

**IDENTIFICATION OF HAZARD POTENTIALS AROUND THE DRILLING POINT USING MULTIBEAM
ECHOSOUNDER AND MAGNETOMETER
(CASE STUDY: MAKASSAR STRAIT, EAST BORNEO)**

**IDENTIFIKASI MORFOLOGI DAN POTENSI BAHAYA SEKITAR TITIK PENGEBORAN MENGGUNAKAN MULTIBEAM
ECHOSOUNDER DAN MAGNETOMETER
(STUDI KASUS: SELAT MAKASSAR, KALIMANTAN TIMUR)**

Moh Gema Perkasa Drakel¹, Ir. Yuwono¹

¹Geomatics Engineering Department, Civil Engineering and Planning Faculty, Sepuluh Nopember Institute of Technology, Surabaya 60111 Indonesia

Email: gema11@mhs.geodesy.its.ac.id, yuwono@geodesy.its.ac.id

Abstract

Offshore construction is the installation of the structures and facilities in the marine environment, usually for production and transmission of electricity, oil, gas and other resources. The Offshore construction involves the extraction of energy in the form of oil or gas. It is usually associated with the construction of The Offshore platforms. Bathymetry survey has been intended to obtain data of depth, seabed topography, and seabed morphology including the hazardous location and objects. The research will be carried out about the offshore construction development planning by using several instruments such as Multibeam Echosounder and Magnetometer. This research is to provide information of the conditions of morphology and the magnetic field or metal objects that embedded at the seafloor around the drilling point that can endanger the project itself. Multibeam Echosounder was used to obtain an overview of the seabed and the morphology feature at the drilling point and Magnetometer were used to obtain an overview if there was an existing pipeline or magnetic field at the seabed of the drilling point. All of these instruments Results can support each other with their advantages and disadvantages in order to make the map of the hazard potentials of morphology and magnetic field to support The Offshore construction activities.

Keywords: Multibeam Echosounder, Magnetometer, Offshore Construction, Hazard Potentials, Morphology, Seabed, Magnetic Field

Abstrak

Konstruksi lepas pantai adalah struktur dan fasilitas di lingkungan laut, digunakan untuk produksi dan mentransmisi listrik, minyak, gas dan sumber daya lainnya. Pembangunan lepas pantai melibatkan ekstraksi energi dalam bentuk minyak atau gas. Hal ini berhubungan dengan pembangunan Bangunan Lepas Pantai. Survei batimetri telah dimaksudkan untuk memperoleh data Kedalaman, topografi dasar laut, dan morfologi dasar laut termasuk lokasi berbahaya dan benda-benda lainnya. Penelitian ini membahas tentang perencanaan pembangunan konstruksi lepas pantai dengan menggunakan beberapa instrumen seperti Multibeam Echo Sounder dan Magnetometer. Penelitian ini bertujuan untuk memberikan informasi tentang kondisi morfologi dan medan magnet atau benda-benda logam yang tertanam di dasar laut sekitar titik pengeboran yang dapat membahayakan proyek itu sendiri. Multibeam Echo Sounder digunakan untuk mendapatkan gambaran dari fitur dan morfologi dasar laut pada sekitar titik pengeboran dan Magnetometer digunakan untuk mendapatkan gambaran jika ada pipa atau medan magnet di dasar laut sekitar titik pengeboran. Semua instrumen ini dapat saling mendukung dengan kelebihan dan kekurangan mereka dalam rangka untuk menunjukkan peta potensi bahaya dari morfologi dan medan magnet untuk mendukung Kegiatan konstruksi lepas pantai.

Kata Kunci: Multibeam Echosounder, Magnetometer, Konstruksi Lepas Pantai, Potensi Bahaya, Morfologi, Dasar Laut, Medan Magnet

PRELIMINERY

Preliminery

Indonesia is a maritime country that is of the area is water. The area of the seas 2/3 (two thirds) of the total area of Indonesia. The potential contains mineral resources in the vast area of Indonesia's sea that needs to be expanded. With larger sea area than land, construction in the sea area, especially offshore has a close relationship with the development of exploration and extraction of energy in the form of oil and gas (Nugraha 2014).

The Offshore construction is the installation of the structures and facilities in the marine environment, usually for production and transmission of electricity, oil, gas and other resources. The Offshore construction involves the extraction of energy in the form of oil or gas. It is usually associated with the construction of offshore platforms. The Offshore structure or building is built offshore to support the exploration or exploitation of minerals. Usually The Offshore drilling rig has a function to analyze the nature of the geological reservoir and to create holes that allow the retrieval reserves of petroleum or natural gas from the reservoir (Drakel and Mukti 2014).

One of the activities that can be conducted in Indonesia sea area is a Hydrographic Survey to support the exploration and exploitation of natural resources contained in the Indonesian seas. The Hydrographic surveying deals with the configuration of the bottom and adjacent land areas of oceans, lakes, rivers, harbors, and other water forms on Earth. Bathymetric survey is one of offshore activities that can show information about the depth of an area in the ocean and also the information about the seabed. The Bathymetry survey has been intended to obtain data of depth, seabed topography, and seabed morphology including the hazardous location and objects.

Echosounder is an instrument for measuring the depth of water by sending a wave of the echo from the surface to the bottom of the water and notes the time until the echo back from the bottom of the water. The Echosounder is an instrument used to determine the depth of the sea, a distance-measuring device using ultra

sonic. Magnetometers measure magnetic fields, to determine the existing pipeline or metal field that is embedded in the seabed that could endanger the plan of the offshore construction.

In any offshore activities required some of supporting surveys before the process of exploration and exploitation done. To determine a drilling point it is necessarily need to see from different aspects such as mineral deposits, a potential hazard, and several sciences that probably could support all the process. In this research depend on the data obtained from the data provider, the drilling point has been determined before the survey of potential hazards was held in the area Area of drilling point.

East Borneo is the plan area for offshore construction building to support the exploitation of minerals. The research will be carried out about the offshore construction development planning by using several instruments such as Multibeam Echosounder and Magnetometer. This research is to provide the information of the conditions of the morphology and the magnetic field or metal objects that embedded at the seafloor around the drilling point that can endanger the project itself.

RESEARCH METHODOLOGY

This is the overall review of the phases of data processing as follows:

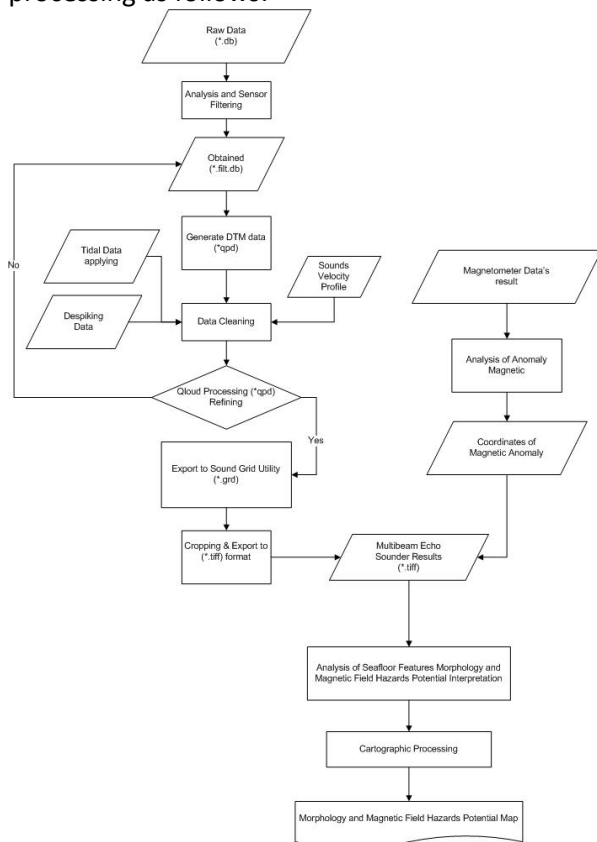


Figure 1. Data Processing Flow Chart

Explanation of Multibeam Echosounder data processing as follows:

The initial analysis of the MBES data processed in (Raw Observation Inspect tool) containing in the Raw Data Manager. This is to clean up the noise in the raw data and to obtained the data wick the format is (*.filt.db). After first filtering process, and then make data DTM which the format is (*.qpd) through (replay – controller) containing in the Raw Data Manager. In This phase, MBES data were cleaned more details of the spike and the other points considered deviant and reduces the quality of the data and also to clean up the MBES data from the spike caused by marine life and other disorders caused by various factors that affect sound waves emitted and received by the transducer which consequently generates noise in the data acquisition. This process is done in the Validator and also applied tidal data. This phase was done to refine the MBES data results from previous phase. After cleaning the data, then the data is exported to the grid format that can be processed and converted by using Sounding Grid Utility. This phase was done to obtain the area used to determine the problem in this research and to export it into (*.tiff) format. Obtaining

the results of the Multibeam Echosounder from Exported data from previous phase.

Explanation of Magnetometer data processing as follows:

This data is the result of data acquisition in the field that displays the magnetic anomalies along the corridor and the position (X,Y) has differentially been corrected by using a GPS device. This, was to analyze the raw data in the form of a numeric list of the magnetic field (nT) and to obtain the coordinates of the location of the magnetic anomaly for the next validation purposes. To Obtain The coordinates, from the highest point of Magnetic Anomaly from analysis phase.

RESULTS AND ANALYSIS

Results

The results of data processing in the form of bathymetric and morphology maps were presented with a horizontal scale of 1: 5000 and the vertical scale 1: 500 on A1 paper size. The actual Depth and actual Coordinates on the map were not be able to be shown in this research, because it was classified or not allowed by the Data Providers according to the company’s requirement. Data processing phases were expected to know the existence of metal objects and magnetic field that embedded on the seabed, especially on the Area around the drilling point that could cause hazardous conditions to the survey project, by presenting data from the Magnetometer into a map of hazard potentials.

Analysis

Analyzed The Data of Multibeam Echosounder for Seabed Morphology Around The Drilling Point

The interpretation of the Multibeam Echosounder data is shown on a picture of the seabed morphology around the survey project area (Figure 3.) and also was obtained from the data acquisition, total of the survey area was 3642291.2817 m². It depended on Bathymetric maps of observations (attached on an attachment), the overall depth of the seabed in the research area was generally between 45 to 54 meters.

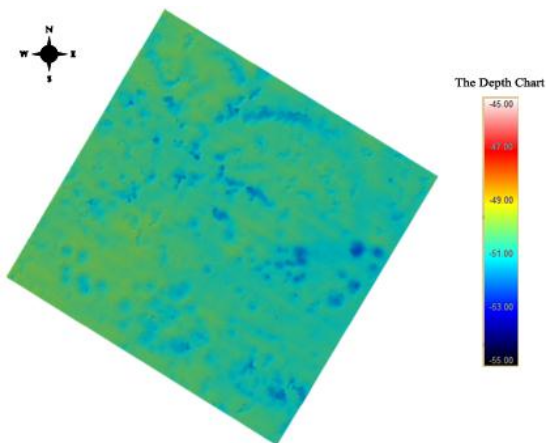


Figure 2. Seabed Morphology of The Survey area.

From the overview of Multibeam Echosounder data results above, the researcher also analyzed that there were no seabed features or shape of seabed morphology that could endanger for offshore construction activities. But it could be seen there was an expanse of undefined object in the middle of the survey area adjacent to the drilling point (Figure 4.) which would be analyzed by using Magnetometer data acquisition.

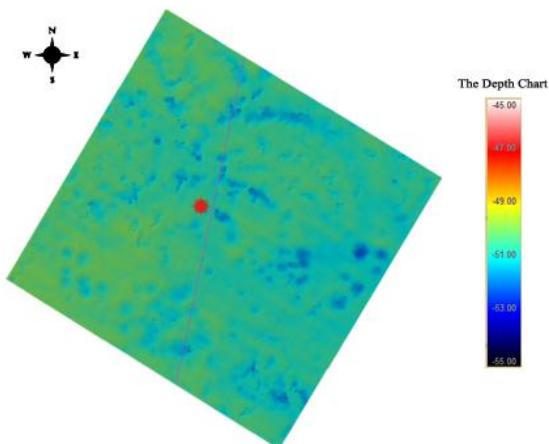


Figure 3. The Appearance of Undefined Object.

Information of Figure 3 :

- a. (●) The red dot is the point of drilling point.
- b. (—) The purple line is an undefined object.
- c. For more information the complete map attached on an attachment.

Analyzed The Data of Magnetometer for Hazard Potentials Caused By Magnetic Field

The Limitation of data processing results of the Magnetometer was to analyze the raw data in the form of a numeric list of the magnetic field (nT) and to obtain the coordinates of the location

of the magnetic anomaly for the next validation purposes. Please noted that Nanotesla (nT) is represent the value contained either on the surface of the earth or on objects that have a value of the magnetic field.

The Researcher continued to analyze 2 raw data acquisition results from the Magnetometer, as you can see on the (Figure 5.) below there are two main lines of acquisitions and on the (Tabel 1.) and (Tabel 2.) are the explanation list of the results from the 1st Main Line and 3rd Main Line.

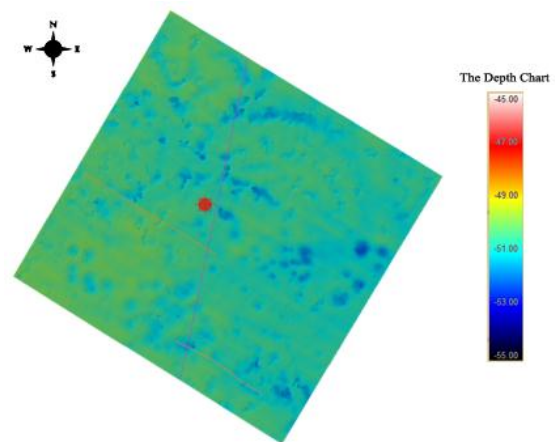


Figure 4. The Main Line of Magnetometer Surveys Acquisitions.

Information of Figure 4 :

- a. (●) The Red dot is the point of drilling point.
- b. (—) The Purple line is an undefined object.
- c. (—) The Orange lines on the figure are the Main Line of Magnetometer Surveys Acquisitions.
- d. For more information the complete map attached on an attachment.

Table 1. The 1st Main Line

Time (Date)	Time (UTC)	Easting (m)	Northing (m)	Magnetic Field MAGNETO METER [nT] Value
9/13/14	3:41:33	507157.23	9815354.51	41970.675
9/13/14	3:41:34	507157.23	9815354.51	41965.689
9/13/14	3:41:34	507155.3	9815355.08	41960.555
9/13/14	3:41:35	507155.3	9815355.08	41955.359
9/13/14	3:41:35	507153.7	9815356.12	41948.893
9/13/14	3:41:36	507153.7	9815356.12	41942.068
9/13/14	3:41:36	507152.28	9815356.55	41934.6
9/13/14	3:41:37	507152.28	9815356.55	41926.9
9/13/14	3:41:37	507150.91	9815357.32	41919.7
9/13/14	3:41:38	507150.91	9815357.32	41914.316
9/13/14	3:41:38	507149.51	9815358.12	41910.92
9/13/14	3:41:39	507149.51	9815358.12	41906.639
9/13/14	3:41:39	507148.11	9815358.95	41820.21

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Time (Date)	Time (UTC)	Easting (m)	Northing (m)	Magnetic Field MAGNETO METER [nT] Value
9/13/14	3:41:40	507148.11	9815358.95	41858.782
9/13/14	3:41:40	507146.55	9815359.7	41808.94
9/13/14	3:41:41	507146.55	9815359.7	41827.612
9/13/14	3:41:41	507145	9815360.59	41886.135
9/13/14	3:41:42	507145	9815360.59	41896.587
9/13/14	3:41:42	507142.95	9815361.35	41873.476
9/13/14	3:41:43	507142.95	9815361.35	41902.145
9/13/14	3:41:43	507141.09	9815362.32	41912.337
9/13/14	3:41:44	507141.09	9815362.32	41918.506
9/13/14	3:41:44	507139.59	9815362.94	41923.914
9/13/14	3:41:45	507139.59	9815362.94	41928.884
9/13/14	3:41:45	507138.16	9815363.67	41933.143
9/13/14	3:41:46	507138.16	9815363.67	41937.346
9/13/14	3:41:46	507136.22	9815364.56	41941.288

Note : All the numerical listed above are not an actual date, neither time, nor coordinates and Magnetic Fields, because it was classified by the Data Provider According to the Company Regulations.

Information of Table 1 :

- Right before The HighLight numbers on the table you could notice that the average number of the magnetic fields were around 41900 (nT) and then there were significant changes amount of the magnetic field numbers to 41800 (nT) and the changes of these numbers are called Magnetic Anomaly.
- The highest of Magnetic field obtained from this anomaly was 41858.782 (nT)

Table 2. The 3rd Main Line

Time (Date)	Time (UTC)	Easting (m)	Northing (m)	Magnetic Field MAGNETO METER [nT] Value
9/13/14	1:22:12	507267.98	9815954.97	41907.795
9/13/14	1:22:13	507269.23	9815954.19	41902.319
9/13/14	1:22:13	507269.23	9815954.19	41899.182
9/13/14	1:22:14	507270.43	9815953.42	41899.991
9/13/14	1:22:14	507270.43	9815953.42	41903.454
9/13/14	1:22:15	507271.63	9815952.64	41908.25
9/13/14	1:22:15	507271.63	9815952.64	41914.547
9/13/14	1:22:16	507272.83	9815951.86	41922.676
9/13/14	1:22:16	507272.83	9815951.86	41932.135
9/13/14	1:22:17	507274.05	9815951.3	41942.527
9/13/14	1:22:17	507274.05	9815951.3	41951.688
9/13/14	1:22:18	507275.2	9815950.59	41958.541
9/13/14	1:22:18	507275.2	9815950.59	41963.079
9/13/14	1:22:19	507276.33	9815949.94	41966.565
9/13/14	1:22:19	507276.33	9815949.94	41969.613
9/13/14	1:22:20	507277.44	9815949.24	41972.275
9/13/14	1:22:20	507277.44	9815949.24	41974.091
9/13/14	1:22:21	507278.83	9815948.67	41975.264
9/13/14	1:22:21	507278.83	9815948.67	41975.749

Time (Date)	Time (UTC)	Easting (m)	Northing (m)	Magnetic Field MAGNETO METER [nT] Value
9/13/14	1:22:22	507278.83	9815948.67	41975.614
9/13/14	1:22:22	507280.12	9815947.95	41975.867
9/13/14	1:22:23	507281.17	9815947.27	41976.099
9/13/14	1:22:23	507281.17	9815947.27	41976.66
9/13/14	1:22:24	507282.26	9815946.59	41976.559
9/13/14	1:22:24	507282.26	9815946.59	41975.788
9/13/14	1:22:25	507283.64	9815945.8	41974.831
9/13/14	1:22:25	507283.64	9815945.8	41974.73
9/13/14	1:22:26	507284.95	9815944.97	41974.992

Note : All the numerical listed above are not an actual date, neither time, nor coordinates and Magnetic Fields, because it was classified by the Data Provider According to the Company Regulations.

Information of Table 2 :

- Right before The HighLight numbers on the table you could notice that the average number of the magnetic fields were around 41900 (nT) and then there were significant changes amount of the magnetic field numbers to 41800 (nT) and the changes of these numbers are called Magnetic Anomaly.
- The highest of Magnetic field obtained from this anomaly was 41899.991 (nT).

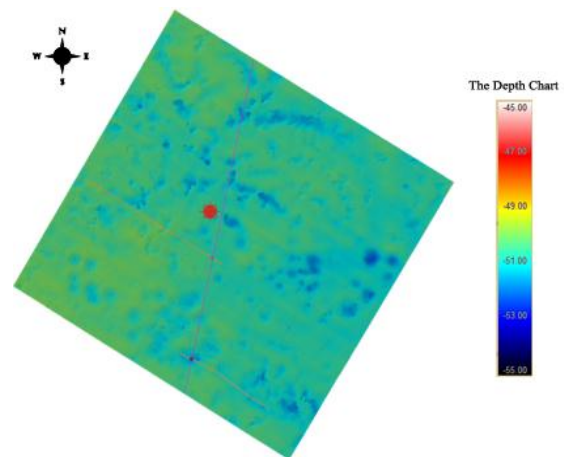


Figure 5. Two points of Magnetic Anomaly.

Information of Figure 5 :

- (●) The Red dot is the point of drilling point.
- (-) The Purple line is an undefined object.
- (-) The Orange lines on the figure are the Main Line of Magnetometer Surveys Acquisitions.

- d. (●) The Grey dot is the first Magnetic Anomaly
- e. (●) The Brown dot is the second Magnetic Anomaly
- f. For more information the complete map attached on an attachment.

From The various analysis phases above that the undefined object was an object that has a magnetic anomaly. The shape of the object was known as a pipeline embedded at the seabed around the drilling point. Due to the position of the drilling point was adjacent with the existing pipeline, and this condition could cause hazard potential to the offshore construction.

CONCLUSIONS

From two main data that used in this research such as Multibeam Echosounder and Magnetometer data acquisitions results were used to determine The Hazard Potential that could cause Hazardous Conditions Around The Drilling Point. Therefore several of the conclusion aspects obtained from The Analyzed Process in this research as follows :

- a. Total Of The Survey Area Was 364.2291 ha and The overall average depth was generally between 45 to 54 meters.
- b. From the analysis and Identification process were proven that were not found such as Boulders, Pockmark, Slope or any Morphologies of the seabed around The Drilling Point which can cause Hazard. For the seabed morphology around the project area were tend to be safe for the Offshore Construction Activities.
- c. There was an expanse of undefined object in the middle of the survey area adjacent to the drilling point. From The Magnetometers analysis and Identification process were proven that The shape of the object was known as a pipeline embedded at the seabed around the drilling point. Due to the position of the drilling point was adjacent with the existing pipeline, this condition could cause Hazard Potential from Magnetic Field for the Offshore Construction Activities.
- d. Based on the analysis, the thesis came up with some results. There were 2 maps obtained

from this research, The first one was Morphology and Hazard Potentials Map and The second one was Bathymetric Map. (all the maps were attached on attachment).

ACKNOWLEDGEMENT

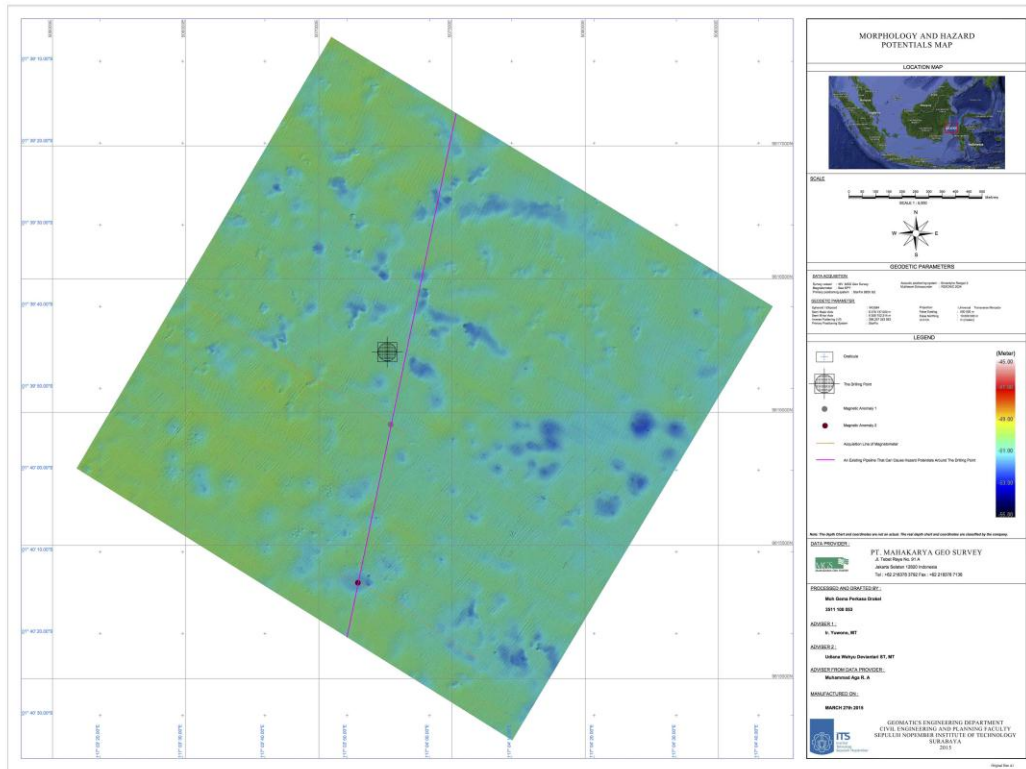
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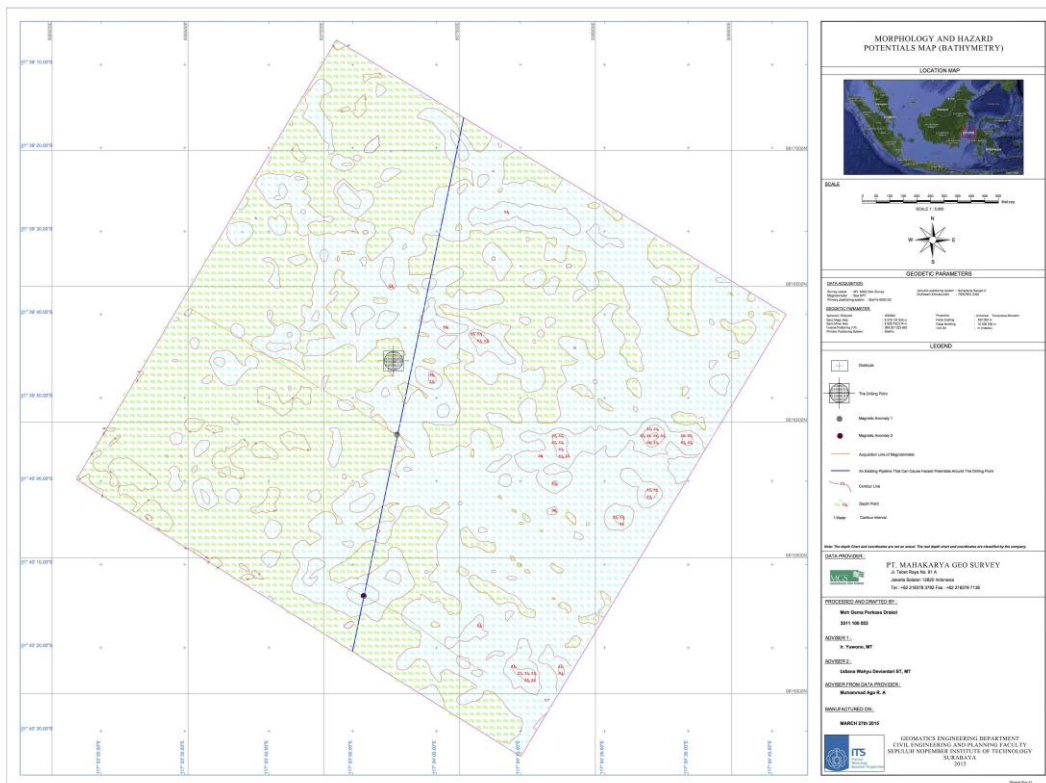
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APPENDIX



Morphology and Hazard Potentials Map



Morphology and Hazard Potentials Map (Bathymetry)