Spring Creek Water Chemistry

By Vicki Hansen '80

- Tested for chloride, DO, pH, conductance
- DO & pH normal throughout
- Chlorides increased several-fold near Woodley and then gradually decreased downstream toward Carleton, but always were well within state standards
- Fecal coliform was not tested

Preliminary Summary 5/12/80

Tim:

- Chlorides increase yet stay within State Standards

- Specific Conductance remains fairly constant also within state standards

- Dissolved Oxygen varies yet all but 2 samplings (⊗) are with state standards

- pH constant at 8 - within state standards

- Recall the weather (ppt... lack of it!) in the past 3 weeks
  ∴ No surface water

  [Am I testing just the ground water? - No, I see increases in Cl^- concentration

- Also remember this testing is over a very short period.

- Nothing quantitative can be stated [and supported]

- Vick

Vicki Hansen

Spring Creek, which is just outside of the Northfield Sewage System, flows along the eastern edge of Northfield and into the Cannon River. Many homes along the creek are equiped with septic systems. I would like to find out if the septic fields are draining into Spring Creek.

Ground water includes varying concentrations of several elements usually in the form of ions. The concentration of the particular ions in the ground water is related to the solubility of each ion with respect to the other ions present in the water and to the availability of the ion due to the chemical environment through which the ground water passes. Water dissolves or precipitates chemical matter, remaining in equilibrium with its present environment.

Various chemical compounds differ in their solubility constant, their ability to be dissolved in water. Sodium-chloride (NaCl) has a high solubility constant and is extremely soluble in water. Silverchloride (Ag Cl) on the other hand has a low solubility constant and is relatively insoluable in water. If the water with NaCl in solution flows through an environment with silver ions present the silver will cause the chloride ion to precipitate, depleating the water in chloride. Chloride is relatively stable as an ion and few elements can cause it to precipitate. Silver and mercury are the most common elements which can cause chloride to precipitate. Although silver and mercury ions can cause chloride to precipitate there is not abundent silver, nor mercury in the soils of Northfield to allow this precipitation.

Chloride's relative stability coupled with the fact that water softeners use large amounts of sodiumchloride releasing chloride ion into the water validates the chloride ion as a valid "tag" for the water flowing from homes, through septic systems. By analyzing Spring Creek for chloride ion concentration relative to various positions along the creek, I should be able to determine whether or not the water from the homes near Spring Creek Road and Woodley flows from the septic systems into Spring Creek.

PURPOSE: The purpose of this study is to determine whether there is flowage of water from the septic systems in the Spring Creek watershed into the creek.

PROCEDURE: In order to do this I analyzed the water of Spring Creek for dissolved oxygen, specific conductance, chloride concentration and pH. Testing was carried out over a five week time period. The water was tested weekly at four regular testing stations.

Dissolved oxygen content, measured in p.p.m.'s was determined in the field by the use of a dissolved oxygen meter from Carleton College Geology Department. Specific conductance was also measured in the field with a meter from the geology department. Specific conductance was measured in micro HMO's. pH was determined with Lamott Chemical testing kit, a test also run in the field. In order ot determine chloride concentration 250 ml. samples were collected at each testing station and brought back to the laboratory. In the laboratory I calculated chloride concentration by a titration with silvernitrate solution. The procedure for this analysis can be found on [redacted] ← in Standard Methods for the Examination of Waste and waste Water Water temperature and creek discharge were also recorded.

DATA: The data collected is presented in the table included with this report.

OBSERVATIONS: These observations can be seen in the data table and with the graphs of dissolved oxygen -vs- distance downstream and chloride concentration -vs- distance downstream.

1) pH remained constant at 8 throughout the entire testing period. pH of 8 is within the state standard of 6.5-8.5.

2) The values of specific conductance seem rather randon and show no relationship to the chloride concentration. A plot of specific conductance -vs- chloride concentration displayed no trends.

3) The dissloved oxygen concentration increases from Station 4 to stations 2 and 3 and decreases again at station 1, showing a slight second increase at LL-0 and LL-1. All values except three were within state standards.

4) The chloride concentration, low at station 4 increased at stations 2 and 3 and decreased again at stations 1, LL-0 and LL-1. Values are all within state standards.

INTERPRETATION/DISCUSSION: The pH remaining at 8 throughout the entire testing period is expected considering the calcarious bedrock in the Northfield area.

The specific conductance, or concentration of total ions, seems to be random from station to station as well as from week to week. Since specific conductance does not differentiate between ions in solution it is impossible to determine anything qualitative from this data alone.

The dissolved oxygen concentration shows a trend although I do not believe this trend is related to the septic systems. The water at stations 1 and 4 were rather stagnent while the water at testing stations 2 and 3 was fast moving. Intuitively it seems that running water should have more dissolved oxygen than stagnent water. This hypothesis is supported by the increase in dissolved oxygen concentration at station LL-0 which is located directly after the falls of uppper Lyman Lakes. Dissolved oxygen data does not seem to be helpful in determining the septic system flow patterns.

Finally, there is an increase in chloride concentration from station 4 to station 3. The chloride concentration at station 4 should be fairly close to the value for the chloride concentration of ground water because there are only four septic systems before that point on the creek. Between stations 3 and 4 there are 9 septic systems (map). There is also an average increase of chloride concentration between stations 2 and 3. Also located near station 2 are four septic systems. Between stations 1 and 2 there are two septic systems and a decrease in chloride concentration is seen. The decrease in chloride concentration is probably due to the unportional increase in ground water to septic systems, diluting the overall chloride concentration. The creek broadedns from station 2 to station 1 with a visual difference in the amount of discharge. The relative chloride concentrations remain low through Lyman Lakes and testing stations LL-0 and LL-1.

FUTURE STUDY: Further study could focus on the effect of the septic systems on Spring Creek, through fecal coliform organism analysis, nitrate analysis and phosphate analysis as well as continued analysis of dissolved oxygen and pH.

MINNESOTA STATE STANDARDS for SPRING CREEK

Dissolved oxygen	not less than 6mg/l April 1 - May 31)
Ammonia	1mg/l
Chromiun	.05 mg/l
Copper	.01 mg/l
Cyanides	.02 mg/l
Oil	.5 mg/l
pH	6.5-8.5
Phenols	.01 mg/l
Fecal coliform organism	200/100ml (at least 5 samples/mo.)
Chlorides	100mg/l
Hardness	250 mg/l
Bicarbonates	5 milliequivalents/l
Boron	.5 mg/l
Specific conductance	1000 micromhos/cm
Total dissolved salts	700 mg/l
Sodium	60% of total cations as milli-equivalents/l
Hydrogen sulfide	.02 mg/l

Testing Station Number	pH	Chloride Concentration in mg/l				
Date and Discharge (reads across)	April - May	April 23 D = 30.5	May 1 D = 31.0	May [illegible] D = 31.5	May 15 D = 31.5	May 22 D = 32.0
4	8.0	14.1	11.6	7.8	11.3	nt
3	8.0	20.1	20.9	20.2	24.4	20.2
2	8.0	22.0	22.3	22.9	17.5	21.1
1	8.0	17.5	19.3	15.85	14.6	19.1
LL-0	8.0	nt	nt	nt	15.2	18.2
LL-1	8.0	nt	nt	nt	14.7	18.0
Minnesota State Standard	6.5 - 8.5	100 mg/liter				

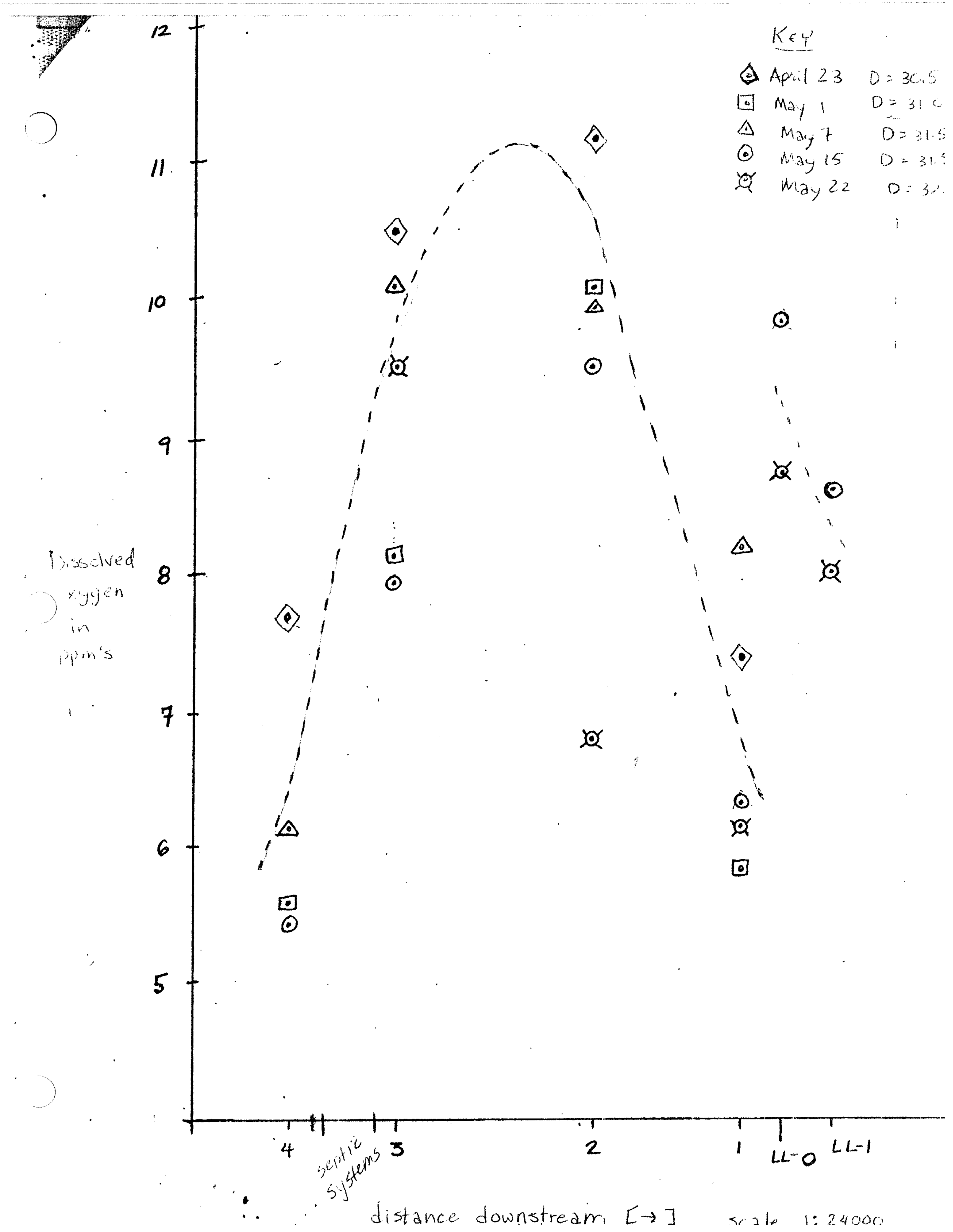
Testing Station Number	Specific Conductance in μMHOs				
Date and Discharge (reads across)	April 23 D = 30.5	May 1 D = 31.0	May 7 D = 31.5	May 15 D = 31.5	May 22 D = 32.0
4	670	630	433	475	nt
3	~~580~~ 610	580	444	363	630
2	570	466	451	510	585
1	540	530	482	610	545
LL-0	nt	nt	nt	490	459
LL-1	nt	nt	nt	495	465
Minnesota State Standard	1,000 μ MHOs				

Testing Station Number	Dissolved Oxygen in p.p.m.'s				
Date and Discharge (reads across)	April 23 D = 30.5	May 1 D = 31.0	May 7 D = 31.5	May 15 D = 31.5	May 22 D = 32.0
4	7.7	5.6*	6.2	5.4*	nt
3	~~14.0~~ 10.5	8.2	10.1	7.9	9.5
2	~~15.0~~ 11.2	10.1	9.9	9.5	6.7
1	7.4	5.8*	8.2	6.3	6.2
LL-0	nt	nt	nt	9.8	8.7
LL-1	nt	nt	nt	8.6	8.0
Minnesota State Standard	not less than 6 ppm's April 1 - May 31				

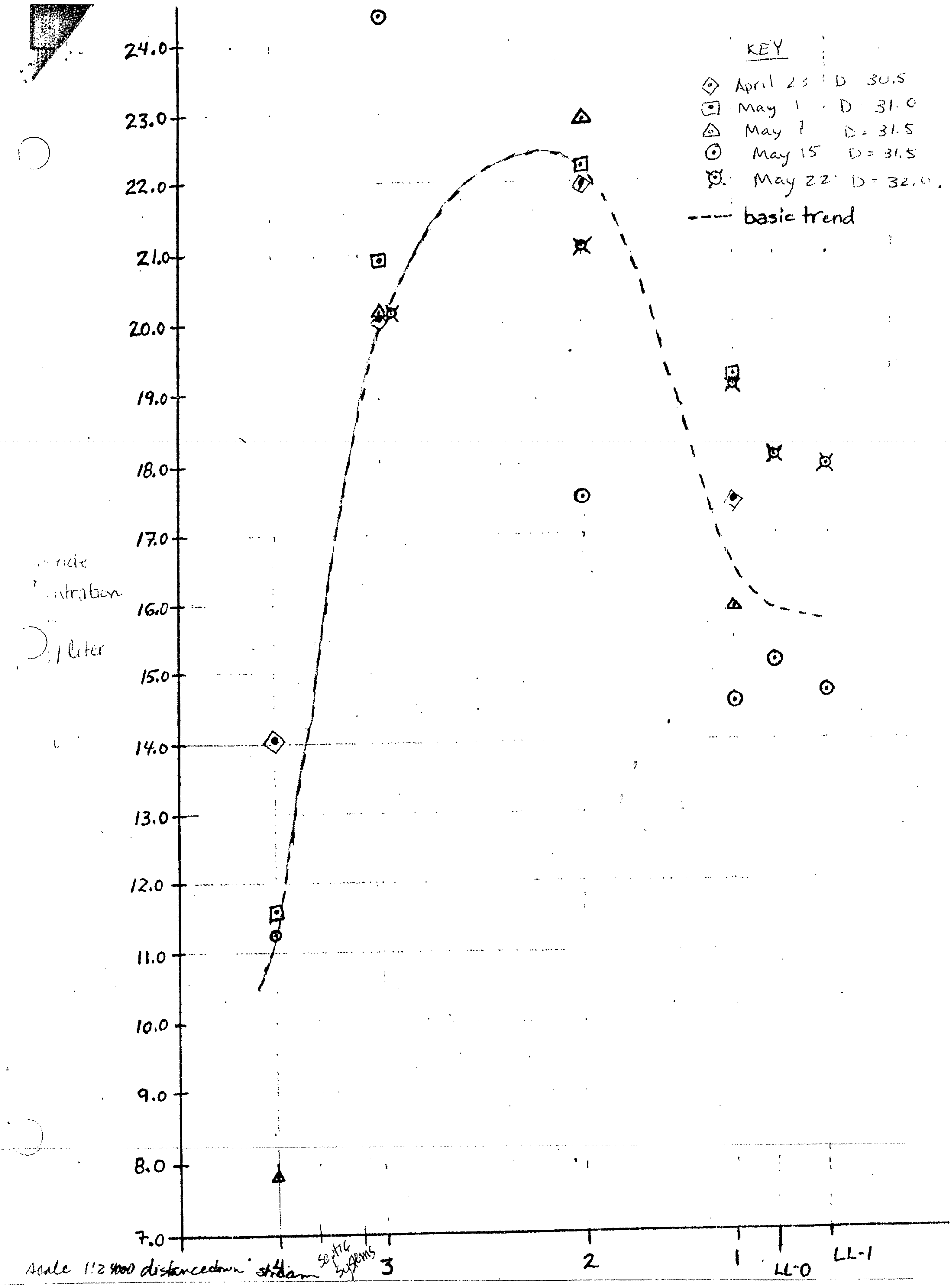
Discharge is given in inches of pipe above water level.

Note: 30.5 is greater discharge than 32.0 [discharge is fairly constant throughout study]

nt = not tested

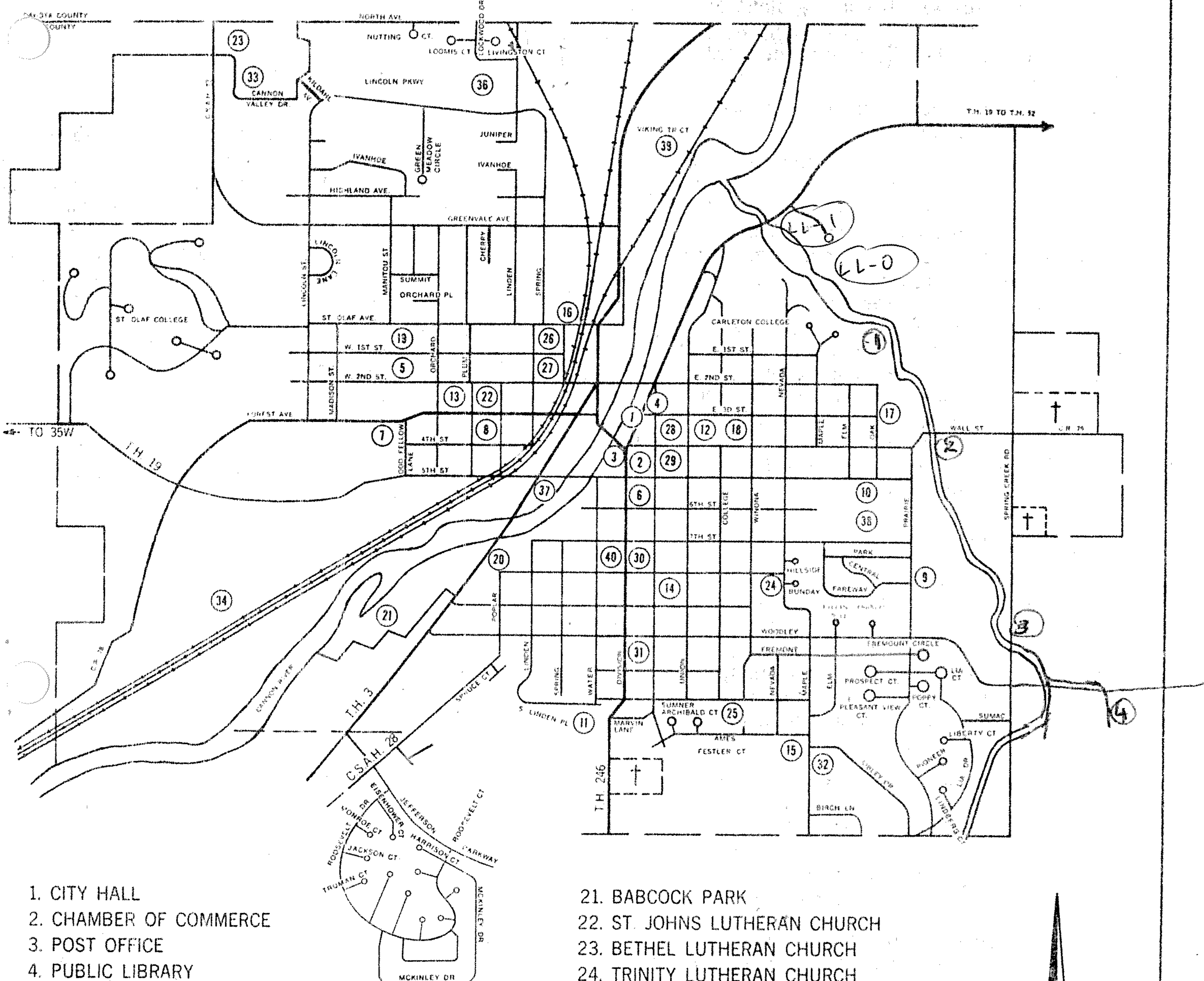


Key
April 23 D = 30.5
May 1 D = 31.0
May 7 D = 31.5
May 15 D = 31.5
May 22
12
11
10
9
8
7
6
5
Dissolved oxygen in ppm's
4
septic systems
3
2
1
LL-0
LL-1
distance downstream [→]
scale 1: 24000



KEY
April 23 D 30.5
May 1 D 31.0
May 7 D = 31.5
May 15 D = 31.5
May 22 D = 32.0
basic trend
24.0
23.0
22.0
21.0
20.0
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
4
3
2
1
LL-0
LL-1

CITY OF NORTHFIELD MINNESOTA



1. CITY HALL
2. CHAMBER OF COMMERCE
3. POST OFFICE
4. PUBLIC LIBRARY
5. HOSPITAL AND CONVALESCENT HOME
6. NATIONAL GUARD ARMORY
7. ODD FELLOWS RETIREMENT HOME
8. SCHILLING MUSEUM
9. NORTHFIELD GOLF CLUB
10. PUBLIC SWIMMING POOL
11. NORTHFIELD SR. HIGH SCHOOL
12. NORTHFIELD JR. HIGH & SCHOOL DIST OFFICES
13. LONGFELLOW ELEMENTARY SCHOOL
14. WASHINGTON ELEMENTARY SCHOOL
15. SIBLEY ELEMENTARY SCHOOL
16. ST. DOMINICS SCHOOL AND CONVENT
17. LAURA BAKER SCHOOL (PRIVATE)
18. CENTRAL PARK
19. WAY PARK
20. RIVERSIDE PARK
21. BABCOCK PARK
22. ST. JOHNS LUTHERAN CHURCH
23. BETHEL LUTHERAN CHURCH
24. TRINITY LUTHERAN CHURCH
25. ST. PETERS LUTHERAN CHURCH
26. ST. DOMINICS CATHOLIC CHURCH
27. ASSEMBLY OF GOD
28. CONGREGATIONAL CHURCH
29. EPISCOPAL CHURCH
30. MORAVIAN CHURCH
31. ALLIANCE CHURCH
32. UNITED METHODIST CHURCH
33. NORTHFIELD RETIREMENT CENTER
34. NORTHFIELD INDUSTRIAL PARK
35. EMMAUS BAPTIST CHURCH
36. GREENVALE PARK ELEMENTARY SCHOOL
37. FIRE — POLICE — RESCUE & CIVIL DEFENSE CENTER
38. PUBLIC SCHOOL ATHLETIC FIELDS
39. MOBILE HOME PARKS
40. N.W. BELL TELEPHONE CO.