

Results of the St. James Bay Surficial Aquifer Constant Discharge Test Franklin County, Florida

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INTRODUCTION

During March 19 through 22, 2002, ATC Associates, Inc. (Marietta, Georgia) conducted, on behalf of Carrabelle Properties, LTD., a multi-well aquifer test of the surficial aquifer system. The test was conducted at a site located in coastal Franklin County (section 32, township 6S, Range 3W). The test was undertaken to determine local-scale aquifer hydraulic characteristics and to examine the feasibility of installing multiple golf course irrigation wells at the site. Aquifer test data and analysis are documented in ATC Associates, Inc. (2002). The purpose of this report is to provide additional documentation regarding the aquifer test, provide greater detail regarding the analysis and allow for the distribution of the test results.

SITE DESCRIPTION

The aquifer test site is located on St. James Island in coastal Franklin County, about three-quarters of a mile northeast of the Gulf of Mexico and about 1.5 miles southwest of the Crooked River. Topography at the site is a relic dune complex with linear uplands parallel to the shoreline alternated with linear, inter-dune wetlands. Land surface elevations at the aquifer test site are about 38 ft above sea level. The base of the surficial aquifer lies no more than about 30 ft below land surface. The aquifer consists of fine sand and gravel. Underlying the surficial aquifer system is the intermediate system regional confining unit. The top of this unit lies at about 8 ft above sea level. The upper part of the intermediate system is composed of sandy, silty clay. Water in the surficial aquifer is considered to be under unconfined conditions. The water table at the site lies at an elevation of about 35 ft above sea level.

AQUIFER TEST

One four-inch diameter test/production well (PIW-1 or NWF_ID 8357) and three two-inch diameter observation wells were constructed at the test site. The test/production well is completed to a depth of 30 ft below land surface. Screen extends from depths of five to 30 ft. The three observation wells are constructed similar to the test/production well. SP-3 (NWF_ID 8360) is nearest to the test/production well, at a radial distance of 49 ft. Prior to the test, the water level in this well was 2.92 ft below land surface. SP-1 (NWF_ID 8358) is located at a radial distance of 90 ft. Prior to the test, the water level was 3.56 ft below land surface. SP-2 (NWF_ID 8359) is furthest away, 137 ft. Prior to the test, the water level in this well was 3.74 ft below land surface.

For the multi-well aquifer test, a submersible pump was installed in the production well. The production well and the observation wells were equipped with digital water level recorders. The planned 72-hour constant discharge drawdown test was begun on March 19, 2002 at 13:00 PM. Drawdown was recorded no less frequently than every minute in the four wells for 4,320 minutes. The test/production well was pumped at a rate of 25 gallons per minute. At 4,320 minutes, the water level in the test/production well had declined 20.34 ft. SP-3 experienced a water level decline of 1.91 ft. SP-1 experienced 0.8 ft of decline and SP-2 0.5 ft. Upon completion of the constant discharge test, recovery data were collected for 7,000 minutes.

TEST ANALYSIS

Analysis of the test data was performed using AquiferWin32 software. AquiferWin32 is proprietary software produced by Environmental Simulations, Inc. The Neuman (1972) analytical solution was used to analyze the test data for wells SP-1, SP-2 and SP-3. The method is intended to simulate the response of an unconfined aquifer with fully-penetrating wells to pumping. Neuman defines the following term:

$$\beta = (r^2/b^2) \times (kz/kr)$$

where;

- r = radial distance to observation well,
- b = aquifer thickness,
- kz = vertical hydraulic conductivity,
- kr = horizontal hydraulic conductivity.

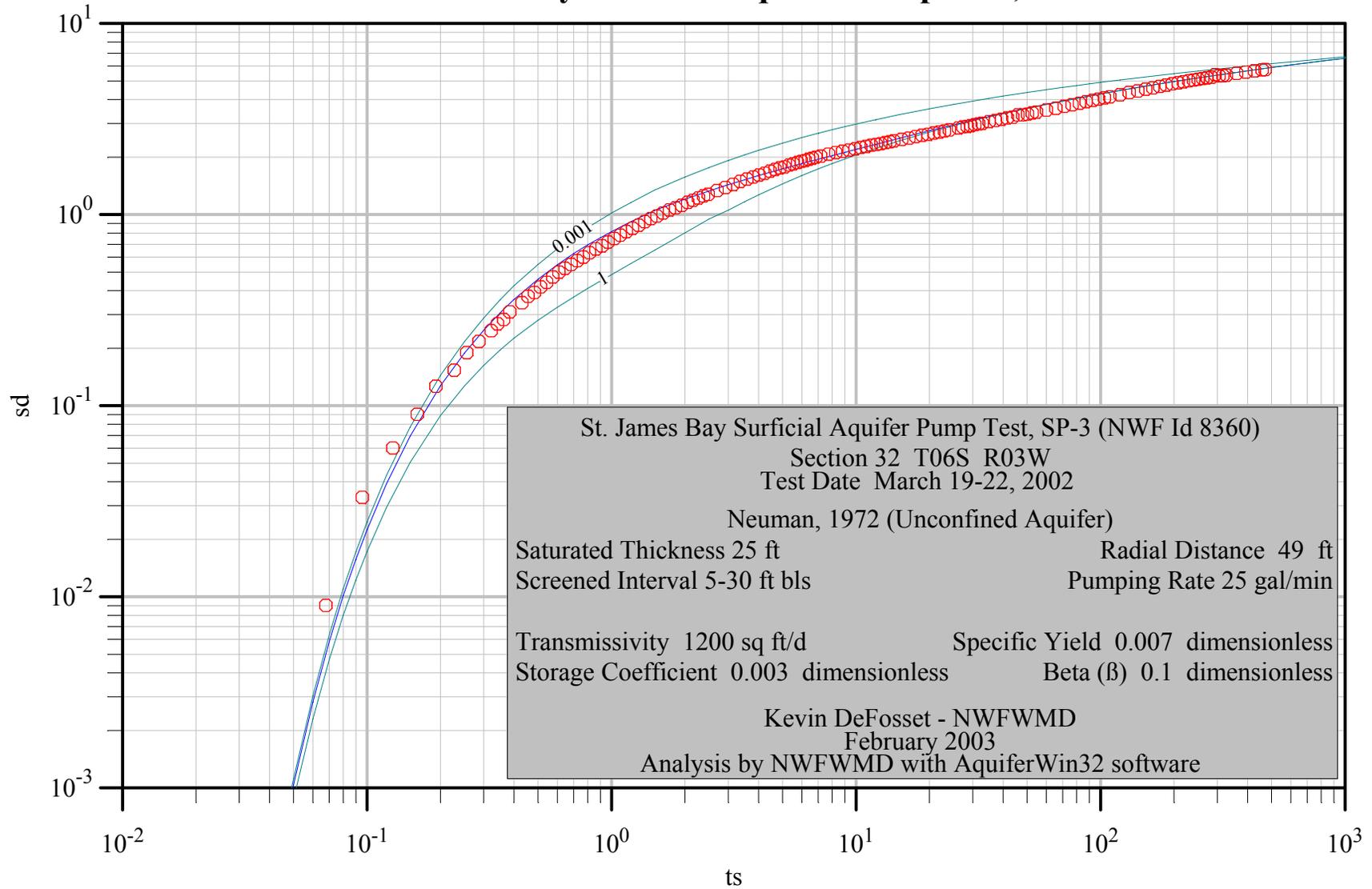
Results obtained from the analysis are summarized below.

<u>Hydraulic Property</u>	<u>SP-3</u>	<u>SP-1</u>	<u>SP-2</u>
r (ft)	49	90	137
b (ft)	25	25	25
r ² /b ²	3.8	13	30
T (ft ² /d)	1,200	1,100	1,200
S	0.003	0.01	0.004
Sy	0.007	0.09	0.09
β	0.1	1.8	2.45
kz/kr	0.03	0.14	0.08

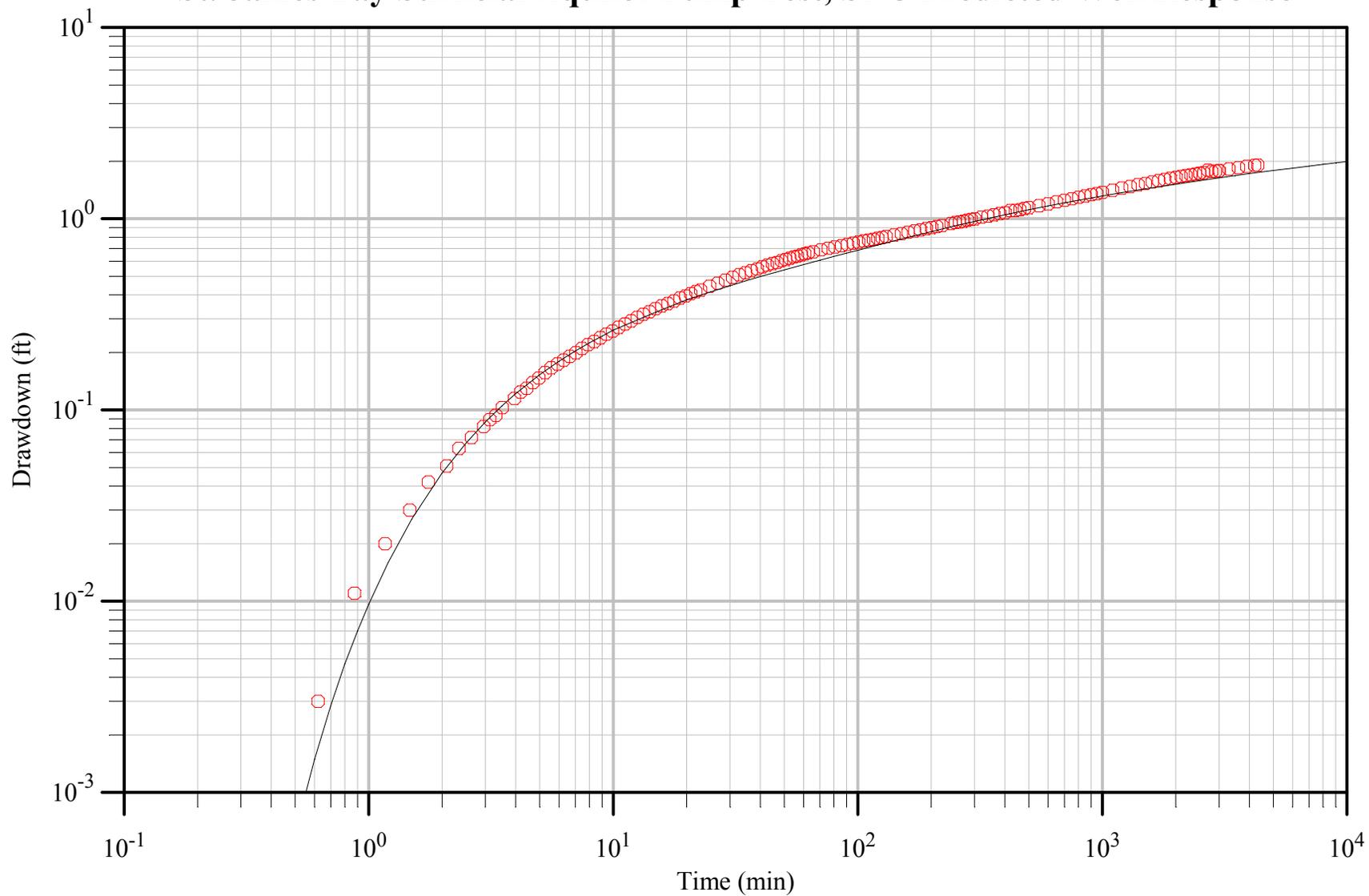
REFERENCE

ATC Associates, Inc., 2002. Description of Anticipated Impact, St. James Bay Development, Franklin County, FL.

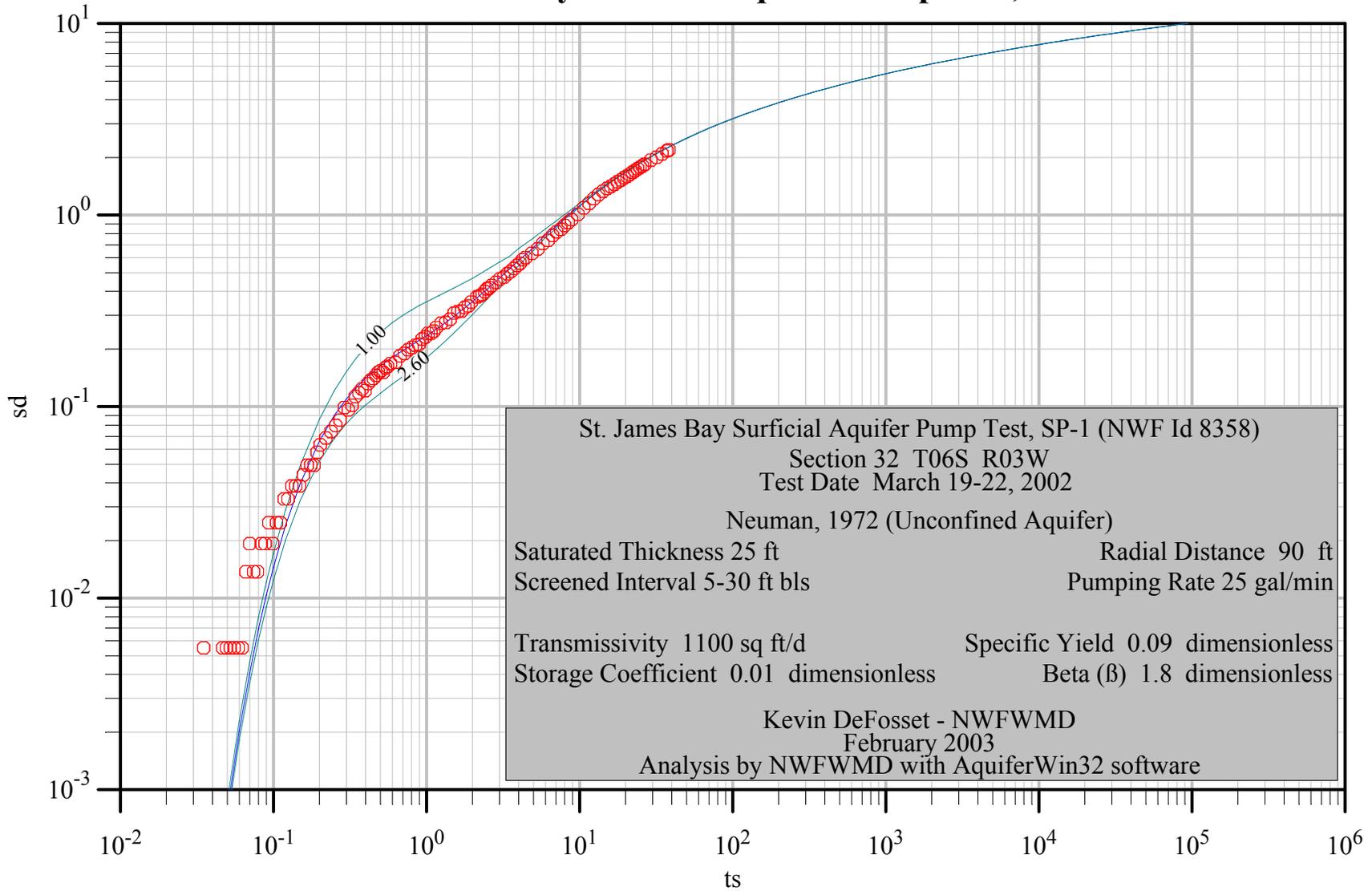
St. James Bay Surficial Aquifer Pump Test, SP-3



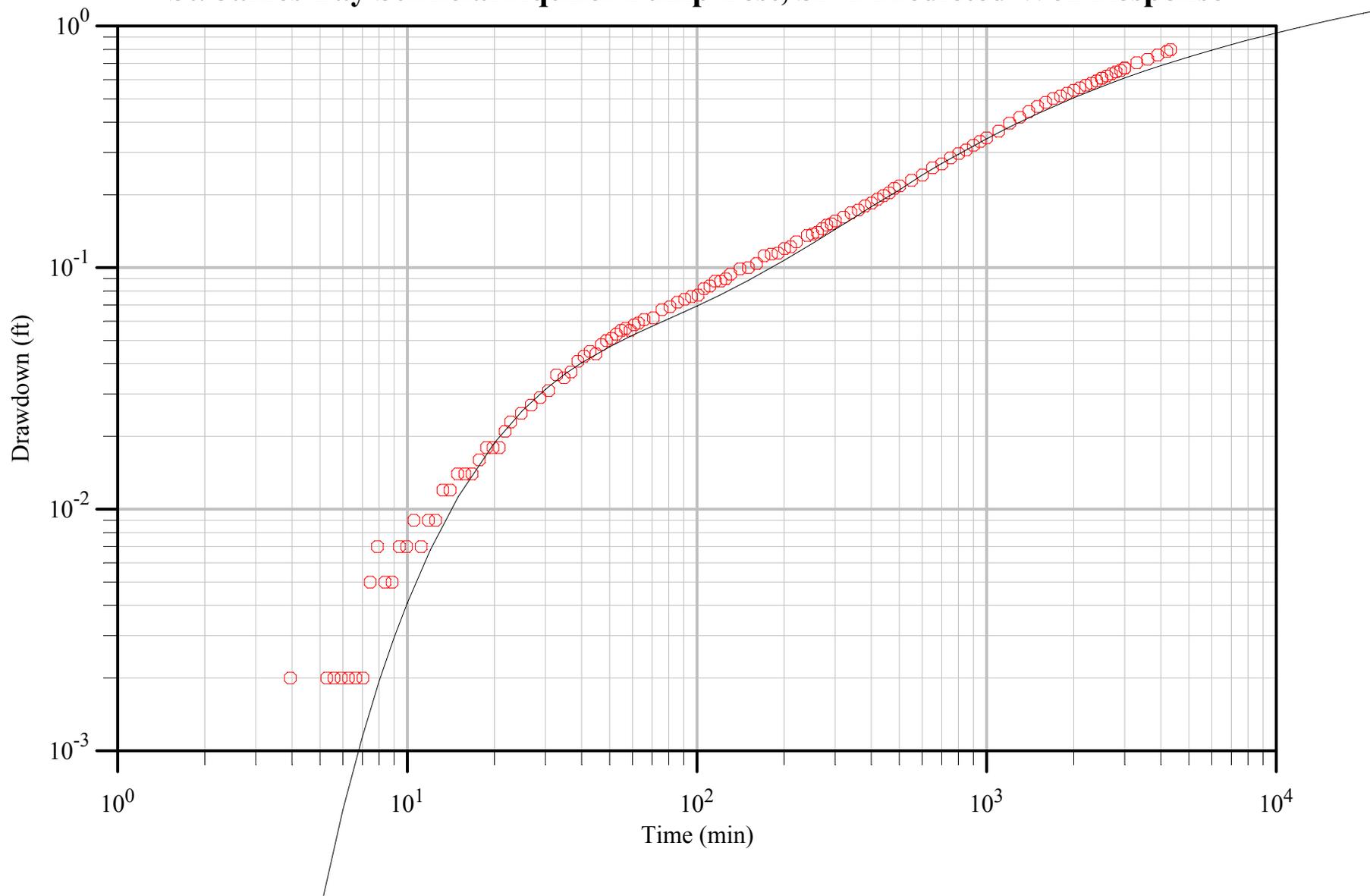
St. James Bay Surficial Aquifer Pump Test, SP-3 Predicted Well Response



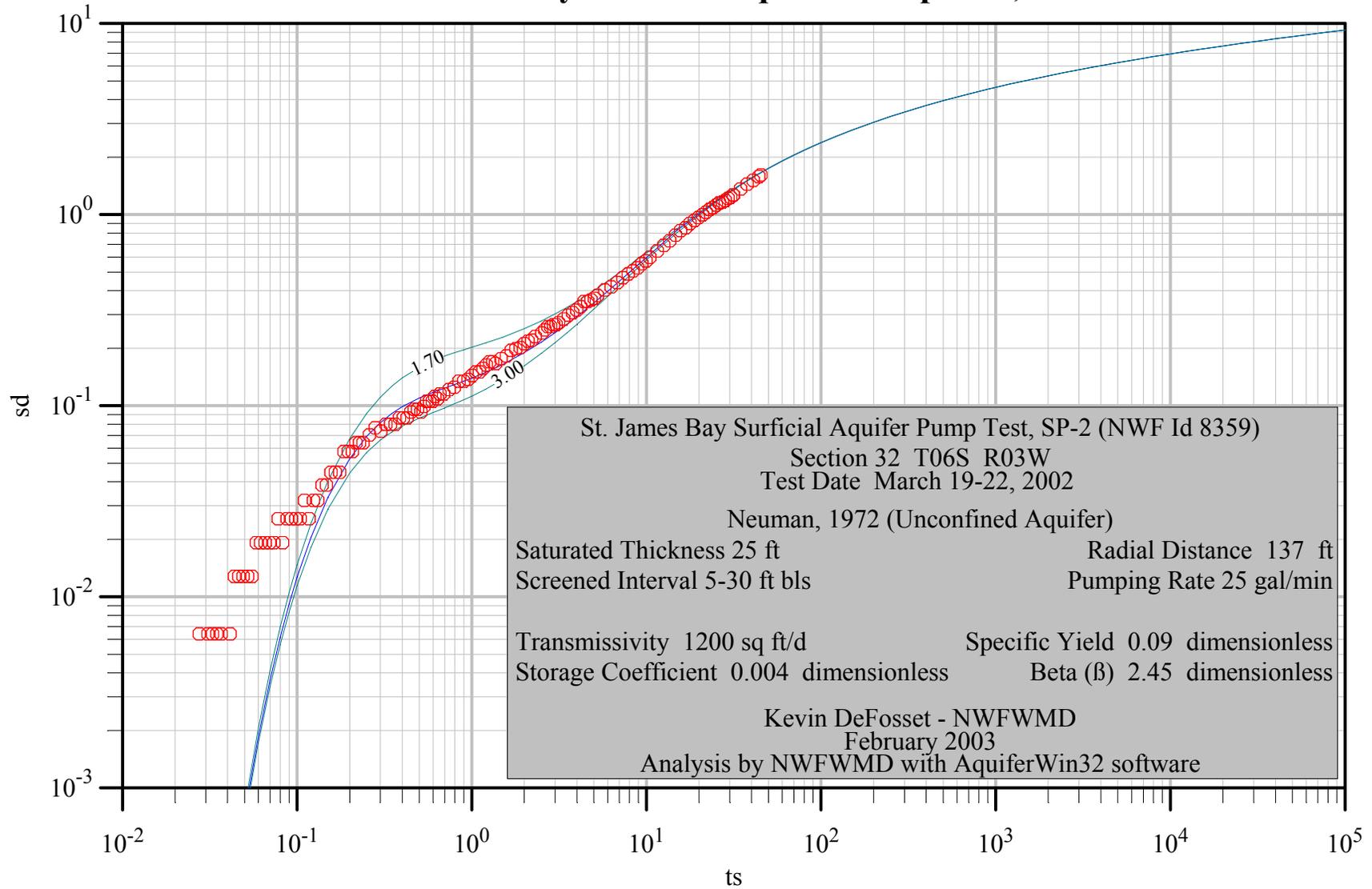
St. James Bay Surficial Aquifer Pump Test, SP-1



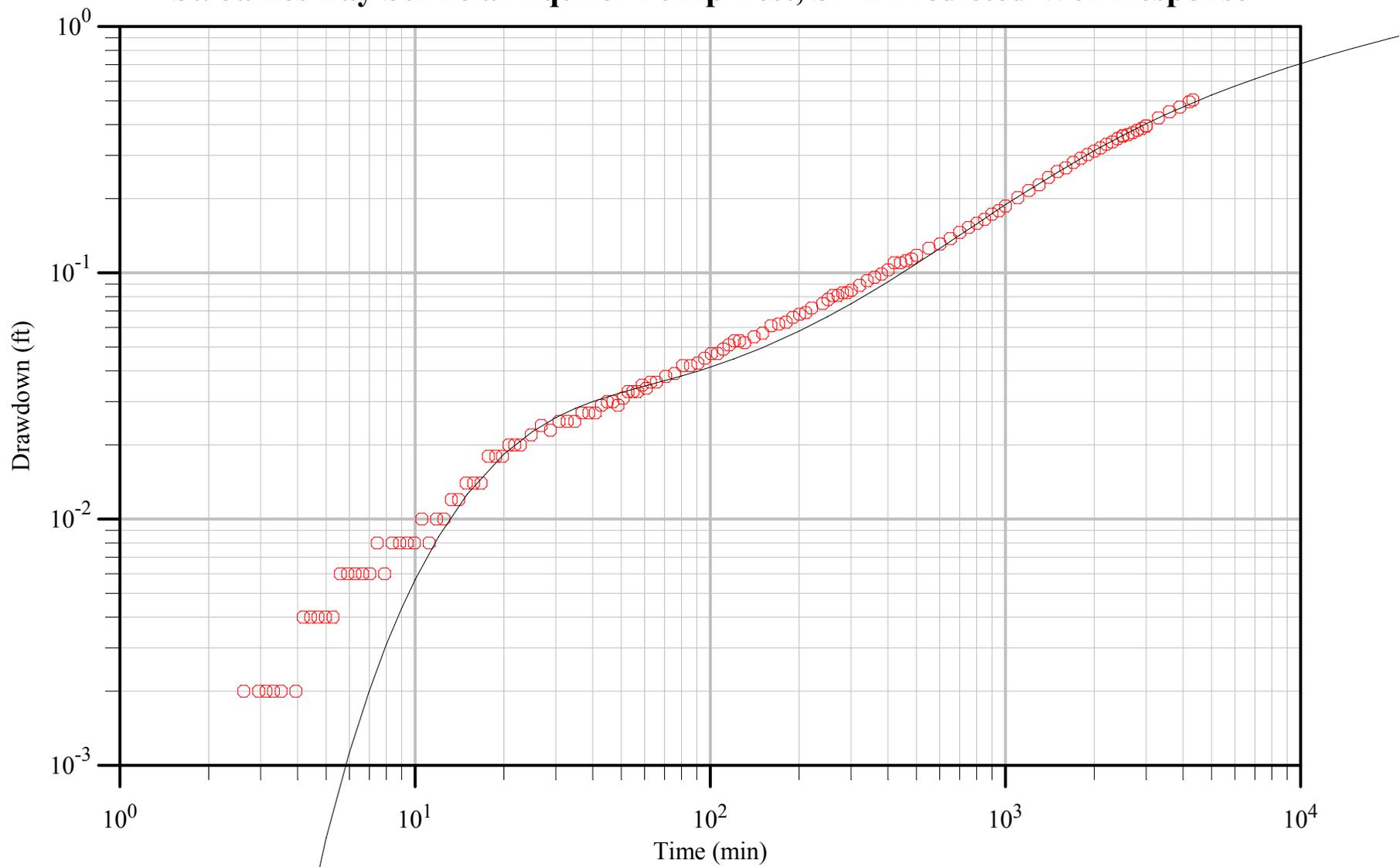
St. James Bay Surficial Aquifer Pump Test, SP-1 Predicted Well Response



St. James Bay Surficial Aquifer Pump Test, SP-2



St. James Bay Surficial Aquifer Pump Test, SP-2 Predicted Well Response



NWF_ID	8360	8358	8359	8357
radial distance (ft)	49	90	137	
time (min)	SP-3	SP-1	SP-2	PIW-1
0.21	-0.02	-0.024	-0.009	1.166
0.3145	-0.014	-0.017	-0.005	3.655
0.4198	-0.006	-0.012	-0.003	5.071
0.6213	0.003	-0.007	-0.001	6.285
0.8762	0.011	-0.005	0	7.113
1.1678	0.02	-0.002	0	7.747
1.4728	0.03	-0.002	0	8.187
1.753	0.042	-0.002	0	8.599
2.0845	0.051	-0.002	0	9.037
2.3412	0.063	-0.002	0	9.29
2.6297	0.072	-0.002	0.002	9.496
2.953	0.082	-0.002	0.002	9.648
3.1297	0.089	0	0.002	9.713
3.3162	0.094	0	0.002	9.778
3.5145	0.103	-0.002	0.002	9.833
3.9463	0.115	0.002	0.002	9.943
4.1812	0.124	0	0.004	9.982
4.4295	0.13	0	0.004	10.059
4.6928	0.139	0	0.004	10.11
4.9728	0.147	0	0.004	10.159
5.2697	0.157	0.002	0.004	10.204
5.583	0.166	0.002	0.006	10.268
5.9145	0.174	0.002	0.006	10.347
6.2663	0.182	0.002	0.006	10.425
6.6395	0.191	0.002	0.006	10.516
7.0345	0.199	0.002	0.006	10.595
7.453	0.21	0.005	0.008	10.685
7.8962	0.22	0.007	0.006	10.77
8.3663	0.228	0.005	0.008	10.841
8.8645	0.239	0.005	0.008	10.917
9.3913	0.249	0.007	0.008	11.088
9.9497	0.259	0.007	0.008	11.163
10.5413	0.271	0.009	0.01	11.148
11.168	0.282	0.007	0.008	11.147
11.8312	0.292	0.009	0.01	11.191
12.5347	0.305	0.009	0.01	11.239
13.2795	0.317	0.012	0.012	11.289
14.0695	0.327	0.012	0.012	11.353
14.9062	0.339	0.014	0.014	11.391
15.7913	0.351	0.014	0.014	11.408
16.7295	0.36	0.014	0.014	11.475
17.723	0.372	0.016	0.018	11.533
18.7762	0.386	0.018	0.018	11.577
19.7762	0.395	0.018	0.018	11.63
20.7762	0.406	0.018	0.02	11.686

NWF_ID	8360	8358	8359	8357
radial distance (ft)	49	90	137	
time (min)	SP-3	SP-1	SP-2	PIW-1
21.7762	0.416	0.021	0.02	11.751
22.7762	0.424	0.023	0.02	11.782
24.7762	0.444	0.025	0.022	11.887
26.7762	0.46	0.027	0.024	11.964
28.7762	0.478	0.029	0.023	12.046
30.7762	0.495	0.031	0.025	12.123
32.7762	0.509	0.036	0.025	12.196
34.7762	0.523	0.035	0.025	12.273
36.7762	0.535	0.037	0.027	12.335
38.7762	0.547	0.041	0.027	12.4
40.7762	0.56	0.043	0.027	12.465
42.7762	0.573	0.045	0.029	12.536
44.7762	0.583	0.044	0.03	12.603
46.7762	0.591	0.048	0.03	12.658
48.7762	0.604	0.05	0.029	12.702
50.7762	0.612	0.051	0.031	12.781
52.7762	0.623	0.053	0.033	12.814
54.7762	0.631	0.055	0.033	12.893
56.7762	0.637	0.056	0.033	12.932
58.7762	0.647	0.055	0.035	12.963
60.7762	0.655	0.058	0.034	13.032
62.7762	0.663	0.059	0.036	13.086
65.7762	0.672	0.061	0.036	13.145
70.7762	0.689	0.062	0.038	13.247
75.7762	0.701	0.067	0.039	13.357
80.7762	0.713	0.069	0.042	13.453
85.7762	0.724	0.072	0.042	13.549
90.7762	0.734	0.074	0.043	13.634
95.7762	0.745	0.076	0.045	13.706
100.7762	0.754	0.077	0.047	13.777
105.7762	0.766	0.082	0.047	13.857
110.7762	0.774	0.084	0.049	13.896
115.7762	0.781	0.088	0.051	13.953
120.7762	0.791	0.088	0.053	14.032
125.7762	0.798	0.09	0.053	14.082
130.7762	0.808	0.094	0.052	14.128
140.7762	0.823	0.099	0.055	14.236
150.7762	0.836	0.1	0.057	14.336
160.7762	0.851	0.104	0.061	14.439
170.7762	0.863	0.112	0.062	14.489
180.7762	0.875	0.114	0.063	14.572
190.7762	0.888	0.115	0.066	14.64
200.7762	0.899	0.12	0.068	14.717
210.7762	0.911	0.122	0.069	14.771
220.7762	0.923	0.128	0.072	14.838

NWF_ID	8360	8358	8359	8357
radial distance (ft)	49	90	137	
time (min)	SP-3	SP-1	SP-2	PIW-1
240.7762	0.944	0.136	0.075	14.937
250.7762	0.955	0.138	0.078	15.015
260.7762	0.963	0.14	0.081	15.051
270.7762	0.972	0.145	0.081	15.086
280.7763	0.982	0.15	0.083	15.149
290.7763	0.991	0.152	0.083	15.178
300.7763	0.997	0.156	0.085	15.245
320.7763	1.02	0.162	0.089	15.311
340.7763	1.034	0.169	0.093	15.383
360.7763	1.049	0.173	0.096	15.481
380.7763	1.064	0.18	0.099	15.552
400.7763	1.076	0.185	0.103	15.606
420.7763	1.106	0.192	0.11	15.686
440.7763	1.106	0.199	0.11	15.726
460.7763	1.116	0.204	0.112	15.83
480.7763	1.131	0.213	0.114	15.881
500.7763	1.144	0.218	0.118	15.937
550.7763	1.171	0.23	0.126	16.072
600.7763	1.198	0.242	0.131	16.219
650.7763	1.226	0.259	0.138	16.379
700.7763	1.249	0.269	0.146	16.493
750.7763	1.274	0.285	0.153	16.639
800.7763	1.295	0.297	0.159	16.735
850.7763	1.316	0.307	0.165	16.829
900.7763	1.337	0.321	0.173	16.9
950.7763	1.355	0.333	0.179	17.012
1000.7763	1.375	0.345	0.187	17.137
1100.7763	1.408	0.368	0.202	17.322
1200.7763	1.446	0.397	0.216	17.538
1300.7763	1.475	0.419	0.228	17.78
1400.7763	1.505	0.443	0.244	17.981
1500.7763	1.532	0.465	0.258	18.215
1600.7763	1.558	0.484	0.267	18.408
1700.7763	1.582	0.502	0.281	18.587
1800.7763	1.606	0.514	0.292	18.764
1900.7763	1.628	0.528	0.302	18.981
2000.7763	1.648	0.543	0.312	19.129
2100.7763	1.667	0.555	0.322	19.299
2200.7762	1.683	0.57	0.333	19.465
2300.7762	1.699	0.58	0.34	19.604
2400.7762	1.715	0.594	0.351	19.738
2500.7762	1.731	0.609	0.361	19.788
2501.7762	1.731	0.609	0.359	19.796
2600.7762	1.742	0.621	0.364	19.898
2700.7762	1.792	0.634	0.371	19.893

NWF_ID	8360	8358	8359	8357
radial distance (ft)	49	90	137	
time (min)	SP-3	SP-1	SP-2	PIW-1
2800.7762	1.765	0.646	0.38	19.885
2900.7762	1.773	0.656	0.386	19.896
3000.7762	1.784	0.67	0.396	19.976
3001.7762	1.784	0.671	0.395	19.956
3300.7762	1.822	0.705	0.426	20.156
3600.7762	1.85	0.729	0.451	20.18
3900.7762	1.877	0.759	0.472	20.27
4200.7762	1.901	0.786	0.495	20.317
4319.7762	1.911	0.798	0.504	20.343