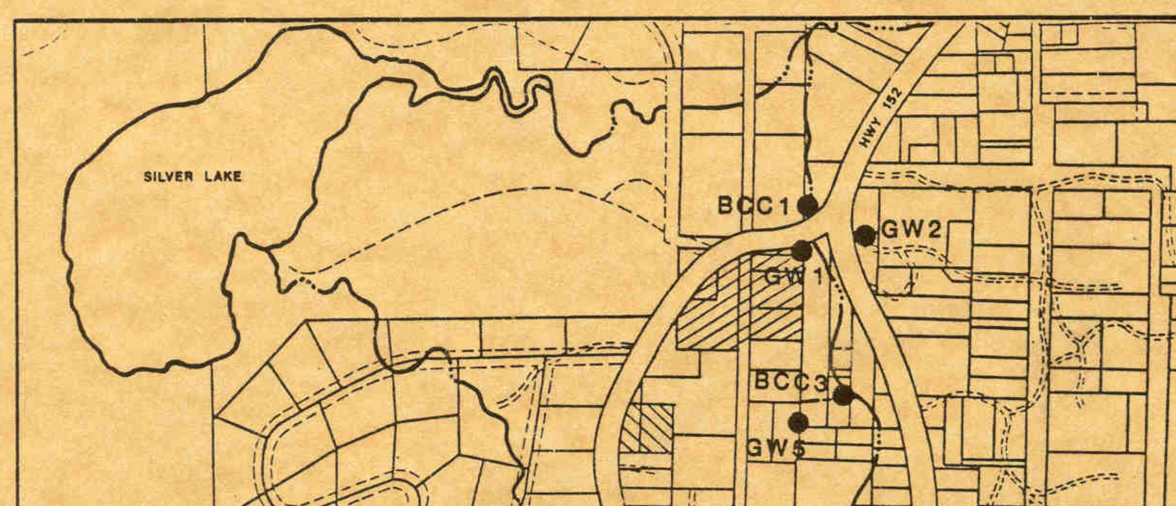
SALT LAKE COUNTY DEPARTMENT OF PUBLIC WORKS

DIVISION OF FLOOD CONTROL & WATER QUALITY

BIG COTTONWOOD CANYON HOME WASTE DISPOSAL ASSESSMENT

MARCH, 1984



Location of Sampling Sites - Brighton Basin Survey.

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BIG COTTONWOOD CANYON HOME WASTE DISPOSAL ASSESSMENT

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MARCH, 1984

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Salt Lake County Highways	Ron Flynn
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INTRODUCTION

The Big Cottonwood Canyon Home Waste Disposal Assessment was undertaken to assess water quality contamination from septic tank leachate in a domestic supply watershed east of Salt Lake Valley, Utah. Under provisions of a planning grant program administered by EPA, priorities for identification of home waste disposal were made jointly by the State of Utah and Salt Lake County. Unpublished records of surface water quality data collected by the Salt Lake City-County Health Department, the Salt Lake City Department of Public Utilities, the U.S. Forest Service and the Salt Lake County Divison of Flood Control and Water Quality have indicated higher bacterial levels in the upper, more developed area of the canyon than in lower, less developed reaches. Therefore, a major emphasis of this study was to determine the source and the extent of this contamination, which involved instream as well as ground-water analysis.

Big Cottonwood Canyon is an area of extensive summer and winter recreational useage. The Canyon is not sewered. The majority of septic wastewater ("black water") is disposed of by discharge to holding tanks or vaults. These vaults are periodically pumped by private haulers and wastes are transported to sewage treatment plants located in the valley. Non-septic wastewater ("gray-water") is discharged to conventional septic tanks and soil absorption systems. Ordinances requiring this disposal arrangement have been in existence since 1965.

Methodology for the assessment included review of instream data in order to determine likely home waste disposal non-point sources.

It has been speculated that the reasons for the elevated bacterial levels in the Brighton Basin area could be the failing integrity of older septic tanks, that some black water is discharged to septic tanks, a concentration of humans and associated activities, or a combination of these factors. Since the area is located in a domestic supply watershed, a possibility exists for pathogenic organisms entering water systems in both the valley and canyon and threatening public health. This concern was the motivation for the assessment.

OBJECTIVES

The overall goals of this study were to identify the sources and extent of home waste water water pollution to Big Cottonwood Creek and to provide input to the Health Department's on-going plan to abate pollution in this hydrologic system.

To achieve the overall goals, the following specific objectives were developed:

- Identify segments of Big Cottonwood Creek that reflect elevated pollutant levels;
- Relate polluted segments to land uses and/or other sources;
- Identify the number, type, age, location, and size of all septic and/or holding tank systems in the watershed and identify the operation and maintenance history of the systems;
- Identify any water quality degradation in stream segments that receive drainage from the systems;
- Analyze all information to ascertain the cause of any water quality degradation (i.e., caused by septic/holding tanks, recreation, natural causes, etc.);
- Provide input to the management plan for the reduction of water quality impairment; and
- Provide input to remove a State and EPA condition to approval of the Salt Lake County Water Quality Management Plan .

STUDY AREA DESCRIPTION

The following is a general description of the Big Cottonwood Creek watershed and the Brighton Basin area.(See Figure 1)

Big Cottonwood Canyon

Big Cottonwood Creek is the source of raw water for the Big Cottonwood Water Treatment Plant (Salt Lake City Water Department). The watershed is used extensively for year-round recreation including alpine skiing (two resorts), nordic skiing, snowmobiling, other winter activities and hiking, camping, picknicking and other summer activities. There are approximately 525 residences in the Canyon. Approximately 15 of these are year-round residences and 510 are summer and very limited winter use cabins.

Water quality monitoring in the canyon began about 30 years ago and has continued to the present. Current data show that the overall quality of the creek is quite good with only localized water quality problems. In 1980, monitoring programs which were being conducted by the U.S. Forest Service, Salt Lake City Water Department, and the Salt Lake City-County Department of Health were combined into one overall program. The total number of stations was reduced from more than twenty to eight. Parameters currently being analyzed at these eight stations are total and fecal coliform bacteria on a once per week basis and a full chemical analysis plus oil and grease at the canyon mouth on a monthly basis.

Compared to numerical criteria for designated beneficial uses for the Canyon segment, Big Cottonwood Creek water quality is far below maximum pollutant levels. The segment is, however, a designated anti-degradation segment which allows for no new point source discharge, treated or otherwise, and water quality must be maintained at existing (1978) or better quality.

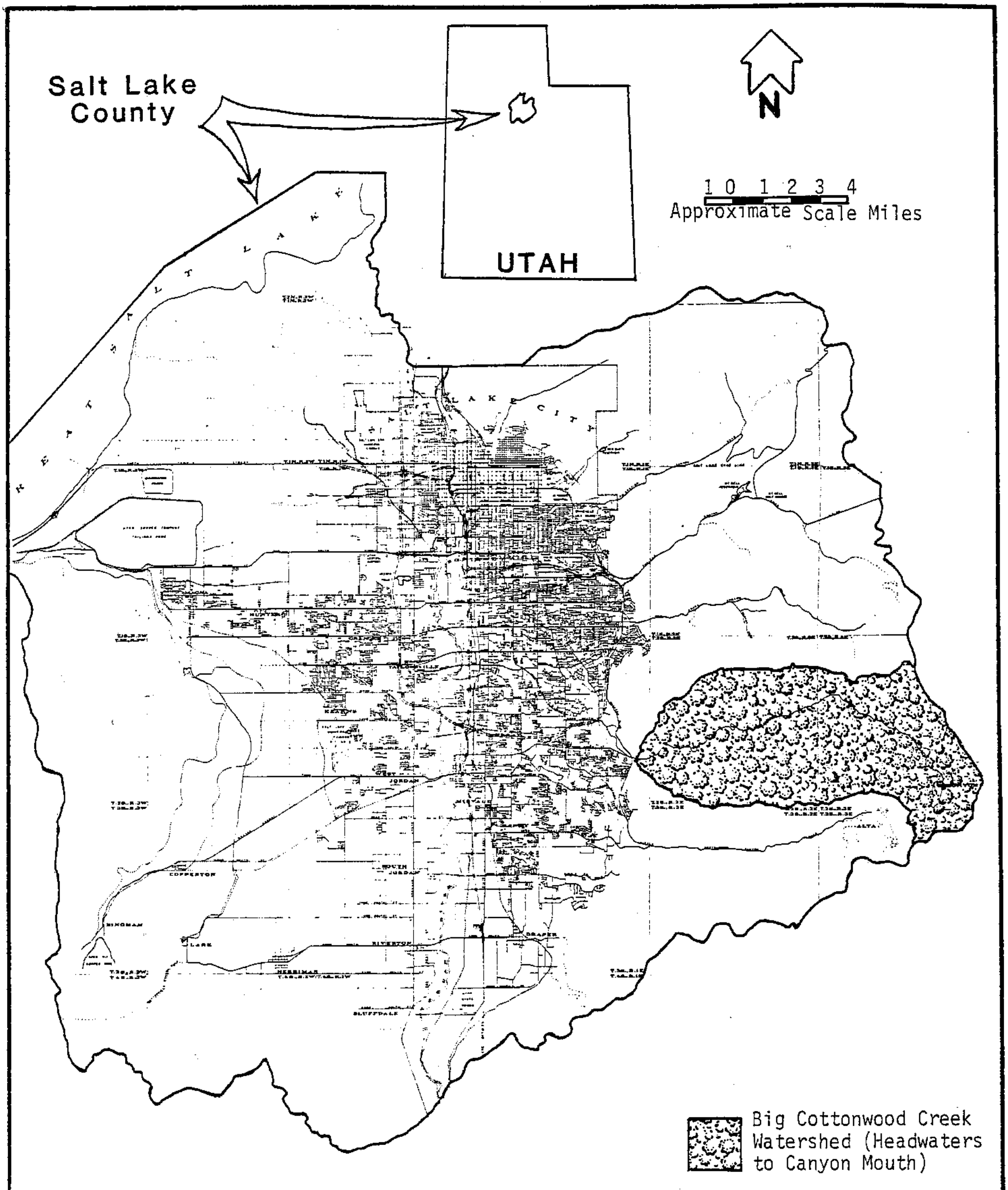

FIGURE 1. Big Cottonwood Creek Watershed, Utah

The watershed from the water treatment plant at the canyon mouth upstream to Utah Power and Light Company's Stairs Power Plant is at low elevation (5,000-6,000 feet MSL stream elevation). Vegetation includes willow, cottonwood, scrub oak, grasses, and exotic plants. Bank cover composition is oak, birch, cottonwood, dogwood, rose and grasses. Bank stabilization is fair and stream shading is adequate for fish protection. Lower reach stream flow is subject to extreme daily fluctuations due to water treatment and power plant operation. Aquatic insects, dominated by mayflies and caddis flies, are abundant. Existing populations of rainbow and brown trout are moderate. There are no homes or cabins in this segment.

The section extending from the Stairs Power Plant upstream to the Storm Mountain Reservoir (0.8 miles/1.3 km) is occasionally dewatered by the diversion located there. There are no homes or cabins in this segment.

From that diversion upstream to the Cardiff Flat Bridge (6 miles/9.7 km), the drainage is of steep gradient and vegetated with conifers, aspen, and oak. Bank vegetation consists of birch, alder, cottonwood, dogwood, and grasses. Stream shading is slightly inadequte for fish protection, but bank stabilization is very good. The entire section has adequate water flow year-round for the fishery. Although the aquatic insect resource (primarily mayflies and caddis flies) is substantial, high stream velocity and lack of suitable fish resting pools (occasioned by steep stream gradient) preclude high natural trout production. The wild fish population, dominated by brown trout, is moderate and augmented with annual plants of catchable rainbow trout. There are some summer cabins located in this segment in addition to a now defunct commercial establishment.

The section extending from Cardiff Flat Bridge upstream to the stream termination at Mary's Lake (6.8 miles/10.9 km) is in a canyon of moderate gradient vegetated with conifer and aspen. Bank stabilization is excellent and provided by alder, willow, birch, and grasses. Stream shading is good. The stream bottom type is good for natural reproduction of fishes. This section is the most productive fishery segment of Big Cottonwood Creek. Mayflies and caddis flies are very abundant and a major food source for the excellent populations of rainbow, brown, and brook trout existing in this section. The majority of homes and cabins are in this segment. The greatest concentrations of year-round residences are the Silver Fork and the Brighton Basin areas. Summer homes are also concentrated in Silver Fork and Brighton Basin in addition to the Spruces and Firs Subdivision areas.

Geology-Brighton Basin

Brighton Basin is a glacial cirque located at the head of Big Cottonwood Canyon, one of several major canyons eroded into the steep western front of the Wasatch Range. The elevation of the cirque floor at the unincorporated community of Brighton is 8,730 feet (3055 m). Nearby peaks rise to over 10,700 feet (3260 m). The average annual precipitation at Brighton (15 year norm) is 43 inches (109 cm), the majority of which falls as snow between November and April.

Most of Brighton basin is underlain by intrusive igneous rocks associated with the Alta and Clayton Peak stocks of Tertiary age. The Alta Stock consists of a light-gray, nonporphytic, biotite, hornblende granodiorite porphry. The Clayton Peak Stock is a dark-gray, fine to medium-grained granodiorite containing abundant dark mafic minerals. Both stocks intrude Mississipian limestone and dolomite belonging to the Fitchville Formation, Gardison and Desert limestones, and the Humbug Formation. These formations are exposed near the northwest edge of the cirque, west of Silver Lake (Figure 2).

The floor of Brighton Basin is covered by glacial deposits of variable thickness. Outliers of the pophyritic inner phase of the Alta Stock protrude through the deposits in several places. The deposits are mainly coarse-grained sandy gravel and gravelly sand containing numerous cobbles and boulders which may reach several feet in diameter. Dark colored, fine-grained sandy and organic clays were encountered in shallow boreholes drilled near the center of the cirque, the location of a former small lake. Similar fine-grained deposists are found northwest of the Brighton loop road in the vicinity of Silver Lake.

Although common elsewhere in Big Cottonwood Canyon, folding and faulting have not been identified in Brighton Basin. Large, through going joints exist in both the intrusive igneous and sedimentary bedrock formations.

Hydrology-Brighton Basin

Five perennial streams head in Brighton Basin and join to form Big Cottonwood Creek, a major source of domestic water for Salt Lake Valley. Three of the streams drain the south and southwest portions of the cirque and receive water from Twin Lakes and Lake Mary reservoirs and from Dog Lake. The three streams combine and flow into Silver Lake on the cirque floor. The two reamaining streams drain the southeast portion of the basin. One flows across the cirque and merges with the outlet for Silver Lake near the north end of the Brighton loop road. The other begins on the north flank of Clayton Peak and reaches Big Cottonwood Creek near the Alpine Forest Camp. Stream flows will vary depending upon the time of year; high flow usually occurs during the spring snowmelt in April and May, low flow during the winter in January and

February. There are no stream flow gaging stations in the area.

Shallow unconfined groundwater occurs in the glacial deposits that mantle Brighton Basin. The depth to water varies with the season of the year and with location in the basin. Soil Conservation Service data estimate a depth of 0-30" during high seasonal periods. In the spring, depths of a foot or less are common adjacent to Silver Lake and in the lowest portion of the cirque (that area circumscribed by the Brighton loop road). The direction of flow is to the north, out of the basin and down Big Cottonwood Canyon. A suspected buried bedrock high (based on topographic expression) is thought to cause ponding of ground-water in the basin and cascading of subsurface water out of the cirque into the glacial deposits and alluvium along Big Cottonwood Canyon.

METHODOLOGY

BACKGROUND SURVEY

To determine areas of home wastewater pollution to the Big Cottonwood Creek hydrological system, a network of surface water sampling stations was established. Sites were chosen downstream of high residential/cabin concentrations to determine relative impacts of residential uses to the creek. Areas of human concentration were determined by investigation of land use maps of the canyon. Sampling sites in the City-County Health/Forest Service/Water Department network were located in relation to developed areas, such as campgrounds and picnic areas. These sites were sampled once per week for sixteen weeks. Grab samples were collected by City-County Health Department personnel, placed on ice, and delivered to the City-County Health Department Laboratory for analysis. Land use and sampling sites of the background survey are shown in Figure 3. Location of all the sample stations are listed in Appendix A-1.

BRIGHTON BASIN SURVEY

The results of the background sampling, as reported and discussed later, indicated areas of possible contamination were concentrated in Brighton Basin. Therefore, a time series surface water sampling program in Brighton Basin was developed. This assessment was initiated prior to subsequent shallow aquifer studies. Therefore, EPA Quality Assurance Guidelines for ground-water sampling were not incorporated into the methodology.

Surface Water Sampling Program

The major tributaries which form Big Cottonwood Creek within Brighton Basin were identified. Nine sampling stations were located on these tributaries as shown in Figure 4. Salt Lake City Water Department and

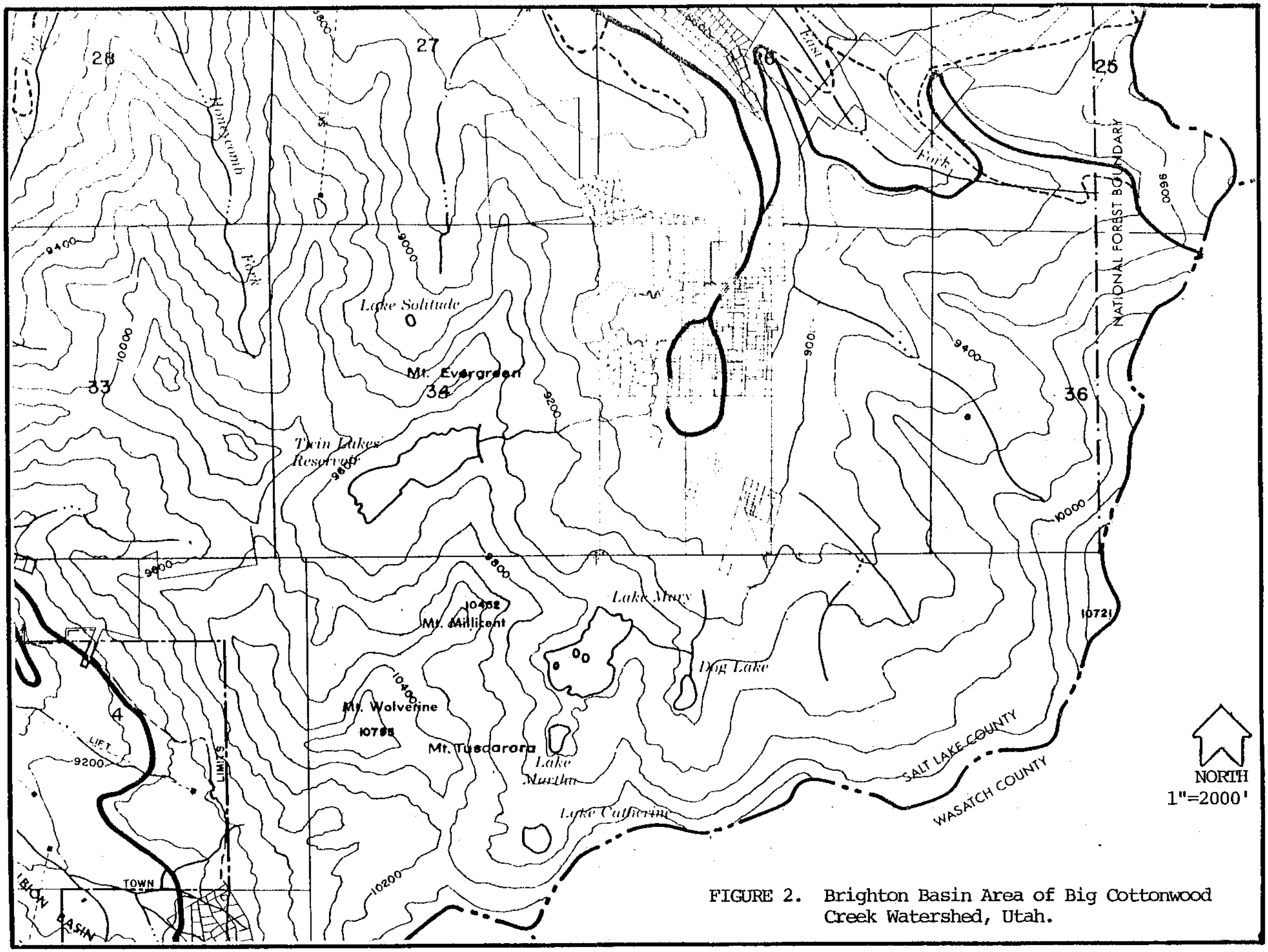

FIGURE 2. Brighton Basin Area of Big Cottonwood Creek Watershed, Utah.

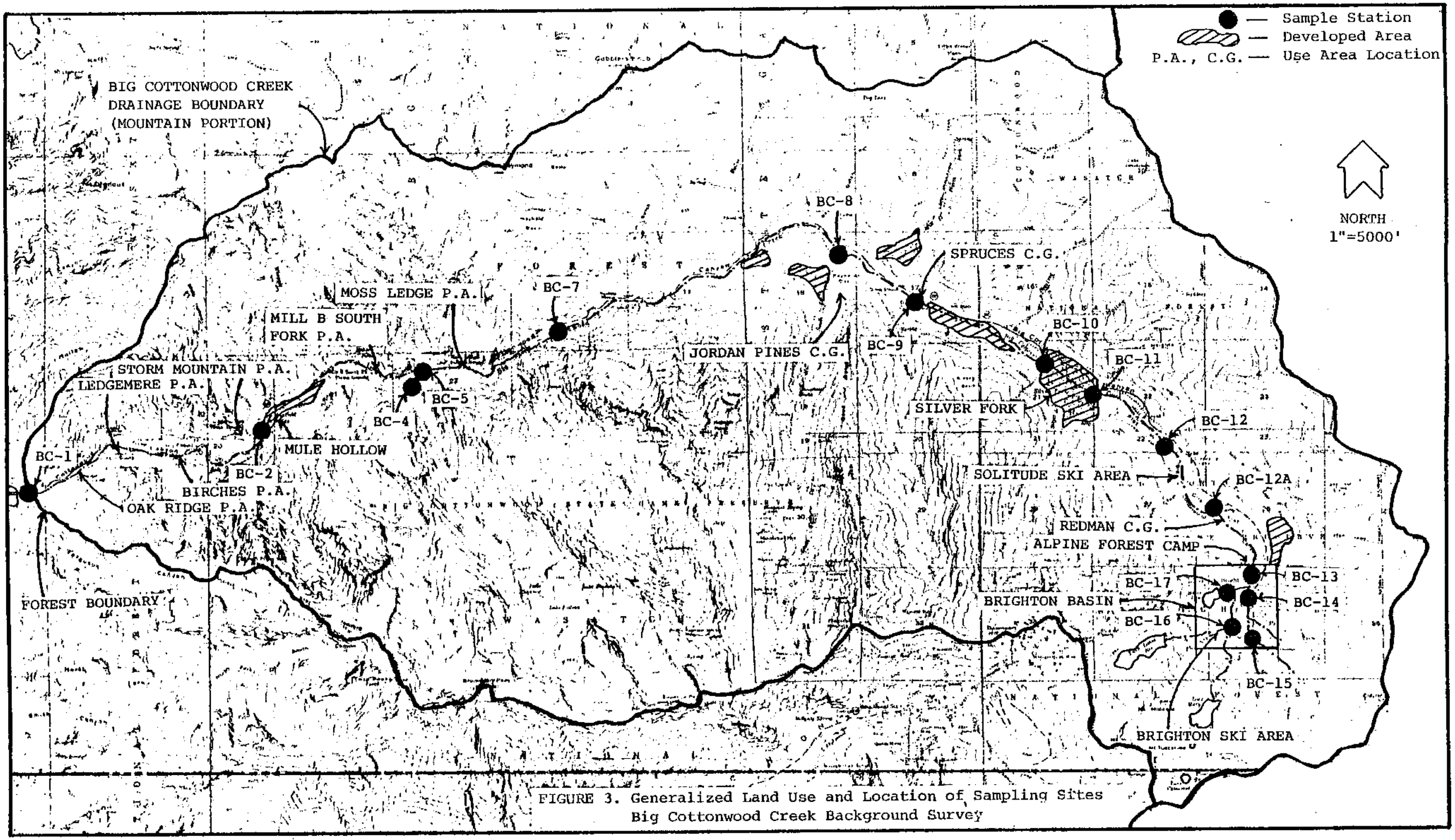

FIGURE 3. Generalized Land Use and Location of Sampling Sites
Big Cottonwood Creek Background Survey

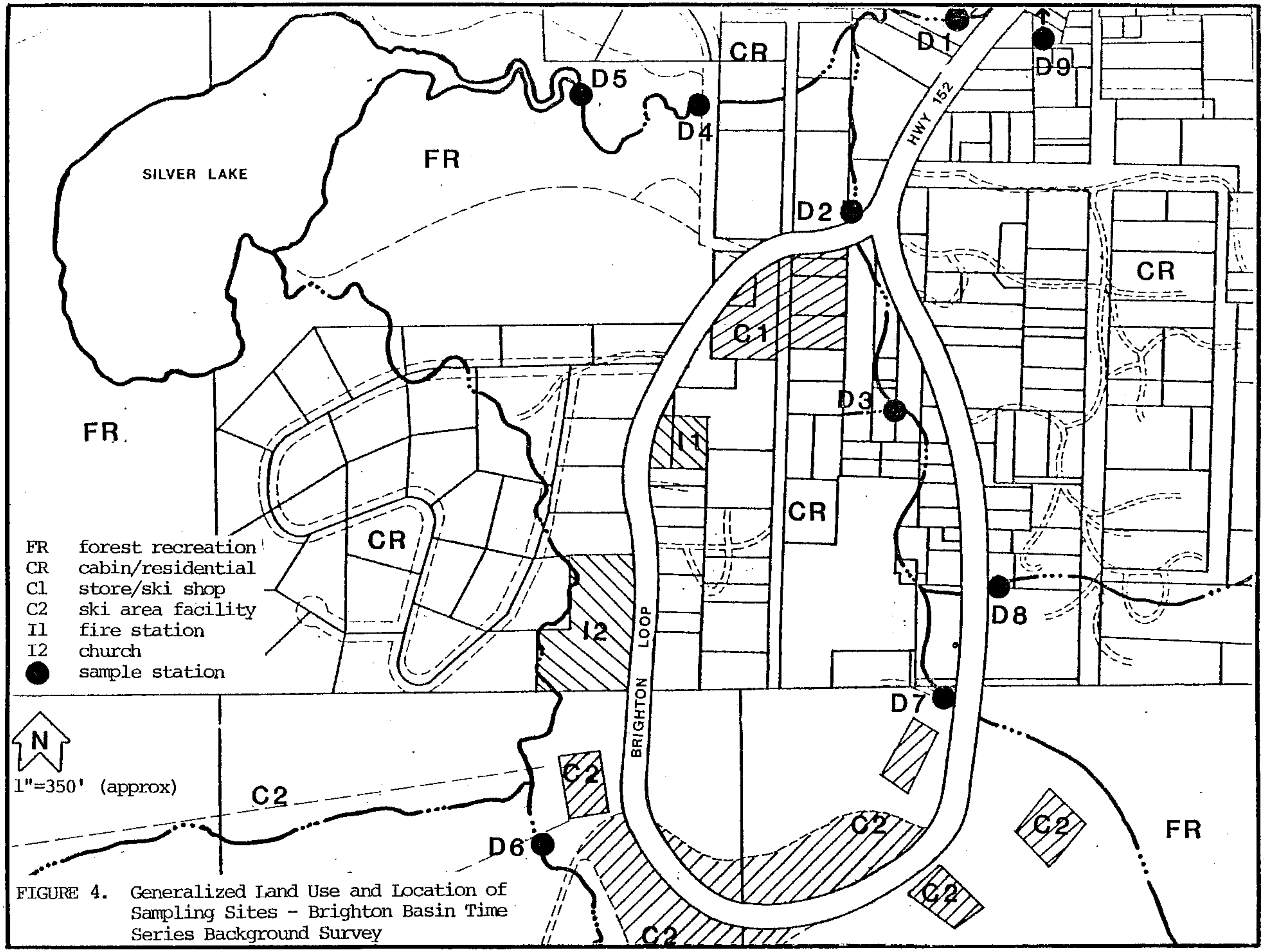

FIGURE 4. Generalized Land Use and Location of Sampling Sites - Brighton Basin Time Series Background Survey

City-County Health personnel assisted in the selection of surface sample locations. Stations D-1, D-2, D-5 and D-7 correspond to stations BCC-13, BCC-14, BCC-17 and BCC-15, respectively. Grab samples were collected from these nine stations three times per day (8 a.m., 12 noon, and 4 p.m.) for three consecutive days following a high use weekend (July 4th Holiday). Samples were iced after collection and delivered to the laboratory daily.

GroundWater Sampling Program

To assess quality of shallow ground-water discharging to surface systems, a network of shallow observation wells and surface sample stations was established based upon results gathered from the background surveys. Two surface water stations were established on the stem of the creek flowing through the most heavily used portion of the basin (stations BCC-1 and BCC-2 in Figure 5). Later, another station, (BCC-3 in Figure 5), was located on a tributary to this stem. This tributary was the outlet from a gravel curtain drain located behind the Brighton General Store. The drain was constructed to divert excess groundwater from the area used by the store's septic system. These surface water sampling sites were established to determine any relationship between shallow groundwater and surface water quality.

These stations were grab sampled daily for three periods of approximately one week each during the study. Samples were surface dipped, stored on ice immediately after collection, then delivered to the laboratory for analysis.

Shallow GroundWater Observation Wells

Five groundwater observation wells were installed in Brighton Basin. Wells were augered by Utah Geological and Mineral Survey (UGMS) personnel and equipment on contract to the Division. Locations of the observation wells are

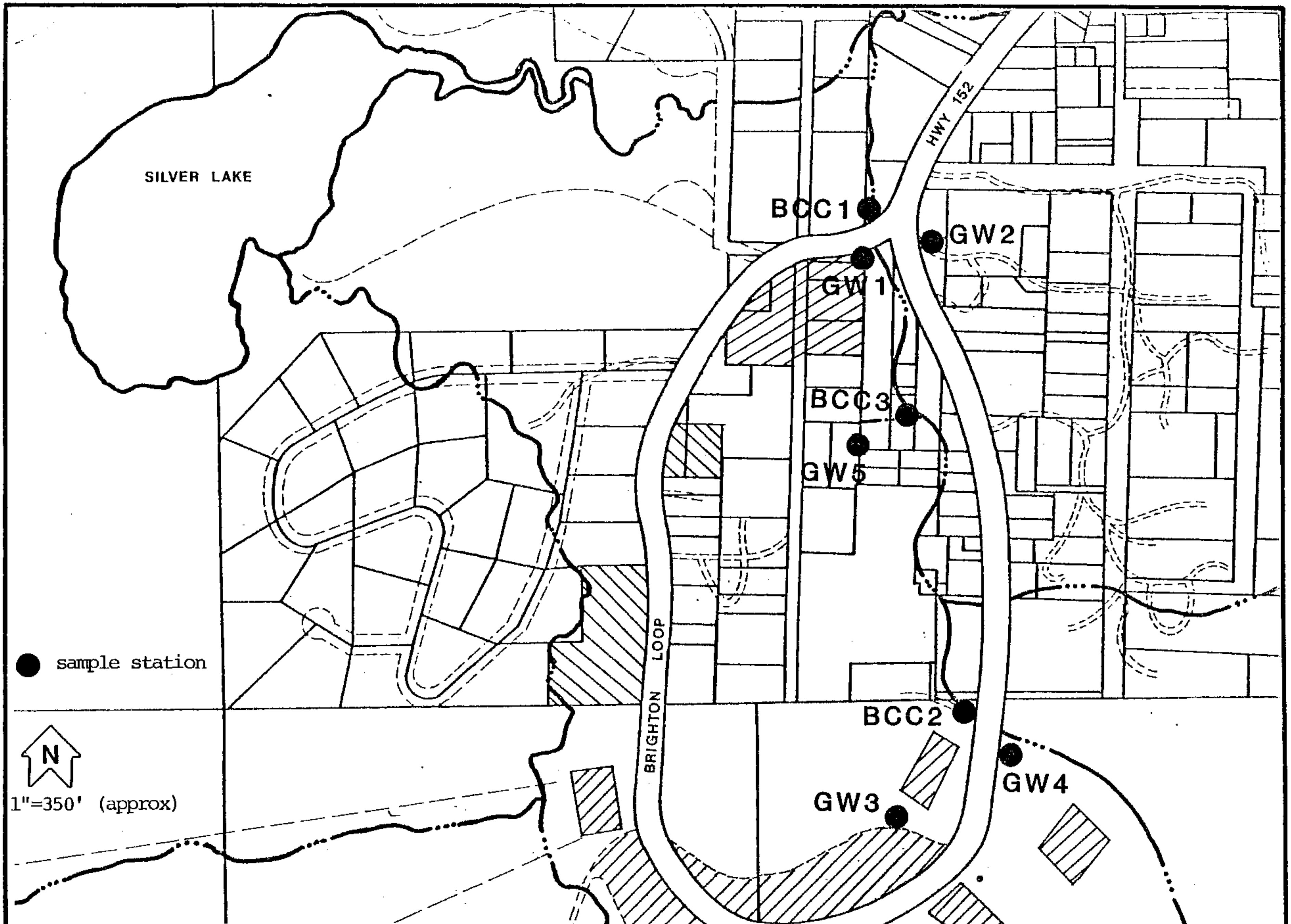

FIGURE 5. Location of Sampling Sites - Brighton Basin Survey.

shown in Figure 5, and were established in consultation with the City-County Health Department.

Wells were drilled to a depth of plus or minus ten feet, cased with a 1 1/2-inch P.V.C. pipe, capped on the bottom and perforated on four sides at four inch intervals. The pipe was fitted with a removable cap. Bore holes were then back-filled with pea gravel (approximately 3/8-inch diameter). A concrete plug approximately eight inches thick and two feet in diameter sealed the top of the bore hole. A standard survey monument cover was set in concrete to protect the top of three of the five wells. The other two wells were located away from vehicle and human access and did not require additional protection.

Wells 1, 2, and 5 (GW-1, GW-2 and GW-5) encountered organic clay, silt, and fine sand which likely represents material deposited in a former tarn lake that supported an abundant growth of aquatic vegetation. Wells 3 and 4 (GW-3 and GW-4) also contain some organic-rich sediment, but coarse, brown, gravelly, silty sand of glacial origin was the principal material encountered. A typical observation well is shown in Figure 6. Well logs provided by UGMS are listed in Appendix A-2.

Grab samples were obtained from the wells using a small DC powered parastaltic pump. Samples were immediately iced and delivered daily to the laboratory for analysis.

To maintain bacteriological sterility between successive samples (no cross-contamination), the following procedure was used in sample collection:

1. A 100 ml aliquot of sterile distilled water was pumped through the tubing.

2. A 1:3 household chlorine bleach-water solution was pumped through the tubing.

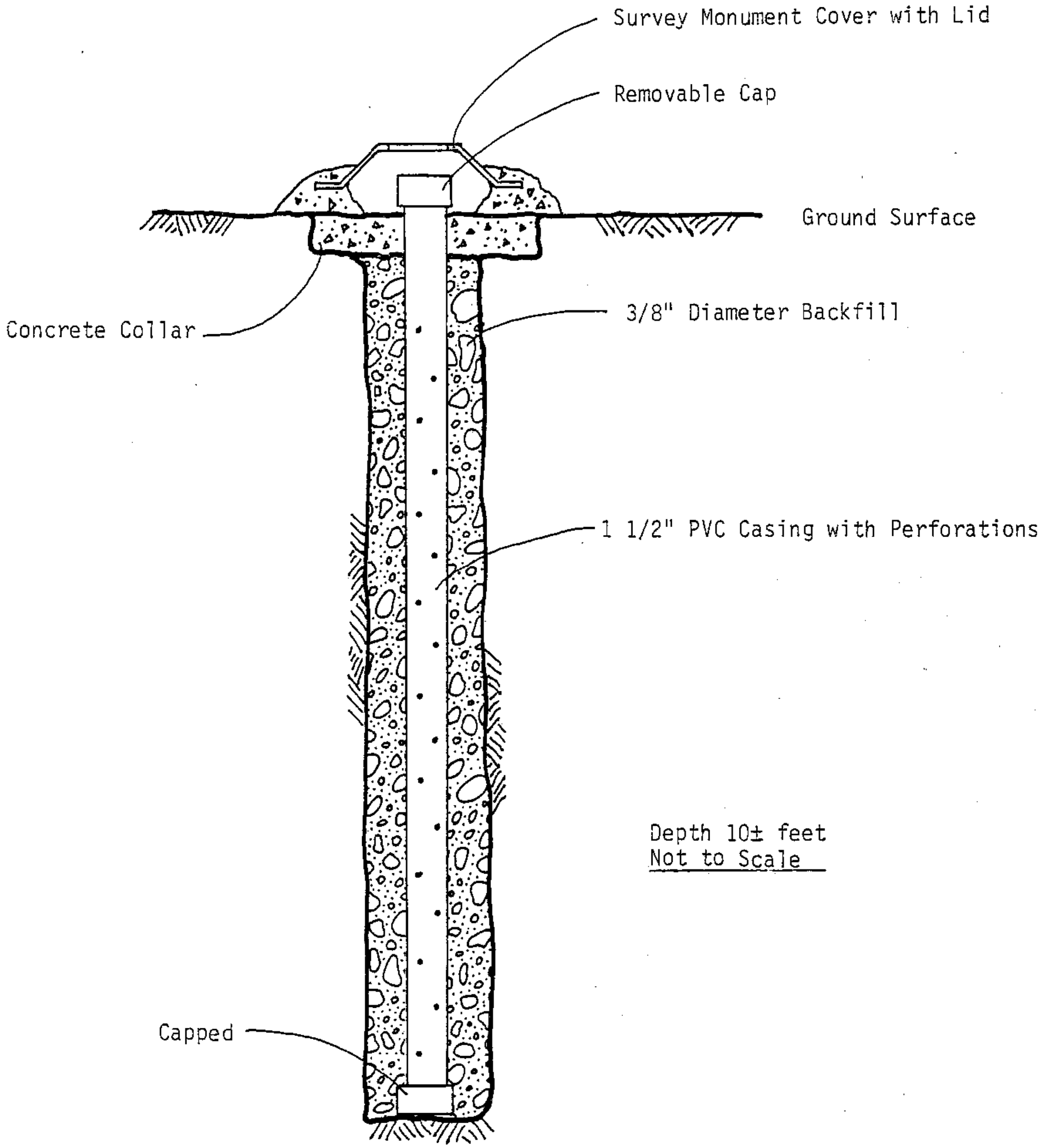

FIGURE 6. Typical Shallow Groundwater Observation Well

3 Another 100 ml aliquot of sterile distilled water was pumped through the tubing.

4 The tubing was inserted into the observation well and the pump turned on. As water was being drawn in the intake, it was inserted further down the well. After a few seconds of discharge from the tubing, a bacteriological sample was collected in a sterile bottle. Well casing volumes were not pumped prior to sampling.

5 A sample for the remainder of the analyses was collected in a clean plastic bottle.

Prior to collection of analyses for study purposes, the above procedure was lab and field tested to determine whether or not the sterilization procedure would work and if subsequent samples would be affected by residual sterilant. It was determined that the procedure did fulfill both requirements. The order in which samples were collected for various wells was varied to cross-check possible contamination during routine course of sampling. City-County Health Department Lab personnel provided necessary confirmation of lab and field tests.

RESULTS

The data presented in this section are summaries of raw data. Raw water quality data for both phases of the study are listed in Appendicies A-3 through A-6.

BACKGROUND SURVEY

Mean bacteriological analysis results of the Big Cottonwood Creek background survey are listed in Table 1 and shown in Figure 7. Samples were collected during the summer low flow period in 1981. Areas of development or high use are also indicated in Figure 7. As can be seen, bacterial quality of the stream generally improves downstream from the Brighton Basin area.

The results of the time series sampling in Brighton Basin are summarized in Table 2 and shown in Figures 8 and 9. These samples were collected over three days at different times of day over a three consecutive day period following a high use period (July 4th Holiday) in the basin.

BRIGHTON BASIN SURVEY

Based upon results of the background survey, an intensive monitoring program as previously outlined was initiated in the Brighton Basin area. Results of the sampling program are summarized in Tables 3 and 4. Results of selected parameter analysis are shown in Figures 10 through 13.

Results of the sampling program are discussed in the following section.

TABLE 1

MEAN TOTAL AND FECAL COLIFORM CONCENTRATIONS - BIG COTTONWOOD CREEK

BACKGROUND SURVEY

Station	Total Coliform (MF#/100ml)		Fecal Coliform (MF#/100ml)	
	Geo. Mean	Range	Geo. Mean	Range
BC-1	31	13-75	10	0-75
BC-2	23	5-86	5	0-26
BC-4	16	3-60	2	0-14
BC-5	25	7-85	4	0-20
BC-7	28	4-110	6	0-28
BC-8	49	13-130	9	0-55
BC-9	46	10-125	10	0-60
BC-10	47	12-175	10	0-75
BC-11	54	14-175	11	0-57
BC-12	52	7-200	15	0-63
BC-12A	54	4-400	11	0-62
BC-13	62	7-500	9	0-50
BC-14	132	10-600	50	2-400
BC-15	23	4-180	5	0-30
BC-16	18	2-150	4	0-26
BC-17	31	12-175	6	0-28

Note: Zero values of fecal coliform were assumed to be 1 in mean calculations for to statistical reasons and because, in all probability, fecal coliform does exist but was not detected.

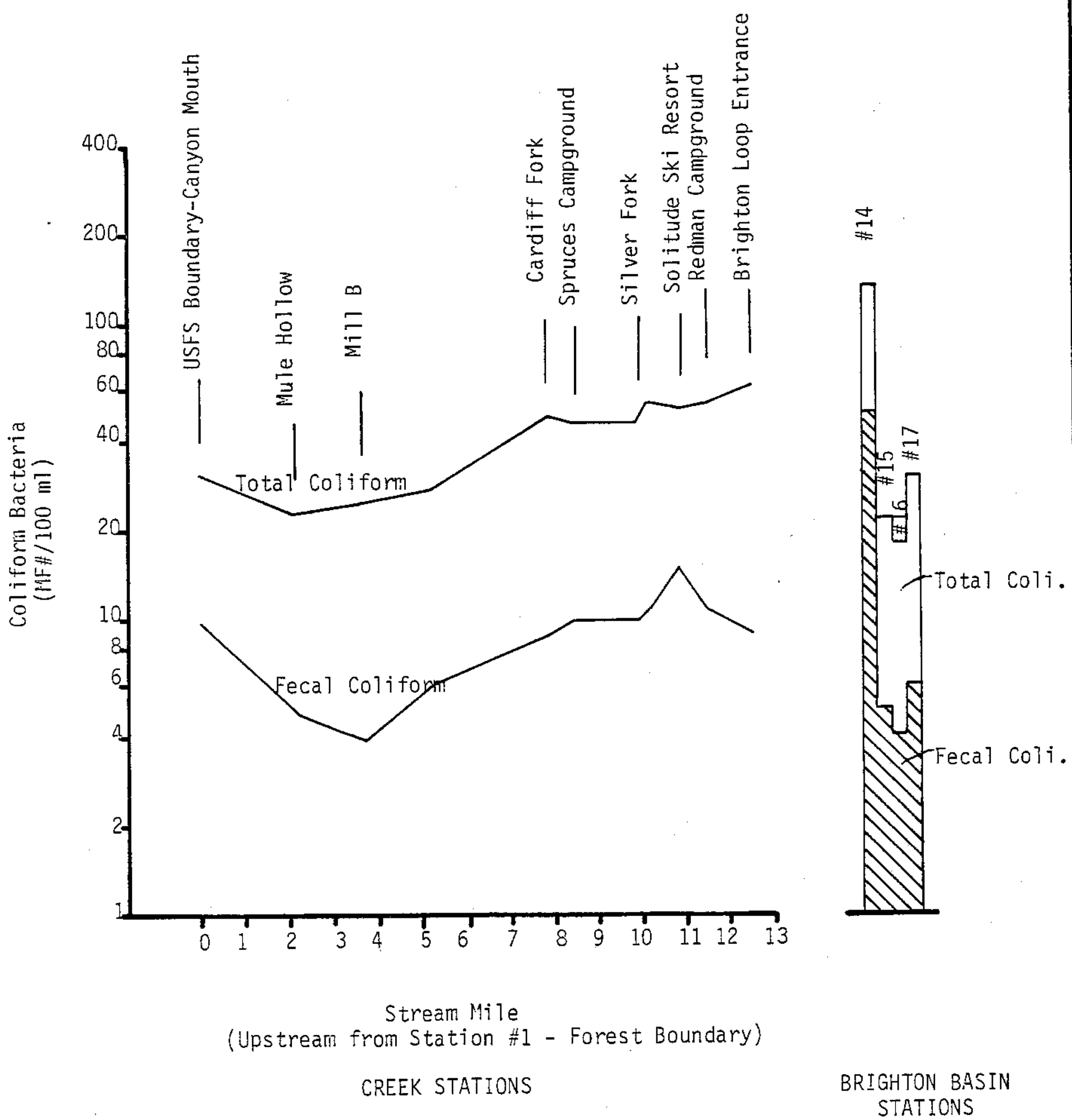

FIGURE 7. Mean Total and Fecal Coliform Concentrations - Big Cottonwood Creek Background Survey

TABLE 2

MEAN TIME SERIES TOTAL AND FECAL COLIFORM CONCENTRATIONS-

BRIGHTON BASIN BACKGROUND SURVEY*

Station	Total Coliform (MF#/100ml)			Fecal Coliform (MF#/100ml)		
	8:00a.m.	12:00Noon	4:00 p.m.	8:00 a.m.	12:00Noon	4:00p.m.
D-1	400	429	340	55	35	21
D-2	843	909	909	114	95	29
D-3	283	176	111	33	51	10
D-4	41	28	33	5	4	3
D-5	9	7	7	4	2	0
D-6	9	41	42	9	15	5
D-7	10	9	10	2	3	9
D-8	8	12	6	7	6	3
D-9	262	193	52	17	14	12

*Samples collected July 6, 7 and 8, 1981. Zero values counted as 1 in mean calculations.

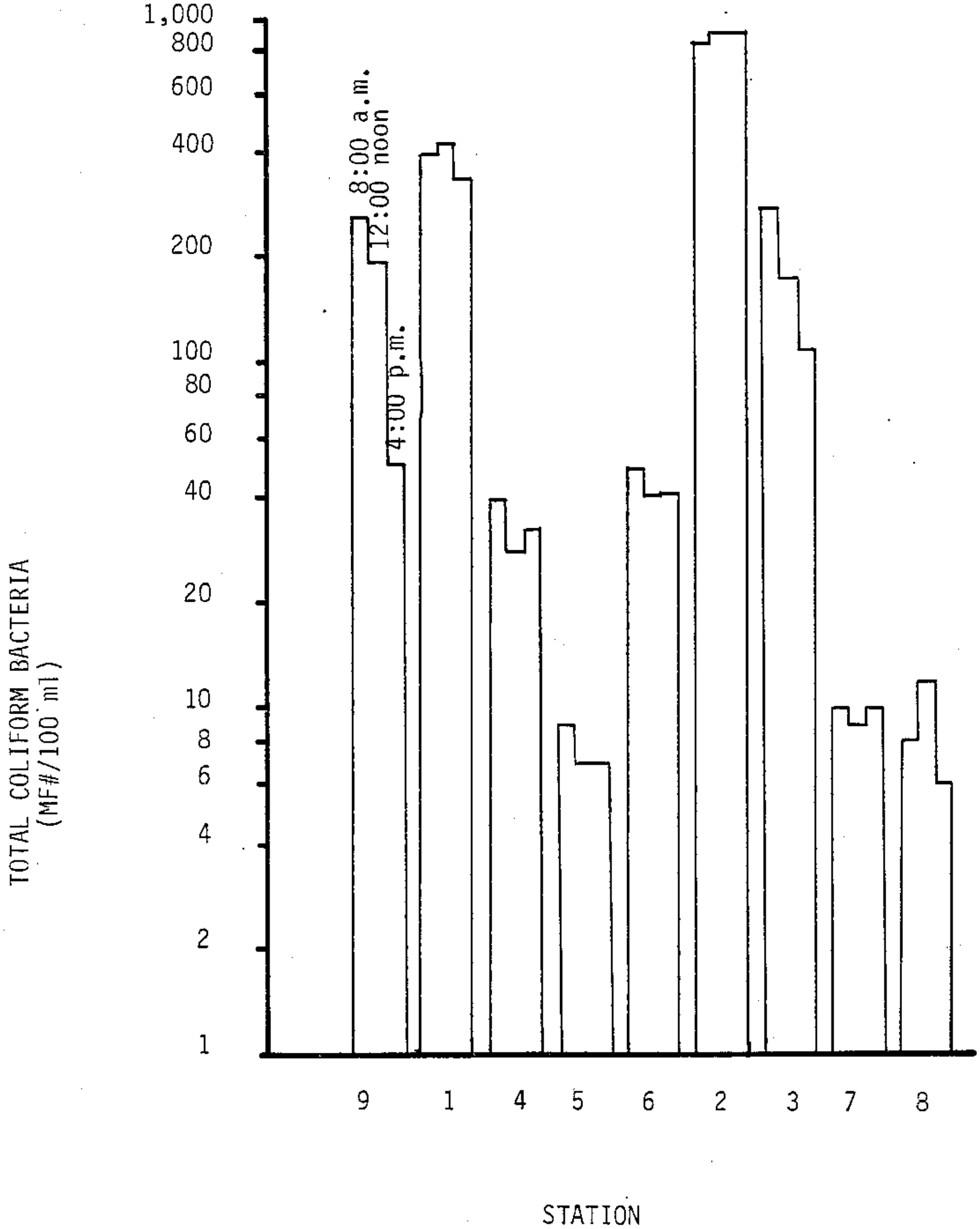

FIGURE 8. Mean Time Series Total Coliform Concentrations - Brighton Basin Background Survey

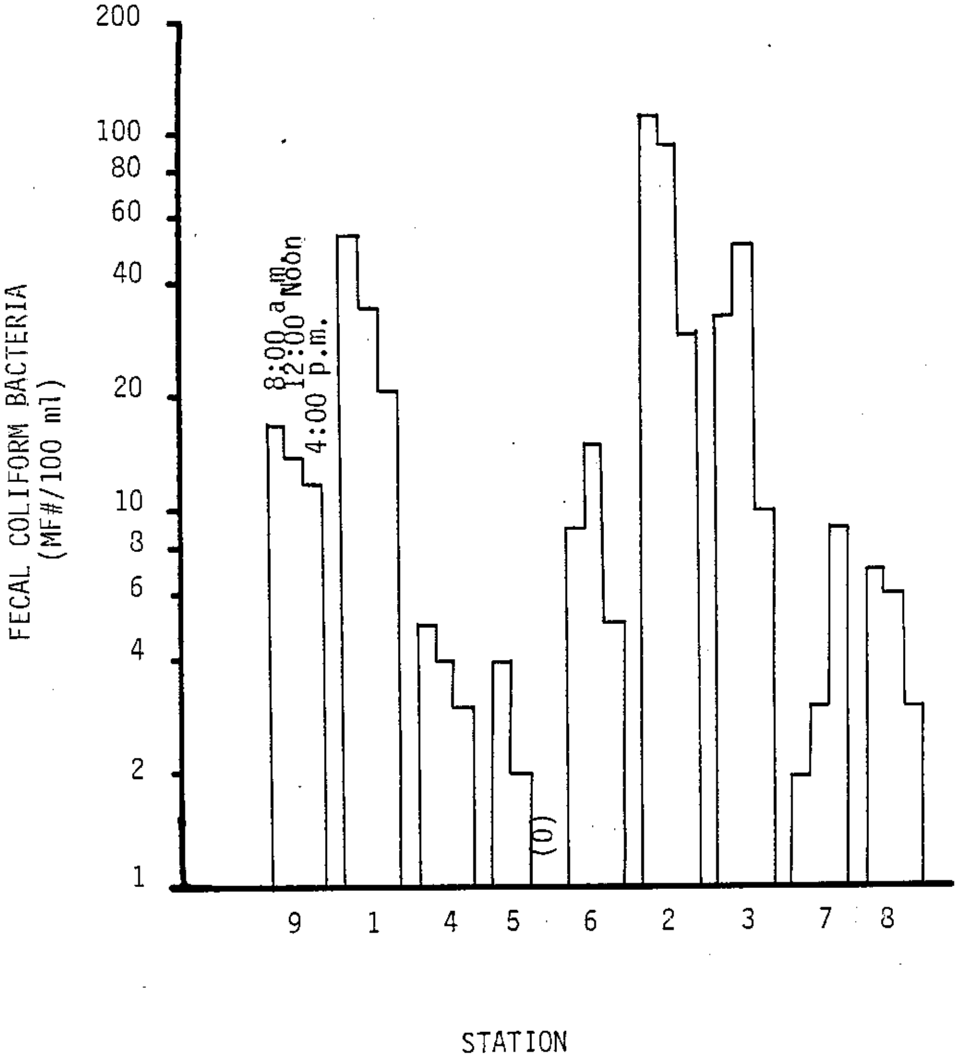

FIGURE 9. Mean Time Series Fecal Coliform Concentrations - Brighton Basin Background Survey

TABLE 3

MEAN SHALLOW GROUND-WATER CONSTITUENT CONCENTRATIONS -

BRIGHTON BASIN SURVEY

Station	Period*	Depth to Water (ft.)	Total Coliform (MF#/100ml)	Fecal Coliform (MF#/100ml)	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)
GW-1	Summer	4.1	5	11						
	E. Fall	4.3	12	10	1.4	50	1.25	0.01	0.1	679
	L. Fall	2.5	112	100		23	0.96			177
GW-2	Summer	2.5	56	6						
	E. Fall	2.6	200	10	1.2	49	1.10	0.01	0.1	1,217
	L. Fall	0.9	651	100		105	5.0			653
GW-3	Summer	3.4	5	4						
	E. Fall	3.0	12	10	1.2	26	0.47	0.01	0.1	17
	L. Fall	1.1	170	100		24	0.45			31
GW-4	Summer	6.6	3	4						
	E. Fall	5.8	10	10	1.0	16	0.31	0.07	0.1	6
	L. Fall	0.9	100	100		18	0.28			1
GW-5	L. Fall	1.5	6,160	120		26	0.49			8

*E. Fall = Early Fall
L. Fall = Late Fall

TABLE 4

MEAN SURFACE WATER CONSTITUENT CONCENTRATIONS

BRIGHTON BASIN SURVEY

Station	Period*	Total Coliform (MF#/100ml)	Fecal Coliform (MF#/100ml)	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)
BCC-1	Summer	143	24						
	E. Fall	201	13	1.0	16	0.30	0.01	0.1	7
	L. Fall	154	100		17	0.37	0.01		16
BCC-2	Summer	167	46						
	E. Fall	80	32	1.0	15	0.28	0.01	0.1	1
	L. Fall	151	100		15	0.32			1
BCC-3	E. Fall	72	12	1.9	20	0.20	0.01	0.1	13
	L. Fall	443	100		17	0.43			51

*E. Fall = Early Fall
L. Fall = Late Fall

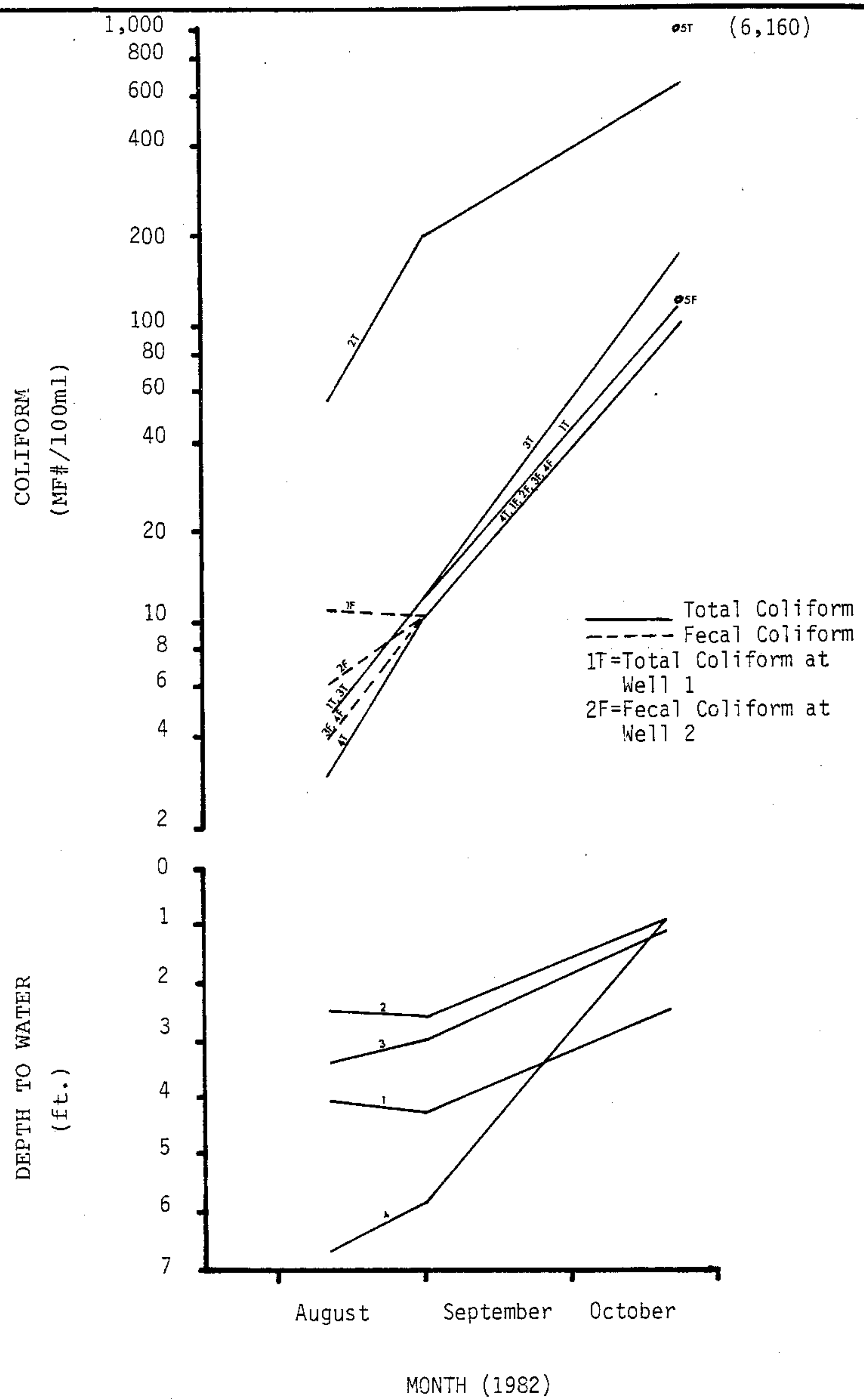

FIGURE 10. Mean Total and Fecal Coliform Concentrations and Groundwater Table Depths in Shallow Groundwater - Brighton Basin

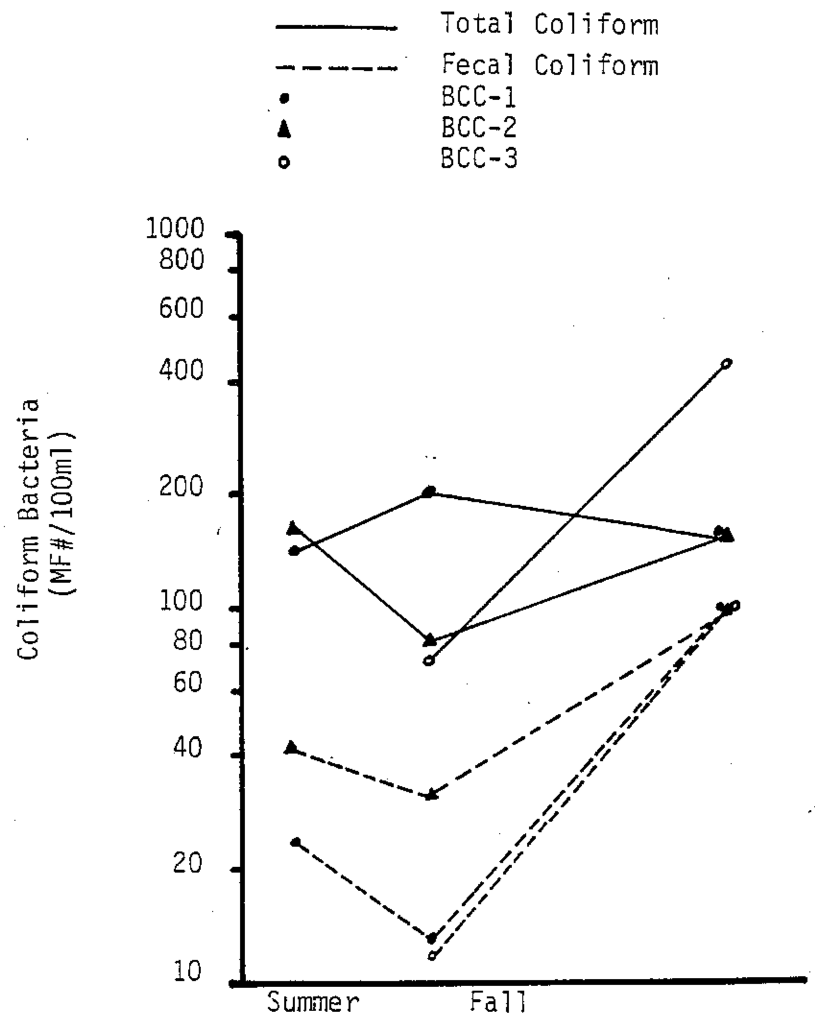

FIGURE 11. Mean Total and Fecal Coliform Concentrations in Surface Water-Brighton Basin

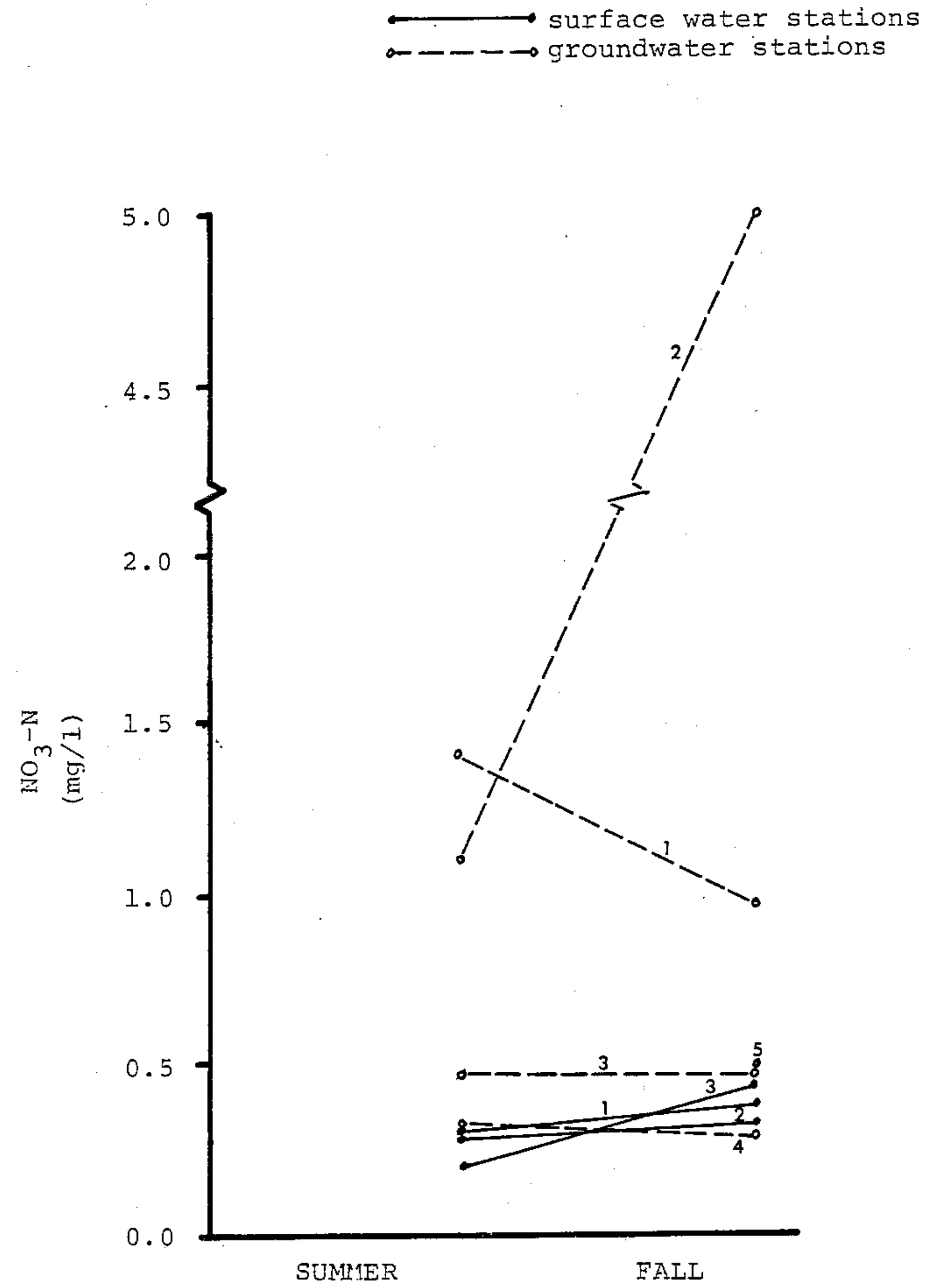

FIGURE 12. Mean Nitrate Concentrations in Surface and Subsurface Water - Brighton Basin.

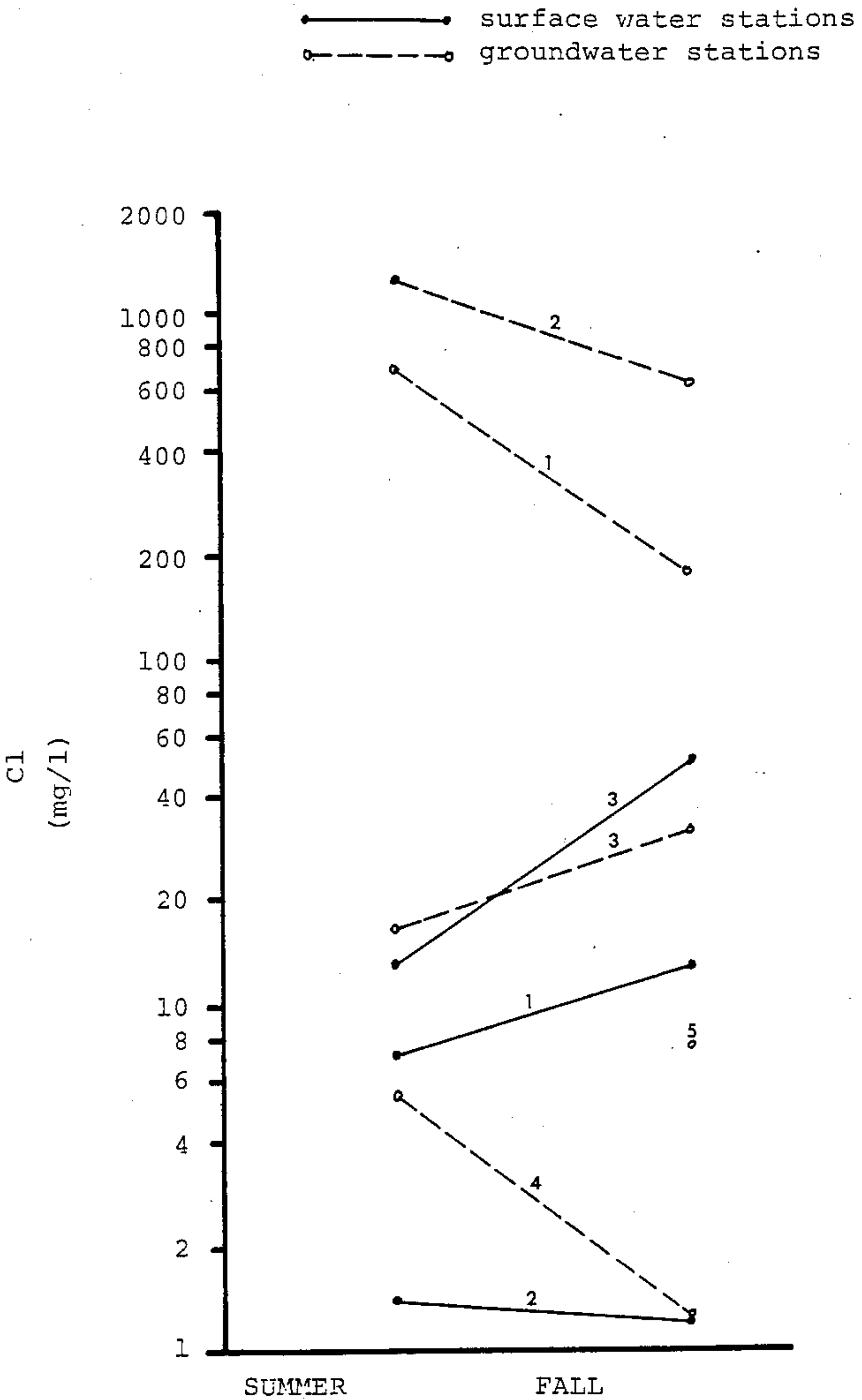

FIGURE 13. Mean Chloride Concentrations in Surface and Subsurface Water - Brighton Basin.

DISCUSSION

BIG COTTONWOOD CREEK

Both mean total and fecal coliform concentrations are at or near their highest levels at or within two stream miles of Brighton Basin. (Figure 7). There is an apparent downward trend in concentrations from this point to about river mile 3 where an upward trend occurs.

The highest mean total and fecal coliform concentrations found in this phase of the study were in Brighton Basin in the tributary east of the Brighton General Store. Other values found in Brighton Basin were in the range of the lower values found in the lower segments of the creek.

As noted earlier, these results were the basis for the intensive monitoring of water quality in Brighton Basin.

It appears that the major source of bacterial pollutants to the creek originates in the Brighton Basin. A lesser contribution originates in other residential and recreational areas such as Silver Fork, Cardiff Fork, and Spruces Campground. Natural aeration, bacterial die-off and dilution by uncontaminated surface and/or subsurface flows compensate for any signficant watershed impairment for culinary use.

BRIGHTON BASIN

Results of the time series sampling of surface water in Brighton Basin indicate two clear trends: coliform counts were (with few exceptions) lower at 4 p.m. than they were at 8 a.m. and highest levels were found at station D-2 and lowest at station D-5.

It was expected that highest levels of both total and fecal coliform would occur at either noon or 4 p.m. rather than at 8 a.m. Heavy use of waste disposal facilities early in the day with short travel times through soil absorption systems could account for this phenomena. However, use throughout the day would imply that high counts should occur later in the day. No surface water or groundwater gaging was employed to determine such fluctuations.

Highest levels of both total and fecal coliform were found in the stem of the creek located near the Brighton General Store. This finding was consistent with results obtained in the Big Cottonwood Creek background survey. Coliform levels dropped from the outlet of the basin (station D-1) to the next station (D-9) located less than one mile downstream. Groundwater and/or surface water dilution could account for this phenomena.

Data obtained from the shallow groundwater sampling phase of the study indicate some interesting trends. There is a very strong relationship between both total and fecal coliform numbers and shallow groundwater depth. With only one exception, bacterial levels increase with a decrease in shallow water table depth. This could be due to interception of contaminated surface and subsurface flows by the observation wells or concentration of bacteria with lack of dilution. Coliform levels were nearly identical for three of the five wells. Bacteria levels in well GW-2 (Figure 10) are about ten times the level found in wells GW-1, GW-3, and GW-4. The results from the one sample period for well GW-5 indicates total coliform levels were about ten times those found in well GW-2. Well GW-5 was located upstream from a gravel curtain drain above the Brighton General Store. Fecal coliform levels in well GW-5 were consistent with those in wells GW-1, GW-3 and GW-4. The adequacy of coliform data in showing groundwater pollution trends is relatively low compared to other parameters. Both State and Federal officials suggested nitrate and chloride as more useful indicators.

The groundwater characteristics in the basin were fairly well defined for one sampling season. Observations indicate that northern-most wells intercept the subsurface flow from east and south and that the flow is contaminated by non-point sources prior to discharge to Big Cottonwood Creek. Key indicator parameters were coliform, nitrate, and chloride.

The source of contamination can only be generalized, but surface water quality data indicate a relationship between location of upstream development and water quality impairment. High nitrate and chloride measurements three to ten times in excess of background conditions in down gradient wells imply that subsurface leachate is present.(See Figures 12 and 13) Specific source identification requires placement of three to four additional wells to intercept subsurface flows from the eastern basin slope. Residential units inside Brighton loop road also need observation wells intercepting downstream subsurface flow. Because flow data were not quantified for the surface discharge system, weighting flow origins to specific basin pollution sources is difficult based on one sampling season of data.

This assessment provides data for only a portion of a single seasonal pattern. Full seasonal data for a three or four year period-of-record would provide a more accurate understanding of the proceses that are occurring. Soil permeability analysis and subsurface soil samples need to be evaluated for observed excessive chloride levels which may relate more to road salting than waste disposal systems. Surface flows should be gaged to construct accurate flow balances and total mass daily pollutant load, and standard State and EPA Quality Assurance sampling procedures should be followed.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

It appears that home waste disposal facilities are contaminating both surface and groundwater in Big Cottonwood Canyon and especially so in Brighton Basin. Fecal coliform bacteria levels, used in this study as an indicator of animal waste pollution, were far below maximum acceptable levels for beneficial uses designated for Big Cottonwood Creek by the State of Utah. This segment of Big Cottonwood Creek is designated as an "antidegradation segment" which means that water quality is to be kept at existing high quality. Elevated concentrations of chloride found in groundwater observation wells could be due to road deicing practices used during snow months (October to May) but could also indicate pollution from waste disposal facilities. Elevated nitrate concentrations in groundwater observation wells are indicative of waste disposal facility contamination. Coliform, chloride and nitrate concentration differences between surface and groundwater sampling sites indicate pollution of shallow groundwater by waste disposal facilities. High concentrations of pollutants are not found at downstream (from Brighton Basin) surface water sample sites. This is probably due to dilution by high quality side-canyon and/or ground-water in the lower reaches of the Canyon.

RECOMMENDATIONS

Based upon the results and conclusions of this study, the following recommendations are made:

1) Monthly or more often sampling at surface and groundwater sample stations in Brighton Basin be continued to: (a) develop a long-term data base in the high use area; (b) provide input to local Health Department enforcement programs; and (c) To track the effectiveness of such programs.

2) The addition of supplemental ground-water observation wells above and below soil absorption systems to verify contributions of pollutants to ground-water and around the perimeter of Brighton Basin, expecially downstream of the high use south-eastern hillside, to identify any pollutant problems not identified in this study.

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APPENDICIES

APPENDIX A-1

DESCRIPTION OF SAMPLING STATIONS

Number	Location
BC-1	Big Cottonwood Creek at Forest Boundary (Canyon Mouth)
BC-2	Big Cottonwood Creek, Storm Mountain Bridge at Mule Hollow
BC-4	Mill B Tributary (Lake Blanch) upstream from Big Cottonwood Creek confluence
BC-5	Big Cottonwood Creek upstream from Mill B tributary confluence
BC-7	Big Cottonwood Creek at Argenta Weather Station
BC-8	Big Cottonwood Creek at Mill D Bridge at Jordan Pines area
BC-9	Big Cottonwood Creek at Bridge at Spruces Campground
BC-10	Big Cottonwood Creek at Silver Fork-lower bridge
BC-11	Big Cottonwood Creek at Silver Fork-upper bridge
BC-12	Big Cottonwood Creek at Solitude Ski Area lower bridge
BC-12A	Big Cottonwood Creek at Redman Campground-lower bridge
BC-13	Big Cottonwood Creek at entrance to Brighton loop road
BC-14	Big Cottonwood Creek at tributary east of Brighton Store from culvert under Brighton loop
BC-15	Big Cottonwood Creek tributary at south end of Brighton loop from culvert by new lodge
BC-16	Big Cottonwood Creek tributary by church and ski lift
BC-17	Silver Lake outfall by weir
D-1	Big Cottonwood Creek at entrance to Brighton loop
D-2	Big Cottonwood Creek at tributary east of Brighton Store from culvert under Brighton loop
D-3	Outfall from curtain drain south of Brighton General Store-100 yds. south of D-2 (BC-14)
D-4	Big Cottonwood Creek tributary at bridge to Evergreen Subdivision
D-5	Silver Lake outfall by weir
D-6	Big Cottonwood Creek tributary at Millicent Ski Lift
D-7	Big Cottonwood Creek tributary at south end of Brighton loop from culvert by new lodge

APPENDIX A-1 (cont'd)

Number	Location
D-8	Big Cottonwood Creek tributary 75 yds. north of D-7 (BC-15)
D-9	Big Cottonwood Creek at bridge to Episcopal camp
BCC-1	Big Cottonwood Creek at tributary east of Brighton Store from culvert under Brighton loop
BCC-2	Big Cottonwood Creek tributary at south end of Brighton loop from culvert by new lodge
BCC-3	Outfall from curtain drain south of Brighton General Store-100 yds. south of D-2 (BC-14)
GW-1	Groundwater well south of Brighton loop intersection, west of Big Cottonwood Creek tributary at entrance to Brighton Store parking lot
GW-2	Groundwater well east of Brighton loop intersection 100 feet east of GW-1
GW-3	Groundwater well in southwest quadrant of Brighton loop 75 feet west of Brighton Ski Area maintenance shed
GW-4	Groundwater well south of Brighton loop 50 feet west of tributary sample sites BC-15, D-7 and BCC-2
GW-5	Groundwater well south of Brighton Store 35 feet south of curtain drain sample sites D-3 and BCC-3

APPENDIX A-2

MONITORING WELL LOGS*

Monitoring Well 1

0.0' - 0.5'	Sandy gravel (GP); brown, coarse; angular road base material.
0.5' - 3.0'	Gravelly silty sand with clay (SM): medium to dark brown, low to medium density, slightly plastic, moist, nonindurated; abundant mica, gravel to 1-1/2 inch diameter.
3.0' - 9.0'	Gravelly sandy silt (ML): black, firm consistency, low plasticity, moist to saturated with depth, nonindurated; abundant mica, gravel to 1/2 inch diameter with occasional cobbles.

Note: Depth to water 4.0 feet immediately after drilling, 3.5 feet 4 hours after drilling.

APPENDIX A-2 (Cont'd)

Monitoring Well 2

0.0' - 0.5'	Gravelly silty sand (SM); brown, low density, nonplastic, dry, nonindurated; road base?
0.5' - 3.0'	Organic clay (OH): black to dark yellow brown, stiff, high plasticity, moist, nonindurated; trace fine sand.
3.0' - 4.0'	Sandy clay (CL); gray, firm, low plasticity, wet, nonindurated; approximately 40 percent fine to coarse sand.
4.0' - 11.0'	Clayey sand with gravel (SC); gray, medium dense, low plasticity, wet to saturated with depth, nonindurated; occasional large gravel and cobbles.

Note: Borehole only sightly moist immediately after drilling, depth to water 2.0 feet 4 hours after drilling.

Monitoring Well 3

0.0' - 1.0'	Gravelly clayey sand (SC); dark brown, loose to medium dense, low to medium plasticity, moist, nonindurated; grave to 2-inch diameter.

APPENDIX A-2 (Cont'd)

1.0' - 2.5'	Organic clay (OH); dark brown to black, firm, high plasticity, moist to saturated with depth, nonindurated; trace fine to coarse sand.
2.5' - 9.0'	Gravelly silty sand (SM); brown to red brown, medium dense, nonplastic to slightly plastic, saturated, nonindurated; gravel to 3-inch diameter and occasional cobbles.

Note: Depth to water 1.8 feet immediately after drilling.

Monitoring Well 4

0.0' - 2.0'	Gravelly silty sand (SM); brown, medium dense, nonplastic, dry, nonindurated; gravel to 1 1/2 inch diameter, some organics (roots).
2.0' - 9.5'	Gravelly silty sand (SM); brown to red brown, medium dense, nonplastic, moist to wet with depth, nonindurated; abundant large gravel and cobbles, difficult drilling.

Note: Borehole only slightly wet immediately after drilling.

APPENDIX A-2 (Cont'd)

Monitoring Well 5

0.0' - 1.0'	Silt clay (CL); dark brown, firm, medium plasticity, moist, nonindurated; 10 percent fine sand.
1.0' - 3.0'	Clay with silt (CH); yellow brown, stiff, high plasticity, moist, nonindurated; strong organic odor.
3.0' - 4.0'	Silty sand (SM); black, low density, none to low plasticity, saturated, nonindurated; strong organic odor.
4.0' - 6.5'	Silty sand with gravel (SM); black, low density, none to low plasticity, saturated, nonindurated; strong organic odor.

Note: Depth to water 3.6 feet immediately after drilling, Refusal at 6.5 feet, boulder?

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*1) Soils classified in accordance with procedures outlined in ASTM Standard D2488-69 (Revised 1975), Description of Soils (Visual Manual Procudures).

2) All observation wells cased with 1 1/2-inch black PVC pipe perforated at 4-inch intervals to within 2 feet of the ground surface. Well annulus packed with clean 3/8 inch pea gravel. Top and bottom of well capped, and top of well protocted by a metal survey monument (with lid) set in concrete.

APPENDIX A-3

RESULTS OF BIG COTTONWOOD CREEK BACKGROUND SURVEY SAMPLING

Total Coliform (MF/100 ml)

Station	DATE (1981)							
	6/17	6/24	7/1	7/8	7/12	7/22	7/29	8/15
BC-1	20	22	20	13	22	50	19	16
BC-2	23	13	24	5	17	12	26	7
BC-4	11	6	60	4	10	12	19	15
BC-5	24	15	28	6	37	7	37	60
BC-7	26	19	26	16	54	38	52	16
BC-8	28	56	60	145	92	100	130	45
BC-9	29	50	100	53	125	21	100	80
BC-10	39	40	90	63	175	44	75	
BC-11	32	52	80	82	175	52	125	55
BC-12	50	56	75	92	200	90	95	64
BC-12A	30	70	130	110	400	100	80	80
BC-13	350	200	170	175	500	180	70	
BC-14	225	300	320	280	600	320	165	200
BC-15	19	50	11	29	150	180	18	34
BC-16	17	12	19	32	20	24	14	30
BC-17	24	48		13	175	110	26	32

APPENDIX A-3 (Cont'd)

Total Coliform (MF/100 ml)

Station	DATE (1981)							
	8/12	8/19	8/26	9/2	9/10	9/16	9/23	9/30
BC-1	90	62	44	41	75	27	40	27
BC-2	18	80	47	86	14	50	45	20
BC-4	18	60	23	55	13	25	16	3
BC-5	14	85	31	76	9	24	42	20
BC-7	44	110	28	80	4	13	48	16
BC-8	56	100	26	130	27	13	64	11
BC-9	32	122	47	45	33	15	65	10
BC-10	56	110	50	46	33	15	31	12
BC-11	34	70	47	43	92	25	50	14
BC-12	74	60	88	40	45	7	33	8
BC-12A	80	56	50	36	40	27	21	4
BC-13	48	32	24	30	33	17	13	7
BC-14	150	120	250	130	40	18	50	10
BC-15	55	30	11	18	150	4	4	4
BC-16	75	48	30	15	150	3	4	2
BC-17	50	28	20	36	21	16	21	12

APPENDIX A-3 (Cont'd)

Fecal Coliform (MF/100 ml)

Station	DATE (1981)							
	6/17	6/24	7/1	7/8	7/12	7/22	7/29	8/15
BC-1	0	6	2	17	12	30	10	2
BC-2	4	5	4	6	9	4	19	2
BC-4	1	0	14	1	6	2	1	5
BC-5	0	6	5	6	12	1	16	20
BC-7	2	8	7	10	16	9	28	16
BC-8	7	32	9	8	22	18	55	18
BC-9	2	24	40	12	50	2	19	60
BC-10	1	18	30	23	75	23	32	
BC-11	7	8	7	20	31	10	57	29
BC-12	12	14	36	32	50	15	63	31
BC-12A	2	23	32	29	62	17	33	30
BC-13	13	32	16	21	50	34	30	
BC-14	120	400	22	150	300	145	125	100
BC-15	0	30	2	17	4	20	9	15
BC-16	2	4	2	8	15	11	12	9
BC-17	13	3	10	4	11	10	25	17

APPENDIX A-3 (Cont'd)

Fecal Coliform (MF/100 ml)

Station	DATE (1981)							
	8/12	8/19	8/26	9/2	9/10	9/16	9/23	9/30
BC-1	75	28	11	7	75	12	4	22
BC-2	8	7	0	26	2	50	1	1
BC-4	1	1	5	5	0	8	0	0
BC-5	16	5	9	2	3	0	0	0
BC-7	12	7	2	2	5	6	0	1
BC-8	23	17	8	55	1	1	0	1
BC-9	45	18	4	5	14	3	4	0
BC-10	26	20	10	5	8	2	0	2
BC-11	21	25	10	9	35	0	0	5
BC-12	37	70	7	10	10	3	0	3
BC-12A	14	42	11	14	9	1	1	0
BC-13	10	32	6	5	1	1	0	6
BC-14	100	74	100	54	24	4	2	2
BC-15	18	6	10	2	3	1	0	0
BC-16	3	26	5	6	2	2	1	0
BC-17	8	28	7	6	5	1	0	2

APPENDIX A-4

RESULTS OF BRIGHTON BASIN TIME SERIES SAMPLING

Date	Station	Total Coliform (MF/100ml)			Fecal Coliform (MF/100ml)		
		8 a.m.	12 noon	4 p.m.	8 a.m.	12 noon	4 p.m.
7/6/81	D-1	400	500	350	72	48	24
	D-2	1,000	1,000	1,000	82	106	40
	D-3	140	200	110	10	40	6
	D-4	26	22	30	10	4	2
	D-5	8	8	6	4	4	0
	D-6	80	84	60	14	48	8
	D-7	12	8	6	2	2	4
	D-8	8	8	6	4	2	2
	D-9	300	260	275	6	8	8
7/7/81	D-1	400	450	450	26	22	20
	D-2	1,000	1,000	1,000	200	250	32
	D-3	270	400	250	100	150	8
	D-4	32	34	20	0	2	2
	D-5	10	4	4	4	2	0
	D-6	60	70	40	4	12	6
	D-7	24	14	6	4	8	4
	D-8	38	36	16	18	10	2
	D-9	200	275	260	16	16	26
7/8/81	D-1	400	350	250	90	110	18
	D-2	600	275	750	90	32	20
	D-3	80	70	50	36	22	20
	D-4	40	30	60	10	8	8
	D-5	10	10	14	4	0	0
	D-6	24	12	30	14	6	2
	D-7	4	6	30	0	2	44
	D-8	2	6	2	4	10	4
	D-9	300	100	80	52	22	8

APPENDIX A-5

RESULTS OF BRIGHTON BASIN

SURFACE WATER SAMPLING

STATION: BCC-1

Date (Mil)	Time (mg/l)	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)	Total Coliform (MF/100ml)	Fecal Coliform MF/100ml)
8/8	1120							180	20
8/8	1630							200	60
8/8	2115							360	50
8/9	1310							10	10
8/10	1305							350	80
8/11	1440							180	10
8/12	1420							100	10
8/13	1355							220	20
8/28	1430							240	20
8/29		1.0	15	0.30	0.01	0.1			
8/30	1343	1.0	15	0.23	0.01	0.1	13.0	310	30
8/31	1336	1.0	15	0.31	0.00	0.1	1.4	140	10
9/1	1253	1.0	15	0.25	0.00	0.1	7.7	170	10
9/2	1113	1.0	15	0.42	0.00	0.1	6.7	160	10
9/3	1052	1.0	15	0.23	0.00	0.1	6.7	260	10
9/6			20	0.38	0.00	0.1	7.7		
10/17	1400		15	0.44			16.0	660	100
10/18	1410		15	0.42			15.0	100	100
10/19	1256		25	0.30			13.0	100	100
10/20	1238		15	0.36			11.0	200	100
10/21	1150		15	0.36			28.0	100	100
10/22	1219		15	0.35			12.0	100	100

APPENDIX A-5 (cont'd)

STATION BCC-2

Date (1982)	Time (Mil)	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)	Total Coliform (MF/100ml)	Fecal Coliform (MF/100ml)
8/8	1210							90	10
8/8	1720							80	40
8/8	2045							90	
30									
8/9	1430							490	340
8/10	1405							940	610
8/11	1520							220	80
8/12	1510							90	10
8/13	1430							100	10
8/28	1435							60	20
8/29		1.0	15	0.57	0.01	0.1			
8/30	1410	1.0	15	0.28	0.01	0.1	1.9	120	20
8/31	1340							30	10
9/1	1329	1.0	15	0.27	0.00	0.1	1.0	150	90
9/2	1116	1.0	15	0.21	0.00	0.1	1.9	90	40
9/3	1147	1.0	15	0.15	0.00	0.1	1.0	90	70
9/6			15	0.22	0.00	0.1	1.0		
10/17	1520		15	0.52			1.0	600	100
10/18	1540			0.29			1.0	100	100
10/19	1325		15	0.30			1.0	100	100
10/20	1308			0.25			1.0	200	100
10/21	1221		15	0.35			2.0	100	100
10/22	1245			0.23			1.0	100	100

APPENDIX A-5 (cont'd)

STATION BCC-3

Date	Time (1982)	BOD_5 (Mil)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)	Total Coliform (MF/100ml)	Fecal Coliform (MF/100ml)
8/28	1440							390	10
8/29		6.1	45	0.26	0.00	0.1			
8/30	1347	1.0	15	0.26	0.01	0.1	18.0	170	10
8/31	1345	1.0	20	0.25	0.00	0.1	6.7	10	30
9/1	1258	1.1	15	0.21	0.00	0.1	15.0	170	10
9/2	1149	1.0	15	0.12	0.00	0.1	13.0	60	10
9/3	1040	1.0	15	0.12	0.00	0.1	13.0	20	10
9/6			15	0.20	0.00	0.1	13.0		
10/17	1450		15	0.49			49.0	5200	100
10/18	1445		15	0.45			17.0	600	100
10/19	1300		23	0.48			60.0	400	100
10/20	1241		15	0.44			61.0	300	100
10/21	1159		18	0.36			58.0	200	100
10/22	1222		15	0.34			60.0	100	100

APPENDIX A-6

RESULTS OF BRIGHTON BASIN SUBSURFACE WATER SAMPLING

STATION GW-1

Date (1982)	Time (Mil)	Depth to Water	BOD_5 (mg/l) Suf.(ft.)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	CL (mg/l)	Total Coliform (MF/100ml)*	Fecal Coliform (MF/100ml
8/8	1100	4.2							2	16
8/8	1100	4.2							8	12
8/8	1630	4.2							12(M)	16
8/8	2115								2(M)	16
8/9	1320	3.7							2(M)	34
8/10	1300	4.2							2(M)	16
8/11	1440	4.1							10	10
8/12	1415	3.9							10	10
8/13	1350								10	10
8/28	1300								10	10
8/29			2.4	40	1.38	0.01	0.1			
8/30	1305	5.3	2.1	30	1.08	0.01	0.1	650	10	10
8/31	1230	4.1	1.0	40	2.55	0.01	0.1	625	10	10
9/1	1228	3.9	1.1	100	1.32	0.00	0.1	625	10	10
9/2	1054	4.0	1.0	40	1.18	0.00	0.1	675	10	10
9/3	1056	4.0	1.5	45	1.03	0.00	0.1	850	30	10
9/6				55	1.24	0.00	0.1	650		
10/17	1400	1.9		15	1.80			130	100	100
10/18	1410	1.9		15	1.20			160	200	100
10/19	1244	3.1		50	0.79			200	100	100
10/20	1218	3.4		30	0.58			180	100	100
10/21	1130	3.4		15	0.76			200	100	100
10/22	1203	1.5		15	0.64			190	100	100

* (M) Indicates "matted" filter-results are not exact.

APPENDIX A-6 (cont'd)

STATION GW-2

Date (1982)	Time (Mil)	Depth To Water Ft.	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)	Total Coliform (MF/100ml)*	Fecal Coliform (MF/100ml)
8/8	1125	2.7							90	10
8/8	1650	2.4							20(M)	2
8/8	2100								18(M)	12
8/9	1350	2.3							22	2
8/10	1330	2.5							32	6
8/11	1450	2.4							70	10
8/12	1430	2.7							290	10
8/13	1415								220	10
8/28	1335	2.3							160	10
8/29			1.0	30	1.07	0.01	0.1			
8/30	1330	2.5	1.6	30	1.16	0.02	0.1	1250	230	10
8/31	1300	2.9	1.1	50	1.21	0.01	0.1	1250	210	10
9/1	1240	2.5	1.6	50	1.17	0.00	0.1	1200	530	10
9/2	1103	2.5	1.0	50	1.02	0.01	0.1	1,200	520	10
9/3	1114	2.8	1.0	80	1.02	0.01	0.1	1,250	30	10
9/6				50	1.06	0.00	0.1	1150		
10/17	1430	1.0		105	3.50			240	3300	100
10/18	1420	1.4		115	4.60			450	1600	100
10/19	1251	0.8		75	3.50			900	400	100
10/20	1228	0.8		130	5.80			675	300	100
10/21	1137	0.7		120	8.10			750	600	100
10/22	1214	0.7		85	4.30			900	200	100

* (M) Indicates "matted" filter-results are not exact counts.

APPENDIX A-6 (cont'd)

STATION GW-3

Date (1982)	Time (Mil)	Depth To Water Ft.	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)	Total Coliform (MF/100ml)*	Fecal Coliform (MF/100ml)
8/8	1150	3.2							8	4
8/8	1710	3.0							2	2
8/8	2030								2	2
8/9	1400	3.1							2	2
8/10	1345	4.2							2	2
8/11	1500	3.3							10	10
8/12	1440	3.3							20	10
8/13	1420								10	10
8/28	1400	3.0							10	10
8/29			1.2	15	0.50	0.01	0.1			
8/30	1358	3.0							10	10
8/31	1310	3.1	1.5	20	0.49	0.01	0.1	16	10	10
9/1	1305	2.8	1.1	15	0.46	0.00	0.1	21	30	10
9/2	1128	2.8	1.0	75	0.46	0.01	0.1	14	10	10
9/3	1126	3.2	1.0	15	0.42	0.01	0.1	19	10	10
9/6				15	0.48	0.00	0.1	13		
10/17	1510	1.0		15	0.67			29	200	100
10/18	1550	1.2		23	0.44			35	200	100
10/19	1318	1.0		25	0.37			28	100	100
10/20	1253	1.1		23	0.38			34	300	100
10/21	1211	1.0		15	0.42			30	200	100
10/22	1236	1.0		40	0.44			31	100	100

APPENDIX A-6 (cont'd)

STATION GW-4

Date (1982)	Time (Mil)	Depth To Water Ft.	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)	Total Coliform (MF/100ml)*	Fecal Coliform (MF/100ml)
8/8	1210	6.6							2	2
8/8	1720	6.9							2	2
8/8	2040								2	2
8/9	1420	6.7							2	2
8/10	1400	6.6							2	2
8/11	1510	6.5							10	10
8/12	1500	6.3							10	10
8/13	1430								1	10
8/28	1415	5.6							10	10
8/29				15	0.43	0.01	0.1			
8/30	1410	5.8	1.0	15	1.00	0.48	0.1	25.0	10	10
8/31	1310	5.6		20	0.15	0.00	0.1	1.9	10	10
9/1	1316	6.1	1.0	15	0.14	0.00	0.1	1.9	10	10
9/2	1140	5.8	1 0	15	0.09	0.00	0.1	1.9	10	10
9/3	1139	5.8	1.0	15	0.19	0.00	0.1	1.0	10	10
9/6				15	0.16	0.00	0.1	1.9		
10/17	1520	1.0		15	0.34			1.0	100	100
10/18	1540	1.0		25	0.28			1.9	100	100
10/19	1329	1.6		18	0.29			1.0	100	100
10/20	1303	1.8		15	0.25			1.0	100	100
10/21	1219	0.9		18	0.27			2.0	100	100
10/22	1242	1.0		40	0.44			1.0	100	100

APPENDIX A-6 (cont'd)

STATION GW-5

Date (1982)	Time (Mil)	Depth To Water Ft.	BOD_5 (mg/l)	COD (mg/l)	NO_3-N (mg/l)	NO_2-N (mg/l)	PO_4-P (mg/l)	Cl (mg/l)	Total Coliform (MF/100ml)*	Fecal Coliform (MF/100ml)
10/17	1450	1.4		30	0.53			3.9	14,000	100
10/18	1445	1.4		30	0.49			7.7	1,700	100
10/19	1304	1.6		30	0.61			7.8	7,900	100
10/20	1243	1.4		25	0.47			11.0	9,000	100
10/21	1203	1.6		25	0.45			14.0	13,000	100
10/22	1225	1.4		15	0.39			1.7	2,800	100

APPENDIX A-7

MISCELLANEOUS WATER QUALITY DATA

Station (See Notes Below)	Date (1982)	Time (Mil)	COD (mg/l)	NO_3-N (mg/l)	Cl (mg/l)	Total Coliform (MF#/100ml)	Fecal Coliform (MF#/100ml)
BCC-4[a]	8/8	1220				210	30
BCC-4[b]	8/8	1240				190	10
GW-1S[b]	8/31	1230				290	10
GW-6[c]	10/21		75	3.00	800	500	100

Notes:

a. Station BCC-4 is Big Cottonwood Creek approximately midway between BCC-1 and BCC-3.

b. Station GW-1S is the pool around the top of Observation Well #1 (GW-1).

c. Station GW-6 is Observation Well #2 (GW-2) at depth of 6' - 8' where water color changed from brown/tan to gray.