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Task 7 _ Add _ Invest.

11- -84

INVESTIGATION AND ASSESSMENT
OF THE LOCKPORT COAL TAR SITE

TASK 7 REPORT
ADDITIONAL INVESTIGATIONS

Prepared for:

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I. SUMMARY

The Task 7 program of additional investigations at the Lockport Coal Tor Site has been completed. The current status of canal water use was researched in order to assess potential risks to public health. Because Lockport's canal water intake is located upstream of the site, any discharge of contaminants into the conol in the site vicinity is not likely to affect the quality of the conol water used os the city's supplementary water supply. Information concerning the location and construction of sewer lines, tunnels, and shafts in the site area was also collected in order to evaluate their potential to act as pathways for contaminant migration. No correlation between sewer tunnels and lateral migration of cool tor contaminants detected in ground water was obvious, but unlined shafts and drill holes may be preferred paths for vertical migration into bedrock. Two additional wells were installed to attempt to bound the northeastern extent of the pollutant plume. Well MW-15 was rehabilitated so that sampling can be resumed at that location. A minimum thickness of 30 inches of a gasoline-like liquid was measured at well MW-17, near the gas station on the corner of Transit and Genessee Streets. This fluid thickness was measured to evaluate the potential existence of a contributing off-site source of ground-water contamination.

2. INTRODUCTION

This report presents the results of Woodward-Clyde Consultants' (WCC) Task 7 investigation at New York State Electric and Gas (NYSEG) Corporation's Lockport Coal Tor Site. The report includes results of research activities os well os field investigations.

The purposes of the additional studies were to determine the lateral extent of contaminant distribution, to evaluate the potential existence of manmade pathways for contaminant migration, and to gather additional data to assess potential risks to public health. Specifically, the objectives of Task 7 investigations were to:

1. Determine the current status of conol water use and modify the conal water sampling plan as appropriate.

2. Collect additional information on existing sewer lines and tunnels/shafts in the vicinity of the site and plot their locations on a base map.

3. Based on information collected under Item 2, install two additional monitoring wells to attempt to bound the northeastern extent of the pollutant plume.

4. Rehabilitate monitoring well MW-15, in which a boiler was lodged, in order to resume sampling at that location.

5. Collect a sample of the gasoline-like substance previously observed in monitoring well MW-17 and measure the thickness of any free-floating hydrocarbons at the time of sampling.

The study was performed in accordance with WCC's proposal dated 7 June 1984 and recommendations in WCC's Second Round Task 3 Sampling Report. Work was performed under Supplement Number 5 to Contract 82S-240.

3. RESULTS OF INVESTIGATIONS

3.1 Status of Canal Water Use

Information concerning the use of canal water as a water supply was obtained from Mr. Harry Laufer, Superintendent of the Lockport Water Department, from Mr. Peter Sharkey, Chief Operator at the Lockport Water Treatment (Filtration) Plant, and from Mr. Ronald Gwozdek of the Lockport office of the Niagara County Health Department. Information gained from interviews and available data is summarized below.

The primary water supply for the City of Lockport is the east branch of the Niagara River in North Tonowanda, New York. Water is diverted by a pipeline approximately 15 miles long, extending from the Niagara River intake to the Summit Street Water Filtration Plant in Lockport (Figure 1). Water from the filtration plant supplies Lockport's 25,000 inhabitants as well as industrial and commerical users.

During periods of extreme drought or when maintenance of supply lines interrupts the primary supply, water is purchased from Niagara County by the City of Lockport. The county obtains its water from the west branch of the Niagara River. Its water intake is located south of the City of Niagara Falls, New York and supplies towns and villages in Niagara County which have no municipal water supplies.

When Niagara County cannot supply sufficient water to accommodate Lockport's needs, water from the Erie Barge Canal is blended with county water. The summer of 1978 is the most recent date of canal water blending, when city water supply lines were shut down for maintenance. Prior to 1978, canal water was last used in 1972, when city lines were again undergoing repairs. The canal water intake is located approximately 4600 feet upstream of the site, about 500 yards northeast of the Summit Street Bridge (Figure 1). According to the Superintendent of the Lockport Water Department, officials of the New York State Department of Health consider canal water undesireable due to its relatively poor quality.

Regular chemical analyses are performed by independent laboratories for the Lockport Water Department. All water entering the filtration facility is analyzed each day, before and after treatment, for hardness, chlorides, pH and alkalinity. Analyses for chlorinated benzenes and toluene are conducted on a weekly basis. Once a year the water is analyzed for trace metals and pesticides by the Niagara County Health Department. The New York State Department of Health conducts a priority pollutant analysis of the canal water upon the request of the Lockport Water Department, and/or when it is to be blended with county water. The last priority pollutant analysis of raw Lockport canal water was performed in June 1984. Results of these analyses for organic priority pollutants have been received from the Niagara County Health Department and indicate that concentrations of all organic priority pollutants were below detection limits. Analytical results are presented in Appendix D.

Processing of raw water entering the filtration plant is accomplished in four steps: chlorination, coagulation, filtration, and rechlorination. The water is first chlorinated with chlorine gas to kill pathogens. Turbidity is reduced by the addition of aluminum sulfate which coagulates colloidally suspended substances. Filtration through graded anthracite coal removes solids. The treated water is rechlorinated to raise residual levels of chlorine. In the summer months, treatment includes sodium chlorite to reduce undesirable tastes and odors.

Although canal water has been used as a supplemental water supply twice within the past twelve years, it does not appear likely that any discharge of contaminants to the canal from the site vicinity would have potential health impacts because the site is located downstream of Lockport's intake. To supplement analytical data of the New York State Department of Health, the canal sampling program has been modified such that samples are collected at two locations upstream of the site and two locations downstream of the site. Because the canal water intake is located in the same canal segment as the site, with no intervening locks, one sampling location is above the Sulphur Springs Guard Lock, upstream of the intake. At each canal sampling location, samples are collected from near the water surface and from near the bottom of the canal. This multi-depth sampling is intended to allow detection of contaminants of different densities.

3.2 Local Sewer Tunnels

Information concerning sewer lines and tunnels/shafts in the City of Lockport was obtained from Mr. William Gurner, Lockport City Engineer, from Mr. Al Rutter, Assistant City Engineer, and from Mr. John Seeley, who was Site Engineeer for McNamee, Porter, and Seeley Associates (MPS) during construction of the Main Interceptor tunnel in 1939. A report describing tunnel cleaning and lining was prepared by MPS in May 1965, entitled "Report on Maintenance on Rock Tunnel Intercepting Sewers Under Contract 1, Lockport, New York, 1963-64-65." This report is included in Appendix A. Information gained from this report as well as from interviews and other data is summarized below.

The City of Lockport, New York has a sewer system which utilizes tunnels excavated in rock as interceptor sewers. Figures 1 and 2 shows the location of the interceptor sewer tunnels, which were constructed in 1939 and 1940.

The Main Interceptor tunnel extends along State Road to South Transit Street, along South Transit Street one block between LaGrange and Genesee Streets, continues along what was formerly Buffalo Street, crossing under the Erie Barge Canal near St. Mary's Church and continuing to Williams Street, where it joins a pipeline extending to the sewage disposal plant on Jackson Street. The tunnel is 8,526 feet in length and has a 331-foot long lateral tunnel at its upper (southwestern) end, referred to as the Prospect Street tunnel. The Main Interceptor tunnel is approximately 6 to 9 feet high and 5 to 6 feet wide. Access to the tunnel is through four shaft openings, as shown in Figure 1. The depth to the tunnel invert below ground surface at access shafts varies from approximately 30 feet to 95 feet. Access shaft number 3 is located on South Transit Street approximately 40 feet northwest of NYSEG's substation. The tunnel invert is approximately 75 feet below street grade at this location.

The Southeastern Interceptor tunnel system comprises two tunneled sections, known as the Mill Street tunnel and the Southeastern Interceptor tunnel (Figure 1). Interior dimensions of both tunnels are similar to those of the Main Interceptor tunnel.

The Mill Street tunnel is 651 feet long and has two branch tunnels near its upper end. The Southeastern Interceptor tunnel is 2,409 feet long and has one 150-foot long branch tunnel near its lower end.

The invert of all tunnels was lined with gunite during construction. The Prospect Street tunnel was fully lined during construction, as were portions of the Main Interceptor tunnel (870 feet) and the Southeastern Interceptor tunnel (106 feet). During a tunnel inspection conducted in March 1962, spalled rock and sediment were observed to have accumulated to depths of over 4 feet, and the gunite lining was in places eroded and in need of repair. The lining of the Prospect Street tunnel was particularly cracked and deteriorated, and large amounts of water reportedly were infiltrating where the tunnel passes beneath the Erie Barge Canal. Subsequent to the removal of rock and soil debris, all tunnels were fully lined with gunite during the period 1963 to 1965.

Mr. John Seeley, former Site Engineer for MPS, observed water seeps in the rock wall during construction of the Main Interceptor tunnel in 1939. The seeps reportedly flowed from bedding planes in the Rochester Shale. No olfactory or visual indicators of coal tar were observed by Mr. Seeley at the time of construction. During inspection of the Main Interceptor tunnel in 1962, coal tar odors were detected by Mr. W. Gurner, City Engineer. Mr. Gurner reports that coal tar odors are present whenever the manhole cover over shaft number 3 is removed.

Effluent collected by the tunnels is transported through pipelines to the Sewage Disposal Plant located on Jackson Street (Figure 1). The interceptor tunnels are fed by a system of sanitary and storm sewer lines constructed of vitrified tile. Flow enters the tunnels through drill holes at various locations along the length of the tunnels. Locations of drill holes and sewer lines in the site vicinity are shown in Figure 2. During periods of heavy storm runoff, when the capacity of the interceptor tunnel is exceeded, untreated effluent is automatically diverted, at the diversion chambers shown in Figure 2, to empty directly into the Erie Barge Canal. Flow in the tunnels was similarly diverted to the canal during tunnel maintenance operations in 1963. This diversion of sewage is likely to have a detrimental effect on canal water quality.

The location of the sewer lines and the sewer interceptor tunnels does not suggest a direct pathway from the site to monitoring well MW-15 (Figure 2), where relatively high concentrations of coal tor constitutents hove been observed. However, unlined drill holes and shafts may be acting as preferred vertical pathways for migration of contaminants into bedrock. Sewage odors detected in several monitoring wells also suggest connection between leaky sewer lines and bedrock.

3.3 Installation, Testing, and Rehabilitation of Monitoring Wells

3.3.1 Well Installation

Two monitoring wells were installed to attempt to establish the northeastern limit of the ground-water contaminant plume.

Locations of the two new wells (MW-18 and MW-19) ore shown on Figure 2, well data ore summarized in Table 1, and boring logs and well installation reports ore included in Appendices B and C, respectively. Wells were installed by North Star Drilling Company under WCC's supervision. Monitoring well MW-18 was drilled to 45 feet below ground surface; MW-19 was drilled to 50 feet below ground surface. Both wells penetrate the upper 10 feet to 15 feet of the Rochester Shale Member. Soil and rock conditions encountered in both wells were consistent with previously observed conditions in the site vicinity.

Although no visual or olfactory indications of coal tor were encountered during drilling, all drilling equipment in contact with potentially contaminated soil, rock and/or water was decontaminated upon completion of drilling operations at each monitoring well. Decontamination procedures consisted of a detergent rinse, followed by on acetone rinse, followed by a clean water rinse.

Wells were advanced through overburden by 6-inch inside diameter (I.D.) hollow stem augers. Split spoon samples were collected at 5-foot intervals. Soil samplers were decontaminated before collection of each sample. Hollow stem augers were

replaced by 4-inch I.D. HW casing which was seated several inches into top of rock. A 2-foot deep rock socket was drilled using a roller bit, and 3-inch I.D. black steel riser pipe was installed to 6 inches below grade. The well was advanced through the Gasport Member using an NX core barrel fitted with a diamond set non-coring bit. The DeCew and Rochester Members were drilled with a roller bit. Upon completion of drilling, the annulus of the black steel riser pipe was tremie grouted to 6-inches below grade as the temporary casing was simultaneously removed. A vented PVC cap was installed on the riser. A cast iron utility box was installed approximately flush with the pavement surface. Both wells were developed to dryness by repeated air-lifting. Each well was air-lifted six times, with partial recharge between lifts.

3.3.2 Permeability Tests

To estimate the hydrualic conductivity (permeability) of bedrock, slug tests were performed in both newly installed monitoring wells. The slug test consists essentially of measuring the rate at which the water level in a monitoring well declines after a known volume ("slug") is introduced instaneously, or conversely, the rate at which the water level in a well rises after a slug is removed. Because the volume of the slug is small compared to the volume of water in the aquifer, the test is on estimate of hydraulic conductivity only in the vicinity of the well.

At the start of the test, the slug was quickly and smoothly lowered into the well until immersed. The water level was allowed to return to the static level as recorded prior to immersion. The slug was then quickly removed from the well. Changes in millivolts produced by the pressure transducer placed in the well, reflecting the change in water level, were recorded on a strip chart. The test was considered complete when the water level again returned to the static level. A computer program was used to calculate permeability.

Test results are included in Table 2. The calculated permeability of 1.9×10^{-2} cm/sec for MW-19 was much higher than the typical values of 10^{-4} cm/sec to 10^{-5}

cm/sec previously calculated for other wells in the site vicinity. The permeability of 7.9×10^{-4} cm/sec calculated for well MW-18 is within this range of typical values.

3.3.3 Rehabilitation of Monitoring Well MW-15

A 3-inch outside diameter (O.D.) PVC bailer had become lodged in monitoring well MW-15 at approximately 20 feet below ground surface during well evacuation on 1 December 1983. Repeated attempts to dislodge the bailer failed, and no sample could be recovered because the water level was below 20 feet. Using a drill rig, NYSEG personnel attempted to remove the bailer on 20 December. Their efforts failed, but they were able to drill through the bailer and push it deeper, to approximately 40 feet. The following day, the well was evacuated, and bulk samples were collected by WCC's representative using a 2-inch O.D. stainless steel bailer. During collection of an additional sample vial, this bailer became lodged at a depth of approximately 27 feet and could not be raised or lowered. An additional attempt to extricate the bailer was made during the second round of Task 3 sampling in March 1984 but was unsuccessful.

Under WCC's supervision, North Star Drilling attempted to raise the stainless steel bailer using a 1-inch rock wedge on 27 August 1984. The bailer was pushed to within 2 feet of the bottom of the well, such that the well was open to a depth ot 45 feet. The well was then reamed 45 feet with a 2-15/16-inch diameter roller bit to smooth rock surfaces. The driller reported irregular surfaces below 27 feet. After reaming, the well was re-developed by air-lifting to remove any fragments of the PVC bailer. No future difficulties with sampling well MW-15 are anticipated.

3.4 Sampling at Monitoring Well MW-17

Strong gasoline odors and oily sheens had been detected at monitoring well MW-17 during previous sampling events. A sample of free-floating (second phase) material was collected during the fourth round of Task 3 sampling, on 20 September 1984. A translucent teflon bailer, measuring 3 feet in length and 1.5 inches in outside diameter, was lowered to a depth 4 feet below the static fluid level in the well. Upon withdrawal,

the bailer contained 30 inches of a dark fluid floating upon a clear fluid presumed to be water. A gasoline odor was noted. The sample was placed into 1-liter gloss sample jars and tightly capped. The sample jars are presently stored on site in NYSEG's unheated storage building at the South Transit Substation.

4.0 CONCLUSIONS

Water from the Erie Barge Canal has been used in past years as a supplemental water supply for the City of Lockport. However, the canal water intake is located approximately 4600 feet upstream of the site, and any discharge of contaminants to the canal in the site vicinity is not likely to affect the quality of the canal water used as Lockport's supplemental supply.

Discharge of untreated sewage into the canal from a diversion chamber in the site vicinity during heavy storm runoff is likely to adversely affect canal water quality. This sewage should be considered as a potential source for contaminants detected in canal water.

The city's system of sewer lines and tunnels does not appear to be acting as a direct conduit for lateral migration of coal tar contaminants. However, unlined shafts and drill holes may be acting as preferred paths for vertical migration of contaminants into bedrock. The presence of coal tar odors in the interceptor tunnel at greater depths than those presently being investigated suggests that contamination may exist below the upper 10 to 15 feet of the Rochester Shale Member.

The installation of two additional monitoring wells and the rehabilitation of well MW-15 should allow collection of useful ground-water quality data at the northeastern end of the contaminant plume.

The presence in MW-17 of at least 30 inches of a dark, oily fluid with a gasoline odor suggests that the gas station on the corner of Transit and Genessee Streets may be a contributing source of ground-water contamination, particularly of volatile aromatic compounds.

TABLE I
BORING AND WELL DATA

Boring No.	Existing Ground Elev.	Depth of Boring	Elev. of Top of Rock	Elev. of Top of DeCew	Elev. of Top of Rochester	Elev. of Water[f]
B-1	607.94	50.0	585.6	574.6	564.7	601.5[b]
B-2	596.32	38.8	588.1	568.6	564.0	a
B-3	607.32	41.8	587.6	574.7	a	606.0[b]
B-3-1[e]	603.39	51.5	589.3	574.4	561.4	d
B-3-2[e]	595.89	50.0	587.2	569.0	563.9	d
MW-1	594.33	48.0	586.4	573.1	566.8	568.7
MW-2	595.00	50.7	578.0	575.2	564.7	576.1
MW-3	600.95	60.0	588.5	572.0	560.8	589.6
MW-4	627.57	82.2	588.2	571.8	563.0	609.9
MW-5	604.91	50.0	586.3	570.9	561.9	591.9
MW-6	604.41	50.0	589.6	574.4	567.9	584.3
MW-7	600.48	55.0	589.8	573.0	560.5	584.4
MW-8	574.47	30.0	570.2	565.5	558.0	565.6
MW-9	602.12	50.0	585.3	575.6	569.6	596.6
MW-10	597.97	50.0	586.0	573.5	564.5	588.9
MW-11	596.49	30.0	587.1	570.0	a	588.0
MW-12	596.35	53.5	586.8	568.9	563.9	561.3
MW-13	593.73	50.0	585.3	568.7	561.7	580.0
MW-14	617.12	70.0	585.6	571.1	563.6	607.2
MW-15	591.31	50.0	586.0	573.8	565.3	566.8
MW-16	574.69	30.0	583.5	568.2	560.7	565.7
MW-17	594.36	35.0	586.4	569.9	563.4	581.9
MW-18	598.94	50.0	586.4	573.9	564.9	589.9
MW-19	592.41	45.0	583.4	574.4	563.4	581.7
IW-1	594.37	11.6	586.5	a	a	589.1
IW-2	604.93	21.0	586.9	a	a	601.9
B# 15*	593	69.5	587	568.5	c	c
B# 16*	594.5	70	582.5	c	c	c
B# 17*	598	73	588.2	c	c	c

*These borings from 1939 New York State Sewer Improvement Plan. (Ground elevations from base mop by Lockwood Support Services.)

NOTE: All elevations are in feet

a - Not encountered
b - Water level before casing was pulled
c - Cannot be interpreted from boring log
d - Not determined
e - Inclined 35° from vertical, to N70W
f - Water level measured on 17 to 21 September 1984

D938/185

TABLE 2

PERMEABILITY TEST DATA

Well No.	Interval Tested (Depth, Feet)	Permeability cm/sec
MW-1	29.5 - 48.0	8.2×10^{-5}
MW-2	20.5 - 50.7	3.9×10^{-5}
MW-3	11.7 - 60.0	5.8×10^{-5}
MW-4	19.0 - 82.2	1.9×10^{-4}
MW-5	21.8 - 50.0	2.3×10^{-4}
MW-6*	39.5 - 49.5	9.5×10^{-6}
MW-7*	44.5 - 54.5	2.5×10^{-6}
MW-8	20.0 - 30.0	1.1×10^{-4}
MW-9	19.0 - 50.0	1.7×10^{-4}
MW-10	14.0 - 50.0	3.0×10^{-4}
MW-11	10.0 - 30.0	8.7×10^{-4}
MW-12*	43.7 - 52.8	1.8×10^{-3}
MW-13	27.4 - 50.0	2.5×10^{-4}
MW-14	11.75 - 70.0	5.1×10^{-4}
MW-16	12.0 - 30.0	1.1×10^{-4}
MW-17	21.7 - 35.0	3.7×10^{-5}
MW-18[a]	11.0 - 45.0	7.9×10^{-4}
MW-19[a]	14.5 - 50.0	1.9×10^{-2}

*Wells sealed in Rochester Shale Member.
[a] Slug test conducted 21 September 1984.
All permeability values calculated from slug tests.
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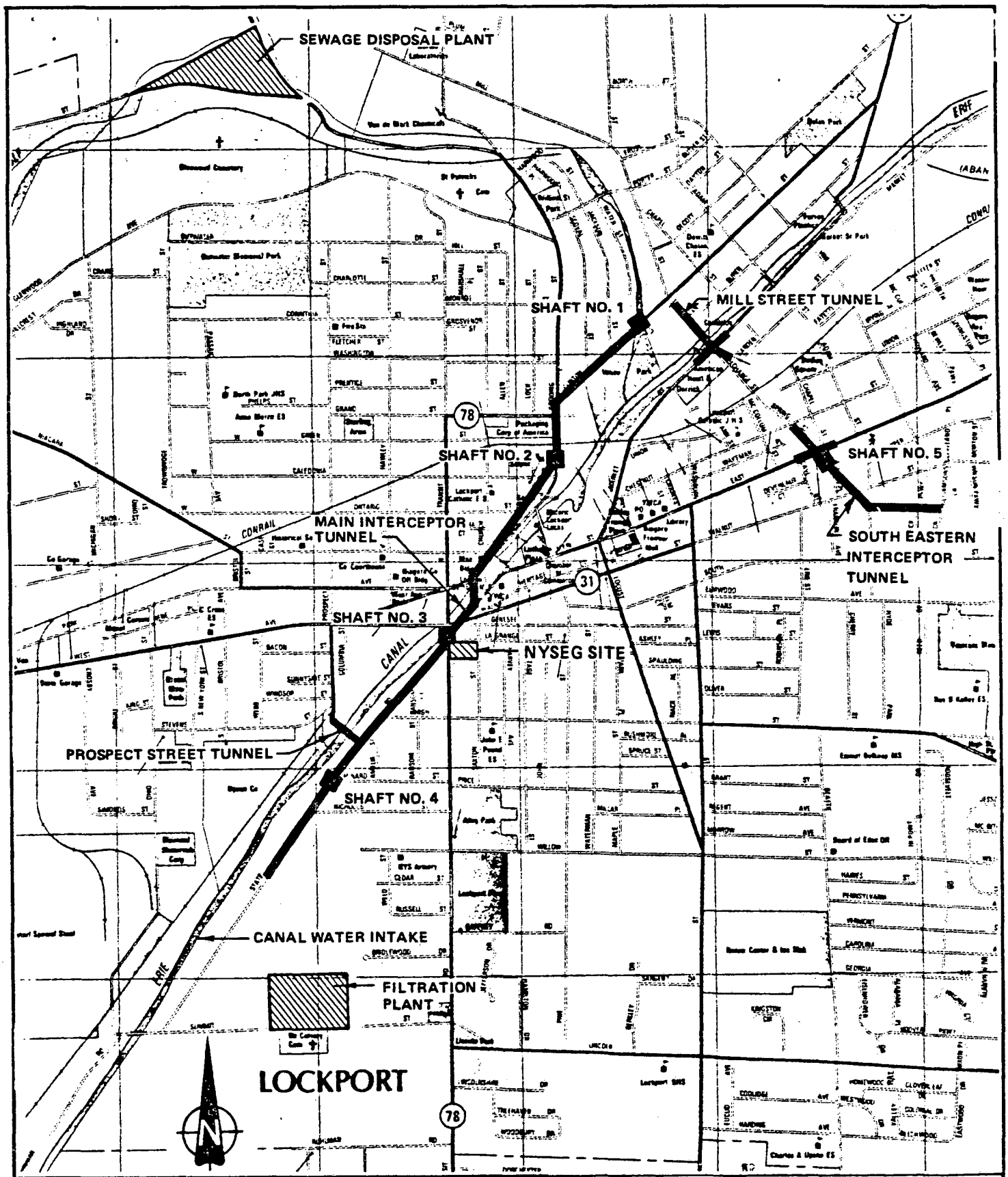


SOURCE: LOCKPORT/EASTERN NIAGARA COUNTY CHAMBER OF COMMERCE, 1984

LEGEND

SEWER TUNNEL

SHAFT

0 1/4 1/2 1 MILE

SCALE

LOCATION MAP
CITY OF LOCKPORT, NEW YORK

WOODWARD—CLYDE CONSULTANTS, INC.

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
NEW YORK, NEW YORK

DR. BY: CIG	SCALE: AS SHOWN	PROJ. NO.: 82C4495-7
CK'D. BY: DRG	DATE: 12 SEPT 1984	FIG. NO.: 1

APPENDIX A

MCNAMEE, PORTER, AND SEELEY ASSOCIATES' REPORT ON TUNNEL MAINTENANCE

REPORT OF MAINTENANCE ON ROCK TUNNEL INTERCEPTING SEWERS UNDER CONTRACT 1, LOCKPORT, NEW YORK

1963-64-65

The City of Lockport, New York has a system of combined sewers utilizing tunnels as interceptor sewers. There are two interceptor tunnels, the Main Interceptor tunnel and the Southeastern Interceptor tunnel, which were constructed in 1939 and 40.

The Main Interceptor tunnel is 8,526 feet in length of which 870 feet was lined during construction in 1939. In addition it contains a laterial tunnel near its upper end which I shall refer to as the Prospect Street tunnel. It is 331 feet long and was fully lined in 1939. The Main Interceptor tunnel is approximately 6 to 9 feet high and 5 to 6 feet wide. The Prospect Street tunnel varies from approximately 4 feet 6 inches to 3 feet 6 inches in height and is approximately 3 feet 6 inches wide. Access to the tunnel is by four shaft openings over the tunnel. The depth to the tunnel invert below the ground surface at the shaft openings varies from approximately 30 feet to 95 feet.

The Southeastern Interceptor contains two tunneled sections; the Mill Street tunnel and the main body of the Southeastern Interceptor. For clarity the Mill Street section will be referred to in this report as the Mill Street tunnel and the main body as the Southeastern Interceptor tunnel. The Mill Street tunnel is 651 feet long with two branch tunnels near

REPORT ON MAINTENANCE ON ROCK TUNNEL INTERCEPTING SEWERS UNDER CONTRACT 1 LOCKPORT, NEW YORK 1963-64-65

its upper end; one 184 feet long and the other 77 feet long. It is 4 1/2 to 6 feet in height and approximately 4 feet wide. Access to the Mill Street tunnel is through a manhole at the lower end at the corner of Mill and Clinton Streets. The Southeastern Interceptor tunnel is 2,405 feet long, and approximately the same size as the Main Interceptor tunnel. Of this length 106 feet were lined during construction of the tunnel in 1939. Near the lower end there is a 151 feet long branch tunnel. Access to the Southeastern Interceptor tunnel is by one shaft opening near its center on Carlton Place.

The invert of all the tunnels was lined with gunite during construction of the tunnels. The Main Interceptor, the Prospect Street tunnel, and the Mill Street tunnel each pass under the New York State Barge Canal. The tunnels were driven through rock strata of limestone, sandstone, and lime shale. The sanitary and storm flow enters the tunnels through drill holes at various locations along the length of the tunnels.

A detailed field inspection of the tunnels was made in March, 1962 by personal of McNamee, Porter and Seeley, Consulting Engineers to the City of Lockport. Approximately 2,200 feet of the tunnels could not be inspected due to the depth of material in the tunnels. It was found that weathering had caused the rock on the ceiling and side walls to loosen and spall off in spots. Where the rock fall was heavy the

tunnel was partially dammed off causing silt and gravel to be deposited on the invert. The depth of material in those areas that could be inspected varied from 6 inches to 3 feet. Also it was found that the gunite on the invert had been eroded away in places leaving holes up to 12 inches deep, and that patching was needed on portions of the sections that were lined during construction of the tunnels.

McNamee, Porter and Seeley reported in July, 1962 to the City of Lockport the results of the inspection and recommended that the entire length of tunnels be cleaned and all loose rock scaled from the side walls and ceiling. Also that portions of the tunnel be lined with a 5000 psi gunite cement lining to prevent further spalling of the rock.

The City of Lockport approved recommendation and commissioned McNamee, Porter and Seeley to prepare plans and specifications for cleaning, scaling and lining portions of the tunnels.

The Contract labled Sanitary Sewer Maintenance Contract 1 was divided into two divisions. Division A consisted of cleaning all the tunnels and scaling and removing all loose rock. The work under Division B was to consist of lining portions of these interceptor tunnels. 5142 feet were to be lined with a 2 inch thick unreinforced 5000 psi gunite cement lining and 122 feet with a 6 inch reinforced 5000 psi gunite cement lining. Also provisions were made in the contract under Division B for repairing the eroded sections of invert and patching the already lined sections where necessary.

To facilitate cleaning, the flow into the tunnels had to be

diverted at the drill holes into the New York State Barge Canal and the Eighteen Mile Creek. As the barge canal was to be drained for the winter December 15, December 1, 1963 was set as the date for completion of Division A. The date for completion of Division B, gunite lining, was December 15, 1963.

The City of Lockport received bids July 10, 1963. The contract for Division A was awarded to Central Pipe Maintenance Company of Akron, Ohio, the low bidder at $54,162.00. Pressure Concrete Company of Florence, Alabama was the low bidder on Division E at $113,159.00 and was awarded the contract. Hereafter Central Pipe Maintenance Company shall be referred to as the cleaning contractor and Pressure Concrete Company as the gunite contractor.

Permission was obtained from the New York State Department of Health to divert the sewage to the Barge Canal and the Eighteen Mile Creek, and the cleaning contractor began working in the Southeastern Interceptor tunnel August 19, 1963. He expected to have this tunnel cleaned in approximately two weeks by dragging a system of buckets, some as large as 48 inches in diameter, through the tunnel collecting material as it went. He then would lift the bucket to the surface by a hoist and dump the material removed on the ground to be trucked away later. When cleaning of the Southeastern Interceptor was completed he would turn it over to the gunite contractor so that he could begin his work.

From the begining the cleaning progressed very slowly. The contractor's equipment and supervision were poor. There were

equipment breakdowns nearly every day and as often as two or three times a day, causing much lost time. Some of the rock was too large to fit into the buckets and had to be dragged from the tunnel individually. The bucket was redesigned so that it worked more as a scraper. This worked better, but the material had to be handled again to be removed from the bottom of the shaft. Most days no more than three or four cubic yards of material would be removed from the tunnel. The Resident Engineer informed the contractor his progress was not satisfactory and suggested some new methods be implemented, but his suggestions went unheeded.

The gunite contractor was finally able to start work on November 1, 1963 on sections of the Southeastern Interceptor that had been cleaned and the cleaning contractor completed his work in this tunnel on November 5, 1963.

The gunite contractor progressed with his work very well, with only occasional inclement weather delaying him. It was recommended by the Resident Engineer that 420 feet of gunite lining be placed in this tunnel in addition to that called for in the contract and some repairs be made in the invert. The City of Lockport approved his recommendation and Change Order 1 was issued. The gunite contractor completed his work on Division B and Change Order 1 in the Southeastern Interceptor November 11, 1963.

As the cleaning was progressing much slower then expected, the cleaning contractor started work on the lower end of the

Main Interceptor tunnel with a second crew on September 27, 1962. His progress in this tunnel was better than in the Southeastern Interceptor tunnel but was still slow with breakdowns of equipment causing much lost time. At best the amount of material removed per day was about 10 cubic yards. A night shift was put on in the Main Interceptor tunnel the middle of November in an attempt to speed up the operation. By December 1, 1963, the date of completion, only about 2100 of the 8,526 feet in this tunnel had been completed.

The gunite contractor, after finishing the Southeastern Interceptor tunnel, moved to the Main Interceptor tunnel and gunited those sections of the tunnel under this contract and which had been cleaned. He moved his equipment from the job November 19, 1963, suspending operations until such time as sufficient tunnel had been cleaned to warrant his return.

By the middle of March, 1964 approximately 50% of the cleaning contract had been completed. On March 31, 1964 at a meeting with the Mayor of the City of Lockport and the Resident Engineer, Central Pipe Maintenance Company announced they intended to default on their contract and all work on cleaning was stopped at this time.

The gunite contractor returned to the job and resumed work April 13, 1964 and gunited all that which was called for and had been cleaned. He moved his equipment from the job site once again on May 8, 1964 with approximately 40% of his contract completed.

After much negotiating between the City of Lockport and Central Pipe Maintenance Company's bonding company. The Great American Insurance Company, a contract was signed with Pressure Concrete Company to complete the cleaning on a cost plus basis. All terms of the original contract were to be met and the City of Lockport had the right to break the contract on one days notice if they were not satisfied with Pressure Concrete Company's progress.

Pressure Concrete Company commenced work on the cleaning contract July 13, 1954. Their method of attacking the problem was by using concrete buggies, or "Georgia" buggies as they are often called, fitted with brackets so that they could be lifted out through the shaft opening by a crane and the material dumped into a truck. They were loaded with shovels by hand and hauled through the tunnel by manual labor. The material removed was handled only once, which was during loading.

Pressure Concrete Company made good progress using this method and removed as much as 30 cubic yards of material per day, averaging better than 20 cubic yards of material per day. Probably the biggest reason for the improved progress was the excellent supervision furnished at the job site by Pressure Concrete Company. The superintendent made every effort to keep the operation as efficient and economical as possible.

After one month's work enough tunnel had been cleaned for the gunite crew to resume work. The guniting as before, went very well. By September 28, 1954 the gunite crew had caught up with the cleaning. They stopped work and moved their equipment from the job site. The gunite contract, Division B and Change Order 1 was approximately 90% completed.

The cleaning crew continued working. As they progressed up the tunnel the rock and deposited material became deeper. In some stretches it was 4 1/2 feet deep, especially in those sections of the tunnel that had not been inspected. On October 28, 1964 a crew was started cleaning in the Mill Street tunnel. The same method of cleaning was used as in the Main Interceptor tunnel, but the progress was slower as the smaller size of the Mill Street tunnel made working difficult. The two crews worked simultaneously until November 25, 1964 at which time the cleaning was completed in the Main Interceptor tunnel. Cleaning was continued in the Mill Street tunnel.

The gunite equipment was returned to the job site and the gunite crew resumed work December 1, 1964. Ouniting under Contract 1 Division A and Change Order 1 was completed in the Main Interceptor tunnel December 7, 1964. The cleaning crew had just completed work in the Mill Street tunnel so the gunite crew immediately started guniting this tunnel. They finished working in this tunnel December 12, 1964. This completed all work under Contract 1 Division B and Change Order 1. Approximately 10% was left to be completed on Contract 1 Division A. This consisted of some re-scaling in the South-eastern Interceptor tunnel, closing of the shaft openings, and general cleanup.

An inspection tour of the tunnels was made by personal of McNamee, Porter and Seeley and the City Engineer of Lockport on October 31, 1964. As the cleaning was nearly completed all sections of the tunnels were inspected, including those that

were impossible to inspect in March 1962. As a result of the inspection McNamee, Porter and Seeley recommended that all the remaining unlined portions of the tunnel be lined with the 2 inch, 5000 psi gunite cement lining. Also it was found that the lining which had been placed during construction of the tunnel, in the Main Interceptor tunnel where it passes under the Barge Canal was not structurally sound. It was recommended that a reinforced lining of 6 inch gunite be placed on the ceiling and of 3 inch gunite on the sidewalls in this section. The lining placed during the construction of the Prospect Street tunnel, which also passes under the Barge Canal was cracked and a large amount of water from the canal was infiltrating into the tunnel. There were voids between the rock and the lining. It was recommended that this section and the 500 foot lined section adjacent to the Prospect Street tunnel in the Main Interceptor tunnel be pressure grouted to fill the voids and stop the infiltration. The City of Lockport approved the recommendations, prices were negotiated with Pressure Concrete Company and Change Order 2 was issued.

The gunite crew began work on Change Order 2 January 5, 1965 in the Mill Street tunnel and completed guniting this tunnel January 7, 1965. The opening to this tunnel was then closed. They next gunited the Main Interceptor tunnel and completed this tunnel with the exception of the stretch under the Barge Canal on February 11, 1965. The equipment was moved to the Southeastern Interceptor tunnel and guniting was begun in this tunel the same day. Work was completed in the Southeastern

Interceptor tunnel March 8, 1965. They completed guniting the section in the Main Interceptor under the Barge Canal March 15, 1965.

Grouting was started in the Prospect Street tunnel March 29, 1965 and stopped by the Resident Engineer the next day. It was found that lining was in a worse condition than first thought and would need patching. This amounted to 831 feet of tunnel. The City of Lockport approved the recommendation for the additional patching and Change Order 3 was issued. The patching was begun April 12, 1965 and completed in three days. Gouting was resumed April 19, 1965 and completed April 22, 1965 thus completing all work on Change Order 2 and Change Order 3.

The remaining shaft openings were closed and general cleanup performed thus completing work on Contract 1 - Division A on April 25, 1965.

We would recommend that an inspection of the entire interceptor tunnel be made in April 1966 and based on the results of this inspection that regular inspection intervals be established at either every year, every two years, three years or five years. We believe that by establishing and maintaining regular inspections, trouble spots can be taken care of before becoming expensive cleaning operations.

The final cost of this project was as follows:

Division A - Cleaning and Scaling

19,205.93 was paid to Central Pipe Maintenance Co.

84,980.44 was paid to Pressure Concrete Co.

for a total of $104,186.37

Of this total amount, $16,248.60 was paid by the Health, Education and Welfare Department of the Federal Government, $50,024.37 was paid by the Great American Insurance Company, and $37,913.40 was paid by the City of Lockport.

Division B - Gunite Lining

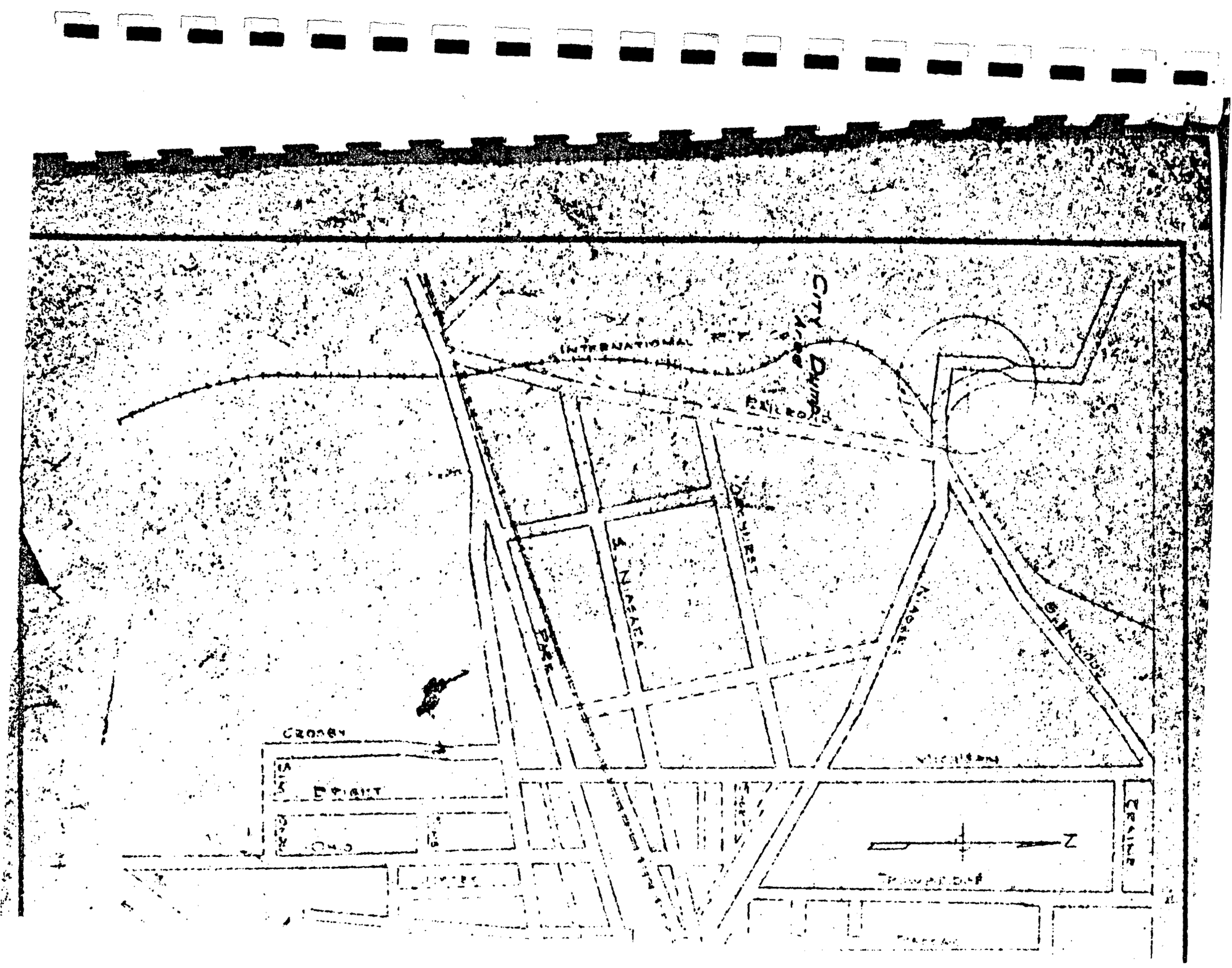
$224,162.13 was paid to Pressure Concrete Co.

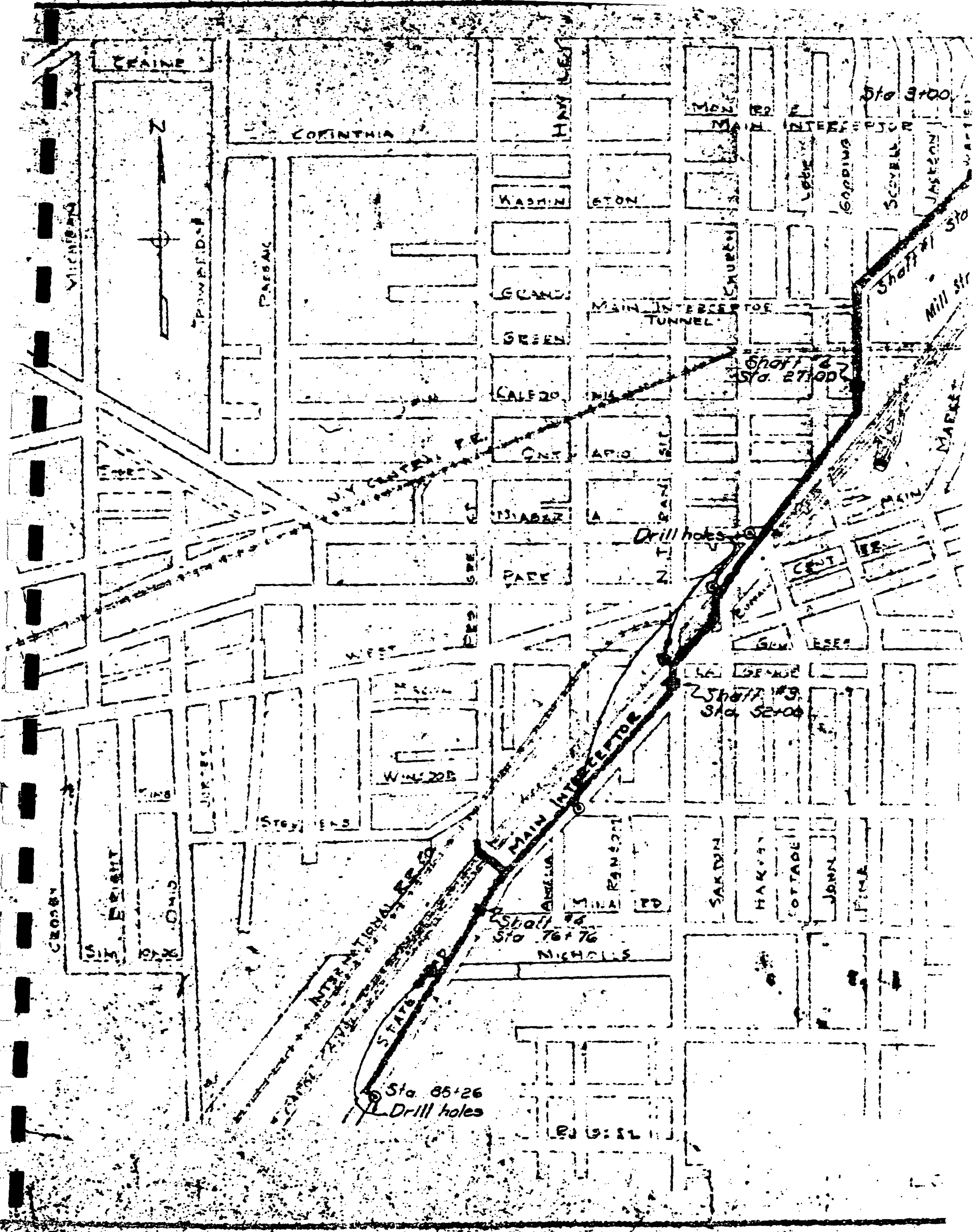
Of this amount 67,248.64 was paid by the Health, Education and Welfare Department and $156,913.49 was paid by the City of Lockport.

The total cost of Divisions A and B was $328,348.20.

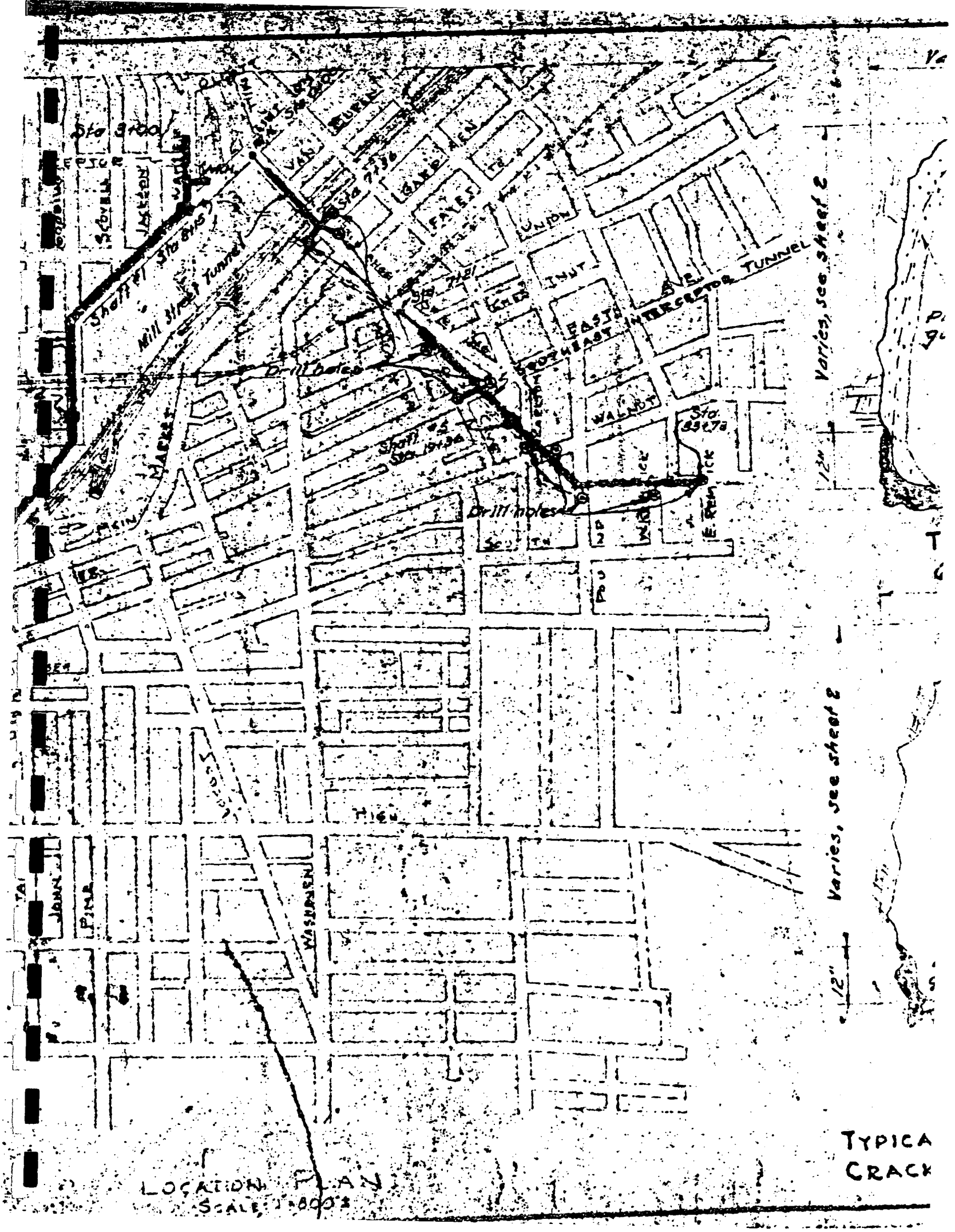
McNAMEE, PORTER AND SEELEY

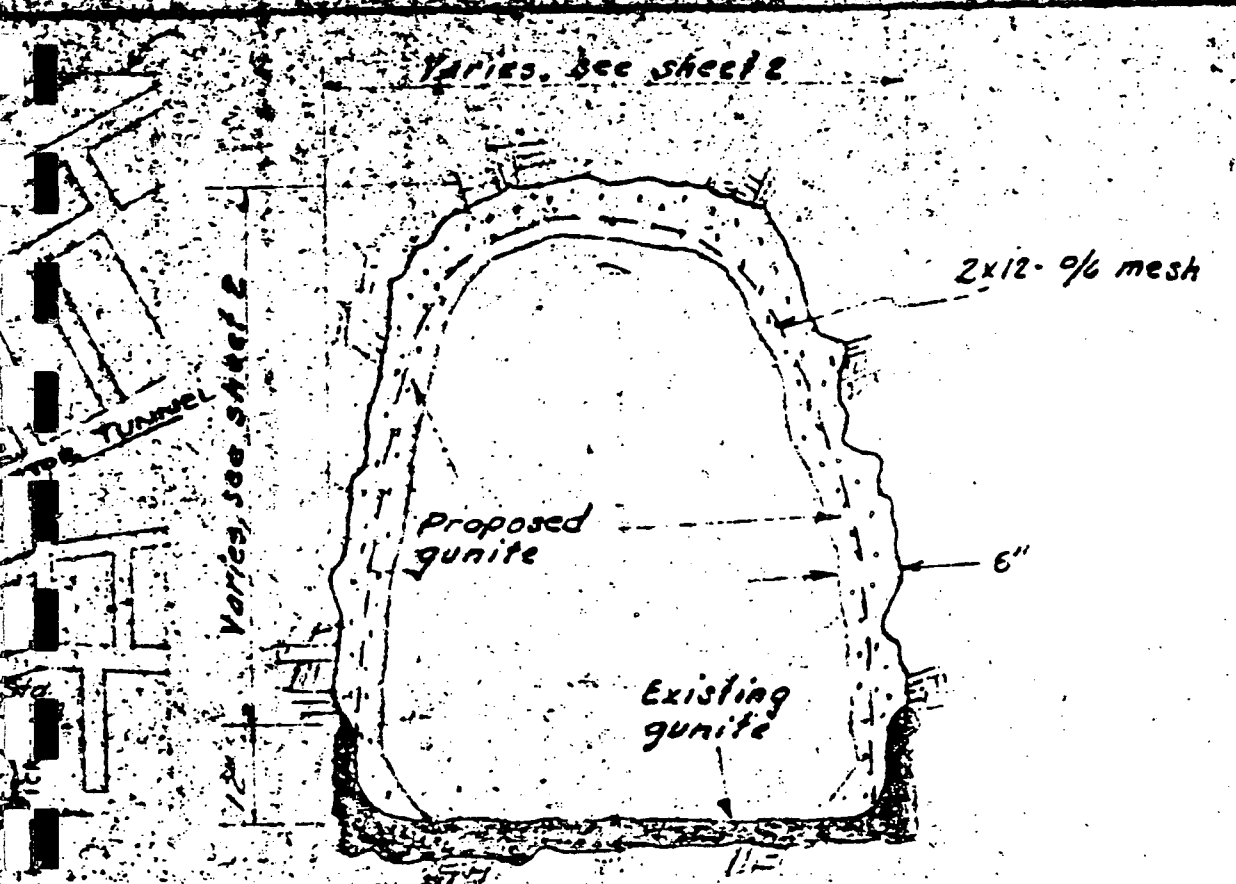
By Richard S. Leeke
Resident Engineer


INTERNATIONAL R.R.
CITY DUMP
R.R.
OAK
FIRST
E. NIAGARA
PARK
NIAGARA
CROSBY
E. FERRY
OHIO
MICHIGAN
GRAND
N

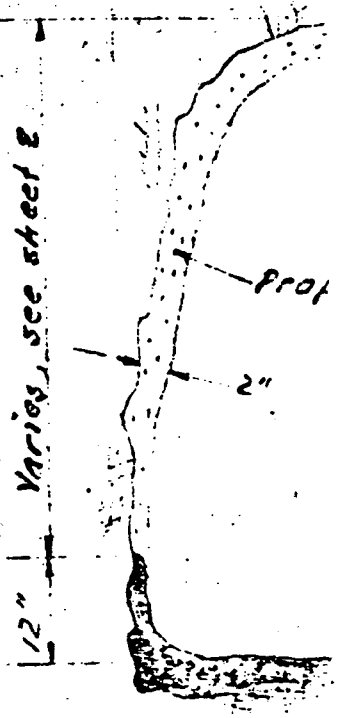


CRAINE
CORINTHIA
MAIN INTERCEPTOR
Sta 3+00
WASHINGTON
GRAND
MAIN INTERCEPTOR
TUNNEL
GREEN
Shaft #1
Mill St
Shaft #2
Sta. 27+00
ONTARIO
N.Y. CENTRAL R.R.
MAIN
Drill holes
PARK
WEST
Shaft #3
Sta. 52+00
MAIN INTERCEPTOR
WINDSOR
STEVENS
INTERNATIONAL R.R. CO
Shaft #4
Sta 76+76
NICHOLS
STATE
Sta. 85+26
Drill holes
CROSBY
BRIGHT
OHIO
COTTAGE
JOHN

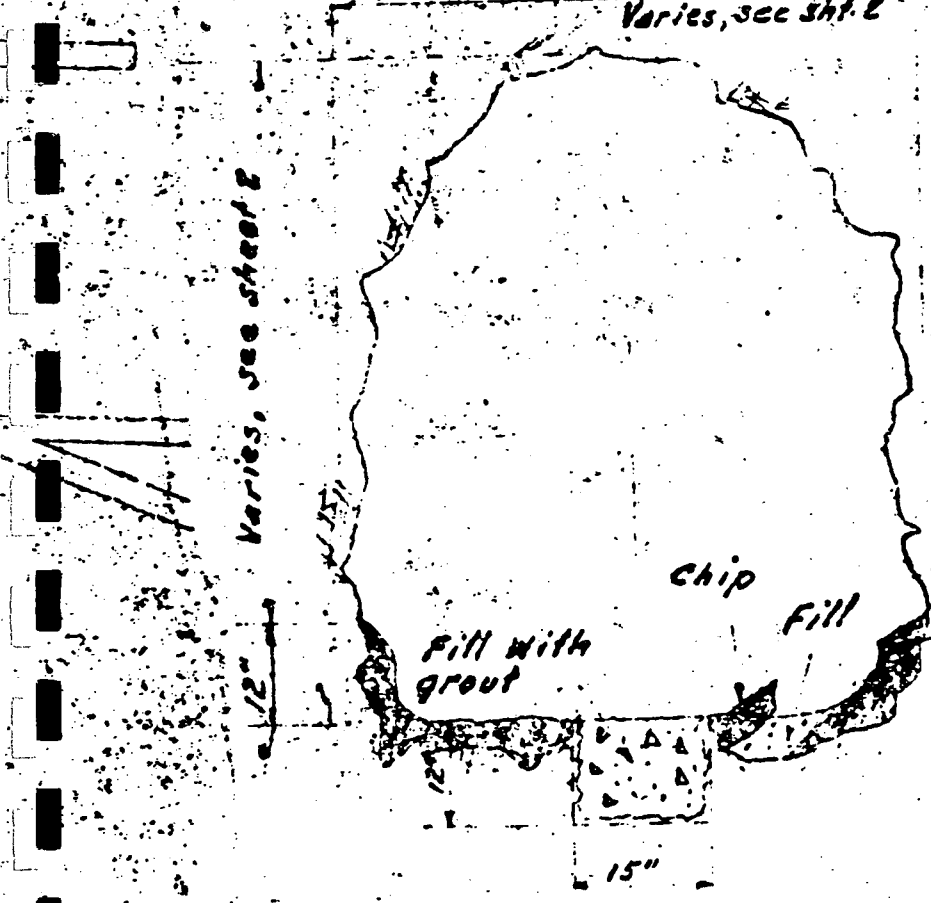

Sta 9+00
Shaft #1 Sta 8+36
Mill Street Tunnel
Drill holes
Shaft #2 Sta 19+36
Drill holes
Sta 23+78
EASTSIDE INTERCEPTOR TUNNEL
MARKET
WALNUT
CHERRY
LOCUST
PINE
WASHINGTON
Varies, see sheet 2
1/2"
LOCATION PLAN
SCALE: 1"=800'
TYPICA
CRACK



TYPICAL DETAIL OF
6" GUNITE LINING



TYPICA
2" GUI

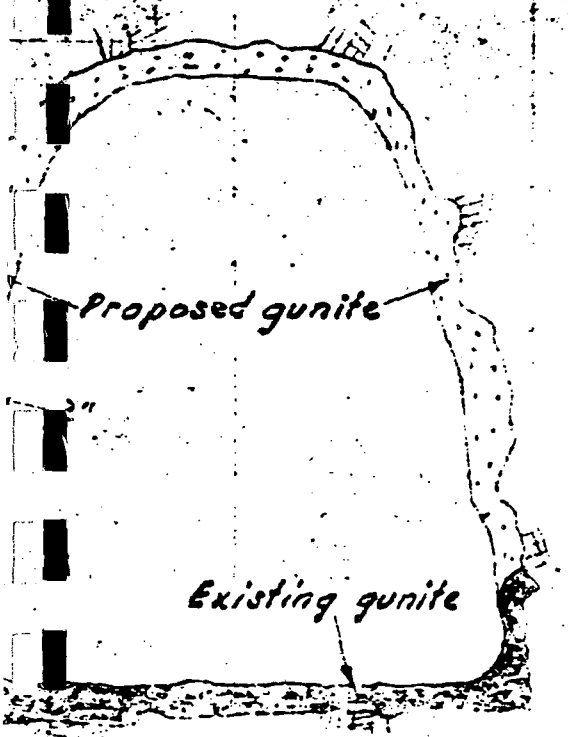


TYPICAL DETAIL OF REPAIR OF
CRACKS IN EXISTING LINING

Note: For location o
of gunite lini
this contract
sht. 1-S-2 wi
construction

Conforming to const
Records
May, 1965

...res, See sheet 2



TYPICAL DETAIL OF
2" GUNITE LINING

LEGEND

- Loose Rock
- Gravel and Silt
- Sludge
- Mixture of sand, silt and rock.
- Inspection of tunnel not possible.

...tion and quantities
...te lining placed under
...ract see tabulation
... which conforms to
...ction records

LOCKPORT, [illegible]
INTERCEPTING SEWERS
CONDITION OF TUNNELS
INSPECTION: MARCH, 1962

PROPOSED GUNITE SECTIONS
LOCATION OF TUNNELS

...onstruction
...s
965

McNAMEE, PORTER AND SEELEY
CONSULTING ENGINEERS
ANN ARBOR, MICHIGAN

SCALE: AS NOTED

DATE: JUNE 1962

SHEET 1 OF 16

APPENDIX B

BORING LOGS

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

LOG OF BORING MW-18 **SHEET** 1 **OF** 3

PROJECT AND LOCATION: LOCKPORT COAL TAR SITE LOCKPORT, NEW YORK		ELEVATION AND DATUM: 598.94	PROJECT NO.: 82C4495-7
DRILLING AGENCY: NORTH STAR DRILLING COMPANY	FOREMAN: J. THEW	DATE STARTED: 8/29/84	DATE FINISHED: 8/29/84
DRILLING EQUIPMENT: TRAILER MOUNTED C.M.E. 35 HYDRODRILL DRILL RIG		COMPLETION DEPTH: 50.0 FT	ROCK DEPTH: 12.5 FT
SIZE AND TYPE OF BIT: 7 7/8 TRICONE ROLLER BIT 6 IN. OD AUGER BIT	SIZE AND TYPE CORE BARREL: 3 IN. NON-CORING BIT NX "DOUBLE TUBE" C.B.	NO. SAMPLES: DIST 3	UNDIST NONE CORE NONE
CASING 4 IN. HW FLUSH JOINT		WATER LEVEL: FIRST 9.5 FT COMPL 6.4 FT 24 HR 9.9	
CASING HAMMER: WEIGHT 300 LB	DROP 24 INCHES	BORING ANGLE AND DIRECTION: VERTICAL	
SAMPLER 2 in. OD/1 3/8 IN I.D. SPLIT SPOON		INSPECTOR: DAVID MUSCALO	
SAMPLER HAMMER: WEIGHT 140 LB	DROP 30 INCHES		

DESCRIPTION	PENETRATION	DEPTH, FT	SAMPLES: TYPE NO. LOG	SAMPLES: RECOV. FT	SAMPLES: PENETR. RESIST. BLOWS/FT	W_n,%	LL,%	PL,%	-200,%	REMARKS
ASPHALT PAVEMENT	6 IN. I.D. BLACK STEEL RISER TO 0.5 FT UELOW GROUND SURFACE	1								DRILLER USED 6 IN O.D. AUGER TO DRILL TO TOP OF ROCK
CONCRETE SLAB										
Tan m SAND and f-m GRAVEL with trace asphalt-(DRY)-(FILL)		2	S-1	0.6	3 5 2					DRILLER SET 4 IN. I.D. CASING TO TOP OF ROCK AT 12.5 FT
		3								
		4								
		5								
		6	S-2	1.5	5 5 3					
Reddish-brown f sandy SILT with trace to some m. sand (Damp) (Glacio-lacustrine)		7								
		8								
		9								
Reddish-brown SILT with trace organics (WET) (Glacio-lacustrine)		10	S-3	1.0	4 7 19					
		11								DRILLER USED 3 7/8 IN ROLLER BIT TO FORM ROCK SOCKET FROM 12.5 TO 14.5 FT
TOP OF ROCK 12.5 FT. ELEV. 586.4 FT M.S.L.		12								
		13								
		14								
Light Gray DOLOMITE (Gasport Member)	3 IN. DIA. OPEN HOLE TO 14.5 FT	15								MILKY WHITE COLORED WASH WATER
		16								
		17	NX RUN-1 C.B.	0						DRILL RATE: 2 MIN/FT
		18								
		19								
		20								

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

LOG OF BORING MW-18 SHEET 2 OF 3

DESCRIPTION	DEPTH, FT	SAMPLER TYPE & NO.	SAMPLER RECOV. FT	W_n, %	LL, %	PL, %	-200, %	REMARKS
Light Gray DOLOMITE (Gasport Member)	21–24	NX Run-2 C.B.	0					DRILL RATE: 2 MIN/FT TO 25 FT
ELEV. 573.9 FT. M.S.L. Dark Gray Shaly DOLOMITE (DeCew Member)	25–26	NX Rubber C.B.	0					WASH WATER COLOR CHANGE FROM MILKY WHITE TO MEDIUM GRAY AT 25 FT
	27–30							DRILLER BEGAN USING 2 15/16 IN ROLLER BIT AT 26 FT
	31–34							DRILL RATE = 4 MIN/FT TO 34 FT.
ELEV. 564.9 FT. M.S.L. Dark Gray Limy SHALE (Rochester Member)	35–39							DRILL RATE = 2.5 TO 2 MIN/FT. WASH COLOR CHANGE FROM MEDIUM GRAY TO DARKER GRAY
	42–45							WASH COLOR DARK GRAY

3 INCH DIA. OPEN ROCK TO 14.5 FT

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

LOG OF BORING MW-18 SHEET 3 OF 3

DESCRIPTION	PENETRATION	DEPTH, FT	SAMPLES: TYPE	SAMPLES: NO.	SAMPLES: RECOV. FT	SAMPLES: PENETR. RESIST. BLOWS/FT.	W_n, %	LL, %	PL, %	-200, %	REMARKS
Dark Gray Limy SHALE (Rochester member)	DIA. 0.4, OPEN HOLE TO 50 FT	46 47 48 49 50									WASH COLOR DARK GRAY DRILL R TI 2.F TO 2 MIN/ FT.
BOREHOLE TERMINUS 50.0 FT ELEV. 548.9 FT. M.S.L.											

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

LOG OF BORING MW-19 SHEET 1 OF 2

PROJECT AND LOCATION: LOCKPORT COAL TAR SITE LOCKPORT, NEW YORK		ELEVATION AND DATUM: 592.41	PROJECT NO.: 82C4495
DRILLING AGENCY: NORTH STAR DRILLING CO.	FOREMAN: J. THEW	DATE STARTED: 8/28/84	DATE FINISHED: 8/28/84
DRILLING EQUIPMENT: TRAILER MOUNTED CME 35 HYDROROTARY DRILL RIG		COMPLETION DEPTH: 45.0 FT	ROCK DEPTH: 9.0 FT
SIZE AND TYPE OF BIT: 5 7/8 IN TRICONE ROLLER BIT - 6 IN HOLLOW STEM AUGER	SIZE AND TYPE CORE BARREL: 3 IN. NON-CORING BIT NX "DOUBLE TUBE" C.B.	NO. SAMPLES: DIST 2	UNDIST NONE CORE NONE
CASING: 4 IN. HW FLUSH JOINT		WATER LEVEL: FIRST N/A	COMPL. 10.5 FT 24 HR 10.4 FT
CASING HAMMER: WEIGHT 300 LB.	DROP 24 IN.	BORING ANGLE AND DIRECTION: VERTICAL	
SAMPLER: 2 IN. O.D. / 1 IN. I.D. SPLIT SPOON		INSPECTOR: D. MUSCALO	
SAMPLER HAMMER: WEIGHT 140 LB	DROP 30 IN.		

DESCRIPTION	PIEZOMETER	DEPTH, FT	SAMPLES: TYPE NO. LOG	RQD/%, FT	PENETR RESIST BLWS/FT	W_n,%	LL,%	PL,%	-200,%	REMARKS
ASPHALT PAVEMENT CONCRETE PAVEMENT BRICK PAVEMENT		1								DRILLER DRILLED 4 IN. CASING TO 9.2 FT - DRILLED ROCK SOCKET 2 FT INTO ROCK TO 11 FT. - USE 3 7/8 IN ROLLER BIT
Reddish-brown gravelly CLAY with trace to some sand and organics - (Damp) (FILL)	3 IN. I.D. BLANK STEEL RISER TO 0.5 FT BELOW G.S.	2	S-1	0.5	7 7 4					
		3								
		4								
Reddish-brown gravelly CLAY with trace to some sand and organics - trace cinders. - piece of cobble - (moist to wet) - (FILL)		5								
		6	S-2	0.5	5 10 25					
		7								
		8								
		9								
TOP OF ROCK 9.0 FT ELEV. 583.41 FT. M.S.L.		10								WASH WATER COLOR MILKY WHITE
Light Gray DOLOMITE (Gasport Member)	3 IN. I.D. OPEN ROCK TO 11.0 FT	11								DRILL RATE - 2 MIN/FT TO 17 FT
		12	NX RUN-1 C.B.							
		13								
		14		0	2 MIN./FT					
		15								
		16								WASH WATER COLOR CHANGE FROM MILK WHITE TO MEDIUM GRAY AT 18.0 FT
		17								
ELEV. 574.4 M.S.L.		18								DRILL RATE INCREASED TO 6 MIN/FT AT 17 FT.
Dark Gray Shaly DOLOMITE (DeCew Member)		19								DRILLER BEGAN USING 2 15/16 ROLLER BIT AT 10.5 FT
		20								

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

LOG OF BORING MW-19 SHEET 2 OF 2

DESCRIPTION	DEPTH, FT	W_n,%	LL,%	PL,%	-200,%	REMARKS
Dark Gray Shaly DOLOMITE (De Cew Member)	21–28					DRILL RATE = 3.5 MIN/FT TO 29 FT. Medium gray COLORED WASH WATER
ELEV. 563.4 FT. M.S.L.	29					DRILL RATE = 2 min./FT FROM 29 FT
Dark Gray Limy SHALE (Rochester Member)	30–36					WASH WATER COLOR CHANGE FROM MEDIUM GRAY TO DARKER GRAY AT 29 FT
3 IN. I.D. OPEN ROCK TO 11.0 FT.	37–40					WASH WATER COLOR DARK GRAY
	41–42					DRILL RATE = 2 FT./MIN.
ELE. 547.4 FT. MS.L.	43–45					WASH WATER COLOR DARK GRAY

BOREHOLE TERMINUS 45 FT

APPENDIX C

MONITORING WELL INSTALLATION REPORTS

MONITOR WELL INSTALLATION REPORT

Monitor Well No. MW-18

Project LOCKPORT COAL TAR SITE — Location WALNUT ST.

Project No. 92C4495 — Installed By J. THEW — Date 5/28/89 — Time 2:30 PM

Method of Installation DRILLED; INSTALLED ROCK SOCKET FROM 12.5 TO 14.5 FT - INSTALLED 2 II BLACK STEEL RISER PIPE IN ROCK SOCKET - DRILLED BOREHOLE TO 50 FT BELOW GROUND SURFACE - TAMPED CEMENT GROUT IN RISER PIPE ANNULUS TO GROUND SURFACE - INSTALLED WATER BOX FLUSH WITH PAVEMENT - INSTALLED PVC CAP AT TOP OF RISER PIPE

LOG OF MONITOR WELL

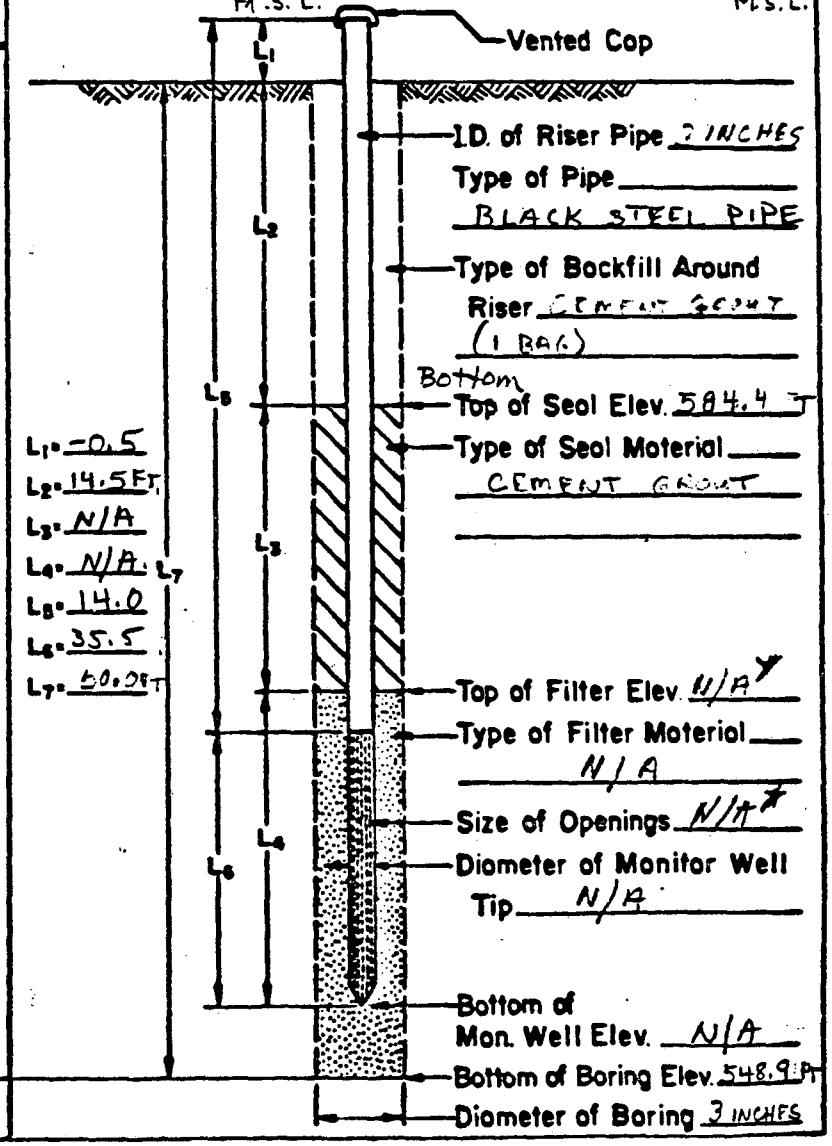
BORING

Depth in ft.	Description	Symbol
0	ASPHALT / CONCRETE	
2	SAND AND GRAVEL (FILL)	
4		
6		
8	Sandy SILT	
10		
12		
14	TOP OF ROCK 12.5 FT ELEV. 586.4 FT Light Gray DOLOMITE (Gasport member)	
16		
18		
20		
22		
24		
26	ELEV. 573.9 MSL Dark Gray Shaly DOLOMITE (DeLew member)	
28		
30		
32		
34	ELEV. 564.9 FT. M.S.L. Dark Gray Limy SHALE (Rochester member)	
36		
38		
40		
42		
44		
46		
48		
50	BOREHOLE TERMINUS 50 FT ELEV. 548.9 FT M.S.L.	

MONITOR WELL

Type of Monitor Well OPEN IN ROCK

Ground Elev. 598.94 FT M.S.L. — Top of Riser Elev. 598.44 FT M.S.L.



- Vented Cap
- I.D. of Riser Pipe 2 INCHES
- Type of Pipe BLACK STEEL PIPE
- Type of Backfill Around Riser CEMENT GROUT (1 BAG)
- Bottom Top of Seal Elev. 584.4 FT
- Type of Seal Material CEMENT GROUT
- Top of Filter Elev. N/A*
- Type of Filter Material N/A
- Size of Openings N/A*
- Diameter of Monitor Well Tip N/A
- Bottom of Mon. Well Elev. N/A
- Bottom of Boring Elev. 548.9 FT
- Diameter of Boring 3 INCHES

L1 = -0.5
L2 = 14.5 FT
L3 = N/A
L4 = N/A
L5 = 14.0
L6 = 35.5
L7 = 50.0 FT

Remarks N/A* = NOT APPLICABLE

DEPTH TO WATER UPON COMPLETION : 6.4 FT

Inspected By David Muscato

WOODWARD-CLYDE CONSULTANTS

MONITOR WELL INSTALLATION REPORT

Monitor Well No. MW-19

Project LOCKPORT COAL TAR SITE — Location COTTAGE - MAIN S INTERSECTION

Project No. 82C4495 — Installed By J. THEW — Date 28 AUGUST 1984 Time 4:30 PM

Method of Installation DRILLER INSTALLED ROCK SOCKET 5 FT INTO TOP OF ROCK - INSTALLED 3 IN. I.D. BLACK STEEL PIPE RISER IN ROCK SOCKET - DRILLED BOREHOLE TO 45 FT BELOW GROUND SURFACE - TREMIED CEMENT GROUT AROUND RISER PIPE TO GROUND SURFACE INSTALLED WATER BOX FLUSH WITH GROUND SURFACE - INSTALLED VENTED PVC CAP AT TOP OF RISER PIPE

LOG OF MONITOR WELL

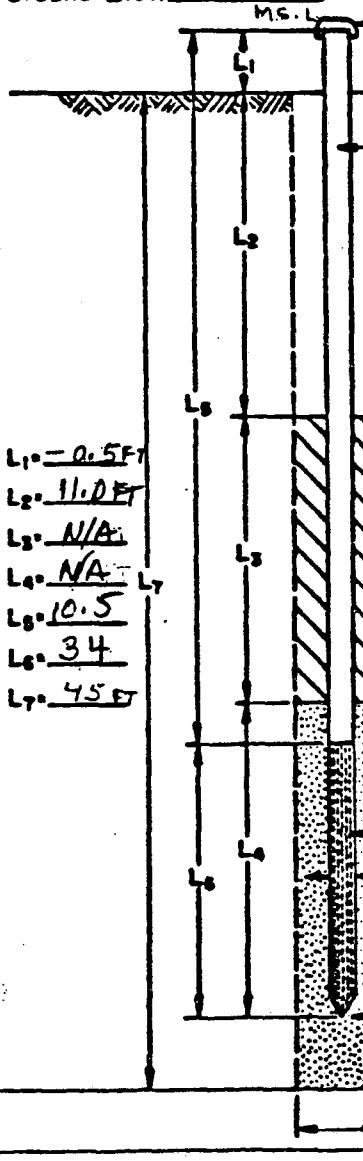
BORING

Depth in ft.	Description	Symbol
0	ASPHALT, CONCRETE AND BRICK PAVEMENT	
2	Gravelly CLAY (FILL)	
4		
6		
8		
10	TOP OF ROCK 5 FT ELEV. 583.41 FT. MS.L. Light Gray DOLOMITE (Gasport Member)	
12		
14		
16		
18		
20	ELEV. 574.41 FT. M.S.L. Dark Gray Shaly DOLOMITE (DeCew Member)	
22		
24		
26		
28		
30	ELEV. 563.41 FT. MSL.	
32		
34		
36		
38	Dark Gray Limy SHALE (Rochester member)	
40		
42		
44		
46	BOREHOLE TERMINUS 45 FT ELEV. 547.41 FT M.S.L	

MONITOR WELL

Type of Monitor Well OPEN IN ROCK

Ground Elev. 592.41 FT. M.S.L. — Top of Riser Elev. 591.91 FT M.S.L.



L_1 = 0.5 FT
L_2 = 11.0 FT
L_3 = N/A
L_4 = N/A
L_5 = 10.5
L_6 = 34
L_7 = 45 FT

- Vented Cap
- I.D. of Riser Pipe 3 INCHES
- Type of Pipe BLACK STEEL PIPE
- Type of Backfill Around Riser CEMENT GROUT (1 BAG)
- Bottom Top of Seal Elev. 581.4
- Type of Seal Moterial CEMENT GROUT
- Top of Filter Elev. N/A*
- Type of Filter Moteriol N/A
- Size of Openings N/A*
- Diometer of Monitor Well Tip N/A
- Bottom of Mon. Well Elev. N/A
- Bottom of Boring Elev. 547.41 FT
- Diameter of Boring 3 INCHES

Remarks N/A NOT APPLICABLE

DEPTH TO WATER UPON COMPLETION: 10.5 FT

Inspected By David Musolo

WOODWARD - CLYDE CONSULTANTS

APPENDIX D

NEW YORK STATE DEPARTMENT OF HEALTH

ANALYTICAL RESULTS

0876 NEW YORK STATE DEPARTMENT OF HEALTH
CENTER FOR LABORATORIES AND RESEARCH

PAGE 1 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 42268 SAMPLE RECEIVED:84/06/20/10
PROGRAM: 100:MUNICIPAL WATER SUPPLIES
SOURCE ID: 756000 DRAINAGE BASIN:03 GAZETTEER CODE:3101
POLITICAL SUBDIVISION:LOCKPORT C. COUNTY:NIAGARA
LATITUDE: . LONGITUDE: . Z DIRECTION:
LOCATION: LOCKPORT SOURCE #1 LOCKPORT C
DESCRIPTION:NYS BARGE CANAL LCPT PUMP STATION F
REPORTING LAB: TOX:LAB FOR ORGANIC ANALYTICAL CHEMISTRY
TEST PATTERN: PPEP:F.R.METHODS 625,601 AND EPA METH 503.1
SAMPLE TYPE: 005:RAW WATER - SPECIAL
TIME OF SAMPLING: 84/06/19 14:15 DATE PRINTED:84/07/18

	PARAMETER	RESULT
T62009	CHLOROMETHANE	< 1. MCG/L
T61809	BROMOMETHANE	< 1. MCG/L
T41009	VINYL CHLORIDE	< 1. MCG/L
T70209	DICHLORODIFLUOROMETHANE	< 1. MCG/L
T61909	CHLOROETHANE	< 1. MCG/L
T61709	TRICHLOROFLUOROMETHANE	< 1. MCG/L
T23809	DICHLOROMETHANE	< 1. MCG/L
T50909	1,1-DICHLOROETHENE	< 1. MCG/L
T51909	1,1-DICHLOROETHANE	< 1. MCG/L
T61209	TRANS-1,2-DICHLOROETHENE	< 1. MCG/L
T39009	CHLOROFORM	< 1. MCG/L
T50809	1,2-DICHLOROETHANE	< 1. MCG/L
T23609	1,1,1-TRICHLOROETHANE	< 1. MCG/L
T36609	CARBON TETRACHLORIDE	< 1. MCG/L
T38909	BROMODICHLOROMETHANE	< 1. MCG/L
T61309	1,2-DICHLOROPROPANE	< 1. MCG/L
T61509	TRANS-1,3-DICHLOROPROPENE	< 1. MCG/L
T41109	TRICHLOROETHYLENE	< 1. MCG/L
T44909	DIBROMOCHLOROMETHANE	< 1. MCG/L
T61409	CIS-1,3-DICHLOROPROPENE	< 1. MCG/L
T51709	1,1,2-TRICHLOROETHANE	< 1. MCG/L
T61109	2-CHLOROETHYLVINYL ETHER	< 1. MCG/L
T42109	BROMOFORM	< 1. MCG/L
T51809	1,1,2,2-TETRACHLOROETHANE	< 1. MCG/L
T41209	TETRACHLOROETHENE	< 1. MCG/L
T40909	CHLOROBENZENE	< 1. MCG/L
T49709	1,3-DICHLOROBENZENE	< 1. MCG/L
T44109	1,2-DICHLOROBENZENE	< 1. MCG/L
T44209	1,4-DICHLOROBENZENE	< 1. MCG/L
T34409	BENZENE	< 1. MCG/L
T39209	TOLUENE	< 1. MCG/L
T51009	ETHYLBENZENE	< 1. MCG/L
T85209	1-CHLOROCYCLOHEXENE-1	< 1. MCG/L

**** CONTINUED ON NEXT PAGE ****

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ASST. COMMR. FOR ENVIRONMENTAL HEALTH
NIAGARA COUNTY HEALTH DEPT.
HUMAN RESOURCES BLDG.
TENTH AND EAST FALLS ST.
NIAGARA FALLS,N.Y. 14302

SUBMITTED BY:DEVALD

SAMPLE ID: 42268 SAMPLE RECEIVED:84/06/20/10
POLITICAL SUBDIVISION:LOCKPORT C. COUNTY:NIAGARA
LOCATION: LOCKPORT SOURCE #1 LOCKPORT C
TIME OF SAMPLING: 84/06/19 14:15 DATE PRINTED:84/07/18

	PARAMETER	RESULT	
T70409	PARA-XYLENE	< 1.	MCG/L
T70309	META-XYLENE	< 1.	MCG/L
T51409	ORTHO-XYLENE	< 1.	MCG/L
T85309	CUMENE	< 1.	MCG/L
T85409	STYRENE	< 1.	MCG/L
T85509	P-BROMOFLUOROBENZENE	< 1.	MCG/L
T51109	N-PROPYLBENZENE	< 1.	MCG/L
T85609	TERT-BUTYLBENZENE	< 1.	MCG/L
T85709	O/P-CHLOROTOLUENE	< 1.	MCG/L
T51209	BROMOBENZENE	< 1.	MCG/L
T50509	META-CHLOROTOLUENE	< 1.	MCG/L
T85809	1,3,5-TRIMETHYLBENZENE	< 1.	MCG/L
T85909	1,2,4-TRIMETHYLBENZENE	< 1.	MCG/L
T86009	P-CYMENE	< 1.	MCG/L
T86109	CYCLOPROPYLBENZENE	< 1.	MCG/L
T86209	SEC-BUTYLBENZENE	< 1.	MCG/L
T86309	N-BUTYLBENZENE	< 1.	MCG/L
T86409	2,3-BENZOFURAN	< 1.	MCG/L
T52509	HEXACHLOROBUTADIENE (C-46)	< 5.	MCG/L
T44009	1,2,4-TRICHLOROBENZENE	< 5.	MCG/L
T65609	NAPHTHALENE	< 5.	MCG/L
T43909	1,2,3-TRICHLOROBENZENE	< 5.	MCG/L
T67109	PHENOL	< 10.	MCG/L
T66409	2-CHLOROPHENOL	< 10.	MCG/L
T66809	2-NITROPHENOL	< 10.	MCG/L
T66609	2,4-DIMETHYLPHENOL	< 10.	MCG/L
T66509	2,4-DICHLOROPHENOL	< 10.	MCG/L
T66309	4-CHLORO-3-METHYLPHENOL	< 10.	MCG/L
T67209	2,4,6-TRICHLOROPHENOL	< 10.	MCG/L
T49609	2,4,5-TRICHLOROPHENOL	< 10.	MCG/L
T66709	2,4-DINITROPHENOL	< 10.	MCG/L
T66909	4-NITROPHENOL	< 10.	MCG/L
T68509	2-METHYL-4,6-DINITROPHENOL	< 10.	MCG/L
T67009	PENTACHLOROPHENOL	< 10.	MCG/L
T85009	BENZOIC ACID		NA
T68109	BIS(2-CHLOROISOPROPYL)ETHER		NA
T63909	BIS(2-CHLOROETHYL)ETHER	< 10.	MCG/L
T65909	N-NITROSODI-N-PROPYLAMINE	< 10.	MCG/L
T65309	HEXACHLOROETHANE	< 10.	MCG/L
T65709	NITROBENZENE	< 10.	MCG/L
T65509	ISOPHORONE	< 10.	MCG/L
T68609	BIS(2-CHLOROETHOXY)METHANE	< 10.	MCG/L
T49209	HEXACHLOROCYCLOPENTADIENE (C-56)	< 10.	MCG/L
T64109	2-CHLORONAPHTHALENE	< 10.	MCG/L
T64909	2,6-DINITROTOLUENE	< 10.	MCG/L
T63109	ACENAPHTHYLENE	< 10.	MCG/L
T64709	DIMETHYLPHTHALATE	< 10.	MCG/L
T63009	ACENAPHTHENE	< 10.	MCG/L

**** CONTINUED ON NEXT PAGE ****

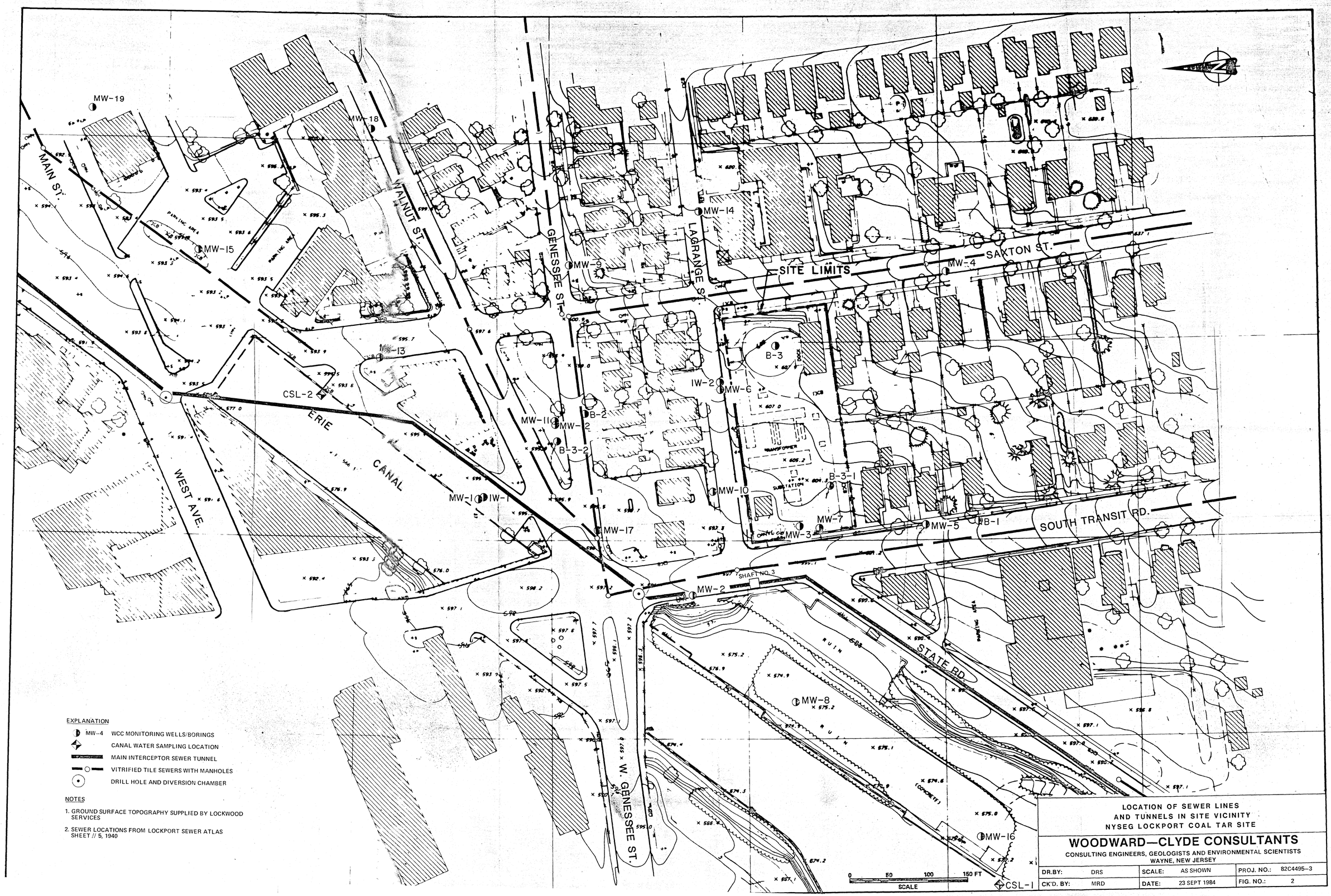
0878 NEW YORK STATE DEPARTMENT OF HEALTH
CENTER FOR LABORATORIES AND RESEARCH

PAGE 3 RESULTS OF EXAMINATION FINAL REPORT

SAMPLE ID: 42268 SAMPLE RECEIVED:84/06/20/10
POLITICAL SUBDIVISION:LOCKPORT C. COUNTY:NIAGARA
LOCATION: LOCKPORT SOURCE #1 LOCKPORT C
TIME OF SAMPLING: 84/06/19 14:15 DATE PRINTED:84/07/18

	PARAMETER	RESULT	
T64809	2,4-DINITROTOLUENE	< 10.	MCG/L
T64609	DIETHYLPHTHALATE	< 10.	MCG/L
T65209	FLUORENE	< 10.	MCG/L
T68409	4-CHLOROPHENYL PHENYL ETHER		NA
T66009	N-NITROSODIPHENYLAMINE	< 10.	MCG/L
T65109	1,2-DIPHENYLHYDRAZINE	< 10.	MCG/L
T68309	4-BROMOPHENYL PHENYL ETHER	< 10.	MCG/L
T48809	HEXACHLOROBENZENE	< 10.	MCG/L
T66109	PHENANTHRENE	< 10.	MCG/L
T63209	ANTHRACENE	< 10.	MCG/L
T64409	DI-N-BUTYLPHTHALATE	< 10.	MCG/L
T68009	FLUORANTHENE	< 10.	MCG/L
T66209	PYRENE	< 10.	MCG/L
T63809	BENZIDINE	< 200.	MCG/L
T64009	BUTYL BENZYL PHTHALATE	< 30.	MCG/L
T63309	BENZO(A)ANTHRACENE	< 30.	MCG/L
T64509	3,3'-DICHLOROBENZIDINE	< 30.	MCG/L
T64209	CHRYSENE	< 30.	MCG/L
T67909	BIS(2-ETHYLHEXYL)PHTHALATE	< 30.	MCG/L
T65009	DIOCTYLPHTHALATE	< 30.	MCG/L
T63409	BENZO(B)FLUORANTHENE		NA
T63509	BENZO(K)FLUORANTHENE		NA
T63609	BENZO(A)PYRENE	< 30.	MCG/L
T65409	INDENO(1,2,3-CD)PYRENE	< 30.	MCG/L
T64309	DIBENZO(A,H)ANTHRACENE	< 30.	MCG/L
T63709	BENZO(GHI)PERYLENE	< 30.	MCG/L
T15709	HCH,ALPHA	< 10.	MCG/L
T15809	HCH,BETA	< 10.	MCG/L
T35609	HCH,GAMMA (LINDANE)	< 10.	MCG/L
T16009	HCH,DELTA	< 10.	MCG/L
T08009	HEPTACHLOR	< 10.	MCG/L
T07709	ALDRIN	< 10.	MCG/L
T08309	HEPTACHLOR EPOXIDE	< 10.	MCG/L
T43309	ENDOSULFAN I	< 10.	MCG/L
T14809	DDE -PARA, PARA	< 10.	MCG/L
T08509	DIELDRIN	< 10.	MCG/L
T08409	ENDRIN	< 10.	MCG/L
T14909	DDD -PARA, PARA	< 10.	MCG/L
T43409	ENDOSULFAN II	< 10.	MCG/L
T67409	ENDRIN ALDEHYDE	< 10.	MCG/L
T67309	ENDOSULFAN SULFATE	< 10.	MCG/L
T14709	DDT -PARA, PARA	< 10.	MCG/L

**** END OF REPORT ****



EXPLANATION

- MW-4 — WCC MONITORING WELLS/BORINGS
- CANAL WATER SAMPLING LOCATION
- MAIN INTERCEPTOR SEWER TUNNEL
- VITRIFIED TILE SEWERS WITH MANHOLES
- DRILL HOLE AND DIVERSION CHAMBER

NOTES

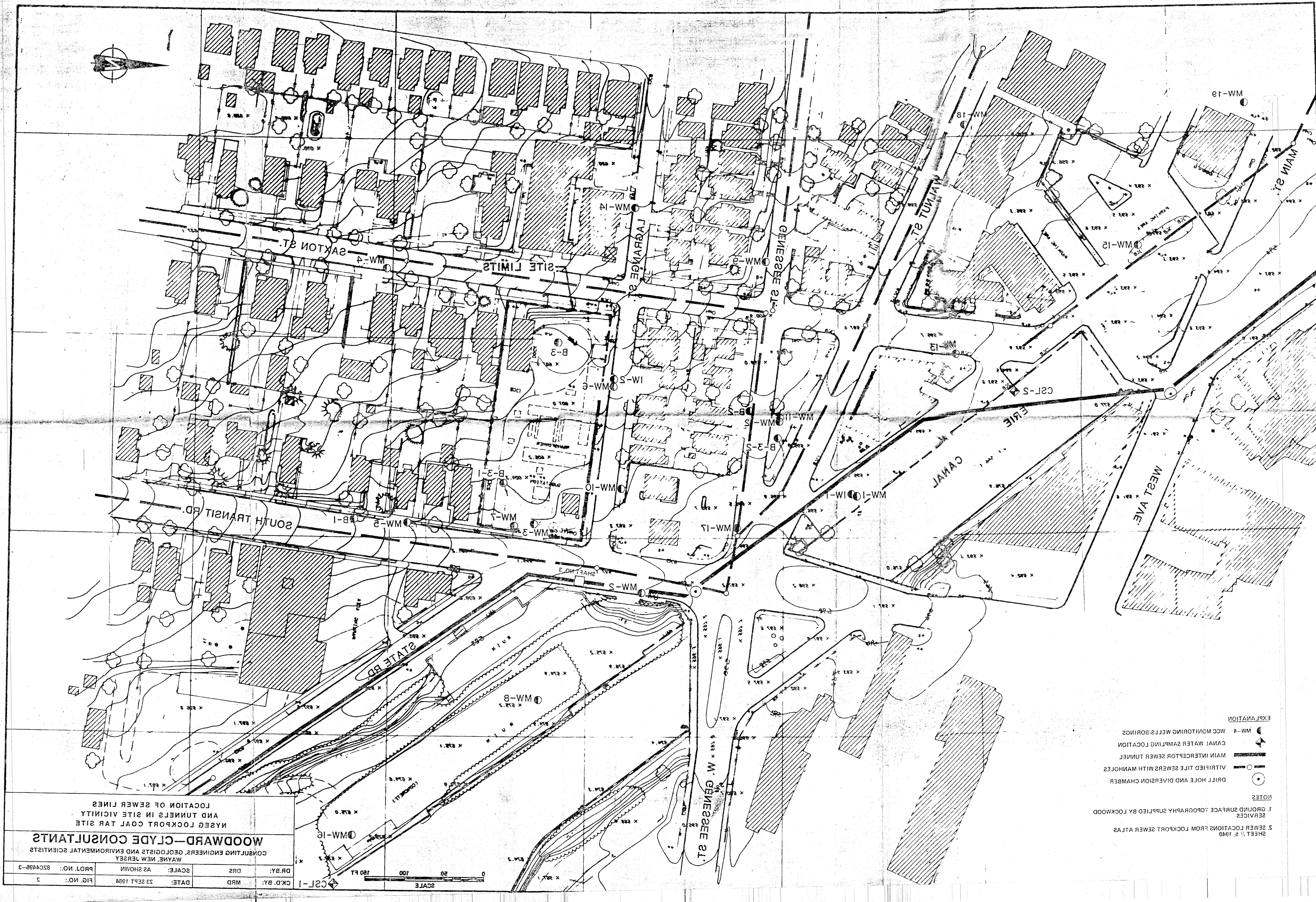
1. GROUND SURFACE TOPOGRAPHY SUPPLIED BY LOCKWOOD SERVICES
2. SEWER LOCATIONS FROM LOCKPORT SEWER ATLAS SHEET // 5, 1940

LOCATION OF SEWER LINES
AND TUNNELS IN SITE VICINITY
NYSEG LOCKPORT COAL TAR SITE

WOODWARD—CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR.BY:	DRS	SCALE:	AS SHOWN	PROJ. NO.:	82C4495-3
CK'D. BY:	MRD	DATE:	23 SEPT 1984	FIG. NO.:	2


LOCATION OF SEWER LINES
AND TUNNELS IN SITE VICINITY
NYSEG LOCKPORT COAL TAR SITE
WOODWARD—CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY
DR.BY: DRS
SCALE: AS SHOWN
PROJ. NO.: 82C4495-3
CKD. BY: MRD
DATE: 23 SEPT 1984
FIG. NO.: 2
SCALE
0 50 100 150 FT
EXPLANATION
MW-4 WCC MONITORING WELLS/BORINGS
CANAL WATER SAMPLING LOCATION
MAIN INTERCEPTOR SEWER TUNNEL
VITRIFIED TILE SEWERS WITH MANHOLES
DRILL HOLE AND DIVERSION CHAMBER
NOTES
1. GROUND SURFACE TOPOGRAPHY SUPPLIED BY LOCKWOOD SERVICES
2. SEWER LOCATIONS FROM LOCKPORT SEWER ATLAS SHEET // 6, 1940
SAXTON ST.
SITE LIMITS
SOUTH TRANSIT RD.
STATE RD.
LAGRANGE ST.
GENESSEE ST.
W. GENESSEE ST.
WALNUT ST.
MAIN ST.
WEST AVE.
ERIE CANAL
SHAFT NO. 3
RUIN
CSL-1
CSL-2
MW-1
MW-2
MW-3
MW-4
MW-5
MW-6
MW-7
MW-8
MW-9
MW-10
MW-11
MW-13
MW-14
MW-15
MW-16
MW-17
MW-18
MW-19
IW-1
IW-2
B-1
B-2
B-3
B-3-1
B-3-2
Task 7
Figure 2