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AN ASSESSMENT OF BOTTOM SEDIMENT CONDITIONS IN THE ILLINOIS RIVER IN THE VICINITY OF PEKIN COMBINED SEWER OVERFLOWS

by
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INTRODUCTION

Many municipalities located along the banks of the Illinois River are served by combined sewers. Most of these sewers, when originally constructed, were designed solely to collect storm and surface water runoff from residential and commercial properties for discharge to the river. They were not intended for transporting wastewater. The connection of property sewers to existing storm sewer drainage systems became common practice with the advent of in-house plumbing. As communities expanded, separate sanitary sewers were constructed; however, the contents of these separate sewers eventually flowed into the storm sewer system in the older sections of communities. Thus the system originally conceived for handling only urban storm drainage became a dual purpose utility, conveying a combination of surface water runoff and was tewater.

Background

The City of Pekin is served by both combined and sanitary sewers. During the past 40 to 50 years efforts have been made to relieve wastewater discharges to the original drainage system by intercepting existing sanitary sewers and conveying the flow of wastewater to sewage treatment facilities. Connections of newly constructed sanitary sewers to the old drainage system have been prohibited, and in addition, a considerable effort has been made to minimize the discharge of wastewater conveyed by the old drainage system into the river. Presently, combined sewers overflow at four locations in the sewer system leading to the treatment plant. An additional overflow is located at the plant site. Regulators are used at the four sites above the plant to maintain dry weather flows to the plant at all times and to divert excess capacity into the river. The purpose of this study was to identify possible chronic effects these overflows have on the stream environment in the immediate area of the outfall.

The consulting engineering firm of Randolph and Associates (R & A) has assessed the effects of the five combined sewer overflows (CSO) on Illinois River water quality. Their work was limited to measuring the pollutional nature of the flows in the combined sewers. The extensive river water quality data base generated during the 1983 Peoria

CSO study (Staff of the Water Quality Section, State Water Survey, 1983) obviates the need to make a similar instream study in the Pekin area. However, conclusions arrived at for the Peoria study relative to benthic or bottom sediment conditions cannot be readily applied to outfall areas at Pekin. Several Pekin outfalls are in protected bay-like areas, which may foster undesirable sediment and sludge accumulations. A survey of stream bottom (benthic) conditions and stream morphology in the outfall areas was needed to identify the extent and nature of any pollutional depositions. The Illinois State Water Survey performed the survey through an intergovernmental research agreement.

Study Area

The four outfall areas located above the wastewater treatment plant which were examined and evaluated are shown on figure 1. The outfalls are identified by the street locations at which the discharges occur. In downstream sequence, they are State, Caroline, Court, and Fayette Streets. State and Caroline discharge into a common side-slough off the river proper, Court discharges about 50 feet back from the river, and Fayette discharges into a "dog-legged" drainage channel at a point approximately 250 feet back from the river bank. Photographs of the respective outfalls and discharge areas are presented as figures 2 through 7. All four sewer outfalls discharge within a 3700-foot reach of the Pekin City river front.

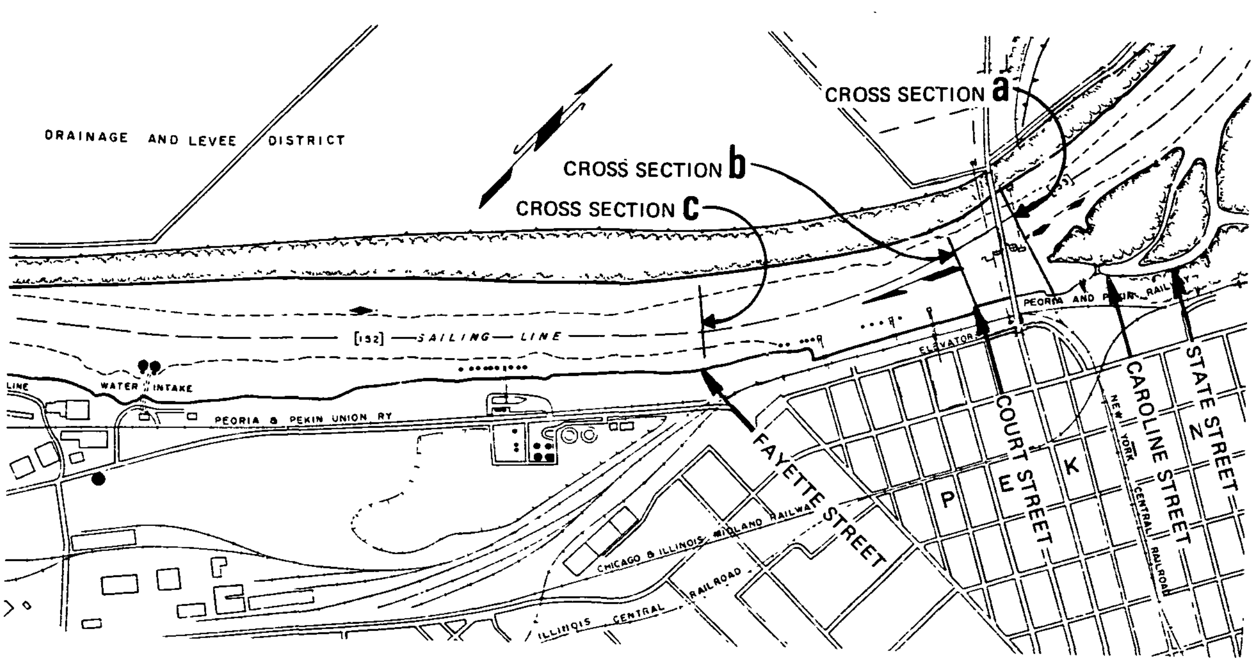


Figure 1. Pekin combined sewer outfall locations examined and evaluated

Figure 2. State Street outfall

Figure 3. Caroline Street outfall

Figure 4. State-Caroline Streets outlet slough, looking downstream from State Street

Figure 5. State-Caroline Streets outlet slough, looking upstream from river bay

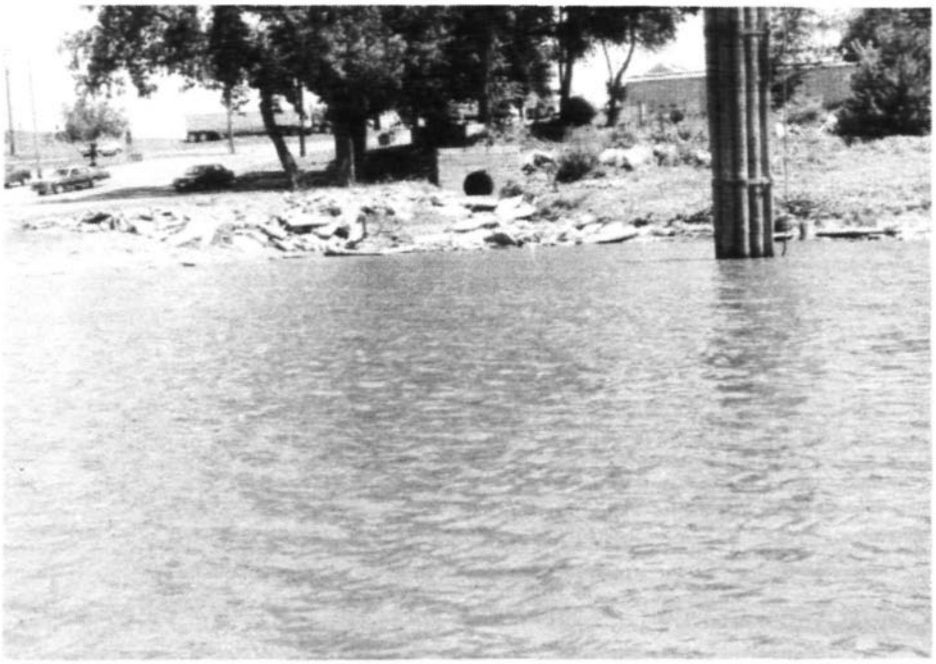


Figure 6. Court Street outfall

Figure 7. Fayette Street outfall

Acknowledgments

This study was sponsored and funded by a grant from the City of Pekin administered through the consulting engineering firm of Randolph and Associates. The work was performed under the general supervision of the Chief of the Illinois State Water Survey. Thanks are extended to Harvey Adkins, Doug Excell, and Scott Knight, who assisted in the field work; William Motherway, Jr., who prepared the illustrations; Linda Johnson, who typed the original manuscript; and Gail Taylor, who edited the report.

STUDY PLAN

Intermittent wastewater discharges, such as those originating from combined sewer overflows, have only a transient effect on the water quality of flowing streams and rivers. Even during periods of very high runoff, the effect of CSO discharges on water quality on a large river like the Illinois is minimal. A conclusion reached as a result of the comprehensive Peoria CSO study was that, although the impacts of combined sewer overflows on water and sediments of the waterway were detectable, the only significant impacts related solely to combined sewer overflow were a substantial increase in fecal coliform densities and transitory occurrences of •floating debris (Staff of the Water Quality Section, State Water Survey, 1983). However, if certain physical conditions exist in outfall areas, the chronic effects of periodic overflows on benthic or bottom sediment quality often become readily evident. Sewer overflows discharging into sloughs, bays, side channels, or other still water areas often cause a buildup of sludges or contaminate indigenous sediments with organic material in the immediate outfall areas. Consequently, the quickest and easiest way to ascertain if CSOs are causing significant instream pollution problems is to physically examine the sediments in the immediate outfall area. This study was conducted with this in mind. An extensive, orderly physical examination was made of the benthic sediments in each of the four outfall areas to ascertain if any sediments visually exhibited organic contamination typical of that which is known to occur in problem areas. Most of the results are, therefore, presented in a descriptive or subjective manner; however, some finite parametric measurements were made at selected locations.

Sediment Sampling Procedures

Two types of sediment samples were collected for physical examination. The majority were collected with a 9-inch Ponar sediment dredge; figure 8 shows the dredge sampler in use.

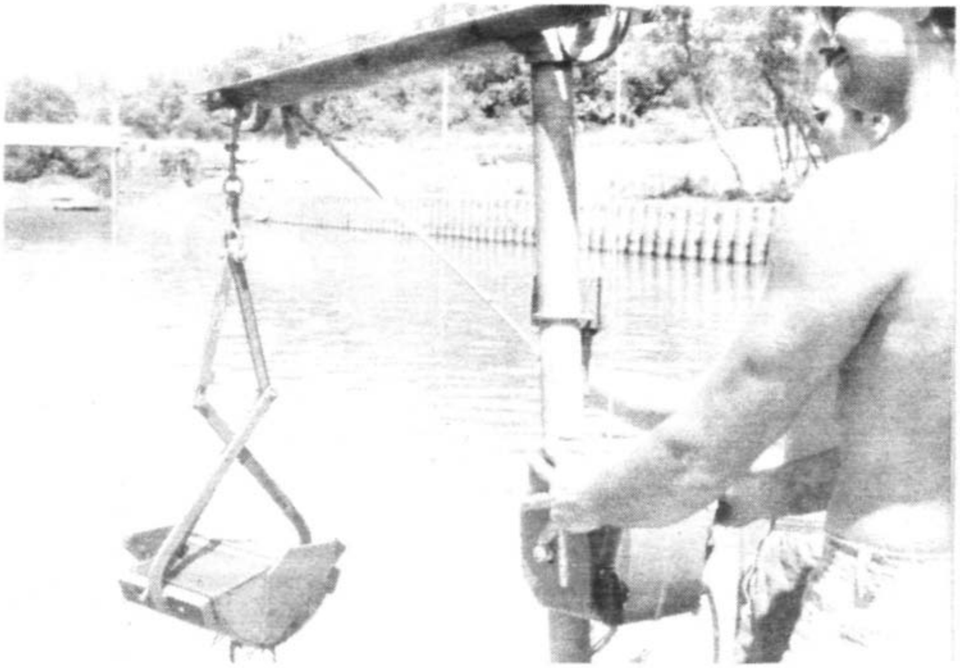


Figure 8. Ponar dredge sediment sampler in use

Figure 9. Core sediment sampler and range finder in use

This sampler collects essentially a 9-square-inch by 6-inch-deep (depending upon substrate type) surface sediment sample. A second type of sample was obtained at selected spots using a core sampler; figures 4 and 9 show the core sampler in use. This sampler is useful in obtaining historical information relative to the buildup of sediments in an area. The Ponar sampler is a proprietary item, whereas the core sampler used was designed and constructed by State Water Survey personnel. It consists of a 2-1/2-inch-diameter by 60-inch-long copper coring tube equipped with a rod plunger to extract the core sample. The sampler is driven into the substrate using a sliding, cylindrical weight attached to the top. Both samplers can be used either from a boat or by wading. The use of the core sampler is limited to certain types of sediments; it cannot be used in rocky or gravelly bottoms or where the sediments are very fluid or loose. In addition, clay-silt samples tend to be compressed and therefore somewhat distorted in the extraction process. The Ponar dredge is difficult to use on bottoms containing large gravel. rocks, and debris.

Extensive dredge samples were taken in the river channel proper at the Court Street and Fayette Street outfall areas and in the outlet bay area leading to the slough which receives the State Street and Caroline Street discharges. The sampling locations are shown on figures 10, 11, and 12. Samples in the State-Caroline area were taken along the centerline of the bay at 25-foot intervals up to a point 400 feet from the face of the roadway bridge shown on figure 10. Samples 16 and 17 were spaced at 50 feet. Upstream of the bridge, in the slough proper, core samples were taken in place of dredge samples. In addition to the dredge sample, a core was taken at station 14 in the bay outlet.

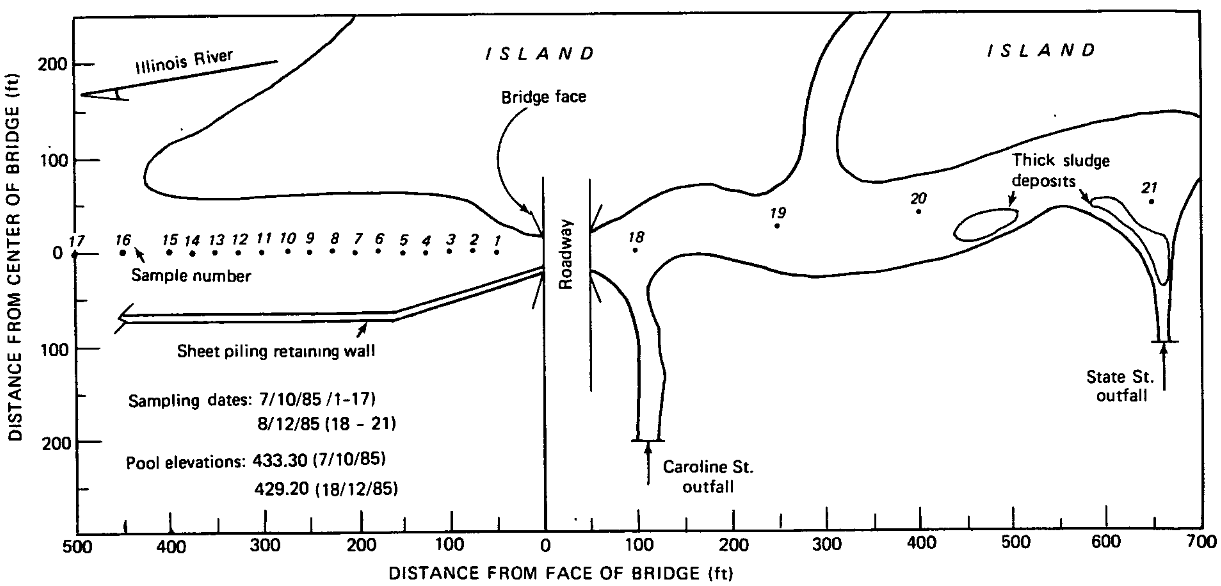


Figure 10. Sampling stations in the State Street and Caroline Street outfall areas

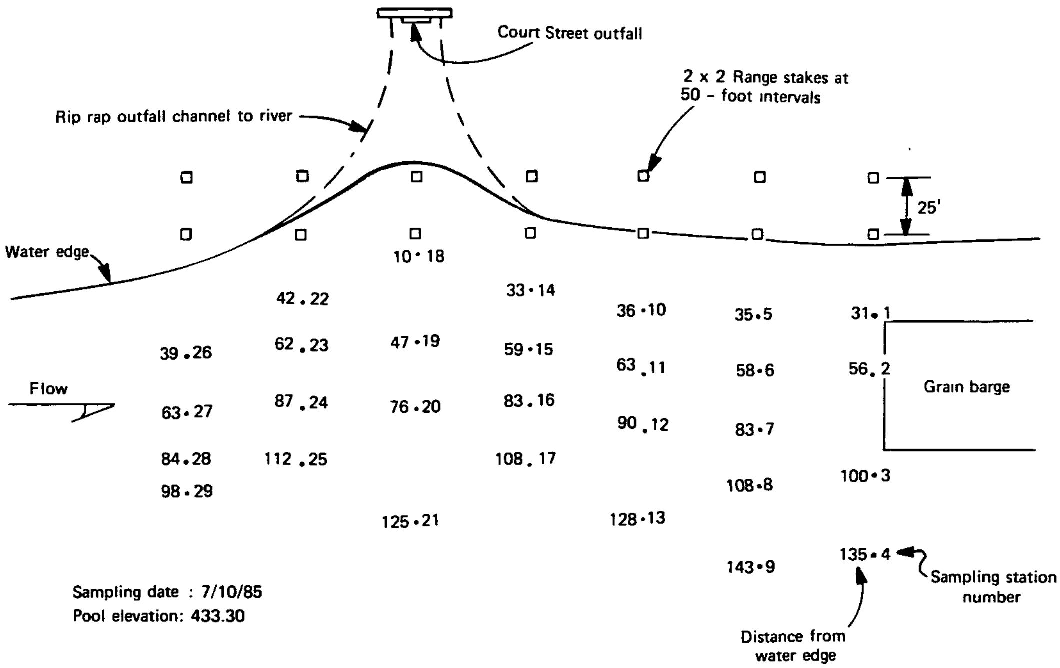


Figure 11. Court Street sewer outfall area sampling stations

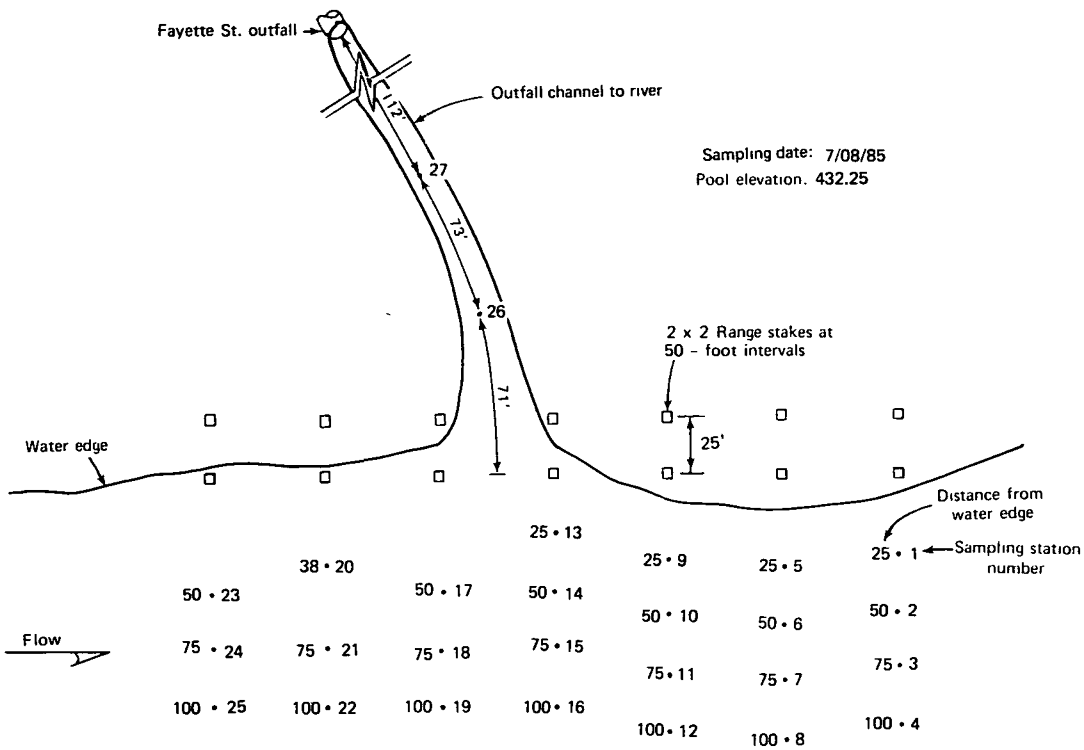


Figure 12. Fayette Street sewer outfall area sampling stations

A grid system was used to sample the river locations at Court and Fayette streets. Baselines were established along the shore as nearly parallel to the water edge as possible. White 2" x 2" stakes were driven in the beach along this line at 50-foot intervals. Secondary stakes were then set back 25 feet from these primary stakes. The baseline and offset stake systems are illustrated on figures 11 and 12. The lines extended approximately 100 feet above the outlets and 200 feet below them. The sampling boat first lined up with two stakes at a given longitudinal position, and while staying in line, obtained the transverse distance by siting the primary stake with a high quality range finder. Figure 9 shows the range finder being used in the Fayette Street outlet channel.

Core samples were taken in the Fayette Street outfall ditch at stations 26 and 27. No core samples were obtained in the Court Street area. The short overland outfall area was covered with riprap which prevented sampling, and the river sediments were too loose and/or watery to be contained in the coring cylinder.

River Cross-Sectional Data

River cross-sectional data were obtained at transects located at the centerline of the Court and Fayette Street outfalls and at a position approximately 66 feet below the tip of the point of the island shown on figure 10. Range poles were driven on both banks forming a line perpendicular to the centerline of the navigation channel. Soundings were taken along this line at 25-foot intervals using a weighted downrigger equipped with a depth counter. Transverse distances were obtained using the range finder shown in figure 9.

Data Generation

The field sampling program was designed principally to provide qualitative and subjective information on the pollutional condition of the sediments and the aesthetics in the outfall areas. Sediments were documented as to color, texture, and odor and were roughly quantified as to clay, silt, sand, and gravel composition. The dredge samples were characterized as one sample, whereas the core samples were dissected and changes in composition were noted at incremental depths. Both dredge and core samples were photographed in black and white, with selected photographs included in this report. Those which have not been included in the report are on file in the Water Quality Section Peoria Laboratory and are available for examination at any time.

The aquatic-related morphological factors in the immediate outfall areas are documented and described in terms of riverine or backwater habitat. Natural accumulations of logs and vegetative debris principally outside the navigation channel are described and documented with black and white photographs.

A limited amount of quantitative data was also generated. At a few sampling sites, sediment samples were collected for laboratory analyses for moisture and volatile solids content and macroinvertebrate populations. Also, two in-situ sediment oxygen demand (SOD) tests were run -- one at station 27 above the Court Street outfall and the other at station 11 below the Court Street outfall. The moisture content is indicative of the liquid or flocculent nature of sediments. Clay, silts, and sludge-like depositions contain a significantly larger fraction of water than do more coarse materials like sand and gravel. Volatile solids content generally is indicative of the organic content of sediments. Raw sewage solids and sludges are composed of a high percentage of volatile material. Consequently, a significant amount of volatile material in a sediment sample may be indicative of sewage contamination, depending upon certain conditions. The sediment oxygen demand test in a stream principally measures benthic bacterial and macroinvertebrate respiration; i.e., the biological usage of dissolved oxygen (DO) by bottom dwelling organisms. A high SOD rate in the absence of a large and diversified macroinvertebrate population generally indicates that the sediments have been polluted with sewage or other organic matter.

RESULTS

The results of this study are based on conditions which existed during visits made on July 8, 10, and 26 and August 12, 1985. Dry weather conditions existed on these specific dates. However, up to August 12, the summer was relatively wet. No discharges were observed coming from any of the four out falls.

Morphological and Aesthetic Considerations

Each outfall area will be described in terms of stream morphology, aquatic habitat, and aesthetic and environmental conditions.

State Street

This is the upstream-most of the four overflow sewers. It discharges into a very shallow off-channel slough (figures 1, 2, and 10). At the time of the survey, only a few stagnant pools existed in the slough above the point where the sewer overflow channel empties into the slough. Figure 2 shows the outfall viewed at sampling station 21 (figure 10). The overflow channel is lined with watery sludge and muck which supports a lush stand of arrowhead along the banks. Figure 4 shows the slough viewed downstream of station 21. Sludge deposits were observed in the slough below the outfall channel in the localized area shown on figure 10. These sludge deposits were approximately 30 to 36 inches deep, smelted septic, and emitted gas bubbles when disturbed. The State Street overflow channel was free of trash and debris often associated with CSOs. The slough below station 20 is free of any significant sludge deposits. This may be an indication that the observed sludge deposits in the State Street outfall area are residual from historical dry weather overflows which frequently occurred prior to extensive lift station rehabilitation during 1972 and 1973.

Caroline Street

The Caroline outfall channel is shown on figure 3 and its location is shown on figures 1 and 10. The channel is free of sludge or pollutional depositions with the bottom consisting primarily of compacted sand. The channel contains some man-made and natural trash and debris. The sewer outfall is set back from the slough approximately 200 feet and is shrouded in a lush canopy of woody vegetation and weeds.

Court Street

The Court Street outfall area is shown in figure 6 and depicted diagrammatically in figure 11; its areal location is shown on figure 1. Figure 13 shows a close-up view of the outfall channel. The course to the river is short, elevated, and lined with riprap. This rough trace causes trash and debris to hang up in the stones and concrete fragments during overflow periods (figures 13 and 14). Immediately downstream of the outfall is a grain elevator barge loading dock, the upstream-most mooring pier of which is shown on figure 6. The spillage of grain in the loading area appears to affect localized bottom conditions.

Fayette Street

The Fayette Street outfall area is shown in figure 7 and depicted diagrammatically in figure 12; its areal location is shown on figure 1. The outfall pipe terminus shown on figure 15 is over 250 feet back from the river shoreline. The outfall channel bottom is lower than the river water surface and is therefore always flooded with about 2 feet of water (figures 9 and 15). An old headwall and attendant pipe opening

Figure 13. Close-up of Court Street outfall channel

Figure 14. Close-up of debris collection in Court Street outfall channel

Figure 15. Close-up of Fayette Street outfall pipe

stand isolated about 100 feet back from the river (figures 7 and 9). The bottom and sides of the outlet channel are relatively firm and free of sludge. The water in the channel, however, shows evidence of pollution. The water appears somewhat black and septic and contains wastewater-related material such as floating solids and condoms. The outfall pipe terminates at the edge of a railroad track, and the area in the vicinity of the pipe is choked with debris and fallout from the tracks (figure 15).

The cross sections taken at the centerline of the outfall areas for Court and Fayette Streets and the one taken essentially perpendicular to the State-Caroline slough outlet are shown on figure 16. The shallow nature of the State-Caroline transect on the left bank side reflects entry into the bay-like area into which the slough terminates. The deep sloping bank in the Court Street outfall probably reflects past dredging in the area to establish deep water for the barge loading operations.

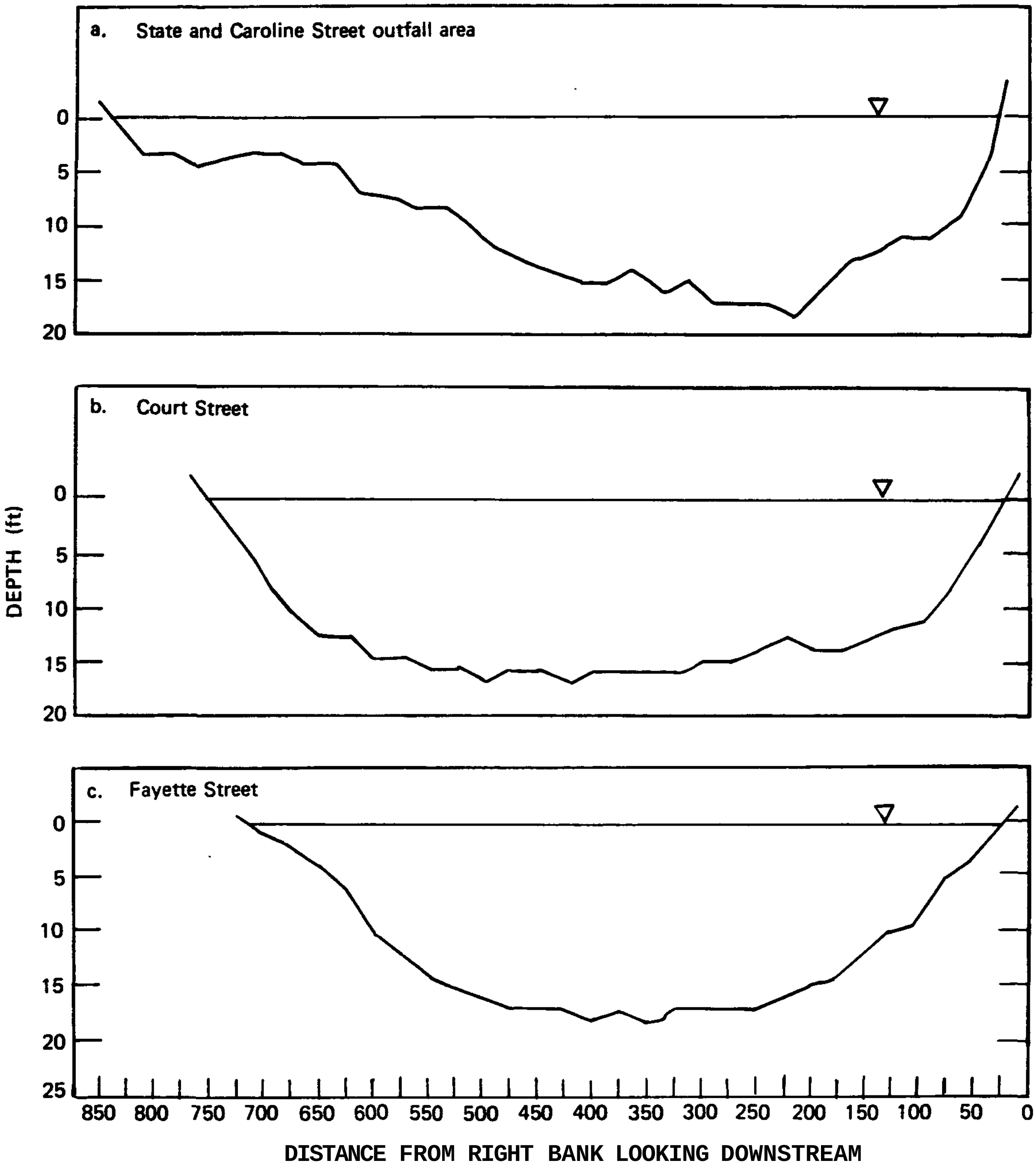


Figure 16. Illinois River cross sections at Pekin combined sewer overflows (pool elevation: 433.20)

Dredge and Core Sediment Descriptions

The areal locations of the sediment sampling stations are shown on figures 10, 11, and 12. Photographs of all the core samples are presented in the text, and selected photographs of dredge samples are presented in the appendices. The dredge sample illustrations were selected to show the full range of substrate types encountered at each outfall location. Overall 70 dredge samples and 7 core samples were collected.

Caroline and State Streets

The sampling locations in the outfall area common to these two overflows are shown on figure 10. Dredge samples were collected at stations 1 through 17; core samples were collected at stations 14, 18, 19, 20, and 21. Figures 17 through 21 show the core samples, and Appendix A shows 6 dredge samples which were selected for illustrative purposes for this area. Samples were collected for water and volatile solid content at stations 19, 20, and 21. Descriptions of the core and dredge samples are presented in tables 1 and 2, respectively.

Court Street

The sampling locations in the Court Street outfall area are shown on figure 11. Dredge samples were collected at

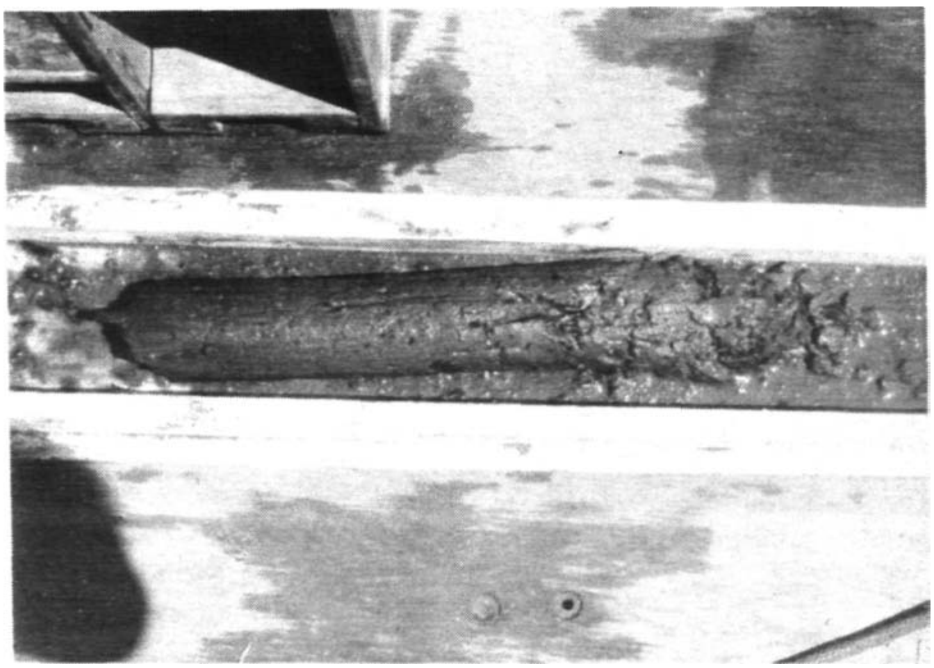


Figure 17. Core sample at State-Caroline sampling station 14

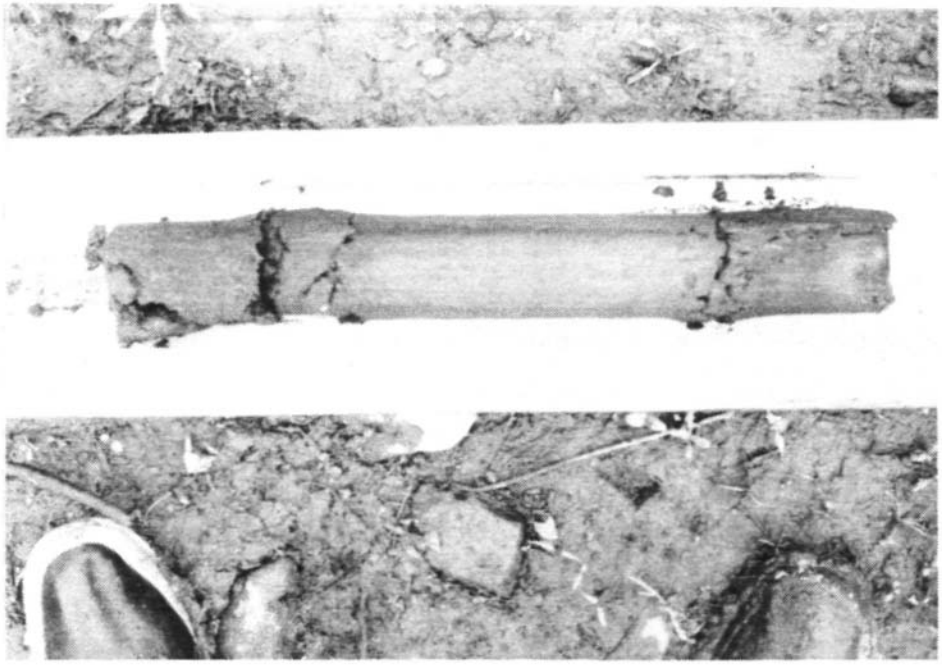


Figure 18. Core sample at State-Caroline sampling station 18

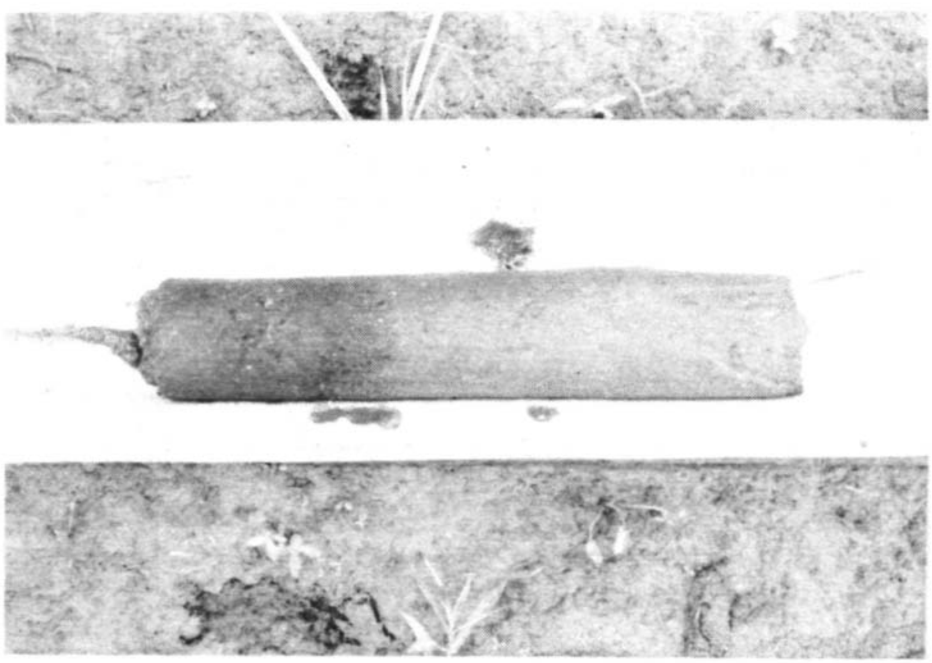


Figure 19. Core sample at State-Caroline sampling station 19

Figure 20. Core sample at State-Caroline sampling station 20

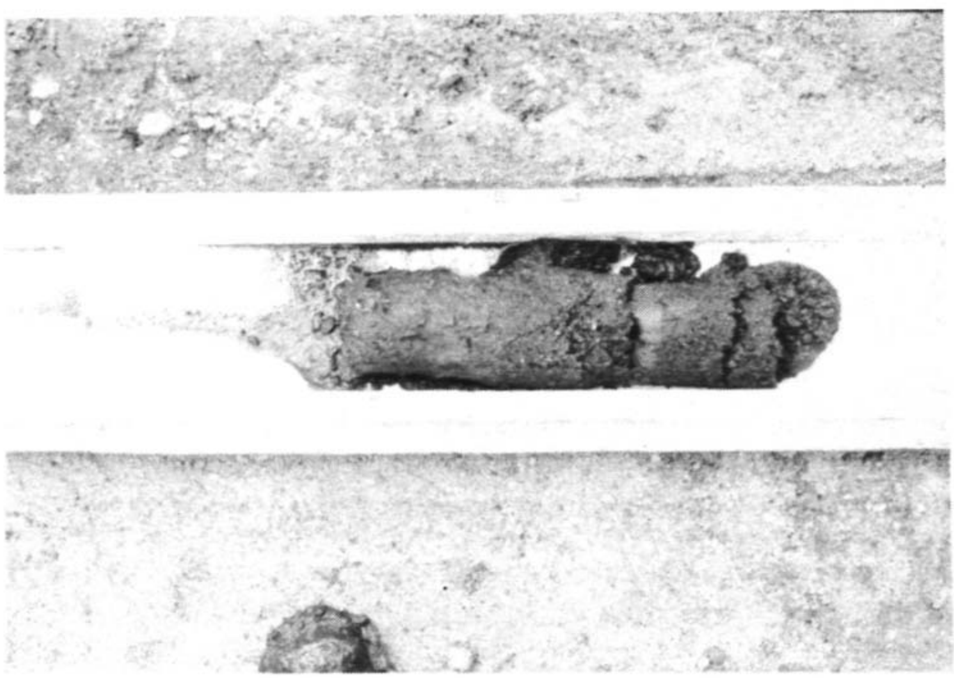


Figure 21. Core sample at State-Caroline sampling station 21

Table 1. Core Sample Characteristics

Sewer Area	Sample Number	Depth Internal (inches)	Description
Fayette	26	0-3	tan to gray-black silt mixed with coarse sand and pea gravel, musty smell
		3-5	tan fine to medium sand
		5-16	tan gray-black silt
		16-19	very fine black uniform sand
	27	0-1	gray to black coarse sand mixed with pea gravel slight septic smell
		1-8	gray-black coarse sand mixed with pea gravel
		8+	light tan "hard pan" silt, clay
State-Caroline	14	0-5	black coarse sand, musty smell
		5-12	gelatinous gray-black silt, clay
	18	0-2	dirty black coarse sand mixed with small to medium pea gravel no significant odor
		2-4	black medium to coarse sand mixed with woody detritus
		4-6	gray-tan fine to coarse sand mixed with woody detritus
		6-14	dry gray silt, fine to medium sand
		14-18	uniform black medium sand mixed with a little small gravel
	19	0-2	watery black medium to coarse sand, leafy detritus slight septic odor
		2-3	dry black medium to coarse sand, twigs and leafy detritus
		3-9	gray very fine sand mixed with some pulverized white shells
		9-13	extremely fine gray sand, relatively dry and mixed with pulverized shells
	20	1-3	very black fine to coarse sand, small shells, slight sewage odor
		3-12	tacky gray silt, no odor
		12-17	tacky gray silt laced with pockets of coarse sand
	21	0-3	loose black septic looking medium to coarse sand, wood chips, slight sewage odor
		3-12	loose very black septic looking medium to coarse sand, pea gravel, slight musty odor

stations 2 through 29, and selected ones are shown in Appendix B. Descriptions are presented in table 3. No core samples were collected in the area. Attempts were made to do so in the river outfall area, especially in the vicinity of the barge loading piers; however, the substrate was composed of watery, coarse sediments which could not be retained in the sampler. No dredge sample could be collected at station 1 because the bottom was very hard and rocky in this vicinity. Since the outfall channel was elevated above the river and was lined with riprap material, no sampling was done in the channel.

Table 2. State Street and Caroline Street Outfall Area Sediment Characteristics*

Sample Number	Water Depth (ft.)	Description
1	2-1/2	watery black silt, clay, musty odor, no sewage smell
2	3-1/2	watery black silt, clay, musty odor, no sewage smell
3	3-1/2	watery black silt, clay, musty odor, no sewage smell
4	3	watery black silt, clay, musty odor, no sewage smell, with small sticks and woody detritus
5	3	watery black silt, clay with small amount of fine sand
6	2-1/2	watery black silt, clay without evidence of sand
7	3	watery black silt, clay without evidence of sand
8	3	watery black silt, clay without evidence of sand
9	2-3/4	watery black silt, clay without evidence of sand
10	3-1/2	watery black silt, clay without evidence of sand, with woody detritus
11	3	watery black silt, clay without evidence of sand, with woody detritus, more watery
12	3-1/2	watery black silt, clay with small amount of fine sand
13	3	watery black silt, clay with small amount of fine sand
14	3-1/2	watery black silt, clay with much coarse sand
15	3-3/4	watery black silt, clay with much coarse sand
16	4	watery black silt, clay with much coarse sand, with much woody detritus, large live clam
17	4-1/2	watery black silt, clay with much coarse sand

* Collected: 7/10/85 Pool Elev. 433.30

Fayette Street

The sampling locations in the Fayette Street outfall area and outfall channel are shown on figure 12. Dredge samples were collected at stations 1 through 25; core samples were collected at stations 26 and 27. The core sample descriptions are presented in table 1 and those for the dredge samples are given in table 4. Selected dredge samples are shown in Appendix C. The core samples are shown as figures 22 and 23.

Measured Sediment Characteristics

Table 5 presents the results of parameter measurements made at selected sites to provide some finite information on the pollutional nature of the sediments. The samples were collected at locations which appeared to be "worse case" situations.

DISCUSSION AND CONCLUSIONS

The sediments in the riverine areas of the outfalls varied widely between outfall areas and even within the

Table 3. Court Street Outfall Area
Sediment Characteristics*

Sample Number	Water Depth (ft.)	Description
1	6-1/2	no dredge sample obtained - bottom appears to be hard pan clay covered with scattered fragments of concrete
2	12-3/4	black fine to coarse sand, musty odor
3	16	thin layer of light to dark black silt on top of watery fine to medium sand, some small rocks
4	16	tan-gray fine to coarse sand, small gravel, rocks, shells
5	10	gray coarse sand loaded with woody detritus
6	13-1/2	gray-black to dark black watery silt on top of black fine to coarse sand, highly organic septic looking, musty odor, gas bubbles evident in water
7	13-3/4	thin watery layer of gray-tan silt on top of silty fine to medium dark black septic looking sand
8	15	uniform tan to gray-black silty sand
9	16	tan to gray fine to coarse sand, small pea gravel, live clam, shell fragments
10	7-1/2	gray to gray-black medium to coarse sand, small pea gravel
11	11-1/2	tan-gray to very black silty sand, highly organic, small sticks and woody detritus, odorous
12	13-1/2	tan silt lenses and clay balls, black coarse sand, woody detritus
13	14-1/2	watery tan to gray silt on top of coarse sand, pea to medium sized gravel and rocks, relatively clean
14	7-1/2	relatively clean tan to gray coarse sand, medium gravel
15	10	gray to black uniform silty coarse sand
16	11-1/2	thin layer tan-gray watery silty fine sand on top of gray-black uniform coarse sand
17	19-3/4	relatively clean tan coarse sand, some medium gravel
18	1	black medium to coarse uniform sand, some small pea gravel
19	3-3/4	relatively clean loose gray-black medium to coarse sand, pea gravel
20	9	watery gray coarse sand, pea gravel, medium rocks
21	12-1/2	fine tan sand on top of gray black fine to medium sand, some very small pea gravel
22	2-1/2	relatively clean tan-gray coarse sand, pea sized to medium gravel
23	4-1/2	relatively clean tan to gray coarse sand, pea gravel
24	6-1/2	thin layer tan fine sand on top of coarse sand, very small gray to gray-black pea gravel, sticks and woody detritus
25	9-1/2	clean coarse sand, pea to medium size gravel
26	3	clean coarse sand, small to large gravel
27	6	clean tan coarse sand, small to medium gravel
28	7-1/4	relatively clean tan fine to coarse sand, some pea gravel
29	10	tan silty fine sand on top of gray black coarse sand, small pea gravel and shells

* Collected: 7/10/85 Pool Elev. 433.30

Table 4. Fayette Street Outfall Area
Sediment Characteristics*

Sample Number	Water Depth (ft.)	Description
1	2-1/2	tan to gray-black coarse sand, pea gravel, small rocks, clam and snail shells, musty odor
2	4-1/2	tan to gray-black fine to medium sand, pea gravel, small rocks, small to medium size broken clam shells
3	6-1/2	tan to gray very fine to coarse sand, pea gravel, small rocks, a few small shells, red worms evident
4	10	tan to gray black fine to coarse sand, very small to pea size gravel, a little silt, shell fragments, woody detritus, musty river bottom odor
5	2	tan to gray-black fine to coarse sand, small gravel, rocks, a few shell fragments, musty odor
6	2-1/2	mostly tan to gray-black fine to coarse sand, some small gravel and a few rocks and shell fragments, musty odor
7	7	tan very fine sand on top of gray-black coarse sand, pea gravel, one large rock, some shells and shell fragments
8	8-1/2	tan very fine watery sand on top of gray-black coarse sand, one small rock, leafy and woody detritus, musty odor
9	1	clean fine to coarse sand, small pea gravel, medium gravel, shell fragments
10	2	tan medium to coarse sand, small pea gravel, a few small shell frag-ments
11	7	tan to gray fine to coarse sand, some coal slag, one shell fragment, one small rock
12	9	thin layer of tan fine to medium sand on top of small pea gravel, one large stone, some shells and shell fragments
13	1	uniform tan fine to coarse sand mixed with pulverized shell fragments
14	1	clean tan coarse sand, pea gravel, some medium gravel, some shell fragments
15	4	clean tan medium sand, small to large pea gravel, a few small shell fragments
16	9	clean tan coarse sand, small pea gravel, small shell fragments
17	2	tan to gray coarse sand, small pea gravel, a few small shell fragments, almost odorless
18	7	thin layer of tan fine sand on top of coarse sand, pea gravel, medium to large gravel, rocks, a few small shells
19	8	tan fine sand, pea gravel, small to medium gravel shell fragments
20	1	tan fine to coarse sand, very small pea gravel, one small rock, a few small shells, coal slag
21	9	watery tan fine to medium sand, small snail shells, a few medium shell fragments
22	11	uniform clean tan fine to medium sand
23	3	uniform tan-gray fine to coarse sand, some medium gravel
24	9	tan-gray fine to coarse sand, some medium gravel, gray-black silt balls
25	12-1/2	watery tan fine to coarse sand, some small gravel, small snail shells, finely pulverized shell fragments

* Collected: 7/08/85 Pool Elev. 432.25

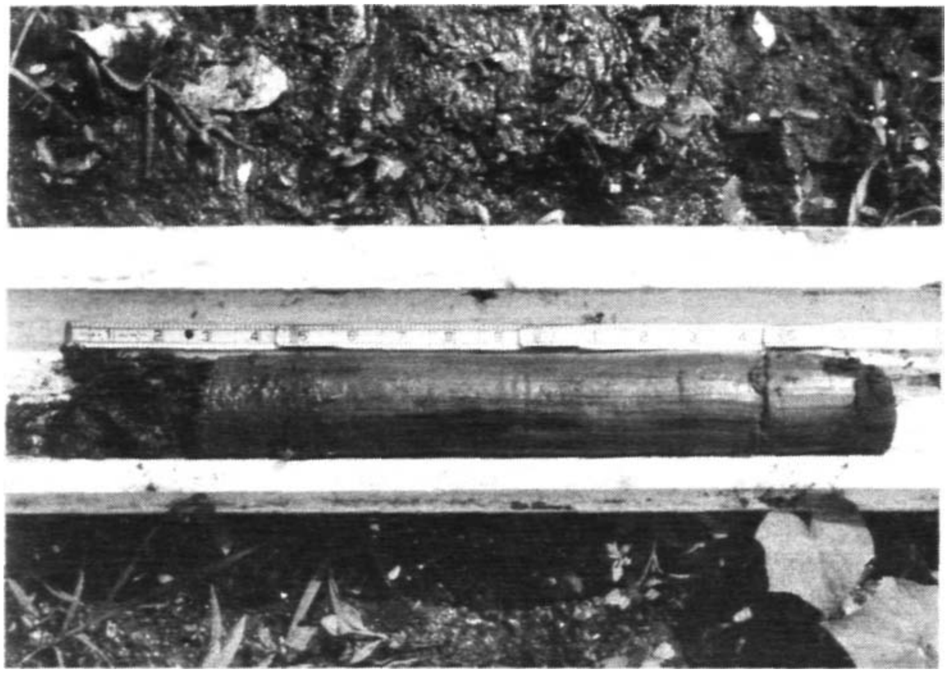


Figure 22. Core sample at Fayette Street sampling station 26

Figure 23. Core sample at Fayette Street sampling station 27

Table 5. Measured Sediment Characteristics
at Selected Sampling Stations

Sewer	Station Number	Parameter: Percent Water	Percent Volatile Solids	Sediment Oxygen. Demand @ 25° C (g/m² /d)
Fayette St.	26	18.0	2.60	-
	27	13.5	1.00	-
Court St.	11	32.5	5.33	0.84
	15	27.2	2.80	-
	27	18.0	2.80	1.15
State-Caroline Sts.	19	21.4	2.60	-
	20	17.8	3.00	-
	21	40.2	6.90	-

confines of given outfall areas. Sludges were not found in the river channel. However, some river sediments revealed evidence of chronic organic contamination and degradation in several confined areas.

State-Caroline Street?

The sediments in the bay-like area into which the slough empties, which receives the State and Caroline overflows, show little or no visual evidence of sewage contamination from the overflows. Sediment deposition is extensive and deep in the area from the bridge to the open water area; however, the consistency, composition, and odor of the sediment are typical of sediments which accumulate in most backwater lakes and sloughs along the Illinois River. In general, it could simply be described as watery black muck having a musty odor. Appendix A shows photographs of six selected dredge samples. The major difference between the samples at stations 1 and 17 is water content. The station 1 sample appears to be somewhat more fluid than the station 17 sample. Also, as can be ascertained from table 2, the outermost samples contained a little more coarse and woody material than did the closer-in sediments.

The core sample taken at station 14 in the bay revealed no evidence of present or past sewage sludge deposition or contamination. The core sample information in table 1 indicates that the sediments in this area consist of about 5 inches of black coarse sand on top of gray-black gelatinous musty smelling muck. The core samples taken in the slough, however, show signs of sewage contamination, the degree of which increases in the upstream direction. The core samples taken at stations 18 through 21 are shown as figures 18 through 21, respectively. Samples 18, 19, and 20 were taken in the centerline of the slough, while sample 21 was taken in the center of the State Street outfall ditch (figure 10). Note from table 1 that the sample at station 18 is relatively clean and odorless, that at 19 smells septic, and those at 20 and 21 smell of sewage. The centerline samples, however, consist mostly of black septic-looking sands, while the left shore above station 20 (looking downstream) was lined with sewage sludge deposits at least 30 inches deep. Such a deposit is evident in the foreground of figure 4; core sampling at station 20 is shown in the background of the photograph. Note from table 5 that the water and percent volatile content at station 21 was the highest of any measured at any location in the study area. Both values are indicative of significant organic pollution from sources other than natural.

Basically, the sludge deposits do not create a pollution or water quality problem. They do, however, pose a potential public health hazard and are aesthetically unsightly and odorous. The relatively isolated nature of the area minimizes these effects on the public to some degree. Also, as previously noted, these could be due to "aged" residual deposits which resulted from dry weather overflows which no longer occur. The receiving slough is also lined with man-made debris and discards, which, along with the sludge deposits, lend an overall unpleasant aura to the area.

Court Street

Of the four CSOs, Court Street comes the closest to discharging directly into the river. It is set back only about 50 feet from the river bank, and the overflow pipe is elevated 4 to 5 feet above the normal river pool elevation, allowing any overflow to cascade rapidly over riprap in its short course to the river. Consequently, the chances for sludge buildup and pooling of contaminated water in the outfall channel are negligible. Nevertheless, public health and aesthetic problems persist around the outfall. Sewage-borne debris and trash have accumulated in the riprap and rocky crevices, creating unwholesome, odorous, and unsightly conditions.

The dredge sediment samples collected in the 300-foot by 140-foot sampling area in the river around the outfall displayed a wide range of characteristics (table 3). For instance, the station 5 sample consisted principally of gray coarse sand, whereas the station 6 sample, taken longitudinally in line with station 5 but 23 feet farther out, exhibited highly organic septic conditions. When the sampler hit the bottom around station 6 a massive amount of gas bubbles was released. Photographs of these respective samples are shown as C5 and C6 in Appendix B. Besides the station 6 sample, significant organic contamination appeared in the samples collected at stations 7 and 11. Samples collected immediately in line with the outfall or immediately downstream, such as those for stations 14 through 21, were relatively clean and free of organics (table 3). The fact that these samples were free of visual organic pollution whereas several farther downstream were not indicates that the sewer overflow probably is not causing the pollution; the more likely cause is grain spillage during barge loading in this area.

Because of the polluted appearance of some of the downstream samples, in-situ sediment oxygen demand tests were run at station 11 below the outfall and at station 27 above to provide more definitive information on pollutional conditions. The results, given in table 5, show that station 11 did not exhibit a high SOD — in fact it was slightly less than that measured at station 27. Table 6 lists sediment classifications ranked according to SOD rates. Note that, based solely on SODs, benthic sediment conditions at stations 11 and 27 would have to be classified as moderately clean and slightly degraded, respectively. This is in spite of the fact that station 11 exhibited a volatile solids content of 5.33 percent compared to the 2.80 percent value for station 27.

Table 7 lists the macroinvertebrate population densities found at the two stations where SODs were measured. Both locations show almost a complete lack of quantity and diversity. While some sludge worms appeared at both

Table 6. Generalized Benthic Sediment Conditions Categorized by SOD Rates (Butts and Evans, 1978)

Generalized Benthic Sediment Condition	SOD Range $g/m^2/day @ 25°C$
Clean	0 - 0.5
Moderately clean	0.5 - 1.0
Slightly degraded	1.0 - 2.0
Moderately polluted	2.0 - 3.0
Polluted	3.0 - 5.0
Heavily polluted	5.0 - 10.0
Sewage sludge	>10.0

Table 7. Benthic Macroinvertebrate Densities at Court Street

Organism	Densities (number per m^2) Station 27	Station 11
Tubificidae (sludge worms)	19	57
Chironomidae (midge fly)		77
Ceratopogonidae (biting midge)		6
Total	19	140

locations, the counts are so small as to be insignificant and meaningless. Sewage sludge or sewage-contaminated sediments usually show Tubificidae counts in terms of thousands. The lack in both numbers and diversity can probably be attributed to tows moving barges in and out of the grain loading area. Tremendous turbulence is created by the tow propellers, and this causes unstable and unsettled conditions which are not conducive to benthic macroinvertebrate propagation and growth.

Fayette Street

The sediments in the Fayette Street outfall channel showed evidence of chronic sewage contamination; the standing water in the outfall channel appeared stagnant and of poor quality. Condoms and floating solids were seen in the channel, and the water pooled around the outfall pipe near the railroad tracks was black and looked septic. However, no sludge deposits, similar to those documented in the State-Caroline outfall slough, were observed. The two core samples taken in the center of the channel are shown as figures 22 and 23. The gray-black color is indicative of chronic sewage contamination, and the sample at station 27 (closest to the outfall) had a slight septic odor (see table 1 descriptions). The volatile content of both samples, however, was relatively low as evidenced by the results in table 5. The volatile solids content of the station 27 sample was lower than that at station 26 because the surface deposition at this station consists of a much coarser material (see figures 22 and 23). The compacted material below the coarse material appears to be native soil.

Twenty five dredge samples were collected in a 300-foot by 100-foot area in the river. Fourteen selected sediment photographs are presented in Appendix C. None of the samples, either above or below the outfall, exhibited any noticeable contamination or degradation. Examination of the detailed descriptions presented in table 4 and the photographs in Appendix C show, however, that within this relatively small area, the consistency and composition of the sediments varied greatly. For example, the station 2 sediment consisted mostly of gravel, rocks, and shells, whereas 50 feet upstream and 25 feet in, the station 5 sample consisted principally of coarse, wet sand.

Conclusions drawn as a result of this study are:

1. <u>The State Court and Favette Street outfall channels exhibit some pollutional effects due to combined sewer overflows: the Caroline Street outfall channel does not</u> The State and Caroline outfall channels discharge into a common outlet channel to the river. Sediment degradation

and potential public health and aesthetic problems exist in the State and Fayette Street outfall channels and in the State-Caroline outlet channel. Only public health and aesthetic problems exist at Court Street. Problems in the State-Caroline outlet channel appear attributable only to State Street sewer overflows.

2. The sediments in the rivering areas around the State-Caroline Street outlet and the Fayette Street outlet show no signs of pollutional degradation: but several samples in the area of the Court Street outlet showed evidence of chronic organic contamination The limited contamination in the Court Street area sediments can probably be attributed to grain spillage during barge loading operations which regularly take place immediately below the outfall. Frequent spillage was observed during the course of this study.

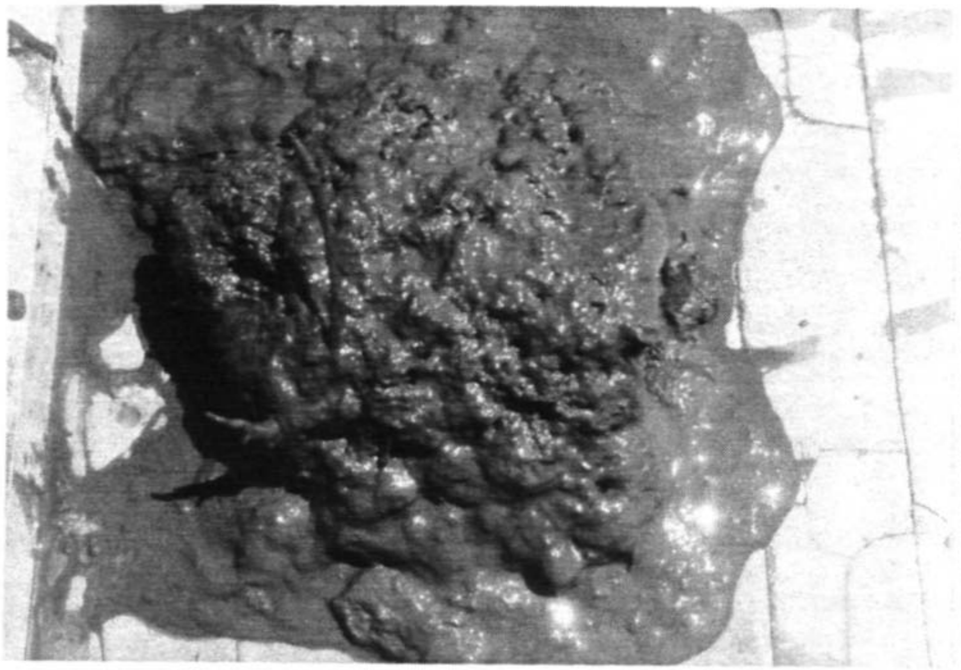
REFERENCES

Butts, T.A., and R.L. Evans. 1978. Sediment Oxygen Demand Studies of Selected Northeastern Illinois Streams Illinois State Water Survey Circular 129, 178 pp.

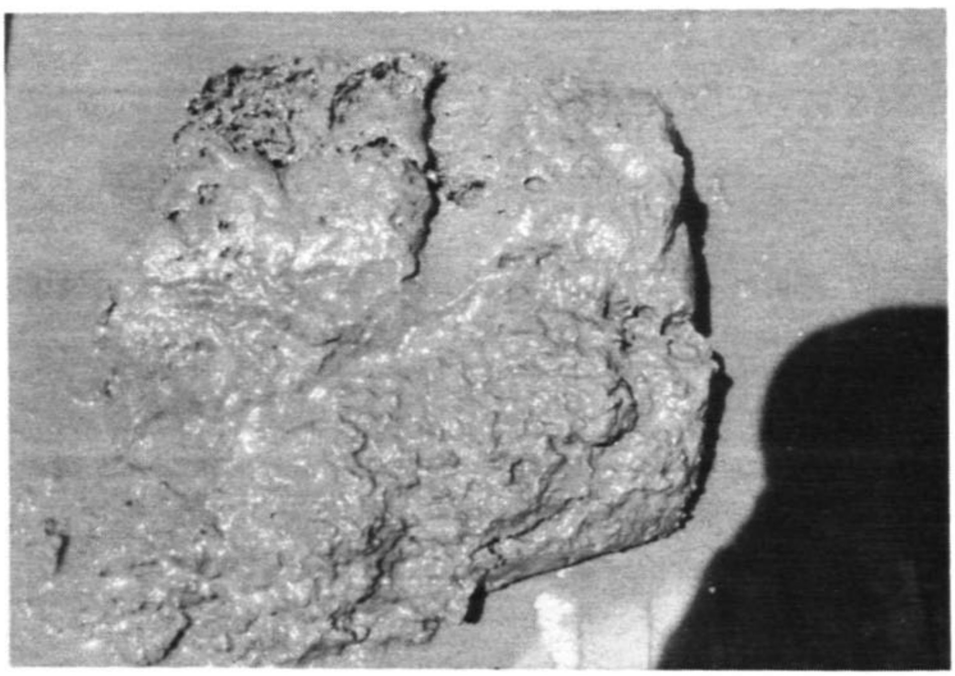
Staff of the Water Quality Section, Illinois State Water Survey. 1983. An Assessment of the Impact of Combined Sewer Overflows at Peoria on the Waters of the Illinois Waterway. Illinois State Water Survey Contract Report 330, 173 pp.

Appendix A

Photographs of Selected Ponar Dredge Samples in
State-Caroline Streets Outfall Area

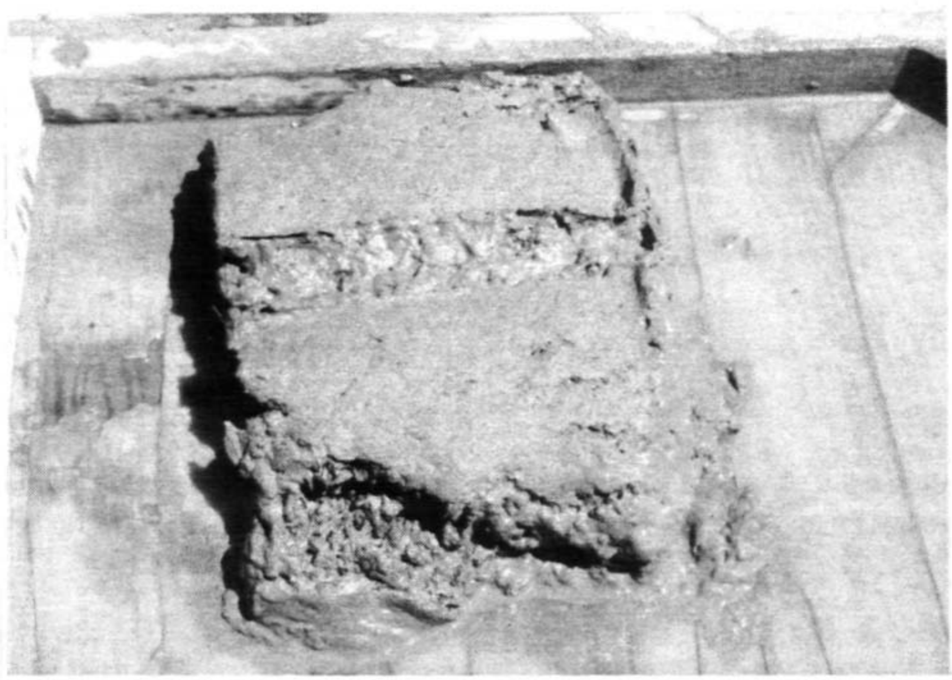


SC1

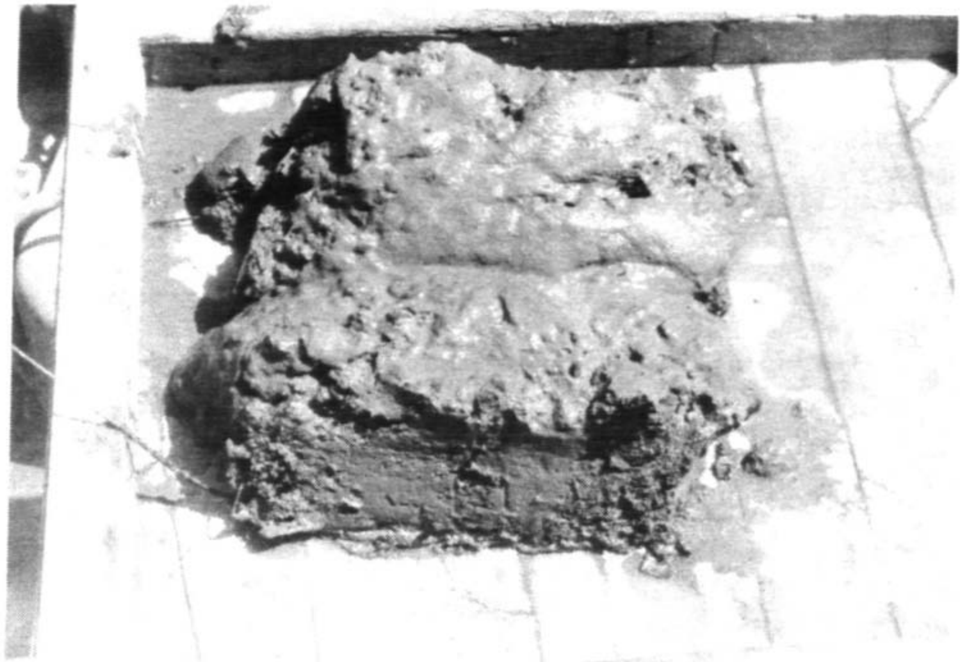


SC3

SC5



SC7



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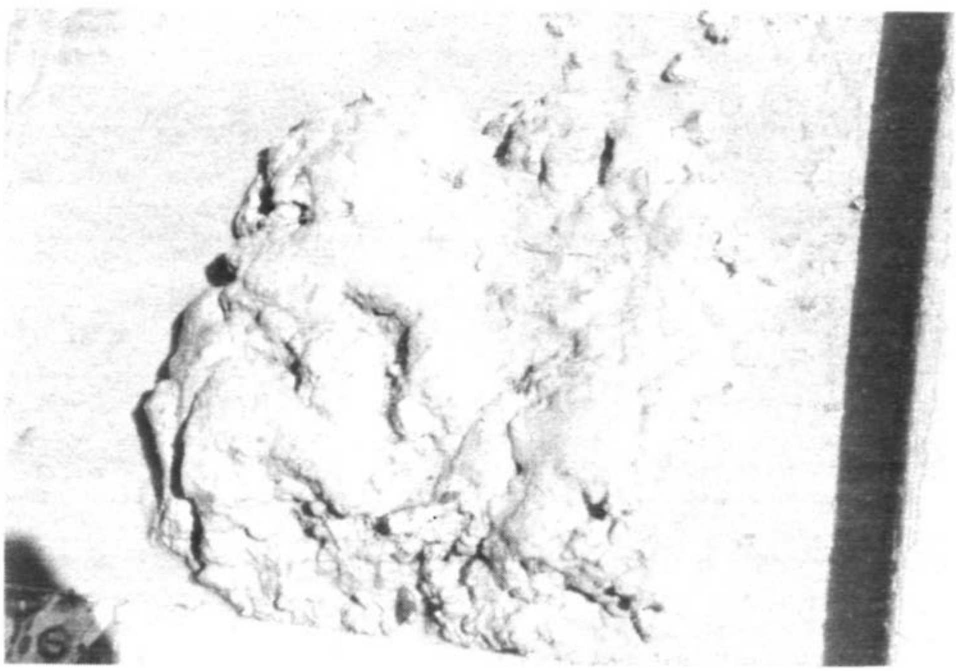
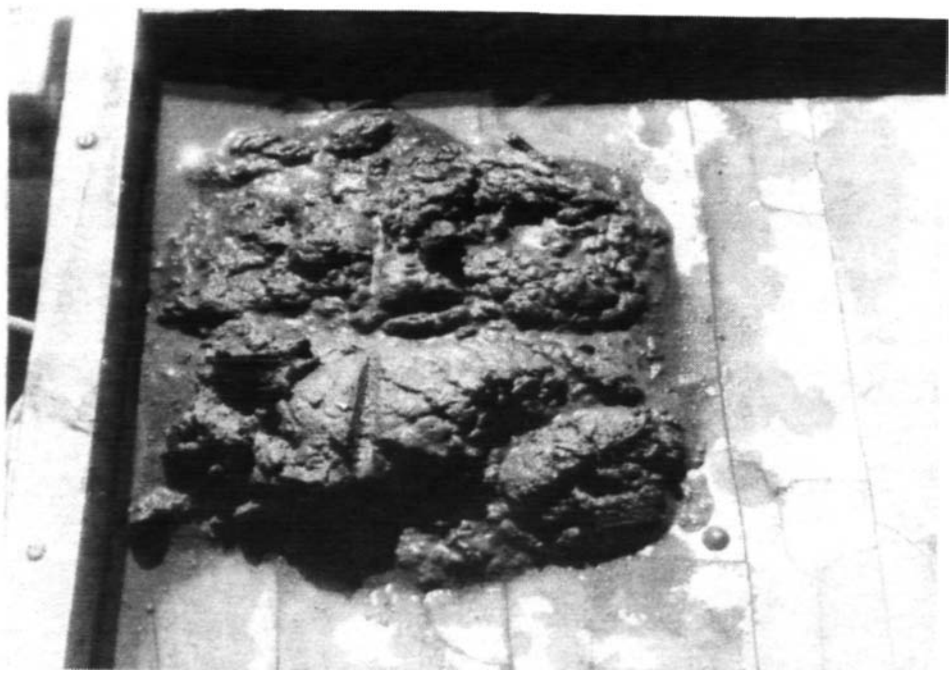


SC17

Appendix B

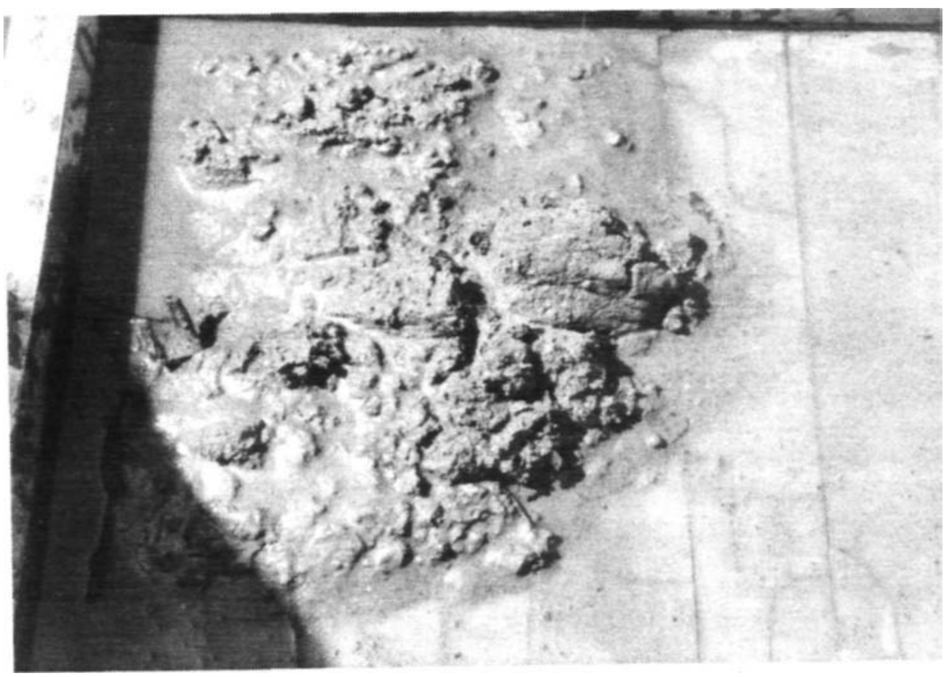
Photographs of Selected Ponar Dredge Samples in Court Street Outfall Area



C1

C2

C4



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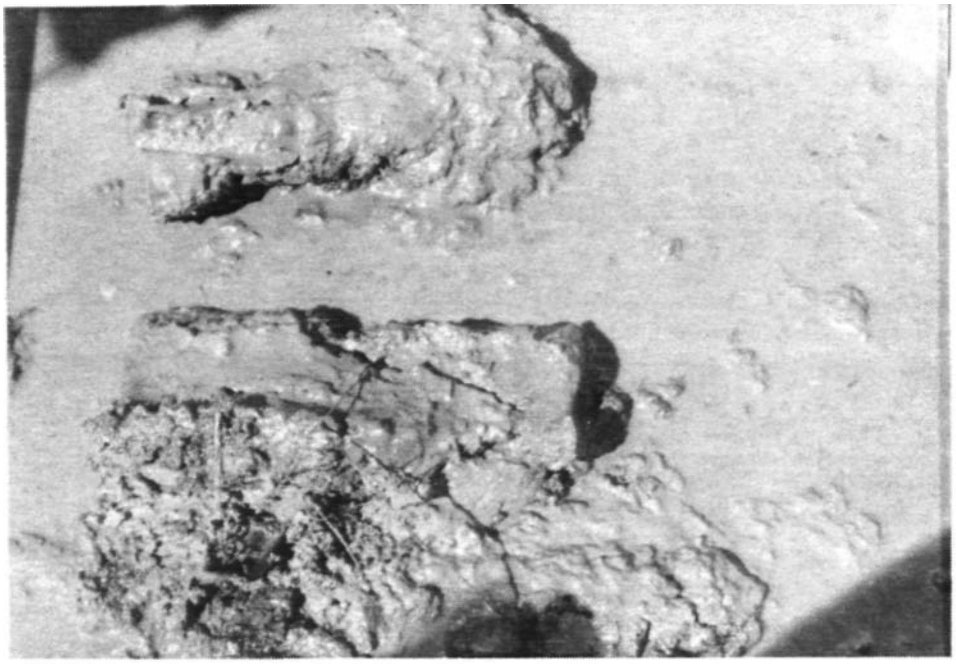

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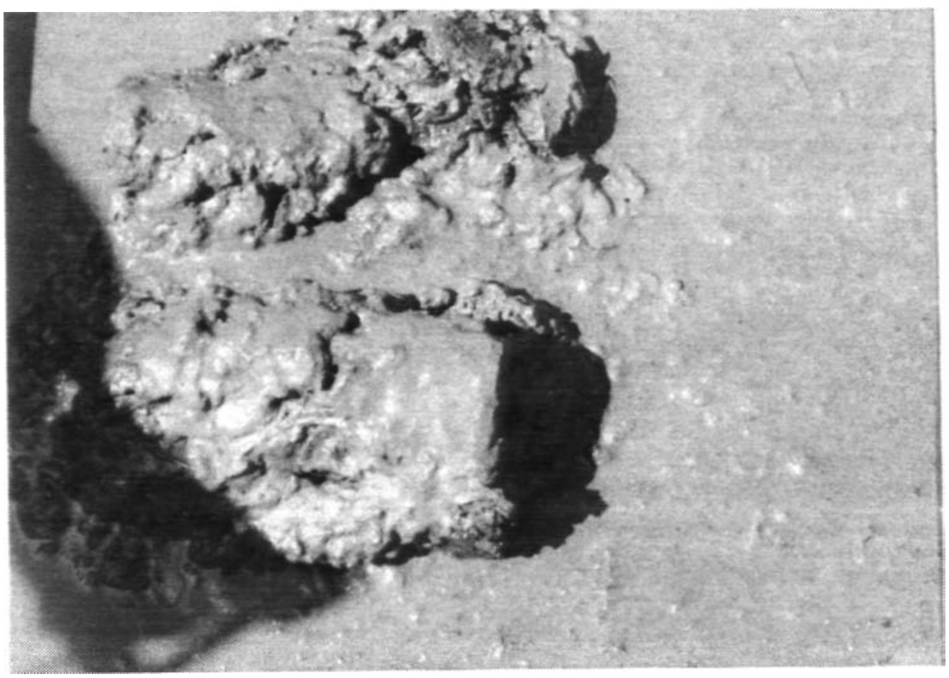

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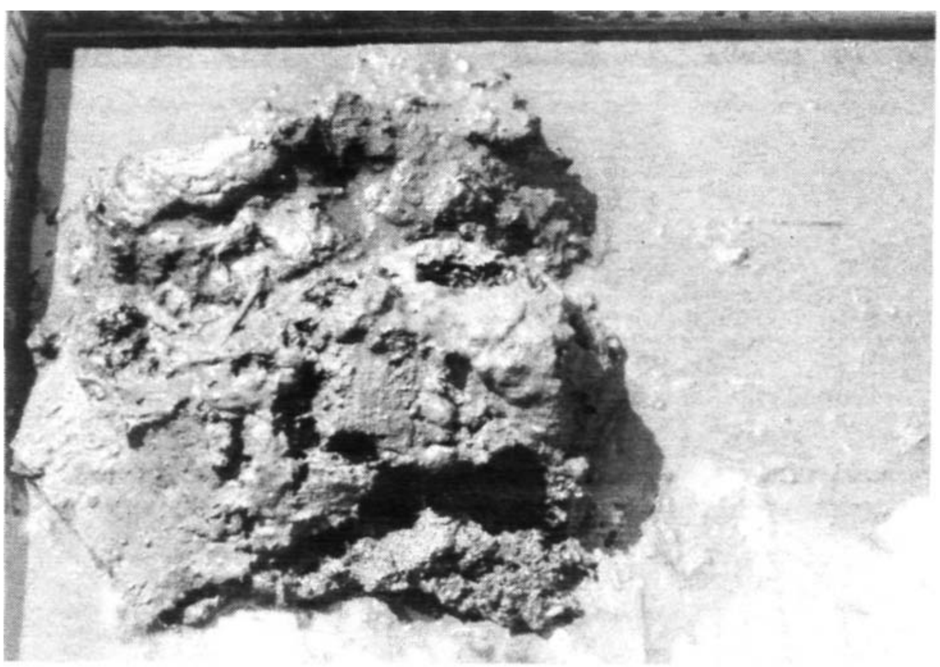
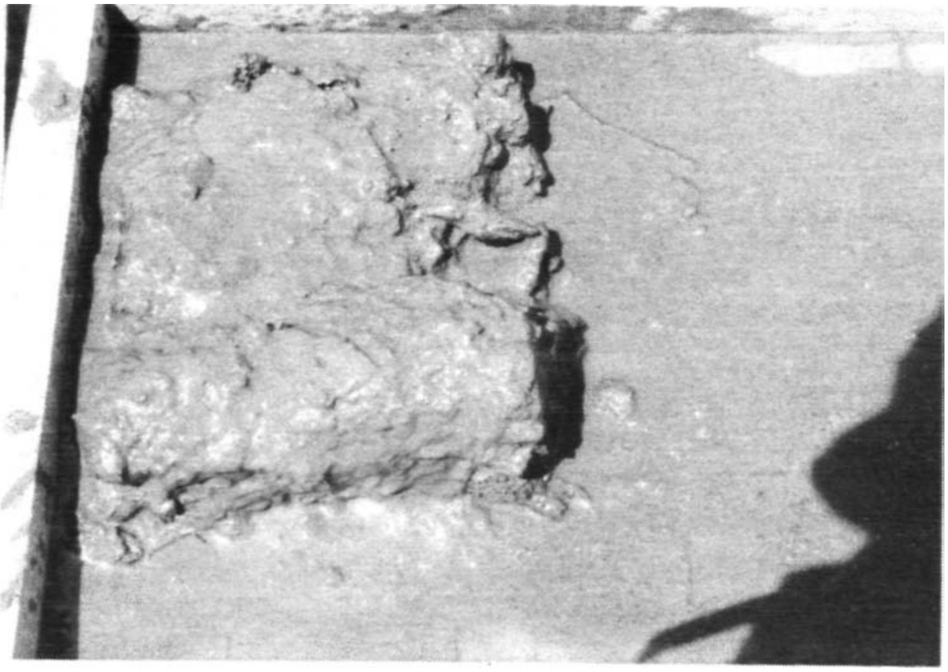
C9



C11

C1 3

C14



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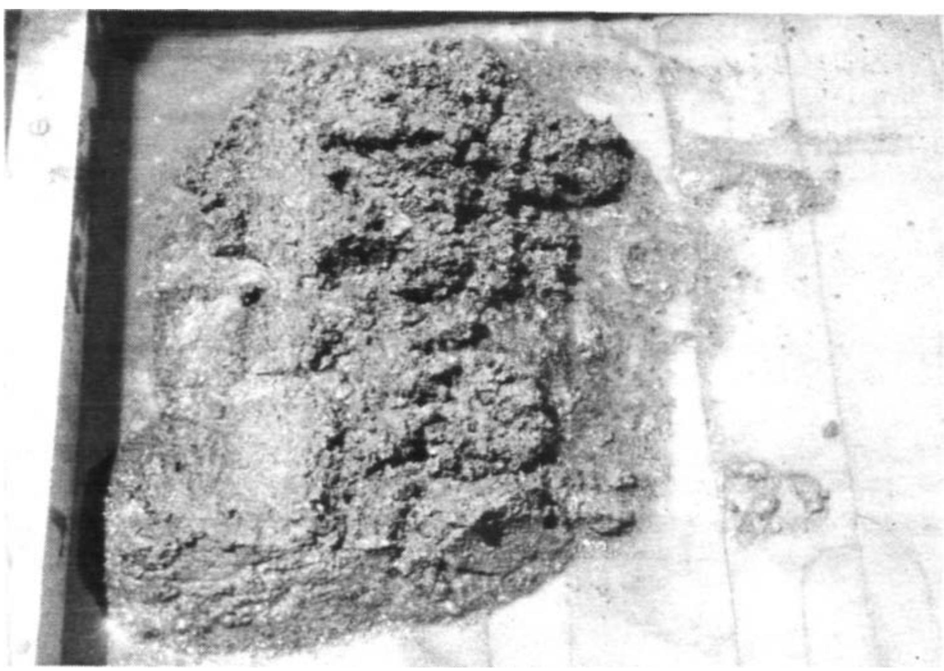
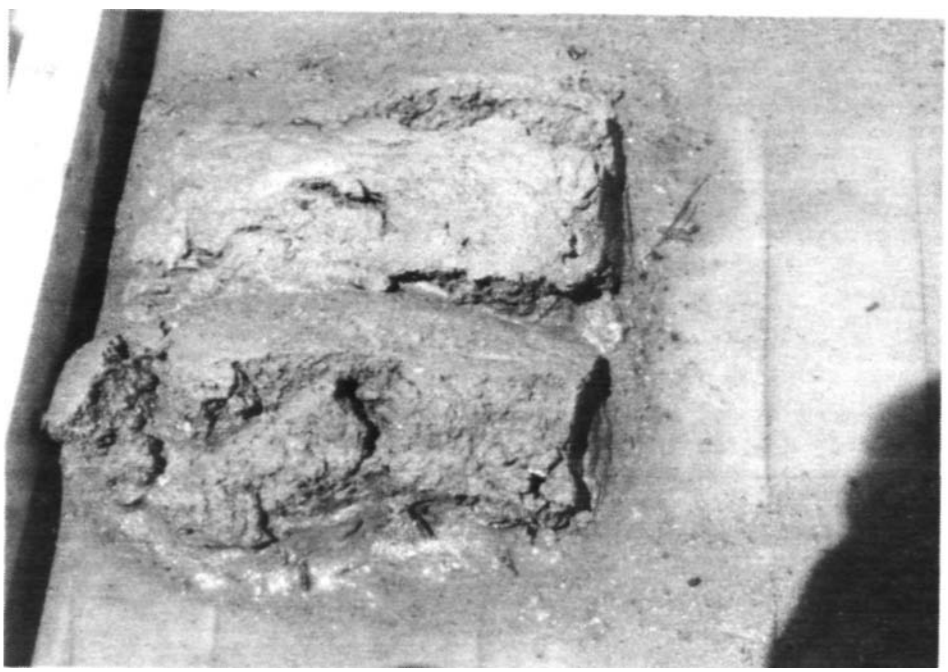


C18

C19



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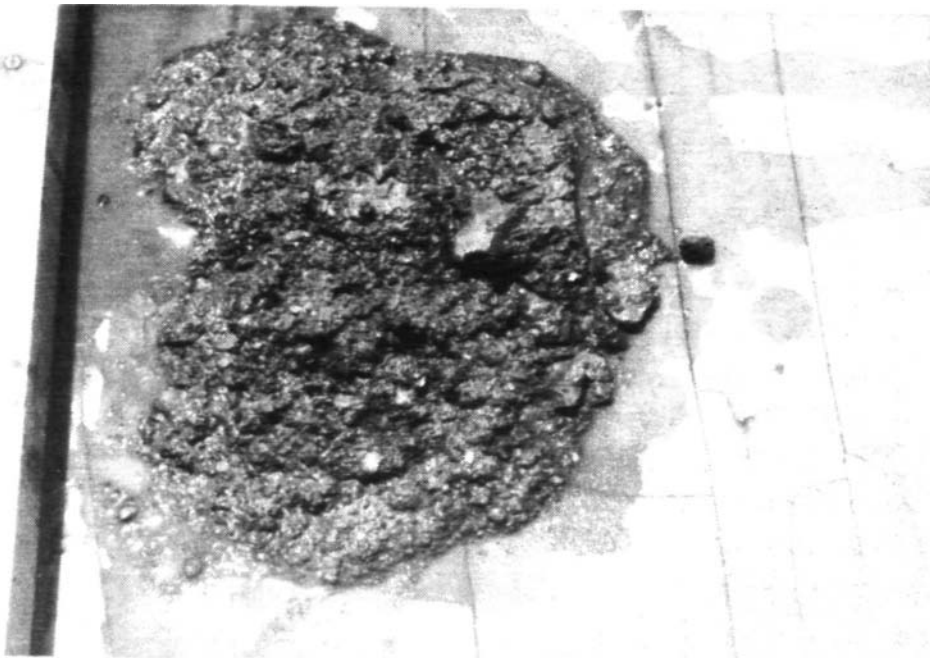

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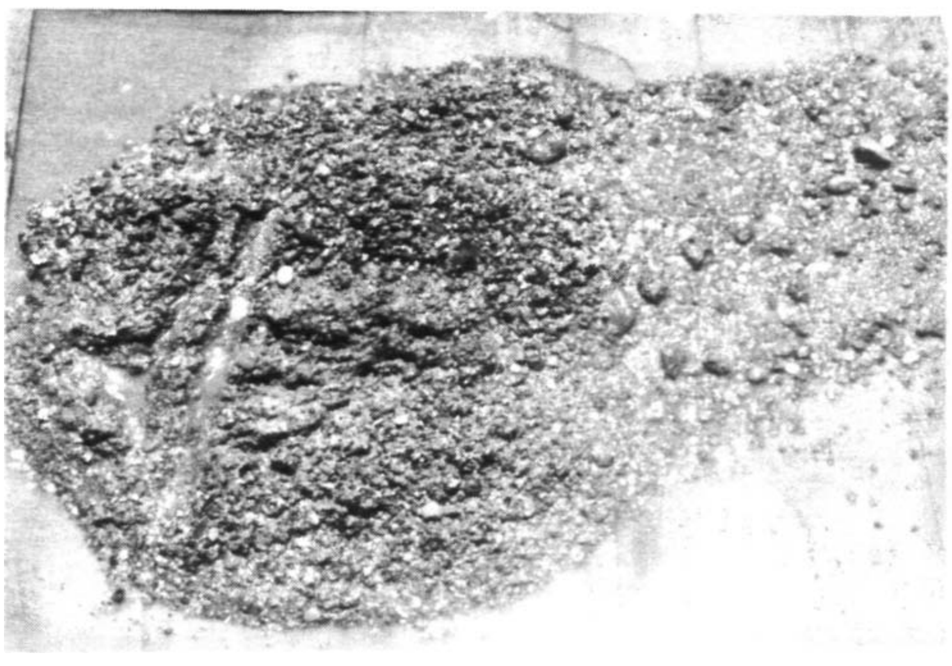

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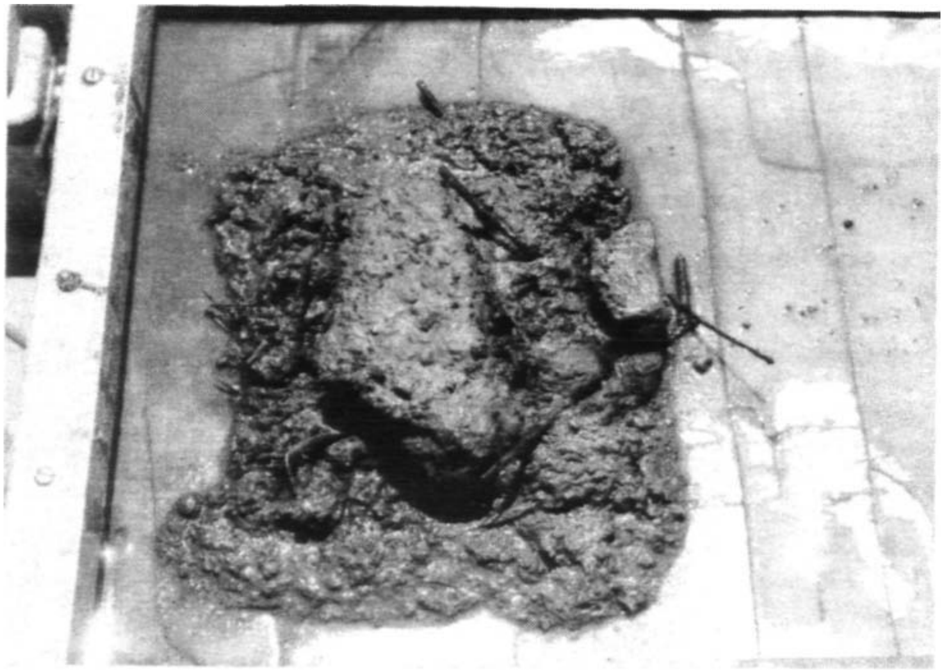

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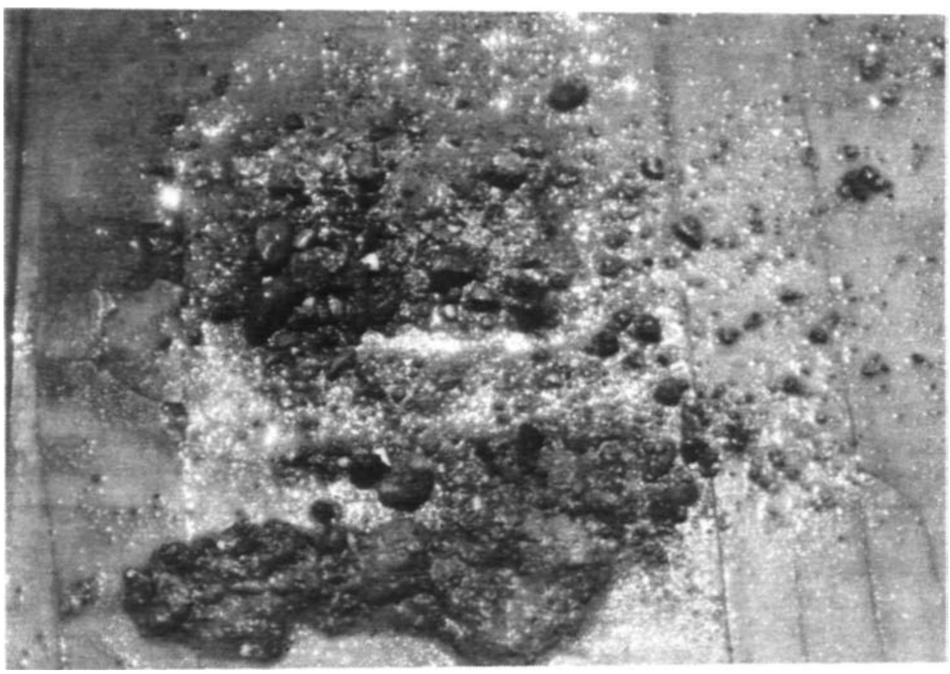

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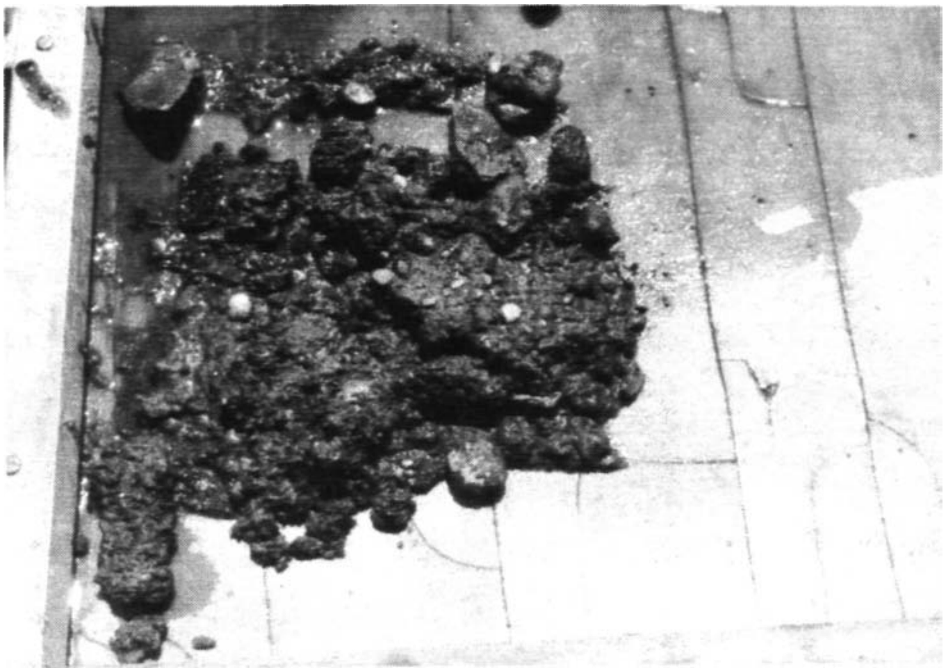

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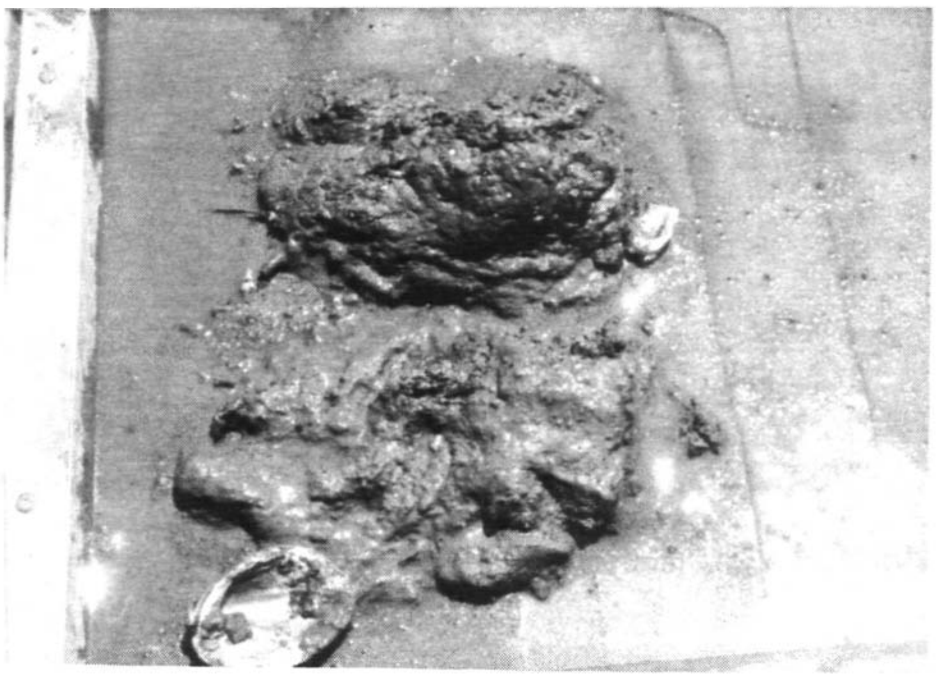
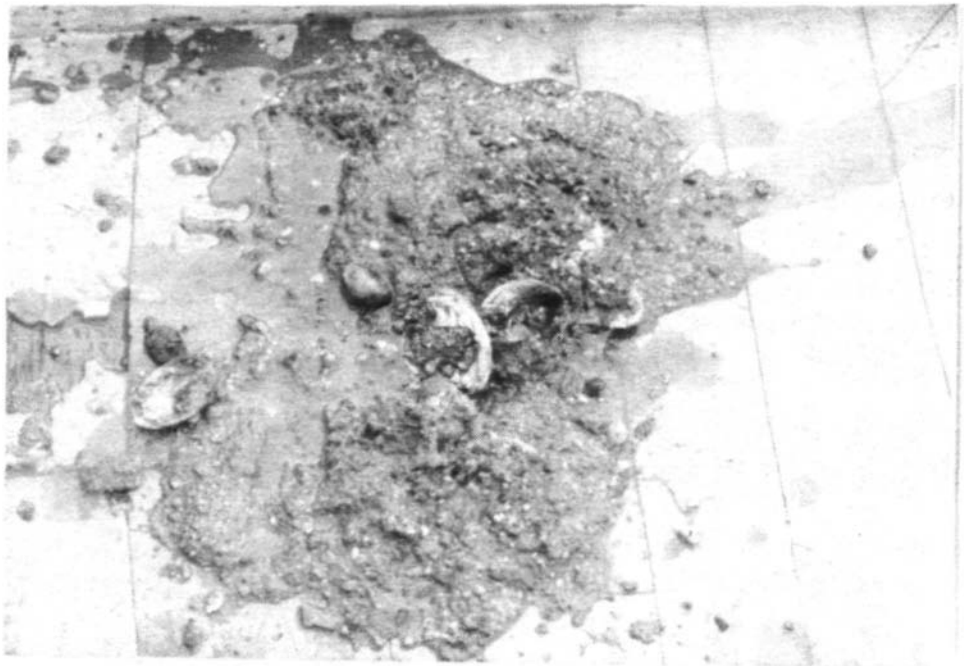


C29

Appendix C

Photographs of Selected Ponar Dredge Samples in Fayette Street Outfall Area



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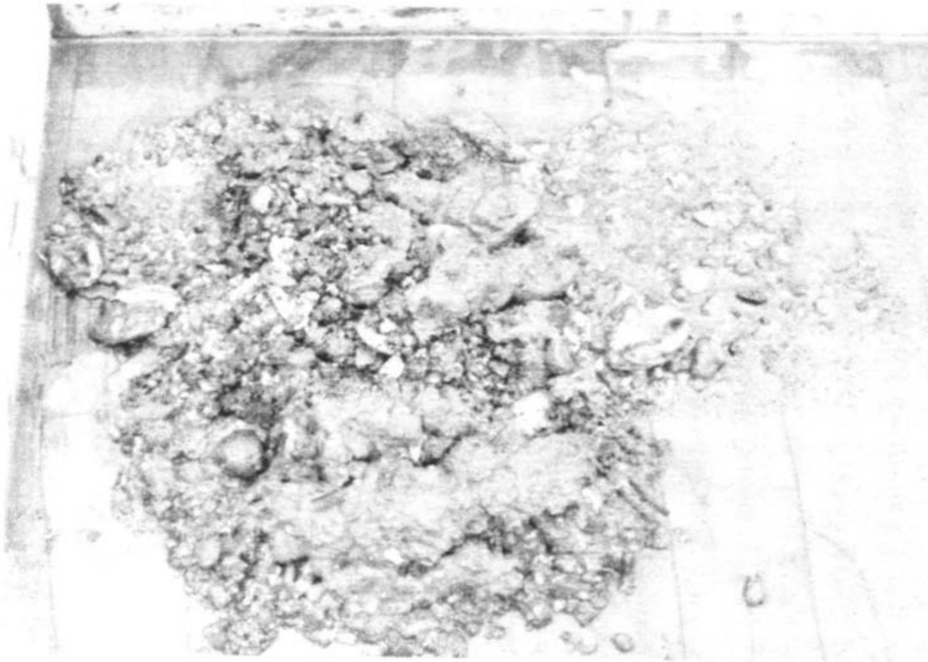
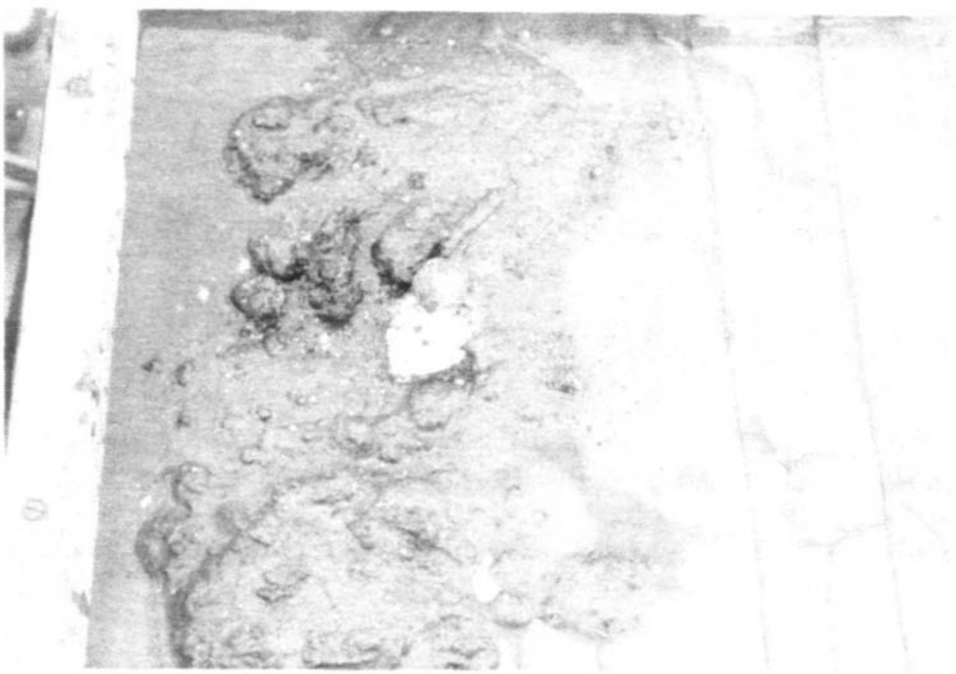
F2



F4

F5

F7



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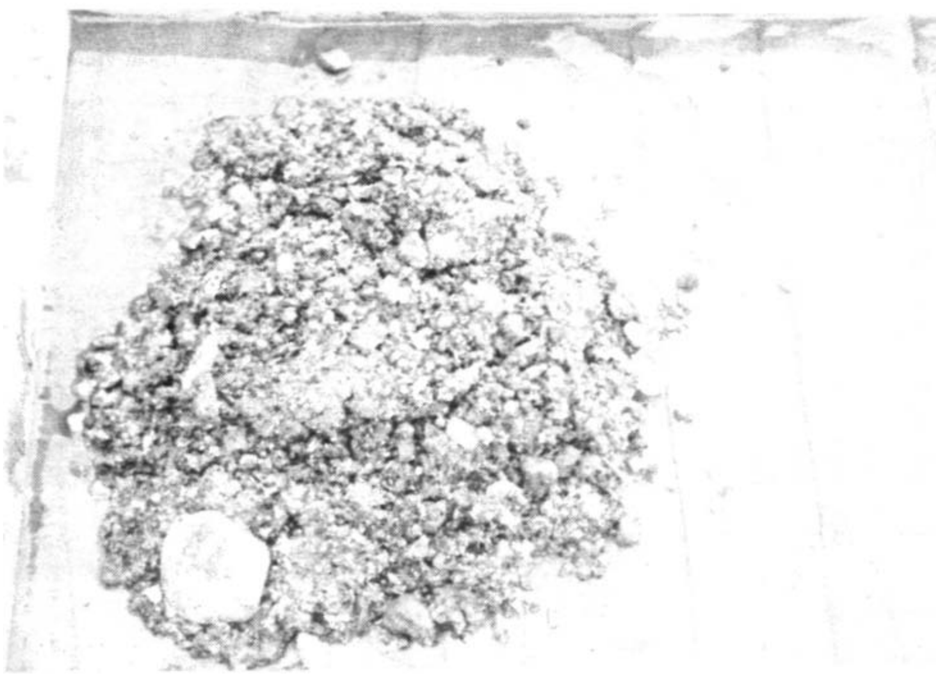
F9



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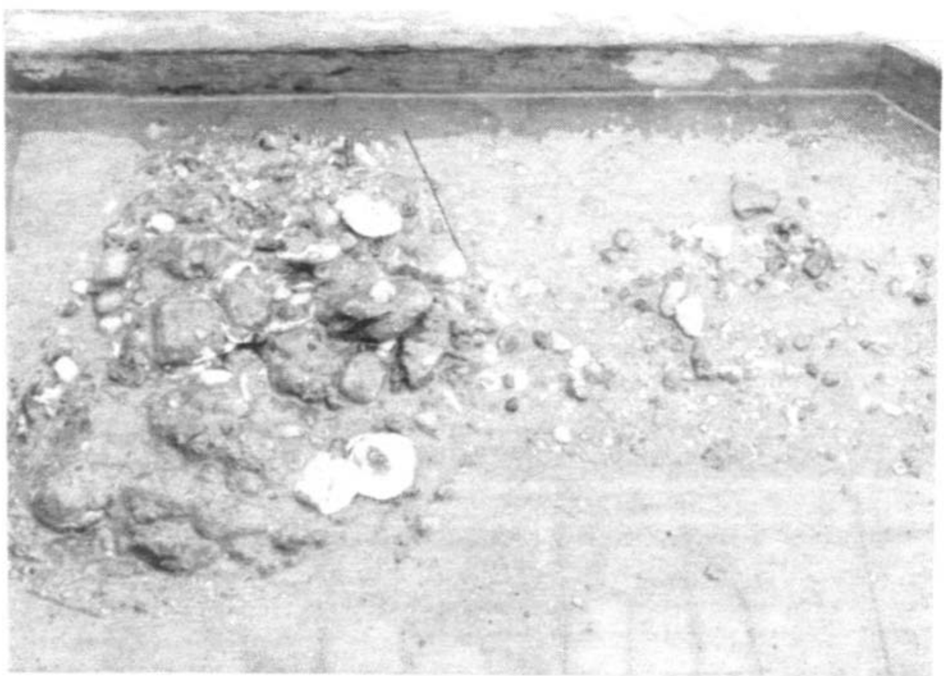
F13



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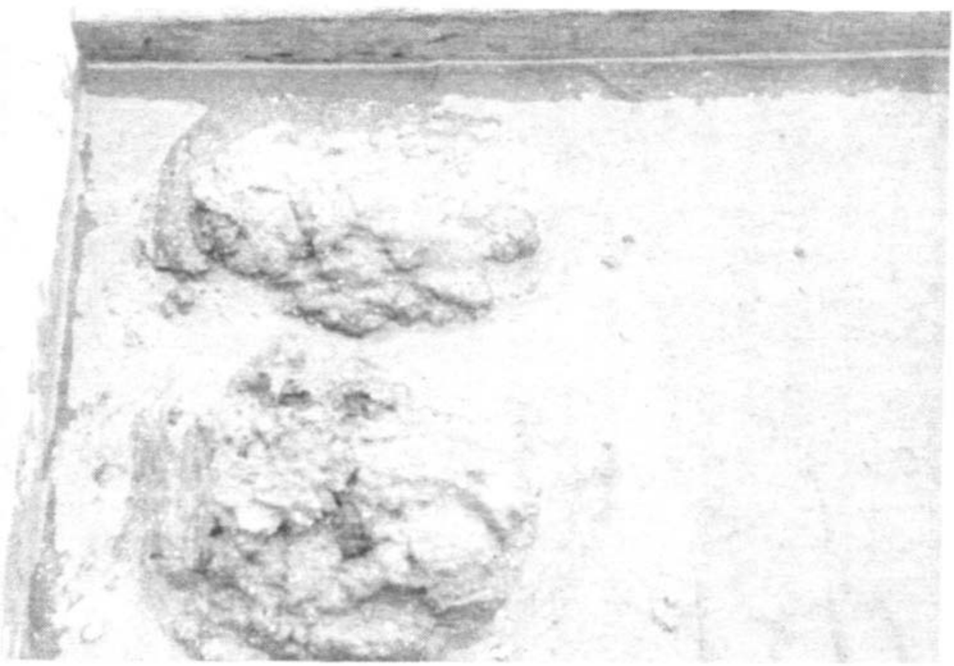
F17



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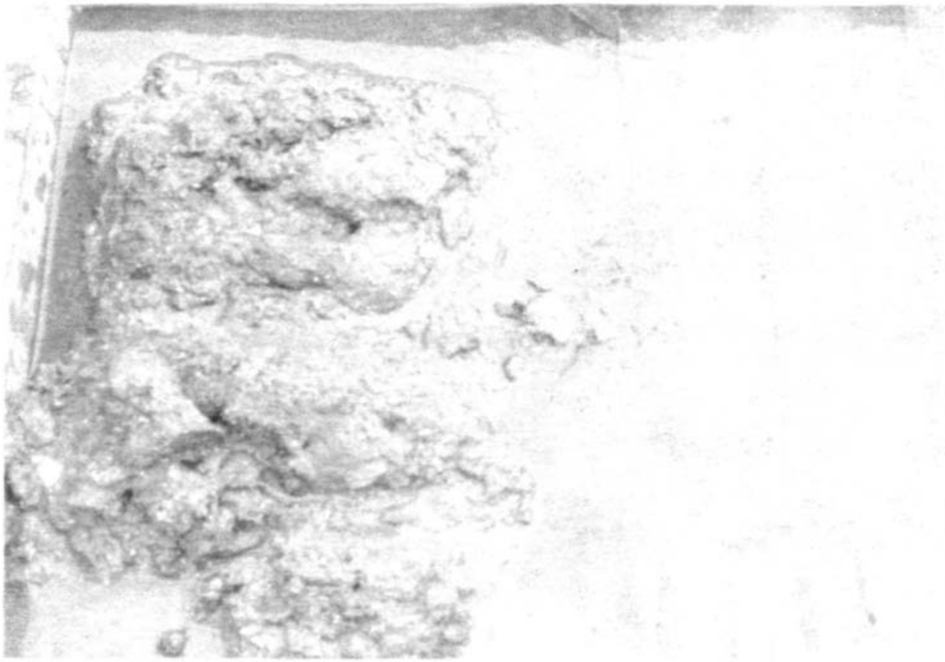

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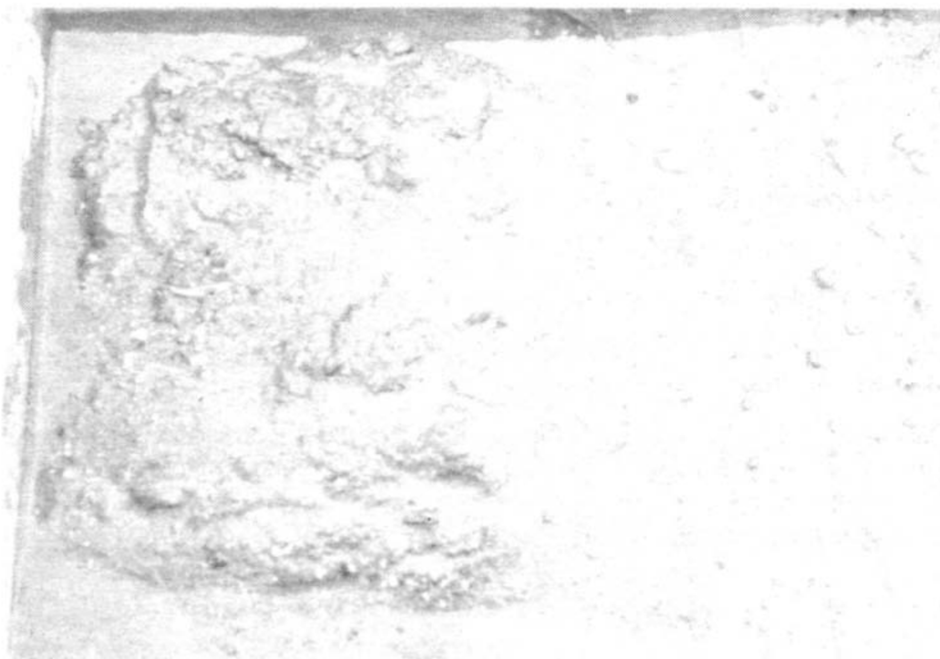

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