4944

CONSTRUCTION QUALITY ASSURANCE
FINAL REPORT

PHASE IV - CELLS 4 AND 5 CONSTRUCTION
ON-SITE DISPOSAL FACILITY

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

prepared by

GEOSYNTEC CONSULTANTS

Fernald Field Office
7400 Willey Road, MS:38
Hamilton, Ohio 45013

under

Fluor Fernald, Inc.
Contract No. 95PS005028

REVISION 0
JUNE 2000
VOLUME

APPENDIX Q

As-Built and Geomembrane Record Drawings

Subgrade

Cell 4

Cell 5

Compacted Clay Liner

Cell 4

Cell 5

Leak Detection System Layer

Cell 4

Cell 5

Leachate Collection System Layer

Cell 4

Cell 5

Protective Layer

Cell 4

Cell 5

Geomembrane Panel Layout

Secondary

Cell 4

Cell 5

Primary

Cell 4

Cell 5

APPENDIX R

HDPE Pipe Test Logs

Butt Fusion Joining

QUALITY EVALUATION PLAN

QEP No. 2016059 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By:	Date:	6. Reviewed By:	Date:
Muriel Vigus	12-23-02	MIKE GODBER	12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 16" SDR#: 11 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MCV 12-26-02		TIME OF TRAIL JOINT: 8:30 None
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MCV 12-26-02		No debris.

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	12-26-02
14. QA Team Coach (Completed QEP):		**Date:**
MIKE GODBER	Michael W. Godber	12/26/02

RECORD

FS-F-4400
REV 2: 01/02/01, QP-07.06

Page 1 of

PAGE 1 OF 6

000055

1-4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. L2016059 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓		FACING PRESSURE : 75psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓		Met.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓		PLATE TEMPERATURE: 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓		HEAT SOAK PRESSURE: Ø Met. Holding heat Soak longer due to Cold Temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓		Met.

RECORD

PAGE 2 OF 6

FS-F-4400
REV 2: 01/02/01, QP-07.08

000056

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016059 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKV 12-26-02		FUSION PRESSURE: 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKV 12-26-02		Cool to touch
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	✓ MKV 12-26-02		Met.
12.	Verify that the test strap is bent such that the ends of the strap touch.	✓ MKV 12-26-02		Met.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	✓ MKV 12-26-02		No disbondment

000057

4944

FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

RECORD PAGE 4 OF 4

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02208-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

PAGE 5 OF 6

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not insert; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from recoiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] the fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which would cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a squarely cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe end. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 6 OF 6

000061

QUALITY EVALUATION PLAN

QEP No. 2016060 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: C-6" TO PIPE#: D-6" NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MG 12-26-02		None
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MG 12-26-02		Clean cloth used.

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	12-26-02
14. QA Team Coach (Completed QEP):		**Date:**
MICHAEL W. GODBER	Michael W. Godber	12/26/02

000062

FS-F-4400
REV 2: 01/02/01, QP-07.06

1-4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. h 2 0 1 6 0 6 0 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		**FACING PRESSURE :** 75 psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKW 12-26-02		Met.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		Alignment is Satisfactory
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKW 12-26-02		**PLATE TEMPERATURE:** 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKW 12-26-02		**HEAT SOAK PRESS:** Ø
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKW 12-26-02		Met. Heat soak is being held longer due to cold Temp.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKW 12-26-02		**FUSION PRESSURE:** 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKW 12-26-02		Met.

000063

4944

FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

PAGE 3 OF 5

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Floor Contract FSC-641
Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02205-006
Reviewed By: RW
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe [illegible]

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. [illegible]

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not insert; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which would cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a shiny cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 5-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 5 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

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QUALITY EVALUATION PLAN

QEP No. 2016061 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6 inch SDR#: 11 IDENTIFY JOINT: PIPE#: D-6" TO PIPE#: E-6" NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKG 12-26-02		425' None.
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKG 12-26-02		no debris

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	12-26-02
14. QA Team Coach (Completed QEP):		**Date:**
MIKE GODBER	Michael W Godber	12/26/02

FS-F-4400
REV 2: 01/02/01, QP-07.06

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016061 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MW 12-26-02		**FACING PRESSURE :** 75 psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MW 12-26-02		Met.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MW 12-26-02		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MW 12-26-02		**PLATE TEMPERATURE:** 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MW 12-26-02		**HEAT SOAK PRESS:** Ø
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MW 12-26-02		Met. Holding heat soak due to cold temps.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MW 12-26-02		**FUSION PRESSURE:** 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MW 12-26-02		Met.

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Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

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ECDC CONTROLLED
COPY NO.
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Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

ubmittal # 641-02205-006
eviewed By: Dwl
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra-caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bend has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 4 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under [illegible]. It is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

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ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Fittings:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

QUALITY EVALUATION PLAN

QEP No. 2016062 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By:	Date:	6. Reviewed By:	Date:
Muriel Vigus	12-23-02	MIKE GODBER	12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: P1-6" TO PIPE#: T1-6" NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKV 12-26-02		None
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKV 12-26-02		Pipe was cleaned with clean cloth. No debris

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus		12-26 MKV-02
14. QA Team Coach (Completed QEP): MIKE GODBER		Date: 12/26/02

FS-F-4400
REV 2: 01/02/01, QP-07.06

Page 1 of 5

RECORD PAGE ___ OF ___

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. h2016062 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		**FACING PRESSURE :** ~~MKW 101~~ 75 psi Met
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKW 12-26-02		Met.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKW 12-26-02		**PLATE TEMPERATURE:** 425° Met
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKW 12-26-02		**HEAT SOAK PRESS:** Ø psi
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKW 12-26-02		Met. Holding heat soak longer due to colder temps.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKW 12-26-02		**FUSION PRESSURE:** 101 psi Met
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKW 12-26-02		Met.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

RECORD
PAGE 2 OF 5

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

ECDC CONTROLLED
COPY NO. 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

ubmittal # 641-02-08-006
eviewed By: Rus
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requiremen
[ ] B - Minor Comment - Incorporate and Resubr
[ ] C - Revise and Resubmit
Sig: Paul Gill Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bend has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 4 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under re[illegible] it is important that the surface melt be obtained quickly it[illegible]o much heat penetration. Otherwise, the pipe may rupture om internal pressure. Consult the manufacturer for specific recom-endations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, uickly examine the pipe and fitting to ensure proper melt atterns, and immediately place the fitting on the pipe. Hold place while exerting suitable force for the specified cooling me.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

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ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected r damage. Polyolefin pipes have reduced impact resistance sub-freezing conditions. Avoid dropping pipe in sub-ezing conditions. When handling coiled pipe at tempera-res below 40°F, it is helpful to uncoil the pipe prior to stallation and let it straighten out. Gradually uncoil the pe and cover it with dirt at intervals to keep it from coil[illegible] Always use caution when cutting the straps on coils p[illegible]cause the outside end of a coil may spring out when e strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Wind and Precipitation*—The heating tool should shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from ad, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe d fitting surfaces to be "joined" or held in clamps should dry and clean and free of ice, frost, snow, dirt, and other ntamination. Regular procedures for preparation of sur-es to be joined, such as facing for butt fusion and ghening for saddle fusion should be emphasized. After paration, the surfaces should be protected from contami-ation until joined. Contamination of the area to be fused l likely cause incomplete fusion. Frost and ice on the faces of the pipe to be clamped in either a cold ring or pment jigs may cause slippage during fusion. Inspect led pipe to see if it has flattened during storage which ld cause incomplete melt pattern or poor fusion. It may necessary to remove several inches at the pipe ends to minate such distortion. Pipe may have a slight toe-in or uced diameter for several inches at the end of the pipe. e toe-in may need to be removed before butt fusing to a hly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have n [illegible]ted from the heating tool, so that melt heat loss is mi[illegible], but still take time (no more than 3 s) to inspect h melt patterns. Keep the heater dry at all times. Check temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring in [illegible] slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store soc[illegible] fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom[illegible]

nended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD
PAGE 5 OF 5

QUALITY EVALUATION PLAN

QEP No. 2016063 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: _____ SDR#: _____ IDENTIFY JOINT: PIPE#: P2-6" TO PIPE#: Elbow 1 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	√ MKG 12-26-02		None
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	√ MKG 12-26-02		no debris

13. QA Team Member (Printed Name): Muriel Vigus (Signature): Muriel Vigus — Date: 12-26-02

14. QA Team Coach (Completed QEP): MIKE GODBER (Signature): Michael W Godber — Date: 12/26/02

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FS-F-4400
REV.2: 01/02/01, QP-07.08

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016063 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		**FACING PRESSURE :** 75 psi Met
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKW 12-26-02		Met
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		Alignment is good.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKW 12-26-02		**PLATE TEMPERATURE:** 425° Met
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKW 12-26-02		**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKW 12-26-02		Met. Holding heat soak longer due to colder temp.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKW 12-26-02		**FUSION PRESSURE:** 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKW 12-26-02		Met.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 2 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager
Soil and Disposal Facility Project
Date

Attachments
WAZ:jkp

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ECDC CONTROLLED
COPY NO. 7117

Floor Contract FSC-641
Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe [illegible]

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. [illegible]

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) during the heating cycle. When the proper melt bend has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 1 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under [illegible], it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] the fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring in normal alignment. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

nended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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PAGE 5 OF 5 RECORD

QUALITY EVALUATION PLAN

QEP No. k2016064 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: P2-6" TO PIPE#: T1-6" NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 26.9° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKG 12-26-02		none
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKG 12-26-02		no debris

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	12-26-02
14. QA Team Coach (Completed QEP):		**Date:**
MIKE GODBER	Michael W Godber	12/26/02

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FS-F-4400
REV 2: 01/02/01, QP-07.06

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016064 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ NKC 12-26-02		**FACING PRESSURE :** 75 psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ NKC 12-26-02		Met.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ NKC 12-26-02		Alignment is good.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ NKC 12-26-02		**PLATE TEMPERATURE:** 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ NKC 12-26-02		**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ NKC 12-26-02		Met. Holding the heat soak longer due to colder temps
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ NKC 12-26-02		**FUSION PRESSURE:** 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ NKC 12-26-02		Met.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 3 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Floor Contract FSC-641
Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

bmittal # 641-02208-006
eviewed By: [illegible]
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate And Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 4 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under [illegible]. It is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from [illegible]. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Tool and Equipment*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is [illegible], but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

QUALITY EVALUATION PLAN

QEP No. 12016065 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: P3-6" TO PIPE#: ~~P4-6"~~ MKV Cap 6" NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 26.9° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKV 12-26-02		None
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKV 12-26-02		No debris

13. QA Team Member (Printed Name) Muriel Vigus (Signature) Muriel Vigus — Date: 12-26-02

14. QA Team Coach (Completed QEP): MIKE GODBER (Signature) Michael W Godber — Date: 12/26/02

FS-F-4400
REV 2: 01/02/01, QP-07.06

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016065 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKW 12-26-03		**FACING PRESSURE :** 75psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKW 12-26-03		MET.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKW 12-26-03		Alignment is good.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKW 12-26-03		**PLATE TEMPERATURE:** 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKW 12-26-03		**HEAT SOAK PRESS:** Ø Met. Holding heat soak longer due to colder temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKW 12-26-03		
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKW 12-26-03		**FUSION PRESSURE:** 101psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKW 12-26-03		Met.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

PAGE 5 OF 5 RECORD

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

Submittal # 641-02-08-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe [illegible]

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. [illegible]

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) [illegible] during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 4 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under [illegible] it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not [illegible] however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected [illegible] damage. Polyolefin pipes have reduced impact resistance [illegible] sub-freezing conditions. Avoid dropping pipe in sub-[illegible]ezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from [illegible]. Always use caution when cutting the straps on coils [illegible] because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion [illegible]*

A1.2.1 *Tool and Equipment*—The heating tool should [illegible] shielded in an insulated container to prevent excessive [illegible] and fusion tools from [illegible] and, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe [illegible]d fitting surfaces to be "joined" or held in clamps should [illegible] dry and clean and free of ice, frost, snow, dirt, and other [illegible]ntamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and [illegible]ughening for saddle fusion should be emphasized. After [illegible]eparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused [illegible]ll likely cause incomplete fusion. Frost and ice on the [illegible]faces of the pipe to be clamped in either a cold ring or [illegible]gnment jigs may cause slippage during fusion. Inspect [illegible]iled pipe to see if it has flattened during storage which [illegible]uld cause incomplete melt pattern or poor fusion. It may [illegible] necessary to remove several inches at the pipe ends to [illegible]minate such distortion. Pipe may have a slight toe-in or [illegible]duced diameter for several inches at the end of the pipe. [illegible]e toe-in may need to be removed before butt fusing to a [illegible]sh cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have [illegible]parated from the heating tool, so that melt heat loss is [illegible]d, but still take time (no more than 3 s) to inspect [illegible]th melt patterns. Keep the heater dry at all times. Check [illegible] temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 5 OF 5

QUALITY EVALUATION PLAN

QEP No. 2016066 Rev. 8

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By:	Date:	6. Reviewed By: MIKE GODBER	Date:
Muriel Vigus	12-23-02		12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: 1-6 TO PIPE#: 4-6 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 26.9° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ 12-26-02		None
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ 12-26-02		no debris

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus		12-26-02
14. QA Team Coach (Completed QEP): MIKE ~~MURIEL~~ ~~GODBER~~		Date: 12/26/02

FS-F-4400
REV 2: 01/02/01, OP-07.C6

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016066 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKU 12-26-00		**FACING PRESSURE :** 75 psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKU 12-26-00		Met.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKU 12-26-00		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKU 12-26-00		**PLATE TEMPERATURE:** 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKU 12-26-00		**HEAT SOAK PRESS:** Ø Met. Holding heat soak longer due to cold temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKU 12-26-00		
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKU 12-26-00		**FUSION PRESSURE:** 101 psi Met
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKU 12-26-00		Met.

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Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 2 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED
COPY NO. 7117

Fluor Contract FSC-641
Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

ubmittal # 641-02-08-006
eviewed By: [illegible]
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bend has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Fittings:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive heat loss. Shield the fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a shiny cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 5-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 5 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

QUALITY EVALUATION PLAN

QEP No. 2016067 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: P3-6" TO PIPE#: T1-6" NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 26.9 WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKV 12-26-02		none
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKV 12-26-02		no debris

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	12-26-02
14. QA Team Coach (Completed QEP):		**Date:**
MIKE GODBER	Michael W. Godber	12/26/02

FS-F-4400
REV 2: 01/02/01, QP-07.06

0001104

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016067 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		**FACING PRESSURE :** 75 psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKW 12-26-02		Met
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKW 12-26-02		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKW 12-26-02		**PLATE TEMPERATURE:** 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKW 12-26-02		**HEAT SOAK PRESS:** Ø Met. Holding heat soak longer due to colder temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKW 12-26-02		
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKW 12-26-02		**FUSION PRESSURE:** 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKW 12-26-02		Met.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED
COPY NO. 7117

Fluor Contract FSC-641
: Enhanced Permanent Leachate
ransmission System Project
STAVER # 7052

bmittal # 641-02-08-006
:yiewed By: Dwl
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirem-n
[ ] B - Minor Comment - Incorporate and Resubr
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra-caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe [illegible]

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS [illegible]

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) [illegible] during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

PAGE 1 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under [illegible], it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected [illegible] damage. Polyolefin pipes have reduced impact resistance [illegible] sub-freezing conditions. Avoid dropping pipe in sub-[illegible]zing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils [illegible] because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion* [illegible]

A1.2.1 *Wind and Precipitation*—The heating tool should [illegible] shielded in an insulated container to prevent excessive [illegible] and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should [illegible] dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 5-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 5 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 5 OF 5

QUALITY EVALUATION PLAN

QEP No. № 2016068 Rev. 8

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: P4-6" TO PIPE#: Elbow 1-6" NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1757 (Standard Fusion Machine) AMBIENT TEMPERATURE: 26.9° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKG 12-26-02		None
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKG 12-26-02		Pipe was cleaned.

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	12-26-02
14. QA Team Coach (Completed QEP): MIKE GODBER	Michael W Godber	Date: 12/26/02

FS-F-4400
REV 2: 01/02/01, QP-07.06

000110

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016068 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	√ MKV 12-26-02		**FACING PRESSURE :** 75 psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	√ MKV 12-26-02		Met
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	√ MKV 12-26-02		Alignment is Satisfactory
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	√ MKV 12-26-02		**PLATE TEMPERATURE:** 425° Met
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	√ MKV 12-26-02		**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	√ MKV 12-26-02		Met. holding heat soak longer due to colder temp.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	√ MKV 12-26-02		**FUSION PRESSURE:** 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	√ MKV 12-26-02		Met.

000111

4944

FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

PAGE 5 OF 5

4944

ECDC CONTROLLED
COPY NO. 7117

Fluor Contract FSC-641
Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

Submittal # 641-02205-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirem
[ ] B - Minor Comment - Incorporate and Resubm
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under re[illegible] it is important that the surface melt be obtained quickly it[illegible] too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not mean however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from co[illegible]. Always use caution when cutting the straps on coils p[illegible] because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been removed from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

000115

QUALITY EVALUATION PLAN

QEP No. № 2016069 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 24° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water. TIME OF TRAIL JOINT: 0830
1.	Verify there are no obstructions inside the pipe.	✓ MVG 12-26-02		No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MVG 12-26-02		no debris

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	12-27-02
14. QA Team Coach (Complete QEP):		**Date:**
MIKE GODBER	Michael W Godber	12/27/02

000116

FS-F-4400
REV 2: 01/02/01, QP-07.06

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QUALITY EVALUATION PLAN
(Continuation Sheet) № 2016069

QEP No. _____ Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKV 12-26-02		**FACING PRESSURE :** 75 psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKV 12-26-02		Met.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKV 12-26-02		Alignment
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKV 12-26-02		**PLATE TEMPERATURE:** 425° Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKV 12-26-02		**HEAT SOAK PRESSURE:** 0 Met. Heat soak is being held longer due to colder temp.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKV 12-26-02		Met

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. _____ Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKU 12-26-02		FUSION PRESSURE: 101 psi Met.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKU 12-26-02		Cool to touch
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	✓ MKU 12-26-02		Met.
12.	Verify that the test strap is bent such that the ends of the strap touch.	✓ MKU 12-26-02		Met.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	✓ MKU 12-26-2		no disbondment

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Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

RECORD PAGE 4 OF 4

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-08-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 5 OF 6

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from recoiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Fittings:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] the fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which would cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a shiny cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent distortion. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

4944

mended by the pipe manufacturer. It will take longer to [illegible]op the initial melt bead completely around the pipe [illegible]. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD
PAGE 6 OF 6

000122

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QUALITY EVALUATION PLAN

QEP No. 2016070 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: 1 TO PIPE#: 2 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 51° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	X NGV 12-31-02		No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	X NGV 12-31-02		Pipe was cleaned, no dust, no debris

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 12-31-02

14. QA Team Coach (Completed QEP): MIKE GODBER — Date: 12-31-02

FS-F-4400
REV 3: 01/02/01, OR 07-06

Page 1 of 5

000123

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2 0 1 6 0 7-0 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	X MKU 12-31-02		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	X MKU 12-31-02		All shavings have been removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	X MKU 12-31-02		Alignment is good.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	X MKU 12-31-02		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	X MKU 12-31-02		**HEAT SOAK PRESS:** Ø
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	X MKU 12-31-02		Bead is Sat.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10 inch SDR11 Fusion Pressure: 218 psi	X MKU 12-31-02		**FUSION PRESSURE:** 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	X MKU 12-31-02		Cool to the touch.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 1 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Floor Contract FSC-641
F Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: Dw
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 4 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Fittings:*

A1.2.1 *Tool and Temperature*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which would cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a shiny cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 2 OF 2

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QUALITY E[illegible]UATION PLAN

QEP No. 2016071 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 33°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	X MKG 1-2-03		TIME OF TRAIL JOINT: 1414 No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	X MKG 1-2-03		Pipe was cleaned with clean cloth, no dust, no debris

13. QA Team Member (Printed Name) Muriel Vigus (Signature) Muriel Vigus — Date: 1-2-03

14. QA Team Coach (Completed QEP): MIKE GODBER (Signature) Mike Godber — Date: 1-2-03

FS-F-4400
REV 2: 01/02/01, QP-07.08

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No № 2016071 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	1. Status SAT	1. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 8 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	X NKU 1-2-03		**FACING PRESSURE :** 75 psi Facing is Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	X NKU 1-2-03		All shavings were removed
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced	X NKU 1-2-03		Alignment is good
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	X NKU 1-2-03		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	X NKU 1-2-03		**HEAT SOAK PRESSURE:** 0 Heat soak was held longer due to colder temperatures.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	X NKU 1-2-03		Bead is Sat.

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016071 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi HDPE DUAL CONTAINMENT 6/10 218 PSI	X NEI 1-2-03		FUSION PRESSURE: 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	X NEI 1-2-03		Sat Pipe is cool to the touch
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	X NEI 1-2-03		Strap is Sat.
12.	Verify that the test strap is bent such that the ends of the strap touch.	X NEI 1-2-03		Sat.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	X NEI 1-2-03		There was no disbondment.

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Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

PAGE 4 OF 4 RECORD

4944

ECDC CONTROLLED
COPY NO.: 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

Submittal # 641-02-08-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

(0 psi) mwb

FUSION: Pressure will not be increased during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under ressure, it is important that the surface melt be obtained quickly ithout too much heat penetration. Otherwise, the pipe may rupture om internal pressure. Consult the manufacturer for specific recomendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, uickly examine the pipe and fitting to ensure proper melt atterns, and immediately place the fitting on the pipe. Hold i place while exerting suitable force for the specified cooling me.

NOTE 10—If a suitable melt pattern has not been achieved, do not eat; however, continue with the fusion and apply the fitting to the pe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected r damage. Polyolefin pipes have reduced impact resistance sub-freezing conditions. Avoid dropping pipe in subezing conditions. When handling coiled pipe at temperres below 40°F, it is helpful to uncoil the pipe prior to stallation and let it straighten out. Gradually uncoil the pe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils pipe because the outside end of a coil may spring out when strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Wind and Precipitation*—The heating tool should shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from od, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe d fitting surfaces to be "joined" or held in clamps should dry and clean and free of ice, frost, snow, dirt, and other ntamination. Regular procedures for preparation of surces to be joined, such as facing for butt fusion and ughening for saddle fusion should be emphasized. After eparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused l likely cause incomplete fusion. Frost and ice on the faces of the pipe to be clamped in either a cold ring or nment jigs may cause slippage during fusion. Inspect iled pipe to see if it has flattened during storage which uld cause incomplete melt pattern or poor fusion. It may necessary to remove several inches at the pipe ends to minate such distortion. Pipe may have a slight toe-in or tuced diameter for several inches at the end of the pipe. e toe-in may need to be removed before butt fusing to a shly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting ave en separated from the heating tool so that melt heat loss is nimized, but still take time (no more than 3 s) to inspect th melt patterns. Keep the heater dry at all times. Check temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3–5 longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to [illegible]op the initial melt bead completely around the pipe [illegible]. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 6 OF 6

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QUALITY EVALUATION PLAN

QEP No. № 2016072 Rev. 8

HAS BEEN SCANNED

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: 2 TO PIPE#: 3 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: ~~32~~ 33° MKG 1-2-03 WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKG 1-2-03		No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKG 1-2-03		Pipe is Satisfactory

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus		1-2-03
14. QA Team Coach (Completed QEP): MIKE GODBER		Date: 1-02-03

FS-F-4400
REV 2: 01/02/01, QP-07.06

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016072 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	X MKC 1-2-03		FACING PRESSURE : 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	X MKC 1-2-03		All shavings have been removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	X MKC 1-2-03		Alignment is good.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	X MKC 1-2-03		PLATE TEMPERATURE: 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	X MKC 1-2-03		HEAT SOAK PRESS: 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	X MKC 1-2-03		Heat was held longer due to the colder temps Bead is Sat.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 6/10 INCH SDR 11 DUAL CONTAINMENT 218PSI	X MKC 1-2-03		FUSION PRESSURE: 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	X MKC 1-2-03		Cool to the touch.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 3 of 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

ubmittal # 641-02-05-006
eviewed By: [illegible]
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requiremen
[ ] B - Minor Comment - Incorporate and Resubi
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pr[illegible] it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

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ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected r damage. Polyolefin pipes have reduced impact resistance sub-freezing conditions. Avoid dropping pipe in sub-eezing conditions. When handling coiled pipe at tempera-res below 40°F, it is helpful to uncoil the pipe prior to stallation and let it straighten out. Gradually uncoil the pe and cover it with dirt at intervals to keep it from co[illegible]. Always use caution when cutting the straps on coils [illegible] because the outside end of a coil may spring out when e strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Tool and Equipment*—The heating tool should shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from nd, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe d fitting surfaces to be "joined" or held in clamps should dry and clean and free of ice, frost, snow, dirt, and other ntamination. Regular procedures for preparation of sur-es to be joined, such as facing for butt fusion and ughening for saddle fusion should be emphasized. After eparation, the surfaces should be protected from contami-nation until joined. Contamination of the area to be fused ll likely cause incomplete fusion. Frost and ice on the rfaces of the pipe to be clamped in either a cold ring or gnment jigs may cause slippage during fusion. Inspect iled pipe to see if it has flattened during storage which uld cause incomplete melt pattern or poor fusion. It may necessary to remove several inches at the pipe ends to minate such distortion. Pipe may have a slight toe-in or duced diameter for several inches at the end of the pipe. e toe-in may need to be removed before butt fusing to a hly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have [illegible] from the heating tool, so that melt heat loss is [illegible]ed, but still take time (no more than 3 s) to inspect th melt patterns. Keep the heater dry at all times. Check e temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as [illegible]

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

PAGE 5 OF 5

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QUALITY EVALUATION PLAN

QEP No. № 2016073 Rev. 8

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: 3 TO PIPE#: ~~4~~ 5 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 33°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKV 1-2-03		No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKV 1-2-03		Pipe is clean and satisfactory

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 1-2-03

14. QA Team Coach (Completed QEP): MIKE GODBER — Date: 1/02/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

Page 5

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016073 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKW 1-2-03		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKW 1-2-03		All shavings were removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKW 1-2-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKW 1-2-03		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKW 1-2-03		**HEAT SOAK PRESS:** Ø Heat was held longer due to colder temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKW 1-2-03		Bead is good.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 6/10 INCH SDR11 FUSION PRESSURE 218PSI	✓ MKW 1-2-03		**FUSION PRESSURE:** 218psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKW 1-2-03		Cool to the touch

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Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

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Chuck Van Arsdale, MS64
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c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

RECORD
PAGE 2 OF 5

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

ubmittal # 641-02-05-006
Reviewed By: Rus
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[x] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 4 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under [illegible] it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

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ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected [illegible] damage. Polyolefin pipes have reduced impact resistance [illegible] sub-freezing conditions. Avoid dropping pipe in sub-[illegible]zing conditions. When handling coiled pipe at tempera-[illegible]res below 40°F, it is helpful to uncoil the pipe prior to [illegible]stallation and let it straighten out. Gradually uncoil the [illegible]e and cover it with dirt at intervals to keep it from [illegible] Always use caution when cutting the straps on coils [illegible] because the outside end of a coil may spring out when [illegible] strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion* [illegible]

[illegible] *Wind and Precipitation*—The heating tool should [illegible] shielded in an insulated container to prevent excessive [illegible] and fusion tools from [illegible]nd, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe [illegible]d fitting surfaces to be "joined" or held in clamps should [illegible] dry and clean and free of ice, frost, snow, dirt, and other [illegible]ntamination. Regular procedures for preparation of sur-[illegible]es to be joined, such as facing for butt fusion and [illegible]ughening for saddle fusion should be emphasized. After [illegible]eparation, the surfaces should be protected from contami-[illegible]tion until joined. Contamination of the area to be fused [illegible]ll likely cause incomplete fusion. Frost and ice on the [illegible]rfaces of the pipe to be clamped in either a cold ring or [illegible]gnment jigs may cause slippage during fusion. Inspect [illegible]iled pipe to see if it has flattened during storage which [illegible]uld cause incomplete melt pattern or poor fusion. It may [illegible] necessary to remove several inches at the pipe ends to [illegible]minate such distortion. Pipe may have a slight toe-in or [illegible]uced diameter for several inches at the end of the pipe. [illegible] toe-in may need to be removed before butt fusing to a [illegible]hly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have [illegible]rated from the heating tool, so that melt heat loss is [illegible]d, but still take time (no more than 3 s) to inspect [illegible]th melt patterns. Keep the heater dry at all times. Check [illegible] temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 5 OF 5

QUALITY EVALUATION PLAN

QEP No. № 2016074 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/4 Dual SDR#: 11 NAME OF JOINER: Sullivan FUSION MACHINE #: 1327 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓MGW 1-3-03		TIME OF TRAIL JOINT: 0830 no obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓MGW 1-3-03		Pipe is Sat.

13. QA Team Member (Printed Name) Muriel Vigus	(Signature) Muriel Vigus	Date: 1-3-03
14. QA Team Coach (Completed QEP): MIKE GODBER	Michael W Godber	Date: 1/03/03

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FS-F-4400
REV 2: 01/02/01, QP-07.06

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2 - - - 7 4 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKU 1-3-03		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKU 1-3-03		All shavings removed
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKU 1-3-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKU 1-3-03		**PLATE TEMPERATURE:** 425°F Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKU 1-3-03		**HEAT SOAK PRESSURE:** Ø Heat was held longer due to colder temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKU 1-3-03		Bead is Sat.

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016074 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 6/10 INCH SDR 11 Fusion Pressure: 218 psi	✓ MKG 1-3-03		FUSION PRESSURE: 218 psi Sat.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKG 1-3-03		Cool to the touch.
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	✓ MKG 1-3-03		Strap is Sat.
12.	Verify that the test strap is bent such that the ends of the strap touch.	✓ MKG 1-3-03		Bend is Sat.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	✓ MKG 1-3-03		No disbondment

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

RECORD PAGE 1 OF 1

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

ECDC CONTROLLED COPY NO.: 7117

Fluor Contract FSC-641
Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: DW
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under ressure, it is important that the surface melt be obtained quickly ithout too much heat penetration. Otherwise, the pipe may rupture om internal pressure. Consult the manufacturer for specific recomendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, uickly examine the pipe and fitting to ensure proper melt atterns, and immediately place the fitting on the pipe. Hold place while exerting suitable force for the specified cooling me.

NOTE 10—If a suitable melt pattern has not been achieved, do not ent; however, continue with the fusion and apply the fitting to the pe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected damage. Polyolefin pipes have reduced impact resistance sub-freezing conditions. Avoid dropping pipe in subezing conditions. When handling coiled pipe at temperres below 40°F, it is helpful to uncoil the pipe prior to stallation and let it straighten out. Gradually uncoil the e and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils pipe because the outside end of a coil may spring out when strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Wind and Precipitation*—The heating tool should shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from d, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe d fitting surfaces to be "joined" or held in clamps should dry and clean and free of ice, frost, snow, dirt, and other ntamination. Regular procedures for preparation of surces to be joined, such as facing for butt fusion and ughening for saddle fusion should be emphasized. After eparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused l likely cause incomplete fusion. Frost and ice on the faces of the pipe to be clamped in either a cold ring or gnment jigs may cause slippage during fusion. Inspect iled pipe to see if it has flattened during storage which uld cause incomplete melt pattern or poor fusion. It may necessary to remove several inches at the pipe ends to minate such distortion. Pipe may have a slight toe-in or duced diameter for several inches at the end of the pipe. e toe-in may need to be removed before butt fusing to a shiv cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have en separated from the heating tool, so that melt heat loss is nimized, but still take time (no more than 3 s) to inspect th melt patterns. Keep the heater dry at all times. Check temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to [illegible]op the initial melt bead completely around the pipe [illegible] Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

PAGE 6 OF 6
#5208

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QUALITY EVALUATION PLAN

QEP No. 2016075 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104	4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: 8 TO PIPE#: 9 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MG 1-3-03		no obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MG 1-3-03		Pipe is clean and free of dust and debris

13. QA Team Member (Printed Name) Muriel Vigus	(Signature) Muriel Vigus	Date: 1-3-03
14. QA Team Coach (Completed QEP): MIKE GODBERT	Michael W Godbert	Date: 1/03/03

FS-F-4400
REV 2: 01/02/01, QP-07.08

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2 0 1 0 7 5 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKW 1-3-03		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKW 1-3-03		All shavings were removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKW 1-3-03		Alignment is good.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKW 1-3-03		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKW 1-3-03		**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKW 1-3-03		Heat soak is longer due to colder temps Bead is good.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10/6 INCH SDR11 FUSION PRESSURE: 218PSI	✓ MKW 1-3-03		**FUSION PRESSURE:** 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKW 1-3-03		Cool to the touch.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

PAGE 3 OF 5 RECORD

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

PAGE 1 OF 5

NOTE 9—When saddle fittings are fused to pipes that are under [illegible], it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Tool and Equipment*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a shiny cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to ensure clearance. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 5 OF 5

000160

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QUALITY EVALUATION PLAN

QEP No. № 2016076 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR#: 11 IDENTIFY JOINT: PIPE#: Horizontal Solid Pipe TO PIPE#: Horizontal 6" perforated pipe in the trench NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MGV 1-3-03		No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MGV 1-3-03		Pipe is Sat.

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 1-3-03

14. QA Team Coach (Completed QEP): MIKE GODBER — Date: 1/03/03

FS-F-4400 Page 1 of 5

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QUALITY EVALUATION PLAN
(Continuation Sheet) № 2016076

QEP No. _____ Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKV 1-3-03		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKV 1-3-03		Shavings have been removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKV 1-3-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKV 1-3-03		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKV 1-3-03		**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKV 1-3-03		Heat soak is longer due to the colder temps. Bead is Sat. MKV 1-3-03
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKV 1-3-03		**FUSION PRESSURE:** ~~218 psi~~ 101 MKV 1-3-03
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKV 1-3-03		Cool to the touch

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FS-F-4400

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-08-006
Reviewed By: DW
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not [illegible] however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Tool and Equipment*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] the fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which would cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a squaring cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

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QUALITY EVALUATION PLAN

QEP No. 2016077 Rev. 8

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 6" SDR: 11 IDENTIFY JOINT: PIPE#: Horizontal 6" solid TO PIPE#: Horizontal 6" solid NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MV 1-3-03		No obstructions in the pipe
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MV 1-3-03		Pipe is clean.

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 1-3-03

14. QA Team Coach (Completed QEP): MIKE GODBER — Date: 1/03/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

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QUALITY EVALUATION PLAN

(Continuation Sheet)

QEP No. № 2016077 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 75 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKV 1-3-03		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKV 1-3-03		All shavings removed
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKV 1-3-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKV 1-3-03		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKV 1-3-03		**HEAT SOAK PRESS:** 0 Heat was held longer due to colder temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKV 1-3-03		Bead is Sat. MKV 1-3-03
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi	✓ MKV 1-3-03		**FUSION PRESSURE:** ~~118~~ 101 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MKV 1-3-03		Cool to the touch.

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FS-F-4400
REV 2: 01/02/01, QP-07.08

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 3 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: Rus
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requirements
[ ] B - Major Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra-caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture under internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

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ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a shiny cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

000172

QUALITY EVALUATION PLAN

QEP No. № 2016078 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 39.5°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MGV 1-8-03		TIME OF TRAIL JOINT: 0952 No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MGV 1-8-03		Pipe is clean.

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	1-8-03
14. QA Team Coach (Completed QEP):		**Date:**
MIKE GODBER	Michael W Godber	1/08/03

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T-4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016078 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MKV 1-8-03		FACING PRESSURE : 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MKV 1-8-03		Shavings removed from pipe.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MKV 1-8-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MKV 1-8-03		PLATE TEMPERATURE: 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MKV 1-8-03		HEAT SOAK PRESSURE: 0 Sat.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MKV 1-8-03		Bead is satisfactory.

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016078 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10 inch SDR 11 Fusion Pressure: 218 psi	✓ NKG 1-8-03		FUSION PRESSURE: 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ NKG 1-8-03		Cool to touch.
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	✓ NKG 1-8-03		Strap is Sat.
12.	Verify that the test strap is bent such that the ends of the strap touch.	✓ NKG 1-8-03		Sat.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	✓ NKG 1-8-03		No disbondment

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

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ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02208-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirem-n
[ ] B - Minor Comment - Incorporate And Resubm
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not remove; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Tool and Equipment*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a thin cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe end. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 6 OF 6

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QUALITY EVALUATION PLAN

QEP No. № 2016079 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: 9 TO PIPE#: 6 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 39.5 WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MG 1-8-03		No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to fusing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MG 1-8-03		Pipe is sat.

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 1-8-03

14. QA Team Coach (Completed QEP): MIKE GODBER — Date: 1/8/03

ES-F-4400 Page 1 of 5

000180

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. #2016078 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be reface.	✓ MCG 1-8-03		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MCG 1-8-03		Shavings were removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MCG 1-8-03		Alignment of pipe is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MCG 1-8-03		**PLATE TEMPERATURE:** 425°
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MCG 1-8-03		Sat. **HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#	✓ MCG 1-8-03		Sat Bead is good.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 6/10 INCH SDR11 FUSION PRESSURE 218 PSI	✓ MCG 1-8-03		**FUSION PRESSURE:** 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamp **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MCG 1-8-03		Cool to the touch.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

PAGE 3 OF 5 RECORD

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

ubmittal # 641-02-08-006
eviewed By: Rus
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[4] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 4 OF 5

4944

NOTE 9—When saddle fittings are fused to pipes that are under [illegible] it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a newly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have separated from the heating tool, so that melt heat loss is [illegible], but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as reco[illegible]

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mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

3

QUALITY EVALUATION PLAN

QEP No. 2016080 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: 6 TO PIPE#: 10 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 51.8° WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MV 1-8-03		no obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to fusing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MV 1-8-03		pipe is sat.

13. QA Team Member (Printed Name) Muriel Vigus (Signature) Muriel Vigus — Date: 1-8-03

14. QA Team Coach (Completed QEP): MIKE GODBER (Signature) Michael U Godber — Date: 1/08/03

FS-F-4400

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016080 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Technique: Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 75 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. NOTE: After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ NKV 1-8-03		FACING PRESSURE: 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ NKV 1-8-03		Shavings have been removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. NOTE: If there is realignment the pipe shall be refaced.	✓ NKV 1-8-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. NOTE: The heater plate shall be cleaned with a clean oil free cloth.	✓ NKV 1-8-03		PLATE TEMPERATURE: 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ NKV 1-8-03		HEAT SOAK PRESS: 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. NOTE: The heat time is dependent on pipe diameter and SDR#.	✓ NKV 1-8-03		Sat. Bead is Sat.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 6/10 INCH SDR11 FUSION PRESSURE 218 PSI	✓ NKV 1-8-03		FUSION PRESSURE: 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. NOTE: The required cooling time is achieved when the joint is cool to the touch.	✓ NKV 1-8-03		Cool to the touch

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Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager
Soil and Disposal Facility Project
Date

Attachments
WAZ:jkp

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ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02205-006
Reviewed By: Dus
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture under internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Fittings:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] the fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring in normal clamps. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 5 OF 5

4

QUALITY EVALUATION PLAN

QEP No. 2016081 Rev. 8

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 SDR#: 11 IDENTIFY JOINT: PIPE#: 11 TO PIPE#: 12 NAME OF JOINER: Sullivan FUSION MACHINE #: 1227 (Standard Fusion Machine) AMBIENT TEMPERATURE: 51.9 WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ NC 1-8-03		No obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to fa ng. Cleaning should extend approximately one inch beyo ıd the fa:e of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ NC 1-8-03		Pipe is clean and free of dust and debris

13. QA Team Member (Printed Name) Muriel Vigus (Signature) Muriel Vigus — Date: 1-8-03

14. QA Team Coach (Completed QEP): MIKE GODBER Michael W. Godber — Date: 1/8/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

Page 1 of 5

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QUALITY EVALUATI ON PLAN
(Continuation Sh et)

Q :P No. 20160.81 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, nspection/Test/Examination Techniques, Accepta e Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pres ure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the ipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi nd the cutting wheel shall continue to rotate to ut the ribb ons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	NKI 1-8-03		**FACING PRESSURE :** 75 psi Facing is Sat
4.	Verify all shavings are removed from the facing and the pipe to assure that e shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	NKI 1-8-03		All shavings have been removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	NKI 1-8-03		Alignment of pipe is satisfactory
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	NKI 1-8-03		**PLATE TEMPERATURE:** 425°
7.	Verify the heater plate is inserted into the machine and the pipe ends are br ught into firm contact with the plate. The pipe shall be under zero pressure when bei g heated.	NKI 1-8-03		Sat. **HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to r noving the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	NKI 1-8-03		Sat. Bead is satisfactory
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool 6 INCH SDR 11 FUSION PRESSURE: 101 psi 16 INCH SDR 11 FUSION PRESSURE: 218 PSI	NKI 1-8-03		**FUSION PRESSURE:** 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the to ch.	NKI 1-8-03		Cool to the touch.

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Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

PAGE 3 OF 5

4944

ECDC CONTROLLED COPY NO.: 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate
Transmission System Project
STAVER # 7052

ubmittal # 641-02-05-006
eviewed By: [illegible]
ate: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[✓] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra-caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bend has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

000197

QUALITY EVALUATION PLAN

QEP No. 2016082 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By:	Date:	6. Reviewed By:	Date:
Muriel Vigus	12-23-02	MIKE GODBER	12/23/02
7. NDE Level III: (When Required)	**Date:**	**8. Approved By:** (When Required)	**Date:**
N/A		N/A	

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 NAME OF JOINER: Sullivan FUSION MACHINE #: 1231 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MKG 1-13-03		TIME OF TRAIL JOINT: 0830 Sat.
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MKG 1-13-03		Sat.

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus		1-13-03
14. QA Team Coach (Completed QEP):		**Date:**
MIKE GODBER		1/13/03

FS-F-4400
REV 2: 01/02/01, QP-07.08

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2 0 1 6 0 8 2 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	NKW 1-13-03		FACING PRESSURE : 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	NKW 1-13-03		Sat.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	NKW 1-13-03		Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	NKW 1-13-03		PLATE TEMPERATURE: 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	NKW 1-13-03		HEAT SOAK PRESSURE: 0 Heat was held longer due to colder temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	NKW 1-13-03		Bead is Sat.

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016082 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10 inch SDR 11 Fusion Pressure: 218 psi	✓ MW 1-13-03		FUSION PRESSURE: 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MW 1-13-03		Sat. Sat.
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	MW 1-13-03		Sat.
12.	Verify that the test strap is bent such that the ends of the strap touch.	MW 1-13-03		Sat.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	✓ MW 1-13-03		Sat.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 1 OF 6

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[4A] - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

RECORD PAGE 2 OF 6

NOTE 9—When saddle fittings are fused to pipes that are under ressure, it is important that the surface melt be obtained quickly ithout too much heat penetration. Otherwise, the pipe may rupture om internal pressure. Consult the manufacturer for specific recom-ndations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, uickly examine the pipe and fitting to ensure proper melt atterns, and immediately place the fitting on the pipe. Hold place while exerting suitable force for the specified cooling me.

NOTE 10—If a suitable melt pattern has not been achieved, do not ment; however, continue with the fusion and apply the fitting to the pe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

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ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected r damage. Polyolefin pipes have reduced impact resistance sub-freezing conditions. Avoid dropping pipe in sub-ezing conditions. When handling coiled pipe at tempera-res below 40°F, it is helpful to uncoil the pipe prior to stallation and let it straighten out. Gradually uncoil the pe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils pipe because the outside end of a coil may spring out when e strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Tool and Equipment*—The heating tool should shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from nd, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe d fitting surfaces to be "joined" or held in clamps should dry and clean and free of ice, frost, snow, dirt, and other ntamination. Regular procedures for preparation of sur-es to be joined, such as facing for butt fusion and ghening for saddle fusion should be emphasized. After eparation, the surfaces should be protected from contami-non until joined. Contamination of the area to be fused il likely cause incomplete fusion. Frost and ice on the faces of the pipe to be clamped in either a cold ring or gnment jigs may cause slippage during fusion. Inspect led pipe to see if it has flattened during storage which uld cause incomplete melt pattern or poor fusion. It may necessary to remove several inches at the pipe ends to minate such distortion. Pipe may have a slight toe-in or luced diameter for several inches at the end of the pipe. e toe-in may need to be removed before butt fusing to a shly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have en separated from the heating tool, so that melt heat loss is nimized, but still take time (no more than 3 s) to inspect th melt patterns. Keep the heater dry at all times. Check temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to [illegible]p the initial melt bead completely around the pipe [illegible]Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 6 OF 6

QUALITY EVALUATION PLAN

QEP No. № 2016083 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: 12 TO PIPE#: 14 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	✓ MC 1-13-03		no Obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MC 1-13-03		Pipe is clean

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	1-13-03
14. QA Team Coach (Completed QEP): MIKE GODBER	Michael W. Godber	Date: 1/13/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2 0 1 6 0 8 3 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ MW 1-13-03		**FACING PRESSURE :** 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ MW 1-13-03		Shavings removed
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ MW 1-13-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ MW 1-13-03		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ MW 1-13-03		**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ MW 1-13-03		Heat longer due to colder temps. Bead is good.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 1(psi 10/6 INCH SDR 11 FUSION PRESSURE: 218 PSI	✓ MW 1-13-03		**FUSION PRESSURE:** 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ MW 1-13-03		Cool to the touch.

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

PAGE 3 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Fluor Contract FSC-641
Of Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

CÓLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under [illegible] it is important that the surface melt be obtained quickly [illegible] too much heat penetration. Otherwise, the pipe may rupture [illegible] internal pressure. Consult the manufacturer for specific recom-[illegible]endations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, [illegible]uickly examine the pipe and fitting to ensure proper melt [illegible]atterns, and immediately place the fitting on the pipe. Hold [illegible] place while exerting suitable force for the specified cooling [illegible]me.

NOTE 10—If a suitable melt pattern has not been achieved, do not [illegible]eat; however, continue with the fusion and apply the fitting to the [illegible]e. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected [illegible] damage. Polyolefin pipes have reduced impact resistance [illegible] sub-freezing conditions. Avoid dropping pipe in sub-[illegible]ezing conditions. When handling coiled pipe at tempera-[illegible]res below 40°F, it is helpful to uncoil the pipe prior to [illegible]stallation and let it straighten out. Gradually uncoil the [illegible]e and cover it with dirt at intervals to keep it from [illegible] Always use caution when cutting the straps on coils [illegible]ecause the outside end of a coil may spring out when [illegible] strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion* [illegible]

A1.2.1 *Wind and Precipitation*—The heating tool should [illegible] shielded in an insulated container to prevent excessive [illegible] and fusion tools from [illegible]nd, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe [illegible]d fitting surfaces to be "joined" or held in clamps should [illegible] dry and clean and free of ice, frost, snow, dirt, and other [illegible]ntamination. Regular procedures for preparation of sur-[illegible]es to be joined, such as facing for butt fusion and [illegible]ughening for saddle fusion should be emphasized. After [illegible]paration, the surfaces should be protected from contami-[illegible]ion until joined. Contamination of the area to be fused [illegible]l likely cause incomplete fusion. Frost and ice on the [illegible]faces of the pipe to be clamped in either a cold ring or [illegible]gnment jigs may cause slippage during fusion. Inspect [illegible]lled pipe to see if it has flattened during storage which [illegible]uld cause incomplete melt pattern or poor fusion. It may [illegible] necessary to remove several inches at the pipe ends to [illegible]minate such distortion. Pipe may have a slight toe-in or [illegible]duced diameter for several inches at the end of the pipe. [illegible]e toe-in may need to be removed before butt fusing to a [illegible]shly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have [illegible]parated from the heating tool, so that melt heat loss is [illegible]d, but still take time (no more than 3 s) to inspect [illegible]th melt patterns. Keep the heater dry at all times. Check [illegible] temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as reco[illegible]

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 5 OF 5

000210

3

QUALITY EVALUATION PLAN

QEP No. № 2016084 Rev. 8

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Technique, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/16 Dual SDR#: 11			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
	IDENTIFY JOINT: PIPE#: 14 TO PIPE#: ~~1237~~ 13 MVG 1-13-03			
	NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine)			
	AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION [ ] yes [X] no			
1.	Verify there are no obstructions inside the pipe.	✓ MVG 1-13-03		no obstructions
2.	Verify the pipe is cleaned with a clear oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	✓ MVG 1-13-03		pipe is free of dust and debris

13. QA Team Member (Printed Name) Muriel Vigus (Signature) Muriel Vigus — Date: 1-13-03

14. QA Team Coach (Completed QEP): MIKE GODBER (Signature) Michael W Godber — Date: 1/13/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

000211

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No 2016084 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	✓ NW 1-13-03		FACING PRESSURE : 75 psi Sat.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	✓ NW 1-13-03		Sat.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	✓ NW 1-13-03		Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	✓ NW 1-13-03		PLATE TEMPERATURE: 425° Sat
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	✓ NW 1-13-03		HEAT SOAK PRESS: 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	✓ NW 1-13-03		Heat was held longer due to bead formation. Bead is Sat.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10/6 INCH SDR 11 FUSION PRESSURE: 218 PSI	✓ NW 1-13-03		FUSION PRESSURE: 218 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	✓ NW 1-13-03		Cool to touch test.

000212

4944

FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

RECORD PAGE 33 OF 75

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02205-006
Reviewed By: [illegible]
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [illegible] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe [illegible]

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS [illegible]

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) [illegible] during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not [illegible]; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Fittings:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] the fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which would cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to correct slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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PAGE 5 OF 5

000216

QUALITY EVALUATION PLAN

QEP No. № 2016085 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL JOINING

3. Project/Task: OSDF PHASE IV, 20104		4. Specification/Drawing/PO/Req.: SPEC SECTION 2605	
5. Prepared By: Muriel Vigus	Date: 12-23-02	6. Reviewed By: MIKE GODBER	Date: 12/23/02
7. NDE Level III: (When Required) N/A	Date:	8. Approved By: (When Required) N/A	Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water. TIME OF TRAIL JOINT: 13:10
1.	Verify there are no obstructions inside the pipe.	X MKG 1-14-03		Met
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	X MKG 1-14-03		Met

13. QA Team Member (Printed Name)	(Signature)	Date:
Muriel Vigus	Muriel Vigus	1-14-03
14. QA Team Coach (Completed QEP):		**Date:**
MIKE GODBER	Michael W. Godber	1/14/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

000217

7-4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2 0 1 6 0 8 5 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	X MKU 1-18-03 14		**FACING PRESSURE :** 75psi Met.
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	X MKU 1-14-03		Sat.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	X MKU 1-14-03		Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	X MKU 1-14-03		**PLATE TEMPERATURE:** 425° Sat.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	X MKU 1-14-03		**HEAT SOAK PRESSURE:** 0 Heat Soak is longer due to colder temps.
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	X MKU 1-14-03		Sat.

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016085 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10 inch SDR 11 Fusion Pressure: 218psi	X MKV 1-14-03		FUSION PRESSURE: 218psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	X MKV 1-14-03		Cool to touch.
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	X MKV 1-14-03		Sat.
12.	Verify that the test strap is bent such that the ends of the strap touch.	X MKV 1-14-03		Sat.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	X MKV 1-14-03		There is no disbondment

000219

4944

FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

RECORD PAGE 4 OF 6

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO.: 7117

Fluor Contract FSC-641
F Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

ubmittal # 641-02205-006
eviewed By: Dwl
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: Neal Griffin Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ EPLTS Job Specifications no welding will occur in periods of precipitation. mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

PAGE 5 OF 6

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from coiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which would cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect the melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to correct dimensions. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reaffirmed or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

RECORD PAGE 6 OF 6

QUALITY EVALUATION PLAN

QEP No. № 2016086 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: VH-6 LCS TO PIPE# 11, 12, 14 and 13 NAME OF JOINER: Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 25°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	X MKV 1-15-03		Met
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	X MKV 1-15-03		Met

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 1-14-03

14. QA Team Coach (Completed QEP): MIKE GODBER — Date: 1/14/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

000224

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. h 2 0 1 6 0 8 6 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.			**FACING PRESSURE :** 75 psi Drag 175 psi
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.			Shavings removed
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.			Alignment is sat
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.			**PLATE TEMPERATURE:** 425°F
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.			**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.			Heat was held longer due to the colder temps.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10/6 INCH SDR11 FUSION PRESSURE 218 PSI			**FUSION PRESSURE:** 218 psi Drag 252 psi
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.			Cool to touch.

000225

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FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

RECORD PAGE 3 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager
Soil and Disposal Facility Project
Date

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
DF Enhanced Permanent Leachate Transmission System Project
STAVER # 7052

Submittal # 641-02-05-006
Reviewed By: Dw
Date: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[X] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

PAGE 4 OF 5 RECORD

NOTE 9—When saddle fittings are fused to pipes that are under re[illegible] it is important that the surface melt be obtained quickly i[illegible] too much heat penetration. Otherwise, the pipe may rupture om internal pressure. Consult the manufacturer for specific recom-endations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, uickly examine the pipe and fitting to ensure proper melt atterns, and immediately place the fitting on the pipe. Hold place while exerting suitable force for the specified cooling me.

NOTE 10—If a suitable melt pattern has not been achieved, do not ear; however, continue with the fusion and apply the fitting to the oe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected r damage. Polyolefin pipes have reduced impact resistance sub-freezing conditions. Avoid dropping pipe in sub-ezing conditions. When handling coiled pipe at tempera-es below 40°F, it is helpful to uncoil the pipe prior to stallation and let it straighten out. Gradually uncoil the pe and cover it with dirt at intervals to keep it from coi[illegible]. Always use caution when cutting the straps on coils [illegible] because the outside end of a coil may spring out when e strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion*

A1.2.1 *Wind and Precipitation*—The heating tool should shielded in an insulated container to prevent excessive [illegible] and fusion tools from nd, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe d fitting surfaces to be "joined" or held in clamps should dry and clean and free of ice, frost, snow, dirt, and other ntamination. Regular procedures for preparation of sur-es to be joined, such as facing for butt fusion and ughening for saddle fusion should be emphasized. After eparation, the surfaces should be protected from contami-tion until joined. Contamination of the area to be fused ll likely cause incomplete fusion. Frost and ice on the faces of the pipe to be clamped in either a cold ring or gnment jigs may cause slippage during fusion. Inspect iled pipe to see if it has flattened during storage which uld cause incomplete melt pattern or poor fusion. It may necessary to remove several inches at the pipe ends to minate such distortion. Pipe may have a slight toe-in or duced diameter for several inches at the end of the pipe. e toe-in may need to be removed before butt fusing to a sniv cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have en[illegible]rated from the heating tool, so that melt heat loss is n[illegible]d, but still take time (no more than 3 s) to inspect th melt patterns. Keep the heater dry at all times. Check e temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store soc[illegible] fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 5 OF 5

000229

QUALITY EVALUATION PLAN

QEP No. 2016087 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- TRIAL OILING

3. Project/Task: OSDF PHASE IV, 20104

Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 16/6 Dual SDR# 11			
	NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine)			**ACCEPTABLE WEATHER CONDITIONS**
	AMBIENT TEMPERATURE: 22°F WEATHER CONDITIONS: FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			• Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	X MKV 1-15-03		TIME OF TRAIL JOINT: 0930 Met
2.	Verify the pipe is cleaned with a clean oil free rag prior to facing. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind	X MKV 1-15-03		Met

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 1-15-03

14. QA Team Coach (Completed QEP): MUBEL VIGUS — Date: 1/15/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

000230

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2 0 1 6 0 8 7 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	X MKU 1-15-03		**FACING PRESSURE :** 75 psi Met
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	X MKU 1-15-03		All shavings have been removed
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	X MKU 1-15-03		Alignment is Sat.
6.	Verify the heater plate is between 400°F and 425°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	X MKU 1-15-03		**PLATE TEMPERATURE:** 425° MKU Met.
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	X MKU 1-15-03		**HEAT SOAK PRESSURE:** 0 Heat soak was held longer due to the
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	X MKU 1-15-03		Bead is good.

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QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. 2016087 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10 inch SDR 11 Fusion Pressure: 218 psi	X MKU 1-15-03		FUSION PRESSURE: 218 psi.
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	X MKU 1-15-03		Sat.
11.	Verify a test strap is prepared (cut out) from the trial butt fusion spool. The test strap shall be at least 6 inches or 15 pipe wall thicknesses long on each side of the fusion and about 1 inch or 1.5 wall thicknesses wide.	X MKU 1-15-03		Sat.
12.	Verify that the test strap is bent such that the ends of the strap touch.	X MKU 1-15-03		Sat.
13.	Verify that there is no disbondment at the fusion. Any disbondment is unacceptable.	X MKU 1-15-03		No disbondment

4944

000232

FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

PAGE 3 OF 5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

4944

ECDC CONTROLLED COPY NO. 7117

Fluor Contract FSC-641
Enhanced Permanent Leachate
ansmission System Project
STAVER # 7052

omittal # 641-02205-006
iewed By: Dw
e: 10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[x] A - Conforms to the Subcontract Requiremen
[ ] B - Minor Comment - Incorporate and Resubm
[ ] C - Revise and Resubmit
Sig: [signature] Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

> **The time required to form the initial melt bead will automatically extend the total melt time cycle. After the melt forms, the standard butt-fusion heat cycle will be followed. A 3/16" to 1/4" melt bead is indicative of an adequate heat soak cycle.**

FUSION: Pressure will not be increased (0 psi) mwb during the heating cycle. When the proper melt bead has been formed, the pipe and heater plate will be separated in a rapid, snap-like motion. The melted surfaces will then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

TRIAL WELDS: Trial welds will be made at the beginning of each production day. Production welds will continue to be made while allowing the trial piece to cool to ambient temperature. After reaching ambient temperature, a strap will be cut from the trial piece and tested per the approved bent strap test procedure. If the bent strap test fails, any production welds made during the cooling period will be removed.

NOTE 9—When saddle fittings are fused to pipes that are under pressure, it is important that the surface melt be obtained quickly without too much heat penetration. Otherwise, the pipe may rupture from internal pressure. Consult the manufacturer for specific recommendations for fusing saddle fittings to pipe under pressure.

9.2.6 When a proper melt is achieved, remove the heater, quickly examine the pipe and fitting to ensure proper melt patterns, and immediately place the fitting on the pipe. Hold in place while exerting suitable force for the specified cooling time.

NOTE 10—If a suitable melt pattern has not been achieved, do not heat; however, continue with the fusion and apply the fitting to the pipe. When the joint has cooled, remove the alignment jig, cut off the top of the fitting to prevent use, and start over at another location.

9.3 Visually inspect the joint against recommended visual inspection guidelines.

9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

ANNEX

(Mandatory Information)

A1. COLD WEATHER PROCEDURES

A1.1 *Cold Weather Handling*—Pipe should be inspected for damage. Polyolefin pipes have reduced impact resistance in sub-freezing conditions. Avoid dropping pipe in sub-freezing conditions. When handling coiled pipe at temperatures below 40°F, it is helpful to uncoil the pipe prior to installation and let it straighten out. Gradually uncoil the pipe and cover it with dirt at intervals to keep it from recoiling. Always use caution when cutting the straps on coils of pipe because the outside end of a coil may spring out when the strapping is removed.

A1.2 *Preparation for Socket, Saddle, and Butt Fusion Joining:*

A1.2.1 *Wind and Precipitation*—The heating tool should be shielded in an insulated container to prevent excessive [illegible] fusion area and fusion tools from wind, snow, and rain by using a canopy or similar device.

A1.2.2 *Pipe and Fitting Surface Preparation*—The pipe and fitting surfaces to be "joined" or held in clamps should be dry and clean and free of ice, frost, snow, dirt, and other contamination. Regular procedures for preparation of surfaces to be joined, such as facing for butt fusion and roughening for saddle fusion should be emphasized. After preparation, the surfaces should be protected from contamination until joined. Contamination of the area to be fused will likely cause incomplete fusion. Frost and ice on the surfaces of the pipe to be clamped in either a cold ring or alignment jigs may cause slippage during fusion. Inspect coiled pipe to see if it has flattened during storage which could cause incomplete melt pattern or poor fusion. It may be necessary to remove several inches at the pipe ends to eliminate such distortion. Pipe may have a slight toe-in or reduced diameter for several inches at the end of the pipe. The toe-in may need to be removed before butt fusing to a freshly cut pipe end, or to a fitting.

A1.2.3 *Heating*—Work quickly once pipe and fitting have been separated from the heating tool, so that melt heat loss is minimized, but still take time (no more than 3 s) to inspect both melt patterns. Keep the heater dry at all times. Check the temperature of the heating tool regularly with a pyrometer. Keep the heating tool in an insulated container between fusions.

A1.3 *Socket Fusion:*

A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. The first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

A1.3.2 *Fitting Condition*—If possible, store socket fittings at a warm temperature, such as in a truck cab, prior to use. This will make it easier to place the fitting on the heating tool because fittings contract when cold.

A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 3-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 3 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe end. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard, or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

PAGE 5 OF 5

000236

2/

QUALITY EVALUATION PLAN

QEP No. 2016088 Rev. 0

1. Source ☐ Receiving ☐ Const./Remediation X Maint./Operations ☐ Waste ☐ Other ☐

2. Item/Title/Description:

VERIFICATION OF THERMAL BUTT FUSION WELDING- PRODUCTION JOINING

3. Project/Task: OSDF PHASE IV, 20104

4. Specification/Drawing/PO/Req.: SPEC SECTION 2605

5. Prepared By: Muriel Vigus — Date: 12-23-02

6. Reviewed By: MIKE GODBER — Date: 12/23/02

7. NDE Level III: (When Required) N/A — Date:

8. Approved By: (When Required) N/A — Date:

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
	PIPE SIZE: 10/6 Dual SDR#: 11 IDENTIFY JOINT: PIPE#: VH6RLCS TO PIPE#: 8,9,6 and 10 NAME OF JOINER: Jim Sullivan FUSION MACHINE #: 1237 (Standard Fusion Machine) AMBIENT TEMPERATURE: 22°F WEATHER CONDITIONS FOG: [ ] yes [X] no PRECIPITATION: [ ] yes [X] no			**ACCEPTABLE WEATHER CONDITIONS** • Do not join HDPE pipe at ambient temperatures below 40° F or above 104° F unless authorized in writing by the Construction Manager; • Do not join HDPE pipe during period of precipitation, in the presence of heavy fog, dew, or areas of ponded water.
1.	Verify there are no obstructions inside the pipe.	X MVG 1-15-03		Pipe is clear of obstructions
2.	Verify the pipe is cleaned with a clean oil free rag prior to joining. Cleaning should extend approximately one inch beyond the face of the pipe. The joint shall be free of moisture, dust, and debris of any kind.	X MVG 1-15-03		Pipe was cleaned with a clean rag. No dust or debris.

13. QA Team Member (Printed Name) Muriel Vigus (Signature) — Date: 1-15-03

14. QA Team Coach (Completed QEP): MIKE GODBER — Date: 1/15/03

FS-F-4400
REV 2: 01/02/01, QP-07.06

Page 1 of 5

000237

4944

QUALITY EVALUATION PLAN
(Continuation Sheet)

QEP No. № 2016088 Rev. 0

9. Char. No.	10. Evaluation Characteristic (Code/Specification, Inspection/Test/Examination Techniques, Acceptance Criteria)	11. Status SAT	11. Status UNSAT	12. General Remarks
3.	Verify the pipe is faced. The wheel pressure shall be approximately 85 psi. Facing is considered complete when approximately 5 ribbons have been cut from the pipe. After 5 full ribbons have been cut the wheel pressure should be dropped to 0 psi and the cutting wheel shall continue to rotate to cut the ribbons from the pipe face. **NOTE:** After the pipe has been faced there shall be no further alignment. If there is realignment the pipe shall be refaced.	X MKU 1-15-03		**FACING PRESSURE :** 75 psi Plus 125 psi drag
4.	Verify all shavings are removed from the facing and the pipe to assure that the shavings are not part of the joint. The operator shall use clean gloves when removing the shavings.	X MKU 1-15-03		All shavings have been removed.
5.	Verify the pipe is checked for proper alignment prior to joining. The jaw can be adjusted to obtain proper alignment. **NOTE:** If there is realignment the pipe shall be refaced.	X MKU 1-15-03		Alignment is good.
6.	Verify the heater plate is between 400°F and 475°F. **NOTE:** The heater plate shall be cleaned with a clean oil free cloth.	X MKU 1-15-03		**PLATE TEMPERATURE:** 425° Met
7.	Verify the heater plate is inserted into the machine and the pipe ends are brought into firm contact with the plate. The pipe shall be under zero pressure when being heated.	X MKU 1-15-03		**HEAT SOAK PRESS:** 0
8.	Verify the melt bead is approximately 1/8 inch to ¼ inch in height prior to removing the heat plate. **NOTE:** The heat time is dependent on pipe diameter and SDR#.	X MKU 1-15-03		Heat soak was held longer due to the cold temps.
9.	Verify the pipe is joined at the required fusion pressure and allowed to cool. 6 INCH SDR 11 FUSION PRESSURE: 101 psi 10/6 INCH SDR 11 FUSION PRESSURE: 218 PSI	X MKU 1-15-03		**FUSION PRESSURE:** 218 psi Plus 232 psi drag
10.	Verify the weld is allowed to cool prior to removing the clamps. **NOTE:** The required cooling time is achieved when the joint is cool to the touch.	X MKU 1-15-03		Cool to touch.

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4944

FS-F-4400
REV 2: 01/02/01, QP-07.06

FLUOR

Memorandum

To:	Distribution	Date:	December 27, 2002
Location:	Various	Reference:	Specification Section 02605
From:	Bill Zebick, MS64	Fernald #:	M:SDFP:2002-0021
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	648-4134	Subject:	**COLD WEATHER FUSION FOR HDPE PIPE**

Distribution:

Tom Beasley, MS64
Frank Flack, MS64
Mike Godber, MS64
Don Goetz, MS64
Uday Kumthekar, MS64
Mike Stumbo, MS64
Chuck Van Arsdale, MS64
Muriel Vigus, MS64

c: File Record Subject – Cold Weather Fusion Approval (Spec. Section 02605)
Project Number 20104.1.5

Pursuant to Specification Section 02605, Part 3.04D, Construction Manager approves joining of HDPE pipes and fittings at temperatures below 40° Fahrenheit (F) or above 104° F, provided joining is performed in accordance with Specification Section 02605 and the attached weather fusion procedure.

If you have any questions or require additional information, please contact me at 648-4134.

Concurrence: Bill Zebick 12/27/02
Bill Zebick, Execution Manager — Date
Soil and Disposal Facility Project

Attachments
WAZ:jkp

PAGE 3 OF 5

4944

ECDC CONTROLLED
COPY NO.
7117

uor Contract FSC-641
nhanced Permanent Leachate
smission System Project
STAVER # 7052

itial # 641-02-05-006
wed By: Rus
10/24/00

Cold Weather Fusion Procedures
Butt-Fused HDPE Pipe

[4] A - Conforms to the Subcontract Requirements
[ ] B - Minor Comment - Incorporate and Resubmit
[ ] C - Revise and Resubmit
Sig: Paul Diffl Date: 10/30/00

COLD WEATHER DEFINED: For the purpose of the fusion of HDPE pipe, cold weather will be defined as "ambient temperatures equal to or less than 40 degrees Fahrenheit." In order to provide a consistent temperature for use in all activities the recorded temperature at the Communications Center, x4444, will be used.

PIPE PREPARATION: Because of reduced impact resistance, extra caution shall be taken when handling pipe in sub-freezing conditions. Pipe will be inspected for damage prior to placement in the fusion machine. All frost, ice, and snow will be removed from the O.D. and I.D. pipe surfaces to be fused. Any ice and snow adhering to the clamps on the fusion machine will be removed. No moisture on pipe mwb

WIND AND PRECIPITATION: A wind-break will be utilized to mitigate the effects of wind gusts which would have a cooling effect on the pipe and equipment during the fusion processes. The heating tool will be kept in an insulated container to prevent heat loss. According to the ~~ELPTS~~ Job Specifications no welding will occur in periods of precipitation. EPLTS mwb

HEATING: The temperature of the heating plate will be checked before each weld is made to ensure that the tool temperature remains within the specified limits. Welders will anticipate extending the heat soak cycle in order to achieve the desired bead "melt" pattern.

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PAGE 5 OF 5

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9.4 *Testing*—Evaluate sample joints to verify the skill and knowledge of the fusion operator. Cut joints into straps (see Fig. 4), visually examine, and test for bond continuity and strength. See Practice F 905 for methods for evaluating the quality of fusion joints.

10. Keywords

10.1 butt fusion; fitting; heat fusion; joining; pipe; polybutylene; polyethylene; polyolefin; polypropylene; saddle fusion; socket fusion

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ANNEX

(Mandatory Information)

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A1.3.1 *Pipe Outside Diameter*—Pipe outside diameter contracts when cold. This results in loose or slipping cold rings. For best results, clamp one cold ring in its normal position adjacent to the depth gage. Place shim material (that is, piece of paper or rag, etc.) around the inside diameter of a second rounding ring and clamp this cold ring directly behind the first cold ring to prevent slippage. This first cold ring allows the pipe adjacent to the heated pipe to expand to its normal diameter during the heating cycle.

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A1.3.3 *Heating*—At colder temperatures the pipe and fitting contract, thus the pipe slips more easily into the heating tool. At very cold outdoor temperatures (particularly with 2, 3, and 4 in. IPS pipe), the pipe may barely contact the heating surface. Longer heating cycles are used so that the pipe first expands (from tool heat) to properly contact the heating tool, then develops complete melt. The length of cycle necessary to obtain a complete melt pattern will depend not only on the outdoor (pipe) temperature but wind conditions and operator variation. Avoid cycles in excess of that required to achieve a good melt pattern. To determine the proper cycle time for any particular condition, make a melt pattern on a scrap piece of pipe, using the heating cycle as instructed by the pipe manufacturer. If the pattern is incomplete (be sure rounding rings are being used), try a 5-s longer cycle on a fresh (cold) end of pipe. If the melt pattern is still not completely around the pipe end, add an additional 5 s and repeat the procedure. Completeness of melt pattern is the key. Keep the heater dry at all times. Check the temperature of the heating tool regularly and keep the heating tool in an insulated container between fusions.

A1.4 *Butt Fusion:*

A1.4.1 *Joining*—The heating cycles shall be as recom-

mended by the pipe manufacturer. It will take longer to develop the initial melt bead completely around the pipe ends. Do not increase pressure during heating. When proper melt bead has been obtained, the pipe and heater shall be separated in a rapid, snap-like motion. The melted surfaces shall then be joined immediately in one smooth motion so as to minimize cooling of the melted pipe ends.

A1.5 *Saddle Fusion:*

A1.5.1 *Surface Preparations*—Regular procedures for roughening the surfaces to be fused on the pipe and the fitting should be emphasized. After the surfaces have been prepared, particular care should be taken to protect against contamination.

A1.5.2 *Heating Time*—Make a trial melt pattern on a scrap piece of pipe. A clean, dry piece of wood is used to push the heating tool against the pipe. If the melt pattern is incomplete, add 3 s to the cycle time and make another trial melt pattern on another section of cold pipe. If the pattern is still incomplete, continue 3-s additions on a fresh section of cold pipe until a complete melt pattern is attained. Use this heating cycle for fusions during prevailing conditions. Regardless of the weather or the type of tools used, the important point to remember is that complete and even melt must occur on the fitting and the pipe in order to produce a good fusion joint. This requires pipe preparation to make it clean, straight, round, and well supported.

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RECORD PAGE 5 OF 5

000242

Pneumatic Testing Results

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ1341 TASK NO.: 041

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: FF CAB Date 06-02 POP (242) 054 Valve # SO-1110331-01-1

TEST DESCRIPTION: HYDROSTATIC: ☐ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☒

PASS/FAIL CRITERION: hold pressure for 15 min w/o change in guage.

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ CARRIER ☒ OTHER: ☐

TARGET PRESSURE: < 10 psi; TEST DURATION: 15 min GAUGE NO.: RE-6 calibration # 00-0A352 PJ GAUGE LOCATION: V-H. 4

TEST LOCATION: Valve House #4 (CSR) (LCS) TO Penetration Box

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☒ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	15 min 6 min	30 July	0920 To 0935	5 PSI	No change / Pass	DLE
2.	15 min 6 min	30 July	0935 To 0950	10 PSI	No change / Pass	DLE
3	15 min 10 min	30 July	1000 To 1015	5 PSI	No change / Pass	DLE
4	15 min 10 min	30 July	1016 To 1031	10 PSI	No change / Pass	DLE
5	15 min 6 min	30 July	1312 To 1327	5 PSI	No change / Pass	DLE
6	15 min 6 min	30 July	1330 To 1345	10 PSI	No change / Pass	DLE
7	15 min 10 min	30 July	1400 To 1415	5 PSI	No change / Pass	DLE
8	15 min 10 min	30 July	1415 To 1430	10 PSI	No change / Pass	DLE

PASS: ☐

FAIL: ☐

VISUAL MONITORING: Jim Sullivan 30 July 2002 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; David L Evans 30 July 2002 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 01 Aug 2002 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 1 Aug 2002 — SITE CQA MANAGER day/mo/yr

COPY TO:

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ1341 TASK NO.: 04.1

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: F F

TEST DESCRIPTION: HYDROSTATIC: ☐ ~~VACUUM~~ VACUUM TEST PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☒

PASS/FAIL CRITERION: minimum 5 min Vacuum stand time / 30 min. @ 21.9 inches of Vacuum

MATERIAL DESCRIPTION: Part # LKA15420-013 FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER ☐ OTHER: ☒ Penetration Box

TARGET PRESSURE: 21.9 TEST DURATION: 30. GAUGE NO.: Ashcroft Gauge OSDF Q8962 GAUGE LOCATION:

TEST LOCATION: ① LDS Penetration Box Size 2 1/2 in Type Gauge 1009 Range 30/0 IMV TO

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☐ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
S 1	5 min 1051	09 Aug	10:51	15 in. Vac	Start Hold	DLE
S 2	5 min ↓	09 Aug	10:56	15 inch VAC	No change	DLE
3	30 min	09 Aug	10:57	21.9 inch VAC	No change	DLE
4	↓	09 Aug	11:27	21.9 inch VAC	No change	DLE
S 5	5 min. start 1141	09 Aug	11:41	15 in. VAC	Start Hold	DLE
6	5 min	09 Aug	11:46	15 in. VAC	No change	DLE
7	30 min	09 Aug	11:47	21.9 in. VAC	Start Hold	DLE
8	↓	09 Aug	12:17	21.9 in VAC	No change	DLE
S 9	5 min start 1338	09 Aug	13:38	15 in. VAC	Start Hold	DLE
10	5 in ↓	09 Aug	13:43	15 in VAC	No change	DLE
11	30 min	09 Aug	13:49	21.9 in. VAC	No change	DLE
12	↓	09 Aug	14:15	21.9 in. VAC	No change	DLE

PASS: ☒

FAIL: ☐

VISUAL MONITORING: Jim Sullivan 09 Aug/2002 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; David L Evans 9 Aug 2002 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 9-8-02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 9 Aug 2002 — SITE CQA MANAGER day/mo/yr

COPY TO:

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GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GO1341 TASK NO.: 04.1

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: F.F, Wise #242 PoP 0.55 Value Date

TEST DESCRIPTION: HYDROSTATIC: ☐ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☒

PASS/FAIL CRITERION: 5 PSI - 15 min / 10 PSI - 15 min / Gauge Not To Drop Below 10

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ CARRIER ☒ OTHER: ☐

Cal. Date 10-24-01 Due 10-24-02 #00-OA-352-PI

TARGET PRESSURE: 5/10 PSI TEST DURATION: 15 min/15 min GAUGE NO.: RE-6 GAUGE LOCATION: V-H-5

TEST LOCATION; Valve House 5 TO Demarcation Box

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☒ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	15 min Start	12 Aug	1430	5 PSI	Start	DLE
2	↓	12 Aug	1445	5 PSI	No Change	DLE
3	15 min Start	12 Aug	1446	10 PSI	Start	DLE
4	↓	12 Aug	~~1516~~ 1501	↓	No Change	DLE
5	15 min Start	12 Aug	1515	5 PSI	Start	DLE
6	↓	12 Aug	1530	5 PSI	No Change	DLE
7	15 min Start	12 Aug	1531	10 PSI	Start	DLE
8	↓	12 Aug	1546	↓	No Change	DLE
~~9~~	~~15 min Start~~	~~12 Aug~~		~~5 PSI~~	~~Start~~	~~DLE~~
~~10~~		~~13 Aug~~				

PASS: ☐

FAIL: ☐

VISUAL MONITORING: Jim Sullivan 12 Aug/02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

David L Evans 12/Aug/02 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: Richard J Schaper 8/12/02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

Collin P. Jackson 12 Aug 2002 — SITE CQA MANAGER day/mo/yr

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4944 27/15/42

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FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ-1341 TASK NO.: 04.1

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: F.F. / Wise Const. Pay of Value # 212

TEST DESCRIPTION: HYDROSTATIC: ☐ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☒

PASS/FAIL CRITERION: 5 PSI - 15 min / 10 PSI - 15 min / Gauge not To Drop Below 10 PSI

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ CARRIER ☒ OTHER: ☐

TARGET PRESSURE: 5/10 psi TEST DURATION: 15 min/15min GAUGE NO.: RE-6 #00-04-352-PI GAUGE LOCATION: VH-5

TEST LOCATION: Valve House 5 TO penetration Box

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☐ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	15 min Start	13 Aug	0950 start	5 PSI	start	DLE
2	15 min comp	13 Aug	1005	5 PSI	No change	DLE
3	15 min start	13 Aug	1006 start	10 PSI	START	DLE
4	15 min comp	13 Aug	1021	10 PSI	No chang	DLE
5	15 min start	13 Aug	1027 start	5 PSI	start	DLE
6	15 min. Comp	13 Aug	1042	5 PSI	No change	DLE
7	15 min start	13 Aug	1045	10 PSI	start	DLE
8	15 min comp	13 Aug	1100	10 PSI	No change	DLE

PASS: ☒

FAIL: ☐

VISUAL MONITORING: Jim Sullivan 13 802 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

David L. Evans 13 Aug/02 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 13/Aug/02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr

[signature] 13 Aug 2002 — SITE CQA MANAGER day/mo/yr

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FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ134 TASK NO.: 04.1

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: Wise / FF

TEST DESCRIPTION: HYDROSTATIC: ☐ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☐ Vacuum test

PASS/FAIL CRITERION: Stab @ 15 - 5min / Test at 21.9 for 30min

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER ☐ OTHER: ☒ Penetration Boxes

TARGET PRESSURE: 21.9 HG (Stab. 15 inch of Vac. (Hg)) TEST DURATION: 30 min GAUGE NO.: ID 06-BA01P-PI GAUGE LOCATION: LDS/RLCS LCS

TEST LOCATION: LDS - RLCS - LCS TO Penetration Boxes

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: N/A → ☐ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING (Vacuum)	CHANGE IN READING	QA ID
Start ①	Start of Stab 5 min	27 Aug 2002	0939	15 HG	Start	DLE
②	↓	27 Aug 2002	0944	15 HG	No change	DLE
③	Test Pump up To 21.9 HG	27 Aug 2002	0945	21.9 HG	Start	DLE
④	↓	27 Aug 2002	1015	21.9 HG	No change	DLE
Start ①	Start of Stab 5 min	27 Aug 2002	1031	15 HG	Start	DLE
②	↓	27 Aug 2002	1038	15 Hg	No change	DLE
③	Test Pump up To 21.9 HG	27 Aug 2002	1040	21.9 HG	Start	DLE
④	↓	27 Aug 2002	1110	21.9 HG	No change	DLE
①	Start of Stab 5 min	27 Aug 2002	1120	15 HG	Start	DLE
②	↓	27 Aug 2002	1125	15 HG	No change	DLE
③	Test pump up To 21.9 HG	27 Aug 2002	1127	21.9 HG	Start	DLE
④	↓ 30 min	27 Aug 2002	1157	21.9 HG	No change	DLE

PASS: ☐

FAIL: ☐

VISUAL MONITORING: Jim Sullivan 27/Aug/2002 CONTRACTOR'S REPRESENTATIVE day/mo/yr — David L Evans 27/Aug/2002 CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 27 Aug 02 CONTRACTOR'S REPRESENTATIVE day/mo/yr — [signature] 27 Aug 2002 SITE CQA MANAGER day/mo/yr

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Hydrostatic Pressure Testing Results

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FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ1341 TASK NO.: 4.1

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: F.F. Cal Date 06-02 Pop off Value 242 # SO. 111033-01-1

TEST DESCRIPTION: HYDROSTATIC: ☒ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☐

PASS/FAIL CRITERION: Stabilize — @ 70 PSI / 1 hr —, Drop To 60 PSI, Hold 1 hr

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☐ CARRIER ☒ OTHER: ☐

TARGET PRESSURE: Stop 70 PSI 60 PSI TEST DURATION: 1 hr GAUGE NO.: RE-6 Calibration # 00-0A 352 PI GAUGE LOCATION: VH-4

TEST LOCATION: Valve House 4 TO Penetration Box (LDS)

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☒ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	start 0931 1 HR.	31 July 2002	0931	78 PSI	Start Test Stabilization	DLE
2			0945	72 PSI		DLE
3			1015	66 PSI		DLE
4			1030	62 PSI		DLE
5	Re Start 70 PSI Stab Test Re Start Refill		1145 Refill			DLE
6			1315 Refill	72 PSI		DLE
7			1330	71 PSI		DLE
8			1345	70 PSI		DLE
9			1400	70 PSI		DLE
Test Start 10	1 hr @ 60 PSI	31 July	1410	60 PSI	Start of 60 PSI Test	DLE
11	15 minutes	31 July	1425	60 PSI	no change	DLE
12	15 min	31 July	1440	60 PSI	no change	DLE
13	15 min	31 July	1455	60 PSI	no change	DLE
14	15 min	31 July	1510	60 PSI		DLE

Filling 6 in Pipe @ 0830

Completed at 0804

Hydro Static Pressure

PASS: ☑
FAIL: ☐

VISUAL MONITORING: Jim Sullivan 31 July 02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr — David L. Evans 31/July/02 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 01 Aug 2002 — CONTRACTOR'S REPRESENTATIVE day/mo/yr — Collin P. Johnson 1 Aug 2002 — SITE CQA MANAGER day/mo/yr

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@ 1125

Standard fill 10 in LDS

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FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ-134 / TASK NO.: 4.1

DESCRIPTION: Phase IV YEAR:

CONTRACTOR: F.F. calibration Date 06-02 POC Hawe #42 SO# 111 6331-01-1

TEST DESCRIPTION: HYDROSTATIC: ☒ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☐

PASS/FAIL CRITERION: Stabilize @ 25 PSI, 1 hr, Drop Back to 15 PSI, 1 hr

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ CARRIER ☐ OTHER: ☐

TARGET PRESSURE: 25 PSI Stab. / 15 PSI TEST DURATION: 1 hr / 1 hr GAUGE NO.: AE-6 calibration #00-OA-352 PI GAUGE LOCATION: VH-4

TEST LOCATION: Valve House 4 TO Penetration Box (LDS)

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☒ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
Fill @ 1125	1 hr. plus	1 Aug 02	1135	25 PSI	Fill	DJE
1	↓		1150	↓	no change	DJE
2			1205		↓	DJE
3			1220			DJE
4			1235			DJE
5			1250			DJE
6			1305			DJE
7 Drop to 15 PSI	1305	1 Aug 02	1305	15 PSI	change to 15 PSI	DJE
1	1 hr. plus		1320	15 PSI	↓	DJE
2	↓		1335	15 PSI		DJE
3			1350	15 PSI		DJE
4	▽	1 Aug 02	1405	15 PSI		DJE

PASS: ☒
FAIL: ☐

VISUAL MONITORING: X Jim Sullivan 01 Aug. 2002 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; David L. Evans 01 Aug. 2002 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 01 Aug 2002 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 1 Aug 2002 — SITE CQA MANAGER day/mo/yr

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GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: G0134/ TASK NO.: 04.1

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: F.F. / Wise Const. / Pop off Valve # 242 calib Date 06-02 50.111033/-01-1

TEST DESCRIPTION: HYDROSTATIC: ☒ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☐

PASS/FAIL CRITERION: Stablize @ 70 PSI, 1 hr / Drop To 60 PSI hold for 1 hr

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ CARRIER ☒ OTHER: ☐

TARGET PRESSURE: Stab. 70 PSI Test 60 PSI TEST DURATION: 1 hr / 1 hr GAUGE NO.: RB-6 GAUGE LOCATION: V 14.5 calib. [redacted] # 00-04-352-PI

TEST LOCATION: Value House 5 6" 10" (LDS) TO Penetration Box

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☒ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
Fill 1	Stand 1 hr 15 min	13 Aug	1400 hr Start	70 PSI	Start	DLE
2		13 Aug	1415	66 PSI	4 PSI / 6 PSI	DLE
Re Fill 3	Re Start 1 hr Stablizing	13 Aug	1433	71 PSI	Re Fill	DLE
4	↓	13 Aug	1453	68 PSI	↓ 3 PSI	DLE
5	↓	13 Aug	1510	68 PSI	No change	DLE
6	↓	13 Aug	1523	68 PSI	No change	DLE
7	↓	13 Aug	1533	68 PSI	No change	DLE
8	↓	13 Aug	1553	68 PSI	No change	DLE
9	Start of test	13 Aug	1554	62 PSI	Start of Test	DLE
10	↓	13 Aug	1624	62 PSI	No change	DLE
11	↓	13 Aug	1654	62 PSI	No change	DLE

PASS: ☒

FAIL: ☐

VISUAL MONITORING: X Jim Sullivan 13 8 02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; David L. Evans 13/Aug/02 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 13 Aug 02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 13 Aug 2002 — SITE CQA MANAGER day/mo/yr

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FLUOR FERNALD, INC.

PRESSURE TEST LOG

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ1341 TASK NO.: 04.1

DESCRIPTION: Phase IV YEAR: 2002

CONTRACTOR: F. F. Cwise Pop off Valve #247 SO-M16331-01-1 Calb. Date 06-02

TEST DESCRIPTION: HYDROSTATIC: ☒ PNEUMATIC (ATTACH WRITTEN AUTHORIZATION): ☐

PASS/FAIL CRITERION: 1 hr @ 25 PSI / 1 hr @ 15 PSI

MATERIAL DESCRIPTION: FORCEMAIN: ☐ CONTAINMENT: ☒ CARRIER ☐ OTHER: ☐

TARGET PRESSURE: Start 25 PSI / 15 PSI TEST DURATION: 1 hr / 1 hr GAUGE NO.: RE-6 Calb. #00-0A-352-PI GAUGE LOCATION: VH-5

TEST LOCATION: Valve House #5 10 in TO Penetration Box

FOR CONTAINMENT PIPE TESTING, CARRIER PIPE PRESSURIZED FIRST: ☒ YES ☐ NO

READING NO.	STABILIZATION TEST PERIOD	DATE (day/mo)	TIME	READING	CHANGE IN READING	QA ID
1	Start	14 Aug	0948	25 PSI	Start	DLE
2	Re fill	14 Aug	0950	23 ↓ PSI	2 PSI	DLE
3	Re fill Valve at Pen Leaks	14 Aug	1020	22 ↓ PSI	3 PSI	DLE
4	Re fill Re Start	14 Aug	1030	25 PSI	Start Hold	DLE
5	↓	14 Aug	1100	25 PSI	No change	DLE
6	↓	14 Aug	1115	25 PSI	No change	DLE
7	↓	14 Aug	1130	25 PSI	No change	DLE
8	↓ Reduce to 15 PSI	14 Aug	1132	↓ 15 PSI	Lowered air valve 15 PSI	DLE
9	↓	14 Aug	1147	15 PSI	No change	DLE
10	↓	14 Aug	1202	15 PSI	No change	DLE
11	↓	14 Aug	1217	15 PSI	No change	DLE
12	Finish	14 Aug	1232	15 PSI	No change	DLE

PASS: ☒

FAIL: ☐

VISUAL MONITORING: Jim Sullivan 14 Aug 02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; David J Evans 14 Aug 02 — CQA REPRESENTATIVE day/mo/yr

FINAL APPROVAL: [signature] 14 Aug 02 — CONTRACTOR'S REPRESENTATIVE day/mo/yr; [signature] 14 Aug 2002 — SITE CQA MANAGER day/mo/yr

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CCT Video Survey and Inspection Logs

4944

FLUOR

Memorandum

To:	Distribution	Date:	April 15, 2003
Location:	Various	Reference:	None
From:	Rob Kneip RWK	Fernald #:	M:ARWWP:2003-0012
Location:	Fernald	Client:	DOE DE-AC24-01OH20115
Extension:	3736	Subject:	**VIDEO INSPECTION OF OSDF LINES**

c: File Record Subject OSDF Lines Video Inspection
Project Number 54000
OSDF Project File, MS64
J.D. Chiou, MS64
Willie Frazier, MS52-5
Everett Henry, MS5205
Bill Hertel, MS52-5
Uday Kumthekar, MS64
Kwasi Badu Tweneboah, MS38

RECEIVED
APR 17 2003

The annual inspection of the Leak Detection System (LDS), Redundant Leachate Collection System (RLCS), and Leachate Collection System (LCS) pipe lines from OSDF Cells 1, 2, 3, 4, and 5 was completed in December of 2002. In addition, the horizontal monitoring well for each of the five OSDF cells was inspected.

Videos of the inspections were reviewed and did not reveal any crushed piping or significant flow obstructions in any of the piping. Several observations of interest are as follows:

- Cell #1 LDS line appears to have a crusted scum layer on top of the water in sections where the line retains water.
- Cell #3 LCS line appears to be holding water over a longer length of pipe than in past years.

RWK

FLOUR FERNALD

Valve House #4

LDS Line

No footage on screen, counter went out.
1 foot, started inspection
Approximately 230 feet, end of inspection

Line holding water and light gravel in some areas. Line okay.

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: Dec 3rd/4th 2002 TIME: _____

STATION: START: LDS VH #4 FINISH: Cell #4

FOOTAGE: START: _____ FINISH: _____

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS Note! No: Location Footage Numbers Recorded
0 Plus	Butt	Round	small amount of water
	Butt	Round	small amount of water
	Butt	Round	Small amount of water
	Butt	Round	Some water
	Butt	Round	Some water
	Butt	Round	Some water
	Coupling 1st Joint	Round	Some water
	Coupling 2nd Joint	Round	Some water and Gravel to Perspipe
	Butt	Round	Per Spipe / w/water
	Butt	Round	Per Spipe w/water and Lots of Gravel
	Butt	Round	Per Spipe water / end of tape

PER: DE

SHEET NO. _____ OF _____

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: Dec 3/4 TIME: _____

STATION: START: VH4 RLCS FINISH: Cell 4

FOOTAGE: START: Ø FINISH: 216.7

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
0 VH			
18 ft	Butt	Round	
58 ft	Butt	Round	
98 ft	Butt	Round	
138 ft	Butt	Round	
144 ft			Some water
162 ft			1/3 full of water
166.6	Butt	Round	1/2 Full of water
178 ft			out of water
180 ft	Butt	Round	
191.1 ft	Coupling	Round	
191.4	Coupling	Round	Some small stones
191.5	Butt	Round	Some stone
201.8	Butt	Round	
205.2	Butt	Round	Perf Pipe
206.5			Some Stone
216.7			End of Tape

PER: DKE

SHEET NO. _____ OF _____

FLOUR FERNALD

Valve House #4

RLCS Line

1 foot, started inspection
163 feet to 174 feet, line holding water
205 feet, perforated pipe
230 feet, end of run

Line okay.

FLOUR FERNALD

Valve House #4

LCS Line

1 foot, inspection started
199 feet, line holding water
207 feet, perforated pipe
210 feet, light gravel
230 feet, end of run

Line okay.

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FLUOR DANIEL FERNALD

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VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: Dec. 3/4 2002 TIME: _____

STATION: START: VH #4 LCS FINISH: cell #4

FOOTAGE: START: Ø FINISH: 231.Ø

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
Ø	@ VH-4		Running water
15.9	Butt	Round	Running water
55.9	Butt	Round	Running water
95.9	Butt	Round	Running water
135.9	Butt	Round	Running water
165.1	Butt	Round	Running water
181.9	Butt	Round	Running water
192.8	Butt	Round	Running water
193.4	Butt	Round	Running water
197.5			under water
203	Coupling	Round	Pen Box? under water
206	Coupling	Round	Pen Box? under water
206.2		Round	Pers Pipe under water
221.6			Gravel / N side pipe
231.Ø			in of Tape

PER: ME

SHEET NO. _____ OF _____

000261

FLOUR FERNALD

Valve House #5

LDS Line

163-178 feet, line holding water
200 feet, perforated pipe
220 feet, gravel
222 feet, heavy gravel
227 feet, heavy gravel
230 feet, end of run

Line okay, except perforated pipe has heavy gravel in it to 230 feet. Recommend line be hydro flushed and video inspected again.

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

4944

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: 12-9-02 TIME: _____

STATION: START: V513-LDS VH #5 FINISH: Cell 5

FOOTAGE: START: Ø FINISH: 230.2

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
Ø	Butt	Round	water in bottom
0.5	Butt	Round	water in bottom
1.Ø	Butt	Round	water in bottom
17.7	Butt	Round	—
* 3Ø.4	—	—	~~cracks ?~~ @ water condensation
4 50.3	Butt	Round	very little water
79.0	—	—	water is abundant
89.5	Butt	Round	—
111.5	—	—	@ ~~crack ?~~ water condensation
113.6	—	—	@ crack ? water condensation
115.0	—	—	@ crack ? water Condensation
129.9	Butt	~~Round~~	water present
133.6	—	—	~~Pipe collapse ? ?~~ @ standing water
160.0	Butt	Round	water is abundant
163.7	—	—	underwater
177.5	—	—	above water
180.0	—	—	Dry
186.6	Butt	Round	—
198.2	Butt	Round	—

PER: CHe

SHEET NO. 1 OF 2

000263

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FLUOR DANIEL FERNALD

4944

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: 12-9-02 TIME: _____

STATION: START: V513 LDS VH#5 FINISH: Cell #5

FOOTAGE: START: 0 FINISH: 230.2

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
199.3	Butt	Round	
200.4	Butt	Round	water
202.0	—	—	Underwater - perforated pipe
213.0	—	—	above water
218.5	—	—	gravel present
224.0	Butt	Round	—
225.0	—	—	gravel abundant
230.2	—	—	filming stopped

PER: CHen

SHEET NO. 2 OF 2

000264

FLOUR FERNALD

Valve House #5

RLCS Line

208 feet, perforated pipe
229 feet, end of run

Line okay, light gravel in perforated pipe.

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

494

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: 12-9-02 TIME: _____

STATION: START: V523 RLCS VH#5 FINISH: Cell #5

FOOTAGE: START: Ø FINISH: 229.4

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
Ø	Coupling	Round	Brown water present
0.5	Butt	Round	—
1.0	Butt	Round	—
1.5	Butt	Round	—
2.0	—	—	water present
20.2	Butt	Round	—
56.3	Butt	Round	—
96.3	Butt	Round	no water present
136.6	Butt	Round	Dry
141.0	—	—	~~cracks~~ ? Water condensation
162.5	Butt	Round	
183.0	~~Coupling~~ ? Butt	Round	water in bottom
193.0	Butt	Round	Dry
193.5	Butt	Round	Dry
194.4	Butt	Round	Dry
197.5	—	—	Gravel Present
200.0	—	—	water present
205.0	Butt	Round	water present
205.8	Butt	Round	water present

PER: [illegible]

SHEET NO. 1 OF 2

000266

GeoSyntec Consultants

FLUOR DANIEL FERNALD

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VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: 12-9-02 TIME: _____

STATION: START: V523 R LCS VH#5 FINISH: Cell#5

FOOTAGE: START: 0 FINISH: 229.4

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
207.3	Butt	Round	- Begin Perforated Pipe
212.0	—	—	Gravel more Abundant
228.5	Butt ?	Round	Dry
229.4	—	—	Filming Stopped

PER: CHW

SHEET NO. 2 OF 2

000267

FLOUR FERNALD

Valve House #5

LCS Line

11- 42 feet, line holding water
150- 161 feet, line holding water
171 feet, perforated pipe
183 feet, light gravel
192 feet, heavy gravel
200 feet, end of run

Line okay, holding some water and perforated pipe has gravel in it.

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

4944

VIDEO TAPE SUMMARY

Carrier Pipe-Leachate Transmission System
Permanent Lift Station to Manhole No. 3

TAPE NO: _____ DATE OF RECORDING: 12-9-02 TIME: _____

STATION: START: V533 LCS VH #5 ? FINISH: Cell #5

FOOTAGE: START: 0 FINISH: 201.1

LOCATION FOOTAGE (FT)	JOINT TYPE BUTT/COUPLING	JOINT CONFIG.	REMARKS
0	Coupling	Round	Water in bottom
11.0	—	—	Camera under water
16.8	Butt	Round	
41.9	Butt	Round	Under water
63.8	Butt	Round	water in bottom
96.1	Butt	Round	
* 125.2	Butt	Round	~~Pen~~
148.0	Butt	Round	under water
156.5	Butt	Round	
157.0	Butt	Round	
157.5	Butt	Round	out of water
168.0	Butt	Round	
168.5	Butt	Round	
170.5	Butt	Round	Perforated Pipe
184.0	—	—	gravel present
186.6	—	—	gravel present
187.4	—	—	gravel present
192.0	—	—	gravel present
201.1	—	—	filming stopped

PER: [illegible]

SHEET NO. 1 OF 1

Cell 6 LDS, LCS, RLCS, and HMW
As-Built Drawings

Concrete Test Results

GEOSYNTEC CONSULTANTS

FLUOR DANIEL FERNALD

CONCRETE PLACEMENT FORM

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO

PROJECT NO.: 6Q134 TASK NO.: 04.1

DESCRIPTION: Phase IV

DATE: 13 day Dec month 2002 year

DESIGN MIX DATA/NO.: 4000 PSI/AE

COMPRESSIVE STRENGTH: 4000 (psi) AT 28 (days) SLUMP RANGE (in.): 3 to 5 AIR CONTENT RANGE (%): 4 to 6

FIELD AND LABORATORY: CONCRETE SUPPLIER: Miami Valley TESTING LABORATORY FMSM

TRUCK NO.	TICKET NO.	SIZE OF LOAD (yd^3)	TIME: LOAD BATCHED	TIME: BEGIN PLACEMENT	TIME: FINISH PLACEMENT	TIME: SAMPLED	LOCATION	TEMPERATURE: AMBIENT (°F/°C)	TEMPERATURE: ASTM C 1064 CONCRETE (°F/°C)	TESTING: WATER ADDED (gal)	TESTING: ASTM C 143 SLUMP (in.)	TESTING: ASTM C 173 AIR CONTENT (%)	TESTING: PASS/FAIL	TESTING: QA ID	TESTING: NO. OF CYLINDERS
69	75714	6 yd^3	0905	0925	0940	0930		37°	64°	5	3"	4.9	P	KS	4

LOCATION NOTES: Sed. Basin 2 Primary Spillover slab/anchor

000273

GEO SYNTEC CONSULTANTS FILE NO. 1-19-CPF

SHEET NO. 1 OF 1

4944

Fuller Mossbarger Scott & May
FMSM ENGINEERS

10018 International Boulevard
Cincinnati, Ohio 45246
(513) 860-1070

RECEIVED
JAN 15 2003

REPORT OF TEST ON CONCRETE CYLINDERS

4944

Cylinder/Set No. 8

Project No. CN2002001

PROJECT DATA

Project Name: Fernald On-Site Disposal Facility

Contractor: Geosyntec

Designer:

Concrete Supplier: Miami Valley

Specified Strength & Type: 4,000

Supplied Strength & Type: 4,000

Location of Concrete: Sed. Basin 2; primary spillover

Slab/anchor

FIELD DATA

Date Sampled: 12/13/02

Slump: 3"

Air Content: 4.9%

Truck No.: 69

Ticket No.: 75714

Ambient Temp.: 37°F

Concrete Temp.: 64°F

Technician: KS

Time of Test: 9:30 a.m.

LABORATORY DATA

Cylinder No.	A	B	C			
Date Received	12/16/02	12/16/02	12/16/02			
Date Tested	12/20/02	1/10/03	1/10/03			
Age When Tested, Days	7	28	28			
Maximum Load, Pounds	76,500	150,000	151,500			
Compressive Strength, psi	2,710	5,310	5,360			
Cylinder Weight in Lbs.	28.3	28.4	28.6			
Type of Break	Shear	Shear	Shear			

REMARKS:
Time batched:
Time arrived:
Time departed:
Water added:
Load size:
Cumulative CY:
Total CY:

FULLER, MOSSBARGER, SCOTT AND MAY
ENGINEERS, INC.

000274

APPENDIX S

Requests for Clarification of Information (RCIs)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

C: Chi 4244

REPLY TO THE ATTENTION OF:

JAN 16 2002

Mr. Johnny Reising
United States Department of Energy
Feed Materials Production Center
P.O. Box 398705
Cincinnati, Ohio 45239-8705

SRF-5J

RE: OSDF DCN for Intervening Layer

Dear Mr. Reising:

The United States Environmental Protection Agency (U.S. EPA) has completed its review of the United States Department of Energy's (U.S. DOE) December 20, 2001, Document Change Notice (DCN) for the On-Site Disposal Facility (OSDF)intervening layer thickness and final cover system.

The letter requests approval for implementation of a design change to improve the long-term safety performance of the OSDF. The proposed design change consists of a 2-foot minimum intervening layer(in lieu of the current 4-foot design), a 2-foot thick category 1 layer under the 3-foot thick select-impacted-material layer, and the use of a 80-mil High Density Polyethylene geomembrane cap in the final cover of the OSDF.

U.S. EPA approves the DCN. It appears these design changes will provide more direct and better protection and support of the final cover system, lower the elevation of debris layers in the OSDF, and allow for potential further reduction on the OSDF footprint.

U.S. EPA recommends U.S. DOE make all efforts to utilize concrete crushing to further reduce the size of the OSDF footprint as well as the OSDF material transfer area. U.S. EPA believes concrete crushing will further improve the overall soil and debris placement operation of the OSDF.

Recycled/Recyclable • Printed with Vegetable Oil Based Inks on 50% Recycled Paper (20% Postconsumer)

Please contact me at (312) 886-0992 if you have any questions regarding this matter.

Sincerely,

James A. Saric
Remedial Project Manager
Federal Facilities Section
SFD Remedial Response Branch #2

cc: Tom Schneider, OEPA-SWDO
Kim Chaney, U.S. DOE-HQ
John Bradburne, Fluor Fernald
Terry Hagen, Fluor Fernald
Tim Poff, Fluor Fernald

OhioEPA

4944

State of Ohio Environmental Protection Agency

Sout

Post-it® Fax Note 7671	Date	# of pages ▶
To J D CHIOU	From Ohio EPA	
Co./Dept.	Co	
Phone #	Phone #	
Fax # x5131	Fax #	

East Fifth Street
Dayton, Ohio 45402-2911
TELE: (

Governor
Governor
Director

January 23, 2002

Mr. Johnny Reising
U.S. Department of Energy, Fernald Area Office
P.O. Box 538705
Cincinnati, OH 45253-8705

RE: APPROVAL OF RCI 20104-001R, OSDF INTERVENING LAYER THICKNESS

Dear Mr. Reising:

This letter provides Ohio Environmental Protection Agency approval of the OSDF Intervening Layer Thickness RCI 20104-001R. Because the RCI itself does not include a description of all of the important factors that are relevant to this issue, we summarize the path-forward as follows:

- The HDPE liner in the cap will be up-graded from 60-mil to 80-mil. Cell 1 will be the only OSDF cell with a 60-mil HDPE geomembrane. The others will be capped with the 80-mil material.
- The select impacted layer directly beneath the cap contouring layer will be underlain by a two-foot layer of Category 1.
- In the portion of Cell 2 where waste placement has already exceeded half the design height, the original 4-foot intervening layer will continue to be used as the design standard. This will prevent a top-heavy condition.
- No waste will be moved in those areas of Cell 2 where waste has already been placed in the horizons directly under the select impacted material layer. These areas of Cell 2 will not follow the criteria that 2-foot of Category 1 material will be placed directly beneath the select layer.
- DOE will set as a goal the elimination of the use of off-site aggregate for road beds and off-site coarse aggregate for erosion control in contaminated remediation areas and in the OSDF. Concrete D&D debris will be crushed to supply 100% of those needs.
- We have receive a grid diagram which indicates by coordinates which grids in Cells 2 and 3 will be completed with the 2-foot intervening layer and which grids will be completed with the 4-foot intervening layer.

During the evolution of the concept of revising the thickness of the intervening layer, DOE has provided several previous submittals. Approval of this RCI should not be construed

4944

to mean that we agree with all the assumptions and details of these documents.

Should you have any questions, please contact Tom Ontko or me.
Sincerely,

Tom Ontko

For Thomas A. Schneider
Fernald Project Manager
Office of Federal Facilities Oversight

cc: Jim Saric, U.S. EPA
Terry Hagen, Fluor Fernald
Mark Shupe, GeoTrans, Inc.
Francie Hodge, Tetra Tech EM Inc.
Ruth Vandergrift, ODH

Q:\ou2\interveningapproval.wpd

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 1	(6) DATE
20104	FSC-653		Dec. 19, 2001

(3) S/C TITLE:	(11) RCI NO.:
On-Site Disposal Facility (OSDF) Phase IV Construction	20104-001R

(4) RESPONSIBLE DISCIPLINE:	(4A) RCI/DCN TITLE:	(11) DCN NO.:
E [ ] M [ ] C [X] OTHER [ ]	Intervening Layer Thickness	

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Impacted Material Placement (IMP) Plan	20100-PL-007	3PCN1	Section 8.0

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

[ ] REQUIRED [ ] NOT REQUIRED

Existing Condition: The OSDF impacted material placement plan currently requires a 4-foot-thick intervening layer of Category 1 material between successive two lift placement of Category 2 material, or between one lift placements of Category 3 material.

Proposed Change: Require a minimum 2-foot-thick intervening layer of Category 1 material between successive two lift placement of Category 2 material, or between one lift placements of Category 3 material. This shall apply to impacted material placement in all areas of the cells except the northern portion of Cell 2 where the top of placed impacted materials already exceeds half of the designed height of the impacted material layer. The minimum thickness requirement of intervening layers at the northern portion of Cell 2 shall remain 4 feet. Also, a two-foot-thick Category 1 layer shall be required under the 3-foot-thick select impacted material layer directly under the final cover system. This shall apply to all areas of the cells except those areas in Cell 2 where impacted material placement has been completed or is already within 2 feet below design elevation of the select impacted material layer.

Justification: Reference Memorandum, J.F. Beech of GeoSyntec Consultants to J.D. Chiou dated October 11, 2001 entitiled "Recommended Improvement to OSDF Performance for Resistance to Future Settlement"

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Chuck Van Arsdale	Fluor Fernald, Inc.	12/19/01	Chuck Van Arsdale	12/19/01

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

Changes will be made in page change format to the Impacted material placement plan and will be submitted upon approval of this RCI/DCN.

Changes from a 60 mil HDPE geomembrane to an 80 mil HDPE geomembrane for the final cover system have already been incorporated into the Phase IV drawings and specifications.

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE:	(20) CHARGE NO. FOR CADD SERVICES TO INCORPORATE:
12/19/01 KWASI BADU-TWENEBOAH, GEOSYNTEC [ ] FIT [ ] FORM [X] FUNCTION	

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

PERFORMANCE GRADE: (17)

(18) CONSTRUCTION CONCURRENCE DATE: 12/19/01	(21) FIELD WORK COMPLETED:
PURCHASE REQUISITION REQUIRED: [ ] YES [ ] NO (19) Bill Zebich	(SIGNOFF BY CE OR PE) DATE:

INFORMATION ONLY ORIGINAL

State of Ohio Envir... Fax Note 7671

South

Date	# of pages ▶
To J D Chiou	From Ohio EPA
Co./Dept.	Co.
Phone #	Phone #
Fax #	Fax # x 5131

401 East Fifth Street
Dayton, Ohio 45402-2911
TELE: (9...

...overnor
...overnor
...Director

M...

TO: J D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA
DATE: August 12, 2002
RE: OSDF Phase IV DCN 20104-002R

This RCI allows the temporary slopes of stockpiled clay (and other excavated materials) to be as steep as 2H:1V when the pile is being worked but requires that after the pile is built it be re-graded to the 3H:1V. The nature of the tills at Fernald allows slopes steeper than 3:1 to be stable. This RCI does not change other stockpile requirements such as sealing, drainage of adjacent areas, etc.

The Ohio EPA approves this RCI.

Approval of these changes does not constitute an assurance that the proposed facilities will operate in compliance with Ohio laws and regulations or that these facilities will perform in a fashion that achieves the objectives of the Operable Unit 2 Record of Decision.

Q:\ou2\dcnph4piles.wpd

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 2	(6) DATE
20104	FSC-653		May 30, 2002

(3) S/C TITLE:	(11) RCI NO.:
On-Site Disposal Facility (OSDF) Phase IV Construction	20104-002R

(4) RESPONSIBLE DISCIPLINE:	(4A) RCI/DCN TITLE:	(11) DCN NO.:
E [ ] M [ ] C [X] OTHER [ ]	OSDF Construction Stockpile Slopes	

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV OSDF CFC Technical Specifications	20104-TS-0001	1	Section 02200, Part 3.06

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

[ ] REQUIRED [ ] NOT REQUIRED

Section 02200 of the OSDF Technical Specifications states that stockpiles of excavated soils for use in OSDF construction activities be constructed no steeper than 3H:1V slopes. It appears that there are currently active stockpiles that may be steeper than 3H:1V. Please advise.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald, Inc.	5/30/02	Charles C. Van Arsdale	5/30/02

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

The maximum allowable slope for any stockpile is determined by stability, which is a function of the internal shear strength of the soil material. Sandy soils rely on internal friction while clayey soils have both internal friction and cohesion to provide the shear strength required for stability. Excavated materials from OSDF Phase IV construction are essentially brown to gray till, which are clayey soils. Therefore, during stockpiling of fill material, working slopes may be steeper than 3H:1V, but no steeper than 2H:1V. The stockpiles shall be constructed and operated in accordance with the site safety requirements, which is addressed in Page 2.
Upon completion of stockpiling activities, the remaining materials from the stockpile shall be graded to the specified 3H:1V slopes, sealed and tracked, and adjacent areas graded to drain, as specified in Section 02200, Part 3.06B. Install surface-water management and erosion control measures; and stabilize with a crusting agent at the end of the construction season in accordance with Sections 02270 and 02930 of the Technical Specifications.

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE:	(20) CHARGE NO. FOR CADD SERVICES TO INCORPORATE:
7/3-2/02 [illegible] [ ] FIT [ ] FORM [X] 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:
Bill Zebich	
PURCHASE REQUISITION REQUIRED: [ ] YES [X] NO (19)	(SIGNOFF BY CE OR PE) DATE:

F-4259
REV. 5: 10/01/99: ED-12-5002

ORIGINAL INFORMATION ONLY

Safety Requirements

Safety and health requirements related to this RCI will be reviewed and incorporated into the Construction Traveler (CT)/Safety and Health (S&H) Work Plan by the Construction Manager. Changes to the CT/S&H Work Plan will be routed to Safety & Health, Engineering & Planning, Construction, QA/QC, Design Organization, and other Sections/Groups for review and comment.

State of Ohio Environmental Protection Agency

Southwest District Office

01 East Fifth Street
yton, Ohio 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6404

Bob Taft, Governor
Maureen O=Connor, Lt. Governor
Christopher Jones, Director

4944

MEMORANDUM

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA
DATE: September 4, 2002
RE: OSDF Phase IV RCI 20104-003R

This RCI 20104-003R modifies the Impacted Material Placement Plan provision which requires pipes greater than 12 inches in diameter to be cut in half lengthwise (or crushed) to reduce potential voids before being placed in the OSDF. This RCI allows steam condensate pipes (6 inch carbon steel with an outside diameter of 10 5/8 inch including asbestos wrapping) to be nested inside live steam pipes whose diameters are 12, 14, and 16 inches. The voids inside the nested pairs of pipes will be comparable in size to the void in a 12 inch pipe. This method will reduce the potential for worker exposure to the asbestos insulation around the pipes.

The Ohio EPA approves this RCI provided that the pipes are placed towards the center of the cell as clarified in RCI No. 20102-056R.

Approval of these changes does not constitute an assurance that the proposed facilities will operate in compliance with Ohio laws and regulations or that these facilities will perform in a fashion that achieves the objectives of the Operable Unit 2 Record of Decision.

C:\DOCUMENTS AND SETTINGS\GEOSYNTEC\LOCAL SETTINGS\TEMPORARY INTERNET FILES\CONTENT.IE5\GLQN85Y7\DCNPH4PIPES.DOC

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 1	(6) DATE
20104	FSC-653		6/25/02

(3) S/C TITLE:	(11) RCI NO.:
On-Site Disposal Facility (OSDF) Phase IV Construction	20104-003R

(4) RESPONSIBLE DISCIPLINE:	(4A) RCI/DCN TITLE:	(11) DCN NO.:
E [ ] M [ ] C [X] OTHER [ ]	Placement of Asbestos Insulation Wrapped Piping within OSDF	

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Impacted Material Placement Plan (IMPP)	20100-PL-007	3PCN1	

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

[ ] REQUIRED [ ] NOT REQUIRED

Steam condensate and live steam pipes are to be manifested for disposal in the OSDF. These pipes are wrapped with insulation containing asbestos. The pipes are made of carbon steel. The steam condensate pipes are 6-inch inner diameter with an outside diameter of 10$^{5/8}$ inches including the insulation. The live steam pipes range from 12 to 16 inches in inner diameter and 16-$^{3/4}$ to 20 inches in outer diameter including the insulation. The current IMPP requirement is to cut pipes (12 inches in diameter or greater) lengthwise in order to reduce voids within the OSDF. Cutting the asbestos insulation could create a potentially hazardous condition. Can the smaller 6 inch diameter pipes be placed within the larger 12, 14, and 16 inch diameter pipes and then placed in the OSDF? This solution appears to reduce the potential hazardous asbestos condition and seems to meet the IMPP requirement by filling a large portion of the void in the pipe. Please advise.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	6/25/02	Charles C. Van Arsdale	6/25/02

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

Based on the proposed placement plan described above, the maximum size of void will be that of the 6-in. thick diameter pipes. This then meets the requirements of the IMP Plan. However, to minimize the potential impact of void collapse on the overall performance of the OSDF, it is recommended that these pipes be placed at least 6 feet below the bottom of the select impacted material layer in the final cover system. This recommendation is consistent with the analysis performed as part of RCI No. 20104-001R. Also, to minimize the potential protrusion of the pipes to the outer slopes, it is suggested that they be placed towards the center of the cell, as clarified in RCI. No. 20102-056R.

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 7/22/02

Kwasi Badu-Tweneboah, GeoSyntec Consultants

[ ] FIT [ ] FORM [X] 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:

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

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

ORIGINAL INFORMATION ONLY

State of Ohio Er
South
East Fifth Street
Dayton, Ohio 45402-2011
TELE: (937

Post-it® Fax Note 7671	Date	# of pages ▶
To J D Chiou	From Ohio EPA	
Co./Dept.	Co.	
Phone #	Phone #	
Fax # 5131	Fax #	

ME

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA Tom Ontko
DATE: September 16, 2002
RE: OSDF Phase IV RCI 20104-004R

This RCI 20104-004R outlines the repair to the clay liner at the penetration box for Cell 5. The Ohio EPA previously verbally approved the repair method and we observed the first several steps of the process. The actual repair differs somewhat from the sketch accompanying this RCI. A brief description of the repair on September 8, 2002 follows: Off-spec material was easily identified visually as gray clay and was removed with hand tools. An excavator removed additional material to form a slope that would be gradual enough to allow a Caterpillar 815 to compact clay in lifts around the box. The Cat 815 compacted as close to the box as it could.

The compacted clay was trimmed around the box to allow the placement of hand-compacted lifts. This step and the hand-compacted lifts were observed and photographed by Ohio EPA.

The sub-grade was compacted with a 'pogo stick' which is operated with compressed air. The actual working face of this tool is 3 or 4 inches in diameter and at first glance this equipment looks like a jack hammer. The bottom of the excavation at this stage is roughly a foot or a foot and a half wide and it extends to the top of the subgrade. If the sketch were re-labeled so that "Clay liner constructed in 7-inch +/- inch lifts" read "Clay compacted with Cat 815" and the label "Soil-bentonite mix" were changed to read "Area of hand-operated machine compaction" then the sketch would more closely resemble the work as it was actually performed.

A 'jumping jack' was used to compact the clay in roughly 6 inch loose lifts. It was possible to bench the hand work into the existing clay liner. GeoSyntech measured the compaction using a Troxler with a 6-inch probe depth after two lifts and the results were satisfactory. By the end of the day, the compacted lifts were placed to within roughly one foot of grade. The work was protected with plastic sheeting and the repair was finished after the week end. Ohio EPA was not present for subsequent work and we have no knowledge of the amount of soil-bentonite mix required or the extent of the areas which were not accessible for hand compaction.

The Ohio EPA approves this RCI.

Approval of these changes does not constitute an assurance that the proposed facilities will operate in compliance with Ohio laws and regulations or that these facilities will perform in a fashion that achieves the objectives of the Operable Unit 2 Record of Decision.

Q:\ou2\dconclay\rcwork.wp1

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 15	(6) DATE
20104	FSC-653		8/29/02

(3) S/C TITLE:	(11) RCI NO.:
On-Site Disposal Facility (OSDF) Phase IV Construction	20104-004R

(4) RESPONSIBLE DISCIPLINE:	(4A) RCI/DCN TITLE:	(11) DCN NO.:
E [ ] M [ ] C [X] OTHER [ ]	Re-work of Cell 5 Clay liner at the Liner Penetration Boxes	

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV OSDF Technical Specifications	20104-TS-0001	1	Section 13005, Part 3.02
			Section 02225, Parts 3.05, 3.06

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

[ ] REQUIRED [ ] NOT REQUIRED

On August 24, 2002, a sump was excavated at the toe of the Cell 5 clay liner near the liner penetration boxes. The sump was excavated to capture storm water in the event that rainfall occurred overnight before all the geosynthetics had been deployed in the cell. If the sump was not excavated, the water could spread out and saturate the currently placed GCL underneath the deployed geomembrane panels. This would have required removal of the saturated GCL. During the excavation of this sump, GeoSyntec CQC personnel noticed that the gray clay (subgrade material) appeared to be at an elevation, which would not allow a 3-foot thickness of brown clay (clay liner material). Previous survey information surrounding the sump area showed that the 3-foot thickness had been achieved. As-built survey measurements were taken and the limits of the gray clay were excavated to the extent where the clay liner reached a 3-foot thickness. Excavation limits of the clay ended up being close to the liner penetration boxes. How can the excavation be backfilled around the liner penetration boxes without removing the boxes?

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	8/28/02	Charles C. Van Arsdale	8/28/02

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

See attached response.

RCI - DCN ACCEPTANCE

INFORMATION ONLY

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 9/4/02

Kwasi Badu-Tweneboah, Geosyntec Consultants

[ ] FIT [ ] FORM [X] 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:

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

Bill Zebuch

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

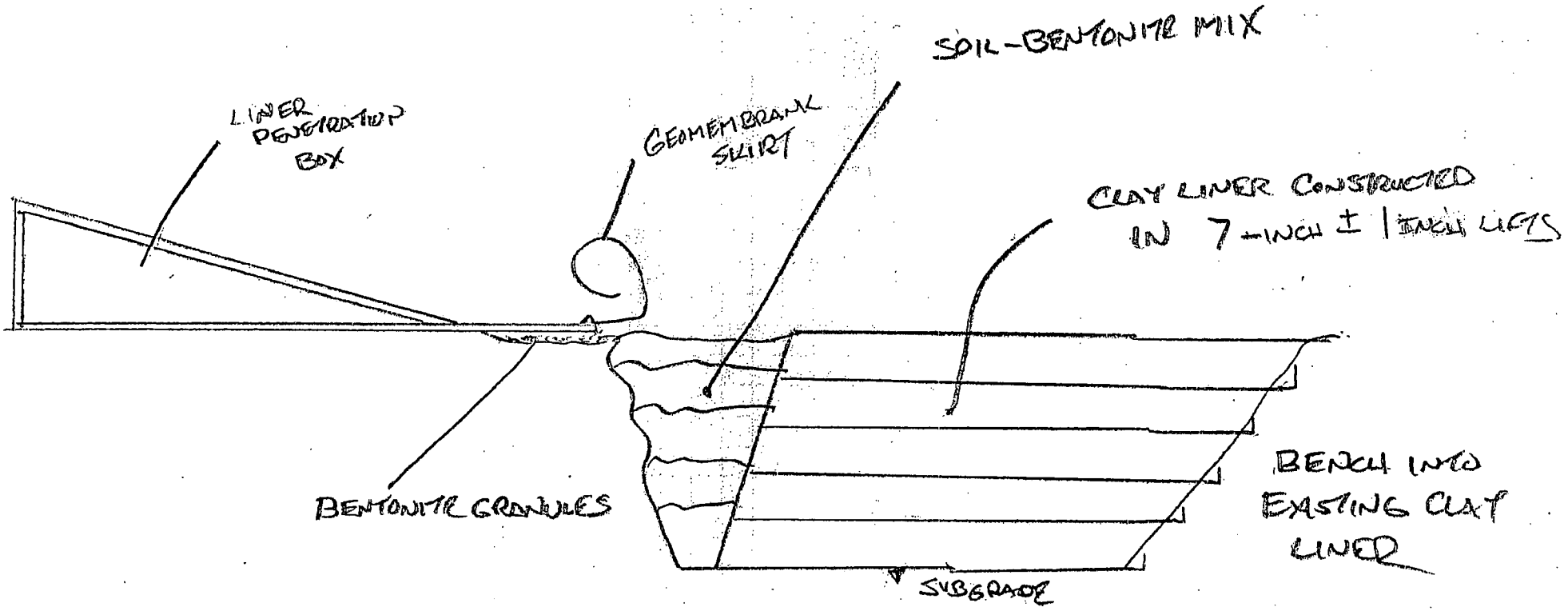
FS-F-4259
REV. 5: 10/01/99: ED-12-5002

RESPONSE TO RCI-004
RE-WORK OF CELL 5 CLAY LINER AT PENETRATION BOXES

The sump area at the Cell 5 liner penetration boxes shall be backfilled with clay liner material from an approved OSDF Borrow Area stockpile. The clay liner material shall be placed in accordance with OSDF Technical Specification Section 02225 and tested in accordance with the OSDF CQA Plan. As shown in the attached sketch, clay material shall be placed in lifts. The distance between the clay material lift edge and liner penetration box shall be enough to operate a vibratory plate compactor. In accordance with Specification Section 13005, a soil bentonite mixture (10% by weight bentonite granules mixed with clay liner material) shall be placed around the liner penetration boxes and compacted in accordance with the requirements of Specification Section 02225. Any interface between the compacted clay liner and liner penetration box shall be filled with bentonite granules.

In addtion, a supplemental layer of GCL-GML shall be installed at the toe near the pipe termination of the liner penetration boxes to provide additional containment. The supplemental geomembrane shall be welded to the secondary geomembrane in accordance with OSDF Technical Specification Section 02770 and tested in accordance with the OSDF CQA Plan.

RCI No. 22184-054R



RE-WORK OF CLAY LINER AT CELL 5 LINER PENETRATION BOX

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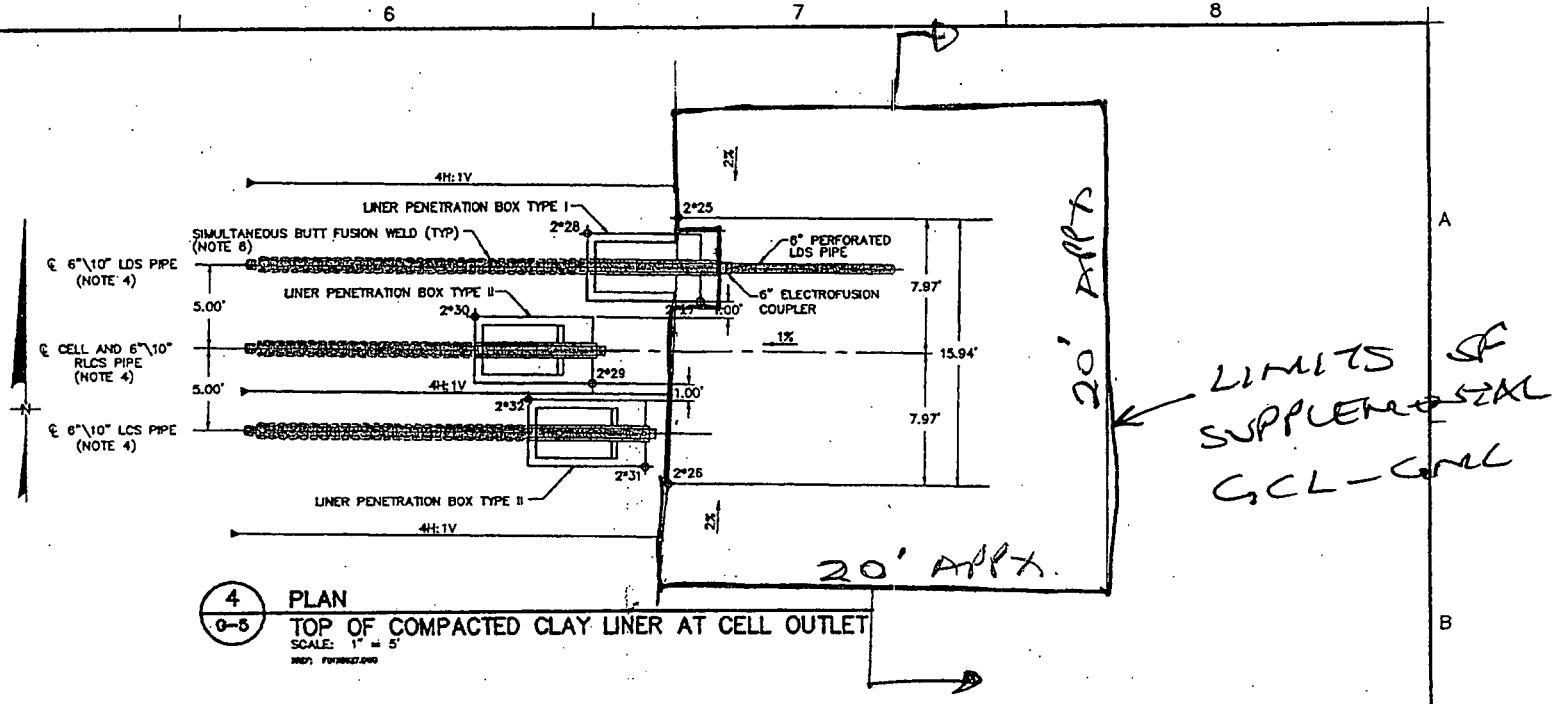
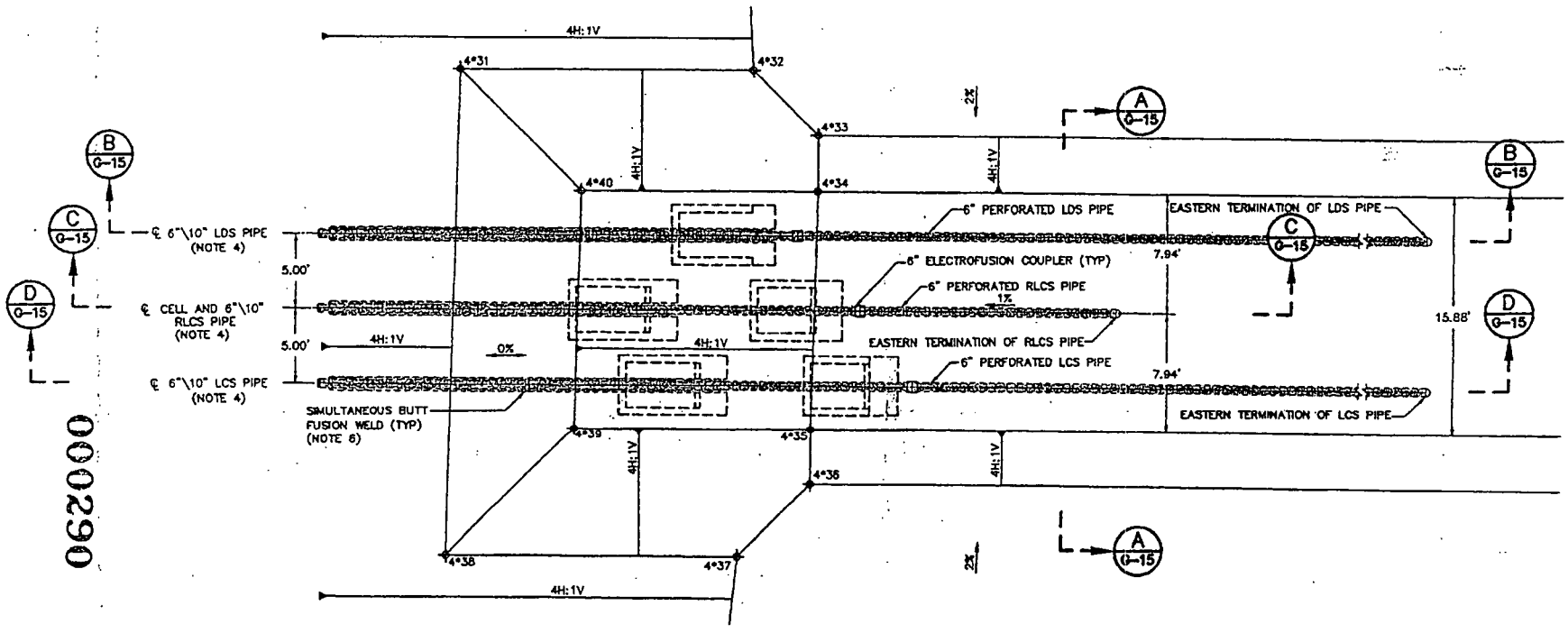
RCI No. 2004-004R



4 G-5 PLAN
TOP OF COMPACTED CLAY LINER AT CELL OUTLET
SCALE: 1" = 5'



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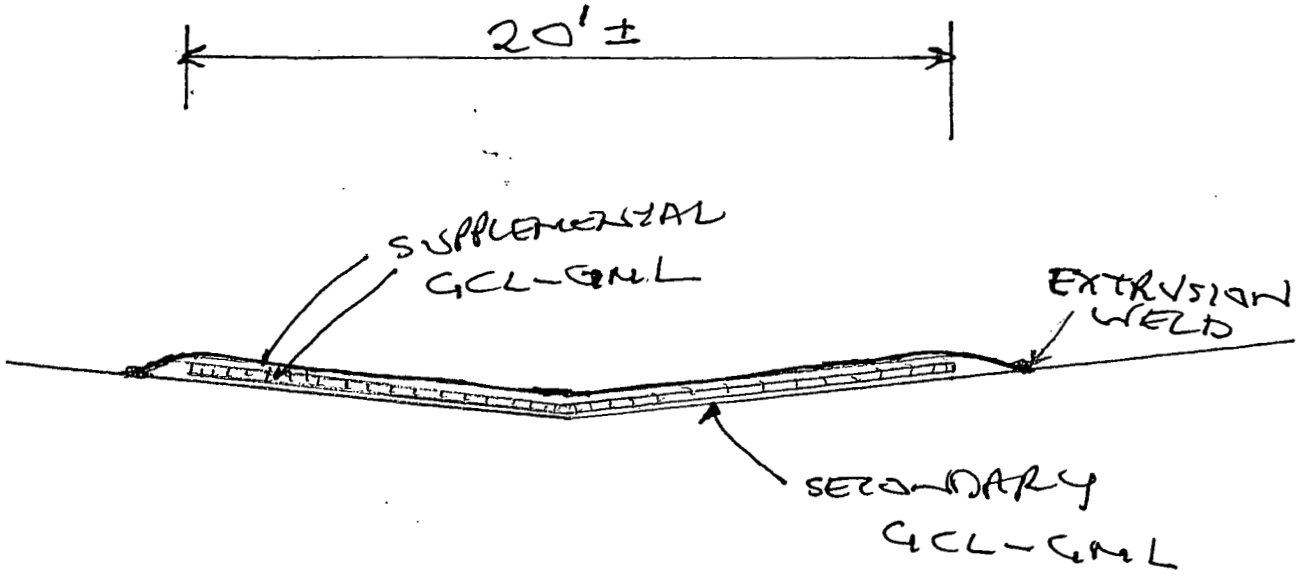
GEOSYNTEC CONSULTANTS

Written by: _____ Date: ___/___/___ (YY MM DD) Reviewed by: _____ Date: ___/___/___ (YY MM DD)

Client: _____ Project: _____ Project/Proposal No.: _____ Task No.: _____

RCI No. 20104-004R



SECTION OF LINER SYSTEM (NTS)

State of Ohio Environmental Protection Agency

Southwest District Office

401 East Fifth Street
Dayton, Ohio 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6404

Bob Taft, Governor
Maureen O=Connor, Lt. Governor
Christopher Jones, Director

MEMORANDUM

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA
DATE: November 27, 2002
RE: OSDF Phase IV DCN 20104-005R

This IMPP currently specifies that new Cells be covered with an initial one-foot lift of protective material followed by a 3 feet of select impacted material. The 3 feet of select material may be reduced in thickness to 2 feet if the subsequent horizon is Category 1 material.

This RCI requests that transite bundles be placed directly on the 2-foot horizon of select impacted material. Placement of the transite bundles would occur over the winter and be performed in accordance with Section 8.4 of the IMPP. The Category 1 material to be placed around and over the transite would occur next construction season.

The RCI does not explain how the liner components will be protected from damage or how reducing the thickness of the select impacted layer will be an improvement to the performance of the OSDF. The RCI does not describe the type of truck to be used to transport the bundles or the method to unload the truck. It does not contain limits on operations caused by wet weather or loss of traction and subsequent rutting of the select material. It does not address a bundle lay-out pattern or how trucks will negotiate their way around groupings of bundles that are only 8 feet apart.

This RCI should be re-written to either address the above concerns or alternately re-submitted so that the select layer will be built to the original 3-foot thickness.

C:\DOCUMENTS AND SETTINGS\GEOSYNTEC\LOCAL SETTINGS\TEMPORARY INTERNET FILES\CONTENT.IE5\SXIFKHQ7\DCN20104-005R-TRANSITEWINTER.DOC

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 2	(6) DATE
20104	FSC-653		11/25/02

(3) S/C TITLE:	(11) RCI NO.:
On-Site Disposal Facility (OSDF) Phase IV Construction	20104-005R

(4) RESPONSIBLE DISCIPLINE:	(4A) RCI/DCN TITLE:	(11) DCN NO.:
E [ ] M [ ] C [X] OTHER [ ]	Transite panel placement over 2 foot thick select impacted material layer	

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
OSDF Impacted Material Placement Plan	20100-PL-007	3PCN1	

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

[ ] REQUIRED [ ] NOT REQUIRED

Currently, Section 7.3.1 of the OSDF Impacted Material Placement (IMP) Plan allows placement of a 2-ft-thick select impacted material layer as long as the next lift placed directly over the select impacted material is Category 1 material. Select impacted material shall have a maximum particle size not exceeding 6 inches and at least 80 percent of the material finer than a 1-inch particle size. Category 1 material cannot contain hard conglomerates greater than 12 inches in greatest dimension. There is no mention in the IMP Plan if transite panels (Category 3 material) can be placed directly above the 2-foot-thick select impacted layer. It is proposed to place stacked bundles of transite panels directly over the 2-ft-thick select impacted material layer this winter in accordance with Section 8.4 of the IMP Plan. The Category 1 material that is required around and over the transite panels will be placed upon opening the cell during the next construction season. The transite panels have a flat bottom and therefore will not penetrate into the underlying select and protective layers and not cause harm to the geosynthetics below the protective layer. Please clarify.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	11/25/02	Charles C. Van Arsdale	11/25/02

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

See attached response.

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 11/25/02

Kwasi Badu-Twenenboah, Geosyntec Consultants

[ ] FIT [ ] FORM [X] 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: 11/25/02

Bill Zebuch

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

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

F-4259
REV. 5: 10/01/99: ED-12-5002

DESIGN ORGANIZATION RESPONSE TO RCI NO. 20104-005

TRANSITE PANEL PLACEMENT OVER 2 FOOT THICK SELECT IMPACTED MATERIAL LAYER

One of the general design criteria identified for the OSDF and specifically applicable to the IMP Plan (Section 2.4, page 2-5) is that "...Impacted material should be placed in a manner that is protective of the liner system and final cover system..." The use of a minimum 3-ft thick select impacted material, or 2-ft thick select impacted material plus one lift of Category 1 material placed in controlled lifts, over the protective layer component of the liner system helps to meet the design objective of protecting the liner system from the overlying impacted material. Protection of the liner system is critical for impacted materials that are placed , spread, and compacted *en masse*, or that contain materials that could protrude into the select impacted material and protective layers to potentially damage the liner system. This is more applicable to Category 2 materials such as general building rubble and debris of irregularly shaped metals or other components with a maximum length of 10 ft that can be transported, placed, spread, and compacted *en masse.*

Bundles of transite panels, which are Category 3 materials, are defined as materials that can be individually handled and placed, and are of the shape such that Category 1 material can be compacted around and against them. The individual and alternate placement procedures presented in Sections 8.4.1 and 8.4.2 of the IMP Plan, respectively, are such that bundles of packaged transite panels are placed in a controlled manner such that they are not likely to protrude into the underlying layers. This has been observed during previous placement of transite panels in the OSDF Cells 1, 2, and 3.

Based on the above rationale and field experience, bundles of packaged transite panels may be placed, in a controlled manner, directly over a minimum of 2-ft thick select impacted material layer placed above the protective layer in the OSDF liner system. The Category 1 material to be placed and compacted around the transite panels, as presented in Section 8.4 of the IMP Plan, shall be soil and soil-like material, as defined in Section 5.2 of the IMP Plan, and be placed in controlled lifts per Section 2.4 of the IMP Plan.

The above clarification and placement of Category 3 material over the 2-ft-thick select impacted material layer is only applicable to placement of bundles of transite panels. It is not applicable to other Category 3 materials such as "...broken concrete foundation members that meet the physical criteria defined in Section 4.3 of the IMP Plan..."

4944

OhioEPA

State of Ohio Envirc

Southwes

401 East Fifth Street
Dayton, Ohio 45402-2911
TELE: (937) 285

Post-it® Fax Note 7671	Date	# of pages ▶
To JDChiou	From OhioEPA	
Co./Dept	Co	
Phone #	Phone #	
Fax # x5131	Fax #	

MEMC

FILE COPY

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA TMO
DATE: January 10, 2003
RE: OSDF Phase IV RCI No. 20104-005R

This RCI was previously reviewed and was not approved in a memo dated November 27, 2002. Our concerns at that time were the reduction in the lift thickness of the select layer from 3 feet to 2 feet.

This revised RCI restores the select layer to its original 3 foot thickness and the transite bundles will be placed on top of the 3-foot select layer and the 1-foot Category 1 layer. The revised version also includes a discussion of the effects of winter freeze-thaw cycles on soil. We concur with the discussion that exposed soils (that is soils not under the bundles) can be repaired before the placement of subsequent Category 1 lifts and we also concur that it will not be necessary next Spring to move the bundles to check or to rework the under-lying soils. Not specifically addressed is the placement of bundles on frozen soil. During our telephone discussion, you indicated that it is not Fluor Fernald's intent to place bundles on frozen soil because of the impracticability of repairing the soil under the bundle.

The Ohio EPA approves this DCN with the condition that transite bundles not be placed on frozen soil. We will reconsider this condition if we are provided with an analysis which justifies the placement on frozen soil. We note that this condition and also the practical difficulties of placement when conditions are muddy will very likely result in a limited window of suitable weather.

Approval of these changes does not constitute an assurance that the proposed facilities will operate in compliance with Ohio laws and regulations or that these facilities will perform in a fashion that achieves the objectives of the Operable Unit 2 Record of Decision.

Q:\ou2\dcnph4transiteapprove.wpd

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 4	(6) DATE
20104	FSC-653		12/18/02

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.: 20104-005R

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

(4A) RCI/DCN TITLE: Transite panel placement over winter timeframe

(11) DCN NO.:

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
OSDF Impacted Material Placement Plan	20100-PL-007	3PCN1	

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

[ ] REQUIRED [ ] NOT REQUIRED

Category 3 materials (transite panels) are planned to be placed in the OSDF over a 4-ft thick layer consisting of: 1-ft thick protective layer, 2-ft thick select impacted material layer; and a 1-ft thick Category 1 material in accordance with the Impacted Material Placement (IMP) Plan. It is proposed to place stacked bundles of transite panels over this 4-ft-thick layer this winter in general accordance with the placement requirements in Section 8.4 of the IMP Plan. The Category 1 material that is [illegible] around and over the transite panels will however be placed and compacted upon opening the cell during the next construction season in the spring of 2003. [illegible]e winter (freeze-thaw) conditions affect the soil directly beneath the transite panels? Please clarify.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	12/18/02	Charles C. Van Arsdale	12/18/02

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

See attached response.

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 1/16/03

Kwasi Badu-Tweneboah, Geosyntec Consultants

[ ] FIT [ ] FORM [X] 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: 1/08/03

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

Bill Jebsen

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

FS-F-4259
REV. 5: 10/01/99: ED-12-5002

DESIGN ORGANIZATION RESPONSE TO RCI NO. 20104-005

TRANSITE PANEL PLACEMENT OVER WINTER TIMEFRAME

Understanding of Proposed Plan:

It is understood that Fluor Fernald proposes to place bundles of packaged transite panels during this winter in general accordance with the individual or alternate placement procedures of the IMP Plan. The attached sketch shows the limits of where transite panels are to be placed to meet the IMP Plan placement requirements. A flatbed trailer will be used to transport bundles of transite panels into the cell at a designated point, where a forklift will unload the material and move the transite panels to the placement location. This will minimize tire ruts from the flatbed trailer. The panels will be stacked to a height of 4 feet and placed in a group of three stacks and a minimum distance of 8 feet horizontally apart between groups in accordance with the IMP Plan.

It is also understood that the Category 1 material (soil) between and above the Category 3 transite panels will be placed in the following spring, when active OSDF construction season resumes. Any weeds or vegetation on the surface of the in-place Category 1 material (placed in the previous construction season) will be removed and the surface tracked to prepare for additional lifts of Category 1 material to be placed and compacted around the transite panels in general accordance with the IMP Plan.

Evaluation of Proposed Plan

The proposed plan for placement of transite panels should not affect the integrity of the OSDF liner system. First the transite panels will be placed on top of a minimum 4-ft thick soil layer above the OSDF liner system as required by the project specifications, IMP Plan, and Quality Assurance (QA) Plan. The 2-ft thick select impacted material layer and the 1-ft thick Category 1 soil material will be placed and compacted in accordance with the IMP Plan. In-place nuclear moisture/density tests will be conducted on each lift of soil to meet the performance requirements presented in the QA Plan of the IMP Plan.

However, during the winter period, the soil in the space between the transite panels will likely be subjected to snow, freeze-thaw cycles, erosion, and other inclement weather conditions. It is also possible that weeds and other vegetation may also grow on top of the Category 1 soil before resumption of the next construction season in March or April. Therefore, inspection and monitoring of the ground surface between the transite panels should be performed as part of the OSDF seasonal cover inspection and monitoring activities (see Table 11-1 of the IMP Plan). Any required repairs, including regrading of eroded areas, removal of snow and/or weeds, etc.) should be performed prior to resumption of active impacted material placement activities. The repaired areas shall be monitored by the CQC Consultant, including testing, if necessary, and surveyed to confirm that the minimum soil layer thickness is maintained. This recommendation is consistent with the IMP Plan requirements and has been a state-of-practice for the OSDF cell placement operations.

(KB7)

DESIGN ORGANIZATION RESPONSE TO RCI NO. 20104-005R

TRANSITE PANEL PLACEMENT OVER WINTER TIMEFRAME

Based on the proposed plan and evaluation presented of the requirements above, placement of transite panels during the winter should not affect the OSDF performance. It should also be noted that each bundle of transite panels is wrapped in a plastic-sheet covering that would prevent direct contact and impact of the underlying soil with rain, snow, or ice. The plastic sheets and weight of the 4-ft high transite-panel stacks would also help insulate the underlying soil from freeze-thaw cycles and potential volume expansion during the winter period of less than two months (i.e., January and February). Therefore, even though the exposed soil in the space between transite panels would be subjected to freeze-thaw cycles, it is very unlikely that the soil underneath the panels would have any similar effect. Soils generally tend to expand (increase in volume) on freezing, but the amount of expansion is dependent on whether the soil is confined or not. It is obvious that freezing temperatures would have more impact on the exposed soil than the soil underneath the transite panels. However, the exposed frozen soil would have the opportunity to thaw during the spring; repaired, if necessary, before placing and compacting additional lifts of Category 1 soil material.

Based on the factors considered above, including: insulation provided by the transite panels and plastic-sheet covering; confining weight provided by the 4-ft high transite-panel stacks; and the very short duration of potential freezing temperature conditions under consideration, it is therefore concluded that the soil directly underneath will not be significantly affected by the winter conditions and should therefore have no adverse impact on the OSDF long-term performance. There should be no need to rearrange the placed transite-panel stacks to check or rework the underlying soil before resumption of soil placement in the coming spring. Visual monitoring of the ground surface between the panels could be conducted to assess if there is any unexpected impact from the winter conditions.

1/08/03

RCI No. 2010-0258
Page 4 of 4
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(1 of 1)

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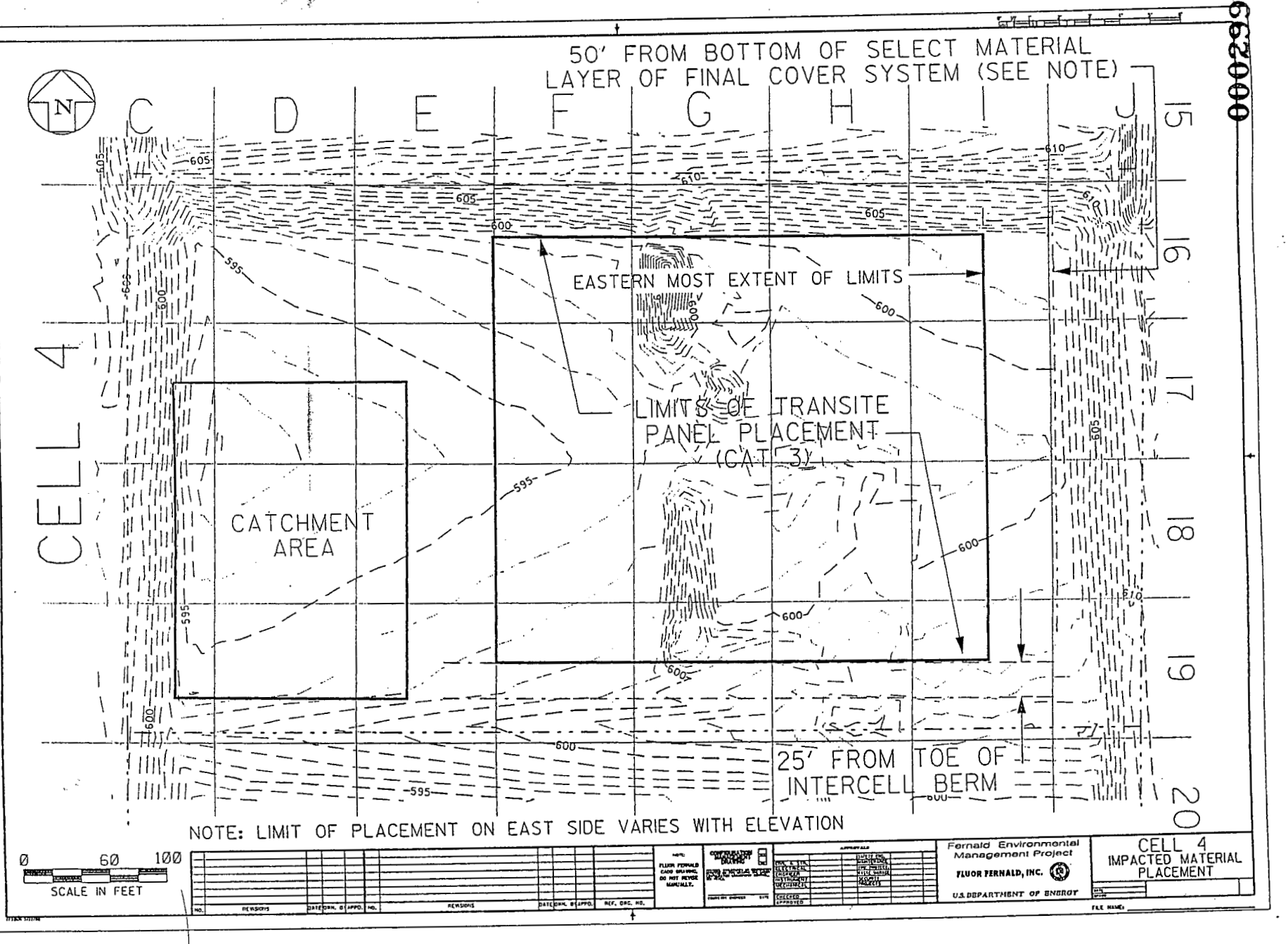

APPENDIX T

Design Change Notices (DCNs)

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 1	(6) DATE
20104	FSC-653		January 10, 2002

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Emergency Access Road Re-alignment

(11) DCN NO.: 20104-001

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Construction Drawings: Site Development Plan II	90X-6000-G-00330	0	Sheet G-2
Phase IV Construction Drawings: Misc. Liner Systems & Road Details	90X-6000-G-00350	0	Sheet G-22

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: The alignment of the emergency access road was changed to reduce the number of curves an emergency vehicle would have to negotiate.

Existing Condition: The current emergency access road horizontal alignment is shown on Sheet G-2 of the Construction Drawings. The alignment angles south of the existing STP excavation areas. A cross section of the proposed road is shown on Sheet G-22

Proposed Change: The attached drawings replaces the emergency access road alignment shown on Sheet G-2 and the cross section shown on Sheet G-22. The attached drawings show centerline stationing and curve data, ditch grading, culvert crossings, and road cross sections. The new emergency access road alignment travels between the two STP excavations to provide a safer access for emergency vehicles.

(10) REQUESTOR: Charles C. Van Arsdale COMPANY: Fluor Fernald, Inc. DATE: 1/10/02

(12) CE / PE Charles C. Van Arsdale DATE: 1/10/02

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

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 1/10/2002

KAYASI BADU-TWENEBOAH, GEOSYNTEC

[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE:(DCN ONLY) DATE: 1/10/02

PERFORMANCE GRADE: (17) 5 - SBDR 2000-0027 Applies Charles C. Van Arsdale

(18) CONSTRUCTION CONCURRENCE DATE:

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

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

ECDC CONTROLLED COPY NO. C 011

ORIGINAL

State of Ohic
Sou
01 East Fifth Street
Dayton, Ohio 45402-2911
TELE:

Post-it® Fax Note 7671	Date	# of pages ▶ 4944
To J D CHIOU	From Ohio EPA	
Co./Dept	Co	
Phone #	Phone #	
Fax # x5131	Fax #	

, Governor
, Governor
s, Director

MEMORANDUM

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA Tom Ontko
DATE: March 21, 2002
RE: OSDF Phase IV DCN 20104-002

DCN 20104-002 provides additional protection to the compacted clay liner at the temporary termination located at the intercell berm. To provide additional protection from the protective layer soil, this DCN extends the secondary GML over the extent of the 5:1 slope of the clay liner.

The Ohio EPA approves this DCN.

Approval of these changes does not constitute an assurance that the proposed facilities will operate in compliance with Ohio laws and regulations or that these facilities will perform in a fashion that achieves the objectives of the Operable Unit 2 Record of Decision.

Q:\ou2\ph4dcngmlterminate.wpd

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.: 20104	(2) S/C NO.: FSC-653	(5) Pg 1 Of 2	(6) DATE March 13, 2002
(3) S/C TITLE: On-Site Disposal Facility (Phase IV) Construction			(11) RCI NO.:
(4) RESPONSIBLE DISCIPLINE: E [ ] M [ ] C [x] OTHER [ ]	(4A) RCI/DCN TITLE: Extension of Secondary Geomembrane Liner Over Compacted Clay Liner		(11) DCN NO.: 20104-002

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Construction Drawings: Liner System Details	90X-6000-G-00342	0	Sheet G-14

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: The compacted clay liner at the sloping end of the liner system temporary termination at intercell berm need additional protection from the protective layer soil.
Existing Condition: The current details 19 and 20 on Sheet G-14 do not show the secondary geomembrane liner extending over the 5H:1V sloping face over the compacted clay liner to provide additional protection of compacted clay liner.
Proposed Change: Extend the secondary geomembrane liner to the limits shown on the attached drawing.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Kwasi Badu-Tweneboah	GeoSyntec	March 13, 2002	Charles C. Van Arsdale	3/14/02

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

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 3/14/02
Kwasi Badu-Tweneboah, GeoSyntec
[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 3/21/02
PERFORMANCE GRADE: (17) 4, SBDR 2000-0027 applies

(18) CONSTRUCTION CONCURRENCE DATE:
PURCHASE REQUISITION REQUIRED: [ ] YES [X] NO (19)
Bill Zebrich 3/14/02

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

ECDC CONTROLLED COPY NO. C011

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

4944

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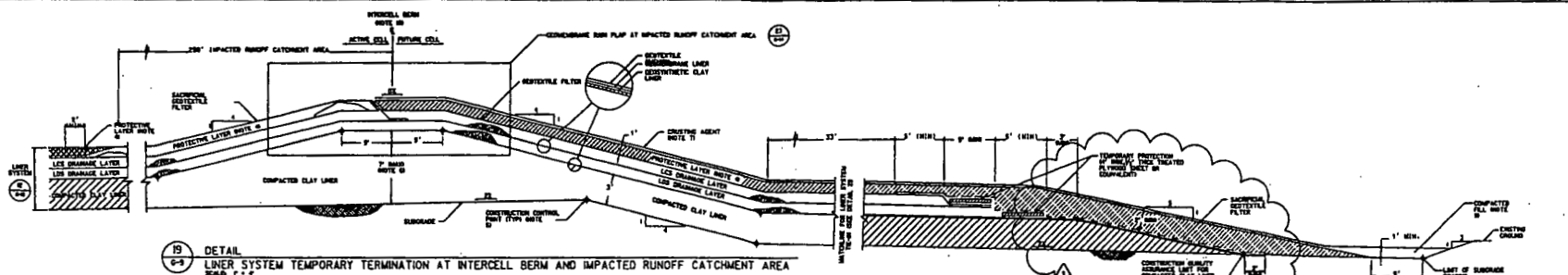
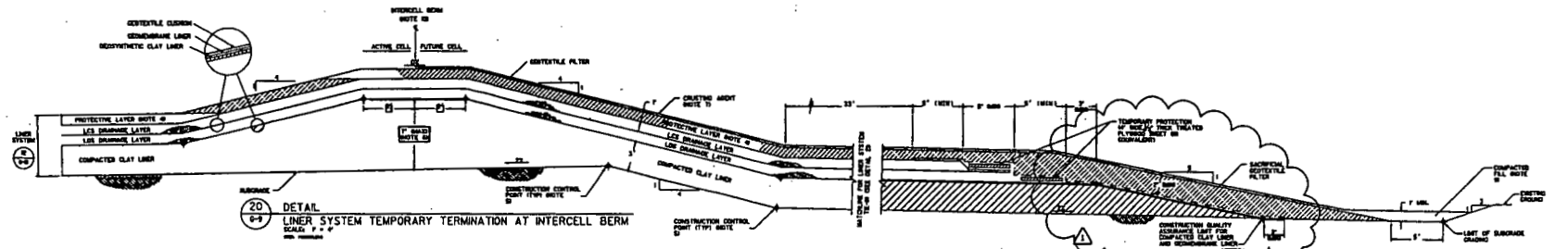
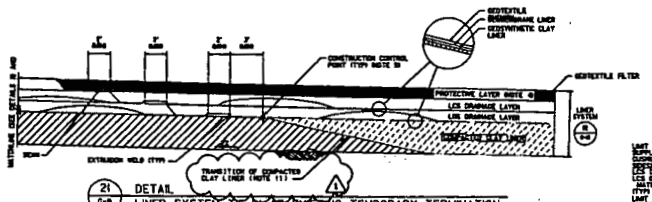


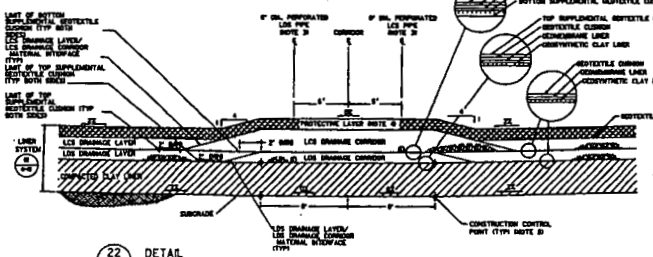
19 DETAIL
LINER SYSTEM TEMPORARY TERMINATION AT INTERCELL BERM AND IMPACTED RUNOFF CATCHMENT AREA



20 DETAIL
LINER SYSTEM TEMPORARY TERMINATION AT INTERCELL BERM



21 DETAIL
LINER SYSTEM TIE-IN AT EXISTING TEMPORARY TERMINATION



22 DETAIL
LINER SYSTEM AT LEACHATE COLLECTION AND LEAK DETECTION CORRIDOR

1. DETAILS ARE SHOWN TO SCALE AS NOTED EXCEPT FOR GEOSYNTHETICS WHICH ARE SHOWN AT AN EXAGGERATED SCALE FOR CLARITY. MATERIAL TOLERANCES SHALL BE WITHIN LIMITS GIVEN IN SPECIFICATIONS.
2. MATERIAL IN DRAINAGE LAYERS AND DRAINAGE CORRIDORS SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02300.
3. LDS AND LCS PIPES SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02800.
4. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED GRANULAR MATERIAL IN IMPACTED RUNOFF CATCHMENT AREA AND IMPACTED MATERIAL IN REMAINING AREA.
   NE CELL AREAS EXCLUDING ACTIVE CELL AREA AT INTERCELL BERM TEMPORARY LINER SYSTEM TERMINATION. PROTECTIVE LAYER SHALL CONSIST OF NON-IMPACTED NON-GRANULAR MATERIAL IN ACTIVE AND FUTURE CELL AREAS AT TEMPORARY LINER SYSTEM TERMINATION. NON-IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02300. IMPACTED PROTECTIVE LAYER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02300.
5. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND COMPACTED CLAY LINER ARE PROVIDED ON DRAWINGS D-3, D-4, D-5 AND D-6.
6. THICKNESS OF COMPACTED CLAY LINER ALONG CENTERLINE OF INTERCELL BERM VARIES FROM A MINIMUM OF 3 FEET TO A MAXIMUM OF 7 FEET.
7. CRUSTING AGENT SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02270.
8. SUMP PLUG SHALL BE CONTINUOUSLY EXTENDED WITH WELDED TO PRIMARY GEOMEMBRANE LINER ALONG INTERCELL BERM. PLUG SHALL TIE-IN TO GEOMEMBRANE AT CREST OF PERIMETER BERM AND EXTEND ON FIELD EAST FROM WEST PERIMETER BERM BASELINE.
9. CONTRACTOR SHALL PLACE COMPACTED FILL TO PROVIDE POSITIVE DRAINAGE TO TEMPORARY DRAINAGE CHANNEL.
10. FOR CONSECUTIVE CONSTRUCTION OF CELLS 4 AND 5, THE INTERCELL BERM SHALL BE MODIFIED AS SHOWN ON DRAWING D-20.
11. CONSTRUCT TRANSITION FROM COMPACTED FILL/GEOTEXTILE/GEOMEMBRANE/COMPACTED CLAY LINER TO NON-IMPACTED SECTION OF COMPACTED CLAY LINER WITHIN 5' ACCORDANCE WITH SPECIFICATIONS/DRAWINGS.

REV. NO.	DATE	DESCRIPTION	DRN. BY	DES. BY	CHK. BY	ENGR. BY	APP. BY
F	01/10/02	REVISED PER DCN ———				05-06-02	
E	11/01/01	REVISED PER PERMITTING TO FLUOR FERNALD, INC./DOE	KCS	DLB	DT	TJC	JPG
D	07/26/01	REVISED PER PERMITTING TO FLUOR FERNALD, INC./DOE	KCS	DLB	DT	TJC	JPG
C	02/05/01	REVISED PER PERMITTING TO FLUOR FERNALD, INC./DOE	KCP	DLB	DT	DJB	JPG
B	01/05/01	REVISED PER PERMITTING TO FLUOR FERNALD, INC./DOE	KCP	DLB	DT	DJB	JPG
A	01/05/01	REVISED PER PERMITTING TO FLUOR FERNALD	KCP	DLB	DT	DJB	JPG

SCALE AS SHOWN

CONTRACTOR:
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:
FLUOR FERNALD, INC.

PROJECT:
ON-SITE DISPOSAL FACILITY - PHASE IV

TITLE:
LINER SYSTEM DETAILS II

THIS DRAWING MAY NOT BE REVISED BY PERSONS OTHER THAN THE ORIGINATOR OR CERTIFIED OFFICIAL.

SIGNATURE

DATE

FOR CONSTRUCTION
D-14
REVISED

1120 NYE BIGGS BOYD
PORTLAND, OREGON 97227

PROJECT NO.: 20104
CONTRACT NO.: 39P5005018
FMP DRAWING NO.: 001-0005-B-00141
MICROSTATION PROJECT NO.: 00141-14.3
MICROSTATION DRAWING NO.: F01-0161
SHEET NO.: D-14
REVISION NO.: 0

CERTIFIED-FOR-CONSTRUCTION

DCN_dwg_F01-0161.m OSDF2 OVER7729 Monday March 18 2002 at 10:30:20 AM EST

4944

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.: 20104	(2) S/C NO.: FSC-653	(5) Pg 1 Of 2	(6) DATE May 20, 2002

(3) S/C TITLE: On-Site Disposal Facility (Phase IV) Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Testing of Liner Penetration Boxes

(11) DCN NO.: 20104-003

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Technical Specifications	20104-TS-0001	1	13005, Parts 2.06 and 3.03

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: Due to safety concerns expressed by the proposed fabricator of the liner penetration boxes for the Phase IV construction in performing air pressure testing, the Specification is being revised to allow for an alternate test.

Existing Condition: The current specifications call for air pressure testing of the liner penetration boxes after fabrication at the plant and after installation in the field.

Proposed Change: Revise Parts 2.06 and 3.03 of Section 13005 as follows (see page 2 of 2).

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Kwasi Badu-Tweneboah	GeoSyntec	May 22, 2002	Charles C. Van Arsdale	5/22/02

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

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 5/22/02

Kwasi Badu-Tweneboah, GeoSyntec

[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 5/22/02

PERFORMANCE GRADE: (17) 4 SBDR 2000-027 Applies Charles C. Van Arsdale

(18) CONSTRUCTION CONCURRENCE DATE: 5/22/02

Bill Zebosh

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

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

CDC CONTROLLED COPY NO. 000305

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

C011

DCN NO. 20104-003

CHANGES TO TECHNICAL SPECIFICATION SECTION 13005 – LINER PENETRATION BOXES

Part 2.06: Renumber C, D, and E as D, E, and F, respectively, and insert C to read as indicated below:

> "The Fabricator may perform an equivalent vacuum test in lieu of the air pressure test specified in this Section. The equivalent vacuum test shall be submitted in writing by the Fabricator for approval by the Construction Manager prior to performing the test. The equivalent test shall meet the requirements of this Section, including methods to locate any leaks found during testing and calibration of gauges used for testing."

Part 3.03: Renumber B, C, D, and E as C, D, E, and F, respectively, and insert B to read as indicated below:

> "An equivalent vacuum test, meeting the requirements of this Section, may be performed in lieu of the air pressure test. The equivalent test shall meet the Fabricator's recommendations and approved in writing by the Construction Manager.

4944

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 2	(6) DATE
20104	FSC-653		June 3, 2002

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Revised Gravity Inlet Structure Coordinates and Elevations

(11) DCN NO.: 20104-004

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Construction Drawing: Surface-Water Management System Details IV	90X-6000-G-00348	0	Sheet G-20
Phase IV Construction Drawing: Subgrade Grading Plan – Cell 5 Liner	90X-6000-G-00332	0	Sheet G-4

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: After further inspection of the Construction Drawings, it was apparent that the elevations shown for the gravity inlet structures (GIS) were incorrect. Also, moving GIS#9 to a location approximately 10 feet to north of the proposed location shown on Sheet G-4 would ensure that Valve House #5 would not be damaged during excavation for the placement of the GIS.

Existing Condition: Sheet G-20, Rev. 0, referenced above, contains incorrect elevations for GIS #8, #9, #10

Proposed Change: The attached chart shows the corrected elevations and modified coordinates for GIS #8, #9, #10

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald, Inc.	June 3, 2002	Charles C. Van Arsdale	June 3, 2002

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

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 6/4/02

KWAKU BADU-TWEREBOAH, GEOTECHNICAL

[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 6/4/02

PERFORMANCE GRADE: (17) 4 - SBDR 2000-0027 Applies

(18) CONSTRUCTION CONCURRENCE DATE: 6/4/02

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

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

F-4259
. 5: 10/01/99: ED-12-5002

ECDC CONTROLLED COPY NO. C011

ORIGINAL

DRAINAGE CHANNEL GRAVITY INLET STRUCTURE AND REINFORCED CONCRETE PIPE CONSTRUCTION CONTROL POINTS

GIS-8, GIS-9, GIS-10

POINT NO.	NORTHING	EASTING	ELEVATION
8081	481595.11	1350668.23	588.05
8082	481595.16	1350664.59	588.05
8083	481595.82	1350610.06	588.50
8091	481405.15	1350665.92	586.62
8092	481405.15	1350662.25	586.62
8093	481405.81	1350607.74	587.08
8101	481195.16	1350663.33	585.05
8102	481195.20	1350659.66	585.05
8103	481195.88	1350605.17	585.50

GEOSYNTEC CONSULTANTS
ATLANTA, GEORGIA

FIGURE NO.	1
PROJECT NO.	GQ1342-05
DOCUMENT NO.	–
FILE NO.	DCN-011

20104-004
Page 2 of 2

4944

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 2	(6) DATE
20104	FSC-653		June 10, 2002

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Alternate intercell berm sideslope revision

(11) DCN NO.: 20104-005

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Construction Drawing: Miscellaneous Liner System and Road Details	90X-6000-G-00350	0	Sheet G-22
Phase IV Construction Drawing: Subgrade Grading Plan – Cell 4 Liner	90X-6000-G-00331	0	Sheet G-3

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: Geomembrane installation during concurrent cell construction will be difficult at the Cell 4/5 intercell berm due to a 4H:1V slope on the southern side.
Existing Condition: Since both Cells 4 and 5 are being constructed concurrently, the Construction Drawings allow an alternate intercell berm between Cell 4 and 5 to be constructed as shown on Sheet G-22. This alternate berm is constructed of 10H:1V sideslopes. The southern part of the berm transitions to a 4H:1V sideslope to match subgrade slopes. Technical Specification Section 02770 does not allow horizontal seaming of geomembrane on slopes greater than 10H:1V.
Proposed Change: Revise the southern sideslope of the alternate intercell berm between Cells 4 and 5 to continue the 10H:1V sideslope to tie into the cell floor slopes. The 4H:1V transition would be eliminated. This will allow geomembrane to be placed continously in an east-west direction, minimizes field seams, and provides a smoother transition while constructing concurrent cells. (See attached plan).

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald, Inc.	June 10, 2002	Charles C. Van Arsdale	June 10, 2002

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

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 6/12/02
KURASH BADVI THE ABOVE, CHECKED
[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 6/10/02
PERFORMANCE GRADE: (17) 4 - SBDR 2000-0027 Applies Charles C. Van Arsdale

(18) CONSTRUCTION CONCURRENCE DATE:

PURCHASE REQUISITION REQUIRED: [ ] YES [X] NO (19) 6/10/02
for Bill Zebich

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

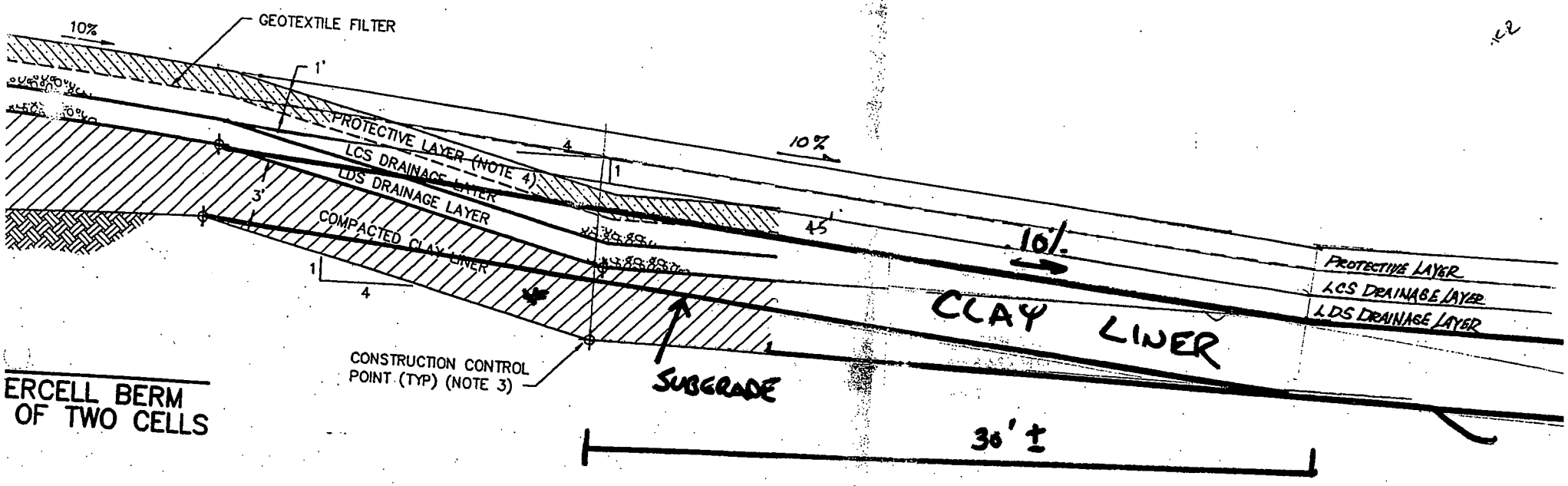
4259
. 5: 10/01/99: ED-12-5002

ECDC CONTROLLED COPY NO. C049

ORIGINAL

4944

000310



ERCELL BERM
OF TWO CELLS

*ADDS APPROX. 1300 CYDS OF COMPACTED FILL

20104-005
Page 2 of 2

Ohio EPA

State of Ohio Environmental Protection Agency

Southwest District Office

401 East Fifth Street
Dayton, Ohio 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6404

Bob Taft, Governor
Maureen O'Connor, Lt. Governor
Christopher Jones, Director

4944

October 16, 2002

Mr. Johnny Reising
U.S. Department of Energy, Fernald Area Office
P.O. Box 538705
Cincinnati, OH 45253-8705

RE: APPROVAL RtC SEDIMENTATION BASIN #2 DCN 20104-006

Dear Mr. Reising:

This letter provides Ohio Environmental Protection Agency approval of the OSDF Sedimentation Basin #2 DCN. The responses to our comments were satisfactory.

Should you have any questions, please contact Tom Ontko or me.

Sincerely,

Tom Ontko

for Thomas A. Schneider
Fernald Project Manager
Office of Federal Facilities Oversight

cc: Jim Saric, U.S. EPA
Terry Hagen, Fluor Fernald
Mark Shupe, GeoTrans, Inc.
Michelle Cullerton, Tetra Tech EM Inc.
Ruth Vandergrift, ODH

Q:\ou2\osdfsedbasin2a.jp.wpd

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 12	(6) DATE
20104	FSC-653		10/3/02

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Addition of Sedimentation Basin #2 to Phase IV scope of work

(11) DCN NO.: 20104-006

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase V Construction Drawing: Subgrade Grading Plan III – Cell 6 Liner System and OSDF Sedimentation Basin No. 2	90X-6000-G-00367	0	Sheet G-5
Phase V Construction Drawing: Surface-Water Management System Details VII	90X-6000-G-00404	0	Sheet G-42

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: If OSDF Cell Liner 6 is to be constructed in calendar year 2003, Sedimentation Basin #2 needs to be constructed in calendar year 2002 to manage storm water at the OSDF in calendar year 2003.

Existing Conditions: Existing Sedimentation Basin #1 will be removed during construction of OSDF Cell Liner 6. Runoff from areas east of OSDF Cells 1 through 5 and areas west and south of OSDF Cell 5 currently drain to Sedimentation Basin #1.

Proposed Change: Add the construction of Sedimentation Basin #2, located just south of Trailer 83, to the Phase IV scope of work in calendar year 2002 in order to be prepared to collect storm water and manage sediment during and after the construction of OSDF Cell Liner 6. Ditches which divert storm water from the east side of the OSDF cells to the existing Borrow Area Sedimentation Basin will be constructed as part of Phase V construction. Revised Drawings which incorporate OEPA comments, and response to comments are attached.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	10/3/02	Charles C. Van Arsdale	10/3/02

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

RCI – DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 10/4/02

KLAUSI BADU-TWEREBOAH, CHIEF SYSTEM

[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 10/4/02

PERFORMANCE GRADE: (17) 5 - SBDR 2000-0027 Applies

(18) CONSTRUCTION CONCURRENCE DATE: 10/4/02

Bill Zebula

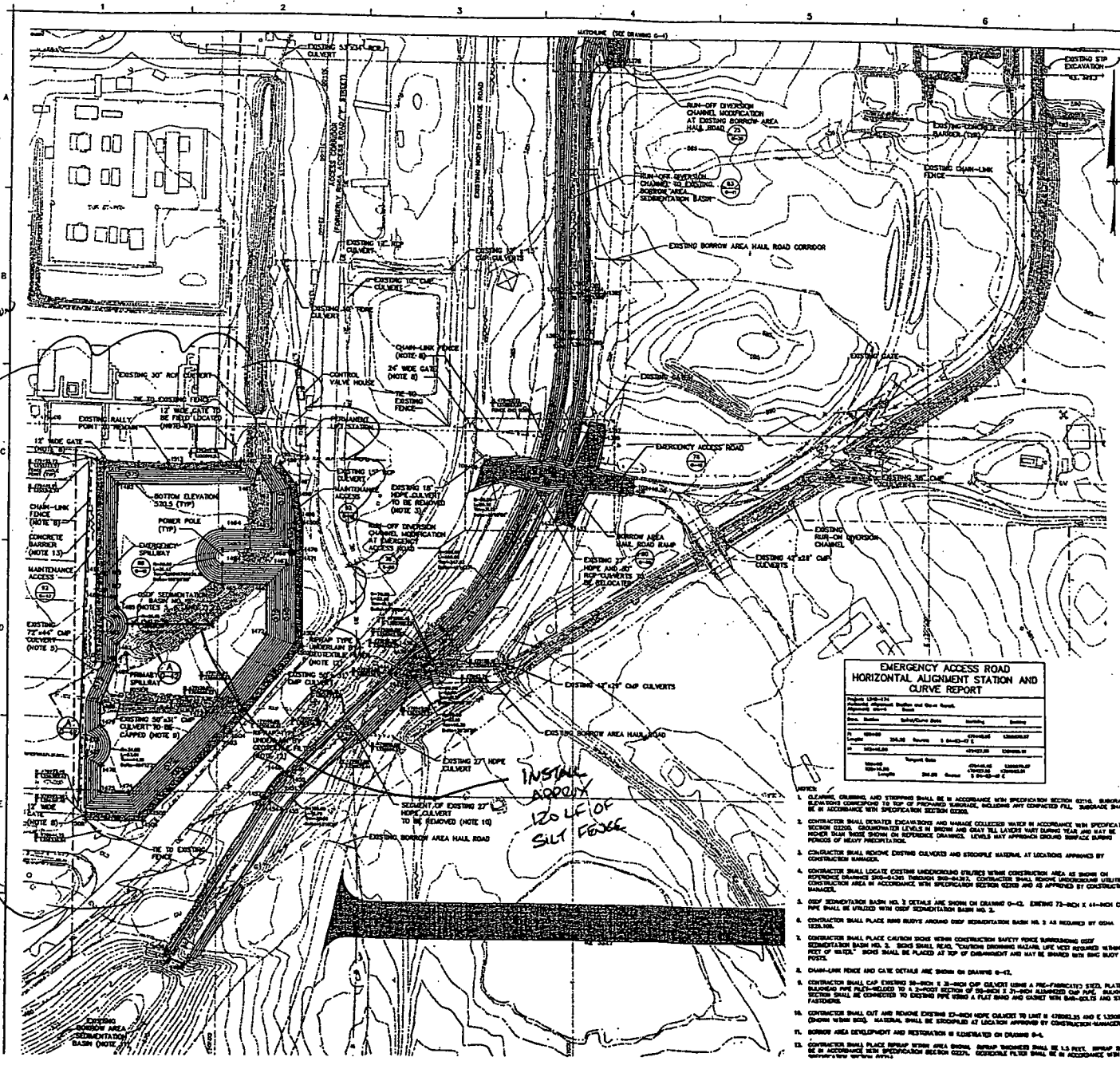
PURCHASE REQUISITION REQUIRED: [✓] YES [ ] NO (19)

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:

ECDC CONTROLLED
COPY NO. C-011

ADD TO PHASE III CONSTRUCTION



SUBGRADE CONSTRUCTION CONTROL POINTS

POINT NO.	NORTHING	EASTING	ELEVATION	POINT NO.	NORTHING	EASTING	ELEVATION
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

20104-006
Pg 2 of 12

LEGEND

- EXISTING GROUND ELEVATION (FEET)
- SUBGRADE ELEVATION (FEET) (NOTE 1)
- FINISHED GRADE ELEVATION (FEET)
- BATTERY LIMIT
- BORROW AREA LIMIT
- EXISTING ENHANCED PERMANENT LEACHATE TRANSMISSION SYSTEM PIPE
- EXISTING INTERIM LEACHATE TRANSMISSION SYSTEM PIPE
- EXISTING LEACHATE TRANSMISSION SYSTEM PIPE
- EXISTING UNDERGROUND ELECTRIC
- EXISTING 24" STORMWATER FORCEMAIN
- SLOPE TOE OR CREST
- DRAINAGE FLOW DIRECTION
- CONSTRUCTION CONTROL POINT
- BERM CREST
- ACCESS CORRIDOR, ACCESS ROAD, ACCESS RAMP, MAINTENANCE ACCESS, OR HAUL ROAD
- RIPRAP LIMIT

EMERGENCY ACCESS ROAD HORIZONTAL ALIGNMENT STATION AND CURVE REPORT

Alignment Name	Station	Type/Curve Data	Northing	Easting
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

NOTES:

1. CLEARING, GRUBBING, AND STRIPPING SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02110. SUBGRADE ELEVATIONS CORRESPOND TO TOP OF PREPARED SUBGRADE, INCLUDING ANY COMPACTED FILL. SUBGRADE SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02200.
2. CONTRACTOR SHALL DEWATER EXCAVATIONS AND MANAGE COLLECTED WATER IN ACCORDANCE WITH SPECIFICATION SECTION 02200. GROUNDWATER LEVELS IN BROWN AND GRAY TILL LAYERS VARY DURING YEAR AND MAY BE HIGHER THAN THOSE SHOWN ON REFERENCE DRAWINGS. LEVELS MAY APPROACH GROUND SURFACE DURING PERIODS OF HEAVY PRECIPITATION.
3. CONTRACTOR SHALL REMOVE EXISTING CULVERTS AND STOCKPILE MATERIAL AT LOCATIONS APPROVED BY CONSTRUCTION MANAGER.
4. CONTRACTOR SHALL LOCATE EXISTING UNDERGROUND UTILITIES WITHIN CONSTRUCTION AREA AS SHOWN ON REFERENCE DRAWINGS 3X0-G-1301 THROUGH 3X0-G-1307. CONTRACTOR SHALL REMOVE UNDERGROUND UTILITIES IN CONSTRUCTION AREA IN ACCORDANCE WITH SPECIFICATION SECTION 02230 AND AS APPROVED BY CONSTRUCTION MANAGER.
5. OSDF SEDIMENTATION BASIN NO. 2 DETAILS ARE SHOWN ON DRAWING G-42. EXISTING 72-INCH X 44-INCH CMP PIPE SHALL BE UTILIZED WITH OSDF SEDIMENTATION BASIN NO. 2.
6. CONTRACTOR SHALL PLACE BUOYS AROUND OSDF SEDIMENTATION BASIN NO. 2 AS REQUIRED BY OSHA 1926.106.
7. CONTRACTOR SHALL PLACE CAUTION SIGNS WITHIN CONSTRUCTION SAFETY FENCE SURROUNDING OSDF SEDIMENTATION BASIN NO. 2. SIGNS SHALL READ, "CAUTION DROWNING HAZARD, LIFE VEST REQUIRED WITHIN 5 FEET OF WATER." SIGNS SHALL BE PLACED AT TOP OF EMBANKMENT AND MAY BE SHARED WITH BIRD BUOY POSTS.
8. CHAIN-LINK FENCE AND GATE DETAILS ARE SHOWN ON DRAWING G-42.
9. CONTRACTOR SHALL CAP EXISTING 30-INCH X 31-INCH CMP CULVERT USING A PRE-FABRICATED 3/8"D. PLATE BULKHEAD PIPE PLUG—WELDED TO A 2-FOOT SECTION OF 30-INCH X 31-INCH ALUMINIZED CMP PIPE. BULKHEAD SECTION SHALL BE CONNECTED TO EXISTING PIPE USING A FLAT BAND AND GASKET WITH 3/4-BOLTS AND STRAP FASTENERS.
10. CONTRACTOR SHALL CUT AND REMOVE EXISTING 27-INCH HDPE CULVERT TO LIMIT N 478282.35 AND E 1320813.31 (SHOWN WITHIN BOX). MATERIAL SHALL BE STOCKPILED AT LOCATION APPROVED BY CONSTRUCTION MANAGER.
11. BORROW AREA DEVELOPMENT AND RESTORATION IS ILLUSTRATED ON DRAWING G-4.
12. CONTRACTOR SHALL PLACE RIPRAP WITHIN AREA SHOWN. RIPRAP THICKNESS SHALL BE 1.5 FEET. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION [illegible]

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	APP. BY
0	03.05.02	CPE SUBMITTAL TO IP/AME/DFA	LHE	JAN	TCD	SGP	JFG
1	04.11.17	PRELIMINARY SUBMITTAL TO IP/AME	LHE	JAN	TCD	SGP	JFG
2	04.12.12	PRELIMINARY SUBMITTAL TO IP/AME	TCD	JAN	LHE	SGP	JFG
3	04.12.21	CONSTRUCTION SUBMITTAL TO IP/AME	TCD	JAN	LHE	SGP	JFG

SCALE IN FEET

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FLUOR FERNALD, INC.

ON-SITE DISPOSAL FACILITY – PHASE V

SUBGRADE GRADING PLAN III – CELL 6 LINER SYSTEM AND OSDF SEDIMENTATION BASIN NO. 2

STATE OF OHIO

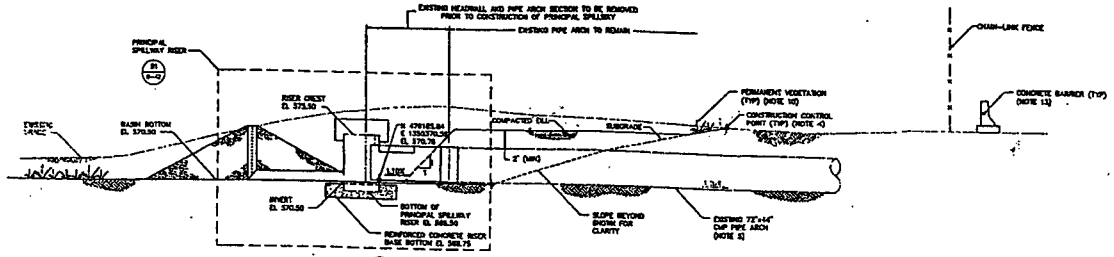
GeoSyntec

000313

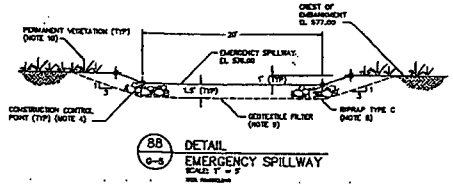
4944

4944

000314

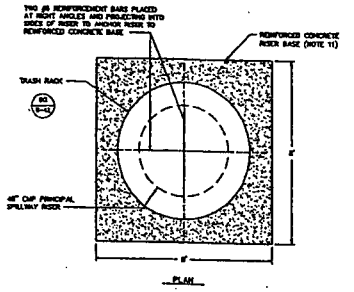


A 0-5 SECTION
PRINCIPAL SPILLWAY
SCALE 1" = 5'

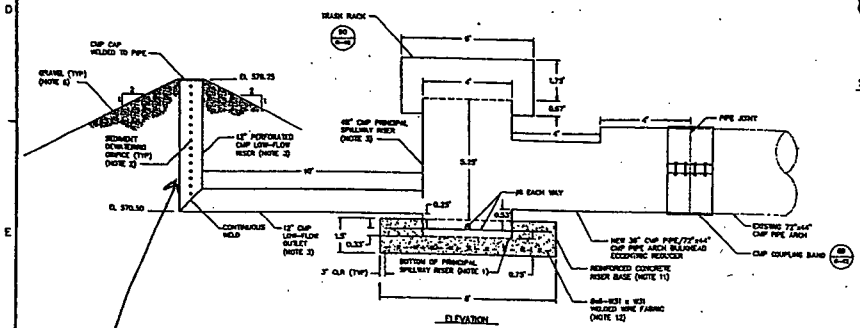


88 0-5 DETAIL
EMERGENCY SPILLWAY
SCALE 1" = 5'

20104-006
Pg 3 of 12



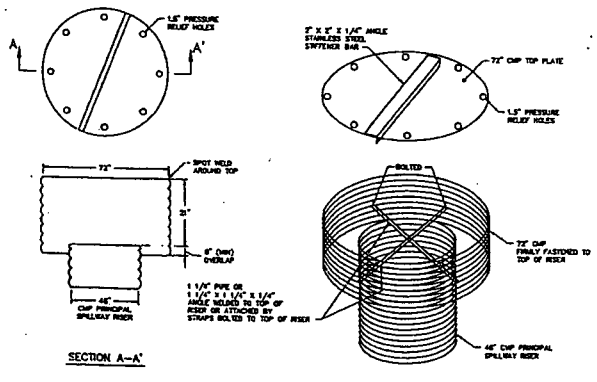
PLAN



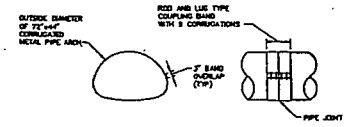
ELEVATION

THE RISER SHALL BE WRAPPED WITH WIRE MESH AND DOUBLE WRAPPED WITH GEOTEXTILE

91 0-42 DETAIL
PRINCIPAL SPILLWAY RISER
SCALE 1" = 2'



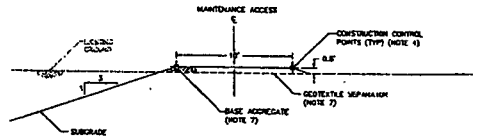
90 0-42 DETAIL
CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE
SCALE NTS



89 0-42 DETAIL
CMP COUPLING BAND
SCALE NTS

NOTES:

1. PRINCIPAL SPILLWAY RISER SHALL BE EMBEDDED 0.75 FEET IN REINFORCED CONCRETE RISER BASE.
2. SEDIMENT DEWATERING ORIFICES SHALL BE 6x6 INCH DIAMETER AND VERTICALLY SPACED AT 4 INCHES ON CENTER WITH 4 ORIFICES AT EACH LEVEL.
3. CULVERTS AND RISERS SHALL BE ALUMINIZED AND IN ACCORDANCE WITH SPECIFICATION SECTION 02721.
4. CONSTRUCTION CONTROL POINTS FOR SUBGRADE AND MAINTENANCE ACCESS ALIGNMENT ARE PROVIDED ON DRAWING 0-3.
5. CONTRACTOR SHALL FILL A MINIMUM OF 2 FEET ABOVE CROWN OF EXISTING CMP PIPE ARCH CULVERT. PLACEMENT AND COMPACTION OF FILL SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02300.
6. AASHTO NO. 57 STONE SHALL BE USED AROUND 12-INCH PERFORATED CMP LOW-FLOW RISER.
7. BASIC AGGREGATE AND GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02230.
8. RIPRAP SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02271.
9. GEOTEXTILE FILTER SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02714.
10. VEGETATION SHALL BE IN ACCORDANCE WITH SPECIFICATION SECTION 02930.
11. CONTRACTOR SHALL FURNISH CONCRETE MIX WITH SUFFICIENT AIR DISPERSING ADMIXTURE TO PROVIDE BE A 3% AIR AT POINT OF DELIVERY IN ACCORDANCE WITH ASTM C231 AND A COMPRESSIVE STRENGTH OF 4000 PSI AT 28 DAYS WHEN TESTED IN ACCORDANCE WITH ASTM C39.
12. CONTRACTOR SHALL FURNISH REINFORCING WELDED STEEL WIRE FABRIC IN ACCORDANCE WITH ASTM A185.
13. CONCRETE BARRIERS SHALL BE SUPPLIED BY FLUOR FERNALD, INC.



92 0-5 DETAIL
MAINTENANCE ACCESS
SCALE 1" = 4'

REV. NO.	DATE	DESCRIPTION	DES. BY	DR. BY	CHK. BY	PRJ. ENG.	APV. BY
0	10.21.03	CPC SUBMITTAL TO FF/KDC/CPA	LHE	JA	KCI	BGP	JFB
0	06.05.03	PRE-FINAL SUBMITTAL TO FF/DOE	LHE	SHH	KCI	BGP	JFB
A	05.15.03	PRELIMINARY SUBMITTAL TO FF/DOE	LHE	SHH	KCI	BGP	JFB

SCALE AS SHOWN

CONCURRENCE/CONCUR:

UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

CLIENT:

FLUOR FERNALD, INC.

PROJECT:

ON-SITE DISPOSAL FACILITY – PHASE V

TITLE:

SURFACE-WATER MANAGEMENT SYSTEM DETAILS VII

STATE OF OHIO
JOHN H. BRUNE
E-54246
REGISTERED PROFESSIONAL ENGINEER

GeoSyntec Consultants

PROJECT NO.: 20105
CONTRACT NO.: DE-AC05-00OR22972
CMP DRAWING NO.: 9023-5000-0-50404
ELECTRONIC PROJECT NO.: 001342-17.4
ELECTRONIC DRAWING NO.: FDI-0040
SHEET NO.: 0-41

DCN 20104-006
pg 4 of 12

4944

RESPONSES TO OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE ON-SITE DISPOSAL FACILITY (OSDF) SEDIMENTATION BASIN #2 DESIGN CHANGE NOTICE #20104-006 (20104)

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

SPECIFIC COMMENTS

Commenting Organization: Ohio EPA Commentator: DSW
Drawing #: Drawing 90X-5000-G-00367 Pg. #: NA Line #: NA Code: C
Original Comment #: 1

Comment: The outlet structure should be located as far away from the inlet as possible. This allows maximum time for sediment to settle out. It should be moved either to the south end of the basin or to the south of the power pole peninsula.

Response: The proposed outlet structure for OSDF Sedimentation Basin No. 2 was located as shown on the referenced drawing to utilize an existing large diameter culvert as the basin principal spillway pipe. This existing culvert conveys flow under the East Parking Area to a location approximately 700 feet west of the proposed outlet structure location. Fluor Fernald recognizes the benefit of providing a longer flow path between the inlet and outlet of the basin to provide a maximum time for suspended sediment to settle out. Accordingly, Fluor Fernald recommends installing an approximately 120-foot long silt fence baffle beginning just north of the proposed outlet structure and aligned in an east-west direction. This porous baffle will lengthen the flow path between the inlet at the northeast corner of the basin and the proposed outlet location, and thus increase the time for suspended sediments to settle out prior to reaching the outlet structure. In addition, this approach will maintain the current design capacity of the proposed basin.

Action: Add silt fence location on drawing with revised DCN

Commenting Organization: Ohio EPA Commentator: DSW
Drawing #: Drawing 90X-5000-G-00404 Pg. #: NA Line #: NA Code: C
Original Comment #: 2

Comment: The sediment dewatering orifice does not comply with Ohio Department of Natural Resources (ODNR) Rainwater and Land Development specifications (pp 98-110). In dewatering option 2, 100% drawdown, the perforated riser must be wrapped with wire mesh and double wrapped with porous geotextile (e.g., silt fence). Please change dewatering to comply with options in ODNR Rainwater and Land Development.

Response: Fluor Fernald will revise the primary spillway riser pipe design to incorporate 1-inch diameter holes at a 4-inch horizontal and vertical spacing and wrapping of the pipe with wire mesh and then two wraps of a geotextile.

Action: Add note on detail drawing with revised DCN

000315

DCN 20104-006
pg 5 of 12
4944

Commenting Organization: Ohio EPA Commentator: DSW
Drawing #: Drawing 90X-5000-G-00404 Pg. #: NA Line #: Note 10 Code: C
Original Comment #: 3

Comment: Specification 02930 was not included in the package. This should be similar to the specification 02900 included in the CFC for South Field Phase II Groundwater Infrastructure (drawing) package (dated August 29, 2002) which includes a dry area permanent seed mix (Table 02900-1A), a set area permanent seed mix (Table 02900-1B), and a mix for interim vegetation (Table 02900-2). Specification packages 02714 and 02271 referenced in the drawing were also missing from the package.

Response: In response to Comment No. 3, Fluor Fernald has transmitted Specification Section 02930 and 02714 via e-mail to Tom Schneider on September 18, 2002.

Action: Specification Section 02271 is provided as an attachment to these responses.

Commenting Organization: Ohio EPA Commentator: DSW
Section #: ES Conclusions Pg. #: 2 of 282 Line #: New Channels Code: C
Original Comment #: 4

Comment: Note that channels with velocities exceeding 3 fps should have rock check dams properly installed.

Response: The text referred to considers the design of channel lining for conditions after the establishment of vegetation. Prior to the establishment of vegetation, appropriate erosion controls (e.g., check dams) will be installed in accordance with the requirements of the OSDF Surface Water Management and Erosion Control Plan.

Action: No Action

Commenting Organization: Ohio EPA Commentator: DSW
Section #: ES Conclusions Pg. #: 3 of 282 Line #: OSDF Sedimentation Basin 2 Code: C
Original Comment #: 5

Comment: The first bullet describes the disturbed upstream drainage area as what was used for the calculation. The entire drainage area needs to be used, not just the disturbed area (see Section 2.8.3B, Page 2-81, Page 32/282, and Section 2.10.2.4B, Page 2-103, Page 47/282 in this document and as indicated in ODNR Rainwater and Land Development).

Response: The minimum required storage volume for the basin was calculated in accordance with the requirements of the OSDF Design Criteria Package (see Page 28/282 of the referenced calculation package). In accordance with these requirements this value was taken as "the larger of the calculated runoff from a 10-year, 24-hour storm event, or, 0.125 acre-foot per year (for each acre) of upgradient disturbed area multiplied by the scheduled frequency of basin cleanout (in years)". Fluor Fernald notes that the minimum available storage area provided by the basin of 8.6 acre-foot also satisfies criteria presented in Rainwater and Land Development (i.e., 175 acres x 0.04 acre-ft/acre=7.0 acre-ft; 8.6>7.0).

Action: No Action

000316

Commenting Organization: Ohio EPA Commentator: DSW
Section #: West OSDF Design Scenarios Pg. #: 8 of 282 Line #: NA Code: C
Original Comment #: 6

Comment: The design here and in Attachment A-2 shows only the cells as being part of the drainage area. The entire drainage area needs to be used, not just the disturbed area (see Section 2.8.3B, Page 2-81, Page 32/282, and Section 2.10.2.4B, Page 2-103, Page 47/282 in this document and as indicated in ODNR Rainwater and Land Development).

Response: The drainage area considered for the West OSDF Design Scenario, as shown on Attachment A-2, includes all areas expected to drain to the OSDF Sedimentation Basin No. 2 after construction of the final OSDF Cell. This drainage area includes all areas expected to be disturbed as well as areas not expected to be disturbed. Specifically, the drainage area includes: (i) the west half of Cells 3 through 7; (ii) an area including the drainage channels just west of these cells; (iii) an area between Cell 7 and the basin; (iv) an area east of the basin; and (v) the basin itself. Other OSDF and associated runon areas drain either to the Former Production Area (FPA) or the Borrow Area Sedimentation Basin and thus are not appropriate for inclusion in the West OSDF Design Scenario.

Action: No Action

Commenting Organization: Ohio EPA Commentator: DSW
Section #: Sedimentation Basins Pg. #: 19 of 282 Line #: OSDF Sed Basin 2 Code: C
Original Comment #: 7

Comment: The last sentence on this page states that the total drainage is used in place of disturbed upstream drainage, however the calculations and drawings for the west drainage do not reflect this. The entire drainage area needs to be used, not just the disturbed area (see Section 2.8.3B, Page 2-81, Page 32/282, and Section 2.10.2.4B, Page 2-103, Page 47/282 in this document and as indicated in ODNR Rainwater and Land Development).

Response: The drainage area considered for the West OSDF Design Scenario, as shown on Attachment A-2, includes all areas expected to drain to the OSDF Sedimentation Basin No. 2 after construction of the final OSDF Cell. This drainage area includes all areas expected to be disturbed as well as areas not expected to be disturbed. Specifically, the drainage area includes: (i) the west half of Cells 3 through 7; (ii) an area including the drainage channels just west of these cells; (iii) an area between Cell 7 and the basin; (iv) an area east of the basin; and (v) the basin itself. Other OSDF and associated runon areas drain either to the FPA or the Borrow Area Sedimentation Basin and thus are not appropriate for inclusion in the West OSDF Design Scenario.

Action: No Action

Commenting Organization: Ohio EPA Commentator: DSW
Section #: 2.8.1 Pg. #: 2-75, 26 of 282 Line #: NA Code: C
Original Comment #: 8

Comment: The bullets do not include runoff from areas that are not disturbed, for which surface water treatment must be sized to include, should that runoff be in the drainage area of the treatment system (see Section 2.8.3B, Page 2-81, Page 32/282, and Section 2.10.2.4B, Page 2-103, Page 47/282 in this document and as indicated in ODNR Rainwater and Land Development).

Response: The bullets referred to in Comment No. 8 provides a list of three categories of surface water considered for design of the surface water management system for the OSDF. The first of these bullets addresses runon from undisturbed areas. For clarification, please note that the design for all structures comprising the surface water management system for the OSDF considered all upstream drainage areas and that the design is in accordance with the OSDF Design Criteria Package. Furthermore, the text commented on is taken directly from the OSDF Design Criteria Package. This text is provided as an attachment to the calculation to serve as a convenient reference to design criteria for the project.

Action: No Action

Commenting Organization: Ohio EPA Commentator: DSW
Section #: 2.8.3A Pg. #: 2-77, 28 of 282 Line #: NA Code: C
Original Comment #: 9
Comment: Outlet structures should comply with the design guidelines from ODNR Rainwater and Land Development.

Response: For clarification, please note that the design of sedimentation basin outlet structures was performed in accordance with the OSDF Design Criteria Package. Furthermore, the text commented on is taken directly from the OSDF Design Criteria Package. This text is provided as an attachment to the calculation as a reference only.

Action: No Action

Commenting Organization: Ohio EPA Commentator: DSW
Section #: NA Pg. #: 2-102, 46 of 282 Line #: NA Code: E
Original Comment #: 10
Comment: This page didn't make it through the copier and only the right half of the page was in the package. It appears as through there may be criteria for the amount of time to discharge a pond's volume in this section. Note that, using dewatering option 1 in ODNR Rainwater and Land Development, the pond should dewater 60% of its volume in 48 to 72 hours.

Response: A corrected copy of Page 46 of 282 is provided as an attachment to these responses. As is evident from this attached page, no criteria is included regarding the amount of time to discharge the pond's volume. Fluor Fernald also notes that the dewatering option 1 from ODNR Rainwater and Land Development appears to apply to "wet" ponds, none of which are present in the design

Action: A corrected copy of Page 46 of 282 is provided as an attachment to these responses.

- Temporary runon control structures should be implemented to minimize runon from entering work areas. Such runon should be diverted around work areas using diversion dikes or channels as appropriate (design consideration).

- Temporary channels for surface-water runoff should be designed to meet the criteria presented in Section 2.8.3 of the DCP (design consideration).

- Permanent channels should be designed to meet the criteria presented in Section 2.8.4 of the DCP (design consideration).

- Culverts should be designed to meet the criteria presented in Section 2.8.4 of the DCP (design consideration).

- Riprap should be designed to meet the criteria presented in Section 2.8.4 of the DCP (design consideration).

- Sediment basins should meet the following criteria [ODNR, 1996] (design considerations).

  - The minimum capacity of the sediment basin to the elevation of the crest of the pipe spillway should be 1,800 cubic ft for each acre within the drainage area that will be disturbed by construction during the design life of the sediment basin.

  - The capacity of the pipe spillway should be sufficient to pass the runoff from the 2-year, 24-hour storm event. For the FEMP property, this event has a rainfall intensity of 2.5 in. [Parsons, 1995a].

  - The combination of the principal and emergency spillways should be capable of safely discharging the flow from the 10-year, 24-hour storm event if the drainage area to the sediment basin is less than or equal to 20 acres, or the 25-year, 24-hour storm event if the drainage area to the sediment basin is greater than 20 acres.

  - Consideration should be given to using the permanent Fernald facility main entrance road as a containment dike for the surface-water runoff in lieu of an emergency spillway.

  - If an emergency spillway is implemented, a minimum freeboard of 1 ft measured from the peak water elevation in the emergency spillway to the top of the embankment, should be provided.

DCN 20104-006
pg 9 of 12

SECTION 02271

RIPRAP

PART 1 GENERAL

1.01 SCOPE

A. This Section includes riprap materials and placement.

1.02 RELATED SECTIONS AND PLANS

A. Section 02100 - Surveying

B. Section 02200 - Earthwork

C. Section 02270 - Surface-Water Management and Erosion Control

D. Section 02714 - Geotextiles

E. Construction Quality Assurance (CQA) Plan

F. Part 8 - Environmental Health & Safety/Training Requirements

G. Part 9 - Quality Assurance Requirements

1.03 REFERENCES

A. Latest version of Ohio Department of Transportation Construction and Material Specifications (Ohio DOT Specifications).

B. Latest version of American Society for Testing and Materials (ASTM) Standard:

1. ASTM C 127. Standard Test Method for Specific Gravity and Absorption of Coarse Aggregate.
2. ASTM C 535. Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machines.
3. ASTM D 5240. Standard Test Method for Testing Rock Slabs to Evaluate Soundness of Riprap by Use of Sodium or Magnesium Sulfate.

C. *"Off-Site Borrow Materials Geotechnical Evaluation Report"* [Parsons, 1996]. This report presents geotechnical data for potential off-site borrow sources for On-Site

Disposal Facility (OSDF) construction materials, including fine concrete aggregates (sand), coarse concrete aggregates (gravel), pea gravel, and riprap.

D. *"Evaluation of Materials for the On-Site Disposal Facility (OSDF) Biointrusion Barrier"* [University of Cincinnati, 2000]. This report presents geologic and geotechnical data for off-site sources of riprap.

1.04 SUBMITTALS

A. Submit the following to the Construction Manager for review with the Contractor's Surface-Water Management and Erosion Control Work Plan specified in Section 02270, within 15 calendar days from Notice to Proceed:
   1. the source of the riprap;
   2. for approved sources identified in Parsons [1996] and University of Cincinnati [2000] or by Fluor Fernald, Inc., certification from the supplier that the Riprap Type C, as shown on the Construction Drawings, meet the material requirements of this Section, and results of tests conducted in accordance with ASTM C 127 on Type C Dumped Rock Fill, as defined in Item 601.07 and 703.04(3) of Ohio DOT Specifications; and
   3. for approved sources identified in Parsons [1996], University of Cincinnati [2000] or by Fluor Fernald, Inc., certification from the supplier that the Riprap Type D, as shown on the Construction Drawings, meet the material requirements of this Section, and results of tests conducted in accordance with ASTM C 535 and ASTM D 5240 on Type D Dumped Rock Fill, as defined in Item 601.07 and 703.04(3) of Ohio DOT Specifications.

B. Notify the Construction Manager at least 14 calendar days in advance of shipment of riprap to the site. Allow Construction Manager and CQC Consultant to conduct visual inspection and approval of riprap materials designated for the project at the quarry producing the riprap.

C. Provide list of equipment, description of construction methods, and other required information related to riprap placement in the Contractor's Earthwork Work Plan specified in Section 02200.

1.05 HEALTH AND SAFETY REQUIREMENTS

A. Environmental health & safety/training requirements shall be in accordance with Part 8 of the Contract Documents.

1.06 CONTRACTOR'S QUALITY ASURANCE

A. Contractor's quality assurance requirements shall be in accordance with Part 9 of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

A. Stone used for riprap shall consist of field stone, rough unhewn quarry stone, or excavated rock with angular or fractured faces.

B. Riprap Type C, as shown on the Construction Drawings, shall conform to requirements of Type C Dumped Rock Fill specified in Item 601.07 and 703.04(3) of the Ohio DOT Specifications.

C. Furnish Riprap Type C having a minimum bulk specific gravity of 2.60 and a maximum absorption of 0.83 percent when measured in accordance with ASTM C 127.

D. Riprap Type D, used for slope protection, channel and ditch lining, and other surface-water management and erosion control measures specified in Section 02270 and as shown on the Construction Drawings, shall conform to requirements of Type D Dumped Rock Fill specified in Item 601.07 and 703.04(3) of the Ohio DOT Specifications. In addition, the Riprap Type D shall be relatively free of laminations, seams, and fractures.

E. The Riprap Type D shall have a maximum loss of 15 percent from a sodium sulfate soundness test conducted in accordance with ASTM D 5240, and a maximum loss of 50 percent in a Los Angeles Abrasion test conducted in accordance with ASTM C 535.

F. Furnish geotextile filter as specified in Section 02714 and as shown on the Construction Drawings.

2.02 EQUIPMENT

A. Furnish equipment to perform work specified in this Section.

DCN 20104-006
pg 12 of 12

PART 3 EXECUTION

3.01 PLACEMENT

A. Place riprap to the thicknesses and limits shown on the Construction Drawings and for ditch check dams in accordance with Section 02270.

B. Place riprap on geotextile filter or prepared subgrade as shown on the Construction Drawings. Geotextiles shall be shingled downgradient and shall be overlapped a minimum of 1 foot as specified in Section 02714.

C. Carefully place riprap to avoid segregation or damage of the underlying material. Place the material in such a manner as to produce a uniform mass of riprap with the minimum practicable percentage of voids. Distribute the larger pieces throughout the entire mass such that the finished riprap is free from non-uniform areas of small or large pieces. Hand placing, to a limited extent, may be required, but only to the extent necessary to obtain the results specified above.

D. Do not place riprap by dumping into chutes or by similar methods likely to cause segregation of various sizes.

E. Do not place riprap in a manner that causes damage to an underlying geotextile filter. Repair damaged geotextile in accordance with Section 02714.

3.02 CONSTRUCTION QUALITY REQUIREMENTS

A. CQC Consultant will perform conformance testing on Riprap Type C to confirm compliance with this Section. Conformance testing to be performed and minimum testing frequencies shall be in accordance with the Construction Quality Assurance (CQA) Plan.

B. CQC Consultant will monitor riprap placement as specified in this Section and the CQA Plan.

3.03 SURVEY CONTROL

A. Survey the limits and thickness of the riprap in accordance with Section 02100.

3.04 TOLERANCE

A. Construct the riprap to within 0.0 to +0.3 feet of the thickness shown on the Construction Drawings.

[END OF SECTION]

OhioEPA

4944

State of Ohio Env
Southw
401 East Fifth Street
Dayton, Ohio 45402-2911
TELE: (937)
MEI

Post-it® Fax Note 7671	Date	# of pages ▶
To J.D. Chiou	From OEPA	
Co./Dept.	Co.	
Phone #	Phone #	
Fax # X5131	Fax #	

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA
DATE: October 15, 2002
RE: OSDF Phase IV DCN 20104-007

This DCN adds an access road to a fueling station located on the southeast side of the OMTA to enable excavation equipment to be fueled without leaving the impacted area.

The Ohio EPA approves this DCN.

Approval of these changes does not constitute an assurance that the proposed facilities will operate in compliance with Ohio laws and regulations or that these facilities will perform in a fashion that achieves the objectives of the Operable Unit 2 Record of Decision.

Q:\ou2\dcnph4fuelroad.wpd

4944

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg	(6) DATE
20104	FSC - 653	1 Of 2	9/30/02

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Non-impacted access to OMTA from Valve House Road

(11) DCN NO.: 20104-007

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Construction Drawing: Subgrade Grading Plan – Cell 5 Liner	90X-6000-G-00332	0	Sheet G-4
Phase IV Construction Drawing: Impacted Material Haul Road Grading Plan and Details	90X-6000-G00336	0	Sheet G-8

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: This road will provide an access to a non-impacted fueling/equipment repair area located in the container area of the On-Site Materials Transfer Area (OMTA). The fueling/equipment repair area will be sectioned off from the impacted side by rad fence. The excavation equipment will be fueled daily from this area. The fueling/equipment repair area is being moved to the southeast portion of OMTA due to its proximity to the new home base for excavation workers, Bldg. 82 (old RIMIA), and that the OMTA area will remain intact in Area 6 until the last year of operation.

Existing Conditions: There is currently no access to the OMTA from the non-impacted side of the site.

Proposed Change: This access road will provide an entrance to a fueling station located on the southeast portion of the OMTA. The road shall be 24-foot wide gravel based with 3H:1V sideslopes. The attached construction drawing shows the details involved for construction.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Kevin Harbin	Fluor Fernald	9/30/02	Charles C. Van Arsdale	9/30/02

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

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 10/4/02

Kwasi Basu-Twenenboah, GeoSyntec Consultants

[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 10/16/02

PERFORMANCE GRADE: (17) 5 – SBDR 2000-0027 Applies

(18) CONSTRUCTION CONCURRENCE DATE: 10/4/02

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

(21) FIELD WORK COMPLETED:

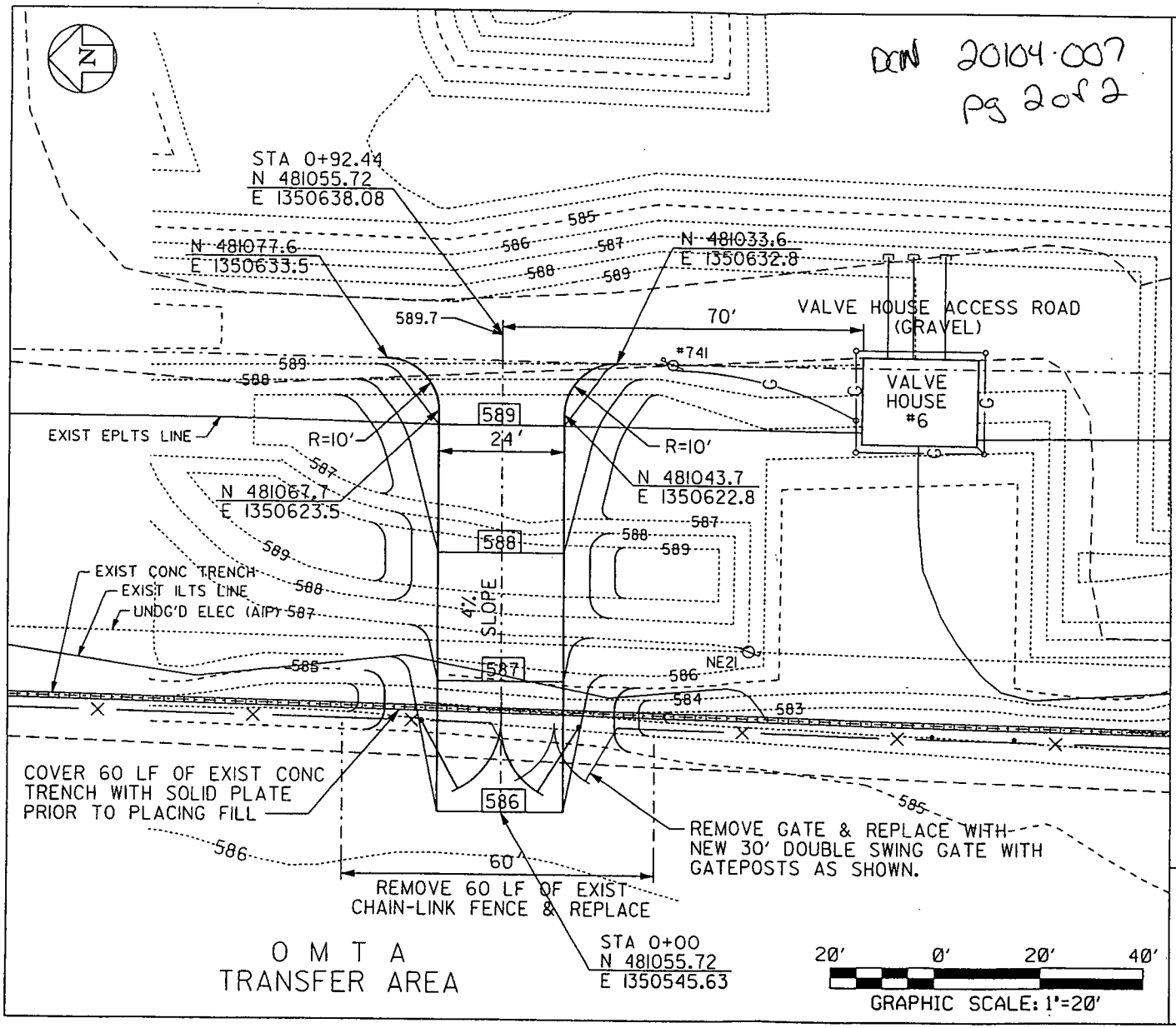
(SIGNOFF BY CE OR PE) DATE:

F-4259
REV. 5: 10/01/99: ED-12-5002

ECDC CONTROLLED COPY NO. C-011

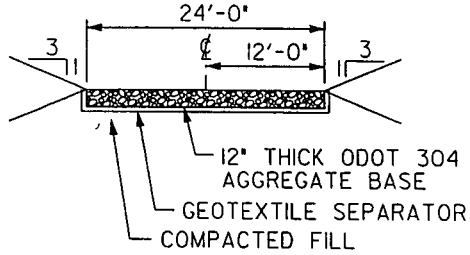
ORIGINAL

DCN 20104-007
pg 2 of 2



GENERAL NOTES:

1. AGGREGATE BASE SHALL BE IN ACCORDANCE WITH OSDF TECHNICAL SPECIFICATION 02200.
2. GEOTEXTILE SEPARATOR SHALL BE IN ACCORDANCE WITH OSDF TECHNICAL SPECIFICATION 02714.
3. COMPACTED FILL SHALL BE PLACED AND COMPACTED IN ACCORDANCE WITH OSDF TECHNICAL SPECIFICATION 02200.



GRAVEL DRIVE DETAIL
NTS

LEGEND

⌀ #741	EXISTING POLE
587	EXISTING CONTOUR
588	PROPOSED CONTOUR
— X —	EXISTING FENCE

OMTA ACCESS ROAD
FROM VALVE HOUSE ROAD TO OMTA TRANSFER AREA

4944

/osdf/valve house access road/fence AccessRoad.dgn

000326

State of Ohio Environmental Protection Agency

Southwest District Office

-4944

[illegible]1 East Fifth Street
[illegible]ton, Ohio 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6404

Bob Taft, Governor
Maureen O'Connor, Lt. Governor
Christopher Jones, Director

MEMORANDUM

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA
DATE: October 25, 2002
RE: OSDF Phase IV DCN 20104-008

This DCN specifies that geomembrane material should have smooth edges. The current purchase specification requires that GML be textured but does not require that the ends be smooth.

The Ohio EPA approves this DCN.

Approval of these changes does not constitute an assurance that the proposed facilities will operate in compliance with Ohio laws and regulations or that these facilities will perform in a fashion that achieves the objectives of the Operable Unit 2 Record of Decision.

C:\TEMP\dcnph4smoothgml.wpd

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 1	(6) DATE
20104	FSC-653		10/21/02

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Smooth edge on Geomembrane liner (GML) material

(11) DCN NO.: 20104-008

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV OSDF Technical Specifications	20104-TS-0001	1	Section 02770, Part 2.03
OSDF Procurement Specifications	20104-TS-0002	0	Section 02770P, Part 2.02

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: Textured geomembrane material can be manufactured with or without smooth edges on the roll. From past experience on site and knowledge from the geosynthetic installers, field seaming of textured geomembrane with smooth edges is more efficient than seaming textured geomembrane material without the smooth edges (texturing continuing to the edges of the roll).

Existing Conditions: *The specifications do not specify if textured geomembrane shall be manufactured with or without smooth edges.*

Proposed Change: Add the following sentence to Part 2.02, Article A of the Procurement Specifications, and Part 2.03, Article A of the Technical Specification to read "HDPE textured geomembrane material shall be manufactured with a 5 inch +/- 1 inch smooth edge. Texturing shall ~~be~~ not be continued to the edges"

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	10/21/02	Charles C. Van Arsdale	10/21/02

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

ECDC CONTROLLED
COPY NO. C- 011

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 10/23/02
KWASI BADU-TWEREBOAH, GEOTECH
[ ] FIT [ ] FORM [X] FUNCTION

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

(16) FDF PE ACCEPTANCE & VERIFICATION THAT ALL REQUIRED REVIEWS ARE COMPLETE: (DCN ONLY) DATE: 10/30/02
PERFORMANCE GRADE: (17) 4 - SBDR 2000-0027 Applies

(18) CONSTRUCTION CONCURRENCE DATE: 10/23/02
PURCHASE REQUISITION REQUIRED: [ ] YES [ ] NO (19)

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

S-F-4259
REV. 5: 10/01/99: ED-12-5002

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 2	(6) DATE
20104	FSC-653		11/4/02

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Catchment area storm pipe under Cell 4/5 impacted material haul road

(11) DCN NO.: 20104-009

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Construction Drawing: Impacted Material Haul Road Grading Plan and Details	90X-6000-G-00336	0	Sheet G-8

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: A storm pipe is necessary to transfer runoff from the Cell 4 catchment area to the Cell 5 catchment area at the time when Cell 4 catchment area is being filled with impacted material. Even though the catchment area of Cell 4 is not anticipated to be filled until 2004, installing the pipe now will avoid its impact on OSDF impacted material placement in the future.

Existing Conditions: The storm pipe is not shown in the current Phase IV construction drawings.

Proposed Change: The following plan and pipe profile provides information to construct the 24" nominal diameter HDPE, SDR-11 storm pipe. The material and installation of the HDPE storm pipe shall be in accordance with Phase IV OSDF Technical Specification 02605, Revision 1. The ends of the pipe shall be capped during installation and opened prior to filling with the Cell 4 catchment area.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	11/4/02	Charles C. Van Arsdale	11/4/02

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

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 11/13/02

Kwasi Badu-Tweneboah, GeoSyntec Consultants, Inc.

[ ] FIT [ ] FORM [X] FUNCTION

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

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

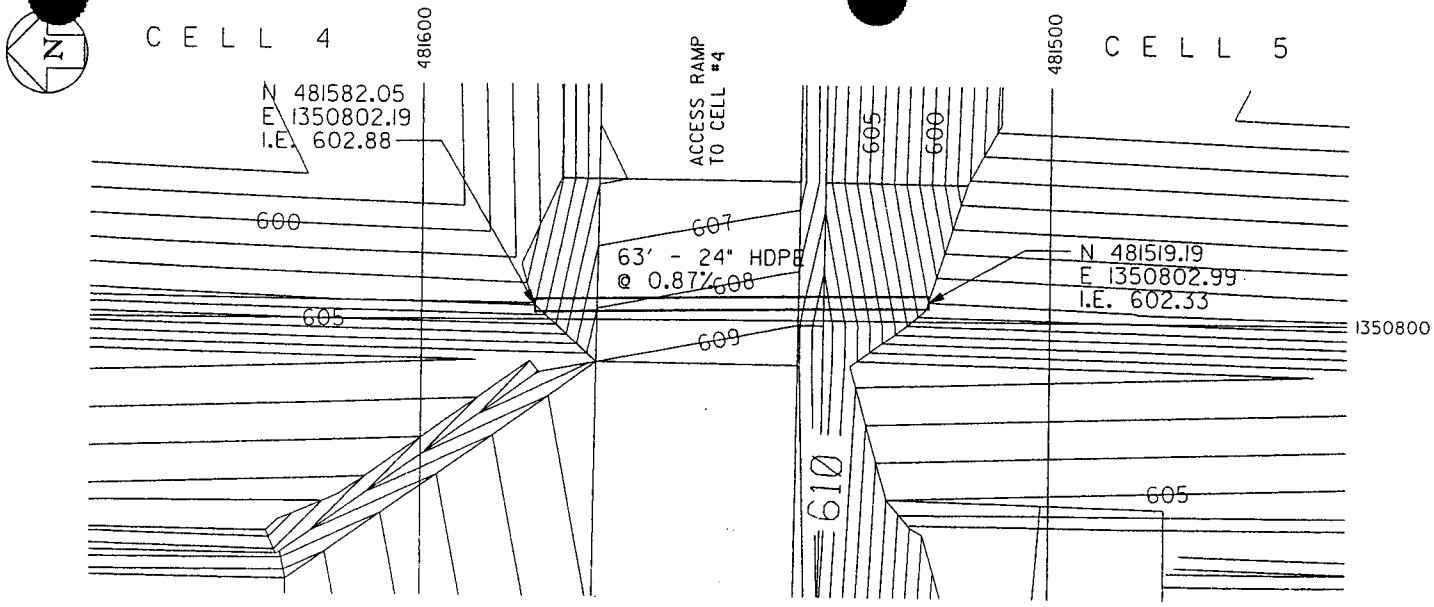
PERFORMANCE GRADE: (17) 4 – SBDR 2000-0027 Applies

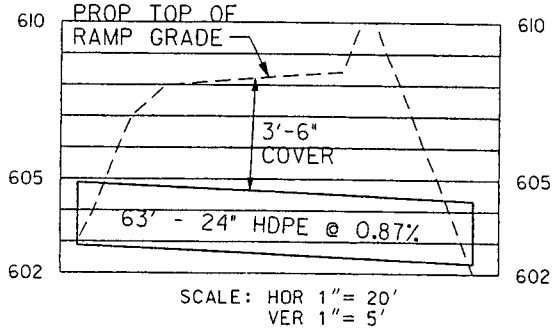
(18) CONSTRUCTION CONCURRENCE DATE:

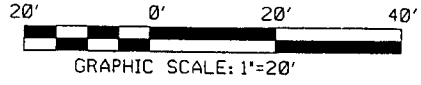
PURCHASE REQUISITION REQUIRED: [ ] YES [ ] NO (19)

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:







24" HDPE STORM PIPE

UNDER CELL #4 ACCESS RAMP

/osdf/phase IV/osdfph4pipe.dgn

000330

4944

Kwasi Badu-Tweneboah

From: tom ontko [tontko@offo2.epa.state.oh.us]
Sent: Thursday, June 05, 2003 11:37 AM
To: JD Chiou
Cc: cullerton, michelle; Rob, Janke,; schneider, tom; kbadu-tweneboah@geosyntec.com
Subject: close out ramp removal DCN

Greetings J.D.!
I took a look at the memo from Colin Sukow to Chuck Van Arsdale (21 May 03) re: the removal of the temporary ramp at the Cell 3/4 intercell berm (DCN 20104-010). This satisfactorily closes out the concerns expressed in our January 14 memo. Thanks Tom Ontko

MEMORANDUM

To: Mr. C. VanArsdale
Soils and Water Projects
Fluor Fernald, Inc.

From: Collin P. Sukow
Site CQC Manager
GeoSyntec Consultants

Date: 21 May 2003

Subject: Removal of the Temporary Ramp Over
The Cell 3 and Cell 4 Intercell Berm
Fernald Environmental Management Project

In November 2002, a cell access ramp was constructed over the intercell berm between Cell 3 and Cell 4 in order to place impacted protective material in Cell 4. During construction of this ramp, material not meeting select impacted material specifications (non-compliant material) was placed above the1-ft thick protective layer on the Cell 3 intercell berm. Also, part of the ramp (the toe slope into Cell 4) was constructed of non-compliant material (material not meeting the protective layer specifications). However, a geotextile separator was placed directly on top of the LCS geotextile filter in Cell 4 for protection. Per the addendum to DCN 20104-010 dated December 6, 2002, this non-compliant material was to be removed in the Spring of 2003.

The non-compliant material was removed from April 23, 2003 to April 25, 2003, and was monitored by GeoSyntec Consultants (GeoSyntec) CQC personnel. Non-compliant material in the ramp was excavated down to the visual contact of brown and gray till marking the top of protective layer at the intercell berm. In order not to damage the underlying LCS geotextile filter in Cell 4, the gray till material was excavated to within 1 foot of the elevation above the geotextile at the toe of the slope in Cell 4 (See attached cross section). GeoSyntec CQC personnel observed no visible oversized rocks in the brown and gray till material at the 1-ft elevation above the geotextile filter. The removed non-compliant material was placed as Category 1 soil material, including select impacted material, in the surrounding grids, and oversized rocks were removed during placement.

Based on GeoSyntec's CQC field observations, the gray till material did not appear to cause damage to the underlying geotextile filter on top of the LCS drainage layer in Cell 4.

Attachment

Copies to:
U. Kumthekar, Fluor Fernald, Inc.
J.D. Chiou, Fluor Fernald, Inc.
K. Harbin, Fluor Fernald, Inc.
J. Ellis, Fluor Fernald, Inc.
M. Godber, Fluor Fernald, Inc.
K. Badu-Tweneboah, GeoSyntec
D. Phillips GeoSyntec

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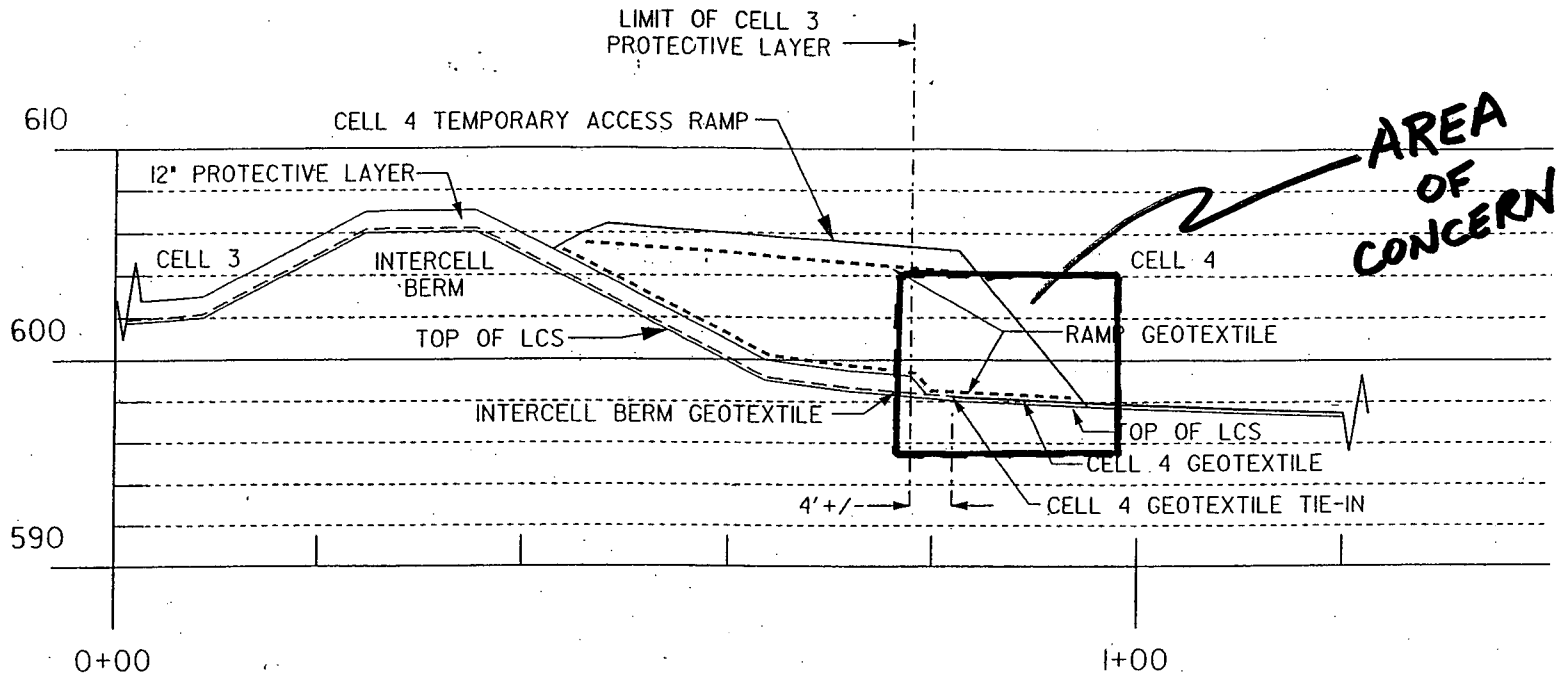


1/1 SECTION 1

1" = 12' HORIZONTAL
1" = 6' VERTICAL

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.

NOTE: FLUOR FERNALD CADD DRAWING, DO NOT REVISE MANUALLY.

CONFIGURATION MANAGEMENT DRAWING

APPROVALS: CIVIL & STR., ELECTRICAL, ENGINEER, INSTRUMENT, MECHANICAL, CHECKED, APPROVED, SAFETY ENG., MAINTENANCE, ENV. PROTECT., WASTE MANAGE., SECURITY, PROJECTS

Fernald Environmental Management Project

FLUOR FERNALD, INC.

U.S. DEPARTMENT OF ENERGY

CELL 4 TEMPORARY ACCESS RAMP

CROSS SECTION

DCN 20104-010 2

FILE NAME: CELL 4 ACCESS RAMP.DGN

Ohio EPA
State of Ohio Environ
Southwest
01 East Fifth Street
Dayton, Ohio 45402-2911
TELE: (937) 285-6

Post-it® Fax Note 7671	Date	# of pages ▶
To J.D Chiou	From Ohio EPA	
Co./Dept	Co	
Phone #	Phone #	
Fax # x5131	Fax #	

MEMORANDUM

TO: J.D Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA
DATE: January 14, 2003
RE: OSDF Phase IV DCN 20104-010 and addendum dated December 6, 2002

The first time this DCN was submitted we did not approve it in a memo dated November 27, 2002. Briefly re-iterated, our concerns were:

1) identification of the location of non-compliant materials
2) removal of non-compliant material without damage to the synthetic liner
3) demonstration that liner damage has not occurred.

The addendum is clear in describing the locations of the non-compliant material and we are satisfied that concern #1 is addressed. Some non-compliant material is on top of the Cell 3 one-foot protective layer but the critical location of non-compliant material is placed directly on top of the ramp geotextile which in turn is directly on top of the Cell 4 geotextile. In other words, there are off-spec rocks in some cases directly on the ramp geotextile and no doubt directly on top of the Cell 4 geotextile in the case of rocks which rolled out from the toe of the ramp.

Concern #2 The addendum states that the heavy equipment will stay on top of the Cell 4 protective and select layers, on the Cell 4 wedge or on areas of the ramp where the remaining thickness of the ramp is two feet or more. We are satisfied that these restrictions are sufficient to prevent damage to the geotextile from truck tires or from equipment treads. We are still unclear how the portions of the ramp will be removed without damaging the geotextile because as noted above, some of the non-compliant materials are located directly on the geotextile.

Concern #3 remains un-addressed.

ADDENDUM TO DCN 20104-010
December 6, 2002

Due to logistical constraints and radiological control requirements, the new access ramps into OSDF cells have always been built using non-impacted material as part of the liner construction activities. The Cell 3/4 Access Ramp was recently constructed in early November to support the waste placement in Cell 4. The as-built drawing of this ramp was included in DCN 20104-010 and submitted for approval. The DCN also requires eventual replacement of a portion of the ramp (see attached Fig. 1) due to material used not meeting specifications for protective or select materials along the Cell 3/4 Intercell Berm. In response to OEPA's disapproval of the DCN, this write up is prepared as an addendum to the original DCN and describes in further details; the construction of the ramp, removal of the unsuitable material, and future plan of this ramp.

The Cell 3/4 Access Ramp was constructed initially with screened brown clay from the borrow area starting from the eastern clay wedge. This screened brown clay did not meet clay liner and cap material requirements, but does meet the particle size limit for protective layer, select material and contouring layer. After the construction had proceeded 20 feet beyond the clay wedge and over the Cell 3/4 Intercell Berm, a field decision was made to switch to gray clay from the borrow area. This decision was made in order to save enough screened brown clay for construction of the Cell 2 contouring layer next year. Due to potentially higher rock content in the unscreened gray clay, geotextile was laid down before placement of gray clay and visible rocks were picked up manually during placement. The Cell 3/4 Intercell Berm and transition zone into Cell 4 already had a 1-foot protective layer (see attached Fig. 2). It was considered safe to use gray clay in this manner over the existing protective layer by Fluor Fernald Engineering and GeoSyntec to construct the access ramp and support initial waste placement in Cell 4. The last portion of the access ramp that turns into Cell 4 beyond the protective layer was predominantly constructed using #78 aggregate base and some screened brown clay to satisfy the protective layer requirements (see attached Fig. 1).

Because most of the clay was placed in thick lifts during the construction of the ramp without sufficient compaction, pumping was observed when heavy equipment traveled on the ramp. This was also determined acceptable by GeoSyntec due to the over all thickness of the ramp over the liner. To reduce pumping, an additional layer of geotextile was placed approximately 2 feet below the ramp surface elevation (See Figure 2).

As shown in Fig. 1 and Fig. 2, the side-slope portion of the ramp sits on top of the drainage layer of the LCS outside the limits of Cell 3/4 Intercell Berm protective layer. It was determined safe to have gray clay in this portion of the ramp temporarily as no heavy equipment will directly travels on top of the side slope. However, gray clay in the bottom portion of the ramp will need to be replaced eventually if it does not satisfy the protective or select material specifications. Evaluations of the as-built data indicate that the bottom three feet of gray clay in the roughly 200-foot length of the access ramp (see Fig. 1) may not satisfy the protective or select materials requirements and will be replaced.

It was determined that the best time to replace the bottom three feet of gray clay from the ramp is after placement of the first layer of impacted Category 1 material on top of the 2-foot select material layer currently in place. It is anticipated that removal/replacement of the bottom portion of the ramp will be completed in the coming Spring. There would not be any significant re-excavation of the placed waste material along the ramp at that time. However, in order to reach the bottom layer of the ramp, the upper portion of the ramp will need to be excavated first. When removing the ramp heavy equipment will stay within area where protective and select layers exist in Cell 4, over the clay wedge, or on the ramp when remaining thickness of the ramp is two feet or more. This will prevent damaging the liner components. Suitable protective and selected impacted material will then be placed. Any acceptable gray clay can also be reused in the bottom three feet. The remaining gray clay can be used as regular Category 1 material, if the material meets Category 1 requirements, and placed in the upper portion. Under better weather conditions this task can be done within a few working days.

After removal/replacement of any unsuitable gray clay in the current ramp, an expanded access ramp into Cell 3 Catchment Area and Cell 4 may be constructed at the current Cell 3/4 Access Ramp location to support placement activities in Cells 3 and 4 in 2003. Most of the remaining Category 1 gray clay may be used in construction of the upper portion of this expanded ramp. If required, a drawing of the expanded ramp will be developed and issued.

State of Ohio Environmental Protection Agency

Southwest District Office

1 East Fifth Street
Dayton, Ohio 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6404

Bob Taft, Governor
Maureen O=Connor, Lt. Governor
Christopher Jones, Director

MEMORANDUM

TO: J.D. Chiou, SDFP Manager, Fluor Fernald
FROM: Tom Ontko, Ohio EPA
DATE: November 27, 2002
RE: OSDF Phase IV DCN 20104-010

This DCN removes the Cell 3/4 access ramp that was constructed so that impacted material could be placed in Cell 4 while the Cell 4/5 haul road and access ramp were being built. The access ramp was built using clean material.

The Ohio EPA approved the access ramp with the understanding that it would also be used to place impacted material in the Cell 3 catchment area. We expected that this road would be permanent and would be built consistent with the IMPP. We approved the ramp with some mental reservations because written design existed and because we are generally opposed to the concept of placing clean materials in the OSDF. Never the less, we verbally approved the Cell 3/4 access ramp with the understanding that it be consistent with the original design (especially maintaining the haul road with no more than a 10H:1V grade) and that we receive >as-builts= with a DCN.

Upon receipt of DCN 20104-010, we find that instead of an as-builts for the access road construction, we now have a DCN to remove the ACell 4 temporary access ramp@. We also discover that instead of being built with merely clean material, the ramp has been built with clean material that does not meet the specification for >select= material or for >protective= material. Large rocks were placed closer to the liner components than the design allows. Furthermore, obvious pumping occurs under the tires of the articulated dump trucks as they drive on the ramp. Time was not taken to build the ramp with materials that were suitable from either a particle size or a moisture content criterion.

We do not approve the removal of this ramp until a Plan is in place to address the following;

1) How will the locations of the non-compliant materials be identified?
2) How will the non-compliant materials be removed without damaging the liner components?
3) How will DOE demonstrate that the liner has not been damaged?

RCI/DCN FORM

REQUEST FOR CLARIFICATION OF INFORMATION / DESIGN CHANGE NOTICE

(1) PROJECT/CWO/RES NO.:	(2) S/C NO.:	(5) Pg 1 Of 2	(6) DATE
20104	FSC-653		11/26/02

(3) S/C TITLE: On-Site Disposal Facility (OSDF) Phase IV Construction

(11) RCI NO.:

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

(4A) RCI/DCN TITLE: Cell 4 Temporary Access ramp

(11) DCN NO.: 20104-010

(7) DOCUMENTS AFFECTED	(7) DOCUMENT NOS.	(7) REV.	(8) OTHER
Phase IV Construction Drawing: Impacted Material Haul Road Grading Plan and Details	90X-6000-G-00336	0	Sheet G-8

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

[ ] REQUIRED [ ] NOT REQUIRED

Justification: In order to place protective impacted material in Cell 4 in a more efficient manner, an access ramp was constructed at the Cell 3/Cell 4 intercell berm.

Existing Conditions: The temporary impacted material access ramp at the intercell berm between Cells 3 and 4 was constructed as shown on following attachment.

Proposed Change: The as-built drawing on the attachment has been prepared to show location and elevation of the temporary Cell 4 access ramp. The ramp portion around the protective clay layer at the top of the berm will be removed at the end of the construction season.

(10) REQUESTOR:	COMPANY:	DATE:	(12) CE / PE	DATE:
Charles C. Van Arsdale	Fluor Fernald	11/26/02	Charles C. Van Arsdale	11/26/02

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

The additional material placed in the Cell 3/Cell 4 access ramp in the area shown on the attachment does not meet the specification for protective impacted and select impacted material layers. This material will be removed and replaced with material meeting the specifications in accordance with Section 7.2 and 7.3 of the Impacted Material Placement Plan.

RCI - DCN ACCEPTANCE

(15) DESIGN ORGANIZATION APPROVAL/DISAPPROVAL DATE: 11/25/02

KURASI BADU-TWEREBOAH, GEOSYNTEC

[ ] FIT [ ] FORM [X] FUNCTION

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

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

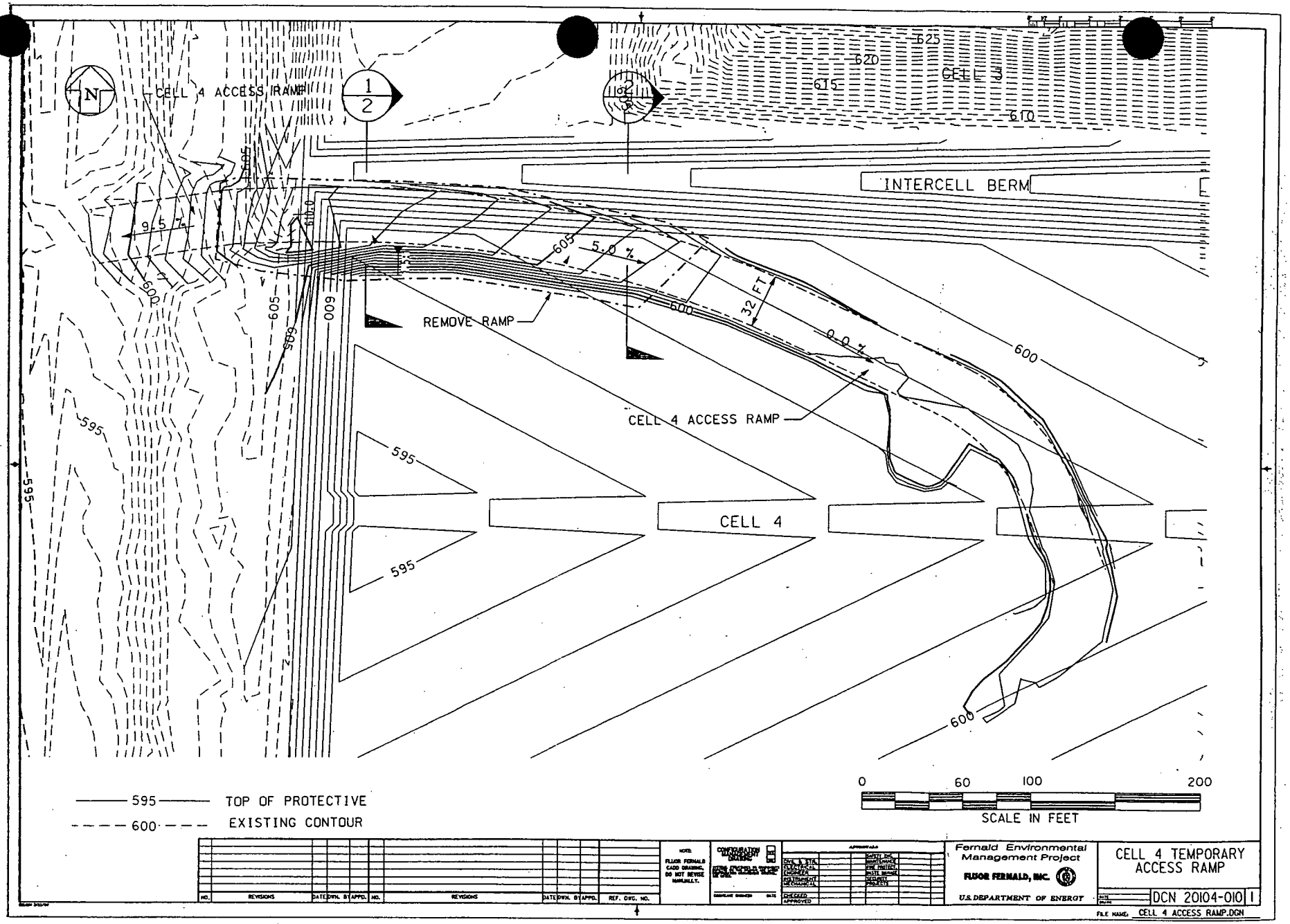
PERFORMANCE GRADE: (17) 4 – SBDR 2000-0027 Applies

(18) CONSTRUCTION CONCURRENCE DATE:

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

(21) FIELD WORK COMPLETED:

(SIGNOFF BY CE OR PE) DATE:



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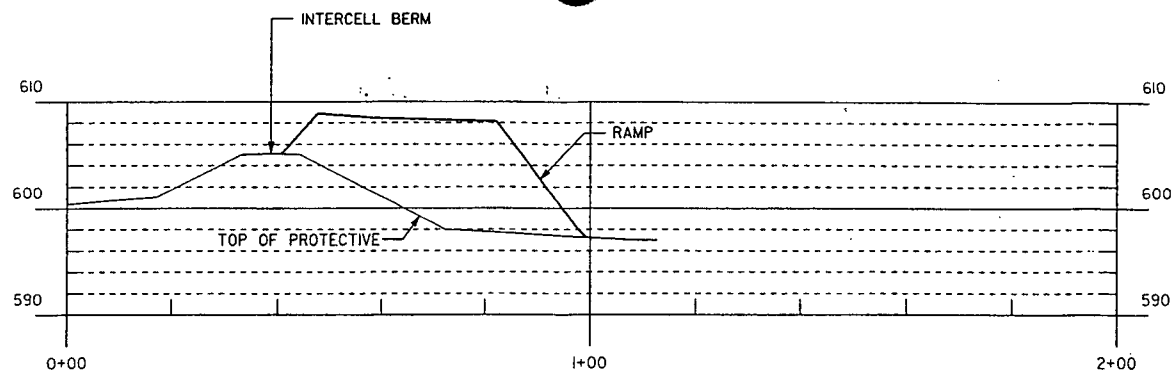
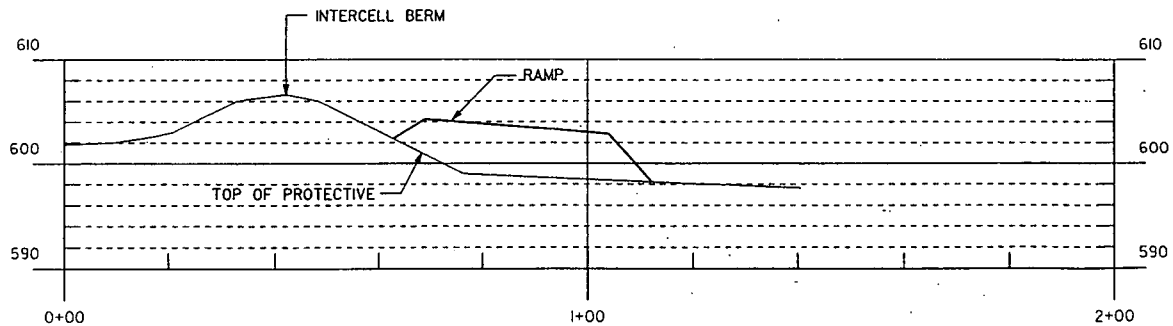


1/1 SECTION 1



2/1 SECTION 2

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.

NOTE: FLUOR FERNALD CADD DRAWING. DO NOT REVISE MANUALLY.

CONFIGURATION MANAGEMENT DOCUMENT

CONSULTANT ENGINEER DATE

APPROVALS: CIVIL & STR. ELECTRICAL PROCESS INSTRUMENT MECHANICAL CHECKED APPROVED

SAFETY, ENG. MAINTENANCE FIRE PROTECT. WASTE MANAGE. SECURITY PROCESS

Fernald Environmental Management Project

FLUOR FERNALD, INC.

U.S. DEPARTMENT OF ENERGY

CELL 4 TEMPORARY ACCESS RAMP

CROSS SECTIONS

DCN 20104-010 2

FILE NAME: CELL 4 ACCESS RAMP.DGN

000340

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APPENDIX U

Nonconformance Reports (NCRs)

GeoSyntec Consultants

GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

1. ORIGINATOR:	2. TITLE/ORGANIZATION:	3. NCR NUMBER:	4. DATE DISCOVERED:
Collin Sukow	Site CQC Manager/GeoSyntec Consultants	NCR-20104-01	05 September 2002

5. RESPONSIBLE ORGANIZATION/PROJECT:	6. ASSESSMENT ACTIVITY:	7. HOLD TAG:
Fluor Fernald Construction/OSDF Phase IV	Construction Quality Control	( ) YES (X) NO
		8. REMOVED (Initial/Date): N/A

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

Specifications 02714.3.01.A:

Do not commence geotextile installation until the CQC Consultant completes performance testing and confirmation of compliance of underlying layers, including acceptance of Contractor's survey results for underlying layers.

10. NONCONFORMANCE TYPE: Construction Nonconformance (X) Material Deviation ( )

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

On 05 September 2002, GeoSyntec pointed out areas needing non-destructive testing on the secondary geomembrane liner in Northwest Cell 4. Nevertheless, geotextile was deployed over the geomembrane liner prior to completion of non-destructive testing. Similar occurrences of premature deployment of geotextiles had been reported to the CQC Manager on 04 September, 03 September, 30 August, and 29 August 2002. This continual practice will likely result in missed non-destructive testing and/or missed QA/QC documentation, resulting in the removal of materials down to the surface of the secondary geomembrane liner or future primary geomembrane liner prior to certification.

12. ORIGINATOR'S SIGNATURE:	13. DATE PROVIDED TO RESPONSIBLE MANAGER:
Collin P. Sukow 5 Sept 2002	05 September 2002

14. RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is ( ) Reject ( ) Other ( ) Repair ( ) Rework ( )

THE GEOTEXTILE WAS CUT OPEN TO ALLOW CQC CONSULTANT ACCESS TO TAKE DESTRUCTIVE SAMPLES. MET WITH THE SUPERINTENDANT & TOLD HIM TO MAKE SURE ALL DESTRUCTIVES SAMPLES FOR GML SEAMS WERE TAKEN & TESTED WITH PASSING RESULTS PRIOR TO PLACEMENT OF OVERLYING GEOTEXTILE.

15. RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

BILL ZEBICK CONSTRUCTION MANAGER

16. RESPONSIBLE MANAGER'S SIGNATURE:	17. PROPOSED COMPLETION DATE:	18. DATE FORWARDED TO APPROVAL AUTHORITY:
Bill Zebick	SEPT 6, 2003	SEPT 6, 2003

GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

19. EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (X) Reject ( )
Comments ( )

20. APPROVAL AUTHORITY SIGNATURE: Collin P. Nelson

21. DATE: 6 Sept. 2002

22. VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):

23. VERIFIER'S SIGNATURE:

24. DATE:

25. APPROVAL AUTHORITY SIGNATURE:

26. DATE CLOSED: 6 Sept 2002

27. CONTINUATION FROM BLOCK ____:

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

DAILY FIELD REPORT

4944

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: 6Q1341 TASK NO.: 04.1

DESCRIPTION: Phase IV DATE: 30 day Aug month 2002 year

CONTRACTOR: Fluor Fernald

WEATHER: See daily weather log.

0800 Arrive on site. Head to Cell 5.

0815 Monitor Fluor place soil around and under the penetration ~~tie~~ boxes. C. Walker informs that textiles have been deployed over patches needing V-Boxing. The textile is being pulled back for non-destructive testing to be completed.

1000 Continue to monitor placement of Clay under the penetration boxes. Fluor uses a jumping jack and pneumatic air compactor to compact the material.

1200 Lunch

1230 Discuss project progress with GeoSyntec personnel.

1300 Continue to monitor the repair efforts around the ~~Cell~~ Cell 5 penetration boxes.

1730 Fluor shuts down for the day. ~6 inches remain to be placed

1800 Leave site.

COPY TO: FILE PER: [signature] HRS: 9.5

000345

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

4944

DAILY FIELD REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ1341 TASK NO.: 04.1

DESCRIPTION: Phase IV DATE: 3 day Sept month 02 year

CONTRACTOR: Fluor Fernald

WEATHER: see daily log

0700 - inspected East floor of Cell #4. Fabric had been placed over patches which were not yet V-boxed. The areas were peeled back.

0900 - trial seam logs / repair and production logs

1200 - safety meeting

1300 - inspected seaming seams / trial seam logs / repair and production logs / destruct log

1730 - departed site

000346

COPY TO: file PER: Christopher H. Walker HRS: 10.5

©GEOSYNTEC CONSULTANTS FILE NO. 1-04-DFR SHEET NO. ____ OF ____

GEOSYNTEC CONSULTANTS

FLUOR FERNALD, INC.

4944

DAILY FIELD REPORT

PROJECT: ON-SITE DISPOSAL FACILITY (OSDF)

LOCATION: FERNALD, OHIO PROJECT NO.: GQ1341 TASK NO.: 04.1

DESCRIPTION: Phase IV Cell 4 & 5 DATE: 5 day Sept month 02 year

CONTRACTOR: Fluor Fernald

WEATHER: see daily log

0630 - safety meeting

0700 - inspected area in Cell #4 (drainage corridor area) where fabric was being deployed. Areas which were not yet V-boxed were pointed out (RS 379, RS 408 and NS Tie in seam) to Mr. Lightfoot. Muriel Vigus of FF was also informed.

0830 - trial welds

0900 - logged repair and production seams. The second lift of clay was being backfilled in the east anchor trench Performed CF02-161

1045 - Fabric was being deployed over areas that were not yet V-boxed (RS 379, RS 501) I reiterated to Mr. Lightfoot that the areas were not yet V-Boxed and the fabric was folded back. On 4 Sept a similar incident occurred. The anchor trench on the east side of Cell #4/5 was covered with fabric prior to v-boxing.

1200 - Lunch

1230 - Safety meeting

1300 - Trial Welds

1330 - logged repairs and trial welds. ISTRE Co. had maintenance problems with #09 wedge and #03 Extruder. Also logged VT results and destruct results.

1700 - assisted Byron York w/ chasing DS 80 which failed.

1800 - departed site

000347

COPY TO: file PER: Christopher H. Walker HRS: 11.0

1944

GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

1. ORIGINATOR:	2. TITLE/ORGANIZATION:	3. NCR NUMBER:	4. DATE DISCOVERED:
Collin P. Sukow	Site CQC Manager	20104-2	04 June through 20 November 2002

5. RESPONSIBLE ORGANIZATION/PROJECT:	6. ASSESSMENT ACTIVITY:	7. HOLD TAG:
Fluor Fernald Construction OSDF Phase IV	Construction Quality Control	( ) YES (x) NO 8. REMOVED (Initial/Date): N/A

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

OSDF Specification 02710.2.01.B; Granular drainage material.....shall meet the AASHTO M-43 modified gradation requirements for No. 78 coarse aggregate, and 02710.2.01.C; Percentage of granular drainage material passing the No. 200 sieve.....shall be less than 2.0 percent by weight when tested in accordance with ASTM C-136.

10. NONCONFORMANCE TYPE: Construction Nonconformance ( ) Material Deviation (x)

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

No. 78 stone samples were collected incrementally as the material was delivered and stockpiled throughout the 2002 construction season. Six of the 21 samples collected did not meet the gradation requirements for No. 78 stone. Five of the samples were to fine grained and one was to coarse grained (see attached).

12. ORIGINATOR'S SIGNATURE:	13. DATE PROVIDED TO RESPONSIBLE MANAGER:
Collin P. Sukow	17 Dec 2002

14. RESPONSIBLE MANAGER'S PROPOSED CORRECTIVE ACTION: Use As-Is (x) Reject ( ) Other ( ) Repair ( ) Rework ( )

The five samples that were to fine grained were outside the specifications by either a few percent passing the 3/8-inch sieve or a few tenths of a percent passing the No. 200 sieve. The one sample that was coarse was still within the maximum particle size parameters. All six samples hydraulic conductivity was within project specifications, and the overall average particle size for all 21 samples fit within grain size parameters. Use as is.

15. RESPONSIBLE MANAGER (NAME, TITLE, ORGANIZATION):

KWASI BADU-TWEREBOAH, PROJECT MANAGER, GEOSYNTEC

16. RESPONSIBLE MANAGER'S SIGNATURE:	17. PROPOSED COMPLETION DATE:	18. DATE FORWARDED TO APPROVAL AUTHORITY:
	30 DEC 2002	18 DEC 2002

GeoSyntec Consultants

CONSTRUCTION NONCONFORMANCE REPORT

19. EVALUATION OF PROPOSED CORRECTIVE ACTION: Accept (X) Reject ( )
Comments ( )

20. APPROVAL AUTHORITY SIGNATURE: [signature]

21. DATE: 12/19/02

22. VERIFICATION OF CORRECTIVE ACTION (Describe who, what, when, where):

ACCEPT CORRECTIVE ACTION.

23. VERIFIER'S SIGNATURE: MIKE GODBER [signature]

24. DATE: 12/19/02

25. APPROVAL AUTHORITY SIGNATURE: [signature]

26. DATE CLOSED: 12/30/02

27. CONTINUATION FROM BLOCK ____:

Sample Number 78 Stone	78 Stone sieve size, passing requirements, and individual sample results							Carbonate Content (%)	Hydraulic Conductivity (cm/sec)	Comments
	3/4-in 100%	1/2-in 85-100%	3/8-in 40-75%	#4 5-25%	#8 0-10%	#16 0-5%	#200 0-2%			
FM02-1	100	85	57	12	4	2	0.9	0.07	3.0	
FM02-2	100	93	70	12	4	2	1.5	0.02	5.8	
FM02-3	100	88	65	12	3	2	1.6	—	2.6	
FM02-4	100	91	69	14	4	3	***2.3***	0.47	2.3	Failed No. 200
FM02-5	100	89	68	10	3	2	1.5	—	1.7	
FM02-6	100	88	63	10	3	2	1.4	0.04	1.7	
FM02-7	100	85	49	5	3	2	1.8	—	3.1	
FM02-8	100	85	54	6	2	2	1.5	0.12	2.9	
FM02-9	100	***69***	***34***	***3***	1	1	0.8	0.05	3.5	Failed coarse sieves
FM02-10	100	94	77	13	4	3	2.0	0.06	3.0	Failed 3/8-in
FM02-11	100	91	69	7	2	1	0.6	0.15	3.0	
FM02-12	100	88	64	10	4	3	***2.2***	0.16	1.8	Failed No. 200
FM02-13	100	85	63	8	2	2	1.6	0.12	2.8	
FM02-14	100	89	67	11	2	2	1.1	0.05	1.9	
FM02-15	100	86	65	13	3	2	2.0	0.11	2.7	
FM02-16	100	86	73	16	3	2	1.1	—	2.7	
FM02-17	100	94	***78***	18	3	2	1.9	—	2.5	Failed 3/8-in
FM02-18	100	88	57	5	1	0	0.1	—	2.5	
FM02-19	100	94	77	20	6	4	***2.2***	0.17	1.2	Failed 3/8-in/No.200
FM02-20	100	89	57	5	2	1	1.0	0.06	4.8	
FM02-21	100	93	75	18	5	3	1.8	—	2.1	
FM02-22	100	91	67	11	4	2	1.3	0.1	2.6	

Fluor Fernald

NONCONFORMANCE REPORT FORM

4944

ORIGINATOR/ASSESSOR

Nonconformance Number/Revision	NCR No.: 394 Revision No. 0
Da[redacted]	Date Discovered: August 9, 2002 Date NCR Issued: August 21, 2002
Type of Nonconformance	[x] FINDING [ ] CONCERN
Project Number Project/Activity @ Fac/Loc/Bldg.	20104/ On-Site Disposal Facility Ph. IV
Hazard Category	Nuclear: [ ] 1 [ ] 2 [ ] 3 Radiological: [ ] Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard Industrial: [x] Standard Industrial Hazard [ ] Other Industrial Hazard Not Designated [ ] Desktop review, document review, etc.
Assessment	[x] Internal (Site) [ ] External (OEPA, DOE) [ ] Supplier/Vendor_____
Assessment Type	[ ] Audit [ ] Surveillance [ ] Inspection [ ] Self Assessment [x] DOCUMENT REVIEW
Assessment Number	NONE
Responsible Program/Project Division/Vendor	[ ] WPRAP [ ] D&DP [X] S&DFP [ ] M&IS [ ] WGS [ ] ARP [ ] ESH&Q [ ] SP [ ] CPM [ ] NMD [ ] OP [ ] ADM [ ]Supplier/Vendor/Subcontractor [ ] Other
Responsible Department/Vendor	FLUOR FERNALD CONSTRUCTION
Responsible Manager/Supervisor/Vendor (Print Name)	(For Concerns, assign to Project/Program Director BILL ZEBICK/ J.D. CHIOU
Functional Area (NA for Vendors) choose any that apply) Ref. RM-0016)	[ ] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI [ ] FM [ ] EP [ ] EW [ ] MT [ ] OP [ ] PT [ ] SE [ ] TR [X CT [ ] HR [ ] PC [ ] EM [ ] FP [ ] NS [ ] SH [ ] RP
Criteria [redacted]ne that applies Ref. RM-0012) Oth[redacted]riteria (CONOPS, etc.) not RM-0012 applicable)	[ ] 1 Program [ ] 2 Training [ ] 3 Quality Improvement [ ] 4 Document/Records [X] 5 Work process [ ] 6 Design [ ] 7 Procurement [ ] 8 Inspect/Test [ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other
Requirement Description 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 Technical Specification for On-Site Disposal Facility Ph . IV, Revision 1, Section 2225, Para. 3.02, which states: Stockpile screened material in approximately 5000 to 10,000 cubic yard stockpiles for clay liner and cap conformance testing and confirmation of compliance with this section. EBT 10/21/02
Nonconformance Description 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.	Stockpile 02-5 was surveyed by Fluor Fernald surveyors to determine its volume. The Stockpile volume was calculated to have 10,367 cubic yards of clay liner material which exceeds the 10,000 cubic yard limit. Stockpile 02-8 was surveyed by Fluor Fernald surveyors to determine its volume. The Stockpile volume was calculated to have 11,142 cubic yards of clay liner material which exceeds the 10,000 cubic yard limit.
Tagging Required / Number of Tags	[ ] Yes [X] No Number of Tags:
Originator/Assessor	Name: MURE VIGUS Signature: [signature] Date: 8-21-02

MANAGER/SUPERVISOR'S REVIEW

Manager/Supervisor [redacted]d/Briefed on QA-0001)	Name: MIKE GODBER Signature: [signature] Date: 8/21/02
Re[redacted]se Date From Responsible Organization	REQUESTED RESPONSE DATE: 9/18/02 (Reply within 20 working days)

NONCONFORMANCE REPORT FORM

4944

RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE

	Nonconformance Number/Revision	NCR No.: 394 Revision No. 0
	Root Cause Analysis Provide documentation as attachment. Use additional or separate sheets as necessary	[ ] YES [X] NO Level 1 Cat.: [ ] (human performance.) [ ] (equip.) [ ] (natural phenom/sabotage [ ] (other) [ ] Supplier/Vendor/Subcontractor (root cause per their program) List Cause:
21	**Corrective Action (CA) Description and Disposition** 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 must also include actions to prevent recurrence. Use additional or separate sheets as necessary. (A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below)	A) Hardware NCR: → [ ] Accept-as-is [ ] Repair [ ] Rework [ ] Reject B) Non-Hardware NCR: → [ ] Other: See Attached Corrective Action Plan [ ] Yes [ ] NA BASED ON GEOSYNTEC'S CALCULATIONS, IN-PLACE VOLUMES FOR BOTH STOCKPILES WERE WITHIN THE 10,000 CY LIMIT REQUIRED BY THE SPECIFICATION. (SEE ATTACHED TECHNICAL REVIEW)
22	**Technical Concurrence/Justification (mark NA if not applicable)**	Name: KWASI BADU-TWEH Signature: Date: 10/29/02
23	**Was a Design Change Notice Required?**	[ ] Yes [X] No DCN # Date Issued
24	**Was a SBDR Performed?** **Was a USQD Performed?**	[ ] Yes [X] No SBDR # Date Issued [ ] Yes [X] No USQD # Date Issued
25	**Actions taken to Prevent Recurrence** Use additional or separate sheets as necessary.	EACH STOCKPILE WILL BE EVALUATED FOR IN PLACE CUBIC YARDS FOR FINAL ACCEPTANCE. TO BE CONSERVATIVE THE LOOSE CUBIC YARDS FOR STOCKPILE WILL BE MAINTAINED ~~AT 10,000~~ MS 10/29/02 LESS THAN 10,000 CY.
	Proposed Completion Date For CA	Date:
	Responsible Manager/Supervisor/Vendor	Name: FRANK L. FLACK BILL ZEBICK Signature: Date: 10/22/02

EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR

28	**Response Acceptable?**	[X] Yes [ ] No
29	**Originator's/Assessor's**	Name: MURIEL VIGUS Signature: Date: 10-29-02

COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION

30	**Date Corrective Action Completed**	Date:
31	**Responsible Manager/Supervisor/Vendor**	Name: FRANK L. FLACK BILL ZEBICK Signature: Date: 10/22/02

VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER

32	**Verification Action** (Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR)	SEE ATTACHED "USE AS IS" JUSTIFICATION.
33	**Verifier**	Name: MURIEL VIGUS Signature: Date: 10-29-02

CLOSURE BY THE VERIFIER'S MANAGER/SUPERVISOR

	Verifier's Manager/Supervisor (NCR Closed)	Name: MIKE GODDE Signature: Date: 10/29/02

000353

Fluor Fernald NCR No. 394

Corrective Action (CA) Description and Disposition

The primary reason for limiting stockpile size to 10,000 cubic yards is to minimize the number of conformance samples, at a frequency of one per 1,500 cubic yards for the index tests, and thereby eliminate the potential of an outlier in the test results.

Stockpile 02-5 was surveyed to be 10,367 cubic yards (bank/unbulked). The in-place volume is estimated by GeoSyntec CQC to be 8,957 cubic yards. GeoSyntec CQC collected six (6) conformance samples from this stockpile, thereby meeting the minimum sampling frequency requirement. Results of geotechnical testing conducted on Stockpile 02-5 met the requirements of the Specifications (see attached copy).

Stockpile 02-8 by Fluor Fernald is actually Stockpile 02-7 per GeoSyntec CQC's sampling, while Stockpile 02-7 should be Stockpile 02-7 (see attached E-mails). Stockpile 02-7 was surveyed to be 11,142 cubic yards (bank/unbulked). The in-place volume is estimated by GeoSyntec CQC to be 9,627 cubic yards. GeoSyntec CQC collected seven (7) conformance samples from this stockpile, thereby meeting the minimum sampling frequency requirement. Results of geotechnical testing conducted on Stockpile 02-7 met the requirements of the Specifications (see attached copy).

Since sufficient samples were collected from each stockpile, and all test passed the specification requirements for compacted clay liner and cap material, it is suggested to accept-as-is.

Godber, Mike

From: Schwing, James
Sent: Wednesday, August 21, 2002 7:02 AM
'Kwasi Badu-Tweneboah'; Schwing, James
Zebick, Bill; Vanarsdale, Chuck; Godber, Mike; Williams, Jerry M
Subject: RE: Screened Pile #8 in the borrow area contains 11,142 c.y.

Kwasi,

You are correct that this pile was initially labeled as 02-7. As I was having a discussion with Jerry, I was informed that this pile was now being labeled as 02-8. Let me touch base with Jerry and confirm the reason for the re-labeling of piles.

Jim

-----Original Message-----
From: Kwasi Badu-Tweneboah [mailto:KBadu-Tweneboah@GeoSyntec.com]
Sent: Tuesday, August 20, 2002 4:06 PM
To: 'Schwing, James '; Kwasi Badu-Tweneboah
Cc: 'Zebick, Bill '; 'Vanarsdale, Chuck '; 'Godber, Mike '; 'Williams, Jerry M '
Subject: RE: Screened Pile #8 in the borrow area contains 11,142 c.y.

Jim,

Is this number for Stockpile 02-7 and not 02-8 per your E-mail? I am told
02-8 was started just last Friday and as such we have collected only 4 samples so far, which would make it about 6,000+/- cubic yards.
If its for Stcokpile 02-7, I would like to remind the Project Team that the
plans call for 10,000 cubic yards maximum per stockpile. Again, we are not
following the plans! In anyway, we would still have to collect at least another sample from this stockpile to come up with a total of 7 samples (10,500 cubic yards total).

-----Original Message-----
From: Schwing, James
To: 'Kwasi Badu-Tweneboah (E-mail) ' (E-mail)
Cc: Zebick, Bill; Vanarsdale, Chuck; Godber, Mike; Williams, Jerry M
Sent: 8/20/2002 3:42 PM
Subject: Screened Pile #8 in the borrow area contains 11,142 c.y.

********** DISCLAIMER **********
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****

STOCKPILE 02-5

Sample Number	Sample Frequency (cu Yds)	Moisture Content %	Standard Proctor (and rock correction)	Modified Proctor pcf @ %	Liquid Limit %	Plastic Limit %	Plasticity Index	Passing #200 sieve %	Clay Content %	Classification (USCS)	Hydraulic Conductivity
LP02-29	1500	11.8	118.1 @ 13.1 119.3 @ 12.7	129.0 @ 9.7 130.0 @ 9.4	33	17	16	72.1	27.0	(CL) Lean Clay w/sand	1.00E-07 —
LP02-30	3000	13.9	122.3 @ 12.6 123.5 @ 12.2	— —	30	15	15	68.9	27.0	(CL) Sandy Lean Clay	— —
LP02-31	4500	11.7	117.3 @ 13.5 120.0 @ 12.6	132.0 @ 8.2 134.2 @ 7.7	28	15	13	64.8	25.0	(CL) Sandy Lean Clay	— —
LP02-34	6000	11.4	118.8 @ 12.0 120.8 @ 11.4	— —	26	15	11	67.4	19.0	(CL) Sandy Lean Clay	— —
LP02-35	7500	11.6	124.1 @ 12.4 125.4 @ 12.0	133.9 @ 9.0 135.0 @ 8.7	24	14	10	69.0	20.0	(CL) Sandy Lean Clay	— —
LP02-36	9000	11.5	123.6 @ 12.4 124.4 @ 12.2	— —	25	15	10	65.8	23.5	(CL) Sandy Lean Clay	— —

Reported total yards, surveyed:	10,367
Converted total yards in place:	8,957
Average Stockpile Moisture:	12.00%
Average Corrected Standard Proctor:	122.2 @ 12.2
Average Corrected Modified Proctor:	133.1 @ 8.6
Cumulative cubic yards:	44,466
Composite Hydraulic Conductivity:	3.30E-08

* Two samples failed remolded permeability testing within the line of optiums. The third sample passed permeability testing by being remolded to the 90% saturation line.

* *1.50E-06*

* *1.30E-07*

000356

4944

STOCKPILE 02-7

Sample Number	Sample Frequency (cu Yds)	Moisture Content %	Standard Proctor (and rock correction)	Modified Proctor pcf @ %	Liquid Limit %	Plastic Limit %	Plasticity Index	Passing #200 sieve %	Clay Content %	Classification (USCS)	Hydraulic Conductivity
LP02-42	1500	12.7	121.1 @ 11.0 122.1 @ 10.7	133.8 @ 9.2 134.6 @ 9.0	26	16	10	65.2	25.0	(CL) Sandy Lean Clay	— —
LP02-44	3000	14.0	116.6 @ 14.4 117.3 @ 14.2	— —	34	17	17	74.6	29.0	(CL) Lean Clay w/sand	— —
LP02-45	4500	13.1	119.6 @ 13.4 120.3 @ 13.2	130.6 @ 10.0 131.2 @ 9.8	29	16	13	69.3	26.0	(CL) Sandy Lean Clay	6.70E-08 —
LP02-46	6000	11.6	120.8 @ 13.0 122.9 @ 12.3	— —	28	16	12	66.8	24.5	(CL) Sandy Lean Clay	— —
LP02-47	7500	11.8	119.9 @ 12.3 121.3 @ 11.9	132.5 @ 9.0 133.6 @ 8.7	27	15	12	67.9	25.0	(CL) Sandy Lean Clay	— —
LP02-48	9000	12.5	122.1 @ 12.9 123.5 @ 12.4	— —	28	15	13	67.8	25.0	(CL) Sandy Lean Clay	— —
LP02-55	9000+	11.2	120.0 @ 12.7 122.2 @ 12.0	132.5 @ 8.5 134.3 @ 8.1	28	16	12	68.1	25.0	(CL) Sandy Lean Clay	— —

Reported total yards, surveyed:	11,142
Converted total yards in place:	9,627
Average Stockpile Moisture:	12.40%
Average Corrected Standard Proctor:	121.4 @ 12.4
Average Corrected Modified Proctor:	133.4 @ 8.9
Cumulative cubic yards:	54,093
Composite Hydraulic Conductivity:	9.90E-08

NONCONFORMANCE REPORT FORM

4944

ORIGINATOR/ASSESSOR

1	Nonconformance Number/Revision	NCR No.: 409 Revision No. 0
2	Dates	Date Discovered: 9/5/02 Date NCR Issued: 9/06/02
3	Type of Nonconformance	[X] FINDING [ ] CONCERN
4	Project Number Project/Activity @ Fac/Loc/Bldg.	20104/ OSDF PHASE IV/ GEOTEXTILE PLACEMENT
5	Hazard Category	Nuclear: [ ] 1 [ ] 2 [ ] 3 Radiological: [ ] Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard Industrial: [X] Standard Industrial Hazard [ ] Other Industrial Hazard Not Designated [ ] Desktop review, document review, etc.
6	Assessment	[X] Internal (Site) [ ] External (OEPA, DOE) [ ] Supplier/Vendor_____
7	Assessment Type	[ ] Audit [ ] Surveillance [ ] Inspection [ ] Self Assessment [X]Other FIELD ASSESSMENT
8	Assessment Number	NONE
9	Responsible Program/Project Division/Vendor	[ ] WPRAP [ ] D&DP [X] S&DFP [ ] M&IS [ ] WGS [ ] ARP [ ] ESH&Q [ ] SP [ ] CPM [ ] NMD [ ] OP [ ] ADM [ ]Supplier/Vendor/Subcontractor [ ] Other
10	Responsible Department/Vendor	CONSTRUCTION
11	Responsible Manager/Supervisor/Vendor (Print Name)	(For Concerns, assign to Project/Program Director BILL ZEBICK/ MIKE STUMBO
12	Functional Area (NA for Vendors) (choose any that apply) (Ref. RM-0016)	[ ] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI [ ] FM [ ] EP [ ] EW [ ] MT [ ] OP [ ] PT [ ] SE [ ] TR [X] CT [ ] HR [ ] PC [ ] EM [ ] FP [ ] NS [ ] SH [ ] RP
13	QA Criteria (choose one that applies Ref. RM-0012) Other Criteria (CONOPS, etc.) (if RM-0012 applicable)	[ ] 1 Program [ ] 2 Training [ ] 3 Quality Improvement [ ] 4 Document/Records [X] 5 Work process [ ] 6 Design [ ] 7 Procurement [ ] 8 Inspect/Test [ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other
14	Requirement Description 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 Specification Section 02714, Paragraph 3.01D which states "After unwrapping the geotextiles from their opaque covers, do not leave them exposed for a period in excess of 10 calendar days or for the Manufacturer's written recommended exposure period.
15	Nonconformance Description 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.	When reviewing Cell 5 on 9/5/02 at approximately 8:30 AM, noticed geotextile that was placed on August 22, 2002 and August 23, 2002 that had not been covered with stone. This material was exposed to weathering for more than 10 calendar day. See attached location of this material.
16	Tagging Required / Number of Tags	[ ] Yes [x] No Number of Tags:
17	Originator/Assessor	Name: DICK SCHEPER Signature: Richard Schepe Date: 9-6-02

MANAGER/SUPERVISOR'S REVIEW

18	Manager/Supervisor (Trained/Briefed on QA-0001)	Name: MIKE GODBER Signature: Michael Godber Date: 9/6/02
	Response Date From Responsible Organization	REQUESTED RESPONSE DATE: ~~9/26/02~~ MG 9/6/02 10/04/02 (Reply within 20 working days)

000358

NONCONFORMANCE REPORT FORM

4944

RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE

	Nonconformance Number/Revision	NCR No.: 409 Revision No. 0
	Root Cause Analysis Provide documentation as attachment. Use additional or separate sheets as necessary	[ ] YES [ ] NO Level 1 Cat.: [ ] (human performance.) [ ] (equip.) [ ] (natural phenom/sabotage [ ] (other) [ ] Supplier/Vendor/Subcontractor (root cause per their program) List Cause:
21	Corrective Action (CA) Description and Disposition 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 must also include actions to prevent recurrence. Use additional or separate sheets as necessary. (A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below)	A) Hardware NCR: → [X] Accept-as-is [ ] Repair [ ] Rework [ ] Reject B) Non-Hardware NCR: → [ ] Other: See Attached Corrective Action Plan [ ] Yes [ ] NA SEE ATTACHED JUSTIFICATION FOR "ACCEPT AS IS".
22	Technical Concurrence/Justification (mark NA if not applicable)	Name: Kwasi Baah-Tuahene Signature: [signature] Date: 10/29/02
23	Was a Design Change Notice Required?	[ ] Yes [X] No DCN # Date Issued
24	Was a SBDR Performed? Was a USQD Performed?	[ ] Yes [X] No SBDR # Date Issued [ ] Yes [X] No USQD # Date Issued
25	Actions taken to Prevent Recurrence Use additional or separate sheets as necessary.	FUTURE CONSTRUCTION ACTIVITIES WILL BE MORE CLOSELY COORDINATED WITH THE GEOSYNTHETICS CONTRACTOR TO REDUCE EXPOSURE TIME.
26	Proposed Completion Date For CA	Date: 10/22/02
	Responsible Manager/Supervisor/Vendor	Name: FRANK L. FLACK Signature: [signature] Date: 10/22/02

EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR

28	Response Acceptable?	[X] Yes [ ] No
29	Originator's/Assessor's	Name: ~~MIKE GODBER~~ FORDICK SCHEFER Signature: [signature] Date: 10/22/02

COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION

30	Date Corrective Action Completed	Date: 10/22/02
31	Responsible Manager/Supervisor/Vendor	Name: ~~MIKE~~ FRANK L. FLACK Signature: [signature] Date: 10/22/02

VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER

32	Verification Action (Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR)	VERIFIED THE GEOTEXTILE MATERIAL WAS COVERED WITHIN 12 DAYS OF BEING INSTALLED.
33	Verifier	Name: ~~MIKE GODBER~~ FORDICK SCHEFER Signature: [signature] Date: 10/22/02

CLOSURE BY THE VERIFIER'S MANAGER/SUPERVISOR

34	Verifier's Manager/Supervisor (NCR Closed)	Name: Dave Capelle Signature: D.P. Capelle Date: 10/29/02

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 10 am

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 20162-22~~ ~~JKL 10-24-99~~ KBT

NCR No. 409

Fluor Fernald NCR No. 409

Corrective Action (CA) Description and Disposition

The referenced geotextile was exposed for a maximum of 12 days before being covered with the overlying LDS drainage layer material. The attached letter from the geotextile manufacturer indicates that if the geotextile were exposed for a 30-day period, it would exhibit a maximum 15 percent loss of strength. Previous testing conducted on similar geotextile products used at the site, and experience, indicate that the 30-day strength is typically greater than the minimum specified strength value.

Since the geotextile referenced in this NCR was exposed for only two days longer the 10-day period, it is anticipated that it would retain sufficient strength to meet the minimum strength requirement in the Specifications. Therefore, it is suggested to accept-as-is.

NONCONFORMANCE REPORT FORM

4944

ORIGINATOR/ASSESSOR

1	Nonconformance Number/Revision	NCR No.: 426 Revision No. 0
2	Dates	Date Discovered: 9-30-02 Date NCR Issued: 10-1-02
3	Type of Nonconformance	[x] FINDING [ ] CONCERN
4	Project Number Project/Activity @ Fac/Loc/Bldg.	20104, Phase IV, Construction of Cells 4 and 5
5	Hazard Category	Nuclear: [ ] 1 [ ] 2 [ ] 3 Radiological: [ ] Non-Nuclear: [ ] High Hazard [ ] Moderate Hazard [ ] Low Hazard Industrial: [x] Standard Industrial Hazard [ ] Other Industrial Hazard Not Designated [ ] Desktop review, document review, etc.
6	Assessment	[x] Internal (Site) [ ] External (OEPA, DOE) [ ] Supplier/Vendor_____
7	Assessment Type	[ ] Audit [ ] Surveillance [ ] Inspection [ ] Self Assessment [x]Other Visual observation
8	Assessment Number	None
9	Responsible Program/Project Division/Vendor	[ ] WPRAP [ ] D&DP [x] S&DFP [ ] M&IS [ ] WMP [ ] ARP [ ] SH&Q [ ] SP [ ] CPM [ ] OP [ ] ADM [ ]Supplier/Vendor/Subcontractor [ ] Other
10	Responsible Department/Vendor	OSDF Construction/ Jerry Istre
11	Responsible Manager/Supervisor/Vendor (Print Name)	(For Concerns, assign to Project/Program Director Bill Zebick
12	Functional Area (NA for Vendors) (choose any that apply) (Ref. RM-0016)	[ ] CM [ ] ED [ ] RD [ ] MS [ ] QA [ ] AC [ ] PM [ ] PI [ ] FM [ ] EP [ ] EW [ ] MT [ ] OP [ ] PT [ ] SE [ ] TR [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 Improvement [ ] 4 Document/Records [x] 5 Work process [ ] 6 Design [ ] 7 Procurement [ ] 8 Inspect/Test [ ] 9 Management Assessment [ ] 10 Independent Assessment [ ] Other
14	Requirement Description 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.	Per OSDF PHASE IV-Spec, Rev 1, Section 02772: Geosynthetic Clay Liner and Cap, Part 3 Execution, 3.03 Placement, H: Install the overlying geomembrane as soon as possible following geosynthetic clay liner and cap installation. Cover all geosynthetic clay liner and cap that is placed during a workday with overlying geomembrane. Cover and protect the edges of geosynthetic clay liner and cap from hydration due to surface water run-on.
15	Nonconformance Description 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.	GCL Sample #1,2, and 3 in Cell 4, in the area of the Drainage Corridor, at the East / West tie in point, exceeded 100 percent hydration, because the GML cover was not fully seamed.
16	Tagging Required / Number of Tags	[ ] Yes [x] No Number of Tags:
17	Originator/Assessor	Name: Muriel Vigus Signature: Muriel Vigus Date: 10-1-02

MANAGER/SUPERVISOR'S REVIEW

18	Manager/Supervisor (Trained/Briefed on QA-0001)	Name: Michael W. Godber Signature: Michael W. Godber Date: 10-1-02
	Response Date From Responsible Organization	REQUESTED RESPONSE DATE: 10-29-02 (Reply within 20 working days)

000362

NONCONFORMANCE REPORT FORM

-4944

RESPONSIBLE ORGANIZATION'S CORRECTIVE ACTION RESPONSE

	Nonconformance Number/Revision	NCR No.: 426 Revision No. 0
	Root Cause Analysis Provide documentation as attachment. Use additional or separate sheets as necessary	[ ] YES [x] NO Level 1 Cat.: [ ] (human performance.) [ ] (equip.) [ ] (natural phenom/sabotage [ ] (other) [ ] Supplier/Vendor/Subcontractor (root cause per their program) List Cause:
21	**Corrective Action (CA) Description and Disposition** 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 must also include actions to prevent recurrence. Use additional or separate sheets as necessary. (A disposition of Accept-as-is or Repair REQUIRES a written Technical Concurrence/Justification below)	A) Hardware NCR: → [ ] Accept-as-is [ ] Repair [X] Rework [ ] Reject B) Non-Hardware NCR: → [ ] Other: See Attached Corrective Action Plan [ ] Yes [ ] NA ATTACHED IS A DRAWING SHOWING 4800 FT² OF MATERIAL WAS REPLACED BECAUSE IT HAD ABSORBED EXCESSIVE MOISTURE.
22	**Technical Concurrence/Justification (mark NA if not applicable)**	Name: NONE Signature: Date:
23	**Was a Design Change Notice Required?**	[ ] Yes [x] No DCN # Date Issued
24	**Was a SBDR Performed?** **Was a USQD Performed?**	[ ] Yes [x] No SBDR # Date Issued [ ] Yes [x] No USQD # Date Issued
25	**Actions taken to Prevent Recurrence** Use additional or separate sheets as necessary.	THE GML INSTALLER WILL INCREASE HIS EFFORT IN SEAMING GML AS IT IS INSTALLED. ALSO, IF RAIN CONDITIONS ARE FORCASTED WE WILL HAVE PUMPS ON HAND TO REMOVE WATER FROM THE LINER TO KEEP IT DRY.
26	**Proposed Completion Date For CA**	Date:
	Responsible Manager/Supervisor/Vendor	Name: Bill Zebick Signature: Bill Zebick Date: 10/29/02

EVALUATION OF THE CORRECTIVE ACTION RESPONSE BY THE ORIGINATOR/ASSESSOR

28	**Response Acceptable?**	[ ] Yes [ ] No
29	**Originator's/Assessor's**	Name: Muriel Vigus Signature: Muriel Vigus Date: 10-29-02

COMPLETION OF THE CORRECTIVE ACTIONS BY THE RESPONSIBLE ORGANIZATION

30	**Date Corrective Action Completed**	Date:
31	**Responsible Manager/Supervisor/Vendor**	Name: Bill Zebick Signature: Bill Zebick Date: 10/29/02

VERIFICATION OF COMPLETED CORRECTIVE ACTIONS BY THE VERIFIER

32	**Verification Action** (Describe what objective evidence was examined to verify completion of this action and attach documentation to the NCR)	QC VERIFIED ALL DEFECTIVE GCL WAS REMOVED FROM CELL 9.
33	**Verifier**	Name: Muriel Vigus Signature: Muriel Vigus Date: 10-29-02

CLOSURE BY THE VERIFIER'S MANAGER/SUPERVISOR

34	**Verifier's Manager/Supervisor (NCR Closed)**	Name: Michael W. Godber Signature: Michael W. Godber Date: 10/29/02

GEOSYNTEC CONSULTANTS

Page ___ of ___

Date: ___/___/___ (YY MM DD)

Reviewed by: ___

Date: ___/___/___ (YY MM DD)

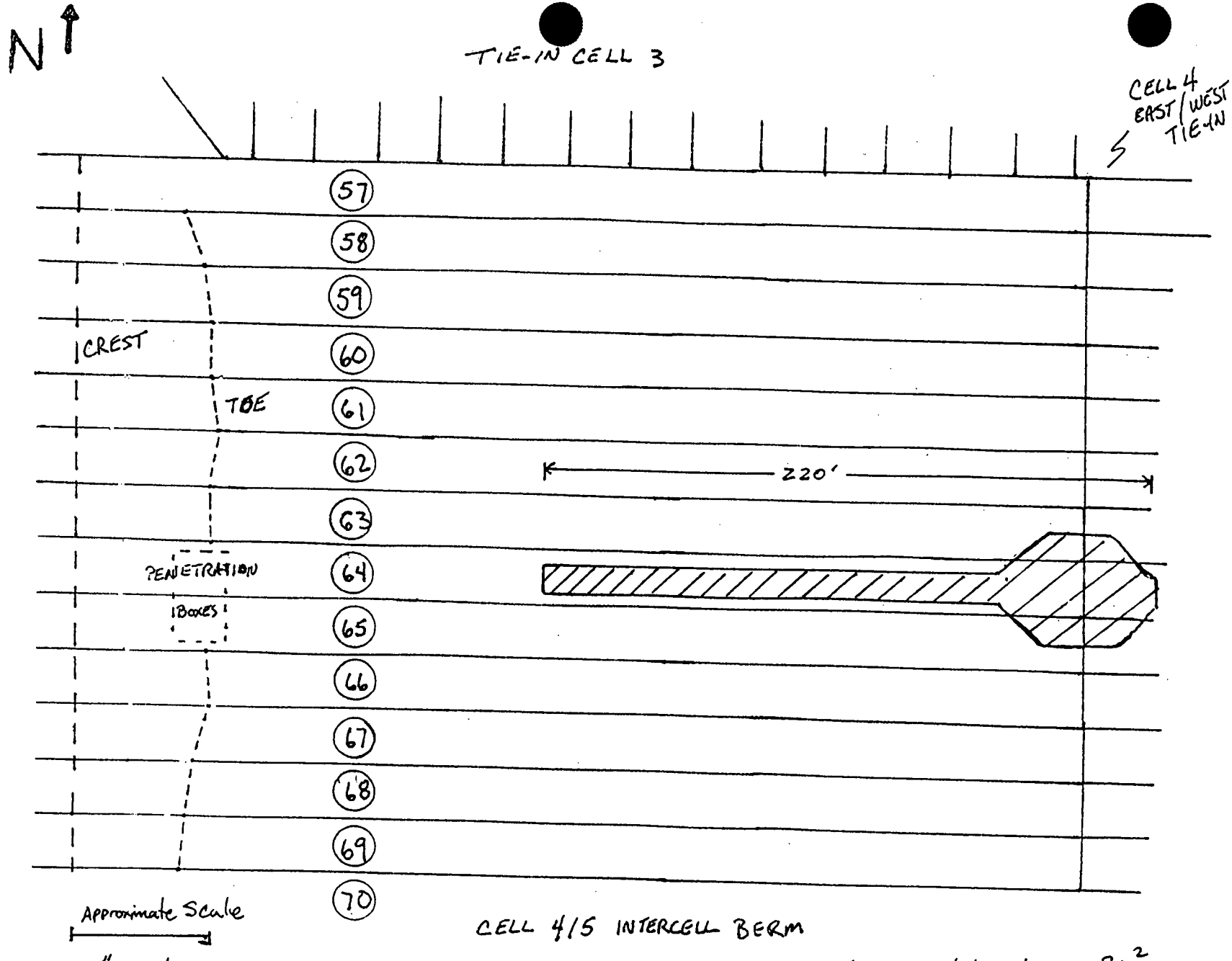
Written by: ___

Project: ___

Project/Proposal No.: ___

Task No.: ___

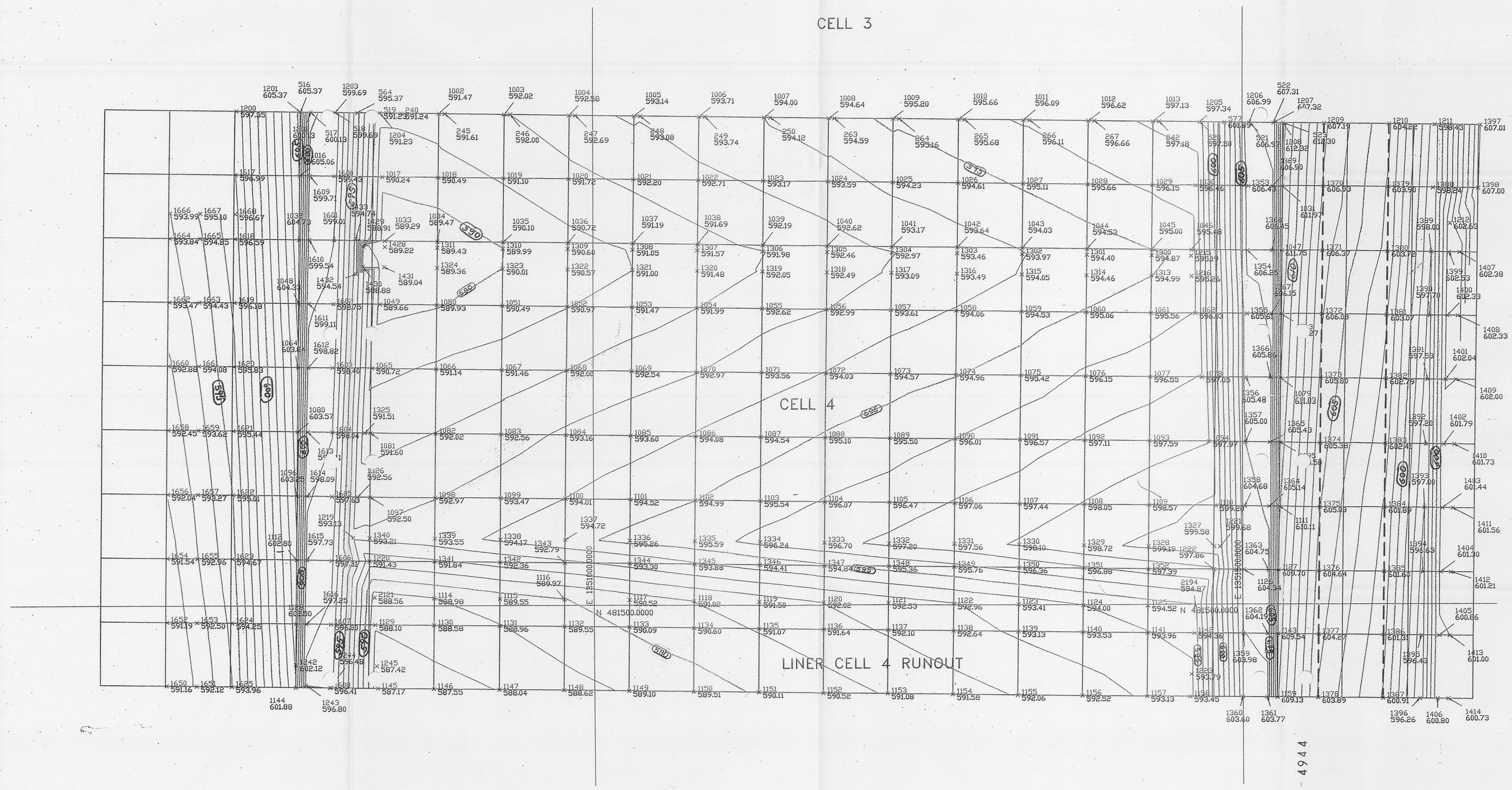
Client: ___



Approximately 4,800 ft^2 of GCL WAS REMOVED AND REPLACED

0003364

4944



× 1156 592.52 ELEVATION AND POINT NUMBER

AS-BUILT INDEX CONTOUR

AS-BUILT INTERMEDIATE CONTOUR

TOE OF SLOPES

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

000005

STATE OF OHIO
THOMAS J. MACK
9-7964
REGISTERED
PROFESSIONAL SURVEYOR

3/19/03

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
HYDROGEOLOGY & LAND SURVEYING
7075 ZIONSVILLE ROAD, P.O. BOX 130, ZIONSVILLE, IN 46077
Tel.: (317) 873-3211 Fax: (317) 873-3220
www.deestesengineering.com

Designed By:
Drawn By: NASSIM DAHER
Checked By: GREG BARKER
Approved By: TOM MACK

REVISIONS:
REVISED 03-07-03 PER FLUOR FERNALD, INC.
REVISED 03-14-03 PER FLUOR FERNALD, INC.
Contour Labels 3/31/03

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

CELL 4
AS-BUILT
SUB GRADE LAYER

Scale: 1" = 40'
Date: 02-07-2003
Sheet No. 1 OF 2
Project No. 201-225

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PNT NO.	NORTH	EAST	PROP ELEV	DESCRIPTION	AS BUILT ELEV	DIFF ELEV	DATE
240	481885.01	1350853.08	591.41	cell3s/gAB	591.24	-0.17	6/13/02
242	481877.88	1351436.59	597.22	cell3s/gAB	597.18	-0.04	6/5/02
245	481884.60	1350888.63	591.76	cell3s/gAB	591.61	-0.15	6/5/02
246	481883.99	1350936.63	592.23	cell3s/gAB	592.00	-0.23	6/5/02
247	481883.38	1350986.63	592.74	cell3s/gAB	592.69	-0.05	6/5/02
248	481882.77	1351036.62	593.12	cell3s/gAB	593.08	-0.04	6/5/02
249	481882.16	1351086.62	593.76	cell3s/gAB	593.74	-0.02	6/5/02
250	481881.55	1351136.61	594.16	cell3s/gAB	594.12	-0.04	6/5/02
263	481880.94	1351186.61	594.66	cell3s/gAB	594.59	-0.07	6/5/02
264	481880.33	1351236.61	595.19	cell3s/gAB	595.16	-0.03	6/5/02
265	481879.71	1351286.60	595.71	cell3s/gAB	595.68	-0.03	6/5/02
266	481879.10	1351336.60	596.16	cell3s/gAB	596.11	-0.05	6/5/02
267	481878.49	1351386.60	596.68	cell3s/gAB	596.66	-0.02	6/5/02
516	481885.96	1350775.27	605.46	cell3s/gAB	605.37	-0.09	7/24/02
517	481885.87	1350783.06	600.27	cell3s/gAB	600.13	-0.14	7/24/02
518	481885.64	1350801.78	599.85	cell3s/gAB	599.69	-0.16	7/24/02
519	481885.21	1350836.64	591.27	cell3s/gAB	591.23	-0.04	7/10/02
520	481877.50	1351467.65	597.50	cell3s/gAB	597.50	0.00	6/5/02
521	481877.04	1351505.38	606.97	cell3s/gAB	606.97	0.00	6/12/02
522	481876.81	1351524.09	607.39	cell3s/gAB	607.31	-0.08	6/12/02
523	481876.72	1351531.88	612.47	cell3s/gAB	612.30	-0.17	6/12/02
564	481885.42	1350819.21	595.63	cell3s/gAB	595.37	-0.26	7/24/02
577	481877.27	1351486.52	602.16	cell3s/gAB	601.89	-0.27	6/5/02
1002	481884.66	1350881.93	591.73	Grid Pt.	591.47	-0.26	6/5/02
1003	481884.04	1350931.93	592.23	Grid Pt.	592.02	-0.21	6/5/02
1004	481883.43	1350981.93	592.73	Grid Pt.	592.58	-0.15	6/2/02
1005	481882.82	1351031.92	593.23	Grid Pt.	593.14	-0.09	6/2/02
1006	481882.21	1351081.92	593.73	Grid Pt.	593.71	-0.02	6/5/02
1007	481881.60	1351131.91	594.23	Grid Pt.	594.00	-0.23	6/2/02
1008	481880.99	1351181.91	594.73	Grid Pt.	594.64	-0.09	6/5/02
1009	481880.38	1351231.91	595.23	Grid Pt.	595.20	-0.03	6/5/02
1010	481879.77	1351281.90	595.73	Grid Pt.	595.66	-0.07	6/2/02
1011	481879.15	1351331.90	596.23	Grid Pt.	596.09	-0.14	6/5/02
1012	481878.54	1351381.90	596.73	Grid Pt.	596.62	-0.11	6/5/02
1013	481877.93	1351431.89	597.23	Grid Pt.	597.13	-0.10	6/5/02
1016	481835.96	1350774.66	605.18	S/G CELL4TO Pbl	605.06	-0.12	7/24/02
1017	481835.18	1350838.43	590.29	S/G CELL4TO E	590.24	-0.05	6/29/02
1018	481834.66	1350881.32	590.73	Grid Pt.	590.49	-0.24	6/13/02
1019	481834.05	1350931.32	591.23	Grid Pt.	591.10	-0.13	6/13/02
1029	481827.94	1351431.28	596.23	Grid Pt.	596.15	-0.08	6/4/02
1030	481827.54	1351464.44	596.56	S/G CELL4TO E	596.46	-0.10	6/4/02
1031	481826.72	1351531.27	612.21	S/G CELL4TO P/SL	611.97	-0.24	6/4/02
1032	481785.97	1350774.05	604.81	S/G CELL4TO Pbl	604.73	-0.08	7/24/02
1033	481785.17	1350840.23	589.32	S/G CELL4TO E	589.29	-0.03	6/29/02
1034	481784.66	1350880.71	589.73	Grid Pt.	589.47	-0.26	6/13/02
1035	481784.05	1350930.71	590.23	Grid Pt.	590.10	-0.13	6/13/02
1036	481783.44	1350980.71	590.73	Grid Pt.	590.72	-0.01	6/13/02
1037	481782.83	1351030.70	591.23	Grid Pt.	591.19	-0.04	6/13/02
1038	481782.22	1351080.70	591.73	Grid Pt.	591.69	-0.04	6/5/02
1039	481781.61	1351130.69	592.23	Grid Pt.	592.19	-0.04	6/5/02
1040	481781.00	1351180.69	592.73	Grid Pt.	592.62	-0.11	6/5/02
1041	481780.38	1351230.69	593.23	Grid Pt.	593.17	-0.06	6/5/02
1042	481779.77	1351280.68	593.73	Grid Pt.	593.64	-0.09	6/5/02
1043	481779.16	1351330.68	594.23	Grid Pt.	594.03	-0.20	6/5/02
1044	481778.55	1351380.68	594.73	Grid Pt.	594.53	-0.20	6/5/02
1045	481777.94	1351430.67	595.23	Grid Pt.	595.00	-0.23	6/5/02
1046	481777.57	1351461.22	595.53	S/G CELL4TO E	595.48	-0.05	6/4/02
1047	481776.73	1351530.66	611.83	S/G CELL4TO P/SL	611.75	-0.08	6/10/02
1048	481735.97	1350773.43	604.43	S/G CELL4TO Pbl	604.33	-0.10	7/24/02
1049	481735.20	1350836.30	589.77	S/G CELL4TO E	589.66	-0.11	6/29/02
1050	481734.67	1350880.10	590.20	GRID PNT	589.93	-0.27	6/13/02
1051	481734.06	1350930.09	590.70	Grid Pt.	590.49	-0.21	6/3/02
1052	481733.44	1350980.09	591.20	GRID PNT	590.97	-0.23	6/3/02
1053	481732.83	1351030.09	591.70	GRID PNT	591.47	-0.23	6/3/02
1054	481732.22	1351080.08	592.20	GRID PNT	591.99	-0.21	6/3/02
1055	481731.61	1351130.08	592.70	GRID PNT	592.62	-0.08	6/3/02
1056	481731.00	1351180.07	593.20	GRID PNT	592.99	-0.21	6/3/02
1057	481730.39	1351230.07	593.70	GRID PNT	593.61	-0.09	6/3/02
1058	481729.78	1351280.07	594.20	GRID PNT	594.06	-0.14	6/3/02
1059	481729.17	1351330.06	594.70	GRID PNT	594.53	-0.17	6/3/02
1060	481728.56	1351380.06	595.20	GRID PNT	595.06	-0.14	6/3/02
1061	481727.95	1351430.06	595.70	GRID PNT	595.56	-0.14	6/3/02
1062	481727.53	1351464.19	596.05	S/G CELL4TO E	596.03	-0.02	6/3/02
1063	481726.73	1351530.05	611.46	S/G CELL4TO P/SL	611.27	-0.19	6/10/02
1064	481685.97	1350772.82	604.06	S/G CELL4TO Pbl	603.84	-0.22	7/24/02
1065	481685.27	1350830.40	590.72	S/G CELL4TO E	590.72	0.00	6/3/02
1066	481684.67	1350879.49	591.20	GRID PNT	591.14	-0.06	6/3/02
1067	481684.06	1350929.48	591.70	GRID PNT	591.46	-0.24	6/3/02
1068	481683.45	1350979.48	592.20	GRID PNT	592.00	-0.20	6/3/02
1069	481682.84	1351029.48	592.70	GRID PNT	592.54	-0.16	6/3/02

PNT NO.	NORTH	EAST	PROP ELEV	DESCRIPTION	AS BUILT ELEV	DIFF ELEV	DATE
1070	481682.23	1351079.47	593.20	GRID PNT	592.97	-0.23	6/3/02
1071	481681.62	1351129.47	593.70	GRID PNT	593.56	-0.14	6/3/02
1072	481681.01	1351179.46	594.20	GRID PNT	594.03	-0.17	6/3/02
1073	481680.39	1351229.46	594.70	GRID PNT	594.57	-0.13	6/3/02
1074	481679.78	1351279.46	595.20	GRID PNT	594.96	-0.24	6/3/02
1075	481679.17	1351329.45	595.70	GRID PNT	595.42	-0.28	6/3/02
1076	481678.56	1351379.45	596.20	GRID PNT	596.15	-0.05	6/3/02
1077	481677.95	1351429.45	596.70	GRID PNT	596.55	-0.15	6/3/02
1078	481677.46	1351469.31	597.10	S/G CELL4TO E	597.05	-0.05	6/3/02
1079	481676.73	1351529.44	611.08	S/G CELL4TO P/SL	611.03	-0.05	6/10/02
1080	481635.98	1350772.21	603.68	S/G CELL4TO Pbl	603.57	-0.11	7/24/02
1081	481635.29	1350828.88	591.70	GRID PNT	591.60	-0.10	7/10/02
1082	481634.67	1350878.88	592.20	GRID PNT	592.02	-0.18	6/3/02
1083	481634.06	1350928.87	592.70	GRID PNT	592.56	-0.14	6/3/02
1084	481633.45	1350978.87	593.20	GRID PNT	593.16	-0.04	6/3/02
1085	481632.84	1351028.87	593.70	GRID PNT	593.60	-0.10	6/3/02
1086	481632.23	1351078.86	594.20	GRID PNT	594.08	-0.12	6/3/02
1087	481631.62	1351128.86	594.70	GRID PNT	594.54	-0.16	6/3/02
1088	481631.01	1351178.85	595.20	GRID PNT	595.10	-0.10	6/3/02
1089	481630.40	1351228.85	595.70	GRID PNT	595.50	-0.20	6/3/02
1090	481629.79	1351278.85	596.20	GRID PNT	596.01	-0.19	6/3/02
1091	481629.18	1351328.84	596.70	GRID PNT	596.57	-0.13	6/3/02
1092	481628.57	1351378.84	597.20	GRID PNT	597.11	-0.09	6/3/02
1093	481627.96	1351428.84	597.70	GRID PNT	597.59	-0.11	6/3/02
1094	481627.40	1351474.43	598.16	S/G CELL4TO E	597.97	-0.19	6/3/02
1095	481626.74	1351528.83	610.71	S/G CELL4TO P/SL	610.58	-0.13	6/10/02
1096	481585.98	1350771.60	603.31	S/G CELL4TO Pbl	603.25	-0.06	7/24/02
1097	481585.29	1350828.27	592.70	GRID PNT	592.50	-0.20	6/29/02
1098	481584.68	1350878.27	593.20	GRID PNT	592.97	-0.23	6/3/02
1099	481584.07	1350928.26	593.70	GRID PNT	593.47	-0.23	6/3/02
1100	481583.46	1350978.26	594.20	GRID PNT	594.01	-0.19	6/3/02
1101	481582.85	1351028.26	594.70	GRID PNT	594.52	-0.18	6/3/02
1102	481582.23	1351078.25	595.20	GRID PNT	594.99	-0.21	6/3/02
1103	481581.62	1351128.25	595.70	GRID PNT	595.54	-0.16	6/3/02
1104	481581.01	1351178.24	596.20	GRID PNT	596.07	-0.13	6/3/02
1105	481580.40	1351228.24	596.70	GRID PNT	596.47	-0.23	6/3/02
1106	481579.79	1351278.24	597.20	GRID PNT	597.06	-0.14	6/3/02
1107	481579.18	1351328.23	597.70	GRID PNT	597.44	-0.26	6/3/02
1108	481578.57	1351378.23	598.20	GRID PNT	598.05	-0.15	6/3/02
1109	481577.96	1351428.23	598.70	GRID PNT	598.57	-0.13	6/3/02
1110	481577.33	1351479.55	599.22	S/G CELL4TO E	599.20	-0.02	6/3/02
1111	481576.74	1351528.22	610.33	S/G CELL4TO P/SL	610.11	-0.22	6/10/02
1112	481535.99	1350770.99	602.93	S/G CELL4TO Pbl	602.80	-0.13	7/24/02
1114	481505.84	1350877.32	589.15	Toe 10%	588.98	-0.17	6/26/02
1115	481505.23	1350927.30	589.65	Toe 10%	589.55	-0.10	6/26/02
1116	481504.62	1350977.30	590.15	Toe 10%	589.97	-0.18	6/26/02
1117	481504.01	1351027.30	590.65	Toe 10%	590.52	-0.13	6/26/02
1118	481503.39	1351077.29	591.15	Toe 10%	591.02	-0.13	6/26/02
1119	481502.78	1351127.29	591.65	Toe 10%	591.50	-0.15	6/24/02
1120	481502.17	1351177.28	592.15	Toe 10%	592.02	-0.13	6/24/02
1121	481501.56	1351227.28	592.65	Toe 10%	592.53	-0.12	6/24/02
1122	481500.95	1351277.28	593.15	Toe 10%	592.96	-0.19	6/24/02
1123	481500.34	1351327.27	593.65	Toe 10%	593.41	-0.24	6/24/02
1124	481499.73	1351377.27	594.15	Toe 10%	594.00	-0.15	6/24/02
1125	481499.12	1351427.27	594.65	Toe 10%	594.52	-0.13	6/28/02
1126	481527.07	1351501.10	604.38	S/G CELL4TO P/SL	604.34	-0.04	6/10/02
1127	481526.75	1351527.61	609.96	S/G CELL4TO P/SL	609.70	-0.26	6/10/02
1128	481485.99	1350770.38	602.56	S/G CELL4TO Pbl	602.50	-0.06	7/24/02
1129	481485.24	1350831.75	588.27	S/G CELL4TO E/SL	588.10	-0.17	7/10/02
1130	481484.69	1350877.05	588.73	GRID PNT	588.58	-0.15	6/26/02
1131	481484.08	1350927.04	589.23	GRID PNT	588.96	-0.27	6/26/02
1132	481483.47	1350977.04	589.73	GRID PNT	589.55	-0.18	6/26/02
1133	481482.86	1351027.03	590.23	GRID PNT	590.09	-0.14	6/26/02
1134	481482.24	1351077.03	590.73	GRID PNT	590.60	-0.13	6/24/02
1135	481481.63	1351127.03	591.23	GRID PNT	591.07	-0.16	6/26/02
1136	481481.02	1351177.02	591.73	GRID PNT	591.64	-0.09	6/26/02
1137	481480.41	1351227.02	592.23	GRID PNT	592.10	-0.13	6/24/02
1138	481479.80	1351277.02	592.73	GRID PNT	592.64	-0.09	6/24/02
1139	481479.19	1351327.01	593.23	GRID PNT	593.13	-0.10	6/24/02
1140	481478.58	1351377.01	593.73	GRID PNT	593.53	-0.20	6/24/02
1141	481477.97	1351427.00	594.23	GRID PNT	593.96	-0.27	6/28/02
1142	481477.53	1351462.76	594.58	S/G CELL4TO E/SL	594.36	-0.22	6/28/02
1143	481476.75	1351527.00	609.58	S/G CELL4TO P/SL	609.54	-0.04	6/10/02
1144	481435.99	1350769.76	602.18	S/G CELL4TO P1.5	601.88	-0.30	7/24/02
1145	481435.22	1350833.54	587.30	S/G CELL4TO E4/1	587.17	-0.13	7/10/02
1146	481434.69	1350876.43	587.73	GRID PNT	587.55	-0.18	6/28/02
1147	481434.08	1350926.43	588.23	GRID PNT	588.04	-0.19	6/26/02
1148	481433.47	1350976.43	588.73	GRID PNT	588.62	-0.11	6/26/02
1149	481432.86	1351026.42	589.23	GRID PNT	589.10	-0.13	6/24/02
1150	481432.25	1351076.42	589.73	GRID PNT	589.51	-0.22	6/24/02
1151	481431.64	1351126.42	590.23	GRID PNT	590.11	-0.12	6/24/02
1152	481431.03	1351176.41	590.73	GRID PNT	590.52	-0.21	6/26/02
1153	481430.42	1351226.41	591.23	GRID PNT	591.08	-0.15	6/24/02
1154	481429.80	1351276.40	591.73	GRID PNT	591.58	-0.15	6/24/02
1155	481429.19	1351326.40	592.23	GRID PNT	592.06	-0.17	6/24/02
1156	481428.58	1351376.40	592.73	GRID PNT	592.52	-0.21	6/24/02
1157	481427.97	1351426.39	593.23	GRID PNT	593.13	-0.10	6/28/02
1158	481427.57	1351459.55	593.56	S/G CELL4TO E4/1	593.45	-0.11	6/28/02
1159	481426.75	1351526.39	609.21	S/G CELL4TO P/SL	609.13	-0.08	6/10/02

PNT NO.	NORTH	EAST	PROP ELEV	DESCRIPTION	AS BUILT ELEV	DIFF ELEV	DATE
1658	481637.19	1350673.20	592.52	CELL4S/G 6% EMAT	592.45	-0.07	7/30/02
1659	481636.91	1350696.42	593.91	CELL4S/G 6%	593.62	-0.29	7/30/02
1660	481687.19	1350673.81	592.89	CELL4S/G 6% EMAT	592.88	-0.01	8/2/02
1661	481686.90	1350697.03	594.28	CELL4S/G 6%	594.08	-0.20	8/2/02
1662	481737.18	1350674.42	593.27	CELL4S/G 6% EMAT	593.47	0.20	8/3/02
1663	481736.90	1350697.64	594.66	CELL4S/G 6%	594.43	-0.23	7/30/02
1664	481787.18	1350675.03	593.64	CELL4S/G 6% EMAT	593.84	0.20	8/3/02
1665	481786.90	1350698.25	595.03	CELL4S/G 6%	594.85	-0.18	8/2/02

4944

NOTE:
NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/- 0.01' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

000006

CELL 4
AS-BUILT
SUB GRADE LAYER

Scale: NA
Date: 02-07-2003
Sheet No. 2 OF 2
Project No. 201-225

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

REVISIONS:
REVISED 03-07-03 PER FLUOR FERNALD, INC.
REVISED 03-14-03 PER FLUOR FERNALD, INC.

Designed By:
Drawn By: NASSIM DAHER
Checked By: GREG BARKER
Approved By: TOM MACK

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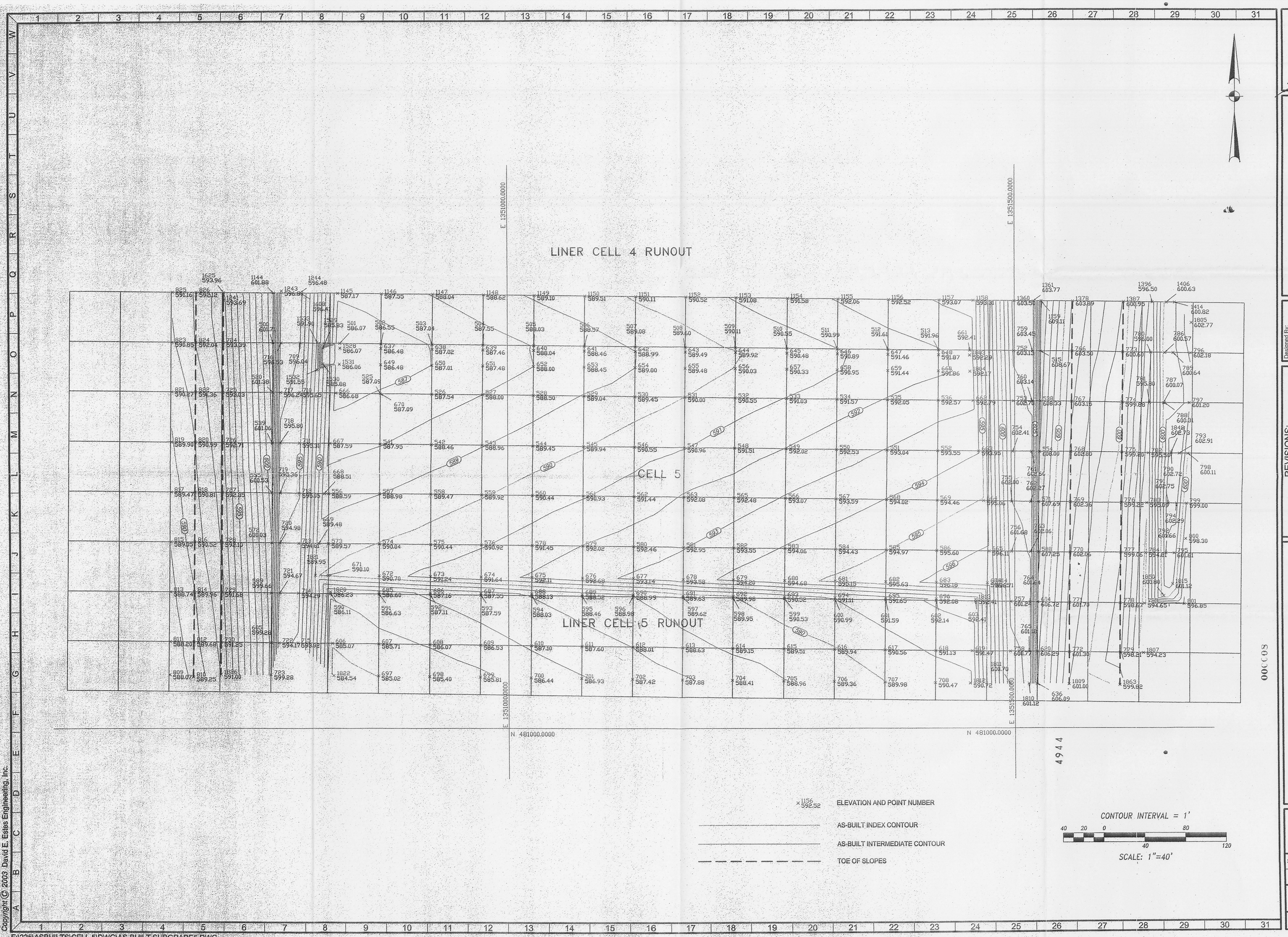
3/18/03

STATE OF OHIO
THOMAS J. MACK
S-7964
REGISTERED
PROFESSIONAL SURVEYOR



STATE OF OHIO
THOMAS J. MACK
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3/18/03

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Checked By: GREG BARBER
Approved By: TOM MACK

REVISIONS:
REVISED 03-07-03 PER FLUOR FERNALD, INC.
REVISED 03-17-03 PER FLUOR FERNALD, INC.

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5
AS-BUILT
SUB GRADE LAYER

Scale: 1" = 40'
Date: 02-07-2003
Sheet No. 1 OF 2
Project No. 201-225

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F:\225\ASBUILTS\CELL 5\DWG\AS-BUILT SUBGRADE5.DWG

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PNT NO.	NORTH	EAST	PROP ELEV	DESCRIPTION	ASBUILT ELEV	DIFF ELEV	DATE
500	481386.00	1350769.15	601.81	CELL5 TOP1.5:1 B	601.71	-0.10	7/24/02
501	481385.19	1350835.33	586.33	CELL5 TOE4:1	586.07	-0.26	6/29/02
502	481384.69	1350875.82	586.73	Grid Pt.	586.55	-0.18	6/26/02
503	481384.08	1350925.82	587.23	Grid Pt.	587.04	-0.19	6/26/02
504	481383.47	1350975.81	587.73	Grid Pt.	587.55	-0.18	6/26/02
505	481382.86	1351025.81	588.23	Grid Pt.	588.03	-0.20	6/26/02
506	481382.25	1351075.81	588.73	Grid Pt.	588.57	-0.16	6/26/02
507	481381.64	1351125.80	589.23	Grid Pt.	589.08	-0.15	6/28/02
508	481381.03	1351175.80	589.73	Grid Pt.	589.60	-0.13	6/28/02
509	481380.42	1351225.79	590.23	Grid Pt.	590.11	-0.12	6/28/02
510	481379.80	1351275.79	590.73	Grid Pt.	590.55	-0.18	6/28/02
511	481379.19	1351325.79	591.23	Grid Pt.	590.99	-0.24	6/28/02
512	481378.58	1351375.78	591.73	Grid Pt.	591.61	-0.12	6/28/02
513	481377.97	1351425.78	592.23	Grid Pt.	591.96	-0.27	6/28/02
515	481376.76	1351525.78	608.84	CELL5TOP6:1	608.67	-0.17	7/17/02
520	481336.00	1350768.54	601.44	CELL5 TOP1.5:1B	601.38	-0.06	7/25/02
525	481334.70	1350875.21	587.21	Grid Pt.	587.09	-0.12	6/24/02
526	481334.09	1350925.21	587.71	Grid Pt.	587.54	-0.17	6/21/02
527	481333.48	1350975.20	588.21	Grid Pt.	588.00	-0.21	6/21/02
528	481332.87	1351025.20	588.71	Grid Pt.	588.50	-0.21	6/21/02
529	481332.25	1351075.19	589.21	Grid Pt.	589.04	-0.17	6/21/02
530	481331.64	1351125.19	589.71	Grid Pt.	589.45	-0.26	6/21/02
531	481331.03	1351175.19	590.21	Grid Pt.	590.00	-0.21	6/19/02
532	481330.42	1351225.18	590.71	Grid Pt.	590.55	-0.16	6/19/02
533	481329.81	1351275.18	591.21	Grid Pt.	591.03	-0.18	6/18/02
534	481329.20	1351325.18	591.71	Grid Pt.	591.57	-0.14	6/18/02
535	481328.59	1351375.17	592.21	Grid Pt.	592.05	-0.16	6/18/02
536	481327.98	1351425.17	592.71	Grid Pt.	592.57	-0.14	6/28/02
538	481326.76	1351525.17	608.46	CELL5TOP6:1	608.33	-0.13	7/17/02
539	481286.00	1350767.93	601.06	CELL5 TOP1.5:1B	601.06	0.00	7/25/02
541	481284.70	1350874.60	588.21	Grid pt.	587.95	-0.26	6/28/02
542	481284.09	1350924.60	588.71	Grid pt.	588.46	-0.25	6/24/02
543	481283.48	1350974.59	589.21	Grid pt.	588.96	-0.25	6/21/02
544	481282.87	1351024.59	589.71	Grid pt.	589.45	-0.26	6/21/02
545	481282.26	1351074.59	590.21	Grid pt.	589.94	-0.27	6/20/02
546	481281.65	1351124.58	590.71	Grid pt.	590.55	-0.16	6/20/02
547	481281.04	1351174.58	591.21	Grid pt.	590.96	-0.25	6/20/02
548	481280.43	1351224.57	591.71	Grid pt.	591.51	-0.20	6/19/02
549	481279.82	1351274.57	592.21	Grid pt.	592.02	-0.19	6/18/02
550	481279.20	1351324.57	592.71	Grid pt.	592.53	-0.18	6/18/02
551	481278.59	1351374.56	593.21	Grid pt.	593.04	-0.17	6/18/02
552	481277.98	1351424.56	593.71	Grid pt.	593.55	-0.16	6/28/02
554	481276.76	1351524.55	608.09	CELL5TOP6:1	608.00	-0.09	7/17/02
555	481236.01	1350767.32	600.69	CELL5 TOP1.5:1B	600.53	-0.16	7/25/02
556	481235.32	1350823.99	588.71	Grid pt.	588.59	-0.12	6/28/02
557	481234.71	1350873.99	589.21	Grid pt.	588.98	-0.23	6/24/02
558	481234.10	1350923.99	589.71	Grid pt.	589.47	-0.24	6/24/02
559	481233.49	1350973.98	590.21	Grid pt.	589.92	-0.29	6/21/02
560	481232.87	1351023.98	590.71	Grid pt.	590.44	-0.27	6/20/02
561	481232.26	1351073.98	591.21	Grid pt.	590.93	-0.28	6/20/02
562	481231.65	1351123.97	591.71	Grid pt.	591.44	-0.27	6/20/02
563	481231.04	1351173.97	592.21	Grid pt.	592.08	-0.13	6/20/02
565	481230.43	1351223.96	592.71	Grid pt.	592.48	-0.23	6/19/02
566	481229.82	1351273.96	593.21	Grid pt.	593.07	-0.14	6/18/02
567	481229.21	1351323.96	593.71	Grid pt.	593.59	-0.12	6/18/02
568	481228.60	1351373.95	594.21	Grid pt.	594.02	-0.19	6/18/02
569	481227.99	1351423.95	594.71	Grid pt.	594.46	-0.25	6/28/02
571	481226.77	1351523.94	607.71	CELL5TOP6:1	607.69	-0.02	7/17/02
572	481186.01	1350766.71	600.31	CELL5 TOP1.5:1B	600.03	-0.28	7/25/02
573	481185.32	1350823.38	589.71	Grid pt.	589.57	-0.14	6/28/02
574	481184.71	1350873.38	590.21	Grid pt.	590.04	-0.17	6/27/02
575	481184.10	1350923.38	590.71	Grid pt.	590.44	-0.27	6/24/02
576	481183.49	1350973.37	591.21	Grid pt.	590.92	-0.29	6/21/02
578	481182.88	1351023.37	591.71	Grid pt.	591.45	-0.26	6/20/02
579	481182.27	1351073.36	592.21	Grid pt.	592.02	-0.19	6/24/02
580	481181.66	1351123.36	592.71	Grid pt.	592.46	-0.25	6/20/02
581	481181.05	1351173.36	593.21	Grid pt.	592.95	-0.26	6/20/02
582	481180.43	1351223.35	593.71	Grid pt.	593.55	-0.16	6/19/02
583	481179.82	1351273.35	594.21	Grid pt.	594.06	-0.15	6/19/02
584	481179.21	1351323.35	594.71	Grid pt.	594.43	-0.28	6/18/02
585	481178.60	1351373.34	595.21	Grid pt.	594.97	-0.24	6/18/02
586	481177.99	1351423.34	595.71	Grid pt.	595.60	-0.11	6/28/02
588	481176.77	1351523.33	607.34	CELL5TOP6:1	607.25	-0.09	7/12/02
589	481136.02	1350766.09	599.94	CELL5 TOP1.5:1B	599.66	-0.28	7/25/02
590	481135.29	1350825.07	586.25	CELL5 TOE4:1	586.11	-0.14	8/16/02
591	481134.71	1350872.77	586.73	GRID PT	586.63	-0.10	8/16/02
592	481134.10	1350922.77	587.23	GRID PT	587.11	-0.12	7/10/02
593	481133.49	1350972.76	587.73	GRID PT	587.59	-0.14	7/10/02
594	481132.88	1351022.76	588.23	GRID PT	588.03	-0.20	7/10/02
595	481132.27	1351072.76	588.73	GRID PT	588.46	-0.27	7/10/02
596	481131.66	1351122.75	589.23	GRID PT	588.98	-0.25	7/10/02
597	481131.04	1351172.75	589.73	GRID PT	589.62	-0.11	7/10/02
598	481130.43	1351222.74	590.23	GRID PT	589.95	-0.28	7/10/02
599	481129.82	1351272.74	590.73	GRID PT	590.53	-0.20	7/10/02
600	481129.21	1351322.74	591.23	GRID PT	590.99	-0.24	7/10/02
601	481128.60	1351372.73	591.73	GRID PT	591.59	-0.14	6/27/02
602	481127.99	1351422.73	592.23	GRID PT	592.14	-0.09	7/10/02
603	481127.52	1351461.40	592.62	CELL5 TOE4:1	592.41	-0.21	7/10/02
604	481126.78	1351522.72	606.96	CELL5TOP6:1	606.72	-0.24	7/17/02

PNT NO.	NORTH	EAST	PROP ELEV	DESCRIPTION	ASBUILT ELEV	DIFF ELEV	DATE
605	481086.02	1350765.48	599.56	CELL5 TOP1.5:1B	599.28	-0.28	7/25/02
606	481085.27	1350826.86	585.27	CELL5 TOE4:1	585.07	-0.20	8/16/02
607	481084.72	1350872.16	585.72	GRID PT	585.71	-0.01	8/16/02
608	481084.11	1350922.15	586.22	GRID PT	586.07	-0.15	6/10/02
609	481083.50	1350972.15	586.72	GRID PT	586.53	-0.19	6/10/02
610	481082.89	1351022.15	587.22	GRID PT	587.10	-0.12	6/10/02
611	481082.28	1351072.14	587.72	GRID PT	587.60	-0.12	6/10/02
612	481081.67	1351122.14	588.22	GRID PT	588.01	-0.21	6/10/02
613	481081.05	1351172.14	588.72	GRID PT	588.63	-0.09	6/10/02
614	481080.44	1351222.13	589.22	GRID PT	589.15	-0.07	6/10/02
615	481079.83	1351272.13	589.72	GRID PT	589.51	-0.21	7/10/02
616	481079.22	1351322.12	590.22	GRID PT	589.94	-0.28	7/10/02
617	481078.61	1351372.12	590.72	GRID PT	590.56	-0.16	6/27/02
618	481078.00	1351422.12	591.22	GRID PT	591.13	-0.09	7/10/02
619	481077.56	1351457.87	591.58	GRID PT	591.47	-0.11	7/10/02
620	481076.78	1351522.11	606.59	CELL5TOP6:1	606.29	-0.30	7/17/02
636	481044.43	1351521.72	606.34	CELL5TOP6:1	606.09	-0.25	7/17/02
637	481379.83	1350875.76	586.62	TOE2%	586.48	-0.14	6/28/02
638	481379.22	1350925.75	587.12	TOE2%	587.02	-0.10	6/28/02
639	481378.60	1350975.75	587.62	TOE2%	587.46	-0.16	6/28/02
640	481377.99	1351025.75	588.12	TOE2%	588.04	-0.08	6/28/02
641	481377.38	1351075.74	588.62	TOE2%	588.46	-0.16	6/28/02
642	481376.77	1351125.74	589.12	TOE2%	588.99	-0.13	6/28/02
643	481376.16	1351175.73	589.62	TOE2%	589.49	-0.13	6/28/02
644	481375.55	1351225.73	590.12	TOE2%	589.92	-0.20	6/28/02
645	481374.94	1351275.73	590.62	TOE2%	590.48	-0.14	6/28/02
646	481374.32	1351325.72	591.12	TOE2%	590.89	-0.23	6/28/02
647	481373.71	1351375.72	591.62	TOE2%	591.46	-0.16	6/28/02
648	481373.10	1351425.72	592.12	TOE2%	591.87	-0.25	6/28/02
649	481363.82	1350875.57	586.63	TOE2%	586.48	-0.15	6/28/02
650	481363.21	1350925.56	587.13	TOE2%	587.01	-0.12	6/28/02
651	481362.60	1350975.56	587.63	TOE2%	587.48	-0.15	6/28/02
652	481361.99	1351025.56	588.13	TOE2%	588.00	-0.13	6/28/02
653	481361.38	1351075.55	588.63	TOE2%	588.45	-0.18	6/28/02
654	481360.77	1351125.55	589.13	TOE2%	589.00	-0.13	6/28/02
655	481360.16	1351175.54	589.63	TOE2%	589.48	-0.15	6/28/02
656	481359.55	1351225.54	590.13	TOE2%	590.03	-0.10	6/28/02
657	481358.94	1351275.54	590.63	TOE2%	590.33	-0.30	6/28/02
658	481358.33	1351325.53	591.13	TOE2%	590.95	-0.18	6/18/02
659	481357.72	1351375.53	591.63	TOE2%	591.44	-0.19	6/18/02
660	481357.11	1351425.53	592.13	TOE2%	591.86	-0.27	6/28/02
661	481377.60	1351456.33	592.54	CELL5 TOE4:1	592.41	-0.13	6/28/02
662	481327.56	1351459.30	593.05	CELL5 TOE4:1	592.79	-0.26	6/28/02
663	481277.49	1351464.42	594.10	CELL5 TOE4:1	593.95	-0.15	6/28/02
664	481227.43	1351469.54	595.16	CELL5 TOE4:1	595.06	-0.10	6/28/02
665	481177.36	1351474.66	596.22	CELL5 TOE4:1	596.11	-0.11	6/28/02
666	481335.23	1350831.41	586.77	CELL5 TOE4:1	586.68	-0.09	6/28/02
667	481285.30	1350825.51	587.72	CELL5 TOE4:1	587.59	-0.13	6/28/02
668	481235.38	1350819.61	588.66	CELL5 TOE4:1	588.51	-0.15	6/28/02
669	481185.43	1350813.71	589.61	CELL5 TOE4:1	589.48	-0.13	6/28/02
670	481334.70	1350875.21	587.21	Duplicate Pt # 525	587.09	-0.12	6/24/02
671	481153.35	1350822.99	590.35	CELL5 TOP4:1	590.10	-0.25	6/28/02
672	481152.74	1350872.99	590.85	CELL5 TOP4:1	590.70	-0.15	6/28/02
673	481152.13	1350922.98	591.35	CELL5 TOP4:1	591.24	-0.11	6/28/02
674	481151.52	1350972.98	591.85	CELL5 TOP4:1	591.64	-0.21	6/28/02
675	481150.91	1351022.97	592.35	CELL5 TOP4:1	592.11	-0.24	6/20/02
676	481150.30	1351072.97	592.85	CELL5 TOP4:1	592.68	-0.17	6/20/02
877	481149.69	1351122.97	593.35	CELL5 TOP4:1	593.14	-0.21	6/20/02
678	481149.08	1351172.96	593.85	CELL5 TOP4:1	593.58	-0.27	6/20/02
679	481148.46	1351222.96	594.35	CELL5 TOP4:1	594.20	-0.15	6/19/02
680	481147.85	1351272.96	594.85	CELL5 TOP4:1	594.68	-0.17	6/19/02
681	481147.24	1351322.95	595.35	CELL5 TOP4:1	595.15	-0.20	6/19/02
682	481146.63	1351372.95	595.85	CELL5 TOP4:1	595.63	-0.22	6/19/02
683	481146.02	1351422.94	596.35	CELL5 TOP4:1	596.18	-0.17	6/28/02
684	481145.41	1351472.94	596.85	CELL5 TOP4:1	596.65	-0.20	6/28/02
685	481136.38	1350872.79	586.76	CELL5 TOE4:1	586.60	-0.16	8/16/02
686	481135.76	1350922.78	587.26	CELL5 TOE4:1	587.16	-0.10	7/10/02
687	481135.15	1350972.78	587.76	CELL5 TOE4:1	587.55	-0.21	7/10/02
688	481134.54	1351022.78	588.26	CELL5 TOE4:1	588.13	-0.13	7/10/02
689	481133.93	1351072.77	588.76	CELL5 TOE4:1	588.52	-0.24	7/10/02
690	481133.32	1351122.77	589.26	CELL5 TOE4:1	588.99	-0.27	7/10/02
691	481132.71	1351172.76	589.76	CELL5 TOE4:1	589.63	-0.13	7/10/02
692	481132.10	1351222.76	590.26	CELL5 TOE4:1	589.98	-0.28	7/10/02
693	481131.48	1351272.76	590.76	CELL5 TOE4:1	590.52	-0.24	7/10/02
694	481130.87	1351322.75	591.26	CELL5 TOE4:1	591.11	-0.15	7/10/02
695	481130.26	1351372.75	591.76	CELL5 TOE4:1	591.65	-0.11	8/27/02
696	481129.65	1351422.75	592.26	CELL5 TOE4:1	592.08	-0.18	7/10/02
697	481052.38	1350871.77	585.08	CELL5 TOP4:1	585.02	-0.06	8/16/02
698	481051.77	1350921.76	585.58	CELL5 TOP4:1	585.40	-0.18	7/10/02
699	481051.16	1350971.76	586.08	CELL5 TOP4:1	585.81	-0.27	7/10/02
700	481050.55	1351021.76	586.58	CELL5 TOP4:1	586.44	-0.14	7/10/02
701	481049.94	1351071.75	587.08	CELL5 TOP4:1	586.93	-0.15	7/10/02
702	481049.33	1351121.75	587.58	CELL5 TOP4:1	587.42	-0.16	7/10/02
703	481048.71	1351171.74	588.08	CELL5 TOP4:1	587.88	-0.20	7/10/02
704	481048.10	1351221.74	588.58	CELL5 TOP4:1	588.41	-0.17	7/10/02
705	481047.49	1351271.74	589.08	CELL5 TOP4:1	588.96	-0.12	7/10/02
706	481046.88	1351321.73	589.58	CELL5 TOP4:1	589.36	-0.22	7/10/02
707	481046.27	1351371.73	590.08	CELL5 TOP4:1	589.98	-0.10	7/10/02
708	481045.66	1351421.73	590.58	CELL5 TOP4:1	590.47	-0.11	7/10/02

PNT NO.	NORTH	EAST	PROP ELEV	DESCRIPTION	ASBUILT ELEV	DIFF ELEV	DATE
709	481385.67	1350795.66	596.24	CELL5 TOP4:1	596.04	-0.20	8/16/02
710	481335.68	1350795.05	595.87	CELL5 TOP4:1	595.65	-0.22	7/17/02
711	481285.68	1350794.44	595.49	CELL5 TOP4:1	595.31	-0.18	7/17/02
712	481235.68	1350793.83	595.12	CELL5 TOP4:1	595.05	-0.07	7/17/02
713	481185.69	1350793.22	594.74	CELL5 TOP4:1	594.61	-0.13	7/17/02
714	481135.69	1350792.61	594.37	CELL5 TOP4:1	594.29	-0.08	7/17/02
715	481085.70	1350792.00	593.99	CELL5 TOP4:1	593.92	-0.07	7/17/02
716	481385.90	1350776.95	596.61	CELL5 TOE1.5:1	596.53	-0.08	7/17/02
717	481335.91	1350776.34	596.24	CELL5 TOE1.5:1	596.24	0.00	7/17/02
718	481285.91	1350775.73	595.86	CELL5 TOE1.5:1	595.80	-0.06	7/17/02
719	481235.92	1350775.12	595.49	CELL5 TOE1.5:1	595.36	-0.13	7/17/02
720	481185.92	1350774.51	595.11	CELL5 TOE1.5:1	594.98	-0.13	7/17/02
721	481135.92	1350773.90	594.74	CELL5 TOE1.5:1	594.67	-0.07	7/17/02
722	481085.93	1350773.28	594.36	CELL5 TOE1.5:1	594.17	-0.19	7/17/02
723	481053.68	1350765.09	599.32	CELL5 TOP1.5:1B	599.28	-0.04	8/16/02
724	481386.60	1350720.22	593.65	CELL5 TOP6%	593.39	-0.26	7/24/02
725	481336.60	1350719.61	593.27	CELL5 TOP6%	593.03	-0.24	7/25/02
726	481286.60	1350718.99	592.90	CELL5 TOP6%	592.71	-0.19	7/25/02
727	481236.61	1350718.38	592.52	CELL5 TOP6%	592.35	-0.17	7/25/02
728	481186.61	1350717.77	592.15	CELL5 TOP6%	592.10	-0.05	3/14/03
729	481136.62	1350717.16	591.77	CELL5 TOP6%	591.68	-0.09	3/14/03
730	481086.62	1350716.55	591.40	CELL5 TOP6%	591.25	-0.15	3/14/03
752	481377.08	1351499.27	603.26	S/GCELL5TOP/SL	603.13	-0.13	6/21/02
753	481327.08	1351498.66	602.88	S/GCELL5TOP/SL	602.70	-0.18	6/21/02
754	481277.08	1351498.04	602.51	S/GCELL5TOP/SL	602.41	-0.10	6/21/02
755	481227.09	1351497.43	602.13	S/GCELL5TOP/SL	602.00	-0.13	6/21/02
756	481177.09	1351496.82	601.76	S/GCELL5TOP/SL	601.68	-0.08	6/21/02
757	481127.10	1351496.21	601.38	S/GCELL5TOP/SL	601.24	-0.14	6/21/02
758	481077.10	1351495.60	601.01	S/GCELL5TOP/SL	600.77	-0.24	6/21/02
759	481376.85	1351517.98	603.64	CELL5TOP2%	603.45	-0.19	6/21/02
760	481326.85	1351517.37	603.26	CELL5TOP2%	603.14	-0.12	6/21/02
761	481276.85	1351516.76	602.89	CELL5TOP2%	602.66	-0.23	6/21/02
762	481226.86	1351516.15	602.51	CELL5TOP2%	602.27	-0.24	6/21/02
763	481176.86	1351515.54	602.14	CELL5TOP2%	602.06	-0.08	6/21/02
764	481126.87	1351514.93	601.76	CELL5TOP2%	601.64	-0.12	6/21/02
765	481076.87	1351514.32	601.39	CELL5TOP2%	601.18	-0.21	6/21/02
766	481376.37	1351557.39	603.56	CELL5TOE6:1	603.50	-0.05	12/2/02
767	481326.37	1351556.78	603.18	CELL5TOE6:1	603.15	-0.03	12/2/02
768	481276.37	1351556.17	602.81	CELL5TOE6:1	602.80	0.00	12/2/02
769	481226.38	1351555.56	602.43	CELL5TOE6:1	602.36	-0.07	12/2/02
770	481176.38	1351554.95	602.06	CELL5TOE6:1	602.06	0.00	12/2/02
771	481126.39	1351554.34	601.68	CELL5TOE6:1	601.70	0.02	12/2/02
772	481076.39	1351553.73	601.31	CELL5TOE6:1	601.30	0.00	12/2/02
773	481375.76	1351607.48	600.56	CELL5TOE6%	600.60	0.22	8/16/02
774	481325.76	1351606.87	600.18	CELL5TOE6%	599.88	-0.30	8/16/02
775	481275.76	1351606.26	599.81	CELL5TOE6%	599.80	-0.01	8/16/02
776	481225.77	1351605.65	599.43	CELL5TOE6%	599.22	-0.21	8/16/02
777	481175.77	1351605.04	599.06	CELL5TOE6%	599.06	0.00	8/16/02
778	481125.78	1351604.43	598.68	CELL5TOE6%	598.67	-0.01	8/29/02
779	481075.78	1351603.81	598.31	CELL5TOE6%	598.21	-0.10	8/29/02
780	481375.42	1351634.67	596.05	S/GCELL5C/LDIT	596.00	-0.05	8/23/02
781	481325.44	1351633.31	595.79	S/GCELL5C/LDIT	595.80	0.01	8/23/02
782	481275.45	1351631.95	595.54	S/GCELL5C/LDIT	595.50	-0.04	8/29/02
783	481225.46	1351630.59	595.29	S/GCELL5C/LDIT	595.09	-0.20	8/29/02
784	481175.48	1351629.23	595.04	S/GCELL5C/LDIT	594.81	-0.23	8/23/02
785	481125.49	1351627.87	594.79	S/GCELL5C/LDIT	594.65	-0.14	8/23/02
786	481375.25	1351648.33	600.58	S/GCELL5TOP3:1	600.57	-0.01	8/16/02
787	481325.27	1351646.97	600.33	S/GCELL5TOP3:1	600.07	-0.26	8/23/02
788	481325.26	1351647.97	600.33	S/GCELL5TOP3:1	600.31	-0.02	8/23/02
789	481375.16	1351656.33	600.58	SG CELL5TOP3:1	600.64	0.06	8/16/02
790	481275.18	1351654.32	602.99	SG CELL5TOP3:1	602.72	-0.27	8/16/02
791	481225.21	1351651.73	602.32	SG CELL5TOP3:1	602.75	0.43	8/16/02
792	481175.24	1351649.14	601.66	SG CELL5TOP3:1	601.66	0.00	8/23/02
793	481275.08	1351662.34	602.99	SG CELL5TOP3:1	602.91	-0.08	8/16/02
794	481225.11	1351659.74	602.33	SG CELL5TOP3:1	602.29	-0.04	8/16/02
795	481175.14	1351657.14	601.66	SG CELL5TOP3:1	601.61	-0.05	8/29/02
796	481374.95	1351673.46	602.35	CELL5CLRUNON	602.18	-0.17	8/23/02
797	481324.97	1351672.16	601.27	CELL5CLRUNON	601.20	-0.07	8/29/02
798	481274.97	1351670.86	600.19	CELL5CLRUNON	600.11	-0.08	8/23/02
799	481224.98	1351669.57	599.11	CELL5CLRUNON	599.00	-0.11	8/23/02
800	481189.42	1351668.64	598.34	CELL5CLRUNON	598.30	-0.04	8/29/02
801	481125.01	1351666.97	596.95	CELL5CLRUNON	596.85	-0.10	8/16/02
809	481054.08	1350666.03	588.16	CELL5S/G6% EMAT	588.07	-0.09	7/25/02
810	481051.74	1350689.13	589.55	CELL5S/G6%	589.25	-0.30	7/25/02
811	481087.23	1350666.47	588.40	CELL5S/G6% EMAT	588.20	-0.20	8/3/02
812	481086.95	1350689.69	589.79	CELL5S/G6%	589.68	-0.11	7/25/02
813	481137.23	1350667.09	588.77	CELL5S/G6% EMAT	588.74	-0.03	8/3/02
814	481136.94	1350690.30	590.16	CELL5S/G6%	589.96	-0.20	8/3/02
815	481187.22	1350667.70	589.15	CELL5S/G6% EMAT	589.05	-0.10	8/3/02
816	481186.94	1350690.92	590.54	CELL5S/G6%	590.52	-0.02	8/3/02
817	481237.22	1350668.31	589.52	CELL5S/G6% EMAT	589.47	-0.05	8/3/02
818	481236.94	1350691.53	590.91	CELL5S/G6%	590.81	-0.10	8/3/02
819	481287.22	1350668.92	589.90	CELL5S/G6% EMAT	589.90	0.00	8/3/02
820	481286.93	1350692.14	591.29	CELL5S/G6%	590.99	-0.30	8/3/02
821	481337.21	1350669.53	590.27	CELL5S/G6% EMAT	590.27	0.00	8/2/02
822	481336.93	1350692.75	591.66	CELL5S/G6%	591.36	-0.30	8/3/02
823	481387.21	1350670.14	590.65	CELL5S/G6% EMAT	590.85	0.20	8/3/02
824	481386.93	1350693.36	592.04	CELL5S/G6%	592.04	0.00	8/3/02
825	481437.20	1350670.75	591.02	CELL5S/G6% EMAT	591.16	0.14	8/3/02

PNT NO.	NORTH	EAST	PROP ELEV	DESCRIPTION	ASBUILT ELEV	DIFF ELEV	DATE
826	481436.92	1350693.97	592.41	CELL5S/G6%	592.12	-0.29	7/30/02
1144	481435.99	1350769.76	602.18	S/GCELL4TOP1.5/	601.88	-0.30	7/24/02
1145	481435.22	1350833.54	587.30	S/GCELL4TOE4/1	587.17	-0.13	7/10/02
1146	481434.69	1350876.43	587.73	Cell4Grid Pt.	587.55	-0.18	6/26/02
1147	481434.08	1350926.43	588.23	Cell4Grid Pt.	588.04	-0.19	6/26/02
1148	481433.47	1350976.43	588.73	Cell4Grid Pt.	588.62	-0.11	6/26/02
1149	481432.86	1351026.42	589.23	Cell4Grid Pt.	589.10	-0.13	6/24/02
1150	481432.25	1351076.42	589.73	Cell4Grid Pt.	589.51	-0.22	6/24/02
1151	481431.64	1351126.42	590.23	Cell4Grid Pt.	590.11	-0.12	6/24/02
1152	481431.03	1351176.41	590.73	Cell4Grid Pt.	590.52	-0.21	6/26/02
1153	481430.42	1351226.41	591.23	Cell4Grid Pt.	591.08	-0.15	6/24/02
1154	481429.80	1351276.40	591.73	Cell4Grid Pt.	591.58	-0.15	6/24/02
1155	481429.19	1351326.40	592.23	Cell4Grid Pt.	592.06	-0.17	6/24/02
1156	481428.56	1351376.40	592.73	Cell4Grid Pt.	592.52	-0.21	6/24/02
1157	481427.97	1351426.39	593.23	Cell4Grid Pt.	593.07	-0.16	6/28/02
1158	481427.57	1351459.55	593.56	S/GCELL4TOE4/1	593.31	-0.25	6/28/02
1159	481426.75	1351526.39	609.21	S/GCELL4TOP/SL	609.11	-0.10	6/21/02
1241	481429.22	1350720.74	593.97	S/G Control Pt	593.69	-0.28	7/24/02
1243	481437.81	1350777.58	597.00	S/G Control Pt	596.80	-0.20	7/17/02
1244	481436.24	1350796.28	596.62	S/G Control Pt	596.48	-0.14	7/17/02
1360	481427.07	1351499.88	603.64	S/GCELL4TOP/SL	603.50	-0.13	6/21/02
1361	481426.84	1351518.59	604.02	S/GCELL4TOP/SL	603.77	-0.25	6/21/02
1378	481428.36	1351558.00	603.94	S/GCELL4TOE6-1	603.89	-0.05	6/10/02
1387	481425.75	1351608.09	600.94	S/GCELL4TOPDIT	600.95	0.01	8/16/02
1396	481425.46	1351636.04	596.28	S/GCELL4C/LDIT	596.50	0.22	8/29/02
1406	481425.26	1351649.70	600.83	S/GCELL4TOP3/1	600.63	-0.20	8/16/02
1414	481425.16	1351657.70	600.83	S/GCELL4B/BERM	600.82	-0.01	8/16/02
1528	481380.32	1350835.51	586.22	CELL5 SG OUTLET	586.07	-0.15	6/29/02
1529	481380.52	1350818.78	586.06	CELL5 SG OUTLET	585.83	-0.23	6/29/02
1530	481364.52	1350818.58	586.06	CELL5 SG OUTLET	585.88	-0.18	6/29/02
1531	481364.32	1350834.85	586.22	CELL5 SG OUTLET	586.06	-0.16	6/29/02
1532	481358.95	1350812.93	591.64	CELL5 SG OUT1/1	591.55	-0.09	8/19/02
1533	481386.51	1350812.99	591.92	CELL5 SG OUT1/1	591.90	-0.02	8/19/02
1608	481435.67	1350796.27	596.62	S/GCELL4TOP4/1	596.41	-0.21	7/17/02
1625	481436.59	1350720.83	594.02	S/GCELL4TOE6/1	593.96	-0.06	7/24/02
1803	481372.73	1351456.02	592.43	S/G Control Pt	592.29	-0.14	6/29/02
1804	481356.73	1351456.32	592.43	S/G Control Pt	592.17	-0.26	6/28/02
1805	481404.97	1351674.24	603.00	S/G Control Pt	602.77	-0.23	8/23/02
1807	481075.51	1351626.51	594.53	S/G Control Pt	594.23	-0.30	8/23/02
1808	481044.05	1351553.33	601.07	S/G Control Pt	601.00	-0.07	12/2/02
1810	481044.53	1351513.92	601.14	S/G Control Pt	601.12	-0.02	8/3/02
1811	481044.76	1351495.20	600.77	S/G Control Pt	600.70	-0.07	8/3/02
1812	481045.24	1351455.79	590.92	S/G Control Pt	590.72	-0.20	7/10/02
1813	481129.18	1351461.20	592.64	S/G Control Pt	592.41	-0.23	7/10/02
1814	481145.35	1351477.93	596.90	S/G Control Pt	596.71	-0.19	7/10/02
1815	481144.76	1351655.56	601.25	S/G Control Pt	601.12	-0.13	8/29/02
1820	481136.96	1350825.01	586.28	S/G Control Pt	586.23	-0.05	8/16/02
1821	481153.51	1350809.94	590.22	S/G Control Pt	589.95	-0.27	6/28/02
1822	481052.92	1350828.02	584.64	S/G Control Pt	584.54	-0.10	8/16/02
1826	481054.28	1350716.15	591.16	S/G Control Pt	591.00	-0.16	3/14/03
1848	481276.31	1351654.38	603.00	S/G Control Pt	602.73	-0.27	8/29/02
1850	481133.00	1351646.95	601.10	S/G Control Pt	600.80	-0.30	8/29/02
1863	481043.35	1351603.42	600.00	S/G Control Pt	599.82	-0.18	12/2/02

4944

000069

NOTE:

NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/- 0.01' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

REVISIONS:

REVISED 03-07-03 PER FLUOR FERNALD, INC.

REVISED 03-17-03 PER FLUOR FERNALD, INC.

Designed By:

Drawn By: NASSIM DAHER

Checked By: GREG BARKER

Approved By: TOM MACK

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
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STATE OF OHIO ★ THOMAS J. MACK S-7964 REGISTERED PROFESSIONAL SURVEYOR ★

3/18/03

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5
AS-BUILT
SUB GRADE LAYER

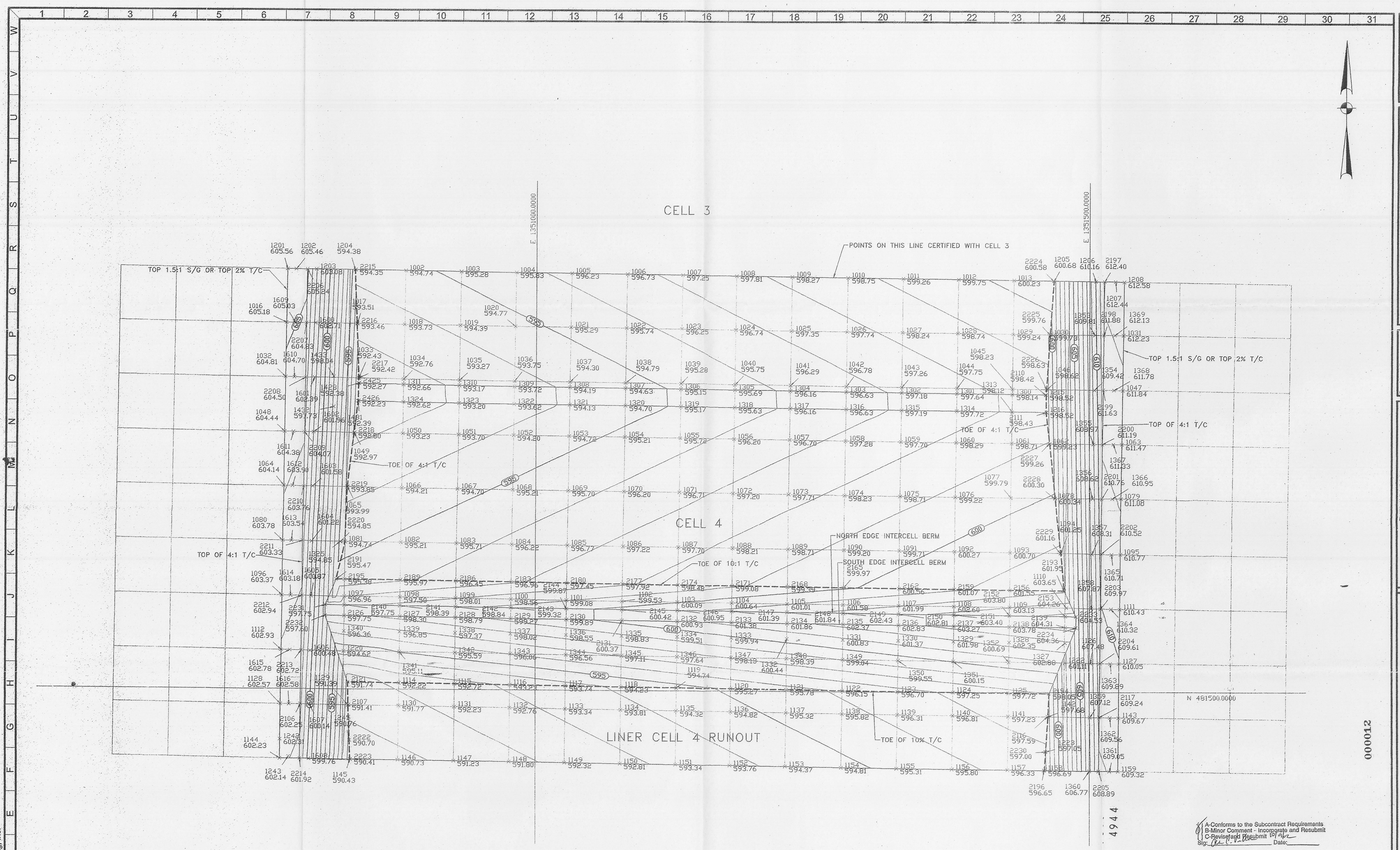
Scale: 1" = 40'

Date: 02-07-2003

Sheet No. 2 OF 2

Project No. 201-225

F:\225\ASBUILTS\CELL 5\DWG\AS-BUILT SUBGRADE5.DWG



A-Conforms to the Subcontract Requirements
B-Minor Comment - Incorporate and Resubmit
C-Revise and Resubmit
Sig: _____ Date: _____

NOTE:

POINTS LESS THAN 2000 ARE SUBGRADE SHOTS WITH ADJUSTED ELEVATIONS FOR TOP CLAY THICKNESS, AND, POINTS ABOVE 2000 WERE COMPUTED FROM SURFACE FURNISHED BY FLUOR FERNALD, INC.

LEGEND:

2100 619.21 = ELEVATION AND POINT NUMBER
= PROPOSED INDEX CONTOUR
= PROPOSED INTERMEDIATE CONTOUR
= TOE OF SLOPES
T/C = TOP OF CLAY
S/G = SUB GRADE

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

000012

STATE OF OHIO
LYNN E. HIRSCH
S-5738
SURVEYOR
Lynn Edward Hirsch
9-3-2002

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
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7075 BOOTH ROAD, FLORENCE, KENTUCKY 41042
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Designed By:	
Drawn By:	F.A.M.
Checked By:	L.E.H.
Approved By:	L.E.H.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

CELL 4
AS-BUILT
TOP CLAY LAYER

Scale:	1" = 40'
Date:	9-3-2002
Sheet No.	1 OF 3
Project No.	201-225

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Y:\201\225\dwg\As-built Topclay4.dwg

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PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1002	481884.66	1350881.93	591.47	594.73	Grid Pt.	594.74	3.27	7/11/02
1003	481884.04	1350931.93	592.02	595.23	Grid Pt.	595.28	3.26	7/12/02
1004	481883.43	1350981.93	592.58	595.73	Grid Pt.	595.83	3.25	7/12/02
1005	481882.82	1351031.92	593.14	596.23	Grid Pt.	596.23	3.09	7/11/02
1006	481882.21	1351081.92	593.71	596.73	Grid Pt.	596.73	3.02	7/11/02
1007	481881.60	1351131.91	594.00	597.23	Grid Pt.	597.25	3.25	7/11/02
1008	481880.99	1351181.91	594.64	597.73	Grid Pt.	597.81	3.17	7/11/02
1009	481880.38	1351231.91	595.20	598.23	Grid Pt.	598.27	3.07	7/11/02
1010	481879.77	1351281.90	595.66	598.73	Grid Pt.	598.75	3.09	7/11/02
1011	481879.15	1351331.90	596.09	599.23	Grid Pt.	599.26	3.17	7/11/02
1012	481878.54	1351381.90	596.62	599.73	Grid Pt.	599.75	3.13	7/12/02
1013	481877.93	1351431.89	597.13	600.23	Grid Pt.	600.23	3.10	7/12/02
1016	481835.96	1350774.66	605.06	605.18	S/GCELL4TOPbl	605.18	None	8/10/02
1017	481835.18	1350838.43	590.24	593.38	S/GCELL4TOE	593.51	3.27	8/21/02
1018	481834.66	1350881.32	590.49	593.73	Grid Pt.	593.73	3.24	7/11/02
1019	481834.05	1350931.32	591.10	594.23	Grid Pt.	594.39	3.29	7/11/02
1020	481833.44	1350981.32	591.72	594.73	Grid Pt.	594.77	3.05	7/16/02
1021	481832.83	1351031.31	592.20	595.23	GRID PT	595.29	3.09	7/12/02
1022	481832.21	1351081.31	592.71	595.73	Grid Pt.	595.74	3.03	7/12/02
1023	481831.60	1351131.30	593.17	596.23	Grid Pt.	596.25	3.08	7/12/02
1024	481830.99	1351181.30	593.59	596.73	Grid Pt.	596.74	3.15	7/12/02
1025	481830.38	1351231.30	594.23	597.23	Grid Pt.	597.35	3.12	7/11/02
1026	481829.77	1351281.29	594.61	597.73	Grid Pt.	597.74	3.13	7/12/02
1027	481829.16	1351331.29	595.11	598.23	Grid Pt.	598.24	3.13	7/11/02
1028	481828.55	1351381.29	595.66	598.73	Grid Pt.	598.74	3.08	7/12/02
1029	481827.94	1351431.28	596.15	599.23	Grid Pt.	599.24	3.09	7/12/02
1030	481827.54	1351464.44	596.46	599.65	S/GCELL4TOE	599.73	3.27	7/12/02
1031	481826.72	1351531.27	611.97	612.21	S/GCELL4TOP/SL	612.23	None	7/11/02
1032	481785.97	1350774.05	604.73	604.81	S/GCELL4TOPbl	604.81	None	8/10/02
1033	481785.17	1350840.23	589.29	592.41	S/GCELL4TOE	592.43	3.14	8/12/02
1034	481784.66	1350880.71	589.47	592.73	Grid Pt.	592.76	3.29	7/12/02
1035	481784.05	1350930.71	590.10	593.23	Grid Pt.	593.27	3.17	7/12/02
1036	481783.44	1350980.71	590.72	593.73	Grid Pt.	593.75	3.03	7/12/02
1037	481782.83	1351030.70	591.19	594.23	Grid Pt.	594.30	3.11	7/12/02
1038	481782.22	1351080.70	591.69	594.73	Grid Pt.	594.79	3.10	7/12/02
1039	481781.61	1351130.69	592.19	595.23	Grid Pt.	595.28	3.09	7/12/02
1040	481781.00	1351180.69	592.62	595.73	Grid Pt.	595.75	3.13	7/12/02
1041	481780.38	1351230.69	593.17	596.23	Grid Pt.	596.29	3.12	7/12/02
1042	481779.77	1351280.68	593.64	596.73	Grid Pt.	596.78	3.14	7/12/02
1043	481779.16	1351330.68	594.03	597.23	Grid Pt.	597.26	3.23	7/12/02
1044	481778.55	1351380.68	594.53	597.73	Grid Pt.	597.75	3.22	7/12/02
1045	481777.94	1351430.67	595.00	598.23	Grid Pt.	598.23	3.23	7/12/02
1046	481777.57	1351461.22	595.48	598.62	S/GCELL4TOE	598.62	3.14	7/12/02
1047	481776.73	1351530.66	611.75	611.83	S/GCELL4TOP/SL	611.84	None	7/11/02
1048	481735.97	1350773.43	604.33	604.43	S/GCELL4TOPbl	604.44	None	8/10/02
1049	481735.20	1350836.30	589.66	592.86	S/GCELL4TOE	592.97	3.31	8/21/02
1050	481734.67	1350880.10	589.93	593.20	GRID PNT	593.23	3.30	7/13/02
1051	481734.06	1350930.09	590.49	593.70	Grid Pt.	593.70	3.21	7/13/02
1052	481733.44	1350980.09	590.97	594.20	GRID PNT	594.20	3.23	7/13/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1053	481732.83	1351030.09	591.47	594.70	GRID PNT	594.72	3.25	7/13/02
1054	481732.22	1351080.08	591.99	595.20	GRID PNT	595.21	3.22	8/9/02
1055	481731.61	1351130.08	592.62	595.70	GRID PNT	595.72	3.10	7/12/02
1056	481731.00	1351180.07	592.99	596.20	GRID PNT	596.20	3.21	7/12/02
1057	481730.39	1351230.07	593.61	596.70	GRID PNT	596.70	3.09	7/12/02
1058	481729.78	1351280.07	594.06	597.20	GRID PNT	597.28	3.22	7/12/02
1059	481729.17	1351330.06	594.53	597.70	GRID PNT	597.70	3.17	7/12/02
1060	481728.56	1351380.06	595.06	598.20	GRID PNT	598.29	3.23	7/12/02
1061	481727.95	1351430.06	595.56	598.70	GRID PNT	598.71	3.15	7/12/02
1062	481727.53	1351464.19	596.03	599.14	S/GCELL4TOE	599.23	3.20	7/12/02
1063	481726.73	1351530.05	611.27	611.46	S/GCELL4TOP/SL	611.47	None	7/11/02
1064	481685.97	1350772.82	603.84	604.06	S/GCELL4TOPbl	604.14	None	8/10/02
1065	481685.27	1350830.40	590.72	593.81	S/GCELL4TOE	593.99	3.27	8/12/02
1066	481684.67	1350879.49	591.14	594.20	GRID PNT	594.21	3.07	7/13/02
1067	481684.06	1350929.48	591.46	594.70	Grid Pt.	594.70	3.24	7/13/02
1068	481683.45	1350979.48	592.00	595.20	GRID PNT	595.21	3.21	7/13/02
1069	481682.84	1351029.48	592.54	595.70	GRID PNT	595.70	3.16	~~7/13/02~~ L.E.H. 8/9/02
1070	481682.23	1351079.47	592.97	596.20	GRID PNT	596.20	3.23	7/13/02
1071	481681.62	1351129.47	593.56	596.70	GRID PNT	596.71	3.15	7/12/02
1072	481681.01	1351179.46	594.03	597.20	GRID PNT	597.20	3.17	7/12/02
1073	481680.39	1351229.46	594.57	597.70	GRID PNT	597.71	3.14	7/12/02
1074	481679.78	1351279.46	594.96	598.20	GRID PNT	598.23	3.27	7/12/02
1075	481679.17	1351329.45	595.42	598.70	GRID PNT	598.71	3.29	7/12/02
1076	481678.56	1351379.45	596.15	599.20	GRID PNT	599.22	3.07	7/12/02
1077	481677.95	1351429.45	596.55	599.70	GRID PNT	599.79	3.24	7/12/02
1078	481677.46	1351469.31	597.05	600.19	S/GCELL4TOE	600.34	3.29	7/12/02
1079	481676.73	1351529.44	611.03	611.08	S/GCELL4TOP/SL	611.08	None	7/11/02
1080	481635.98	1350772.21	603.57	603.68	S/GCELL4TOPbl	603.78	None	8/10/02
1081	481635.29	1350828.88	591.60	594.70	Grid Pt.	594.74	3.14	8/12/02
1082	481634.67	1350878.88	592.02	595.20	GRID PNT	595.21	3.19	7/13/02
1083	481634.06	1350928.87	592.56	595.70	Grid Pt.	595.71	3.15	7/13/02
1084	481633.45	1350978.87	593.16	596.20	GRID PNT	596.22	3.06	7/13/02
1085	481632.84	1351028.87	593.60	596.70	GRID PNT	596.77	3.17	7/13/02
1086	481632.23	1351078.86	594.08	597.20	GRID PNT	597.22	3.14	7/13/02
1087	481631.62	1351128.86	594.54	597.70	GRID PNT	597.70	3.16	7/13/02
1088	481631.01	1351178.85	595.10	598.20	GRID PNT	598.21	3.11	7/13/02
1089	481630.40	1351228.85	595.50	598.70	GRID PNT	598.71	3.21	7/13/02
1090	481629.79	1351278.85	596.01	599.20	GRID PNT	599.20	3.19	7/13/02
1091	481629.18	1351328.84	596.57	599.70	GRID PNT	599.71	3.14	7/13/02
1092	481628.57	1351378.84	597.11	600.20	GRID PNT	600.27	3.16	7/13/02
1093	481627.96	1351428.84	597.59	600.70	GRID PNT	600.70	3.11	7/13/02
1094	481627.40	1351474.43	597.97	601.25	S/GCELL4TOE	601.25	3.28	7/13/02
1095	481626.74	1351528.83	610.58	610.71	S/GCELL4TOP/SL	610.77	None	7/11/02
1096	481585.98	1350771.60	603.25	603.31	S/GCELL4TOPbl	603.37	None	8/10/02
1097	481585.29	1350828.27	592.50	596.96	Grid Pt.	596.96	4.46	8/12/02
1098	481584.68	1350878.27	592.97	597.46	GRID PNT	597.50	4.53	8/12/02
1099	481584.07	1350928.26	593.47	597.96	Grid Pt.	598.01	4.54	7/25/02
1100	481583.46	1350978.26	594.01	598.46	GRID PNT	598.56	4.55	7/25/02
1101	481582.85	1351028.26	594.52	598.96	GRID PNT	599.08	4.56	7/22/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1102	481582.23	1351078.25	594.99	599.46	GRID PNT	599.53	4.54	7/20/02
1103	481581.62	1351128.25	595.54	599.96	GRID PNT	600.09	4.55	7/22/02
1104	481581.01	1351178.24	596.07	600.46	GRID PNT	600.64	4.57	7/20/02
1105	481580.40	1351228.24	596.47	600.96	GRID PNT	601.01	4.54	7/22/02
1106	481579.79	1351278.24	597.06	601.46	GRID PNT	601.58	4.52	7/22/02
1107	481579.18	1351328.23	597.44	601.96	GRID PNT	601.99	4.55	7/22/02
1108	481578.57	1351378.23	598.05	602.46	GRID PNT	602.60	4.55	7/22/02
1109	481577.96	1351428.23	598.57	602.96	GRID PNT	603.13	4.56	7/22/02
1110	481577.33	1351479.55	599.20	603.48	S/GCELL4TOE	603.65	4.45	7/22/02
1111	481576.74	1351528.22	610.11	610.33	S/GCELL4TOP/SL	610.43	None	7/11/02
1112	481535.99	1350770.99	602.80	602.93	S/GCELL4TOPbl	602.93	None	8/13/02
1114	481505.84	1350877.32	588.98	592.15	Toe 10%	592.22	3.24	7/25/02
1115	481505.23	1350927.30	589.55	592.65	Toe 10%	592.72	3.17	7/25/02
1116	481504.62	1350977.30	589.97	593.15	Toe 10%	593.23	3.26	7/25/02
1117	481504.01	1351027.30	590.52	593.65	Toe 10%	593.74	3.22	7/25/02
1118	481503.39	1351077.29	591.02	594.15	Toe 10%	594.23	3.21	7/25/02
1119	481502.78	1351127.29	591.50	594.65	Toe 10%	594.74	3.24	7/25/02
1120	481502.17	1351177.28	592.02	595.15	Toe 10%	595.27	3.25	7/25/02
1121	481501.56	1351227.28	592.53	595.65	Toe 10%	595.78	3.25	7/25/02
1122	481500.95	1351277.28	592.96	596.15	Toe 10%	596.15	3.19	7/25/02
1123	481500.34	1351327.27	593.41	596.65	Toe 10%	596.70	3.29	7/25/02
1124	481499.73	1351377.27	594.00	597.15	Toe 10%	597.25	3.25	7/25/02
1125	481499.12	1351427.27	594.52	597.65	Toe 10%	597.72	3.20	7/19/02
1126	481527.07	1351501.10	604.34	607.47	S/GCELL4TOP/SL	607.48	3.14	7/22/02
1127	481526.75	1351527.61	609.70	609.96	S/GCELL4TOP/SL	610.05	None	7/17/02
1128	481485.99	1350770.38	602.50	602.56	S/GCELL4TOPbl	602.57	None	8/13/02
1129	481485.24	1350831.75	588.10	591.36	S/GCELL4TOE/SL	591.39	3.29	8/13/02
1130	481484.69	1350877.05	588.58	591.73	Grid Pt.	591.77	3.19	8/16/02
1131	481484.08	1350927.04	588.96	592.23	Grid Pt.	592.23	3.27	8/15/02
1132	481483.47	1350977.04	589.55	592.73	Grid Pt.	592.76	3.21	8/15/02
1133	481482.86	1351027.03	590.09	593.23	Grid Pt.	593.34	3.25	7/25/02
1134	481482.24	1351077.03	590.60	593.73	Grid Pt.	593.81	3.21	7/25/02
1135	481481.63	1351127.03	591.07	594.23	Grid Pt.	594.32	3.25	7/25/02
1136	481481.02	1351177.02	591.64	594.73	Grid Pt.	594.82	3.18	7/25/02
1137	481480.41	1351227.02	592.10	595.23	Grid Pt.	595.32	3.22	7/25/02
1138	481479.80	1351277.02	592.64	595.73	Grid Pt.	595.82	3.18	7/25/02
1139	481479.19	1351327.01	593.13	596.23	Grid Pt.	596.31	3.18	7/25/02
1140	481478.58	1351377.01	593.53	596.73	Grid Pt.	596.81	3.28	7/25/02
1141	481477.97	1351427.00	593.96	597.23	Grid Pt.	597.23	3.27	7/25/02
1142	481477.53	1351462.76	594.36	597.67	S/GCELL4TOE/SL	597.68	3.32	7/23/02
1143	481476.75	1351527.00	609.54	609.58	S/GCELL4TOP/SL	609.67	None	7/17/02
1144	481435.99	1350769.76	601.88	602.18	S/GCELL4TOP1.5	602.23	None	8/14/02
1145	481435.22	1350833.54	587.17	590.39	S/GCELL4TOE4/1	590.43	3.28	8/14/02
1146	481434.69	1350876.43	587.55	590.73	Grid Pt.	590.73	3.18	8/16/02
1147	481434.08	1350926.43	588.04	591.23	Grid Pt.	591.23	3.19	8/15/02
1148	481433.47	1350976.43	588.62	591.73	Grid Pt.	591.80	3.18	8/15/02
1149	481432.86	1351026.42	589.10	592.23	Grid Pt.	592.32	3.22	7/25/02
1150	481432.25	1351076.42	589.51	592.73	Grid Pt.	592.81	3.30	7/25/02
1151	481431.64	1351126.42	590.11	593.23	Grid Pt.	593.34	3.23	7/25/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1152	481431.03	1351176.41	590.52	593.73	Grid Pt.	593.76	3.24	7/25/02
1153	481430.42	1351226.41	591.08	594.23	Grid Pt.	594.37	3.29	7/25/02
1154	481429.80	1351276.40	591.58	594.73	Grid Pt.	594.81	3.23	7/25/02
1155	481429.19	1351326.40	592.06	595.23	Grid Pt.	595.31	3.25	7/25/02
1156	481428.58	1351376.40	592.52	595.73	Grid Pt.	595.80	3.28	7/25/02
1157	481427.97	1351426.39	593.07	596.23	Grid Pt.	596.33	3.26	7/25/02
1158	481427.57	1351459.55	593.31	596.65	S/GCELL4TOE4/1	596.69	3.38	7/23/02
1159	481426.75	1351526.39	609.11	609.21	S/GCELL4TOP/SL	609.32	None	7/23/02
1201	481885.96	1350775.27	605.37	605.56	S/GCONT.PTS	605.56	None	8/12/02
1202	481885.87	1350783.06	600.13	605.40	S/GCONT.PTS	605.46	5.33	8/10/02
1203	481885.64	1350801.78	599.69	603.08	S/GCONT.PTS	603.08	3.39	8/10/02
1204	481885.21	1350836.64	591.23	594.36	S/GCONT.PTS	594.38	3.15	8/12/02
1205	481877.50	1351467.65	597.34	600.67	S/GCONT.PTS	600.68	3.34	7/12/02
1206	481877.04	1351505.38	606.99	610.10	S/GCONT.PTS	610.16	3.17	7/16/02
1207	481876.81	1351524.09	607.32	612.43	S/GCONT.PTS	612.44	5.12	7/11/02
1208	481876.72	1351531.88	612.32	612.58	S/GCONT.PTS	612.58	None	7/11/02
1215	481772.70	1351460.91	595.19	598.52	S/GCONT.PTS	598.52	3.33	7/13/02
1216	481756.70	1351461.21	595.26	598.52	S/GCONT.PTS	598.52	3.26	7/16/02
1220	481535.29	1350827.66	591.43	594.55	GRID PT 10%	594.62	3.19	8/13/02
1222	481527.35	1351478.09	597.86	601.06	GRID PT 10%	601.11	3.25	7/19/02
1223	481445.21	1351460.68	593.79	597.01	S/GCONT.PTS	597.05	3.26	7/23/02
1242	481453.65	1350769.98	602.12	602.31	S/GCONT.PTS	602.31	None	8/14/02
1243	481437.81	1350777.58	596.80	602.04	Toe/1.5:1Cell4	602.14	5.34	8/14/02
1245	481452.89	1350832.91	587.42	590.73	S/GCONT.PTS	590.76	3.34	8/14/02
1300	481773.07	1351430.61	594.87	598.13	S/GCELL4	598.14	3.27	7/13/02
1301	481773.68	1351380.62	594.40	597.63	S/GCELL4	597.64	3.24	7/13/02
1302	481774.29	1351330.62	593.97	597.13	S/GCELL4	597.18	3.21	7/13/02
1303	481774.90	1351280.62	593.46	596.63	S/GCELL4	596.63	3.17	7/13/02
1304	481775.52	1351230.63	592.97	596.13	S/GCELL4	596.16	3.19	7/13/02
1305	481776.13	1351180.63	592.46	595.63	S/GCELL4	595.69	3.23	7/13/02
1306	481776.74	1351130.63	591.98	595.13	S/GCELL4	595.15	3.17	7/13/02
1307	481777.35	1351080.64	591.57	594.63	S/GCELL4	594.63	3.06	7/13/02
1308	481777.96	1351030.64	591.05	594.13	S/GCELL4	594.19	3.14	7/13/02
1309	481778.57	1350980.65	590.48	593.63	S/GCELL4	593.72	3.24	7/13/02
1310	481779.18	1350930.65	590.00	593.13	S/GCELL4	593.17	3.17	7/13/02
1311	481779.79	1350880.65	589.43	592.63	S/GCELL4	592.66	3.23	7/13/02
1313	481757.08	1351430.41	594.99	598.12	S/GCELL4	598.12	3.13	7/13/02
1314	481757.69	1351380.42	594.46	597.62	S/GCELL4	597.72	3.26	7/13/02
1315	481758.30	1351330.42	594.05	597.12	S/GCELL4	597.19	3.14	7/13/02
1316	481758.91	1351280.42	593.49	596.62	S/GCELL4	596.63	3.14	7/13/02
1317	481759.52	1351230.43	593.09	596.12	S/GCELL4	596.16	3.07	7/13/02
1318	481760.13	1351180.43	592.49	595.62	S/GCELL4	595.63	3.14	7/13/02
1319	481760.74	1351130.43	592.05	595.12	S/GCELL4	595.17	3.12	7/13/02
1320	481761.35	1351080.44	591.48	594.62	S/GCELL4	594.70	3.22	7/13/02
1321	481761.96	1351030.44	591.00	594.12	S/GCELL4	594.13	3.13	7/13/02
1322	481762.57	1350980.45	590.57	593.62	S/GCELL4	593.62	3.05	7/13/02
1323	481763.18	1350930.45	590.01	593.12	S/GCELL4	593.20	3.19	7/13/02
1324	481763.79	1350880.45	589.36	592.62	S/GCELL4	592.62	3.26	7/13/02
1325	481635.35	1350824.50	591.51	594.75	S/GCELL4TOE	594.85	3.34	8/12/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1327	481545.37	1351478.31	599.58	602.86	10% PT	602.88	3.30	7/19/02
1328	481545.99	1351427.84	599.19	602.34	GRID PNT	602.35	3.16	7/19/02
1329	481546.60	1351377.84	598.72	601.85	SG TOP	601.98	3.26	7/20/02
1330	481547.21	1351327.84	598.10	601.35	SG TOP	601.37	3.27	7/20/02
1331	481547.82	1351277.85	597.56	600.85	S/GCELL4TOP/SL	600.83	3.27	7/20/02
1332	481548.43	1351227.85	597.20	600.35	S/GCELL4TOP	600.44	3.24	7/20/02
1333	481549.05	1351177.85	596.70	599.85	S/GCELL4TOP/SL	599.94	3.24	7/20/02
1334	481549.66	1351127.86	596.24	599.35	S/GCELL4TOP/SL	599.51	3.27	7/20/02
1335	481550.27	1351077.86	595.59	598.85	S/GCELL4TOP	598.83	3.24	7/20/02
1336	481550.88	1351027.87	595.26	598.35	S/GCELL4TOP	598.55	3.29	7/20/02
1337	481551.49	1350977.87	594.72	597.85	S/GCELL4TOP/SL	598.02	3.30	8/9/02
1338	481552.10	1350927.87	594.17	597.35	S/GCELL4TOP/SL	597.37	3.20	8/9/02
1339	481552.71	1350877.88	593.55	596.85	S/GCELL4TOP/SL	596.85	3.30	8/13/02
1340	481553.32	1350827.88	593.21	596.35	S/GCELL4TOP/SL	596.36	3.15	8/13/02
1341	481534.68	1350877.66	591.84	595.05	GRID PT 10%	595.11	3.27	8/13/02
1342	481534.07	1350927.65	592.36	595.55	GRID PT 10%	595.59	3.23	7/25/02
1343	481533.46	1350977.65	592.79	596.05	GRID PT 10%	596.06	3.27	7/25/02
1344	481532.85	1351027.65	593.30	596.55	GRID PT 10%	596.56	3.26	7/20/02
1345	481532.24	1351077.64	593.88	597.05	GRID PT 10%	597.11	3.23	7/20/02
1346	481531.63	1351127.64	594.41	597.55	GRID PT 10%	597.64	3.23	7/20/02
1347	481531.02	1351177.63	594.84	598.05	GRID PT 10%	598.13	3.29	7/20/02
1348	481530.40	1351227.63	595.36	598.55	GRID PT 10%	598.39	3.03	7/20/02
1349	481529.79	1351277.63	595.76	599.05	GRID PT 10%	599.04	3.28	7/20/02
1350	481529.18	1351327.62	596.36	599.55	GRID PT 10%	599.55	3.19	7/25/02
1351	481528.57	1351377.62	596.88	600.05	GRID PT 10%	600.15	3.27	7/25/02
1352	481527.96	1351427.62	597.39	600.55	GRID PT 10%	600.69	3.30	7/19/02
1353	481827.04	1351504.77	606.43	609.72	S/GCELL4TOP/SL	609.81	3.38	7/16/02
1354	481777.05	1351504.16	606.25	609.35	S/GCELL4TOP/SL	609.42	3.17	7/16/02
1355	481727.05	1351503.55	605.61	608.97	S/GCELL4TOP/SL	608.97	3.36	7/16/02
1356	481677.05	1351502.93	605.48	608.60	S/GCELL4TOP/SL	608.62	3.14	7/16/02
1357	481627.06	1351502.32	605.00	608.22	S/GCELL4TOP/SL	608.31	3.31	7/16/02
1358	481577.06	1351501.71	604.68	607.85	S/GCELL4TOP/SL	607.87	3.19	7/16/02
1359	481477.07	1351500.49	603.98	607.10	S/GCELL4TOP/SL	607.12	3.14	7/22/02
1360	481427.07	1351499.88	603.50	606.72	S/GCELL4TOP/SL	606.77	3.27	7/23/02
1361	481426.84	1351518.59	603.91	609.05	S/GCELL4TOP/SL	609.07	5.16	7/23/02
1362	481476.84	1351519.20	604.19	609.43	S/GCELL4TOP/SL	609.56	5.37	7/17/02
1363	481526.84	1351519.81	604.75	609.80	S/GCELL4TOP/SL	609.89	5.14	7/17/02
1364	481576.83	1351520.42	605.14	610.18	S/GCELL4TOP/SL	610.32	5.18	7/11/02
1365	481626.83	1351521.04	605.43	610.55	S/GCELL4TOP/SL	610.71	5.28	7/11/02
1366	481676.82	1351521.65	605.86	610.93	S/GCELL4TOP/SL	610.95	5.09	7/11/02
1367	481726.82	1351522.26	606.15	611.30	S/GCELL4TOP/SL	611.33	5.18	7/11/02
1368	481776.82	1351522.87	606.45	611.68	S/GCELL4TOP/SL	611.78	5.33	7/11/02
1369	481826.81	1351523.48	606.90	612.05	S/GCELL4TOP/SL	612.13	5.23	7/11/02
1428	481780.29	1350840.40	589.22	592.31	C4 SGCELLOUT	592.38	3.16	8/13/02
1431	481764.29	1350839.74	589.04	592.31	C4 SGCELLOUT	592.39	3.35	8/21/02
1432	481758.92	1350817.82	594.44	597.73	C4 SGCELLOUT	597.73	3.29	8/10/02
1433	481766.48	1350817.88	594.74	598.01	C4 SGCELLOUT	598.04	3.30	8/10/02
1600	481835.64	1350801.17	599.43	602.71	S/GCELL4TOP/4/1	602.71	3.28	8/10/02
1601	481785.65	1350800.56	599.01	602.33	S/GCELL4TOP/4/1	602.39	3.38	8/10/02

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NOTE:
NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/- 0.01' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

CELL 4
AS-BUILT
TOP CLAY LAYER

Scale:
Date: 9-3-2002
Sheet No. 2 OF 3
Project No. 201-225

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
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STATE OF OHIO
LYNN E. HIRSCH
S-5786
SURVEYOR

Lynn Edward Hirsch
9-3-2002

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PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1602	481735.65	1350799.94	598.75	601.96	S/GCELL4TOP/4/1	601.96	3.21	8/10/02
1603	481[illegible]85.65	1350799.33	598.40	601.58	S/GCELL4TOP/4/1	601.58	3.18	8/10/02
1604	481635.66	1350798.72	598.04	601.21	S/GCELL4TOP/4/1	601.22	3.18	8/10/02
1605	481585.66	1350798.11	597.63	600.83	S/GCELL4TOP/4/1	600.87	3.24	8/10/02
1606	481535.67	1350797.50	597.31	600.46	S/GCELL4TOP/4/1	600.48	3.17	8/13/02
1607	481485.67	1350796.88	596.80	600.08	S/GCELL4TOP/4/1	600.14	3.34	8/13/02
1608	481435.67	1350796.27	596.41	599.71	S/GCELL4TOP/4/1	599.76	3.35	8/14/02
1609	481835.87	1350782.45	599.71	605.03	S/GCELL4TOE	605.03	5.32	8/10/02
1610	481785.88	1350781.84	599.54	604.65	S/GCELL4TOE	604.70	5.16	8/10/02
1611	481735.88	1350781.23	599.11	604.28	S/GCELL4TOE	604.38	5.27	8/10/02
1612	481685.88	1350780.61	598.82	603.90	S/GCELL4TOE	603.90	5.08	8/10/02
1613	481635.89	1350780.00	598.41	603.53	S/GCELL4TOE	603.54	5.13	8/10/02
1614	481585.89	1350779.39	598.09	603.15	S/GCELL4TOE	603.18	5.09	8/10/02
1615	481535.90	1350778.78	597.73	602.78	S/GCELL4TOE	602.78	5.05	8/13/02
1616	481485.90	1350778.17	597.25	602.40	S/GCELL4TOE	602.58	5.33	8/13/02
2106	481486.03	1350788.42		602.20	Top4:1slCell4TC	602.25	None	8/13/02
2107	481485.50	1350832.09		591.28	Toe4:1 Cell4tc	591.41	None	8/13/02
2110	481772.68	1351460.52		598.42	Toe4:1Cell4tc	598.42	None	7/13/02
2111	481756.73	1351460.83		598.43	Toe4:1Cell4tc	598.43	None	7/13/02
2116	481477.79	1351462.40		597.58	T/CCell4-Control Pt	597.59	None	7/23/02
2117	481477.22	1351508.96		609.22	T/CCell4-Control Pt	609.24	None	7/22/02
2121	481506.41	1350831.34	588.56	591.69	Toe 10%	591.74	None	8/13/02
2126	481567.42	1350828.05		597.75	Top/SLIntercell4	597.75	None	8/12/02
2127	481566.81	1350878.05		598.25	Top/SLIntercell4	598.30	None	8/12/02
2128	481566.20	1350928.04		598.75	Top/SLIntercell4	598.79	None	7/25/02
2129	481565.59	1350978.04		599.25	Top/SLIntercell4	599.27	None	8/9/02
2130	481564.98	1351028.04		599.75	Top/SLIntercell4	599.89	None	7/22/02
2131	481564.36	1351078.03		600.25	Top/SLIntercell4	600.37	None	7/22/02
2132	481563.75	1351128.03		600.75	Top/SLIntercell4	600.93	None	7/20/02
2133	481563.14	1351178.02		601.25	Top/SLIntercell4	601.38	None	7/20/02
2134	481562.53	1351228.02		601.75	Top/SLIntercell4	601.86	None	7/20/02
2135	481561.92	1351278.02		602.25	Top/SLIntercell4	602.37	None	7/20/02
2136	481561.31	1351328.01		602.75	Top/SLIntercell4	602.83	None	7/20/02
2137	481560.70	1351378.01		603.25	Top/SLIntercell4	603.27	None	7/20/02
2138	481560.09	1351428.01		603.75	Top/SLIntercell4	603.78	None	7/19/02
2139	481559.47	1351478.48		604.26	Top/SLIntercell4	604.31	None	7/19/02
2140	481577.42	1350828.17		597.75	Top/SLIntercell4	597.75	None	8/12/02
2141	481576.81	1350878.17		598.25	Top/SLIntercell4	598.39	None	8/12/02
2142	481576.20	1350928.16		598.75	Top/SLIntercell4	598.84	None	8/12/02
2143	481575.59	1350978.16		599.25	Top/SLIntercell4	599.32	None	8/12/02
2144	481574.98	1351028.16		599.75	Top/SLIntercell4	599.87	None	7/22/02
2145	481574.37	1351078.15		600.25	Top/SLIntercell4	600.42	None	7/22/02
2146	481573.76	1351128.15		600.75	Top/SLIntercell4	600.95	None	7/22/02
2147	481573.15	1351178.14		601.25	Top/SLIntercell4	601.39	None	7/22/02
2148	481572.54	1351228.14		601.75	Top/SLIntercell4	601.84	None	7/22/02
2149	481571.92	1351278.14		602.25	Top/SLIntercell4	602.43	None	7/20/02
2150	481571.31	1351328.13		602.75	Top/SLIntercell4	602.81	None	7/20/02
2151	481570.70	1351378.13		603.25	Top/SLIntercell4	603.40	None	7/22/02
2152	481570.09	1351428.13		603.75	Top/SLIntercell4	603.80	None	7/19/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2153	481569.48	1351478.60		604.26	Top/SLIntercell4	604.26	None	7/19/02
2156	481593.77	1351428.42		601.38	Toe/10%slcell4tc	601.55	None	7/22/02
2159	481594.38	1351378.42		600.88	Toe/10%slcell4tc	601.07	None	7/22/02
2162	481594.99	1351328.42		600.38	Toe/10%slcell4tc	600.56	None	7/22/02
2165	481595.60	1351278.43		599.88	Toe/10%slcell4tc	599.97	None	7/22/02
2168	481596.21	1351228.43		599.38	Toe/10%slcell4tc	599.39	None	7/22/02
2171	481596.83	1351178.43		598.88	Toe/10%slcell4tc	599.08	None	7/22/02
2174	481597.44	1351128.44		598.38	Toe/10%slcell4tc	598.48	None	7/22/02
2177	481598.05	1351078.44		597.88	Toe/10%slcell4tc	597.92	None	7/22/02
2180	481598.66	1351028.45		597.38	Toe/10%slcell4tc	597.45	None	7/22/02
2183	481599.27	1350978.45		596.88	Toe/10%slcell4tc	596.96	None	7/22/02
2186	481599.88	1350928.45		596.38	Toe/10%slcell4tc	596.45	None	7/22/02
2189	481600.49	1350878.46		595.88	Toe/10%slcell4tc	595.97	None	7/22/02
2191	481601.19	1350820.82		595.30	Toe/4:1slcell4tc	595.47	None	8/13/02
2193	481593.17	1351477.54		601.87	Toe/4:1slCell4	601.95	None	7/19/02
2194	481498.68	1351463.74	594.87	598.01	Toe/10%slCell4tc	598.05	None	7/22/02
2195	481601.10	1350828.46		595.38	Toe/10%slCell4tc	595.38	None	8/13/02
2196	481427.57	1351459.17		596.56	Toe/4:1slCell4tc	596.65	None	7/23/02
2197	481876.93	1351513.84		612.22	Top/4:1slCell4tc	612.40	None	7/11/02
2198	481826.94	1351513.23		611.85	Top/4:1slCell4tc	611.88	None	7/11/02
2199	481776.95	1351512.62		611.47	Top/4:1slCell4tc	611.63	None	7/11/02
2200	481726.95	1351512.01		611.10	Top/4:1slCell4tc	611.19	None	7/11/02
2201	481676.95	1351511.40		610.72	Top/4:1slCell4tc	610.76	None	7/11/02
2202	481626.96	1351510.79		610.35	Top/4:1slCell4tc	610.52	None	7/11/02
2203	481576.96	1351510.18		609.97	Top/4:1slCell4tc	609.97	None	7/11/02
2204	481526.97	1351509.57		609.60	Top/4:1slCell4tc	609.61	None	7/22/02
2205	481426.97	1351508.35		608.85	Top/4:1slCell4tc	608.89	None	7/23/02
2206	481885.74	1350793.31		605.19	Top/4:1slCell4tc	605.24	None	8/10/02
2207	481835.74	1350792.70		604.82	Top/4:1slCell4tc	604.83	None	8/10/02
2208	481785.75	1350792.09		604.44	Top/4:1slCell4tc	604.50	None	8/10/02
2209	481735.75	1350791.47		604.07	Top/4:1slCell4tc	604.07	None	8/10/02
2210	481685.75	1350790.86		603.69	Top/4:1slCell4tc	603.76	None	8/10/02
2211	481635.76	1350790.25		603.32	Top/4:1slCell4tc	603.33	None	8/10/02
2212	481585.76	1350789.64		602.94	Top/4:1slCell4tc	602.94	None	8/10/02
2213	481535.77	1350789.03		602.57	Top/4:1slCell4tc	602.72	None	8/13/02
2214	481435.77	1350787.81		601.82	Top/4:1slCell4tc	601.92	None	8/14/02
2215	481885.21	1350836.99		594.28	Toe/4:1slCell4tc	594.35	None	8/12/02
2216	481835.18	1350838.78		593.30	Toe/4:1slCell4tc	593.46	None	8/21/02
2217	481785.16	1350840.57		592.33	Toe/4:1slCell4tc	592.42	None	8/21/02
2218	481735.20	1350836.66		592.79	Toe/4:1slCell4tc	592.80	None	8/21/02
2219	481685.27	1350830.76		593.71	Toe/4:1slCell4tc	593.85	None	8/12/02
2220	481635.34	1350824.86		594.66	Toe/4:1slCell4tc	594.85	None	8/12/02
2222	481452.89	1350833.03		590.65	Toe/4:1slCell4tc	590.70	None	8/14/02
2223	481435.21	1350833.89		590.31	Toe/4:1slCell4tc	590.41	None	8/14/02
2224	481877.50	1351467.36		600.58	Toe/4:1slCell4tc	600.58	None	7/12/03
2225	481827.54	1351464.28		599.56	Toe/4:1slCell4tc	599.76	None	7/12/03
2226	481777.57	1351461.21		598.54	Toe/4:1slCell4tc	598.63	None	7/12/03
2227	481727.54	1351463.81		599.04	Toe/4:1slCell4tc	599.26	None	7/12/03
2228	481677.47	1351468.93		600.09	Toe/4:1slCell4tc	600.30	None	7/12/03

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2229	481627.41	1351474.04		601.15	Toe/4:1slCell4tc	601.16	None	7/13/02
2230	481445.21	1351460.30		596.83	Toe/4:1slCell4tc	597.00	None	7/23/02
2231	481577.63	1350811.04		597.58	Top /Berm @ toe 4:1	597.75	None	8/13/02
2232	481567.63	1350810.92		597.58	Top /Berm @ toe 4:1	597.60	None	8/13/02
2233	481569.36	1351488.08		604.36	Top /Berm @ toe 4:1	604.53	None	7/15/02
2234	481559.35	1351487.96		604.36	Top /Berm @ toe 4:1	604.36	None	7/19/02
2425	481780.25	1350840.75		592.23	T/CCell4 Outlet	592.27	None	8/21/02
2426	481764.32	1350840.10		592.22	T/CCell4 Outlet	592.23	None	8/21/02

4944

000014

NOTE:
NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/-0.01' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
HYDROGEOLOGY & LAND SURVEYING
7073 INDUSTRIAL ROAD, FLORENCE, KENTUCKY 41042

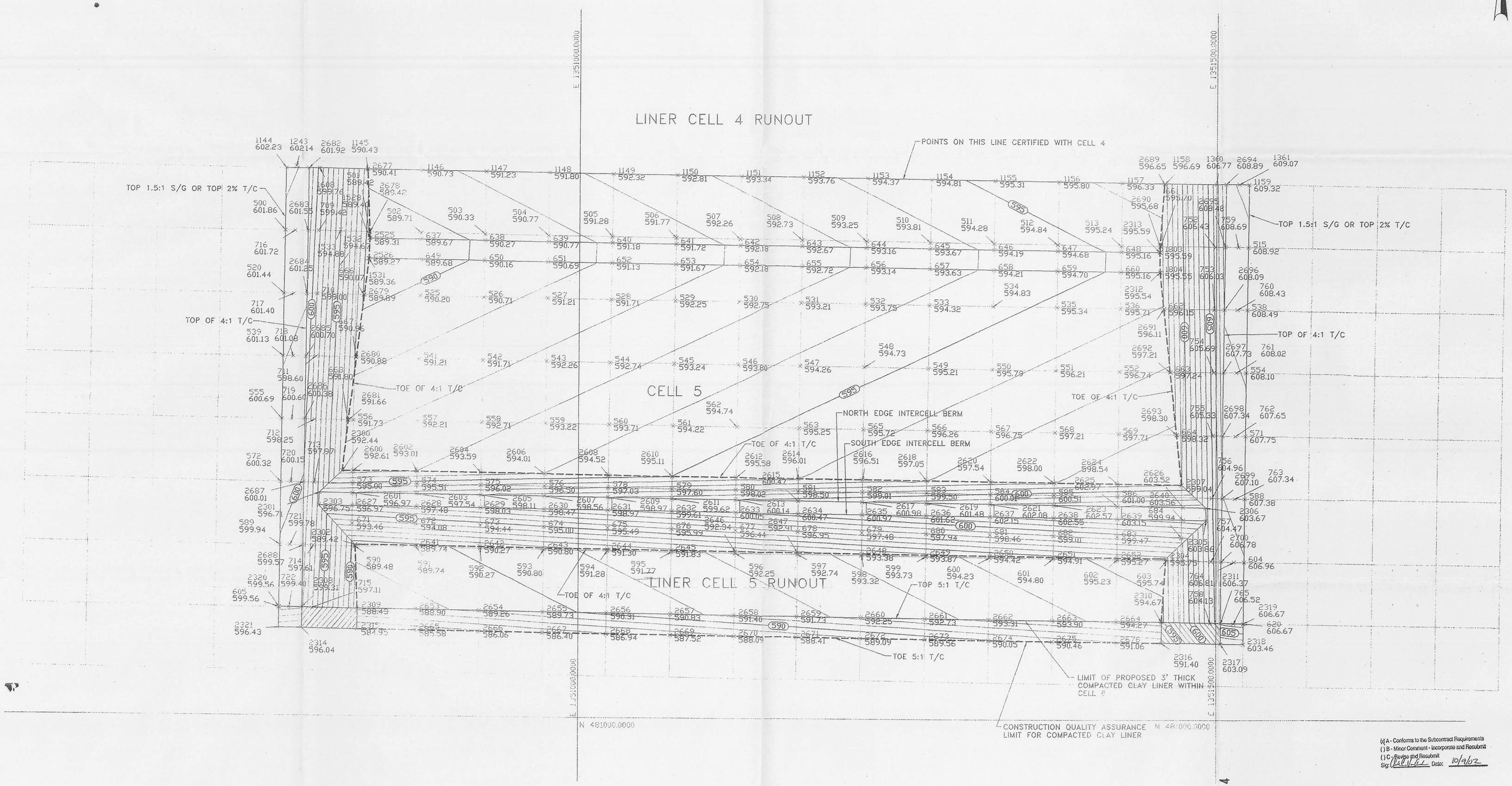
STATE OF OHIO
LYNN E. HIRSCH
S-6798
SURVEYOR

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

CELL 4
AS-BUILT
TOP CLAY LAYER

Scale:
Date: 9-3-2002
Sheet No. 3 OF 3
Project No. 201-225

Y:\201\225\dwg\As-built Topclay4.dwg



(X) A - Conforms to the Subcontract Requirements
( ) B - Minor Comment - Incorporate and Resubmit
( ) C - Revise and Resubmit
Sign: [illegible] Date: 10/9/02

4944

NOTE:

POINTS 606 TO 619 NOT USED IN THIS CELL.

LEGEND:

× 2100 619.21	= ELEVATION AND POINT NUMBER
	= PROPOSED INDEX CONTOUR
	= PROPOSED INTERMEDIATE CONTOUR
	= TOE OF SLOPES
T/C	= TOP OF CLAY
S/G	= SUB GRADE

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

STATE OF OHIO
LYNN E. HIRSCH
S-5738
SURVEYOR
Lynn Edward Hirsch
9-5-2002

David E. Estes Engineering, Inc.
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Designed By:	
Drawn By:	F.A.M.
Checked By:	L.E.H.
Approved By:	L.E.H.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

000016

CELL 5
AS-BUILT
TOP CLAY LAYER

Scale: 1" = 40'

Date: 9-5-2002

Sheet No. 1 OF 3

Project No. 201-225

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PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
500	481386.00	1350769.15	601.71	601.81	CELL5 TOP1.5:1B	601.86	None	8/21/02
501	481385.19	1350835.33	586.07	589.42	CELL5 TOE4:1	589.42	3.35	9/3/02
502	481384.69	1350875.82	586.55	589.73	GRID	589.71	3.16	9/3/02
503	481384.08	1350925.82	587.04	590.23	GRID	590.33	3.29	8/15/02
504	481383.47	1350975.81	587.55	590.73	GRID	590.77	3.22	8/15/02
505	481382.86	1351025.81	588.03	591.23	GRID	591.28	3.25	7/25/02
506	481382.25	1351075.81	588.57	591.73	GRID	591.77	3.20	7/25/02
507	481381.64	1351125.80	589.08	592.23	GRID	592.26	3.18	7/25/02
508	481381.03	1351175.80	589.60	592.73	GRID	592.73	3.13	7/25/02
509	481380.42	1351225.79	590.11	593.23	GRID	593.25	3.14	7/25/02
510	481379.80	1351275.79	590.55	593.73	GRID	593.81	3.26	7/25/02
511	481379.19	1351325.79	590.99	594.23	GRID	594.28	3.29	7/25/02
512	481378.58	1351375.78	591.61	594.73	GRID	594.84	3.23	7/25/02
513	481377.97	1351425.78	591.96	595.23	GRID	595.24	3.28	7/25/02
515	481376.76	1351525.78	608.67	608.84	CELL5TOP6:1	608.92	None	7/29/02
520	481336.00	1350768.54	601.38	601.44	CELL5 TOP1.5:1B	601.44	None	8/22/02
525	481334.70	1350875.21	587.09	590.21	GRID	590.20	3.11	9/3/02
526	481334.09	1350925.21	587.54	590.71	GRID	590.71	3.17	8/20/02
527	481333.48	1350975.20	588.00	591.21	GRID	591.21	3.21	8/20/02
528	481332.87	1351025.20	588.50	591.71	GRID	591.71	3.21	8/1/02
529	481332.25	1351075.19	589.04	592.21	GRID	592.25	3.21	8/1/02
530	481331.64	1351125.19	589.45	592.71	GRID	592.75	3.30	8/1/02
531	481331.03	1351175.19	590.00	593.21	GRID	593.21	3.21	7/25/02
532	481330.42	1351225.18	590.55	593.71	GRID	593.75	3.20	7/25/02
533	481329.81	1351275.18	591.03	594.21	GRID	594.32	3.29	7/25/02
534	481329.20	1351325.18	591.57	594.71	GRID	594.83	3.26	7/25/02
535	481328.59	1351375.17	592.05	595.21	GRID	595.34	3.29	7/25/02
536	481327.98	1351425.17	592.57	595.71	GRID	595.71	3.14	7/25/02
538	481326.76	1351525.17	608.33	608.46	CELL5TOP6:1	608.49	None	7/23/02
539	481286.00	1350767.93	601.06	601.06	CELL5 TOP1.5:1B	601.13	None	8/22/02
541	481284.70	1350874.60	587.95	591.21	Grid Pt.	591.21	3.26	8/22/02
542	481284.09	1350924.60	588.46	591.71	Grid Pt.	591.71	3.25	8/20/02
543	481283.48	1350974.59	588.96	592.21	Grid Pt.	592.26	3.30	8/20/02
544	481282.87	1351024.59	589.45	592.71	Grid Pt.	592.74	3.29	8/1/02
545	481282.26	1351074.59	589.94	593.21	Grid Pt.	593.24	3.30	8/1/02
546	481281.65	1351124.58	590.55	593.71	Grid Pt.	593.80	3.25	8/1/02
547	481281.04	1351174.58	590.96	594.21	Grid Pt.	594.26	3.30	8/1/02
548	481280.43	1351224.57	591.51	594.71	Grid Pt.	594.73	3.22	8/1/02
549	481279.82	1351274.57	592.02	595.21	Grid Pt.	595.21	3.19	8/1/02
550	481279.20	1351324.57	592.53	595.71	Grid Pt.	595.79	3.26	8/1/02
551	481278.59	1351374.56	593.04	596.21	Grid Pt.	596.21	3.17	8/1/02
552	481277.98	1351424.56	593.55	596.71	Grid Pt.	596.74	3.19	8/1/02
554	481276.76	1351524.55	608.00	608.09	CELL5TOP6:1	608.10	None	7/23/02
555	481236.01	1350767.32	600.53	600.69	CELL5 TOP1.5:1B	600.69	None	8/22/02
556	481235.32	1350823.99	588.59	591.71	Grid Pt.	591.73	3.14	8/22/02
557	481234.71	1350873.99	588.98	592.21	Grid Pt.	592.21	3.23	8/20/02
558	481234.10	1350923.99	589.47	592.71	Grid Pt.	592.71	3.24	8/20/02
559	481233.49	1350973.98	589.92	593.21	Grid Pt.	593.22	3.30	8/20/02
560	481232.87	1351023.98	590.44	593.71	Grid Pt.	593.71	3.27	8/1/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
561	481232.26	1351073.98	590.93	594.21	Grid Pt.	594.22	3.29	8/1/02
562	481231.65	1351123.97	591.44	594.71	Grid Pt.	594.74	3.30	8/1/02
563	481231.04	1351173.97	592.08	595.21	Grid Pt.	595.25	3.17	8/1/02
565	481230.43	1351223.96	592.48	595.71	Grid Pt.	595.72	3.24	8/1/02
566	481229.82	1351273.96	593.07	596.21	Grid Pt.	596.26	3.19	8/1/02
567	481229.21	1351323.96	593.59	596.71	Grid Pt.	596.75	3.16	8/1/02
568	481228.60	1351373.95	594.02	597.21	Grid Pt.	597.21	3.19	8/1/02
569	481227.99	1351423.95	594.46	597.71	Grid Pt.	597.71	3.25	8/1/02
571	481226.77	1351523.94	607.69	607.71	CELL5TOP6:1	607.75	None	7/23/02
572	481186.01	1350766.71	600.03	600.31	CELL5 TOP1.5:1B	600.32	None	8/26/02
573	481185.32	1350823.38	589.57	595.00	Grid Pt.	595.00	5.43	8/22/02
574	481184.71	1350873.38	590.04	595.50	Grid Pt.	595.51	5.47	7/29/02
575	481184.10	1350923.38	590.44	596.00	Grid Pt.	596.02	5.58	7/29/02
576	481183.49	1350973.37	590.92	596.50	Grid Pt.	596.50	5.58	7/29/02
578	481182.88	1351023.37	591.45	597.00	Grid Pt.	597.03	5.58	7/29/02
579	481182.27	1351073.36	592.02	597.50	Grid Pt.	597.60	5.58	7/29/02
580	481181.66	1351123.36	592.46	598.00	Grid Pt.	598.02	5.56	7/29/02
581	481181.05	1351173.36	592.95	598.50	Grid Pt.	598.50	5.55	7/29/02
582	481180.43	1351223.35	593.55	599.00	Grid Pt.	599.01	5.46	7/29/02
583	481179.82	1351273.35	594.06	599.50	Grid Pt.	599.50	5.44	7/29/02
584	481179.21	1351323.35	594.43	600.00	Grid Pt.	600.01	5.58	7/29/02
585	481178.60	1351373.34	594.97	600.50	Grid Pt.	600.51	5.54	7/29/02
586	481177.99	1351423.34	595.60	601.00	Grid Pt.	601.00	5.40	7/29/02
588	481176.77	1351523.33	607.25	607.34	CELL5TOP6:1	607.38	None	7/23/02
589	481136.02	1350766.09	599.66	599.94	CELL5 TOP1.5:1B	599.94	None	8/26/02
590	481135.29	1350825.07	586.11	589.34	CELL5 TOE4:1	589.48	3.37	8/22/02
591	481134.71	1350872.77	586.63	589.73	Grid Pt.	589.74	3.11	8/26/02
592	481134.10	1350922.77	587.11	590.23	GRID PT	590.27	3.16	8/26/02
593	481133.49	1350972.76	587.59	590.73	GRID PT	590.80	3.21	8/22/02
594	481132.88	1351022.76	588.03	591.23	GRID PT	591.28	3.25	7/31/02
595	481132.27	1351072.76	588.46	591.73	GRID PT	591.77	3.31	7/31/02
596	481131.66	1351122.75	588.98	592.23	GRID PT	592.25	3.27	7/31/02
597	481131.04	1351172.75	589.62	592.73	GRID PT	592.74	3.12	7/31/02
598	481130.43	1351222.74	589.95	593.23	GRID PT	593.32	3.37	7/31/02
599	481129.82	1351272.74	590.53	593.73	GRID PT	593.73	3.20	7/31/02
600	481129.21	1351322.74	590.99	594.23	GRID PT	594.23	3.24	7/31/02
601	481128.60	1351372.73	591.59	594.73	GRID PT	594.80	3.21	7/31/02
602	481127.99	1351422.73	592.14	595.23	GRID PT	595.23	3.09	7/31/02
603	481127.52	1351461.40	592.41	595.71	CELL5 TOE4:1	595.74	3.33	7/29/02
604	481126.78	1351522.72	606.72	606.96	CELL5TOP6:1	606.96	None	7/23/02
605	481086.02	1350765.48	599.28	599.56	CELL5 TOP1.5:1B	599.56	None	8/27/02
606	481085.27	1350826.86	585.07	588.22	CELL5 TOE4:1	not used	None	
607	481084.72	1350872.16	585.71	588.67	GRID PT not used	not used	None	
608	481084.11	1350922.15	586.07	589.17	GRID PT not used	not used	None	
609	481083.50	1350972.15	586.53	589.67	GRID PT not used	not used	None	
610	481082.89	1351022.15	587.10	590.17	GRID PT not used	not used	None	
611	481082.28	1351072.14	587.60	590.67	GRID PT not used	not used	None	
612	481081.67	1351122.14	588.01	591.17	GRID PT not used	not used	None	
613	481081.05	1351172.14	588.63	591.67	GRID PT not used	not used	None	

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
614	481080.44	1351222.13	589.15	592.17	GRID PT not used	not used	None	
615	481079.83	1351272.13	589.51	592.67	GRID PT not used	not used	None	
616	481079.22	1351322.12	589.94	593.17	GRID PT not used	not used	None	
617	481078.61	1351372.12	590.56	593.67	GRID PT not used	not used	None	
618	481078.00	1351422.12	591.13	594.17	GRID PT not used	not used	None	
619	481077.56	1351457.87	591.47	594.53	GRID PT not used	not used	None	
620	481076.78	1351522.11	606.29	606.59	CELL5TOP6:1	606.67	None	7/23/02
637	481379.83	1350875.76	586.48	589.62	TOE2%	589.67	3.19	9/3/02
638	481379.22	1350925.75	587.02	590.12	TOE2%	590.27	3.25	8/28/02
639	481378.60	1350975.75	587.46	590.62	TOE2%	590.77	3.31	8/28/02
640	481377.99	1351025.75	588.04	591.12	TOE2%	591.18	3.14	8/1/02
641	481377.38	1351075.74	588.46	591.62	TOE2%	591.72	3.26	8/1/02
642	481376.77	1351125.74	588.99	592.12	TOE2%	592.18	3.19	7/25/02
643	481376.16	1351175.73	589.49	592.62	TOE2%	592.67	3.18	7/25/02
644	481375.55	1351225.73	589.92	593.12	TOE2%	593.16	3.24	7/25/02
645	481374.94	1351275.73	590.48	593.62	TOE2%	593.67	3.19	7/25/02
646	481374.32	1351325.72	590.89	594.12	TOE2%	594.19	3.30	7/25/02
647	481373.71	1351375.72	591.46	594.62	TOE2%	594.68	3.22	7/25/02
648	481373.10	1351425.72	591.87	595.12	TOE2%	595.16	3.29	7/25/02
649	481363.82	1350875.57	586.48	589.63	TOE2%	589.68	3.20	9/3/02
650	481363.21	1350925.56	587.01	590.13	TOE2%	590.16	3.15	8/28/02
651	481362.60	1350975.56	587.48	590.63	TOE2%	590.69	3.21	8/28/02
652	481361.99	1351025.56	588.00	591.13	TOE2%	591.13	3.13	8/1/02
653	481361.38	1351075.55	588.45	591.63	TOE2%	591.67	3.22	8/1/02
654	481360.77	1351125.55	589.00	592.13	TOE2%	592.18	3.18	8/1/02
655	481360.16	1351175.54	589.48	592.63	TOE2%	592.72	3.24	7/25/02
656	481359.55	1351225.54	590.03	593.13	TOE2%	593.14	3.11	7/25/02
657	481358.94	1351275.54	590.33	593.63	TOE2%	593.63	3.30	7/26/02
658	481358.33	1351325.53	590.95	594.13	TOE2%	594.21	3.26	7/25/02
659	481357.72	1351375.53	591.44	594.63	TOE2%	594.70	3.26	7/25/02
660	481357.11	1351425.53	591.86	595.13	TOE2%	595.16	3.30	7/25/02
661	481377.60	1351456.33	592.41	595.63	CELL5 TOE4:1	595.70	3.29	7/23/02
662	481327.56	1351459.30	592.79	596.14	CELL5 TOE4:1	596.15	3.36	7/23/02
663	481277.49	1351464.42	593.95	597.19	CELL5 TOE4:1	597.24	3.29	7/23/02
664	481227.43	1351469.54	595.06	598.25	CELL5 TOE4:1	598.32	3.26	7/23/02
666	481335.23	1350831.41	586.77	589.86	CELL5 TOE4:1	590.07	3.30	9/3/02
667	481285.30	1350825.51	587.59	590.81	CELL5 TOE4:1	590.96	3.37	8/22/02
668	481235.38	1350819.61	588.51	591.75	CELL5 TOE4:1	591.80	3.29	8/22/02
671	481153.35	1350822.99	590.10	593.44	CELL5 4:1	593.46	3.36	8/22/02
672	481152.74	1350872.99	590.70	593.94	CELL5 4:1	594.08	3.38	8/22/02
673	481152.13	1350922.98	591.24	594.44	CELL5 4:1	594.44	3.20	8/22/02
674	481151.52	1350972.98	591.64	594.94	CELL5 4:1	595.00	3.36	8/22/02
675	481150.91	1351022.97	592.11	595.44	CELL5 4:1	595.49	3.38	7/31/02
676	481150.30	1351072.97	592.68	595.94	CELL5 4:1	595.99	3.31	7/31/02
677	481149.69	1351122.97	593.14	596.44	CELL5 4:1	596.44	3.30	7/31/02
678	481149.08	1351172.96	593.58	596.94	CELL5 4:1	596.95	3.37	7/31/02
679	481148.46	1351222.96	594.20	597.44	CELL5 4:1	597.48	3.28	7/31/02
680	481147.85	1351272.96	594.68	597.94	CELL5 4:1	597.94	3.26	7/31/02
681	481147.24	1351322.95	595.15	598.44	CELL5 4:1	598.46	3.31	7/31/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
682	481146.63	1351372.95	595.63	598.94	CELL5 4:1	599.01	3.38	7/31/02
683	481146.02	1351422.94	596.18	599.44	CELL5 4:1	599.47	3.29	7/31/02
684	481145.41	1351472.94	596.65	599.94	CELL5 4:1	599.94	3.29	7/29/02
709	481385.67	1350795.66	596.04	599.33	CELL5 TOP4:1	599.42	3.38	8/23/02
710	481335.68	1350795.05	595.65	598.96	CELL5 TOP4:1	599.00	3.35	8/22/02
711	481285.68	1350794.44	595.31	598.58	CELL5 TOP4:1	598.60	3.29	8/22/02
712	481235.68	1350793.83	595.05	598.21	CELL5 TOP4:1	598.25	3.20	8/22/02
713	481185.69	1350793.22	594.61	597.83	CELL5 TOP4:1	597.97	3.36	8/22/02
714	481135.69	1350792.61	594.29	597.46	CELL5 TOP4:1	597.61	3.32	8/22/02
715	481085.70	1350792.00	593.92	597.08	CELL5 TOP4:1	597.11	3.19	8/26/02
716	481385.90	1350776.95	596.53	601.65	CELL5 TOE1.5:1	601.72	5.19	8/22/02
717	481335.91	1350776.34	596.24	601.28	CELL5 TOE1.5:1	601.40	5.16	8/22/02
718	481285.91	1350775.73	595.80	600.90	CELL5 TOE1.5:1	601.08	5.28	8/22/02
719	481235.92	1350775.12	595.36	600.53	CELL5 TOE1.5:1	600.60	5.24	8/22/02
720	481185.92	1350774.51	594.98	600.15	CELL5 TOE1.5:1	600.15	5.17	8/26/02
721	481135.92	1350773.90	594.67	599.78	CELL5 TOE1.5:1	599.78	5.11	8/26/02
722	481085.93	1350773.28	594.17	599.40	CELL5 TOE1.5:1	599.40	5.23	8/26/02
752	481377.08	1351499.27	603.13	606.34	S/GCELL5TOP/SL	606.43	3.30	7/23/02
753	481327.08	1351498.66	602.70	605.97	S/GCELL5TOP/SL	606.03	3.33	7/23/02
754	481277.08	1351498.04	602.41	605.59	S/GCELL5TOP/SL	605.69	3.28	7/23/02
755	481227.09	1351497.43	602.00	605.22	S/GCELL5TOP/SL	605.33	3.33	7/23/02
756	481177.09	1351496.82	601.68	604.84	S/GCELL5TOP/SL	604.96	3.28	7/29/02
757	481127.10	1351496.21	601.24	604.47	S/GCELL5TOP/SL	604.47	3.23	7/29/02
758	481077.10	1351495.60	600.77	604.09	S/GCELL5TOP/SL	604.13	3.36	7/29/02
759	481376.85	1351517.98	603.45	608.68	CELL5TOP2%	608.69	5.24	7/23/02
760	481326.85	1351517.37	603.14	608.30	CELL5TOP2%	608.43	5.29	7/23/02
761	481276.85	1351516.76	602.66	607.93	CELL5TOP2%	608.02	5.36	7/23/02
762	481226.86	1351516.15	602.27	607.55	CELL5TOP2%	607.65	5.38	7/23/02
763	481176.86	1351515.54	602.06	607.18	CELL5TOP2%	607.34	5.28	7/23/02
764	481126.87	1351514.93	601.64	606.80	CELL5TOP2%	606.81	5.17	7/23/02
765	481076.87	1351514.32	601.18	606.43	CELL5TOP2%	606.52	5.34	7/23/02
1144	481435.99	1350769.76	601.88	602.19	S/GCELL4TOP1.5/	602.23	None	8/14/02
1145	481435.22	1350833.54	587.17	590.39	T/CCELL4TOE4/1	590.43	3.26	8/14/02
1146	481434.69	1350876.43	587.55	590.73	Cell4Grid Pt.	590.73	3.18	8/16/02
1147	481434.08	1350926.43	588.04	591.23	Cell4Grid Pt.	591.23	3.19	8/15/02
1148	481433.47	1350976.43	588.62	591.73	Cell4Grid Pt.	591.80	3.18	8/15/02
1149	481432.86	1351026.42	589.10	592.23	Cell4Grid Pt.	592.32	3.22	7/25/02
1150	481432.25	1351076.42	589.51	592.73	Cell4Grid Pt.	592.81	3.30	7/25/02
1151	481431.64	1351126.42	590.11	593.23	Cell4Grid Pt.	593.34	3.23	7/25/02
1152	481431.03	1351176.41	590.52	593.73	Cell4Grid Pt.	593.76	3.24	7/25/02
1153	481430.42	1351226.41	591.08	594.23	Cell4Grid Pt.	594.37	3.29	7/25/02
1154	481429.80	1351276.40	591.58	594.73	Cell4Grid Pt.	594.81	3.23	7/25/02
1155	481429.19	1351326.40	592.06	595.23	Cell4Grid Pt.	595.31	3.25	7/25/02
1156	481428.58	1351376.40	592.52	595.73	Cell4Grid Pt.	595.80	3.28	7/25/02
1157	481427.97	1351426.39	593.07	596.23	Cell4Grid Pt.	596.33	3.26	7/25/02
1158	481427.57	1351459.55	593.31	596.65	T/CCELL4TOE4/1	596.69	3.38	7/23/02
1159	481426.75	1351526.39	609.11	609.21	S/GCELL4TOP/SL	609.32	None	7/23/02
1243	481437.81	1350777.58	596.80	602.04	S/G Control Pt	602.14	5.34	8/14/02
1360	481427.07	1351499.88	603.50	606.72	S/GCELL4TOP/SL	606.77	3.27	7/23/02

PNT NO.	NORTH	EAST	ASBUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1361	481426.84	1351518.59	603.77	609.05	S/GCELL4TOP/SL	609.07	5.30	7/23/02
1528	481380.32	1350835.51	586.07	589.31	CELL5 TC OUTLET	589.40	3.33	8/28/02
1531	481364.32	1350834.85	586.06	589.31	CELL5 TC OUTLET	589.36	3.30	9/3/02
1532	481358.95	1350812.93	591.62	594.73	CELL5 SG OUT1/1	594.67	3.05	9/3/02
1533	481386.51	1350812.99	591.83	595.01	CELL5 SG OUT1/1	594.88	3.05	9/3/02
1608	481435.67	1350796.27	596.41	599.70	S/GCELL4TOP4/1	599.76	3.35	8/14/02
1803	481372.73	1351456.02	592.29	595.52	T/C TOE4:1	595.59	3.30	7/23/02
1804	481356.73	1351456.32	592.17	595.52	T/C TOE4:1	595.55	3.38	7/23/02
2300	481195.38	1350815.25		592.43	TOE4:1	592.44	None	8/22/02
2301	481177.77	1350797.37		596.71	N/ED INTCELLBERM	596.71	None	8/22/02
2302	481136.55	1350825.38		589.27	TOE4:1	589.42	None	8/22/02
2303	481167.77	1350796.96		596.70	S/ED INTCELLBERM	596.75	None	8/27/02
2304	481128.79	1351460.79		595.63	TOE 4:1	595.75	None	7/31/02
2305	481159.27	1351492.35		603.66	S/ED INTERBERM	603.86	None	8/2/02
2306	481169.28	1351492.16		603.66	N/ED INTERBERM	603.67	None	7/29/02
2307	481187.33	1351473.26		599.01	TOE4:1	599.04	None	7/29/02
2308	481086.06	1350783.53		599.20	TOP4:1	599.31	None	8/26/02
2309	481085.53	1350827.20		588.28	TOE4:1	588.43	None	8/26/02
2310	481077.82	1351457.50		594.58	TOE4:1	594.67	None	8/0/02
2311	481077.25	1351504.07		606.22	TOP4:1	606.37	None	7/23/02
2312	481356.76	1351455.94		595.43	TOE4:1	595.54	None	7/23/02
2313	481372.71	1351455.63		595.42	TOE4:1	595.59	None	7/23/02
2314	481069.39	1350783.33		595.87	TOP4:1	596.04	None	8/26/02
2315	481068.86	1350827.00		584.95	TOE5:1	584.95	None	8/27/02
2316	481061.15	1351457.32		591.26	TOE5:1	591.40	None	8/1/02
2317	481060.59	1351503.87		602.89	TOP4:1	603.09	None	8/3/02
2318	481060.37	1351521.90		603.26	TOP2%BL BERM	603.46	None	8/3/02
2319	481077.03	1351522.11		606.59	TOP2%BL BERM	606.67	None	7/23/02
2320	481086.28	1350765.49		599.56	TOP2%BL BERM	599.56	None	8/27/02
2321	481069.61	1350765.29		596.23	TOP2%BL BERM	596.43	None	8/27/02
2525	481380.28	1350835.87		589.23	TOE4:1	589.31	None	9/3/02
2526	481364.35	1350835.21		589.22	TOE4:1	589.27	None	9/3/02
2600	481195.28	1350823.50		592.51	TOE4:1	592.61	None	8/22/02
2601	481177.45	1350823.28		596.97	TOP 4:1	596.97	None	8/22/02
2602	481194.67	1350873.50		593.01	TOE 4:1	593.01	None	7/29/02
2603	481176.84	1350873.28		597.47	TOP 4:1	597.54	None	7/29/02
2604	481194.06	1350923.50		593.51	TOE 4:1	593.59	None	7/29/02
2605	481176.23	1350923.28		597.97	TOP 4:1	598.11	None	7/29/02
2606	481193.44	1350973.49		594.01	TOE 4:1	594.01	None	7/29/02
2607	481175.62	1350973.27		598.47	TOP 4:1	598.56	None	7/29/02
2608	481192.83	1351023.49		594.51	TOE 4:1	594.52	None	7/29/02
2609	481175.01	1351023.27		598.97	TOP 4:1	598.97	None	7/29/02
2610	481192.22	1351073.48		595.01	TOE 4:1	595.11	None	7/29/02
2611	481174.40	1351073.26		599.47	TOP 4:1	599.62	None	7/29/02
2612	481191.61	1351123.48		595.51	TOE 4:1	595.58	None	7/29/02
2613	481173.79	1351123.26		599.97	TOP 4:1	600.14	None	7/29/02
2614	481191.00	1351173.48		596.00	TOE 4:1	596.01	None	7/29/02
2615	481173.18	1351173.26		600.47	TOP 4:1	600.47	None	7/29/02
2616	481190.39	1351223.47		596.51	TOE 4:1	596.51	None	7/29/02

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NOTE:

NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/- 0.01' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

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

Lynn Edward Hirsch 9-5-2002

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Checked By: L.E.H.
Approved By: L.E.H.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5
AS-BUILT
TOP CLAY LAYER

Scale:
Date: 9-5-2002
Sheet No. 2 OF 3
Project No. 201-225

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PNT NO	NORTH	EAST	AS BUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2617	481172.67	1351223.25		600.97	TOP 4:1	600.98	None	7/2/02
2618	481189.77	1351273.47		597.00	TOE 4:1	597.05	None	7/2/02
2619	481171.95	1351273.25		601.47	TOP 4:1	601.48	None	7/2/02
2620	481189.16	1351323.47		597.50	TOE 4:1	597.54	None	7/2/02
2621	481171.34	1351323.25		601.97	TOP 4:1	602.08	None	7/2/02
2622	481188.55	1351373.46		598.00	TOE 4:1	598.00	None	7/2/02
2623	481170.73	1351373.24		602.47	TOP 4:1	602.57	None	7/2/02
2624	481187.94	1351423.46		598.50	TOE 4:1	598.54	None	7/2/02
2625	481170.12	1351423.24		602.97	TOP 4:1	602.97	None	7/2/02
2626	481169.50	1351474.56		603.47	TOP 4:1	603.52	None	7/2/02
2627	481167.45	1350823.16		596.97	TOE 4:1	596.97	None	8/2/02
2628	481166.84	1350873.16		597.47	TOP 4:1	597.48	None	8/2/02
2629	481166.23	1350923.16		597.97	TOP 4:1	598.03	None	7/2/02
2630	481165.62	1350973.15		598.47	TOP 4:1	598.47	None	7/2/02
2631	481165.01	1351023.15		598.97	TOP 4:1	598.97	None	7/2/02
2632	481164.39	1351073.14		599.47	TOP 4:1	599.61	None	7/2/02
2633	481163.78	1351123.14		599.97	TOP 4:1	600.05	None	7/2/02
2634	481163.17	1351173.14		600.47	TOP 4:1	600.47	None	7/2/02
2635	481162.56	1351223.13		600.97	TOP 4:1	600.97	None	7/2/02
2636	481161.95	1351273.13		601.47	TOP 4:1	601.62	None	7/2/02
2637	481161.34	1351323.13		601.97	TOP 4:1	602.15	None	7/2/02
2638	481160.73	1351373.12		602.47	TOP 4:1	602.55	None	7/2/02
2639	481160.12	1351423.12		602.97	TOP 4:1	603.15	None	7/2/02
2640	481159.49	1351474.44		603.47	TOP 4:1	603.56	None	7/2/02
2641	481136.97	1350872.78		589.74	TOE 4:1	589.74	None	8/2/02
2642	481136.36	1350922.78		590.24	TOE 4:1	590.27	None	8/2/02
2643	481134.75	1350972.77		590.74	TOE 4:1	590.80	None	8/2/02
2644	481134.14	1351022.77		591.24	TOE 4:1	591.30	None	7/31/02
2645	481133.53	1351072.76		591.74	TOE 4:1	591.83	None	7/31/02
2646	481132.92	1351122.76		592.24	TOE 4:1	592.34	None	7/31/02
2647	481132.31	1351172.76		592.74	TOE 4:1	592.91	None	7/31/02
2648	481131.70	1351222.75		593.24	TOE 4:1	593.38	None	7/31/02
2649	481131.09	1351272.75		593.74	TOE 4:1	593.87	None	7/31/02
2650	481130.48	1351322.75		594.24	TOE 4:1	594.42	None	7/31/02
2651	481129.87	1351372.74		594.74	TOE 4:1	594.91	None	7/31/02
2652	481129.25	1351422.74		595.24	TOE 4:1	595.27	None	7/31/02
2653	481084.96	1350872.16		588.73	TOP 5:1	588.90	None	8/26/02
2654	481084.37	1350922.16		589.23	TOP 5:1	589.26	None	8/26/02
2655	481083.76	1350972.15		589.73	TOP 5:1	589.79	None	8/26/02
2656	481083.15	1351022.15		590.23	TOP 5:1	590.31	None	8/1/02
2657	481082.53	1351072.15		590.73	TOP 5:1	590.83	None	8/1/02
2658	481081.92	1351122.14		591.23	TOP 5:1	591.40	None	8/1/02
2659	481081.31	1351172.14		591.73	TOP 5:1	591.73	None	8/1/02
2660	481080.70	1351222.13		592.23	TOP 5:1	592.25	None	8/1/02
2661	481080.09	1351272.13		592.73	TOP 5:1	592.73	None	8/1/02
2662	481079.48	1351322.13		593.23	TOP 5:1	593.31	None	8/1/02
2663	481078.86	1351372.12		593.73	TOP 5:1	593.90	None	8/1/02
2664	481078.25	1351422.12		594.23	TOP 5:1	594.27	None	8/1/02
2665	461068.31	1350871.96		585.58	TOE 5:1	585.40	None	8/26/02

PNT NO	NORTH	EAST	AS BUILT S/GELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2666	481067.70	1350921.96		588.90	TOP 4:1	588.96	None	8/26/02
2667	481067.09	1350971.95		588.40	TOE 5:1	588.40	None	8/26/02
2668	481066.48	1351021.95		588.90	TOE 5:1	588.94	None	8/1/02
2669	481065.86	1351071.94		587.40	TOE 5:1	587.52	None	8/1/02
2670	481065.25	1351121.94		587.90	TOE 5:1	588.09	None	8/1/02
2671	481064.64	1351171.94		588.40	TOE 5:1	588.41	None	8/1/02
2672	481064.03	1351221.93		588.90	TOE 5:1	589.09	None	8/1/02
2673	481063.42	1351271.93		589.40	TOE 5:1	589.56	None	8/1/02
2674	481062.81	1351321.93		589.90	TOE 5:1	590.05	None	8/1/02
2675	481062.19	1351371.92		590.40	TOE 5:1	590.46	None	8/1/02
2676	481061.58	1351421.92		590.90	TOE 5:1	591.06	None	8/1/02
2677	481435.21	1350883.90		590.30	TOE 4:1	590.41	None	8/14/02
2678	481438.19	1350836.69		589.33	TOE 4:1	589.42	None	9/3/02
2679	481433.23	1350831.77		589.77	TOE 4:1	589.89	None	8/22/02
2680	481438.30	1350825.67		590.72	TOE 4:1	590.88	None	8/22/02
2681	481439.37	1350819.97		591.66	TOE 4:1	591.66	None	8/22/02
2682	481436.77	1350787.81		601.80	TOP 4:1	601.92	None	8/14/02
2683	481438.78	1350787.19		601.45	TOP 4:1	601.55	None	8/21/02
2684	481438.78	1350786.58		601.07	TOP 4:1	601.25	None	8/22/02
2685	481438.78	1350785.97		600.70	TOP 4:1	600.70	None	8/22/02
2686	481438.79	1350785.36		600.32	TOP 4:1	600.38	None	8/22/02
2687	481438.79	1350784.75		599.95	TOP 4:1	600.01	None	8/26/02
2688	481438.80	1350784.14		599.57	TOP 4:1	599.57	None	8/26/02
2689	481437.57	1351459.16		596.66	TOE 4:1	596.65	None	7/23/02
2690	481437.60	1351456.95		595.54	TOE 4:1	595.68	None	7/23/02
2691	481437.57	1351458.92		596.05	TOE 4:1	596.11	None	7/23/02
2692	481277.50	1351464.04		597.10	TOE 4:1	597.21	None	7/23/02
2693	481227.44	1351469.16		598.16	TOE 4:1	598.30	None	7/23/02
2694	481428.97	1351508.35		608.84	TOP 4:1	608.89	None	7/23/02
2695	481376.98	1351507.73		608.47	TOP 4:1	608.46	None	7/23/02
2696	481326.98	1351507.12		608.09	TOP 4:1	608.09	None	7/23/02
2697	481276.98	1351506.51		607.72	TOP 4:1	607.73	None	7/23/02
2698	481226.99	1351505.90		607.34	TOP 4:1	607.34	None	7/23/02
2699	481176.99	1351505.29		606.97	TOP 4:1	607.10	None	7/23/02
2700	481125.99	1351504.68		606.59	TOP 4:1	606.78	None	7/23/02

NOTE:
NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/- 0.05' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

000018

4944

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5
AS-BUILT
TOP CLAY LAYER

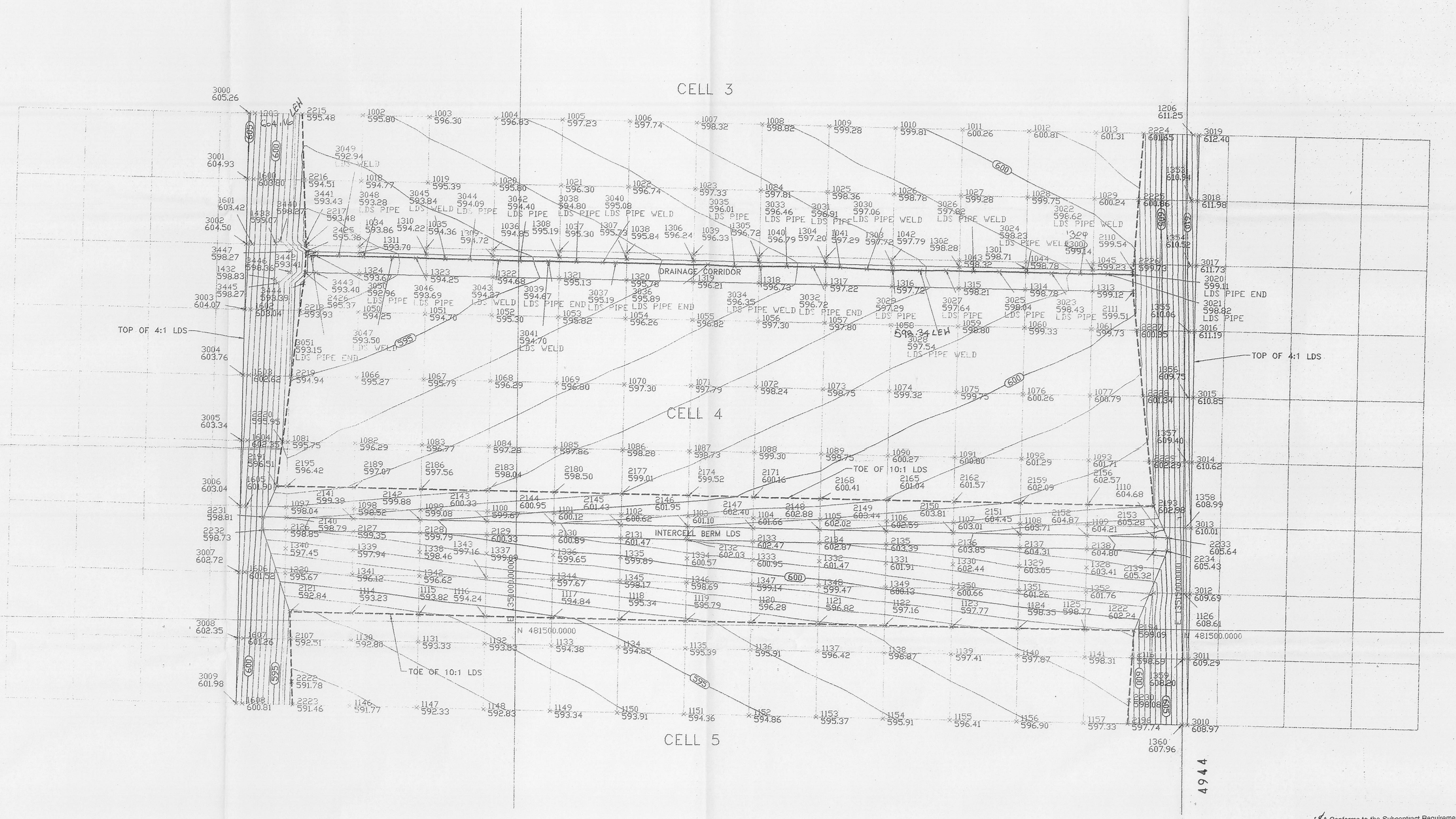
Scale:
Date: 9-5-2002
Sheet No. 3 OF 3
Project No. 201-225

REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
HYDROGEOLOGY & LAND SURVEYING
7010 MILITARY TRAIL, FLORENCE, KENTUCKY 41042
Tel: (859)342-6180 Fax: (859)342-6188 Email: de@deestesengineering.com
www.deestesengineering.com

STATE OF OHIO
LYNN E. HIRSCH
S-6798
SURVEYOR
9-5-2002
Lynn Edward Hirsch



LEGEND:

- 2100 619.21 = ELEVATION AND POINT NUMBER
- ——— = AS-BUILT INDEX CONTOUR
- ——— = AS-BUILT INTERMEDIATE CONTOUR
- - - - - = TOE OF SLOPES

NOTE:

POINTS LESS THAN 3000 ARE SUBGRADE AND TOP CLAY SHOTS WITH ADJUSTED ELEVATIONS FOR THE TOP OF LDS LAYER. AND, POINTS ABOVE 3000 WERE COMPUTED FROM TYPICAL SECTIONS FURNISHED BY FLUOR FERNALD, INC.

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

[X] A-Conforms to the Subcontract Requirements
[ ] B-Minor Comment - Incorporate and Resubmit
[ ] C-Revise and Resubmit
Sig: [signature] Date: 10/1/02

STATE OF OHIO
LYNN E. HIRSCH
S-5738
SURVEYOR
Lynn Edward Hirsch
9-30-2002

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
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Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

CELL 4
AS-BUILT
LDS

Scale: 1" = 40'
Date: 9-30-2002
Sheet No. 1 OF 2
Project No. 201-225

000021

4944

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Y:\201\225\DWG\CELL4 LDS.DWG

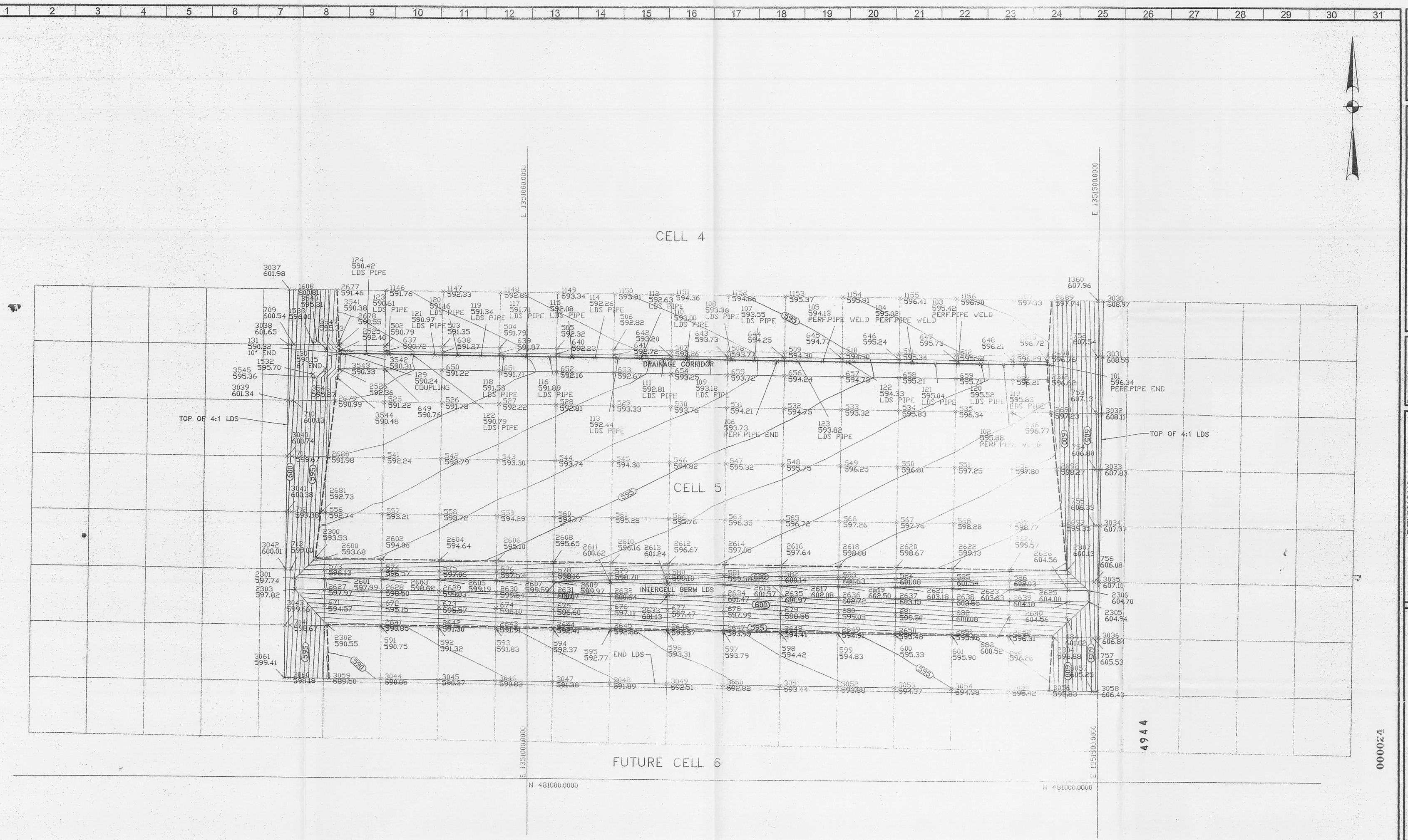
PNT NO.	NORTH	EAST	ASBUILT T/C ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1002	481884.66	1350881.93	594.74	595.74	Grid Pt.	595.80	1.06	9/17/02
1003	481884.04	1350931.93	595.28	596.28	Grid Pt.	596.30	1.02	9/17/02
1004	481883.43	1350981.93	595.83	596.83	Grid Pt.	596.83	1.00	9/17/02
1005	481882.82	1351031.92	596.23	597.23	Grid Pt.	597.23	1.00	9/17/02
1006	481882.21	1351081.92	596.73	597.73	Grid Pt.	597.74	1.01	9/17/02
1007	481881.60	1351131.91	597.25	598.25	Grid Pt.	598.32	1.07	9/11/02
1008	481880.99	1351181.91	597.81	598.81	Grid Pt.	598.82	1.01	9/11/02
1009	481880.38	1351231.91	598.27	599.27	Grid Pt.	599.28	1.01	9/11/02
1010	481879.77	1351281.90	598.75	599.75	Grid Pt.	599.81	1.06	9/4/02
1011	481879.15	1351331.90	599.26	600.26	Grid Pt.	600.26	1.00	9/4/02
1012	481878.54	1351381.90	599.75	600.75	Grid Pt.	600.81	1.06	9/4/02
1013	481877.93	1351431.89	600.23	601.23	Grid Pt.	601.31	1.08	9/4/02
1018	481834.66	1350881.32	593.73	594.73	Grid Pt.	594.77	1.04	9/17/02
1019	481834.05	1350931.32	594.39	595.39	Grid Pt.	595.39	1.00	9/17/02
1020	481833.44	1350981.32	594.77	595.77	Grid Pt.	595.80	1.03	9/17/02
1021	481832.83	1351031.31	595.29	596.29	GRID PT	596.30	1.01	9/17/02
1022	481832.21	1351081.31	595.74	596.74	Grid Pt.	596.74	1.00	9/17/02
1023	481831.60	1351131.30	596.25	597.25	Grid Pt.	597.33	1.08	9/11/02
1024	481830.99	1351181.30	596.74	597.74	Grid Pt.	597.81	1.07	9/11/02
1025	481830.38	1351231.30	597.35	598.35	Grid Pt.	598.36	1.01	9/11/02
1026	481829.77	1351281.29	597.74	598.74	Grid Pt.	598.78	1.04	9/11/02
1027	481829.16	1351331.29	598.24	599.24	Grid Pt.	599.28	1.04	9/5/02
1028	481828.55	1351381.29	598.74	599.74	Grid Pt.	599.75	1.01	9/4/02
1029	481827.94	1351431.28	599.24	600.24	Grid Pt.	600.24	1.00	9/4/02
1034	481784.66	1350880.71	592.76	593.76	Grid Pt.	593.86	1.10	9/18/02
1035	481784.05	1350930.71	593.27	594.27	Grid Pt.	594.36	1.09	9/18/02
1036	481783.44	1350980.71	593.75	594.75	Grid Pt.	594.85	1.10	9/18/02
1037	481782.83	1351030.70	594.30	595.30	Grid Pt.	595.30	1.00	9/18/02
1038	481782.22	1351080.70	594.79	595.79	Grid Pt.	595.84	1.05	9/18/02
1039	481781.61	1351130.69	595.28	596.28	Grid Pt.	596.33	1.05	9/11/02
1040	481781.00	1351180.69	595.75	596.75	Grid Pt.	596.79	1.04	9/11/02
1041	481780.38	1351230.69	596.29	597.29	Grid Pt.	597.29	1.00	9/11/02
1042	481779.77	1351280.68	596.78	597.78	Grid Pt.	597.79	1.01	9/11/02
1043	481779.16	1351330.68	597.26	598.26	Grid Pt.	598.32	1.06	9/5/02
1044	481778.55	1351380.68	597.75	598.75	Grid Pt.	598.78	1.03	9/5/02
1045	481777.94	1351430.67	598.23	599.23	Grid Pt.	599.23	1.00	9/4/02
1050	481734.67	1350880.10	593.23	594.23	GRID PNT	594.25	1.02	9/18/02
1051	481734.06	1350930.09	593.70	594.70	Grid Pt.	594.70	1.00	9/17/02 9/18/02 LEH
1052	481733.44	1350980.09	594.20	595.20	GRID PNT	595.30	1.10	9/18/02
1053	481732.83	1351030.09	594.72	595.72	GRID PNT	595.82	1.10	9/18/02
1054	481732.22	1351080.08	595.21	596.21	GRID PNT	596.26	1.05	9/18/02
1055	481731.61	1351130.08	595.72	596.72	GRID PNT	596.82	1.10	9/12/02
1056	481731.00	1351180.07	596.20	597.20	GRID PNT	597.30	1.10	9/12/02
1057	481730.39	1351230.07	596.70	597.70	GRID PNT	597.80	1.10	9/12/02
1058	481729.78	1351280.07	597.28	598.28	GRID PNT	598.34	1.06	9/11/02
1059	481729.17	1351330.06	597.70	598.70	GRID PNT	598.80	1.10	9/5/02
1060	481728.56	1351380.06	598.29	599.29	GRID PNT	599.33	1.04	9/5/02
1061	481727.95	1351430.06	598.71	599.71	GRID PNT	599.73	1.02	9/4/02
1066	481684.67	1350879.49	594.21	595.21	GRID PNT	595.27	1.06	9/18/02

PNT NO.	NORTH	EAST	ASBUILT T/C ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1067	481684.06	1350929.48	594.70	595.70	Grid Pt.	595.79	1.09	9/18/02
1068	481683.45	1350979.48	595.21	596.21	GRID PNT	596.29	1.08	9/18/02
1069	481682.84	1351029.48	595.70	596.70	GRID PNT	596.80	1.10	9/18/02
1070	481682.23	1351079.47	596.20	597.20	GRID PNT	597.30	1.10	9/18/02
1071	481681.62	1351129.47	596.71	597.71	GRID PNT	597.79	1.08	9/12/02
1072	481681.01	1351179.46	597.20	598.20	GRID PNT	598.24	1.04	9/12/02
1073	481680.39	1351229.46	597.71	598.71	GRID PNT	598.75	1.04	9/12/02
1074	481679.78	1351279.46	598.23	599.23	GRID PNT	599.32	1.09	9/12/02
1075	481679.17	1351329.45	598.71	599.71	GRID PNT	599.75	1.04	9/5/02
1076	481678.56	1351379.45	599.22	600.22	GRID PNT	600.26	1.04	9/5/02
1077	481677.95	1351429.45	599.79	600.79	GRID PNT	600.79	1.00	9/4/02
1081	481635.29	1350828.88	594.74	595.74	Grid Pt.	595.75	1.01	9/18/02
1082	481634.67	1350878.88	595.21	596.21	GRID PNT	596.29	1.08	9/18/02
1083	481634.06	1350928.87	595.71	596.71	Grid Pt.	596.77	1.06	9/18/02
1084	481633.45	1350978.87	596.22	597.22	GRID PNT	597.28	1.06	9/18/02
1085	481632.84	1351028.87	596.77	597.77	GRID PNT	597.86	1.09	9/18/02
1086	481632.23	1351078.86	597.22	598.22	GRID PNT	598.28	1.06	9/18/02
1087	481631.62	1351128.86	597.70	598.70	GRID PNT	598.73	1.03	9/12/02
1088	481631.01	1351178.85	598.21	599.21	GRID PNT	599.30	1.09	9/12/02
1089	481630.40	1351228.85	598.71	599.71	GRID PNT	599.75	1.04	9/12/02
1090	481629.79	1351278.85	599.20	600.20	GRID PNT	600.27	1.07	9/12/02
1091	481629.18	1351328.84	599.71	600.71	GRID PNT	600.80	1.09	9/5/02
1092	481628.57	1351378.84	600.27	601.27	GRID PNT	601.29	1.02	9/5/02
1093	481627.96	1351428.84	600.70	601.70	GRID PNT	601.71	1.01	9/4/02
1097	481585.29	1350828.27	596.96	597.97	Grid Pt.	598.04	1.08	9/18/02
1098	481584.68	1350878.27	597.50	598.51	GRID PNT	598.52	1.02	9/18/02
1099	481584.07	1350928.26	598.01	599.02	Grid Pt.	599.08	1.07	9/18/02
1100	481583.46	1350978.26	598.56	599.57	GRID PNT	599.67	1.11	9/18/02
1101	481582.85	1351028.26	599.08	600.09	GRID PNT	600.12	1.04	9/18/02
1102	481582.23	1351078.25	599.53	600.54	GRID PNT	600.62	1.09	9/18/02
1103	481581.62	1351128.25	600.09	601.10	GRID PNT	601.10	1.01	9/13/02
1104	481581.01	1351178.24	600.64	601.65	GRID PNT	601.66	1.02	9/12/02
1105	481580.40	1351228.24	601.01	602.02	GRID PNT	602.02	1.01	9/12/02
1106	481579.79	1351278.24	601.58	602.59	GRID PNT	602.59	1.01	9/12/02
1107	481579.18	1351328.23	601.99	603.00	GRID PNT	603.01	1.02	9/5/02
1108	481578.57	1351378.23	602.60	603.61	GRID PNT	603.71	1.11	9/4/02
1109	481577.96	1351428.23	603.13	604.14	GRID PNT	604.21	1.08	9/4/02
1110	481577.33	1351479.55	603.65	604.66	S/GCELL4TOE	604.68	1.03	9/4/02
1114	481505.84	1350877.32	592.22	593.23	Toe 10%	593.23	1.01	9/19/02
1115	481505.23	1350927.30	592.72	593.73	Toe 10%	593.82	1.10	9/19/02
1116	481504.62	1350977.30	593.23	594.24	Toe 10%	594.24	1.01	9/19/02
1117	481504.01	1351027.30	593.74	594.75	Toe 10%	594.84	1.10	9/18/02
1118	481503.39	1351077.29	594.23	595.24	Toe 10%	595.34	1.11	9/18/02
1119	481502.78	1351127.29	594.74	595.75	Toe 10%	595.79	1.05	9/13/02
1120	481502.17	1351177.28	595.27	596.28	Toe 10%	596.28	1.01	9/13/02
1121	481501.56	1351227.28	595.78	596.79	Toe 10%	596.82	1.04	9/13/02
1122	481500.95	1351277.28	596.15	597.16	Toe 10%	597.16	1.01	9/13/02
1123	481500.34	1351327.27	596.70	597.71	Toe 10%	597.77	1.07	9/13/02
1124	481499.73	1351377.27	597.25	598.26	Toe 10%	598.35	1.10	9/4/02

PNT NO.	NORTH	EAST	ASBUILT T/C ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1125	481499.12	1351427.27	597.72	598.73	Toe 10%	598.77	1.05	9/4/02
1126	481527.07	1351501.10	607.48	608.51	S/GCELL4TOP/SL	608.61	1.13	9/4/02
1130	481484.69	1350877.05	591.77	592.77	Grid Pt.	592.80	1.03	9/19/02
1131	481484.08	1350927.04	592.23	593.23	Grid Pt.	593.33	1.10	9/19/02
1132	481483.47	1350977.04	592.76	593.76	Grid Pt.	593.83	1.07	9/19/02
1133	481482.86	1351027.03	593.34	594.34	Grid Pt.	594.38	1.04	9/19/02
1134	481482.24	1351077.03	593.81	594.81	Grid Pt.	594.85	1.04	9/19/02
1135	481481.63	1351127.03	594.32	595.32	Grid Pt.	595.39	1.07	9/13/02
1136	481481.02	1351177.02	594.82	595.82	Grid Pt.	595.91	1.09	9/13/02
1137	481480.41	1351227.02	595.32	596.32	Grid Pt.	596.42	1.10	9/13/02
1138	481479.80	1351277.02	595.82	596.82	Grid Pt.	596.87	1.05	9/13/02
1139	481479.19	1351327.01	596.31	597.31	Grid Pt.	597.41	1.10	9/13/02
1140	481478.58	1351377.01	596.81	597.81	Grid Pt.	597.87	1.06	9/13/02
1141	481477.97	1351427.00	597.23	598.23	Grid Pt.	598.31	1.08	9/4/02
1146	481434.69	1350876.43	590.73	591.73	Grid Pt.	591.77	1.04	9/20/02
1147	481434.08	1350926.43	591.23	592.23	Grid Pt.	592.33	1.10	9/19/02
1148	481433.47	1350976.43	591.80	592.80	Grid Pt.	592.83	1.03	9/19/02
1149	481432.86	1351026.42	592.32	593.32	Grid Pt.	593.34	1.02	9/19/02
1150	481432.25	1351076.42	592.81	593.81	Grid Pt.	593.91	1.10	9/18/02
1151	481431.64	1351126.42	593.34	594.34	Grid Pt.	594.36	1.02	9/13/02
1152	481431.03	1351176.41	593.76	594.76	Grid Pt.	594.86	1.10	9/13/02
1153	481430.42	1351226.41	594.37	595.37	Grid Pt.	595.37	1.00	9/13/02
1154	481429.80	1351276.40	594.81	595.81	Grid Pt.	595.91	1.10	9/13/02
1155	481429.19	1351326.40	595.31	596.31	Grid Pt.	596.41	1.10	9/13/02
1156	481428.58	1351376.40	595.80	596.80	Grid Pt.	596.90	1.10	9/13/02
1157	481427.97	1351426.39	596.33	597.33	Grid Pt.	597.33	1.00	9/4/02
1203	481885.64	1350801.78	603.08	604.11	S/GCONT.PTS	604.16	1.08	9/17/02
1206	481877.04	1351505.38	610.16	611.19	S/GCONT.PTS	611.25	1.09	9/4/02
1220	481535.29	1350827.66	594.62	595.63	GRID PT 10%	595.67	1.05	9/19/02
1222	481527.35	1351478.09	601.11	602.14	GRID PT 10%	602.24	1.13	9/4/02
1300	481773.07	1351430.61	598.14	599.14	S/GCELL4	599.14	1.00	9/4/02
1301	481773.68	1351380.62	597.64	598.64	S/GCELL4	598.71	1.07	9/5/02
1302	481774.29	1351330.62	597.18	598.18	S/GCELL4	598.28	1.10	9/5/02
1303	481774.90	1351280.62	596.63	597.63	S/GCELL4	597.72	1.09	9/11/02
1304	481775.52	1351230.63	596.16	597.16	S/GCELL4	597.20	1.04	9/11/02
1305	481776.13	1351180.63	595.69	596.69	S/GCELL4	596.72	1.03	9/11/02
1306	481776.74	1351130.63	595.15	596.15	S/GCELL4	596.24	1.09	9/11/02
1307	481777.35	1351080.64	594.63	595.63	S/GCELL4	595.73	1.10	9/18/02
1308	481777.96	1351030.64	594.19	595.19	S/GCELL4	595.19	1.00	9/18/02
1309	481778.57	1350980.65	593.72	594.72	S/GCELL4	594.72	1.00	9/18/02
1310	481779.18	1350930.65	593.17	594.17	S/GCELL4	594.22	1.05	9/18/02
1311	481779.79	1350880.65	592.66	593.66	S/GCELL4	593.70	1.04	9/18/02
1313	481757.08	1351430.41	598.12	599.12	S/GCELL4	599.12	1.00	9/4/02
1314	481757.69	1351380.42	597.72	598.72	S/GCELL4	598.78	1.06	9/5/02
1315	481758.30	1351330.42	597.19	598.19	S/GCELL4	598.21	1.02	9/5/02
1316	481758.91	1351280.42	596.63	597.63	S/GCELL4	597.72	1.09	9/12/02
1317	481759.52	1351230.43	596.16	597.16	S/GCELL4	597.22	1.06	9/12/02
1318	481760.13	1351180.43	595.63	596.63	S/GCELL4	596.73	1.10	9/12/02
1319	481760.74	1351130.43	595.17	596.17	S/GCELL4	596.21	1.04	9/12/02

PNT NO.	NORTH	EAST	ASBUILT T/C ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1320	481761.35	1351080.44	594.70	595.70	S/GCELL4	595.78	1.08	9/18/02
1321	481761.96	1351030.44	594.13	595.13	S/GCELL4	595.13	1.00	9/18/02
1322	481762.57	1350980.45	593.62	594.62	S/GCELL4	594.68	1.06	9/18/02
1323	481763.18	1350930.45	593.20	594.20	S/GCELL4	594.25	1.05	9/18/02
1324	481763.79	1350880.45	592.62	593.62	S/GCELL4	593.67	1.05	9/18/02
1328	481545.99	1351427.84	602.35	603.36	GRID PNT	603.41	1.06	9/4/02
1329	481546.60	1351377.84	601.98	602.99	SG TOP	603.05	1.07	9/4/02
1330	481547.21	1351327.84	601.37	602.38	SG TOP	602.44	1.07	9/13/02
1331	481547.82	1351277.85	600.83	601.84	S/GCELL4TOP/SL	601.91	1.08	9/13/02
1332	481548.43	1351227.85	600.44	601.45	S/GCELL4TOP	601.47	1.03	9/13/02
1333	481549.05	1351177.85	599.94	600.95	S/GCELL4TOP/SL	600.95	1.01	9/13/02
1334	481549.66	1351127.86	599.51	600.52	S/GCELL4TOP/SL	600.57	1.06	9/13/02
1335	481550.27	1351077.86	598.83	599.84	S/GCELL4TOP	599.89	1.06	9/18/02
1336	481550.88	1351027.87	598.55	599.56	S/GCELL4TOP	599.65	1.10	9/18/02
1337	481551.49	1350977.87	598.02	599.03	S/GCELL4TOP/SL	599.09	1.07	9/18/02
1338	481552.10	1350927.87	597.37	598.38	S/GCELL4TOP/SL	598.46	1.09	9/19/02
1339	481552.71	1350877.88	596.85	597.86	S/GCELL4TOP/SL	597.94	1.09	9/19/02
1340	481553.32	1350827.88	596.36	597.37	S/GCELL4TOP/SL	597.45	1.09	9/19/02
1341	481534.68	1350877.66	595.11	596.12	GRID PT 10%	596.12	1.01	9/19/02
1342	481534.07	1350927.65	595.59	596.60	GRID PT 10%	596.62	1.03	9/19/02
1343	481533.46	1350977.65	596.06	597.07	GRID PT 10%	597.16	1.10	9/18/02
1344	481532.85	1351027.65	596.56	597.57	GRID PT 10%	597.67	1.11	9/18/02
1345	481532.24	1351077.64	597.11	598.12	GRID PT 10%	598.17	1.06	9/18/02
1346	481531.63	1351127.64	597.64	598.65	GRID PT 10%	598.69	1.05	9/13/02
1347	481531.02	1351177.63	598.13	599.14	GRID PT 10%	599.14	1.01	9/13/02
1348	481530.40	1351227.63	598.39	599.40	GRID PT 10%	599.47	1.08	9/13/02
1349	481529.79	1351277.63	599.04	600.05	GRID PT 10%	600.13	1.09	9/13/02
1350	481529.18	1351327.62	599.55	600.56	GRID PT 10%	600.66	1.11	9/13/02
1351	481528.57	1351377.62	600.15	601.16	GRID PT 10%	601.26	1.11	9/4/02
1352	481527.96	1351427.62	600.69	601.70	GRID PT 10%	601.76	1.07	9/4/02
1353	481827.04	1351504.77	609.81	610.84	S/GCELL4TOP/SL	610.94	1.13	9/4/02
1354	481777.05	1351504.16	609.42	610.45	S/GCELL4TOP/SL	610.52	1.10	9/4/02
1355	481727.05	1351503.55	608.97	610.00	S/GCELL4TOP/SL	610.06	1.09	9/4/02
1356	481677.05	1351502.93	608.62	609.65	S/GCELL4TOP/SL	609.75	1.13	9/4/02
1357	481627.06	1351502.32	608.31	609.34	S/GCELL4TOP/SL	609.40	1.09	9/4/02
1358	481577.06	1351501.71	607.87	608.90	S/GCELL4TOP/SL	608.99	1.12	9/4/02
1359	481477.07	1351500.49	607.12	608.15	S/GCELL4TOP/SL	608.20	1.08	9/4/02
1360	481427.07	1351499.88	606.91	607.94	S/GCELL4TOP/SL	607.96	1.05	9/4/02
1432	481758.92	1350817.82	597.73	598.76	C4 SG ELLOUT	598.83	1.10	9/18/02
1433	481786.48	1350817.88	598.04	599.07	C4 SG ELLOUT	599.07	1.03	9/18/02
1600	481835.64	1350801.17	602.71	603.74	S/GCELL4TOP/4/1	603.80	1.09	9/17/02
1601	481785.65	1350800.56	602.39	603.42	S/GCELL4TOP/4/1	603.42	1.03	9/17/02
1602	481735.65	1350799.94	601.96	602.99	S/GCELL4TOP/4/1	603.04	1.08	9/17/02
1603	481685.65	1350799.33	601.58	602.61	S/GCELL4TOP/4/1	602.62	1.04	9/17/02
1604	481635.66	1350798.72	601.22	602.25	S/GCELL4TOP/4/1	602.35	1.13	9/17/02
1605	481585.66	1350798.11	600.87	601.90	S/GCELL4TOP/4/1	601.90	1.1[illegible]	9/17/02
1606	481535.67	1350797.50	600.48	601.51	S/GCELL4TOP/4/1	601.52	[illegible]	9/19/02
1607	481485.67	1350796.88	600.14	601.17	S/GCELL4TOP/4/1	601.26	1.1[illegible]	9/19/02
1608	481435.67	1350796.27	599.76	600.79	S/GCELL4TOP/4/1	600.8[illegible]	1.05	9/26/02

PNT NO.	NORTH	EAST	ASBUILT T/C ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2107	481485.50	1350832.09	591.41	592.44	Toe4:1 Cell4tc	592.51	1.10	9/19/02
2110	481772.68	1351460.52	598.42	599.45	Toe4:1Cell4tc	599.54	1.12	9/4/02
2111	481756.73	1351460.83	598.43	599.46	Toe4:1Cell4tc	599.51	1.08	9/4/02
2116	481477.79	1351462.40	597.59	598.62	T/CCell4-Control Pt	598.69	1.10	9/4/02
2121	481506.41	1350831.34	591.74	592.77	Toe 10%	592.84	1.10	9/19/02
2126	481567.42	1350828.05	597.75	598.75	Top/SLIntercell4	598.85	1.10	9/19/02
2127	481566.81	1350878.05	598.30	599.30	Top/SLIntercell4	599.35	1.05	9/19/02
2128	481566.20	1350928.04	598.79	599.79	Top/SLIntercell4	599.79	1.00	9/19/02
2129	481565.59	1350978.04	599.27	600.27	Top/SLIntercell4	600.33	1.06	9/18/02
2130	481564.98	1351028.04	599.89	600.89	Top/SLIntercell4	600.89	1.00	9/18/02
2131	481564.36	1351078.03	600.37	601.37	Top/SLIntercell4	601.47	1.10	9/18/02
2132	481563.75	1351128.03	600.93	601.93	Top/SLIntercell4	602.03	1.10	9/13/02
2133	481563.14	1351178.02	601.38	602.38	Top/SLIntercell4	602.47	1.09	9/12/02
2134	481562.53	1351228.02	601.86	602.86	Top/SLIntercell4	602.87	1.01	9/12/02
2135	481561.92	1351278.02	602.37	603.37	Top/SLIntercell4	603.39	1.02	9/12/02
2136	481561.31	1351328.01	602.83	603.83	Top/SLIntercell4	603.85	1.02	9/5/02
2137	481560.70	1351378.01	603.27	604.27	Top/SLIntercell4	604.31	1.04	9/4/02
2138	481560.09	1351428.01	603.78	604.78	Top/SLIntercell4	604.80	1.02	9/4/02
2139	481559.47	1351478.48	604.31	605.31	Top/SLIntercell4	605.32	1.01	9/4/02
2140	481577.42	1350828.17	597.75	598.75	Top/SLIntercell4	598.79	1.04	9/18/02
2141	481576.81	1350878.17	598.39	599.39	Top/SLIntercell4	599.39	1.00	9/18/02
2142	481576.20	1350928.16	598.84	599.84	Top/SLIntercell4	599.88	1.04	9/18/02
2143	481575.59	1350978.16	599.32	600.32	Top/SLIntercell4	600.33	1.01	9/18/02
2144	481574.98	1351028.16	599.87	600.87	Top/SLIntercell4	600.95	1.08	9/18/02
2145	481574.37	1351078.15	600.42	601.42	Top/SLIntercell4	601.43	1.01	9/18/02
2146	481573.76	1351128.15	600.95	601.95	Top/SLIntercell4	601.95	1.00	9/13/02
2147	481573.15	1351178.14	601.39	602.39	Top/SLIntercell4	602.40	1.01	9/12/02
2148	481572.54	1351228.14	601.84	602.84	Top/SLIntercell4	602.88	1.04	9/12/02
2149	481571.92	1351278.14	602.43	603.43	Top/SLIntercell4	603.44	1.01	9/12/02
2150	481571.31	1351328.13	602.81	603.81	Top/SLIntercell4	603.81	1.00	9/5/02
2151	481570.70	1351378.13	603.40	604.40	Top/SLIntercell4	604.45	1.05	9/4/02
2152	481570.09	1351428.13	603.80	604.80	Top/SLIntercell4	604.87	1.07	9/4/02
2153	481569.48	1351478.60	604.26	605.26	Top/SLIntercell4	605.28	1.02	9/4/02
2156	481593.77	1351428.42	601.55	602.56	Toe/10%slcell4tc	602.57	1.02	9/4/02
2159	481594.38	1351378.42	601.07	602.08	Toe/10%slcell4tc	602.09	1.02	9/4/02
2162	481594.99	1351328.42	600.56	601.57	Toe/10%slcell4tc	601.57	1.01	9/5/02
2165	481595.60	1351278.43	599.97	600.98	Toe/10%slcell4tc	601.04	1.07	9/12/02
2168	481596.21	1351228.43	599.39	600.40	Toe/10%slcell4tc	600.41	1.02	9/12/02
2171	481596.83	1351178.43	599.08	600.09	Toe/10%slcell4tc	600.16	1.08	9/12/02
2174	481597.44	1351128.44	598.48	599.49	Toe/10%slcell4tc	599.52	1.04	9/12/02
2177	481598.05	1351078.44	597.92	598.93	Toe/10%slcell4tc	599.01	1.09	9/18/02
2180	481598.66	1351028.45	597.45	598.46	Toe/10%slcell4tc	598.50	1.05	9/18/02
2183	481599.27	1350978.45	596.96	597.97	Toe/10%slcell4tc	598.04	1.08	9/18/02
2186	481599.88	1350928.45	596.45	597.46	Toe/10%slcell4tc	597.56	1.11	9/18/02
2189	481600.49	1350878.46	595.97	596.98	Toe/10%slcell4tc	597.07	1.10	9/18/02
2191	481601.19	1350820.82	595.47	596.50	Toe/4:1slcell4tc	596.51	1.04	9/18/02
2193	481593.17	1351477.54	601.95	602.98	Toe/4:1slCell4	602.98	1.03	9/4/02
2194	481498.68	1351463.74	598.05	599.08	Toe 10%	599.09	1.04	9/4/02
2195



NOTE:

POINTS LESS THAN 3000 ARE SUBGRADE AND TOP CLAY SHOTS WITH ADJUSTED ELEVATIONS FOR THE TOP OF LDS LAYER. AND, POINTS ABOVE 3000 WERE COMPUTED FROM TYPICAL SECTIONS FURNISHED BY FLUOR FERNALD, INC.

LEGEND:

× 2100 619.21 = ELEVATION AND POINT NUMBER

———— = AS-BUILT INDEX CONTOUR

———— = AS-BUILT INTERMEDIATE CONTOUR

- - - - - = TOE OF SLOPES

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

4944

000024

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Y:\201\225\DWG\CELL5 LDS.DWG

STATE OF OHIO
LYNN E. HIRSCH
S-5738
SURVEYOR
Lynn Edward Hirsch
10-24-2002

David E. Estes Engineering, Inc.
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Designed By:	
Drawn By:	F.A.M.
Checked By:	L.E.H.
Approved By:	L.E.H.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5
AS-BUILT
LDS

Scale:	1" = 40'
Date:	10-24-2002
Sheet No.	1 OF 2
Project No.	201-225

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PNT NO.	NORTH	EAST	ASBUILT T/CELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
502	481384.69	1350875.82	589.71	590.71	GRID	590.79	1.08	9/26/02
503	481384.08	1350925.82	590.33	591.33	GRID	591.35	1.02	9/24/02
504	481383.47	1350975.81	590.77	591.77	GRID	591.79	1.02	9/24/02
505	481382.86	1351025.81	591.28	592.28	GRID	592.32	1.04	9/24/02
506	481382.25	1351075.81	591.77	592.77	GRID	592.82	1.05	9/23/02
507	481381.64	1351125.80	592.26	593.26	GRID	593.26	1.00	9/13/02
508	481381.03	1351175.80	592.73	593.73	GRID	593.77	1.04	9/13/02
509	481380.42	1351225.79	593.25	594.25	GRID	594.30	1.05	9/13/02
510	481379.80	1351275.79	593.81	594.81	GRID	594.90	1.09	9/13/02
511	481379.19	1351325.79	594.28	595.28	GRID	595.34	1.06	9/13/02
512	481378.58	1351375.78	594.84	595.84	GRID	595.92	1.08	9/13/02
513	481377.97	1351425.78	595.24	596.24	GRID	596.29	1.05	9/13/02
525	481334.70	1350875.21	590.20	591.20	GRID	591.22	1.02	9/26/02
526	481334.09	1350925.21	590.71	591.71	GRID	591.78	1.07	9/24/02
527	481333.48	1350975.20	591.21	592.21	GRID	592.22	1.01	9/23/02
528	481332.87	1351025.20	591.71	592.71	GRID	592.81	1.10	9/23/02
529	481332.25	1351075.19	592.25	593.25	GRID	593.33	1.08	9/23/02
530	481331.64	1351125.19	592.75	593.75	GRID	593.76	1.01	9/16/02
531	481331.03	1351175.19	593.21	594.21	GRID	594.21	1.00	9/16/02
532	481330.42	1351225.18	593.75	594.75	GRID	594.75	1.00	9/16/02
533	481329.81	1351275.18	594.32	595.32	GRID	595.32	1.00	9/16/02
534	481329.20	1351325.18	594.83	595.83	GRID	595.83	1.00	9/16/02
535	481328.59	1351375.17	595.34	596.34	GRID	596.34	1.00	9/9/02
536	481327.98	1351425.17	595.71	596.71	GRID	596.77	1.06	9/6/02
541	481284.70	1350874.60	591.21	592.21	Grid Pt.	592.24	1.03	9/24/02
542	481284.09	1350924.60	591.71	592.71	Grid Pt.	592.79	1.08	9/23/02
543	481283.48	1350974.59	592.26	593.26	Grid Pt.	593.30	1.04	9/23/02
544	481282.87	1351024.59	592.74	593.74	Grid Pt.	593.74	1.00	9/23/02
545	481282.26	1351074.59	593.24	594.24	Grid Pt.	594.30	1.06	9/23/02
546	481281.65	1351124.58	593.80	594.80	Grid Pt.	594.82	1.02	9/16/02
547	481281.04	1351174.58	594.26	595.26	Grid Pt.	595.32	1.06	9/16/02
548	481280.43	1351224.57	594.73	595.73	Grid Pt.	595.75	1.02	9/16/02
549	481279.82	1351274.57	595.21	596.21	Grid Pt.	596.25	1.04	9/16/02
550	481279.20	1351324.57	595.79	596.79	Grid Pt.	596.81	1.02	9/16/02
551	481278.59	1351374.56	596.21	597.21	Grid Pt.	597.25	1.04	9/9/02
552	481277.98	1351424.56	596.74	597.74	Grid Pt.	597.80	1.06	9/6/02
556	481235.32	1350823.99	591.73	592.73	Grid Pt.	592.74	1.01	9/24/02
557	481234.71	1350873.99	592.21	593.21	Grid Pt.	593.21	1.00	9/24/02
558	481234.10	1350923.99	592.71	593.71	Grid Pt.	593.72	1.01	9/24/02
559	481233.49	1350973.98	593.22	594.22	Grid Pt.	594.29	1.07	9/24/02
560	481232.87	1351023.98	593.71	594.71	Grid Pt.	594.77	1.06	9/24/02
561	481232.26	1351073.98	594.22	595.22	Grid Pt.	595.28	1.06	9/24/02
562	481231.65	1351123.97	594.74	595.74	Grid Pt.	595.76	1.02	9/16/02
563	481231.04	1351173.97	595.25	596.25	Grid Pt.	596.35	1.10	9/16/02
565	481230.43	1351223.96	595.72	596.72	Grid Pt.	596.72	1.00	9/16/02
566	481229.82	1351273.96	596.26	597.26	Grid Pt.	597.26	1.00	9/16/02
567	481229.21	1351323.96	596.75	597.75	Grid Pt.	597.76	1.01	9/16/02
568	481228.60	1351373.95	597.21	598.21	Grid Pt.	598.28	1.07	9/9/02
569	481227.99	1351423.95	597.71	598.71	Grid Pt.	598.77	1.06	9/9/02

PNT NO.	NORTH	EAST	ASBUILT T/CELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
573	481185.32	1350823.38	595.00	596.03	Grid Pt.	596.13	1.13	9/24/02
574	481184.71	1350873.38	595.51	596.54	Grid Pt.	596.57	1.06	9/24/02
575	481184.10	1350923.38	596.02	597.05	Grid Pt.	597.06	1.04	9/24/02
576	481183.49	1350973.37	596.50	597.53	Grid Pt.	597.53	1.03	9/24/02
578	481182.88	1351023.37	597.03	598.06	Grid Pt.	598.16	1.13	9/24/02
579	481182.27	1351073.36	597.60	598.63	Grid Pt.	598.70	1.10	9/16/02
580	481181.66	1351123.36	598.02	599.05	Grid Pt.	599.10	1.08	9/16/02
581	481181.05	1351173.36	598.50	599.53	Grid Pt.	599.58	1.08	9/16/02
582	481180.43	1351223.35	599.01	600.04	Grid Pt.	600.14	1.13	9/16/02
583	481179.82	1351273.35	599.50	600.53	Grid Pt.	600.63	1.13	9/16/02
584	481179.21	1351323.35	600.01	601.04	Grid Pt.	601.08	1.07	9/16/02
585	481178.60	1351373.34	600.51	601.54	Grid Pt.	601.54	1.03	9/9/02
586	481177.99	1351423.34	601.00	602.03	Grid Pt.	602.03	1.03	9/9/02
591	481134.71	1350872.77	589.74	590.74	Grid Pt.	590.75	1.01	9/25/02
592	481134.10	1350922.77	590.27	591.27	GRID PT	591.32	1.05	9/25/02
593	481133.49	1350972.76	590.80	591.80	GRID PT	591.83	1.03	9/25/02
594	481132.88	1351022.76	591.28	592.28	GRID PT	592.37	1.09	9/25/02
595	481132.27	1351072.76	591.77	592.77	GRID PT	592.77	1.00	9/16/02
596	481131.66	1351122.75	592.25	593.25	GRID PT	593.31	1.06	9/16/02
597	481131.04	1351172.75	592.74	593.74	GRID PT	593.79	1.05	9/16/02
598	481130.43	1351222.74	593.32	594.32	GRID PT	594.42	1.10	9/16/02
599	481129.82	1351272.74	593.73	594.73	GRID PT	594.83	1.10	9/16/02
600	481129.21	1351322.74	594.23	595.23	GRID PT	595.33	1.10	9/16/02
601	481128.60	1351372.73	594.80	595.80	GRID PT	595.90	1.10	9/9/02
602	481127.99	1351422.73	595.23	596.23	GRID PT	596.26	1.03	9/9/02
606	481085.27	1350826.86			NOT USED			
607	481084.72	1350872.16			NOT USED			
608	481084.11	1350922.15			NOT USED			
609	481083.50	1350972.15			NOT USED			
610	481082.89	1351022.15			NOT USED			
611	481082.28	1351072.14			NOT USED			
612	481081.67	1351122.14			NOT USED			
613	481081.05	1351172.14			NOT USED			
614	481080.44	1351222.13			NOT USED			
615	481079.83	1351272.13			NOT USED			
616	481079.22	1351322.12			NOT USED			
617	481078.61	1351372.12			NOT USED			
618	481078.00	1351422.12			NOT USED			
619	481077.56	1351457.87			NOT USED			
637	481379.83	1350875.76	589.67	590.67	TOE2%	590.72	1.05	9/26/02
638	481379.22	1350925.75	590.27	591.27	TOE2%	591.27	1.00	9/24/02
639	481378.60	1350975.75	590.77	591.77	TOE2%	591.87	1.10	9/24/02
640	481377.99	1351025.75	591.18	592.18	TOE2%	592.23	1.05	9/24/02
641	481377.38	1351075.74	591.72	592.72	TOE2%	592.72	1.00	9/24/02
642	481376.77	1351125.74	592.18	593.18	TOE2%	593.20	1.02	9/14/02
643	481376.16	1351175.73	592.67	593.67	TOE2%	593.73	1.06	9/14/02
644	481375.55	1351225.73	593.16	594.16	TOE2%	594.25	1.09	9/14/02
645	481374.94	1351275.73	593.67	594.67	TOE2%	594.77	1.10	9/14/02
646	481374.32	1351325.72	594.19	595.19	TOE2%	595.24	1.05	9/14/02

PNT NO.	NORTH	EAST	ASBUILT T/CELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
647	481373.71	1351375.72	594.68	595.68	TOE2%	595.73	1.05	9/14/02
648	481373.10	1351425.72	595.16	596.16	TOE2%	596.21	1.05	9/14/02
649	481363.82	1350875.57	589.68	590.68	TOE2%	590.76	1.08	9/26/02
650	481363.21	1350925.56	590.16	591.16	TOE2%	591.22	1.06	9/24/02
651	481362.60	1350975.56	590.69	591.69	TOE2%	591.71	1.02	9/24/02
652	481361.99	1351025.56	591.13	592.13	TOE2%	592.16	1.03	9/24/02
653	481361.38	1351075.55	591.67	592.67	TOE2%	592.67	1.00	9/24/02
654	481360.77	1351125.55	592.18	593.18	TOE2%	593.25	1.07	9/14/02
655	481360.16	1351175.54	592.72	593.72	TOE2%	593.72	1.00	9/14/02
656	481359.55	1351225.54	593.14	594.14	TOE2%	594.24	1.10	9/14/02
657	481358.94	1351275.54	593.63	594.63	TOE2%	594.73	1.10	9/14/02
658	481358.33	1351325.53	594.21	595.21	TOE2%	595.21	1.00	9/14/02
659	481357.72	1351375.53	594.70	595.70	TOE2%	595.71	1.01	9/14/02
660	481357.11	1351425.53	595.16	596.16	TOE2%	596.21	1.05	9/14/02
671	481153.35	1350822.99	593.46	594.49	CELL5 4:1	594.57	1.11	9/25/02
672	481152.74	1350872.99	594.08	595.11	CELL5 4:1	595.15	1.07	9/25/02
673	481152.13	1350922.98	594.44	595.47	CELL5 4:1	595.57	1.13	9/25/02
674	481151.52	1350972.98	595.00	596.03	CELL5 4:1	596.10	1.10	9/25/02
675	481150.91	1351022.97	595.49	596.52	CELL5 4:1	596.60	1.11	9/25/02
676	481150.30	1351072.97	595.99	597.02	CELL5 4:1	597.11	1.12	9/16/02
677	481149.69	1351122.97	596.44	597.47	CELL5 4:1	597.47	1.03	9/16/02
678	481149.08	1351172.96	596.95	597.98	CELL5 4:1	597.99	1.04	9/16/02
679	481148.46	1351222.96	597.48	598.51	CELL5 4:1	598.55	1.07	9/16/02
680	481147.85	1351272.96	597.94	598.97	CELL5 4:1	599.05	1.11	9/16/02
681	481147.24	1351322.95	598.46	599.49	CELL5 4:1	599.50	1.04	9/16/02
682	481146.63	1351372.95	599.01	600.04	CELL5 4:1	600.08	1.07	9/9/02
683	481146.02	1351422.94	599.47	600.50	CELL5 4:1	600.52	1.05	9/9/02
684	481145.41	1351472.94	599.94	600.97	CELL5 4:1	601.02	1.08	9/9/02
709	481385.67	1350795.66	599.42	600.45	CELL5 TOP4:1	600.54	1.12	9/26/02
710	481335.68	1350795.05	599.00	600.03	CELL5 TOP4:1	600.13	1.13	9/24/02
711	481285.68	1350794.44	598.60	599.63	CELL5 TOP4:1	599.67	1.07	9/24/02
712	481235.68	1350793.83	598.25	599.28	CELL5 TOP4:1	599.38	1.13	9/24/02
713	481185.69	1350793.22	597.97	599.00	CELL5 TOP4:1	599.00	1.03	9/24/02
714	481135.69	1350792.61	597.61	598.64	CELL5 TOP4:1	598.67	1.06	9/25/02
752	481377.08	1351499.27	606.43	607.46	S/GCELL5TOP/SL	607.54	1.11	9/6/02
753	481327.08	1351498.66	606.03	607.06	S/GCELL5TOP/SL	607.13	1.10	9/6/02
754	481277.08	1351498.04	605.69	606.72	S/GCELL5TOP/SL	606.80	1.11	9/6/02
755	481227.09	1351497.43	605.33	606.36	S/GCELL5TOP/SL	606.39	1.06	9/6/02
756	481177.09	1351496.82	604.96	605.99	S/GCELL5TOP/SL	606.08	1.12	9/6/02
757	481127.10	1351496.21	604.47	605.50	S/GCELL5TOP/SL	605.53	1.06	9/9/02
1146	481434.69	1350876.43	590.73	591.73	Cell4Grid Pt.	591.76	1.03	9/24/02
1147	481434.08	1350926.43	591.23	592.23	Cell4Grid Pt.	592.33	1.10	9/20/02
1148	481433.47	1350976.43	591.80	592.80	Cell4Grid Pt.	592.83	1.03	9/20/02
1149	481432.86	1351026.42	592.32	593.32	Cell4Grid Pt.	593.34	1.02	9/20/02
1150	481432.25	1351076.42	592.81	593.81	Cell4Grid Pt.	593.91	1.10	9/18/02
1151	481431.64	1351126.42	593.34	594.34	Cell4Grid Pt.	594.36	1.02	9/13/02
1152	481431.03	1351176.41	593.76	594.76	Cell4Grid Pt.	594.86	1.10	9/13/02
1153	481430.42	1351226.41	594.37	595.37	Cell4Grid Pt.	595.37	1.00	9/13/02
1154	481429.80	1351276.40	594.81	595.81	Cell4Grid Pt.	595.91	1.10	9/13/02

PNT NO.	NORTH	EAST	ASBUILT T/CELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1155	481429.19	1351326.40	595.31	596.31	Cell4Grid Pt.	596.41	1.10	9/13/02
1156	481428.58	1351376.40	595.80	596.80	Cell4Grid Pt.	596.90	1.10	9/13/02
1157	481427.97	1351426.39	596.33	597.33	Cell4Grid Pt.	597.33	1.00	9/5/02
1360	481427.07	1351499.88	606.91	607.94	S/GCELL4TOP/SL	607.96	1.05	9/5/02
1532	481358.95	1350812.93	594.67	595.70	CELL5 SG OUT1/1	595.70	1.03	9/30/02
1533	481386.51	1350812.99	594.88	595.91	CELL5 SG OUT1/1	596.00	1.12	9/30/02
1608	481435.67	1350796.27	599.76	600.79	S/GCELL4TOP4/1	600.81	1.05	9/26/02
2300	481195.38	1350815.25	592.44	593.47	TOE4:1	593.53	1.09	9/24/02
2301	481177.77	1350797.37	596.71	597.74	N-EDGEINTCELLBER	597.74	1.03	9/24/02
2302	481136.55	1350825.38	589.42	590.45	TOE4:1	590.55	1.13	9/25/02
2303	481167.77	1350796.96	596.75	597.78	S-EDGEINTCELLBER	597.82	1.07	9/24/02
2304	481128.79	1351460.79	595.75	596.78	TOE 4:1	596.88	1.13	9/9/02
2305	481159.27	1351492.35	603.86	604.89	S-EDGEINTERBERM	604.94	1.08	9/6/02
2306	481169.28	1351492.16	603.67	604.70	N-EDGEINTERBERM	604.70	1.03	9/6/02
2307	481187.33	1351473.26	599.04	600.07	TOE4:1	600.13	1.09	9/6/02
2312	481356.76	1351455.94	595.54	596.57	TOE4:1	596.62	1.08	9/5/02
2313	481372.71	1351455.63	595.59	596.62	TOE4:1	596.72	1.13	9/5/02
2525	481380.28	1350835.87	589.31	592.40	TOE4:1	592.40	3.09	9/30/02
2526	481364.35	1350835.21	589.27	592.36	TOE4:1	592.36	3.09	9/30/02
2600	481195.28	1350823.50	592.61	593.64	TOE4:1	593.68	1.07	9/24/02
2601	481177.45	1350823.28	596.97	597.97	TOP 4:1	597.99	1.02	9/23/02
2602	481194.67	1350873.50	593.01	594.04	TOE 4:1	594.08	1.07	9/24/02
2603	481176.84	1350873.28	597.54	598.54	TOP 4:1	598.62	1.08	9/23/02
2604	481194.06	1350923.50	593.59	594.62	TOE 4:1	594.64	1.05	9/24/02
2605	481176.23	1350923.28	598.11	599.11	TOP 4:1	599.19	1.08	9/23/02
2606	481193.44	1350973.49	594.01	595.04	TOE 4:1	595.10	1.09	9/24/02
2607	481175.62	1350973.27	598.56	599.56	TOP 4:1	599.59	1.03	9/23/02
2608	481192.83	1351023.49	594.52	595.55	TOE 4:1	595.65	1.13	9/24/02
260[illegible]	481175.01	1351023.27	598.97	599.97	TOP 4:1	599.97	1.00	9/24/02
2610	481192.22	1351073.48	595.11	596.14	TOE 4:1	596.16	1.05	9/16/02
2611	481174.40	1351073.26	599.62	600.62	TOP 4:1	600.62	1.00	9/16/02
2612	481191.61	1351123.48	595.58	596.61	TOE 4:1	596.67	1.09	9/16/02
2613	481173.79	1351123.26	600.14	601.14	TOP 4:1	601.24	1.10	9/16/02
2614	481191.00	1351173.48	596.01	597.04	TOE 4:1	597.05	1.04	9/16/02
2615	481173.18	1351173.26	600.47	601.47	TOP 4:1	601.57	1.10	9/16/02
2616	481190.39	1351223.47	596.51	597.54	TOE 4:1	597.64	1.13	9/16/02
2617	481172.57	1351223.25	600.98	601.98	TOP 4:1	602.08	1.10	9/16/02
2618	481189.77	1351273.47	597.05	598.08	TOE 4:1	598.08	1.03	9/16/02
2619	481171.95	1351273.25	601.48	602.48	TOP 4:1	602.50	1.02	9/16/02
2620	481189.16	1351323.47	597.54	598.57	TOE 4:1	598.67	1.13	9/16/02
2621	481171.34	1351323.25	602.08	603.08	TOP 4:1	603.18	1.10	9/16/02
2622	481188.55	1351373.46	598.00	599.03	TOE 4:1	599.13	1.13	9/9/02
2623	481170.73	1351373.24	602.57	603.57	TOP 4:1	603.63	1.06	9/9/02
2624	481187.94	1351423.46	598.54	599.57	TOE 4:1	599.57	1.03	9/6/02
2625	481170.12	1351423.24	602.97	603.97	TOP 4:1	604.00	1.03	9/6/02
2626	481169.50	1351474.56	603.52	604.52	TOP 4:1	604.56	1.04	9/6/02
2627	481167.45	1350823.16	596.97	597.97	TOP 4:1	597.97	1.00	9/24/02
2628	481166.84	1350873.16	597.48	598.48	TOP 4:1	598.50	1.02	9/23/02
2629	481166.23	1350923.16	598.03	599.03	TOP 4:1	599.03	1.00	9/23/02

PNT NO.	NORTH	EAST	ASBUILT T/CELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2630	481165.62	1350973.15	598.47	599.47	TOP 4:1	599.54	1.07	9/23/02
2631	481165.01	1351023.15	598.97	599.97	TOP 4:1	600.07	1.10	9/23/02
2632	481164.39	1351073.14	599.61	600.61	TOP 4:1	600.64	1.03	9/16/02
2633	481163.78	1351123.14	600.05	601.05	TOP 4:1	601.13	1.08	9/16/02
2634	481163.17	1351173.14	600.47	601.47	TOP 4:1	601.47	1.00	9/16/02
2635	481162.56	1351223.13	600.97	601.97	TOP 4:1	601.97	1.00	9/16/02
2636	481161.95	1351273.13	601.62	602.62	TOP 4:1	602.72	1.10	9/16/02
2637	481161.34	1351323.13	602.15	603.15	TOP 4:1	603.15	1.00	9/16/02
2638	481160.73	1351373.12	602.55	603.55	TOP 4:1	603.55	1.00	9/9/02
2639	481160.12	1351423.12	603.15	604.15	TOP 4:1	604.18	1.03	9/6/02
2640	481159.49	1351474.44	603.56	604.56	TOP 4:1	604.56	1.00	9/6/02
2641	481135.97	1350872.78	589.74	590.77	TOE 4:1	590.85	1.11	9/25/02
2642	481135.36	1350922.78	590.27	591.30	TOE 4:1	591.30	1.03	9/25/02
2643	481134.75	1350972.77	590.80	591.83	TOE 4:1	591.91	1.11	9/25/02
2644	481134.14	1351022.77	591.30	592.33	TOE 4:1	592.41	1.11	9/25/02
2645	481133.53	1351072.76	591.83	592.86	TOE 4:1	592.86	1.03	9/16/02
2646	481132.92	1351122.76	592.34	593.37	TOE 4:1	593.37	1.03	9/16/02
2647	481132.31	1351172.76	592.91	593.94	TOE 4:1	593.99	1.08	9/16/02
2648	481131.70	1351222.75	593.38	594.41	TOE 4:1	594.41	1.03	9/16/02
2649	481131.09	1351272.75	593.87	594.90	TOE 4:1	594.91	1.04	9/16/02
2650	481130.48	1351322.75	594.42	595.45	TOE 4:1	595.48	1.06	9/16/02
2651	481129.87	1351372.74	594.91	595.94	TOE 4:1	595.96	1.05	9/9/02
2652	481129.25	1351422.74	595.27	596.30	TOE 4:1	596.31	1.04	9/9/02
2677	481435.21	1350833.90	590.41	591.44	toe 4:1	591.46	1.05	9/20/02
2678	481385.19	1350835.69	589.42	590.45	toe 4:1	590.55	1.13	9/30/02
2679	481335.23	1350831.77	589.89	590.92	toe 4:1	590.99	1.10	9/26/02
2680	481285.30	1350825.87	590.88	591.91	toe 4:1	591.98	1.10	9/24/02
2681	481235.37	1350819.97	591.66	592.69	toe 4:1	592.73	1.07	9/24/02
2689	481427.57	1351459.16	596.65	597.68	toe 4:1	597.74	1.09	9/5/02
2690	481377.60	1351455.95	595.68	596.71	toe 4:1	596.76	1.08	9/5/02
2691	481327.57	1351458.92	596.11	597.14	toe 4:1	597.23	1.12	9/5/02
2692	481277.50	1351464.04	597.21	598.24	toe 4:1	598.27	1.06	9/6/02
2693	481227.44	1351469.16	598.30	599.33	toe 4:1	599.35	1.05	9/6/02
3030	481427.02	1351504.23		608.89	Top 4:1 LDS	608.97	None	9/5/02
3031	481377.02	1351503.61		608.48	Top 4:1 LDS	608.55	None	9/5/02
3032	481327.03	1351503.00		608.09	Top 4:1 LDS	608.11	None	9/6/02
3033	481277.03	1351502.39		607.73	Top 4:1 LDS	607.83	None	9/5/02
3034	481227.04	1351501.78		607.34	Top 4:1 LDS	607.37	None	9/6/02
3035	481177.04	1351501.17		607.10	Top 4:1 LDS	607.10	None	9/6/02
3036	481127.04	1351500.56		606.78	Top 4:1 LDS	606.84	None	9/9/02
3037	481435.72	1350791.93		601.92	Top 4:1 LDS	601.98	None	9/26/02
3038	481385.73	1350791.31		601.55	Top 4:1 LDS	601.65	None	9/26/02
3039	481335.73	1350790.70		601.25	Top 4:1 LDS	601.34	None	9/24/02
3040	481285.74	1350790.09		600.70	Top 4:1 LDS	600.74	None	9/24/02
3041	481235.74	1350789.48		600.38	Top 4:1 LDS	600.38	None	9/24/02
3042	481185.74	1350788.87		600.01	Top 4:1 LDS	600.01	None	9/24/02
3043	481135.75	1350788.26		599.57	Top 4:1 LDS	599.66	None	9/25/02
3044	481087.98	1350872.20		589.96	END LDS	590.05	None	9/25/02
3045	481087.37	1350922.19		590.32	END LDS	590.37	None	9/25/02

PNT NO.	NORTH	EAST	ASBUILT T/CELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
3046	481086.76	1350972.19		590.79	END LDS	590.83	None	9/25/02
3047	481086.15	1351022.19		591.37	END LDS	591.38	None	9/25/02
3048	481085.53	1351072.18		591.89	END LDS	591.89	None	9/19/02
3049	481084.92	1351122.18		592.46	END LDS	592.51	None	9/19/02
3050	481084.31	1351172.18		592.79	END LDS	592.82	None	9/19/02
3051	481083.70	1351222.17		593.31	END LDS	593.44	None	9/19/02
3052	481083.09	1351272.17		593.79	END LDS	593.88	None	9/19/02
3053	481082.48	1351322.16		594.37	END LDS	594.37	None	9/19/02
3054	481081.86	1351372.16		594.96	END LDS	594.98	None	9/9/02
3055	481081.25	1351422.16		595.33	END LDS	595.42	None	9/9/02
3056	481080.62	1351457.68		595.73	END LDS TOE 4:1	595.83	None	9/19/02
3057	481079.95	1351495.63		605.15	END LDS 4:1	605.25	None	9/19/02
3058	481080.11	1351499.98		606.37	END LDS Top 4:1	606.43	None	9/19/02
3059	481088.53	1350827.09		589.49	END LDS Toe 4:1	589.50	None	9/25/02
3060	481088.96	1350792.04		598.13	END LDS 4:1	598.18	None	9/25/02
3061	481089.01	1350787.69		599.31	END LDS Top 4:1	599.41	None	9/25/02
3540	481388.52	1350816.16		595.27	Cell Outlet	595.31	None	9/30/02
3541	481388.28	1350835.70		590.38	Cell Outlet	590.38	None	9/30/02
3542	481380.17	1350843.92		590.31	Cell Outlet	590.31	None	9/30/02
3543	481364.26	1350843.27		590.30	Cell Outlet	590.33	None	9/30/02
3544	481355.87	1350834.34		590.38	Cell Outlet	590.48	None	9/30/02
3545	481356.11	1350814.83		595.26	Cell Outlet	595.36	None	9/30/02
3546	481364.50	1350823.43		595.26	Cell Outlet	595.27	None	9/30/02
3547	481380.42	1350824.08		595.27	Cell Outlet	595.33	None	9/30/02

4944

000025

NOTE:

NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/- 0.01' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

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STATE OF OHIO LYNN E. HIRSCH S-5738 SURVEYOR
Lynn Edward Hirsch 10-24-2002

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5 AS-BUILT LDS

Scale:
Date: 10-24-2002
Sheet No. 2 OF 2
Project No. 201-225

Y:\2011\225\DWG\CELL5 LDS.DWG

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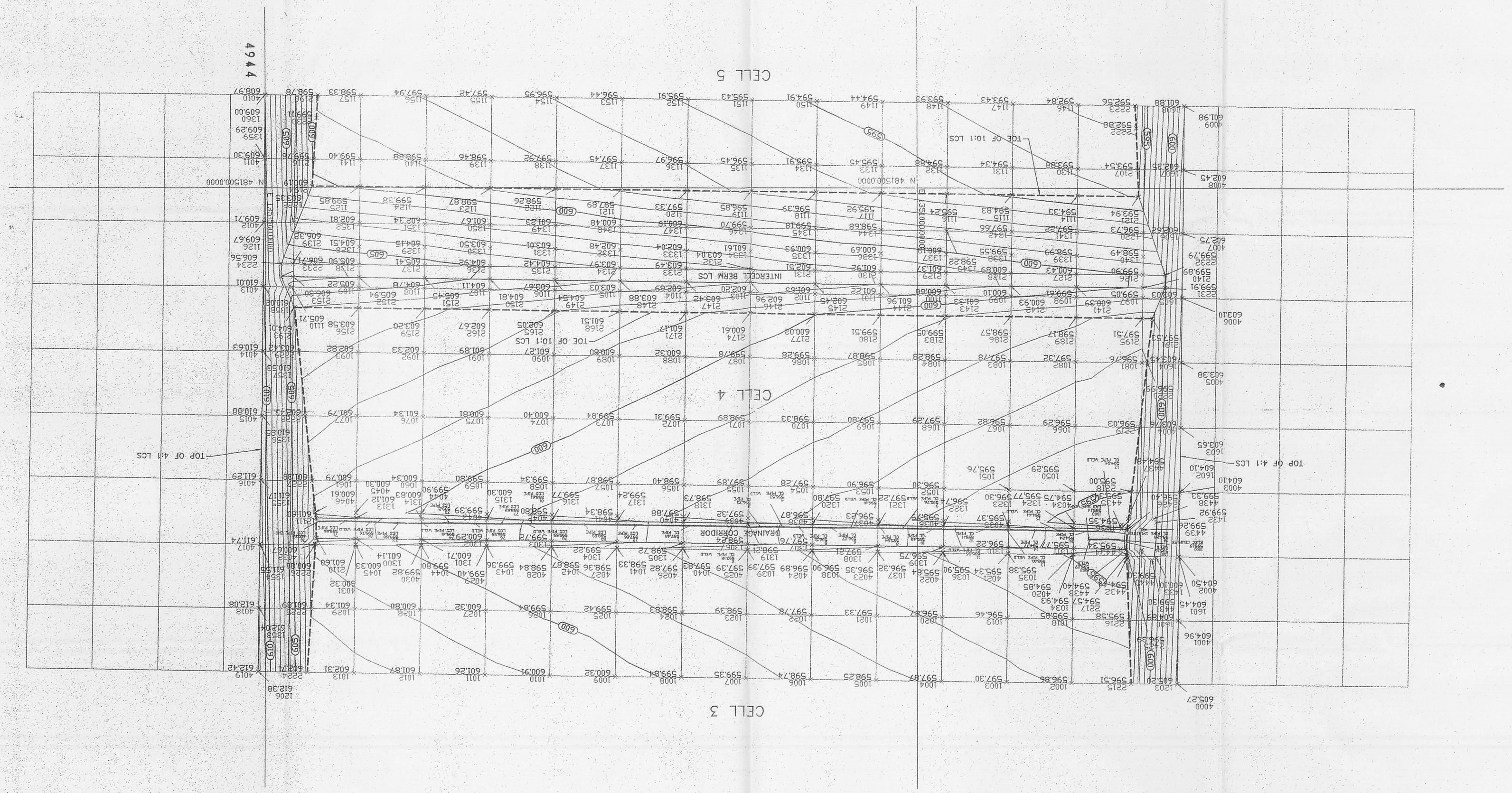

NOTE:
POINTS LESS THAN 4000 ARE SUBGRADE 'TOP CLAY' AND LDS LAYER SHOTS WITH ADJUSTED ELEVATIONS FOR THE TOP OF LCS LAYER AND POINTS ABOVE 4000 WERE COMPUTED FROM TYPICAL SECTIONS FURNISHED BY FLUOR FERNALD, INC.

000028

AS-BUILT
LCS
CELL 4

Scale: 1" = 40'
Date: 11-12-2002
Sheet No: 1 OF 3
Project No: 201-225

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL
MANAGEMENT PROJECT
OSDF CELL 4

REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

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STATE OF OHIO
LYNN E. HIRSCH
S-6738
SURVEYOR

Lynn Edward Hirsch
11-12-2002

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PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1002	481884.66	1350881.93	595.80	596.80	Grid Pt.	596.86	1.06	10/28/02
1003	481884.04	1350931.93	596.30	597.30	Grid Pt.	597.30	1.00	10/28/02
1004	481883.43	1350981.93	596.83	597.83	Grid Pt.	597.87	1.04	10/28/02
1005	481882.82	1351031.92	597.23	598.23	Grid Pt.	598.25	1.02	10/28/02
1006	481882.21	1351081.92	597.74	598.74	Grid Pt.	598.74	1.00	10/28/02
1007	481881.60	1351131.91	598.32	599.32	Grid Pt.	599.35	1.03	10/28/02
1008	481880.99	1351181.91	598.82	599.82	Grid Pt.	599.84	1.02	10/28/02
1009	481880.38	1351231.91	599.28	600.28	Grid Pt.	600.32	1.04	10/28/02
1010	481879.77	1351281.90	599.81	600.81	Grid Pt.	600.91	1.10	10/28/02
1011	481879.15	1351331.90	600.26	601.26	Grid Pt.	601.26	1.00	10/12/02
1012	481878.54	1351381.90	600.81	601.81	Grid Pt.	601.87	1.06	10/12/02
1013	481877.93	1351431.89	601.31	602.31	Grid Pt.	602.31	1.00	10/12/02
1018	481834.66	1350881.32	594.77	595.77	Grid Pt.	595.85	1.08	10/28/02
1019	481834.05	1350931.32	595.39	596.39	Grid Pt.	596.46	1.07	10/28/02
1020	481833.44	1350981.32	595.80	596.80	Grid Pt.	596.87	1.07	10/28/02
1021	481832.83	1351031.31	596.30	597.30	GRID PT	597.33	1.03	10/28/02
1022	481832.21	1351081.31	596.74	597.74	Grid Pt.	597.78	1.04	10/28/02
1023	481831.60	1351131.30	597.33	598.33	Grid Pt.	598.39	1.06	10/28/02
1024	481830.99	1351181.30	597.81	598.81	Grid Pt.	598.83	1.02	10/28/02
1025	481830.38	1351231.30	598.36	599.36	Grid Pt.	599.42	1.06	10/28/02
1026	481829.77	1351281.29	598.78	599.78	Grid Pt.	599.84	1.06	10/28/02
1027	481829.16	1351331.29	599.28	600.28	Grid Pt.	600.32	1.04	10/28/02
1028	481828.55	1351381.29	599.75	600.75	Grid Pt.	600.80	1.05	10/11/02
1029	481827.94	1351431.28	600.24	601.24	Grid Pt.	601.34	1.10	10/11/02
1034	481784.66	1350880.71	593.86	594.86	Grid Pt.	594.93	1.07	10/28/02
1035	481784.05	1350930.71	594.36	595.36	Grid Pt.	595.38	1.02	10/28/02
1036	481783.44	1350980.71	594.85	595.85	Grid Pt.	595.90	1.05	10/28/02
1037	481782.83	1351030.70	595.30	596.30	Grid Pt.	596.32	1.02	10/28/02
1038	481782.22	1351080.70	595.84	596.84	Grid Pt.	596.90	1.06	10/28/02
1039	481781.61	1351130.69	596.33	597.33	Grid Pt.	597.39	1.06	10/28/02
1040	481781.00	1351180.69	596.79	597.79	Grid Pt.	597.83	1.04	10/28/02
1041	481780.38	1351230.69	597.29	598.29	Grid Pt.	598.33	1.04	10/28/02
1042	481779.77	1351280.68	597.79	598.79	Grid Pt.	598.87	1.08	10/28/02
1043	481779.16	1351330.68	598.32	599.32	Grid Pt.	599.36	1.04	10/28/02
1044	481778.55	1351380.68	598.78	599.78	Grid Pt.	599.80	1.02	10/28/02
1045	481777.94	1351430.67	599.23	600.23	Grid Pt.	600.33	1.10	10/16/02
1050	481734.67	1350880.10	594.25	595.25	GRID PNT	595.29	1.04	10/30/02
1051	481734.06	1350930.09	594.70	595.70	GRID PNT	595.76	1.06	10/30/02
1052	481733.44	1350980.09	595.30	596.30	GRID PNT	596.30	1.00	10/30/02
1053	481732.83	1351030.09	595.82	596.82	GRID PNT	596.90	1.08	10/30/02
1054	481732.22	1351080.08	596.26	597.26	GRID PNT	597.28	1.02	10/30/02
1055	481731.61	1351130.08	596.82	597.82	GRID PNT	597.89	1.07	10/30/02
1056	481731.00	1351180.07	597.30	598.30	GRID PNT	598.40	1.10	10/30/02
1057	481730.39	1351230.07	597.80	598.80	GRID PNT	598.87	1.07	10/30/02
1058	481729.78	1351280.07	598.34	599.34	GRID PNT	599.34	1.00	10/30/02
1059	481729.17	1351330.06	598.80	599.80	GRID PNT	599.80	1.00	10/30/02
1060	481728.56	1351380.06	599.33	600.33	GRID PNT	600.34	1.01	10/11/02
1061	481727.95	1351430.06	599.73	600.73	GRID PNT	600.79	1.06	10/11/02
1066	481684.67	1350879.49	595.27	596.27	GRID PNT	596.29	1.02	10/30/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1320	481761.35	1351080.44	595.78	597.78	S/GCELL4	597.80	2.02	10/30/02
1321	481761.96	1351030.44	595.13	597.13	S/GCELL4	597.22	2.09	10/30/02
1322	481762.57	1350980.45	594.68	596.68	S/GCELL4	596.74	2.06	10/30/02
1323	481763.18	1350930.45	594.25	596.25	S/GCELL4	596.30	2.05	10/30/02
1324	481763.79	1350880.45	593.67	595.67	S/GCELL4	595.77	2.10	10/30/02
1328	481545.99	1351427.84	603.41	604.42	GRID PNT	604.51	1.10	10/10/02
1329	481546.60	1351377.84	603.05	604.06	SG TOP	604.15	1.10	10/10/02
1330	481547.21	1351327.84	602.44	603.45	SG TOP	603.50	1.06	10/17/02
1331	481547.82	1351277.85	601.91	602.92	S/GCELL4TOP/SL	603.01	1.10	10/17/02
1332	481548.43	1351227.85	601.47	602.48	S/GCELL4TOP	602.48	1.01	10/26/02
1333	481549.05	1351177.85	600.95	601.96	S/GCELL4TOP/SL	602.04	1.09	10/26/02
1334	481549.66	1351127.86	600.57	601.58	S/GCELL4TOP/SL	601.61	1.04	10/26/02
1335	481550.27	1351077.86	599.89	600.90	S/GCELL4TOP	600.93	1.04	10/26/02
1336	481550.88	1351027.87	599.65	600.66	S/GCELL4TOP	600.69	1.04	10/30/02
1337	481551.49	1350977.87	599.09	600.10	S/GCELL4TOP/SL	600.18	1.09	10/30/02
1338	481552.10	1350927.87	598.46	599.47	S/GCELL4TOP/SL	599.55	1.09	10/30/02
1339	481552.71	1350877.88	597.94	598.95	S/GCELL4TOP/SL	598.99	1.05	10/30/02
1340	481553.32	1350827.88	597.45	598.46	S/GCELL4TOP/SL	598.49	1.04	10/30/02
1341	481534.68	1350877.66	596.12	597.13	GRID PT 10%	597.22	1.10	10/30/02
1342	481534.07	1350927.65	596.62	597.63	GRID PT 10%	597.66	1.04	10/30/02
1343	481533.46	1350977.65	597.16	598.17	GRID PT 10%	598.22	1.06	10/30/02
1344	481532.85	1351027.65	597.67	598.68	GRID PT 10%	598.68	1.01	10/26/02
1345	481532.24	1351077.64	598.17	599.18	GRID PT 10%	599.18	1.01	10/26/02
1346	481531.63	1351127.64	598.69	599.70	GRID PT 10%	599.70	1.01	10/26/02
1347	481531.02	1351177.63	599.14	600.15	GRID PT 10%	600.19	1.05	10/26/02
1348	481530.40	1351227.63	599.47	600.48	GRID PT 10%	600.48	1.01	10/26/02
1349	481529.79	1351277.63	600.13	601.14	GRID PT 10%	601.23	1.10	10/17/02
1350	481529.18	1351327.62	600.66	601.67	GRID PT 10%	601.67	1.01	10/17/02
1351	481528.57	1351377.62	601.26	602.27	GRID PT 10%	602.34	1.08	10/10/02
1352	481527.96	1351427.62	601.76	602.77	GRID PT 10%	602.81	1.05	10/10/02
1353	481827.04	1351504.77	610.94	611.97	S/GCELL4TOP/SL	612.04	1.10	10/12/02
1354	481777.05	1351504.16	610.52	611.55	S/GCELL4TOP/SL	611.55	1.03	10/16/02
1355	481727.05	1351503.55	610.06	611.09	S/GCELL4TOP/SL	611.17	1.11	10/11/02
1356	481677.05	1351502.93	609.75	610.78	S/GCELL4TOP/SL	610.85	1.10	10/11/02
1357	481627.06	1351502.32	609.40	610.43	S/GCELL4TOP/SL	610.53	1.13	10/11/02
1358	481577.06	1351501.71	608.99	610.02	S/GCELL4TOP/SL	610.02	1.03	10/11/02
1359	481477.07	1351500.49	608.20	609.23	S/GCELL4TOP/SL	609.29	1.09	10/10/02
1360	481427.07	1351499.88	607.96	608.99	S/GCELL4TOP/SL	609.00	1.04	10/10/02
1432	481758.92	1350817.82	598.83	599.86	C4 SGCELLOUT	599.92	1.09	10/30/02
1433	481786.48	1350817.88	599.07	600.10	C4 SGCELLOUT	600.10	1.03	10/30/02
1600	481835.64	1350801.17	603.80	604.83	S/GCELL4TOP/4/1	604.89	1.09	10/28/02
1601	481785.65	1350800.56	603.42	604.45	S/GCELL4TOP/4/1	604.45	1.03	10/30/02
1602	481735.65	1350799.94	603.04	604.07	S/GCELL4TOP/4/1	604.10	1.06	10/30/02
1603	481685.65	1350799.33	602.62	603.65	S/GCELL4TOP/4/1	603.65	1.03	10/30/02
1604	481635.66	1350798.72	602.35	603.38	S/GCELL4TOP/4/1	603.45	1.10	10/31/02
1605	481585.66	1350798.11	601.90	602.93	S/GCELL4TOP/4/1	603.03	1.13	10/31/02
1606	481535.67	1350797.50	601.52	602.55	S/GCELL4TOP/4/1	602.62	1.10	10/30/02
1607	481485.67	1350796.88	601.26	602.29	S/GCELL4TOP/4/1	602.35	1.09	10/30/02
1608	481435.67	1350796.27	600.81	601.84	S/GCELL4TOP/4/1	601.88	1.07	10/30/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1067	481684.06	1350929.48	595.79	596.79	Grid Pt.	596.82	1.03	10/30/02
1068	481683.45	1350979.48	596.29	597.29	GRID PNT	597.29	1.00	10/30/02
1069	481682.84	1351029.48	596.80	597.80	GRID PNT	597.80	1.00	10/30/02
1070	481682.23	1351079.47	597.30	598.30	GRID PNT	598.33	1.03	10/30/02
1071	481681.62	1351129.47	597.79	598.79	GRID PNT	598.89	1.10	10/30/02
1072	481681.01	1351179.46	598.24	599.24	GRID PNT	599.31	1.07	10/30/02
1073	481680.39	1351229.46	598.75	599.75	GRID PNT	599.84	1.09	10/30/02
1074	481679.78	1351279.46	599.32	600.32	GRID PNT	600.40	1.08	10/30/02
1075	481679.17	1351329.45	599.75	600.75	GRID PNT	600.81	1.06	10/30/02
1076	481678.56	1351379.45	600.26	601.26	GRID PNT	601.34	1.08	10/11/02
1077	481677.95	1351429.45	600.79	601.79	GRID PNT	601.79	1.00	10/11/02
1081	481635.29	1350828.88	595.75	596.75	Grid Pt.	596.76	1.01	10/30/02
1082	481634.67	1350878.88	596.29	597.29	GRID PNT	597.32	1.03	10/30/02
1083	481634.06	1350928.87	596.77	597.77	Grid Pt.	597.78	1.01	10/30/02
1084	481633.45	1350978.87	597.28	598.28	GRID PNT	598.28	1.00	10/30/02
1085	481632.84	1351028.87	597.86	598.86	GRID PNT	598.87	1.01	10/30/02
1086	481632.23	1351078.86	598.28	599.28	GRID PNT	599.28	1.00	10/30/02
1087	481631.62	1351128.86	598.73	599.73	GRID PNT	599.78	1.05	10/30/02
1088	481631.01	1351178.85	599.30	600.30	GRID PNT	600.32	1.02	10/30/02
1089	481630.40	1351228.85	599.75	600.75	GRID PNT	600.80	1.05	10/30/02
1090	481629.79	1351278.85	600.27	601.27	GRID PNT	601.27	1.00	10/30/02
1091	481629.18	1351328.84	600.80	601.80	GRID PNT	601.89	1.09	10/30/02
1092	481628.57	1351378.84	601.29	602.29	GRID PNT	602.33	1.04	10/11/02
1093	481627.96	1351428.84	601.71	602.72	GRID PNT	602.82	1.11	10/11/02
1097	481585.29	1350828.27	598.04	599.05	Grid Pt.	599.05	1.01	10/30/02
1098	481584.68	1350878.27	598.52	599.53	GRID PNT	599.61	1.09	10/30/02
1099	481584.07	1350928.26	599.08	600.09	Grid Pt.	600.10	1.02	10/30/02
1100	481583.46	1350978.26	599.67	600.68	GRID PNT	600.68	1.01	10/30/02
1101	481582.85	1351028.26	600.12	601.13	GRID PNT	601.22	1.10	10/30/02
1102	481582.23	1351078.25	600.62	601.63	GRID PNT	601.63	1.01	10/26/02
1103	481581.62	1351128.25	601.10	602.11	GRID PNT	602.20	1.10	10/26/02
1104	481581.01	1351178.24	601.66	602.67	GRID PNT	602.69	1.03	10/26/02
1105	481580.40	1351228.24	602.02	603.03	GRID PNT	603.03	1.01	10/26/02
1106	481579.79	1351278.24	602.59	603.60	GRID PNT	603.67	1.08	10/17/02
1107	481579.18	1351328.23	603.01	604.02	GRID PNT	604.11	1.10	10/17/02
1108	481578.57	1351378.23	603.71	604.72	GRID PNT	604.78	1.07	10/11/02
1109	481577.96	1351428.23	604.21	605.22	GRID PNT	605.22	1.01	10/11/02
1110	481577.33	1351479.55	604.68	605.69	S/GCELL4TOE	605.71	1.03	10/11/02
1114	481505.84	1350877.32	593.23	594.24	Toe 10%	594.33	1.10	10/30/02
1115	481505.23	1350927.30	593.82	594.83	Toe 10%	594.83	1.01	10/30/02
1116	481504.62	1350977.30	594.24	595.25	Toe 10%	595.24	1.00	10/30/02
1117	481504.01	1351027.30	594.84	595.85	Toe 10%	595.92	1.08	10/24/02
1118	481503.39	1351077.29	595.34	596.35	Toe 10%	596.39	1.05	10/24/02
1119	481502.78	1351127.29	595.79	596.80	Toe 10%	596.85	1.06	10/24/02
1120	481502.17	1351177.28	596.28	597.29	Toe 10%	597.33	1.05	10/24/02
1121	481501.56	1351227.28	596.82	597.83	Toe 10%	597.89	1.07	10/24/02
1122	481500.95	1351277.28	597.16	598.17	Toe 10%	598.26	1.10	10/17/02
1123	481500.34	1351327.27	597.77	598.78	Toe 10%	598.87	1.10	10/17/02
1124	481499.73	1351377.27	598.35	599.36	Toe 10%	599.38	1.03	10/10/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2107	481485.50	1350832.09	592.51	593.54	Toe4:1Cell4tc	593.54	1.03	10/30/02
2110	481772.68	1351460.52	599.54	601.60	Toe4:1Cell4tc	601.60	2.06	10/16/02
2111	481756.73	1351460.83	599.51	601.57	Toe4:1Cell4tc	601.60	2.09	10/16/02
2116	481477.79	1351462.40	598.69	599.72	T/CCell4-Control Pt	599.78	1.09	10/10/02
2121	481506.41	1350831.34	592.84	593.87	Toe 10%	593.94	1.10	10/30/02
2126	481567.42	1350828.05	598.85	599.85	Top/SLIntercell4	599.90	1.05	10/30/02
2127	481566.81	1350878.05	599.35	600.35	Top/SLIntercell4	600.43	1.08	10/30/02
2128	481566.20	1350928.04	599.79	600.79	Top/SLIntercell4	600.89	1.10	10/30/02
2129	481565.59	1350978.04	600.33	601.33	Top/SLIntercell4	601.37	1.04	10/30/02
2130	481564.98	1351028.04	600.89	601.89	Top/SLIntercell4	601.92	1.03	10/30/02
2131	481564.36	1351078.03	601.47	602.47	Top/SLIntercell4	602.51	1.04	10/26/02
2132	481563.75	1351128.03	602.03	603.03	Top/SLIntercell4	603.04	1.01	10/26/02
2133	481563.14	1351178.02	602.47	603.47	Top/SLIntercell4	603.49	1.02	10/26/02
2134	481562.53	1351228.02	602.87	603.87	Top/SLIntercell4	603.97	1.10	10/26/02
2135	481561.92	1351278.02	603.39	604.39	Top/SLIntercell4	604.42	1.03	10/17/02
2136	481561.31	1351328.01	603.85	604.85	Top/SLIntercell4	604.92	1.07	10/17/02
2137	481560.70	1351378.01	604.31	605.31	Top/SLIntercell4	605.41	1.10	10/11/02
2138	481560.09	1351428.01	604.80	605.80	Top/SLIntercell4	605.90	1.10	10/11/02
2139	481559.47	1351478.48	605.32	606.32	Top/SLIntercell4	606.32	1.00	10/11/02
2140	481577.42	1350828.17	598.79	599.79	Top/SLIntercell4	599.89	1.10	10/30/02
2141	481576.81	1350878.17	599.39	600.39	Top/SLIntercell4	600.39	1.00	10/30/02
2142	481576.20	1350928.16	599.88	600.88	Top/SLIntercell4	600.93	1.05	10/30/02
2143	481575.59	1350978.16	600.33	601.33	Top/SLIntercell4	601.33	1.00	10/30/02
2144	481574.98	1351028.16	600.95	601.95	Top/SLIntercell4	601.96	1.01	10/30/02
2145	481574.37	1351078.15	601.43	602.43	Top/SLIntercell4	602.45	1.02	10/26/02
2146	481573.76	1351128.15	601.95	602.95	Top/SLIntercell4	602.96	1.01	10/26/02
2147	481573.15	1351178.14	602.40	603.40	Top/SLIntercell4	603.42	1.02	10/26/02
2148	481572.54	1351228.14	602.88	603.88	Top/SLIntercell4	603.88	1.00	10/26/02
2149	481571.92	1351278.14	603.44	604.44	Top/SLIntercell4	604.54	1.10	10/17/02
2150	481571.31	1351328.13	603.81	604.81	Top/SLIntercell4	604.81	1.00	10/17/02
2151	481570.70	1351378.13	604.45	605.45	Top/SLIntercell4	605.45	1.00	10/11/02
2152	481570.09	1351428.13	604.87	605.87	Top/SLIntercell4	605.94	1.07	10/11/02
2153	481569.48	1351478.60	605.28	606.28	Top/SLIntercell4	606.30	1.02	10/11/02
2156	481593.77	1351428.42	602.57	603.58	Toe/10%slcell4tc	603.58	1.01	10/11/02
2159	481594.38	1351378.42	602.09	603.10	Toe/10%slcell4tc	603.20	1.11	10/11/02
2162	481594.99	1351328.42	601.57	602.58	Toe/10%slcell4tc	602.67	1.10	10/26/02
2165	481595.60	1351278.43	601.04	602.05	Toe/10%slcell4tc	602.05	1.01	10/26/02
2168	481596.21	1351228.43	600.41	601.42	Toe/10%slcell4tc	601.51	1.10	10/26/02
2171	481596.83	1351178.43	600.16	601.17	Toe/10%slcell4tc	601.17	1.01	10/26/02
2174	481597.44	1351128.44	599.52	600.53	Toe/10%slcell4tc	600.61	1.09	10/26/02
2177	481598.05	1351078.44	599.01	600.02	Toe/10%slcell4tc	600.02	1.01	10/26/02
2180	481598.66	1351028.45	598.50	599.51	Toe/10%slcell4tc	599.51	1.01	10/30/02
2183	481599.27	1350978.45	598.04	599.05	Toe/10%slcell4tc	599.05	1.01	10/30/02
2186	481599.88	1350928.45	597.56	598.57	Toe/10%slcell4tc	598.57	1.01	10/30/02
2189	481600.49	1350878.46	597.07	598.08	Toe/10%slcell4tc	598.17	1.10	10/30/02
2191	481601.19	1350820.82	596.51	597.52	Toe/4:1slcell4tc	597.53	1.02	10/30/02
2193	481593.17	1351477.54	602.98	604.01	Toe/4:1slCell4	604.01	1.03	10/11/02
2194	481498.68	1351463.74	599.09	600.10	Toe 10%	600.19	1.10	10/10/02
2195	481601.10	1350828.46	596.42	597.43	Toe/10%slCell4tc	597.51	1.09	10/30/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1125	481499.12	1351427.27	598.77	599.78	Toe 10%	599.85	1.08	10/10/02
1126	481527.07	1351501.10	608.61	609.64	S/GCELL4TOP/SL	609.67	1.06	10/10/02
1130	481484.69	1350877.05	592.80	593.80	Grid Pt.	593.88	1.08	10/30/02
1131	481484.08	1350927.04	593.33	594.33	Grid Pt.	594.34	1.01	10/30/02
1132	481483.47	1350977.04	593.83	594.83	Grid Pt.	594.88	1.05	10/24/02
1133	481482.86	1351027.03	594.38	595.38	Grid Pt.	595.45	1.07	10/24/02
1134	481482.24	1351077.03	594.85	595.85	Grid Pt.	595.91	1.06	10/24/02
1135	481481.63	1351127.03	595.39	596.39	Grid Pt.	596.45	1.06	10/24/02
1136	481481.02	1351177.02	595.91	596.91	Grid Pt.	596.97	1.06	10/24/02
1137	481480.41	1351227.02	596.42	597.42	Grid Pt.	597.45	1.03	10/24/02
1138	481479.80	1351277.02	596.87	597.87	Grid Pt.	597.92	1.05	10/17/02
1139	481479.19	1351327.01	597.41	598.41	Grid Pt.	598.46	1.05	10/17/02
1140	481478.58	1351377.01	597.87	598.87	Grid Pt.	598.88	1.01	10/10/02
1141	481477.97	1351427.00	598.31	599.31	Grid Pt.	599.40	1.09	10/10/02
1146	481434.69	1350876.43	591.77	592.77	Grid Pt.	592.84	1.07	10/30/02
1147	481434.08	1350926.43	592.33	593.33	Grid Pt.	593.43	1.10	10/30/02
1148	481433.47	1350976.43	592.83	593.83	Grid Pt.	593.93	1.10	10/30/02
1149	481432.86	1351026.42	593.34	594.34	Grid Pt.	594.44	1.10	10/24/02
1150	481432.25	1351076.42	593.91	594.91	Grid Pt.	594.91	1.00	10/24/02
1151	481431.64	1351126.42	594.36	595.36	Grid Pt.	595.43	1.07	10/24/02
1152	481431.03	1351176.41	594.86	595.86	Grid Pt.	595.91	1.05	10/24/02
1153	481430.42	1351226.41	595.37	596.37	Grid Pt.	596.44	1.07	10/24/02
1154	481429.80	1351276.40	595.91	596.91	Grid Pt.	596.95	1.04	10/17/02
1155	481429.19	1351326.40	596.41	597.41	Grid Pt.	597.42	1.01	10/17/02
1156	481428.58	1351376.40	596.90	597.90	Grid Pt.	597.94	1.04	10/10/02
1157	481427.97	1351426.39	597.33	598.33	Grid Pt.	598.33	1.00	10/10/02
1203	481885.64	1350801.78	604.16	605.19	S/GCONT.PTS	605.20	1.04	10/28/02
1206	481877.04	1351505.38	611.25	612.28	S/GCONT.PTS	612.38	1.13	10/12/02
1220	481535.29	1350827.66	595.67	596.67	GRID PT 10%	596.73	1.06	10/30/02
1222	481527.35	1351478.09	602.24	603.27	GRID PT 10%	603.35	1.11	10/10/02
1300	481773.07	1351430.61	599.14	601.14	S/GCELL4	601.14	2.00	10/16/02
1301	481773.68	1351380.62	598.71	600.71	S/GCELL4	600.71	2.00	10/16/02
1302	481774.29	1351330.62	598.28	600.28	S/GCELL4	600.29	2.01	10/30/02
1303	481774.90	1351280.62	597.72	599.72	S/GCELL4	599.72	2.00	10/30/02
1304	481775.52	1351230.63	597.20	599.20	S/GCELL4	599.22	2.02	10/30/02
1305	481776.13	1351180.63	596.72	598.72	S/GCELL4	598.72	2.00	10/30/02
1306	481776.74	1351130.63	596.24	598.24	S/GCELL4	598.24	2.00	10/30/02
1307	481777.35	1351080.64	595.73	597.73	S/GCELL4	597.76	2.03	10/30/02
1308	481777.96	1351030.64	595.19	597.19	S/GCELL4	597.21	2.02	10/30/02
1309	481778.57	1350980.65	594.72	596.72	S/GCELL4	596.75	2.03	10/30/02
1310	481779.18	1350930.65	594.22	596.22	S/GCELL4	596.22	2.00	10/30/02
1311	481779.79	1350880.65	593.70	595.70	S/GCELL4	595.77	2.07	10/30/02
1313	481757.08	1351430.41	599.12	601.12	S/GCELL4	601.12	2.00	10/16/02
1314	481757.69	1351380.42	598.78	600.78	S/GCELL4	600.83	2.05	10/16/02
1315	481758.30	1351330.42	598.21	600.21	S/GCELL4	600.30	2.09	10/30/02
1316	481758.91	1351280.42	597.72	599.72	S/GCELL4	599.77	2.05	10/30/02
1317	481759.52	1351230.43	597.22	599.22	S/GCELL4	599.24	2.02	10/30/02
1318	481760.13	1351180.43	596.73	598.73	S/GCELL4	598.73	2.00	10/30/02
1319	481760.74	1351130.43	596.21	598.21	S/GCELL4	598.21	2.00	10/30/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2196	481427.57	1351459.17	597.74	598.77	Toe/4:1slCell4tc	598.78	1.04	10/10/02
2215	481885.21	1350836.99	595.48	596.51	Toe/4:1slCell4tc	596.51	1.03	10/28/02
2216	481835.18	1350838.78	594.51	595.54	Toe/4:1slCell4tc	595.58	1.07	10/28/02
2217	481785.16	1350840.57	593.48	594.51	Toe/4:1slCell4tc	594.57	1.09	10/30/02
2218	481735.20	1350836.66	593.93	594.96	Toe/4:1slCell4tc	595.00	1.07	10/30/02
2219	481685.27	1350830.76	594.94	595.97	Toe/4:1slCell4tc	596.03	1.09	10/30/02
2220	481635.34	1350824.86	595.95	596.98	Toe/4:1slCell4tc	596.99	1.04	10/30/02
2222	481452.89	1350833.03	591.78	592.81	Toe/4:1slCell4tc	592.88	1.10	10/30/02
2223	481435.21	1350833.89	591.46	592.49	Toe/4:1slCell4tc	592.56	1.10	10/30/02
2224	481877.50	1351467.36	601.65	602.68	Toe/4:1slCell4tc	602.71	1.06	10/12/02
2225	481827.54	1351464.28	600.86	601.89	Toe/4:1slCell4tc	601.89	1.03	10/12/02
2226	481777.57	1351461.21	599.73	600.76	Toe/4:1slCell4tc	600.80	1.07	10/16/02
2227	481727.54	1351463.81	600.35	601.38	Toe/4:1slCell4tc	601.38	1.03	10/11/02
2228	481677.47	1351468.93	601.34	602.37	Toe/4:1slCell4tc	602.43	1.09	10/11/02
2229	481627.41	1351474.04	602.29	603.32	Toe/4:1slCell4tc	603.42	1.13	10/11/02
2230	481445.21	1351460.30	598.08	599.11	Toe/4:1slCell4tc	599.11	1.03	10/10/02
2231	481577.63	1350811.04	598.81	599.84	Top /Berm @ toe 4:1	599.91	1.10	10/30/02
2232	481567.63	1350810.92	598.73	599.76	Top /Berm @ toe 4:1	599.79	1.06	10/30/02
2233	481569.36	1351488.08	605.64	606.67	Top /Berm @ toe 4:1	606.71	1.07	10/11/02
2234	481559.35	1351487.96	605.43	606.46	Top /Berm @ toe 4:1	606.56	1.13	10/10/02
2425	481780.25	1350840.75	595.36	596.39	T/CCell4 Outlet	596.39	1.03	10/30/02
2426	481764.32	1350840.10	595.37	596.40	T/CCell4 Outlet	596.40	1.03	10/30/02
4000	481885.64	1350801.55		605.26	Top 4:1 LCS	605.27	NONE	10/28/02
4001	481835.64	1350800.94		604.93	Top 4:1 LCS	604.96	NONE	10/28/02
4002	481785.65	1350800.33		604.50	Top 4:1 LCS	604.50	NONE	10/30/02
4003	481735.65	1350799.71		604.07	Top 4:1 LCS	604.10	NONE	10/30/02
4004	481685.65	1350799.10		603.76	Top 4:1 LCS	603.76	NONE	10/30/02
4005	481635.66	1350798.49		603.34	Top 4:1 LCS	603.38	NONE	10/31/02
4006	481585.66	1350797.88		603.04	Top 4:1 LCS	603.10	NONE	10/31/02
4007	481535.67	1350797.27		602.72	Top 4:1 LCS	602.75	NONE	10/30/02
4008	481485.93	1350796.66		602.35	Top 4:1 LCS	602.45	NONE	10/30/02
4009	481435.67	1350796.05		601.98	Top 4:1 LCS	601.98	NONE	10/30/02
4010	481427.04	1351500.11		608.97	Top 4:1 LCS	608.97	NONE	10/10/02
4011	481477.29	1351500.72		609.29	Top 4:1 LCS	609.30	NONE	10/10/02
4012	481527.05	1351501.33		609.69	Top 4:1 LCS	609.71	NONE	10/10/02
4013	481577.04	1351501.94		610.01	Top 4:1 LCS	610.01	NONE	10/11/02
4014	481627.04	1351502.55		610.62	Top 4:1 LCS	610.63	NONE	10/11/02
4015	481677.03	1351503.16		610.85	Top 4:1 LCS	610.88	NONE	10/11/02
4016	481727.03	1351503.77		611.19	Top 4:1 LCS	611.29	NONE	10/11/02
4017	481777.03	1351504.38		611.73	Top 4:1 LCS	611.74	NONE	10/15/02
4018	481827.02	1351504.99		611.98	Top 4:1 LCS	612.08	NONE	10/12/02
4019	481877.01	1351505.60		612.40	Top 4:1 LCS	612.42	NONE	10/12/02
4020	481784.11	1350880.70		594.78	Toe 4:1 LCS	594.85	NONE	10/28/02
4021	481783.50	1350930.70		595.30	Toe 4:1 LCS	595.34	NONE	10/28/02
4022	481782.89	1350980.70		595.80	Toe 4:1 LCS	595.84	NONE	10/28/02
4023	481782.28	1351030.69		596.27	Toe 4:1 LCS	596.35	NONE	10/28/02
4024	481781.67	1351080.69		596.81	Toe 4:1 LCS	596.89	NONE	10/28/02
4025	481781.06	1351130.68		597.32	Toe 4:1 LCS	597.39	NONE	10/28/02
4026	481780.45	1351180.68		597.80	Toe 4:1 LCS	597.82	NONE	10/28/02

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STATE OF OHIO — LYNN E. HIRSCH — S-5738 — SURVEYOR
Lynn Edward Hirsch 11-12-2002

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Approved By: L.E.H.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL
MANAGEMENT PROJECT
OSDF CELL 4

AS-BUILT
LCS
CELL 4

Scale: 1" = 40'
Date: 11-12-2002
Sheet No. 2 OF 3
Project No. 201-225

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POINT NO.	NORTH	EAST	ASBUILT LCS ELEV.	PROP. ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
4027	481779.94	1351230.68		598.28	Toe 4:1 LCS	598.36	NONE	10/28/02
4028	481779.22	1351280.67		598.80	Toe 4:1 LCS	598.84	NONE	10/28/02
4029	481778.61	1351330.67		599.36	Toe 4:1 LCS	599.40	NONE	10/28/02
4030	481778.00	1351380.67		599.79	Toe 4:1 LCS	599.82	NONE	10/16/02
4031	481777.39	1351430.66		600.22	Toe 4:1 LCS	600.32	NONE	10/16/02
4032	481777.02	1351461.13		600.62	Toe 4:1 LCS	600.67	NONE	10/16/02
4034	481759.47	1350980.40		594.75	Toe 4:1 LCS	594.75	NONE	10/30/02
4035	481758.86	1350930.40		595.33	Toe 4:1 LCS	595.37	NONE	10/30/02
4036	481758.25	1350980.40		595.76	Toe 4:1 LCS	595.79	NONE	10/30/02
4037	481757.64	1351030.39		596.21	Toe 4:1 LCS	596.23	NONE	10/30/02
4038	481757.03	1351080.39		596.86	Toe 4:1 LCS	596.87	NONE	10/30/02
4039	481756.42	1351130.38		597.29	Toe 4:1 LCS	597.32	NONE	10/30/02
4040	481755.81	1351180.38		597.81	Toe 4:1 LCS	597.88	NONE	10/30/02
4041	481755.20	1351230.38		598.30	Toe 4:1 LCS	598.34	NONE	10/30/02
4042	481754.59	1351280.37		598.80	Toe 4:1 LCS	598.86	NONE	10/30/02
4043	481753.98	1351330.37		599.29	Toe 4:1 LCS	599.39	NONE	10/30/02
4044	481753.37	1351380.37		599.86	Toe 4:1 LCS	599.90	NONE	10/16/02
4045	481752.76	1351430.36		600.20	Toe 4:1 LCS	600.36	NONE	10/16/02
4046	481752.38	1351461.27		600.59	Toe 4:1 LCS	600.61	NONE	10/16/02
4431	481788.47	1350821.16		599.27	Cell Outlet	599.39	NONE	10/30/02
4432	481788.23	1350840.70		594.39	Cell Outlet	594.44	NONE	10/30/02
4433	481783.87	1350845.11		594.34	Cell Outlet	594.40	NONE	10/30/02
4434	481780.17	1350845.07		595.27	Cell Outlet	595.34	NONE	10/30/02
4435	481764.30	1350844.42		595.27	Cell Outlet	595.34	NONE	10/30/02
4436	481760.59	1350844.37		594.34	Cell Outlet	594.35	NONE	10/30/02
4437	481755.88	1350839.33		594.39	Cell Outlet	594.48	NONE	10/30/02
4438	481756.10	1350819.83		599.26	Cell Outlet	599.33	NONE	10/30/02
4439	481764.49	1350828.43		599.26	Cell Outlet	599.26	NONE	10/30/02
4440	481780.37	1350829.08		599.27	Cell Outlet	599.33	NONE	10/30/02

4944

000030

Project No.	201-225
Sheet No.	3 OF 3
Date:	11-12-2002
Scale:	1" = 40'
	AS-BUILT LCS CELL 4

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
HYDROGEOLOGY & LAND SURVEYING
7075 INDUSTRIAL ROAD, FLORENCE, KENTUCKY 41042
Tele: (859) 342-6100 Fax: (859) 342-6725 email: DES@estesengineering.com
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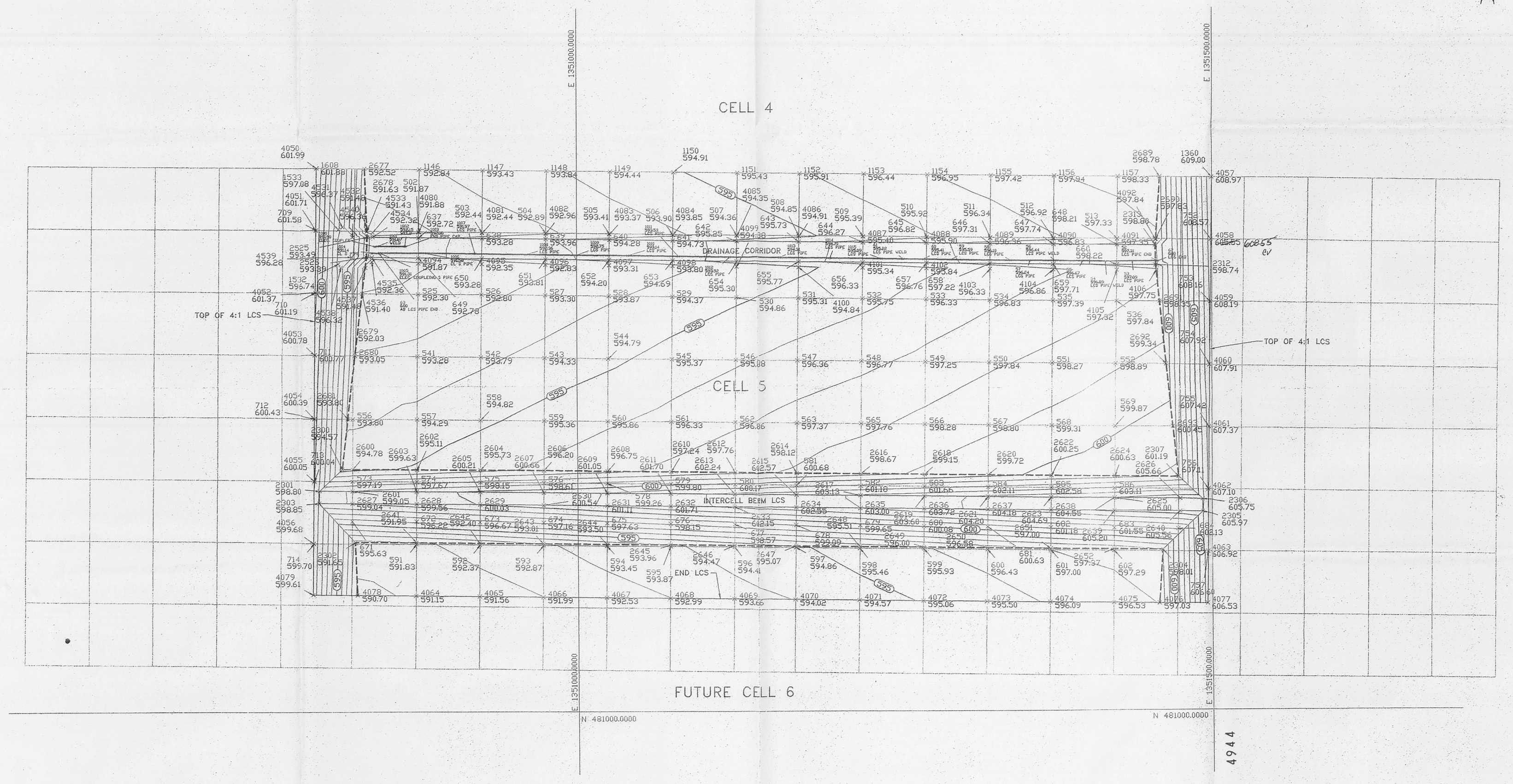
STATE OF OHIO
LYNN E. HIRSCH
S-6738
SURVEYOR
11-12-2002



NOTE:

POINTS LESS THAN 4000 ARE SUBGRADE ,TOP CLAY, AND LDS LAYER SHOTS WITH ADJUSTED ELEVATIONS FOR THE TOP OF LCS LAYER. AND, POINTS ABOVE 4000 WERE COMPUTED FROM TYPICAL SECTIONS FURNISHED BY FLUOR FERNALD, INC.

LEGEND:

× 2100 619.21 = ELEVATION AND POINT NUMBER

——— = AS-BUILT INDEX CONTOUR

——— = AS-BUILT INTERMEDIATE CONTOUR

- - - - = TOE OF SLOPES

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

STATE OF OHIO
LYNN E. HIRSCH
S-5738
SURVEYOR
Lynn Edward Hirsch
11-15-2002

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Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

AS-BUILT
LCS
CELL 5

Scale: 1" = 40'
Date: 11-15-2002
Sheet No. 1 OF 2
Project No. 201-225

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Y:\201\225\DWG\CELL5 LCS.DWG

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PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
502	481384.69	1350875.82	590.79	591.79	GRID	591.87	1.08	10/31/02
503	481384.08	1350925.82	591.35	592.35	GRID	592.44	1.09	10/31/02
504	481383.47	1350975.81	591.79	592.79	GRID	592.89	1.10	10/31/02
505	481382.86	1351025.81	592.32	593.32	GRID	593.41	1.09	10/31/02
506	481382.25	1351075.81	592.82	593.82	GRID	593.90	1.08	10/31/02
507	481381.64	1351125.80	593.26	594.26	GRID	594.36	1.10	10/31/02
508	481381.03	1351175.80	593.77	594.77	GRID	594.85	1.08	10/31/02
509	481380.42	1351225.79	594.30	595.30	GRID	595.39	1.09	10/31/02
510	481379.80	1351275.79	594.90	595.90	GRID	595.92	1.02	10/31/02
511	481379.19	1351325.79	595.34	596.34	GRID	596.34	1.00	10/31/02
512	481378.58	1351375.78	595.92	596.92	GRID	596.92	1.00	10/10/02
513	481377.97	1351425.78	596.29	597.29	GRID	597.33	1.04	10/10/02
525	481334.70	1350875.21	591.22	592.22	GRID	592.30	1.08	10/24/02
526	481334.09	1350925.21	591.78	592.78	GRID	592.80	1.02	10/24/02
527	481333.48	1350975.20	592.22	593.22	GRID	593.30	1.08	10/24/02
528	481332.87	1351025.20	592.81	593.81	GRID	593.87	1.06	10/24/02
529	481332.25	1351075.19	593.33	594.33	GRID	594.37	1.04	10/24/02
530	481331.64	1351125.19	593.76	594.76	GRID	594.86	1.10	10/22/02
531	481331.03	1351175.19	594.21	595.21	GRID	595.31	1.10	10/22/02
532	481330.42	1351225.18	594.75	595.75	GRID	595.75	1.00	10/16/02
533	481329.81	1351275.18	595.32	596.32	GRID	596.33	1.01	10/16/02
534	481329.20	1351325.18	595.83	596.83	GRID	596.83	1.00	10/16/02
535	481328.59	1351375.17	596.34	597.34	GRID	597.39	1.05	10/4/02
536	481327.98	1351425.17	596.77	597.77	GRID	597.84	1.07	10/4/02
541	481284.70	1350874.60	592.24	593.24	Grid Pt.	593.28	1.04	10/24/02
542	481284.09	1350924.60	592.79	593.79	Grid Pt.	593.79	1.00	10/24/02
543	481283.48	1350974.59	593.30	594.30	Grid Pt.	594.33	1.03	10/24/02
544	481282.87	1351024.59	593.74	594.74	Grid Pt.	594.79	1.05	10/24/02
545	481282.26	1351074.59	594.30	595.30	Grid Pt.	595.37	1.07	10/24/02
546	481281.65	1351124.58	594.82	595.82	Grid Pt.	595.88	1.06	10/22/02
547	481281.04	1351174.58	595.32	596.32	Grid Pt.	596.36	1.04	10/22/02
548	481280.43	1351224.57	595.75	596.75	Grid Pt.	596.77	1.02	10/16/02
549	481279.82	1351274.57	596.25	597.25	Grid Pt.	597.25	1.00	10/16/02
550	481279.20	1351324.57	596.81	597.81	Grid Pt.	597.84	1.03	10/16/02
551	481278.59	1351374.56	597.25	598.25	Grid Pt.	598.27	1.02	10/4/02
552	481277.98	1351424.56	597.80	598.80	Grid Pt.	598.89	1.09	10/4/02
556	481235.32	1350823.99	592.74	593.74	Grid Pt.	593.80	1.06	10/24/02
557	481234.71	1350873.99	593.21	594.21	Grid Pt.	594.29	1.08	10/24/02
558	481234.10	1350923.99	593.72	594.72	Grid Pt.	594.82	1.10	10/23/02
559	481233.49	1350973.98	594.29	595.29	Grid Pt.	595.36	1.07	10/23/02
560	481232.87	1351023.98	594.77	595.77	Grid Pt.	595.86	1.09	10/23/02
561	481232.26	1351073.98	595.28	596.28	Grid Pt.	596.33	1.05	10/23/02
562	481231.65	1351123.97	595.76	596.76	Grid Pt.	596.86	1.10	10/22/02
563	481231.04	1351173.97	596.35	597.35	Grid Pt.	597.37	1.02	10/22/02
565	481230.43	1351223.96	596.72	597.72	Grid Pt.	597.76	1.04	10/16/02
566	481229.82	1351273.96	597.26	598.26	Grid Pt.	598.28	1.02	10/16/02
567	481229.21	1351323.96	597.76	598.76	Grid Pt.	598.80	1.04	10/16/02
568	481228.60	1351373.95	598.28	599.28	Grid Pt.	599.31	1.03	10/4/02
569	481227.99	1351423.95	598.77	599.77	Grid Pt.	599.87	1.10	10/4/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
573	481185.32	1350823.38	596.13	597.16	Grid Pt.	597.19	1.06	10/31/02
574	481184.71	1350873.38	596.57	597.60	Grid Pt.	597.67	1.10	10/31/02
575	481184.10	1350923.38	597.06	598.09	Grid Pt.	598.15	1.09	10/31/02
576	481183.49	1350973.37	597.53	598.56	Grid Pt.	598.61	1.08	10/31/02
578	481182.88	1351023.37	598.16	599.19	Grid Pt.	599.26	1.10	10/23/02
579	481182.27	1351073.36	598.70	599.73	Grid Pt.	599.80	1.10	10/23/02
580	481181.66	1351123.36	599.10	600.13	Grid Pt.	600.17	1.07	10/22/02
581	481181.05	1351173.36	599.58	600.61	Grid Pt.	600.68	1.10	10/22/02
582	481180.43	1351223.35	600.14	601.17	Grid Pt.	601.18	1.04	10/16/02
583	481179.82	1351273.35	600.63	601.66	Grid Pt.	601.66	1.03	10/16/02
584	481179.21	1351323.35	601.08	602.11	Grid Pt.	602.11	1.03	10/16/02
585	481178.60	1351373.34	601.54	602.57	Grid Pt.	602.58	1.04	10/4/02
586	481177.99	1351423.34	602.03	603.06	Grid Pt.	603.11	1.08	10/4/02
591	481134.71	1350872.77	590.75	591.75	Grid Pt.	591.83	1.08	11/7/02
592	481134.10	1350922.77	591.32	592.32	GRID PT	592.37	1.05	11/7/02
593	481133.49	1350972.76	591.83	592.83	GRID PT	592.87	1.04	11/7/02
594	481132.88	1351022.76	592.37	593.37	GRID PT	593.45	1.08	10/23/02
595	481132.27	1351072.76	592.77	593.77	GRID PT	593.87	1.10	10/23/02
596	481131.66	1351122.75	593.31	594.31	GRID PT	594.41	1.10	10/23/02
597	481131.04	1351172.75	593.79	594.79	GRID PT	594.86	1.07	10/22/02
598	481130.43	1351222.74	594.42	595.42	GRID PT	595.46	1.04	10/22/02
599	481129.82	1351272.74	594.83	595.83	GRID PT	595.93	1.10	10/17/02
600	481129.21	1351322.74	595.33	596.33	GRID PT	596.43	1.10	10/17/02
601	481128.60	1351372.73	595.90	596.90	GRID PT	597.00	1.10	10/4/02
602	481127.99	1351422.73	596.26	597.26	GRID PT	597.29	1.03	10/4/02
606	481085.27	1350826.86		0.00	NOT USED			
607	481084.72	1350872.16		0.00	NOT USED			
608	481084.11	1350922.15		0.00	NOT USED			
609	481083.50	1350972.15		0.00	NOT USED			
610	481082.89	1351022.15		0.00	NOT USED			
611	481082.28	1351072.14		0.00	NOT USED			
612	481081.67	1351122.14		0.00	NOT USED			
613	481081.05	1351172.14		0.00	NOT USED			
614	481080.44	1351222.13		0.00	NOT USED			
615	481079.83	1351272.13		0.00	NOT USED			
616	481079.22	1351322.12		0.00	NOT USED			
617	481078.61	1351372.12		0.00	NOT USED			
618	481078.00	1351422.12		0.00	NOT USED			
619	481077.56	1351457.87		0.00	NOT USED			
637	481379.83	1350875.76	590.72	592.72	TOE2%	592.72	2.00	10/31/02
638	481379.22	1350925.75	591.27	593.27	TOE2%	593.28	2.01	10/31/02
639	481378.60	1350975.75	591.87	593.87	TOE2%	593.96	2.09	10/31/02
640	481377.99	1351025.75	592.23	594.23	TOE2%	594.28	2.05	10/31/02
641	481377.38	1351075.74	592.72	594.72	TOE2%	594.73	2.01	10/31/02
642	481376.77	1351125.74	593.20	595.20	TOE2%	595.25	2.05	10/22/02
643	481376.16	1351175.73	593.73	595.73	TOE2%	595.73	2.00	10/22/02
644	481375.55	1351225.73	594.25	596.25	TOE2%	596.27	2.02	10/22/02
645	481374.94	1351275.73	594.77	596.77	TOE2%	596.82	2.05	10/22/02
646	481374.32	1351325.72	595.24	597.24	TOE2%	597.31	2.07	10/22/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
647	481373.71	1351375.72	595.73	597.73	TOE2%	597.74	2.01	10/4/02
648	481373.10	1351425.72	596.21	598.21	TOE2%	598.21	2.00	10/4/02
649	481363.82	1350875.57	590.76	592.76	TOE2%	592.78	2.02	10/31/02
650	481363.21	1350925.56	591.22	593.22	TOE2%	593.28	2.06	10/31/02
651	481362.60	1350975.56	591.71	593.71	TOE2%	593.81	2.10	10/31/02
652	481361.99	1351025.56	592.16	594.16	TOE2%	594.20	2.04	10/31/02
653	481361.38	1351075.55	592.67	594.67	TOE2%	594.69	2.02	10/31/02
654	481360.77	1351125.55	593.25	595.25	TOE2%	595.30	2.05	10/22/02
655	481360.16	1351175.54	593.72	595.72	TOE2%	595.77	2.05	10/22/02
656	481359.55	1351225.54	594.24	596.24	TOE2%	596.33	2.09	10/22/02
657	481358.94	1351275.54	594.73	596.73	TOE2%	596.76	2.03	10/22/02
658	481358.33	1351325.53	595.21	597.21	TOE2%	597.22	2.01	10/22/02
659	481357.72	1351375.53	595.71	597.71	TOE2%	597.71	2.00	10/4/02
660	481357.11	1351425.53	596.21	598.21	TOE2%	598.22	2.01	10/4/02
671	481153.35	1350822.99	594.57	595.60	CELL5 4:1	595.63	1.06	11/7/02
672	481152.74	1350872.99	595.15	596.18	CELL5 4:1	596.22	1.07	11/7/02
673	481152.13	1350922.98	595.57	596.60	CELL5 4:1	596.67	1.10	11/7/02
674	481151.52	1350972.98	596.10	597.13	CELL5 4:1	597.16	1.06	11/7/02
675	481150.91	1351022.97	596.60	597.63	CELL5 4:1	597.63	1.03	10/23/02
676	481150.30	1351072.97	597.11	598.14	CELL5 4:1	598.15	1.04	10/23/02
677	481149.69	1351122.97	597.47	598.50	CELL5 4:1	598.57	1.10	10/22/02
678	481149.08	1351172.96	597.99	599.02	CELL5 4:1	599.09	1.10	10/22/02
679	481148.46	1351222.96	598.55	599.58	CELL5 4:1	599.65	1.10	10/16/02
680	481147.85	1351272.96	599.05	600.08	CELL5 4:1	600.08	1.03	10/16/02
681	481147.24	1351322.95	599.50	600.53	CELL5 4:1	600.63	1.13	10/16/02
682	481146.63	1351372.95	600.08	601.11	CELL5 4:1	601.18	1.10	10/4/02
683	481146.02	1351422.94	600.52	601.55	CELL5 4:1	601.55	1.03	10/4/02
684	481145.41	1351472.94	601.02	602.05	CELL5 4:1	602.13	1.11	10/3/02
709	481385.67	1350795.66	600.54	601.57	CELL5 TOP4:1	601.58	1.04	10/31/02
710	481335.68	1350795.05	600.13	601.16	CELL5 TOP4:1	601.19	1.06	10/31/02
711	481285.68	1350794.44	599.67	600.70	CELL5 TOP4:1	600.77	1.10	10/31/02
712	481235.68	1350793.83	599.38	600.41	CELL5 TOP4:1	600.43	1.05	10/31/02
713	481185.69	1350793.22	599.00	600.03	CELL5 TOP4:1	600.04	1.04	10/31/02
714	481135.69	1350792.61	598.67	599.70	CELL5 TOP4:1	599.70	1.03	11/7/02
752	481377.08	1351499.27	607.54	608.57	S/GCELL5TOP/SL	608.57	1.03	10/10/02
753	481327.08	1351498.66	607.13	608.16	S/GCELL5TOP/SL	608.16	1.03	10/3/02
754	481277.08	1351498.04	606.80	607.83	S/GCELL5TOP/SL	607.92	1.12	10/3/02
755	481227.09	1351497.43	606.39	607.42	S/GCELL5TOP/SL	607.42	1.03	10/3/02
756	481177.09	1351496.82	606.08	607.11	S/GCELL5TOP/SL	607.11	1.03	10/3/02
757	481127.10	1351496.21	605.53	606.56	S/GCELL5TOP/SL	606.60	1.07	10/3/02
1146	481434.69	1350876.43	591.76	592.76	Cell4Grid Pt.	592.84	1.08	10/30/02
1147	481434.08	1350926.43	592.33	593.33	Cell4Grid Pt.	593.43	1.10	10/30/02
1148	481433.47	1350976.43	592.83	593.83	Cell4Grid Pt.	593.84	1.01	10/30/02
1149	481432.86	1351026.42	593.34	594.34	Cell4Grid Pt.	594.44	1.10	10/24/02
1150	481432.25	1351076.42	593.91	594.91	Cell4Grid Pt.	594.91	1.00	10/24/02
1151	481431.64	1351126.42	594.36	595.36	Cell4Grid Pt.	595.43	1.07	10/24/02
1152	481431.03	1351176.41	594.86	595.86	Cell4Grid Pt.	595.91	1.05	10/24/02
1153	481430.42	1351226.41	595.37	596.37	Cell4Grid Pt.	596.44	1.07	10/24/02
1154	481429.80	1351276.40	595.91	596.91	Cell4Grid Pt.	596.95	1.04	10/17/02

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1155	481429.19	1351326.40	596.41	597.41	Cell4Grid Pt.	597.42	1.01	10/17/02
1156	481428.58	1351376.40	596.90	597.90	Cell4Grid Pt.	597.94	1.04	10/10/02
1157	481427.97	1351426.39	597.33	598.33	Cell4Grid Pt.	598.33	1.00	10/10/02
1360	481427.07	1351499.88	607.96	608.99	S/GCELL4TOP/SL	609.00	1.04	10/10/02
1532	481358.95	1350812.93	595.70	596.73	CELL5 SG OUT1/1	596.74	1.04	10/31/02
1533	481386.51	1350812.99	596.00	597.03	CELL5 SG OUT1/1	597.08	1.08	10/31/02
1608	481435.67	1350796.27	600.81	601.84	S/GCELL4TOP4/1	601.88	1.07	10/30/02
2300	481195.38	1350815.25	593.53	594.56	TOE4:1	594.57	1.04	10/23/02
2301	481177.77	1350797.37	597.74	598.77	N-EDGEINTCELLBER	598.80	1.06	11/7/02
2302	481136.55	1350825.38	590.55	591.58	TOE4:1	591.65	1.10	11/7/02
2303	481167.77	1350796.96	597.82	598.85	S-EDGEINTCELLBER	598.85	1.03	11/7/02
2304	481128.79	1351460.79	596.88	597.91	TOE 4:1	598.01	1.13	10/3/02
2305	481159.27	1351492.35	604.94	605.97	S-EDGEINTERBERM	605.97	1.03	10/3/02
2306	481169.28	1351492.16	604.70	605.73	N-EDGEINTERBERM	605.75	1.05	10/3/02
2307	481187.33	1351473.26	600.13	601.16	TOE4:1	601.19	1.06	10/3/02
2312	481356.76	1351455.94	596.62	598.68	TOE4:1	598.74	2.12	10/4/02
2313	481372.71	1351455.63	596.72	598.78	TOE4:1	598.80	2.08	10/4/02
2525	481380.28	1350835.87	592.40	593.43	TOE4:1	593.49	1.09	10/31/02
2526	481364.35	1350835.21	592.36	593.39	TOE4:1	593.39	1.03	10/31/02
2600	481195.28	1350823.50	593.68	594.71	TOE4:1	594.78	1.10	10/23/02
2601	481177.45	1350823.28	597.99	598.99	TOP 4:1	599.05	1.06	10/31/02
2602	481194.67	1350873.50	594.08	595.11	TOE 4:1	595.11	1.03	10/23/02
2603	481176.84	1350873.28	598.62	599.62	TOP 4:1	599.63	1.01	10/31/02
2604	481194.06	1350923.50	594.64	595.67	TOE 4:1	595.73	1.09	10/23/02
2605	481176.23	1350923.28	599.19	600.19	TOP 4:1	600.21	1.02	10/31/02
2606	481193.44	1350973.49	595.10	596.13	TOE 4:1	596.20	1.10	10/23/02
2607	481175.62	1350973.27	599.59	600.59	TOP 4:1	600.66	1.07	10/31/02
2608	481192.83	1351023.49	595.65	596.68	TOE 4:1	596.75	1.10	10/23/02
2609	481175.01	1351023.27	599.97	600.97	TOP 4:1	601.05	1.08	10/23/02
2610	481192.22	1351073.48	596.16	597.19	TOE 4:1	597.24	1.08	10/23/02
2611	481174.40	1351073.26	600.62	601.62	TOP 4:1	601.70	1.08	10/23/02
2612	481191.61	1351123.48	596.67	597.70	TOE 4:1	597.76	1.09	10/22/02
2613	481173.79	1351123.26	601.24	602.24	TOP 4:1	602.24	1.00	10/22/02
2614	481191.00	1351173.48	597.05	598.08	TOE 4:1	598.12	1.07	10/22/02
2615	481173.18	1351173.26	601.57	602.57	TOP 4:1	602.57	1.00	10/22/02
2616	481190.39	1351223.47	597.64	598.67	TOE 4:1	598.67	1.03	10/16/02
2617	481172.57	1351223.25	602.08	603.08	TOP 4:1	603.13	1.05	10/16/02
2618	481189.77	1351273.47	598.08	599.11	TOE 4:1	599.15	1.07	10/16/02
2619	481171.95	1351273.25	602.50	603.50	TOP 4:1	603.60	1.10	10/16/02
2620	481189.16	1351323.47	598.67	599.70	TOE 4:1	599.72	1.05	10/16/02
2621	481171.34	1351323.25	603.18	604.18	TOP 4:1	604.20	1.02	10/16/02
2622	481188.55	1351373.46	599.13	600.16	TOE 4:1	600.25	1.12	10/4/02
2623	481170.73	1351373.24	603.63	604.63	TOP 4:1	604.69	1.06	10/3/02
2624	481187.94	1351423.46	599.57	600.60	TOE 4:1	600.63	1.06	10/4/02
2625	481170.12	1351423.24	604.00	605.00	TOP 4:1	605.00	1.00	10/4/02
2626	481169.50	1351474.56	604.56	605.56	TOP 4:1	605.66	1.10	10/3/02
2627	481167.45	1350823.16	597.97	598.97	TOP 4:1	599.04	1.07	11/7/02
2628	481166.84	1350873.16	598.50	599.50	TOP 4:1	599.56	1.06	11/7/02
2629	481166.23	1350923.16	599.03	600.03	TOP 4:1	600.03	1.00	11/7/02

TOLERANCE?

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2630	481165.62	1350973.15	599.54	600.54	TOP 4:1	600.54	1.00	11/7/02
2631	481165.01	1351023.15	600.07	601.07	TOP 4:1	601.11	1.04	10/23/02
2632	481164.39	1351073.14	600.64	601.64	TOP 4:1	601.71	1.07	10/23/02
2633	481163.78	1351123.14	601.13	602.13	TOP 4:1	602.15	1.02	10/22/02
2634	481163.17	1351173.14	601.47	602.47	TOP 4:1	602.55	1.08	10/22/02
2635	481162.56	1351223.13	601.97	602.97	TOP 4:1	603.00	1.03	10/16/02
2636	481161.95	1351273.13	602.72	603.72	TOP 4:1	603.72	1.00	10/16/02
2637	481161.34	1351323.13	603.15	604.15	TOP 4:1	604.18	1.03	10/16/02
2638	481160.73	1351373.12	603.55	604.55	TOP 4:1	604.55	1.00	10/3/02
2639	481160.12	1351423.12	604.18	605.18	TOP 4:1	605.20	1.02	10/3/02
2640	481159.49	1351474.44	604.56	605.56	TOP 4:1	605.56	1.00	10/3/02
2641	481135.97	1350872.78	590.85	591.88	TOE 4:1	591.95	1.10	11/7/02
2642	481135.36	1350922.78	591.30	592.33	TOE 4:1	592.40	1.10	11/7/02
2643	481134.75	1350972.77	591.91	592.94	TOE 4:1	593.01	1.10	11/7/02
2644	481134.14	1351022.77	592.41	593.44	TOE 4:1	593.50	1.09	10/23/02
2645	481133.53	1351072.76	592.86	593.89	TOE 4:1	593.96	1.10	10/23/02
2646	481132.92	1351122.76	593.37	594.40	TOE 4:1	594.47	1.10	10/23/02
2647	481132.31	1351172.76	593.99	595.02	TOE 4:1	595.07	1.08	10/22/02
2648	481131.70	1351222.75	594.41	595.44	TOE 4:1	595.51	1.10	10/22/02
2649	481131.09	1351272.75	594.91	595.94	TOE 4:1	596.00	1.09	10/17/02
2650	481130.48	1351322.75	595.48	596.51	TOE 4:1	596.58	1.10	10/17/02
2651	481129.87	1351372.74	595.96	596.99	TOE 4:1	597.00	1.04	10/4/02
2652	481129.25	1351422.74	596.31	597.34	TOE 4:1	597.37	1.06	10/4/02
2677	481435.21	1350833.90	591.46	592.49	toe 4:1	592.52	1.06	11/7/02
2678	481385.19	1350835.69	590.55	591.58	toe 4:1	591.63	1.08	10/31/02
2679	481335.23	1350831.77	590.99	592.02	toe 4:1	592.03	1.04	10/31/02
2680	481285.30	1350825.87	591.98	593.01	toe 4:1	593.05	1.07	10/24/02
2681	481235.37	1350819.97	592.73	593.76	toe 4:1	593.80	1.07	10/24/02
2689	481427.57	1351459.16	597.74	598.77	toe 4:1	598.78	1.04	10/10/02
2690	481377.60	1351455.95	596.76	597.79	toe 4:1	597.83	1.07	10/10/02
2691	481327.57	1351458.92	597.23	598.26	toe 4:1	598.35	1.12	10/3/02
2692	481277.50	1351464.04	598.27	599.30	toe 4:1	599.34	1.07	10/3/02
2693	481227.44	1351469.16	599.35	600.38	toe 4:1	600.45	1.10	10/3/02
4050	481435.67	1350796.04		601.98	TOP 4:1LCS	601.99	NONE	11/7/02
4051	481385.68	1350795.43		601.65	TOP 4:1LCS	601.71	NONE	10/31/02
4052	481335.68	1350794.82		601.34	TOP 4:1LCS	601.37	NONE	10/31/02
4053	481285.69	1350794.21		600.74	TOP 4:1LCS	600.78	NONE	10/31/02
4054	481235.69	1350793.60		600.38	TOP 4:1LCS	600.39	NONE	10/31/02
4055	481185.69	1350792.99		600.01	TOP 4:1LCS	600.05	NONE	10/31/02
4056	481135.70	1350792.38		599.66	TOP 4:1LCS	599.68	NONE	11/7/02
4057	481427.07	1351500.11		608.97	TOP 4:1LCS	608.97	NONE	10/10/02
4058	481377.08	1351499.50		608.55	TOP 4:1LCS	605.55	NONE	10/10/02
4059	481327.08	1351498.88		608.11	TOP 4:1LCS	608.19	NONE	10/3/02
4060	481277.08	1351498.27		607.83	TOP 4:1LCS	607.91	NONE	10/3/02
4061	481227.09	1351497.66		607.37	TOP 4:1LCS	607.37	NONE	10/3/02
4062	481177.09	1351497.05		607.10	TOP 4:1LCS	607.10	NONE	10/3/02
4063	481127.09	1351496.44		606.84	TOP 4:1LCS	606.92	NONE	10/3/02
4064	481092.98	1350872.26		591.15	END LCS	591.15	NONE	11/7/02
4065	481092.37	1350922.25		591.47	END LCS	591.56	NONE	11/7/02

TOLERANCE?

OFF BY 3 FEET MAYBE SHOULD BE 608.55

PNT NO.	NORTH	EAST	ASBUILT LDS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
4066	481091.76	1350972.25		591.93	END LCS	591.99	NONE	11/7/02
4067	481091.14	1351022.25		592.48	END LCS	592.53	NONE	10/23/02
4068	481090.53	1351072.24		592.99	END LCS	592.99	NONE	10/23/02
4069	481089.92	1351122.24		593.61	END LCS	593.66	NONE	10/23/02
4070	481089.31	1351172.24		593.92	END LCS	594.02	NONE	10/23/02
4071	481088.70	1351222.23		594.54	END LCS	594.57	NONE	10/23/02
4072	481088.09	1351272.23		594.98	END LCS	595.06	NONE	10/17/02
4073	481087.48	1351322.22		595.47	END LCS	595.50	NONE	10/17/02
4074	481086.86	1351372.22		596.08	END LCS	596.09	NONE	10/17/02
4075	481086.25	1351422.22		596.52	END LCS	596.53	NONE	10/17/02
4076	481085.81	1351458.02		596.93	END LCS	597.03	NONE	10/3/02
4077	481085.35	1351495.93		606.53	END LCS	606.53	NONE	10/3/02
4078	481093.53	1350826.91		590.60	END LCS	590.70	NONE	11/7/02
4079	481093.96	1350791.87		599.51	END LCS	599.61	NONE	11/7/02
4080	481384.15	1350875.81		591.80	TOE 4:1LCS	591.88	NONE	10/31/02
4081	481383.54	1350925.80		592.35	TOE 4:1LCS	592.44	NONE	10/31/02
4082	481382.92	1350975.80		592.95	TOE 4:1LCS	592.96	NONE	10/31/02
4083	481382.31	1351025.80		593.31	TOE 4:1LCS	593.37	NONE	10/31/02
4084	481381.70	1351075.79		593.80	TOE 4:1LCS	593.85	NONE	10/31/02
4085	481381.09	1351125.79		594.28	TOE 4:1LCS	594.35	NONE	10/31/02
4086	481380.48	1351175.79		594.81	TOE 4:1LCS	594.91	NONE	10/31/02
4087	481379.87	1351225.78		595.33	TOE 4:1LCS	595.40	NONE	10/31/02
4088	481379.26	1351275.78		595.85	TOE 4:1LCS	595.90	NONE	10/31/02
4089	481378.64	1351325.77		596.32	TOE 4:1LCS	596.36	NONE	10/31/02
4090	481378.03	1351375.77		596.81	TOE 4:1LCS	596.83	NONE	10/4/02
4091	481377.42	1351425.77		597.29	TOE 4:1LCS	597.35	NONE	10/4/02
4092	481377.05	1351455.91		597.80	TOE 4:1LCS	597.84	NONE	10/10/02
4094	481359.50	1350875.52		591.84	TOE 4:1LCS	591.87	NONE	10/31/02
4095	481358.89	1350925.51		592.30	TOE 4:1LCS	592.35	NONE	10/31/02
4096	481358.28	1350975.51		592.79	TOE 4:1LCS	592.83	NONE	10/31/02
4097	481357.67	1351025.50		593.24	TOE 4:1LCS	593.31	NONE	10/31/02
4098	481357.06	1351075.50		593.75	TOE 4:1LCS	593.80	NONE	10/31/02
4099	481356.45	1351125.50		594.33	TOE 4:1LCS	594.38	NONE	10/22/02
4100	481355.84	1351175.49		594.80	TOE 4:1LCS	594.84	NONE	10/22/02
4101	481355.23	1351225.49		595.32	TOE 4:1LCS	595.34	NONE	10/22/02
4102	481354.62	1351275.49		595.81	TOE 4:1LCS	595.84	NONE	10/22/02
4103	481354.01	1351325.48		596.29	TOE 4:1LCS	596.33	NONE	10/16/02
4104	481353.40	1351375.48		596.79	TOE 4:1LCS	596.86	NONE	10/4/02
4105	481352.79	1351425.47		597.29	TOE 4:1LCS	597.32	NONE	10/4/02
4106	481352.41	1351456.38		597.70	TOE 4:1LCS	597.75	NONE	10/4/02
4531	481388.50	1350816.29		596.27	Cell Outlet	596.37	NONE	10/31/02
4532	481388.26	1350835.82		591.39	Cell Outlet	591.48	NONE	10/31/02
4533	481383.90	1350840.24		591.34	Cell Outlet	591.43	NONE	10/31/02
4534	481380.20	1350840.19		592.27	Cell Outlet	592.32	NONE	10/31/02
4535	481364.33	1350839.54		592.27	Cell Outlet	592.36	NONE	10/31/02
4536	481360.62	1350839.49		591.34	Cell Outlet	591.40	NONE	10/31/02
4537	481355.89	1350834.45		591.39	Cell Outlet	591.48	NONE	10/31/02
4538	481356.12	1350814.96		596.26	Cell Outlet	596.32	NONE	10/31/02
4539	481364.52	1350823.55		596.26	Cell Outlet	596.28	NONE	10/31/02
4540	481380.40	1350824.20		596.27	Cell Outlet	596.36	NONE	10/31/02

TOLERANCE?

MISSING POINT No. 4093

MISSING POINT No. 4107

4944

000033

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: L.E.H.
Approved By: L.E.H.

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
HYDROGEOLOGY & LAND SURVEYING
7075 INDUSTRIAL ROAD, FLORENCE, KENTUCKY 41042
Tele: (859) 342-6100 Fax: (859) 342-8725 email: DE3@estesengineering.com
www.estesengineering.com

STATE OF OHIO — LYNN E. HIRSCH — S-5738 — SURVEYOR
Lynn Edward Hirsch 11-15-2002

AS-BUILT LCS CELL 5

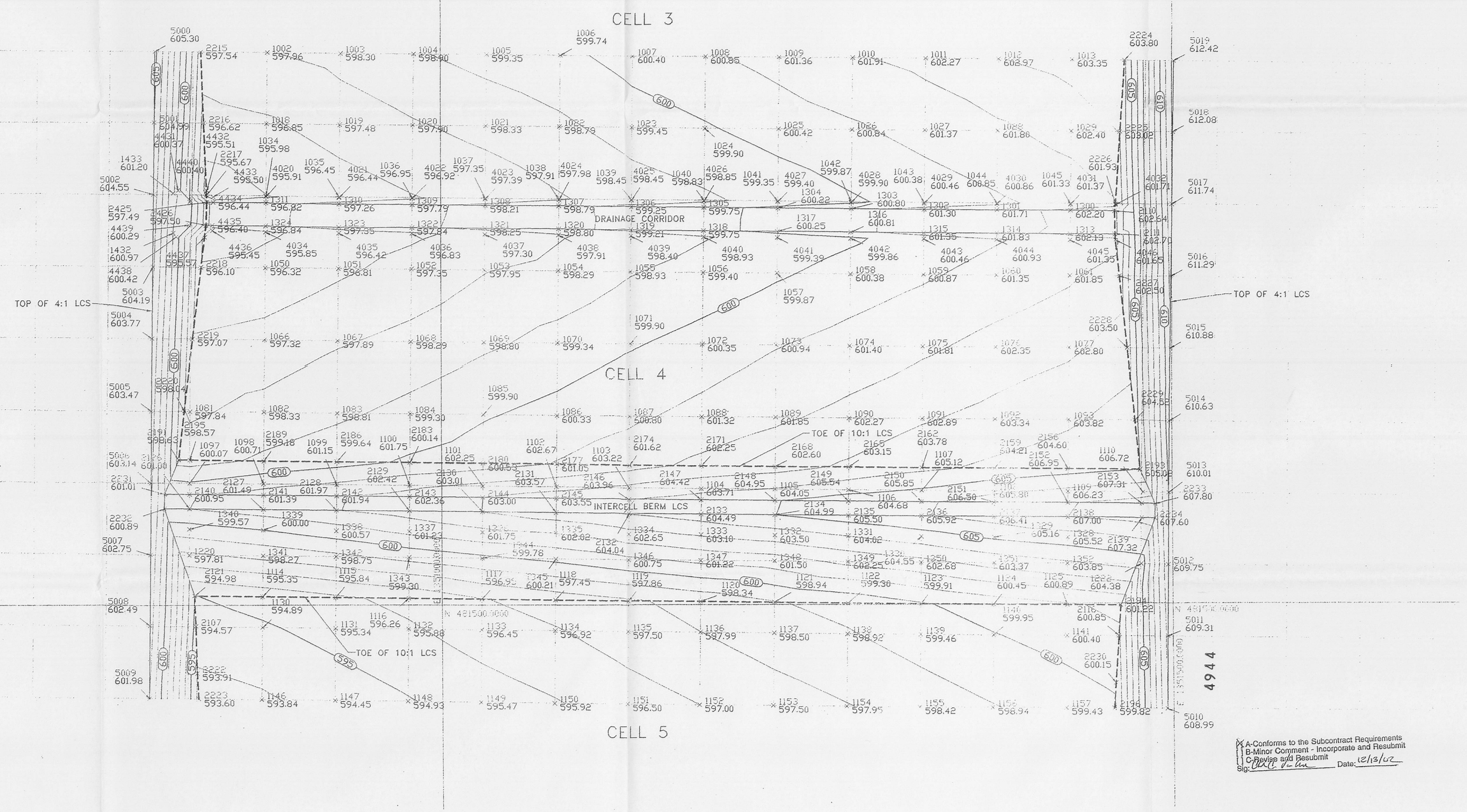
Scale: 1" = 40'

Date: 11-15-2002

Sheet No. 2 OF 2

Project No. 201-225

Y:\201\225\DWG\CELL5 LCS.DWG



X A-Conforms to the Subcontract Requirements
B-Minor Comment - Incorporate and Resubmit
C-Revise and Resubmit
Sig: David E. Estes Date: 12/3/02

LEGEND:

× 2100 619.21 = ELEVATION AND POINT NUMBER
——— = AS-BUILT INDEX CONTOUR
——— = AS-BUILT INTERMEDIATE CONTOUR
– – – – = TOE OF SLOPES

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

000036

STATE OF OHIO THOMAS J. MACK S-7961 PROFESSIONAL SURVEYOR
12-3-2002

David E. Estes Engineering, Inc.
CIVIL & ENVIRONMENTAL ENGINEERING
LAND SURVEYING & LANDSCAPE ARCHITECTURE
7075 INDUSTRIAL ROAD, FLORENCE, KENTUCKY 41042
Tele. (859) 342-8100; Fax. (859) 342-8123; email: DE@estesengineering.com;
www.estesengineering.com

Designed By:
Drawn By: F.A.M.
Checked By: T.J.M.
Approved By: T.J.M.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

AS-BUILT PROTECTIVE LAYER CELL 4

Scale: 1" = 40'
Date: 12-3-2002
Sheet No. 1 OF 3
Project No. 201-225

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PNT NO.	NORTH	EAST	ASBUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1002	481884.66	1350881.93	596.86	597.86	Grid Pt.	597.96	1.10	11/16/02
1003	481884.04	1350931.93	597.30	598.30	Grid Pt.	598.30	1.00	11/16/02
1004	481883.43	1350981.93	597.87	598.87	Grid Pt.	598.90	1.03	11/16/02
1005	481882.82	1351031.92	598.25	599.25	Grid Pt.	599.35	1.10	11/16/02
1006	481882.21	1351081.92	598.74	599.74	Grid Pt.	599.74	1.00	11/25/02
1007	481881.60	1351131.91	599.35	600.35	Grid Pt.	600.40	1.05	11/25/02
1008	481880.99	1351181.91	599.84	600.84	Grid Pt.	600.85	1.01	11/15/02
1009	481880.38	1351231.91	600.32	601.32	Grid Pt.	601.36	1.04	11/15/02
1010	481879.77	1351281.90	600.91	601.91	Grid Pt.	601.91	1.00	11/15/02
1011	481879.15	1351331.90	601.26	602.26	Grid Pt.	602.27	1.01	11/15/02
1012	481878.54	1351381.90	601.87	602.87	Grid Pt.	602.97	1.10	11/16/02
1013	481877.93	1351431.89	602.31	603.31	Grid Pt.	603.35	1.04	11/16/02
1018	481834.66	1350881.32	595.85	596.85	Grid Pt.	596.85	1.00	11/25/02
1019	481834.05	1350931.32	596.46	597.46	Grid Pt.	597.48	1.02	11/16/02
1020	481833.44	1350981.32	596.87	597.87	Grid Pt.	597.90	1.03	11/25/02
1021	481832.83	1351031.31	597.33	598.33	Grid Pt.	598.33	1.00	11/16/02
1022	481832.21	1351081.31	597.78	598.78	Grid Pt.	598.79	1.01	11/25/02
1023	481831.60	1351131.30	598.39	599.39	Grid Pt.	599.45	1.06	11/25/02
1024	481830.99	1351181.30	598.83	599.83	Grid Pt.	599.90	1.07	11/25/02
1025	481830.38	1351231.30	599.42	600.42	Grid Pt.	600.42	1.00	11/25/02
1026	481829.77	1351281.29	599.84	600.84	Grid Pt.	600.84	1.00	11/15/02
1027	481829.16	1351331.29	600.32	601.32	Grid Pt.	601.37	1.05	11/15/02
1028	481828.55	1351381.29	600.80	601.80	Grid Pt.	601.80	1.00	11/16/02
1029	481827.94	1351431.28	601.34	602.34	Grid Pt.	602.40	1.06	11/16/02
1034	481784.66	1350880.71	594.93	595.93	Grid Pt.	595.98	1.05	11/2/02
1035	481784.05	1350930.71	595.38	596.38	Grid Pt.	596.45	1.07	11/2/02
1036	481783.44	1350980.71	595.90	596.90	Grid Pt.	596.95	1.05	11/2/02
1037	481782.83	1351030.70	596.32	597.32	Grid Pt.	597.35	1.03	11/20/02
1038	481782.22	1351080.70	596.90	597.90	Grid Pt.	597.91	1.01	11/20/02
1039	481781.61	1351130.69	597.39	598.39	Grid Pt.	598.45	1.06	11/18/02
1040	481781.00	1351180.69	597.83	598.83	Grid Pt.	598.83	1.00	11/20/02
1041	481780.38	1351230.69	598.33	599.33	Grid Pt.	599.35	1.02	11/18/02
1042	481779.77	1351280.68	598.87	599.87	Grid Pt.	599.87	1.00	11/18/02
1043	481779.16	1351330.68	599.36	600.36	Grid Pt.	600.38	1.02	11/18/02
1044	481778.55	1351380.68	599.80	600.80	Grid Pt.	600.85	1.05	11/18/02
1045	481777.94	1351430.67	600.33	601.33	Grid Pt.	601.33	1.00	11/18/02
1050	481734.67	1350880.10	595.29	596.29	GRID PNT	596.32	1.03	11/2/02
1051	481734.06	1350930.09	595.76	596.76	Grid Pt.	596.81	1.05	11/2/02
1052	481733.44	1350980.09	596.30	597.30	GRID PNT	597.35	1.05	11/2/02
1053	481732.83	1351030.09	596.90	597.90	GRID PNT	597.95	1.05	11/18/02
1054	481732.22	1351080.08	597.28	598.28	GRID PNT	598.29	1.01	11/18/02
1055	481731.61	1351130.08	597.89	598.89	GRID PNT	598.93	1.04	11/18/02
1056	481731.00	1351180.07	598.40	599.40	GRID PNT	599.40	1.00	11/16/02
1057	481730.39	1351230.07	598.87	599.87	GRID PNT	599.87	1.00	11/16/02
1058	481729.78	1351280.07	599.34	600.34	GRID PNT	600.38	1.04	11/16/02
1059	481729.17	1351330.06	599.80	600.80	GRID PNT	600.87	1.07	11/16/02
1060	481728.56	1351380.06	600.34	601.34	GRID PNT	601.35	1.01	11/16/02
1061	481727.95	1351430.06	600.79	601.79	GRID PNT	601.85	1.06	11/16/02
1066	481684.67	1350879.49	596.29	597.29	GRID PNT	597.32	1.03	11/2/02

PNT NO.	NORTH	EAST	ASBUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1067	481684.06	1350929.48	596.82	597.82	Grid Pt.	597.89	1.07	11/2/02
1068	481683.45	1350979.48	597.29	598.29	GRID PNT	598.29	1.00	11/2/02
1069	481682.84	1351029.48	597.80	598.80	GRID PNT	598.80	1.00	11/18/02
1070	481682.23	1351079.47	598.33	599.33	GRID PNT	599.34	1.01	11/18/02
1071	481681.62	1351129.47	598.89	599.89	GRID PNT	599.90	1.01	11/18/02
1072	481681.01	1351179.46	599.31	600.31	GRID PNT	600.35	1.04	11/18/02
1073	481680.39	1351229.46	599.84	600.84	GRID PNT	600.94	1.10	11/16/02
1074	481679.78	1351279.46	600.40	601.40	GRID PNT	601.40	1.00	11/16/02
1075	481679.17	1351329.45	600.81	601.81	GRID PNT	601.81	1.00	11/16/02
1076	481678.56	1351379.45	601.34	602.34	GRID PNT	602.35	1.01	11/16/02
1077	481677.95	1351429.45	601.79	602.79	GRID PNT	602.80	1.01	11/20/02
1081	481635.29	1350828.88	596.76	597.76	Grid Pt.	597.84	1.08	11/2/02
1082	481634.67	1350878.88	597.32	598.32	GRID PNT	598.33	1.01	11/2/02
1083	481634.06	1350928.87	597.78	598.78	Grid Pt.	598.81	1.03	11/2/02
1084	481633.45	1350978.87	598.28	599.28	GRID PNT	599.30	1.02	11/15/02
1085	481632.84	1351028.87	598.87	599.87	GRID PNT	599.90	1.03	11/18/02
1086	481632.23	1351078.86	599.28	600.28	GRID PNT	600.33	1.05	11/18/02
1087	481631.62	1351128.86	599.78	600.78	GRID PNT	600.80	1.02	11/18/02
1088	481631.01	1351178.85	600.32	601.32	GRID PNT	601.32	1.00	11/18/02
1089	481630.40	1351228.85	600.80	601.80	GRID PNT	601.85	1.05	11/16/02
1090	481629.79	1351278.85	601.27	602.27	GRID PNT	602.27	1.00	11/16/02
1091	481629.18	1351328.84	601.89	602.89	GRID PNT	602.89	1.00	11/16/02
1092	481628.57	1351378.84	602.33	603.33	GRID PNT	603.34	1.01	11/16/02
1093	481627.96	1351428.84	602.82	603.82	GRID PNT	603.82	1.00	11/16/02
1097	481585.29	1350828.27	599.05	600.06	Grid Pt.	600.07	1.02	11/2/02
1098	481584.68	1350878.27	599.61	600.62	Grid Pt.	600.71	1.10	11/2/02
1099	481584.07	1350928.26	600.10	601.11	Grid Pt.	601.15	1.05	11/2/02
1100	481583.46	1350978.26	600.68	601.69	Grid Pt.	601.75	1.07	11/2/02
1101	481582.85	1351028.26	601.22	602.23	Grid Pt.	602.25	1.03	11/9/02
1102	481582.23	1351078.25	601.63	602.64	Grid Pt.	602.67	1.04	11/9/02
1103	481581.62	1351128.25	602.20	603.21	Grid Pt.	603.22	1.02	11/23/02
1104	481581.01	1351178.24	602.69	603.70	Grid Pt.	603.71	1.02	11/23/02
1105	481580.40	1351228.24	603.03	604.04	Grid Pt.	604.05	1.02	11/23/02
1106	481579.79	1351278.24	603.67	604.68	Grid Pt.	604.68	1.01	11/23/02
1107	481579.18	1351328.23	604.11	605.12	Grid Pt.	605.12	1.01	11/24/02
1108	481578.57	1351378.23	604.78	605.79	Grid Pt.	605.80	1.02	11/24/02
1109	481577.96	1351428.23	605.22	606.23	Grid Pt.	606.23	1.01	11/24/02
1110	481577.33	1351479.55	605.71	606.72	S/GCELL4TOE	606.72	1.01	11/18/02
1114	481505.84	1350877.32	594.33	595.34	Toe 10%	595.35	1.02	11/24/02
1115	481505.23	1350927.30	594.83	595.84	Toe 10%	595.84	1.01	11/24/02
1116	481504.62	1350977.30	595.24	596.25	Toe 10%	596.26	1.02	11/24/02
1117	481504.01	1351027.30	595.92	596.93	Toe 10%	596.95	1.03	11/24/02
1118	481503.39	1351077.29	596.39	597.40	Toe 10%	597.45	1.06	11/24/02
1119	481502.78	1351127.29	596.85	597.86	Toe 10%	597.86	1.01	11/24/02
1120	481502.17	1351177.28	597.33	598.34	Toe 10%	598.34	1.01	11/24/02
1121	481501.56	1351227.28	597.89	598.90	Toe 10%	598.94	1.05	11/24/02
1122	481500.95	1351277.28	598.26	599.27	Toe 10%	599.30	1.04	11/22/02
1123	481500.34	1351327.27	598.87	599.88	Toe 10%	599.91	1.04	11/24/02
1124	481499.73	1351377.27	599.38	600.39	Toe 10%	600.45	1.07	11/22/02

PNT NO.	NORTH	EAST	ASBUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1125	481499.12	1351427.27	599.85	600.86	Toe 10%	600.89	1.04	11/24/02
1130	481484.69	1350877.05	593.88	594.88	Grid Pt.	594.89	1.01	11/23/02
1131	481484.08	1350927.04	594.34	595.34	Grid Pt.	595.34	1.00	11/23/02
1132	481483.47	1350977.04	594.88	595.88	Grid Pt.	595.88	1.00	11/23/02
1133	481482.86	1351027.03	595.45	596.45	Grid Pt.	596.45	1.00	11/23/02
1134	481482.24	1351077.03	595.91	596.91	Grid Pt.	596.92	1.01	11/23/02
1135	481481.63	1351127.03	596.45	597.45	Grid Pt.	597.50	1.05	11/24/02
1136	481481.02	1351177.02	596.97	597.97	Grid Pt.	597.99	1.02	11/24/02
1137	481480.41	1351227.02	597.45	598.45	Grid Pt.	598.50	1.05	~~11/23/02~~ — 11/24/02 SK
1138	481479.80	1351277.02	597.92	598.92	Grid Pt.	598.92	1.00	11/23/02
1139	481479.19	1351327.01	598.46	599.46	Grid Pt.	599.46	1.00	11/23/02
1140	481478.58	1351377.01	598.88	599.88	Grid Pt.	599.95	1.07	11/23/02
1141	481477.97	1351427.00	599.40	600.40	Grid Pt.	600.40	1.00	11/24/02
1146	481434.69	1350876.43	592.84	593.84	Grid Pt.	593.84	1.00	11/23/02
1147	481434.08	1350926.43	593.43	594.43	Grid Pt.	594.45	1.02	11/23/02
1148	481433.47	1350976.43	593.93	594.93	Grid Pt.	594.93	1.00	11/23/02
1149	481432.86	1351026.42	594.44	595.44	Grid Pt.	595.47	1.03	11/23/02
1150	481432.25	1351076.42	594.91	595.91	Grid Pt.	595.92	1.01	11/23/02
1151	481431.64	1351126.42	595.43	596.43	Grid Pt.	596.50	1.07	11/23/02
1152	481431.03	1351176.41	595.91	596.91	Grid Pt.	597.00	1.09	11/24/02
1153	481430.42	1351226.41	596.44	597.44	Grid Pt.	597.50	1.06	~~11/23/02~~ — 11/24/02 SK
1154	481429.80	1351276.40	596.95	597.95	Grid Pt.	597.95	1.00	11/23/02
1155	481429.19	1351326.40	597.42	598.42	Grid Pt.	598.42	1.00	11/24/02
1156	481428.58	1351376.40	597.94	598.94	Grid Pt.	598.94	1.00	11/23/02
1157	481427.97	1351426.39	598.33	599.33	Grid Pt.	599.43	1.10	11/24/02
1220	481535.29	1350827.66	596.73	597.74	GRID PT 10%	597.81	1.08	11/9/02
1222	481527.35	1351478.09	603.35	604.38	GRID PT 10%	604.38	1.03	11/24/02
1300	481773.07	1351430.61	601.14	602.14	S/GCELL4	602.20	1.06	11/18/02
1301	481773.68	1351380.62	600.71	601.71	S/GCELL4	601.71	1.00	11/18/02
1302	481774.29	1351330.62	600.29	601.29	S/GCELL4	601.30	1.01	11/18/02
1303	481774.90	1351280.62	599.72	600.72	S/GCELL4	600.80	1.08	11/18/02
1304	481775.52	1351230.63	599.22	600.22	S/GCELL4	600.22	1.00	11/20/02
1305	481776.13	1351180.63	598.72	599.72	S/GCELL4	599.75	1.03	11/20/02
1306	481776.74	1351130.63	598.24	599.24	S/GCELL4	599.25	1.01	11/18/02
1307	481777.35	1351080.64	597.76	598.76	S/GCELL4	598.79	1.03	11/20/02
1308	481777.96	1351030.64	597.21	598.21	S/GCELL4	598.21	1.00	11/18/02
1309	481778.57	1350980.65	596.75	597.75	S/GCELL4	597.79	1.04	11/2/02
1310	481779.18	1350930.65	596.22	597.22	S/GCELL4	597.26	1.04	11/2/02
1311	481779.79	1350880.65	595.77	596.77	S/GCELL4	596.82	1.05	11/2/02
1313	481757.08	1351430.41	601.12	602.12	S/GCELL4	602.13	1.01	11/16/02
1314	481757.69	1351380.42	600.83	601.83	S/GCELL4	601.83	1.00	11/16/02
1315	481758.30	1351330.42	600.30	601.30	S/GCELL4	601.35	1.05	11/16/02
1316	481758.91	1351280.42	599.77	600.77	S/GCELL4	600.81	1.04	11/16/02
1317	481759.52	1351230.43	599.24	600.24	S/GCELL4	600.25	1.01	11/18/02
1318	481760.13	1351180.43	598.73	599.73	S/GCELL4	599.75	1.02	11/20/02
1319	481760.74	1351130.43	598.21	599.21	S/GCELL4	599.21	1.00	11/20/02
1320	481761.35	1351080.44	597.80	598.80	S/GCELL4	598.80	1.00	11/18/02
1321	481761.96	1351030.44	597.22	598.22	S/GCELL4	598.25	1.03	11/20/02
1322	481762.57	1350980.45	596.74	597.74	S/GCELL4	597.84	1.10	11/2/02

PNT NO.	NORTH	EAST	ASBUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
1323	481763.18	1350930.45	596.30	597.30	S/GCELL4	597.35	1.05	11/2/02
1324	481763.79	1350880.45	595.77	596.77	S/GCELL4	596.84	1.07	11/2/02
1328	481545.99	1351427.84	604.51	605.52	GRID PNT	605.52	1.01	11/22/02
1329	481546.60	1351377.84	604.15	605.16	SG TOP	605.16	1.01	11/24/02
1330	481547.21	1351327.84	603.50	604.51	SG TOP	604.55	1.05	11/22/02
1331	481547.82	1351277.85	603.01	604.02	S/GCELL4TOP/SL	604.02	1.01	11/23/02
1332	481548.43	1351227.85	602.48	603.49	S/GCELL4TOP	603.50	1.02	11/22/02
1333	481549.05	1351177.85	602.04	603.05	S/GCELL4TOP/SL	603.10	1.06	11/24/02
1334	481549.66	1351127.86	601.61	602.62	S/GCELL4TOP/SL	602.65	1.04	11/24/02
1335	481550.27	1351077.86	600.93	601.94	S/GCELL4TOP	602.02	1.09	11/9/02
1336	481550.88	1351027.87	600.69	601.70	S/GCELL4TOP	601.75	1.06	11/9/02
1337	481551.49	1350977.87	600.18	601.19	S/GCELL4TOP/SL	601.23	1.05	11/9/02
1338	481552.10	1350927.87	599.55	600.56	S/GCELL4TOP/SL	600.57	1.02	11/9/02
1339	481552.71	1350877.88	598.99	600.00	S/GCELL4TOP/SL	600.00	1.01	11/9/02
1340	481553.32	1350827.88	598.49	599.50	S/GCELL4TOP/SL	599.57	1.08	11/9/02
1341	481534.68	1350877.66	597.22	598.23	GRID PT 10%	598.27	1.05	11/9/02
1342	481534.07	1350927.65	597.66	598.67	GRID PT 10%	598.75	1.09	11/9/02
1343	481533.46	1350977.65	598.22	599.23	GRID PT 10%	599.30	1.08	11/9/02
1344	481532.85	1351027.65	598.68	599.69	GRID PT 10%	599.78	1.10	11/9/02
1345	481532.24	1351077.64	599.18	600.19	GRID PT 10%	600.21	1.03	11/9/02
1346	481531.63	1351127.64	599.70	600.71	GRID PT 10%	600.75	1.05	11/24/02
1347	481531.02	1351177.63	600.19	601.20	GRID PT 10%	601.22	1.03	11/24/02
1348	481530.40	1351227.63	600.48	601.49	GRID PT 10%	601.50	1.02	11/23/02
1349	481529.79	1351277.63	601.23	602.24	GRID PT 10%	602.25	1.02	11/23/02
1350	481529.18	1351327.62	601.67	602.68	GRID PT 10%	602.68	1.01	11/24/02
1351	481528.57	1351377.62	602.34	603.35	GRID PT 10%	603.37	1.03	11/24/02
1352	481527.96	1351427.62	602.81	603.82	GRID PT 10%	603.85	1.04	11/22/02
1432	481758.92	1350817.82	599.92	600.95	C4 SGCELLOUT	600.97	1.05	11/2/02
1433	481786.48	1350817.88	600.10	601.13	C4 SGCELLOUT	601.20	1.10	11/2/02
2107	481485.50	1350832.09	593.54	594.57	Toe4:1 Cell4tc	594.57	1.03	11/24/02
2110	481772.68	1351460.52	601.60	602.63	Toe4:1Cell4tc	602.64	1.04	11/24/02
2111	481756.73	1351460.83	601.60	602.63	Toe4:1Cell4tc	602.70	1.10	11/16/02
2116	481477.79	1351462.40	599.78	600.81	T/CCell4-Control Pt	600.85	1.07	11/24/02
2121	481506.41	1350831.34	593.94	594.97	Toe 10%	594.98	1.04	11/24/02
2126	481567.42	1350828.05	599.90	600.90	Top/SLintercell4	601.00	1.10	11/9/02
2127	481566.81	1350878.05	600.43	601.43	Top/SLintercell4	601.49	1.06	11/9/02
2128	481566.20	1350928.04	600.89	601.89	Top/SLintercell4	601.97	1.08	11/9/02
2129	481565.59	1350978.04	601.37	602.37	Top/SLintercell4	602.42	1.05	11/9/02
2130	481564.98	1351028.04	601.92	602.92	Top/SLintercell4	603.01	1.09	11/9/02
2131	481564.36	1351078.03	602.51	603.51	Top/SLintercell4	603.57	1.06	11/9/02
2132	481563.75	1351128.03	603.04	604.04	Top/SLintercell4	604.04	1.00	11/23/02
2133	481563.14	1351178.02	603.49	604.49	Top/SLintercell4	604.49	1.00	11/22/02
2134	481562.53	1351228.02	603.97	604.97	Top/SLintercell4	604.99	1.02	11/22/02
2135	481561.92	1351278.02	604.42	605.42	Top/SLintercell4	605.50	1.08	11/23/02
2136	481561.31	1351328.01	604.92	605.92	Top/SLintercell4	605.92	1.00	11/24/02
2137	481560.70	1351378.01	605.41	606.41	Top/SLintercell4	606.41	1.00	11/23/02
2138	481560.09	1351428.01	605.90	606.90	Top/SLintercell4	607.00	1.10	11/23/02
2139	481559.47	1351478.48	606.32	607.32	Top/SLintercell4	607.32	1.00	11/22/02
2140	481577.42	1350828.17	599.89	600.89	Top/SLintercell4	600.95	1.06	11/2/02

PNT NO.	NORTH	EAST	ASBUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2141	481576.81	1350878.17	600.39	601.39	Top/SLintercell4	601.39	1.00	11/2/02
2142	481576.20	1350928.16	600.93	601.93	Top/SLintercell4	601.94	1.01	11/2/02
2143	481575.59	1350978.16	601.33	602.33	Top/SLintercell4	602.36	1.03	11/2/02
2144	481574.98	1351028.16	601.96	602.96	Top/SLintercell4	603.00	1.04	11/9/02
2145	481574.37	1351078.15	602.45	603.45	Top/SLintercell4	603.55	1.10	11/9/02
2146	481573.76	1351128.15	602.96	603.96	Top/SLintercell4	603.96	1.00	11/22/02
2147	481573.15	1351178.14	603.42	604.42	Top/SLintercell4	604.42	1.00	11/23/02
2148	481572.54	1351228.14	603.88	604.88	Top/SLintercell4	604.95	1.07	11/23/02
2149	481571.92	1351278.14	604.54	605.54	Top/SLintercell4	605.54	1.00	11/23/02
2150	481571.31	1351328.13	604.81	605.81	Top/SLintercell4	605.85	1.04	11/23/02
2151	481570.70	1351378.13	605.45	606.45	Top/SLintercell4	606.50	1.05	11/23/02
2152	481570.09	1351428.13	605.94	606.94	Top/SLintercell4	606.95	1.01	11/23/02
2153	481569.48	1351478.60	606.30	607.30	Top/SLintercell4	607.31	1.01	11/24/02
2156	481593.77	1351428.42	603.58	604.59	Toe/10%slcell4tc	604.60	1.02	11/18/02
2159	481594.38	1351378.42	603.20	604.21	Toe/10%slcell4tc	604.21	1.01	11/18/02
2162	481594.99	1351328.42	602.67	603.68	Toe/10%slcell4tc	603.78	1.11	11/18/02
2165	481595.60	1351278.43	602.05	603.06	Toe/10%slcell4tc	603.15	1.10	11/18/02
2168	481596.21	1351228.43	601.51	602.52	Toe/10%slcell4tc	602.60	1.09	11/18/02
2171	481596.83	1351178.43	601.17	602.18	Toe/10%slcell4tc	602.25	1.08	11/18/02
2174	481597.44	1351128.44	600.61	601.62	Toe/10%slcell4tc	601.62	1.01	11/18/02
2177	481598.05	1351078.44	600.02	601.03	Toe/10%slcell4tc	601.05	1.03	11/23/02
2180	481598.66	1351028.45	599.51	600.52	Toe/10%slcell4tc	600.53	1.02	11/23/02
2183	481599.27	1350978.45	599.05	600.06	Toe/10%slcell4tc	600.14	1.09	11/2/02
2186	481599.88	1350928.45	598.57	599.58	Toe/10%slcell4tc	599.64	1.07	11/2/02
2189	481600.49	1350878.46	598.17	599.18	Toe/10%slcell4tc	599.18	1.01	11/2/02
2191	481601.19	1350820.82	597.53	598.54	Toe/4:1slcell4tc	598.63	1.10	11/2/02
2193	481593.17	1351477.54	604.01	605.02	Toe/4:1slCell4	605.02	1.01	11/18/02
2194	481498.68	1351463.74	600.19	601.20	Toe 10%	601.22	1.03	11/24/02
2195	481601.10	1350828.46	597.51	598.52	Toe/10%slCell4tc	598.57	1.06	11/2/02
2196	481427.57	1351459.17	598.78	599.81	Toe/4:1slCell4tc	599.82	1.04	11/24/02
2215	481885.21	1350836.99	596.51	597.54	Toe/4:1slCell4tc	597.54	1.03	11/25/02
2216	481835.18	1350838.78	595.58	596.61	Toe/4:1slCell4tc	596.62	1.04	11/25/02
2217	481785.16	1350840.57	594.57	595.60	Toe/4:1slCell4tc	595.67	1.10	11/2/02
2218	481735.20	1350836.66	595.00	596.03	Toe/4:1slCell4tc	596.10	1.10	11/2/02
2219	481685.27	1350830.76	596.03	597.06	Toe/4:1slCell4tc	597.07	1.04	11/2/02
2220	481635.34	1350824.86	596.99	598.02	Toe/4:1slCell4tc	598.04	1.05	11/2/02
2222	481452.89	1350833.03	592.88	593.91	Toe/4:1slCell4tc	593.91	1.03	11/24/02
2223	481435.21	1350833.89	592.56	593.59	Toe/4:1slCell4tc	593.60	1.04	11/24/02
2224	481877.50	1351467.36	602.71	603.74	Toe/4:1slCell4tc	603.80	1.09	11/16/02
2225	481827.54	1351464.28	601.89	602.92	Toe/4:1slCell4tc	603.02	1.13	11/16/02
2226	481777.57	1351461.21	600.80	601.83	Toe/4:1slCell4tc	601.93	1.13	11/16/02
2227	481727.54	1351463.81	601.38	602.41	Toe/4:1slCell4tc	602.50	1.12	11/16/02
2228	481677.47	1351468.93	602.43	603.46	Toe/4:1slCell4tc	603.50	1.07	11/16/02
2229	481627.41	1351474.04	603.42	604.45	Toe/4:1slCell4tc	604.52	1.10	11/16/02
2230	481445.21	1351460.30	599.11	600.14	Toe/4:1slCell4tc	600.15	1.04	11/24/02
2231	481577.63	1350811.04	599.91	600.94	Top /Berm @ toe 4:1	601.01	1.10	11/2/02
2232	481567.63	1350810.92	599.79	600.82	Top /Berm @ toe 4:1	600.89	1.10	11/2/02
2233	481569.36	1351488.08	606.71	607.74	Top /Berm @ toe 4:1	607.80	1.09	11/18/02
2234	481559.35	1351487.96	606.56	607.59	Top /Berm @ toe 4:1	607.60	1.04	11/24/02

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REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: T.J.M.
Approved By: T.J.M.

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL
MANAGEMENT PROJECT
OSDF CELL 4

AS-BUILT PROTECTIVE LAYER CELL 4

Scale:
Date: 12-3-2002
Sheet No. 2 OF 3
Project No. 201-225

David E. Estes Engineering, Inc.
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STATE OF OHIO * THOMAS J. MACK S-7964 * PROFESSIONAL SURVEYOR
12-3-2002

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PNT NO.	NORTH	EAST	ASBUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
2425	481780.25	1350840.75	596.39	597.42	T/CCell4 Outlet	597.49	1.10	11/2/02
2426	481764.32	1350840.10	596.40	597.43	T/CCell4 Outlet	597.50	1.10	11/2/02
4020	481784.11	1350880.70	594.85	595.88	Toe 4:1 LCS	595.91	1.06	11/2/02
4021	481783.50	1350930.70	595.34	596.37	Toe 4:1 LCS	596.44	1.10	11/2/02
4022	481782.89	1350980.70	595.84	596.87	Toe 4:1 LCS	596.92	1.08	11/2/02
4023	481782.28	1351030.69	596.35	597.38	Toe 4:1 LCS	597.39	1.04	11/20/02
4024	481781.67	1351080.69	596.89	597.92	Toe 4:1 LCS	597.98	1.09	11/18/02
4025	481781.06	1351130.68	597.39	598.42	Toe 4:1 LCS	598.45	1.06	11/20/02
4026	481780.45	1351180.68	597.82	598.85	Toe 4:1 LCS	598.85	1.03	11/20/02
4027	481779.84	1351230.68	598.36	599.39	Toe 4:1 LCS	599.40	1.04	11/18/02
4028	481779.22	1351280.67	598.84	599.87	Toe 4:1 LCS	599.90	1.06	11/18/02
4029	481778.61	1351330.67	599.40	600.43	Toe 4:1 LCS	600.46	1.06	11/18/02
4030	481778.00	1351380.67	599.82	600.85	Toe 4:1 LCS	600.86	1.04	11/18/02
4031	481777.39	1351430.66	600.32	601.35	Toe 4:1 LCS	601.37	1.05	11/18/02
4032	481777.02	1351461.13	600.67	601.70	Toe 4:1 LCS	601.71	1.04	11/18/02
4034	481759.47	1350880.40	594.75	595.78	Toe 4:1 LCS	595.85	1.10	11/2/02
4035	481758.86	1350930.40	595.37	596.40	Toe 4:1 LCS	596.42	1.05	11/2/02
4036	481758.25	1350980.40	595.79	596.82	Toe 4:1 LCS	596.83	1.04	11/2/02
4037	481757.64	1351030.39	596.23	597.26	Toe 4:1 LCS	597.30	1.07	11/20/02
4038	481757.03	1351080.39	596.87	597.90	Toe 4:1 LCS	597.91	1.04	11/20/02
4039	481756.42	1351130.38	597.32	598.35	Toe 4:1 LCS	598.40	1.08	11/20/02
4040	481755.81	1351180.38	597.88	598.91	Toe 4:1 LCS	598.93	1.05	11/20/02
4041	481755.20	1351230.38	598.34	599.37	Toe 4:1 LCS	599.39	1.05	11/18/02
4042	481754.59	1351280.37	598.80	599.83	Toe 4:1 LCS	599.86	1.06	11/18/02
4043	481753.98	1351330.37	599.39	600.42	Toe 4:1 LCS	600.46	1.07	11/18/02
4044	481753.37	1351380.37	599.90	600.93	Toe 4:1 LCS	600.93	1.03	11/18/02
4045	481752.76	1351430.36	600.30	601.33	Toe 4:1 LCS	601.35	1.05	11/18/02
4046	481752.38	1351461.27	600.61	601.64	Toe 4:1 LCS	601.65	1.04	605.30 11/24/02 SK
4431	481788.47	1350821.16	599.30	600.33	Cell Outlet	600.37	1.07	604.99 11/02/02
4432	481788.23	1350840.70	594.44	595.47	Cell Outlet	595.51	1.07	11/2/02
4433	481783.87	1350845.11	594.40	595.43	Cell Outlet	595.50	1.10	11/2/02
4434	481780.17	1350845.07	595.34	596.37	Cell Outlet	596.44	1.10	11/2/02
4435	481764.30	1350844.42	595.34	596.37	Cell Outlet	596.40	1.06	11/2/02
4436	481760.59	1350844.37	594.35	595.38	Cell Outlet	595.45	1.10	11/2/02
4437	481755.86	1350839.33	594.48	595.51	Cell Outlet	595.57	1.09	11/2/02
4438	481756.10	1350819.83	599.33	600.36	Cell Outlet	600.42	1.09	11/2/02
4439	481764.49	1350828.43	599.26	600.29	Cell Outlet	600.29	1.03	11/2/02
4440	481780.37	1350829.08	599.30	600.33	Cell Outlet	600.40	1.10	11/2/02
5000	481885.59	1350805.67	605.27	605.27	TOP 4:1	605.30	NONE	605.30 11/26/02 SK
5001	481835.59	1350805.06	604.96	604.96	TOP 4:1	604.99	NONE	604.99 11/2 5/02
5002	481785.60	1350804.45	604.50	604.50	TOP 4:1	604.55	NONE	11/2/02
5003	481735.60	1350803.83	604.10	604.10	TOP 4:1	604.19	NONE	11/2/02
5004	481685.60	1350803.22	603.76	603.76	TOP 4:1	603.77	NONE	11/2/02
5005	481635.61	1350802.61	603.38	603.38	TOP 4:1	603.47	NONE	11/2/02
5006	481585.61	1350802.00	603.10	603.10	TOP 4:1	603.14	NONE	11/2/02
5007	481535.62	1350801.39	602.75	602.75	TOP 4:1	602.75	NONE	11/15/02
5008	481485.88	1350800.78	602.45	602.45	TOP 4:1	602.49	NONE	11/24/02
5009	481435.62	1350800.17	601.98	601.98	TOP 4:1	601.98	NONE	11/24/02
5010	481427.09	1351495.99	608.97	608.97	TOP 4:1	608.99	NONE	11/24/02

PNT NO.	NORTH	EAST	ASBUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS BUILT ELEV	LAYER THICKNESS	DATE
5011	481477.34	1351496.60	609.30	609.30	TOP 4:1	609.31	NONE	11/24/02
5012	481527.10	1351497.21	609.71	609.71	TOP 4:1	609.75	NONE	11/24/02
5013	481577.09	1351497.82	610.01	610.01	TOP 4:1	610.01	NONE	11/20/02
5014	481627.09	1351498.43	610.63	610.63	TOP 4:1	610.63	NONE	11/20/02
5015	481677.08	1351499.04	610.88	610.88	TOP 4:1	610.88	NONE	11/18/02
5016	481727.08	1351499.65	611.29	611.29	TOP 4:1	611.29	NONE	11/18/02
5017	481777.08	1351500.26	611.74	611.74	TOP 4:1	611.74	NONE	11/18/02
5018	481827.07	1351500.87	612.08	612.08	TOP 4:1	612.08	NONE	11/18/02
5019	481877.06	1351501.48	612.42	612.42	TOP 4:1	612.42	NONE	11/18/02
5021	481573.11	1350771.44		N/A	CornerCatchment		NONE	
5022	481823.09	1350774.50		N/A	CornerCatchment		NONE	
5023	481820.50	1350986.48		N/A	CornerCatchment		NONE	
5024	481570.52	1350983.43		N/A	CornerCatchment		NONE	

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STATE OF OHIO
THOMAS J. MACK
S-7964
REGISTERED
PROFESSIONAL SURVEYOR
12-3-2002

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Checked By: T.J.M.
Approved By: T.J.M.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

AS-BUILT PROTECTIVE LAYER CELL 4

Scale:
Date: 12-3-2002
Sheet No. 3 OF 3
Project No. 201-225

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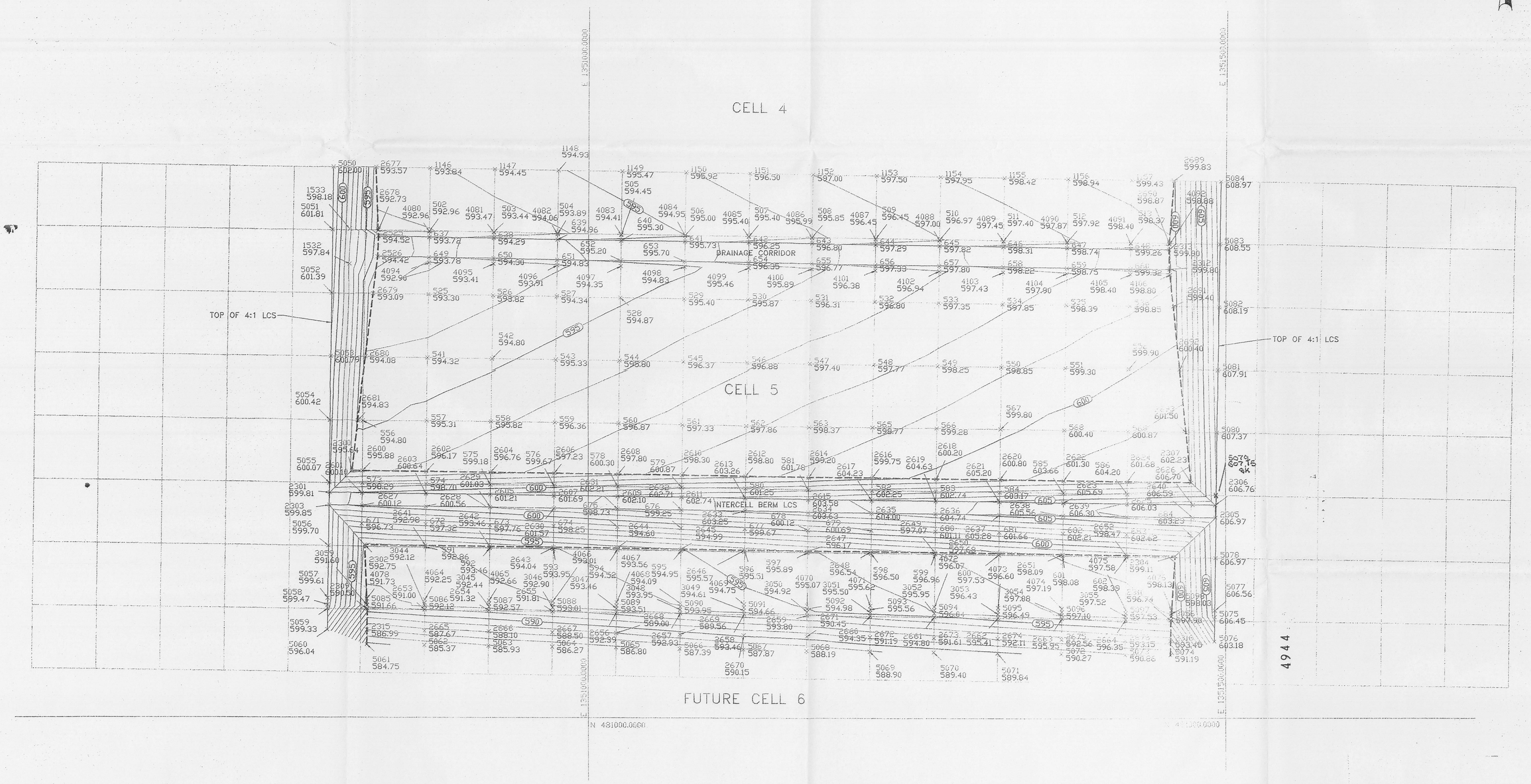

LEGEND:

× 2100 619.21 = ELEVATION AND POINT NUMBER

= AS-BUILT INDEX CONTOUR

= AS-BUILT INTERMEDIATE CONTOUR

= TOE OF SLOPES

CONTOUR INTERVAL = 1'

40 20 0 40 80 120

SCALE: 1"=40'

4944

000040

STATE OF OHIO
THOMAS J. MACK
S-7964
REGISTERED
PROFESSIONAL SURVEYOR
12-19-2002

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Checked By:	T.J.M.
Approved By:	T.J.M.

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FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

AS-BUILT PROTECTIVE LAYER CELL 5

Scale:	1" = 40'
Date:	12-19-2002
Sheet No.	1 OF 3
Project No.	201-225

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PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
502	481384.69	1350875.82	591.87	592.87	GRID	592.96	1.09	11/6/02
503	481384.08	1350925.82	592.44	593.44	GRID	593.44	1.00	11/6/02
504	481383.47	1350975.81	592.89	593.89	GRID	593.89	1.00	11/6/02
505	481382.86	1351025.81	593.41	594.41	GRID	594.45	1.04	11/24/02
506	481382.25	1351075.81	593.90	594.90	GRID	595.00	1.10	11/25/02
507	481381.64	1351125.80	594.36	595.36	GRID	595.40	1.04	11/25/02
508	481381.03	1351175.80	594.85	595.85	GRID	595.85	1.00	11/25/02
509	481380.42	1351225.79	595.39	596.39	GRID	596.45	1.06	11/24/02
510	481379.80	1351275.79	595.92	596.92	GRID	596.97	1.05	11/24/02
511	481379.19	1351325.79	596.34	597.34	GRID	597.40	1.06	11/24/02
512	481378.58	1351375.78	596.92	597.92	GRID	597.92	1.00	11/24/02
513	481377.97	1351425.78	597.33	598.33	GRID	598.37	1.04	11/24/02
525	481334.70	1350875.21	592.30	593.30	GRID	593.30	1.00	11/6/02
526	481334.09	1350925.21	592.80	593.80	GRID	593.82	1.02	11/6/02
527	481333.48	1350975.20	593.30	594.30	GRID	594.34	1.04	11/6/02
528	481332.87	1351025.20	593.87	594.87	GRID	594.87	1.00	11/24/02
529	481332.25	1351075.19	594.37	595.37	GRID	595.40	1.03	11/24/02
530	481331.64	1351125.19	594.86	595.86	GRID	595.87	1.01	11/24/02
531	481331.03	1351175.19	595.31	596.31	GRID	596.31	1.00	11/24/02
532	481330.42	1351225.18	595.75	596.75	GRID	596.80	1.05	11/24/02
533	481329.81	1351275.18	596.33	597.33	GRID	597.35	1.02	11/22/02
534	481329.20	1351325.18	596.83	597.83	GRID	597.85	1.02	11/22/02
535	481328.59	1351375.17	597.39	598.39	GRID	598.39	1.00	11/22/02
536	481327.98	1351425.17	597.84	598.84	GRID	598.85	1.01	11/22/02
541	481284.70	1350874.60	593.28	594.28	Grid Pt.	594.32	1.04	11/6/02
542	481284.09	1350924.60	593.79	594.79	Grid Pt.	594.80	1.01	11/6/02
543	481283.48	1350974.59	594.33	595.33	Grid Pt.	595.33	1.00	11/6/02
544	481282.87	1351024.59	594.79	595.79	Grid Pt.	595.80	1.01	11/24/02
545	481282.26	1351074.59	595.37	596.37	Grid Pt.	596.37	1.00	11/24/02
546	481281.65	1351124.58	595.88	596.88	Grid Pt.	596.88	1.00	11/24/02
547	481281.04	1351174.58	596.36	597.36	Grid Pt.	597.40	1.04	11/24/02
548	481280.43	1351224.57	596.77	597.77	Grid Pt.	597.77	1.00	11/24/02
549	481279.82	1351274.57	597.25	598.25	Grid Pt.	598.25	1.00	11/22/02
550	481279.20	1351324.57	597.84	598.84	Grid Pt.	598.85	1.01	11/22/02
551	481278.59	1351374.56	598.27	599.27	Grid Pt.	599.30	1.03	11/22/02
552	481277.98	1351424.56	598.89	599.89	Grid Pt.	599.90	1.01	11/22/02
556	481235.32	1350823.99	593.80	594.80	Grid Pt.	594.80	1.00	11/7/02
557	481234.71	1350873.99	594.29	595.29	Grid Pt.	595.31	1.02	11/7/02
558	481234.10	1350923.99	594.82	595.82	Grid Pt.	595.82	1.00	11/7/02
559	481233.49	1350973.98	595.36	596.36	Grid Pt.	596.36	1.00	11/7/02
560	481232.87	1351023.98	595.86	596.86	Grid Pt.	596.87	1.01	11/24/02
561	481232.26	1351073.98	596.33	597.33	Grid Pt.	597.33	1.00	11/24/02
562	481231.65	1351123.97	596.86	597.86	Grid Pt.	597.86	1.00	11/24/02
563	481231.04	1351173.97	597.37	598.37	Grid Pt.	598.37	1.00	11/24/02
565	481230.43	1351223.96	597.76	598.76	Grid Pt.	598.77	1.01	11/24/02
566	481229.82	1351273.96	598.28	599.28	Grid Pt.	599.28	1.00	11/24/02
567	481229.21	1351323.96	598.80	599.80	Grid Pt.	599.80	1.00	11/24/02
568	481228.60	1351373.95	599.31	600.31	Grid Pt.	600.40	1.09	11/24/02
569	481227.99	1351423.95	599.87	600.87	Grid Pt.	600.87	1.00	11/24/02

PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
573	481185.32	1350823.38	597.19	598.22	Grid Pt.	598.29	1.10	11/7/02
574	481184.71	1350873.38	597.67	598.70	Grid Pt.	598.70	1.03	11/7/02
575	481184.10	1350923.38	598.15	599.18	Grid Pt.	599.18	1.03	11/7/02
576	481183.49	1350973.37	598.61	599.64	Grid Pt.	599.67	1.06	11/7/02
578	481182.88	1351023.37	599.26	600.29	Grid Pt.	600.30	1.04	11/27/02
579	481182.27	1351073.36	599.80	600.83	Grid Pt.	600.87	1.07	12/2/02
580	481181.66	1351123.36	600.17	601.20	Grid Pt.	601.25	1.08	12/2/02
581	481181.05	1351173.36	600.68	601.71	Grid Pt.	601.78	1.10	12/2/02
582	481180.43	1351223.35	601.18	602.21	Grid Pt.	602.25	1.07	12/2/02
583	481179.82	1351273.35	601.66	602.69	Grid Pt.	602.74	1.08	12/2/02
584	481179.21	1351323.35	602.11	603.14	Grid Pt.	603.17	1.06	11/26/02
585	481178.60	1351373.34	602.58	603.61	Grid Pt.	603.66	1.08	11/26/02
586	481177.99	1351423.34	603.11	604.14	Grid Pt.	604.20	1.09	11/26/02
591	481134.71	1350872.77	591.83	592.86	Grid Pt.	592.86	1.03	11/20/02
592	481134.10	1350922.77	592.37	593.40	GRID PT	593.46	1.09	11/20/02
593	481133.49	1350972.76	592.87	593.90	GRID PT	593.95	1.08	11/20/02
594	481132.88	1351022.76	593.45	594.48	GRID PT	594.52	1.07	11/20/02
595	481132.27	1351072.76	593.87	594.90	GRID PT	594.95	1.08	11/25/02
596	481131.66	1351122.75	594.41	595.44	GRID PT	595.51	1.10	11/25/02
597	481131.04	1351172.75	594.86	595.89	GRID PT	595.89	1.03	11/25/02
598	481130.43	1351222.74	595.46	596.49	GRID PT	596.50	1.04	11/25/02
599	481129.82	1351272.74	595.93	596.96	GRID PT	596.96	1.03	11/25/02
600	481129.21	1351322.74	596.43	597.46	GRID PT	597.53	1.10	11/25/02
601	481128.60	1351372.73	597.00	598.03	GRID PT	598.08	1.08	11/25/02
602	481127.99	1351422.73	597.29	598.32	GRID PT	598.39	1.10	11/25/02
606	481085.27	1350826.86		N/A	NOT USED			
607	481084.72	1350872.16		N/A	NOT USED			
608	481084.11	1350922.15		N/A	NOT USED			
609	481083.50	1350972.15		N/A	NOT USED			
610	481082.89	1351022.15		N/A	NOT USED			
611	481082.28	1351072.14		N/A	NOT USED			
612	481081.67	1351122.14		N/A	NOT USED			
613	481081.05	1351172.14		N/A	NOT USED			
614	481080.44	1351222.13		N/A	NOT USED			
615	481079.83	1351272.13		N/A	NOT USED			
616	481079.22	1351322.12		N/A	NOT USED			
617	481078.61	1351372.12		N/A	NOT USED			
618	481078.00	1351422.12		N/A	NOT USED			
619	481077.56	1351457.87		N/A	NOT USED			
637	481379.83	1350875.76	592.72	593.72	TOE2% S/G CELL5	593.72	1.00	11/6/02
638	481379.22	1350925.75	593.28	594.28	TOE2% S/G CELL5	594.29	1.01	11/6/02
639	481378.60	1350975.75	593.96	594.96	TOE2% S/G CELL5	594.96	1.00	11/6/02
640	481377.99	1351025.75	594.28	595.28	TOE2% S/G CELL5	595.30	1.02	11/25/02
641	481377.38	1351075.74	594.73	595.73	TOE2% S/G CELL5	595.73	1.00	11/25/02
642	481376.77	1351125.74	595.25	596.25	TOE2% S/G CELL5	596.25	1.00	11/25/02
643	481376.16	1351175.73	595.73	596.73	TOE2% S/G CELL5	596.80	1.07	11/25/02
644	481375.55	1351225.73	596.27	597.27	TOE2% S/G CELL5	597.29	1.02	11/25/02
645	481374.94	1351275.73	596.82	597.82	TOE2% S/G CELL5	597.82	1.00	11/24/02
646	481374.32	1351325.72	597.31	598.31	TOE2% S/G CELL5	598.31	1.00	11/24/02

PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
647	481373.71	1351375.72	597.74	598.74	TOE2% S/G CELL5	598.74	1.00	11/24/02
648	481373.10	1351425.72	598.21	599.21	TOE2% S/G CELL5	599.26	1.05	11/24/02
649	481363.82	1350875.57	592.78	593.78	TOE2% S/G CELL5	593.78	1.00	11/6/02
650	481363.21	1350925.56	593.28	594.28	TOE2% S/G CELL5	594.30	1.02	11/6/02
651	481362.60	1350975.56	593.81	594.81	TOE2% S/G CELL5	594.83	1.02	11/6/02
652	481361.99	1351025.56	594.20	595.20	TOE2% S/G CELL5	595.20	1.00	11/25/02
653	481361.38	1351075.55	594.69	595.69	TOE2% S/G CELL5	595.70	1.01	11/25/02
654	481360.77	1351125.55	595.30	596.30	TOE2% S/G CELL5	596.35	1.05	11/25/02
655	481360.16	1351175.54	595.77	596.77	TOE2% S/G CELL5	596.77	1.00	11/25/02
656	481359.55	1351225.54	596.33	597.33	TOE2% S/G CELL5	597.33	1.00	11/25/02
657	481358.94	1351275.54	596.76	597.76	TOE2% S/G CELL5	597.80	1.04	11/24/02
658	481358.33	1351325.53	597.22	598.22	TOE2% S/G CELL5	598.22	1.00	11/24/02
659	481357.72	1351375.53	597.71	598.71	TOE2% S/G CELL5	598.75	1.04	11/24/02
660	481357.11	1351425.53	598.22	599.22	TOE2% S/G CELL5	599.32	1.10	11/24/02
671	481153.35	1350822.99	595.63	596.66	CELL5 4:1	596.73	1.10	11/20/02
672	481152.74	1350872.99	596.22	597.25	CELL5 4:1	597.32	1.10	11/20/02
673	481152.13	1350922.98	596.67	597.70	CELL5 4:1	597.76	1.09	11/20/02
674	481151.52	1350972.98	597.16	598.19	CELL5 4:1	598.25	1.09	11/20/02
675	481150.91	1351022.97	597.63	598.66	CELL5 4:1	598.73	1.10	11/20/02
676	481150.30	1351072.97	598.15	599.18	CELL5 4:1	599.25	1.10	11/25/02
677	481149.69	1351122.97	598.57	599.60	CELL5 4:1	599.67	1.10	11/25/02
678	481149.08	1351172.96	599.09	600.12	CELL5 4:1	600.12	1.03	11/25/02
679	481148.46	1351222.96	599.65	600.68	CELL5 4:1	600.69	1.04	11/25/02
680	481147.85	1351272.96	600.08	601.11	CELL5 4:1	601.11	1.03	11/25/02
681	481147.24	1351322.95	600.63	601.66	CELL5 4:1	601.66	1.03	11/25/02
682	481146.63	1351372.95	601.18	602.21	CELL5 4:1	602.21	1.03	11/25/02
683	481146.02	1351422.94	601.55	602.58	CELL5 4:1	602.62	1.07	11/25/02
684	481145.41	1351472.94	602.13	603.16	CELL5 4:1	603.23	1.10	11/25/02
1146	481434.69	1350876.43	592.84	593.84	Cell4Grid Pt.	593.84	1.00	11/23/02
1147	481434.08	1350926.43	593.43	594.43	Cell4Grid Pt.	594.45	1.02	11/23/02
1148	481433.47	1350976.43	593.93	594.93	Cell4Grid Pt.	594.93	1.00	11/23/02
1149	481432.86	1351026.42	594.44	595.44	Cell4Grid Pt.	595.47	1.03	11/23/02
1150	481432.25	1351076.42	594.91	595.91	Cell4Grid Pt.	595.92	1.01	11/23/02
1151	481431.64	1351126.42	595.43	596.43	Cell4Grid Pt.	596.50	1.07	11/23/02
1152	481431.03	1351176.41	595.91	596.91	Cell4Grid Pt.	597.00	1.09	11/24/02
1153	481430.42	1351226.41	596.44	597.44	Cell4Grid Pt.	597.50	1.06	11/24/02
1154	481429.80	1351276.40	596.95	597.95	Cell4Grid Pt.	597.95	1.00	11/23/02
1155	481429.19	1351326.40	597.42	598.42	Cell4Grid Pt.	598.42	1.00	11/24/02
1156	481428.58	1351376.40	597.94	598.94	Cell4Grid Pt.	598.94	1.00	11/23/02
1157	481427.97	1351426.39	598.33	599.33	Cell4Grid Pt.	599.43	1.10	11/24/02
1532	481358.95	1350812.93	596.74	597.77	CELL5 SG OUT1/1	597.84	1.10	11/6/02
1533	481386.51	1350812.99	597.08	598.11	CELL5 SG OUT1/1	598.18	1.10	11/6/02
2300	481195.38	1350815.25	594.57	595.60	TOE4:1	595.64	1.07	11/7/02
2301	481177.77	1350797.37	598.80	599.80	N/EDGEINTCELLBER	599.81	1.01	12/2/02
2302	481136.55	1350825.38	591.65	592.68	TOE4:1	592.75	1.10	11/21/02
2303	481167.77	1350796.96	598.85	599.85	S/EDGEINTCELLBER	599.85	1.00	12/2/02
2304	481128.79	1351460.79	598.01	599.04	TOE 4:1	599.11	1.10	11/25/02
2305	481159.27	1351492.35	605.97	606.97	S/EDGEINTERBERM	606.97	1.00	11/25/02
2306	481169.28	1351492.16	605.75	606.75	N/EDGEINTERBERM	606.76	1.01	11/25/02

PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
2307	481187.33	1351473.26	601.19	602.22	TOE4:1	602.23	1.04	11/26/02
2309	481085.53	1350827.20	588.43	590.49	TOE4:1	590.50	2.07	11/27/02
2310	481077.82	1351457.50	594.67	596.73	TOE4:1	596.74	2.07	11/27/02
2312	481356.76	1351455.94	598.74	599.77	TOE4:1	599.80	1.06	11/24/02
2313	481372.71	1351455.63	598.80	599.83	TOE4:1	599.90	1.10	11/24/02
2315	481068.86	1350827.00	584.95	586.99	TOE5:1	586.99	2.04	11/27/02
2316	481061.15	1351457.32	591.40	593.44	TOE5:1	593.45	2.05	11/27/02
2525	481380.28	1350835.87	593.49	594.52	TOE4:1	594.52	1.03	11/6/02
2526	481364.35	1350835.21	593.39	594.42	TOE4:1	594.42	1.03	11/6/02
2600	481195.28	1350823.50	594.78	595.81	TOE 4:1	595.88	1.10	11/7/02
2601	481177.45	1350823.28	599.05	600.05	TOP 4:1	600.10	1.05	11/7/02
2602	481194.67	1350873.50	595.11	596.14	TOE 4:1	596.17	1.06	11/7/02
2603	481176.84	1350873.28	599.63	600.63	TOP 4:1	600.64	1.01	11/7/02
2604	481194.06	1350923.50	595.73	596.76	TOE 4:1	596.76	1.03	11/7/02
2605	481176.23	1350923.28	600.21	601.21	TOP 4:1	601.21	1.00	11/7/02
2606	481193.44	1350973.49	596.20	597.23	TOE 4:1	597.23	1.03	11/7/02
2607	481175.62	1350973.27	600.66	601.66	TOP 4:1	601.69	1.03	11/7/02
2608	481192.83	1351023.49	596.75	597.78	TOE 4:1	597.80	1.05	11/27/02
2609	481175.01	1351023.27	601.05	602.05	TOP 4:1	602.10	1.05	11/27/02
2610	481192.22	1351073.48	597.24	598.27	TOE 4:1	598.30	1.06	12/2/02
2611	481174.40	1351073.26	601.70	602.70	TOP 4:1	602.74	1.04	11/21/02
2612	481191.61	1351123.48	597.76	598.79	TOE 4:1	598.80	1.04	11/24/02
2613	481173.79	1351123.26	602.24	603.24	TOP 4:1	603.26	1.02	11/21/02
2614	481191.00	1351173.48	598.12	599.15	TOE 4:1	599.20	1.08	12/2/02
2615	481173.18	1351173.26	602.57	603.57	TOP 4:1	603.58	1.01	11/21/02
2616	481190.39	1351223.47	598.67	599.70	TOE 4:1	599.75	1.08	12/2/02
2617	481172.57	1351223.25	603.13	604.13	TOP 4:1	604.23	1.10	11/21/02
2618	481189.77	1351273.47	599.15	600.18	TOE 4:1	600.20	1.05	12/2/02
2619	481171.95	1351273.25	603.60	604.60	TOP 4:1	604.63	1.03	11/21/02
2620	481189.16	1351323.47	599.72	600.75	TOE 4:1	600.80	1.08	11/26/02
2621	481171.34	1351323.25	604.20	605.20	TOP 4:1	605.20	1.00	11/25/02
2622	481188.55	1351373.46	600.25	601.28	TOE 4:1	601.30	1.05	11/26/02
2623	481170.73	1351373.24	604.69	605.69	TOP 4:1	605.69	1.00	11/25/02
2624	481187.94	1351423.46	600.63	601.66	TOE 4:1	601.68	1.05	11/26/02
2625	481170.12	1351423.24	605.00	606.00	TOP 4:1	606.03	1.03	11/25/02
2626	481169.50	1351474.56	605.66	606.66	TOP 4:1	606.70	1.04	11/25/02
2627	481167.45	1350823.16	599.04	600.04	TOP 4:1	600.12	1.08	11/20/02
2628	481166.84	1350873.16	599.56	600.56	TOP 4:1	600.56	1.00	11/20/02
2629	481166.23	1350923.16	600.03	601.03	TOP 4:1	601.03	1.00	11/20/02
2630	481165.62	1350973.15	600.54	601.54	TOP 4:1	601.57	1.03	11/20/02
2631	481165.01	1351023.15	601.11	602.11	TOP 4:1	602.21	1.10	11/20/02
2632	481164.39	1351073.14	601.71	602.71	TOP 4:1	602.71	1.00	11/21/02
2633	481163.78	1351123.14	602.15	603.15	TOP 4:1	603.25	1.10	11/21/02
2634	481163.17	1351173.14	602.55	603.55	TOP 4:1	603.63	1.08	11/21/02
2635	481162.56	1351223.13	603.00	604.00	TOP 4:1	604.00	1.00	11/21/02
2636	481161.95	1351273.13	603.72	604.72	TOP 4:1	604.74	1.02	11/21/02
2637	481161.34	1351323.13	604.18	605.18	TOP 4:1	605.28	1.10	11/25/02
2638	481160.73	1351373.12	604.55	605.55	TOP 4:1	605.56	1.01	11/25/02
2639	481160.12	1351423.12	605.20	606.20	TOP 4:1	606.30	1.10	11/25/02

PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
2640	481159.49	1351474.44	605.56	606.56	TOP 4:1	606.59	1.03	11/25/02
2641	481135.97	1350872.78	591.95	592.98	TOE 4:1	592.98	1.03	11/20/02
2642	481135.36	1350922.78	592.40	593.43	TOE 4:1	593.46	1.06	11/20/02
2643	481134.75	1350972.77	593.01	594.04	TOE 4:1	594.04	1.03	11/20/02
2644	481134.14	1351022.77	593.50	594.53	TOE 4:1	594.60	1.10	11/20/02
2645	481133.53	1351072.76	593.96	594.99	TOE 4:1	594.99	1.03	11/20/02
2646	481132.92	1351122.76	594.47	595.50	TOE 4:1	595.57	1.10	11/25/02
2647	481132.31	1351172.76	595.07	596.10	TOE 4:1	596.17	1.10	11/25/02
2648	481131.70	1351222.75	595.51	596.54	TOE 4:1	596.54	1.03	11/25/02
2649	481131.09	1351272.75	596.00	597.03	TOE 4:1	597.07	1.07	11/25/02
2650	481130.48	1351322.75	596.58	597.61	TOE 4:1	597.68	1.10	11/25/02
2651	481129.87	1351372.74	597.00	598.03	TOE 4:1	598.09	1.09	11/25/02
2652	481129.25	1351422.74	597.37	598.40	TOE 4:1	598.47	1.10	11/25/02
2653	481084.98	1350872.16	588.90	590.94	TOP 5:1	591.00	2.10	11/27/02
2654	481084.37	1350922.16	589.26	591.30	TOP 5:1	591.32	2.06	11/27/02
2655	481083.76	1350972.15	589.73	591.77	TOP 5:1	591.81	2.08	11/27/02
2656	481083.15	1351022.15	590.31	592.35	TOP 5:1	592.39	2.08	11/27/02
2657	481082.53	1351072.15	590.83	592.87	TOP 5:1	592.93	2.10	11/27/02
2658	481081.92	1351122.14	591.40	593.44	TOP 5:1	593.46	2.06	11/27/02
2659	481081.31	1351172.14	591.73	593.77	TOP 5:1	593.80	2.07	11/27/02
2660	481080.70	1351222.13	592.25	594.29	TOP 5:1	594.35	2.10	11/27/02
2661	481080.09	1351272.13	592.73	594.77	TOP 5:1	594.80	2.07	11/27/02
2662	481079.48	1351322.13	593.31	595.35	TOP 5:1	595.41	2.10	11/27/02
2663	481078.86	1351372.12	593.90	595.94	TOP 5:1	595.95	2.05	11/27/02
2664	481078.25	1351422.12	594.27	596.31	TOP 5:1	596.35	2.08	11/27/02
2665	481068.31	1350871.96	585.58	587.62	toe 5:1	587.67	2.09	11/27/02
2666	481067.70	1350921.96	586.06	588.10	toe 5:1	588.10	2.04	11/27/02
2667	481067.09	1350971.95	586.40	588.44	toe 5:1	588.50	2.10	11/27/02
2668	481066.48	1351021.95	586.94	588.98	toe 5:1	589.00	2.06	11/27/02
2669	481065.86	1351071.94	587.52	589.56	toe 5:1	589.56	2.04	11/27/02
2670	481065.25	1351121.94	588.09	590.13	toe 5:1	590.15	2.06	11/27/02
2671	481064.64	1351171.94	588.41	590.45	toe 5:1	590.45	2.04	11/27/02
2672	481064.03	1351221.93	589.09	591.13	toe 5:1	591.19	2.10	11/27/02
2673	481063.42	1351271.93	589.56	591.60	toe 5:1	591.61	2.05	11/27/02
2674	481062.81	1351321.93	590.05	592.09	toe 5:1	592.11	2.06	11/27/02
2675	481062.19	1351371.92	590.46	592.50	toe 5:1	592.56	2.10	11/27/02
2676	481061.58	1351421.92	591.06	593.10	toe 5:1	593.15	2.09	11/27/02
2677	481435.21	1350833.90	592.52	593.55	toe 4:1	593.57	1.05	11/24/02
2678	481385.19	1350835.69	591.63	592.66	toe 4:1	592.73	1.10	11/6/02
2679	481335.23	1350831.77	592.03	593.06	toe 4:1	593.09	1.06	11/6/02
2680	481285.30	1350825.87	593.05	594.08	toe 4:1	594.08	1.03	11/7/02
2681	481235.37	1350819.97	593.80	594.83	toe 4:1	594.83	1.03	11/7/02
2689	481427.57	1351459.16	598.78	599.81	toe 4:1	599.83	1.05	11/24/02
2690	481377.60	1351455.95	597.83	598.86	toe 4:1	598.87	1.04	11/24/02
2691	481327.57	1351458.92	598.35	599.38	toe 4:1	599.40	1.05	11/24/02
2692	481277.50	1351464.04	599.34	600.37	toe 4:1	600.40	1.06	11/24/02
2693	481227.44	1351469.16	600.45	601.48	toe 4:1	601.50	1.05	11/24/02
3044	481087.98	1350872.20	590.05	592.11	END LDS	592.12	2.07	11/27/02
3045	481087.37	1350922.19	590.37	592.43	END LDS	592.44	2.07	11/27/02

4944

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REVISIONS:

Designed By:
Drawn By: F.A.M.
Checked By: T.J.M.
Approved By: T.J.M.

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PROFESSIONAL SURVEYOR
12-19-2002

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

AS-BUILT PROTECTIVE LAYER CELL 5

Scale:
Date: 12-19-2002
Sheet No. 2 OF 3
Project No. 201-225

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PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
3046	481086.76	1350972.19	590.83	592.89	END LDS	592.90	2.07	11/27/02
3047	481086.15	1351022.19	591.38	593.44	END LDS	593.46	2.08	11/27/02
3048	481085.53	1351072.18	591.89	593.95	END LDS	593.95	2.06	11/27/02
3049	481084.92	1351122.18	592.51	594.57	END LDS	594.61	2.10	11/27/02
3050	481084.31	1351172.18	592.82	594.88	END LDS	594.92	2.10	11/27/02
3051	481083.70	1351222.17	593.44	595.50	END LDS	595.50	2.06	11/27/02
3052	481083.09	1351272.17	593.88	595.94	END LDS	595.95	2.07	11/27/02
3053	481082.48	1351322.16	594.37	596.43	END LDS	596.43	2.06	11/27/02
3054	481081.86	1351372.16	594.98	597.04	END LDS	597.08	2.10	11/27/02
3055	481081.25	1351422.16	595.42	597.48	END LDS	597.52	2.10	11/27/02
3056	481080.62	1351457.68	595.83	597.89	END LDS TOE 4:1	597.90	2.07	11/27/02
3059	481088.53	1350827.09	589.50	591.56	END LDS Toe 4:1	591.60	2.10	12/2/02
4064	481092.98	1350872.26	591.15	592.16	END LCS	592.25	1.10	11/25/02
4065	481092.37	1350922.25	591.56	592.57	END LCS	592.66	1.10	11/25/02
4066	481091.76	1350972.25	591.99	593.00	END LCS	593.01	1.02	11/25/02
4067	481091.14	1351022.25	592.53	593.54	END LCS	593.56	1.03	11/25/02
4068	481090.53	1351072.24	592.99	594.00	END LCS	594.09	1.10	11/25/02
4069	481089.92	1351122.24	593.66	594.67	END LCS	594.75	1.09	11/25/02
4070	481089.31	1351172.24	594.02	595.03	END LCS	595.07	1.05	11/25/02
4071	481088.70	1351222.23	594.57	595.58	END LCS	595.62	1.05	11/25/02
4072	481088.09	1351272.23	595.06	596.07	END LCS	596.07	1.01	11/25/02
4073	481087.48	1351322.22	595.50	596.51	END LCS	596.60	1.10	11/25/02
4074	481086.86	1351372.22	596.09	597.10	END LCS	597.19	1.10	11/25/02
4075	481086.25	1351422.22	596.53	597.54	END LCS	597.58	1.05	11/25/02
4076	481085.81	1351458.02	597.03	598.06	END LCS	598.13	1.10	11/25/02
4078	481093.53	1350826.9[illegible]	590.70	591.73	END LCS	591.73	1.03	11/25/02
4080	481384.15	1350875.81	591.88	592.91	TOE 4:1LCS	592.96	1.08	11/6/02
4081	481383.54	1350925.80	592.44	593.47	TOE 4:1LCS	593.47	1.03	11/6/02
4082	481382.92	1350975.80	592.96	593.99	TOE 4:1LCS	594.06	1.10	11/6/02
4083	481382.31	1351025.80	593.37	594.40	TOE 4:1LCS	594.41	1.04	11/25/02
4084	481381.70	1351075.79	593.85	594.88	TOE 4:1LCS	594.95	1.10	11/25/02
4085	481381.09	1351125.79	594.35	595.38	TOE 4:1LCS	595.40	1.05	11/25/02
4086	481380.48	1351175.79	594.91	595.94	TOE 4:1LCS	595.99	1.08	11/25/02
4087	481379.87	1351225.78	595.40	596.43	TOE 4:1LCS	596.45	1.05	11/25/02
4088	481379.26	1351275.78	595.90	596.93	TOE 4:1LCS	597.00	1.10	11/24/02
4089	481378.64	1351325.77	596.36	597.39	TOE 4:1LCS	597.45	1.09	11/24/02
4090	481378.03	1351375.77	596.83	597.86	TOE 4:1LCS	597.87	1.04	11/24/02 ←
4091	481377.42	1351425.77	597.35	598.38	TOE 4:1LCS	598.40	1.05	11/24/02
4092	481377.05	1351455.91	597.84	598.87	TOE 4:1LCS	598.88	1.04	11/24/02
4094	481359.50	1350875.52	591.87	592.90	TOE 4:1LCS	592.90	1.03	11/6/02
4095	481358.89	1350925.51	592.35	593.38	TOE 4:1LCS	593.41	1.06	11/6/02
4096	481358.28	1350975.51	592.83	593.86	TOE 4:1LCS	593.91	1.08	11/6/02
4097	481357.67	1351025.50	593.31	594.34	TOE 4:1LCS	594.35	1.04	11/25/02
4098	481357.06	1351075.50	593.80	594.83	TOE 4:1LCS	594.83	1.03	11/25/02
4099	481356.45	1351125.50	594.38	595.41	TOE 4:1LCS	595.46	1.08	11/25/02
4100	481355.84	1351175.49	594.84	595.87	TOE 4:1LCS	595.89	1.05	11/25/02
4101	481355.23	1351225.49	595.34	596.37	TOE 4:1LCS	596.38	1.04	11/25/02
4102	481354.62	1351275.49	595.84	596.87	TOE 4:1LCS	596.94	1.10	11/24/02
4103	481354.01	1351325.48	596.33	597.36	TOE 4:1LCS	597.43	1.10	11/24/02

PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
4104	481353.40	1351375.48	596.86	597.89	TOE 4:1LCS	597.90	1.04	11/24/02
4105	481352.79	1351425.47	597.32	598.35	TOE 4:1LCS	598.40	1.08	11/24/02
4106	481352.41	1351456.38	597.75	598.78	TOE 4:1LCS	598.80	1.05	11/25/02
5030	481173.14	1350766.53		N/A	COR CATCHMENT		None	
5031	481423.12	1350769.58		N/A	COR CATCHMENT		None	
5032	481420.53	1350981.57		N/A	COR CATCHMENT		None	
5033	481170.55	1350978.52		N/A	COR CATCHMENT		None	
5050	481435.62	1350800.17		601.98	TOP 4:1	602.00	None	11/24/02
5051	481385.63	1350799.55		601.71	TOP 4:1	601.81	None	11/7/02
5052	481335.63	1350798.94		601.37	TOP 4:1	601.39	None	11/7/02
5053	481285.64	1350798.33		600.78	TOP 4:1	600.79	None	11/7/02
5054	481235.64	1350797.72		600.39	TOP 4:1	600.42	None	11/7/02
5055	481185.64	1350797.11		600.05	TOP 4:1	600.07	None	11/7/02
5056	481135.65	1350796.50		599.68	TOP 4:1	599.70	None	11/27/02
5057	481093.91	1350795.99		599.61	TOP 4:1	599.61	None	11/27/02
5058	481088.91	1350795.93		599.41	TOP 4:1	599.47	None	11/27/02
5059	481085.91	1350795.89		599.31	TOP 4:1	599.33	None	11/27/02
5060	481069.24	1350795.69		596.04	TOE 5:1 TOP CLAY	596.04	None	11/27/02
5061	481057.53	1350826.86		584.72	TOE 5:1	584.75	None	11/27/02
5062	481056.98	1350871.82		585.35	TOE 5:1	585.37	None	11/27/02
5063	481056.37	1350921.82		585.83	TOE 5:1	585.93	None	11/27/02
5064	481055.76	1350971.81		586.17	TOE 5:1	586.27	None	11/27/02
5065	481055.15	1351021.81		586.71	TOE 5:1	586.80	None	11/27/02
5066	481054.53	1351071.81		587.29	TOE 5:1	587.39	None	11/27/02
5067	481053.92	1351121.80		587.86	TOE 5:1	587.87	None	11/27/02
5068	481053.31	1351171.80		588.18	TOE 5:1	588.19	None	11/27/02
5069	481052.70	1351221.80		588.86	TOE 5:1	588.90	None	11/27/02
5070	481052.09	1351271.79		589.33	TOE 5:1	589.40	None	11/27/02
5071	481051.48	1351321.79		589.82	TOE 5:1	589.84	None	11/27/02
5072	481050.87	1351371.78		590.23	TOE 5:1	590.27	None	11/27/02
5073	481050.25	1351421.78		590.83	TOE 5:1	590.86	None	11/27/02
5074	481049.82	1351457.20		591.17	TOE 5:1	591.19	None	11/27/02
5075	481080.21	1351491.75		606.43	TOP 4:1	606.45	None	11/27/02
5076	481060.74	1351491.51		603.09	TOP 4:1	603.18	None	11/27/02
5077	481085.40	1351491.81		606.53	TOP 4:1	606.56	None	11/27/02
5078	481127.14	1351492.32		606.92	TOP 4:1	606.97	None	11/27/02
5079	481177.14	1351492.93		607.10	TOP 4:1		None	
5080	481227.14	1351493.54		607.37	TOP 4:1	607.37	None	11/24/02
5081	481277.13	1351494.15		607.91	TOP 4:1	607.91	None	11/24/02
5082	481327.13	1351494.76		608.19	TOP 4:1	608.19	None	11/24/02
5083	481377.13	1351495.38		608.55	TOP 4:1	608.55	None	11/24/02
5084	481427.12	1351495.99		608.97	TOP 4:1	608.97	None	11/24/02
5085	481090.86	1350826.92		591.65	TOP 5:1	591.66	None	11/27/02
5086	481090.31	1350872.23		592.10	TOP 5:1	592.12	None	11/27/02
5087	481089.70	1350922.22		592.51	TOP 5:1	592.57	None	11/27/02
5088	481089.09	1350972.22		592.94	TOP 5:1	593.01	None	11/27/02
5089	481088.47	1351022.21		593.48	TOP 5:1	593.51	None	11/27/02
5090	481087.86	1351072.21		593.04	TOP 5:1	593.95	None	11/27/02
5091	481087.25	1351122.21		594.61	TOP 5:1	594.66	None	11/27/02

PNT NO.	NORTH	EAST	AS-BUILT LCS ELEV	PROP ELEV	DESCRIPTION	AS-BUILT ELEV	LAYER THICKNESS	DATE
5092	481086.64	1351172.20		594.97	TOP 5:1	594.98	None	11/27/02
5093	481086.03	1351222.20		595.52	TOP 5:1	595.56	None	11/27/02
5094	481085.42	1351272.20		596.01	TOP 5:1	596.04	None	11/27/02
5095	481084.81	1351322.19		596.45	TOP 5:1	596.49	None	11/27/02
5096	481084.19	1351372.19		597.04	TOP 5:1	597.10	None	11/27/02
5097	481083.58	1351422.18		597.48	TOP 5:1	597.53	None	11/27/02
5098	481083.14	1351457.98		597.98	TOP 5:1	598.03	None	11/27/02

4944

000042

STATE OF OHIO * THOMAS J. MACK S-7964 * PROFESSIONAL SURVEYOR

12-19-2002

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Checked By: T.J.M.
Approved By: T.J.M.

REVISIONS:

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL
MANAGEMENT PROJECT
OSDF CELL 5

AS-BUILT PROTECTIVE LAYER CELL 5

Scale:

Date: 12-19-2002

Sheet No. 3 OF 3

Project No. 201-225

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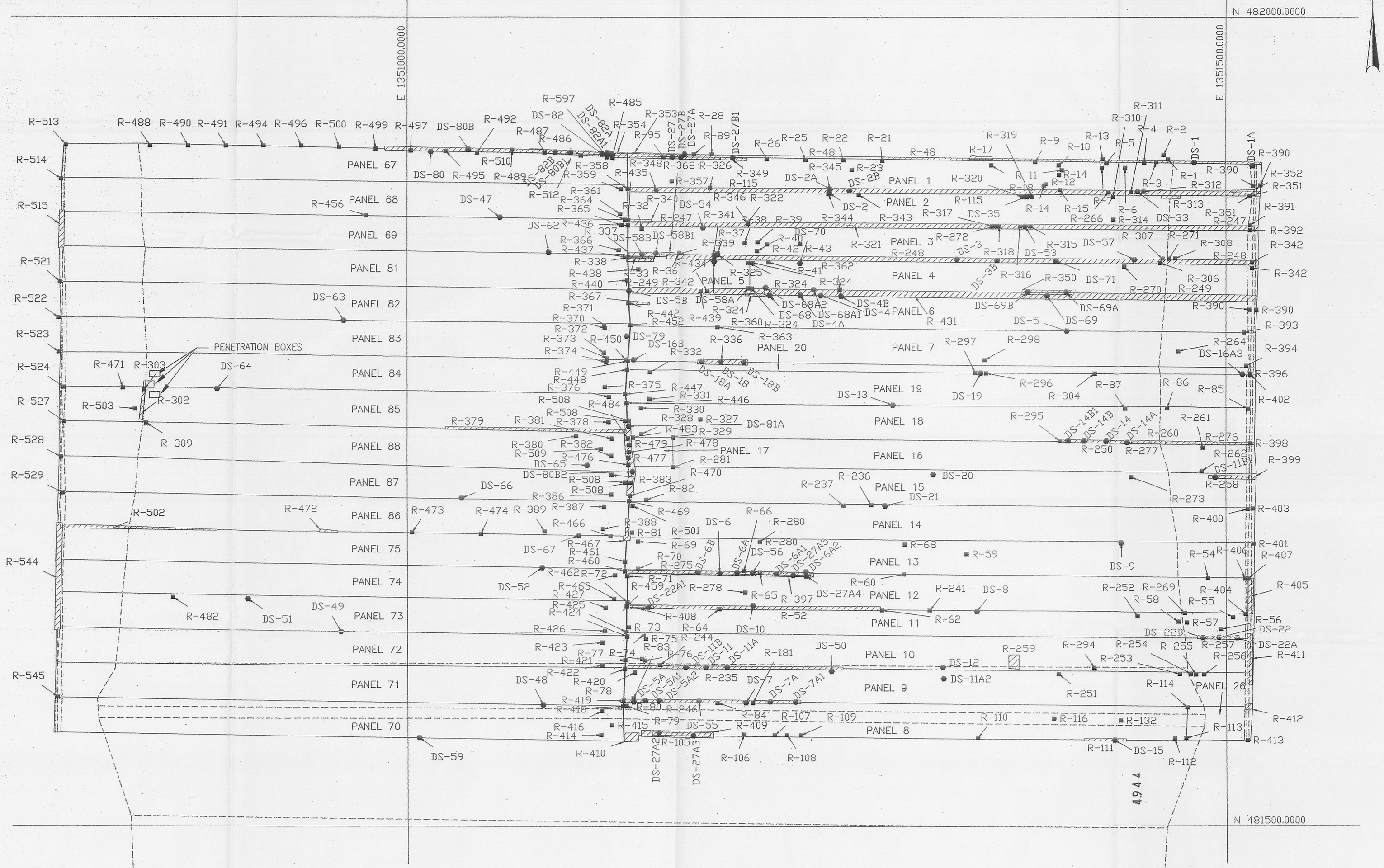

NOTE:

REPAIRS 8, 16, 19, 20, 27, 29, 30, 31, AND 45 ARE ORIGINAL REPAIRS THAT WERE NOT FIELD LOCATED AND ARE CAPPED BY REPAIR 48. ALSO, R-111 IS CAPPED BY R-300, AND R-228 CAPPED BY R-301.

LEGEND:

■ = PATCH REPAIR LOCATION

● = DESTRUCTIVE TEST

▨ = CAPPED SEAM

30 15 0 60 30 90

SCALE: 1"=30'

000045

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STATE OF OHIO
THOMAS J. MACK
S-7964
REGISTERED
PROFESSIONAL SURVEYOR
02-07-2003

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REVISIONS:
REVISED 12-10-02 PER GEOSYNTEC CONSULTANTS
REVISED 1-24-03 PER FLUOR FERNALD, INC.
REVISED 2-07-03 PER FLUOR FERNALD, INC.

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

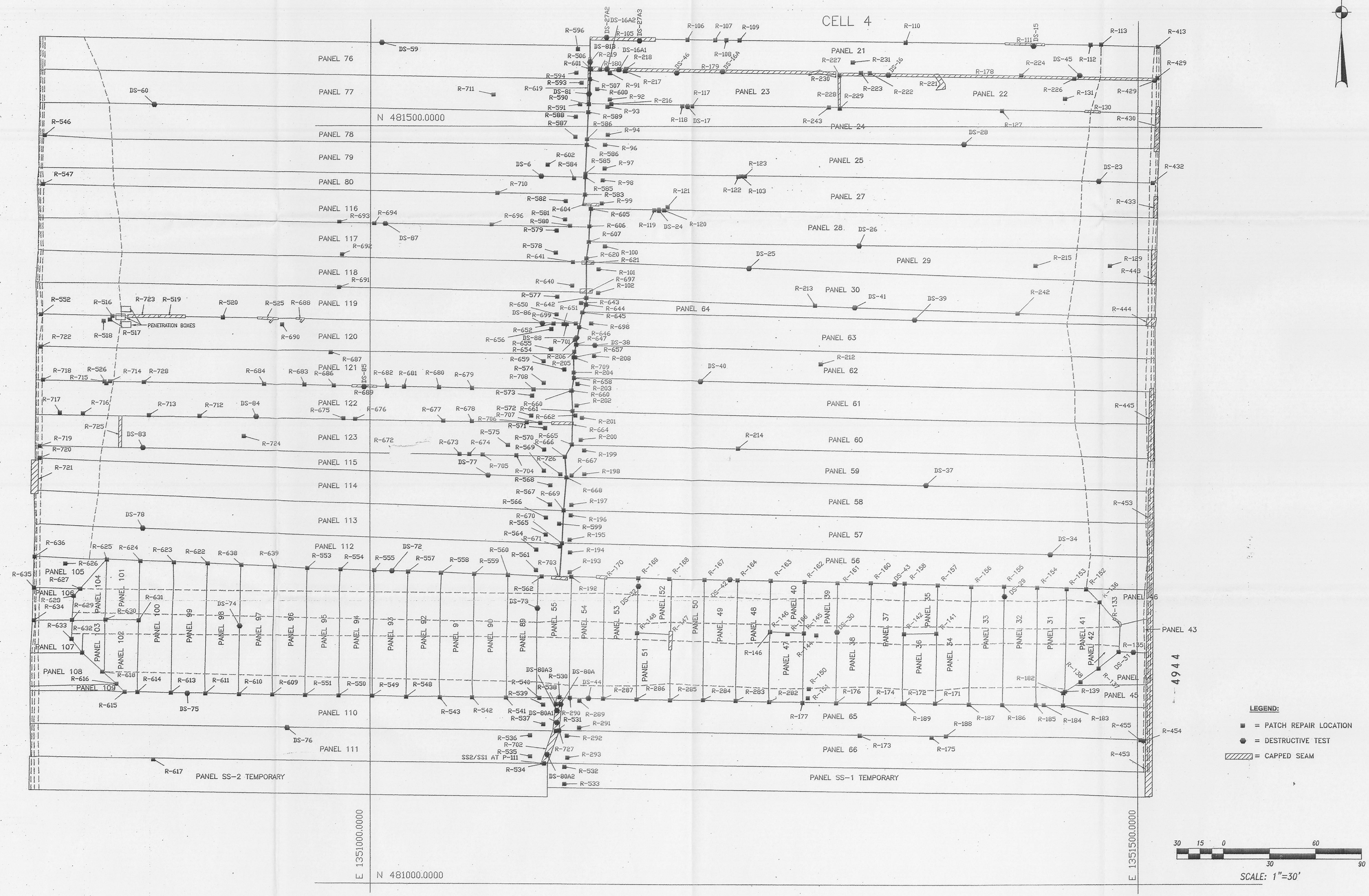
CELL 4
SECONDARY
GEOMEMBRANE
PANEL AS-BUILT
LAYOUT

Scale: 1" = 30'

Date: 02-07-2003

Sheet No.
1 OF 1

Project No.
201-225



LEGEND:

- ■ = PATCH REPAIR LOCATION
- ● = DESTRUCTIVE TEST
- ▨ = CAPPED SEAM

SCALE: 1"=30'

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STATE OF OHIO
THOMAS J. MACK
S-7964
PROFESSIONAL SURVEYOR
02-07-2003

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REVISED 12-12-02 PER GEOSYNTEC CONSULTANTS
REVISED 1-24-03 PER FLUOR FERNALD, INC.
REVISED 2-07-03 PER FLUOR FERNALD, INC.

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5 SECONDARY GEOMEMBRANE PANEL AS-BUILT LAYOUT

Scale: 1" = 30'
Date: 02-07-2003
Sheet No. 1 OF 1
Project No. 201-225

NOTE:

REPAIR-3 IS CAPPED BY R-31.

LEGEND:

- ■ = PATCH REPAIR LOCATION
- ● = DESTRUCTIVE TEST
- ▨ = CAPPED SEAM

30 15 0 60 30 90

SCALE: 1"=30'

STATE OF OHIO
THOMAS J. MACK
S-7964
REGISTERED
PROFESSIONAL SURVEYOR
02-07-2003

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REVISIONS:
REVISED 1-8-03
REVISED 2-28-03
Dennis Estes 3/31/03

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 4

CELL 4
PRIMARY
GEOMEMBRANE
PANEL LAYOUT
AS-BUILT

Scale: 1" = 30'
Date: 02-07-2003
Sheet No. 1 OF 1
Project No. 201-225

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LEGEND:

- ■ = PATCH REPAIR LOCATION
- ● = DESTRUCTIVE TEST
- ▨ = CAPPED SEAM

SCALE: 1"=30'

STATE OF OHIO
THOMAS J. MACK
S-7964
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02-07-2003

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Approved By: TOM MACK

REVISIONS:
REVISED 1-8-03
REVISED 2-28-03
Drawing Edits 3/3/03

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 5

CELL 5
PRIMARY
GEOMEMBRANE
PANEL LAYOUT
AS-BUILT

Scale: 1" = 30'
Date: 02-28-2003
Sheet No. 1 OF 1
Project No. 201-225

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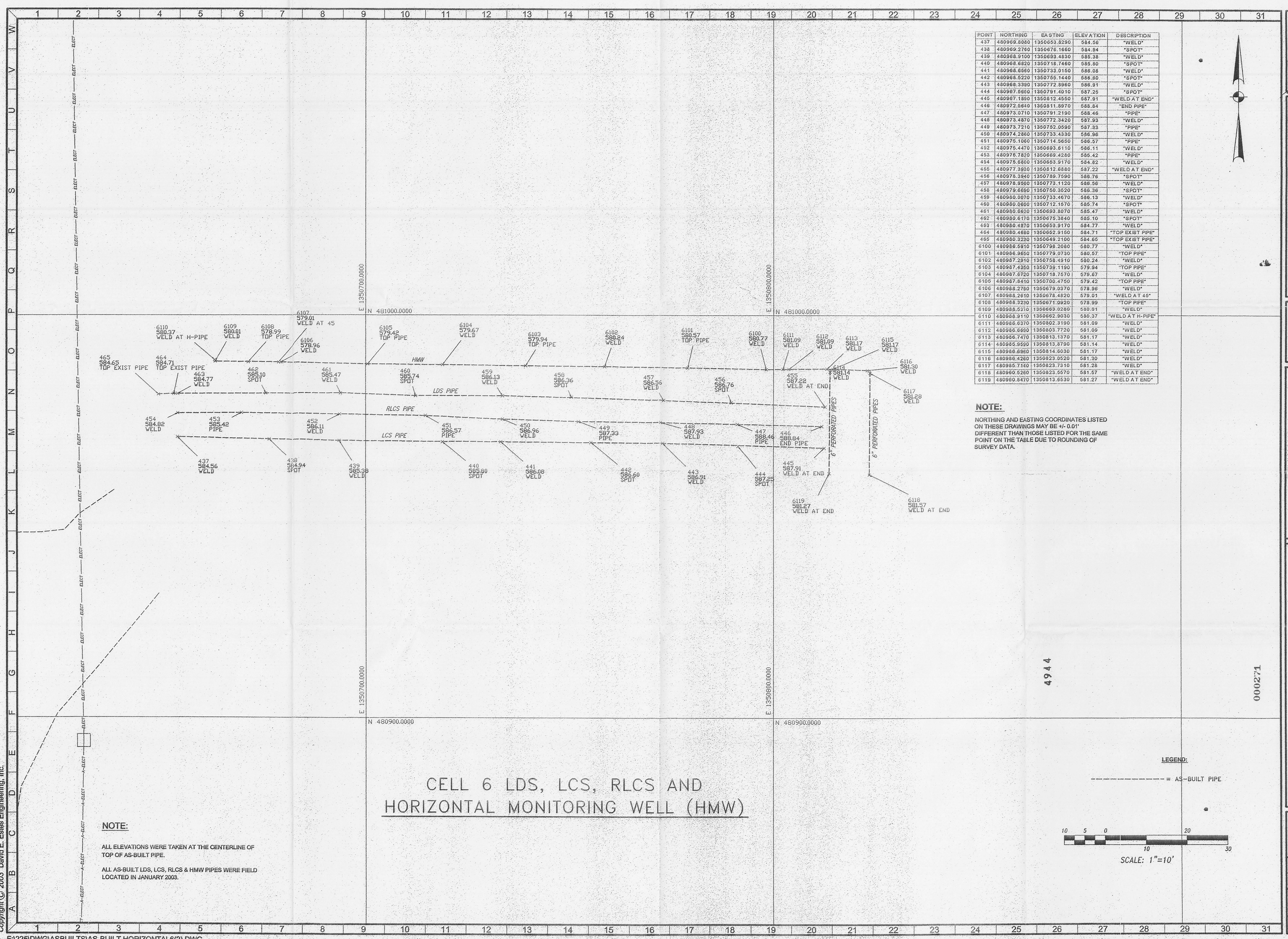

POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
437	480969.8080	1350653.8290	584.56	"WELD"
438	480969.2760	1350676.1660	584.94	"SPOT"
439	480968.9100	1350693.4830	585.38	"WELD"
440	480968.6820	1350718.7460	585.80	"SPOT"
441	480968.6560	1350733.0150	586.08	"WELD"
442	480968.5220	1350755.1440	586.60	"SPOT"
443	480968.3390	1350772.8960	586.91	"WELD"
444	480967.5660	1350791.4010	587.25	"SPOT"
445	480967.1890	1350812.4550	587.91	"WELD AT END"
446	480972.5640	1350811.8970	588.84	"END PIPE"
447	480973.0710	1350791.2190	588.46	"PIPE"
448	480973.4870	1350772.3420	587.93	"WELD"
449	480973.7210	1350752.0590	587.33	"PIPE"
450	480974.2860	1350733.4330	586.96	"WELD"
451	480975.1060	1350714.5650	586.57	"PIPE"
452	480975.4470	1350693.6110	586.11	"WELD"
453	480975.7820	1350669.4260	585.42	"PIPE"
454	480975.6800	1350653.9170	584.82	"WELD"
455	480977.3930	1350812.6880	587.22	"WELD AT END"
456	480978.3940	1350789.7590	586.76	"SPOT"
457	480978.9900	1350773.1120	586.56	"WELD"
458	480979.6690	1350750.3620	586.36	"SPOT"
459	480980.0070	1350733.4670	586.13	"WELD"
460	480980.0600	1350712.1570	585.74	"SPOT"
461	480980.6620	1350693.8070	585.47	"WELD"
462	480980.6170	1350675.3840	585.10	"SPOT"
463	480980.4870	1350653.9170	584.77	"WELD"
464	480980.4680	1350652.9150	584.71	"TOP EXIST PIPE"
465	480980.3230	1350649.2100	584.65	"TOP EXIST PIPE"
6100	480986.5810	1350798.2080	580.77	"WELD"
6101	480986.9650	1350779.0730	580.57	"TOP PIPE"
6102	480987.2810	1350758.4910	580.24	"WELD"
6103	480987.4350	1350739.1190	579.94	"TOP PIPE"
6104	480987.6720	1350718.7570	579.67	"WELD"
6105	480987.8410	1350700.4750	579.42	"TOP PIPE"
6106	480988.2790	1350679.0370	578.96	"WELD"
6107	480988.2610	1350676.4820	579.01	"WELD AT 45"
6108	480988.3230	1350671.0920	578.99	"TOP PIPE"
6109	480988.5310	1350663.0280	580.01	"WELD"
6110	480988.9110	1350662.9030	580.37	"WELD AT H-PIPE"
6111	480986.6370	1350802.3190	581.09	"WELD"
6112	480986.6690	1350803.7720	581.09	"WELD"
6113	480986.7470	1350813.1370	581.17	"WELD"
6114	480986.9590	1350813.8790	581.14	"WELD"
6115	480986.6960	1350814.6030	581.17	"WELD"
6116	480986.4260	1350823.0520	581.30	"WELD"
6117	480985.7140	1350823.7310	581.28	"WELD"
6118	480960.5260	1350823.5670	581.57	"WELD AT END"
6119	480960.8470	1350813.6530	581.27	"WELD AT END"

NOTE:

NORTHING AND EASTING COORDINATES LISTED ON THESE DRAWINGS MAY BE +/- 0.01' DIFFERENT THAN THOSE LISTED FOR THE SAME POINT ON THE TABLE DUE TO ROUNDING OF SURVEY DATA.

NOTE:

ALL ELEVATIONS WERE TAKEN AT THE CENTERLINE OF TOP OF AS-BUILT PIPE.

ALL AS-BUILT LDS, LCS, RLCS & HMW PIPES WERE FIELD LOCATED IN JANUARY 2003.

CELL 6 LDS, LCS, RLCS AND HORIZONTAL MONITORING WELL (HMW)

LEGEND:

= AS-BUILT PIPE

SCALE: 1"=10'

4944

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STATE OF OHIO
THOMAS J. MACK
8-7984
REGISTERED
PROFESSIONAL SURVEYOR

3/18/03

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Drawn By: NASSIM DAHER
Checked By: GREG BARKER
Approved By: TOM MACK

REVISIONS:
REVISED 03-13-03 PER FLUOR FERNALD, INC.

FLUOR FERNALD, INC.
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
OSDF CELL 6

CELL 6
AS-BUILT
LCS, LDS & RLCS
HORIZONTAL

Scale: 1" = 10'
Date: 02-25-2003
Sheet No. 1 OF 1
Project No. 201-225