Town of Earlham Thorpe Well Co.

Drilling started August 5, 1966 -- Completed Feb. 23, 1967.

Feet	Formation	Total depth
3	Black dirt	3
54	Clay	57
96	Shale & Drift	153
2	Lime	155
4	Shale & Lime	159
19	Red Shale	178
72	Lime & Shale	250
12	Gray Shale	262
3	Lime	265
19	Dark Shale & Lime Streaks	284
11	Shale	295
5	Lime	300
18	Shale	316
7	Shale Red	323
59	Shale Brown	382
9	Shale Gray	391
10	Shale Dark	401
5	Lime	406
8	Red Shale	414
9	Gray Shale	423
7	Dark Shale	430
20	Red Shale	450
8	Lime & Shale	458
33	Blue Shale Sandy	497
21	Sand	518
38	Sandy Lime Brown	556
7	Shale	563

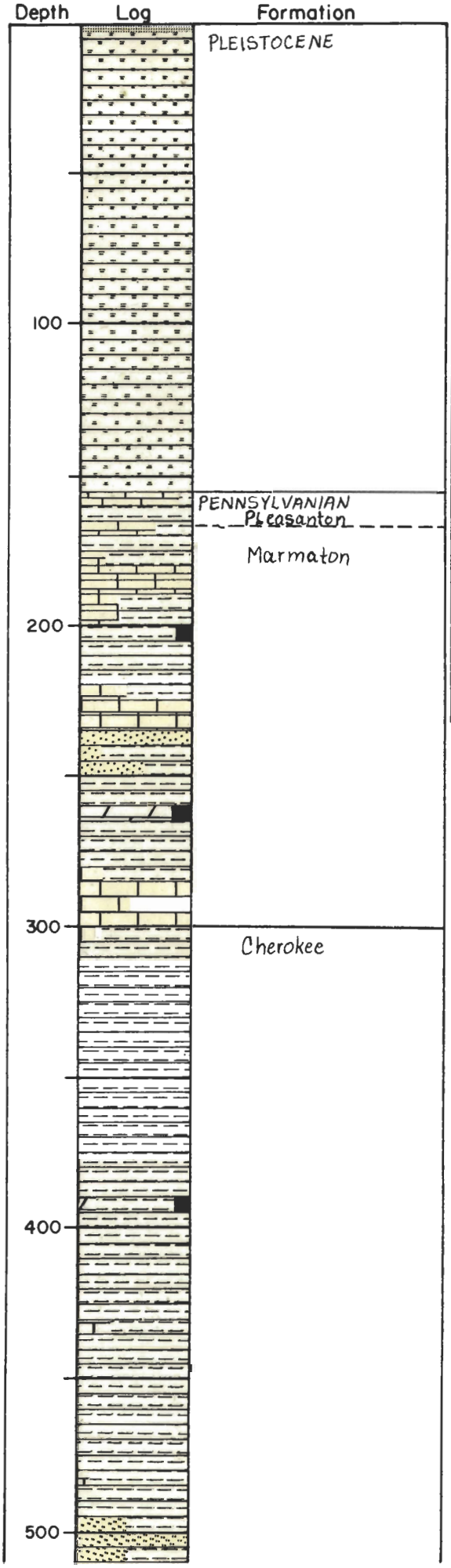
491

14	Lime & Shale	577
38	Sandy Lime	615
21	Sand	636
22	Sand with Shale Streaks	658
15	Sandstone	673
22	Black Shale	695
35	Lime Sandy Dolomites	730
33	Shale Light	763
4	Lime	767
4	Shale	771
12	Lime	783
12	Lime & Shale	795
6	Lime	801
29	Lime & Shale	830
53	Lime	883
199	Lime broken with Shale	1082
131	Lime	1213
2	Red Shale	1215
3	Lime	1218
5	Dhale	1223
8	Lime	1231
55	Shale	1286
48	Lime	1334
6	Shale	1340
130	Lime	1470
31	Lime & Shale	1501
127	Lime	1628
21	Broken Lime & Shale	1649
11	Broken Lime	1666
57	Lime	1723
21	Lime & Chert	1744

91	Lime	1835
68	Lime & Shale	1903
72	LIme & Chert	1975
20	Red Shale	1995
53	Gray Shale	2048
25	Lime	2073
67	Lime Gray	2160
9	Dolomite	2169
5	Shale	2174
44	Lime & Shale	2218
66	Lime	2284
4	Shale Light	2288
12	Lime	2300
25	Lime & Shale	2325
12	Shale	2337
4	Lime & Shale	2341
10	Lime	2351
16	Lime Brown	2367
15	Sandy Lime	2382
27	Lime	2409
11	Lime Gray Sandy	2420
20	Lime Brown Sandy	2440
14	Lime	2454
8	Shale	2462
5	Lime	2467
13	Lime Brown	2480
10	Shale & Lime	2490
226	St. Peter Sand	2516
96	Lime	2610
58	Lime & Dolomite	2670
30	Sand	2700

151	Lime	2851
17	[illegible] Sand	2868
63	Lime	2931
17	Sand	2948

The final measurement was actually 2950 feet; so including the error in addition (at 491 feet) there is a difference of 8 feet. However, the driller said he went 5 feet into Dolomite below the sand

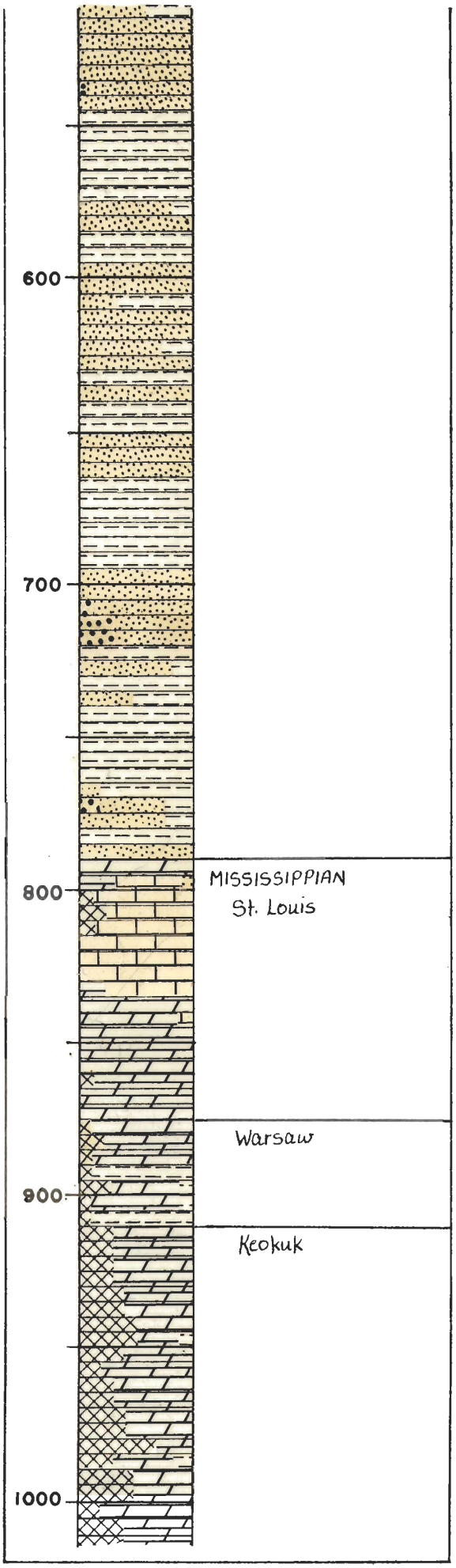


IOWA GEOLOGICAL SURVEY
In Cooperation with
U. S. GEOLOGICAL SURVEY
Iowa City, Iowa

Name *Earlham Town Well*	State *Iowa*
Town *Earlham* County *Madison*	Loc. *SW*
Contractor *Thorpe Well Co.* Driller	Sec. *6*
Drilling Dates *Aug. 1966 - February 1967*	T. *77* N., R. *28* W.
Casing Record *163' of 16" O.D. csg. 0-163'* *14" liner set @ 460'* *12" liner set @ 795'* *109' of 10" liner set @ 1298'* *Not Complete*	
S.W.L. *368'* G.P.M. *320* D.D. *52* (S.W.L. *311* after deepening to the Jordan)	
Static water level rose to 311' after deepening to the Jordan.	
Remarks: Specific Capacity 5.1 30 Grains Hardness Temp. 82°	Elev. *1105 ±* T.D. *2950'*
Logged By *Northup*	I.G.S. No. *W-18838*

Explanation of Colors

- Soil
- Loess, Silt or Siltstone
- Drift
- Sand & Gravel
- Shale
- Sandstone
- Limestone
- Dolomite
- Chert
- Gypsum or Anhydrite
- Coal
- N S — No Samples
- Oölitic Limestone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800
900
1000
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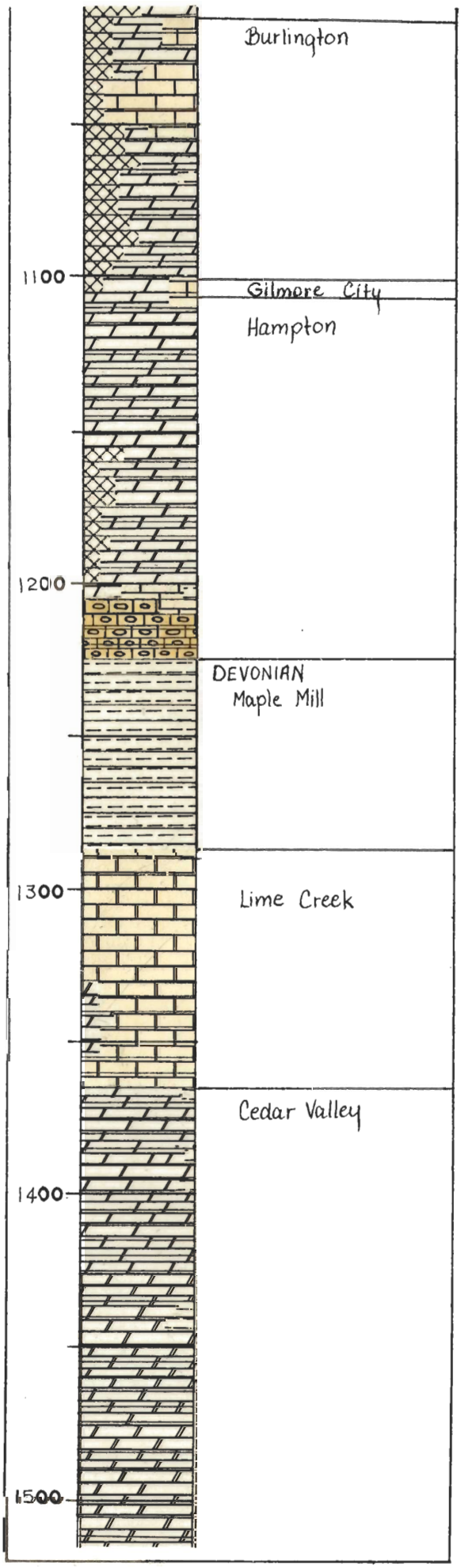
St. Louis
Warsaw
Keokuk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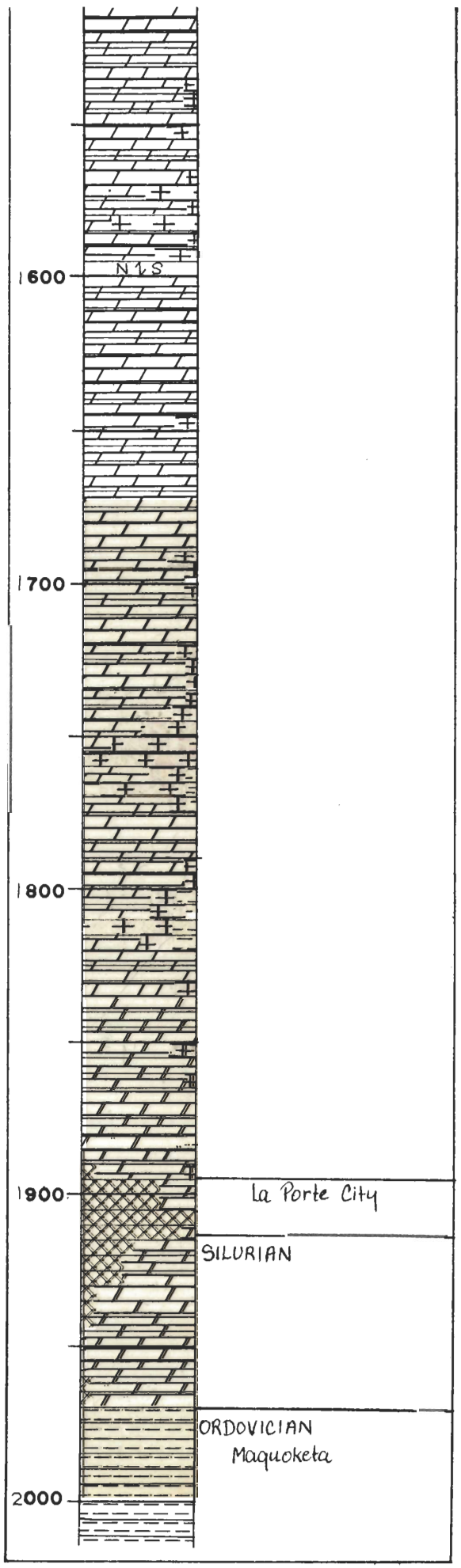
Gilmore City
Hampton
1200
DEVONIAN
Maple Mill
1300
Lime Creek
Cedar Valley
1400
1500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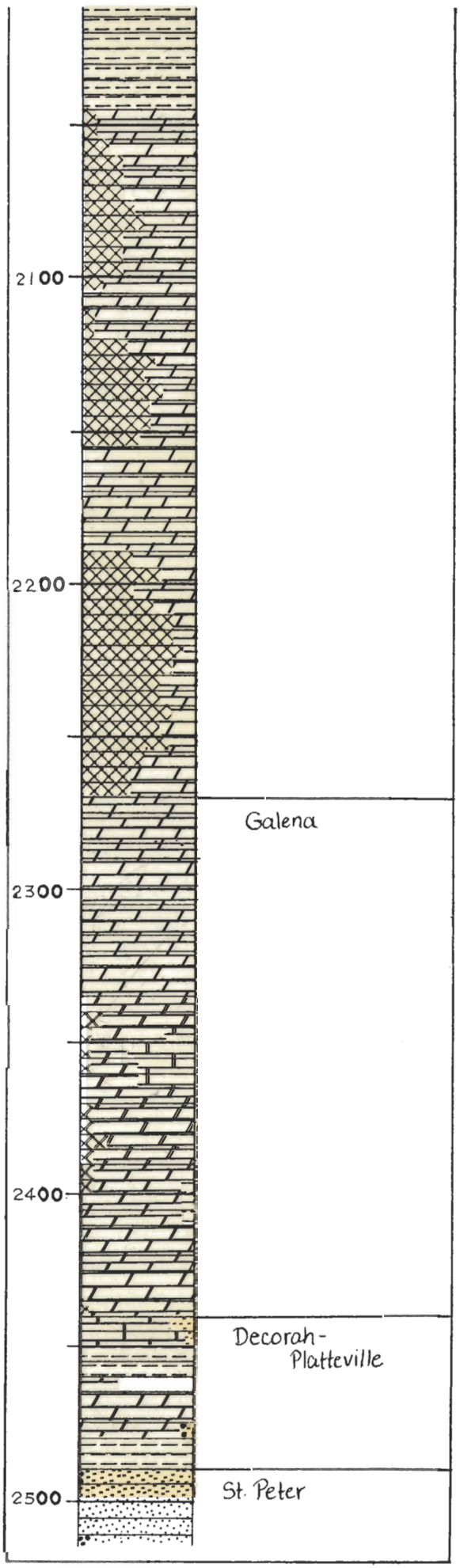
1900
2000
N 1 S
La Porte City
SILURIAN
ORDOVICIAN
Maquoketa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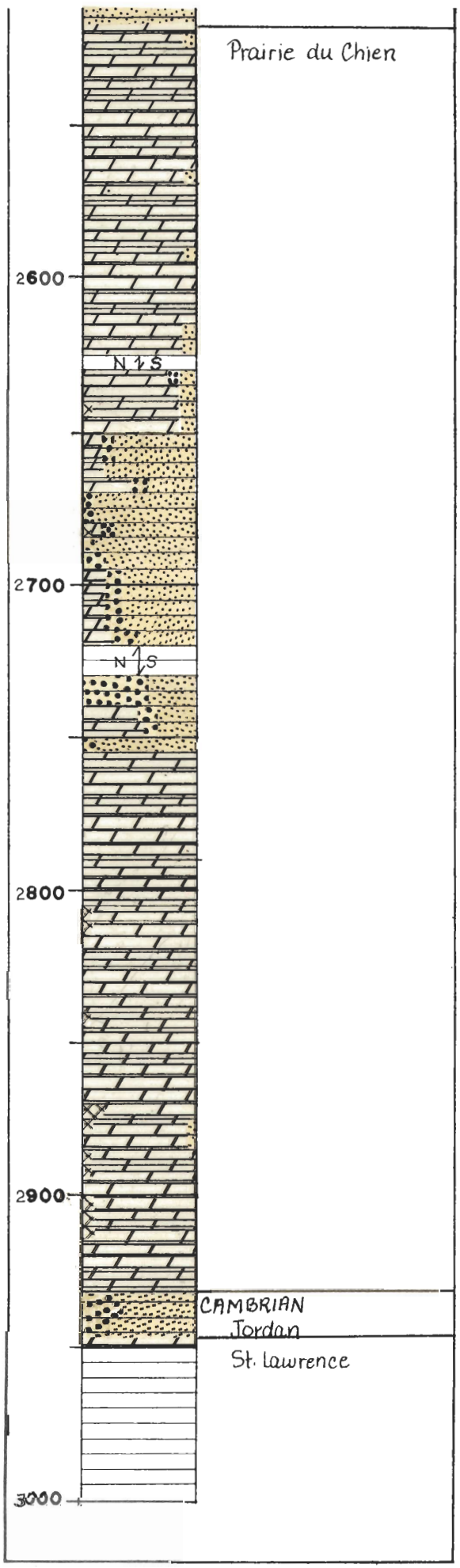
2200
Galena
2300
2400
Decorah-
Platteville
St. Peter
2500


Prairie du Chien
2600
N S
2700
N S
2800
2900
CAMBRIAN
Jordan
St. Lawrence
3000

Professional Service Industries, Inc.
Analytical Services Division

ANALYTICAL REPORT

TESTED FOR: Coster Engineering
1501 Ohio Street
Des Moines, Iowa 50314

Attention: Tom Gidwitz

PROJECT: EARLHAM MUNICIPAL WELL

DATE: May 9, 1986

OUR REPORT NO.: 174-63076-1

REMARKS: Samples submitted April 29, 1986.

Test Results

Sample Identification:	Raw Water, Jordan Well	Jordan Well Water Through "70" membrane
pH	7.4	8.6
Sulfate, mg/l	710	15.5
Nitrate, mg/l	1	1
Calcium Carbonate, $CaCO_3$, mg/l	628.0	28.0
Fluoride, mg/l	2.3	1.0
Chloride, mg/l	242.2	84.0
Chlorine, mg/l	0.5	0.4
Bicarbonate, mg/l	168.0	42.0
Arsenic, As, mg/l	0.062	0.008
Barium, Ba, mg/l	1.52	1.52
Cadmium, Cd, mg/l	0.02	0.01
Calcium, Ca, mg/l	121.4	7.12
Chromium, Cr, mg/l	0.07	0.07
Copper, Cu, mg/l	0.03	0.03
Iron, Fe, mg/l	0.38	0.12
Lead, Pb, mg/l	0.007	0.007
Magnesium, Mg, mg/l	38.3	2.46

Continued page 2

Test Results Continued:

Sample Identification:	Raw Water, Jordan Well	Jordan Well Water Through "70" membrane
Manganese, Mn, mg/l	0.13	0.06
Mercury, Hg, mg/l	0.003	0.003
Potassium, K, mg/l	18.9	5.48
Selenium, Se, mg/l	0.058	0.021
Silica Dioxide, mg/l	0.011	0.011
Silver, Ag, mg/l	0.02	0.02
Sodium, Na, mg/l	167.8	62.6
Zinc, Zn, mg/l	0.005	0.005

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Lab Nos. D319, D320

Professional Service Industries, Inc.
Analytical Services Division

ANALYTICAL REPORT

TESTED FOR: Coster Engineering
1501 Ohio Street
Des Moines, Iowa 50314

Attention: Tom Gidwitz

PROJECT: CARLHAM MUNICIPAL WELL

DATE: May 14, 1986

OUR REPORT NO: 174-63076-2

REMARKS: Samples submitted April 29, 1986.

Test Results

Sample Identification:	Raw Water, Jordan Well	Jordan Well Water Through "70" membrane
Gross Alpha, pCi/l	10.4 ± 3.5	2.6 ± 0.9
Gross Beta, pCi/l	19.0 ± 12.0	<10.0
Total Radium, pCi/l	10.5 ± 4.9	< 2.0
Radium 226, pCi/l	14.7 ± 3.5	<1.0
Radium 228, pCi/l	<2.0	< 2.0

Respectfully submitted,

PROFESSIONAL SERVICE INDUSTRIES, INC.

Lab Nos. D319, D320

PUMP TEST RECORD

THORPE WELL COMPANY, BOX 1376, DES MOINES, IOWA

For Town Of Earlham Located at Earlham, Iowa

Make, Kind and Size of Power 40 Horse Sumo, Control with 250 TW Generator

Bowl No. 6F31 Size 8" Stages 6

Column Setting 500' ft. Size 5" Shaft size _____ and _____

Static Level Before Pumping 368 After Pumping _____ Temperature 82°

Date	Time	Engine R.P.M.	Pump R.P.M.	Pumping Level	Gallons Per. Min.	Temp. Discharge Description	Sand P.P.M. Volume
2-8-67	2:15	1800	3400	420	320	Dirty 82°	Little Sand
	3:15	1800	3400	420	320	Clearing 82°	No Sand
	4:15	1800	3400	420	320	Clear 82°	No Sand
	5:15	1800	3400	420	320	Clear 82°	No Sand
	6:15	1800	3400	420	320	Clear 82°	No Sand
	7:15	1800	3400	420	320	Clear 82°	No Sand
	8:15	1800	3400	420	320	Clear 82°	No Sand
	9:15	1800	3400	420	320	Clear 82°	No Sand
	10:15	1800	3400	420	320	Clear 82°	No Sand
	11:15	1800	3400	420	320	Clear 82°	No Sand
	12:15	1800	3400	420	320	Clear 82°	No Sand

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	5:15	1800	3400	420	320	Clear 82°	No Sand
	6:15	1800	3400	420	320	Clear 82°	No Sand
	7:15	1800	3400	420	320	Clear 82°	No Sand
	8:15	1800	3400	420	320	Clear 82°	No Sand
	9:15	1800	3400	420	320	Clear 82°	No Sand
	10:15	1800	3400	420	320	Clear 82°	No Sand
	11:15	1800	3400	420	320	Clear 82°	No Sand
	12:15	1800	3400	420	320	Clear 82°	No Sand

February 24, 1967

MEMORANDUM

TO: Dr. H. G. Hershey

FROM: Richard C. Northup

RE: Progress on Earlham City well

Mr. Atchison phoned early Friday morning to advise that the Earlham well is now at 2950'. They are positive that they are through the Jordan at last, having picked up a good white sand at 2931' and dolomite again at 2944'. This is a very thin Jordan, but not out of line with the thin section found at Redfield. The samples are being sent parcel post and should be here by tomorrow morning. Mr. Atchison reports that the static water level ~~wa~~ has risen from 368' (when they pumped from the Root Valley Section) to 311' now, so they will probably wind up with a better well if the quality turns out to be satisfactory.

GW Earlham city well
folder 1966

INVENTORY OF VISITORS phone call

Name O. Atchinson Date 10/27/66

Affiliation Thorpe Well Co.

Address Des Moines.

Information Requested The drilling depth of the Earlham city well is 2016'. The top of Maquoketa was encountered at 1975'. He wanted how much shale he would have, so that casing could be set. The Hunt & Macklin well approximately 3 miles north had 50' of shale before the dolomites of the M. Atchinson were encountered.

He requested that samples to 2016 be spot checked and then that he be called. [Bud picked samples up Wednesday - at this writing he had not returned]

Later Bud returned with samples which I checked. Top Maquoketa 1970'. Called Atchinson called.

M. Parker

Survey Contact

Earlham well folder

March 8, 1967

Mr. D. W. Ebert
State Hygenic Laboratory
405 State Office and Laboratory Building
East 7th and Court
Des Moines, Iowa 50309

Dear Mr. Ebert:

This is in reference to our letter of February 7, in which we indicated our aggeement of sponsorship of the analysis of water samples from the well being drilled by the Thorpe Drilling Company for the town of Earlham. Mr. Thorpe has informed us that he has received the analyses and has been charged for them. Because we had agreed to sponsor these samples it would be appreciated if you would cancel the charges to Mr. Thorpe, and also if you would send us copies of the analyses.

We have also received inquiry from the Chemplex Corporation of Clinton about a sample from the Chemplex No. 6 well that was submitted by the Survey on November 28, 1966. As no analysis has been received the question arises as to whether or not the sample reached your laboratory. If not we will collect another sample from that well.

Your cooperation in resolving these matters will be appreciated.

Very truly yours,

H. G. Hershey

HGH-OVE/1

CW Earlham well folder

The University of Iowa

ENVIRONMENTAL SANITATION

State Hygienic Laboratory

DES MOINES BRANCH

405 State Office & Laboratory Building, E. 7th & Court

Telephone—Area 515: 281-5371

Des Moines, Iowa 50309

9 March 1967

Dr H G Hershey
Director and State Geologist
Geological Survey Building
Iowa City, Iowa 52240

EARLHAM AND KEMPLEX, CLINTON, MINERAL SAMPLES

In response to your letter of 8 March 1967 we have the following information:

Thorpe Well Company must be confused regarding the samples from Earlham, one of which was covered in your letter to us dated 7 February 1967. The first sample, covered in your letter of 7 February, was collected on 9 February at 2771 feet depth and partial analysis was reported to Thorpe Well Company by telephone; the second sample was collected from the same well at approximately 2900 feet on 26 February and partial analysis was reported to the Thorpe Well Company by telephone. Although we have not received a second authorizing letter from you, we are accepting this second sample as under your sponsorship. Neither of these two Earlham samples has been billed to the Thorpe Well Company. The mineral analysis has not yet been completed on either sample, and reports will go to you when completed. If you wish the partial analytical data we will be happy to send it to you promptly.

The sample from the Kemplex Corporation of Clinton, Well #6, collected on 28 November 1966, was received in this laboratory on 6 December 1966. We are sorry that this sample is not yet analyzed; because of the delayed receipt (eight days after collection) this sample has been superceded by others of higher priority. We shall try to report it to you before the end of this month, by giving it special attention. We have a later sample from the Kemplex Corporation, Well #3, collected on 11 February 1967. We expect to report this sample shortly.

Thank you for your understanding in these matters of mutual concern, and we appreciate your writing to us about the apparent Thorpe Company misunderstanding.

D W Ebert

D W Ebert
Associate Chemist

cmb

cc: Dr Morris

Earlham well folder

February 7, 1967

Mr. D. W. Ebert
State Hygenic Laboratory
405 State Office and Lab. Bldg.
East 7th and Court
Des Moines, Iowa 50309

Dear Mr. Ebert,

As you probably know, the Thorpe Well Drilling Company is presently in the process of drilling a deep well for the town of Earlham, Iowa. The well was planned to obtain water from the Jordan Sandstone.

On this date we received a telephone call from Mr. Tom Thorpe to inform us that because a thick sand section was encountered in the Prairie du Chien Formation, they wish to test pump at this time. Mr. Thorpe requested permission to submit a water sample for analysis under our sponsorship. We indicated our agreement.

Because the quality of the water will be a factor in determining if drilling should be continued to the Jordan, a preliminary partial analysis is requested. The partial analysis probably should include sulphate, chloride, sodium, and hardness determinations.

Your cooperation in this matter will be appreciated.

Very truly yours,

H. G. Hershey

HGH/ove/w
cc: 1-Dr. Robert L. Morris

COSTER

COSTER ENGINEERING
Water Systems Technology

Corporate Office
P.O. Box 3407
Mankato, MN 56001
Phone (507) 625-6621

Laboratory
1501 Ohio St.
Des Moines, IA. 50314
Phone (515) 244-0327

May 30, 1986

Paul VanDorpe
Iowa Geological Survey
123 North Capitol Street
Iowa City, IA 52242

Dear Paul:

Thank you very much for your help on the Ottumwa well information.

I am enclosing a test we made on the municipal well at Earlham. Unfortunately, I do not have its exact depth on file here. However, there is only one deep well that the town uses, so if you have records of the town's well depth, this is the one.

The second set of numbers shows the effects of reverse osmosis filtration.

We will be making tests on other cities in the future. I will continue to send you the results.

Thanks again,

Tom Gidwitz

Earlham well folder

February 9, 1967

MEMORANDUM

TO: Dr. H. G. Hershey

FROM: Richard C. Northup

RE: Earlham City Well

I have just run the latest samples from the Earlham City Well (interval 2570' - 2765')and find that there is an excellent Root Valley Section running from 2650' - 2755'. By all rights this should probably furnish a good water supply for Earlham, although there is always the problem of pumping sand. The sandstone for the most part runs from fine to very fine, with smaller percentages running to medium grained. Some samples show minor amounts of sandy dolomite and oolitic chert. The Oneota was picked at 2755, the last two samples being all dolomite. The well was to have been pumped two days ago, as Bud reported, and Thorpe was to let us know the results of their test. Bud says they might acidize the well if they failed to get enough water, but as they would be treating a sandstone section primarily, it seems uncertain as to how good the results would be. Of course there are a number of types of acid jobs used in the oil fields now ("sand fracture") which employ hydrofluoric acid and sometimes a combination of hydrochloric and hydroflouric acid. To my knowledge they have never done a "Sand Frac" job in Iowa, except once at Redfield. Thorpe might be interested in this method of development.

Below their present total depth, I look for the Jordan at about 2870' and the St. Lawrence around 2900'.

GW Earlham well folder (1966
Madison Co

February 17, 1967

MEMORANDUM

TO: Dr. H. G. Hershey

FROM: Richard C. Northup

RE: Progress on Earlham town well

Mr. Atchison, at Thorpe Well Co. has sent us samples from the Earlham Town Well from 2770' to 2875'. He had previously phoned to say that their driller had reported the Jordan at 2851' and the St. Lawrence at 2868'. This seemed high to me, and after checking the samples find they are still in the Oneota. Our forecast for the Jordan was for 2885' so they should be in it very soon. Though we expect it to be very thin(probably in the neighborhood of 20 feet) it will surely show up in the samples. I phoned Atchison back, giving him the information, so he will have them continue to drill. They felt so sure they were into the St. Lawrence that they were ready to set their pump for another test.

February 20, 1967

MEMORANDUM

TO: Dr. H. G. Hershey

FROM: Richard C. Northup

RE: Earlham town well

Additional samples were received from Thorpe Well Co. this morning from 2875' - 2910', and I still don't think they have penetrated the Jordan. Our original estimate to the Jordan was 2885', but it could easily be a bit deeper. Almost all the samples show a trace of very fine sand, but with the thick section of Root Valley open above this is not surprising. While the samples are very finely ground it seems to be practically all cream to tan colored dolomite with minor amounts of chert. It is always possible that the Jordan may be missing, as it is only 10' to 15' thick at Redfield. However I would expect some Jordan present, and the fact that the dolomite does contain some chert makes me believe they are still in the Oneota, as the St. Lawrence is almost invariably chert-free. As of now, they have lost a bit in the hole and are undecided as to whether to keep on a way or settle for what they have. From the Root Valley they made 320 gpm. Static was 368' and pumping level 420'. Hardness was 30 grains. I phoned Mr. Atchison at Thorpe's and told hin that they still probably haven't reached the Jordan, and they will now have to decide with Anderson Engineering Co. of Des Moines and the town as to their next step. Mr. Duane McClelland of the Engineering Company phoned later in the morning and I gave him the facts also.

From the way he sounded, the town might be willing to settle for what they have now, as they are short of funds. Also Mr. McClelland says they have an option to stop short of the Jordan if they have sufficient water of acceptable quality.