A-2

Volume Calculations for SCA Final Cover Design

(Same as submitted and approved as part of the SCA Final Cover Design Report 2015 Construction [Parsons and Beech and Bonaparte 2015], except for an addendum that has been included as an update.)

Beech and Bonaparte
engineering p.c.

an affiliate of Geosyntec Consultants

CALCULATION PACKAGE COVER SHEET

Client: Honeywell **Project:** Onondaga Lake SCA Final Cover Design **Project/Proposal #:** GD5497

TITLE OF COMPUTATIONS **VOLUME CALCULATIONS FOR SCA FINAL COVER DESIGN**

COMPUTATIONS BY:	Signature		02/06/15
	Printed Name and Title	Ray Wu Staff Engineer	DATE
ASSUMPTIONS AND PROCEDURES CHECKED BY:	Signature		02/06/15
	Printed Name and Title	Sowmya Bulusu., P.E. Project Engineer	DATE
COMPUTATIONS CHECKED BY:	Signature		02/06/15
	Printed Name and Title	Sowmya Bulusu, P.E. Project Engineer	DATE
COMPUTATIONS BACKCHECKED BY:	Signature		02/06/15
	Printed Name and Title	Ray Wu Staff Engineer	DATE
APPROVED BY:	Signature		04/10/15
	Printed Name and Title	Jay Beech, Ph.D., P.E. Principal	DATE

STATE OF NEW YORK · JOHN F. BEECH · No. 066337 · LICENSED PROFESSIONAL ENGINEER

APPROVAL NOTES:

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Written by:	**Ray Wu**	Date:	**02/06/2015**	Reviewed by:	**Sowmya Bulusu / Jay Beech**	Date:	**02/06/2015**
Client:	**Honeywell**	Project:	**Onondaga Lake SCA Final Cover Design**	Project/ Proposal No.:	**GD5497**	Task No.:	**03**

VOLUME CALCULATIONS FOR SCA FINAL COVER DESIGN

INTRODUCTION

This package was prepared in support of the final cover design for the Sediment Consolidation Area (SCA). The primary goal of this package is to present preliminary material volume calculations for the proposed SCA final cover.

PROPOSED SCA FINAL COVER DESIGN

The existing SCA is approximately 50 acres and includes a perimeter berm, composite liner system, and geotextile tubes. The SCA final cover will be placed on top of the geotextile tubes and consists of the following layers, as shown in Figures 1A and 1B:

- Leveling layer consisting of soil fill, with variable thickness as needed to establish design grades;
- Linear low-density polyethylene (LLDPE) geomembrane;
- Geocomposite drainage layer (used only on the side slopes of the main deck);
- 18-inch thick protective soil layer; and
- 6-inch thick vegetative soil layer.

Volume calculations were performed to estimate the fill material needed for the leveling layer, protective soil layer, and vegetative soil layer.

METHODOLOGY

The volume calculations presented in this package were computed using the proposed SCA grading plans and AutoCAD® Civil 3D® 2014 [Autodesk, 2014]. AutoCAD® creates 3-D surfaces (Triangular Irregular Network surfaces) based on the contours on the grading plans and uses these surfaces to calculate the volume and thickness of each layer. The thicknesses are then graphed as isopachs, which are contours connecting points of equal thickness.

The filling of geotextile tubes was completed in early November 2014, and a detailed topographic survey of the SCA was taken on 7 December 2014. The topographic survey provides information on the configuration of geotextile tubes and delineation of the SCA sumps, berms, and

debris management area (DMA). The volume calculations for the leveling layer and final cover system are based on the surveyed top of geotextile tube elevations. Settlement due to the filled geotextile tubes between the date of the survey and beginning of construction of the leveling layer was not considered for the volume calculations presented in this package.

It is assumed that the construction of the final cover system (including the leveling layer) will occur over greater than one year. Therefore, the leveling layer grading was assumed to occur at two instances: (i) an initial leveling layer on the top of the geotextile tube surface to create a minimum 1% slope, and (ii) an additional leveling layer on top of the post-settlement surface of the initial leveling layer to achieve bottom of final cover design grades. Settlement of the initial leveling layer has been calculated and the estimated post-settlement surface of the initial leveling layer is presented in the Settlement Package. It is noted that the nodes used for the settlement calculations were located based on the needs of settlement calculations, which may lead to irregularly shaped contours, and these contours shall be considered approximate.

The final cover system (protective and vegetative soil layers) was assumed to be placed immediately after the placement of the additional leveling layer. Therefore, settlement due to the additional leveling layer and the components of the final cover layer were not considered for the volume calculations presented in this package.

Given these assumptions required to estimate the surfaces and isopachs shown herein, the calculated volumes presented in this package should be treated as general approximations.

CALCULATIONS

The surveyed top of geotextile tubes and design grading plans for the top of initial leveling layer, top of additional leveling layer, top of protective soil layer, and top of final cover (i.e., top of vegetative soil layer) are provided in Attachment A. Figures A1 through A5 were prepared for purposes of calculating required material volumes based on the aforementioned assumptions; therefore, additional settlement from placement of the additional leveling layer and final cover materials has not been accounted for in these figures.

Isopachs of the initial leveling layer thickness (difference between Figures A2 and A1), the additional leveling layer thickness (difference between Figures A3 and A2), the protective soil layer thickness (difference between Figures A4 and A3), and the vegetative soil layer thickness (difference between Figures A5 and A4) are shown in Figures 2, 3, 4, and 5, respectively.

RESULTS

The approximate calculated soil volumes for the leveling layer (initial and additional), protective soil, and vegetative soil are shown in Table 1. The average total leveling layer (initial and additional) thickness was calculated to be approximately 4.7 ft (i.e., 320,000 cubic yards plus 56,000 cubic yards over a plan area of 50 acres). It should be noted that because of the detailed information from the topographic survey, the initial leveling layer thickness and volume includes the volume needed to fill the gaps between adjacent geotextile tubes and at the corners of four geotextile tubes, the DMA, and the zones between the boundary of geotextile tubes and the SCA berm.

The initial leveling layer volume also includes the 6-ft of gravel needed to fill the sump areas, as shown on the Contract Drawings. It is recommended that the east and west sump areas be loaded with leveling layer soil at the beginning of the construction season for settlement purposes. At the end of the construction season, the filled sump areas shall be regraded with additional soil as needed to provide smooth grades that tie to the surrounding leveling layer. The initial leveling layer volume includes the fill needed for the east and west sump areas, but does not include the volume needed to regrade the sump areas after settlement. The additional volume for regrading the sump areas after settlement is approximately 3,000 to 8,000 cubic yards. As mentioned in the Methodology section of this calculation package, the volume calculations should be treated as general approximations.

REFERENCES

Autodesk, Inc. (Autodesk). "AutoCAD® Civil 3D® 2014", 2014.

Tables

Table 1: Calculated Soil Volumes

Soil Type	Volume (cy)
Initial Leveling Layer[1,2]	320,000
Additional Leveling Soil[3] (after accounting for settlement due to placement of the initial leveling layer)	56,000
Protective Soil	122,000
Vegetative Soil	41,000

Notes:

1. The initial leveling layer soil volume includes the volume necessary to fill the gaps between adjacent geotextile tubes and the corners of four geotextile tubes, the DMA, and the zones between the boundary of geotextile tubes and the SCA perimeter berm.
2. The initial leveling layer soil volume also includes the volume necessary to fill the sump areas with 6 ft of gravel, as shown on the Contract Drawings. This volume does not include the volume necessary to regrade the sump areas after settlement. The additional volume for regrading the sump areas after settlement is approximately 3,000 to 8,000 cy.
3. The additional leveling soil is the net volume of fill (i.e., fill volume minus cut volume) required to regrade the post-settlement initial leveling layer to achieve bottom of final cover design grades.

Figures

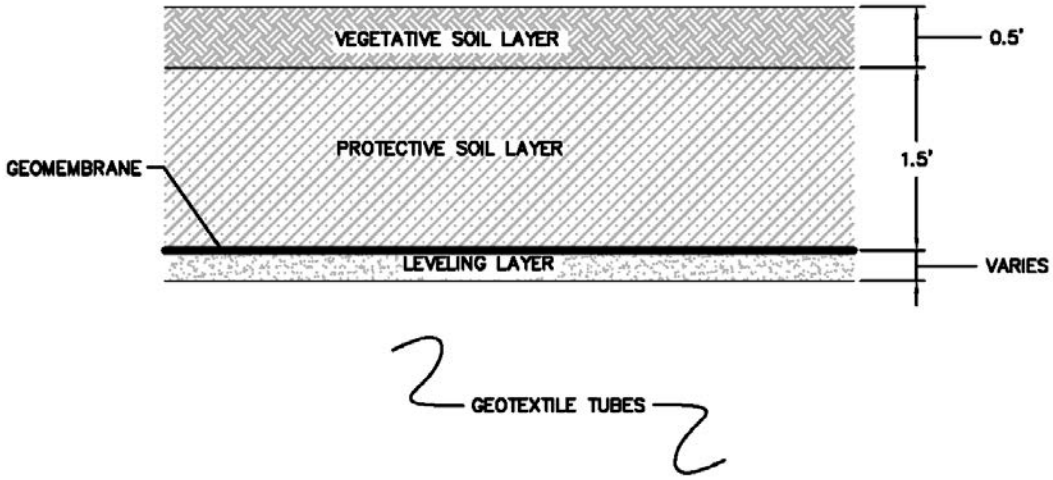

Figure 1A: Proposed Final Cover Detail (1% slopes on the Top Deck and Main Deck and Top Deck Side Slopes)

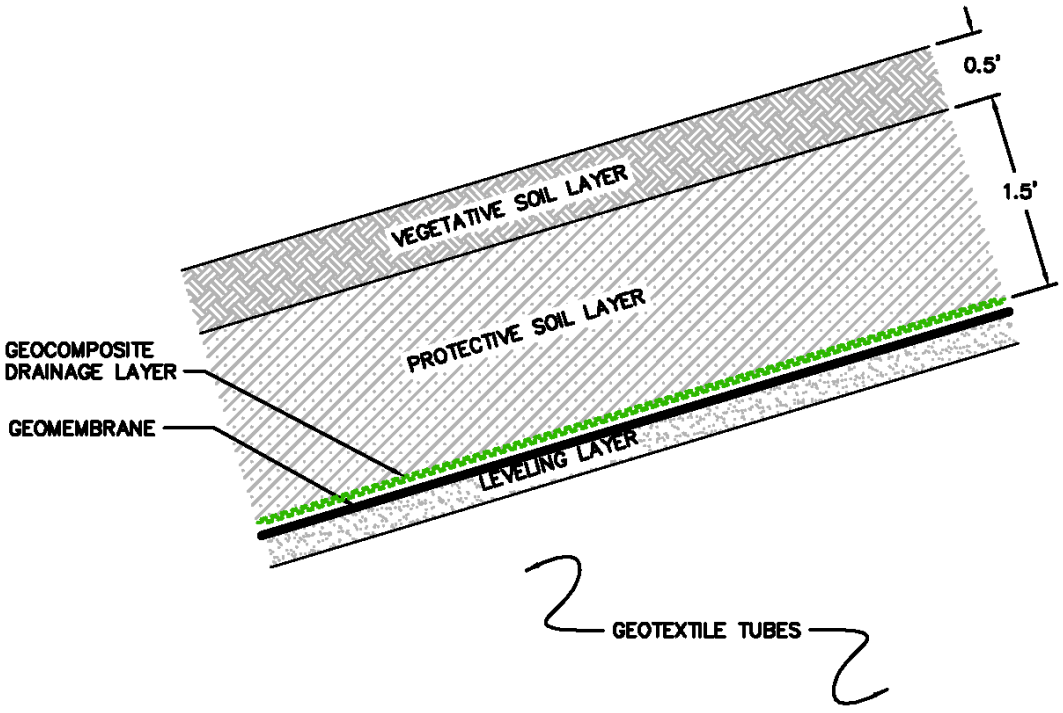

Figure 1B: Proposed Final Cover Detail (Main Deck Side Slopes)

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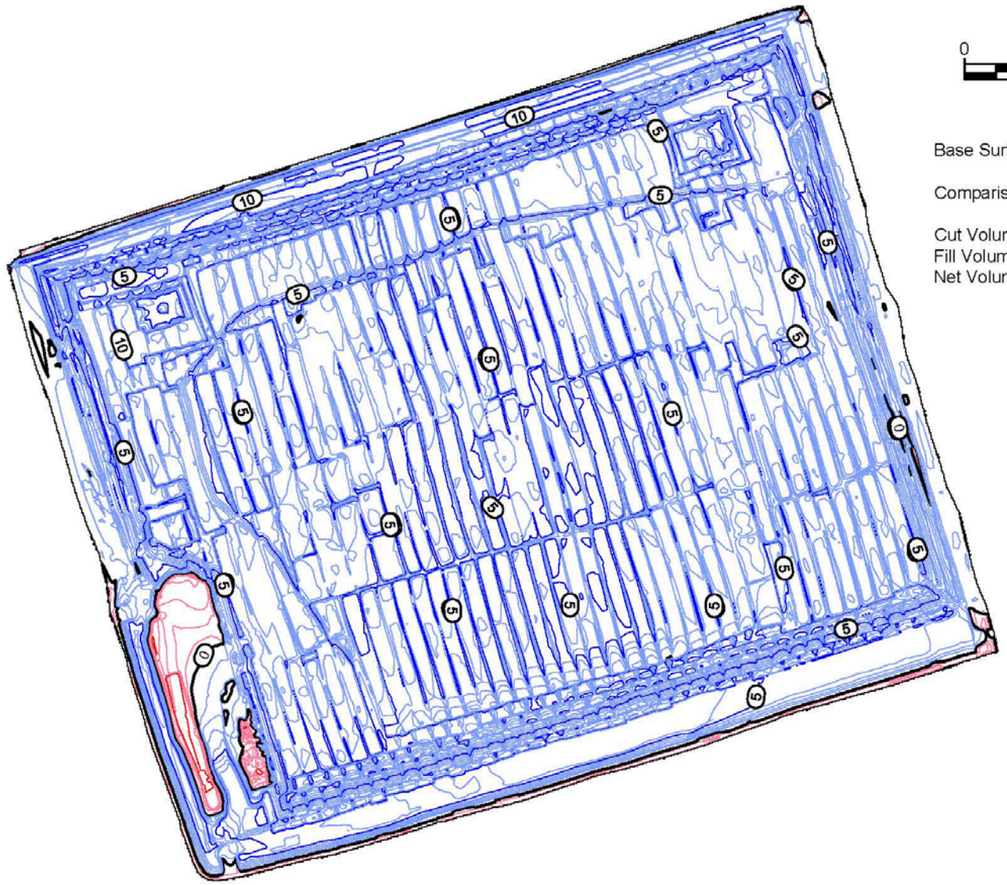

Base Surface: TOP OF FINAL GEOTEXTILE TUBES LAYER (DECEMBER 7, 2014 SURVEY)
Comparison Surface: TOP OF INITIAL LEVELING LAYER (PRE-SETTLEMENT)
Cut Volume (unadjusted): 5,539.17 cu. yd.
Fill Volume (unadjusted): 324,945.25 cu. yd.
Net Volume (unadjusted): 319,406.08 cu. yd. <Fill>

Figure 2: Isopach of Initial Leveling Layer Thickness

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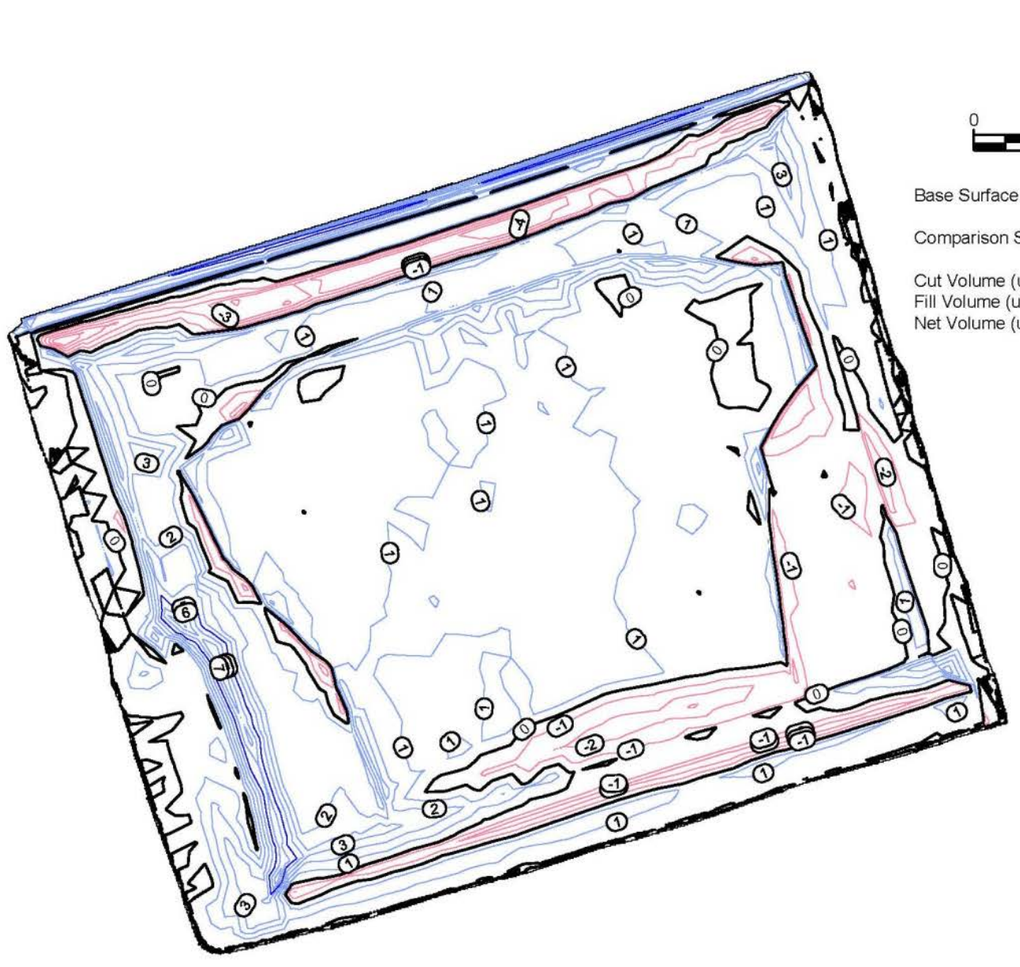

Figure 3: Isopach of Additional Leveling Layer Thickness

Note: The additional leveling layer is used to achieve the bottom of final cover design grades after accounting for settlement due to the placement of the initial leveling layer.

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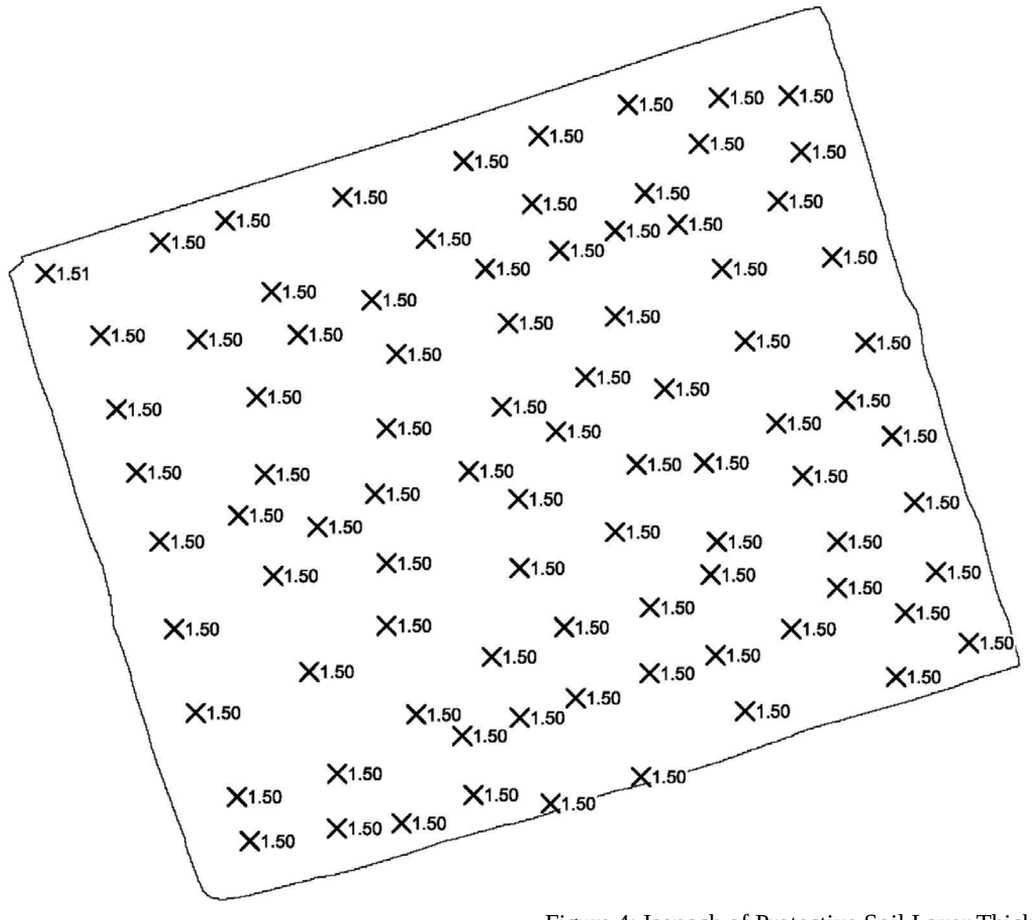

Figure 4: Isopach of Protective Soil Layer Thickness

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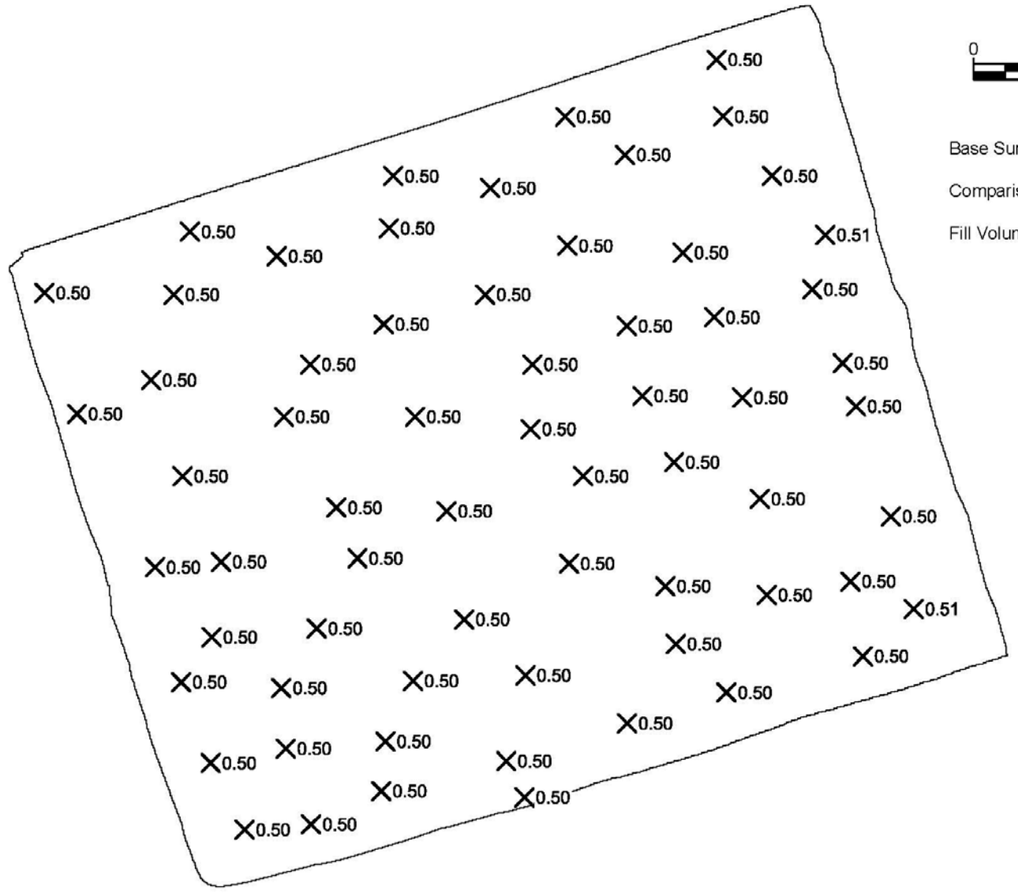

Figure 5: Isopach of Vegetative Soil Layer Thickness

Attachment A: Design Grading Plans

Written by: **Ray Wu** Date: **02/06/2015** Reviewed by: **Sowmya Bulusu / Jay Beech** Date: **02/06/2015**

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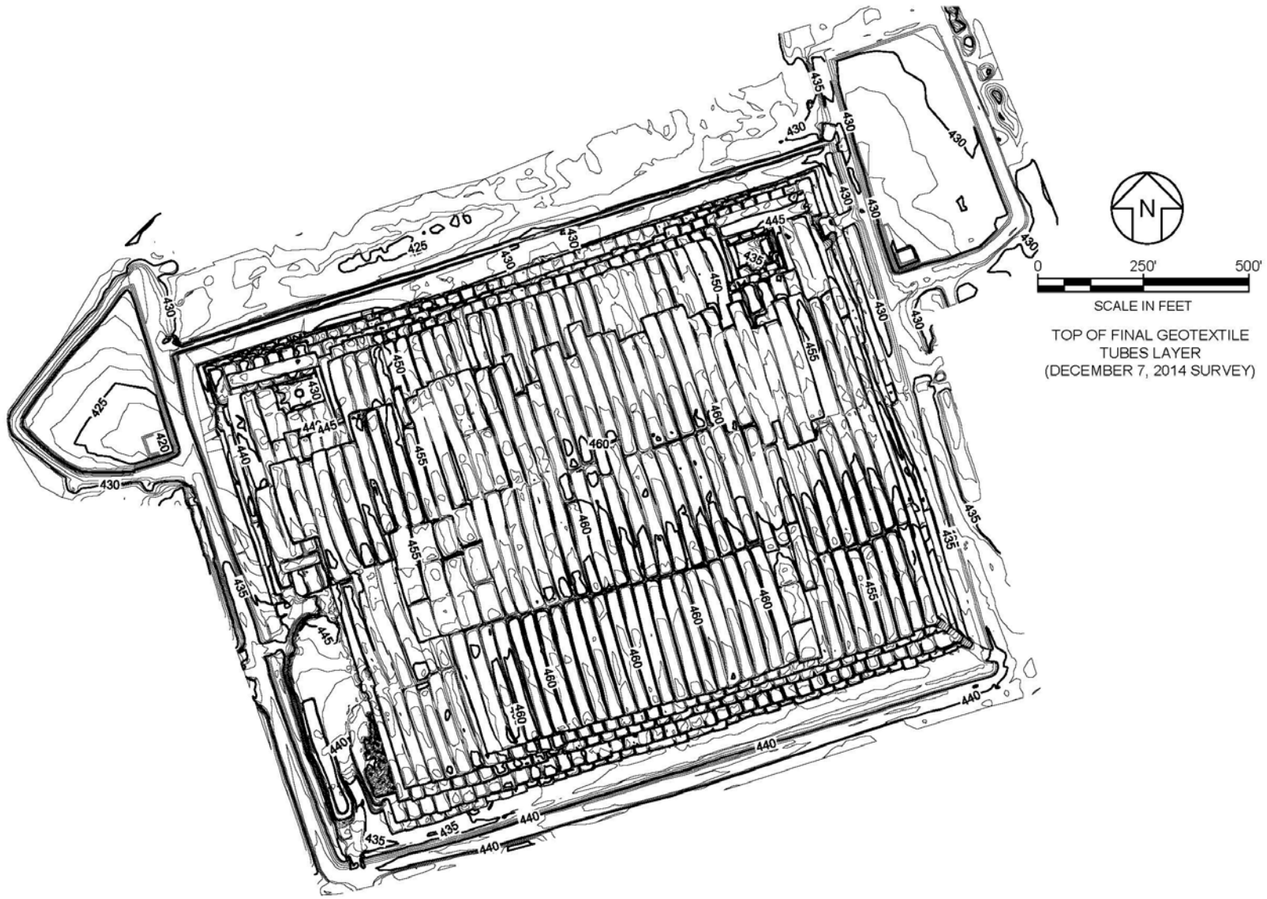

Figure A1: Top of Final Layer of Geotextile Tubes from Topographic Survey of SCA conducted 7 December 2014

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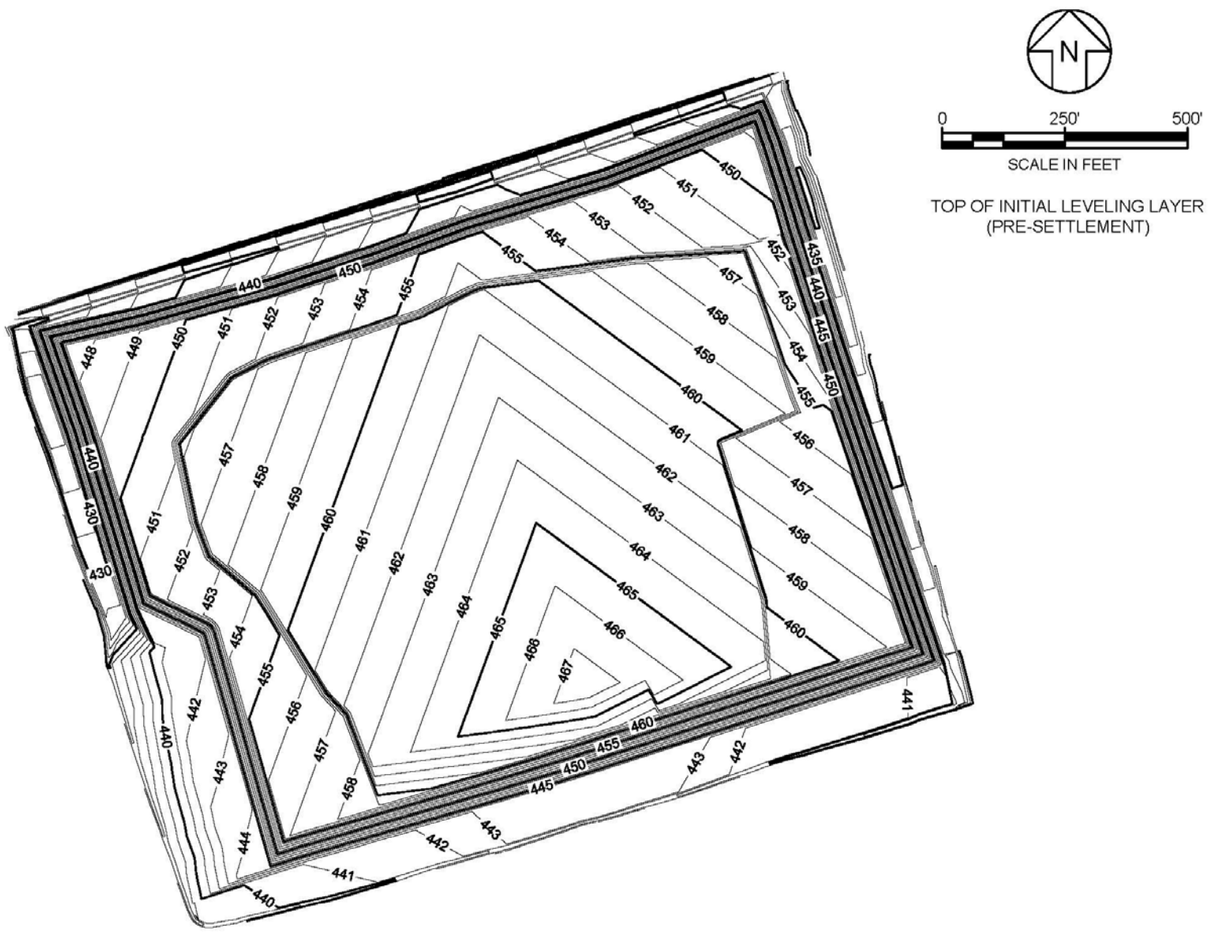

Figure A2: Top of Initial Leveling Layer

Note: This grading plan was prepared for the purpose of calculating the required soil volumes to construct the SCA Final Cover, and additional settlement from placement of the leveling layer and final cover materials has not been accounted for in this figure.

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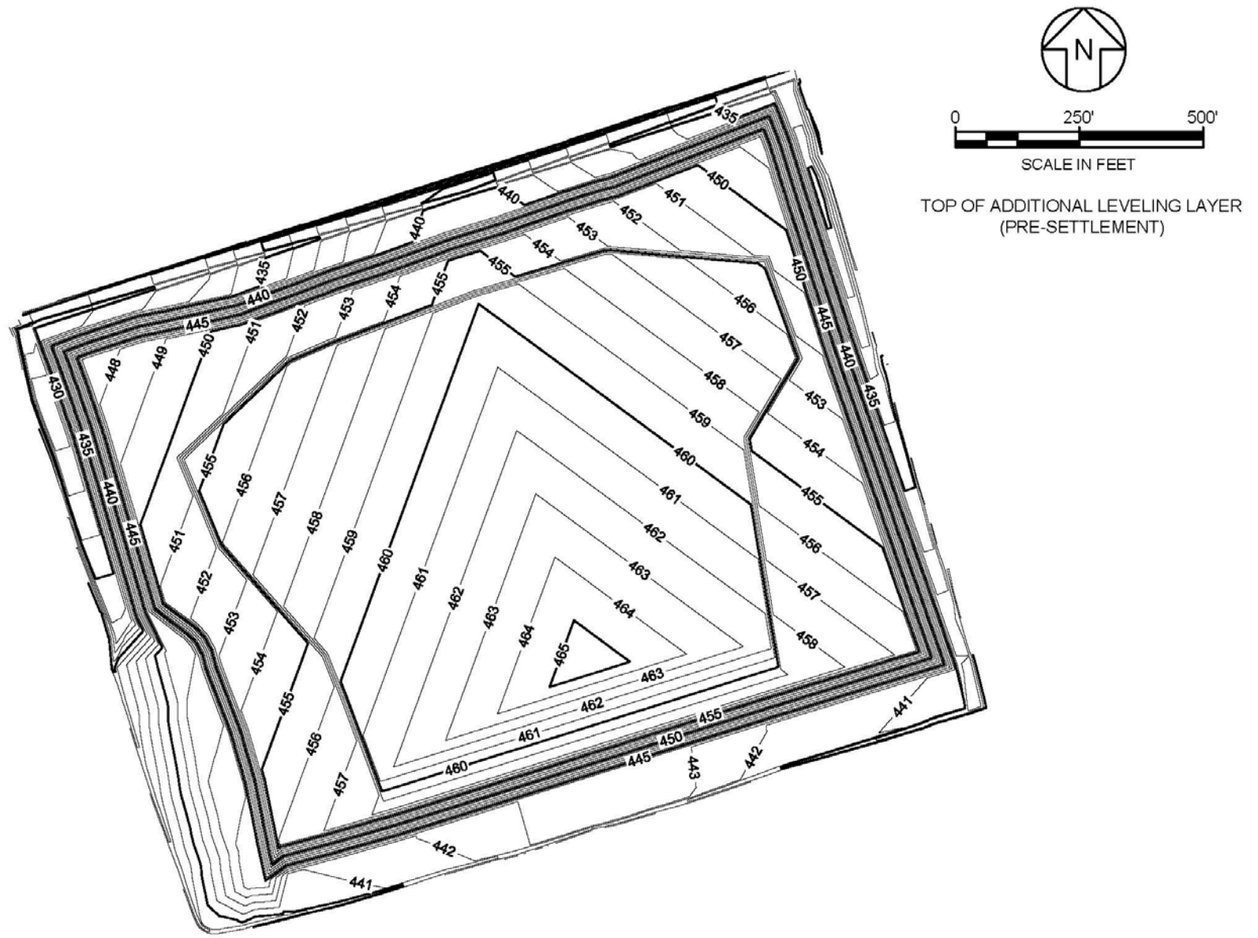

Figure A3: Top of Additional Leveling Layer (to achieve bottom of final cover design grades)

Note: This grading plan was prepared for the purpose of calculating the required soil volumes to construct the SCA Final Cover, and additional settlement from placement of the leveling layer and final cover materials has not been accounted for in this figure.

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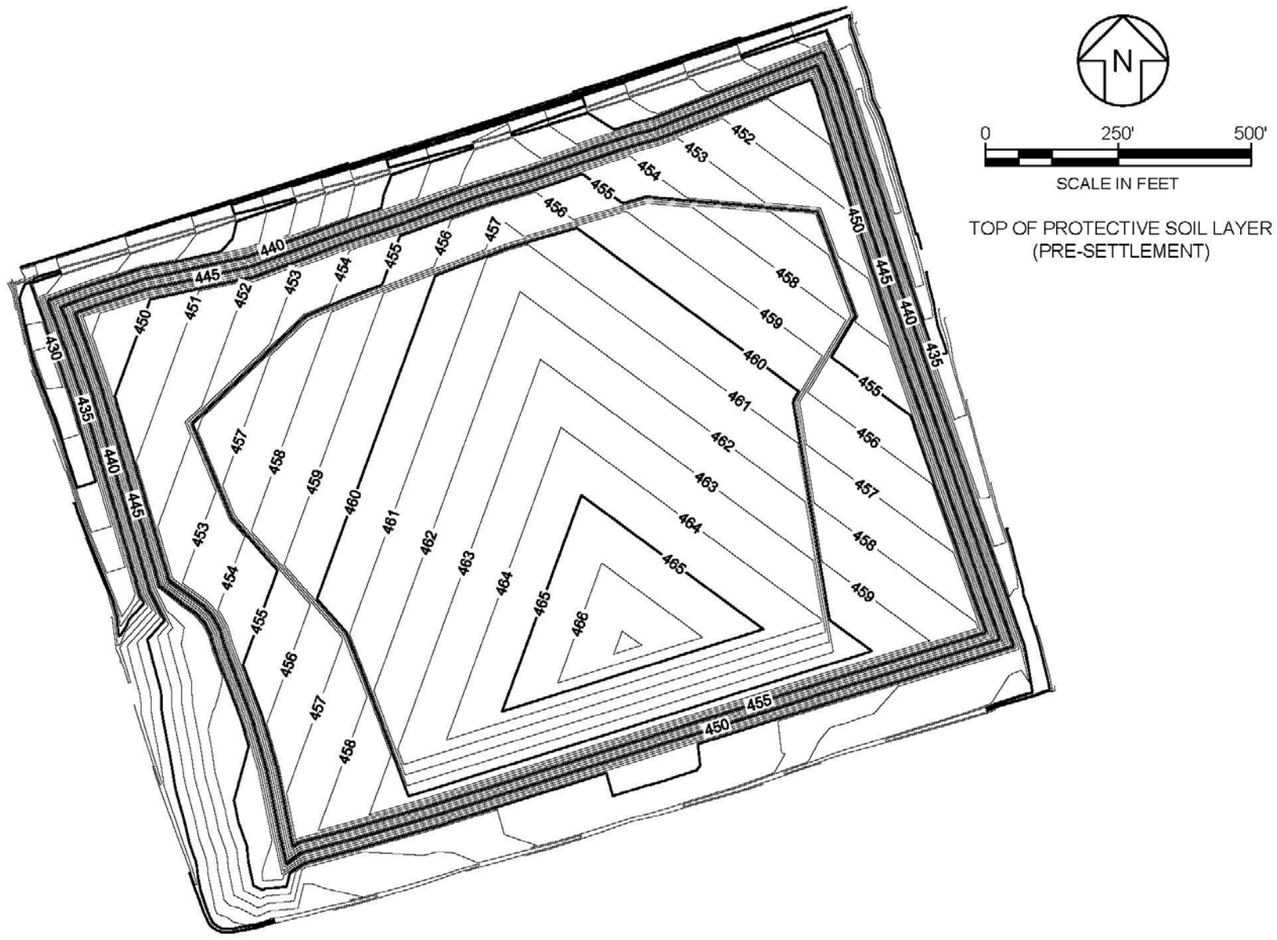

Figure A4: Top of Protective Soil Layer

Note: This grading plan was prepared for the purpose of calculating the required soil volumes to construct the SCA Final Cover. The grades shown were prepared using the top of additional leveling layer grading plan. Additional settlement from placement of the leveling layer and final cover materials has not been accounted for in this figure.

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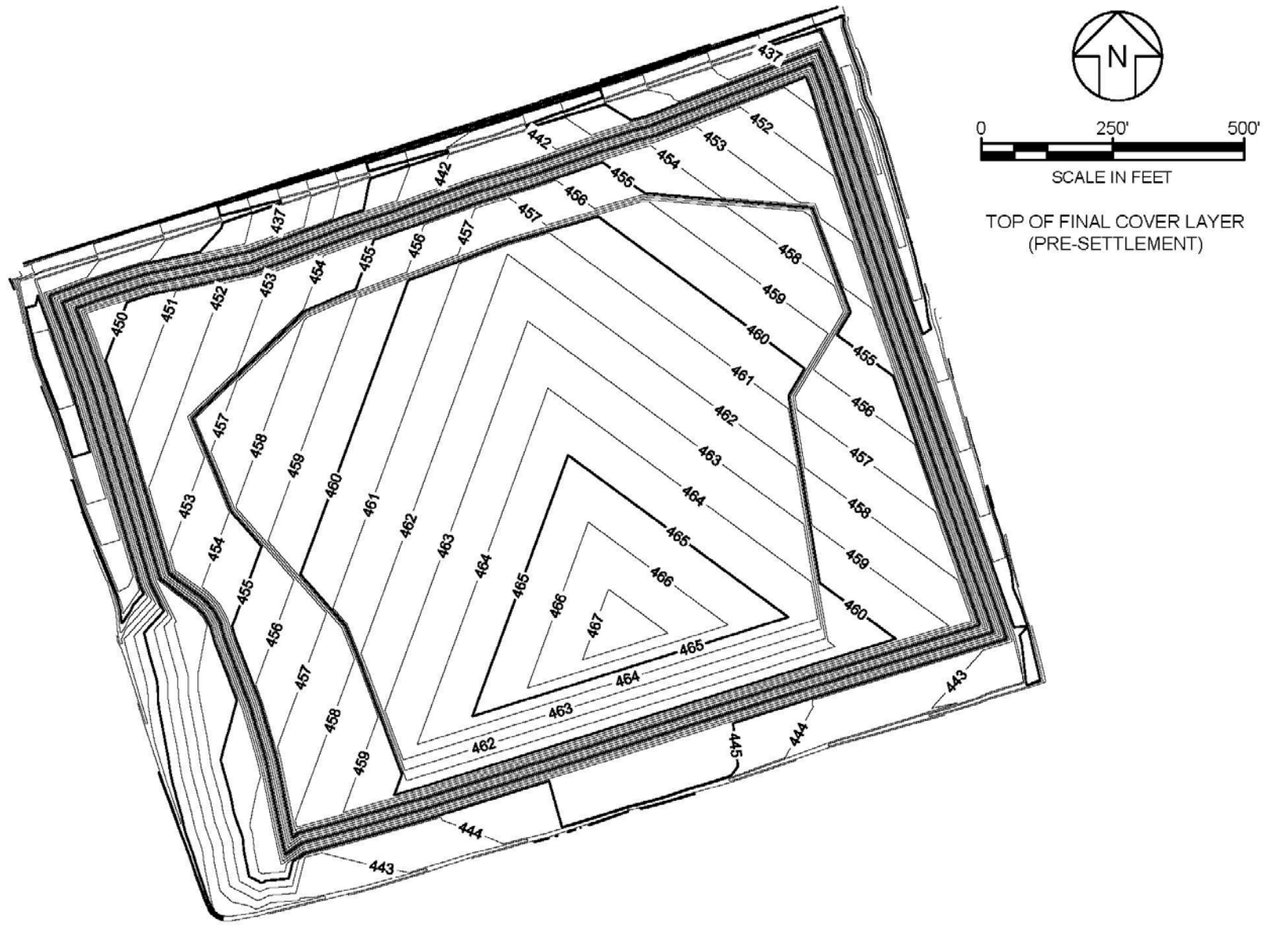

Figure A5: Top of Vegetative Soil Layer

Note: This grading plan was prepared for the purpose of calculating the required soil volumes to construct the SCA Final Cover. The grades shown were prepared using the top of additional leveling layer grading plan. Additional settlement from placement of the additional leveling layer and final cover materials has not been accounted for in this figure.