

DATA REPORT Rev. 1
GEOTECHNICAL EXPLORATION AND TESTING

| Rev. 1

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA NUCLEAR POWER STATION
MINERAL, LOUISA COUNTY, VIRGINIA

| Rev. 1

September 28, 2007

| Rev. 1

VOLUME 2

APPENDICES C and D

Prepared For:

Virginia Electric and Power Company
Richmond, Virginia

| Rev. 1

Prepared By:

MACTEC Engineering and Consulting, Inc.
Raleigh, North Carolina

MACTEC Project No. 6468-06-1472

APPENDIX C.1

OBSERVATION WELL LOGS, DEVELOPMENT RECORDS AND SAMPLING RECORDS

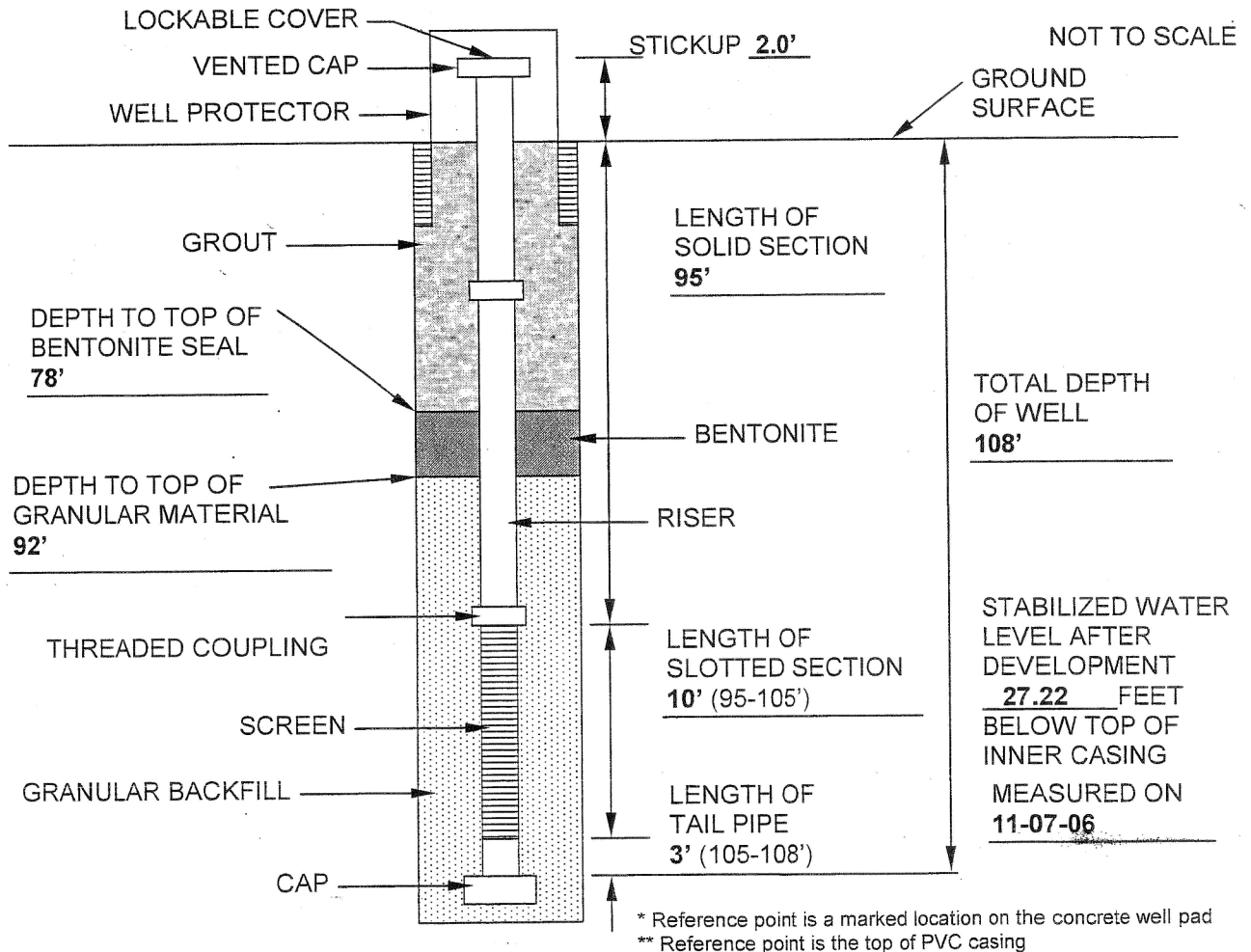
NORTH ANNA COL

**DATA REPORT REV. 0
JANUARY 23, 2007**

MACTEC PROJECT NO. 6468-06-1472

OBSERVATION WELL INSTALLATION RECORD

JOB NAME NORTH ANNA COL	JOB NUMBER 6468-06-1472
WELL NUMBER OW-901	INSTALLATION DATE 10-31-06
LOCATION (NAD83) N = 3,909,772.32 E = 11,685,917.49	
GROUND SURFACE ELEVATION* (NAVD88) 309.62	REFERENCE POINT ELEVATION** (NAVD88) 311.32
GRANULAR BACKFILL MATERIAL Southern Silica #1 Sand	SLOT SIZE .010
SCREEN MATERIAL PVC Schd. 40-Standard	SCREEN DIAMETER 2 in.
RISER MATERIAL PVC Schd. 40-Standard	RISER DIAMETER 2 in.
DRILLING TECHNIQUE Air rotary	DRILLING CONTRACTOR Bedford
BOREHOLE DIAMETER 6"	MACTEC FIELD REPRESENTATIVE Kim Charles-Smith
LOCK BRAND Master	SIZE/MODEL N/A
KEY CODE/COMBINATION #3206	



NORTH ANNA POWER STATION
MINERAL, VIRGINIA
COL PROJECT
Dominion Purchase Order 7015798

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OBSERVATION WELL
INSTALLATION RECORD

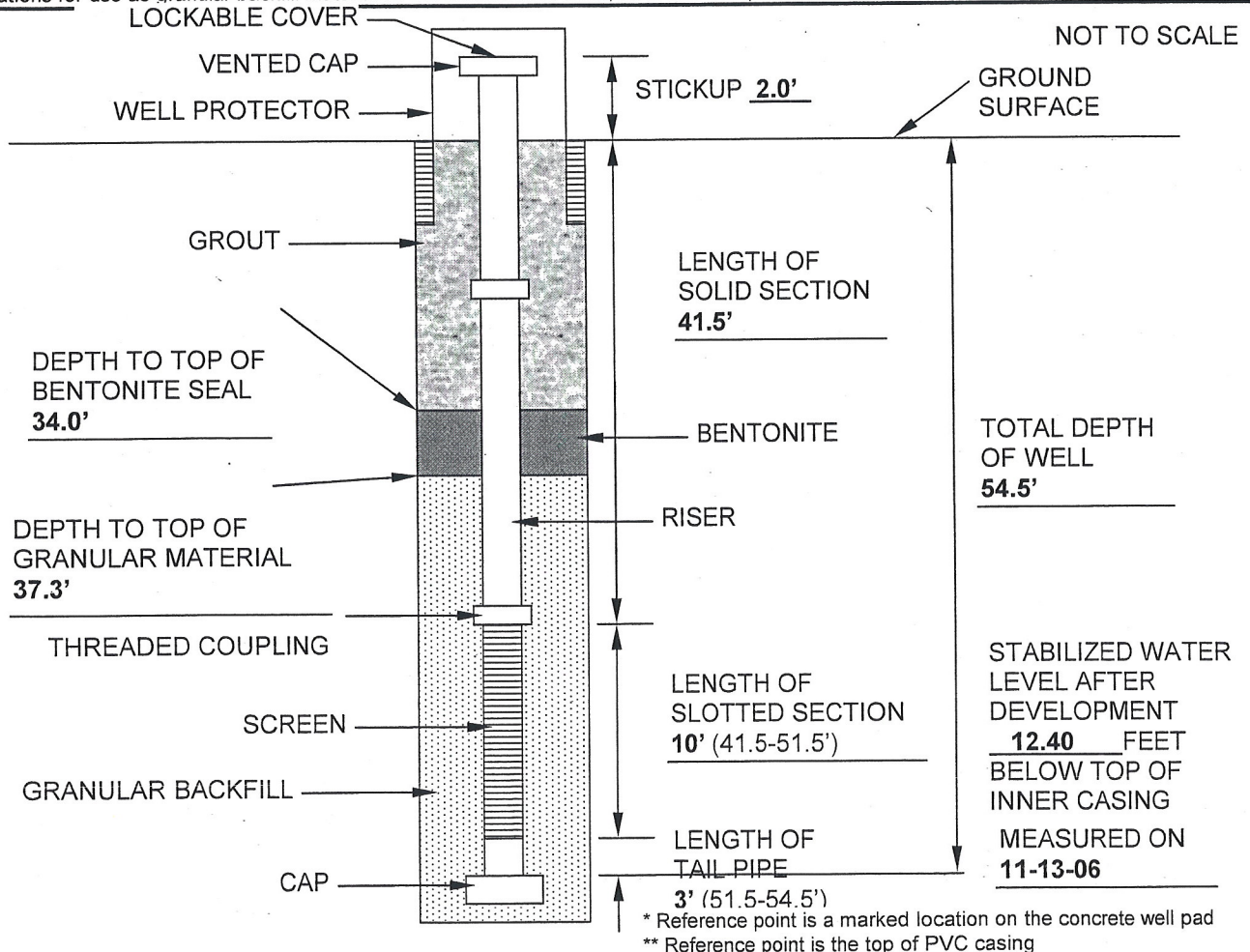
gag 1-19-07

OBSERVATION WELL INSTALLATION RECORD

JOB NAME NORTH ANNA COL	JOB NUMBER 6468-06-1472
WELL NUMBER OW-945	INSTALLATION DATE 11-07-06
LOCATION (NAD83) N = 3,910,136.49 E = 11,683,793.31	
GROUND SURFACE ELEVATION* (NAVD88) 281.56	REFERENCE POINT ELEVATION** (NAVD88) 283.08
GRANULAR BACKFILL MATERIAL Southern Silica #1 & #3 Sand*	SLOT SIZE .010
SCREEN MATERIAL PVC Schd. 40-Standard	SCREEN DIAMETER 2 in.
RISER MATERIAL PVC Schd. 40-Standard	RISER DIAMETER 2 in.
DRILLING TECHNIQUE Hollow-stem auger 4.25" I.D.	DRILLING CONTRACTOR MACTEC
BOREHOLE DIAMETER Approximately 8"	MACTEC FIELD REPRESENTATIVE Kim Charles-Smith
LOCK BRAND Master	SIZE/MODEL N/A

KEY CODE/COMBINATION **#3206**

* MACTEC initiated well construction using #3 sand, but did not have enough to complete the well. Because both #1 and #3 sands met technical specifications for use as granular backfill material for the observation wells, MACTEC completed the well using #1 sand.



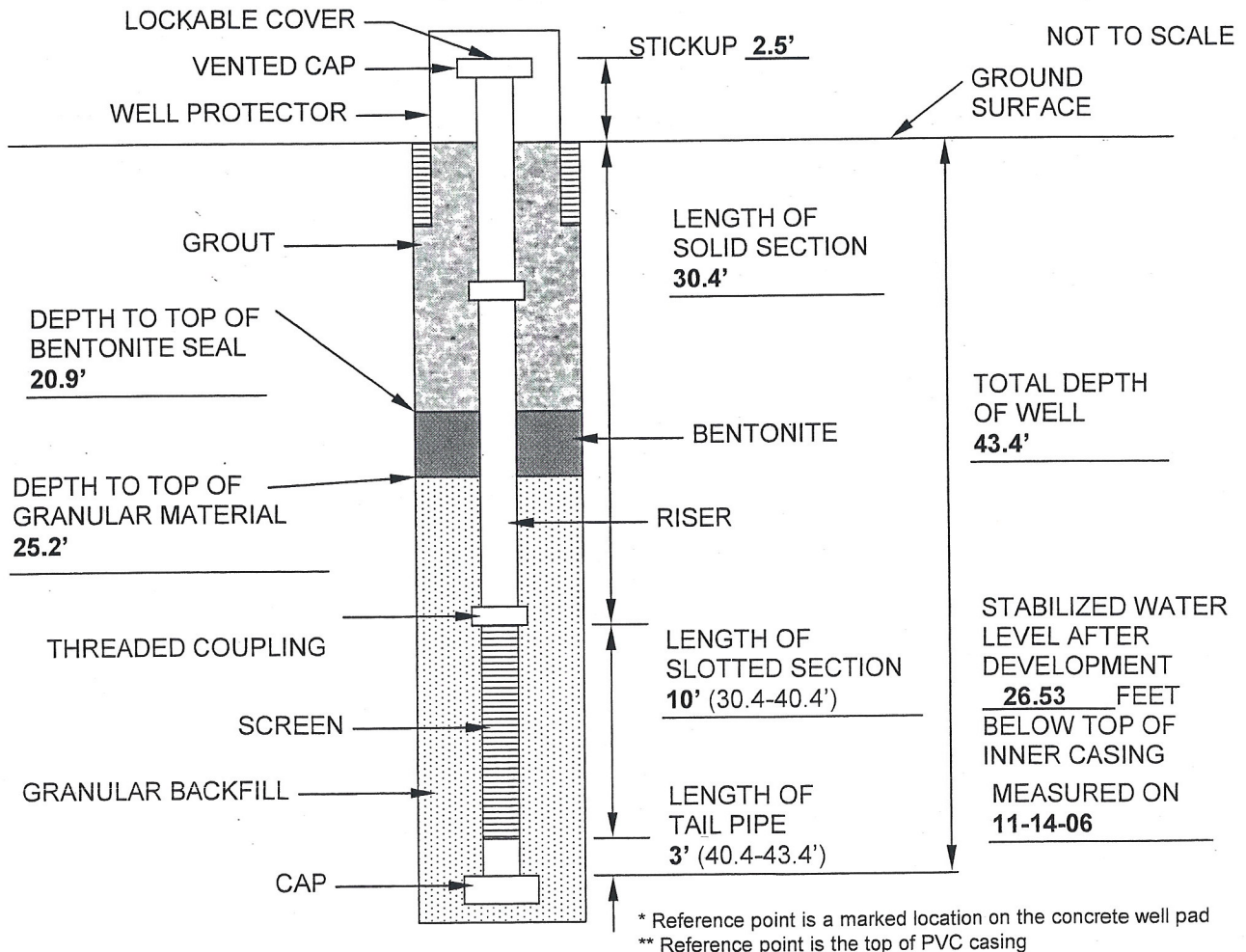
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OBSERVATION WELL
 INSTALLATION RECORD

OBSERVATION WELL INSTALLATION RECORD

JOB NAME <u>NORTH ANNA COL</u>	JOB NUMBER <u>6468-06-1472</u>
WELL NUMBER <u>OW-946</u>	INSTALLATION DATE <u>11-13-06</u>
LOCATION (NAD83) <u>N = 3,908,787.97 E = 11,683,822.73</u>	
GROUND SURFACE ELEVATION* (NAVD88) <u>334.04</u>	REFERENCE POINT ELEVATION** (NAVD88) <u>335.58</u>
GRANULAR BACKFILL MATERIAL <u>Southern Silica #3 Sand</u>	SLOT SIZE <u>.010</u>
SCREEN MATERIAL <u>PVC Schd. 40-Standard</u>	SCREEN DIAMETER <u>2 in.</u>
RISER MATERIAL <u>PVC Schd. 40-Standard</u>	RISER DIAMETER <u>2 in.</u>
DRILLING TECHNIQUE <u>Hollow-stem auger 4.25" I.D.</u>	DRILLING CONTRACTOR <u>MACTEC</u>
BOREHOLE DIAMETER <u>Approximately 8"</u>	MACTEC FIELD REPRESENTATIVE <u>Joe Wallen</u>
LOCK BRAND <u>Master</u>	SIZE/MODEL <u>N/A</u>
KEY CODE/COMBINATION <u>#3206</u>	



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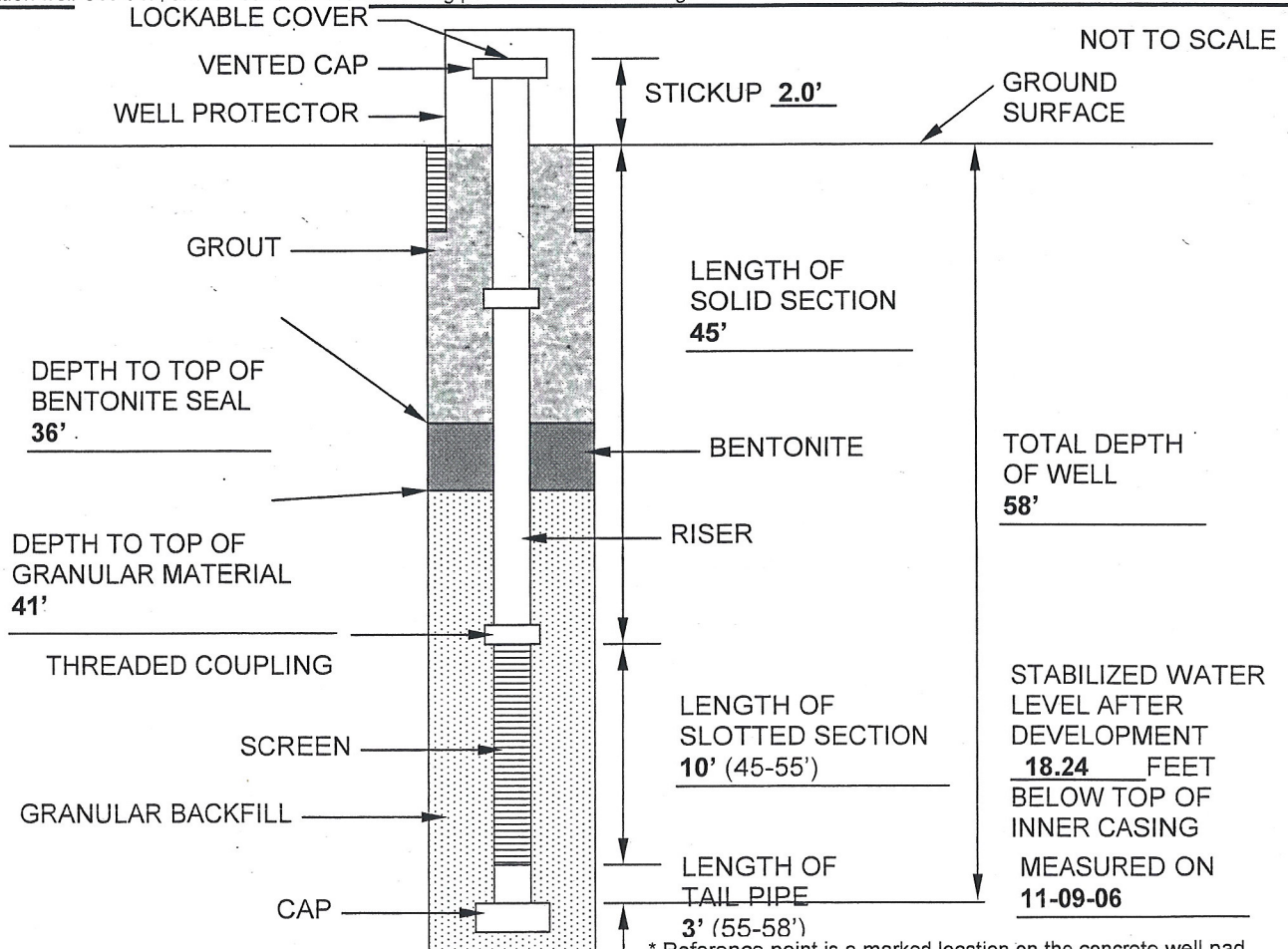
OBSERVATION WELL
INSTALLATION RECORD

Joe Wallen 11-18-07

OBSERVATION WELL INSTALLATION RECORD

JOB NAME NORTH ANNA COLJOB NUMBER 6468-06-1472WELL NUMBER OW-947INSTALLATION DATE 11-06-06LOCATION (NAD83) N = 3,909,579.58 E = 11,686,371.84GROUND SURFACE ELEVATION* (NAVD88) 313.30REFERENCE POINT ELEVATION** (NAVD88) 315.08GRANULAR BACKFILL MATERIAL Southern Silica #1 & #3 Sand*SLOT SIZE .010SCREEN MATERIAL PVC Schd. 40-StandardSCREEN DIAMETER 2 in.RISER MATERIAL PVC Schd. 40-StandardRISER DIAMETER 2 in.DRILLING TECHNIQUE Hollow-stem auger 4.25" I.D.DRILLING CONTRACTOR MACTECBOREHOLE DIAMETER Approximately 8"MACTEC FIELD REPRESENTATIVE Kim Charles-SmithLOCK BRAND MasterSIZE/MODEL N/AKEY CODE/COMBINATION #3206

* Both #1 and #3 sand met the technical specifications for use as granular backfill material. MACTEC used #3 sand to backfill the sump portion of observation well OW-947, and #1 sand for the remaining portion of the well boring.



* Reference point is a marked location on the concrete well pad
** Reference point is the top of PVC casing

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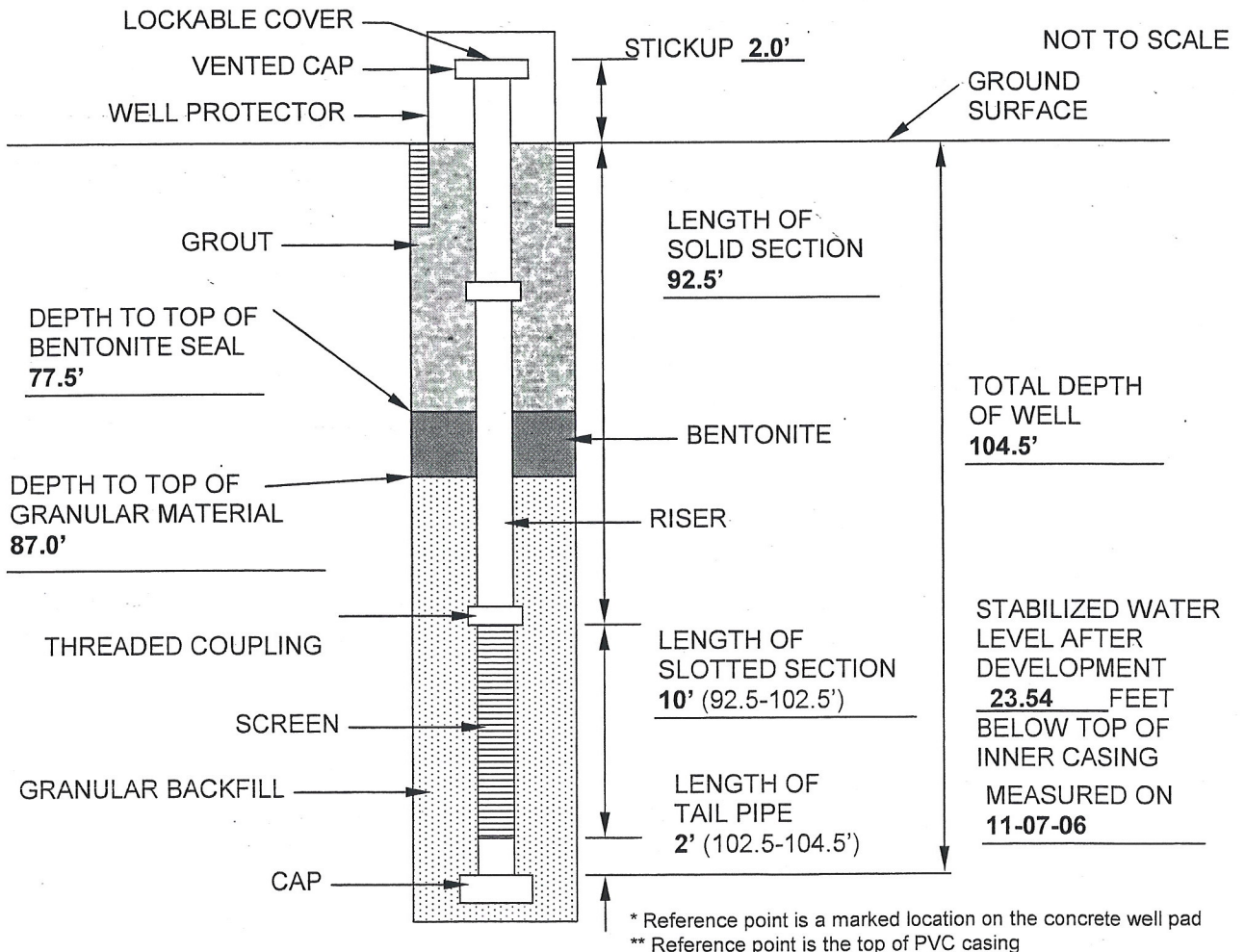
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OBSERVATION WELL
INSTALLATION RECORD

Joe 11-08-07

OBSERVATION WELL INSTALLATION RECORD

JOB NAME <u>NORTH ANNA COL</u>	JOB NUMBER <u>6468-06-1472</u>
WELL NUMBER <u>OW-949</u>	INSTALLATION DATE <u>10-30-06</u>
LOCATION (NAD83) <u>N = 3,909,025.20 E = 11,685,153.35</u>	
GROUND SURFACE ELEVATION* (NAVD88) <u>335.67</u>	REFERENCE POINT ELEVATION** (NAVD88) <u>336.91</u>
GRANULAR BACKFILL MATERIAL <u>Southern Silica #1 Sand</u>	SLOT SIZE <u>.010</u>
SCREEN MATERIAL <u>PVC Schd. 40-Standard</u>	SCREEN DIAMETER <u>2 in.</u>
RISER MATERIAL <u>PVC Schd. 40-Standard</u>	RISER DIAMETER <u>2 in.</u>
DRILLING TECHNIQUE <u>Air rotary</u>	DRILLING CONTRACTOR <u>Bedford</u>
BOREHOLE DIAMETER <u>6"</u>	MACTEC FIELD REPRESENTATIVE <u>Mike Lear</u>
LOCK BRAND <u>Master</u>	SIZE/MODEL <u>N/A</u>
KEY CODE/COMBINATION <u>#3206</u>	



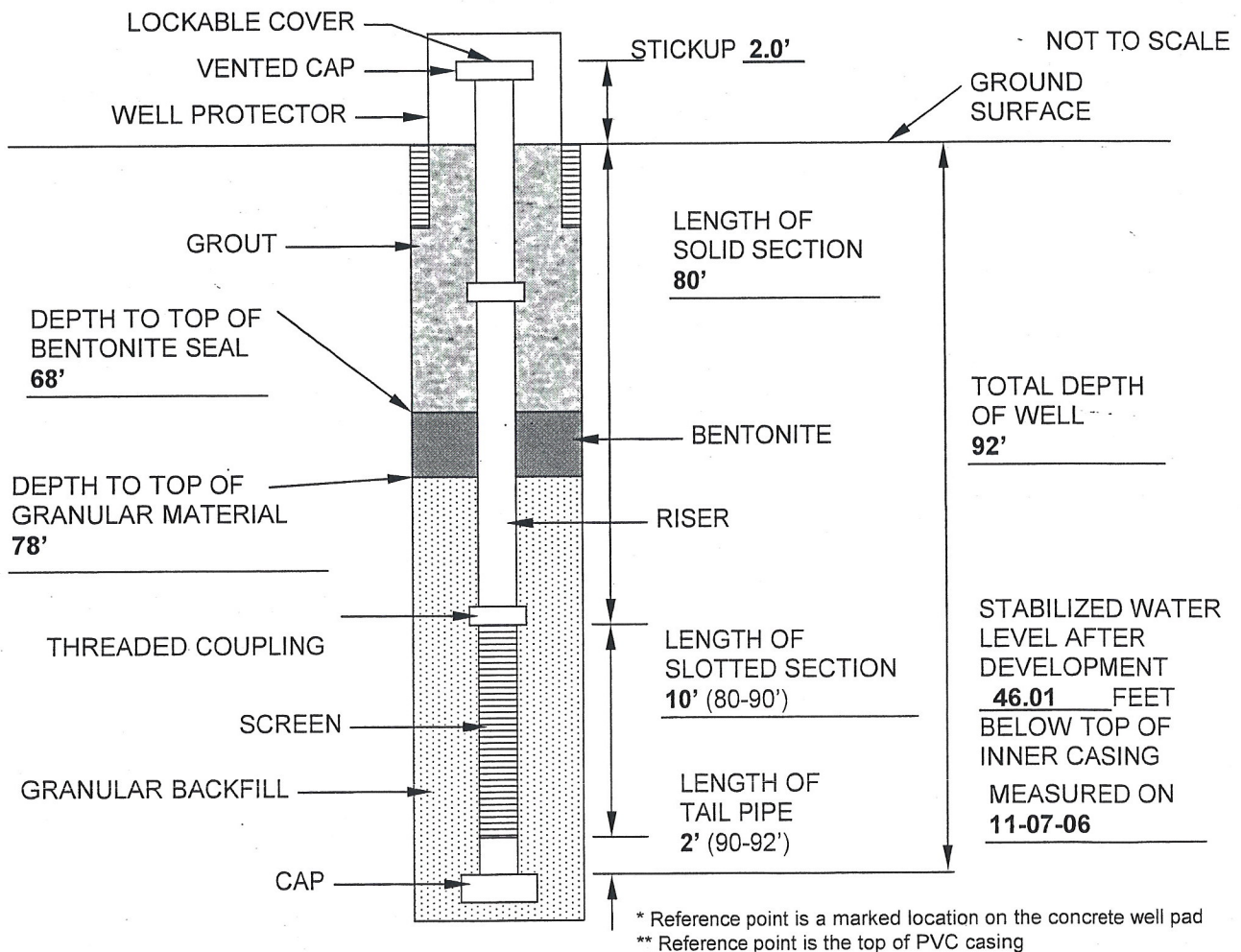
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OBSERVATION WELL
 INSTALLATION RECORD

JA2 1-12-07

OBSERVATION WELL INSTALLATION RECORD

JOB NAME NORTH ANNA COLJOB NUMBER 6468-06-1472WELL NUMBER OW-950INSTALLATION DATE 10-31-06LOCATION (NAD83) N = 3,910,842.18 E = 11,686,285.15GROUND SURFACE ELEVATION* (NAVD88) 282.98REFERENCE POINT ELEVATION** (NAVD88) 284.49GRANULAR BACKFILL MATERIAL Southern Silica #1 SandSLOT SIZE .010SCREEN MATERIAL PVC Schd. 40-StandardSCREEN DIAMETER 2 in.RISER MATERIAL PVC Schd. 40-StandardRISER DIAMETER 2 in.DRILLING TECHNIQUE Air rotaryDRILLING CONTRACTOR BedfordBOREHOLE DIAMETER 6"MACTEC FIELD REPRESENTATIVE Kim Charles-SmithLOCK BRAND MasterSIZE/MODEL N/AKEY CODE/COMBINATION #3206

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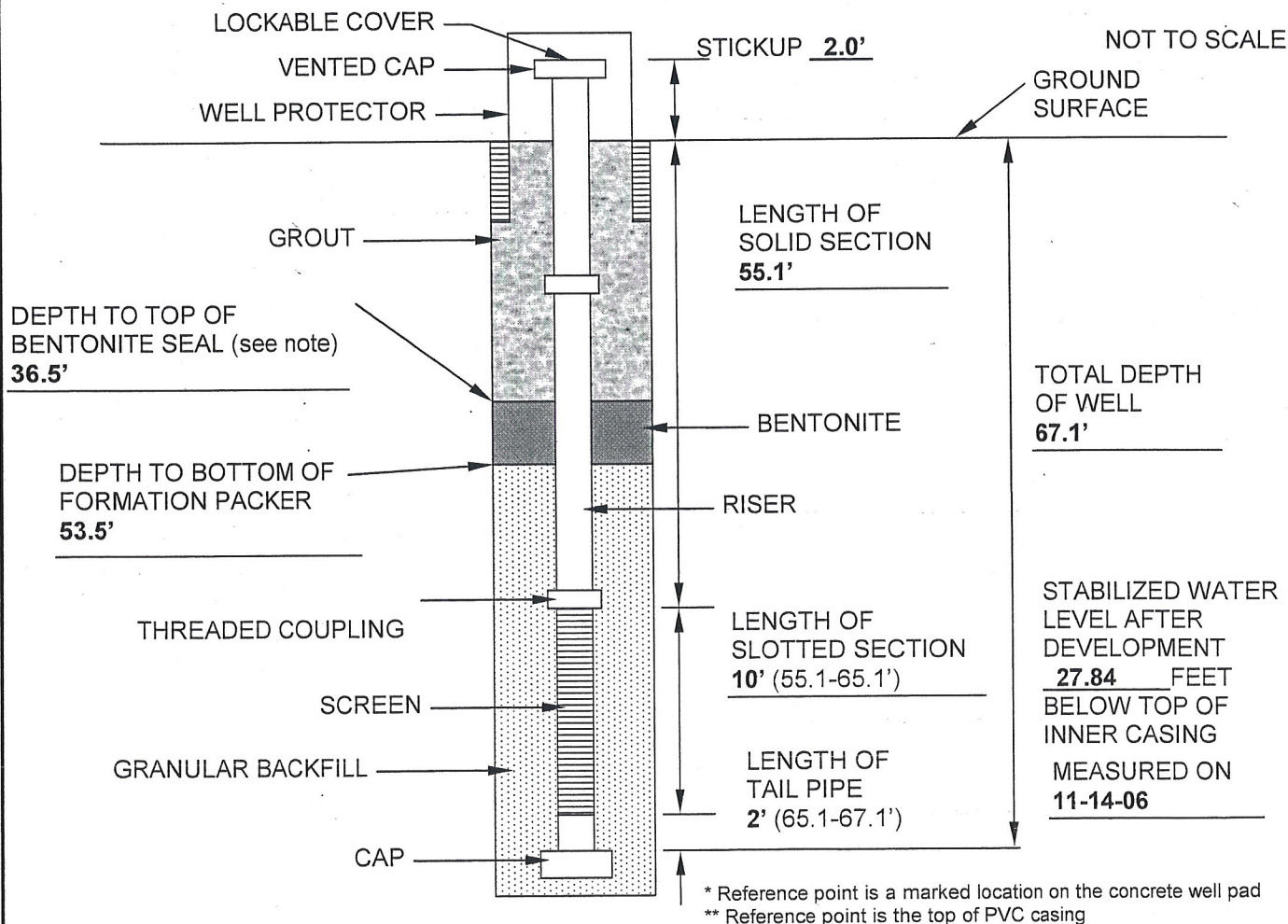
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OBSERVATION WELL
INSTALLATION RECORD

Joe 1-18-07

OBSERVATION WELL INSTALLATION RECORD

JOB NAME <u>NORTH ANNA COL</u>	JOB NUMBER <u>6468-06-1472</u>
WELL NUMBER <u>OW-951</u>	INSTALLATION DATE <u>11-10-06</u>
LOCATION (NAD83) <u>N = 3,910,521.44 E = 11,686,786.01</u>	
GROUND SURFACE ELEVATION* (NAVD88) <u>249.69</u>	REFERENCE POINT ELEVATION** (NAVD88) <u>250.68</u>
GRANULAR BACKFILL MATERIAL <u>Southern Silica #3 Sand</u>	SLOT SIZE <u>.010</u>
SCREEN MATERIAL <u>PVC Schd. 40-Standard</u>	SCREEN DIAMETER <u>2 in.</u>
RISER MATERIAL <u>PVC Schd. 40-Standard</u>	RISER DIAMETER <u>2 in.</u>
DRILLING TECHNIQUE <u>Hollow-stem auger 4.25" I.D.</u>	DRILLING CONTRACTOR <u>MACTEC</u>
BOREHOLE DIAMETER <u>Approximately 8"</u>	MACTEC FIELD REPRESENTATIVE <u>Kim Charles-Smith</u>
LOCK BRAND <u>Master</u>	SIZE/MODEL <u>N/A</u>
KEY CODE/COMBINATION <u>#3206</u>	



NOTE: DSI granular bentonite used above packer

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OBSERVATION WELL
 INSTALLATION RECORD

jas 1-18-07



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Observation Well Development Worksheet

MACTEC JOB NUMBER **6468-06-1472**

OBSERVATION WELL NUMBER ow-901

SITE NAME **North Anna Power Station**

DATE (MO/DAY/YR) 11-02-06

TIME (MILITARY) 1100

FIELD PERSONNEL Kim Charles-Smith

WEATHER CONDITIONS Partly cloudy to sunny

TOTAL WELL DEPTH (TWD) 108' FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE 2' FT.

DESCRIPTION OF MEASURING POINT TOC

DEPTH TO GROUNDWATER (DGW) 27.37' FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION DISPOSABLE BAILER ☒ OTHER: Grundfos pump

TOTAL VOLUME OF WATER REMOVED Approx. 41.0 GAL. CASING DIAMETER 2 IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER NA

SCREENED INTERVAL (FROM ID PLATE) 95'-105' (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING YES ☒ NO ☐ COMMENTS

LOCKING CAP YES ☒ NO ☐

PROTECTIVE POST/ABUTMENT YES ☐ NO ☒

NONPOTABLE LABEL YES ☐ NO ☐

ID PLATE YES ☐ NO ☐

WELL INTEGRITY SATISFACTORY YES ☒ NO ☐

WELL YIELD LOW ☒ MODERATE ☐ HIGH ☐ COMMENTS See note

GROUNDWATER PARAMETERS

VOLUME (GAL.)	1 st volume	2 nd volume	3 rd volume			
			<u>See note</u>			
pH (S.U.)	<u>6.99</u>	<u>6.62</u>	<u>6.38</u>			
SP. COND. (µMHOS/CM)	<u>143.4</u>	<u>132.4</u>	<u>121.5</u>			
WATER TEMP. (°C)	<u>13.7</u>	<u>15.0</u>	<u>12.5</u>			
TURBIDITY* (NTU)	<u>4.22</u>	<u>42.2</u>	<u>32.9</u>			

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

note: 3rd well volume pumped on 11-03-06 0819 hrs.
- Turbidity increased after 1st well volume
was removed. Kef 01-15-07

Kef
11-03-06



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Observation Well Development Worksheet

MACTEC JOB NUMBER **6468-06-1472**

OBSERVATION WELL NUMBER **OW-945**

SITE NAME **North Anna Power Station**

DATE (MO/DAY/YR) **11-09-06**

TIME (MILITARY) **1102**

FIELD PERSONNEL **Kim Charles-Smith**

WEATHER CONDITIONS **Sunny ~ 70°F**

TOTAL WELL DEPTH (TWD) **54.5'** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **2'** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **12.43'** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION DISPOSABLE BAILER ☐ OTHER: **Grundfos Pump**

TOTAL VOLUME OF WATER REMOVED **Approx. 85** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **41.5' - 51.5'** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING YES ☐ NO ☐ COMMENTS

LOCKING CAP YES ☒ NO ☐

PROTECTIVE POST/ABUTMENT YES ☐ NO ☐

NONPOTABLE LABEL YES ☐ NO ☐

ID PLATE YES ☐ NO ☐

WELL INTEGRITY SATISFACTORY YES ☒ NO ☐

WELL YIELD LOW ☐ MODERATE ☐ HIGH ☒ COMMENTS **Pumped @ Approx. 2.5 gpm**

GROUNDWATER PARAMETERS

VOLUME (GAL.)	14 gal	21 gal	35 gal	50 gal	70 gal	85 gal
pH (S.U.)	6.60	6.78	6.61	6.34	6.00	6.00
SP. COND. (µMHOS/CM)	47.5	32.1	27.6	22.1	20.8	19.3
WATER TEMP. (°C)	20.1	18.3	17.7	17.1	17.0	17.1
TURBIDITY* (NTU)	>1000	>1000	402	71.5	50.3	31.0

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

NOTE: pH/COND meter calibrated w/ 7.0 buffer #4803 Exp 01-25-07 7.0 = 7.0
4.0 buffer #4804 Exp 01-25-07 4.0 = 3.99
Turbidity 100 = 101 20 = 19.9
500 = 799 20.1 = 0.09 See page 6 of Field Book for lot + exp date



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Observation Well Development Worksheet

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW946

SITE NAME North Anna Power Station

DATE (MO/DAY/YR) 11-14-06

TIME (MILITARY) 1421

FIELD PERSONNEL Kim Chicks-Smith + Mike Lear

WEATHER CONDITIONS Sunny Approx 68°F

TOTAL WELL DEPTH (TWD) 43.4

FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE 2.5

FT.

DESCRIPTION OF MEASURING POINT TOC

DEPTH TO GROUNDWATER (DGW) 26.39

FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION

DISPOSABLE
BAILER ☐

OTHER:

GroundFos Pump

TOTAL VOLUME OF WATER REMOVED 30

GAL.

CASING DIAMETER 2

IN.

CASING MATERIAL

PVC ☒

S.S. ☐

TEFLON ☐

OTHER

SCREENED INTERVAL (FROM ID PLATE) 30.4 - 40.4

(DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING

YES ☒

NO ☐

COMMENTS

pumped @ approx.

LOCKING CAP

YES ☒

NO ☐

2 gpm

PROTECTIVE POST/ABUTMENT

YES ☐

NO ☐

NONPOTABLE LABEL

YES ☐

NO ☐

2.84 gal = 1 Val.

ID PLATE

YES ☐

NO ☐

WELL INTEGRITY SATISFACTORY

YES ☒

NO ☐

WELL YIELD

LOW ☐

MODERATE ☒

HIGH ☐

COMMENTS

GROUNDWATER PARAMETERS

11-14-06

VOLUME (GAL.)	<u>6 gal.</u>	<u>18 gal.</u>	<u>21 gal.</u>	<u>24 gal.</u>	<u>27 gal.</u>	<u>30 gal.</u>
pH (S.U.)	<u>7.27</u>	<u>5.68</u>	<u>5.96</u>	<u>5.91</u>		<u>5.25</u>
SP. COND. (µMHOS/CM)	<u>143.2</u>	<u>51.0</u>	<u>51.9</u>	<u>44.8</u>		<u>45.4</u>
WATER TEMP. (°C)	<u>17.6</u>	<u>16.5</u>	<u>16.1</u>	<u>15.9</u>	<u>11-14-06</u>	<u>16.1</u>
TURBIDITY* (NTU)	<u>536</u>	<u>680</u>	<u>165</u>	<u>20.6</u>		<u>7.90</u>

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

PH/COND meter calibrated 7.0 buffer Lot # 4803 Exp 01-25-07
7.0 = 7.01; 4.0 buffer Lot # 484 Exp. 01-25-07 4.0 = 4.02
Turbidity meter calibrated w/ 100 = 999; 100 = 100; 20 = 20.1; 5.0 = 5.01
etc.



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Observation Well Development Worksheet

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW-947

SITE NAME North Anna Power Station

DATE (MO/DAY/YR) 11-08-06

TIME (MILITARY) 1147

FIELD PERSONNEL Kim Charles-Smith

WEATHER CONDITIONS Cloudy - Light Rain

TOTAL WELL DEPTH (TWD) 58.0 FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE 2.0 FT.

DESCRIPTION OF MEASURING POINT TOC

DEPTH TO GROUNDWATER (DGW) 18.02 FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION DISPOSABLE BAILER ☒ OTHER: bailed + pumped w/ grinders

TOTAL VOLUME OF WATER REMOVED 87 GAL. CASING DIAMETER 2 IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) 45'-55' (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING YES ☐ NO ☐ COMMENTS

LOCKING CAP YES ☐ NO ☐

PROTECTIVE POST/ABUTMENT YES ☐ NO ☐

NONPOTABLE LABEL YES ☐ NO ☐

ID PLATE YES ☐ NO ☐

WELL INTEGRITY SATISFACTORY YES ☒ NO ☐

WELL YIELD LOW ☐ MODERATE ☒ HIGH ☐ COMMENTS

GROUNDWATER PARAMETERS

VOLUME (GAL.)	14 gal.	21 gal.	35 gal.	50 gal.	80 gal.	87 gal.
pH (S.U.)	6.15	7.11	6.53	6.47	6.44	6.32
SP. COND. (µMHOS/CM)	81.0	75.1	71.7 6.47 key mistake	67.9	56.2	56.9
WATER TEMP. (°C)	15.6	15.5	16.2	16.1	15.5	15.5
TURBIDITY* (NTU)	71000	71000	71000	71000	234	142

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

NOTE: Bailed + pumped well per Work Instruction Attachment NC. 19
pH, COND meter calibrated with 7.0 buffer lot #4803 Exp 01-25-07
7.0 read 6.99 4.0 buffer 4 lot #4804 Exp. 01-25-07 4.0 = 4.02



Observation Well Development Worksheet

MACTEC JOB NUMBER **6468-06-1472**

OBSERVATION WELL NUMBER OW-949

SITE NAME **North Anna Power Station**

DATE (MO/DAY/YR) 11-02-06

TIME (MILITARY) 1325

FIELD PERSONNEL Kim Charles-Smith

WEATHER CONDITIONS partly cloudy - sunny

TOTAL WELL DEPTH (TWD) 105' FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE 2' FT.

DESCRIPTION OF MEASURING POINT TOC

DEPTH TO GROUNDWATER (DGW) 23.80' FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION DISPOSABLE ☒ BAILER OTHER: Grundfos pump

TOTAL VOLUME OF WATER REMOVED Approx. 150 GAL. CASING DIAMETER 2 IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) 105'-95' (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING YES ☒ NO ☐ COMMENTS

LOCKING CAP YES ☒ NO ☐

PROTECTIVE POST/ABUTMENT YES ☐ NO ☒

NONPOTABLE LABEL YES ☐ NO ☐

ID PLATE YES ☐ NO ☐

WELL INTEGRITY SATISFACTORY YES ☒ NO ☐

WELL YIELD LOW ☐ MODERATE ☐ HIGH ☒ COMMENTS pumped @ ~2.5 gpm with no drawdown

GROUNDWATER PARAMETERS

VOLUME (GAL.)	5 th volume	6 th volume	7 th volume	8 th volume	9 th volume	10 th volume
pH (S.U.)	6.71	6.60	6.58	6.53	6.54	6.66
SP. COND. (µMHOS/CM)	92.8	92.4	91.8	92.9	90.4	96.6
WATER TEMP. (°C)	15.8	15.8	15.9	16.2	15.8	16.8
TURBIDITY* (NTU)	<u>11-02-06</u> 240	187	129	75.2	79.3	52.9

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

NOTE: Removed 3 well volumes via stagger pumping then removed 7 more volumes.

KY
11-2-06



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Observation Well Development Worksheet

MACTEC JOB NUMBER **6468-06-1472**

OBSERVATION WELL NUMBER **OW-950**

SITE NAME **North Anna Power Station**

DATE (MO/DAY/YR) **11-02-06**

TIME (MILITARY) **0935**

FIELD PERSONNEL **Kim Charles-Smith**

WEATHER CONDITIONS **Partly cloudy to Sunny**

TOTAL WELL DEPTH (TWD) **92'** FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE **2'** FT.

DESCRIPTION OF MEASURING POINT **TOC**

DEPTH TO GROUNDWATER (DGW) **46.07** FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION DISPOSABLE BAILER ☐ OTHER: **Grundfos pump**

TOTAL VOLUME OF WATER REMOVED **Approx. 23.0** GAL. CASING DIAMETER **2** IN.

CASING MATERIAL PVC ☒ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) **80'-90'** (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING YES ☒ NO ☐ COMMENTS

LOCKING CAP YES ☒ NO ☐

PROTECTIVE POST/ABUTMENT YES ☐ NO ☒

NONPOTABLE LABEL YES ☐ NO ☐

ID PLATE YES ☐ NO ☐

WELL INTEGRITY SATISFACTORY YES ☒ NO ☐

WELL YIELD LOW ☒ MODERATE ☐ HIGH ☐ COMMENTS **See note**

GROUNDWATER PARAMETERS

VOLUME (GAL.)	1 Volume	2 Volume	3 Volume			
	~ 8.0 gal	~ 8 gal.	See note			
pH (S.U.)	6.58	7.10	7.27			
SP. COND. (µMHOS/CM)	427.2	310.6	202.4			
WATER TEMP. (°C)	13.1	15.4	9.1			
TURBIDITY* (NTU)	946	>1000	540			

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

note: 3rd well volume purged on 11-03-06 0900 hrs.



MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue
Raleigh, North Carolina 27604

Observation Well Development Worksheet

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW-951

SITE NAME North Anna Power Station

DATE (MO/DAY/YR) ~~11-17-06~~ 11-13-06 Ky 11-13-06 TIME (MILITARY) 0805

FIELD PERSONNEL Kim Charles-Smith

WEATHER CONDITIONS cloudy - mid 50's

TOTAL WELL DEPTH (TWD) 67.1' FT. (DEPTH BELOW MEASURING POINT)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE 2 FT.

DESCRIPTION OF MEASURING POINT TOC

DEPTH TO GROUNDWATER (DGW) 27.84' FT. (DEPTH BELOW MEASURING POINT)

METHOD OF WELL EVACUATION DISPOSABLE BAILER ☐ OTHER: Grundfos Pump

TOTAL VOLUME OF WATER REMOVED 3 well vol. GAL. CASING DIAMETER 2 IN.

CASING MATERIAL PVC ☐ S.S. ☐ TEFLON ☐ OTHER

SCREENED INTERVAL (FROM ID PLATE) (DEPTHS BELOW LAND SURFACE - FT.)

STEEL GUARD PIPE AROUND CASING YES ☒ NO ☐ COMMENTS No for Ky 11-13-06

LOCKING CAP YES ☒ NO ☐

PROTECTIVE POST/ABUTMENT YES ☐ NO ☐

NONPOTABLE LABEL YES ☐ NO ☐

ID PLATE YES ☐ NO ☐

WELL INTEGRITY SATISFACTORY YES ☒ NO ☐

WELL YIELD LOW ☒ MODERATE ☐ HIGH ☐ COMMENTS

11-13-06 GROUNDWATER PARAMETERS

VOLUME (GAL.)	1 well vol. 6 gal.	11-14-06 6 gal.	11-15-06 7 gal.			
pH (S.U.)	7.70	7.67	6.27		Ky 11-17-06	
SP. COND. (µMHOS/CM)	357.6	3223	1878			
WATER TEMP. (°C)	16.3 ^{15.6}	16.3	16.5			
TURBIDITY*	>1000	172	306			

* VISUAL DETERMINATION ONLY (1) CLEAR (2) SLIGHT (3) MODERATE (4) HIGH

NOTE: well pumped dry after each attempt and was slow to recover. 4 Ky 01-15-07



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3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER 00-901

SITE NAME North Anna Coh

DATE (MO/DAY/YR) 11-16-06

TIME (MILITARY) 1330

FIELD PERSONNEL Kim Charles-Smith / Joe Wallan

WEATHER CONDITIONS light rain

PHYSICAL CONDITION OF THE WELL
very good / new

WELL HEAD OBSERVATIONS AND MEASUREMENTS

TOTAL WELL DEPTH (TWD) 108' FT. (DEPTH BELOW MEASURING POINT)

SCREENED INTERVAL (FT) 103'-95' SAND PACK INTERVAL (FT) 108'-92' (16')

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE FT.

DESCRIPTION OF MEASURING POINT TOC (DEPTHS BELOW LAND SURFACE - FT.)

DEPTH TO FREE PRODUCT (DFP) NA FT. (DEPTH BELOW MEASURING POINT)

DEPTH TO GROUNDWATER (DGW) 26.63' FT. (DEPTH BELOW MEASURING POINT)

MEASURING DEVICE Slope Indicator DEVICE ID NUMBER SN: 15287

METHOD OF WELL EVACUATION Grundfos pump

DECONTAMINATION PROCEDURE Alconox Wash / Tap Rinse

TOTAL VOLUME OF WATER REMOVED Approx 17.0 GAL. CASING DIAMETER IN. 2

FIELD ANALYSIS

FIELD PARAMETER INSTRUMENT USED YSI 600XL INSTRUMENT ID NO. SN: 010629

CALIBRATION RECORD FOR INSTRUMENT In Field Book DATE 11-15-06 TIME 1330

see note		PURGING				STABILIZED	SAMPLING
TIME (MILITARY)	Sample 1455	X					
PURGE RATE (gpm)	Approx 1.5 gpm						
VOLUME (GAL.)	17.0						
pH (S.U.)	6.26						
SP. COND. (mS/cm)	.150						
WATER TEMP. (°C)	15.2						
D.O. (mg/l)	2.50						
O.R.P. (mv)	-18.0						
Turbidity (NTUs)	101	X					
Appearance (visual)	clear						

NOTE: well purged by Allowed to Recover obtained Sample, no Field parameters during purging per ASTM 655-99 (Section 7.6.3.2)

OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

ACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW-901

SITE NAME North Anna Col

DATE (MO/DAY/YR) 11-16-06

TIME (MILITARY) 1330

FIELD PERSONNEL Kim Charles-Smith / Joe Waller

SAMPLE COLLECTION

PUMPING RATE (gpm) Approx .5 gpm due to inability to get water to wellhead @ lower rate.

DESCRIPTION OF SAMPLING EQUIPMENT Grundfos pump w/HDPE tubing

DESCRIPTION OF SAMPLE APPEARANCE Clear

SAMPLE COLLECTED FOR (IN CHRONOLOGICAL ORDER)

DATE

TIME (MILITARY)

160.1 ; 300.0 ; 310.1

11-16-06

1455

350.1 ; 353.1

11-16-06

1455

RY
11-16-06

NOTE: 100ml sample given to Hach Physics (Dominic RAS) Analysis.

DESCRIPTION OF PURGE WATER MANAGEMENT purge water dumped near well on the ground - handled the same as well development water.

WELL VOLUME CALCULATION

WELL CASING VOLUME =

HEIGHT OF WATER COLUMN (FT) * 0.0218 FT² (AREA OF 2" CASING)

$$\underline{81.37} * 0.0218 = \underline{1.77} \text{ FT}^3$$

SAND PACK VOLUME =

SOIL WELL

ROCK WELL

SAND PACK INTERVAL (FT) * 0.0767 ft² (AREA FOR 4 1/4" HOLE)

SAND PACK INTERVAL (FT) * 0.1744 ft² (AREA FOR 6" HOLE)

$$\underline{\quad} * 0.0767 = \underline{\quad} \text{ FT}^3$$

$$\begin{array}{rcl} \text{K8} & & \\ 11-17-06 & \underline{16} & * 0.0767 = \underline{1.23} \text{ FT}^3 \\ & \underline{13} & \\ & & 0.1744 \quad \underline{0.99} \text{ TJW 11/18/06} \\ & & \text{TJW 11/18/06} \quad \underline{2.27} \end{array}$$

WELL VOLUME =

WELL CASING VOLUME + (SAND PACK VOLUME * 0.30) * 7.48 GAL/FT³

ASSUMED 30% POROSITY IN SAND PACK

$$\begin{array}{rcl} \underline{1.77} & + & \underline{1.23} \text{ K8 11-17-06} \\ & & \text{TJW 11/18/06} \\ & & \underline{0.99} \text{ 0.68} \\ & & \underline{20.69} \text{ 18.3} \end{array}$$

THREE WELL VOLUMES =

$$\begin{array}{rcl} \text{WELL VOLUME} * 3 & & \\ \underline{18.3} & * & \underline{3} \\ & & \underline{55} \text{ GAL} \\ & & \text{TJW 11/18/06} \end{array}$$



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OBSERVATION WELL SAMPLING WORKSHEET
IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER 00-945

SITE NAME North Anna Col

DATE (MO/DAY/YR) 11/17/06

TIME (MILITARY) 10:05

FIELD PERSONNEL Kim Charles-Smith, Joe Wallen, Steve Nizely

WEATHER CONDITIONS Sunny Approx 65°F

PHYSICAL CONDITION OF THE WELL

Very good / New

WELL HEAD OBSERVATIONS AND MEASUREMENTS

TOTAL WELL DEPTH (TWD) 54.5' from ground surface

FT. (DEPTH BELOW MEASURING POINT)

SCREENED INTERVAL (FT) 51.5' - 41.5'

SAND PACK INTERVAL (FT) 54.5' - 37.3'

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE

2

FT.

DESCRIPTION OF MEASURING POINT TOC

(DEPTHS BELOW LAND SURFACE - FT.)

DEPTH TO FREE PRODUCT (DFP)

N/A

FT. (DEPTH BELOW MEASURING POINT)

DEPTH TO GROUNDWATER (DGW)

11.99

FT. (DEPTH BELOW MEASURING POINT)

MEASURING DEVICE

slope Indicator

DEVICE ID NUMBER

SN: 15287

METHOD OF WELL EVACUATION Grundfos Pump

DECONTAMINATION PROCEDURE Alconox Wash / Tap Rinse

TOTAL VOLUME OF WATER REMOVED

67.2

GAL.

CASING DIAMETER IN.

2

FIELD ANALYSIS

FIELD PARAMETER INSTRUMENT USED

YSI 600XL

INSTRUMENT ID NO.

SN: 01L0629

CALIBRATION RECORD FOR
INSTRUMENT In Field Book

DATE 11-17-06

TIME 0715 hrs.

PURGING

STABILIZED

SAMPLING

TIME (MILITARY)

10:45

11:16

11:33

11:47

12:02

12:17

PURGE RATE (gpm)

0.5

0.5

0.5

0.5

0.5

0.5

VOLUME (GAL.)

17

33.6

42.5

50.4

58.8

67.2

pH (S.U.)

5.83

5.75

5.74

5.72

5.72

5.71

SP. COND. (mS/cm)

0.017

0.017

0.017

0.017

0.017

0.017

WATER TEMP. (°C)

14.03

14.08

13.99

13.99

14.00

14.01

D.O. (mg/l)

7.64

7.38

7.20

7.14

7.19

7.15

O.R.P. (mv)

125.9

187.6

199.1

204.7

210.1

216.1

Turbidity (NTUs)

6.40

1.68

1.29

0.95

0.79

0.70

Appearance (visual)

clear

clear

clear

clear

clear

clear

OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

ACTEC JOB NUMBER 648-06-1472

OBSERVATION WELL NUMBER OW-945

SITE NAME North Anna Coh

DATE (MO/DAY/YR) 11/17/06

TIME (MILITARY) 1005

FIELD PERSONNEL Kim Chels-Smith, Joe Weller, Steve Nicely

SAMPLE COLLECTION 12:20

PUMPING RATE (gpm) 0.4 gpm

DESCRIPTION OF SAMPLING EQUIPMENT Grundfos pump / HDPE Tubing

DESCRIPTION OF SAMPLE APPEARANCE Clear

SAMPLE COLLECTED FOR (IN CHRONOLOGICAL ORDER)

DATE

TIME (MILITARY)

160.1, 300.0, 310.1

11-17-06

1220

350.1, 353.1

11-17-06

1220

11-17-06

NOTE: 100 ml sample given to (Raj) Pannu for Health physics.

DESCRIPTION OF PURGE WATER MANAGEMENT purge water dumped near well on the ground
- handled the same as well development purge water

WELL VOLUME CALCULATION

WELL CASING VOLUME =

HEIGHT OF WATER COLUMN (FT) * 0.0218 FT² (AREA OF 2" CASING)

42.51 * 0.0218 = 0.927 FT³

SAND PACK VOLUME =

SOIL WELL

ROCK WELL

SAND PACK INTERVAL (FT) * 0.0767 ft² (AREA FOR 4 1/4" HOLE)

SAND PACK INTERVAL (FT) * 0.1744 ft² (AREA FOR 6" HOLE)

17.2 * 0.0767 = 1.32 FT³
11/17/06

 * 0.0767 = FT³

WELL VOLUME =

WELL CASING VOLUME + (SAND PACK VOLUME * 0.30) * 7.48 GAL/FT³

ASSUMED 30% POROSITY IN SAND PACK

0.927 + 1.32 * 7.48 = 12.7 GAL
11/17/06

THREE WELL VOLUMES =

WELL VOLUME * 3

12.7 * 3 = 38.1 GAL
11/17/06



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OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW-946

SITE NAME North Anna COL

DATE (MO/DAY/YR) 11/28/06

TIME (MILITARY) 17:15

FIELD PERSONNEL Joe Wallen, Mike Lear

WEATHER CONDITIONS Partly Cloudy, 50s

PHYSICAL CONDITION OF THE WELL

New

WELL HEAD OBSERVATIONS AND MEASUREMENTS

TOTAL WELL DEPTH (TWD) 45.9' below top casing FT. (DEPTH BELOW MEASURING POINT)

SCREENED INTERVAL (FT) 32.9' - 42.9' below top casing SAND PACK INTERVAL (FT) 28.7' - 45.9' below top casing

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE 2.5' FT.

DESCRIPTION OF MEASURING POINT Top of casing (2.5' above ground sur.) (DEPTHS BELOW LAND SURFACE - FT.)

DEPTH TO FREE PRODUCT (DFP) N/A FT. (DEPTH BELOW MEASURING POINT)

DEPTH TO GROUNDWATER (DGW) 25.47 FT. (DEPTH BELOW MEASURING POINT)

MEASURING DEVICE Solinst water Level Meter
MODEL 101

DEVICE ID NUMBER 29658

METHOD OF WELL EVACUATION Grundfos pump

DECONTAMINATION PROCEDURE Alconox / water

TOTAL VOLUME OF WATER REMOVED GAL.

CASING DIAMETER IN. 2"

FIELD ANALYSIS

FIELD PARAMETER INSTRUMENT USED YSI 600 XL

INSTRUMENT ID NO. 01J0527

CALIBRATION RECORD FOR INSTRUMENT

DATE 11/28/06

TIME 08:30

PURGING

STABILIZED

SAMPLING

TIME (MILITARY)	17:52	17:59	18:04	18:09	18:14		
PURGE RATE (gpm)	0.5	0.5	0.5	0.5	0.5		
VOLUME (GAL.)	13.8	16.3	18.8	21.3	23.8		
pH (S.U.)	5.80	5.79	5.79	5.78	5.79		
SP. COND. (mS/cm)	0.059	0.059	0.058	0.057	0.057		
WATER TEMP. (°C)	14.32	14.31	14.33	14.33	14.34		
D.O. (mg/l)	7.20	7.26	7.28	7.30	7.35		
O.R.P. (mv)	203.7	205.7	206.5	208.8	208.9		
Turbidity (NTUs)	4.87	3.48	1.60	1.65	0.95		
Appearance (visual)	Clear	Clear	Clear	Clear	Clear		



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OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW-946

SITE NAME North Anna COL

DATE (MO/DAY/YR) 11/28/06

TIME (MILITARY) 17:15

FIELD PERSONNEL Joe Wallen, Mike Lear

SAMPLE COLLECTION

PUMPING RATE (gpm) 0.5

DESCRIPTION OF SAMPLING EQUIPMENT Grundfos Pump

DESCRIPTION OF SAMPLE APPEARANCE clear

SAMPLE COLLECTED FOR (IN CHRONOLOGICAL ORDER)

DATE

TIME (MILITARY)

DESCRIPTION OF PURGE WATER MANAGEMENT

On site disposal

WELL VOLUME CALCULATION

WELL CASING VOLUME =

HEIGHT OF WATER COLUMN (FT) * 0.0218 FT² (AREA OF 2" CASING)

20.4 * 0.0218 = 0.445 FT³

SAND PACK VOLUME =

SOIL WELL

ROCK WELL

SAND PACK INTERVAL (FT) * 0.0767 ft² (AREA FOR 4 1/4" HOLE)

SAND PACK INTERVAL (FT) * 0.1744 ft² (AREA FOR 6" HOLE)

18.2 * 0.0767 = 1.40 FT³

* 0.0767 = FT³

WELL VOLUME =

WELL CASING VOLUME + (SAND PACK VOLUME * 0.30) * 7.48 GAL/FT³

ASSUMED 30% POROSITY IN SAND PACK

0.445 + 1.40 * 7.48 = 13.8 GAL

THREE WELL VOLUMES =

11 VOLUME * 3 * 7.48 = GAL



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OBSERVATION WELL SAMPLING WORKSHEET
IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

CTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW-947

SITE NAME North Anna Col

DATE (MO/DAY/YR) 11-17-06

TIME (MILITARY) 1330

FIELD PERSONNEL Kim Charles-Smith / Steve Nicely / Joe Walker

SAMPLE COLLECTION

PUMPING RATE (gpm) 0.28 - 0.4 gpm

DESCRIPTION OF SAMPLING EQUIPMENT Grundfos pump / LDPE Tubing

DESCRIPTION OF SAMPLE APPEARANCE Clear

SAMPLE COLLECTED FOR (IN CHRONOLOGICAL ORDER)

DATE

TIME (MILITARY)

160.1; 300.0; 310.1

11-17-06

1508

350.1; 353.1

11-17-06

1508

K/S 11-17-06

DESCRIPTION OF PURGE WATER MANAGEMENT

purge water dumped near well on the ground handled same manner as well developed ^{purge} water.

WELL VOLUME CALCULATION

WELL CASING VOLUME =

HEIGHT OF WATER COLUMN (FT) * 0.0218 FT² (AREA OF 2" CASING)

40.15 * 0.0218 = 0.875 FT³

SAND PACK VOLUME =

SOIL WELL

ROCK WELL

SAND PACK INTERVAL (FT) * 0.0767 ft² (AREA FOR 4 1/4" HOLE)

SAND PACK INTERVAL (FT) * 0.1744 ft² (AREA FOR 6" HOLE)

17 * 0.0767 = 1.30 FT³

 * 0.0767 = FT³

WELL VOLUME =

WELL CASING VOLUME + (SAND PACK VOLUME * 0.30) * 7.48 GAL/FT³

ASSUMED 30% POROSITY IN SAND PACK

0.875 + 1.30 * 7.48 = 16.3 GAL

THREE WELL VOLUMES =

16.3 * 3 * 7.48 = 48.9 GAL



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OBSERVATION WELL SAMPLING WORKSHEET
IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER <u>6468-06-1472</u>		OBSERVATION WELL NUMBER <u>OW-949</u>								
SITE NAME <u>North Anna COL</u>										
DATE (MO/DAY/YR) <u>11/28/06</u>		TIME (MILITARY) <u>15:30</u>								
FIELD PERSONNEL <u>Joe Wallen, Mike Lear</u>										
WEATHER CONDITIONS <u>Partly cloudy, 40s</u>										
PHYSICAL CONDITION OF THE WELL <u>New</u>										
WELL HEAD OBSERVATIONS AND MEASUREMENTS										
TOTAL WELL DEPTH (TWD) <u>106.4'</u>		FT. (DEPTH BELOW MEASURING POINT)								
SCREENED INTERVAL (FT) <u>94.5' - 104.5' below top casing</u>		SAND PACK INTERVAL (FT) <u>89.0' - 106.5' below top casing</u>								
HEIGHT OF MEASURING POINT ABOVE LAND SURFACE <u>Top casing</u>		<u>2.0 FT.</u>								
DESCRIPTION OF MEASURING POINT <u>Top casing</u>		(DEPTHS BELOW LAND SURFACE - FT.)								
DEPTH TO FREE PRODUCT (DFP) <u>N/A</u>		FT. (DEPTH BELOW MEASURING POINT)								
DEPTH TO GROUNDWATER (DGW) <u>23.22</u>		FT. (DEPTH BELOW MEASURING POINT)								
MEASURING DEVICE <u>Solinst Water Level Meter</u> <u>MODEL 101</u>		DEVICE ID NUMBER <u>29658</u>								
METHOD OF WELL EVACUATION <u>Grundfos Pump</u>										
DECONTAMINATION PROCEDURE <u>Alconox / water</u>										
TOTAL VOLUME OF WATER REMOVED <u>34.5</u>		GAL. CASING DIAMETER IN. <u>2"</u>								
FIELD ANALYSIS										
FIELD PARAMETER INSTRUMENT USED <u>YSI 600XL</u>		INSTRUMENT ID NO. <u>01J0527</u>								
CALIBRATION RECORD FOR INSTRUMENT		DATE <u>11/28/06</u> TIME <u>08:30</u>								
PURGING							TJDW 11/28/06 STABILIZED		SAMPLING	
TIME (MILITARY)	<u>14:51</u>	<u>14:56</u>	<u>15:01</u>	<u>15:06</u>	<u>15:11</u>	<u>15:16</u>	<u>15:21</u>	<u>15:26</u>		
PURGE RATE (gpm)	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>		
VOLUME (GAL.)	<u>20.5</u>	<u>22.5</u>	<u>24.5</u>	<u>26.5</u>	<u>29.5</u>	<u>30.5</u>	<u>32.5</u>	<u>34.5</u>		
pH (S.U.)	<u>6.19</u>	<u>6.19</u>	<u>6.16</u>	<u>6.16</u>	<u>6.17</u>	<u>6.16</u>	<u>6.17</u>	<u>6.18</u>		
SP. COND. (mS/cm)	<u>0.113</u>	<u>0.113</u>	<u>0.113</u>	<u>0.112</u>	<u>0.112</u>	<u>0.111</u>	<u>0.111</u>	<u>0.111</u>		
WATER TEMP. (°C)	<u>16.17</u>	<u>16.15</u>	<u>16.16</u>	<u>16.20</u>	<u>16.16</u>	<u>16.16</u>	<u>16.13</u>	<u>16.15</u>		
D.O. (mg/l)	<u>3.26</u>	<u>3.24</u>	<u>3.26</u>	<u>3.25</u>	<u>3.24</u>	<u>3.28</u>	<u>3.24</u>	<u>3.26</u>		
O.R.P. (mv)	<u>170.8</u>	<u>174.9</u>	<u>178.6</u>	<u>183.4</u>	<u>187.0</u>	<u>188.6</u>	<u>190.2</u>	<u>191.4</u>		
Turbidity (NTUs)	<u>25.1</u>	<u>27.4</u>	<u>19.3</u>	<u>15.4</u>	<u>18.0</u>	<u>15.5</u>	<u>15.4</u>	<u>14.1</u>		
Appearance (visual)	<u>clear</u>	<u>clear</u>	<u>clear</u>	<u>clear</u>	<u>clear</u>	<u>clear</u>	<u>clear</u>	<u>clear</u>		



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3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-06-1478

OBSERVATION WELL NUMBER OW-949

SITE NAME North Anna Col

DATE (MO/DAY/YR) 11/28/06

TIME (MILITARY) 15:30

FIELD PERSONNEL Joe Wallen, Mike Bear

SAMPLE COLLECTION

PUMPING RATE (gpm) 0.4

DESCRIPTION OF SAMPLING EQUIPMENT Grundfos pump

DESCRIPTION OF SAMPLE APPEARANCE Clear

SAMPLE COLLECTED FOR (IN CHRONOLOGICAL ORDER)

DATE

TIME (MILITARY)

DESCRIPTION OF PURGE WATER MANAGEMENT

on site disposal

WELL VOLUME CALCULATION

WELL CASING VOLUME =

HEIGHT OF WATER COLUMN (FT) * 0.0218 FT² (AREA OF 2" CASING)

83.28 * 0.0218 = 1.82 FT³

SAND PACK VOLUME =

SOIL WELL

ROCK WELL

SAND PACK INTERVAL (FT) * 0.0767 ft² (AREA FOR 4 1/4" HOLE)

SAND PACK INTERVAL (FT) * 0.1744 ft² (AREA FOR 6" HOLE)

_____ * 0.0767 = _____ FT³

TJW 11/28/06
17.5 * 0.0767 = 3.05 FT³
0.1744

WELL VOLUME =

WELL CASING VOLUME + (SAND PACK VOLUME * 0.30) * 7.48 GAL/FT³

ASSUMED 30% POROSITY IN SAND PACK

TJW 11/28/06
1.82 + 0.916 * 7.48 = 12.5 GAL
20.5

THREE WELL VOLUMES =

1.1 VOLUME * 3 _____ * 7.48 = _____ GAL

OBSERVATION WELL SAMPLING WORKSHEET
IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-d6-1472

OBSERVATION WELL NUMBER OW-950

SITE NAME North Anna Col

DATE (MO/DAY/YR) 11-16-06

TIME (MILITARY) 1011

FIELD PERSONNEL Kim Charles-Smith / Mike Hear

WEATHER CONDITIONS Cloudy light rain

PHYSICAL CONDITION OF THE WELL

very good/new

WELL HEAD OBSERVATIONS AND MEASUREMENTS

TOTAL WELL DEPTH (TWD) 92'

FT. (DEPTH BELOW MEASURING POINT)

SCREENED INTERVAL (FT) 80'-90'

SAND PACK INTERVAL (FT) 92'-78' (14 ft.)

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE

2.0

FT.

DESCRIPTION OF MEASURING POINT TOC

(DEPTHS BELOW LAND SURFACE - FT.)

DEPTH TO FREE PRODUCT (DFP) NA

FT. (DEPTH BELOW MEASURING POINT)

DEPTH TO GROUNDWATER (DGW) 45.37'

FT. (DEPTH BELOW MEASURING POINT)

MEASURING DEVICE Slope Indicator

DEVICE ID NUMBER Sn: 15287

METHOD OF WELL EVACUATION Grundfos pump

DECONTAMINATION PROCEDURE Alconox wash / TAP Rinse

TOTAL VOLUME OF WATER REMOVED Approx 11.5 GAL.

CASING DIAMETER IN. 2

FIELD ANALYSIS

FIELD PARAMETER INSTRUMENT USED YSI 600 XL

INSTRUMENT ID NO. SN: 0140629

CALIBRATION RECORD FOR INSTRUMENT In Fieldbook

DATE 11-15-06

TIME 1600

see note		PURGING				STABILIZED	SAMPLING
TIME (MILITARY)	<u>Sample 1210</u>	X <u>11-16-06</u>					
PURGE RATE (gpm)	<u>Approx 1.5 gpm</u>						
VOLUME (GAL.)	<u>11.5</u>						
pH (S.U.)	<u>6.46</u>						
SP. COND. (mS/cm)	<u>262</u>						
WATER TEMP. (°C)	<u>16.37</u>						
D.O. (mg/l)	<u>2.43</u>						
O.R.P. (mv)	<u>146.4</u>						
Turbidity (NTUs)	<u>67.5</u>						
Appearance (visual)	<u>clear</u>						

NOTE: well purged Dry. Allow to recover determined Stratus, no Field parameters during purging per ASTM 6452-99 (Section 7.6.3.2)



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3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-06-1472

OBSERVATION WELL NUMBER OW-950

SITE NAME North Anna Col

DATE (MO/DAY/YR) 11-16-06

TIME (MILITARY) 1011

FIELD PERSONNEL Kim Charles-Smith

SAMPLE COLLECTION

PUMPING RATE (gpm) Approx .5 gpm Could not pump @ lower rate - had to increase rate to get water down to well head.

DESCRIPTION OF SAMPLING EQUIPMENT Grundfos pump w/HDPE Tubing

DESCRIPTION OF SAMPLE APPEARANCE Clear

SAMPLE COLLECTED FOR (IN CHRONOLOGICAL ORDER)

DATE

TIME (MILITARY)

160.1', 300.0', 310.1

11-16-06

1210

350.1', 353.1

11-16-06

1210

11-16-06

NOTE: 100 ml sample given to Dominion (R&S) for Health Physics Analysis

DESCRIPTION OF PURGE WATER MANAGEMENT purge water dumped near well on the ground - handled the same as well development purge water

WELL VOLUME CALCULATION

WELL CASING VOLUME =

HEIGHT OF WATER COLUMN (FT) * 0.0218 FT² (AREA OF 2" CASING)

32.63 * 0.0218 = 0.711 FT³

SAND PACK VOLUME =

SOIL WELL

ROCK WELL

SAND PACK INTERVAL (FT) * 0.0767 ft² (AREA FOR 4 1/4" HOLE)

SAND PACK INTERVAL (FT) * 0.1744 ft² (AREA FOR 6" HOLE)

 * 0.0767 = FT³

14' * 0.0767 = 1.07 FT³

WELL VOLUME =

WELL CASING VOLUME + (SAND PACK VOLUME * 0.30) * 7.48 GAL/FT³

ASSUMED 30% POROSITY IN SAND PACK

0.711 + 1.07 * 7.48 = 13.31 GAL

THREE WELL VOLUMES = 39.93 Gal.

WELL VOLUME * 3

13.31 * 3 = 39.93 GAL

11-16-06



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3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER CA68-06-1472

OBSERVATION WELL NUMBER OW-951

SITE NAME North Anna Col

DATE (MO/DAY/YR) 11-17-06

TIME (MILITARY) 0902

FIELD PERSONNEL Kim Charles Smith / Steve Nicely / Joe Wallen

WEATHER CONDITIONS Sunny

PHYSICAL CONDITION OF THE WELL

very GOOD/new

WELL HEAD OBSERVATIONS AND MEASUREMENTS

TOTAL WELL DEPTH (TWD) 67.1

FT. (DEPTH BELOW MEASURING POINT)

SCREENED INTERVAL (FT) 65.1 - 55.1

SAND PACK INTERVAL (FT) NA

HEIGHT OF MEASURING POINT ABOVE LAND SURFACE 1.5

FT.

DESCRIPTION OF MEASURING POINT TOC

(DEPTHS BELOW LAND SURFACE - FT.)

DEPTH TO FREE PRODUCT (DFP) NA

FT. (DEPTH BELOW MEASURING POINT)

DEPTH TO GROUNDWATER (DGW) 31.68'

FT. (DEPTH BELOW MEASURING POINT)

MEASURING DEVICE Slope Indicator

DEVICE ID NUMBER SN: 15287

METHOD OF WELL EVACUATION Grundfos pump

CONTAMINATION PROCEDURE Alconox Wash / Tap Rinse

TOTAL VOLUME OF WATER REMOVED 6.5

GAL.

CASING DIAMETER IN. 2

FIELD ANALYSIS

FIELD PARAMETER INSTRUMENT USED NA

INSTRUMENT ID NO. NA

CALIBRATION RECORD FOR INSTRUMENT NA

DATE NA

TIME NA

PURGING					STABILIZED	SAMPLING
TIME (MILITARY)						
PURGE RATE (gpm)						
VOLUME (GAL.)						
pH (S.U.)						
SP. COND. (mS/cm)						
WATER TEMP. (°C)						
D.O. (mg/l)						
O.R.P. (mv)						
idity (NTUs)						
Appearance (visual)						



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3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA 27604

OBSERVATION WELL SAMPLING WORKSHEET

IN ACCORDANCE WITH ASTM D 6089-97 (REAPPROVED 2003)

MACTEC JOB NUMBER 6468-dc-1472

OBSERVATION WELL NUMBER OW-951

SITE NAME North Anna COL

DATE (MO/DAY/YR)

TIME (MILITARY)

0902

FIELD PERSONNEL Kim Charles-Smith / Steven Self / Joe Wallen

SAMPLE COLLECTION

PUMPING RATE (gpm) 11-17-06 7 gpm - to pull water to well head

DESCRIPTION OF SAMPLING EQUIPMENT Grundfos pump / HDPE Tubing

DESCRIPTION OF SAMPLE APPEARANCE Clear

SAMPLE COLLECTED FOR (IN CHRONOLOGICAL ORDER)

DATE

TIME (MILITARY)

160.1'; 300.0'; 310.1

11-17-06

1548

350.1'; 353.1

11-17-06

1548

11-17-06

DESCRIPTION OF PURGE WATER MANAGEMENT

purge water dumped near well on the ground
handled the same as well development purge water.

WELL VOLUME CALCULATION

WELL CASING VOLUME =

HEIGHT OF WATER COLUMN (FT) * 0.0218 FT² (AREA OF 2" CASING)

55.11 * 0.0218 = FT³

SAND PACK VOLUME =

SOIL WELL

ROCK WELL

SAND PACK INTERVAL (FT) * 0.0767 ft² (AREA FOR 4 1/4" HOLE)

SAND PACK INTERVAL (FT) * 0.1744 ft² (AREA FOR 6" HOLE)

100 * 0.0767 = FT³

 * 0.0767 = FT³

WELL VOLUME =

WELL CASING VOLUME + (SAND PACK VOLUME * 0.30) * 7.48 GAL/FT³

 + * 7.48 = GAL

THREE WELL VOLUMES =

WELL VOLUME * 3 * 7.48 = GAL

NOTE: not applicable no sand
pack in well
Formation packer @ 53.5'

Well purged to 55.45' static
Static Allowed to recover
then sampled.

ASSUMED 30% POROSITY IN SAND PACK

no Field Parameters obtained
per ASTM 6462-99
Section 7.6.3.2.