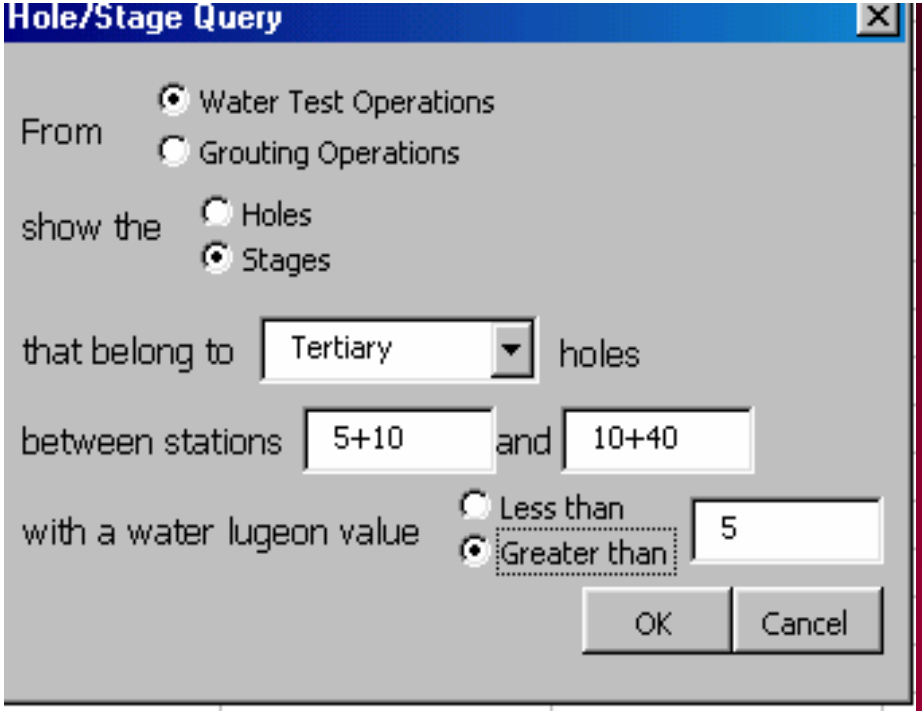
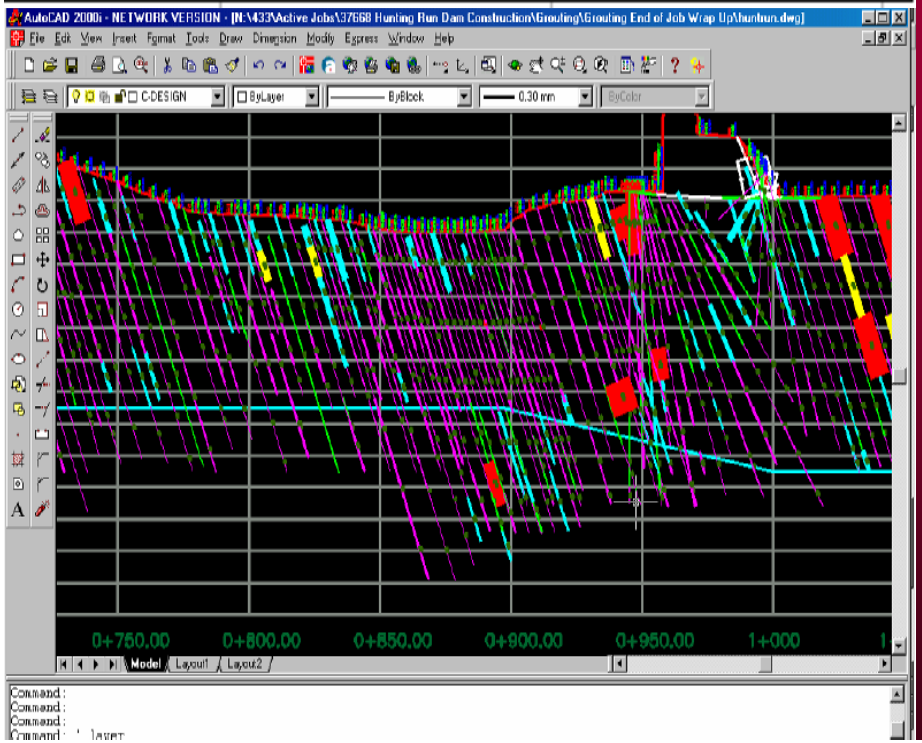




2005 Tri-Service Infrastructure Systems Conference

Re-Energizing Engineering Excellence

State of the Art in Computer Monitoring and Analysis of Grouting

Trent L. Dreese, P.E.
David B. Wilson, P.E.

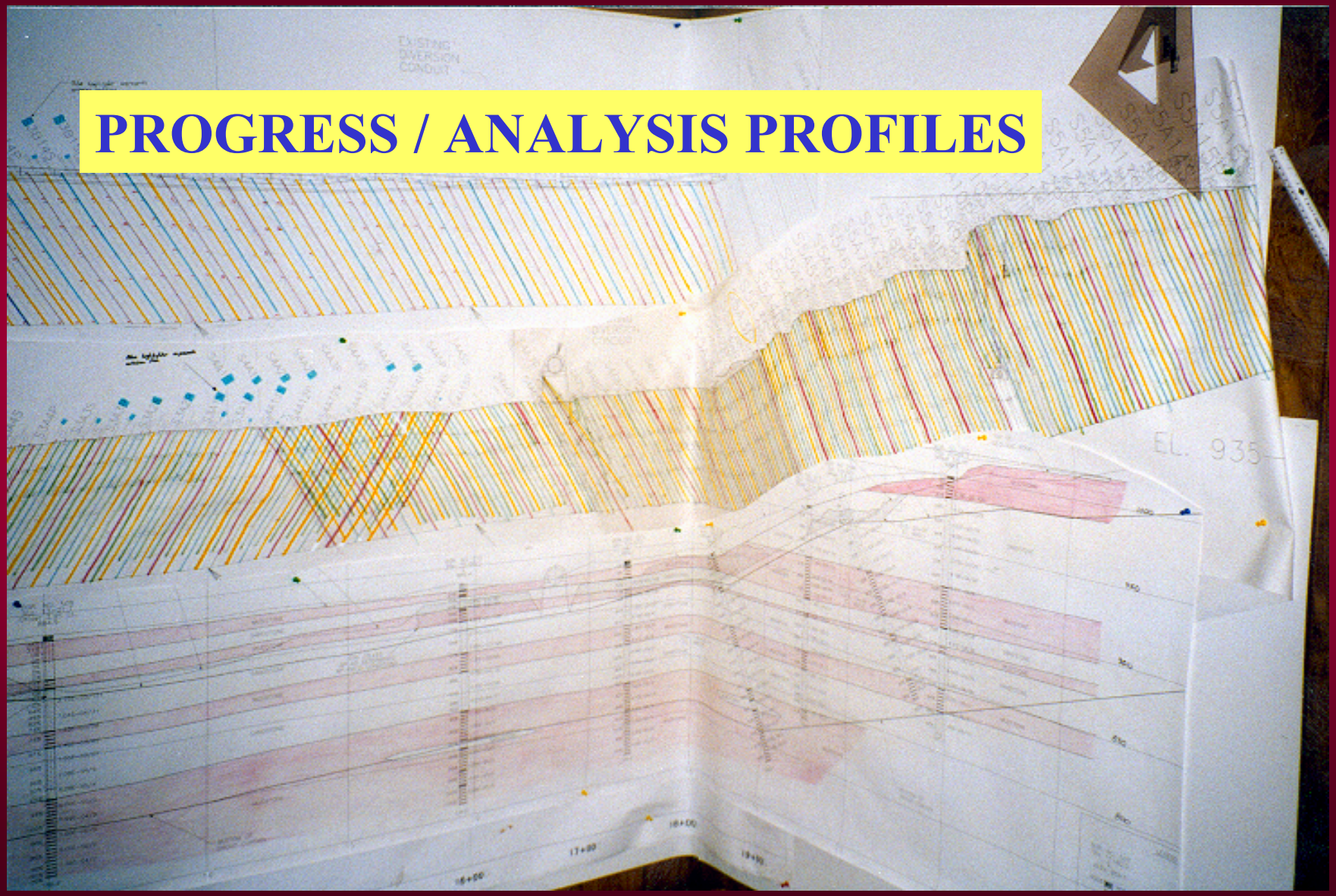
Gannett Fleming
ENGINEERS AND PLANNERS

The Old Way of Grouting

- Qualitative Design
  - Example: Depth of holes equal to height of dam
- Vertical Holes –
  - might or might not be appropriate depending on geology
- Unstable Grouts –
  - Typically neat cement grouts
- Pressures – Based on usually conservative rules of thumb
- Data Acquisition – Dipstick and Gauge Technology
- Data Recording - Inspector at each header manually recording and plotting grout take versus time with average pressure recorded.

Data Collection & Monitoring (2000)

Analysis (2000)



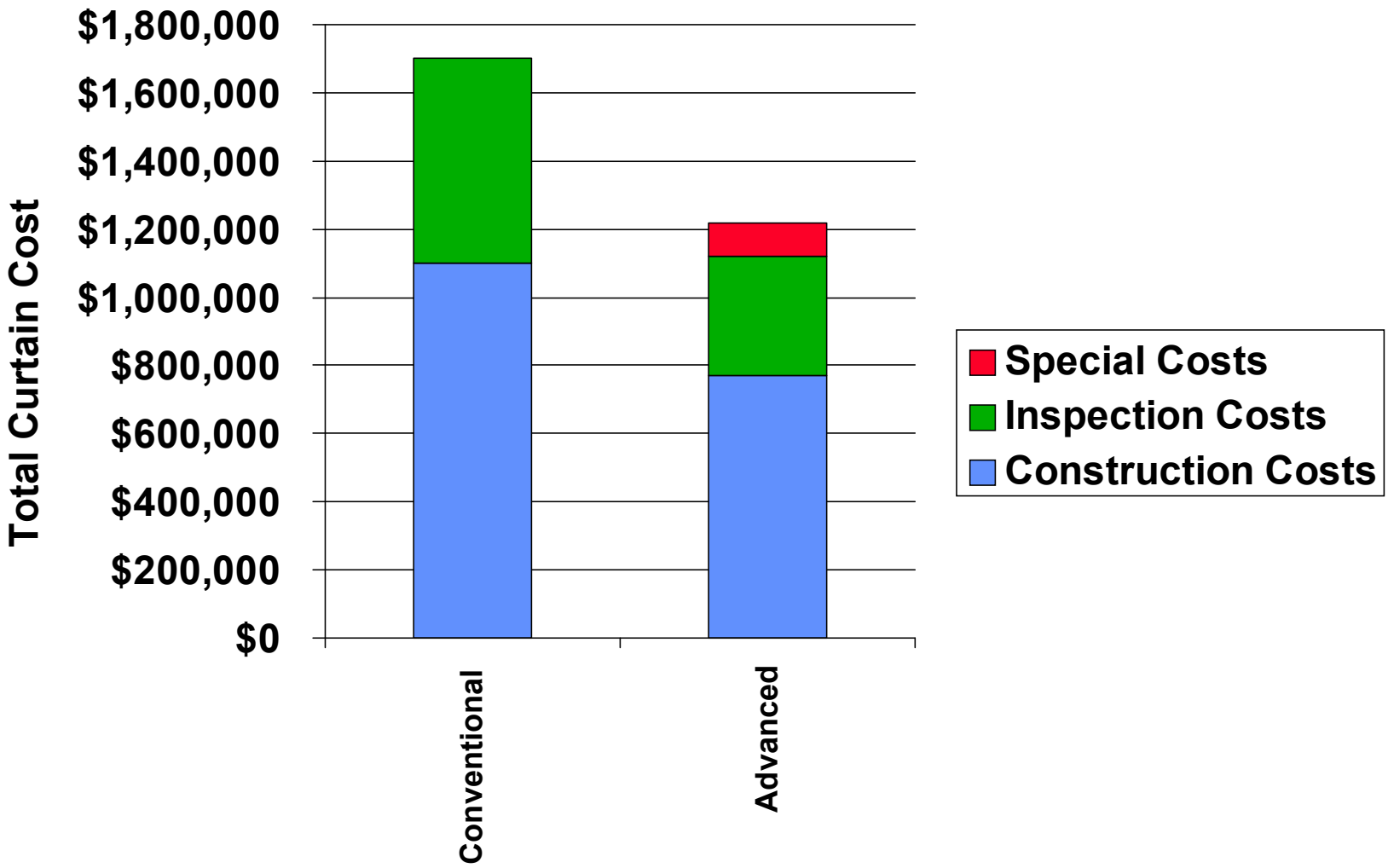
The New Way of Grouting

- Quantitative Design
  - Intensity of Grouting consistent with design assumptions and requirements
- Hole Orientation and Depth selected consistent with site geology
- Stable Grouts with multiple admixtures
- Pressures – Maximum safe pressure utilized
- Data Acquisition – Flowmeters and Pressure Transducers
- Data Recording – Computer Monitoring by experienced Engineer of Geologist

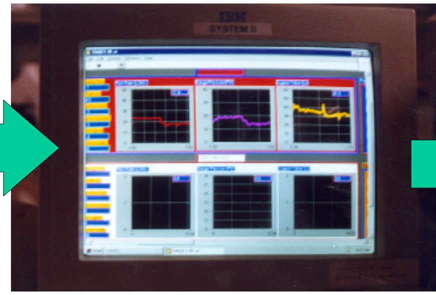
Advantages

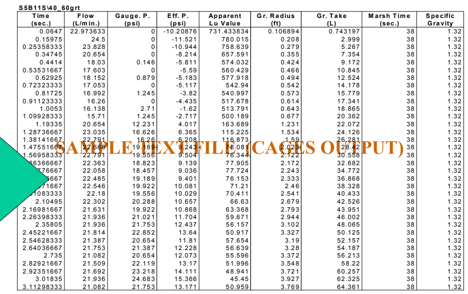
- Measurement Accuracy Significantly Improved
- Real Time Data is obtained (2-10 seconds vs. 5-15 min.)
- Allows one to use higher pressures with confidence; Dilation and Lifting easily picked up on screen
- Formation Response to procedure changes (mix or pressure) are known immediately
- Accelerates the Work
- Reduces Inspection Manpower Requirements
- Permits reallocation of resources to analyze program results and recommend cost effective program modifications.

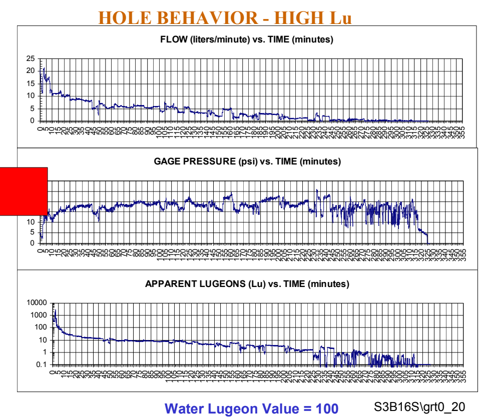
Curtain Total Costs

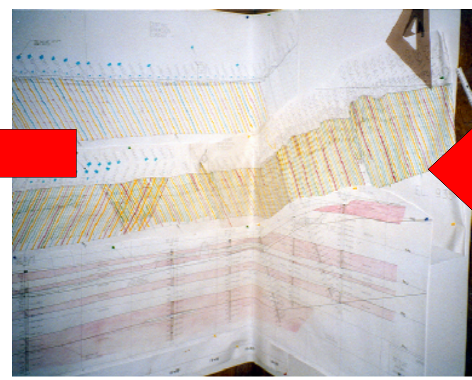


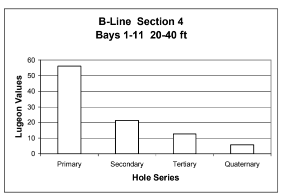
Level 2 Technology

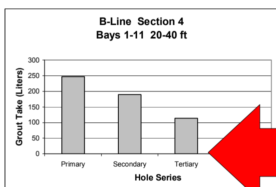


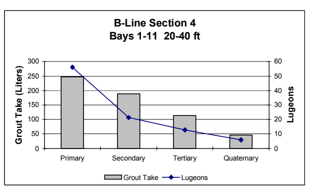












Key:

- Automatically obtained by system
- Obtained with moderate additional effort
- Obtained with significant additional effort

Original CAGES File 2.txt - Notepad

File Edit Format View Help

CAGES Output

Project: Lyman Run Dam

C:\Lyman Run Dam\CS24_100-107.6_GRT.xls
Grouting Date 08\09\2005
Starting Time 10:54 AM

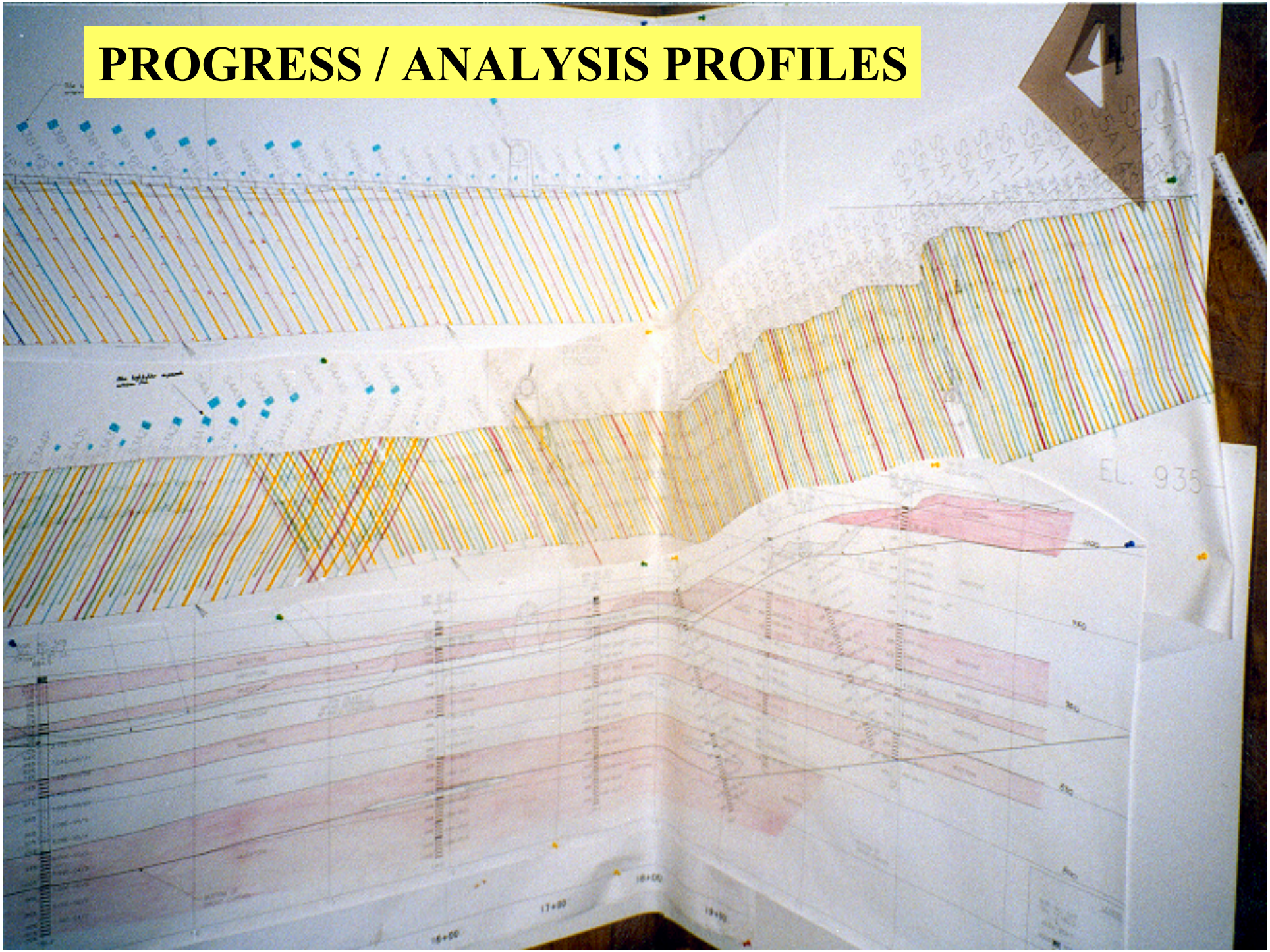
Unit Type: US Standard
Grouting Type: Rock Grouting

Comments:

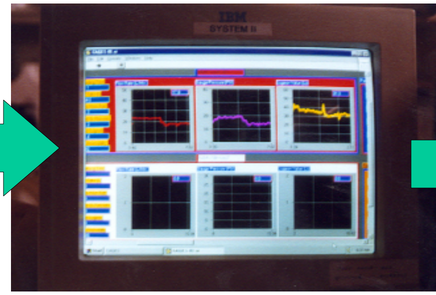
Accessible Porosity	Lugeon Start	Lugeon End	Stage Length (ft)	Packer Depth (ft)	Water Lu	Gauge Ht. (ft)	Hole Ht. (ft)	H. Plunge (deg)	G.W.Table (ft)	Hole Dia. (in)
0.75 180 360	7.6 100 18	4.5 0 80	-9.7 3							

Elapsed Time (secs)	Time	Flow (gpm)	Gauge P. (psi)	Eff P. (psi)	App. Lugeon	Gr Radius (ft)	Gr Take (ft3)	Marsh Time	Mix S.G.	Mix	Init. Lugeon	Init Amenability
4.994 10:54:55 AM	0 1.239719	16.607795	0 0	0 38	1.4 Mix A	0 0						
9.925 10:55:00 AM	0 1.280615	16.648692	0 0	0 38	1.4 Mix A	0 0						
14.899 10:55:05 AM	0 1.178473	16.54651	0 0	0 38	1.4 Mix A	0 0						
20.001 10:55:10 AM	0 1.226538	16.594575	0 0	0 38	1.4 Mix A	0 0						
24.984 10:55:15 AM	0 1.244559	16.612596	0 0	0 38	1.4 Mix A	0 0						
29.926 10:55:20 AM	0 1.226538	16.594575	0 0	0 38	1.4 Mix A	0 0						
34.887 10:55:25 AM	0 4.286663	19.654699	0 0	0 38	1.4 Mix A	0 0						
40.001 10:55:30 AM	0.4683 4.200621	19.282994	7.664959	0.528367	0.005336	38	1.4	Mix A	0	0		
44.964 10:55:35 AM	1.237083 4.212635	18.826051	20.73956	0.99743	0.019015	38	1.4	Mix A	0	0		
49.926 10:55:40 AM	1.23802 5.378234	19.991079	19.545707	1.308147	0.032707	38	1.4	Mix A	0	0		
54.889 10:55:45 AM	1.237812 5.474364	20.087338	19.448774	1.317909	0.046389	38	1.4	Mix A	0	0		
60.003 10:55:50 AM	1.684798 5.498399	19.810909	28.469212	1.849196	0.061358	38	1.4	Mix A	0	0		
64.964 10:55:55 AM	1.685714 5.483152	19.617312	28.480881	1.991149	0.082739	38	1.4	Mix A	0	0		
69.93 10:56:00 AM	1.686631 4.729342	18.684364	27.463431	2.311362	0.102108	38	1.4	Mix A	0	0		
74.892 10:56:05 AM	1.660111 4.732948	19.088317	27.449179	2.510504	0.120462	38	1.4	Mix A	0	0		
80.005 10:56:10 AM	10.10297 4.719728	13.924953	228.989346	3.510586	0.235553	38	1.4	Mix A	0	0		
84.967 10:56:15 AM	10.10149 4.747367	13.952276	228.552709	4.262424	0.347251	38	1.4	Mix A	0	0		
89.93 10:56:20 AM	10.103052 4.81346 14.017415	227.523768	4.900448	0.458988	38	1.4	Mix A	0	0			
94.894 10:56:25 AM	10.107637 4.829078	14.031444	227.356859	5.464723	0.570776	38	1.4	Mix A	0	0		
100.003 10:56:30 AM	10.86113 4.81346 13.516207	252.869674	6.02757 0.694407	38	1.4	Mix A	0	0				
104.969 10:56:35 AM	10.863108 0	8.741541	392.216688	6.528406	0.814599	38	1.4	Mix A	0	0		
109.932 10:56:40 AM	10.861964 0	8.748338	391.109887	8.992734	0.934595	38	1.4	Mix A	0	0		
114.894 10:56:45 AM	0 0	15.368037 0	8.992734	0.934595	38	1.4	Mix A	0	0			
120.007 10:56:50 AM	0 0	15.368037 0	8.992734	0.934595	38	1.4	Mix A	0	0			
124.969 10:56:55 AM	0 0	15.368037 0	8.992734	0.934595	38	1.4	Mix A	0	0			
129.933 10:57:00 AM	0 0	15.368037 0	8.992734	0.934595	38	1.4	Mix A	0	0			
134.896 10:57:05 AM	2.91922 0	13.648312 65.194361	7.1084	0.965769	38	1.4	Mix A	0	0			
140.01 10:57:10 AM	2.820262 0	13.647677 65.221486	7.225691	0.997903	38	1.4	Mix A	0	0			
144.969 10:57:15 AM	2.817658	14.084168 27.733433	32.065989	7.337534	1.029035	38	1.4	Mix A	0	0		
149.933 10:57:20 AM	0 14.069751	29.437788 0	7.337534	1.029035	38	1.4	Mix A	0	0			
154.895 10:57:25 AM	0 14.082968	29.451005 0	7.337534	1.029035	38	1.4	Mix A	0	0			
160.01 10:57:30 AM	0 16.581196	31.949233 0	7.337534	1.029035	38	1.4	Mix A	0	0			
164.973 10:57:35 AM	0 16.582398	31.950434 0	7.337534	1.029035	38	1.4	Mix A	0	0			
169.933 10:57:40 AM	0 16.583599	31.951635 0	7.337534	1.029035	38	1.4	Mix A	0	0			
174.899 10:57:45 AM	0 18.589606	31.957643 0	7.337534	1.029035	38	1.4	Mix A	0	0			
180.012 10:57:50 AM	0 25.306361	40.674398 0	7.337534	1.029035	38	1.4	Mix A	0	0			
184.972 10:57:55 AM	0 25.313569	40.681606 0	7.337534	1.029035	38	1.4	Mix A	0	0			
189.937 10:58:00 AM	0 25.289541	40.657578 0	7.337534	1.029035	38	1.4	Mix A	0	0			
194.997 10:58:05 AM	0 35.34132	50.709357 0	7.337534	1.029035	38	1.4	Mix A	0	0			
200.01 10:58:10 AM	0 34.926757	50.294793 0	7.337534	1.029035	38	1.4	Mix A	0	0			
204.976 10:58:15 AM	0.013092 34.92075	50.2808 0.082179	7.338051	1.029179	38	1.4	Mix A	0.017659	0.001104			
209.937 10:58:20 AM	0.012363 34.926737	50.287232 0.077594	7.338538	1.029316	38	1.4	Mix A	0.028252	0.001766			
214.9 10:58:25 AM	0.01455 42.563229	57.92239 0.079283	7.339111	1.029477	38	1.4	Mix A	0.036887	0.002305			
220.014 10:58:30 AM	0.012467 42.593273	57.953705 0.067898	7.339618	1.029619	38	1.4	Mix A	0.041493	0.002593			
224.976 10:58:35 AM	2.530745 42.628121	56.452403 14.149005	7.438671	1.057597	38	1.4	Mix A	1.778182	0.111136			
229.94 10:58:40 AM	2.532827 44.335695	58.158668 13.745201	7.536541	1.085161 38	1.4	Mix A	3.125557	0.195347				
234.9 10:58:45 AM	2.531266 48.826215	62.65018 12.731913	7.633019	1.113382	38	1.4	Mix A	4.166081	0.260379			
240.013 10:58:50 AM	3.178113 48.82742	62.216564 18.113831	7.716123	1.149791	38	1.4	Mix A	5.317083	0.332818			
244.98 10:58:55 AM	3.147771 49.819007	63.207209 15.913718	7.87272 1.184621	38	1.4	Mix A	6.29272	0.393294				
248.943 10:59:00 AM	3.145187 52.361069	65.814541 15.082892	7.98744	1.219389	38	1.4	Mix A	7.042341	0.440159			
254.903 10:59:05 AM	3.144667 54.739527	68.189317 14.555202	8.100464	1.25415 38	1.4	Mix A	7.652263	0.478266				
260.019 10:59:10 AM	2.204257 54.741932	68.765372 10.117015	8.181203	1.279275	38	1.4	Mix A	7.844137	0.490259			
264.981 10:59:15 AM	2.202727 54.729911	68.753668 10.115348	8.259738	1.303639	38	1.4	Mix A	8.003629	0.500227			
269.943 10:59:20 AM	2.205403 22.555792	36.578333 19.029245	8.335611	1.32802 38	1.4	Mix A	8.400565	0.525084				

PROGRESS / ANALYSIS PROFILES



Level 3 Technology

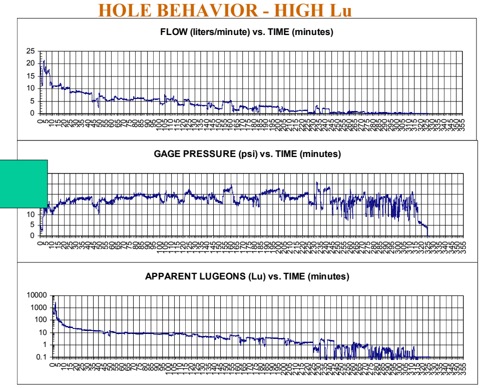


S5B11S\40_60grt

Time (sec.)	Flow (L/min.)	Gauge. P. (psi)	Eff. P. (psi)	Apparent Lu Value	Gr. Radius (ft)	Gr. Take (L)	Marsh Time (sec.)	Specific Gravity
0.0647	22.973633	0	-10.20876	731.433834	0.106894	0.743197	38	1.32
0.15975	24.5	0	-11.521	780.015	0.208	2.999	38	1.32
0.25358333	23.828	0	-10.944	758.639	0.279	5.267	38	1.32
0.34745	20.654	0	-8.214	657.591	0.355	7.354	38	1.32
0.4414	18.03	0.146	-5.811	574.032	0.424	9.172	38	1.32
0.53531667	17.603	0	-5.59	560.429	0.466	10.845	38	1.32
0.62925	18.152	0.879	-5.183	577.918	0.494	12.524	38	1.32
0.72323333	17.053	0	-5.117	542.94	0.542	14.178	38	1.32
0.81725	16.992	1.245	-3.82	540.997	0.573	15.779	38	1.32
0.91123333	16.26	0	-4.435	517.678	0.614	17.341	38	1.32
1.0053	16.138	2.71	-1.62	513.791	0.643	18.865	38	1.32
1.09928333	15.71	1.245	-2.717	500.189	0.677	20.362	38	1.32
1.19335	20.654	12.231	4.017	163.689	1.231	22.072	38	1.32
1.28736667	23.035	16.626	6.365	115.225	1.534	24.126	38	1.32
1.38141667	22.791	16.26	6.208	116.873	1.59	26.281	38	1.32
1.47551667	22.668	19.189	9.243	78.081	2.023	28.42	38	1.32
1.56958333	22.791	19.556	9.504	76.344	2.122	30.558	38	1.32
[illegible]66366667	22.363	18.823	9.139	77.905	2.172	32.682	38	1.32
[illegible]76667	22.058	18.457	9.036	77.724	2.243	34.772	38	1.32
[illegible]667	22.485	19.189	9.401	76.153	2.333	36.868	38	1.32
[illegible]71667	22.546	19.922	10.081	71.21	2.46	38.328	38	1.32
[illegible]1083333	22.18	19.556	10.029	70.411	2.541	40.433	38	1.32
2.10495	22.302	20.288	10.657	66.63	2.679	42.526	38	1.32
2.16981667	21.631	19.922	10.868	63.368	2.793	43.951	38	1.32
2.26398333	21.936	21.021	11.704	59.671	2.944	46.002	38	1.32
2.35805	21.936	21.753	12.437	56.157	3.102	48.065	38	1.32
2.45221667	21.814	22.852	13.64	50.917	3.327	50.125	38	1.32
2.54628333	21.387	20.654	11.81	57.654	3.19	52.157	38	1.32
2.64036667	21.753	21.387	12.228	56.639	3.28	54.187	38	1.32
2.735	21.082	20.654	12.073	55.596	3.372	56.213	38	1.32
2.82921667	21.509	22.119	13.17	51.996	3.548	58.22	38	1.32
2.92351667	21.692	23.218	14.111	48.941	3.721	60.257	38	1.32
3.01835	21.936	24.683	15.366	45.45	3.927	62.325	38	1.32
3.11298333	21.082	21.753	13.171	50.959	3.769	64.361	38	1.32

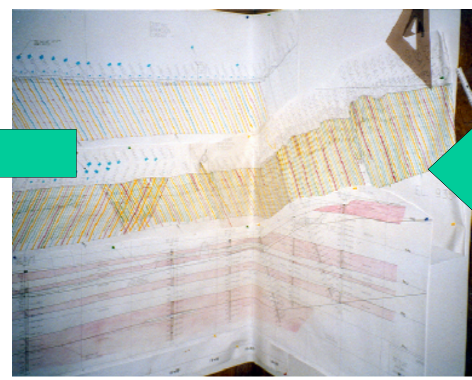
SAMPLE TEXT FILE (CAGES OUTPUT)

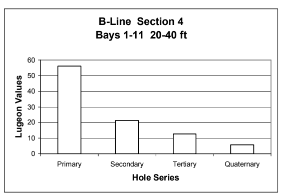
HOLE BEHAVIOR - HIGH Lu

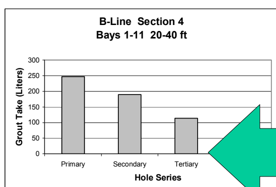


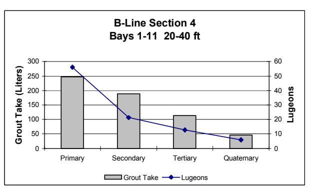
Water Lugeon Value = 100

S3B16S\grt0_20





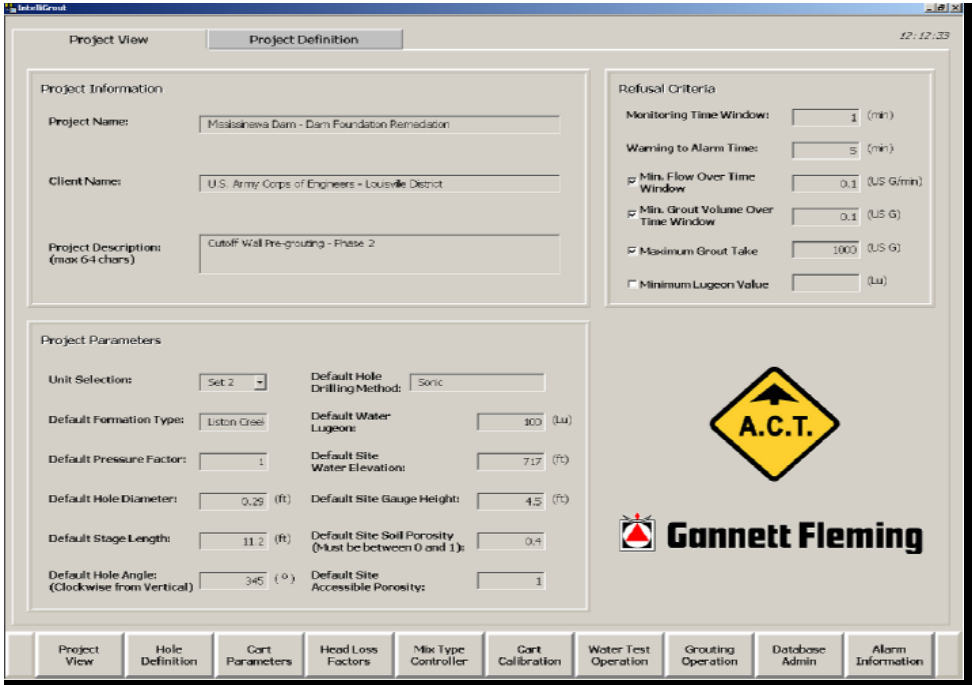


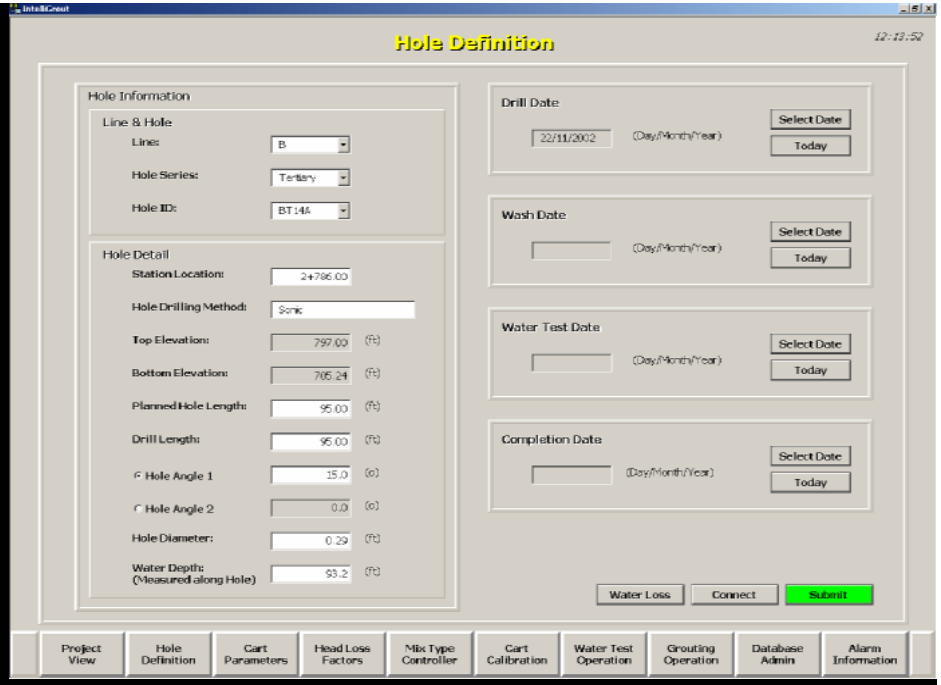


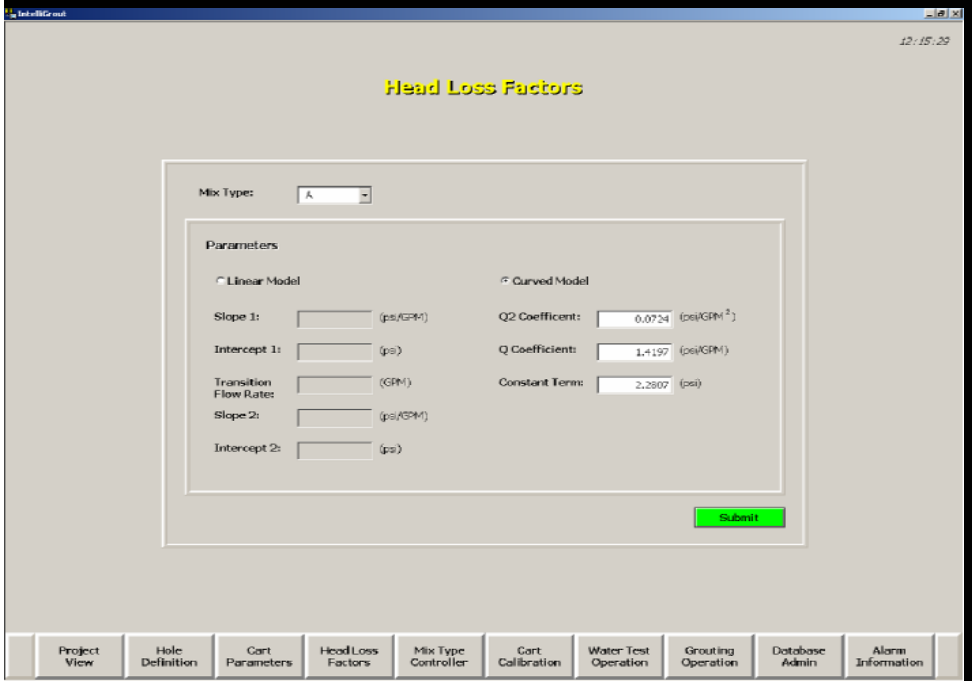
Key:

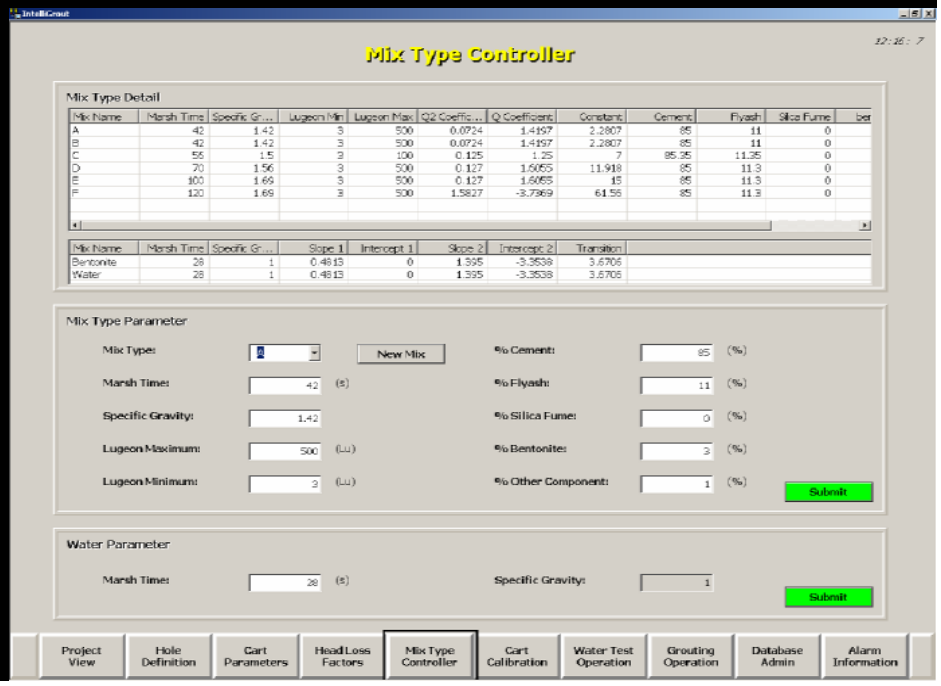
- Automatically obtained by system (green)
- Obtained with moderate additional effort (yellow)
- Obtained with significant additional effort (red)

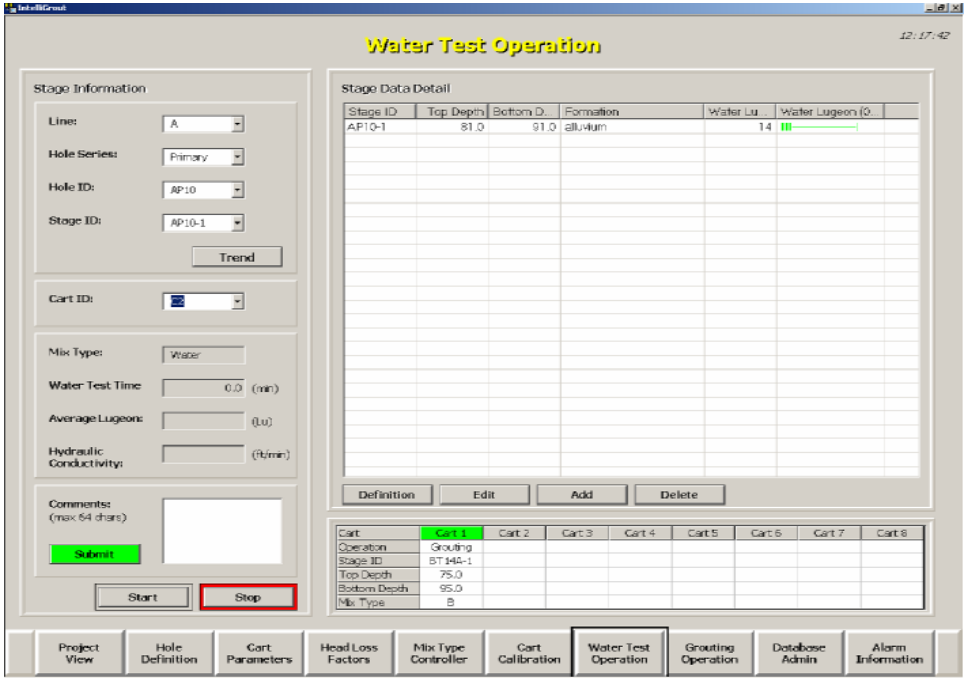

01/06/2003

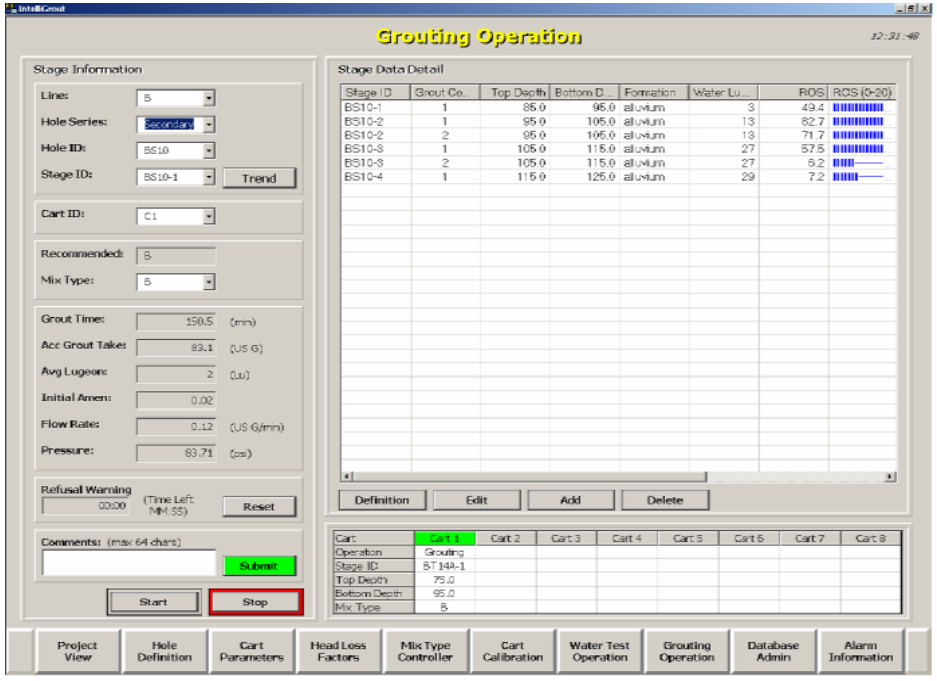

Project View
Project Definition
12:12:33
Project Information
Project Name:
Mississinewa Dam - Dam Foundation Remediation
Client Name:
U.S. Army Corps of Engineers - Louisville District
Project Description: (max 64 chars)
Cutoff Wall Pre-grouting - Phase 2
Refusal Criteria
Monitoring Time Window:
Warning to Alarm Time:
Min. Flow Over Time Window
Min. Grout Volume Over Time Window
Maximum Grout Take
Minimum Lugeon Value
Project Parameters
Unit Selection:
Default Hole Drilling Method:
Default Formation Type:
Default Water Lugeon:
Default Pressure Factor:
Default Site Water Elevation:
Default Hole Diameter:
Default Site Gauge Height:
Default Stage Length:
Default Site Soil Porosity (Must be between 0 and 1):
Default Hole Angle: (Clockwise from Vertical)
Default Site Accessible Porosity:
A.C.T.
Gannett Fleming
Project View
Hole Definition
Cart Parameters
Head Loss Factors
Mix Type Controller
Cart Calibration
Water Test Operation
Grouting Operation
Database Admin
Alarm Information

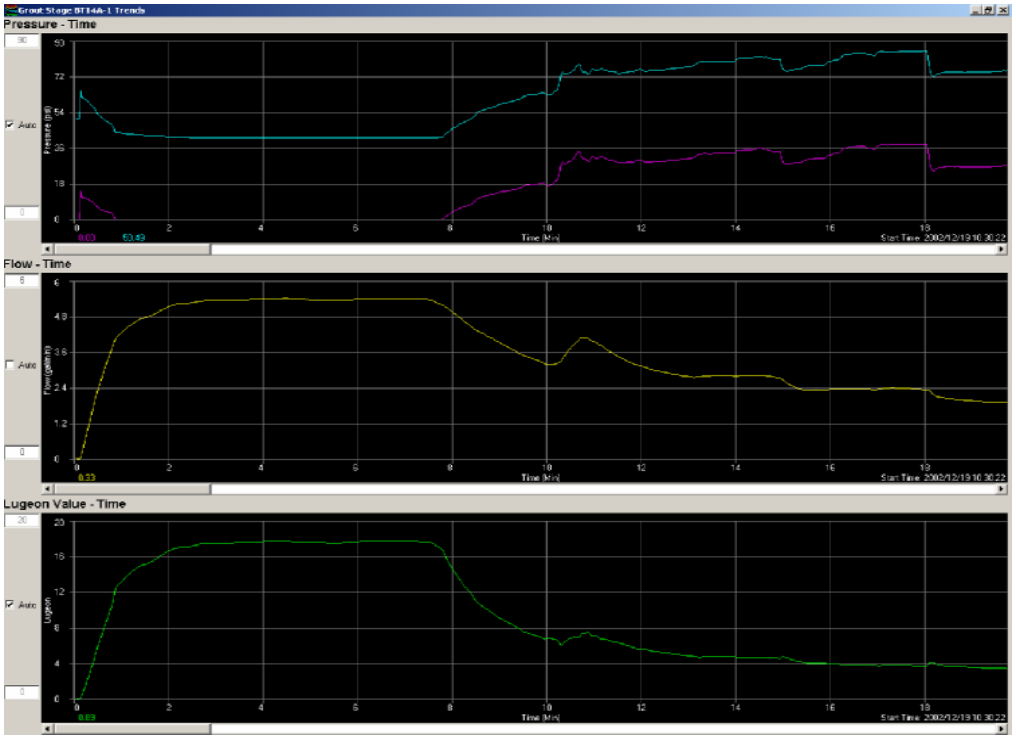

Hole Definition
12:13:52
Hole Information
Line & Hole
Line:
Hole Series:
Hole ID:
Hole Detail
Station Location:
Hole Drilling Method:
Top Elevation:
Bottom Elevation:
Planned Hole Length:
Drill Length:
Hole Angle 1
Hole Angle 2
Hole Diameter:
Water Depth: (Measured along Hole)
Drill Date
Wash Date
Water Test Date
Completion Date
Select Date
Today
Water Loss
Connect
Submit
Project View
Hole Definition
Cart Parameters
Head Loss Factors
Mix Type Controller
Cart Calibration
Water Test Operation
Grouting Operation
Database Admin
Alarm Information

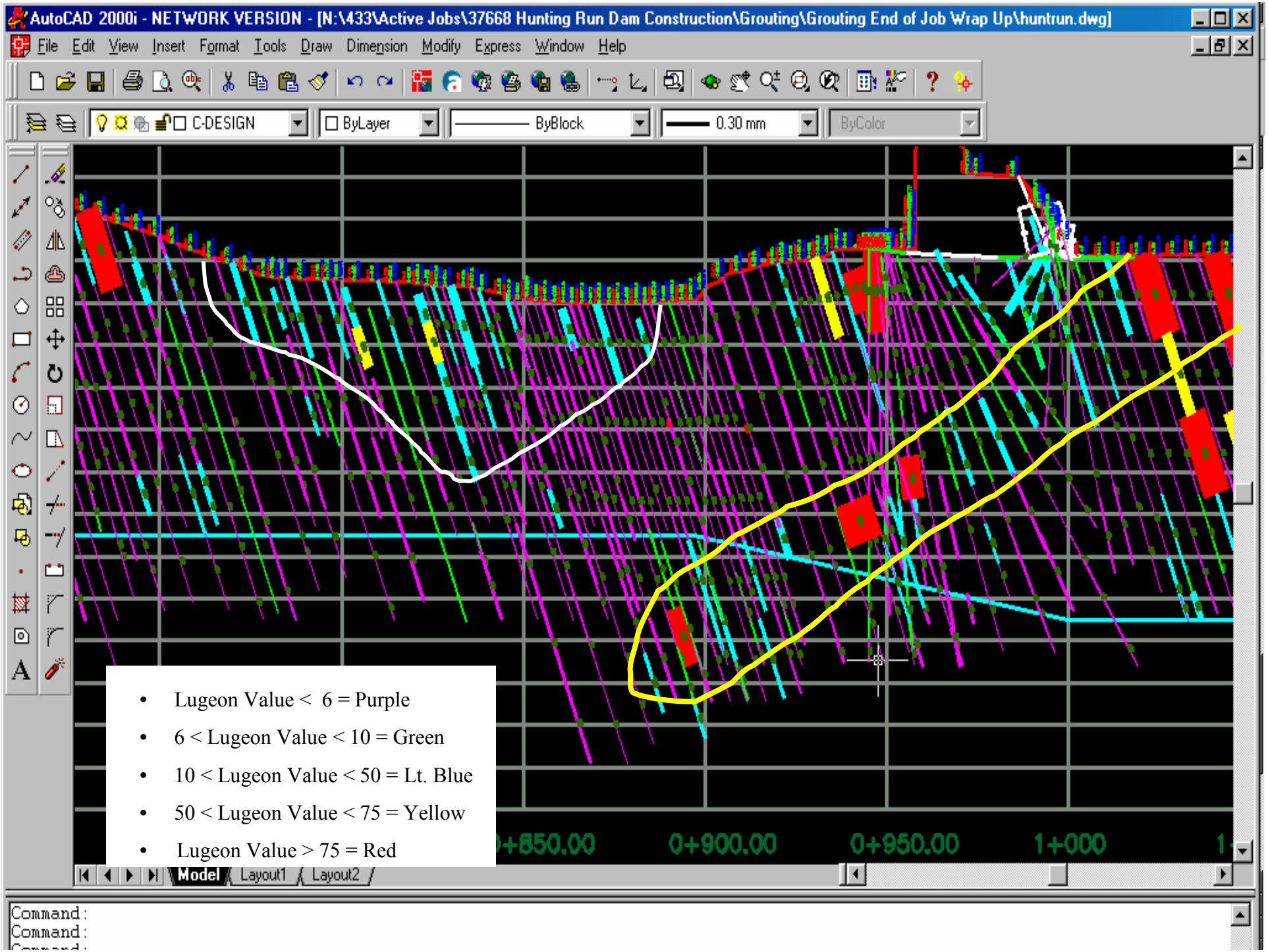

12:15:29
Head Loss Factors
Mix Type:
Parameters
Linear Model
Curved Model
Slope 1:
Intercept 1:
Transition Flow Rate:
Slope 2:
Intercept 2:
Q2 Coefficient:
Q Coefficient:
Constant Term:
Submit
Project View
Hole Definition
Cart Parameters
Head Loss Factors
Mix Type Controller
Cart Calibration
Water Test Operation
Grouting Operation
Database Admin
Alarm Information

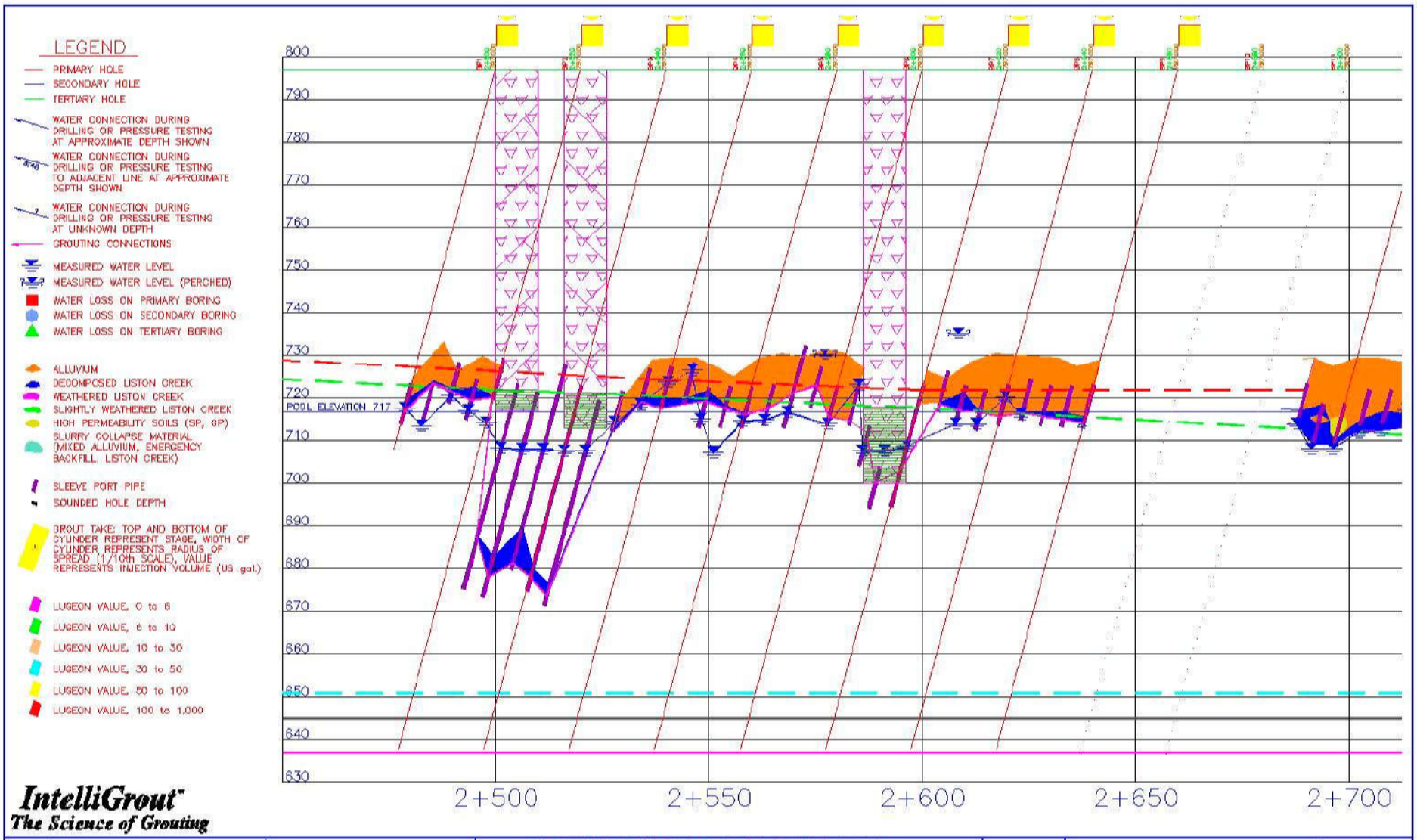

12:16: 7
Mix Type Controller
Mix Type Detail
Mix Name
Marsh Time
Specific Gr...
Lugeon Min
Lugeon Max
Q2 Coefficient
Q Coefficient
Constant
Cement
Flyash
Silica Fume
Bentonite
Water
Mix Type Parameter
Mix Type:
New Mix
Marsh Time:
Specific Gravity:
Lugeon Maximum:
Lugeon Minimum:
% Cement:
% Flyash:
% Silica Fume:
% Bentonite:
% Other Component:
Submit
Water Parameter
Marsh Time:
Specific Gravity:
Submit
Project View
Hole Definition
Cart Parameters
Head Loss Factors
Mix Type Controller
Cart Calibration
Water Test Operation
Grouting Operation
Database Admin
Alarm Information


Water Test Operation
12:17:42
Stage Information
Line:
A
Hole Series:
Primary
Hole ID:
AP10
Stage ID:
AP10-1
Trend
Cart ID:
C2
Mix Type:
Water
Water Test Time
0.0
(min)
Average Lugeon:
(Lu)
Hydraulic Conductivity:
(ft/min)
Comments:
(max 64 chars)
Submit
Start
Stop
Stage Data Detail
Stage ID
Top Depth
Bottom D..
Formation
Water Lu..
Water Lugeon (Q..
AP10-1
81.0
91.0
alluvium
14
Definition
Edit
Add
Delete
Cart
Cart 1
Cart 2
Cart 3
Cart 4
Cart 5
Cart 6
Cart 7
Cart 8
Operation
Grouting
Stage ID
BT14A-1
Top Depth
75.0
Bottom Depth
95.0
Mix Type
B
Project View
Hole Definition
Cart Parameters
Head Loss Factors
Mix Type Controller
Cart Calibration
Water Test Operation
Grouting Operation
Database Admin
Alarm Information


Grouting Operation
12:31:48
Stage Information
Line:
B
Hole Series:
Secondary
Hole ID:
BS10
Stage ID:
BS10-1
Trend
Cart ID:
C1
Recommended:
B
Mix Type:
B
Grout Time:
150.5
(min)
Acc Grout Take:
83.1
(US G)
Avg Lugeon:
2
(Lu)
Initial Amen:
0.02
Flow Rate:
0.12
(US G/min)
Pressure:
83.71
(psi)
Refusal Warning
00:00
(Time Left MM:SS)
Reset
Comments: (max 64 chars)
Submit
Start
Stop
Stage Data Detail
Stage ID
Grout Co..
Top Depth
Bottom D..
Formation
Water Lu...
ROS
ROS (0-20)
BS10-1
1
85.0
95.0
alluvium
3
49.4
BS10-2
1
95.0
105.0
alluvium
13
82.7
BS10-2
2
95.0
105.0
alluvium
13
71.7
BS10-3
1
105.0
115.0
alluvium
27
57.5
BS10-3
2
105.0
115.0
alluvium
27
6.2
BS10-4
1
115.0
125.0
alluvium
29
7.2
Definition
Edit
Add
Delete
Cart
Cart 1
Cart 2
Cart 3
Cart 4
Cart 5
Cart 6
Cart 7
Cart 8
Operation
Grouting
Stage ID
BT14A-1
Top Depth
75.0
Bottom Depth
95.0
Mix Type
B
Project View
Hole Definition
Cart Parameters
Head Loss Factors
Mix Type Controller
Cart Calibration
Water Test Operation
Grouting Operation
Database Admin
Alarm Information


Grout Stage BT14A-1 Trends
Pressure - Time
Pressure (psi)
Time (Min)
Flow - Time
Flow (gals/min)
Time (Min)
Lugeon Value - Time
Lugeon
Time (Min)


AutoCAD 2000i - NETWORK VERSION - [N:\433\Active Jobs\37668 Hunting Run Dam Construction\Grouting\Grouting End of Job Wrap Up\huntrun.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Express Window Help
C-DESIGN
ByLayer
ByBlock
0.30 mm
ByColor
0+850.00
0+900.00
0+950.00
1+000
Model
Layout1
Layout2
Command:
Command:
• Lugeon Value < 6 = Purple
• 6 < Lugeon Value < 10 = Green
• 10 < Lugeon Value < 50 = Lt. Blue
• 50 < Lugeon Value < 75 = Yellow
• Lugeon Value > 75 = Red



IntelliGrout™
The Science of Grouting

ADVANCED CONSTRUCTION TECHNIQUES, LTD.
WAPLE, ONTARIO

CANNETT FLEMING, INC.
HARRISBURG, PENNSYLVANIA

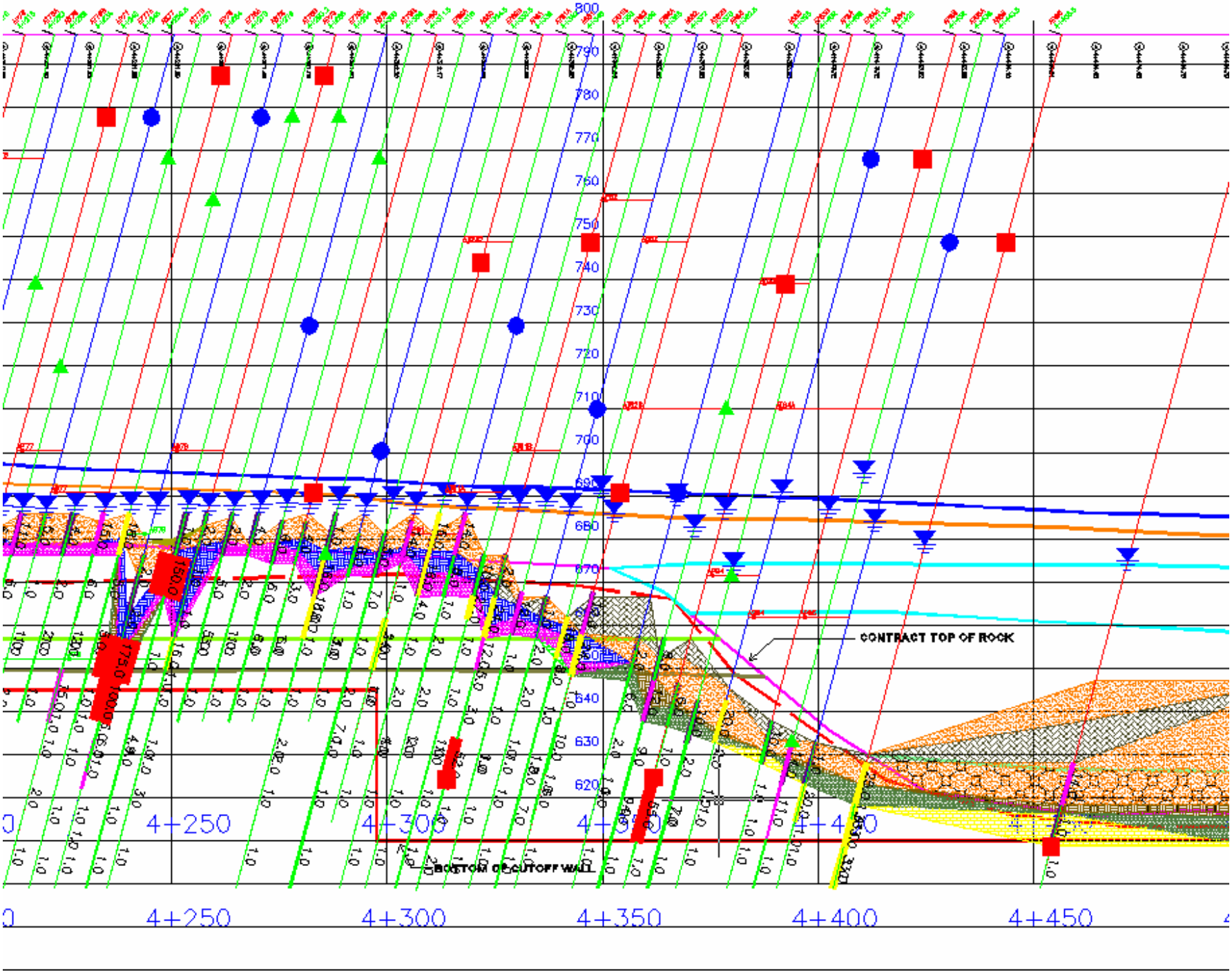
B-LINE INITIAL WATER LEVELS

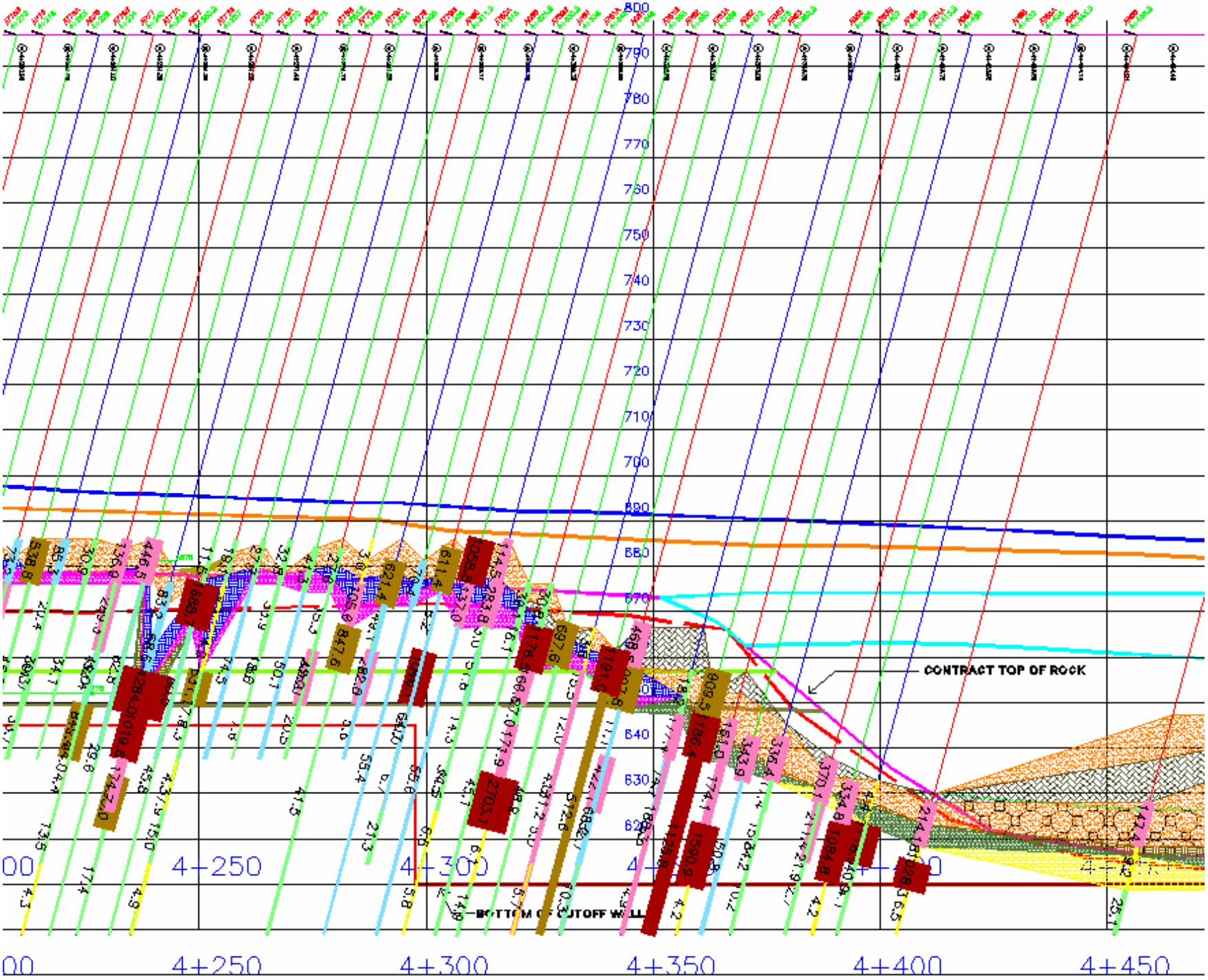
GROUTING TEST SECTION

B-LINE BAYS 1 THROUGH 10

MISSISSINEWA LAKE, INDIANA
CUT-OFF WALL PRE-GROUTING
DAM FOUNDATION REMEDIATION
CONTRACT NO.: DACW27-01-C-0018

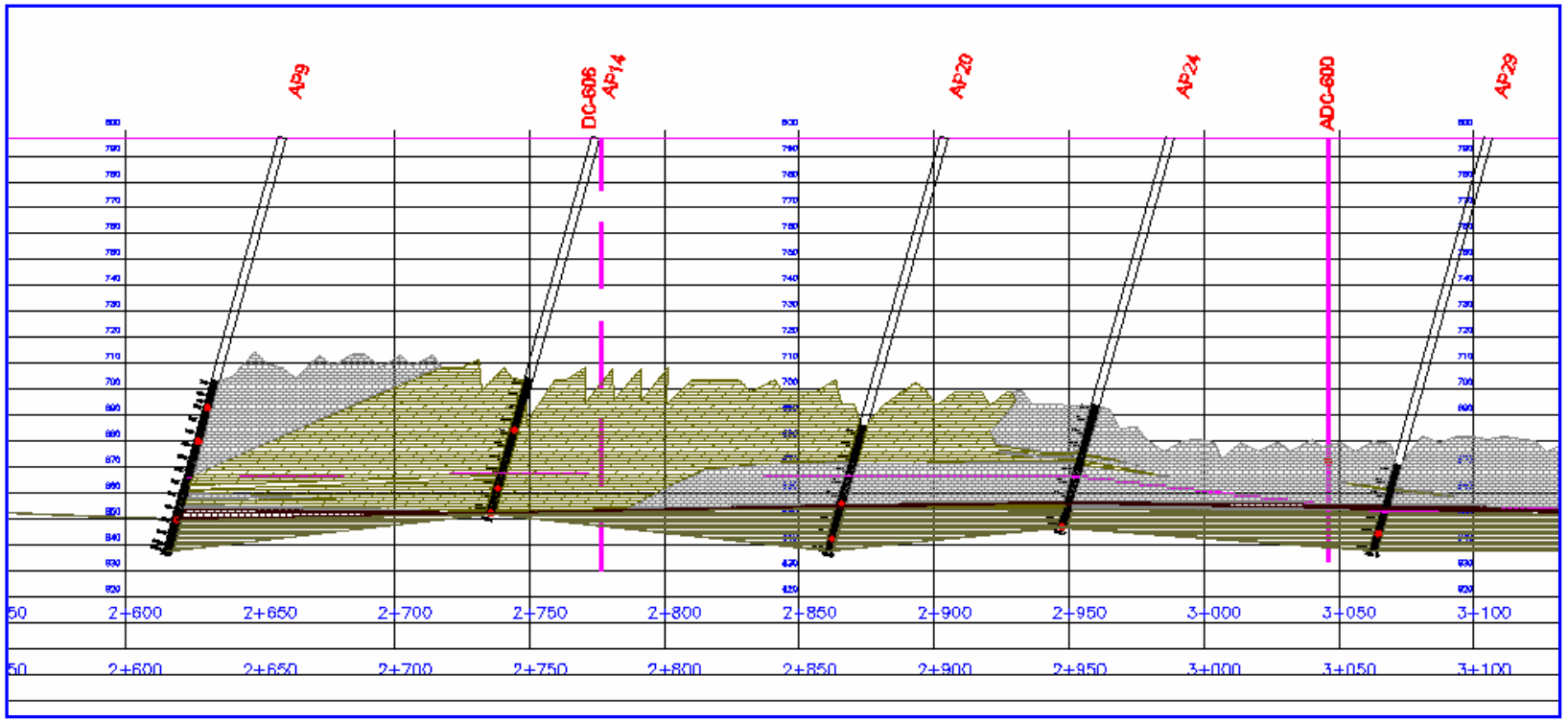
U.S. Army Corps of Engineers
Louisville District


800
790
780
770
760
750
740
730
720
710
700
690
680
670
660
650
640
630
620
CONTRACT TOP OF ROCK
BOTTOM OF CUTOFF WALL
4+250
4+300
4+350
4+400
4+450

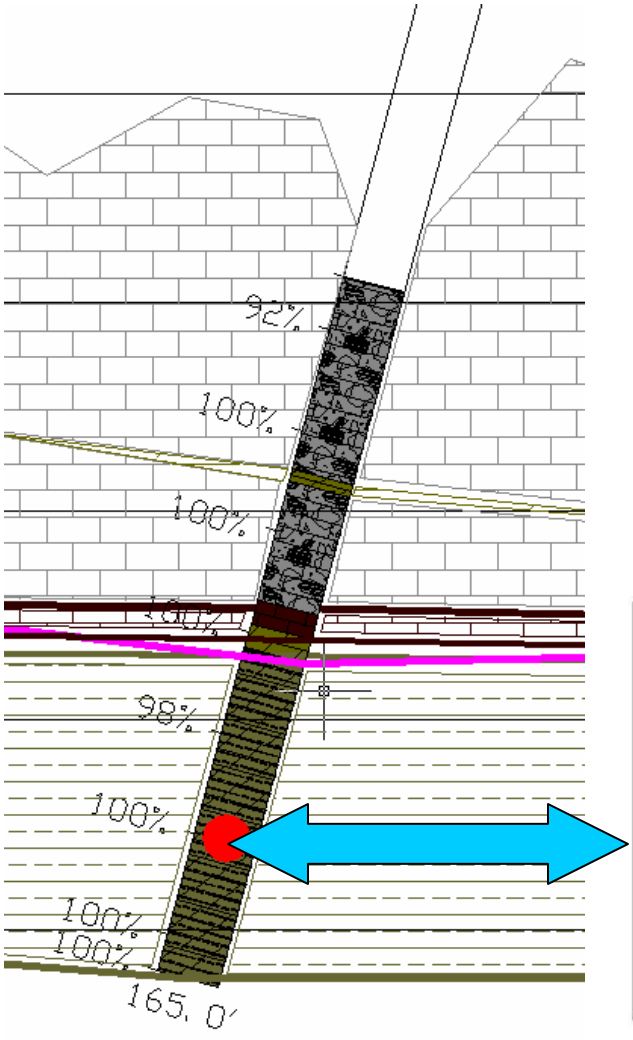

800
790
780
770
760
750
740
730
720
710
700
690
680
670
660
650
640
630
620
CONTRACT TOP OF ROCK
4+250
4+300
4+350
4+400
4+450

Interactive Geology

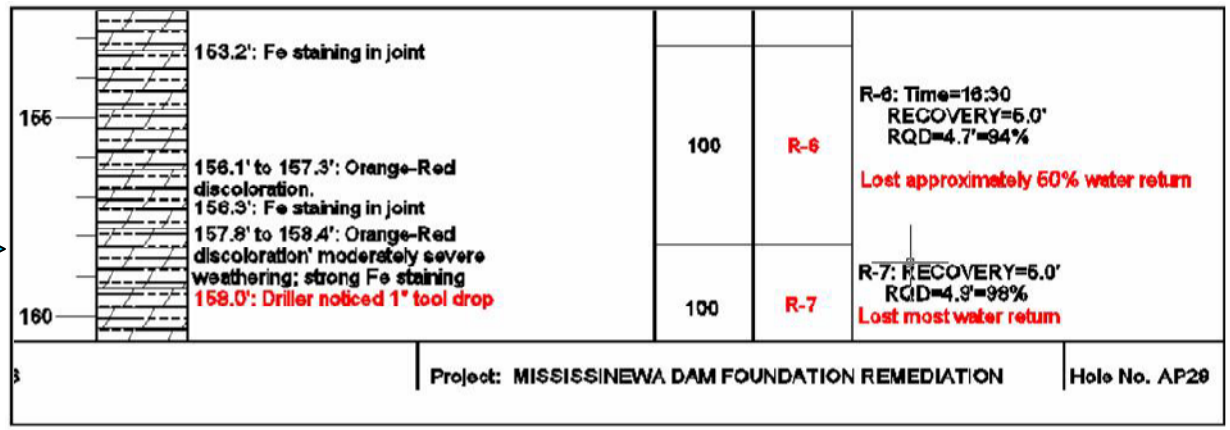
- Logical organization of Geotechnical and Geological Data
- Electronic link between data
- Eliminates sorting through paper logs, photographs, lab test results, etc. to interpret conditions



- Typed boring logs and stick logs are inserted into AutoCAD file
- Detailed geologic profile generated
- Data is linked using Hyperlinks



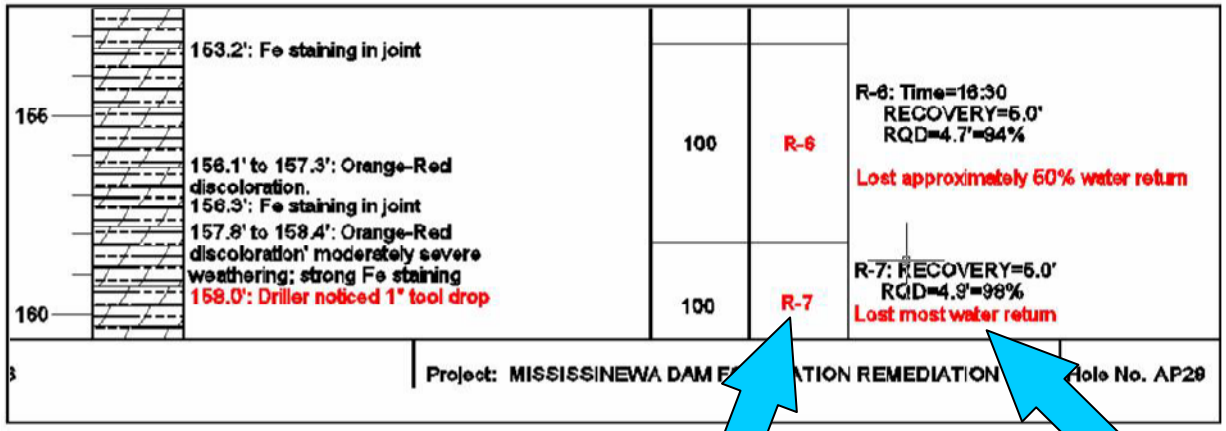
Hot spot on Stick boring log links to view of drilling log



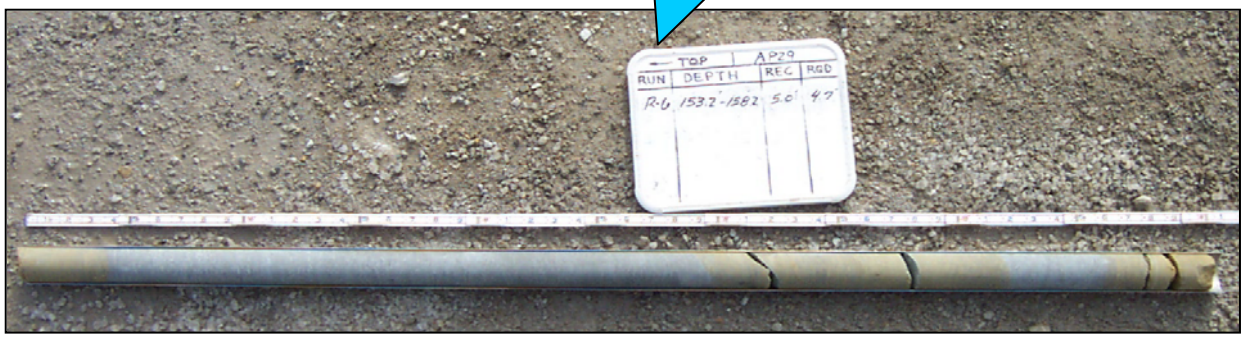
Red text on drilling logs indicates additional linked information.

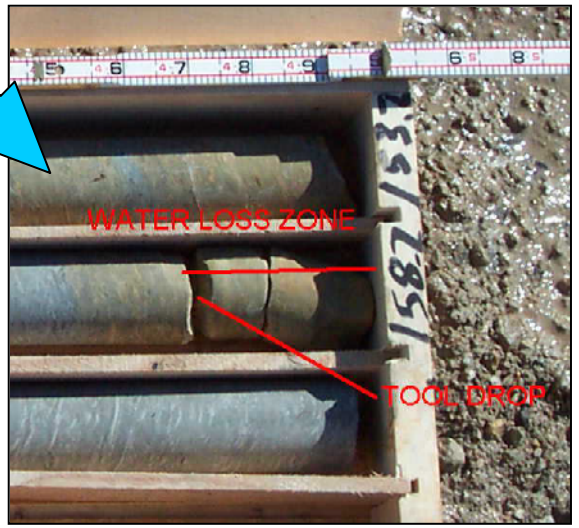
Core Run ID links to photo of recovered sample

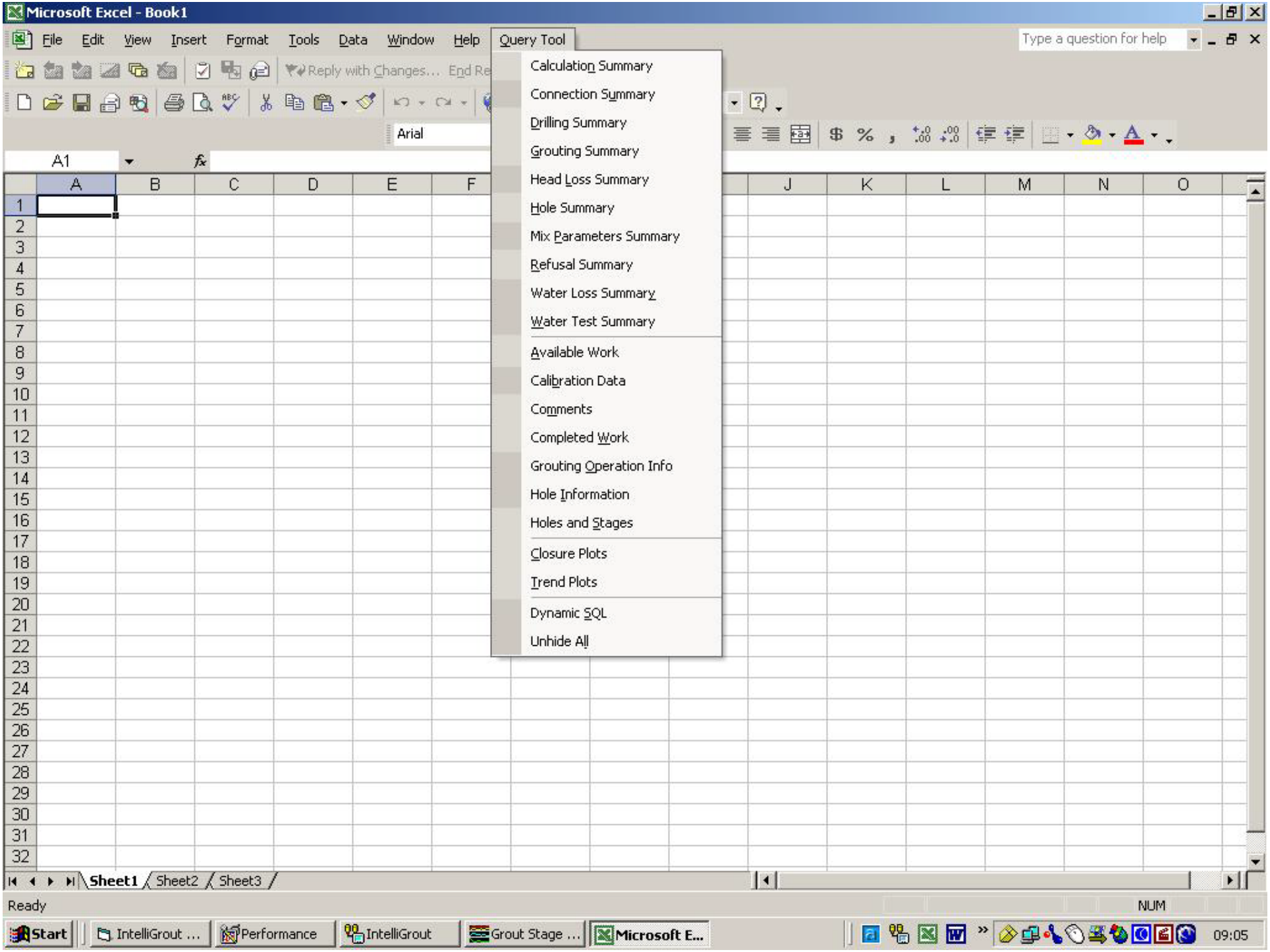
Comments links to photo of core box

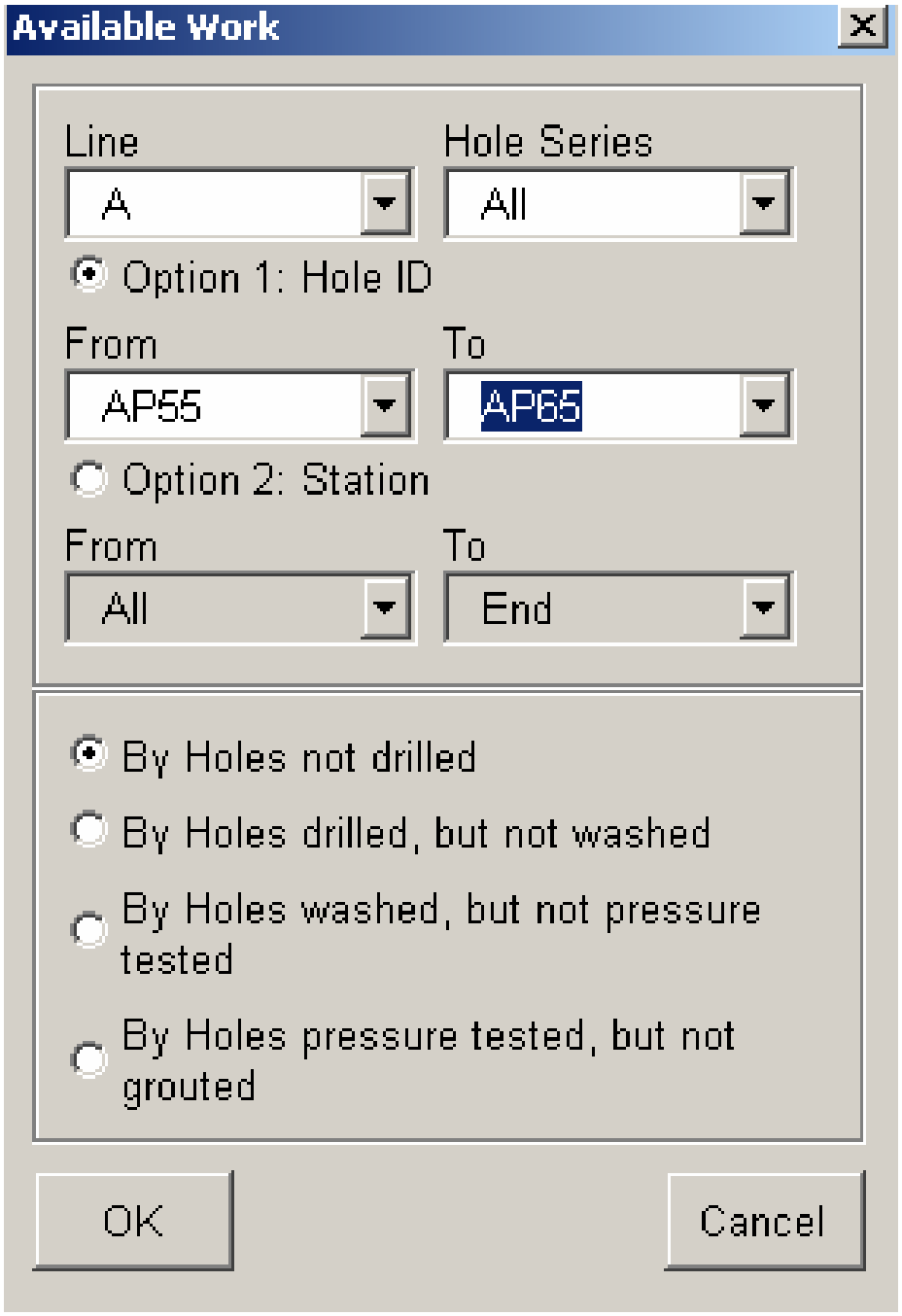


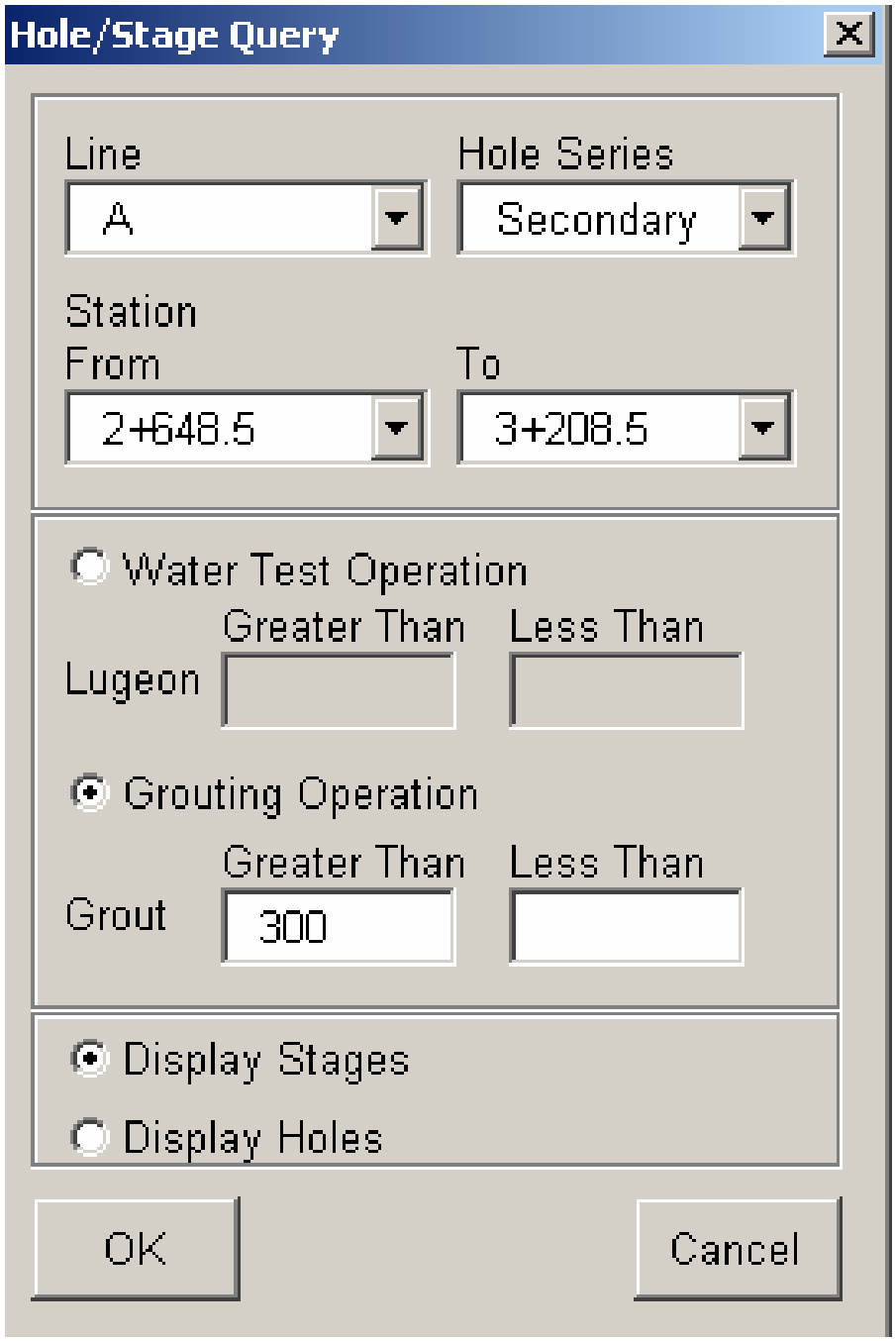
In this case a tool drop and loss of water return was noted.

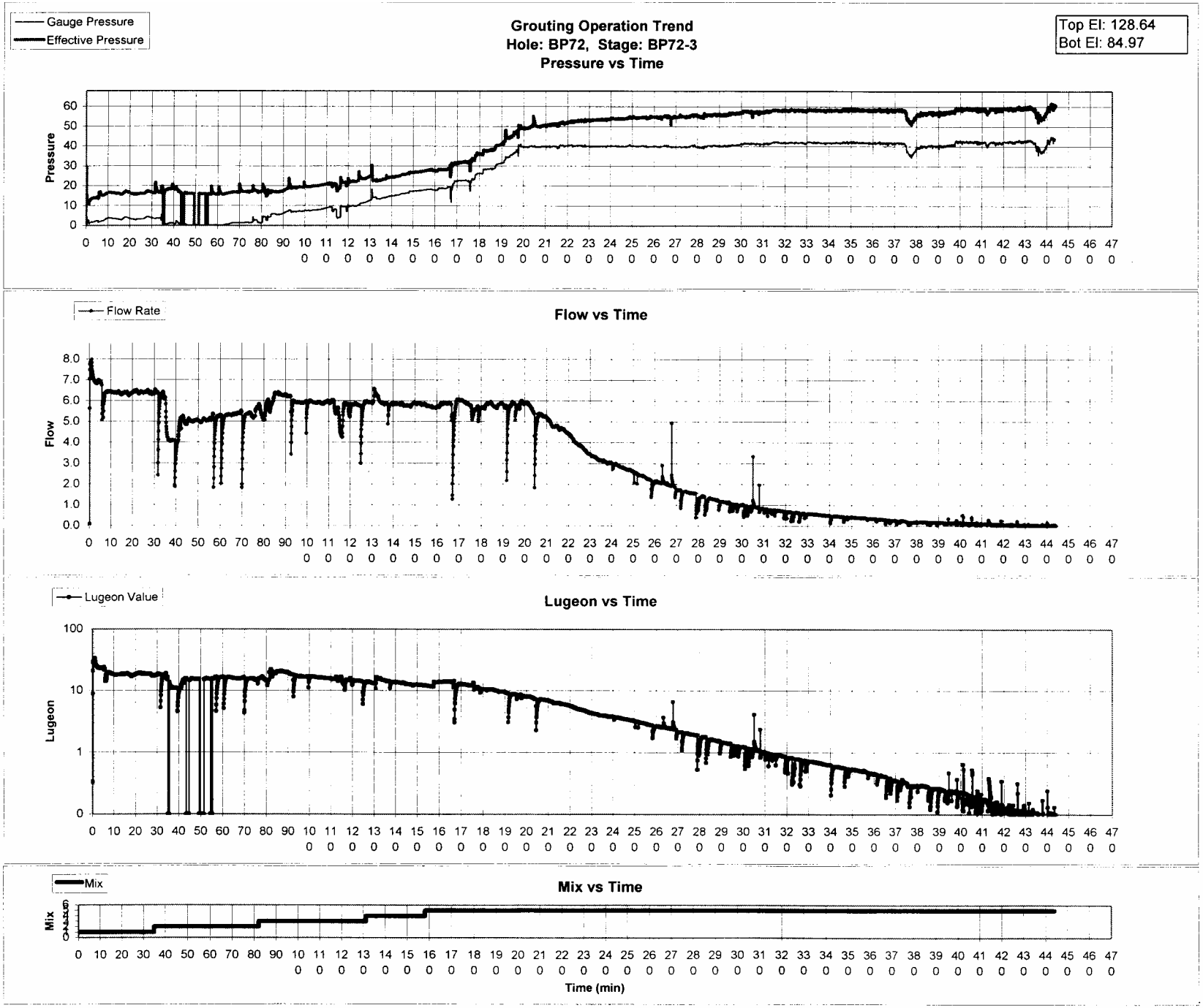




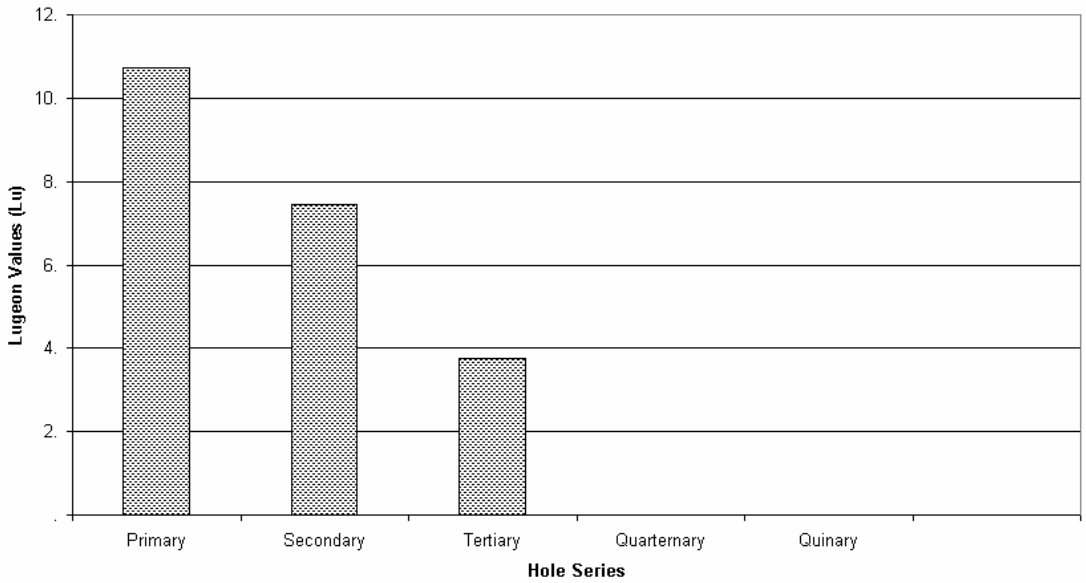

Microsoft Excel - Book1
File Edit View Insert Format Tools Data Window Help Query Tool
Type a question for help
Reply with Changes... End Re
Arial
A1
Calculation Summary
Connection Summary
Drilling Summary
Grouting Summary
Head Loss Summary
Hole Summary
Mix Parameters Summary
Refusal Summary
Water Loss Summary
Water Test Summary
Available Work
Calibration Data
Comments
Completed Work
Grouting Operation Info
Hole Information
Holes and Stages
Closure Plots
Trend Plots
Dynamic SQL
Unhide All
Sheet1 Sheet2 Sheet3
Ready
NUM
Start
IntelliGrout ...
Performance
IntelliGrout
Grout Stage ...
Microsoft E...
09:05


Available Work
Line
A
Hole Series
All
Option 1: Hole ID
From
AP55
To
AP65
Option 2: Station
From
All
To
End
By Holes not drilled
By Holes drilled, but not washed
By Holes washed, but not pressure tested
By Holes pressure tested, but not grouted
OK
Cancel

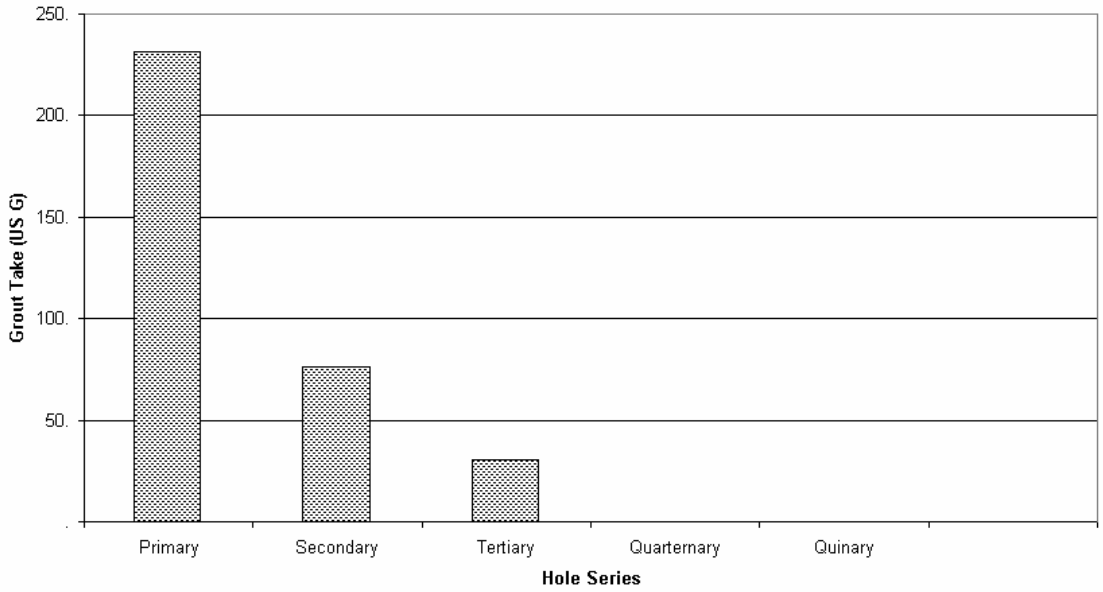

Hole/Stage Query
Line
A
Hole Series
Secondary
Station
From
2+648.5
To
3+208.5
Water Test Operation
Greater Than
Less Than
Lugeon
Grouting Operation
Greater Than
Less Than
Grout
300
Display Stages
Display Holes
OK
Cancel


Gauge Pressure
Effective Pressure
Grouting Operation Trend
Hole: BP72, Stage: BP72-3
Pressure vs Time
Top El: 128.64
Bot El: 84.97
Pressure
Flow Rate
Flow vs Time
Flow
Lugeon Value
Lugeon vs Time
Lugeon
Mix
Mix vs Time
Time (min)

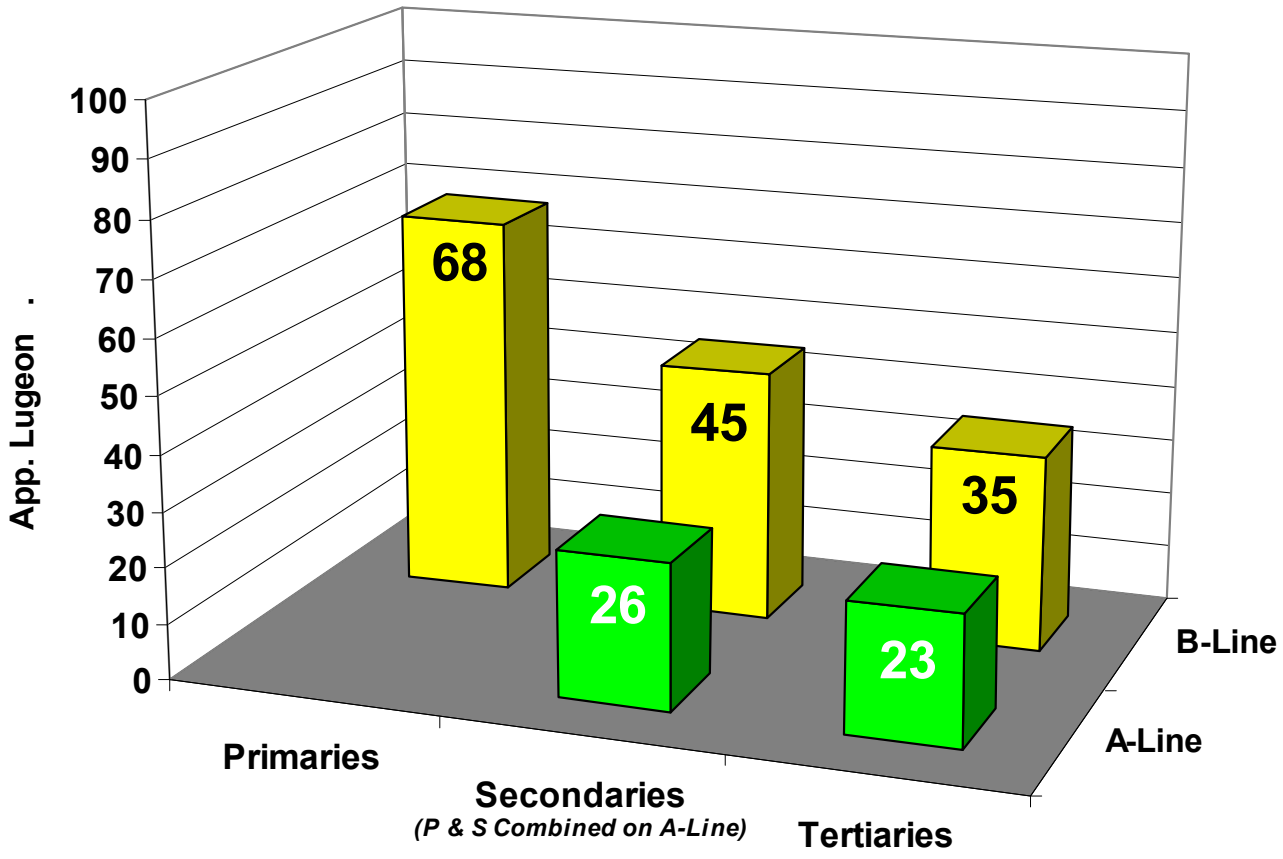
Mean Water Lugeon Values Plot
Line: A , Hole Series: All , Hole ID: AP15 To AP17 , Stage : All



Mean Grout Take Values Plot
Line: A , Hole Series: All , Hole ID: AP15 To AP17 , Stage : All



Test Section - Lugeon Values in Liston Creek




CUTOFF WALL TEST SECTION
A-LINE GROUT TAKES
9 11:35

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IntelliGrout™

The Science of Grouting

Contents

Project Drawing Updates

- Mississinewa Dam
- McCook Reservoir

Administration

- Download .DWF Viewing Software

Contacts

- Drawing Issues
- Web Page Issues

For information on the *IntelliGrout*™ system, please contact:

David B. Wilson,
Gannett Fleming, Inc.
or
James C. Cockburn,
Advanced Construction Techniques

Gannett Fleming

A.C.T. ADVANCED CONSTRUCTION TECHNIQUES

Done Internet

Start Intelligrout, The Scie... C:\Documents and Settin... Microsoft PowerPoint - [... 3:03 PM

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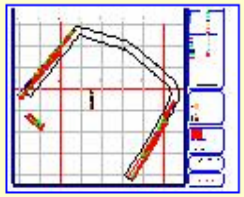
Address http://www.intelligrout.com/McCook/acwebpublish.htm Go Links

McCook Reservoir - Grout Test

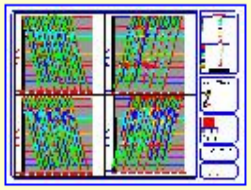
Gannett Fleming

A.C.T. ADVANCED CONSTRUCTION TECHNIQUES

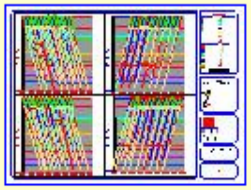
Preliminary Intelligrout Drawing Update (updated 11/01/03)



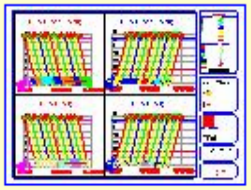
Plan View



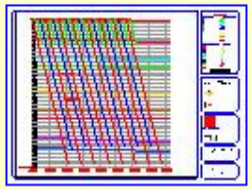
Comp Pres Test



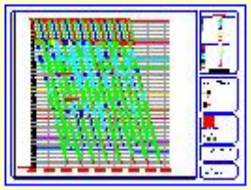
Comp Grouting



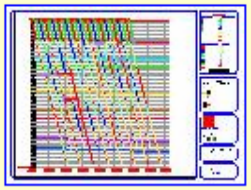
Demo Section



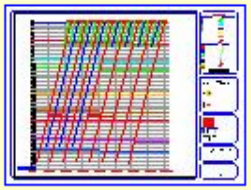
A-Drilling



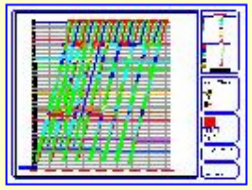
A-Pres Test

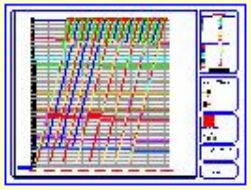


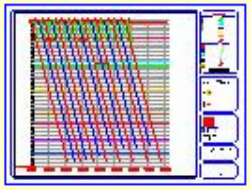
A-Grouting

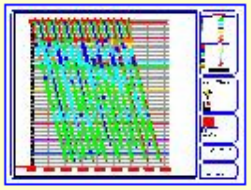


B-Drilling







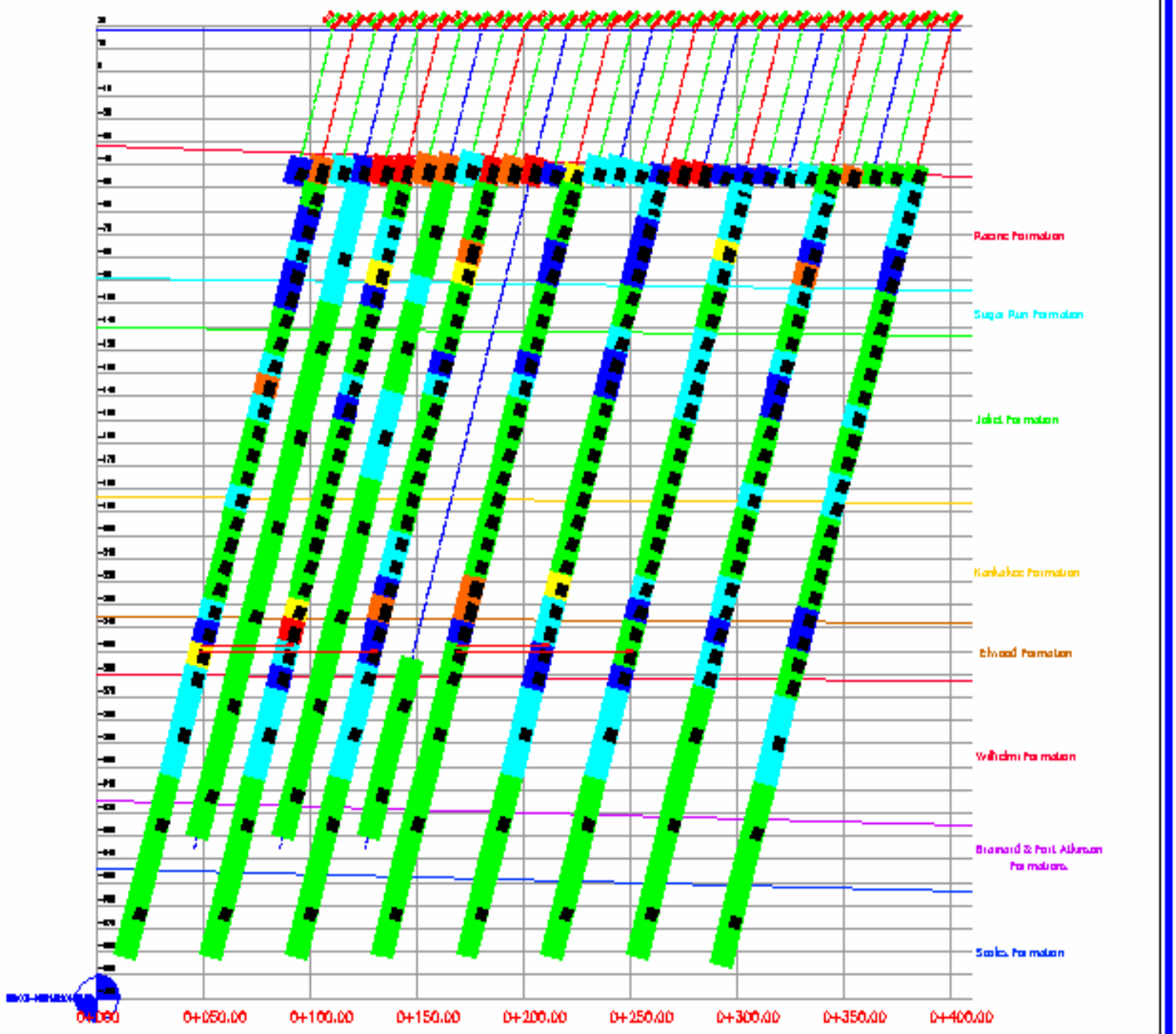


Notes:

1. Update drawings are not record drawings. Information shown is preliminary based on work in progress and is subject to revision.

2. Efforts will be made to provide update drawings on approximately a weekly basis.

Done Internet



Legend

Grout Hole

Pressure Testing

Hole Characteristics

Grouting

IntelliGrout™

The Science of Grouting

Advanced Construction Techniques

Cornell Dubilier

US Army Corps of Engineers
Chicago District

Black & Veatch Corporation

Chicagoland Underflow Plan (CUP)
McCook Reservoir Grout Test
Contract No.: DACW25-02-C0006

Grout Test Section

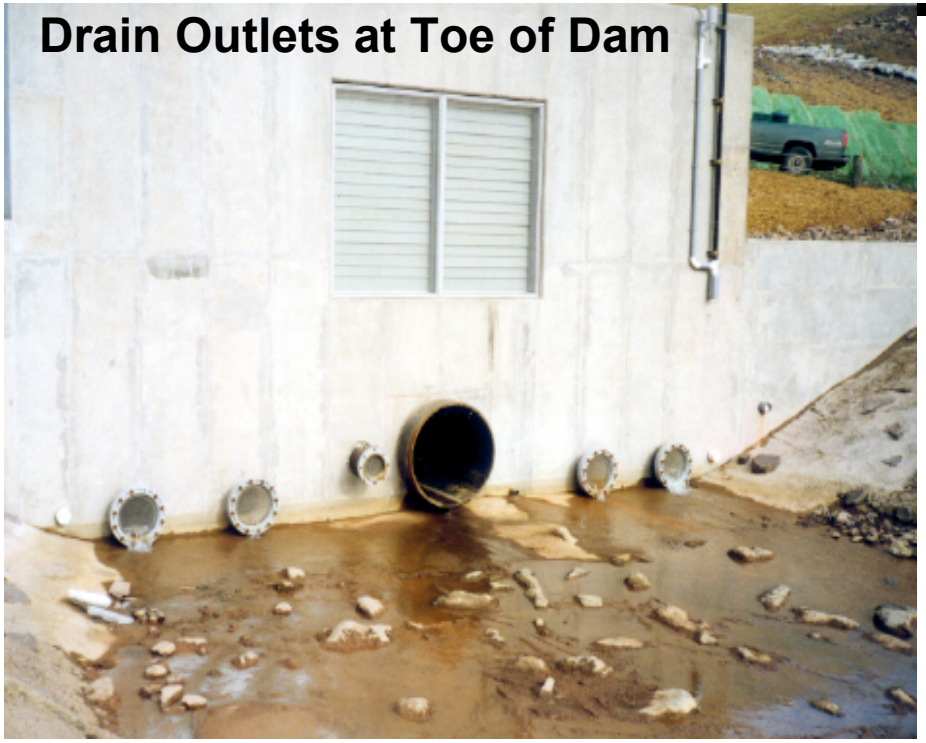
B-LINE

PRESSURE TESTING

Summary

- Computer monitoring and and analysis of grouting has come of age as a reliable and effective tool for better faster and less expensive grouting.

- When combined with proper investigation, design, and contract mechanisms, real time data collection and analysis by a competent grouting engineer or geologist results in engineered grout curtains constructed with dependable predictable performance with virtually the same degree of confidence in quality as visible above ground construction.



Project Success

QUESTIONS

Trent L. Dreese, P.E.

Gannett Fleming Inc.

tdreese@gfnet.com

717-763-7211, ext. 2686