PHASE II APPLICATION
CAMP HOPE RUN LANDFILL
BOGGS TOWNSHIP, CLEARFIELD COUNTY, PENNSYLVANIA

FORM J
ATTACHMENT J-1
Narrative Responses

REVISED JUNE 2019

ATTACHMENT J-1
(NARRATIVE RESPONSES)

FORM J - SOILS INFORMATION – PHASE II

SECTION B. SOILS INFORMATION

1.0 INTRODUCTION

Soils on the Camp Hope Run Landfill (CHRL) (Site) consist of undisturbed native soils and replaced/disturbed soils/mine spoils in areas that were disturbed by past surface coal mining operations. The undisturbed soils have been identified in **Form F** – **Phase I Soils**. These native soil materials have been quantified for use in the construction of the landfill for various purposes, such as in the liner and cap systems, berms, and other general construction purposes, as included in **Form F - Attachment F-5**. Quality assurance plans and specifications for these construction materials are detailed in **Form 24**.

During mining, the majority of the soil and rock were removed and replaced back to approximate original contour as is common in surface coal mining. However, selected portions of the overburden rock strata were required to be special handled due to their potential to produce acidic discharges. These special handled materials (SHMs) were identified by the mining operations and placed in constructed “pods” within the backfilled mine areas. During re-excavation of the previously mined area for landfill development, these pods will be encountered. As these materials are encountered they will be excavated and disposed of as waste in the active, lined landfill. This will eliminate the possibility that these soils will contribute to acid mine drainage (AMD) in the future, and remove a source of AMD that currently affects the surface and groundwater at the Site.

Unmined areas of the site are planned to be excavated such that zones previously sampled and analyzed and determined to contain potentially acid forming mineralogy will be avoided where possible or handled separately where necessary as discussed in the Materials Handling Plan (**Attachment 14-2**).

2.0 BACKGROUND

The CHRL is situated on approximately 2,000 acres of land located in Boggs Township, Clearfield County, Pennsylvania. Prior to PA Waste, LLC purchasing the property in 2006, it was owned by Al Hamilton Contracting Company (AHCC) who operated a surface mine on portions of the property’s northern and southern sections, which are divided by Camp Hope Run. Both portions were surfaced mined for the Lower Kittanning (LK) coal seam. The surface mined area on the southern portion of the property coincides with the proposed CHRL permit area. Specifically, the previously mined area coincides with the S3 area of the landfill. During development of the CHRL these mined areas will be re-excavated and reused as discussed in the Material Handling Plan (**Attachment 14-2)**. The redevelopment of this area will result in the elimination of the current source of AMD at the site, reduce AMD discharges to groundwater, and eliminate several surface discharges of AMD from the previous mined area.

The following presents information obtained during geologic investigations of the site performed for the surface mining permit and subsequently for the subject landfill permit. In addition, information from the LK mining operations relative to the actual special handling of material is presented. This information includes overburden investigations and analysis results, special handling and alkaline addition procedures for surface mining at the site, and discussion of procedures used during mining operations as it relates to the special handling of acidic materials and the construction of pods.

Overburden drilling and analysis in the southern portion of the site, identified in the surface mine permit as the Kauffman South tract, revealed the presence of potentially acid-forming sulfur-bearing strata and a lack of alkaline overburden strata in most of the proposed surface mine areas. Initial attempts to permit this property for mining were denied by the Pennsylvania Department of Environmental Protection (PADEP) since PADEP prohibits mining in areas showing acid producing potential. In response to the PADEP action AHCC decided to propose a mining demonstration project to show that, through the proper identification, special handling of sulfur-bearing strata and addition of off-site alkaline material, areas like the Kauffman South site could be mined without causing degradation of groundwater.

AHCC formed a team, in cooperation with PADEP, of noted professional geologists and scientists from Penn State University, PADEP, and selected consultants to conduct investigations and studies required for the demonstration project. The primary purpose of the demonstration project was to find an environmentally safe and economically viable method of mining “virgin” areas of land with overburden containing sulfur-bearing strata. Extensive overburden drilling, sampling, testing, installation of numerous groundwater monitoring wells, and background groundwater and surface water sampling/analyses were performed at the site in preparation of issuance of the mining permit and permit operations.

As previously referenced, the Kauffman South area coincides with the proposed CHRL area. Portions of the proposed waste disposal area of CHRL, where excavation of overburden will be performed, coincide with areas that were intensively studied as part of the Kauffman South mining permit. Specifically, Phase VI, and a portion of Phase V, of the surface mine permit area, which was the subject of extensive overburden analysis and subsequent surface mining, coincides with the S3 area of the proposed landfill waste disposal area. Sulfur-bearing strata identified and special handled by the surface mining operation was segregated and placed in pods inter-layered with alkaline material in the proposed S3 area. The CHRL development proposes to excavate the overburden in the Phase V and Phase VI areas for a portion of the lined landfill area. Therefore, the SHM placed in pods will be excavated and disposed of within the proposed lined landfill.

Phases V and VII, and portions of Phases II and III of the Kauffman South surface mine permit area coincide with the S2 area of the proposed CHRL. These former phases were extensively investigated as part of the former surface mining permit, with sulfur-bearing strata being identified. However, only a small portion of the Phase V area was surface mined. The proposed S2 waste disposal area is outside of previously mined areas and has been designed to minimize contact with sulfur-bearing strata identified by the prior overburden analysis. Refer to **Figure J-1.2** for a plan of these areas.

3.0 SITE CHARACTERISTICS

This section provides details concerning the proposed CHRL site characteristics and results of investigations performed as part of the Kauffman South mine permit. In addition, this section provides information concerning the PADEP approved special handling and alkaline addition procedures implemented by the prior mining operations that are relevant to the proposed landfill development.

3.1 GENERAL SITE CHARACTERISTICS

The proposed CHRL is located on top of a broad, flat ridge bounded by Clearfield Creek, Sanbourn Run, Camp Hope Run, and PA State Route 153. The uppermost coal seams on the ridge are two closely spaced splits of the LK that range in depth from grade at the outcrops to a maximum of about 80 to 100 feet. During overburden investigation studies conducted as part of the former Kauffman South surface mine permit, strata containing sulfur-bearing zones, which when mined and exposed to weather can produce AMD, were identified. These strata are generally found a few feet above the LK coal and are associated with the Lower Kittanning Rider (LKr) coal.

During the surface mining permit investigation it was discovered that, although the permit area had not formerly been mined, site surface water and groundwater were degraded from the mining activities conducted on the adjacent John A. Thompson (Thompson) mine located to the east across PA Route 153, which also surface mined the LK coal. Moderate to severe AMD impacted groundwater was encountered in the groundwater monitoring wells on the Kauffman South site. This AMD is presumed to have originated from the Thompson mine and has apparently migrated beneath PA Route 153, primarily in the Clarion coal strata, which now contaminates the groundwater underlying the Kauffman South site (i.e. CHRL). Surface waters in Camp Hope Run and Sanbourn Run are also degraded by AMD impacted groundwater discharges from the Thompson mine.

3.2 MINING OVERBURDEN ANALYSIS INVESTIGATION

The method of mining, special handling of sulfur-bearing strata, and the alkaline application rates and procedures used by the prior surface mining operations were the product of a thorough study of site conditions and overburden analysis. A significant effort was expended to obtain the most accurate characterization of the site's overburden possible, utilizing a reasonable number of overburden holes. Deep holes were drilled and overburden samples obtained/analyzed to determine the characteristics of overburden under maximum cover conditions. The overburden was also sampled/analyzed from shallow overburden holes to evaluate the effect of weathering on sulfur and alkaline content near the LK outcrop.

3.2.1 Method of Overburden Sampling

Drilling and overburden samples were obtained from both air rotary drill samples and cored drill samples with samples being collected over a several year period from approximately 1987 to 1990. Overburden holes identified as "OB", "A", and "C" were drilled in February 1987, February 1990, and December 1989, respectively. In general, the "OB" holes sampled sandstone units at five foot maximum intervals and other strata at three foot intervals, while "A" and "C" holes used a three foot interval for sampling of all the strata. Samples were also taken at all changes in stratigraphy. A total of about 533 overburden samples were analyzed and used in the determination of sulfur-bearing and alkaline strata, and the acid/base calculations to determine requirements for alkaline addition.

3.2.2 Laboratory Techniques and Methods of Analysis

As reported in the Kauffman South permit application, "OB" overburden samples were analyzed by Hess and Fisher Engineers, Inc. "A" overburden samples were analyzed by Geochemical Testing and "C" overburden samples were analyzed by Penn State University. Laboratory analysis for acid/base accounting were conducted in accordance with procedures outlined in the EPA publications (EPA-600/2-78-054) *Field and Laboratory Methods Applicable to Overburdens* and *Mine Soils and/or Overburden Sampling and Testing Manual* prepared by Energy Center, Inc. The chemical analysis for acid/base accounting included neutralization potential and maximum potential acidity by total sulfur determination. The two base chemical analysis procedures used are briefly described as follows:

- Neutralization Potential

  The amount of neutralizing bases, including carbonates, present in overburden materials is found by treating a sample with a known excess of standardized hydrochloric acid. The calcium carbonate ($CaCO_3$) equivalent of the sample is obtained by determining the amount of unconsumed acid by titration with standardized sodium hydroxide (Jackson, 1958).

- Maximum Potential Acidity by Total Sulfur Determination

  This method measures the total sulfur in a sample. Since sulfur generally occurs in three distinct forms in a typical overburden sample: pyretic, sulfate, and organic – using total sulfur is a conservative approach because only pyretic and sulfate forms produce acidic water at a mine site. To determine the total sulfur content a sample is heated to approximately 1,600º C. Sulfuric dioxide is released from the sample and collected in a dilute hydrochloric acid solution. This solution is titrated with a standard potassium iodate solution. The amount of potassium iodate solution used during the titration is recorded. The calculation of the percent total sulfur is based on the potassium iodate measurement (Smith, et al, 1974).

The tons of $CaCO_3$ equivalent/1,000 tons of material computed for each lithologic unit are used in developing alkaline addition rates for each stratum individually and cumulatively for each mined area. The values determined for the strata for each overburden hole are shown on the overburden analysis

(OBA) spreadsheets. The OBA spreadsheets for the overburden holes used to determine Special Handling/Alkaline Addition for the mined areas are included as **Exhibit J-1.1**.

3.2.3 Overburden Analysis Results

Results of overburden laboratory analysis are presented on the OBA spreadsheets (**Exhibit J-1.1**) and Geologic Log Drill Holes included as **Exhibit J-2.2**. The thickness of sulfur-bearing strata that were used in alkaline addition calculations are presented in the OBA spreadsheets. The mineable coal seams (LK top and bottom splits) are included on the Geologic Log Drill Holes as overburden sample units; however, it should be noted that mining removed the LK top split of the LK coal; therefore it will not constitute part of the post mining overburden. The LKr coal seam was not thick enough or consistent enough across the site to mine. If present, the LKr sulfur-bearing zone was special handled and placed in pods within the backfilled areas.

3.2.4 Identification of Sulfur-Bearing Stratigraphic Units

Strata that exhibited the potential for producing AMD as well as strata that possess inherent alkalinity that would assist in retarding acid production was determined by analysis of the Site's overburden. Identification and classification of strata that qualified for inclusion in the acid/base accounting calculations was based on PADEP policy governing alkaline addition practices. Based on this policy, strata with low percentages of total sulfur and those that have low neutralization potentials with no reaction to dilute hydrochloric acid are not considered significant in regards to the site's overall acid-producing potential and therefore, were not included in acid/base accounting calculations. The following criteria, based on PADEP procedures, were used to identify significant sulfur-bearing or alkaline stratigraphy:

- All lithologic samples exhibiting a percentage of total sulfur of 1.0 or greater;
- All lithologic samples that produced fizz when subjected to a 25% solution of hydrochloric acid and exhibit neutralization potential of 30 or greater; and
- All lithologic samples that did not fall into these two categories were presumed to be insignificant with respect to alkaline addition requirement calculations.

This criteria was used to identify the Site's acid-producing potential and provide an estimate of the alkaline material required to balance the acidic potential. Based on the calculations, the AHCC Team determined that a special handling plan for selected sulfur-bearing strata, combined with the site's inherent alkaline strata, plus calculated additions of alkaline material, would effectively prevent impacts to groundwater and acidic discharges following mining.

3.3 ALKALINE ADDITION PLAN

The OBA spreadsheets developed by PADEP were utilized to perform acid/base accounting calculations to determine alkalinity excesses and deficiencies for 19 of the overburden test holes established at the site. Areas of influence for the 19 overburden test holes were developed employing the polygon theory with an adjustment made to take into account weathering judged to have occurred under insufficient cover (overburden). The shallow overburden holes, designated "A" test holes, showed virtually no alkalinity in 60 feet of cover. For this reason, the PADEP decided that when the area of influence of a "C" or "OB" test hole was extended to the LK outcrop any alkalinity that was present in the upper 60 feet would be disregarded in acid/base calculations.

The amount of off-site alkaline material required for each mining phase was calculated. The alkaline addition requirements were outlined in detail in the mining permit application, along with a description of where the alkaline material will be positioned during the backfilling process and how this placement would coincide with the mine plan and special handling plan.

In general, when off-site alkalinity was required to neutralize the acid material present, the mining/special handling and alkaline addition plan described placement of the alkaline material in the following four locations:

I. ***On the regraded backfill prior to top soil placement*****:** a minimal application rate of alkaline material was called for on the regraded backfill. After placement of the alkaline material, the area was "back dragged" by a bulldozer to mix it into the overburden. This was done to avoid producing a very alkaline environment in the root zone, which could inhibit plant growth.

II. ***Around special handled material pods*****:** employment of alkaline material for this purpose was considered to be very important and a substantial portion of the total required volume was allotted for this portion of the alkaline addition plan. An exact percentage of total required alkaline material was not specified for this use. The quantity was based upon the ratio of SHM and other acidic material placed in the pods. The alkaline material was positioned in equal amounts under and on top of the special handled pod and when more than one 2-foot layer is required it was also positioned between the layers. Based on reports by mining personnel, the pods were constructed in layers with an 8-inch layer of alkaline material placed on top of each 2-foot layer of acidic material.

III. ***On the mining area following a blast*****:** applications of alkaline material were placed on the top of the area immediately after the blast to provide for a mixing of alkalinity with overburden during overburden removal. A significant amount of the total required alkalinity was allotted to this procedure to ensure alkaline material was incorporated throughout the spoil to promote an alkaline environment. This was considered important because acidic strata not thick enough to be special handled was spoiled with the rest of the site's overburden.

IV. ***On the pit floor*****:** a minimal amount of the calculated alkaline material was placed on the pit floor to develop an alkaline environment in the area most likely to be affected by groundwater movement.

3.4 SPECIAL HANDLING AND ALKALINE ADDITION – PHASE VI

Phase VI of the surface mine coincides with the S3 area of the proposed CHRL. The following is a brief description of the mining methods, equipment, special handling procedures, and alkaline addition techniques employed for mining in the Phase VI area. This information was used to determine the quantity and location of previously SHMs. Refer to **Figure J-1.2** for a plan of this area.

3.4.1 Phase VI Mining

According to the Surface Mine Permit (SMP) Operations Plan, mining of the Phase VI area was performed primarily by the box-cut method with cuts oriented northeast-southwest, with successive (approximately) 100-foot-wide cuts advanced to the southwest. Initial cuts to commence mining were along the crop of the LK coal on the eastern side of Phase VI area. The sequence of mining and layout of the strip cuts are shown on **Figure J-1.1, Phase VI – Field Operations Map**.

Equipment used for the Phase VI mining reportedly included front end loaders, rock trucks, bulldozers, and a dragline. Material requiring special handling was removed by the mobile equipment, typically a front end loader and rock truck.

According to the PADEP correspondence, dated March 17, 1995 (**Exhibit J-1.3**), when the original application for the Kauffman Demonstration Permit was under review, all parties agreed that rock strata containing more than 1% total sulfur would be targeted for special handling and placed into constructed pods. Two distinct and fairly continuous strata within the LK overburden were noted, which exceeded the 1% sulfur threshold. The thicker of the two high sulfur content zones was reportedly associated with the

LKr coal seam. The LKR stratum, when present, was reportedly easily identified due to the presence of the LKr coal and the associated dark gray shale. The other stratum is associated with the PADEP identified as a lingula bearing dark gray to black shale unit between the LKr and the top of the LK coal seam (top split).

The PADEP correspondence stated that because the thickness of the LKr strata varied significantly across the Phase VI area, the thickness of LKr strata to be special handled was four feet, if the LKR was present. Additionally, the lingula bearing dark gray to black shale that was identified over a very limited portion of the area was not easily identifiable. Therefore, the PADEP did not require this material to be special handled.

To implement the mining plan, initial strip cuts were made along the eastern side of Phase VI, parallel to the outcrop of the LK in areas where the LKr was shallow, i.e. less than 15 feet of overburden. Due to the shallow depth of the LKr in this area, special handling was not required, as specified in PADEP's October 16, 1995 letter, which is included in **Exhibit J-1.3**. As noted in this PADEP letter, special handling of this material was not required since it was expected that the sulfur content of the LKr strata was effectively "weathered out" where the LKr overburden was less than 15 feet. Approximately four successive strip cuts were made along the crop of the LK coal in the eastern side of Phase VI.

Box-cuts were then advanced through the topographic saddle approximately 200 feet southwest of the phase boundary between Phase V and Phase VI. Areas where the overburden above the LKr exceeded 15 feet was mined in two benches, as shown on the **Figure J-1.1 Phase VI – Field Operations Map** and **Figure J-1.2 Phase VI – Special Handling Map**. This permitted the LKr and associated overburden possessing a total sulfur percentage greater than 1.0% to be special handled, when present. During the two-bench operation, a mobile unit reportedly removed overburden overlying the LKr and the LKr and associated sulfur-bearing strata for special handling, then a dragline removed the inter-burden between the SHM and the LK coal seam. Mining in the Phase VI area recovered the LK coal top split. The LK bottom split was not mined in the Phase VI area because it was of poor quality, thin, and discontinuous.

All LK pit cleanings, the carbonaceous shale immediately overlying the LK top split, and LK binders were to be special handled throughout the Phase VI area. According to the special handling plans, a mobile unit (loader and truck) was used to segregate and reposition this material in the constructed pods.

3.4.2 Special Handling of Sulfur-Bearing Strata

Excluding the LK coal seam and binders, the majority of material to be special handled was associated with the LKr strata; thus, a mining bench was established at the horizon to permit material segregation. Front-end loaders and rock trucks were used to segregate and transport the material, directly to the constructed pods in the backfill. The SHM was spread and compacted into 2-foot thick layers. Then a layer of alkaline material was spread over the SHM. Additional 2-foot layers were placed on top of the initial layer, with a maximum three layers in each of the pods. Positioning of the SHM was performed to keep material in the upper third of the backfill; however, the requirement to maintain a distance of 10 feet above the final pit floor, 10 feet from the final highwall, and 15 feet below the regraded ground surface was used as the ultimate governing factor. **Figure J-1.3** depicts (approximates) special handled pod placement within the backfilled areas.

The following is the stratum that was special handled, keyed to the site's mining phases, and shown on the **Figure J-1.2 Phase VI – Special Handling Map**:

Phase VI

- 3'8" unit – LKr coal and gray shale, identified on OB4 (OBA No. 12 and 13) and projected to TH3, not verified by OB analysis, and toward TH6
- Binders around LK coal and LK coal pit cleanings throughout the phase area.

As noted previously, the three foot gray siltstone corresponds to the lingula bearing strata. Pursuant to PADEP and as this unit was difficult to identify in the field, this strata was not special handled.

In general, all overburden other than the SHM was considered as “clean fill” for backfilling purposes by the PADEP. All SHM was repositioned in the backfill in specially constructed pods as depicted in **Figure J-1.3**. Repositioning of the SHM was generally in a multi-layered pod with maximum thickness of the layer restricted to two feet. Following compaction of the initial two foot layer, two additional layers were placed on top of the first. An 8-inch thick layer of alkaline material was placed on top of each two foot layer.

According to information obtained through interviews with personnel who worked for AHCC during the overburden drilling and mining of the Kauffman South site, less acidic rock strata was encountered than was predicted by the overburden drilling and analysis. Mr. Ken Maney (Environmental Compliance Manager for AHCC) was involved in the Kauffman South mining operations and observed the special handling and alkaline addition operations in the Phase I, II, and VI mining areas. During his involvement, the SHM pods were constructed and he kept track of the alkaline addition material placed on the site. It was Mr. Maney’s observations that significantly less sulfur-bearing strata was encountered during the actual mining than was predicted by the overburden analysis, particularly in the Phase VI area. He reported that there were areas where there was no LKr or black shale, and over most of the area this zone was much thinner than predicted. He reported that this zone was easily identified in the highwall, when present; because of the contrast this zones dark color relative to the other rock. In the areas where the LKr and shale was present, he estimated that this zone averaged two to three feet thick. As a result, significantly less sulfur-bearing strata was special handled than was originally calculated for this area. A copy of correspondence from Mr. Ken Maney is included as **Attachment J-2**.

Mr. Maney also provided descriptions of the constructed special handling pods. According to Mr. Maney, the pods were constructed within the strip cuts at least 10 feet above the pit floor on non-acidic overburden rock from the adjacent strip cut. The typical size of the pods was approximately 75 feet wide by 200 feet in length. Mr. Maney described that the pods were started by placing a 2-foot layer of compacted clay, then a 2-foot layer of acidic rock (SHM) was placed, compacted, and covered with an 8-inch layer of alkaline material. The pods typically contained three 2-foot layers of SHM and alkaline material. After three layers of SHM was placed in the pod, they were then covered and capped with a 2-foot layer of compacted clay. Mr. Maney indicated that on occasion, compacted clay soil would be placed over the pod if it was not completed and was to be left for a period of time. Mr. Maney reported that once a pod was started it was used until completed with three lifts of acidic material. In some of the strip cuts of Phase VI, no pods were reported constructed due to the fact that some areas had little to no acidic strata. Finally, Mr. Maney reported that given the high contrast in color of the dark SHM and light gray alkaline layers and the constructed nature of the pods, these pods will be very easy to identify visually.

3.5 VOLUME CALCULATIONS OF SPECIAL HANDLED MATERIALS

Based on the aerial extent and thickness of sulfur-bearing strata as identified by the overburden analysis the volume of acidic rock placed in the special handling pods was calculated. The calculation used the strata thickness as reported in the overburden analysis spreadsheets and influence areas for each overburden hole as shown on **Figure J-1.4 - Overburden Analysis Map.**

The calculations of the volume of SHM placed in the pods used the overburden data from drill holes OB4, C2, C1, OB3, OB1.1 and A1. The results of the calculation are presented in **Table J-1.1**. According to the overburden analysis and special handling plan requirements, it is estimated that about 203,600 (in-situ) cubic yards (CY) of potentially acidic rock consisting of the LKr, and associated shale, along with the carbonaceous material above the LK and pit cleanings associated with mining the LK top split was special handled and placed in the constructed pods. In addition, it is estimated that approximately 131,600 CY of carbonaceous rock and the LK bottom split, which was reportedly not mined, remain at the floor of the strip cuts.

During excavation of the Phase VI mined area for the development of the proposed S3 landfill area, the SHM in the pods will be excavated and placed in the lined landfill area as waste.

3.6 PHASE VI ALKALINE ADDITION

According to PADEP correspondence, a decision was reached at an October 5, 1995 meeting between representatives of PADEP, Penn State University, AHCC, and EEW Consultants, Inc., regarding the alkaline addition plan for Phase VI. According to the record, the alkaline addition plan for Phase VI was revised to provide a greater margin of safety with respect to post-mining water quality. This revision proposed a uniform alkaline addition rate of 1,000 tons per acre for the entire Phase VI area based in part on water quality data collected during prior water quality monitoring. This prior water quality monitoring indicated that the higher level of alkaline addition would successfully inhibit the production of AMD. To accomplish this, imported alkaline material was to be applied at the rate of 1,000 tons per acre through the Phase VI area, and distributed at various levels in the mined area according to the following alkaline addition application rates (as contained in Module 10 of the Surface Mining Permit Application):

Phase VI Alkaline Addition Application

Prior to Top Soil Placement	= 100 T/A x 85.87 acre =	***8,587*** T
Mining Area after Blast	= 453 T/A x 85.87 acre =	***38,907*** T
Around Special Handled Material (pods)	= ***29,789*** T/186.18 ac. – ft =	160 T/ac. – ft
Pit Floor	= 100 T/A x 85.87 acre =	***8,587*** T
	Total =	***85,870*** **T**

According to the SMP, the application of 1,000 tons/acre of imported alkaline material throughout Phase VI would result in the application of about 13,810 tons (161 tons/acre [T/ac.]) of alkaline material in excess of the amount required by computations using alkaline deficiencies obtained through overburden analysis.

M&E evaluated the previously Permitted Alkaline Addition Rates at the Kauffman Strip Mine Within the S3 Areas and determined that the alkaline material added to the Phase VI non-pod material is slightly in excess of what is required to neutralize the potential acidity, resulting in a Net Neutralization Potential of 0.1 tons/1,000 tons in the Phase VI area prior to any landfill alkaline additions. Refer to **Exhibit J-1.4**.

3.7 OFF SITE ALKALINE ADDITION MATERIAL

Based on the overburden analysis and the PADEP acid/base accounting methods, it was determined that the in-situ alkalinity of the strata on the site was not sufficient to neutralize the site's acidic strata. Therefore, it was necessary to import alkaline material from an off site source. The alkaline sources selected and used were bag house lime from Centre Lime and Stone, Inc., and scrubber sludge from Bellefonte Lime, Inc. These alkaline sources were waste products from area lime manufacturers that were readily available and possessed high neutralization potential as established by laboratory analysis. Therefore, these alkaline materials were hauled and stockpiled on the site and applied in sufficient quantity to offset the neutralization potential deficiencies calculated for the Phase VI area. The alkaline material was also added to the SHM pods, strip mine floor, mixed with the overburden rock, and placed on top of the regraded overburden prior to revegetation.

3.8 VOLUME OF CONSTRUCTED PODS

Based on overburden analysis, the quantity (in-situ volume) of sulfur-bearing strata in the Phase VI area that was special handled was calculated to be approximately **203,603 CY** (Refer to Section 3.5). Using this assumption, the volume of the constructed pods was calculated as follows (Refer to **Table J-1.2**). If a swell factor of 20% is applied to this volume, the estimated SHM volume in the constructed pods would be approximately **244,324 CY**. Using this volume of SHM and the presumption that the pods are approximately 75 feet by 200 feet in size and contain three 2-foot-thick lifts of SHM, it is estimated that there are approximately 74 pods in the Phase VI area as shown on **Figure J-1.5**.

As previously referenced, alkaline material was placed in 8-inch lifts on top of each two foot lift of SHM. Using this assumption, it is estimated that there is approximately **82,200 CY** of alkaline material in the pods. The soil volume (i.e. compacted clay beneath and above each pod) in the pods was estimated presuming that 2-foot soil layers were compacted beneath and on top of each pod. This results in approximately **164,400 CY** of soil in the pods. Cumulatively, these three volumes in the pods would indicate that the total pod volume is approximately **491,000 CY** (see **Table J-1.2**).

3.9 SULFUR-BEARING STRATA IN S2

Mining was planned for the Phase V and VII areas of the site, corresponding to the proposed S2 area of the landfill, but this mining was not performed. Mining did, however, encroach into a small portion of the Phase V area as part of the mining in the adjacent Phase VI area. Similarly to the Phase VI area, extensive geologic investigations and overburden analysis were performed in these areas. The investigations delineated sulfur-bearing strata in the overburden associated with LK coal seam and overlying LKr coal. In addition, a coal seam occurring above the LKr was encountered in a limited portion of the Phase VII mining area (i.e. proposed S2 landfill area). This coal seam was determined to be an isolated remnant of the Middle Kittanning (MK) coal. The MK coal in this area varies in thickness and is abruptly discontinuous, being sharply truncated by sandstone channel deposits. The occurrence of the MK coal is associated with the topographic high that occurs in the proposed S2 landfill area in the vicinity of monitoring well cluster W-4. The S2 area has been designed to minimize the excavation of sulfur-bearing strata delineated by the overburden analyses, such that there will be limited acid-forming materials encountered within the S2 area.

During the drilling of the eight new wells in April 2014 as directed by M&E, rock chip samples were collected at 1-foot intervals from the air rotary drilling for overburden analyses. These samples were collected and combined based on the PADEP procedures outlined in Tarantino and Shaffer, 1998. M&E used the conservative approach of analyzing the samples for total sulfur and assuming that all of the total sulfur was pyritic sulfur (i.e. no organic or sulfate sulfur were present in the sample). Samples were collected through the whole length of drilling for the five Wells, S2-1, S2-2, S2-3, S2-4, and S2-5 (**refer to Figure J-1.6 for locations**) in the S2 area. The drill logs for these locations are shown in **Form 6 Attachment 6-5**. The OBA spreadsheets for these locations are included in **Exhibit J-1.1**.

Table J-1.3 lists the overburden intervals with total sulfur greater than 0.5 percent for the eight overburden holes within the S2 Area, and two adjacent drill holes to the S2 Area that were drilled for the Kauffman Mine Operation. The lithologic logs for these ten holes that include all of the overburden analyses are in **Form 6 Attachment 6-4**. **Table J-1.4** lists the overburden intervals with total sulfur greater than 0.5 percent for the five overburden holes drilled in April 2014 within the S2 Area. The lithologic logs for these five holes that include the overburden analyses are in **Attachment 6-5**. The subbase elevations, **Drawing No. S3,** were developed to minimize contact with potential acid producing material with zones greater than 0.5 percent sulfur, as listed in **Tables J-1.3 and J-1.4** for the S2 Area.

3.10 SURFACE AND GROUNDWATER MONITORING

An extensive surface and groundwater monitoring system was established around the Kauffman South mine permit area to determine the success of the demonstration project. The monitoring plan included numerous cased monitoring wells installed to characterize existing groundwater conditions. The purpose of the monitoring system was to determine long term effects of the Kauffman mining and to separate the effects of the Kauffman mining operations from the existing contamination flowing from the Thompson mine site to the east.

To satisfy the normal permit requirements for the surface mining permit for surface and groundwater monitoring, a base level program was performed to document receiving streams and significant groundwater discharges within the permit and adjacent area. The monitoring system was developed, including special monitoring programs involving wells in the backfill, in native down dip strata, strata below the pit floor, and shallow waters near the crop line to directly assess the effects of mining on groundwater. Mining commenced on the Phase VI area in 1996 and took approximately seven years to complete. Special groundwater monitoring continued until approximately 2003.

Groundwater data collected from the existing and new monitoring wells installed as part of the landfill investigation indicated that the special handling and alkaline addition plan achieved only limited success. The groundwater monitoring wells installed in the backfill of the mined areas show a change in water quality over time and two small acidic discharges have developed southwest of the backfilled mined area. In addition, PADEP noted a change in groundwater quality in monitoring wells associated with the Kauffman mined areas. However, in some instances the water quality in the wells is alkaline with lower than expected metals, in particular iron, indicating that the water is neutralized acidic mine drainage. It is important to note that groundwater at this site is less degraded than the AMD from the adjacent Thompson mining site, indicating that the special handling and alkaline addition helped to substantially reduce the impacts of the Kauffman mining operations. Removal of the overburden in the previously mined areas by the proposed landfill operations, disposal of the pod materials within the lined landfill area, and implementing additional alkaline material will eliminate the source of the AMD impacts from the Kauffman mined area on the groundwater and surface water at the site.

4.0 IDENTIFICATION OF PODS – S3 AREA

Upon reaching base grades in the S2 area and construction of the first active lined landfill cell – (S2-1), re-excavation in S3 will be initiated. The re-excavation of S3, beginning in the Cell S3-1 area, will eventually encounter previously placed pods in S3 and it is intended to dispose of this material as waste in the lined landfill area. Within the S3 Area, the previously placed pods have been described as dark gray or black material placed into 74 pods measuring about 200'x75'x6' each comprised of alternating layers (bottom to top) of dark gray to black shaley materials (these are expected to be primarily finer materials), alkaline material (again, fine-grained and white to light gray) and a layer of clay (fine-grained, red to brown). Each pod was constructed in two to three cycles of these layers. Therefore, it is expected that these "pods" will stand-out in contrast to the surrounding overburden materials which were randomly placed and will be a more heterogeneous mixture of various colored material of variable sizes. Given these facts, the pods should be easily identifiable in the field which will ensure that they will not be inadvertently processed.

The remaining sulfur-bearing strata in S3 include the LK coal bottom split and overlying binders/shale. These sulfur-bearing strata represent the former surface mine's pit floor, which will be easily identifiable during excavation activities. Alkaline material was also placed on top of the surface mine pit floor prior to placement of structural fill and overlying liner systems. These combined features and the contrast in disturbed versus in place rock will provide an easily identifiable marker horizon. These strata will not be excavated.

5.0 MATERIAL HANDLING PLAN

The Material Handling Plan is included under **ATTACHMENT 14-2**.

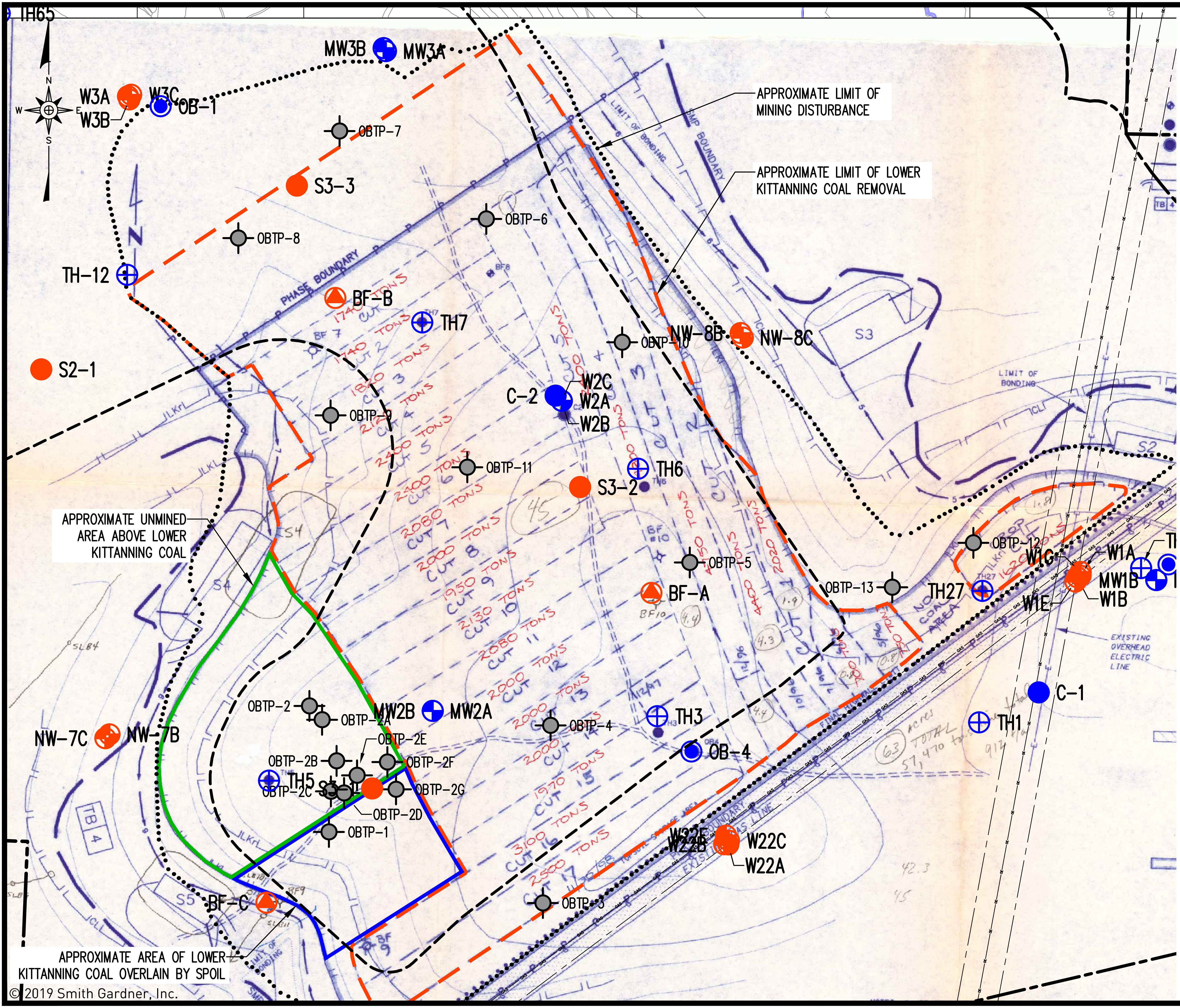
6.0 FINAL COVER GRADE

Final cover grades will be established by following the final grading plans. This can be accomplished by GPS surveying techniques, grade stakes, grid survey, GPS-mounted equipment or other similar methods. There will be a minimum of three (3) permanent physical survey control monuments (benchmarks) located on the landfill property within close proximity to the waste disposal area. Permanent survey control monuments will consist of a standard surveyor's monument disc cast in concrete. During the construction of the final cover system, a survey crew will go to the work site as needed to stake-out the various construction perimeters and control points. The survey crew will return to the site as needed to re-establish the control points if/when they are damaged or lost.

PHASE II APPLICATION
CAMP HOPE RUN LANDFILL
BOGGS TOWNSHIP, CLEARFIELD COUNTY, PENNSYLVANIA

FORM J
ATTACHMENT J-1
Figures

REVISED JUNE 2019



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LEGEND

—1770—	*EXISTING GROUND CONTOUR (10' INTERVAL)*
— - - —	*PROPERTY LINE*
— - —	*FACILITY BOUNDARY*
—-·-—	*FACILITY LIMIT COINCIDENT WITH PROPERTY LINE*
—OE—OE—OE—	*EXISTING OVERHEAD POWER TRANSMISSION LINE*
—GAS—GAS—GAS—	*EXISTING GAS LINE*
—— - ——	*RIGHT OF WAY*
- - - - -	PROPOSED LIMIT OF WASTE (LINED AREA)
◕ MW1A	*GROUNDWATER WELL USED FOR SITE CHARACTERIZATION*
▲ BF-B	*GROUNDWATER WELL USED FOR SITE CHARACTERIZATION*
⊕ TH1	*GEOLOGIC WELL USED FOR SITE CHARACTERIZATION*
● C-1, CH-1	*COREHOLE USED FOR SITE CHARACTERIZATION*
◉ OB-3,A-4,C-5	*OVERBURDEN ANALYSIS BOREHOLE USED FOR SITE CHARACTERIZATION*
◕ NW-1, W1	*GROUNDWATER WELL USED FOR SITE CHARACTERIZATION*
● S2, S3	*INVESTIGATIVE WELLS (APRIL 2014, M&E)*
S2	*SURFACE WATER IMPOUNDMENT*
SB	*SEDIMENT BASIN FROM FORMER MINING OPERATIONS*
TB	*TREATMENT BASIN FROM FORMER MINING OPERATIONS*
〰	*STREAM*
⊕ OBTP-7	*OVERBURDEN TEST PIT LOCATION (SEE REFERENCE 2)*

REFERENCES

1. AL HAMILTON CONTRACTING COMPANY, KAUFFMAN OPERATION: PHASE VI – FIELD OPERATIONS MAP HIGHWALL STATUS 11/30/98.
2. OBTP LOCATIONS ARE BASED ON STAKE–OUT POINTS BY GEOTECHNICAL ENGINEERING INC. OF MORRISDALE, PA PRIOR TO EXCAVATING THE TEST PITS, EXCEPT FOR OTB–2A THROUGH 2G, OBTP–12 AND OBTP–13 WHICH WERE BASED ON FIELD MEASUREMENTS FROM KNOWN POINTS.

0 300' 600'

PREPARED BY:

SMITH+GARDNER

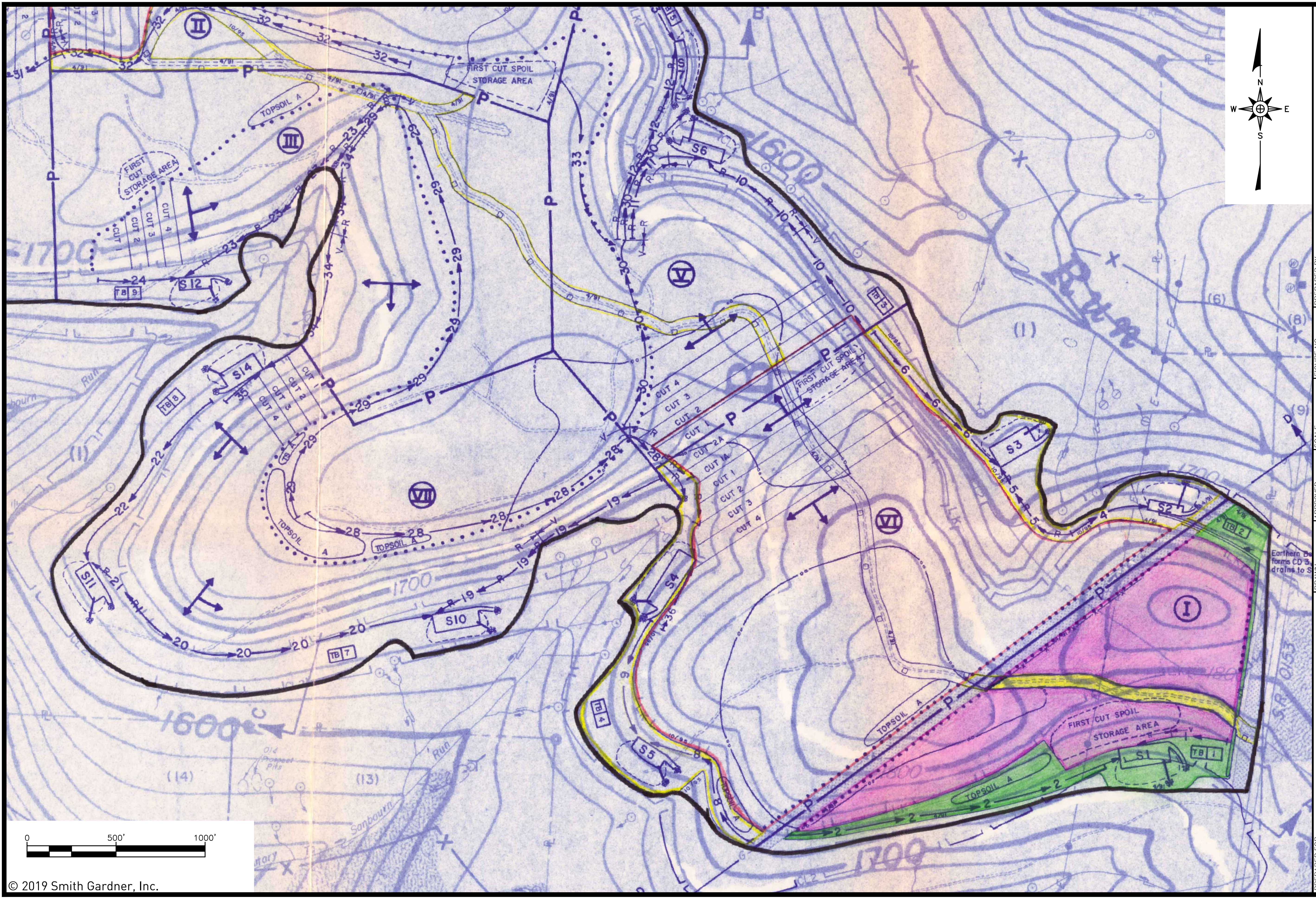
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

FIGURE NO.	J-1.1	FILENAME:	PAWASTE-B0078
SCALE:	AS SHOWN	PROJECT NO:	PAWASTE 16-1
APPROVED:	G.G.M.	DATE:	Feb 2019
DRAWN:	C.T.J.		

PREPARED FOR:

PA WASTE, LLC

OVERBURDEN TEST PIT LOCATIONS



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PREPARED FOR:

PA WASTE LLC - CAMP HOPE RUN LANDFILL
CLEARFIELD COUNTY
KAUFFMAN OPERATION
PHASE VI - SPECIAL HANDLING MAP

DRAWN:	APPROVED:	SCALE:	FIGURE NO.
C.T.J.	W.M.B.	AS SHOWN	J-1.2

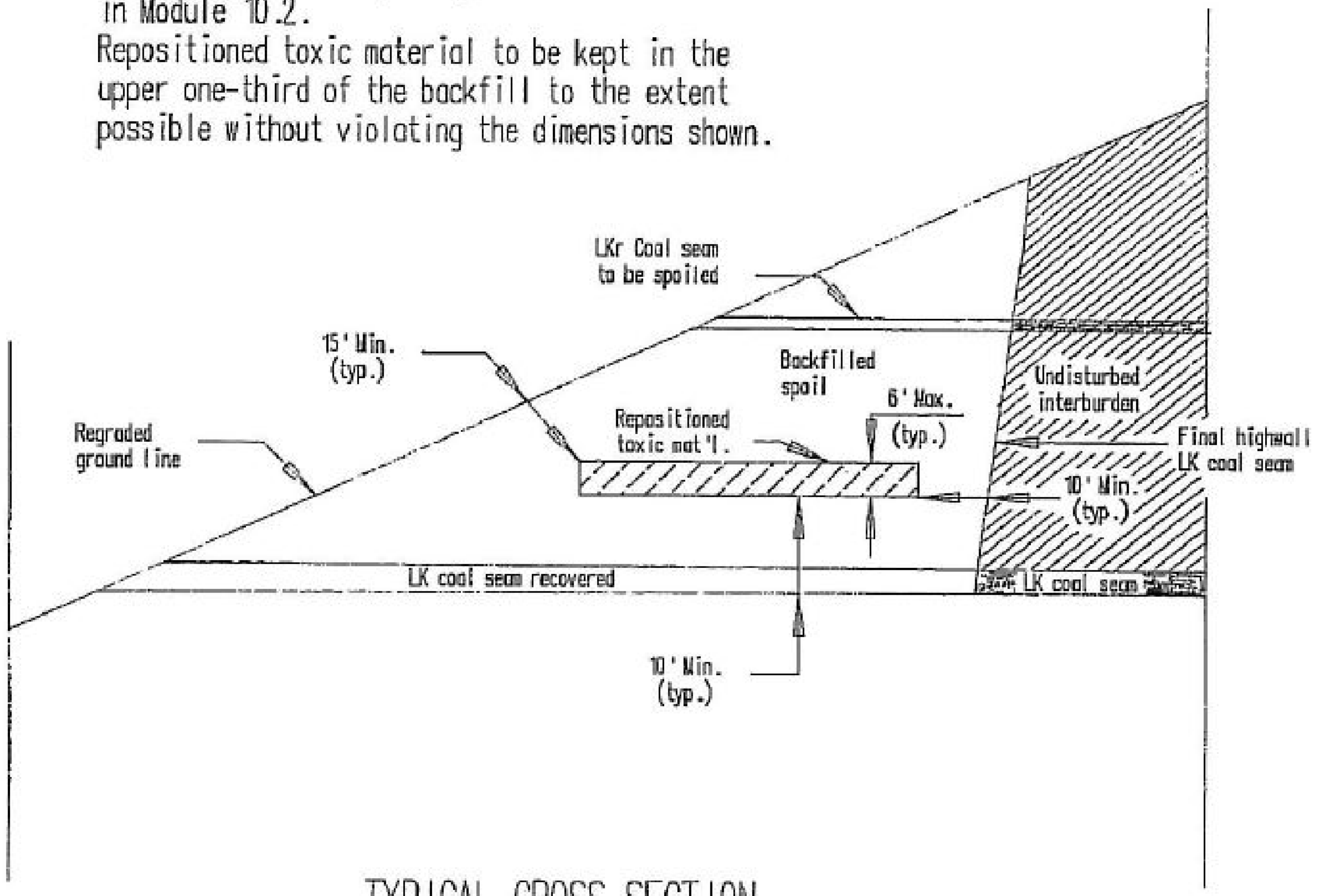
DATE:	PROJECT NO:	FILENAME:
Feb 2019	PAWASTE 16-1	PAWASTE-B0080

PREPARED BY:

SMITH+GARDNER

14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

NOTE: Alkaline material to be positioned on pit floor, around repositioned toxic material, on the area to be mined following a blast and on the regraded backfill prior to topsoil placement as discussed in Module 10.2.
Repositioned toxic material to be kept in the upper one-third of the backfill to the extent possible without violating the dimensions shown.



TYPICAL CROSS SECTION

POSTMINING PLACEMENT OF POTENTIALLY TOXIC MATERIAL

No Scale

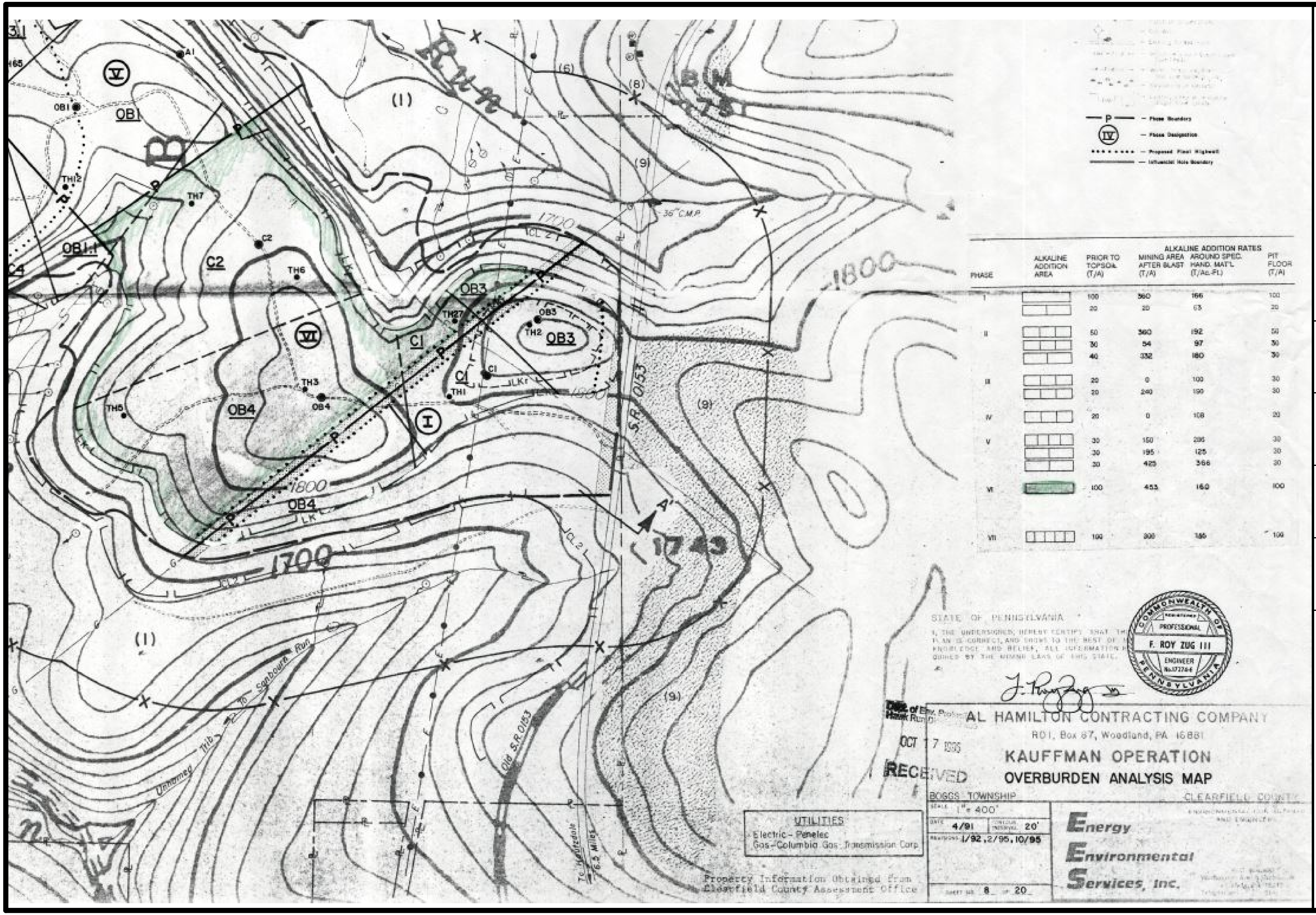
REF: KAUFFMAN SOUTH SURFACE PERMIT SMP #17890115, MODULE 10.

SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

FIGURE NO.: J-1.3
SCALE: NOT TO SCALE
APPROVED: JMG
DRAWN: DMM
FILENAME:
PROJECT NO.: PA WASTE 16-1
DATE: FEB. 2018

PA WASTE LLC - CAMP HOPE RUN LANDFILL
CLEARFIELD COUNTY

KAUFFMAN OPERATION
SPECIAL HANDLED MATERIALS PLACEMENT DETAIL



		ALKALINE ADDITION RATES			
PHASE	ALKALINE ADDITION AREA	PRIOR TO TOPSOIL (T/A)	MINING AREA AFTER BLAST (T/A)	AROUND SPEC. HAND. MAT'L (T/Ac.-Ft.)	PIT FLOOR (T/A)
I	☐	100	360	166	100
	☐☐	20	20	63	20
II	☐☐☐	50	360	192	50
	☐☐☐	30	54	97	30
	☐☐	40	332	180	30
III	☐☐☐	20	0	100	30
	☐☐☐	20	240	190	30
IV	☐☐☐	20	0	108	20
V	☐☐☐☐	30	150	206	30
	☐☐	30	195	125	30
	☐☐	30	425	366	30
VI	🟩	100	453	160	100
VII	☐☐☐☐☐	100	300	185	100

STATE OF PENNSYLVANIA

I, THE UNDERSIGNED, HEREBY CERTIFY THAT THE PLAN IS CORRECT, AND SHOWS TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL INFORMATION REQUIRED BY THE MINING LAWS OF THIS STATE.

F. ROY ZUG III

F. Roy Zug III

OCT 17 1995

RECEIVED

UTILITIES
Electric – Penelec
Gas – Columbia Gas Transmission Corp.

Property Information Obtained from
Clearfield County Assessment Office

AL HAMILTON CONTRACTING COMPANY
RD1, Box 87, Woodland, PA 16881

KAUFFMAN OPERATION
OVERBURDEN ANALYSIS MAP

BOGGS TOWNSHIP
CLEARFIELD COUNTY

SCALE 1" = 400'
DATE 4/91
CONTOUR INTERVAL 20'
REVISIONS 1/92, 2/95, 10/95
SHEET NO. 8 OF 20

Energy
Environmental
Services, Inc.

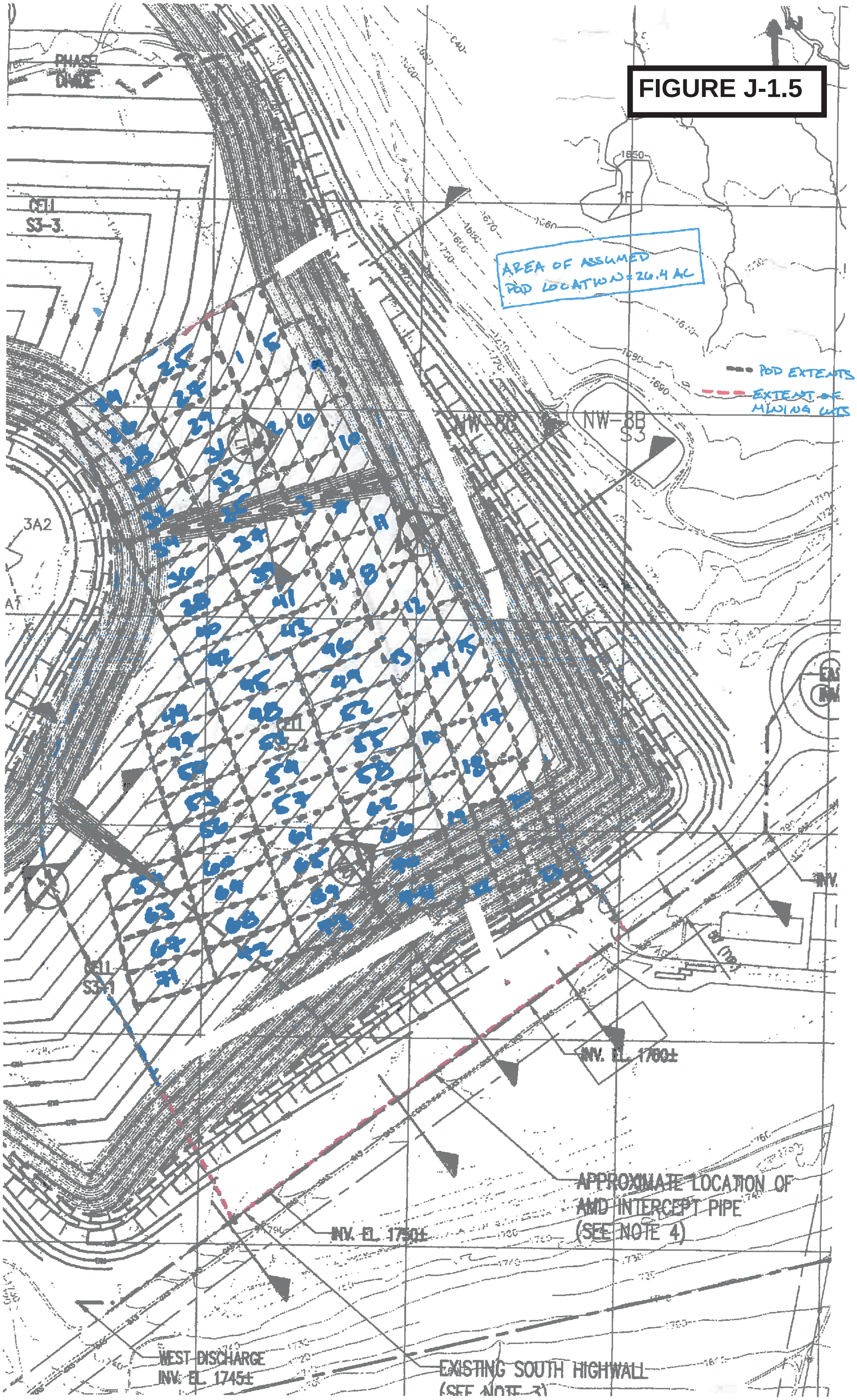
PA WASTE LLC - CAMP HOPE RUN LANDFILL
CLEARFIELD COUNTY

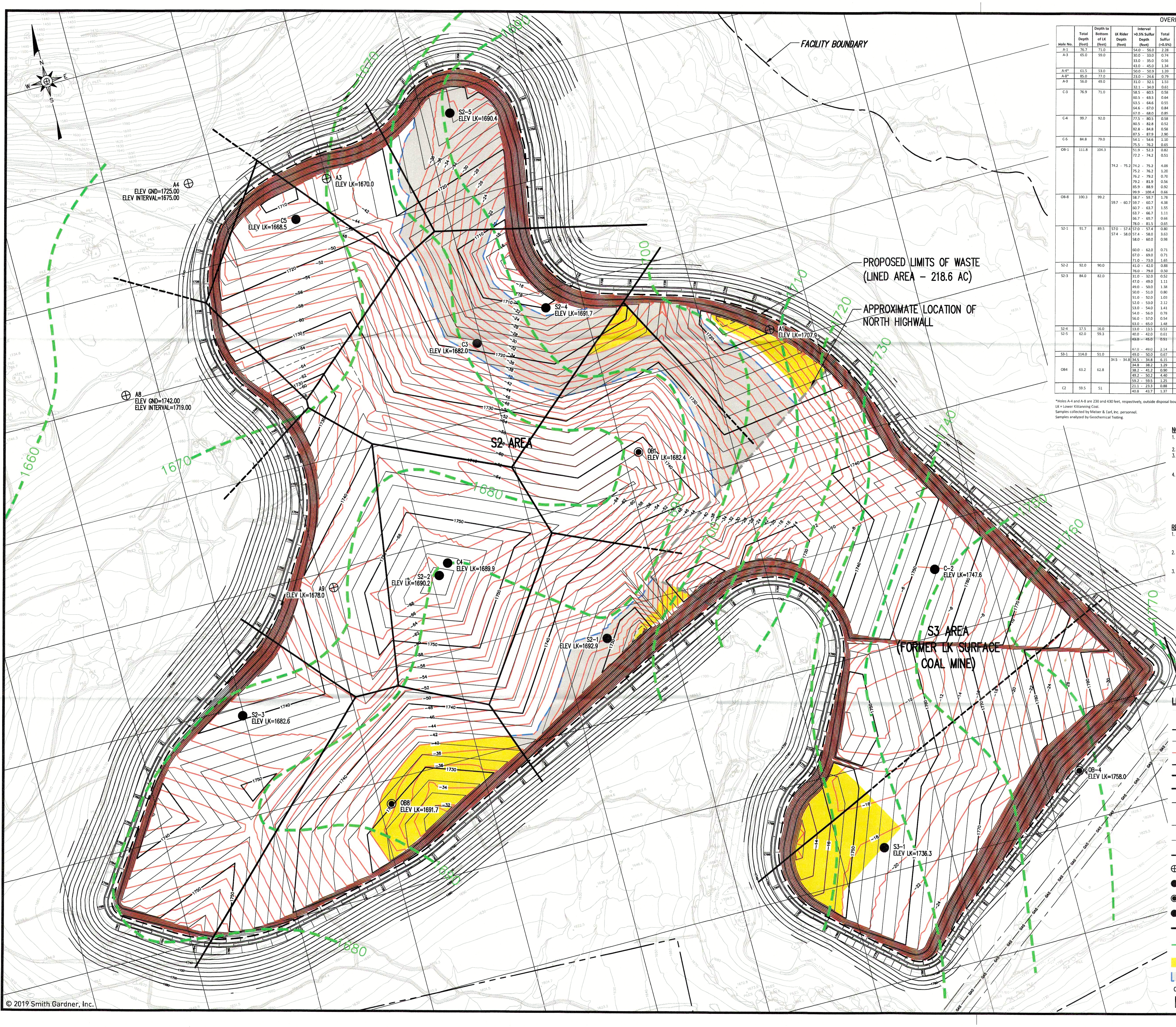
KAUFFMAN OPERATION
PHASE VI - OVERBURDEN ANALYSIS MAP

DRAWN: DMM
APPROVED: JMG
SCALE: NOT TO SCALE
FIGURE NO.: J-1.4
DATE: FEB. 2018
PROJECT NO.: PA WASTE 16-1
FILENAME:

SMITH+GARDNER
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577

FIGURE J-1.5


PHASE DIVIDE
CELL S3-3
3A2
AREA OF ASSUMED POD LOCATION = 26.4 AC
POD EXTENTS
EXTENT OF MINING CUTS
NW-8C
NW-8B
S3
CELL S3-2
CELL S3-1
INV. EL. 1760±
APPROXIMATE LOCATION OF AMD INTERCEPT PIPE (SEE NOTE 4)
INV. EL. 1750±
WEST DISCHARGE INV. EL. 1745±
EXISTING SOUTH HIGHWALL (SEE NOTE 3)



OVERBURDEN ANALYSIS SUMMARY

Hole No.	Total Depth (feet)	Depth to Bottom of LK (feet)	LK Rider Depth (feet)	Interval >0.5% Sulfur Depth (feet)	Total Sulfur (>0.5%)	Height Above Bottom of LK (feet)	LK Rider Height Above Bottom of LK (feet)	Description
A-1	76.7	71.0		54.0 - 56.0	2.28	17.0 - 15.0		Dark gray shale
A-3	65.0	59.0		30.0 - 33.0	0.74	29.0 - 26.0		Dark gray , coarse-grained sandstone, many binders
				33.0 - 35.0	0.56	26.0 - 24.0		Dark gray , coarse-grained sandstone, many binders
				43.0 - 45.0	1.34	16.0 - 14.0		Dark gray shale
A-4*	61.5	53.0		50.0 - 50.9	1.20	9.0 - 8.1		Coal and dark gray shale
A-8*	85.0	77.0		23.0 - 24.6	0.79	54.0 - 52.4		Dark gray sandy shale
A-9	56.0	49.0		31.0 - 32.1	1.53	18.0 - 16.9		Dark sandstone with coal
				32.1 - 34.0	0.61	16.9 - 15.0		Dark gray shale with black layers
C-3	76.9	71.0		58.5 - 60.5	0.58	12.5 - 10.5		Light gray sandstone laminae
				60.5 - 63.5	0.64	10.5 - 7.5		Medium-dark to medium-light gray siltstone
				63.5 - 64.6	0.55	7.5 - 6.4		Light gray, very fine-grained sandstone
				64.6 - 67.0	0.84	6.4 - 4.0		Medium gray, very fine-grained sandstone to claystone
				67.0 - 68.0	0.85	4.0 - 3.0		Dark gray claystone (on coal)
C-4	99.7	92.0		77.5 - 80.5	0.58	14.5 - 11.5		Grayish black siltstone, decreasing organic with depth
				80.5 - 82.8	0.52	11.5 - 9.2		Grayish black siltstone, decreasing organic with depth
				82.8 - 84.8	0.58	9.2 - 7.2		Grayish black siltstone, decreasing organic with depth
				87.5 - 87.9	2.90	4.5 - 4.1		Medium black to dark gray siltstone (on coal)
C-5	84.8	79.0		54.1 - 54.6	1.10	24.9 - 24.4		Fine sandstone 50%-70% coal stringers
				75.5 - 76.2	0.65	3.5 - 2.8		Medium gray, fine sandstone (on coal)
OB-1	111.8	104.3		51.9 - 52.3	0.82	52.4 - 52.0		Black carbonaceous shale intermixed with coal
				72.2 - 74.2	0.51	32.1 - 30.1		Dark gray carbonaceous sandstone, black carbonaceous shale, intermixed with coal
			74.2 - 75.2	74.2 - 75.2	4.09	30.1 - 29.1	30.1 - 29.1	Coal **LK rider**
				75.2 - 76.2	1.20	29.1 - 28.1		Dark gray carbonaceous shale intermixed with coal
				76.2 - 79.2	0.70	28.1 - 25.1		Dark gray shale
				79.2 - 81.9	0.56	25.1 - 22.4		Dark gray shale
				85.9 - 88.9	0.92	18.4 - 15.4		Dark gray shale
				99.9 - 100.4	0.66	4.4 - 3.9		Dark gray shale and coal
OB-8	100.3	99.2		58.7 - 59.7	1.78	40.5 - 39.5		Gray-black shale
			59.7 - 60.7	59.7 - 60.7	4.38	39.5 - 38.5	39.5 - 38.5	**LK rider coal** and black shale
				60.7 - 63.7	1.55	38.5 - 35.5		Dark gray clay shale
				63.7 - 66.7	1.11	35.5 - 32.5		Dark gray shale
				66.7 - 69.7	0.66	32.5 - 29.5		Dark gray shale
				78.0 - 81.5	0.65	21.2 - 17.7		Dark gray clay shale
S2-1	91.7	89.5	57.0 - 57.4	57.0 - 57.4	0.80	32.5 - 32.1	32.5 - 32.1	Coal and black shale, **LK rider**
			57.4 - 58.0	57.4 - 58.0	3.63	32.1 - 31.5	32.1 - 31.5	Coal and siltstone, **LK rider**
				58.0 - 60.0	0.98	31.5 - 29.5		Gray and yellowish brown, fine-grained to very fine-grained sandstone
				60.0 - 62.0	0.71	29.5 - 27.5		Gray very fine-grained sandstone
				67.0 - 69.0	0.71	22.5 - 20.5		Gray very fine-grained sandstone
				71.0 - 73.0	1.65	18.5 - 16.5		Gray silty shale.
S2-2	92.0	90.0		41.0 - 42.0	0.88	49.0 - 48.0		Gray claystone, thin coal
				76.0 - 79.0	0.50	13.1 - 10.1		Medium-dark gray very fine-grained sandstone
S2-3	84.0	82.0		31.0 - 32.0	0.52	51.0 - 50.0		Black shale and gray siltstone
				47.0 - 49.0	1.11	35.0 - 33.0		Gray siltstone
				49.0 - 50.0	1.38	33.0 - 32.0		Medium-dark gray shale
				50.0 - 51.0	0.80	32.0 - 31.0		Medium-dark gray shale
				51.0 - 52.0	1.03	31.0 - 30.0		Medium-dark gray shale
				52.0 - 53.0	2.12	30.0 - 29.0		Medium-dark gray shale
				53.0 - 54.0	1.41	29.0 - 28.0		Gray siltstone very fine-grained sandstone
				54.0 - 56.0	0.78	28.0 - 26.0		Gray siltstone
				56.0 - 57.0	0.54	26.0 - 25.0		Gray siltstone
				63.0 - 65.0	1.48	19.0 - 17.0		Gray shale
S2-4	17.5	16.0		13.0 - 13.5	0.53	3.0 - 2.5		Yellow clay on coal
S2-5	62.0	59.3		40.0 - 42.0	0.61	19.3 - 17.3		Gray very fine-grained sandstone
				43.0 - 45.0	0.51	16.3 - 14.3		Gray very fine-grained sandstone, shale siltstone interbed
				47.0 - 49.0	2.14	12.3 - 10.3		Gray shale
S3-1	114.0	51.0		49.0 - 50.0	0.67	1.0 - 2.0	-	Medium brown shale
OB4	63.2	62.8	34.5 - 34.8	34.5 - 34.8	6.15	28.3 - 28.0	28.3 - 28.0	LK Rider - coal
				34.8 - 38.2	1.29	28.0 - 24.6	-	Medium gray shale
				38.2 - 41.2	0.90	24.6 - 21.6	-	Medium gray sandy shale
				49.2 - 50.2	4.40	13.6 - 12.6	-	Dark gray/black shale
				59.2 - 59.5	1.25	3.6 - 3.3	-	Dark gray shale and coal
C2	59.5	51		21.1 - 23.3	0.88	29.9 - 27.7	-	Light gray sandstone
				40.8 43.7	1.37	10.2 7.3	-	Dark gray siltstone - lingula

*Holes A-4 and A-8 are 230 and 430 feet, respectively, outside disposal boundary.
LK = Lower Kittanning Coal.
Samples collected by Meiser & Earl, Inc. personnel.
Samples analyzed by Geochemical Testing.

NOTES

1. HOLES A–4 AND A–8 ARE (APPROXIMATELY) 230 AND 430 FEET, RESPECTIVELY OUTSIDE THE WASTE DISPOSAL BOUNDARY.
2. LK: LOWER KITTANNING COAL.
3. THE ISOPACH LINES REPRESENT THE DISTANCE BETWEEN THE SUBBASE CONTOURS AND THE STRUCTURAL CONTOUR BASE OF THE LOWER KITTANING COAL. A NEGATIVE VALUE REPRESENTS DEPTH BELOW SUBBASE.
4. THE LOWER KITTANNING RIDER COAL (LKr) NOT PREVIOUSLY IDENTIFIED TO BE > 1.0% TOTAL SULFUR MAY BE INCIDENTALLY ENCOUNTERED DURING SUBGRADE EXCAVATION WITHIN THE HORIZONTAL LIMITS IDENTIFIED FROM 20 TO 40 FEET ABOVE THE BASE OF THE LOWER KITTANING COAL AS A COAL WITH CARBONACEOUS SHALE INTERMIXED WITH BLACK SHALE. THIS COAL ALONG WITH BLACK SHALE COULD BE UP TO 2 FEET ABOVE AND BELOW THE COAL WILL BE DISPOSED WIHTIN THE LANDFILL AS A "WASTE".

REFERENCES

1. DIGITAL TOPOGRAPHY FOR THE SITE WAS COMPILED FROM AERIAL PHOTOGRAPHY OBTAINED ON DECEMBER 20, 2004, BY MAPMAKER PHOTOGRAMMETRIC SERVICES, ST. ALBANS, VERMONT.
2. TOPOGRAPHY AUGMENTED WITH TOPOGRAPHIC AND CULTURAL INFORMATION FROM U.S.G.S. 7.5 MINUTE GLEN RICHEY (1993) AND WALLACETON (1993) PA TOPOGRAPHIC QUADRANGLE MAPS.
3. PUBLICATION TITLED, "COAL MINE DRAINAGE PREDICTION AND POLLUTION PREVENTION IN PENNSYLVANIA", PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION, OCTOBER 1998, CHAPTER 11, INTERPRETATION OF ACID–BASE ACCOUNTING.

LEGEND

1770	*EXISTING GROUND CONTOUR (10' INTERVAL)*
1832	SUBBASE CONTOUR (10' INTERVAL)
	SUBBASE CONTOUR (2' INTERVAL)
-30	ISOPACH LINES (2' INTERVAL) (SEE NOTE 3)
	PROPERTY LINE
	FACILITY BOUNDARY
	FACILITY LIMIT COINCIDENT WITH PROPERTY LINE
OE OE	*EXISTING OVERHEAD POWER TRANSMISSION LINE*
GAS GAS GAS	*EXISTING GAS LINE*
	RIGHT OF WAY
	PROPOSED LIMIT OF WASTE (LINED AREA)
⊕ A4, TH-1	*GEOLOGIC WELL*
● C1, CH-1	*COREHOLE*
◉ OB3	*OVERBURDEN ANALYSIS BOREHOLE*
● S2, S3	*INVESTIGATIVE WELLS (2014 MEISER & EARL)*
	THEISSEN POLYGON CONSTRUCTION LINE (SEE REFERENCE 3)
1680	*STRUCTURAL CONTOUR BASE OF LOWER KITTANNING COAL*
🟨	*TOTAL SULFUR >1.0%*
▨	*POTENTIAL LKr LIMITS (SEE NOTE 4)*

0 200' 400' 600'

PREPARED FOR:

PA WASTE, LLC
CLEARFIELD COUNTY, PA

PREPARED BY:

SMITH+ GARDNER ENGINEERS
14 N. Boylan Avenue, Raleigh NC 27603 | 919.828.0577
1526 Richland St., Columbia SC 29201

SEAL

JOHN M. GARDNER
No. 036615-E
7/1/19

SEAL

REV.	DATE	DESCRIPTION
1	3/19	RESPONSE TO 11/26/18 PADEP COMMENTS
2	6/19	RESPONSE TO 6/4/19 PADEP COMMENTS

PROJECT TITLE:

PA WASTE, LLC
CAMP HOPE RUN LANDFILL
CLEARFIELD COUNTY, PA

DRAWING TITLE:

OVERBURDEN ANALYSES AREAS OF INFLUENCE FOR S2 AREA

DESIGNED: J.M.G.	PROJECT NO: PAWASTE 16-1
DRAWN: C.T.J.	SCALE: AS SHOWN
APPROVED:	DATE: FEB. 2018
FILENAME: PAWASTE-D0057	
SHEET NUMBER:	DRAWING NUMBER: J-1.6

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PHASE II APPLICATION
CAMP HOPE RUN LANDFILL
BOGGS TOWNSHIP, CLEARFIELD COUNTY, PENNSYLVANIA

FORM J
ATTACHMENT J-1
Tables

Table J-1.1
Area S3 "Special Handled Material" Volumes

Former Area Designation	**Acres within S3**	**Thickness (ft) of "Special Handled Material"**	**Thickness (ft) of LK bottom and binders**	**Volume (cubic feet) of "Special Handled Material" (within pods)**	**Volume (cubic yards) of "Special Handled Material" (within pods)**	**Volume (cubic feet) of LK and binders**	**Volume (cubic yards) of LK and binders**
OB4***a***	30.29	3.67		4,842,317	179,345		
OB4***b***	38.29	0.33		550,411	20,386		
OB4***c***	38.29		0.70			1,167,539	43,242
Subtotal		*4.00*	*0.70*	*5,392,728*	*199,731*	*1,167,539*	*43,242*
C2***d***	40.92		1.25			2,228,094	82,522
Subtotal		*0.00*	*1.25*	*0*	*0*	*2,228,094*	*82,522*
C1***e***							
OB3***f***							
OB1.1	1.20	2.00		104,544	3,872		
OB1.1	1.20		2.58			134,862	4,995
Subtotal		*2.00*	*2.58*	*104,544*	*3,872*	*134,862*	*4,995*
A1	0.47		1.16			23,749	880
Subtotal		*0.00*	*1.16*	*0*	*0*	*23,749*	*880*
Total (Material in Pods)		**6.00**		**5,497,272**	**203,603**		
Total LK bottom split with binders			**5.69**			**3,554,243**	**131,639**

Notes:

OB4***a*** - acreage of OB4 reduced by 8 acres due to the lack of overburden above the LK rider zone as per PADEP letter of October 1995.

OB4***b*** - includes the clay binder above the LK top split that was special handled in OB4.

OB4***c*** - includes the clay binder above the LK bottom split and the LK bottom split over the entire OB4 area.

C2***d*** - includes the clay binder above and below LK bottom split and the LK bottom split over the entire C2 area.

C1e - no "Special Handled Material" identified and the area is outside the footprint of the proposed landfill.

OB3f - LK was not split at this location and the only "Special Handled Material" was beneath the LK. The area is outside the footprint of the proposed landfill.

Total Special Handled Material in Pods (less C2) - does not include the lingula bearing zone as the PADEP noted it was not practicable to special handle.

Table J-1.2

S3 Area - Volume of Material in Constructed Pods

Date: **3/30/2019**
By: **WMB**

Camp Hope Run Landfill
PA Waste LLC
Boggs Township, Clearfield County, PA

Purpose:

Determine the volume of material placed in the constructed pods located within the Phase VI area of the surface mine permit, which coincides with the proposed S3 area of the landfill. This estimated volume of special handled material will be removed as part of the excavation of the S3 area and placed in the lined areas of the landfill.

Assumptions:

1. Each Pod consists of the following layers from Top to Bottom:

   - 2-foot-thick soil layer
   - 2-foot-thick acid rock layer
   - 8-inch-thick alkaline layer
   - 2-foot-thick acid rock layer
   - 8-inch-thick alkaline layer
   - 2-foot-thick acid rock layer
   - 8-inch-thick alkaline layer
   - 2-foot-thick soil layer

2. The volume of special handled material (SHM) in Phase VI area is 203,603 cubic yards (cy) based on overburden analysis. Assuming a swell factor of 20 percent for this material when placed in pods the special handled material is estimated to have a volume of approximately 244,324 cy.

3. Constructed pod size is 75 ft x 200 ft or 15,000 square feet (sf).

Total Estimated SHM: 244,324 cy

Number of Pods Based on SHM Volume:

75 ft x 200 ft x 6 ft of special handled material = 90,000 cubic feet (cf) per pod
3,333 cubic yards(cy) per pod

244,324 cy SHM/ 3,333 cy = 74 pods

Alkaline Material in Pods:

3 (8-inch-lifts) x 74 (pods) x 15000 sf = 2,220,000 cf
82,222 cy

Soil in Pods:

2 (2-foot-lifts) x 74 (pods) x 15000 sf = 4,440,000 cf
164,444 cy

Total Volume in Pods

Special Handled Material (SHM)	=	244,324	cy
Alkaline Material	=	82,222	cy
Soil	=	164,444	cy
Total Pod Volume =		**490,990**	**cy**

TABLE J-1.3
PA Waste, LLC
Camp Hope Run Landfill
Overburden Analyses Summary
Kauffman Mine Operation Drill Holes
S2 Area

Hole No.	Total Depth (feet)	Depth to Bottom of LK (feet)	LK Rider Depth (feet)	Interval >0.5% Sulfur Depth (feet)	Total Sulfur (>0.5%)	Height Above Bottom of LK (feet)	LK Rider Height Above Bottom of LK (feet)	Description
A-1	76.7	71.0		54.0 - 56.0	2.28	17.0 - 15.0		Dark gray shale
A-3	65.0	59.0		30.0 - 33.0	0.74	29.0 - 26.0		Dark gray , coarse-grained sandstone, many binders
				33.0 - 35.0	0.56	26.0 - 24.0		Dark gray , coarse-grained sandstone, many binders
				43.0 - 45.0	1.34	16.0 - 14.0		Dark gray shale
A-4*	61.5	53.0		50.0 - 50.9	1.20	9.0 - 8.1		Coal and dark gray shale
A-8*	85.0	77.0		23.0 - 24.6	0.79	54.0 - 52.4		Dark gray sandy shale
A-9	56.0	49.0		31.0 - 32.1	1.53	18.0 - 16.9		Dark sandstone with coal
				32.1 - 34.0	0.61	16.9 - 15.0		Dark gray shale with black layers
C-3	76.9	71.0		58.5 - 60.5	0.58	12.5 - 10.5		Light gray sandstone laminae
				60.5 - 63.5	0.64	10.5 - 7.5		Medium-dark to medium-light gray siltstone
				63.5 - 64.6	0.55	7.5 - 6.4		Light gray, very fine-grained sandstone
				64.6 - 67.0	0.84	6.4 - 4.0		Medium gray, very fine-grained sandstone to claystone
				67.0 - 68.0	0.85	4.0 - 3.0		Dark gray claystone (on coal)
C-4	99.7	92.0		77.5 - 80.5	0.58	14.5 - 11.5		Grayish black siltstone, decreasing organic with depth
				80.5 - 82.8	0.52	11.5 - 9.2		Grayish black siltstone, decreasing organic with depth
				82.8 - 84.8	0.58	9.2 - 7.2		Grayish black siltstone, decreasing organic with depth
				87.5 - 87.9	2.90	4.5 - 4.1		Medium black to dark gray siltstone (on coal)
C-5	84.8	79.0		54.1 - 54.6	1.10	24.9 - 24.4		Fine sandstone 50%-70% coal stringers
				75.5 - 76.2	0.65	3.5 - 2.8		Medium gray, fine sandstone (on coal)
OB-1	111.8	104.3		51.9 - 52.3	0.82	52.4 - 52.0		Black carbonaceous shale intermixed with coal
				72.2 - 74.2	0.51	32.1 - 30.1		Dark gray carbonaceous sandstone, black carbonaceous shale, intermixed with coal
			74.2 - 75.2	74.2 - 75.2	4.09	30.1 - 29.1	30.1 - 29.1	Coal **LK rider**
				75.2 - 76.2	1.20	29.1 - 28.1		Dark gray carbonaceous shale intermixed with coal
				76.2 - 79.2	0.70	28.1 - 25.1		Dark gray shale
				79.2 - 81.9	0.56	25.1 - 22.4		Dark gray shale
				85.9 - 88.9	0.92	18.4 - 15.4		Dark gray shale
				99.9 - 100.4	0.66	4.4 - 3.9		Dark gray shale and coal
OB-8	100.3	99.2		58.7 - 59.7	1.78	40.5 - 39.5		Gray-black shale
			59.7 - 60.7	59.7 - 60.7	4.38	39.5 - 38.5	39.5 - 38.5	**LK rider coal** and black shale
				60.7 - 63.7	1.55	38.5 - 35.5		Dark gray clay shale
				63.7 - 66.7	1.11	35.5 - 32.5		Dark gray shale
				66.7 - 69.7	0.66	32.5 - 29.5		Dark gray shale
				78.0 - 81.5	0.65	21.2 - 17.7		Dark gray clay shale

*Holes A-4 and A-8 are 230 and 430 feet, respectively, outside disposal boundary.

LK = Lower Kittanning Coal.

TABLE J-1.4
PA Waste, LLC
Camp Hope Run Landfill
Overburden Analyses Summary
April 2014 Drill Holes
S2 Area

Hole No.	Total Depth (feet)	Depth to Bottom of LK (feet)	Surface Elevation (feet)	LK Rider Depth (feet)	Interval >0.5% Sulfur Depth (feet)	Total Sulfur (>0.5%)	Height Above Bottom of LK (feet)	LK Rider Height Above Bottom of LK (feet)	Description
S2-1	91.7	89.5	1781.1	57.0 - 57.4	57.0 - 57.4	0.80	32.5 - 32.1	32.5 - 32.1	Coal and black shale, **LK rider**
				57.4 - 58.0	57.4 - 58.0	3.63	32.1 - 31.5	32.1 - 31.5	Coal and siltstone, **LK rider**
					58.0 - 60.0	0.98	31.5 - 29.5		Gray and yellowish brown, fine-grained to very fine-grained sandstone
					60.0 - 62.0	0.71	29.5 - 27.5		Gray very fine-grained sandstone
					67.0 - 69.0	0.71	22.5 - 20.5		Gray very fine-grained sandstone
					71.0 - 73.0	1.65	18.5 - 16.5		Gray silty shale.
S2-2	92.0	90.0	1780.7		41.0 - 42.0	0.88	49.0 - 48.0		Gray claystone, thin coal
					76.0 - 79.0	0.50	13.1 - 10.1		Medium-dark gray very fine-grained sandstone
S2-3	84.0	82.0	1763.4		31.0 - 32.0	0.52	51.0 - 50.0		Black shale and gray siltstone
					47.0 - 49.0	1.11	35.0 - 33.0		Gray siltstone
					49.0 - 50.0	1.38	33.0 - 32.0		Medium-dark gray shale
					50.0 - 51.0	0.80	32.0 - 31.0		Medium-dark gray shale
					51.0 - 52.0	1.03	31.0 - 30.0		Medium-dark gray shale
					52.0 - 53.0	2.12	30.0 - 29.0		Medium-dark gray shale
					53.0 - 54.0	1.41	29.0 - 28.0		Gray siltstone very fine-grained sandstone
					54.0 - 56.0	0.78	28.0 - 26.0		Gray siltstone
					56.0 - 57.0	0.54	26.0 - 25.0		Gray siltstone
					63.0 - 65.0	1.48	19.0 - 17.0		Gray shale
S2-4	17.5	16.0	1710.0		13.0 - 13.5	0.53	3.0 - 2.5		Yellow clay on coal
S2-5	62.0	59.3	1750.0		40.0 - 42.0	0.61	19.3 - 17.3		Gray very fine-grained sandstone
					43.0 - 45.0	0.51	16.3 - 14.3		Gray very fine-grained sandstone, shale siltstone interbed
					47.0 - 49.0	2.14	12.3 - 10.3		Gray shale

LK = Lower Kittanning Coal.
Samples collected by Meiser & Earl, Inc. personnel.
Samples analyzed by Geochemical Testing.

TABLE J-1.5
PA Waste, LLC
Camp Hope Run Landfill
Overburden Analyses Summary
S3 Area

Hole No.	Total Depth (feet)	Depth to Bottom of LK (feet)	LK Rider Depth (feet)	Interval >0.5% Sulfur Depth (feet)	Total Sulfur (>0.5%)	Height Above Bottom of LK (feet)	LK Rider Height Above Bottom of LK (feet)	Description
S3-1	114.0	51.0	-	49.0 - 50.0	0.67	1.0 - 2.0	-	Medium brown shale
OB4	63.2	62.8	34.5 - 34.8	34.5 - 34.8	6.15	28.3 - 28.0	28.3 - 28.0	LK Rider - coal
			-	34.8 - 38.2	1.29	28.0 - 24.6	-	Medium gray shale
			-	38.2 - 41.2	0.90	24.6 - 21.6	-	Medium gray sandy shale
			-	49.2 - 50.2	4.40	13.6 - 12.6	-	Dark gray/black shale
			-	59.2 - 59.5	1.25	3.6 - 3.3	-	Dark gray shale and coal
C2	59.5	51	-	21.1 - 23.3	0.88	29.9 - 27.7	-	Light gray sandstone
			-	40.8 43.7	1.37	10.2 7.3	-	Dark gray siltstone - lingula