ATTACHMENT 2

NMED COMMENTS ITEM 2 –

REPOSITORY RECONFIGURATION OF PANELS 9 AND 10

2-1: PMR Table 4.1.1, Pages B-2 and B-3

Provide redline strike out text revising “Final Waste Volume” column to “Final Waste Volume Disposed” and to revising note 3 of the table to clearly state the volumes in this column only shows the volume of each panel and that the total final volume cannot exceed repository limits.

Response:

The revised redline/strikeout of the proposed Permit text is provided in Appendix 2-A. In addition, the Permittees corrected the formatting in footnote 1 by superscripting the “ft2” and “m2” to read “ft^2” and “m^2,” added a period to the end of footnote note 3 and added a space between “15,927” and “m^3.” The Permittees have included proposed Permit text for Attachment J, Table J-3 that matches the changes made in Part 4, Table 4.1.1. The portions of the text that were changed are highlighted in yellow.

2-2: PMR Section A-4 Facility Type, Pages B-6

Provide redline strike out text revising sentence from “as Panels 1 through 8, 9A and 10A” to only say “as Panels 1 through 10A”. (See PMR page B-7, Section A2-1)

Response:

The revised redline/strikeout of the proposed Permit text is provided in Appendix 2-A. The portions of the text that were changed are highlighted in yellow.

2-3: Section A2-2a(3), Underground Ventilation System Description, Page B-8

The description in this section provides no demonstration of the ability of the current ventilation system to adequately ventilate the underground facility given the increased repository volumes and longer ventilation drifts in the proposed reconfiguration. Please provide demonstration of whether the current ventilation system is adequate to maintain current ventilation requirements or what changes if any will be necessary to meet those requirements.

Response:

This comment raises two concerns with regard to ventilation: repository volume and tunnel length. Because the Permittees operate the repository in a manner that only ventilates areas needed for work activities, adding panels will not pose a “repository volume” concern. Ventilation is split between disposal and construction. The reconfiguration will not result in more disposal or construction areas simultaneously needing air. When areas are filled, they are taken out of the ventilation circuit so new areas can be opened up.

Tunnel length is a concern since frictional losses and leakage make it more difficult to pull the air through the facility. To this end, improvements have been made in the underground drifts in order to ensure that the Permit required ventilation is available for waste disposal operations in Panels 9A and 10A.

The following ventilation and maintenance activities in the Waste Isolation Pilot Plant (**WIPP**) underground facility have reduced the resistance to air flow in the E-300 drift:

- Overcast structures in the E-300 exhaust were removed by December 2010, thereby decreasing the resistance to air flow in the E-300 drift. Lower resistance to air flow reduces the effort to pull air through the repository.

- During the 2010 Long Maintenance Break (December 2010 through January 2011), the floor was trimmed in the E-300 exhaust drift to restore the height to at least the original height of 13 feet. Trimming the floor increases the cross sectional area of the drift which in turn reduces the resistance to air flow of the drift.

The improvement in the system efficiency is reflected in the reduction in pressure drop from removing the overcasts and increasing the cross sectional area of the E-300 exhaust drift. This reduction is exhibited in Table 2-3.1 (below). Table 2-3.1 presents the October 2010 and March 2012 test and balance results for comparable (filled) panels for the ventilation system. During the October 2010 test and balance, the average pressure drop measured across filled panels was 143 milli-inches water gage. During the March 2012 test and balance, the average pressure drop measured across filled panel entries was 84 milli-inches water gage and the maximum pressure drop was 87 milli-inches water gage (see right-hand column of Table 2-3.1). This is less than the average pressure drop measured in the October 2010 test and balance which was prior to system improvements.

Table 2-3.1 Pressure Drop Data

	Data from the October 2010 Test and Balance		Data from the March 2012 Test and Balance	
Panel*	**Panel Status**	**Pressure Drop (milli-inches water gage)**	**Panel Status**	**Pressure Drop (milli-inches water gage)**
1	filled	211	filled	87
2	filled	162	filled	87
3	filled	55	filled	79

* Only waste-filled Panels 1, 2 and 3 are presented since they were the only ones where ventilation was not being diverted around the panel entries when the test and balance was performed.

Source: Mine Ventilation Services (2010, 2012).

Because the ventilation system has the capacity to provide at least 42,000 actual ft^3/min (35,000 standard ft^3/min) as required by the Permit Part 4, Section 4.5.3.2 to Panels 9A and 10A, no changes were proposed to these rates in the Permit Modification Request (**PMR**). Therefore, compliance with the ventilation requirements of the Permit is achievable for the new configuration.

Mine Ventilation Services, Inc. (**MVS**) evaluated the ventilation system of the WIPP repository for various configurations to support the mining and operation of the proposed Panels 9A and 10A. The MVS ventilation modeling verifies that the ventilation system is capable of providing the required air flow to Panels 9A and 10A. The MVS report is provided in Appendix 2-C.

2-4: Section A2-2a(3), Underground Ventilation System Description, Page B-8

In item 1 of the PMR, the air intake flow rate through a closed panel was calculated assuming a pressure drop across the intake and exhaust drifts of 170 milli-inches of water gage (Appendix C, Page C-81). New Mexico Environment Department (**NMED**) understands that current pressure drops are less than 100 milli-inches of water gage. Please demonstrate that the average pressure drop across closed waste panels under the reconfigured layout would not exceed the value used in the air flow calculations in Item 1. Include additional, more recent and any lower pressure drop data in the demonstration if available.

Response:

This comment is related to the Panel Closure Design (Item 1 in the PMR). See the response to Comment No. 1-11.

2-5: Overview 1. Describe the exact change to be made

Are waste emplacement plans (including documented intent) different for panels 9, 10 versus proposed panels 9A and 10A? If so, clearly describe and compare the former and proposed plans for panels 9, 10 against 9A and 10A. Please include capacity comparisons.

Response:

Panels 9 and 10 are not authorized for disposal. Therefore, the Permittees have not prepared a final engineering design for these areas. Consequently, a volume capacity has not been established. The Permittees are not requesting to dispose of more than the 6.2 million cubic feet of transuranic (**TRU**) mixed waste identified in the Land Withdrawal Act. The capacities listed for each Hazardous Waste Disposal Unit, including Panels 9A and 10A, are consistent with the volumes in the existing Permit Part 4, Table 4.1.1 for Panels 7-8 and reflect the respective disposal unit capacities.

2-6: Overview 3. Explain why the modification is needed

The modification request states, “Engineering evaluations of Panels 9 and 10 … have led to the conclusion that relocation of Panels 9 and 10 to an alternative location … is preferred over widening the entries…” Have there been any other engineering evaluations besides the Geotechnical Analysis Report for July 2009-June 2010 that is referenced in the PMR? If so, provide a copy of such evaluations and point to specific data that supports the Permittees conclusion. If there are no such evaluations please provide a discussion that addresses “increased convergence rates and higher fracturing” as it relates to the enlarging of the south access drifts for waste disposal.

Response:

There have been two additional Geotechnical Analysis Reports developed for July 2010-June 2011 and July 2011-June 2012, as required by the Permit Part 4, Section 4.6.1.2. These reports are consistent with the Geotechnical Analysis Report for July 2009-June 2010 which was referenced in the Class 3 PMR. The south access drifts are among the oldest drifts in the mine and have accumulated fractures and damaged rock zones over more than 25 years of use. Enlarging the width of these access drifts will reduce the pillars and increase the roof span, leading to higher convergence rates, increased fracturing in the rock surrounding the drifts, and likely require increased maintenance activities. From a mining safety perspective, it is always preferable to mine in an area that does not have fracturing (such as Panels 9A and 10A) than an area that has extensive fracturing (such as parts of the south access drifts). The Permittees have significant experience dealing with these issues. This experience indicates that mining in new rock for Panels 9A and 10A offers less risk to mining personnel and a more stable geotechnical environment than widening the south access drifts. Less effort will be required to maintain ground control in areas with a smaller span.

Ground control maintenance is performed in all accessible areas of the WIPP underground including the disposal rooms. Depending on the extent of the required ground control, maintenance can and has been performed in the south access drifts. The installation of ground control or major scaling is not performed simultaneous with waste disposal activities in the same area. An increase in convergence rate will also increase the rate that the size of the opening is shrinking. This may require mining the floor to regain the operating height required by the waste handling equipment. If required, waste handling activities will be suspended to allow ground control equipment access to an area.

2-7: Geotechnical Overview

Provide a reference to the permit and/or the administrative record that supports the geological adequacy of the proposed locations for Panels 9A and 10A.

Response:

There is a long history of geological characterization of the Salado Formation (Salado) in southeastern New Mexico and West Texas. According to Bachman, 1980, parts of the Salado are mined for potash minerals in eastern Eddy and western Lea Counties, New Mexico, and the formation has been drilled at numerous places during exploration for these minerals. Consequently, the details of Salado stratigraphy are well known and have been summarized extensively in the literature.

Much of this work was conducted for the federal government in conjunction with the selection of the site for the WIPP facility and the characterization of that site for performance modeling. These results are reported in Griswold (1977); Powers et al. (1978); and Lappin (1989).

This effort included drilling and surface based geophysics such as seismic, gravity, magnetic, and electromagnetic surveys. These geophysical activities confirmed the uniformity of the Salado. This uniformity implies no significant deviations from the geology already observed in the underground to the locations designated as Panels 9A and 10A.

According to Griswold, 1977, who interpreted seismic and other geophysical data, the area needed for underground disposal reveals "…an area of uniform and gentle dips on all horizons ranging down from the top of the Salado Formation to the Devonian Limestone…"

There is no evidence in the data for brine pockets in the Salado or other formations over the waste disposal panels (ERTC, 1988). The results of a time-domain electromagnetic (**TDEM**) survey over the waste disposal panels including the area proposed for Panels 9A and 10A, show the first occurrence of significant quantities of brine at depths corresponding to the Castile Formation in portions of the area and to the Bell Canyon Formation in the rest of the area, some 400 to 600 meters below the mined depth of the waste panels in the Salado.

More recently, during the renewal of the Permit in 2010, the Permittees provided prefiled testimony from Dr. Dennis Powers regarding the implications of geological and hydrological data collected since 1999 (Hance Scarborough, 2010). Dr. Powers' testimony principally deals with the geology and hydrology of the units above the disposal horizon where most of the ongoing study is focused. Dr. Powers reaches the following conclusions regarding the adequacy of the entire WIPP site:

> *Investigations since 1999 of the geology and geohydrology of the WIPP site continue to support the conclusion that the site is appropriate for disposal of TRU mixed waste. The site has a long history of general geological stability, and that stability is supported by continued investigations. Field work to establish additional hydrology test and monitor wells has helped to refine our understanding of the processes by which these formations were deposited and subsequently altered. The main difference in geological understanding from early years is a sedimentological basis for the distribution of halite in the Rustler. The main difference in understanding and modeling the hydrology of the Culebra is a well-established relationship between hydraulic parameters and geologic factors.*
>
> *These developments provide confidence of the appropriateness of WIPP for continued use as a disposal site for TRU mixed waste. The rock system is well characterized for understanding potential pathways that are being monitored. Thick evaporites protect the waste, and they are clear evidence of the lack of circulating water through the rock system to the disposal horizon. WIPP is located in an area of general, long-term geological stability, and surface processes are not a threat to deep disposal at the site.*
>
> *It is my professional opinion that the geologic characteristics of the WIPP site and surrounding area will prevent releases to the ground water or subsurface environment, and thus are protective of human health and the environment in accordance with 40 CFR Part 264, Subpart X.*

Therefore, based on the data gathered during and subsequent to site characterization and through construction and operation of the underground facility, the stratigraphy, moisture content and geotechnical characteristics of the Salado in the area designated for Panels 9A and 10A are consistent with what has been observed. These panels will be constructed in the "Repository Horizon" as described in Permit Part 4, Section 4.5.2.1. Note that no changes are proposed to the "Repository Horizon" described in the Permit (Permit Attachment A3).

Bachman, 1980: Bachman, G. O., *Regional Geology and Cenozoic History of Pecos Region, Southeastern New Mexico*, Open-File Report 80-1099, Denver, CO, U.S. Geological Survey.*

ERTC, 1988: *Final Report for Time Domain Electromagnetic (TDEM) Surveys at the WIPP Site,* Earth Technology Corporation, Golden, Colorado.*

Griswold, 1977: Griswold, George B., *Site Selection and Evaluation Studies of the Waste Isolation Pilot Plant (WIPP), Los Medaños, Eddy County, NM,* Underground Process Control Division 5732, Sandia Laboratories, Albuquerque, NM 87115.*

Hance Scarborough, LLP, 2010: *In the Matter of the Renewed Hazardous Waste Facility Permit for the Waste Isolation Pilot Plant; Applicants' Notice of Intent to Present Technical Testimony; HWB 10-26 (P),* TESTIMONY OF DENNIS W. POWERS, Ph.D., Letter to Ms. Sally Worthington, Hearing Clerk, New Mexico Environment Department, Santa Fe, NM July 16, 2010**

Lappin, 1989: Lappin, A. R., *Summary of Site-Characterization Studies Conducted From 1983 Through 1987 at the Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico*, Sandia Laboratories, Albuquerque, NM 87115.***

Powers, et al., 1978: Powers, D. W., Steven J. Lambert, Sue-Ellen Shaffer, Leslie R. Hill, Wendell D. Weart, Editors, *Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico*, Sandia Laboratories, Albuquerque, NM 87115.*

*Item is in the administrative record for the renewal (on the Supplemental Information DVD).

** Item is in the administrative record for the renewal.

***Item is in the administrative record for the WIPP Compliance Certification Application submitted to EPA in 1996 as Appendix SUM.

2-8: Figure D-5, Underground Emergency Equipment Locations and Underground Evacuation Routes, Pages C-8 and C-23

Revise figure to include planned and existing panels to the legend, and add Panels 9A and 10A as planned panels.

Response:

The Permittees have revised this figure as suggested. In addition, the Permittees have made editorial corrections to update the figure to current WIPP facility conditions. A revised figure is provided in Appendix 2-B. The portions of the figure that were changed are marked with red shading.

Also, the Permittees are providing the revised figures from the Class 1 Permit Modification Notification in Appendix 2-B. These figures have been updated for the Class 3 PMR to include Panels 9A and 10A and various editorial corrections to update the figure to current WIPP facility conditions. The portions of the figures that were changed are marked with red shading. The figures provided are listed below.

- Attachment A2, Figure A2-1 Repository Horizon

- Attachment A4, Figure A4-4 Typical Underground Transport Route Using E-140
- Attachment A4, Figure A4-4a Typical Underground Transport Route Using W-30
- Attachment B, Appendix B3, Figure B3-2 Repository Horizon
- Attachment D, Figure D-3 WIPP Underground Facilities
- Attachment D, Figure D-5 Underground Emergency Equipment Locations and Underground Evacuation Routes
- Attachment D, Figure D-9 Designated Underground Assembly Areas
- Attachment G, Figure G-1 Location of Underground HWDUs and Anticipated Closure Locations
- Attachment G, Figure G-6 Approximate Location of Boreholes in Relation to the WIPP Underground
- Attachment G2, Figure G2-1 View of the WIPP Underground Facility
- Attachment H1, Figure H1-1 Spatial View of WIPP Surface and Underground Facilities

2-9: Figure G-6, Approximate Location of Boreholes in Relation to the WIPP Underground, Pages C-11 and C-26

Revise figure to include location markers for WIPP-19 and H-16.

<u>Response:</u>

The Permittees have revised this figure as suggested. In addition, the Permittees have made editorial corrections to update the figure to current WIPP facility conditions. A revised figure is provided in Appendix 2-B. The portions of the figure that were changed are marked with red shading.

2-10: Figure G2-1, View of the WIPP Underground Facility, Pages C-12 and C-27

Revise figure label to read “PANELS 8-10A NOT YET EXCAVATED”

<u>Response:</u>

The Permittees have revised this figure as suggested. In addition, the Permittees have made editorial corrections to update the figure to current WIPP facility conditions. A revised figure is provided in Appendix 2-B. The portions of the figure that were changed are marked with red shading.

2-11: Figure H1-1, Spatial View of WIPP Surface and Underground Facilities, Pages C-13 and C-28

The figure in the PMR is not the correct figure that is referenced in the Permit. The correct figure must be initially referenced in the PMR. Any proposed changes to the figure can then be requested.

Response:

The Permittees have revised this figure as suggested. In addition, the Permittees have made editorial corrections to update the figure to current WIPP facility conditions. A revised figure is provided in Appendix 2-B. The portions of the figure that were changed are marked with red shading.

2-12: Figure H1-4, Perimeter Fenceline and Roadway, Pages C-14 and C-29

The figure in the PMR is not the correct figure that is referenced in the Permit. The correct figure must be initially referenced in the PMR. Any proposed changes to the figure can then be requested.

Response:

The Permittees have revised this figure as suggested. In addition, the Permittees have made editorial corrections to update the figure to current WIPP facility conditions. A revised figure is provided in Appendix 2-B. The portions of the figure that were changed are marked with red shading.

2-13: Figure N-1, Panel Flow Area, Pages C-15 and C-30

The figure in the PMR is not the correct figure that is referenced in the Permit. The correct figure must be initially referenced in the PMR. Any proposed changes to the figure can then be requested. Revise figure to include a legend, Panel 7 as an existing panel, and Panel 8 as a planned panel.

Response:

The Permittees have revised this figure as suggested. In addition, the Permittees have made editorial corrections to update the figure to current WIPP facility conditions and have revised the figure to be consistent with the changes in Item 3. A revised figure is provided in Appendix 2-B. The portions of the figure that were changed are marked with red shading.

APPENDIX 2-A
REVISED PERMIT TEXT

Table 4.1.1 - Underground HWDUs			
Description[1]	**Waste Type**	**Maximum Capacity**[2]	**Final Waste Volume Disposed**[3]
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)	370,800 ft^3 (10,500 m^3)
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)	635,600 ft^3 (17,998 m^3)
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)	603,600 ft^3 (17,092 m^3)
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)	503,500 ft^3 (14,258 m^3)
	RH TRU	12,570 ft^3 (356 m^3)	6,200 ft^3 (176 m^3)
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)	562,500 ft^3 (15,927 m^3)
	RH TRU	15,720 ft^3 (445 m^3)	8,300 ft^3 (235 m^3)
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)	
	RH TRU	18,860 ft^3 (534 m^3)	
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)	
	RH TRU	22,950 ft^3 (650 m^3)	
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)	
	RH TRU	22,950 ft^3 (650 m^3)	
Panel 9A	CH TRU	662,150 ft^3 (18,750 m^3)	
	RH TRU	22,950 ft^3 (650 m^3)	
Panel 10A	CH TRU	662,150 ft^3 (18,750 m^3)	
	RH TRU	22,950 ft^3 (650 m^3)	
Total Disposed in	**CH TRU**	~~5,244,900 ft^3 (148,500 m^3)~~*	**2,676,000 ft^3 (75,775 m^3)**

Filled Panels	**RH TRU**	~~93,050 ft³ (2,635 m³)~~*	**14,500 ft³ (411 m³)**

[1] The area of each panel is approximately 124,150 ft^2 (11,533 m^2).

[2] "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. ~~The maximum repository capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)~~

[3] The total final waste volume disposed cannot exceed the maximum repository capacity (final waste volume disposed) of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended).

*Total only applies to the Final Waste Volume Disposed column.

A-4 Facility Type

The underground structures include the underground Hazardous Waste Disposal Units (**HWDUs**), an area for future underground HWDUs, the shaft pillar area, interconnecting drifts and other areas unrelated to the Hazardous Waste Facility Permit. The underground HWDUs are defined as waste panels, each consisting of seven rooms and two access drifts. The WIPP underground area is designated as Panels 1 through ~~8, 9A, and 10A~~~~10, although only Panels 1 through 8 will be used under the terms of this permit~~. Each of the seven rooms is approximately 300 feet long, 33 feet wide and 13 feet high. Part 4 of the permit authorizes the management and disposal of CH and RH TRU mixed waste containers in underground HWDUs. The Disposal Phase consists of receiving CH and RH TRU mixed waste shipping containers, unloading and transporting the waste containers to the underground HWDUs, emplacing the waste in the underground HWDUs, and subsequently achieving closure of the underground HWDUs in compliance with applicable State and Federal regulations. As required by 20.4.1.500 NMAC (incorporating 40 CFR §264.601), the Permittees shall ensure that the environmental performance standards for a miscellaneous unit, which are applied to the underground HWDUs in the geologic repository, will be met. Permit Attachment A2 describes the underground HWDUs, the TRU mixed waste management facilities and operations, and compliance with the technical requirements of 20.4.1.500 NMAC.

Table J-3
Underground Hazardous Waste Disposal Units

Description[1]	Waste Type	Maximum Capacity[2]	Final Waste Volume Disposed[3]	Container Equivalent
Panel 1	CH TRU	636,000ft^3 (18,000 m^3)	370,800 ft^3 (10,500 m^3)	86,500 55-Gallon Drums
Panel 2	CH TRU	636,000 ft^3 (18,000 m^3)	635,600 ft^3 (17,998 m^3)	86,500 55-Gallon Drums
Panel 3	CH TRU	662,150 ft^3 (18,750 m^3)	603,600 ft^3 (17,092 m^3)	90,150 55-Gallon Drums
Panel 4	CH TRU	662,150 ft^3 (18,750 m^3)	503,500 ft^3 (14,258 m^3)	90,150 55-Gallon Drums
	RH TRU	12,570 ft^3 (356 m^3)	6,200 ft^3 (176 m^3)	400 RH TRU Canisters
Panel 5	CH TRU	662,150 ft^3 (18,750 m^3)	562,500 ft^3 (15,927 m^3)	90,150 55-Gallon Drums
	RH TRU	15,720 ft^3 (445 m^3)	8,300 ft^3 (235 m^3)	500 RH TRU Canisters
Panel 6	CH TRU	662,150 ft^3 (18,750 m^3)		90,150 55-Gallon Drums
	RH TRU	18,860 ft^3 (534 m^3)		600 RH TRU Canisters
Panel 7	CH TRU	662,150 ft^3 (18,750 m^3)		90,150 55-Gallon Drums
	RH TRU	22,950 ft^3 (650 m^3)		730 RH TRU Canisters
Panel 8	CH TRU	662,150 ft^3 (18,750 m^3)		90,150 55-Gallon Drums
	RH TRU	22,950 ft^3 (650 m^3)		730 RH TRU Canisters
Panel 9A	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)		
Panel 10A	CH TRU	662,150 ft^3 (18,750 m^3)		
	RH TRU	22,950 ft^3 (650 m^3)		
Total Disposed in Filled Panels	**CH TRU**	**5,244,900 ft^3 (148,500 m^3)***	**2,676,000 ft^3 (75,775 m^3)**	**713,900 55-Gallon Drums**
	RH TRU	**93,050 ft^3 (2,635 m^3)***	**14,500 ft^3 (411 m^3)**	**2960 RH TRU Canisters**

1 The area of each panel is approximately 124,150 ft^2 (11,533 m^2).

2 "Maximum Capacity" is the maximum volume of TRU mixed waste that may be emplaced in each panel. The maximum repository capacity of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended)

3 The total final waste volume disposed cannot exceed the maximum repository capacity (final waste volume disposed) of "6.2 million cubic feet of transuranic waste" is specified in the WIPP Land Withdrawal Act (Pub. L. 102-579, as amended).

* Total only applies to the Final Waste Volume Disposed column.

APPENDIX 2-B
REVISED PERMIT FIGURES

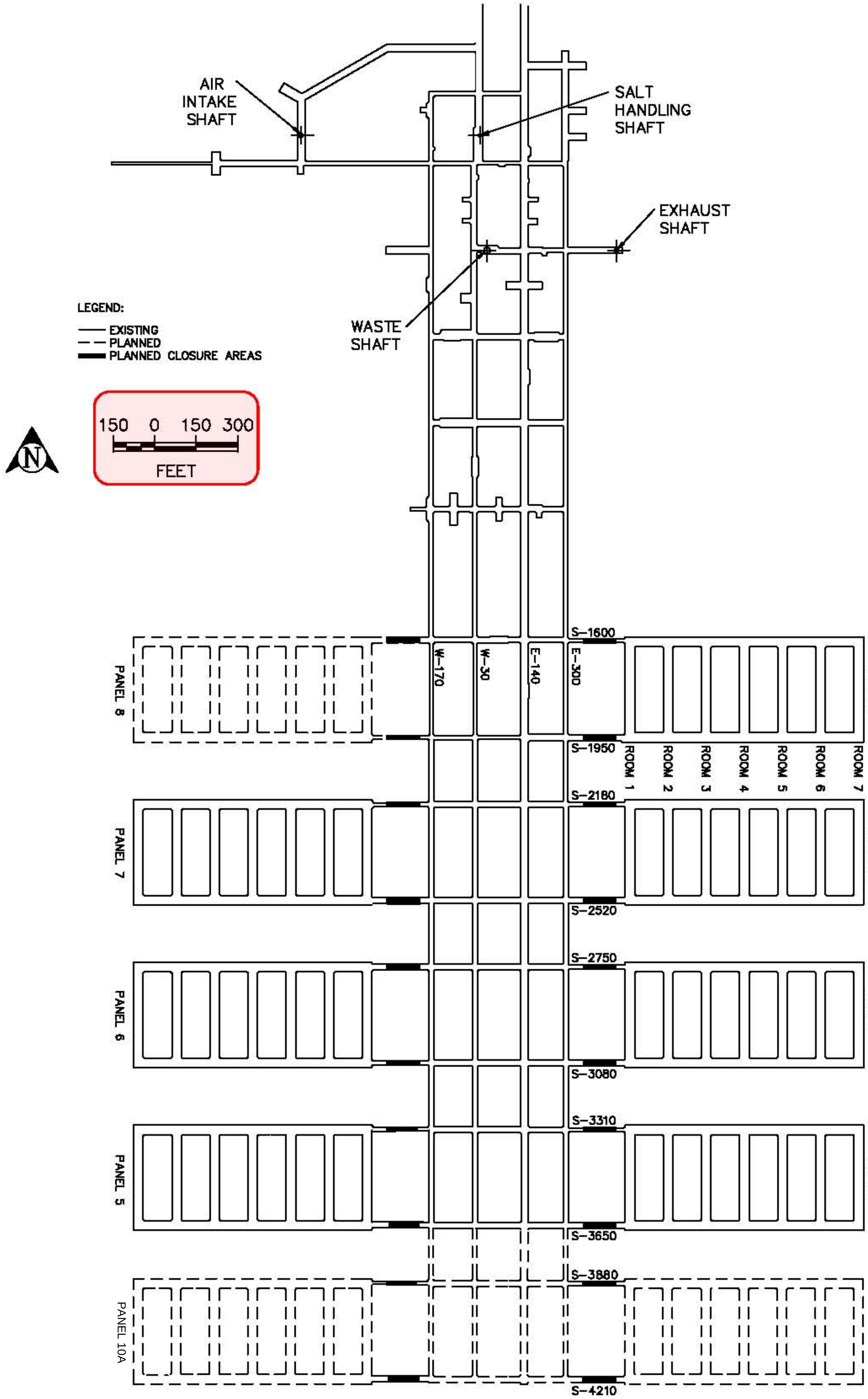

Figure A2-1
Repository Horizon

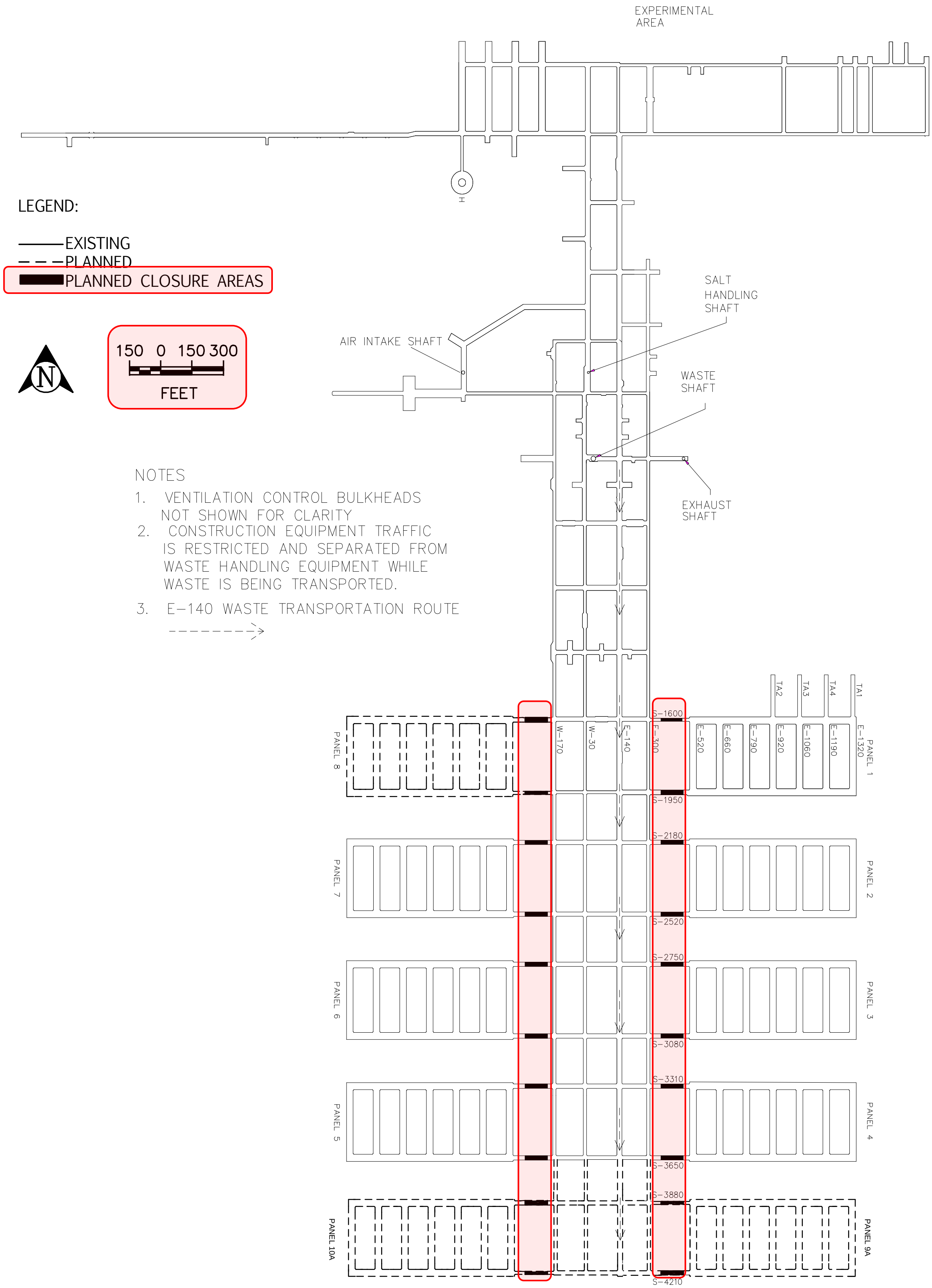

Figure A4-4
Typical Underground Transport Route Using E-140

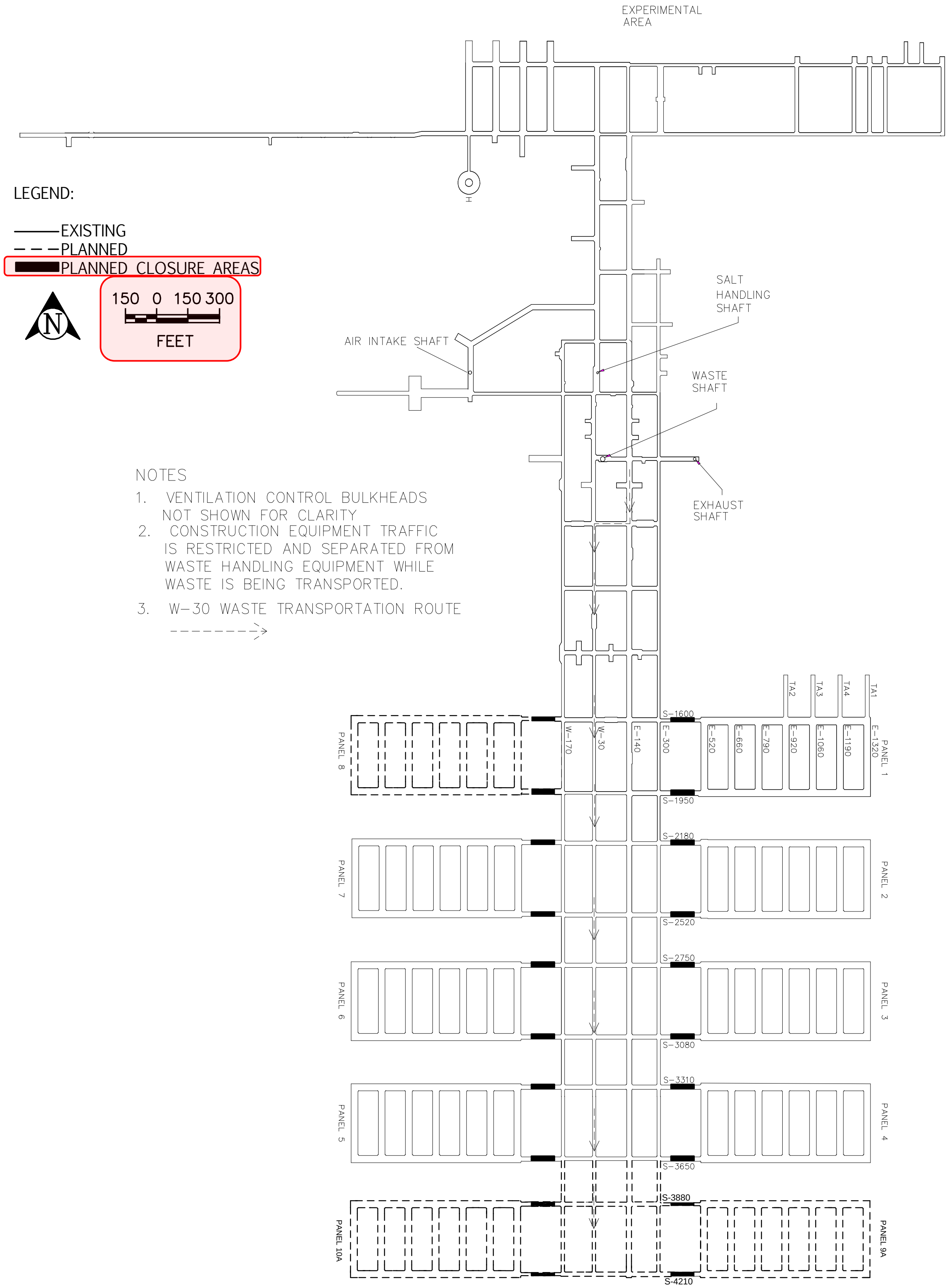

Figure A4-4a
Typical Underground Transport Route Using W-30

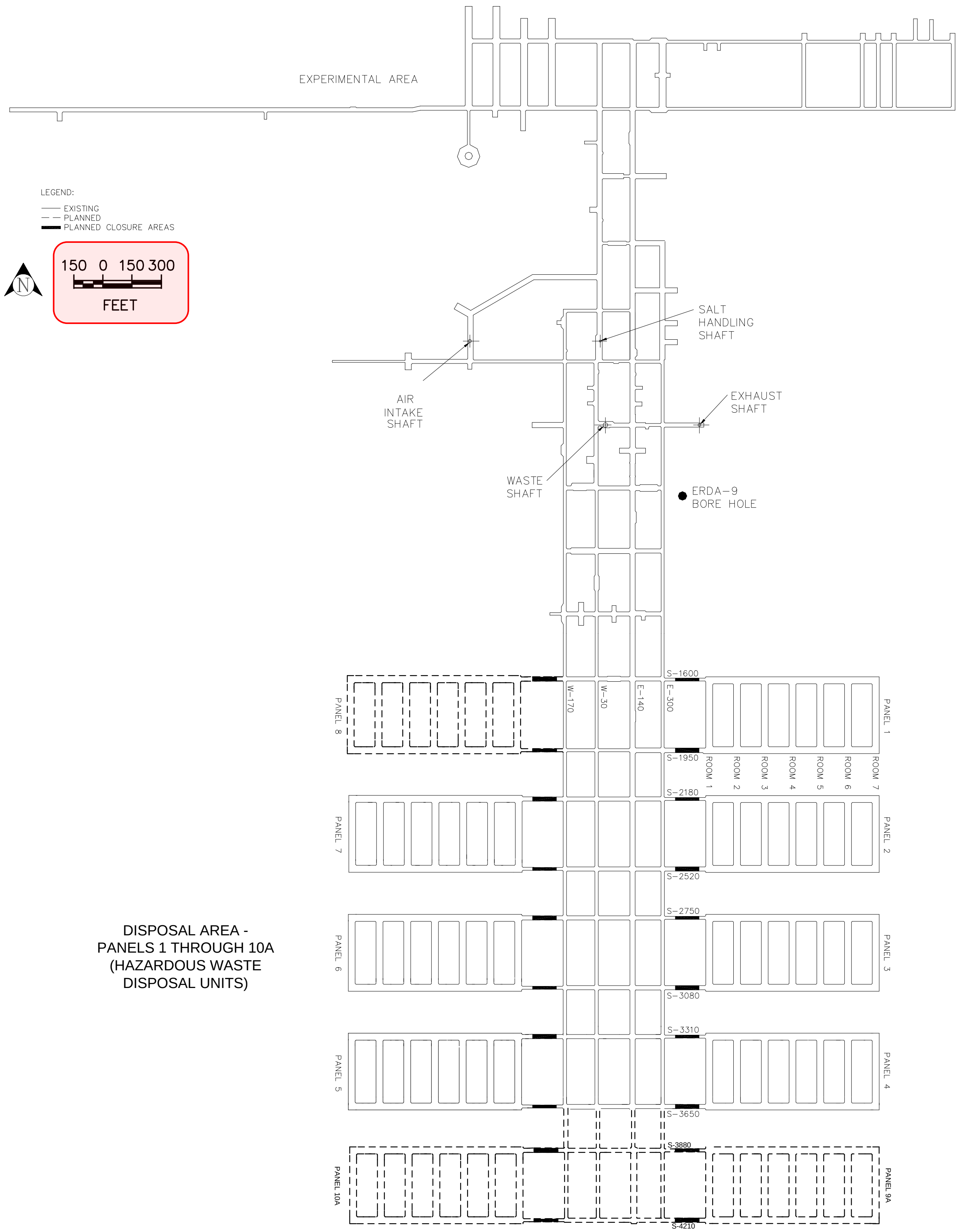

Figure B3-2
Repository Horizon

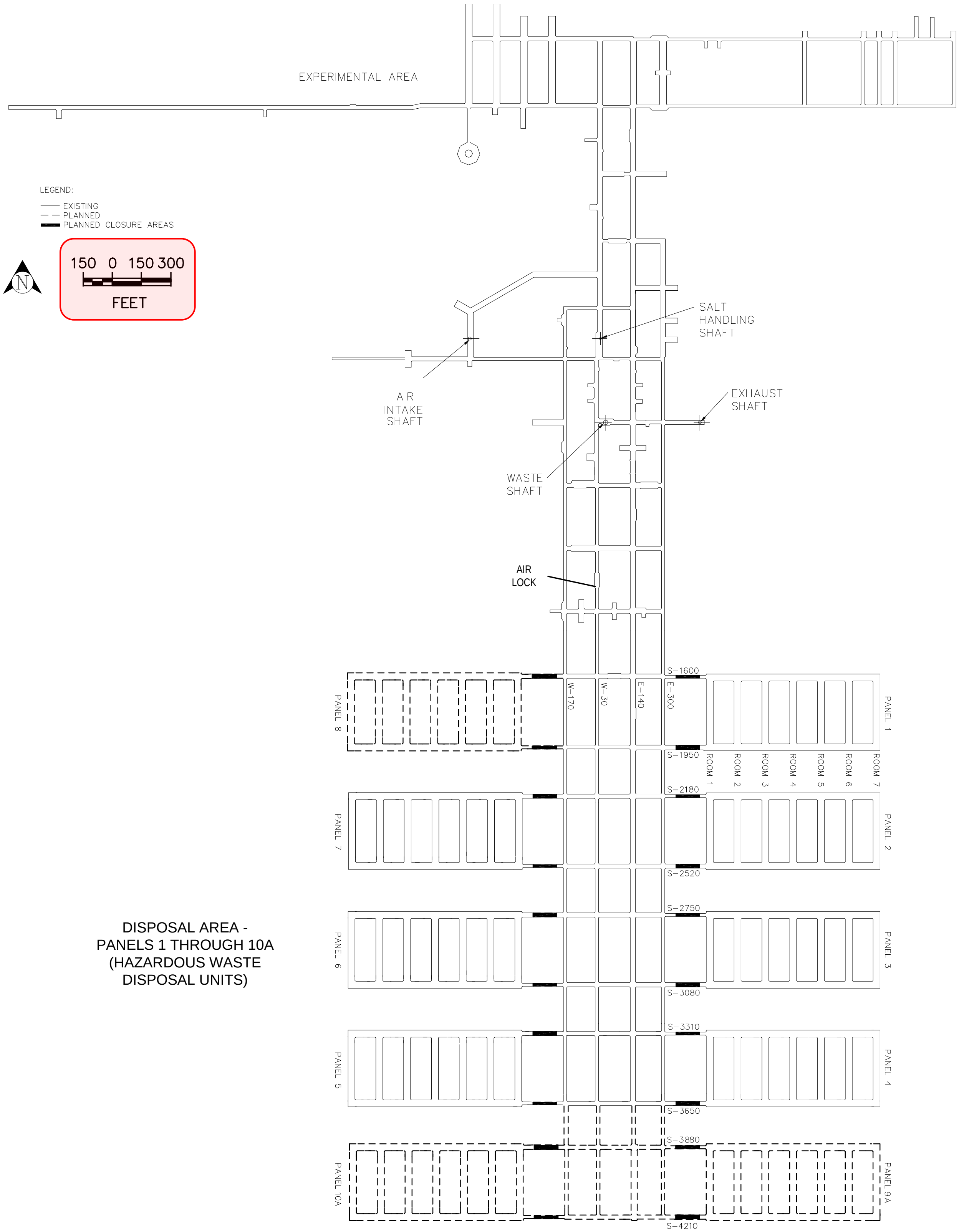

Figure D-3
WIPP Underground Facilities

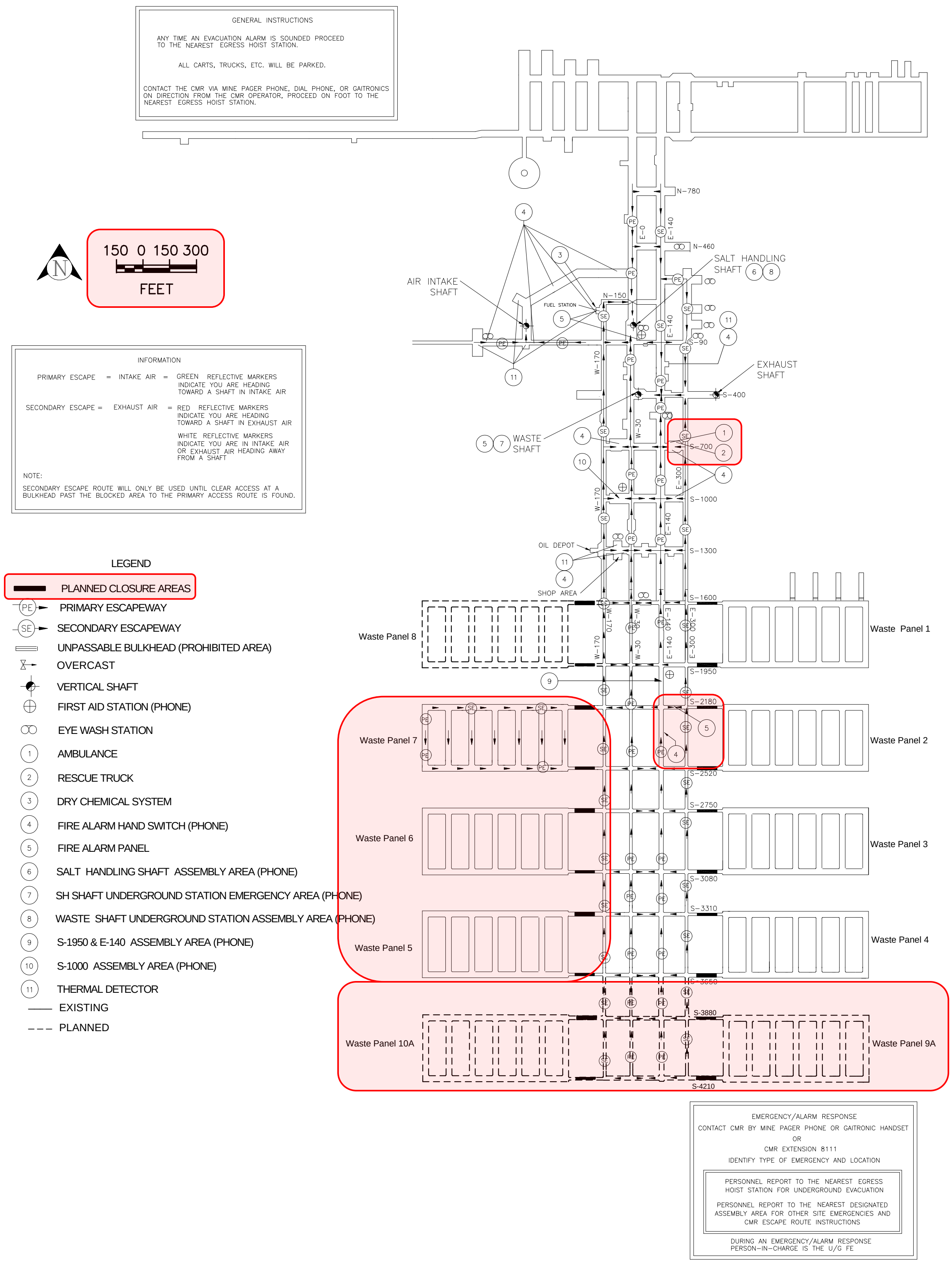

Figure D-5
Underground Emergency Equipment Locations and Underground Evacuation Routes

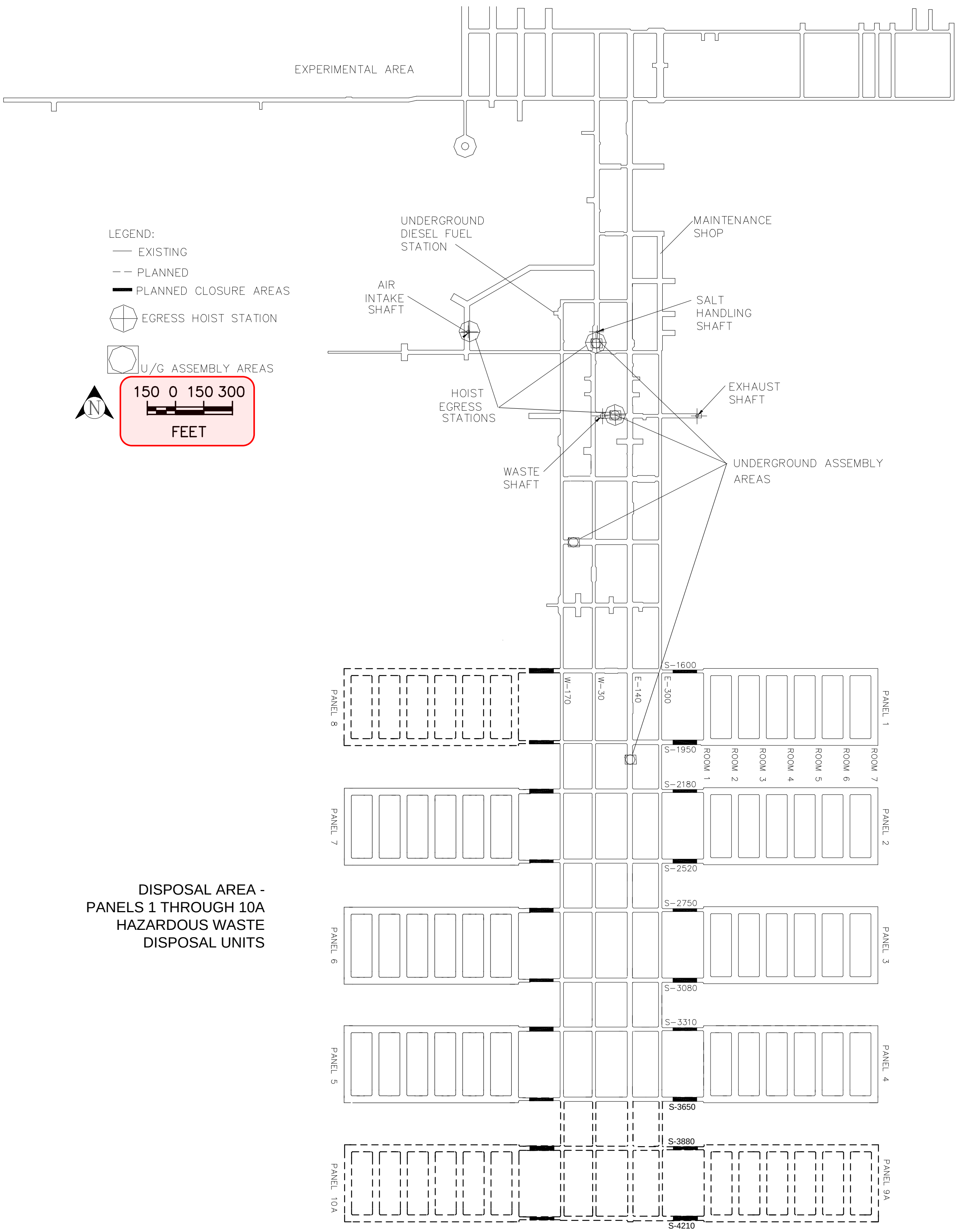

Figure D-9
Designated Underground Assembly Areas

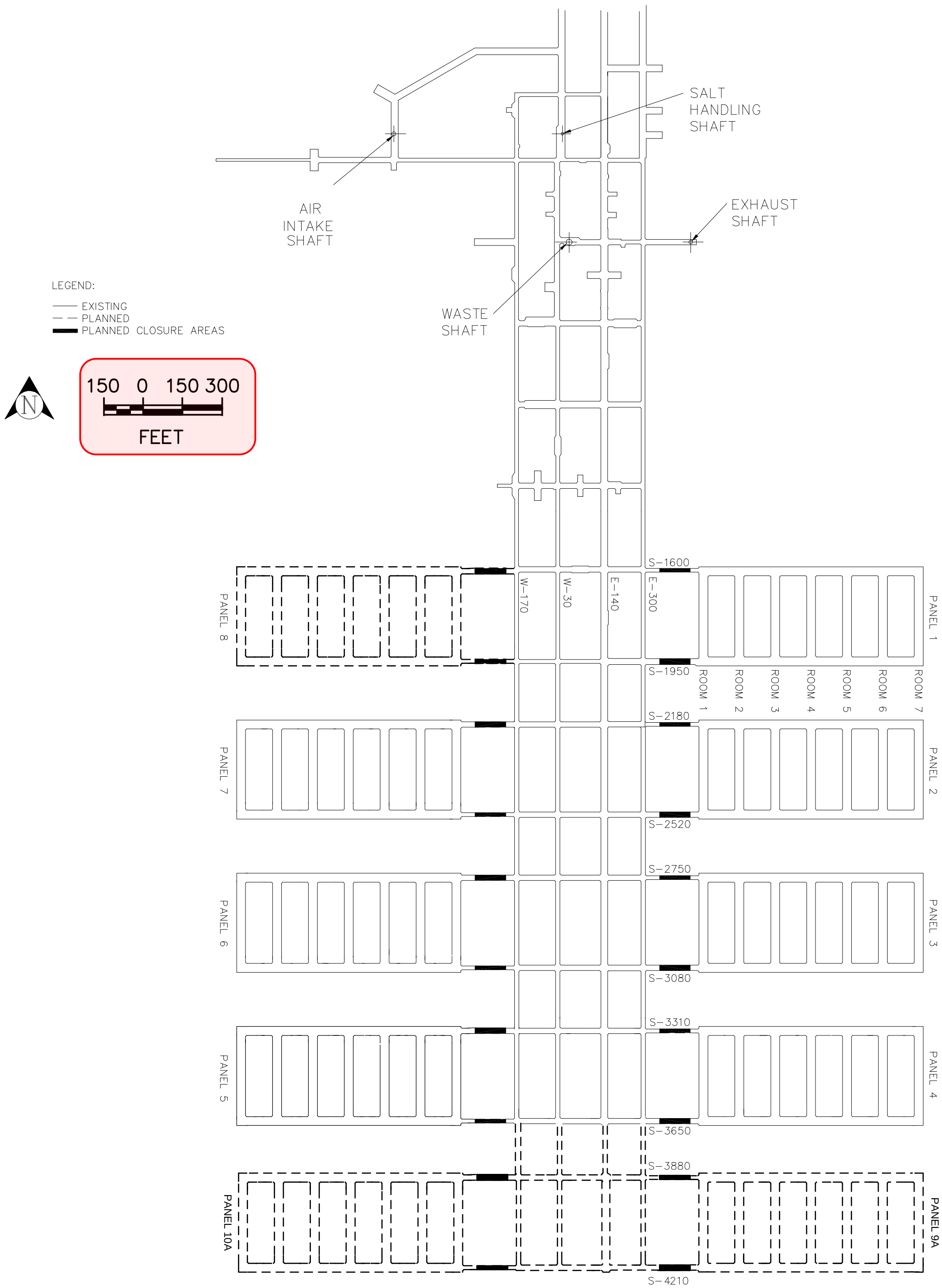

Figure G-1
Location of Underground HWDUs and Anticipated Closure Locations

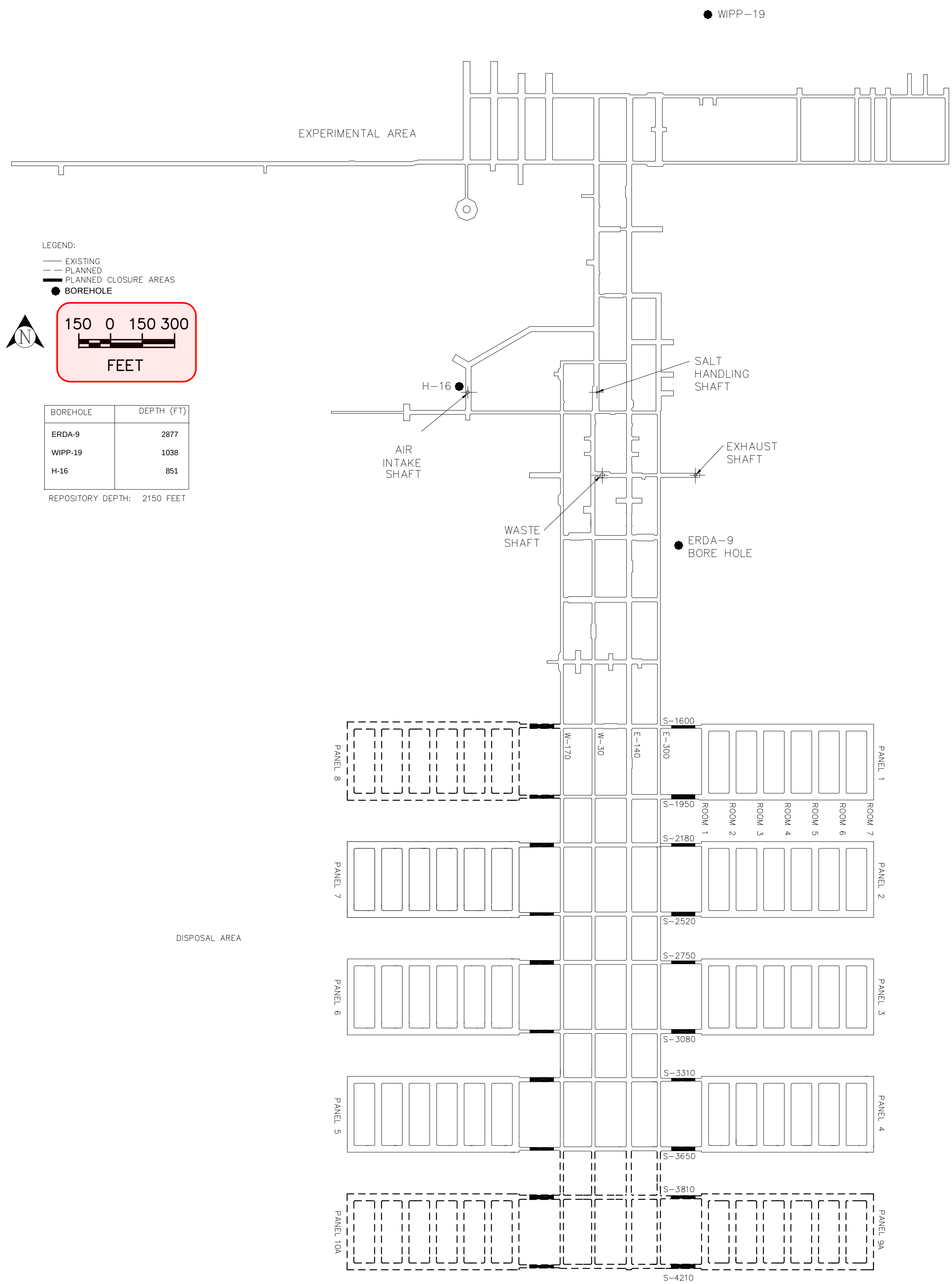

Figure G-6
Approximate Location of Boreholes in Relation to the WIPP Underground

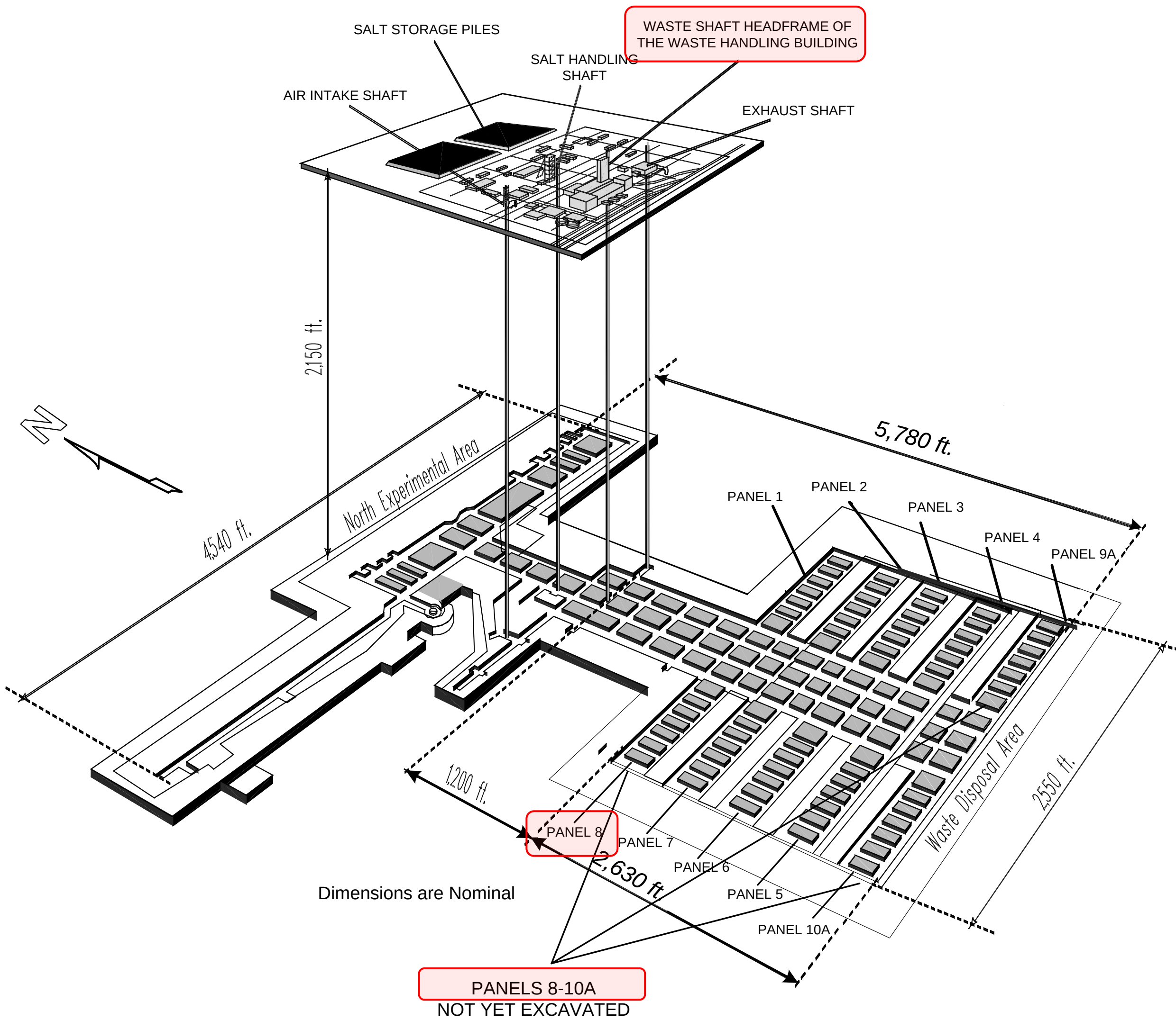

Figure G2-1
View of the WIPP Underground Facility

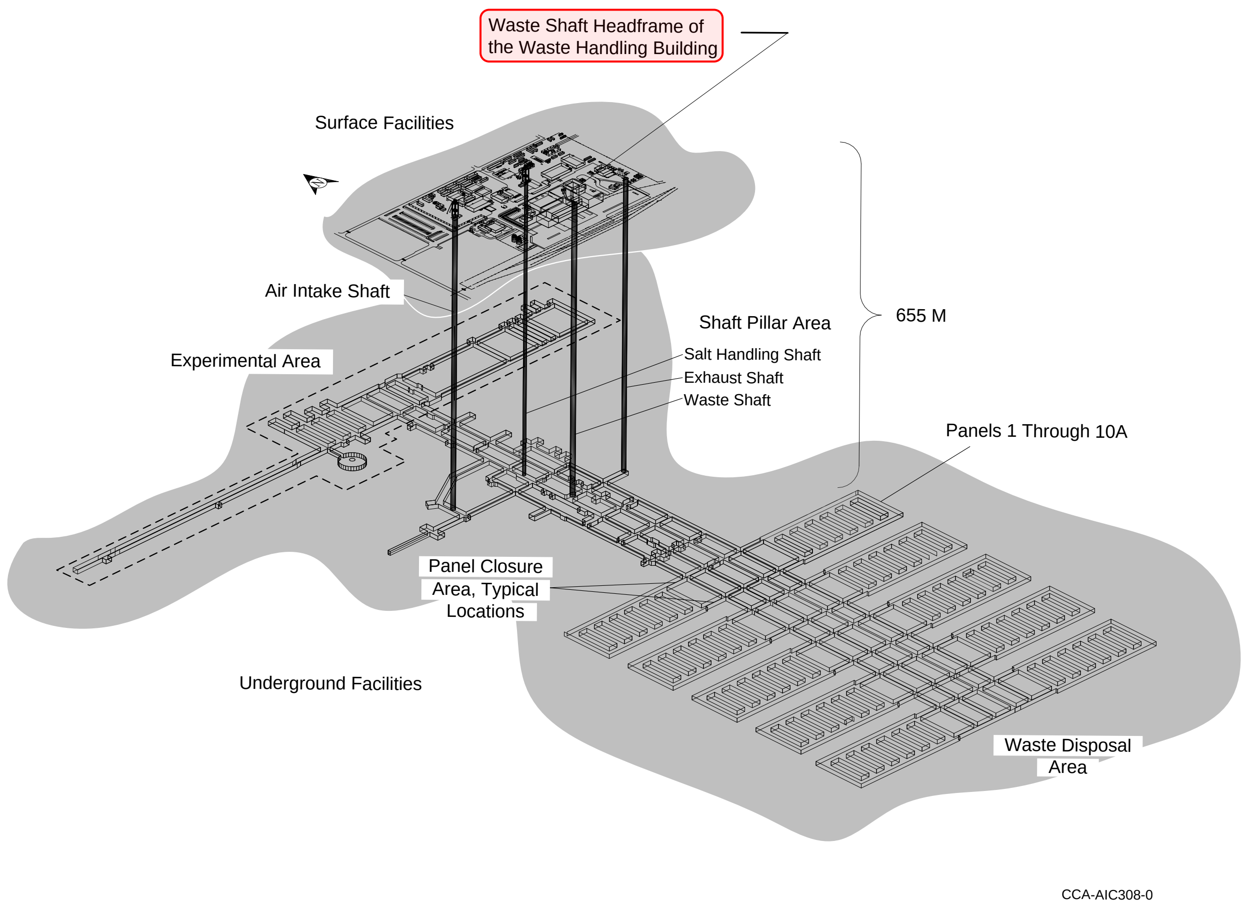

Figure H1-1
Spatial View of WIPP Surface and Underground Facilities

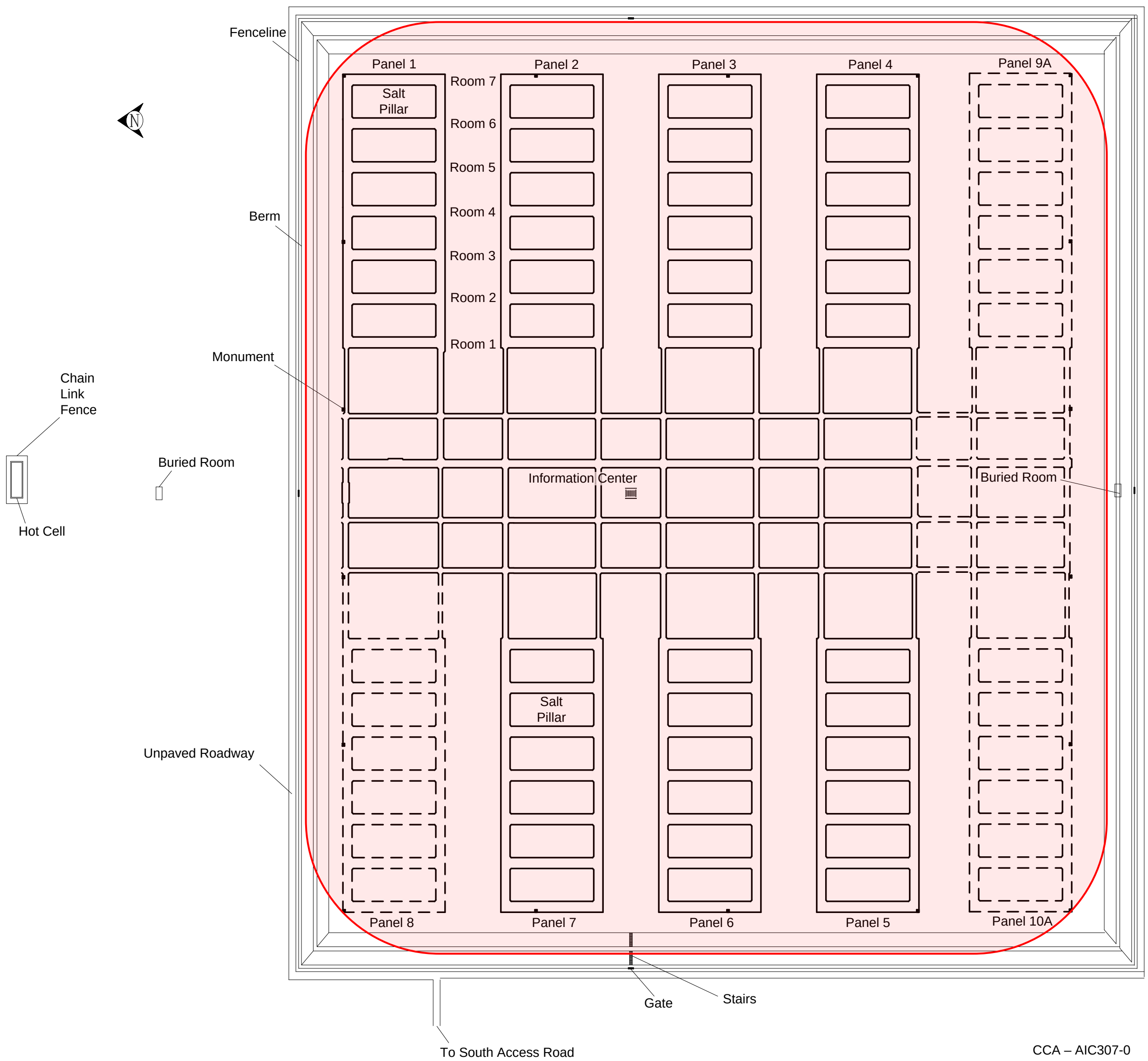

Figure H1-4
Perimeter Fenceline and Roadway

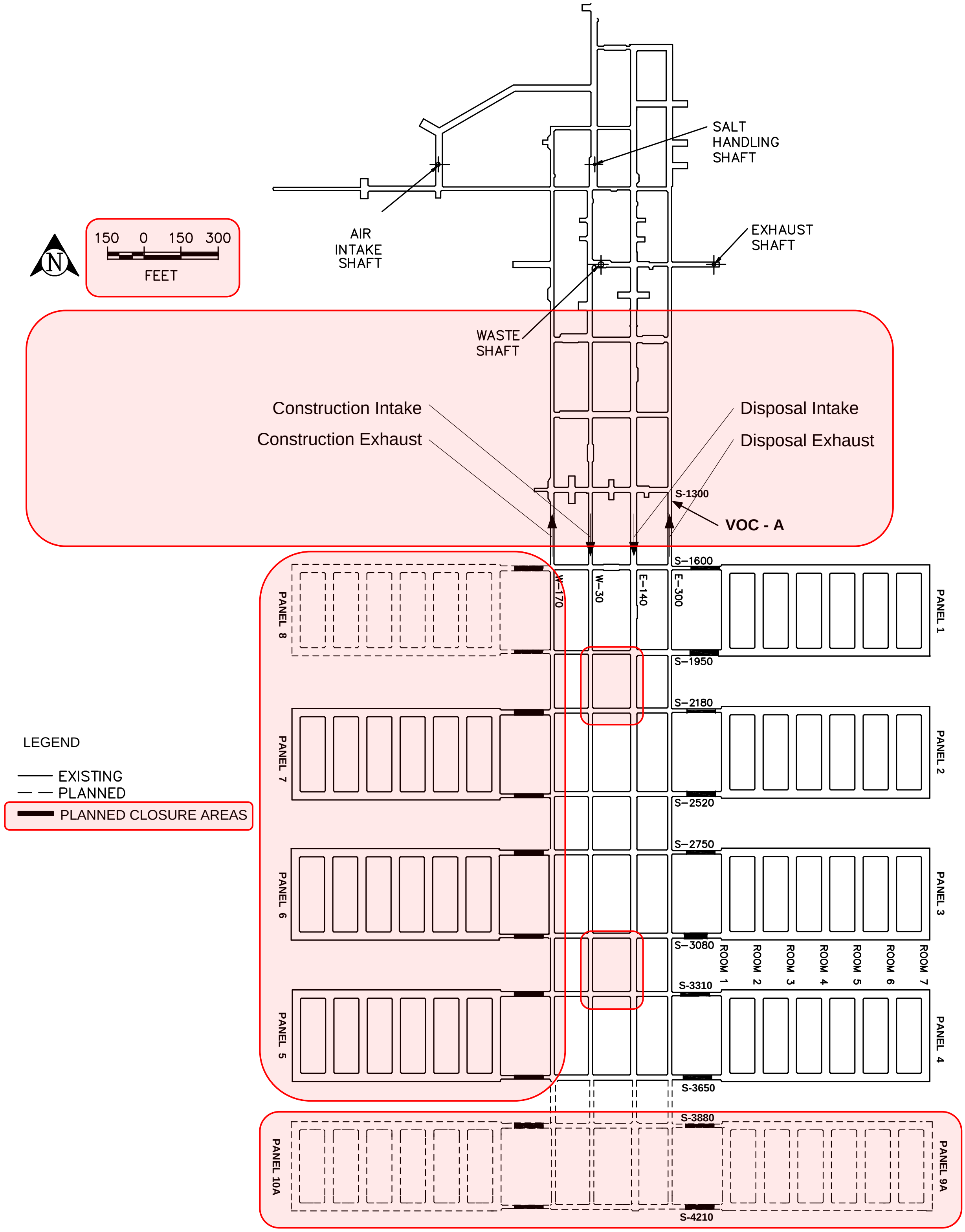

Figure N-1
Location of Station VOC-A

APPENDIX 2-C
VENTILATION SYSTEM DESIGN FOR PANEL 9A AND PANEL 10A FOR THE UNDERGROUND VENTILATION SYSTEM AT THE WIPP FACILITY

VENTILATION SYSTEM DESIGN FOR PANEL 9A AND PANEL 10A FOR THE UNDERGROUND VENTILATION SYSTEM AT THE WIPP FACILITY – REVISION 1

Prepared For:

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April 2013

I, J. Daniel Stinnette, certify this report "Ventilation System Design for Panel 9A and Panel 10A for the Underground Ventilation System at the WIPP Facility – Revision 1" has been prepared according to the Mine Ventilation Services, Inc. quality assurance manuals "Quality Assurance Manual for Mine Ventilation Services, Inc. – Revision 5" and "Project Quality Assurance Manual (PQAM) For Providing Technical Services Related to the Underground Ventilation System at the Waste Isolation Pilot Plant (WIPP) Project" using accepted industry design practices.

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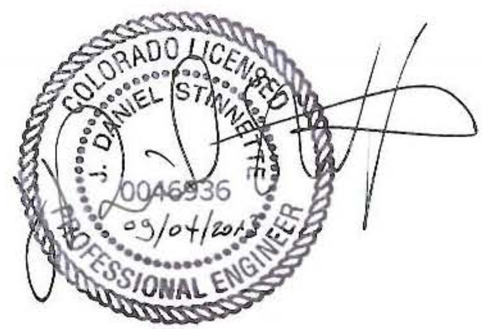

LIST OF FIGURES

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LIST OF EQUATIONS

1. EXECUTIVE SUMMARY

Mine Ventilation Services, Inc. (MVS) was contracted by Washington TRU Solutions, LLC (WTS) to evaluate the ventilation system at the Waste Isolation Pilot Plant (WIPP) for various configurations to support the mining of new proposed Panels 9A and 10A. These panels are to be added south of Panels 4 and 5. Several alternatives were also investigated in order to evaluate possible systems should the E-140 drift be impassable because of ground control work. In addition, alternatives were investigated to use the W-30 drift for disposal transporter movement and E-140 for construction equipment movement. Three alternatives were studied when mining is initiated towards Panel 9A and emplacement is occurring in Panel 7 with Panel 8 having been certified. Three more alternatives were investigated when Panel 10A is under construction and emplacement is occurring in Panels 8 and 9A.

The results of the modeling showed that every scenario analyzed could be successfully ventilated to the criteria given in Section 3. A series of doors, regulators and auxiliary duct with fans are required to control the airflow throughout the facility. This infrastructure and airflow distribution values are described in detail in Sections 4 through 9. Section 10 compares the results of each system studied.

MVS engineers also analyzed the shift to filtration capabilities and concluded with the design as presented in this report. All configurations could be successfully shifted to filtration by the closing of strategic doors and regulators and the conversion of the surface 700 fans to a single 860 fan in filtration mode.

A description of ventilation related structures and recommended monitoring systems are also discussed in Section 10.

2. INTRODUCTION

This report describes the ventilation designs generated to investigate methods of providing airflow to mine Panels 9A and 10A. These panels are to be added south of Panels 4 and 5. The models investigate mining strategies developed by WTS engineers. These strategies include concepts to provide air for disposal in Panels 7 and 8 while initiating mining for Panels 9A and 10A and disposal in Panel 8 and 9A while developing Panel 10A. In addition to these goals, a further constraint was given if the main disposal intake, E-140, is not available for equipment movement because of major ground control work (e.g. the installation of additional support resulting in blocking equipment movement, but not airflow).

In most of these scenarios, the transport of TRU waste will travel through an area that is used as an intake for the construction circuit. It is MVS' understanding that a permit change has been granted to allow this to occur. The disposal transporter will either need to cross a construction intake drift, or will be in a common intake to both the disposal and construction air splits, depending on the scenario investigated.

MVS did not include in this design those infrastructure components needed to support the W-30 alternate waste transportation route prior to the inclusion of the 9A and 10A panels (e.g. the proposed doors in W-30 between S-600 and S-700 and the regulator in S-700 between W-170 and W-30).

2.1 DESCRIPTION OF THE VENTILATION SYSTEM

Ventilation of the underground facility at WIPP is accomplished with four main ventilation splits: the north split, the construction split, the waste disposal split, and the waste shaft station split. In order to minimize occupational exposure of underground personnel to radiation and radioactive materials, the facility is designed and constructed based on the "As Low As Reasonably Achievable" (ALARA) concept. This concept resulted in a design where the nuclear waste transportation and disposal areas are separated from the mining and non-radioactive experimental areas. The ventilation system is also designed such that air leakage is from the mining and north areas into the waste disposal areas. Furthermore, radiation detectors are strategically located in the underground, and a contingent exhaust filtration system is installed on surface to minimize the effects of an unlikely release of radioactive material to the environment.

The underground facility is accessed and ventilated through four vertical shafts, three of which supply intake air, with the fourth acting as a common exhaust. Ventilation of the facility is provided by running either one or two of the three 600 hp centrifugal main fans (700A, 700B and 700C).

During concurrent mining and disposal operations, two of the main fans operate in parallel (Normal Ventilation Mode) to provide a minimum of 425,000 scfm (standard cubic feet of air per minute at a density of 0.075 lb/ft^3). In the unlikely event of an underground radioactive material release, the ventilation system is shifted to Filtration Mode. In Filtration Mode, the underground airflow is reduced to approximately 60,000 scfm. This is achieved by de-energizing all 600 hp fan(s) in operation and starting one of three 235 hp centrifugal filtration fans (860A, 860B, or 860C). Isolation dampers open and close to divert the air through the High Efficiency Particulate Air (HEPA) filters.

For normal operation the direction of the pressure differential between the mining and waste disposal systems is from the mining circuit to the waste disposal circuit. A pressure difference less than 2.00 in. w.g. and greater than 0.05 in. w.g. in the correct direction is desired between these systems. The waste shaft is kept as a low flow, downcast shaft. The negative pressure developed across the head frame should not exceed -1.8 in. w.g. during normal operation. However, because of the system-fans in BH 309, the operating pressure-range of the waste tower can be reduced to between -0.3 and -1.6 in. w.g. by opening the AAIT louvers (located in Building 465 on surface). By reducing the tower pressure an increased pressure drop is realized on BH 308.

Figure 1 shows the underground facility infrastructure with shops, bulkheads, shafts, doors and regulators locations. To meet the airflow criteria established for this study, MVS engineers modified some of the infrastructure. These modifications are also shown on this figure. Figure 2 shows the surface fan configuration.

2.2 OBJECTIVE

The objective of this study is to develop a series of models to simulate the ventilation of Panel 9A and Panel 10A. This report will include analyses, results and the viability of the six ventilation configurations required.

2.3 SCOPE OF STUDY

- Develop network models representing the B-1, B-2A, B-2B, B-3, B-4A, and B-4B ventilation configurations.
- Compare and contrast the ventilation related benefits and potential issues for each ventilation configuration and determine the system viability.
- Evaluate one scenario during a shift to filtration to validate the concept.
- Ensure that each model and ventilation layout is checked for accuracy and all calculations and reports are developed in accordance with the Project Quality Assurance Manual (PQAM) for Providing Technical Services Related to the Underground Ventilation System at the Waste Isolation Pilot Plant (WIPP) Project.
- Prepare a detailed report on the results of the ventilation modeling.

2.4 PROCEDURES

The procedures and quality assurance requirements for this project are described in detail in the MVS documents; "Project Quality Assurance Manual (PQAM) For Providing Technical Services Related to the Underground Ventilation System at the Waste Isolation Pilot Plant (WIPP) Project" (Rev. 5 dated August 2009), and in the "Quality Assurance Manual for Mine Ventilation Services, Inc." (Rev. 5 dated August 2009).

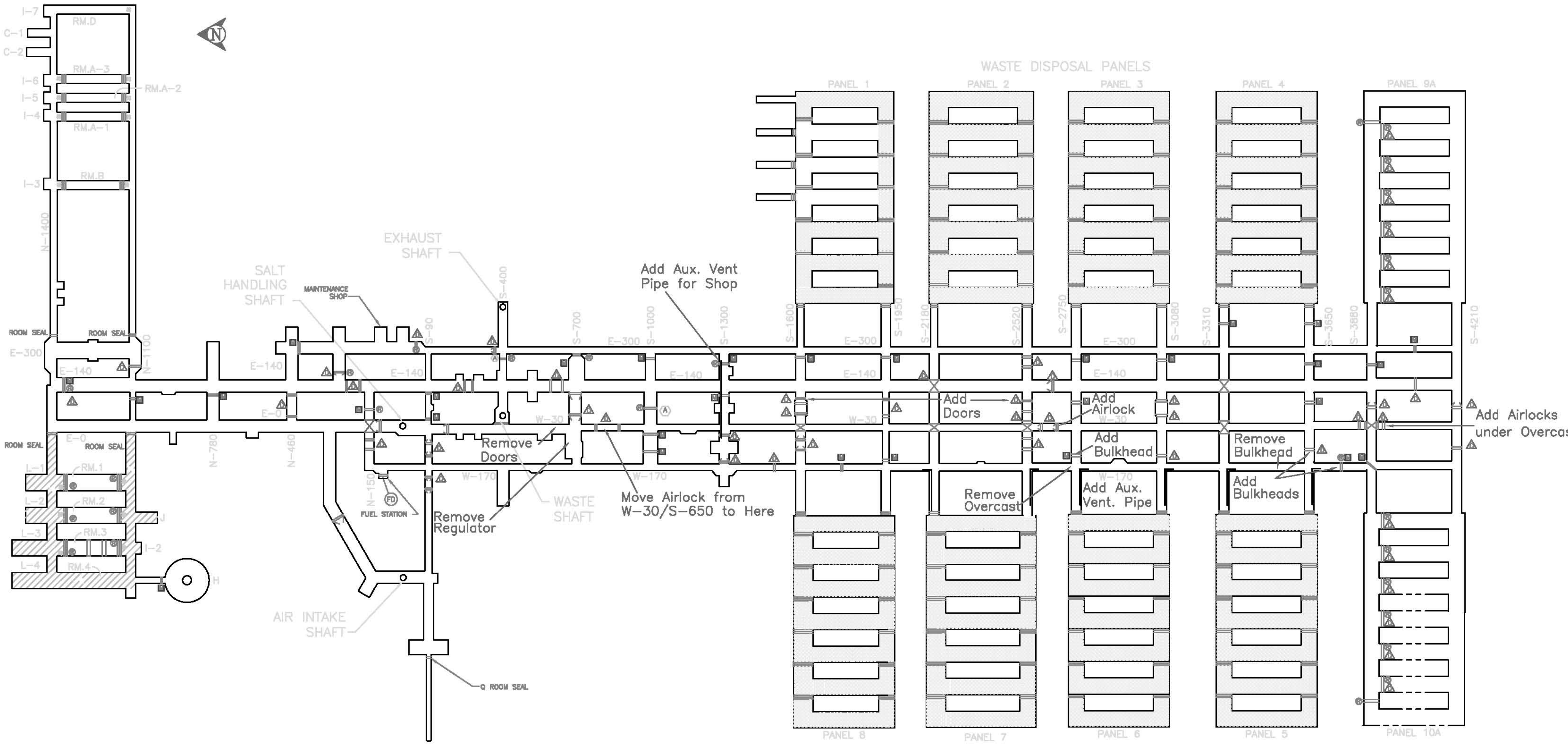

Figure 1: Underground Facility Infrastructure Including Shop Locations, Door and Regulator Locations, and Main Shafts. Modifications to Infrastructure are also shown.

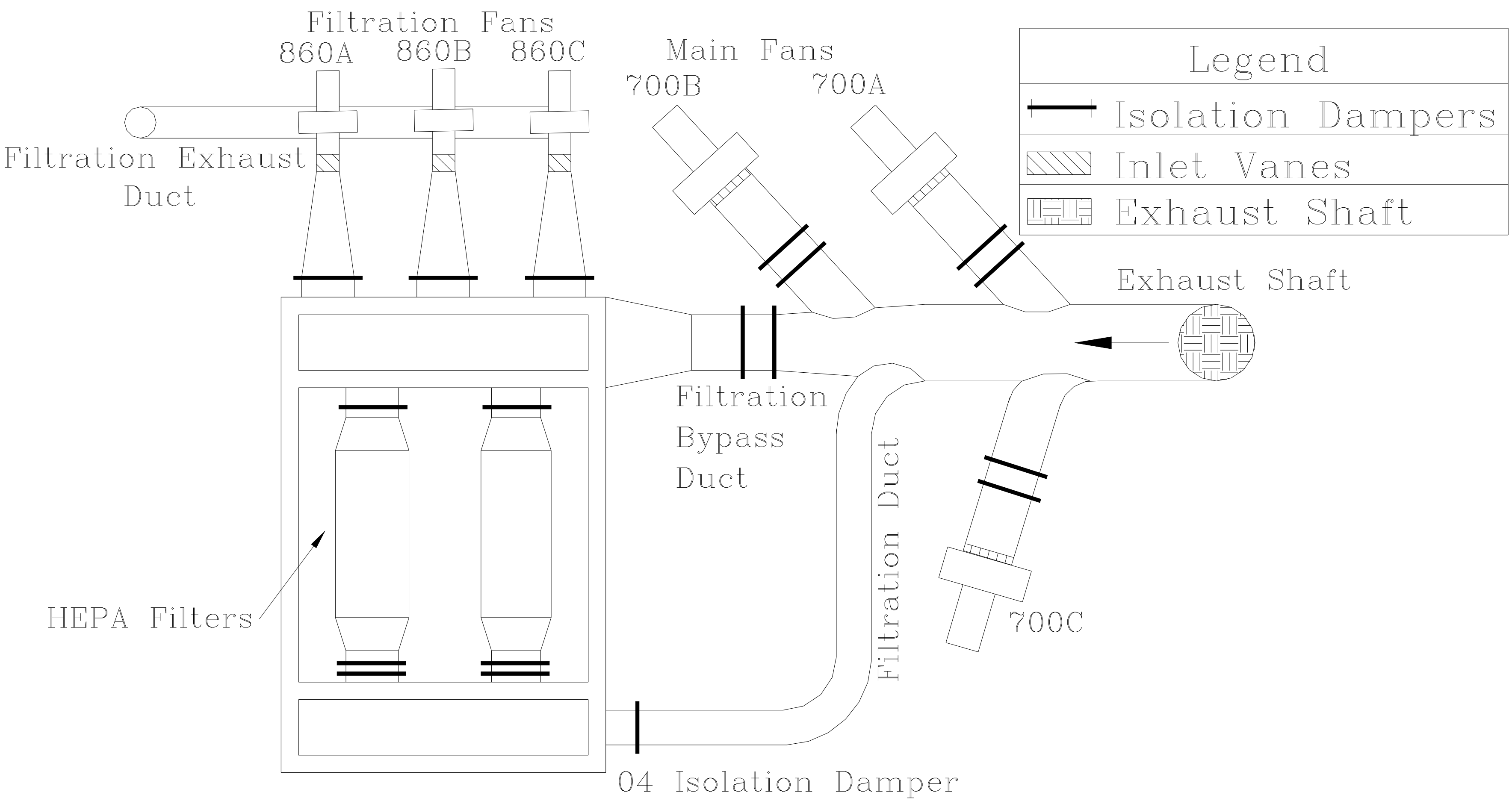

Figure 2: Main Surface Fan Configuration. (Not to Scale)

3. DESIGN CRITERIA

The scenarios described in this report are based on the Normal Mode model developed from the testing and balance conducted in 2010. The basis of the design includes the concept that all air leakage was to be maintained from the construction circuit to the waste handling circuit. In addition, the system must successfully shift to filtration. In this regard, MVS adopted the philosophy that a shift to filtration must include all disposal panels with accessible waste and all air leakage must be from the construction to the waste handling circuits.

Modifications to the E-300, which include the removal of overcast and slashing of the drift, are incorporated in the ventilation base model. This is critical to the success of the system, as the current bulkheads and E-300 are inadequate to control leakage from E-140 to E-300.

Where feasible, MVS worked with the infrastructure currently in the facility. However, because the W-170 drift is not used as a construction air return split, all air from the construction area will be exhausted to E-300. MVS was instructed that the E-300 will be mined to 16 ft x 15 ft from S-2180 to S-3310 and at 16 ft x 13 ft from S-2180 to S-400. In addition, all bulkheads between E-140 and E-300 will be rebuilt with bulkheads with mandoors only (except at S-2520 where an automated drive through airlock will be established). These changes will result in much better leakage control from E-140 to E-300. The modeled systems in this report will only work if these changes are done.

For design scenarios B-1, B-2A, and B-2B Panel 7 has two disposal rooms open while Panel 8 is ready for disposal with room 7 actively ventilated for this purpose. The construction circuit is assumed to have mined the mains towards S-4210 and is preparing to mine the entries to Panel 9A. For scenarios B-3, B-4A and B-4B, active disposal is being completed in one room of Panel 8 with two rooms available in Panel 9A. Panel 10A is under construction with one room mined. The difference in the scenarios for the same layouts deals with the whether the disposal transporter has access to E-140. Most of the scenarios assume the disposal transporter traveling in W-30 while the haulage trucks haul in E-140. Some of the scenarios assume that E-140 will be having major ground support requirements that result in no passing of vehicles, although airflow can pass by this construction area. If E-140 is closed to disposal and/or haulage truck transportation, then W-30 must be available for this purpose.

In the initial information provided to MVS, Washington TRU Solution engineers showed a set of doors in W-30 at S-650 and a regulator in S-700 at W-80. In analyzing all scenarios for this study, MVS concluded that these structures are not required. These structures would have been necessary if Panels 9A and 10A were not to be mined and W-30 was to be used as an alternative disposal route. In addition to these changes, MVS engineers added infrastructure to control airflow to strategic areas in the facility. These additions are described in each scenario. Additional changes to the original infrastructure suggested by MVS engineers includes removing the overcast at S-2750 and W-170, installing a regulator in W-170 at S-2600, removing the bulkhead in W-170 at S-3500 and adding bulkheads at S-3650 and W-140 and in W-170 at S-3700. In addition the S-1300 shop had a 36 inch duct installed to carry air from the shop to E-300 exhaust.

A resistance to airflow is computed for each branch in the ventilation network schematic. Based on previous testing and balance ventilation surveys conducted at the WIPP facility a measure friction factor of 40 lbf $min^2/ft^4 \times 10^{-10}$ was determined. Branch resistances are computed using the Atkinson's equation, as given in Equation 1, with Table 1 listing the various resistance values for ventilation controls modeled.

Equation 1: $$R = \frac{k\,(L + L_e)\,P_{er}}{52\,A^3}$$

Where:

	k	=	friction factor (lbf $min^2/ft^4 \times 10^{10}$)
	L	=	length of airway (ft)
	L_e	=	equivalent length of shock loss (ft)
	P_{er}	=	perimeter of airway (ft)
	A	=	cross-sectional area (ft^2)

Table 2 lists the height, width, area and perimeter for various airway dimensions at the WIPP facility used for the design scenarios projections. For these analyses, WIPP personnel provided new entry dimensions for the E-300. The entry dimensions and locations used in the analyses are listed Table 3. Table 4 lists the Panels 9A and 10A design target airflow quantities for the underground WIPP facility.

Table 1: Ventilation Control Resistances

Description	Resistance (PU)
Single Overcast Installation	0.0112
Future Emplacement Panel Regulator (closed)	100
Brattice/Curtain	2
Bulkhead	500
Vehicle Airlock Doors	25
Sealed Brattice	25
Panel Room Regulators (fully open)	0.0785

Table 2: Airway Drift Dimensions for Various Airways at the WIPP Underground Facility

Location	Height (ft)	Width (ft)	Area (ft^2)	Perimeter (ft)
W-170	11.8	15.5	182.9	54.6
W-30	13.0	15.5	201.5	57.0
E-140	15.4	26.0	400.4	82.8
Panel Rooms	15.6	33.6	524.2	98.4
Panel Access Drifts - Intake	15.0	20.0	300.0	70.0
Panel Access Drifts - Return	12.5	14.5	181.3	54.0

Table 3: E300 Newly Mined Airway Dimensions at the WIPP Underground Facility (WIPP)

Location	Height (ft)	Width (ft)	Area (ft^2)	Perimeter (ft)
E300: S2180 to S3310	16.0	15.0	240.0	62.0
E300: S2180 to S400	16.0	13.0	208.0	58.0

Table 4: Design Target Airflow Quantities for WIPP Panels 9A and 10A

Description	Quantity (kcfm)
Panel Room 1	43
Panel Room 2	43
Panel Room 3	43
Fuel Bay	20
S-1300 Shop	15
Construction Split Regulator	50
North Experimental Regulator	60
North Shop	55
Waste Handling Shaft Station	50 to 65

For bulkheads simulated with vehicle doors open an equivalent length of 50 ft is added to incorporate shock losses attributed to the vehicle doors open. For the simulations, the 700 A and 700 C fans are used for modeling. These fans are used to be conservative because 700 C has a lower operating point. This assumption allows the WIPP facility with the option to utilize any combination of two of the three fans for normal operations. For each of the six configurations specific design assumptions are identified. The design assumptions for each of the six configurations are identified in Sections 4 through 9.

4. VENTILATION CONFIGURATION: B-1

Scenario B-1 shows the alternative where Panel 7 and Panel 8 are available for disposal. Construction is occurring in the mains driving them south to S-4210. The basic layout keeps the ventilation circuits similar to the current system where disposal intake is in E-140 and construction intake is in W-30. For this scenario the transporter crosses the construction intake W-30 at either S-1600 or S-2520.

Figure 3 illustrates the underground facility infrastructure for the B-1 configuration provided to MVS by WTS engineers and the primary disposal and truck haulage routes.

4.1 DESIGN CRITERIA AND ASSUMPTIONS

The following lists assumptions and modifications that were specified for the B-1 configuration to be incorporated into the ventilation system design:

- Waste disposal is taking place in Panel 7 with Panel 8 having been certified.
- Mining/Construction is taking place at the southern end of the mains. The mains are being extended to accommodate two more panels (Panel 9A and Panel 10A).
- The waste disposal transportation route is as follows (E-140 not blocked by repair work):
  - Waste Shaft to S-400/E-140
  - South in E-140 to S-1600 (P8) or S-2520 (P7)
  - West in either S-1600 or S-2520 to the open disposal room
- The mining transportation route is as follows:
  - Empty trucks from Salt Handling Shaft (SHS) south in W-30 to the mining face (southern mains)
  - Loaded trucks north in W-30 from the mining face (southern mains) to the SHS
- The mine has been configured as follows:
  - The 402/403 airlock at S-90/W-200 is open.
  - The 305/306 airlock at S-90/W-140 is open.
  - The 302 regulator is set for 20,000 cfm. This allows ventilation of the diesel fueling station.
  - An overcast with airlocks on the east and west side (under the overcast) is located at S-1600/W-30. This overcast allows the disposal circuit air from E-140 to travel across W-30 without mixing with the construction circuit air. The airlocks allow the waste transporter to cross W-30 and access Panel 8 (transporter is temporarily in the construction circuit when traveling through the W-30/S-1600 intersection).

- An isolation door is located in the S-1600/E-100 cross-cut. This door is open for this scenario. This door is installed in the event the disposal route is moved to W-30.
- An overcast with airlocks on the east and west side (under the overcast) is located at S-2520/W-30. This overcast allows the disposal circuit air from E-140 to travel across W-30 without mixing with the construction circuit air. The airlocks allow the waste transporter to cross W-30 and access Panel 7 (transporter is temporarily in the construction circuit when traveling through the W-30/S-1600 intersection).
- An isolation door is located in the S-2520/E-100 cross-cut. This door is open for this scenario. This door is installed in the event the disposal route is moved to W-30.
- An overcast is installed at S-3310/W-30. This overcast exhausts air from the block walls of Panels 5 and 6 to the exhaust at E-300 without mixing with the construction circuit. This area will be ventilated via a regulator in W-170 at S-2600 to take 15 kcfm from the disposal intake to the overcast. Auxiliary ventilation systems will pass approximately 10,000 cfm per face to the seals in S3310 and S3080. The design assumes series ventilation to each seal. Ventilating the block walls will dilute and VOCs emitting from behind the seals.
- The construction split regulator is located in E-300 between S-3650 and S-3310.
- A bulkhead with vehicle doors is located at E-140/S-2600. For this scenario these doors are closed.
- An airlock with vehicle doors is located at W-30/S-2600. For this scenario these doors are open.
- The bulkhead in S-2750 at E-50 is temporarily removed to allow construction air to enter from W-30 to E-140.
- An airlock is installed in W-30 at S-800. For this scenario, the airlock is kept open, but will be closed in the event the disposal route is moved to W-30.

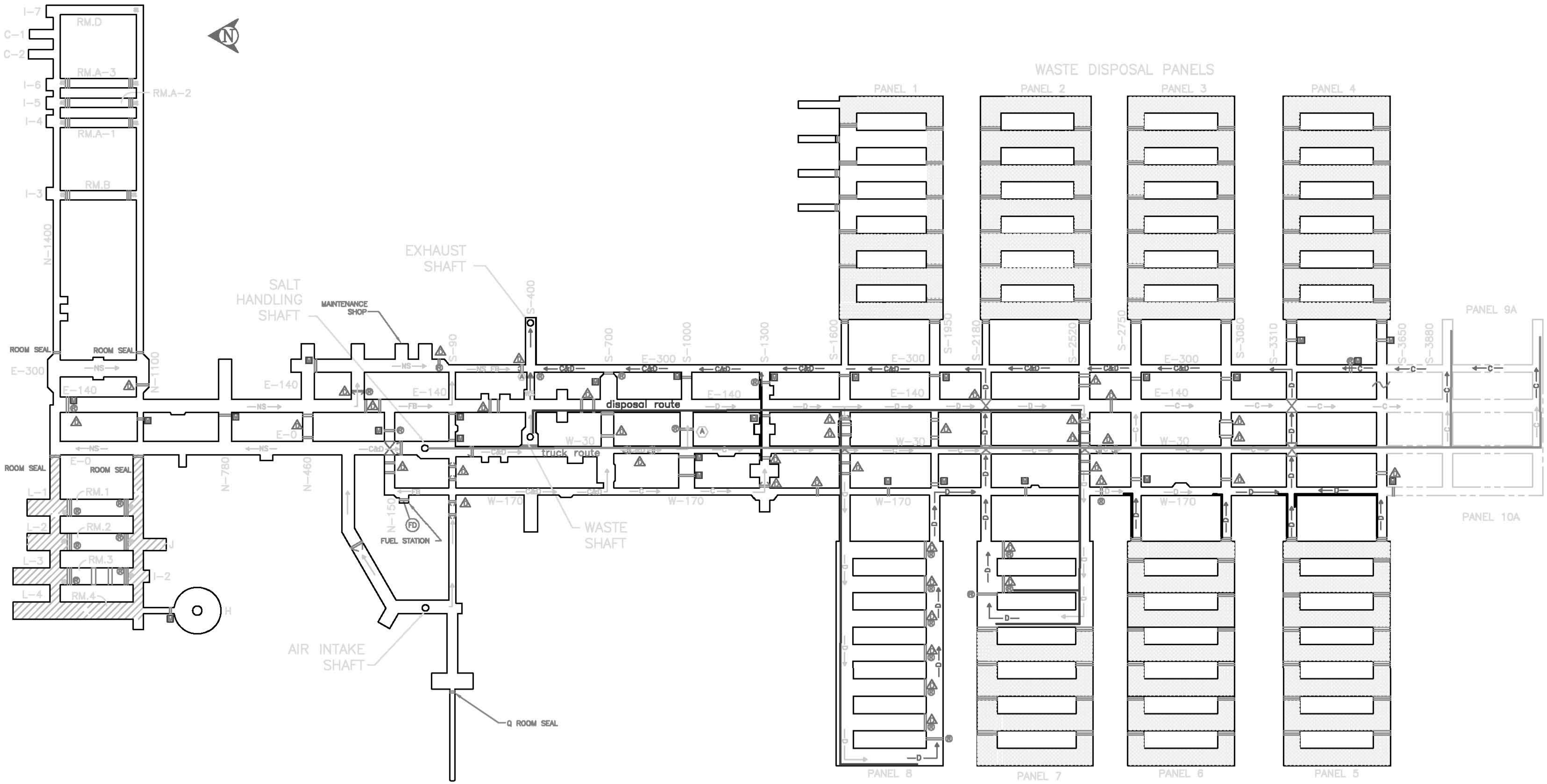

Figure 3: Underground Facility Infrastructure Locations and Primary Disposal and Truck Haulage Routes for the B-1 Ventilation Configuration

4.2 B-1 VENTILATION SCENARIO RESULTS

The results of the B-1 ventilation analyses showed that all airflow criteria could be achieved. The basic flow routes with strategic predicted airflows are shown on Figure 4 and Figure 5 illustrates strategic predicted pressure differentials. This alternative assumed 700C is operating with 700A. Both were set at maximum flow. The natural ventilation pressures were maintained as those calculated during the 2010 Test and Balance.

A total volume of 20,000 cfm is passing through BH-302 to provide air for the diesel fuel bay. A total of 55,000 cfm is exhausting the construction circuit. With leakage, the flow to this zone is closer to 70,000 cfm (the sum of the intake air in W-30 and E-140 south of S-2750). The North zone is ventilated with 55,000 cfm and the Waste Shaft Station at 67,000 cfm. All leakage is from the construction circuit to the disposal circuit. From S-2750 to S-4210, the air can course through both the E-140 and W-30 drifts to the mining area. Localized control of the air can be achieved by opening bulkheads between W-30 and E-140 or use of curtains.

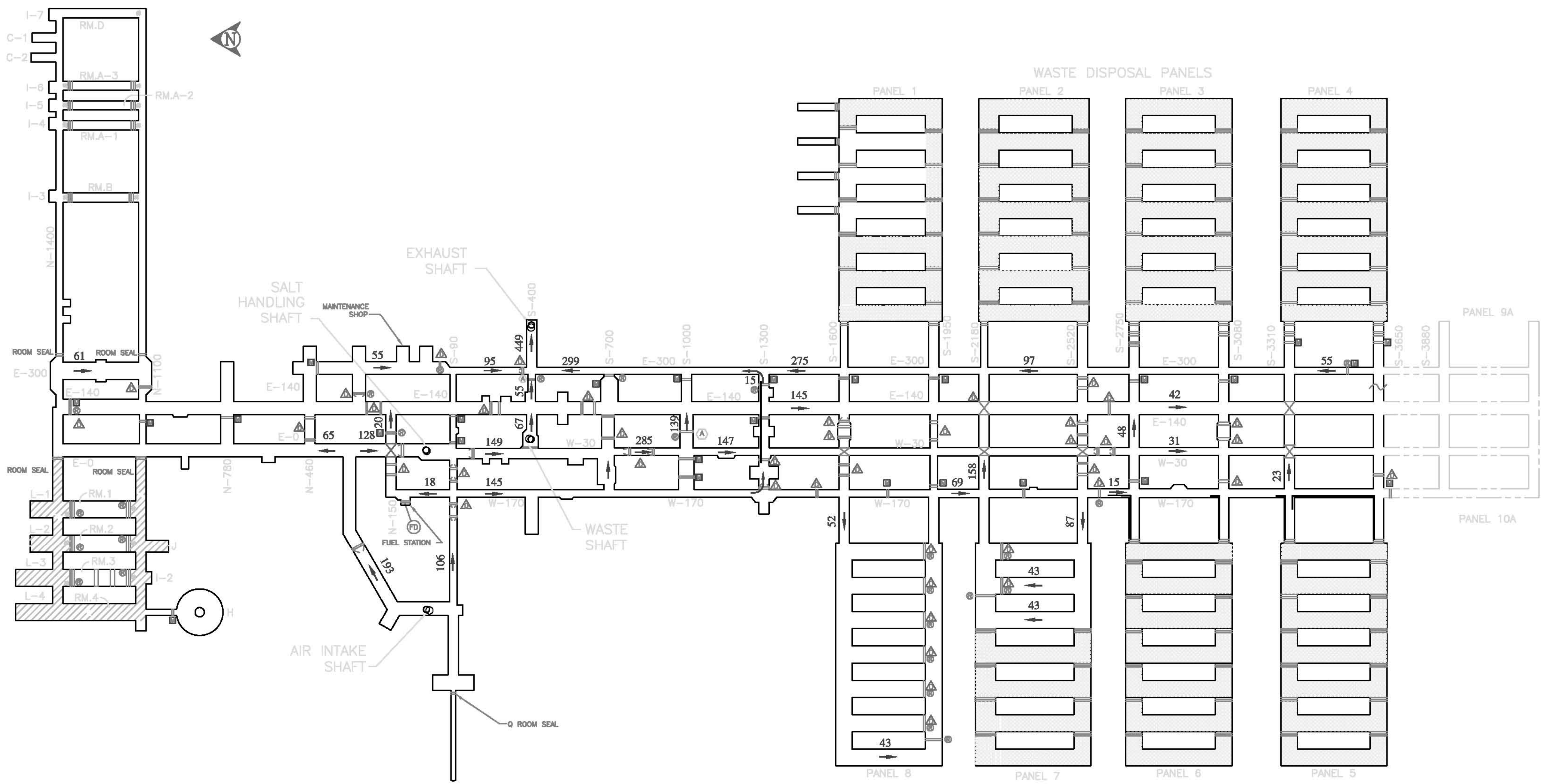

Figure 4: Results of Ventilation Modeling for Scenario B-1 with Predicted Airflow Distribution (kcfm).

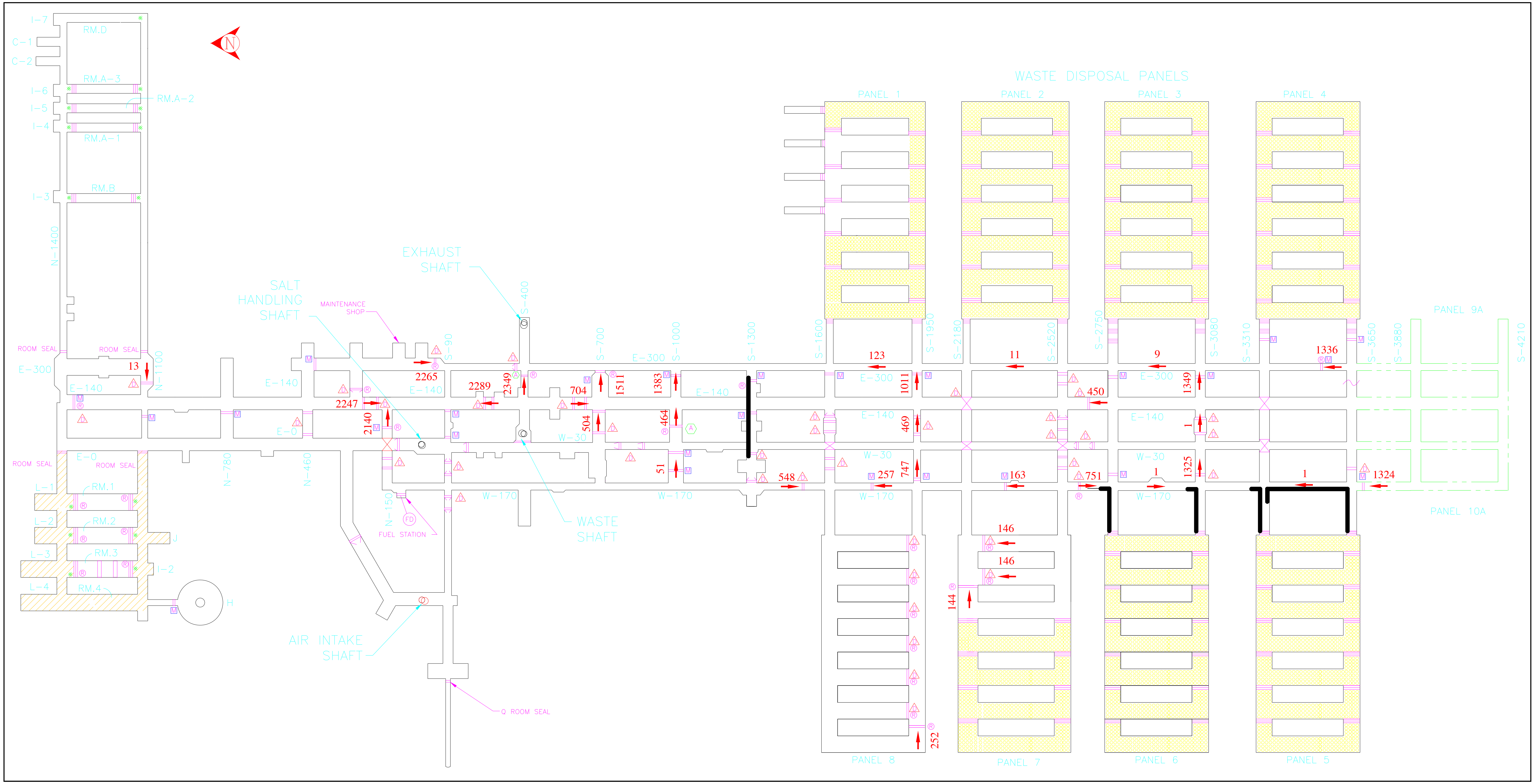

Figure 5: Results of Ventilation Modeling for Scenario B-1 with Predicted Pressure Distribution (milli inch w.g).

5. VENTILATION CONFIGURATION: B-2A

Configuration B-2A is similar to configuration B-1, except the disposal airflow is routed to W-30 instead of E-140. Construction air and vehicles move in E-140 for this scenario (it is not blocked by repair work). For this configuration, the airlock doors in S-700 between W-30 and E-140 are opened and the airlock doors in W-30 between S-700 and S-1000 are closed. The isolation doors in S-1600/E-100 and S-2520/E-100 are closed.

5.1 DESIGN CRITERIA AND ASSUMPTIONS

The design criteria described in Section 4.1 is identical to the B-1 configuration except as follows:

- The waste disposal transportation route is as follows:
  - Waste Shaft to S400/E140
  - South in E140 to S700
  - West in S-700 to W30
  - South in W-30 to either S1600 or S2520
  - West in either S1600 or S2520 to the open disposal room
- The mining transportation route is as follows (E-140 is not blocked by repair work):
  - Empty trucks from SHS south in W-30 to S-700
  - East in S-700 to E-140
  - South in E-140 to the mining face
  - Loaded return along the same route to the SHS
- The mine has been reconfigured to accommodate the W-30 Alternative Waste Disposal Route.
  - Airflow is routed to E-140 then through Bulkhead 313 to supply air to the disposal circuit.
  - The airlock doors in S-700 between W-30 and E0140 are opened.
  - The airlock doors in W-30 between S-700 and S-1000 are closed
  - An isolation door is located in the S-1600/E-100 cross-cut. This door is closed for this scenario.
  - An isolation door is located in the S-2520/E-100 cross-cut. This door is closed in this scenario.
  - An overcast with airlock doors on the east and west side (under the overcast) is located at S-1600/W-30. For this scenario the doors of the west airlock are open.
  - An overcast with airlock doors on the east and west side (under the overcast) is located at S-2520/W-30. For this scenario the doors of the west airlock are open.

- An airlock with vehicle doors is located at W-30/S-2600. For this scenario these doors are closed.
- An airlock with vehicle door is located at E-140/S-2600. For this scenario these doors are open.

5.1 B-2A VENTILATION SCENARIO RESULTS

MVS was successful in achieving all ventilation criteria for this scenario. The basic ventilation design configuration with primary transportation routes is shown on Figure 6. Figure 7 shows the predicted airflow distribution for this scenario with strategic predicted pressure differentials shown on Figure 8.

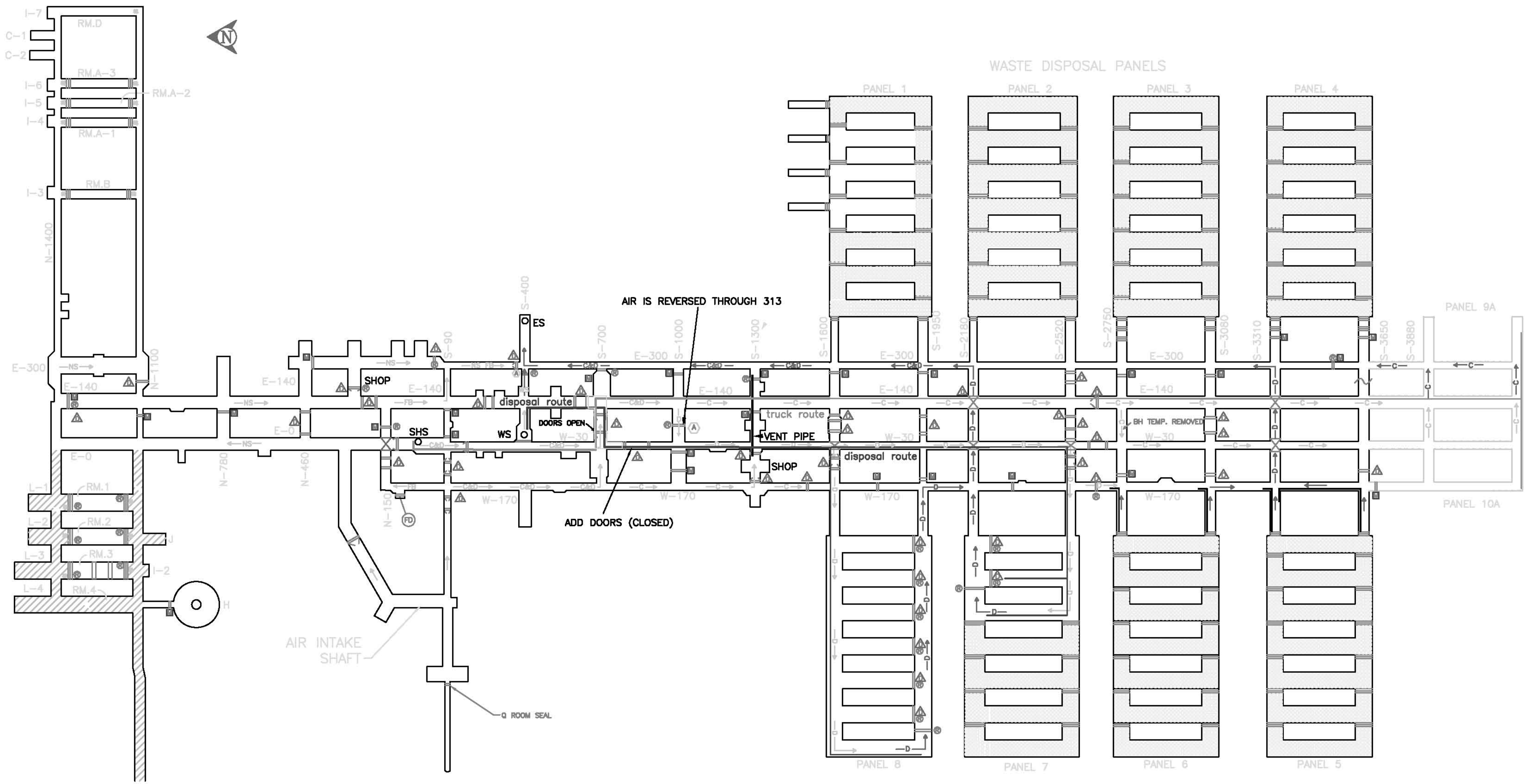

Figure 6: Ventilation Configuration for Option B-2A including Main Transportation Routes.

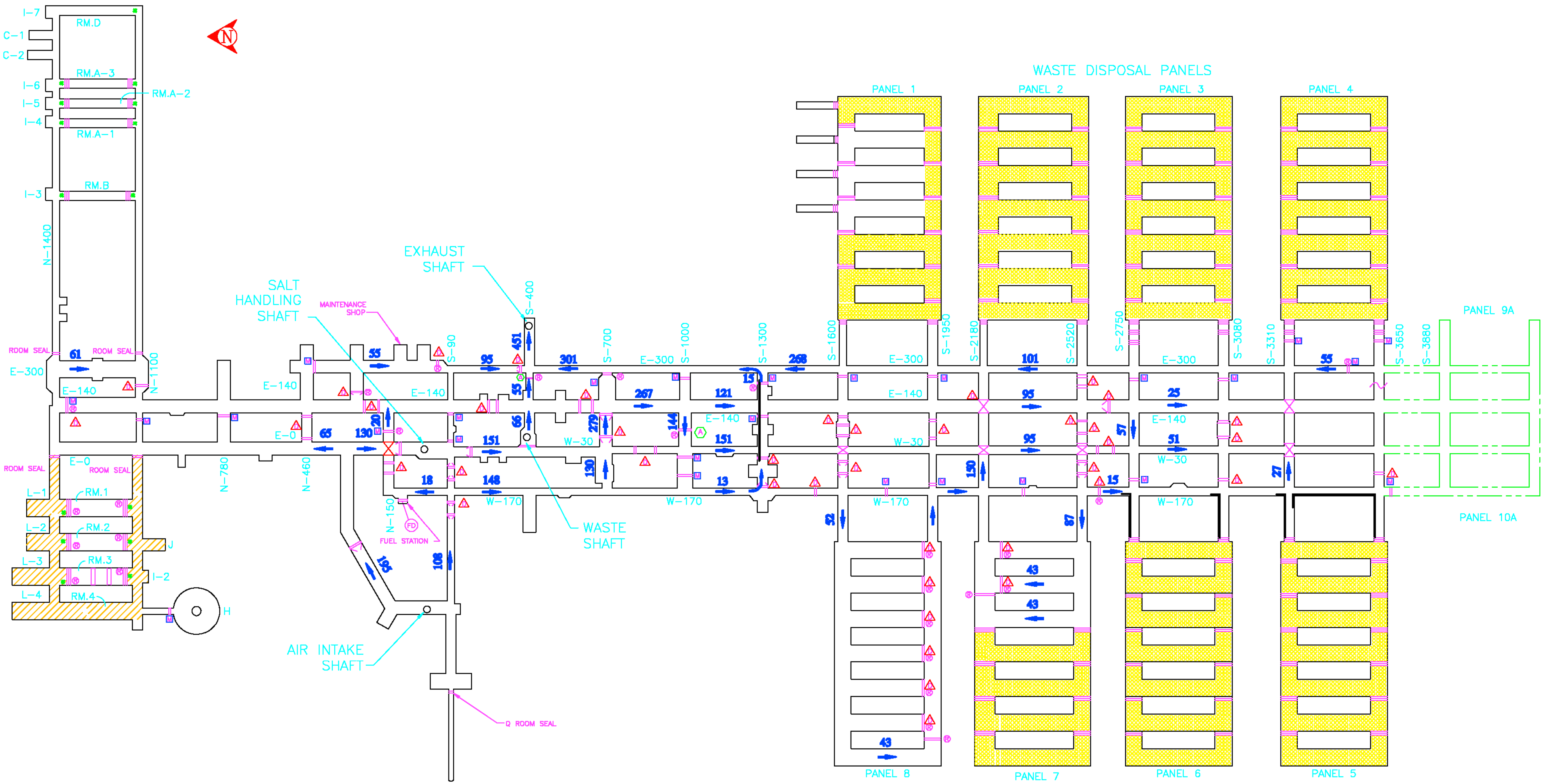

Figure 7: Predicted Airflow Distribution for B-2A Ventilation Configuration (kcfm).

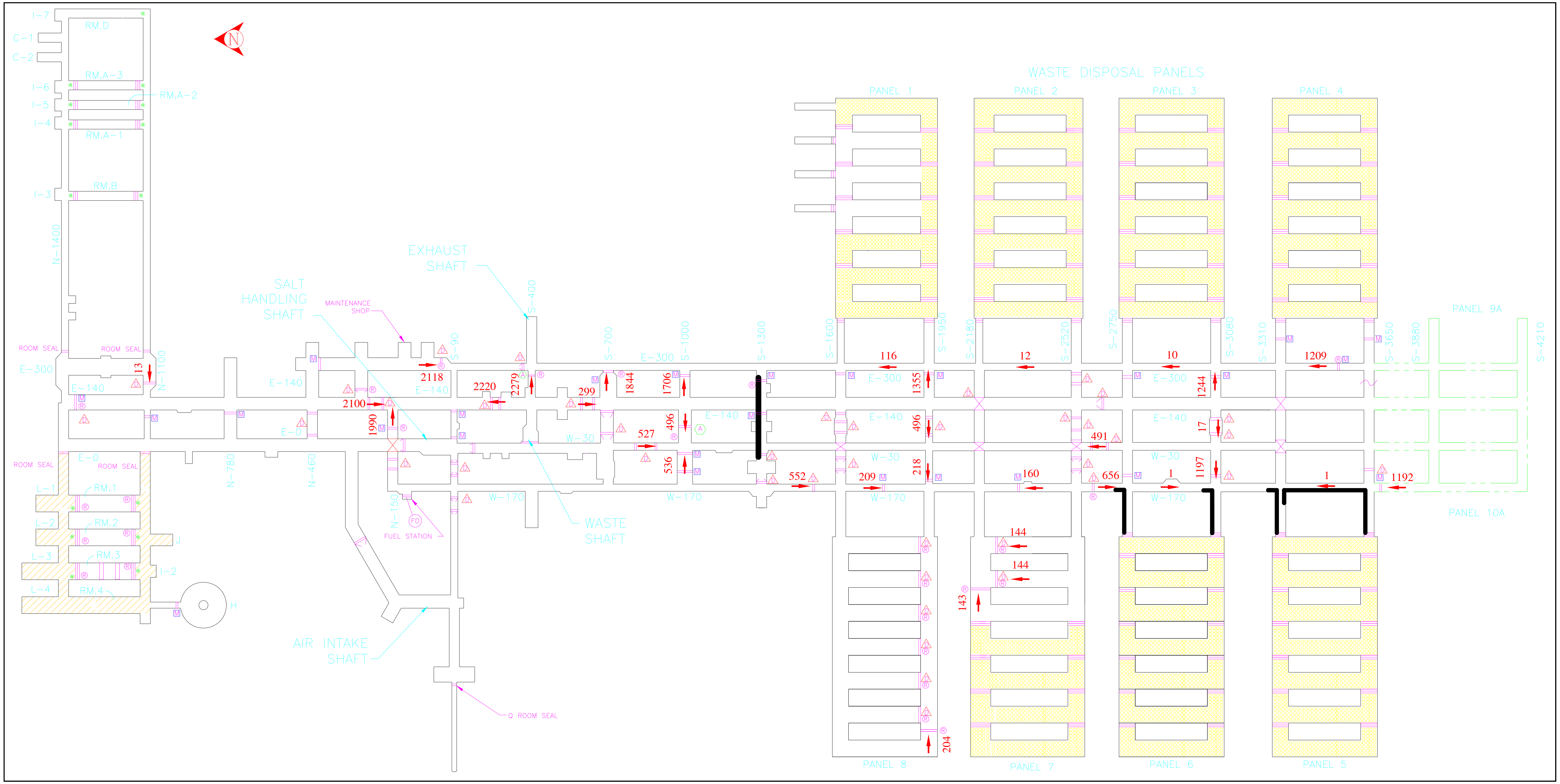

Figure 8: Predicted Pressured Distribution for B-2A Ventilation Configuration (milli inch w.g.).

6. VENTILATION CONFIGURATION: B-2B

Configuration B-2B is identical to B-2A except that E-140 is closed to vehicle traffic and all mining vehicles must route through W-30.

6.1 DESIGN CRITERIA AND ASSUMPTIONS

The design criteria are identical to the B-2A configuration except as follows:

- The mining transportation route is as follows (E140 is blocked by repair work):
    - Empty trucks from SHS south in W-30 to the mining face. Optional truck routes can be through the doors located at S-1950 and S-2520 around the repair work area.
    - Loaded return along the same route to the SHS

6.2 B-2B VENTILATION SCENARIO RESULTS

MVS was successful in achieving all ventilation criteria for this scenario. This basic ventilation design configuration and primary transportation routes are shown Figure 9.

The modeling results for the airflow distribution for scenario B-2B are identical to the scenario B-2A. The only difference is the truck haulage routing from the mining area. Figure 7 illustrates the predicted airflow distribution for this scenario with predicted pressure differentials shown on Figure 8. The results show that all criteria are achieved.

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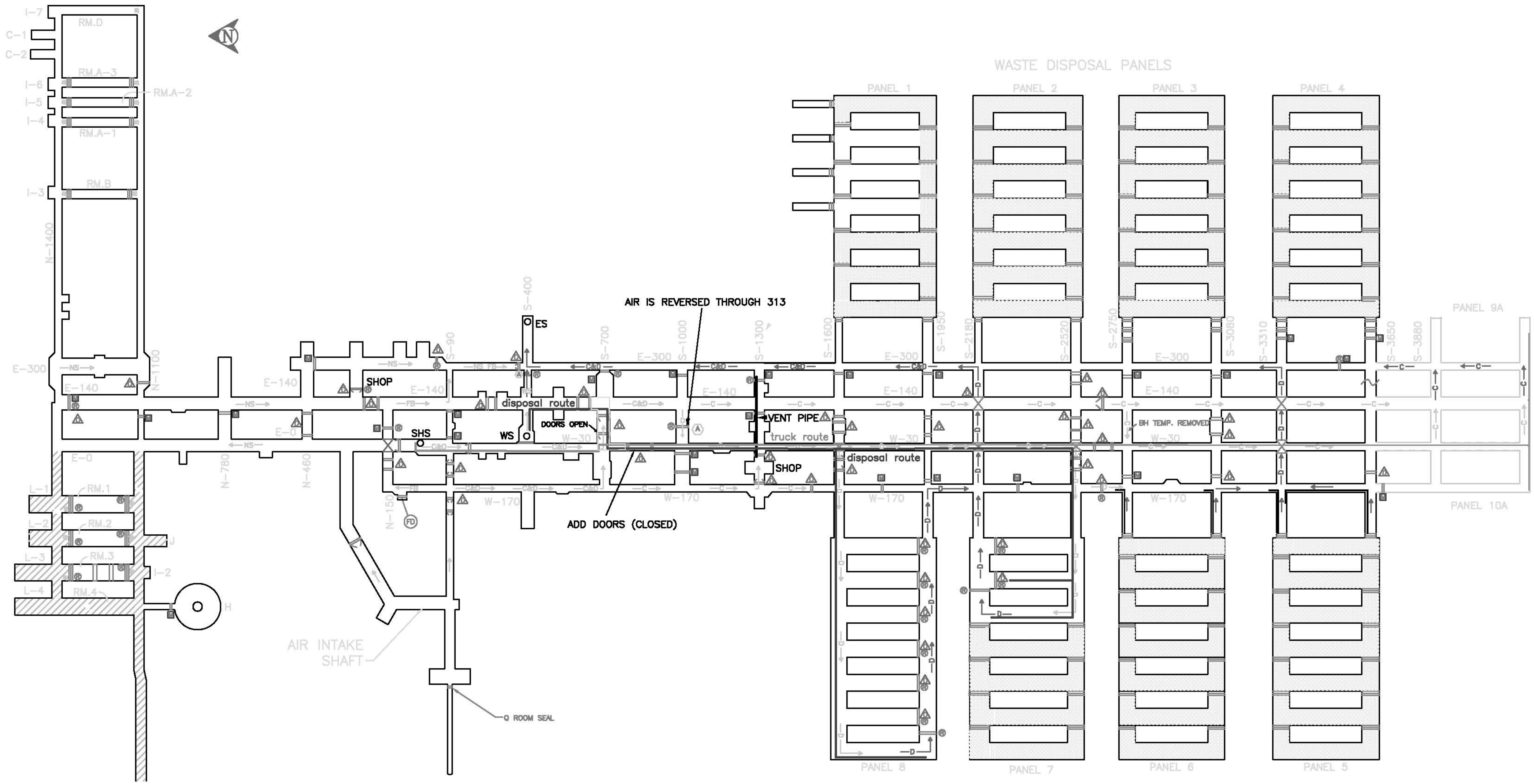

Figure 9: Ventilation Configuration for Option B-2B including Main Transportation Routes.

7. VENTILATION CONFIGURATION: B-3

Configuration B-3 is the base case for mining in Panel 10A while emplacing operations are in Panel 8 and Panel 9A. For this scenario, the transporter will need to cross W-30 at S-1600 in order to reach Panel 8.

This alternative assumed 700C is operating with 700A. Both were set at maximum flow. The natural ventilation pressures were maintained as those calculated during the 2010 Test and Balance.

7.1 DESIGN CRITERIA AND ASSUMPTIONS

The criteria and assumptions used for the B-1 configuration are used for the B-3 configuration with the following exceptions:

- Waste disposal is taking place in Panel 8 and Panel 9A.
- Mining/Construction is taking place in Panel 10A.
- The waste disposal transportation route is as follows (E-140 is not blocked by repair work):
    - Waste Shaft to S-400/E-140
    - South in E-140 to S-1600 or S-4210
    - West in S-1600 to P8 or east in S-4210 to Panel 9A
- The mining transportation route is as follows:
    - Empty trucks from SHS south in W-30 to the mining face (Panel 10A)
    - Loaded return along the same route (W-30) to the SHS.
- Other changes to the system include:
    - Move the construction split regulator to W-170/S-3700.
    - Remove the regulator at W-170/S-2600.
    - The air doors installed at S-2520/E-100 are closed for this scenario.
    - A bulkhead with vehicle doors is located at E-140/S-2600. For this scenario these doors are open (if no other scenarios are considered, then this bulkhead could be removed).
    - Install a diagonal brattice bulkhead at the W-170/S-3880 intersection
    - Install an overcast at W-30/S-3880 with double airlock doors underneath the overcast. For this scenario the double doors are open.
    - Install air door at E-140/S-4000. For this scenario this doors is open.
    - Install air doors at S-3880/E-100 and S-4210/E-100. For this scenario these doors are closed.

- Install air door at S-4210/W-100. For this scenario the doors are closed.
- Install panel room regulators.

Figure 10 illustrates the underground facility infrastructure locations for the B-3 ventilation configuration. This figure also shows the primary vehicle transportation routes.

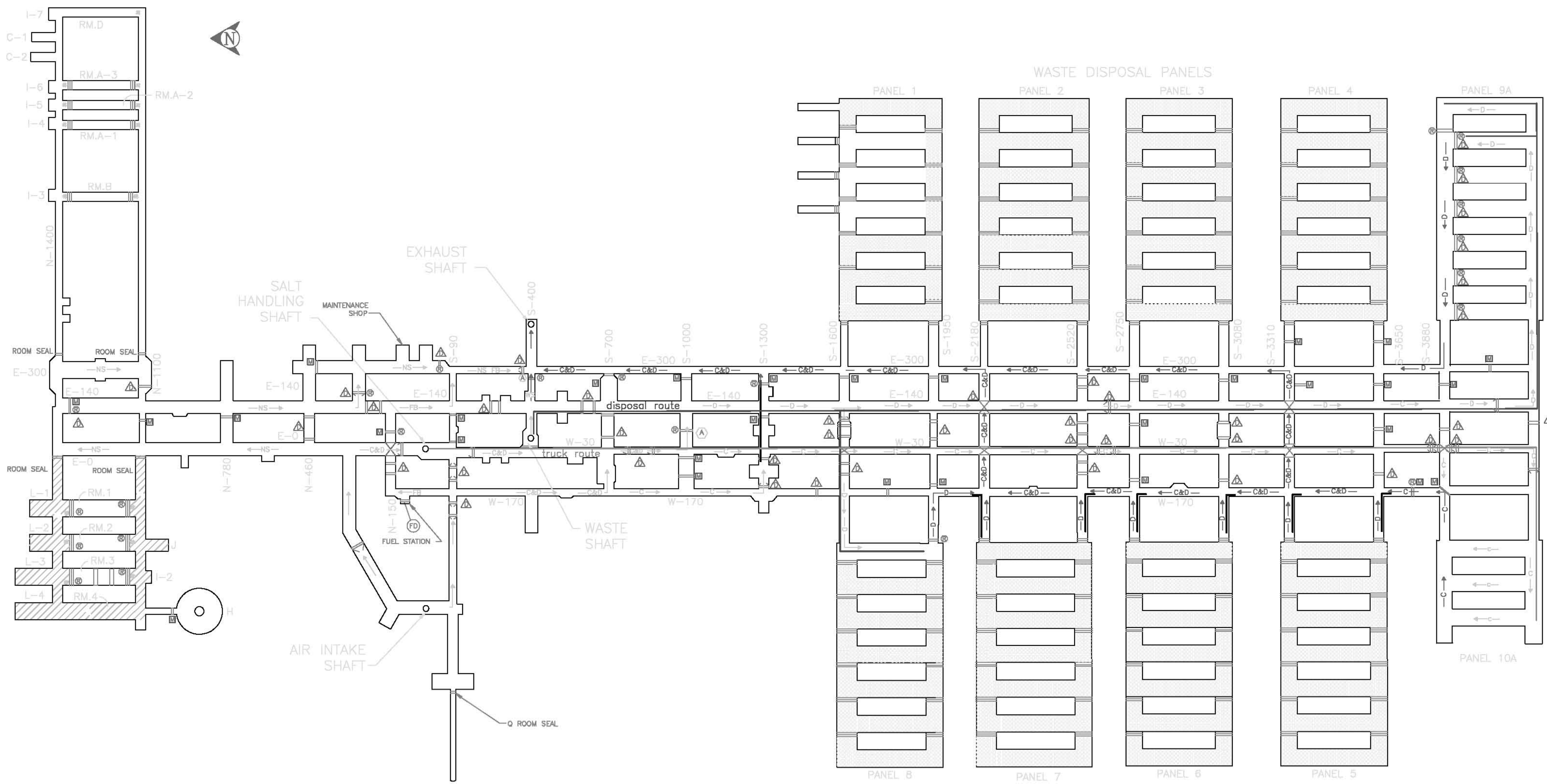

Figure 10: Underground Facility Infrastructure Locations and Primary Disposal and Truck Haulage Routes for the B-3 Ventilation Configuration.

7.2 B-3 Ventilation Scenario Results

The results of the B-3 ventilation analyses showed that all airflow criteria could be achieved. This alternative assumed 700C and 700A are both operating. Both were set at maximum flow. The natural ventilation pressures were maintained as those calculated during the 2010 Test and Balance.

A total volume of 20,000 cfm is passing through BH-302 to provide air for the diesel fuel bay. A total of 80,000 cfm is exhausting the construction circuit. With leakage, the construction flow to this zone is closer to 90,000 cfm. The North Shop is ventilated with 55,000 cfm and the Waste Shaft Station is over 60,000 cfm. All leakage is from the construction circuit to the disposal circuit. Figure 11 shows the predicted airflow distribution for this scenario and Figure 12 illustrates strategic predicted pressured differentials.

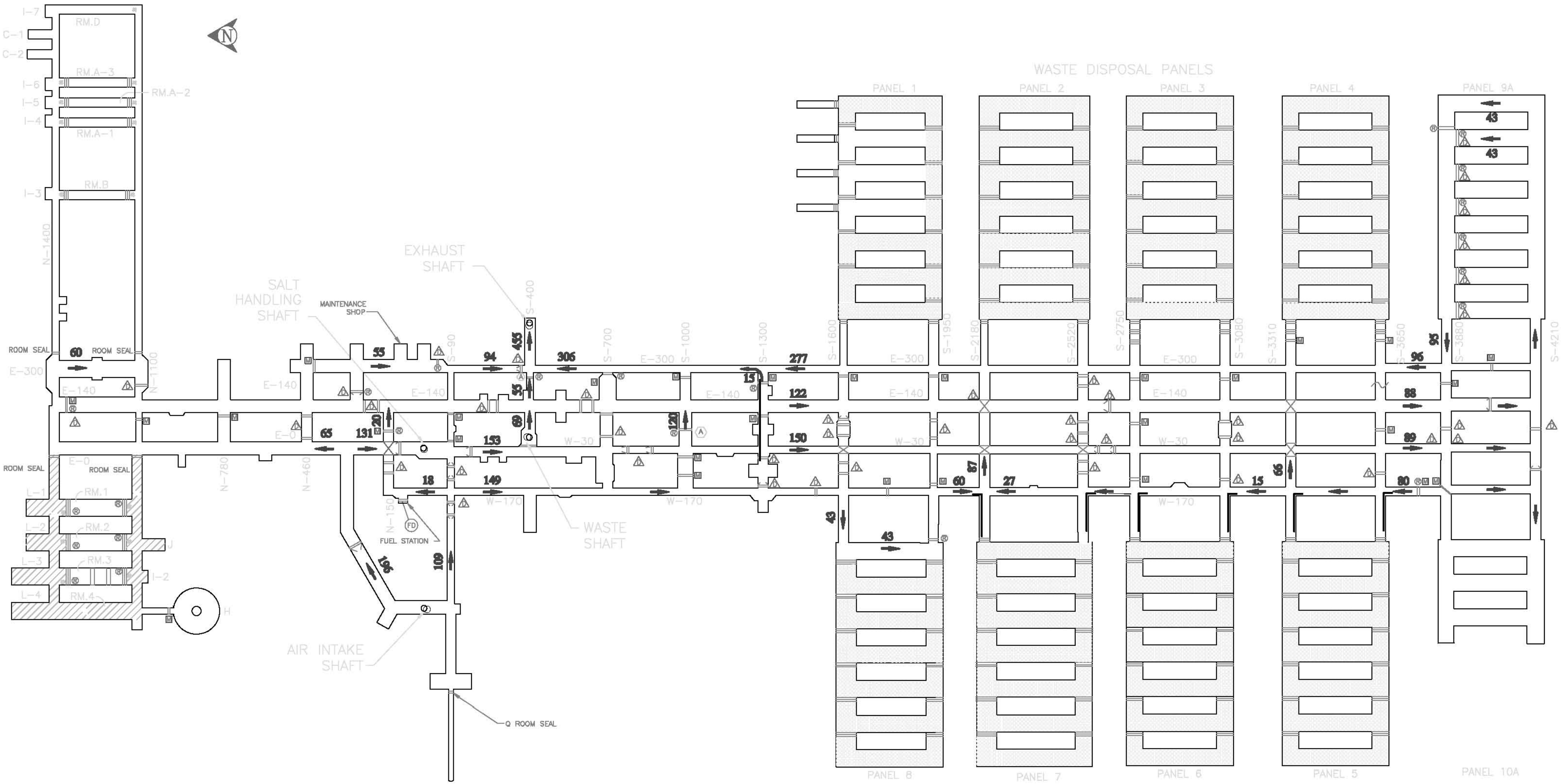

Figure 11: Predicted Airflow Distribution for Configuration B-3 (kcfm).

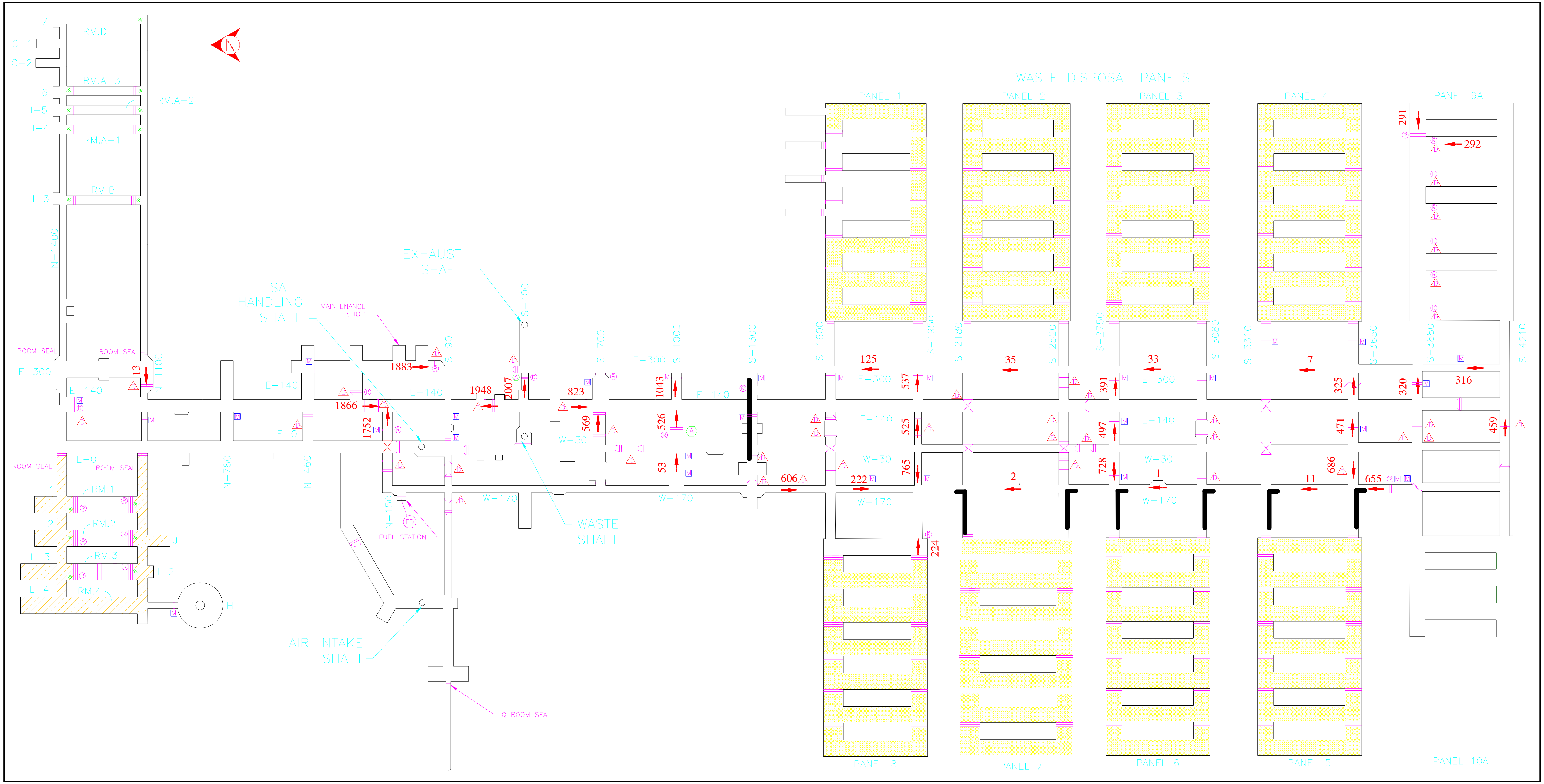

Figure 12: Predicted Pressure Distribution for Configuration B-3 (milli inch w.g.).

8. VENTILATION CONFIGURATION: B-4A

Configuration B-4A is similar to configuration B-3, except the disposal airflow is routed to W-30 instead of E-140. Construction air and vehicles move in E-140 for this scenario (it is not blocked by repair work). For this configuration, the doors in S-700 between W-30 and E-140 are opened and the doors in W-30 between S-700 and S-1000 are closed. The isolation doors in S-1600/E-100 are opened. In addition, the airlock doors under the overcast at W-30/S-3880 are closed as well as the door at S-4210/W-100 and E-140/S-4000. Doors are opened at S-3880/E100 and S-4210/E-100.

8.1 DESIGN CRITERIA AND ASSUMPTIONS

The design criteria described in Section 7.14.1 are identical to the B-3 configuration except as follows:

- The waste disposal transportation route is as follows:
  - Waste Shaft to S-400/E-140
  - South in E-140 to S-700
  - West in S-700 to W-30
  - South in W-30 to S-1600 (for P8 waste emplacement) or to S-4210 (for P9A waste emplacement). At S-3880 the disposal transporter must cross the truck haulage route.
- The mining transportation route is as follows (E-140 is not blocked by repair work):
  - Empty trucks from SHS south in W-30 to S-700
  - East in S-700 to E-140
  - South in E-140 to S-3880
  - West in S-3880 to W-170
  - South in W-170 to S-4210 and Panel 10A
  - Loaded return along the same route listed above to the SHS
- Other infrastructure requirements include:
  - West airlock doors under the overcast at W-30/S-1600 are open
  - Airlock doors under the overcast at W-30/S-3880 are closed
  - Doors are closed at S-4210/W-100 and E-140/S-3900
  - Doors are opened at S-3880/E-100 and S-4210/E-100
  - Install a diagonal brattice bulkhead at the W-170/S-3880 intersection.

Figure 13 illustrates the underground facility infrastructure locations and primary haulage routes for the B-4A ventilation configuration.

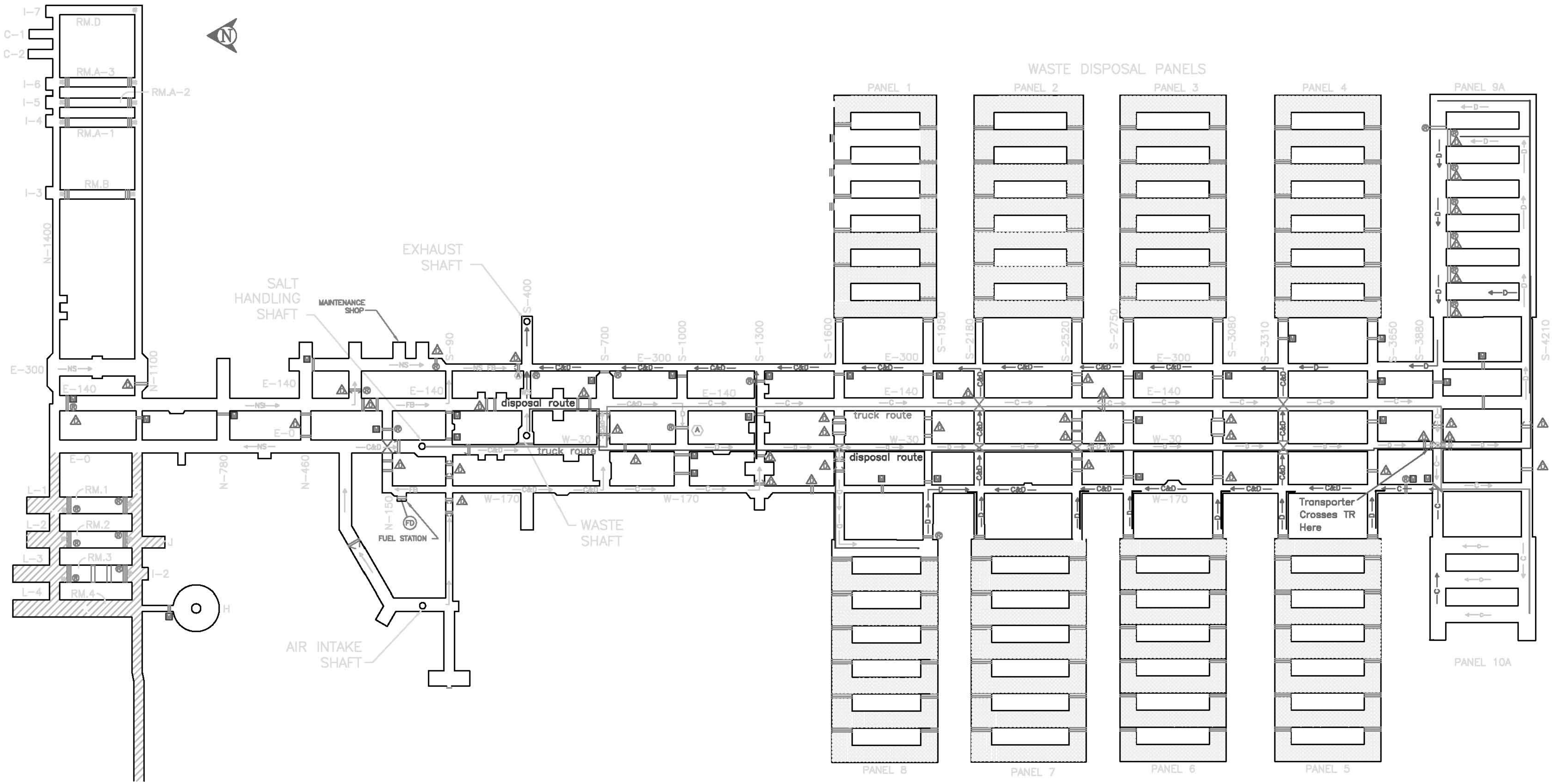

Figure 13: Ventilation Configuration for Option B-4A including Main Transportation Routes.

8.1 B-4A VENTILATION RESULTS

The results of the B-4A ventilation analyses showed that all airflow criteria could be achieved. This alternative assumed 700C is operating with 700A. Both were set at maximum flow. The natural ventilation pressures were maintained as those calculated during the 2010 Test and Balance.

A total volume of 20,000 cfm is passing through BH-302 to provide air for the diesel fuel bay. A total of 85,000 cfm is exhausting the construction circuit. The North Shop is ventilated with 55,000 cfm and the Waste Shaft Station is over 60,000 cfm. All leakage is from the construction circuit to the disposal circuit. Figure 14 shows the predicted airflow distribution for this scenario and Figure 15 illustrates the predicted pressure differentials.

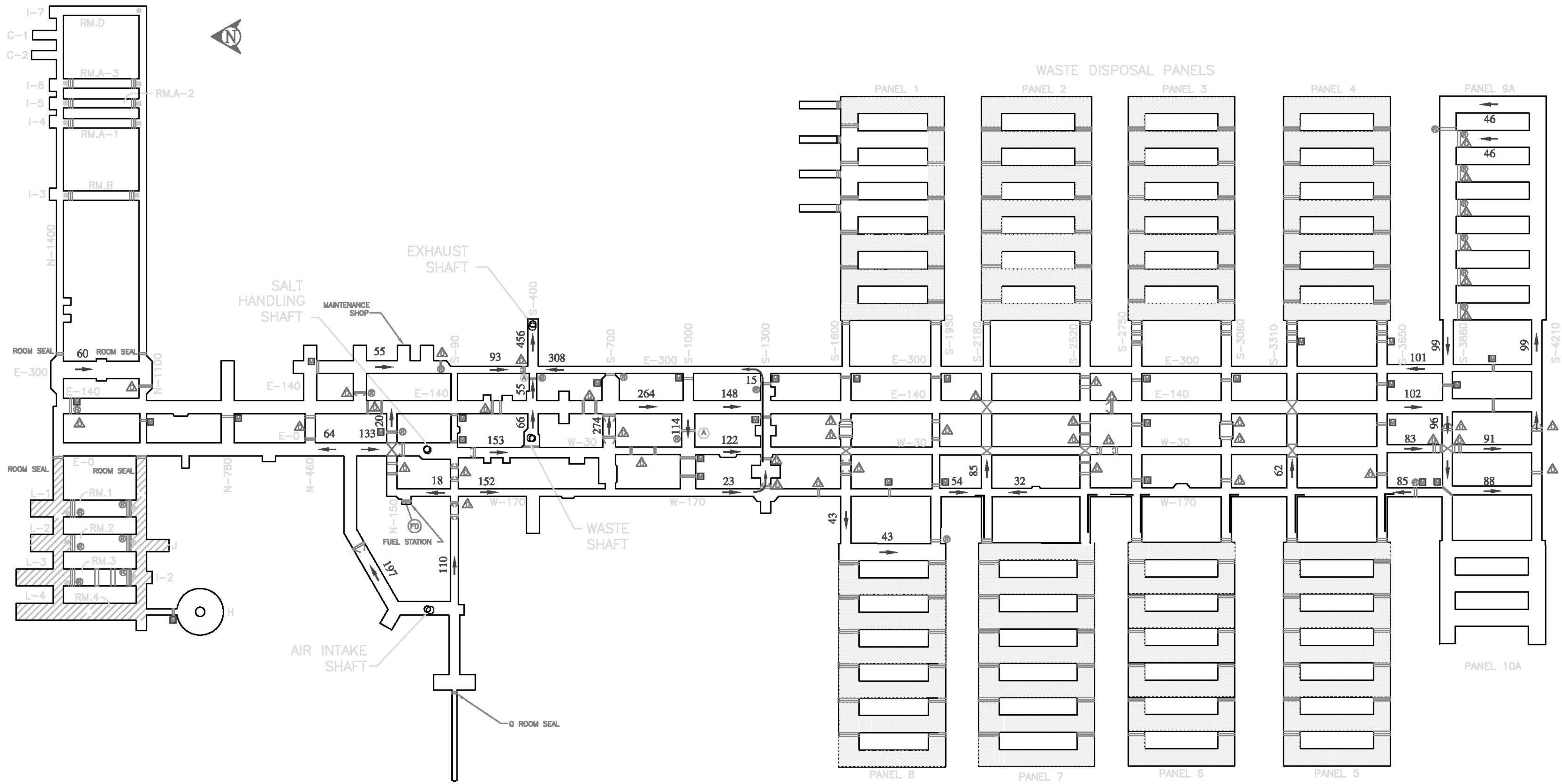

Figure 14: Predicted Airflow Distribution for Configuration for B-4A (kcfm).

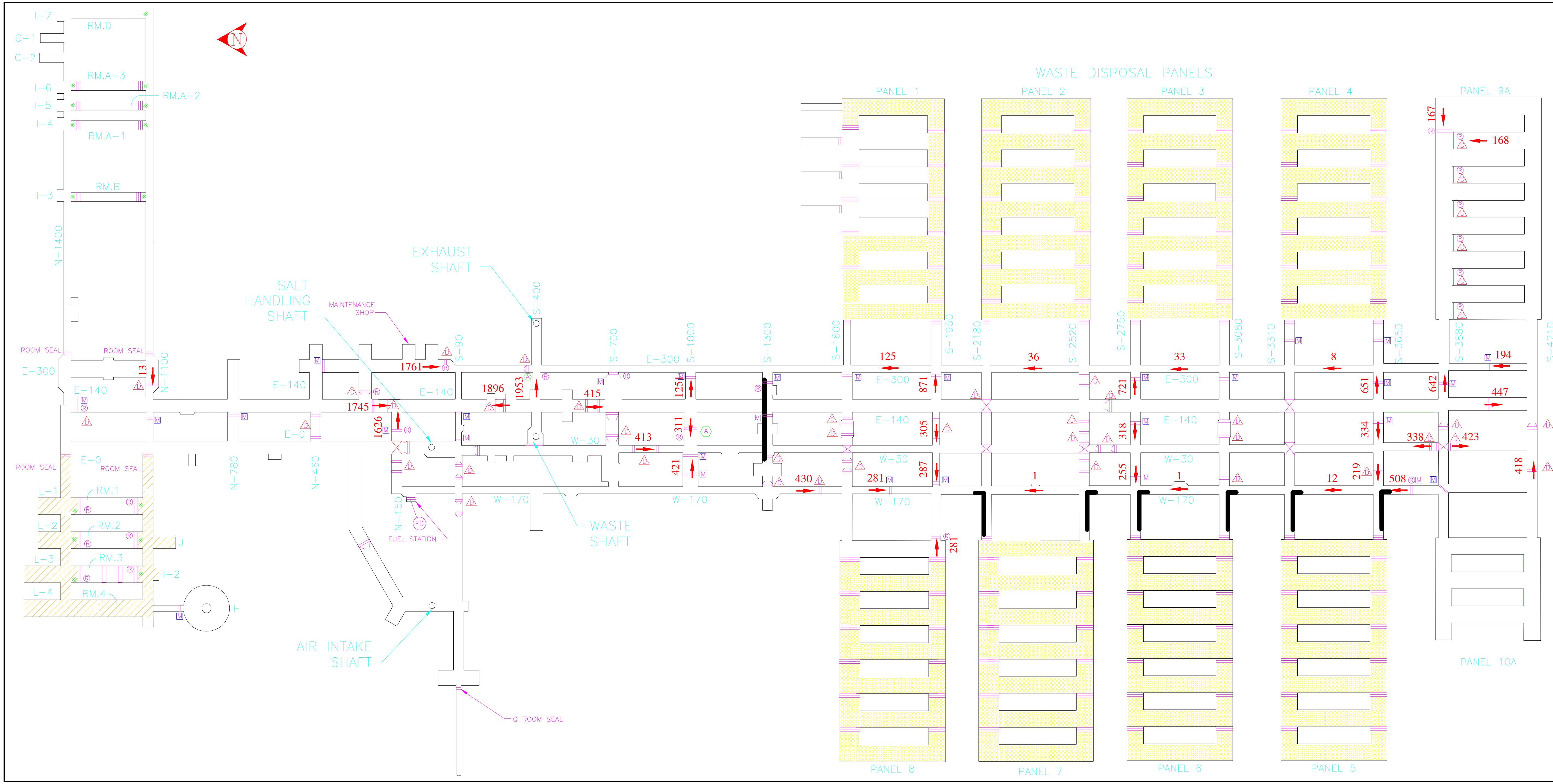

Figure 15: Predicted Pressure Distribution for Configuration for B-4A (milli inch w.g.)

9. VENTILATION CONFIGURATION: B-4B

Configuration B-4B is identical to B-4A except that E-140 is closed to vehicle traffic and all mining vehicles must travel through W-30.

9.1 DESIGN CRITERIA AND ASSUMPTIONS

The design criteria are identical to the B-4A configuration except as follows:

- The mining transportation route is as follows (E-140 is blocked by repair work):
  - Empty trucks from SHS south in W-30 to the mining faces at Panel 10A. The mining vehicles will exit W-30 via the airlock under the overcast at the S-3880 intersection. Optional truck routes can be through the doors located at S-1950, S-2520 and S-3810 around the E-140 repair work area.
  - Loaded return along the same route to the SHS

9.2 B-4B VENTILATION SCENARIO RESULTS

MVS was successful in achieving all ventilation criteria for this scenario. This basic ventilation design configuration and primary transportation routes are shown on Figure 16.

The modeling results for the airflow distribution for scenario B-4B are identical to the scenario B-4A. The only difference is the truck haulage routing from the mining area. Figure 14 illustrates the predicted airflow distribution for this scenario and Figure 15 illustrates the predicted pressure differentials. The results show that all criteria are achieved.

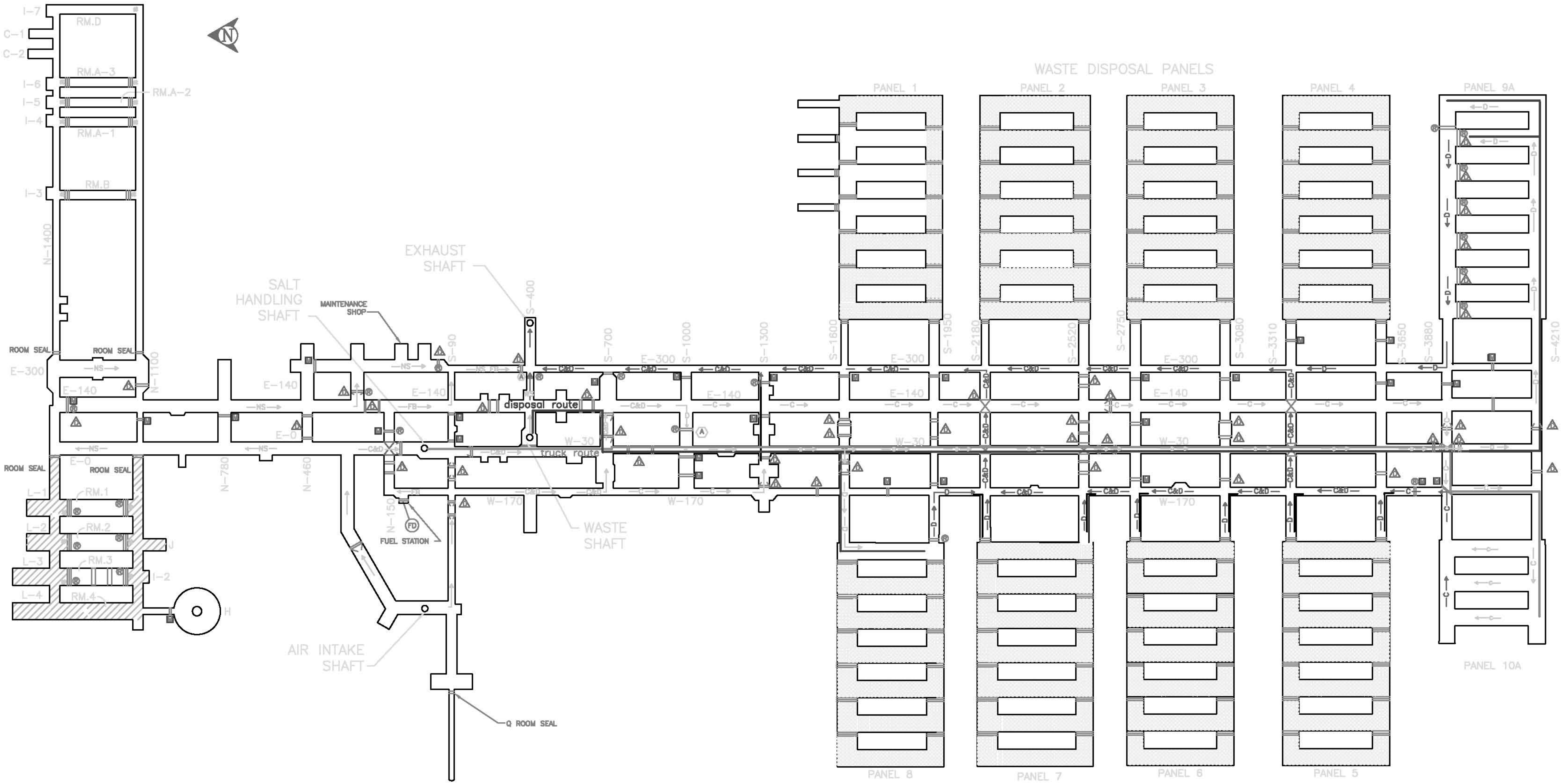

Figure 16: Ventilation Configuration for Option B-4B including Main Transportation Routes.

10.SUMMARY OF RESULTS

In summary, all scenarios investigated were modeled successfully. This means that all airflow criteria were successfully achieved. The predicted airflows for each configuration as compared with the design value on Table 5, with Table 6 showing the primary fan operating points for each model.

Table 5: Airflow Summary for the Ventilation Configurations Studied

		Scenario B-1	Scenario B-2A Scenario B-2B	Scenario B-3	Scenario B-4A Scenario B-4B
Location	Design Flow (kcfm)	Model Predicted Flow (kcfm)	Model Predicted Flow (kcfm)	Model Predicted Flow (kcfm)	Model Predicted Flow (kcfm)
North Experimental Area	60	61	61	60	60
North Maintenance Shop	50	55	55	55	55
Waste Shaft Station	50	67	66	69	66
Waste Shaft Exhaust (BH 308)	none	55	55	55	55
Fuel Bay (BH 302)	20	20	20	20	20
S-1300 Shop	15	15	15	15	15
Panel Airflow					
Panel 7 Room 2	43	43	43	n/a	n/a
Panel 7 Room 3	43	43	43	n/a	n/a
Panel 8 Room 7	43	43	43	n/a	n/a
Panel 9A Room 7	43	n/a	n/a	43	46
Panel 9A Room 6	43	n/a	n/a	43	46
Panel 8 Room 1	43	n/a	n/a	43	43
Mining Consplit Regulator	50	55	55	80	85
Panel 5 and 6 Regulator (W-170)	15	15	15	n/a	n/a
Intake Disposal Circuit (BH 313)	none	139	144	120	114
Air Intake Shaft S-90	none	106	108	109	110
Air Intake Shaft North	none	193	195	196	197
Salt Handling Shaft	none	89	90	90	90
Exhaust at S-400	none	449	451	455	456

Note: n/a – not available (not in models). Red indicates flow from E-140 to W-30 through BH 313.

Table 6: Summary of Primary Fan Operating Duties for the Ventilation Configurations Studied

	Scenario B-1		Scenario B-2A and Scenario B-2B		Scenario B-3		Scenario B-4A and Scenario B-4B	
Location	Predicted Flow (kcfm)	Predicted Fan Pressure (in. w.g.)	Predicted Flow (kcfm)	Predicted Fan Pressure (in. w.g.)	Predicted Flow (kcfm)	Predicted Fan Pressure (in. w.g.)	Predicted Flow (kcfm)	Predicted Fan Pressure (in. w.g.)
700 A Fan	255	7.7	255	7.7	254	7.8	258	7.5
700 C Fan	230	7.7	230	7.7	229	7.7	233	7.4

From the above tables it is noted that all design criteria are met. In addition, the primary operating fans do not differ significantly for the various ventilation configurations. The results show each scenario to be viable. The decision as to which option works best is not so much a ventilation question, as an operational question. If work is ongoing in E-140 for ground support, then moving the disposal equipment to W-30 is a viable alternative. Conversely, maintaining E-140 for disposal is also practical.

To make the system operate successfully, an auxiliary ventilation duct/fan system was assumed for the S-1300 Shop and into each drift connecting to room 1 of Panels 5, 6 and 7. The later auxiliary systems were for controlling potential VOC releases from these panels.

In each configuration the waste handling transporter will need to either cross a construction air split, or will need to be upstream in a common split of air to both construction and disposal operations. MVS understands that WTS has a permit change to allow this to occur. This permit needs to ensure that this “crossing over” of the disposal transporter in construction air (or mixed with construction equipment) is allowed to the S-3880 intersection. The only real viable way for the transporter to effectively operate is to cross the construction air split.

Of concern to MVS engineers in the design of this ventilation system was the ability to successfully shift to filtration (STF) in all configurations analyzed. MVS conducted several STF models for the scenario B-4B configuration and noted that the basic requirements of a STF are met. These requirements are a) maintain the Waste Shaft tower at a negative pressure and b) maintain the differential pressure from the disposal circuit to the construction circuit. These requirements can be met by:

1. Closing BH 336 (E-300/S-350).
2. Closing BH 313 (regardless of airflow direction through the regulator).
3. Closing the Consplit regulator.

4. If open, depending on the configuration, close the doors in S-700/E-100 (although not necessarily required, closing these doors applies a greater negative pressure on the Waste Shaft tower).

In addition, after a STF, an airflow route can be established, if needed, to ventilate a single panel in filtration mode. This would allow WTS radiological staff to re-enter an area for any required work. If W-30 is used as the disposal circuit, the configuration is as follows:

1. Close the doors in S-700/E-100
2. Ensure doors at W-30/S-800 are closed
3. Open the doors south of the Waste Shaft in E-140/S-650
4. Open BH 313
5. Close BH 308
6. Control the airflow in the panel of interest by closing the room regulators in the panels where ventilation is not required.

If E-140 is used as the disposal route, the following actions are required:

1. Open the doors south of the Waste Shaft in E-140/S650
2. Close BH 308
3. Control the airflow in the panel of interest by closing the room regulators in those panels with no need for ventilation.

From the modeling, MVS concludes that each configuration analyzed can be effectively ventilated and have a successful shift to filtration. However, there are several features of the WIPP ventilation system that will need consideration. First, at present a differential pressure device is located at the S-1300 bulkhead separating W-30 from E-140. This device is used to alarm should the differential pressure drops below a set point. Obviously if configurations B-2A, B-2B, B-4A or B-4B are implemented, the pressure drop across this sensor will be reversed. A logic system needs to be installed to allow for the differential pressure to be monitored depending on the configuration.

In addition, because the differential pressure will be reversed (over the present configuration), all doors, both drive through and mandoors) will require latches and be monitored, since the doors will be opening with the pressure in some configurations. No self-closing doors should be used between W-30 and E-140. In addition, some configurations will have doors opening with the pressure which will make for a less tight seal.

The ventilation to the S-1300 Shop (between W-170 and W-30) was simplified in every model such that access to the shop was always from the W-170 side. This allowed for the duct system to be installed to the W-30 side of the shop with air sweeping across the shop from W-170. Doors can still be opened to W-30 for temporary movement of equipment, but should be closed on a regular basis.

The ventilation system as designed has the advantage of being very flexible between the configurations. By opening and closing strategic doors throughout the facility, the system can be readily adjusted to move the disposal route from E-140 to W-30 and vice versa. The time required to open and close doors could be a matter of an hour or so. This is advantageous if ground control is limited or completed in the E-140 airway.

In order to ensure the system is operating successfully, WTS should consider adding additional airflow and differential pressure devices in the underground. Additional units to monitor airflow should be considered at:

1. S-90 from the AIS shaft
2. W-170 for the flow to Panels 5, 6 and 7 (at the regulator providing airflow to the W-170 drift when panel 9A is being constructed and at the Consplit regulator in later scenarios sending air to W-170 from panel 10A).

Differential pressure should considered at:

1. The air door located at E-140/S-2600
2. Airlock at W-30/S-800

Door open/closed position devices are required on all doors in the facility. A logic diagram needs to be developed to show those doors that are required to be open or closed for the various configurations. In addition, a control system needs to be implemented that ensures the facility is configured correctly for the scenarios. The sequence of converting the scenarios is also required since it is possible to close doors and block the primary airflow routes from the intake shafts to the exhaust shaft (e.g. closing the doors in W-30/S-800 and S-700/E-100 at the same time). The procedure to convert the scenarios may consider reducing the primary fan system to Alternate Mode (a single 700 fan in operation) to minimize the risk during a changeover of inadvertently closing doors out of sequence. Finally, one of the doors in S-90 at W-200 should be designated a “fire door” for the AIS shaft. This is required to be in compliance with current WIPP standards.

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