Attachment VI-3

Design Engineering Report

For

Cells B/6 and 7

CLEAN HARBORS GRASSY MOUNTAIN, LLC TOOELE COUNTY, UTAH

LANDFILL CELLS 6B AND 7 CLOSURE DESIGN MODIFICATIONS FOR VERTICAL EXPANSION

DESIGN ENGINEERING REPORT

(HAL PROJECT NO 064 82 100)

December 2010

HANSEN ALLEN & LUCE inc
ENGINEERS

RECEIVED
DEC 16 2010
UTAH DIVISION OF
SOLID & HAZARDOUS WASTE

CLEAN HARBORS
GRASSY MOUNTAIN, LLC

LANDFILL CELLS 6B AND 7
CLOSURE DESIGN MODIFICATIONS
FOR VERTICAL EXPANSION

DESIGN ENGINEERING REPORT

Prepared by

HANSEN, ALLEN & LUCE, INC
Consulting Engineers
6771 South 900 East
Midvale, Utah 84047
(801) 566-5599

December 2010

TABLE OF CONTENTS

This page was left blank intentionally

CHAPTER I

INTRODUCTION

Clean Harbors Grassy Mountain, LLC (Clean Harbors) is interested in increasing the height and the top slope of the closure caps of Landfill Cells 6B and 7, which will provide an increase in the permitted waste capacities within each of the cells Clean Harbors requested that Hansen, Allen & Luce, Inc (HAL) provide engineering evaluations to determine the potential for closure design modification Applied Geotechnical Engineenng Consultants (AGEC) was retained to perform geotechnical stability analyses of the raised closure caps to ensure stability under static and seismic conditions This report provides a summary of background information associated with the design of the landfills and closure caps, presents proposed design modifications, and provides a summary of results from the geotechnical evaluation and other engineering calculations for the proposed design modifications The geotechnical evaluation and engineering calculations are to provide a basis for approval of a permit modification from the Utah Division of Solid and Hazardous Waste (DSHW) for the proposed design modifications

This page was left blank intentionally

CHAPTER II

BACKGROUND

LANDFILL CELL 6B

Landfill Cell Design

The original design of Landfill Cell B/6 was completed and presented in a design engineering report dated January 1992 as RCRA Landfill Cell 6, with an original design capacity of 493,300 cy Revisions to the design were completed and presented in a design engineering report dated September 1992 which incorporated design modifications and discussions resulting from regulatory changes that were made to the rules in 1992 The September 1992 design modifications included a design change to lower the floor by a vertical distance of 5 feet, which changed the design capacity to approximately 592,000 cy A report dated January 1993 provided information regarding the effects of groundwater on lowering the floor 5 feet from the original design The current permitted capacity of 592,000 cy reflects acceptance of the September 1992 design and the January 1993 report

After construction of Landfill Cell 6 (constructed in 1993), the permit was revised to allow disposal of TSCA wastes in Cell 6 and the cell was given the designation of Landfill Cell B/6 or Landfill Cell 6B Both references have been used for the landfill since it was permitted to receive TSCA waste

Closure Cap Design

The original closure cap design used to determine the permitted waste capacity consisted of the following (from top to bottom)

4 inches of gravel armor erosion protection
2 feet of protective soil cover
8 oz Non-woven geotextile filter fabric
geonet
60-mil HDPE geomembrane (textured on the 2H 1V perimeter slopes)
2 feet (minimum) of compacted clay liner

Original design slopes consisted of 2H 1V (horizontal to vertical) perimeter slopes around closure caps extending from the top of the cell embankments to the outside edge of the closure cap's top slope The top slope consisted of 5 percent slopes from the top center to the outside edges of the caps and 0 63 percent cross slopes to provide a resultant slope of 0 7 percent in the perimeter drainage ditches

Original drainage design from the closure cap includes six different drainage areas Runoff from the six drainage areas collects in the perimeter ditches that convey runoff to six different down drains (or down spouts) that convey storm water from the top of the closure cap to the bottom toe of the cell embankments

LANDFILL CELL 7

Landfill Cell Design

Design of RCRA Landfill Cell 7 was completed and presented in a design engineering report dated December 1995 with an original design capacity of 645,100 cy Construction of the cell was completed and construction documentation was submitted in November 1996 Engineering evaluations and geotechnical stability and settlement analyses were completed in December 2000, and were provided to the facility for a permit application to increase the capacity to 733,000 cubic yards by raising the height of the closure cap 2 18 feet and by replacing the compacted clay liner with GCL This permit modification was approved by DSHW

Closure Cap Design

The original closure cap design used to determine the permitted waste capacity consisted of the following (from top to bottom)

On the top slopes
4 inches of gravel armor erosion protection
2 feet of protective soil cover
8 oz Non-woven geotextile filter fabric
geonet
60-mil HDPE geomembrane
geosynthetic clay liner (GCL)
six inches (minimum) of soil cushion

On the perimeter slopes
4 inches of gravel armor erosion protection
2 feet of protective soil cover
8 oz Non-woven geotextile filter fabric
geonet
60-mil HDPE textured geomembrane
2 feet minimum of compacted clay liner (CCL)

Original design slopes consisted of 2H 1V (horizontal to vertical) perimeter slopes around closure caps extending from the top of the cell embankments to the outside edge of the top slope of the closure caps The top slope consisted of 5 percent slopes from the top center to the outside edges of the caps and 0 63 percent cross slopes to provide a resultant slope of 0 7 percent in the perimeter drainage ditches

Original drainage design from the closure cap includes four different drainage areas Runoff from the four drainage areas collects in the perimeter ditches that convey runoff to four different down drains (or down spouts) that convey storm water from the top of the closure cap to the bottom toe of the cell embankments

CHAPTER III

MODIFIED CLOSURE DESIGN

CLOSURE CAP CONFIGURATIONS

The proposed closure cap design for both Landfill Cell 6B and Landfill Cell 7 consists of the following from top to bottom (See Exhibit A for drawings)

On the top 10% slopes
4 inches of gravel armor erosion protection
2 feet of protective soil cover
Double sided geocomposite (consisting of 8 oz Non-woven geotextile filter fabric bonded to both sides of geonet)
60-mil HDPE textured geomembrane
geosynthetic clay liner (GCL)
six inches (minimum) of soil cushion

On the perimeter 3H 1V slopes
4 inches of gravel armor erosion protection
2 feet of protective soil cover (compacted clay soil)
60-mil HDPE textured geomembrane
2 feet minimum of compacted clay liner (CCL)

Design slopes include 3H 1V (horizontal to vertical) perimeter slopes around closure cap extending from the top of the cell embankments to the outside edge of the top slope of the closure cap The top slope consists of 10 percent slopes from the top center to the outside edges of the cap and 0 80 percent cross slopes to provide a resultant slope of 1 14 percent in the perimeter drainage ditches

Landfill Cell 6B is designed to have a maximum vertical height of 31 98 feet from the top of the cell embankment to the top of the perimeter berm Total vertical height at the center of the Cell 6B closure cap is 48 82 feet above the cell embankment Landfill Cell 7 is designed to have a maximum vertical height of 33 13 feet from the top of the cell embankment to the top of the perimeter berms Total vertical height at the center of the Cell 7 closure cap is 63 92 feet above the cell embankment Landfill Cell 7 has a much higher center height because it is approximately 286 feet wider than Landfill Cell 6B which provides a greater distance of rise for the 10 percent slope

The perimeter drainage ditches are V-shaped with a perimeter berm providing the outside 3H 1V slope and the 10 percent closure cap slope providing the inside side slope for the ditches The penmeter ditches are designed to receive storm water runoff from the 10 percent cap slope areas and convey the runoff to down drains, which convey storm water to the bottom exterior toes of the landfill cell embankments

LANDFILL CAPACITIES

Capacities of the landfill cells were determined using volume calculation routines within AutoCAD Civil 3D 2010 by Autodesk Surfaces were built within AutoCAD, representing the surface of the protective soil cover above the bottom lining system within the cell and the top of the waste mound based on the modified closure cap design These two surfaces were then defined to determine the capacity within the landfill cell using a gnd spacing of 2 feet in both the north/south and the east/west directions The modified capacity within Cell 6B is approximately 1,022,600 cubic yards and the modified capacity within Cell 7 is approximately 1,106,000 cubic yards

CLOSURE CAP DRAINAGE

Hydrology

Runoff was estimated using the SCS curve number methodology and the unit hydrograph procedure developed by the USDA Soil Conservation Service Hydrologic calculations are presented in Exhibit C Rainfall depth for the 100-year, 24-hour precipitation event of 1 85 inches was obtained from Point Precipitation Frequency Estimates from NOAA Atlas 14 using the coordinates and elevations of the Grassy Mountain Facility

A gravel road with hydrologic soil group B has a curve number of 85 The gravel armor erosion protective layer is not compacted, has less fines, and has greater storm water retention potential than a gravel road Therefore, a curve number of 83 was estimated to conservatively represent the runoff conditions for the gravel armor surfaces

Design of the perimeter drainage ditches and the down drains was based on using the largest drainage areas for Landfill Cells 6B and 7 Therefore, the drainage areas for Cells 6B and 7 were evaluated to determine the largest contributing area to the perimeter ditch and to the down drain Runoff calculated on the largest areas was then used for design of all perimeter ditches and for all down drains for both landfill cell closure caps

The closure cap for landfill Cell 6B consists of six different drainage areas that collect and convey storm water runoff to six down drains (or down spouts) located around the perimeter of the closure cap Four drainage areas are located at each of the four corners of the closure cap, and two of the drainage areas are located at the center of the north and south sides of the closure cap The drainage areas at the center of the north and south sides each have areas of 64,157 square feet (1 473 acres) which are larger than the four drainage areas located at the corners of the closure cap A single drainage area contributes runoff to a segment of the penmeter ditch and two of the center drainage areas (128,314 square feet or 2 946 acres) combine to contribute drainage to a single down drain

The closure cap for Landfill Cell 7 is symmetrical such that four drainage areas are located in the corners of the closure cap and the drainage areas are all equal in size The largest area contnbuting runoff to the penmeter ditches is 53,339 square feet (1 225 acres) and the largest area contributing runoff to a down drain is 106,678 square feet (2 45 acres)

Perimeter Ditch and Down Dram Design

Using 1 473 acres of area provides an estimated peak discharge of 0 96 cfs to the drainage ditches and using an area of 2 946 acres provides an estimated peak discharge of 1 92 cfs (i e 2 x 0 96 cfs) to the down drains The penmeter ditches will convey 0 96 cfs with a flow depth of about 0 4 foot and a safety factor of about 1 33 against erosion of the gravel armor material in the perimeter ditches An 18-inch diameter pipe will convey the 1 92 cfs with a headwater depth of 0 7 foot at the pipe inlet Since the inlet boxes are 1 5 feet deep below the perimeter ditch flow lines, the headwater depth of 0 7 foot will not obstruct or back storm water in the perimeter ditches

Erosion Protection

Erosion protection calculations were completed on the gravel armor material for both the 10 percent top slope and the 3H 1V penmeter slopes of the closure caps These calculations were completed for the longest slopes (worst case conditions) represented for the closure caps of both cells Results were then applied to all slopes on both of the closure caps "Erosion and Sedimentation in Utah - A Guide for Control" published by the Utah Water Research Laboratory, February 1984, was used to determine the depth of the gravel armor needed for erosion protection The maximum length of the 10 percent slopes for both cells is 361 feet and the maximum length of the 3H 1V slopes is 99 36 feet Using these slope lengths, the minimum gravel armor thickness is 1 inch for the 10 percent slopes and 2 inches for the 3H 1V slopes

Stephens method from NUREG/CR-4651was used to determine the minimum D_{50} size for the gravel armor matenal based on the estimated flow per foot of width across the gravel armor The flow per unit width was calculated using the storm water discharge rate estimated for an acre of area for the closure caps The slope length for the 10 percent slopes for the largest area under evaluation is 190 feet resulting in a width of 230 feet and the slope length for the 3H 1V slopes is 94 feet resulting in a width of 463 feet for corresponding one acre areas Dividing that storm water discharge of 0 65 cfs per acre by 190 and by 94 gives a flow per unit width of 0 003 cfs per foot for the 10 percent slopes and 0 002 cfs per foot for the 3H 1V slopes Concentration factors are not a component of NUREG/CR-4651 procedure, but are provided to show the types of flow concentration that may occur, beyond the safety factors already provided in the procedure, and still maintain erosion stability The concentration factors were calculated assuming a D_{50} size of approximately 1 inch, which is representative of the local gravel source histoncally used for the gravel armor A D_{50} size of 1 inch will allow for additional flow concentrations of 66 times on the 10 percent slopes and of 12 times on the 3H 1V slopes and still maintain stability against erosion An additional factor of 1 35, called Oliver's constant, was also applied to the flow rates as suggested in NUREG/CR-4651 Flow rates used for calculating the D_{50} size, after applying the factors discussed, are 0 273 cfs per foot for the 10 percent slopes and 0 032 cfs per foot for the 3H 1V slopes Calculated minimum D_{50} sizes are 0 90 inch for the 10 percent slopes and 0 96 inch for the 3H 1V slopes

The minimum gravel thickness should accommodate twice the D_{50} size rock which is about 2 inches Applying erosion control procedures for determining gravel thickness and using critena for establishing the D_{50} rock size results in minimum gravel thicknesses of 2 inches for the 10 percent slopes and 3 inches for the 3H 1V slopes

The closure caps and cell embankments have historically received a gravel armor thickness of 4 inches (as is shown on the closure cap design drawings) due to the difficulty in consistently placing less thickness of gravel armor with a D_{50} size of about 1 inch Observations show no noticeable erosion where gravel armor has previously been placed on closure caps and embankment slopes Therefore, it is recommended that the erosion control measures consist of a targeted 4 inches of gravel armor thickness on all surfaces with a minimum of 3 inches on the 3H 1V slopes and a minimum of 2 inches on the 10 percent slopes

LEACHATE WITHDRAWAL PIPES

The leachate withdrawal pipes were evaluated to determine their structural integrity under the increased weight (or loading) resulting from the vertical expansion High density polyethylene (HDPE) pipes with a standard dimension ratio (SDR) of 21 (Cell 6B) and 17 (Cell 7) were installed in the landfills and were evaluated for wall crushing, wall buckling, and ring deflection Calculations show the vertical expansion should not jeopardize the structural integrity of the leachate withdrawal pipes

GEOTECHNICAL EVALUATIONS

Geotechnical stability and settlement evaluations were completed by Applied Geotechnical Engineering Consultants (AGEC) to determine the feasibility of increasing the closure cap height and are provided in a letter report dated September 28, 2009 (revised December 6, 2010) The letter report in included in Exhibit B

Results from these evaluations show that the closure cap for Landfill Cell 6B can be raised to a height of 31 98 feet and the closure cap height for Landfill Cell 7 can be raised to a height of 33 13 feet from the top of the landfill cell embankments to the top of the highest point of the perimeter berms around the closure caps and still maintain stability and the integrity of other engineering aspects of the landfill cell and the closure cap

Stability

Stability analysis included an evaluation of global stability of the landfill and underlying soil structure with the proposed additional waste in place Local stability of the 3 1 cap slope and liner interface stability were also considered Stability analysis was conducted assuming both static and seismic conditions

Stability evaluations were based on a seismic event having a 90 percent probability of not being exceeded in a 250 year period A bedrock peak horizontal acceleration of 0 15g was used resulting in a horizontal ground acceleration of 0 20g for the site, which was used in the stability analysis A seismic coefficient of one half of the PGA (k = 0 10g) was used for the pseudo-static stability analysis Soil parameters used were obtained from reports of previous geotechnical studies at the site Safety factors were determined under static and seismic conditions for the overall landfill including subsurface soils and for the closure cap side slopes Results of the analysis are presented in Table III-1

Infinite slope stability analyses were used to determine interface stability safety factors for the design components of the 3H 1V and the 10 percent slopes of the closure caps Results from

these analyses are also presented in Table III-1 The soil strength at the interface with the HDPE textured membrane on the 3H 1V slopes were evaluated to ensure that soil strength will not be exceeded

TABLE III-1
Minimum Landfill and Closure Cap Safety Factors
for Stability of Landfill Cell 6B and Landfill Cell 7

Descnption	Safety Factor	
	Static	Seismic
Overall landfill slope stability, including subsurface soils	2 0	1 5
Closure cap slope stability	2 0	1 5
Interface slope stability on 3H 1V perimeter slopes using infinite slope analysis	4 5	3 5
Interface slope stability on top 10% slopes using infinite slope analysis	5 1	2 5

Note Safety factors presented are minimum and are similar for Landfill Cells 6B and 7 combined

Settlement

Calculations were performed considenng the additional waste height and increase in final closure top slope Settlement calculations were completed to provide a settlement profile and to determine the final slope of the cell floor after settlement Subsurface soil profiles and conditions were obtained from previous geotechnical evaluations performed at the site

Landfill Cell 6B had a design slope of 2 7 percent at the time of construction and is estimated to have a final floor slope of 2 1 percent after settlement and Landfill Cell 7 had a design slope of 2 3 percent at the time of construction and is estimated to have a final floor slope of 1 8 percent after settlement with the modified closure designs The final floor slopes meet the regulatory minimum slope requirements of 1 percent

This page was left blank intentionally

CHAPTER IV

CONCLUSIONS

The Landfill Cell 6B and Landfill Cell 7 closure cap designs can be raised and modified as presented herein The modified design is presented in the design drawings provided in Exhibit A and is summarized herein

Layers (from the uppermost layer to the bottom layer) within the 10 percent top slopes and the 3H 1V penmeter slopes are provided below

10 Percent Top Slopes
4 inches of gravel armor erosion protection
2 feet of protective soil cover
Double sided geocomposite (consisting of 8 oz Non-woven geotextile filter fabric bonded to both sides of geonet)
60-mil HDPE textured geomembrane
geosynthetic clay liner (GCL)
six inches (minimum) of soil cushion

3H 1V Perimeter Slopes
4 inches of gravel armor erosion protection
2 feet of protective soil cover (compacted clay soil)
60-mil HDPE textured geomembrane
2 feet minimum of compacted clay liner (CCL)

Landfill Cell 6B is designed to have a maximum vertical height of 31 98 feet from the top of the cell embankment to the top of the penmeter berms Total vertical height at the center of the Cell 6B closure cap is 48 82 feet above the cell embankment Landfill Cell 7 is designed to have a maximum vertical height of 33 13 feet from the top of the cell embankment to the top of the perimeter berms Total vertical height at the center of the Cell 7 closure cap is 63 92 feet above the cell embankment

The penmeter drainage ditches are V-shaped with a penmeter berm providing the outside 3H 1V slope and the 10 percent closure cap slope providing the inside side slope for the ditches The penmeter ditches are designed to receive storm water runoff from the 10 percent cap slope areas and convey the runoff to down drains which convey storm water to the bottom extenor toes of the landfill cell embankments

The armor plating thickness (stone mulch) should be a minimum of 3 inches on the 3H 1V perimeter slopes and 2 inches on the 10% slopes The target thickness of 4 inches provided on all surfaces in the design drawings allows for some grading tolerance during placement

The modified capacity within Cell 6B is approximately 1,022,600 cubic yards and the modified capacity within Cell 7 is approximately 1,106,000 cubic yards This vertical expansion will increase the capacity of Cells 6B and 7 by 430,600 cy and 373,000 cy, respectively

This page was left blank intentionally

EXHIBIT A

DESIGN DRAWINGS

Clean Harbors®
ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY

LANDFILL CELL 6B CLOSURE

MODIFIED DESIGN

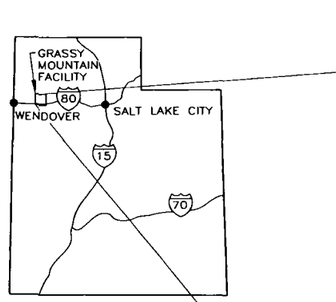
DECEMBER 2010

FACILITY LOCATION

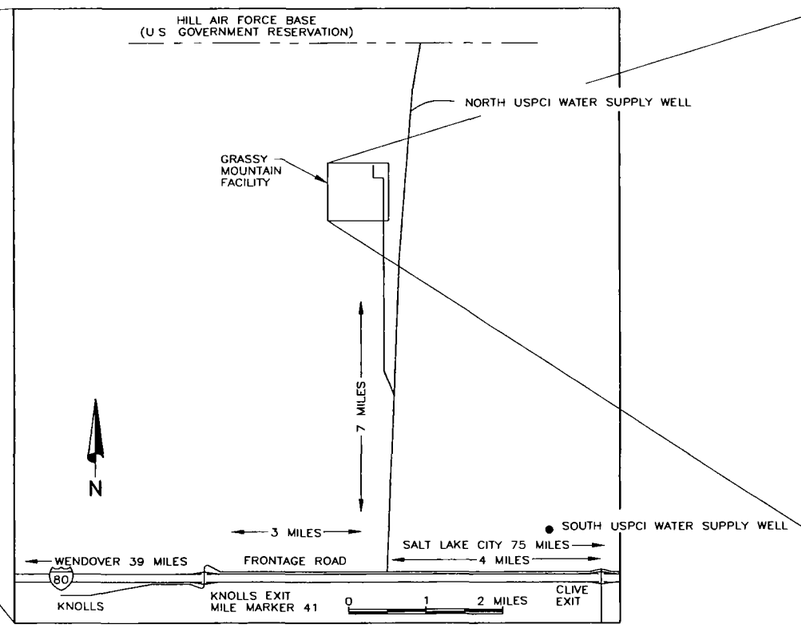
KNOLLS, UTAH
Phone (435) 884-8900

REGIONAL HEADQUARTERS

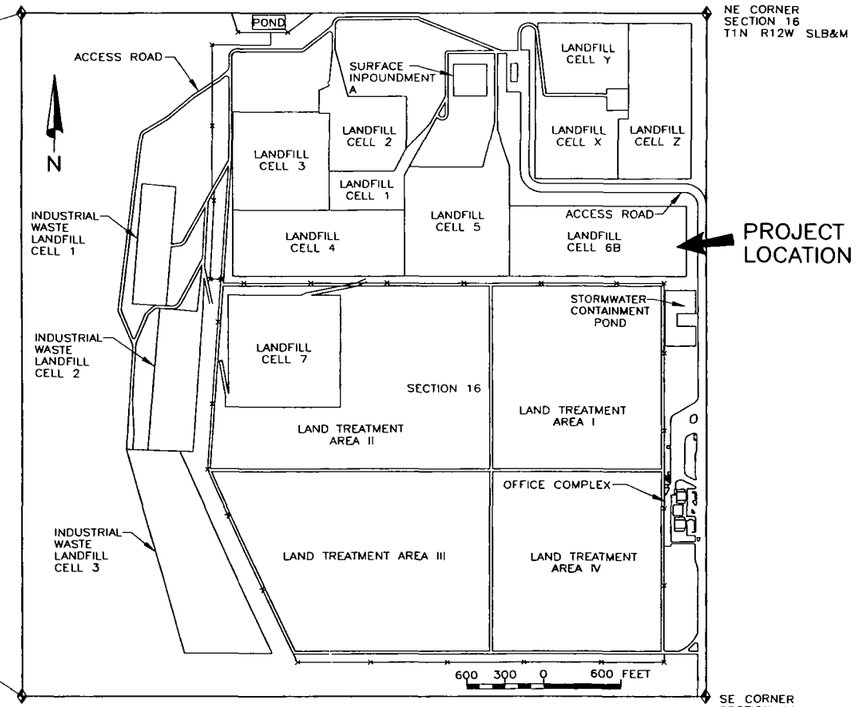
42 LONGWATER DRIVE
NORWELL, MA 02061
Phone (781) 792-5000



STATE OF UTAH



VICINITY MAP



PROJECT LOCATION

PROFESSIONAL ENGINEER
12/7/10
NO 151898
MARVIN E
ALLEN
STATE OF UTAH

HANSEN ALLEN & LUCE, Inc.
CONSULTANTS
ENGINEERS
Salt Lake City
Utah

FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - CB6-C7 MOUNDING\CAD\CELL 6B\CURRENT DESIGN\G6B-1 CELL 6B COVER.DWG
FILE DATE 12 6 2010 10 48 02 (CAH)

7/95

GENERAL NOTES

1 COORDINATES AND ELEVATIONS PROVIDED ARE BASED ON SITE SPECIFIC COORDINATE SYSTEM AND DATUM CONTROL

2 ALL ELEVATIONS PROVIDED ARE BASED ON ORIGINAL EMBANKMENT DESIGN AND CONSTRUCTION ELEVATIONS ADJUSTMENTS SHALL BE MADE PRIOR TO CLOSURE TO ACCOUNT FOR SETTLEMENT

LINING SYSTEM SUBGRADES & SOIL FILL

1 ALL SURFACES PROVIDING SUBGRADES FOR LINING SYSTEMS SHALL BE PROOF ROLLED FOR SOFT AND/OR YIELDING SURFACES SOFT AND/OR YIELDING SURFACES SHALL BE COMPACTED TO PROVIDE A FIRM SUBGRADE FOR LINING SYSTEMS

2 ALL CLAY LINER MATERIALS SHALL BE COMPACTED TO 95% OF ASTM D-698 AT A MOISTURE CONTENT BETWEEN MINUS 2% AND PLUS 4% OF OPTIMUM ALL CLAY LINER SHALL MEET THE REQUIRED PERMEABILITY OF 1 X 10-7 CM/SEC A DEFLOCCULATING AGENT (SODIUM-TRIPOLY PHOSPHATE) MIXED WITH THE CLAY LINER AT A MINIMUM RATE OF 3 5 POUNDS PER 50 CUBIC FEET OF LOOSE MATERIAL IS TYPICALLY REQUIRED TO MEET THE REQUIRED PERMEABILITY CLAY LINER SURFACES SHALL BE MAINTAINED UNTIL PLACEMENT OF OVERLYING GEOSYNTHETIC MATERIALS

3 ALL FILL MATERIALS REQUIRING COMPACTION ON THE PERIMETER SIDESLOPES PIPE BACKFILL AND OTHER DESIGNATED COMPACTION AREAS SHALL BE COMPACTED TO 95% OF ASTM D-698 AT A MOISTURE REQUIRED TO FACILITATE COMPACTION

4 THE SUB-GRADE FOR THE GEOSYNTHETIC MATERIALS SHALL BE FREE OF PROTRUDING ROCKS AND DEBRIS THAT MAY POTENTIALLY CAUSE DAMAGE TO THE GEOSYNTHETIC MATERIALS THE SUBGRADE SHALL ALSO BE ROLLED WITH A SMOOTH DRUM ROLLER TO LEAVE THE SURFACE SMOOTH

5 BORROW SOURCES FOR 6-INCH THICK SAND AND 2-FOOT THICK PROCTECTIVE SOIL COVER LAYERS TO BE APPROVED BASED ON THE FOLLOWING TESTS USING LIQUID OBTAINED FROM SYNTHETIC LEACHATE PRODUCED USING BORROW SOURCE SOILS 1" SCREENING CLAY PORTION OF GEOSYNTHETIC CLAY LINER FOR CHEMICAL COMPATIBILITY TO LIQUIDS (ASTM D6141) 2 SWELL INDEX (ASTM D5890) 3 FLUID LOSS TESTING (ASTM D5891) ANO 4 HYDRAULIC CONDUCTIVITY (ASTM D6766 OR ASTM D5084) AS REQUIRED BY THE ENGINEER BASED ON RESULTS OF OTHER TESTING MAXIMUM HYDRAULIC CONDUCTIVITY OF GCL SHALL MEET AN EQUIVALENCY OF A 2-FOOT THICK COMPACTED CLAY LINER WITH A HYDRAULIC CONDUCTIVITY OF 1X10-7 CM/SEC

6 COMPACTED CLAY SOIL ON THE PERIMETER SLOPES HAS NO PERMEABILITY REQUIREMENT AND SHALL BE COMPACTED TO 95% OF ASDM D-698

GENERAL GEOSYNTHETICS

1 MANUFACTURER S CERTIFICATIONS SHALL BE PROVIDED FOR ALL RAW ANO MANUFACTURED MATERIALS CERTIFICATIONS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER S MATERIAL SPECIFICATIONS AND PROJECT COA PLAN CRITERIA AND SHALL INCLUDE ALL TEST DATA FOR MATERIALS DELIVERED AND AT A MINIMUM THE TEST FREQUENCIES DESIGNATED IN THE MANUFACTURER S QUALITY ASSURANCE MANUALS AND SPECIFICATIONS AND THE PROJECT COA PLAN

2 ALL GEOSYNTHETIC MATERIALS SHALL BE LOADED TRANSPORTED OFF-LOADEE STORED AND HANDLED IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS

3 AT A MINIMUM ALL GEOSYNTHETIC MATERIALS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER S RECOMMENDATIONS AND INSTALLATION GUIDES AND IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND COA PLAN

4 THE GEOSYNTHETIC INSTALLER SHALL PROVIDE A SUBGRADE ACCEPTANCE CERTIFICATION FOR ALL AREAS OF GCL DEPLOYMENT

GEOSYNTHETIC CLAY LINER (GCL)

1 ALL GCL MATERIALS SHALL BE NEEDLE PUNCH REINFORCED

2 GCL SHALL BE DEPLOYED WITH NON-WOVEN GEOTEXTILE SIDE UP

3 ALL DEPLOYED GCL MATERIALS SHALL BE COVERED BY THE END OF EACH WORK DAY TO MINIMIZE EVAPORATION OF MOISTURE WITHIN THE BENTONITE AND TO PROTECT THE CCL MATERIALS FROM EXPOSURE TO RAINY AND SNOWY WEATHER

4 SEAMING SHALL BE IN ACCORDANCE WITH MANUFACTURER S RECOMMENDATIONS THE PROJECT SPECIFICATIONS AND THE PROJECT COA PLAN

5 GCL MATERIALS THAT ARE MANUFACTURED TO PROVIDE SELF-SEALING SEAMS AND DO NOT REQUIRE A BENTONITE BEAD SHALL RECEIVE A BENTONITE BEAD WHEN THE SELF-SEALING DESIGN IS COMPROMISED ON THE ENDS OF PANELS AND WHERE THE SELF-SEALING GROOVE (IF PART OF THE SELF-SEALING DESIGN) HAS BEEN REMOVED FROM PARTIAL WIDTH ROLLS

6 GCL MATERIALS THAT HAVE NOT BEEN MANUFACTURED TO PROVIDE SELF SEALING SEAMS SHALL RECEIVE A BENTONITE BEAD TO PROVIDE THE SEAM SEAL IN ACCORDANCE WITH MANUFACTURER S RECOMMENDATIONS

GEOMEMBRANE LINER

1 ALL GEOMEMBRANE MATERIALS SHALL BE TEXTURED ON BOTH SIDES

2 NO GEOMEMBRANE MATERIALS SHALL BE DEPLOYED IN SUB-FREEZING TEMPERATURES UNLESS APPROVED BY OWNER WITH AN APPROVED COLD WEATHER DEPLOYMENT PLAN

3 NO SEAMING SHALL BE ALLOWED IN SUB-FREEZING TEMPERATURES WITHOUT OWNER APPROVAL OF AN APPROPRIATE COLD WEATHER SEAMING PLAN AND ONLY AFTER PROPER DEMONSTRATION OF PRE-QUALIFIED TEST SEAMS

4 FIELD TESTING AND QUALITY CONTROL SHALL FOLLOW AT A MINIMUM THE REQUIREMENTS PROVIDED IN THE MOST RECENT VERSION OF THE INTERNATIONAL ASSOCIATION OF GEOSYNTHETIC INSTALLERS HDPE AND LLDPE GEOMEMBRANE INSTALLATION SPECIFICATION THE MANUFACTURERS INSTALLATION PROCEDURES AND/OR THE PROJECT SPECIFICATIONS AND COA PLAN WHICHEVER IS MOST STRINGENT

DRAINAGE COMPOSITE

1 DOUBLE-SIDED DRAINAGE COMPOSITE SHALL CONSIST OF 802 NON-WOVEN GEOTEXTILE BONDED TO BOTH SIDES OF GEONET

2 GEOMEMBRANE MATERIALS SHALL BE CLEANED OF DIRT AND DEBRIS PRIOR TO DEPLOYMENT OF DRAINAGE COMPOSITS

3 DRAINAGE COMPOSITE SHALL BE FASTENED OR SECURED WITH HEAT BONDING SEWING OR OTHER APPROVED METHOD BETWEEN GEOTEXTILE FABRIC MATERIALS ALONG THE ENTIRE LENGTH OF THE SEAMS

4 OVERLAPS OF SEAMS SHALL BE AT A MINIMUM THE DIMENSIONS RECOMMENDED BY THE MANUFACTURES

PROTECTIVE SOIL COVER

1 CARE SHALL BE EXERCISED DURING PLACEMENT OF PROTECTIVE SOIL COVER MATERIALS A MINIMUM COVER THICKNESS AS DESIGNATED IN THE PROJECT SPECIFICATIONS AND/OR THE PROJECT COA PLAN SHALL BE MAINTAINED AT ALL TIMES BETWEEN THE TIRES OR TRACKS OF EQUIPMENT AND THE UNDERLYING GEOSYNTHETIC MATERIALS

2 NO SHARP ABRUPT OR PIVOTING TURNS SHALL BE ALLOWED BY EQUIPMENT USED ABOVE THE PROTECTIVE SOIL COVER THAT MAY CAUSE SOIL DISPLACEMENT AND DAMAGE TO UNDERLYING GEOSYNTHETIC MATERIALS

3 ANY WAVES OR WRINKLES THAT BEGIN TO FORM SHALL BE TRAPPED BY PLACING SUFFICIENT PROTECTIVE SOIL COVER BEYOND THE WAVES OR WRINKLES TO HOLD THEM IN PLACE AND KEEP THEM FROM COMBINING INTO LARGER WAVES OR WRINKLES

GRAVEL ARMOR PLATING (STONE MULCH)

1 STONE MULCH SHALL BE PLACED TO A THICKNESS OF 4 INCHES ON ALL CLOSURE SURFACES MINIMUM THICKNESS SHALL BE 2 INCHES ON 10% SLOPES AND 3 INCHES ON 3H IV SLOPES

2 MINIMUM D50 SIZE FOR STONE MULCH SHALL BE 0 98 INCH AND SHALL BE VERIFIED BY TESTING

STORM DRAINAGE SYSTEM

1 ALL MANHOLES LIDS AND RINGS AND COVERS SHALL BE RATED FOR H20 LOADINGS

2 RINGS AND COVERS AND GRATED COVERS SHALL PROVIDE A MINIMUM OPENING FOR ACCESS OF 30 INCHES

3 GRATED COVERS SHALL BE USED FOR EMBANKMENT DRAINAGE DITCH INLETS

4 A 10 X ID CONCRETE APRON SHALL BE PLACED AROUND ALL MANHOLE COVERS

5 RIPRAP APRON AT CONCRETE BAFFLED OUTLETS TO EXTEND A MINIMUM DISTANCE OF 5 FEET TO BE 12 INCHES THICK AND HAVE A D_{50}=3

6 TYPE L RIPRAP AND TYPE II FILTER TO EXTEND AT A RADIUS OF 14 FEET MINIMUM FROM THE DOWNSPOUT PIPE OUTLET (WHERE BAFFLED OUTLETS ARE NOT PROVIDED) AND TO CONSIST OF THE FOLLOWING GRADATIONS

	% SMALLER BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)	MEAN ROCK DIAMETER D_{50} (INCHES)
TYPE L RIPRAP	70-100	14	
	50-70	12	
	35-50	9	9
	2-10	3	

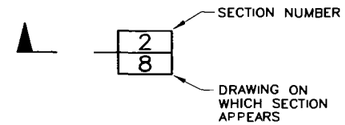
	U S STANDARD SIEVE SIZE	PERCENT PASSING BY WEIGHT
TYPE II GRANULAR FILTER	3-INCH	90-100
	3/4 INCH	35-90
	NO 4	8-30
	NO 16	0-10
	NO 200	0-3

INDEX OF DRAWINGS

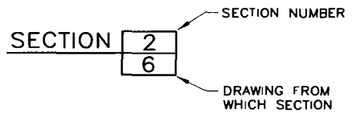
SECTION & DETAIL IDENTIFICATION

SECTION IDENTIFICATION

SECTION CUT ON DRAWING NO 6 AND SHOWN ON DRAWING NO 8
ON DRAWING NO 6 THIS SECTION IS REFERENCED AS

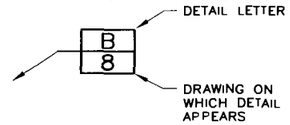


ON DRAWING NO 8 THIS SECTION IS IDENTIFIED AS

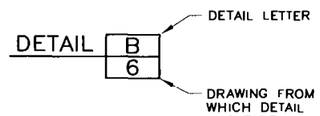


DETAIL IDENTIFICATION

DETAIL CALL-OUT ON DRAWING NO 6 AND SHOWN ON DRAWING NO 8
ON DRAWING NO 6 THIS DETAIL IS REFERENCED AS



ON DRAWING NO 8 THIS DETAIL IS IDENTIFIED AS



NOTES

1 IF SECTION AND DETAILS ARE SHOWN ON THE SAME DRAWING AS SECTION CUTS AND SECTION OR DETAIL CALL-OUTS DRAWING NUMBER IS REPLACED BY A LINE

2 DETAIL LETTERS "I" AND "O NOT USED

TABLE OF ABBREVIATIONS

●	=	AIR GAS VENT	MH	=	MANHOLE
@	=	AT	MIN	=	MINIMUM
AVG	=	AVERAGE	N	=	NORTH
C C	=	CENTER TO CENTER	N T S	=	NOT TO SCALE
℄	=	CENTER LINE	O C	=	ON CENTER
CLR	=	CLEARANCE	PC	=	POINT OF CURVE
CONT	=	CONTINUOUS	PI	=	POINT OF INTERSECTION
CPP	=	CORRUGATED POLYETHYLENE PIPE	PSI	=	POUND PER SQUARE INCH
DIA	=	DIAMETER	PT	=	POINT OF TANGENT
DWG	=	DRAWING	REINF	=	REINFORCEMENT
E	=	EAST	SDR	=	STANDARD DIMENSIONAL RATIO
EF	=	EACH FACE	SF	=	SQUARE FEET
EL	=	ELEVATION	SQ	=	SQUARE
E W	=	EACH WAY	STA	=	STATION
FL	=	FLOW LINE	TL	=	TOP OF LINER
HDPE	=	HIGH DENSITY POLYETHYLENE	T O C	=	TOP OF CONCRETE
ID	=	INSIDE DIAMETER	TYP	=	TYPICAL
MAX	=	MAXIMUM	UBC	=	UNTREATED BASE COURSE

FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - C86-C7 MOUNDING\CAD\CELL 6B\CURRENT DESIGN\G6B-2 CELL 6B INDEX_SHEET DWG
FILE DATE 12 6 2010 10 48 41 (CAH)

HANSEN ALLEN & LUCE, INC.

PROFESSIONAL ENGINEER 12/7/10 NO 15189 MARVIN E ALLEN

PROJECT ENGINEER

DESIGNED	KCS	3	
DRAFTED	CAH	2	
CHECKED	MEA	1	
DATE	DECEMBER 2010	NO	DATE

REVISIONS | BY | APVD

SCALE NOT TO SCALE

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 6B – CLOSURE
INDEX SHEET

SHEET G6B-2

64 82 100

10/07

EXISTING LANDFILL CELL X

EXISTING LANDFILL CELL Z

EXISTING LANDFILL CELL 5

4242 080 MW 36

4242 170 MW 57

4245 410 MW 74

4244 980 MW 73

4243 730 MW 72

4242 740 MW 71

N

0 50 100

SCALE IN FEET

3 1 TO 1 5 1 BREAKLINE EL 4275 00 (TYP)

3 1

1 5 1

N 1 084 99
W 1 479 49
EL 4293 73

N 1 076 00
W 1 217 50
EL 4296 72

N 1 087 75
W 875 00
EL 4292 81

N 1 076 00
W 532 50
EL 4296 72

N 1 084 99
W 270 51
EL 4293 73

S=1 14%

S=10 00%

S=0 80%

N 893 50
W 1 288 00
EL 4314 41

N 893 50
W 462 00
EL 4314 41

N 893 50
W 1 472 92
EL 4295 92

N 893 50
W 1 217 50
EL 4314 97

N 893 50
W 875 00
EL 4312 23

N 893 50
W 532 50
EL 4314 97

N 893 50
W 277 08
EL 4295 92

N 711 00
W 1 217 50
EL 4296 72

N 711 00
W 532 50
EL 4296 72

N 702 01
W 1 479 49
EL 4293 73

N 702 01
W 270 51
EL 4293 73

N 699 25
W 875 00
EL 4292 81

WASTE GRADE PERIMETER BREAKLINE (TYP)

TOP OF LANDFILL CELL PROTECTIVE SOIL COVER (TYP)

TOE OF WASTE MOUND (TYP)

EXISTING TOP OF EMBANKMENT (TYP)

EXISTING LEACHATE WITHDRAWL PIPE AND SUPPORTS (TYP)

EXISTING MONITORING WELL (TYP)

4246 550 MW-67

4245 820 MW-68

4245 360 MW-69

4245 540 MW-70

FILE NAME PROJECTS\064 – CLEAN HARBORS\82 100 – CURRENT – C6B–C7 MOUNDING\CAD\CELL 6B\CURRENT DESIGN\C6B–1 CELL 6B CLOSURE _ WASTE GRADE PLAN DWG
FILE DATE 12 6 2010 10 49 27 (CAH)

PROFESSIONAL ENGINEER NO 15189 MARVIN E ALLEN STATE OF IDAHO

HANSEN ALLEN & LUCE

DESIGNED KCS	3						
DRAFTED CAH	2						
CHECKED MEA	1						
PROJECT ENGINEER	NO	DATE	REVISIONS		BY	APVD	
DATE DECEMBER 2010							

SCALE AS SHOWN

Clean Harbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 6B – CLOSURE
WASTE GRADE PLAN

SHEET C6B–1

64 82 100

10/07

EXISTING LANDFILL CELL X

EXISTING LANDFILL CELL Z

EXISTING LANDFILL CELL 5

4242 980 MW 36

4242 170 MW 57

4245 410 MW 74

4244 980 MW 73

4243 730 MW 72

4242 740 MW 71

N

0 50 100

SCALE IN FEET

N 1 165 50
W 1 560 00
EL 4269 00

N 1 165 50
W 190 00
EL 4269 00

N 1 091 75
W 1 486 25
EL 4293 50

N 1 082 89
W 1 217 50
EL 4296 54

N 1 094 63
W 875 00
EL 4292 62

N 1 082 89
W 532 50
EL 4296 54

N 1 091 75
W 263 75
EL 4293 50

N 893 50
W 1 479 80
EL 4295 73

N 893 50
W 1 217 50
EL 4315 48

N 893 50
W 875 00
EL 4312 74

N 893 50
W 532 50
EL 4315 48

N 893 50
W 462 00
EL 4314 91

N 893 50
W 270 20
EL 4295 73

N 695 25
W 1 486 25
EL 4293 50

N 704 11
W 1 217 50
EL 4296 54

N 692 37
W 875 00
EL 4292 62

N 704 11
W 532 50
EL 4296 54

N 695 25
W 263 75
EL 4293 50

N 621 50
W 1 560 00
EL 4269 00

N 621 50
W 190 00
EL 4269 00

3 1

S=1 14%

S=0 80%

S=10 00%

LINER SURFACE TOP PERIMETER BREAKLINE (TYP)

TOE OF LINER SURFACE

EXISTING TOP OF EMBANKMENT

EXISTING LEACHATE WITHDRAWL PIPE AND SUPPORTS (TYP)

4246 550 MW-67

4245 820 MW-68

4245 360 MW-69

4245 540 MW-70

EXISTING MONITORING WELL (TYP)

PROFESSIONAL ENGINEER
12/7/10
NO 151898
MARVIN E. ALLEN
STATE OF NEVADA

HARDESTY ALLEN & DICE

PROJECT ENGINEER

DESIGNED	KCS	3			
DRAFTED	CAH	2			
CHECKED	MEA	1			
DATE	DECEMBER 2010	NO	DATE	REVISIONS	BY APVD

SCALE AS SHOWN

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 6B – CLOSURE
LINER SURFACE PLAN

SHEET C6B–2

64 82 100

FILE NAME PROJECTS\064 – CLEAN HARBORS\82 100 – CURRENT – C6B–C7 MOUNDING\CAD\CELL 6B\CURRENT DESIGN\C6B–2 CELL 6B CLOSURE _ LINER SURFACE PLAN DWG
FILE DATE 12 6 2010 10 50 15 (CAH)

10/07

EXISTING LANDFILL CELL X

EXISTING LANDFILL CELL Z

EXISTING LANDFILL CELL 5

4242 080 MW 38

4242 170 MW 57

4242 740 MW 71

4243 730 MW 72

4244 980 MW 73

4245 410 MW 74

N

0 50 100 SCALE IN FEET

N 1 172 88
W 1 567 38
EL 4269 00

N 1 172 88
W 182 62
EL 4269 00

N 1 080 79
W 1 475 29
FL EL 4297 03

N 1 071 95
W 1 217 05
FL EL 4299 98

N 1 083 69
W 875 00
FL EL 4296 06

N 1 071 95
W 532 50
FL EL 4299 98

N 1 080 79
W 274 71
FL EL 4297 03

N 893 50
W 1 288 00
EL 4317 26

N 893 50
W 462 00
EL 4317 26

N 893 50
W 1 468 87
FL EL 4299 17

N 893 50
W 1 217 50
EL 4317 82

N 893 50
W 875 00
EL 4315 08

N 893 50
W 532 50
EL 4317 82

N 893 50
W 281 13
FL EL 4299 17

N 706 21
W 1 475 29
FL EL 4297 03

N 715 05
W 1 217 50
FL EL 4299 98

N 703 31
W 875 00
FL EL 4296 06

N 715 05
W 532 50
FL EL 4299 98

N 706 21
W 274 71
FL EL 4297 03

N 614 12
W 1 567 38
EL 4269 00

N 614 12
W 182 62
EL 4269 00

3 1

S=1 14%

S=10 00%

S=0 80%

2 C6B-4

1 C6B-4

PERIMETER DITCH FLOW LINE (TYP)

TOP OF PERIMETER BERM (TYP)

MANHOLE (TYP)

EXISTING LEACHATE WITHDRAWL PIPE AND SUPPORTS (TYP)

TOE OF GRAVEL ARMOR PLATING (TYP)

EXISTING TOP OF EMBANKMENT

DRAINAGE PATTERNS FOR DITCHES ON TOP OF CELL EMBANKMENTS (TYP)

DRAINAGE PIPE (TYP)

NOTE
PROVIDE V-TYPE DRAINAGE DITCHES ON TOP OF CELL EMBANKMENTS TO DIRECT STORM WATER FROM 3H 1V PERIMETER SLOPES TO MANHOLES

4246 550 MW-67

4245 820 MW-68

4245 360 MW-69

4245 540 MW-70

EXISTING MONITORING WELL (TYP)

FILE NAME PROJECTS\064 – CLEAN HARBORS\82 100 – CURRENT – C6B-C7 MOUNDING\CAD\CELL 6B\CURRENT DESIGN\C6B-3 CELL 6B CLOSURE – FINAL CLOSURE PLAN DWG
FILE DATE 12 8 2010 10 51 02 (CAH)

PROFESSIONAL ENGINEER 12/7/10 NO 15188 WAYNE ALLEN STATE OF NEVADA

HANSEN ALLEN & LUCE, INC.

PROJECT ENGINEER

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED MEA	1					
DATE DECEMBER 2010	NO	DATE	REVISIONS	BY	APVD	

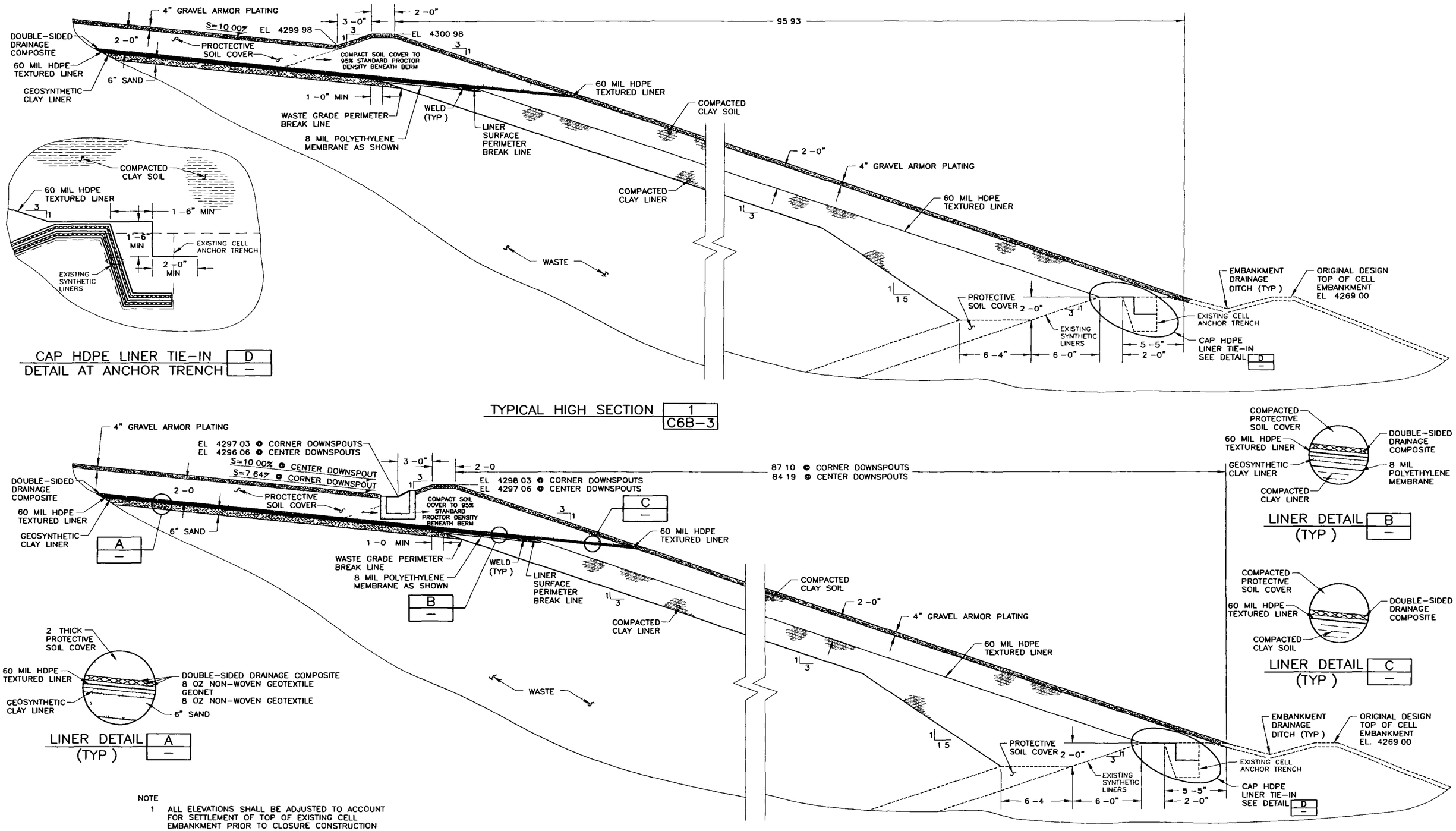
SCALE AS SHOWN

Clean Harbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 6B – CLOSURE
FINAL CLOSURE PLAN

SHEET C6B-3

64 82 100



CAP HDPE LINER TIE-IN DETAIL AT ANCHOR TRENCH — D —

TYPICAL HIGH SECTION 1 / C6B-3

LINER DETAIL (TYP) — A —

LINER DETAIL (TYP) — B —

LINER DETAIL (TYP) — C —

NOTE
1 ALL ELEVATIONS SHALL BE ADJUSTED TO ACCOUNT FOR SETTLEMENT OF TOP OF EXISTING CELL EMBANKMENT PRIOR TO CLOSURE CONSTRUCTION

TYPICAL LOW SECTION 2 / C6B-3

FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - CB6-C7 MOUNDING\CAD\CELL 6B\CURRENT DESIGN\C6B-4 CELL 6B TYP HIGH LOW SECTIONS DWG
FILE DATE 12 6 2010 10 52 12 (CAH)

HOLMSER ALLEN & LOCKE

PROFESSIONAL ENGINEER 12/7/10 NO 15188 MARVIN E. ALLEN

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED MEA	1					
PROJECT ENGINEER	DATE DECEMBER 2010	NO	DATE	REVISIONS	BY	APVD

SCALE NOT TO SCALE

CleanHarbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 6B – CLOSURE
TYPICAL HIGH-LOW SECTIONS

SHEET C6B-4
64 82 100

10/07

CleanHarbors®
ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY

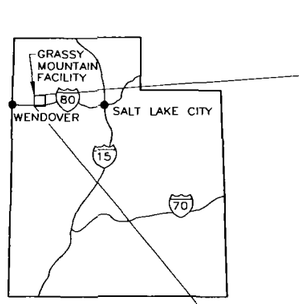
LANDFILL CELL 7 CLOSURE

MODIFIED DESIGN

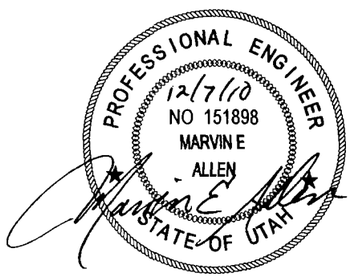
DECEMBER 2010

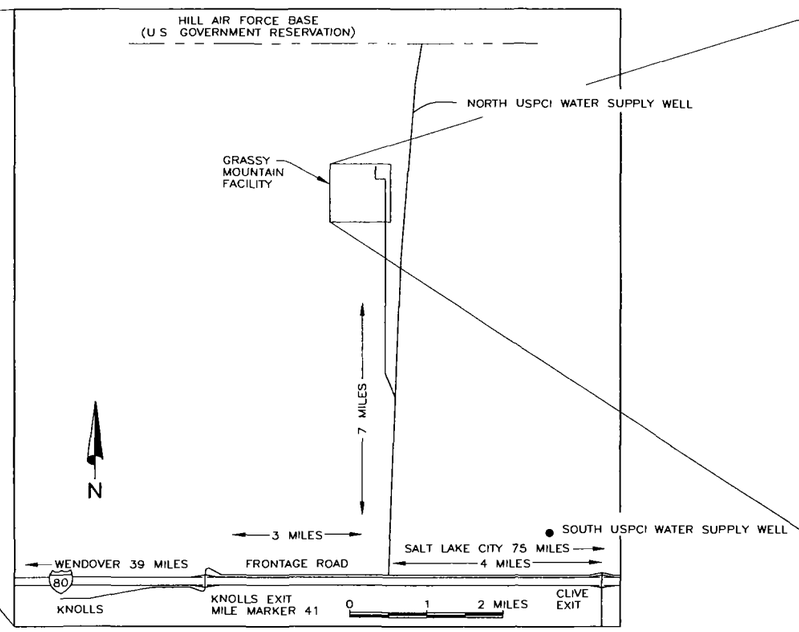
FACILITY LOCATION
KNOLLS, UTAH
Phone (435) 884-8900

REGIONAL HEADQUARTERS
42 LONGWATER DRIVE
NORWELL, MA 02061
Phone (781) 792-5000

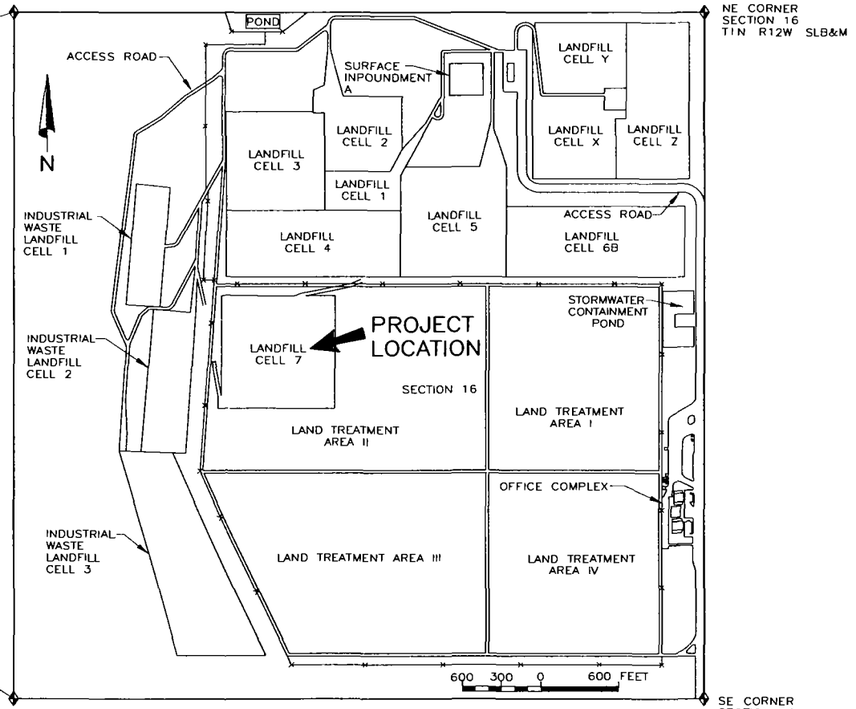


STATE OF UTAH





VICINITY MAP



PROJECT LOCATION

HANSEN ALLEN & LUCE, Inc.
CONSULTANTS
ENGINEERS
Salt Lake City
Utah

FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - CB6-C7 MOUNDING\CAD\CELL 7\CURRENT DESIGN\87-41 CELL 7 COVER DWG
FILE DATE 12 6 2010 10 56 30 (CAH)

7/95

GENERAL NOTES

1 COORDINATES AND ELEVATIONS PROVIDED ARE BASED ON SITE SPECIFIC COORDINATE SYSTEM AND DATUM CONTROL

2 ALL ELEVATIONS PROVIDED ARE BASED ON ORIGINAL EMBANKMENT DESIGN AND CONSTRUCTION ELEVATIONS ADJUSTMENTS SHALL BE MADE PRIOR TO CLOSURE TO ACCOUNT FOR SETTLEMENT

LINING SYSTEM SUBGRADES & SOIL FILL

1 ALL SURFACES PROVIDING SUBGRADES FOR LINING SYSTEMS SHALL BE PROOF ROLLED FOR SOFT AND/OR YIELDING SURFACES SOFT AND/OR YIELDING SURFACES SHALL BE COMPACTED TO PROVIDE A FIRM SUBGRADE FOR LINING SYSTEMS

2 ALL CLAY LINER MATERIALS SHALL BE COMPACTED TO 95% OF ASTM D-698 AT A MOISTURE CONTENT BETWEEN MINUS 2% AND PLUS 4% OF OPTIMUM ALL CLAY LINER SHALL MEET THE REQUIRED PERMEABILITY OF 1 X 10-7 CM/SEC A DEFLOCCULATING AGENT (SODIUM-TRIPOLY PHOSPHATE) MIXED WITH THE CLAY LINER AT A MINIMUM RATE OF 3 5 POUNDS PER 50 CUBIC FEET OF LOOSE MATERIAL IS TYPICALLY REQUIRED TO MEET THE REQUIRED PERMEABILITY CLAY LINER SURFACES SHALL BE MAINTAINED UNTIL PLACEMENT OF OVERLYING GEOSYNTHETIC MATERIALS

3 ALL FILL MATERIALS REQUIRING COMPACTION ON THE PERIMETER SIDESLOPES PIPE BACKFILL AND OTHER DESIGNATED COMPACTION AREAS SHALL BE COMPACTED TO 95% OF ASTM D-698 AT A MOISTURE REQUIRED TO FACILITATE COMPACTION

4 THE SUB-GRADE FOR THE GEOSYNTHETIC MATERIALS SHALL BE FREE OF PROTRUDING ROCKS AND DEBRIS THAT MAY POTENTIALLY CAUSE DAMAGE TO THE GEOSYNTHETIC MATERIALS THE SUBGRADE SHALL ALSO BE ROLLED WITH A SMOOTH DRUM ROLLER TO LEAVE THE SURFACE SMOOTH

5 BORROW SOURCES FOR 6-INCH THICK SAND AND 2-FOOT THICK PROCTECTIVE SOIL COVER LAYERS TO BE APPROVED BASED ON THE FOLLOWING TESTS USING LIQUID OBTAINED FROM SYNTHETIC LEACHATE PRODUCED USING BORROW SOURCE SOILS 1 SCREENING CLAY PORTION OF GEOSYNTHETIC CLAY LINER FOR CHEMICAL COMPATIBILITY TO LIQUIDS (ASTX D6141) 2 SWELL INDEX (ASTM D5890) 3 FLUID LOSS TESTING (ASTM D5891) AND 4 HYDRAULIC CONDUCTIVITY (ASTM D6766 OR ASTM D5084) AS REQUIRED BY THE ENGINEER BASED ON RESULTS OF OTHER TESTING MAXIMUM HYDRAULIC CONDUCTIVITY OF GCL SHALL MEET AN EQUIVALENCY OF A 2-FOOT THICK COMPACTED CLAY LINER WITH A HYDRAULIC CONDUCTIVITY OF 1X10-7 CM/SEC

6 COMPACTED CLAY SOIL ON THE PERIMETER SLOPES HAS NO PERMEABILITY REQUIREMENT AND SHALL BE COMPACTED TO 95% OF ASDM D-698

GENERAL GEOSYNTHETICS

1 MANUFACTURER S CERTIFICATIONS SHALL BE PROVIDED FOR ALL RAW AND MANUFACTURED MATERIALS CERTIFICATIONS SHALL BE IN ACCORDANCE WITH THE MANUFACTURER S MATERIAL SPECIFICATIONS AND PROJECT COA PLAN CRITERIA AND SHALL INCLUDE ALL TEST DATA FOR MATERIALS DELIVERED AND AT A MINIMUM THE TEST FREQUENCIES DESIGNATED IN THE MANUFACTURER S QUAUTY ASSURANCE MANUALS AND SPECIFICATIONS AND THE PROJECT COA PLAN

2 ALL GEOSYNTHETIC MATERIALS SHALL BE LOADED TRANSPORTED OFF-LOADED STORED AND HANDLED IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS

3 AT A MINIMUM ALL GEOSYNTHETIC MATERIALS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURER S RECOMMENDATIONS AND INSTALLATION GUIDES AND IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND COA PLAN

4 THE GEOSYNTHETIC INSTALLER SHALL PROVIDE A SUBGRADE ACCEPTANCE CERTIFICATION FOR ALL AREAS OF GCL DEPLOYMENT

GEOSYNTHETIC CLAY LINER (GCL)

1 ALL GCL MATERIALS SHALL BE NEEDLE PUNCH REINFORCED

2 GCL SHALL BE DEPLOYED WITH NON-WOVEN GEOTEXTILE SIDE UP

3 ALL DEPLOYED GCL MATERIALS SHALL BE COVERED BY THE END OF EACH WORK DAY TO MINIMIZE EVAPORATION OF MOISTURE WITHIN THE BENTONITE AND TO PROTECT THE GCL MATERIALS FROM EXPOSURE TO RAINY AND SNOWY WEATHER

4 SEAMING SHALL BE IN ACCORDANCE WITH MANUFACTURER S RECOMMENDATIONS THE PROJECT SPECIFICATIONS AND THE PROJECT COA PLAN

5 GCL MATERIALS THAT ARE MANUFACTURED TO PROVIDE SELF-SEALING SEAMS AND DO NOT REQUIRE A BENTONITE BEAD SHALL RECEIVE A BENTONITE BEAD WHEN THE SELF-SEALING DESIGN IS COMPROMISED ON THE ENDS OF PANELS AND WHERE THE SELF-SEALING GROOVE (IF PART OF THE SELF-SEAUNG DESIGN) HAS BEEN REMOVED FROM PARTIAL WIDTH ROLLS

6 GCL MATERIALS THAT HAVE NOT BEEN MANUFACTURED TO PROVIDE SELF SEALING SEAMS SHALL RECEIVE A BENTONITE BEAD TO PROVIDE THE SEAM SEAL IN ACCORDANCE WITH MANUFACTURER S RECOMMENDATIONS

GEOMEMBRANE LINER

1 ALL GEOMEMBRANE MATERIALS SHALL BE TEXTURED ON BOTH SIDES

2 NO GEOMEMBRANE MATERIALS SHALL BE DEPLOYED IN SUB-FREEZING TEMPERATURES UNLESS APPROVED BY OWNER WITH AN APPROVED COLD WEATHER DEPLOYMENT PLAN

3 NO SEAMING SHALL BE ALLOWED IN SUB-FREEZING TEMPERATURES WITHOUT OWNER APPROVAL OF AN APPROPRIATE COLD WEATHER SEAMING PLAN AND ONLY AFTER PROPER DEMONSTRATION OF PRE-QUALIFIED TEST SEAMS

4 FIELD TESTING AND QUALITY CONTROL SHALL FOLLOW AT A MINIMUM THE REQUIREMENTS PROVIDED IN THE MOST RECENT VERSION OF THE INTERNATIONAL ASSOCIATION OF GEOSYNTHETIC INSTALLERS HDPE AND LLDPE GEOMEMBRANE INSTALLATION SPECIFICATION THE MANUFACTURERS INSTALLATION PROCEDURES AND/OR THE PROJECT SPECIFICATIONS AND CQA PLAN WHICHEVER IS MOST STRINGENT

DRAINAGE COMPOSITE

1 DOUBLE-SIDED DRAINAGE COMPOSITE SHALL CONSIST OF 8OZ NON-WOVEN GEOTEXTILE BONDED TO BOTH SIDES OF GEONET

2 GEOMEMBRANE MATERIALS SHALL BE CLEANED OF DIRT AND DEBRIS PRIOR TO DEPLOYMENT OF DRAINAGE COMPOSITS

3 DRAINAGE COMPOSITE SHALL BE FASTENED OR SECURED WITH HEAT BONDING SEWING OR OTHER APPROVED METHOD BETWEEN GEOTEXTILE FABRIC MATERIALS ALONG THE ENTIRE LENGTH OF THE SEAMS

4 OVERLAPS OF SEAMS SHALL BE AT A MINIMUM THE DIMENSIONS RECOMMENDED BY THE MANUFACTURES

PROTECTIVE SOIL COVER

1 CARE SHALL BE EXERCISED DURING PLACEMENT OF PROTECTIVE SOIL COVER MATERIALS A MINIMUM COVER THICKNESS AS DESIGNATED IN THE PROJECT SPECIFICATIONS AND/OR THE PROJECT CQA PLAN SHALL BE MAINTAINED AT ALL TIMES BETWEEN THE TIRES OR TRACKS OF EQUIPMENT AND THE UNDERLYING GEOSYNTHETIC MATERIALS

2 NO SHARP ABRUPT OR PIVOTING TURNS SHALL BE ALLOWED BY EQUIPMENT USED ABOVE THE PROTECTIVE SOIL COVER THAT MAY CAUSE SOIL DISPLACEMENT AND DAMAGE TO UNDERLYING GEOSYNTHETIC MATERIALS

3 ANY WAVES OR WRINKLES THAT BEGIN TO FORM SHALL BE TRAPPED BY PLACING SUFFICIENT PROTECTIVE SOIL COVER BEYOND THE WAVES OR WRINKLES TO HOLD THEM IN PLACE AND KEEP THEM FROM COMBINING INTO LARGER WAVES OR WRINKLES

GRAVEL ARMOR PLATING (STONE MULCH)

1 STONE MULCH SHALL BE PLACED TO A THICKNESS OF 4 INCHES ON ALL CLOSURE SURFACES MINIMUM THICKNESS SHALL BE 2 INCHES ON 10% SLOPES AND 3 INCHES ON 3H IV SLOPES

2 MINIMUM 050 SIZE FOR STONE MULCH SHALL BE 0 98 INCH AND SHALL BE VERIFIED BY TESTING

STORM DRAINAGE SYSTEM

1 ALL MANHOLES LIDS AND RINGS AND COVERS SHALL BE RATED FOR H20 LOADINGS

2 RINGS AND COVERS AND GRATED COVERS SHALL PROVIDE A MINIMUM OPENING FOR ACCESS OF 30 INCHES

3 GRATED COVERS SHALL BE USED FOR EMBANKMENT DRAINAGE DITCH INLETS

4 A 10 X 10 CONCRETE APRON SHALL BE PLACED AROUND ALL MANHOLE COVERS

5 RIPRAP APRON AT CONCRETE BAFFLED OUTLETS TO EXTEND A MINIMUM DISTANCE OF 5 FEET TO BE 12 INCHES THICK AND HAVE A D_{50}=3

6 TYPE L RIPRAP AND TYPE II FILTER TO EXTEND AT A RADIUS OF 14 FEET MINIMUM FROM THE DOWNSPOUT PIPE OUTLET (WHERE BAFFLED OUTLETS ARE NOT PROVIDED) AND TO CONSIST OF THE FOLLOWING GRADATIONS

	% SMALLER BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)	MEAN ROCK DIAMETER D_{50} (INCHES)
TYPE L RIPRAP	70-100	14	
	50-70	12	
	35-50	9	9
	2-10	3	

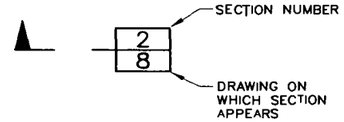
	U S STANDARD SIEVE SIZE	PERCENT PASSING BY WEIGHT
TYPE II GRANULAR FILTER	3-INCH	90-100
	3/4 INCH	35-90
	NO 4	8-30
	NO 16	0-10
	NO 200	0-3

INDEX OF DRAWINGS

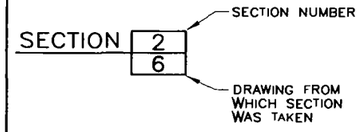
SECTION & DETAIL IDENTIFICATION

SECTION IDENTIFICATION

SECTION CUT ON DRAWING NO 6 ANO SHOWN ON DRAWING NO 8 ON DRAWING NO 6 THIS SECTION IS REFERENCED AS

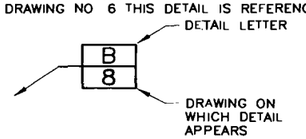


ON DRAWING NO 8 THIS SECTION IS IDENTIFIED AS

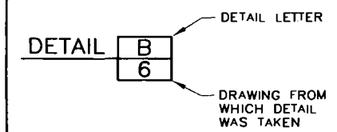


DETAIL IDENTIFICATION

DETAIL CALL-OUT ON DRAWING NO 6 AND SHOWN ON DRAWING NO 8 ON DRAWING NO 6 THIS DETAIL IS REFERENCED AS



ON DRAWING NO 8 THIS DETAIL IS IDENTIFIED AS



NOTES

1 IF SECTION AND DETAILS ARE SHOWN ON THE SAME DRAWING AS SECTION CUTS AND SECTION OR DETAIL CALL-OUTS DRAWING NUMBER IS REPLACED BY A LINE

2 DETAIL LETTERS I" AND "O" NOT USED

TABLE OF ABBREVIATIONS

●	=	AIR GAS VENT	MH	=	MANHOLE
@	=	AT	MIN	=	MINIMUM
AVG	=	AVERAGE	N	=	NORTH
C C	=	CENTER TO CENTER	N T S	=	NOT TO SCALE
℄	=	CENTER LINE	O C	=	ON CENTER
CLR	=	CLEARANCE	PC	=	POINT OF CURVE
CONT	=	CONTINUOUS	PI	=	POINT OF INTERSECTION
CPP	=	CORRUGATED POLYETHYLENE PIPE	PSI	=	POUND PER SQUARE INCH
DIA.	=	DIAMETER	PT	=	POINT OF TANGENT
DWG	=	DRAWING	REINF	=	REINFORCEMENT
E	=	EAST	SDR	=	STANDARD DIMENSIONAL RATIO
EF	=	EACH FACE	SF	=	SQUARE FEET
EL	=	ELEVATION	SQ	=	SQUARE
E W	=	EACH WAY	STA.	=	STATION
FL	=	FLOW LINE	TL	=	TOP OF LINER
HDPE	=	HIGH DENSITY POLYETHYLENE	T O C	=	TOP OF CONCRETE
ID	=	INSIDE DIAMETER	TYP	=	TYPICAL
MAX	=	MAXIMUM	UBC	=	UNTREATED BASE COURSE

PROFESSIONAL ENGINEER 12/4/10 NO 15686 MARVIN E. ALLEN STATE OF FLORIDA

HANSEN ALLEN & LUCE

PROJECT ENGINEER

DESIGNED KCS	3				
DRAFTED CAH	2				
CHECKED MEA	1				
DATE DECEMBER 2010	NO	DATE	REVISIONS	BY	APVD

SCALE NOT TO SCALE

CleanHarbors ENVIRONMENTAL SERVICES, INC.

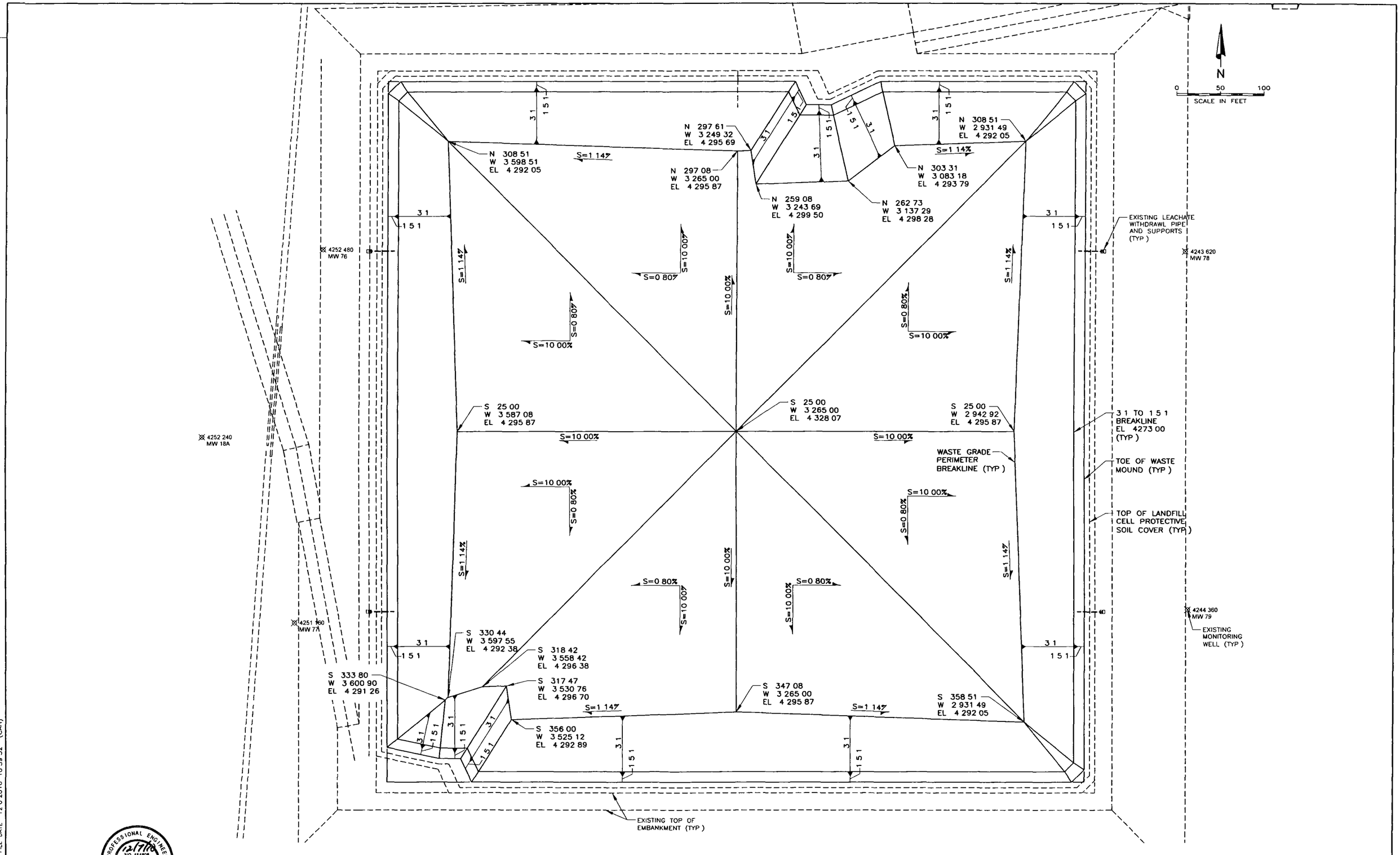
GRASSY MOUNTAIN FACILITY
LANDFILL CELL 7 – CLOSURE
INDEX SHEET

SHEET G7-2

64 82 100

FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - CB6-C7 MOUNDING\CAD\CELL 7\CURRENT DESIGN\G7-2 CELL 7 INDEX_SHEET DWG
FILE DATE 12 6 2010 10 58 12 (CAH)

10/07



FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - C86-C7 MOUNDING\CAD\CELL 7\CURRENT DESIGN\C7-1 CELL 7 CLOSURE - WASTE GRADE PLAN DWG
FILE DATE 12/6/2010 10:59:32 (CAH)

HARTSER ALLEN & DOYLE	PROJECT ENGINEER	DESIGNED KCS	3					SCALE AS SHOWN	CleanHarbors ENVIRONMENTAL SERVICES, INC.	GRASSY MOUNTAIN FACILITY LANDFILL CELL 7 – CLOSURE WASTE GRADE PLAN	SHEET C7–1
		DRAFTED CAH	2								64 82 100
		CHECKED MEA	1								
		DATE DECEMBER 2010	NO	DATE	REVISIONS	BY	APVD				

PROFESSIONAL ENGINEER NO 15198 MARVIN E. ALLEN STATE OF NEVADA

10/07

N 390 00
W 3 680 00
EL 4267 00

N 390 00
W 2 850 00
EL 4267 00

N

0 50 100
SCALE IN FEET

N 315 13
W 3 605 13
EL 4291 84

N 303 96
W 3 265 00
EL 4295 68

N 315 13
W 2 924 87
EL 4291 84

3 1

S=1 14%

S=0 80%

S=10 00%

EXISTING LEACHATE WITHDRAWL PIPE AND SUPPORTS (TYP)

4252 480
MW 76

4243 620
MW 78

S 25 00
W 3 593 96
EL 4295 68

S 25 00
W 3 265 00
EL 4328 58

S 25 00
W 2 936 04
EL 4295 68

LINER SURFACE TOP PERIMETER BREAKLINE (TYP)

TOE OF LINER SURFACE

4252 240
MW 18A

4251 160
MW 77

4244 360
MW 79

EXISTING MONITORING WELL (TYP)

S 365 13
W 3 605 13
EL 4291 84

S 353 96
W 3 265 00
EL 4295 68

S 365 13
W 2 924 87
EL 4291 84

S 440 00
W 3 680 00
EL 4267 00

S 440 00
W 2 850 00
EL 4267 00

EXISTING TOP OF EMBANKMENT (TYP)

FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - C85-C7 MOUNDING\CAD\CELL 7\CURRENT DESIGN\C7-2 CELL 7 CLOSURE - LINER SURFACE PLAN DWG
FILE DATE 12 2 2010 11 01 03 (CAH)

PROFESSIONAL ENGINEER
12/7/10
NO 15169
MARVIN E ALLEN
STATE OF NEVADA

HARDESTY ALLEN & LUCE

PROJECT ENGINEER

DESIGNED	KCS	3			
DRAFTED	CAH	2			
CHECKED	MEA	1			
DATE	DECEMBER 2010	NO	DATE	REVISIONS	BY APVD

SCALE
AS SHOWN

CleanHarbors
ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 7 – CLOSURE
LINER SURFACE PLAN

SHEET
C7-2
64 82 100

N 397 38
W 3 687 38
EL 4267 00

N 397 38
W 2 842 62
EL 4267 00

N
0 50 100
SCALE IN FEET

N 304 31
W 3 594 31
FL EL 4295 36

N 293 02
W 3 265 00
FL EL 4299 12

N 304 31
W 2 935 69
FL EL 4295 36

3 1

S=1 14%

S=10 00%

S=0 80%

EXISTING LEACHATE WITHDRAWL PIPE AND SUPPORTS (TYP)

4252 480
MW 76

4243 620
MW 78

4252 240
MW 18A

4251 760
MW 77A

4244 360
MW 79

EXISTING MONITORING WELL (TYP)

S 25 00
W 3 583 02
FL EL 4299 12

S 25 00
W 3 265 00
EL 4330 92

S 25 00
W 2 946 98
FL EL 4299 12

TOE OF GRAVEL ARMOR PLATING (TYP)

TOP OF PERIMETER BERM (TYP)

PERIMETER DITCH FLOW LINE (TYP)

EXISTING TOP OF EMBANKMENT (TYP)

S 354 31
W 3 594 31
FL. EL 4295 36

S 343 02
W 3 265 00
FL EL 4299 12

S 354 31
W 2 935 69
FL EL. 4295 36

2
C7-4

1
C7-4

S 447 38
W 3 687 38
EL 4267 00

S 447 38
W 2 842 62
EL 4267 00

MANHOLE (TYP)

DRAINAGE PIPE (TYP)

DRAINAGE PATTERNS FOR DITCHES ON TOP OF CELL EMBANKMENTS (TYP)

NOTE
PROVIDE V-TYPE DRAINAGE DITCHES ON TOP OF CELL EMBANKMENTS TO DIRECT STORM WATER FROM 3H IV PERIMETER SLOPES TO MANHOLES

PROFESSIONAL ENGINEER NO 15198 MARVIN E ALLEN STATE OF WYOMING

HARTMAN ALLEN & LOCKE	DESIGNED KCS	3					
	DRAFTED CAH	2					
	CHECKED MEA	1					
	PROJECT ENGINEER	DATE DECEMBER 2010	NO	DATE	REVISIONS	BY	APVD

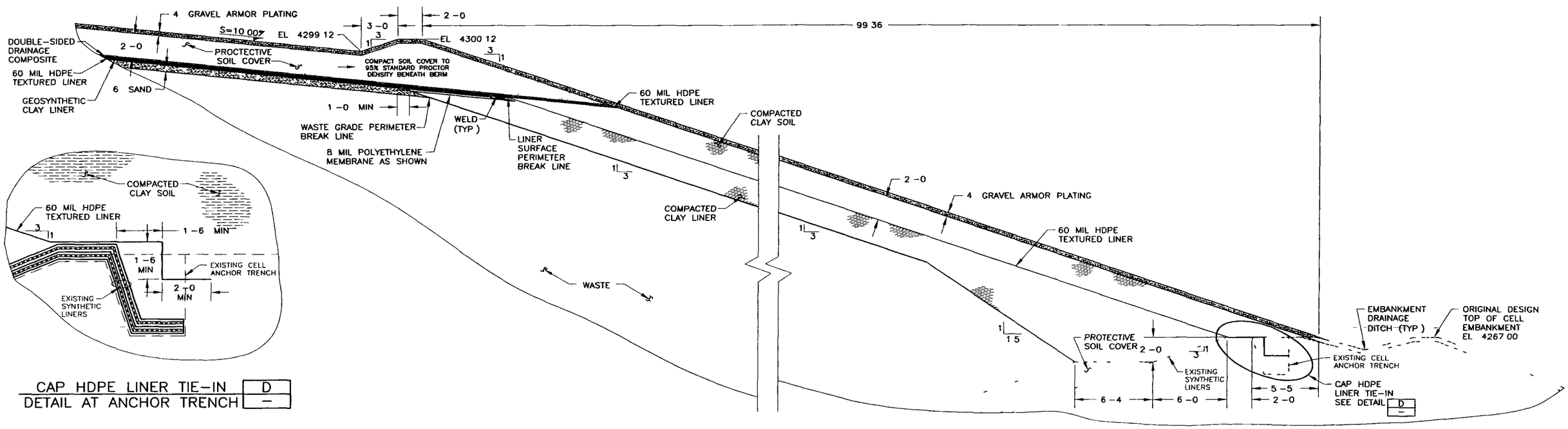
SCALE AS SHOWN

Clean Harbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 7 – CLOSURE
FINAL CLOUSURE PLAN

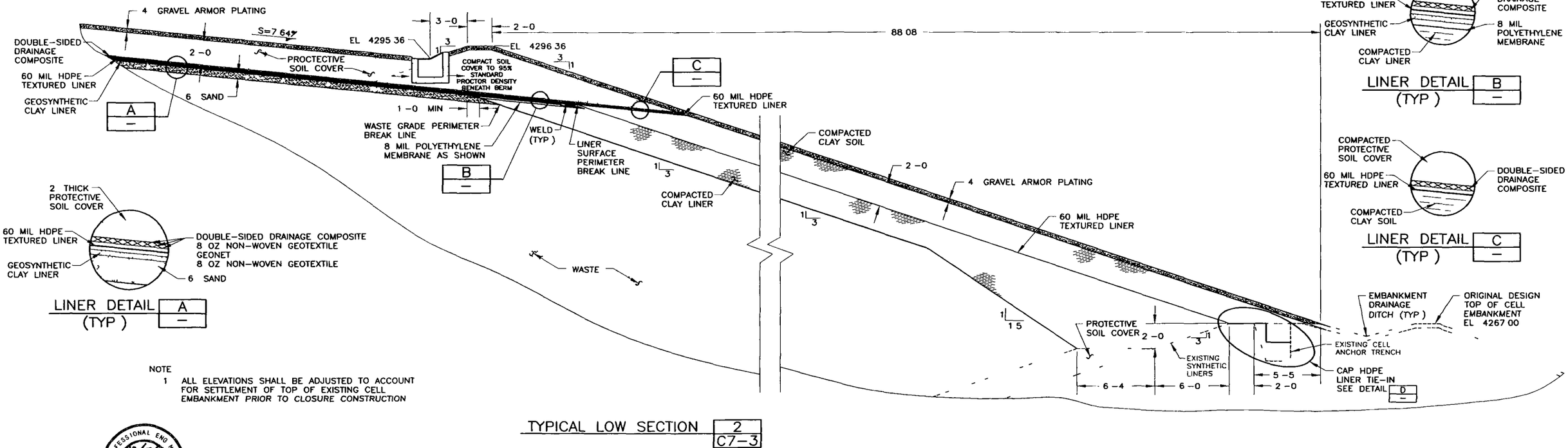
SHEET C7-3

64 82 100



CAP HDPE LINER TIE-IN DETAIL AT ANCHOR TRENCH | D —

TYPICAL HIGH SECTION | 1 | C7-3



LINER DETAIL (TYP) | A —

LINER DETAIL (TYP) | B —

LINER DETAIL (TYP) | C —

NOTE
1 ALL ELEVATIONS SHALL BE ADJUSTED TO ACCOUNT FOR SETTLEMENT OF TOP OF EXISTING CELL EMBANKMENT PRIOR TO CLOSURE CONSTRUCTION

TYPICAL LOW SECTION | 2 | C7-3

FILE NAME PROJECTS\064 - CLEAN HARBORS\82 100 - CURRENT - CB6-C7 MOUNDING\CAD\CELL 7\CURRENT DESIGN\C7-4 CELL 7 TYP HIGH LOW SECTIONS DWG
FILE DATE 12 6 2010 11 03 55 (CAH)

HANSEN ALLEN & LUCE, Inc.

PROFESSIONAL ENGINEER 12/7/10 NO 15168 MARVIN E. ALLEN STATE OF UTAH

PROJECT ENGINEER

DESIGNED KCS	3					
DRAFTED CAH	2					
CHECKED MEA	1					
DATE DECEMBER 2010	NO	DATE	REVISIONS	BY	APVD	

SCALE NOT TO SCALE

Clean Harbors ENVIRONMENTAL SERVICES, INC.

GRASSY MOUNTAIN FACILITY
LANDFILL CELL 7 – CLOSURE
TYPICAL HIGH–LOW SECTIONS

SHEET C7-4

64 82 100