BEST PRACTICES

Bleeder System Design

Section 75.334(b)(1)

- During pillar recovery a bleeder system shall be used to

  - Control the air passing through the area

  - Continuously dilute and move methane-air mixtures and other gasses, dusts, and fumes from the worked-out area away from active workings

  - And into a return air course or to the surface of the mine

Design Considerations

- Bleeder System Design Considerations Include:
  - -Ground control issues
  - -Life expectancy of the system
  - -Airflow distribution
  - -Methane drainage
  - -Method of evaluation
  - -Consideration for future sealing
- MSHA's Bleeder and Gob Ventilation Systems course in 1996 discussed these

Today's Bleeder Systems

- Today's Longwall Bleeder Systems Are Larger
  - Longer Panels
  - Wider Faces
  - Increasing Number of Panels
- Ventilation Requirements Have Changed
  - Higher Pressure Fans
  - Methane Degasification (horizontal and vertical)
  - Increased Rate of Coal Production and Growth of the Pillared Area

Changing Bleeder Systems

- Ventilation Capacities Have Not Always Kept Pace
  - Fewer Bleeder Entries
  - Fewer Gate Entries
  - Support of Airflow Paths
- Resulting in…
  - Changes in Bleeder System Design
  - Travel and Access Issues
  - Evaluation Issues
  - Effectiveness Issues

Performance

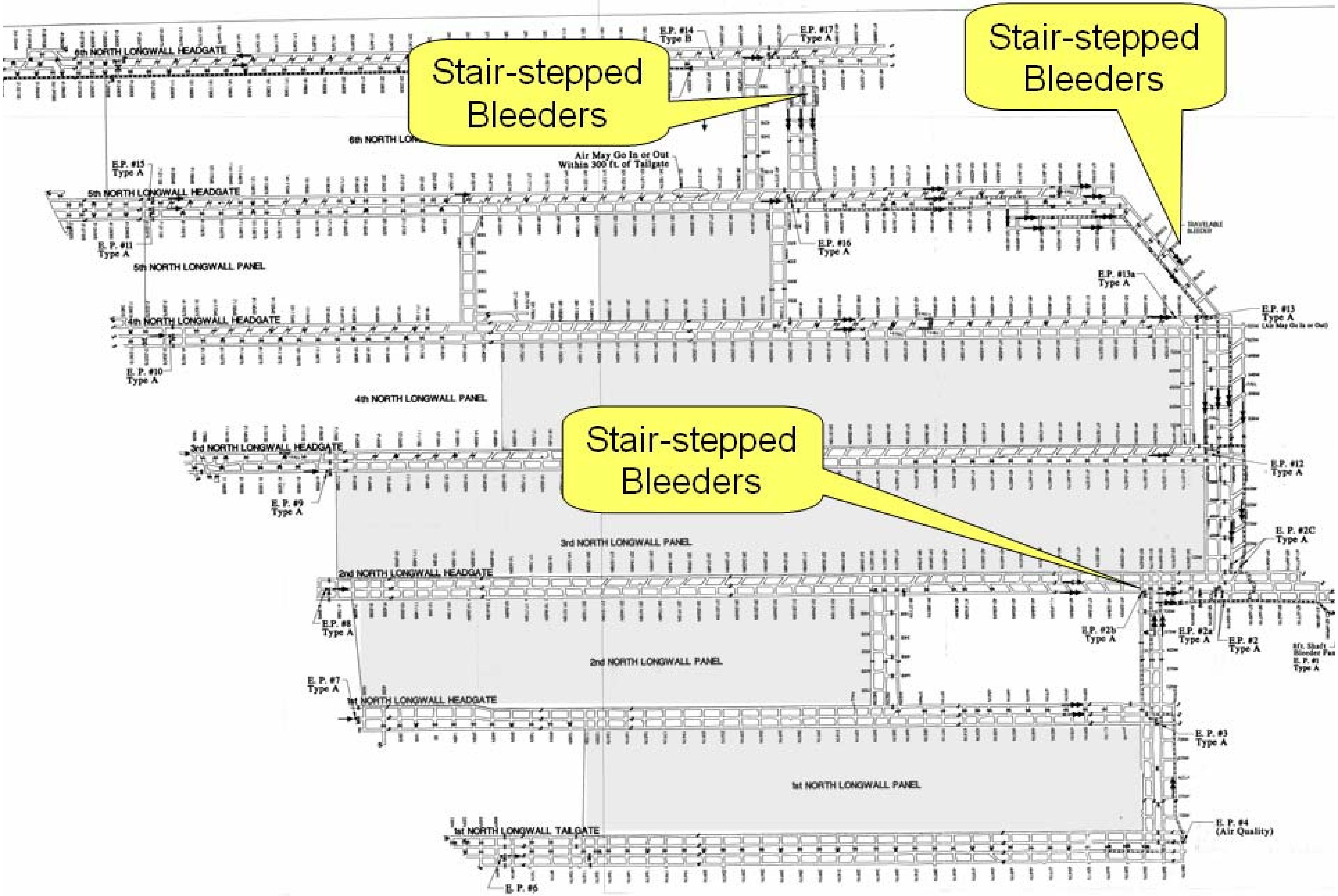
Bleeder system performance depends on:

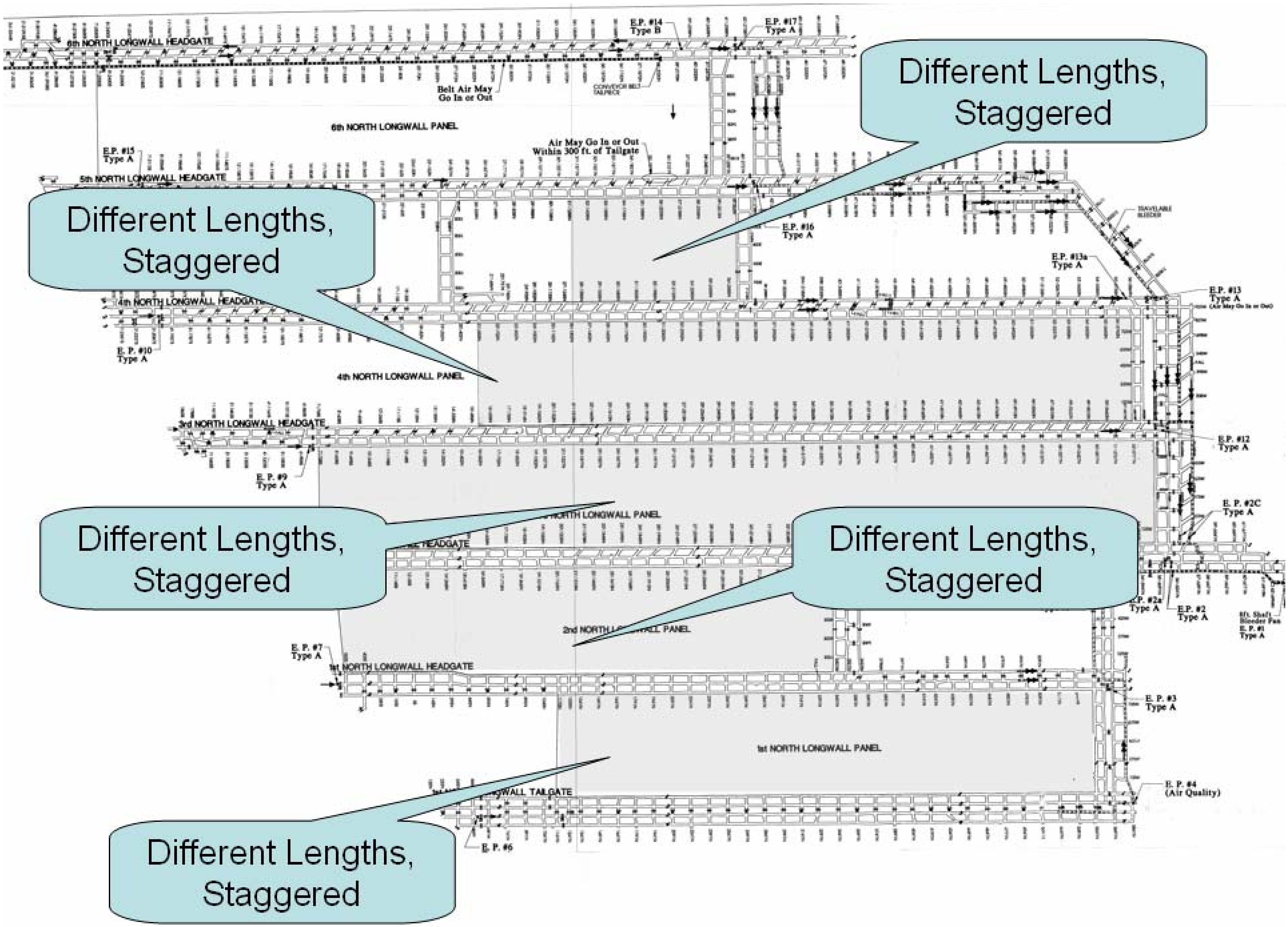
- the ability to provide the necessary airflow through the primary internal flowpaths

- and the ability to effectively distribute the airflow.

Factors Affecting Bleeder System Performance

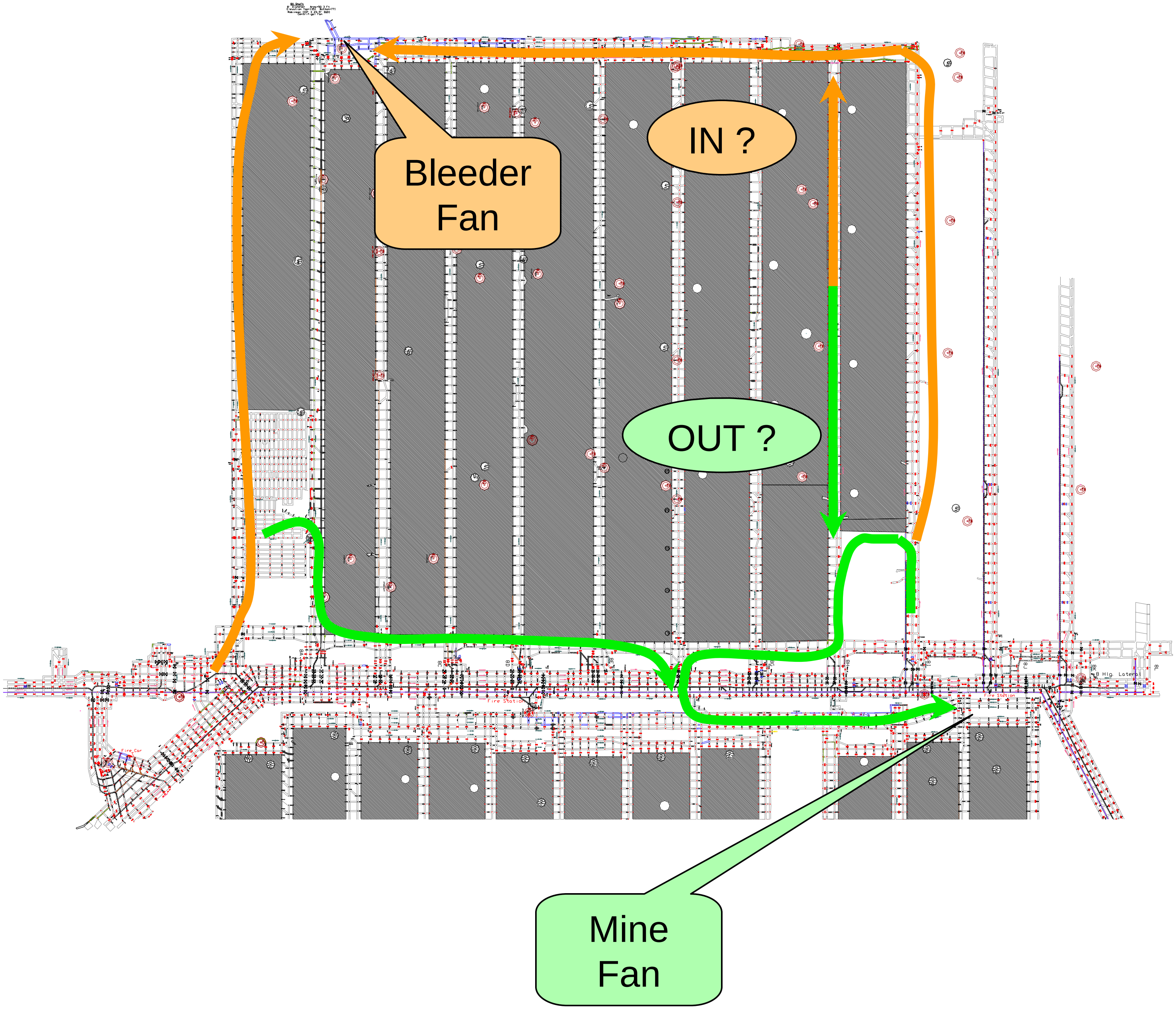
- Complex Design or Arrangement
  - Unusual Configurations
    - Intermixed short and long panels, staggers, stair-steps, simultaneous operation of multiple panels on same system

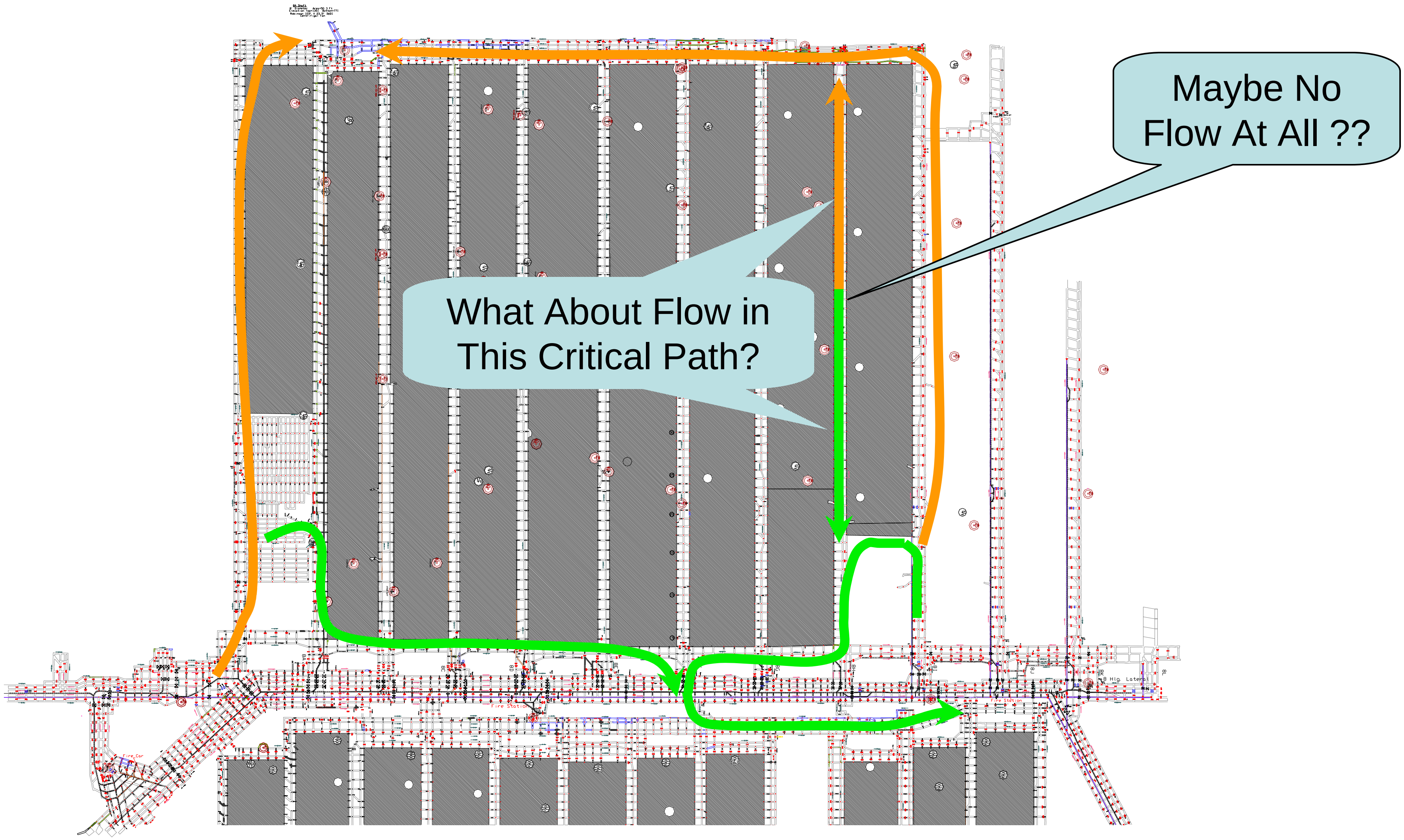

Stair-stepped Bleeders
Stair-stepped Bleeders
Stair-stepped Bleeders
6th NORTH LONGWALL HEADGATE
5th NORTH LONGWALL HEADGATE
5th NORTH LONGWALL PANEL
4th NORTH LONGWALL HEADGATE
4th NORTH LONGWALL PANEL
3rd NORTH LONGWALL HEADGATE
3rd NORTH LONGWALL PANEL
2nd NORTH LONGWALL HEADGATE
2nd NORTH LONGWALL PANEL
1st NORTH LONGWALL HEADGATE
1st NORTH LONGWALL PANEL
1st NORTH LONGWALL TAILGATE
Air May Go In or Out Within 300 ft. of Tailgate
E.P. #14 Type B
E.P. #17 Type A
E.P. #15 Type A
E. P. #11 Type A
E.P. #16 Type A
E.P. #13a Type A
E.P. #13 Type A
E. P. #10 Type A
E.P. #12 Type A
E. P. #9 Type A
E. P. #2C Type A
E.P. #8 Type A
E.P. #2b Type A
E.P. #2a Type A
E.P. #2 Type A
E. P. #7 Type A
E. P. #3 Type A
E. P. #4 (Air Quality)
E. P. #6



Different Lengths, Staggered
Different Lengths, Staggered
Different Lengths, Staggered
Different Lengths, Staggered
Different Lengths, Staggered
6th NORTH LONGWALL HEADGATE
6th NORTH LONGWALL PANEL
5th NORTH LONGWALL HEADGATE
4th NORTH LONGWALL HEADGATE
4th NORTH LONGWALL PANEL
3rd NORTH LONGWALL HEADGATE
2nd NORTH LONGWALL PANEL
1st NORTH LONGWALL HEADGATE
1st NORTH LONGWALL PANEL
Belt Air May Go In or Out
Air May Go In or Out Within 300 ft. of Tailgate
E.P. #14 Type B
E.P. #17 Type A
E.P. #15 Type A
E.P. #16 Type A
E.P. #13a Type A
E.P. #13 Type A
E. P. #10 Type A
E. P. #9 Type A
E.P. #12 Type A
E. P. #2C Type A
E.P. #2 Type A
E. P. #1 Type A
E. P. #7 Type A
E. P. #3 Type A
E. P. #4 (Air Quality)
E. P. #6

- Complex Design or Arrangement
  - Unusual Configurations
    - Intermixed short and long panels, staggers, stair-steps, simultaneous operation of multiple panels on same system
  - Two or More Fans Ventilating the Area
    - Air is pulled in opposing directions, often resulting in "dead areas" with no airflow and accumulated gases
    - Which way did it go?

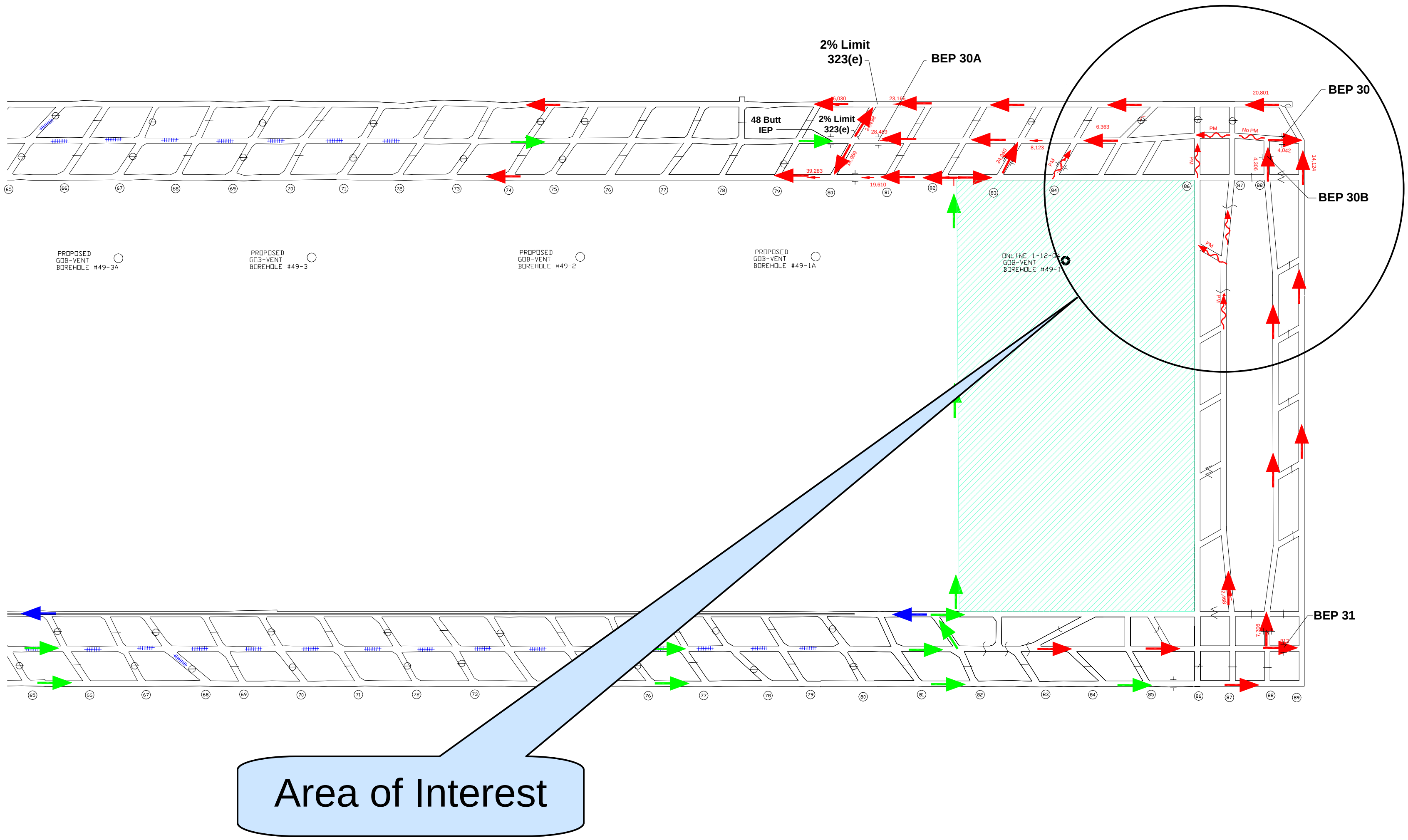

Bleeder Fan
IN ?
OUT ?
Mine Fan


Maybe No Flow At All ??
What About Flow in This Critical Path?

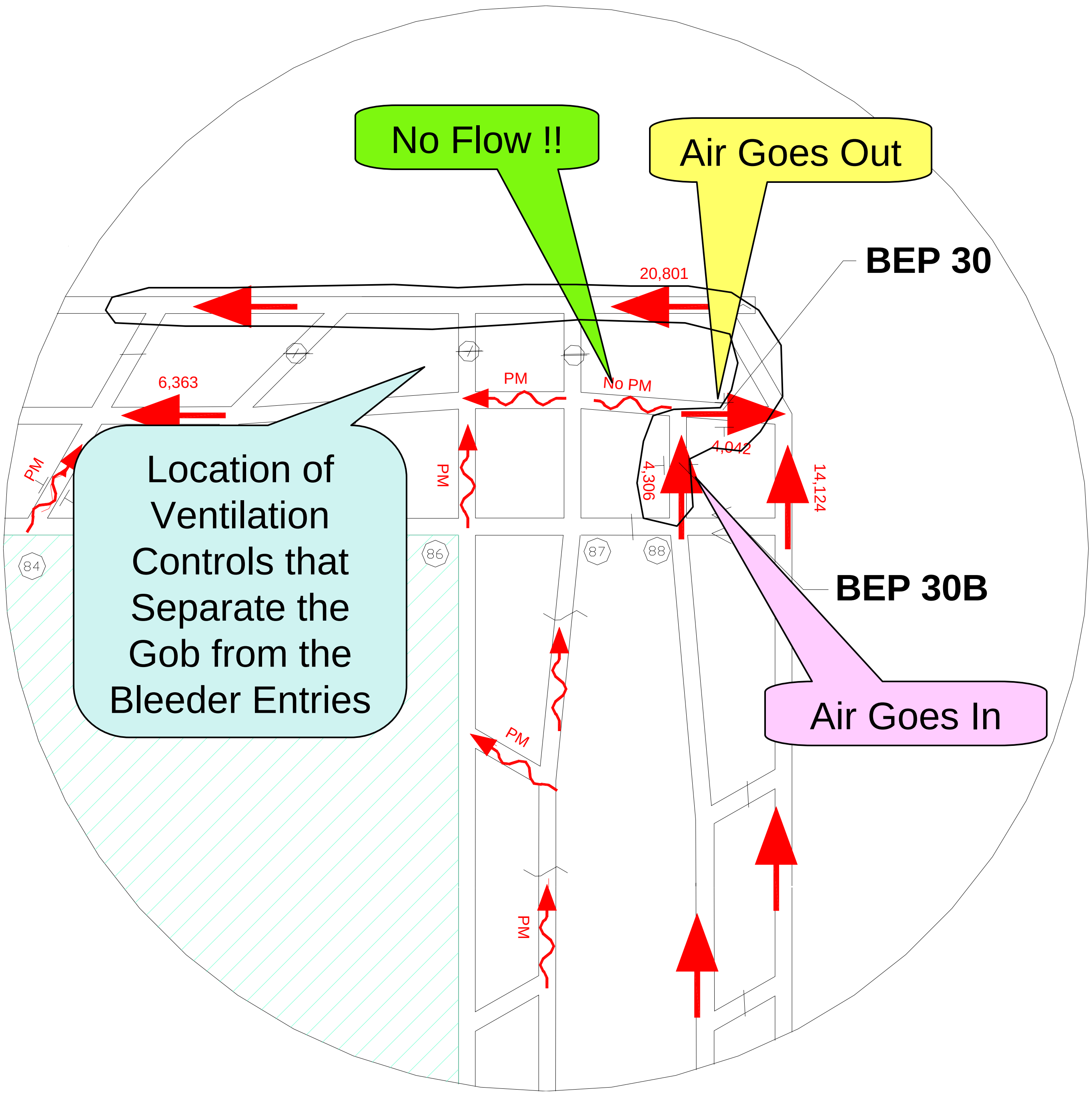
Factors affecting Bleeder System Performance

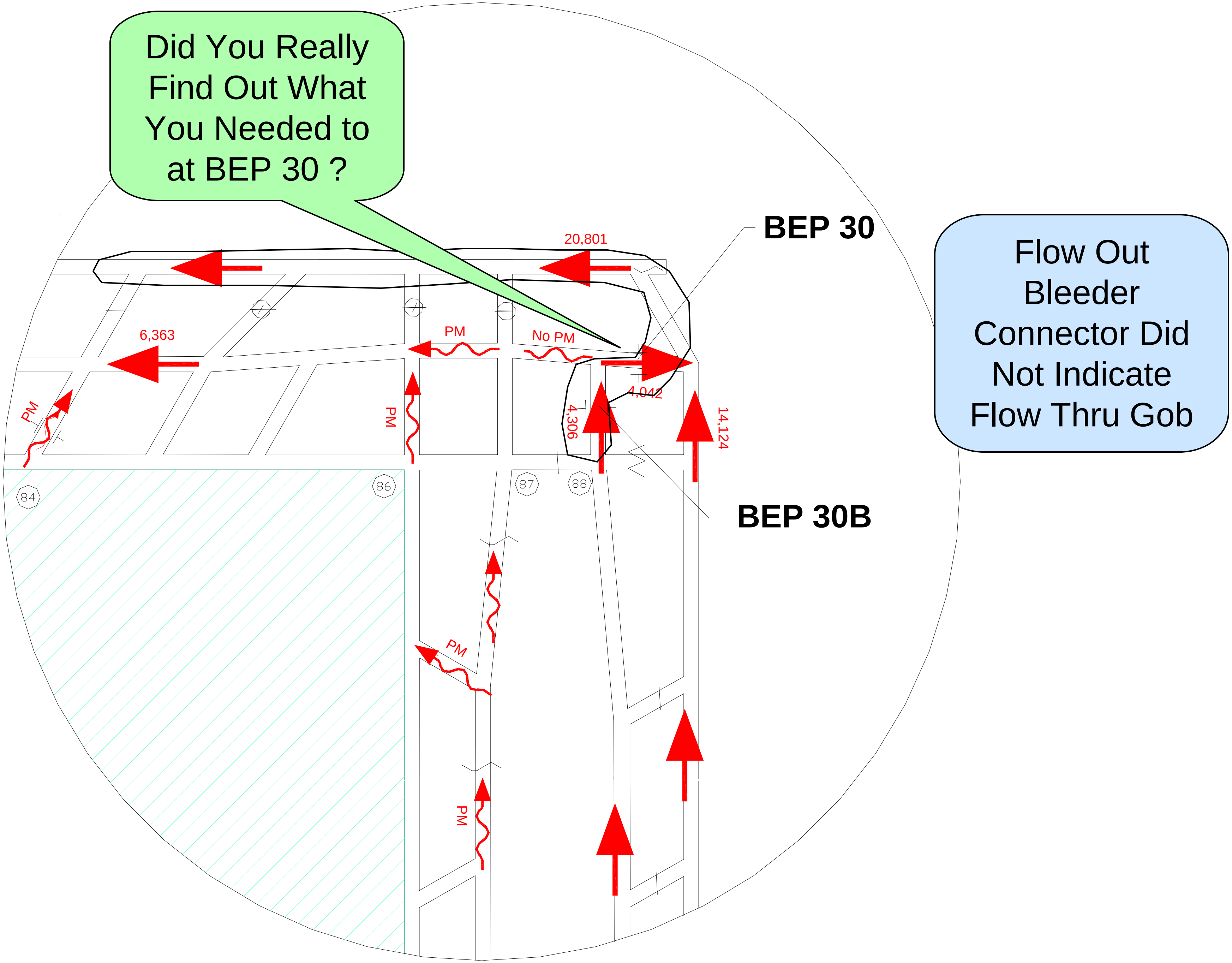
- Complex Design or Arrangement
  - Unusual Configurations
    - Intermixed short and long panels, staggers, stair-steps, simultaneous operation of multiple panels on same system
  - Two or More Fans Ventilating the Area
    - Air is pulled in opposing directions, often resulting in "dead areas" with no airflow and accumulated gases
    - Which way did it go?
  - Inlets Located Near Outlets
    - Why? Lack of adequate airflow through the worked-out area?

- Complex Design or Arrangement
  - Unusual Configurations
    - Intermixed short and long panels, staggers, stair-steps, simultaneous operation of multiple panels on same system
  - Two or More Fans Ventilating the Area
    - Air is pulled in opposing directions, often resulting in "dead areas" with no airflow and accumulated gases
    - Which way did it go?
  - Inlets Located Near Outlets
    - Why? Lack of adequate airflow through the worked-out area?



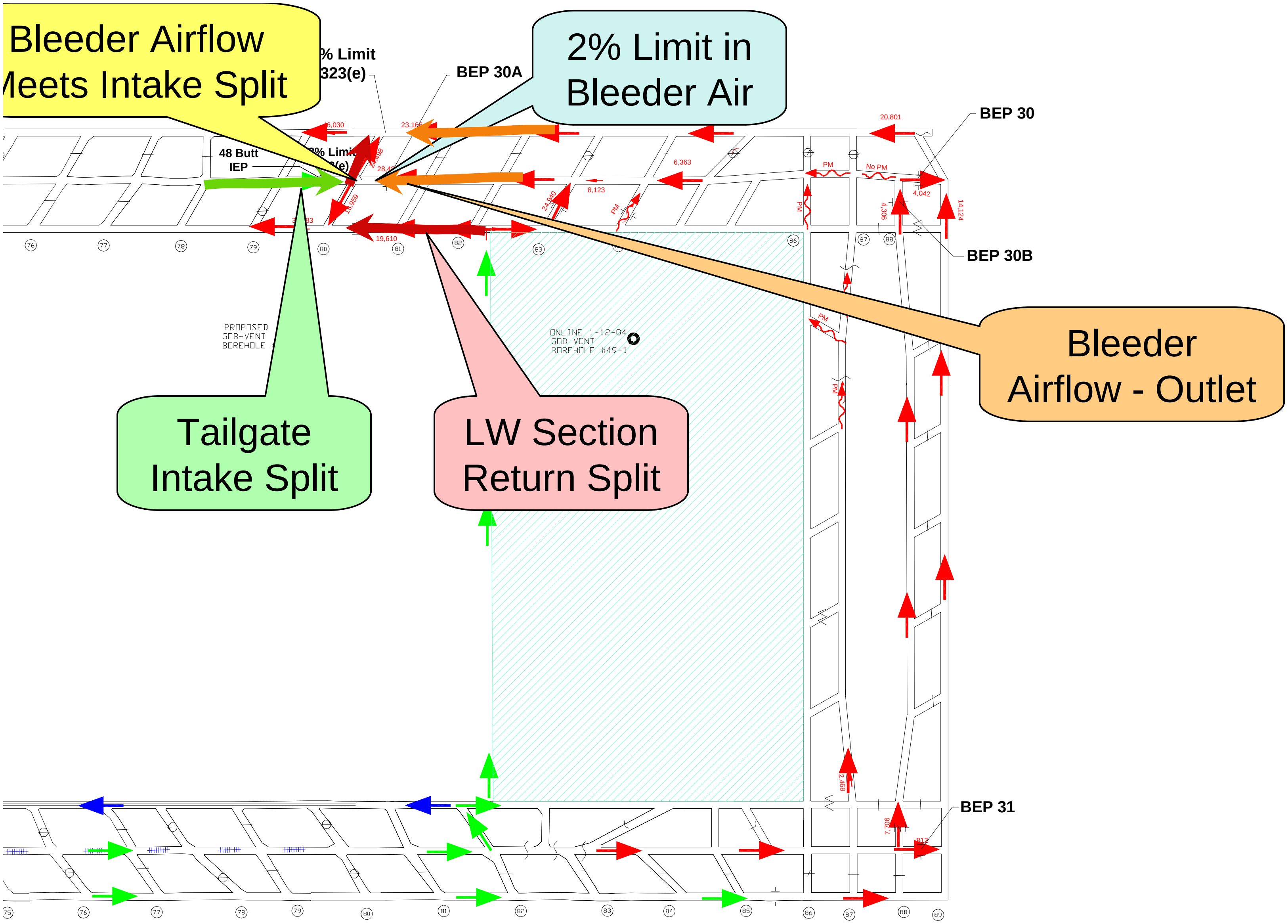
2% Limit
323(e)
BEP 30A
BEP 30
48 Butt
IEP
2% Limit
323(e)
BEP 30B
PROPOSED
GOB-VENT
BOREHOLE #49-3A
PROPOSED
GOB-VENT
BOREHOLE #49-3
PROPOSED
GOB-VENT
BOREHOLE #49-2
PROPOSED
GOB-VENT
BOREHOLE #49-1A
BEP 31
Area of Interest

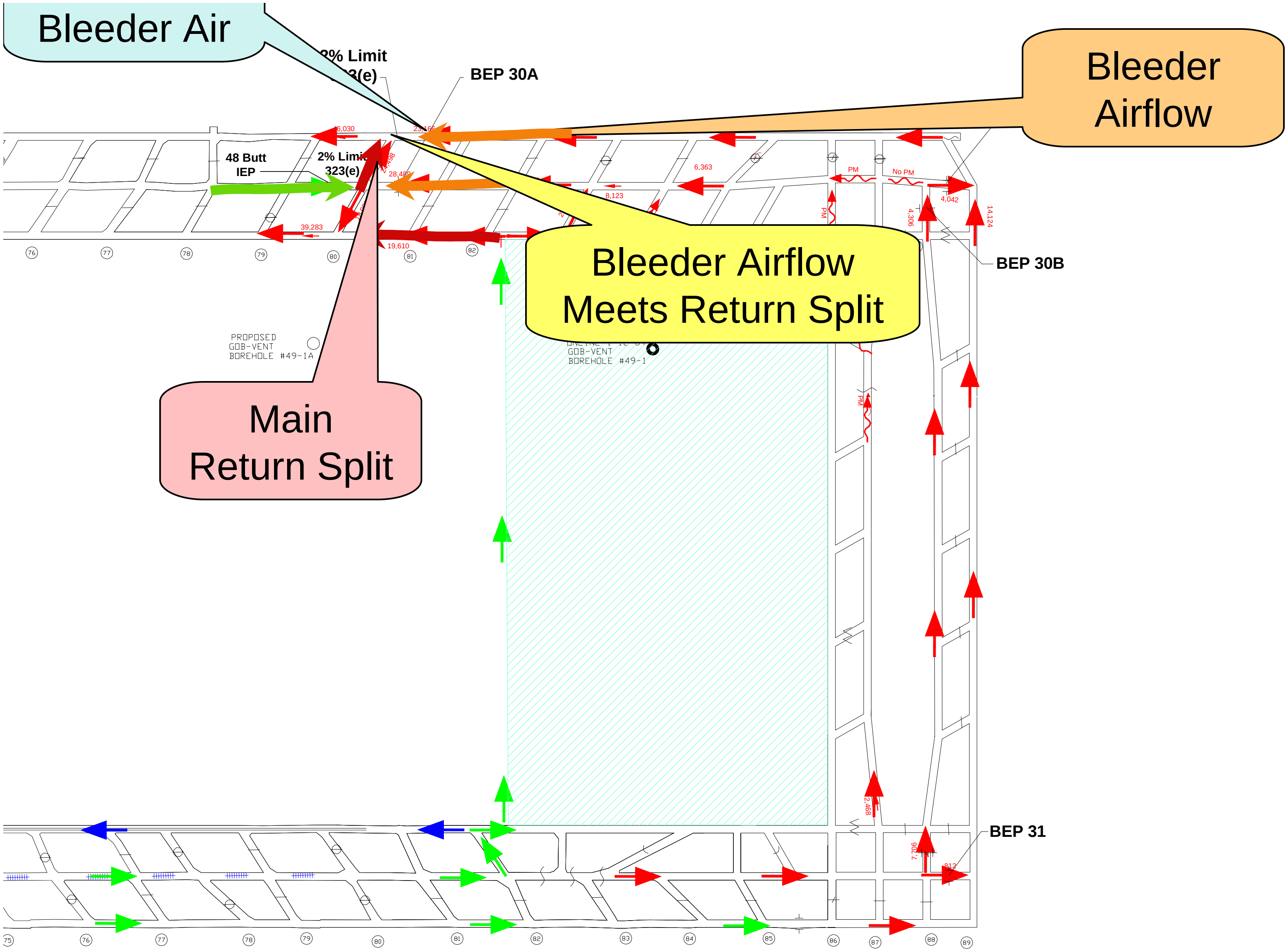

No Flow !!
Air Goes Out
BEP 30
20,801
6,363
PM
No PM
4,042
4,306
14,124
PM
PM
Location of Ventilation Controls that Separate the Gob from the Bleeder Entries
84
86
87
88
BEP 30B
PM
Air Goes In
PM


Did You Really Find Out What You Needed to at BEP 30 ?
Flow Out Bleeder Connector Did Not Indicate Flow Thru Gob
BEP 30
BEP 30B
20,801
6,363
PM
No PM
4,042
4,306
14,124
84
86
87
88

Factors affecting Bleeder System Performance

- Complex Design or Arrangement
  - Influence of Other Splits on Bleeder Airflow
    - 2 Percent Methane Location
      - Other splits directly enter bleeder split

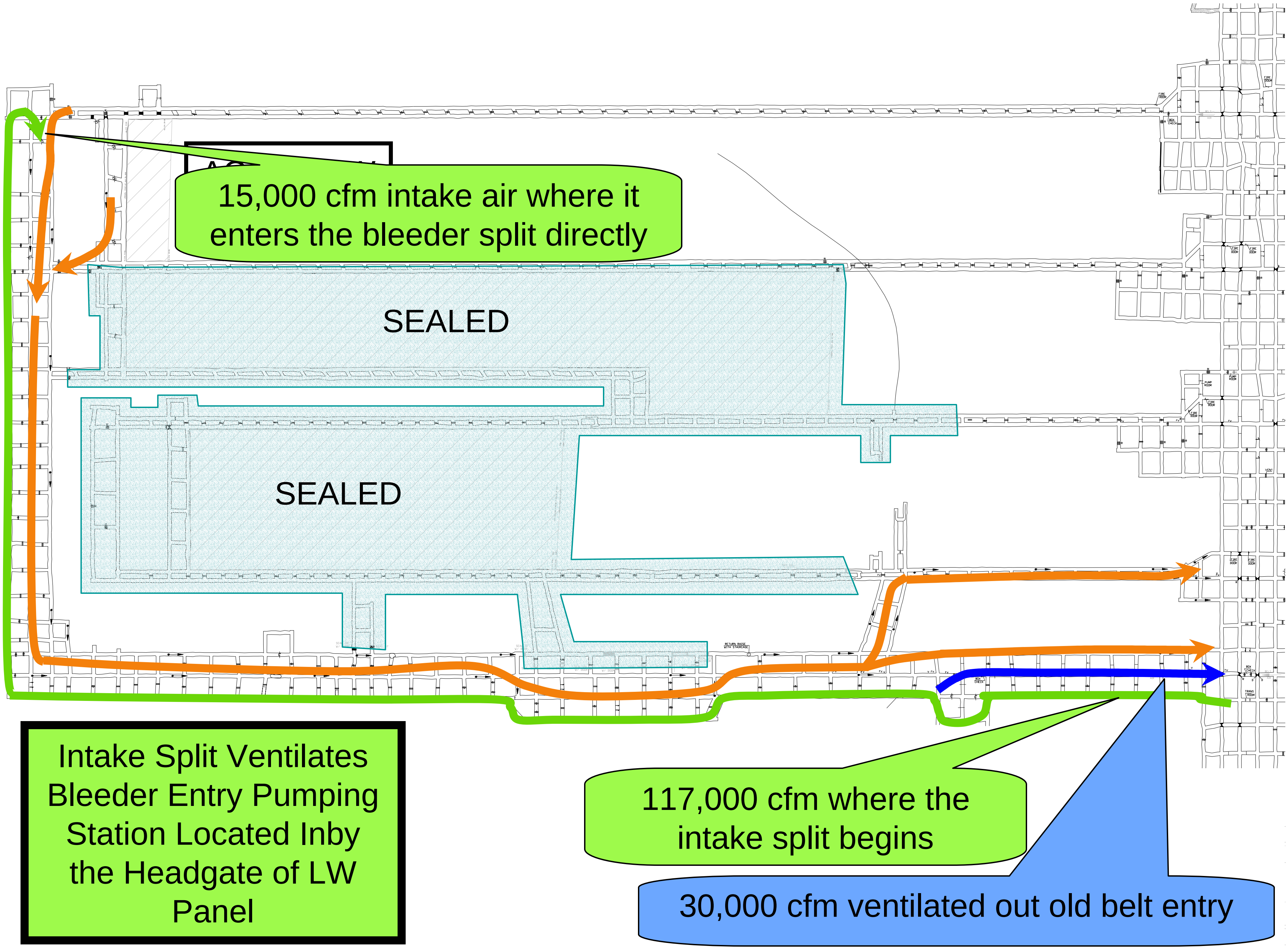

Bleeder Airflow
leets Intake Split
2% Limit in Bleeder Air
BEP 30A
BEP 30
BEP 30B
BEP 31
48 Butt IEP
PROPOSED GOB-VENT BOREHOLE
ONLINE 1-12-04 GOB-VENT BOREHOLE #49-1
Tailgate Intake Split
LW Section Return Split
Bleeder Airflow - Outlet

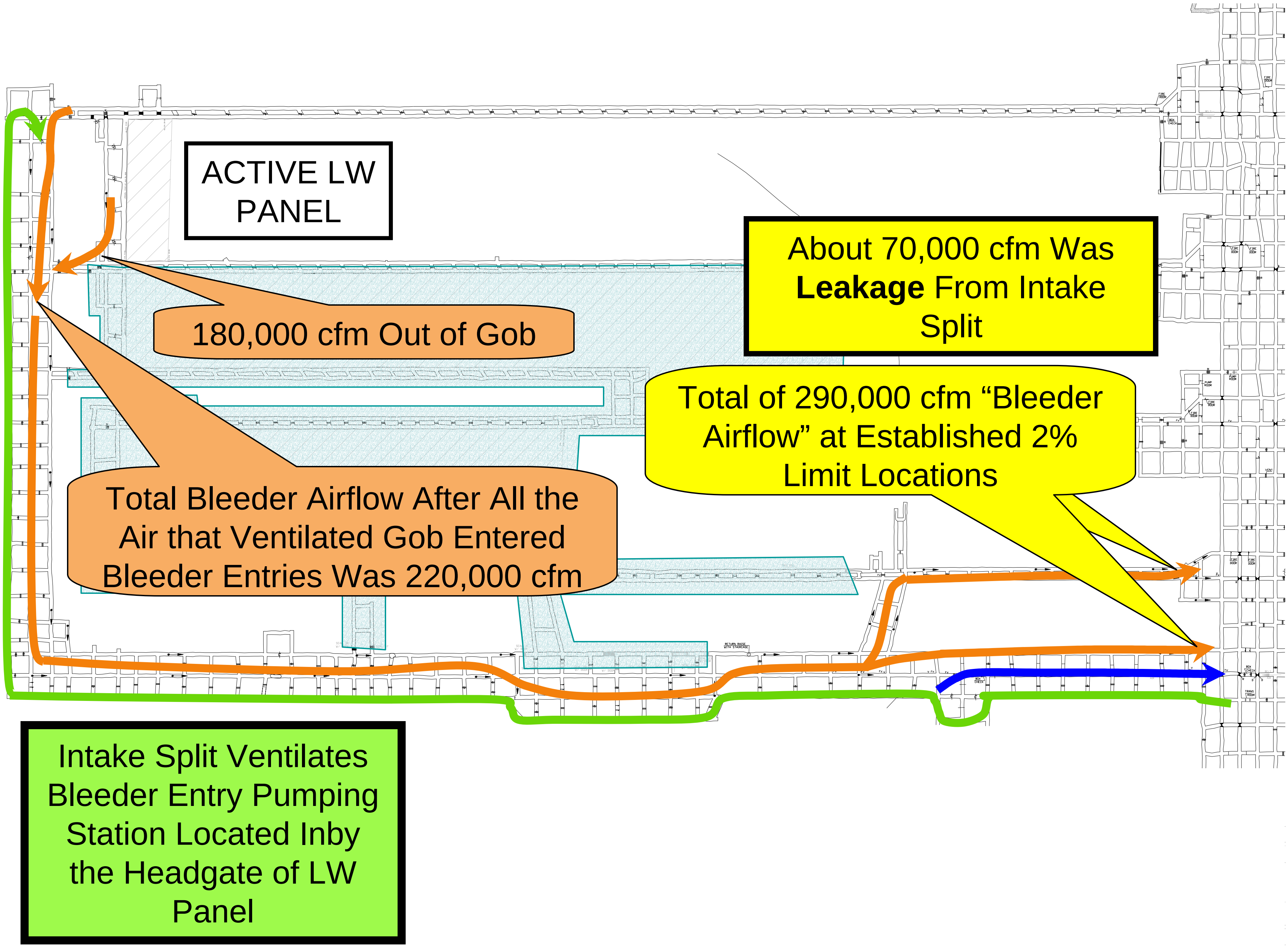


Bleeder Air
Bleeder Airflow
Main Return Split
Bleeder Airflow Meets Return Split
BEP 30A
BEP 30B
BEP 31
48 Butt IEP
2% Limit 323(e)
PROPOSED GOB-VENT BOREHOLE #49-1A
GOB-VENT BOREHOLE #49-1

Factors affecting Bleeder System Performance

- Complex Design or Arrangement
  - Influence of Other Splits on Bleeder Airflow
    - 2 Percent Methane Location
      - Other splits directly enter bleeder split
      - Other splits adjacent to bleeder airflow
        - » Does significant leakage from separate split enter bleeder airflow?


15,000 cfm intake air where it enters the bleeder split directly
SEALED
SEALED
Intake Split Ventilates Bleeder Entry Pumping Station Located Inby the Headgate of LW Panel
117,000 cfm where the intake split begins
30,000 cfm ventilated out old belt entry

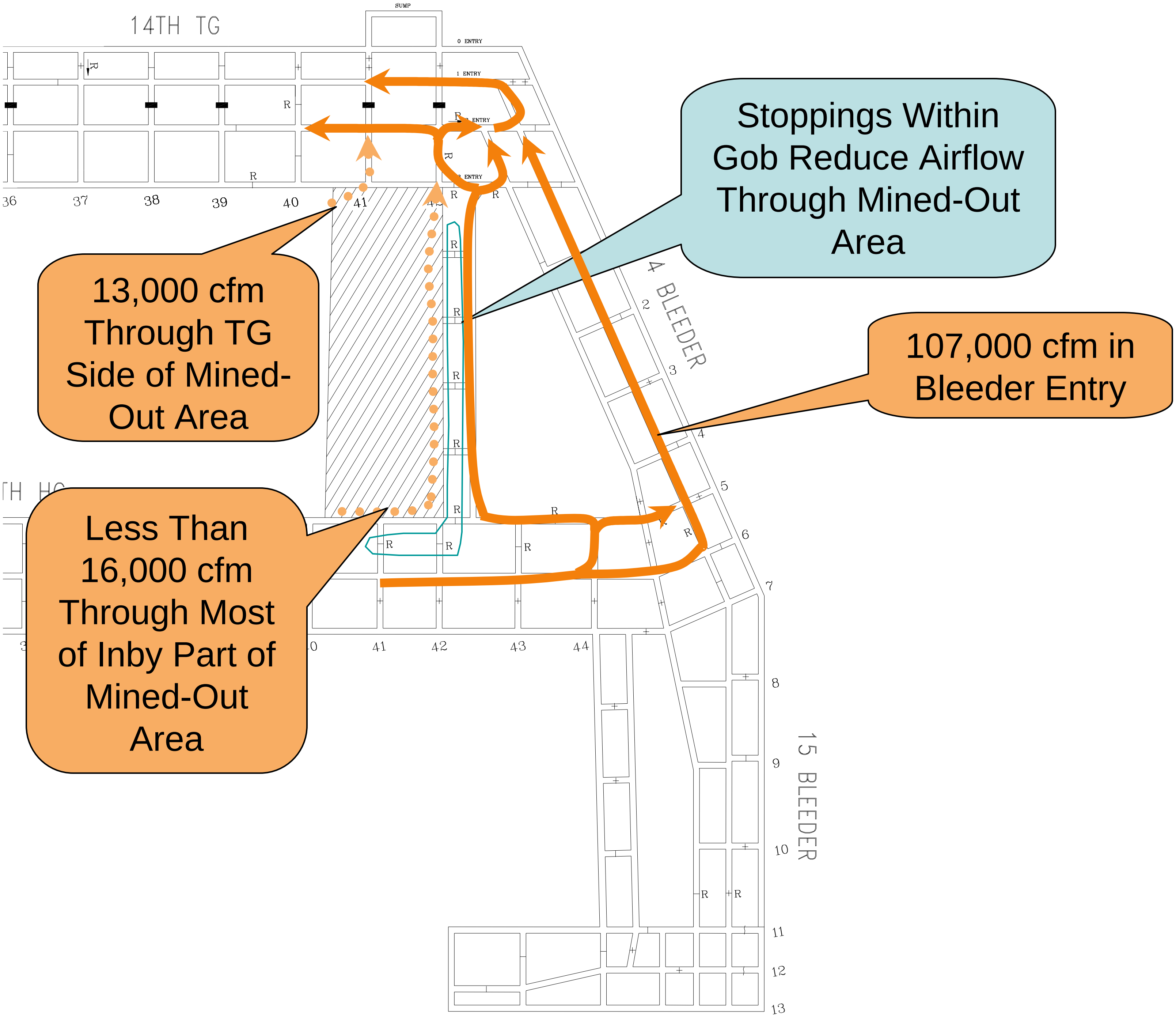

ACTIVE LW PANEL
About 70,000 cfm Was **Leakage** From Intake Split
180,000 cfm Out of Gob
Total of 290,000 cfm “Bleeder Airflow” at Established 2% Limit Locations
Total Bleeder Airflow After All the Air that Ventilated Gob Entered Bleeder Entries Was 220,000 cfm
Intake Split Ventilates Bleeder Entry Pumping Station Located Inby the Headgate of LW Panel

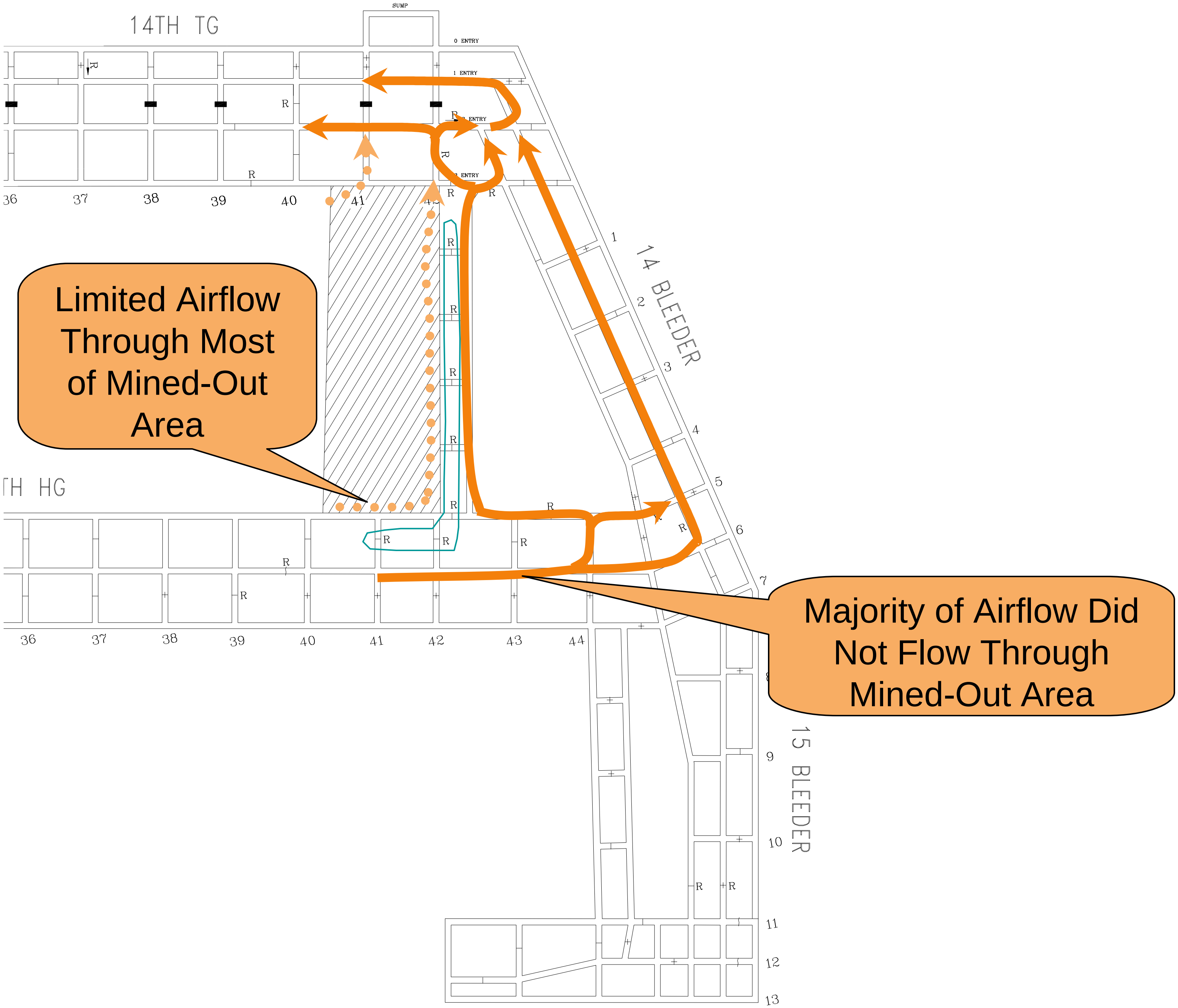
Factors affecting Bleeder System Performance

- Complex Design or Arrangement

  - Influence of Other Splits on Bleeder Airflow
    - 2 Percent Methane Location
      - Other splits directly enter bleeder split
      - Other splits adjacent to bleeder airflow
        - » Does significant leakage from separate split enter bleeder airflow?

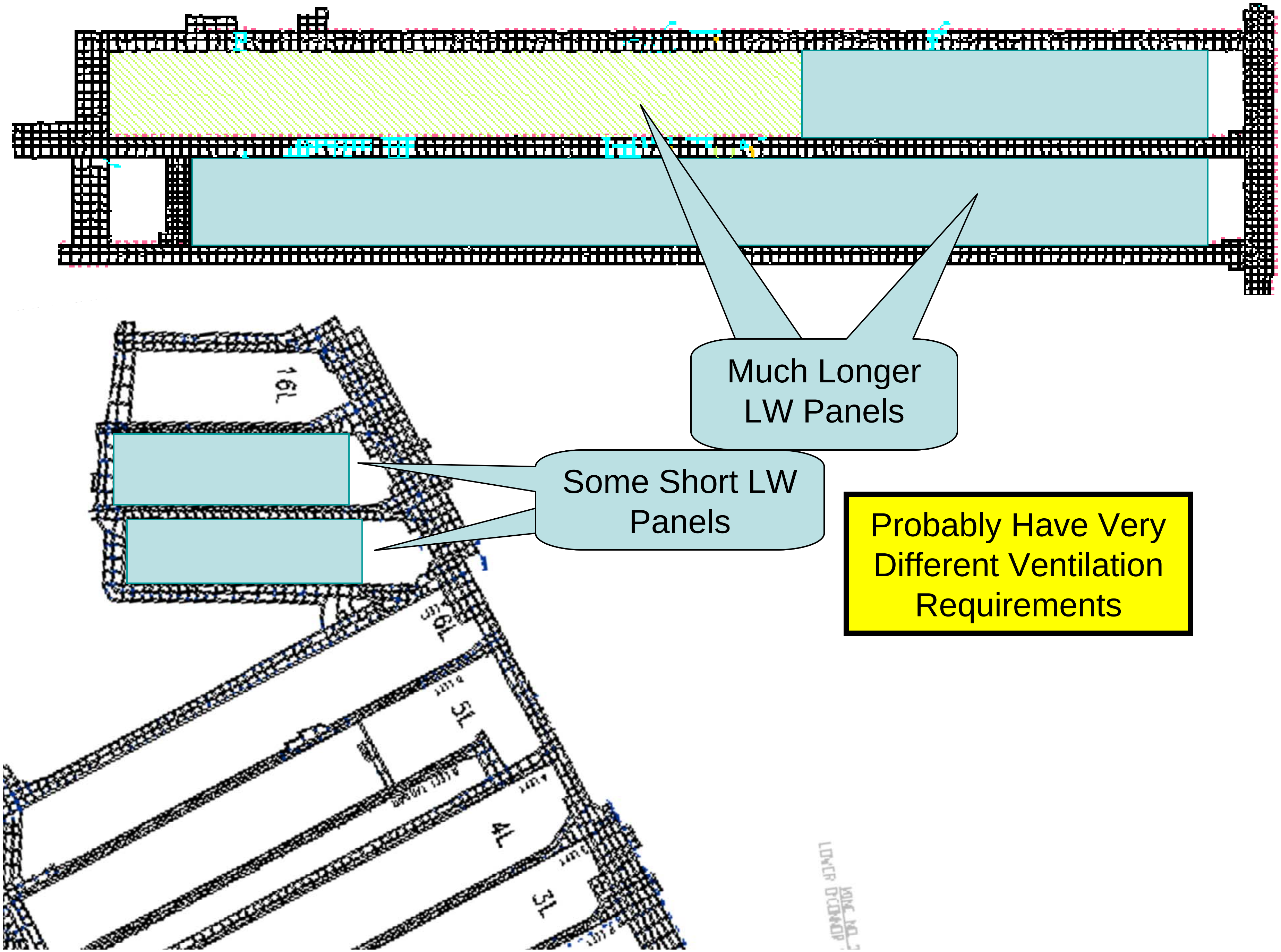
  - "To Ventilate or Not to Ventilate?" – That Is the Question
    - Does most of the bleeder airflow ventilate the "gob" or does it just stay in the bleeder entries?


14TH TG
SUMP
0 ENTRY
1 ENTRY
Stoppings Within Gob Reduce Airflow Through Mined-Out Area
13,000 cfm Through TG Side of Mined-Out Area
107,000 cfm in Bleeder Entry
Less Than 16,000 cfm Through Most of Inby Part of Mined-Out Area
4 BLEEDER
15 BLEEDER
36
37
38
39
40
41
42
43
44


14TH TG
SUMP
0 ENTRY
1 ENTRY
14 BLEEDER
TH HG
15 BLEEDER
Limited Airflow Through Most of Mined-Out Area
Majority of Airflow Did Not Flow Through Mined-Out Area

Factors affecting Bleeder System Performance

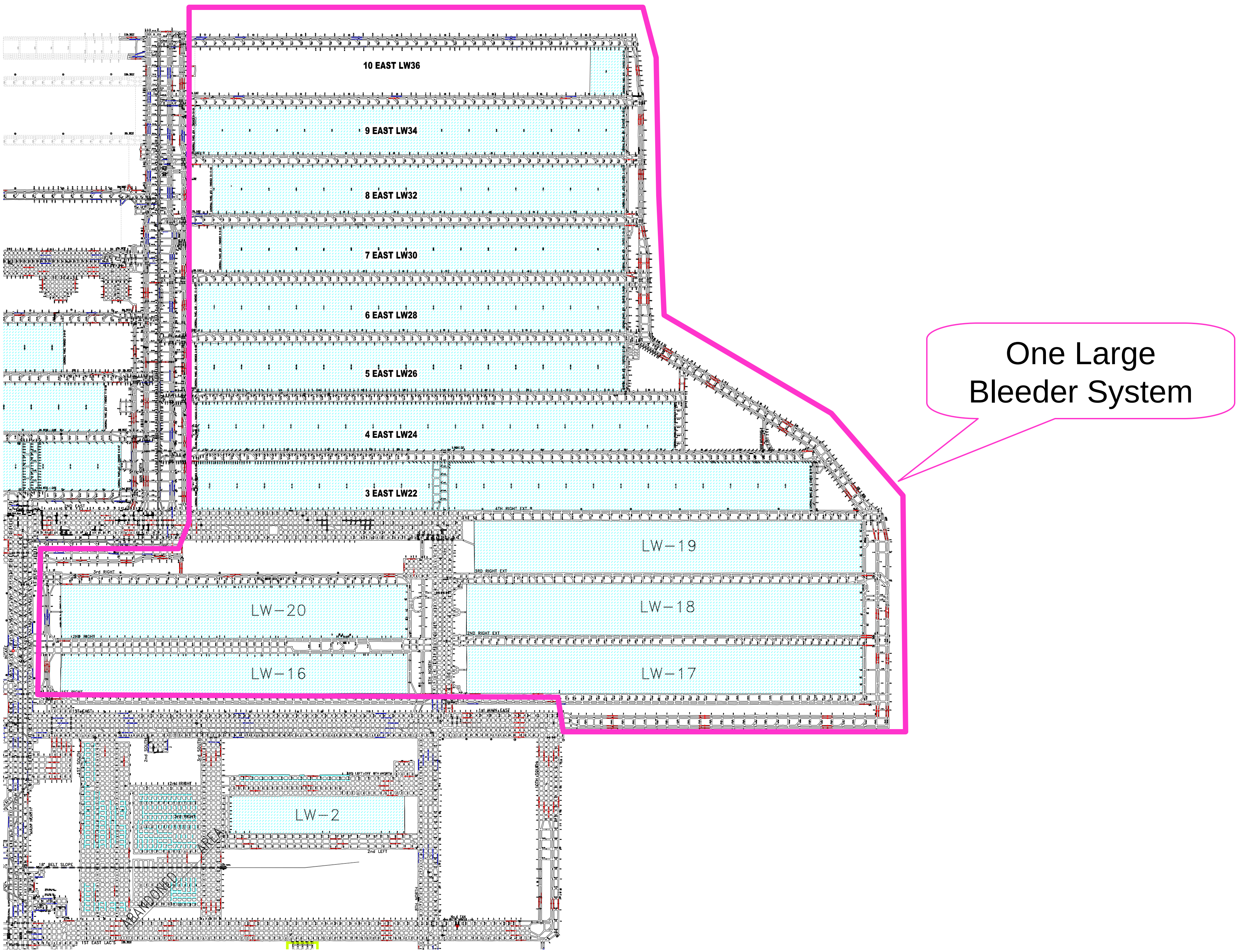
- Limited Capacity
  - Size Does Matter
    - Longer panels, wider panels generally mean greater airflow resistance, possibly more contaminants



Probably Have Very Different Ventilation Requirements

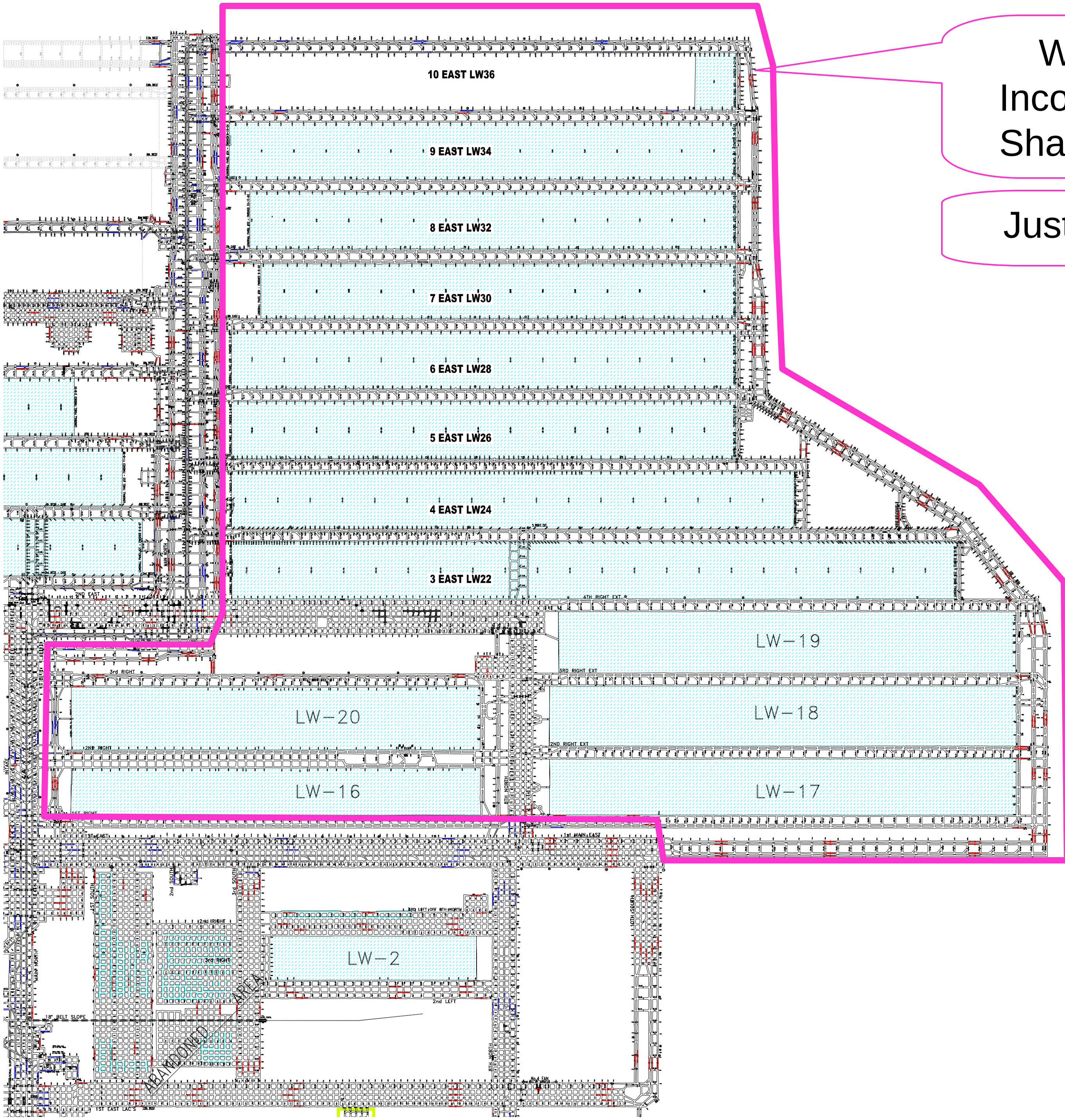
Factors affecting Bleeder System Performance

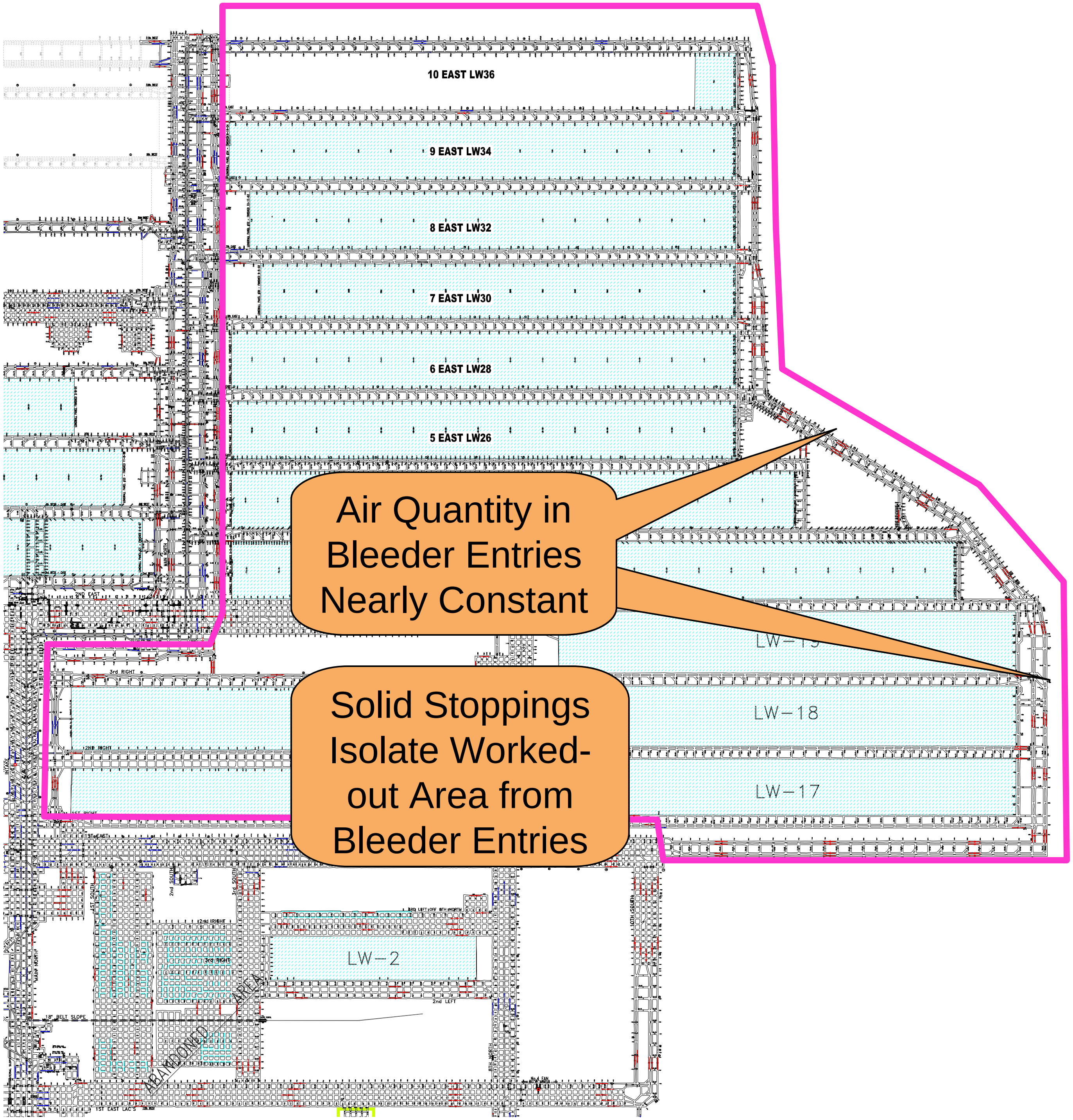
- Limited Capacity
  - Size Does Matter
    - Longer panels, wider panels generally mean greater airflow resistance, possibly more contaminants
  - Ahh … Just One More !
    - How many times has the longwall district been extended "this one last" panel?

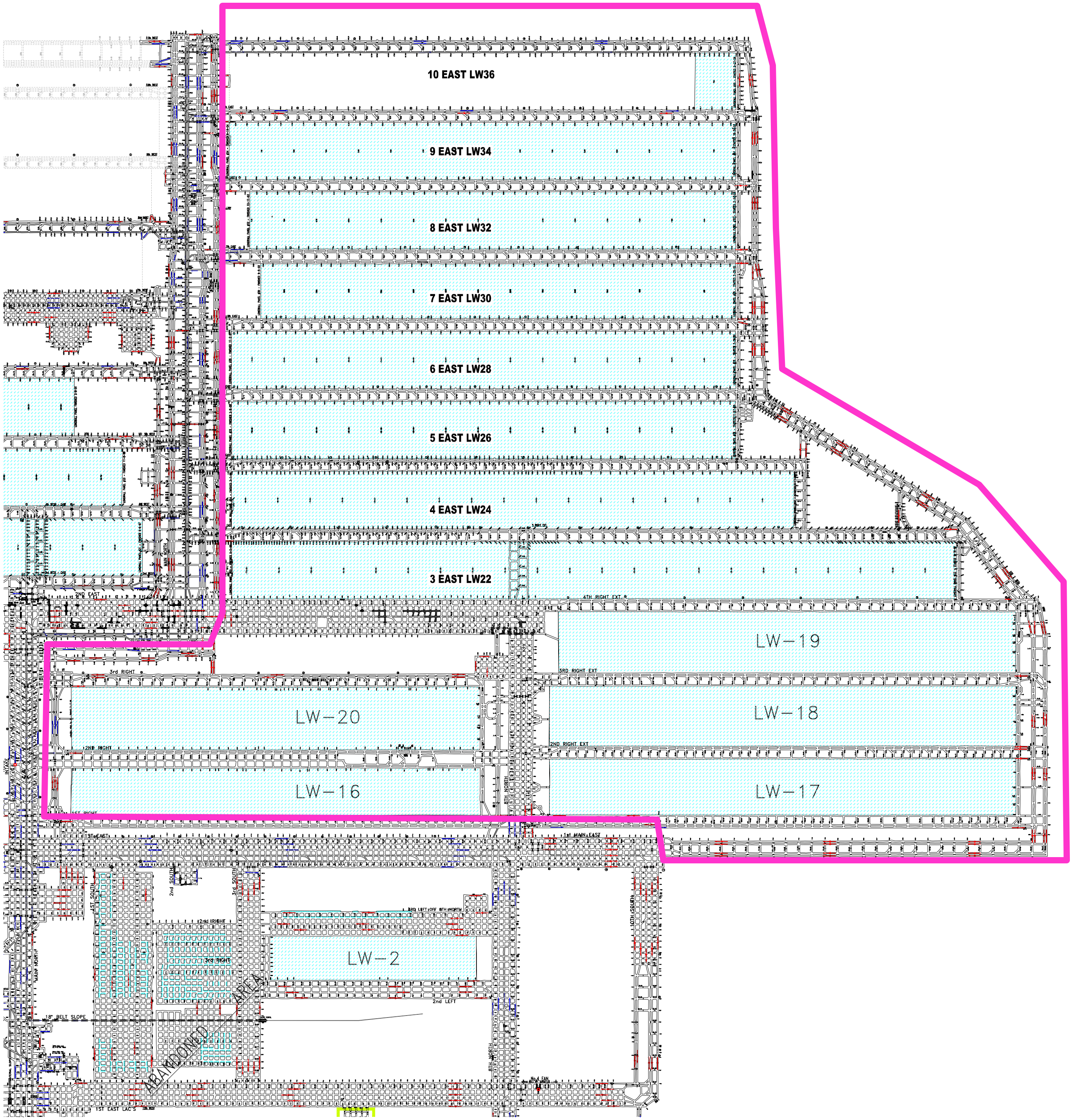

10 EAST LW36
9 EAST LW34
8 EAST LW32
7 EAST LW30
6 EAST LW28
5 EAST LW26
4 EAST LW24
3 EAST LW22
LW−19
LW−18
LW−17
LW−20
LW−16
LW−2
One Large Bleeder System

Was Reported to Incorporate a Bleeder Shaft and Fan, **But ...**

Just One More Panel



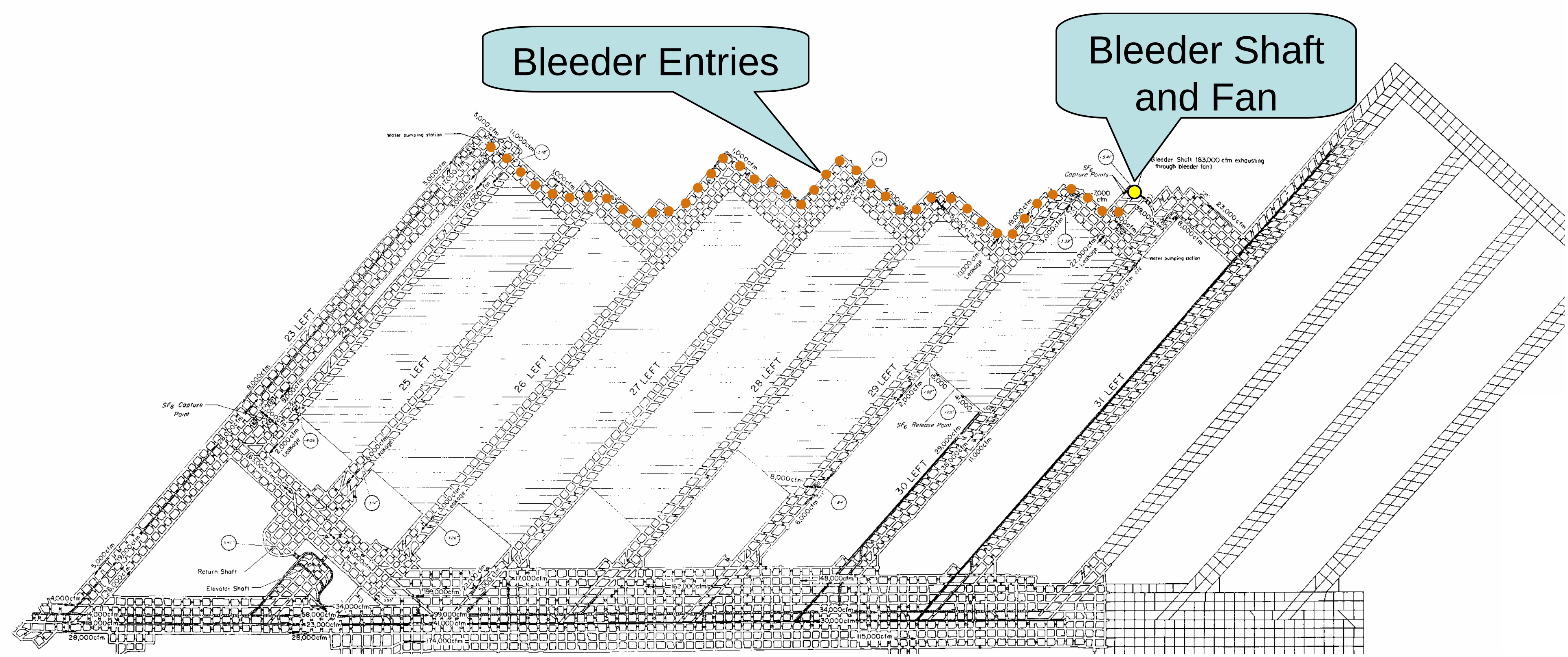

10 EAST LW36
9 EAST LW34
8 EAST LW32
7 EAST LW30
6 EAST LW28
5 EAST LW26
Air Quantity in Bleeder Entries Nearly Constant
LW-18
Solid Stoppings Isolate Worked-out Area from Bleeder Entries
LW-17
LW-2
ABANDONED AREA



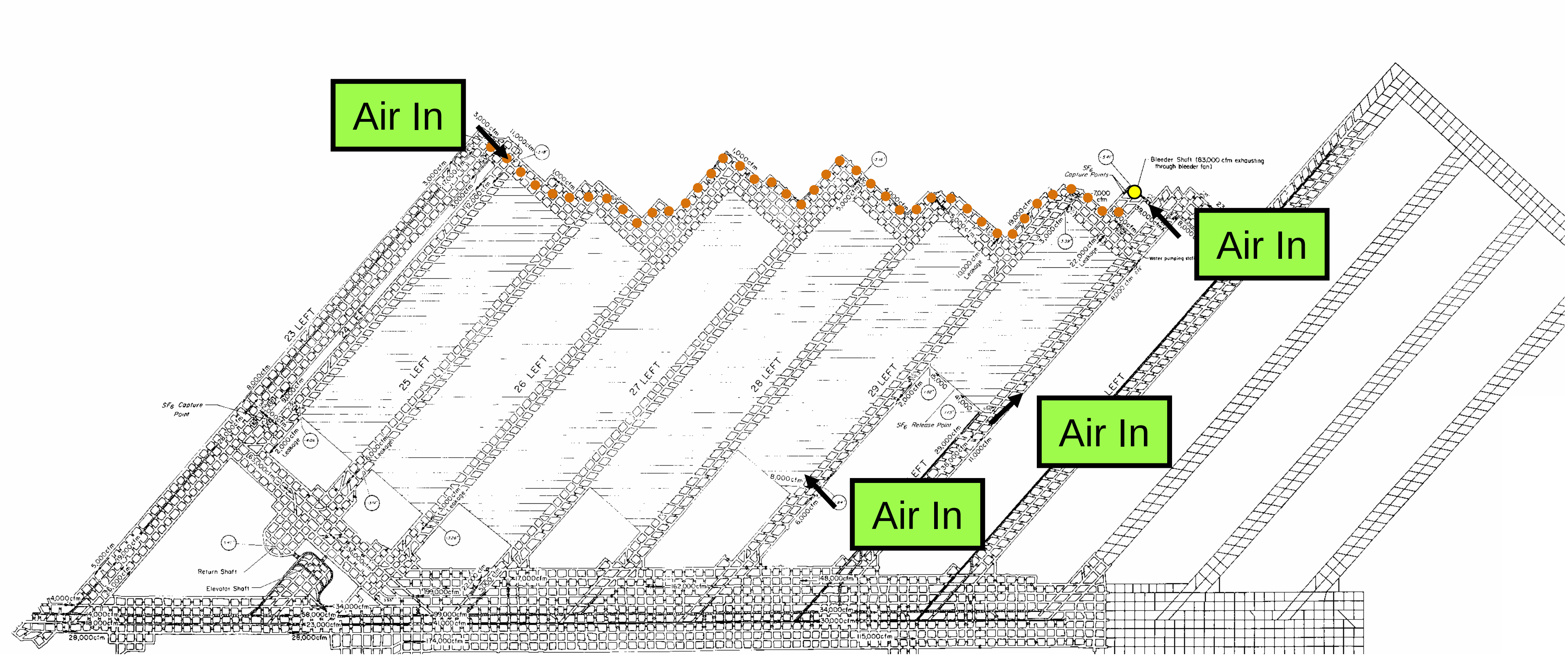
Is Large Portion of Worked-out Area Ventilated at All?

Typical Indicators

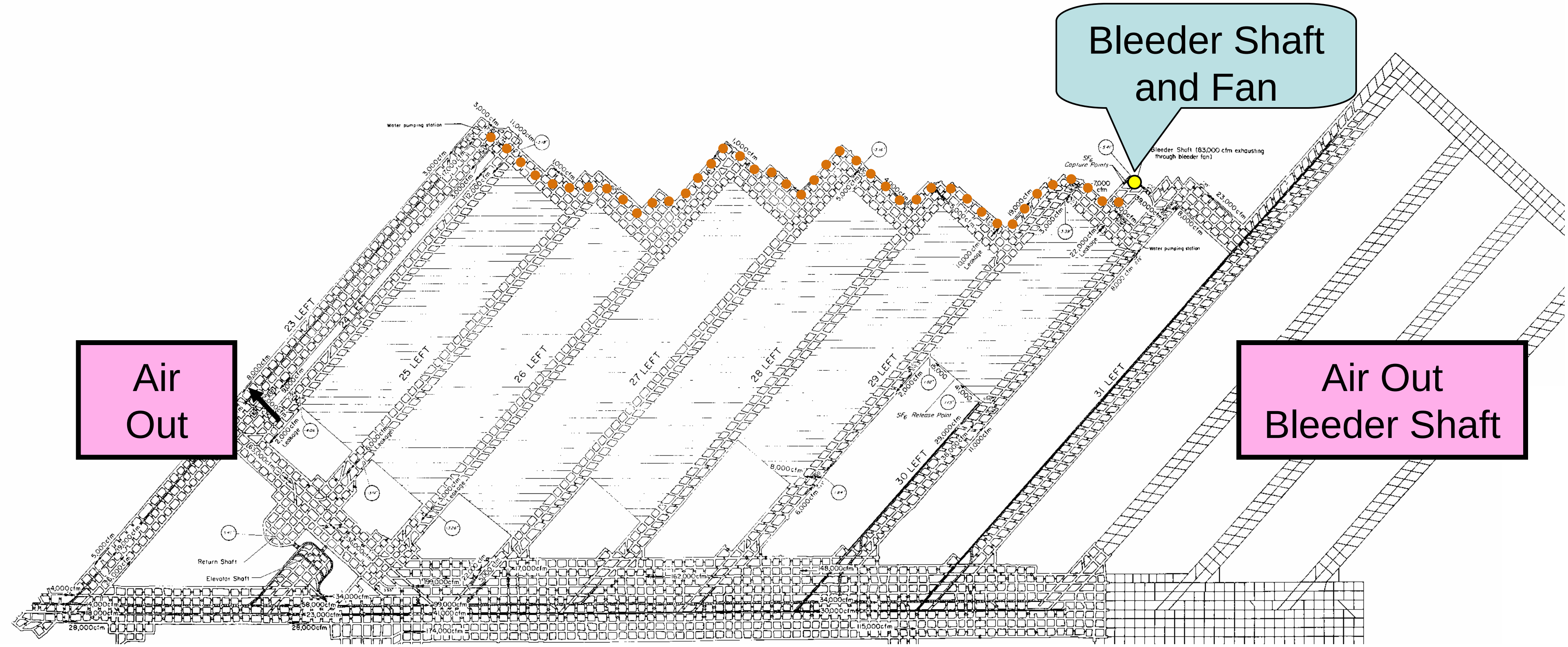
- Limited Capacity
  - You Mean Actually Travel the Bleeder Entries?
    - Are they traveled in their entirety? – Why Not?



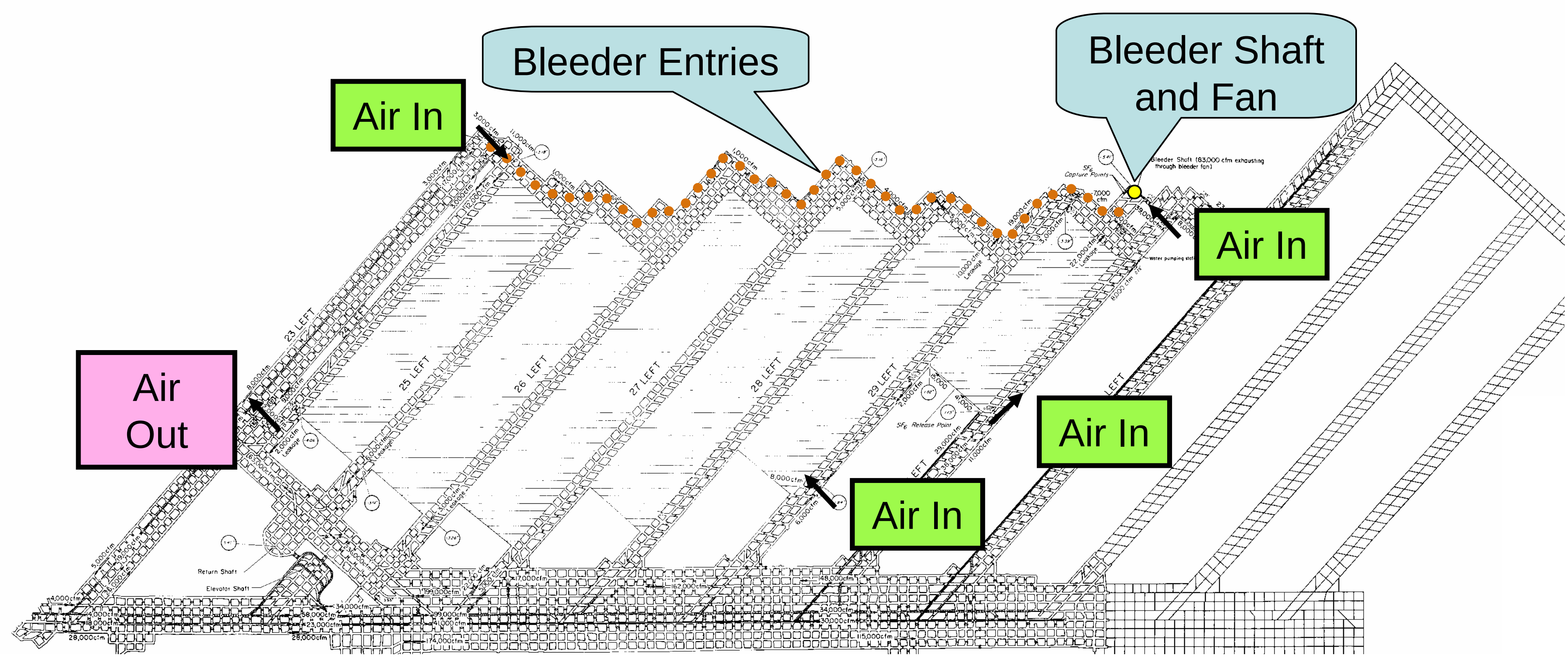
What Do You Know About the System Performance If You Just go to the Surface of the Bleeder Fan?



What Do You Know About the System Performance If You Just go to the Surface of the Bleeder Fan?



What Do You Know About the System Performance If You Just go to the Surface of the Bleeder Fan?



Travel of Bleeder Entries Actually Found Deep Water Accumulations, Roof Falls, Unexpected Airflow Direction In Bleeder Entries, Unknown "Split Points", Airflow Too Low to Measure….

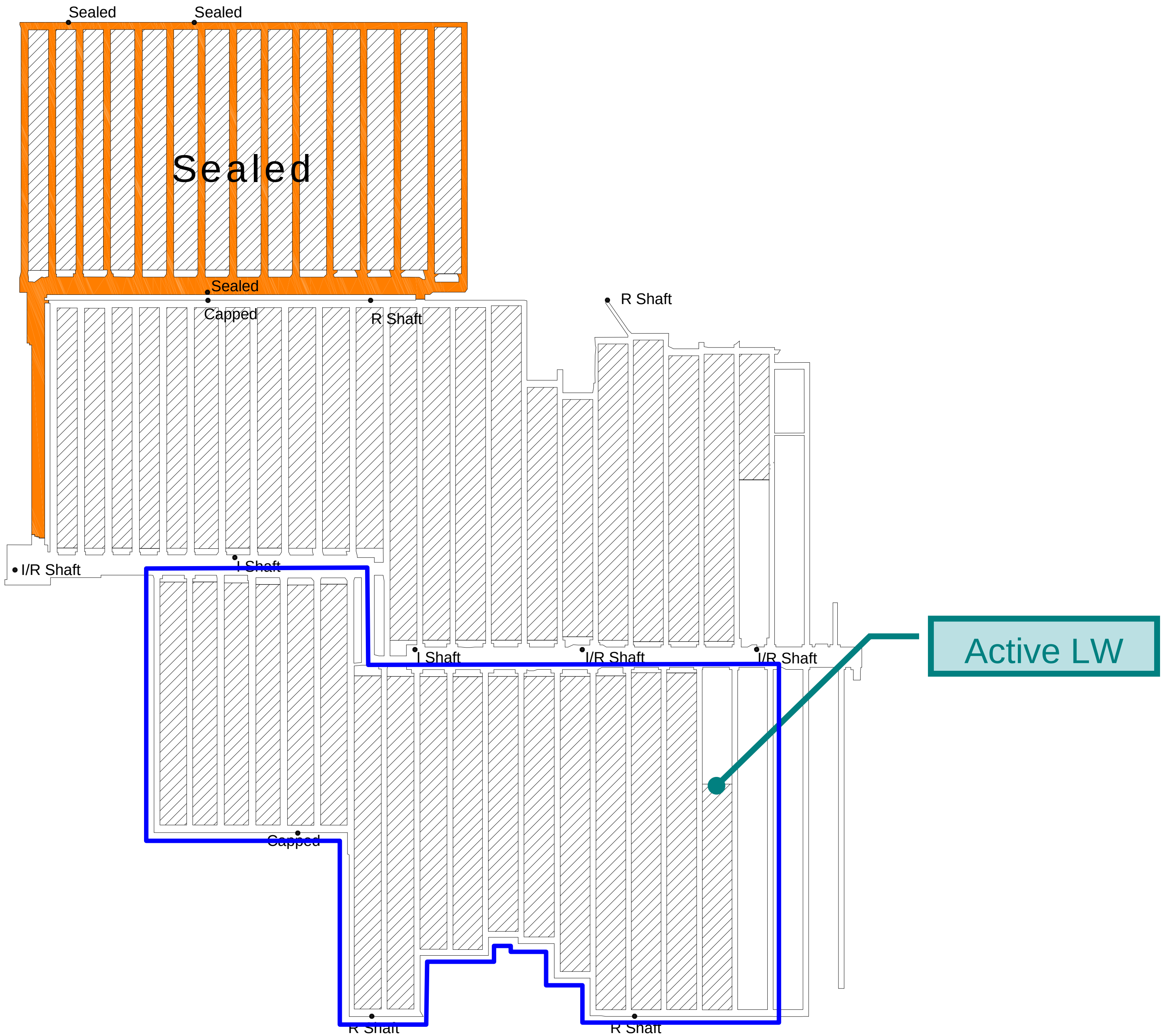
Typical Indicators

- Oxygen Deficiency

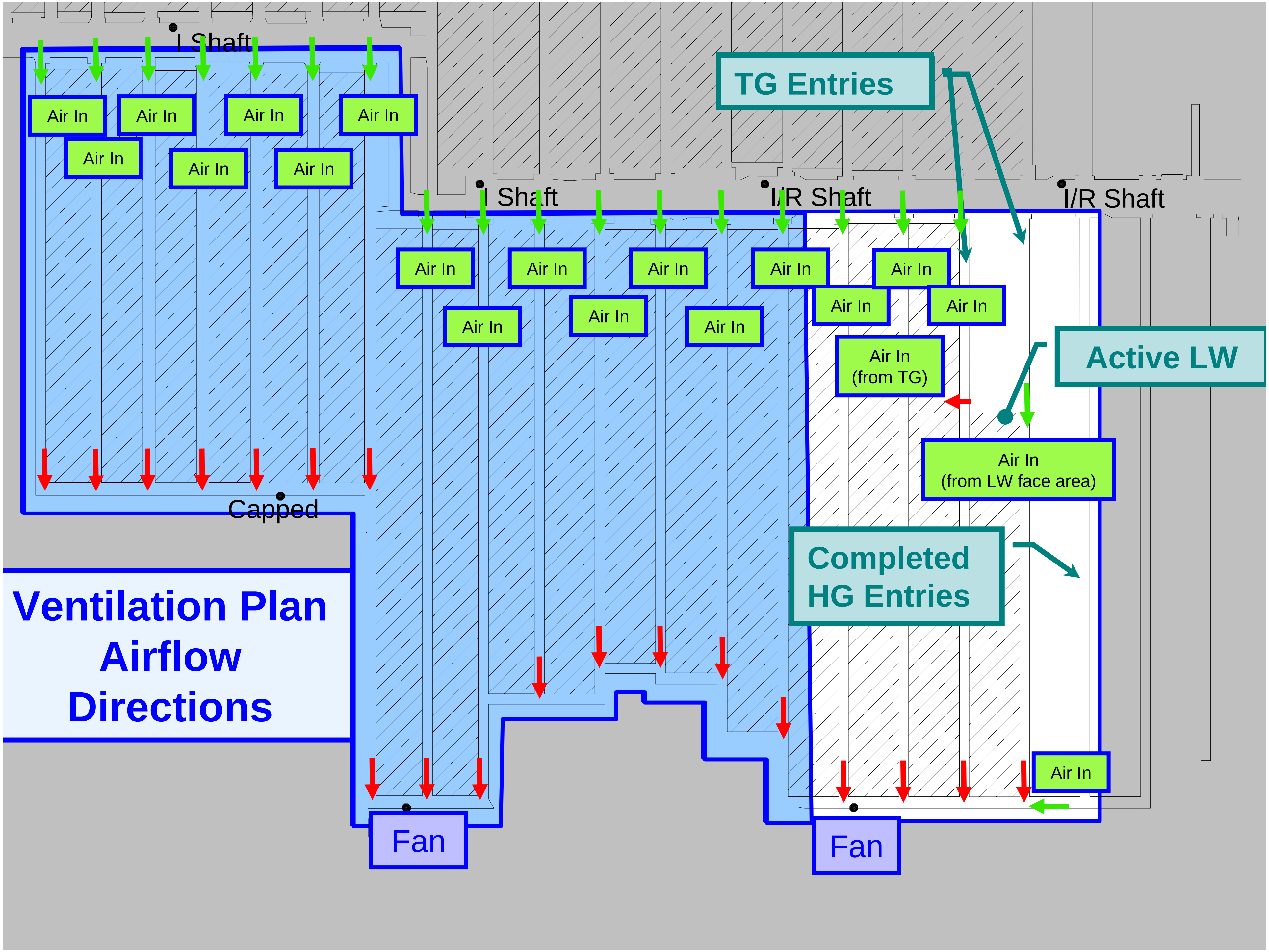
  The Existence of Oxygen Deficiency Itself Is Not Indicative of an Ineffective Bleeder System ………

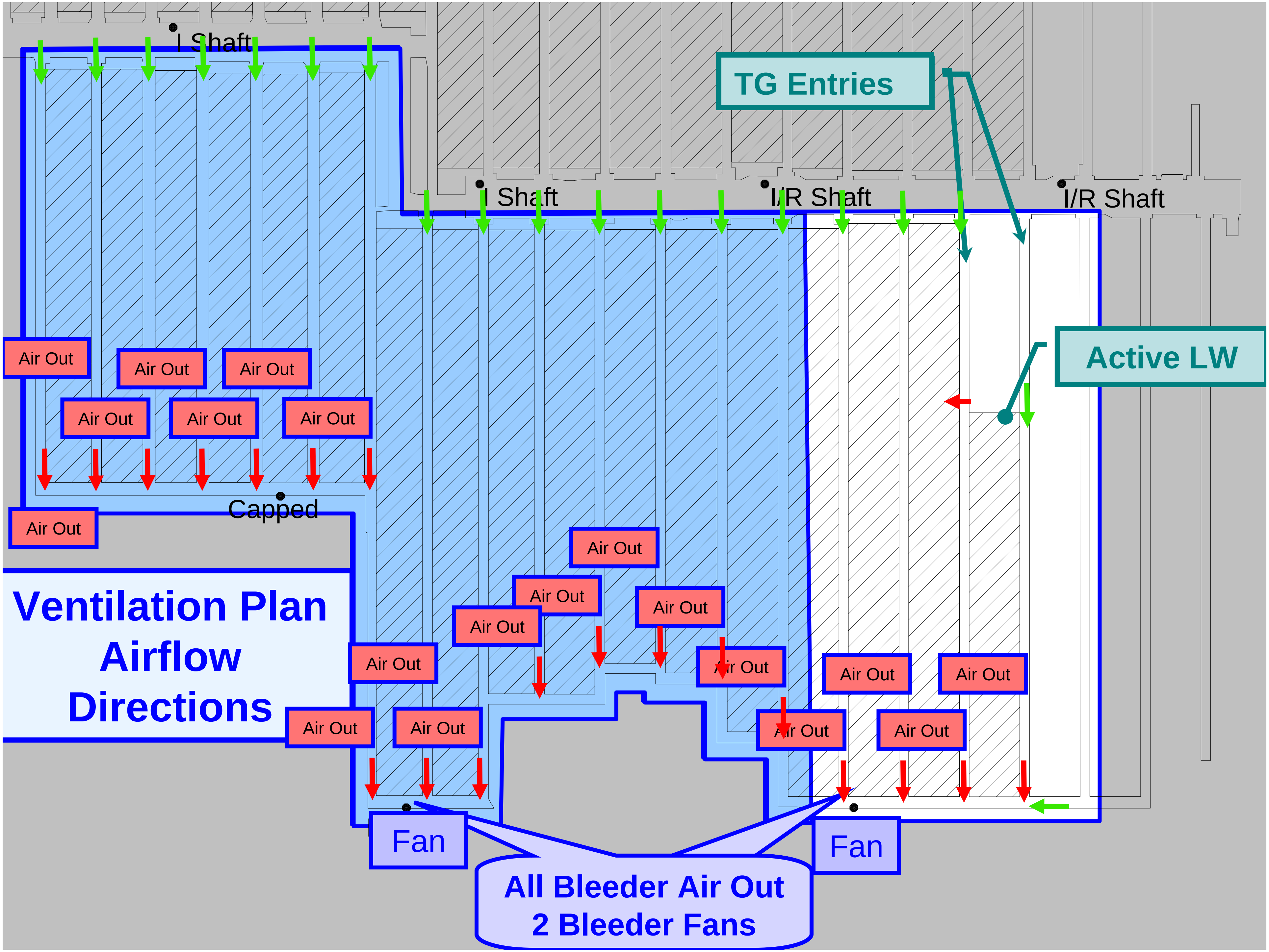
  ……… But Oxygen Deficiency that Prevents Continued Evaluation of the Bleeder System Does Indicate the Bleeder System Has Exceeded Its Capacity………

  ……… System Should be Sealed.

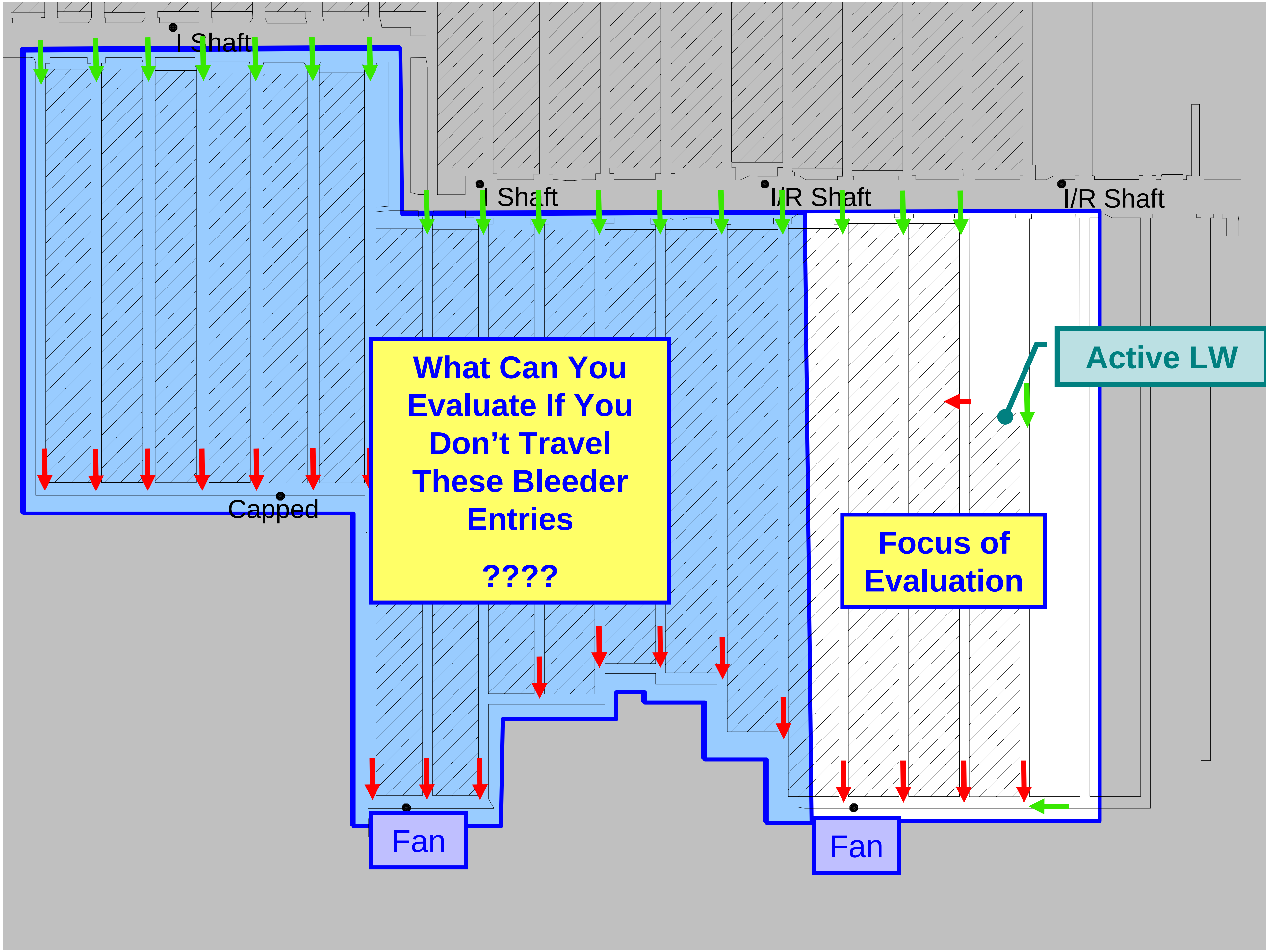


Sealed
Sealed
Sealed
Sealed
Capped
R Shaft
R Shaft
I/R Shaft
I Shaft
I Shaft
I/R Shaft
I/R Shaft
Active LW
Capped
R Shaft
R Shaft


Ventilation Plan Airflow Directions
I Shaft
I Shaft
I/R Shaft
I/R Shaft
TG Entries
Active LW
Completed HG Entries
Air In
Air In (from TG)
Air In (from LW face area)
Capped
Fan
Fan



I Shaft
I Shaft
I/R Shaft
I/R Shaft
TG Entries
Active LW
Air Out
Capped
Ventilation Plan Airflow Directions
Fan
Fan
All Bleeder Air Out
2 Bleeder Fans


I Shaft
I Shaft
I/R Shaft
I/R Shaft
Active LW
What Can You Evaluate If You Don't Travel These Bleeder Entries
????
Focus of Evaluation
Capped
Fan
Fan

Typical Indicators

- Oxygen Deficiency

  Effective Bleeder Systems Provide Sufficient Airflow to Enable Safe Access to Necessary Examination Locations

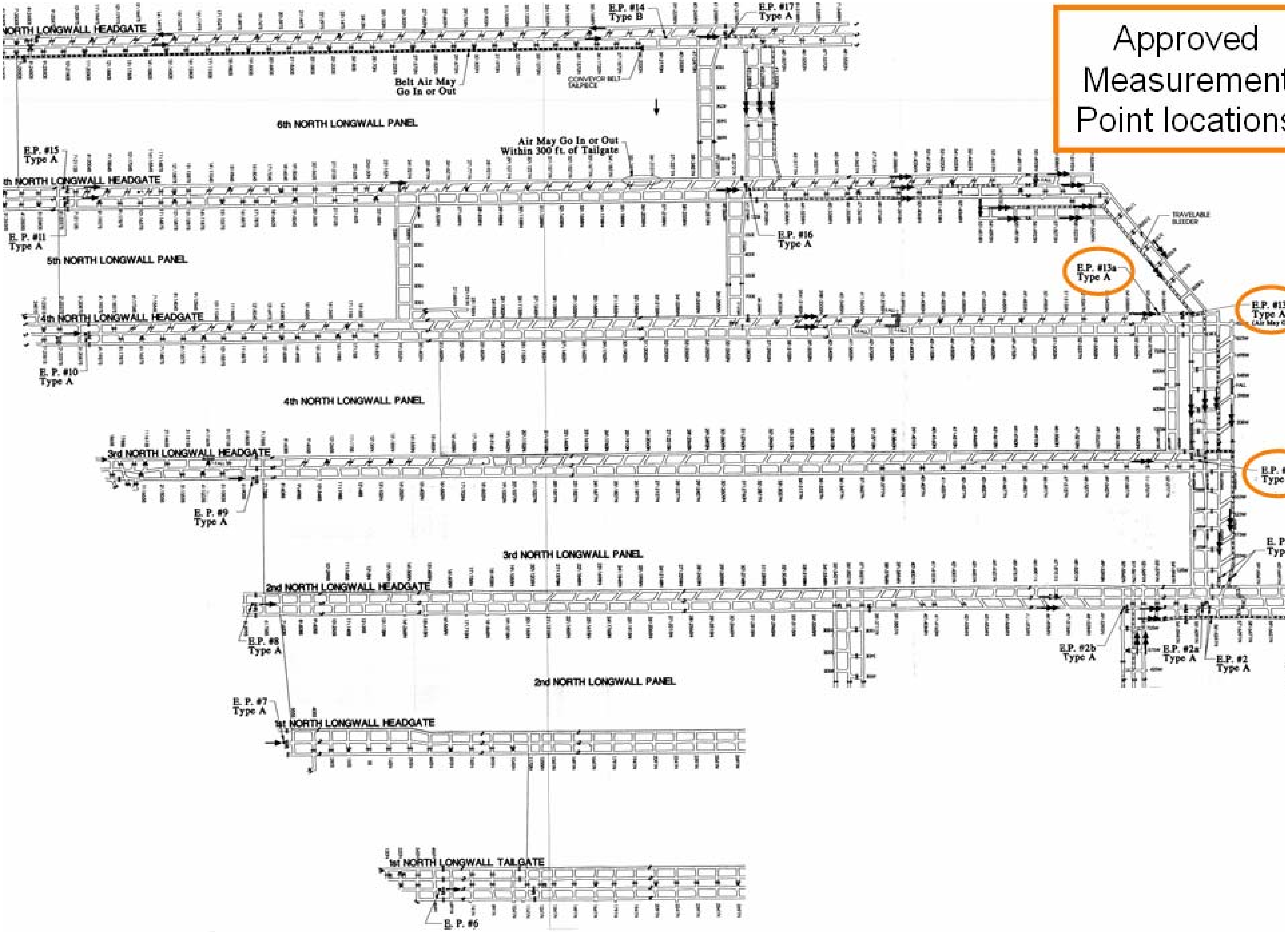
  Lack of Access May Result in an Inability to Determine Bleeder System Effectiveness

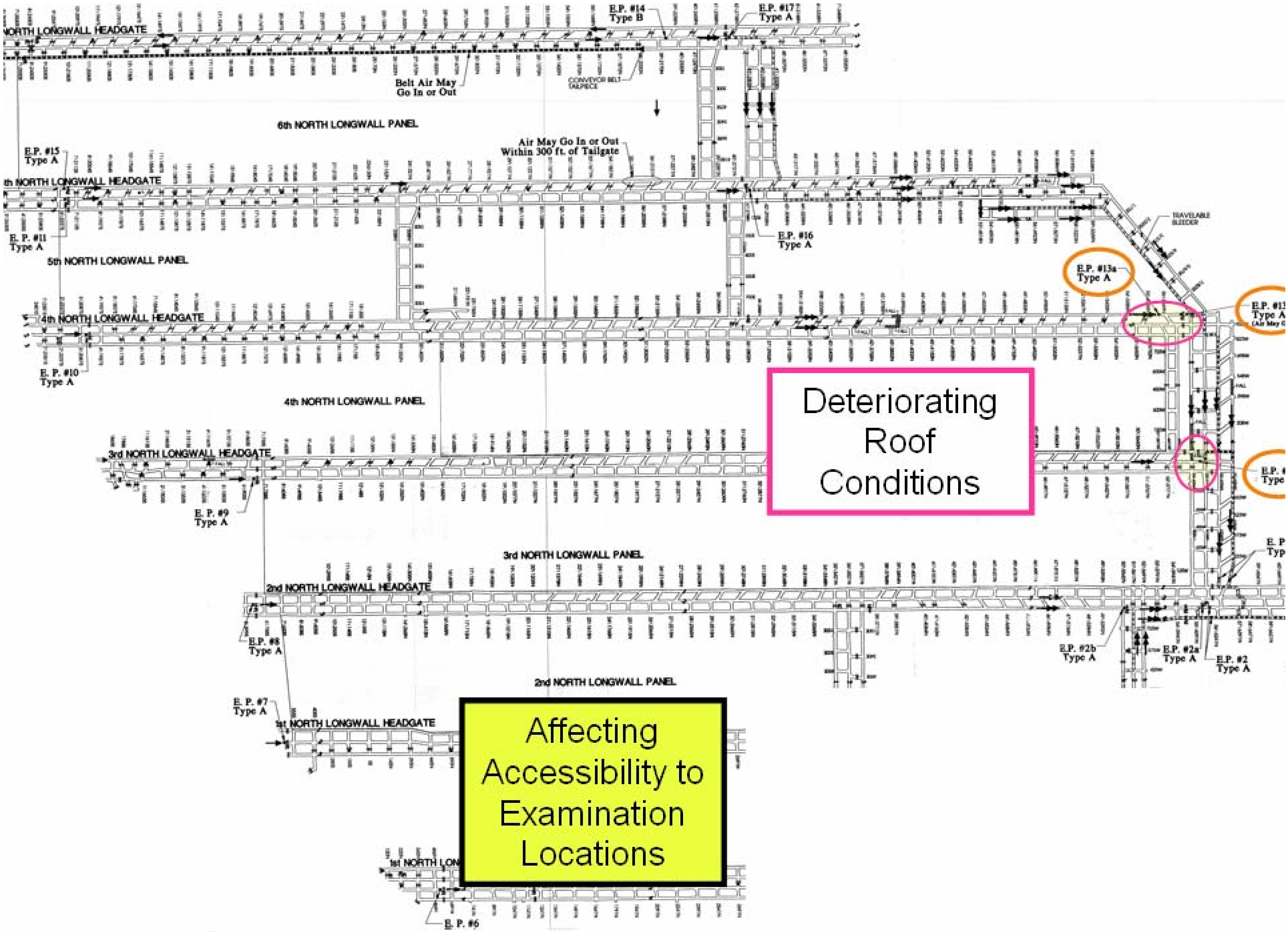
Typical Indicators

- Limited Capacity

  - Traveling the Bleeder Entries
    - Are they traveled in their entirety? – Why Not?
    - Is supplemental roof support installed?
      - All bleeder entries?
      - Is it adequate?
      - Are there roof falls blocking access or restricting airflow?
    - Are bleeder connectors accessible?

Approved Measurement Point locations




NORTH LONGWALL HEADGATE
E.P. #14
Type B
E.P. #17
Type A
Belt Air May
Go In or Out
6th NORTH LONGWALL PANEL
Air May Go In or Out
Within 300 ft. of Tailgate
E.P. #15
Type A
th NORTH LONGWALL HEADGATE
E. P. #11
Type A
5th NORTH LONGWALL PANEL
E.P. #16
Type A
E.P. #13a
Type A
4th NORTH LONGWALL HEADGATE
E. P. #10
Type A
4th NORTH LONGWALL PANEL
Deteriorating Roof Conditions
3rd NORTH LONGWALL HEADGATE
E. P. #9
Type A
3rd NORTH LONGWALL PANEL
2nd NORTH LONGWALL HEADGATE
E.P. #8
Type A
E.P. #2b
Type A
E.P. #2a
Type A
E.P. #2
Type A
2nd NORTH LONGWALL PANEL
E. P. #7
Type A
1st NORTH LONGWALL HEADGATE
Affecting Accessibility to Examination Locations
E. P. #6

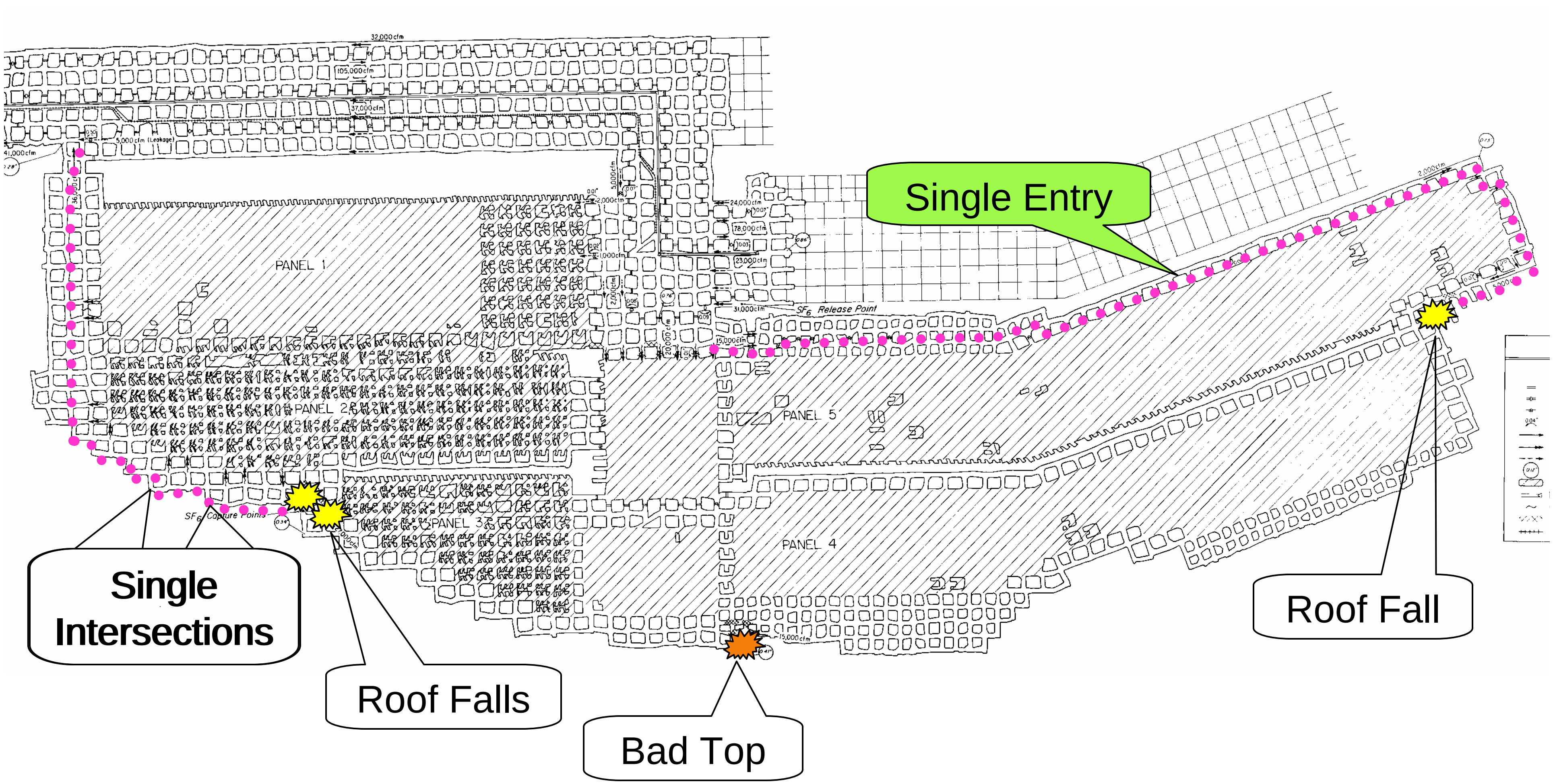
Typical Indicators

- Limited Capacity

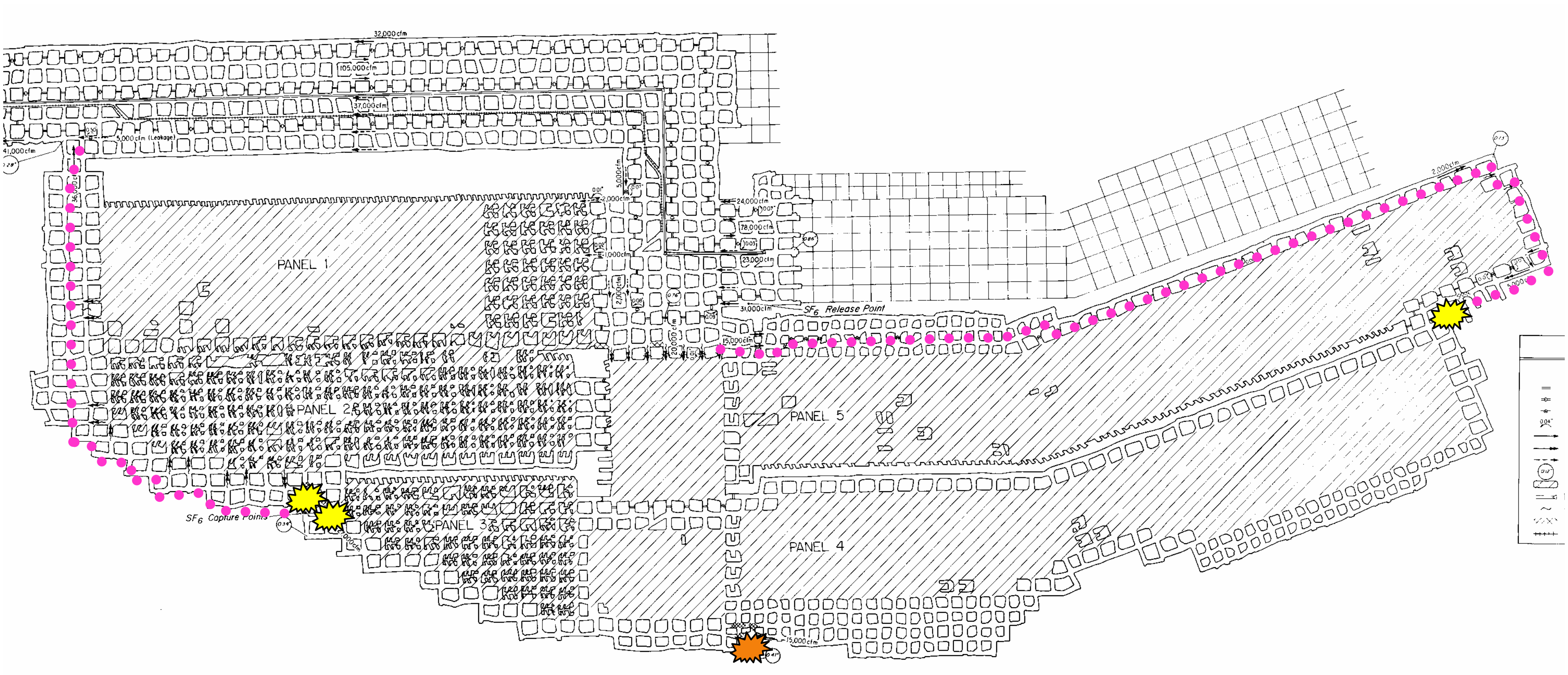
  - Traveling the Bleeder Entries
    - Are they traveled in their entirety? – Why Not?
    - Is supplemental roof support installed?
      - All bleeder entries?
      - Is it adequate?
      - Are there roof falls blocking access or restricting airflow?
    - Are bleeder connectors accessible?
    - Are there water accumulations?

Factors affecting Bleeder System Performance

- Limited Capacity
  - More than One Bleeder Entry?
    - Is the airflow velocity in the bleeder entries high?
      - Is most of the pressure consumed in a single bleeder entry?
      - Is there any reserve capacity should methane liberation exceed expected amounts?
    - One way in – one way out?



Single Entry
Single Intersections
Roof Falls
Bad Top
Roof Fall
PANEL 1
PANEL 2
PANEL 3
PANEL 4
PANEL 5
SF6 Release Point
SF6 Capture Points
32,000 cfm
105,000 cfm
37,000 cfm
5,000 cfm (Leakage)
41,000 cfm
24,000 cfm
78,000 cfm
23,000 cfm
31,000 cfm
15,000 cfm
2,000 cfm



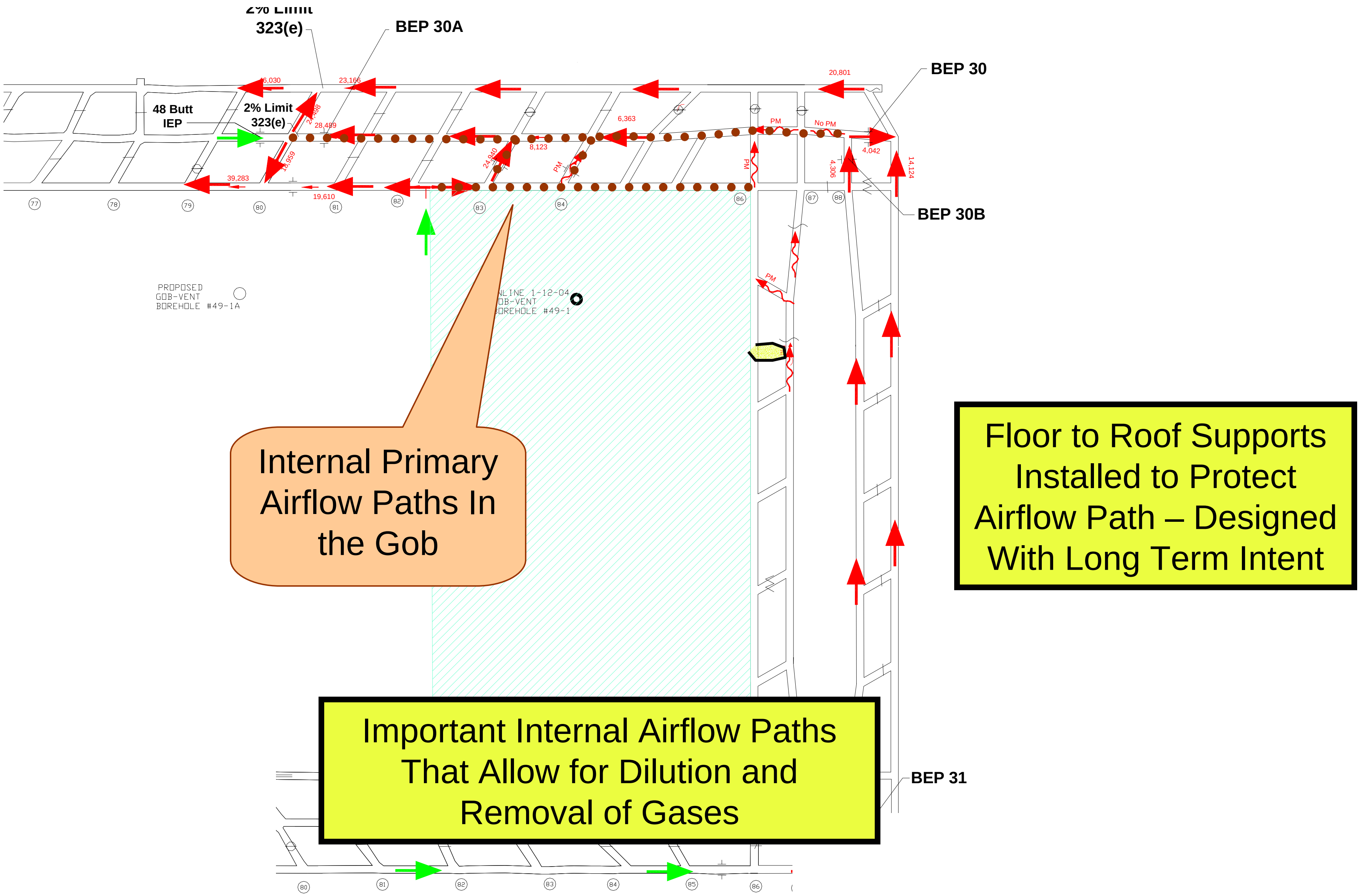
EXPOSURE?

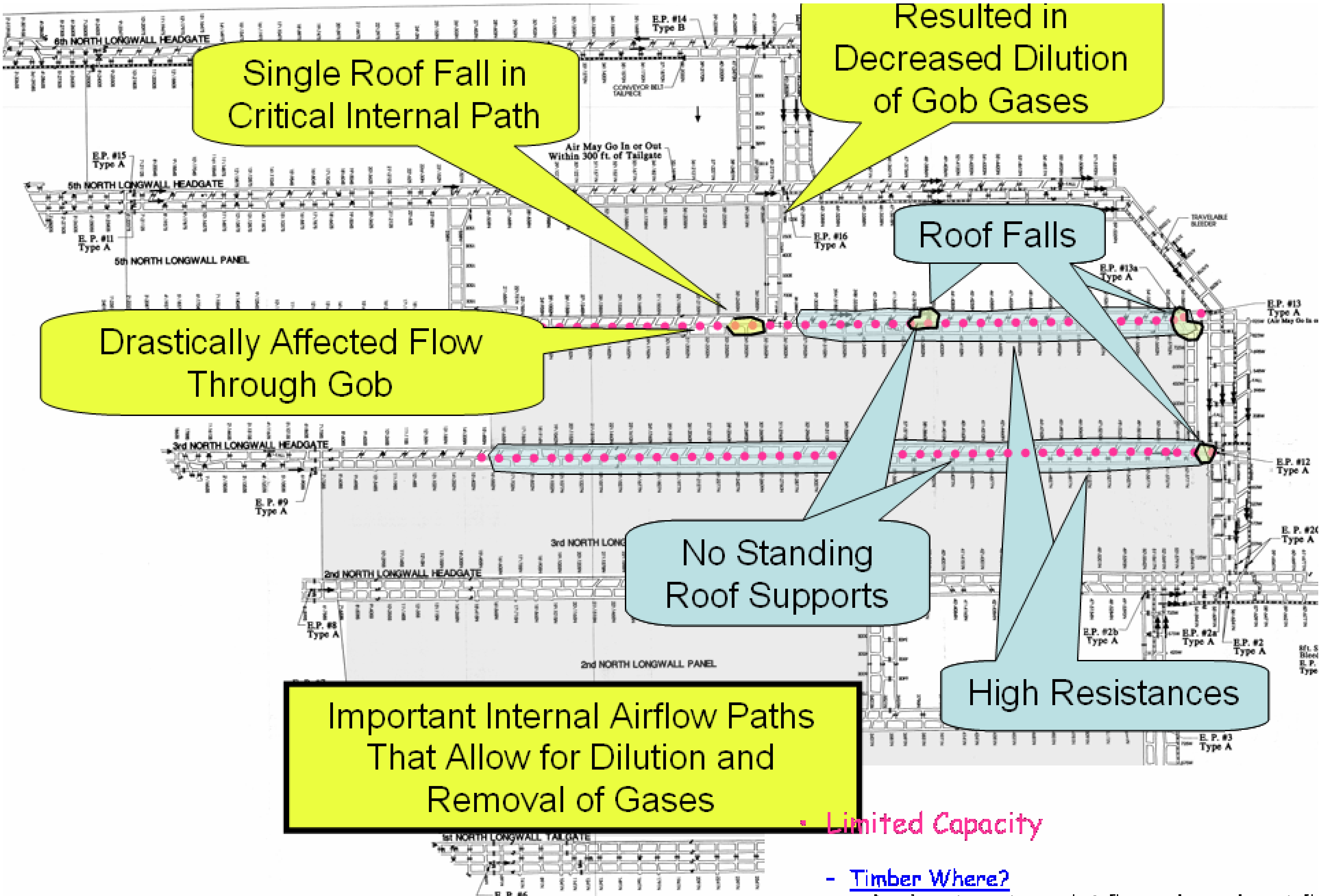
Sustained Access?

Continued Performance?

Factors affecting Bleeder System Performance

- Limited Capacity
  - Timber Where?
    - Do the primary internal airflow paths conduct airflow?
    - Is supplemental roof support installed?
      - Is it adequate?
      - Are there roof falls restricting airflow?

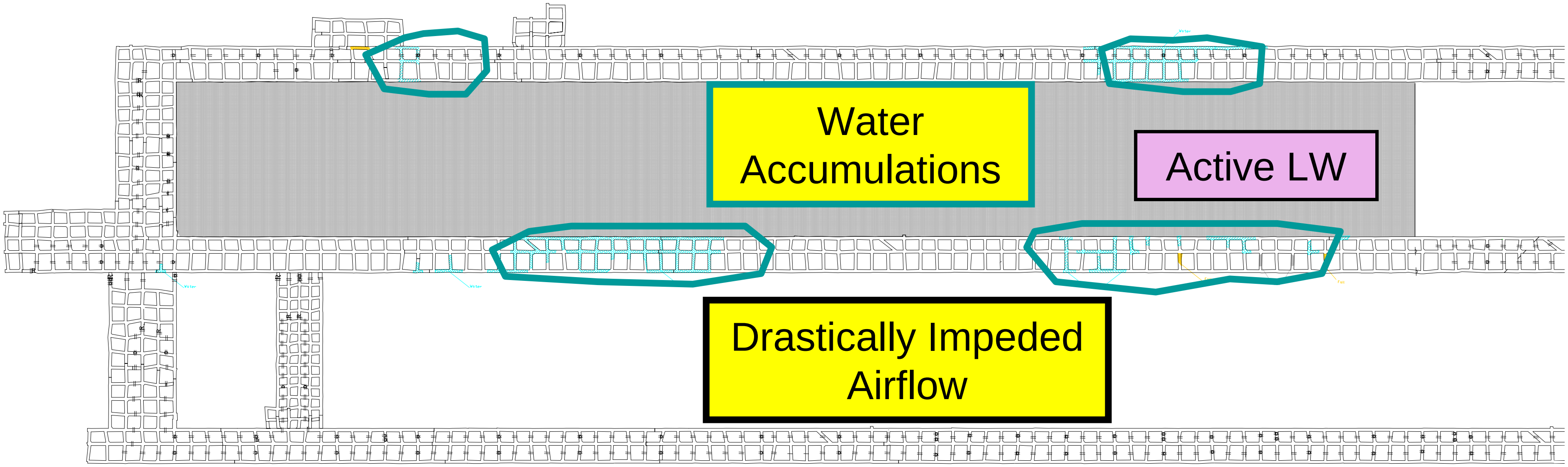

2% Limit
323(e)
BEP 30A
BEP 30
48 Butt
IEP
2% Limit
323(e)
BEP 30B
PROPOSED
GOB-VENT
BOREHOLE #49-1A
Internal Primary Airflow Paths In the Gob
Floor to Roof Supports Installed to Protect Airflow Path – Designed With Long Term Intent
Important Internal Airflow Paths That Allow for Dilution and Removal of Gases
BEP 31
20,801
23,165
39,283
19,610
6,363
8,123
4,042
PM
No PM



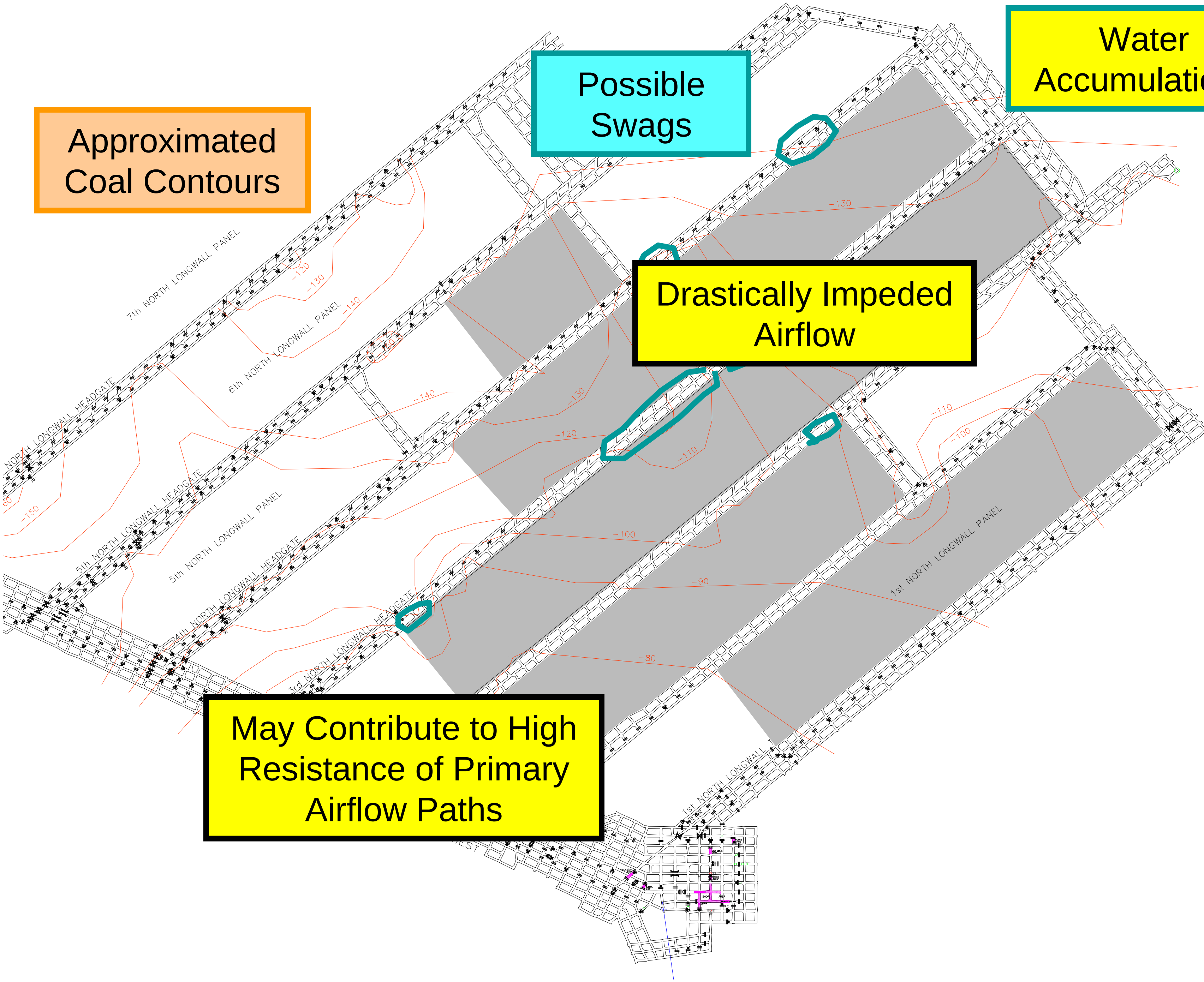
- Limited Capacity
  - Timber Where?
    - Do the primary internal airflow paths conduct airfl
    - Is supplemental roof support installed?
      - Is it adequate?
      - Are there roof falls restricting airflow?

Factors affecting Bleeder System Performance

- Limited Capacity
  - Timber Where?
    - Do the primary internal airflow paths conduct airflow?
    - Is supplemental roof support installed?
      - Is it adequate?
      - Are there roof falls restricting airflow?
    - **Are there water accumulations?**

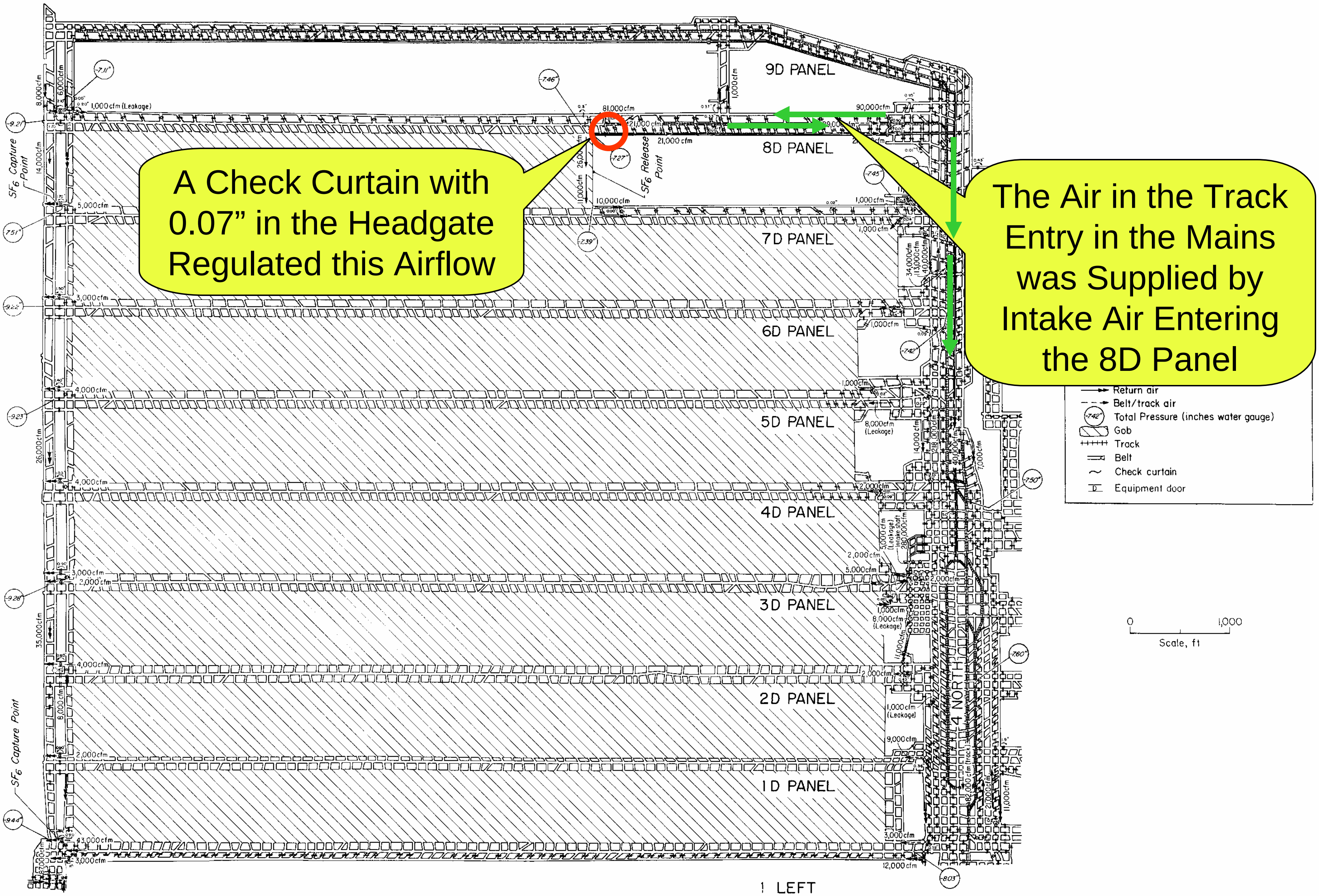


May Contribute to High Resistance of Primary Airflow Paths

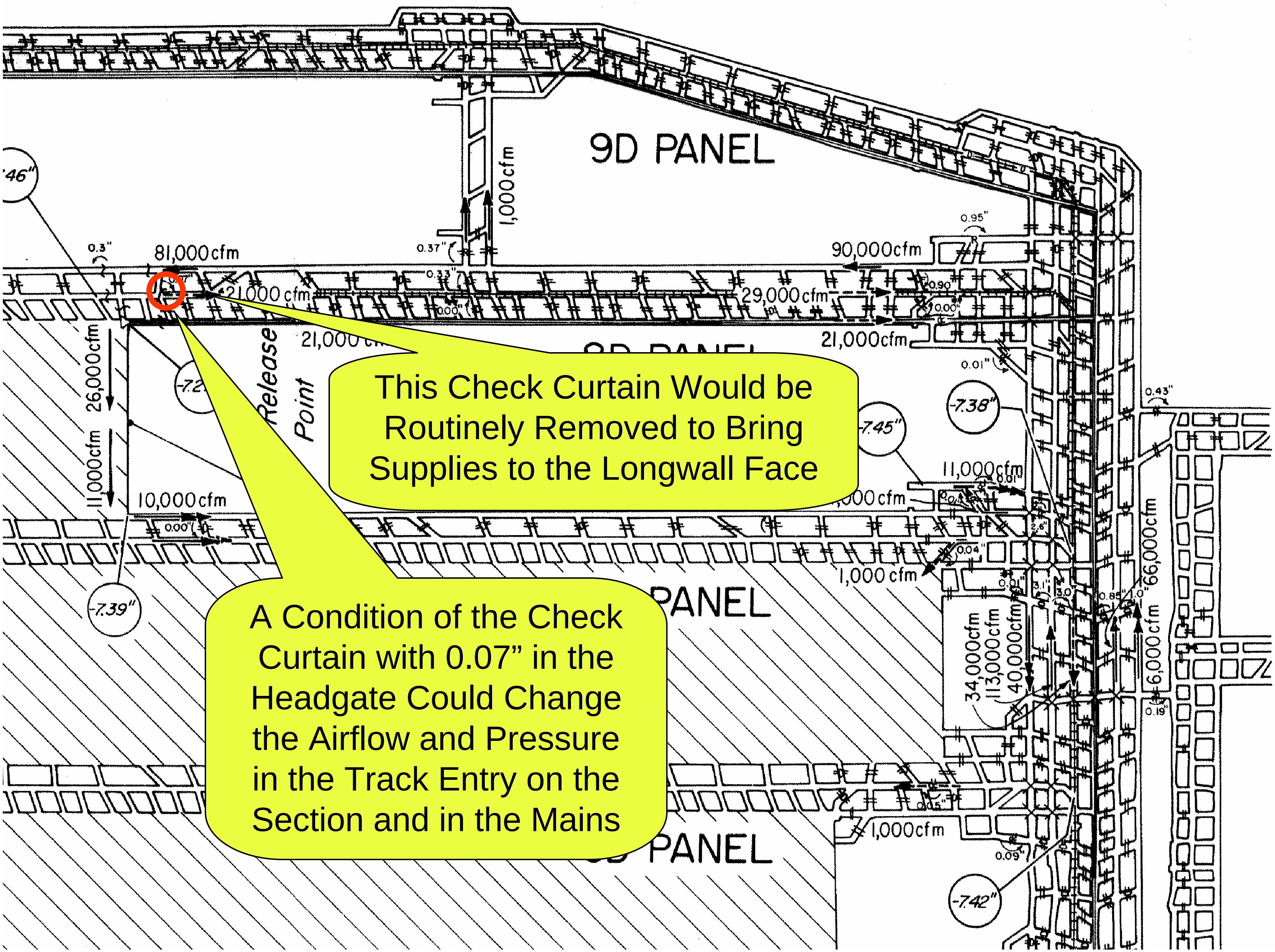

Approximated Coal Contours
Possible Swags
Water Accumulations
Drastically Impeded Airflow
May Contribute to High Resistance of Primary Airflow Paths
7th NORTH LONGWALL PANEL
6th NORTH LONGWALL PANEL
5th NORTH LONGWALL PANEL
1st NORTH LONGWALL PANEL
5th NORTH LONGWALL HEADGATE
4th NORTH LONGWALL HEADGATE
3rd NORTH LONGWALL HEADGATE
-130
-120
-110
-100
-90
-80

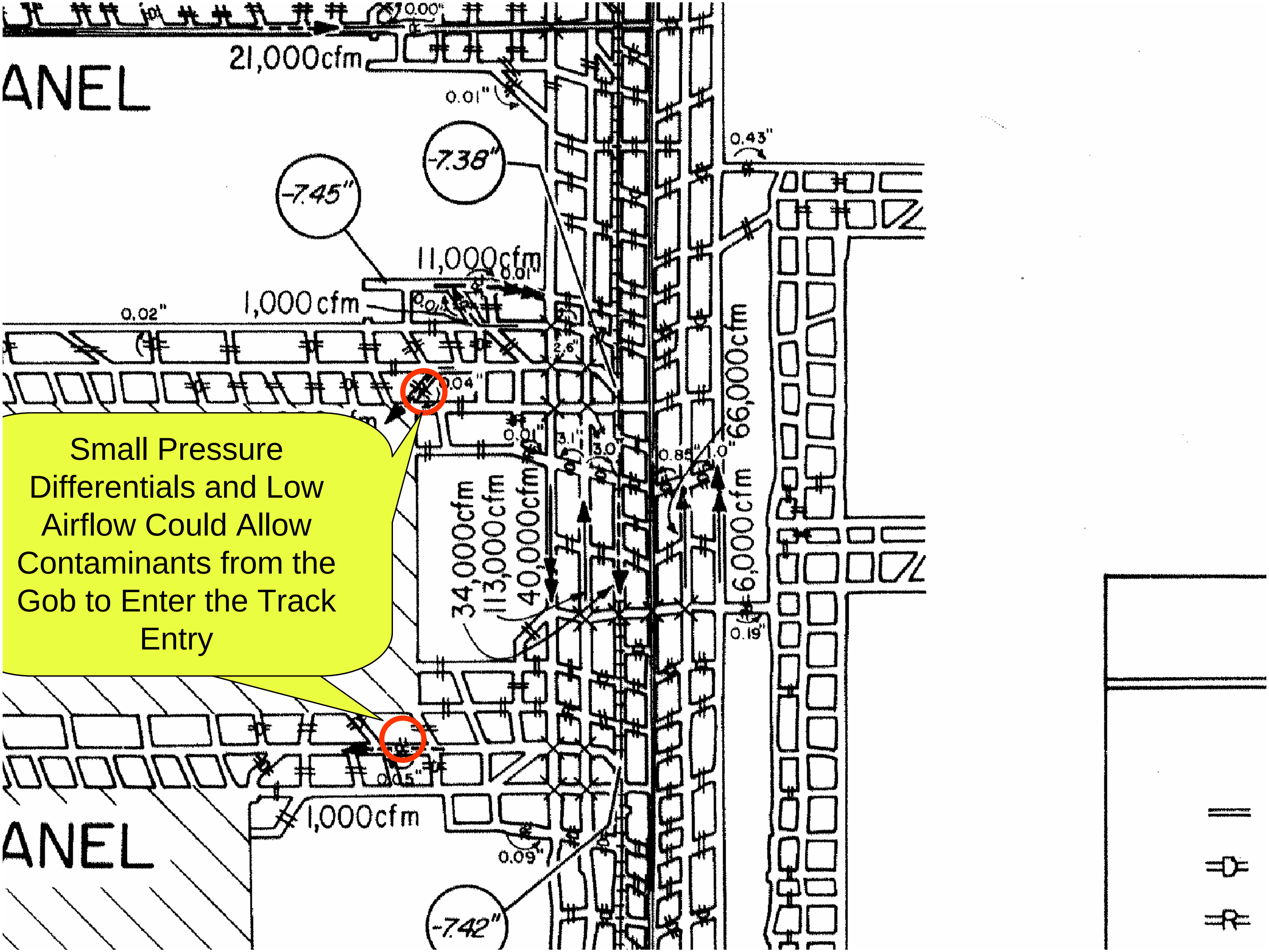
Inlets from Intakes

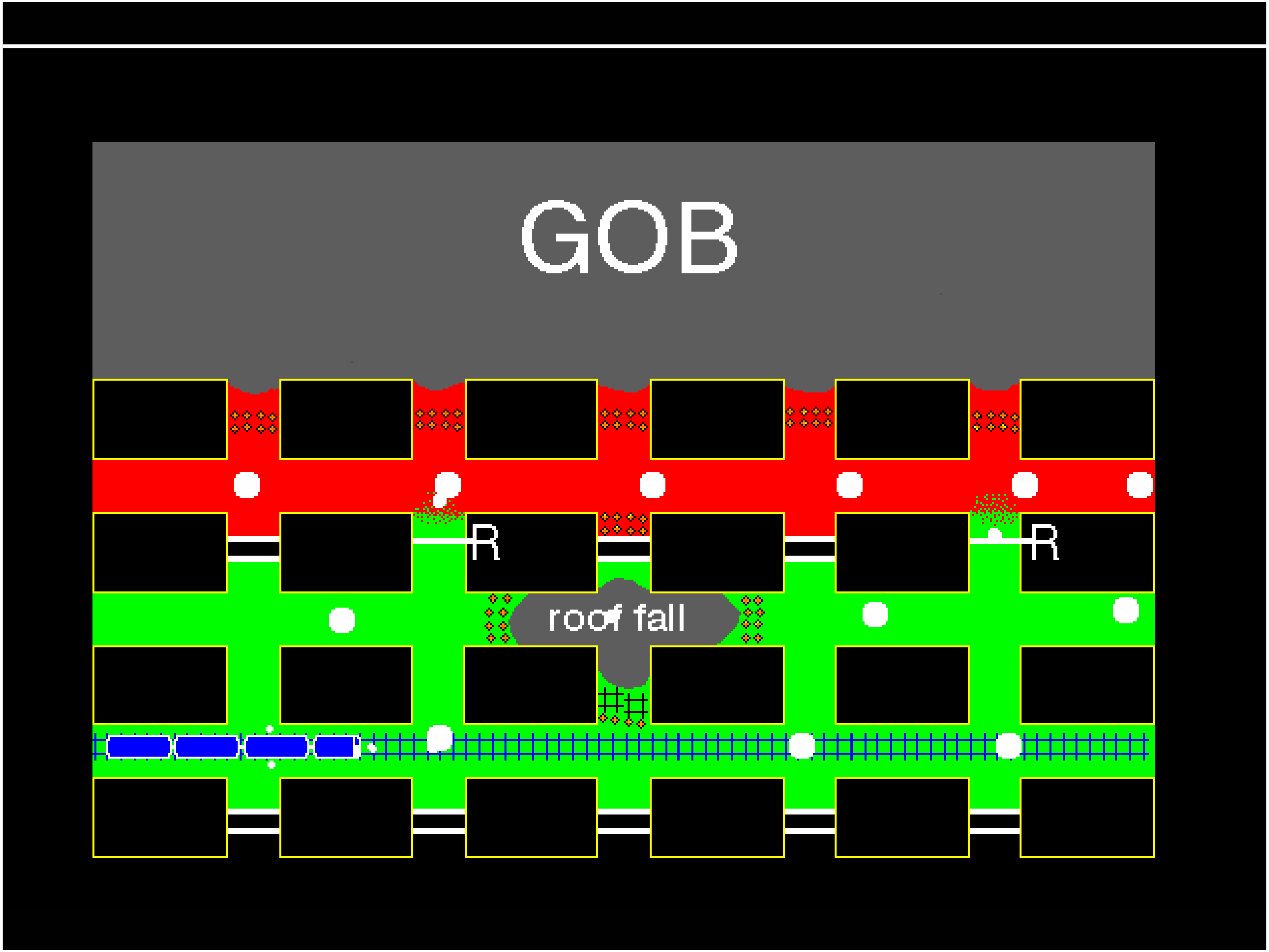
- Low Pressure Differentials
  - Possibly Susceptible to Inadvertent Changes
    - One reported example

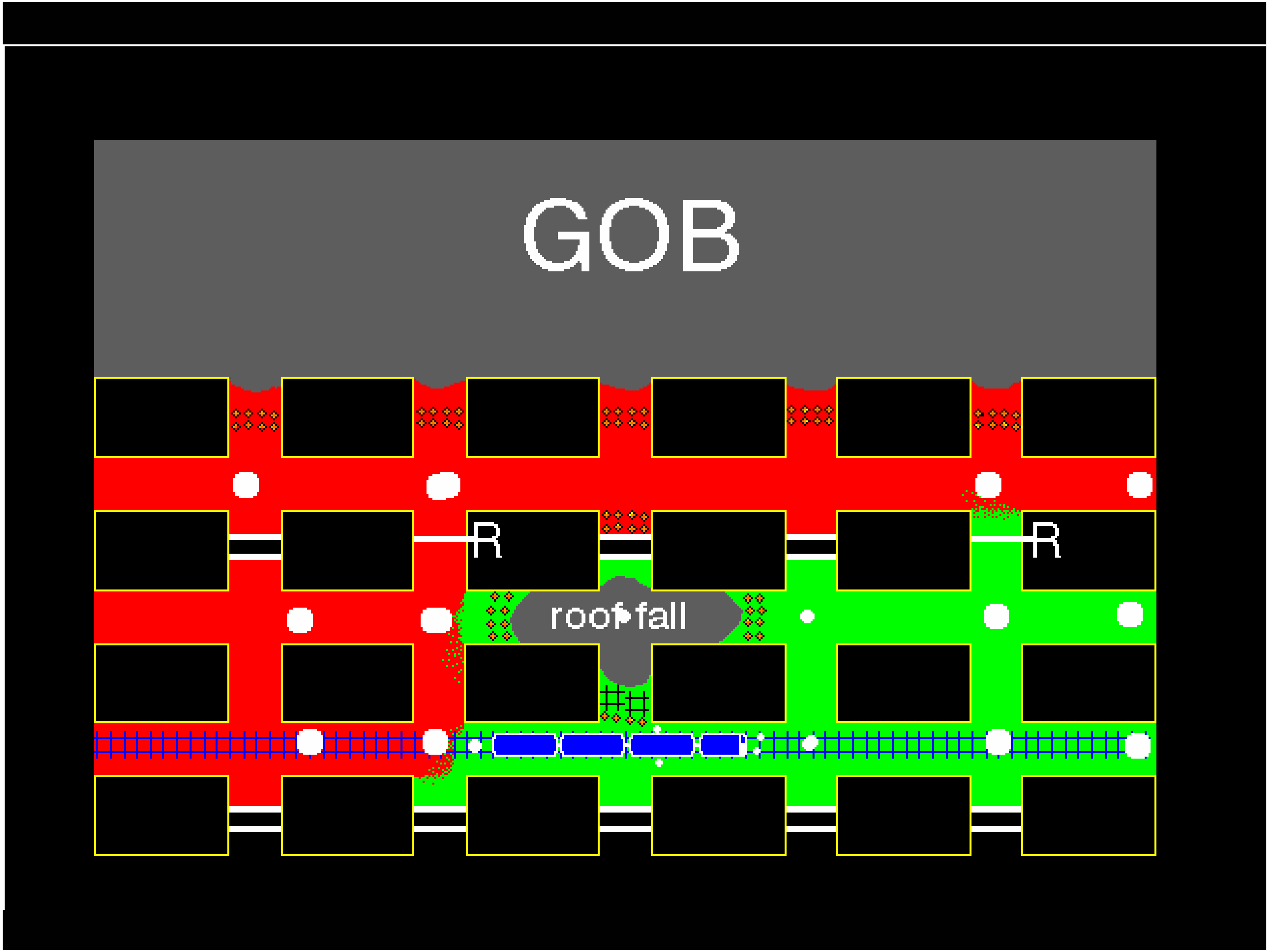


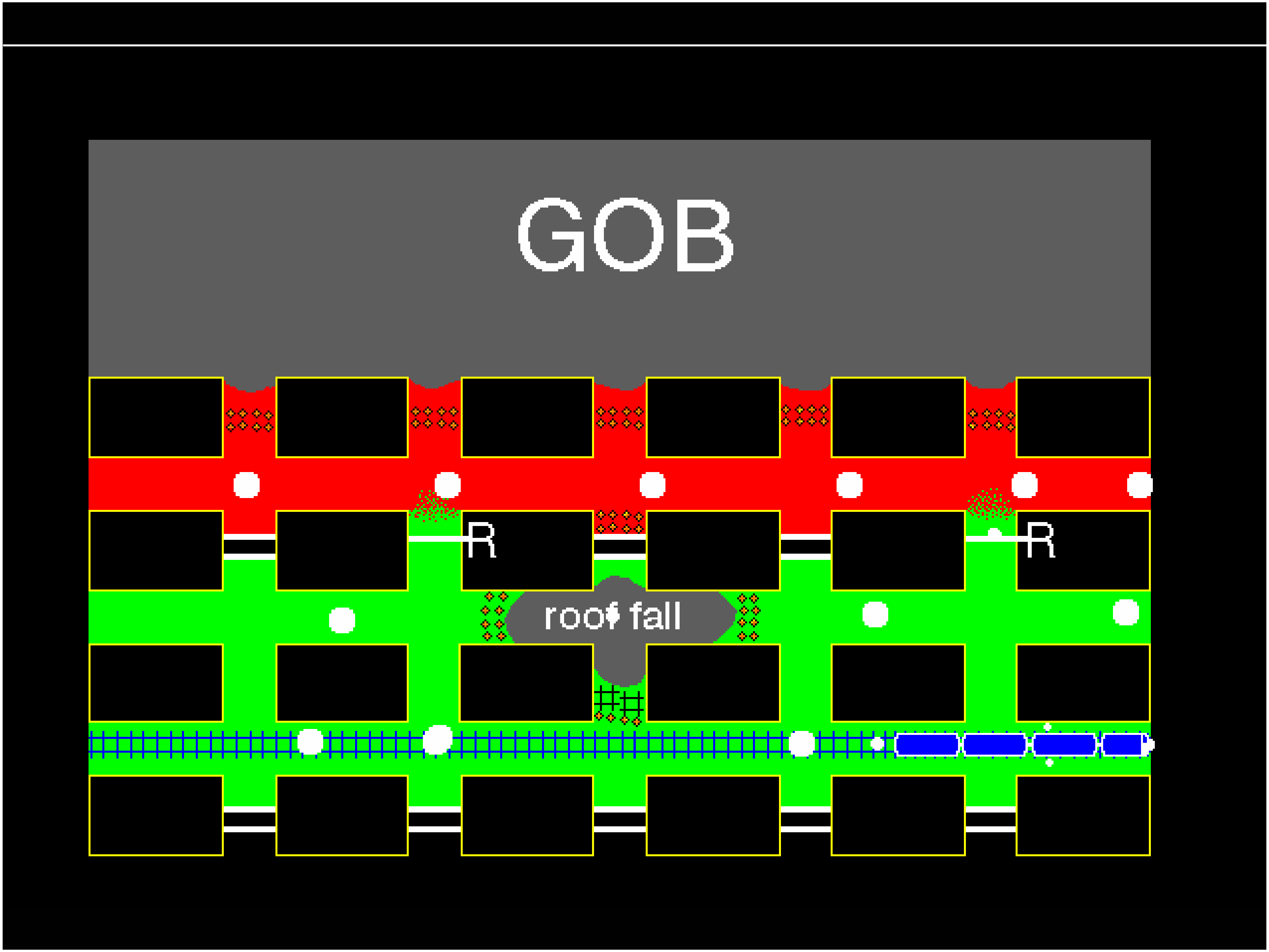
A Check Curtain with 0.07" in the Headgate Regulated this Airflow
The Air in the Track Entry in the Mains was Supplied by Intake Air Entering the 8D Panel
9D PANEL
8D PANEL
7D PANEL
6D PANEL
5D PANEL
4D PANEL
3D PANEL
2D PANEL
1D PANEL
1 LEFT
4 NORTH
SF6 Capture Point
SF6 Release Point
Return air
Belt/track air
Total Pressure (inches water gauge)
Gob
Track
Belt
Check curtain
Equipment door
Scale, ft
0
1,000


9D PANEL
81,000 cfm
90,000 cfm
1,000 cfm
21,000 cfm
29,000 cfm
21,000 cfm
26,000 cfm
11,000 cfm
10,000 cfm
11,000 cfm
1,000 cfm
1,000 cfm
34,000 cfm
113,000 cfm
40,000 cfm
66,000 cfm
6,000 cfm
Release Point
-7.39"
-7.38"
-7.45"
-7.42"
PANEL
PANEL
This Check Curtain Would be Routinely Removed to Bring Supplies to the Longwall Face
A Condition of the Check Curtain with 0.07" in the Headgate Could Change the Airflow and Pressure in the Track Entry on the Section and in the Mains


Small Pressure Differentials and Low Airflow Could Allow Contaminants from the Gob to Enter the Track Entry
ANEL
21,000cfm
0.00"
0.01"
-7.38"
-7.45"
0.43"
11,000cfm
0.01"
1,000 cfm
0.02"
2.6"
0.04"
66,000cfm
0.01"
3.1"
5.0"
0.85"
1.0"
34,000cfm
113,000cfm
40,000cfm
6,000cfm
0.19"
0.05"
1,000cfm
ANEL
0.09"
-7.42"


GOB
R
R
roof fall


GOB
R
R
roof fall


GOB
R
R
roof fall

BEST PRACTICES

Bleeder System Design