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CATALOG DOCUMENTATION
EMAP-ESTUARIES PROVINCE LEVEL DATABASE
LOUISIANIAN PROVINCE 1991-1994
SEDIMENT GRAIN DATA

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1. DATA SET IDENTIFICATION

1.1 Title

EMAP-Estuaries Province Level Database
Louisianian Province
Sediment Grain Characterization for a Station

1.2 Catalog Author

Virginia Engle, U.S. Environmental Protection Agency - NHEERL/GED
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Tom Heitmuller, U.S. Geological Survey - BRD/GBPO

1.3 Catalog Revision Date

March 4, 1999

1.4 Data Set Name

SEDGRAIN

1.5 Task Group

ESTUARIES

1.6 Data set identification code

00054, 00094, 00134, 00174

1.7 Version number for a data set

001

1.8 Requested acknowledgment

If you plan to publish these data in any way, EPA requires a standard statement for work is has supported:

"Although the data described in this article have been funded wholly or in part by the U.S. Environmental Protection Agency through its EMAP Estuaries Program, it has not been subjected to Agency review, and therefore does not necessarily reflect the views of the Agency and no official endorsement should be inferred."

2. INVESTIGATOR INFORMATION

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2.2 Sample Collection Investigator

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2.4 Data Analysis Investigator

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2.5 Additional Investigators

N/A

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3. DATA SET ABSTRACT

3.1 Abstract of the Data Set

The Sediment Grain Size data set presents the results of grain composition and characterization analyses. These analyses were conducted on a surface sediment sample collected at a station in a Province.

The sediment samples were derived from either homogenate of the top 2 cm of sediment from several grabs or from small core samples taken from the 3 individual sediment grabs collected for benthic community assessments. The homogenate was divided into samples for sediment chemistry analysis, sediment full grain characterization and sediment toxicity testing. Grain composition include per cent of sand and silt/clay. Grain characterization includes: 25, 50 and 75% quartile phi measurements and quartile deviation and skewness calculations.

3.2 Keywords for the Data Set

Sediment, grain composition, grain characterization, silt/clay.

4. OBJECTIVES AND INTRODUCTION

4.1 Program Objective

The Environmental Monitoring and Assessment Program (EMAP) was designed to periodically estimate the status and trends of the Nation's ecological resources on a regional basis. EMAP provides a strategy to identify and bound the extent, magnitude and location of environmental degradation and improvement on a regional scale based on randomly located station sites. Only the randomly located Base Sampling Sites were included in this data set.

4.2 Data Set Objective

The objective of the sediment grain data set is to present the results of analyses conducted to characterize the grain size distribution of sediments collected from estuaries in the Louisianian Province.

4.3 Data Set Background Information

The concentration of contaminants in sediments is dependent upon interactions between natural (e.g., physical sediment characteristics) and anthropogenic factors (e.g., type and volume of contaminant loadings). Sediment grain size determinations were made to supplement contaminant analyses.

4.4 Summary of Data Set Parameters

Grain size and composition parameters were measured from surface sediment collected at a station.

4.5 Year-Specific Information about Investigation Parameters

Sediment characterizations were conducted for all years, but in 1991 the work was conducted at the University of Mississippi, Oxford, MS, and in the following years, at the Gulf Coast Research Laboratory, Ocean Springs, MS. The rationale and approach for sediment characterization and grain size determination in the Louisianian Province remained in a developmental mode and underwent several revisions during the first couple of years of monitoring as reflected in the following.

Percent silt/clay determinations were made during every year; a complete grain size distribution analysis was only conducted in 1991. In 1991 and 1992, two different types of sediment characterization samples were collected at each sampling station. The first type sample, "Homogenate Profile" (HP) was a subsample of the composited homogenate (comprised of the top 2-3 cm of sediment taken from collective grabs). The second type of sample "Sediment Profile" (SP) was a small core samples taken from each of the three sediment grabs collected for benthic community assessments (resulting in three replicates).

In both 1991 and 1992, the SP samples were used for the determination of percent silt/clay.

In 1991, the HP sample was analyzed for full grain size distribution; in 1992, grain size distribution was dropped as a parameter of sediment characterization and the HP sample, although collected, went unanalyzed.

For the 1993 and 1994 monitoring in the Louisianian Province, it was decided that only sediment silt/clay would be determined and that the sample would be taken from the composited homogenate; no SP samples were collected.

5. METHODS

5.1 Data Acquisition

5.1.1 Sampling Objective

Collect sediment samples suitable for the analysis of sediment constituents.

5.1.2 Sample Collection Methods Summary

The grab sampler was attached to the end of a winch line with a shackle, and was then cocked. The grab sampler was lowered through the water column. The grab penetrated the sediment by gravity releasing a trigger which kept the jaws of the grab open. When the grab was pulled from the sediment using the winch, the jaws closed, encapsulating the sediment sample.

For the SP sample (see Section 3.4), a small, clear plastic core sampler (modified 60 cc disposable syringe) was inserted into a random location in each grab collected for

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benthic community assessment to extract a sample that was stored in a container at 4 C for later analysis of silt/clay and moisture content. Additionally, the depth (mm) to the black anoxic or Redox Potential Discontinuity (RPD) layer was measured in the core.

The HP samples (approximately 100 cc) were taken from a composited homogenate that consisted of the surficial layer of sediment removed from collective (5-6) grabs. A stainless steel spoon was used to carefully scoop the top 2-3 cm of sediment from the grab. The sediment was added to a stainless steel pan and the process was repeated until the pan contained approximately 4000 cc of sediment; each addition of sediment was thoroughly mixed in with that already contained in the pan to yield the final composite homogenate. Additional samples types were also taken from the homogenate, including those for sediment chemistry and sediment toxicity testing.

Both SP and HP sediment samples were held at near 4EC to await laboratory analyses.

5.1.3 Beginning Sampling Date

09 July 1991
08 July 1992
06 July 1993
06 July 1994

5.1.4 Ending Sampling Date

10 September 1991
11 September 1992
19 August 1993
15 September 1994

5.1.5 Sampling Platform

Each team was supplied with a 25-foot SeaArk work boat equipped with a 7.5 L gas engine fitted with a Bravo outdrive, an "A" frame boom assembly and hydraulic winch. On-board electronics consist of: a Loran C unit, GPS (beginning in 1993), radar unit, 2 VHF radios, cellular phone, compass, a depth finder, a tool kit, and all required and suggested safety equipment. One completely outfitted spare boat was stored at the Field Operations Center (EPA Lab) as backup.

5.1.6 Sampling Equipment

A 1/25 m2, stainless steel, Young-modified Van Veen Grab sampler was used to collect sediments. This grab sampled an area of 440 cm2 and a maximum depth of penetration in the sediment of 10 cm.

5.1.7 Manufacturer of Sampling Equipment

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5.1.8 Key Variables

5.1.9 Sampling Method Calibration

The sampling gear does not require any calibration. It required inspection for deformities incurred due to mishandling or impact on rocky substrates.

5.1.10 Sample Collection Quality Control

A successful grab had relatively level, intact sediment over the entire area of the grab and a sediment depth of 7-10 centimeters. Unacceptable grabs included those: containing no sediments, which were partially filled or had shelly substrates or grossly slumped surfaces. Grabs completely filled to the top, where the sediment was oozing from the hinged top, were also unacceptable.

Field technicians were trained to follow Standard Operating Procedures to insure the collection of representative, uncontaminated and high quality samples. Examples of QA/QC measures taken in the field to avoid or reduce contamination and insure the collection of representative samples include the following: use of stainless steel implements for mixing and transferring sediments, thorough cleaning and rinsing of the grab sampler and implements between samples, use of pre-cleaned sample containers for sediment storage, and immediate storage of samples on ice following collection.

The chance of sampling the exact same location twice was minimized. After three (3) grabs were taken, the boat was moved five (5) meters downstream by letting out the appropriate length of anchor line.

5.1.11 Sample Collection Method Reference

Macauley, J.M. 1991. Environmental Monitoring and Assessment Program-Near Coastal Louisianian Province: 1991 Monitoring Demonstration. Field Operations Manual. EPA/600/X-91/XXX. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561.

Macauley, J.M. 1992. Environmental Monitoring and Assessment Program: Louisianian Province:1992 Sampling: Field Operations Manual. EPA/ERL-GB No. SR-119. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561.

Macauley, J.M. 1993. Environmental Monitoring and Assessment Program: Louisianian Province:1993 Sampling: Field Operations Manual. EPA/ERL-GB No. SR-XXX. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561.

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Macauley, J.M. 1994. Environmental Monitoring and Assessment Program: Louisianian Province:1993 Sampling: Field Operations Manual. EPA/ERL-GB No. SR-XXX. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561.

5.1.12 Sample Collection Method Deviations

None

5.2 Data Preparation and Sample Processing

5.2.1 Data Preparation Objective

Process uncontaminated sediment samples to characterize the grain size distribution of the sediment samples.

5.2.2 Data Processing Methods Summary

The sediment sample was homogenized before a sub-sample was removed for analysis. For sandy sediments (anticipated sand content of approximately 25% or more by weight), about 50 g wet weight was removed and placed in a beaker. For muddy sediments (anticipated sand content of less than approximately 25%), about 20 g wet weight was removed and placed in a beaker. Five mL of sodium hexametaphosphate (6.2 g/L) and 50 mL of distilled water were added to the sample and stirred on a magnetic stirrer for 1-5 minutes. The suspension was then sieved through a 63 um sieve.

The <63 um portion of the sample was transferred to a 1 L graduated cylinder and brought up to 1 L with distilled water. The cylinder was shaken to create an even suspension, then 40 mL were immediately removed and placed in a tared evaporating dish. This sub-sample was dried at 100 degrees Centigrade and weighed. The >63 um portion of the sample was transferred from the sieve to a tared evaporating dish, dried at 100 degrees Centigrade, and weighed.

The full analysis of grain size distribution was only conducted in 1991. The tedious procedures are based on a time series of extractions taken from a suspension of sediment (< 63 um fraction) as it is allowed to settle. For a detailed discussion refer to EMAP -Estuaries Laboratory Methods Manual Vol. 1.

5.2.3 Sample Processing Method Calibration

5.2.4 Sample Processing Quality Control

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5.2.5 Sample Processing Method Reference

U.S. EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual - Estuaries, Volume 1: Biological and Physical Analyses. United States Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/620/R-95/008.

5.2.6 Sample Processing Method Deviations

None

6. DATA ANALYSIS AND MANIPULATIONS

6.1 Name of New or Modified Values

SICL_PC	% SILTCLAY
SAND_PC	% SAND
SILT_PC	% SILT
CLAY_PC	% CLAY
Q1_PHI	25th percentile phi
Q3_PHI	75th percentile phi
QUARDVTN	Quartile Deviation
SKEWNESS	Skewness
MED_DIAM	50th percentile phi

6.2 Data Manipulation Description

The data manipulations calculated the percentages of grain composition, based on the < 63 um and the > 63 um fraction weights. Quartile phi measurements were also estimated.

6.3 Data Manipulation Examples

6.3.1 Siltclay

SICL_PC represents the arithmetic mean of the silt/clay content (%) of the sediments from each core of the benthic grab.

The silt-clay weight calculation is as follows using the < 63 um fraction:

Silt-clay weight = (gross wt. - tare wt.) * (total volume in cylinder)/ (sample volume from cylinder)

The percent silt-clay calculation is as follows:

% silt-clay = silt-clay wt/(sand wt + silt-clay wt) * 100

6.3.2 Sand (%)

SAND_PC represents the arithmetic mean of the sand content (%) of the sediments from each core of the benthic grab.

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The sand weight calculation is as follows using the >63 um fraction:

sand weight = (gross wt. - tare wt.)

The percent silt-clay calculation is as follows:

% sand = sand wt/(sand wt + silt-clay wt) * 100

6.3.3 Q1_PHI

Q1_PHI represents the 25% quartile diameter range of the sediment grains. Among the cumulative % fraction weights find the cumulative % weights on either side of the percentile of interest. The Phi percentile is calculated as:

Phi percentile of interest = Phi value at lower percentile +[{(percentile of interest - lower cumulative % fraction weight)/(higher cumulative % fraction weight - lower cumulative fraction weight)} x {higher fraction Phi value - lower fraction Phi value}]

For example, for the 25th percentile, the values may be 18.37% at 4 Phi and 33.96% at 6 Phi. In this example the 25th percentile would be:

Phi25 = 4 + [{ (25 - 18.37) / (33.96-18.37) } * {6-4}] = 4.85 Phi

6.3.4 Q3_PHI

Q3_PHI represents the 75% quartile diameter range of the sediment grains. Among the cumulative % fraction weights find the cumulative % weights on either side of the percentile of interest. The Phi percentile is calculated as:

Phi percentile of interest = Phi value at lower percentile + [{(percentile of interest - lower cumulative % fraction weight)/(higher cumulative % fraction weight - lower cumulative fraction weight)} x {higher fraction Phi value - lower fraction Phi value}]

For example, for the 75th percentile, the values may be 18.37% at 8 Phi and 33.96% at 9 Phi. In this example the 75th percentile would be:

Phi75 = 8 + [{ (75 - 18.37) / (33.96-18.37) } * {9-8}] = 11.63 Phi

6.3.5 QUARDVTN

QUARDVTN represents the Phi quartile deviation and is calculated as:

(Phi 75 - Phi 25) / 2.

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6.3.6 SKEWNESS

SKEWNESS represents the Phi quartile skewness and is calculated as:

Skewness = (Phi 25 + Phi 75 - (2 x (Phi 50) / 2

6.3.7 MED_DIAM

MED_DIAM represents the 50% quartile diameter range (the median diameter) of the sediment grains. Among the cumulative % fraction weights find the cumulative % weights on either side of the percentile of interest. The Phi percentile is calculated as:

Phi percentile of interest = Phi value at lower percentile + [{(percentile of interest - lower cumulative % fraction weight)/(higher cumulative % fraction weight - lower cumulative fraction weight)} x {higher fraction Phi value - lower fraction Phi value}]

For example, for the 50th percentile, the values may be 18.37% at 6 Phi and 33.96% at 8 Phi. In this example the 50th percentile would be:

Phi50 = 6 + [{ (50 - 18.37) / (33.96-18.37) } * {8-6}] = 10.06 Phi

6.4 Data Manipulation Computer Code Set

6.5 Data Manipulation Computer Code Language

6.6 Data Manipulation Computer Code

7. DESCRIPTION OF PARAMETERS

7.1 Description of Parameters

7.1.1 Parameter Name

Variable	Type	Format	Label
STA_NAME	Char	8.	The Station Identifier
VST_DATE	Num	YYMMDD6.	The Date the Sample was Collected
SAND_PC	Num	5.1	Sand (%) in Sample
SILT_PC	Num	5.1	Silt (%) in Sample
SICL_PC	Num	5.1	Silt/Clay (%) in Sample
CLAY_PC	Num	5.1	Clay (%) in Sample
Q1_PHI	Num	5.1	25 % Quartile Diameter (Phi)
Q3_PHI	Num	5.1	75 % Quartile Diameter (Phi)
QUARDVTN	Num	5.1	Phi Quartile Deviation (Folk 1974)
SKEWNESS	Num	5.1	Phi Quartile Skewness (Folk 1974)
MED_DIAM	Num	5.1	50 % Quartile Diameter (Phi)

7.1.6 Precision to which values are reported

Values are reported to one decimal point.

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7.1.7 Minimum Value in Data Set

1991
1992
1993
1994

SAND_PC
1.2
0.7
0.2
1.2

SILT_PC
.
.
.
.

SICL_PC
5.2
1.6
0.1
0.4

CLAY_PC
.
.
.
.

Q1_PH1
0.2
.
.
.

Q3_PHI
1.6
.
.
.

QUARDVTN
0.1
.
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SKEWNESS
-0.3
.
.
.

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MED_DIAM
0.5
.
.
.

7.1.8 Maximum Value in Data Set

1991
1992
1993
1994

SAND_PC
94.8
98.4
99.9
99.6

SILT_PC
.
.
.
.

SICL_PC
98.8
99.3
99.8
98.8

CLAY_PC
.
.
.
.

Q1_PH1
3.9
.
.
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Q3_PHI
7.9
.
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QUARDVTN
2.0
.
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SKEWNESS
1.0
.
.
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MED_DIAM
5.6
.
.
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7.2 Data Record Example

7.2.1 Column Names for Example Records

STA_NAME VST_DATE SAND_PC SILT_PC SICL_PC
CLAY_PC Q1_PHI Q3_PHI QUARDVTN SKEWNESS
MED_DIAM

7.2.2 Example Data Records

OBS	STA_NAME	VST_DATE	SAND_PC	SILT_PC	SICL_PC	CLAY_PC	Q1_PHI
1	LA91LR01	910721	23.3	.	76.7	.	2.2
2	LA91LR02	910721	57.6	.	42.4	.	1.9
3	LA91LR03	910722	82.8	.	17.2	.	1.0
4	LA91LR05	910818	15.0	.	85.0	.	3.8
5	LA91LR06	910822	24.4	.	75.6	.	2.2

OBS	Q3_PHI	QUARDVTN	SKEWNESS	MED_DIAM
1	2.9	0.3	-0.1	2.6
2	2.4	0.3	0.0	2.2
3	2.3	0.7	0.0	1.7
4	6.4	1.3	0.6	4.5
5	3.1	0.5	0.0	2.7

7.3 Related Data Sets

7.3.1 Related Data Set Name

7.3.2 Related Data Set Identification Code

8. GEOGRAPHIC AND SPATIAL INFORMATION

8.1 Minimum Longitude

-97 Degrees 27 Minutes 13.20 Decimal Seconds

8.2 Maximum Longitude

-82 Degrees 39 Minutes 28.20 Decimal Seconds

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8.3 Maximum Latitude

30 Degrees 48 Minutes 30.00 Decimal Seconds

8.4 Minimum Latitude

26 Degrees 02 Minutes 55.80 Decimal Seconds

8.5 Name of the area or region

Louisianian Province - Coastal distribution of sampling is along the Gulf of Mexico from the Rio Grande, TX to Anclote Key, FL. States represented: Texas, Louisiana, Alabama, Mississippi, Florida

8.6 Direct Spatial Reference Method

Point

8.7 Horizontal Coordinate System Used

Universal Transverse Mercator

8.8 Resolution of Horizontal Coordinates

0.5

8.9 Units for Horizontal Coordinates

Meters

8.10 Vertical Coordinate System

N/A

8.11 Resolution of Vertical Coordinates

N/A

8.12 Units for Vertical Coordinates

N/A

9. QUALITY CONTROL AND QUALITY ASSURANCE

9.1 Measurement Quality Objectives

The MQOs for particle size (% silt/clay) analysis are to maintain precision within a variance of 10% relative percent difference (RPD) between replicate measurements; a goal of 100% completeness was established in respect to obtaining sample results. Accuracy was not applicable for this analysis.

9.2 Quality Assurance/Control Methods

QC checks for sediment particle size analysis are based on the reanalysis of a portion of each technician' s work. Approximately

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10% of samples from a batch are randomly selected for reanalysis and the results are compared against those for the original sample. To pass the QC check the absolute difference between the original value and the second must be#10%. If the reanalysis failed the QC check, the entire batch would be reanalyzed, providing there was an adequate volume of sample.

9.3 Actual Measurement Quality

The laboratories routinely met the QC criteria for sediment particle size determinations; the agreement between replicate analysis for all QC samples resulted RPDs of # 10%. It should be noted, however, when comparing year-to-year results for % silt/clay across the province, the 1991 data appear biased toward overestimating the silt/clay condition province-wide. This is thought to be an artifact linked to some procedural difference between the two laboratories involved. Since the % silt/clay data remained consistent in 1992-93, the 1991 data appear outlier and users should regard these data only as categorical estimates of bottom type (e.g., silty, silt-sand, or sandy).

9.4 Sources of Error

9.5 Known Problems with the Data

9.6 Confidence Level/Accuracy Judgement

9.7 Allowable Minimum Values

9.8 Allowable Maximum Values

9.9 QA Reference Data

10. DATA ACCESS

10.1 Data Access Procedures

A Data Request Package can be requested from a contact under Section 7.3. Data can be downloaded from the WWW site.

10.2 Data Access Restrictions

Data can only be accessed from the WWW site.

10.3 Data Access Contact Persons

Dr. J. Kevin Summers
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10.4 Data Set Format

Data can be transmitted in a variety of formats derived from SAS data files when a Data Request Form is submitted.

10.5 Information Concerning Anonymous FTP

Not accessible

10.6 Information Concerning World Wide Web

Data can be downloaded from the WWW

10.7 EMAP CD-ROM Containing the Data set

Data not available on CD-ROM.

11. REFERENCES

11.1 EMAP References

Heitmuller, P.T. and R. Valente. 1991. Environmental Monitoring and Assessment Program: EMAP-Estuaries Louisianian Province: 1991 quality assurance project plan. EPA/ERL-GB No. SR-120. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561.

Macauley, J.M. 1991. Environmental Monitoring and Assessment Program-Near Coastal Louisianian Province: 1991 Monitoring Demonstration. Field Operations Manual. EPA/600/X-91/XXX. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561.

Macauley, J.M. and J.K. Summers. 1991. Environmental Monitoring and Assessment Program, Near Coastal - Louisianian Province: 1991 Field Reconnaissance Report - East Region. EPA/600/04-91/XXX. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561.

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Summers, J.K., J.M. Macauley and P.T. Heitmuller. 1991. Environmental Monitoring and Assessment Program. Implementation Plan for Monitoring the Estuarine Waters of the Louisianian Province - 1991 Demonstration. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561. EPA/600/5-91/228.

Summers, J.K., J.M. Macauley, J.M., P.T. Heitmuller, V.D. Engle, A.M. Adams and G.T. Brooks. 1992. Annual Statistical Summary: EMAP-Estuaries Louisianian Province - 1991. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32561. EPA/600/R-93/001.

U.S. EPA. 1995. Environmental Monitoring and Assessment Program (EMAP): Laboratory Methods Manual - Estuaries, Volume 1: Biological and Physical Analyses. United States Environmental Protection Agency, Office of Research and Development, Narragansett, RI. EPA/620/R-95/008.

11.2 Background References

Engle, V.D., J.K. Summers, G.R. Gaston. 1994. A Benthic Index of Environmental Condition of Gulf of Mexico Estuaries. Estuaries. 17:372-384.

Summers, J. Kevin, John F. Paul, Andrew Robertson. 1995. Monitoring The Ecological Condition Of Estuaries In The United States. U.S. Environmental Protection Agency, Office of Research and Development, Environmental Research Laboratory, Gulf Breeze, FL 32651.

12. GLOSSARY AND TABLE OF ACRONYMS

12.1 Acronym used in the Detailed Documentation

12.2 Definition of Acronym

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