

What is the depth of garbage in that landfill?



An investigation of the Cathcart Sanitary Landfill in Snohomish County, Washington

EPA Greenhouse Gas Emission Calculations

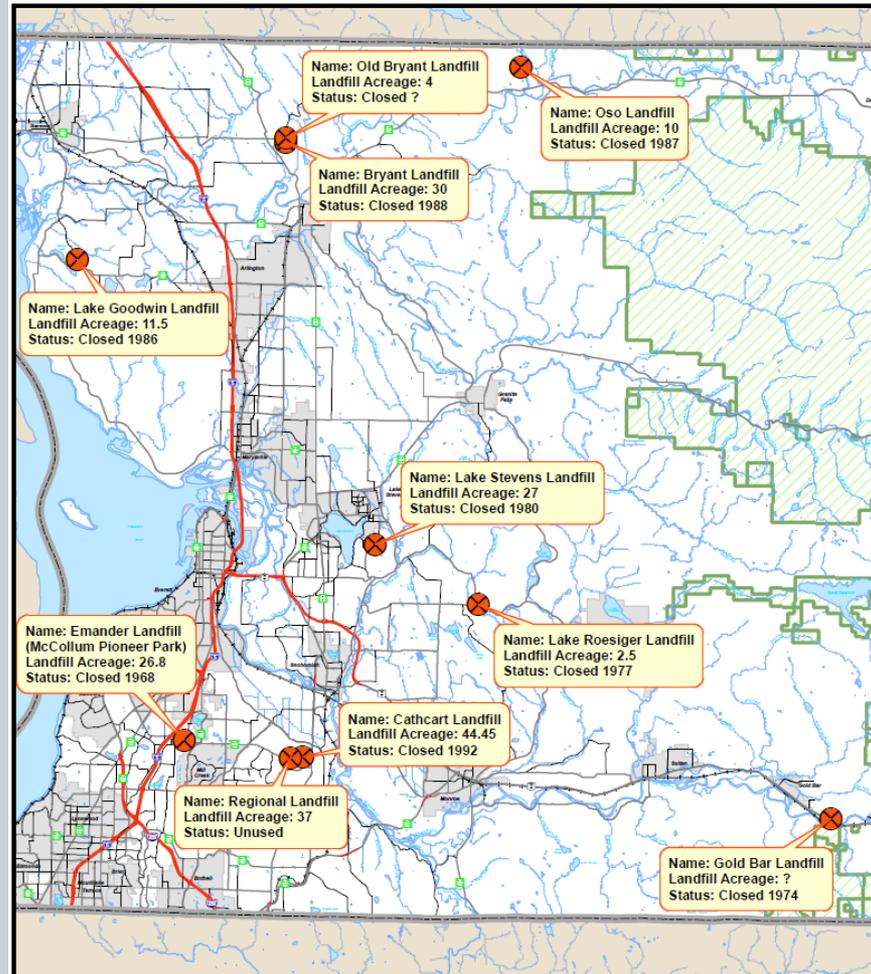


(Equation HH-1)

$$G_{CH_4} = \left[\sum_{x=S}^{T-1} \left\{ W_x \times MCF \times DOC \times DOC_F \times F \times \frac{16}{12} \times \left(e^{-k(T-x-1)} - e^{-k(T-x)} \right) \right\} \right]$$

- Modeled methane generation rate in reporting year.
- Quantity of waste placed in the landfill in year x.

Snohomish County Closed Landfills



Cathcart Landfill History



- Opened in 1980
- One of the first landfills in the United States built under new standards regulating landfills:
 - Flexible membrane liner
 - Leachate collection system
 - Active landfill gas extraction system for capturing methane
- 52 acre site
- Closed in 1992
- 3.5 million tons of refuse

Cathcart Landfill Today

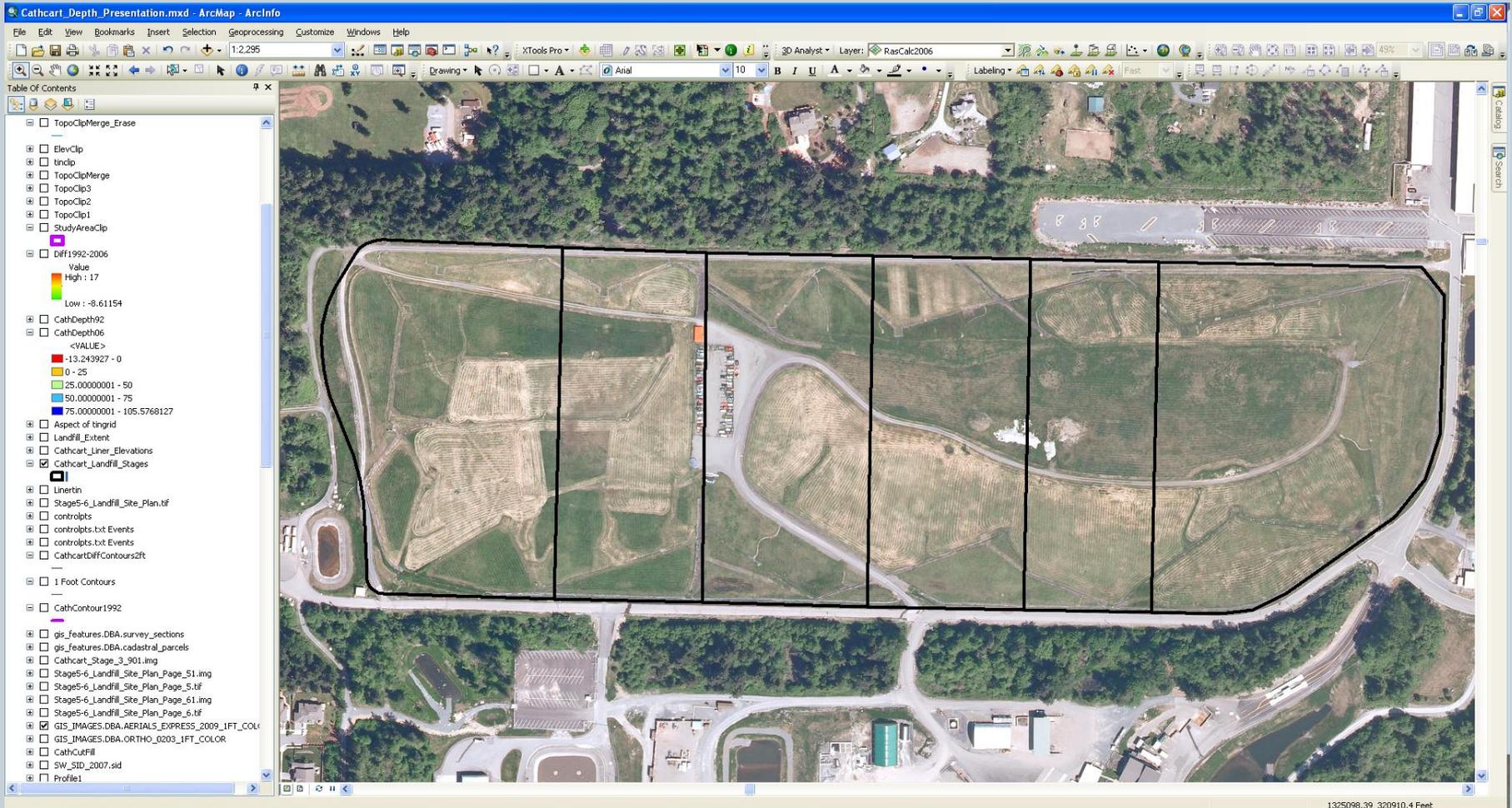


Stage 5 – Looking to the East



Stage 6 – Looking to the Northeast

Cathcart Landfill – 2009



Cathcart Landfill – Liner System



A large 100 foot by 200 foot sheet of plastic is pulled into place by crews working in the landfill basin. When completed, Cathcart will contain seven -ten foot lifts of solid waste installed in a fifty six acre disposal area. The overall site consists of some 200 acres which provide vegetative screening and allow room for access roads, a leachate treatment facility, a check dam, an office building, a truck wash, a scale house and soil stockpile areas.

Cathcart Landfill – Stage 1 Completion



The first phase of the landfill basin will be completed within the next few weeks. The bottom of the basin, with an area of almost seven acres, is covered with a blanket of polyvinyl chloride and a protective layer of soil to prevent leachate migration into groundwater. The side slopes are made of a tough, reinforced hypalon material. This basin was excavated into the ground resulting in a stockpile of soil for cover material to be used as the landfill progresses.

Cathcart Landfill – August 18, 1989

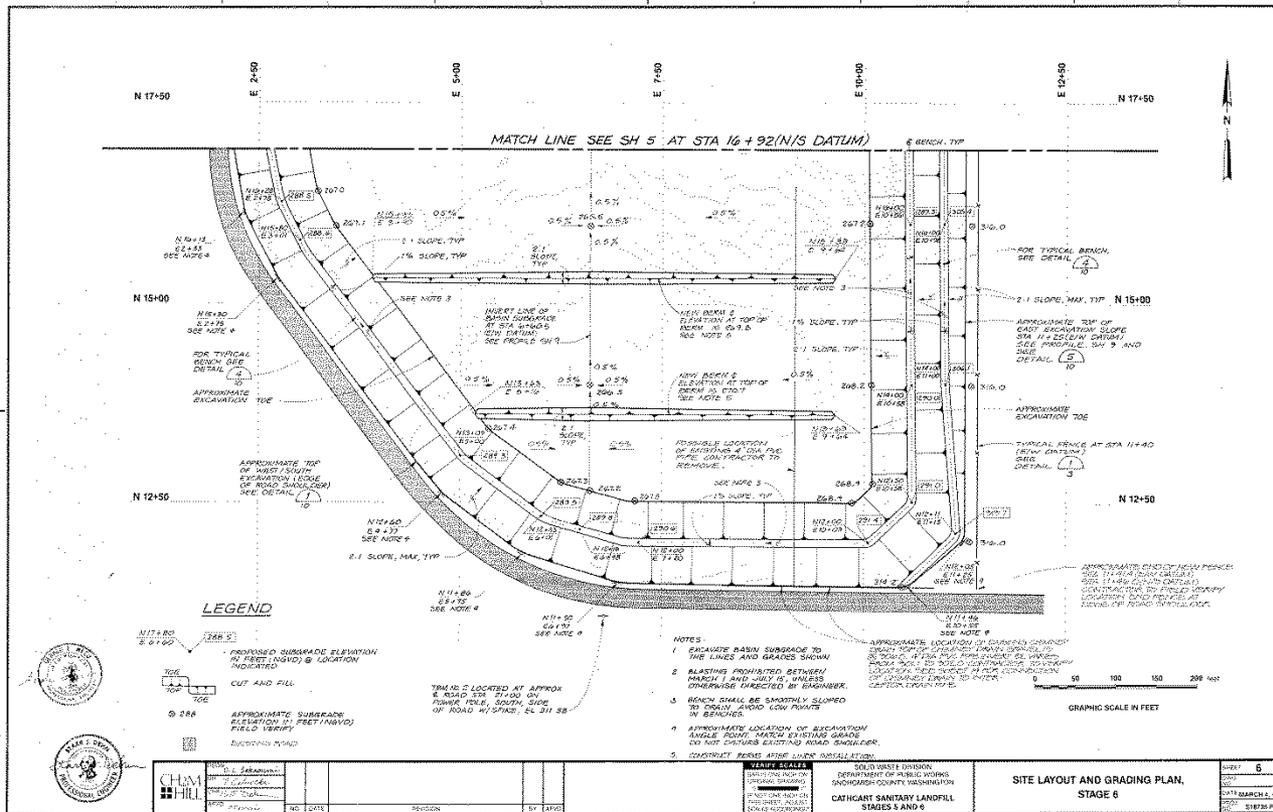


What data is needed for analysis?

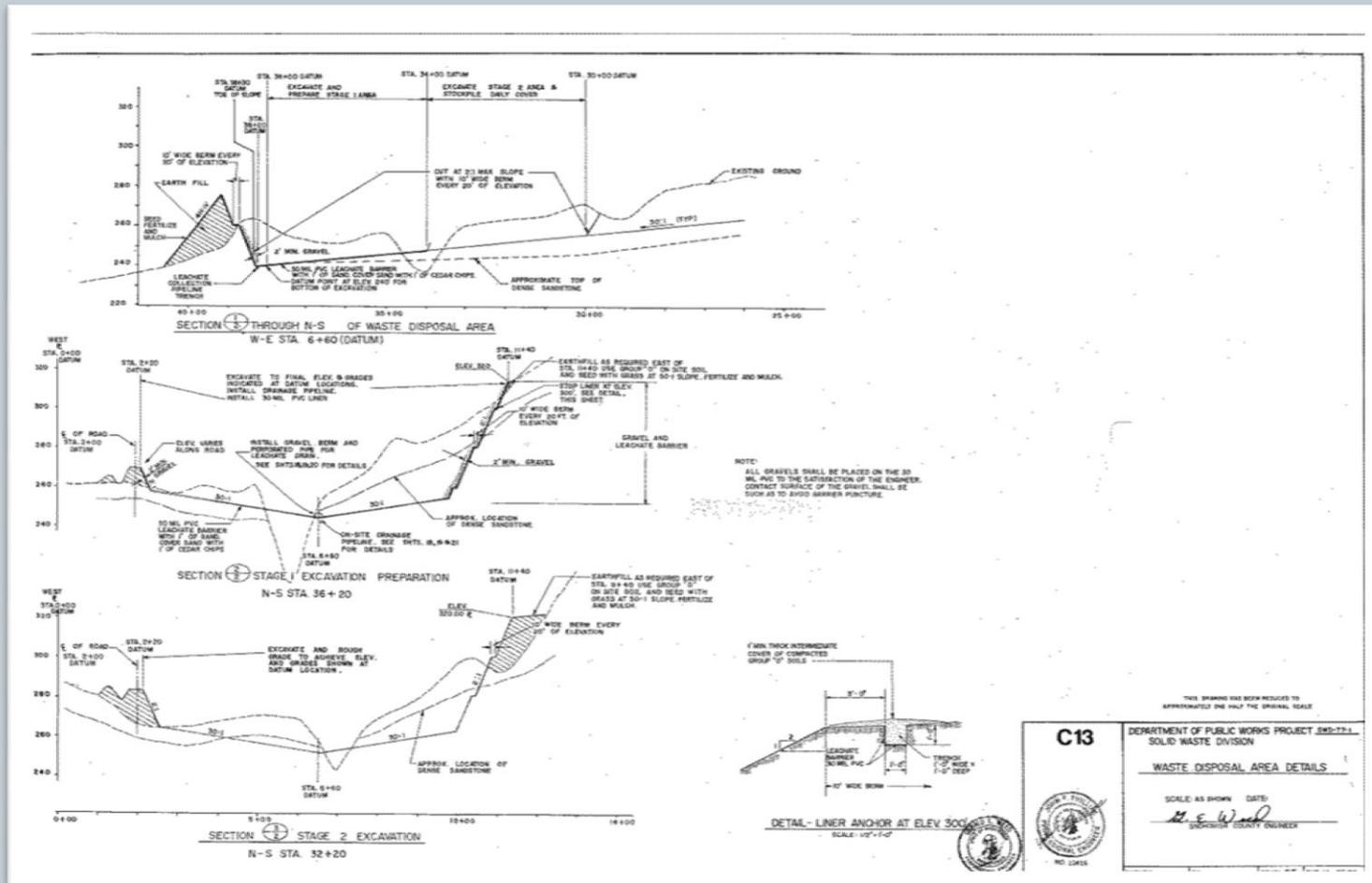


- Current topography (2006 Lidar)
- Closure topography (1992 survey)
- Facility Construction plans
 - Landfill Stage boundaries
 - Base elevation points for each stage of construction

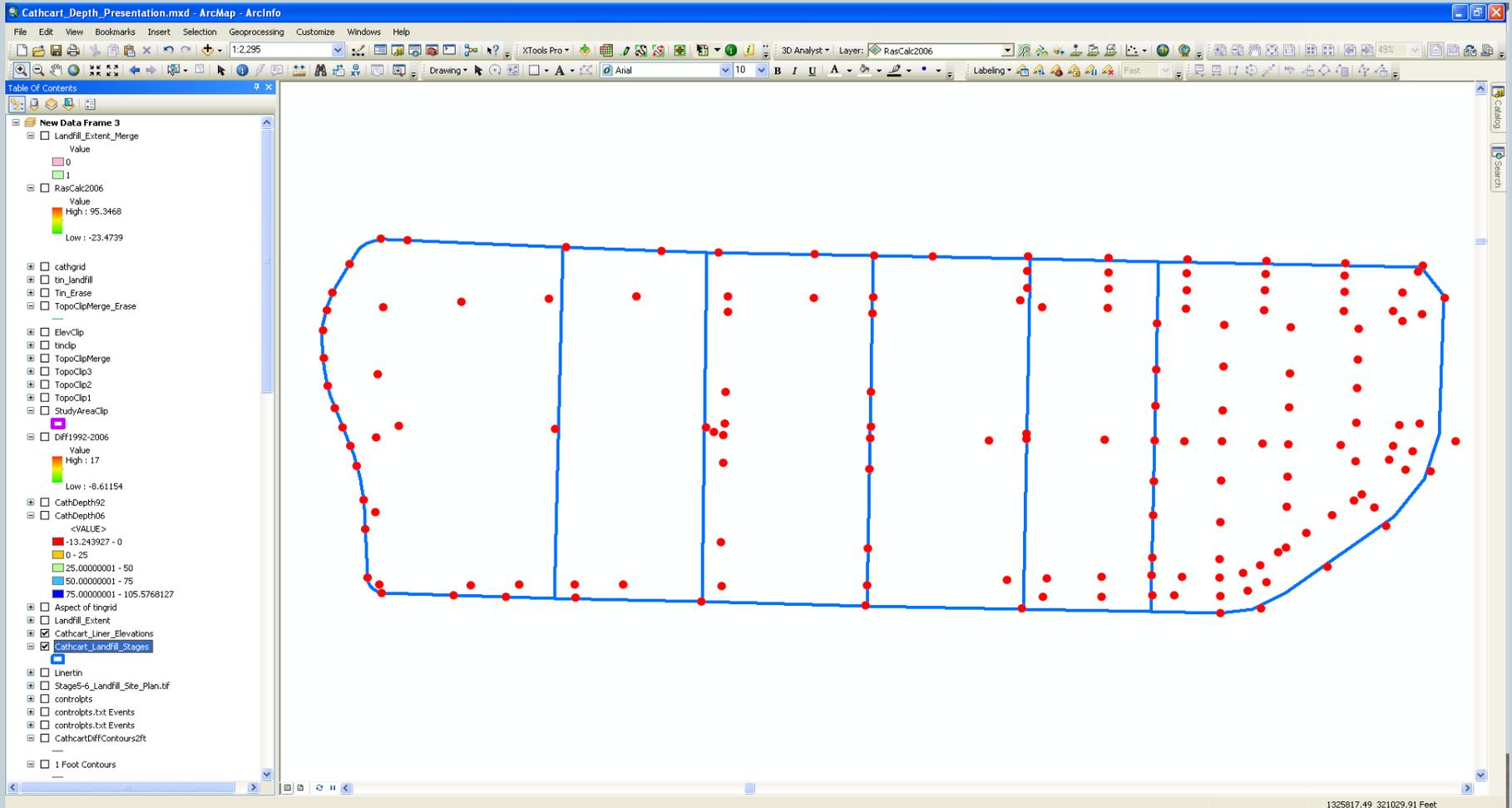
Cathcart Landfill – Stage 6 Grading Plan



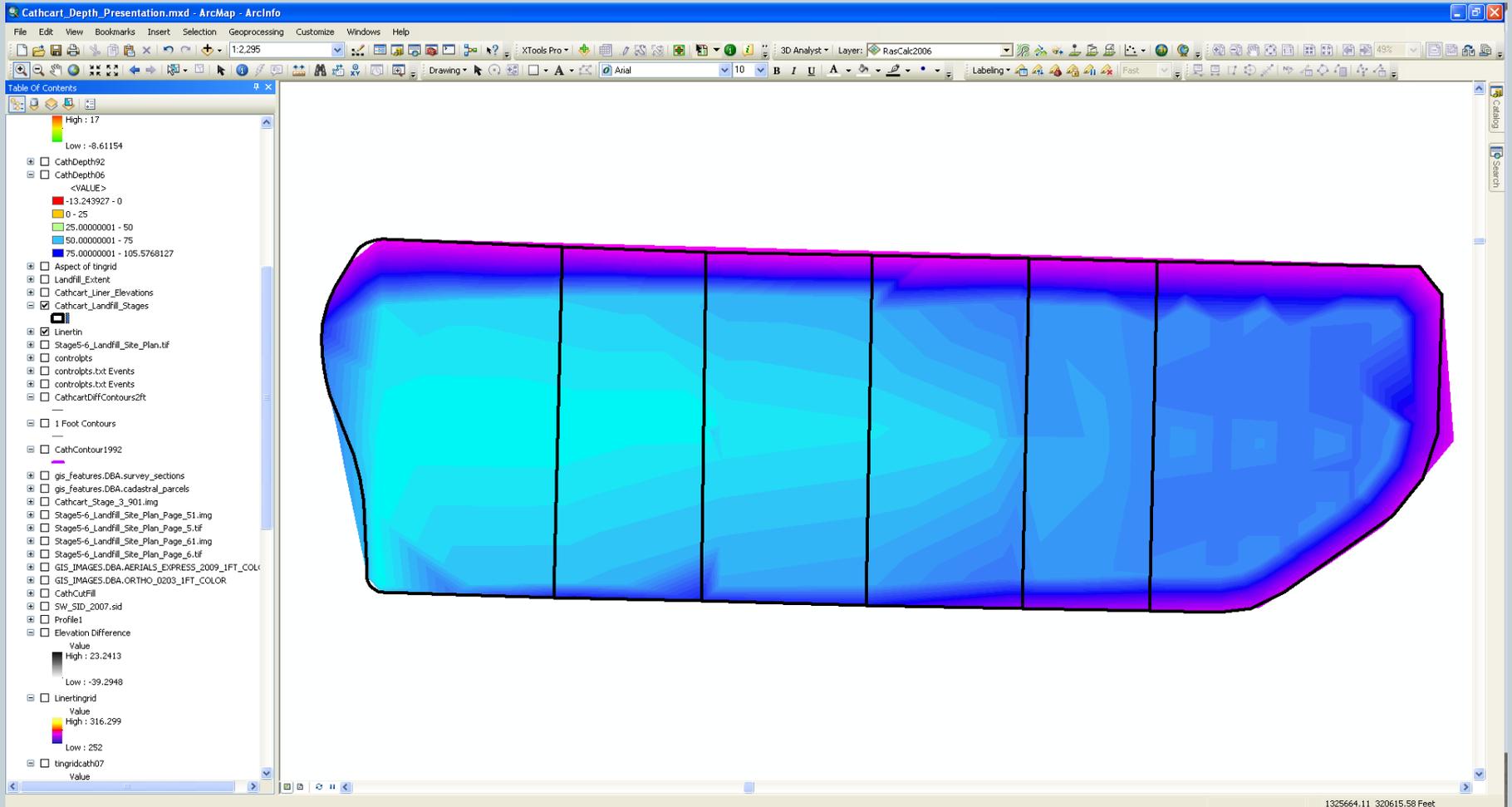
Cathcart Landfill – Stage 1/2 Construction Profile



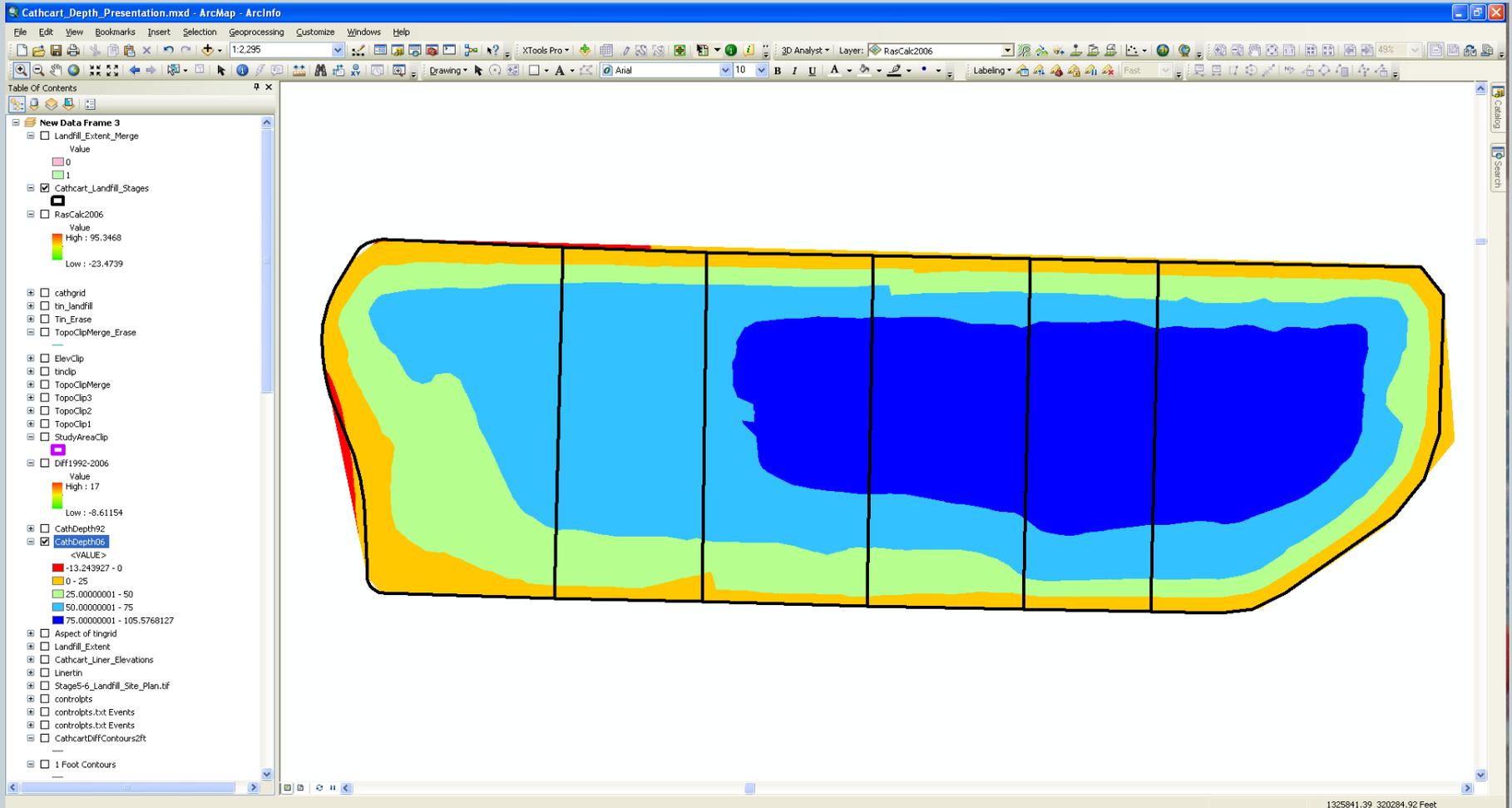
Control Points used to build liner model



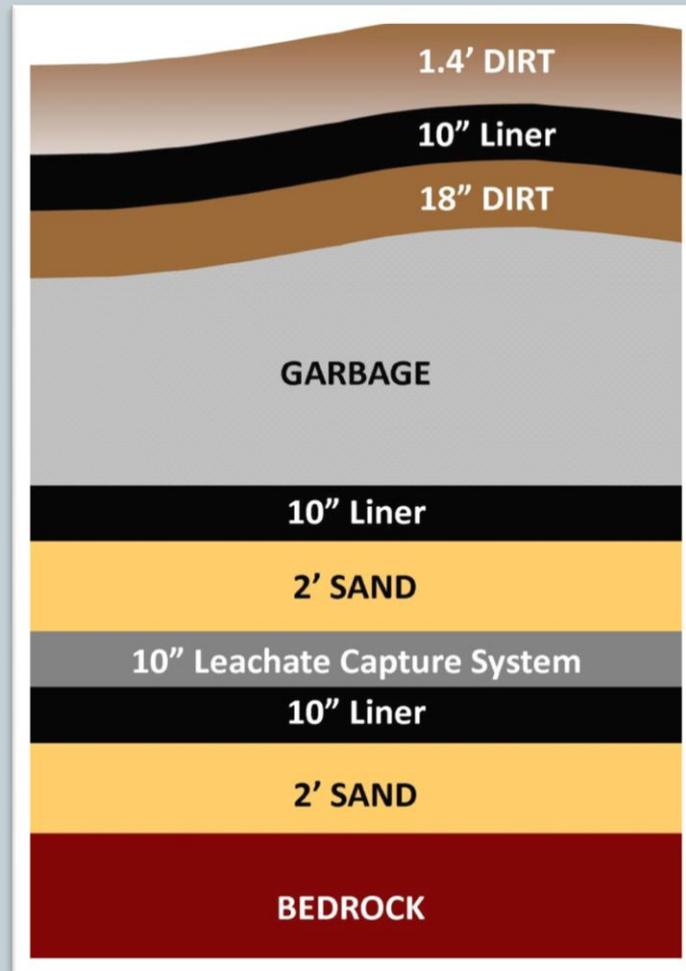
Cathcart Landfill Liner Surface



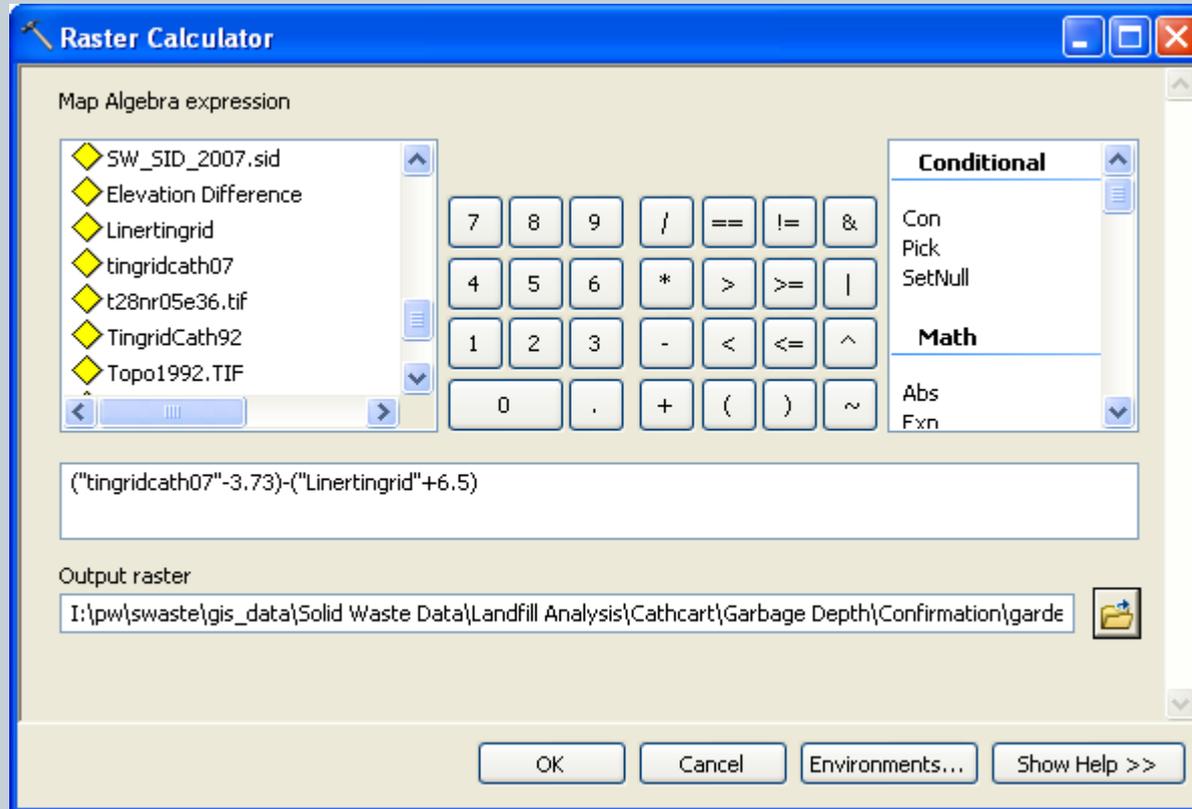
2006 Depth of Garbage (no liner or daily cover)



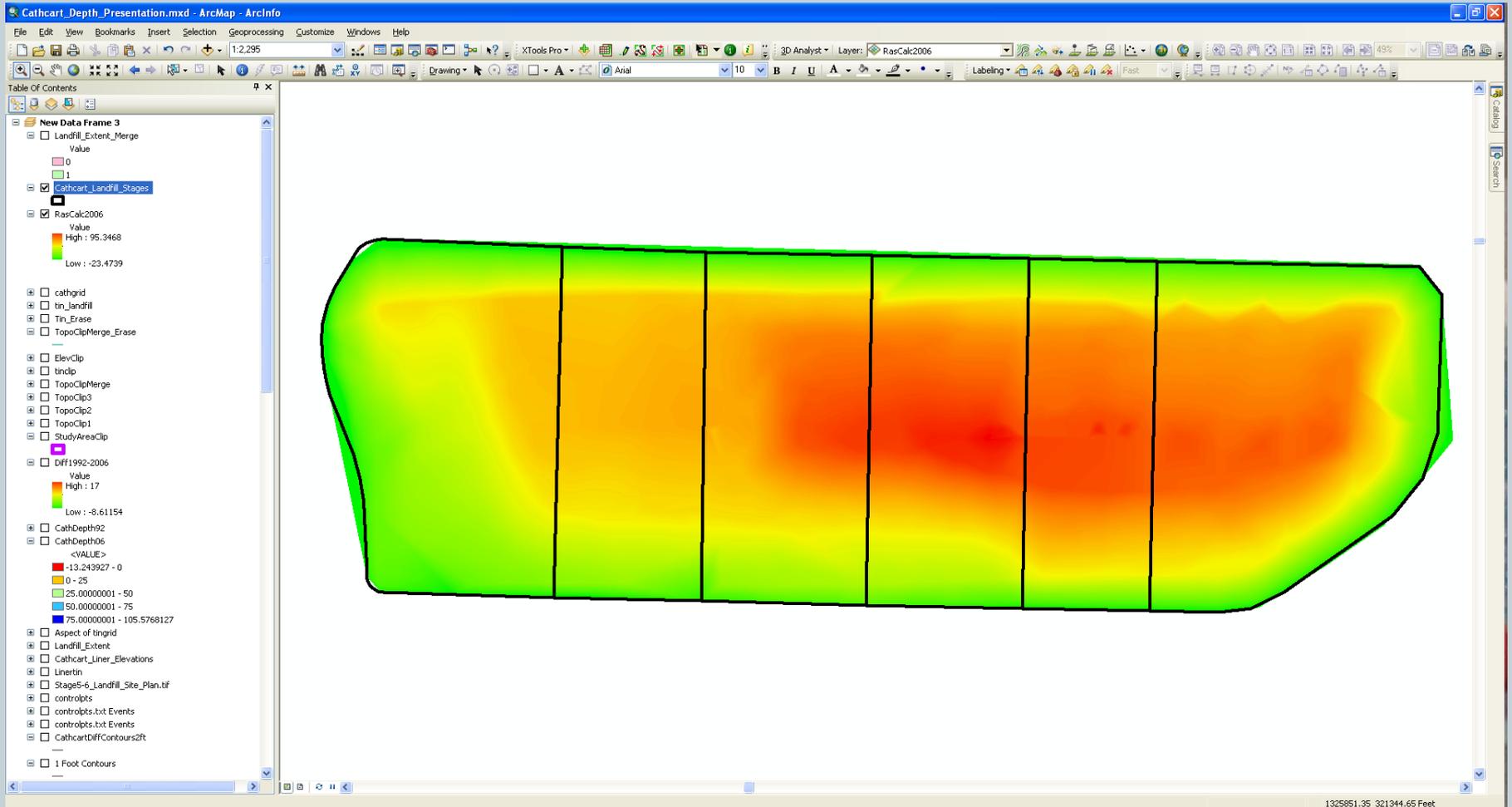
Cathcart Landfill Average Profile



ArcToolbox, Spatial Analyst, Map Algebra



Depth of Garbage (as of 2006)



Results



ArcToolbox, Spatial Analyst Tools, Zonal, Zonal Statistics as Table

Layer Properties

General **Source** Extent Display Symbology

| Property | Value |
|------------------|--|
| Datum | D_North_American_1983 |
| Statistics | |
| Band_1 | |
| Build Parameters | skipped columns:1, rows:1, ignored value(s): |
| Min | -23.47392272949219 |
| Max | 95.3468017578125 |
| Mean | 48.27690854289325 |
| Std dev. | 26.30684248581741 |
| Classes | 0 |

Data Source

Data Type: File System Raster
 Folder: I:\pw\swaste\gis_data\Solid Waste Data\Landfill Analysis\Cathcart\Garbage Depth\
 Raster: RasCalc2006

Set Data Source...

OK Cancel Apply

Zonal Statistics as Table

Input raster or feature zone data

Zone field

Input value raster

Output table

Ignore NoData in calculations (optional)

Statistics type (optional)
ALL

OK Cancel Environments... Show Help >>

Table

zonalstages_06_mean_with_liner

| Rowid | ID | COUIT | AREA | MIN | MAX | RAIGE | MEAN | STD | SUM |
|-------|----|--------|--------|------------|-----------|-----------|-----------|-----------|----------|
| 1 | 1 | 490846 | 490846 | -18.258926 | 59.714844 | 77.97377 | 29.233816 | 18.751266 | 14349302 |
| 2 | 2 | 336509 | 336509 | -11.171173 | 64.450592 | 75.621765 | 46.444042 | 18.31868 | 15628838 |
| 3 | 3 | 382374 | 382374 | -5.657532 | 89.103912 | 94.761444 | 54.433334 | 22.696724 | 20813892 |
| 4 | 4 | 360347 | 360347 | -5.43985 | 95.346802 | 100.78665 | 59.942097 | 26.37409 | 21599954 |
| 5 | 5 | 294628 | 294628 | -6.186371 | 91.205902 | 97.392273 | 62.108837 | 24.33045 | 18299002 |
| 6 | 6 | 570662 | 570662 | -6.899475 | 85.251556 | 92.151031 | 51.555153 | 25.355236 | 29420566 |

(0 out of 6 Selected)

zonalstages_06_mean_with_liner

EPA: e-GGRT



The screenshot shows the EPA e-GGRT web application. The browser window title is "e-GGRT - Mozilla Firefox". The address bar shows the URL: https://ghgreporting.epa.gov/ghg/datareporting/subparthh/hh_wastedepths.do. The page header includes the EPA logo and the text "United States Environmental Protection Agency". The navigation menu has tabs for "HOME", "FACILITY REGISTRATION", "FACILITY MANAGEMENT", and "DATA REPORTING". The "DATA REPORTING" tab is active. The user is logged in as "Deanna Carveth".

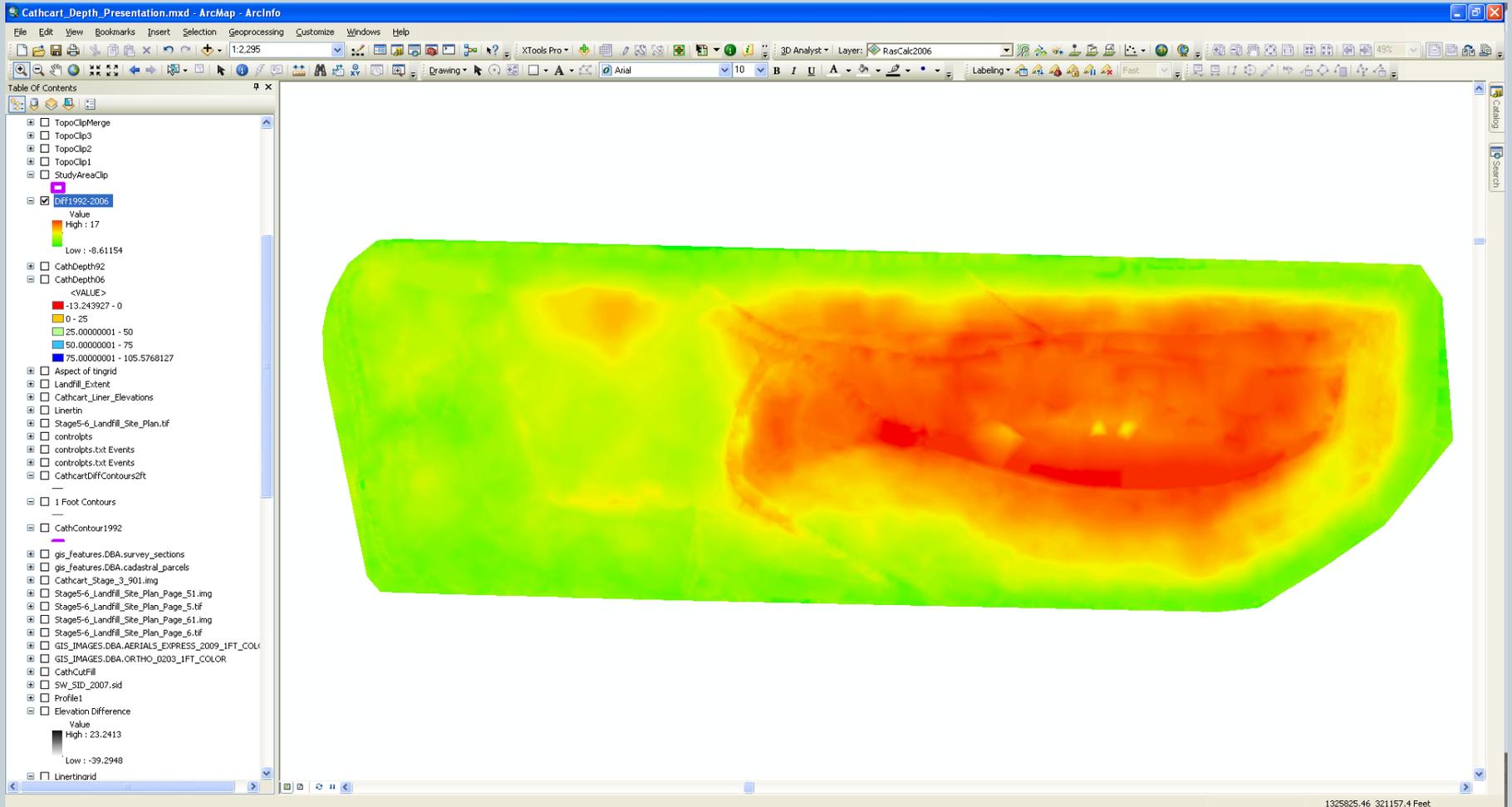
The main content area is titled "Cathcart Landfill (2010)" and "Subpart HH: Municipal Solid Waste Landfills". Below this, there is a section for "WASTE DEPTH ESTIMATIONS" with instructions: "Please provide the estimated depth of each of the areas of the landfill, as shown below. For additional information, please use the e-GGRT Help link(s) provided."

The "ESTIMATED WASTE DEPTHS" section contains a table with five rows, each representing a different area of the landfill. The table has two columns: a description of the area and a text input field for the depth in meters.

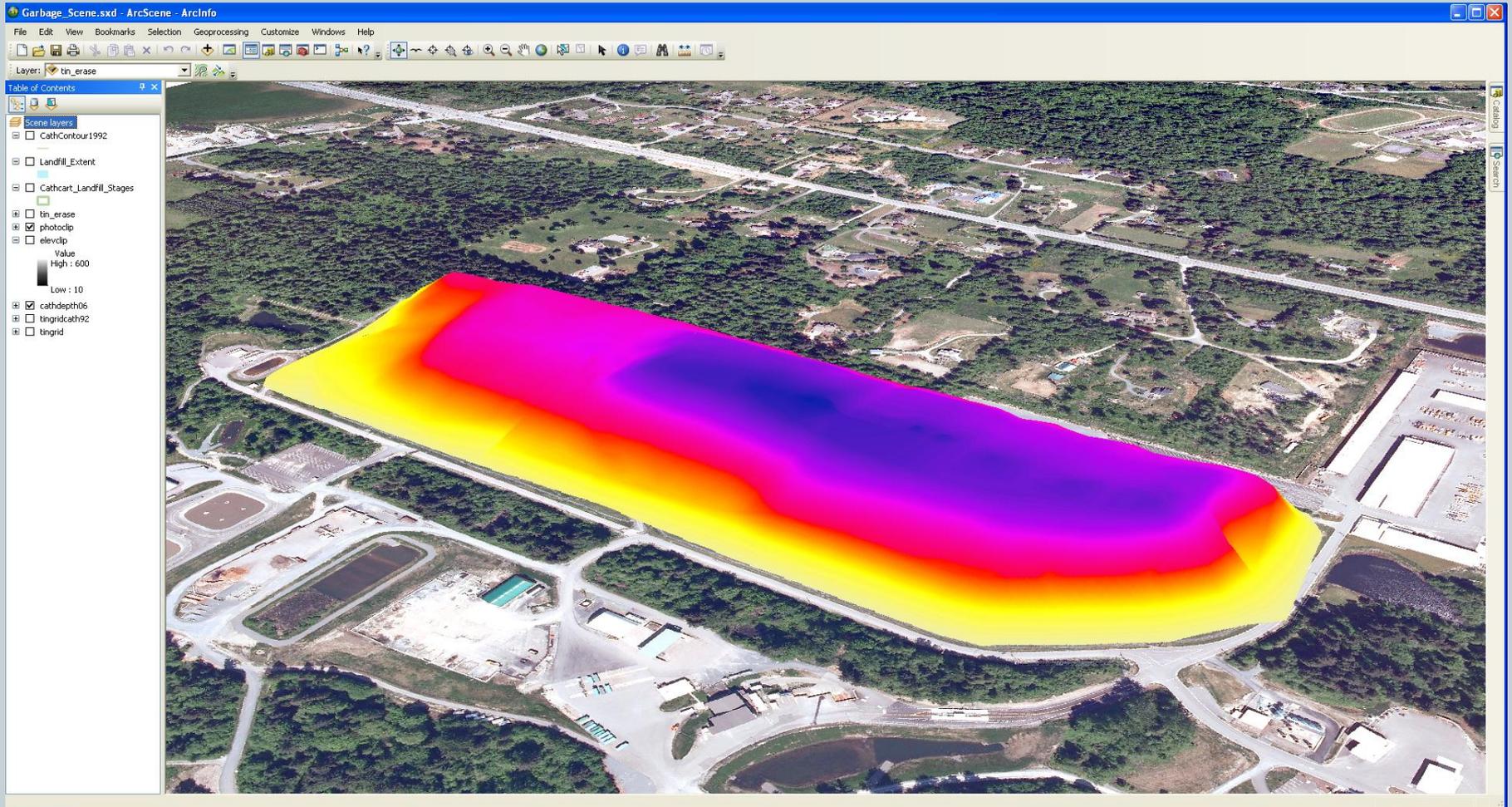
| Area Description | Estimated Depth (meters) |
|--|------------------------------------|
| A1: Depth of area with no waste in-place | <input type="text" value="0"/> |
| A2: Depth of area without active gas collection, regardless of cover type | <input type="text" value="0"/> |
| A3: Depth of area with daily soil cover and active gas collection | <input type="text" value="0"/> |
| A4: Depth of area with an intermediate soil cover, or a final soil cover not meeting the criteria for A5 | <input type="text" value="0"/> |
| A5: Depth of area with a final soil cover of 3 feet or thicker of clay and/or geomembrane cover system and active gas collection | <input type="text" value="14.71"/> |

At the bottom of the form, there are three buttons: "Subpart Overview", "CANCEL", and "SAVE".

Elevation Settlement between 1992 and 2006



ArcScene – Garbage Depth at Cathcart Landfill



Questions?



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