TECHNICAL PUBLICATION SJ 89-3

LITTLE WEKIVA RIVER FLOODPLAIN STUDY

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (continued)

LIST OF TABLES

1.0 INTRODUCTION

1.1 Purpose and Scope

The Little Wekiva River Basin, located in Orange and Seminole counties, within the St. Johns River Water Management District, has experienced considerable flooding and rapid urbanization in recent years and has been identified as a basin seriously in need of surface water management. In 1982, at the request of Orange and Seminole counties (Exhibit A), the District commenced a water management study of the basin.

The objectives of the study were to complete a floodplain study and to develop a comprehensive water management plan for the basin. This report presents the results of the floodplain study. This floodplain study consists of detailed hydraulic and hydrologic analyses to determine flood elevations and flood prone areas throughout the basin. The report includes a description of the basin, flood profiles for the 10 yr, 25 yr and 100 yr 24-hour storm events, and 100 yr floodplain maps for the existing conditions of the basin. The report also includes flood discharges and velocities for critical locations in the basin and identifies areas of major flood hazard.

Cross sectional survey data and elevation details of several bridges and culverts within the basin were provided by Orange and Seminole counties.

1.2 General Description and Historical Perspective

The Little Wekiva River Basin lies within Orange and Seminole counties (Figure 1). The Little Wekiva River and Black Water Creek are major tributaries to the Wekiva River which is a tributary to the Middle St. Johns River (Figure 2).

1.2.1 Flood History: The largest flood of record within the Little Wekiva River Basin occurred during the month of September 1960. Rainfall resulting from the tropical storm Florence followed by Hurricane Donna combined with unusually wet antecedent conditions caused extensive damage to citrus groves and other rural areas. The damage in urban areas was principally to roads and residential areas adjoining the river and the lakes within the basin. Other known floods include those which occurred in September 1945, September 1947, September 1948, August 1949, September 1953, October 1956, August 1964, and March-April 1987.

1.2.2 Environmental Problems: Extensive urban development along the Little Wekiva River and its tributary basins has contributed to a general degradation of environmental quality in the basin. In addition to the pollutant loading associated with urban stormwater runoff, high channel velocities have caused scouring of the river banks, adding an increased sediment load to the stream.

1.3 Chronology of Significant Events in the Study Area

In response to the frequency and severity of the flooding problem in the upper reaches of the basin, Orange County in the mid 1960s undertook a series of flood control measures to reduce

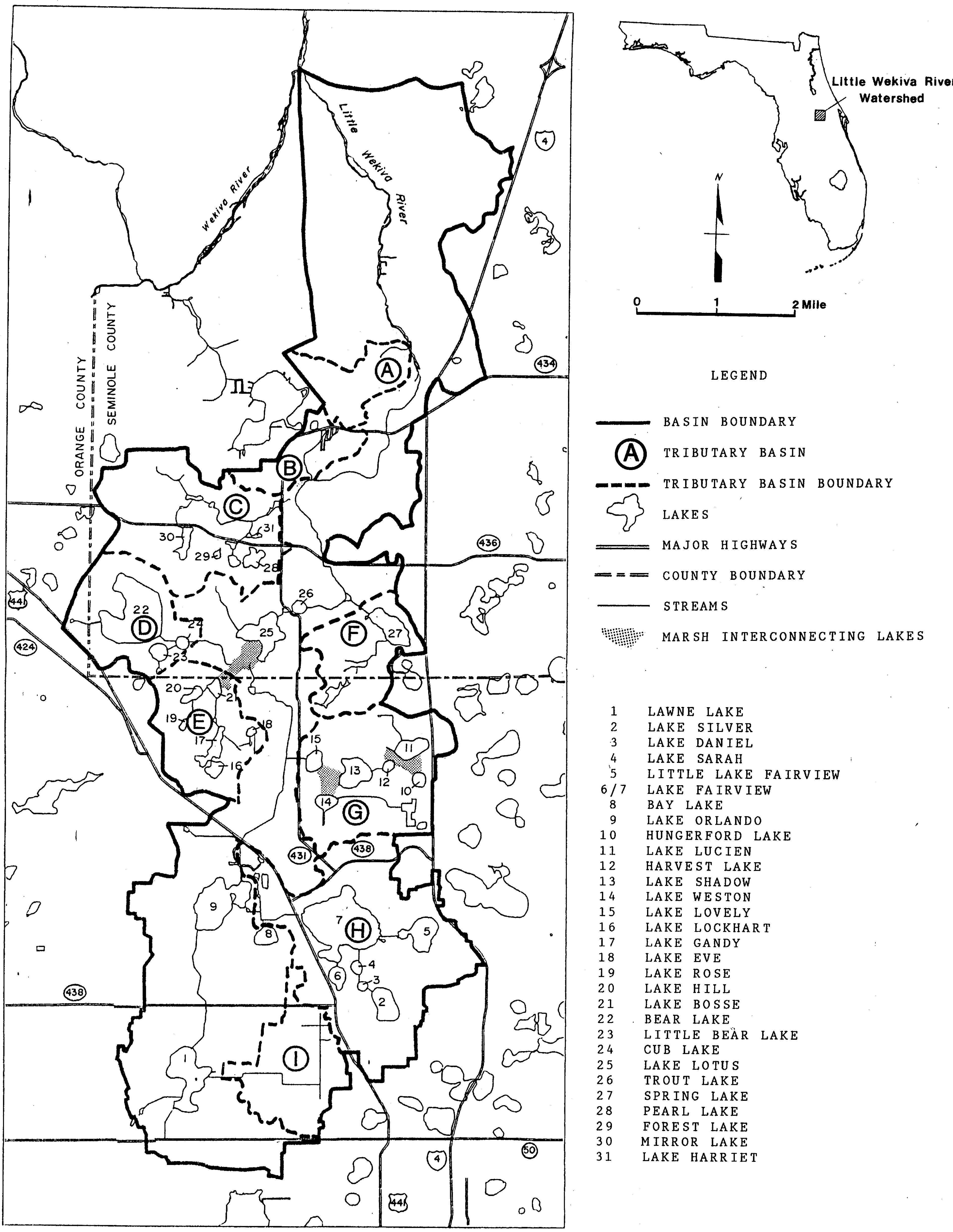

Figure 1. The Little Wekiva River Basin

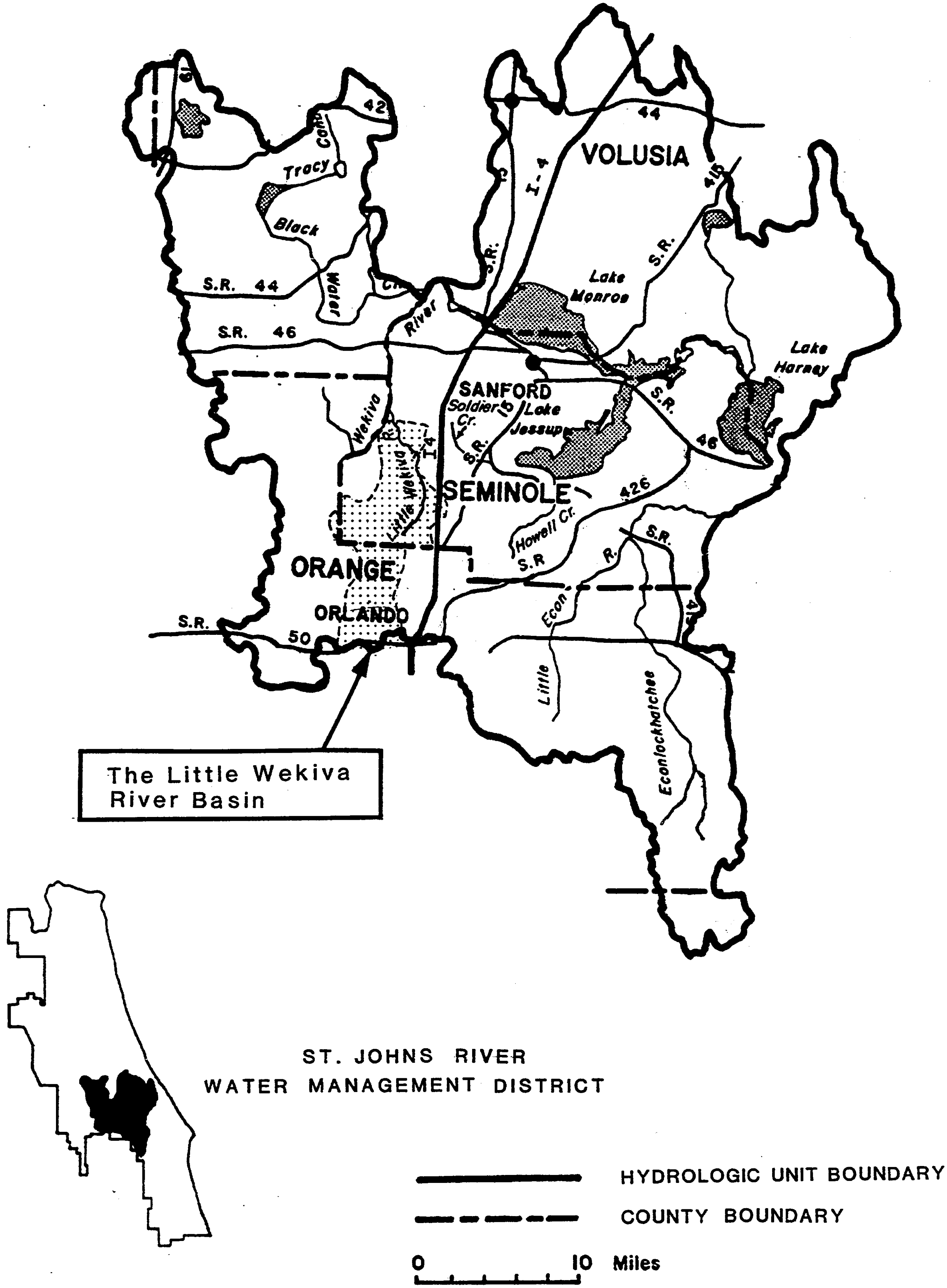

Figure 2. The Middle St. Johns River Basin

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flood stages in this area. Among these measures was the construction of a drainage channel between Lawne Lake and Lake Orlando (Figure 1). This channel has significantly lowered flood stages in Lawne Lake. Subsequently, a major portion of the river course within Orange County was channelized.

A particular problem area in Orange County is the Riverside Acres Subdivision (Figure 3; Subbasin 33 in Figure 4). During the August 1964 flood, erosion of the river banks was so severe that sheet piles were driven into the river bank to prevent a house from collapsing into the river. Orange County undertook an engineering study of the problems in the Riverside Acres Subdivision and later constructed a 12 foot high by 18 foot 7 inch wide structural plate pipe-arch culvert to convey flow through most of the subdivision.

1.4 Summary of Previous Studies

1.4.1 Flood Studies: Floodplain information reports completed by the U.S. Army Corps of Engineers (USACOE), and flood insurance study reports released by the Federal Emergency Management Agency (FEMA) are the major sources of information on potential flooding in the study area. Following is a list of reports completed.

Floodplain information reports:

1. Little Wekiva River, Orange County, Florida, April 1970.
2. Little Wekiva River, Seminole County, Florida, September 1970.

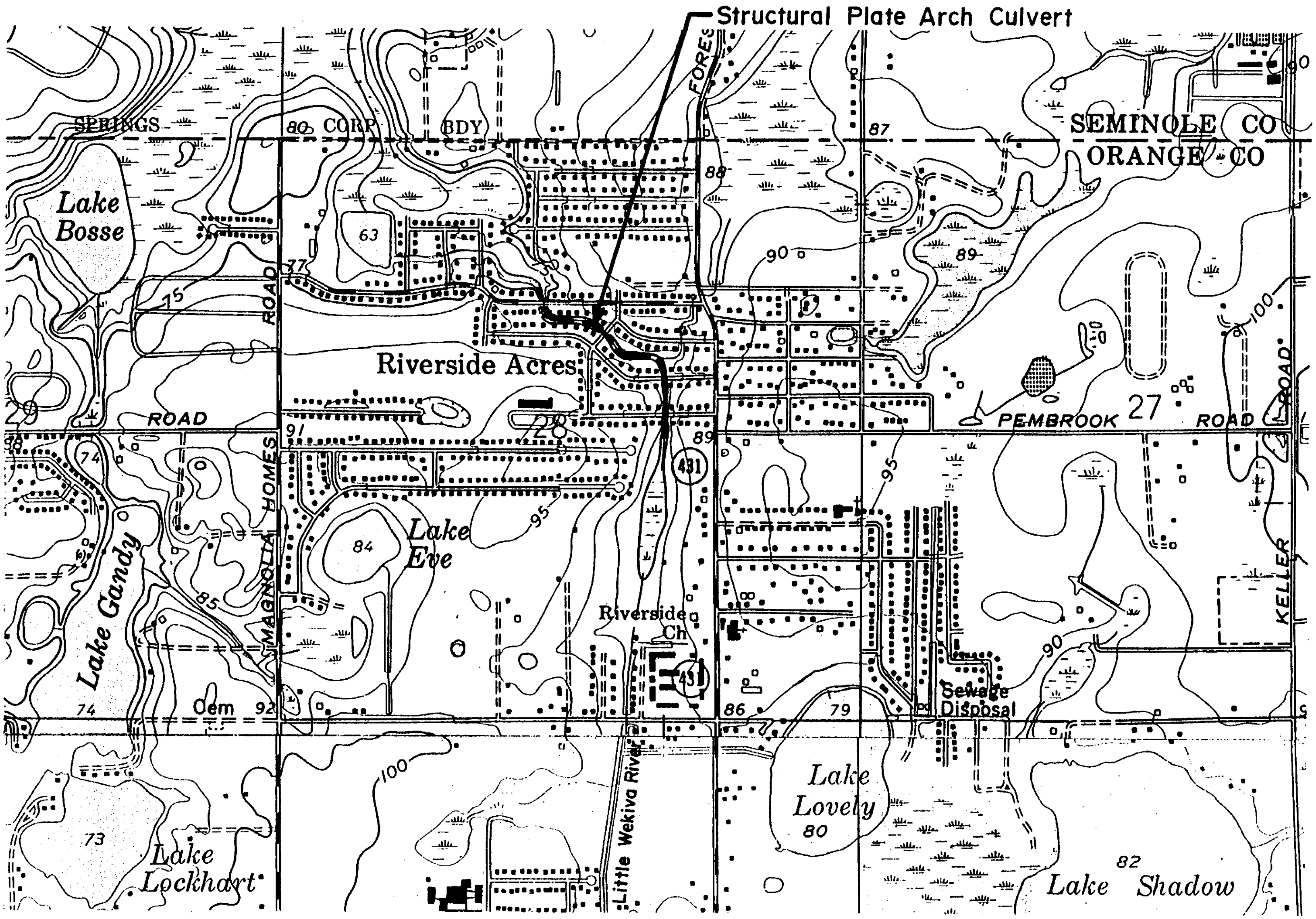

Figure 3. Riverside Acres Subdivision, Orange County

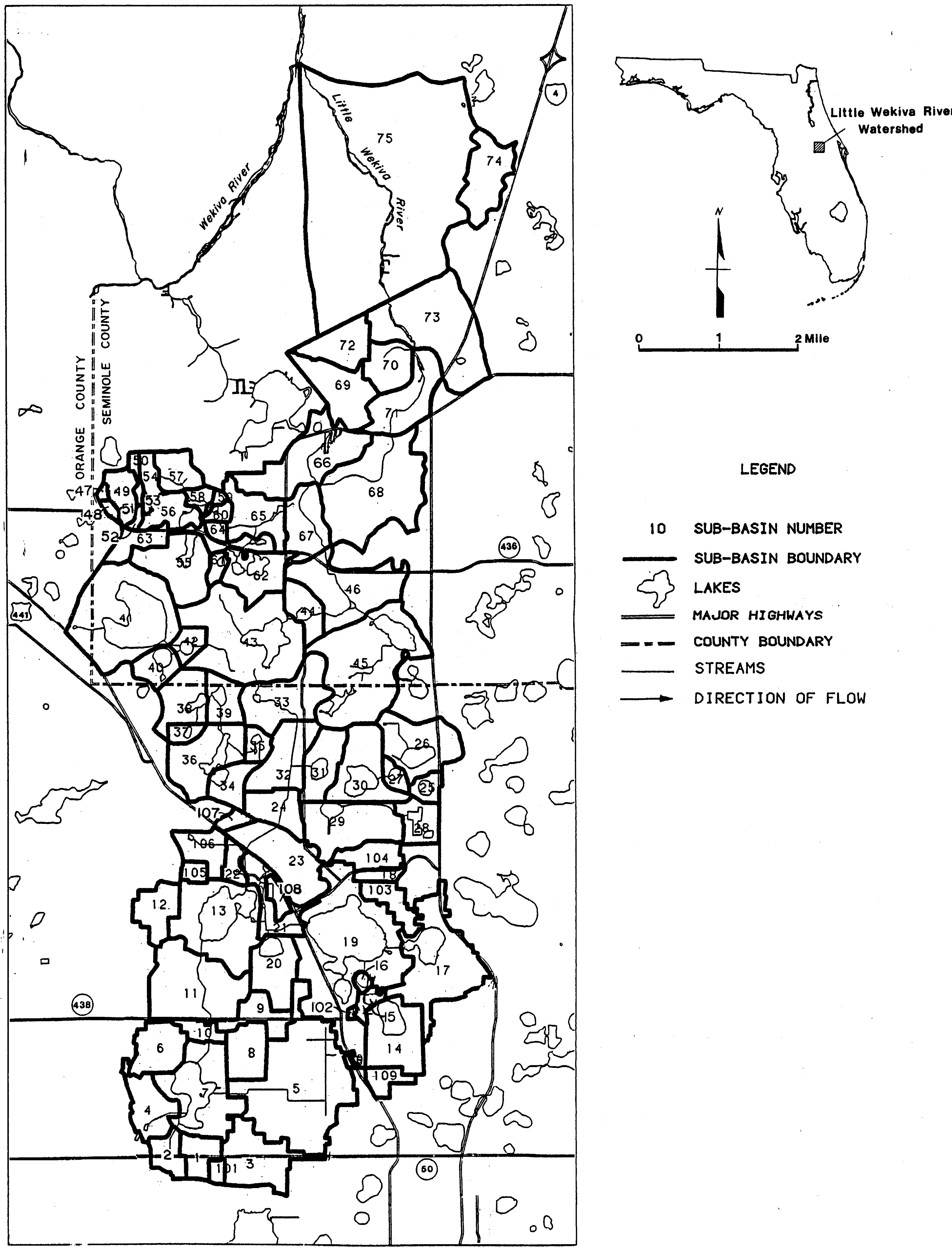

Figure 4. Subbasin Delineation in the Little Wekiva River Basin

Flood insurance study reports:

1. City of Orlando, Florida, Orange County, December 1978.
2. City of Altamonte Springs, Seminole County, September 1979.
3. Seminole County, Florida, Unincorporated Areas, November 1980, (Revised January, 1987).
4. Orange County, Florida, Unincorporated Areas, June 1981 (Revised August, 1986).

The hydrologic and hydraulic analyses for the flood insurance studies also were prepared by the USACOE. For the Little Wekiva River, however, no additional analyses were conducted.

1.4.2 Environmental Studies: The East Central Florida Regional Planning Council released a report titled "Urban Stormwater Management Plan, Little Wekiva River Sub-Basin" in February 1980. It consists of two parts. Part one contains the background information including: an overview of the subbasin, the characteristics of the subbasin, an assessment of the drainage systems, a listing of water pollution sources in the subbasin, and an assessment of the water quality management needs. Part two, subtitled "Urban Stormwater Management Strategies," includes information on: the existing water quality sampling system, the existing stormwater management practices in the subbasin, and some alternative urban stormwater management strategies.

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portion of the Wekiva River and Little Wekiva River basins north of State Road 434 in Seminole County. The committee expresses several concerns regarding extreme environmental degradation in the basin as a result of urbanization. Its recommendations include halting further development in the basin until a comprehensive water resources management plan is completed and acquiring the remaining undeveloped river corridor of the basin.

The Bureau of Water Analysis, Florida Department of Environmental Regulation, published a report, "Little Wekiva River Intensive Study (Seminole County)," as a part of its Water Quality Technical Series (McClelland, 1982). The Report contains an analysis of data collected from the sampling of 15 sites during October 1981.

2.0 BASIN DESCRIPTION

2.1 Physiography

2.1.1 study Area Delineation: The Little Wekiva River Basin lies in portions of Orange and Seminole counties. The river flows from south to north with its headwaters in Lawne Lake (Figure 1). Drainage basins which contribute runoff into Lawne Lake extend south of State Road 50 in Orlando.

The study area is divided into 75 contributing subbasins (S.B. 1 through 75) and nine non-contributing subbasins (S.B. 101 through 109); see Figure 4. Non-contributing basins are basins which are not hydrologically connected to the primary tributary. The total area of the Little Wekiva River Basin is about 42 sq. mi. Areas of individual subbasins, excluding S.B. 75, range from about 14 acres to about 1,070 acres. Subbasin 75, which is predominantly a riverine hardwood swamp, is about 3,620 acres.

2.1.2 Urban Areas: Urban areas include portions of the City of Orlando, including the Rosemont Development surrounding Lake Orlando (S.B. Numbers 1 through 22, Figure 4), Riverside Acres Subdivision (S.B. 33, Figure 4), the City of Altamonte Springs (S.B. 66, 67 and 68, Figure 4), and several other subdivisions adjacent to the river or in the near vicinity.

2.1.3 Rivers and Streams: The Little Wekiva River is the only natural channel within the study area. Several drainage ditches and laterals exist throughout the basin. Figure 1 shows the mainstem of the river and major tributaries (A through I) including interconnected lakes.

Six drainage laterals or ditches discharge into Lawne Lake (Figure 5). The main channel of the river flows north from Lawne Lake into Lake Orlando. Several smaller ditches discharge into the river along this stretch.

Downstream of Lake Orlando, Tributary H joins the river just upstream of three box culverts beneath U.S. 441 (Figures 5 and 6). This tributary, a man-made drainage conveyance, routes discharge from Bay Lake, Lakes Fairview, Daniel, Sarah, and Silver and Little Lake Fairview through the golf course to the east of Lake Orlando. Several other ditches and culverts discharge into this reach of the river from the west.

Upstream of Riverside Park Road, Tributary G joins the river from the east (Figure 6). This drainageway conveys the routed discharge from Harvest Lake, Hungerford Lake, Lakes Lovely, Lucien, Shadow and Weston and the Eatonville Borrow Pit.

On Tributary E (Figure 7), Lakes Lockhart and Gandy are interconnected by a short natural channel. Lake Eve discharges into Lake Gandy via a culvert and a channel. Lake Gandy discharges to the north via a culvert and a county owned drainage easement into Lake Bosse. Lakes Rose and Hill, which lie on a separate prong of Tributary E, also discharge into Lake Bosse. Lake Bosse discharges through a natural hardwood swamp into Lake Lotus.

Bear Lake, Cub Lake, and Little Bear Lake (Figure 7) contribute to Tributary D which enters Lake Lotus. An additional unnamed stream enters Lake Lotus from the north. The river next flows through Trout Lake which is the last lake prior to its confluence with the Wekiva River.

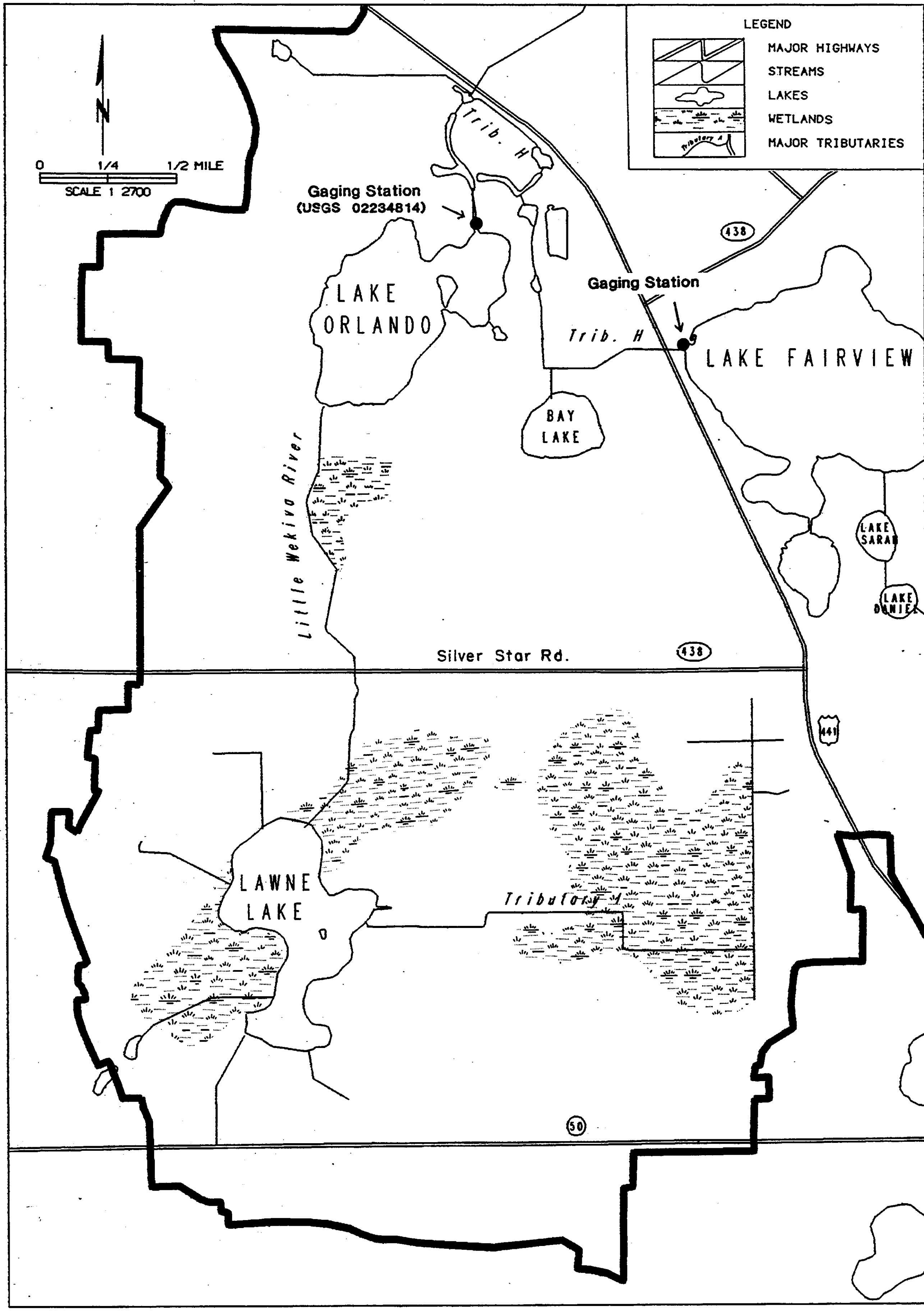

Figure 5: The Little Wekiva River Basin Upstream of U.S. 441

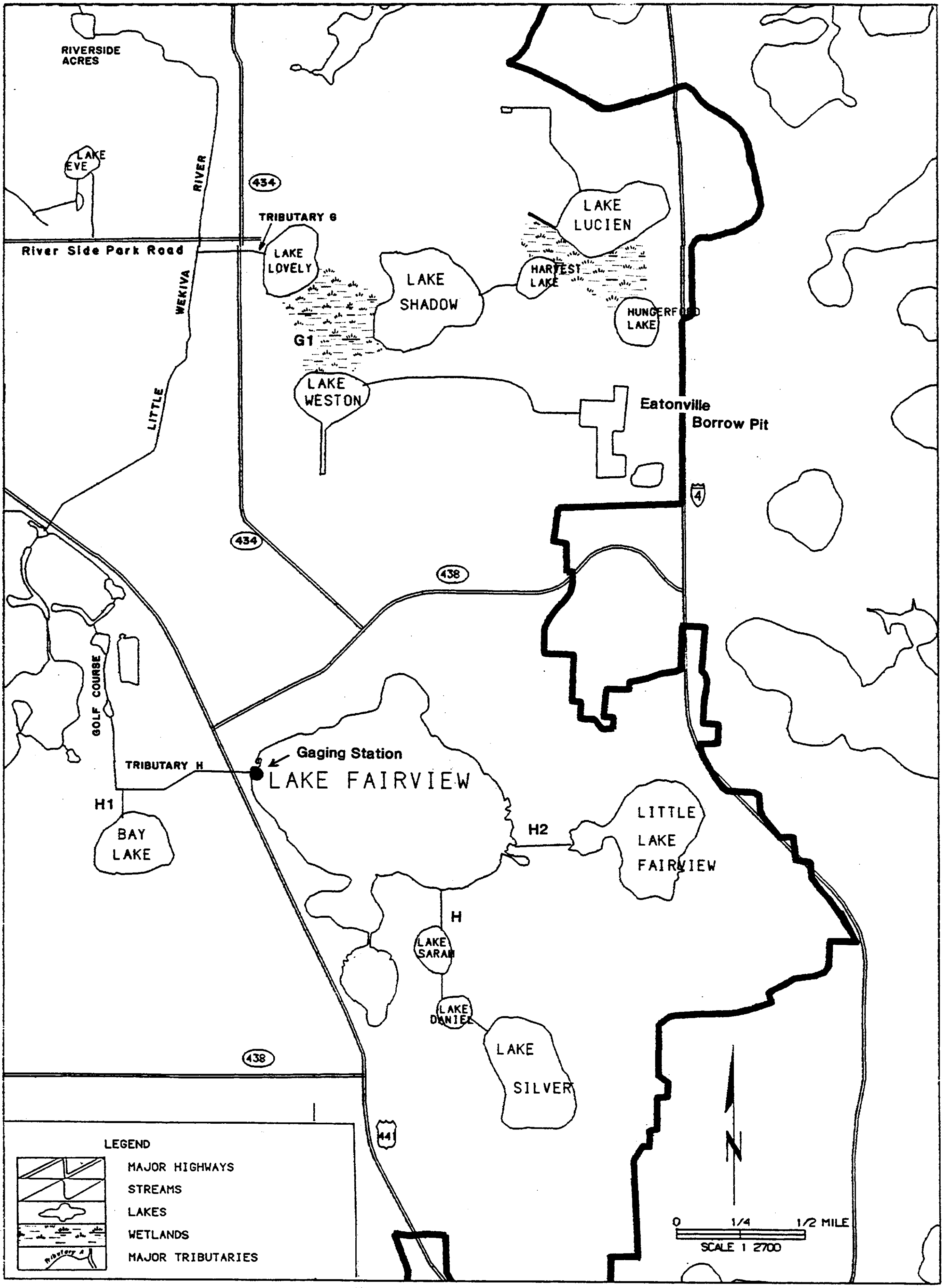

Figure 6. Tributaries G and H

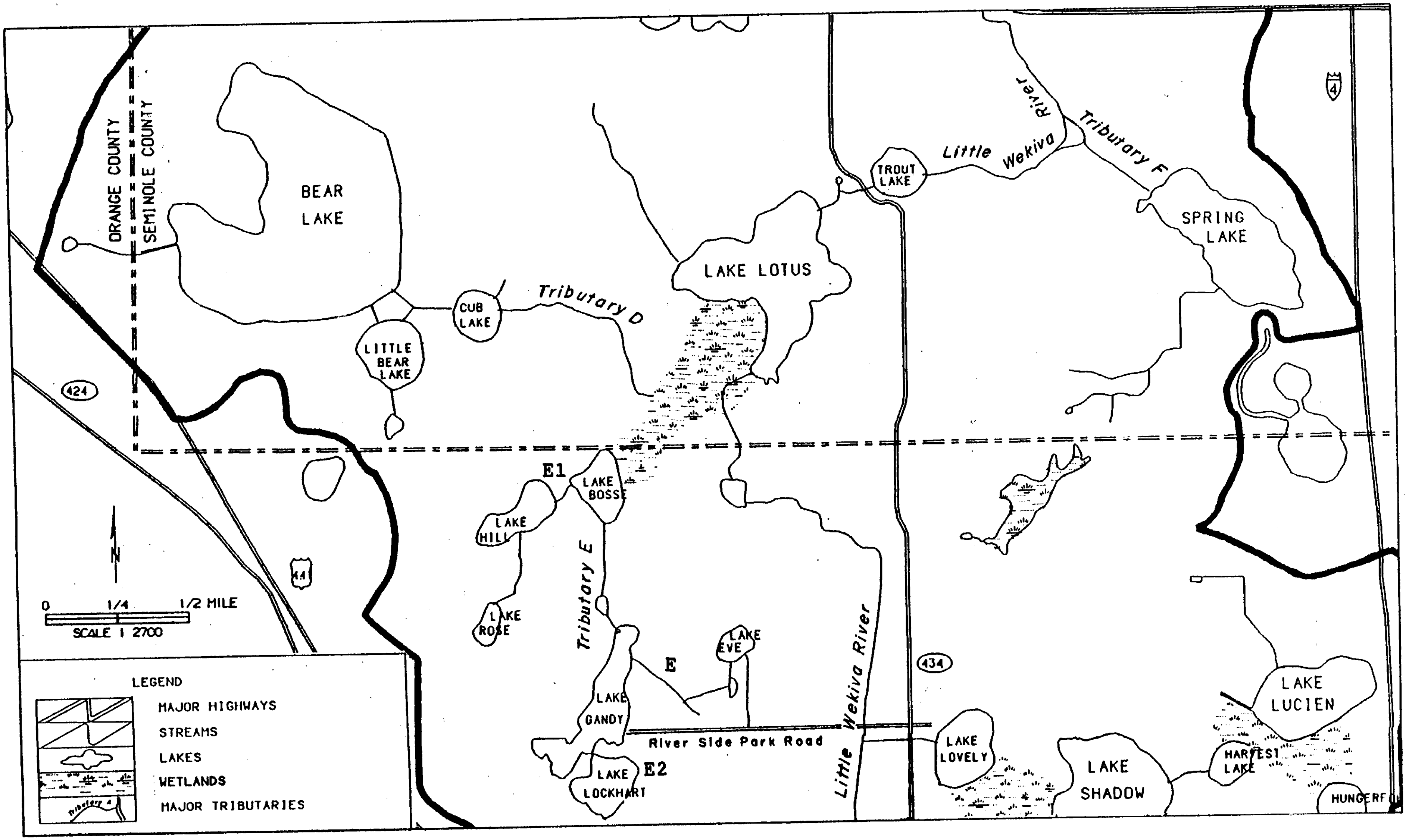

Figure 7. Tributaries D, E, and F

Discharge from Spring Lake (Figure 7) enters the river downstream of Trout Lake through Tributary F. The remaining lakes in Seminole County (Mirror, Forest, Pearl and Harriet, see Figure 8) contribute flow to Tributary C which enters the river downstream of State Road 436. Tributaries A and B contribute flow from areas near the northern limit of the study area in Seminole County.

2.1.4 Springs: Springs which discharge into the Little Wekiva River are limited to downstream reaches of the river within Seminole County. Sanlando Springs (Figure 8) lies entirely within a private housing development called the Springs (S.B. 71, Figure 4). Discharge from this cluster of springs enters the river at two locations downstream of State Road 434. Palm Springs (Figure 8) discharges into the river further downstream.

2.1.5 Lakes

A. Major Lakes: The study area includes five lakes with a surface area greater than 100 acres which are designated as major lakes. They are:

Lawne Lake	154 acres
Lake Orlando	192 acres
Lake Fairview	393 acres
Bear Lake	309 acres
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B. Minor Lakes: Lakes of less than 100 acres in size are denoted as minor lakes.

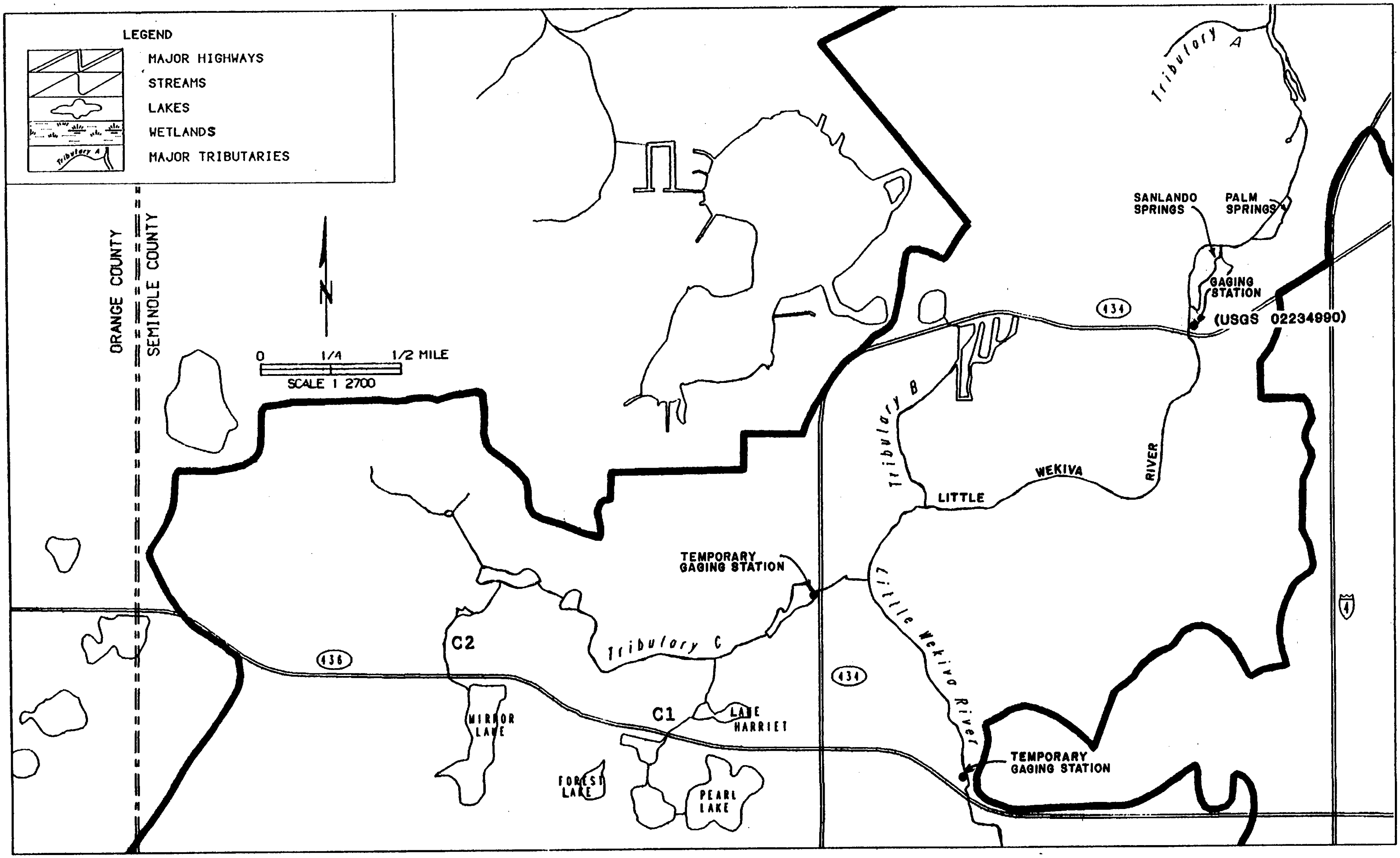

Figure 8. Tributaries A, B, and C

In Orange County they are:

Bay Lake,	Lake Lovely,
Harvest Lake,	Lake Lucien,
Hungerford Lake,	Lake Rose,
Lake Bosse,	Lake Sarah,
Lake Daniel,	Lake Shadow,
Lake Eve,	Lake Silver,
Lake Gandy,	Lake Weston, and
Lake Hill,	Little Lake Fairview.
Lake Lockhart,	

In Seminole County they are:

Cub Lake,	Forest Lake,
Lake Harriet,	Little Bear Lake,
Mirror Lake,	Pearl Lake, and
Spring Lake,	Trout Lake.

2.1.6 Wetlands: Wetlands have experienced significant encroachment within the Little Wekiva River Basin. Significant wetlands in Orange County include portions of the area south of Silver Star Road (S.R. 438) and east of Lawne Lake (Figure 5), the area surrounded by lakes Lovely, Shadow, and Weston (Figure 6), the area north and east of Lake Bosse (Figure 7), an area east of S.R. 434 near the Orange County/Seminole County line (Figure 7), and the littoral fringes around various lakes.

Significant wetlands in Seminole County include the natural depression between Lake Bosse and Lake Lotus (Figure 7) and the Riverine Hardwood Swamp which extends from downstream of State Road 434 to and including the confluence with the Wekiva River (portions of S.B. 73, and major portion of S.B. 75, Figure 4).

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2.1.8 Soils: The soils within Orange County in the Little Wekiva River Basin consist of the Lakeland-Eustis-Blanton-Orlando association and the Leon-Immokalee-Pomello-St. Johns association. The former association is considered to be somewhat excessively drained to moderately drained (Soil Survey, Orange County, 1960). The latter soils are considered to be somewhat poorly drained.

The soils within Seminole County fall into three soil associations, i.e., the swamp, Blanton-Lakeland, and Leon-Immokalee-Plummer associations. The Wekiva River Swamp (parts of S.B. 69, 70, 71 and a major portion of 73, and 75, Figure 4) makes up what is referred to as the Swamp Association (Soil Survey, Seminole County, 1966) which is inundated most of the year and is nearly level. Most of the remainder of the basin has Blanton-Lakeland association soils which are moderately well to excessively drained sandy soils that contain scattered lakes, ponds and depressional wetlands. The third soil association in the Seminole county area, the Leon-Immokalee-Plummer association, is somewhat poorly drained, sandy, and has a brown organic pan. In lower areas, this association becomes very poorly drained.

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C. Lake Stage Stations: The USGS maintains one lake stage recorder within the basin on Lake Orlando (USGS Station Number 02234814, Figure 5). This lake is being called Lake Wekiva by the USGS and the mean daily stages are reported under that designation.

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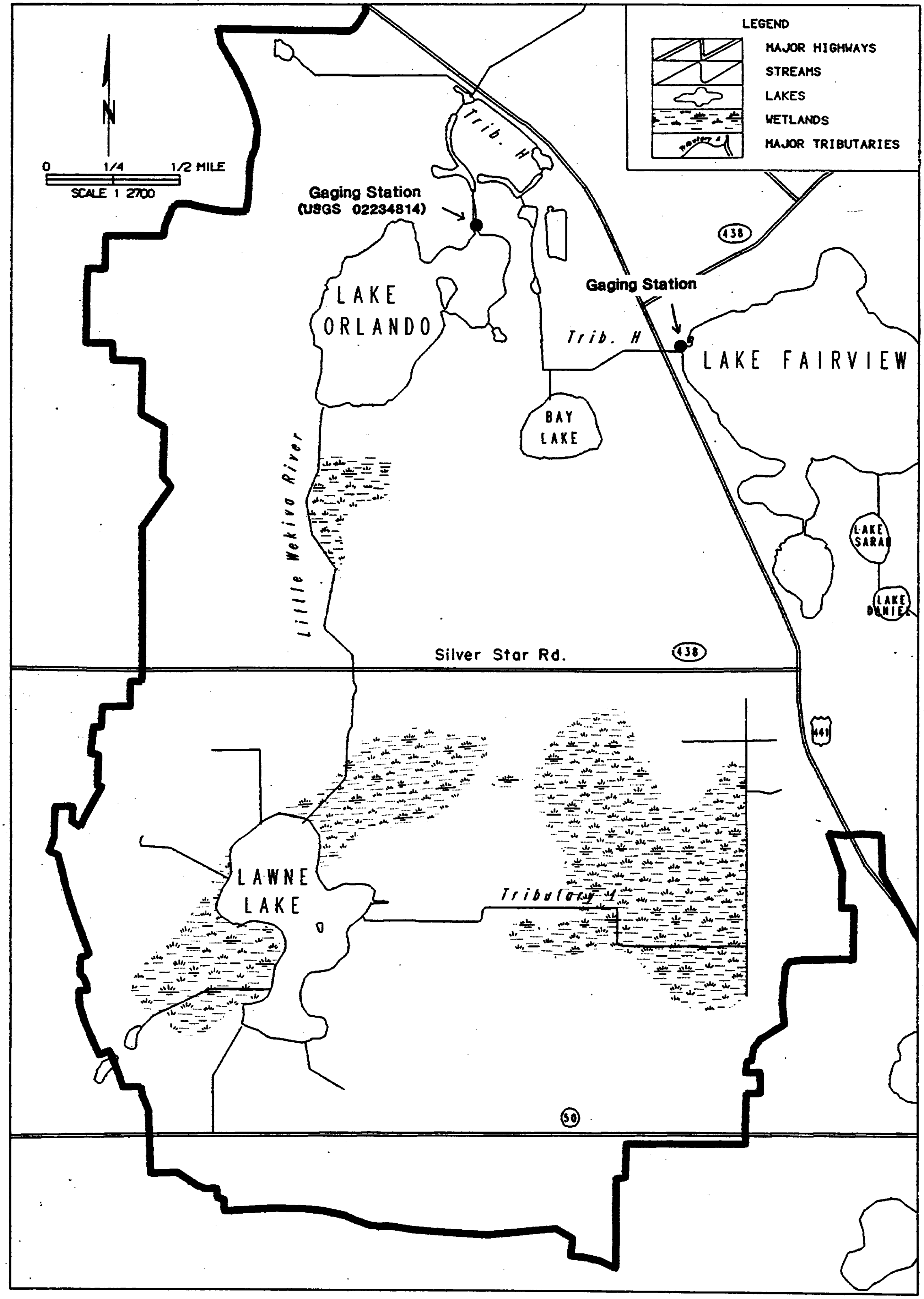

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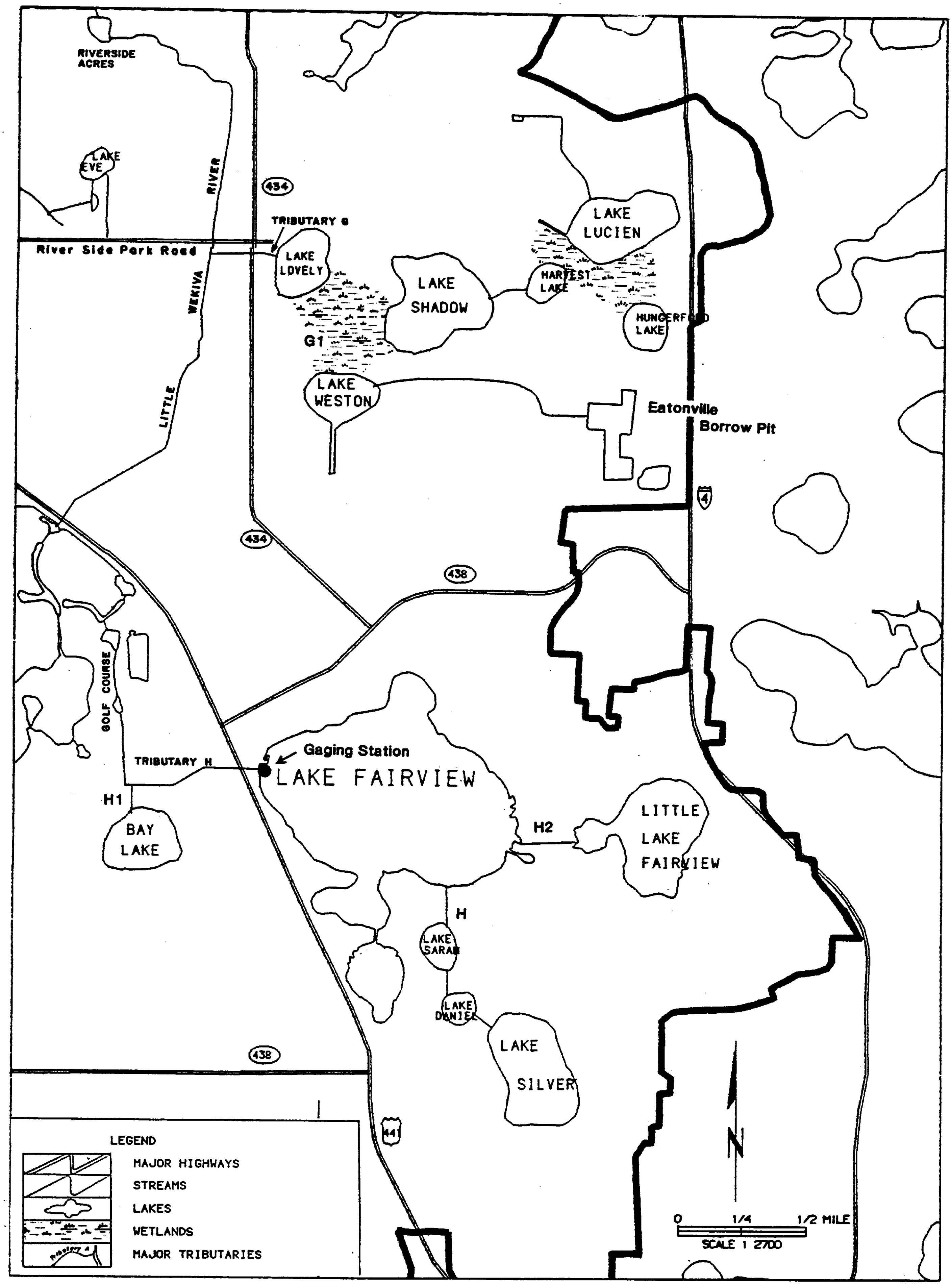

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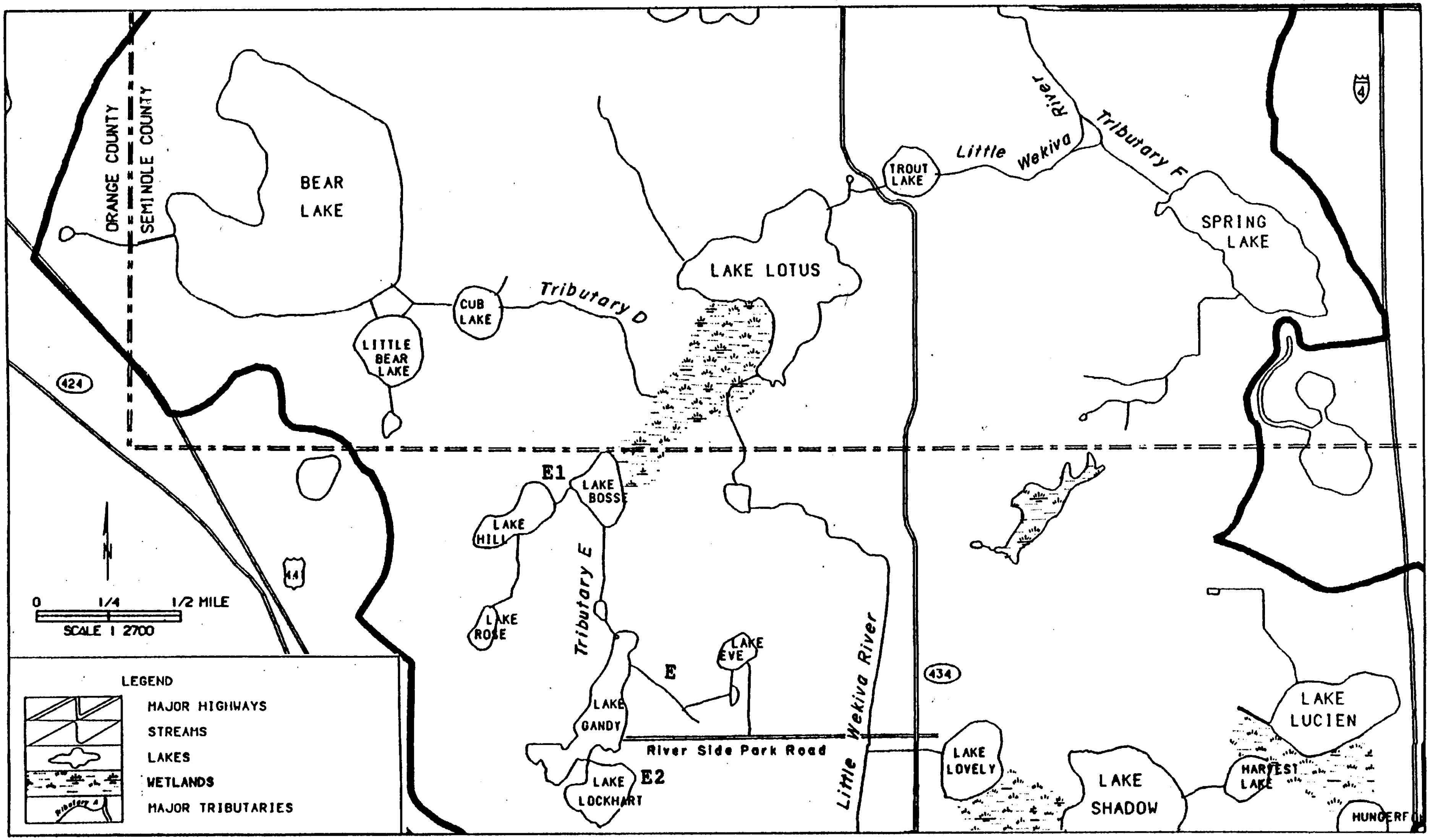

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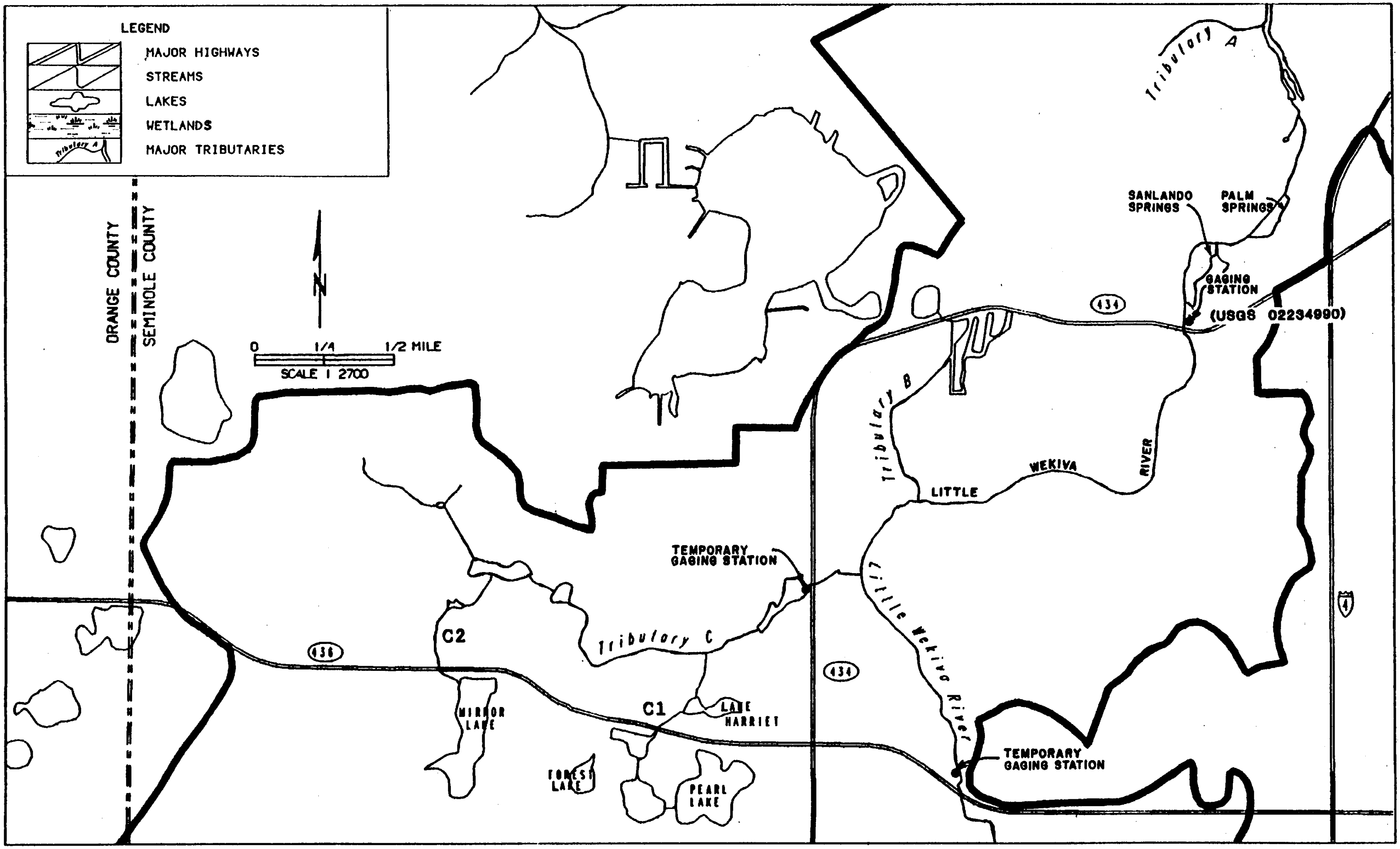

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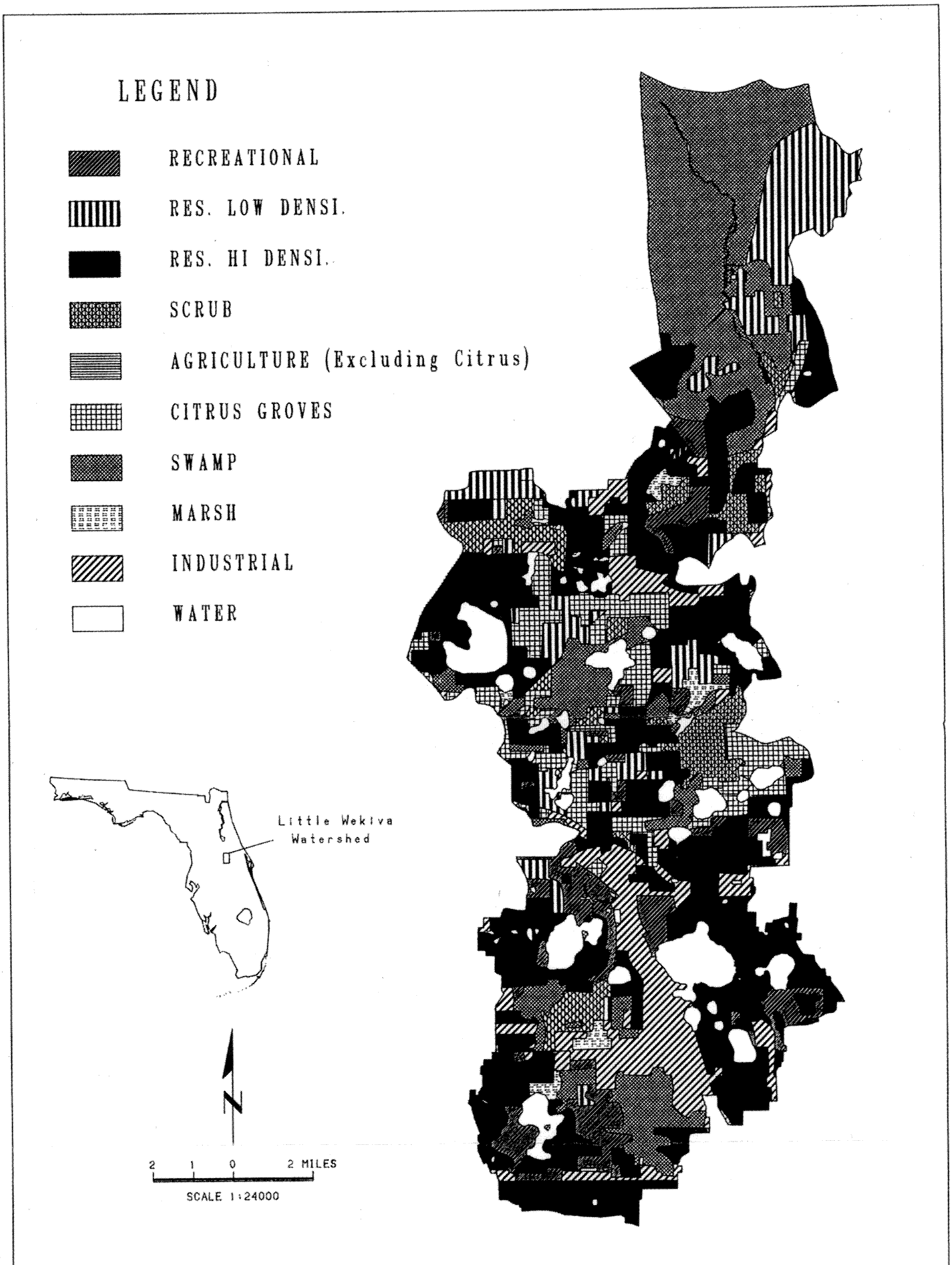

Figure 9. Land Use in the Little Wekiva River Basin

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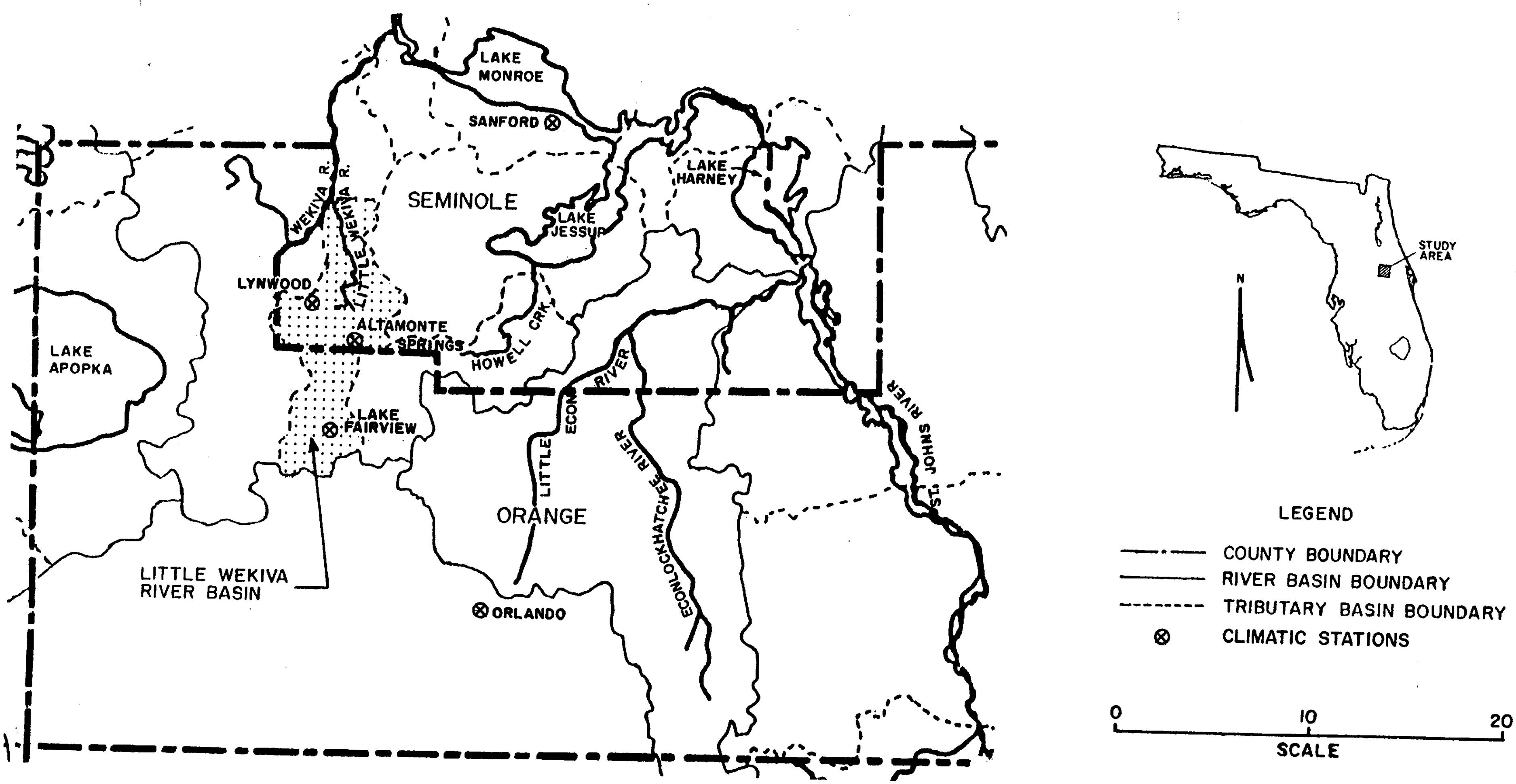


Figure 10. Location of Climatological stations

The District, in cooperation with Seminole County, established two temporary stage recorders during the course of this study. These recorders were established to record stage data for Tributary C and for the Little Wekiva River downstream of State Road 436 (Figure 8).

The District, in cooperation with Orange County, established another stage recorder at the Orange County/Seminole County line (Figure 7). However, the recorder and platform were vandalized in less than 24 hours and the site was abandoned.

Orange County has established a stage recorder and a rainfall recorder at the control structure on Lake Fairview (Figure 6). In addition, at the beginning of each month, Orange County measures the levels of fourteen lakes in the basin. These data were used in model calibration and in selecting the initial lake stages for modeling storm events.

2.2.2 Climate: The climate of the Little Wekiva River Basin is semi-tropical, characterized by warm, humid summers and mild, dry winters. Normal monthly temperatures at Orlando and Sanford, the two long-term weather stations nearest the basin, range from about 60°F to 82.5°F, Orlando recording slightly higher (Table 1). Normal annual rainfall is about 50.50 in. for the basin, most of which occurs during the June through September rainy season.

Tables 2 and 3 summarize 24-hr to 10-day annual maximum rainfall data for Orlando and Sanford, respectively. A maximum 24-hr rainfall of 9.89 in. was recorded at Orlando in 1933 and 9.12 in. at Sanford in 1945. For a 24-hr storm, the 10 yr, 25 yr, and 100 yr point rainfalls for the study area were estimated

Table 1: Normal Temperature and Rainfall at Orlando and Sanford

Month	Temperature, °F		Rainfall, inches	
	Orlando	Sanford	Orlando	Sanford
January	60.5	59.6	2.17	2.42
February	61.5	60.5	3.15	3.26
March	66.8	65.8	3.29	3.65
April	72.0	70.8	2.28	2.42
May	77.3	76.1	3.75	3.48
June	80.9	80.0	7.06	6.38
July	82.4	81.8	8.03	7.25
August	82.5	81.7	6.55	7.11
September	81.1	80.0	6.39	6.90
October	74.9	73.9	3.06	4.02
November	67.5	66.5	1.89	2.12
December	62.0	61.0	1.93	2.13
Annual	72.5	71.5	49.55	51.14

Table 2. 24-Hr to 10-Day Maximum Rainfall Data for Orlando, Inches

ORLANDO WSO MCCOY(+ORLANDO 1931-73) (1931-1986) - RAINFALL IN INCHES (NOAA NUMBER: 6628)

HIGHEST TOTAL VALUES FOR THE FOLLOWING DURATIONS IN YEAR ENDING DECEMBER 31

YEAR	24 HR	48 HR	72 HR	96 HR	5 DAY	10 DAY	STARTING DAYS:-					
1931	2.59	3.21	4.42	5.04	5.39	5.69	201	200	201	200	199	196
1932	4.49	4.63	4.69	4.76	5.27	6.25	150	149	148	147	150	149
1933	9.89	11.77	12.34	12.83	13.17	13.32	248	248	247	247	247	242
1934	3.84	4.86	7.21	8.20	8.78	9.02	166	166	164	164	164	160
1935	4.43	5.04	5.09	5.23	5.93	6.62	265	265	264	195	265	257
1936	3.06	3.98	4.50	5.42	6.19	8.90	167	166	155	153	153	148
1937	2.87	3.19	4.02	4.20	4.54	6.02	243	227	243	242	243	240
1938	2.90	3.86	4.79	5.37	5.50	6.24	147	147	146	145	145	145
1939	4.08	5.57	6.67	7.52	7.83	8.81	166	165	165	165	165	165
1940	3.22	4.42	4.43	4.44	4.76	7.06	359	242	241	240	242	242
1941	2.72	3.19	3.54	3.72	4.19	4.68	128	292	292	292	91	165
1942	2.04	2.22	2.29	2.32	3.14	5.37	55	107	106	105	237	174
1943	3.38	3.48	3.79	3.86	4.89	7.66	227	227	260	260	261	256
1944	6.97	7.90	8.03	8.12	8.12	8.14	292	292	291	290	290	287
1945	9.41	10.69	11.11	11.60	11.92	13.86	259	258	257	256	255	250
1946	3.65	4.54	4.73	4.97	5.06	7.14	225	262	261	262	259	255
1947	4.42	5.05	5.40	6.40	7.45	8.92	184	183	182	181	180	175
1948	5.43	6.07	6.17	6.17	6.24	9.35	265	264	263	263	261	264
1949	5.30	5.65	5.67	5.70	5.72	7.15	239	238	238	238	238	233
1950	8.90	12.63	14.01	14.19	14.19	14.20	290	290	289	288	287	285
1951	3.13	4.53	5.44	5.89	6.09	8.32	259	319	189	188	188	189
1952	2.27	4.18	4.24	4.24	4.24	4.28	75	85	85	84	83	78
1953	3.87	4.39	4.75	4.75	4.76	7.12	329	328	327	327	325	231
1954	3.54	4.11	6.47	7.04	7.32	8.79	207	207	205	205	205	205
1955	2.38	3.02	3.08	4.44	4.52	5.75	250	187	186	250	249	244
1956	6.97	7.46	7.60	7.74	7.83	8.10	290	289	288	287	286	288
1957	3.82	4.77	5.24	5.47	5.61	6.11	235	235	234	233	232	232
1958	3.18	3.98	4.25	4.41	6.45	8.09	204	208	207	206	204	202
1959	3.45	4.82	5.29	5.48	5.53	7.07	242	168	168	167	167	254
1960	8.39	8.57	9.47	9.65	10.80	13.47	207	207	205	205	207	198
1961	4.41	4.61	5.10	5.18	5.18	8.39	260	259	184	183	182	177
1962	2.69	5.77	6.16	6.16	7.05	8.60	194	261	261	260	208	256
1963	3.84	4.20	4.84	5.22	5.73	6.46	314	175	265	265	175	175
1964	4.90	5.99	5.99	6.91	6.91	8.19	254	253	252	253	252	245
1965	3.00	3.87	4.37	4.59	4.72	9.09	200	199	198	197	196	191
1966	3.90	3.94	3.95	3.95	3.95	5.60	181	181	180	179	178	181
1967	2.08	3.66	4.41	4.49	4.49	6.79	255	167	167	166	165	167
1968	8.67	10.56	10.79	10.87	10.87	12.37	156	156	155	155	154	149
1969	3.37	3.79	3.86	3.91	4.31	5.06	343	343	342	341	273	269
1970	4.37	4.91	4.91	4.91	5.07	5.30	34	33	32	31	33	31
1971	3.15	3.67	3.70	3.96	4.31	5.11	135	134	133	227	226	221
1972	4.32	5.28	5.28	5.28	5.89	8.10	91	170	169	168	221	235
1973	5.69	6.27	6.57	6.95	7.09	7.11	269	269	268	267	266	265
1974	4.60	7.38	9.36	10.36	10.74	12.43	177	177	177	176	175	175
1975	2.51	3.24	3.85	4.25	4.95	6.13	301	171	171	132	130	127
1976	3.09	3.67	5.14	6.01	6.10	7.72	133	133	133	133	133	128
1977	3.63	3.67	3.67	3.94	4.41	5.49	269	268	267	266	265	260
1978	4.19	4.51	4.74	5.64	6.31	7.52	153	153	153	153	153	200
1979	3.69	3.76	3.78	3.83	3.93	5.99	246	246	245	244	243	188
1980	3.16	3.18	3.76	3.80	3.80	4.56	130	129	320	319	318	128
1981	5.06	5.54	5.62	5.66	5.66	7.39	161	161	160	159	158	153
1982	3.83	4.25	4.38	4.95	5.08	7.56	206	168	167	168	167	199
1983	2.79	2.79	3.84	4.05	4.15	5.77	363	362	157	156	156	150
1984	4.54	5.04	5.04	5.04	5.04	5.58	94	93	92	91	90	90
1985	4.06	4.06	5.02	5.57	6.13	7.43	80	79	230	229	228	227
1986	4.23	4.31	4.36	4.55	4.59	6.98	10	10	9	7	7	1

Table 3. 24-Hr to 10-Day Maximum Rainfall Data for Sanford, Inches

SANFORD EXP STN(+SANFORD 1931-56) (1931-1986) - RAINFALL IN INCHES (NOAA NUMBER: 7982)

HIGHEST TOTAL VALUES FOR THE FOLLOWING DURATIONS IN YEAR ENDING DECEMBER 31

YEAR	24 HR	48 HR	72 HR	96 HR	5 DAY	10 DAY	STARTING DAYS:-					
1931	2.22	2.97	4.36	4.49	4.51	5.73	193	241	191	191	191	185
1932	2.58	3.23	3.31	3.64	3.91	4.74	310	309	309	154	154	150
1933	6.90	9.30	9.82	9.86	9.88	9.96	248	248	247	246	245	240
1934	6.40	7.54	8.43	8.84	9.06	9.12	166	165	164	164	164	160
1935	4.33	4.33	4.70	4.88	4.89	6.03	287	286	196	195	194	189
1936	3.08	3.67	3.69	3.69	4.12	5.78	156	155	155	154	152	148
1937	3.36	3.84	4.00	4.19	4.32	5.58	273	273	273	273	273	266
1938	4.28	4.44	4.45	4.74	4.93	7.77	199	198	197	196	195	190
1939	3.63	4.66	5.92	6.49	6.49	6.94	205	165	166	165	164	165
1940	2.98	3.42	3.44	4.11	5.79	6.46	178	358	358	213	174	354
1941	2.58	3.93	4.47	5.11	5.62	7.17	319	292	292	190	190	186
1942	3.05	3.45	3.90	4.11	4.40	5.66	155	154	153	152	152	152
1943	4.25	5.51	6.09	6.50	6.78	8.84	261	261	261	261	261	256
1944	8.98	9.30	9.54	9.73	9.75	9.75	293	293	293	291	290	290
1945	9.12	9.41	9.47	9.98	11.58	12.10	175	174	174	173	171	170
1946	5.32	5.37	5.65	5.71	7.07	9.43	175	174	209	208	175	174
1947	3.22	4.02	4.06	5.73	6.47	8.19	266	44	44	163	163	163
1948	3.24	4.03	4.32	5.19	5.46	9.02	206	265	264	206	206	201
1949	6.03	7.06	7.23	7.36	7.37	9.82	240	239	239	239	239	233
1950	5.31	7.82	9.41	9.84	10.06	10.80	292	291	290	289	289	241
1951	3.45	5.31	5.88	7.53	8.77	8.99	320	271	271	271	271	267
1952	3.51	4.02	4.03	4.03	4.03	5.14	281	281	281	280	279	281
1953	4.47	5.61	5.80	6.36	6.88	10.35	192	192	191	237	237	238
1954	3.02	4.66	6.43	7.37	7.53	8.12	269	208	206	206	206	201
1955	2.74	3.28	5.24	6.08	6.21	7.16	246	243	244	243	243	243
1956	5.90	6.45	6.63	6.85	7.04	8.99	290	289	288	287	286	179
1957	2.77	4.96	5.44	5.49	5.81	6.53	192	217	216	215	214	209
1958	3.97	4.06	4.40	4.45	4.60	7.02	304	304	216	216	216	208
1959	3.55	5.45	6.42	6.49	6.53	7.69	169	168	167	167	167	70
1960	6.29	7.85	8.52	8.83	9.09	12.31	255	254	254	253	252	253
1961	3.03	5.16	5.24	5.24	5.24	5.69	178	78	77	76	75	175
1962	2.89	3.28	3.85	4.15	4.53	4.72	250	250	262	262	262	258
1963	6.14	7.24	7.83	7.87	8.95	10.56	266	266	266	266	264	260
1964	6.20	6.96	7.07	7.96	8.52	8.57	254	253	253	253	253	248
1965	3.27	3.42	4.56	4.79	4.87	7.36	189	189	187	186	186	186
1966	3.92	4.29	4.29	4.29	4.29	6.71	181	181	180	179	178	262
1967	2.90	2.91	3.66	3.71	3.71	5.34	255	255	240	239	238	217
1968	5.56	7.24	8.22	8.57	8.57	13.37	156	156	156	155	154	156
1969	3.60	4.31	4.35	4.41	4.57	5.53	265	343	265	341	263	258
1970	3.30	3.30	3.30	3.85	4.50	6.30	217	216	215	3	217	217
1971	3.17	5.48	5.48	5.48	5.48	5.57	135	38	38	37	36	35
1972	3.89	5.00	5.02	6.42	6.97	9.98	239	170	169	236	235	230
1973	2.64	2.81	3.82	4.23	4.39	6.15	182	270	210	210	210	210
1974	5.37	6.30	7.50	8.68	9.00	13.17	178	178	177	176	175	173
1975	3.23	3.23	3.23	3.88	3.88	5.35	302	302	301	299	299	253
1976	2.86	2.88	2.90	2.90	3.23	5.10	137	136	135	134	249	249
1977	2.72	2.72	2.80	3.39	4.03	5.65	205	204	224	202	205	205
1978	2.54	2.55	2.55	3.88	4.05	5.53	40	40	39	359	359	193
1979	4.07	4.48	4.70	5.33	5.76	6.91	246	246	245	246	246	264
1980	4.50	5.08	5.09	5.20	5.74	6.85	206	206	205	204	206	203
1981	3.51	3.91	3.91	3.91	5.20	6.78	362	239	238	237	239	235
1982	6.61	7.82	8.58	8.58	8.58	8.94	99	99	99	98	97	97
1983	3.44	3.60	3.60	3.77	3.77	5.94	290	290	289	220	219	288
1984	6.78	6.89	6.92	7.28	7.39	10.53	204	204	204	201	201	204
1985	2.90	3.12	3.24	4.38	4.97	6.93	240	240	240	263	262	257
1986	2.24	4.60	5.23	5.47	5.63	5.84	209	10	10	9	8	3

as 6.60 in., 8.30 in. and 11.30 in., respectively (Rao, 1988b).

2.2.3 Surface Water

A. Rivers and Streams: USGS Station No. 02234990 (Little Wekiva River near Altamonte Springs, i.e., at S.R. 434) has stage and discharge records from February 1972 to September 1979 and from February 1981 to the current year. Average discharge for water years 1973-79 and 1983-86 is 35.1 cfs. The monthly mean values are summarized in Table 4.

1. Extreme Value Data: Table 5 presents the highest mean discharges recorded for different durations for the Little Wekiva River at S.R. 434. The one-day values shown are the instantaneous peak values. The maximum discharge of 592 cfs was recorded on July 22, 1984. That discharge corresponds to an elevation of 27.34 ft. NGVD. The highest stage at this site, 28.14 ft. NGVD measured on April 1, 1987, is believed to have been caused by the backwater effects of downstream foot-bridges. This stage corresponded to a discharge of 402 cfs as measured by the USGS. The minimum discharge recorded at this site was 1.9 cfs, on May 7, 1973. The minimum gage height of 23.14 ft. NGVD occurred on January 1, 1985.

2. Frequency Analysis: A frequency analysis was performed on 1972-1987 annual (instantaneous) peak flow data (Table 5) by log Pearson type 3 distribution. Two estimation methods were used; i.e., the WRC (Water Resources Council) Method (U.S. Department of the Interior, Bulletin No. 17B, 1982) and Mixed Moments-I Method, MXM1 (Rao, 1983, 1988a). The results are as follows:

TABLE 4. Monthly Mean Discharges for the Little Wekiva River Near Altamonte Springs (at S.R. 434)

MONTHLY DATA FOR WATER YEARS - LITTLE WEKIVA RIVER AT ALTAMONTE SPRINGS (1973-79,83-86), DISCH-CFS

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1973	10.18	13.90	23.11	30.66	36.79	20.32	18.50	12.72	16.11	41.90	45.03	85.83
1974	60.90	13.34	14.54	13.74	14.68	14.83	11.84	13.49	59.87	156.87	56.87	70.67
1975	26.94	11.35	10.80	12.70	13.79	10.44	8.74	14.30	23.83	63.03	86.84	67.50
1976	87.29	29.60	18.32	17.13	12.86	14.39	13.07	33.10	45.40	52.10	44.13	42.67
1977	17.77	15.10	19.65	19.52	23.14	19.84	14.75	8.27	10.38	12.52	34.90	29.06
1978	14.75	12.50	17.69	23.77	39.49	40.96	14.27	14.90	31.81	108.03	89.88	20.41
1979	13.45	11.37	16.97	44.13	28.54	32.32	10.82	42.10	26.57	43.65	64.00	101.77
1983	26.68	16.97	14.97	15.06	60.24	45.55	43.33	22.58	43.00	52.13	75.35	39.60
1984	30.62	19.03	22.73	29.22	26.38	22.72	31.35	40.90	41.55	96.34	83.90	53.53
1985	26.76	19.45	17.66	15.72	19.18	22.42	22.67	23.19	43.68	45.71	77.23	85.78
1986	57.74	30.14	26.48	79.95	34.53	28.04	20.68	18.82	47.28	33.55	89.41	71.62
MEAN	33.92	17.52	18.45	27.42	28.15	24.71	19.09	22.22	35.41	64.17	67.96	60.77
MAX	87.29	30.14	26.48	79.95	60.24	45.55	43.33	42.10	59.87	156.87	89.88	101.77
MIN	10.18	11.35	10.80	12.70	12.86	10.44	8.74	8.27	10.38	12.52	34.90	20.41

Table 5. High Flow Data for the Little Wekiva River Near Altamonte Springs (at S.R. 434)

@@@@@ LITTLE WEKIVA RIVER AT S.R. 434 NEAR ALTAMONTE SPRINGS, DISCHARGE-CFS (1972-79,83-87)

HIGHEST MEAN VALUES FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MAY 31

YEAR	1	7	14	30	60	120	183	274	1 YEAR
1972	280.00								
1973	119.00	99.43	75.57	55.60	36.75	27.65	27.12	25.25	22.76
1974	334.00	158.29	125.71	108.03	75.62	59.45	43.94	34.10	28.94
1975	384.00	333.43	284.79	182.60	121.97	89.33	64.03	46.89	37.98
1976	409.00	168.43	144.43	120.17	87.37	77.98	60.18	45.46	39.11
1977	454.00	62.14	60.57	54.43	49.95	46.30	36.22	31.09	26.86
1978	151.00	71.71	58.34	53.74	40.54	30.51	24.92	25.32	22.02
1979	394.00	229.37	199.54	151.14	102.18	63.94	46.23	41.68	37.77
1983	280.00								
1984	309.00	138.43	112.71	79.80	64.57	53.14	43.44	37.81	36.21
1985	592.00	212.65	172.18	113.19	95.08	70.19	53.84	41.78	37.04
1986	269.00	193.85	129.75	87.99	84.45	69.38	60.19	53.58	45.83
1987	402.00								

Note: The 1-day values shown are instantaneous maximum discharges

Return Period	Discharge, Cubic feet per second	
	By WRC Method	By MXM1 Method
10 yr	511	506
25 yr	586	572
50 yr	636	613
100 yr	683	648
500 yr	779	715

B. Lakes: Lake Wekiva (Orlando) has stage records from August 1969 to the current year. Lake level is controlled by a concrete weir with removable boards. Since August 1972, an undetermined amount of water has been diverted through a drop culvert and underground pipeline to Horseshoe Lake, 2 miles west for the purpose of recharge to the aquifer. Table 6 summarizes monthly mean elevations recorded for the lake. No other lakes have daily records.

1. Extreme Value Data: Table 7 presents the highest mean elevations recorded for different durations for Lake Orlando (Wekiva). The maximum daily elevation, 87.04 ft. NGVD, was recorded on June 30, 1974. The minimum daily elevation, 82.09 ft. NGVD, was recorded on July 18, 1981.

2. Frequency Analyses: A frequency analysis of 1970-1987 annual peak stages (see 1-day values, Table 7) was performed using log Pearson type 3 Distribution by MXM1 Method. This analysis produced the following results:

Return Period	Lake Elevation, ft. NGVD
10 yr	85.76
25 yr	86.48
50 yr	87.02
100 yr	87.57

TABLE 6. Monthly Mean Stages for Lake Wekiva (Orlando) Near Maitland

MONTHLY DATA FOR WATER YEARS - LAKE WEKIVA NEAR MAITLAND, ELEV - FT NGVD

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1970	83.80	83.62	83.67	83.74	83.79	83.65	83.48	83.37	83.58	83.69	83.79	83.61
1971	83.51	83.48	83.49	83.49	83.94	83.94	83.96	83.98	84.02	84.18	84.11	84.09
1972	83.97	83.68	83.69	83.62	83.88	83.86	84.00	83.97	83.63	83.90	83.96	83.94
1973	83.89	84.11	84.05	84.04	83.98	83.42	83.36	83.05	83.14	83.70	83.40	84.26
1974	84.12	83.11	83.17	83.22	83.25	83.21	83.26	83.13	84.01	84.72	84.25	84.30
1975	84.07	83.55	83.38	83.36	83.83	83.58	83.15	83.12	83.54	84.14	84.61	84.08
1976	83.95	83.38	83.20	83.15	83.17	83.47	83.33	83.80	83.55	83.56	83.83	83.84
1977	83.27	83.26	83.29	83.41	83.43	83.35	83.07	82.68	82.98	83.70	83.93	84.10
1978	83.30	83.27	83.47	83.40	83.99	83.97	83.04	83.10	83.56	84.16	83.85	83.27
1979	83.10	82.93	83.00	83.76	83.41	83.57	83.15	83.43	83.36	83.50	83.57	83.44
1980	83.36	83.26	83.26	83.26	83.16	83.31	83.27	83.27	83.21	83.06	83.25	83.33
1981	82.84	82.87	83.16	82.95	83.25	83.07	82.96	82.54	82.38	82.18	82.43	83.69
1982	83.16	83.58	83.69	83.73	83.37	83.56	83.64	83.39	83.71	83.54	83.58	83.65
1983	83.36	83.42	83.22	83.16	83.79	83.72	83.63	83.19	83.65	83.67	83.89	83.70
1984	83.50	83.30	83.41	83.57	83.39	83.34	83.43	83.48	83.71	83.98	83.75	83.70
1985	83.22	83.01	83.08	82.99	82.95	82.88	82.84	83.00	83.56	83.56	83.78	83.79
1986	83.54	83.32	83.36	83.72	83.50	83.43	83.11	82.84	83.55	83.75	84.05	83.84
MEAN	83.53	83.36	83.39	83.45	83.53	83.49	83.33	83.25	83.48	83.71	83.77	83.80
MAX	84.12	84.11	84.05	84.04	83.99	83.97	84.00	83.98	84.02	84.72	84.61	84.30
MIN	82.84	82.87	83.00	82.95	82.95	82.88	82.84	82.54	82.38	82.18	82.43	83.27

Table 7. Mean High Stages Recorded for Various Durations for Lake Wekiva (Orlando) Near Maitland

@@@@@ LAKE WEKIVA NEAR MAITLAND, ELEVATION - FT NGVD

HIGHEST MEAN VALUES FOR THE FOLLOWING NUMBER OF CONSECUTIVE DAYS IN YEAR ENDING MAY 31

YEAR	1	7	14	30	60	120	183	274	1 YEAR
1970	84.48	84.14	83.96	83.85	83.80	83.78	83.74	83.74	83.68
1971	84.28	84.16	84.10	84.01	83.98	83.95	83.79	83.71	83.70
1972	84.39	84.25	84.22	84.19	84.16	84.10	84.01	83.92	83.92
1973	84.78	84.32	84.18	84.12	84.08	84.06	84.02	83.95	83.78
1974	85.92	85.53	85.04	84.66	84.20	83.88	83.63	83.49	83.41
1975	87.04	86.56	86.06	85.21	84.69	84.45	84.15	83.96	83.78
1976	85.37	84.99	84.87	84.69	84.50	84.23	83.95	83.70	83.65
1977	84.15	84.10	84.03	83.97	83.84	83.70	83.55	83.49	83.37
1978	84.87	84.68	84.50	84.44	84.02	83.78	83.63	83.68	83.52
1979	84.66	84.48	84.40	84.31	84.03	83.72	83.48	83.46	83.43
1980	84.26	83.92	83.79	83.67	83.62	83.48	83.42	83.35	83.34
1981	83.84	83.69	83.56	83.44	83.30	83.21	83.10	83.10	83.04
1982	84.44	84.17	83.96	83.87	83.73	83.62	83.61	83.53	83.23
1983	84.39	84.13	83.95	83.81	83.77	83.62	83.54	83.50	83.49
1984	84.51	84.33	84.18	83.97	83.80	83.73	83.62	83.57	83.53
1985	84.51	84.39	84.15	83.99	83.91	83.79	83.56	83.38	83.26
1986	84.80	84.24	83.93	83.82	83.79	83.72	83.60	83.57	83.46
1987	85.56	84.74	84.36	84.08	83.98	83.89	83.75	83.70	83.69

Neither the streamflow data (Table 5) nor stage data (Table 7) recorded for the basin during 1970-1987 should be regarded as a representative data sample for estimating the long-term maximum values because 1970-1987 is a generally low rainfall period (Table 2). The maximum 24 hr rainfall of 5.69 in. recorded during this period (at Orlando) is below a 10 yr value. During 1931-1969, rainfall in excess of a 10 yr value occurred for seven years at Orlando, four of these events exceeding a 25-yr rainfall of 8.3 in. (see Table 2). Thus, the maximum elevation estimates given above and the streamflow estimates given in Section 2.2.3 should be regarded as underestimates.

3.0 FLOODPLAIN INVESTIGATION

3.1 Hydraulic Analysis

3.1.1 Model Selection: The USACOE computer model "HEC-2 Water Surface Profiles" (1982) was selected for use in this investigation. The program is intended for calculating water surface profiles for steady, gradually varied flow in natural or man-made channels. The effects of various obstructions such as bridges, culverts, weirs, and other structures in the floodplain may be considered in computations. The program is also designed for application in floodplain management studies to assess the effects of channel improvements, levees, and structural modifications on water surface profiles.

3.1.2 Model Input Data: Input parameters used in the HEC-2 model include channel and overbank Manning's roughness coefficients, channel and structure (bridges and culverts) profiles, areas in orifice flow, and weir flow and other loss coefficients.

Field-surveyed channel cross sections and details of culverts and bridges were furnished by Orange and Seminole counties. Locations of cross-sections were selected according to the guidelines provided in the HEC-2 Users Manual. Exhibits A and B, Appendix II, show locations of selected cross-sections.

For obtaining cross-sectional data of the floodplain, the contour information available on photogrammetric maps was used. The aerial photography was conducted in February 1981 for Orange County and in March 1982 for Seminole County. The aerial maps have a scale of 1 inch to 200 feet and show contour lines at 1 foot intervals.

The channel roughness coefficients were assessed based on field inspections and color photographs taken at various sites. Further adjustments were made by calibration based on observed stage and discharge data. Channel characteristics and other stream features at selected locations are shown by photographs presented in Figures 11 through 31. Roughness coefficients for channels varied from 0.012 (where concrete lined) to 0.080. Overbank roughness has a range of 0.035 - 0.100.

3.1.3 Stage-Storage-Discharge Relationships: With few exceptions, stage-discharge relationships for various control structures were determined directly from the HEC-2 output. However, several iterations were made to reflect appropriate backwater effects at each stage. Stage-storage relationships for those portions of the basin where the surveyed cross-sections adequately described the available stage-area relationships were obtained from the HEC-2 output. For lakes and other areas of ponding, the stage-area relationships were determined by digital planimetry and by the use of a compensating polar planimeter.

3.2 Hydrologic Analysis

3.2.1 Model Selection: "The HEC-1 Flood Hydrograph Package" computer model of the USACOE was used for the study. This model is designed to simulate the surface runoff response of a river basin to precipitation by representing the basin as an interconnected system of hydrologic and hydraulic components. It

(Looking Upstream)

(Looking Upstream)

Figure 11. Little Wekiva River at Springs Landing Boulevard

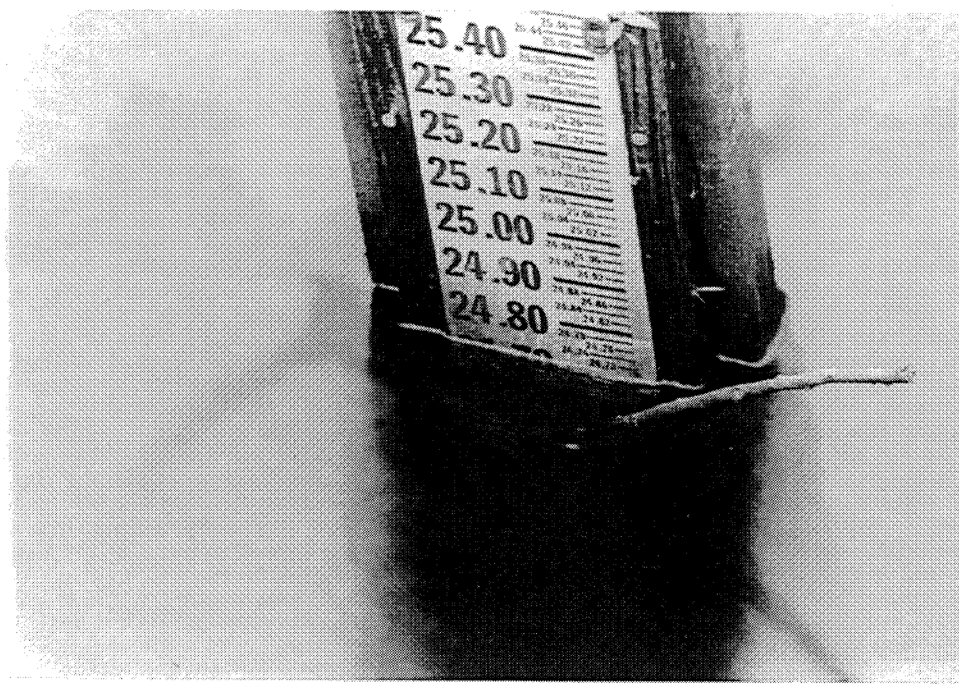


Figure 12. USGS Gaging Station No. 02234990: Little Wekiva River Near Altamonte Springs, FL

(Looking Upstream)

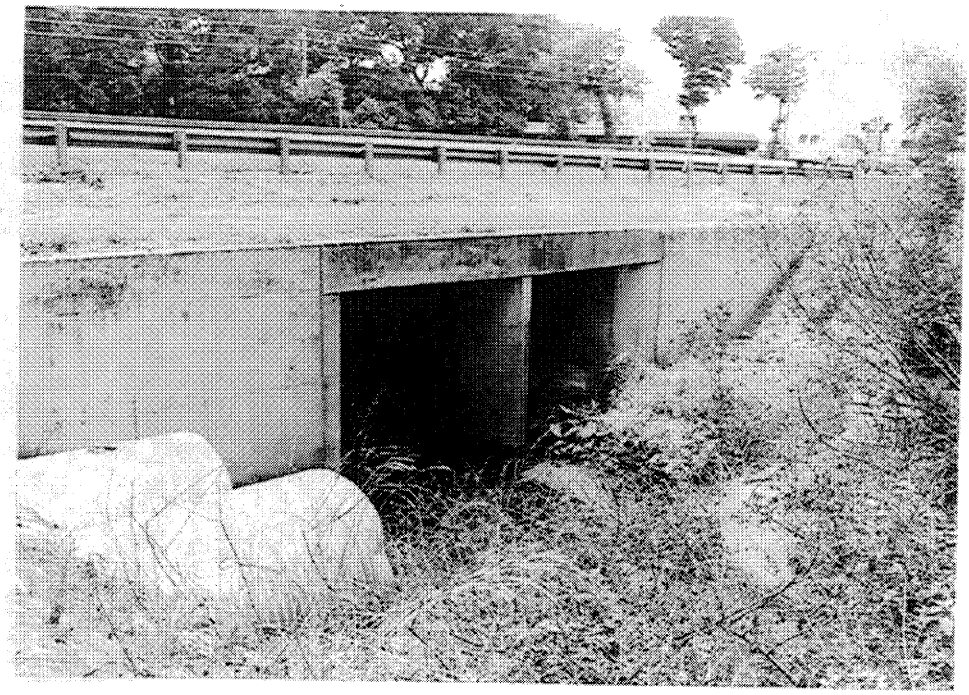
(Looking Downstream)

Figure 13. Little Wekiva River at State Road 434 Bridge

(Looking Upstream)

(Looking Downstream)

Figure 14. Little Wekiva River at Montgomery Road Bridge



(Looking Upstream)

(Looking Downstream)

Figure 15. Little Wekiva River at State Road 436 Box Culverts

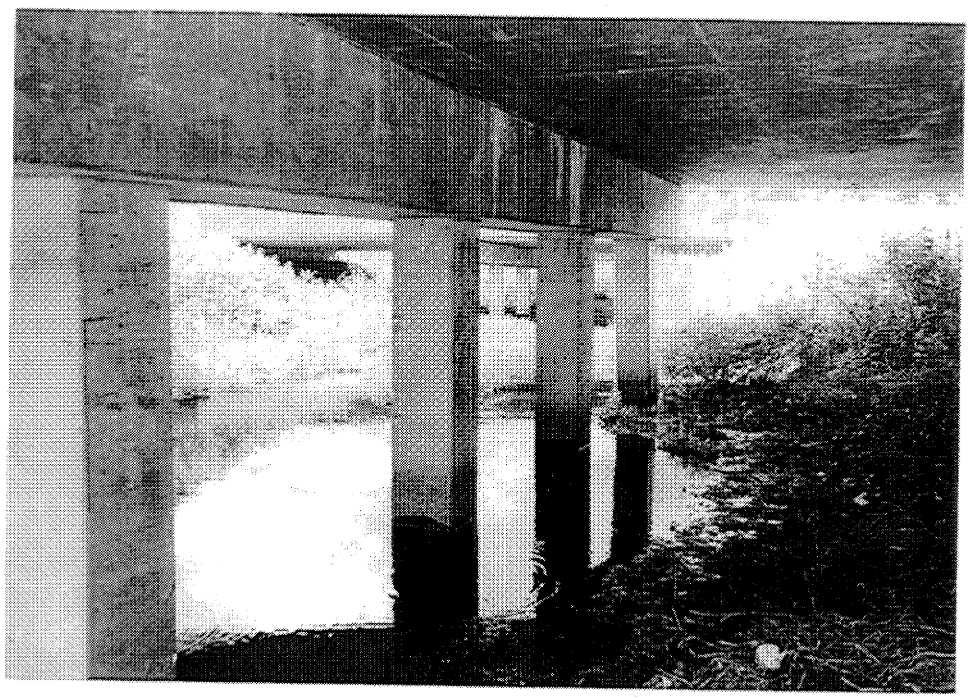
(Looking Downstream)

(Looking Upstream)

Figure 16. Little Wekiva River at Northwestern Avenue Bridge

(Looking Downstream)

Figure 17. Little Wekiva River Upsteam of Trout Lake



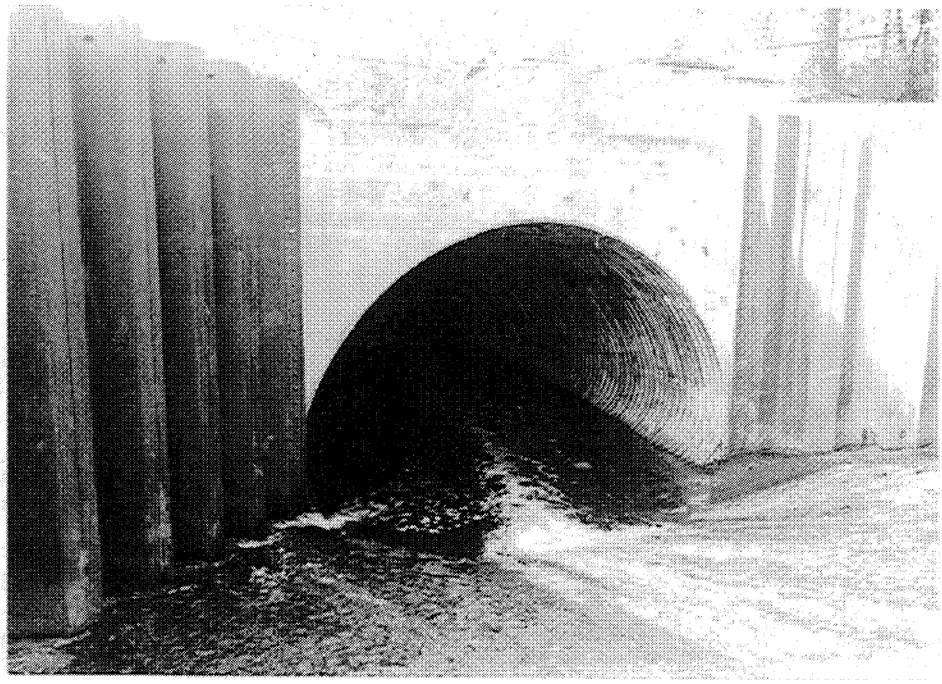
(Looking Downstream)

Figure 18. Little Wekiva River at Forest City Road (SR434) Bridge

(Looking Upstream)

(Looking Downstream)

Figure 19. Little Wekiva River at Oranole Road Bridge



Inlet

Outlet

Figure 20. Little Wekiva River at Riverside Acres Culvert

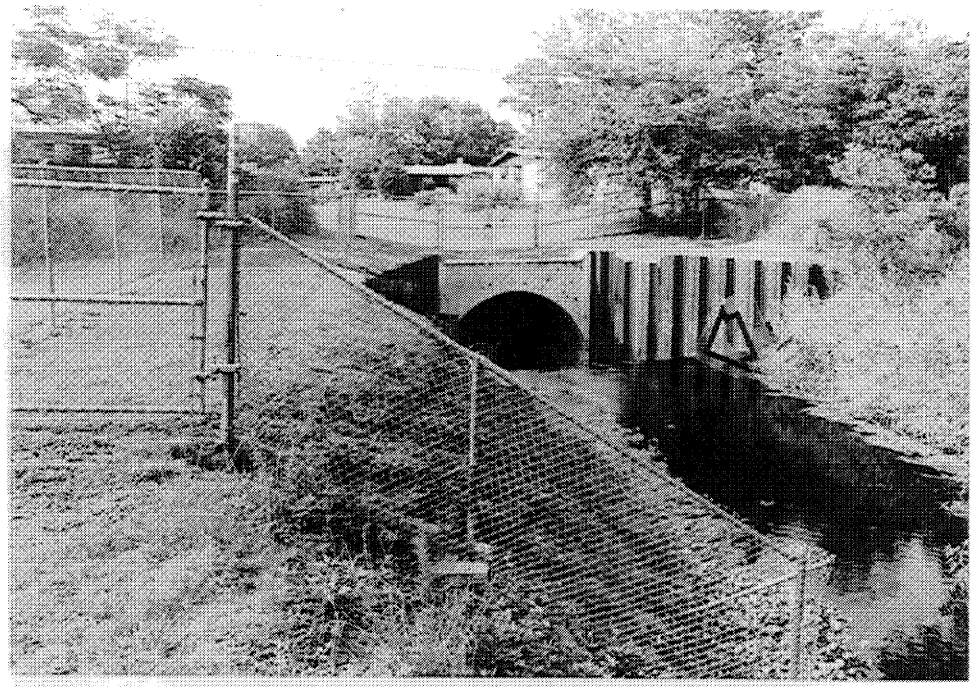
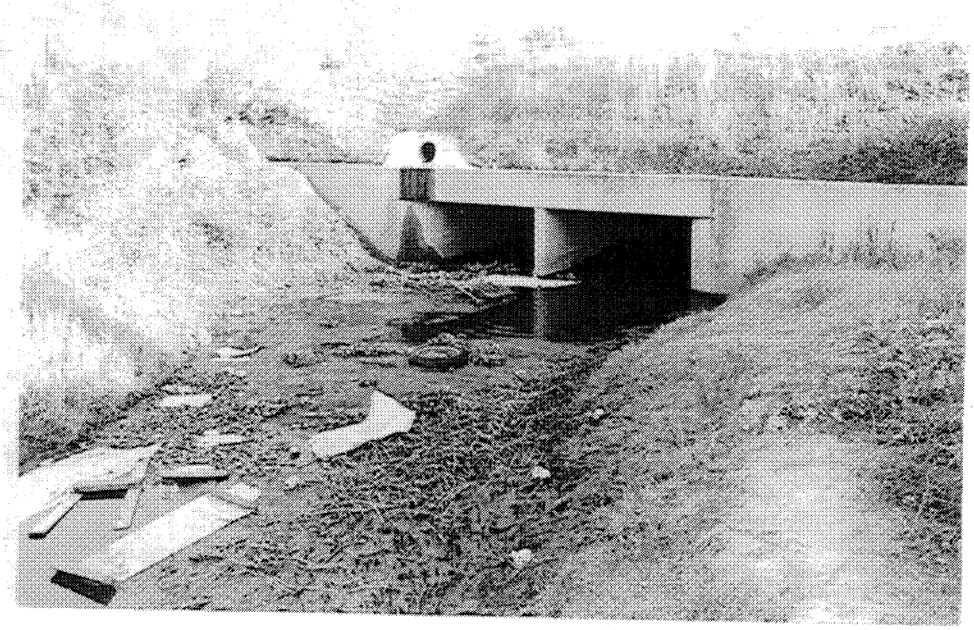


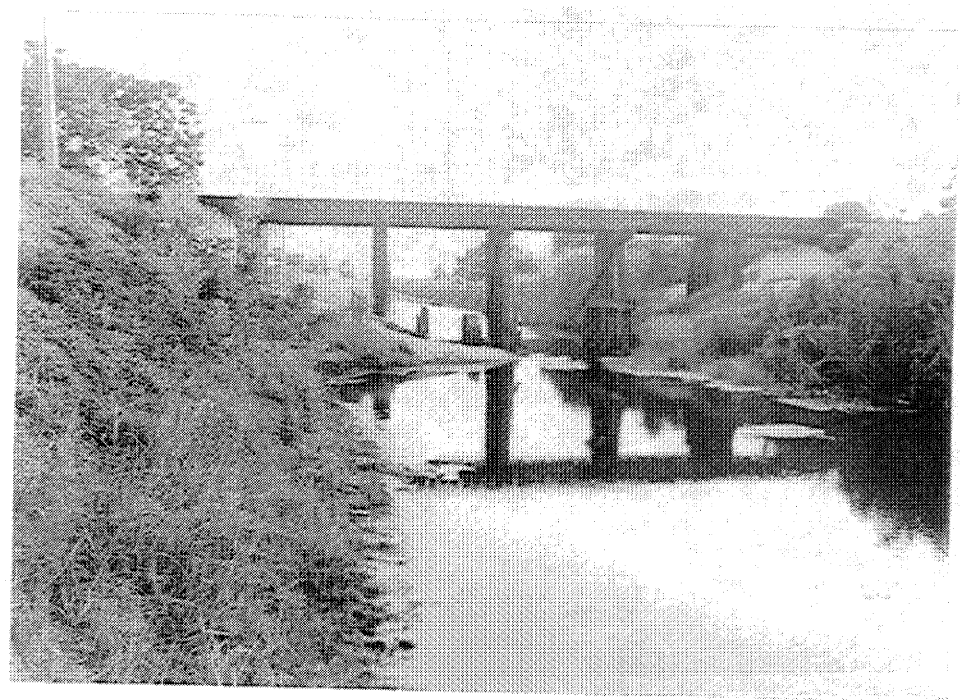
Figure 21. Sheetpile Weir at Inlet to Riverside Acres Culvert

Figure 22. Channel upstream of Riverside Park Road



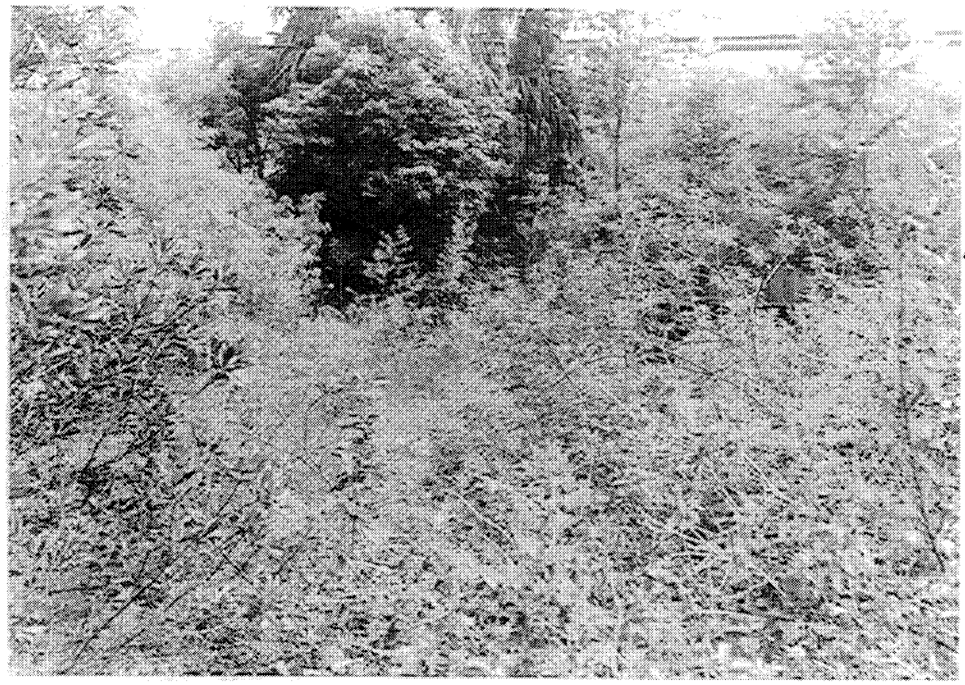
(Looking Upstream)

Figure 23. Little Wekiva River at Edgewater Drive

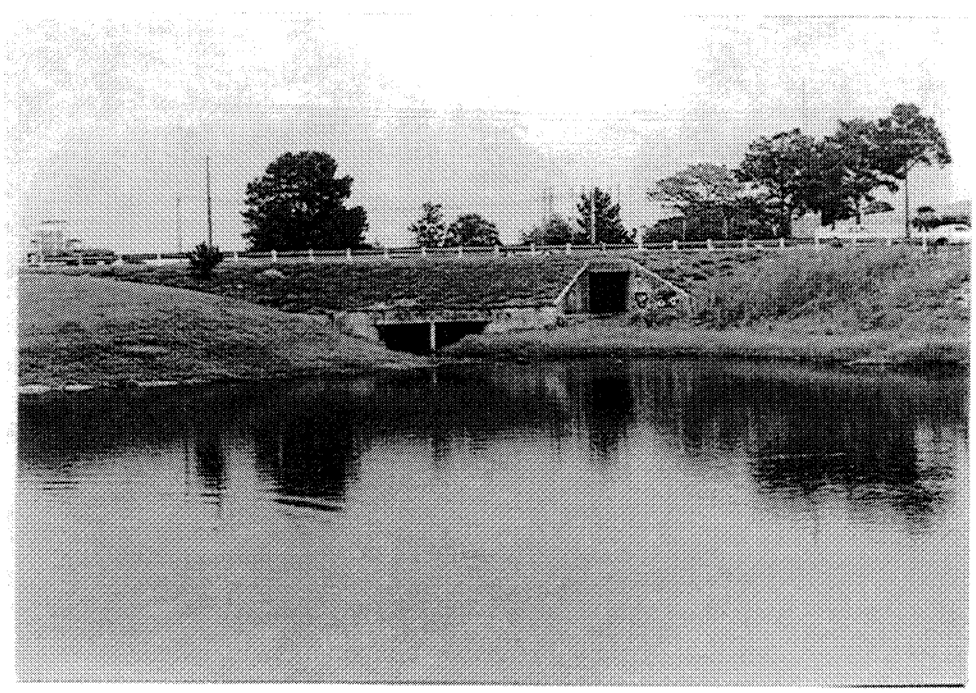


(Looking Upstream)

Figure 24. Little Wekiva River at SCL Railroad Bridge (Sta. 546+00)

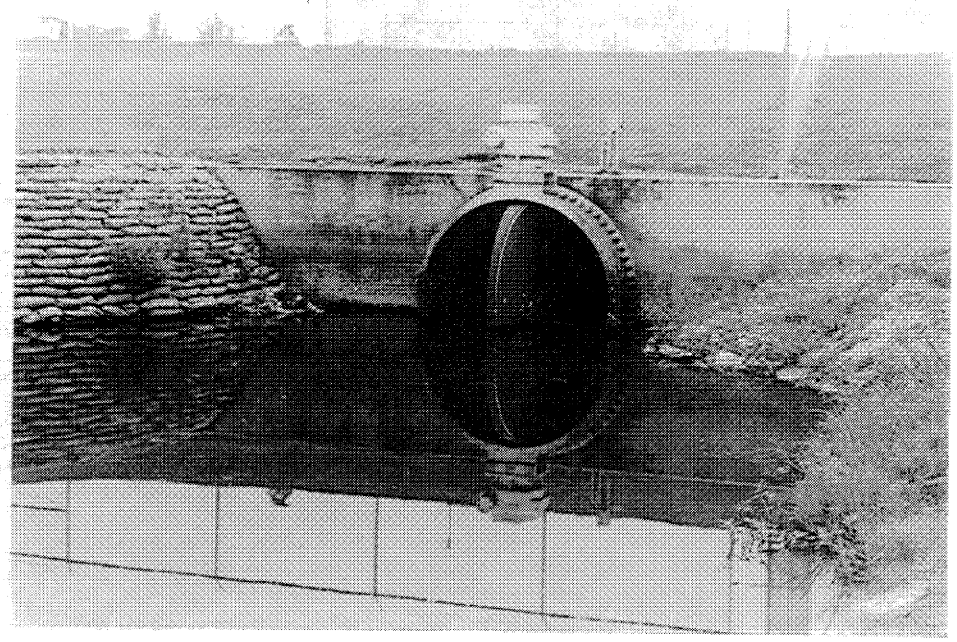


(Looking Upstream)



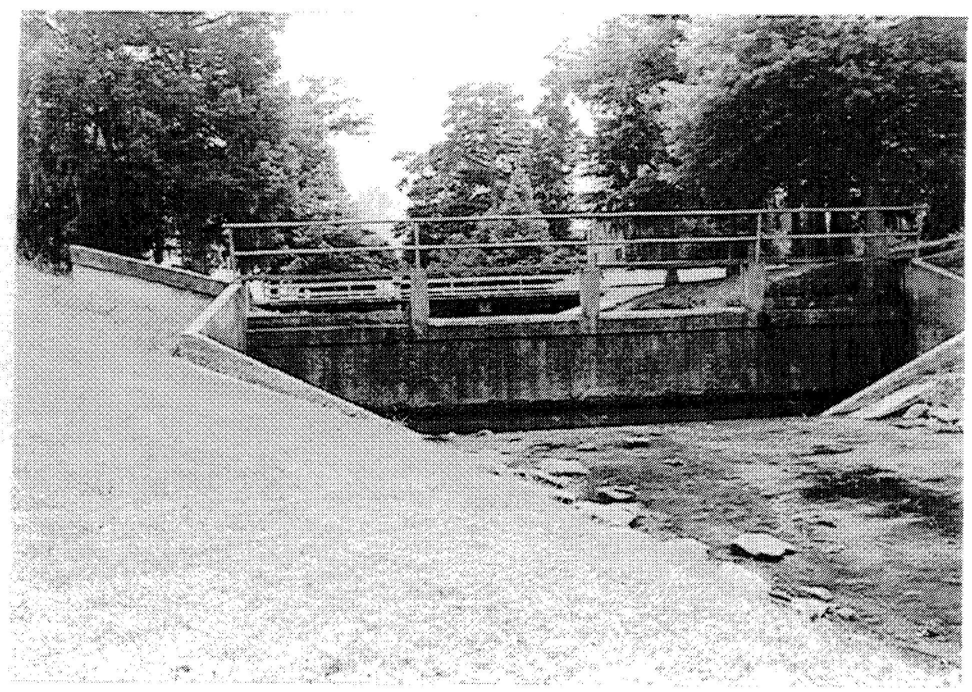
(Looking Downstream)

Figure 25. U.S. 441 Box Culverts



(a)

(Looking Upstream)



(b)

(Looking Upstream)

Figure 26. Lake Orlando Control Structures: (a) Butterfly Valve at Rosewood Way, and (b) Lake Orlando Weir

(Looking Upstream)

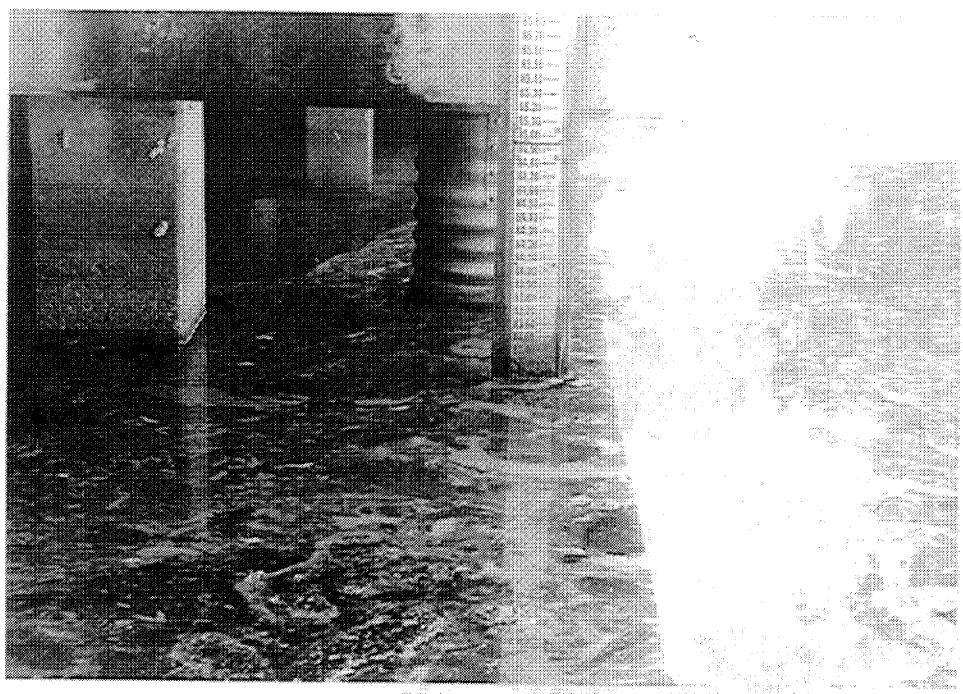
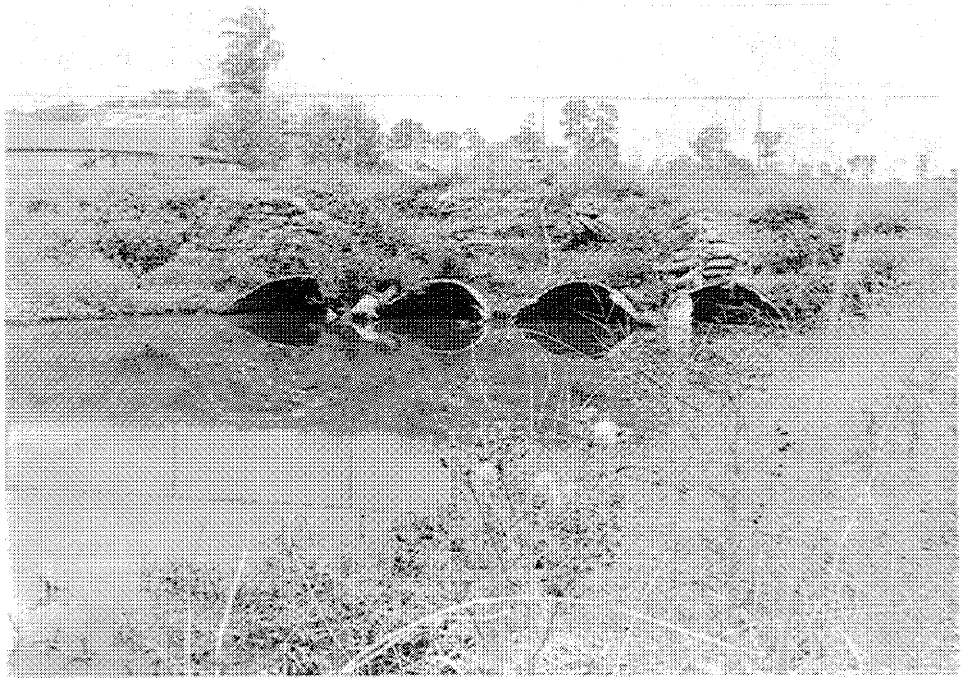
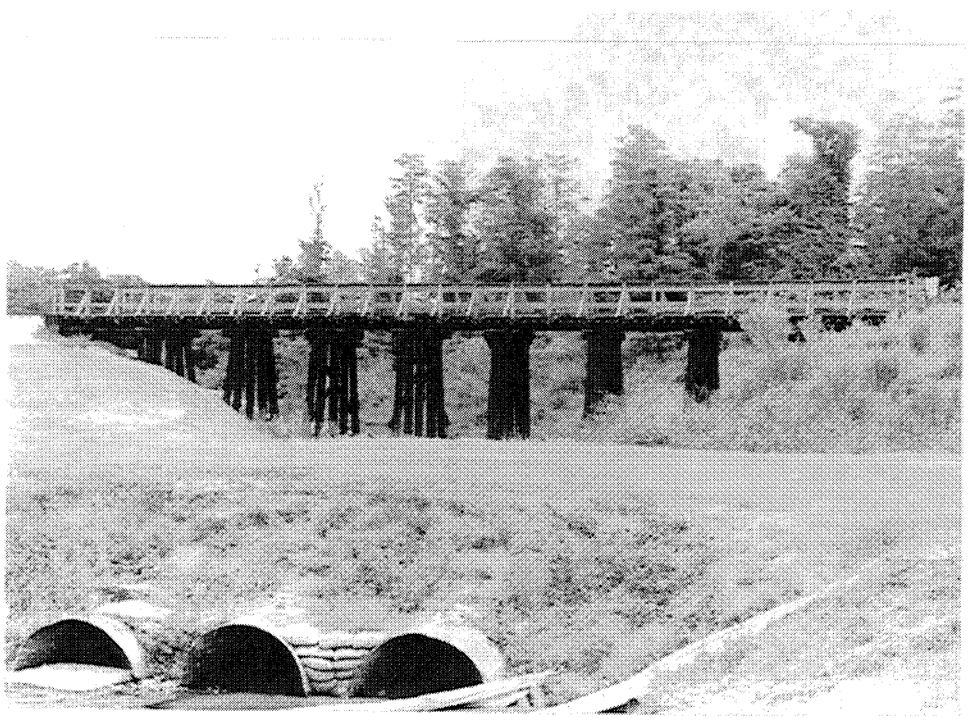


Figure 27. USGS Gaging Station No. 02234814: Lake Wekiva (Orlando) Near Maitland, FL



(Looking Downstream)

Figure 28. Little Wekiva River at Orlando Parkway South

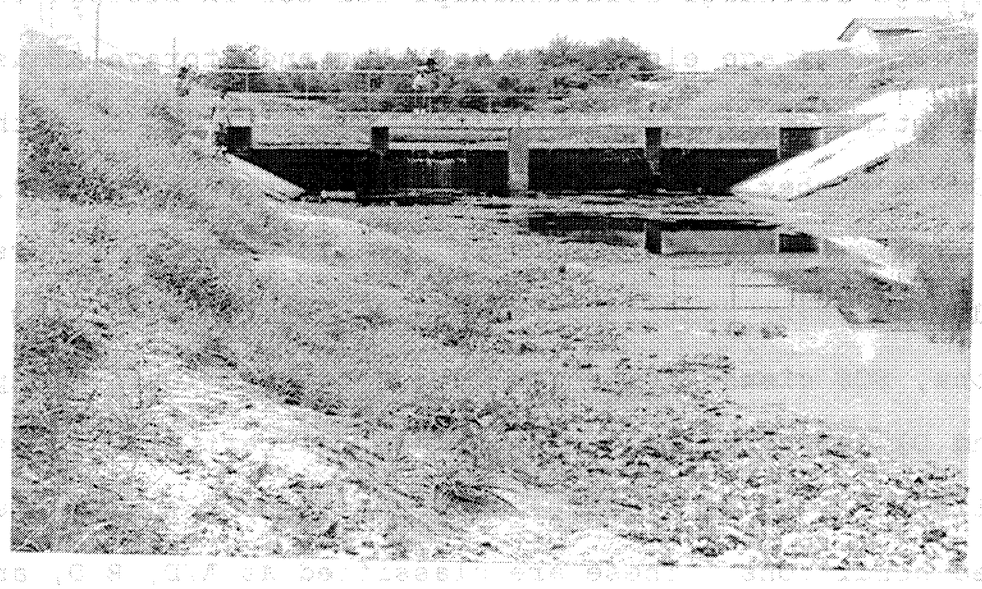


(Looking Downstream)

Figure 29. Little Wekiva River at SCL Railroad Bridge (Sta. 679+34)

(Looking Downstream)

Figure 30. Little Wekiva River at Seaboard Road Bridge (Sta. 687+84)



(Looking Upstream)

Figure 31. Lawne Lake Control Structure

has five major components; i.e., a land surface runoff component, a river routing component, a reservoir component, a diversion component, and a pump component. Available techniques for modeling some of these components are not unique. Several different, but equally meritorious methodologies exist in literature. The HEC-1 program incorporates all well known methodologies. This program provides the user with a choice of these methodologies. The reader is referred to the "HEC-1 Flood Hydrograph Package" Users Manual (1981) for details.

For modeling the surface runoff component, the Soil Conservation Service (SCS) methods (SCS National Engineering Handbook, 1972) were selected.

3.2.2 Model Input Data: Input parameters for the HEC-1 model include: SCS runoff curve number (CN), watershed lag, basin area, Muskingum Routing parameters for channel routing, stage-storage-discharge relationships for use in storage routing, and the initial stage elevations in lakes and storage areas.

For estimating runoff from storm rainfall, SCS uses the Runoff Curve Number (CN) method (see chapters 4 through 10, NEH-4, SCS, 1972). Determination of CN depends upon the watershed's soil and land cover conditions. For adequately describing these conditions, SCS classifies soils into four hydrologic groups (A, B, C, and D) depending on their drainage properties. However, some soils in A, B, or C group behave as group D soils under saturated conditions. These are classified as A/D, B/D, and C/D groups, respectively. The CN value of a given soil is determined from its hydrologic soil group and land use. Soil data for the study area are extracted from the SCS Soil Surveys (SCS, 1960 and 1966). Land use is determined from the 1981-1982 aerial photographs and the land use maps prepared by the Center for Wetlands, University of Florida (1973). Ten different groups of land use were identified for the study area (Table 8). The CN values for various hydrologic soil groups associated with these land uses are summarized in Table 9. An average antecedent moisture condition (AMC II) was assumed for the basin in determining these values. This condition represents a 5-day antecedent rainfall of 0.5 in. to 1.1 in. during the dry season and 1.4 in. to 2.1 in. during the wet season. For each subbasin, a weighted CN was calculated based on soils and land use.

The basin lag (L) for a given subbasin can be calculated based on travel time or time of concentration (T_c) by the relation L= 0.6 T_c. However, for most of the subbasins in this study the SCS equation given below was used to calculate L.

$$L = \frac{\ell^{0.8} (S + 1)^{0.7}}{1{,}900\ Y^{0.5}}$$

where

L = lag in hours,

ℓ = hydraulic length of watershed in feet,

$S = \frac{1{,}000}{CN'} - 10$ and,

(where CN' is the retardance factor and is equivalent to the runoff curve number)

Y = average watershed land slope in percent.

TABLE 8. Summary of Existing Land Use in the Little Wekiva River Basin

TYPE OF LAND USE	AREA (Acres)	PERCENTAGE(%)
Open Land, Recreation	1844.0	6.9
Residential - Low Density	2372.0	8.8
Residential - Medium Density	6404.0	23.9
Residential - High Density	2451.0	9.1
Improved Pasture	1509.0	5.6
Woods	1880.0	7.0
Swamp	5456.0	20.4
Marsh	280.0	1.0
Industrial	2462.0	9.2
Lakes	2164.0	8.1
Total	26,822.0	100.0
	========	=====

TABLE 9. Runoff Curve Numbers for Selected Soil and Land-Use Complexes.

(Antecedent Moisture Condition II)

DESCRIPTION OF LAND USE	HYDROLOGIC SOIL GROUP				
	A	B	C	D	A/D
Open land, recreation	39	61	74	80	80
Residential - low density (1/3 acre lots)	57	72	81	86	86
Residential - medium density (1/4 acre lots)	61	75	83	87	87
Residential - high density (1/8 acre lots)	77	85	90	92	92
Improved pasture	68	79	86	89	89
Citrus	55	73	82	86	86
Swamp	65	82	89	95	82
Marsh	78	90	94	98	90
Industrial	89	92	94	95	95
Lakes	98	98	98	98	98

A/D - This soil changes its behavior from Group A to Group D with saturation. The values given under Column A/D are used in this study for this kind of soils.

The HEC-1 program uses a peak rate factor of 484 for runoff calculations by the SCS methods. The peak rate factor, however, has been known to vary from 300 in flat swampy areas to 600 in steep terrain. For the Little Wekiva River Basin it can be less than 484. However, the peak rate factor of 484 was retained for this study.

It is necessary to revise the L value (or T_c) upwards for the following conditions: 1) ponding behind small or inadequate drainage systems, including storm drain inlets and road culverts; b) reduction of land slope through grading; and c) the presence of pond and swamp areas in the basin. For such subbasins, L calculated by the SCS equation was increased by a factor of 1.67 after a few trial calculations. The initial abstraction for these basins also was increased appropriately.

Initial elevations for lakes and other storage areas were estimated based on long-term stage records, USGS quadrangle maps, and the photogrammetric maps. Table 10 summarizes subbasin areas together with basin weighted CN and lag (L) values. Table 11 presents the initial elevations assumed for the study. The initial elevations assumed for some of the lakes are much below those found on the USGS quadrangle maps which represent the elevations of the 1950s. Major urban development and drainage improvements took place in the basin since the 1950s and most of the lakes cannot be as high as those shown on these maps under normal conditions. For example, the USGS quadrangle maps show elevations of 86.00 ft. NGVD and 66.00 ft. NGVD for Lake Orlando

Table 10. Summary of Subbasin Areas, Runoff Curve Numbers and Lag Time

Subbasin Number	Area (acres)	Weighted Runoff Curve Number	Lag (hrs)
1	147.3	79.0	1.77
2	130.6	87.8	1.76
3	396.9	86.1	4.52
4	251.6	89.5	1.79
5	1,156.0	85.9	11.70 *
6	250.9	81.1	1.77
7	574.5	84.3	2.50 *
8	227.0	80.0	2.07
9	181.6	91.6	1.24
10	93.7	82.3	1.24
11	632.0	83.5	4.90
12	207.4	64.1	3.36
13	667.3	82.4	1.51
14	395.3	93.6	1.08
15	58.8	92.6	0.32
16	28.8	94.6	0.10
17	674.1	92.1	2.79
18	60.7	93.1	0.21
19	1,288.7	94.1	1.15
20	292.1	78.2	5.67 *
21	230.9	83.1	3.17
22	86.7	80.9	1.74
23	437.6	91.5	3.95
24	212.1	83.9	0.55
25	78.7	70.9	0.90
26	406.1	73.1	4.12 *
27	64.9	77.8	0.54
28	170.4	74.4	1.71
29	461.8	77.3	2.80
30	388.7	82.7	2.92 *
31	243.4	83.6	2.20 *
32	335.4	69.2	3.34
33	437.4	70.4	6.40 *
34	157.9	72.9	1.21
35	86.9	65.5	1.15
36	396.7	83.7	1.06
37	63.6	88.0	0.54
38	265.6	65.1	2.53 *
39	176.0	71.4	1.63 *
40	142.2	77.9	1.96 *

* L = 1.67 *(Lag calculated by SCS Equation)

TABLE 10. (Continued)

Subbasin Number	Area (Acres)	Weighted Runoff Curve Number	Lag (hrs)
41	946.3	76.9	0.83
42	102.8	70.7	0.98
43	986.3	70.8	3.10 *
44	184.4	63.9	1.85 *
45	970.1	80.0	5.10 *
46	550.3	64.8	3.67
47	15.6	40.6	0.99
48	24.7	65.6	0.46
49	109.9	62.7	0.68
50	40.8	59.2	1.01
51	18.7	68.0	0.23
52	25.3	68.0	0.25
53	14.3	66.0	0.28
54	80.7	59.4	1.39
55	382.9	64.3	0.85
56	166.2	75.3	1.85 *
57	161.4	63.3	0.91
58	57.3	69.4	0.80 *
59	24.1	65.8	0.28
60	44.7	73.7	0.42
61	52.7	64.3	0.67
62	276.9	73.1	0.94
63	256.0	70.2	3.24
64	39.6	80.7	0.28
65	283.3	67.5	6.32 *
66N	259.1	73.1	1.24
66S	290.5	73.1	3.00 *
67	284.5	65.1	2.55
68	852.6	61.2	5.21
69	351.9	66.8	2.54
70A	104.2	81.9	0.57
70B	111.9	81.9	1.15
71	362.1	71.4	5.70 *
72	247.0	72.0	3.35 *
73	819.6	74.7	7.95
74	333.4	57.1	2.03
75	3,622.0	87.6	11.35 *

NOTE: The non-contributing subbasins (Subbasins 101 through 109) have a total area of about 810 acres.

* L = 1.67 *(Lag calculated by the SCS Equation)

Table 11. Initial Lake and Pond Elevations Assumed in the Study

Lake Name or Pond Designation	Initial Stage (ft NGVD)
Mercy Drive	87.71
Lawne Lake	87.71
Lake Orlando Parkway South	83.80
Lake Orlando	83.80
Lake Silver	91.25
Lake Daniel	90.70
Lake Sarah	87.90
Little Lake Fairview	89.00
Lake Fairview	87.90
Bay Lake	89.70
Butterfly Valve at the Mouth of Tributary H	78.50
Triple Boxes US-441	78.50
Hungerford Lake	94.00
Lake Lucien	89.50
Harvest Lake	89.50
Lake Weston	81.50
Eatonville Borrow Pit	93.00
Lake Shadow	81.50
Lake Lovely	76.00
Lake Lockhart	72.00
Lake Gandy	72.00
Lake Eve	80.00
Lake Rose	70.00
Little Bear Lake	103.80
Bear Lake	103.80
Cub Lake	101.00
Lake Lotus	57.00
Trout Lake	57.00
Spring Lake	64.00
Basin 1A (SB47)	92.00
Basin 1B (SB48)	77.00
Basin 1C (SB49)	63.00
Basin 1D (SB50)	63.00
Basin 1E (SB51)	85.00
Basin 1F (SB52)	72.00
Basin 2 (SB53)	64.00
Basin 3 (SB54)	54.50
Basin 4 (SB56)	50.00
Mirror Lake	60.50
Basin 5 (SB57)	52.00

Table 11 (Continued)

Lake Name or Pond Designation	Initial Stage (ft NGVD)
Basin 6 (SB58)	49.00
Basin 7B (SB60)	49.00
Basin 8 (SB64)	48.00
Forest Lake	65.00
Pearl Lake	59.00
Lake Harriet	52.10
SR434 Reservoir	44.80
Jamestown Blvd Culvert	38.10
Tributary B Ponds	35.00
Tributary A (SB69)	27.00
Tributary A (SB70)	24.00
Depressions (SB74)	40.00

(Lake Wekiva) and Spring Lake, respectively. Water levels in these two lakes are currently controlled by weirs with crest elevations at 83.5 ft. NGVD and 64.00 ft. NGVD, respectively. An elevation of 86.00 ft. NGVD in Lake Orlando was equaled or exceeded only during one year since the records began in 1969 for this lake (see Table 7). Table 11 represents elevations based on the recent information.

3.2.3 Calibration: Model calibration/verification was performed based on the rainfall event of March 25 through March 31, 1987. Rainfall data collected every 5 minutes and recorded every fifteen minutes were available from the Water Management Section, Orange County Engineering Department, for this period at a site adjacent to the Lake Fairview outfall structure. The rainfall totaled 9.4 in. in depth. This corresponds to a 5-yr, 7-day storm (Miller, 1964). A stage of 85.60 ft. NGVD was observed for Lake Orlando at 1:30 p.m. on March 31, 1987. The model gave a value of 85.64 ft. NGVD.

3.3 Flood Discharges

3.3.1 Simulation of Storm Events: Flood discharges for 10-yr, 25-yr, and 100-yr return periods were obtained by simulating single storm events of the same recurrence intervals. Point rainfall estimates for the study area are 6.60 in., 8.30 in. and 11.30 in. respectively for the 10-yr, 25-yr, and 100-yr storm events of 24-hour duration. A specific rainfall distribution developed for the Little Wekiva River Basin was used in this study. The 24-hr point rainfall amounts mentioned above were adjusted for the size of the contributing area at major locations of the basin. For example, at U.S. 441 (Figure 5) the river has a total contributing area of about 12.6 sq. mi. To compute 100-yr 24-hr storm discharge for this location an adjusted rainfall amount of 11.3 x 0.98 = 11.07 in. was used in modeling. The adjustment factor of 0.98 was obtained from the Weather Bureau Publication (Hershfield, 1961). The derivation of storm distribution and details of other modeling techniques are described in the SJRWMD Technical Publication SJ 88-6 (Rao, 1988c).

The aerial photographic maps of 1981/1982 were used for inventorying major structural features (bridges, culverts, roads, etc.) of the basin. Since these photographs were taken, however, urban development has occurred throughout the basin. Notable structural changes affecting flood stages are: construction of Rosewood Way and Winter Rose Drive near U.S. 441 (Figure 32); replacement of a culvert with inadequate discharge capacity by a wider walk-way bridge downstream of Lake Orlando Weir; and the removal of a low capacity culvert downstream of Old Silver Star Road between Lawne Lake and Lake Orlando (Figure 5). With the exception of Rosewood Way/Winter Rose Drive, which could cause a major restriction to the flow path between Lake Orlando and U.S. 441 during a 100 yr storm event, no other recent changes were considered in the study. It was also assumed that bridges and culverts are well maintained and free of silt or debris. In the next phase of study (water management study) the effect of siltation of various structures on flood elevations will be evaluated.

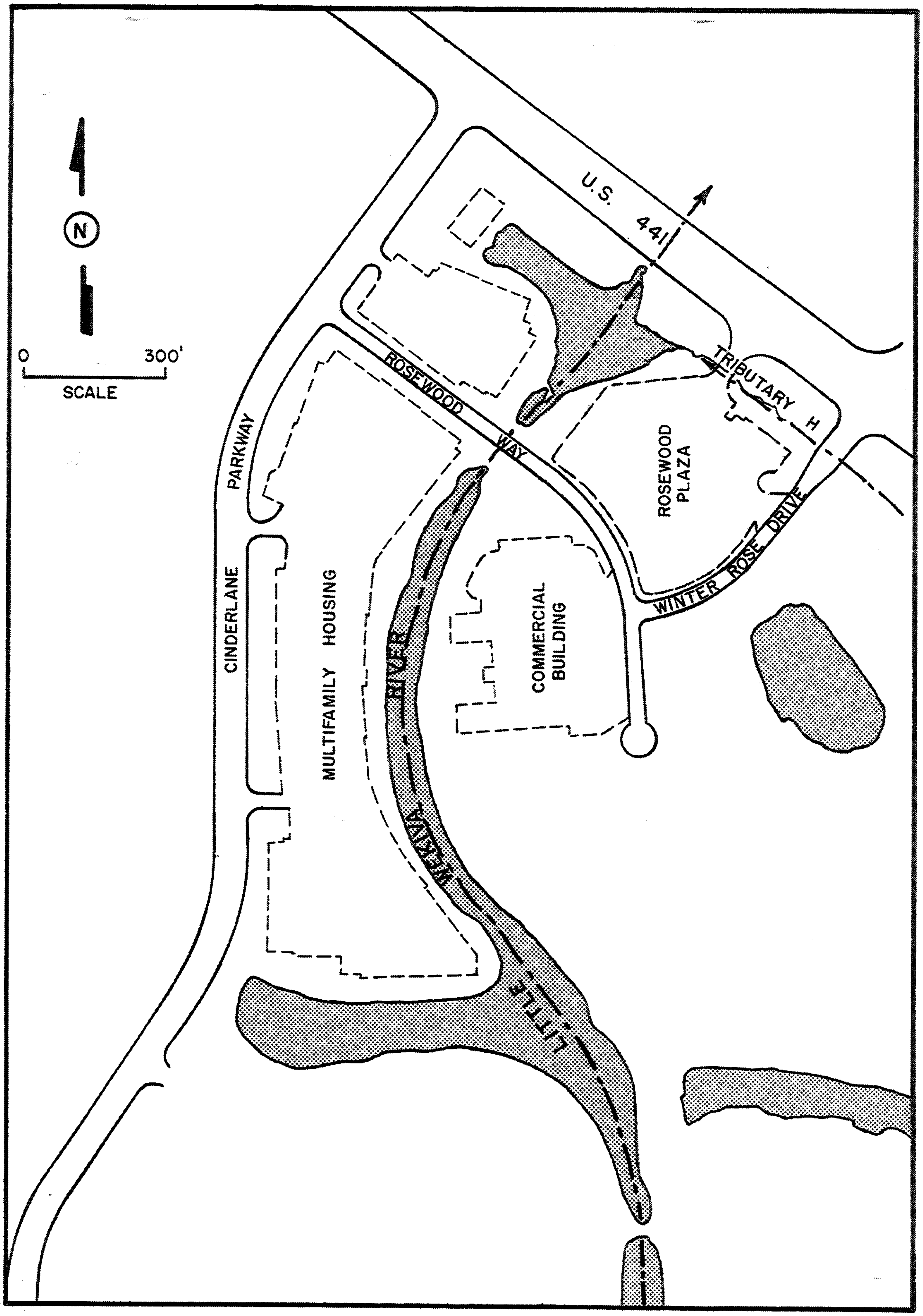


Figure 32. Rosewood Way and Winter Rose Drive Complex near U.S. 441

Peak discharges for the 100-yr return period ranged from 494 cfs to 3,030 cfs on the mainstem of the Little Wekiva River and 16 cfs to 559 cfs on the tributaries (Table 12). Major lakes on both the mainstem of the river and the tributaries provided considerable attenuation to peak flows.

3.3.2 Comparison with Other Studies: The USACOE, Jacksonville District, completed floodplain information reports for the Little Wekiva River in Orange and Seminole counties in April 1970 and September 1970, respectively. Flood discharge estimates presented in these reports were also used in the preparation of 'Flood Insurance Study' reports for the unincorporated areas of Orange and Seminole counties (FEMA, 1986 and 1987, respectively) and for the City of Altamonte Springs (FEMA, 1979). Discharges from these reports are compared with discharges from the present study (SJRWMD) in Table 13. Major urban development in the basin since 1970 and more detailed modeling procedures used in this study resulted in the higher estimates of peak discharges for the basin compared to the FEMA (i.e., USACOE) 1970 estimates. The result was expected.

3.4 Flood Elevations

3.4.1 Computation of Peak Elevations/Flood Profiles: Peak elevations for all lakes and storage areas were obtained by the HEC-1 modeling. For the mainstem of the Little Wekiva River and other tributaries, flood profiles were computed by the HEC-2 program using peak discharges generated by the HEC-1 program.

Table 12 includes the 10-yr, 25-yr, and 100-yr maximum elevations for key locations in the basin, including lakes. Appendix I presents flood profiles.

Table 12. Summary of Peak Discharges, Elevations, and Velocities.

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
LITTLE WEKIVA RIVER										
0 + 00	Limit of Study	1200	1810	3030	18.00	19.20	20.00	0.46	0.44	0.59
38 + 20	Confluence w/ Tributary A	1200	1810	3030	19.70	20.20	20.90	2.96	2.70	3.17
46 + 40	Springs Landing Blvd.	1200	1810	3030	20.24	20.65	21.31	2.28	3.01	4.14
60 + 96	Channel *	1170	1760	2950	20.88	21.48	22.40	4.23	4.17	4.34
95 + 84	Footbridge 1	1140	1720	2870	26.40	26.60	27.27	6.33	7.27	7.16
102 + 44	Channel *	1140	1720	2870	26.65	27.06	27.89	3.75	4.48	4.85
105 + 80	Footbridge 2	1110	1670	2780	27.35	27.94	28.77	4.26	4.95	5.72
107 + 85	Channel *	1110	1670	2780	27.48	28.10	28.95	3.17	3.76	4.59
111 + 01	Footbridge 3	1070	1620	2720	27.81	28.48	29.39	3.66	3.88	4.20
114 + 14	Footbridge 4	1040	1580	2640	28.56	29.34	30.26	4.75	5.78	6.72
116 + 56	Woodbridge Ave.	1010	1530	2560	30.11	31.35	32.69	3.34	3.71	4.66
118 + 86	Channel *	1010	1530	2560	30.19	31.44	32.84	2.69	3.18	4.19
120 + 66	S.R. 434	1010	1530	2560	30.59	31.85	33.36	3.04	3.15	3.73
160 + 66	Channel *	1010	1530	2560	34.55	35.73	37.55	5.10	6.10	7.34
170 + 21	Montgomery Road	809	1220	2040	36.09	37.71	40.25	4.58	4.06	5.63
200 + 51	Confluence w/ Tributary B	809	1220	2040	39.34	40.24	41.79	4.33	5.08	4.47
206 + 51	Footbridge 5 (Dismantled)	809	1220	2040	39.96	40.89	42.19	4.33	5.08	4.47
224 + 81	Confluence w/ Tributary C	712	1020	1570	41.60	42.55	43.70	4.76	4.96	5.66
261 + 95	Abandoned SCL RR Bridge	631	869	1410	48.79	49.54	51.23	9.37	9.94	10.15
273 + 45	Channel *	631	869	1410	52.07	52.94	54.39	3.42	3.75	4.41

NOTE: At all named streets, elevations refer to the upstream side of a bridge or culvert, velocities are the maximum values. An asterisk (*) refers to a typical channel section between two structures (e.g., bridges); these locations are included mainly to indicate flow velocities in the channel.

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
LITTLE WEKIVA RIVER (CONTINUED)										
275 + 55	S.R. 436	631	869	1410	52.31	53.28	55.04	3.90	4.85	6.80
277 + 70	Orange Ave.	631	869	1410	52.56	53.65	55.71	5.34	6.22	7.88
283 + 90	Channel *	631	869	1410	53.94	54.95	56.85	5.43	5.79	6.30
290 + 20	Footbridge 6	609	833	1370	56.46	57.01	58.65	4.21	4.45	4.88
296 + 40	Channel *	609	833	1370	57.15	57.87	59.53	3.39	3.86	4.41
297 + 35	Weathersfield Ave.	609	833	1370	57.55	58.45	60.49	5.40	6.48	8.39
301 + 85	Channel *	609	833	1370	58.16	59.06	60.98	4.44	4.86	5.35
302 + 47	Footbridge 7	609	833	1370	58.69	59.57	62.32	6.32	6.64	6.96
307 + 87	Channel *	609	833	1370	59.41	60.33	62.83	1.55	1.64	1.45
308 + 54	Covered Bridge at Stables	609	833	1370	60.73	61.67	63.02	5.23	4.95	4.58
309 + 04	Confluence w/ Tributary F	609	833	1370	60.73	61.68	63.03	3.21	3.54	4.30
330 + 90	Northwestern Ave.	546	686	1080	62.49	63.27	64.91	3.80	4.16	5.39
341 + 20	D/S Side of Trout Lake	546	686	1080	62.49	63.27	64.91	2.00	2.11	2.38
349 + 80	U/S Side of Trout Lake	546	686	1080	62.49	63.27	64.91	0.98	1.10	1.33
352 + 63	Forest City Road (S.R. 434)	549	691	1030	62.66	63.47	64.99	0.98	1.10	1.33
359 + 23	D/S Side of Lake Lotus	549	691	1030	62.66	63.47	64.99	1.78	1.67	1.57
383 + 20	Confluence w/ Tributary D	549	691	1030	62.66	63.47	64.99	0.09	0.10	0.11
383 + 21	Confluence w/ Tributary E	549	691	1030	62.66	63.47	64.99	0.09	0.10	0.11
400 + 48	U/S Side of Lake Lotus	549	691	1030	62.66	63.47	64.99	5.86	6.11	5.33
414 + 82	Oranole Road	795	1080	1450	65.90	67.28	68.22	3.72	4.18	4.70
428 + 63	Campo Way	776	1050	1400	66.87	68.08	68.98	3.91	3.58	2.23
432 + 74	Egret Way	756	1010	1360	67.72	68.81	69.52	3.01	3.34	3.50
435 + 99	Elba Way	737	983	1310	68.26	69.20	69.90	3.45	3.90	4.54

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
LITTLE WEKIVA RIVER (CONTNUED)										
441 + 97	Channel *	737	983	1310	68.52	69.53	70.33	1.26	1.49	1.81
443 + 22	Riverside Acres Culvert Outlet	737	983	1310	68.45	69.42	70.15	3.10	3.82	4.84
464 + 57	Riverside Acres Culvert Inlet	718	951	1270	69.72	71.31	77.99	5.14	6.08	4.20
464 + 79	Sheet Pile Weir	718	951	1270	73.77	74.48	78.32	9.12	9.79	4.64
483 + 54	Channel *	583	775	1010	75.65	76.48	78.84	4.85	5.26	4.25
490 + 35	Riverside Park Road	583	773	1010	76.48	77.37	79.43	4.19	4.60	4.16
491 + 25	Confluence w/ Tributary G	583	773	1010	76.50	77.39	79.44	5.53	5.90	5.00
508 + 56	Sherry Drive	582	772	1010	78.87	79.69	81.25	5.33	5.70	5.27
511 + 87	Kelvington Drive	582	772	1010	79.33	80.15	81.76	5.65	6.14	5.72
514 + 98	Wallington Drive	582	772	1010	79.70	80.56	82.06	5.63	6.01	5.66
529 + 48	Gusty Lane	557	737	872	81.74	82.65	83.75	6.23	7.27	7.55
536 + 40	Edgewater Drive (S.R. 424)	557	737	872	83.52	85.27	87.02	5.68	6.62	6.90
545 + 22	Channel *	530	664	783	83.68	85.39	87.13	2.19	2.07	1.46
546 + 00	SCL R.R. Bridge	530	664	783	83.75	85.45	87.16	2.62	2.22	1.90
555 + 50	Channel *	502	592	695	83.76	85.45	87.16	2.57	2.11	1.49
564 + 19	U.S. 441	475	519	606	84.45	85.83	87.36	3.42	4.06	3.61
564 + 79	Confluence w/ Tributary H	475	519	606	84.45	85.83	87.36	1.12	0.97	0.90
569 + 52	Rosewood Way	375	471	552	86.41	87.14	88.42	4.33	5.09	5.37
591 + 14	Channel *	375	471	552	86.41	87.14	88.42	0.55	0.56	0.04
591 + 68	Lake Orlando Weir	375	471	552	86.56	87.24	88.42	3.58	3.31	0.86
593 + 33	Lake Orlando Parkway North	375	471	552	86.56	87.24	88.42	2.15	2.24	1.76
593 + 93	D/S Side of Lake Orlando	375	471	552	86.56	87.24	88.42	2.15	2.24	1.76

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
LITTLE WEKIVA RIVER (CONTNUED)										
644 + 93	U/S Side of Lake Orlando	562	702	1059	86.56	87.24	88.42	1.44	1.30	1.19
647 + 03	Golf Cart Bridge	562	702	1059	86.56	87.24	88.42	3.16	3.15	2.97
650 + 87	Golf Cart Crossing	562	702	1059	87.40	87.90	88.59	3.17	3.48	3.10
656 + 22	Channel *	562	702	1059	87.51	87.99	88.64	2.80	3.29	4.25
657 + 10	Lake Orlando Parkway South	562	702	1059	88.03	88.64	89.08	2.99	3.16	4.25
678 + 10	Channel *	562	702	1059	88.03	88.64	89.08	2.56	2.53	3.10
678 + 84	SCL R.R. Bridge	425	487	617	88.03	88.63	89.07	3.18	3.31	3.87
680 + 14	Culverted Crossing	425	487	617	89.31	89.84	90.23	2.76	2.04	1.83
687 + 34	Seaboard Road	425	487	617	89.35	89.88	90.28	1.31	1.36	1.55
699 + 78	Channel *	354	403	494	89.41	89.94	90.35	1.72	1.84	2.15
702 + 88	Old Silver Star Road (SR-438)	354	403	494	89.94	90.87	92.38	1.51	1.53	1.56
705 + 78	New Silver Star Road	354	403	494	89.94	90.87	92.38	1.86	1.77	1.58
718 + 18	Lawne Lake Weir	354	403	494	89.94	90.87	92.38	2.57	1.74	0.63
734 + 62	D/S Side of Lawne Lake	354	403	494	89.94	90.87	92.38	0.47	0.33	0.24
745 + 58	Confluence w/ Tributary I	354	403	494	89.94	90.87	92.38	0.04	0.04	0.05
759 + 12	U/S Side of Lawne Lake	354	403	494	89.94	90.87	92.38	0.06	0.06	0.07
TRIBUTARY A										
0 + 00	Confluence w/ Little Wekiva R.	141	198	289	19.70	20.20	20.90	2.61	3.09	3.62
7 + 61	Springs Landing Blvd.	99	147	227	25.79	26.88	28.53	7.15	9.28	11.08
12 + 57	Wisteria Drive	99	147	227	26.95	27.84	28.74	4.74	4.31	2.25
25 + 57	Channel *	99	147	227	26.95	27.84	28.74	0.25	0.24	0.26
32 + 42	Wisteria Drive	122	177	260	31.72	32.24	33.05	8.37	9.42	6.23
36 + 92	Study Limit	122	177	260	31.72	32.24	33.05	3.50	3.95	4.22

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
TRIBUTARY B										
0 + 00	Confluence w/ Little Wekiva R.	264	372	559	39.34	40.24	41.79	2.21	2.26	2.09
21 + 47	Jamestown Blvd.	108	143	197	41.12	42.05	42.92	2.65	3.07	2.64
39 + 87	Upper Limit of Tributary B	108	143	197	41.14	42.06	42.92	0.08	0.09	0.11
TRIBUTARY C										
0 + 00	Confluence w/ Little Wekiva R.	171	282	445	41.60	42.55	43.70	1.44	2.05	2.77
9 + 73	S.R. 434	171	282	445	46.59	47.20	47.93	3.73	4.66	5.71
20 + 13	Channel *	151	228	370	46.59	47.20	47.93	0.23	0.29	0.40
31 + 43	Confluence of Branch C1 w/ Tributary C	151	228	370	46.59	47.20	47.93	2.14	2.64	3.49
31 + 93	Alder Ave.	21	34	69	49.40	49.79	50.66	5.85	6.84	8.64
38 + 73	Willow Ave.	21	34	69	50.08	50.66	51.95	3.42	2.67	2.15
42 + 23	Channel *	21	34	69	50.90	51.26	52.26	1.31	1.60	1.83
44 + 73	Culvert D/S of Lake Brantley Road.	21	34	69	51.00	51.44	52.35	2.05	2.74	2.63
53 + 13	Channel *	21	34	69	51.25	51.78	52.75	2.32	2.70	3.57
54 + 28	Lake Brantley Road	21	34	69	52.26	52.94	54.76	6.14	7.26	10.04
58 + 98	Channel *	21	34	69	52.26	52.95	54.76	0.05	0.07	0.10
63 + 38	Dirt Road	21	34	69	52.51	53.55	54.77	4.60	2.20	2.12
72 + 08	Channel *	21	34	69	52.53	53.56	54.78	0.13	0.12	0.15
81 + 15	Dirt Road	21	34	69	53.77	55.89	56.11	7.68	2.56	3.07
93 + 00	Channel *	21	34	69	53.78	55.89	56.11	0.04	0.03	0.06
97 + 30	Confluence of Branch C2 w/ Tributary C	21	34	69	55.18	56.04	56.48	1.28	1.17	1.89
101 + 85	Dirt Road	**	2	20	55.97	56.68	57.70		3.58	2.02
105 + 15	Channel *	**	2	20	55.97	56.68	57.70		0.00	0.01

** Discharge not significant.

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
TRIBUTARY C (CONTINUED)										
112 + 90	Upper Limit of Tributary C				55.97	56.68	57.70			
BRANCH C1										
0 + 00	Confluence w/ Tributary C	137	197	337	46.59	47.20	47.93	----	----	----
12 + 70	D/S Side of Lake Harriet	137	197	337	54.75	55.72	56.84	----	----	----
16 + 70	U/S Side of Lake Harriet	137	197	337	54.75	55.72	56.84	----	----	----
24 + 85	D/S Side of Little Pearl Lake	28	49	68	60.31	60.72	61.59	----	----	----
27 + 65	Confluence of Forest Lake Outlet w/ Branch C1	28	49	68	60.31	60.72	61.59	----	----	----
31 + 05	U/S Side of Little Pearl Lake	28	49	68	60.31	60.72	61.59	----	----	----
35 + 40	D/S Side of West Pearl Lake	28	49	68	60.31	60.72	61.59	----	----	----
46 + 30	U/S Side of West Pearl Lake	28	49	68	60.31	60.72	61.59	----	----	----
46 + 95	Pearl Lake Causeway & D/S Side of Pearl Lake	28	49	68	60.31	60.72	61.59	----	----	----
62 + 20	U/S Side of Pearl Lake (Upper Limit of Branch C1)				60.31	60.72	61.59			
BRANCH C2										
0 + 00	Confluence w/ Tributary C	32	50	79	55.18	56.04	56.48	----	----	----
0 + 75	Dirt Road	32	50	79	56.56	57.38	57.43	5.35	6.20	7.20
22 + 70	Channel *	21	27	36	56.57	57.39	57.44	0.01	0.02	0.02
43 + 00	S.R. 436	21	27	36	62.26	63.15	64.77	7.00	7.60	8.37
46 + 50	D/S Side of Mirror Lake	21	27	36	62.26	63.15	64.77	0.04	0.04	0.03
79 + 95	U/S Side of Mirror Lake (Upper Limit of Branch C2)				62.26	63.15	64.77			
FOREST LAKE OUTLET										
0 + 00	Confluence w/ Branch C1	8	12	19	60.31	60.72	61.59	----	----	----

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
FOREST LAKE OUTLET (CONTINUED)										
6 + 25	D/S Side of Forest Lake	8	12	19	65.83	66.33	67.27	----	----	----
15 + 30	U/S Side of Forest Lake (Upper Limit of Forest Lake Outlet)				65.83	66.33	67.27			
TRIBUTARY D										
0 + 00	Confluence w/ Little Wekiva R.	41	54	82	62.66	63.47	64.99	0.04	0.04	0.04
11 + 80	Country Creek Parkway	41	54	82	87.58	87.75	88.06	2.33	2.57	3.04
21 + 30	Channel *	41	54	82	95.66	95.85	96.16	1.43	1.58	1.85
29 + 80	Eden Park Road	41	54	82	101.99	102.36	103.05	2.27	2.68	3.46
30 + 30	Channel *	41	54	82	102.02	102.40	103.11	2.60	2.93	3.50
30 + 90	Seaboard Coast Line	41	54	82	102.27	102.72	103.57	2.45	2.74	3.24
40 + 40	D/S Side of Cub Lake	41	54	82	102.92	103.22	103.92	0.01	0.01	0.01
47 + 90	U/S Side of Cub Lake	41	54	82	102.92	103.22	103.92	0.02	0.02	0.03
55 + 30	Little Bear Lake Outlet Confluence w/ Tributary D	41	54	82	103.04	103.36	104.07	2.60	2.91	3.29
55 + 31	D/S Side of Bear Lake Road	16	21	37	103.04	103.36	104.07	4.05	4.42	5.67
62 + 89	D/S Side of Bear Lake	16	21	37	105.35	105.72	106.36	0.01	0.01	0.02
113 + 09	U/S Side of Bear Lake (Upper Limit of Tributary D)	16	21	37	105.35	105.72	106.36	0.02	0.02	0.03
LITTLE BEAR LAKE OUTLET										
0 + 00	Confluence w/ Tributary D	22	23	25	103.04	103.36	104.07	1.39	1.24	1.00
3 + 80	D/S Side of Little Bear Lake	22	23	25	105.35	105.72	106.36	0.02	0.02	0.02
25 + 55	U/S Side of Little Bear Lake (Upper Limit of Little Bear Lake Outlet)				105.35	105.72	106.36			
TRIBUTARY E										
0 + 00	Confluence w/ Little Wekiva R.	7	16	35	62.66	63.47	64.99	0.00	0.00	0.01

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
TRIBUTARY E (CONTINUED)										
25 + 68	D/S Side of Lake Bosse	7	16	35	62.66	63.47	64.99	0.00	0.00	0.00
31 + 20	Confluence of Branch E1 w/ Tributary E	7	16	35	62.66	63.47	64.99	0.00	0.00	0.00
37 + 35	U/S Side of Lake Bosse	7	16	35	62.66	63.47	64.99	0.00	0.00	0.00
47 + 38	Rundle Road	7	16	35	74.67	75.41	76.83	4.09	5.15	6.42
57 + 58	D/S Side of Lake Gandy	5	10	20	74.67	75.41	76.83	0.00	0.00	0.00
61 + 48	Confluence of Branch E2 w/ Tributary E	5	10	20	74.67	75.41	76.83	0.00	0.00	0.00
64 + 98	U/S Side of Lake Gandy	5	10	20	74.67	75.41	76.83	0.28	0.21	0.15
73 + 03	Dirt Road	5	10	20	80.38	80.81	81.19	2.66	5.31	6.89
76 + 03	Channel *	5	10	20	80.70	80.87	81.13	3.03	3.72	4.52
77 + 03	Magnolia Home Road	5	10	20	81.88	82.27	83.03	3.04	4.42	6.71
91 + 13	D/S Side of Lake Eve	5	10	20	81.88	82.27	83.03	0.00	0.00	0.01
96 + 75	U/S Side of Lake Eve (Upper Limit of Tributary E)				81.88	82.27	83.03			
BRANCH E1										
0 + 00	Confluence w/ Tributary E & U/S Side of Lake Bosse	5	10	20	62.64	63.68	64.96	----	----	----
0 + 40	Eden Park Road & D/S Side of Lake Hill	5	10	20	62.64	63.68	64.96	----	----	----
17 + 15	U/S Side of Lake Hill (Upper Limit of Branch E1)				62.64	63.68	64.96			
BRANCH E2										
0 + 00	Confluence w/ Tributary E	5	10	20	74.67	75.48	76.83	----	----	----
17 + 10	U/S Side of Lake Gandy	5	10	20	74.67	75.48	76.83	----	----	----
30 + 60	D/S Side of Lake Lockhart	5	10	20	74.67	75.48	76.83	----	----	----

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
BRANCH E2 (CONTINUED)										
31 + 85	U/S Side of Lake Lockhart (Upper Limit of Branch E2)	----	----	----	74.67	75.48	76.83	----	----	----
TRIBUTARY F										
0 + 00	Confluence with the Little Wekiva River.	210	268	319	60.73	61.68	63.03	0.56	0.46	0.35
1 + 59	Footbridge	210	268	319	60.74	61.69	63.04	0.76	0.62	0.45
1 + 79	Rock Weir	210	268	319	60.75	61.70	63.05	0.95	0.69	0.46
2 + 84	Channel *	210	268	319	60.76	61.71	63.05	0.80	0.62	0.43
4 + 49	Horse Lovers Lane	210	268	319	60.82	61.74	63.08	4.74	2.63	1.23
9 + 54	Channel *	210	268	319	61.23	61.86	63.08	4.44	4.73	4.25
14 + 77	Spring Valley Road	210	268	319	64.54	66.16	67.98	5.99	6.82	7.19
14 + 84	Spring Lake Weir	210	268	319	65.98	66.64	68.06	4.70	4.64	4.40
16 + 92	D/S Side of Spring Lake	210	268	319	65.98	66.64	68.10	1.85	1.98	1.67
44 + 32	U/S Side of Spring Lake (Upper Limit of Tributary F)				65.98	66.64	68.10			
TRIBUTARY G										
0 + 00	Confluence w/ Little Wekiva R.	109	176	291	76.50	77.39	79.44	1.46	1.88	2.00
2 + 45	Footbridge	109	176	291	76.62	77.72	79.52	2.86	3.50	4.01
8 + 15	Channel *	109	176	291	77.42	78.46	80.05	4.31	4.19	4.08
9 + 05	Forest City Road	109	176	291	80.61	81.03	81.70	6.41	7.79	9.15
16 + 45	D/S Side of Lake Lovely	109	176	291	80.61	81.03	81.70	0.01	0.02	0.03
23 + 45	U/S Side of Lake Lovely	124	184	282	80.61	81.03	81.70	0.04	0.05	0.07
36 + 45	Confluence of Branch G1 w/ Tributary G	124	184	282	82.91	83.21	83.61	0.13	0.16	0.19
39 + 45	D/S Side of Lake Shadow	124	184	282	82.96	83.27	83.72	0.09	0.13	0.17

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
TRIBUTARY G (CONTINUED)										
55 + 70	U/S Side of Lake Shadow	124	184	282	82.96	83.27	83.72	0.01	0.02	0.02
67 + 90	Keller Road	52	73	93	90.74	91.23	92.17	6.79	7.96	3.92
68 + 80	D/S Side of Harvest Lake	52	73	93	90.74	91.23	92.17			
75 + 75	U/S Side of Harvest Lake	52	73	93	90.74	91.23	92.17	0.03	0.04	0.04
81 + 40	D/S Side of Lake Lucien	52	73	93	90.76	91.24	92.17	0.02	0.02	0.02
90 + 90	U/S Side of Lake Lucien	15	38	110	90.76	91.24	92.17	0.00	0.00	0.01
97 + 50	Maitland Colonnades Control Structure	15	38	110	91.52	91.57	92.24	1.17	2.12	0.95
99 + 75	D/S Side of Lake Hungerford	15	38	110	94.72	94.92	95.12	0.01	0.02	0.07
122 + 60	U/S Side of Lake Hungerford (Upper Limit of Tributary G)	15	38	110	94.72	94.92	95.12	0.02	0.06	0.16
BRANCH G1										
0 + 00	Confluence w/ Tributary G	69	89	122	82.91	83.21	83.62	0.00	0.00	0.00
7 + 30	Lake Avenue	69	89	122	83.75	84.52	85.92	2.29	2.85	3.73
9 + 00	D/S Side of Lake Weston	69	89	122	83.75	84.52	85.92	0.07	0.05	0.03
10 + 00	Confluence of Eatonville Borrow Pit Outlet w/ Branch G1	69	89	122	83.75	84.52	85.92	0.02	0.02	0.02
23 + 20	U/S Side of Lake Weston				83.75	84.52	85.92			
36 + 20	Upper Limit of Branch G1				83.75	84.52	85.92			
EATONVILLE BORROW PIT OUTLET										
0 + 00	Confluence w/ Branch G1	9	12	16	83.75	84.52	85.92			
64 + 05	Culvert	9	12	16	94.77	95.38	96.43			
70 + 35	D/S Side of Eatonville Borrow Pit	9	12	16	94.77	95.38	96.43			
95 + 90	U/S Side of Eatonville Borrow Pit (Upper Limit of Eatonville Borrow Pit Outlet)				94.77	95.38	96.43			

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
TRIBUTARY H										
0 + 00	Confluence w/ Little Wekiva R.	101	122	140	84.45	85.83	87.36			
1 + 21	Butterfly Valve D/S Side of Winter Rose Drive	101	122	140	84.74	87.19	88.48	1.47	1.25	@
4 + 91	Winter Rose Drive	101	122	140	84.88	87.19	88.48	2.33	1.71	@
19 + 74	Rosewood Way	101	122	140	85.16	87.19	88.48	2.12	0.89	@
27 + 49	Rosemont Drive	101	122	140	85.25	87.19	88.48	2.30	1.86	@
39 + 19	Golf Course Culvert No. 1	101	122	140	85.39	87.19	88.48	2.35	1.85	@
45 + 49	Golf Course Culvert No. 2	101	122	140	85.50	87.45	88.48	2.46	1.83	@
49 + 21	Golf Course Culvert No. 3	101	122	140	85.59	87.58	88.48	2.64	3.18	@
51 + 66	Lake Breeze Road	101	122	140	85.69	87.67	88.48	2.40	2.84	@
53 + 13	Lake Orlando Parkway	101	122	140	85.82	87.79	88.48	2.91	3.20	@
59 + 20	Confluence of Branch H1 w/ Tributary H	101	122	140	85.97	87.84	88.48	1.01	0.72	@
61 + 64	Bay Breeze Road	102	125	140	86.37	88.35	88.54	4.49	3.54	3.72
72 + 16	John Young Parkway	102	125	140	87.19	88.68	89.43	7.28	5.05	4.27
86 + 62	U.S. 441	102	125	140	88.36	89.39	90.64	4.79	5.32	3.78
89 + 62	Channel *	102	125	140	88.56	89.77	90.89	1.29	1.06	0.88
91 + 72	Culvert Inlet U/S of U.S. 441	102	125	140	89.39	90.11	91.07	5.51	4.86	4.48
91 + 90	Lake Fairview Discharge Control Structure	102	125	140	89.65	90.14	91.08	2.49	2.46	2.01
124 + 95	U/S Side of Lake Fairview (Confluence of Branch H2 w/ Tributary H)	80	102	145	89.65	90.14	91.08			
134 + 80	D/S Side of Lake Sarah	80	102	145	89.65	90.14	91.08	0.70	0.65	0.44
142 + 41	U/S Side of Lake Sarah	60	80	144	89.65	90.14	91.08			

@ - Tributary H will not function as a distinct channel.

Table 12. - continued

STATION	LOCATION	DISCHARGE (cfs) 10 YR	25 YR	100 YR	ELEVATION (ft. NGVD) 10 YR	25 YR	100 YR	VELOCITY of FLOW (fps) 10 YR	25 YR	100 YR
TRIBUTARY H (CONTINUED)										
144 + 07	Private Drive Between lakes Sarah & Daniel	60	80	144	93.21	93.57	94.42	7.57	8.33	5.49
147 + 71	D/S Side of Lake Daniel	60	80	144	93.21	93.57	94.42	0.02	0.02	0.04
153 + 86	U/S Side of Lake Daniel	28	49	144	93.21	93.57	94.42	1.08	1.72	3.98
155 + 86	Maury Road	28	49	144	93.43	93.96	94.67	1.44	2.14	5.19
156 + 41	Channel into Lake Silver	28	49	144	93.43	93.96	94.67	1.77	2.55	6.04
159 + 36	D/S Side of Lake Silver	28	49	144	93.43	93.96	94.67			
182 + 86	U/S Side of Lake Silver (Upper Limit of Tributary H)				93.43	93.96	94.67			
BRANCH H1										
0 + 00	Confluence w/ Tributary H	22	80	202	86.48	87.84	88.48			
7 + 10	D/S Side of Bay Lake	22	80	202	92.03	92.12	92.26	----	----	----
119 + 41	U/S Side of Bay Lake (Upper Limit of Branch H1)				92.03	92.12	92.26	----	----	----
BRANCH H2										
0 + 00	Confluence w/ Tributary H	117	131	147	89.65	90.14	91.08	----	----	----
26 + 90	D/S Side of Little Lake Fairview	117	131	147	91.01	91.63	92.66	----	----	----
54 + 05	U/S Side of Little Lake Fairview (Upper Limit of Branch H2)				91.01	91.63	92.66	----	----	----
TRIBUTARY I										
0 + 00	Confluence w/ Lawne Lake	189	187	191	89.94	90.87	92.38			
9 + 50	Channel *	189	187	191	89.94	90.87	92.38	0.77	0.68	0.58
11 + 04	Mercy Drive	189	187	191	92.50	93.47	95.22	3.78	3.36	2.95
11 + 54	Channel *	189	187	191	92.50	93.47	95.22	0.27	0.24	0.20
57 + 20	John Young Parkway (Upper Limit of Tributary I)				92.50	93.47	95.22			

Table 13. Comparison of Peak Discharges Estimated by SJRWMD and the Federal Emergency Management Agency (FEMA)

Location	Peak Discharge (cfs) 10 year SJRWMD	10 year FEMA	100 year SJRWMD	100 year FEMA
Little Wekiva River				
From Lawne Lake	---	---	494	120
From Lake Orlando (Wekiva)	---	---	601	180
Edgewater Drive	---	---	872	580
Just South of Riverside Acres	---	---	1,280	900
Just South of Orange County/ Seminole County line	---	---	1,450	900
Lake Lotus (S.R. 431/now 434)	547	550	1,030	1,050
Trout Lake	---	---	1,020	1,030
S.C.L.R.R. downstream of S.R. 436	631	700	1,410	1,370
Upstream (west) of Montgomery Road	809	780	2,040	1,520
S.R. 434	1,010	920	2,560	1,800
Tributary A	141	110	289	230
Tributary B	264	150	559	400

3.4.2 Comparison with Other Studies: Table 14 presents a comparison of maximum elevations computed in this study (SJRWMD) with those of FEMA. The sources for the FEMA results are the same as those described in Section 3.3.2.

The 10-yr flood elevations are significantly higher than those computed by the FEMA for Bay Lake, Lawne Lake and Lake Orlando, and for the Little Wekiva River at Oranole Road and at the sheetpile weir near the Riverside Acres Subdivision. SJRWMD 100-yr elevations are higher for most locations. As mentioned earlier, urban development in the basin since 1970 and detailed modeling procedures used in this study have generally resulted in an upward revision of flood elevations for the basin. The few exceptions in which the SJRWMD estimates are lower (e.g., Lake Shadow) may be the result of drainage improvements in the basin since 1970.

3.4.3 Structural Hazards: Several culverts and bridges in the study area are likely to be overtopped during major storm events. Erosion near the structures and other damages can occur. Table 15 summarizes depths of overtopping of the various affected structures. About six structures may be overtopped during a 10-yr storm event, 18 during a 25-yr event and 25 during a 100-yr event.

3.5 Flood Velocities

Velocity of flow near bridges and culverts, and at several locations in the channel were computed by the HEC-2 program. 10-yr, 25-yr, and 100-yr velocities are summarized in Table 12

Table 14. Comparison of Maximum Elevations Computed by SJRWMD and the Federal Emergency Management Agency (FEMA)

Location	Maximum Elevation (ft. NGVD) 10 year		100 year	
	SJRWMD	FEMA	SJRWMD	FEMA
Little Wekiva River				
Bay Lake	92.03	91.40	92.26	92.60
Lake Bosse	62.64	63.20	64.96	64.80
Lake Fairview	89.65	89.80	91.08	90.80
Lake Gandy	74.67	74.60	76.83	76.00
Lawne Lake	89.96	89.10	92.63	90.40
Lake Orlando (Wekiva)	86.55	85.20	88.48	87.90
Lake Shadow	82.96	83.60	83.72	84.60
Edgewater Drive	83.52	84.80	87.02	87.00
Sheetpile Weir at the Riverside Acres Subdivision	73.77	71.25	78.32	74.30
Oranole Road	65.90	62.30	68.22	65.50
Bear Lake	105.43	105.60	107.37	106.90
Cub Lake	102.86	104.20	103.87	104.60
Lake Lotus	62.66	62.20	64.99	64.40
Forest City Road (S.R. 434)	62.66	62.00	64.99	64.00
Trout Lake	62.49	61.70	64.91	63.50
Northwestern Avenue	62.49	60.50	64.91	62.00
Spring Lake	65.98	65.40	68.10	67.20
Orange Ave.	52.56	52.00	55.71	54.70
S.C.L.R.R. d/s of S.R. 436	48.79	49.00	51.23	51.10
S.R. 436	52.31	51.50	55.04	53.70
Pearl Lake	60.31	60.40	61.59	61.10
Upstream (West) of Montgomery Rd.	36.09	34.75	40.25	36.30
S.R. 434	30.20	28.00	32.91	29.50
Tributary B				
Jamestown Blvd.	41.12	41.00	42.92	42.50
Tributary C				
S.R. 434	46.59	46.50	47.93	47.75

Table 15. List of Bridges and Culverts Overtopped

LOCATION	ROAD ELEV. (ft. NGVD)	DEPTH OF OVERTOPPING (ft.) 10 YR	25 YR	100 YR
Little Wekiva River				
Footbridge 1	26.70	0.00	0.00	0.38
Footbridge 2	28.00	0.00	0.00	0.68
Footbridge 3	27.70	0.04	0.72	1.64
Footbridge 4	28.90	0.00	0.34	1.24
Woodbridge Avenue	29.40	0.00	0.08	2.28
Footbridge 7	61.70	0.00	0.00	0.53
Covered Bridge at Stables	60.30	0.43	1.37	2.72
Oranole Road	66.40	0.00	0.74	1.61
Campo Way	67.30	0.00	0.72	1.67
Egret Way	68.10	0.00	0.67	1.14
Elba Way	68.00	0.14	1.22	1.98
Golf Cart Cross u/s of Lake Orlando	87.00	0.40	0.91	1.59
Lake Orlando Parkway S.	88.40	0.00	0.24	0.68
TRIBUTARY "A"				
Wisteria Drive (North)	27.30	0.00	0.54	1.44
TRIBUTARY "B"				
Jamestown Blvd.	42.60	0.00	0.00	0.23
TRIBUTARY "C"				
Culvert d/s of Lake Brantley Rd.	51.80	0.00	0.00	0.49
Dirt Road	53.30	0.00	0.24	1.46
Dirt Road	55.80	0.00	0.08	0.28
Dirt Road	57.50	0.00	0.00	0.18

Table 15. -Continued

LOCATION	ROAD ELEV. (ft. NGVD)	DEPTH OF OVERTOPPING (ft.) 10 YR	25 YR	100 YR
TRIBUTARY "F"				
Footbridge	58.20	2.54	3.49	4.84
Horse Lovers Lane	60.90	0.00	0.82	2.17
TRIBUTARY "G"				
Footbridge	77.30	0.00	0.16	2.24
Keller Road	91.90	0.00	0.00	0.40
TRIBUTARY "H"				
Lake Orlando Parkway	87.50	0.00	0.12	0.98
Private Drive between Lakes Sarah and Daniel	93.30	0.00	0.27	1.12

for important locations in the basin. High velocities are expected near bridges and culverts because of channel constrictions at these structures. These structures are designed normally for protection against such velocities. Channel reaches subject to high velocities, however, should be investigated for safety against erosion.

3.6 Flood Hazard Areas

Floodplain maps have been prepared for the 100-yr return period from the results obtained in this study. The 1981/1982 aerial maps (scale 1 in. = 200 ft. with contours at 1 foot interval) were used for locating the limits of 100-yr floodplain (Appendix II). These maps indicate that flood hazard areas are scattered throughout the basin. Figures 33 through 36 show approximate locations of these areas. Over 400 structures, primarily single family houses and some multifamily and commercial units, are located within the 100 yr floodplain. The extent of damage that may occur to these structures would depend upon the depth of flooding and the type of structure. In the next phase of study (water management study) a detailed structural inventory of the affected properties (first floor elevation, property value, etc.) will be conducted. Flood damage assessments will be made based on the information collected.

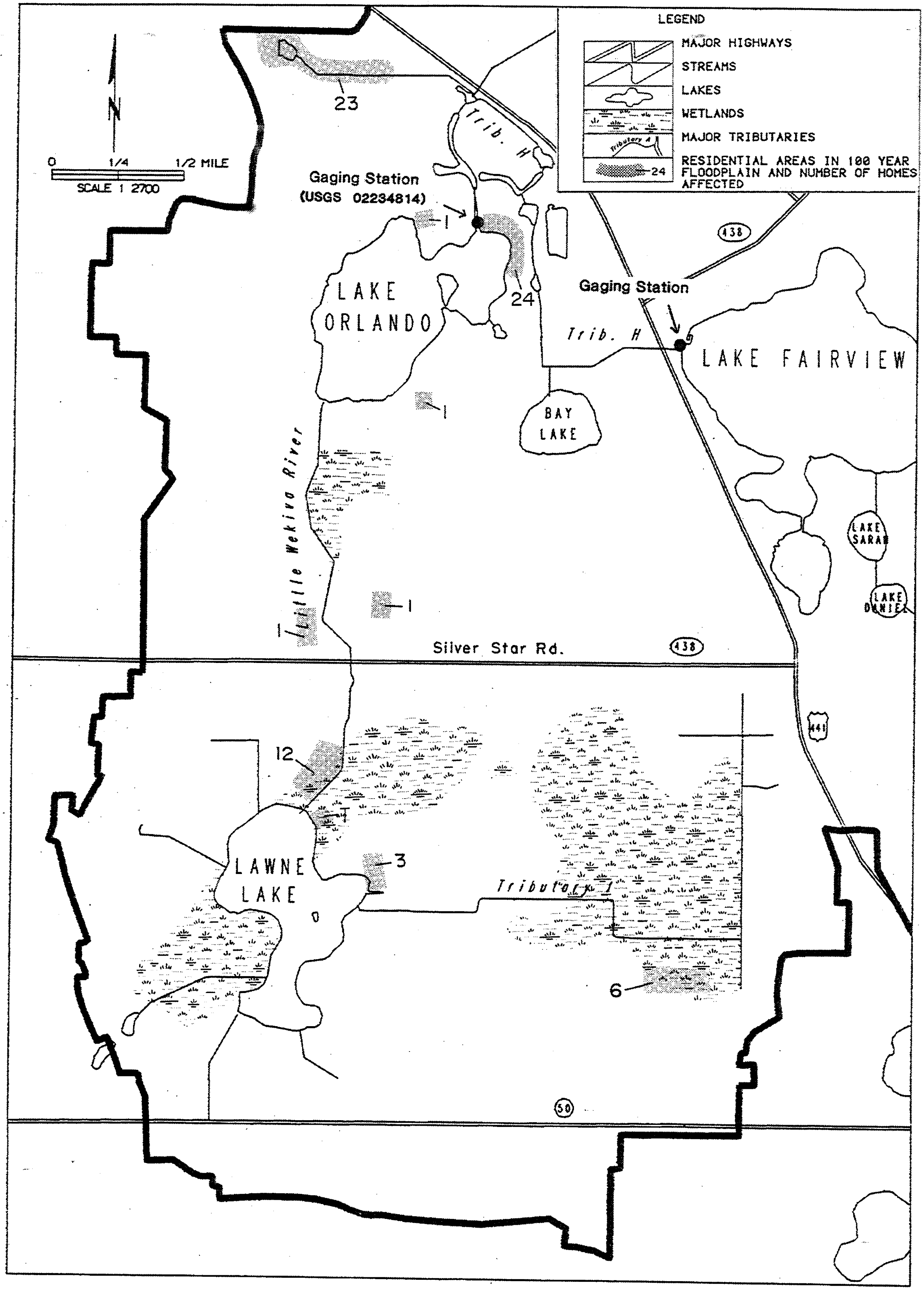


Figure 33: The Little Wekiva River Basin Upstream of U.S. 441: Location of Flood Hazard Areas

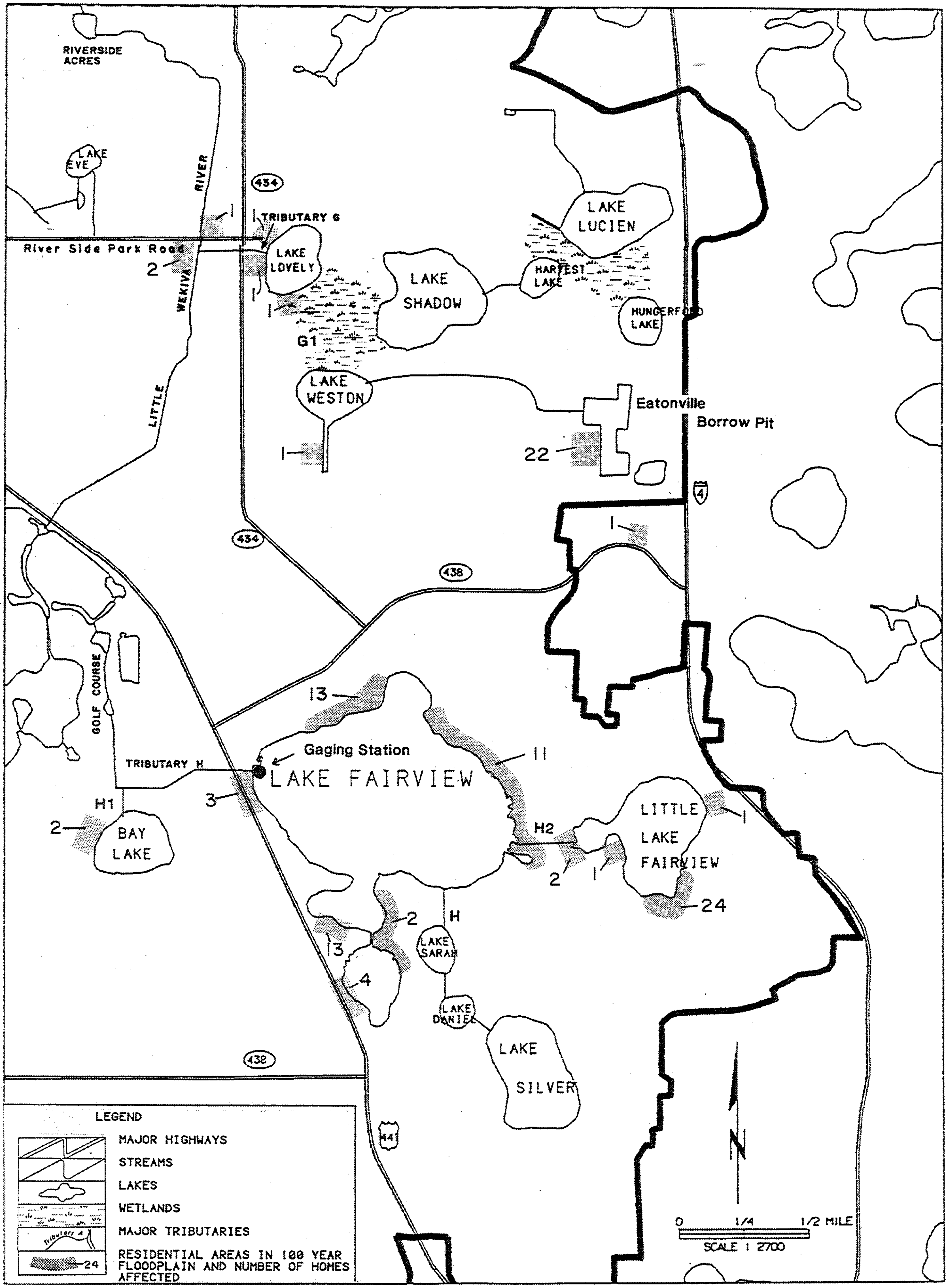


Figure 34: Tributaries G and H: Location of Flood Hazard Areas

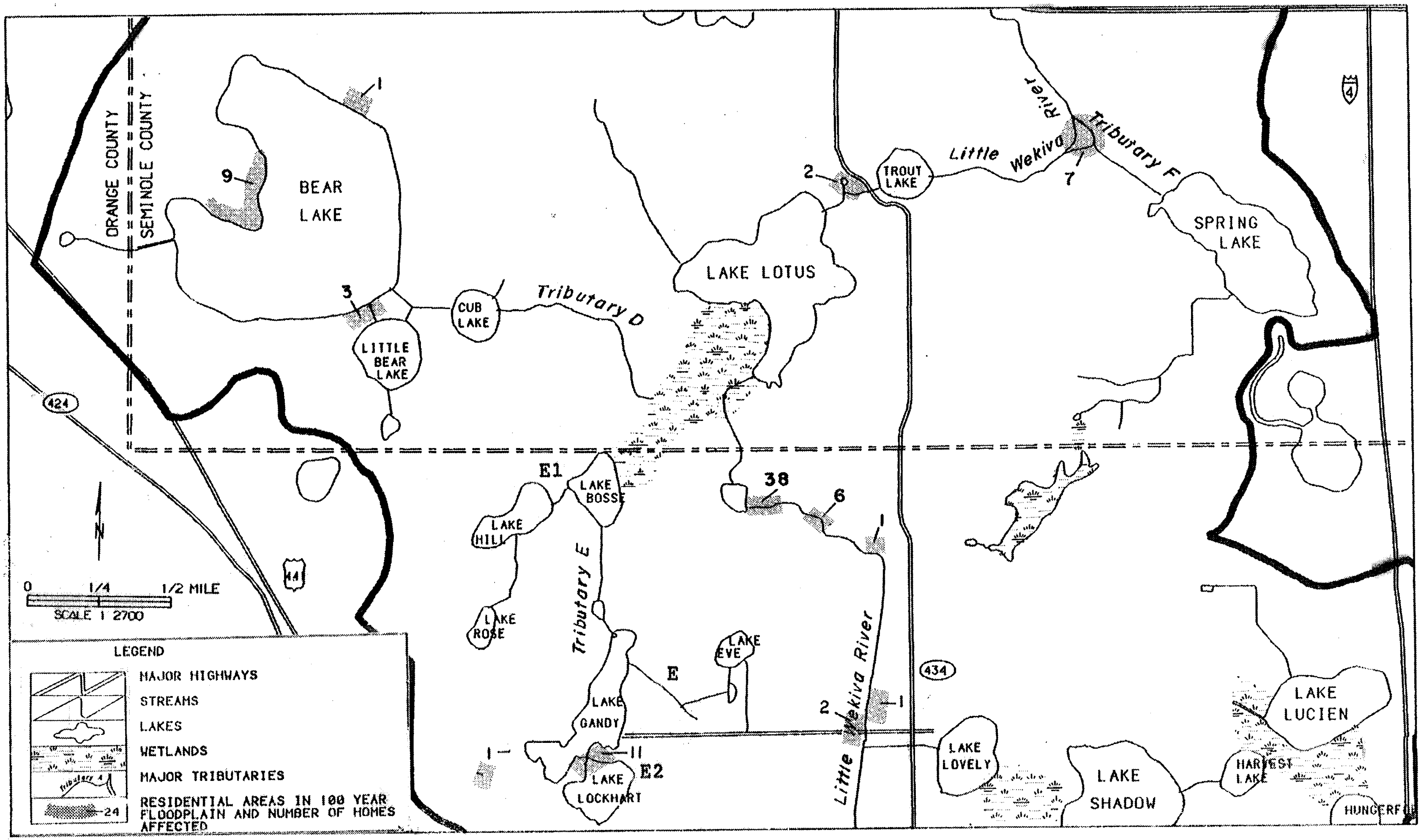


Figure 35. Tributaries D, E and F: Location of Flood Hazard Areas

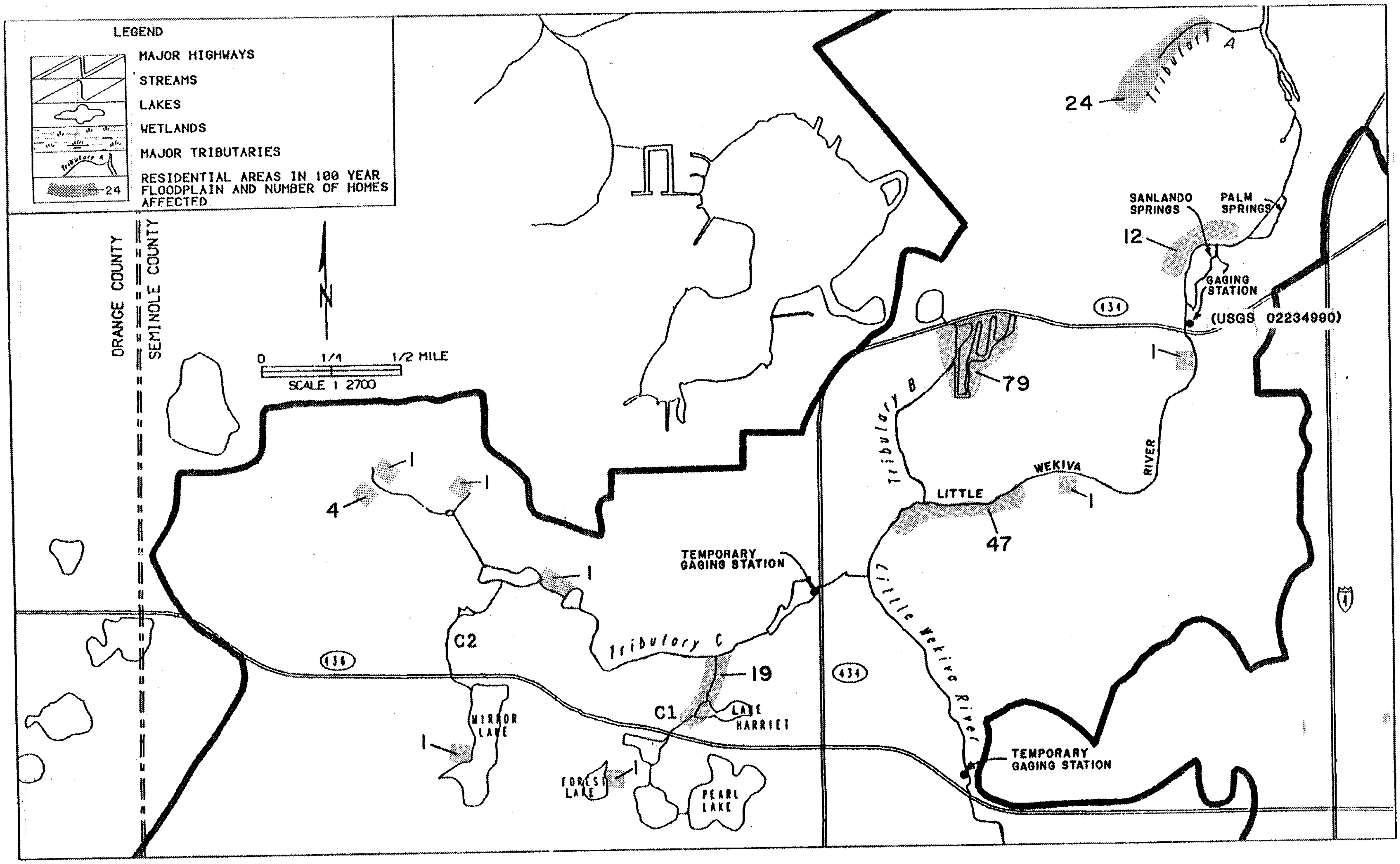


Figure 36. Tributaries A, B, and C: Location of Flood Hazard Areas

4.0 SUMMARY AND RECOMMENDATIONS

The Little Wekiva River Basin, comprising parts of Orange and Seminole counties, experiences periodic flooding, causing channel erosion and damages to urban property. Even though water management measures such as channelization and water control structures are provided at several locations, the basin lacks a comprehensive water management plan. In the absence of such a plan, major storms remain a threat to the safety of various structures located on the river, i.e., bridges, culverts, and water control weirs, and to the urban developments along the water courses and the associated lakes. This report, consisting of a floodplain study, is the first step in the development of a water management plan for the basin.

The basin hydraulic and hydrologic characteristics have been studied utilizing a detailed inventory of soils, land use, hydraulic control structures; a delineation of basin and sub-basin boundaries; and a survey of channel cross-sections and structural elevations and dimensions.

Estimates of flood discharges for 10-yr, 25-yr, and 100-yr return periods were obtained by rainfall-runoff modeling using single storm events. The U.S. Army Corps of Engineers' HEC-1 (Flood Hydrographs Package) and HEC-2 (Water Surface Profiles) computer programs were used for this purpose. Flood elevations for lakes and other storage areas were calculated by the HEC-1 program. Flood profiles were computed for return periods, 10 yr, 25 yr, and 100 yr for the entire Little Wekiva River and nine of its major tributaries (Appendix I). These profiles include all lakes connected by the mainstem of the river and its tributaries.

The 100 year floodplain boundaries were located on the 1981/1982 aerial photographic maps (Appendix II). Over 400 structures, primarily single family houses and some multifamily and commercial units, have been found to lie within the 100-yr floodplain. These structures are scattered throughout the basin. The study also indicates that about six river structures (bridges and culverts) may be overtopped during a 10-yr storm event, 18 during a 25-yr event and 25 during a 100-yr event.

A comparison with the U.S. Army Corps of Engineers' 1970 'Flood Plain Information' reports (on which the current FEMA 'Flood Insurance Study' reports are based) indicates that, in general, the SJRWMD (this study) estimates of flood discharges and flood elevations are higher. The reasons for this upward revision of flood estimates are urban development in the basin since 1970 and the detailed modeling procedures used in this study.

4.1 Plan for Future Studies

This study identified the areas of major flood hazard, houses and other structures which may be inundated by the 100 yr flood, and bridges and culverts which may be overtopped. A detailed inventory of all these structures should be obtained prior to developing water management alternatives. Non-structural and minimum structural alternatives, which include flood mitigation by regulating water levels in lakes and other storage areas, acquiring floodplains, etc., should be considered.

Some capital improvements, e.g., replacement of the current butterfly valves near U.S. 441 by more efficient culverts, expansion of some culverts and bridges, etc., appear inevitable. Construction of levees appears to be the only feasible solution for protecting some houses. All these measures should be evaluated in detail in the next phase of study.

4.2 Additional Data Collection Needs

Several approximations were made with regard to the discharge conveyed by minor streams and controls provided by some structures (i.e., culverts). These approximations may not significantly affect the final results. However, for those areas where flood damages are projected to be significant, these approximations should be re-examined and detailed analysis performed if necessary.

In this study an assumption was made that all bridges and culverts are well maintained and free of silt or debris. Some structures may have persistent siltation problems in spite of good maintenance. An inventory of all such structures should be made, noting the degree of problems. The effect of major siltation problems should be considered in evaluting flood elevations during the next phase of study.

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14. Rao, D.V., 1988c. Development of Site-Specific Hypothetical Storm Distributions, Technical Publication SJ 88-6, SJRWMD, Palatka, FL.

15. U.S. Army Corps of Engineers, April 1970. Flood Plain Information, Little Wekiva River, Orange County, Florida, Jacksonville District, Jacksonville, FL.

16. ______________________________, September 1970. Flood Plain Information, Little Wekiva River, Seminole County, Florida, Jacksonville District, Jacksonville, FL.

17. ______________________________, September 1981. HEC-1 Flood Hydrograph Package, Users Manual, Hydrologic Engineering Center, Davis, CA.

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19. U.S. Department of Agriculture, Soil Conservation Service and University of Florida Agricultural Experiment Stations, 1960. Soil Survey, Orange County, Florida.

20. U.S. Department of Agriculture, Soil Conservation Service and University of Florida Agricultural Experiment Stations, 1966. Soil Survey, Seminole County, Florida.

21. U.S. Department of Agriculture, Soil Conservation Service, 1972. National Engineering Handbook, Section 4, Hydrology (NEH-4), Washington, D.C.

22. U.S. Department of the Interior, 1982. Guidelines for Determining Flood Flow Frequency, Bulletin No. 17B, Geological Survey, Office of Water Data Coordination, Reston, Virginia.

EXHIBIT A

Regional Water Resource Assistance Program Proposal Summary

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

REGIONAL WATER RESOURCE ASSISTANCE PROGRAM

PROPOSAL SUMMARY

A

APPLICANT Orange and Seminole Counties

ADDRESS See Attachment CITY ____

COUNTY ____ STATE ____ ZIP ____ TELEPHONE ____/____

B

TITLE OF PROPOSED PROGRAM

LITTLE WEKIVA BASIN STUDY DATE 2-10-82

C

PROGRAM DESCRIPTION

WHAT IS THE NATURE AND SCOPE OF THE PROPOSED PROGRAM?

(See Attachment)

WHAT ARE THE PRINCIPAL OBJECTIVES TO BE ACCOMPLISHED?

(See Attachment)

HOW WILL THE RESULTS BE UTILIZED?

(See Attachment)

D

PROPOSED SOURCES OF FUNDING (See Attachment)

	INKIND*	CASH
ST. JOHNS RIVER WATER MANAGEMENT DISTRICT	$	$
LOCAL	$	$
STATE (AGENCY)	$	$
FEDERAL (AGENCY)	$	$
OTHER (SPECIFY)	$	$
TOTAL	$	$

* SPECIFY TYPES OF INKIND SERVICES PROPOSED ____

E

AUTHORIZING LOCAL UNIT (Refer to attached Resolutions)

MAILING ADDRESS (Refer to A. above)

AUTHORIZED BY ____

TELEPHONE ____/____

SIGNATURE ____

C. PROJECT DESCRIPTION

WHAT IS THE NATURE AND SCOPE OF THE PROPOSED PROGRAM?

In the early 1960's both Orange and Seminole Counties experienced substantial flood damages and were in fact declared a disaster area.

As a result of that experience, Orange County set up what today is called the "Orange County Primary Water System". A consulting firm was retained by the County to develop a plan that would alleviate the conditions produced by a 1960's type storm. The basic plan developed at that time, was one that relied upon the construction of a series of canal systems and lake level controls that would expedite the removal of flood waters from the urbanized flood damage areas to less populated agricultural areas and/or the borders of Orange County.

The rapid urbanization of predominatly agricultural areas not only in Orange County, but also in neighboring counties, coupled with the emergence of environmental concerns, indicates that the original plan for the disposition of storm water within Orange County is no longer valid. Portions of the original plan, however, have been constructed by the County, and are currently operated and maintained by Orange County Water Management Personnel.

While Seminole County has not developed a Water Management Plan, it has initiated a Water Management Study through the development of its Comprehensive Plan. Water Management criteria have been adopted in the Seminole County Land Development Code, consistent with the SJRWMD policies to implement this plan. Historically recurring drainage problems have been experienced in Seminole County. Yet the only drainage improvements funded were those associated with the County Road System. Rapid urban development caused areawide drainage problems to evolve beyond the County's financing capabilities to solve these problems.

The Little Wekiva Drainage Basin has been identified by both Orange and Seminole Counties as being one of the most critical, in addition to the Howell Branch Basin, due to rapid urbanization. It should be noted that both Orange and Seminole Counties have requested and received funding in FY 1980 and FY 1981 from the St. Johns River Water Management District for contour mapping in their respective portions of this basin. This drainage basin is entirely located within the St. Johns River Water Management District. The area of the basin is 52 square miles, of which the upland 24 square miles are located in Orange County and the lower 28 square miles in Seminole County.

The Little Wekiva Drainage Basin is located in the northcentral portion of Orange County and the western portion of Seminole County. The portion of the basin containing development stretches from the headwaters (Lake Lawne) downstream to the beginning of the Wekiva River Swamp; about one (1) mile north of S.R. 434. In the developed portion of the Basin the results of development have reduced the natural drainage patterns and in some cases have significantly reduced the flowage way of the River, requiring extensive channelization and drainage work to be undertaken.

Rapid urban development has caused periodic flooding problems in some of the drainage areas within this basin. Therefore, the need for additional means of alleviating the flooding problems and controlling urban stormwater runoff has been recognized as being necessary. In order to develop a program of management of surface waters for this basin (by using existing structures and possibly by additional capital improvements), the following study is deemed necessary.

WHAT ARE THE PRINCIPAL OBJECTIVES TO BE ACCOMPLISHED?

FY 1982

For 100-year storm, 25 year/24 hour storm, and 25 year/6 hour storm;

Calculate the runoff and route it through the drainage basin. Develop water surface profiles for: (1) existing conditions and (2) fully developed conditions in order to identify the flood prone areas. Plot these flood zones on contour maps and identify major damage centers.

FY 1983

Develop an operating schedule for existing structures to provide maximum control of flooding. Recalculate discharges and water surface profiles. Plot the revised flood zones on contour maps.

Recommend improvements (if any) needed to reduce flooding problems, estimate the cost of building these structures, and develop a priority schedule for any needed structural improvements. Determine stages and flows consistent with Chapter 373.042 F. A. C.

HOW WILL THE RESULTS BE UTILIZED?

County personnel will review, with St. John's Water Management District, the recommended operation schedule developed by the District to obtain a satisfactory operation schedule. Once a schedule is agreed upon and adopted by St. John's River Water Management District and the two (2) counties, both Counties will take responsibilities for implementing the schedule. Capital improvements recommended by the District will be considered by each County, based on their abilities to finance.

The study as proposed will complement and supplement District programs and plans such as contributing to the development of more refined regulatory criteria. District and local government regulatory program coordination would be enhanced between Orange and Seminole Counties and the District through the proposed study providing a basis for the District's exercising its power and authorities. Local capabilities would be up-graded by the study providing a basis for the Counties to make informed water management decisions.

D. SOURCES OF FUNDING

Cost of carrying out this study to be determined by the St. John's Water Management District.

Participation by Orange and Seminole Counties in this project would be in the form of services. Examples of the services that can be provided are:

1. <u>Surveying</u>

Surveying personnel from Orange and Seminole Counties can be provided to obtain an inventory of existing structures and stream cross-section within their respective Counties.

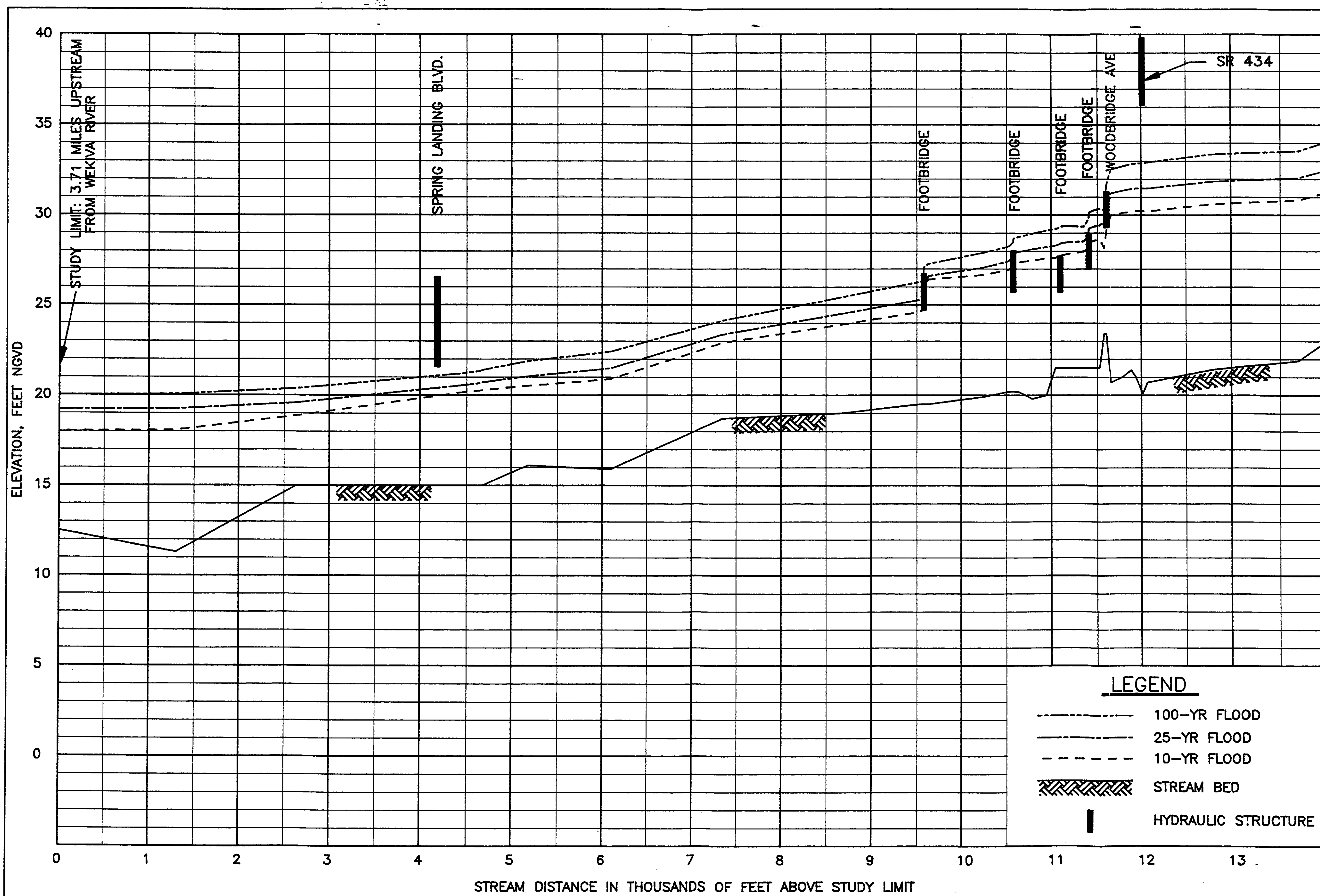
2. <u>Engineering</u>

Some of the following tasks can be performed by Orange and Seminole Counties' engineering personnel: obtaining water surface profiles, plotting flood prone areas on maps, etc.

APPENDIX I

Flood Profiles for 10-yr, 25-yr, and 100-yr 24-hr Storm Events under Existing Conditions

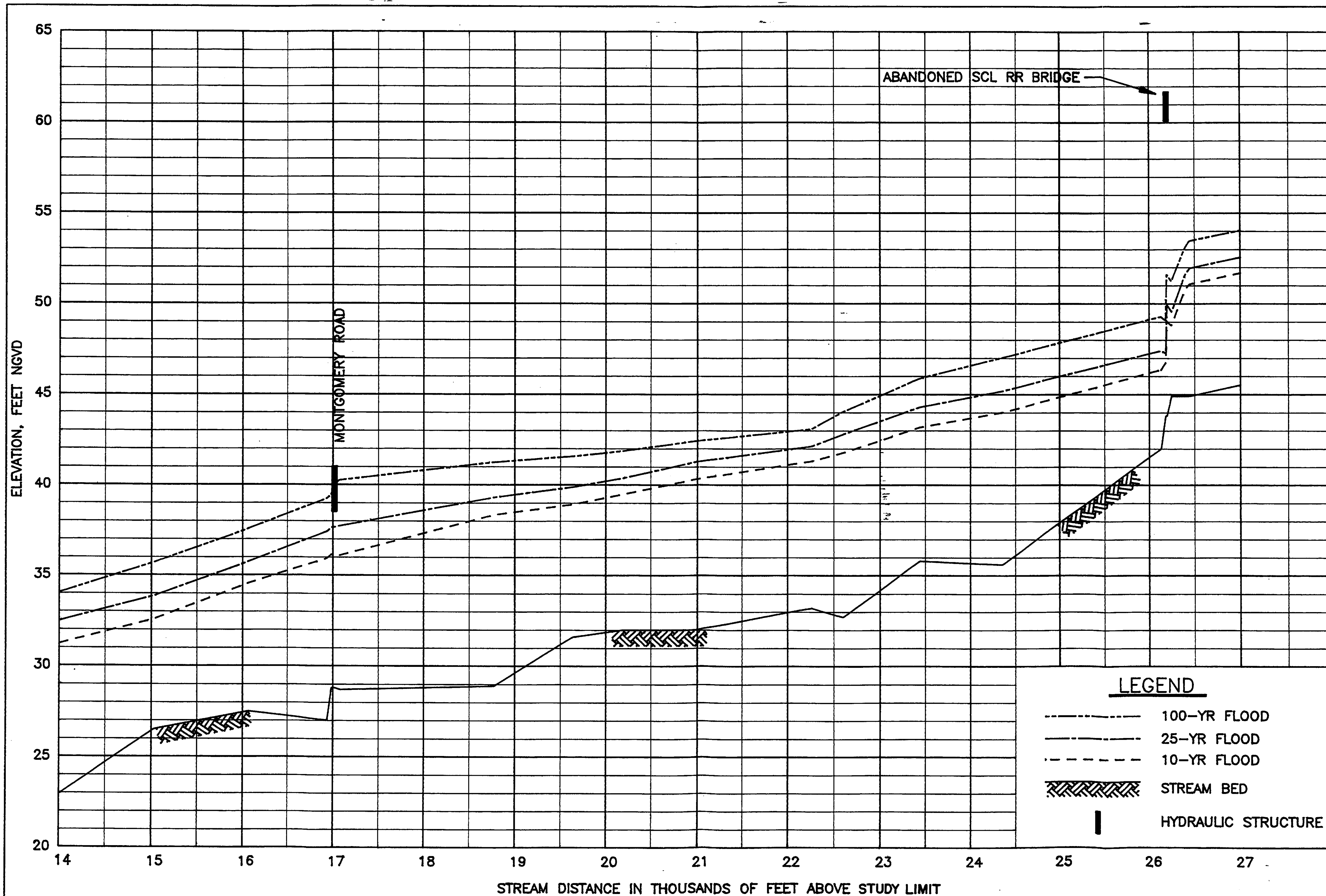
FLOOD PROFILES



FLOOD PROFILES – EXISTING CONDITIONS
LITTLE WEKIVA RIVER
STA 0+00 TO STA 140+00

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

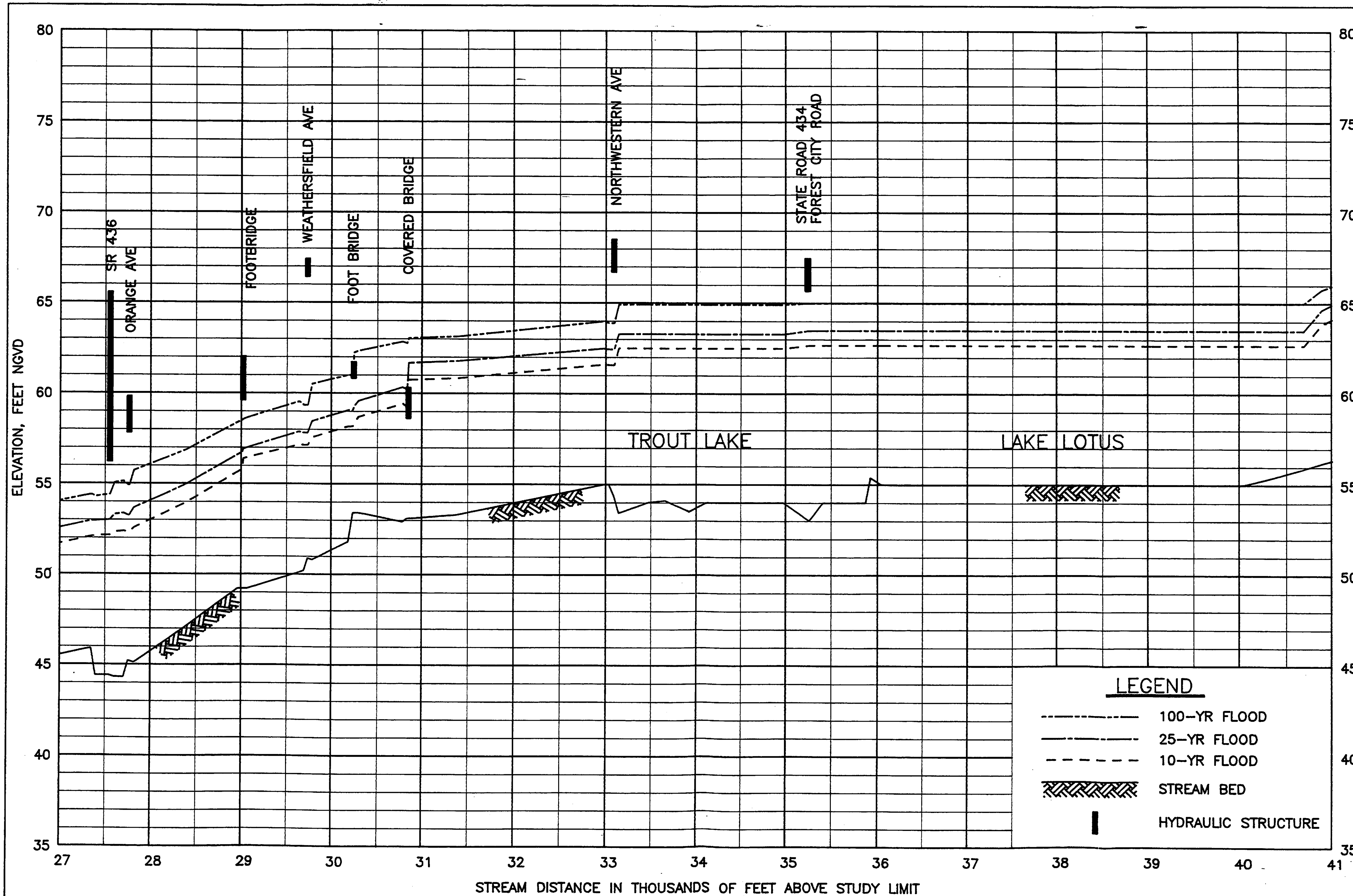
Plate No.
1



FLOOD PROFILES - EXISTING CONDITIONS
LITTLE WEKIVA RIVER
STA 140+00 TO STA 270+00

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

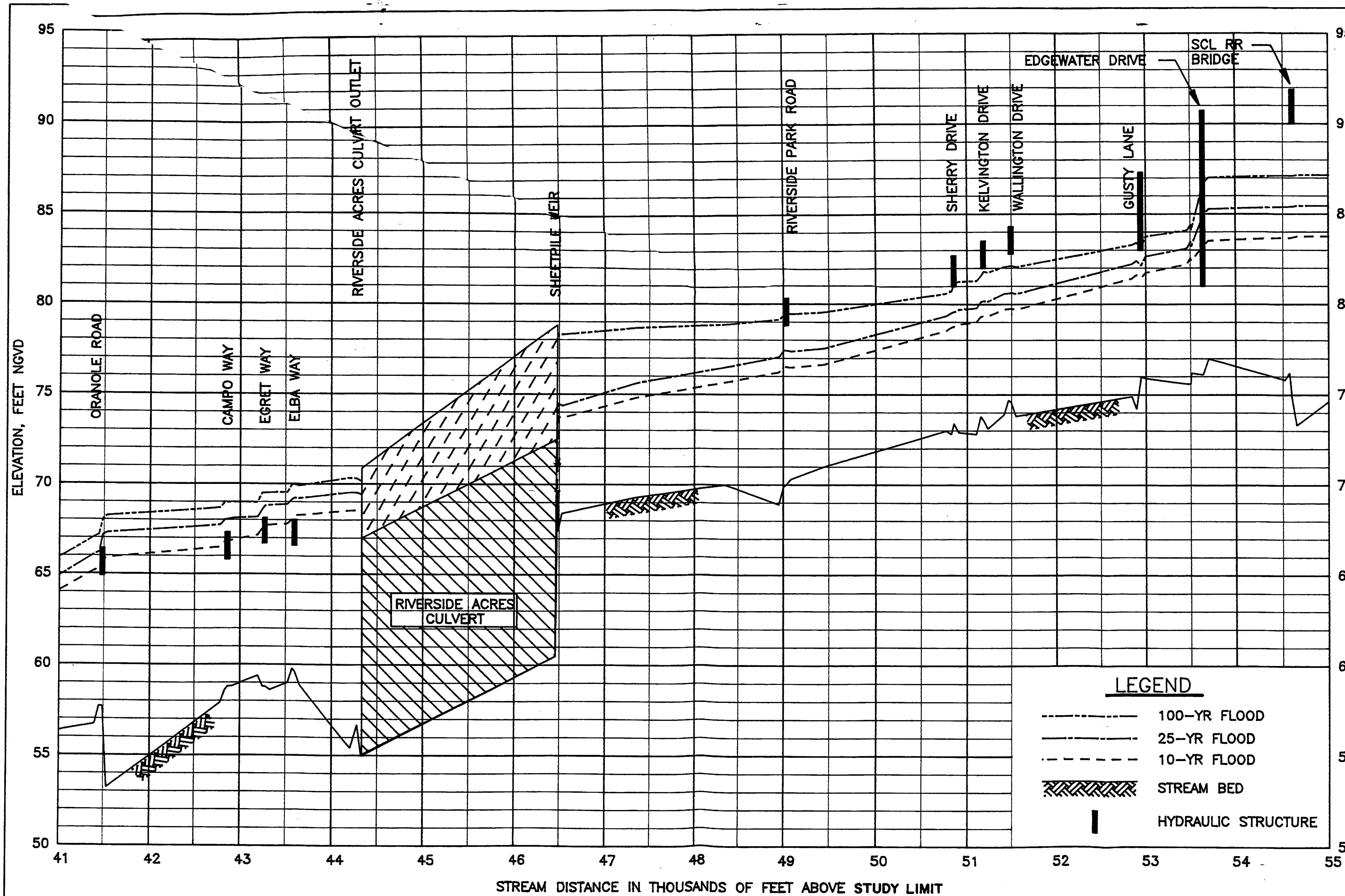
Plate No.
2



FLOOD PROFILES - EXISTING CONDITIONS
LITTLE WEKIVA RIVER
STA 270+00 TO STA 410+00

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

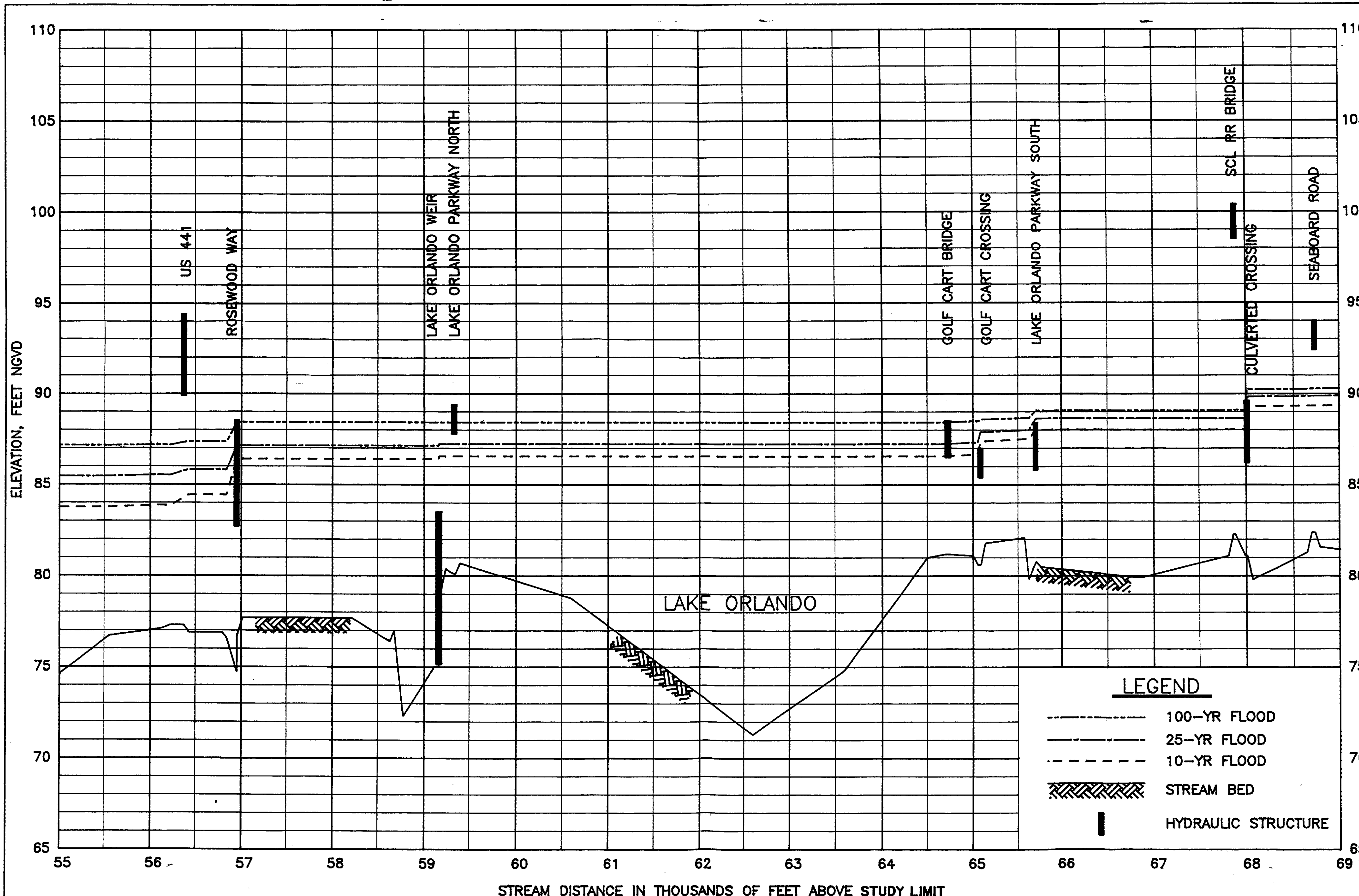
Plate No.
3



FLOOD PROFILES - EXISTING CONDITIONS
LITTLE WEKIVA RIVER
STA 410+00 TO STA 550+00

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

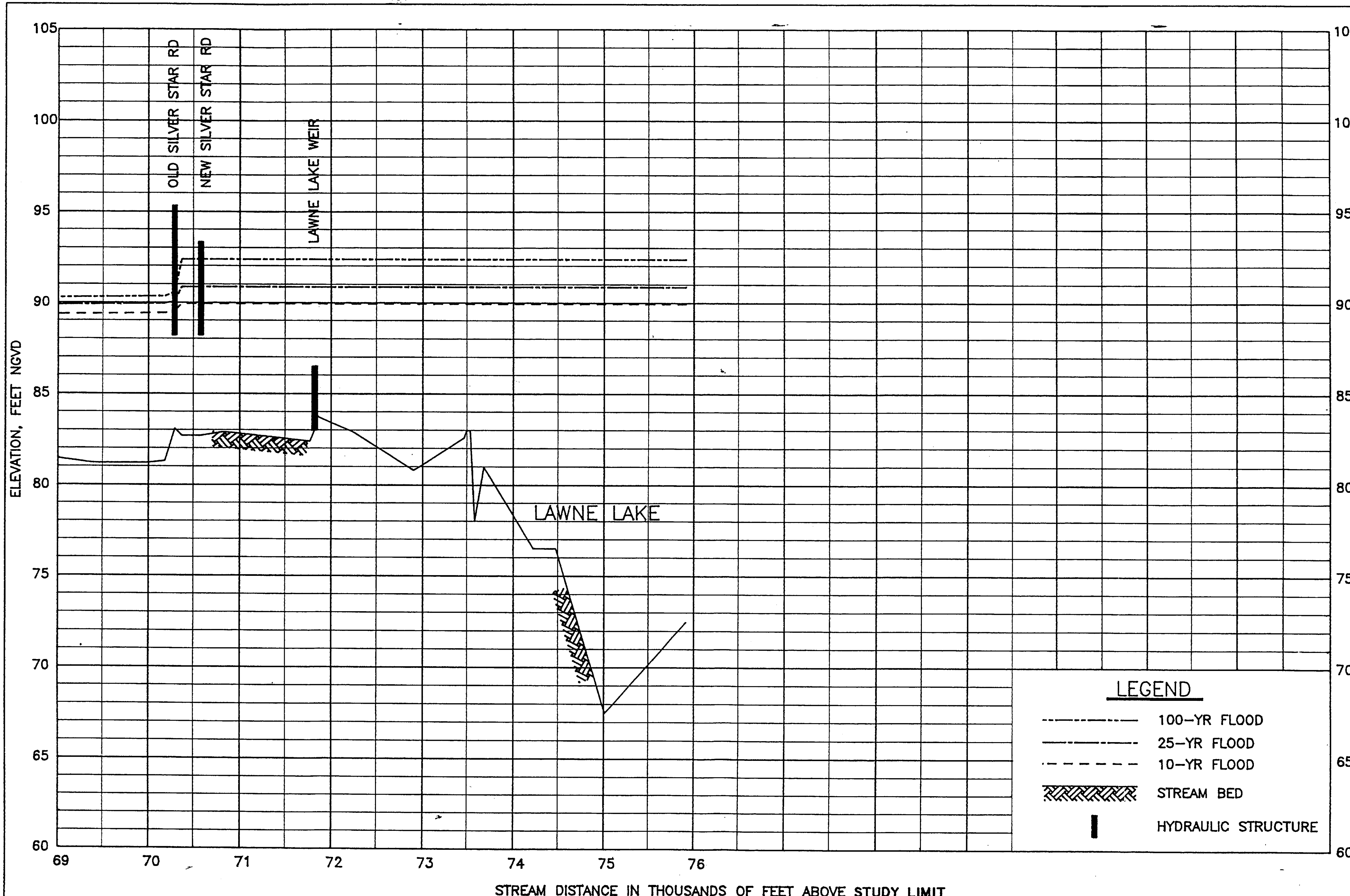
Plate No. 4



FLOOD PROFILES - EXISTING CONDITIONS
LITTLE WEKIVA RIVER
STA 550+00 TO STA 690+00

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

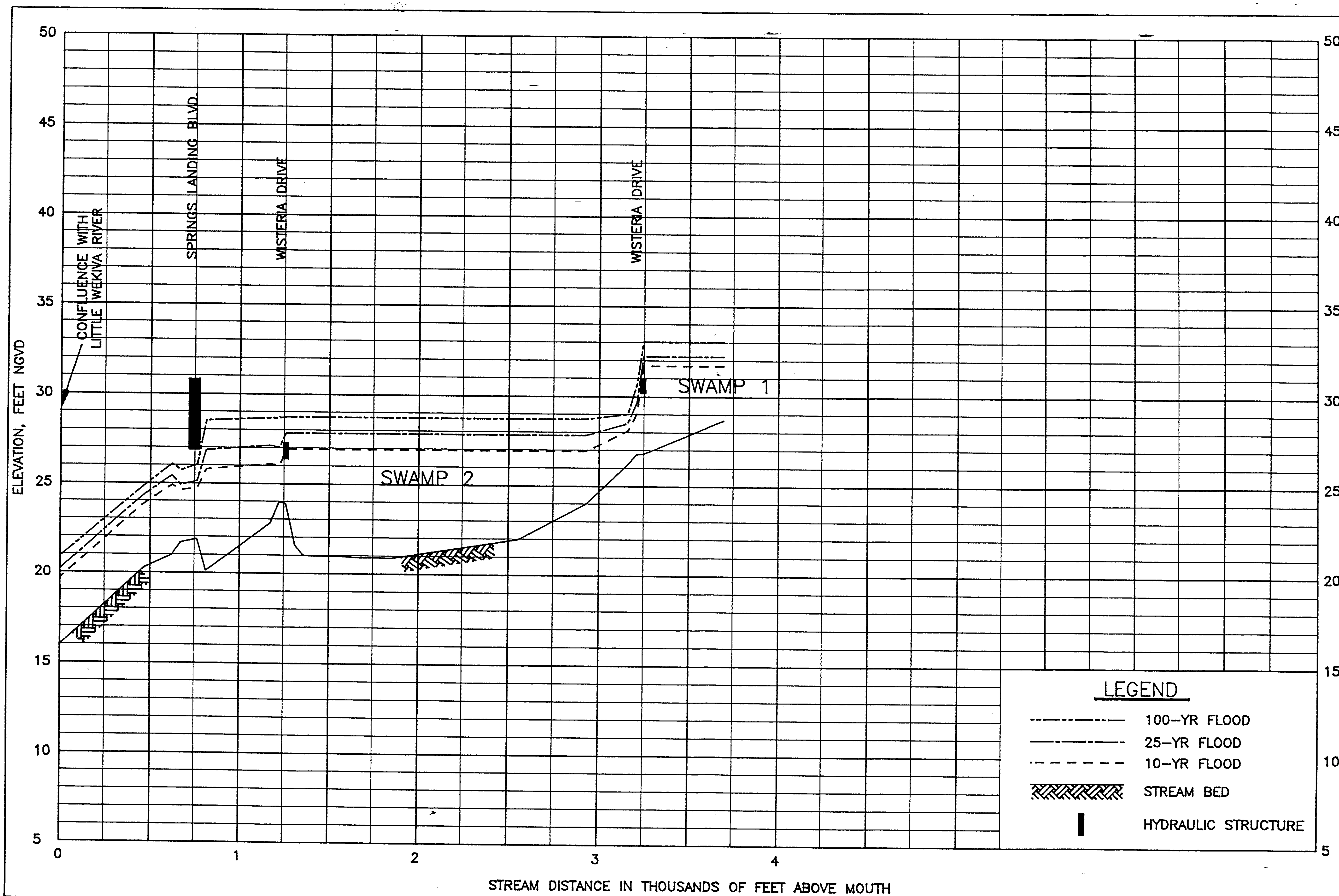
Plate No.
5



FLOOD PROFILES - EXISTING CONDITIONS
LITTLE WEKIVA RIVER
STA 690+00 TO STA 795+12

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

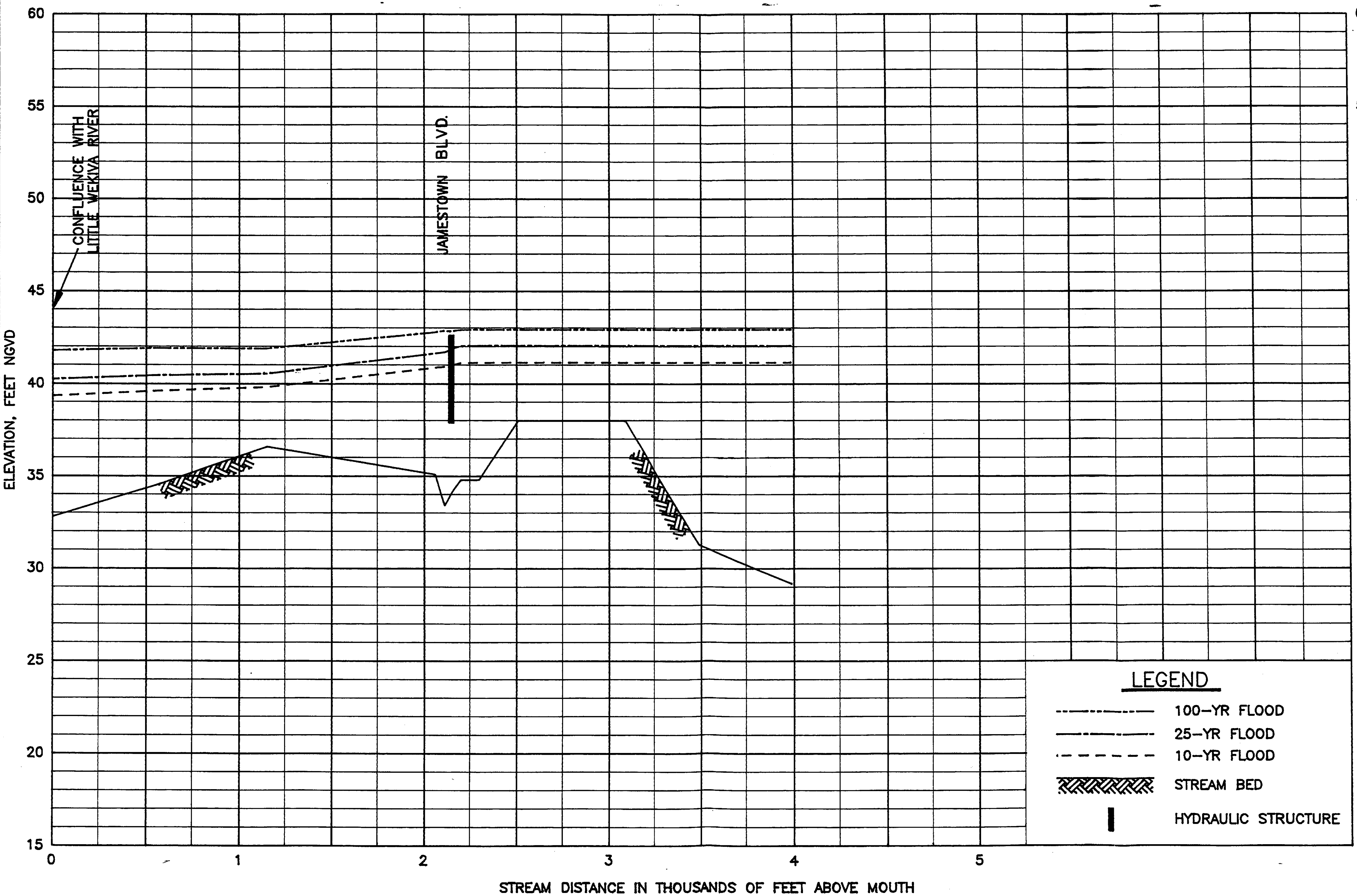
Plate No.
6



FLOOD PROFILES - EXISTING CONDITIONS
TRIBUTARY A
STA 0+00 TO STA 36+92

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

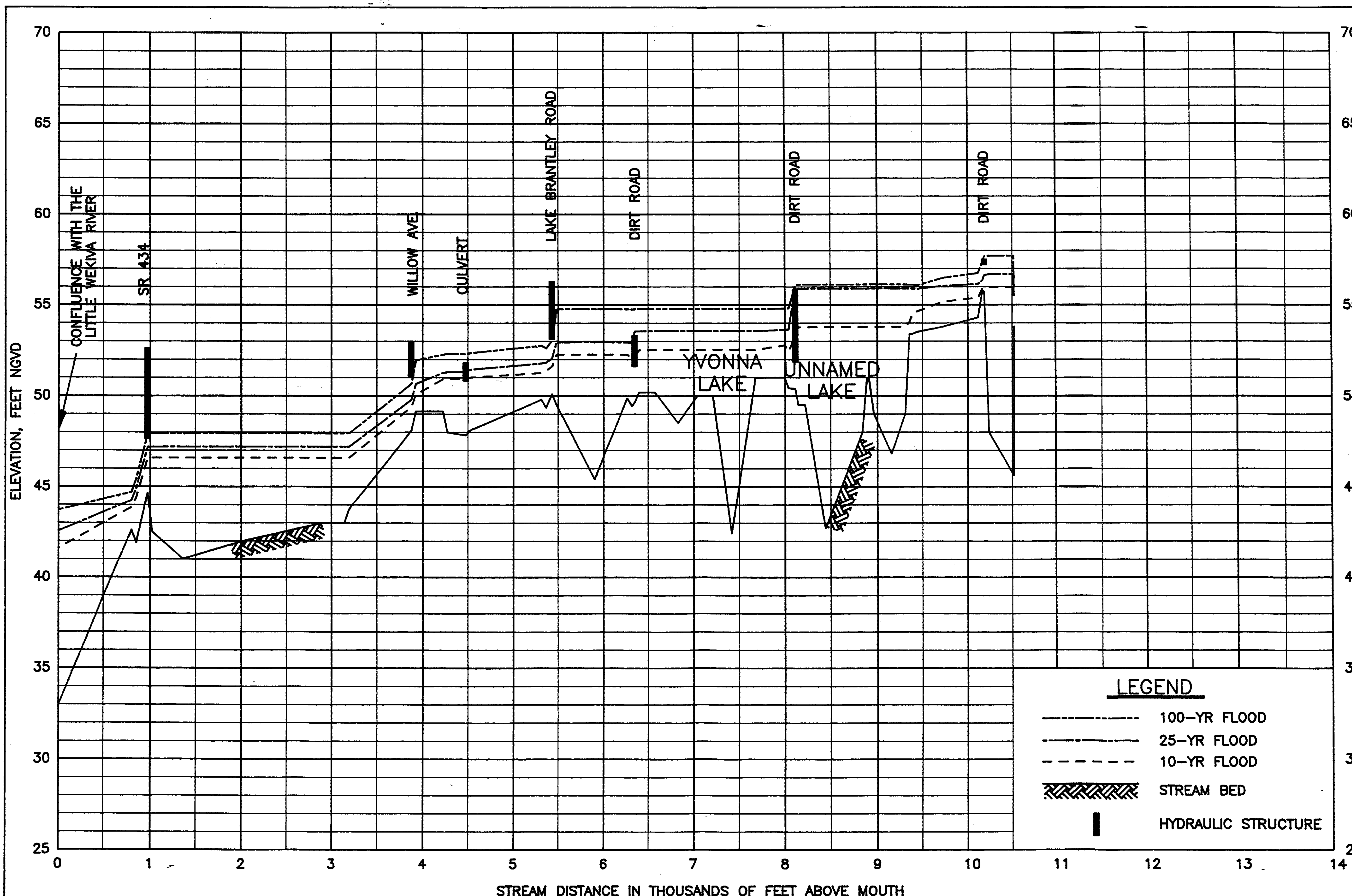
Plate No.
7



FLOOD PROFILES - EXISTING CONDITIONS
TRIBUTARY B
STA 0+00 TO STA 39+87

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

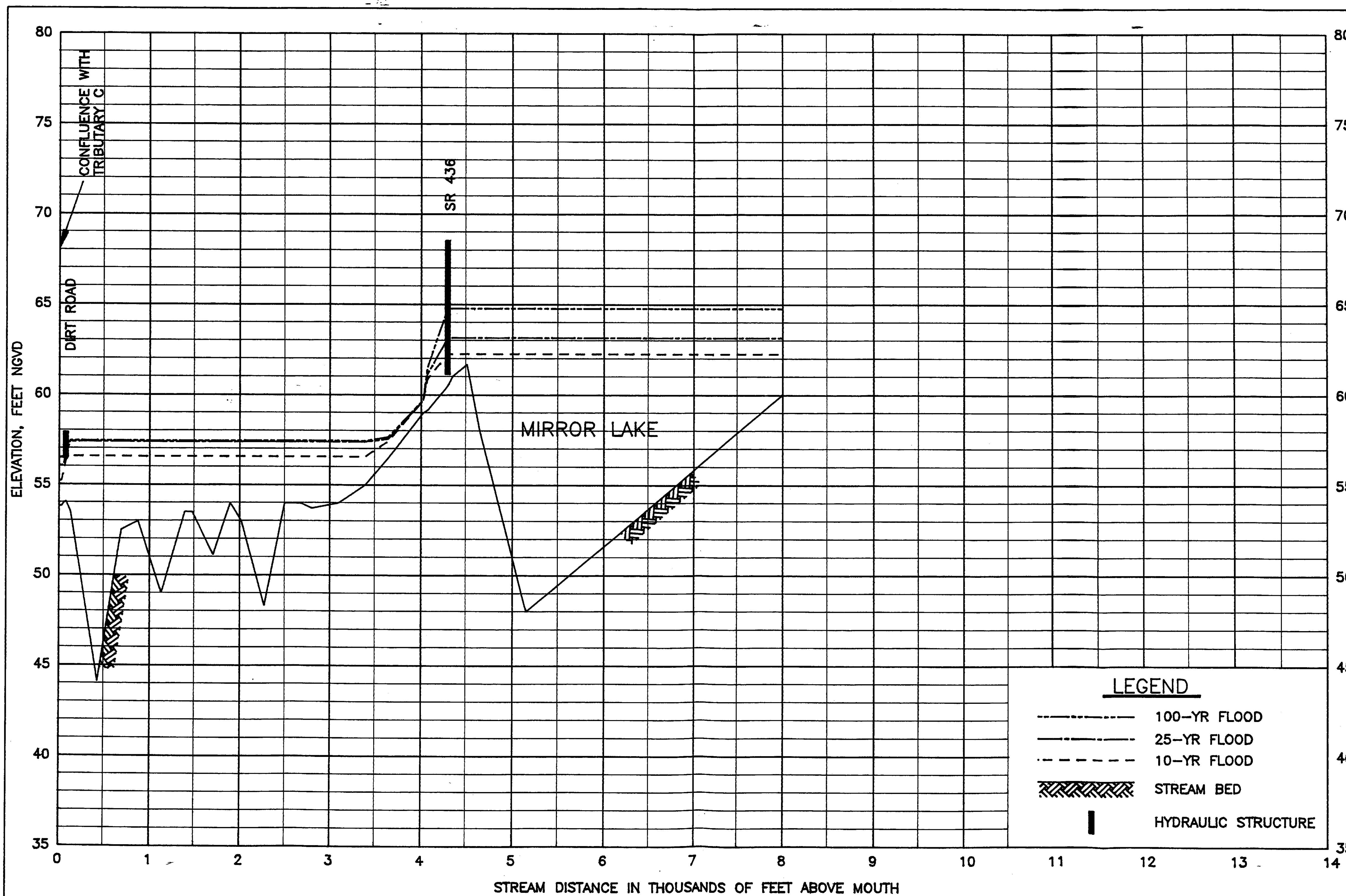
Plate No.
8



REVISED FLOOD PROFILES - EXISTING CONDITIONS
TRIBUTARY C
STA 0+00 TO STA 105+15

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

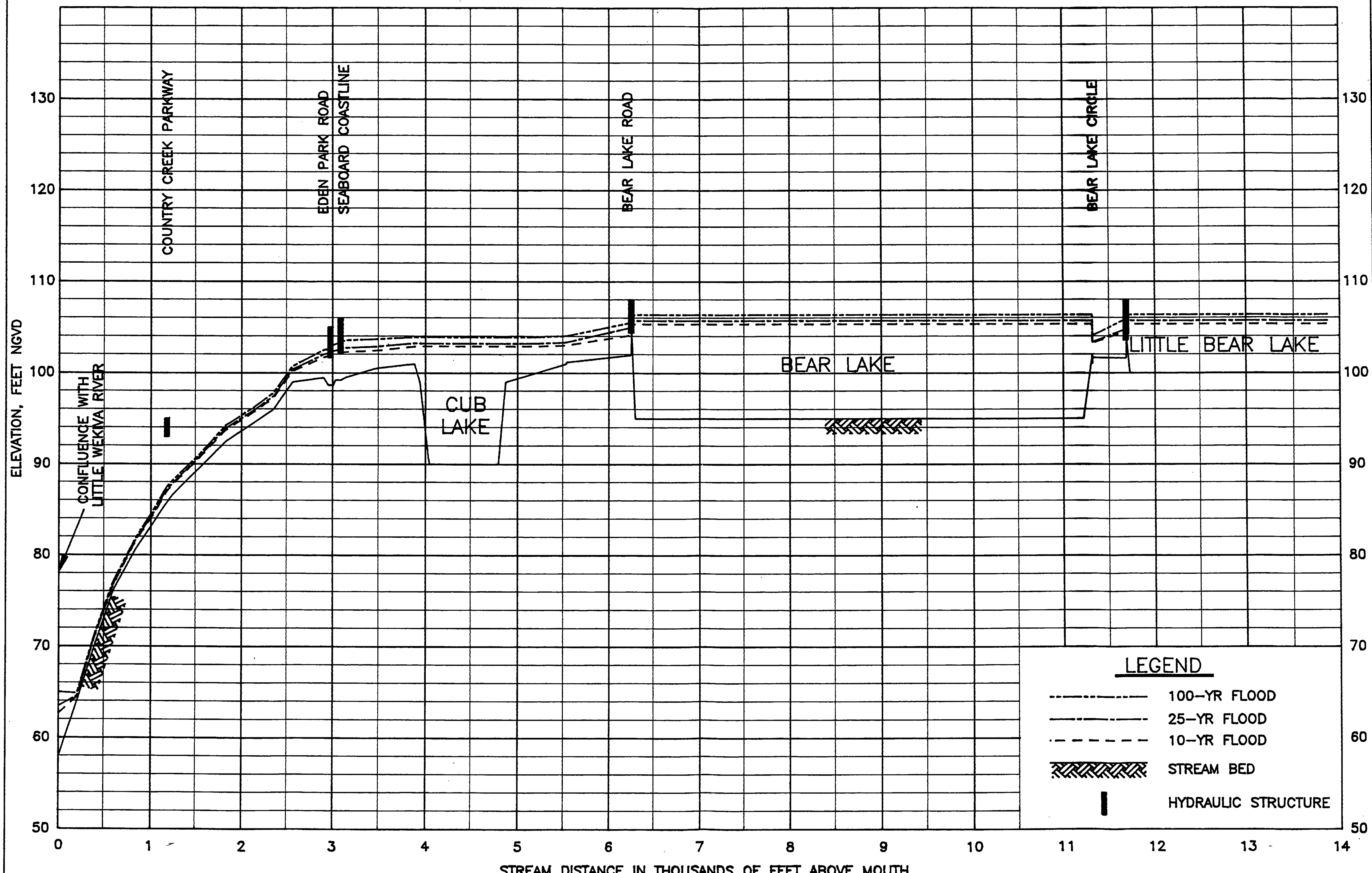
Plate No.
9



FLOOD PROFILES – EXISTING CONDITIONS
BRANCH C2
STA 0+00 TO STA 79+95

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

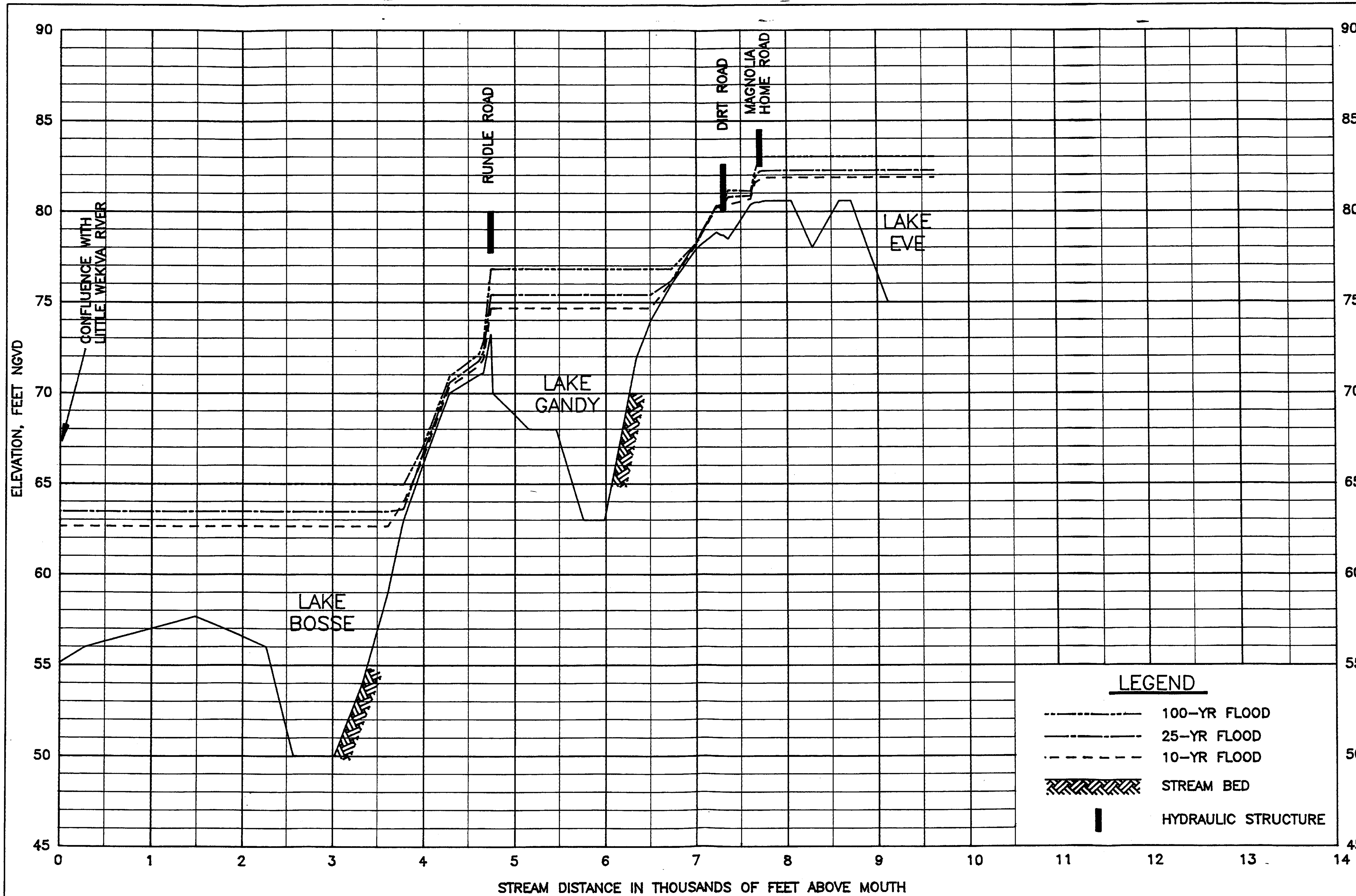
Plate No.
10



FLOOD PROFILES - EXISTING CONDITIONS
TRIBUTARY D
STA 0+00 TO STA 40+90

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

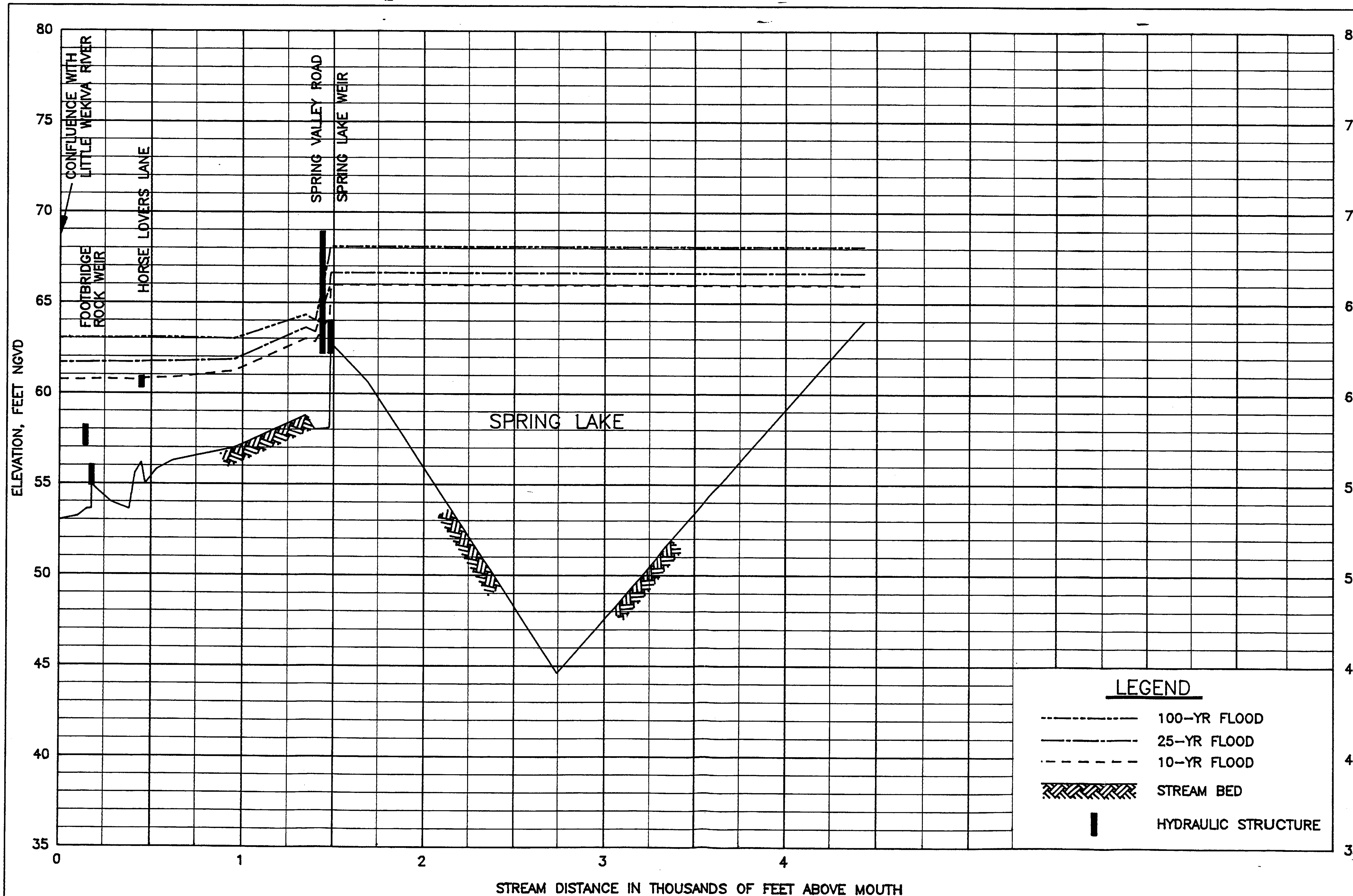
Plate No.
11



FLOOD PROFILES - EXISTING CONDITIONS
TRIBUTARY E
STA 0+00 TO STA 96+23

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

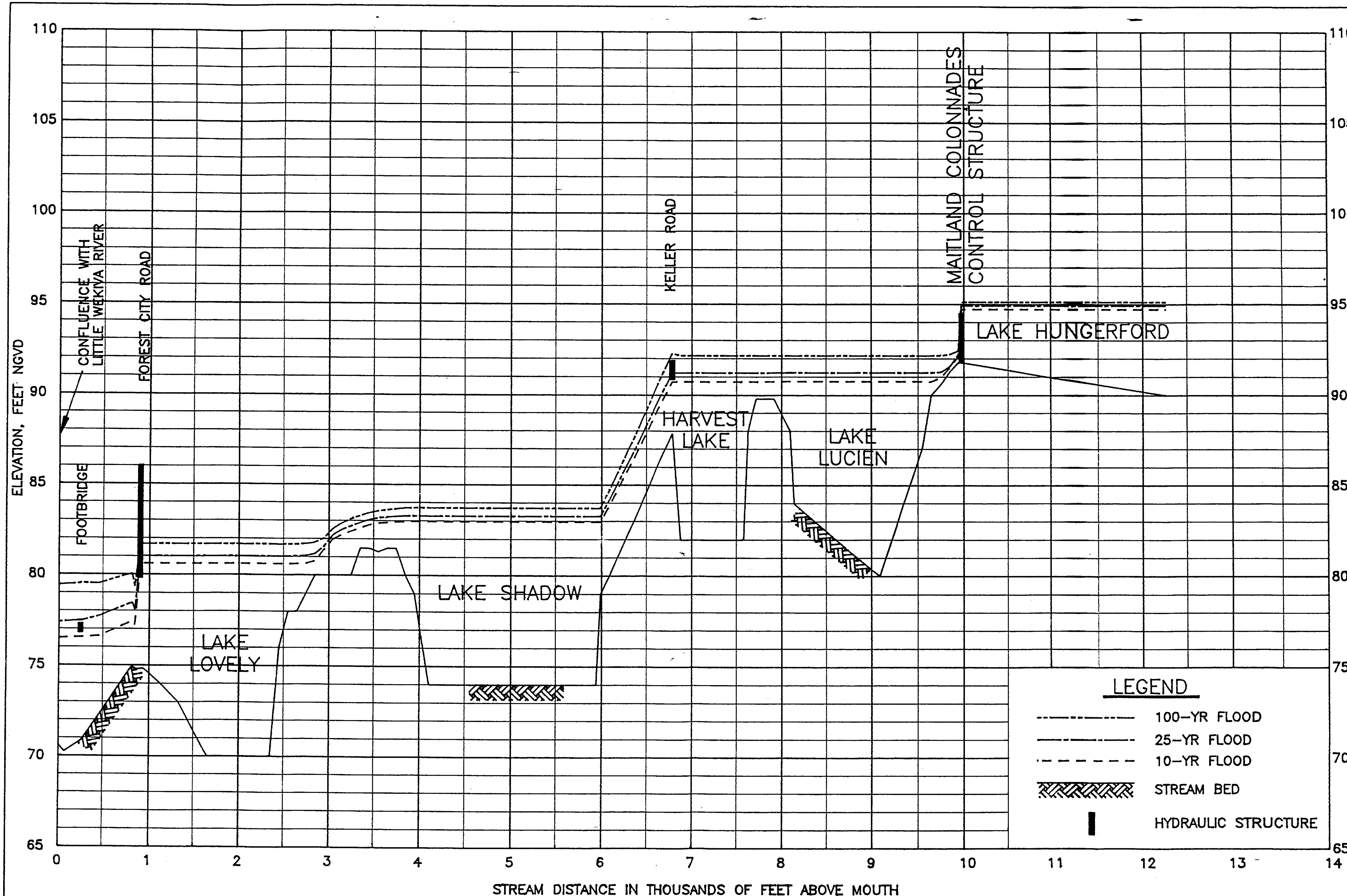
Plate No.
12



FLOOD PROFILES - EXISTING CONDITIONS
TRIBUTARY F
STA 0+00 TO STA 36+21

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

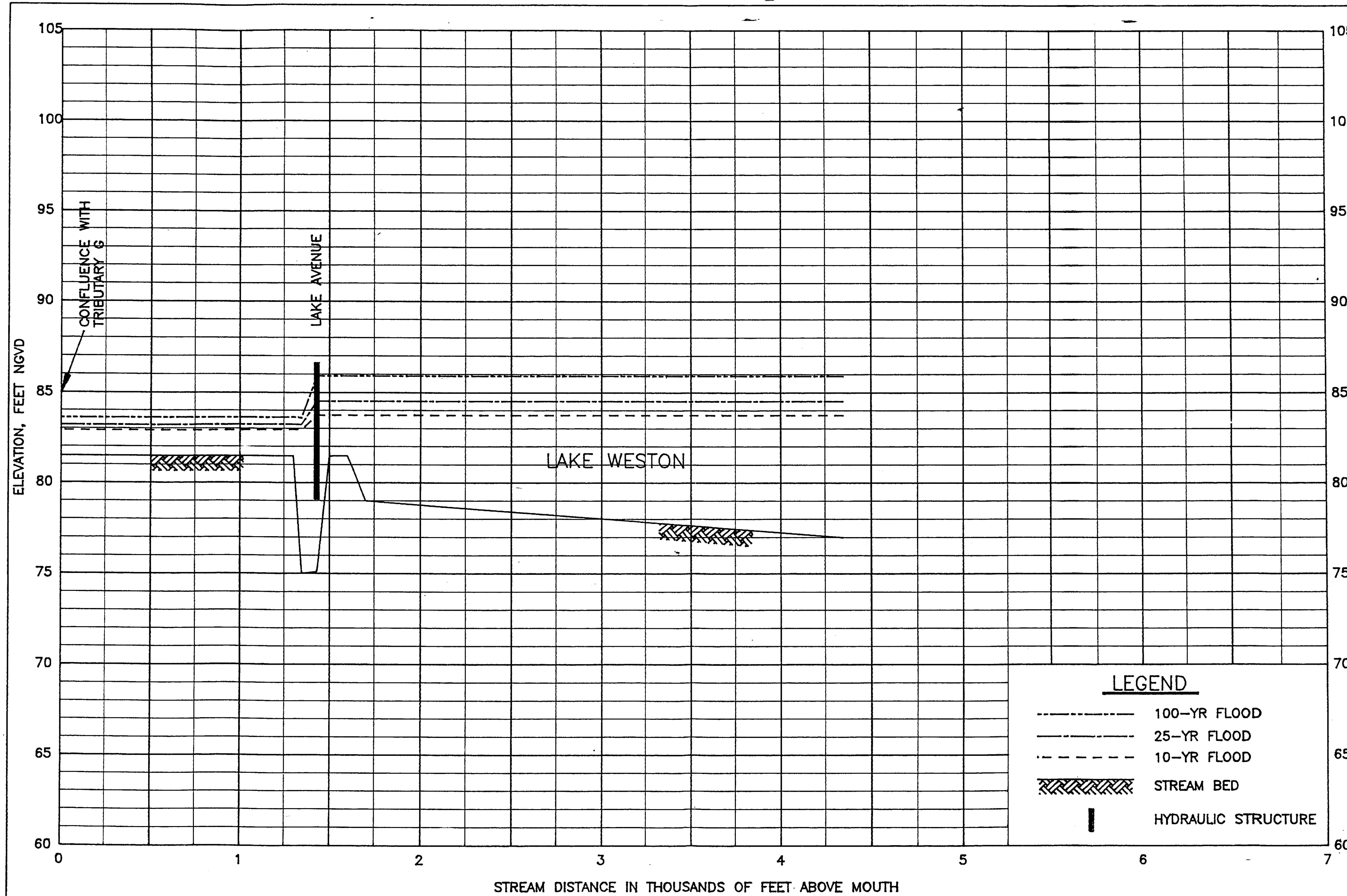
Plate No. 13



FLOOD PROFILES – EXISTING CONDITIONS
TRIBUTARY G
STA 0+00 TO STA 122+60

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

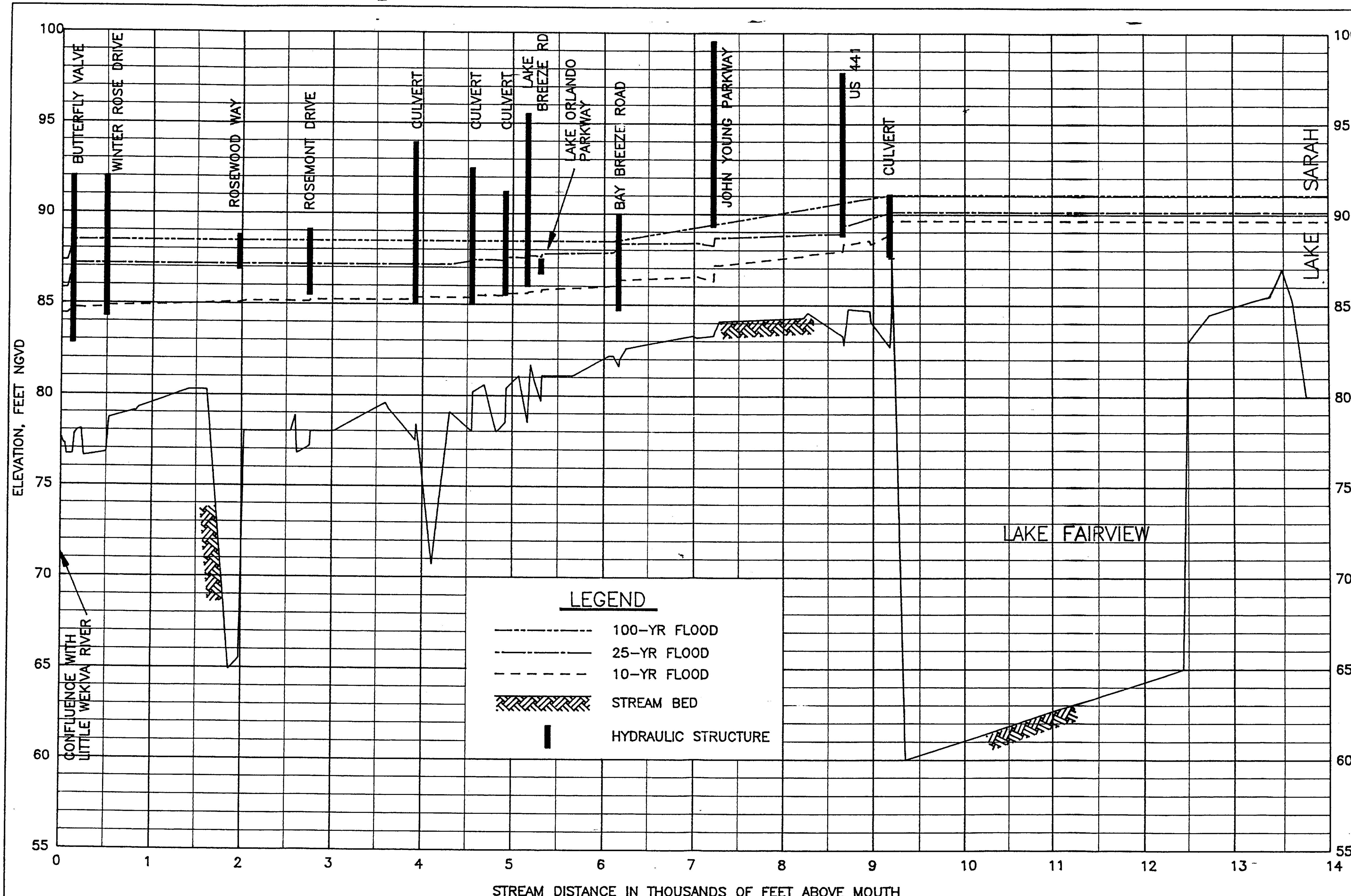
Plate No. 14



FLOOD PROFILES – EXISTING CONDITIONS
BRANCH G1
STA 0+00 TO STA 43+20

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

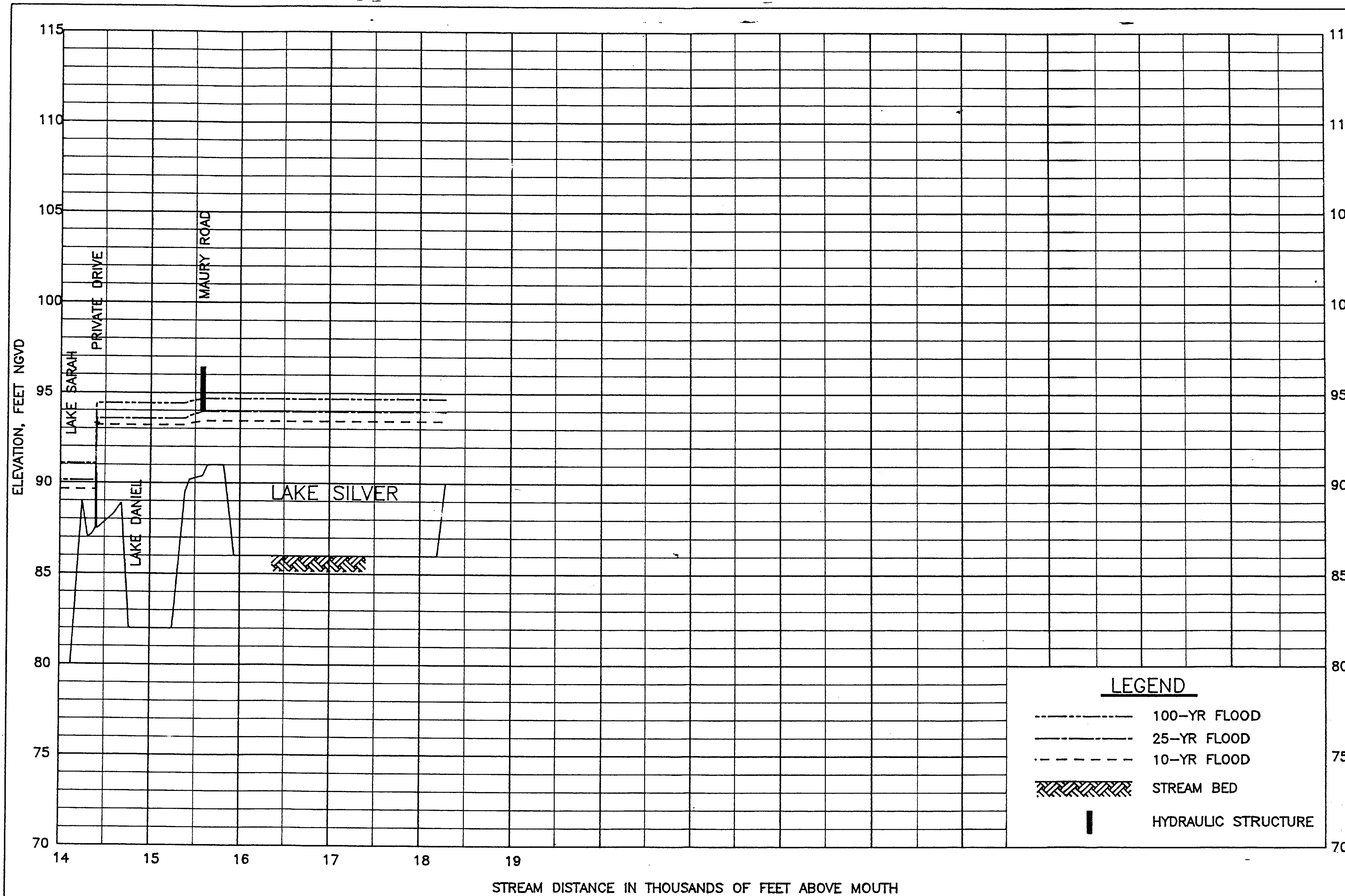
Plate No.
15



FLOOD PROFILES – EXISTING CONDITIONS
TRIBUTARY H
STA 0+00 TO STA 140+00

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

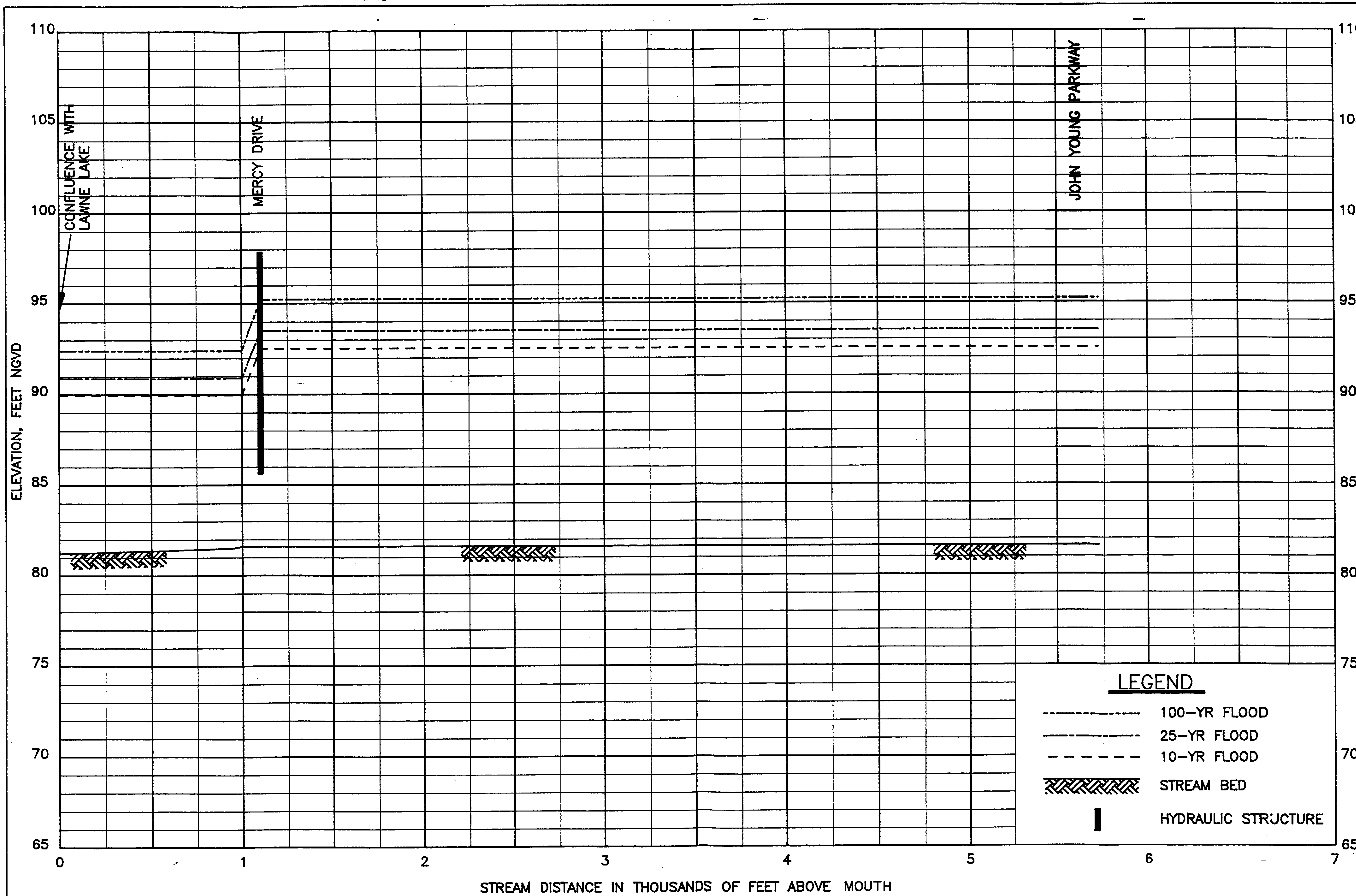
Plate No.
16



FLOOD PROFILES – EXISTING CONDITIONS
TRIBUTARY H
STA 140+00 TO STA 184+31

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

Plate No.
17



FLOOD PROFILES - EXISTING CONDITIONS
TRIBUTARY I
STA 0+00 TO STA 57+20

ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
THE LITTLE WEKIVA RIVER BASIN

Plate No.
18