

CLOSURE AND POST-CLOSURE PLAN

MUSCATINE POWER AND WATER Muscatine County, Iowa Coal Combustion Residue Landfill

October 17, 2016

Prepared For:

Muscatine Power and Water



Prepared By:



**CLOSURE AND POST CLOSURE PLAN
COAL COMBUSTION RESIDUE LANDFILL**

PERMIT NO. 70-SDP-06-82P

**Muscatine Power and Water
3205 Cedar Street
Muscatine, IA 52761**

October 2016

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CERTIFICATION

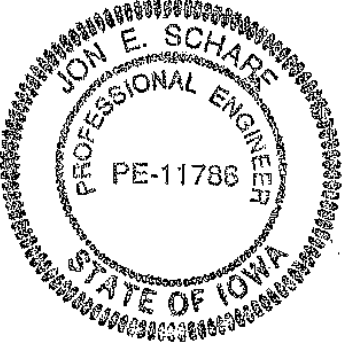
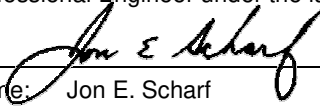
	<p>I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.</p>
	<p> Date: 10/11/2016</p>
	<p>Name: Jon E. Scharf</p>
	<p>License Number: 11786</p>
	<p>My renewal date is: 12/31/17</p>
	<p><u>Pages or sheets covered by this seal:</u> Entire Bound Document</p>
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1.0 INTRODUCTION

1.1 FACILITY DESCRIPTION

Muscatine Power and Water (MP&W) operates a coal fired power station in Muscatine Iowa having a generating nameplate capacity of 293.55 MW. Coal combustion residual (CCR) that is not beneficially used is disposed of in their landfill located approximately 10 miles west of the power station near the town of Letts, IA. A location map (Figure 1) and a site map (Figure 2) are included in Appendix A. The landfill was placed into operation in December 1985 and is under sole control of MP&W. The area occupied by the active and future permitted fill (disposal) area is about 34 acres. Management of CCR at this site has been regulated under permits issued by the Iowa Department of Natural Resources (IDNR).

The United States Environmental Protection Agency (USEPA) published the final rule for the management of coal combustion residuals (CCR) on April 17, 2015. The purpose of this document is to comply with subpart §257.102(b) and §257.104(d) of the CCR rule which requires that the Owner or Operator of a CCR landfill prepare a written Closure and Post-Closure Plan (Plan).

1.2 RELATED PERMITS

In addition to the federal provisions of Part §257 *Standards for Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments*, Muscatine Power and Water's CCR Landfill is currently subject to the following permits administered by the Iowa Department of Natural Resources:

- Iowa Department of Natural Resources Sanitary Disposal Project Permit, Permit Number 70-SDP-06-82P and Amendments 1-6, Expiration date 8/9/2020
- Iowa Department of Natural Resources NPDES Permit, Iowa Permit Number 7000109, Issued 1/19/2010, Expiration Date 1/18/2015 (application was submitted on time per requirements; renewed permit pending)

1.3 INITIAL AND AMENDED PLANS

In accordance with §257.102(b)(2) and §257.104(d)(2), the initial written closure plan and post-closure plan must be completed no later than October 17, 2016. Either plan may be amended at any time provided the revised plan is placed in the facility's operating record. Either plan must be amended whenever there is a change in conditions that would substantially affect the written plan in effect. Both the initial plans and any amendments of the written plans must be certified by a qualified professional engineer stating that the plan meets the requirements of the rule.

1.4 RECORD KEEPING

The written closure and post-closure plans, and any amendments of the plans are subject to compliance with the recordkeeping requirements specified in §257.105(i) for placement in the facility operating record. According to the rule, the plans are considered complete when they have been placed in the facility's operating record. Corresponding requirements include regulatory notifications specified in §257.106(i), and internet posting of record documents specified in §257.107(i).

Each document subject to these requirements must be retained for at least five years following the date of each occurrence, measurement, maintenance, corrective action, report, record, or study. Any required documentation must be readily retrievable for submittal to the State Director, if requested.

1.4.1 Notification

In accordance with §257.106(d), the State Director must be notified within 30 days of when information is placed in the facility operating record and on the Owner/Operator's publicly accessible internet site. Unless directed otherwise by IDNR staff, official notification should be sent to:

Mick Leat
Land Quality
Iowa Department of Natural Resources
502 East 9th Street
Des Moines, IA 50319-0034

1.4.2 CCR Website

As required, MP&W maintains a publicly accessible internet site which contain pertinent information from the facility operating record as specified in subparagraphs §257.107(e)–(j). In part, this includes this written closure plan, post-closure plan, and subsequent amendments. The materials to be forwarded to the CCR Web site must be posted within 30 days of placing the pertinent information in the facility operation record.

The publicly accessible internet site for Muscatine Power and Water is:

<https://www.mpw.org/utilities/ccr-rule>

2.0 CLOSURE PLAN §257.102(b)

The landfill began operation in 1985. In 1991 the landfill was re-designed in order to comply with changing regulations occurring at that time. Since then, the 1991 design has provided the general basis for site development. The design plans ⁽¹⁾ comprise 19 sheets and are included in Appendix A.

2.1 WASTE INVENTORY AND CAPACITY

The landfill is designed in four phases. The design airspace volume (potential disposal volume for CCR) as reported in the original supporting landfill design documentation ⁽²⁾ is as follows:

**TABLE 2-1
CCR LANDFILL DESIGN VOLUMES**

Phase	Air Space Design Volume (CY)	Current Status
I	384,000	Active
II	559,000	Active
III	508,000	Future
IV	381,000	Future
Total	1,832,000	

The cells are constructed and filled in sequential order (from east to west). Currently Phase I and II are open and are actively being filled with CCR. In September 2015, HR Green estimated that that approximate volume of CCR in these cells was 765,000 cubic yards ⁽⁴⁾. Based on the original 1991 design documents, the estimated maximum inventory of CCR on-site over the active life of the CCR unit is 1,832,000 cubic yards. This will occur when all four Phases are developed and reach the proposed design grade.

2.2 FINAL COVER AREA

The total design footprint of the landfill is 34 acres. Prior to the time of the landfill expansion design in 1991⁽⁵⁾, approximately 5 acres of the 34 acre unit was filled and final cover was applied. The cover reportedly consists of five feet of mixed sandy clay and one foot of topsoil with grass established on the surface ⁽⁴⁾. As shown on Figure 3 in Appendix A, the covered area is located along the north, east and south edges of Phase I. The remaining 29 acres would therefore represent the largest area of the CCR unit ever requiring a final cover that meets the performance requirements of §257.102(d), or applicable State rules, at any time during the CCR unit's active life.

2.3 CLOSURE SCHEDULE

MP&W currently markets the majority of its CCR for beneficial use. Therefore, the amount of CCR that is landfilled is variable in direct relation to the available markets. For example, since 2010 annual disposal volume of CCR at the landfill has ranged from approximately 7,000 to

15,000 cubic yards, for an average of about 10,000 cubic yards per year. In 2017 and 2018, MP&W projects a significant reduction in landfilled CCR, less than 3,000 cubic yards annually.

Considering the variability of annual airspace use, it is difficult to provide a reasonable estimate of the time in which all closure activities for the CCR unit will be completed. However considering that roughly 1,060,000 cubic yards of airspace remains, the design life of the landfill appears to be at least 100 years.

At the time of closure, the written closure plan will be amended and the schedule of activities will be updated. The following schedule shows the timeline based on requirements of §257.102 shortly before, during, and after closure.

**TABLE 2-2
CCR LANDFILL CLOSURE SCHEDULE**

Amendment of a written closure plan §257.102(b)(3)(iii)	At least 60 days prior to a planned change in operation of the facility.
Notification of intent to close CCR landfill and engineer certification §257.102(g)	No later than the date of closure initiation.
Initiation of closure activities §257.102(e)(i)	No later than 30 days after final receipt of CCR.
Completion of closure activities §257.102(f)(i)	Within six months of commencing closure activities.
Notification of closure of CCR landfill §257.102(h)	Within 30 days of completion of closure.
Deed notations §257.102(i)	Following closure of CCR unit.
Notification placed in facility operating record §257.102(i)(3)	Within 30 days of recording a deed notation.

2.4 DESCRIPTION OF CLOSURE SEQUENCE

Final cover will be constructed in a phased approach as areas are filled to final design grades. Development will progress in numerical order of the landfill phases as depicted in the 1991 landfill expansion design ⁽¹⁾, Sheets 5 through 9 (Appendix A). MP&W plans to construct final cover over portions of Phase I within the next few years. Filling will continue in Phase II and the open portions of Phase I until additional disposal capacity is needed. When the development of Phase III begins, final cover will be completed in Phase I and over portions of Phase II. North and south let-down storm water structures will be constructed at that time. With development of Phase IV, final cover will be completed in Phase II and over portions of Phase III. When Phase IV development is complete, final cover will be constructed over the remaining area. The third storm water let-down structure and final storm water interceptor ditches will be constructed during and at the conclusion of Phase IV.

2.5 FINAL COVER SYSTEM

The design of the cover system required in the federal rule §257.102(d) and the design required in State of Iowa rule [567] IAC 103.1(5)b are slightly different but appear to meet the same objective. A comparison of these liner systems are as follows

Federal rule §257.102(d)(3)(i)

- (A) The permeability of the final cover system must be less than or equal to the permeability of any bottom liner system or natural subsoil present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less.
- (B) The infiltration of liquids through the closed CCR unit must be minimized by the use of an infiltration layer that contains a minimum of 18 inches of earthen material.
- (C) The erosion of the final cover system must be minimized by the use of an erosion layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth.
- (D) The disruption of the integrity of the final cover system must be minimized through a design that accommodates settling and subsidence.

State of Iowa rule [567] IAC 103.1(5)b

The State of Iowa rule reads – “The final cover shall consist of not less than two feet of compacted soil and one foot of uncompacted soil capable of sustaining a growth of common grasses.” Application of the State rule (as it relates to permeability) results in the IDNR applying an informal maximum permeability requirement of the compacted layer of 1×10^{-7} cm/sec.

Unless otherwise required by future rule changes, MP&W plans to proceed with cover design based on the rules and permit requirements in place by the State of Iowa. This Closure Plan is based on the premise that the State required cover system meets the criteria of an alternative final cover design system as allowed in §257.102(d)(3)(ii). In accordance with Iowa Administrative Code 567 Chapter 103.1(5), the final cover will consist of not less than two feet of compacted soil and one foot of un-compacted soil capable of sustaining growth of common grasses. Specifications for the compacted layer will include material quality and installation criteria to result in a monolithic low-permeable barrier that will minimize water infiltration through the cap. These cover layers, described from top to bottom are as follows:

1. Erosion Layer: 12-inches uncompacted earthen material that is capable of supporting native plant growth. The top portion of this layer may be topsoil.
2. Compacted Clay Layer: 24-inches of compacted clay having permeability no greater than 1×10^{-7} cm/sec.

2.6 FINAL COVER PERFORMANCE STANDARD

This landfill is subject to the closure performance standard described in §257.102(d)(1). The CCR landfill will be closed in a manner that will:

- (i) Control, minimize or eliminate, to the maximum extent feasible, post-closure infiltration of liquids into the waste and releases of CCR, leachate, or contaminated run-off to the ground or surface waters or to the atmosphere;
- (ii) Preclude the probability of future impoundment of water, sediment, or slurry;
- (iii) Include measures that provide for major slope stability to prevent the sloughing or movement of the final cover system during the closure and post-closure care period;
- (iv) Minimize the need for further maintenance of the CCR unit; and
- (v) Be completed in the shortest amount of time consistent with recognized and generally accepted good engineering practices.

In accordance with §257.102(d)(iii), the Closure Plan includes the methods and procedures to be used to install the final cover and discussion how the final cover system will achieve the performance standards listed above. The above criteria are met through the existing landfill design and by quality assurance and control of future construction, as described in the following Section.

2.7 QUALITY CONTROL AND ASSURANCE PROGRAM

Construction of final cover will be completed under a Quality Control and Assurance (QC&A) program, including quality control inspections, sampling, testing, survey controls, and other activities.

2.7.1 Subgrade Preparation

The CCR is placed according to the grades presented on the 1991 landfill expansion design 1991⁽¹⁾. The surface of the CCR will be graded for preparation of final cover construction, including construction of terraces designed for storm water control and slope stability. This may require correction of soft areas, grading to fill depressions, and grading to obtain final slopes. Soft or loose areas should be subcut and replaced with stabilizing compacted fill material. The slope of the landfill area after final closure will be according to the approved plans.

QC&A Activities:

- Identify and correct potential soft areas.
- Record observations and corrective actions.
- Verify that survey is completed and elevations are in accordance with the approved construction drawings.
- Verify that any damage (such as tire/equipment rutting) is repaired.

2.7.2 Clay Source Documentation-Hydraulic Conductivity/Density Correlation

Field densities of the compacted clay liner must be performed to verify that the density, as correlated to permeability by laboratory analysis, has been achieved. In order to correlate the compaction density to permeability, initial permeability testing shall be performed in a laboratory prior to placement of the compacted clay layer. QC&A personnel will collect representative clay soil samples for each soil type to be used for the compacted clay layer. The samples shall be submitted to the testing laboratory for the following:

Test Parameter	ASTM Reference
Particle Size	D422
Atterberg Limits	D4318
Standard Proctor	D698
Permeability	D5084

For each sample, the laboratory shall determine hydraulic conductivity (permeability) at 90 and 95 percent of standard Proctor density at a moisture content about two percent over optimum. The results of these tests will provide the basis to correlate compaction effort (percent of optimum density) with the in-place hydraulic conductivity of the compacted clay.

QQ&A Activities:

- Document sample collection.
- Review all the test results as they are received from the laboratory.
- Verify clay source testing meets project specifications.
- Determine from laboratory test results that the specified compaction density correlates with the specified permeability during installation of the compacted clay.

2.7.3 Compacted Clay Layer Placement and Compaction

The compacted clay layer of the final cover will be installed directly over the graded and compacted CCR. Loose lift thickness shall not exceed eight (8) inches. Note that with compaction, a minimum of 4 loose lifts will be required to achieve a 24 inch thick compacted layer. The compacted clay layer shall meet the following criteria:

1. Moisture content shall be 2 to 4 percentage points wet of optimum moisture as determined by standard Proctor testing.
2. The minimum allowable density shall be 95 percent of standard Proctor density or as modified by Engineer following further density/permeability correlation.

Testing shall be at a frequency of at least one field moisture/density test per lift per acre (1 tests/lift/acre) to verify and document that the specified density and moisture content is achieved.

QC&A Activities:

- Observe clay placement and thickness of each lift as it is placed and compacted.
- Verify that clay material is uniform, free from lenses, pockets, streaks or layers of material differing substantially in texture or gradation from surrounding material. Moisture should be uniformly distributed in each lift of clay material prior to compaction. Excessively dry or wet soil must be conditioned before placement of additional lifts.
- Observe the action of the compaction and heavy hauling equipment on the construction surface (sheep foot penetration, pumping, cracking, etc.).
- Define areas of unsuitable material and direct its removal. Observe the areas once the unsuitable material has been removed.
- Record the locations and test results. The test locations are to be chosen randomly within a specified grid.
- Approve areas that meet the specified moisture and compaction.
- Rework and then retest areas not meeting the specified moisture or compaction until the area is approved.

2.7.4 Maintenance of Compacted Clay Layer

The integrity of the compacted clay layer must be maintained during the construction period until it is covered by the uncompacted layer. The surface of the compacted clay layer must not be allowed to dry or desiccate. If desiccation occurs, affected areas must be repaired by raking or disking, conditioning, adding moisture and re-compacting the affected area. The clay layer should be covered as soon as possible to prevent desiccation.

QC&A Activities:

- Regularly observe the compacted clay surface for drying and cracking.
- Observe rework, and retest if necessary.

2.7.5 Uncompacted (Erosion) Layer Placement

The uncompacted (erosion) layer and topsoil will be carefully placed to prevent damage to the underlying compacted clay layer. Compaction of these materials will be only what is incidental from construction placement equipment, such as light bulldozers. The uncompacted layer will be capable of sustaining appropriate vegetative cover.

QC&A Activities:

- Regularly observe placement of erosion layer and verify that underlying compacted clay is not damaged during placement.
- Verify that layer is free of large rocks or cobbles.
- Verify required thickness is achieved.

2.7.6 Vegetative Cover

Common grasses will be seeded on the final cover area, all reclaimed portions of the site, and adjacent disturbed areas. Wood excelsior mat or straw mat will be placed in the flow lines of ditches, over berms, and on steep grades as necessary to minimize erosion and promote the establishment of vegetation.

QC&A Activities:

- Observe seeding, fertilizing, and mulching to verify conformance with specifications.
- Collect certified seed tags from packaging for documentation.
- Verify erosion mat product and placement is as specified.

3.0 POST-CLOSURE PLAN §257.104(d)

In accordance with §257.104(c) MP&W will be required to conduct post-closure care of the CCR landfill for at least 30 years. If at the end of that period the CCR unit is operating under assessment monitoring, post-closure care must continue until the CCR unit returns to detection monitoring in accordance with §257.95.

3.1 FACILITY CONTACT

The office to contact about the facility during the post-closure period is as follows:

Mike Avesing
Manager, Power Generation
Muscatine Power and Water
3205 Cedar Street
Muscatine, Iowa 52761
Phone: (563) 263-2631

3.2 PLANNED SITE USES DURING POST-CLOSURE PERIOD

The ultimate land use will be permanent vegetation. The grasses may be mowed and harvested for hay. Deed restrictions will promote protection of the facility in perpetuity.

3.3 MONITORING AND MAINTENANCE

Monitoring and maintenance of the environmental systems at the landfill will be in accordance with good engineering practice and applicable regulations at the time of closure. Routine inspection of the site will occur monthly or semi-annually, depending on the feature to be inspected. In addition, non-routine inspections will occur after severe weather events such as heavy rain, high winds, hail, tornado, ice storm, etc. The inspections will include:

- Evaluation of cap integrity (including observation for settlement, erosion, and vegetation quality);
- Evaluation of surface water drainage;
- Inspection of the leachate collection system;
- Inspection of monitoring systems; and
- Inspection of site features (roads, signs, fences, etc.).

If the site inspection reveals problems with leachate collection systems, monitoring systems, site features, or the final cap systems, appropriate corrective measures will be taken. All maintenance and repair completed at the facility will be done in accordance with the approved plans, specifications, and quality assurance/quality control provisions in effect at the time. That is, all repair and maintenance work will comply with the ongoing design and operating intent of the facility.

The following sections provide a general summary of monitoring and maintenance practices that will be employed during the post-closure period. A schedule of post-closure inspections and maintenance addressing specific features and systems is included in Appendix B.

3.3.1 Final Cover Maintenance

MP&W will maintain the integrity and effectiveness of the final cover system, including making repairs to the final cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover.

Inspections will include checking the landfill surface for erosion and settlement. Inspections will occur on scheduled occasions and whenever severe weather, including peak rainfalls and periods of drought, occur in the area of the landfill. Land surface repairs will be performed as needed. Supplemental cover soil will be placed when needed due to erosion and settlement. Seeding, fertilizing, and mulching of bare soil will be provided where required. All surface repairs will be performed within 30 working days of the inspection, when appropriate.

3.3.2 Leachate Collection System Maintenance and Operation

MP&W will maintain the integrity and effectiveness of the leachate collection and removal system and operating the leachate collection and removal system in accordance with the requirements of §257.70

MP&W will continue to operate and maintain the leachate control system throughout the post-closure period. During this time, the system will be inspected monthly and repairs made as necessary. The system will be jetted on an as-needed basis to maintain collection efficiency. Collected leachate will continue to be managed as provided in the approved NPDS permit, as applicable.

3.3.3 Groundwater Monitoring

MP&W will maintain the groundwater monitoring system and monitoring the groundwater in accordance with the federal CCR requirements of Part §257.90 through 257.98.

The groundwater monitoring system and procedures are described in detail in the *Groundwater Monitoring System and Sampling and Analysis Program* (HR Green, May 2016, with any subsequent amendments thereto). That document addresses the sub-rules pertaining to Groundwater Monitoring and Corrective Action under Part 257 sections: Applicability (§257.90), Groundwater Monitoring Systems (§257.91), Groundwater Sampling and Analysis Requirements (§257.93), Detection Monitoring Program (§257.94), Assessment Monitoring Program (§257.95), Assessment of Corrective Measures (§257.96), Selection of Remedy (§257.97), and Implementation of the Corrective Action Program (§257.98).

As a short summary, the Groundwater Monitoring System includes:

1. Monitoring points:
 - (1) Upgradient/background quality monitoring wells: MW-8 and MW-10.
 - (2) Downgradient quality monitoring wells: MW-4A, MW-5B, MW-6A, MW-13, MW-14A, MW-15A, MW-18A, and MW-21.
 - (3) Surface water monitoring is not required under the federal rule.
 - (4) Iowa DNR requirements: in addition to the above federal requirements, the Iowa DNR currently requires sampling of upstream point SW-22 and downstream points SW-23, SW-24, SW-25, and SW-26 (farm pond).

- a) State requirements are under [567] Iowa Administrative Code Chapter 103 in effect at the time of this document, and/or the site's current Landfill Permit.
2. Chemical constituents:
 - (1) Detection monitoring constituents include boron, calcium, chloride, fluoride, pH, sulfate, and total dissolved solids from Appendix III Part 257.
 - (2) Assessment monitoring constituents include antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, fluoride, lead, lithium, mercury, molybdenum, selenium, thallium, and radium 226 & 228 combined from Appendix IV Part 257.
 - (3) Iowa DNR requirements: In addition to the above federal requirements, the Iowa DNR currently requires the following constituents: aluminum, copper, iron, magnesium, manganese, nickel, strontium, and vanadium, and zinc.
 - a) State requirements are under [567] Iowa Administrative Code Chapter 103 in effect at the time of this document, and/or the site's Landfill Permit.
3. Sample collection and testing:
 - (1) Consistent sampling and analysis procedures will be employed to provide accurate representation of groundwater quality, including,
 - a) The upgradient / background monitoring wells will be sampled first.
 - b) A low flow sampling methodology will be employed.
 - c) One (1) field quality control sample will be collected per event (i.e., 10%).
 - d) Groundwater samples will not be field-filtered prior to laboratory analysis of total recoverable metals.
 - e) A certified laboratory will be used for the analytical analysis.
4. Sampling frequency and maintenance:
 - (1) Sampling events will be conducted semiannually during the fall and spring; or at a frequency otherwise dictated by the results of the statistical analysis of data and the system's status within Detection, Assessment, or Corrective Action monitoring.
 - a) An alternative monitoring frequency for repeated sampling and analysis may be considered, with such a proposal including the documentation requirements under §257.94(d)(1-3).
 - (2) The wells will be inspected visually for damage during each monitoring event. Damaged or non-functioning wells will be repaired or replaced as required.
5. Water level measurements:
 - (1) During each sampling event groundwater level measurements will be obtained at each active monitoring well, including MW-8, MW-10, MW-4A, MW-5B, MW-6A, MW-13, MW-14A, MW-15A, MW-18A, and MW-21; plus at each active leachate piezometer, including LPZ-1, LPZ-2, LPZ-3, and LPZ-4.
6. Evaluation of monitoring results:
 - (1) The selected statistical approach will be effective in detecting changes in groundwater quality based on EPA, Unified Guidance (2009). The methodology to screen background data and establish background constituent levels is described in the *Groundwater Monitoring System and Sampling and Analysis Program*.
 - (2) The analytical results for each downgradient well/constituent will be evaluated for statistically significant increases (SSI) above background levels, or statistically significant level (SSL) above a groundwater protection standard, by using the upgradient/background quality monitoring wells listed above and the selected

statistical method, as applicable for Detection, Assessment, or Corrective Action monitoring requirements.

7. Selection of a Remedy and Implementation of a Corrective Action Program:
 - (1) If needed based on the results of the assessment of corrective measures, select a remedy that is protective of human health and environment, attains the established groundwater protection standard, controls the source(s) of release, and removes from the environment as much of the contaminated material as feasible.
 - (2) As needed, implement a corrective action groundwater monitoring program that meets the requirements of an assessment monitoring program and implement the corrective action remedy, and address any interim measures that might be needed to reduce the contaminants leaching from the CCR unit.
 - (3) The remedy will be considered complete when compliance with the GWPS has been achieved at all points within the plume of contamination that lie beyond the groundwater monitoring well system and concentrations of constituents listed in Appendix IV of Part 257 have not exceeded the relevant groundwater protection standard for a period of three consecutive years.
8. Water Quality Reporting:
 - (1) A *Groundwater Monitoring and Corrective Action Report* will be available annually by January 31. The report will document the status the groundwater monitoring and corrective action program, summarize actions completed, describe problems encountered, and identify activities for the upcoming year.
9. Recordkeeping, notification, and posting of information:
 - (1) Maintain the federal rule Part §257.105 through §257.107 requirements for recordkeeping, notification, and posting of information.

4.0 REFERENCES

- (1) Green Environmental Services, Inc., "Muscatine Power and Water Coal Combustion Residue Landfill", Drawing Set, 19 Sheets, November 1991.
- (2) Green Environmental Services, Inc., "Supporting Documentation for Muscatine Power and Water Coal Combustion Residue Landfill", Report, November 1991.
- (3) HR Green, Inc., "Groundwater Monitoring System and Sampling and Analysis Program", May 2016.
- (4) HR Green, Inc., "Annual Inspection Report, Existing Coal Combustion Residue (CCR) Landfill, Muscatine Power and Water", Report, December 23, 2015.
- (5) Muscatine Power and Water, Letter w/ attachments to IDNR, "Response to September 10, 2009 Letter MP&W CCR Landfill Renewal Application", December 17, 2009.

APPENDIX A
FIGURES AND DRAWINGS

Figure 1

LOCATION MAP

CCR Landfill
Muscatine Power and Water

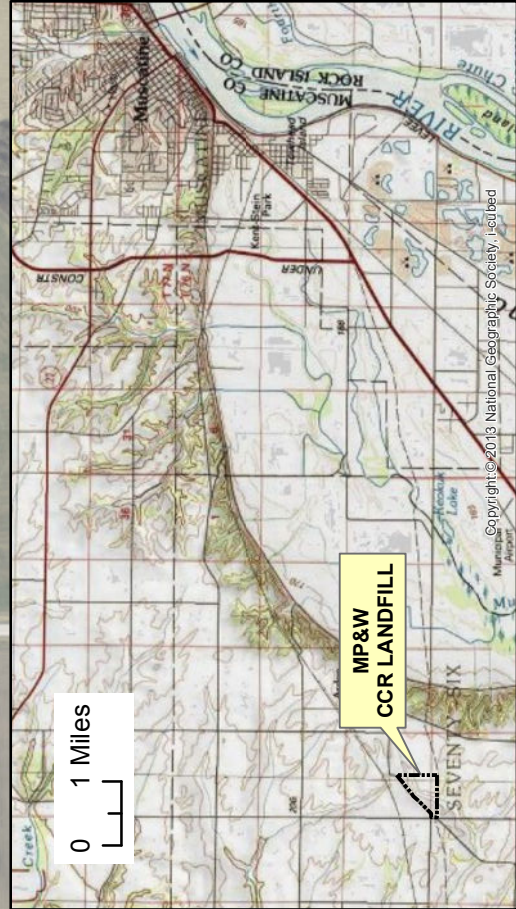
Legend

- Property Line (Approx.)
- Permitted Fill Area



0 500 Feet

Projected Coordinate System:
NAD 1983 StatePlane Iowa_South










Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure 2
SITE MAP

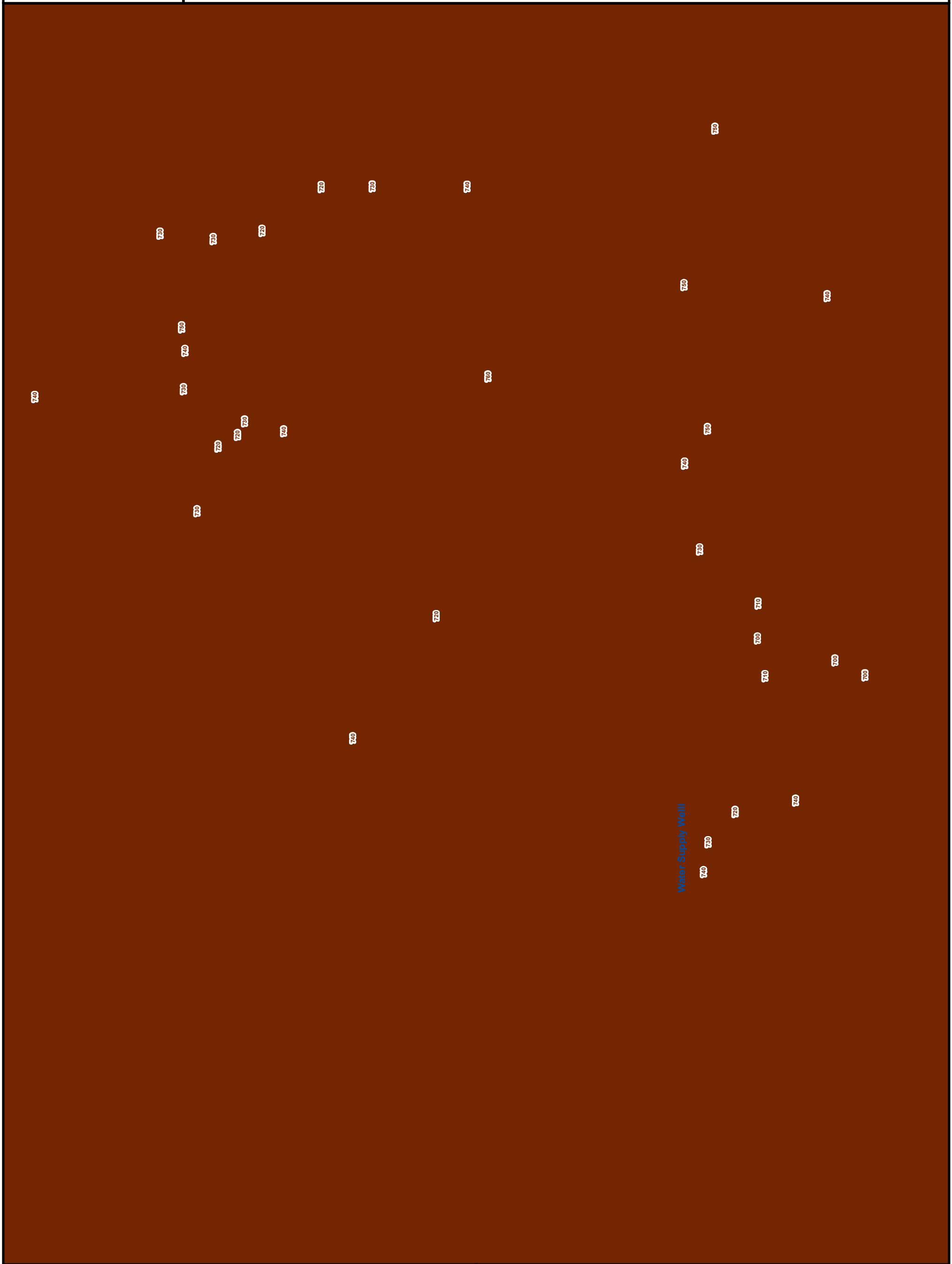
CCR Landfill
Muscatine Power and Water

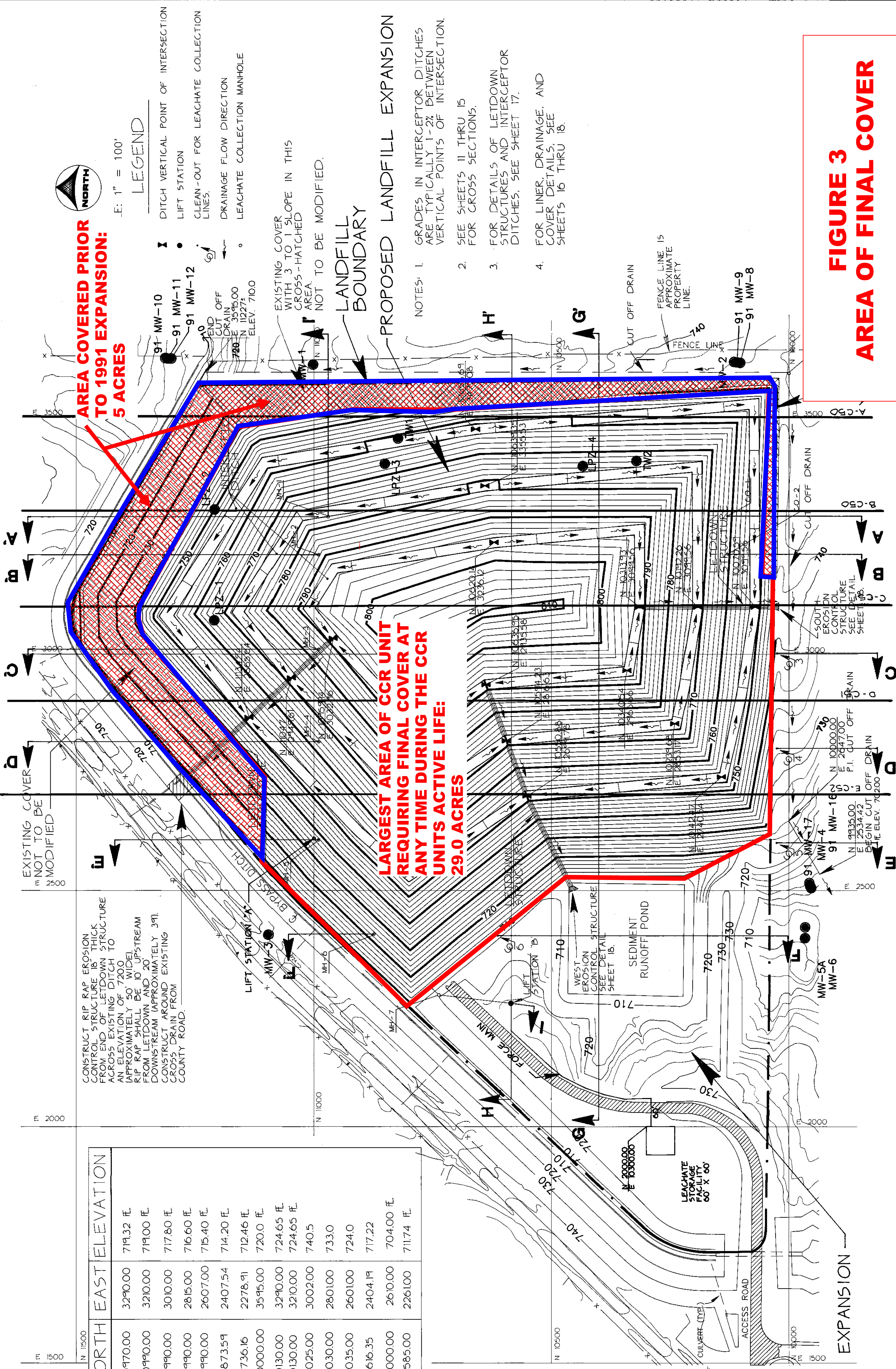
Legend

-  Monitoring Wells
-  Piezometers
-  Water Supply Well
-  Phase Boundaries
-  Groundwater Cut-Off Drain
-  Permitted Development Area
-  Property Line (Approx.)



Projected Coordinate System:
NAD 1983 StatePlane Iowa_South





AREA COVERED PRIOR TO 1991 EXPANSION: 5 ACRES

LARGEST AREA OF CCR UNIT REQUIRING FINAL COVER AT ANY TIME DURING THE CCR UNITS ACTIVE LIFE: 29.0 ACRES

**FIGURE 3
AREA OF FINAL COVER**

LABEL	NORTH	EAST	ELEVATION
MH-1	10970.00	3290.00	719.32 EL
MH-2	10990.00	3210.00	719.00 EL
MH-3	10990.00	3010.00	717.80 EL
MH-4	10990.00	2815.00	716.60 EL
MH-5	10990.00	2607.00	715.40 EL
MH-6	10873.59	2407.54	714.20 EL
MH-7	10736.16	2278.91	712.46 EL
MH-8	10000.00	3595.00	720.0 EL
CO-1	10130.00	3290.00	724.65 EL
CO-2	10130.00	3210.00	724.65 EL
CO-3	10025.00	3002.00	740.5
CO-4	10030.00	2801.00	733.0
CO-4	10035.00	2601.00	724.0
CO-5	10616.35	2404.19	717.22
LIFT STA. A	11000.00	2610.00	704.00 EL
LIFT STA. B	10585.00	2261.00	711.74 EL

CONSTRUCT RIP RAP EROSION CONTROL STRUCTURE IS THICK FROM END OF LETDOWN STRUCTURE ACROSS EXISTING DITCH TO AN ELEVATION OF 7200 (APPROXIMATELY 50' WIDE). RIP RAP SHALL BE 10' UPSTREAM FROM LETDOWN AND 20' DOWNSTREAM (APPROXIMATELY 39'). CONSTRUCT DRAIN AROUND EXISTING COUNTY ROAD.

- NOTES:
1. GRADES IN INTERCEPTOR DITCHES ARE TYPICALLY 1-2% BETWEEN VERTICAL POINTS OF INTERSECTION.
 2. SEE SHEETS 11 THRU 15 FOR CROSS SECTIONS.
 3. FOR DETAILS OF LETDOWN STRUCTURES AND INTERCEPTOR DITCHES, SEE SHEET 17.
 4. FOR LINER DRAINAGE, AND COVER DETAILS, SEE SHEETS 16 THRU 18.

FUTURE LANDFILL EXPANSION

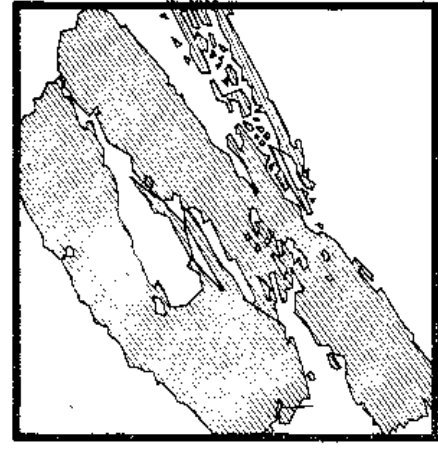
DRAWN: JEG/CAD/CASEI		SURVEYED: _____	
APPROVED: _____		FIELD BOOK NO. _____	
DATE: NOVEMBER 15, 1991		JOB NO. 705910	
NO.		DATE	BY
1	11/19/91	JEG	XSEC 11 NUMBER NOTES EXTEND XSEC F. LIFT STA. A/B
2	11-11-91	ERJ	ADDED SECTION'S A. THRU D.
REVISION DESCRIPTION		DMK 08/11/91	
GREEN ENVIRONMENTAL SERVICES, INC.			
MUSCATINE POWER AND WATER CCR LANDFILL 1991			
PROPOSED FINAL CONTOURS			
SHEET NO. _____			

MUSCATINE POWER AND WATER

COAL COMBUSTION RESIDUE LANDFILL

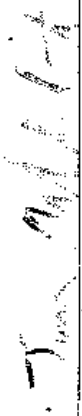
MUSCATINE, IOWA

1991



GREEN
ENVIRONMENTAL
SERVICES, INC.

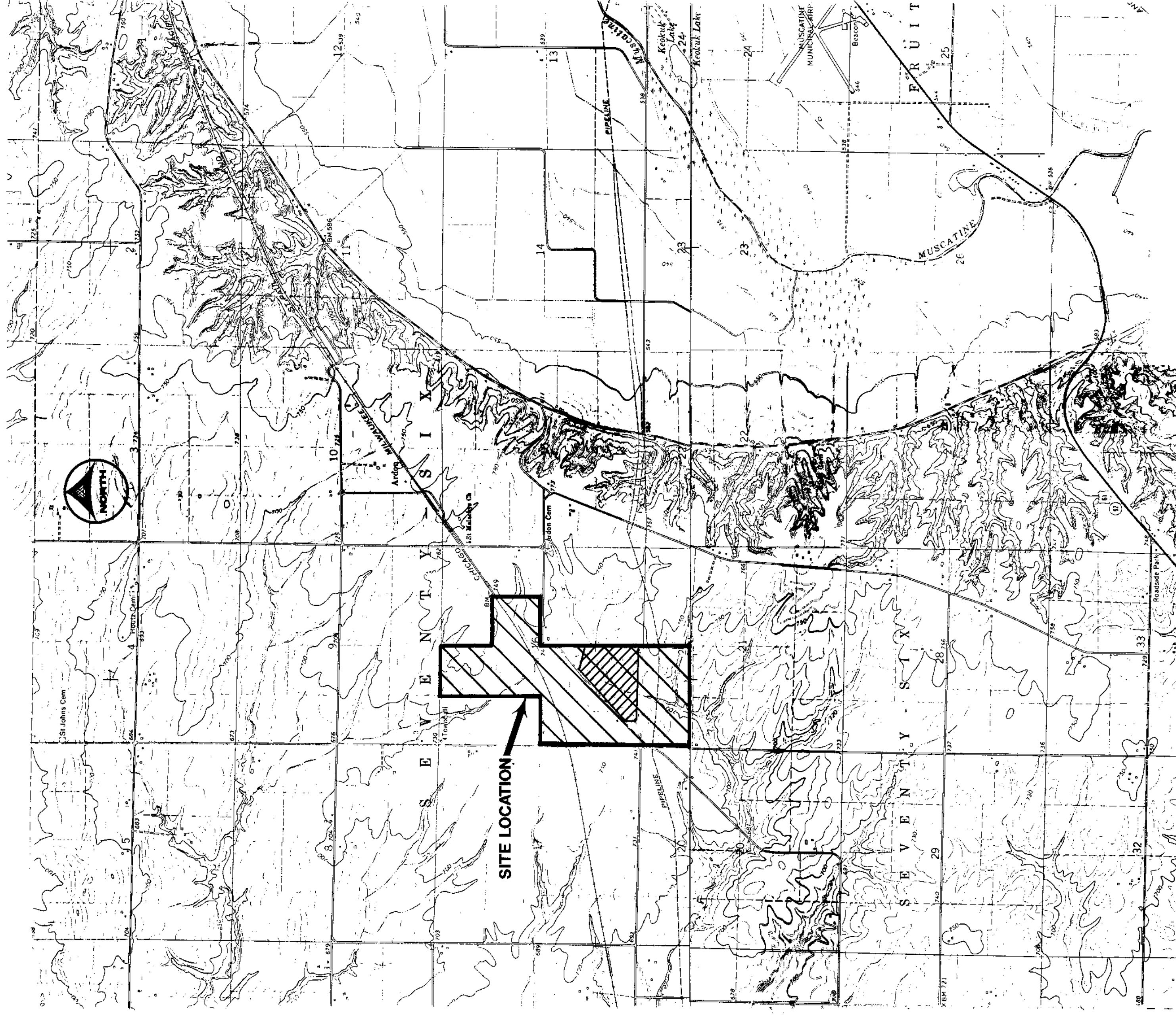
I hereby certify that this plan, specification, or report was prepared by me or under my direct personal supervision and that I am a duly Registered Professional Engineer under the laws of the State of Iowa.


Date 11/21/91 Reg. No. 11949
Jim Mikolajts

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6.	PROPOSED LINER SYSTEM
7.	LANDFILL DEVELOPMENT - PHASE I
8.	LANDFILL DEVELOPMENT - PHASE II
9.	LANDFILL DEVELOPMENT PHASE III
10.	LEACHATE COLLECTION DEVELOPMENT
11.	CROSS SECTIONS A - A' AND B - B'
12.	CROSS SECTIONS C - C' AND D - D'
13.	CROSS SECTIONS E - E' AND F - F'
14.	CROSS SECTIONS G - G' AND H - H'
15.	CROSS SECTION I - I'
16.	LINER DETAILS
17.	DRAINAGE AND COVER DETAILS
18.	MISCELLANEOUS DETAILS
19.	THREE DIMENSIONAL VIEW OF LANDFILL PHASES



LANDFILL SITE: PART OF THE SOUTHWEST 1/4 OF SECTION 16,
TOWNSHIP 76 NORTH, RANGE 3 WEST, MUSCATINE COUNTY.

APPROXIMATELY 360 ACRES

SITE LOCATION MAP

DRAWN: DCK SURVEYED: _____
 APPROVED: _____ FIELD BOOK NO. 105910
 DATE: NOVEMBER 14, 1991 JOB NO. _____

NO.	DATE	BY	REVISION DESCRIPTION

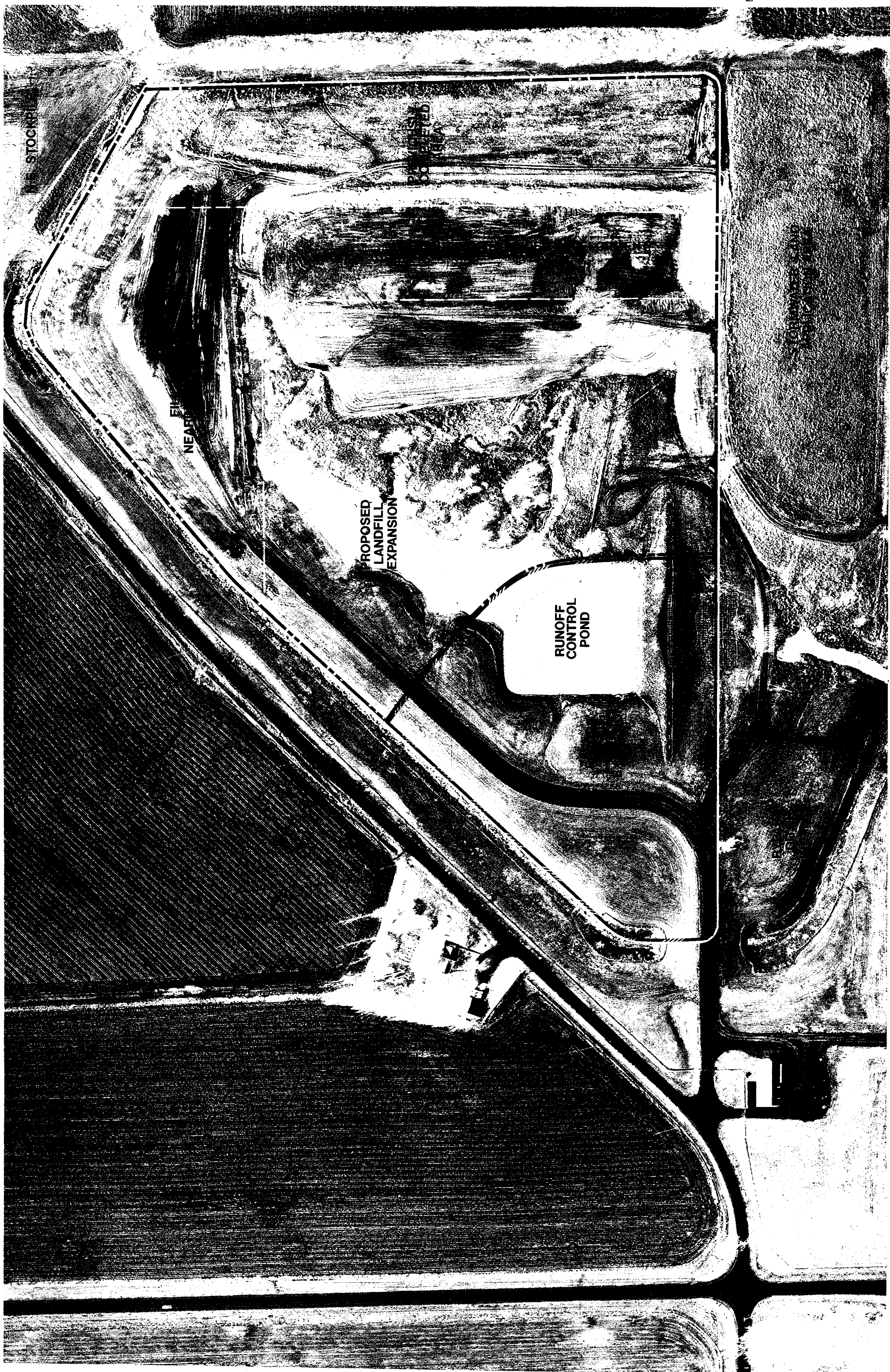


MUSCATINE POWER AND WATER
CCR LANDFILL
1991

INDEX/LOCATION MAP



SCALE 1" = 100'



DATE OF AERIAL PHOTOGRAPHY:
NOVEMBER 22, 1990

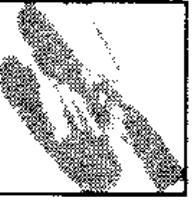
DRAWN: PCK

SURVEYED:

APPROVED: FIELD BOOK NO. 705910

DATE: NOVEMBER 14, 1991 JOB NO. 705910

NO. DATE BY REVISION DESCRIPTION



Green
Environmental
Services, Inc.

MUSCATINE POWER AND WATER
CCR LANDFILL
1991

AERIAL SITE PLAN

SHEET NO.

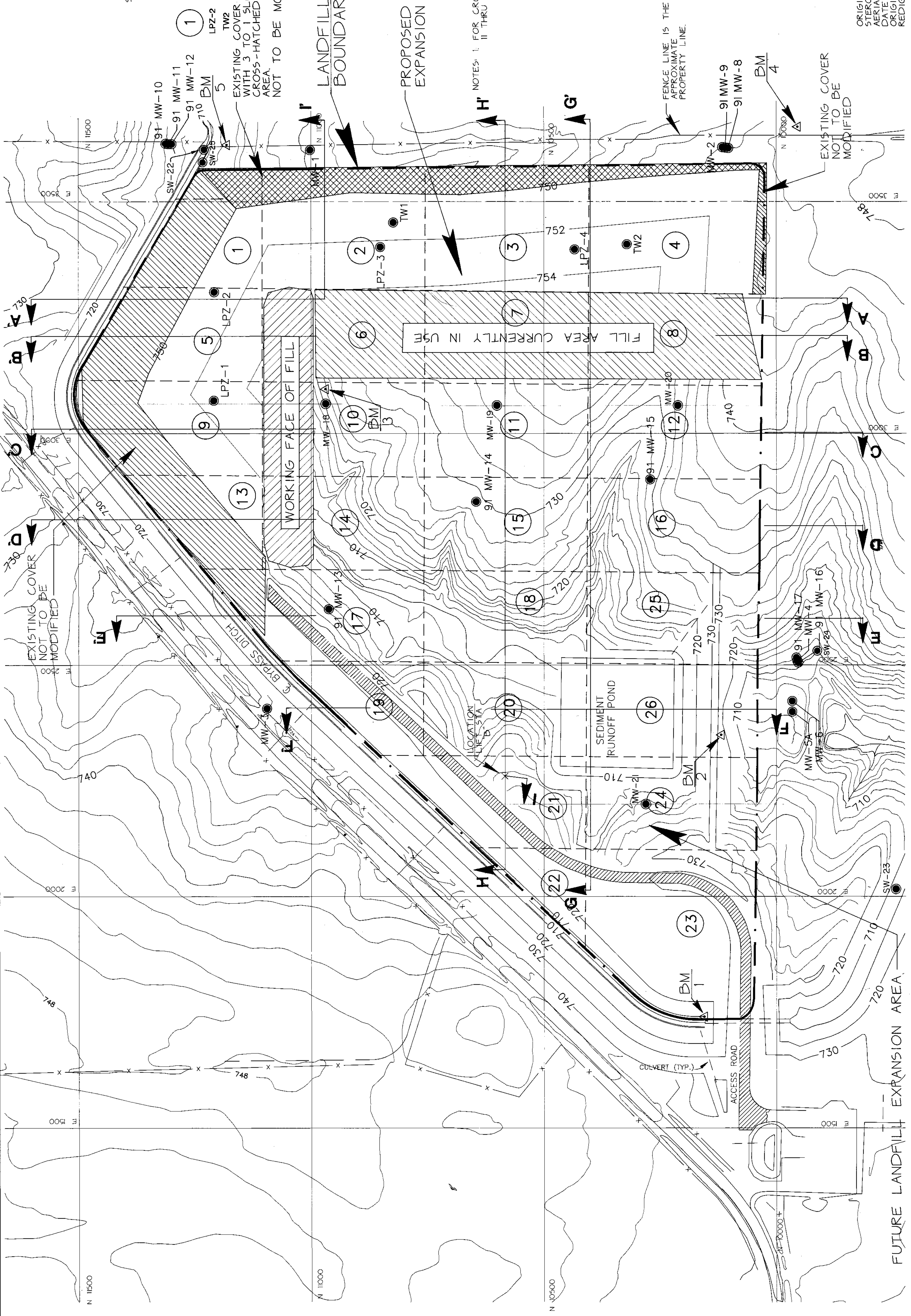
3



0 100'
SCALE: 1" = 100'

LEGEND

- 1 LANDFILL CELL NUMBERS AS PER PREVIOUS LANDFILL PLANS.
- LANDFILL PIEZOMETER
- TEST WELL
- EXISTING COVER WITH 3 TO 1 SLOPE IN THIS CROSS-HATCHED AREA. NOT TO BE MODIFIED
- LANDFILL BOUNDARY
- PROPOSED LANDFILL EXPANSION AREA



NOTES: 1 FOR CROSS SECTIONS, SEE SHEETS II THRU V.

ORIGINAL CONTOURS WERE COMPILED BY STEREO-PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY. DATE OF AERIAL PHOTOGRAPHY, 1980. ORIGINAL CONTOUR INTERVAL, 1 FOOT. REDIGITIZED AT 2 FEET.

SHEET NO. **4**

EXISTING TOPOGRAPHY

MUSCATINE POWER AND WATER CCR LANDFILL 1991

GREEN ENVIRONMENTAL SERVICES, INC.



NO.	DATE	BY	REVISION DESCRIPTION
5	11-19-96	EBG	REMOVED BENCHMARK DATA PER GRP

DRAWN: JEG/CAD/EX15T
APPROVED:
DATE: NOVEMBER 18, 1991
SURVEYED:
FIELD BOOK NO.
JOB NO. 705910



SCALE: 1" = 100'

LEGEND

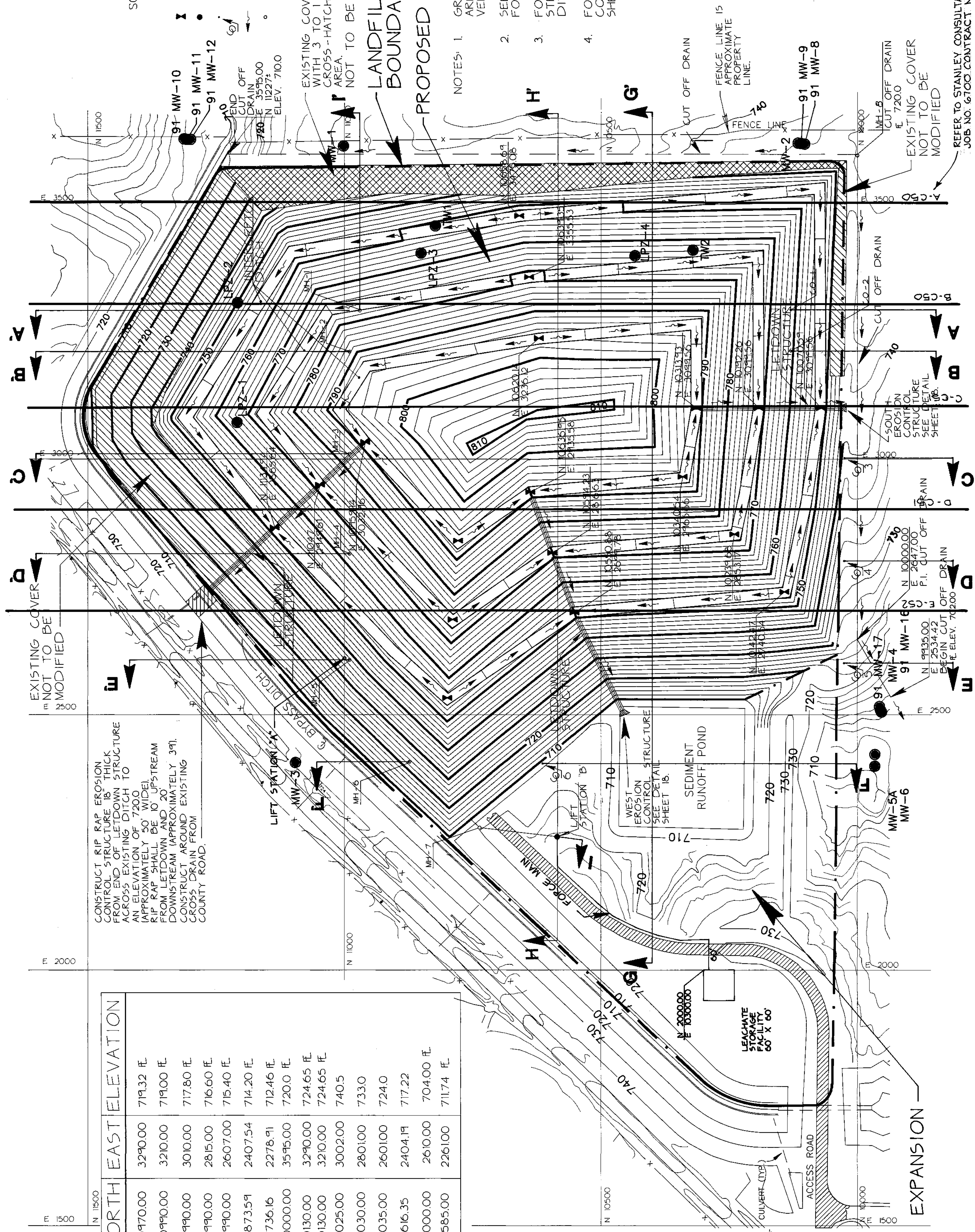
- DITCH VERTICAL POINT OF INTERSECTION
- LIFT STATION
- CLEAN-OUT FOR LEACHATE COLLECTION LINES
- DRAINAGE FLOW DIRECTION
- LEACHATE COLLECTION MANHOLE

EXISTING COVER WITH 3 TO 1 SLOPE IN THIS CROSS-HATCHED AREA. NOT TO BE MODIFIED.

LANDFILL BOUNDARY

PROPOSED LANDFILL EXPANSION

- NOTES:
1. GRADES IN INTERCEPTOR DITCHES ARE TYPICALLY 1-2% BETWEEN VERTICAL POINTS OF INTERSECTION.
 2. SEE SHEETS 11 THRU 15 FOR CROSS SECTIONS.
 3. FOR DETAILS OF LETDOWN STRUCTURES AND INTERCEPTOR DITCHES, SEE SHEET 17.
 4. FOR LINER, DRAINAGE, AND COVER DETAILS, SEE SHEETS 16 THRU 18.



LABEL	NORTH	EAST	ELEVATION
MH-1	10970.00	3290.00	719.32 EL
MH-2	10990.00	3210.00	719.00 EL
MH-3	10990.00	3010.00	717.80 EL
MH-4	10990.00	2815.00	716.60 EL
MH-5	10990.00	2607.00	715.40 EL
MH-6	10873.59	2407.54	714.20 EL
MH-7	10736.16	2278.91	712.46 EL
MH-8	10000.00	3595.00	720.0 EL
CO-1	10130.00	3290.00	724.65 EL
CO-2	10130.00	3210.00	724.65 EL
CO-3	10025.00	3002.00	740.5
CO-4	10030.00	2801.00	733.0
CO-4	10035.00	2601.00	724.0
CO-5	10616.35	2404.19	717.22
LIFT STA. A	11000.00	2610.00	704.00 EL
LIFT STA. B	10585.00	2261.00	711.74 EL

CONSTRUCT RIP RAP EROSION CONTROL STRUCTURE 18" THICK FROM END OF LETDOWN STRUCTURE ACROSS EXISTING DITCH TO AN ELEVATION OF 7200 (APPROXIMATELY 50' WIDE). RIP RAP SHALL BE 10' UPSTREAM FROM LETDOWN AND 20' DOWNSTREAM (APPROXIMATELY 39'). CONSTRUCT AROUND EXISTING CROSS DRAIN FROM COUNTY ROAD.

FUTURE LANDFILL EXPANSION

DRAWN: JEG/CAD/CASEI		SURVEYED: _____		FIELD BOOK NO. _____	
APPROVED: _____		NOVEMBER 15, 1991		JOB NO. 705-110	
DATE: _____		NOVEMBER 15, 1991		JOB NO. 705-110	
NO.		DATE		BY	
1		11/19/91		JEG	
2		11-11-91		EBG	
REVISION DESCRIPTION		EXTEND XSEC F. LIFT STA. A/D			
ADDED SECTIONS A - THRU D					

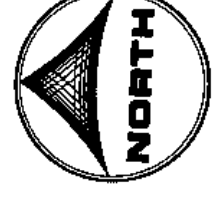
GREEN ENVIRONMENTAL SERVICES, INC.

MUSCATINE POWER AND WATER CCR LANDFILL 1991

PROPOSED FINAL CONTOURS

SHEET NO. **5**

DLF0001E D1-E(A)



SCALE: 1" = 100'

LEGEND

○ MANHOLE

● LIFT STATION

--- CLEAN-OUT FOR LEACHATE COLLECTION LINE.

--- AREA TO BE PROVIDED WITH 4 FOOT THICK COMPACTED SOIL LINER.

--- LEACHATE COLLECTION LINES

--- LEACHATE HEADER AND CLEANOUT LINES

--- FORCE MAIN

NOTE: 1. FOR CROSS SECTIONS IN LINER AREA, SEE SHEET NUMBERS 11 THRU 15.

2. FOR DETAILS, SEE SHEET NUMBERS 16 THRU 18.

3. LEACHATE COLLECTION LINE SHALL BE 6" φ PERFORATED PVC PIPE.

4. LEACHATE HEADER AND CLEANOUT LINES SHALL BE 6" φ SCHEDULE 80 SOLID PVC PIPE.

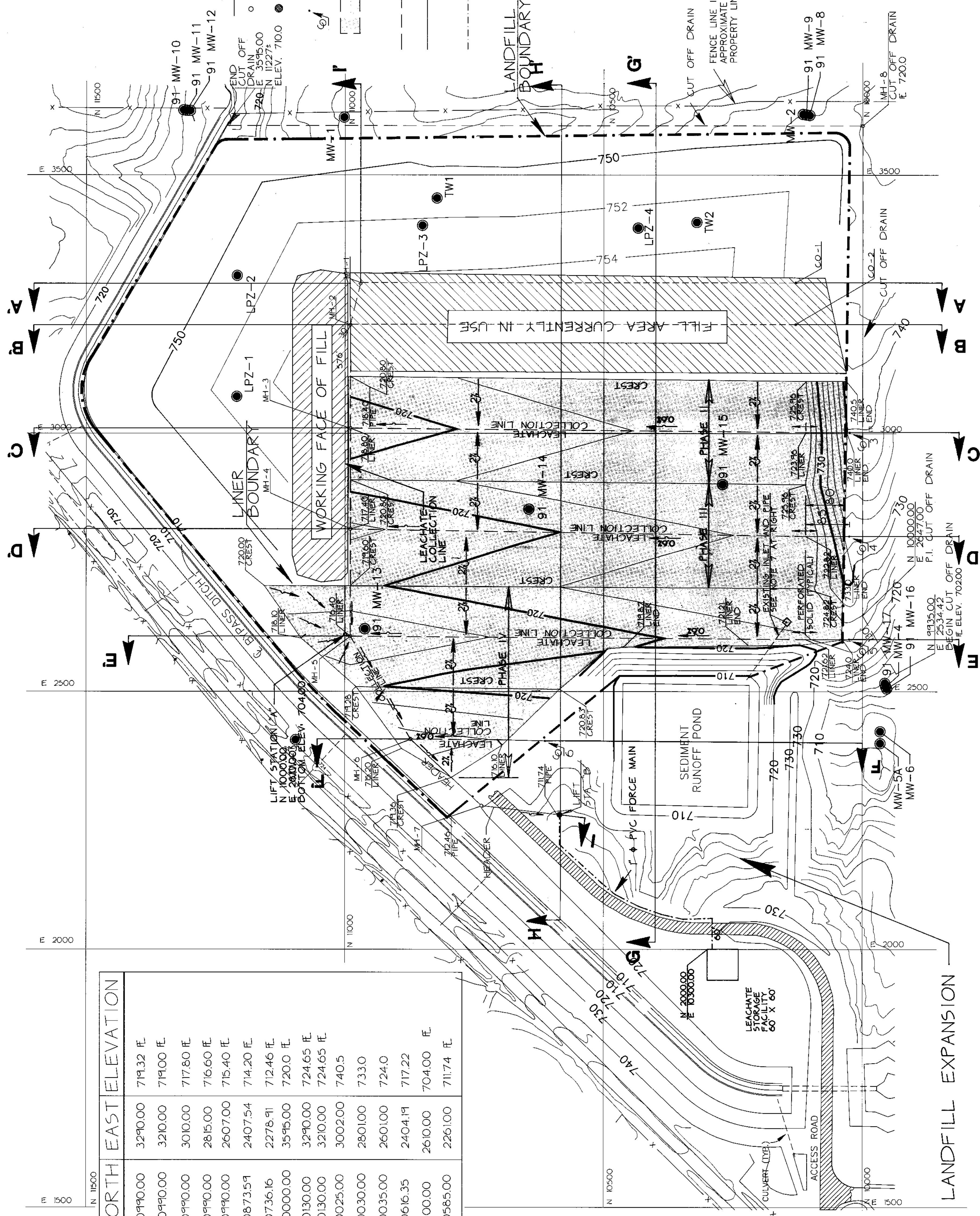
5. PIPE ELEVATIONS ARE 1' BELOW LINER ELEVATIONS UNLESS OTHERWISE NOTED.

6. ADJUST CLEANOUT ELEVATIONS TO FIT SITE CONDITIONS.

7. EXISTING INLET AND PIPE IN LINER AREA TO BE REMOVED PRIOR TO CONSTRUCTION OF LINER.

8. NOTE THAT AREA NORTH OF WORKING FACE OF FILL HAS NOT BEEN RAISED TO FINAL CONTOUR SHOWN ON THIS SHEET.

9. 91-MW-13, 14, + 15 SHALL BE PLUGGED AND ABANDONED WHEN LINER SYSTEM IS CONSTRUCTED.



LABEL	NORTH	EAST	ELEVATION
MH-1	10990.00	3290.00	719.32 E
MH-2	10990.00	3210.00	719.00 E
MH-3	10990.00	3010.00	717.80 E
MH-4	10990.00	2815.00	716.60 E
MH-5	10990.00	2607.00	715.40 E
MH-6	10873.59	2407.54	714.20 E
MH-7	10736.16	2278.91	712.46 E
MH-8	10000.00	3595.00	720.0 E
CO-1	10130.00	3290.00	724.65 E
CO-2	10130.00	3210.00	724.65 E
CO-3	10025.00	3002.00	740.5
CO-4	10030.00	2801.00	733.0
CO-5	10035.00	2601.00	724.0
CO-6	10616.35	2404.91	717.22
LIFT STA. A	10000.00	2610.00	704.00 E
LIFT STA. B	10585.00	2261.00	711.74 E

DRAWN: JEG/CAD/LINER

APPROVED: _____

DATE: NOVEMBER 16, 1991

SURVEYED: _____

FIELD BOOK NO. _____

JOB NO. 705910

NO.	DATE	BY	REVISION DESCRIPTION
1	11/19/91	JEG	NUMBER NOTES, XSEC 1-1, LIFT STA LABELS
2	11/20/91	JEG	REVISE LINER BOUNDARY

MUSCATINE POWER AND WATER

CCR LANDFILL

1991

PROPOSED LINER AND DRAINAGE

SHEET NO. **6**

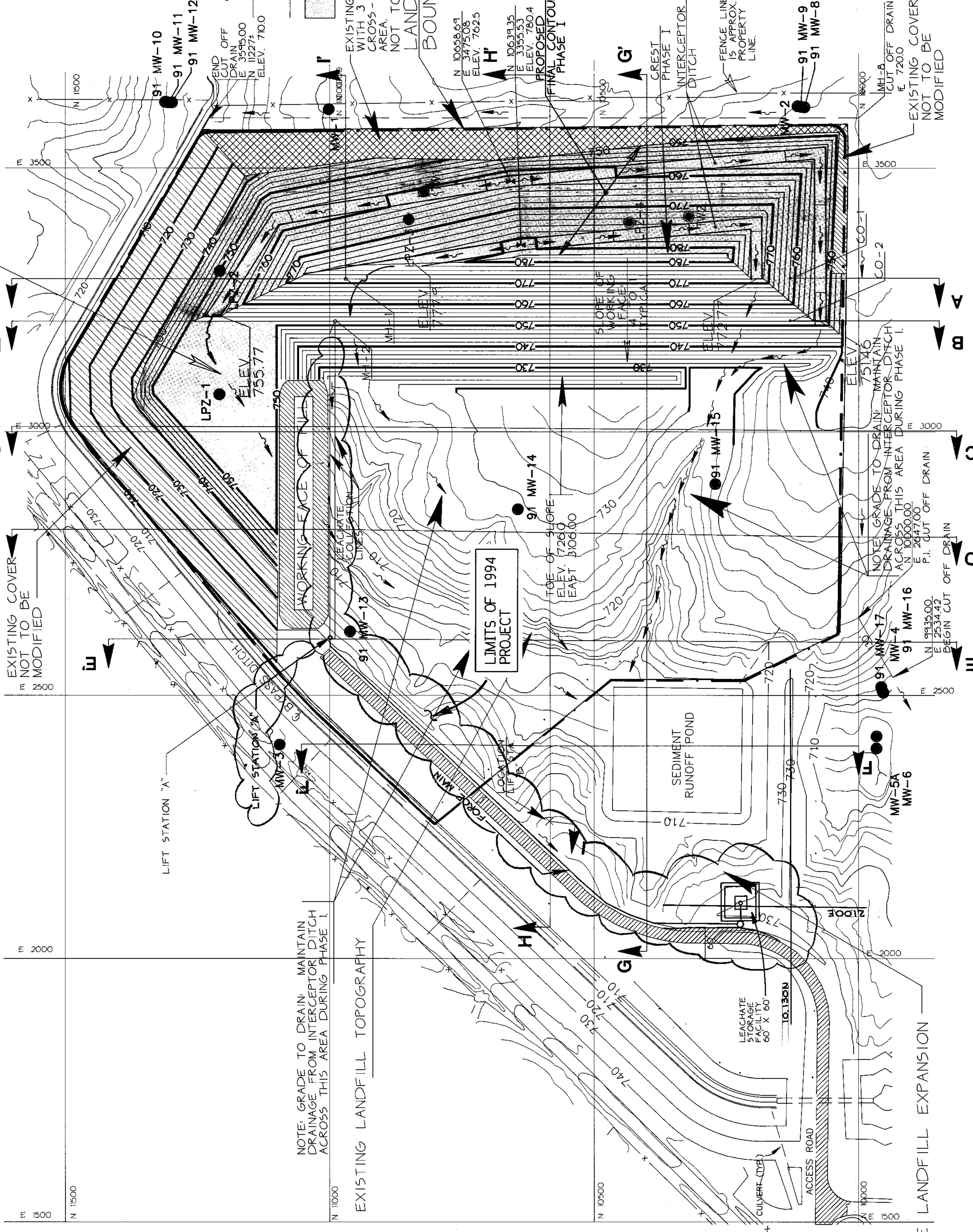
FUTURE LANDFILL EXPANSION

NOTE: GRADE TO DRAIN DRAINAGE FROM INTERCEPTOR DITCH ACROSS THIS AREA DURING PHASE I.

EXISTING COVER NOT TO BE MODIFIED

NOTE: GRADE TO DRAIN DRAINAGE FROM INTERCEPTOR DITCH ACROSS THIS AREA DURING PHASE I.

EXISTING LANDFILL TOPOGRAPHY



SCALE: 1" = 100'

LEGEND

- MANHOLE
- LIFT STATION
- CLEAN-OUT FOR LEACHATE COLLECTION LINE.
- LEACHATE COLLECTION LINE
- HEADER OR FORCE MAIN AREA IN USE DURING PHASE I.
- ▭ EXISTING COVER WITH 3 TO 1 SLOPE IN THIS CROSS-HATCHED AREA NOT TO BE MODIFIED
- ▭ LANDFILL BOUNDARY

EXISTING COVER WITH 3 TO 1 SLOPE IN THIS CROSS-HATCHED AREA NOT TO BE MODIFIED

LANDFILL BOUNDARY

LEACHATE COLLECTION LINE SHALL BE 6" φ SCHEDULE 80 PERFORATED PVC PIPE.

TEMPORARY FORCE MAIN SHALL BE 1" φ SCHEDULE 40 SOLID PVC PIPE.

LEACHATE HEADER LINES SHALL BE 6" φ SCHEDULE 80 SOLID PVC PIPE.

GRADES IN INTERCEPTOR DITCHES ARE TYPICALLY 1-2% BETWEEN VERTICAL POINTS OF INTERSECTION.

LANDFILL PIEZOMETERS, MANHOLES, AND CLEANOUTS SHALL BE EXTENDED VERTICALLY AS NEEDED.

FOR CROSS SECTIONS, SEE SHEETS 11 THRU 15.

FOR LEACHATE COLLECTION DEVELOPMENT PLANS, SEE SHEET 10.

NOTE:

1. LEACHATE COLLECTION LINE SHALL BE 6" φ SCHEDULE 80 PERFORATED PVC PIPE.
2. TEMPORARY FORCE MAIN SHALL BE 1" φ SCHEDULE 40 SOLID PVC PIPE.
3. LEACHATE HEADER LINES SHALL BE 6" φ SCHEDULE 80 SOLID PVC PIPE.
4. GRADES IN INTERCEPTOR DITCHES ARE TYPICALLY 1-2% BETWEEN VERTICAL POINTS OF INTERSECTION.
5. LANDFILL PIEZOMETERS, MANHOLES, AND CLEANOUTS SHALL BE EXTENDED VERTICALLY AS NEEDED.
6. FOR CROSS SECTIONS, SEE SHEETS 11 THRU 15.
7. FOR LEACHATE COLLECTION DEVELOPMENT PLANS, SEE SHEET 10.

FINAL CONTOURS PHASE I

CRIST PHASE I INTERCEPTOR DITCH

FENCE LINE IS APPROX. PROPERTY LINE.

EXISTING COVER NOT TO BE MODIFIED

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

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LEACHATE STORAGE FACILITY 60' X 60'

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ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

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ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD

CULVERT (TYB)

LEACHATE STORAGE FACILITY 60' X 60'

SEDIMENT RUNOFF POND

ACCESS ROAD



SCALE: 1" = 100'

LEGEND

- DITCH VERTICAL POINT OF INTERSECTION
- LIFT STATION
- MANHOLE
- CLEAN-OUT FOR LEACHATE COLLECTION LINES
- DRAINAGE FLOW DIRECTION
- LEACHATE COLLECTION LINE
- LEACHATE HEADER, CLEANOUT LINE, OR FORCE MAIN
- AREA IN USE DURING PHASE II

NOTE: GRADE TO DRAIN: MAINTAIN DRAINAGE FROM INTERCEPTOR DITCH ACROSS THIS AREA DURING PHASE II.

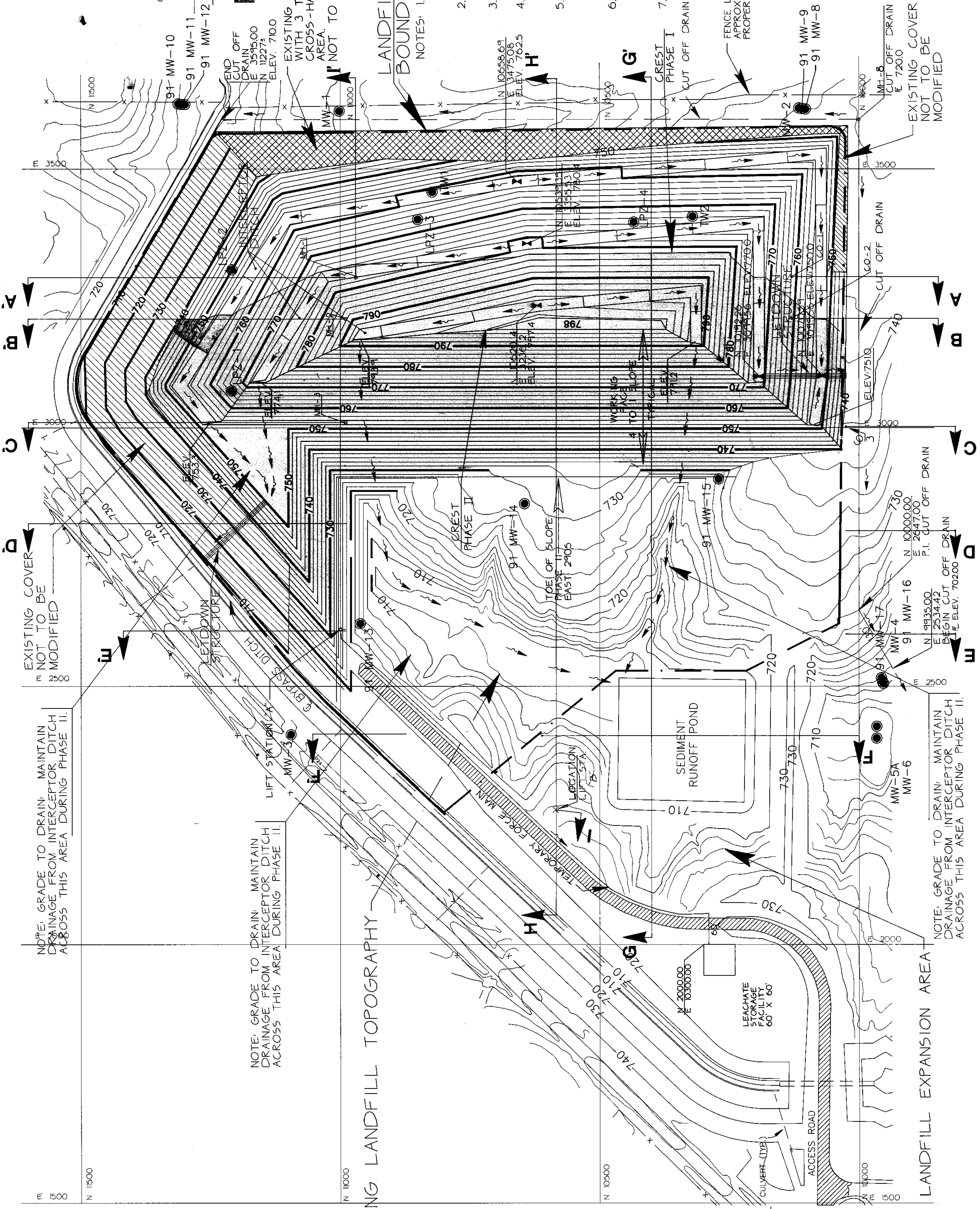
NOTE: GRADE TO DRAIN: MAINTAIN DRAINAGE FROM INTERCEPTOR DITCH ACROSS THIS AREA DURING PHASE II.

NOTE: GRADE TO DRAIN: MAINTAIN DRAINAGE FROM INTERCEPTOR DITCH ACROSS THIS AREA DURING PHASE II.

EXISTING LANDFILL TOPOGRAPHY

LANDFILL BOUNDARY

- NOTES:
- GRADES IN INTERCEPTOR DITCHES ARE TYPICALLY 1-2% BETWEEN VERTICAL POINTS OF INTERSECTION. SEE SHEETS 11 THRU 15 FOR CROSS SECTIONS.
 - FOR DETAILS SEE SHEETS 16 THRU 18.
 - LEACHATE COLLECTION LINE SHALL BE 6" ϕ SCHEDULE 80 PERFORATED PVC PIPE.
 - LEACHATE HEADER AND CLEANOUT LINES SHALL BE 6" ϕ SCHEDULE 80 SOLID PVC PIPE.
 - TEMPORARY FORCE MAIN FROM LIFT STATION "B" TO LEACHATE STORAGE FACILITY SHALL BE 1" ϕ SCHEDULE 40 PVC PIPE.
 - LANDFILL PIEZOMETERS, MANHOLES AND CLEANOUTS SHALL BE VERTICALLY EXTENDED AS NEEDED.



FUTURE LANDFILL EXPANSION AREA

NOTE: GRADE TO DRAIN: MAINTAIN DRAINAGE FROM INTERCEPTOR DITCH ACROSS THIS AREA DURING PHASE II.

DRAWN: JEG/CAD/CIP-2
 APPROVED: _____
 DATE: NOVEMBER 15, 1991

NO.	DATE	BY	REVISION DESCRIPTION

GREEN ENVIRONMENTAL SERVICES, INC.

MUSCATINE POWER AND WATER CCR LANDFILL 1991

PROPOSED PHASE II CONTOURS

SHEET NO. 8



SCALE: 1" = 100'

LEGEND

- ⊠ DITCH VERTICAL POINT OF INTERSECTION
- MANHOLE
- LIFT STATION
- CLEAN-OUT FOR LEACHATE COLLECTION LINE
- ▨ AREA IN USE DURING PHASE III
- DRAINAGE FLOW DIRECTION
- ▧ LEACHATE COLLECTION LINE
- LEACHATE HEADER, CLEANOUT LINE, OR FORCE MAIN

EXISTING COVER WITH 3 TO 1 SLOPE IN THIS CROSS-HATCHED AREA. NOT TO BE MODIFIED

LANDFILL BOUNDARY

NOTE: 1. FOR DETAILS, SEE SHEET NUMBERS 16 THRU 18.

2. LEACHATE COLLECTION LINE SHALL BE 6" φ PERFORATED PVC PIPE.

3. LEACHATE HEADER AND CLEANOUT LINES SHALL BE 6" φ SCHEDULE 80 SOLID PVC PIPE.

4. ADJUST CLEANOUT ELEVATIONS TO FIT SITE CONDITIONS.

5. 91-MW-13, 14 + 15 SHALL BE PLUGGED AND ABANDONED WHEN LINER SYSTEM IS CONSTRUCTED.

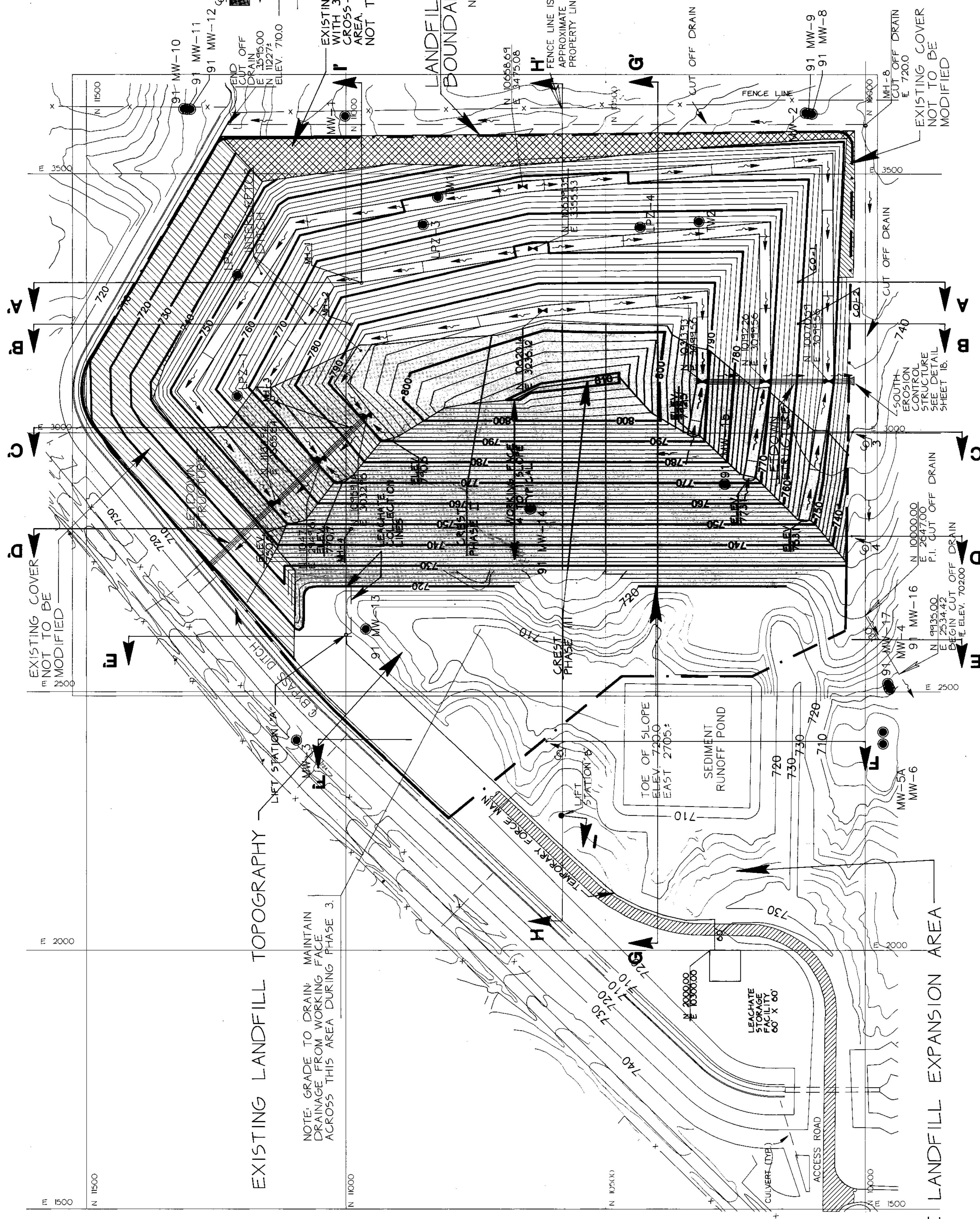
6. GRADES IN INTERCEPTOR DITCHES ARE TYPICALLY 1-2% BETWEEN VERTICAL POINTS OF INTERSECTION.

7. SEE SHEETS 11 THRU 15 FOR CROSS SECTIONS.

8. FOR DETAILS OF LETDOWN STRUCTURES, SEE SHEET 7.

9. FORCE MAIN FROM LIFT STATION TO LEACHATE STORAGE FACILITY SHALL BE 1" φ SCHEDULE 80 PVC PIPE.

10. LANDFILL PIEZOMETERS, MANHOLES, AND CLEANOUTS SHALL BE EXTENDED VERTICALLY AS NEEDED.



EXISTING COVER NOT TO BE MODIFIED

NOTE: GRADE TO DRAIN; MAINTAIN DRAINAGE FROM WORKING FACE ACROSS THIS AREA DURING PHASE 3.

FUTURE LANDFILL EXPANSION AREA

DRAWN: JEG/CAD/CFH3 APPROVED: _____ DATE: NOVEMBER 8, 1991	REVISION DESCRIPTION NO. DATE BY JEG XSEC. F. LIFT STA. LABELS. NUMBER NOTES. DR. ARROWS 1 11/20/91	MUSCATINE POWER AND WATER CCR LANDFILL 1991	SHEET NO. 9
GREEN ENVIRONMENTAL SERVICES, INC.		PROPOSED PHASE III CONTOURS	
NO. DATE BY JEG XSEC. F. LIFT STA. LABELS. NUMBER NOTES. DR. ARROWS 1 11/20/91		SHEET NO. 9	

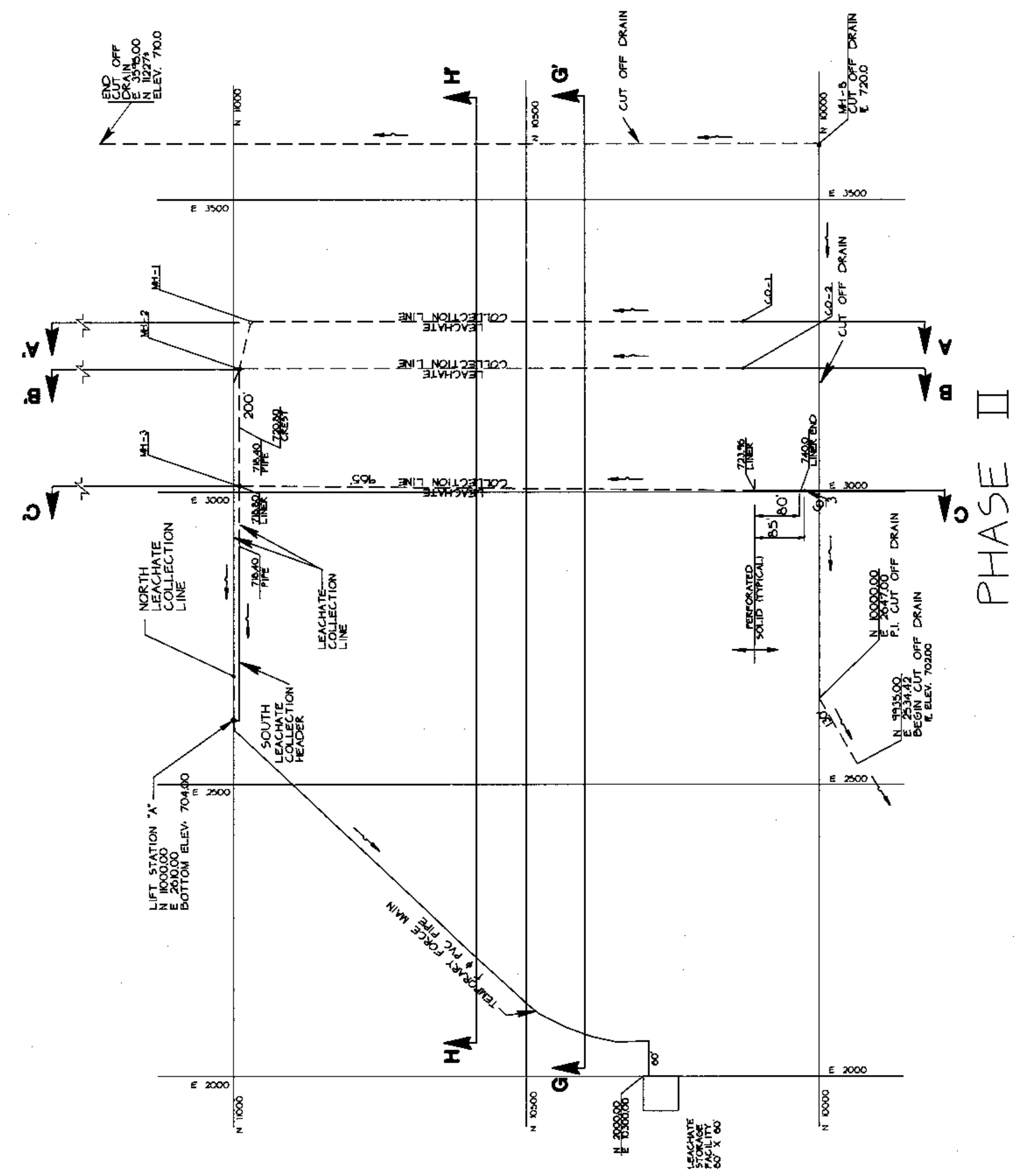
LEGEND

- MANHOLE
- LIFT STATION
- CLEAN-OUT FOR LEACHATE COLLECTION LINE.
- - - PERFORATED PIPE
- SOLID PIPE

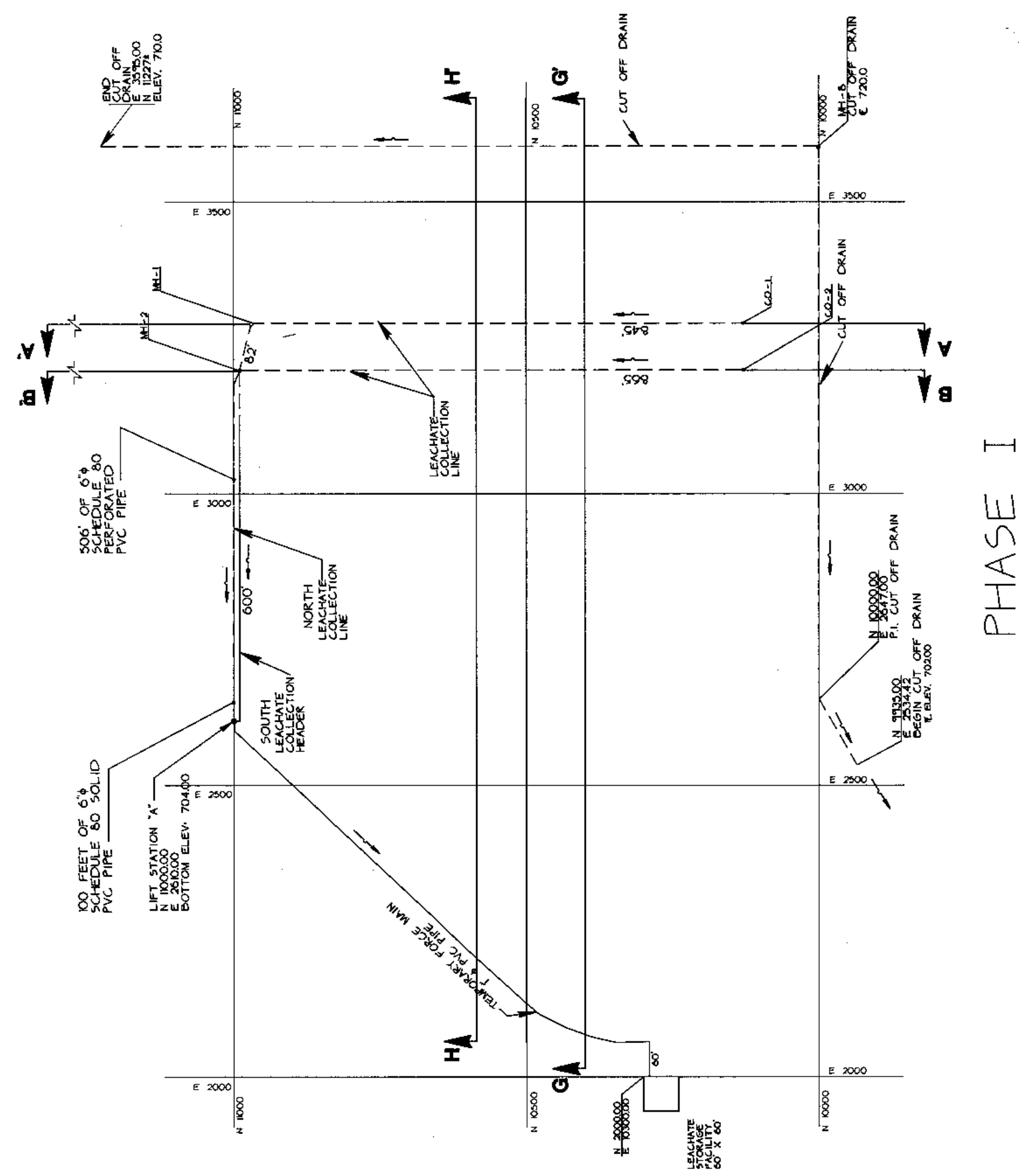
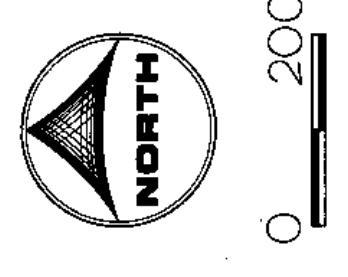
LABEL	NORTH	EAST	ELEVATION
MH-1	10970.00	3290.00	719.32 E.
MH-2	10990.00	3210.00	71900 E.
MH-3	10990.00	3010.00	717.80 E.
MH-4	10990.00	2815.00	716.60 E.
MH-5	10990.00	2607.00	715.40 E.
MH-6	10873.59	2407.54	714.20 E.
MH-7	10736.16	2278.91	712.45 E.
MH-8	10000.00	3595.00	7200 E.
CO-1	10130.00	3290.00	724.65 E.
CO-2	10130.00	3210.00	724.65 E.
CO-3	10025.00	3002.00	740.5 (GROUND)
CO-4	10030.00	2801.00	733.0 (GROUND)
CO-5	10035.00	2601.00	724.0 (GROUND)
CO-6	10616.35	2404.19	717.22 (GROUND)
LIFT STA. A	11000.00	2610.00	704.00 E.
LIFT STA. B	10585.00	2261.00	711.74 E.

NOTES

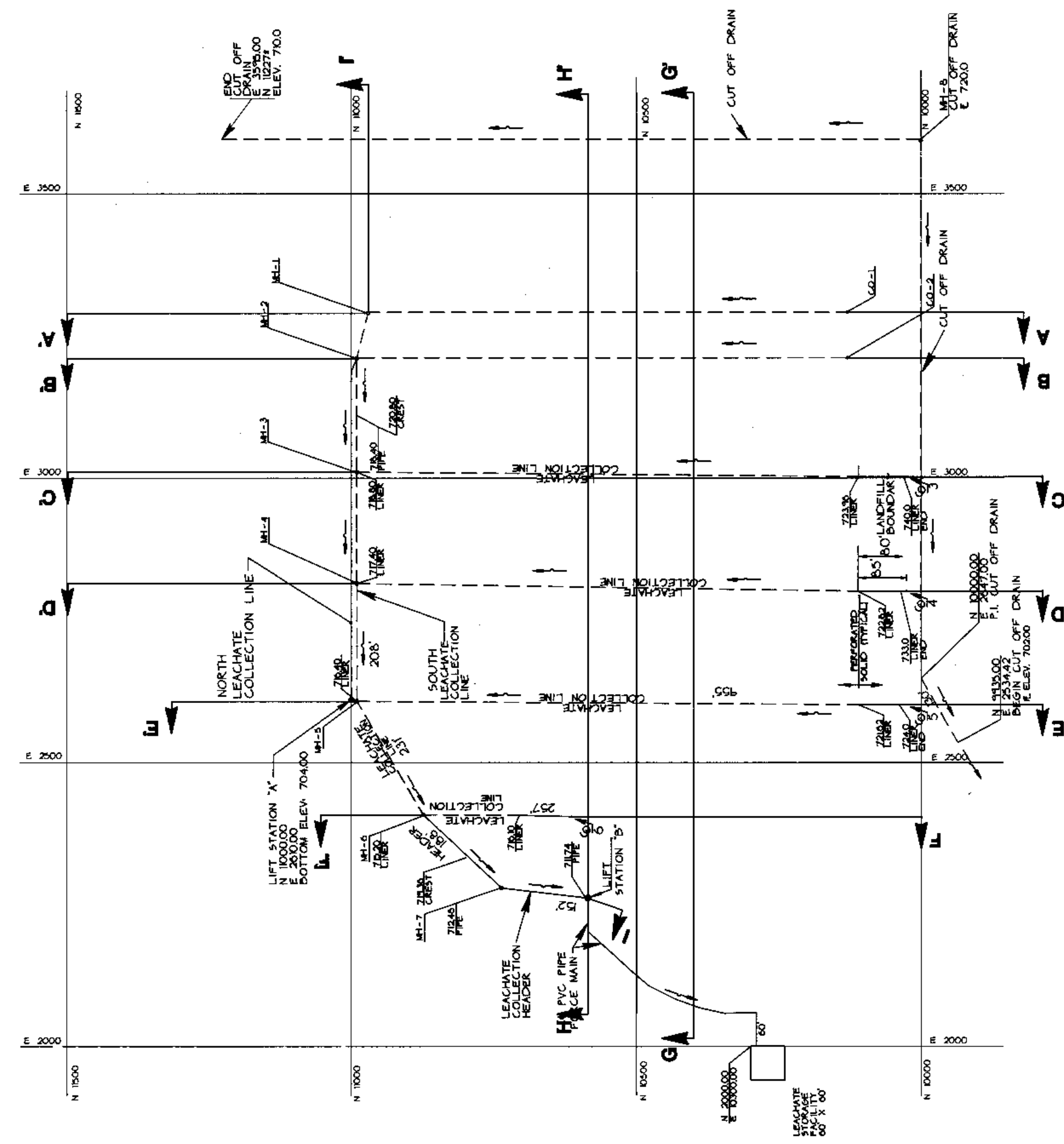
1. FOR CROSS SECTIONS IN LINER AREA, SEE SHEET NUMBERS 11 THRU 15.
2. FOR DETAILS, SEE SHEET NUMBERS 16 THRU 18.
3. LEACHATE COLLECTION LINE SHALL BE 6" PERFORATED PVC PIPE.
4. LEACHATE HEADER AND CLEANOUT LINES SHALL BE 6" SCHEDULE 80 SOLID PVC PIPE.
5. PIPE ELEVATIONS ARE 1' BELOW LINER ELEVATIONS UNLESS OTHERWISE NOTED.
6. NORTH LEACHATE COLLECTION LINE IS PARALLEL TO SOUTH LEACHATE COLLECTION LINE AND SEPARATED HORIZONTALLY BY 10 FEET OR AS REQUIRED BY SITE CONDITIONS.
7. ADJUST CLEANOUT ELEVATIONS TO FIT SITE CONDITIONS.
8. 91-MW-13.14, + 15 SHALL BE PLUGGED AND ABANDONED WHEN LINER SYSTEM IS CONSTRUCTED.
9. TEMPORARY FORCE MAIN FROM LIFT STATION "A" TO LEACHATE STORAGE FACILITY SHALL BE 1" SCHEDULE 40 PVC PIPE.
10. FOR PLAN OF LINER, SEE SHEET NUMBER 6.
11. AT PHASE IV, MH-5, MH-6 AND MH-7 SHALL BE CONSTRUCTED AND THE CONNECTION FROM THE SOUTH LEACHATE COLLECTION LINE TO LIFT STATION "A" SHALL BE ELIMINATED. AT THE TIME LIFT STATION "B" BECOMES OPERATIONAL, A 1" FORCE MAIN FROM LIFT STATION "A" TO MH-5 SHALL BE INSTALLED. THE 1" FORCE MAIN FROM LIFT STATION "A" TO THE NORTH OF LIFT STATION "B" SHALL THEN BE ABANDONED.



PHASE I
PHASE II



PHASE III



PHASE IV

DRAWN: JES/CAD/PIPE SURVEYED: _____

APPROVED: _____ FIELD BOOK NO. _____

DATE: NOVEMBER 17, 1991 JOB NO. 705-910

REVISION DESCRIPTION

NO.	DATE	BY	PIPE LENGTHS	FLOW ARROWS	NOTES
1	11/21/91	JES			

MUSCATINE POWER AND WATER CCR LANDFILL 1991

GREEN ENVIRONMENTAL SERVICES, INC.

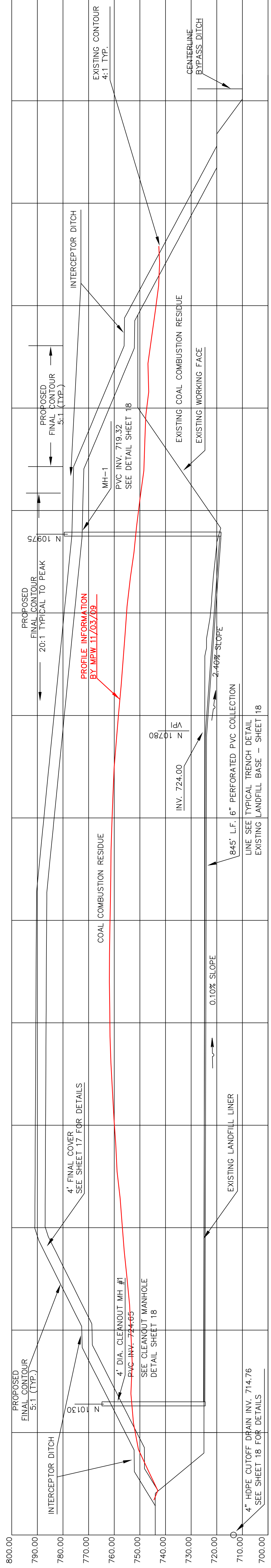
LEACHATE COLLECTION DEVELOPMENT PLAN

SHEET NO. **10**

DLF0001K D1-J

A' NORTH

SOUTH

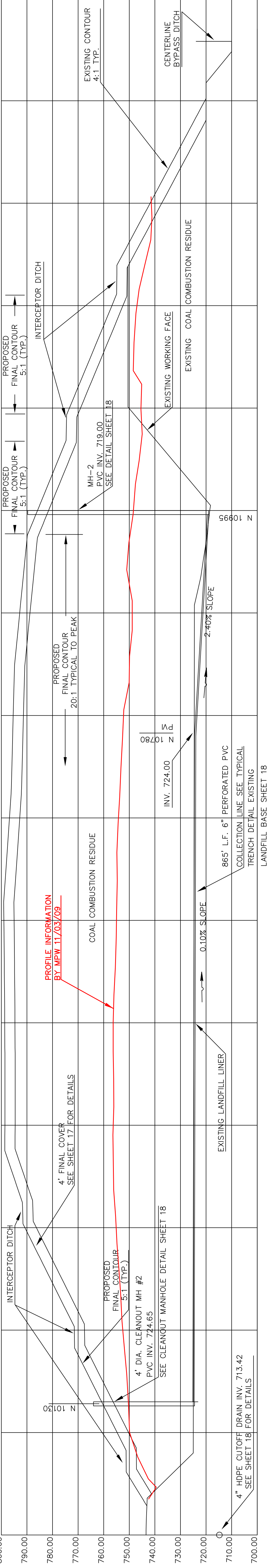


N 11500
E 3293.5
N 11400
N 11200
N 11000
N 10800
N 10600
N 10400
N 10200
N 10000
E 3282

SCALE: 1" = 50' HORIZONTAL
1" = 20' VERTICAL

B' NORTH

SOUTH



N 11500
E 3214
N 11400
N 11200
N 11000
N 10800
N 10600
N 10400
N 10200
N 10000
E 3202

SCALE: 1" = 50' HORIZONTAL
1" = 20' VERTICAL

DRAWING CREATED FROM GREEN ENVIRONMENTAL SERVICES DRAWING #: 705910 SHEET 11 OF 19

REV.	DESCRIPTION	DATE	BY	CHECKED	DATE	DATE	DATE	DATE	DATE
1	PLACED ON MW BORDER AND ADDED SECTION INFORMATION IN RED	12/15/09	GP	12/15/09	GP	12/15/09	GP	12/15/09	GP

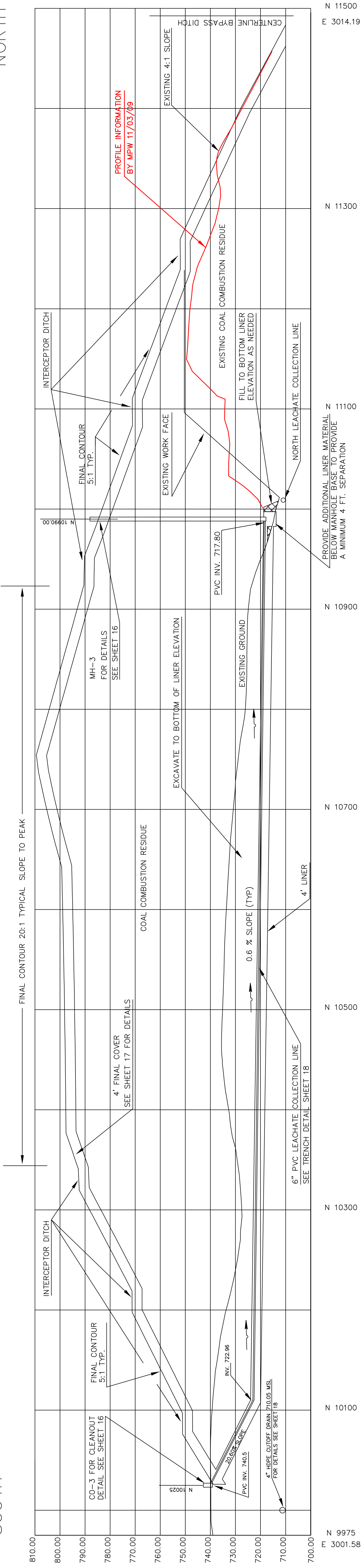
DESIGNED BY:	DAMON SHANNON	DATE:	11/19/09
CHECKED BY:	GERALD R. PETERSON	DATE:	12/15/09
DATE:	12/15/09	DATE:	12/15/09

PROJECT NO.:	705910	SCALE AS NOTED	FILE NO.:	34
DRAWING NO.:	DLF0001L	REV. NO.:	1	

CCR LANDFILL
CROSS SECTIONS
A - A' AND B - B'



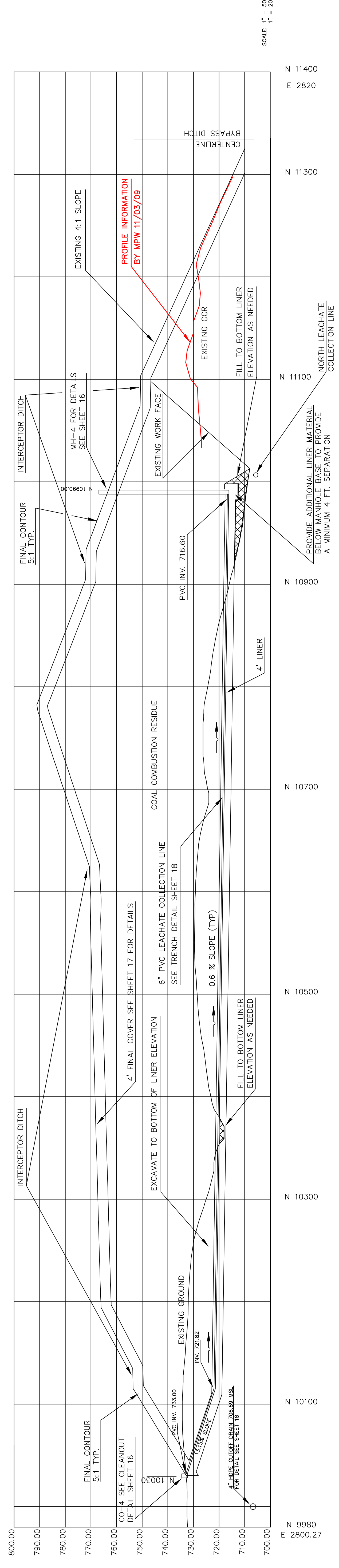
C SOUTH NORTH



N 9975
E 3001.58
N 10100
N 10300
N 10500
N 10700
N 10900
N 11100
N 11300
E 3014.19
N 11500

SCALE: 1" = 50' HORIZONTAL
1" = 20' VERTICAL

D SOUTH NORTH



N 9880
E 2800.27
N 10100
N 10300
N 10500
N 10700
N 10900
N 11100
N 11300
E 2820
N 11400

SCALE: 1" = 50' HORIZONTAL
1" = 20' VERTICAL

DRAWING CREATED FROM GREEN ENVIRONMENTAL SERVICES DRAWING #: 705910 SHEET 12 OF 19

REV.	DESCRIPTION	DATE	BY	APP'D	DATE	BY	APP'D
1	PLACED ON MW BORDER AND ADDED SECTION INFORMATION (H. RED)	12/15/09	GRP	DDG	12/15/09	GRP	DDG

DESIGNED BY:	DAMON SHANNON	DATE:	11/19/09
CHECKED BY:	GERALD R. PETERSON	DATE:	12/15/09
DATE:	12/15/09	DATE:	12/15/09

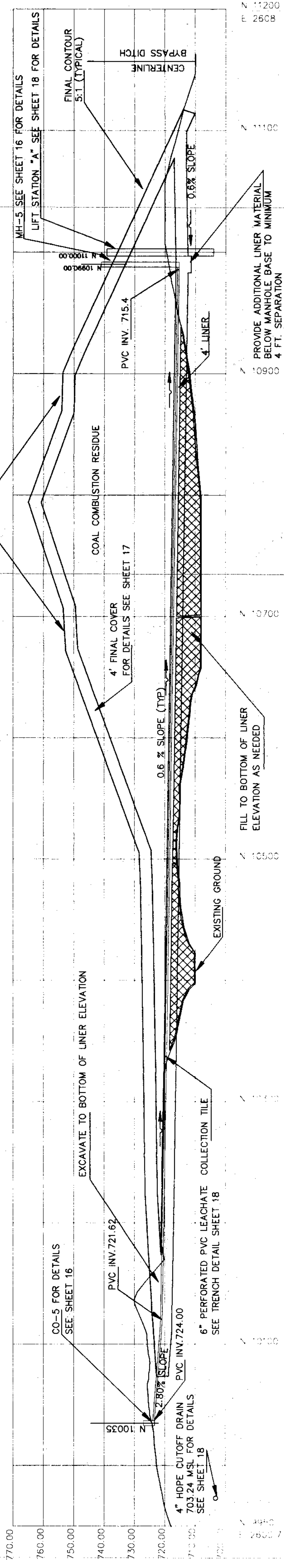
PROJECT:	CCR LANDFILL
DRAWING NO.:	DLF0001M
SCALE:	AS NOTED
FILE NO.:	34
REV. NO.:	1

CROSS SECTIONS
C - C' AND D - D'

CCR LANDFILL

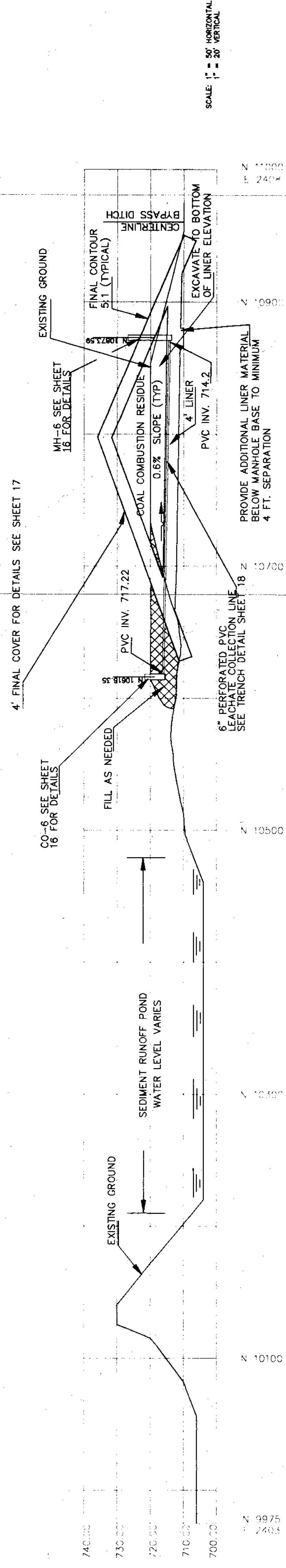
E SOUTH

E' NORTH



F SOUTH

F' NORTH



DRAWN: KOK/CAD/XSEC SURVEYED: _____
 APPROVED: _____ FIELD BOOK NO. _____
 DATE: NOVEMBER 6, 1991 JOB NO. 709500

NO. _____ DATE _____ BY _____
 REVISION DESCRIPTION

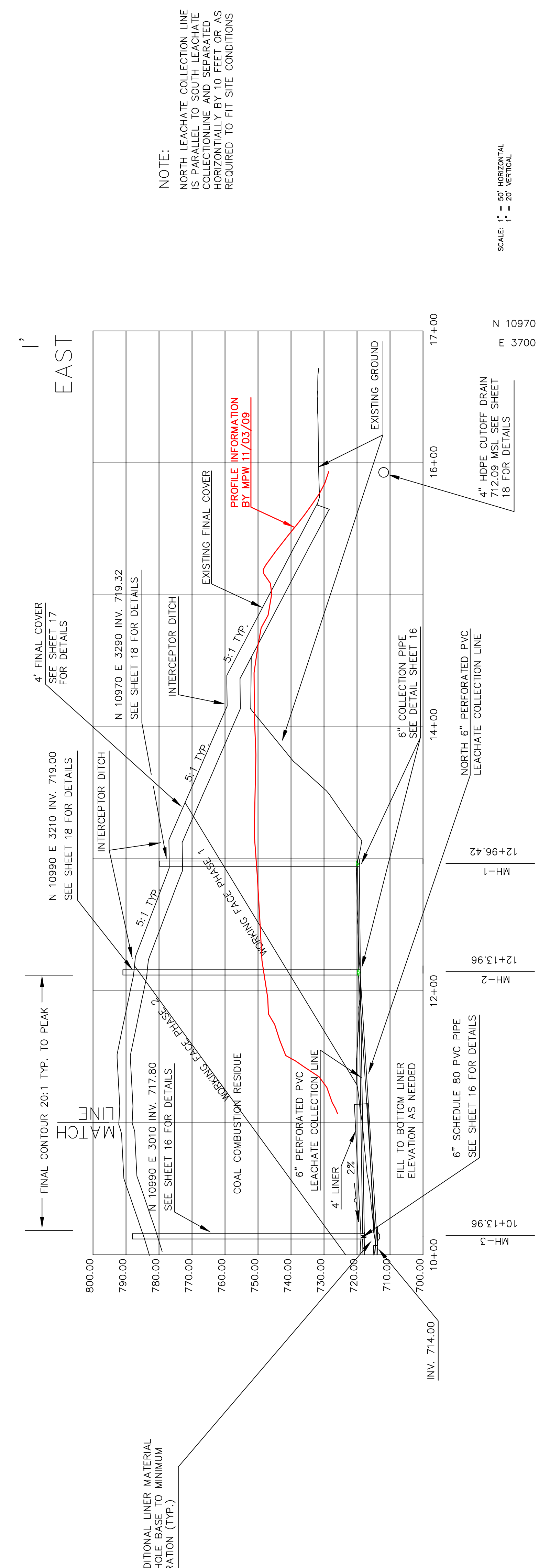
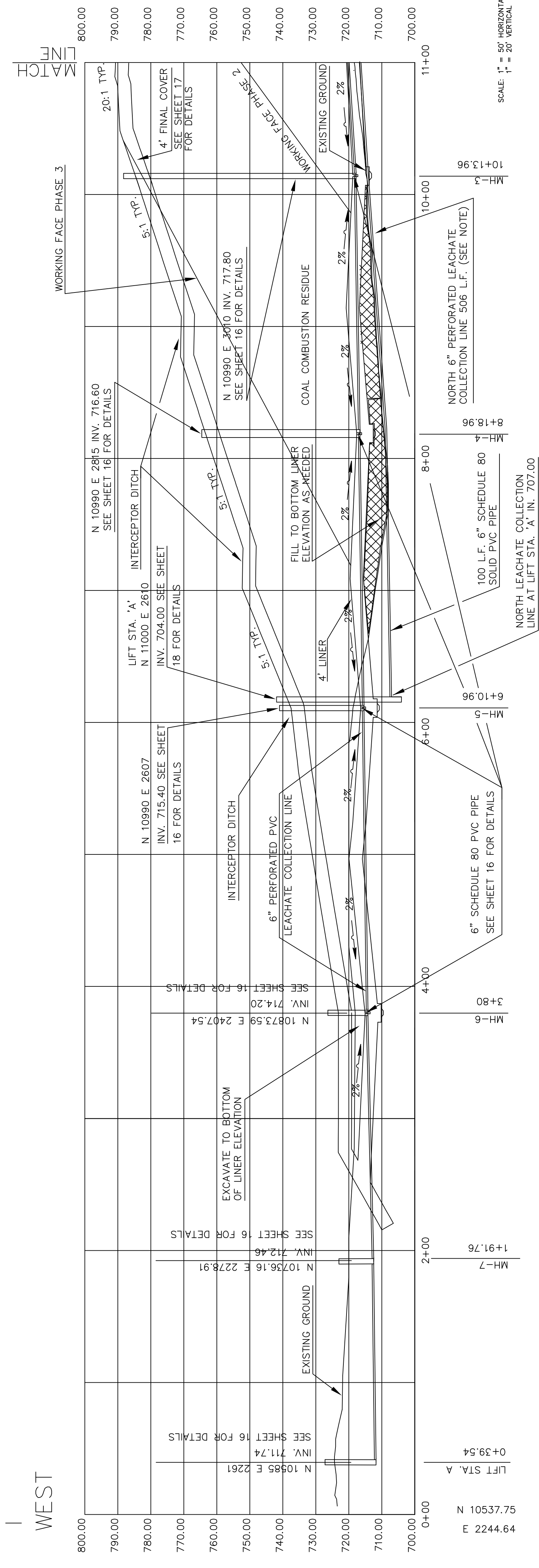
GREEN ENVIRONMENTAL SERVICES, INC.

**MUSCATINE POWER AND WATER
CCR LANDFILL
1991**

**CROSS SECTIONS
E - E' F - F'**

SHEET NO. **13**

DLF0001N D1-M



NOTE:
NORTH LEACHATE COLLECTION LINE IS PARALLEL TO SOUTH LEACHATE COLLECTION LINE AND SEPARATED CORRESPONDINGLY BY 10 FEET. REVISIONS REQUIRED TO FIT SITE CONDITIONS

SCALE: 1" = 50' HORIZONTAL
1" = 20' VERTICAL

WEST

EAST

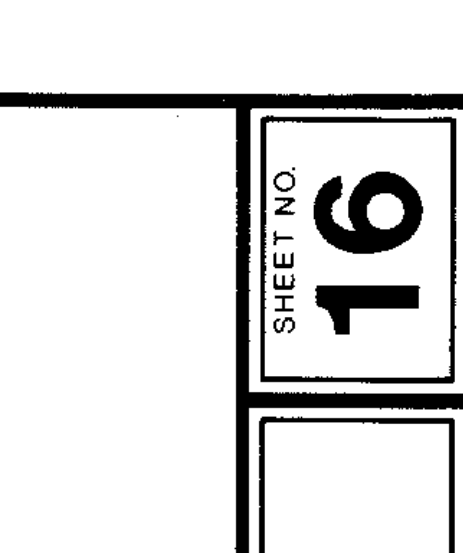
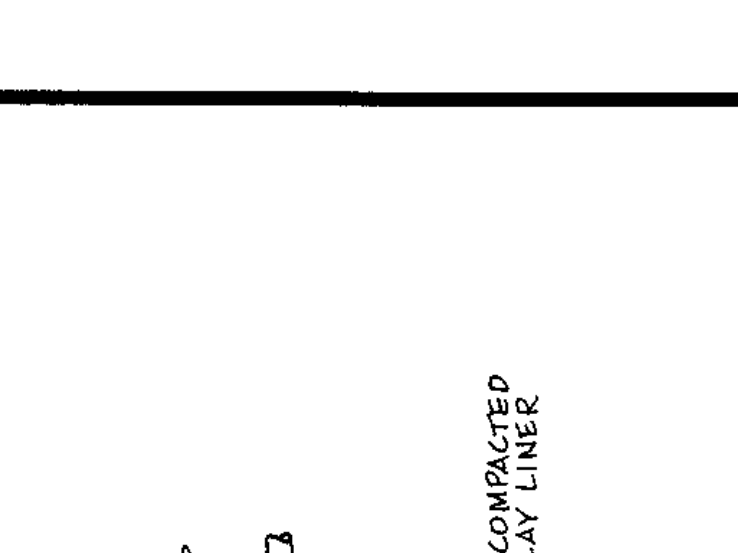
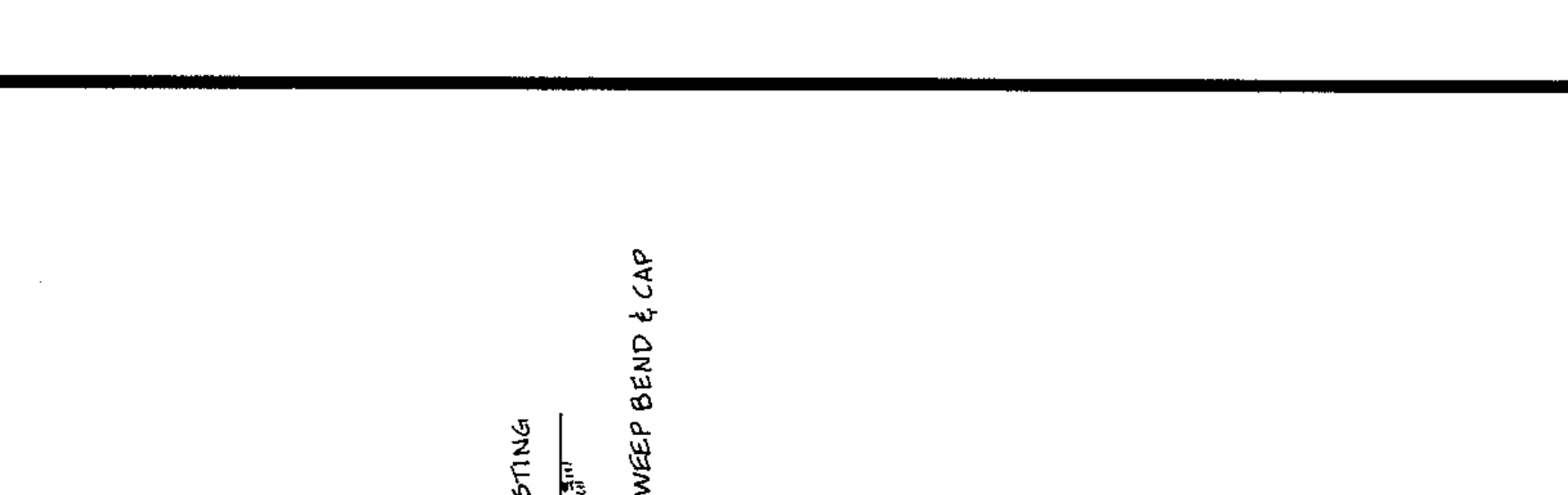
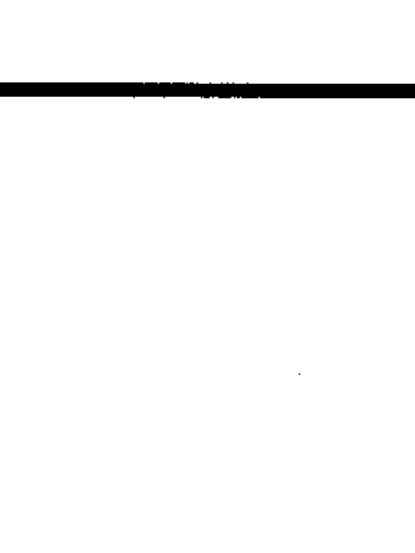
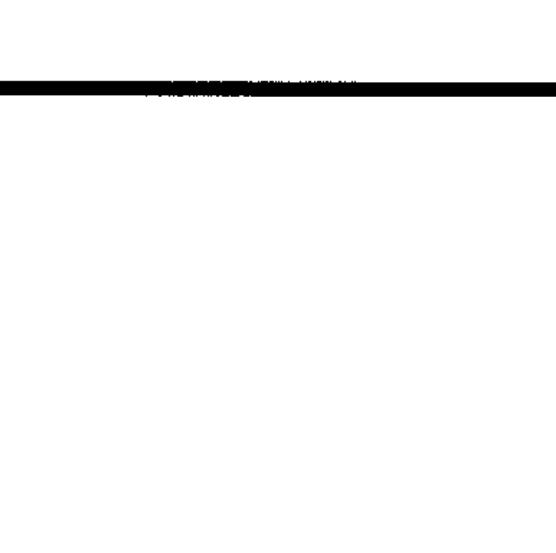
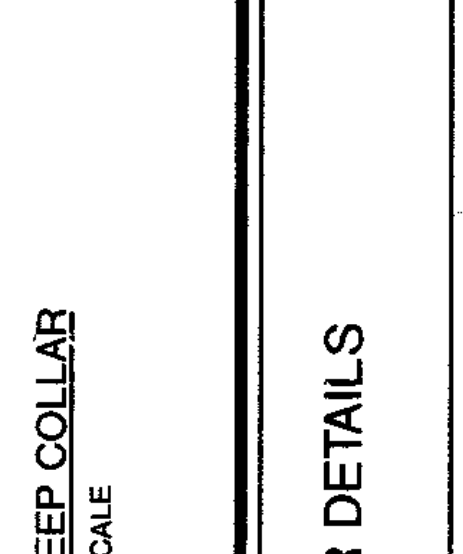
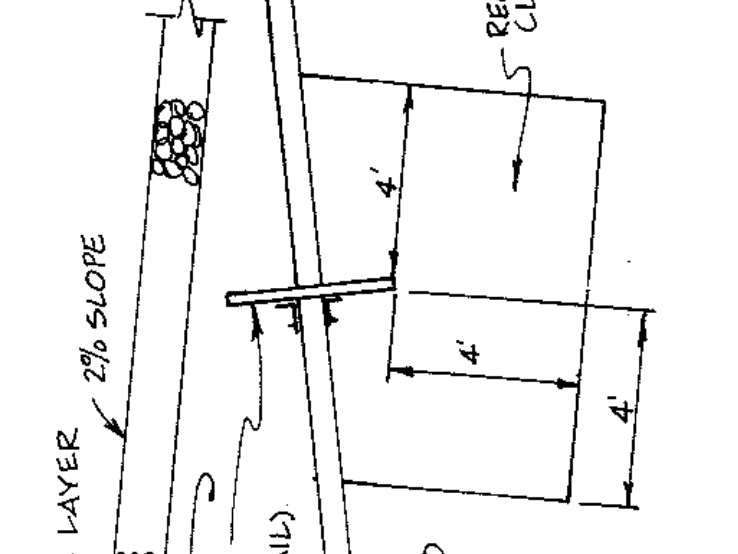
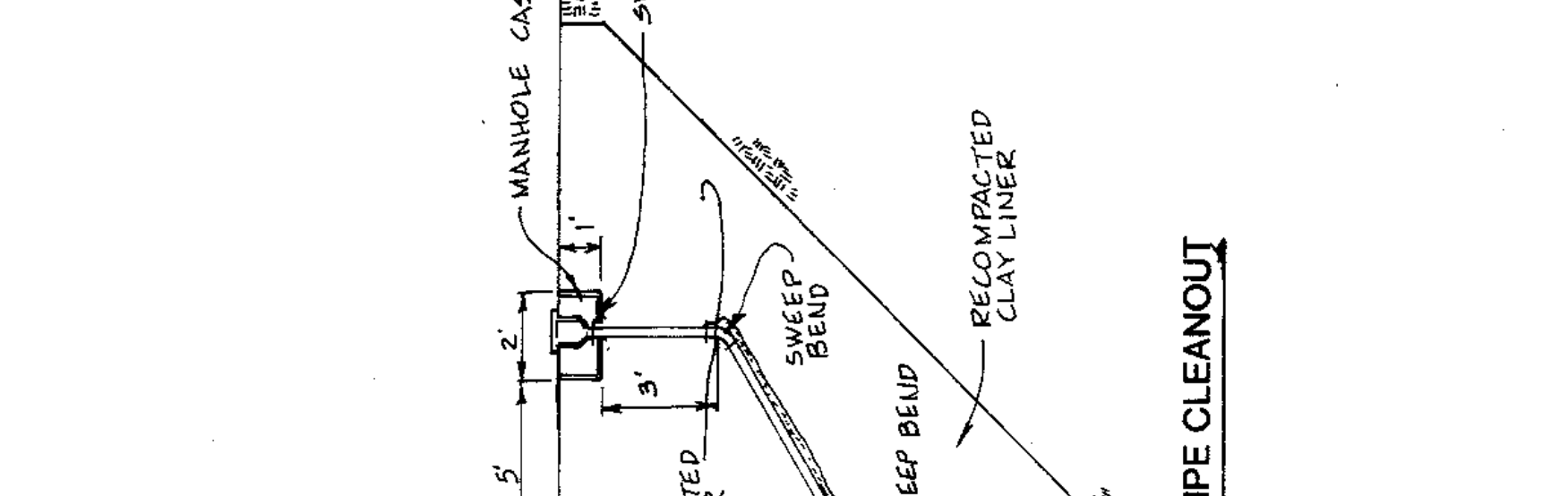
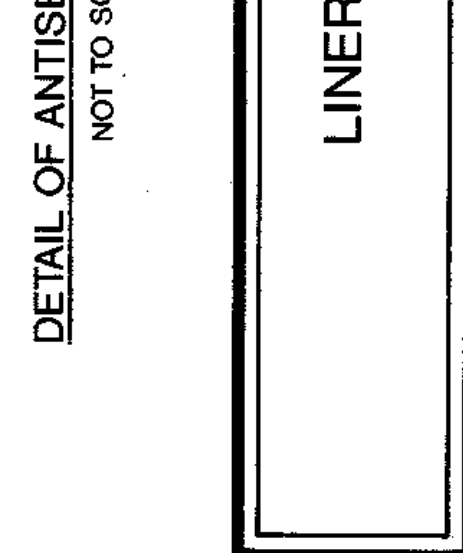
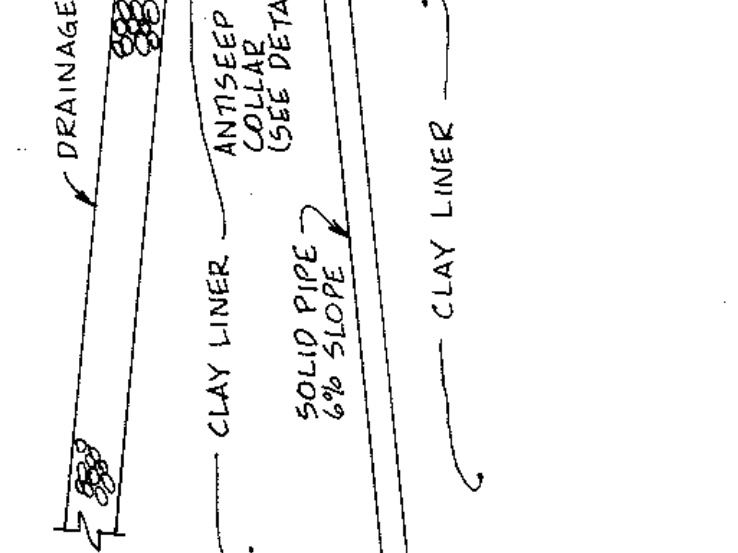
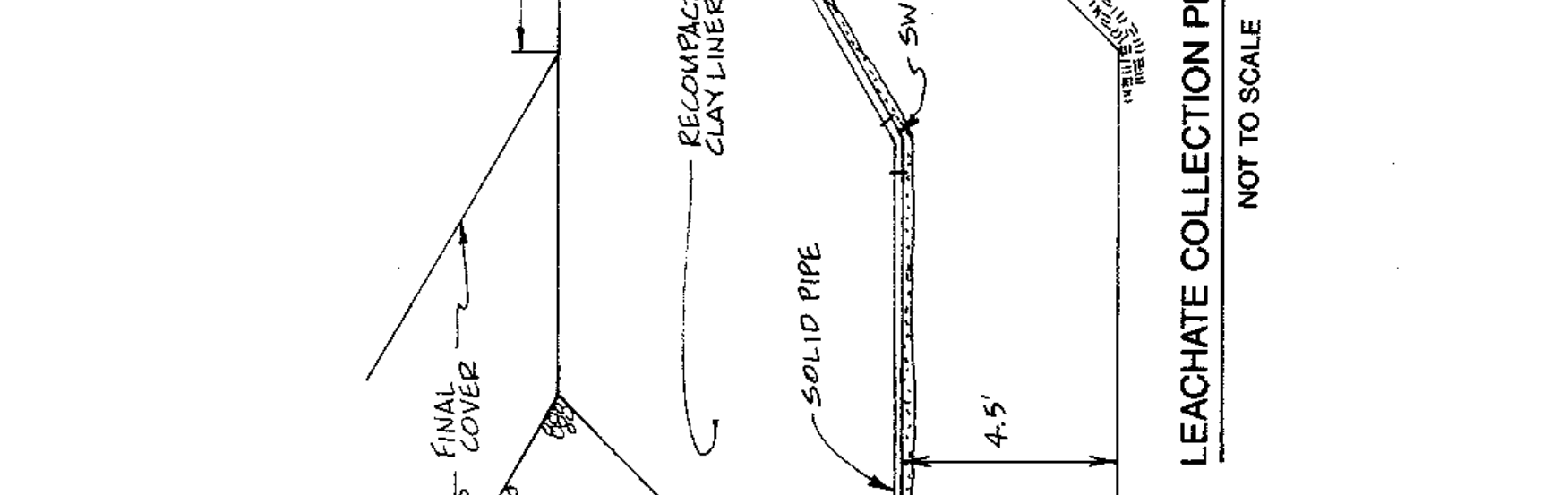
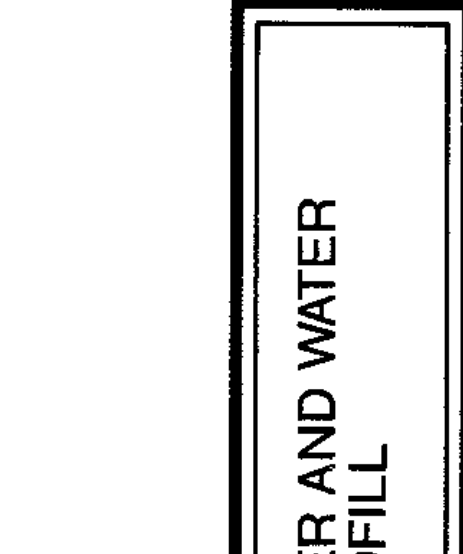
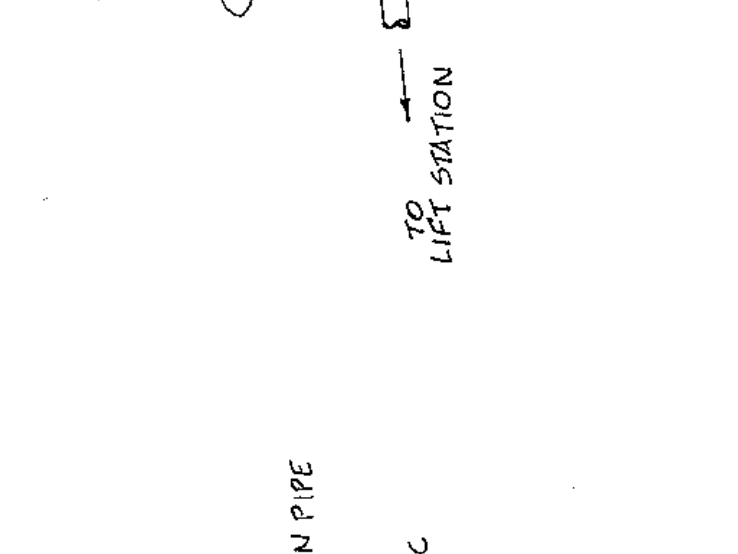
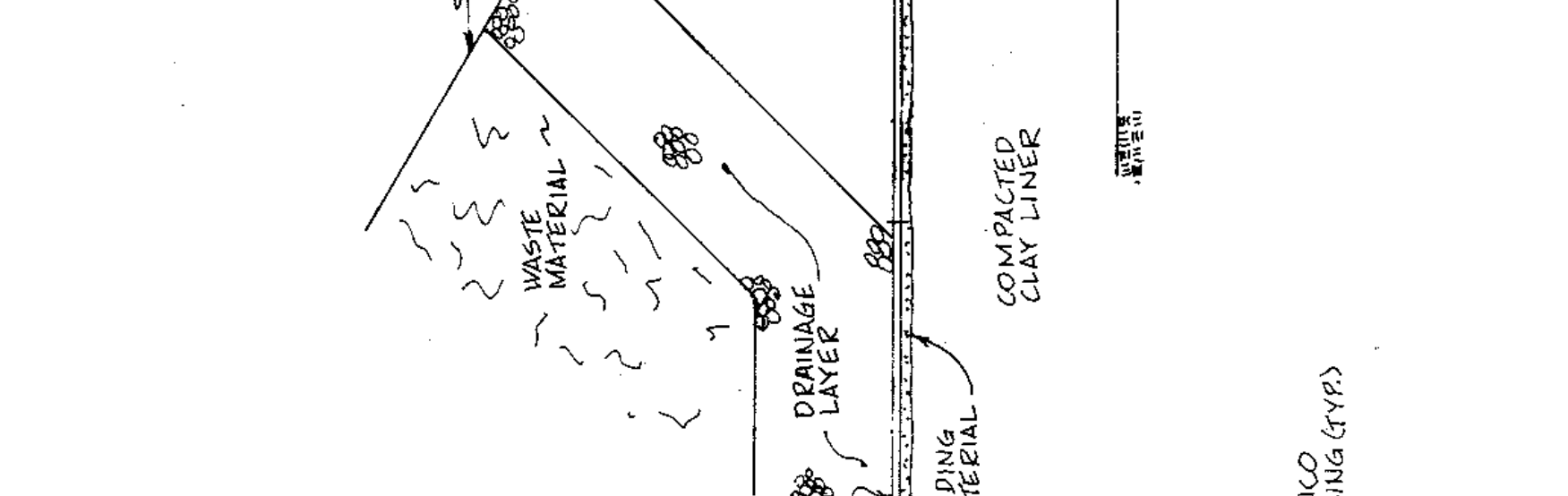
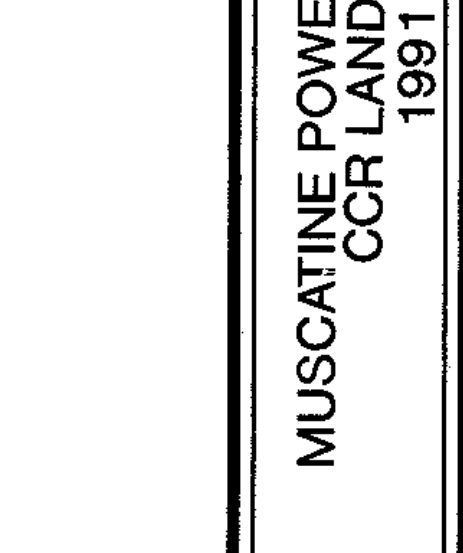
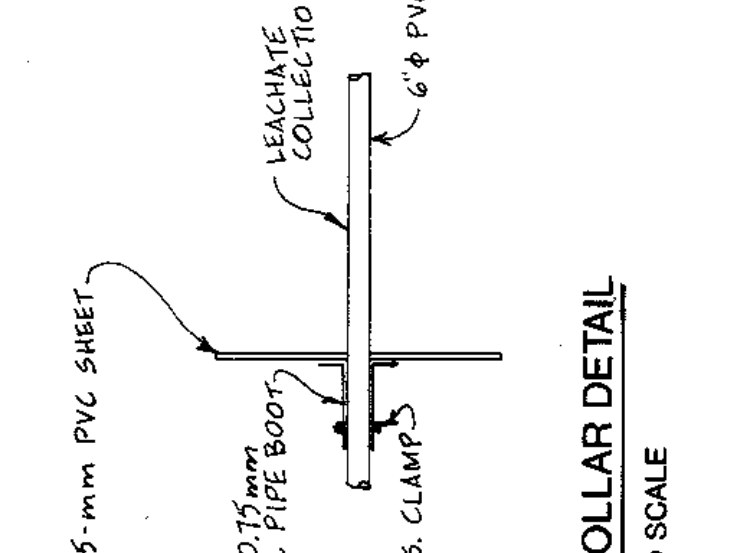
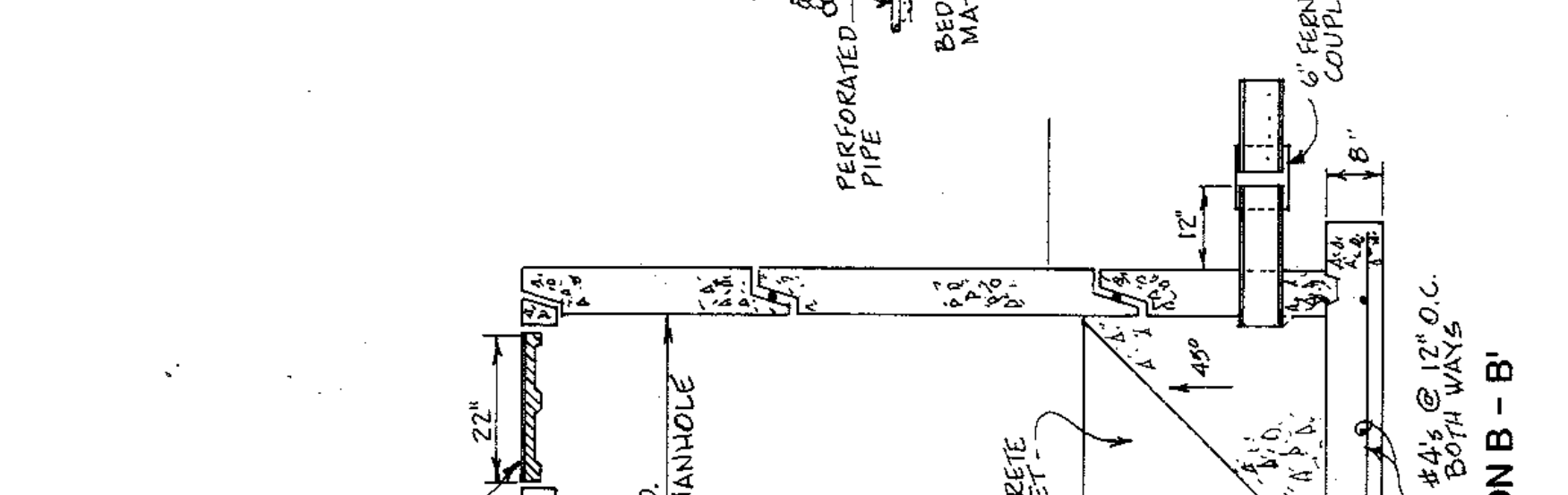
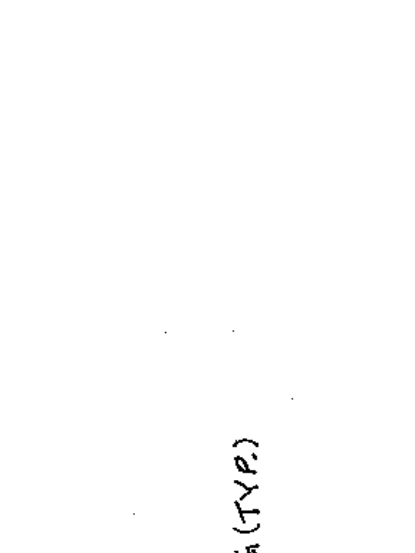
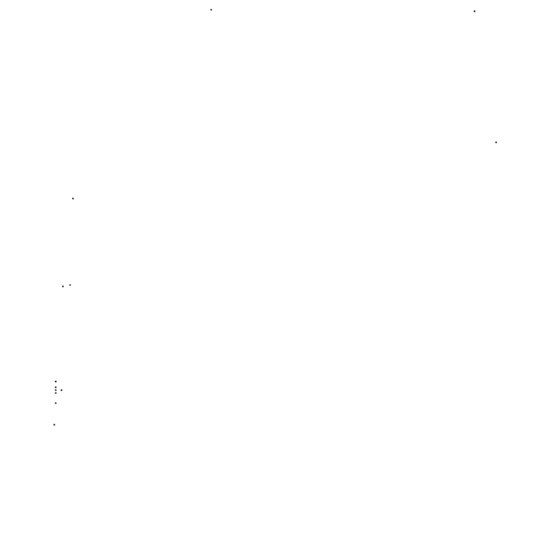
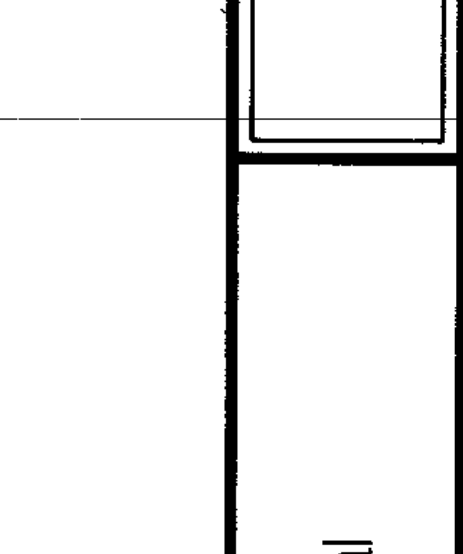
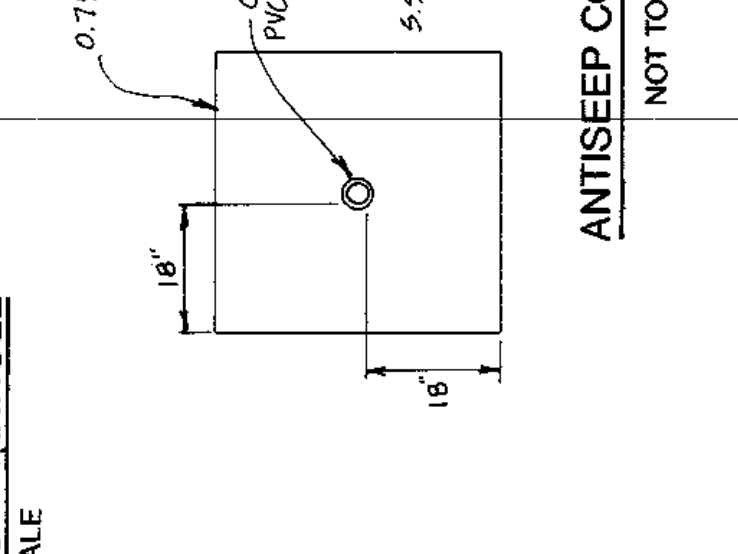
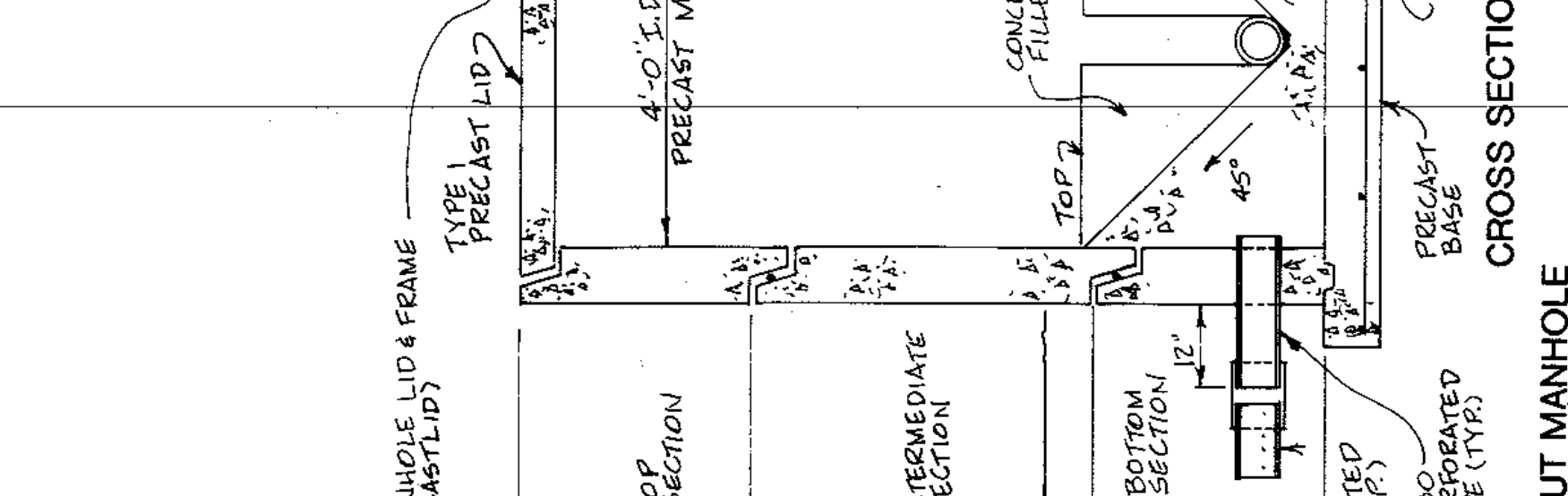
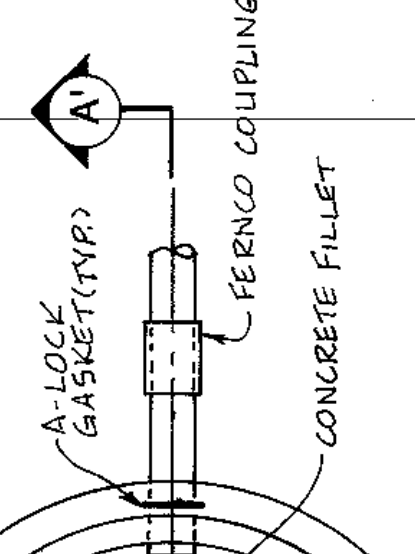
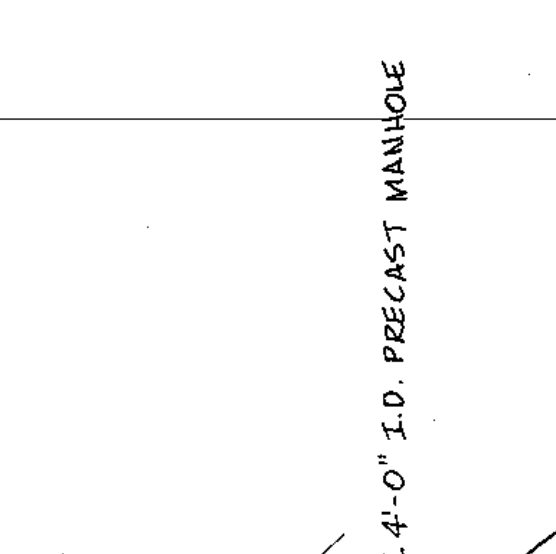
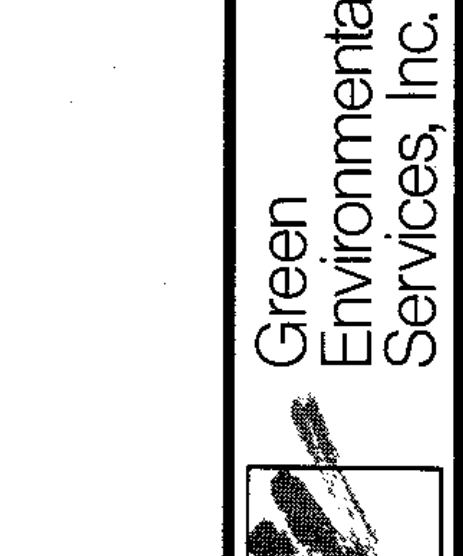
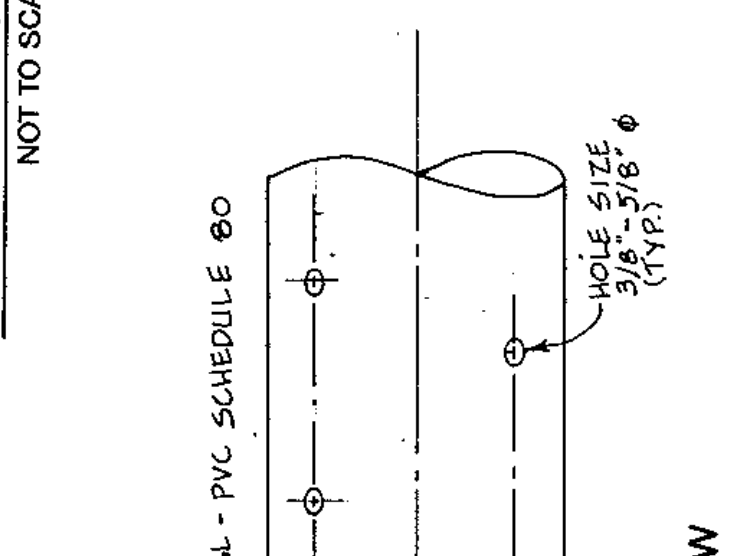
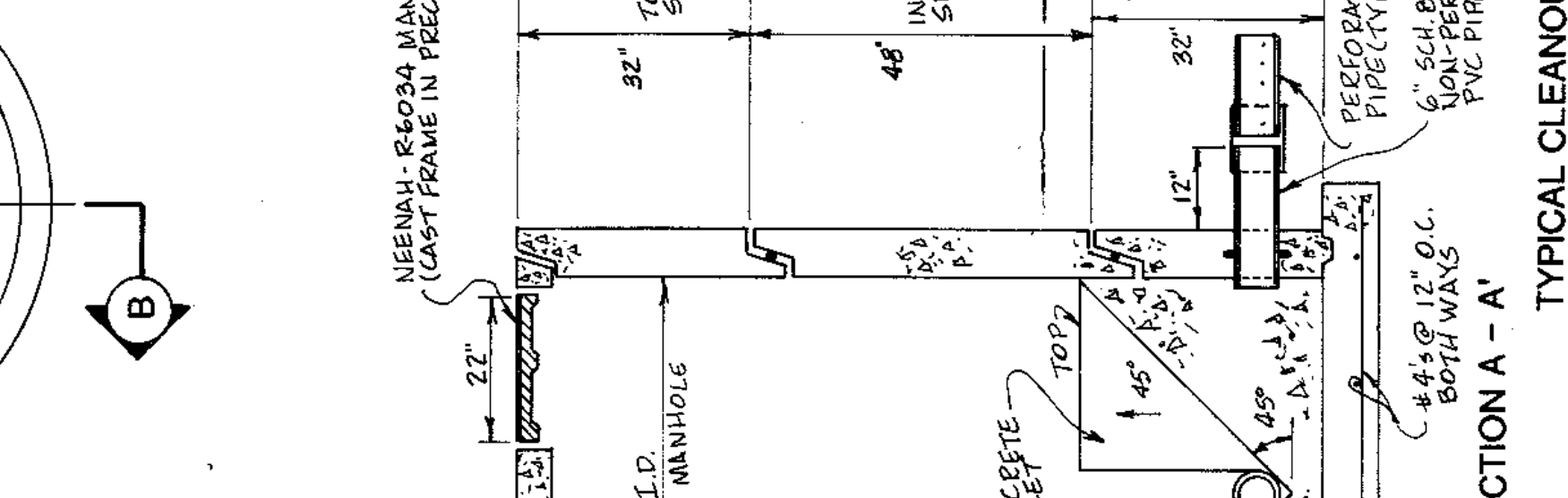
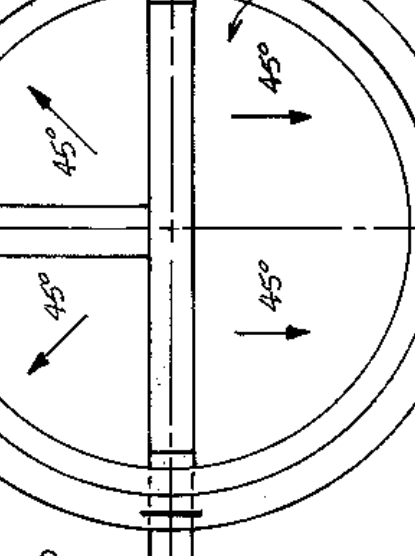
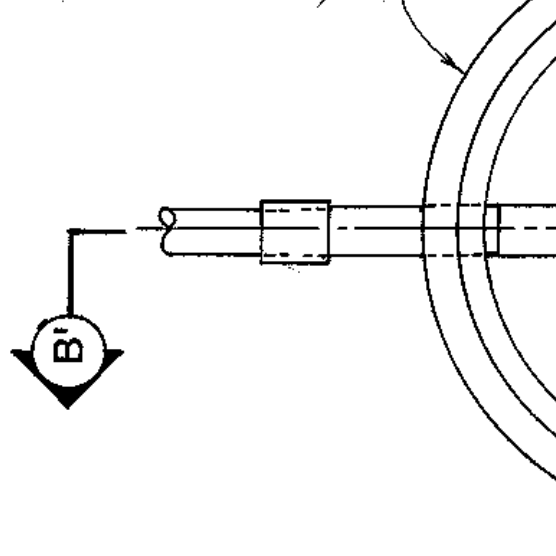
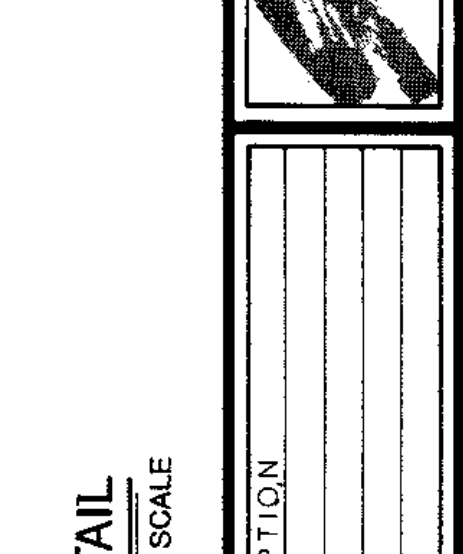
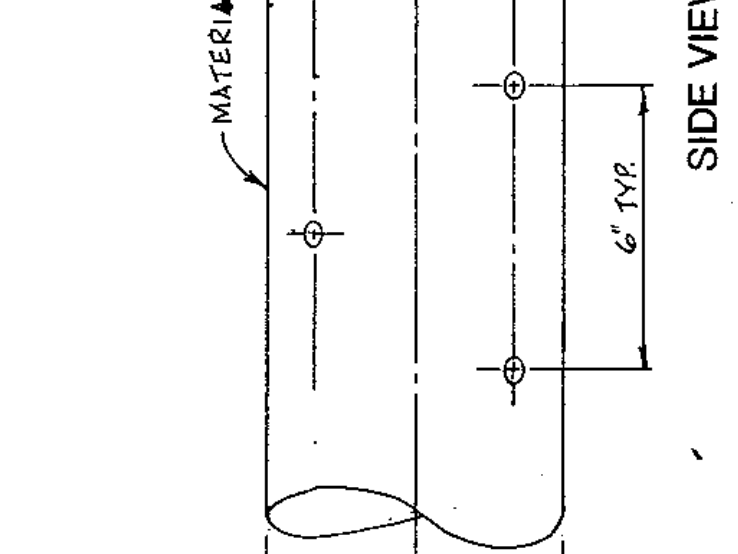
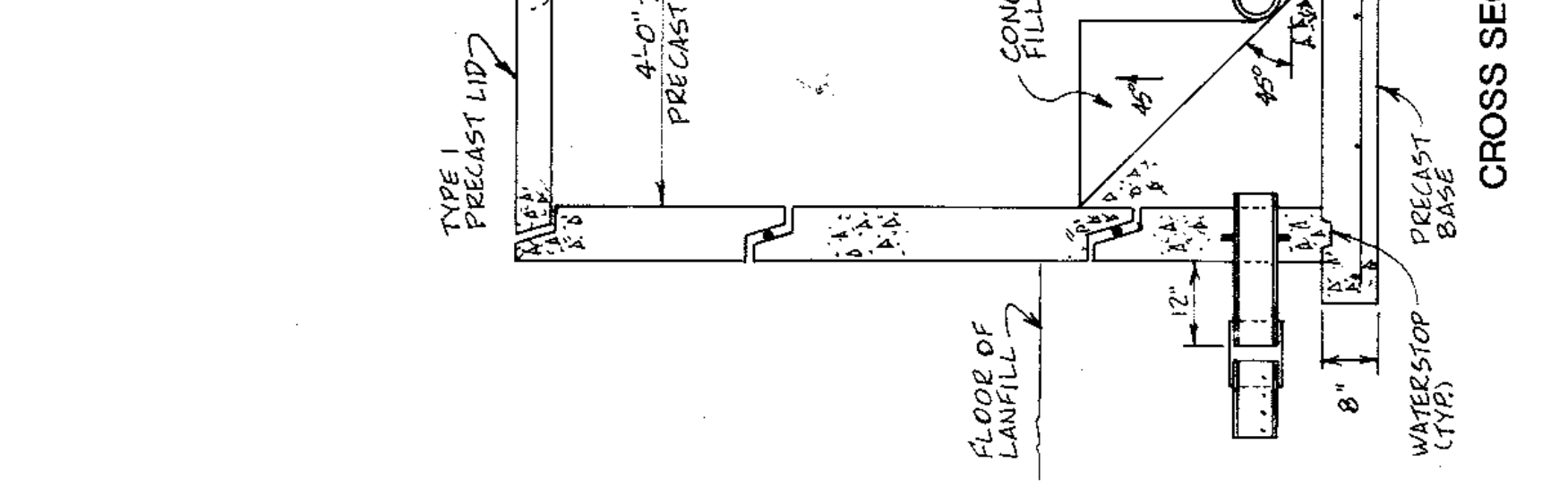
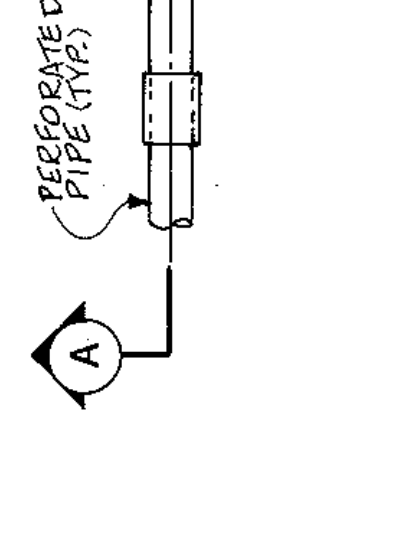
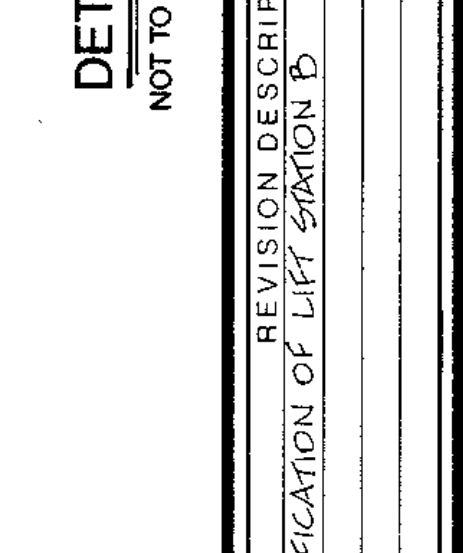
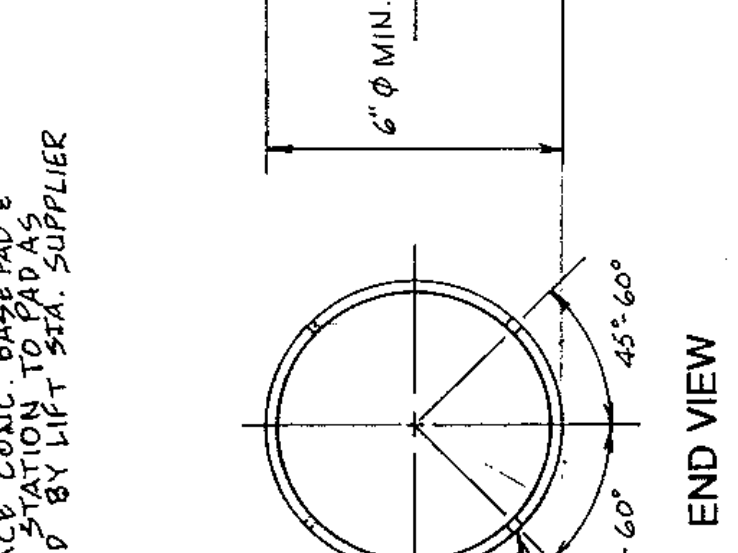
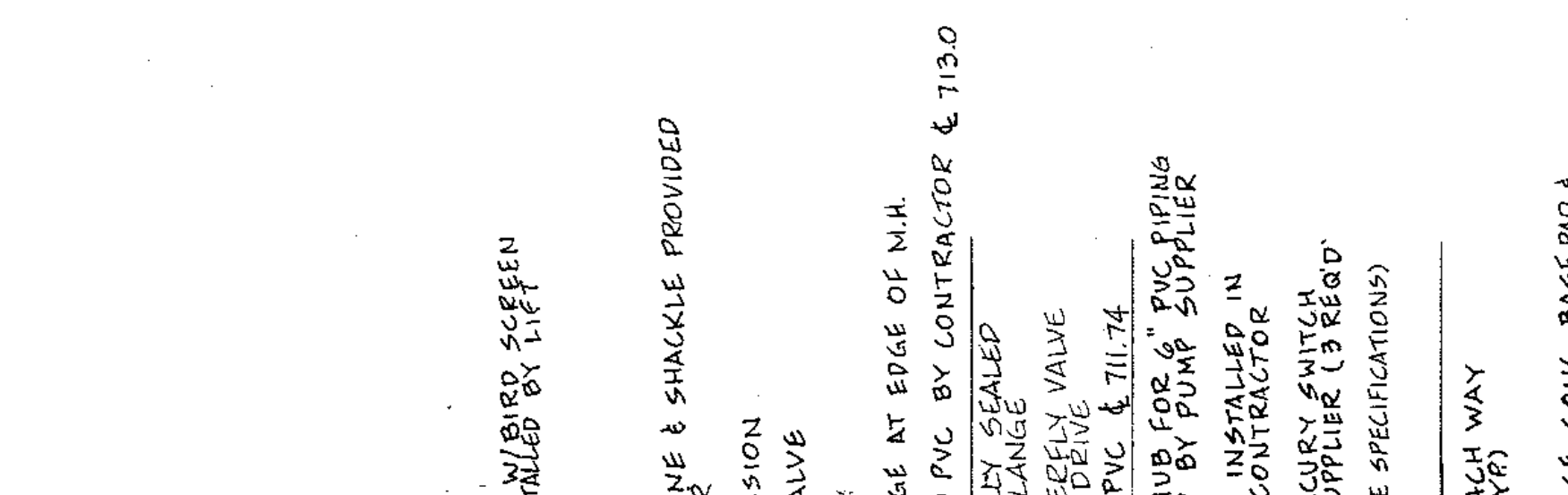
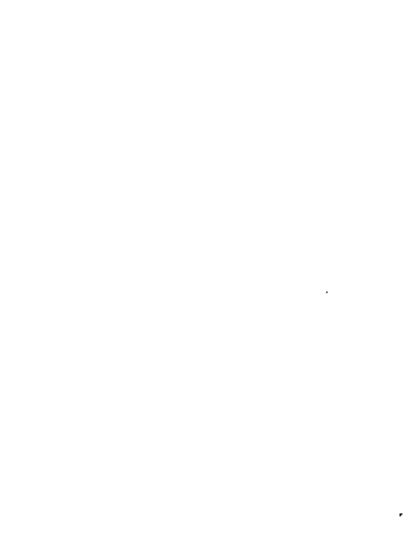
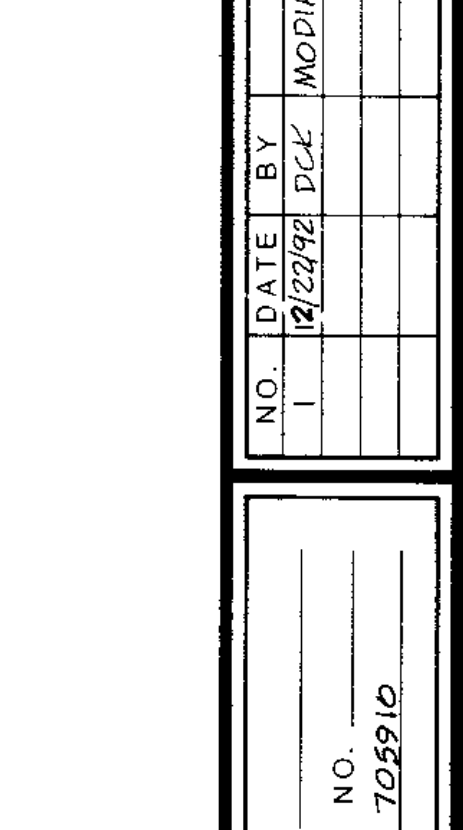
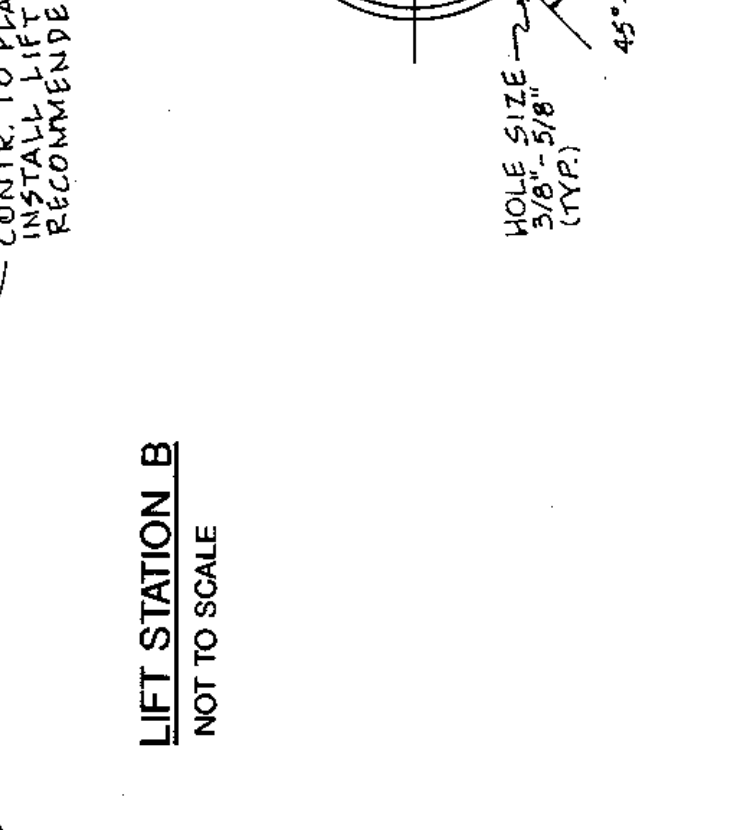
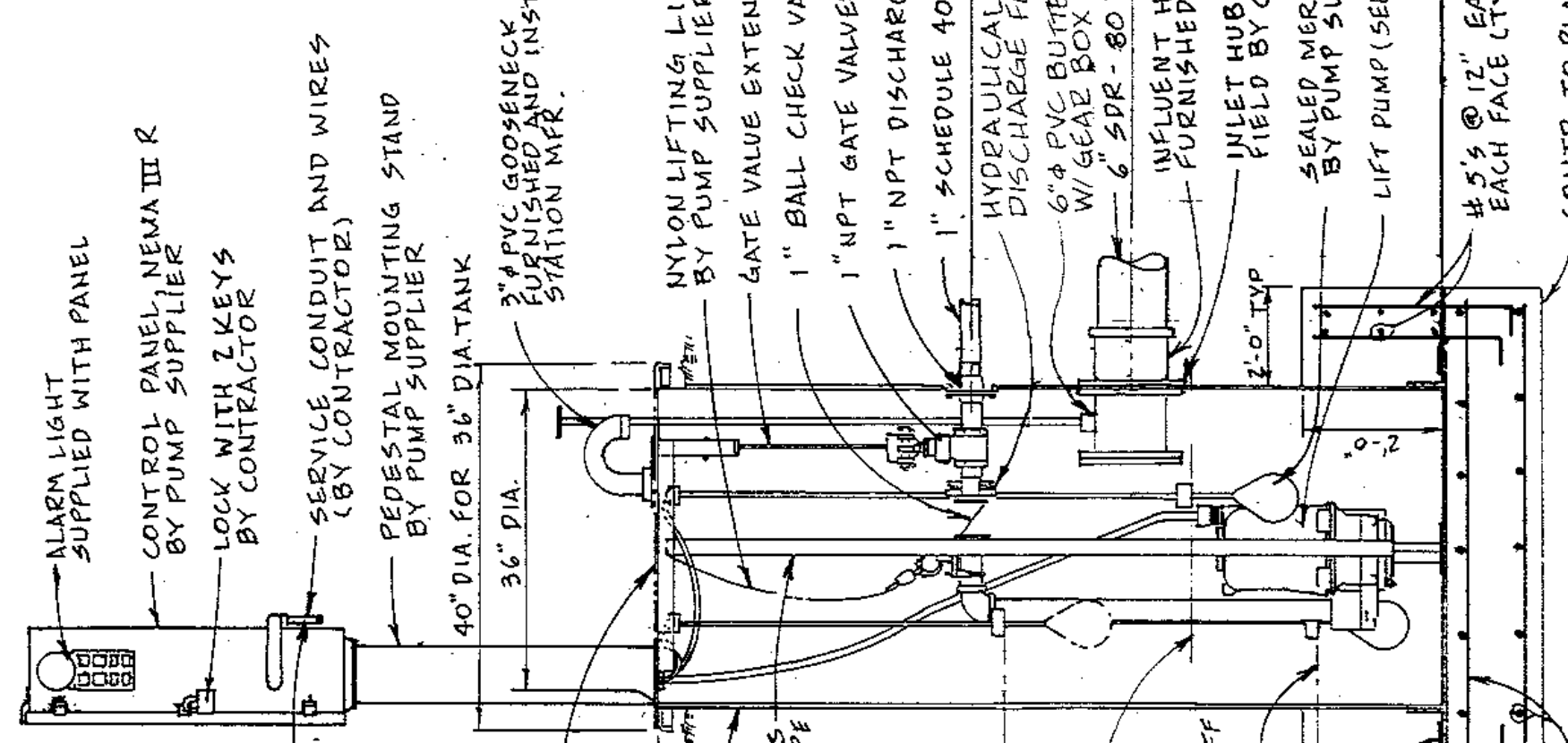
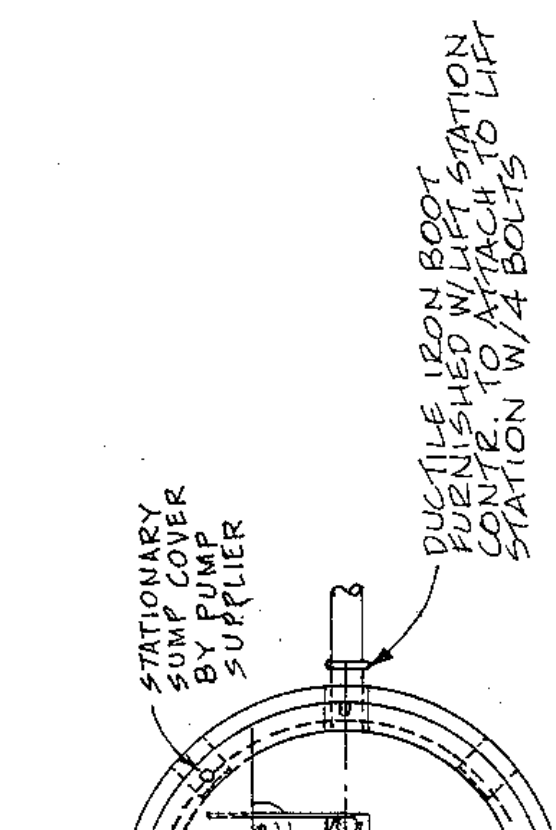
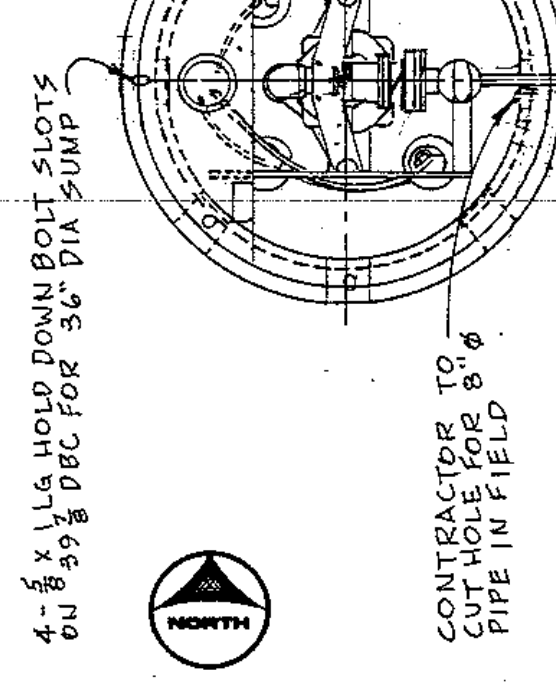
PROJECT NO.	708910	DATE	11/19/09
SCALE AS NOTED	FILE NO.	DESIGNED BY	DAMON SHANNON
DRAWINGS	34	CHECKED BY	GERALD R. PETERSON
DLF0001P	1	DATE	12/15/09

NO.	DATE	BY	DESCRIPTION
1	11/19/09	GP	PLACED ON P/W BORDER AND ADDED SECTION INFORMATION (H.R.)



CCR LANDFILL

CROSS SECTION
1-1'



SHEET NO. **16**

DLF0001Q

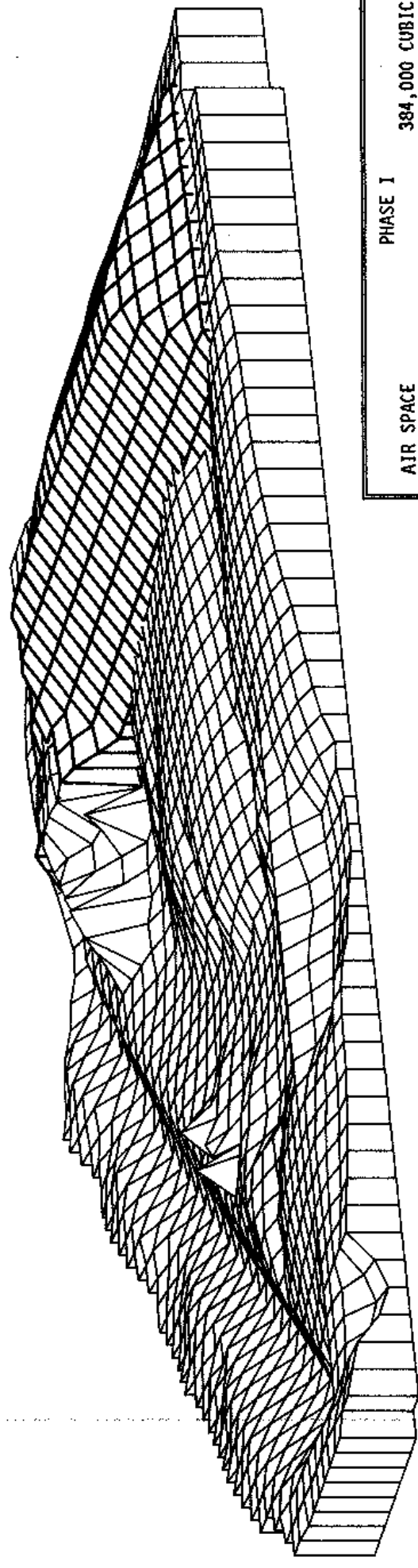
D1-P

MUSCATINE POWER AND WATER CCR LANDFILL 1991

Green Environmental Services, Inc.

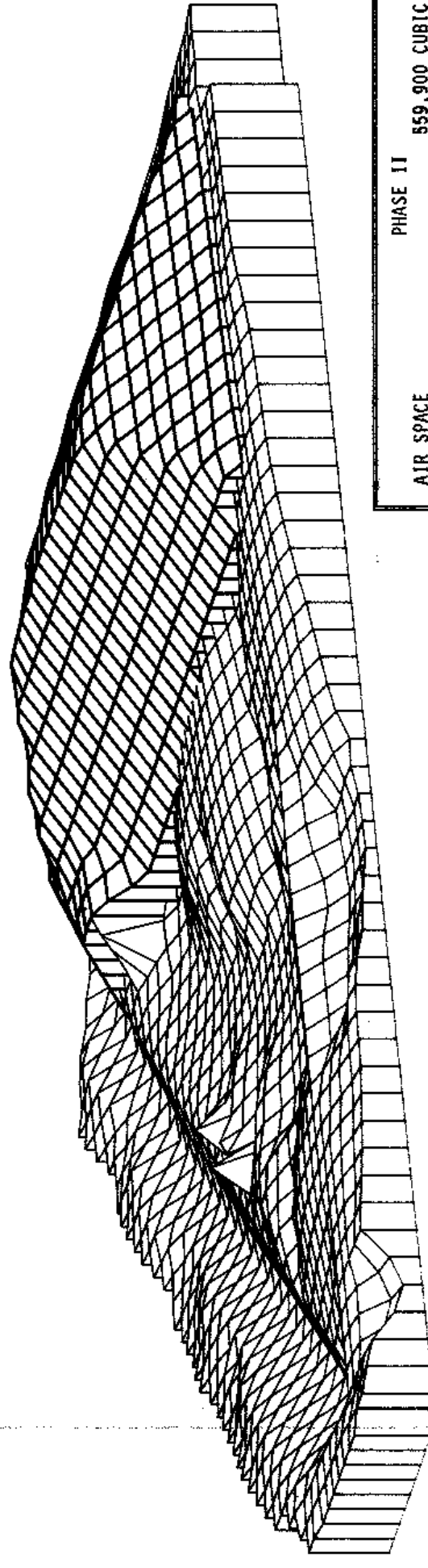
NO.	DATE	BY	REVISION DESCRIPTION
1	10/22/92	DCK	MODIFICATION OF LIFT STATION B

DRAWN: DCK	SURVEYED:	FIELD BOOK NO.:	JOB NO.:
APPROVED:		705910	
DATE: 10/23/91			



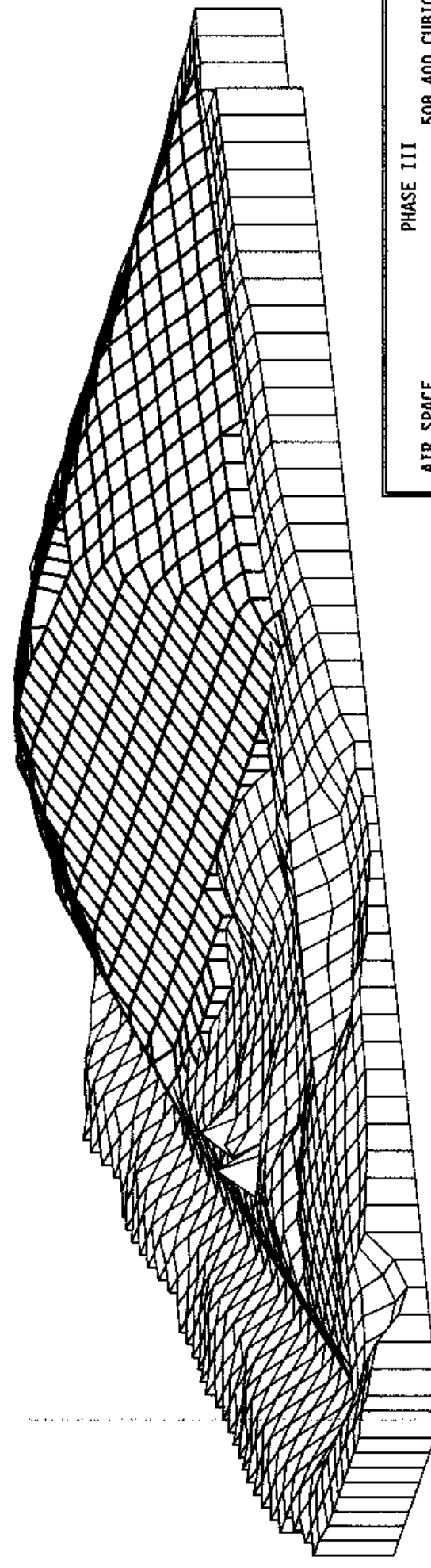
PHASE I	
AIR SPACE	384,000 CUBIC YARDS
CCR TONNAGE	377,300 TONS
CCR VOLUME	377,300 CUBIC YARDS
FINAL COVER AREA	285,000 SQUARE FEET
FINAL COVER TOPSOIL	19,500 CUBIC YARDS
FINAL COVER SOIL	19,500 CUBIC YARDS
FINAL COVER COMPACTED SOIL	0 CUBIC YARDS
FINAL COVER MEDIA	0 CUBIC YARDS
FINAL COVER BOTTOM	0 CUBIC YARDS
FINAL COVER TO LINER BOTTOM	47,000 CUBIC YARDS
RECOVERABLE SOIL VOLUME	39,000 CUBIC YARDS
BORROW REQUIREMENTS	1992-2004
OPERATIONAL YEARS	11.5 YEARS
REMAINING CAPACITY	

PHASE I



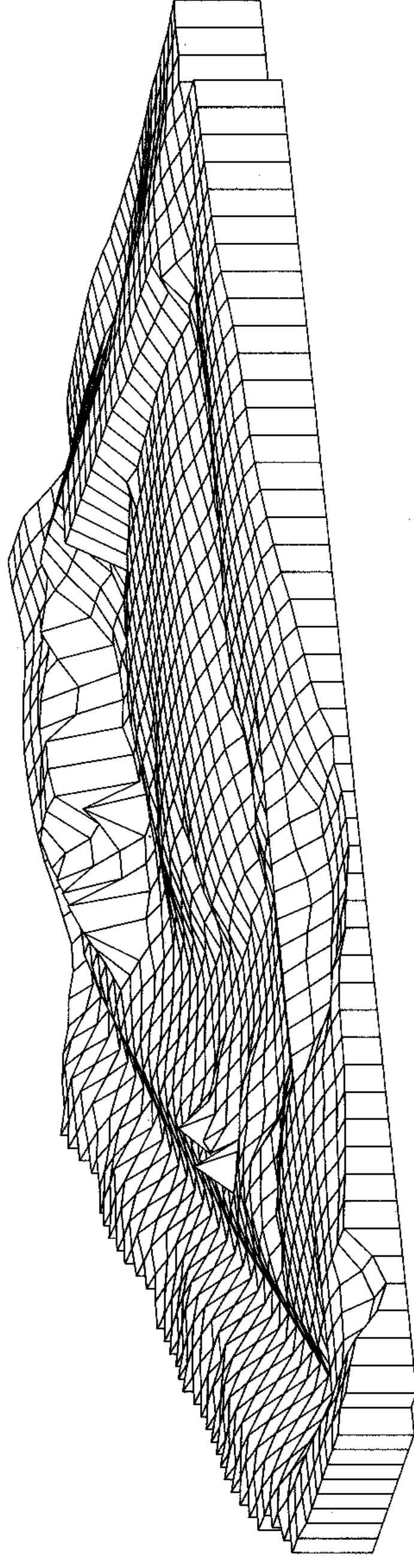
PHASE II	
AIR SPACE	658,800 CUBIC YARDS
CCR TONNAGE	659,300 TONS
CCR VOLUME	659,300 CUBIC YARDS
FINAL COVER AREA	493,200 SQUARE FEET
FINAL COVER TOPSOIL	210,000 CUBIC YARDS
FINAL COVER SOIL	210,000 CUBIC YARDS
FINAL COVER COMPACTED SOIL	15,600 CUBIC YARDS
FINAL COVER MEDIA	191,800 SQUARE FEET
FINAL COVER BOTTOM	7,100 CUBIC YARDS
FINAL COVER TO LINER BOTTOM	78,800 CUBIC YARDS
RECOVERABLE SOIL VOLUME	66,700 CUBIC YARDS
BORROW REQUIREMENTS	1993-2000
OPERATIONAL YEARS	6.1 YEARS
REMAINING CAPACITY	

PHASE II

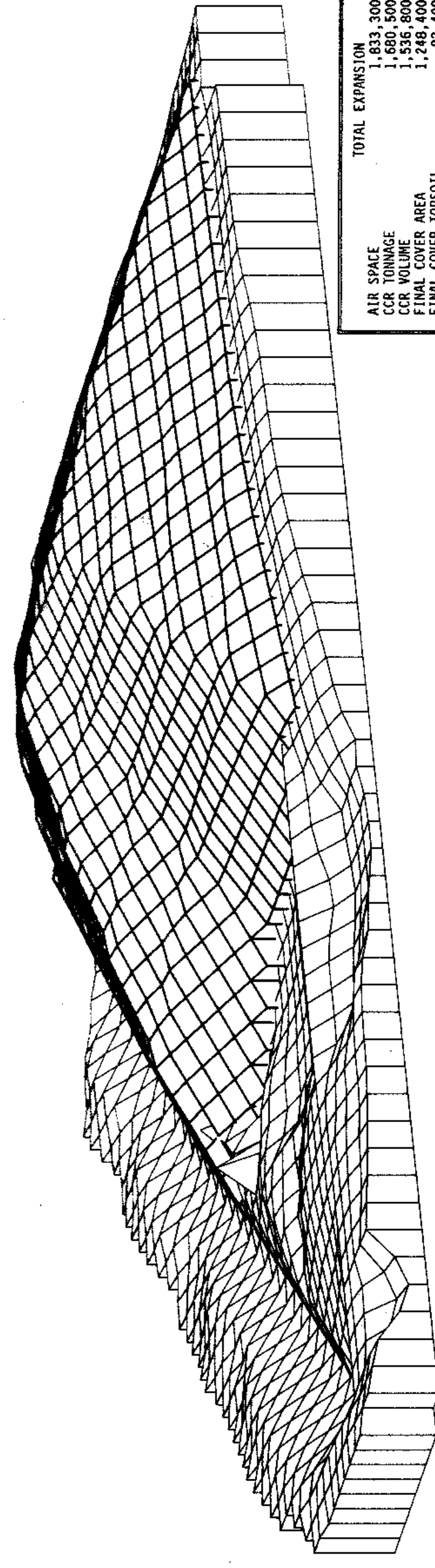


PHASE III	
AIR SPACE	508,400 CUBIC YARDS
CCR TONNAGE	480,600 TONS
CCR VOLUME	439,500 CUBIC YARDS
CCR VOLUME	16,500 CUBIC YARDS
FINAL COVER AREA	16,500 SQUARE FEET
FINAL COVER TOPSOIL	16,500 CUBIC YARDS
FINAL COVER SOIL	16,500 CUBIC YARDS
FINAL COVER COMPACTED SOIL	28,700 CUBIC YARDS
FINAL COVER MEDIA	7,200 CUBIC YARDS
FINAL COVER BOTTOM	50,600 CUBIC YARDS
FINAL COVER TO LINER BOTTOM	68,900 CUBIC YARDS
RECOVERABLE SOIL VOLUME	2000-2004
BORROW REQUIREMENTS	2.2 YEARS
OPERATIONAL YEARS	
REMAINING CAPACITY	

PHASE III



EXISTING TOPOGRAPHY



FINAL TOPOGRAPHY

TOTAL EXPANSION	
AIR SPACE	1,833,300 CUBIC YARDS
CCR TONNAGE	1,800,500 TONS
CCR VOLUME	1,800,500 CUBIC YARDS
FINAL COVER AREA	1,248,400 SQUARE FEET
FINAL COVER TOPSOIL	92,400 CUBIC YARDS
FINAL COVER SOIL	92,400 CUBIC YARDS
FINAL COVER COMPACTED SOIL	603,100 CUBIC YARDS
FINAL COVER MEDIA	89,300 CUBIC YARDS
FINAL COVER BOTTOM	22,400 CUBIC YARDS
FINAL COVER TO LINER BOTTOM	147,000 CUBIC YARDS
RECOVERABLE SOIL VOLUME	296,500 CUBIC YARDS
BORROW REQUIREMENTS	1992-2004
OPERATIONAL YEARS	15.1 YEARS
REMAINING CAPACITY	

PHASE IV	
AIR SPACE	281,000 CUBIC YARDS
CCR TONNAGE	259,100 TONS
CCR VOLUME	259,100 CUBIC YARDS
FINAL COVER AREA	550,500 SQUARE FEET
FINAL COVER TOPSOIL	40,800 CUBIC YARDS
FINAL COVER SOIL	40,800 CUBIC YARDS
FINAL COVER COMPACTED SOIL	217,400 CUBIC YARDS
FINAL COVER MEDIA	32,500 CUBIC YARDS
FINAL COVER BOTTOM	2,500 CUBIC YARDS
FINAL COVER TO LINER BOTTOM	101,000 CUBIC YARDS
RECOVERABLE SOIL VOLUME	2004-2007
BORROW REQUIREMENTS	0 YEARS
OPERATIONAL YEARS	
REMAINING CAPACITY	

NOTE: VERTICAL EXAGGERATION: 250%



DRAWN: JEG/JMH/CAD
 APPROVED: _____
 DATE: NOVEMBER 20, 1991

NO.	DATE	BY	REVISION DESCRIPTION

GREEN ENVIRONMENTAL SERVICES, INC.

MUSCATINE POWER AND WATER CCR LANDFILL 1991

THREE DIMENSIONAL VIEWS

SHEET NO. 19

APPENDIX B

TABLES

**TABLE B-1
POST CLOSURE INSPECTION SCHEDULE**

<u>Inspection Item</u>	<u>Routine</u>	<u>Non-Routine</u>
Site Features Access Road Signage Maintenance Building Fences	1/month	As required *
Lift Station Surface Facilities Pump Operations General Visual Conditions	1/month	As required *
Bypass Ditch Clear of Debris Riprap Condition Let Down Structures Access Road Crossing Erosion/Bank Failures Grass Cover	1/month	As required *
Vegetative Cover Bare Spots Erosion Weeds Trees Mowed as Scheduled	1/month	As required *
Drainage System Diversions Erosion Rodents Bare Spots Let Down Structures Inlet Structures Riprap/Gabions Lines Clear	1/month	As required *
Runoff Control Pond Dam Integrity Erosion Rodent Damage Riprap/Gabions	1/month	As required *

TABLE B-1 (Continued)
POST CLOSURE INSPECTION SCHEDULE

<u>Inspection Item</u>	<u>Routine</u>	<u>Non-Routine</u> *
Monitoring Wells	Spring/Fall	As required *
Metal Enclosures		
General Condition		
Paint		
Locks		
Oil Locks and Cover Hinges		
Survey Ground Control	Spring/Fall	As required *
Present		
Guard Post In Place		
Guard Posts Painted		
Groundwater Cut-off Drain	Spring/Fall	As required *
Manhole		
Cover		
Structure		
Steps		
Invert		
Outlet, North		
Clear		
Rodent Guard in Place		
Outlet, West		
Clear		
Rodent Guard in Place		
Leachate Collection System	Spring/Fall	As required *
Manholes 1-7		
Cover		
Structure		
Steps		
Inverts		
Valves		
Cleanouts 1-5		
Condition		

* Non-routine inspections will occur as deemed necessary after severe weather events such as heavy rain, high winds, hail, tornado, ice storm, etc.