



The Dow Chemical Company
Midland, MI 48674

January 17, 2011

Ms. Mary Logan
Remediation Project Manager
U.S. Environmental Protection Agency, Region 5
77 West Jackson
Chicago, IL 60604

**Re: Segment 1 Product Recovery Investigation SMA 2, 3, 4, 5, and 6-Settlement Agreement No. V-W-10-C-942 for The Tittabawassee River/Saginaw River & Bay Site
Dow Submittal Number 2011-013**

Ms. Logan:

Attached please find the Segment 1 Product Recovery Investigation for Sediment Management Areas 2, 3, 4, 5, and 6 prepared for The Dow Chemical Company (Dow) for the Tittabawassee River/Saginaw River & Bay Site. This submittal has been prepared in accordance with the requirements contained in Administrative Settlement Agreement and Order on Consent (AOC) and Section 1 of the Statement of Work (Attachment A of AOC) (effective January 21, 2010) ("Settlement Agreement"). Please let me know if you have any questions or concerns.

Sincerely,
The Dow Chemical Company

A handwritten signature in black ink that reads "Todd Konechne".

Todd Konechne
Project Coordinator

CC: Al Taylor, MDNRE
Diane Russell, U.S. EPA
Joseph Haas, U.S. Fish and Wildlife
Greg Cochran, Dow
Steve Lucas, Dow
Peter Wright, Dow

**SEGMENT 1 PRODUCT RECOVERY INVESTIGATION
SMA 2, 3, 4, 5 AND 6
THE TITTABAWASSEE RIVER/SAGINAW RIVER & BAY SITE**



**PREPARED BY:
TITTABAWASSEE & SAGINAW RIVER TEAM**

**PREPARED FOR AND SUBMITTED BY:
THE DOW CHEMICAL COMPANY**

**JANUARY 17, 2011
DOW SUBMITTAL NUMBER 2011.013**

TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	FIELD ACTIVITIES	1
2.1	TEST LOCATIONS	1
2.2	WELL INSTALLATION	1
2.3	WELL MONITORING.....	2
	2.3.1 Product Detection.....	2
	2.3.2 Product Recovery.....	2
2.4	WELL DEPTH ADJUSTMENTS	2
2.5	WELL REMOVAL.....	3
3.0	RESULTS	3
4.0	SUMMARY AND CONCLUSIONS	3

FIGURES

Figure 1	SMA-2 & 3 Recovery Test Well Locations
Figure 2	SMA-4 & 5 Recovery Test Well Locations
Figure 3	SMA-5 & 6 Recovery Test Well Locations

TABLES

Table 1	Product Recovery Investigation Summary of Results
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APPENDICES

Appendix A.....	Recovery Test Well Construction Logs
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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) and the Michigan Department of Natural Resources and Environment (DNRE) (herein collectively referred to as the “Agencies”) requested Dow to conduct an investigation to determine if recoverable product exists in sediment management areas (SMAs) 2 through 6. The Segment 1 Product Recovery Investigation was implemented to verify the suspected presence/absence of recoverable product in these SMAs. The data collected during this investigation will be used to inform the Segment 1 Response Proposal and the data will be incorporated into the final Response Proposal.

The product recovery investigation was originally discussed with the Agencies during the October 2010 Agency meeting held in Grand Rapids, Michigan. The scope of work for the investigation was provided to the Agencies in a November 2, 2010 work plan and approved by the Agencies on November 4, 2010. Further additions to the scope of work were presented to the Agencies during the November Agency meeting held in Midland, Michigan.

2.0 FIELD ACTIVITIES

A total of nine recovery test wells were installed in SMAs 2 through 6 to verify the presence/absence of recoverable product. There were two test wells installed at SMAs 2 through 5 and one test well installed in SMA-6. The test wells consisted of a 2-inch diameter, 3.7 foot long, 10-slot stainless steel well point screen and a riser pipe attached to the top of the well point screen. The riser pipe length was established to allow the top of the well to extend above the water surface. The riser pipe was constructed of 2-inch diameter galvanized steel pipe.

2.1 TEST LOCATIONS

One test well was originally installed within each of the five SMAs, as was proposed in the November 2010 Work Plan. Each of the five original test wells were installed at a previous core location, with the highest subsurface secondary constituents of interest (SCOI) concentrations. During the November Agency meeting it was agreed that a second test well be installed in the SMAs where product had not been detected in the original test wells (SMA 2 through 5). The product recovery test well locations are shown on Figures 1, 2 and 3. The test well locations and corresponding SMA and core locations are summarized in Table 1.

2.2 WELL INSTALLATION

Each test well was to be advanced into the top of the till so that the bottom of the well screen was located below the top of the till. The test wells were installed by first driving a pilot rod into the sediment until that pilot rod reached refusal/till. The pilot rod was then withdrawn from the sediment and the test well was then driven down the pilot hole until refusal/till was reached. The depth at which the pilot rod encountered significant resistance was recorded and is depicted on the well construction logs provided in Appendix A as “2010 Resistance”. Approximately 5-feet

of riser pipe was left exposed above water surface at the time of installation. The top of casing elevation and horizontal global positioning system (GPS) coordinates were collected at each well after installation.

Each monitoring well was developed using a “surge and purge” method. The wells were surged using a polyvinyl chloride (PVC) surge block and then purged using a submersible pump. Each well was surged and purged until the purge water ran relatively clear (low turbidity).

Phase I to install one test well in SMAs 2 through 6 (Recovery Test Wells (RTW) 1 through 5) was conducted on November 8 and 9, 2010. One additional test well was installed in SMAs 2 through 5 during Phase II well installation, which occurred during November 16, and 17, 2010.

2.3 WELL MONITORING

The monitoring of each test well consisted of two components; product detection and product recovery. Each component is explained below.

2.3.1 Product Detection

An oil water interface probe was used to detect the presence of free-phase product in each test well. The probe was slowly lowered into each test well and the applicable measurements were recorded. These measurements included: depth to water, depth to product (if applicable), and total well depth. If product was detected, the product layer thickness was calculated by subtracting depth to product from total well depth. All measurements were recorded in “feet.”

2.3.2 Product Recovery

Pumping was performed during each monitoring event to determine if there were any recoverable amounts of product in each test well. A peristaltic pump with Teflon[®] tubing was used to pump liquid from the bottom of each test well. The tubing was lowered to the bottom of each well and connected to the peristaltic pump. Approximately 1-liter of liquid was pumped from each test well into a clear glass container. The volume of water and the volume of product recovered were recorded. The greatest volume of product recovered at any given well during the product recovery phase was approximately 0.6-liters. In the event that there was more than 1-liter of product present, an attempt would be made to purge all product from the well; however, this scenario was not encountered.

2.4 WELL DEPTH ADJUSTMENTS

To ensure wells without any detectable or recoverable amounts of product were sufficiently installed into the till, an attempt was made to drive the wells deeper. All test wells were driven deeper with the exception of RTW-5, which was in SMA-6 and showed a recoverable amount of product. The wells were driven deeper until refusal was again encountered. The depth adjustments ranged from 0.3 to 1.6-feet of additional depth. The well depth adjustments were

performed on December 3 and 6, 2010. Well depth, top of sediment bed, and estimated till elevations are recorded in the well logs provided in Appendix A.

2.5 WELL REMOVAL

Monitoring was halted and wells were removed from the river when it was determined that the current investigation was not going to provide any additional information on the suspected presence/absence of recoverable product. After the final monitoring event on each test well, the well was pulled out of the potential product zone and purged of any potential residual product remaining in the well before being completely removed from the river sediment. Once this was complete, the well was removed from the river and each well point was cleaned, labeled and stored.

3.0 RESULTS

A brief summary of results from the Product Recovery Investigation is presented below. See Table 1 for a more detailed summary of results. "Product Detected" indicates the oil-water interface probe detected product; however, measureable product was not recovered.

SMA	Results
SMA-2	Product Recovered
SMA-3	Product Detected
SMA-4	No Detection
SMA-5	No Detection
SMA-6	Product Recovered

4.0 SUMMARY AND CONCLUSIONS

In total, nine recovery test wells were installed in SMAs 2 through 6. These wells were monitored over a period of five to twelve days for the presence of product, and the ability to remove product if present. Over the monitoring period all but eight wells were driven deeper into the till to help verify product depth or detection. Over the time of monitoring no product was detected in the wells in SMAs 4 and 5, product was detected but not at recoverable quantities in SMA 3, and product was recovered from SMAs 2 and 6.

TABLES

Table 1: Product Recovery Investigation Summary of Results

Table 1
Product Recovery Investigation Summary of Results
Segment 1: SMA 2, 3, 4, 5, and 6
November and December 2010

SMA	Well ID	Date Installed	Core Location	Results													
				11/9	11/10	11/11	11/12	11/16	11/18	11/22	11/24	11/29	12/3	12/6	12/9	12/10	
SMA 2	RTW-1	11/8	RE-73+50-IC30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<>	PD, PR	PD, PR, WR	
	RTW-6	11/17	No Previous Core							ND	ND	ND	ND	<>	ND	ND, WR	
SMA 3	RTW-2	11/8	RF-83+00-IC69	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<>	ND		ND, WR
	RTW-7	11/17	RF-82+50-IC75						PD	PD	PD	PD	PD	<>	PD		PD, WR
SMA 4	RTW-3	11/9	RG-137+50-IC71		ND	ND	ND	ND	ND	ND	ND	ND	ND	<>	ND		ND, WR
	RTW-8	11/17	RG-137+50-IC114						ND	ND	ND	ND	ND	<>	ND	ND, WR	
SMA 5	RTW-4	11/9	RH-145+00-IC118		ND	ND	ND	ND	ND	ND	ND	ND	ND		<>	ND	ND, WR
	RTW-9	11/16	No Previous Core						ND	ND	ND	ND	ND		<>		ND, WR
SMA 6	RTW-5	11/9	RH-151+50-IC33		ND	ND	PD, PR	PD, PR	PD, PR	PD, PR	PD, PR	PD, PR	PD, PR			WR	

Notes: SMA - Sediment Management Area
 ND - Nothing Detected
 PD - Product Detected
 PR - Product Recovered
 <> Well driven deeper
 WR - Well Removed

FIGURES

Figure 1: SMA-2 & 3 Recovery Test Well Locations

Figure 2: SMA-4 & 5 Recovery Test Well Locations

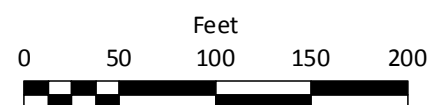
Figure 3: SMA-5 & 6 Recovery Test Well Locations



LEGEND

- Product Recovery Test Wells
- ⊕ Sample Locations - In-Channel
- Reach
- ▭ Sediment Management Areas

NOTES:
Image Source - Dow 2007



Tittabawasse River
SMA 2 and 3 - Recovery Test Well Locations

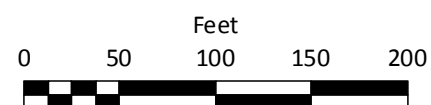
Figure
1



LEGEND

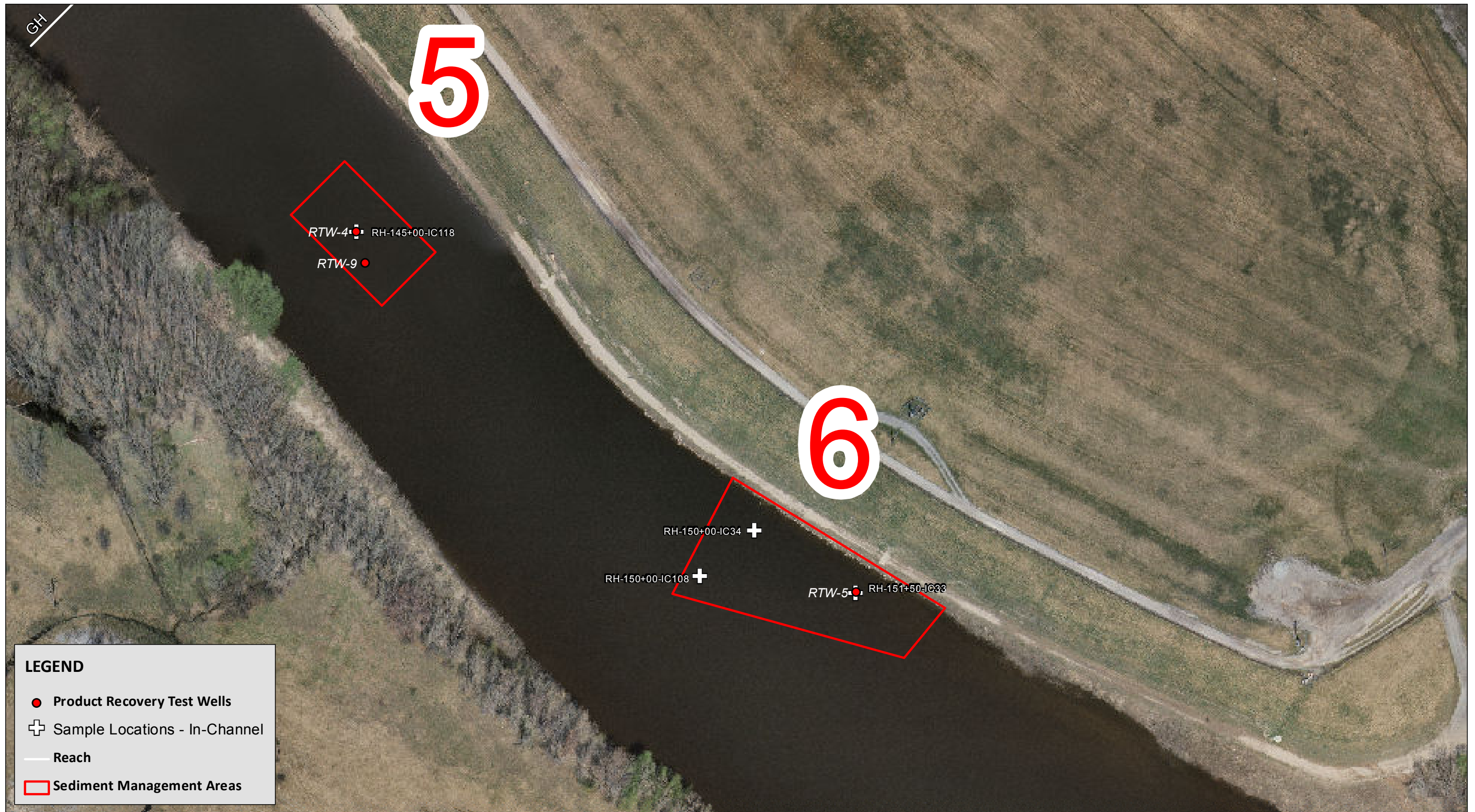
- Product Recovery Test Wells
- ⊕ Sample Locations - In-Channel
- Reach
- ◊ Sediment Management Areas

NOTES:
Image Source - Dow 2007



Tittabawasse River
SMA 4 and 5 - Recovery Test Well Locations

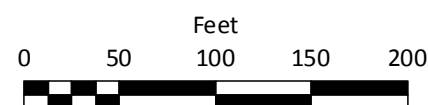
Figure
2



LEGEND

- Product Recovery Test Wells
- + Sample Locations - In-Channel
- Reach
- Sediment Management Areas

NOTES:
Image Source - Dow 2007



Tittabawasse River
SMA 5 and 6 - Recovery Test Well Locations

Figure
3

APPENDICES

Appendix A: Recovery Test Well Construction Logs



A - ORIGINAL DEPTH OF WELL - NOVEMBER 8TH, 2010
 B - FINAL DEPTH OF WELL - DECEMBER 3RD, 2010
 11.67' - DOWNHOLE DEPTH TO BOTTOM

WATER ELEV - 589.0'± (11/8/2010)

2010 TOP OF SEDIMENT (586.8')
 2009 TOP OF SEDIMENT (586.7')**

4.3'

2.2'

3.3'

5.5'

2010 RESISTANCE

2009 TILL*

BOTTOM OF WELL - A

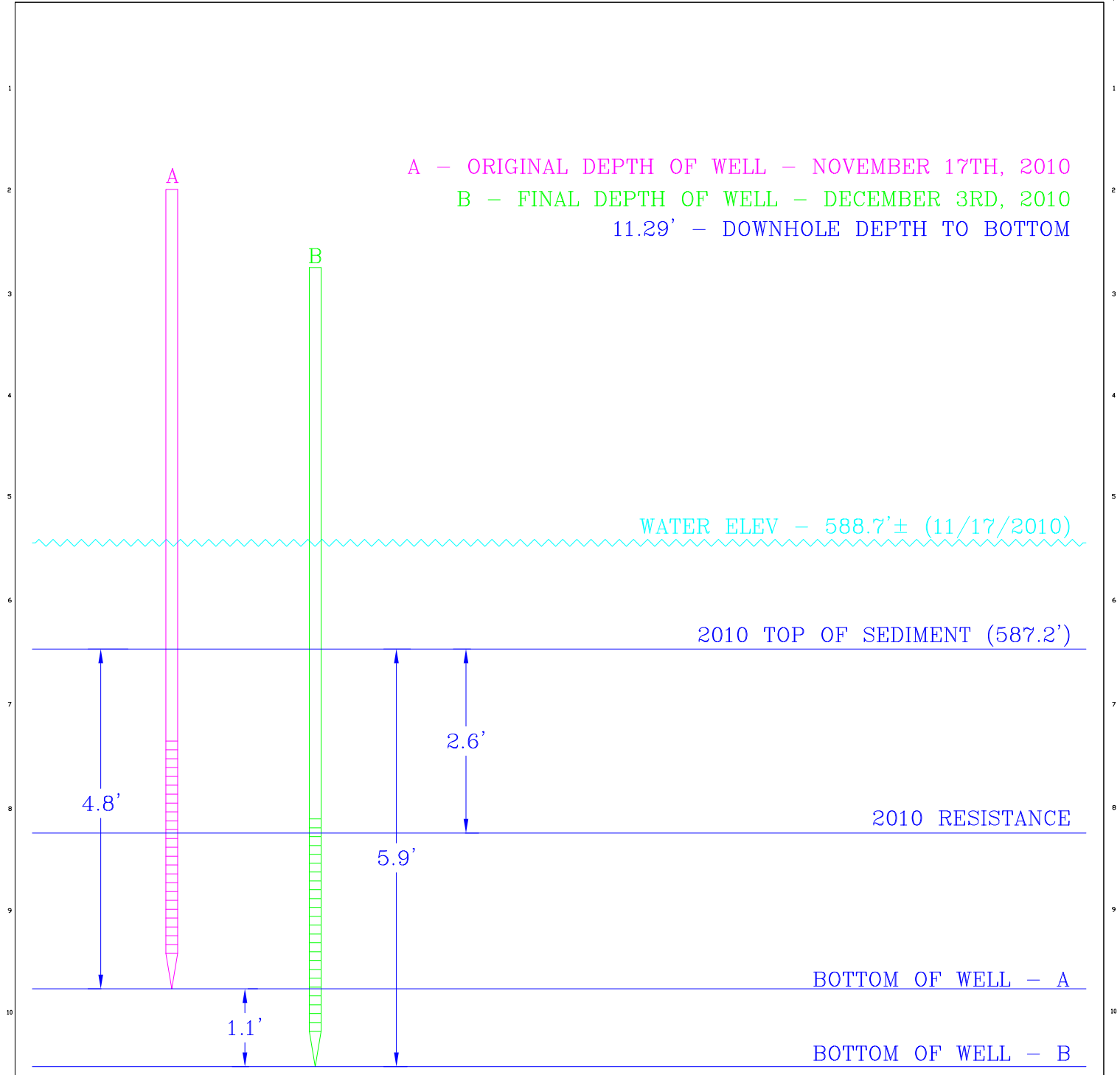
1.2'

BOTTOM OF WELL - B

* 2009 TILL DEPTH BASED ON NOVEMBER 2009 SEDIMENT BORING (RE-73+50-IC30)
 ** 2009 TOP OF SEDIMENT ELEVATION BASED ON GPS MEASUREMENT AT TIME OF BORING

THE DOW CHEMICAL COMPANY				DESIGNED		
PRODUCT RECOVERY INVESTIGATION				REDRAWN		C.M.B. 12/10
SMA-2 (RTW-1)				CHECKED		
DATE CREATED				APPROVED		
DECEMBER 20TH, 2010				PROJ. ENGR.		
SCALE (8.5 x 11 ONLY)				MFG. REP.		T.S.K. 12/10
1" = 2"				REV.		
RE-73+50-IC30				PRINTED		
				VER.		

A - ORIGINAL DEPTH OF WELL - NOVEMBER 17TH, 2010
 B - FINAL DEPTH OF WELL - DECEMBER 3RD, 2010
 11.29' - DOWNHOLE DEPTH TO BOTTOM



WATER ELEV - 588.7' ± (11/17/2010)

2010 TOP OF SEDIMENT (587.2')

2010 RESISTANCE

BOTTOM OF WELL - A

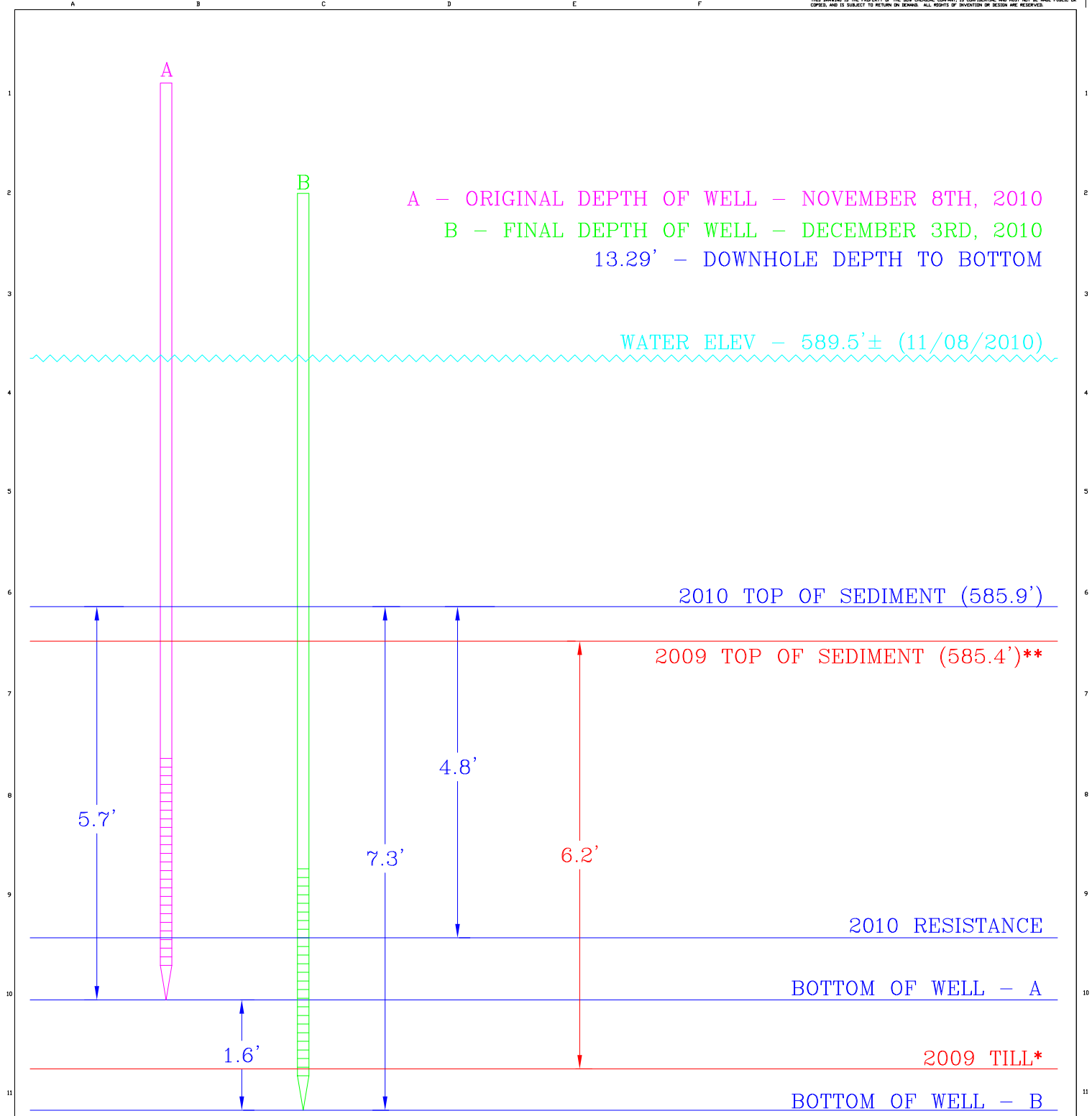
BOTTOM OF WELL - B

NOTE - NO PREVIOUS CORE AT THIS LOCATION

THE DOW CHEMICAL COMPANY				DESIGNED		
PRODUCT RECOVERY INVESTIGATION				REDRAWN		C.M.B. 12/10
SMA-2 (RTW-6)				CHECKED		
DATE CREATED				APPROVED		
DECEMBER 20TH, 2010				PROJ. ENGR.		
SCALE (8.5 x 11 ONLY)				MFG. REP.		T.S.K. 12/10
1" = 2"				PRINTED		
NO PREVIOUS LOCATION				VER.		
REV.						

A - ORIGINAL DEPTH OF WELL - NOVEMBER 8TH, 2010
 B - FINAL DEPTH OF WELL - DECEMBER 3RD, 2010
 13.29' - DOWNHOLE DEPTH TO BOTTOM

WATER ELEV - 589.5'± (11/08/2010)



2010 TOP OF SEDIMENT (585.9')

2009 TOP OF SEDIMENT (585.4')**

2010 RESISTANCE

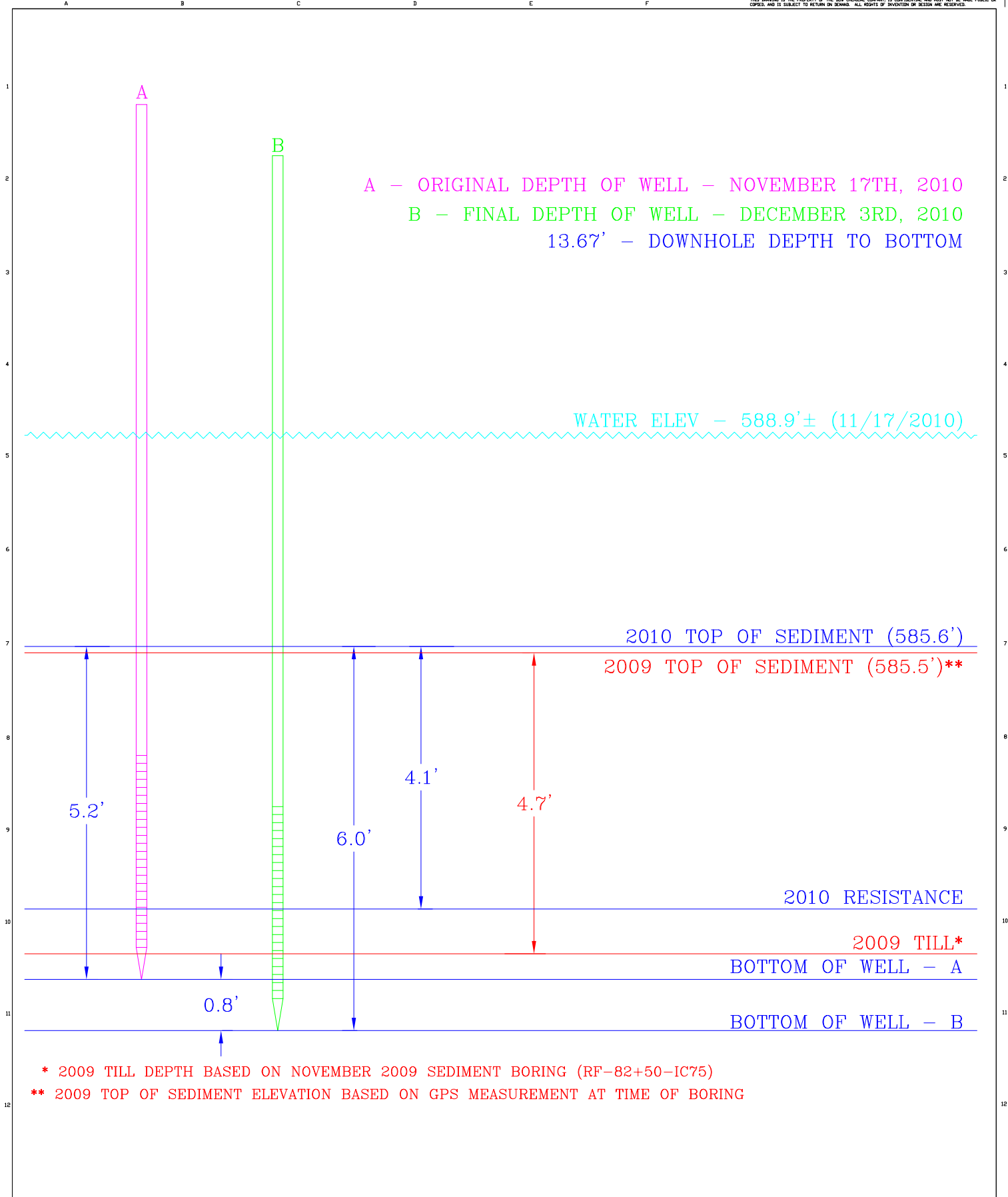
BOTTOM OF WELL - A

2009 TILL*

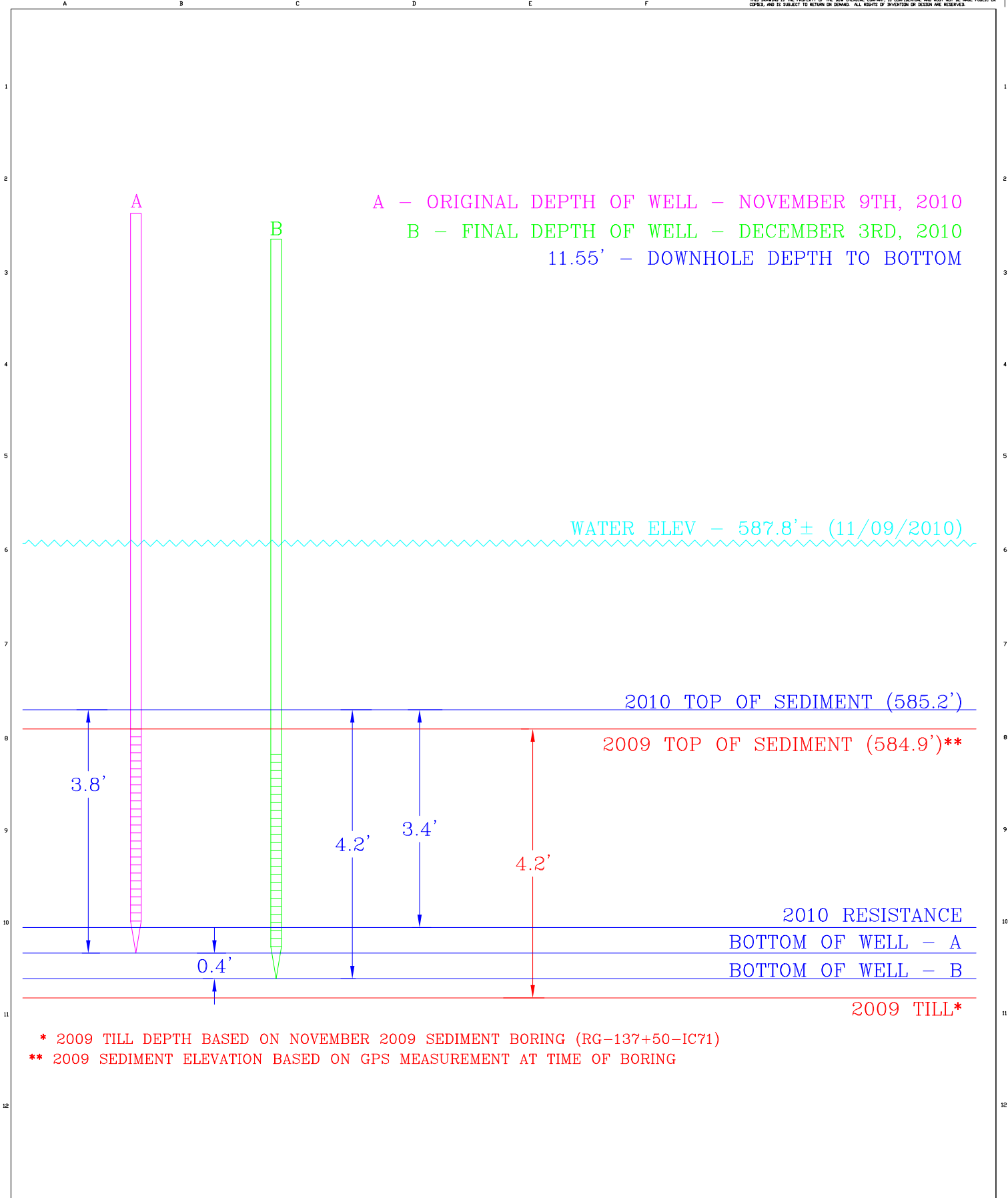
BOTTOM OF WELL - B

* 2009 TILL DEPTH BASED ON NOVEMBER 2009 SEDIMENT BORING (RF-83+00-IC69)
 ** 2009 TOP OF SEDIMENT ELEVATION BASED ON GPS MEASUREMENT AT TIME OF BORING

THE DOW CHEMICAL COMPANY				DESIGNED		
PRODUCT RECOVERY INVESTIGATION				REDRAWN		C.M.B. 12/10
SMA-3 (RTW-2)				CHECKED		
DATE CREATED				APPROVED		
DECEMBER 20TH, 2010				PROJ. ENGR.		
SCALE (8.5 x 11 ONLY)		RF-83+00-IC69		MFG. REP.		T.S.K. 12/10
1" = 2"		REV.		PRINTED		VER.



THE DOW CHEMICAL COMPANY				DESIGNED	
				REDRAWN	C.M.B.
PRODUCT RECOVERY INVESTIGATION				CHECKED	
				APPROVED	
SMA-3 (RTW-7)				PROJ. ENGR.	
				MFG. REP.	T.S.K.
DATE CREATED DECEMBER 20TH, 2010	SCALE (8.5 x 11 ONLY) 1" = 2'	RF-82+50-IC75	REV.		



* 2009 TILL DEPTH BASED ON NOVEMBER 2009 SEDIMENT BORING (RG-137+50-IC71)
 ** 2009 SEDIMENT ELEVATION BASED ON GPS MEASUREMENT AT TIME OF BORING

THE DOW CHEMICAL COMPANY						DESIGNED			
PRODUCT RECOVERY INVESTIGATION						REDRAWN		C.M.B.	12/10
SMA-4 (RTW-3)						CHECKED			
DATE CREATED				SCALE (8.5 x 11 ONLY)		REV.			
DECEMBER 20TH, 2010		1" = 2'		RG-137+50-IC71					
				MFG. REP.		T.S.K.	12/10		

A - ORIGINAL DEPTH OF WELL - NOVEMBER 17TH, 2010
 B - FINAL DEPTH OF WELL - DECEMBER 3RD, 2010
 13.39' - DOWNHOLE DEPTH TO BOTTOM

WATER ELEV - 588.1'± (11/17/2010)

2010 TOP OF SEDIMENT (586.0')

2009 TOP OF SEDIMENT (585.6')**

6.3'

6.6'

5.7'

5.9'

2010 RESISTANCE

2009 TILL*

BOTTOM OF WELL - A
 BOTTOM OF WELL - B

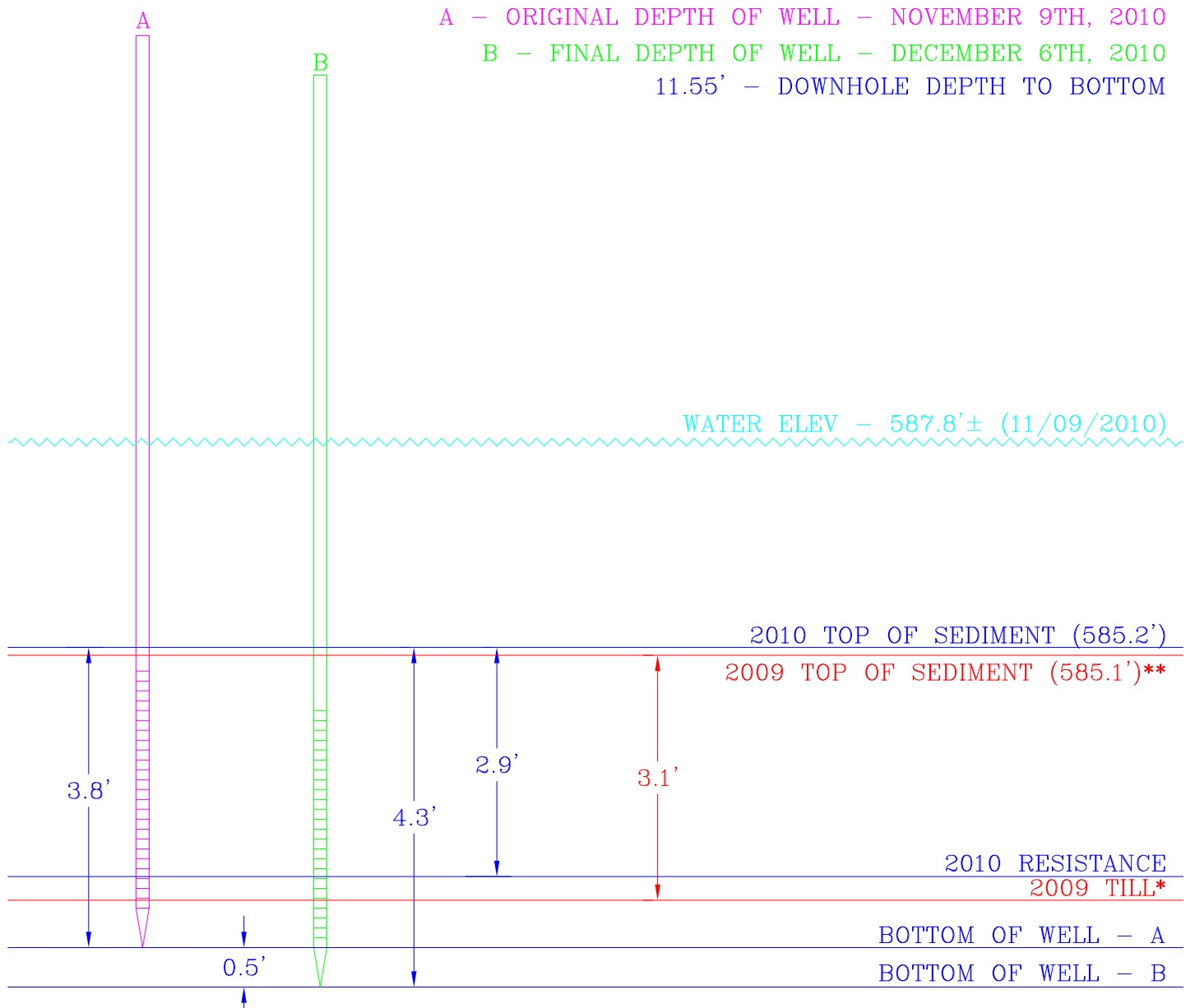
0.3'

* 2009 TILL DEPTH BASED ON NOVEMBER 2009 SEDIMENT BORING (RG-137+50-IC114)
 ** 2009 TOP OF SEDIMENT ELEVATION BASED ON GPS MEASUREMENT AT TIME OF BORING

THE DOW CHEMICAL COMPANY				DESIGNED		
PRODUCT RECOVERY INVESTIGATION				REDRAWN		C.M.B. 12/10
SMA-4 (RTW-8)				CHECKED		
DATE CREATED DECEMBER 20TH, 2010				APPROVED		
SCALE (8.5 x 11 ONLY) 1' = 2'				PROJ. ENGR.		
RG-137+50-IC114				MFG. REP.		T.S.K. 12/10
REV.				PRINTED		VER.

A - ORIGINAL DEPTH OF WELL - NOVEMBER 9TH, 2010
 B - FINAL DEPTH OF WELL - DECEMBER 6TH, 2010
 11.55' - DOWNHOLE DEPTH TO BOTTOM

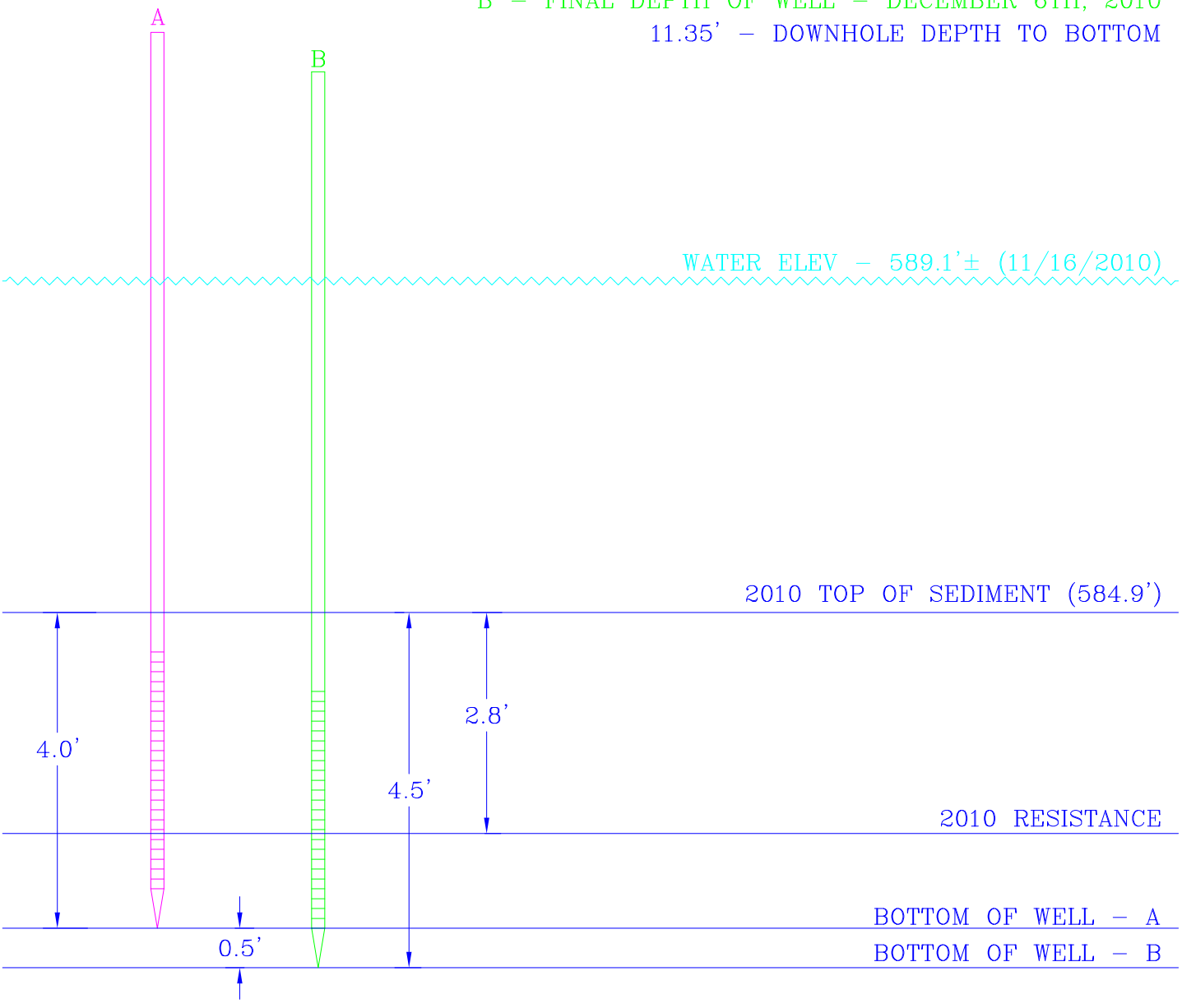
WATER ELEV - 587.8'± (11/09/2010)



* 2009 TILL DEPTH BASED ON NOVEMBER 2009 SEDIMENT BORING (RH-145+00-IC118)
 ** 2009 TOP OF SEDIMENT ELEVATION BASED ON GPS MEASUREMENT AT TIME OF BORING

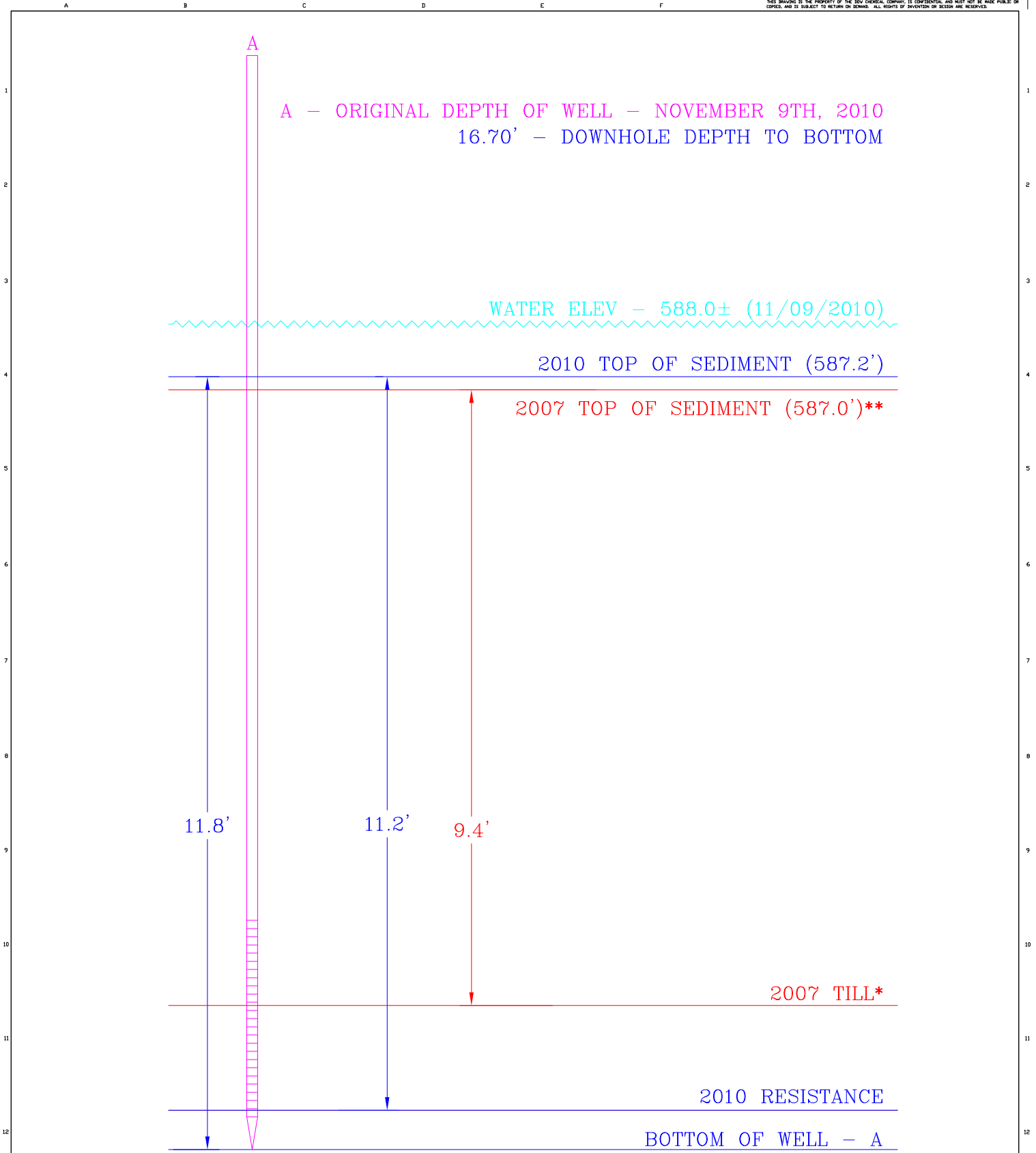
THE DOW CHEMICAL COMPANY				DESIGNED	
				REDRAWN	C.M.B.
PRODUCT RECOVERY INVESTIGATION				CHECKED	
				APPROVED	
SMA-5 (RTW-4)				PROJ. ENGR.	
				MFG. REP.	T.S.K.
DATE CREATED DECEMBER 20TH, 2010	SCALE (8.5 x 11 ONLY) 1" = 2'	RH-145+00-IC118	REV.		

A - ORIGINAL DEPTH OF WELL - NOVEMBER 16TH, 2010
 B - FINAL DEPTH OF WELL - DECEMBER 6TH, 2010
 11.35' - DOWNHOLE DEPTH TO BOTTOM



NOTE - NO PREVIOUS CORE AT THIS LOCATION

THE DOW CHEMICAL COMPANY				DESIGNED		
PRODUCT RECOVERY INVESTIGATION				REDRAWN		C.M.B. 12/10
SMA-5 (RTW-9)				CHECKED		
DATE CREATED DECEMBER 20TH, 2010				APPROVED		
SCALE (8.5 x 11 ONLY) 1" = 2"				PROJ. ENGR.		
NO PREVIOUS LOCATION				MFG. REP.		T.S.K. 12/10
REV.				PRINTED		VER.



A - ORIGINAL DEPTH OF WELL - NOVEMBER 9TH, 2010
 16.70' - DOWNHOLE DEPTH TO BOTTOM

WATER ELEV - 588.0± (11/09/2010)

2010 TOP OF SEDIMENT (587.2')

2007 TOP OF SEDIMENT (587.0')**

11.8'

11.2'

9.4'

2007 TILL*

2010 RESISTANCE

BOTTOM OF WELL - A

* 2007 TILL DEPTH BASED ON OCTOBER 2007 SEDIMENT BORING (RH-151+50-IC33)

** 2007 TOP OF SEDIMENT ELEVATION BASED ON GPS MEASUREMENT AT TIME OF BORING

THE DOW CHEMICAL COMPANY	
PRODUCT RECOVERY INVESTIGATION	
SMA-6 (RTW-5)	
DATE CREATED DECEMBER 20TH, 2010	SCALE (8.5 x 11 ONLY) 1" = 2"
RH-151+50-IC33	
	REV.

DESIGNED		
REDRAWN	C.M.B.	12/10
CHECKED		
APPROVED		
PRD.J. ENGR.		
MFG. REP.	T.S.K.	12/10