

**Environmental Monitoring Programs**  
**Operated by the**  
**Manatee County Environmental Management Department**  
**Watershed Management Division**

(Revised 05/07)

**Executive Summary**

Manatee County's Environmental Management Department (EMD) currently conducts a number of environmental monitoring programs in and around the County. These programs vary in their scope and subject matter. EMD's programs monitor ambient water quality, sediment quality and benthic biology, seagrass health and conditions, and hydrologic studies. Some of the programs are run solely by EMD and the data is shared among local, state, and federal agencies, while others are run in cooperation with several of these agencies.

The programs outlined in the following document include EMD's Regional Ambient Monitoring Program and Surface Water Ambient Monitoring Program, Tampa Bay Estuary Program's (TBEP) Benthic Biological Monitoring, TBEP's Seagrass Monitoring Program, and EMD's Hydrologic Monitoring of Braden River Tributaries.

**Purpose**

The environmental monitoring programs conducted by the EMD serve several purposes in fulfilling the County's requirements for participation in various agencies and regulatory programs. These include monitoring the effectiveness of Best Management Practices associated with the County owned municipal storm sewer system and the Stormwater Management Plan that was developed to meet the requirements of the County's National Pollutant Discharge Elimination System permit. The data from these programs is also submitted to State and Federal databases so it can be used to evaluate the effectiveness of the State's Impaired Waters Rule. Furthermore, the data collected by EMD contributes to various regional efforts put forth by the Tampa Bay, Sarasota Bay and Charlotte Harbor National Estuary Programs and meets the County's obligation to those agencies as a member participating in the Estuary Programs' Comprehensive Conservation and Management Plans. EMD's data is also utilized to support regional modeling efforts, where appropriate, through the National Estuary Programs and cooperative funding efforts through Southwest Florida Water Management District. The County-wide hydrologic monitoring efforts are utilized to evaluate the health of our estuarine systems and specifically evaluate the Evers Reservoir watershed to ensure that the reservoir is not adversely affected by development within that watershed.

**RAMP Estuary Monitoring**

The Environmental Management Department ambient water quality monitoring program for Manatee County's estuarine waters is the Regional Ambient Monitoring Program. RAMP, beginning in November, 1995, is the successor to EMD's old AWP station network that had



operated since 1988. It uses EPA's EMAP stratified random sampling design to infer water quality trends on an areal basis. RAMP evolved from a series of Tampa Bay Estuary Program sponsored workshops on the methods, variables and field techniques of estuarine water quality monitoring. An important objective of the workshops was to improve data compatibility among the water quality monitoring programs of the different jurisdictions that all monitor portions of a larger area, such as Tampa Bay. All RAMP implementations use the same sampling design and include the same set of core measurements. The RAMP concept has been endorsed by the Tampa Bay, Sarasota Bay, and Charlotte Harbor National Estuary Programs.

Manatee County RAMP divides the County's lower estuarine area into 2 segments of 24, 3.56km<sup>2</sup> hexagonal sampling areas each (see Figure 1.1). The segment boundaries approximate the boundaries of the two local National Estuary Programs. The north segment encompasses lower Tampa Bay north of the Manatee River mouth and south of the County line, Terra Ceia Bay, and the lower Manatee River below the Braden River confluence. The south segment includes Anna Maria Sound and adjoining parts of lower Tampa Bay, Palma Sola Bay, and Sarasota Bay north of the county line.

Sampling points were randomly located within each hexagon at the start of the program. A hexagonal sampling area was included in the program if the randomly generated sampling point was at least 4ft deep by the nautical chart and verified during program reconnaissance. If an old AWP estuarine station was located within the sampling area and met the depth criteria, that station was used as the sampling point in the hexagon. This allowed some degree of data continuity with the previous monitoring program. Ten RAMP sampling points are old AWP stations. The statistical basis of the EMAP design allows for the addition of pre-selected stations if there was no overriding physical reason for the station's geographic placement at a particular point.

The extinction coefficient of photosynthetically active radiation (PAR) measures the amount of light penetrating as it moves through the water column. EMD takes PAR readings with the apparatus illustrated in Figure 1.3. The apparatus is made up of two light sensors which give readings at two different depths. A total of three replicates readings are taken, at each of the upward-facing 2-pi sensors.

One-third of the sampling points in each segment, eight points, are sampled monthly. All sampling points in a segment are visited within each calendar quarter. Inferences on ambient water quality trends for each segment are made on quarterly time scales. The program's water quality observations are listed in Table 1.

### **TBNEP Benthic Biological Monitoring**

The Tampa Bay National Estuary Program initiated several long-term monitoring programs to measure the success of program management actions. The Benthic community biological monitoring program was developed for use as a long term trend indicator of the Bay area's water and sediment quality. The benthic monitoring program was initiated in 1993 by the TBNEP. This program uses a subset of the EPA Louisianan Province Environmental Monitoring Assessment



Program (EMAP) Benthic protocol. EMD samples TBNEP's Manatee River, Terra Ceia Bay, and portions of Lower Tampa Bay as well as conducting the silt/clay analysis on all the samples collected for the program. There is one sampling episode per year, during the September-October EMAP index period. At each site grab samples are collected for benthic macroinvertebrate community analysis, sediment composition (% silt/clay), and sediment contaminant analysis along with corresponding hydrographic data.

In 2002, the program was redesigned to scale back the number of samples collected within each bay segment. The reporting period changes from one year to four year intervals and the redesign combined the Terra Ceia Bay and the Manatee River segments into a single reporting unit.

### **SWAMP Watershed Monitoring**

EMD's Surface Water Ambient Monitoring Program is the EMD's ambient water quality monitoring program for the County's watersheds, rivers, and tidal creeks. The program uses a conventional, fixed-station design where all stations are sampled monthly (see Figure 1.2). It is an amalgam of two predecessor water quality monitoring programs. Stations in the upper estuary, the Lake Manatee Watershed, and the Myakka River were originally part of our AWP network. Stations in the Evers Reservoir watershed are from a cooperative water quality study involving the County, the City of Bradenton, and the USGS. As a result of this investigation, an extensive stage gage network was established on the sub-watersheds of the Evers Reservoir (see Hydrologic Monitoring of Braden River Tributaries).

Prior data commitments in the Evers Reservoir watershed and physical constraints at many stations cause the variable set for this program to vary considerably between watersheds (Table 2). For example, salinity measurements are made at only two estuarine stations and many tributary stations are too shallow for transparency measurements or depth-composite sampling for laboratory analyses.

In 2005 the SWAMP stations were modified to better sample the full area that the County's Stormwater Management Program was designed to cover. As a result, four new stations were added and two stations were removed in the Evers Reservoir watershed since this area has been and continues to be extensively monitored by the County and the City of Bradenton. The four new stations are located in Frog Creek, Cedar Hammock Drain, and along the Lower Manatee River (see Table 3).

### **Tampa Bay Seagrass Monitoring Program**

The Tampa Bay Estuary Program initiated a fixed transect seagrass monitoring program for Tampa Bay in 1998. This program was designed to monitor spatial and temporal changes of seagrass species in established meadows and document new colonization where no current vegetation was present. The monitoring of transects will allow TBEP to compare seagrass coverage to the seagrass target depths established for Tampa Bay by the Technical Advisory Committee for the TBEP in 1994. The transects are monitored on an annual basis.



EMD is responsible for performing the seagrass transect monitoring for 14 permanent transects through shallow subtidal or intertidal seagrass meadows in Lower Tampa Bay. Transects are oriented perpendicular to shore, begin near the high tide mark, and extend to a seaward endpoint. The seaward endpoint generally occurs at the 2m contour for Lower Tampa Bay, however if coverage is found beyond that, the transect ends in the last 100m segment that has  $\leq 25\%$  coverage within that 100m. Water quality data is taken at three sites along each transect using a Hydrolab multiparameter water quality monitoring instrument. The hydrographic data collected includes DO, pH, salinity, temperature, photosynthetically active radiation (PAR), and samples taken for chlorophyll a and turbidity. Secchi depth is recorded at the deep end of each transect as well.

The Braun Blanquet system is used to rate seagrass coverage along each transect. Coverage is determined using a meter square placed at predetermined locations. Other data collected from this meter square placement include seagrass epiphytic cover and sediment composition, water column depth and time of the depth measurement. Shoot density and blade length are recorded for *Halodule wrightii*, *Syringodium filiforme*, and *Thalassia testudinum*.

### **Hydrologic Monitoring of Braden River Tributaries**

In 1988, EMD began monitoring five tributaries of the Braden River with stage gages. The gage stations are located in Hickory Hammock, Cedar Creek, Rattlesnake Slough, Nonsense Creek, and Cooper Creek (see Figure 1.4). Stage and discharge data are continuously collected, along with flow measurements every fifteen minutes. These 15-minute interval data are then used to compute daily mean, maximum, and minimum values of stage and discharge. The data is submitted to EMD monthly. The report submitted by the consultant maintaining the gages contains tables of mean daily discharge, mean daily gage height, a summary of discharge measurements made, an expanded rating table of gage height vs. discharge as well as a log-log plot of the data, and unit values (15 minute) of gage height and discharge.

### **Special Monitoring Programs**

A variety of special water quality studies have been conducted on an 'as-needed' basis. These programs are generally of short duration and/or of limited geographical scope.

One such program is the Bishop Harbor monitoring that EMD is conducting to monitor the effects of the Piney Point discharge to that waterbody. This monitoring effort has been in place since 1998. EMD samples for water quality parameters at 5 stations within Bishop Harbor on a monthly basis.

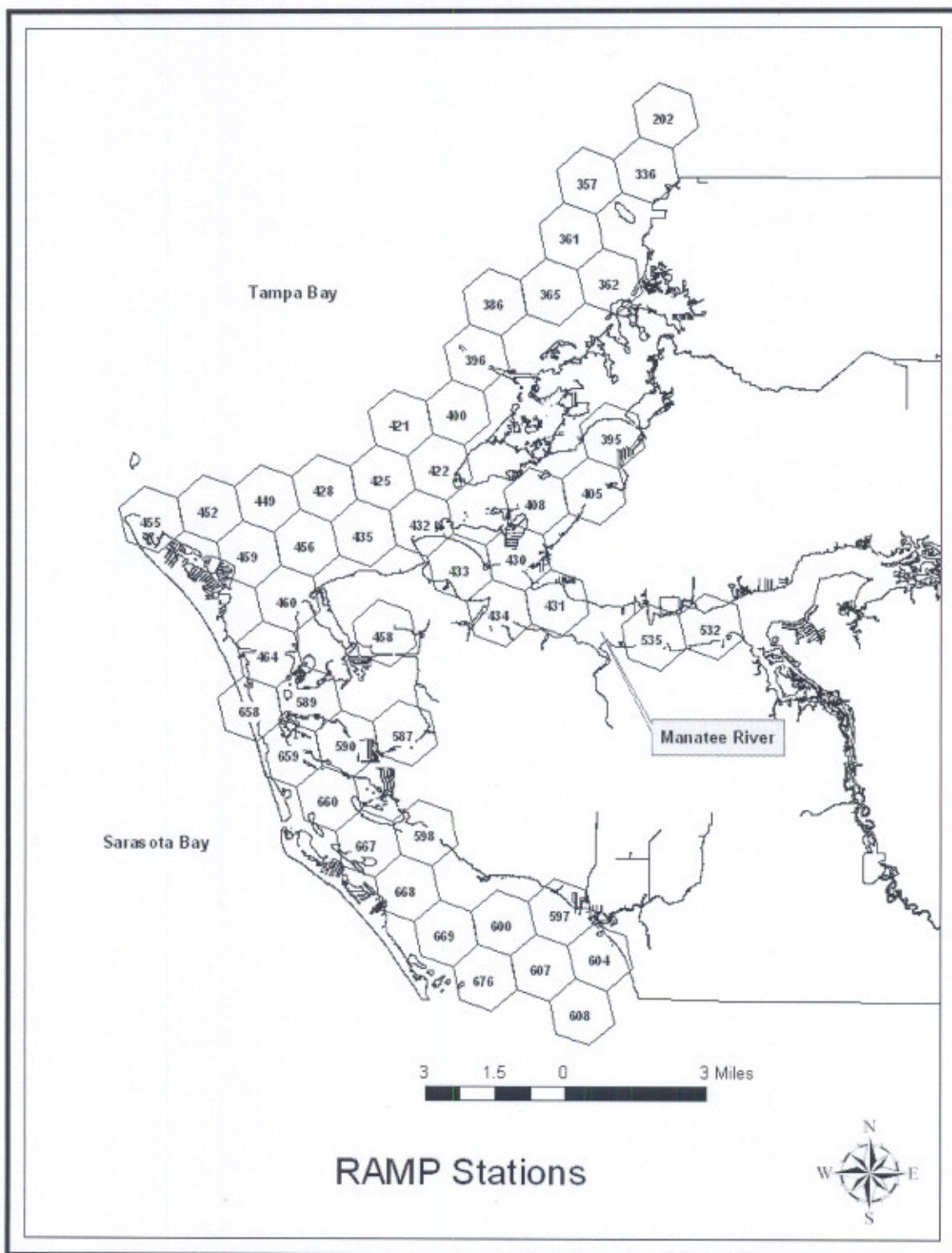
Another special program is additional hydrologic monitoring that will begin in spring of 2007 in the Bowlees Creek basin. A new gage station will be installed on Bowlees Creek to collect stage and discharge data.

## **Data Management**

EMD utilizes ArcGIS 9 to map station locations as needed. Coastlines, basin topography, soils, land use/land cover, and data collection points are represented on the GIS and may be linked with water quality observations. Exact station locations for all stations of our permanent water quality monitoring programs are listed in Table 3. These data are subject to change.

EMD's historic data are available from the EPA Legacy STORET archive under the agency code 21FLMANA. This system has most data from the ongoing and predecessor programs are current through the end of 1998. Data submitted to EPA after January 1, 1999 is available from the Modernized STORET system via the Internet.





**Figure 1.1: Regional Ambient Monitoring Program Stations**

This map shows program strata and sampling regions for each station. For more accurate station locations see Table 3.

**Table 1.** RAMP water quality measurements. All *in situ* measurements and laboratory samples are taken at 1 meter in depth.

*In situ*

Depth  
pH  
Temperature  
Dissolved Oxygen  
Salinity  
Conductivity  
Transparency  
Photometry  
(Extinction coefficient for PAR between 1.0-1.5 meters, see attached illustration)

Laboratory

Turbidity (method # SM2130B)  
Total Suspended Solids (method # SM2540D)  
Total Phosphorous (method # EPA365.4)  
Total Kjeldahl Nitrogen (method # EPA351.2)  
Ammonia (method # EPA350.3)  
Nitrate (method # EPA352.1)  
Nitrite+Nitrate  
Chlorophyll-a (fluorometric)  
Apparent Color (method # SM2120B)

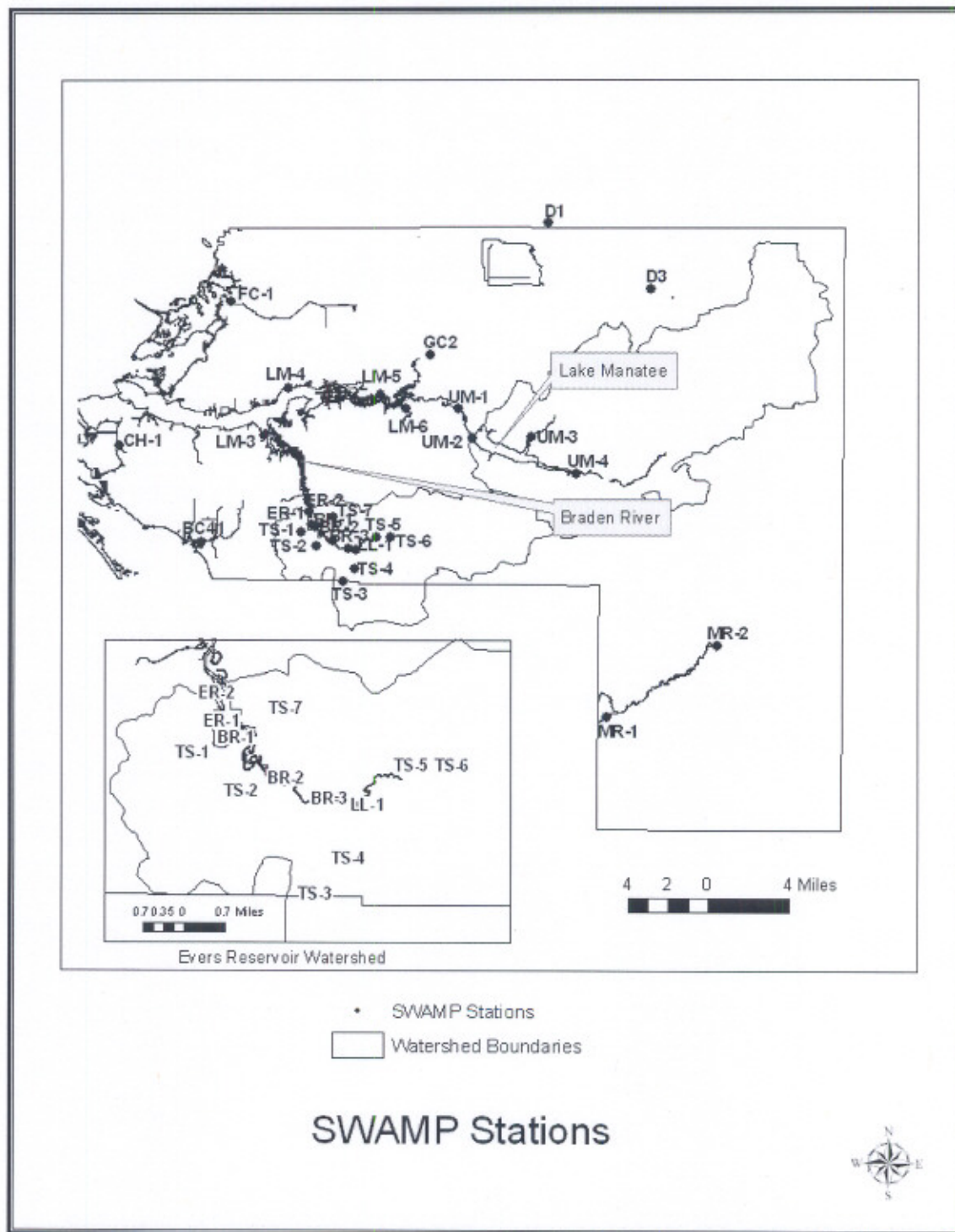


Figure 1.2: Surface Water Ambient Monitoring Program Stations



**Table 2.** SWAMP water quality measurements. Variables and collection methods vary based on the predecessor program that established the station. All measurements and sample collections are made at the surface.

*In situ*

Depth  
     (other than tributary stations)  
 Temperature  
 Salinity  
     (at Bowlees Creek and Pelican Pier (I-75) stations only)  
 Conductivity  
 pH  
 Dissolved Oxygen  
 Transparency  
     (Evers Reservoir and Braden River stations only)

Laboratory

Biochemical Oxygen Demand (method # EPA405.1)  
 Turbidity (method # SM2130B)  
 Total Suspended Solids (method # SM2540D)  
 TDS (method # SM2540C)  
     (Evers Reservoir watershed stations only)  
 Total Phosphorous (method # EPA365.4)  
 Orthophosphorous (method # SM4500-PE)  
 Total Kjeldahl Nitrogen (method # EPA351.2)  
 Ammonia (method # EPA350.3)  
 Nitrate (method # EPA352.1)  
 Nitrite+Nitrate  
 Chlorophyll-a (fluorometric)  
 Color (method # SM2120B)  
 Fluoride (method # SM4500 F-C)  
 Bacteria  
     Fecal coliform (method # SM9222D)  
         (Evers Reservoir, Braden River, and Lake Manatee Watershed stations only)

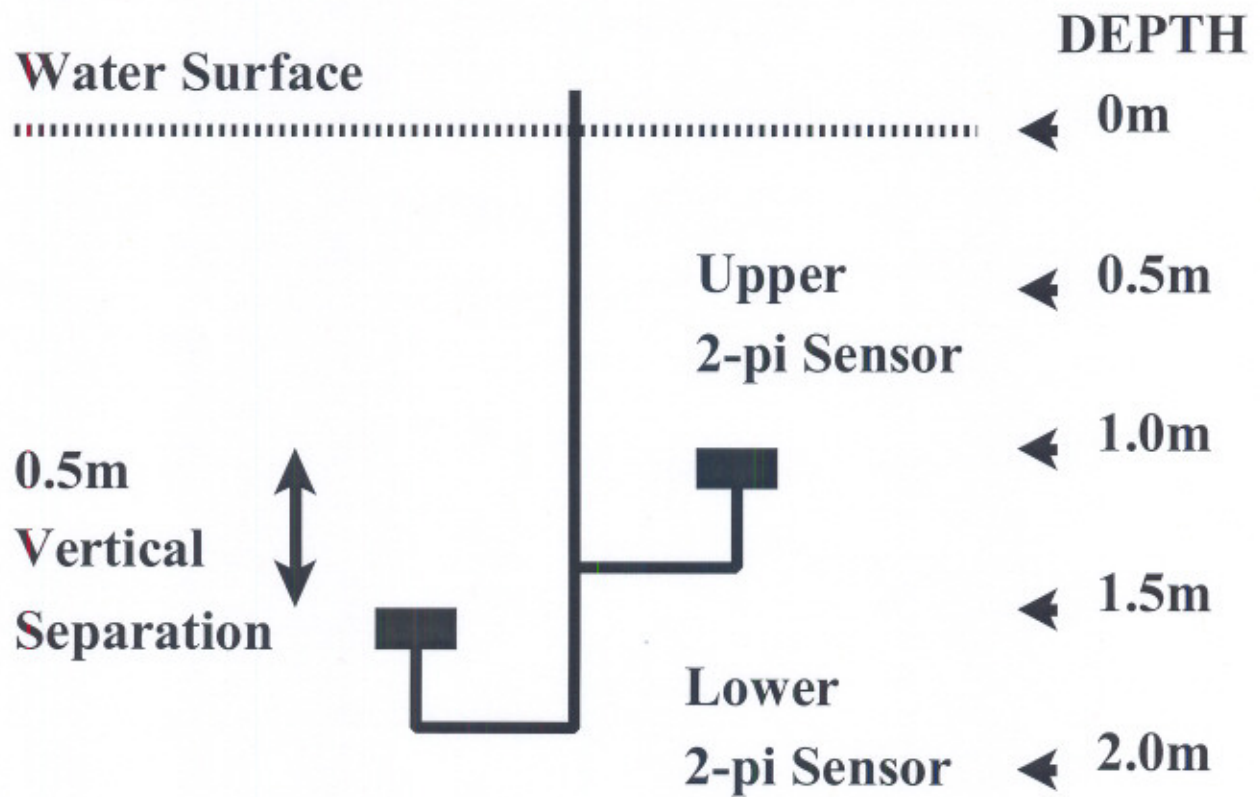


Figure 1.3: Schematic drawing of the PAR photometry sensor apparatus.



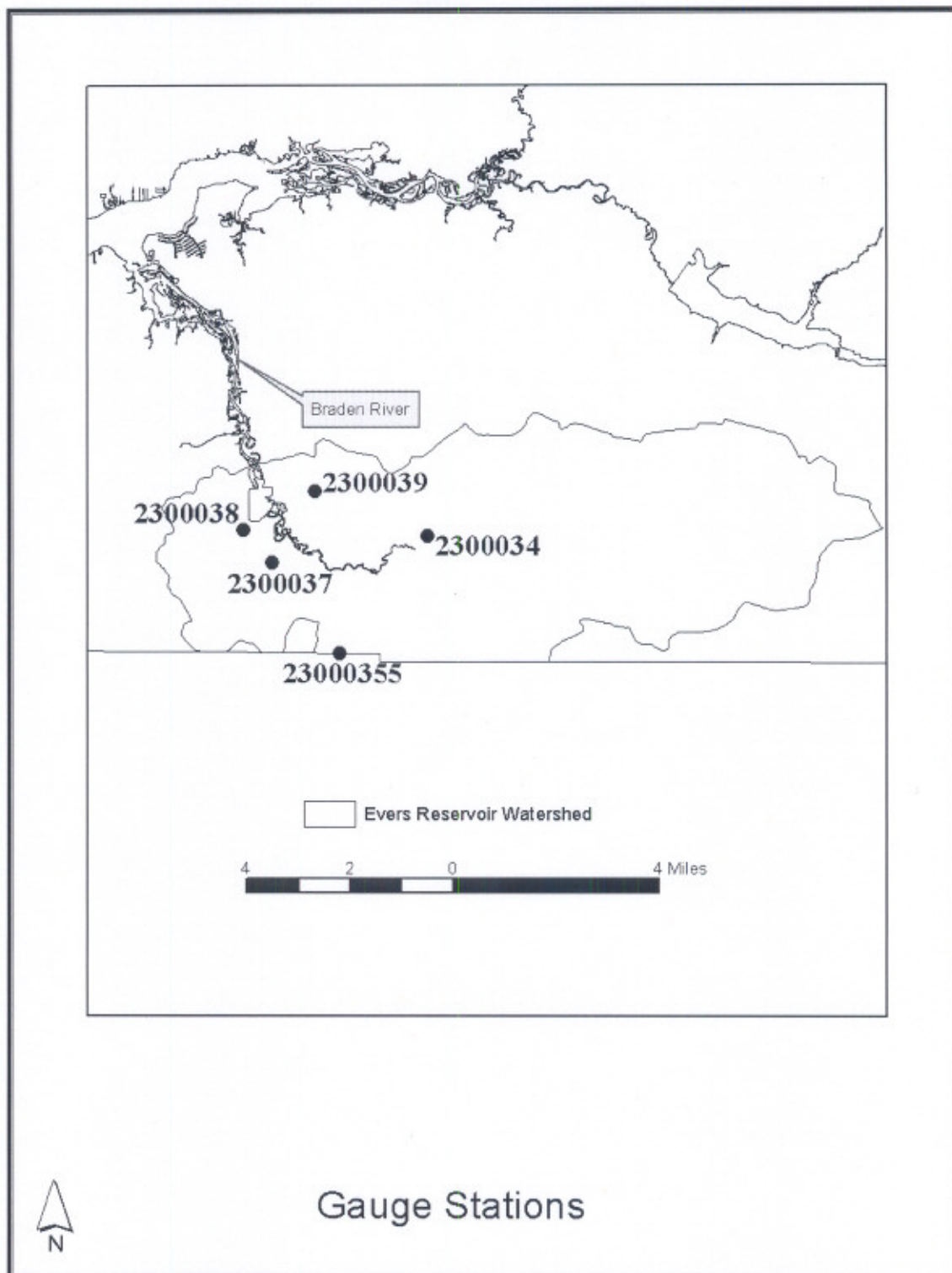


Figure 1.4: Hydrologic Monitoring of Braden River Tributaries

**Table 3.** Sampling station locations for all permanent water quality monitoring programs. Some RAMP program stations may be known by both the 3-digit numerical designation of the name of the old AWP program station actually sampled for that grid cell. Most stations are shown on the accompanying maps.

Station ID	Station Description	Latitude (d m s)	Longitude (d m s)
ER-1	Reservoir Intake Structure (Removed 6/05)	27 25 47.4	82 29 9.6
ER-2	Middle Reservoir	27 26 18.6	82 29 15
BR-1	Braden River Near Reservoir (Removed 6/05)	27 25 40.8	82 28 57
BR-2	Braden River at Power line	27 25 1.8	82 28 4.8
BR-3	Braden River at I-75	27 24 45	82 27 21
LL-1	Linger Lodge	27 24 41.4	82 26 56.4
TS-1	Rattlesnake Slough	27 25 27	82 29 40.2
TS-2	Cedar Creek	27 24 50.4	82 28 52.8
TS-3	Foley Creek	27 23 17.4	82 27 34.8
TS-4	Cooper Creek	27 23 49.8	82 27 2.4
TS-5	Hickory Creek	27 25 14.4	82 25 59.4
TS-6	Braden River	27 25 14.4	82 25 17.4
TS-7	Nonsense Creek	27 26 6	82 28 6
BC41	Bowless Creek (Relocated 12/95)	27 24 59.1	82 34 29.7
LM-3	Braden River Mouth	27 29 39.6	82 31 28.8
LM-4	I-75 Bridge	27 31 43.8	82 30 18.6
LM-5	Fort Hamer	27 31 28.67	82 25 56.28
LM-6	Mill Creek at Upper Manatee River Rd	27 30 49.61	82 24 33.16
UM-1	Rye Road	27 30 51	82 22 0.6
UM-2	Lake Manatee Dam	27 29 36	82 21 17.4
UM-3	Gilley Creek	27 29 40.2	82 18 27.6
UM-4	Bethany Bridge	27 28 3	82 16 14.4
MR-1	Myakka River at Clay Gulley Road	27 17 24.6	82 14 43.8
MR-2	Myakka River at SR 70 (New 6/97)	27 20 34	82 09 25
CH-1	Cedar Hammock Drain at Palma Sola Bay	27 29 11.11	82 38 30.23
FC-1	Frog Creek	27 35 27.85	82 33 8.86
202	RAMP North Segment	27 39 56.53	82 33 32.64
336	"	27 38 50.72	82 33 54.58
357	"	27 38 58.12	82 34 42.43
361	"	27 37 42.66	82 35 30.96
362	"	27 36 46.71	82 34 39.51
365	"	27 36 44.81	82 36 23.94
386	"	27 36 21.55	82 37 4.2
395	"	27 34 3.19	82 34 23.06
396	"	27 35 27.81	82 37 18.32
400	"	27 34 21.3	82 37 46.72
405	"	27 33 9.6	82 35 14.4
408	"	27 32 52.2	82 35 57
421	"	27 34 35.43	82 39 8.98
422	"	27 33 26.94	82 37 59.58
425	"	27 32 53.78	82 39 38.64
428	"	27 33 7.23	82 40 18.12
430	"	27 31 38.39	82 36 34.49
431	"	27 30 40.31	82 35 52.58
432	"	27 32 35.16	82 38 40.39
433	"	27 31 15.47	82 37 57.65



**Table 3. (cont)**

<b>Station ID</b>	<b>Station Description</b>	<b>Latitude (d m s)</b>	<b>Longitude (d m s)</b>
434	"	27 31 2.4	82 37 7.8
435	"	27 31 58.8	82 40 0.6
532	"	27 30 20.5	82 32 31.28
535	"	27 30 12	82 34 3
449	RAMP South Segment	27 32 44.91	82 42 3.42
452	"	27 32 28.06	82 43 1.4
455	"	27 32 6	82 43 52.8
456	"	27 31 56.25	82 41 18.4
458	"	27 29 49.2	82 39 24.6
459	"	27 31 43.78	82 42 13
460	"	27 31 0.15	82 41 7.14
464	"	27 29 45.73	82 41 43.59
587	"	27 28 23.48	82 38 55.47
589	"	27 28 53.41	82 40 59.07
590	"	27 28 8.4	82 39 49.2
597	"	27 24 54.91	82 35 40.82
598	"	27 26 8.1	82 38 23.31
600	"	27 25 7.49	82 36 21.36
604	"	27 24 8.71	82 34 50.31
607	"	27 23 56.55	82 36 1.86
608	"	27 22 48.73	82 35 32.08
658	"	27 28 52.02	82 41 57.43
659	"	27 27 59.4	82 41 15
660	"	27 27 11.95	82 40 30.8
667	"	27 26 13.72	82 39 38.81
668	"	27 25 17.47	82 38 48.68
669	"	27 24 40.2	82 38 35.4
676	"	27 23 51.66	82 37 36.7
02300037	Braden River Gage Station	27 24 51	82 28 53
023000355	"	27 23 18	82 27 35
02300034	"	27 25 18	82 25 55.99
02300039	"	27 26 3.98	82 28 4
02300038	"	27 25 23.99	82 29 25