CQA Plan. Installation of these geosynthetics shall not commence until GeoSyntec has completed conformance testing and approved the use of these materials.

Field Testing:

HDPE liner

Trial seaming must be conducted at the beginning of each seaming period and at least once each five hours for each apparatus used that day prior to seaming. Additionally, each seamer shall make at least one trial seam each day the seamer performs work. The trial seams are to be at lest 5-ft. long by 1-ft. wide (after seaming) with the seam centered lengthwise for fusion equipment; and at least 3-ft. long by 1-ft. wide for extrusion equipment. Cut 4 specimens, each 1-in. wide from the trial seam sample -- test 2 specimens in shear and 2 in peel using field tensiometer. All specimens must pass the test; if a specimen fails, repeat the entire operation. Should a second trial seam fail then two consecutive trial seams must pass prior to allowing the equipment to be used.
Nondestructive seam continuity testing will be conducted over the full length of the liner seams. Continuity testing must be performed as the seaming work progresses, not at the completion of field seaming. Use vacuum testing for extrusion welds and air pressure testing for double-track fusion seams. The vacuum testing equipment must be able to apply a vacuum of 5 ±1 psi for a period of 20 seconds.

**Construction Tolerances and Level of Workmanship:**

Geotextiles:

F-2741

- Once unwrapped, the geotextiles will not be exposed for a period in excess of 10 calendar days.
- Continuously overlap a min. of 6-in. and sew filter (7-oz.), cushion (10oz.) and supplemental cushion (16-oz.) geotextiles using a "single prayer" seam. Overlap separator geotextiles (7-oz.) a min. of 12-in. and spot sew at intervals necessary to ensure the overlap is maintained. Seams shall be along, not across slopes.
- Repair any holes or tears in the geotextiles using a patch made from the same material. Extend patches a min. of 1-ft. beyond the damaged area. Sew geotextile patches into place no closer than 1-in. from any panel edge.
- Install the geotextile along with the other geosynthetic layers into the anchor trenches at the crest of the slope. Backfill with compacted clay once all geosynthetic layers are installed into the trench.
- To the extent possible, do not place granular drainage material for the LDS or LCS on the side slopes until after the anchor trenches are completely backfilled, unless authorized by the CM.
- Do not drive directly on the geotextile. Only use equipment that has the approved ground pressure as denoted in the specifications (02714-3.05.D). Place aggregate and /or soil over the geotextile prior to trafficking.

HDPE Liner:

- Do not deploy geomembrane until the layout drawings are approved by the CM. Additionally, do not deploy liner in an area until the CM has been provided with a Certificate of Subgrade Acceptance for that area. Do not deploy until GeoSyntec has completed a performance evaluation of previous work, including evaluation of survey results for previous work.
- Each field panel shall be given an identification code, as agreed upon between GeoSyntec and the Installer.
- Place each panel one at a time and seam each panel immediately after its placement. Use temporary rubsheets to prevent displacement or damage to underlying geosynthetics.
- Do not place any liner during any precipitation, in the presence of heavy fog or dew, in an area of ponded water, or in the presence of high wind. Do not seam at ambient temperatures below 40° F or above 104° F.
- Ensure that: No vehicular traffic is permitted directly on the liner; equipment used does not damage the liner; personnel working on the liner do not smoke or engage in any activity that would damage the liner; the method used to unroll the sheets does no scratch or crimp the liner and does not damage the underlying geosynthetics or compacted clay soil; wrinkles are minimized - adjust or repair any area of liner wrinkles where the wrinkle height during the hottest part of the day is more than 4-inches; and the liner is anchored or weighted with sandbags to prevent damage or uplift from wind.
- Do not install liner between 1-hr. before sunset and 1-hr. after sunrise unless approved by the CM.
- Do not perform seaming unless a "master seamer" and GeoSyntec are on-site. Orient seams parallel to the liner of max. slope. Minimize the number of seams in corners. No horizontal seam shall be less than 10-ft. from the toe of the slope. Do not locate seams at an area of potential stress concentration.
- Sufficiently overlap liner panels for welding and to allow peel tests to be performed on each seam. Prior to seaming, clean the seam area to ensure the area to be bonded is free from moisture, dust, dirt, debris, etc. if seam overlap grinding is required, complete the process within 20 minutes of the seaming operation. Do not grind to a depth that exceeds 10% of the liner thickness. Grinding marks shall not appear beyond 0.25-inches of the extrudate after its placed. Align seams with the fewest possible number of wrinkles and "fishmouths".
- Extend seams to the outside edge of the panels to be placed in the anchor trench.
- Repair any portion of the liner exhibiting a flaw or failing test using the most appropriate method of the available procedures listed in specification section 02770-3.02.K.4.
- Temporarily anchor each liner panel in the anchor trench at the crest of the slope as soon as the panel is deployed or positioned. Do not entrap soil, sandbags, etc. between the geosynthetic layers.
- Do not drive equipment directly on the geomembrane liner except that which has the appropriate ground pressure requirements per specification section 02770-3.04.B.

2741

C. Petro will begin placing the 1 foot protective cover at the intercell berm on October 13, 1999. They then plan to inspect the LCS/LDS piping using a video camera as required by the specifications and then proceed to construction of the wedge.

D. Petro is currently placing Category 2 material from the OMTA and from the STP.

E. Electrofusion coupling at the liner penetration boxes will take place on October 6, 1999.

F. Kevin Harbin will coordinate with Petro to determine an acceptable grid in which to place the thorium contaminated soil. Placement should occur this week.

G. Seeding of the Borrow area is part of Petro's scope of work and should take place this week.

## XII. QUALITY AND INSPECTION

A. Petro has not submitted the certifications for the liner penetration boxes. This could become an issue relative to final certification of Cell 3. Mike Godber and Rick Schairbaum have been coordinating this issue.

## XIII. DESIGN AND CONSTRUCTION ISSUES

A. FDF, GeoSyntec and Petro will review the placement of geotextile relative to having it covered within ten days of installation.

B. FDF requires one week advance notice from Petro prior to Petro excavating the Active Flyash Pile.

C. FDF and Petro will meet to discuss the latest debris delivery schedule and Cell 3 logic.

D. Lou Wehlitz noted that there will be no electrical power in the OSDF area on Saturday, October 9, 1999 due to a required power outage. This will not affect the area of Petro's administrative trailers.

## XIV. MATERIAL, DCN AND VENDOR DATA STATUS

A. No report.

2741

# ENGINEERED SYNTHETIC PRODUCTS, INC.

**Representing**

**TNS Advanced Technologies & SKAPS Industries**

**405 Hood Road**
**Lilburn, GA 30047**
**770/564-1857 Phone**
**770/564-1818 Fax**

October 20, 1999

RECEIVED
OCT 20 1999
KBT

Mr. Kwasi Badu-Tweneboah
GeoSyntec Consultants
Fernald Field Office
7400 Willey Road
Hamilton, OH 45013

Via fax: 513/648-3415

This letter is in regard to the Fluor Daniel Fernald Project located in Fernald, Ohio. With respect to the TNS E070 nonwoven geotextile exposed at this site for a 30 day period, will exhibit a loss of strength no more than approximately 15% of its original value. This will result in a net strength of 170 pounds per ASTM D-4632.

Sincerely,

Richard Franklin

Richard Franklin
Engineered Synthetic Products, Inc.

RFJ/kal

REF. NOE 20102-22 JSt 10-21-99

000161

# TABLE 02714P-1

## REQUIRED PROPERTY VALUES FOR GEOTEXTILE FILTER

| PROPERTIES | QUALIFIER | UNITS[5] | SPECIFIED[4] VALUES | TEST METHOD |
|---|---|---|---|---|
| Type | | | | |
| Nonwoven needlepunched | | | | (-) |
| Polymer composition | minimum | % | 95 polypropylene or polyester by weight | (-) |
| Mass per unit area | minimum | $oz/yd^2$ | 7 | ASTM D 5261 |
| Filter Requirements | | | | |
| Apparent opening size ($O_{95}$) | maximum | mm | 0.212 | ASTM D 4751 |
| Permittivity | minimum | $sec^{-1}$ | 0.5 | ASTM D 4491 |
| Mechanical Requirements | | | | |
| Grab strength | minimum | lb | 180 | ASTM D 4632[1] |
| Tear strength | minimum | lb | 75 | ASTM D 4533[2] |
| Puncture strength | minimum | lb | 75 | ASTM D 4833[3] |
| Burst strength | minimum | psi | 350 | ASTM D 3786 |
| Durability | | | | |
| Ultraviolet Resistance | minimum | % | 70 | ASTM D 4355 |

FROM SPECS

Notes:

(1) Minimum of values measured in machine and cross machine directions with 1 inch clamp on Constant Rate of Extension (CRE) machine.
(2) Minimum value measured in machine and cross machine direction.
(3) Tension testing machine with a 1.75-inch diameter ring clamp, the steel ball being replaced with 0.31-inch diameter solid steel cylinder with flat tip centered within the ring clamp.
(4) All values represent minimum average roll values.
(5) mm = millimeter
% = percent
$oz/yd^2$ = ounce per square yard
sec = second
lb = pound
psi = pound per square inch

REF. NCR FY 2002-22

--2741

**GeoTesting Express, Inc.**
1145 Massachusetts Ave.
Boxborough, MA 01719
Tel: 978-635-0424
Fax: 978-635-0266

# FAX

| | |
|---|---|
| To: Mr. Kwasi | From: Mr. Gary T. Torosian |
| Fax: 513-648-3415 | Pages: 3 (including cover page) |
| Re: On-Site Disposal Facility | Date: 10/21/99 |
| Cc: | |

☒ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply

**Comments:**

2 grab strengths (ASTM D 4632)

TEST RESULTS
FROM SAMPLES
COLLECTED ON 10/20/99
ADK 10/21/99

RECEIVED
OCT 21 1999
KBT @ 1250

REF. NCR 20102-22

2741

# Breaking Load and Elongation of Geotextiles (Grab Method) by ASTM D 4632

constant rate of extension (CRE) tensile testing machine

**Client:** GeoSyntec Consultants, Inc.
**Project Name:** On-Site Disposal Facility
**Project Location:** Fernald, OH

**GTX #:** 2318
**Test Date:** 10/21/99

**Sample ID:** GT-7; 1
**Sample Description:** 7 oz black non-woven geotextile

**Testing Machine:** Instron 1000
**Grip Separation:** 3 in

**Testing Speed:** 12 in/min
**Grips:** Curtis "Geo" Grip

**Maximum Load Obtainable in Range:** 1000 lb

**Padding:** —
**Condition:** dry

| Specimen Number | Direction A Maximum Breaking Strength, lb | Direction A Apparent Breaking Elongation, % | Direction B Maximum Breaking Strength, lb | Direction B Apparent Breaking Elongation, % |
|---|---|---|---|---|
| 1 | 259 | 63 | 239 | 59 |
| 2 | 235 | 65 | 226 | 62 |
| 3 | 219 | 62 | 260 | 62 |
| 4 | 212 | 60 | 261 | 61 |
| 5 | 234 | 53 | 225 | 59 |
| 6 | 248 | 67 | 260 | 58 |
| 7 | 204 | 50 | 230 | 61 |
| 8 | 223 | 57 | 207 | 59 |
| 9 | 252 | 50 | 259 | 70 |
| 10 | 280 | 52 | 244 | 70 |
| Average | 237 | 58 | 241 | 62 |
| Standard Deviation | 23.4 | 6.3 | 18.9 | 4.6 |
| Coefficient of Variation, % | 9.89 | 11 | 7.84 | 7.4 |

**Comments:**

Tested By: mhm
Checked By: gtt

RECEIVED OCT 21 1999 KBT @ 1250

Ref. NCR 2002-22

Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

000164

2741

# Breaking Load and Elongation of Geotextiles (Grab Method) by ASTM D 4632

constant rate of extension (CRE) tensile testing machine

**Client:** GeoSyntec Consultants, Inc.
**Project Name:** On-Site Disposal Facility
**Project Location:** Fernald, OH

**GTX #:** 2318
**Test Date:** 10/21/99

**Sample ID:** GT-7; 2
**Sample Description:** 7 oz black non-woven geotextile

**Testing Machine:** Instron 1000
**Grip Separation:** 3 in

**Testing Speed:** 12 in/min
**Grips:** Curtis "Geo" Grip

**Maximum Load Obtainable In Range:** 1000 lb

**Padding:** —
**Condition:** dry

| Specimen Number | Direction A Maximum Breaking Strength, lb | Direction A Apparent Breaking Elongation, % | Direction B Maximum Breaking Strength, lb | Direction B Apparent Breaking Elongation, % |
|---|---|---|---|---|
| 1 | 260 | 61 | 217 | 69 |
| 2 | 197 | 57 | 246 | 71 |
| 3 | 217 | 53 | 268 | 65 |
| 4 | 222 | 61 | 241 | 69 |
| 5 | 212 | 60 | 200 | 62 |
| 6 | 271 | 60 | 220 | 60 |
| 7 | 226 | 57 | 197 | 60 |
| 8 | 186 | 59 | 171 | 53 |
| 9 | 199 | 56 | 190 | 56 |
| 10 | 248 | 62 | 189 | 57 |
| Average | 224 | 59 | 214 | 62 |
| Standard Deviation | 28.0 | 2.8 | 30.3 | 6.3 |
| Coefficient of Variation, % | 12.5 | 4.7 | 14.2 | 10 |

**Comments:**

Tested By: mhm
Checked By: gtt

RECEIVED
OCT 21 1999
KBT @ 1250

REF. NCR 2002-22

Notes: These results apply only to the sample tested for the specific test conditions. The test procedures employed follow accepted industry practice and the indicated test method. GeoTesting Express has no specific knowledge as to conditioning, origin, sampling procedure or intended use of the material.

000165

FIGURE 1

F-2741

GeoSyntec Consultants



# CONSTRUCTION NONCONFORMANCE REPORT

| 1. ORIGINATOR: | 2. TITLE/ORGANIZATION: | 3. NCR NUMBER: | 4. DATE DISCOVERED |
|---|---|---|---|
| Byran York | Sr. Eng. Technician/GeoSyntec | 20102-023 | 05 October 1999 |

| 5. RESPONSIBLE ORGANIZATION/PROJECT: | 6. ASSESSMENT ACTIVITY: | 7. HOLD TAG: |
|---|---|---|
| FDF Construction, Petro/OSDF Phase II | Construction Quality Control | ( ) YES (☒) NO |
| | | 8. REMOVED (Initial/Date): |

9. REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

Technical Specifications, Phase II, 02710-2

Part 2.01 B – Furnish granular drainage material for the leachate collection system (LCS) drainage layer which classifies as GP in accordance with the Unified Soil Classification System (per ASTM D 2487), and having a gradation (per ASTM 136) that meets the requirements listed in this section.

10. NONCONFORMANCE TYPE: Construction Nonconformance ( ) Material Deviation ( x )

11. NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

A total of 9 samples were taken from the granular drainage material (No. 78 Stone) stockpiles for sieve analysis. Two of the sieve samples (LCS III–7 and LCS III-9) failed to meet the project specifications with approximately 79.9 percent and 73.3 percent, respectively, passing the ½ inch sieve. The above stated specification requires a minimum of 80 percent passing the ½ inch sieve.

| 12. ORIGINATOR'S SIGNATURE: | 13. DATE PROVIDED TO RESPONSIBLE MANAGER: |
|---|---|
| Byran York | 13 October 1999 |

14. RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( x ) Reject ( ) Other ( ) Repair ( ) Rework ( )

The material is slightly coarser than the specifications require. However, it does meet the maximum particle size requirement and does not increase the potential for damaged GML during placement. Being coarser, the material should have a higher hydraulic conductivity, which is desirable. In fact, the measured hydraulic conductivity (per ASTM D 2434) values were 6.5 cm/s for the LCS III-7 sample and 5.4 cm/s for the LCS III-9 sample. Both exceed the specified value of 0.1 cm/s minimum. Use as-is.

15. RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

Kwasi Badu-Tweneboah, Certifying Engineer, GeoSyntec

| 16. RESPONSIBLE MANAGER'S SIGNATURE: | 17. PROPOSED COMPLETION DATE: | 18. DATE FORWARDED TO APPROVAL AUTHORITY: |
|---|---|---|
| K Badu-Tweneboah | 20 October 1999 | 20 October 1999 |

000166

FIGURE 2

GeoSyntec Consultants

2741



## CONSTRUCTION NONCONFORMANCE REPORT

19. EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (X) Reject ( )
Comments ( )

20. APPROVAL AUTHORITY SIGNATURE: Bill Zebick / BILL ZEBICK (FOF CONST) / Anthony P. Kumek / ANTHONY P. KUMEK (FOF ENG)

21. DATE: 10/21/99 / 10/21/99

22. VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):
ACCEPT-AS-IS DISPOSITION - NO VERIFICATION ACTION REQUIRED / JJS 10/21/99

23. VERIFIER'S SIGNATURE: Frank Thompson

24. DATE: 10/21/99

25. APPROVAL AUTHORITY SIGNATURE:

26. DATE CLOSED: 10/21/99

27. CONTINUATION FROM BLOCK ____:

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF) F-2741

LOCATION: FERNALD, OHIO PROJECT NO: GC0409 TASK NO.: 04.1

DESCRIPTION: Phase II DATE: 5 day OCT. month 1999 year

MATERIAL TYPE: 78 STONE SAMPLE NO.: LCS III-7

## SOIL SAMPLE SIZE

| APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams) | SAND | FINE GRAIN |
|---|---|---|
| | 115 | 65 |

| | | BEFORE WASH | AFTER WASH |
|---|---|---|---|
| TARE NO. | | Big PAN | |
| WT. OF DRY SAMPLE PLUS TARE | (grams) | ~~2.1~~ 12.75 LB 5783.4 | |
| WT. OF TARE | (grams) | 2.1 LB 952.56 gm | |
| WT. OF DRY SAMPLE | (grams) | 4830.8 | |

## SIEVE ANALYSIS

GA ID: DLE

| SIEVE NO. | DIAMETER (mm) | WT. RETAINED (grams) | % RETAINED | % FINER | PROJECT SPECIFICATIONS |
|---|---|---|---|---|---|
| 5" | 125.0 | Ø | Ø | | 100 |
| 4" | 100.0 | Ø | Ø | | ↓ |
| 3" | 75.0 | Ø | Ø | | |
| 2½" | 63.0 | Ø | Ø | | |
| 2" | 50.0 | Ø | Ø | | |
| 1½" | 37.50 | Ø | Ø | | |
| 1" | 25.0 | Ø | Ø | | |
| ¾" | 19.0 | Ø | Ø | | 100 |
| ½" | 12.5 | 968.9 | 20.1 | 79.9 | 80 TO 100 |
| ⅜" | 9.5 | 1958.1 | 40.5 | 59.5 | 40 TO 75 |
| #4 | 4.75 | 4030.5 | 83.4 | 16.6 | 5 TO 25 |
| #8 | 2.36 | 4623.3 | 95.7 | 4.3 | 0 TO 10 |
| #16 | 1.18 | 4716.7 | 97.6 | 2.4 | 0 TO 5 |
| #30 | 0.600 | 4747.7 | 98.3 | 1.7 | 0 TO 5 |
| #50 | 0.300 | 4762.7 | 98.6 | 1.4 | 0 TO 5 |
| #100 | 0.150 | 4788.5 | 99.1 | 0.9 | 0 TO 5 |
| #200 | 0.075 | 4812.2 | 99.6 | 0.4 | 0 TO 2 |
| PAN | | 4830.8 | | | |

000168

%FINER = 100 − Σ% RETAINED

©GEOSYNTEC CONSULTANTS FILE NO. 2-14-PMS CHECKED BY: TBW SHEET NO. ____ OF ____

2741

**Geotechnical, Environmental and Material Testing Laboratory**

A division of GeoSyntec Consultants Laboratories

# RIGID WALL PERMEABILITY TEST

## ASTM 2434

| | |
|---|---|
| Project Name: | FERNALD OSDF PHASE11 |
| Project Number: | GQ0409 |
| Client Project Number: | |
| Client/Site ID: | LCSIII-7 |
| Sample Number: | 99J24 |
| Material Type: | GRAVEL |
| Expected/Specified Value: | |
| Date Received: | 10/5/99 |

| Specimen Number | Specimen Initial Conditions | | Gradient Range | Hydraulic Conductivity |
|---|---|---|---|---|
| | Dry Unit Weight (pcf) | Moisture Content (%) | (-) | (cm/s) |
| 1 | 114.9 | 0.5 | 0.11 - 0.37 | 6.5E+0 |

Notes:

Tested/Checked by: MT Date: 10-8-99 Approved by: [illegible] Date: 10-15-99

2741

# GeoSyntec Consultants

Geomechanics and Environmental Laboratory

**Sample ID:** LCSIII-7
**Project Name:** FERNALD OSDF-OPTION YEAR 1
**Project No.:** GQ0409

Various Test Standards | **SOIL INDEX PROPERTIES** | Figure

**AS RECEIVED MOISTURE CONTENT**
ASTM D 2216 ☐
ASTM D 4643 ☐
Moisture Content (%):

**DRY UNIT WEIGHT OF UNDISTURBED SAMPLE**
ASTM D 2937
Dry Unit Weigh ($\gamma_d$, pcf):

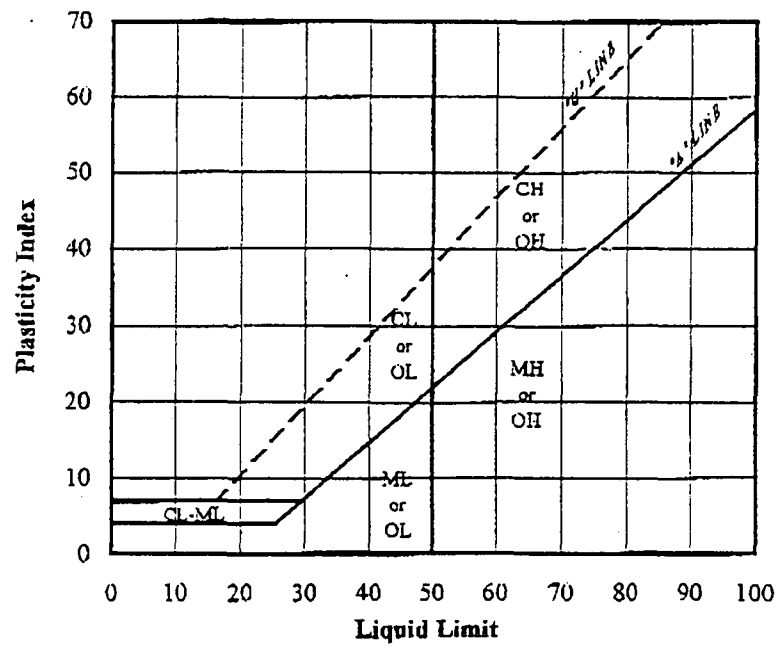
**SPECIFIC GRAVITY**
ASTM D 854 ☐
ASTM C 127 ☐
Specific Gravity (-):

**SOIL pH**
ASTM D 4972 ☐
EPA MET. 9045 ☐
pH: (with distilled-deionized water)
pH: (with 0.01 M $CaCl_2$ solution)

**SOIL ORGANIC CONTENT**
ASTM D 2974
Organic Content (%):

**CARBONATE CONTENT**
ASTM D 4373 ☐
ASTM D 3042 ☒ (see figures)
Carbonate Content (%): 0.1

**ATTERBERG LIMITS**
ASTM D 4318
Liquid Limit (LL, %):
Plastic Limit (PL, %):
Plasticity Index (PI):




| Sample ID | Lab Sample Number | Moisture Content (%) | Dry Unit Weight (pcf) | Specific Gravity (-) | Soil pH (water) (-) | Soil pH ($CaCl_2$) (-) | Organic Content (%) | Carbonate Content (%) | Atterberg Limits LL (%) | Atterberg Limits PL (%) | Atterberg Limits PI (-) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LCSIII-7 | 99J24 | | | | | | | 0.1 | | | |

Note(s): HCL acid bath solution adjusted to pH4 as requested by the client.

10 10/16/99

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO — PROJECT NO: GC0409 — TASK NO.: 04.1 — 2741

DESCRIPTION: Phase II — DATE: 18 day Oct month 1999 year

MATERIAL TYPE: 7% Stone — SAMPLE NO.: LCS III-9

## SOIL SAMPLE SIZE

| APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams) | SAND | FINE GRAIN |
|---|---|---|
| | 115 | 65 |

| | | BEFORE WASH | AFTER WASH |
|---|---|---|---|
| TARE NO. | | 2-5 | |
| WT. OF DRY SAMPLE PLUS TARE | (grams) | 6555.5 | |
| WT. OF TARE | (grams) | 35.5 | |
| WT. OF DRY SAMPLE | (grams) | 6520.0 | |

## SIEVE ANALYSIS

QA ID: DLE

| SIEVE NO. | DIAMETER (mm) | WT. RETAINED (grams) | % RETAINED | % FINER | PROJECT SPECIFICATIONS |
|---|---|---|---|---|---|
| 3/4 | 19.000 | Ø | Ø | Ø | 100 |
| 1/2 | 12.500 | 1738.9 | 26.7 | 73.3 | 80 TO 100 |
| 3/8 | 9.500 | 3405.9 | 52.2 | 47.8 | 40 TO 75 |
| #4 | 4.750 | 5877.6 | 90.1 | 9.9 | 5 TO 25 |
| #8 | 2.360 | 6417.3 | 98.4 | 1.6 | 0 TO 10 |
| #16 | 1.180 | 6466.2 | 99.2 | 0.8 | 0 TO 5 |
| #30 | 0.600 | 6476.6 | 99.3 | 0.7 | 0 TO 5 |
| #50 | 0.300 | 6482.2 | 99.4 | 0.6 | 0 TO 5 |
| #100 | 0.150 | 6496.0 | 99.6 | 0.4 | 0 TO 5 |
| #200 | 0.075 | 6513.2 | 99.9 | 0.1 | 0 TO 2 |
| PAN | | | | | |

000171

%FINER = 100 − Σ% RETAINED

**Geotechnical, Environmental and Material Testing Laboratory**

A division of GeoSyntec Consultants Laboratories

# RIGID WALL PERMEABILITY TEST

2741

ASTM 2434

| | |
|---|---|
| Project Name: | FERNALD OSDF PHASE II |
| Project Number: | GQ0409 |
| Client Project Number: | |
| Client/Site ID: | LCSIII-9 |
| Sample Number: | 99J139 |
| Material Type: | GRAVEL |
| Expected/Specified Value: | |
| Date Received: | 10/20/99 |

| Specimen Number | Specimen Initial Conditions | | Gradient Range | Hydraulic Conductivity |
|---|---|---|---|---|
| | Dry Unit Weight (pcf) | Moisture Content (%) | (-) | (cm/s) |
| 1 | 110.0 | 0.7 | 0.05 - 0.30 | 5.4E+0 |

Notes:

Tested/Checked by: MT Date: 10/20/99 Approved by: NSR Date: 10/20/99

FIGURE 1

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2741



## CONSTRUCTION NONCONFORMANCE REPORT

| 1. ORIGINATOR: | 2. TITLE/ORGANIZATION: | 3. NCR NUMBER: | 4. DATE DISCOVERED |
|---|---|---|---|
| K. Badu-Tweneboah | Certifying Engineer/GeoSyntec | 20102-024 | 13 October 1999 |

| 5. RESPONSIBLE ORGANIZATION/PROJECT: | 6. ASSESSMENT ACTIVITY: | 7. HOLD TAG: |
|---|---|---|
| FDF Construction, Petro/OSDF Phase II | Construction Quality Control | ( ) YES (☒) NO |
| | | 8. REMOVED (Initial/Date): |

9. REQUIREMENTS (Identify requirement from document [e.g., CQA plan, specification, drawing, etc.]):

Technical Specifications, Phase II, 02710-2

Part 2.01.B – Furnish granular drainage material for the leachate collection system (LCS) drainage layer, leachate detection system (LDS) drainage layer… classifying as GP in accordance with the Unified Soil Classification System (per ASTM D 2487), and having a gradation (per ASTM C 136) that meets the requirements listed in this section.

10. NONCONFORMANCE TYPE: Construction Nonconformance ( ) Material Deviation ( x )

11. NONCONFORMANCE (Fully describe as it relates to requirements. Use supplemental sheets as required):

A total of 9 samples were taken from the granular drainage material (No. 78 Stone) stockpiles for sieve analysis. One of the sieve samples (LCS III–5) failed to meet the project specifications with approximately 25.5 percent passing the No. 4 sieve size. The above stated specification requires 5 to 25 percent passing the No. 4 sieve size.

| 12. ORIGINATOR'S SIGNATURE: | 13. DATE PROVIDED TO RESPONSIBLE MANAGER: |
|---|---|
| K Badu-Tweneboah | 13 October 1999 |

14. RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( x ) Reject ( ) Other ( ) Repair ( ) Rework ( )

The material is slightly finer than the specifications require for the No. 4 sieve size. However, it does meet the maximum particle size requirement and had a laboratory measured hydraulic conductivity value of 5.2 cm/s, which exceeds the specified value of 0.1 cm/s minimum. Therefore, use as-is.

15. RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

Kwasi Badu-Tweneboah, Certifying Engineer, GeoSyntec

| 16. RESPONSIBLE MANAGER'S SIGNATURE: | 17. PROPOSED COMPLETION DATE: | 18. DATE FORWARDED TO APPROVAL AUTHORITY: |
|---|---|---|
| K Badu-Tweneboah | 20 October 1999 | 20 October 1999 |

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FIGURE 2

GeoSyntec Consultants

2741



## CONSTRUCTION NONCONFORMANCE REPORT

19. EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (X) Reject ( )
Comments ( )

20. APPROVAL AUTHORITY SIGNATURE: (FOF CONST) Bill Zebrick / BILL ZEBRICK (FOF ENG) Anthony P. Klimek / ANTHONY P. KLIMEK

21. DATE: 10/21/99 / 10/21/99

22. VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):
ACCEPT-AS-IS DISPOSITION - NO FURTHER ACTION - REQUIRED - Frank Thompson 10-21-99

23. VERIFIER'S SIGNATURE: Frank Thompson

24. DATE: 10/21/99

25. APPROVAL AUTHORITY SIGNATURE: [illegible]

26. DATE CLOSED: 10/21/99

27. CONTINUATION FROM BLOCK ____:

000174

GQ0409-03.1/PH2NCR020A.CDA

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO — PROJECT NO: ~~CC0409~~ 2741 — TASK NO.: 04.1

DESCRIPTION: Phase II — DATE: 1 day July month 1999 year

MATERIAL TYPE: 78 Stone — SAMPLE NO.: LCS-99.5

| SOIL SAMPLE SIZE | Weight in Pounds | Weight in grams |
|---|---|---|
| | 6.14 | 2784.77 |

| APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams) | SAND | FINE GRAIN |
|---|---|---|
| | 115 | 65 |

| | BEFORE WASH | AFTER WASH |
|---|---|---|
| TARE NO. | 009 | |
| WT. OF DRY SAMPLE PLUS TARE (grams) | 2820.30 | |
| WT. OF TARE (grams) | 35.53 | |
| WT. OF DRY SAMPLE (grams) | 2784.77 | |

SIEVE ANALYSIS — CA ID: _____

| SIEVE NO. | DIAMETER (mm) | WT. RETAINED (grams) | % RETAINED | % FINER | PROJECT SPECIFICATIONS |
|---|---|---|---|---|---|
| 2" | 50.00 | Ø | Ø | 100 | 100 |
| 1½" | 37.50 | Ø | Ø | 100 | |
| 1" | 25.00 | Ø | Ø | 100 | |
| ¾" | 19.00 | Ø | Ø | 100 | 100 |
| ½" | 12.50 | 289.80 | 10.4 | 89.6 | 80 to 100 |
| ⅜" | 9.50 | 792.99 | 28.5 | 71.5 | 40 To 75 |
| #4 | 4.75 | 2073.60 | 74.5 | 25.5 | 5 To 25 |
| #8 | 2.36 | 2638.90 | 94.8 | 5.2 | 0 To 10 |
| #16 | 1.18 | 2717.90 | 97.6 | 2.4 | 0 To 5 |
| #30 | 0.600 | 2733.20 | ~~98.1~~ 98.2 | ~~1.9~~ 1.8 | 0 To 5 |
| #50 | 0.300 | 2739.70 | 98.4 | 1.6 | 0 To 5 |
| #100 | 0.150 | 2755.80 | 99.0 | 1.0 | 0 To 5 |
| #200 | 0.75 | 2770.60 | 99.5 | 0.5 | 0 To 2 |
| PAN | | 2784.60 | — | — | |

KBT KBT

000175

%FINER = 100 − Σ% RETAINED



CHECKED BY: KBT

SHEET NO. ____ OF ____

Geotechnical, Environmental and Material Testing Laboratory

A division of GeoSyntec Consultants Laboratories

# RIGID WALL PERMEABILITY TEST

ASTM 2434

F-2741

| | |
|---|---|
| Project Name: | FERNALD OSDF-OPTION YEAR1 |
| Project Number: | GQ0409 |
| Client Project Number: | |
| Client/Site ID: | LCSIII-5 |
| Sample Number: | 99I178 |
| Material Type: | GRAVEL |
| Expected/Specified Value: | |
| Date Received: | 9/16/99 |

| Specimen Number | Specimen Initial Conditions | | Gradient Range | Hydraulic Conductivity |
|---|---|---|---|---|
| | Dry Unit Weight (pcf) | Moisture Content (%) | (-) | (cm/s) |
| 1 | 103.6 | 1.3 | 0.05 - 0.20 | 5.2E+0 |

Notes:

Tested/Checked by: MT Date: 9-24-99 Approved by: BSS Date: 9-28-99

# FLUOR DANIEL FERNALD

# NONCONFORMANCE REPORT FORM

-2741

| | | |
|---|---|---|
| | | ORIGINATOR/ASSESSOR |
| 1 | Nonconformance Number/Revision | NCR No.: 2000-025 Revision No. 0 |
| 2 | Dates | Date Discovered: 10/11/99 Date NCR Report Issued: 10/16/99 |
| 3 | Type of Nonconformance | [X] FINDING [ ] CONCERN |
| 4 | Project/Activity @ Fac/Loc/Bldg | OSDF PH. II, OPTION A, CELL #3, TRIAL WELD |
| 5 | Hazard Category | Nuclear: [ ] 1 [ ] 2 [ ] 3 [ ] Radiological<br>Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard<br>Industrial: [ ] Hazardous Waste Activity [X] Standard Industrial Hazard [ ] FEMP SIH |
| 6 | Assessment | [ ] Internal [ ] External (OEPA, DOE) [ X ] Supplier/Vendor Geosyntec Consultants |
| 7 | Assessment Type | [ ] Audit [ x] Surveillance [ ] Inspection [ ] Other |
| 8 | Assessment Number | 20008B7 |
| 9 | Responsible FDF Division/Vendor | [X] S&WP [ ] WMT&SP [ ] FC&DP [ ] O&PI [ ] PS [ ]SUPPLIER/VENDOR |
| 10 | Responsible FDF Department/Vendor | CONSTRUCTION/ Geosyntec Consultants |
| 11 | Responsible Team Leader/Coach/Vendor (Print Name) | Bill Zebick/ Geosyntec Consultants |
| 12 | Functional Area (NA for Vendors) (choose any that apply) (Ref. RM-0016) | [ ] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI<br>[ ] FM [ ] EP [ ] EW [ ] MT [ ] OP [ ] PT [ ] SE [ ] TR<br>[X ] CT [ ] HR [ ] PC [ ] EM [ ] FP [ ] NS [ ] SH [ ] RP |
| 13 | QA Criteria (choose one that applies Ref. RM-0012) Other Criteria (CONOPS, etc.) (not RM-0012 applicable) | [ ] 1 Program [ ] 2 Training [ ] 3 Quality Improv. [ ] 4 Document/Records<br>[ ] 5 Work process [ ] 6 Design [ ] 7 Procurement [x] 8 Inspect/Test<br>[ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other |
| 14 | Requirement Description<br>Cite the requirement (clearly, concisely, and completely) and its source, including document identification number, page and paragraph number. A copy of the document (or page of the document) in which the requirement appears may be attached or added to the NCR file. Use additional or separate sheets as necessary. | Reference: Contract Number FSC 614, Southern Waste Units Excavation/ On Site Disposal Facility (OSDF) Phase II, Spec. 2770, Section 2.03H which states trial seams are to be conducted at the beginning of each seaming period and at least once each five hours for each seaming apparatus used that day prior of seaming.<br>RECORD |
| 15 | Nonconformance Description<br>Describe the nonconformance. Include details such as supplier names, container numbers, purchase order, work order, or requisition numbers) and clearly describe the deviation from the written requirement. Use additional or separate sheets as necessary. | Nonconformance Title or Short Description:<br>Trial weld and seaming logs for both the primary and secondary geomembrane layers for Cell III were reviewed to ensure the seamer performed a trial weld within 5 hours of production seaming. From review of the logs, there were isolated cases when the seamer performed a production seam and the trial seam was performed more then 5 hours earlier. Attached are seaming and trial seam logs representing this nonconformng condition. |
| 16 | Tagging Required / Number of Tags | [ ] Yes [X] No Number of Tags 0 |
| 17 | Originator/Assessor | Name: MIKE GODBER Signature: [signature] Date: 10/18 1999 |
| | | ORIGINATOR'S/ASSESSOR'S TEAM LEADER'S/COACH'S REVIEW |
| 18 | Originator's/Assessor's Team Leader/Coach | Name: FRANK THOMPSON Signature: Frank Thompson Date: 10-18-99 |
| 19 | Response Date From Resp. Organ. | (Reply within 20 working days)<br>11/15/99 |

# NONCONFORMANCE REPORT FORM

2741

| | | |
|---|---|---|
| | **RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE** | |
| | **Nonconformance Number/ Revision** | NCR No.: ~~EV99-1~~ FY2000-025 Revision 0 |
| 20 | **Root Cause Analysis**<br>Provide documentation as attachment. Use additional or separate sheets as necessary | [ ] YES Level 1 Cat. [ ] 1H (human perf.) [ ] 1N (nat. phenom/sabotage [ ] 1E (equip.) [ ] 1Z (other)<br>[ ] NO<br>TapRoot Cause Code(s) |
| 21 | **Corrective Action (CA) Description and Disposition**<br>Describe the actions necessary to correct the nonconformance. Corrective actions must be detailed and complete. They must be written in a clear, concise, and verifiable manner. The corrective action plan must also include actions to prevent recurrence. Use additional or separate sheets as necessary.<br>(A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below) | Hardware: [X] Accept-as-is [ ] Repair [ ] Rework [ ] Reject<br>Non-Hardware: [ ] Other<br>See attached response |
| 22 | **Technical Concurrence/ Justification (mark NA if not applicable)** | Name: KWASI BADU-TWEREBOAH Signature: [signature] Date: 10/21/99 |
| 23 | **Was a Design Change Notice Required?** | [ ] Yes [X] No DCN # Date Issued |
| 24 | **Was a SBDR Performed?**<br>**Was a USQD Performed?** | [ ] Yes [X] No SBDR # Date Issued<br>[ ] Yes [X] No USQD # Date Issued |
| 25 | **Actions taken to Prevent Recurrence**<br>Use additional or separate sheets as necessary. | SEE ATTACHED RESPONSE. IN FUTURE, CGC PERSONNEL WILL MONITOR TIME REGARDING THIN WELDS |
| 26 | **Proposed Completion Date For CA** | Date: NEXT CONSTRUCTION SEASON |
| 27 | **Responsible Team Leader/Coach/Vendor** | Name: BILL ZEBICH Signature: [signature] Date: 10/21/99 |
| | **EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR** | |
| 28 | **Response Acceptable?** | [X] Yes [ ] No |
| 29 | **Originator's/Assessor's** | Name: FRANK THOMPSON Signature: [signature] Date: 10/21/99 |
| | **COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION** | |
| 30 | **Date Corrective Action Completed** | Date: 10/21/99 |
| 31 | **Responsible Team Leader/Coach /Vendor** | Name: BILL ZEBICH Signature: [signature] Date: 10/21/99 |
| | **VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER** | |
| 32 | **Verification Action**<br>(Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR) | TEST RESULTS ATTACHED<br>OCT 18, 1999 MEMO REVIEWED ... ACCEPTABLE<br>RECEIVED |
| 33 | **Verifier** | Name: REINHARD FRISKE Signature: [signature] Date: 10-21-99 |
| | **CLOSURE BY THE ASSESSOR'S VERIFIER'S TEAM LEADER/COACH** | |
| 34 | **Verifier's Team Leader/Coach (NCR Closed)** | Name: FRANK THOMPSON Signature: [signature] Date: 10/21/99 |

**Response to FDF's NCR No. FY2000-0025**
**Dated 18 October 1999**
**(Block 21, page 2 of 2)**

Phase II Technical Specifications Section 02770, Part 3.0H further states that: "...Also, each seamer shall make at least one trial seam each. For each day that seaming is performed by that seamer." Trial seams may also be taken at the request of the field inspector (i.e., CQC personnel for the OSDF project), or whenever seaming personnel or equipment changes and when climatic conditions reflect wide changes in geomembrane temperature, or other conditions that could affect seam quality. The purpose of trial seams is to establish proper seaming temperatures, pressure and rates, along with the necessary geomembrane preparation procedures and subsequent seam evaluation. Ideally, trial seams could be used to evaluate production seam quality and thereby minimize damage to the installed geomembrane liner through destructive sampling and testing.

For the OSDF Cell 3 construction, CQC personnel continuously monitored all seaming operations, and as such were able to assess whether a seamer was having equipment and/or seaming problems at any time. In addition, destructive seam samples were taken and tested to evaluate seam strength and integrity at the frequencies specified in the CQA Plan and Technical Specifications. The following paragraphs address each of the nonconforming seaming operations described in this NCR.

On 11 September 1999, seamer MM performed a trial extrusion seam with machine No. 03 at 13:45. Two of the production seams by seamer MM, using machine No. 03, were performed at 18:55 and 19:03, which are 10 min. and 18 min., respectively, beyond the 5-hr limit. The two seams were 17 and 7 lineal feet long, respectively. CQC personnel had confidence in the quality of production extrusion seams performed by seamer MM. All destructive tests performed on production extrusion seams by seamer MM passed. In the case of the production seam performed by seamer MM at 19:25, which was 40 min. beyond the 5-hr limit, the entire seam performed from 19:05 to 19:35 on that was rejected by CQC personnel and was capped as noted on the Production Extrusion Seam Summary Log. The seams were rejected and capped because they had exceeded the 5-hr limit and also CQC personnel suspected the quality of the production seams during that time of day.

EBT

On 15 September 1999, seamer JM performed trial fusion with machine No. 02 at 1300. The production fusion seams by seamer JM, using machine No. 02, were performed at 18:25 and 19:30, which are 25 min. and 1 hrs. 30 min., respectively, beyond the 5-hr limit. Destructive sample, DP-11, taken from the seam performed during this time period by seamer JM failed and was chased until the passing results were obtained in accordance with the requirements of the Technical Specifications. Therefore, GeoSyntec is confident that the seams performed beyond the 5-hr trial seam limit still met the requirements of the specifications.

RECORD

On 15 September 1999, seamers JB and MM performed trial extrusion seams with machine Nos. 04 and 03 at 13:00 and 13:15, respectively. Five production extrusion seams, each measuring 8, 8, 10, 10, and 7 linear ft, were performed by seamer JB using machine No. 04 at 18:20, 18:25, 18:40, 18:51, and 19:00, respectively. (The production extrusion seam performed at 18:15 was performed by seamer MM and incorrectly recorded. The error has been corrected on the Production Extrusion Seam Summary Log.) A destructive seam sample, DP-15, taken on the production extrusion seam performed by seamer JB with machine No. 04 on the same day passed. Four production extrusion seams, each measuring 45, 6, 23, and 16 lineal ft, were performed by seamer MM using machine No. 03 at 18:15, 18:35, 18:39, and 18:50, respectively. A destructive seam sample, DP-16, taken on the production extrusion seam performed by seamer MM with machine No. 03 on the same day passed. As previously indicated CQC personnel had confidence in the quality of production extrusion seams performed by seamer MM.

On 21 September 1999, seamer MM performed trial extrusion seam with machine No. 03 at 11:00. Three production extrusion seams, each measuring 23, 9, and 3 lineal ft, were performed by seamer MM using machine No. 03 at 16:53, 17:10, and 17:15, respectively. A destructive seam sample, DP-18, taken on the production extrusion seam performed by seamer MM with machine No. 03 on the same day passed. Again, CQC personnel had confidence in the quality of production extrusion seams performed by seamer MM.

In summary, there were isolated cases where production seams were performed with the same equipment for more than the 5-hr trial seams required by the specifications. However, each seamer performed at least one trial seam on each of the days those production seams were performed. In addition, the production seams performed on those days had destructive samples taken on the production seams performed by each seamer. The seams were evaluated to meet the specifications by passing destructive tests or repaired. Also, all seams were non-destructively tested with passing results. Therefore, accept-as-is.

For future liner and cap construction projects, the 5-hr trial seam limit will be strongly enforced. CQC personnel will keep separate time logs on each seamer so that there is no potential confusion on when each trial weld was performed.

10/21/99

Kwasi Badu-Tweneboah, Ph.D., P.E.
Certifying Engineer

RECORD

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# TRIAL SEAM LOG - EXTRUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GO0409 TASK NO.: 04.1

DESCRIPTION: PHASE II YEAR: 1999

CONTRACTOR: ISTRE Co. TENSIOMETER DESCRIPTION: COLUMBINE ACCURA-LITE

| TRIAL SEAM NO. | DATE (day/mo) | TIME | MACHINE NO. | OPER ID | (1) MATERIAL DESCRIPTION | EXTRUSION PREHEAT (SET/°C/°F) | EXTRUSION BARREL (°C/°F) | TEST RESULTS PEEL (ppi/psi) | TEST RESULTS SHEAR (ppi/psi) | PASS | FAIL | RE-TEST NO. | QA ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-51 | 10 SEPT | 1315 | 03 | MM | T/T | 410 | 425 | 157/156 | 173/169 | P | — | — | TBC |
| E-52 | 10 SEPT | 1745 | 04 | JB | T/T | 400 | 480 | 139/140 | 200/183 | P | — | — | TBC |
| E-53 | 11 SEPT | 0900 | 04 | JB | T/T | 400 | 480 | 178/169 | 192/197 | P | — | — | TBC |
| E-54 | 11 SEPT | 1345 | 03 | MM | T/T | 410 | 425 | 142/140 | 162/159 | P | — | — | TBC |
| E-55 | 11 SEPT | 1730 | 04 | JB | T/T | 400 | 480 | 122/124 | 158/166 | P | — | — | TBC |
| E-56 | 14 SEPT | 0915 | 04 | JB | T/T | 400 | 480 | 167/150 | 202/213 | P | — | — | TBC |
| E-57 | 14 SEPT | 1315 | 04 | JB | T/T | 375 | 425 | 134/139 | 160/161 | P | — | — | TBC |
| E-58 | 15 SEPT | 0815 | 03 | MM | T/T | 490 | 495 | 117/101 | 186/199 | P | — | — | TBC |
| E-59 | 15 SEPT | 0820 | 03 | EM | T/T | 490 | 495 | 94/100 | 184/190 | P | — | — | TBC |
| E-60 | 15 SEPT | 1300 | 04 | JB | T/T | 400 | 425 | 124/133 | 171/161 | P | — | — | TBC |
| E-61 | 15 SEPT | 1315 | 03 | MM | T/T | 410 | 425 | 129/131 | 155/162 | P | — | — | TBC |
| E-62 | 16 SEPT | 1315 | 04 | JB | T/T | 380 | 425 | 158/157 | 204/215 | P | — | — | TBC |
| E-63 | 16 SEPT | 1315 | 03 | MM | T/T | 425 | 435 | 148/155 | 187/182 | P | — | — | TBC |
| E-64 | 16 SEPT | 1500 | 06 | JB | T/T | 410 | 480 | 126/118 | 170/166 | P | — | — | TBC |
| E-65 | 17 SEPT | 0800 | 03 | MM | T/T | 490 | 495 | 173/159 | 205/203 | P | — | — | TBC |
| E-66 | 17 SEPT | 0810 | 04 | JB | T/T | 375 | 480 | 156/168 | 205/207 | P | — | — | TBC |
| E-67 | 17 SEPT | 0930 | 06 | JM | T/T | 445 | 475 | 140/130 | 182/184 | P | — | — | TBC |
| E-68 | 17 SEPT | 1300 | 03 | MM | T/T | 420 | 425 | 142/135 | 167/164 | P | — | — | TBC |
| E-69 | 17 SEPT | 1315 | 04 | JB | T/T | 375 | 425 | 125/153 | 185/171 | P | — | — | TBC |
| E-70 | 17 SEPT | 1300 | 06 | JM | T/T | 400 | 450 | 135/131 | 187/183 | P | — | — | TBC |
| E-71 | 17 SEPT | 1745 | 04 | JB | T/T | 375 | 450 | 142/121 | 174/184 | P | — | — | TBC |
| E-72 | 17 SEPT | 1755 | 06 | JM | T/T | 400 | 450 | 129/143 | 163/173 | P | — | — | TBC |
| E-73 | 17 SEPT | 1800 | 03 | MM | T/T | 420 | 425 | 150/149 | 199/170 | P | — | — | TBC |
| E-74 | 20 SEPT | 0900 | 04 | JB | T/T | 375 | 450 | 133/134 | 199/197 | P | — | — | TBC |
| E-75 | 21 SEPT | 0845 | 04 | JB | T/T | 400 | 475 | 147/178 | 215/215 | P | — | — | TBC |

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

RECORD 00182

GEOSYNTEC CONSULTANTS

FERNALD

# PRODUCTION SEAM SUMMARY LOG (EXTRUSION)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO — PROJECT NO.: GQ04Ø9 — TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 — YEAR: 1999

PRIMARY: ☐ SECONDARY: ■ OTHER: ☐ — CONTRACTOR: ISTRE Co.

| | PRODUCTION SEAM | | | | LOCATION | | | | | NONDESTRUCTIVE TEST | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DATE (day/mo) | TIME | MACHINE NO. | OPER ID | SEAM NO. | BEGIN | END | ACTUAL SEAM LENGTH (ft) | QA ID | LOCATION (ft) | AIR PRESSURE (__±__psi for 5 min.) | V-BOX (___sec.) | OPERATOR ID | PASS/ FAIL | RETEST DATE | Q I |
| | 1Ø SEPT | 1444 | Ø4 | JB | S-57/S-72 | 79 | 11Ø | 31 | TBU | 79-11Ø | NA | VTOK | WA 13 SEPT | P - | NA | TB |
| | — | — | — | — | — | — | — | — | — | — | — | — | — | - - | — | — |
| | 11 SEPT | 165Ø | Ø3 | MM | S-70/S-73 | 1Ø5 | 70 | 35 | TBU | 1Ø5-7Ø | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| | 11 SEPT | 1725 | Ø3 | MM | S-70/S-73 | 7Ø | Ø | 7Ø | TBU | 7Ø-Ø | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| Δ | 11 SEPT | 18ØØ | Ø4 | JB | S-74/SR-214 | 7 | Ø | 7 | TBU | — | CAPPED BY | SR-214 | | | | TB |
| Δ | 11 SEPT | 1805 | Ø4 | JB | S-71/SR-214 | Ø | 18 | 18 | TBU | — | CAPPED BY | SR-214 | | | | TB |
| Δ | 11 SEPT | 1812 | Ø3 | MM | S-74/SR-214 | 7 | 52 | 45 | TBU | — | CAPPED BY | SR-214 | | | | TB |
| | 11 SEPT | 182Ø | Ø4 | JB | S-73/LCS BOX | 0 | 28 | 28 | TBU | Ø-28 | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| | 11 SEPT | 1835 | Ø4 | JB | S-74/LCS BOX | Ø | 28 | 28 | TBU | Ø-28 | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| | 11 SEPT | 184Ø | Ø3 | MM | S-64/S-74 | Ø | 17 | 17 | TBU | Ø-17 | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| | 11 SEPT | 1845 | Ø3 | MM | S-65/S-74 | Ø | 6 | 6 | TBU | Ø-6 | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| | 11 SEPT | 1855 | Ø3 | MM | S-65/S-73 | Ø | 17 | 17 | TBU | 0-17 | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| | 11 SEPT | 19Ø3 | Ø3 | MM | S-66/S-73 | Ø | 7 | 7 | TBU | Ø-7 | NA | VTOK | WA 14 SEPT | P - | NA | TB |
| | | | | | | | TOTAL (1) | 239 | | | | | | | | |

NOTE: (1) SEAM LENGTH: THIS PAGE _____ (ft) ACCUMULATED 2,629 (ft)

N/A = NOT APPLICABLE Δ THESE SEAMS WERE WELDED TO TEMPORARILY COVER THE PENETRATION BOX AREA. NOT INTENDED FOR THE PERMANENT SEAMING LOG.

LAST TRIAL 13:95

700183

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PRODUCTION SEAM SUMMARY LOG (EXTRUSION)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO — PROJECT NO.: GQ04009 TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 — YEAR: 1999

PRIMARY: ■ SECONDARY: ☐ OTHER: ☐ — CONTRACTOR: ISTRE Co.

| | PRODUCTION SEAM | | | | LOCATION | | | | | NONDESTRUCTIVE TEST | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DATE (day/mo) | TIME | MACHINE NO. | OPER ID | SEAM NO. | BEGIN | END | ACTUAL SEAM LENGTH (ft) | QA ID | LOCATION (ft) | AIR PRESSURE (__psi for 5 min.) | V-BOX (__sec.) | OPERATOR ID | PASS/ FAIL | RETEST DATE | QA ID |
| | 11 SEPT | 1850 | 04 | JB | S-71 LESR BOX | 0 | 28 | 28 | TBV | 0-28 | NA | VTOK | WA 14 SEPT | P - | NA | TBV |
| Δ | 11 SEPT | 1905 | 04 | JB | S-71 SR-208 | 18 | 33 | 15 | TBV | — | CAPPED BY | SR-214 | — | | — | TBV |
| Δ | 11 SEPT | 1910 | 04 | JB | S-71 SR-208 | 98 | 52 | 46 | TBV | — | CAPPED BY | SR-214 | — | | — | TBV |
| Δ | 11 SEPT | 1925 | 03 | MM | S-71 SR-208 | 98 | 65 | 33 | TBV | — | CAPPED BY | SR-214 | — | | — | TBV |
| Δ | 11 SEPT | 1930 | 04 | JB | S-71 S-208 | 52 | 65 | 13 | TBV | — | CAPPED BY | SR-214 | — | | — | TBV |
| Δ | 11 SEPT | 1935 | 04 | JB | S-71 S-208 | 33 | 52 | 19 | TBV | — | CAPPED BY | SR-214 | — | | — | TBV |
| | 14 SEPT | 1126 | 04 | JB | S-71 SR-214 | 70 | 98 | 28 | TBV | 70-98 | NA | VTOK | WA 14 SEPT | P - | NA | TBV |
| | 14 SEPT | 1140 | 04 | JB | S-71 SR-214 | 98 | 60 | 38 | TBV | 98-60 | NA | VTOK | WA 14 SEPT | P - | NA | TBV |
| | 14 SEPT | 1335 | 04 | JB | S-71 SR-214 | 70 | 64 | 6 | TBV | 70-64 | NA | VTOK | WA 14 SEPT | P - | NA | TBV |
| | 14 SEPT | 1345 | 04 | JB | S-71 SR-214 | 64 | 49 | 15 | TBV | 64-49 | NA | VTOK | WA 14 SEPT | P - | NA | TBV |
| | 14 SEPT | 1352 | 04 | JB | S-71 SR-214 | 49 | 60 | 11 | TBV | 49-60 | NA | VTOK | WA 14 SEPT | P - | NA | TBV |
| | 14 SEPT | 1400 | 04 | JB | S-71 SR-214 | 0 | 49 | 49 | TBV | 0-49 | NA | VTOK | WA 14 SEPT | P - | NA | TBV |
| | | | | | | | TOTAL (1) | 175 | | | | | | | | |

NOTE: (1) SEAM LENGTH: THIS PAGE _____ (ft) ACCUMULATED 2804 (ft)

N/A = NOT APPLICABLE Δ THESE SEAMS WERE WELDED TO TEMPORARILY COVER THE PENETRATION BOX AREA. NOT INTENDED FOR THE PERMANENT SEAMING LOG

CASI TRIAC 15:96

RECEIVED 000184

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# TRIAL SEAM LOG - FUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF) F-2741

LOCATION: FERNALD, OHIO PROJECT NO: GQ0409 TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 YEAR: 1999

CONTRACTOR: ISTRE CO. TENSIOMETER DESCRIPTION: COLUMBINE ACCURA-LITE

| TRIAL SEAM NO. | DATE (day/mo) | TIME | MACHINE NO. | OPER ID | (1) MATERIAL DESCRIPTION | FUSION WEDGE (SET/°C/°F) | FUSION MEASURED SPEED (°C/°F) | TEST RESULTS PEEL (ppi/psi) | TEST RESULTS SHEAR (ppi/psi) | TEST RESULTS PASS | TEST RESULTS FAIL | QA ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F-61 | 11 SEPT | 0900 | 01 | LL | S/S | 811 | 7.5 | 162/158 | 203 | P | - | TB2 |
| | | | | | | | | 162/175 | 202 | P | - | TB3 |
| F-62 | 11 SEPT | 0900 | 02 | JM | S/S | 811 | 7.0 | 162/175 | 204 | P | - | TB4 |
| | | | | | | | | 176/180 | 203 | P | - | TB9 |
| F-63 | 11 SEPT | 0910 | 02 | JM | S/T | 811 | 7.5 | 176/177 | 198 | P | - | TB2 |
| | | | | | | | | 181/183 | 205 | P | - | TB3 |
| F-64 | 11 SEPT | 0920 | 02 | JM | T/T | 811 | 7.5 | 180/184 | 219 | P | - | TB3 |
| | | | | | | | | 184/183 | 214 | P | - | TB3 |
| F-65 | 11 SEPT | 1330 | 02 | JM | S/S | 811 | 7.0 | 149/157 | 162 | P | - | TB2 |
| | | | | | | | | 151/150 | 163 | P | - | TB3 |
| F-66 | 11 SEPT | 1400 | 01 | LL | S/S | 811 | 7.5 | 131/131 | 154 | P | - | TB3 |
| | | | | | | | | 139/145 | 152 | P | - | TB4 |
| F-67 | 14 SEPT | 0830 | 02 | JM | S/S | 811 | 7.0 | 176/182 | 227 | P | - | TB2 |
| | | | | | | | | 184/195 | 240 | P | - | TB4 |
| F-68 | 14 SEPT | 1315 | 02 | JM | S/S | 811 | 7.0 | 150/154 | 165 | P | - | TB2 |
| | | | | | | | | 152/149 | 174 | P | - | TB4 |
| F-69 | 14 SEPT | 1415 | 01 | MM | S/S | 811 | 7.5 | 158/144 | 162 | P | - | TB4 |
| | | | | | | | | 14/140 | 164 | P | - | TB4 |
| F-70 | 15 SEPT | 1030 | 02 | JM | S/S | 811 | 7.0 | 143/160 | 195 | P | - | TB2 |
| | | | | | | | | 160/155 | 195 | P | - | TB4 |
| F-71 | 15 SEPT | 1300 | 02 | JM | S/S | 811 | 7.0 | 133/146 | 161 | P | - | TB4 |
| | | | | | | | | 138/133 | 164 | P | - | TB3 |
| F-72 | 15 SEPT | 1830 | 01 | LL | S/S | 811 | 7.0 | 153/155 | 189 | P | - | TB2 |
| | | | | | | | | 151/160 | 187 | P | - | TB4 |

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

000185

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PRODUCTION SEAM SUMMARY LOG (FUSION)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: _____ TASK NO.: 04.1

DESCRIPTION: _____ YEAR: _____

PRIMARY: ☐ SECONDARY: ☐ OTHER: ☐ _____ CONTRACTOR: _____

| PRODUCTION SEAM | | | | LOCATION | | | | | NONDESTRUCTIVE TEST | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE (day/mo) | TIME | MACHINE NO. | OPER ID | SEAM NO. | BEGIN | END | ACTUAL SEAM LENGTH (ft) | QA ID | LOCATION (ft) | AIR PRESSURE (__±__psi for 5 min.) | | V-BOX (____sec.) | OPERATOR ID | PASS/FAIL | RETEST DATE | QA ID |
| 14 Sept | 1618 | Ø2 | JM | P25/P26 | 381 | Ø | 381 | CS | 381-Ø | 1034-1039 | 3Ø-3Ø | NA | WA 15 Sept | P - | NA | TBH |
| 14 Sept | 1647 | Ø1 | MM | P26/P27 | 375 | Ø | 375 | CS | 50-100<br>100-280<br>280-375 | 1515-1530<br>1560-1605<br>1506-1531 | 30-30<br>30-30<br>30-30 | NA | WA 15 Sept | P - | NA | TBH |
| 15 Sept | 1200 | Ø2 | JM | P-29/P-29 | Ø | 68 | 68 | TBH | 5Ø-68 | 163Ø-1635 | 3Ø-3Ø | NA | WA 15 Sept | P - | NA | TBH |
| 15 Sept | 1335 | Ø2 | JM | P-27/P-29 | 68 | 96 | 28 | TBH | 68-96 | 1644-1649 | 3Ø-3Ø | NA | WA 15 Sept | P - | NA | TBH |
| 15 Sept | 1405 | Ø2 | JM | P-29/P-30 | Ø | 87 | 87 | TBH | Ø-87 | 1618-1623 | 3Ø-3Ø | NA | WA 15 Sept | P - | NA | TBH |
| 15 Sept | 1448 | Ø2 | JM | P-29/P-3Ø | 87 | 387 | 3ØØ | TBH | 87-387 | 1609-1614 | 3Ø-3Ø | NA | WA 15 Sept | P - | NA | TBH |
| 15 Sept | 1600 | Ø2 | JM | P-30/P-31 | Ø | 383 | 383 | TBH | Ø-383 | 173Ø-1735 | 3Ø-3Ø | NA | WA 15 Sept | P - | NA | TBH |
| 15 Sept | 1715 | Ø2 | JM | P-31/P-32 | Ø | 377 | 377 | TBH | 17-Ø<br>377-17 | 1458-1503<br>1417-1422 | 3Ø-3Ø<br>3Ø-3Ø | NA | WA 16 Sept | P - | NA | TBH |
| 15 Sept | 1825 | Ø2 | JM | P-27/P-29 | 96 | 375 | 279 | TBH | 225-375<br>Ø-96 | 1446-1451 | 3Ø-3Ø<br>NA | NA | RS 17 Sept | P - | NA | TBH |
| 15 Sept | 1855 | Ø1 | LL | P-32/P-33 | Ø | 316 | 316 | TBH | 96-316 | 1434-1439 | 3Ø-3Ø | NA | WA 16 Sept | P - | NA | TBH |
| 15 Sept | 1930 | Ø2 | JM | P-32/P-33 | 316 | 366 | 50 | TBH | 366-316 | 1432-1437 | 3Ø-3Ø | NA | WA 16 Sept | P - | NA | TBH |
| | | | | | | TOTAL (1) | 2644 | | | | | | | | | |

1.5 HRS. CAPPED

NOTE: (1) SEAM LENGTH: THIS PAGE _____ (ft) ACCUMULATED 6088 (ft)

N/A = NOT APPLICABLE

SEAM P-27/P-29 FROM Ø-50' WAS CAPPED BY PR-77.

SEAM P-27/P-29 FROM 96'-225' WAS CAPPED BY PR-72.

0001186

REVIEWED BY: ✓

SHEET NO. 4 OF 9

E-2741

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# TRIAL SEAM LOG - EXTRUSION

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GO0409 TASK NO.: 04.1

DESCRIPTION: PHASE II YEAR: 1999

CONTRACTOR: ISTRE CO. TENSIOMETER DESCRIPTION: COLUMBINE ACCURA-LITE

| TRIAL SEAM NO. | DATE (day/mo) | TIME | MACHINE NO. | OPER ID | (1) MATERIAL DESCRIPTION | EXTRUSION PREHEAT (SET/C/F) | EXTRUSION BARREL (°C/°F) | TEST RESULTS PEEL (ppi/psi) | TEST RESULTS SHEAR (ppi/psi) | PASS | FAIL | RE-TEST NO. | QA ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-51 | 10 SEPT | 1315 | 03 | MM | T/T | 410 | 425 | 157/156 | 173/169 | P | — | — | TBC |
| E-52 | 10 SEPT | 1745 | 04 | JB | T/T | 400 | 480 | 139/140 | 200/183 | P | — | — | TBC |
| E-53 | 11 SEPT | 0900 | 04 | JB | T/T | 400 | 480 | 178/169 | 192/197 | P | — | — | TBC |
| E-54 | 11 SEPT | 1345 | 03 | MM | T/T | 410 | 425 | 142/140 | 162/159 | P | — | — | TBC |
| E-55 | 11 SEPT | 1730 | 04 | JB | T/T | 400 | 480 | 122/124 | 158/166 | P | — | — | TBC |
| E-56 | 14 SEPT | 0915 | 04 | JB | T/T | 400 | 480 | 167/150 | 202/213 | P | — | — | TBC |
| E-57 | 14 SEPT | 1315 | 04 | JB | T/T | 375 | 425 | 134/139 | 160/161 | P | — | — | TBC |
| E-58 | 15 SEPT | 0815 | 03 | MM | T/T | 490 | 495 | 117/101 | 186/199 | P | — | — | TBC |
| E-59 | 15 SEPT | 0820 | 03 | EM | T/T | 490 | 495 | 94/100 | 184/190 | P | — | — | TBC |
| E-60 | 15 SEPT | 1300 | 04 | JB | T/T | 400 | 425 | 124/133 | 171/161 | P | — | — | TBC |
| E-61 | 15 SEPT | 1315 | 03 | MM | T/T | 410 | 425 | 129/131 | 155/162 | P | — | — | TBC |
| E-62 | 16 SEPT | 1315 | 04 | JB | T/T | 380 | 425 | 158/157 | 204/215 | P | — | — | TBC |
| E-63 | 16 SEPT | 1315 | 03 | MM | T/T | 425 | 435 | 148/155 | 187/182 | P | — | — | TBC |
| E-64 | 16 SEPT | 1500 | 06 | JB | T/T | 410 | 480 | 126/118 | 170/166 | P | — | — | TBC |
| E-65 | 17 SEPT | 0800 | 03 | MM | T/T | 490 | 495 | 173/159 | 205/203 | P | — | — | TBC |
| E-66 | 17 SEPT | 0810 | 04 | JB | T/T | 375 | 480 | 156/168 | 205/207 | P | — | — | TBC |
| E-67 | 17 SEPT | 0930 | 06 | JM | T/T | 445 | 475 | 140/130 | 182/184 | P | — | — | TBC |
| E-68 | 17 SEPT | 1300 | 03 | MM | T/T | 420 | 425 | 142/135 | 167/164 | P | — | — | TBC |
| E-69 | 17 SEPT | 1315 | 04 | JB | T/T | 375 | 425 | 125/153 | 185/171 | P | — | — | TBC |
| E-70 | 17 SEPT | 1300 | 06 | JM | T/T | 400 | 450 | 135/131 | 187/183 | P | — | — | TBC |
| E-71 | 17 SEPT | 1745 | 04 | JB | T/T | 375 | 450 | 142/121 | 174/184 | P | — | — | TBC |
| E-72 | 17 SEPT | 1755 | 06 | JM | T/T | 400 | 450 | 129/143 | 163/173 | P | — | — | TBC |
| E-73 | 17 SEPT | 1800 | 03 | MM | T/T | 420 | 425 | 150/149 | 199/170 | P | — | — | TBC |
| E-74 | 20 SEPT | 0900 | 04 | JB | T/T | 375 | 450 | 133/134 | 199/197 | P | — | — | TBC |
| E-75 | 21 SEPT | 0845 | 04 | JB | T/T | 400 | 475 | 147/178 | 215/215 | P | — | — | TBC |

000187

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PRODUCTION SEAM SUMMARY LOG (EXTRUSION)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ04Ø9 TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 YEAR: 1999

PRIMARY: ■ SECONDARY: ☐ OTHER: ☐ CONTRACTOR: ISTRE CO.

| PRODUCTION SEAM | | | | LOCATION | | | | | NONDESTRUCTIVE TEST | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE (day/mo) | TIME | MACHINE NO. | OPER ID | SEAM NO. | BEGIN | END | ACTUAL SEAM LENGTH (ft) | QA ID | LOCATION (ft) | AIR PRESSURE (__t__psi for 5 min.) | V-BOX (____sec.) | OPERATOR ID | PASS/ FAIL | RETEST DATE | QA ID |
| 15 SEPT | 1515 | Ø4 | JB | P-3/PR-22 | 26 | 12 | 14 | TBU | CAPPED BY PR-97 | | | | | | TBU |
| 15 SEPT | 1528 | Ø4 | JB | P-2/PR-22 | 19 | Ø | 19 | TBU | CAPPED BY PR-97 | | | | | | TBU |
| 15 SEPT | 1540 | Ø4 | JB | P-3/PR-22 | Ø | 12 | 12 | TBU | CAPPED BY PR-97 | | | | | | TBU |
| 15 SEPT | 1645 | Ø4 | JB | P-4/PR-31 | Ø | 7 | 7 | TBU | Ø-7 | NA | VTOK | WA 2ØSEPT | P | NA | TBU |
| 15 SEPT | 1650 | Ø4 | JB | P-5/PR-31 | 7 | Ø | 7 | TBU | Ø-7 | NA | VTOK | WA 2ØSEPT | P | NA | TBU |
| 15 SEPT | 1735 | Ø4 | JB | P-10/PR-37 | 100 | 84 | 16 | TBU | 1ØØ-84 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| 15 SEPT | 1745 | Ø4 | JB | P-11/PR-37 | 84 | 100 | 16 | TBU | 1ØØ-84 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| 15 SEPT | 1815 | Ø3 | *MM ~~JB~~ TBU | P-21/PR-39 | 22Ø | 265 | 45 | TBU | 222-265 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| 15 SEPT | 1820 | Ø4 | JB | P-12/PR-40 | 100 | 92 | 8 | TBU | 100-92 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| 15 SEPT | 1825 | Ø4 | JB | P-11/PR-40 | 92 | 100 | 8 | TBU | 92-100 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| 15 SEPT | 1835 | Ø3 | MM | P-15/PR-39 | 265 | 259 | 6 | TBU | 265-259 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| 15 SEPT | 1839 | Ø3 | MM | P-14/PR-39 | 259 | 236 | 23 | TBU | 259-236 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| 15 SEPT | 1840 | Ø4 | JB | P-12/PR-40 | 92 | 82 | 1Ø | TBU | 92-82 | NA | VTOK | WA 17SEPT | P | NA | TBU |
| | | | | | | TOTAL (1) | 191 | | | | | | | | |

EXCEEDED 13:00 TRIAL

NOTE: (1) SEAM LENGTH: THIS PAGE _____ (ft) ACCUMULATED 768 (ft)

N/A = NOT APPLICABLE

EXCEEDING TIME LIMIT.

* THIS ENTRY WAS WELDED BY MM. THE ENTRY WAS MISWRITTEN IN THE FIELD TBU

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SHEET NO 3 OF 13

00188

GEOSYNTEC CONSULTANTS

FLOOR DANIEL FERNALD

# PRODUCTION SEAM SUMMARY LOG (EXTRUSION)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: 60Ø4Ø9 TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 YEAR: 1999

PRIMARY: ■ SECONDARY: ☐ OTHER: ☐ CONTRACTOR: ISTRE CO.

EXCEEDED TIME

| PRODUCTION SEAM | | | | LOCATION | | | | | NONDESTRUCTIVE TEST | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE (day/mo) | TIME | MACHINE NO. | OPER ID | SEAM NO. | BEGIN | END | ACTUAL SEAM LENGTH (ft) | QA ID | LOCATION (ft) | AIR PRESSURE (__psi for 5 min.) | V-BOX (___sec.) | OPERATOR ID | PASS/FAIL | RETEST DATE | QA ID |
| 15 SEPT | 185Ø | Ø3 | MM | P-13/PR-39 | 236 | 220 | 16 | TBU | 236-22Ø | NA | VTOK | WA 17 SEPT | P - | NA | TBU |
| 15 SEPT | 1851 | Ø4 | JB | P-11/PR-40 | 82 | 92 | 1Ø | TBU | 82-92 | NA | VTOK | WA 17 SEPT | P - | NA | TBU |
| 15 SEPT | 19ØØ | Ø4 | JB | P-12/PR-40 | 82 | 75 | 7 | TBU | 82-75 | NA | VTOK | WA 17 SEPT | P - | NA | TBU |
| — | — | — | — | — | — | — | — | — | — | — | — | — | - - | — | — |
| 16 SEPT | 143Ø | Ø4 | JB | P-33/CII P-35 | Ø | 22 | 22 | TBU | Ø-22 | NA | VTOK | WA 22 SEPT | P - | NA | TBU |
| 16 SEPT | 1515 | Ø6 | JB | P-33/CII P-35 | [redacted] | 55 | 33 | TBU | 22-55 | NA | VTOK | WA 22 SEPT | P - | NA | TBU |
| 16 SEPT | 1528 | Ø3 | MM | P-32/PR-44 | 364 | 377 | 13 | TBU | — CAPPED BY PR-11Ø — | | | | | | TBU |
| 16 SEPT | 1535 | Ø3 | MM | P-31/PR-44 | 377 | 364 | 13 | TBU | — CAPPED BY PR-11Ø — | | | | | | TBU |
| 16 SEPT | 162Ø | Ø6 | JB | P-33/CII P-35 | 55 | 175 | 12Ø | TBU | 175-55 | NA | VTOK | WA 22 SEPT | P - | NA | TBU |
| 16 SEPT | 175Ø | Ø6 | JB | P-33/CII P-35 | 175 | 232 | 57 | TBU | 175-232 | NA | VTOK | WA 22 SEPT | P - | NA | TBU |
| — | — | — | — | — | — | — | — | — | — | — | — | — | - - | — | — |
| 17 SEPT | Ø815 | Ø3 | MM | P-11/PR-55 | 4Ø | Ø | 4Ø | TBU | Ø-4Ø | NA | VTOK | WA 17 SEPT | P - | NA | TBU |
| 17 SEPT | Ø83Ø | Ø3 | MM | P-10/PR-55 | Ø | 4Ø | 4Ø | TBU | Ø-4Ø | NA | VTOK | WA 17 SEPT | P - | NA | TBU |
| | | | | | TOTAL (1) | | 371 | | | | | | | | |

NOTE: (1) SEAM LENGTH: THIS PAGE _____ (ft) ACCUMULATED 1139 (ft)

N/A = NOT APPLICABLE

2741

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REVIEWED BY:

SHEET NO. 4 OF 13

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# TRIAL SEAM LOG - EXTRUSION

F-2741

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO: GO0409 TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 YEAR: 1999

CONTRACTOR: ISTRE CO. TENSIOMETER DESCRIPTION: COLUMBINE ACCURA-LITE

| TRIAL SEAM NO. | DATE (day/mo) | TIME | MACHINE NO. | OPER ID | (1) MATERIAL DESCRIPTION | EXTRUSION PREHEAT (SET/°C/°F) | EXTRUSION BARREL (°C/°F) | TEST RESULTS PEEL (ppi/psi) | TEST RESULTS SHEAR (ppi/psi) | PASS | FAIL | RE-TEST NO. | QA ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-76 | 21 SEPT | 1100 | 03 | MM | T/T | 490 | 495 | 168/184 | 205/210 | P | — | — | TBC |
| E-77 | 21 SEPT | 1330 | 04 | JB | T/T | 400 | 475 | 162/160 | 196/200 | P | — | — | TBC |
| E-78 | 21 SEPT | 1345 | 06 | JM | T/T | 450 | 480 | 121/128 | 169/176 | P | — | — | TBC |
| E-79 | 22 SEPT | 0800 | 04 | JB | T/T | 400 | 480 | 124/117 | 208/231 | P | — | — | TBC |
| E-80 | 22 SEPT | 0815 | 03 | MM | T/T | 490 | 495 | 137/139 | 187/189 | P | — | — | TBC |
| E-81 | 22 SEPT | 1615 | 03 | MM | T/T | 415 | 420 | 160/161 | 155/153 | P | — | — | TBC |
| E-82 | 22 SEPT | 1630 | 04 | JB | T/T | 400 | 480 | 160/171 | 182/187 | P | — | — | TBC |
| E-83 | 23 SEPT | 0800 | 04 | JB | T/T | 400 | 480 | 151/164 | 240/236 | P | — | — | TBC |
| E-84 | 23 SEPT | 0945 | 03 | MM | T/T | 460 | 465 | 158/170 | 196/187 | P | — | — | TBC |
| E-85 | 23 SEPT | 1315 | 03 | MM | T/T | 415 | 420 | 150/147 | 184/189 | P | — | — | TBC |
| E-86 | 23 SEPT | 1330 | 04 | JB | T/T | 400 | 480 | 164/137 | 187/180 | P | — | — | TBC |
| E-87 | 23 SEPT | 1430 | 03 | JB | T/T | 415 | 420 | 126/125 | 166/159 | P | — | — | TBC |
| E-88 | 24 SEPT | 0915 | 04 | JB | T/T | 400 | 480 | 128/139 | 182/191 | P | — | — | TBC |
| E-89 | 24 SEPT | 1330 | 04 | JB | T/T | 400 | 480 | 118/115 | 158/163 | P | — | — | TBC |
| E-90 | 25 SEPT | 0830 | 04 | JB | T/T | 400 | 480 | 146/145 | 193/198 | P | — | — | TBC |
| E-91 | 25 SEPT | 1315 | 04 | JB | T/T | 400 | 480 | 126/142 | 154/157 | P | — | — | TBC |
| E-92 | 27 SEPT | 0830 | 04 | JB | T/T | 400 | 480 | 137/138 | 190/187 | P | — | — | TBC |
| E-93 | 27 SEPT | 0830 | 03 | JM | T/T | 425 | 475 | 120/133 | 183/202 | P | — | — | TBC |
| E-94 | 27 SEPT | 1300 | 04 | JB | T/T | 400 | 480 | 126/117 | 165/177 | P | — | — | TBC |
| E-95 | 27 SEPT | 1300 | 03 | JM | T/T | 400 | 420 | 130/133 | 174/167 | P | — | — | TBC |
| E-96 | 28 SEPT | 0800 | 04 | JB | T/T | 400 | 480 | 138/134 | 190/189 | P | — | — | TBC |

000190

NOTE: (1) MATERIAL DESCRIPTION REFERS TO EITHER SMOOTH/SMOOTH (S/S); SMOOTH/TEXTURED (S/T); OR TEXTURED/TEXTURED (T/T).

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PRODUCTION SEAM SUMMARY LOG (EXTRUSION)

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: G0404 9 TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 YEAR: 1999

PRIMARY: ■ SECONDARY: ☐ OTHER: ☐ CONTRACTOR: ISTRE Co.

EXCEEDED TIME LIMITS 11:00 TRIAL WELD

| PRODUCTION SEAM | | | | LOCATION | | | | | NONDESTRUCTIVE TEST | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE (day/mo) | TIME | MACHINE NO. | OPER ID | SEAM NO. | BEGIN | END | ACTUAL SEAM LENGTH (ft) | QA ID | LOCATION (ft) | AIR PRESSURE (__±__psi for 5 min.) | V-BOX (____sec.) | OPERATOR ID | PASS/ FAIL | RETEST DATE | QA ID |
| 21 Sept | 1653 | 03 | MM | P-29/PR-107 | 274 | 251 | 23 | TBU | 274-251 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 21 Sept | 1700 | 04 | JB | PR-109/PR-108 | 103 | 113 | 10 | TBU | 103-113 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 21 Sept | 1710 | 04 | JB | P-29/PR-108 | 113 | 103 | 10 | TBU | 113-103 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 21 Sept | 1710 | 03 | MM | P-30/PR-107 | 274 | 283 | 9 | TBU | 274-283 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 21 Sept | 1715 | 03 | MM | P-29/PR-107 | 277 | 274 | 3 | TBU | 277-274 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| — | — | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 22 Sept | 0900 | 03 | MM | P-30/PR-107 | 283 | 320 | 37 | TBU | 283-320 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 22 Sept | 0905 | 04 | JB | P-29/PR-107 | 277 | 313 | 36 | TBU | 277-313 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 22 Sept | 0922 | 03 | MM | P-29/PR-107 | 320 | 313 | 7 | TBU | 320-313 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 22 Sept | 0940 | 03 | MM | P-30/PR-107 | 320 | 343 | 23 | TBU | 320-343 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 22 Sept | 0943 | 04 | JB | P-29/PR-107 | 320 | 343 | 23 | TBU | 320-343 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 22 Sept | 1018 | 03 | MM | P-30/PR-107 | 343 | 355 | 12 | TBU | 343-355 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| 22 Sept | 1024 | 03 | MM | P-29/PR-107 | 355 | 343 | 12 | TBU | 355-343 | NA | VTOK | WA 22 Sept | P | NA | TBU |
| | | | | | TOTAL (1) | | 205 | | | | | | | | |

NOTE: (1) SEAM LENGTH: THIS PAGE _____ (ft) ACCUMULATED 2942 (ft)

N/A = NOT APPLICABLE

T-274

0001091

# NONCONFORMANCE REPORT FORM

2741

| | | |
|---|---|---|
| | | ORIGINATOR/ASSESSOR |
| 1 | Nonconformance Number/Revision | NCR No.: FY2000-0024 Revision No. 0 |
| 2 | Dates | Date Discovered: 10/11/99 Date NCR Report Issued: 10/16/99 |
| 3 | Type of Nonconformance | [X] FINDING [ ] CONCERN |
| 4 | Project/Activity @ Fac/Loc/Bldg | OSDF PH. II, OPTION A, CELL #3, GEOMEMBRANE REPAIR |
| 5 | Hazard Category | Nuclear: [ ] 1 [ ] 2 [ ] 3 [ ] Radiological<br>Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard<br>Industrial: [ ] Hazardous Waste Activity [X] Standard Industrial Hazard [ ] FEMP SIH |
| 6 | Assessment | [ ] Internal [ ] External (OEPA, DOE) [ X ] Supplier/Vendor Geosyntec Consultants |
| 7 | Assessment Type | [ ] Audit [ x] Surveillance [ ] Inspection [ ] Other |
| 8 | Assessment Number | 2000887 |
| 9 | Responsible FDF Division/Vendor | [X] S&WP [ ] WMT&SP [ ] FC&DP [ ] O&PI [ ] PS [ ]SUPPLIER/VENDOR |
| 10 | Responsible FDF Department/Vendor | CONSTRUCTION/ Geosyntec Consultants |
| 11 | Responsible Team Leader/Coach/Vendor (Print Name) | Bill Zebick/ Geosyntec Consultants |
| 12 | Functional Area (NA for Vendors) (choose any that apply) (Ref. RM-0016) | [ ] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI<br>[ ] FM [ ] EP [ ] EW [ ] MT [ ] OP [ ] PT [ ] SE [ ] TR<br>[X ] CT [ ] HR [ ] PC [ ] EM [ ] FP [ ] NS [ ] SH [ ] RP |
| 13 | QA Criteria (choose one that applies Ref. RM-0012) Other Criteria (CONOPS, etc.) (not RM-0012 applicable) | [ ] 1 Program [ ] 2 Training [ ] 3 Quality Improv. [ ] 4 Document/Records<br>[ ] 5 Work process [ ] 6 Design [ ] 7 Procurement [X] 8 Inspect/Test<br>[ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other |
| 14 | Requirement Description<br>Cite the requirement (clearly, concisely, and completely) and its source, including document identification number, page and paragraph number. A copy of the document (or page of the document) in which the requirement appears may be attached or added to the NCR file. Use additional or separate sheets as necessary. | Reference: Contract Number FSC 614, Southern Waste Units Excavation/ On Site Disposal Facility (OSDF) Phase II, Spec. 2770, Section 2.03I states each extrusion seam is to be vacuum tested at 5 plus or minus 1 psi gauge and the examination time during testing is not less than 20 seconds.<br>MG 10/18/99 |
| 15 | Nonconformance Description<br>Describe the nonconformance. Include details such as supplier names, container numbers, purchase order, work order, or requisition numbers) and clearly describe the deviation from the written requirement. Use additional or separate sheets as necessary. | Nonconformance Title or Short Description:<br>From ~~our~~ my review of the primary geomembrane layer (Cell III) asbuilt drawing, DP 26 did not have a repair number so therefore there was no documentation the repair was complete and tested. |
| 16 | Tagging Required / Number of Tags | [ ] Yes [X] No Number of Tags: 0 |
| 17 | Originator/Assessor | Name: MIKE GOTTS Signature: [signature] Date: OCT. 18 1999 |
| | | ORIGINATOR'S/ASSESSOR'S TEAM LEADER'S/COACH'S REVIEW |
| 18 | Originator's/Assessor's Team Leader/Coach | Name: FRANK THOMPSON Signature: [signature] Date: 10-18-99 |
| 19 | Response Date From Resp. Organ. | 11/15/99 (Reply within 20 working days) |

# NONCONFORMANCE REPORT FORM

JTT 10-20-99

2741

| | | |
|---|---|---|
| | **RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE** | |
| | **Nonconformance Number/ Revision** | NCR No.: ~~FY99-1~~ FY2000-6024 Revision 0 |
| 20 | **Root Cause Analysis**<br>Provide documentation as attachment. Use additional or separate sheets as necessary | [ ] YES Level 1 Cat. [ ] 1H (human perf.) [ ] 1N (nat. phenom/sabotage [ ] 1E (equip.) [ ] 1Z (other)<br>[ ] NO<br>**TapRoot Cause Code(s)** |
| 21 | **Corrective Action (CA) Description and Disposition**<br>Describe the actions necessary to correct the nonconformance. Corrective actions must be detailed and complete. They must be written in a clear, concise, and verifiable manner. The corrective action plan must also include actions to prevent recurrence. Use additional or separate sheets as necessary.<br>(A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below) | Hardware: [X] Accept-as-is [ ] Repair [ ] Rework [ ] Reject<br>Non-Hardware: [ ] Other<br>See attached Response<br>ANTHONY P. KLIMEK 10/20/99 |
| 22 | **Technical Concurrence/ Justification (mark NA if not applicable)** | Name: KWASI BADU-TWEREBOAH Signature: Date: 10/20/99 |
| 23 | **Was a Design Change Notice Required?** | [ ] Yes [X] No DCN # Date Issued |
| 24 | **Was a SBDR Performed?**<br>**Was a USQD Performed?** | [ ] Yes [X] No SBDR # Date Issued<br>[ ] Yes [X] No USQD # Date Issued |
| 25 | **Actions taken to Prevent Recurrence**<br>Use additional or separate sheets as necessary. | SEE ATTACHED RESPONSE |
| | **Proposed Completion Date For CA** | Date: 10/21/99 |
| 27 | **Responsible Team Leader/Coach/Vendor** | Name: BILL ZEBICH Signature: Bill Zebich Date: 10/21/99 |
| | **EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR** | |
| 28 | **Response Acceptable?** | [X] Yes [ ] No |
| 29 | **Originator's/Assessor's** | Name: James T. TURNER Signature: Date: 10-21-99 |
| | **COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION** | |
| 30 | **Date Corrective Action Completed** | Date: 10/21/99 |
| 31 | **Responsible Team Leader/Coach /Vendor** | Name: BILL ZEBICH Signature: Bill Zebich Date: 10/21/99 |
| | **VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER** | |
| 32 | **Verification Action**<br>(Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR) | Reviewed attached paperwork |
| 33 | **Verifier** | Name: James T. TURNER Signature: Date: 10-21-99 |
| | **CLOSURE BY THE ASSESSOR'S VERIFIER'S TEAM LEADER/COACH** | |
| | **Verifier's Team Leader/Coach (NCR Closed)** | Name: FRANK THOMPSON Signature: Frank Thompson Date: 10-21-99 |

**Response to FDF's NCR No. FY2000-0024**
**Dated 18 October 1999**
**(Block 21, page 2 of 2)**

The DP-26 area was exposed on 12 October 1999 and found to have been repaired and non-destructively tested with the Installer's marking on the primary liner geomembrane. The repaired area was marked as PR-147; this number had however been used for another repaired area. Therefore, the DP-26 repair was documented appropriately as PR-224 (see copy of attached Repair Summary Log).

It should be noted that this area was in the runoff catchment area where leak detection testing was conducted on the primary liner geomembrane. First, the Installer would not allow the leak detection testing to be conducted until he had completed his own quality control (QC) to assure that all areas had been repaired with passing test results. Secondly, the leak detection testing was conducted in this area and no leaks were found, as documented in "Electrical Leak Detection Testing Report, Cell 3 On-Site Disposal Facility, Revision A, October 1999. These two assured the undersigned that indeed the suspect area had been properly repaired and tested prior to exposing the liner for verification.

For future liner or cap construction projects CQC Consultant should complete performance evaluation and documentation, including internal QC checks, prior to proceeding with placement of overlying layers. This is consistent with Part 3.01A, Section 02714 (Geotextiles) and Part 3.01A, Section 02710 (Granular Drainage Material) of the Technical Specifications.

10/20/99

Kwasi Badu-Tweneboah, Ph.D., P.E.
Certifying Engineer

GEOSYNTEC CONSULTANTS

FERNALD

# REPAIR SUMMARY LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO — PROJECT NO.: GQ04Ø8 TASK NO.: 04.1

DESCRIPTION: PHASE II - CELL #3 — YEAR: 1999

PRIMARY: ■ SECONDARY: ☐ OTHER: ☐ — CONTRACTOR: ISTRE Co.

| | REPAIR NO. AND CODE (1) | DATE (day/mo) | LOCATION | | | REPAIR TYPE (2) | SIZE | | | WELDER ID | | QA ID | NON-DESTRUCTIVE TESTING | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PANEL OR SEAM NO. | DIST. (ft) | OFFSET (ft) | | LENGTH (ft) | WIDTH (ft) | DIA (ft) | MACH NO. | OPER ID | | DATE (day/mo) | OPER ID | PASS/FAIL | ACTION | QA ID |
| ✓ | PR-211(P) | 27 Sept | P-41/P-42/P-57 | 260 | — | E | 1 | 1 | — | Ø4 | JB | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-212(P) | 27 Sept | P-20/P-21/P-57 | 275 | — | E | 4 | 2 | — | Ø3 | JM | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-213(P) | 27 Sept | P-57 | 275 | 5' NORTH OF P-41 | E | — | — | 2 | Ø4 | JB | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-214(P) | 27 Sept | P-40/P-41/P-57 | 283 | — | E | 1 | 1 | — | Ø4 | JB | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-215(P) | 27 Sept | P-39/P-40/P-57 | 306 | — | E | 1 | 1 | — | Ø4 | JB | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-216(P) | 27 Sept | P-38/P-39/P-57 | 330 | — | E | 1 | 1 | — | Ø4 | JB | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-217(P) | 27 Sept | P-20/P-38/P-57 | 353 | — | E | 1 | 1 | — | Ø4 | JB | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-218(P) | 27 Sept | P-20/P-57 | 373 | — | E | 3 | 2 | — | Ø3 | JM | TBU | 27 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-219(P) | 28 Sept | P-58/P-59 | 4 | — | E | — | — | 2 | Ø4 | JB | TBU | 28 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-220(P) | 28 Sept | P-59 | 13 | 1' NORTH OF PS9/P60 | E | 2 | 1 | — | Ø4 | JB | TBU | 28 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-221(P) | 28 Sept | P-57/P-58 | 4 | — | E | — | — | 2 | Ø4 | JB | TBU | 28 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-222(P) | 28 Sept | P-52 | 48' | 5' SOUTH OF PS1/PS2 | E | — | — | 3 | Ø4 | JB | TBU | 28 Sept | WA | P - | VTOK | TBU |
| ✓ | PR-223(P) | 28 Sept | P-33/CII P-35 | 70' | NORTH TO SOUTH | E | 19 | 3 | — | Ø4 | JB | TBU | 28 Sept | WA | P - | VTOK | TBU |
| | PR-224(DP-26) (15) | 28 Sept * | P-48/P-49 | 81 | — | E | 6 | 2 | — | Ø4 | JB | TBU | 28 Sept | WA | P - | VTOK | TBU |

NOTES: (1) REPAIR NO.: REPAIRS CAN BE NUMBERED SEQUENTIALLY, IF NECESSARY.
(1) REPAIR CODES: P = PATCH, C = CAP, S = ANCHOR TRENCH EXTENSION (SKIRT), DS = DESTRUCTIVE SAMPLE, G = GRIND & WELD, T = TOPPING ALONG FUSION SEAM, R = RECONSTRUCTION
(2) REPAIR TYPES: E = EXTRUSION, F = FUSION

SEE BLOCK 32 - REF. NCR 2000-24

©GEOSYNTEC CONSULTANTS FILE NO. 3-09-RSI REVIEWED BY: SHEET NO. 15 OF 15

* UPON REVIEW OF THE PRIMARY GEOSYNTHETICS DOCUMENTATION, IT WAS FOUND THAT DP-26 DID NOT HAVE A DOCUMENTED REPAIR. ON 12 OCTOBER 1999, THE STONE AND GEOTEXTILE WERE REMOVED TO UNCOVER THIS AREA. WE DISCOVERED THAT 2 REPAIRS WERE GIVEN SAME NUMBER, SO REPAIR ON DP-26 WAS GIVEN PR-224

000195

274

NON-CONTROLLED DOCUMENT

# ELECTRICAL LEAK DETECTION TESTING REPORT

2741
RECEIVED
OCT 14 1999

## Cell 3
## On-Site Disposal Facility

Revision A
October 1999

## United States Department of Energy

**Fernald Environmental Management Project**
**Hamilton, Ohio**

*Prepared by*

GeoSyntec Consultants
1100 Lake Hearn Drive, NE, Suite 200
Atlanta, Georgia 30342

*Under*

**Fluor Daniel Fernald**
Subcontract 95PS005028

RE NCA 2000-24
0001.96

# 6. CONCLUSIONS AND RECOMMENDATIONS

## 6.1 Conclusions

Demonstration and testing using the electrical leak detection testing method at the FEMP provided added confidence that the installation, CQC, and CQA activities for the OSDF Cell 3 primary geomembrane liner have been completed to very high standards. A review of the available testing data from electrical leak detection testing reports reveal that the number of leaks detected are an indicator of the level of CQC and CQA implemented during liner construction. The results of testing on OSDF Cell 3 (i.e., no leaks detected) provides additional data to confirm that high quality work is being demanded and attained during OSDF construction.

## 6.2 Recommendations

### 6.2.1 Future Testing

GeoSyntec recommends that electrical leak detection testing be implemented for supplemental CQC testing of the primary geomembrane liner for future OSDF cells. Specifically, the following implementation parameters should be considered:

- a specialty subcontractor for electrical leak detection testing should be procured by the installer as supplemental CQC testing of the installed primary geomembrane liner;
- requirements for electrical leak detection testing should be included in the performance specifications for future OSDF primary geomembrane liners;
- the CQA Plan should be revised to provide requirements for the CQC Consultant to monitor electrical leak detection testing; and
- lessons learned during demonstration and testing at the FEMP should be integrated into requirements.

Ref. WCR FY 2000-24

# PART 3 EXECUTION

## 3.01 MATERIAL PLACEMENT

A. Do not commence placement of the granular drainage material until the CQC Consultant has completed conformance evaluation of the granular drainage materials and performance evaluation of previous work, including evaluation of the Contractor's survey results for previous work.

B. Construct the granular drainage material to the thicknesses, elevations, and locations shown on the Construction Drawings.

C. Place the granular drainage material directly on top of the geotextile cushion, supplemental geotextile cushion, as shown on the Construction Drawings. Do not dump granular drainage material directly on the geotextile. Place the granular drainage material by dumping onto previously placed granular drainage material and then carefully spread using low ground-pressure equipment meeting the ground pressure requirements of Section 02714.

D. Spread granular drainage material over the geotextile to cause the material to cascade over the geotextile rather than be shoved across the geotextile.

E. Do not drive equipment directly on the geotextile cushion or supplemental cushion. Only use equipment to place, spread, and compact the granular drainage material that meets the ground pressure requirements of Section 02714.

F. Place the granular drainage material in one loose lift.

G. Compact the granular drainage material with one pass of equipment having ground-pressure less than 5 pounds per square inch. Use portable compactors in constricted locations and adjacent to structures.

## 3.02 CONSTRUCTION QUALITY REQUIREMENTS

A. The CQC Consultant will perform conformance testing on the granular drainage material to establish compliance with this Section. The conformance testing to be performed and the testing frequencies are given in the Construction Quality Assurance Plan, referenced in Part 9 of the Contract Documents.

REF. NCR-FY-2000-14

4. roll number; and
5. roll dimensions.

D. Geotextile rolls not labeled in accordance with this Section or on which labels are illegible shall be rejected and replaced. The Contractor shall notify the Construction Manager of any rolls not labeled in accordance with the Section.

## 2.03 ACCEPTANCE, HANDLING AND STORAGE

A. Within 45 days of Authorization to Mobilize, Contractor shall inspect and inventory the geotextile material and the manner in which it is being stored. Contractor shall provide letter of acceptance within 45 days to the Construction Manager if material is acceptable for installation. Contractor shall also notify the Construction Manager in writing within 45 days of any geotextile material that is not acceptable for installation.

B. Maintain a program for protection and preservation of geotextile to include, but not be limited to:
   1. protection from sunlight, moisture, excessive heat or cold, puncture, mud, dirt, and dust or other damaging or deleterious conditions; follow all geotextile manufacturer recommendations for handling and storage; Manufacturer recommendations will be provided by the Construction Manager; and
   2. storage of rolls on palates or other elevated structures; do not store rolls directly on the ground.

# PART 3 EXECUTION

## 3.01 PLACEMENT

A. Do not commence geotextile installation until the CQC Consultant completes performance evaluation of previous work, including evaluation of Contractor's survey results for previous work.

B. Handle geotextiles so as to ensure they are not damaged in any way.

C. Take precautions to prevent damage to underlying layers including rutting during placement of the geotextiles.

D. After unwrapping the geotextiles from its opaque cover, do not leave them exposed for a period in excess of 10 calendar days.

Ref. RH2000-24

# NONCONFORMANCE REPORT FORM

2000877
105 OF 124

1-2741

| | | |
|---|---|---|
| | | ORIGINATOR/ASSESSOR |
| 1 | Nonconformance Number/Revision | NCR No.: FY99-1130 Revision No. 0 |
| 2 | Dates | Date Discovered: 9/13/99 Date NCR Report Issued: 9/16/99 |
| 3 | Type of Nonconformance | [X] FINDING [ ] CONCERN |
| 4 | Project/Activity @ Fac/Loc/Bldg | ON-SITE-DISPOSAL FACILITY, PH. 2/ CELL 3 |
| 5 | Hazard Category | Nuclear: [ ] 1 [ ] 2 [ ] 3 [ ] Radiological<br>Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard<br>Industrial: [ ] Hazardous Waste Activity [X] Standard Industrial Hazard [ ] FEMP SIH |
| 6 | Assessment | [ ] Internal [ ] External (OEPA, DOE) [X] Supplier/Vendor_____ |
| 7 | Assessment Type | [ ] Audit [ ] Surveillance [ ] Inspection [X] Other OVERVIEW |
| 8 | Assessment Number | NONE |
| 9 | Responsible FDF Division/Vendor | [X] S&WP [ ] WMT&SP [ ] FC&DP [ ] O&PI [ ] PS [ ]SUPPLIER/VENDOR |
| 10 | Responsible FDF Department/Vendor | CONSTRUCTION MANAGEMENT/ PETRO ENVIRONMENTAL |
| 11 | Responsible Team Leader/Coach/Vendor (Print Name) | Bill Zebick, J.D. Chiou, PETRO Environmental |
| 12 | Functional Area (NA for Vendors) (choose any that apply) (Ref. RM-0016) MARKED IN ERROR 9-16-99 | [x] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI<br>[ ] FM [ ] EP [ ] EW [ ] MT [X] OP [ ] PT [ ] SE [ ] TR<br>[X] CT [ ] HR [ ] PC [ ] EM [ ] FP [ ] NS [ ] SH [ ] RP |
| 13 | QA Criteria (choose one that applies Ref. RM-0012) Other Criteria (CONOPS, etc.) (not RM-0012 applicable) | [ ] 1 Program [ ] 2 Training [ ] 3 Quality Improv. [ ] 4 Document/Records<br>[X] 5 Work process [ ] 6 Design [ ] 7 Procurement [ ] 8 Inspect/Test<br>[ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other |
| 14 | Requirement Description<br>Cite the requirement (clearly, concisely, and completely) and its source, including document identification number, page and paragraph number. A copy of the document (or page of the document) in which the requirement appears may be attached or added to the NCR file. Use additional or separate sheets as necessary. | In accordance to Contract Number FSC 614, Southern Waste Units Excavation/ On Site Disposal Facility (OSDF) Phase II, Part 7, Specification Section 2710, Para. 1.04, "Submittals"; states the source of the granular drainage material along with a certification from the supplier that the granular drainage material meets the specification requirements shall be submitted. |
| 15 | Nonconformance Description<br>Describe the nonconformance. Include details such as supplier names, container numbers, purchase order, work order, or requisition numbers) and clearly describe the deviation from the written requirement. Use additional or separate sheets as necessary. | Nonconformance Title or Short Description:<br>The granular drainage material that was placed in Cell 3 for the drainage corridor failed the gradation requirements specified in the technical specifications. Since the material gradation is coarser than the what is allowed by specification, the material supplier can not submit a certification that the granular material meets the requirements of the specifications a KBT 9/23/99 |
| 16 | Tagging Required / Number of Tags | [ ] Yes [X] No Number of Tags: 0 |
| 17 | Originator/Assessor | Name: MIKE GODBER_____ Signature: [signature] Date: [illegible] 1999<br>MIKE GODBER |
| | | ORIGINATOR'S/ASSESSOR'S TEAM LEADER'S/COACH'S REVIEW |
| 18 | Originator's/Assessor's Team Leader/Coach | Name: FRANK THOMPSON Signature: [signature] Date: 9-16-99 |
| 19 | Response Date From Resp. Organ. | SEPTEMBER 24, 1999 (Reply within 20 working days) |

RECORD

FS-F-4370-RV0 [illegible] FOR TECHNICAL ASSISTANCE, CONTACT THE NONCONFORMANCE ADMINISTRATOR AT 7526, FAX 7540, MS9[illegible]

000200

# NONCONFORMANCE REPORT FORM

2000871
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2741

| | | |
|---|---|---|
| | **RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE** | |
| | **Nonconformance Number/ Revision** | NCR No.: FY99-1 Revision 0 |
| | **Root Cause Analysis**<br>Provide documentation as attachment. Use additional or separate sheets as necessary | [ ] YES Level 1 Cat. [ ] 1H (human perf.) [ ] 1N (nat. phenom/sabotage [ ] 1E (equip.) [ ] 1Z (other)<br>[ ] NO<br>TapRoot Cause Code(s) |
| 1 | **Corrective Action (CA) Description and Disposition**<br>Describe the actions necessary to correct the nonconformance. Corrective actions must be detailed and complete. They must be written in a clear, concise, and verifiable manner. The corrective action plan must also include actions to prevent recurrence. Use additional or separate sheets as necessary.<br>(A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below) | Hardware: [X] Accept-as-is [ ] Repair [ ] Rework [ ] Reject<br>Non-Hardware: [ ] Other<br>See attached Response<br>KWASI BADU-TWENEBOAH 9/23/99 |
| 2 | **Technical Concurrence/ Justification (mark NA if not applicable)** | Name: ANTHONY P. KLIMEK Signature: Date: 9/23/99 |
| 3 | **Was a Design Change Notice Required?** | [ ] Yes [X] No DCN # Date Issued |
| 4 | **Was a SBDR Performed?**<br>**Was a USQD Performed?** | [ ] Yes [X] No SBDR # Date Issued<br>[ ] Yes [X] No USQD # Date Issued |
| 5 | **Actions taken to Prevent Recurrence**<br>Use additional or separate sheets as necessary. | CQC SHALL TEST FOR PERMIBILITY & GRADATION. MANUFACTOR CERTIFICATIONS PRIOR TO DELIVERY. |
| | **Proposed Completion Date For CA** | Date: 9/23/99 |
| | **Responsible Team Leader/Coach/Vendor** | Name: BILL ZERICK Signature: Date: 9/23/99 |
| | **EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR** | |
| 8 | **Response Acceptable?** | [X] Yes [ ] No |
| 9 | **Originator's/Assessor's** | Name: MIKE GODBER Signature: Date: 9/23/99 |
| | **COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION** | |
| 9 | **Date Corrective Action Completed** | Date: |
| | **Responsible Team Leader/Coach /Vendor** | Name: BILL ZERICK Signature: Date: 9/23/99 |
| | **VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER** | |
| | **Verification Action**<br>(Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR) | FROM REVIEW OF THE DATA, ALL PERMEABILITY TESTS PASSED. ALSO THE ENGINEER CALCULATED THE THE COUSER 57 STONE STILL MAINTAINS ITS FILTERING PROPERTIES. |
| | **Verifier** | Name: MIKE GODBER Signature: Date: 9/23/99 |
| | **CLOSURE BY THE ASSESSOR'S VERIFIER'S TEAM LEADER/COACH** | |
| | **Verifier's Team Leader/Coach (NCR Closed)** | Name: FRANK THOMPSON Signature: Date: 10/11/99 |

2000872
107 OF 124

**Response to Block 21 of FDF's NCR No. FY99-1130**
**(Dated 9/16/99)**

2741

The results of sieve analysis provided by Petro indicated that the No. 57 stone for the LCS and LDS drainage corridors had 20.9 percent, by weight, of particles finer than the 0.5-in. particle size. Section 02710 of the specifications required 25 to 60 percent, by weight of particles to be finer than the 0.5-in. particle size. This implies that the proposed No. 57 stone for the LCS/LDS drainage corridors is slightly coarser than required.

A sample, taken by GeoSyntec for conformance testing met the specification requirements for gradation. However, a second conformance sample indicated that the material is coarser than required. This sample had 11.4 percent, by weight, of particles finer than the 0.5-in. particle size.

In all three tests the No. 57 stone classified as GP per ASTM D 2487 as required by the specification, and met the hydraulic conductivity (ASTM D 2434) and carbonate content (ASTM D 3042) requirements. Since the material is coarser than specified, it meets the performance requirements of the drainage corridor to handle flow. Also, the material is encapsulated on the top and bottom of the drainage corridor by 16-oz/yd$^2$ nonwoven geotextile, which provides puncture protection of the geomembrane liners from the No. 57 stone. Finally, it was verified through a filter design evaluation that the No. 57 stone used as the LCS/LDS drainage corridor material would indeed function as a natural filter to the No.78 stone used as the LCS/LDS drainage layer material.

Based on the above technical justifications, it is suggested that the supplied No. 57 stone be used-as-is.

K Badu-Tweneboah 9/23/99
Kwasi Badu-Tweneboah, Ph.D., P.E.
Certifying Engineer

RECORD 000202

Written by: KBT Date: 99/09/23 (YY MM DD) Reviewed by: F-2741 Date: / / (YY MM DD)

Client: FDF Project: OSDF CELL 3 Project/Proposal No.: G00409 Task No.: 03.1

where $D_{15}$, $D_{50}$, and $D_{85}$ are the particle sizes from a particle-size distribution curve at 15, 50, and 85%, respectively finer by weight. The subscripts F and S represent filter (in this case No. 57 stone) and soil (No. 78 stone), respectively.

Attached is a particle-size distribution plot showing the results on No. 57 stone by GeoSyntec and Nuttting. GeoSyntec's results are used because the material appears to be coarser than the specification. Also shown on the plot is the finer portion of the No. 78 stone as presented in the specifications. The finer portion is used because of its merits, any other portion falling within the specification band (range) will also work; i.e. conservative.

From the particle-size distribution curve

$D_{15F} = 14$ mm $D_{15S} = 3.6$ mm

$D_{50F} = 19$ mm $D_{50S} = 6.9$ mm

$D_{85S} = 12$ mm



RECORD

Written by: KBT Date: 99/09/23 (YY/MM/DD) Reviewed by: _____ Date: __/__/__ (YY/MM/DD)

Client: FDF Project: OSDF CELL 3 Project/Proposal No.: G00409 Task No.: 03.1

From Equation (1) 2741

$D15F / D85S = 14/12 = 1.2 < 5$ ok

From Equation (2)

$D15F / D15S = 14/3.6 = 3.9 < 20$ ok
close to 4
so ok.

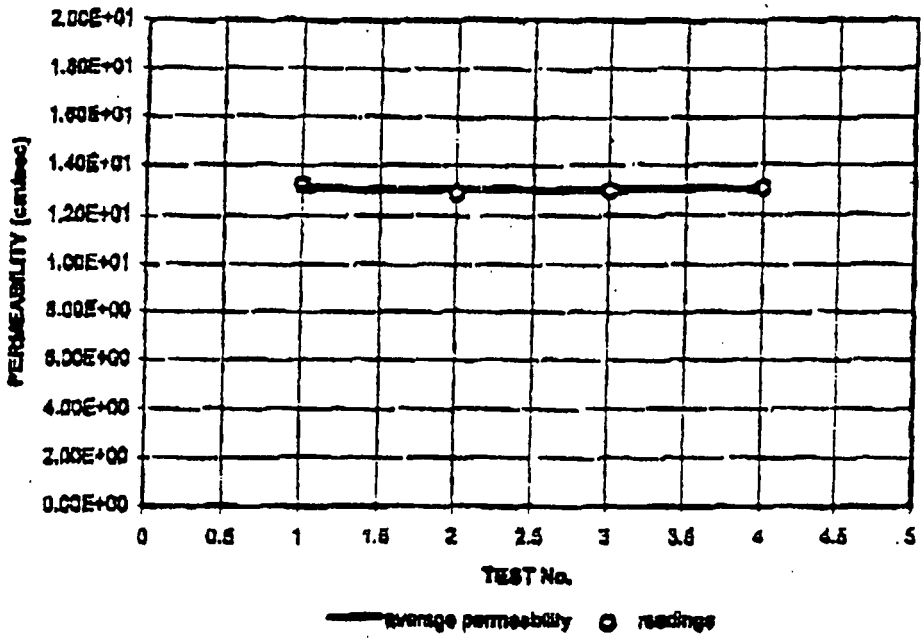
From Equation (3)

$D50F / D50S = 19/6.9 = 2.75 < 25$ ok

Therefore, the No. 57 stone supplied by Watson should be able to act as a filter to the No. 78 stones of the specifications.

6000877
1100E 124
PETRO
2741

# CONSTANT HEAD PERMEABILITY TEST




Test Specification: ASTM D 2434

| Test No. | Manometers H1 (cm) | Manometers H2 (cm) | Water Levels L1 (cm) | Water Levels L2 (cm) | Water Head (cm) | Flow Volume (cm^3) | Elapsed Time (s) | Calculated Permeability (cm/s) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 7.62 | 50.8 | 25.4 | 7.62 | 16288.582 | 7.69 | 1.32E+01 |
| 2 | | 7.62 | 50.8 | 25.4 | 7.62 | 16288.582 | 7.88 | 1.29E+01 |
| 3 | | 7.62 | 50.8 | 25.4 | 7.62 | 16288.582 | 7.82 | 1.30E+01 |
| 4 | | 7.62 | 50.8 | 25.4 | 7.62 | 16288.582 | 7.77 | 1.31E+01 |
| Average | | | | | | | | 1.30E+01 |

13 cm per Spec

| Specimen Conditions | | | |
|---|---|---|---|
| Diameter D (in) | 11.3 | Weight of Specimen (gms) | 30735.0 |
| Length of Specimen (in) | 12.0 | Density of Specimen (pcf) | 98.2 |
| Length of Flow (in) | 12.0 | Approximate Porosity | 0.4 |

| Material Description | Remarks |
|---|---|
| Carbonate Content (%) Loss w/pH of 4 = 0.31%<br>USCS | |

MOR
thus

| | | | |
|---|---|---|---|
| Project No | FERNALD OSDS-CELL # 3 | Tested by FCE | Review. by TGG |
| Client ID PETRO | HCN W.O.# 13962.009 | CONSTANT HEAD PERMEABILITY TEST | |
| Sample Number | S-5661 | | |
| Sample Location | SOURCE: Watson Gravel | H. G. MUTTING COMPANY | |
| Date 1-Sep-99 | Lab No. 5661 | | |

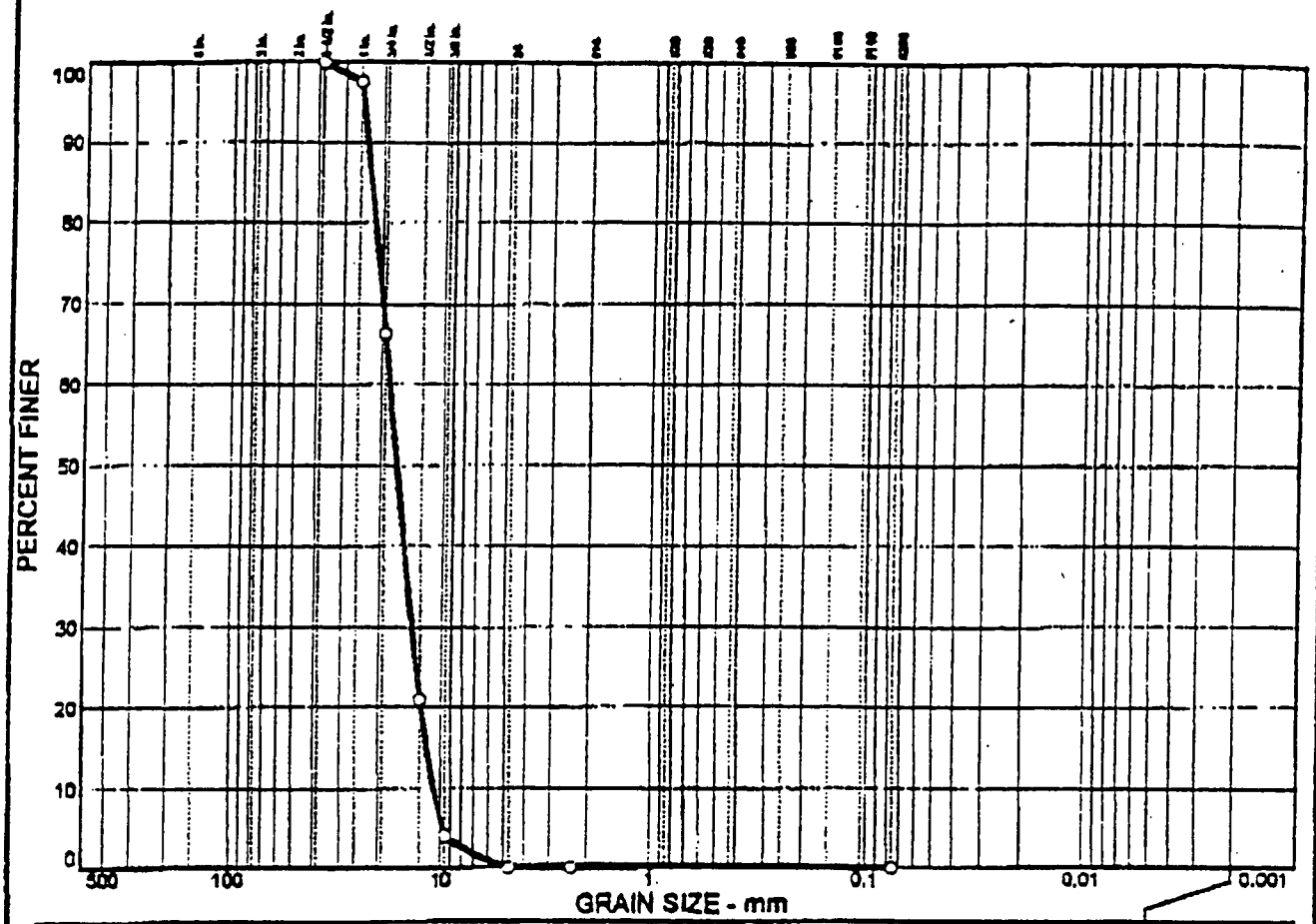
RECORD

9/1/99
000205

000871
111 OF 124 PETRO

2741

# Grain Size Distribution Test Report




| % COBBLES | % GRAVEL | % SAND | % SILT | % CLAY |
|---|---|---|---|---|
| 0.0 | 100.0 | 0.0 | | |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|---|---|---|---|
| 1.5 in. | 100.0 | 100 | yes |
| 1 in. | 97.6 | 95-100 | yes |
| .75 in. | 66.2 | — | — |
| .5 in. | 20.9 | 25-60 | no |
| .375 in. | 4.0 | — | — |
| #4 | 0.0 | 0-10 | yes |
| #8 | 0.0 | 0-5 | yes |
| #200 | 0.0 | 0-2 | yes |

* (no specification provided)

**Soil Description**

NO. 57 GRAVEL (Poorly graded gravel)

**Atterberg Limits**

PL= LL= PI=

**Coefficients**

$D_{85}$= 22.6 $D_{60}$= 18.1 $D_{50}$= 16.6
$D_{30}$= 14.0 $D_{15}$= 11.8 $D_{10}$= 10.9
$C_u$= 1.66 $C_c$= 0.99

**Classification**

USCS= GP AASHTO=

**Remarks**

LAB NO. 6661

**Sample No.:** BUCKET **Source of Sample:** L-6661 **Date:** 9/1/99
**Location:** SOURCE: WATSON SAND & GRAVEL **Elev./Depth:**

H. C. NUTTING COMPANY

**Client:** Petro Environmental
**Project:** Fernald OSDS, Cell 1
**Project No:** 13962.009 **Plate**

RECORD

000296

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

# PARTICLE SIZE ANALYSIS MECHANICAL SIEVE METHOD (ASTM D 422)

2741

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO — PROJECT NO: GC0409 TASK NO.: 04.1

DESCRIPTION: Phase II — DATE: 12 day Aug month 1999 year

MATERIAL TYPE: #57 Stone — SAMPLE NO.: LDS III-3A

SOIL SAMPLE SIZE — WATSON SAND & GRAVEL

| APPROXIMATE MINIMUM WT. OF SAMPLE (PASSING NO. 10 SIEVE) (grams) | SAND 118 | FINE GRAIN 55 |
|---|---|---|

| | | BEFORE WASH | AFTER WASH |
|---|---|---|---|
| TARE NO. | | BP | |
| WT. OF DRY SAMPLE PLUS TARE | (grams) | 17514.3 | |
| WT. OF TARE | (grams) | 939.8 | |
| WT. OF DRY SAMPLE | (grams) | 16574.5 | |

K = 10 cm/s
Coarse Coeff = 0.1

SIEVE ANALYSIS — CALC BY: MH/CS

| SIEVE NO. | DIAMETER (mm) | WT. RETAINED (grams) | % RETAINED | % FINER | PROJECT SPECIFICATIONS |
|---|---|---|---|---|---|
| 2" | 50.00 | Ø | Ø | 100 | |
| 1.5" | 37.50 | Ø | Ø | 100 | 100 |
| 1" | 25.00 | 901.6 | 5.4 | 94.6 | 95-100 |
| 3/4" | 19.00 | 8066.1 | 48.7 | 51.3 | ~~25-60~~ EXH 7 |
| 1/2" | 12.50 | 14692.4 | 88.6 | 11.4 | ~~0-10~~ 25-60 |
| 3/8" | 9.50 | 16197.1 | 97.7 | 2.3 | |
| #4 | 4.75 | 16514.4 | 99.6 | 0.4 | 0-10 |
| 8 | 2.36 | 16516.8 | 99.7 | 0.3 | 0-5 |
| 16 | 1.18 | 16519.6 | 99.7 | 0.3 | |
| 30 | 0.600 | 16522.4 | 99.7 | 0.3 | |
| 50 | 0.300 | 16525.1 | 99.7 | 0.3 | |
| 100 | 0.150 | 16527.5 | 99.7 | 0.3 | |
| 200 | 0.075 | 16532.1 | ~~2.7~~ 99.7 | 0.3 | 0-2 |
| PAN | — | 16544.6 | | | |

RECORD

000207

FINER = 100 − Σ% RETAINED

FLUOR DANIEL FERNALD

# NONCONFORMANCE REPORT FORM

2741

| | | |
|---|---|---|
| | **ORIGINATOR/ASSESSOR** | |
| 1 | Nonconformance Number/Revision | NCR No.: FY99- 0923 Revision No. 0 |
| 2 | Dates | Date Discovered: 08 July 1999 Date NCR Report Issued: 08 July 1999 |
| 3 | Type of Nonconformance | [X] FINDING [ ] CONCERN |
| 4 | Project/Activity @ Fac/Loc/Bldg | Soil and Disposal Facility Project (S&DFP) |
| 5 | Hazard Category | Nuclear: [ ] 1 [ ] 2 [ ] 3 [ ] Radiological<br>Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard<br>Industrial: [ ] Hazardous Waste Activity [X] Standard Industrial Hazard [ ] FEMP SIH |
| 6 | Assessment | [ ] Internal [ ] External (OEPA, DOE) [X] Supplier/Vendor GSE Lining Technologies, Inc. |
| 7 | Assessment Type | [ ] Audit [ ] Surveillance [ ] Inspection [X] Other Submittal Review |
| 8 | Assessment Number | N/A |
| 9 | Responsible FDF Division/Vendor | [X] S&WP [ ] WMT&SP [ ] FC&DP [ ] O&PI [ ] PS [X]SUPPLIER/VENDOR |
| 10 | Responsible FDF Department/Vendor | GSE Lining Technologies, Inc. |
| 11 | Responsible Team Leader/Coach/Vendor (Print Name) | Kathy Fisher |
| 12 | Functional Area (NA for Vendors) (choose any that apply) (Ref. RM-0016) | [ ] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI<br>[ ] FM [ ] EP [ ] EW [ ] MT [ ] OP [ ] PT [ ] SE [ ] TR<br>[ ] CT [ ] HR [ ] PC [ ] EM [ ] FP [ ] NS [ ] SH [ ] RP |
| 13 | QA Criteria (choose one that applies Ref. RM-Q012) Other Criteria (CONOPS, etc.) (not RM-0012 applicable) | [ ] 1 Program [ ] 2 Training [ ] 3 Quality Improv. [ ] 4 Document/Records<br>[ ] 5 Work process [ ] 6 Design [ ] 7 Procurement [X] 8 Inspect/Test<br>[ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other |
| 14 | Requirement Description<br>Cite the requirement (clearly, concisely, and completely) and its source, including document identification number, page and paragraph number. A copy of the document (or page of the document) in which the requirement appears may be attached or added to the NCR file. Use additional or separate sheets as necessary. | "For each proposed geosynthetic clay liner (GCL) material lot, submit to FDF for review . . . the results of . . . internal and interface shear strength tests including description of test methods, procedure, and conditions. Geosynthetic clay liner for the internal and interface shear strength shall be tested using procedures and conditions specified in Article 2.01.G.1. and 2 of this Section. (Specification 02772P, Rev. 2, p. 3, section 1.04.B., dated 11 December 1998)<br><br>"Tests will be performed in accordance with ASTM D 5321 . . . ." (Specification 02772P, Rev. 2, p. 5, section 2.01.G.1., dated 11 December 1998) |
| 15 | Nonconformance Description<br>Describe the nonconformance. Include details such as supplier names, container numbers, purchase order, work order, or requisition numbers) and clearly describe the deviation from the written requirement. Use additional or separate sheets as necessary. | Nonconformance Title or Short Description: Test Method ASTM D 6243-B Used<br><br>Vector Engineering, Inc., of Grass Valley, California, used ASTM D 6243-B as its method of conducting GCL Interface Shear testing, instead of ASTM D 5321 as specified.<br><br>VALIDATED QUALITY RECORD INITIAL DS DATE 8-19-99 |
| 16 | Tagging Required / Number of Tags | [ ] Yes [X] No Number of Tags: 347 (if rolls received by FDF) |
| 17 | Originator/Assessor | Name: James T. TURNER Signature: [signature] Date: 08 July 1999 |
| | **ORIGINATOR'S/ASSESSOR'S TEAM LEADER'S/COACH'S REVIEW** | |
| 18 | Originator's/Assessor's Team Leader/Coach | Name: Michael W. GODBER Signature: [signature] Date: 8 JULY 1999 |
| 19 | Response Date From Resp. Organ. | 06 August 1999 (Reply within 20 working days) |

000208

FLUOR DANIEL FERNALD

# NONCONFORMANCE REPORT FORM

**RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE**

| | | |
|---|---|---|
| | Nonconformance Number/Revision | NCR No.: FY99- 0923 Revision No. 0 |
| 20 | Root Cause Analysis<br>Provide documentation as attachment. Use additional or separate sheets as necessary | [ ] YES [X] NO<br>Level 1 Cat. [ ] 1H (human perf.) [ ] 1E (equip.) [ ] 1N (nat. phenom/sabotage [ ] 1Z (other)<br>TapRoot Cause Code(s) N/A |
| 21 | Corrective Action (CA) Description and Disposition<br>Describe the actions necessary to correct the nonconformance. Corrective actions must be detailed and complete. They must be written in a clear, concise, and verifiable manner. The corrective action plan must also include actions to prevent recurrence. Use additional or separate sheets as necessary.<br>(A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below) | Hardware: [X] Accept-as-is [ ] Repair [ ] Rework [ ] Reject<br>Non-Hardware: [ ] Other<br>ASTM D 6243 is a new test method specifically developed for testing GCLs. Test procedures are equal to those of ASTM D 5321 in the specifications. Therefore, test results should be acceptable. |
| 22 | Technical Concurrence/Justification (mark NA if not applicable) | Name: KRISHNA BADU-TWENEBOAH Signature: [signature] Date: 8/12/99 |
| 23 | Was a Design Change Notice Required? | [ ] Yes [X] No DCN # N/A Date Issued |
| 24 | Was a SBDR Performed?<br>Was a USQD Performed? | [ ] Yes [X] No SBDR # N/A Date Issued<br>[ ] Yes [X] No USQD # N/A Date Issued |
| 25 | Actions taken to Prevent Recurrence<br>Use additional or separate sheets as necessary. | Specifications for future cell construction will be revised to incorporate new test method for GCLs. |
| 26 | Proposed Completion Date For CA | Date: 8/12/99 |
| 27 | Responsible Team Leader/Coach/Vendor | Name: KATHY FISHER Signature: [signature] Date: 8/13/99 |

**EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR**

| | | |
|---|---|---|
| 28 | Response Acceptable? | [X] Yes [ ] No |
| 29 | Originator's/Assessor's | Name: James T. TURNER Signature: [signature] Date: 16 Aug. 1999 |

**COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION**

| | | |
|---|---|---|
| 30 | Date Corrective Action Completed | Date: August 16, 1999 |
| 31 | Responsible Team Leader/Coach /Vendor | Name: KATHY FISHER Signature: [signature] Date: 8/16/99 |

**VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER**

| | | |
|---|---|---|
| 32 | Verification Action<br>(Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR) | Looked up both standard test methods on the American Society for Testing and Materials (ASTM) web page. Summary printouts are attached. |
| 33 | Verifier | Name: James T TURNER Signature: [signature] Date: 16 Aug 1999 |

**CLOSURE BY THE ASSESSOR'S VERIFIER'S TEAM LEADER/COACH**

| | | |
|---|---|---|
| 34 | Verifier's Team Leader/Coach (NCR Closed) | Name: MIKE GOOBER Signature: [signature] Date: 8/16/99 |

000209

FY99-0923 Rev. 0
8-16-99 p. 3 of 4
—2741

# D5321-92(1998) Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

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## 1. Scope

1.1 This test method covers a procedure for determining the shear resistance of a geosynthetic against soil, another geosynthetic, or a soil and geosynthetic in any combination.

1.1.1 The test method is intended to indicate the performance of the selected specimen by attempting to model certain field conditions.

1.2 The test method is applicable for all geosynthetics. Remolded or undisturbed soil samples can be used in the test device.

1.3 The test method is not suited for the development of exact stress-strain relationships within the test specimen due to the non-uniform distribution of shearing forces and displacement.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.5 This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

**Adopted by:** Building Codes
**Developed by ASTM Subcommittee:** D35.01

**Ordering Information**

Price: $ 30.00 Printed Pages: 6

The information above is only a summary of the ASTM standard. Order the complete standard in three ways:

WEB DOXX SERVICE

Immediate Download.* Cost: Price as noted above. **CREDIT CARDS ONLY.**
Notes about PDF Quality | Note about Acrobat

*This service requires use of Adobe Acrobat Software and PDF.

PDF Delivery

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Delivery 5-10 minutes. Cost: Price as noted above, plus fax charge. **CREDIT CARDS ONLY.**
Notes about Fax Quality

Fax Delivery



000210

FY99-0923 Rev. 0
2741 8-16-99 p. 4 of 4

# D6243-98 Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method

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## 1. Scope

1.1 This test method covers a procedure for determining the internal shear resistance of a Geosynthetic Clay Liner (GCL) or the interface shear resistance between the GCL and an adjacent material under a constant rate of displacement or constant stress.

**Adopted by:**
**Developed by ASTM Subcommittee:** D35.04

**Ordering Information**

Price: $ 30.00 Printed Pages: 6

The information above is only a summary of the ASTM standard. Order the complete standard in three ways:

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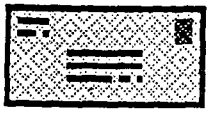
PDF Delivery

Delivery 5-10 minutes. Cost: Price as noted above, plus fax charge. **CREDIT CARDS ONLY.**
Notes about Fax Quality

Fax Delivery



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Mail Delivery - North America: $ 30.00
Mail Delivery - International: $ 33.00

Mail Delivery

**Subject Index**

coefficient of friction; direct shear; GCL; interface shear resistance; performance test; shear resistance

---

Support Desk

Designation: D 6243 – 98

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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2741

# Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method[1]

This standard is issued under the fixed designation D 6243; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This test method covers a procedure for determining the internal shear resistance of a Geosynthetic Clay Liner (GCL) or the interface shear resistance between the GCL and an adjacent material under a constant rate of displacement or constant stress.

1.2 This test method is intended to indicate the performance of the selected specimen by attempting to model certain field conditions.

1.3 This test method is applicable to all GCLs. Remolded or undisturbed soil samples can be used in the test device.

1.4 This test method is not suited for the development of exact stress-strain relationships within the test specimen due to the nonuniform distribution of shearing forces and displacement.

1.5 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft lbf/ft$^3$(600 kN-m/m$^3$))[2]

D 1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56 000 ft/lbf/ft$^3$(2700 kN-m/m$^3$))[2]

D 2435 Test Method for One Dimensional Consolidation Properties of Soils[2]

D 3080 Method for Direct Shear Test of Soils Under Consolidated Drained Conditions[2]

D 4354 Practice for Sampling of Geosynthetics for Testing[3]

D 4439 Terminology for Geosynthetics[3]

D 5321 Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method[3]

D 6072 Guide for Obtaining Samples of Geosynthetic Clay Liners[3]

## 3. Terminology

3.1 *Definitions*—For definitions of terms relating to soil and rock, refer to Terminology D 653. For definitions of term relating to GCLs, refer to Terminology D 4439.

3.2 *Definitions of Terms Specific to This Standard.*

3.2.1 *adhesion, $c_a$, n*—the shearing resistance between two unlike materials under zero normal stress.

3.2.2 *angle of friction, n*—(angle of friction between solid bodies, °,) the angle whose tangent is the ratio between the limiting value of the shear stress that resists slippage between two solid bodies at rest with respect to each other and the normal stress across the contact surface.

3.2.2.1 *Discussion*—Limiting values may be at the peak shear stress or at some other failure condition defined by the user.

3.2.3 *atmosphere for testing geosynthetics, n*—air maintained at a relative humidity of between 50 and 70 % and temperature of 21 ± 2°C (70 ± 4°F).

3.2.4 *coefficient of friction, n*—a constant proportionality factor relating normal stress and the corresponding critical shear stress for a defined failure condition.

3.2.5 *cohesion, c, n*—the portion of the internal shear strength indicated by the term $c$, in Coulomb's equation $\tau = c + \sigma_n \tan(\phi)$.

3.2.6 *direct shear friction test, n*—for GCLs, a procedure in which the internal GCL or the interface between a GCL and any other surface, under a range of normal stresses specified by the user, is stressed to failure by the relative movement of one surface against the other.

3.2.7 *GCL, n*—a manufactured hydraulic barrier consisting of clay bonded to a layer, or layers, of geosynthetic materials.

[1] This test method is under the jurisdiction of ASTM Committee D-35 on Geosynthetics and is the direct responsibility of Subcommittee D35.04 on Geosynthetic Clay Liners.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.



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## 4. Summary of Test Method

4.1 The shear resistance internal to the GCL or between a GCL and adjacent material, or between any GCL combination selected by the user, is determined by placing the GCL and one or more contact surfaces, such as soil, within a direct shear box. A constant normal stress representative of field stresses is applied to the specimen, and a tangential (shear) force is applied to the apparatus so that one section of the box moves in relation to the other section. The shear force is recorded as a function of the horizontal displacement of the moving section of the shear box.

4.2 The test is performed for a minimum of three different normal stresses, selected by the user, to model appropriate field conditions. The peak shear stresses, or shear stresses at some post-peak displacement, or both, are plotted against the applied normal stresses used for testing. The test data generally are represented by a best fit straight line whose slope is the coefficient of friction between the two materials where the shearing occurred, or within the GCL. The $y$-intercept of the straight line is the cohesion intercept for internal shearing or adhesion intercept for interface shearing.

## 5. Significance and Use

5.1 The procedure described in this test method for the shear resistance for the GCL or the GCL interface is intended as a performance test to provide the user with a set of design values for the test conditions examined. The test specimens and conditions, including normal stresses, generally are selected by the user.

5.2 This test method may be used for acceptance testing of commercial shipments of GCLs, but caution is advised as outlined in 5.2.1.

5.2.1 The shear resistance can be expressed only in terms of actual test conditions (see Note 1 and Note 2). The determined value may be a function of the applied normal stress, material characteristics, size of sample, moisture content, drainage conditions, displacement rate, magnitude of displacement, and other parameters.

NOTE 1—In the case of acceptance testing requiring the use of soil, the user must furnish the soil sample, soil parameters, and direct shear test parameters.

NOTE 2—Testing under this test method should be performed by laboratories qualified in the direct shear testing of soils, especially since the test results may be dependent on site-specific and test conditions.

5.2.2 This test method measures the total resistance to shear within a GCL or between a GCL and adjacent material. Total shear resistance may be a combination of sliding, rolling, interlocking of soil particles, or adjacent surfaces, and shear strain, or a combination thereof, within the GCL specimen.

5.2.3 This test method does not distinguish between individual mechanisms, which may be a function of the soil used, method of soil placement, normal and shear stresses applied, rate of horizontal displacement, and other factors. Every effort should be made to identify, as closely as is practicable, the sheared area and failure mode of the specimen. Care should be taken, including close visual inspection of the specimen after testing, to ensure that the testing conditions are representative of those being investigated.

5.2.4 Information on precision between laboratories is incomplete. In cases of dispute, comparative tests to determine whether a statistical bias exists between laboratories may be advisable.

5.3 The test results can be used in the design of GCL applications, including but not limited to, the design of liners and caps for landfills, cutoffs for dams, and other hydraulic barriers.

## 6. Apparatus

6.1 *Shear Device*—A rigid device to hold the specimen securely and in such a manner that a uniform force without torque can be applied to the specimen. The device consists of both a stationary and moving container, each of which is capable of containing dry or wet soil and are rigid enough to not distort during shearing of the specimen. The traveling container must be placed on firm bearings and rack to ensure that the movement of the container is only in a direction parallel to that of the applied shear force.

NOTE 3—The position of one of the containers should be adjustable in the normal direction to compensate for deformation of the GCL and adjacent materials.

6.1.1 Square or rectangular containers are recommended. They should have a minimum dimension that is greater of 300 mm (12 in.), 15 times the $d_{35}$ of the coarser soil used in the test, or a minimum of five times the maximum opening size (in plan) of the geosynthetic tested. The depth of each container should be 50 mm (2 in.) or six times the maximum particle size of the coarser soil tested, whichever is greater.

NOTE 4—The minimum container dimensions given in 6.1.1 are guidelines based on requirements for testing most combinations of GCLs and adjacent materials. Containers smaller than those specified in 6.1.1 can be used if it can be shown that data generated by the smaller devices contain no bias from scale or edge effects when compared to the minimum size devices specified in 6.1.1. The user should conduct comparative testing prior to the acceptance of data produced on smaller devices. For direct shear testing involving soils, competent geotechnical review is recommended to evaluate the compatibility of the minimum and smaller direct shear devices.

6.2 *Normal Stress Loading Device*, capable of applying and maintaining a constant uniform normal stress on the specimen for the duration of the test. Careful control and accuracy (±2 %) of normal stress is important. Normal stress loading devices include, but are not limited to, weights, pneumatic or hydraulic bellows, or piston-applied stresses. For jacking systems, the tilting of loading plates must be limited to less than 2° from horizontal during shearing.

NOTE 5—Due to the potential inaccuracies in the normal stress applied by some test devices, the operating range of normal stresses for a device should be limited to between 10 and 90 % of its calibrated range. If a device is used outside this range, the report shall so state and give a discussion of the potential effect of uncertainties in normal stress on the measured results.

6.3 *Shear Force Loading Device*, capable of applying a shearing force to the specimen at a constant rate of horizontal displacement (strain controlled), or at a constant horizontal stress (stress controlled) in a direction parallel to the direction of travel of the soil container, or both. The rate of displacement should be controlled to an accuracy of ±10 % over a range of at least 6.35 mm/min (0.25 in./min) to 0.025 mm/min (0.001



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in./min). In a constant stress test, the horizontal stress shall be maintained to an accuracy of ±2 % of the normal stress. The system must allow constant measurement and readout of the applied shear force. An electronic load cell or proving ring arrangement is generally used. The shear force loading device should be connected to the test apparatus in such a fashion that the point of the load application to the traveling container is in the plane of the shearing interface and remains the same for all tests.

6.4 *Displacement Indicators*, for providing continuous readout of the horizontal shear displacement, and if desired, vertical displacement of the specimen during the consolidation or shear phase, or both. Dial indicators, or linear variable differential transformers (LVDTs), capable of measuring a displacement of at least 75 mm (3 in.) for horizontal displacement and 25 mm (1 in.) for vertical displacement are recommended. The sensitivity of displacement indicators should be at least 0.02 mm (0.001 in.) for measuring horizontal displacement.

6.5 *GCL Clamping Devices*, required for fixing GCL specimens to the stationary section or container, the traveling container, or both, during shearing of the specimen. Clamps shall not interfere with the shearing surfaces within the shear box and must keep the GCL specimens flat during testing. Flat jaw-like clamping devices normally are sufficient for interface testing. Where the internal shear resistance is to be measured, rough (textured) surfaces must be used on the top and bottom of the GCL to cause internal shearing within the GCL. These surfaces must permit flow of water into and out of the test specimen. Work is still in progress to define the best type of rough surfaces.

6.5.1 Selection of the type of rough (textured) surface should be based on the flowing criteria:

6.5.1.1 The gripping surface should be able to mobilize fully the friction between the gripping surface and the outside surfaces of the GCL:

6.5.1.2 The gripping surface should be able to transfer completely the shear stress through the outside surfaces into the inside of the GCL:

6.5.1.3 No slippage should occur between the gripping surfaces and the outside surfaces of the GCL, such that a tensile failure occurs within one or both of these surfaces of the GCL:

6.5.1.4 The gripping surface should not damage the outside surfaces of the GCL and should not influence the shear strength behavior of the GCL:

6.5.1.5 The resulting failure surface should be entirely within the GCL.

6.5.2 A textured steel gripping surface made of wood working rasps mounted on a rigid substrate has been found to work. Gluing of the GCL to a substrate may influence the strength behavior of the GCL and should not be used.

NOTE 6—The selection of specimen substrate may influence the test results. For instance, a test performed using a rigid substrate, such as a wood or metal plate, may not simulate field conditions as accurately as that using a soil substrate. The user should be aware of the influence of substrate on direct shear resistance data. Accuracy and reproducibility should be considered when selecting a substrate for testing.

6.6 *Soil Preparation Equipment*, for preparing or compacting bulk soil samples, as outlined in Test Methods D 698, D 1557, or D 3080.

6.7 *Miscellaneous Equipment*, as required for preparing specimens. A timing device and equipment required for maintaining saturation of the geosynthetic or soil samples, if desired.

## 7. GCL Sampling

7.1 *Lot Sample*—Divide the product into lots, and for any lot to be tested, take the lot sample as directed in Guide D 6072 (see Note 5 and Note 6).

7.2 *Laboratory Sample*—Consider the units in the lot sample as the units in the laboratory sample for the lot to be tested. For a laboratory sample, take a sample extending the full width of the GCL production unit and of sufficient length so that the requirements of 7.3 can be met. Take a sample that will exclude material from the outer edge.

7.3 *Test Specimens*—From each unit in the laboratory sample, remove the required number of specimens as outlined in 7.3.1.

7.3.1 Remove a minimum of three specimens for shearing in a direction parallel to the machine, or roll, direction of the laboratory sample and three specimens for shearing in a direction parallel to the cross-machine (cross-roll) direction, if required (see Note 7 and Note 8). The specimens should be slightly larger than the inside dimensions in all directions of the soil container described in 6.1.1, and they should be of sufficient size to facilitate clamping. All specimens should be free of surface defects, etc., that are not typical of the laboratory sample. Space the specimens along a diagonal of the unit of the laboratory sample. Take no specimens nearer the edge of the GCL production unit than 1/10 the width of the unit.

NOTE 7—Lots for GCLs usually are designated by the producer during manufacturing. While this test method does not attempt to establish a frequency of testing for the determination of design-oriented data, the lot number of the laboratory sample should be identified. The lot number should be unique to the raw material and manufacturing process for a specific number of units, for example, rolls, panels, etc., designated by the producer.

NOTE 8—The strength characteristics of some GCLs may depend on the direction tested. In many applications, it is necessary to perform shear tests in only one direction. The direction of shear in the GCL specimen(s) must be noted clearly in these cases.

## 8. Shear Device Calibration

8.1 The direct shear device is calibrated to measure the internal resistance to shear inherent to the device. The inherent shear resistance is a function of the geometry and mass of the traveling container, type and condition of the bearings, and type of shear loading system, and the applied normal stress. The calibration procedure described in this section is applicable to certain devices. Other procedures may be required for specific devices. Refer to the manufacturer's literature for recommended calibration procedures.

8.2 Assemble the shear device completely without placing a specimen inside it. Do not apply a normal stress. Apply the shear force to the traveling container at a rate of 6.35 mm/min (0.25 in./min). Record the shear force required to sustain movement of the traveling container for at least 50 mm (2 in.) total horizontal displacement. Record any large variation in





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applied shear force after movement of the traveling container has been initiated. Any such variations may be indications of damaged or misaligned bearings, or an eccentric application of the shear force.

8.3 The maximum shear force recorded is the internal shear correction to be applied to shear force data after the testing of soil specimens.

## 9. Conditioning

9.1 Maintain samples at the as-received moisture content until ready to cut specimens for testing.

9.2 For tests on GCL without soil, test specimens at the temperature specified in the standard atmosphere for testing geosynthetics. Humidity control normally is not required for direct shear testing.

9.3 When soil is included in the test specimen, the method of conditioning is selected by the user or mutually agreed upon by the user and the testing agency. In the absence of specified conditioning criteria as described in 9.4, the test should be performed at the temperature specified in the standard atmosphere for testing GCLs. Relative humidity should be controlled when specified by the user.

9.4 The minimum user specified conditioning criteria include the following:

9.4.1 The test configuration, including from the top to bottom, all components, that is supporting substrates, soil, geosynthetics, GCLs, and gripping surfaces.

9.4.2 Type of clamping, or gripping surfaces, or both.

9.4.3 Compaction criteria for soil(s), including dry unit weight, moisture content and conditions for compacting the soil adjacent to the GCL or other geosynthetics.

9.4.4 Sample conditioning, such as, wetting, soaking/hydration, and consolidation of GCL separately or with entire test section. Wetting should be defined by either pouring water onto the sample or by spraying GCL or other geosynthetic with water. Conditions must be defined during soaking/hydration for the type of fluid, duration of soaking, criteria to define completion of consolidation during soaking, normal stress to be applied during soaking, and whether GCL is to be hydrated by itself or with other interface components assembled.

9.4.5 Normal stresses during the shear phase.

9.4.6 Method of shearing, that is constant rate of horizontal displacement or constant horizontal stress. For constant rate of horizontal displacement tests, the shear rate must be defined or the procedure for the lab to follow to establish the shear rate must be given (see 10.7 and 11.6). For constant stress tests, the applied shear load, method of application, and test duration must be defined (see Note 10).

## 10. Procedure A—GCL Internal Shear Resistance

10.1 Adjust the lower roughened surface so that it is one-half the thickness of the GCL below the top of the lower box. Place the GCL over the lower roughened surface. The specimen must cover the entire substrate. Half the thickness of the GCL should extend above the top of the lower box. The GCL should be sufficiently long to be clamped.

10.2 Slide the two halves of the shear box together and fix them in the start position.

10.3 Place a top roughened surface over the GCL specimen. Fix the loading plate and apply the normal stress to the specimen.

10.4 Apply a normal seating load. If the test is for a wet condition, inundate the specimen and monitor vertical displacements until the sample comes to equilibrium. (see Note 9)

NOTE 9—The acceptance sequence for the seating load, normal load, and wetting will depend on the application, as described in 9.4. Insufficient information exists at this time to provide a single application sequence. Tailor the test sequence to application conditions. Use methods described in Test Method D 2435 to determine when primary consolidation is complete. Use a degree of primary consolidation of 90 % or more as the equilibrium condition.

10.5 If the seating load does not equal the normal load for testing, apply the normal load for the test and monitor vertical displacements until the sample comes to equilibrium. Verify equilibrium (see Note 9) before proceeding. If the GCL has been hydrated in a separate apparatus and transferred to the shear box, apply the same load used in hydration in the shear box and verify equilibrium.

10.6 Place and zero the horizontal displacement indicators onto the traveling container. Assemble the shear force loading device such that the loading ram is in contact with the traveling container, but no shear force is applied. If necessary, adjust the location of the loading ram to minimize the induced moment.

10.7 Apply the shear force using a constant rate of displacement or constant stress condition. The rate of loading should be specified by the user. The displacement rate should normally be relatively slow so that insignificant excess pore pressures exist at failure. Some applications may require rapid loading to simulate field conditions.

NOTE 10—Some people use a horizontal displacement of 1 mm/min (0.04 in./min). This value comes from the default value given in Test Method D 5321 for testing the interface strength between geosynthetics and soils. The appropriate rate of horizontal loading for GCLs depends on several factors, including the GCL, the materials on both sides of the GCL, the normal stress level, the hydrating conditions and the field drainage conditions. For drained shearing, the following equation can be used as a guide to determine the maximum rate of horizontal displacement:

$$R = \frac{d_f}{50 \cdot t_{50} \cdot \eta} \quad (1)$$

where:

$R$ = rate of horizontal displacement, mm/min,

$d_f$ = estimated horizontal displacement at peak shear stress or at the residual shear strength as requested by the user, mm,

$t_{50}$ = time required for specimen to reach 50 % consolidation under the current normal stress increment determined from methods described in Test Method D 2435 with double drainage, min, and

$\eta$ = factor to account for drainage conditions on the shear plane:
- use 1 for internal shear of GCL with drainage at both boundaries;
- use 4 for shear of the interface between GCL and an impermeable material;
- use 0.002 for shear of the interface between GCL and a pervious material.

10.7.1 At some values of normal stress, the specimen will





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not exhibit well defined time-displacement curves from which to determine $t_{50}$ in those instances, at $t_{50}$ estimated for the material with sufficient normal stress to cause compression (not swelling) should be used. If an alternate value of $t_f$, is selected, the rationale for the selection shall be explained with the test results.

NOTE 11—Direct shear tests also may be conducted using a constant shear stress approach. This approach can be achieved by any of the following three methods:

(a) *Controlled Stress Rate Method*, where the shear force is applied to the test specimen under a uniform rate of horizontal load increase until slipping or failure of the test specimen occurs;

(b) *Incremental Stress Method*, where the shear force is applied in uniform or doubling increments and held for a specific time before proceeding to the next increment, until slipping or failure of the test specimen occurs;

(c) *Constant Stress Creep Method* where the shear force is applied using method (a) or (b) until the specified constant shear stress is reached. The constant shear stress then is maintained and the test monitored for the duration specified.

The user shall specify the desired loading conditions for the constant shear stress approach.

10.8 Record the shear force as a function of displacement. If the data are not recorded continuously, 20 data points minimum should be obtained per test.

10.9 Run the test until the horizontal displacement exceeds 50 mm (2 in.) or other value specified by the user.

10.10 At the end of the test, remove the normal stress from the specimen and disassemble the device carefully. Inspect the failure surface and clamp area carefully in order to identify the failure mechanisms involved. Note evidence of shear strains within the specimen or at the clamps. Evidence of shear strains from testing of a specimen that is not typical of other specimens tested may result in discarding of the specimen and retesting. If excessive strains in the specimen or slipping occur, the test may have to be rerun at a lower normal stress.

10.11 Repeat the test at a new normal stress with a new GCL specimen. Test a minimum of three specimens, each at a different normal stress specified by the user.

10.12 Plot the test data as a graph of applied shear force versus container displacement. For this plot, identify the peak shear force and the shear force at the end of the test, if required. Determine the horizontal displacements for these shear forces.

10.13 Calculate the peak shear stress, and alternatively, the shear stress at the end of the test, if required, as directed in Section12. Subtract the internal shear correction (determined in 8.3) from the shear stress. The difference between the recorded shear stress and the internal shear correction is the actual shear stress applied to the specimen.

## 11. Procedure B—Interface Shear Resistance

11.1 Place the soil (if used), clamping substrate (if used), and geosynthetic within the lower shear box. If soil is to be used in the lower box, compact it into the lower box to the specified moisture and density. Fill the lower container with soil so that the surface of the soil specimen protrudes a distance equal to one-half of the $d_{95}$ of the soil, as described in Method D3080. A protrusion of 1 mm is sufficient for fine-grained soils. Carefully level the soil surface.

11.2 Place the GCL loosely onto the roughened surface. Remove all folds and wrinkles in the GCL. The GCL must extend in the direction of relative movement of the upper box a sufficient distance to permit clamping the GCL to the upper box.

11.3 Bring the upper half of the box into position and assemble the normal loading apparatus as given by the manufacturer's instructions. Use a roughened plate between the top of the GCL and the normal loading plate. Clamp the GCL to the upper box.

NOTE 12—Sections 11.1-11.3 apply to commonly occurring test conditions. Other interface conditions, test conditions, and material combinations may be desired to model specific test conditions. The test report should describe specific variations made from this test method to model specific conditions.

11.4 Apply the normal seating load. If the test is for a wet condition, inundate the specimen and monitor vertical displacements until the sample comes to equilibrium (see Note 9). If the GCL has been hydrated in a separate apparatus and transferred to the shear box, apply the same load used in hydration in the shear box and verify equilibrium.

11.5 Place the displacement indicators. Assemble the shear force loading device such that the loading ram is in contact with the traveling container, but no shear force is applied. If necessary, adjust the location of the loading ram to minimize the induced moment.

11.6 Apply the shear force using a constant rate of displacement that is slow enough to dissipate soil pore pressures, as described in 10.7. If excess pore pressures are not anticipated on the interface, apply the shear force at a rate of 1 mm/min (0.04 in./min).

11.7 Record the shear force as described in 10.8. Continue the test until the horizontal displacement exceeds 50 mm (2 in.) or other value specified the user.

11.8 Remove the normal stress and disassemble the device at the end of the test. Carefully inspect and identify the failure surface of the specimen and the area of the specimen clamp. Specimen failures should be consistent for all tests in order for the test data to be comparable.

11.9 At the end of the test, remove the soil specimen to determine the moisture content, if required.

11.10 Repeat the procedure for a minimum of two additional normal stresses.

11.11 Plot the test data as directed in 10.12 and 10.13.

## 12. Calculation

12.1 For tests using soil, calculate the initial and final water content, unit weight, and degree of saturation, if required.

12.2 Calculate the apparent shear stress applied to the specimen for each recorded shear force as follows:

$$\tau = F_s/A_c \quad (2)$$

where:

$\tau$ = shear stress (kPa),
$F_s$ = shear force (kN), and
$A_c$ = corrected area ($m^2$).

12.2.1 For tests in which the area of specimen contact decreases with increased displacement, a corrected area may be calculated. This will occur in test devices in which the stationary and traveling containers have the same overall plan





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dimensions. In this case, the actual contact area will decrease as a function of horizontal displacement of the traveling container. For square or rectangular containers, the corrected area is calculated for each displacement reading using the following equation:

$$A_c = A_o - (d \times W) \quad (3)$$

where:

$A_c$ = corrected area ($m^2$),
$A_o$ = initial specimen contact area ($m^2$),
$d$ = horizontal displacement of the traveling container (m), and
$W$ = specimen contact width in a direction perpendicular to that of shear force application (m).

12.2.2 No area correction may be required for tests in which the stationary container is larger than the traveling container, provided that the horizontal displacement of the traveling container does not result a decrease in specimen contact area (see Note 13).

NOTE 13—For devices which apply the normal stress as a constant force, for example by dead weights, any area correction applied to the shear force also should be applied to the normal force.

12.3 Plot the limiting values of shear stress versus applied normal stress for each test conducted. Limiting values typically are at peak shear stress and at the end of the test. Other limiting values may be specified by the user. The shear stress and normal stress axes must be drawn to the same scale.

12.4 Connect the data points with a best-fit straight line. Some judgment and experience may be required to construct this line, which is referred to as the peak failure envelope. The slope of the failure envelope is the coefficient of friction. The angle of friction is determined using the following equation:

$$\tau = c + \sigma_n \times \tan(\phi) \quad (4)$$

where:

$\tau$ = peak shear stress,
$\sigma_n$ = normal stress,
$\phi$ = angle of friction (degrees), and
$c$ = cohesion intercept.

The $y$-intercept of the straight line with $x = 0$ axis is the adhesion intercept, intercept $c_a$, or cohesion intercept.

12.5 Additionally, the coefficient of friction may be calculated based on shear stresses at some displacement or at the end of the test. The procedures in 12.4 can be used to determine a friction angle and cohesion intercept, using the shear stress and normal stress for this other condition. Parameters obtained for a condition other than peak should be clearly identified with what condition they relate.

## 13. Report

13.1 In the report of the internal or interface shear resistance by the direct shear method, include the following information:

13.1.1 Project, type(s), and description of GCL specimens tested and direction tested.

13.1.2 Complete information on any soils used in testing, including soil preparation, compaction, moisture, gradation, classification, etc., and the methods used.

13.1.3 Description of the test apparatus, including container dimensions, loading apparatus, and recording devices used.

13.1.4 All test conditions, including normal pressures used, rate of horizontal displacement, specimen (including soil) construction, and clamping methods used. A sketch of the test specimen and test setup is recommended.

13.1.5 Statement of any departures from the suggested test procedure, including use of the test device outside of its calibrated operating range, as required for special studies, so that the results can be evaluated and used.

13.2 Complete test data, including plots of shear force versus horizontal displacement and a plot of peak shear stress versus normal stress for the tests conducted. Clearly mark all data points, the failure envelope, and the adhesion or cohesion intercept, and friction angle values. Indicate over what normal stress range the values of adhesion or cohesion and friction angle apply.

## 14. Precision and Bias

14.1 *Precision*—The precision of this test method is being established.

14.2 *Bias*—The value of the internal and interface shear resistance of GCL can be defined only in terms of the materials and conditions used during testing. Because of the many variables involved and the lack of a superior standard or referee method, there are no direct data to determine bias.

14.2.1 The value of the internal and interface shear resistance of GCL can be defined only in terms of a test method. When this test method is the determining test method, measurements of the internal or interface shear resistance of GCL have no bias.

## 15. Keywords

15.1 coefficient of friction; direct shear; GCL; interface shear resistance; performance test; shear resistance

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FLUOR DANIEL FERNALD

# NONCONFORMANCE REPORT FORM — 2741

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| | **ORIGINATOR/ASSESSOR** | |
| 1 | Nonconformance Number/Revision | NCR No.: FY99- 0920 Revision No. 0 |
| 2 | Dates | Date Discovered: 07 July 1999 Date NCR Report Issued: 08 July 1999 |
| 3 | Type of Nonconformance | [X] FINDING [ ] CONCERN |
| 4 | Project/Activity @ Fac/Loc/Bldg | Soil & Disposal Facility Project |
| 5 | Hazard Category | Nuclear: [ ] 1 [ ] 2 [ ] 3 [ ] Radiological<br>Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard<br>Industrial: [ ] Hazardous Waste Activity [X] Standard Industrial Hazard [ ] FEMP SIH |
| 6 | Assessment | [ ] Internal [ ] External (OEPA, DOE) [X] Supplier/Vendor GSE Lining Technologies, Inc. |
| 7 | Assessment Type | [ ] Audit [ ] Surveillance [ ] Inspection [X] Other Submittal Review |
| 8 | Assessment Number | N/A |
| 9 | Responsible FDF Division/Vendor | [X] S&WP [ ] WMT&SP [ ] FC&DP [ ] O&PI [ ] PS [X]SUPPLIER/VENDOR |
| 10 | Responsible FDF Department/Vendor | GSE Lining Technologies, Inc. |
| 11 | Responsible Team Leader/Coach/Vendor (Print Name) | Kathy Fisher |
| 12 | Functional Area (NA for Vendors) (choose any that apply) (Ref. RM-0016) | [ ] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI<br>[ ] FM [ ] EP [ ] EW [ ] MT [ ] OP [ ] PT [ ] SE [ ] TR<br>[ ] CT [ ] HR [ ] PC [ ] EM [ ] FP [ ] NS [ ] SH [ ] RP |
| 13 | QA Criteria (choose one that applies Ref. RM-0012) Other Criteria (CONOPS, etc.) (not RM-0012 applicable) | [ ] 1 Program [ ] 2 Training [ ] 3 Quality Improv. [ ] 4 Document/Records<br>[X] 5 Work process [ ] 6 Design [ ] 7 Procurement ~~[X] 8~~ Inspect/Test jtt 7-7-99<br>[ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other |
| | Requirement Description<br>Cite the requirement (clearly, concisely, and completely) and its source, including document identification number, page and paragraph number. A copy of the document (or page of the document) in which the requirement appears may be attached or added to the NCR file. Use additional or separate sheets as necessary. | "GCL Propertiese - Bentonite Moisture Content / Qualifiers - Maximum / Units - % / Specified Values - 25 / Test Method - ASTM D 4643" (Specification 02772P, Rev. 2, p. 9, Table 02772P-1, "Required Geosynthetic Clay Liner and Cap Property Values," dated 13 January, 1999) |
| 15 | Nonconformance Description<br>Describe the nonconformance. Include details such as supplier names, container numbers, purchase order, work order, or requisition numbers) and clearly describe the deviation from the written requirement. Use additional or separate sheets as necessary. | Nonconformance Title or Short Description: Maximum Moisture Content Exceeded, 5065-5097<br>For the tests and rolls listed, the moisture content was measured at 25.5% (test roll 5073) and 25.7% (test roll 5089), in excess of the maximum moisture content allowable by specification. Therefore, these rolls are not represented by valid test data in accordance with the specification.<br>VALIDATED QUALITY RECORD INITIAL DS DATE 7-30-99<br>33 jtt 7-7-99 |
| 16 | Tagging Required / Number of Tags | [ ] Yes [✓] No Number of Tags: ~~55~~ (if rolls are received at FDF) |
| 17 | Originator/Assessor | Name: James T. TURNER Signature: [signature] Date: 7-7-99 |
| | **ORIGINATOR'S/ASSESSOR'S TEAM LEADER'S/COACH'S REVIEW** | |
| | Originator's/Assessor's Team Leader/Coach | Name: Michael W. GODBER Signature: [signature] Date: 7/7/99 |
| 19 | Response Date From Resp. Organ. | 05 August 1999 (Reply within 20 working days) |

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FLUOR DANIEL FERNALD

# NONCONFORMANCE REPORT FORM

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|---|---|---|
| | **RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE** | |
| | Nonconformance Number/Revision | NCR No.: FY99- 0920 Revision No. 0 |
| | Root Cause Analysis<br>Provide documentation as attachment. Use additional or separate sheets as necessary | [ ] YES [✓] NO<br>Level 1 Cat. [ ] 1H (human perf.) [ ] 1E (equip.) [ ] 1N (nat. phenom/sabotage [ ] 1Z (other)<br>TapRoot Cause Code(s) N/A |
| 21 | Corrective Action (CA) Description and Disposition<br>Describe the actions necessary to correct the nonconformance. Corrective actions must be detailed and complete. They must be written in a clear, concise, and verifiable manner. The corrective action plan must also include actions to prevent recurrence. Use additional or separate sheets as necessary.<br>(A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below) | Hardware: [✓] Accept-as-is [ ] Repair [ ] Rework [ ] Reject<br>Non-Hardware: [ ] Other<br>GCL moisture content non-conformance was discovered on 26 May 1999 plant visit/inspection by FDF and Geosyntec personnel. Rolls 5066 through 5097 were being manufactured then. CETCO (plant) was advised of specification moisture requirement. Moisture content being only slightly above specification is considered a minimal discrepancy that will not adversely affect GCL performance. |
| 22 | Technical Concurrence/Justification (mark NA if not applicable) | Name: Jim Burnett Signature: Jim Burnett Date: 21 July 1999 |
| 23 | Was a Design Change Notice Required? | [ ] Yes [✓] No DCN # N/A Date Issued |
| 24 | Was a SBDR Performed?<br>Was a USQD Performed? | [ ] Yes [✓] No SBDR # N/A Date Issued<br>[ ] Yes [✓] No USQD # N/A Date Issued |
| 25 | Actions taken to Prevent Recurrence<br>Use additional or separate sheets as necessary. | Plant was reminded of GCL moisture content specification during 25-27 May plant visit/inspection by FDF and Geosyntec personnel. |
| | Proposed Completion Date For CA | Date: Immediately |
| 27 | Responsible Team Leader/Coach/Vendor | Name: Kathy Fisher Signature: Kathy Fisher Date: 7/22/99 |
| | **EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR** | |
| 28 | Response Acceptable? | [✓] Yes [ ] No |
| 29 | Originator's/Assessor's | Name: James T. TURNER Signature: [signature] Date: 22 July 1999 |
| | **COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION** | |
| 30 | Date Corrective Action Completed | Date: July 22, 1999 |
| 31 | Responsible Team Leader/Coach /Vendor | Name: KATHY FISHER Signature: Kathy Fisher Date: July 22, 1999 |
| | **VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER** | |
| 32 | Verification Action<br>(Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR) | Have reviewed the GCL moisture content for all samples taken for this FEMP order. Only the two measurements documented in Block 15 were over 25% (to two significant digits as specified). |
| 33 | Verifier | Name: James T. TURNER Signature: [signature] Date: 7-23-99 |
| | **CLOSURE BY THE ASSESSOR'S VERIFIER'S TEAM LEADER/COACH** | |
| 34 | Verifier's Team Leader/Coach (NCR Closed) | Name: MICHAEL W. GOSSER Signature: [signature] Date: 7/28/99 |

000219

Author: Diana Sparks/FERMCO at FERMCO
Date: 7/30/99 1:49 PM
Normal
BCC: Diana Sparks at FNUN-01
Kathy Fisher/FERMCO at FERMCO
CC: Jim Turner/FERMCO at FERMCO, Brenda Hoog/FERMCO at FERMCO,
Diana Sparks/FERMCO at FERMCO
Subject: NCR FY99-0920 has been Closed

2741

---------- Message Contents

This NCR has been Closed and all closure documentation has been attached:FY99-0920 (Finding) Maximum Moisture Content Exceeded, 5065-5097 - For the tests and rolls listed, the moisture content was measured at 25.2% (test roll 5073) and 25.7% (test roll 5089), in excess of the maximum moisture content allowable by specification. Therefore, these rolls are not represented by valid test data in accordance with the specification.