Lake Middleton Rehabilitation Report

PHEASANT BRANCH CREEK/BOAT LANDING RESTORATION FEASIBILITY STUDY

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In Cooperation with: Wisconsin Department of Natural Resources Lake Protection Program

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Chapter 1. Introduction and Background

The Pheasant Branch Creek (creek) watershed is comprised of 26.67 square miles of land situated within the cities of Madison and Middleton and the Towns of Middleton, Springfield and Westport in central Dane County, Wisconsin. Of the 25.67 square miles, 6.12 square miles do not contribute runoff to the creek, leaving 19.55 square miles draining into the creek and eventually into Lake Mendota (Lake) at Baskerville harbor. A map showing the watershed is shown in Figure 1.

The Pheasant Branch Marsh (marsh) is a unique resource for the City of Middleton (City) located on the lower portion of the creek (as shown in Figure 1). The marsh provides unique plant and wildlife habitat for several endangered species (wild petunia, Blanding's turtle, prairie vole and western harvest mouse). The Frederick Spring is also located in the marsh which is a major water source for the Lake providing 60,000 gallons of water per hour. Surrounding the marsh is 504 acres of open space called the Pheasant Branch and Belfontaine Conservancy (conservancy)

As shown in Figure 1, the creek consists of four reaches:

- north fork,
- south fork,
- upper main (from north/south fork confluence to marsh),
- lower main (from marsh to Lake outlet)

Since 1967, 19 reports and studies have documented the natural conditions and challenges within the watershed. Following a recommendation from an earlier 1967 study, the creek was re-aligned in 1974 to flow to the northeast through the marsh prior to discharging into the lake.

In general, the past studies address the deteriorating condition of the marsh caused by:

- upstream erosion from new developments and steep creek banks,
- sediment transport through the creek and
- sediment deposition in the marsh and lower main.

An earlier report (Northern Lake Mendota Regional Plan, 1999, Schreiber/Anderson) describes this problem succinctly:

> "In the early 1970s, the decision was made by city officials to redirect the channel into its historical course. With the creek in its historic bed, the marsh now provided protection to lake Mendota by acting as a sink for sediments and some nutrients flowing into it from Pheasant Branch. The additional sedimentation, as well as seeds and nutrients carried into the marsh by the new stream direction have had a negative impact on the marsh. As long

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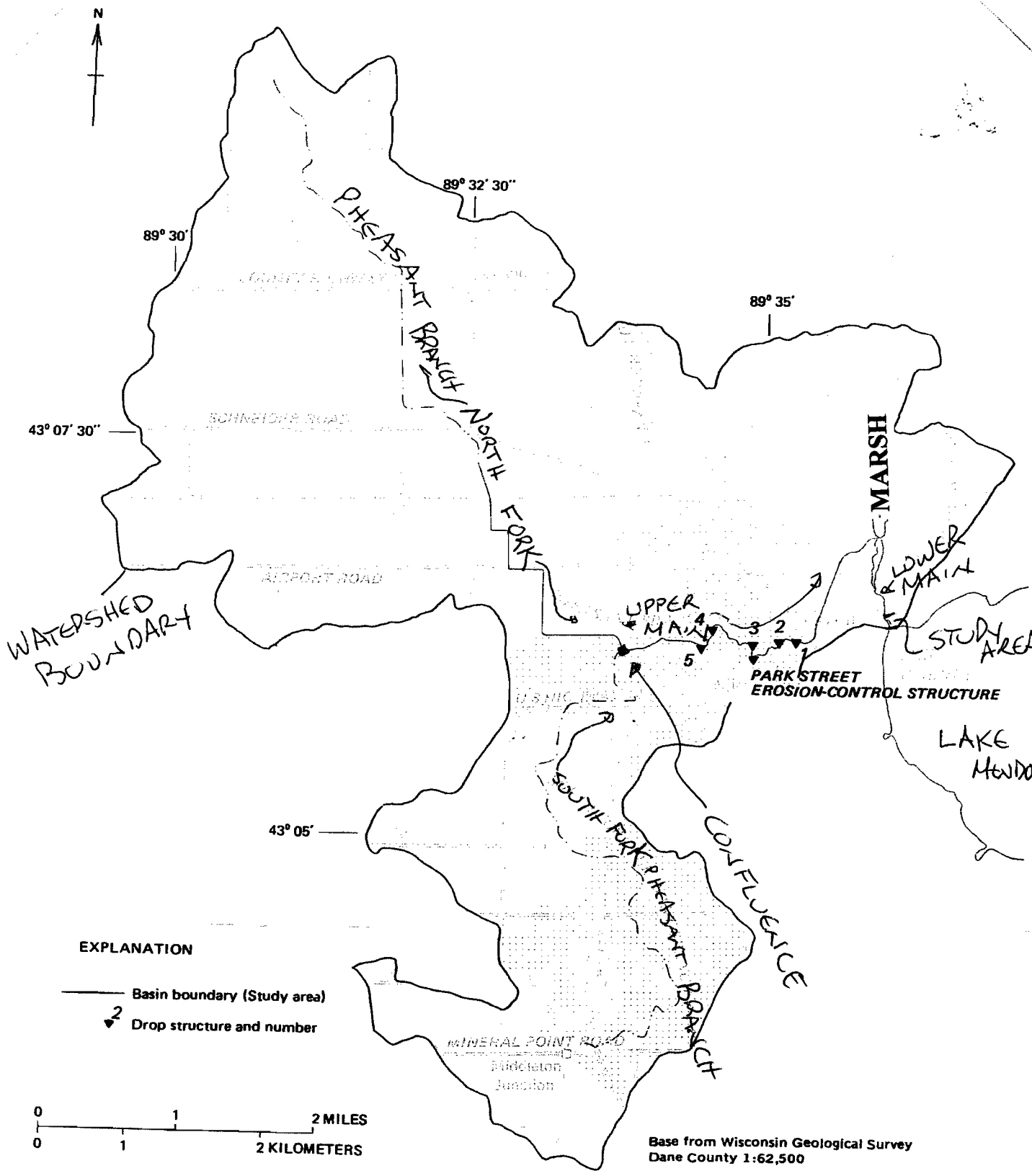

Figure 1- Pheasant Branch Creek Watershed

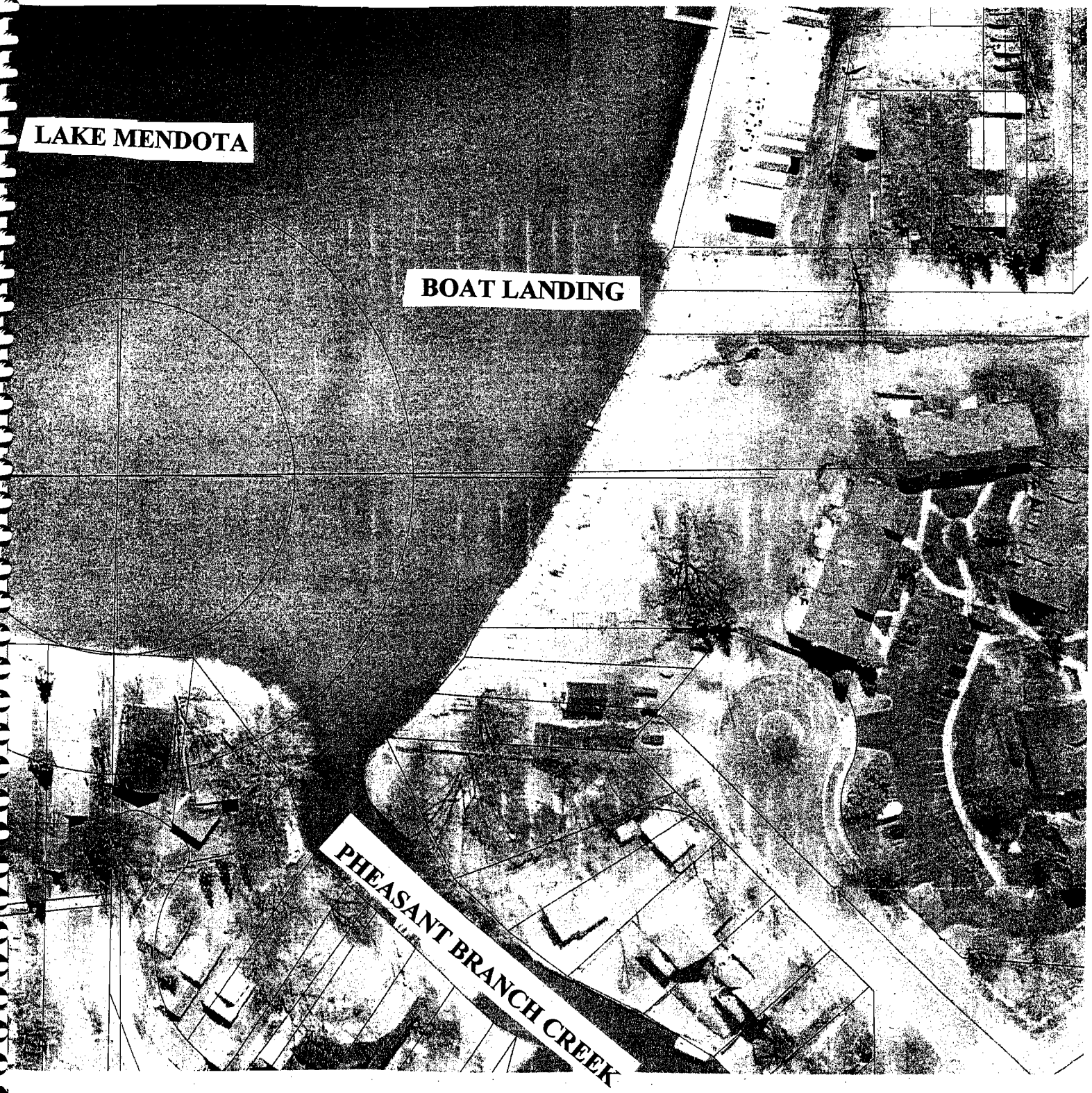

Figure 2- Project Study Area (Not to Scale)

as the creek is diverted in this manner to flow north and then south through the marsh, the water quality of the marsh will continue to be influenced primarily by upstream agricultural runoff and urban stormwater."

In response to the increasing sediment load, the city implemented numerous sediment control measures along the upper main including:

- five drop structures to reduce velocities,
- sections of sheet pile walls, rip-rap and gabions to protect eroding creek-banks,
- two wet detention basins near the north/south fork confluence to trap sediment,
- diversion channels at the top of the steep creek banks,
- sediment control structure at Park Street.

However, rapid population growth in the upstream watershed has partially negated these controls by increasing the sediment loading into the creek.

The purpose of this report is to address the feasibility of restoration of the lower main portion of the creek by removing sediment to 6 feet of depth from the Century Avenue Bridge to the lake outlet and the City boat landing as shown in Figure 2.

Since the creek was last restored in 1974, the downstream reach has become choked with three to five feet of sediment so that motorboats can no longer enter the creek. In addition, bluegills and other fish can no longer migrate up the creek to spawn.

A new boat launch was installed in 2002 by the City at the end of Lake Street. This area is also filled with approximately three feet of sediment causing difficulty with motorboat access to the boat launch. An inboard motorboat needs three feet of clearance between the lake bottom and water surface to safely operate without propeller damage.

Chapter 2. Sediment and Nutrient Inflow

In general, Total Suspended Sediment (TSS) is one of the major storm water pollutants causing degradation to receiving waters. As described in Chapter 1, developing areas within both the City and other upstream areas have caused a substantial increase in the sediment load delivered to the creek over the last thirty years.

The WDNR describes erosion/sedimentation as a water pollution source as follows: (Wisconsin Stormwater Manual, Vol 1, Ch 1 Pg 4 and 5, Publication Number WR-349-94)

> "Erosion (in streams and rivers) is often quick and severe because most floodplain soils are loose and wash away easily. However, downstream transport of eroded sediment is slow. Much of the sediment moves downstream gradually as "bed-load". These constantly shifting deposits may form sand bars and smother bottom life for many years.....
>
> Although existing urban sources (e.g. parking lots, road surfaces, industrial storage areas) are important sources of sediment, by far the highest loads of sediment come from areas of construction. The Wisconsin Department of Natural Resources (DNR) estimates that an average acre under construction delivers 60,000 pounds (30 tons) of sediment to downstream waterways, about 60 times more than any other land use....
>
> Because phosphorus compounds attach themselves to sediment particles, land uses that produce high sediment loads also tend to produce high phosphorus loads. This makes construction sites a significant source of phosphorus as well as sediment.... Phosphorus is of greatest concern in stormwater runoff because it usually promotes weed and algae growth in freshwater lakes and streams."

The purpose of this chapter is to describe the sources of upstream sediment and past practices to mitigate erosion/sedimentation upstream.

A. USGS SEDIMENT DATA

The U.S.G.S. has operated 4 data collection stations, collecting phosphorus and TSS water quality samples along the creek, for various periods from 1974 to the present (listed in downstream order):

- Station #05427943- Pheasant Branch Creek at Airport Road near Middleton
- Station #05427948 - Pheasant Branch Creek at Middleton (at Highway 12)
- Station #05427950 - Pheasant Branch Creek at Century Avenue at Middleton
- Station #05427952 - Pheasant Branch Creek at Mouth at Middleton

The locations of these stations are shown in Figure 4a-d. Figure 5a-d shows the TSS concentration data collected at these stations since 1974.

In the USGS report " Effects of Urbanization, Sediment Loads and Channel Morphology in Pheasant Branch Basin near Middleton, WI, the sediment load was calculated at the four USGS stations for rainfall periods and on a monthly basis from 1978 to 1981 as shown in Figures 6 and 7. Figure 8 shows the average annual sediment concentration at the Pheasant Branch at Middleton (Highway 12) site from 1974 to 2003.

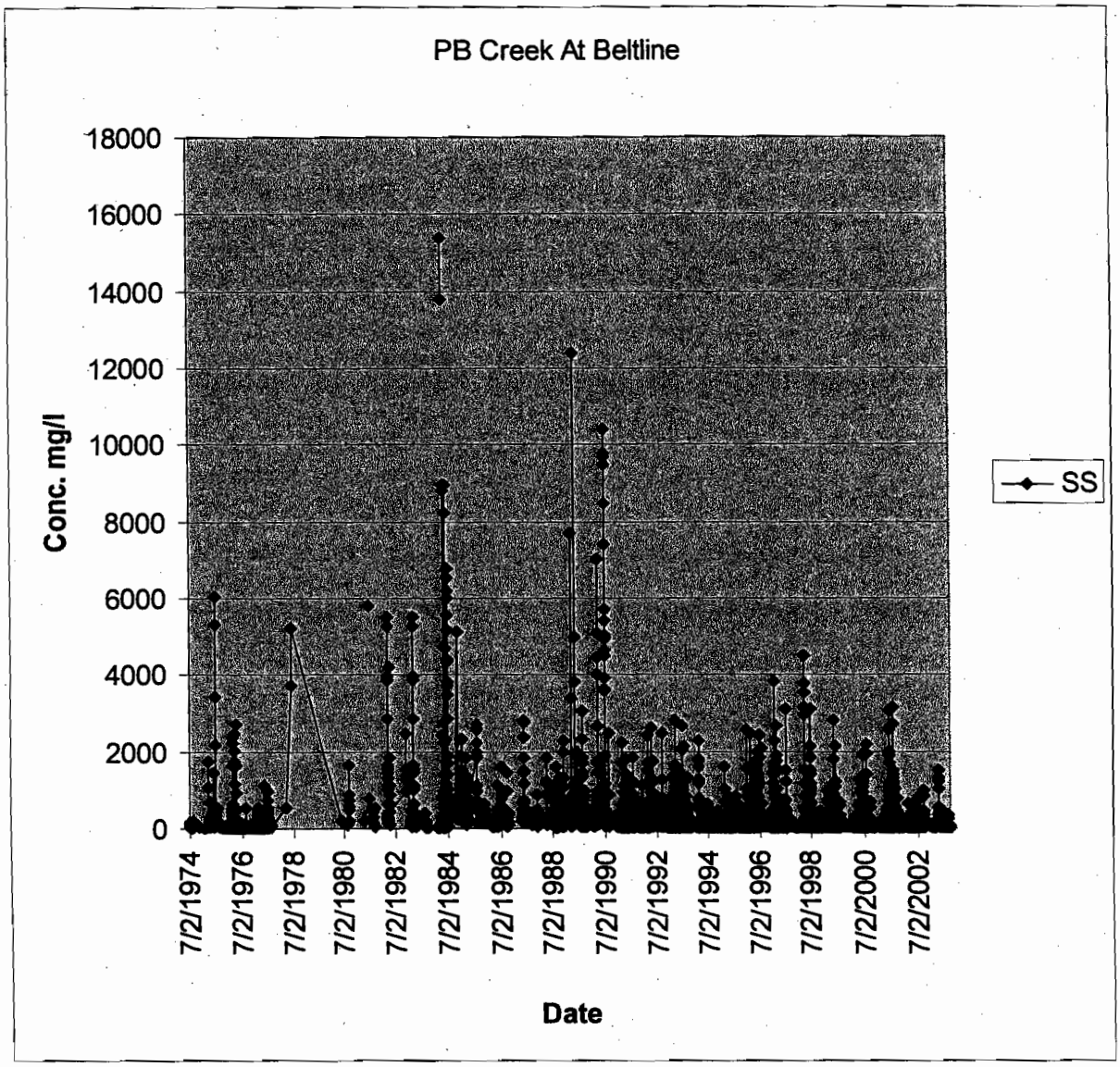

FIGURE 5a- RECORDED TSS CONCENTRATIONS AT 4 USGS GAGING STATIONS IN/NEAR MIDDLETON

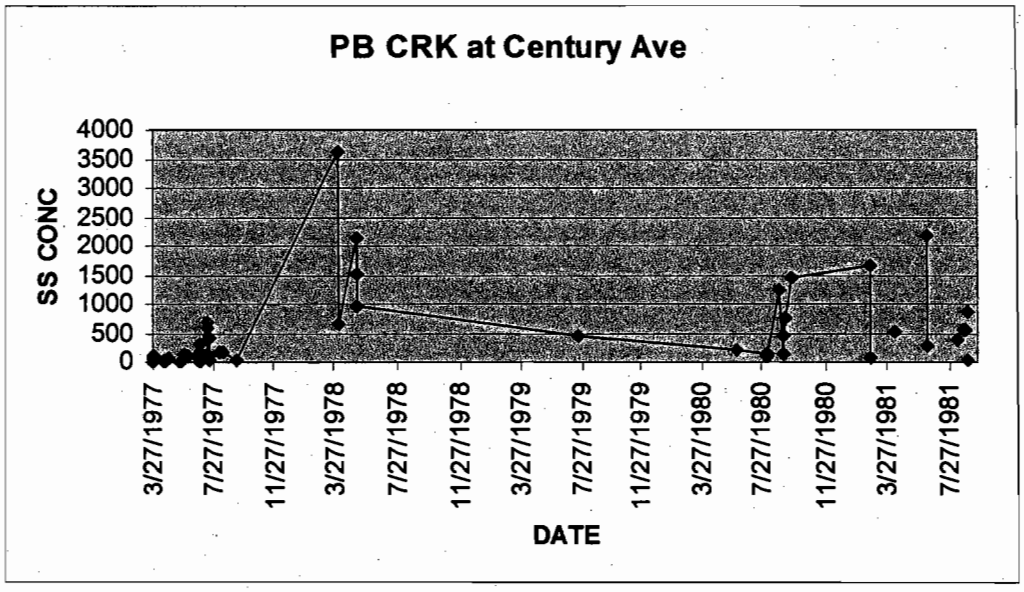

FIGURE 5b(continued)- RECORDED TSS CONCENTRATIONS AT 4 USGS GAGING STATIONS IN/NEAR MIDDLETON

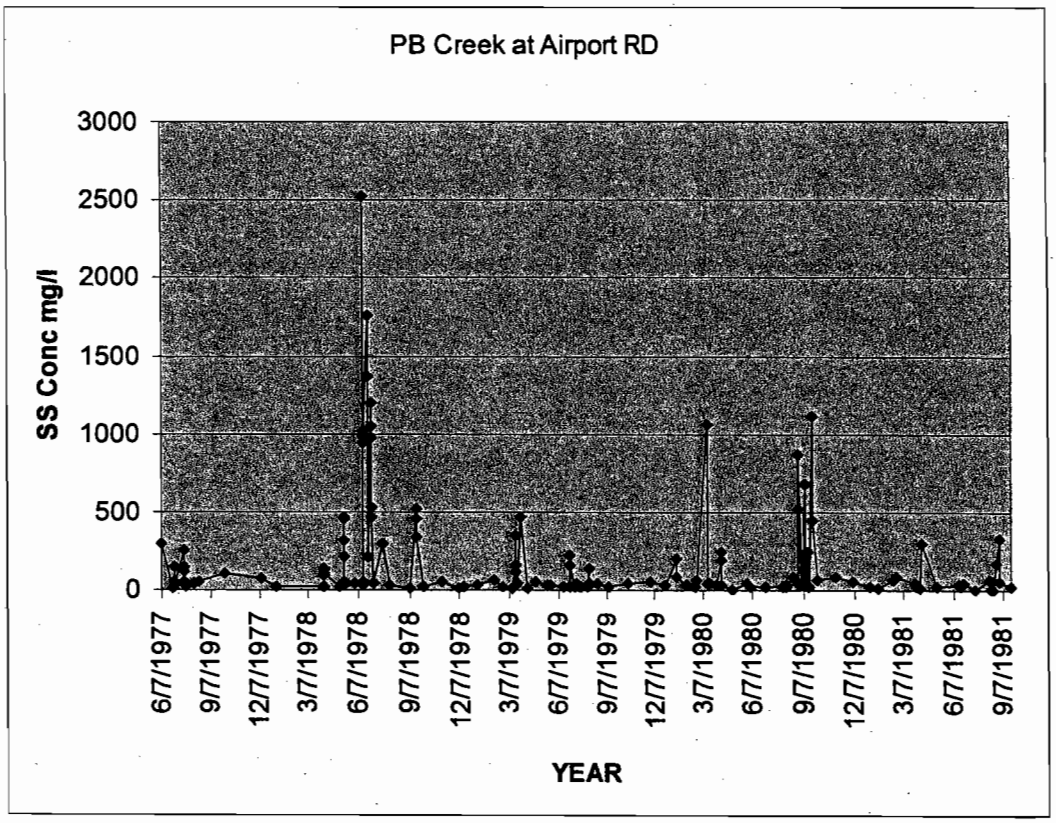

FIGURE 5c(continued)- RECORDED TSS CONCENTRATIONS AT 4 USGS GAGING STATIONS IN/NEAR MIDDLETON

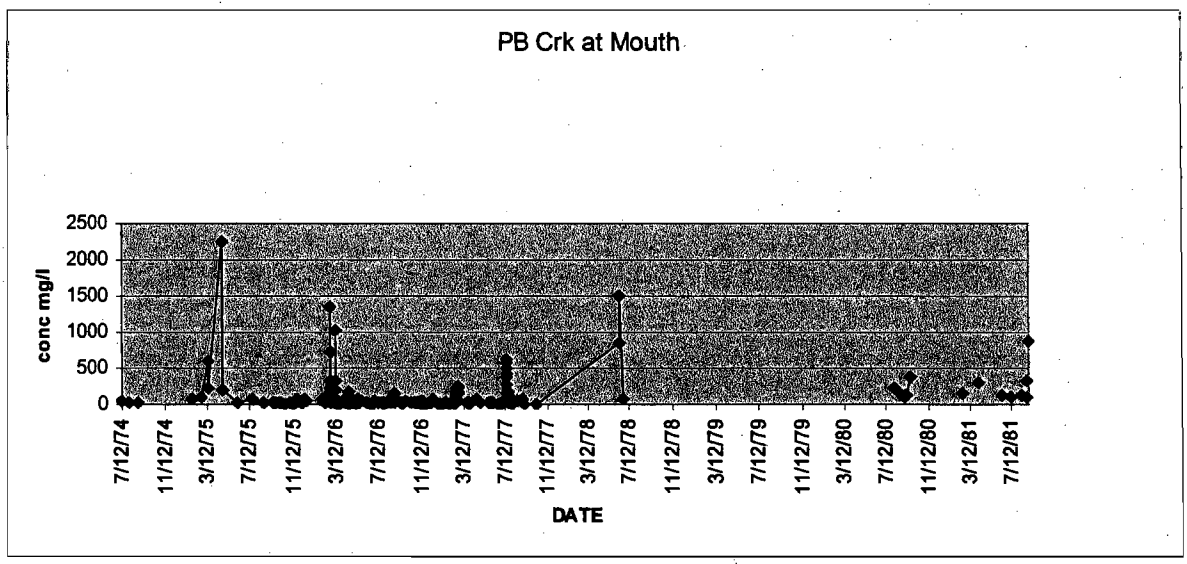

FIGURE 5d(continued)- RECORDED TSS CONCENTRATIONS AT 4 USGS GAGING STATIONS IN/NEAR MIDDLETON

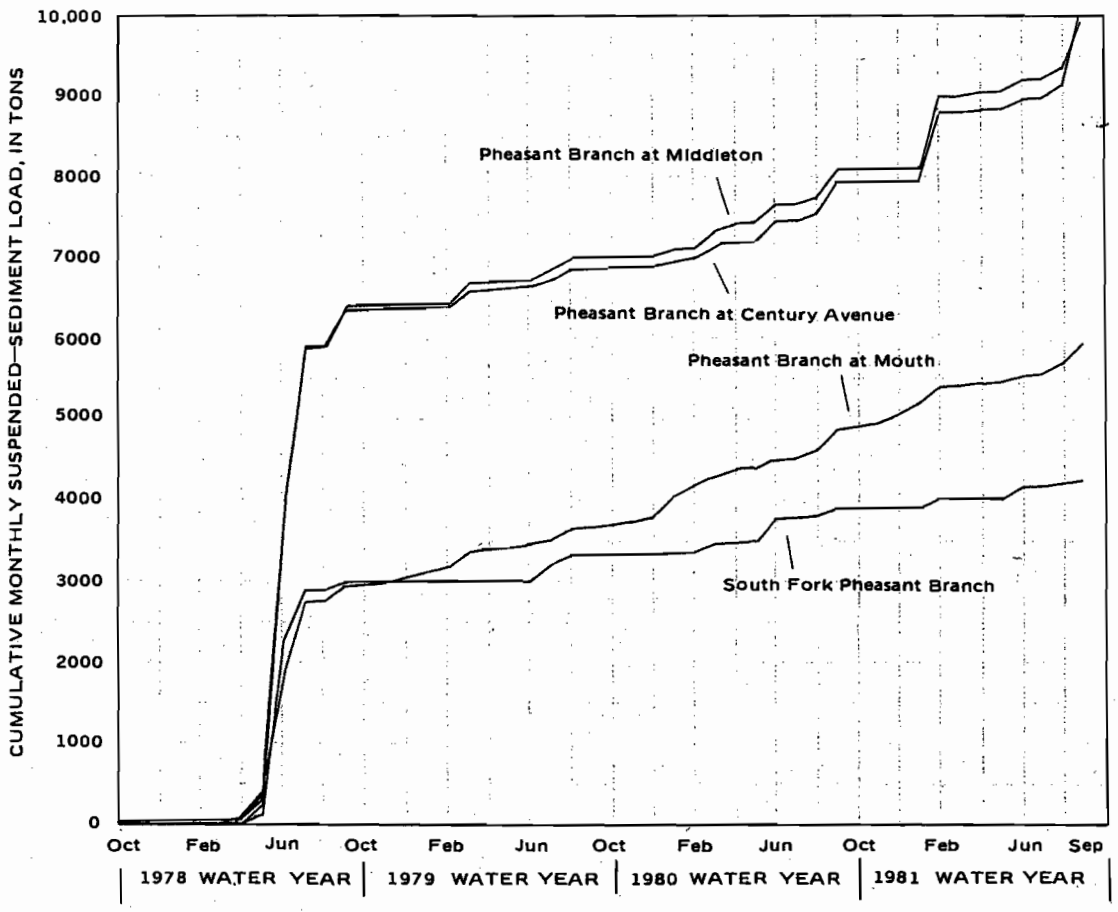

Figure 6- Cumulative Monthly TSS Loading

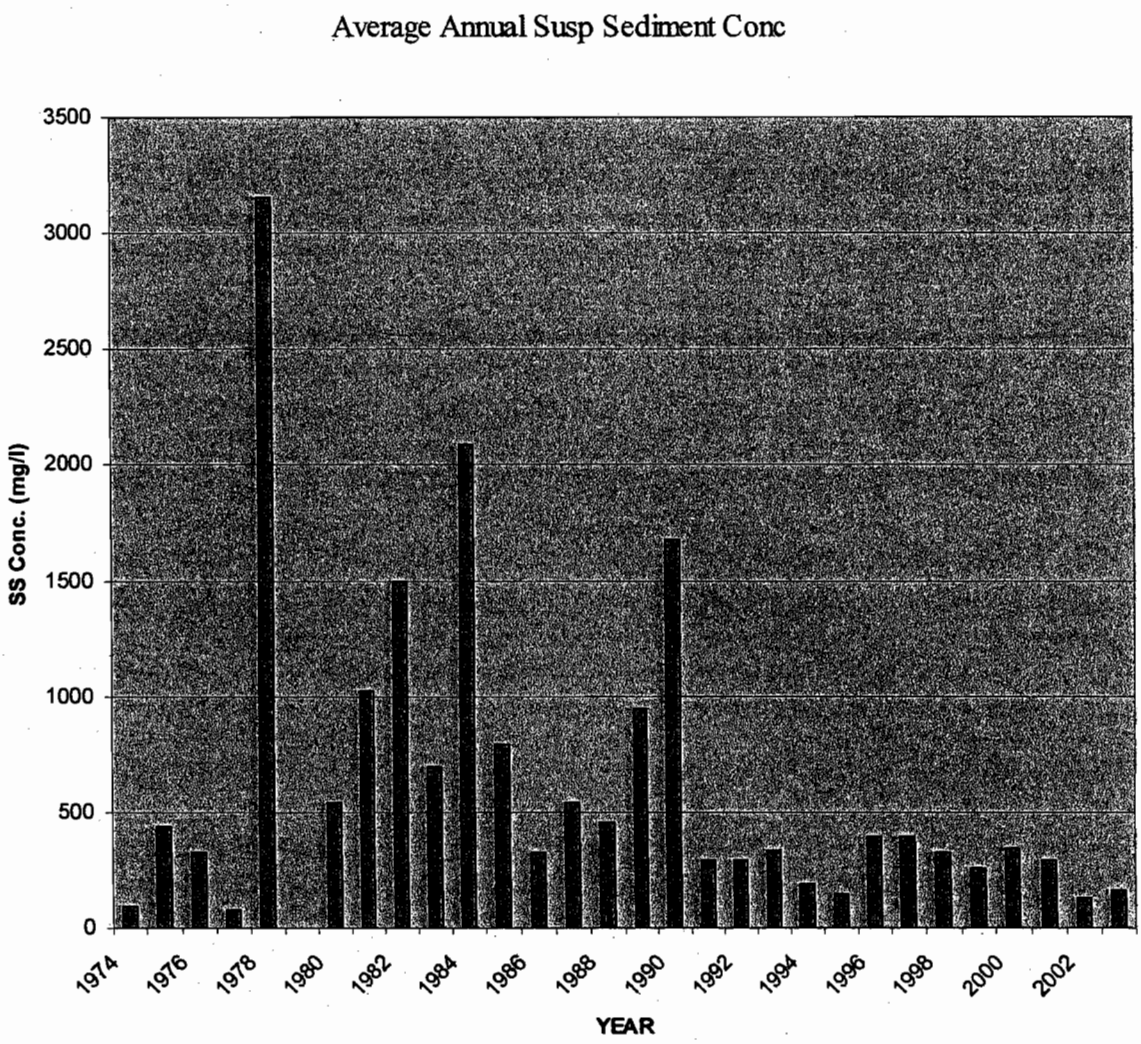

FIGURE 8 - AVERAGE ANNUAL TSS CONCENTRATION FOR PHEASANT BRANCH CREEK AT MIDDLETON

B. EXISTING EROSION CONTROL MEASURES

As described in Chapter 1, the city implemented numerous sediment control measures along the upper main including:

- five drop structures to reduce velocities (installed 1974),
- sections of sheet pile walls, rip-rap and gabions to protect eroding creek-banks,
- two wet detention basins near the north/south fork confluence to trap sediment (installed 1998) and Airport Road Business park smaller basins (installed 1993),
- diversion channels at the top of the steep creek banks,
- sediment control structure at Park Street (installed early 1970's).

The locations of these control measures are shown in Figure 9. Analyzing the existing data (Figures 6 ,7 and 8) compared to the date of installation of these practices illustrates the following:

1. **Construction of the wet detention basins near the north/ south fork confluence has decreased the sediment load substantially**. -Two on-line wet basins were installed near the confluence from 1998 to 2001. A series of smaller off-line wet basins were installed along the north fork as a part of the Airport Road Business Park construction from 1993 to 1998. These basins trap sediment and phosphorus from upstream urbanization and construction. As shown in Figure 8, since the basins were constructed in the 1990s, the sediment concentration recorded at Station #05427948 (just downstream of the confluence) has substantially decreased.
2. **Sediment transport is consistent throughout the creek to the marsh** - For the overlapping period of record for the four stations from 1974 to 1981, the large peaks in suspended sediment concentration coincide with each other. These peaks are large rainfall events which increase the suspended sediment concentration throughout the creek.
3. **The marsh acted as a sediment sink during spring and summer months**.- In comparing the concentration of suspended sediment moving in the downstream direction, the concentrations at the mouth shows a large decrease indicating that the marsh was trapping sediment during the late 70's and early 80's. The USGS report estimates that 4000 tons of sediment was trapped in the marsh from 1978 to 1981 and for larger storms as much as 80% of the sediment load was reduced. Unfortunately, no data exists currently at the mouth to give an indication of how the marsh is functioning currently as a sink.
4. **The marsh acted as a sediment source to the lake during fall/early winter**- Although the marsh traps sediment, comparing the fall and winter sediment loading in Figure 6 and 7 suggests that the marsh releases the trapped sediment to the lake. As described in the USGS report:

> " Water leaving the marsh was noticeably turbid during the fall: this was probably caused by the drawdown of Lake Mendota to its winter level. The reach of Pheasant Branch at its mouth and much of the Pheasant Branch marsh is

affected by backwater from the lake from about April to October. As the lake is lowered in November, the water surface slope increases through the marsh and this reach of Pheasant Branch. The stream velocity also increases as the slope decreases. The increased stream velocity along with the reduction in vegetation resuspends much of the sediment and moves it into the lake."

5. **The erosion control structure at Park Street functions to remove sediment-** In 1979 and 1974, the channel upstream of the erosion control structure was dredged and 300-400 tons of sediment removed. However, within 2 ½ years , the channel had filled up again. This structure has been dredged periodically since then. In 2000, the City installed a concrete floor and sidewalls to ease sediment removal. Since this installation, approximately 37 tons of sediment had been removed each year. The dredged material is mostly sand and the frequency of sediment removal is on a quarterly basis.

C. CURRENT SOURCES OF EROSION

The sources of the continuing erosion and sedimentation problems on the creek are on lower and upper main reaches (from the Highway 12 crossing to the marsh). The 1999 report "Northern Lake Mendota Regional Plan, Pheasant Branch and Belfontaine Conservancies" by Schreiber-Anderson cites three developments in and around the conservancy which could discharge sediment into the conservancy:

- North Lake subdivision- A 278 lot single-family residential subdivision located at the northeast corner of the conservancy constructed from 1995-2000
- Conservancy condominiums- A 80 unit luxury condominium project constructed from 1995 to 2000 along the western periphery of the conservancy, east of Pheasant Branch Road
- Pheasant Branch Ridge development- A 120 unit single family residential subdivision west of Pheasant Branch Road developed in 1995-1999.

These three developments are located very close to the marsh and conservancy and erosion causes an immediate sediment load into the marsh. Construction of these three residential developments is essentially complete. However, the detention basins have not been checked for accumulated sediment.

Discovery Springs and the Airport Road Business Park are two large business parks which continue to develop north of Highway 14 and south of Airport Road. Substantial erosion has already occurred within this development due to inoperable erosion control practices. The locations of these potential erosion control sources are shown in Figure 10.

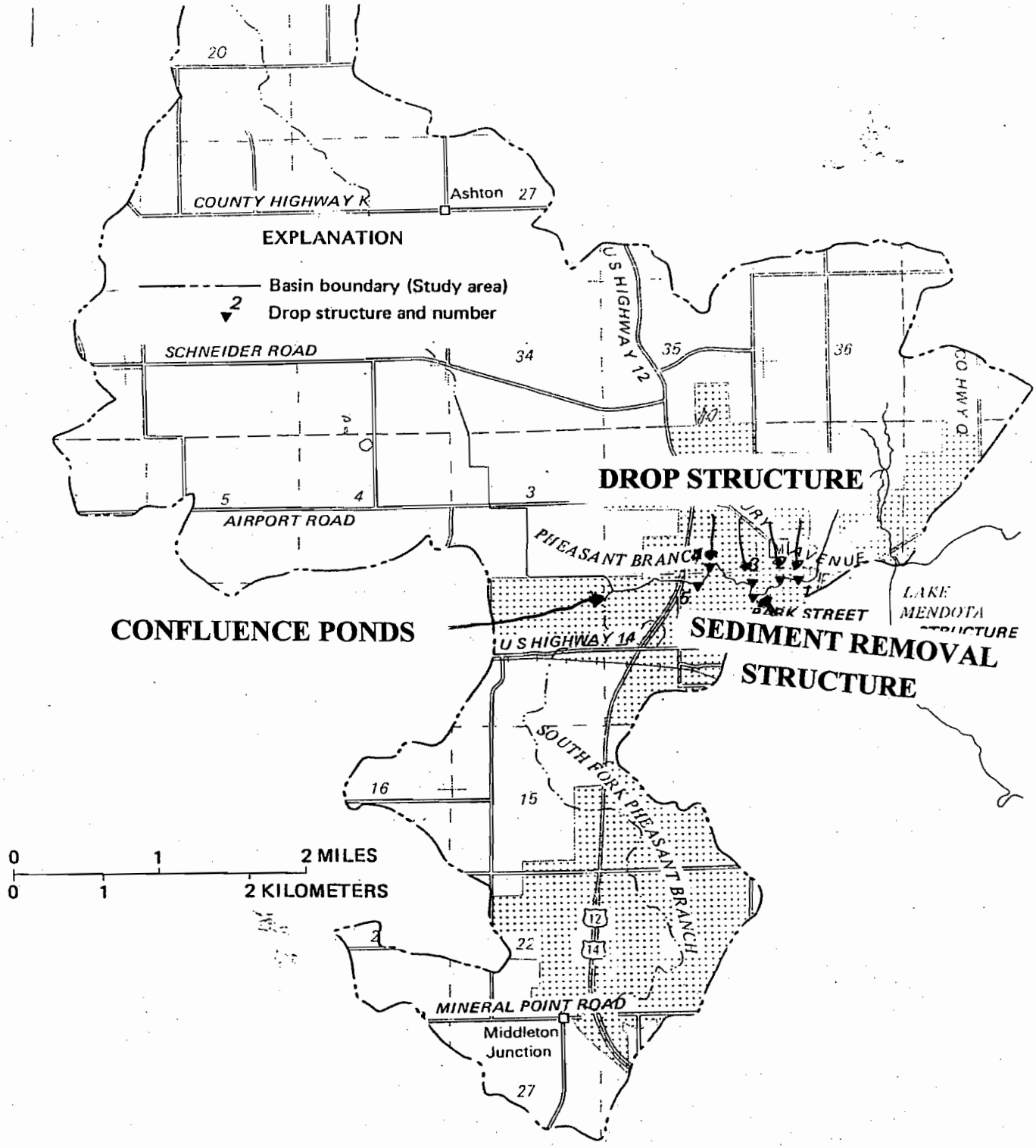

Figure 9- Location of Existing Sediment Control Practices

D. PROPOSED EROSION CONTROL PRACTICES

In 2005, the City received an Urban NPS grant from the WDNR to prepare a city-wide stormwater master plan which will address the erosion and sediment problem on the creek in detail and recommend improvements. The purpose of this chapter was to summarize the past activities, practices and reports to focus on the remaining problem-controlling erosion and sediment deposition along the upper and lower main reaches of the creek. Preliminary recommendations for sediment control practices are presented in the next chapter.

In summary, the City has implemented significant sediment reduction practices in the past. However, the sediment load continues to increase as upstream areas urbanize. Several future activities would further reduce the sediment load and preserve the marsh and lake downstream.

The problems associated with sediment and erosion on the creek is summarized in simple terms in the attached press release.

Chapter 3. Alternative Management Strategies

Reducing the sediment load on the creek and removing sediment from the downstream reaches are complimentary in the sense that one does not work over the long term without the other. The size of the suspended sediment is also very small, as shown in Figure 11, making it difficult to remove. A number of alternative strategies were considered as complimentary or alternative measures to sediment removal:

1. **Long-term permanent solution upstream**-Sediment removal is a temporary solution to the long-term sediment transport problem on the creek. Clearly, a permanent solution is needed upstream to reduce the sediment load into the marsh and into the Lake. If the improvement is not constructed within several years after sediment removal occurs, then the channel may need to be restored again. However, the channel took 30 years to fill up during the extensive urbanization upstream (in the late-1970s and early-1980s). As shown in Figure 8, a much larger sediment load was occurring during this period of rapid expansion than is occurring now. Even if the sediment load was reduced substantially upstream, the accumulated sediment in the channel would still need to be removed for recreational and fish habitat issues.
    i. **Pros**
        1. Permanent solution
        2. Marsh restoration
    ii. **Cons**
        1. Expensive
        2. Planning, design not yet done.
    iii. **Recommendations**
        1. Install upstream erosion control practices within the next five to ten years.

An earlier report (Sediment and Erosion Control Investigations, Pheasant Branch Creek, Spooner Engineering North, Feb 1980) recommends constructing a sediment basin at the entrance to the marsh in the vicinity of the delta deposits. The location of this sediment basin is shown in Figures 12 and 13.

> " This basin will be formed by the construction of a curved dike extending from the existing access road out into the marsh, then tying into the high ground on the west side. The primary outlet will be a 200-foot long broad crested weir constructed out of gabions which will pass most of the water including the 100-year flow. The secondary structure is a corrugated metal pipe containing stop-logs or a sluice gate, which will serve to control the water level under low flow conditions (less than 2-3 cfs). With the stop logs removed, (or gate raised), the secondary structure will also serve to drain the basin prior to the settlement excavation of the trapped sediment." (Page 58, Spooner Engineering-North report.)

2. **Sediment removal to the marsh**-Another alternative management strategy is to remove sediment from the mouth all the way up to the marsh. A WDNR fishery

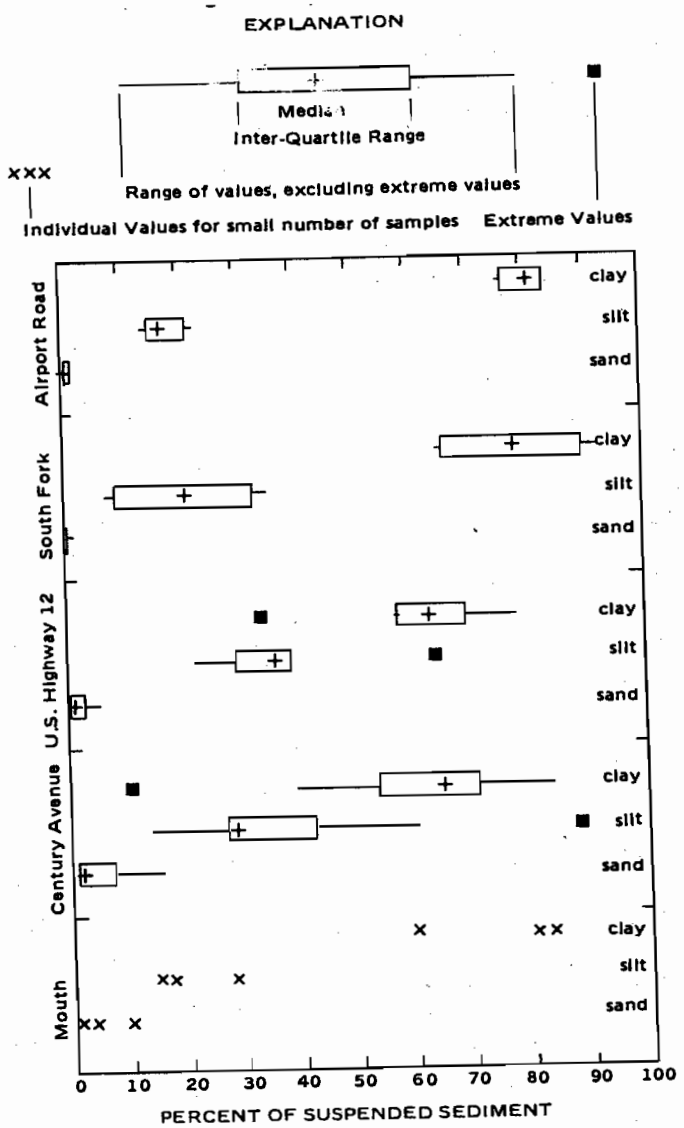

Figure 7. Box plots of percent of clay (< 0.004 mm), silt (0.004–0.0625 mm), and sand (0.0625-2.0 mm) in sediment samples.

Figure 11- Suspended Sediment Size for Pheasant Branch Creek

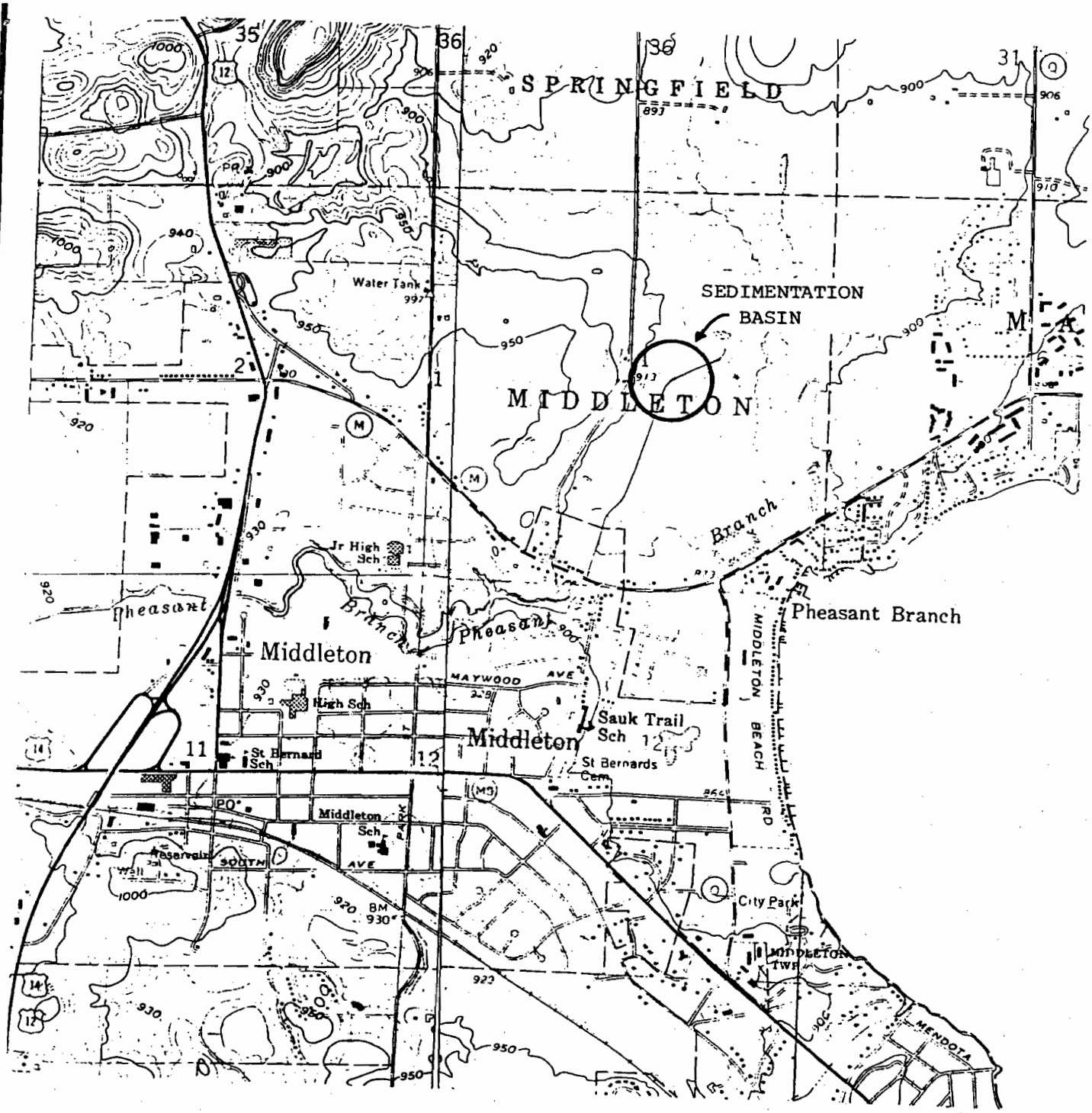

Figure 12- Location of Proposed Sediment Basin

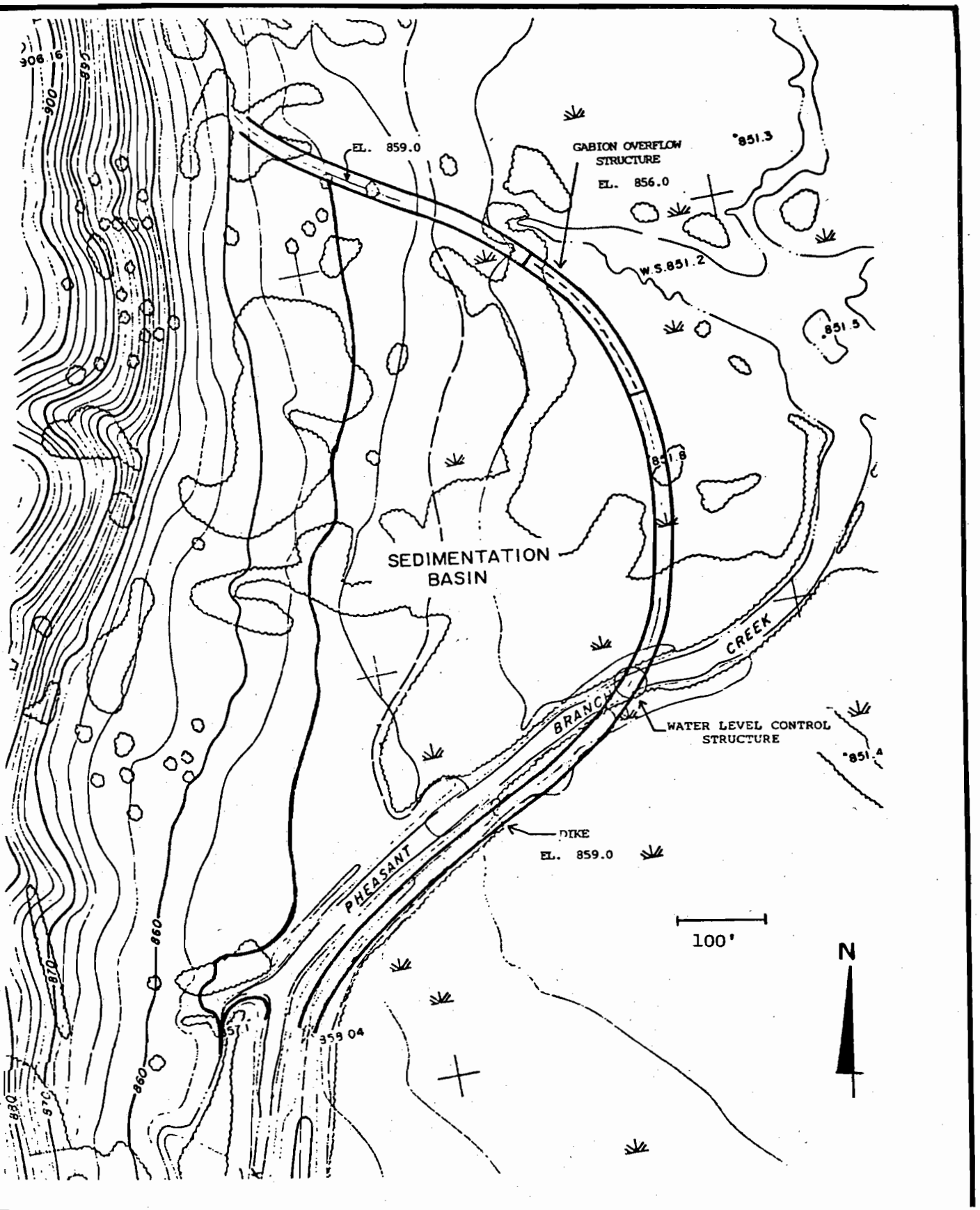

Figure 13- Proposed Sediment Basin upstream of Marsh

manager, Michael Vogelsang, pursued this alternative in the late 1990's (personal correspondence).

i. **Pros-**
   1. Habitat improvement benefit of restoring the northern pike spawning beds in the banks of the marsh.
   2. Additional sediment would be removed upstream so that the lower reach will not fill in so quickly.

ii. **Cons-**
   1. The sediment removal cost would increase dramatically due to the increased volume. Preliminary dredging volume is 10,000 cubic yards at an additional cost of $60,000.
   2. The marsh and conservancy is also an environmentally sensitive area with endangered species and fragile wildlife habitat.
   3. The RBF funding source could not be used for this additional dredging because motorboat access is not allowed in the conservancy.

iii. **Recommendation:** The high cost and negative environmental issues make this alternative infeasible.

3. **Periodic monitoring and dredging of the sediment from the neighborhood detention basins.** The North Lake and the Middleton Hills neighborhoods drain to wet detention basins which act to trap and remove sediment. The depth of sediment in these basins has never been checked. These basins, as well as all detention basins within the city, should be checked on an annual basis for accumulated sediment and dredged, if needed.

i. **Pros-**
   1. Reduce sediment loading into the creek.
   2. Easy to monitor.

ii. **Cons-**
   1. High cost of dredging (if needed).
   2. No disposal sites identified.

iii. **Recommendation**: Monitor sediment depths in all wet detention basins on an annual basis.

Chapter 4. Conceptual Rehabilitation Plans

A. PAST SEDIMENT REMOVAL ACTIVITIES

The channel and the boat landing area were dredged in the fall of 1970 and spring of 1971. 70,120 cubic yards of sediment was removed from the channel and portions of the lake bottom near Lake Street. The dredging depth was 5 to 6 feet. A delta island was also removed (see enclosed article in Figure 14) at the mouth of the channel and 1,050 feet of steel bulkhead protection installed in the channel.

Hydraulic dredging was used with an 8-inch cutter and a 12 inch floating discharge line to a 10-acre dewatering site. The site had an 8-foot high earthen wall constructed around the perimeter. The fill from this project was used to form the strip mall west of Lake Street. A chapter 30 permit was obtained for this work and is shown in Appendix A.

B. PROPOSED FUTURE SEDIMENT REMOVAL

Depths along three transects were measured on Pheasant Branch Creek as shown in Figures 15 and 16 a, b and c. The transect data is shown in Table 1.

Table 1- Sediment Data for Pheasant Branch Creek below Century Ave. Bridge

Transect #	Location	Max Depth (ft)	Area Sediment (ft^2)	Volume Sediment (yd^3)
1	at Century Ave. bridge	5.8	51.05	256
2	Midway between bridge and mouth	7.3	181.47	1549.2
3	@ mouth of channel	7	176.2	1109.4
4	200 ft out from mouth	Not measured (a)		489.4
Between Boat Landing and Mouth	50 feet out along shore	Not measured (b)	150 (b)	1944
Boat Landing	250 ft out from end of Lake Str	Not Measured (b)	150 (b)	1388
Total				6735

Note: For transects without depths measured:

a. **Area and depth based on extrapolation from Transect #3**

b. **Depth of Sediment to be removed assumed to be 3 ft and 50 feet wide.**

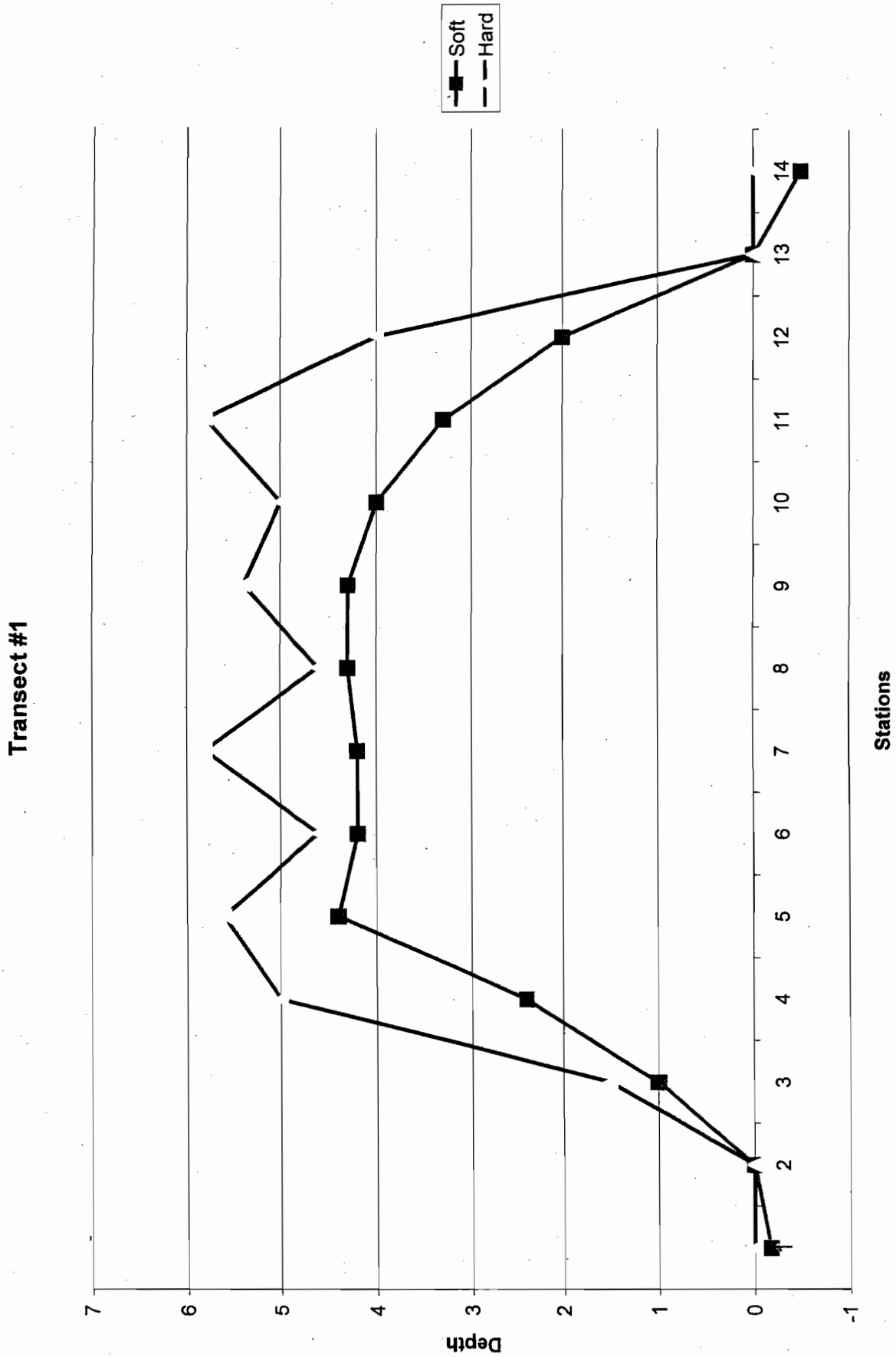

Figure 16a- Transect at Century Avenue Bridge

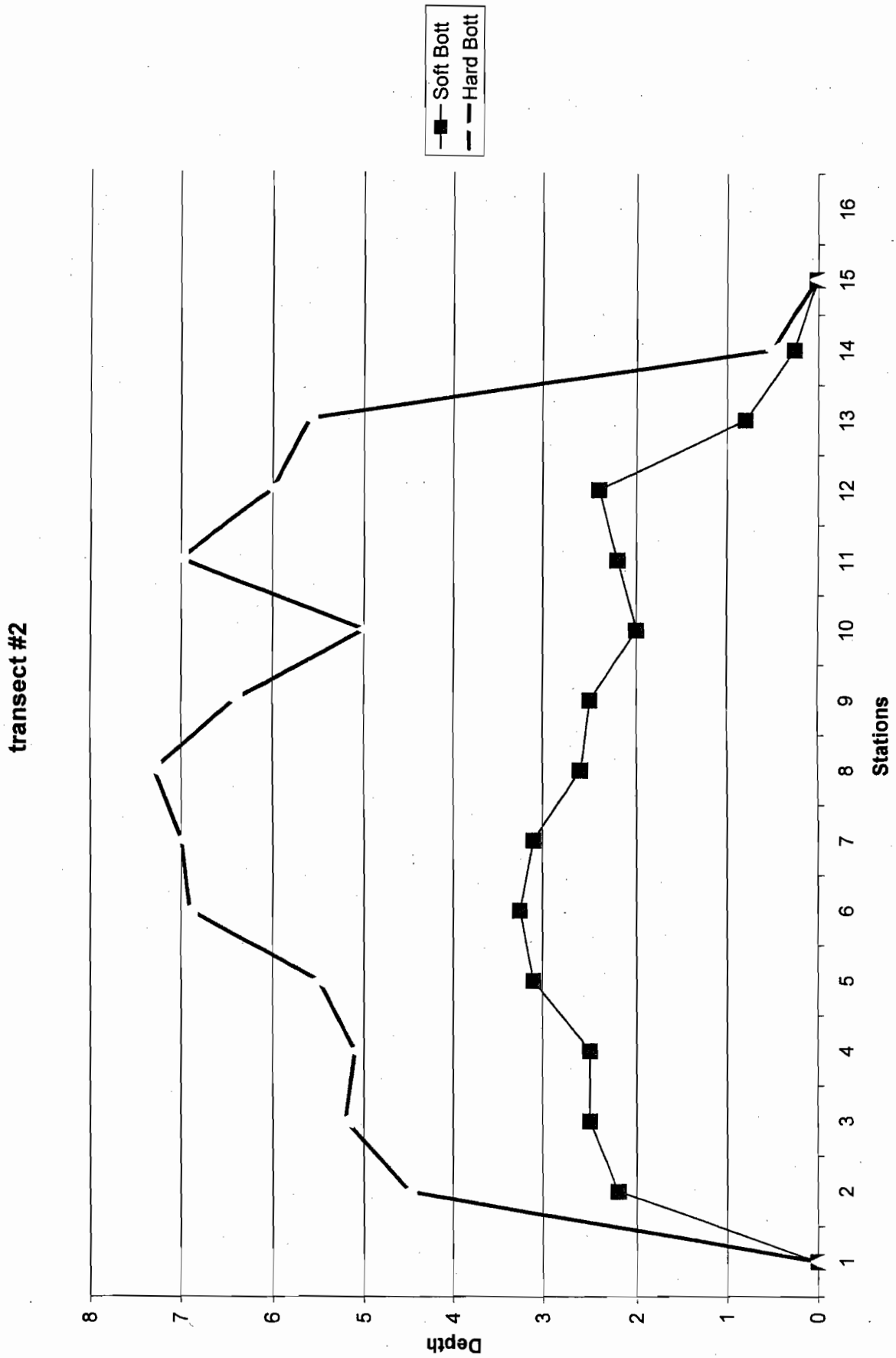

Figure 16b- Transect midway between Century Avenue Bridge and Mouth

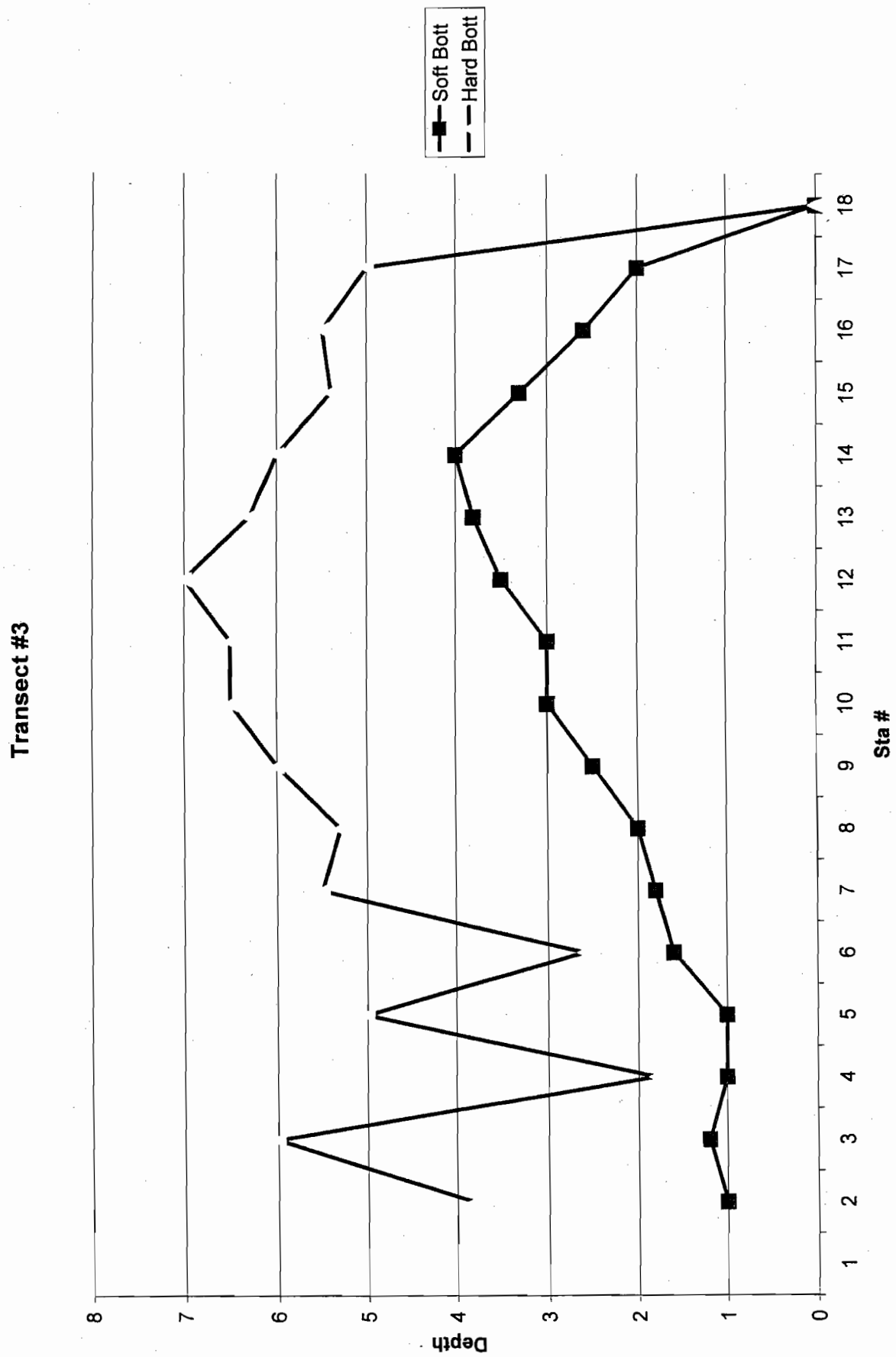

Figure 16c- Transect at Lake Mouth

The sediment depth calculations are shown in Appendix B. As shown in Table 1, 6735 cubic yards of sediment removal is required to a depth of 6 feet for a 50 foot wide channel below the bridge and out from the boat landing.

C. FUNDING SOURCES

A number of funding sources exist for this project including the:

Recreational boating facility grant- The Recreational Boating Facilities program, authorized under section 30.92 of the Wisconsin Statutes encourages the development of recreational boating facilities and related activities by providing cost sharing assistance to municipalities. The city could receive a grant for 50% of the cost of dredging and installation of an underwater concrete ramp at Lake Street. This project is a continuation of the boat landing restoration project started in 2002. The first phase of the boat landing restoration project was to put in the dock and construct the boat ramps.
An integral portion of these grants is that the project provides or improves public access to lakes and motorboat travel. Dredging of a channel of a waterway is covered under the grant to the degree necessary to accommodate recreational watercraft. Eligible costs include engineering, soil borings, dredging and mobilization; construction of a temporary holding area; and transportation of dredge spoils. The RBF grant application must be submitted and presented to the Waterway Commission which meets quarterly. The chapter 30 permit must be obtained before the grant presentation to the Waterways Commission. The RBF grant can only be used for dredging purposes by a municipality once every ten years.

Fish America Foundation grant- The Fish America foundation unites the sport-fishing industry with conservation groups, government natural resource agencies, corporations and charitable foundations to invest in fish and habitat conservation and research across the country. The Fish America foundation has grown over the years and now provides nearly $1 million in matching grants each year to community partners, supporting conservation projects in all 50 states. Over the last twenty years, Fish America provided more than $6 million for more than 750 grass roots conservation projects nationwide. 66 fish restoration projects were funded in Wisconsin ranging from $2,000 to $20,000.

Sport Fish Restoration Grant- The Federal Aid in Sport Fish Restoration Act provides a funding source for management, conservation and restoration of fishery resources. The Sport Fish Restoration program is funded by revenues collected from the manufacturers of fishing rods, reels, creels, lures, flies and artificial baits through an excise tax to the US Treasury. Appropriate state agencies are the only entities eligible to receive grant funds. Each state's share is based 60% on its licensed anglers and 40% on its land and water area. No state receives more than 55% or less than 1%. The program is a cost-reimbursement program where the state covers the full amount of an approved project and then applies for reimbursement through Federal Aid for up to 75% of the project expenses.

EPA Clean Lakes Program under Section 319 grants - Clean Water Act Section 319(h) funds are provided only to designated state and tribal agencies to implement their approved nonpoint source management programs. State and tribal nonpoint source programs include a variety of components, including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and regulatory programs. Each year, EPA awards Section 319(h) funds to states in accordance with a state-by-state allocation formula that EPA has developed in consultation with the states.

The May 1996 guidance states that "(s)ection 319 funds should not be used for in-lake work, such as aquatic macrophyte harvesting or dredging, unless the sources of pollution have been addressed sufficiently to assure that the pollution remediated will not occur." Restrictions were put on in-lake work such as aquatic macrophyte harvesting and dredging due to concerns that the sources of the pollution need to be addressed first and also due to cost considerations.

National Fish and Wildlife Foundation grants-The National Fish and Wildlife Foundation operates a conservation grants program that awards matching grants, on a competitive basis, to eligible grant recipients, including federal, tribal, state, and local governments, educational institutions, and non-profit conservation organizations. Project proposals are received on a year-round, revolving basis with two decision cycles per year. Grants typically range from $10,000-$150,000, based upon need. Matching grants are awarded to projects that:

- Address priority actions promoting fish and wildlife conservation and the habitats on which they depend;
- Work proactively to involve other conservation and community interests;
- Leverage available funding; and
- Evaluate project outcomes.

A number of other payment options exist:

Local landowners- The landowners with lots abutting the channel and lakeshore could be assessed a portion of the dredging cost. Although all of the city residents will benefit from dredging the boat landing, the dredging of the channel will primarily benefit the local property owners.

Dane County- Dane County is responsible for controlling erosion control and sediment transport within the Pheasant Branch creek watershed originating from the unincorporated towns upstream of the City. Since the majority of the watershed is within the rural area of the Towns of Middleton, Westport and Springfield, Dane County should pay a portion of the dredging cost based on the percentage of the watershed within the towns. In 1972, Dane County contributed 33% of the dredging cost and recently has agreed to pay a portion of the dredging cost of the Yahara River as shown in Appendix C.

D. DREDGE MATERIAL DISPOSAL

Dredging can be of two types- either mechanical or hydraulic. The choice of which method is determined by a number of factors including:

- Chemical constituency of soil- If a chemical analysis shows toxic material in the dredge material then mechanical dredging is needed to transport the material to a landfill.
- Location of nearby disposal site- If a site is located close to the dredging which is open and suitable for dewatering, hydraulic dredging is possible. These sites should be 3000 feet or closer to the dredging site.
- Barge accessibility- Mechanical dredging is often performed by a dragline and the dredge material loaded on a barge. Barges cannot enter a small channel with little bottom clearance. However, Kori amphibious excavators can remove sediment from shallow channels and load the barge out in the deeper water of the lake. These excavators are used to dredge swamps in the southeastern part of the country.

Several sites exist within 3000 feet of the dredging site suitable for dewatering. To dewater 6800 cubic yards, a 13,600 cubic yard dewatering volume is needed (using a safety factor of 2). Assuming the dewatering chamber is 8 feet deep, a 45,900 sq foot area is needed. If the dewatering chamber was 4 feet deep, a 91,800 sq foot area is needed. City-owned areas available for dewatering chambers within the 3000 foot radius include:

- Site A- City-owned parcel south of Lake Street-Approximately 1 acre is available for a dewatering chamber at this site. However, the majority of this site is wetland according to the City of Middleton wetland maps as shown in Figure 17. A wetland delineation will determine the exact amount of space available. However, this site isn't suited for dewatering due to the limited non-wetland area.
- Site B-Wooded area west of Middleton Beach Road- The city has applied for a grant to purchase the Jacobsen property west of Middleton Beach Road and build a warm water fishery pond. The dewatering site could be constructed here and the fill used as berms for the new fishery pond. However, portions of this site could be wetlands unsuitable for fill placement. A wetland delineation will determine the amount of space available for dredge dewatering. This area is approximately four acres in size. However, only .5 acres fronting Allen Blvd is not wetland according to City wetland maps as shown in Figure 17 .

However, this site provides enough volume to dewater the boat landing site.

- Site C-City Lakeview Park East- The city owns land just east of Allen Boulevard which is used as a small park. Just south of this area is another city owned parcel which is zoned as a wetland restoration zone. The two contiguous parcels could be used as a dewatering chamber. This area is approximately 8 acres in size and is within 2000 feet of the dredging area. Of the 8 acres, 3.5 acres are not delineated wetlands. Therefore, this site has enough volume to build a dewatering basin for both the channel and boat landing.
- Site D- Water Tower Property- The school district owns a 19 acre parcel near Highland Way north of Century Avenue. This area is large enough but the discharge line would have to cross several major roads to reach this area. This area may also not be available in the long-term, since it is currently being sold.
- Site E- Conservancy Lands- A dewatering chamber could be constructed in the conservancy lands just upstream of the Century Avenue Bridge. This site would have the advantage of being located close to the stream for discharge. However, the conservancy is an environmentally sensitive area which is not be suitable for dewatering.

Figure 18 shows the location of these five potential sites.

To achieve quiescent settling conditions to allow the solids to separate out, a multi-celled system is needed to avoid re-suspension due to turbulence from the pump discharge. Settleability tests are recommended prior to sediment removal to determine settling efficiency. The use of Polyacrilimide can also help remove solids by increasing settling rates.

The % solids of both samples ranges from 24% to 40% with the particles primarily silt and sand. After dewatering, approximately 2200 cubic yards of sediment would be available. This fill material could be used for berms around the warm water pike rearing pond in the Jacobsen property or as fill for the sediment basin at the entrance to the marsh (see Chapter 3).

E. Permitting Issues

A chapter 30 permit is needed for dredging activities under Emergency Rule Chapter 345 "Dredging in Navigable Waterways". Under section 345.04(f) "Standards for maintenance dredging of previously dredged areas", this dredging is eligible for a general permit as long as dredging occurs in the fall or early winter and less than 3000 c.y. is removed. At a meeting on April, the WDNR Water Permit Coordinator (Cami Peterson), confirmed that dredging is eligible for a general permit provided the laboratory analysis of the dredged material does

not show hazardous materials. A general permit can be issued 30 days after application whereas an individual permit can take much longer.

For hydraulic dredging, a separate WPDES permit is needed to discharge the water from the dewatering chamber back into the lake. A general permit is available for this discharge and the TSS content cannot exceed 80 mg/l.

A general permit is also required for installation of the boat ramp under NR 329.04(2)(d).

If over 3000 cubic yards of sediment is dredged, an environmental assessment (EA) is required under NR 150.20 (2)(c). Dredging is considered a Type II activity. Type II actions require the issue identification, EA and decision procedures of the Environmental Impact Statement (EIS) process under ss.150.21. An EA report form is shown in Appendix D.

F. Courtesy Dock

As part of this feasibility study, the placement of a floating dock at the downstream, east side of the Century Avenue bridge was investigated. A city pump station is located at this site. The dock would be approximately 8 feet wide and 20 feet long. A portable restroom or bait vending machine could be placed here. This dock would provide fisherman with a safe place to fish from the shore and also provide a courtesy location for people to use the restroom once on the lake.

The triangular lot on the east corner of the Century Avenue bridge is owned by the City of Middleton. The land was sold to the City in a warranty deed by R. Adrian Davis on May 21, 1958 as shown in Appendix E. The Madison Fishing Exposition Club has agreed to donate the cost of purchasing and installing a pier at this location. Access to this lot would be by an ADA accessible ramp from Century Avenue.

G. Cost Estimates

Several dredging contractors were contacted to obtain a preliminary cost estimate for hydraulic dredging. These contractors estimated the setup cost and set down cost to be between $10,000 to $45,000 (depending on the size of the dredge used). A 10-inch discharge line will pump 5000 to 6000 gallons per minute while an 8-inch discharge will pump between 2600 to 2700 gpm. The estimate for dredging ranged from $6 to $9 per cubic yard. Both contractors' estimates ranged from $75,000 to $100,000 with one charging less per cubic yard and more to set up while the other charged less to set up and more per cubic yard.

Chapter 5-Chemical Constituents of Sediment

Two sediment samples were collected in January of 2005-one at the boat landing and one at the Pheasant Branch channel. These samples were analyzed at the State Lab of Hygiene for a variety of inorganic and organic constituents required for a Chapter 30 sediment removal permit. After a review by the WDNR, sediment disposal on-site is allowed as documented in Appendix F. The sediment chemical analysis for these two sites is listed below:

Chapter 6- Recommendations

1. Dredge boat landing site and channel together . The City has budgeted to remove sediment from the boat landing area and install the underwater concrete boat ramp in the 2005 year. To remove the EA requirement and allow for a general Chapter 30 permit, the City can dredge the boat landing area later this year and look to dredge the channel at a later year. However, the RBF grant is only available for one dredging activity every ten years. During a Parks and Recreational Committee meeting in April 2005, a concern was also raised that if the channel was not dredged at the same time as the boat landing, the boat landing would fill in with the sediment from the channel shortly after dredging. Although the permitting process is longer, the dredging of the boat landing and the channel combined is recommended for practical and economical reasons.

2. City use hydraulic dredging with Lakeview Park East disposal site- Hydraulic dredging is suitable for both the channel and boat landing dredging. The recommended dewatering chamber could be constructed along Allen Blvd in Lakeview Park East and the wooded area south of the park. At a Conservation Land Committee meeting in April of 2005, a concern was raised concerning two issues- the smell of the dewatered material and discharge of the water back to the lake. The discharge of water back into the lake could be in two underground pipes near 2409 Middleton Beach Road or an underground pipe at the intersection of Mendota Drive and Middleton Beach Road. The smell issue will be addressed when the settleability tests are run. The loss of trees in the wooded area will be considered in the design phase.

3. City install floating dock at downstream side of Century Avenue bridge- A courtesy dock should be installed at the city-owned lot at the Century Avenue Bridge. As described above, the dock will have multiple functions and be ADA assessable.

4. City pursue installation of sediment control structures upstream of dredging site-As described above, a long-term sediment control structure upstream of the marsh will control sediment and reduce the sedimentation on the lower main. A city-wide storm water master plan will address the long-term sediment control practices in more detail at a later date.

5. City negotiate with County regarding cost-share for dredging- Cost share agreements should be pursued with the County to cover a portion of the dredging cost. The County is actively involved in budgeting for the 2006 financial year.

6. City monitor sediment level in detention basins- As described above, the sediment level in neighborhood detention basins close to the creek should be monitored for sediment buildup.

7. Meeting with RBF Grant Coordinator- A meeting with the WDNR grant coordinator is recommended to discuss financing options for the dredging and boat ramp construction project.

References

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