FORSITE
CORPORATION
1505 Elm Street
14th Floor
Dallas, Texas 75201
(214) 740-0040
FAX 740-0125

August 11, 1992

P-91432B

Mr. Robert Kalish
Environmental Services
The Dow Chemical Company
Louisiana Division
P.O. Box 150, Building 3502-E
Plaquemine, Louisiana 70764

VIA FEDERAL EXPRESS

Subject: Dispersion Modeling Analysis for Eleven Toxic Air Pollutant Compounds Emitted by the Dow Louisiana Division

Dear Mr. Kalish:

As requested by the Dow Louisiana Division, FORSITE has performed a dispersion modeling analysis for eleven toxic air pollutant (TAP) compounds emitted by the Louisiana Division. The following eleven TAPs were modeled:

- 1,3-Butadiene
- Benzene
- Chlorinated Dibenzo Furans
- 1,2-Dichloroethane (Ethylene Dichloride)
- Ethylene Oxide
- Vinyl Chloride
- Biphenyl
- Chlorine
- Sulfuric Acid
- Hydrochloric Acid
- Mercury

The first six TAPs have Louisiana Department of Environmental Quality (LDEQ) Title 33, Part III, Chapter 51, Table 51.2 annual air quality standards. The last five TAPs have 8-hour Table 51.2 air quality standards.

This letter describes the dispersion modeling analysis approach and presents the modeling results. The dispersion modeling analysis was conducted in accordance with guidance contained in the U.S. EPA Guideline on Air Quality Models (Revised) (1986) and Supplement A (1987), hereafter referred to as the "Guideline." The analysis is also in accordance with a dispersion modeling protocol dated March 25, 1992, which was submitted to LDEQ and approved with comments by the LDEQ on April 16, 1992.

Summary

Attachment A summarizes the results of the dispersion modeling for the eleven Dow Louisiana Division TAP compounds analyzed. The listed concentration for each of the eleven TAPs in Attachment A represents the highest predicted annual or 8-hour concentration, for any off-property receptor. Each listed concentration is below the respective LDEQ Title 33, Part III, Chapter 51, Table 51.2 ambient air quality standard.

Attachments B-1 through B-11 show the location and magnitude of the maximum predicted annual or 8-hour concentration for each TAP compound in the order listed in Attachment A. Each maximum predicted concentration occurs along or in the near vicinity of the Louisiana Division property line. The concentrations decrease with increasing distance from the Dow property line.

Modeling Approach

In accordance with the modeling protocol, FORSITE used Version 90346 of the EPA-approved Industrial Source Complex Short-Term (ISCST) model to predict 8-hour average concentrations for the five Louisiana Division TAP compounds with 8-hour standards. FORSITE also used Version 90008 of the EPA-approved Industrial Source Complex Long-Term (ISCLT) model to predict annual average concentrations for the six Louisiana Division TAP compounds with annual standards. In accordance with EPA modeling guidance, the regulatory default option was used for all modeling.

Property line information for this analysis was provided to FORSITE by the Dow Louisiana Division. The Dow property lines used for this modeling analysis were confirmed with the LDEQ during a June 9, 1992 meeting with Dow Louisiana Division personnel. These property lines represent the outer property lines judged by the LDEQ to be appropriate for the determination of compliance with the Table 51.2 ambient air standards.

The terrain within the modeling area (i.e., approximately 5 km from the Louisiana Division centroid), has uniform elevations, with a maximum elevation of approximately 52 feet above mean sea level in isolated locations on the Mississippi River levee. Because of the terrain uniformity, flat terrain was used for the modeling (i.e., terrain heights were not input to the model).

A land use analysis was performed within a 3-kilometer radius of the Louisiana Division centroid. Land-use classifications were determined by applying the Guideline-recommended Auer procedure during an on-site detailed survey of the region, which was supplemented for a few inaccessible areas by

details on recent aerial photographs of the region. Less than 30% of the region surveyed can be classified as having urban land usage (i.e., industrial, commercial, or compact residential). Accordingly, the region was classified as rural, and rural dispersion coefficients were used in the modeling.

Dow provided the individual emission rates, source information and descriptions, and building dimensions used in the modeling. The source parameters used in the modeling were developed by FORSITE based on on-site source surveys, accepted modeling practice, and FORSITE experience in developing representative model inputs from actual source data. FORSITE's work did not include independent verification of the Louisiana Division input data.

In order to perform the modeling analysis, the EIQ-designated emission sources were first characterized into ISC source types and then subdivided into individual ISC sources as necessary (e.g., for volume-type sources). The methodology for the source characterization was described in detail in the referenced modeling protocol.

Each sub-divided fugitive source (i.e., volume source) emission rate was prorated based on a conditional two-step process. First, Dow-provided percentages of the total emission rate were used. However, if these percentages were not provided, the emission rate for each subdivided source was based on the ratio of the area of each sub-divided source to the total area for that source. For example, if a source was subdivided into two sources, each having 50% of the area of the original source, then the emission rate for each subdivided source was 50% of the original emission rate for the source.

The Universal Transverse Mercator (i.e., UTM) coordinates for all sources were based on a Dow-provided formula for the conversion of plant coordinates to UTM coordinates. The plant coordinates were determined using Dow-provided CAD drawings of both the entire Louisiana Division and the individual Dow process blocks.

A directional downwash analysis was conducted for all stack sources based upon guidance provided in the "Guideline for Determination of Good Engineering Practice Stack Height" (EPA-450/4-80-023R, June 1985). Direction-dependent Schulman-Scire downwash parameters and omnidirectional Huber-Snyder downwash and parameters were calculated for each emission point (i.e., stack) using an ISC-specific algorithm.

A total of 1765 discrete receptors was used in the modeling. In accordance with the modeling protocol, accepted modeling practice and LDEQ guidance provided at the June 9, 1992 meeting with Dow personnel, receptors were placed along the outer Dow property line with 100-meter spacing. In addition, numerous rows of 100-meter spaced receptors were extended outward from the Dow property line to a 1-km distance to identify all close-in predicted maximum concentrations.

In accordance with the modeling protocol, the 8-hour (e.g., ISCST) modeling used a preprocessed meteorological data file consisting of 1985 Baton Rouge

hourly surface observations and twice-daily mixing heights derived from Lake Charles, Louisiana upper air temperatures and Baton Rouge surface temperatures. The meteorological input for the annual (e.g., ISCLT) modeling consisted of a five-year Stability Array (STAR) distribution for the Baton Rouge, Louisiana, National Weather Service Office for the period 1981-1985, in accordance with the modeling protocol. Both the preprocessed meteorological data and STAR data are representative of the Louisiana Division vicinity. The STAR data distribution consisted of six Pasquill-Gifford stability classes (i.e., A, B, C, D, E and F), as recommended for ISCLT input by EPA modeling guidance. The five-year average temperature inputs for ISCLT were computed for each stability class from hourly Baton Rouge meteorological data for the 1981 to 1985 period. The ISCLT mixing height inputs were determined for each stability class using the interpolation and scaling procedure recommended in the ISCLT User's Guide.

Modeling Results

Attachment A summarizes the highest predicted annual and 8-hour concentrations for the eleven Louisiana Division TAP compounds modeled. Attachment A compares the maximum predicted concentration for each of the eleven TAPs with the LDEQ Title 33, Part III, Chapter 51, Table 51.2 ambient air quality concentrations (i.e., the standards). As Attachment A shows, the maximum predicted concentrations for all eleven compounds are below the respective LDEQ ambient air standard.

Attachments B-1 through B-11 depict the location and magnitude of the maximum predicted concentration in units of micrograms per cubic meter for each of the TAPs. As Attachments B-1 through B-11 indicate, the maximum predicted concentration for all eleven compounds occurs along or in the near vicinity of the Louisiana Division outer property line because of the low-level, non-buoyant nature of the emissions and the proximity of the emission sources to the Louisiana Division property line. Predicted concentrations diminish with increasing distance from the Louisiana Division and from the sources modeled.

Please contact me if you have any questions concerning the dispersion modeling analysis.

Sincerely,

Colburn L. Norton
Principal Meteorologist

CLN/gd

Attachments

cc: Mr. David Grossman (FORSITE)

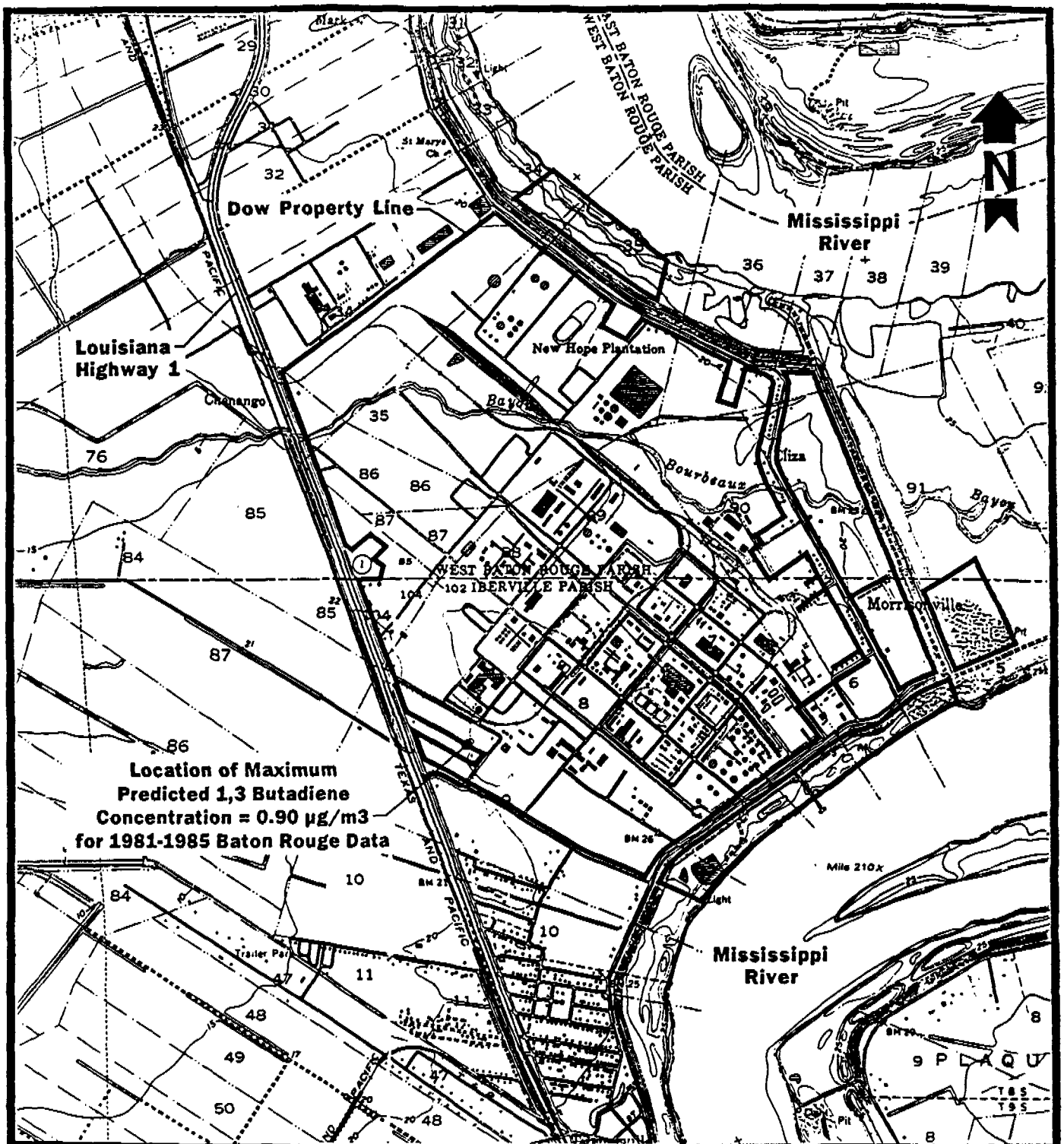
ATTACHMENT A

DOW LOUISIANA DIVISION

MAXIMUM PREDICTED OFF-PROPERTY CONCENTRATIONS OF TABLE 51.2 COMPOUNDS [a]

Chemical Names in LDEQ's Table 51.2	Abbreviated Dow Chemical Name	LDEQ Table 51.2 Averaging Period	Maximum Predicted Concentration ($\mu g/m^3$)	LDEQ Table 51.2 Standard ($\mu g/m^3$)	Percent of Standard (%)
1,3-Butadiene	BD	Annual	0.90	0.92	97.83
Benzene	BZ	Annual	6.29	12.0	52.42
Chlorinated Dibenzo Furans	CDF	Annual	0.0023	0.003	76.67
1,2-Dichloroethane	EDC	Annual	3.13	3.85	81.30
Ethylene Oxide	EO	Annual	0.56	1.0	56.00
Vinyl Chloride	VCL	Annual	1.17	1.19	98.32
Biphenyl	BIP	8-hour	6.71	31.0	21.65
Chlorine	CL2	8-hour	6.79	35.7	19.02
Sulfuric Acid	H2SO4	8-hour	2.33	23.8	9.79
Hydrochloric Acid	HCL	8-hour	88.53	180.0	49.18
Mercury	HG	8-hour	0.12	1.19	10.08

[a] The Dow Louisiana Division property lines used in this modeling analysis were confirmed during a June 9, 1992 meeting between LDEQ and Dow representatives.



Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-1

USGS Map Showing Dow Louisiana Division and Maximum Predicted Annual 1,3 Butadiene Concentration (8-6-92)

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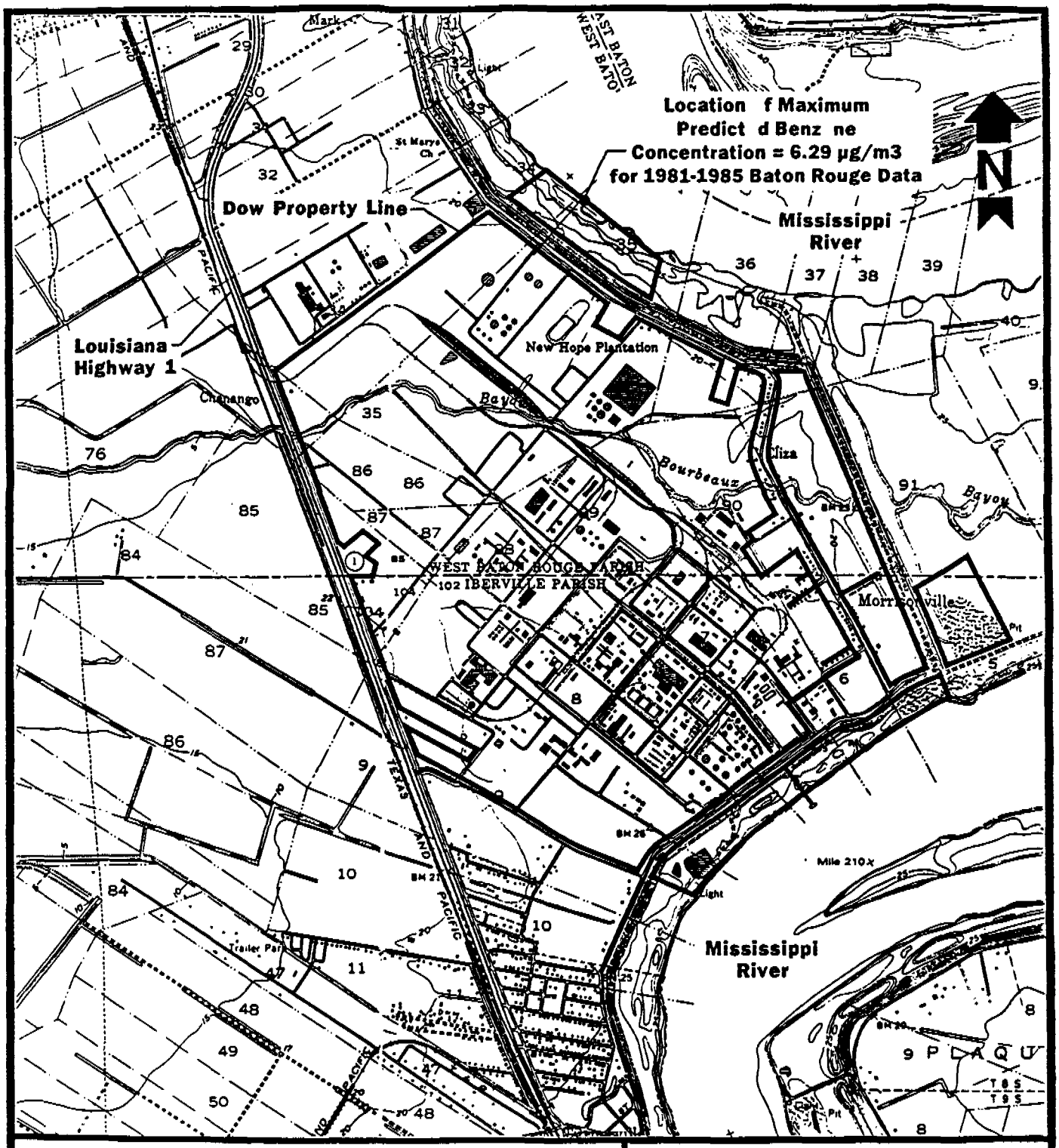

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ATTACHMENT B-2

USGS Map Showing Dow L uisiana Division and Maximum Predicted Annual Benzene Conc ntration (8-6-92)

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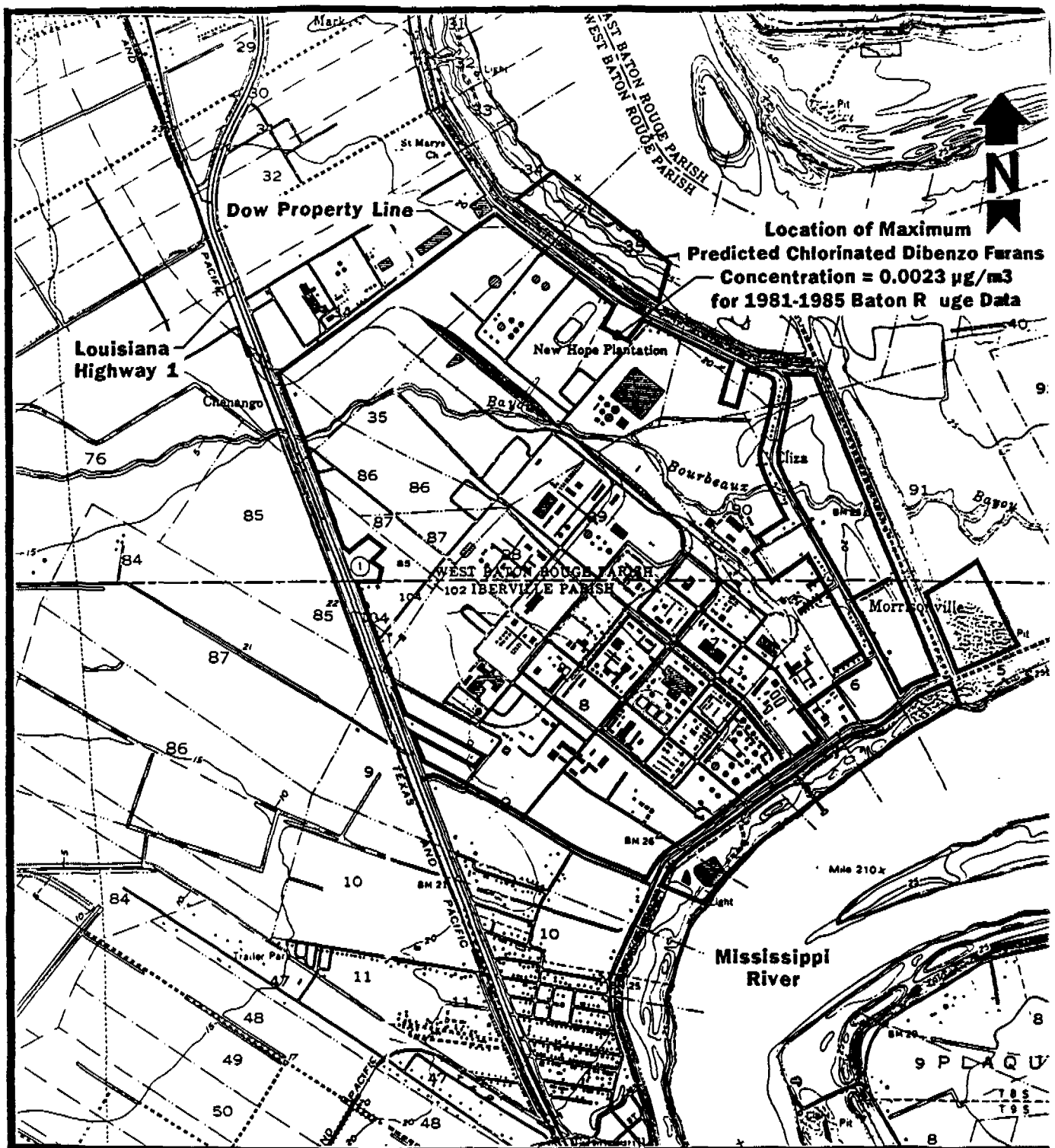

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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Louisiana Division

ATTACHMENT B-3

USGS Map Showing Dow Louisiana Division and Maximum Predicted Annual Chlorinat d Dibenzo Furans Concentrati n (8-6-92)

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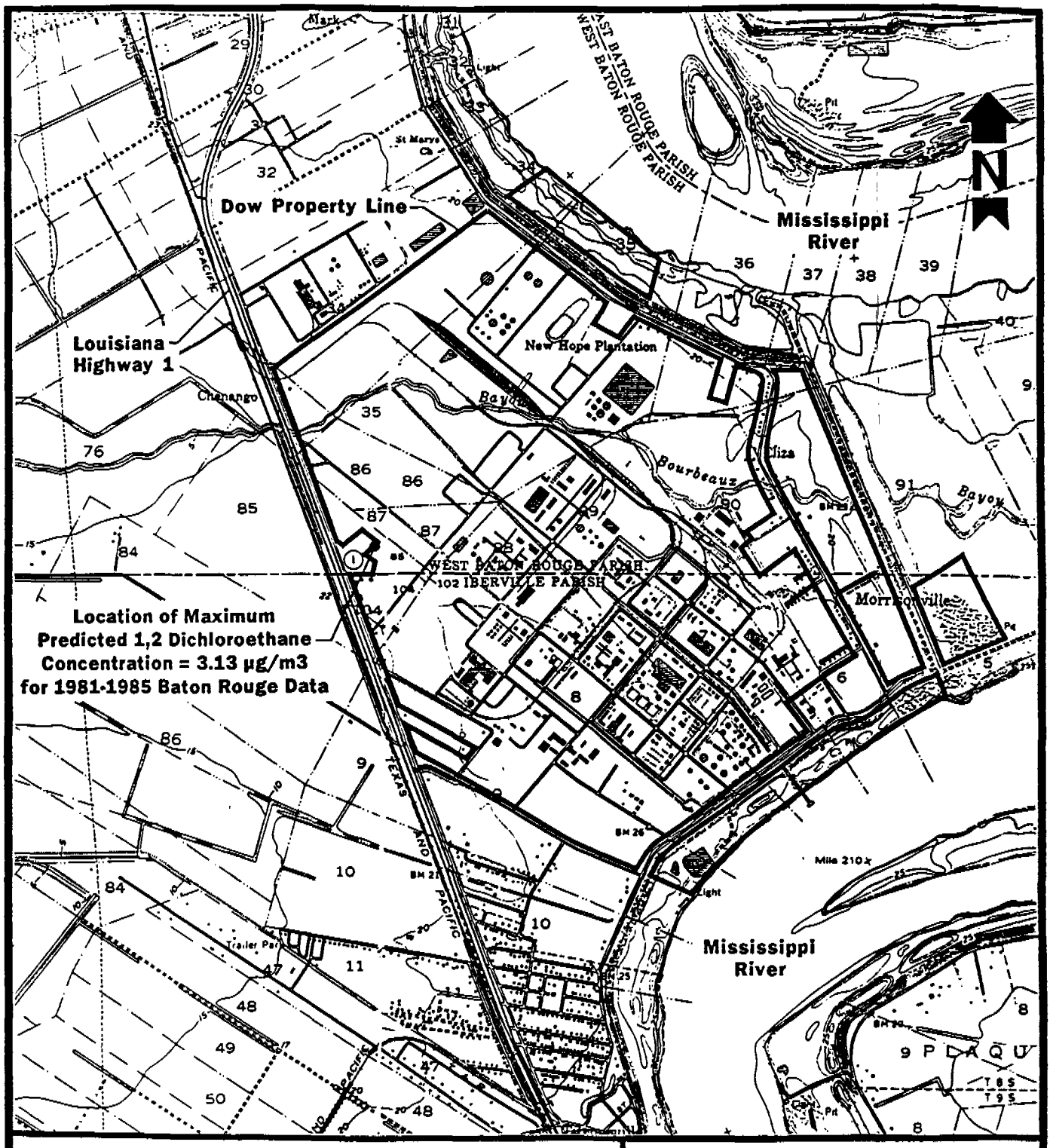

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-4

USGS Map Showing Dow Louisiana Division and Maximum Predicted Annual 1,2 Dichloroethan Conc ntration (8-6-92)

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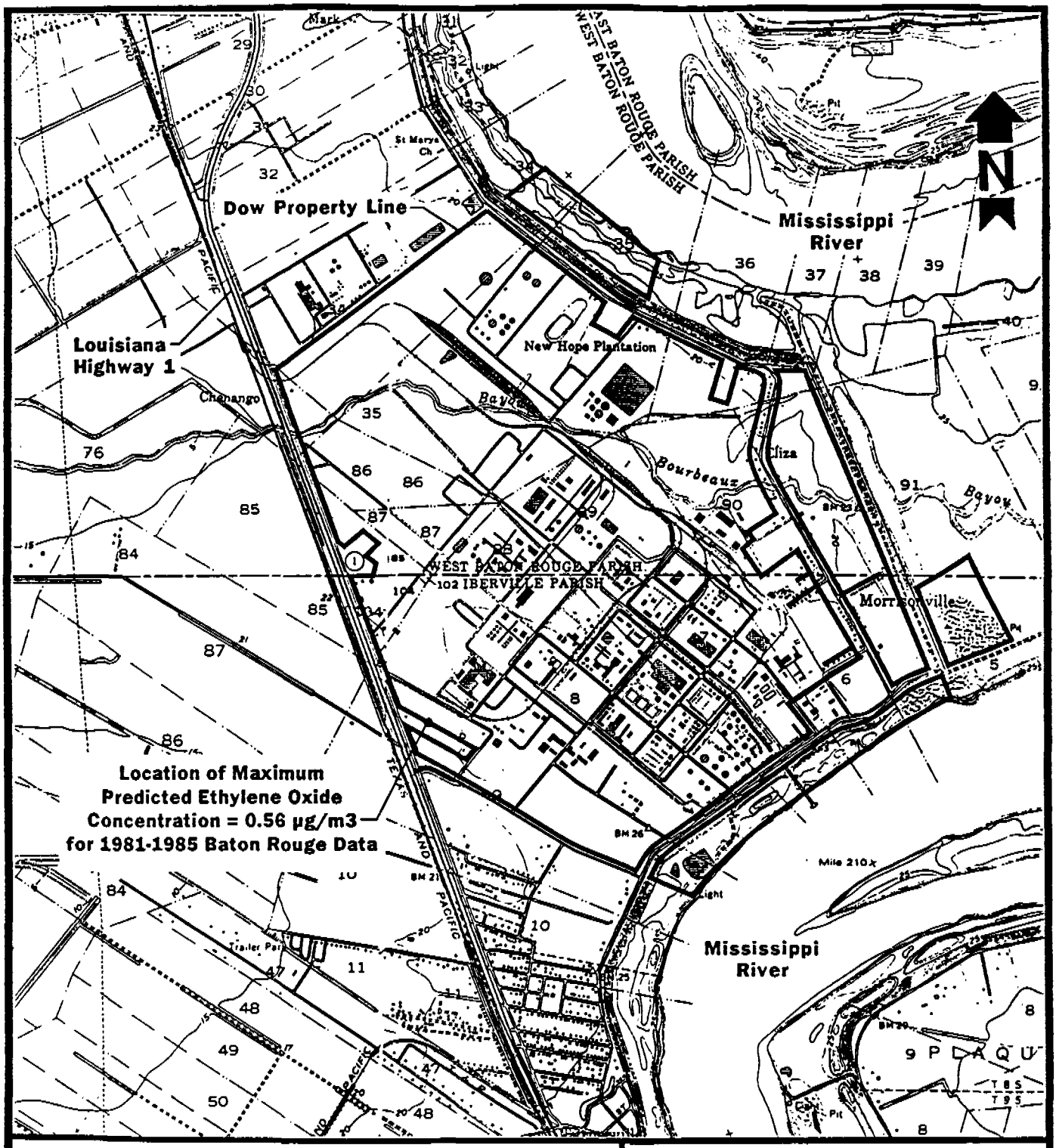

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-5

USGS Map Showing Dow Louisiana Division and Maximum Predict d Annual Ethylene Oxide Conc ntration (8-6-92)

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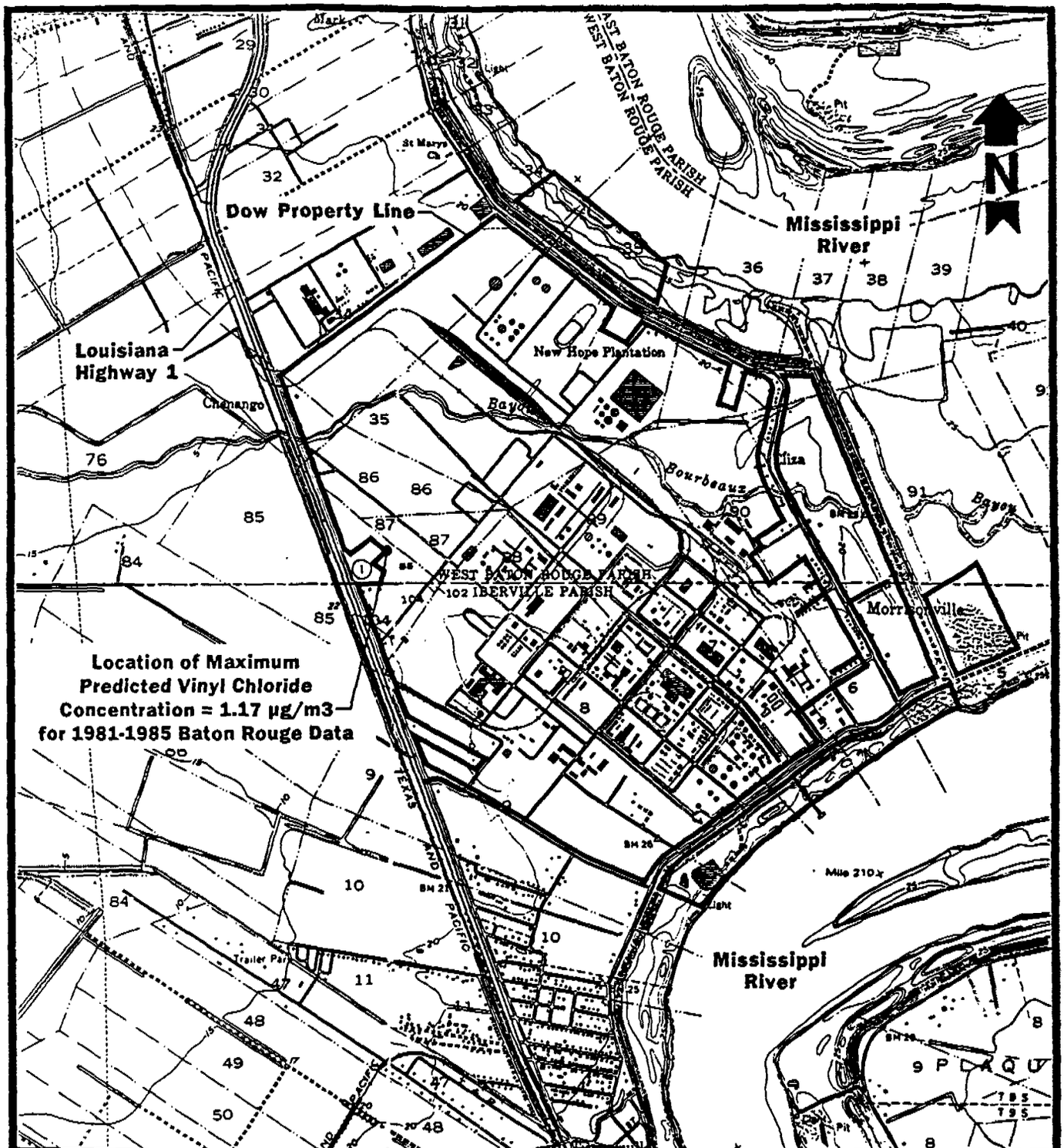

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-6

USGS Map Showing Dow Louisiana Division and Maximum Predicted Annual Vinyl Chloride Concentration (8-6-92)

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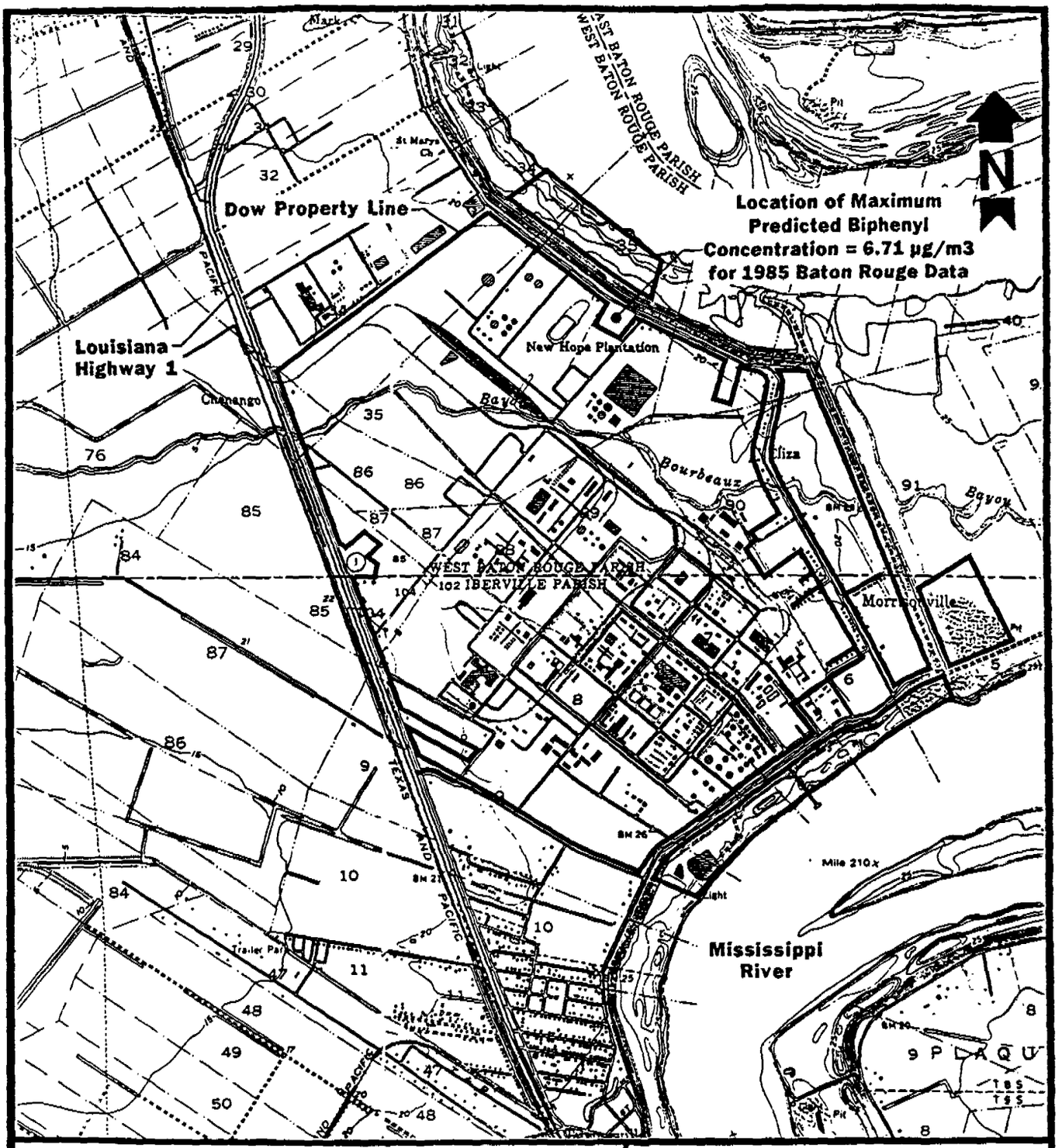

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-7

USGS Map Showing Dow Louisiana Division and Maximum Predict d 8-Hour Biphenyl Concentration (8-6-92)

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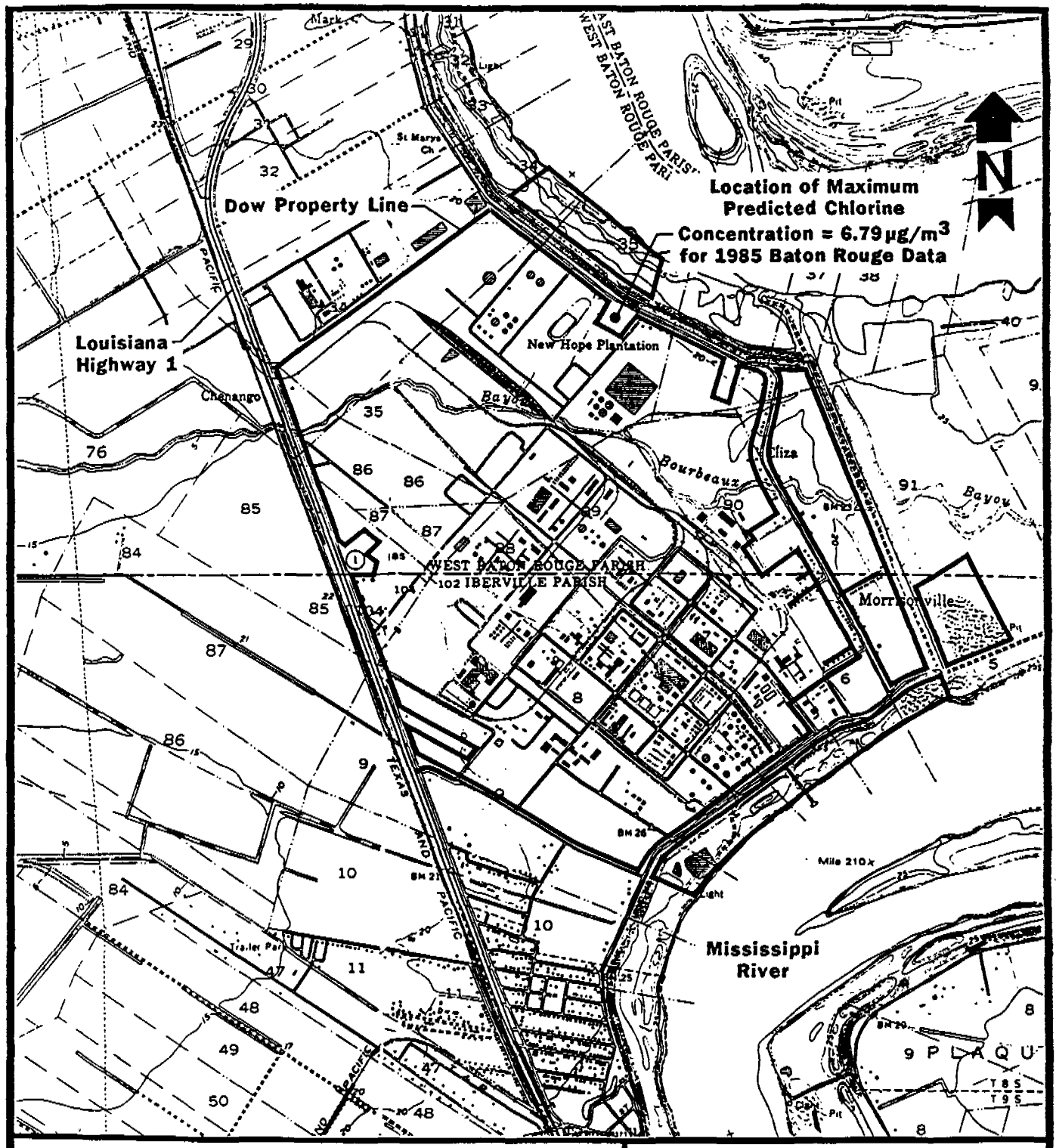

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ATTACHMENT B-8

USGS Map Showing Dow Louisiana Division and Maximum Predicted 8-Hour Chlorine Concentration (8-6-92)

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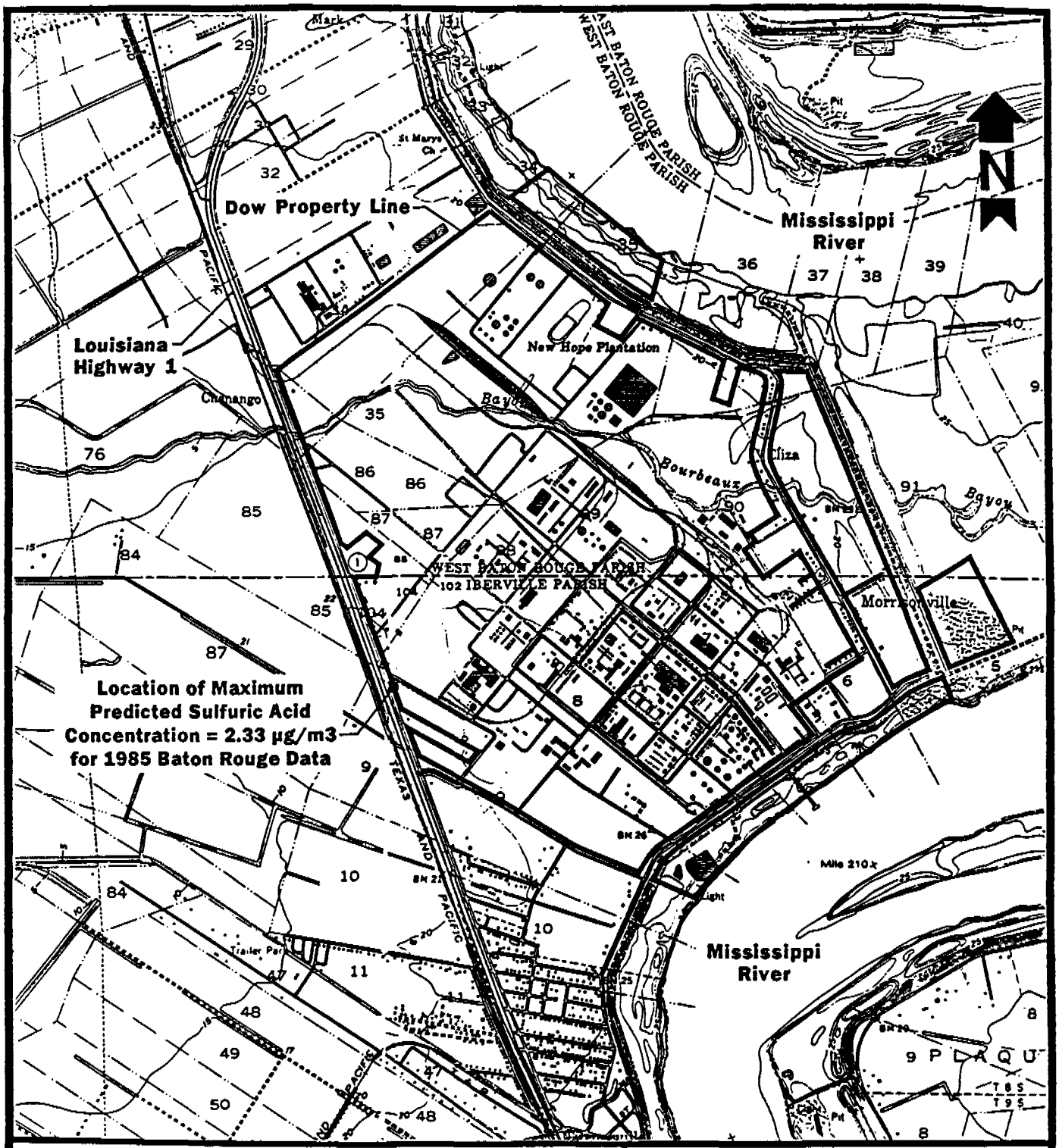

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-9

USGS Map Showing Dow Louisiana Division and Maximum Predicted 8-Hour Sulfuric Acid Concentration (8-6-92)

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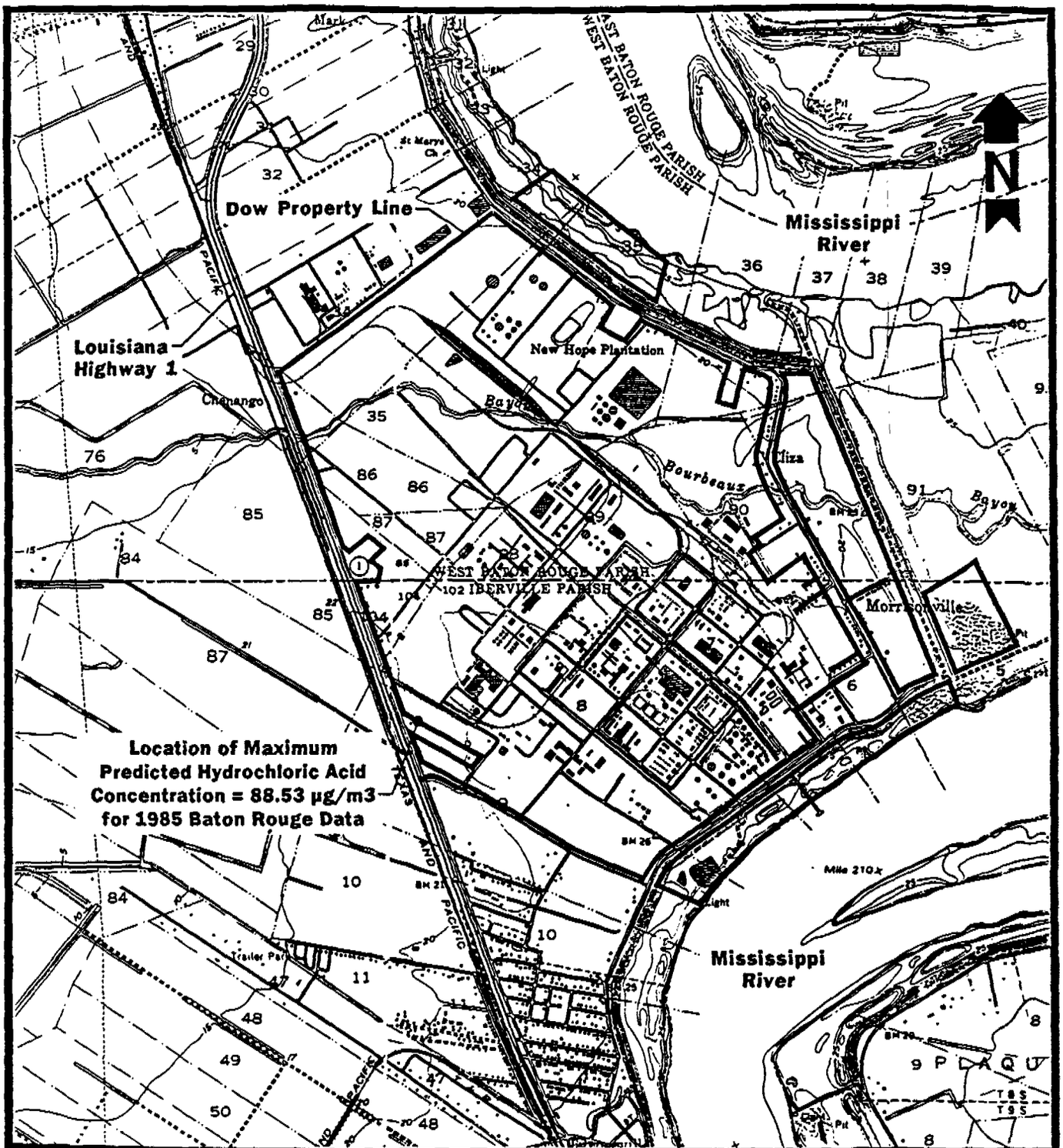

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-10

USGS Map Showing D w L uisiana Division and Maximum Predicted 8-Hour Hydrochloric Acid C nc ntration (8-6-92)

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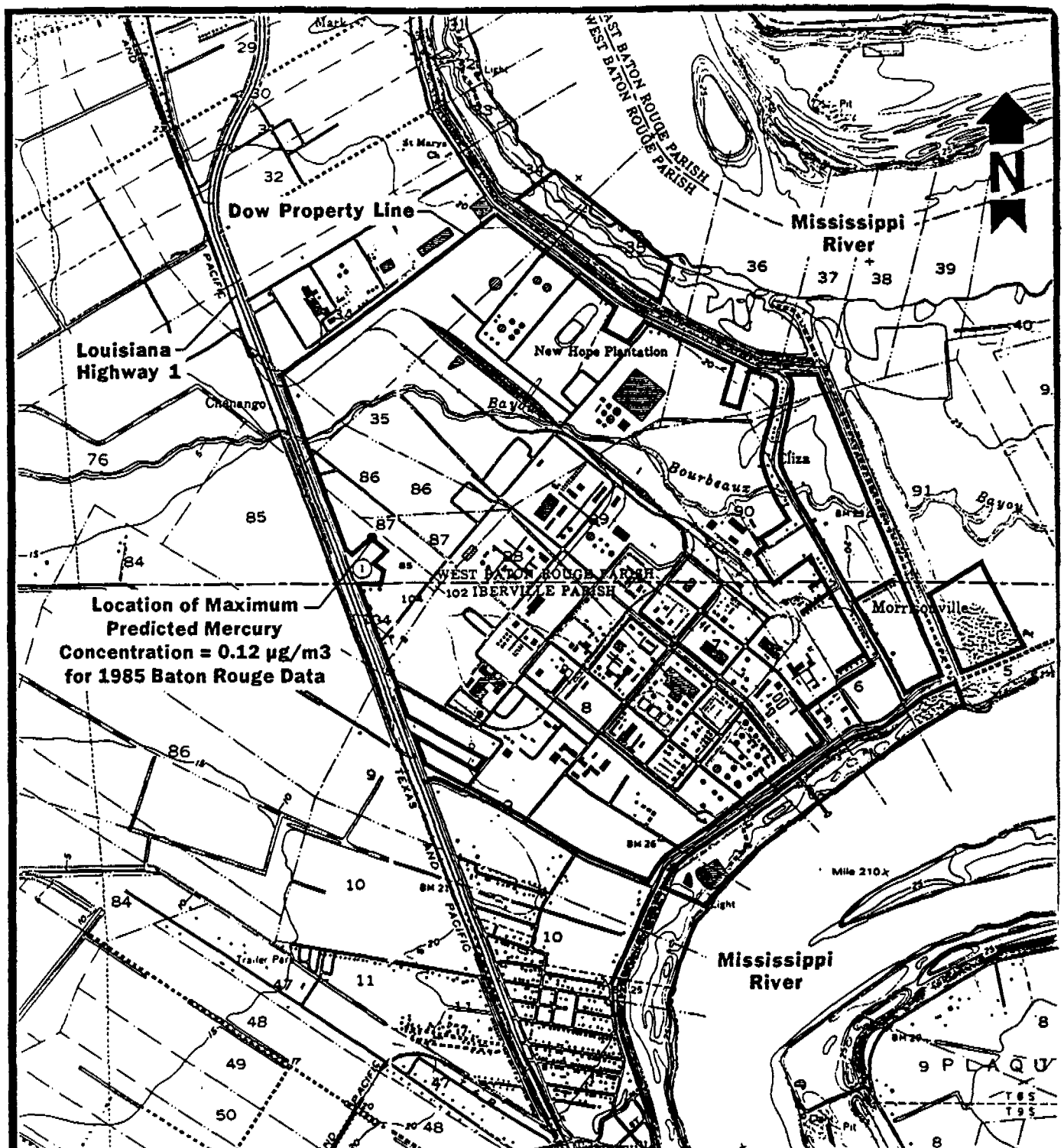

Scale

0 0.5 1 2

Kilometers

0 0.5 1

Miles

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ATTACHMENT B-11

USGS Map Showing Dow Louisiana Division and Maximum Predicted 8-Hour Mercury Concentration (8-6-92)

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