Seven Months to Dewater a 6000yd^3 Excavation

(Observational Method used to control A 200,000yd^3 quicksand 'tank')

for USACE Structure 37A, Pompano Beach, FL

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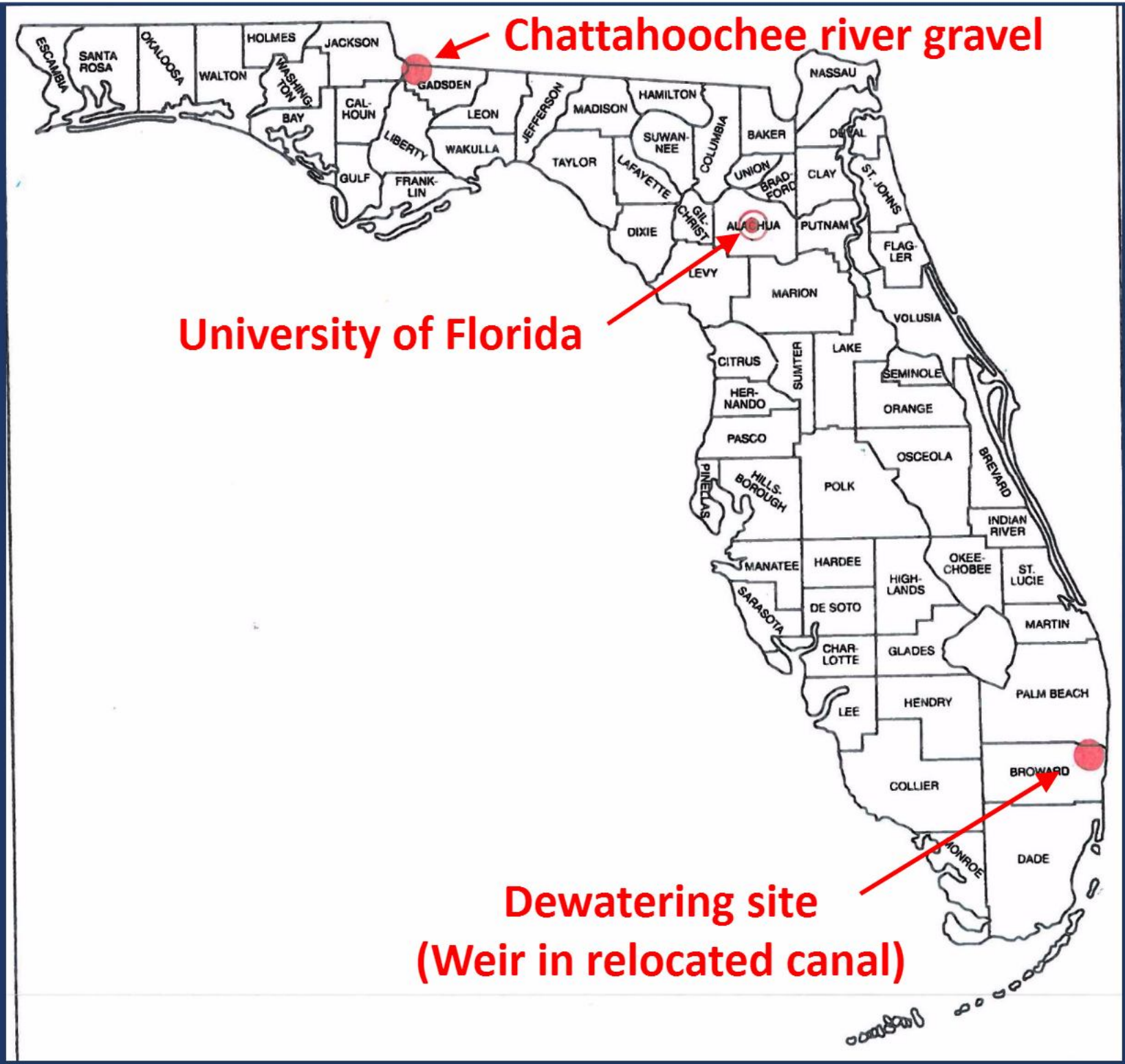
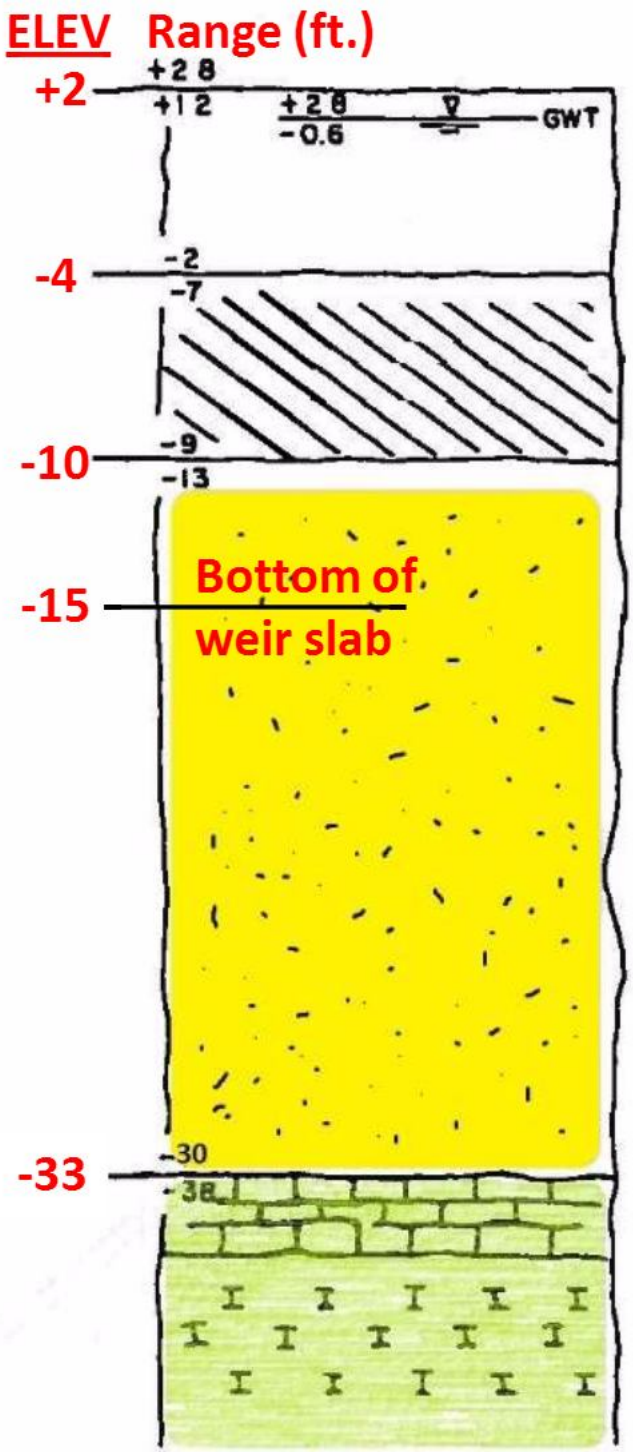
GeoVirginia 2015

‘Flow’ of Lecture

- Site, Objective
- 452 Wellpoints, Boils
- Piez & pumping tests
- Dewatering alternatives
- Weighted filter blanket design and construction
- Initial dewatering, self-pumping wellpoints
- Final dewatering and slab construction
- Dewatering summary


Chattahoochee river gravel
University of Florida
Dewatering site
(Weir in relocated canal)
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
HOLMES
WASHING-TON
BAY
JACKSON
CAL-HOUN
LIBERTY
GULF
FRANK-LIN
GADSDEN
LEON
WAKULLA
JEFFERSON
MADISON
TAYLOR
HAMILTON
SUWAN-NEE
LAFAYETTE
COLUMBIA
BAKER
UNION
BRAD-FORD
NASSAU
DUVAL
CLAY
ST. JOHNS
PUTNAM
FLAG-LER
VOLUSIA
GIL-CHRIST
DIXIE
ALACHUA
LEVY
MARION
CITRUS
SUMTER
LAKE
SEMINOLE
HER-NANDO
ORANGE
PASCO
OSCEOLA
BREVARD
PINELLAS
HILLS-BOROUGH
POLK
INDIAN RIVER
MANATEE
HARDEE
HIGH-LANDS
OKEE-CHOBEE
ST. LUCIE
SARASOTA
DE SOTO
MARTIN
CHAR-LOTTE
GLADES
LEE
HENDRY
PALM BEACH
BROWARD
COLLIER
MONROE
DADE

Site 100 ft. from Existing Canal Pumping 8000 gpm, Need 5’ Deeper



Thin Layer
Peat over Sand

Porous limestone
replaced with sand

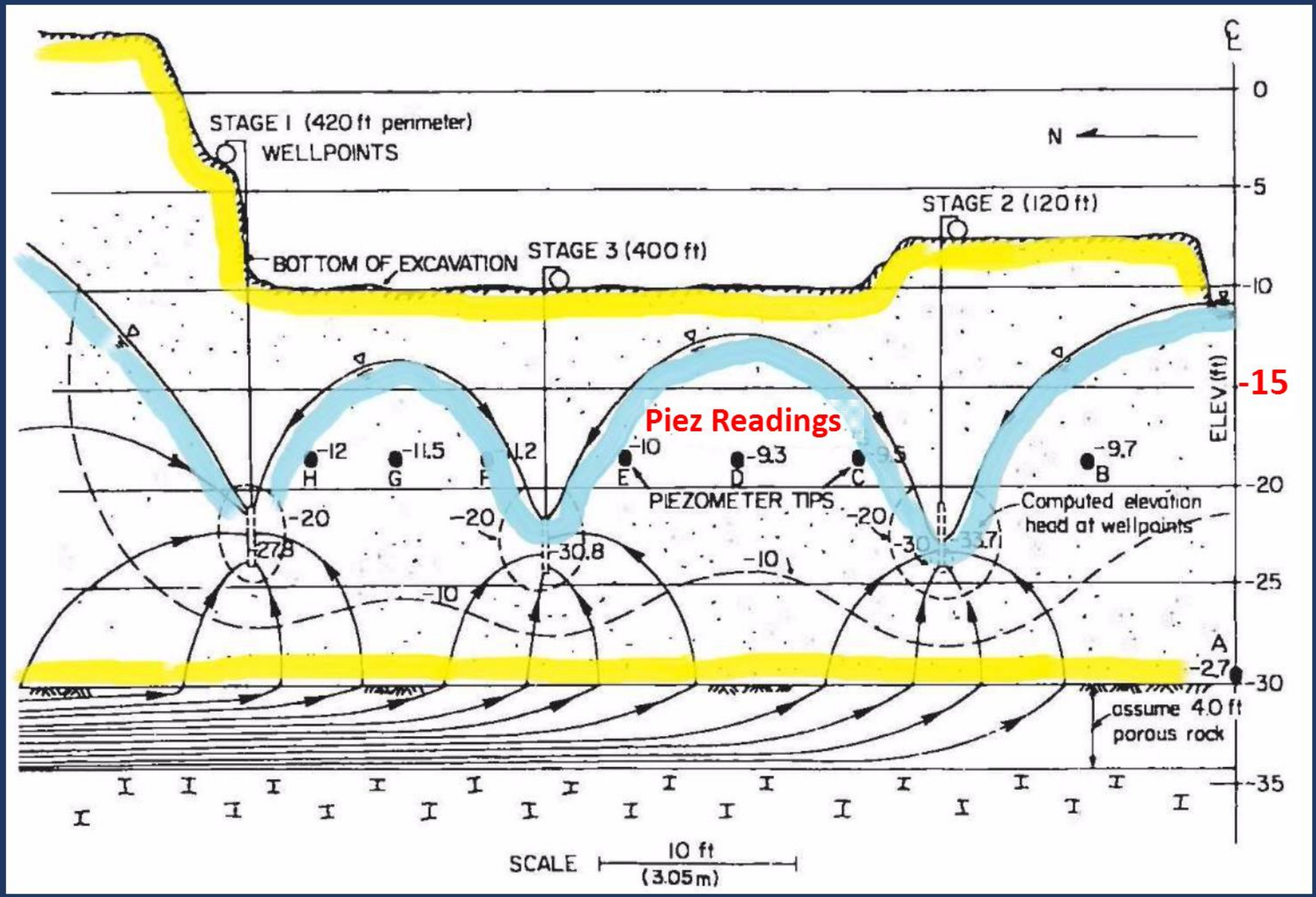
Uniform fine
sand

Porous limestone

Average geologic section based on 6 USACE SPT borings under 40 x 60’ weir slab

452 Wellpoints in 3 Stages

Flownet matched to wellpoint, piez. and stage gpm data



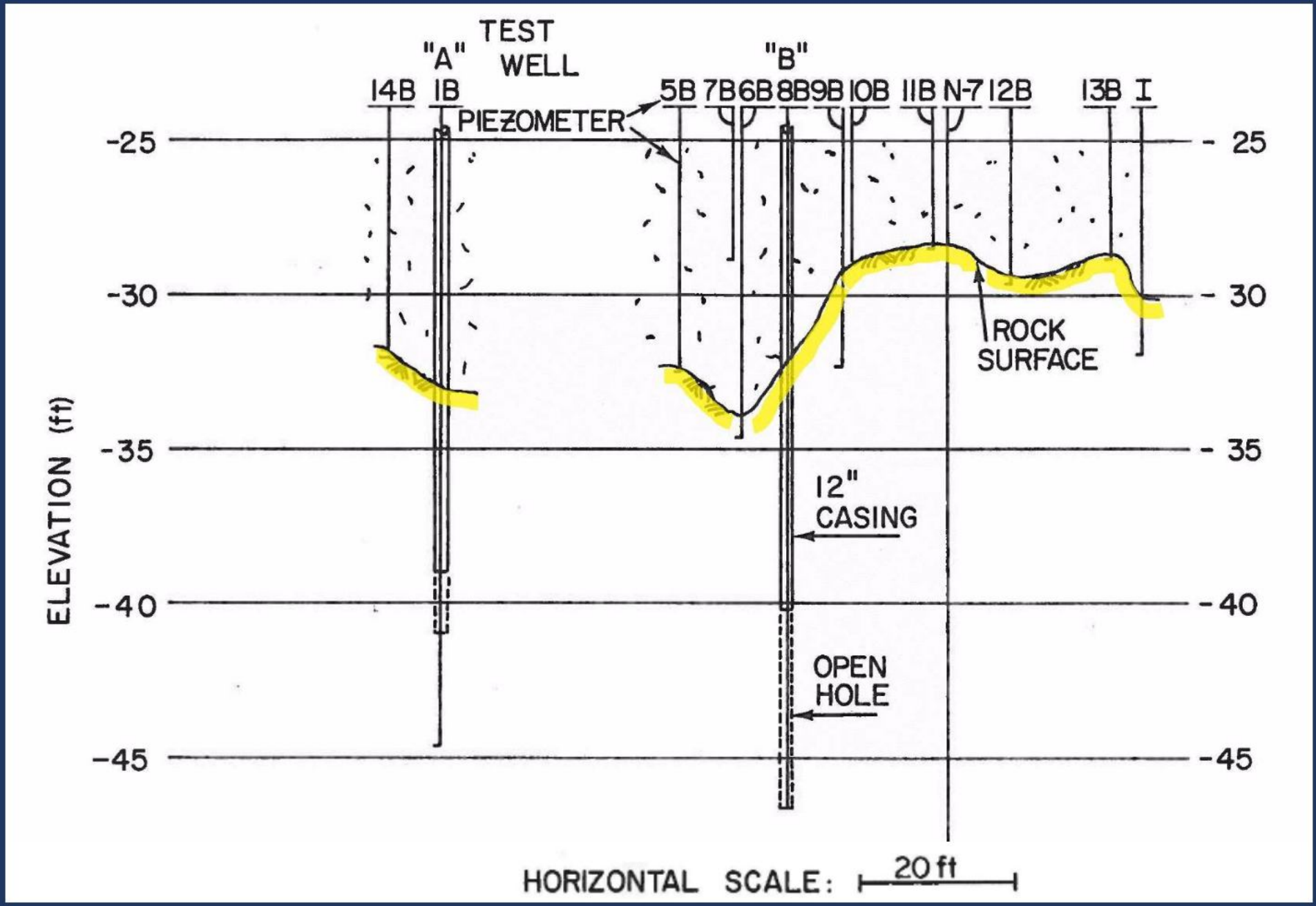
Date (1)	Head Loss, ΔH		
	Estimated H in rock (2)	Surface of excavation (3)	ΔH, in feet (4)
October 20	−1	−12	11
October 29	−1	−7.5	6.5
November 5	−1	−10	9

Vertical Flow		
Rock elevation estimated (5)	ΔL, in feet (6)	$\bar{i}_v = \Delta H/\Delta L$ (7)
−30	18	0.61
−30	22.5	0.30
−30	20	0.45

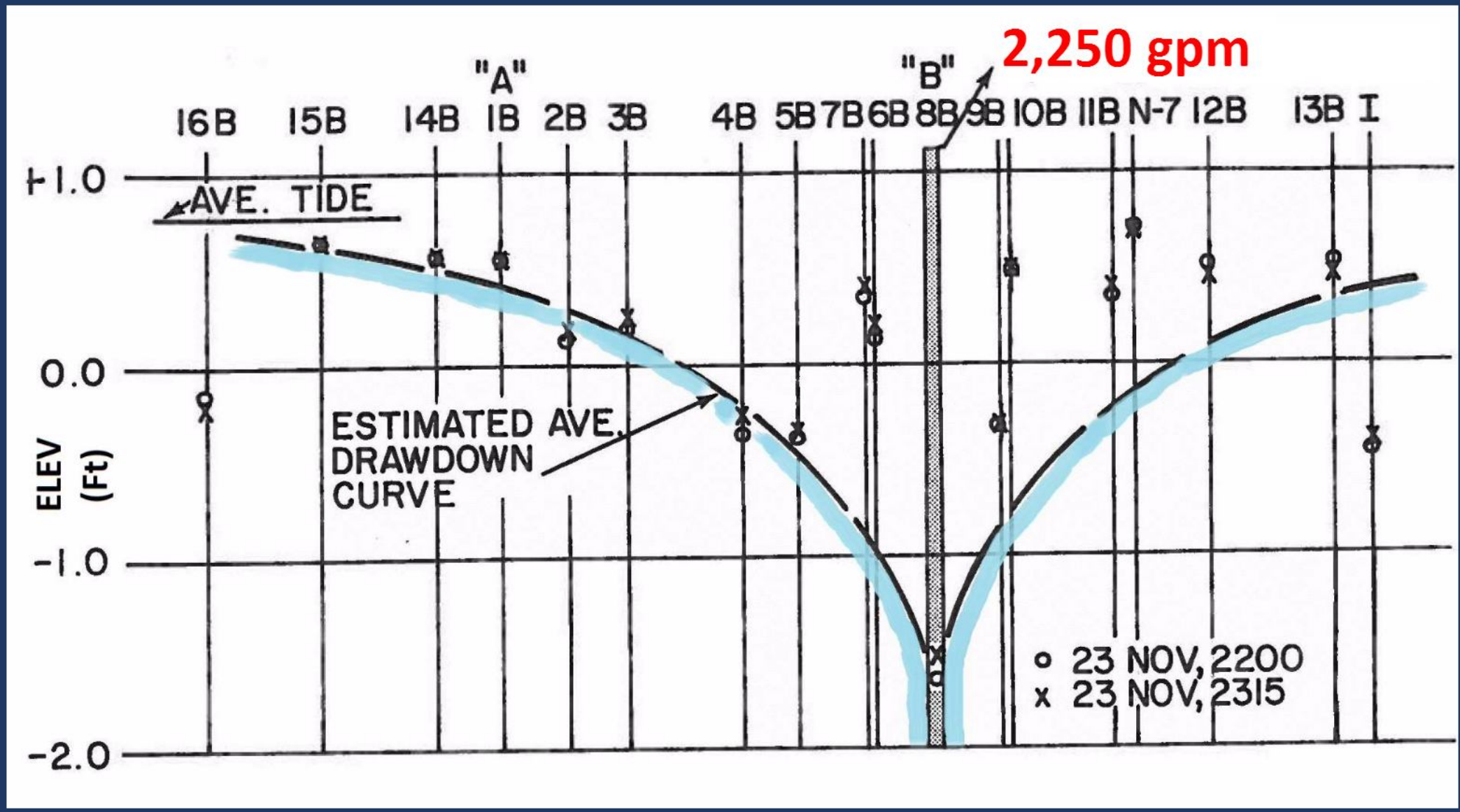
Average vertical gradients to start each of the 3 boils

Pressure relief well pumping tests

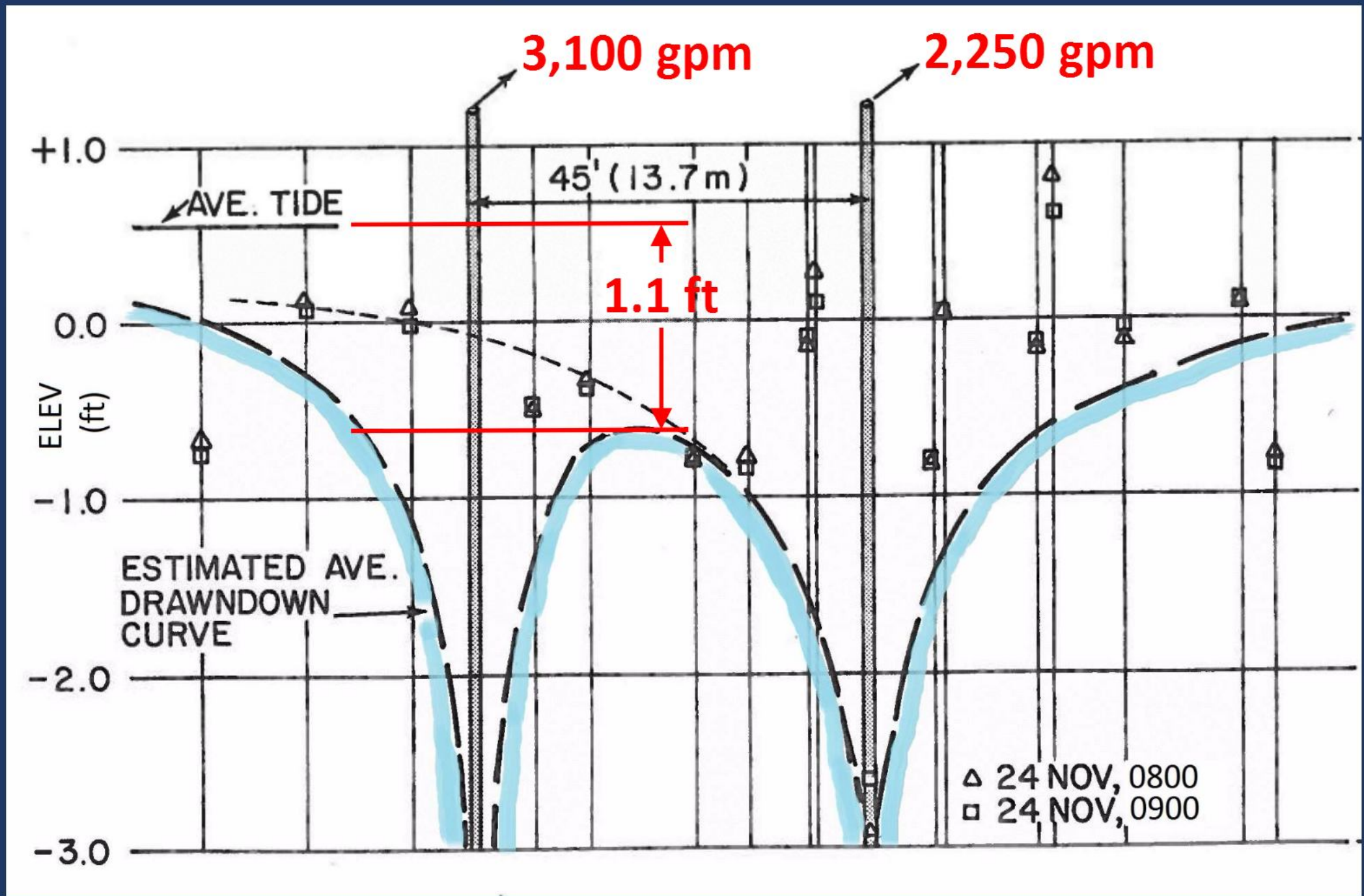
Well Pumping Test Section



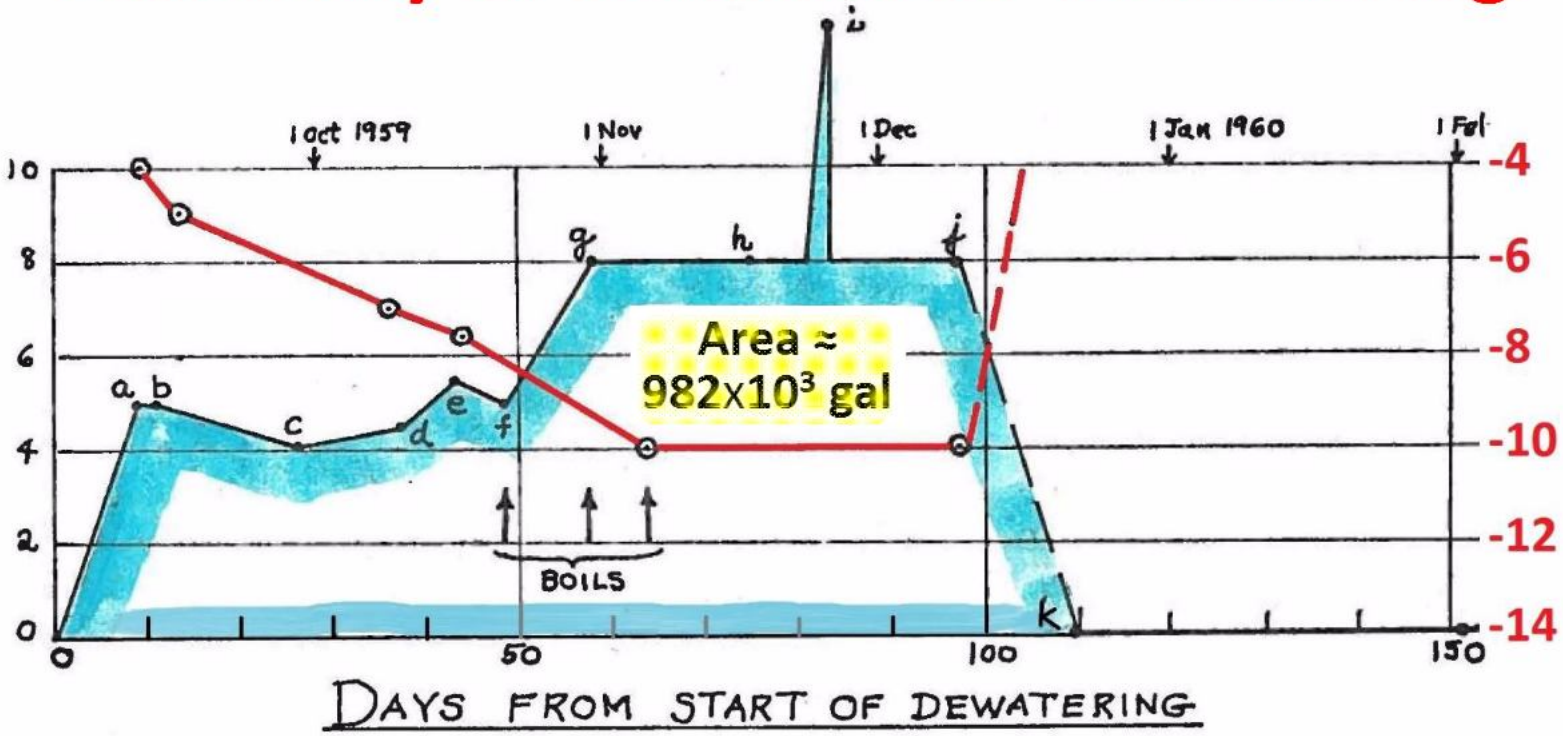
Pumping one well, drawdown data



Pumping both wells



Summary of Contractors' Dewatering

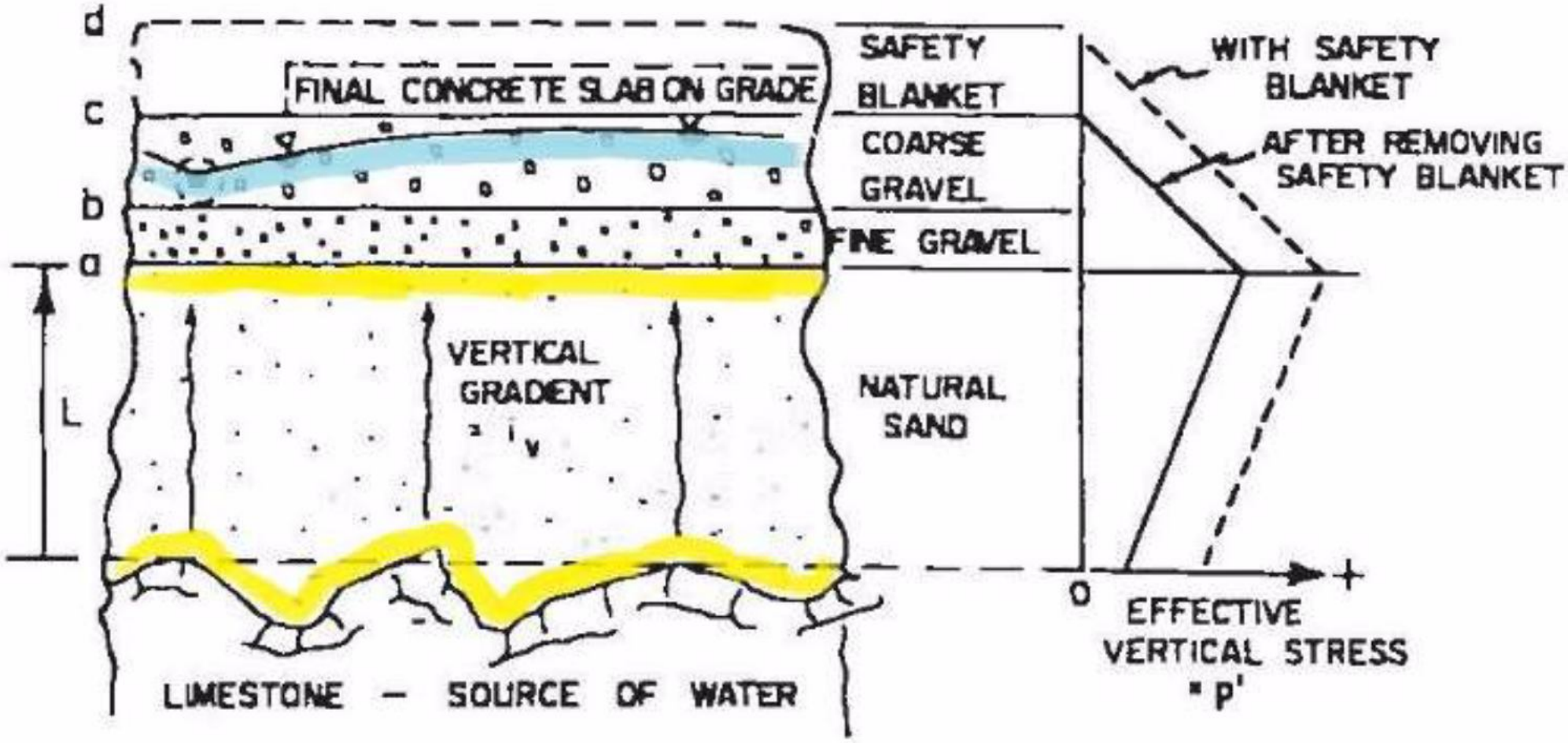


a. Stage 1 (longer) completed, 220 wps, tips at -30.
b. Ditched and backfilled upper limestone.
c. Shortened stage 1, added 36 wps, tips at -24.
d. Put in temporary stage just inside stage 1, 100 wps, tips at -15.
e. Stage 2 completed, 50 wps, tips at -24.5.
f. Removed temp. 100 wp line.
g. Stage 3 completed, 146 wps, tips at -24, CONSULTANT CONTACTED.
h. 7 new N-borings completed.
i. 12" well pumping tests.
j. Decision to attempt gravel blanket scheme.
k. Removed all wps, flooded and started underwater excavation.
l. Started filter and drain construction.
m. Pumped flooded excavation to below top of gravel blanket (at -10.5)
n. 1st tests for relief wps.

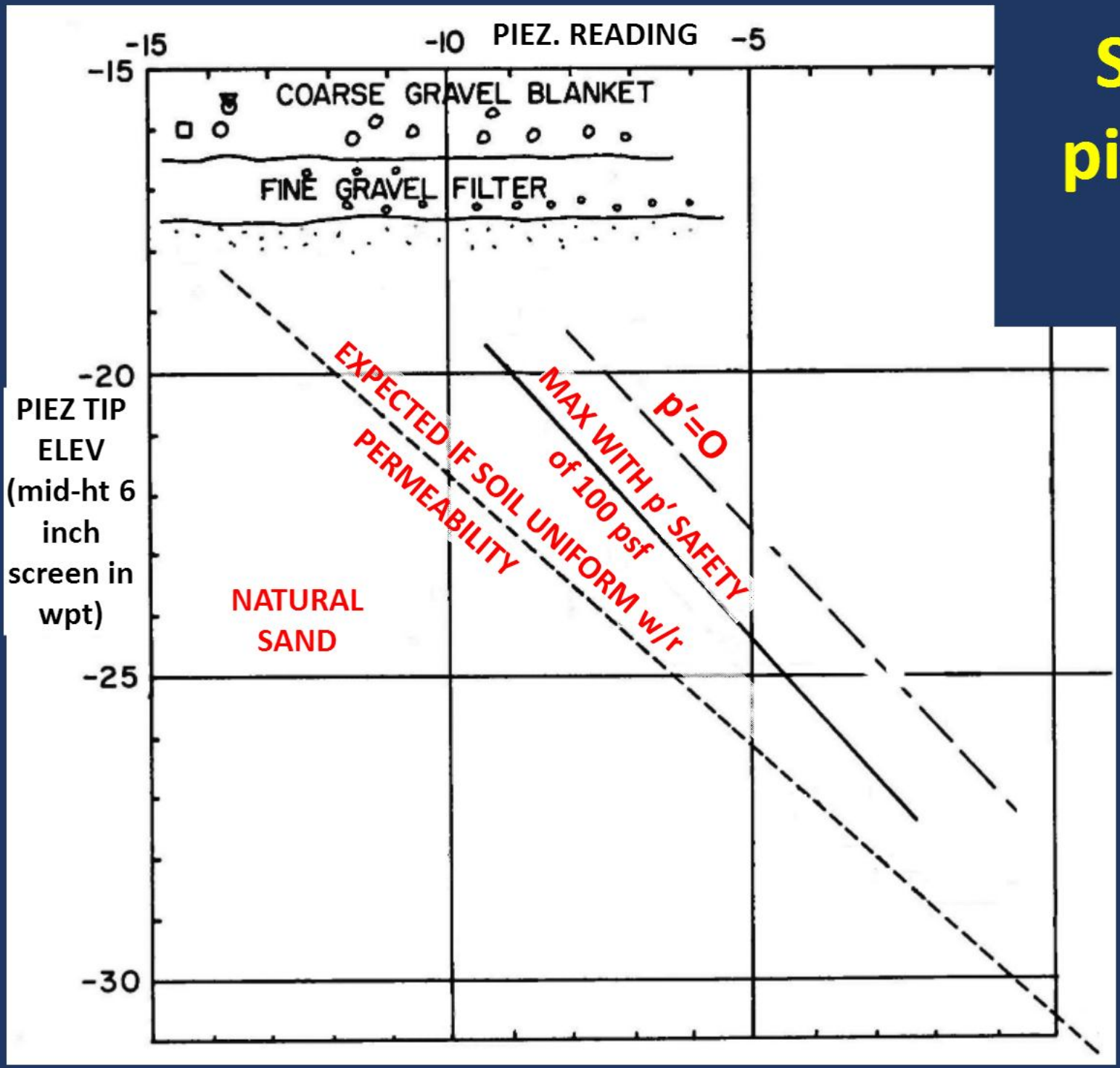
Alternate Dewatering Methods

Method	Likely Success	Relative Cost Estimate	Notes
Wellpoints	None	'Infinite'	Failed
Sheet Pile and Tremie Mat	High	100	Conventional
Pressure Relief Wells	Good	125	gpm very high 100,000 +
Grout Top of Limestone	Fair-Poor	90	Continuity?
Gravel Blanket	Unknown	50	New (but intriguing)

Schematic Diagram of Gravel Blanket Method



Setup for piezometer control



Need to import filter gravel 500 mi. to obtain $\Delta \sigma'_v = +100$ psf

Chattahoochee river gravel: $\bar{\gamma}' \approx 60$ pcf

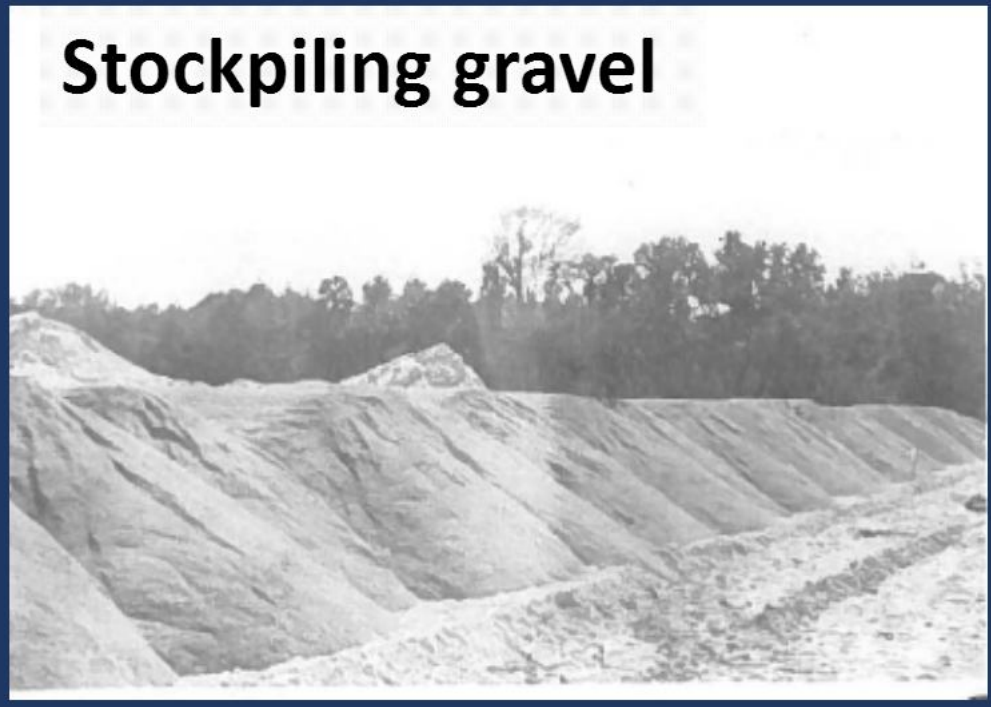
Local limestone gravel: $\bar{\gamma}' \approx 37$ pcf

$\Delta \approx 23$ pcf

River gravel increases $\bar{\gamma}'$ by 62%

500mi gravel delivery

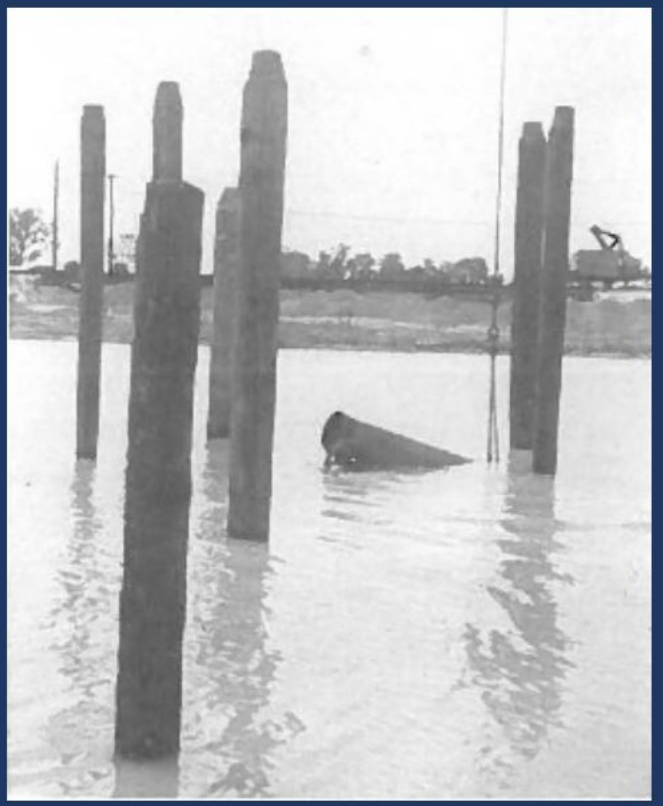
Stockpiling gravel



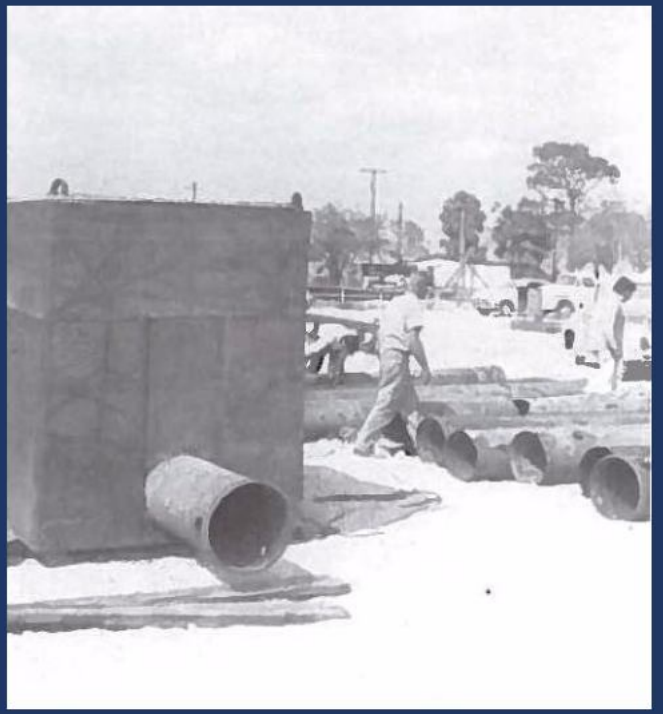
Blanket drainage pipe

Skin divers installing pipe

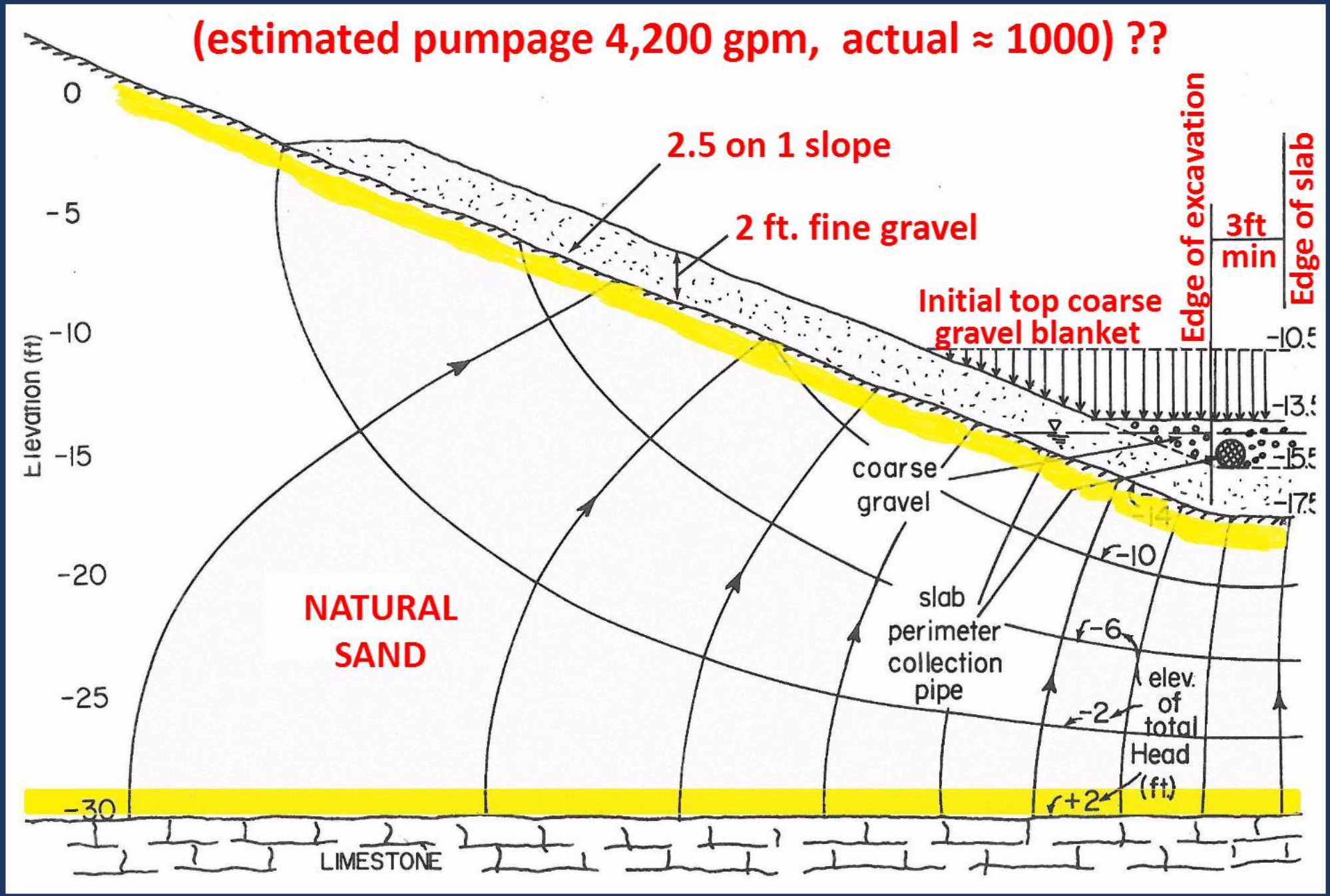
Connecting drainage pipe to sump platform



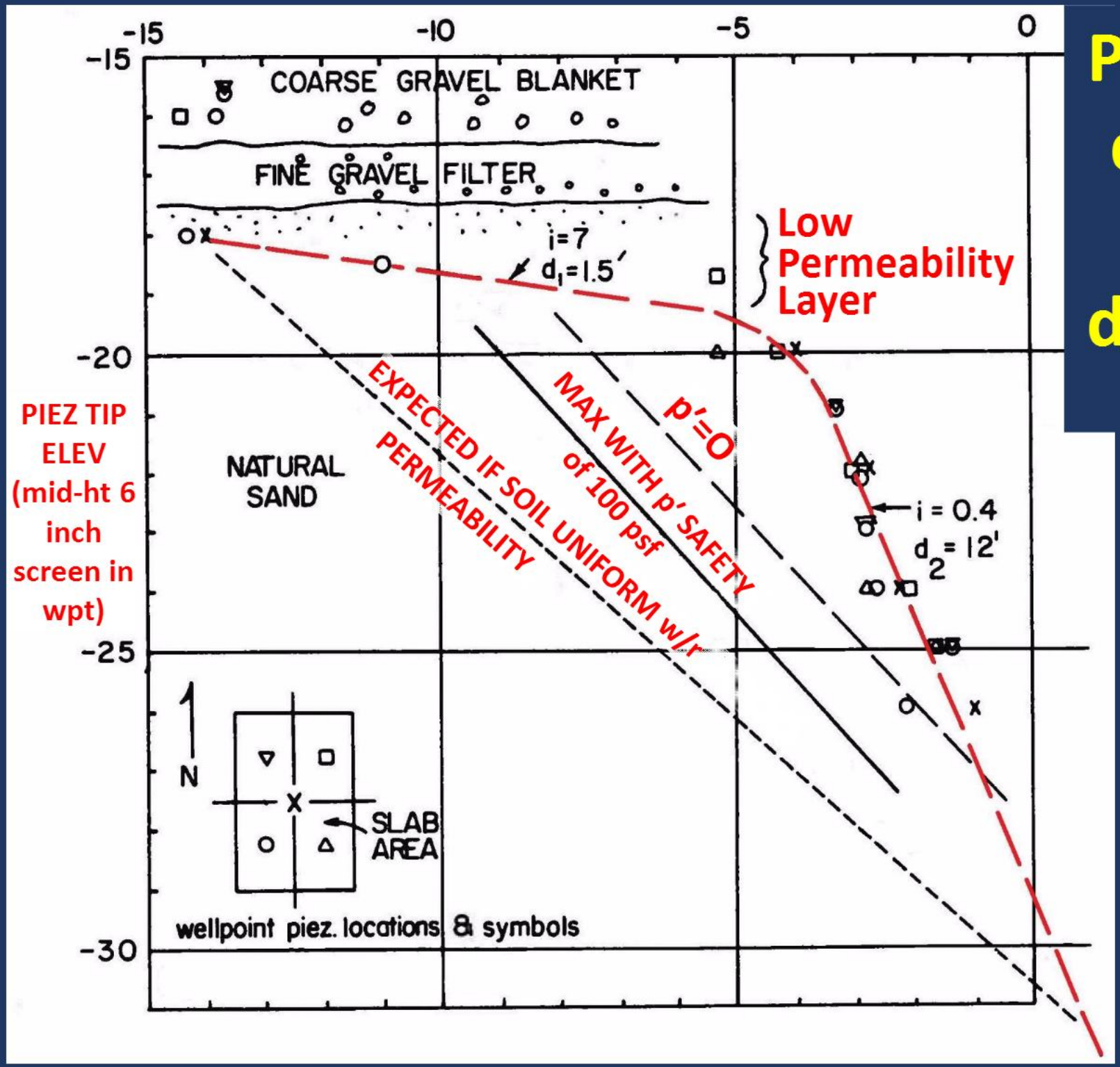
Sump cage

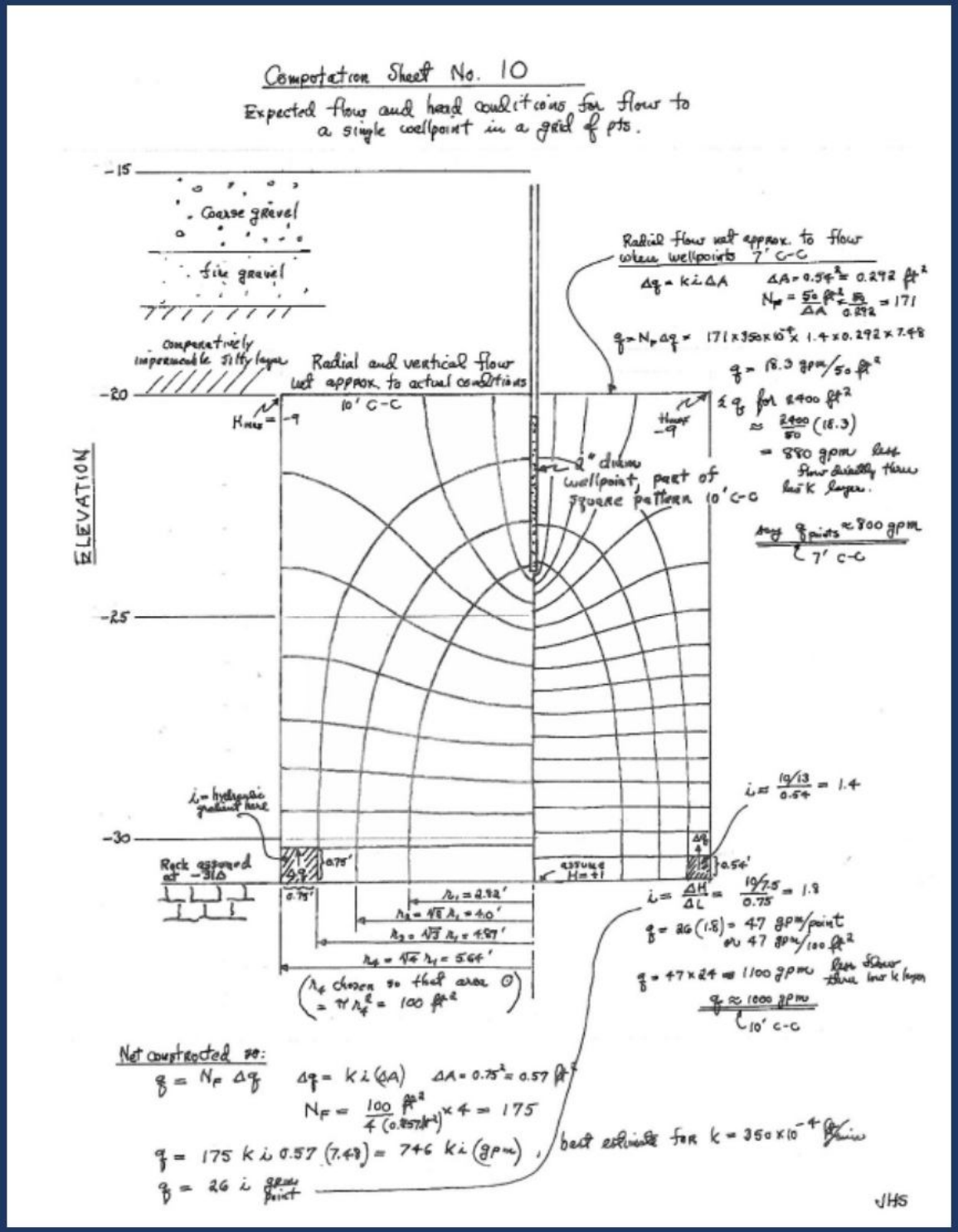


Flownet to gravel blanket

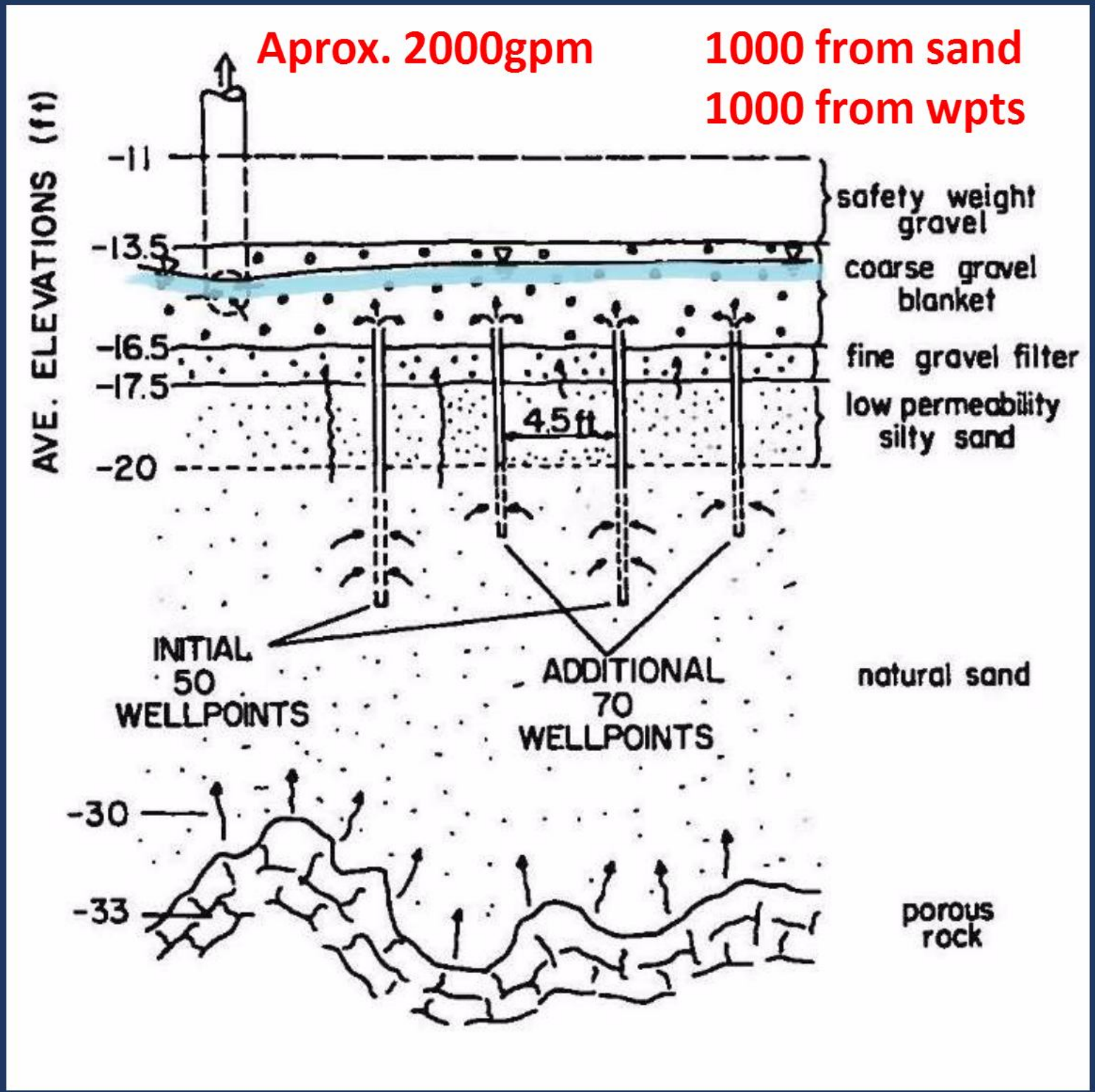


Piezometer data after initial dewatering



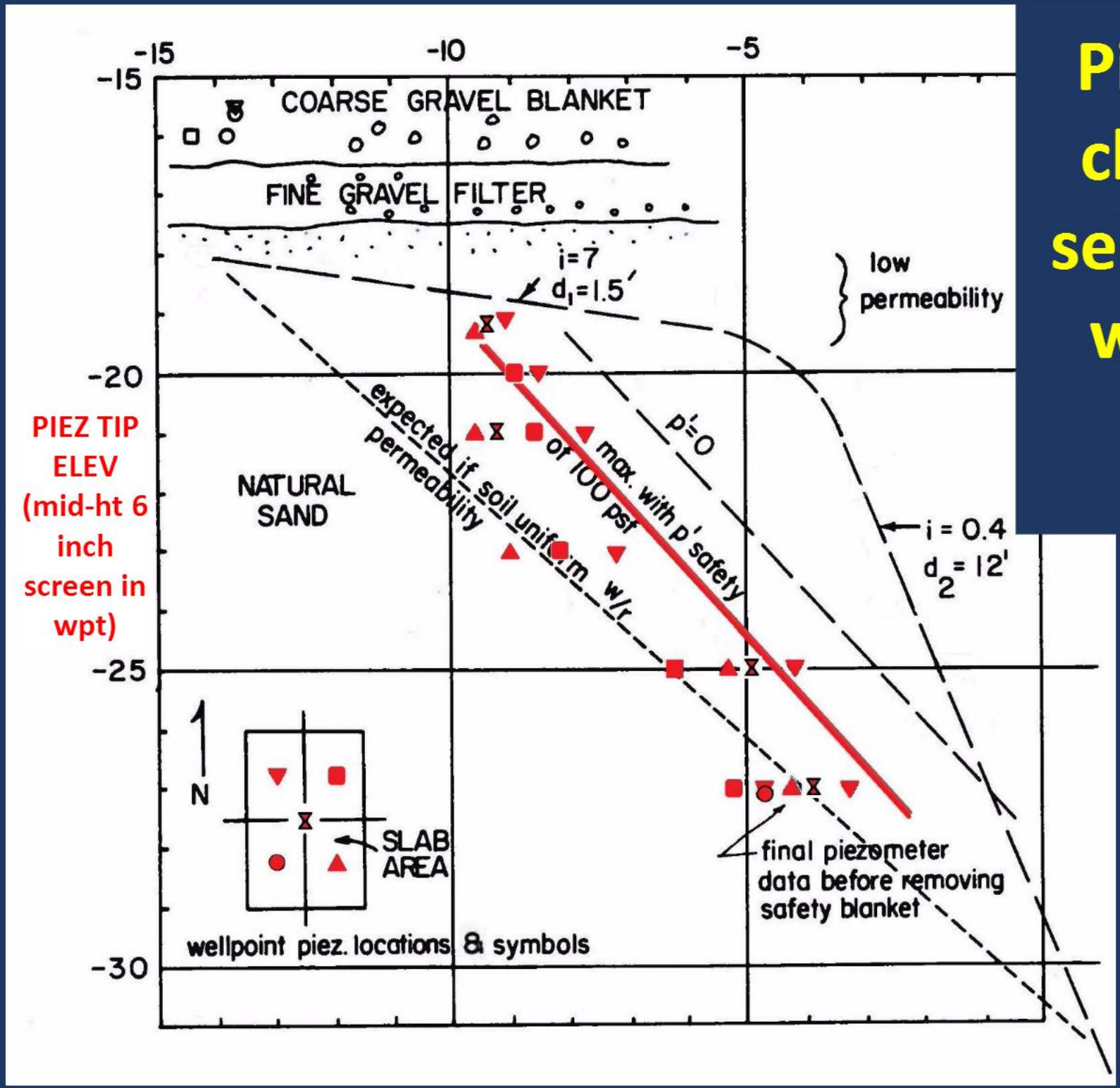


Estimating pressure relief and flow through low-k layer using self-pumping wellpoints

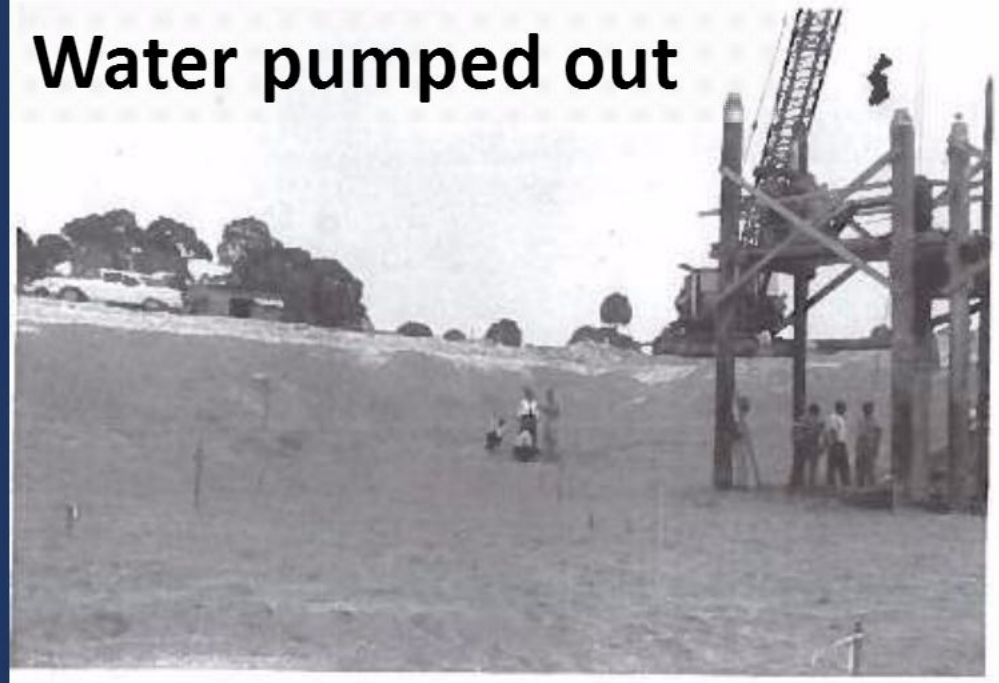


Self-pumping wellpoint field used for pressure relief under gravel blanket

Piezometer check after self pumping wellpoints installed

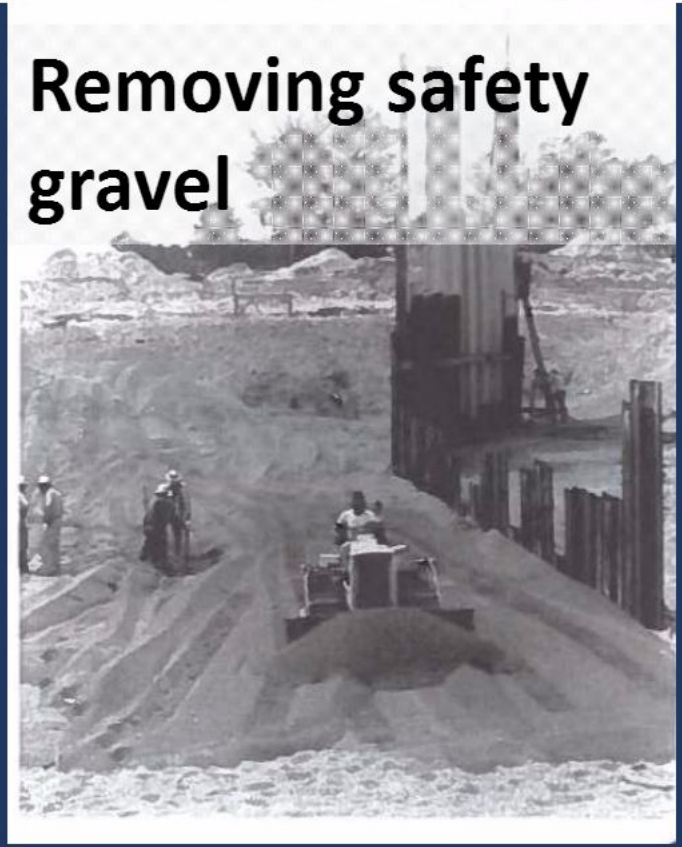


Water pumped out

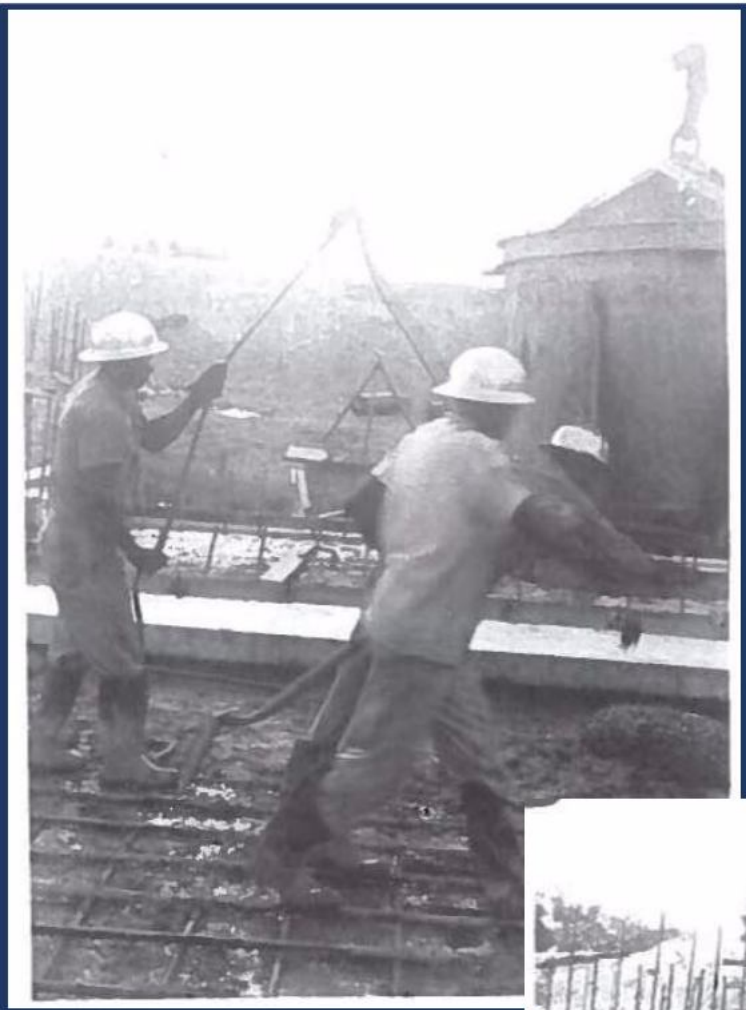


below blanket

Removing safety gravel

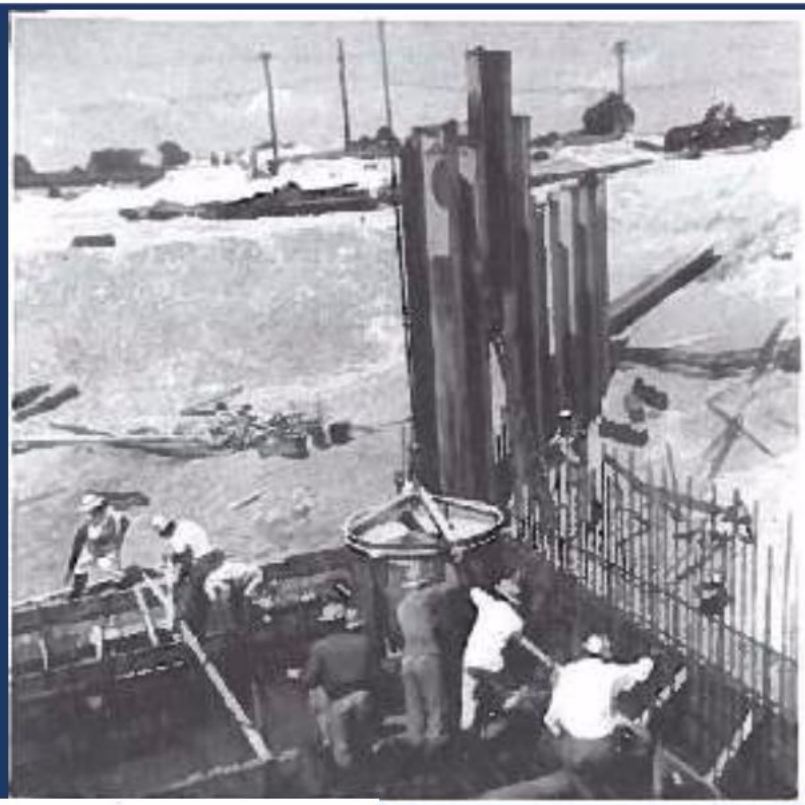


Starting foundation slab



Rushing to finish

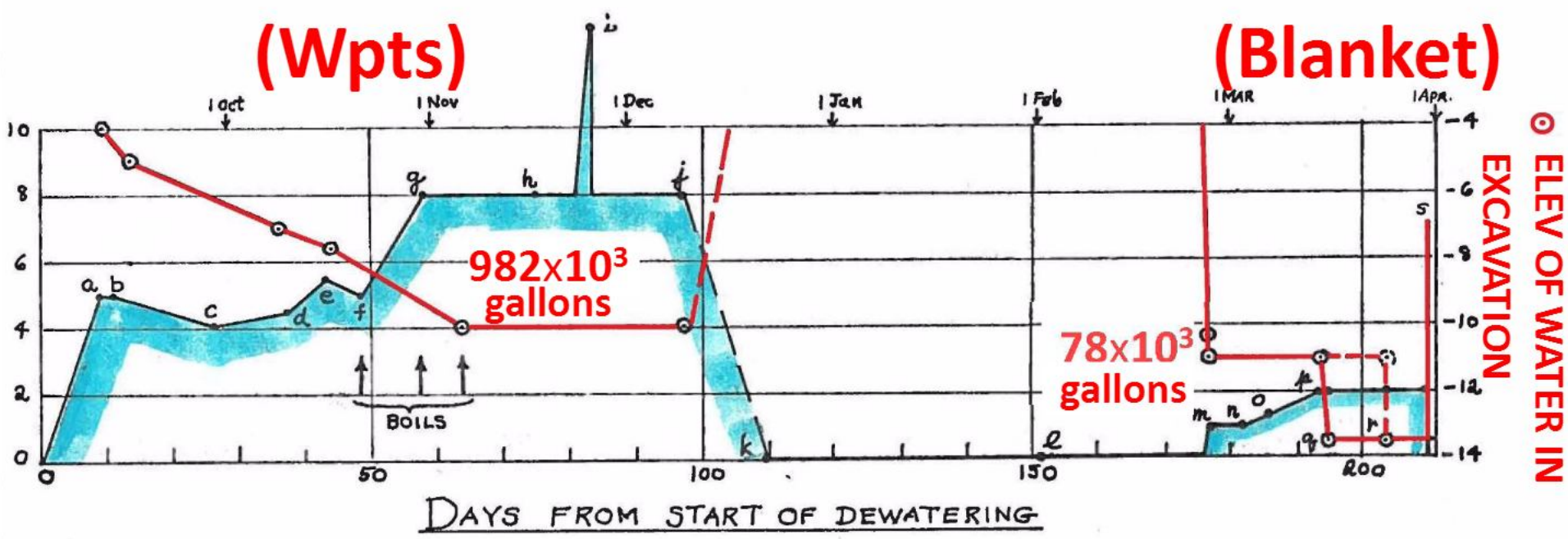
(time an enemy)



Pouring concrete

Critical point passed!

Dewatering Summary



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l. Started filter and drain construction.
m. Pumped flooded excavation to below top of gravel blanket (at -10.5)
n. 1st tests for relief wps.
o. Initial 50, 2", No. 60 screen, relief wps installed.
p. Additional 70 relief wps installed.
q. Removed south half of safety gravel.
r. Removed north half of safety gravel.
s. Foundation slab completed, critical point now past.

HISTORY OF DEWATERING AT STRUCTURE 37A
FT. LAUDERDALE, FLORIDA

John H. Schmertmann

For All the Details, See…

10803 SEPTEMBER 1974 CO3

JOURNAL OF THE CONSTRUCTION DIVISION

DEWATERING CASE HISTORY IN FLORIDA

By John H. Schmertmann,[1] F. ASCE

INTRODUCTION

Dewatering occasionally becomes a surprisingly difficult phase of construction. This paper describes the dewatering of a small foundation in Southeast Florida in 1959–1960 where the difficulty proved an uncomfortable and expensive surprise to both engineers and contractor. Although the contractor bid the dewatering at $20,000, it actually cost about $130,000, not including lost-time costs. He expected to do it in 2 weeks but it actually took 7 months! At one point,

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The End

Thank you!