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Industrial Wastes in the Calumet Area, 1869-1970

A Historical Geography

Craig E. Colten

Illinois State Museum

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Illinois State Museum
Springfield, Illinois

Reprinted June 1992

Illinois Department of Energy and Natural Resources

INDUSTRIAL WASTES IN THE CALUMET AREA, 1869-1970

An Historical Geography

by

Craig E. Colten
Illinois State Museum
Springfield, Illinois

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EXECUTIVE SUMMARY

The formation of the Environmental Protection Agency and passage of waste-monitoring legislation has provided means to assess hazardous waste production levels and disposal methods. However, the record maintained by state and federal agencies reaches back only a few years. The long-term threat posed by hazardous substances and the lengthy history of industry in Illinois demanded a more complete accounting of past disposal methods. In an effort to document the location of pre-1970 disposal sites and determine the quantity of industrial wastes, a study of the historical geography of the Lake Calumet industrial complex was conducted.

The Lake Calumet area in southeast Chicago provided an excellent setting for such research. Since 1869 it has been the scene of heavy manufacturing activity, and because of the marshy conditions there, it has also been the site of extensive industrial waste disposal. Recent exposure of several illegal waste disposal sites has brought public attention to the area and has prompted calls for environmental analysis.

The use of historical methods can greatly aid researchers monitoring current environmental conditions. Through an analysis of historical documents, changing patterns of land use can be mapped, the location of disposal sites determined, and the composition of waste streams ascertained. This knowledge is particularly useful to hydrologists and geochemists attempting to locate plumes of contaminated groundwater. Application of historical methods to the Calumet situation helped develop a chronology of waste disposal techniques, and it will facilitate evaluation of other industrial areas in Illinois. The value of the chronology is that it aids in identifying the types of wastes that were commonly produced during certain periods and alerts researchers to how they were likely to have been discarded. Furthermore, examination of the historical record allows verification of what transpired in the past and decreases our dependence on speculation. Ultimately, this will prove useful in policy decisions regarding mitigation of hazardous waste disposal sites.

The methodology employed in the Calumet study was exploratory, since few precedents existed. Initially, an analysis of historical maps and business directories provided an inventory of industries for selected dates--1897, 1913, 1928 and 1960. This information, coupled with government records, provided a fairly complete accounting of waste disposal practices used in the area. Calculations of waste generation estimates were made using techniques borrowed from the U.S. Department of Health, Education and Welfare. Based on the known location of disposal sites and the types of waste produced, disposal sites were rated according to the hazard they currently present. All information was mapped and should prove useful in future analyses of the area.

Although this study uncovered no "Love Canal-type" disposal facility, it did document the major patterns of waste disposal before 1970. Generally, industries discarded unwanted wastes in the nearest stream or on low ground. This caused sedimentation in the Calumet Rivers, biological degradation of the area's wetlands and lakes, and tainted the drinking water of Chicago. Public health agencies tried to control the effects of industrial pollution, but industry was reluctant to abide by environmental protection laws through the 1960s. In recent years, there has been greater compliance and water quality has improved.

The last 100 years of land-disposal have eliminated hundreds of acres of wetlands destroying habitats and may pose a human health risk as well. The greatest hazard is likely to be found on industrial property. Accumulations of hazardous substances in the soil and in buildings remain, although exact concentrations are unknown. As the Calumet industrial complex begins an era of modernization and transformation, demolition and reconstruction at old factory sites could disturb accumulated wastes, exposing workers and area residents to unrecognized risks. The possibility of gradual release to the environment also remains.

The chronicle of industrial activity in the Calumet area not only proves the viability of historical inquiry in hazardous waste questions; it also provides a model for future work of a similar nature.

Recommendations

1. To facilitate future historical analyses of hazardous waste sites, a comfortable relationship with industry must be established by the HWRIC. It is essential that industry's records of production levels and site use be included among the sources consulted to enhance the reliability of historical reporting.

2. The identification by this study of numerous waste disposal sites not located by the Illinois Environmental Protection Agency (IEPA) may provide a basis for the re-evaluation of soil and water conditions. Any further environmental analysis should concentrate on the known disposal sites.

3. Future research should be conducted using recognized geographical units such as counties, townships, or census tracts. This would facilitate data compilation and enhance diachronic analysis.

4. Subsequent historical studies should be conducted in conjunction with full-scale environmental analysis of hazardous waste sites. The historical reports should precede other work and provide the foundation for closer examination of soil and water conditions.

PREFACE

Until about a year ago I had given very little thought to an undertaking of this nature. Fortunately, others had and I am grateful to them for launching this endeavor. Bill Frerichs of the Illinois Department of Energy and Natural Resources, Jim King, Bonnie Styles, and Michael Wiant of the Illinois State Museum played critical roles in the conceptualization of the project. Walt Zyznieuski provided guidance at critical stages and Michael Barcelona pushed for its inclusion in the Hazardous Waste Research and Information Center program. Without their foresight, this work would not exist.

Many others contributed as the research progressed. I am deeply indebted to the numerous library and archive personnel who helped identify useful sources. Without the assistance of many municipal, state, and federal agencies, little of the primary information would have been gathered.

The steady hand of Julie Snider drafted the hand-drawn maps and Gerard Breen completed the machine-drawn cartography, among other useful tasks. Patty Wieties undertook the ultimate task of typing the final manuscript. Their special contributions are deeply appreciated.

Finally, a thanks must be extended to Professor John Thompson, Wendy Garrison, Ed Mehnert, and Christina Komadina for their helpful comments on an earlier draft. Their suggestions were welcomed, although I assume full responsibility for any inaccuracies or shortcomings.

Funding for this research came from the Illinois Department of Energy and Natural Resources, Contract HW-16.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I--INDUSTRY AND WASTES OF THE PAST

The Southeast Chicago Example

As early as the 1860s, developers foresaw the transformation of Chicago's southeast side into a mighty industrial center. They planned the modification of a low marshy area twelve miles south of the central city and adjacent to the Indiana State line, into a well-drained port where mills would roll steel and manufacture products for the entire nation. Much of this vision became reality when the Army Engineers created industrial sites accessible to ore and grain carriers by dredging and straightening the sluggish Calumet River. Yet today, many of the developers' dreams for the Calumet area seem strangely out of place. Production has declined dramatically, the Wisconsin Steel mill is being dismantled, U.S. Steel has announced plans to destroy several old structures, and other plants stand idle. Editorial writers have compared the factories of the Calumet area to the mastadon collection of the Field Museum, such comments suggest the old steel mills are merely relics of an extinct breed. Yet, the landscapes of decay found in the Calumet area must not be considered solely as benign reminders of a prosperous era. Instead, they represent a century of heavy manufacturing with its attendant uncontrolled and unregulated industrial waste disposal. The rusting machinery looms over a massive graveyard of unknown and unrecorded proportions where the residue of manufacturing processes is interred. This report chronicles the use of the Calumet area as an industrial and waste disposal ground between 1869 and 1970.

The Calumet area, as defined here, is a thirty-one-mile-square tract on the southeast side of Chicago. It surrounds Lake Calumet and includes the Calumet River and portions of the Grand Calumet and Little Calumet Rivers. The following boundaries delineate the study area: North-95th Street; South-146th Street; West-Indiana Avenue; East-Indiana State Line (Fig. 1-1). The area was selected because of its lengthy industrial history and because its boundaries coincide with those used in a recent study by the Illinois Environmental Protection Agency (IEPA).(1) The agency became interested in the area after the discovery of several illegally operated dumps and following requests from citizens for an assessment of environmental hazards. The history of environmental contamination did not begin in the last few years, rather the study area has been subjected to long-term exposure to industrial wastes. The Army Engineers expressed dissatisfaction with industrial dumping in the Calumet River as early as the 1890s. During the first decade of this century, public officials criticized industrial and sewage pollution of Lake Michigan and they responded to an anti-smoke drive, which called for limiting atmospheric pollution.

The study period encompasses the years 1869-1970. The dates chosen represent at one extreme the arrival of industry to the region and at the other effective environmental action. In 1869 the Corps of Engineers initiated modifications at the mouth of the Calumet River, and made it a more secure anchorage. This was the first in a long series of harbor improvements that allowed industries to line the river banks. During the next one hundred years, the Calumet Region grew into one of the premier industrial districts in the country. It produced a variety of products including primary metals and metal goods, industrial and agricultural chemicals, paints, and wood and grain products. Such activity inevitably produced large quantities of by-products

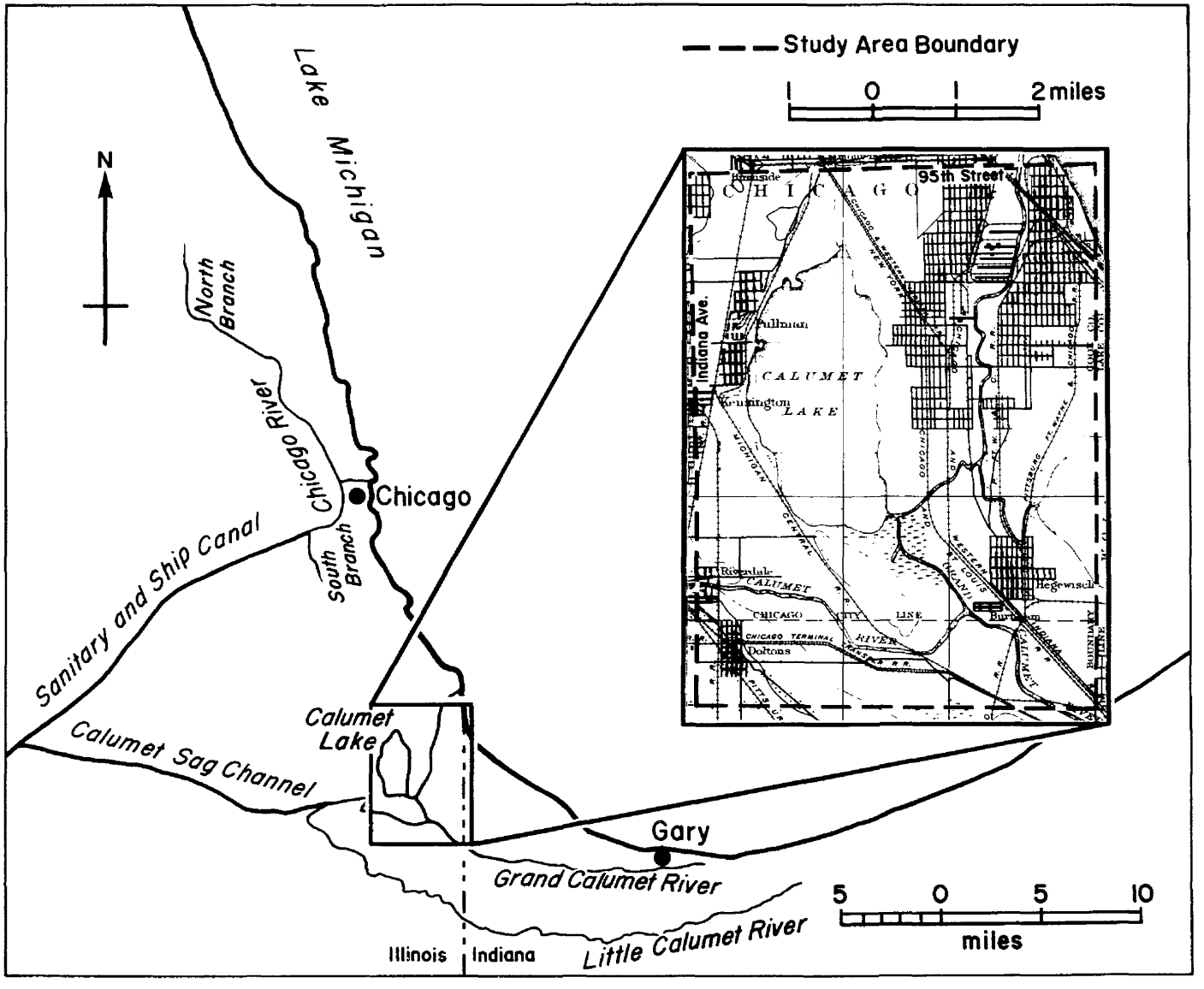


Figure 1-1: Study Area

and wastes. Through the years state and local agencies have dealt with the problems of waste in a piecemeal fashion. Only with the formation of the U.S. Environmental Protection Agency (USEPA) in 1969 were uniform regulations enacted. Now both the USEPA and IEPA monitor the disposal of hazardous wastes, but before 1969 there was no effective record of disposal activity. This study supplements their relatively recent efforts by focusing on the previously undocumented period.

The following chapters conform to historic periods distinguished by waste disposal practices. The end of each period coincides with a significant change in either the legal or technological framework that waste disposers worked within. The first period, from 1869 to 1921, encompasses the initial modification of the natural environment and early industrialization of the Calumet area. In 1922 the flow of the Calumet River was diverted from Lake Michigan to the Mississippi River drainage basin. This reoriented the flow of much waste material and commenced the second period, which lasted until 1940 when the City of Chicago opened a major landfill at the north end of Lake Calumet. Since then, greater and greater amounts of waste have been land buried, due in part to the growing corpus of knowledge about industrial waste hazards and to increasingly rigid water pollution laws. Each chapter addresses the central questions of this investigation within the period covered by that chapter. The questions include: 1) What type of industries were operating? 2) What were their by-products and waste-products? 3) In what quantities were these items produced? 4) Where were they disposed of and in what manner? By addressing these simple questions, it is hoped that some formerly evasive information can be assembled and then used to create an accurate picture of the impact of industrial waste on a mixed residential, industrial, and wetland area.

Current regulations require generators, transporters, and disposers of hazardous wastes to report the type and volume of material they handle. Even with this inventory system, an accurate accounting is a complicated and somtimes faulty procedure. Tabulating volumes of specific wastes produced over the past century is even more difficult. To make this project manageable, modern definitions of "hazardous" and "special" wastes have been dispensed with. This report considers all wastes: hazardous and non-hazardous, industrial and domestic, solid and liquid. In the past it was common for a variety of substances to be mixed, so by noting the existence of one waste stream other wastes may be found. Ultimately, an attempt is made to single out the disposal sites and waste streams posing the greatest hazard.

Nature of the Problem

Waste Disposal

Public attitudes toward waste and the means used to dispose of it greatly affect public policy. This section presents a brief overview of changing public perceptions, modifications in legal controls, and improvements in technology as they relate to industrial wastes.

During the 1860s and 1870s municipal leaders across the country were engaged in an effort to root out social evils by eliminating filth in the urban environment. Known as the "Sanitary Movement," this national campaign reached Illinois during the 1870s.(2) Chief among the concerns of public

health officials directing this "movement" were the removal of biological wastes from urban areas and the provision of pure water supplies. It was believed that epidemics originated in the miasmas emanating from such items as "night soil," discarded food, and trade wastes from slaughter houses. Such beliefs led to local ordinances requiring the removal of putrescible wastes to low, swampy areas near most cities.(3) This technique served two purposes: it not only put a safe distance between the population and its refuse, but it helped reclaim useless land and eliminated the perceived danger of swamp-generated miasmas. The enactment of legislation aimed at controlling the wastes of packing houses, breweries, and granaries meant that businesses making barbed wire, steel rails, and agricultural machinery were left to their own devices. It was common for these industries to deposit their unusable by-products in the nearest waterbody or fill in low ground on their property.(4) Whatever the method, it usually involved little serious thought, although the chief concerns were to avoid impeding production and to spend as little as possible. In the Calumet region, this meant building land out into Lake Michigan or filling in the adjacent marsh with production wastes.

Acceptance of germ theory during the 1890s reoriented waste disposal techniques. To combat newly recognized bacterial hazards, sanitation experts advocated diluting human and organic industrial wastes. The disposal of garbage in flowing watercourses, it was believed, would carry the wastes away from the population. Although sanitation officials thought streams could purify themselves completely as they coursed along, undesirable consequences resulted downstream. Pollution destroyed aquatic communities and carried disease to cities along the stream's path. As researchers directed their attention to these problems, techniques were developed to chlorinate water and to filter harmful bacteria. Still, little attention was directed to industrial wastes, and some experts even argued they had germicidal properties.(5)

Citizens critized odor and taste problems caused by industrial wastes, and sanitary officials complained that manufacturing effluents interfered with sewage treatment processes or were harmful to aquatic life.(6) Nevertheless, the real initiative during the 1910s and 1920s was to eliminate "waste"--that is to reduce the amount of unused raw materials and to find commercial uses for by-products. Articles appeared frequently in trade journals calling for the collection of scrap materials and encouraging managers to direct these items back into the manufacturing cycle.(7)

Concern with industrial wastes waned during the early thirties as production plummeted; consequently, the amount of wastes declined. Despite the state of the economy, the second half of the thirties spawned a new interest in environmental stewardship. Publication of texts on industrial waste management and the organization of an annual conference on the subject in the early 1940s denote growing interest during this period.(8) Both applied and theoretical researchers began to investigate scientific means of handling industrial wastes. They sought ways to accommodate industrial wastes in municipal sewage treatment plants or in on-site facilities. The unique problems posed by industrial by-products lured more professionals into the field of waste management and universities responded by offering courses in this speciality.

Even as a waste management profession grew during the 1940s, water bodies

were overloaded with municipal and industrial refuse. The expansion of industrial activity during the war years and newly constructed sewage treatment plants released excessive quantities of waste into streams and lakes.(9) By 1948 the damage was apparent, and Congress reacted with legislation to curtail stream pollution. The Clean Water Act of 1948 provided research support rather than means for policing polluters. Although the statute lacked effective enforcement provisions, it ushered in the most recent era of land disposal of industrial wastes. During the 1950s the sanitary landfill was promoted as an attractive alternative to open dumps on deep-sea dumping.(10) Proponents claimed landfills not only posed a minimal health hazard, but they could be used after closure to bring vacant land into productive use as parks or subdivisions. Some researchers cautioned against the toxic or explosive qualities of landfills, but by-in-large, they were accepted widely.(11) During the 1950s most county and city governments enacted regulations to control disposal operations. Most municipal statutes sought to restrict the "nuisance" of dumps and enforcement was lax as long as neighbors did not complain about rats or blowing trash.

Public demands for a cleaner and safer environment grew during the 1960s and culminated in stronger federal legislation. Chief among the new laws were modifications of the Clean Water Act that pushed for elimination of all effluents to streams by 1985.(12) Also, increasing attention was directed towards solid waste disposal. The amended Solid Waste Disposal Act of 1965 allocated monies for research and development to improve local disposal programs.(13) The creation of the USEPA in 1969 consolidated research, advocacy, and enforcement powers in a single agency. Subsequent legislation gave them greater power to monitor and regulate waste management.(14) States followed suit and the Illinois EPA was established in 1971 by the Illinois Environmental Protection Act.

During the 1960s, environmental laws caused the Corps of Engineers to cease dumping dredge spoil impregnated with industrial wastes in Lake Michigan. Manufacturers also eliminated most liquid wastes from the watercourses of the area.(15) However, restrictions placed on water disposal merely served to redirect the wastes to land disposal sites. As a consequence, the reminders of industrial activity remain highly visible, and they have attracted considerable attention and incited protests against dumping there.

Industries

The industrial composition and the types of technology employed directly affect the type of by-products found in any manufacturing district. After the Civil War, when Chicago industries began to search for space to expand, many industries turned to the low marshlands of the Calumet area. First were the iron and steel manufacturers, who located along the lower reaches of the Calumet River. A variety of auxiliary firms followed to either supply materials used by the iron and steel companies or to use their finished products. Chemical companies produced the acids used as pickling liquors, and Pullman built his celebrated railroad cars. Serving Pullman was a paint manufacturing company that also made a line of arsenic-based pesticides. Other industries dependent on rail- or water-delivered raw materials included grain elevators, flour mills, and beverage firms. Wooden building materials were also processed, and brick makers excavated several clay pits. In winter,

ice cutting gangs invaded the lake and carved ice to be sold to meat packers.

The ensemble of manufacturing concerns found in the Calumet area produced a variety of specific by-products. The most copious quantities of by-products and the most hazardous were produced by iron and steel makers. Among the known hazardous wastes were phenols, cyanides, and napthalene. These particular wastes can persist in lake or river sediments or in land disposal sites for many years and may still pose a health hazard.(16) Slag was the most abundant and most visible by-product of the steel mills. It had numerous commercial uses, such as railroad ballast, cement, and fertilizer, but much was heaped on vacant land near the factories. Slag generally was dumped while at a very high temperature, and sometimes other wastes were poured on to be incinerated by the residual heat. If incompletely burned, the tars and quenching liquids could leach into the ground or remain in the slag. Surface disturbances can potentially release these contaminants.

Other hazardous substances worked with during the last century include: arsenic, lead, DDT, and a variety of acids. The arsenic, lead, and DDT were manufactured by Sherwin-Williams on the western shore of Lake Calumet. Both these substances are very persistent in the environment. Industrial-chemical firms produced nitric, sulphuric, and muriatic acid for the steel mills and disposed wastes into the area rivers.

Indirect actions taken by other firms also may have contributed to environmental hazards. One area of concern are the numerous clay pits that were refilled after operations ceased. They pose a double threat in that they reduce the thickness of the relatively impermeable clay overburden. This increased the liklihood that compounds deposited in them may leach into the groundwater. Most have been filled with municipal refuse, but their complete contents are unknown.

The number of industries in the Calumet area grew over the course of the study period. Only 34 firms were shown on the 1897 Sanborn Maps, while 117 were listed in a 1960 business directory (see Appendix). Throughout the last century, the selection of industries has remained fairly stable. Iron and steel, chemicals, construction materials, and grain-handling activities still predominate.

The stable mix of industries has expanded from three distinguishable cores. The first and most important is the area below the junction of Lake Calumet and the Calumet River. Along this five-mile stretch of river, the first speculators reclaimed marsh and erected factories. Industrial development along the entire lower course was slow, yet there has been a continuous presence of factories in this section. First brought into use in 1880, the lands along the western shore of Lake Calumet represent the second core. Pullman's industrial town attracted other companies catering to the car magnate's activities, and although the Pullman works are now closed, this area is still a major producing area and has expanded northward. A competitor to Pullman established a car works and workers' town at Hegewisch and initiated the third core. Never equalling the scale of the other two nodes, this area has been the scene of metal-working businesses for nearly a century.

Literature Review

To locate industrial wastes, a grasp of industrial location history and theory is helpful. Weber's discussion of transportation costs considers industrial wastes as a factor in siting industry. However, other than implying that accumulations of waste would be greatest near the source of bulky raw materials, Weber offers little to explain or predict the location of specific waste sites.(17)

The models of urban structure developed by Burgess, Hoyt, Harris and Ullman shed little light on the waste issue. Each model depicted a stage in the expansion of industry away from the city center, and in many respects the Calumet area is a good example of those trends. While each presented a schematic model of urban form, none considered the spatial demands of waste.(18) Pred found that rail service for freight and commuters was necessary for "decentralization" of industry,(19) and although these services were found in southeast Chicago by the 1870s, they do not fully explain the rapid growth of the area. Ample space at a low cost was another requisite met by the Calumet area and this enabled entrepreneurs to construct the expansive factories of the late nineteenth century.(20) Still, none of these factors touches on an aspect of the Calumet not met by other industrial sites: Industrial wastes proved a cheap source of fill and the availability of wetlands ready for reclamation reduced the cost of waste disposal. All these preceeding factors favored the growth of the Calumet, but only the last has been neglected in models of urban morphology.

Theories of industrial location or urban structure are much too general for use in identifying abandoned disposal sites. The nature of hazardous wastes requires exact determination of internment sites and a knowledge of specific industrial processes. Existing theory only provides the grossest resolution and is useless for anything more than preliminary evaluation of an urban region.

Perhaps the most useful work on past disposal practices is the work of public health historians. Numerous case studies recount the gradual establishment of health agencies as municipal officials grappled with epidemic disease, potable water supplies, and garbage problems.(21) One central, although seldom mentioned, theme of these studies is that industrial wastes were of secondary concern to turn-of-the-century law makers. The chief perceived threat to health was domestic garbage and sewage.(22) Because little attention was given to industrial by-products, few historical investigations report on past methods of disposal. Tarr's chronology is the most ambitious attempt to construct a temporal framework for waste disposal technology and perceptions.(23) Another isolated example of historical inquiry into industrial hazards considers the potential risks posed by arsenic, iron and steel wastes, coal products, and the accumulation of sediments behind dams.(24)

One explanation for the lack of progress in industrial waste research is that many reports are site specific, and they are often prepared in politically sensitive situations. Historical section frequently are assembled by researchers with no or little experience in historical methods, and often they are brief and superficial.(25) Because the existing literature is largely unsatisfactory, most states are now attempting to inventory abandoned disposal

sites before panic situations arise.(26) Still, their reports seldom consider historic sources on disposal technology. Thus, a number of case study sources exists, but they present a disjointed view of history and are of limited use to other researchers.

Another related body of literature is the work on technological development. Certain industries receive more intensive coverage in this literature, specifically the iron and steel and railroad trades.(27) There also is a substantial body of literature dealing with the chemical industry.(28) While this body of information provides a general chronology for developments in certain industrial fields, it cannot provide the detail necessary to assess local hazards.

Because hazardous waste disposal is a human impact on the earth it is akin to geographical studies in the man-land tradition. Despite an intellectual overlap, there is little in this field to guide hazardous waste researchers. Carl Sauer and his students studied the role of humans in changing the face of the earth, although their work focused on pre-industrial societies.(29) They sought the large-scale changes wrought by relatively primitive techniques--such as deforestation or the introduction of agriculture. Little work of this nature is applicable to urban environments.(30)

Histories and geographies of the city provide little understanding of the hazardous waste issue. Urban historians have attempted to explain the role of the social environment rather than how humans have affected the natural environment.(31) Geographers have explained the processes of urban morphogenesis rather than assessed the extent of human impacts.(32) The preceeding summary of marginally relevant studies underlines the fact that a dearth of scholary work on historical waste disposal practices exists.

Local documents prove to be the best source of information on past disposal practices, although they did not provide a framework for conducting research on the topic. Insurance maps and business directories provided the best means to inventory industrial activity over the last century. The former suffers from infrequent publication, and the latter, while providing an annual record, fails to report all locations of manufacturing activity.

The Metropolitan Sanitary District monitored industrial waste disposal after 1924, but their archives did not contain all the detailed measurements taken through the years.(33) Both the City of Chicago and the Corps of Engineers maintained additional records of waste disposal activity.(34) Since 1965 federal agencies also monitored waste disposal activity in the area, and their reports reveal waste treatment practices at the dawn of federal regulation.(35)

Methodology

The method employed here is adapted to the specific study area, although it can be employed at other sites. The nature of the historical resources, the type of industries found in the area, and the local environment demand such treatment. Reporting on a small urban area requires a fine resolution and detailed mapping; therefore, broad generalizations are inappropriate. This is not to suggest that this effort will not yield techniques that can be

applied to other situations. Rather, it implies that a rigid formula cannot accommodate the many variables of any given locality. This section will present the methodology both as an explanation of the procedure followed here and as a rough guide for future research.

Industrial Inventory - The first phase of this work included an inventory of manufacturing firms that operated at some time during the entire study period. The primary sources were the Sanborn Insurance Maps and business directories. Of the two, the insurance maps provided the greatest detail and most accurate geographical information. They plotted each industry, the location of specific processes within each plant, and the layout of the water-supply system. For the Calumet area, updates were available for 1897, 1911-13, 1938 and 1947, and 1976. To supplement the infrequently revised Sanborn Maps, business directories were consulted. Two editions, 1929 and 1960, provided listings of manufacturing firms and the number of employees at each. The one major flaw with the directories is their tendency to list the address of the central office, which is sometimes separate from the plant. Also the directories may fail to record multiple operations within a single company. For the Calumet area, the directories under-represented the activity shown in other sources.

Based on the information compiled from directories and insurance maps, and supplemented with other documentary sources, a series of maps was produced. Industries are identified by Standard Industrial Classification (SIC) code numbers and are plotted for the years 1897, 1913, 1929, and 1960. These maps depict the industrial geography of the area at specific dates within the study period.

Levels of Production - To estimate levels of waste generation, some measure of production levels was necessary. An attempt to solicit past production figures from industries proved futile, so surrogate measures had to be used. The best available gauge of iron and steel production was the tonnage figures for iron ore receipts at Calumet Harbor.(36) Although some ore arrived by rail during the winter months, nearly all steel was a product of water-delivered ore. Therefore using the amount of ore handled within the area defined as the Calumet Harbor provides a close approximation of the total used there. From the recorded amount of ore used, estimates of steel production can be made using known ratios.

Calculation of production totals for other industries is not as simple or as accurate. Most coal arrived by rail and crude oil by pipeline, and the statistics of rail and pipeline service provide no summary of raw material consumption. Monetary figures found in annual reports or financial publications prove problematic because of the fluctuating value of the dollar and rapidly changing costs of raw materials. The U.S. Census reports the number of employees in its Census of Manufacturers, and multipliers have been developed to estimate production based on this variable. Using these multipliers and the number of employees reported in the business directories, estimates of production in the non-ore consuming businesses can be made.

Waste Production - Two techniques provide estimates of waste production. One applies only to the iron and steel trades and uses the production levels based on iron ore receipts. Ratios of waste to finished product calculated by the U.S. Department of Interior (USDI) furnish a means to compute rough

totals.(37) The USDI figures are superior to employee totals because they take into account technological change. Using this method, estimates for the iron and steel industry were prepared at five-year intervals between 1885 and 1970.

To estimate wastes produced by other firms, less reliable methods were used. Businesses were assigned SIC codes and the employee totals for 1929 and 1960 were multiplied by factors for the given industry.(38) This technique provides estimates of solid wastes only. Although this procedure omits liquid wastes and overestimates the waste totals for 1929, it provides a rough base for comparison.

Waste Management - A variety of sources contributed to the inventory of waste management practices used in the Calumet area. Municipal reports on disposal sites and industrial effluents entering the Calumet River system provide limited insight. Federal agencies documented water pollution at certain times during the study period, and their reports augment the local sources. Aerial photographs reveal disposal sites, quarries, and clay pits that may have received industrial wastes. Interviews with area residents and municipal officials provided additional information. Unfortuantely, municipal records of permitted dump sites prior to 1970 were not available. Nevertheless, the existing sources allowed former dumps to be mapped and the contents of some sites to be determined. Treatment methods of area industries are also documented.

Projected Results

It is clear that mismanaged hazardous waste can pose a serious threat to human and biological communities. Only in the last few years has effective legislation been enacted regulating how hazardous wastes are managed and requiring that disposal be monitored. Before these statutes were drafted, most industrial wastes were handled in a manner that is no longer considered responsible. Thus, there exists the frightening possibility that untold quantities of wastes lie beneath our cities. If the location of these dumps were known, it would facilitate their clean up. However, most abandoned dumps were never registered with authorities or regulated by law, and few if any records of their existence survive. The task of locating and assessing the hazards of forgotten dumps is a major challenge. This report will address that challenge in three distinct ways.

First, it will demonstrate that historical inquiry can enlarge our understanding of past disposal practices. Valuable resources were uncovered in the Calumet study and it is plausible that equally useful information could be discovered for other areas.

With this information, a general chronology of industrial waste disposal practices was developed. This chronology can serve as a framework for subsequent studies and speed the organization of historical material into a coherent narrative.

Finally, this project explored methods of estimating waste production in the past. Such techniques are essential for assessing the hazards of former disposal sites.

Together, these accomplishments provide a means to approach effectively

the problem posed by a century of unregulated waste disposal. While not a solution to the problem or a faultless method to expose it, this report can serve as an example of the viability of historical techniques in hazardous waste questions.

Notes--Chapter 1

1. IEPA, The Southeast Chicago Study, 1984. The term "Calumet area" will refer to the study area as defined in the text, while the term "Calumet region" refers to the natural drainage basin of the Calumet River system. This larger territory includes land outside the study area in both Illinois and Indiana.

2. The Illinois experience is discussed in Davenport, "Sanitation Revolution." 1973.

3. Tarr, "Risk Perception," 1984, p. 6.

4. Ingle, "Industrial Site Building," 1982, pp. 253-4.

5. Tarr, footnote 3, p. 9.

6. Ibid.

7. Frequent forums for such issues were Iron Age and Industrial Management. Both carried numerous reports during the 1920s.

8. Eldridge, Industrial Waste, 1946 provided coverage of a broad spectrum of industries including non-agriculture processes. Other works preceded his contribution but focused on the by-products of farm-related manufacturers. An annual conference devoted to discussing industrials wastes began at Purdue University in 1947.

9. The increasing role of the federal government in municipal affairs is treated by McKelvey, Emergence of Metropolitan America, 1968.

10. Tarr, "Search for the Ultimate Sink," 1984, p. 20.

11. Two inquiries into the safety of landfills are Eliassen, "Housing Construction on Refuse Landfill, 1947; and First, et al., "Control of Toxic and Explosive Hazards," 1966.

12. Tarr, footnote 10, pp. 8-9.

13. Ibid, p. 23.

14. A review of regulatory activity as it relates to Illinois is found in Illinois Department of Energy and Natural Resources, Hazardous Waste In Illinois, 1984, pp. 50-70.

15. A summary account of waste disposal in the Chicago area appears in U.S. Department of the Interior, Water Pollution Problems of Lake Michigan, 1968.

16. Coates, Nineteenth-Century Technology, 1982.

17. Weber, Theory of the Location of Industry, 1929.

18. Burgess in Park, The City, 1925; Hoyt, The Structure and Growth, 1939; and Harris and Ullman, "The Nature of Cities," 1945.

19. Pred, "Intrametropolitan Location," 1969, p. 168-9.

20. A discussion of land values in Chicago is found in Hoyt, One Hundred Years, 1933; and the landscapes of industrial districts are described in Stilgoe, Metropolitan Corridor, 1984.

21. The evolution of public health organizations are discussed in Rosenkrantz, Public Health and the State, 1972; Duffy, History of Public Health in New York, 1974; Lubove, Twentieth Century Pittsburgh, 1969. An excellent presentation of Chicago's struggle to obtain pure drinking water is found in Cain, Sanitation Strategy, 1978.

22. The two leading scholars in urban waste disposal are Melosi, Garbage in the Cities, 1981; and Tarr, footnote 10.

23. Tarr, footnote 3.

24. Coates, footnote 16.

25. See New York State Department of Health, Love Canal, 1981, p. 57. An exception to this is Gibb, Hazardous Waste in Ogle and Winnebago, 1983.

26. Such studies have recently been completed in Wisconsin, Louisiana, and New Jersey.

27. Warren, The American Steel Industry, 1973; Gale, Iron and Steel, 1969. General treatments of industrial technology include Clark, History of Manufacturers in the U.S., V. 1-3, 1929; and Singer, A History of Technology, 1958, 1976.

28. Taylor, History of Industrial Chemistry, 1957; and Rogers, Industrial Chemistry, 1921.

29. For an overview of Sauer's work see Leighly, Land and Life, 1963.

30. Superior examples of studies of agriculture societies and their use of the land see, Lemon, Best Poor Man's Country, 1972; and Malin, The Grasslands of North America, 1947. For a summary of this tradition, as well as a few examples of such work in urban settings, see Thomas, Man's Role in Changing the Face of the Earth, 1956.

31. Warner, The Urban Wilderness, 1972; Ward, Cities and Immigrants, 1971.

32. Vance, This Scene of Man, 1977.

33. Summaries of the Industrial Waste Section of the MSD are found in Chicago Metropolitan Sanitary District, Annual Report of the Engineer, 1930-1950.

34. Up until 1967 the Corps dumped dredge spoil in Lake Michigan, but after that date they redirected spoil to land sites. Various reports at the Chicago District office recount this history.

35. U.S. Dept. of Health, Education and Welfare, Proceedings: 1965, 1966, 1967, 1968, and 1969. These efforts began after the Clean Water Act was strengthened in 1965.

36. U.S. Army, Corps of Engineers, Waterborne Commerce, 1885-1970.

37. U.S. Department of the Interior, Cost of Clean Water, V. III.

38. Weston, Solid Waste Management, 1974.

CHAPTER II -- FROM MARSH TO PORT, 1869-1921

Introduction

The selection of the Calumet area for factory sites was the result of a vigorous promotional drive carried out during the late nineteenth century. Ingnoring physical realities of the Calumet wetlands, developers aggressively hawked property and hustled congressional funding for river improvements. Their claim that the Calumet area was an ideal industrial location had merit, but it was the situation and not the site that made this so. This chapter will contrast the site and situation and consider how they relate to the issue of industrial waste disposal. As a means of assessing the volume and type of industrial waste produced, a chronicle of manufacturing activity up to 1921 is offered, and estimates of waste production are made.

"Natural Advantages"

Between the years 1869 and 1921, several plans were advanced for the creation of a protected inland harbor in the Calumet region.(1) Major Wheeler of the U.S. Army made one of the first proposals in 1869. He stated, "Taken by itself the Calumet River is suseptible to being made a capacious and a good harbor and under certain conditions would furnish relief to the crowded conditions of Chicago and a harbor of refuge under certain winds."(2) Although Wheeler concluded that the plan was economically unreasonable, entrepreneurs were attracted to the idea.(3) The same year, the Calumet and Chicago Canal and Dock Company was chartered and began to consolidate 5,000 acres of land along the Calumet River.(4) When they put this land on the market five years later, advertisements listed the seven existing factories and described improvements made by the owners and the Army Engineers. They proclaimed:

> As a location for iron furnaces it has no equal. The ore of Michigan and Wisconsin can be placed at South Chicago at low rates. The coal required can most favorably meet the ore at this point, permitting the manufacture of iron at figures low enough to command the markets of the Northwest, with a good margin to the producer.(5)

This description enumerated the situation advantages of water access for shipping and processing, rail connections, and proximity to an expanding market. The pamphlet also argued for the advantages of lower property prices, lower taxes, and lower construction costs.(6) While these characteristics of the Calumet region were situation advantages, boosters littered their writings with the term "natural advantage."(7) However, true natural advantages were hard to find.

The landscape encountered by developers in 1870 was little altered from the area surveyed in 1834. The dominant feature of the plain was Lake Calumet (Fig. 2-1). Its indistinct boundaries fluctuated with each rise and fall in Lake Michigan's level, although Lake Calumet generally extended about three miles along its north-south axis and was about one and one-half miles wide. Marshes surrounded it and were described by surveyors as "impassable" or as a "quagmire."(8) The lake itself was only six to ten feet deep, while in places, water in the marsh measured two feet. The depression that the lake occupies was formed before Lake Michigan receded into its present basin. Stony Island,

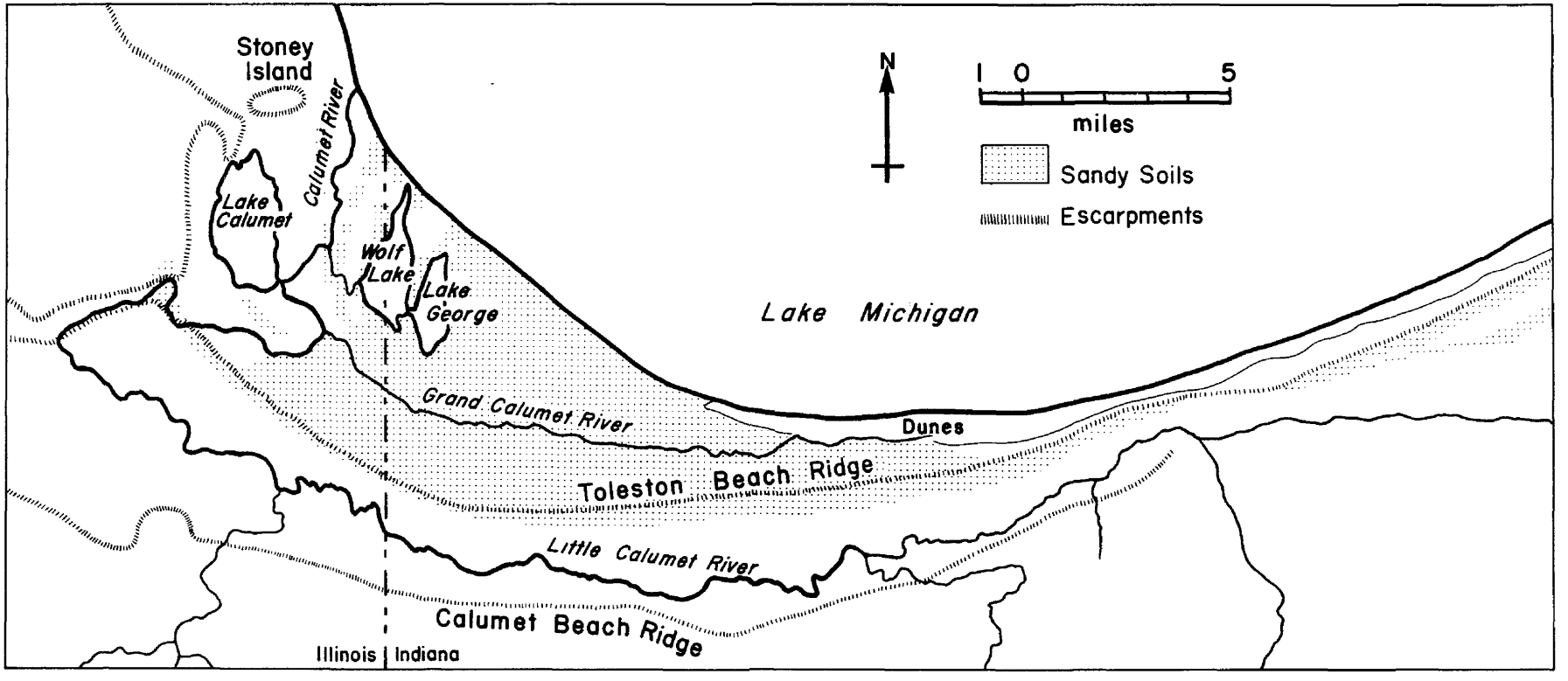


Figure 2-1: Calumet Area Topography
Source: After Bretz, 1939.

a rock outcrop rising above the formerly higher lake surface, deflected southerly currents to the east, thereby inhibiting deposition of coarse materials where Lake Calumet now lays.(9) Instead, lake-bottom deposits, composed of fine silt and clays accumulated,(10) and recent borings show the lacustrine deposits extending to a depth of forty feet, while twenty feet of clay hardpan separates the upper layer from bedrock.(11) This subsurface inhibits percolation of surface water to the bedrock layer and causes ponding of surface water. The marshland created by these conditions supported a large population of water fowl and muskrats that lured hunters and trappers, from prehistoric to modern times.

To the west of the lake stood the Toleston Beach ridge. Rising ten to fifteen feet above the lake plain, the modest bluff of till roughly parallels Indiana Avenue, about one block to the west. The well-drained soils of the terrace were occupied from an early date by the truck farmers and qarrying activity near the Little Calumet River exploited sand deposits that eroded from the ridge face when Lake Michigan waters were at a higher level. This area is also underlain by dolomite bedrock.(12)

To the east and south of the lake exists another area with dry ground. Several sandy beach ridges run parallel to Lake Michigan from near the mouth of the Calumet River to Hammond, Indiana. They were formed during the late Wisconsin Age when Lake Michigan was higher than it is today. Offshore currents, deflecting around Stony Island, created offshore bars that now form the Hammond beach.(13) Other inland ridges exist and measure ten to fifteen feet thick. The Calumet River meandered between two of these ridges, and Wolf Lake is hemmed in between others. Although a 1912 soil survey stated "There were no distinct beaches as in other townships," the Indian trails identified in the original surveyor's notes attest to the presence of higher ground.(14) One path ran from near the junction of the Grand and Little Calumet Rivers, north toward the mouth of the Calumet. Another crossed the Little Calumet and tracked northwestward towards Pullman.(15)

Another soil type found in the eastern portion of the study area is peat. In areas with standing water, twenty to thirty inches of peat overlay sandy soils.(16) These conditions are most common in the Wolf Lake basin.

Although the area furnished ample quantities of surface water, groundwater was also accessible from shallow dolomite aquifers. The uppermost is a low-yielding stratum about sixty feet below the surface and is separated from deeper sandstone strata by shale deposits. There have been few users of the upper aquifer or even the Ironton-Galesville sandstone source (1500 feet below the surface).(17) The water that has been pumped from these aquifers has been used primarily by industries.

In 1869 the low-lying surface drained into Lake Michigan; this remained true until 1922. The combined discharge of the Little Calumet, the Grand Calumet, and Lake Calumet formed the Calumet River, which breached the beach ridges. The low gradient and high water table produced a site unsuited to large scale factory construction (Fig. 2-2). In 1887 the Chief of the Army Engineers wrote, "The banks of this stream and the land through which it flows are very low[,] much of it swampy and in the rainy season covered with water... The banks of the stream being poorly defined it is difficult to know just where private rights are likely to be infringed upon by the proposed

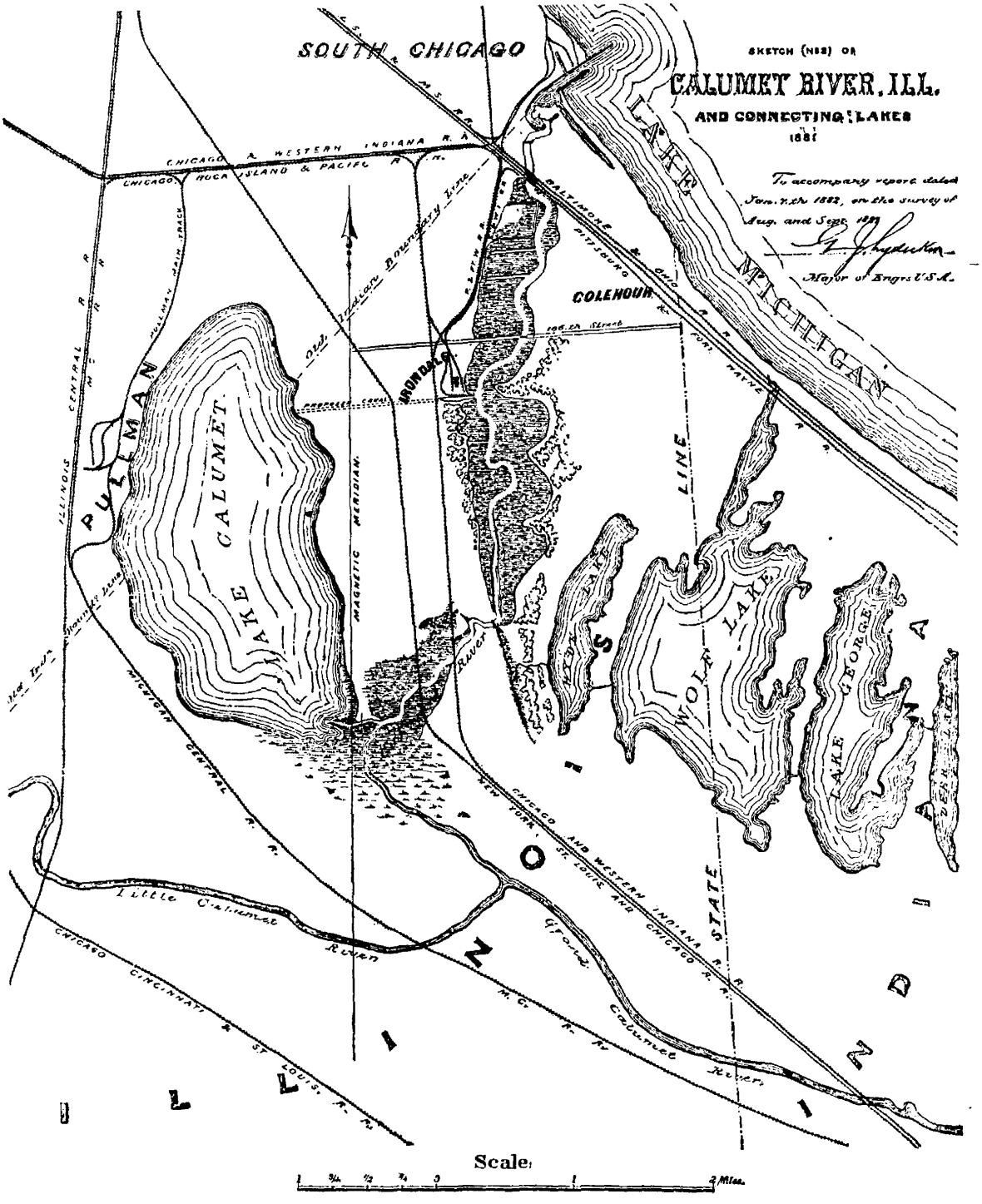


Figure 2-2: Lake Calumet Area, 1881. Dark areas represent marsh.
Source: U.S. Congress, Senate, Exec. Doc., 1st Ses. 1882, No. 77, p. 5.

improvements."(18) Rises in the level of Lake Michigan caused flooding of riverside sites, thereby exacerbating already poor conditions.

The sandy ridges east of Lake Calumet provided the best sites for construction, yet even there it was necessary for the manufacturers to "artificially raise" the ground. Local sand and dredge spoil were used for raising building sites,(19) but the expense of large-scale improvements limited early development along the lower course of the Calumet. Even with the aid of the Army Engineers, sale of industrial sites lagged behind expectations. The chief engineer from Chicago reported that "improvement to the river, however, seems to be in advance of the uses of bordering lands..."(20), and in 1895 two-thirds of the frontage was still unoccupied.(21)

Despite the inhospitable conditions of the Calumet site, the situation was attractive, and boosters extolled the virtues of this wetland as a manufacturing district. Trunk rail lines to the Eastern Seaboard cut through the area, as did the Illinois Central. Land prices were cheap, and the marshlands could accommodate the expansive factories and offer room for growth, raw material storage, and waste disposal. Such realities outweighed any criticism of the area, and the experience of rebuilding Chicago bolstered developers' faith that the same could be done in the Calumet Region.

Transformation of the Calumet

The main participants in the modification of the Calumet Region's natural environment were the Army Engineers and the individual firms that located there. The Calumet and Chicago Canal and Dock Company and other real estate dealers made few actual changes, but they did bring the area to the attention of Congress, thus beginning the transformation.

Although the Army concluded improvements of the Calumet would not be worth the expense, Congress allocated $50,000 in 1869 to begin work on a harbor at the mouth of the river.(22) The first step was to cut through the sand bar at the mouth of the river and then construct two piers extending into Lake Michigan. The intent was to prevent re-establishment of a spit across the mouth and provide protection for ships during storms. By 1882 Army Engineers had completed the piers at the mouth of the river but nothing more.

Congress allocated money to deepen and widen the river upstream, but the Engineers were reluctant to proceed without legal rights to alter the river banks. In numerous reports to Washington between 1881 and 1887, the Chicago commander recounted his efforts to gain the right-of-way from the mouth of the Calumet River to Lake Calumet. He refused to begin dredging until all land owners had surrendered riparian rights. Most owners realized that profitable land sales would be impossible without a navigable channel, and they gladly gave up riverfrontage in exchange for dredging. However, a few speculators delayed channel improvements by denying right-of-way to the Army in hopes of extracting higher bids for their property.(23) Their speculative dealings postponed work on a deep-water channel until 1888.(24)

Great strides were made in 1891, when a channel sixteen feet deep and twenty feet wide was completed upriver to 108th Street (Fig. 2-3).(25) In addition, two meanders were cut off to provide a straight course for the large

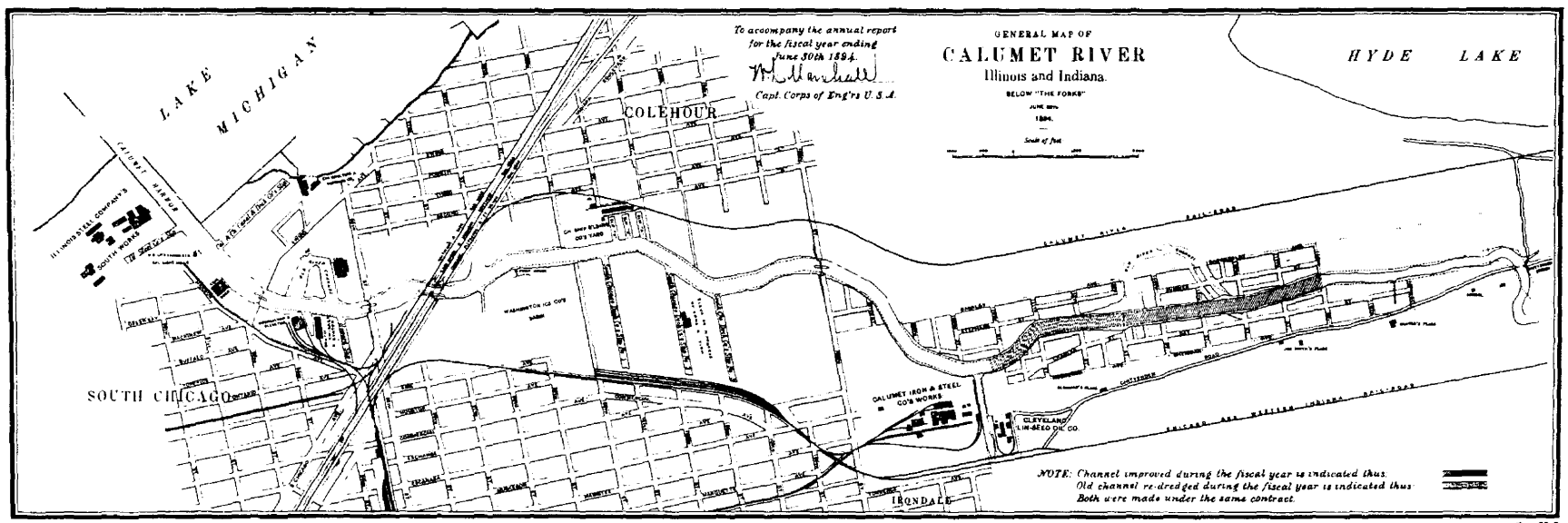


Figure 2-3: Calumet River Improvements, 1894. Shaded area indicates portion of river dredged during preceding year. By 1894 improvements were complete nearly to 120th Street.
Source: U.S. Congress, House, Ex. Doc., 3rd Ses. 3299. v.2, pt. 4, opp. p. 2148.

vessels. Thus by the end of 1891, the river was finally ready to accomodate freighters carrying bulk cargo to the plants along the river. The Army Engineers continued to enlarge the river channel and had reached Lake Calumet by 1896, although only a ten foot channel extended that far inland.

Developers had not waited for the Army Engineers to begin their long-awaited dredging and several plants were in place by the time the channel was enlarged. These included three steel mills, a ship yard, several grain elevators, an ice company and linseed oil maker. Most land owners had dredged sections of the river and used the spoil to improve their sites.(26) In their 1879 annual report, the Calumet and Chicago Canal and Dock Company disclosed expenditures of $4,800 for filling and grading and another $12,000 for dredging.(27) Exactly where this work took place was not specified, but the disbursements were small compared to the Army's. By 1881, over $296,000 of federal money had been spent on harbor improvements.

Manufacturers also undertook to make their property habitable at their own expense. When George Pullman began work on his massive factory and "ideal town," he first had to make site improvements. Chicago's former superintendent of sewage was hired to direct raising and grading the site and to supervise installation of a sewer system.(28) During the spring of 1880 he filled up a two by one-half mile section of property on the western shore of Lake Calumet. Raised five feet above the adjacent marsh, the site was ready for construction work by midsummer the same year. Dredging and filling continued as the Pullman facilities expanded along the Calumet shore. In addition to dredging for fill, Pullman's companies also scoured the lake bed for clay to be used in making bricks. In a letter to the Army, L.M. Johnson reported: "Brick is being manufactured at the rate of 100,000 per day, when the season favors and this may be soon doubled. The bed of Lake Calumet furnishes a stock of the best clay[,] practically inexhaustible."(29) He went on to suggest that such activity could perhaps "go far towards excavating the lake, or at least that portion of it required for slips and dock fronts." Although excavations went thirty feet below the land surface, they were never extensive enough to accomodate a harbor.

At the mouth of the Calumet River, the North Chicago Rolling Mill was actively building up and enlarging their site. They complained to the Army Engineers that they had paid $13,000 for dredging the harbor in front of their docks and argued the government should reimburse them.(30) The dredged material taken from the river, along with natural deposition, were enlarging the area north of the government pier at a rate of four acres a year.(31) This process was viewed as an opportunity to enlarge the factory site, and efforts were taken to augment it.

> In the year 1878 and 1879 the company commenced to deposit systematically, great quantities of slag and refuse from their mills, on the shore and in the lake along it thereby artificially increasing the natural advance of the shore line.(32)

By 1882 over thirty acres of land had been created by the combination of natural and human deposition, and eventually 300 acres were built-up. Such practices of building land with waste material became the norm throughout the Calumet region. South of the river mouth, Iroguois Iron and the American

Smelting and Refining Company combined to create 400 acres.(33)

Although the actual content of the "made land" is uncertain, it appears it was generally a combination of dredge spoil and industrial wastes--especially slag. In addition to the Pullman site and the North Chicago Rolling Mill, most other factory sites show evidence of land building. The Army Engineers reported industries along the Calumet River had "artificially raised" their holdings(34) and the 1911 Sanborn map shows an area of "Land in Making" on Sherwin-Williams' property.(35) A soil survey conducted in 1912 reported that most of the area along the lower reaches of the Calumet river and in the vicinity of Lake Michigan "is fairly well built up."(36) The Army also contributed to the surface alterations. In 1891 nearly 400,000 cubic yards of material were dredged from the Calumet River and required disposal.(37) The local commander chose the location for disposing of the dredged material but was required to "remove it to points from where it cannot return to the areas dredged or the present navigable channel."(39) Some was used to fill the meanders that were artificially cut-off, and presumably, some was placed along the banks of the river. Complaints from Captain Marshall that the undeveloped sites were rapidly eroding suggest spoil was heaped up along the river in anticipation of industrial development. However construction proceeded slower than expected, and without restraining walls, the exposed spoil banks eroded back into the river.(38) During the early years of the Calumet's growth, the spoil posed only minor hazards, but this changed through the years as will be discussed in the following section.

Waste Disposal 1869-1921

Methods and Locations

Two methods for disposing of industrial waste prevailed throughout the period before 1921. Liquid wastes were directed into nearby waterbodies, usually untreated, although in some situations they were diluted with non-contact waste water. Solid refuse was removed to vacant land near the factory and dumped. There was limited concern about the hazardous quality of industrial by-products, and health authorities directed most of their attention to the problems of biological wastes, both domestic and industrial. Their attention to deomestic sewage resulted from a known connection between taited water supplies and cholera and typhoid epidemics. There was little or no recognition of the relationship between synthetic organic, or inorganic, chemicals and chronic or acute health effects. A consideration of general waste disposal practices in the Chicago area is necessary because domestic and industrial wastes sometimes were carried in the same sewers or deposited in the same refuse heaps. This section will consider the social, legal, and scientific climate that influenced the handling of urban waste in Chicago, and will attempt to determine the quality and quantity produced in the Calumet area and describe how it was disposed.

Chicago officials had grappled with the proper disposal of sewage since the mid-nineteenth century. After fighting cholera epidemics in 1849 and 1850, the city built a sewage system that drained into the Chicago River, where it was directed via a canal into the Illinois River.(40) To secure pure drinking water, a water intake was extended two miles into Lake Michigan and linked to the domestic water delivery system in 1861. This was thought to be an adequate arrangement until a heavy rain in 1877 caused the flow of the

Chicago River to revert into Lake Michigan. When sewage entered the municipal water system, citizens and health officials reacted with alarm.(41) Following this incident, a protracted battle to eliminate the threat of pollution began. Establishment of the Chicago Sanitary District in 1889 was the climax of this struggle, but it was only the beginning of the fight to preserve pure drinking water.

The Sanitary District decided to build a larger drainage canal that could accommodate the increasing output of municipal sewage, the wastes from the meat-packing plants, and also the runoff from heavy rainstorms. This decision led to the construction of the Sanitary and Ship Canal (Fig. 1-1), and when it was opened in 1900, Chicagoans felt they had solved their drinking water and sewage disposal problems.(42)

The rationale for the earliest waste disposal system was the desire to put a safe distance between citizens and putrefying matter and thereby eliminate "spontaneous" production of disease. With the development of germ theory in the late nineteenth century, concern with infectious disease prompted the adoption of dilution techniques. Sanitation officials claimed that flowing streams purified themselves through bacterial degradation of biological wastes, but they initially neglected the impact of excessive loads to downstream communities.(43) Sanitary District researchers reported they were not damaging water supplies along the Illinois River, although their claim was disputed by officials in Peoria and other river cities. Despite diversion of its own wastes, Chicago still had to contend with pollution from its neighbor. Raw sewage from Indiana caused continued outbreaks of cholera until chlorination of municipal water supplies began in 1912.(44)

Throughout the pre-World War I period, the emphasis in urban sanitation was on the removing of biological wastes; this was true for liquid and solid wastes. Sanitary Movement reformers sought to secure regular transport of horse manure and household refuse beyond the city limits. By 1892 this was the common practice in Chicago, where private scavengers collected garbage and carted it beyond the city limits to be dumped in low areas.(45) An incinerator displayed at the Chicago World's Fair in 1893 exemplified the latest technology, but it did not alter city-wide disposal methods. A 1902 survey reported that Chicago did not separate its municipal wastes and that all was "dumped."(47) By 1914 much of the garbage service in the city had been consolidated under municipal direction--at least under the authority of "ward bosses." A report on city wastes stated that rubbish and ashes were discarded "in various sections of the city, principally in low lands or where excavations have been made for clay used in brick manufacturing."(46) It went on to add that such methods "will not create a [health] nuisance, and at the same time improve land."(48) The interest of city officials clearly lay in removing domestic wastes, for the report stated it was not concerned with "trade wastes."

With the exception of offensive wastes from meat-packing plants, industrial wastes were neglected before 1917. Public health organizations in New York strove to control the disposal of carcasses and manure with mixed success.(49) Likewise in Chicago, the one effort to control industrial waste was waged against the meat packers.(50) The dangers of most other industrial wastes were poorly understood. Appeals for regulation won few supporters among industrialists, and industry apologists wrote:

> The demand of a given manufactory that their wastes be disposed of without creating a nuisance would, in many instances be equal to the demand that they discontinue business inasmuch as the cost of disposal of these wastes in a satisfactory manner would be to prohibit the financial success of the industry.(51)

M.O. Leighton addressed the American Bureau of Public Health in 1904 and stated that research on industrial waste disposal lagged behind that for domestic sewage. This was due in part to the common understanding that "industrial wastes do not normally contain germs of disease."(52) He argued, however, that industrial wastes have an indirect bearing on public health. He cited evidence that biological wastes can burden natural filtration systems of rivers, and trade wastes from metal-working industries can prevent septic action of sewage disposal plants.(53) However, nuisances from trade wastes were not severe enough to impel public officials to action.

The legal system provided limited protection against stream pollution in the nineteenth century, although courts generally held polluters liable for damages caused by waste disposal in streams. Illinois' judicial branch protected the rights of riparian landowners to have both water quality and quantity undisturbed by upstream users.(54) Decisions during the early twentieth century continued this pattern, but apparently had little effect on the Calumet area. Water disposal continued unabated, and despite tainted supplies of process water, there is no record of suits by industries to halt pollution.

A complete account of waste disposal in the Calumet area is unavailable, but uncontrolled disposal of industrial wastes in waterways was the primary cause of pollution. One of the first complaints in the Chicago area came from the Army Engineers' commander who said that he felt it was futile to attempt to maintain the channel of the Grand Calumet. He wrote in 1893 that it "has been worse than useless as the channels excavated have filled up rapidly by slaughterhouse refuse and filth from manufacturing establishments and solid matter from the sewage poured into the dead stream."(55) Work on the section between the mouth of the Grand Calumet and Lake Calumet he described as "desultory," because:

> What goes into it stays there for lack of current to carry it off. Several towns and some great filth-producing manufacturing establishments have filled the dredge channels with filth as fast as excavated..."(56)

Aggradation in the main channel was also reported as early as 1891, but the cause cited was bank erosion, not waste disposal. As industries began to occupy the lots along the river, maintenance dredging became the major role of the Army Engineers. In 1895 redredging accounted for nearly twenty-five percent of the total expenditures on Calumet improvements in spite of the fact that the original plans were still far from complete.(57) The nature of the Army Engineers' duties lead the commander to protest that they were "simply the scavengers for the vicinity."(58)

George Pullman and his associates widely proclaimed their progressive

thinking about sewage removal. They felt it unwise "to permit the sewage to flow into Lake Calumet, as it would make a cesspool of that body of water."(58) Although Pullman's drinking water was supplied from Lake Michigan, the shops used water from Lake Calumet. To avoid fouling this source, Pullman built a showcase sewer system that linked both factory and town to a "sewage farm" near the Little Calumet River. In 1890, 1.8 million gallons of domestic and industrial wastes were pumped to the farm and spread over the fields. The percolation of the liquid wates through the soil was viewed as a means of filtration and fertilization.(60) However, by 1887 most sewage was directed into Lake Calumet "in order to save the crops."(61) Eventually, maintenance difficulties forced an abandonment of the sewage farm and by 1907 Pullman's sewage went untreated into the Little Calumet River.(62)

The effects of indiscriminate waste disposal did not go unrecognized. During a hearing on the feasibility of creating an inland port in Lake Calumet, the following remarks were made:

> Alderman Emerson: The water is so bad there [the mouth of the Calumet River] that they cannot bathe in the lake at the mouth of the river.
>
> Alderman Long: I think that was because of the discharge of the steel works.(63)

Indeed, there were dozens of outfalls from the factories that drained processing wastes as well as factory sanitation sewers. Little if any of the effluent was treated before discharge.

Bathers were not the only water users endangered during the early years of the twentieth century. So bad were the Calumet wastes, the Sanitary District began work on plans to divert the Calumet River from Lake Michigan. A report presented in 1909 charged that all sewers south of 87th street flowed into the Calumet River, and periodically this filth was washed into Lake Michigan, threatening Chicago's potable water.(64) Even the wastes from the Pullman plant were being pumped into the Little Calumet making it "quite objectionable."(65) Concerns over the wastes of the Calumet area led to discussions of a canal connecting the Calumet system with the Sanitary and Ship Canal. Such a plan would complete the redirection of streams in the Chicago region from the Great Lakes to the Mississippi River drainage basins. Until such a channel was completed however, industrial wastes continued to pour into Lake Michigan.

In addition to the liquid wastes, solids suspended in these liquid wastes began to pose health and navigational problems. Solids emitted to the river in solution or suspension settled on the river bed and had to be dredged to maintain the channel of the Calumet River. Contractors barged most of these wastes to nearby Lake Michigan. Authorities realized the potential danger these wastes posed to drinking water as early as 1911. Although at the time, Congress prohibited dumping dredge spoil within eight miles of water intakes, violations continued.(66)

Land disposal was a viable method for industries to enlarge or improve their property in the marhsy environs of the Calumet region. A major study of the iron and steel industry concluded:

> Even the marshy conditions have proved to be an advantage since the waste material can be dumped in the depressions. Plants located along the lake shore have certain advantages in regards to possible extensions of area, and waste disposal.(67)

North of the government piers at the mouth of the Calumet River, a huge industrial site was prepared by filling a combination of lake sands and industrial wastes,(68) and nearly 400 acres were built up with slag and other wastes on the south side of the piers. Encroachments on the marsh were characterized by the 1908 Wisconsin Steel purchase of land at 100th and Muskegon for use as a slag dump.(69) The greatest risk for contamination of shallow aquifers exists in the areas first used for factory construction and landfilling activity (see appendix).

Waste Streams

While detailed records are lacking, the general patterns of waste production in the Calumet area are known and estimates of amounts can be made. The leading industrial activity in the Calumet region was the manufacture of iron and steel and processing the finished metal into rails, wire, and other products. In 1897 there were ten metal-working firms in the study area, (Fig. 2-4), and they ran the gamut from pig iron production to the forging of railroad car wheels and rolling rails or extruding wire. Before 1900 most steel in the Calumet area was produced using Bessemer furnaces, but by 1919 the Open Hearth technique surpassed the Bessemer.(70) This newer technology consumed more scrap metal although the type of waste remained similar.

The most accurate gauge of local production levels is the ore receipt figures reported by the Army Engineers. Although these statistics are complied for Calumet Harbor, an area slightly larger than the study area, the information is useful.(71) Production in Calumet Harbor blossomed after 1890 (Table 2-1), as reflected by the sharp jump in ore received between 1890 and 1895. Steady expansion was interrupted by a brief recession after 1910, but production picked up and continued to grow during and after World War I.

The period of rapid expansion coincided with annnouncements of water pollution in the area. The mills produced huge quantities of phenols and cyanides and expelled them into the water courses adjacent to their operations (Table 2-1). Solids settled in the Calumet River and accumulated until dredged by the Army Engineers. Both the deposition of solids in area streams and the dredging of these wastes disrupted aquatic communities and eliminated most sport and commercial fishing in the river and adjacent Lake Michigan shore waters during this period.(72)

Pickle liquors were another large-volume by-product of plants processing finished steel. These wastes were sulphuric acid solutions used to remove rust from steel forms. It was possible to neutralize the spent liquor with the addition of lime, but this practice became widespread only after mills were linked to sewage systems. Since this did not occur in the Calumet area until after 1921, it is reasonable to conclude that spent pickle liquors were discharged into the Calumet river untreated.

Organic wastes from grain-handling firms were also present. A brewery, a

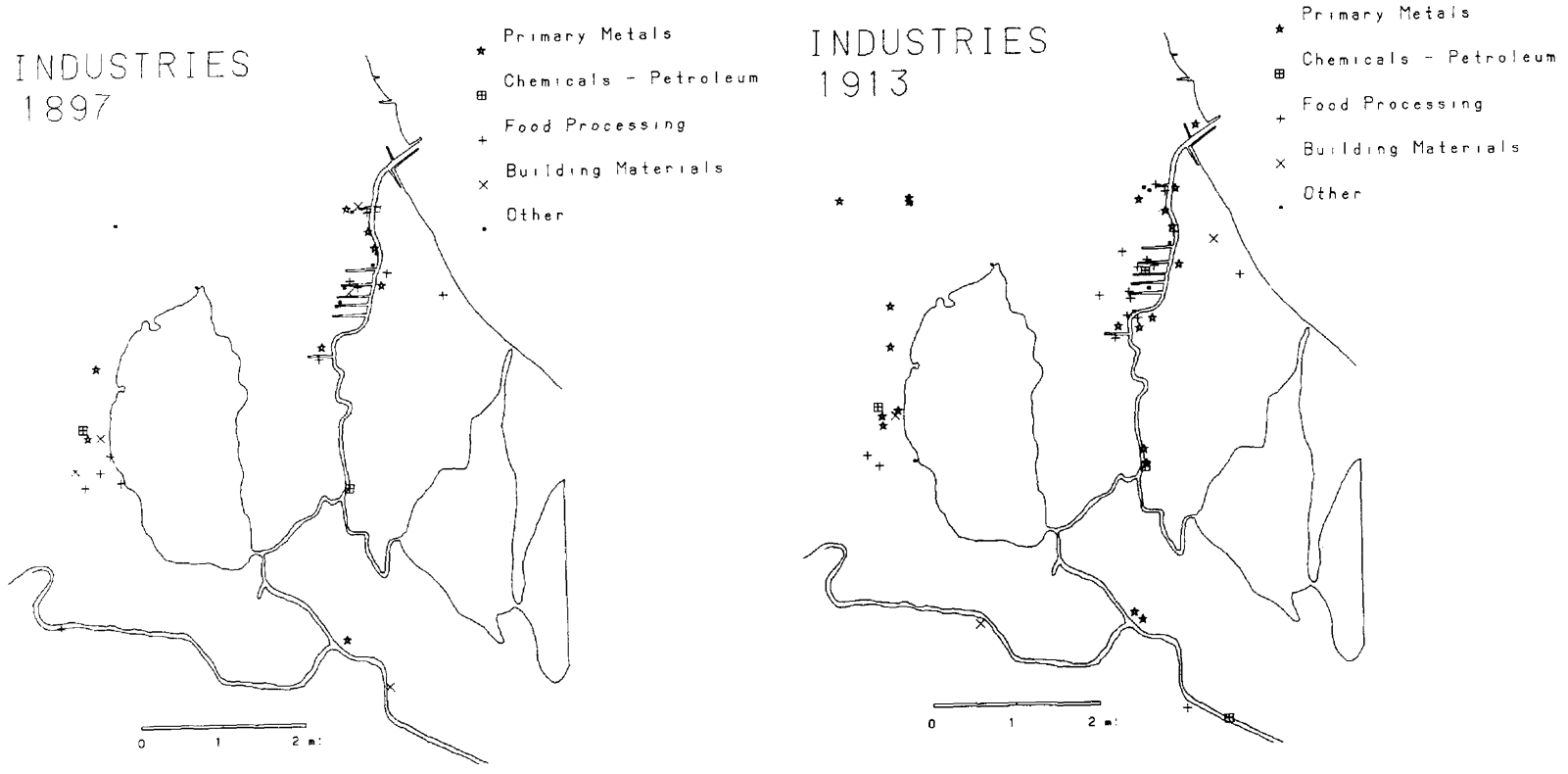


Figure 2-4: Calumet Area Industries, 1897 and 1913. Not only did the number of manufacturers increase during this time, but the capacity of most existing firms was enlarged as well.
Source: Sanborn Insurance Maps.

Table 2-1: ESTIMATES OF IRON AND STEEL WASTE PRODUCTION, 1895-1920

Year	Tns Ore Received	Ingot tns/ Year	Suspended Solids (1000 lb/yr)	Phenols (lb/yr)	Cyanide (lb/yr)	Lube Oil (lbs/yr)	H2SO4 (lbs/yr)	FeSO4 (lbs/yr)
1885	360,000	192,513	19,829	13,283	5,583	1,108,800	1,090,800	4,068,000
1890	703,149	376,016	38,730	25,945	10,904	2,165,699	2,130,541	7,945,584
1895	1,865,700	992,888	102,267	68,509	28,794	5,718,636	5,625,801	20,980,710
1900	2,333,381	1,247,797	128,523	86,098	36,186	7,186,813	7,070,144	26,367,205
1905	3,215,626	1,719,586	177,117	18,651	49,868	9,904,128	9,743,347	36,336,574
1910	6,026,736	3,222,853	331,954	222,377	93,463	18,562,347	18,261,010	68,102,117
1915	4,214,964	2,253,991	232,161	155,525	65,366	12,982,089	12,771,341	47,629,093
1920	7,257,558	3,881,047	399,748	267,792	112,550	22,353,279	21,990,401	82,010,405
Ave	3,246,014	1,735,836	178,791	119,773	50,339	9,997,724	9,835,423	36,679,961

Source: Corps of Engineers, Waterborne Commerce.

Multipliers: Suspended Solids 103, Phenols .069, Cyanides .029, Lube Oils 3.08
H2SO4 3.03, FeSO4 11.3.

After: USDI, Cost of Clean Water, 1967, p. 55.

distillery, two pneumatic malt plants, and three grain elevators were found in the area in 1897 (Fig. 2-4). The total number of grain-using companies was up to eight by 1913. Since most grain arrived by rail, the waterborne commerce figures are of little value for estimating quantities. Grain elevators along the Calumet River had a capacity for over six million bushels, and local manufacturers probably used a large portion of this. No direct account of their waste disposal methods survives, but the general practice is known. Distillery slop was generally fed to cattle, which were sold at the close of the distilling season. According to a contemporary authority, this "results in a more dangerous pollution than would arise from the direct discharge of slops into the river."(73) European researchers were experimenting with the use of brewery wastes as fertilizer during the twenties, but this was not a widespread technique before 1920.(74) If grain wastes were not used as feed or fertilizer, they probably found their way to municipal dumps or waterways. One dump receiving organic waste from South Chicago existed at 93rd and Torrence, although commercial use was outlawed in 1887.(75) Distilleries and breweries also may have used a commercial scavenger who had an operation at the southern edge of the Eastside neighborhood, or they disposed of their waste on-site.

The third group of producers who contributed to waste production were the various chemical, paint, and oil manufacturers. Throughout the first period, a chemical firm making pickling liquors for steel mills operated in the bend of the Calumet River. The Sanborn maps show vats for muriatic, sulphuric, and nitric acid within the walls of this plant. South of Pullman, the Calumet Paint Company, later Sherwin-Williams, worked with lead and various vegetable oils to produce paints, varnishes, and lacquers. Additional lines of products added between 1903 and 1920 included arsenic-based insecticides, white lead, beta napthal, para nitraniline, toluidine, acetic acid, and lithopone.(76) The only measure of production was a reported 1,250,000 gallons of paint produced in 1911.(77) Liquid wastes from Sherwin-Williams presumably were handled by the Pullman sewage system, and solids probably were disposed on-site. Before 1900 the Cleveland Linseed Oil Company operated on the west bank of the Calumet River, and Jenkins and Company stored and barreled oil near the river and 95th Street. Just beyond the study area was the Hammond Glue Company, which the Army Engineers accused of contributing to the pollution of the Grand Calumet.

Another waste product produced by most operations in the area was fly ash. Coal was the primary fuel for manufacturing power and the skies of the Calumet were heavily laden with particulate matter. One outspoken editorial writer argued that smoke was a barometer of foolishness and not of prosperity.(78) An anti-smoke drive during the first few years of the twentieth century culminated in legislation aimed at controlling emissions, but it regulated only railroads. The drive to reduce atmospheric pollution promoted the expansion of electric rail lines, but the large electric generators continued to burn coal, as did the manufacturers. Their waste ash frequently was mixed with other refuse in landfills and could contribute to ground-water contamination. Silica and acidic leachates are associated with fly-ash.

The impact of industrial pollution was highly visible in the Calumet Region during the first decade of the twentieth century, as witnessed by the anti-smoke campaign and the Sanitary District's discussion on methods to

control water pollution there. Still, until 1917 there was little effort to control the quantity of waste produced. When America entered World War I, journalists and trade associations made patriotic appeals to eliminate waste and reclaim scrap materials. Local papers across the country expressed the theme, calling on citizens to turn in waste products and preserve America's scarce "virgin natural resources."(79) Trade journals appealed to manufacturers to reduce waste and salvage scrap materials.(80) Although some waste may have been recycled as a result of this effort, the general increase in production during the war probably offset any reductions. Furthermore, the loss of German industrial chemicals at the outset of the war forced a rapid expansion of the American chemical industry.(81) The combined increase in production of war materials and the growth of the industrial chemical industry would have raised waste production levels despite reclamation drives.

Conclusions

Between 1869 and 1921 the character of the Calumet region was altered profoundly. Changes were relatively slow at first, but by the turn of the century the pace had quickened along an irreversible course. The most pronounced changes during this period were the result of direct modifications in the natural environment through the actions of the Army Engineers and the indirect effects of industrial waste disposal.

Dredging the Calumet River and land building along its banks attracted certain industries to the region. Iron and steel firms, as well as grain handling facilities, chose to locate there because the bulk cargos could be handled by deep-draft lake ships. Another inducement was the ample supply of open land--some of which could be used for waste disposal. As the scale of production grew during the twentieth century, the companies employed customary practices for removing industrial wastes. Liquids and some solids were dumped into water courses, while bulky solids were piled up in the marsh.

Such rudimentary methods were used because the research on domestic garbage and sewage disposal eclipsed analysis of industrial waste management. The perception that manufacturing residue was not a health threat delayed serious investigation other than inquiries into packing-house wastes. Modest efforts to "reclaim" wastes during and after World War I were merely patriotic gestures, rather than effective waste treatment or recycling programs.

The most dramatic effect on the local environment was the encroachment on the wetlands. Factory sites along the river and waste disposal sites irreversably altered hundreds of acres of marsh and beach. Although much of the Calumet region is designated as having a low risk of ground-water contamination, initial development took place atop the sandy soils with the greatest potential for contaminant movement. This area is also in proximity to the Eastside neighborhood, and its water supply may have been tainted during the early period. The sale of alcoholic beverages made with Lake Michigan water could have introduced contaminated products to a very large region. In addition, industrial sewage severely impacted the aquatic life and retarded recreational activity within the study area. Highly visible atmospheric emissions prompted a vocal anti-smoke campaign, which led to increased use of electric commuter trains. Despite the severity and quantity of the early industrial waste disposal activities, the dangers of subsurface aquifer contamination was retarded by the presence of clays beneath the

Calumet dump sites. Only the fact that the aquifers were not used as a drinking water source prevented serious human health impacts.

Notes--Chapter 2

1. Examples of Lake Calumet as an inland port can be found in an 1880's Snyder's Real Estate Map of Cook County, and a later formal proposal known as the Van Vlissingen Plan released in 1921.

2. Quoted in East Side Centennial Committee, History and Progress of the East Side, 1951, p. 7

3. Larson, Those Army Engineers, 1979, p. 118

4. Hoyt, One Hundred Years, 1933, p. 109

5. Calumet and Chicago Canal and Dock, Pamphlet, 1874, p. 6, Chicago Historical Society, Chicago, Ill.

6. Ibid.

7. There were several perspectives on the advantages of the Calumet location. George Pullman emphasized its distance from the "debasing" influence of Chicago. See Buder, Pullman, 1967, p. 42. Others simply noted the ample space for industrial expansion. Calumet Record, 19 September 1912.

8. Surveyors' notes made in 1834 and 1835 are housed in the Illinois State Archives, Springfield, Illinois. See, Field Notes, V. 491A, pp. 37-45

9. Salisbury, The Geography of Chicago, n.d., p 52.

10. William, Summary of the Geology, 1971, p. 49.

11. Chicago Regional Port District, Lake Calumet Area, 1981, p. 27.

12. Bretz, Geology of the Chicago Region, pt. 2, 1955, p. 123.

13. Ibid. See also, "Cook County Soil Survey," 1912-13, Urbana, Illinois.

14. "Cook County Soil Survey", 1912-13, T37N, R14E, and T37N, R15E, Urbana, Illinois

15. These trails are shown in Mayer, "Circulation and Settlement," 1954, p. 246.

16. "Cook County Soil Survey", footnote 13, 1912-13, T37N, R15E.

17. Suter, Ground-water Resources, 1959, p. 46.

18. Army Corps of Engineers, Report of Operations, Correspondence 17 February 1887, Chicago, Ill.

19. The sandy soils are noted in Cook County Soil Survey, 1912-13, footnote 13, T37N, R15E. It also suggested the best use for this area was for factory sites.

20. U.S. Army, Report: Chief of Engineers, 1891, p. 2607.

21. Larson, Those Army Engineers, 1979, p. 201.

22. Ibid, p. 118.

23. Army Corps of Engineers, Report of Operations, Correspondence, 12 May 1885, Chicago, Ill.

24. U.S. Army, Report: Chief of Engineers, 1889, p. 2142.

25. U.S. Army, Report: Chief of Engineers, 1891.

26. The North Chicago Rolling Mill spent $13,000 in 1880 to dredge the area in front of their dock and asked the Army to reimburse them. U.S. Army, Report: Chief of Engineers, 1881, p. 2172.

27. Calumet and Chicago Canal and Dock Company, Annual Report, 1889, p. 3, Chicago, Ill.

28. Buder, Pullman, 1967, p. 51. Irregular expenditures for dredging are listed in the Pullman Journal, Newberry Library, Chicago, Illinois.

29. Letter from L.M. Johnson, 5 July 1881, published in U.S. Army, Report: Chief of Engineers, 1881, p. 2173.

30. Ibid, p. 2172.

31. U.S. Congress, "Survey of the Calumet River", 1882, p. 3.

32. Ibid.

33. Illinois Rivers and Lakes Commission, Annual Report, 1913, p. 31.

34. Army Corps of Engineers, Report of Operations, Correspondence, 28 May 1887, Chicago, Ill.

35. Sanborn, Chicago, V. G, 1911, plate 103.

36. "Cook County Soil Survey," footnote 13, 1912-13, T37N, R15E.

37. U.S. Army, Report: Chief of Engineers, 1891, p. 2600.

38. Army Corps of Engineers, Report of Operations, "Specifications for Dredge Disposal," June 1887, Chicago, Ill.

39. U.S. Army, Report: Chief of Engineers, 1891, p. 2607.

40. Rauch, "Sanitary Problems of Chicago," 1877, pp. 10-11.

41. Davenport, "Sanitation Revolution in Illinois, 1973, pp. 309-10.

42. A thorough account of the Chicago sanitary history is found in Cain, Sanitation Strategy, 1978, See also, Cain, "Unfouling the Public's Nest," 1974.'

43. Tarr, "Risk Perception," 1984, p. 74. The concern over pollution along the Illinois and Mississippi River forced the Chicago Sanitary District to analyze water from Chicago to St. Louis. See, Reynolds, Report of Streams, 1902.

44. Galishoff, "Triumph and Failure," in Melosi, 1980, p. 49.

45. Melosi, Garbage in the Cities, 1981, p. 29.

46. Winslow, "Some Statistics of Garbage Disposal," 1902, pp. 142-43. This report distinquished between three types of waste: ashes, combustible wastes, and garbage. No industrial wastes were considered. Separation of municipal wastes was common on the East Coast. It entailed allowing scavengers to cull reusable items, such as glass bottles and rags, from garbage. Remaining biological wastes were often sold as hog slop.

47. Chicago City Waste Commission, Report, 1914, p. 15.

48. Ibid, p. 23.

49. For a discussion of devlopments in New York City see, Duffy, History of Public Health, 1974. The Boston case is presented in Rosenkrantz, Public Health and the State, 1972.

50. The Metropolitan Sanitary District waged a running legal battle with the packing houses between 1914 and 1926. Results of monitoring industrial effluents are presented in, Sanitary District of Chicago, Report on Industrial Wastes, 2 vols., 1914 and 1921. In 1926 the Illinois Appeals Court ruled in favor of the Sanitary District when it concluded the packing-house wastes were indeed a hindarence to the natural flow of the Sanitary Canal. See 241 Ill. App. 288 (1926); in Illinois Digest, 1969, pp. 290-98.

51. Swartz, "Report of the Committee on Disposal of Industrial Wastes," 1903, p. 166.

52. Leighton, "Industrial Wastes, 1905, p. 29.

53. Ibid, p. 30

54. Several examples illustrate the precedent. Bliss v. Kennedy, 43 ILL 67 (1867); Tetherington v Donk Bros., 83 N.E. 1048, 232 ILL 522 (1908); and regarding groundwater Iliff v. School Directors, 45 ILL, App 419 (1892). Summaries of these decisions are found in Illinois Digest, 1965.

55. Quoted in Larson, Those Army Engineers, 1979, p. 197.

56. U.S. Army, Report: Chief of Engineers, 1895, p.2591.

57. Ibid. p. 2596. Lowering the stream bed and the consequent reduction in velocity would have contributed to the accumulation of sediments.

58. Quoted in Larson, Those Army Engineers, 1979, p. 199.

59. Doty, Town of Pullman, 1893, p. 163.

60. Pullman Foundation, Scrapbook, "The Sewage," Chicago, Ill.

61. "Sewage Purification in America: Pullman," 1893, p. 27.

62. Hering, "Report to Robert McCormick," 1907, p. 7

63. Lee,"Chicago Harbor Needs," 1911, p. 6.

64. Wisner, "Sewage Disposal," 1909, p. 3.

65. Hering, "Report to Robert McCormick," 1907, p. 7.

66. Chicago Metropolitan Sanitary District, Report on Sewage Disposal, 1911, p. 72.

67. Appleton, The Iron and Steel Industry, 1925, p. 80.

68. See footnote 31.

69. Bulanda, "South Deering" in Kijewski, Historical Development, 1973, p. 65. An elongated mound of slag was piled up over twenty feet high and endowed the adjoining neighborhood with the nickname "Slag Valley."

70. Appleton, footnote 67, p. 38.

71. The dimensions of Calumet Harbor included industries slightly beyond the study area, including Illinois Steel and Interlake Iron, and the former accounted for about half the ore receipts. Nevertheless, they both contributed to the pollution load of the Calumet River system and thus were vital components in the waste disposal history of the area.

72. Conversations with members of the Southeastern Sportsmen's Club and Greenfield, "Assessment of Fish Fauna," 1984, p. 83. Greenfield reported "there appeared to be a reduction in the number of fish species present at sites where the most extensive habitat modifications have occurred."

73. Leighton, "Industrial Wastes," 1905, p. 30.

74. Bruttini, Uses of Waste Materials, 1923.

75. Daily Calumet, 23 July 1887, p. 1.

76. Federal Writers Project, Box 69, "Paint and Varnish Manufacturers," Illinois State Historical Library, Springfield, Ill.

77. Calumet Record, 19 September 1912, p. 52.

78. Chicago Record-Herald, 26 January 1906, p. 10.

79. A local example can be found in Daily Calumet, 19 May 1919, p. 3.

80. The trade publication, Industrial Management delivered this message steadfastly. See, Berkeley, "Industrial Waste," 1917; Conover, "Salvaging and Utilizing Wastes," 1918; and Howe, "Common Wastes," 1919.

81. Research Corp. of New England, Solid Waste In Industrial Chemistry, 1973, p. 23.

CHAPTER III - RECLAMATION TO RESEARCH, 1922-1940

Introduction

Two major waste management changes occurred in the Calumet region during the early 1920s. These were the opening of the Cal-Sag Channel and the construction of the Calumet Sewage Treatment Plant. As a result, some of the industrial effluent received treatment before discharge, and the Cal-Sag redirected the Calumet River system away from Lake Michigan. These two projects culminated a decade-old effort to reduce the amount of industrial pollution to Lake Michigan. They did not solve the problem of industrial waste disposal; they merely rerouted and slightly modified the flow. However, they stand as testimony to public concern that arose prior to 1920.

The economic euphoria of the twenties diminished public interest in such matters and caused levels of production to soar. The completed canal and treatment plant were considered final solutions; however, the Chicago Sanitary District encountered a new set of problems. Industrial wastes overwhelmed their system, and caustic substances interferred with biological processes designed to break down sewage. To identify the inhibiting agents, the Sanitary District closely monitored industrial effluents. The records of their investigation provide the first real documentation of the amount and type of industrial waste disposed in the area.

This chapter describes the consequences of opening the pollution control facilities in the Calumet area and traces the development of industrial waste research. Based on the research of the Metropolitan Sanitary District and levels of industrial production, an analysis of industrial waste streams and disposal techniques will be offered. A final section will discuss the impact of industrial wastes on area residents.

Diversion and Treatment

Public officials voiced concerns about the sewage in the Calumet area during the early years of the 1900s, and eventually they took tentative steps to alleviate the problem. Given the technology of the day, the choice was to dilute. In 1909 the Sanitary District recommended constructing a sewer system for the residential areas of the Calumet region. A pumping station near the banks of the Little Calumet was to draw the liquid refuse away from homes and discharge it into the Little Calumet.(1) To avoid dumping domestic sewage into Lake Michigan, the Sanitary District proposed to reverse the flow of the Little Calumet by connecting it with the Sanitary and Ship Canal (Fig. 1-1). Fresh water drawn from Lake Michigan would dilute the sewage in the Little Calumet and flush industrial wastes from the Calumet River.

Before the Sanitary District could dig a connector canal, they had to obtain approval from the U.S. War Department. Canada and other Great Lakes states were uneasy with the plan and urged the Secretary of the Army to reject Chicago's proposal. Several years earlier they had objected strenuously to diversion of water through the Sanitary and Ship Canal, opened in 1900; although Chicago finally won approval to divert 5,000 cubic feet per second (cfs).(2) When talk of the second canal surfaced, opponents argued it would cause a drop in Lake Michigan's water level. Initial discussions of a 4,000 cfs diversion met strong resistance, and despite rejection of their initial

application, the Sanitary District finally won approval in 1910 to divert 2,000 cfs.(3) The following year, work began on the sixteen-mile canal through the Sag Valley. However in 1913 the federal government withdrew permission to divert Lake Michigan water through the channel.(4) Although the Sanitary District fought the injunction, engineers were forced to consider alternative methods of handling sewage.

If the federal government were ultimately to deny use of Lake Michigan water, the area's sewage would require treatment before discharge into the Little Calumet. Due to the uncertainty of obtaining a permit, the Sanitary District entertained proposals to build sewage treatment facilities.(5) While the Cal-Sag project was in litigation, work began on a domestic sewer system and a pumping station, which were completed in 1921.(6) This station provided the neighborhoods surrounding Lake Calumet with sewage service, and initially their untreated wastes were pumped into the Little Calumet River. In 1922 the sewer system was tied into the Calumet treatment works.(7) It provided a filtration form of treatment and employed an Imhoff sludge digestion system.(8) The combined process yielded a sludge that the Sanitary District hoped to use as fertilizer.(9) In addition to the treatment works, the MSD was allowed to open the Cal-Sag Channel that same year.

Thus by 1922, major steps had been taken to limit the disposal of sewage in Lake Michigan via the Calumet River. Nevertheless, industrial wastes remained a major concern. Factories along the lower Calumet River, in the vicinity of Pullman, and across the state line in Indiana continued to expel their wastes into the Calumet River system. At times, these wastes found their way into Lake Michigan when storm runoff forced the current of the Calumet River into the lake. The source of the problem was not affected by the costly projects, and waste production continued undiminished.

Industrial Wastes

General Disposal Practices

During the twenties and thirties there was a gradual shift from "waste reclamation" methods to scientific investigations of industrial waste reduction. Nevertheless, in the Calumet area old habits were hard to break and the period from 1922 to 1940 resembled the preceding one, with a single exception: an intensive effluent monitoring program was initiated by the Sanitary District, who hoped it would help them evaluate the effects of wastes on their system. Although surveilance waned during the 1930s as industrial production fell, the program acquainted the Sanitary District with the nature of the problem.

The term "waste" in the 1920s generally referred to inefficiencies and scrap material. Trade journal articles continued their war-time encouragement that producers exchange wasteful techniques for profit-producing methods. In the iron and steel business, this meant finding a use for by-products, thereby transforming trash into commodities.(10) The increasing use of Open Hearth furnaces aided in this movement by consuming scrap metal in larger proportions then the Bessemer. Other reclamation projects included construction of benzol recycling facilities at coke plants and the continued use of slag in building materials and as a fertilizer ingredient.(11) The Open Hearth furnaces of the Calumet region produced a basic slag suited for use in Portland cement. In

fact, the Carson Pirie Scott building, designed by Louis Sullivan, included building materials containing Calumet region slag.(12) Overall, the pre-war situation prevailed, and when manufacturers discovered both an economical method of reclamation and a ready market, they took tentative steps to reduce waste streams.

The scientific community was beginning to recognize the true nature of industrial wastes, but their understanding was not always put to the best use. In a 1931 article one engineer recounted that although cities had built water purification plants to protect their water from upstream polluters, industries were still burdening streams with "poisons, color and other obnoxious matter."(13) Summarizing attitudes of the day, he characterized sentiment toward industrial wastes as a desire to find "a place to put them out of sight."(14) Most liquid wastes, he stated, were dumped untreated in the nearest stream, and he concluded this situation posed a greater problem than solid wastes.(15) Contrary to appeals by chemists and engineers, industry spokesmen continued to advocate stream dumping. The practice of stream dumping he identified corresponded with techniques advocated by industry spokesmen. They suggested the most profitable means of waste disposal was "up the chimney or down the river."(16) Seeking to promote more responsible management of solid wastes, engineers proposed three techniques for dealing with solid wastes. They included incineration of combustible wastes, containerization of organic substances, and use of "stable" material as fill.(17) Both slag and ash were considered stable fill material, although today the use of fly ash as cover is discouraged.(18) Despite a true concern, engineers won few converts to responsible waste management.

There was increasing public pressure to clean wastes from potable water supplies after consumers complained about the taste and odor produced by pollutants. During the 1930s sanitation engineers fretted over their inability to remove foul tastes by simply adding chemicals to the water, and some concluded that eliminating wastes from public water supplies would be the optimal method for solving the problem.(19) To help relieve the pollution load, the federal government allocated funds for sewage treatment plants in the National Industrial Recovery Act.(20) However, few industrialists were willing to expend precious capital on "non-productive" projects while the economy was depressed.

Industry resented government efforts to control noxious discharges, claiming that they were intrusive and that they hindered economic recovery. One commentator wrote:

> As in England, [the movement to halt water pollution] begat some rascally offspring, smart neighbors who discovered that nuisance suits against chemical and metallurgical corporations made a strong appeal to any jury in the land, and unscrupulous local politicans who learned that threats of injunctions or municipal ordinances were heavy well-spiked clubs to swing at the managers of such corporations.(21)

While these remarks may not typify industry's attitude toward waste disposal, they do epitomize management's feeling about government regulation and are very characteristic of management's reaction to outside interference.

Waste treatment specialists were handicapped by management's stance on the implementation of waste control facilities, but they did make significant advances in the analysis of specific wastes. During the 1930s significant advances were made in determining the effect of organic trade wastes on biochemical oxygen demand. Although researchers recognized toxic properties of some industrial by-products and acknowledged their threat to public health, organic substances discharged from food processing operations remained research priorities.(22) Manufacturers were encouraged to store inorganic wastes in settling ponds or holding tanks. Tests of biological purification methods and neutralization of phenols were conducted, but implementation of viable techniques was limited.(23)

The use of settling tanks and land disposal methods for liquid wastes prompted some concern about groundwater contamination. Textbooks cautioned against locating a well too close to pollution sources, but one reported an experimental method to "cleanse" polluted water by filtering it through depleted aquifers. It claimed the practice would recharge the water-bearing strata, in addition to purifying the contaminated water.(24) Whether it was put to use in the Calumet area is unknown, but doubtful.

Disposal in the Calumet Area

The opening of the sewage treatment plant and the diversion of the Little Calumet did not completely solve the industrial waste problem in the Calumet Region. Few industries were connected to the treatment plant; in fact only fourteen of 123 factories investigated in 1925 discharged industrial sewage to a treatment facility.(25) Because most waste producers along the lower reaches of the Calumet River had no access to the MSD treatment facility, their wastes went directly into the river and periodically into Lake Michigan. The sluggish currents allowed solids to settle in the stream bed forcing frequent dredging by the Army Engineers.(26) Sludge deposits from Indiana manufacturers formed a hydrologic barrier in the Grand Calumet and caused the current to reverse its direction, This allowed industrial sewage to reach Lake Michigan through the Indiana Harbor Ship Canal.(27)

After a decade of concentrating on the biological wastes of the meat-packing companies, the Sanitary District decided to expand their investigations to other industrial wastes in the 1920s. Hoping to identify the main producers and determine the effect of various waste streams, they conducted a survey in 1924 and 1925. The report identified 123 firms that discharged wastes to area waterbodies and listed the types of effluent. It estimated that over 5,000,000 gallons of oil refinery wastes and 2,400,000 gallons of coke production wastes were produced in the area annually.(28) Much of the volume could be accounted for by non-contact cooling water; however discharges included phenols, cyanide, spent pickling liquors, paraffin, oil, suspended iron fines, and other process wastes.

The MSD also scrutinized the effects of industrial wastes on their sewage treatment plants. A 1927 study, conducted in cooperation with Sherwin-Williams, concluded that the paint manufacturer's wastes had "an inhibiting effect on the sewage treatment of the Calumet Sewage works."(29) To reduce the interference, Sherwin-Williams tried to neutralize their sulphuric acid wastes, and later they attempted to precipitate copper from their

effluent.(30) One corrective measure taken after consultation with the MSD was the construction of a holding tank at the Sherwin-Williams plant. It was designed to allow an even discharge of wastes rather than bulk flushings. By releasing a steady flow of wastes, the Sherwin-Williams effluent would be diluted sufficiently and not interfere with operation of the treatment facility.(31)

Not all industries consented to effluent monitoring. Although the Sanitary District argued the purpose of measuring discharges was to protect municipal water supplies and insure efficient operation of their treatment plants, industries suspected the MSD wanted to enforce changes in manufacturing processes.(32) Consequently, there was little cooperation with the Sanitary District.

The Illinois Legislature amended the Enabling Act in 1927 giving the Sanitary District authority "to control and regulate the discharge of industrial wastes."(33) This measure led to some modifications in disposal methods. A 1930 report concluded "Industrial plants in Illinois are eliminating the wastes voluntarily, but Indiana's disposal of sanitary sewage in the lake is far from solution."(34) Effluents to the Calumet River were reduced by the construction of holding tanks or storage ponds at Interlake Iron, Wisconsin Steel and Youngstown Sheet and Tube. Wastes still entered Lake Michigan, but the volume was reduced and discharges could be curtailed when the river flowed toward the lake.(35) Indiana legislators took action too, but their effort had little impact on the Calumet area. Indiana statutes restricted industrial discharges into streams and lakes; however they exempted the Gary, Whiting, and Hammond areas.(36) So despite progress in Illinois, Indiana sources continued to contribute to the pollution of Lake Michigan.

Perhaps the most important factor in the decreasing volume of wastes during the 1930s was the economic depression. The Sanitary District continued its investigations of industrial wastes but reported low quantities in 1932 and found no hazardous levels in 1935.(37) As production tapered off, so did investigations, but new laws were enacted to assist the MSD as the economic recovery began. Legislation passed in 1935 gave the Sanitary District power to levy a surcharge against industries that discharged more than 10,000 gallons of waste a day into the sewer system.(38) To enforce their new powers, a special Industrial Waste Section was created to analyze industrial discharges. In 1936 they monitored ammonia-still liquor from the steel mills along the Calumet River, the pickling wastes from Illinois Steel, and Pullman and Sherwin-Williams' liquid wastes.(39) Throughout Chicago, the special force carried out a total of 250 investigations between 1935 and 1940; unfortunately no detailed records of these inquiries survive.(40)

Throughout the 1920s and 1930s, the Army Engineers periodically dredged the navigable channel of the Calumet and transferred the spoil to Lake Michigan. Recognizing the potential threat this practice posed to potable water, the U.S. Government delineated an authorized dumping ground twelve miles offshore and nine miles from the nearest water intake (Fig. 3-1). The amount of dredge material transported to this dump varied from year to year ,depending on the status of new projects. Between 1921 and 1940, $2.3 million was spent on maintenance dredging and only $1.6 on new work (Table 3-1). The peak expenditure was in 1938 when 500,000 cubic yards of bottom sediment were removed from the Calumet River and Harbor.(41) Additional quantities were

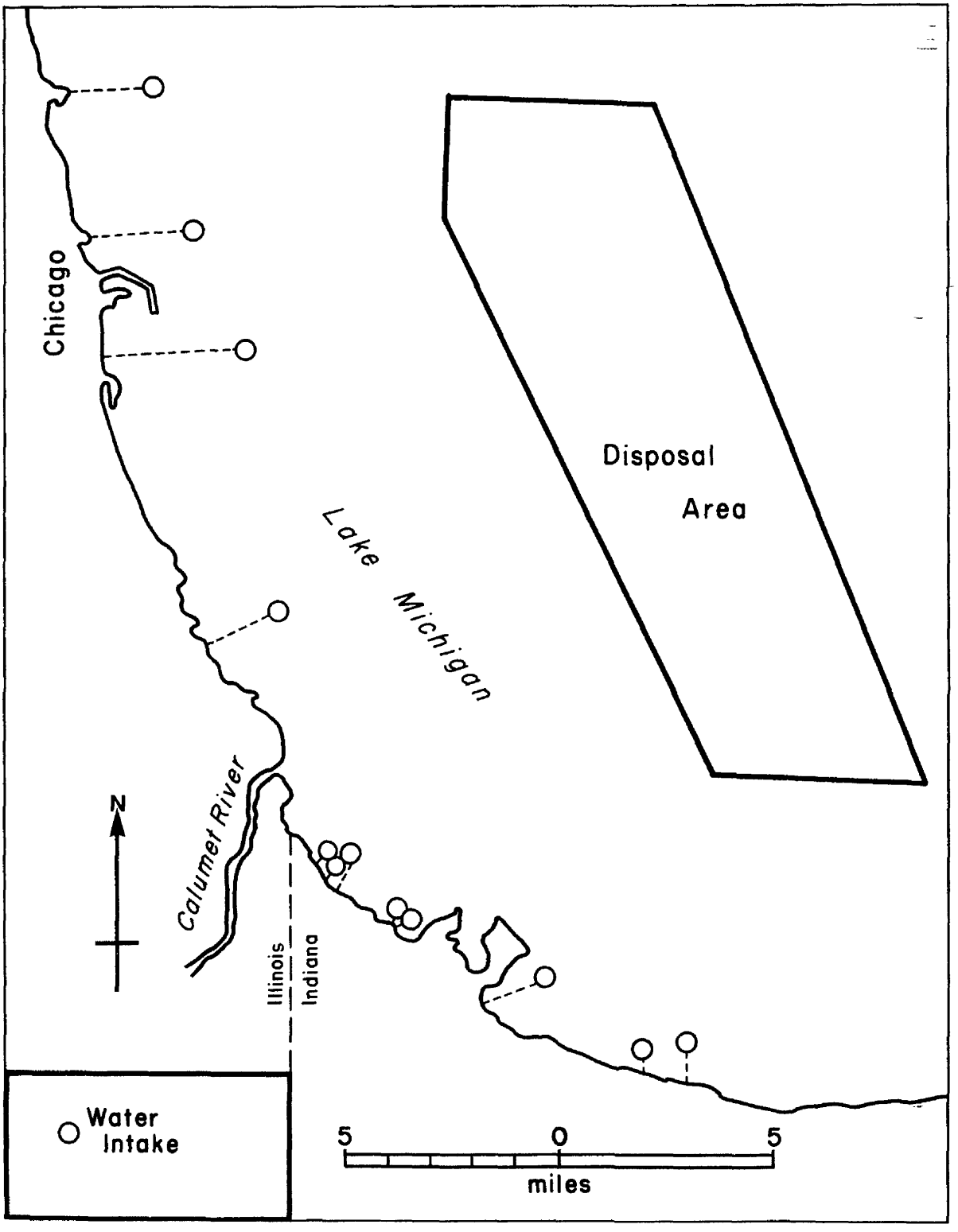


Figure 3-1: Offshore Disposal Area used between 1924 and 1967.
Source: U.S. Army Corps of Engineers. Dredging and Water Quality, Fig. M1-2.

Table 3-1: EXPENDITURES ON CALUMET HARBOR DREDGING ($)

Year	New	Maintenance
1921	52,433	187,878
1922	172,552	102,720
1923		123,191
1924		190,155
1925		84,487
1926		88,512
1927		94,325
1928		47,909
1929		46,015
1930		2,343
1931		396,478
1932		12,874
1933		62,276
1934		
1935		
1936	1,167,430	81,803
1937	100,581	490,763
1938	91,621	271,183
1939		16,213
1940		3,633
Total	$1,584,617	2,302,758

Source: U.S. Army, Annual Report: Chief of Engineers

delivered to the Lake Michigan dumping ground from Indiana Harbor.

When the Engineers began work on the turning basin at the south end of Lake Calumet, dredge spoil was pumped behind a slag dike to create land for dock facilities.(42) Thus, the overall impact of the Army Engineers was to continue their transfer of solid wastes from the river to the lake, and they continued land-building along the river with dredge spoil.

Topographic maps and aerial photographs provide evidence of other areas of industrial dumping. Although steel mills sold some slag for use in cement, fertilizers, and other purposes, not all found a ready market. What was not sold was trucked to the marshes and dumped. An area of slag deposit extended into the marsh south of 95th Street near Torrence (Fig. 3-2).(43) The buildup there was sufficient for eventual residential use of the property. Several narrow peninsulas of waste material appear on 1938 aerial photographs in the marsh west of Torrence Boulevard. Other areas of disturbed land appeared along the Little Calumet.

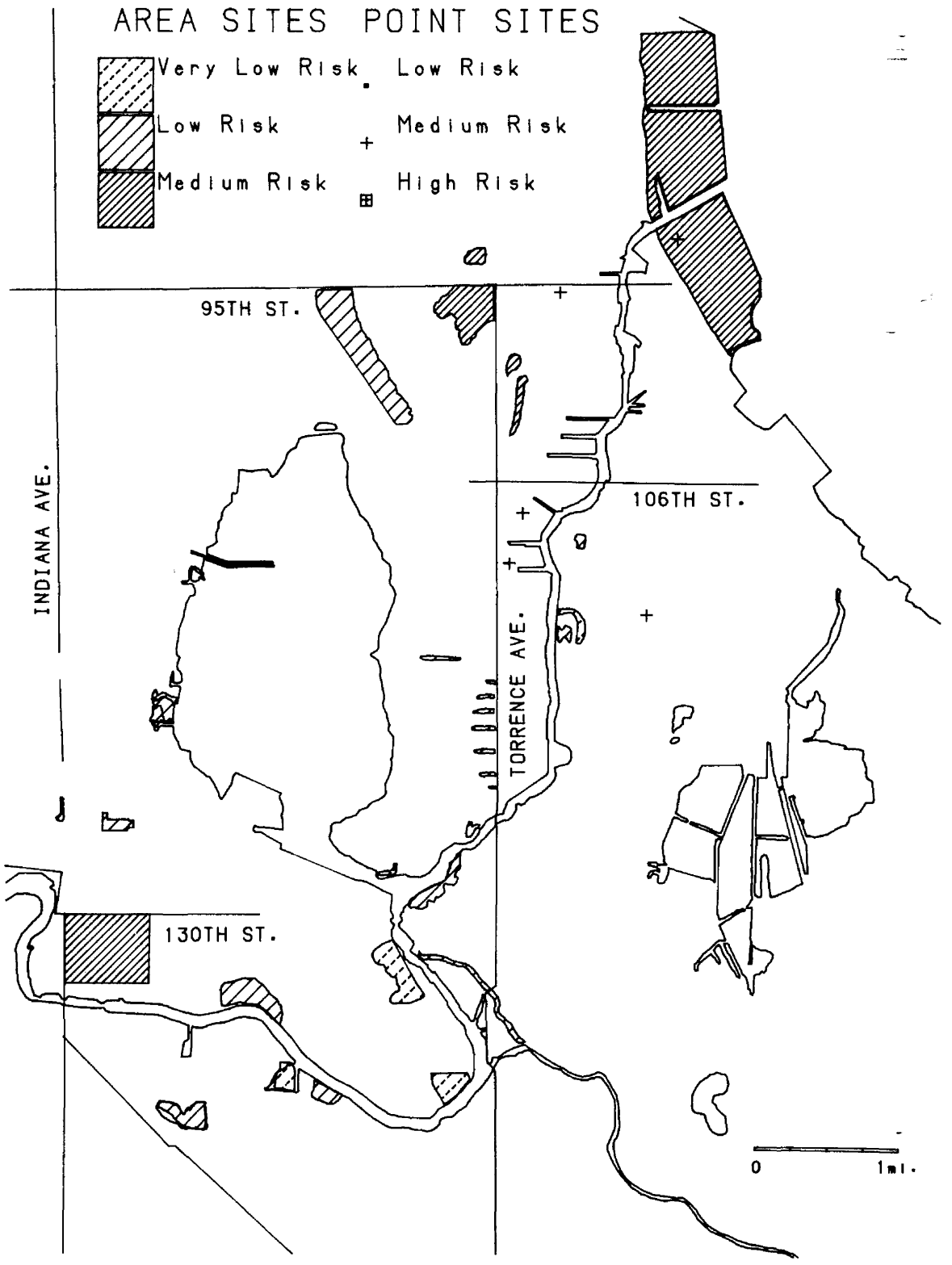
Slag deposits are generally alkaline and stable; however the addition of foreign substances can make them hazardous. Quenching liquids poured over the slag can leach into groundwater and carry dissolved material with it. It was also a common practice to dump acid sludge, tars, and oils into hot slag for incineration. If completely burned, however, these substances could leach into the groundwater, and the acids could weaken foundations of buildings constructed on top of slag fills.(44) In addition, slags contain heavy metals, which have been found in high concentrations around industrial sites in the Calumet area.(45)

Waste Generation Levels

The iron and steel industry continued to be the largest producer of industrial wastes during this second period. Twenty-five manufacturers in the Illinois portion of the Calumet region produced iron and steel products (Fig. 3-3). Eight of these produced either pig iron or steel. These firms were concentrated along the lower course of the Calumet River and received the bulk of their raw material by lake freighter. Although some irregular shipments arrived by rail during the winter, the waterborne commerce statistics probably provide an accurate gauge of steel production in the area.

The average receipts of ore for the four years shown in Table 3-2 indicate that about six million tons of ore arrived annually. The lingering effects of the depression are indicated by the low total in 1935, but imports rose steadily thereafter. Estimates of iron and steel industry wastes are also shown on Table 3-2.(46) Although tentative, these figures provide insight into the relative volume of wastes. The phenols, cyanide, and suspended solids were primarily outputs of the furnaces producing pig iron. Rolling mills were responsible for producing lube oil wastes and the sulphuric acid and $FeSO_4$ derived from the pickling processes. Most of these wastes were discharged into the Calumet River in a diluted form and contributed to the phenol tastes in Chicago's drinking water.

A detailed examination of industrial outfalls by the Sanitary District confirms the large volume of waste. Crouhurst's report tallied waste in gallons per day, and his totals cannot be compared accurately to the preceding



PRE-1940 WASTE DISPOSAL SITES

Figure 3-2: Disposal sites used prior to 1940. Risk designators refer to health hazards presently posed by former disposal sites. The ranking system considers length of existence, type of material discarded, soil permeability, and distance to residential areas. See Appendix for explanation of shading.
Source: Compiled from miscellaneous maps, reports, and aerial photographs.

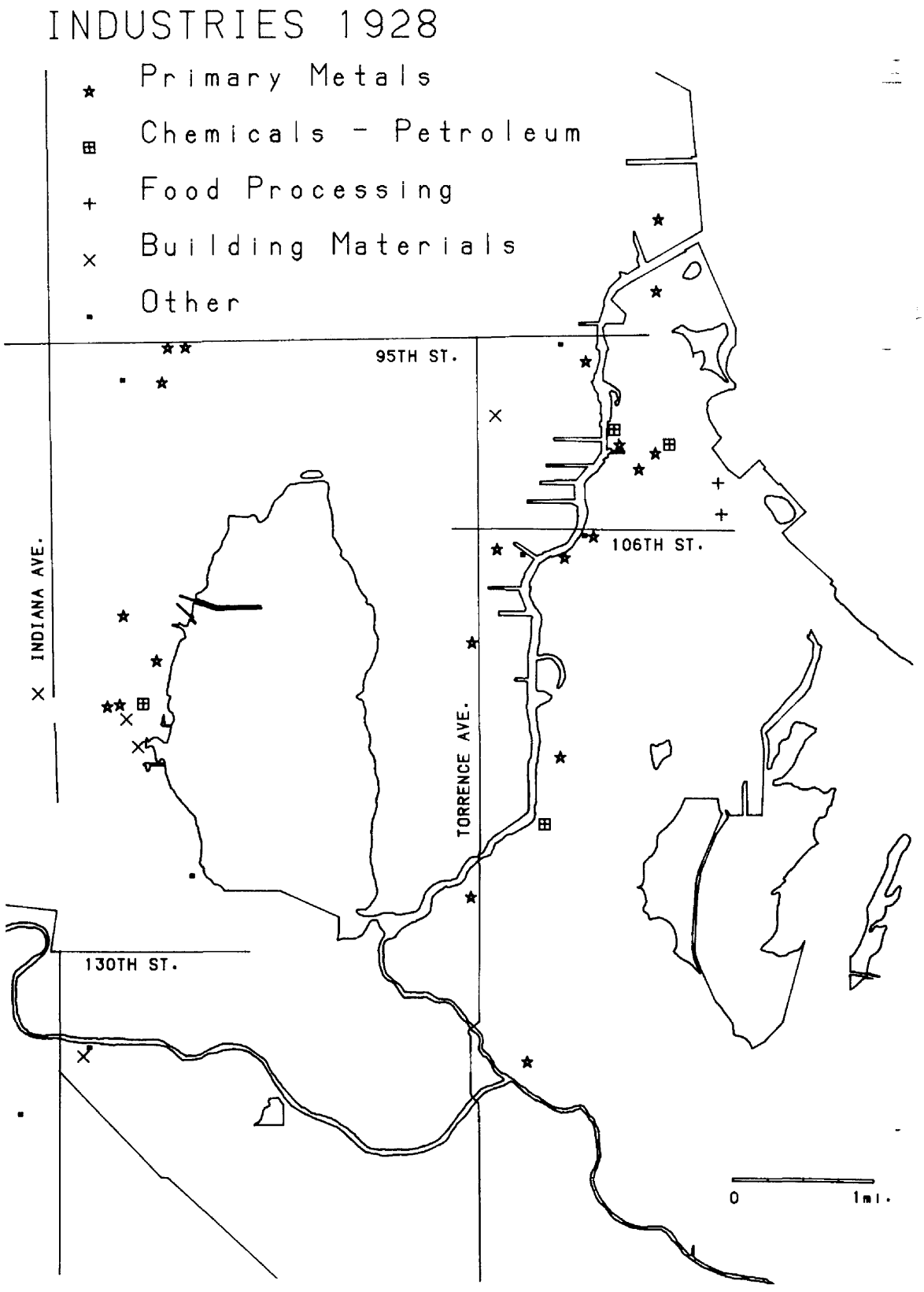


Figure 3-3: The seemingly small numbers of industries belies the level of industrial activity in the Calumet area. Many factories required extensive land holdings and most engaged in multiple operations. Source: Directory of Illinois Manufacturers, 1928.

Table 3-2: ESTIMATES OF IRON AND STEEL WASTES PRODUCTION. 1925-1940

Year	Tns Ore Received	Ingot Tns/Yr	Suspended Solids (1000 lb/yr)	Phenols (lbs/yr)	Cyanide (lbs/yr)	Lube Oils (lbs/yr)	H2SO4 (lbs/yr)	FeSO4 (lbs/yr)
1925	7,387,755	3,950,671	418,771	272,596	114,569	12,168,067	11,970,534	44,642,584
1930	6,871,660	3,674,684	389,517	253,553	106,566	11,318,028	11,134,294	41,523,935
1935	3,392,503	1,814,173	192,302	125,178	52,611	5,587,652	5,496,943	20,500,152
1940	7,393,717	3,953,859	419,109	272,816	114,662	12,177,887	11,980,194	44,678,611
Ave.	6,261,409	3,348,347	354,925	231,036	97,102	10,312,909	10,145,491	37,836,320

Source: Corps of Engineers, Waterborne Commerce.

Multipliers: Suspended Solids 103, Phenols, .069, Cyanides .029, Lube Oils 3.08
H2SO4 3.03, FeSO4 11.3.

After: USDI, Cost of Clean Water, 1967, p. 55.

estimates. But they do record significant volumes and verify the nature of the waste streams (Table 3-3).(47) The furnaces of Illinois Steel, Youngstown Sheet and Tube, and Inland Steel contributed the largest amount of waste liquids, which contained phenols, cyanide, and suspended solids. Commonwealth-Edison's large volume was principally cooling water and contained few if any contaminants.

In addition to liquid wastes, significant quantities of solid wastes were produced (Table 3-4).(48) These estimates are based on the number of employees at each factory, and they provide a gauge to the contribution of each type of industry. As expected, the largest volume comes from the blast furnaces, foundries, and rolling mills--SIC 33--and the bulk of it would be slag. Other important solid waste streams would emanate from the transportation equipment manufacturers--SIC 37. Included in this category would be the railroad car builders, ship manufacturers, and automobile assembly plants. The next largest stream was produced by the chemical companies--SIC 28. In the Calumet Region arsenic pesticides, lead-based paints, and acids for pickling purposes constituted the main products of the chemical industries.

The preceding tables reflect the difficulties of determining exact past waste production levels. Calculating volumes from distinct and incompatable sources creates a collection of numbers that are neither comparable nor particularly precise. Nevertheless, each estimate confirms the general composition of waste streams and suggests that the volume was substantial.

Human Exposure

To appreciate the extent of human exposure to industrial wastes, a discussion of the residential history of the Calumet area is necessary. Millgate communities clustered just beyond the gates of the industrial concentrations from the earliest years of manufacturing activity. There appears to have been little overlap of land use for industrial and residential purposes through the years, and hence little danger that homes now stand atop former factory sites (Fig. 3-4). However, there have been housing developments built over former dumping grounds, which makes exposure to industrial wastes possible in the domestic environment. However, the most extensive exposure came in the work place. This section discusses how humans may have come in contact with potentially hazardous substances in the period from initial development until 1940.

The same entrepreneurs who were selling industrial sites were also engaged in residential development in the Calumet area. Because they deemed riverside locations optimal manufacturing sites, such areas were never considered for residential use. Neighborhood development began with a renewed effort to promote South Chicago in 1869,(49) and the subsequent platting of East Side in 1873.(50) These two neighborhoods provided workers with easy access to their places of employment, and neighborhood growth paralleled the expansion of the steel mills. The sudden blossoming of houses and shops during the 1870s amazed observers, but the pace slowed and steady growth continued through the first decade of the twentieth century. A survey of houses in Chicago neighborhoods shows a period of active construction between 1885 and 1930.(51) New houses were needed to accommodate European laborers recruited by manufacturers. The number of residents in the communities in East Side and Irondale (South Deering-Fig. 3-5) increased from 11,000 in 1910

Table 3-3: SELECTED LIQUID INDUSTRIAL WASTES

Company	Wastes	Gal/Day
Illinois Steel	cooling water, gas wash, hydraulic fluids	223,350,000
Youngstown Sheet and Tube	cooling water, pig machining water, gas wash	32,727,000
American Maize Products	wash water	1,500,000
Standard Oil Co. (Whiting, Ind.)	steam still, coke plant waste cooling water	65,000,000
Inland Steel	gas wash, coke plant waste, cooling water	135,000,000
Youngstown Sheet and Tube	coke plant waste, gas wash, cooling water	64,000,000
Commonwealth Edison	cooling water	288,000,000
By-Product Coke	still wastes, NH_3	12,000,000
Interstate Iron and Steel	cooling water	7,000,000
United Chemical & Organics	osine water, grease, sludge	500,000

Source: Crouhurst, 1926, Table 7.

Table 3-4: ESTIMATES OF SOLID WASTE PRODUCTION, 1928

SIC	Industry	Tns/Yr	SIC	Industry	Tns/Yr
20	Food Products	1,205	30	Rubber & Plastic Products	20
23	Apparel	5,949	32	Stone, Clay & Glass	3,519
24	Lumber & Wood Products	3,850	33	Primary Metals	560,378
27	Printing & Publishing	18	34	Fabricated Metal Products	4,794
28	Chemical & Allied Products	6,201	35	Machinery	21
29	Petroleum & Coal Products	612	37	Transportation Equipment	10,298
Total		17,835			579,030

Source: Number of Employees found in Chicago Business Directory, 1929.

Tons/year = # employess x w
w determined by Weston, 1974, pp. 89-B13.
Multiplier was calculated for each SIC grouping based on average technology used in the early 1970s.

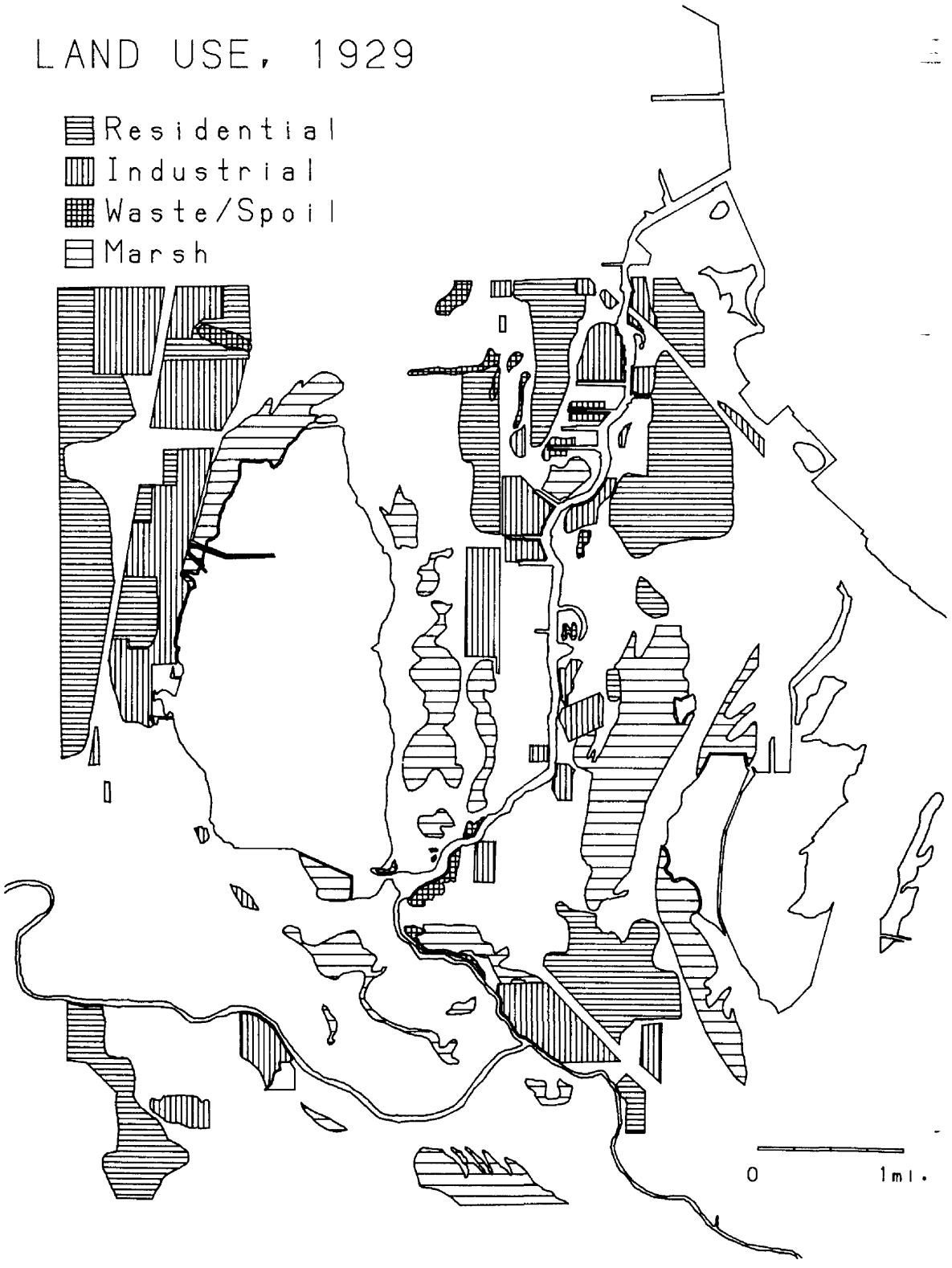


Figure 3-4: Source: U.S. Geological Service, Calumet Quadrangle, 1901 and Lake Calumet Quadrangle, 1929

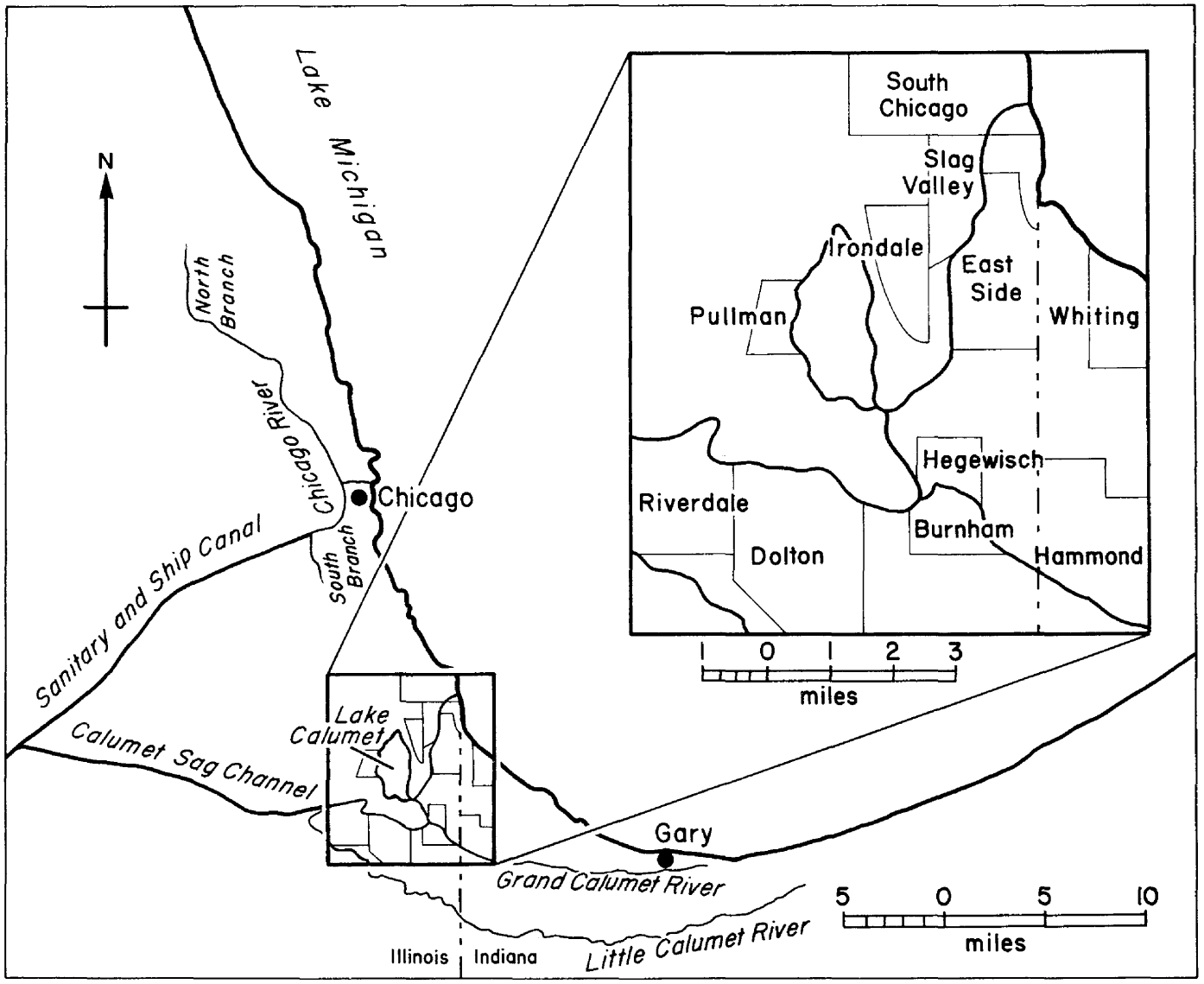


Figure 3-5: Calumet Area Neighborhoods

to over 24,000 in 1930.(52) In East Side a large share of the immigrants were Polish, while recruiters lured Italians, Serbians, and Croatians to Irondale before World War I. After the outbreak of war, Mexicans were added to the ethnic mixture in Irondale.(53)

Both East Side and South Chicago were constructed on dry ground and needed little if any filling before 1930. Scavengers operating in the neighborhood may have done some filling. At least two were active in the area east of the Calumet River during this time, and presumably they disposed of wastes in low lying areas (Fig. 3-2). Charles Brown's name appears in the Polk Business Directory in 1901 and again in 1913, but disappeared by 1929.(54) His business address was at a site south of the residential cluster at the marsh's edge. Another scavenger advertised in the Daily Calumet during the late 1880s.(55) He listed a home address just west of the Calumet River. Exactly what these men collected and where it was disposed is unknown, but they most likely gathered domestic trash and discarded it in the marsh. Their dumps probably did not constitute a major health hazard.

Irondale residents lived close to industrial wastes throughout the history of the community (Fig.'s 3-4 and 3-5). The Wisconsin Steel slag bank at Muskegon and 100th began receiving wastes in 1908 and eventually endowed the neighborhood with the nickname "Slag Valley."(56) Industrial by-products were spread on the Lake Calumet plain south of 95th street and west of Torrence Avenue. This area developed as a residential neighborhood after 1935. One of the chief additions was the construction of Trumbull Park Houses, a public housing project, in 1938.(57) It was constructed atop a sand fill and not above slag.(58)

Two planned industrial communities attracted other population concentrations. Pullman, built in the early 1880s, declined in population after the strike in 1894 and continued to drop during the 1900s. Achilles Hegewisch platted the town that bore his name in 1882 and constructed housing for 1,500 workers.(59) Although envisioned as a rival to Pullman, it never challenged its rival in notoriety but did house more residents by 1930--7,800 to Pullman's 6,700.(60) Hegewisch was built on the sandy beach ridges and not a former disposal site. The foundation for Pullman is dredge spoil from Lake Calumet, which was relatively pristine in 1880, so there is no reason to suspect the fill is contaminated with hazardous substances.

The potential for migration of leachate is greatest through sandy soils, and two of the residential areas in the Calumet are built on top of such soils. Both East Side and Hegewisch are adjacent to industrial complexes, where it was common practice to dispose of wastes on site. Leachate from quenching liquids, slag, or other wastes incompletely incinerated in the slag could have moved significant distances since 1900. Fortunately, because of the geography of the area, movement most likely would be towards the rivers and not towards residential areas.

Area residents faced the greatest hazards at the work place. Before 1900 employers provided few safety devices, and accidents frequently resulted from "hurry up" tactics used by management to raise production. Hazardous substances included ore dust which could cause silicosis, and grease-coated steel bars, which could cause skin diseases.(61) Employees organized safety committees to lessen work hazards, and the state formed a Factory Inspection

Commission responsible for reducing the number of child workers and eliminating unsafe work conditions. One of the hazards that came under scrutiny during the 1930s was lead. Numerous studies were conducted to determine the nature of problems associated with lead and how to control them. These investigations led to the institution of numerous safety procedures for the work place, although they did not consider the hazards lead posed beyond the factory's margins.

Conclusions

The main thrust of waste management during the period from 1922 until 1940 was to ameliorate the effects of waste disposal. The Chicago Sanitary District opened the Cal-Sag Channel to divert industrial and municipal sewage away from the potable water supply. They conducted studies of industrial waste production and urged manufacturers to provide primary treatment or to control discharges in order to reduce peak demands on their system. Legislation gave the Sanitary District power to restrict discharges into its system and also to levy a surcharge on industrial users. All these measures contributed to a reduction in the threat to drinking water supplies.

After a decade of prosperity, American industry fell into deep depression, and the drop in industrial production during the early thirties made an even greater dent in the level of waste production. Although the urgency of pollution control disappeared during this period, some safeguards were enacted. Encouraged by federal incentives and local ordinances, industries in the Calumet area installed treatment facilities during the thirties. The use of offshore disposal sites for dredge spoil also added a degree of protection to area residents. Together, these factors mitigated the industrial waste threat; however by 1940, production levels were approaching pre-depression levels and the spectre was to return. Area residents, surrounded by factories, polluted waterways, and waste disposal grounds, faced exposure to hazardous substances daily. The greatest exposure came at the workplace, although reformers began addressing these hazards during the 1930s.

Notes--Chapter 3

1. Chicago Metropolitan Sanitary District, Annual Report, 1909, pp. 376-7. This system was intended to handle domestic sewage rather than industrial effluents.

2. This amount was only half their original request. See, Cain, "Unfouling the Public's Nest," 1974, p. 600.

3. Cain, Sanitation Strategy, 1978, p. 100.

4. Ibid, p. 101.

5. Ibid.

6. Chicago Metropolitan Sanitary District, Annual Report, 1921.

7. Chicago Metropolitan Sanitary District, Annual Report 1927, p. 1985.

8. A complete description of the system is contained in Metropolitan Sanitary District, Proceedings of the Board of Trustees of the Sanitary District, 1922, p. 610-88.

9. Ibid, p. 357.

10. Thau, "Fields for Investigating Waste Elimination," 1920, pp. 1155-57; Hall, "Reclaiming Steel Works and Industrial Wastes," 1919, pp. 326-27; and Howe, "Common Wastes of Industrial Materials," 1919, pp. 303-7.

11. The many uses of slag are discussed in Guren, "Blast Furnace Slag," 1921, pp. 273-5. Production of Portland cement from slag in the Calumet Region began as early as 1903. See, Federal Writer's Project, Calumet Region, 1939, pp. 91-2.

12. Illinois Steel Company, "Universal Portland Cement," 1905.

13. Besselievre, "Getting Rid of Industrial Wastes," 1931, p. 21.

14. Besselievre, "Disposal of Indusrial Chemicals," 1931, p. 516.

15. Ibid.

16. Haynes, American Chemical Industry, V. 3, 1945, p. 114.

17. Besselievre, footnote 14.

18. Ash is porous and contains toxic substances. These qualities make it a poor landfill cover. Roy, Coal Fly Ash, 1981, p. 38.

19. Gibbons, "Elimination of Tastes and Odors," 1932; and Baylis, "Effect of Certain Industrial Wastes," 1933.

20. "National Industrial Recovery Act," 1933, p. 495.

21. Haynes, footnote 16, p. 113.

22. Baylis, footnote 19, pp. 522-4; and Warwick, "Relative Importance of Industrial Wastes," 1933.

23. Gluud, International Handbook, 1932, p. 653.

24. Toulman, Groundwater, 1937, p. 185.

25. Crouhurst, Report of Investigation, 1926, p. 10. This study included Indiana industries as well as Illinois firms, hence the large number.

26. In 1926 they requested that the MSD pay for a share of dredging expenses. See, Proceedings, footnote 8, 1926, p. 277.

27. Crouhurst, footnote 25, p. 5.

28. Ibid, p. 21.

29. Metropolitan Sanitary District, footnote 1, 1927, p. 63.

30. Ibid, 1930, p. 54-5.

31. Ibid.

32. Ibid, p. 60.

33. Ibid, p. 59.

34. Steadman, Public Health, 1930, p. 194.

35. Gorman, "Survey of Sources," 1933, pp. 519-20.

36. Steadman, footnote 34, p. 96.

37. Metropolitan Sanitary District, footnote 1, 1932 and 1935.

38. Hurwitz, "Industrial Waste Problem," 1956, p. 553.

39. Metropolitan Sanitary District, footnote 1, 1937, pp. 50-51.

40. Hurwitz, footnote 38, p. 553. Repeated efforts by Sanitary District personnel failed to locate the detailed reports compiled by the Industrial Waste Investigations staff.

41. Ibid, 1938, p. 1518.

42. U.S. Army, Corps of Engineeers, Chicago District, Calumet File, Permit 20, September 1937.

43. The site rating scheme employed in Fig. 3-2 is explained in the Appendix. Aerial photographs, U.S.D.A., Soil Conservation Service, Cook County, 1938-39.

44. Although no mention has been found of this practice in the Calumet area, it was reportedly a common one. In addition, other wastes could have been handled in a similar manner. See Ruldofs, Industrial Waste Disposal, 1953, p. 374.

45. The Illinois EPA found higher than normal concentrations of heavy metals near sites with lengthy industrial histories. See, Illinois EPA, Southeast Chicago, 1984, pp. 57-62.

46. The ratio for ore to iron for the Illinois-Indiana steel-producing area was 1.87 tons of ore to 1 ton of iron. Hartshorne, "Location Factors," 1928, p. 243. Multipliers were obtained from U.S. Department of Interior, Cost of Clean Water, V. 3, 1967, p. 55.

47. Crouhurst, footnote 25, Table 7. This table includes non-contact cooling water which accounts for a large share of the total.

48. The number of employees were found in Directory of Illinois Manufacturers, 1928, pp. 235-555. Estimates of waste were then calculated using multipliers supplied by Weston, Solid Waste Management, 1974, pp. B9-B13. It should be noted that there are inherent weaknesses in this method. The multipliers were developed for post-World War II industrial processes which utilized high-speed techniques and produced larger volumes of waste. Also, labor intensive methods used in the 1920s would have required a larger number of workers per product output. Together these factors would tend to produce over-estimates.

49. Drury, "South Chicago," 1949, p. 16.

50. Drury, "Eastside," 1950, p. 14.

51. Statistics revealing the number of houses built before 1940 appear in Chicago Planning Commission, Housing in Chicago Communities, 1940.

52. Ibid.

53. Kornblum, Blue Collar Community, 1974, p. 12.

54. Polk's Directory of Chicago, 1901, 1913, and 1929.

55. Daily Calumet, 18 July 1887.

56. Bulanda, "South Deering," in Kijewski, 1973, pp. 65-6.

57. Bowly, Poorhouse, 1978, p. 24.

58. Personal communication with Jim Wesley, January 1985.

59. Federal Writer's Project, Hegewisch Folder, Illinois Historical Society Library, Springfield, Ill.

60. Chicago Plan Commission, footnote 51.

61. Pacyga, "Villages of Packinghouses," 1981, p. 42. See also Bate, "Development of Iron and Steel," 1948, p. 147.

CHAPTER IV -- RISE OF THE LANDFILL, 1940-1970

Introduction

The opening of a municipal sanitary landfill in the north end of Lake Calumet ushered in a new era of waste disposal. Beginning with proclamations that landfills were the most efficient and sensible means for disposing of city refuse, the period from 1940 to 1970 witnessed a transfer from water disposal to land disposal of industrial wastes.

First among the changes was a shift in the course of waste disposal research. Stimulated by federal subsidies, scientists focused on treatment as a solution to waste problems. However industry saw treatment as an burdensome expense, not as a responsibility, and scientific progress received little practical application. Significant progress was made only after public pressure in the late 1960s set legislators to work drafting stringent environmental laws. The more exacting statutes forced industries to reduce their emissions into stream courses, and consequently to increase their land interment of wastes. This situation was compounded by the introduction of land disposal of spoil by the Corps of Engineers, who set aside several designated spoil dumps in the Calumet area. In addition to these legal disposal sites, there arose a new breed of outlaw waste disposers. Manufacturers entrusted their waste to seemingly reputable companies and then wiped their hands clean of their residue. In the more remote sections of the Calumet area, however, irresponsible dumping created several cesspools of hazardous wastes.

The situation in the Calumet area since World War II has also been affected by production technology. High-speed techniques increased the volume of wastes, while products such as DDT spawned a new generation of hydrocarbon wastes. These facts, in conjunction with continued high levels of production, yielded substantial quantities of industrial wastes. Public officials were not blind to the industrial waste issue, even if legislative action came fairly late. Both the Corps of Engineers and the Metropolitan Sanitary District pressed industries to clean up, although neither had much success before 1970. This chapter reviews the technological, legal, and geographical dimensions of waste disposal in the Calumet area from 1940 to 1970.

Industrial Waste Research

Federal authorities entered the field of industrial pollution control in 1948 with the passage of the Water Pollution Control Act. The legislation delegated legislative and enforcement responsibilities to state and municipal bodies, while the federal government promoted research.(1) The goals of the Industrial Waste Section of the U.S. Public Health Service reveal the pioneering stage of inquiry. The agency sought to 1) review the available literature and collect data pertaining to waste characteristics and 2) conduct field investigations at specific industrial plants.(2)

The federal government also made loans available for construction of sewage treatment facilities.(3) More than $22 million was allocated annually for projects throughout the nation. The emphasis of the program was to treat municipal wastes, and local governments encouraged industry to tie into their new systems. The combination of domestic and industrial sewage caused

problems at treatment works. In Chicago the main issue was:

> to handle all industrial wastes at the sewage treatment works along with human sewage, but at our Southwest Treatment Works we sometimes wonder if we are not operating an industrial treatment plant five days per week and a sewage treatment works on Saturday and Sunday.(4)

In spite of all efforts, water quality continued to deteriorate and researchers claimed more effective treatment was necessary because 1) industrial and municipal water sources were decreasing in quality, 2) recreational and aesthetic values of water resources were declining, and 3) wastes were overloading municipal treatment works.(5) To counter these trends, researchers sought methods to prevent system overloads, to reclaim usable by-products, and to prevent accidental spills. There was little attention given to reducing the volume of wastes, and industry continued to proclaim the most effective means of controlling waste was the least expensive.(6)

Advances in treatment methods during the 1950s were little more than refinements of old technologies. Rudofs listed the basic treatment methods as 1) separation of solids from liquids, 2) oxidation of organic materials, 3) neutralization of acidic or akaline wastes, 4) removal of poisonous substances, and 5) land disposal of residues.(7) While he urged implementation of pollution control methods, Rudofs lamented that such procedures were ignored all too frequently.(8)

Sanitary landfills became the favored method for disposal of solid wastes after 1945. Wastes that were covered and compacted daily posed fewer health hazards than open dumps or water disposal, and many municipalities adopted the sanitary methods.(9) In addition, low quality land could be reclaimed for industrial or recreational use at a minimal cost. Landfills, however, had their critics. They argued that fills continued to settle for up to thirty years and that they were unsuitable for residential use. Gases emanating from the decomposing wastes, such as carbon dioxide and methane, could migrate into basements and cause explosions. Still, authorities felt the problems were controllable,(10) and landfills received a huge share of municipal and industrial waste.

Research on land disposal, however, was piecemeal, and the dangers of ground-water pollution and methane escape, while recognized, were poorly understood. Pressure from city officials and reports from professional societies eventually prompted the passage of the Solid Waste Disposal Act in 1965.(11) Much like the Water Pollution Act of 1948, this bill encouraged research but offered no regulatory guidelines for management of solid wastes.(12) One outcome of the act was that the U.S. Department of Health sponsored an assessment of the solid waste problem in the country. The principal investigators concluded that:

> It is significant that the national survey can provide little information about industrial solid wastes. This lack of information indicates local government's reluctance to regulate or assist in the management of these wastes...a responsibility that is rightfully theirs. Too long industry has been left to fend for itself

in solid waste management. The absence of uniform regulations and control has left industry with no option but to seek the easiest and cheapest method of management.(13)

Their remarks of frustration reveal two stark facts. Little information existed on waste disposal practices, and without such information, an accurate assessment was impossible. Second, there was no uniform control, and industries continued to employ unsophisticated methods of disposal.

In Chicago, research on industrial wastes continued under the direction of the Metropolitan Sanitary District. Between 1940 and 1955 a total of 453 investigations were carried out.(14) These investigations sought to determine what effect industrial wastes were having on the sewage treatment facilities. The Sanitary District apparently felt their plants could handle industrial wastes for they encouraged manufacturers to link into their system, but they also promoted on-site treatment.(15)

Ordinances Affecting Industrial Waste Disposal

Legislation in the 1940s and 1950s not only promoted research, but provided regulations as well. Both Illinois and the Metropolitan Sanitary District enacted statutes to regulate industrial wastes by the late 1940s. These statutes were similar and prohibited waste disposal in state and Sanitary District waters, although they provided exemptions.(16) The state law limited manufacturers to a total of 3.65 million gallons of waste emission a year. The Sanitary District's ordinance had a similar provision and levied a moderate fine for excessive discharges. For every million gallons of liquid wastes over the limit, a manufacturer was required to pay $8.03 and for every ton of suspended solids, $8.07.(17) The statute also prohibited the discharge of objects that would obstruct the flow through the sewers and outlawed specific substances from sewers. Included on this list were grease, hides, hair, gas tar, fuel oil, cyanides, mineral acids, and waste acid liquors. The intent was to prevent burdening the sewage treatment plants, which were receiving greater and greater quantities of industrial waste.

The Federal Water Pollution Control Act of 1948, while directing most of its resources toward research, included some enforcement provisions. It gave the Surgeon General power to recommend remedial action against known polluters. If his suggestions were not heeded within a reasonable length of time, a public hearing would be called, after which the Attorney General would be free to prosecute the offender. The statute did not prescribe discharge limits nor did it fund monitoring efforts. These weaknesses caused it to remain, effectively, an advisory measure.(18)

The Sanitary Water Board Act of 1929 which prohibited water pollution was revised in 1951. The new act mandated that "no waste [is to] be discharged into any waters of the state without first being given..treatment necessary to prevent the pollution of such waters..."(19) Although the law's definition of "waste" included industrial effluents, it made provisions for limited discharges by "permitted" disposers (Sec. 145.10). Furthermore, violators convicted of polluting would be sentenced to pay a fine of $500, plus $100 per day as long as they continued their offense. If pollutants destroyed aquatic life, the producer of the toxic material would be held liable for restocking

the waterbody. While these statutes were improvements over earlier efforts, they lacked a rigorous definition of waste and failed to impose stringent penalities.

In 1962, the Sanitary District again tried to improve the Industrial Waste Ordinance. This version required permits to connect industrial sewers to the Sanitary District's system. It also listed specific wastes that were prohibited, such as water with more than 100 ppm fats, oils or grease; flamable liquids or solids; wastes with a pH below 4.5 or greater than 10.0; water containing toxic substances or radioactive wastes; and material with a temperature above 150 F. Although more specific than previous statutes, the 1962 version still was effective without enforcement.

Not until 1970 did the Sanitary District make satisfactory progress in cleaning up the Calumet River system. The Sewage and Waste Control Ordinance of 1969 stated "There shall be no discharge of any sewage, industrial waste, or other wastes of any kind into the waters of Lake Michigan."(20) Under the authority of this law, the Sanitary District filed suits against several industries in 1970, and by 1977 these manufacturers and the Sanitary District reached a court-ordered agreement. The plan called for installation of court-mandated pollution control devices at the companies' expense and the establishement of effluent criteria written by the MSD. By 1983 most of the improvements had been implemented or were under construction.(21)

Land disposal has been regulated since the 1940s, but has received little legislative attention until recent years. In 1949 landfill operations were under the authority of the Chicago Streets and Sanitation Department, which required operators to obtain permits. A report published by the U.S. Health Service identified several operating without permits and stated that the number could be much larger.(22) State laws in 1966 forbid open dumping and burning, but sanitary landfills were permissable, although under local jurisdiction.(23) Federal regulations passed in 1967 forced the Corps of Engineers to halt lake disposal of dredge material. Since that date, "secure" landfills have received all Corps spoil throughout the Great Lakes region.(24)

Enforcement remained a problem to both state and local officials, although by 1976 major strides had been made towards uniform regulations. Illinois enacted a permit system that allowed state agencies to control what materials were deposited in landfills.(25) The Federal Resource Conservation and Recovery Act (RCRA) enacted even more stringent monitoring methods in 1976. Among other things, it provided a means to track hazardous materials from their place of production to their disposal site. It has not, however, halted all illegal or undocumented dumping.

Disposal Practices

The evidence of waste disposal activity in the Calumet area since 1940 is uneven, but superior to previous decades. Court proceedings along with federal and municipal records provide the documentation necessary to construct a fairly comprehensive narrative.

In 1940 a landfill was opened at the northern end of Lake Calumet to receive municipal waste from the City of Chicago. The 300-acre site was owned by the city and operated by the Illinois Development Company.(26) City

officials considered the marshy area "particularly suited" for a landfill because of its isolated location, the availability of the property, and the clay soils that underlay the area. There was concern that leachate from the dump would enter Lake Calumet, so a dike was constructed across the lake at 110th Street. It was a composite structure containing slag and ash and it stood forty feet wide and six feet high.(27) After heavy rains washed out a section of ash fill in 1945, it was reinforced with slag.(28) Behind this dike, trucks and trains delivered about 1800 cubic yards of refuse daily.(29) Although the landfill is now nearing capacity, it has been in continuous operation since its opening and has filled in the northern quarter of Lake Calumet.

Other landfills in the area received a mixture of refuse delivered by private scavengers (Fig. 4-1). The sites mentioned in a 1949 report included a ten-acre dump at Doty and 118th receiving about 500 cubic yards a day and a twenty-acre facility at Doty and 125th.(30) Another operator received mixed refuse at Avenue A and the Indiana state line. His facility was described as a "land reclamation" project, but was not considered a sanitary operation because flies, rats, and hogs abounded. Although the city required permits, none of the private operations had them, and the Health Service report concluded other dumps may have existed in the area.(31) The longevity of these sites, unfortunately, is not known.

The Northeast Illinois Metropolitan Area Planning Commission indentified additional landfills in a 1963 report. These included two east of Lake Calumet in section 24 of Hyde Park township and another in a clay pit south of the Little Calumet River at Cottage Grove Avenue.(32)

Material interred in landfills included not just municipal and construction refuse. Various industrial wastes were trucked to land disposal sites as early as 1956. One of the most difficult products to handle was spent pickle liquor. Most fabricators trucked the waste to convenient disposal areas, and others experimented with acid recovery or neutralization before disposal.(33)

The movement of leachates from municipal landfills in the Chicago area has been studied and results suggest the area's till soils restrict significant movement of hazardous substances.(34) Both chlorides and dissolved solids migrated from landfills in glacial till. The movement, however, was minimal, even over extended periods of time, and did not threaten aquifers. Also, as would be expected, concentrations decreased with the distance from the landfill. Circumstances in the Calumet area are somewhat different. The high water table and the presence of sandy ridges beneath disposal sites increases the risk of human exposure to hazardous leachate.(35)

Water samples taken beneath a smelting operation have revealed lead concentrations above EPA's allowed limits. An obvious conclusion is that the lead filtered into the soil from the smelting plant. There are, however, other tenable explanations. Sherwin-Williams had worked with lead on adjoining property since at least 1897, and the municipal dump beneath the smelter could contain tin cans with lead solder and old batteries. The dump accumulation is over thirty feet thick in places and is saturated to within ten feet of the surface.(36) Acids in the moist soil could release lead into the ground-water and contribute to the high readings.(36)

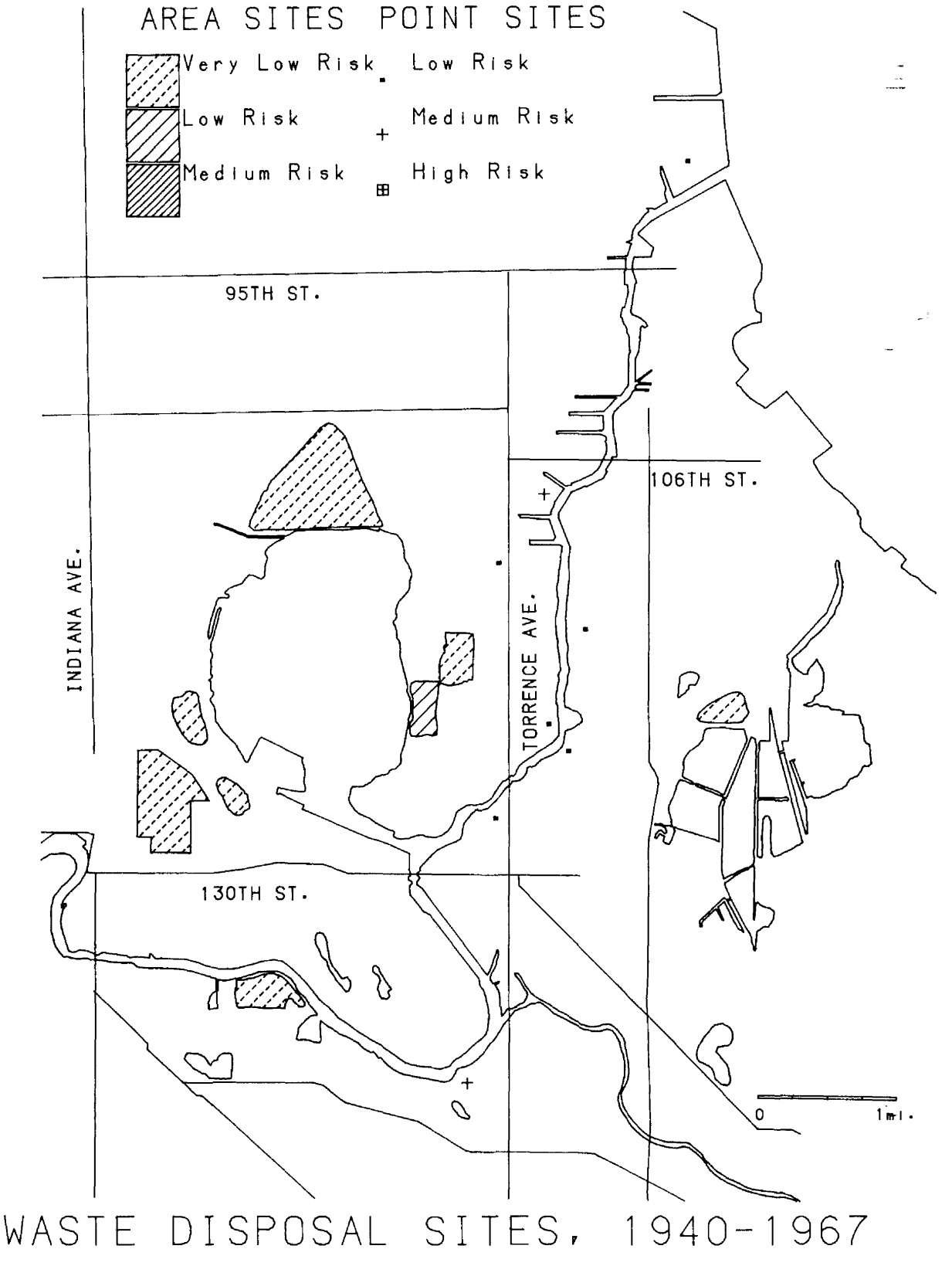


Figure 4-1: Waste Disposal Sites, 1940-1967. Risk designators refer to health hazards presently posed by former disposal sites. The ranking system considers length of existence, type of material discarded, soil permeability, and distance to residential areas. See appendix for explanation of rating system.

Surface soils and limited use of deep aquifers reduce the threat to human health posed by downward movement of hazardous substances. There were seven industrial users of Cambrian-Ordivician aquifers in the Calumet area in 1959.(37) Even when combined with a number of municipal users, the consumption of non-surface water averaged only about 143,000 gallons a day. This is an insignificant amount of water when compared to the 8 to 12 million gallons drawn from aquifers in other townships in the Chicago area.(38) Furthermore, industrial users of these water-bearing strata have decreased since 1960.(39) The danger does exist that derelict well holes could permit vertical movement of hazardous wastes.

Before regulations were enacted in 1970 water disposal of solids and liquids was a significant issue in the Calumet region, and the proceedings of a court case involving the Corps of Engineers and several industries exposed waste disposal practices. After unsuccessful attempts to convince area steel-mill operators to share the expense of maintenance dredging, the Corps brought charges against Republic Steel, International Harvester (Wisconsin Steel), and Interlake Iron in 1954. The Corps' lawyers claimed that the industries were discharging wastes that were obstructing navigation, and the Corps argued that the accumulation of sediments should be removed at the expense of the steel mills.(40) Ultimately, the Supreme Court ruled in favor of the Corps, citing the Navigation Act of 1899 as the basis for its decision.(41)

Testimony presented in court unveiled common disposal practices. During the 1940s and up through 1951, the defendants had periodically helped remove sediments from the river. They refused, however, to participate in 1951, and the Corps was forced to remove a two-year accumulation. The dredging company removed an estimated 127,200 cubic yards from the river along side the defendants' plants in 1951.(42) The Corps claimed that this material entered the river from the more than twenty outfalls from the three steel companies.(43) It identified the bottom sediments, which contained "iron fines" and slag, as industrial wastes and thereby attributed the material to the defendants.(44) By its own calculations, Republic Steel contributed over 10,000 tons of solids to the channel annually, and International Harvester confessed to adding more than 27,000 tons per year.(45) The third defendant, Interlake Iron, estimated more than 20,000 tons of solids per year flowed from its sewers into the river.(46) Production figured for the postwar period remained high (Table 4-1) and this suggests deposition of wastes in the Calumet River continued.

A map of the International Harvester sewer system showed that 13.6 million gallons of waste entered the Calumet River daily in an untreated form, with another 4.9 million gallons receiving primary treatment before discharge.(47) The wastes derived from the blooming mill, merchant mill, and blast furnaces. The diagram of the International Harvester Plant confirms that the Calumet River was the primary repository for industrial wastes--some treated, others not--and use of the river as a sink for wastes continued even after the Supreme Court ruling.

Stream pollution persisted and worsened during the 1960s eventually prompting the U.S. Department of Health Education and Welfare (HEW) to evaluate water quality in the area. The agency identified eight polluters within the study area who contributed approximately 376 million gallons of liquid waste per day (Table 4-2). (48) Although Commonwealth Edison's cooling

Table 4-1: ESTIMATES OF IRON AND STEEL WASTES PRODUCTION, 1945-1970

Year	Tons Ore Received	Ingot Tns.Yr	Suspended Solids (1000 lb/yr)	Phenols (lbs/yr)	Cyanide (lbs/yr)	Lube Oil (lbs/yr)	H2SO4 (lbs/yr)	FeSO4 (lbs/yr)
1945	8,824,380	4,718,920	589,865	302,011	132,130	12,835,462	16,704,976	62,289,741
1950	10,376,739	5,549,058	693,632	355,140	155,374	15,093,439	19,643,666	73,247,569
1955	10,964,904	5,863,585	732,948	375,269	164,180	15,948,951	20,757,091	77,399,322
1960	6,929,853	3,705,804	463,225	237,171	103,763	10,079,786	13,118,545	48,916,609
1965	8,475,246	4,532,217	566,527	290,062	126,902	12,327,631	16,044,049	59,825,266
1970	8,641,643	4,621,199	577,650	295,757	129,394	12,569,663	16,359,046	60,999,833
Ave.	9,035,461	4,831,797	603,975	309,235	135,290	13,142,488	17,104,562	63,779,724

Source: Corps of Engineers, Waterborne Commerce

Multipliers: Suspended Solids 103, Phenols .064, Cyanide .028,
Lube Oils 2.72, H3SO4 3.54, FeSO4 13.2

After: USDI, Cost of Clean Water, 1967, p. 55.

Table 4-2: QUANTITIES OF INDUSTRIAL WASTES, 1965

Industry	Discharge MGD	Pounds Per Day		
		Ammonia Nitrogen	Phenolics	Oil
Commonwealth Edison	220.0			
Wisconsin Steel Works	40.0	100	10	800
Interlake Iron Corp.	37.0	700	900	260
Allied Chemical	4.0			
Cargill, Inc.	0.4			590
Ford Motor Co.	0.5			
Acme Steel Corp.	48.0			

Source: U.S. HEW, Report on Pollution, 1965, Table VI-6b.

water constituted the largest share of this liquid waste, the steel mills discharged more than 900 pounds of phenols per day, along with 800 pounds of ammonia and nitrogen. Other waste products included oils, pickle liquors, suspended solids, phosphates, and raw sewage.(49) The steel plants coking wastes went to the Sanitary District's sewage treatment plant before discharged into the Little Calumet.(50) Most plants provided some treatment before releasing their effluents (Table 4-3), and industry spokesmen vigorously defended their efforts to clean up the area.(51) The study, however, concluded that the streams of the Calumet region were severely polluted with both industrial and domestic sewage.

A final measure of waste production identifies waste volumes by SIC code (Table 4-4). Primary metals--SIC 33--again dominate the waste production totals. Other significant producers included chemical manufacturers--SIC 28--and transportation equipment makers--SIC 37.

One step taken to alleviate the pollution of Lake Michigan was to curtail disposal of dredge spoil in the lake. Designated dredge spoil disposal beds in the lake had been used since 1924, but because the spoil was contaminated with industrial wastes the Corps deemed it prudent to direct it away from Chicago's water source.(52) The Corps designated eleven sites in the Calumet area to receive dredge spoil from the immediate vicinity (Fig. 4-2). The largest area was adjacent to the O'Brien Locks south of 130th Street. Between 1967 and 1976 an estimated two million cubic yards of spoil from the Calumet River and Harbor were placed in these sites.(53) Several of the Corps' designated disposal sites are now commercial landfill sites.(54)

Effects of Waste Disposal Practices

A century of waste disposal in the Calumet area has had noticeable effects. While recent legislation has halted traditional disposal practices, it did not eliminate or heal the damage.

In the early 1960s, industrial and municipal sewage again threatened water quality in Lake Michigan, and the U.S. Department of HEW called for an examination of pollution sources. Their investigation of the Calumet River system revealed that all three streams were severely polluted.(55) The worst conditions, characterized as "barren biologically," existed in the Grand Calumet. High concentrations of toxic pollutants and dropping levels of dissovled oxygen prevented the survival of even sludgworm communities.(56) The river system delivered phenols and ammonia compounds to the lake in such concentrations that they prompted consumer complaints of unpleasant odors and tastes.(57)

Biological conditions suffered less in Lake Calumet. Spared from most of the direct discharges of industrial wastes, lake conditions remained superior to the surrounding stream environments. An assessment of aquatic life in 1984 characterized the fish population as "relatively good." While the lake as a whole supported a fairly diverse aquatic community, there was some concern that areas of the lake subject to dredging or other disturbances sheltered fewer species.(58) Most of the eastern third of the lake has now been dredged or filled and thus has been subjected to the types of disturbances that impact fish communities.

Table 4-3: SOURCES OF INDUSTRIAL WASTE, 1965

Industry	Nature of Waste	Treatment Provided
Commonwealth Edison Calumet Station	Cooling water	
Wisconsin Steel Works	Flue dust, some neutralized pickle liquor, coke breeze	Thickener, neutralizer
Interlake Iron Corp.	Some coke wastes, flue dust	Thickeners, closed coke quench
Republic Steel Corp.	Flue dust, pickle liquor	Thickeners, scale pits
Allied Chemical	Inorganic chemicals	
Cargill, Inc.	Soybean oil	Neutralization (treatment plant under construction in 1965)
Ford Motor Company	Paint, alkali chromium	Filtration, (treatment plant under construction in 1965)
Swift and Company	Fertilizer	
Acme Steel Corp.	Raw sewage, mill scale, pickle liquor	Thickener, scale pits, oil separation

Source: U.S. HEW, Report on Pollution, 1965, Table VI-4a.

Table 4-4: ESTIMATED SOLID WASTE PRODUCTION, 1960

SIC	Industry	Tns/Yr	SIC	Industry	Tns/Yr
20	Food Produts	1,450	32	Stone, Clay & Glass	3,527
22	Textiles	89	33	Primary Metals	140,387
24	Lumber and Wood Products	3,319	34	Fabricated Metal Products	368
25	Furniture and Fixtures	346	35	Machinery	1,960
26	Paper and Allied Products	618	36	Electrical Machinery	53
27	Printing & Publishing	14	37	Transportation Equipment	10,893
28	Chemcial & Allied Products	30,761	39	Miscellaneous Manufacture	86
Totals		39,148			196,422

Source: Number of Employees from Chicago-Cook County Industrial Directory, 1960; SIC multipliers, Weston, 1974.

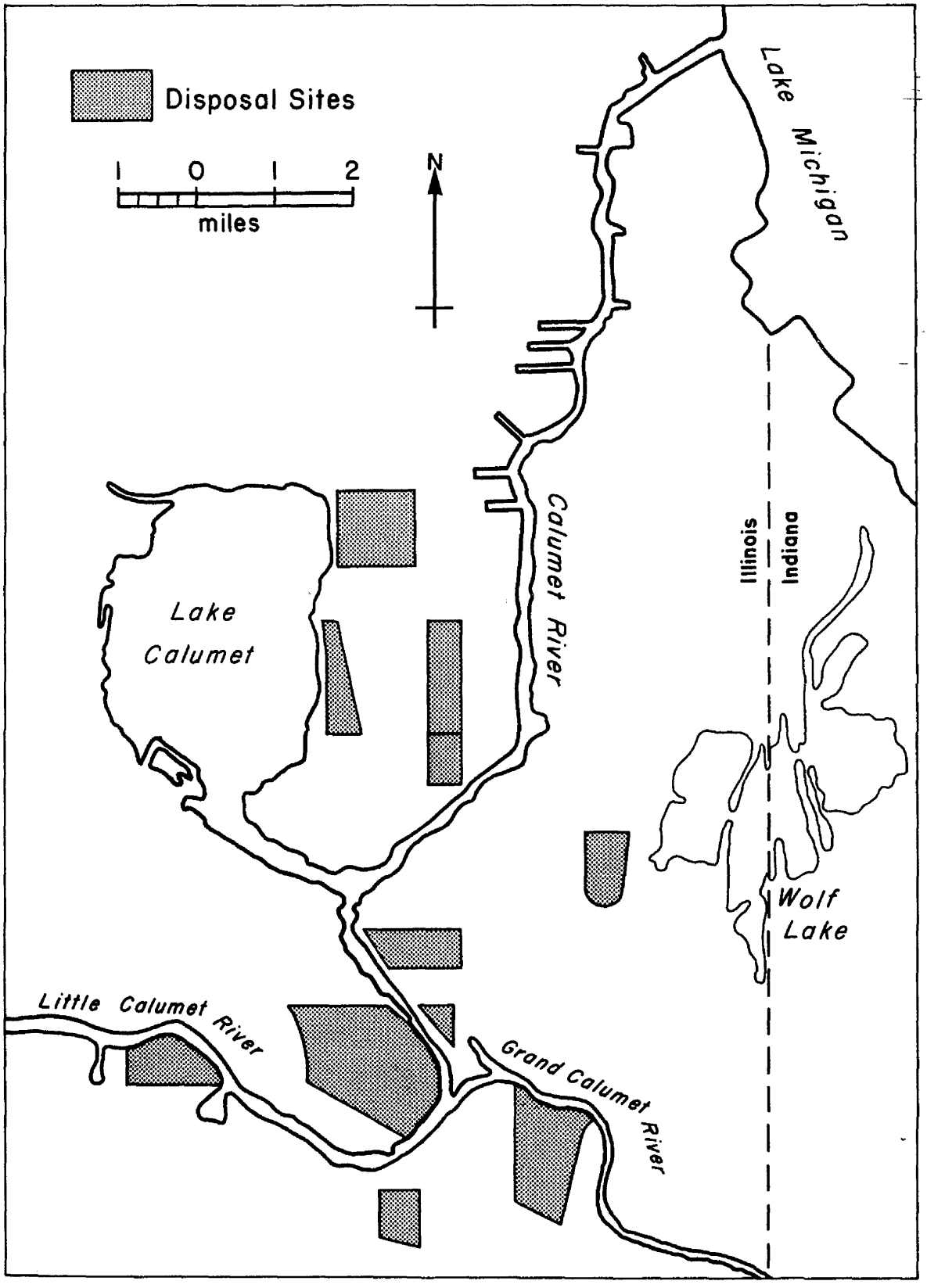


Figure 4-2: Corps of Engineeers Dredge Spoil Disposal Sites
Source: U.S. Army Corps of Engineers, Dredging and Water Quality, 1968, Fig. M1-4.

The surrounding marsh area, once home to significant numbers of muskrat and waterfowl, has been disturbed extensively. Fill activity to create factory sites, residential areas, and transportation right-of-ways has reduced the area of undisturbed marsh. Solid waste fill has further encroached on the former wetlands. Approximately 680 acres of undeveloped property in the area has received waste at some time in the last few decades (cf. Fig.'s 4-3 and 3-4). Sunflower communities thrive on disturbed ground where little subsidence has occurred, and where fill compaction has exceeded accumulation, marsh conditions have reappeared. Cattails flourish in such sites, partly because they are tolerant of many toxic substances.(59)

The diversity of animal life has decreased in the area over the last few decades. Sensitive species, such as the spotted turtle, were not sighted in a recent survey of fauna. Investigators felt the water quality was unsuited for their survival east of Lake Calumet.(60) Crayfish were also missing at some survey sites, presumably because of poor water quality, and their absence has contributed to a decline in water snakes.(61) Also affected by landfilling and human activity is the muskrat population. Once abundant, they are still the most common mammal in the area but no longer survive in sufficient number for commercial exploitation.(62) Despite reductions in the number of other animals, several endangered avian species still visit the area. Among those sighted in a 1978 inventory were two species of hawk, the common tern, and the black-crowned heron. It is not known if they nest there, and their presence does not suggest the area is a suitable habitat for supporting large numbers.(63) As a result of initiatives to clean area streams, residents now fish in the Little Calumet River and Wolf Lake, suggesting conditions have improved since the early 1960s. Desirable commercial and sport species however, are just returning.

Modifications in the natural landscape have destroyed substantial areas of prime habitat and contamination of surface waters has eliminated many species in the marshes. Overall, this has caused a noticeable reduction in the biological diversity of the Calumet area.

The impact that industrial waste disposal had on Lake Michigan remains uncertain. The HEW report of 1965 reported that discharges of industrial wastes into Lake Michigan "created a condition deleterious to aquatic life."(64) It went on to proclaim that the pollution of Lake Michigan adjacent to the Calumet region "was practically irreversible." The lack of strong lake currents and the absence of scouring stream action were cited as contributing to the persistence of the problem. Even with the completion of the O'Brien locks in 1965--intended to halt the flow of water into Lake Michigan--some of the flow through the lower course of the river continued to enter Lake Michigan, and dredge spoil was dumped in the lake until 1967.

A recent study of the dredge spoil's impact on lake-bottom environments did not completely support the 1965 prediction. When researchers examined both disposal grounds and control areas, they obtained ambiguous results. Lake sediments showed little chemical difference between disposal and non-disposal areas, and biological data documented a stressed population at only a small percentage of the sites investigated.(65) One possible explanation for the lack of differences between disposal sites and other bottom areas was the practice of "short-dumping." Apparently, it was common for contractors to dump dredge spoil in unauthorized areas short of the designated sites.(66) This

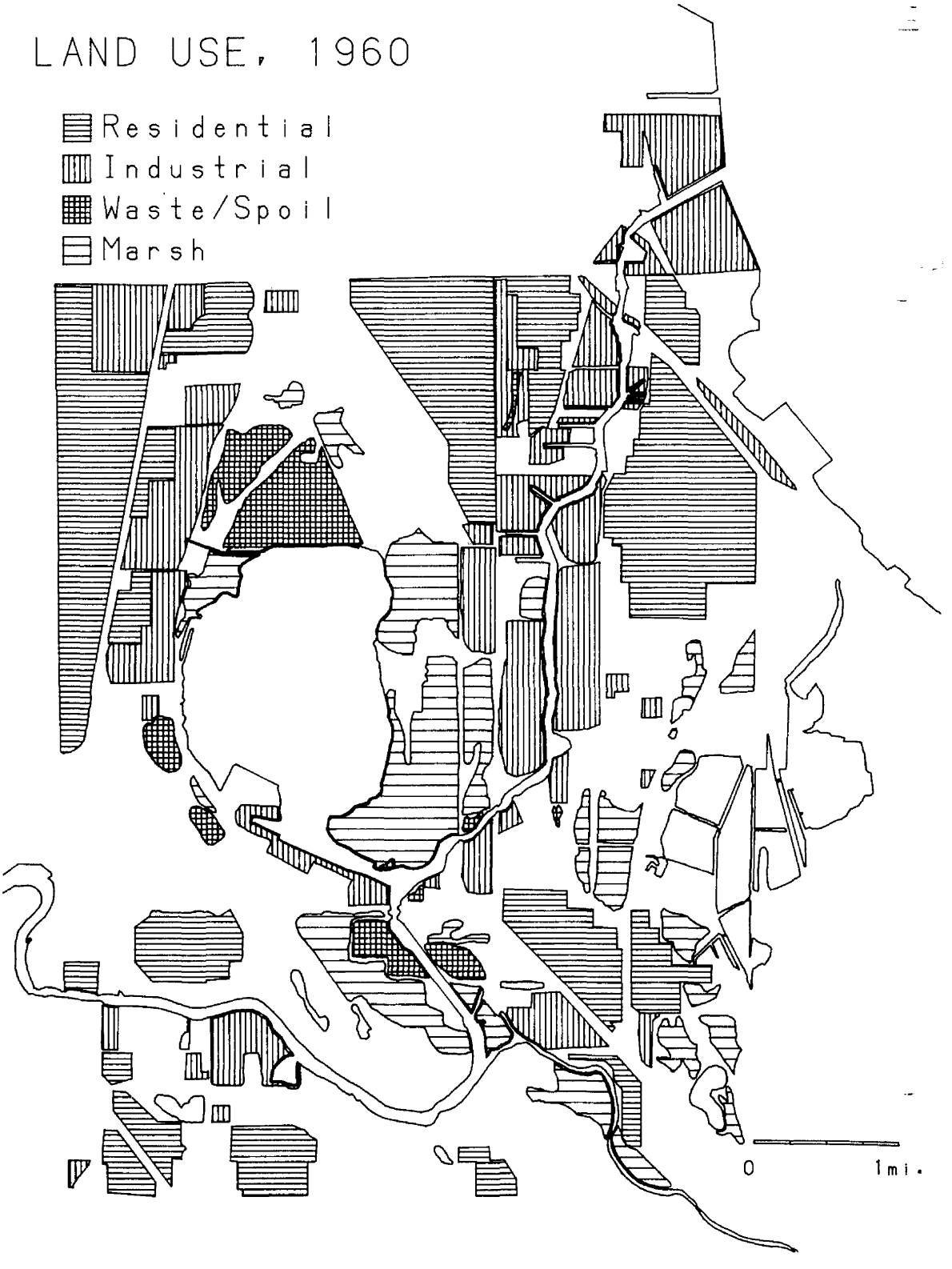


Figure 4-3: Calumet Area Land Use, 1960
Source: U.S.G.S., Lake Calumet Quadrangle, 1960.

would have reduced the concentration of dredge spoil in designated dump areas and distributed spoil material over a much larger area, thereby reducing the biological and chemical differences between the study and control areas. The cessation of dumping in 1967 terminated the accumulation of dredge spoil, but it did not remove dredge spoil containing hazardous substances.

The impact of industrial wastes on humans in the area is difficult to assess. An IEPA study reported no unusual mortality figures for the years from 1969 to 1981.(67) The dispersal of Calumet wastes through the public water system, via air-borne mechanisms, and in the form of beverages produced with contaminated water may have spread the hazardous substances throughout the Chicago region, making it difficult to establish a control population. Out-migration of Calumet residents may have also affected the results of the health study.

Direct exposure could have come from a variety of sources. Air-borne contaminants are now largely controlled, but did pose a significant problem in the past. Methane leaking from landfills presently is an atmospheric irritant, although movement of this gas through the soil is unlikely through clay soils. Lead or arsenic may be found in buildings in the vicinity of Sherwin-Williams, where these materials have been used in products. The potential of leachates from on-site waste dumps reaching the East Side neighborhood also exists.(68)

In addition, two residential areas have been constructed on top of former dumping grounds.(cf. Fig's. 4-3 and 3-4) Much of the area between 95th, Van Vlissingen, and Torrence is built on a former slag dump.(69) To the southwest, a portion of Altgeld Gardens is over the former Pullman sewage farm. For a few years in the 1880's domestic and industrial sewage was piped to this site for natural soil filtration. It is uncertain what dangers juxtaposing a modern housing complex and an old sewage farm presents, since IEPA did not take soil samples from this portion of the project.(70)

Finally, sporting activities have declined precipitously. Although some fishermen have returned to the Calumet waterways, local sportsmen claim conditions are not satisfactory.(71)

Conclusions

Two significant themes emerge during the period from 1941 to 1970. First, legislation aimed at curbing, and later curtailing, industrial discharges into waterways characterized the period. Secondly, land disposal practices claimed huge new tracts of land as the tougher laws prompted the adoption of alternative waste management techniques.

The 1948 Clean Water Act initiated the era of anti-pollution legislation by funding research on pollution sources and treatment, and it subsidized the construction of sewage treatment plants. State laws followed and forbade discharging industrial wastes without permits. Later modifications added penalties to manufacturers who discharged more than a specified amount. Such statutes, along with legal pressure from the Corps of Engineers and the Sanitary District, impelled waste producers to consider other methods of disposal--either treatment of wastes or land disposal. New treatment facilities were installed at most firms, although pollution of area streams

continued into the 1970s.

Land disposal became the most widely accepted method and was welcomed as a safe and economic means of waste disposal. In addition to slag and other material that had long been handled in this way, sludges from treatment facilities could be trucked to nearby dumps in the marshland of the Calumet area. Furthermore, with the prohibition of dredge spoil disposal in Lake Michigan after 1967, the Corps of Engineers brought huge areas of wetland into use as disposal sites. In addition to accommodating the large volume of dredge material, these sites also were used as repositories for increasing quantities of industrial deposits. During the 1970s some of the Corps-designated disposal areas became commercial waste disposal sites where a variety of liquid and solid wastes have been deposited.

These disposal practices have threatened the viability of the marshland. Efforts to stem water pollution have made progress towards cleaning up the streams, but they have had negative impacts on the wetlands. The effects of expanding land disposal activity are irreversible. While riverine environments can rebound from degraded conditions when discharges are curtailed, marshland buried by landfilling activity is unlikely to return to its natural state for centuries, if at all.

Notes--Chapter 4

1. An annual allocation of $1,000,000 was made toward treatment research. See Schwob, "1948 Federal Stream Pollution," 1948, p. 15; and MacKenzie, "U.S. Public Health Service," 1949, p. 7. In addition to funding research, this bill provided substantial support for the construction of municipal sewage treatment facilities.

2. MacKenzie, footnote 1, p. 10.

3. Schwob, footnote 1, p. 17. See also, McKelvey, Emergence of Metropolitan America, 1961, pp. 166-67.

4. Mohlman, "Utilization and Disposal," 1944, p. 57.

5. Eldridge, Industrial Waste, 1946, p. 1.

6. Mohlman, footnote 4, p. 44.

7. Rudofs, Industrial Wastes, 1953, p. 6.

8. Ibid, pp. 322 and 374.

9. Tarr, "Search for the Ultimate Sink," 1984, p. 20.

10. Eliassen, "Housing Construction," 1947, pp. 756-60; and First, et al. "Control of Toxic and Explosive Hazards," 1966, pp. 419-28.

11. Tarr, footnote 9, p. 22.

12. Ibid, pp. 23-4.

13. Black, et al., National Solid Waste Survey, 1968, p. 44.

14. Hurwitz, "Industrial Waste Problems," 1956, pp. 556.

15. Ibid.

16. Both statutes are reprinted in Chicago Metropolitan Sanitary District, "Industrial Waste Ordinance," 1949, pp. 2-4.

17. Ibid, p. 4.

18. Schwob, footnote 1, p. 16.

19. Illinois Department of Public Health, Sanitary Water Board Act, 1951, p. 4.

20. Metropolitan Sanitary District of Greater Chicago, Progress of U.S. Steel, 1983, p. 29.

21. Ibid, p. 30.

22. U.S. Health Service, Chicago-Cook County Health Survey, 1949, p. 164. Disposal permits are now issued by Chicago's Department of Streets and Sanitation. Officials there were unable to locate old files of permits and reported that such documents are destroyed after seven years.

23. Illinois Department of ENR, Hazardous Waste in Illinois, 1984, p. 57.

24. U.S. Army, Corps of Engineers, Chicago District, Dredging and Water Quality Problems, 1968, pp. M1-7--M1-8.

25. Ibid.

26. U.S. Health Service, footnote 22, p. 205.

27. U.S. Army, Corps of Engineers, Chicago District, Lake Calumet Files, Permit #4678, 1945.

28. Ibid, Correspondence, 7 March 1945.

29. U.S. Health Service, footnote 22, p. 205. A site at 103rd and Calumet received approximately 1600 cubic yards daily.

30. Ibid, p. 208. See ratings used in Fig. 4-1 are explained in the Appendix.

31. Ibid, p. 30. The Health Service's supposition is supported by the existance of numerous dump sites located on aerial photographs.

32. Northeastern Illinois Metropolitan Area Planning Commission, Refuse Disposal Needs, 1963, p. 70.

33. No specific firms or disposal sites are mentioned by Hurwitz, footnote 14, p. 557.

34. Hughes, et al., Summary of Findings, 1971.

35. An evaluation of the area is found in Berg, et al., "Potential for Contamination," 1984.

36. Inland Metals Refining Co., Company Site Records, Pullman, Ill.

37. Suter, Ground-water Resources, 1959, pp. 81-2.

38. Ibid, p. 47.

39. Sasman, Groundwater Pumpage, 1974, p. 17.

40. U.S. Court of Appeals, Seventh Circuit, Records and Briefs, 3 (1957).

41. This act forbid obstruction of navigable waterways. For decision see, "U.S. v. Republic Steel," U.S. Reports 363 (1960):481-510.

42. U.S. District Court, Northern District of Illinois, Transcripts of Proceedings V. 1, 1957, pp. 771-2.

43. Ibid, pp. 103-66.

44. Ibid, p. 1392.

45. U.S. Court of Appeals, Seventh Circuit, footnote 40, pp. 2433 and 2447.

46. Ibid, p. 1392.

47. Ibid, p. 2437. Similar depictions were not found for other defendants.

48. U.S. Department of HEW, Report on Pollution, 1965, see Tables VI-6a and VI-4a.

49. Ibid, Table VI-4a.

50. Ibid, p. 3.

51. Statements from various industry representatives were entered in the proceedings of a conference held in Chicago. Although all the reports were from Indiana establishments, they are indicative of the attempts industry made to present a responsible image. Statements were received from Cities Service Oil Company, DuPont, U.S. Lead, Blaw-Knox, Union Carbide, Mobil Oil, and the Sinclair Refinery. See U.S. HEW, Proceedings in the Matter of Pollution, V. 3, 1965, pp. 951-1020.

52. U.S. Army, footnote 24, M1-7--M1-8.

53. Larson, Those Army Engineers, 1979, p. 271. Nearly two million cubic yards were hauled to off-shore dumping grounds during the preceding decade. See, Ibid, M1-5.

54. Illinois EPA, Southeast Chicago Study, 1984, pp. 33-42.

55. U.S. HEW, footnote 48, p. 30.

56. Ibid, p. 31.

57. Ibid, pp. 38-9.

58. Greenfield, "Assessment of Fish Fauna," 1984, pp. 82-3.

59. Chicago Department of Public Works, Ecological Analysis, 1978, pp. 13-19.

60. Ibid, p. 21.

61. Ibid, p. 20.

62. Conversations with area sportsmen at a meeting of the Southeastern Sportsmen's Club, 12 December 1984.

63. Chicago Department of Public Works, footnote 59, pp. 23-29.

64. U.S. HEW, footnote 48, p. 35.

65. Plumb, "Characterization of Dredge Material," n.d., p. 124.

66. Ibid, p. 25.

67. IEPA, footnote 54, p. 8.

68. These comments represent the authors speculations and not the analysis of IEPA.

69. The Trumbull Park housing project is not atop the slag fill. Conversation with Jim Wesley, Chicago Housing Authority, January 1985.

70. IEPA, footnote 54, p. 56.

71. Southeastern Sportsmen's Club, footnote 62.

CHAPTER V - SUMMATION AND RECOMMENDATIONS

This project sought to increase the understanding of waste disposal practices for the period before regulation. There were few precedents for this type of work and only scanty source material. Yet, this report opened a window to a scene of irresponsible activity and unhealthy environments. Although such a view is unappealing, understanding how it came to be is preferable to moving through that landscape in ignorance. This section summarizes how a more complete historical knowledge of industrial waste practices can benefit current hazardous waste inquiries.

One benefit of historical analysis is the recognition of a chronology of industrial waste disposal practices used in the Calumet region. To develop this chronology, an assessment of archival and documentary records was made. These records proved useful in reconstructing historical waste disposal practices, and they will be useful for other investigations in the Chicago area and throughout the state. Recognition of distinct historic periods is the first step toward determining the type of sites and methods of disposal employed at certain dates in the past.

Once former disposal sites and waste streams are identified, an evaluation of the hazard posed by each site is possible. In this chapter a rating system is used to determine the potential hazards of known sites. Although a trial method, it provides a starting point for a fine-tuned investigation of water and soil quality in a region beset with potential hazards.

Based on the knowledge gained from a year of study, several comments on the social, political, and environmental implications of a century of waste disposal will be offered, along with recommendations for future research.

Waste Disposal Chronology

When contrasted with national developments in waste disposal technology, industries in the Calumet area generally lagged in accepting new technology and dallied in adhering to regulations. Tarr's chronology of industrial waste disposal methods illustrates these points (Fig. 5-1).(1) He characterized the most widely accepted method of waste disposal after the discovery of germ theory, as dilution in water. Following this method industries dumped most effluents directly into watercourses, while giving the remainder primary treatment. This is generally what happened in the Calumet area, although huge quantities of material were still heaped up in the marsh. The unique physical characteristics of the area gave disposers two choices: they could discharge wastes into streams or continue traditional land disposal practices in areas otherwise considered useless.

Public concern with drinking water supplies in the Calumet area forced health agencies to modify waste handling methods after 1922. Thus the Calumet area entered a phase of limited treatment that lasted until 1948. Treatment methods included linking industries to municipal sewage works, adoption of chemical neutralization techniques, or on-site filtration. In addition, the MSD opened the Cal-Sag Channel to divert industrial effluents from Lake Michigan into the Illinois River system. Although each of these methods had some beneficial effet, few manufacturers adopted treatment technology, and

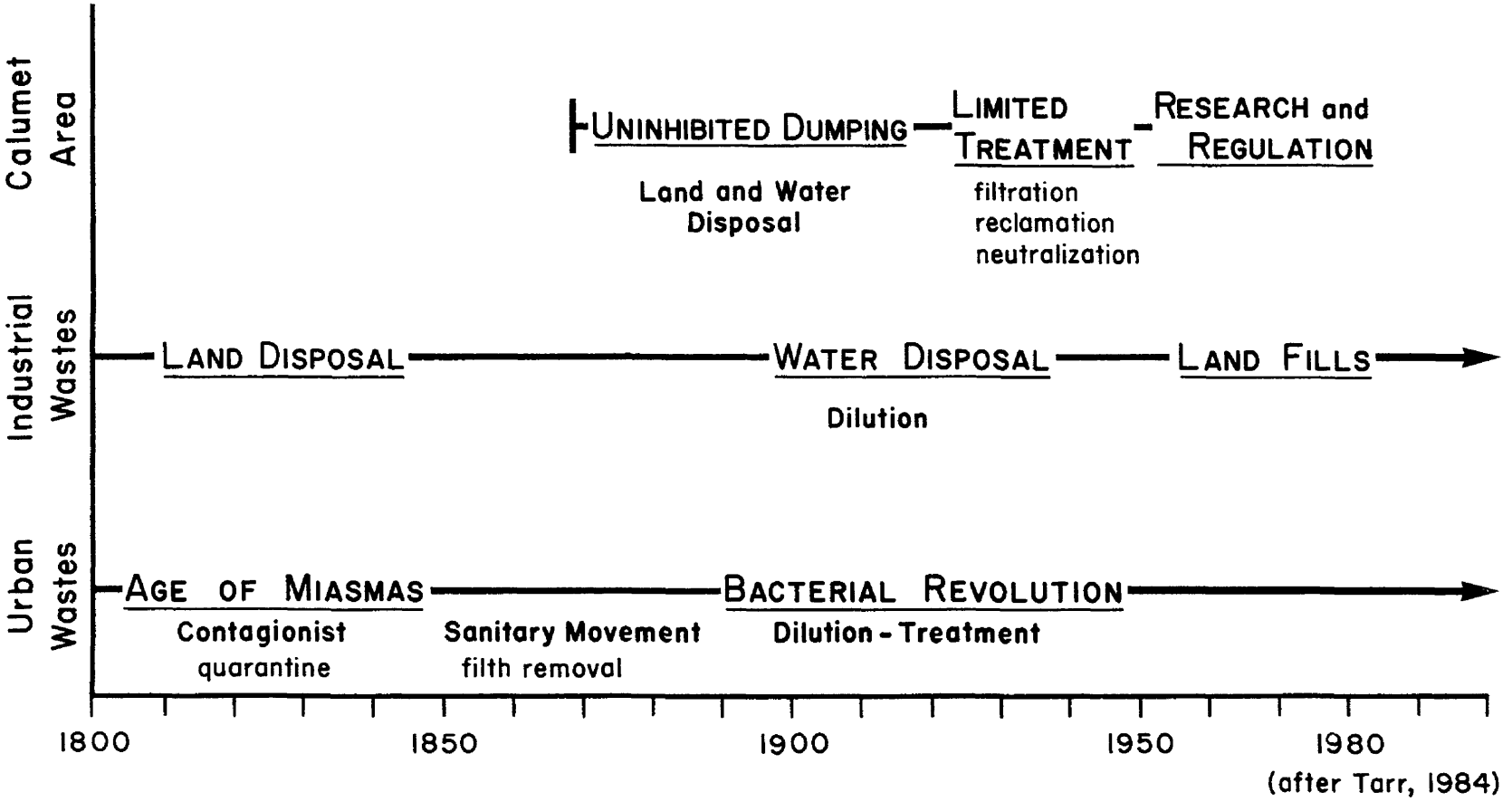


Figure 5-1: Generalized Waste Disposal Practices

consequently, treatment had a minimal influence on the volume of waste. The Great Depression had a much greater impact on water pollution than did the voluntary treatment programs of the twenties. By causing production levels to drop, waste production also fell and pollution problems decreased. In addition, the massive infusion of public aid and governmental involvement in the economic recovery led to programs promoting waste treatment. Still, industry proved reluctant to voluntarily adopt pollution controls, and they ignored statutes that forbade deposition of industrial wastes in watercourses. The burden of protecting public health fell on public agencies that struggled to keep up with the burgeoning quantities of industrial wastes after 1935.

The inability of local officials to enforce anti-pollution laws drew the federal government into the industrial waste arena after World War II. The 1948 Clean Water Act promoted construction of municipal sewage treatment plants and subsidized research on treatment technology. Although it provided few enforcement powers, the federal government's entry into the fray represents an important turning point. There followed an increased public awareness of water pollution issues, and this led to a shift to land disposal practices. Public health agencies strongly promoted use of sanitary landfills, and industry resorted to on-site ponding of wastes. In the Calumet area a huge municipal landfill began filling the northern quarter of the lake, and dikes materials were constructed to contain the hazardous leachate from the landfill. The modified Calumet River system allowed industries to continue water disposal, and the case against Republic Steel, Interlake Iron and Wisconsin Steel illustrated industry's uninhibited use of the waterways. Disposal of wastes in the Calumet River continued until the courts finally forced industries to halt untreated discharges in the late 1970s.

A major contributor to land accumulations of waste was the Corps of Engineers. After 1967 they were required to dispose of dredge spoil in "secure" land sites, where approximately two million cubic yards have been placed. Land disposal of this spoil, a mixture of industrial wastes and river sediments, has rendered huge tracts of land unsuitable for any purpose other than waste disposal. In recent years, private companies have purchased some of the former Corps sites and now operate them as commercial dumps. This action, along with the construction of the O'Brien Locks, contributed to short-term water quality improvement but they also initiated a cycle of marsh destruction.

Throughout the first century of industrial development in the Calumet area, water disposal has been common. Before 1922 liquid and suspended solids traveled freely into Lake Michigan, although the placement of dredge spoil on the river banks returned much industrial waste to the land. After 1922 the Cal-Sag Channel diverted liquid wastes into the Illinois River, although some continued to enter Lake Michigan, as did all dredge spoil. The ease with which industries could dispose of wastes in area waterways diminishes the possibility that large caches of containerized waste were created before 1970. When Federal regulation began forcing land disposal, the marsh proved to be a convenient repository for uncontrolled and non-containerized disposal. Thus, the impact of a century of waste disposal is widespread in both the wetlands and waterbodies.

Hazards Presented by Past Waste Disposal

The full dimension of waste hazards may never be known, but this study provides a fuller accounting of where waste was disposed over the past century. Fifty-one disposal sites have been identified, including sanitary landfills, on-site settling ponds, and general refuse dumps. Until the true contents of the seemingly inert dumps are known, hazards cannot be ruled out. Priority status, however, should be given to the sites deemed most hazardous.

A standard ranking system was used in an attempt to rate the potential hazard of each disposal site.(2) This system assigns to each site a numeric value to each site that is the sum of scores based on the degree of hazard of the waste material, the permeability of the soil, the length of the site's existence, and its distance from the nearest residential area. The total score possible for any given site was thirty-eight, and none of the area sites exceeded thirty. According to this ranking, the greatest risk is for residences built directly on top of old dumps (Fig. 5-2).

Another potential hazard is posed by on-site disposal facilities at either abandoned or closed plants. A large amount of industrial waste was handled within the confines of the respective facilities, enabling owners to avoid the cost of safe disposal. Although several plants recently have closed and one is being demolished, there is no reason to suppose that all risks have been eliminated. Significant accumulations of cyanide, camdium, heavy metals, arsenic, and other materials may be present on the grounds of closed factories. Bulldozing old structures to make room for future occupants can stir up years of accumulated dust containing hazardous substances. Resale of bricks or other equipment can spread the hazard to unsuspecting victims, and users of the sites may be exposed unwittingly to hazards. With proposals for sites in the area ranging from marinas to cargo airports, and hydrophonic gardens to chemical incineration, the probability that old wastes will be disturbed is great. Every proponent of future development must investigate past land uses.

Additional hazards may have existed or continue to exist. Much waste was directed into Lake Michigan over the last century, and the effect that water supplies had on consumers fifty years ago is unknown. Breweries and distilleries using the same water as the city could have affected consumers hundreds of miles away. In the past, sportsmen fished the Calumet waters, and their catches were certainly tainted. The visible effluents largely have been controlled, and fishermen are returning to the waterways; nevertheless, leachates still can migrate into the streams and enter the food chain. Ground-water monitoring around currently-operated disposal sites will alert authorities to current movements, but they may not pick up leachate beyond the established network of monitor wells. Continued evaluation of fish flesh is necessary to recognize the arrival of leachate from long-abandoned dumps.

Political, Social, and Environmental Damage

The damage done to the Calumet area is both tangible and intangible. A century of unrestricted waste disposal has rendered portions of the marshlands a chemical quagmire. Biological diversity has been reduced, and the quality of life for humans has also declined. Beyond these apparent effects, other

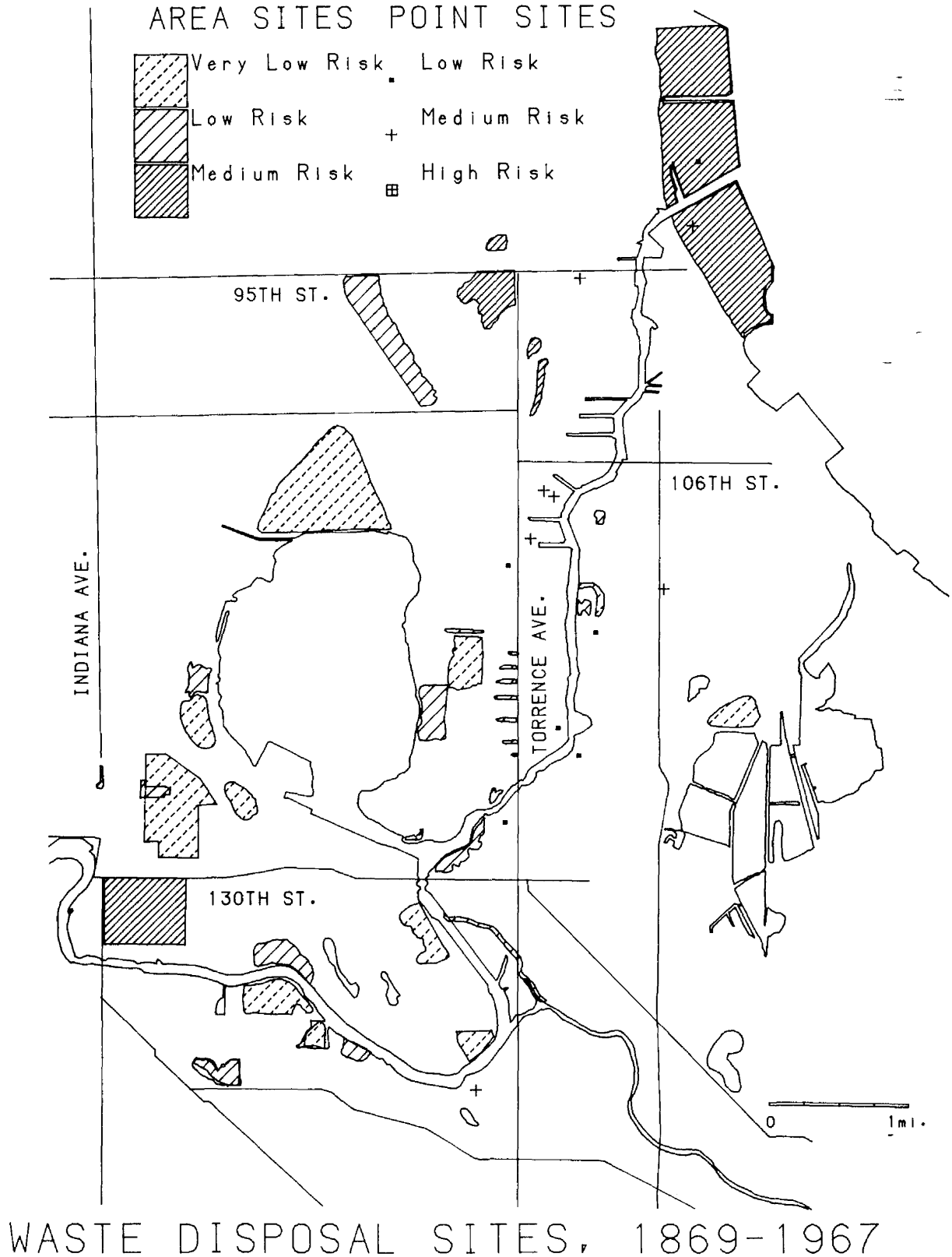


Figure 5-2: Waste Disposal Site Rating for the Calumet Area. Risk designators refer to health hazards presently posed by former disposal sites. The ranking system considers length of existence, type of material discarded, soil permeability, and distance to residential areas.

less tangible components of the area have been damaged. The rusting industrial skyline and the view of an open wasteland east of Pullman give the public the impression that the Calumet area is nothing more than an out-dated manufacturing district. Landscapes of dereliction do little for an area's public image, and imagery is critical in future development. Demolition crews and waste heaps define the area as incapacitated and suggest that garbage disposal is the most fitting use for this property. As long as the Calumet area is associated with such an image, politicians and policy makers will be predisposed to think of it in those terms. Clean-ups and new construction, rather than plans on the drafting table or landscaped waste heaps, will remake the tarnished image.

Over the last century, efforts to control environmental degradation have, until recently, been aimed at limiting discharges into waterways. Public outcries over contaminated water supplies in Chicago were heard in the first decade of this century, but no progress was made on pollution control before 1922. The projects of the Metropolitan Sanitary District were delayed by international debates over the level of Lake Michigan, and industry took no action to alleviate the problem during the delay. After legislation in 1927 finally gave the MSD greater control over industrial discharges, industries remained reluctant to cooperate with researchers seeking to monitor effluents. Nevertheless, by 1935, some firms had installed on-site holding tanks or settling ponds, and Sherwin-Williams had experimented with ways to reduce the effects of its sewage. Still, industrial pollution of the area waterways remained at high levels, even after the passage of the first Clean Water Act. Public testimony by industry officials in the 1954 river obstruction case affirmed manufacturers' resistance to environmental regulation. Proof that there were no improvements after the Supreme Court ruling can be found in the 1965 report, which described the Calumet River as "biologically barren."

The historical record recalls a long-running struggle on the part of the public and concerned scientists to preserve healthful living conditions, while industry either side-stepped regulation or, more recently, complied reluctantly. Until 1970, local and state public agencies bore full responsibility for protecting citizens and the environment. The agencies had only minimal enforcement powers and received little cooperation from industry. As a result, legislative action frequently has been aimed at redressing years of neglect and it often strikes industry with a financial whallop. Legislative reaction and industrial inaction have created an unproductive adversarial climate and left the public exposed to unnecessary environmental hazards.

When considering the record of hazardous waste production and irresponsible disposal in the area, it must be remembered that, although shocking by today's standards, few of the hazards were understood fully at the turn of the century. Early efforts to dispose of unwanted material were seen as a means of improving the area, and they reflected the ideals of the Progressive Era--a period of unabashed entrepreneurial and industrial expansion. Although some developers enjoyed hunting and fishing in the Calumet marsh and carousing in the sportmen's lodges, they felt no obligation to protect the wetlands. Today it is all too apparent that their actions have eliminated most of the wetlands and altered what little remains. Although there is little hope of returning the area to a pristine quality, there is merit to preserving the wildlife and natural areas that can be salvaged. The

area still serves as a resting place for migratory waterfowl and acts as a natural resevoir for urban runoff. If the development plans that have been proposed over the past century are ever completed, these benefits of the Calumet area would be lost.

It is hoped that this historical perspective on environmental change in the Calumet area will illustrate to future generations that seemingly unimportant actions can have long-lasting, cumulative effects with serious consequences.

Recommendations

In conclusion, several recommendations for future research will be offered. In part, they reflect shortcomings of this study and point to future research agendas for the state of Illinois.

1. Of primary importance is the need to gain access to relevant sources. One of the weaknesses of this report is its failure to present a full accounting of on-site industrial waste disposal. Contacts with industry, in most cases, proved futile. Only the producers' records of site use, industrial process, production levels, and waste disposal will provide the accuracy lacking up till now. A comfortable working relationship between HWRIC and industry will facilitate the gathering of more complete information.

Sources held by government agencies proved elusive as well. Permit records from the Chicago Department of Streets and Sanitation and the reports from the MSD Industrial Waste Section were not located by departmental personnel. A cooperative search for these records may prove beneficial to all parties involved and would certainly aid in future studies in the Chicago area.

2. The locations of abandoned waste disposal sites in the area suggest that a re-evaluation of soil and water quality should be made. IEPA test sites were selected on the basis of proximity to schools or playgrounds. They did not consider former waste disposal practices except when trying to explain higher-than-average concentrations of hazardous substances. This study identified a number of dumps that were operated since the 1870s. Some may have received mostly municipal refuse and not hazardous substances, but this assumption cannot be applied to most sites, because industries often mixed their wastes. This was particularly true of the steel industry which used its slag heaps as all-purpose dumps.

A re-examination of soil chemistry in the vicinity of the older dumps would augment the work done by IEPA and provide a better understanding of the long term impact of industrial waste disposal. Samples should be taken in arcs radiating outward from the dumps to determine the rate of movement and the type of substances leaching from the slag heaps. Continued monitoring of fish-flesh could be useful in protecting human health and monitoring the extent of pollution in the area, although it may take some time for leachate to accumulate in sufficient quantities to be noticeable in fish. Samples of waste taken from the numerous "refuse" dumps could help determine their contribution to ground and surface-water contaminants.

3. Future studies of the Calumet Region or other industrial areas should

conform to existing political units. In larger urban areas, townships would provide an suitable scale of investigation, and in less densely built-up areas county units would prove manageable. Other possible geographical areas would be census tracts or ports as defined by the Corps of Engineers. Use of such pre-defined political or statistical boundaries would facilitate data gathering and make diachronic analysis possible for a complete unit.

Natural drainage basins might also be useful areal units. While these may be the best for dealing with surface waters, there would be problems in gathering demographic or economic data. Such an approach would require interstate or intercounty cooperation.

4. Based on the results of this investigation, it seems prudent to conduct studies of this type throughout Illinois. Despite the efforts of regulatory agencies, all disposal sites have not been located, and retrospective assessment of all major industrial districts is essential. Historical inquiries can assist in locating abandoned dumps and determining possible contents. They are cost-effective and should preface major anlayses of soil or water conditions. This would eliminate the need for expensive random sampling and streamline the efforts of other scientists. In addition, retrospective analysis of waste disposal practices provides a firm foundation for rational decision making in a politically volatile atmosphere.

Notes

1. Tarr, "The Search for the Ultimate Sink," 1984; and "Risk Perception in Waste Disposal," 1984.

2. The rating method used here is a modification of technique described in U.S. EPA, " A Manual for Evaluating Contamination Potential," 1978. For an explanation of the rating sytem see the appendix.

Appendix

The system used to rate the waste disposal sites is a modified version of a method developed by the USEPA.(1) Two measures were deleted from the original method and two replacement categories substituted. The deleted measures weighted the distance to an aquifer and the quality of water in the aquifer. In the Calumet area the deep aquifers are threatened minimally and the water in shallow bedrock aquifers is not used domestically, so these categories were dropped. The greatest threat posed by hazardous wastes in the study area is migration to residential areas. To reflect this concern, a "distance to population" factor was included. Also, owning to the lengthy history of industrial dumping in the Calumet area, a "length of existence" measure was added.

For hazardous materials and soil permeability, scores ranged from 0 to 9, and for length of existence and distance to population, 0-10. Higher scores represent greater risk, and the highest possible score is 38.

Category	Score
Hazardous Material	0-9
Soil Permeability	0-9
Length of Existence	0-10
Distance to Population	0-10

Hazardous Material--Scores range from 0 to 9 based on the contaminant potential of the interred substance. The higher the score the higher the potential hazard. Selected scores for the Calumet area are:

Waste Material	Score
Municipal refuse	1
Grain Mill products	2
Sewage Treatment Systems	2-5
Electric Services	3-5
Lumber	4
Stone, Clay Products	3-4
Primary Metals	3-7
Petroleum Refineries	7-8

Two soil permeability ratings were used for the entire area. Although this is a generalization, detailed examination of each site would be necessary to make the rating more precise. Since this is a preliminary analysis, it should prove adequate. The rating of 6 refers to the sandy soils with an approximate permeability of 1 x 10-3 cm/sec. The rating of 4 was applied to lacustrine soils with an average permeability of 1 x 10-8 cm/sec.

The two additions to this rating method were length of existence and distance to population. For each decade of existence the rating was increased by one, hence a possible score of ten. No adjustments were made for duration or changing use of the site. There were several reasons for this decision. Inadequate records of the length of active existence of each disposal site prevented adjusting the ranking system to take this into account. In addition, the "length of existence" factor was included to determine potential linear

movement through time, not to calculate the volume expected to have moved a given distance. Hence, the choice of the years of existence over years of active use.

Distance from each site to the nearest residential area, other than those separated by a waterway, was measured. The base score of ten was reduced by a factor of one for each one tenth mile from a residential area. Thus the farther removed from a residential area the lower the score. Any sites more than a mile away received a zero.

Sites included industrial and municipal waste sites, and all sites mentioned in public records, published sources, or found on aerial photographs and topographic maps were mapped. There may be ommissions, but the list is fairly complete.

The rating scheme is not to be misconstrued as an exact hazard assessment technique. It has not been verified by field test and is based on a system with a moderate level of confidence. In addition, the rating system only assesses wastes deposited in sites prior to 1967. This omits large quantities of toxic substances delivered to certain sites since that date, but this activity has been monitored by IEPA.(2) It is, however, adapted to the locality and can serve as a preliminary assessment of old disposal sites.

Notes

1. U.S. Environmental Protection Agency, "A Manual for Evaluating Contamination Potential of Surface Impoundments," EPA 570/9-78-003, June, 1978.

2. For a discussion of more recent use of sites see, Illinois EPA, Southeast Chicago Study, 1984.

Table A-1: AREA DISPOSAL SITE RATING, PRE-1940

Site Number	Known Date	Hazardous Material	Soil Permeability	Length of Existence	Distance to Pop.	Rating
1	1914	1	4	7.0	10	22.0
2	1870	1	6	10.0	10	27.0
3	1929	6	4	5.5	10	25.5
4	1908	6	4	8.0	10	28.0
5	1908	6	4	8.0	10	28.0
6	1929	3	4	5.5	8	20.5
7	1939	6	4	4.5	1	15.0
8	1939	3	4	4.5	6	17.5
9	1939	6	4	4.5	5	19.5
10	1939	6	4	4.5	0	14.5
11	1939	6	4	4.5	0	14.5
12	1939	6	4	4.5	0	14.5
13	1939	6	4	4.5	0	14.5
14	1939	6	4	4.5	0	14.5
15	1939	6	4	4.5	0	14.5
16	1939	3	4	4.5	0	11.5
17	1929	3	4	4.5	0	12.5
18	1929	3	4	4.5	6	18.5
19	1929	3	4	4.5	0	12.5
20	1939	3	4	4.5	6	17.5
21	1939	3	6	4.5	0	13.5
22	1939	3	6	4.5	0	13.5
23	1939	3	6	4.5	6	19.5
24	1929	2	4	5.5	6	17.5
25	1939	3	4	4.5	10	21.5
26	1929	2	4	5.5	9	20.5
27	1881	6	4	10.0	10	30.0
28	1922	4	4	6.0	6	20.0
29	1914	2	6	7.0	10	25.0
30	1881	2	4	10.0	6	22.0
31	1880	6	4	10.0	10	30.0
32	1880	6	4	10.0	10	30.0

Source: Complied by author.

Table A-2: AREA DISPOSAL SITE RATING: 1940-1967

Site Number	Known Date	Hazardous Material	Soil Permeability	Lenght of Existence	Distance to Pop.	Rating
1	1940	1	4	4.0	4	13.0
2	1949	4	4	3.5	6	17.5
3	1922	4	4	6.0	8	22.0
4	1949	1	4	3.5	5	13.5
5	1949	1	4	3.5	4	12.5
6	1949	6	4	3.5	0	13.5
7	1963	6	4	2.0	1	12.5
8	1963	1	6	2.0	3	11.5

Table A-3: POINT SITE RATING, PRE-1940

Site Number	Known Date	Hazardous Material	Soil Permeability	Length of Existence	Distance to Pop.	Rating
1	1890	1	4	9.0	10	24.0
2	1890	1	4	9.0	10	24.0
3	1932	6	4	5.0	8	23.0
4	1932	6	4	5.0	7	22.0
5	1932	6	4	5.0	6	21.0

Table A-4: POINT SIDE RATING, 1940-1967

Site Number	Known Date	Hazardous Material	Soil Permeability	Length of Existence	Distance to Pop.	Rating
1	1965	3	4	2.0	7	16.0
2	1965	6	4	2.0	7	19.0
3	1965	6	4	2.0	6	18.0
4	1965	6	4	2.0	6	18.0
5	1965	6	4	2.0	0	12.0
6	1965	6	4	2.0	3	14.5
7	1965	6	4	2.0	6	18.0
8	1965	6	4	2.0	8	20.0

Source: Complied by author.

Table A-5: CALUMET AREA INDUSTRIES, 1897

Company	Site Number	SIC
Lehigh Valley Coal	1	5052
Kraetzer, Fische and Co.	2	2431
Calumet Elevator Co.	3 & 9	4221
People's Gas Light and Coke Co. & By-Products	4	4911
Jenkins and Co.	5	3412
Mohr and Sons Boiler Works	6	3443
Willard Sons and Bell Company	7	3462
Knickerbocker Ice Co.	8	2097
Morton and Co.	10 & 12	5161
Western Plaster Works	11	2894
Chicago & O'Neill Grain Co.	13	4221
Cleveland Linseed Oil Company	14	2076
Calumet Iron and Steel	15	3315
South Chicago Brewing Co.	16	2082
Chicago Ship Building Co.	17	3441
Aaron, L.I. Co.	18	2083
Chappell Chemical Co.	19	2819
U.S. Car Co.	20	3743
Compound Door Co.	21	1751
Iroquois Iron & Steel	22	3325
Illinois Central Railroad	23	4013

Winterbotham, JH and Sons	24	2444
Michigan Central Elevator	25	4221
Purcell, W.H.	26	2083
Swift and Co.	27	2097
Pullman Standard Car Co.	28 & 32	3743
Chicago Drop Forge and Foundry	29	3321
Calumet Paint Co.	30	2851
Smith and Co., J.P.	31	2097
Riverdale Distillery	33	2085
Illinois Terra Cotta Lumber Co.	34	3259
Silicon Steel	35	3312

Source: Sanborn Maps, 1897

Table A-6: CALUMET AREA INDUSTRIES, 1928

Company	Site Number	SIC
Schwill and Company	1	2083
Columbia Malting	2	2083
American Linseed Company	3	2076
Chicago Riverdale Lumber Company	4	2431
South End Publishing	5	2752
Sherwin-Williams Paint Company	6	2851
Calumet Yeast and Grain Products	7	2861
Calumet Refining Company	8	2911
Illinois Central Railroad	9	4013
Rosenbaum Elevators	10	4221
Keystone Elevator	11	4221
Illinois Steel Company	12	3325
Pullman Standard Car Company	13	3743
South Chicago Screen Company	14	3452
Griffin Wheel Company	15	3462
American Nokol Company	16	3433
Chicago Ship Building Company	17	3441
Mohr and Sons Boiler Works	18	3443
Calumet Storage Battery Company	19	3069

Illinois Slag and Ballast Company	20	3295
Illinois Brick Yard	21	3255
Kensington Concrete Construction Company	22	3271
South Chicago Pattern Works	23	3565
Calumet Pattern Works	24	3565
Travis Vacuum Products Company	25	3662
American Brake Shoe Company	26	3743
Ryan Car Company	27	3743
Ford Motor Company	28	3711
By-Products Coke Corporation	29	3312
Black Products	30	4324
Peoples Gas Light and Coke Company & By-Products	31	4911
Kensington Elevator	32	5153
Highland Door & Steel	33	3316
Interstate Steel	34	3312
Riverside Iron	35	3321
Kensington Steel	36	3325
Iroquois Iron and Steel	37	3325
Wisconsin Steel	38	3323

Source: Sanborn Maps 1897.

Table A-7: CALUMET AREA INDUSTRIES, 1960

Company	Site Number	SIC
Acorn Scrap and Wrecking Co.	1	5093
Adar Sales Co.	2	5161
Allied Equipment and Supplies	3	5085
American Asphalt Paving Company	4	2951
American Ship Building	5	3731
Anderson Construction	6	3567
Bernard Welding	7	3623
Bird Printers	8	2731
Burnham Specialities	9	3544
Byas, George	10	2731
Calumet Coal	11	3271
Calumet Pattern Works	12	3565
Calumite Company	13	3295
Cargill Inc.	14	2075
Ghanenson Tire and Supply	15	5014
Chicago Block Company	16	3271
Chicago Steel and Wire	17	3315
Connelly Slag Plant	18	3295
East Side Pattern and Model Shop	19	3565
East Side Printing	20	2731
East Side Saw and Tool Company	21	7699

Elmac Engineering Company	22	3651
Estelles Pastry Shop	23	2051
Firth-Loach Metals	24	2819
Gremp, Henry Company	25	3312
Illinois Slag and Ballast	26	3295
Illinois Steel Wire	27	3315
In Print	28	2711
Inland Feather and Down	29	5159
Interlake Iron	30	3312
Jakse, J & W	31	2099
Kasle Steel	32	3361
Kern, L.R.	33	2894
Mohr and Sons	34	3316
National Block	35	3271
Remmers Chemical Company	36	2869
Riverside Iron	37	3321
Sennholtz, Charles	38	2499
South Chicago Machine Works	39	3452
Sugar Service	40	5149
Tow Motor Corporation	41	3537
Travel Home of America	42	3792
Valley Mould and Iron Corporation	43	3544
Valvoline Oil Company	44	2992
Western Metal Products	45	3541
Wisconsin Steel	46	3316

Acme Steel	47	3312
Anderson Speciality	48	2851
Barker Chemical	49	2851
Black Products Company	50	3949
Chromium Mining and Smelting	51	3313
Johnswood Company	52	3471
Kern, Conrad, Flour and Feed	53	2041
Riverdale Millwork Company	54	2431
State Forging Die and Tool Company	55	3544
Aetna Engineering Works	56	3312
American Steel and Supply	57	5074
Baker Products Company	58	2911
Bell Gossett Chemical Company	59	2821
Booth Felt Company	60	2291
Brentwood Trailers	61	3792
Chicago Alumi File	62	3259
Chicago Hydraulic	63	3292
D and H Distributor	64	5149
DeVries Distribution Company	65	5149
Dicks Armstrong-Pontias	66	2851
Englander Company, Inc.	67	2515
Great Lakes Iron and Steel	68	3494
Hyndman, A.H. Company	69	3567
Imperial Smelting	70	3341

Inland Metals Refining	71	3339
Italian Cheese Company	72	4222
J and J Tool	73	2531
Jays Food Inc.	74	2099
Jennudd and Norman	75	2434
Kennedy Laundry Company	76	7211
Kensington Steel Company	77	3369
L & G Printing Company	78	2754
Lake Calumet Smelting Company	79	3332
Lundstrom Manufacturing	80	3585
Maes George	81	3994
Marder, B.L. Company	82	3953
Mississippi Valley Equipment	83	4225
Narin, TD	84	2869
Norman, Walter Company	85	2434
Novo Division Industrial Enterprise Inc.	85	3677
Pel-Door and Plywood Inc.	87	2431
Pennant Furniture Div.	88	2511
Pinecrest Lumber	89	5211
Pullman Pattern Works	90	3565
Pullman Sheet Metal Works	91	3444
Pullman Steel Warehouse Inc.	92	5051
Reade Manufacturing Co.	93	2879
Schulze, John and Son	94	2800

Sherwin-Williams Paint Company	95	2851
Stuart Paint Company	96	2851
Topper Speciality Products	97	3423
Tovino Bakery	98	2051
Tuthill Building Material Company	99	3290
Union Glass Company	100	3231
United Specialities	101	3714
U.S. Foot Appliances Corporation	102	2251
U.S. Plywood Corp.	103	2436
Vapofier Corp.	104	3433
Vega Industries	105	3443
Wilson, L.S. Manufacturing Company	106	3496
Wojton Pharmaceutical Company	107	2879
Bee Chemical Company	108	2891
Calumet Harbor Lumber Company	109	2661
Cyclone Fence Department U.S. Steel	110	3446
Globe Roofing Products	111	2952
Grayline Company	112	3651
Hakansson Industries	113	----
Iron and Steel Products Incorporated.	114	5088
Keystone Cartage Co.	115	6214
Lock Joint Pipe Co.	116	3259

Logo Inc. (Bee Chemical)	117	2851

Source: Chicago-Cook County Industrial Directory, 1960.

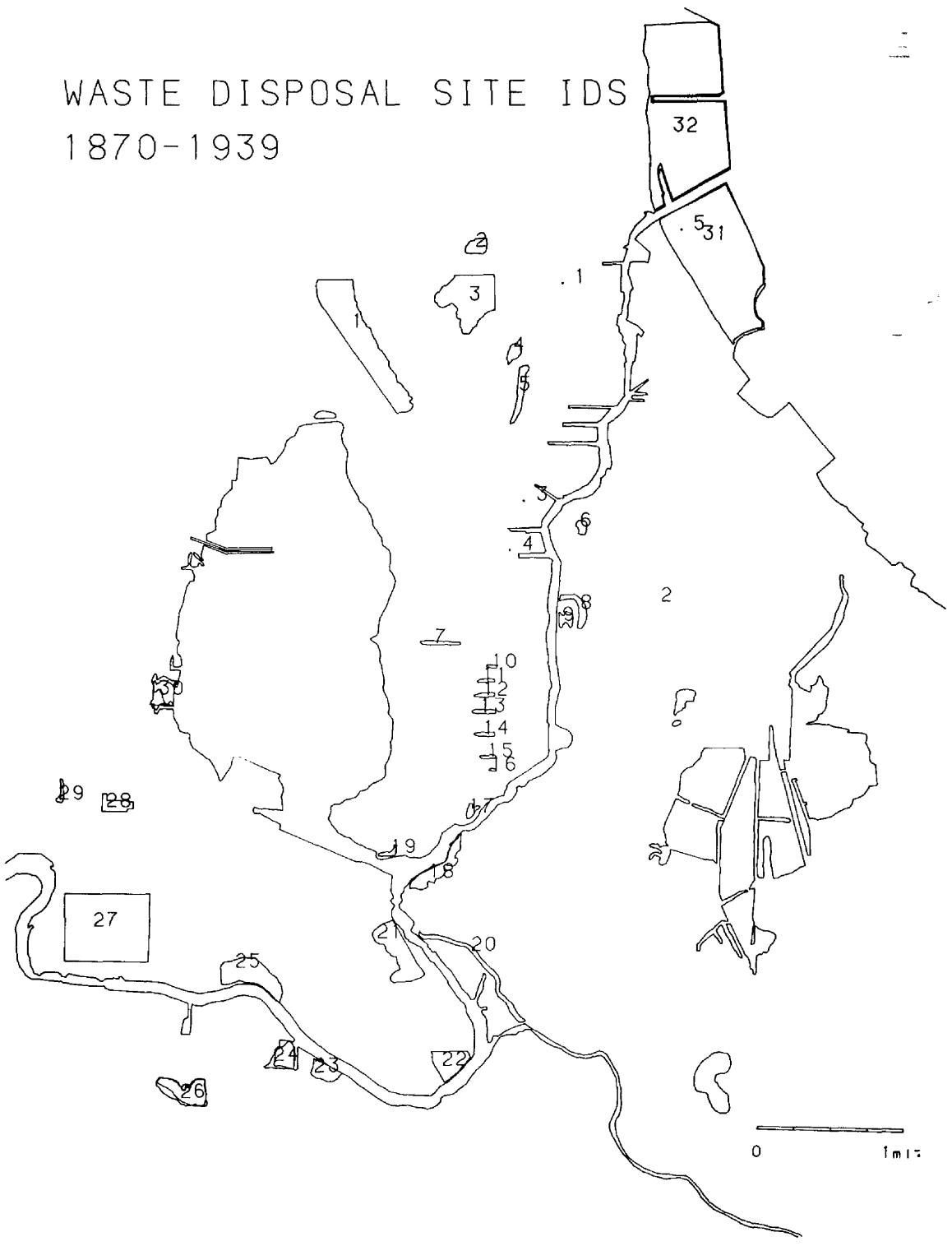


Figure A-1: Waste Disposal Site Numbers, Pre-1940

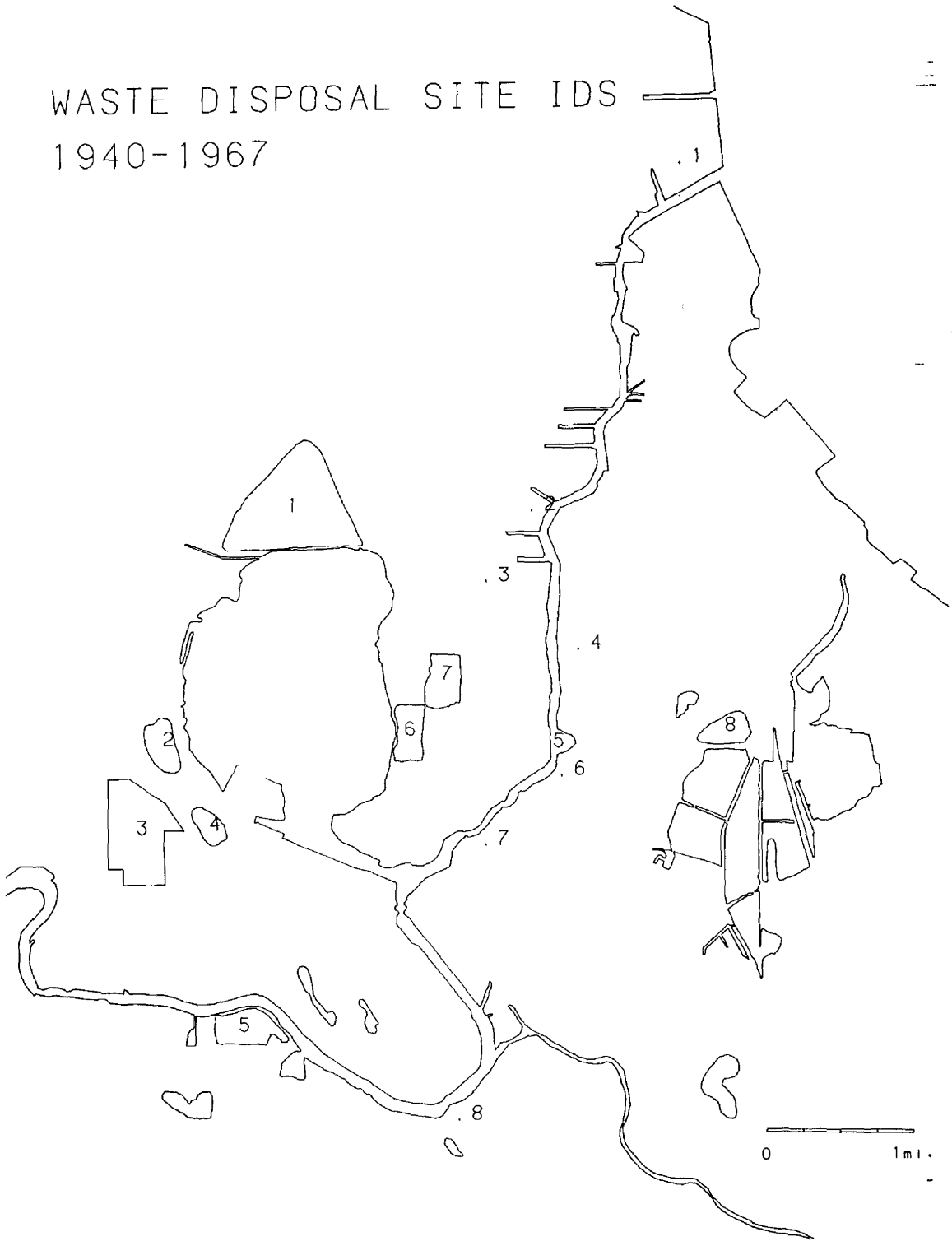


Figure A-2: Waste Disposal Site Numbers, 1940-1967

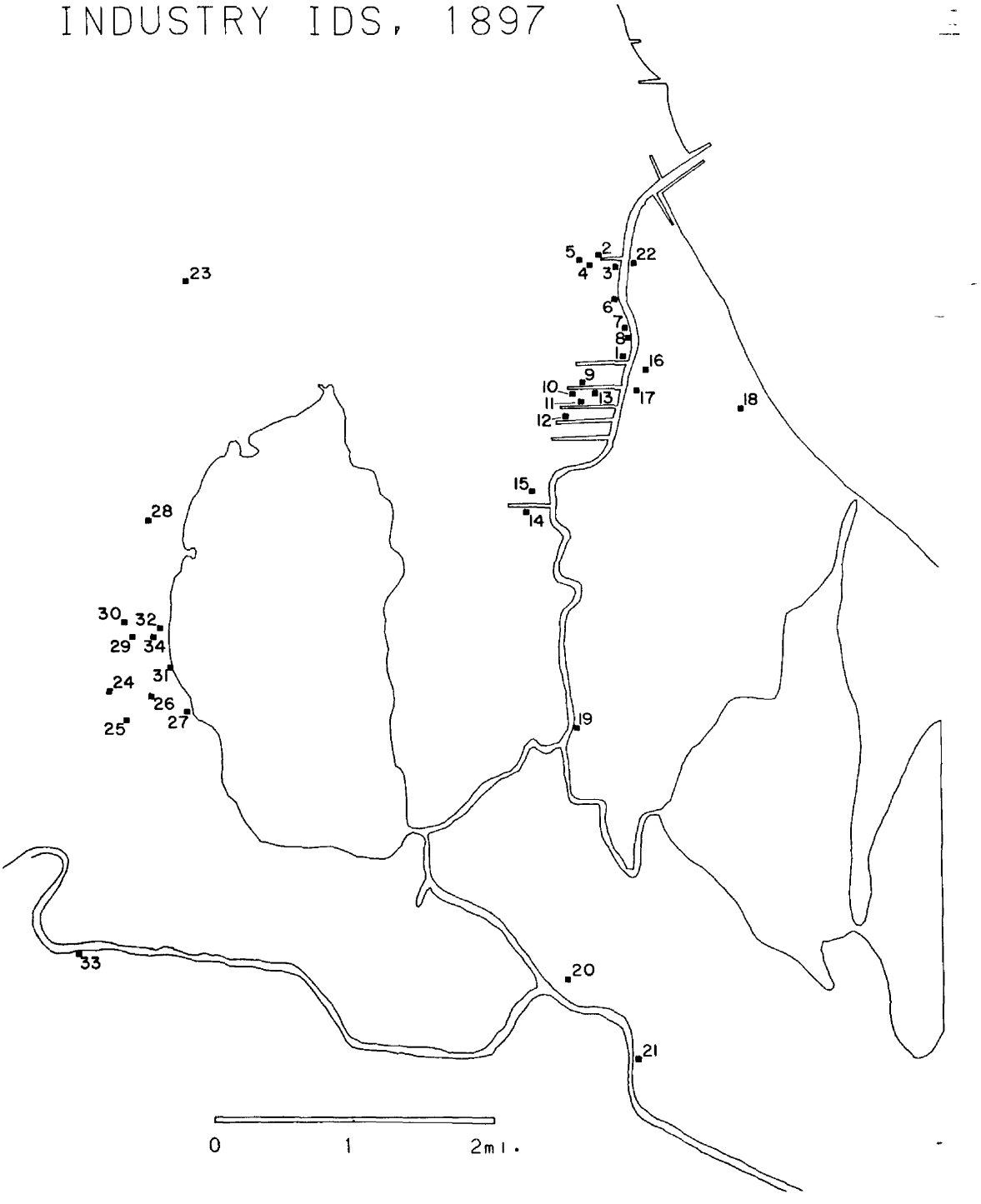


Figure A-3: Calumet Area Industry Site Numbers, 1897

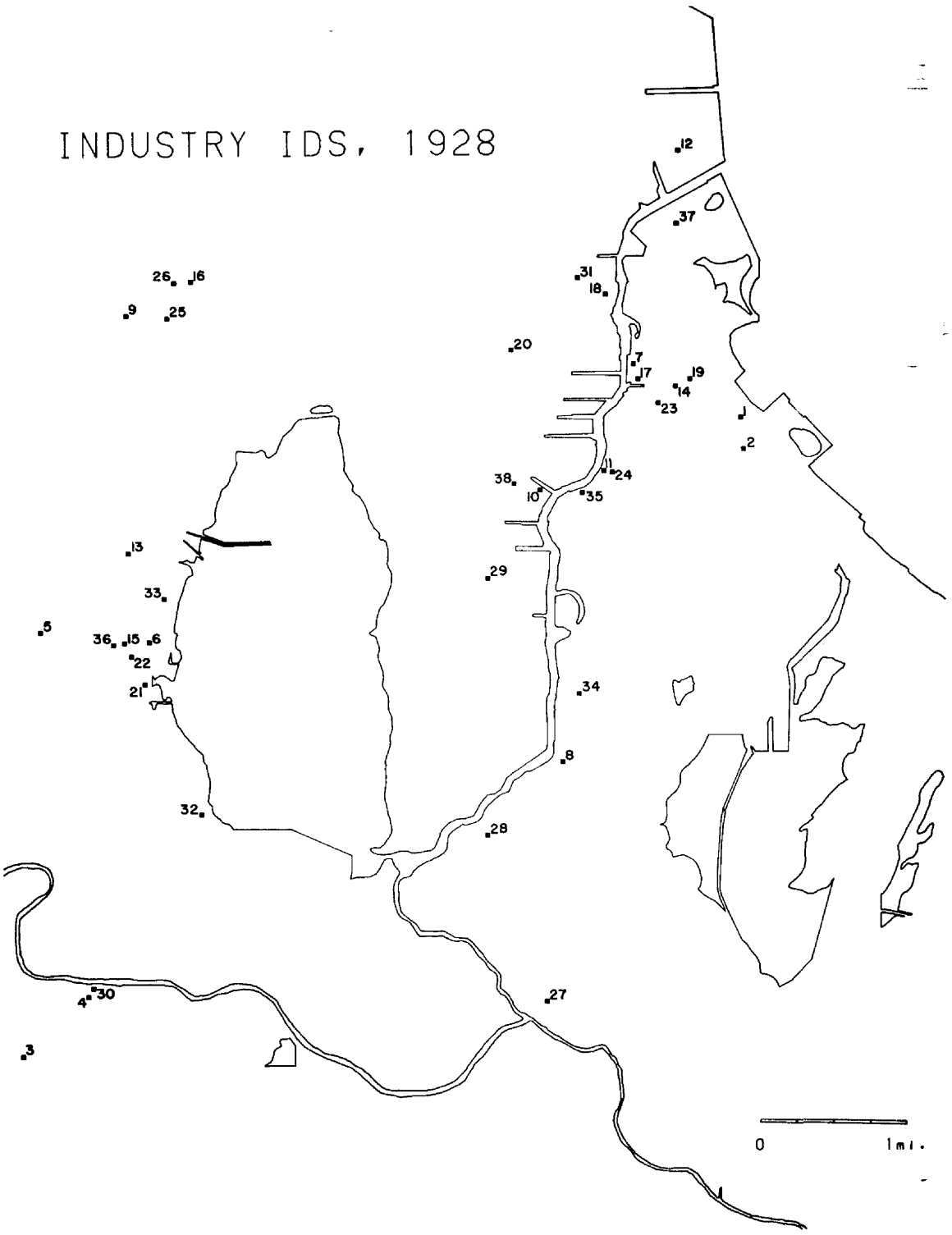


Figure A-4: Calumet Area Industry Site Numbers, 1928

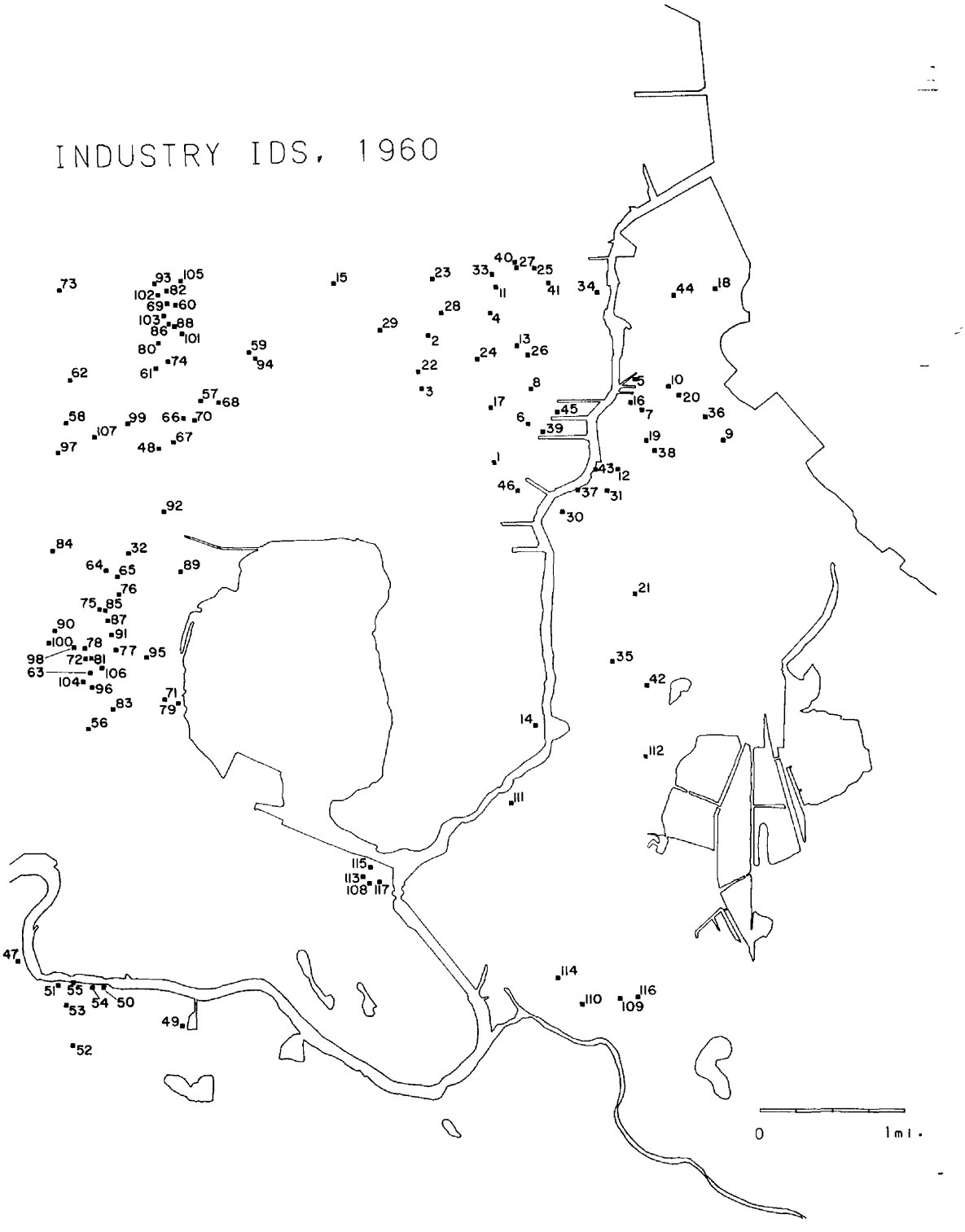


Figure A-5: Calumet Area Industry Site Numbers, 1960

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