RUN-ON AND RUN-OFF CONTROL SYSTEM PLAN

FOR THE:
APPALACHIAN POWER COMPANY
MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL

PREPARED FOR:
AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OHIO 43215

PREPARED BY:
HULL & ASSOCIATES, INC.
219 SOUTH ERIE STREET
TOLEDO, OHIO 43604

SEPTEMBER 2021

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1.0 INTRODUCTION

This Run-on and Run-off Control System Plan (Plan) has been prepared for the Little Broad Run Landfill (Landfill) in New Haven, West Virginia, to comply with the requirements of Federal Regulation Title 40, Subpart §257.81. The Landfill is currently being operated under a Class F Industrial Landfill Facility permit (permit no. WV0077038), issued by the West Virginia Department of Environmental Protection (WVDEP).

Federal Regulation Title 40, Subpart §257.81 states that the Owner or Operator of an existing or new coal combustion residual (CCR) landfill or any lateral expansion of a CCR landfill must comply with the following:

a. Design, construct, operate, and maintain:

   1. A run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm; and

   2. A run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

b. Run-off from the active portion of the CCR unit must be handled in accordance with the surface water requirements under § 257.3-3.

c. Prepare a Run-on and Run-off Control System Plan for existing CCR landfills according to the following timelines:

   1. The initial run-on and run-off control system plan is completed no later than October 17, 2016.

   2. Periodic run-on and run-off control system plans (from the date the initial Plan) are placed in the Landfill's Operating Record every five years.

d. Obtain a certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of §257.81.

e. Comply with the recordkeeping requirements specified in § 257.105(g), the notification requirements specified in § 257.106(g), and the internet requirements specified in § 257.107(g).

This Plan represents the 5-year revision of the original September 2016 Plan, as required by § 257.81(c)(4), and is in compliance with the requirements listed above. The design of the run-on and run-off control measures for the active portion of the CCR unit were completed as part of the current permit for the Landfill, which was obtained after submittal of the Little Broad Run Landfill Vertical Expansion Solid Waste/NPDES Permit Application, dated November 2008 (Vertical Expansion Application). Run-on and run-off control measures for any areas outside the active area of the Landfill will be addressed during future closure activities, as needed, and controlled in accordance with Federal Regulation Title 40, Subpart §257.81.

The Landfill has installed and is maintaining many of the stormwater controls discussed within this Plan. Figures 1 through 6 in Appendix A provide additional information related to the controls.

2.0 RUN-ON CONTROLS

The Preamble from Subpart 257 of CFR 40 defines run-on as "any liquid that drains over land onto any part of a CCR landfill or any lateral expansion of a CCR landfill. In surface water hydrology, run-on is a quantity of surface run-off, or excess rain, snowmelt, or other sources of water, which flows from an upstream catchment area onto a specific downstream location." This section of this Plan describes the controls at the Landfill to manage run-on from outside the Landfill footprint and from inside the Landfill footprint, which are designed to manage the peak flow from a 24-hour, 25-year storm event.

2.1 Run-on Controls from Outside the Landfill Footprint

The Landfill is a "valley fill" landfill and was constructed in such way that most stormwater flows away from the Landfill, thus not generating run-on. For the areas where stormwater flows towards the Landfill (northeast and southeast corners), perimeter ditches are located to collect run-on and keep it away from the Landfill. Run-on that is collected by these ditches is conveyed to the Area 7 Sediment Ponds, which ultimately discharge to Little Broad Run creek located east of the Landfill. Calculations were performed to verify that the perimeter ditches would manage the peak flow from a 24-hour, 25-year storm event.

Figure 1 shows the general layout of the Landfill and nearby existing topography.

2.2 Run-on Controls from Inside the Landfill Footprint

The Landfill, since obtaining approval from WVDEP for the Vertical Expansion Application, is being developed in phases in accordance with the phasing plan from the Vertical Expansion Application. Each phase is developed in sub-phases (cells) based on the Landfill's needs and long-term plans. During construction of each new cell, perimeter berms are constructed along the boundaries of the cell in areas where run-on may be a possibility. Low-lying areas are also filled to promote stormwater drainage away from the new cell.

2.2.1 Current Phase (Phase 1)

The current phase of the Landfill is Phase 1, which consists of filling the middle of the northern portion of the Landfill, as shown on Figure 2. During operations of the Landfill, filling occurs in such way that the upstream/upper-most area of the phase is filled first. Filling then progresses upwards and towards the downstream portions of the phase. This filling practice, along with the cell perimeter berms, minimize run-on towards the active portion of the Landfill.

2.2.2 Future Phases

Future phases of the Landfill (Phases 2 through 5) will occur in sequence, in accordance with the Vertical Expansion Application. The final grades for the preceding phase will be dependent upon the Landfill operational needs. Areas that reach final approved grades during the previous phase may be covered with the Final Cover System. Stormwater from these areas will be managed in accordance with the Vertical Expansion Application and Section 3.1 of this Plan, and therefore, will not generate run-on towards the active portion of the Landfill. For the areas from the preceding phase(s) that are at higher elevations than the phase at any given time, diversion berms will be constructed to divert stormwater around the active portion of the Landfill to minimize stormwater run-on, as shown on Figures 3 through 6. The diversion berms will be constructed of soil, per Detail 3 on Drawing no. 1-30134-28 from the Vertical Expansion Application. These diversions will discharge to stormwater management structures (e.g., letdowns, ditches, culverts, etc.) located either within the Landfill boundary (outside of the active portion of the Landfill) or outside the Landfill boundary, which ultimately discharge to sediment ponds. Water discharged from the sediment ponds flows to outfalls per the Landfill's NPDES permit. The size of the areas downstream of the diversion berms will be as small as practical based on site conditions and stormwater from these areas will be managed as contact water in accordance with Section 3.2 of this Plan. Calculations were performed to verify that the diversion berms will manage the peak flow from a 24-hour, 25-year storm event and are provided in Appendix B.

3.0 RUN-OFF CONTROLS

The Preamble from Subpart 257 of CFR 40 defines run-off as "any liquid that drains over land from any part of the CCR landfill." This section of this Plan describes the controls at the Landfill to manage run-off from the Landfill's Final Cover System and from the active filling area, which are designed to manage the peak flow from a 24-hour, 25-year storm event. Details for the run-off controls discussed below are provided in the Vertical Expansion Application and are shown on Figures 2 through 6.

3.1 Run-off Controls from Landfill's Final Cover System

The Landfill's Final Cover System has been designed to minimize stormwater infiltration into the Landfill, thus minimizing leachate generation. The surface of the Final Cover System consists of a vegetated cover to minimize erosion of the final cover soils. Stormwater from the Final Cover System flows away from the active filling area and discharges to perimeter ditches, which ultimately discharge to sediment ponds. Water discharged from the sediment ponds flow to outfalls per the Landfill's NPDES permit.

There are areas from the Landfill's original permit that have vegetated soil cover placed in accordance with the original permit (Areas 1 through 4 shown in Figure 1). These areas ultimate discharge off-site to outfalls per the Landfill's NPDES permit.

As the new phases of the Landfill are developed and filled, Final Cover System will be placed in accordance with the Vertical Expansion Application. Run-off from the new phases will be collected and conveyed by the stormwater control structures (e.g., letdowns, ditches, culverts, etc.) and discharge to sediment ponds per the Vertical Expansion Application. The design calculations for the run-off controls are provided in the Vertical Expansion Application.

3.2 Run-off Controls from Active Fill Areas

Run-off generated within the active filling area will be managed as contact water and conveyed to the Leachate Ponds located east of the Landfill. As waste is placed in the active filling areas, the outer slopes will be covered in accordance with the permit to minimize contact water generation. "Chimney drains" made with bottom ash are located in several areas of the Landfill to convey contact water within the active areas to the leachate collection system in the bottom of the Landfill. Also, filling operations will occur in such a way that the inner grades of the Landfill will be sloped to allow contact water (i.e., contact water that is not drained by the "chimney drains") to gravity-drain to a low spot within the active area and be pumped to the manhole southeast of Area 7 (Manhole 1), which then gravity drains to the Leachate Ponds. Perimeter berms are installed to keep the water within the active area prior to pumping. Details and the design calculations for the run-off controls are provided in the Vertical Expansion Application.

3.3 Leachate Collection and Management System

Leachate from the Landfill is managed in accordance with the Vertical Expansion Application. Leachate collected within the Landfill is conveyed via gravity to the Leachate Ponds. Leachate is then pumped to the Leachate Surge Pond, which is a retention pond that is designed to accommodate large storm events, as detailed in the Leachate Surge Pond Design Package, prepared by Hull, dated October 2010. An on-site treatment system has been constructed to treat the Landfill's leachate prior to discharging it to the Mountaineer Plant's Bottom Ash Pond Complex, which ultimately discharges to the Ohio River.

4.0 PLAN AMENDMENTS AND REVISIONS

In accordance with §257.81(c)(2), this Plan may be amended at any time, if desired by the owner or operator of the Landfill or if there is a change in conditions that substantially affect the written plan in effect (e.g., changes in the Landfill design, construction, operation, and/or maintenance). In such cases, amendments shall be made to the written plan and placed in the Landfill's operating record.

In accordance with §257.81(c)(4), the owner or operator must prepare periodic run-on and run-off control system plans every five years, at a minimum. This Plan represents the 5-year revision of the original September 2016 Plan, as required by § 257.81(c)(4). The original plan was placed in the Landfill's operating record on October 16, 2016.

All amendments resulting from changes in in the Landfill design, construction, operation, and/or maintenance shall be reviewed and certified by a qualified professional engineer in accordance with Section 5.0 of this Plan. All scheduled reviews and amended plans shall be recorded in the Plan Review Log provided in Appendix C. The five-year reviews shall be recorded even if no changes are made to the Plan as a result of the review.

5.0 PROFESSIONAL ENGINEER CERTIFICATION

The original plan and all reviews and amended plans must obtain certification from a qualified professional engineer stating that the initial and periodic run-on and run-off control system plans meet the requirements of §257.

The undersigned licensed Professional Engineer (P.E.) certifies that this Run-on and Run-off Control Plan has been prepared, reviewed, and/or revised in accordance with the current requirements of Federal Regulation Title 40, Subpart §257.81, including consideration of good engineering practice and industry standards. This certification in no way relieves the owner or operator of the Landfill of his/her duty to fully implement this Plan.

Signature _____

Name Angela M. Gerdeman

Registration Number 17858

State West Virginia

Date 09/29/2021

9/29/2021

APPENDIX A

Figures

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COUNTY ROAD 9
AREA 3 COMPLETED
AREA 4 COMPLETED
PHASE 2 (FUTURE)
AREA 5 COMPLETED
NORTHWEST SEDIMENT POND (EXISTING)
PHASE 1A (CURRENT)
SOUTHWEST SEDIMENT POND (FUTURE)
VERTICAL EXPANSION BOUNDARY
PHASE 1B/1C (CURRENT)
AREA 2 COMPLETED
NORTHEAST SEDIMENT POND (FUTURE)
PHASE 4 (FUTURE)
PHASE 3 (FUTURE)
AREA 6 COMPLETED
AREA 8 SEDIMENT POND (FUTURE)
AREA 1 COMPLETED
AREA 7 COMPLETED
AREA 8 (FUTURE)
GENERAL LOCATION OF SOUTHEAST SEDIMENT POND (TO BE DESIGNED IN THE FUTURE)
AREA 7 SEDIMENT PONDS (EXISTING)
24" CPE LEACHATE PIPE
AREA 9 (FUTURE)
AREA 9 SEDIMENT POND (FUTURE)
STACKOUT PAD
LEACHATE POND #1
24" HDPE LEACHATE PIPE
LEACHATE FORCEMAIN PIPES
LEACHATE SURGE POND
LEACHATE POND #2
MOUNTAINEER POND COMPLEX

N
0 250 500
SCALE IN FEET

LEGEND

- AREAS 1-7 BOUNDARY
- AREAS 8-9 BOUNDARY
- VERTICAL EXPANSION BOUNDARY
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4

NOTE:

1. THE AERIAL TOPOGRAPHY WAS UPDATED FROM HENDERSON AERIAL SURVEYS ON MAY 22, 2007 AND MARCH 20, 2012 AND BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED OCTOBER 23, 2018 AND BY AMERICAN ELECTRIC POWER DATED DECEMBER 18, 2019. THIS MAP UPDATED FROM A FIELD SURVEY CONDUCTED BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED DECEMBER 15, 2020.

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FIGURE 1
GENERAL SITE PLAN

MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL
NEW HAVEN, WEST VIRGINIA

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/16/2021
PROJECT NO.	AP0076
FIGURE NO.	1

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AREA 8 SEDIMENT POND (FUTURE)
AREA 9 SEDIMENT POND (FUTURE)
TO LEACHATE PONDS
NORTHEAST SEDIMENT POND (FUTURE)
AREA 8 (FUTURE)
CURRENT ACTIVE AREA (APPROXIMATE)
NORTHWEST SEDIMENT POND (EXISTING)
PHASE 4 (FUTURE)
AREA 7 SEDIMENT PONDS (EXISTING)
MANHOLE 1
VERTICAL EXPANSION BOUNDARY
PHASE 1B/1C (CURRENT)
AREA 7 COMPLETED
AREA 9 (FUTURE)
PHASE 1A (CURRENT)
AREA 4 COMPLETED
AREA 6 COMPLETED
PHASE 2 (FUTURE)
CONTACT WATER PIPE (APPROXIMATE LOCATION FOR ILLUSTRATIONAL PURPOSES ONLY)
AREA 5 COMPLETED
COUNTY ROAD 9
PHASE 3 (FUTURE)
AREA 3 COMPLETED
AREA 2 COMPLETED
AREA 1 COMPLETED
SOUTHWEST SEDIMENT POND (FUTURE)
GENERAL LOCATION OF SOUTHEAST SEDIMENT POND (TO BE DESIGNED IN THE FUTURE)

N
0 300 600
SCALE IN FEET

LEGEND

- AREAS 1–7 BOUNDARY
- AREAS 8–9 BOUNDARY
- VERTICAL EXPANSION BOUNDARY
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4
- PROPERTY LINE
- LEACHATE COLLECTION PIPE (SEE NOTE 3)
- PERIMETER BERM
- EXISTING CONTACT WATER
- LEACHATE MANAGEMENT COMPONENTS
- DIRECTION OF FLOW
- GENERAL FLOW DIRECTION
- APPROXIMATE FILLING AREA THIS PHASE

NOTES:

1. THE AERIAL TOPOGRAPHY WAS UPDATED FROM HENDERSON AERIAL SURVEYS ON MAY 22, 2007 AND MARCH 20, 2012 AND BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED OCTOBER 23, 2018 AND BY AMERICAN ELECTRIC POWER DATED DECEMBER 18, 2019. THIS MAP UPDATED FROM A FIELD SURVEY CONDUCTED BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED DECEMBER 15, 2020.
2. FILLING OF THE VERTICAL EXPANSION PHASES ALSO INCLUDES FILLING ABOVE AREAS 5–9, PER THE GRADES SHOWN IN THE VERTICAL EXPANSION PLANS.
3. LEACHATE COLLECTION PIPES WITHIN PHASE 1 ARE SHOWN FOR CLARITY. ADDITIONAL COMPONENTS WILL BE ADDED IN FUTURE PHASES PER THE VERTICAL EXPANSION.

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FIGURE 2
PHASE 1
RUN-ON AND RUN-OFF CONTROLS

MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL
NEW HAVEN, WEST VIRGINIA

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/16/2021
PROJECT NO.	AP0076
FIGURE NO.	2

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AREA 8 SEDIMENT POND (FUTURE)
AREA 9 SEDIMENT POND (FUTURE)
TO LEACHATE PONDS
NORTHEAST SEDIMENT POND (FUTURE)
AREA 8 (FUTURE)
NORTHWEST SEDIMENT POND (EXISTING)
PHASE 4 (FUTURE)
AREA 7 SEDIMENT PONDS (EXISTING)
MANHOLE 1
VERTICAL EXPANSION BOUNDARY
PHASE 1B/1C (CURRENT)
AREA 7 COMPLETED
AREA 9 (FUTURE)
PHASE 1A (CURRENT)
AREA 4 COMPLETED
AREA 6 COMPLETED
PHASE 2 (FUTURE)
AREA 5 COMPLETED
CONTACT WATER PIPE (APPROXIMATE LOCATION FOR ILLUSTRATIONAL PURPOSES ONLY)
COUNTY ROAD 9
PHASE 3 (FUTURE)
AREA 3 COMPLETED
AREA 2 COMPLETED
AREA 1 COMPLETED
SOUTHWEST SEDIMENT POND (FUTURE)
GENERAL LOCATION OF SOUTHEAST SEDIMENT POND (TO BE DESIGNED IN THE FUTURE)

0 300 600
SCALE IN FEET

LEGEND

- AREAS 1–7 BOUNDARY
- AREAS 8–9 BOUNDARY
- VERTICAL EXPANSION BOUNDARY
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4
- PROPERTY LINE
- DIVERSION BERM
- STORMWATER RUN–ON
- CONTACT WATER (SEE NOTE 4)
- LEACHATE MANAGEMENT COMPONENTS
- DIRECTION OF FLOW
- GENERAL FLOW DIRECTION
- APPROXIMATE FILLING AREA THIS PHASE

NOTES:

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2. FILLING OF THE VERTICAL EXPANSION PHASES ALSO INCLUDES FILLING ABOVE AREAS 5–9, PER THE GRADES SHOWN IN THE VERTICAL EXPANSION PLANS.
3. STORMWATER RUN–ON SHALL BE DIVERTED AWAY FROM ACTIVE AREA, AS MUCH AS FEASIBLE, VIA THE DIVERSION BERMS SHOWN ON THIS PLAN.
4. CONTACT WATER GENERATION WILL BE MINIMALIZED AS THE ACTIVE FILLING AREA WILL BE AS SMALL AS PRACTICAL.

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FIGURE 3
PHASE 2
RUN–ON AND RUN–OFF
CONTROLS

MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL
NEW HAVEN, WEST VIRGINIA

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/16/2021
PROJECT NO.	AP0076
FIGURE NO.	3

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AREA 8 SEDIMENT POND (FUTURE)
AREA 9 SEDIMENT POND (FUTURE)
TO LEACHATE PONDS
NORTHEAST SEDIMENT POND (FUTURE)
AREA 8 (FUTURE)
NORTHWEST SEDIMENT POND (EXISTING)
PHASE 4 (FUTURE)
AREA 7 SEDIMENT PONDS (EXISTING)
MANHOLE 1
VERTICAL EXPANSION BOUNDARY
PHASE 1B/1C (CURRENT)
AREA 7 COMPLETED
AREA 9 (FUTURE)
PHASE 1A (CURRENT)
AREA 4 COMPLETED
AREA 6 COMPLETED
PHASE 2 (FUTURE)
CONTACT WATER PIPE (APPROXIMATE LOCATION FOR ILLUSTRATIONAL PURPOSES ONLY)
AREA 5 COMPLETED
COUNTY ROAD 9
AREA 2 COMPLETED
PHASE 3 (FUTURE)
AREA 3 COMPLETED
AREA 1 COMPLETED
SOUTHWEST SEDIMENT POND (FUTURE)
GENERAL LOCATION OF SOUTHEAST SEDIMENT POND (TO BE DESIGNED IN THE FUTURE)

N

0 300 600
SCALE IN FEET

LEGEND

- AREAS 1–7 BOUNDARY
- AREAS 8–9 BOUNDARY
- VERTICAL EXPANSION BOUNDARY
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4
- PROPERTY LINE
- DIVERSION BERM
- STORMWATER RUN–ON
- CONTACT WATER
- LEACHATE MANAGEMENT COMPONENTS
- DIRECTION OF FLOW
- GENERAL FLOW DIRECTION
- APPROXIMATE FILLING AREA THIS PHASE

NOTES:

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2. FILLING OF THE VERTICAL EXPANSION PHASES ALSO INCLUDES FILLING ABOVE AREAS 5–9, PER THE GRADES SHOWN IN THE VERTICAL EXPANSION PLANS.
3. CONTACT WATER GENERATION WILL BE MINIMALIZED AS THE ACTIVE FILLING AREA WILL BE AS SMALL AS PRACTICAL.

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FIGURE 4
PHASE 3
RUN–ON AND RUN–OFF CONTROLS

MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL
NEW HAVEN, WEST VIRGINIA

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/16/2021
PROJECT NO.	AP0076
FIGURE NO.	4

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AREA 8 SEDIMENT POND (FUTURE)
AREA 9 SEDIMENT POND (FUTURE)
TO LEACHATE PONDS
NORTHEAST SEDIMENT POND (FUTURE)
AREA 8 (FUTURE)
NORTHWEST SEDIMENT POND (EXISTING)
PHASE 4 (FUTURE)
AREA 7 SEDIMENT PONDS (EXISTING)
MANHOLE 1
VERTICAL EXPANSION BOUNDARY
PHASE 1B/1C (CURRENT)
AREA 7 COMPLETED
AREA 9 (FUTURE)
CONTACT WATER PIPE (APPROXIMATE LOCATION FOR ILLUSTRATIONAL PURPOSES ONLY)
PHASE 1A (CURRENT)
AREA 4 COMPLETED
AREA 6 COMPLETED
PHASE 2 (FUTURE)
AREA 5 COMPLETED
COUNTY ROAD 9
PHASE 3 (FUTURE)
AREA 2 COMPLETED
AREA 3 COMPLETED
AREA 1 COMPLETED
SOUTHWEST SEDIMENT POND (FUTURE)
GENERAL LOCATION OF SOUTHEAST SEDIMENT POND (TO BE DESIGNED IN THE FUTURE)

N
0 300 600
SCALE IN FEET

LEGEND

- AREAS 1–7 BOUNDARY
- AREAS 8–9 BOUNDARY
- VERTICAL EXPANSION BOUNDARY
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4
- PROPERTY LINE
- DIVERSION BERM
- STORMWATER RUN–ON
- CONTACT WATER
- LEACHATE MANAGEMENT COMPONENTS
- DIRECTION OF FLOW
- GENERAL FLOW DIRECTION
- APPROXIMATE FILLING AREA THIS PHASE

NOTES:

1. THE AERIAL TOPOGRAPHY WAS UPDATED FROM HENDERSON AERIAL SURVEYS ON MAY 22, 2007 AND MARCH 20, 2012 AND BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED OCTOBER 23, 2018 AND BY AMERICAN ELECTRIC POWER DATED DECEMBER 18, 2019. THIS MAP UPDATED FROM A FIELD SURVEY CONDUCTED BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED DECEMBER 15, 2020.
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3. CONTACT WATER GENERATION WILL BE MINIMALIZED AS THE ACTIVE FILLING AREA WILL BE AS SMALL AS PRACTICAL.

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FIGURE 5
PHASE 4
RUN–ON AND RUN–OFF CONTROLS

MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL
NEW HAVEN, WEST VIRGINIA

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/16/2021
PROJECT NO.	APO076
FIGURE NO.	5

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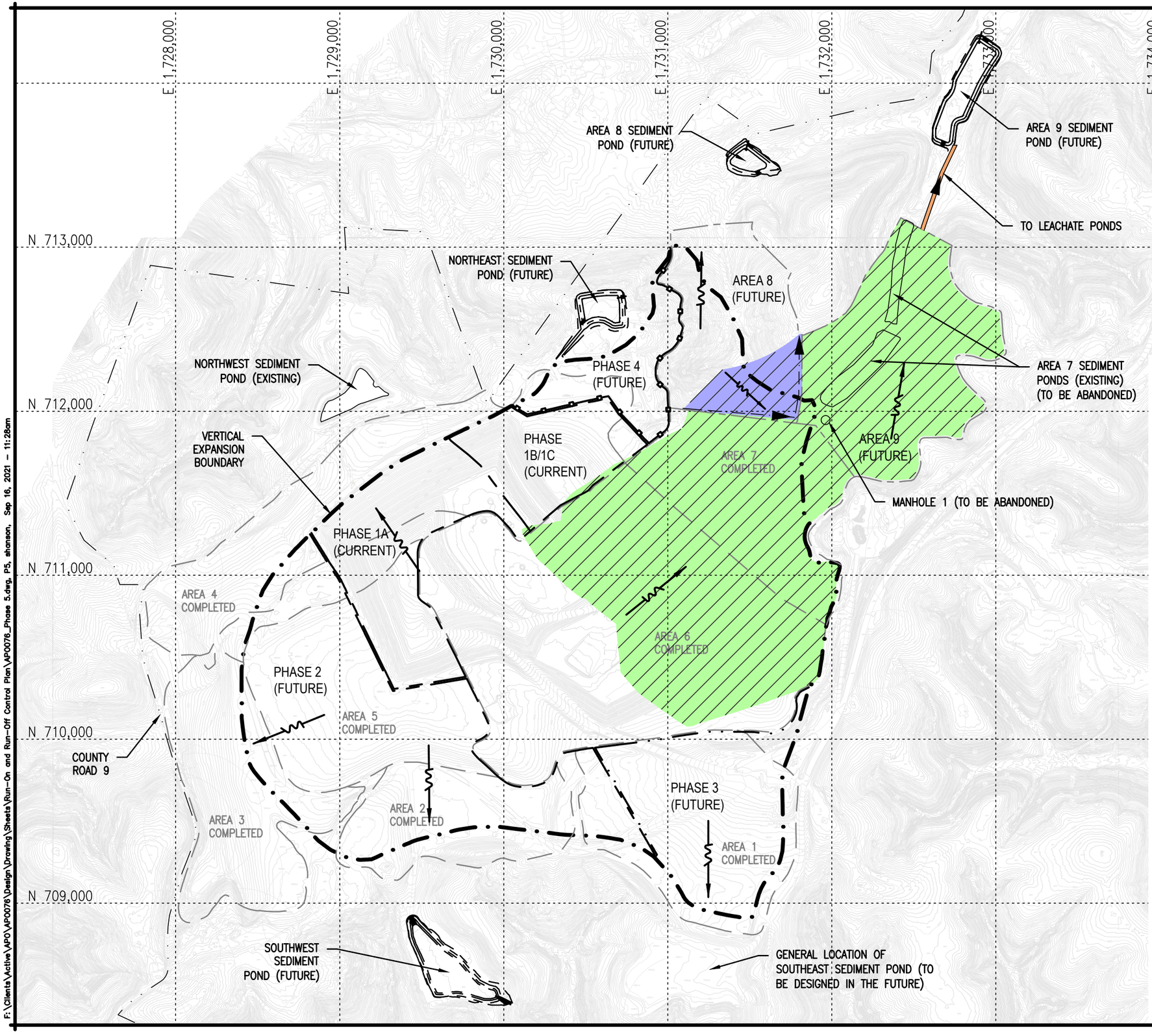

LEGEND

- AREAS 1–7 BOUNDARY
- AREAS 8–9 BOUNDARY
- VERTICAL EXPANSION BOUNDARY
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4
- PROPERTY LINE
- DIVERSION BERM
- STORMWATER RUN–ON
- CONTACT WATER
- LEACHATE MANAGEMENT COMPONENTS
- DIRECTION OF FLOW
- GENERAL FLOW DIRECTION
- APPROXIMATE FILLING AREA THIS PHASE

NOTES:

1. THE AERIAL TOPOGRAPHY WAS UPDATED FROM HENDERSON AERIAL SURVEYS ON MAY 22, 2007 AND MARCH 20, 2012 AND BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED OCTOBER 23, 2018 AND BY AMERICAN ELECTRIC POWER DATED DECEMBER 18, 2019. THIS MAP UPDATED FROM A FIELD SURVEY CONDUCTED BY THE JOHN E. DOLAN CIVIL LAB SECTION DATED DECEMBER 15, 2020.
2. FILLING OF THE VERTICAL EXPANSION PHASES ALSO INCLUDES FILLING ABOVE AREAS 5–9, PER THE GRADES SHOWN IN THE VERTICAL EXPANSION PLANS.
3. CONTACT WATER GENERATION WILL BE MINIMALIZED AS THE ACTIVE FILLING AREA WILL BE AS SMALL AS PRACTICAL.

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FIGURE 6
PHASE 5
RUN–ON AND RUN–OFF
CONTROLS

MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL
NEW HAVEN, WEST VIRGINIA

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/16/2021
PROJECT NO.	APO076
FIGURE NO.	6

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APPENDIX B

Calculations

Hydrograph Summary Report

Hydraflow Hydrographs by Intelisolve v9.22

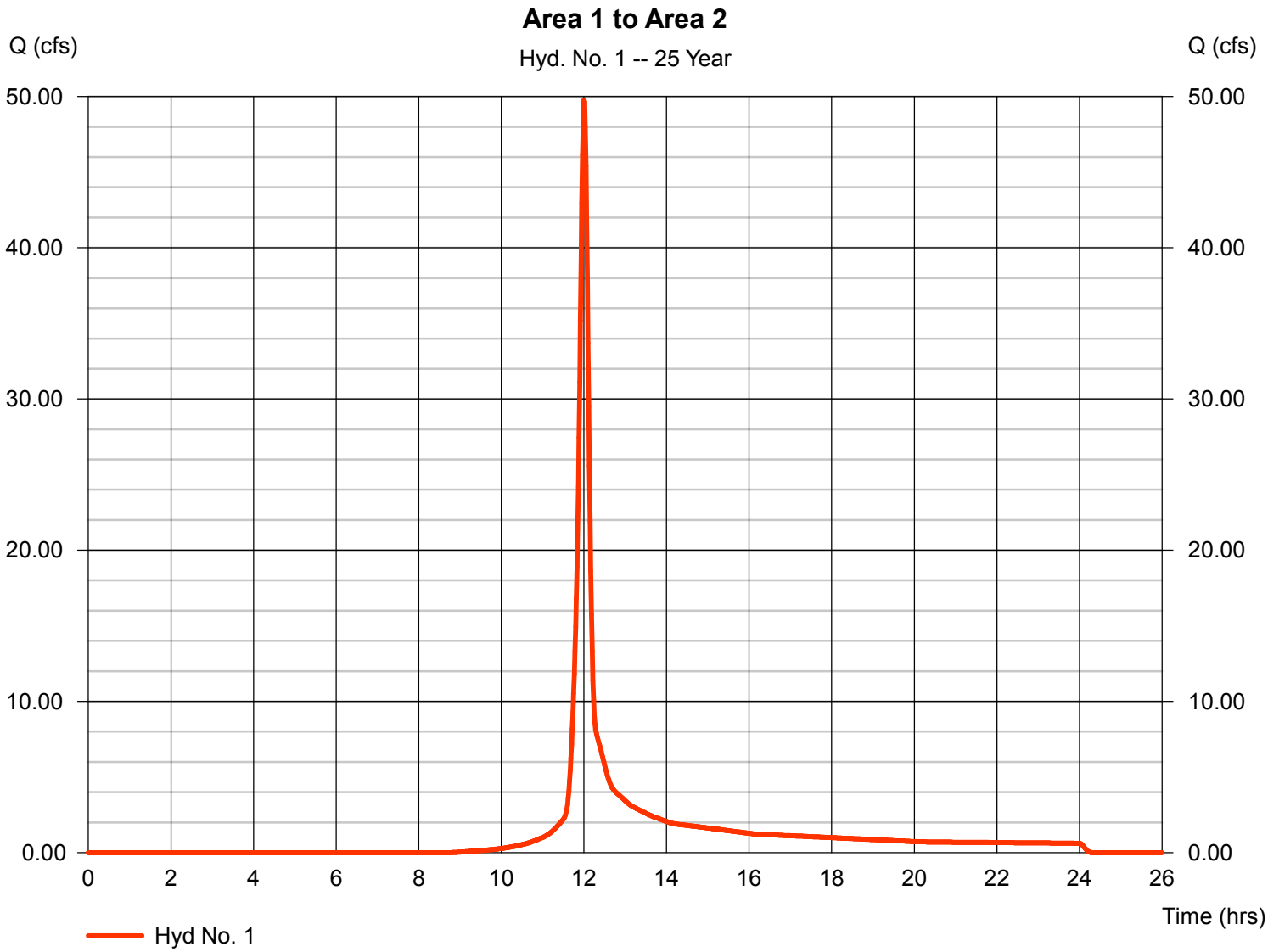
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	49.77	1	720	120,397	----	------	------	Area 1 to Area 2

Hydrograph Report

Hyd. No. 1

Area 1 to Area 2

Hydrograph type	=	SCS Runoff	Peak discharge	=	49.77 cfs
Storm frequency	=	25 yrs	Time to peak	=	12.00 hrs
Time interval	=	1 min	Hyd. volume	=	120,397 cuft
Drainage area	=	16.300 ac	Curve number	=	78
Basin Slope	=	0.0 %	Hydraulic length	=	0 ft
Tc method	=	TR55	Time of conc. (Tc)	=	11.70 min
Total precip.	=	4.14 in	Distribution	=	Type II
Storm duration	=	24 hrs	Shape factor	=	484



TR55 Tc Worksheet

Hyd. No. 1

Area 1 to Area 2

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.200		0.011		0.011		
Flow length (ft)	= 300.0		0.0		0.0		
Two-year 24-hr precip. (in)	= 2.55		0.00		0.00		
Land slope (%)	= 33.00		0.00		0.00		
Travel Time (min)	**= 10.84**	**+**	**0.00**	**+**	**0.00**	**=**	**10.84**
Shallow Concentrated Flow							
Flow length (ft)	= 500.00		0.00		0.00		
Watercourse slope (%)	= 33.00		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	= 9.27		0.00		0.00		
Travel Time (min)	**= 0.90**	**+**	**0.00**	**+**	**0.00**	**=**	**0.90**
Channel Flow							
X sectional flow area (sqft)	= 0.00		0.00		0.00		
Wetted perimeter (ft)	= 0.00		0.00		0.00		
Channel slope (%)	= 0.00		0.00		0.00		
Manning's n-value	= 0.015		0.015		0.015		
Velocity (ft/s)	= 0.00		0.00		0.00		
Flow length (ft)	= 0.0		0.0		0.0		
Travel Time (min)	**= 0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**

Total Travel Time, Tc ..... 11.70 min

Run-On Diversion Berm

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.01000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	33.00	ft/ft (H:V)
Discharge	49.77	ft³/s

Results

Normal Depth	0.97	ft
Flow Area	16.38	ft²
Wetted Perimeter	34.11	ft
Hydraulic Radius	0.48	ft
Top Width	33.87	ft
Critical Depth	0.87	ft
Critical Slope	0.01747	ft/ft
Velocity	3.04	ft/s
Velocity Head	0.14	ft
Specific Energy	1.11	ft
Froude Number	0.77	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.97	ft
Critical Depth	0.87	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.01747	ft/ft

E. 1,728,000
E. 1,729,000
E. 1,730,000
E. 1,731,000
E. 1,732,000
E. 1,733,000
E. 1,734,000
E. 1,735,000

N 713,000
N 712,000
N 711,000
N 710,000
N 709,000

AREA 8 SEDIMENT POND (FUTURE)
AREA 9 SEDIMENT POND (FUTURE)
TO LEACHATE PONDS
NORTHEAST SEDIMENT POND (FUTURE)
AREA 8 (FUTURE)
NORTHWEST SEDIMENT POND (EXISTING)
PHASE 4 (FUTURE)
AREA 7 SEDIMENT PONDS (EXISTING)
MANHOLE 1
VERTICAL EXPANSION BOUNDARY
PHASE 1B/1C (CURRENT)
AREA 7 COMPLETED
AREA 9 (FUTURE)
SHALLOW CONCENTRATED FLOW (500 FEET)
PHASE 1A (CURRENT)
SHEET FLOW (300 FEET)
AREA 4 COMPLETED
AREA 6 COMPLETED
PHASE 2 (FUTURE)
CONTACT WATER PIPE (APPROXIMATE LOCATION FOR ILLUSTRATIONAL PURPOSES ONLY)
AREA 5 COMPLETED
COUNTY ROAD 9
PHASE 3 (FUTURE)
AREA 3 COMPLETED
AREA 2 COMPLETED
AREA 1 COMPLETED
SOUTHWEST SEDIMENT POND (FUTURE)
GENERAL LOCATION OF SOUTHEAST SEDIMENT POND (TO BE DESIGNED IN THE FUTURE)

N
0 300 600
SCALE IN FEET

LEGEND

- AREAS 1–7 BOUNDARY
- AREAS 8–9 BOUNDARY
- VERTICAL EXPANSION BOUNDARY
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4
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DIVERSION BERM CALCULATIONS

MOUNTAINEER PLANT
LITTLE BROAD RUN LANDFILL
NEW HAVEN, WEST VIRGINIA

LAYOUT BY:	SAH
CHECKED BY:	AMG
DRAWN BY:	SAH
DATE:	9/16/2021
PROJECT NO.	AP0076
FIGURE NO.	-

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APPENDIX C

Plan Review Log

Run-On and Run-Off Plan Amendment Log

By	Date	Amendment Description	PE Certification Required?	PE Name	Licensing State: Registration No.
Hull & Associates, Inc.	9/29/2016	Initial Plan	Yes	Angela M. Gerdeman	WV 17858
Hull & Associates, LLC	9/29/2021	5-Year Plan Revision	Yes	Angela M. Gerdeman	WV 17858