Issues in Field Sampling

Safety

DIG-SAFE

Cross contamination

Artifacts

QA/QC

Field Screening

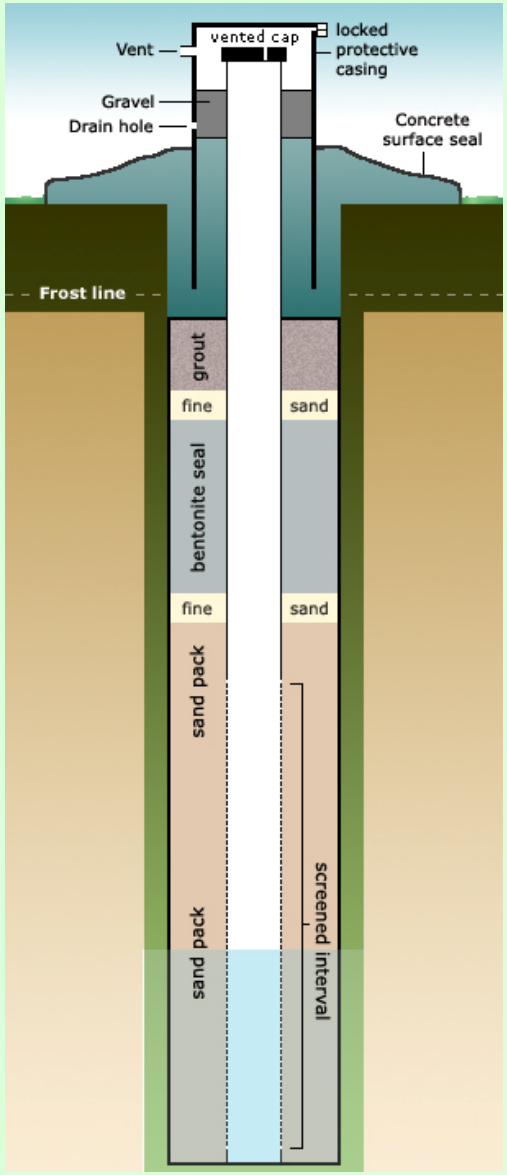
Sampling Handling

Potential Artifacts

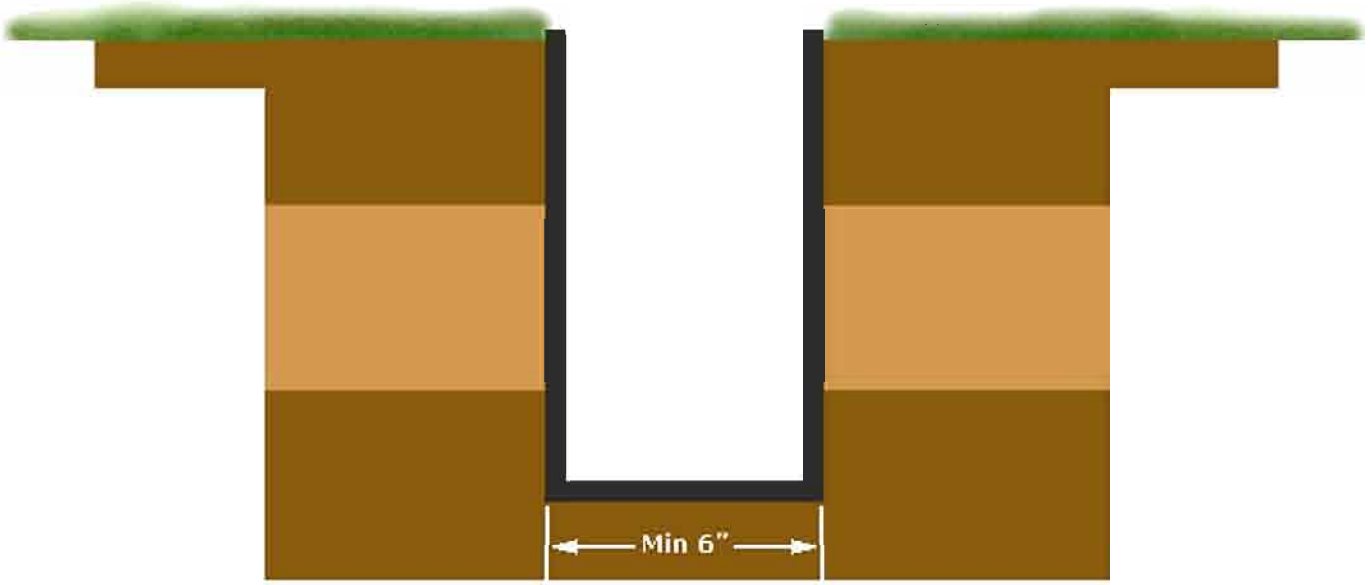
Methylene chloride, MEK, chloroform, carbon tet.	Laboratory solvents
Phthalates	Plasticizers in tubing
Trihalomethanes (chloroform)	Domestic water
Acetone, isopropyl alcohol, hexane	Field decontaminants
Barium, high pH	Drilling fluid, grout
Carbon disulfide, methyl chloride	Natural chemicals
MEK	Duct tape

Source: Morrison, R. D., 1999. *Environmental Forensics: Principles and Applications*. CRC Press, Boca Raton, Florida.

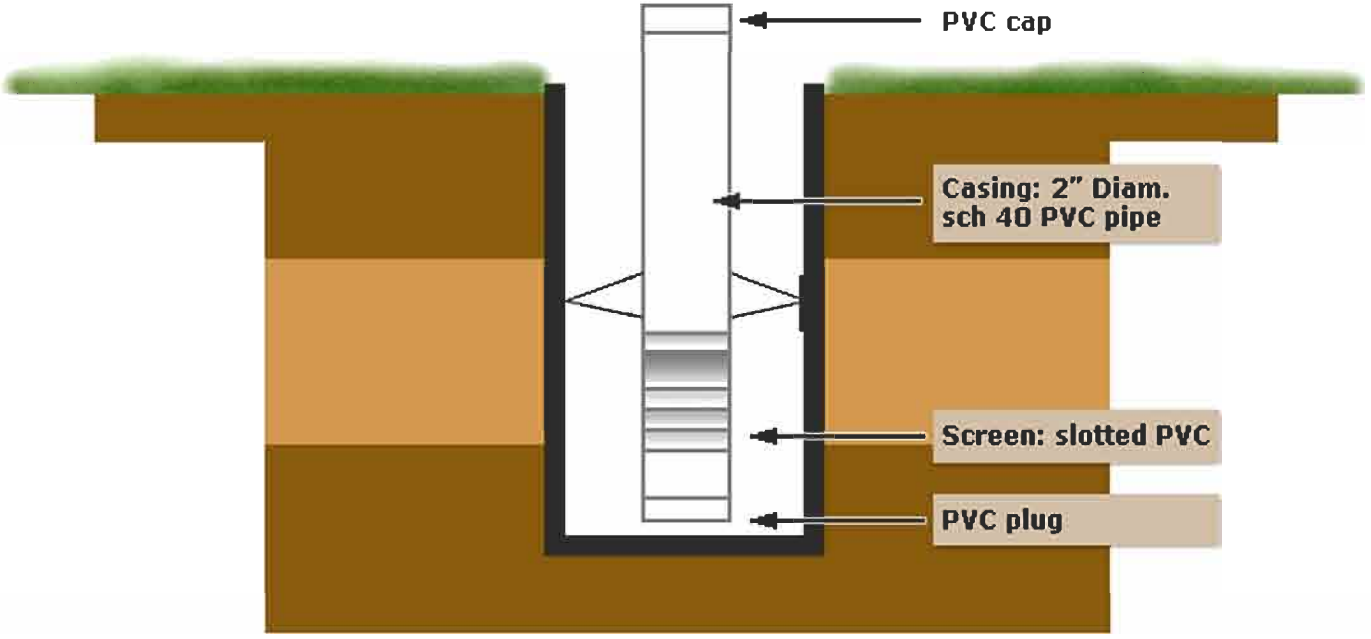
Components of monitoring well



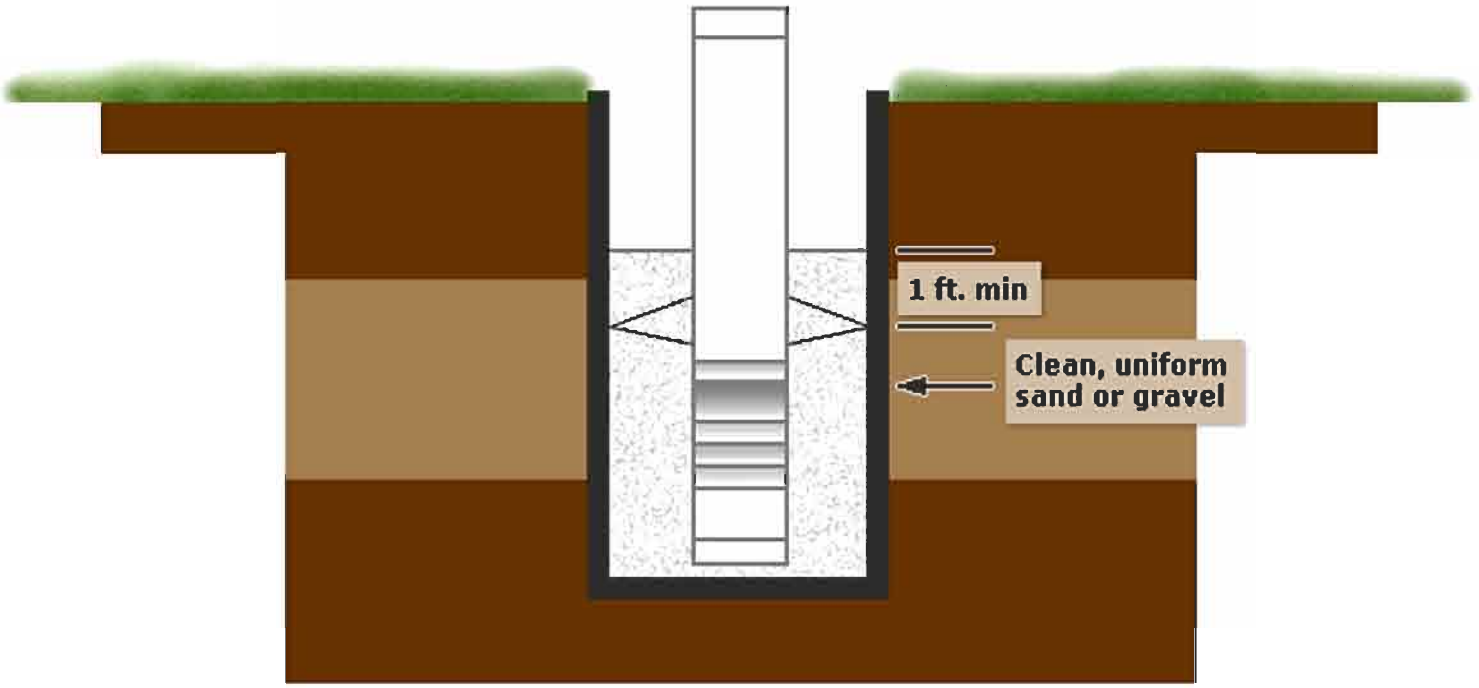
1. Drill and log borehole.
Select screen interval.



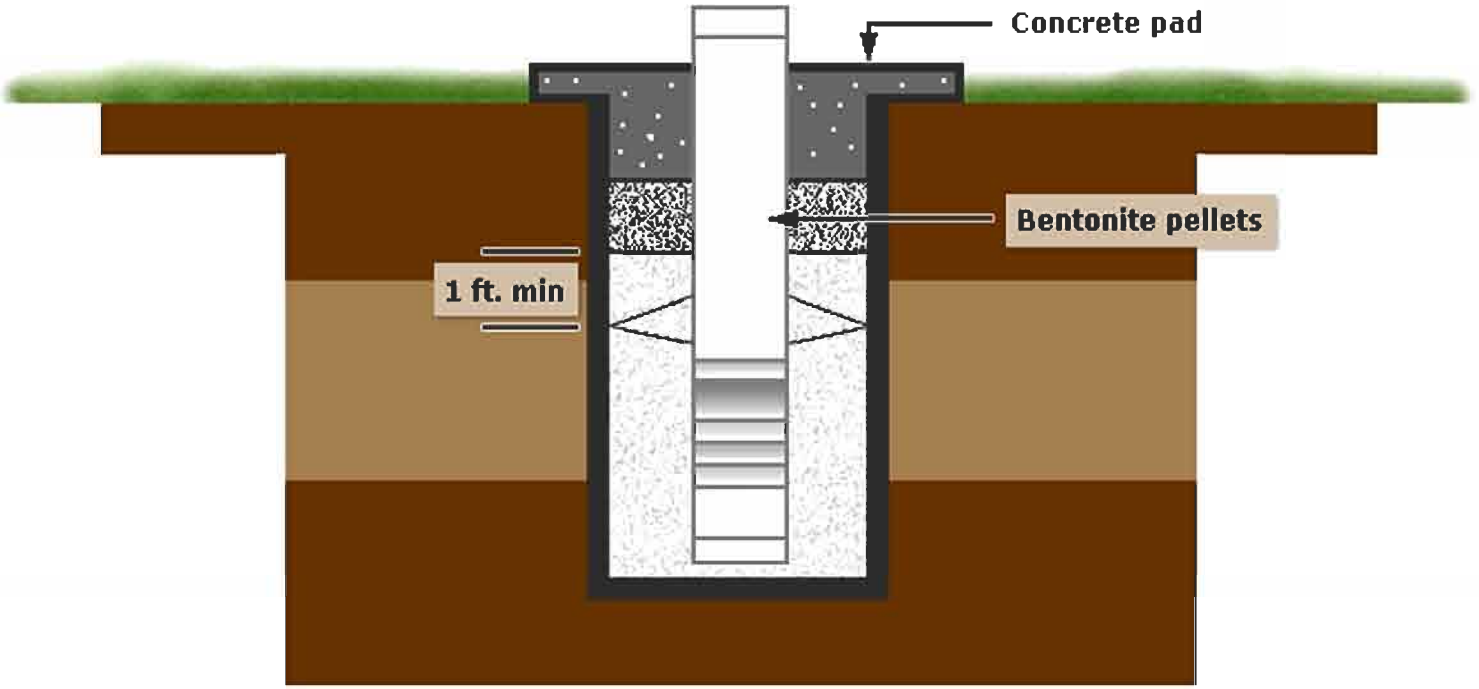
2. Construct well casing and center in the borehole



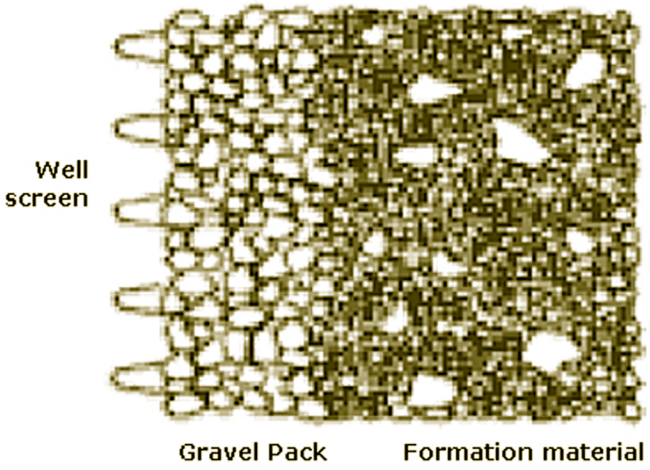
3. Install clean, coarse backfill to 1 ft height above top of screen

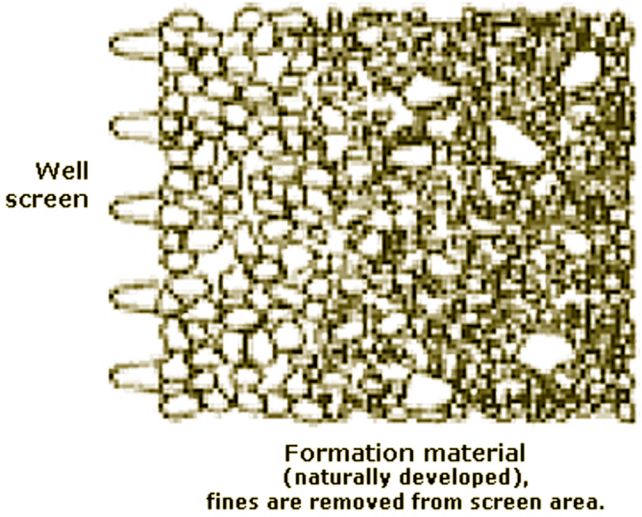


4. Add bentonite seal. Grout to surface pad. Wait 24 hr to develop.



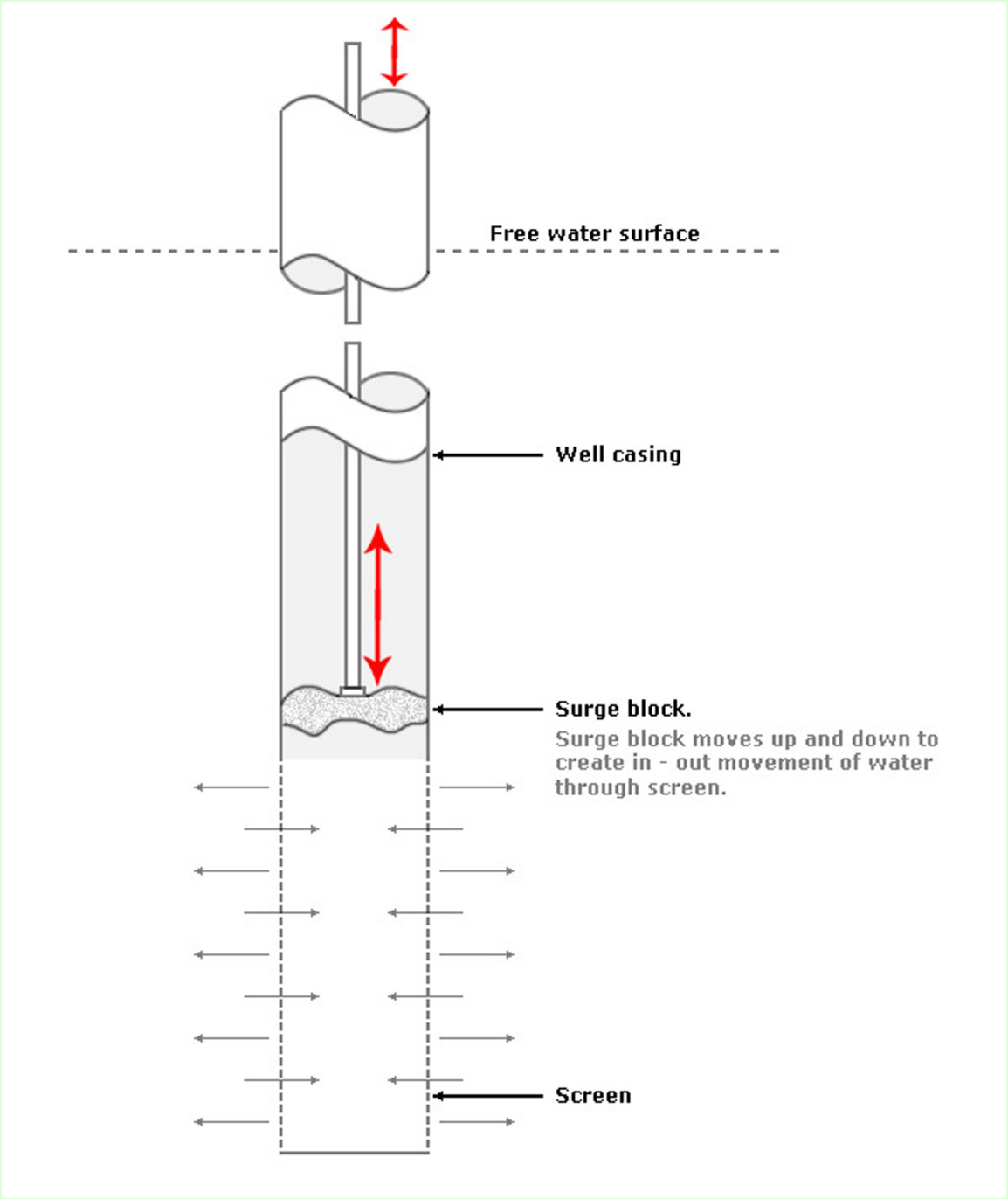
Well development





Source: North Dakota State University Extension Service, 2002. Water Spouts. No. 200. October 2002. http://www.ext.nodak.edu/extnews/spouts/spout200.htm, Accessed February 23, 2003.

Well development by surge block



Surge block

See image at the Web site of Robertson GeoConsultants, Inc., RGC Image Library, Technology Themes, Hydrogeology and Hydrology: http://www.robertsongeoconsultants.com/RGC_Images/pages/RGC_Technical_ThemesHydrogeologyHYFU_rgc027101.asp .
Accessed May 11, 2004.

Well Logs

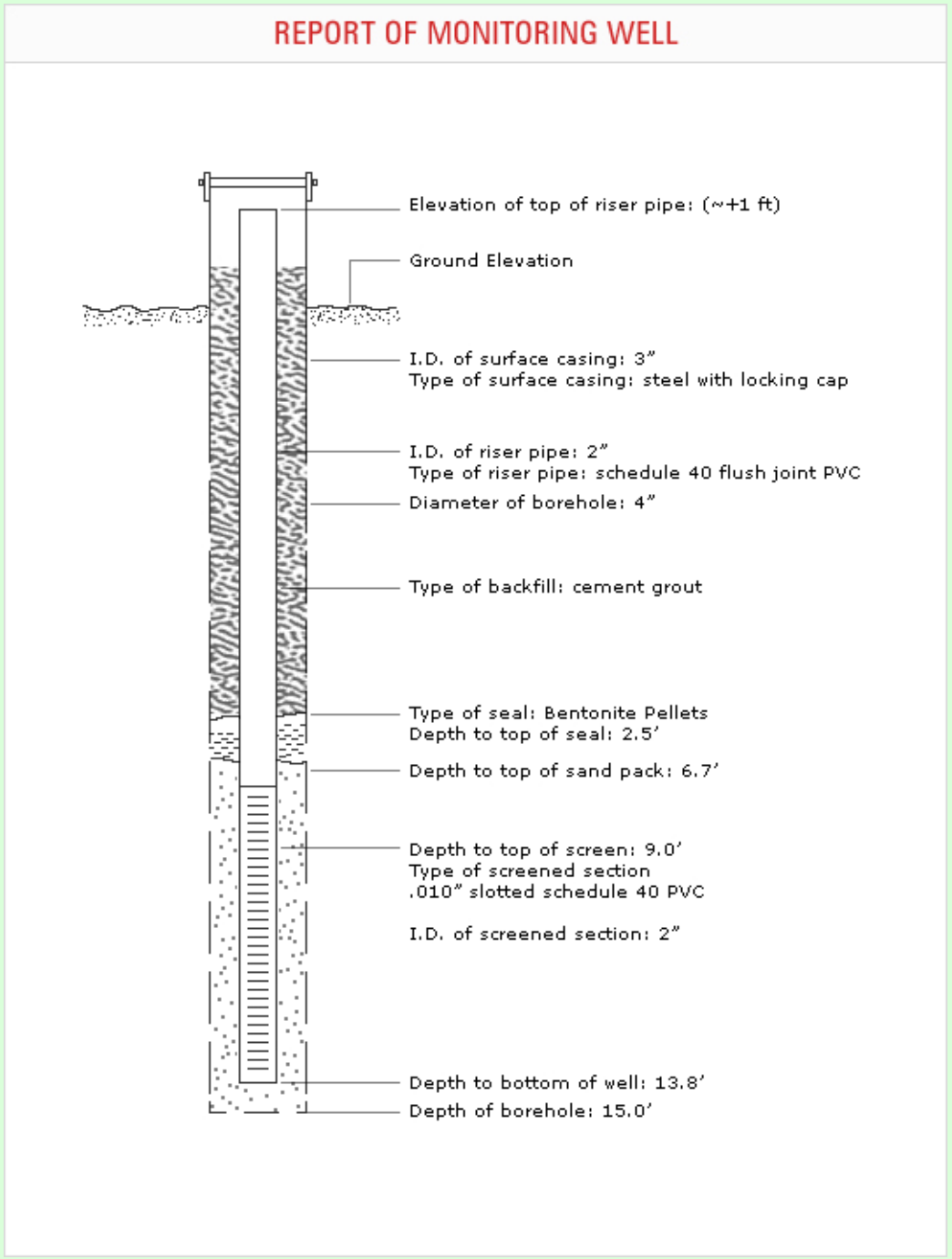
Source: Shinn, E., R. Reese, and C. Reich. “Fate and Pathways of Injection-Well Effluent in the Florida Keys.” US Geological Survey Report OFR 94-276. http://sofia.usgs.gov/publications/ofr/94-276/appendixb.html. Accessed May 11, 2004.

WELL LOG

FORM NO.: 22	PROJ. NO.: 9470-61139
PRINCIPAL INVESTIGATOR: **E.A. Shinn**	TITLE: **Subsurface pathways for pollutant transport**
COMPANY: **U.S. GEOLOGICAL SURVEY**	LOCATION: PLACE - Key Largo Inland #1B (KLI-1B) DATE BEGAN - 12-21-92 DATE FINISHED - 12-21-92 GPS : LAT. - 25°05'51 N LONG. - 80°26'18 W
TOTAL DEPTH: 20 feet ELEVATION: +5 feet	
DRILLING SYSTEM: **NX WIRELINE SYSTEM HYDRAULIC ROTARY DRILL**	REMARKS:
LOGGED BY: Christopher Reich DATE: 4-16-93 PLOTTED BY: Christopher Reich DATE: 4-16-93	

Depth	ø	Cores	Description - (e.g. lithology, color, fossils, sed. structures, other remarks)
top			Topsoil with grass.
			Montastrea sp. (blackened by dirt leaching from above).
			Brown calcareous soil.
1 m			White packstone with brown soil infilling fissures and vugs. ***Acropora*** sp. fragment.
			Montastrea sp. with vugs, and pholad borings infilled with brown soil.
5 ft			***Montastrea*** partially infilled with lime mud.
			Diploria sp. infilled with lime mud and brown soil in voids.
2 m			Grainstone-packstone.
			Diploria sp. with pholad bore holes and brown soil.
			Chalky-white grainstone with shell imprints and pholad bores. (brown soil stops at 9 feet).
3 m 10 ft			***Montastrea*** sp. leached and partially infilled with mud.
			Chalky-white grainstone with vugs.
4 m			***Montastrea*** sp. leached and partially recrystallized. Pholad bore holes and shell fragments.
15 ft			
5 m			***Diplora*** sp. infilled with lime mud. Bore holes and shell fragments.
			Chalky-white grainstone with yellow coating in vugs.
			Leached ***Montastrea*** sp. Very vuggy.
			Chalky-white grainstone
6 m 20 ft			***Montastrea*** sp. infilled with mud and grainstone.

Well installation Diagram ("Well cartoon")



Driller's Log

March 5, 1945

John J.Riley Co.
228 Snlem Street
Woburn, Kass.

Contlemen:

We are submitting herewith a log of test. and observation wells as driven by us recently on your property near your present pumphouse.

Test Well #1

0 - 2'	Loam
2' - 15'	Brown medium sand
15' - 20'	Gray fine sand to rock
	Tight - did not pump freely.

Test Well #2

0 - 3'	Mud and loam
3' - 18'	Medium sand and gravel
18' - 23'	Coarse gravel
23' - 38'	Sand and gravel to rook
	Pumped free - 60 0.P.M.
	Observation Well at 37'
	This well tested for both capacity and drawdown.

It is in our opinion that at location #2 we could develop you, with one of our large diameter gravel filter wells, 500 0.P.M. with a safe drawdown and would run a preliminary test on this well at the above rated capacity for a period of forty-eight hours to determine the actual drawdown on this well.

Example cross sections

Source: Bemidji Crude-Oil Research Project, US Geological Survey, http://mn.water.usgs.gov/bemidji/maps.html. Accessed May 11, 2004.

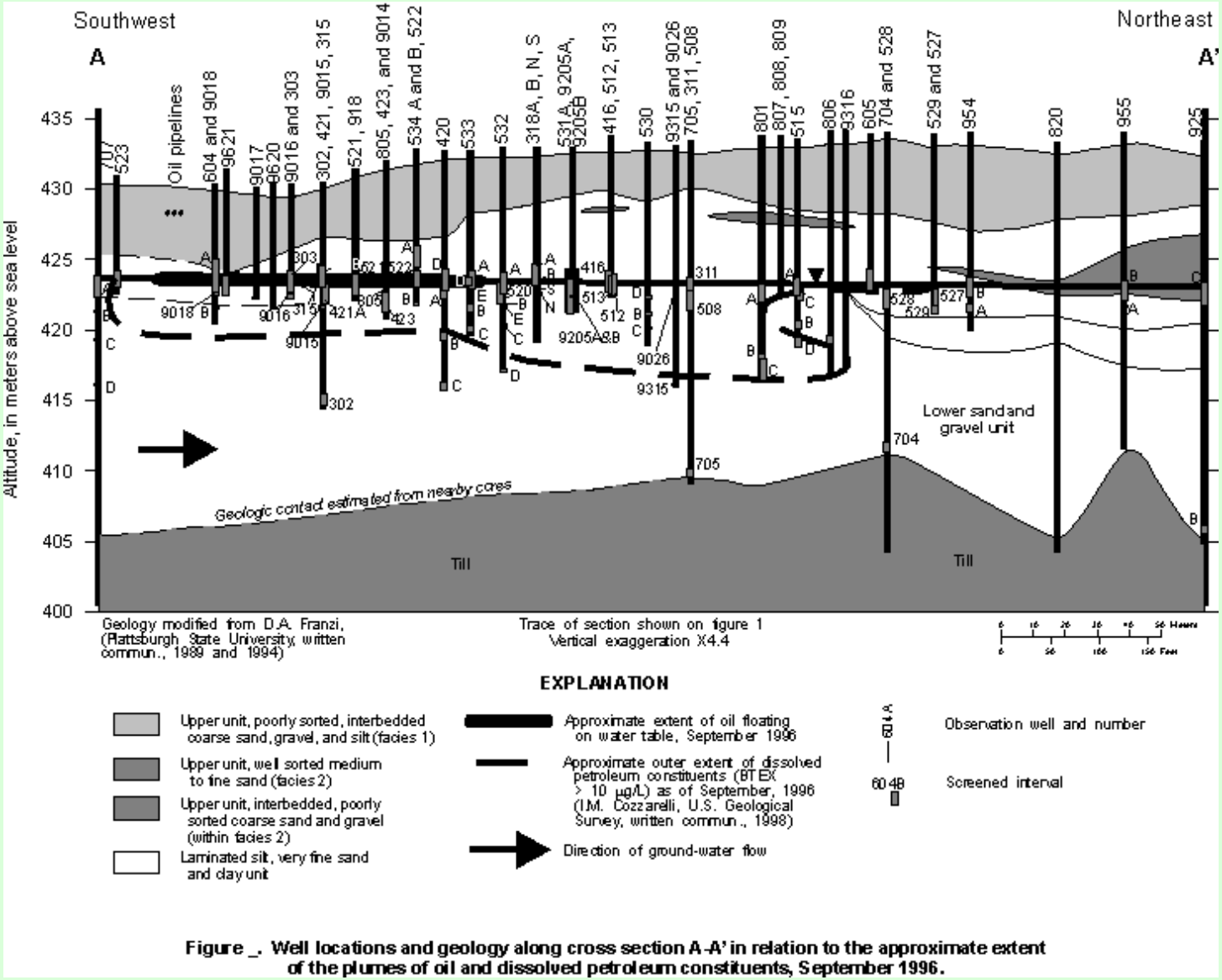
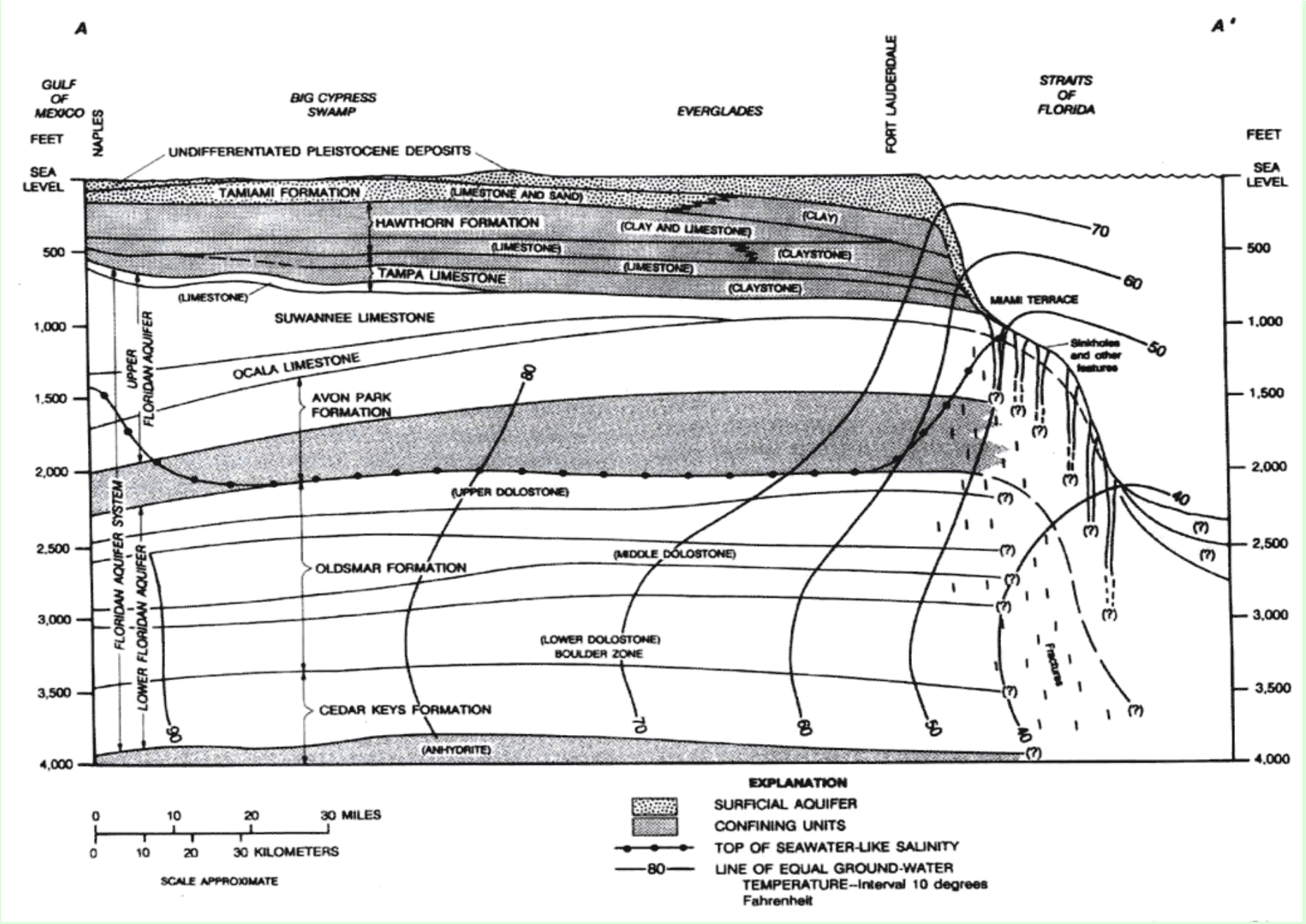


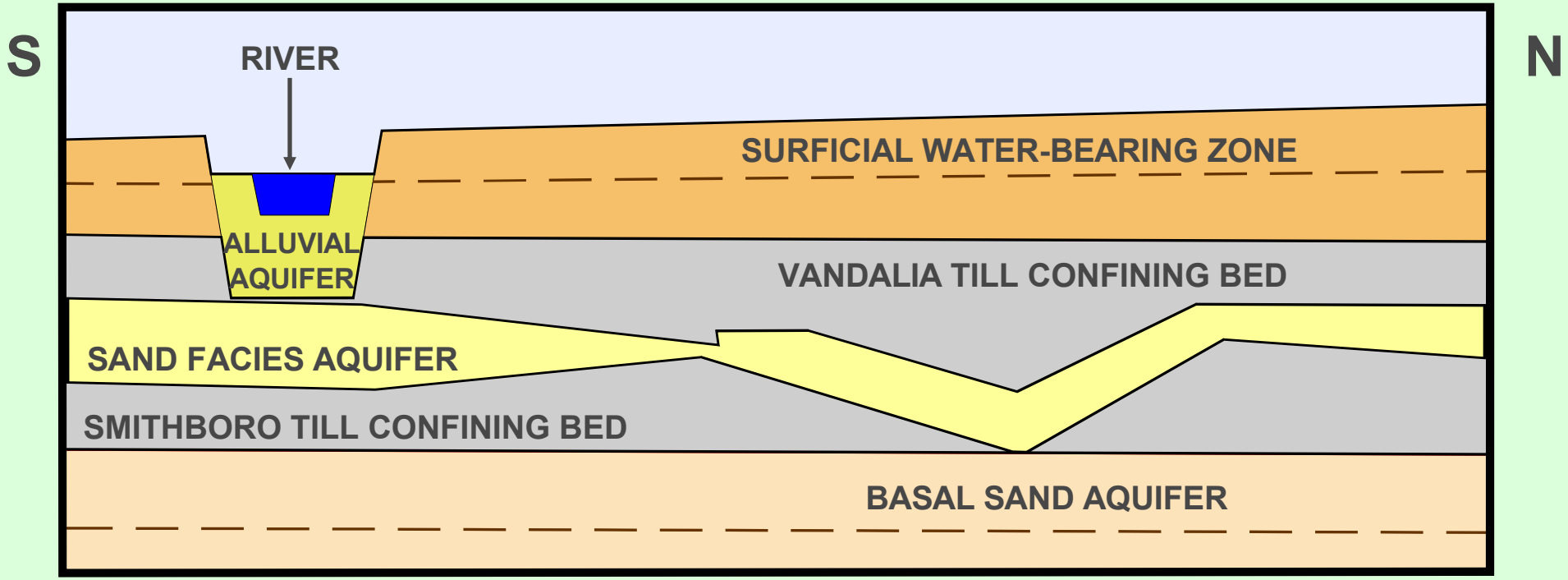
Figure _. Well locations and geology along cross section A-A' in relation to the approximate extent of the plumes of oil and dissolved petroleum constituents, September 1996.

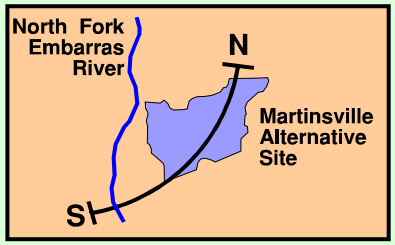
Note vertical exaggeration!



Source: Meyer, F.W. “Hydrogeology of Southern Florida: Floridan Aquifer System.” US Geological Survey, http://sofia.usgs.gov/publications/papers/pp1403g/flaqsys.html. Accessed May 11, 2004.

Martinsville Alternative Site Hydrostratigraphy





Well construction

Flush-mounted well

Source: Johnson Creek Basin Monitoring, US Geological Survey, http://oregon.usgs.gov/projs_dir/or175/htmls_dir/holgate.html. Accessed May 11, 2004.

"Stick-up" well and protective cover

Source: Acadian Pontchartrain (ACAD) Groundwater Studies, US Geological Survey, http://la.water.usgs.gov/nawqa/liaison/gwgeneral.htm. Accessed May 11, 2004.

Water-level meter

See images at the Web site of Solinst Canada Ltd. http://www.solinst.com/Prod/101/101an.html Accessed May 11, 2004.

Bailer for sample collection from wells

See images at the Web site of Solinst Canada Ltd. http://www.solinst.com/Prod/428/428.html Accessed May 11, 2004.

Collection of volatile organics samples

Source: Berndt, M.P., Hatzell, H.H., Crandall, C.A., Turtora, M., Pittman, J.R., and Oaksford, E.T., 1998, “Water Quality in the Georgia-Florida Coastal Plain, Georgia and Florida, 1992-96: U.S. Geological Survey Circular 1151”, http://water.usgs.gov/pubs/circ/circ1151/nawqa91.2.html. Accessed May 11, 2004.

Soil sample collection

Stainless steel sampling trowel

Source: Region 10 Superfund: Boomsnub/AIRCO site, US Environmental Protection Agency, http://yosemite.epa.gov/R10/CLEANUP.NSF/0/d4f7133deabb8eea88256a1700634f74?OpenDocument. Accessed May 11, 2004.

Drum Thief or Coliwasa

See image at the Web site of GENEQ Inc.
http://www.geneq.com/catalog/en/coliwasa_liquid_waste.html
Accessed May 11, 2004.

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME					NO. OF CON-TAINERS	ANALYSIS						REMARKS
SAMPLERS: (Signature)													
STA NO.	DATE	TIME	COMP	GRAB	STATION LOCATION								

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

Source: “Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. -- Testing Manual,” US Environmental Protection Agency, http://www.epa.gov/waterscience/itm/ITM/appxg.htm. Accessed May 11, 2004.

Laboratory Analysis

Full analysis - $1100

(volatiles, semivolatiles, RCRA Appendix 8, pesticides, herbicides)

Volatile organics - $185

Semivolatile organics - $360

RCRA Appendix 8 metals - $110

(As, Ba, Cd, Cr, Pb, Hg, Se, Ag)

TAL metals - $240

(Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn)

Pesticides - $145

Herbicides - $250

Source: Alpha Analytical Labs, Westborough, MA. April 2001 price list

Peristaltic (suction-lift) pump

See images at the Web site of the Georgia Tech course on Environmental Field Methods:
http://hydrate.eas.gatech.edu/eas4420/water.htm
Accessed May 11, 2004.

Maximum sampling depth ≈ 25 feet ≈ 8 meters

Submersible Pump

See images at the Web site of Noor Scientific and Trade. http://www.noor-scientific.com/survey_groundwater_instruments.htm. Accessed May 11, 2004.

WaTerra Positive Displacement Pump

See images at the Web site of Noor Scientific and Trade. http://www.noor-scientific.com/survey_groundwater_instruments.htm. Accessed May 11, 2004.

Bladder Pump

See images at the Web site of Solinst Canada Ltd. http://www.solinst.com/Prod/407/407d5.html. Accessed May 11, 2004.

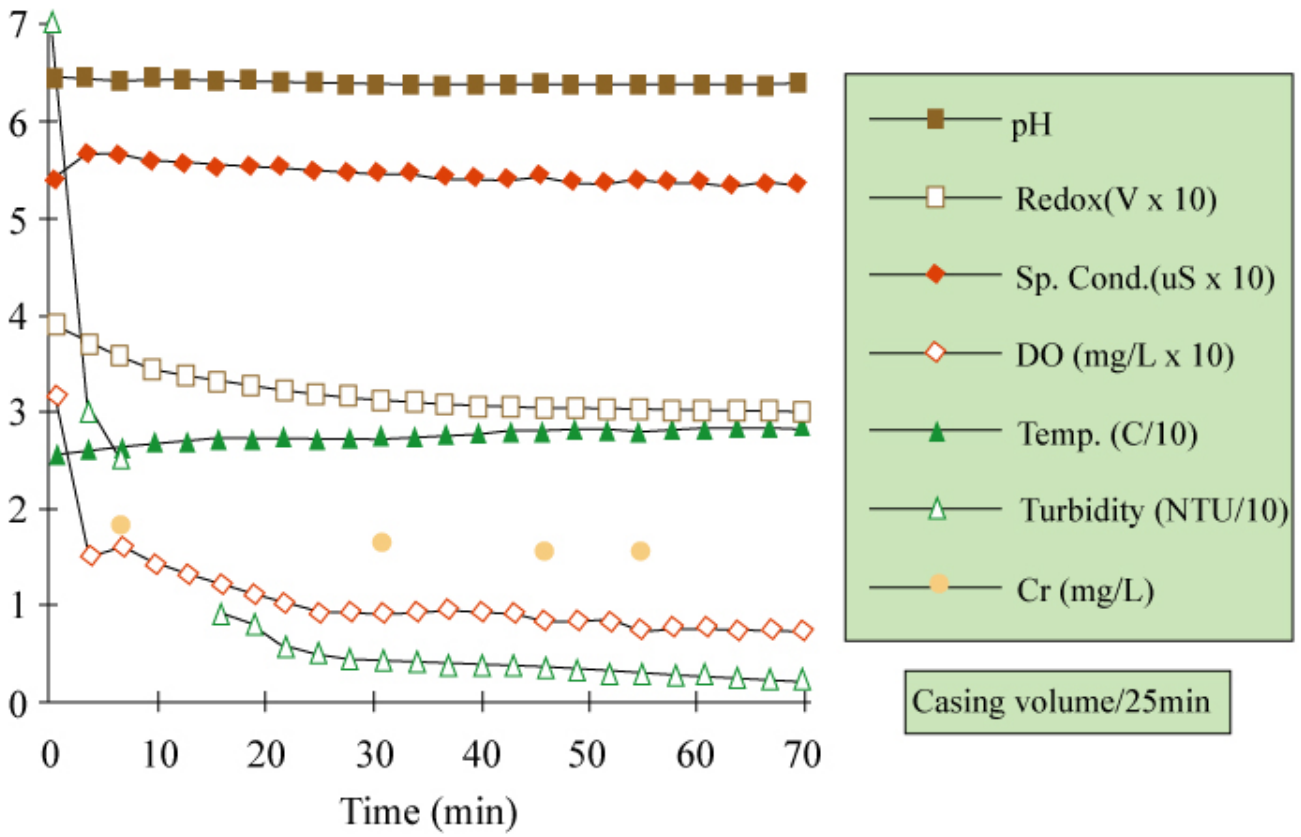
Bladder Pump

See images at the Web site of Solinst Canada Ltd. http://www.solinst.com/Prod/407/407d5.html. Accessed May 11, 2004.

Soil Water Lysimeter

See images at the Web sites of Earth Systems Solutions (http://www.earthsystemssolutions.com/assets/watersampler.htm) and the Wisconsin Department of Natural Resources, Vadose Zone Soil-Water Monitoring (http://www.dnr.state.wi.us/org/water/dwg/gw/dsk-7a.htm). Accessed May 11, 2004.

Well purging before sampling



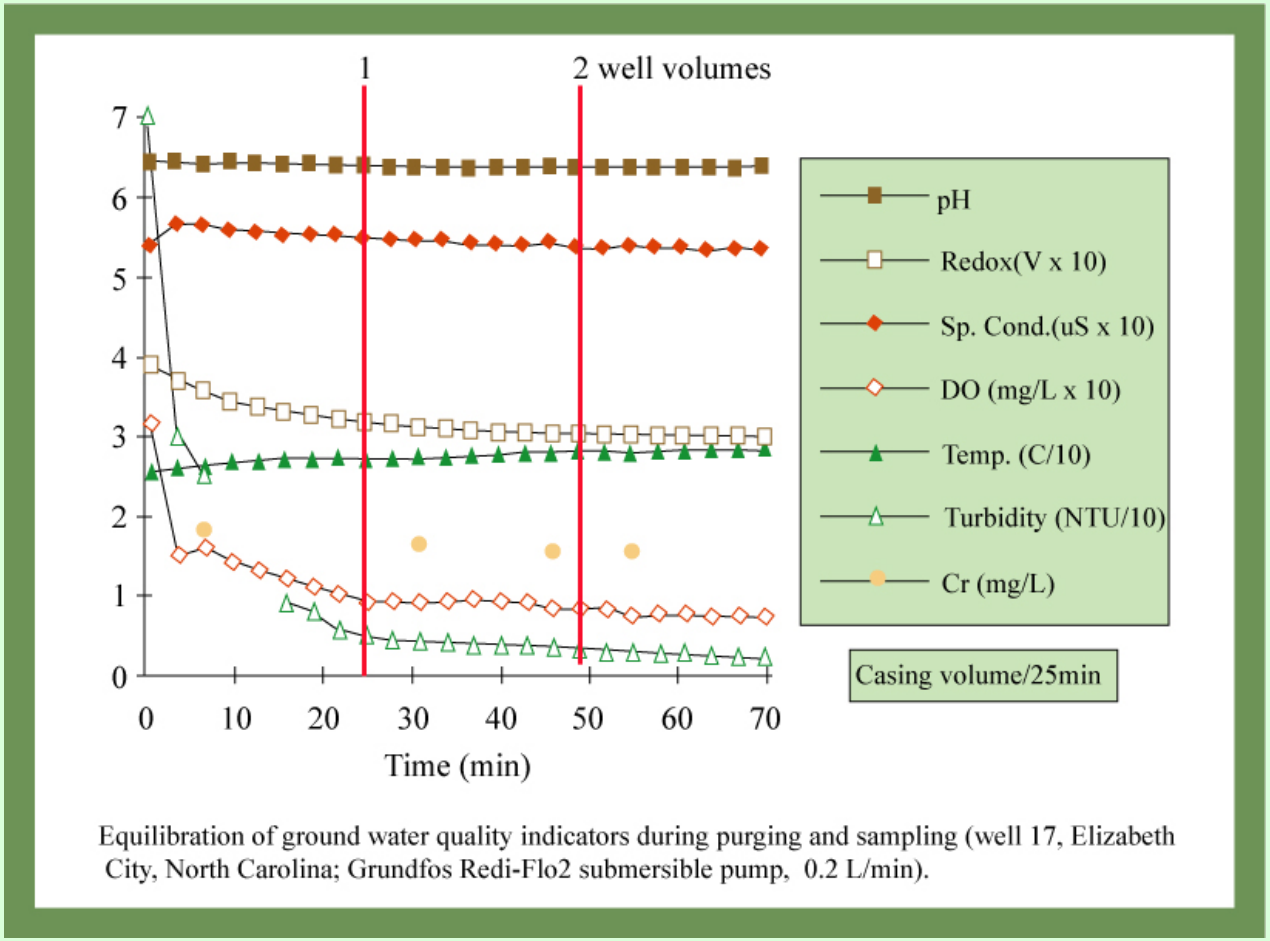
Equilibration of ground water quality indicators during purging and sampling (well 17, Elizabeth City, North Carolina; Grundfos Redi-Flo2 submersible pump, 0.2 L/min).

Source: Puls, R. W. and R. M. Powell (1992). "Acquisition of representative ground water quality samples for metals." Ground Water Monitoring Review **12**(3): 167.

Well purging before sampling

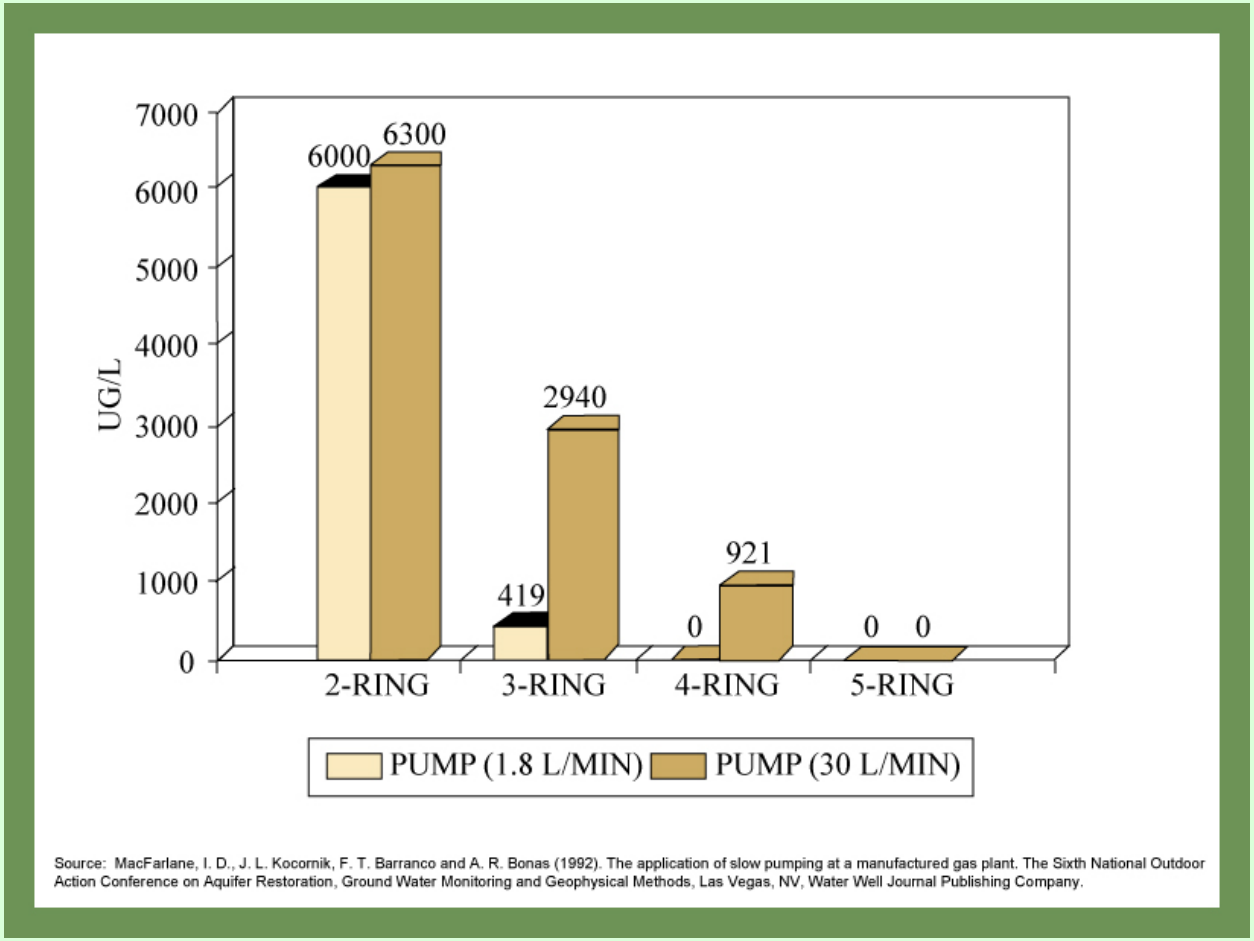
Rule of thumb is to purge 3 to 5 well volumes before sampling

Results from previous slide show stabilization of parameters after around one well volume



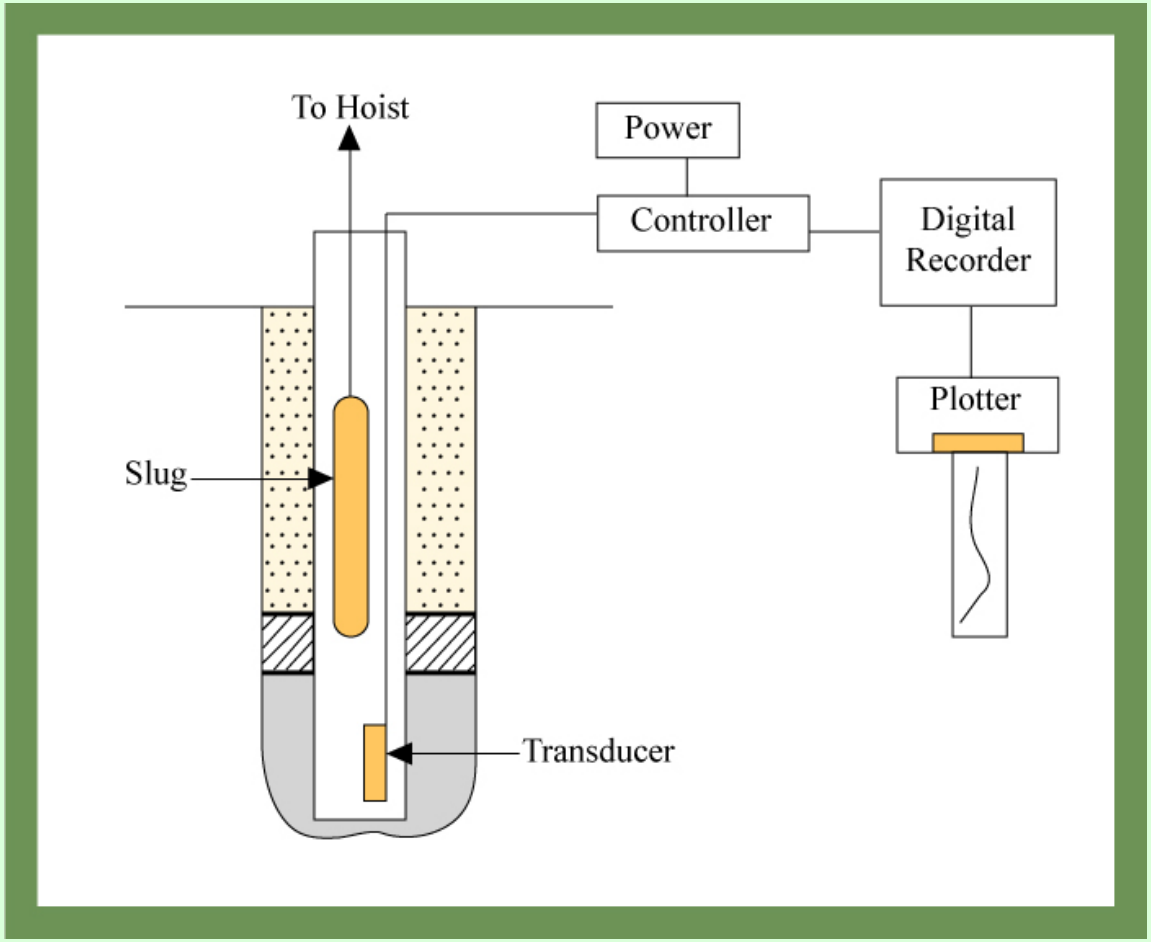
Equilibration of ground water quality indicators during purging and sampling (well 17, Elizabeth City, North Carolina; Grundfos Redi-Flo2 submersible pump, 0.2 L/min).

“Low-flow” sampling



Source: MacFarlane, I. D., J. L. Kocornik, F. T. Barranco and A. R. Bonas (1992). The application of slow pumping at a manufactured gas plant. The Sixth National Outdoor Action Conference on Aquifer Restoration, Ground Water Monitoring and Geophysical Methods, Las Vegas, NV, Water Well Journal Publishing Company.

Slug test


To Hoist
Power
Controller
Digital Recorder
Plotter
Slug
Transducer

Slug test results