# Atlantic Coast Pipeline and Supply Header Project Volumetric Analysis

*prepared for*

Appalachian Mountain Advocates

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RESPEC

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# 1.0 INTRODUCTION

Appalachian Mountain Advocates (AMA) contacted Respec, Inc. on March 31, 2017 with respect to an ongoing project concerning the Atlantic Coast Pipeline and Supply Header Project (ACP) as proposed by Atlantic Coast Pipeline, LLC (Atlantic) and Dominion Transmission, Inc. (DTI).

AMA tasked Respec with conducting an analysis of the overburden volumetrics for the proposed ACP pipeline with special emphasis on the areas of the pipeline that would be located beneath the topographic ridges. A deadline of EOB on Wednesday, April 5, 2017 was discussed.

A follow-up conference call was conducted on April 4$^{th}$, 2017 to focus the analysis to be conducted by Respec on the "ridge" areas with additional requests for 3 dimensional figures to be included in the final document.

# 2.0 SCOPE OF WORK

The scope of work, as described to Respec by AMA will include two major tasks, as outlined below:

## 2.1 OVERALL PIPELINE VOLUMETRICS

This task will include an overall analysis of the overburden excavation, backfill and excess spoil volumetrics along pipeline AP-1 of the ACP.

## 2.2 CASE STUDY OF A TYPICAL RIDGELINE PIPELINE INSTALLATION

This task will include analysis of the overburden excavation, fill placement and excess spoil volumetrics along pipeline AP-1 of the ACP in a section located beneath a topographical ridgeline. Typical sections will be produced along the chosen section to describe the different profiles used in the volumetric analysis. Included will be an analysis of the access roads and potential adjacent fill placement locations if needed.

# 3.0 DATA RECEIVED

On March 31, 2017, the following data was sent to Respec by email:

- Documents
    - Volume 1, 2 and 3 of the ACP SHP DEIS
- GIS Mapping
    - ACP_Access_Roads_20170224
    - ACP_AR_Transects_HEA_SS_20170321
    - ACP_Filed_Centerline_20170119
    - ACP_SteepSlopes_gt7_Final_20170228
    - ACP_Transects_HEA_SS_20170321
- Figures

    - ACP-Excavation
- Spreadsheets
    - Excavation-20170319-2

Note that the GIS files named above include multiple GIS files that support the graphical interface.

# 4.0 OVERALL PIPELINE VOLUMETRICS

## 4.1 ENGINEERING ASSUMPTIONS

The following sections include the significant engineering assumptions that were made to complete the Overall Pipeline Volumetrics analysis. Some of the engineering assumptions are industry standards and are referenced within the document. There are engineering assumptions included in this analysis that are made from the engineering judgement made by Respec personnel due to industry experience.

### 4.1.1 Soil Thickness

A cursory look at the thickness of the soil layer along the centerline of the pipeline was conducted on the Web Soil Survey (operated by the USDA Natural Resources conservation Service NCRS) website. Five of the counties within the  The overall average of the soil thickness for ground slopes less than 20% is approximately 5 feet, with the overall average of the soil thickness for ground slopes greater than 20% is approximately 4 feet.

### 4.1.2 Swell/Shrinkage

Swell/Shrink factors utilized for the bedrock and soil to be excavated from the pipeline trench were taken from the Federal Highway Administration/U.S. Department of Transportation/Geotechnical Technical Guidance Manual (2007). Shown below are those respective swell factors:

**Table 4-1. Swell/Shrinkage from FHA**

| Material | Initial Swell/Shrink % | Net Swell/Shrink % |
|---|---|---|
| Sandstone/ Rock | 61 | 34 |
| Soil | 53 | -14 |

The Net Swell/Shrink percentage describes the net effect of the placing of each material into an engineered structure. Soil Swell/Shrink in Table 4-1 is defined by the average of Topsoil, Loam and Clay.

### 4.1.3 Definition of Steep Slopes

For the analysis in this document, a slope of 20% (11.3°) or greater will be considered a “Steep” slope. All other slopes will be referred to as Non-Steep.

## 4.2 TYPICAL CROSS-SECTIONS

Typical Cross-sections were designed to facilitate the computation of the Excavated and Backfilled volumetrics. Two pipeline categories and two slope steepness categories were chosen as outlined below:

1. Basic – Steep The Basic - Steep category is defined as the topography of the centerline of Pipeline AP-1 that is not located on a ridgeline and has an overall slope of greater than 20%. The Basic-Steep typical cross-section is shown below in Figure 4-1.

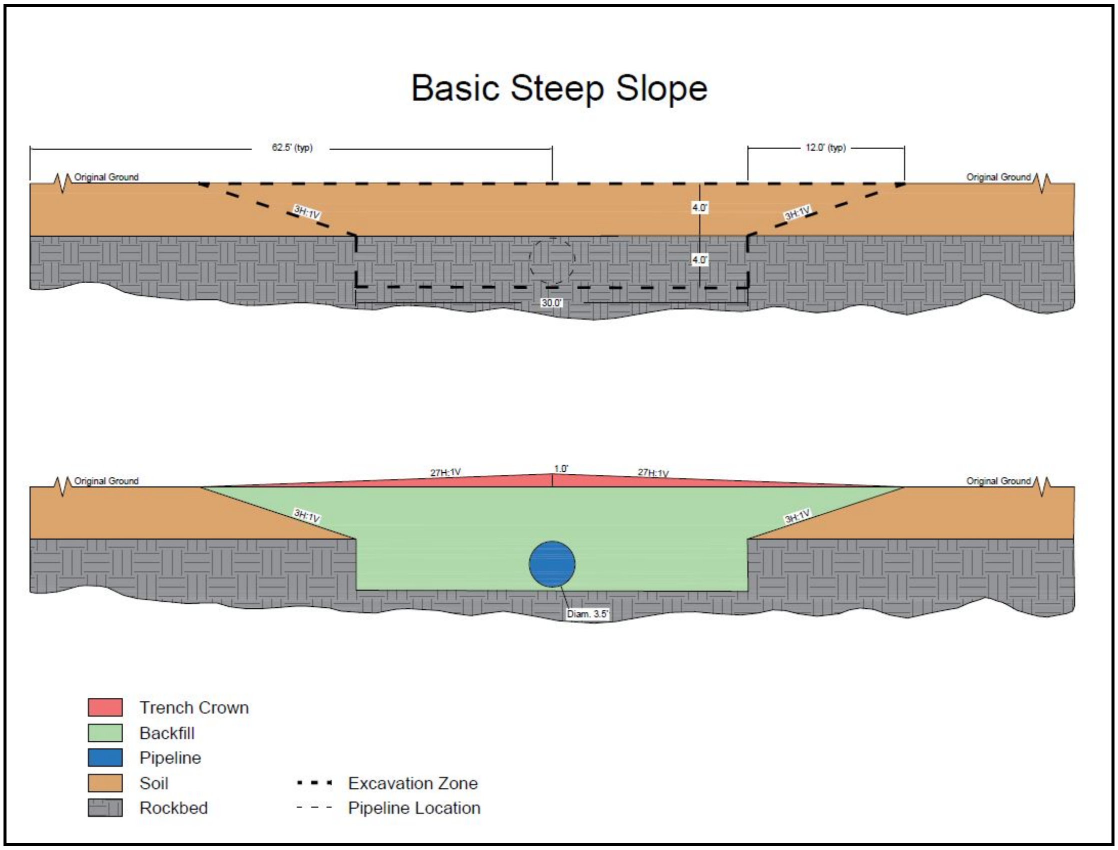



**Figure 4-1.** Basic – Steep Typical Cross-section

2. Basic – Non-Steep The Basic - Non-Steep category is defined as the topography of the centerline of Pipeline AP-1 that is not located on a ridgeline and has an overall slope of less than 20%. The Basic - Non-Steep typical cross-section is shown below in Figure 4-2.

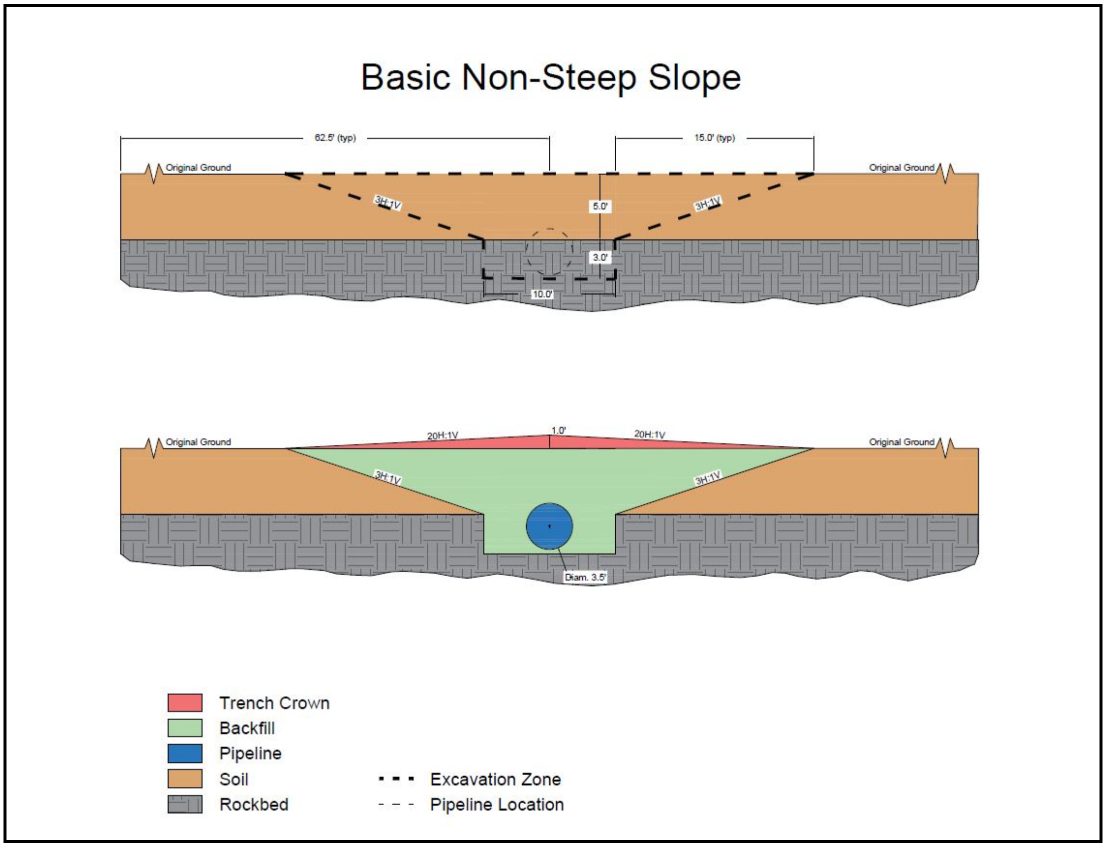



**Figure 4-2.** Basic – Non-Steep Typical Cross-section

3. Ridgeline – Steep The Ridgeline - Steep category is defined as the topography of the centerline of Pipeline AP-1 that is located on a ridgeline and has an overall slope of greater than 20%. The Ridgeline - Steep typical cross-section is shown below in Figure 4-3.

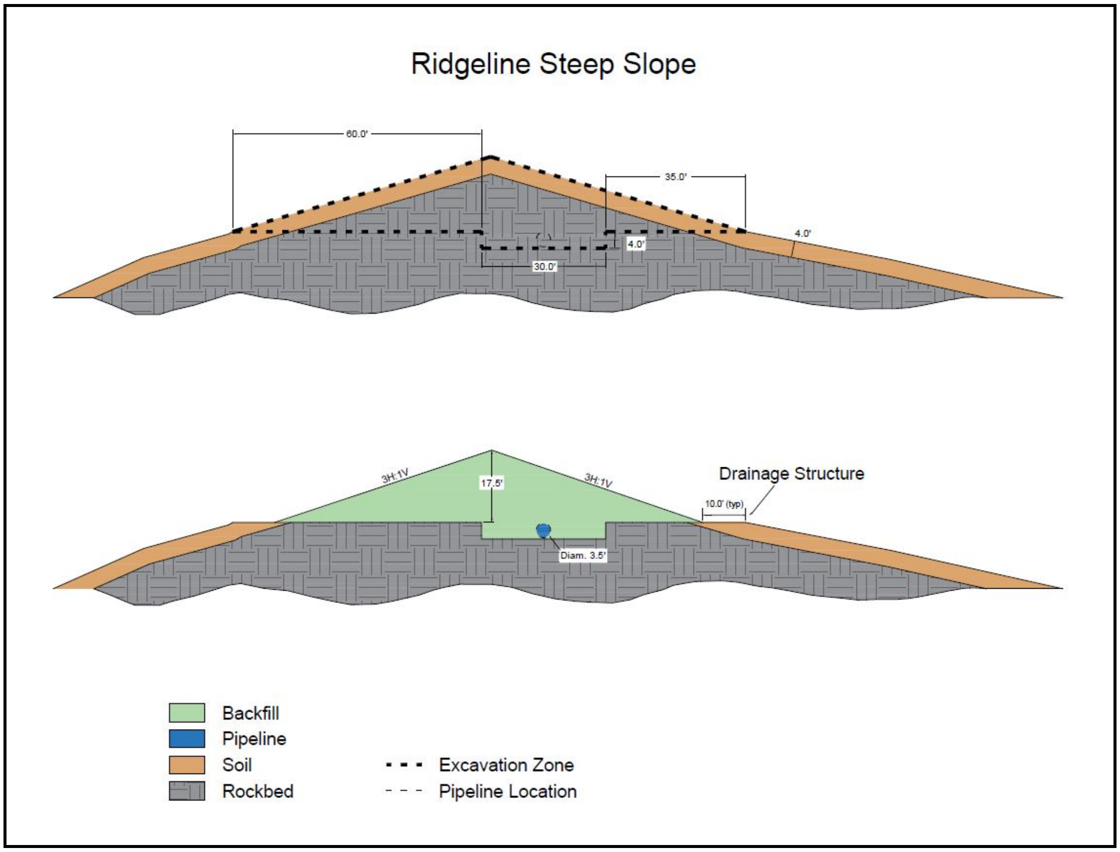



**Figure 4-3.** Ridgeline – Steep Typical Cross-section

4. Ridgeline – Non-Steep The Ridgeline - Non-Steep category is defined as the topography of the centerline of Pipeline AP-1 that is located on a ridgeline and has an overall slope of less than 20%. The Ridgeline - Non-Steep typical cross-section is shown below in Figure 4-4.

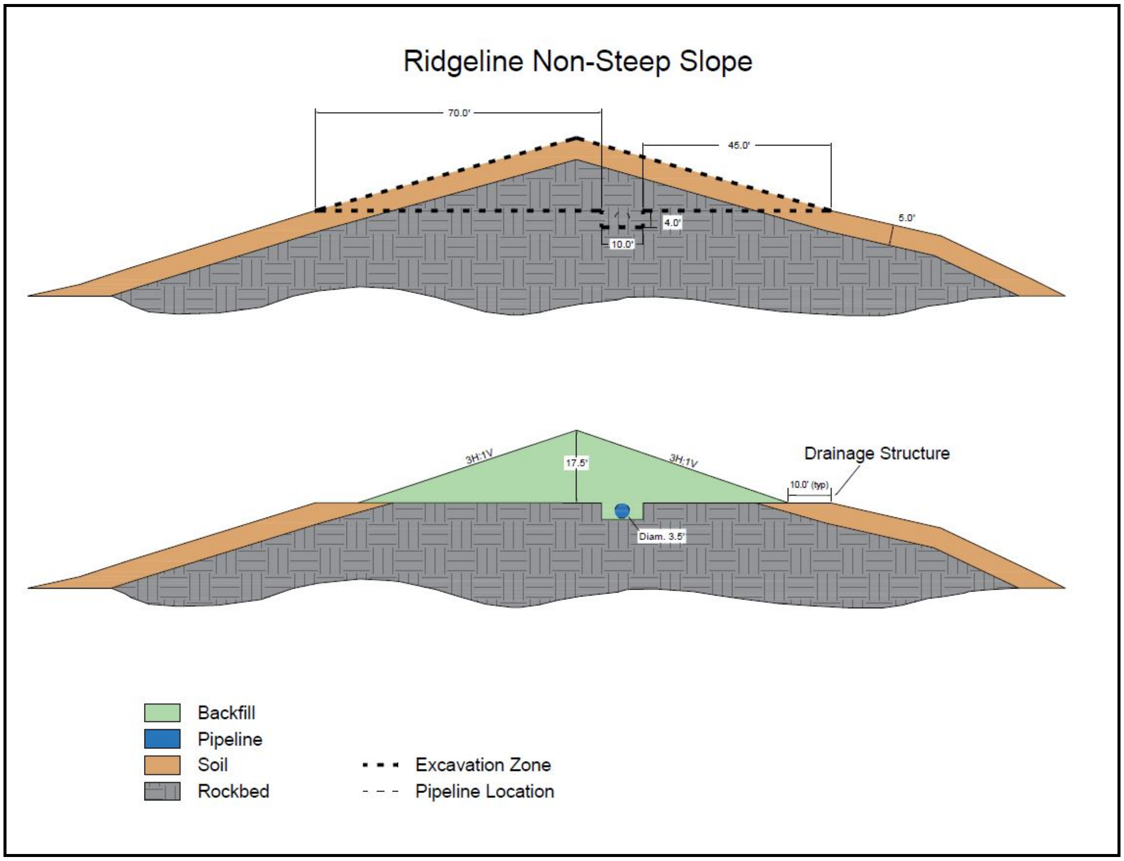



**Figure 4-4.** Ridgeline – Non-Steep Typical Cross-section

## 4.3 SPOIL BALANCE

Shown below in Table 4-2 is the Spoil Balance for the AP-1 pipeline within the ACP. The Excess Spoil volume is the difference between the Total Excavated volume of material to install the pipeline and the Backfilled volume that can be placed on the pipeline construction pad. In addition, the Excess Spoil volume is the material that will require an off-site fill location of similar capacity.

**Table 4-2. Spoil Balance for AP-1 Pipeline (on a per ft. basis)**

| Pipeline Description | Slope Steepness | Total Excavation (Swelled yd³) | Backfill Volume (Swelled yd³) | Excess Spoil Volume (Swelled yd³) |
|---|---|---|---|---|
| Basic | Steep | 11.3 | 11.3 | 0.0 |
| Basic | Non-Steep | 5.4 | 6.1 | -0.7 |
| Ridgeline | Steep | 43.9 | 37.6 | 6.3 |
| Ridgeline | Non-Steep | 42.6 | 35.0 | 7.6 |

# 5.0 CASE STUDY – RIDGELINE PIPELINE INSTALLATION

A Case Study on a two-mile-long Ridgeline portion of Pipeline SG-1 between milepost 96 and 98 was conducted to investigate the total impact of the installation of the pipeline.

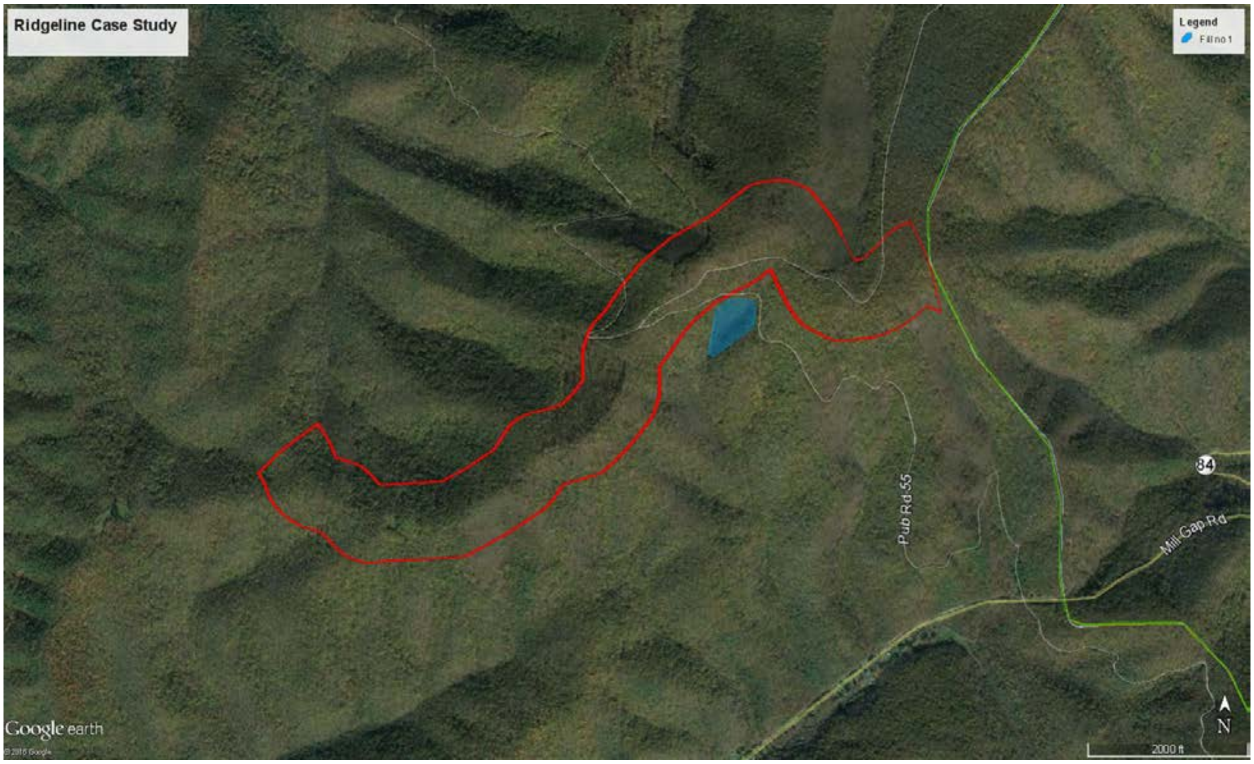
## 5.1 CASE STUDY VOLUMETRICS

A volumetric analysis was performed along the case study portion to determine whether excess spoil will be produced during the pipeline construction. This was accomplished by creating multiple representative cross-sections along the 2-mile-long section. Each of the sections were categorized as Ridgeline Steep or Ridgeline Non-Steep based on the slope of the centerline of the pipeline, reference section 4.1.3 for the definition of steep slope. A spoil balance calculation was then performed for each section resulting in a typical excess spoil value for both scenarios along the designated steep and non-steep lengths. The results are provided in Table 5-1.

**Table 5-1. Spoil Balance for Ridgeline Case Study**

| Pipeline Description | Slope Steepness | Total Excavation (Swelled yd³) | Backfill Volume (Swelled yd³) | Excess Spoil Volume (Swelled yd³) |
|---|---|---|---|---|
| Ridgeline | Steep | 150,000 | 120,000 | 30,000 |
| Ridgeline | Non-Steep | 380,000 | 280,000 | 100,000 |
| **Totals** | | **530,000** | **400,000** | **130,000** |

Shown below is a satellite image of the location of the Ridgeline Case Study and the adjacent access road. Also included on the image is a potential location for an excess spoil fill that would accommodate the 130,000 cubic yards of excess spoil and impact approximately 7 acres.




## 6.0 CONCLUSIONS

Typical spoil balance was established for each of the four scenarios along with the ridgeline case study which found that excess spoil would be expected through the ridgeline construction areas. Due to the lack of data in the DEIS, the case study and typical spoil balance cannot be used to extrapolate the total volumetric along the entire pipeline with precision. However, it is indicative that removal of excess spoil will be required. Based on this conclusion, a spoil relocation plan will be required to properly dispose of the material either onsite or off.