

**technical book for implementing a 3D seismic survey in Zumlat al-Moher and a 2D seismic survey in the Damascus area**

The Syrian Petroleum Company requests the implementation of field work to obtain land seismic data according to the following specifications:

- 1- 3D land Seismic survey in the Zumlat al-Moher area in accordance with the technical conditions and work requirements mentioned in the attached technical description. This detailed-technical description includes all the works, activities and operations required to implement the Seismic survey to collect 3D seismic data for an area of approximate 230 square kilometers using vibrators or Dynamite detonation points according to the survey requirements, and after carrying out an investigative operation in the survey area. It is estimated that approximately 85% - 90% of the total survey area to be carried out by means of vibrators, and that Dynamite is to be used in areas where vibrators are not applicable due to difficult terrain, wetlands, and swamps, if any.
- 2- 2D Land Seismic survey in Damascus area which located in the southwestern part of Syria, and according to the detailed specifications. This area it is distributed over( 59) 2D profiles, and the length of the required survey lines equals approximately (2753 km  $\pm$  10%, out of which 50% - 55% considered topographically difficult areas that require using dynamite). The total number of source points is 55,060  $\pm$  10% and according to the aforementioned tables and maps; the western area is generally rugged and uneven (mountains, valleys,... etc.), the other few parts are not difficult (medium to easy).

The bidder has the right to present his technical offer either by using traditional recording equipment such as geophones, cables, with matching recording systems, or to present a technical offer that uses modern methods of seismic surveying which use wireless recording systems and point receivers such as Nodal System / Smartsolo system / Quantum / or their equivalent. ....etc.

**1- Purpose of the survey:**

The propose of implementing the seismic survey is to define – clearly and with high accuracy- the geologic column of the subsurface reflectors in the survey area. Enabling the creation of time and depth maps identical to the geological reality with high reliability.

**2- Geological Tasks Of 3D Survey:**

The implementation of the survey according to modern technologies and the recording of seismic waves - in a professional and high-accurate manner – which covers the following goals:

- The survey should represent the subsurface-geological structures with seismic reflectors within the geological column in the area, which are:

( arak marl- rmah shirt- Judia- hayan- Rutba- Qamshouka- sirjielou- Muss- Adaya- Butma- Kurachina anhydrite- Kurachina dolomite- Amanos Sand- Markad.....).

- To clarify and draw tectonic maps and unconformity aspects.
- To clarify and draw the boundaries of potential traps in the survey area.
- To enables the study of special structural- geological features, cracks and thicknesses.
- To be able to obtain a three-dimensional structural geological model of the study area.
- To study of the weathering-layer by executing a special survey of it.

(Changes could be added to the study proposed by SPC and implemented by the bidder during implementation in the purpose of defining precisely the traps. All these changes will be discussed & agreed upon with SPC Supervision Committee during survey operations).

### 3- Geological tasks of 2D survey:

- Implementing 2D seismic survey - based on modern technology and methods of generating and recording seismic waves - in the purpose of achieving high-clear seismic results.
- Implementing a detailed study to clarify the geological structure of the North-Damascus area by identifying the main horizontal levels of the subsurface geological layers in the surveyed area.
- Identifying expected new traps within the boundaries of the 2D seismic survey area.
- Identifying located traps precisely within the boundaries of the 2D seismic survey area.
- Studying the weathering layer through up-hole wells and surface refraction – survey of the weathering layer.
- The Syrian Petroleum Company has the right to modify or change the locations of some seismic profiles , while maintaining the total long kilometers of the project, according to the technical requirements that they deem necessary in comparison with the initial proposal for this purpose. All previous cases will be approved by both Syrian Petroleum Company supervision committee and the bidder.

### 4- Mobilizing the crew to survey area (MOBILIZATION):

The process of Mobilizing the crew includes shipping all of the equipment, Vibrators, recording systems, rigs, vehicles and everything related to the survey crew from the bidder's country to the work-site and within the survey area. The Syrian Petroleum Company bears the cost of mobilizing the equipment of the bidder when the bidder mobilize all of his equipment from abroad until they reach the camp of the 3D survey that will be carried out firstly.

**5- Mobilizing the crew outside the survey area (Demobilization):**

After completing all recording and seismic survey operations for both the 2D and 3D surveys, the bidder will remove all the equipment, supplies and machinery that he brought, to outside the survey area and hand over the work-site to the Syrian Petroleum Company. When the operations' site is delivered to the Syrian Petroleum Company, free of any equipment belonging to the bidder, the Syrian Petroleum Company pay the demobilization value.

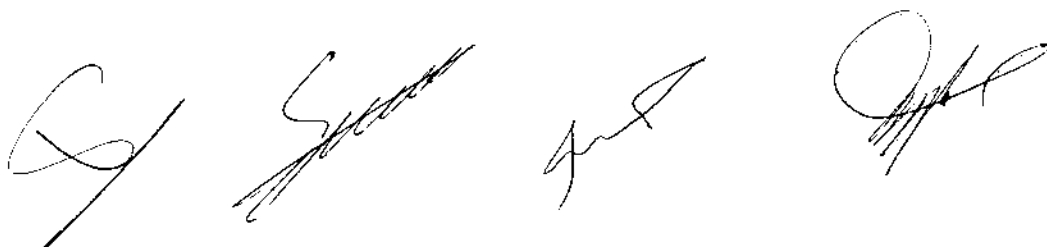
**6- Implementation timeline (schedule time planning):**

The bidder submits a time plan in which he explains the time period required for each stage from the beginning of mobilizing the equipment until the end of the survey operations and moving the crew outside the survey area. The bidder has the right, through submitting an official written request submitted to the Syrian Petroleum Company, and after receiving the work-site and Commencement order, to request for changes, in case the time frame for some stages increases or decreases, depending on the progress of the survey operations, while maintaining the total implementation duration of the two projects. All changes should approved by Syrian petroleum management.

**7- General conditions:**

- 1- The bidder is responsible, and at his own expense, for paying all wages, providing equipment, experts, workers, accommodation and food expenses for all his personnel working in the crew, in addition to paying the value of fuel and dynamite needed for implementing the project.
- 2- The bidder is responsible for all bulldozer's work and all engineering works needed to implement the project according to the highest international standards.
- 3- The bidder is committed to designing the geometry model for the 2D and 3D seismic survey, and that this design is consistent with the established registration parameters. The bidder has the right to submit more than one geometrical design as a technical advice, provided that designs are consistent with the technical specifications and according to the book of technical conditions. The Syrian Petroleum company shall choose the appropriate geometrical technical design, if more than one is presented.
- 4- The bidder is committed to providing response procedures for emergency situations, in addition to providing emergency ambulance services to all personnel working on the project.
- 5- The bidder pledges that he possesses all necessary equipment, materials, equipment, and vehicles sufficient to implement the project, in addition to spare parts.
- 6- The bidder is committed to carrying out the works assigned to him in order to complete all required operations in the survey area and within the established time periods and according to the required technical specifications.
- 7- The bidder is responsible for correcting or re-shooting unacceptable data that not matched the technical specifications stated within the technical book, or any other misfit work. This will be determined by the supervisor of the Syrian Petroleum Company and the cost will be at the bidder's expense.

- 8- The bidder is responsible for all tests for recording equipment, cables, devices, geophones and vibrator, which must be periodic. These tests to be are required by the Supervision Committee of the Syrian Petroleum Company before and during implementation.
- 9- The bidder must provide accommodation for four technicians from the Syrian Petroleum Company (two supervisors and two trainees).
- 10- The number of channels that will be provided for both projects should not be less than 9,000 channels, and each channel consists of 2 strings; i.e. the total number of strings when using the cable system shall equals at least 18,000.
- 11- The number of rigs that will be used in the 2D seismic project shall not be less than 30 rigs of all capacities and types.
- 12- The bidder is obligated to provide geophones provided that the year of manufacture is not less than 2021 (the manufacturing period does not exceed three years), so that they still maintain the properties of flexibility needed to guarantee high-accurate recording quality and in full conformity to the specifications set in the technical book.
- 13- The bidder is obligated to provide vibrators whose year of manufacture is not be less than 2015. These vibratos should contain all the equipment, electronic control devices and programs which monitor and examine their performance. And they should meet all technical conditions related to the sweep characters control.
- 14- The bidder provides a list of the technical equipment and supplies that will be used to implement the project.
- 15- The bidder shall submit a list of his technical experts who will carry out the survey process. Those experts must possess the scientific and professional level necessary to carry out such works, in addition to having previous experience in implementing seismic surveys.
- 16- The bidder has the right to employ workers and technicians from the local market in the number required for the work.
- 17- The bidder has the right to use machinery and equipment rented from the local market according to his needs.
- 18- The Syrian Petroleum Company has the right to supervise the implementation of the survey operations in details, and to inspect all the steps that will be implemented, and to view and evaluate the results during the survey operations.
- 19- The bidder is committed to providing all facilities to the staff supervising the survey operations, and to providing them with required information without hiding any technical information.
- 20- The Syrian Petroleum Company is committed to providing all approvals and permissions for the use of communication devices, GPS devices, radio and wireless communication devices, and all work requirements for seismic-survey teams.
- 21- In order to implement the survey service, the bidder shall be granted the necessary exemptions for the entry and exit of all its equipment, devices, machinery and vehicles. The contractor shall also be granted grant the necessary exemptions for the entry and exit of his foreign employees and experts to and from the territory of the Syrian Arab Republic in



accordance with the applicable laws and regulations. Machinery, cars, equipment and supplies are entered after obtaining the required approvals.

22- The Syrian Petroleum Company is responsible for compensation for agricultural and non-agricultural damages in accordance with regulations and Syrian laws. .

23- The Syrian Petroleum Company is committed to facilitate providing the bidder's vehicles with fuel, so that the bidder pays the value of the fuel at his own expense calculated by the Industrial Price.

24- The Syrian Petroleum Company is committed to provide full protection for the crew camp, equipment, and personnel working in the crew.

25- The Syrian Petroleum Company facilitates providing the dynamite necessary for the survey process, its transportation, delivery, storage, and all procedures that guarantee security and safety, in accordance with the rules followed in Syrian Arab Republic. The bidder pays the value of the delivered dynamite. If dynamite is not available in the Ministry of Defense Manufacturing factory , the Syrian Petroleum Company facilitates issuing the necessary approvals and import licenses to supply the dynamite and detonators needed to implement the survey.

26- The Syrian Petroleum Company has the right to make amendments to the coordinates of the survey area within the region according to SPC technical approach, while maintaining the total number of points and within the conditions mentioned in the technical specifications book.

27- The bidder has the right to present his technical proposal either by using traditional recording equipment such as geophones, cables, and corresponding recording systems, or to submit a technical offer that uses modern methods of seismic survey that use wireless recording systems and pointed receivers such as Nodal System / Smartsolo system / Quantum / or their equivalent. ....etc.

28- The bidder is committed to providing technical information about the crew (recording system, vibrators, camp, equipment...)

29- In the event that the contractor stops working for reasons beyond his control or security reasons, he will be given a (Daily Stand by) which he provide in his Financial Offer, according to the following conditions:

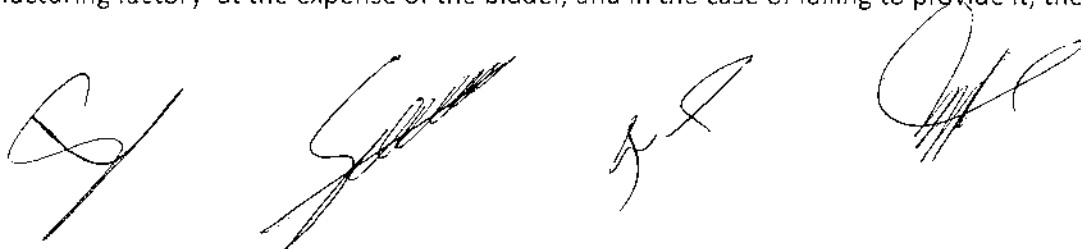
a - The bidder will not be given any stand by fees if he was responsible, partially or completely, for the stoppage of work.

b - The bidder will not be given any stand by fees resulting from not providing fuel, noting that the Syrian Petroleum Company adheres to facilities, at its most capability, to facilitate getting necessary approvals to supply the bidder with fuel according Industrial price.

c - In the event that the bidder stops the works of this project for reasons related to bad-weather, the bidder will be given daily stand by fees, provided the stoppage duration should not to exceed 15 days per year.

d - In the event that the bidder stops the works of this project for security reasons, the bidder will be given daily stand by fees, provided the stoppage duration should not to exceed 5 days per month and not to exceed 15 days per year.

e - The Syrian Petroleum Company facilitates providing dynamite from the Ministry of Defense Manufacturing factory at the expense of the bidder, and in the case of failing to provide it, the



bidder then has the right to stop the works of this project until a license to import needed dynamite is granted and the crew receive needed dynamite. In this case, the stoppage period is not counted as part of the contract execution period, and the contractor shall be given a substitute period of time equal to the stoppage period. And in the event that security conditions caused by the unjust economic boycott do not allow the import of needed dynamite, the bidder shall implement the seismic profiles that can be done by vibrators only, and skip all points which need using dynamite and replace them with additional points or lines that can be done by vibrators. This skipping and replacing process should be discussed and approved by the Syrian Petroleum Company.

f - The bidder shall not be given any daily stand by fees outside the cases mentioned above (A,B,C,D&E). And he shall not have the right to claim any daily stand by fees in any case not mentioned above.

30- The bidder is obligated to provide Technical Equipment which are in good condition, sufficient for use and operating properly within the field parameters . The bidder shall bring Equipment and Materials in quantities which are enough and there will no short supply during the implementation of the service. The Syrian Petroleum Company also has the right to request the replacement or change of any equipment or supplies that are operating incorrectly and do not achieve good and accurate use during their operation or have malfunctions that prevent them from performing the work properly. And the bidder is obligated to change them at his own expense.

31- The bidder shall provide a detailed list of the equipment he is going to use on a schedule includes the following information:

- Manufacturer's name
- Production date
- Technical Specifications

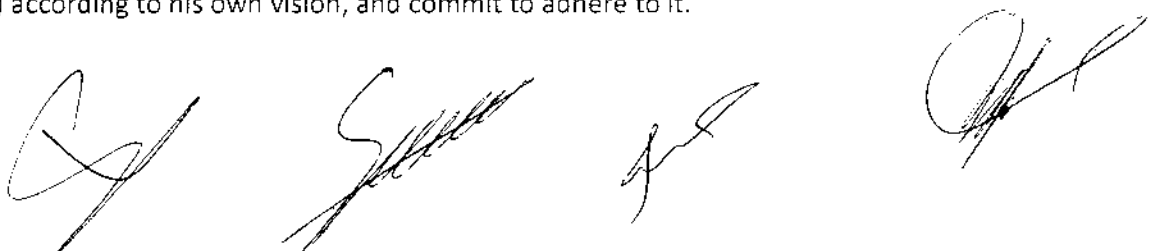
The bidder should also include maintenance and testing steps for the equipment whose operation requires auditing and inspection before putting it into work.

32- The bidder must inform the Syrian Petroleum Company regarding any modern and new equipment, techniques, or implements that he wants to import or replace.

33- The Syrian Petroleum Company has the right to inspect and test to examine the equipment and the supplies that the bidder enters before the equipment starts its work in order to verify that this equipment is in good condition and flawless and identical to the technical book to carry out the service.

### **8- Implementation period**

The implementation period is 900 calendar days for both surveys (2D and 3D) starting from the receipt date of the work-site by the bidder. This implementation period could be extended due force majeure reasons (weather conditions or exceptional circumstances) determined by a Supervisory Committee and to be approved by the Syrian Petroleum Company. The bidder is committed to setting a time plan of implementation covers all stages of the works (stage by stage) according to his own vision, and commit to adhere to it.



Payment to the bidder will be schedules according to the number of shot points, vibrating points and weather-layer survey points recorded on a monthly invoices provided by the bidder and approved by the supervision committee and Syrian petroleum company management .

#### **9- Warranty period**

The warranty period for recorded field data extends for three months for all recorded field data after finishing of the filed recording operation and finalize all recording processes. During this period, it is ensured that the field data is free of any technical defect resulting from the recording process, and it is ensured that all data is accept on seismic data processing center without any defect or technical fault, after warranty period performance bond should be released.

Payment to the bidder will be through monthly invoices containing the number of points and services provided by the bidder and the percentages of completion. These invoices will be disbursed after being approved by the supervision committee and Syrian Petroleum Company management .

#### **10- Personnel and experts:**

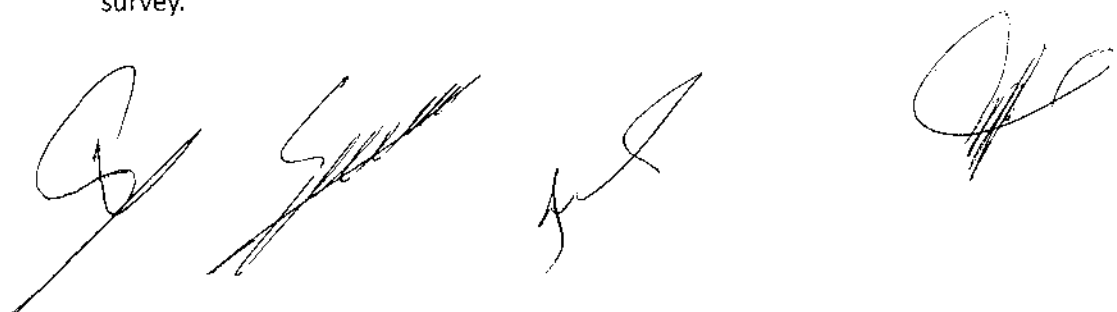
- 1- The bidder provides a list of personnel, including experts and technicians, who will implement the service.
- 2- The bidder shall submit a CV for each expert or technician stating the years of experience in the same field for each one.

#### **11- Topographic Survey Team:**

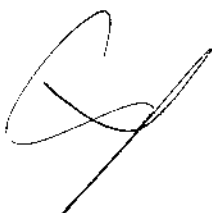
The bidder provides Sufficient survey team, station devices, high-accurate DGPS monitoring devices DGPS 1+4 L1 – L2 Ref. stations and rovers, monitoring devices, signal repetition units, scanning computers, printers...

##### **11-1- Topographic Survey:**

- The main objective of implementing the topographic survey is to determine coordinates of the polygon within which the survey area is located, and to determine the correct elevations and coordinates for each receivers points & shot-points.
- All Source point lines **SPL** and Receiver Point Lines **RPL**, in addition to points within them, must be approved by Syrian Petroleum Company before starting the topographic survey.
- Numbering of lines and points must be done before executing the topographic survey.



- The topographic survey must fulfill Syrian Petroleum Company requirements, and in accordance with vision and planning of the contractor & international standards.
- The contractor shall provide a detailed list of equipment to be used in survey works.
- The contractor shall provide a list of experts and technicians working in survey works.
- The contractor shall use GPS devices which work in accordance with modern international technologies.
- The contractor shall provide a list of software to be used, and the surveying systems available to him.
- Tolerance and accuracy while extending the receiving points (center of geophone array) and (center of vibrator array) equals (+/- 0.5 meter) in coordinates and (no more than 0.25 meter) in heights.
- "COG central of gravity" for vibrators should not exceed
- 3 meters.
- The contractor, for the purpose of executing static survey, shall create a "reference network" for the points by specifying no less than 4 fixed geodesic points to be referenced to within the survey area.
- The contractor determines the reference points after conducting a survey and taking measurements by at least three GPS devices. And that the period of taking readings is not less than two hours, and number of associated satellites is no less than 5.
- Reference measurements shall be executed using RTK technology.
- Surveyors, working for the contractor, shall calculate Conversion Factors.
- When executing the topographic survey, workers should number vibrating points & receiving points using a piece of wood or metal skewer with a small flag at its end showing the point number. Provided that flags' color of vibrating points should be different from that of receiving points.
- OFFSETE: points for receiving and vibrating points, which cannot be fixed in their default location due to rough terrain, are shifted according to certain measurements to be agreed upon.





**11-2 Quality and Specificity control during implementing the topographic survey:**

The contractor shall comply to quality control procedures & systems while executing the topographic works as follows:

- At the beginning of each working-day when the surveying technician begins the work to proceed in fixing the points, they should take measurements of the last three points carried out in previous day and ensures their accuracy & matching.
- The survey section prepares a daily report of executed works which should be uploaded to relevant maps and programs available at the survey section to ensure their accuracy.
- Before starting implementation of survey work, all equipment, devices and systems which will be used, shall be tested to ensure that they are working properly, and Supervision Committee of Syrian Petroleum Company is to be informed about all these tests.
- Survey technicians shall take the coordinates of existing-obstacles in the survey area, in addition to the electricity & HT lines, oil pipelines and all other topographic obstacles, and to upload them to relevant maps.
- All of offsite measures, for the points which were moved from their default locations, should be gathered in a daily list and handed to Syrian Petroleum Company Supervision Committee for approval.
- After defining the “surface of reference points and datum plane”, the contractor shall deliver the following information:
  - a) map of “reference network” according to GPS system.
  - b) data of “reference network”.
  - c) coordinates & heights of all receiving and vibrating points mentioned in the SPS files.
  - d) list of coordinates of well-drilling sites needed for surveying the weathering layer.
  - e) list of used equipment.
  - f) List of data & original and converted coordinates.
  - g) All topographic information.

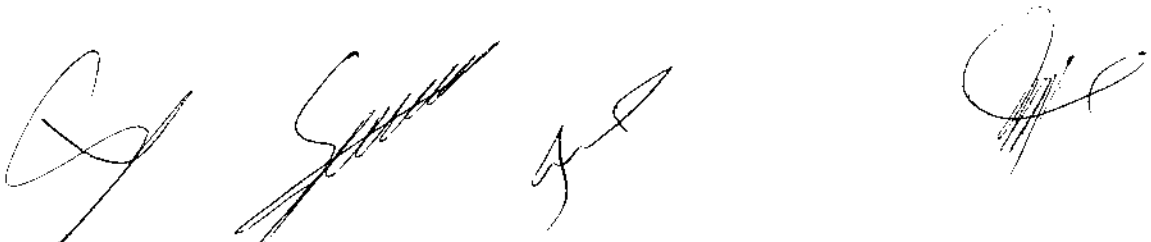
**12- Required Equipment:****12-1- Equipment:**

The equipment and related spare parts, consumable materials, and materials provided by the bidder must be in very good condition and of good quality that allow an effective implementation of services. They must conform to good international specifications applied by oil and gas exploration companies, and suitable and fit for the required purpose. It must also ensure continuity of implementation. The bidder must also guarantee the good quality, including the necessary maintenance and parts, at his own expense.

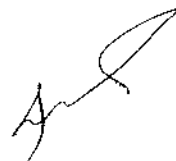
**12-2- Vibrators:**

Vibrators must meet the following specifications:

- The number of Vibrators must be at least six units (four working units and two stand by).



- The Vibrators must be in very good technical condition and the year of manufacture must be no less than 2015.
- The pick force of the Vibrators must be at least 60,000 lbs. per Vibrator.
- The Vibrators must be able to generate a sweep of 6 Hz.
- Feedback is used to control the basic power (phase and amplitude).
- Wired similarities tests are required at the beginning of work once a month, and wireless similarities tests are required once a day for each vibrator. The similarities are recorded on the SSD.
- Daily and monthly tests are to be carried out according to standard procedures applied by the manufacturer and the bidder. And the testing schedule is to be submitted to the Syrian Petroleum company Supervision Committee for approval.
- The operation of the vibrators is to be checked via a wireless channel using the vib QC program or its equivalent . The vibrators is to be checked daily before the start of operations and after every forced stoppage, and for each vibrator separately before the start of operations.
- The drive level must not fall below 70% of the theoretically required drive level (to be determined through testing) It can be reduced according to field requirements in some places to 50%.
- Limits can be changed with respect to surface conditions and after being approved of the Supervision Committee of Syrian Petroleum Company. The electronics controlling the source must be of world-renowned with DGPS identification systems included.
- The system for controlling the quality of vibrating must be at the place where the report is prepared, and at least mention the average rate and maximum limit of the phase, the average rate and maximum limit of distortion , and the minimum and maximum strength of each vibrator individually and also for each sweep. These data must be shown in real time within the recording station, and should be statistically analyzed at the end of each day and available to the Supervision Committee of Syrian Petroleum company.
- A maintenance record book is to be kept for each vibrator separately, and must be available at all times for inspection by the Supervision Committee of Syrian Petroleum company, taking into account the high and low pressure of the hydraulic systems, the correct air pressure in the airbags of the vibrator, maintaining base-lifting chains of the vibrator and avoiding excessive slack in the bars and connections of the vibrating base.
- The reaction-mass must be centered within (+/- one centimeter) in the static position and there must be no breakage or bending at the base of the vibrator.
- There should not be any excess leakage from the lifting and lowering cylinder-gaskets.
- Modern vibrators are preferred, which have the ability to control frequencies more widely.
- Minimum power capacity (60,000 lbs.).
- The maximum rate of maximum distortion of capacity power is 40%.
- The average rate of maximum distortion is 30%.
- maximum average phase error is 10 degrees.
- maximum phase error is 5 degrees.
- Daily tests: radio similarities sandwich box test.



- Periodic tests/wire similarities at the beginning of each line and after the repair of each main vibrator, which also includes DGPS positioning in the real-time of the vibrator adequately.

### 12-3- Rigs:

The number of rigs should not be less than 30 rigs of multi-sizes that can work in mountainous topography, including up-hole rigs.

### 12-4- Recording equipment:

- One telemetric recording system (24, 32 bits) - including stack and emulator capable of survey processing in real-time, storage system, field camera, vibrator's electronics with monitoring control system of vibrator quality, field monitoring system (QC), radios (RADIOS) and line monitors. Recording systems from Sercel 428/508, I/O systems, Inova or Smartsolo systems, or their equivalent.
- Two copies of all recorded data must be sent to the Syrian Petroleum Company according to the standards of oil companies on hard disks (H.D.).
- The bidder must prepare at least 9,000 channels; and the higher number of channels, the better for implementing this project.
- Sufficient field equipment, signal-refining units, and feeding-units to carry out the survey.
- List all other proposed equipment, repair equipment, testing equipment, etc.).
- Mention the country of origin , manufactured date and type of proposed recording devices.

### Cables for traditional recording systems:

- Sending a sufficient number of cables and crossover cables to implement the survey effectively.
- The bidders offer must include the country of origin, type, number, and length of cables and crossover cables.
- Cables must be new or in very good condition at the beginning of the survey, and the quality of the cable must be tested once every two weeks.
- The bidder must mention the properties and quality of the cable and repair equipment.
- For modern technologies that do not use cables, all the equipment to be used is to be mentioned along with its technical specifications, the name of the manufacturer, and the date of manufacture.

### 12-5- Geophone groups that use cables:

- The bidder must provide at least 9,000 high-quality channels for the survey process.
- Geophone system: distance 5 m.
- Indent distance of 10m from both ends with waterproof connector.
- Natural frequency: 10 Hz, preferably 5 Hz
- Humidity resistance: 1000 Ohm.
- Distortion: 2% maximum.

- All geophone assemblies must be in good condition and must be operated and tested to meet the highest seismic surveying standards at least once every two weeks.
- The year of manufacture must not be less than 2021

#### 12-6 Group of geophones that do not use cables:

- The year of manufacture must not be less than 2021.
- Supports sampling of times 1/2/4 milliseconds.
- initial gain from 0 to 24 DB.
- Storage capacity for each unit ranges from 8 – 16 GB.
- The positioning time during continuous survey operations is not less than 25 days.
- Ability to communicate with the GPS system.
- Sensitivity from 5 to 10 Hz.
- Real time accuracy  $\pm 10\mu\text{s}$ .
- GNSS Mode GPS.
- Water and moisture resistant.
- High accuracy in recording vibration data.
- The default battery life for continuous recording is no less than 25 days.

The bidder must state:

- Type, country of origin and manufacturer of geophones and proposed units.
- Specifications: frequency, distance between geophones, and number of wires connecting the units.
- All other proposed equipment, including repair kits and testing equipment.

#### 12-7- Up Hole unit and refraction survey for weathering layer:

Providing and determining a sufficient number of personnel and equipment according to the expected production conditions, with an average hole depth of 50 meters, and one hole every 4 square kilometers in a 3D survey. The depth of final hole is to be determined by tests. A refraction –survey point for the weathering layer every 4 long kilometers in the 2D survey.

The bidder must state:

- The cost of each usable engraved meter (to be included in the financial offer).
- The cost per point using surface refractive survey for the weathering layer to be included in the financial offer).
- Type and year of manufacture, name of the manufacturer, and all specifications of the used equipment: source, geophones, cables, and camera (minimum 24 camera channel Sigma – Delta, 24 byte recording with printer).

The bidder must provide sufficient office equipment, computer software and personnel to calculate the final field static corrections for any line, and to have them ready to be sent to the processing center within a period not exceeding ten days after the seismic line is recorded.

**12-7-1 - Up hole unite and shallow refraction survey for weathering layer:**

- UPHOLE surveys to be carried out in the wells, and the Syrian Petroleum company determines their depth, in addition to the estimated number of wells at a rate one hole per 4 kilometers. The depth and number of holes can be reduced by decision of the Syrian Petroleum company.
- When there are difficult natural obstacles that prevent the possibility of recording using the UPHOLE technology, the bidder performs a shallow refraction point and this is agreed upon with the Supervision Committee of the Syrian Petroleum company.
- Provide UPHOLE coordinates to the bidder within a maximum period of 30 days before the start of work according to the operation plan.
- Use a multichannel-digital vibrating station (no less than 24 channels) suitable for the required work.
- Rate of recording sample is 1 millisecond, and to checked out by a Supervision Committee of Syrian Petroleum Company.
- A geophysicist specialized in UPHOLE Drilling keeps accurate records of lithological changes, depths of various formations, groundwater level if any, and other relevant information.
- The received vibration-wave must have a frequency of 6-10 Hz, and the choice is made for the purpose of implementation in the operations area and after being agreed upon by the Supervision Committee of Syrian Petroleum Company.
- The bidder has the right to estimate the best way to survey the weathering layer according to his own vision, and after being agreed upon this with the Supervision Committee of the Syrian Petroleum Company to ensure correct results.

**12-7-2- UPHOLE processing and refractive data recorded by refraction weathering survey**

- The processing is to be carried out by qualified personnels. The initial recording time is to be received and performed digitally on the screen clearly.
- All field data that is processed and the results of the processing are to be recorded on the SSD and submitted to the Syrian Petroleum Company.
- The UPHOLE processing is to be executed by the bidder within the framework of a field database, or its equivalent that allows the following to be carried out:
  - Static corrections.
  - UPHOLE processing and retractive survey.
  - Final files SPS -segd – segy.
  - Topographic works.

**12-7-3- The bidder must provide the following information to the Syrian Petroleum Company per month:**

- Stored data in files named after the UPHOLE wells which must include the following information:
  - raw data SEG-D, SEG-Y in a special file.
  - Copies of camera recording diagrams.
  - Monitor report.

- Report of the drill man.
- All traces of UPHOLE measurement and refractive survey in SEGD, SEG Y format classified under correct main headings.
- Analysis of the initial refraction time
- processing and interpreting the results of UPHOLE measurement and refractive survey on hard disks copies and paper charts.
- Calculation of the first arrival time to depth, corrected in Excel or ASCII format.
- Model of the Layer Velocity and lithological section in chart and Excel or ASCII format.
- A table showing the UPHOLE works of and refractive survey (depth - map - history - workflow - work area) in a hard copy and a photo.
- Static corrections in SPS file format.
- The UPHOLE database and refractive survey both updated in an Excel file to be approved by both parties.

The goal of the weathering-layer survey is to determine the thickness of the weathering-layer along the survey area, and to determine the velocities within the layer to implement static corrections properly and correctly, so that a hole is distributed over every 4 square kilometers in the 3D survey, and the approximate total number of holes is 57. While the number of points in 2D survey is 688 Refraction survey point.

- The bidder is committed to providing all equipment for drilling weathering-layer wells, and relevant recording equipment.
- The weathering-layer wells to be distributed within a network within the survey area, and the bidder should present a map showing their distribution.
- The total depth of the weathering-layer wells to be determined by drilling a well that penetrate the weathering layer, and the capacity of the used rigs shouldn't be not less than 100 meters.
- Measurement - in weathering-layer - shall be executed through a set of detectors (geophone-hydrophone). SPC Supervision Committee can make two measurements; the first one direct during lowering of the geophone cable, and the second one reversed during pulling up the cable, then most appropriate method is to be chosen.
- Sampling time for the weathering layer survey 1 millisecond, depending on the test results.
- The survey of weathering layer should be executed by a professional and qualified geophysicist who has a special experience in the Survey of the weathering layer.
- After executing the weathering layer survey, the bidder is should provide a "processing of the data related to weathering layer & calculations of static corrections".
- The bidder shall provide all collected survey data organized in integrated reports that contain all the information & applied calculating methods of velocities and corrections.
- The bidder shall provide the raw field data recorded in two formats SEGD – SEG Y, with all reports of field recorder and the first time arrivals chosen using ASCII tables.
- The bidder shall provide a map of the thickness of the weathering layer & a map of the velocities.

- processing and interpreting the results of UPHOLE measurement and refractive survey on hard disks copies and paper charts.
- Calculation of the first arrival time to depth, corrected in Excel or ASCII format.
- Model of the Layer Velocity and lithological section in chart and Excel or ASCII format.
- A table showing the UPHOLE works of and refractive survey (depth - map - history - workflow - work area) in a hard copy and a photo.
- Static corrections in SPS file format.
- The UPHOLE database and refractive survey both updated in an Excel file to be approved by both parties.

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- The bidder shall provide a map of the thickness of the weathering layer & a map of the velocities.

### **13- Field management system and QC system for field-quality control:**

The bidder must provide all systems and programs that ensure the quality control process, whether it uses a recording system that includes traditional geophones or recording systems

**13- Field management system and QC system for field-quality control:**

The bidder must provide all systems and programs that ensure the quality control process, whether it uses a recording system that includes traditional geophones or recording systems that include receiving points and cables or made up of pointed geophones, such as his own nodal system.

The seismic crew must also have a field-management system and field-monitoring of the results' quality in order to achieve general control accurately and reliably. In addition to improvements related to the field data sent to the processing center. A detailed explanation of the QC system, computer programs and procedures proposed by the bidder should be mentioned .

**13-1- The bidder must execute the following procedures related to quality control:**

- to Perform quality control of topographic data.
- detecting the presence of double or missing points in the recording files so that the double points to be excluded before sending the data.
- testing the validity of main data and recording locations.
- testing the distances between SPS – RPS, and the deviations from the chart locations.
- testing the shifts of recording points and vibrating points.
- checking the values of geophones (leakage -tilt -bad cabling)
- checking distortion values and dead trace values.
- testing the operation of the vibrators on a daily basis, as well as the system of layout equipment.
- analyzing the spectral of the signal, and removing the noise.
- Providing the Syrian Petroleum Company with daily and monthly reports on all required work in paper form and on a hard disk.

**14 - Test programs for field parameters for recording:**

The objective of carrying out pre-survey tests before the actual seismic survey is to specify the best field-parameters for recording which guarantee best results.

The tests should be carried out following a schedule organized in advance, and should cover following tests:

- noise-waves tests.
- Useful-Signal tests.
- test to Choose quantity of vibrators to be used in each location.
- test to determine the best low-frequency.
- test to determine the best high-frequency.
- test to determine number of Sweep Per Shot.
- test to determine Sweep Length.
- test to determine Ground Force.
- test to determine sweep's type; linear or nonlinear.
- test to determine the spacing between the vibrators.



- test to determine number of holes when using dynamite.
- test to determine hole-depth when using dynamite.
- test to determine weight of charge to be used in hole when using the dynamite.

The Syrian Petroleum company has the right to request any additional tests necessary in the survey process that are not mentioned in the technical specification's book, provided that the total duration of the tests should not exceed one working day. In case the vibration data in any part of the survey is not good, it is necessary to change the Field work-parameters. one test day for 3D survey and not more then 3 days for 2D survey

## **15- Generation of vibrational waves:**

### **15-1- Explosives:**

- The bidder is obligated to pay the value and costs of loading, transporting and storing explosive materials and their detonators, and to pay the costs all operations related to explosives under the supervision of the Syrian Petroleum Company in a way that ensures the security and safety of personnel. In addition to that, the bidder should abide by all laws related to the use and transport of explosives in the Syrian Arab Republic.
- A sufficient number of drilling-using dynamite rigs with sufficient personnel and technicians must be available to execute the survey work using dynamite.
- Transporting and storage of explosive materials should be subject to professional-security conditions and safety conditions, and after getting needed approvals from relevant authorities.
- The amount of charge used in each hole, and the number of holes in each point to be determined by the testing processes.
- It must be ensured after the explosion process that all the charges in all the holes have been exploded.
- The quality of used dynamite in surveying operations must be of good quality and with a manufacturing date not exceeding two or three years at most, according to what is available in the Ministry of Defense Manufacturing Plants or according to related used import license.
- The charges of dynamite and detonators must have the ability to explode in wet soil without changing their physical properties.
- The bidder must be qualified to provide all requirements for using dynamite; and electric-detonators exclusively. The bidder must also have experienced and trained staff for these tasks.
- Both the depth of the hole and the weight of the charges should be determined through tests, and should be approved by the Supervision Committee of Syrian Petroleum Company.
- The bidder undertakes to implement all necessary procedures during the exploding operations, and to lowering down the charges to agreed-upon depths within error limits not exceeding 1 meter.
- If any of the charges in the holes does not explode, it will be dealt with by the bidder's team; marking their locations and exploding them should be done using the methods and means applied by the bidder's technicians.

- Generating of seismic waves through an exploded source from drilled holes should be agreed upon after testing.

- The bidder must provide at least 30 rigs that enable him to carry out the drilling works necessary for the surveying process in order to implement highly-efficient work.

- Exploded wells must be carefully filled with clay or mud to prevent the emission of any charge.

- The bidder's personnel, who are specialized in the process of treating explosives and detonators, must have related qualifying certification duly, and the bidder must submit those relevant certificates to the Supervision Committee of Syrian Petroleum Company.

• **The bidder must meet the following requirements:**

- Not using damaged explosives or explosives in damaged warping-packages.

- Using electric detonators only.

- Using two detonators to prepare the charge.

- Selecting main parameters through a test to generate the wave (depth and weight of the charge); this should be agreed upon with the Supervision Committee of Syrian Petroleum Company.

- The bidder obliges to not using unlicensed explosives.

• **Storage requirements for explosives and detonators:**

- The Syrian Petroleum Company shall provide the required explosives and detonators at the expense of the bidder. The Syrian Petroleum Company is committed to protecting and storing the dynamite and detonators required during survey operations, and the bidder must adhere to all requirements of security and occupational safety announced by the Syrian Petroleum Company and applied in the Syrian Arab Republic.

- The Syrian Petroleum Company will be responsible for the security of dynamite and detonators in the crew camp, and for the transportation operations from the crew camp or the storage place to the work site, and the expenses should be borne by the bidder.

- The bidder must temporarily prepare stores for the explosives within the works' area in order to implement the seismic field-works. These procedures should be approved upon by both Syrian Petroleum Company and the competent governmental authorities (the bidder should initiate those approval procedures at least 45 days before starting drilling operations).

- The bidder should determine the storage capacity of the temporary- store of explosives; as it must guarantee that the drilling and exploding crews could continue the services for a period of 15 days as a minimum.

• **Safety and legal requirements:**

The bidder must keep safe distances around the temporary-store of explosives, and must maintain the wells of exploded & charged points. These measures are necessary to minimize damages to homes and civilian facilities in the area (safe distances should be organized and cooperated with the concerned authorities or organizations and bodies responsible for supervision) and in accordance with relevant international standards.

• **Non-explosive charges :**

The bidder must oversee the detonators of all explosion wells, and to report about the places where the actual explosion did not occur. All unexploded-wells should be destroyed according to the regulations in force in the Syrian Arab Republic.

• **Preparing reports:**

The bidder must provide the Supervision Committee of Syrian Petroleum company with daily and monthly reports that include:

-data about the charged holes; their number, the depth of explosion and the person responsible for the hole,

-used quantity of explosives in the field works, and the remaining quantity of explosives.

The bidder must provide the Supervision Committee of Syrian Petroleum company with a detailed and separate report that includes information about all unexploded charges, indicating the procedures to be adopted to handle them.

**15-2 Using the vibrators:**

During the implementation of seismic survey, the bidder is obligated to adhere to following conditions concerning used vibrators:

1- Number of used vibrators by the bidder shouldn't be less than 6 vibrators.

2- The power (force) of each vibrator shouldn't be less than 60,000 lb/cm.

3- Manufacturing year shouldn't be less than 2015.

4- The vibrator should be able to generate a typical vibration-wave starting from 6 Hz.

5- All accessories of special-test for the vibrators should be provided and working properly (radio similarity, sandwich box test, ...). And these tests should be carried out periodically.

6- The functioning of the vibrators should be checked using "VIBQC program" or other equivalent programs periodically and on daily and monthly bases.

7- Phase differences between different vibrators shouldn't be more than 5 degrees, and the total phase difference (peak phase) should not exceed 10 degrees.

8- The "drive level" shouldn't be less than 70%, knowing that its values should be determined through testing processes, It can be reduced to 50% in some special areas.

9- Distortion maximum limit shouldn't be more than 40%, and average distortion shouldn't be more than 30%.

10-Electronic control systems of the vibrators must be "SERCEL VE" or "Pelton VIBRO" or their equivalent, and they should be equipped with GPS.

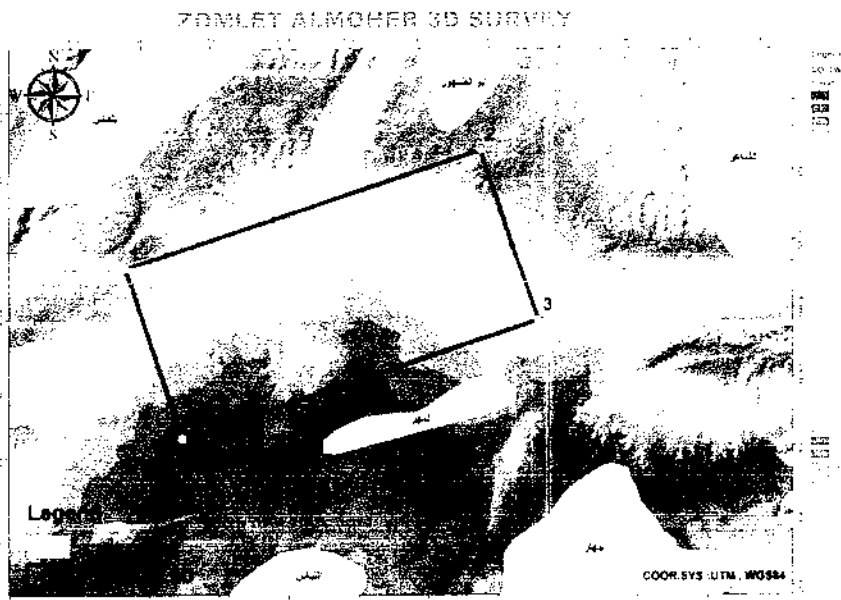
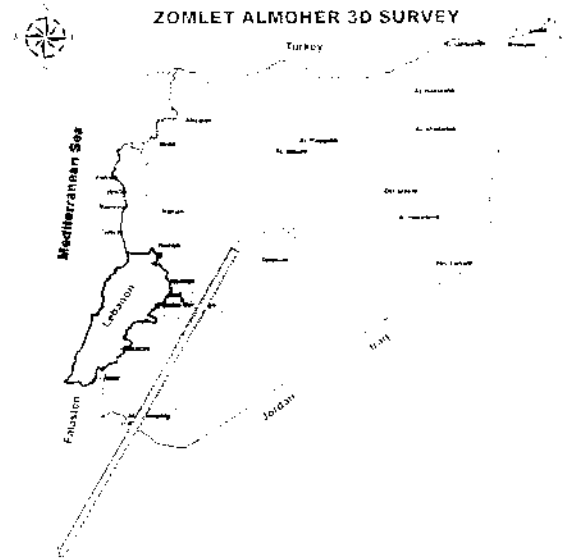
11-During recording operations, the Quality Control Unit must produce reports for daily works which include values of phase, dispersion, and power, in addition to all data for each recording point.

12-Every vibrator must have a Handbook which include record of maintenance works carried out on it, dates of scheduled periodic maintenance and results of tests carried out using it. Vibrators equipped with modern control devices is preferred so that they generate regular vibrating waves with a wide spectrum of frequencies.

**16- Technical specifications for implementing a land 3D seismic survey in the Zumlat al-Moher area**

The following figures shows the boundaries of the survey area on a topographic map. In addition to the extension and distance of the survey area specified within the following coordinates:

Polygon coordinates		
NO	X	Y
1	317883	313738
2	321170	303858
3	341582	310700
4	338277	320566



*(Handwritten signatures)*

**16-1 General requirements for the 3D land seismic Survey:****16-2- Scouting report :**

After conducting the scouting of the survey area, the bidder should submit a detailed report containing the following information:

- 1- Logistics support; the proposed structure of this support and Logistics lines.
- 2- Places of wet soil, the ability to moving in vibrators, and the places of water swamps.
- 3- Contaminated places and mines places if any, in addition to the proposed methods for dealing with them. Provided that the Syrian Petroleum company, and at its own expense, should clean the area and send an official letter to the bidder in this concern before starting the implementation of the works.
- 4- Residential areas, agricultural areas, main roads, and high-voltage electrical lines.

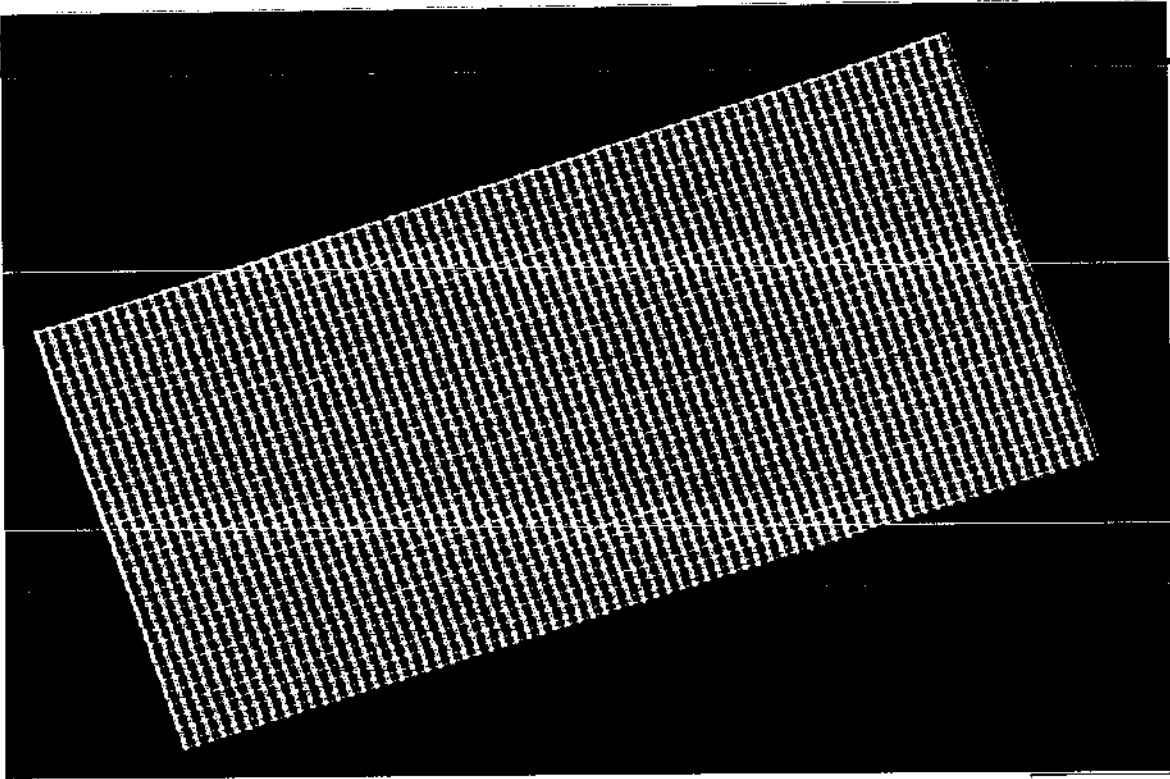
**16-3- Bidder experts:**

The bidder must present details about his technical experts who will implement the survey operations, and they must be of the scientific and professional level necessary to implement such works, in addition to having significant previous experience in implementing seismic surveys.

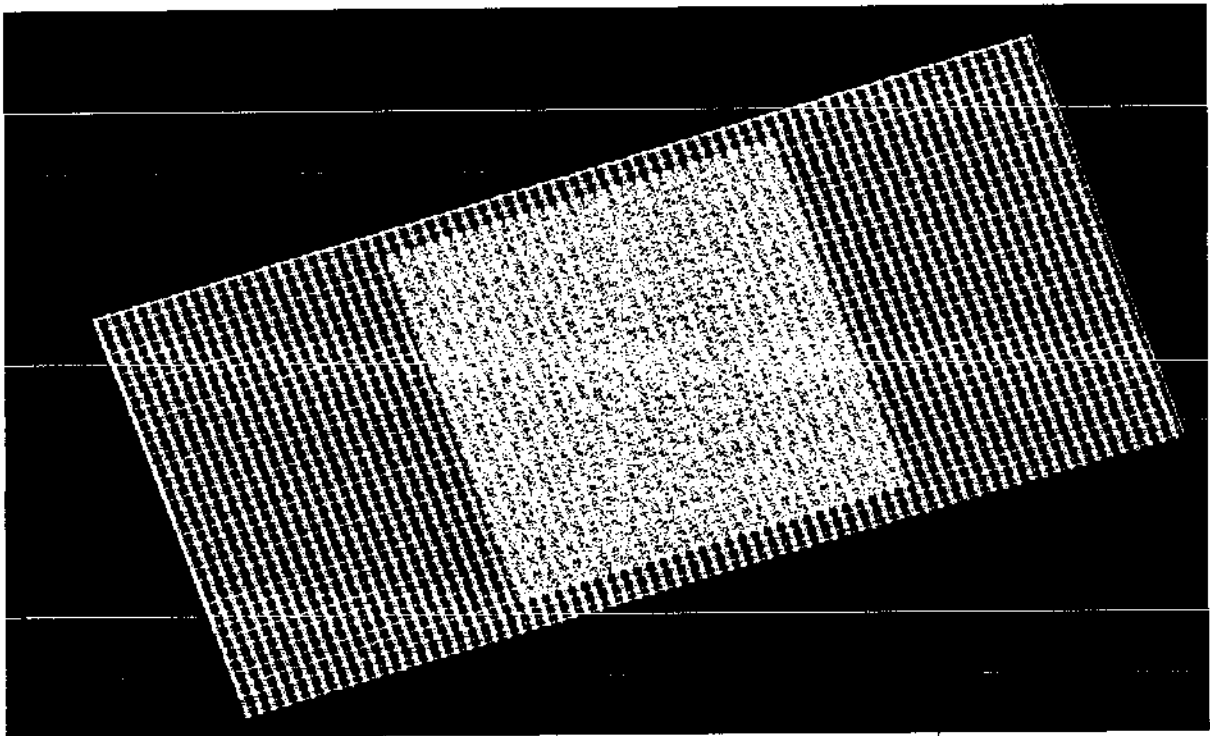
**16-4- Survey and recording parameters to be implemented:**

<u>Parameters of the 3D survey</u>		
1	Full nominal CMP coverage (Full Fold)*	225.0
2	Bin size (by sampler geometry) $[B_r \tilde{O} B_s]$ [m x m]	25.00 x 25.00
<u>Parameters characterizing density of intervals</u>		
3	Number of sources per 1 km <sup>2</sup>	66.7
<u>Description of the sample and its displacements</u>		
Geometry of the receiving lines in template:		
4	Number of receiving lines (RPL) in template	30
5	Distance between the receiving lines [m]	300
6	Number of receiving points (RP) on receiving line (RPL)	180
7	Distance between the receiving points (PP) on a RPL [m]	50
8	Number of active channels (NC)	5400

<b>Geometry of the source lines in a template:</b>		
9	Number of explosion lines for individual template	1
10	Distance between the explosion lines (SPL) [m]	300
11	Number shot points (SP) on the shot points line (SPL)	6.0
	(Salvo)	6.0
12	Distance of the shot points (SP) on the shot points (SPL) [m]	50
<b><u>Parameters of the template moving:</u></b>		
13	Along the swath (Inline Roll):	
	- in the amount of intervals between SPLs	1
	- in meters	300
14	Moving of the template to the next swath (Crossline Roll):	
	- in the amount of receiving lines (Number of RPLs)	1
	- in meters	300
<b><u>Type of the 3D survey design (Layout arrangement):</u></b>		
15	Type of SP Lines positioning	Cross
16	Type of Layout (in Inline direction)	Split, Symmetrical



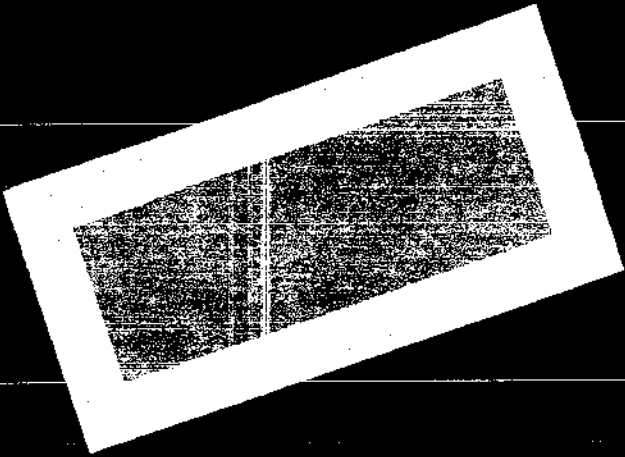
Layout map



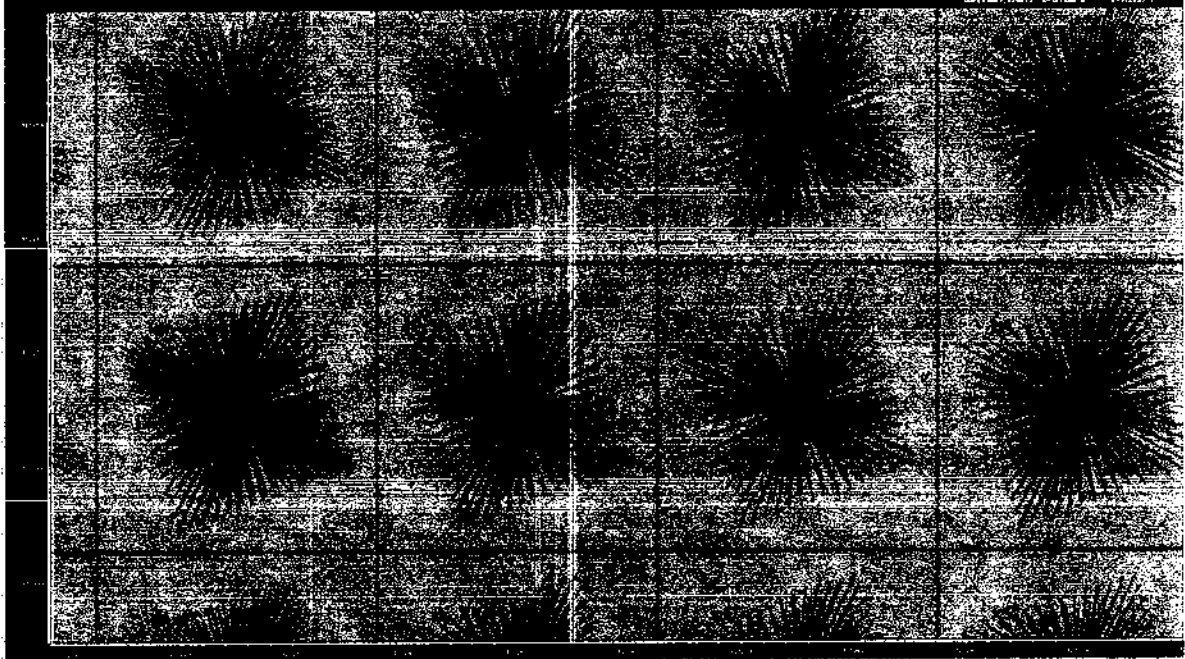
Active spread map

*[Handwritten signatures]*

Row	Col	Value
1	1	11.000
1	2	121.000
1	3	131.000
1	4	141.000
1	5	151.000
1	6	161.000
1	7	171.000
1	8	181.000
1	9	191.000
1	10	201.000
1	11	211.000
1	12	221.000
1	13	231.000
1	14	241.000
1	15	251.000
1	16	261.000
1	17	271.000
1	18	281.000
1	19	291.000
1	20	301.000
1	21	311.000
1	22	321.000
1	23	331.000
1	24	341.000
1	25	351.000
1	26	361.000
1	27	371.000
1	28	381.000
1	29	391.000
1	30	401.000
1	31	411.000
1	32	421.000
1	33	431.000
1	34	441.000
1	35	451.000
1	36	461.000
1	37	471.000
1	38	481.000
1	39	491.000
1	40	501.000
1	41	511.000
1	42	521.000
1	43	531.000
1	44	541.000
1	45	551.000
1	46	561.000
1	47	571.000
1	48	581.000
1	49	591.000
1	50	601.000
1	51	611.000
1	52	621.000
1	53	631.000
1	54	641.000
1	55	651.000
1	56	661.000
1	57	671.000
1	58	681.000
1	59	691.000
1	60	701.000
1	61	711.000
1	62	721.000
1	63	731.000
1	64	741.000
1	65	751.000
1	66	761.000
1	67	771.000
1	68	781.000
1	69	791.000
1	70	801.000
1	71	811.000
1	72	821.000
1	73	831.000
1	74	841.000
1	75	851.000
1	76	861.000
1	77	871.000
1	78	881.000
1	79	891.000
1	80	901.000
1	81	911.000
1	82	921.000
1	83	931.000
1	84	941.000
1	85	951.000
1	86	961.000
1	87	971.000
1	88	981.000
1	89	991.000
1	90	1001.000



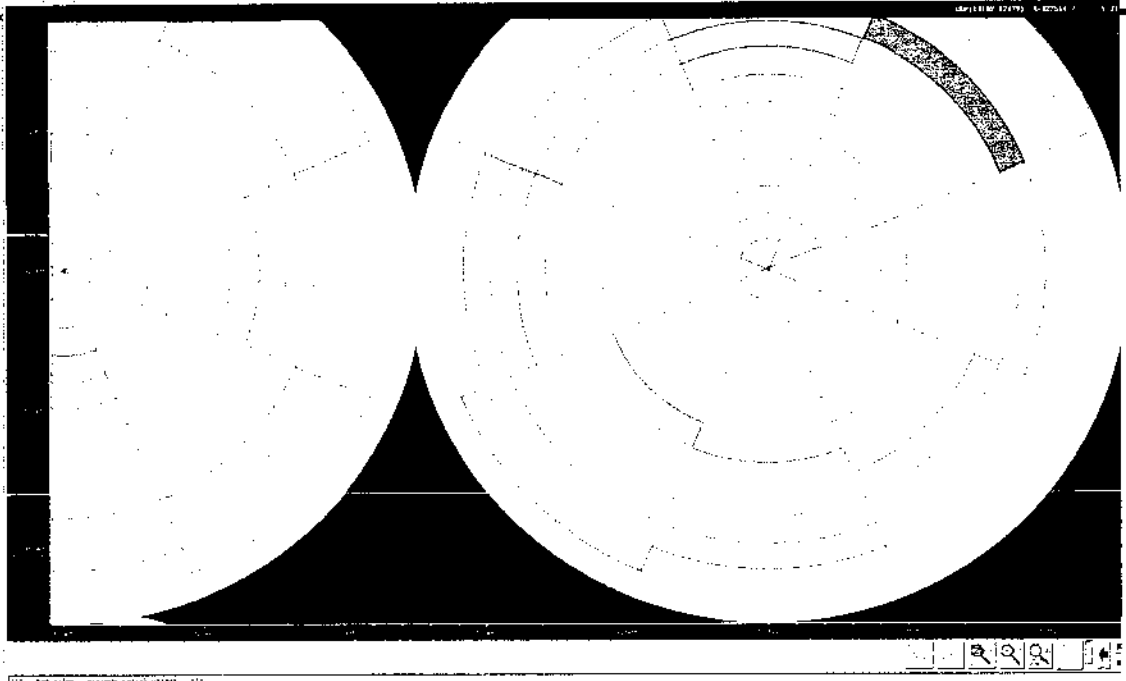
Fold map



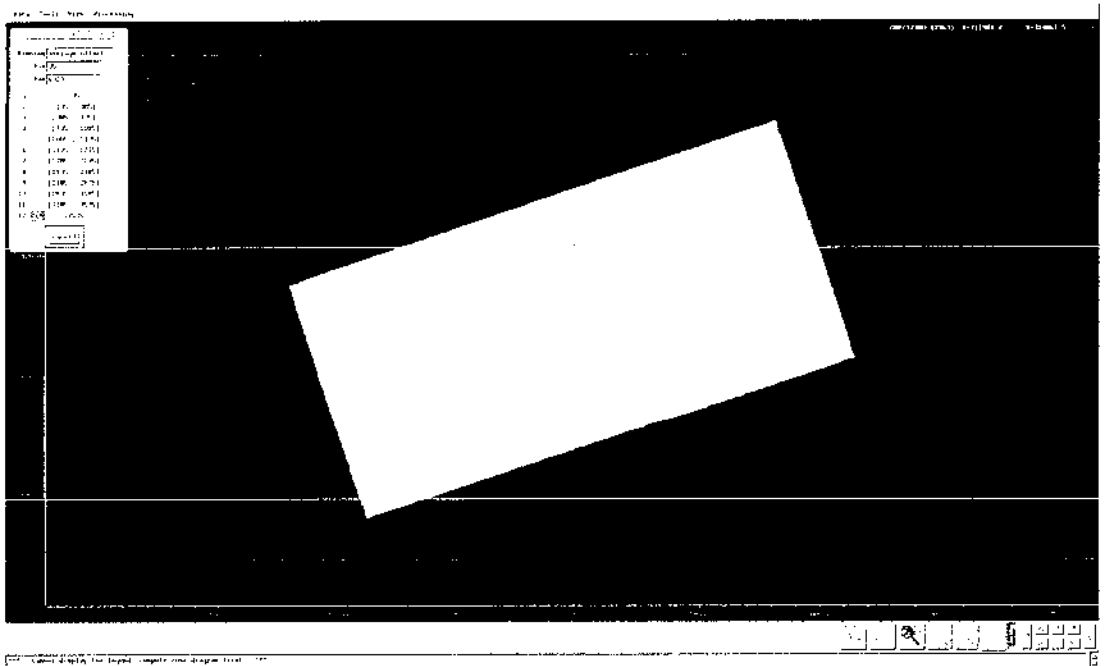
Average azimuth map

*[Handwritten signatures and scribbles]*





Rose diagram map



Offset map

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The bidder should commit to an geometrical -design - for the survey - that complies with the technical requirements of the required degree of coverage. The bidder also has the right to submit his offer to implement the survey using the Nodal system.

#### 16-5 Recording parameters:

- Vibratory data should be recorded using "SERCEL" or "INOVA" software or its equivalent, and it is preferable to use modern software such as smartsolo system and nodal system.

Recording parameters should be according to the following table:

Recording system	24 or 32 -bit telemetric seismic station. SERCEL 428 XL or 508 , I/O 1V (Scorpion) ,smartsolo , or equivalent
Recording format	24-bit SEG-D Revision 1 or higher
Medium of storage	Magnetic cartridge 3592, LTO, DLT ,hard disk or any other modern one (shall be cleared with the Company)
Time break	Recorded on an auxiliary channel
Vertical time	Recorded on an auxiliary channel
Low-cut frequency filter	Switched off
High-cut frequency filter	½ of Nyquist frequency Lin phase
Notch filter	Switched off
Sample rate	2 msec
Type of the geophone sensor	Geophones and marsh phones (water resistant). Wireless nodal system geophones , geophones or nodal system geophones, geophones
Type of the geophone group	Linear layout in line (series and parallel connection), Wireless nodal system geophones , one geophone per point
Natural frequency of the geophones	not high than 10 Hz (the most low-frequency ones are preferable)
Number of the geophones in the array	not less than 12 on linear base (base 50 meters) or one geophone when use Nodal system
Number of the marsh	not less than 12 on linear base (base 50 meters)

phones in the array	or one geophone when use Nodal system
Polarity	SEG standard
Seismic source	Explosion in holes /Vibrators
Sweep type	(Will be determined during the Testing Work)
Sweep length	Not more than 14 sec (Will be determined during the Testing Work)
Listening time	To be tested
In-line separation of vibrators	(Will be determined during the Testing Work)
Sweeps per VP	(Will be determined during the Testing Work)
Depth of charge	Not more than 12 meters (depth of charge will be determined during the Testing Work)
Explosive charge	Not more than 3 kg (amount of charge will be determined during the Testing Work)

- The contractor adheres to use recording equipment (which includes recorder, geophones and cables) of good quality and in sufficient quantities. The recoding systems which use cables should have no less than 9000 channels, and no less than 18000 string of geophones groups.
- Any Seismic Trace or group of geophones within the one string will be rejected if one of the following conditions is found; and if so, the Supervision Committee of Syrian Petroleum Company has the right to demand changing them:
  - 1- If the group does not pass daily test procedures.
  - 2- If the sensitivity and resistance of the group of geophones exceed 5% of fixed average-values.
  - 3- In case of a dead trace or if its amplitude differs - from the neighboring traces - by more than two or three folds.
  - 4- In case auxiliary channels are not recorded correctly.
  - 5- Bad connecting or bad contacting between geophones of value more than "1 ohm leakage.

6- In case noise-signals' rates are remarkably high.

7- If the tilt of the geophones is more than 10 degrees.

- The contractor will be provided with a list of basic rules for rejecting recorded points due to technical problems resulting from fault in execution.

**16-6 Processing field data:**

- The bidder is obligated to provide an initial-processing of the field data in the crew-camp, through which the quality of recorded data shall be monitored on a daily basis to ensure its correctness and being free of any technical errors.
- Field processing shall to be done using its particular & up-to-date software such as "geocluster", "Promax" or its equivalent. In addition to special design programs, such as "Geoland", "MESA" "OMNI" or its equivalent.
- All recorded-daily data should be saved on magnetic-tapes (3590 / LTO cartridge).
- The bidder is obliged to provide the steps of daily-field processing of "the 3D seismic data" as follows:

No	Process
1	Geometry input and control
2	Arranging of the attribute maps for SPs and RPs (amplitudes in various windows, signal noise ratio, the dominant frequency) and spectral analysis in various windows per request of the Company's Supervision Committee
3	Edition of the defective traces
4	Input of elevation statics (datum and replacement velocity per request of the Company's Representative)
5	FB muting
6	Exponential gain
7	Recovering of amplitude
8	Deconvolution
9	Velocity analysis (in the 3D mode by the grid of 2x2 km)
10	NMO correction
11	BP filtering
12	Residual static's correction
13	Stacking
14	Post-stack time migration

15	Output of in-line/cross-line and attribute's maps per request of the Company's Representative
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Any changes in the processing sequence concerning the processing of field- data should be agreed upon and approved by the Supervision Committee of Syrian Petroleum Company.

#### 16-7 Quality Control the of Field-data:

- The operations of controlling the quality of the Field-data should be executed by the "QC office" in the crew; which must be include two expert geophysicists and two assistant-geophysicists at least.
- Quality control operations should be executed as the following:


No	QC-Process
1	Check of the presence of doubled or missed points in the data files. Missed points shall be explained, while doubling points shall be excluded prior to data delivery
2	Check of the data headers correctness and locations of records
3	Check of distances between SP's and RP's and deviations from preplot positions
4	Check of all offsets
5	Analysis of the recording system and spread testing results
6	Geometry control
7	Daily vibrators work control
8	Quality control of SPS files
9	Control over the geophone groups rotation schedule compliance for testing
10	Records QC - to find anomaly noise level, reverse polarity, zeroed and defective traces
11	System quality analysis and registration of initial field seismic gathers
12	Calculation and drawing the maps of the following parameters: for SP and RP – signal to noise ratio maps, maps of dominant frequency, effective spectrum width and RMS amplitudes of the signal.
13	Analysis of spectral composition of the signal and noise waves
14	Control of shot holes' depth in terms of vertical time and first arrival of the seismic gather
15	control of topographic data, SPS files editing and creation
16	quality control and processing of U phole-results

**16-7 Saving & delivering raw -field-data:**

After implementing all tasks assigned to the bidder in the survey area professionally and with high-accuracy, the bidder should hand over all resulted documents and information to the Syrian Petroleum Company according to following table; noting that additional items could be added to the table-format later on during the survey operations:

No	Specifications	copies	format
1	Original field records of Seismic Data	3	SUGD
2	Tape listing	1	ASCII
3	Magnetic cartridges logbook	1	
4	Final survey UTM and WGS84 coordinates for all receivers and sources delivered	1	SEG-PI
5	List of offset RP's and SP's with preplan and final UTM and WGS84 coordinates, offset distance and a reason for offsetting	1	Excel file, ex: RP_Offsets.xls)
6	List of skipped SP's and RP's with UTM and WGS84 coordinates and reasons for skipping	1	(Excel file, ex: RP_skipped.xyz)
7	Summary file (Excel) describing total number of SP's and RP's, number of offsets, skipped RP's and SP's, terrain type, maximum and minimum elevations, dates of surveying, coordinates of base stations (UTM and WGS84), name of the surveyor responsible for preparation and QC of final survey data	1	Excel file, ex: Survey_Summary.xls).
8	Full recording parameter listing, plus source and receiver diagrams	1	DWG, TIFF or JPEG
9	Line final post-plot shot point map and fold coverage	1	DWG, TIFF or JPEG
10	Observer reports	1	ASCII
11	In-field processing QC report	1	PDF, graphics in TIFF or JPEG.

12	Uphole data and listing of static (electronic copy)	1	SEG-D-SEG-Y-exl- files-ASCII
13	Vertical (Uphole) time map profile (per line)	1	pdf
14	Charge size and depth profile	1	Excel file
15	Final Operation report.	1	Word-PDF
16	Field Brute Stack	1	SEGY
17	Raw shots after geometry	1	SEGY



**17- Technical specifications for the 2D survey of the northern Damascus area****17-1- Technical specifications:****17-1-1- layout :**

The start of recording must consist of:

- Two lines, each line containing (420) effective channels. The distance between the two lines is (25 m).
- The distribution of geophones must be (24) geophones per channel when using a recording system with cables
- One point geophone with high technical specifications when using Nodal System technology.
- The recording is symmetrical in the horizontal and vertical directions.
- Coverage (210) degrees.

**17-1-2- recording parameters:**

Number of reception points: 840 channels distributed over two reception lines.

- Receiver points spacing: 25 m.
- The shot point spacing is 50 meters.
- Coverage degree: 210 degrees.
- Length of effective recording time: 5 seconds.
- Sampling time: 2 milliseconds.
- Filters will be determined before starting.
- The length of the sweep is determined by tests
- The number of vibrators in each point is determined by tests
- The number of sweeps at each point is determined by tests

**17-2- Explosion parameters:****17-2-1- Source: vibrators .**

- Number of vibrators 4 + 2.
- The source point spacing is 50 m.
- The minimum force is 60,000 lbs.
- Number of sweep by testing.
- Sweep length according to the test.
- Sweep frequency according to the test.
- Sweep model according to the test.

**17-2-2- Dynamite explosion points.**

- Hole depth: 12 meters
- Weight of the dynamite charge: 12 meter hole / 2 kg, 3 kg per hole /.

Blasting parameters and depth will be determined through tests



**17-3- scouting report on the work area:**

The bidder carries out scouting tour in the northern Damascus area, where he submits his report to the SPC (a logistical presentation of the work area and the obstacles present in it (soil condition - swamps - areas of fragile land and mountains - populated areas...)).

The bidder must have the required skills and use them while implementing the services required to work through qualified people to organize the services in order to carry out the work and meet the company's need.

The bidder must specify a suitable location for camping and inform the company representatives of its location, which includes all the supplies. He must also provide health and safety supplies under appropriate conditions.

**17-4- tolerance required for implementation:**

- RP (geophone array center) is positioned within +/- 1 meter of the center of the point.
- SP (vibrator array Center) is positioned within +/- 2 meters of the vib point center.
- The bidder must determine the location of the RP-SP with an accuracy not exceeding +/- half a meter horizontally and +/- 0.25 cm vertically with regard to the coordinates of the receivers and shot points.

**17-5- Limits of overtaking SPs', RPs' and the offset spacing:**

- In the event that it is not possible to layout SPs', RPs' in their correct locations, which may be limited due to circumstances (protected area, engineering constructions, or topographical obstacles...) the survey points must be moved to new places that secure Required coverage.
- Changes in the design locations (spacing) of SPs' and RPs' will be implemented according to the principles listed below:
  - The SP-RP spacing can be shifted by a radius not exceeding 2 meters from the designed location without rebuilding the coordinates
  - SPs' can be moved in any direction with a radius not exceeding 10 meters from a place before their coordinates chart, otherwise they must be re-surveyed.
  - If the spacing of SPs' – RPs' in the direction shown above is not possible, it can be made perpendicular to the direction of the source line for these points with the aim of doubling the separation distance between SPs'-RPs' by 50 metres.
  - The permissible reduction of the effective coverage CMP from its theoretically designed value in relation to all SPs'-RPs' locations is agreed upon with the company Supervision Committee and is subject to re-measuring the coordinates again by the implementer.

**17-6- Documents:**

Test results documents are delivered to the field quality control center after being processed to the company Supervision Committee in the form of a report containing the results of the tests carried out. After completing all services (especially field work), the bidder must submit within 30 days the final report stating all the requirements listed below:

- GPS return network diagram.
- Data about the network diagram.

- Coordinates and elevation lines of the SPS'-RPs' points in the SPS-SEGPI and all other points that have been verified with the points set by the company.
- Table of locations of surface refraction survey points for the weathering layer with final correction time values.
- Checking the values of topographic points.
- SPS'-RPs' schemes registered by agreement.
- List of topographic equipment and computer software.
- List of sent data.
- All topographical information is provided to the company on triplicate SSD
- The dominant frequency in the signal window and in the noise window is conical.
- The RMS amplitudes in the signal window and in the noise window are conical.
- Noise to signal ratio.
- Estimating the effective spectrum width
- Providing results of recording parameters and field acquisition in an optimal manner.
- Transferring all test results to the company Supervision Committee in an approved form and signed by both parties.
- The station must be able to record at least 6,000 channels with an average sampling time of 2 m/s according to the following table:

<b>Recording system</b>	32 or 24-bit telemetric seismic station.
<b>Recording format</b>	32 or 24-bit SEG-D Revision 1 or higher
<b>Medium of storage</b>	LTO, DLT cartridge 3590, or any other modern one (shall be cleared with the Company )
<b>Time break</b>	Recorded on an auxiliary channel
<b>Vertical time</b>	Recorded on an auxiliary channel
<b>Low-cut frequency filter</b>	Switched off
<b>High-cut frequency filter</b>	½ of Nyquist frequency 1 in phase
<b>Notch filter</b>	Switched off
<b>Sample rate</b>	2 m sec
<b>Type of the geophone sensor</b>	Geophones and marsh phones (water resistant)
<b>Type of the geophone group</b>	Linear layout in line (series and parallel connection)
<b>Natural frequency of the</b>	not high than 10 Hz (5 Hz will preferable )

geophones	
Number of the geophones in the array	2 strings for cable geophones . 1 pointed Geophone for nodal system
Number of the marsh phones in the array	2 strings for cable geophones . 1 pointed Geophone for nodal system
Polarity	SEGD standard
Seismic source	Explosion in single wells .Vibrators
Sweep type	(Will be determined during the Testing Work)
Sweep length	Not more than 14 sec (Will be determined during the Testing Work)
Listening time	By test
In-line separation of vibrators	(Will be determined during the Testing Work)
Sweeps per VP	(Will be determined during the Testing Work)
Depth of charge	Not more than 12 meters (depth of charge will be determined during the Testing Work)
Explosive charge	Not more than 3 kg (amount of charge will be determined during the Testing Work)

#### 17-7- Implementation of SPs' (re-shooting ):

- Random noise not more than 5%.
- traces that are abnormal from normal values do not exceed 5%.
- traces that are abnormal from normal and adjacent values, not exceeding 2%.
- Dead traces, reversed polarity, distorted by interference traces, etc. They are defined as abnormal traces .

The company Supervision Committee inspects all shot points and identifies the rejected points, and all shot points are re-recorded at the bidder's expense.

#### 17-8- Cables and geophones:

- Field recording equipment must be in excellent technical condition or almost new, provided that the geophones were manufactured date no less than 2021.
- All equipment and all technical specifications must be checked before work and company requirements must be met (control of entries).
- Geophone groups:

- Not less than 24 geophone connected in parallel or in linear form within one point or one point geophone in the nodal system to one receiving point.
- Connecting telemetric parameters with suitable watertight connections in wet areas (canals or swamps) using a geophone special for swamps.
- SMI (150 or higher) for geophone or equivalent.
- There are multiple standards to check geophones or cable leaks.
- A sufficient quantity of spare geophones for repair.
- Complete tool boxes for repairing geophones and cables.
- Tool box for cable installation.
- Requirements for operating recording and testing equipment (not less than 3% of total volume). It must be tested daily at the camp headquarters for the equipment to operate 100% periodically during the month.

**17-9- Equipment testing:**

- Carrying out equipment testing according to approved specifications and standards
- Testing of the recording system, geophone groups (arrays) and telemetric cables must be carried out according to the approved specifications.

The bidder must test the complete field blasting equipment before starting operations, submit the results to the company representative, and both parties must sign the readiness of the recording equipment.

- Record the results of daily tests and monthly tests before starting work and record them on the SSD

**17-10- seismic data processing for the field data, quality control:**

The field processing center must be at the base camp to ensure quality control and processing of field data during the recording operation.

- Processing field data at the end of each field work day.
- The processing station must have capabilities for 2D-3D field processing
- Recording field data on LTO/DLT/cartridge 3590/HD tapes.
- Control data quality by using appropriate seismic processing programs.
- Creating a database in the group that is connected to each other via a local network, which the company Supervision Committee has the right to access at any time.

The bidder must carry out all basic processing sequence and ensure the possibility of processing the data recorded in the global processing centers. He is also required to submit a copy of each line that was recorded in SEG Y format, and the processing must be in accordance with international standards and according to the following table:

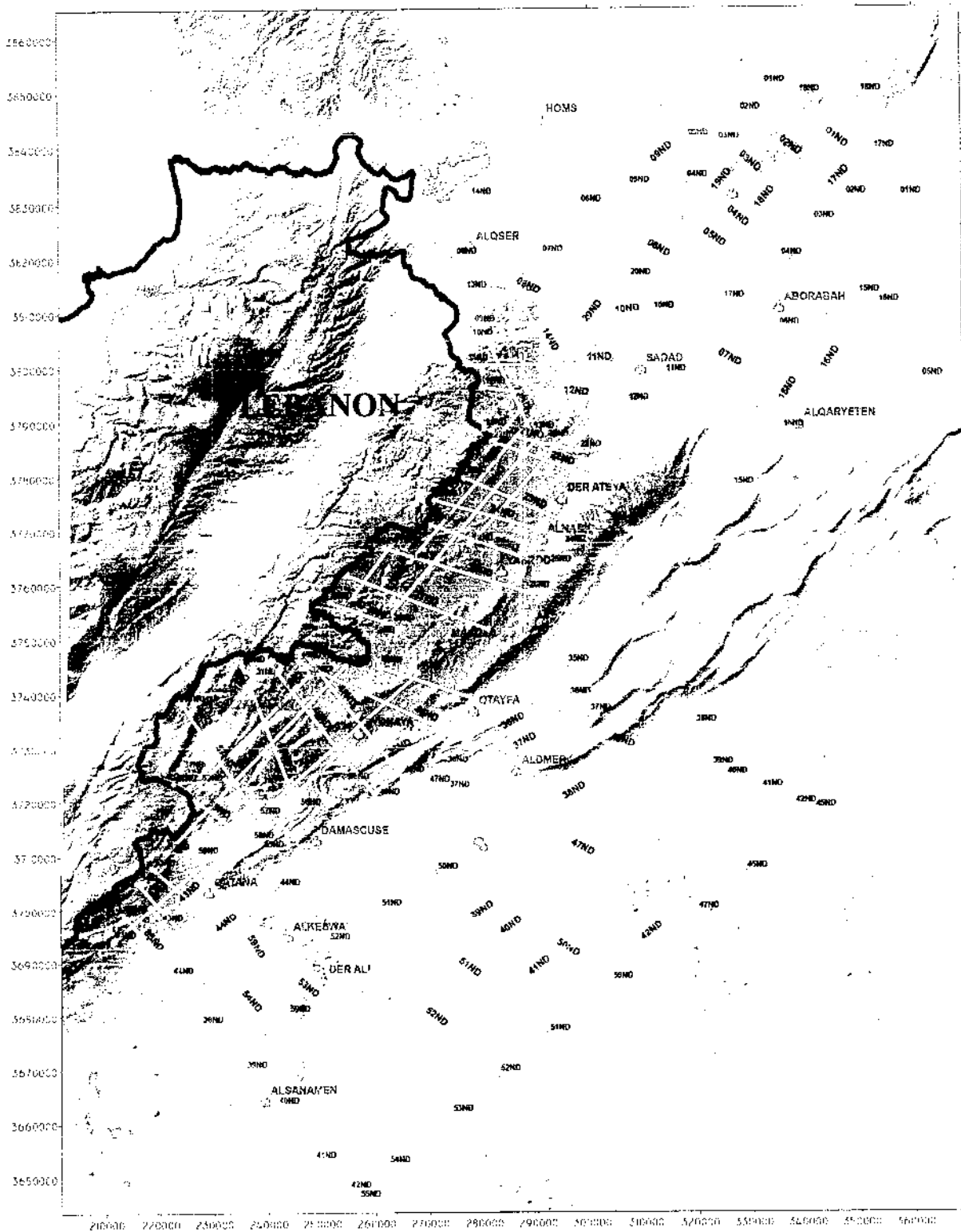
No	Process
1	Geometry input and control

2	Arranging of the attribute maps for SPs and RPs (amplitudes in various windows, signal/noise ratio, the dominant frequency) and spectral analysis in various windows per request of the Company's Representative
3	Edition of the defective traces
4	Computation of Refraction statics using Delay time, Head wave & diving wave tomographic methods etc. Compare Refraction statics solution with Elevation & Field statics and application of the one producing best results
5	First break picking manual and automatic (not less than 10 cables per shot) & Ray Tracing Tomographic static modelling for refraction statics computation and application (short and long refraction tomography). output all the QC's and statics on suitable media
6	Exponential gain
7	Recovering of amplitude
8	Linear Noise Attenuation (Ground noise attenuation, and or Guided wave attenuation, and or Remaining linear noise attenuations using FK in shot and receiver domains, Tau-P in shot and receiver domains and or offset domains
9	Deconvolution
10	1st pass velocity analysis (every 1000 m).
11	Residual Statics computation & application
12	2nd pass velocity analysis (every 500 m).
13	NMO correction
14	Multiple attenuation
15	Final Stack

Taking into account the possibility of adding any processing sequence or any change in the steps of the processing in cooperation with the bidder and it is authenticated by the company Supervision Committee in a documented manner. A bidder who provides complete processing steps is preferred.



# NORTH DAMASCUSE 2D SURVEY LINES

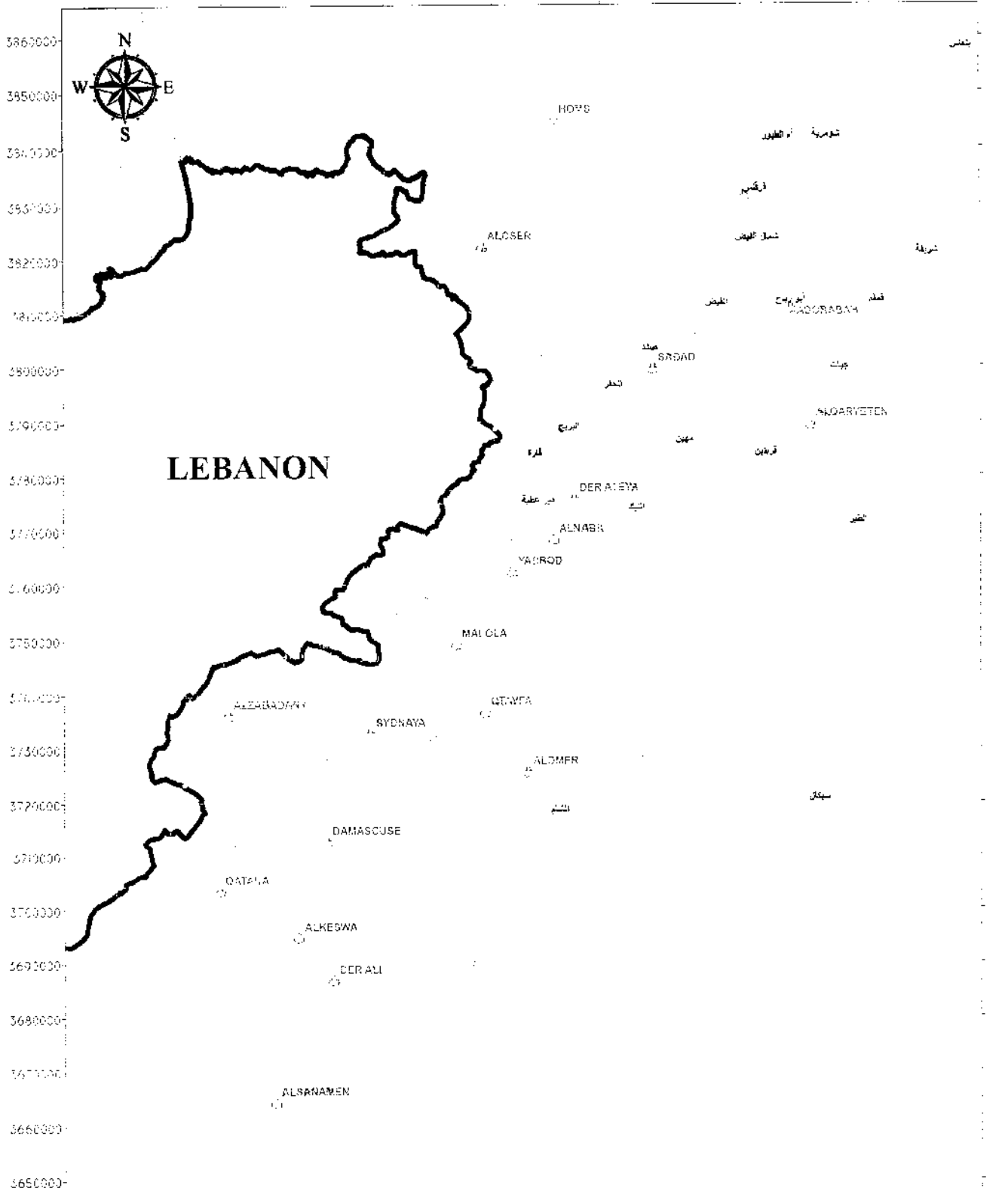


## LEGEND

Elevation				---	LINE_ID
	3000 - 3150	2250 - 2400	1500 - 1650	750 - 900	BORDER_LABANON
	2850 - 3000	2100 - 2250	1350 - 1500	600 - 750	
	2700 - 2850	1950 - 2100	1200 - 1350	450 - 600	
	2550 - 2700	1800 - 1950	1050 - 1200	300 - 450	
	2400 - 2550	1650 - 1800	900 - 1050		

W E
   
 S
   
 COOR.SYS. WGS 84 UTM

# NORTH DAMASCUSE 2D SURVEY LINES



COORD. SYS : UTM , WGS84

270000 275000 280000 285000 290000 295000 300000 305000 310000 315000 320000 325000 330000 335000 340000 345000 350000

## Legend

LINE\_ND

structure



**18- Financial offer:**

The bidder should offer his detailed prices for implementing the survey service according to the following:

**A- Fees for mobilization the crew from the bidder's country to the survey camp:**

	Description	Total price
<b>Mobilization</b>	mobilizing all the bidder's equipment from his country to the crew's camp in 3D seismic survey	\$.....

**B- 3D survey:**

1- The price of one working day for 3D recording parameters testing:

One working day for 3D recording parameter testing	Price/day
	\$ .....

2- The price of the vibrating point using the vibrator in 3D survey:

Determine the price of one vibrating-point for sources that use four vibrators as energy-sources and four sweep at location , and the sweep length is 14 seconds.

SOURCE POINT USED 4 VIBRATORS			
FOUR (4) SWEEPS PER location VP/3D			
		Unit price for VP	Total price for 13950 VP
Sweep Length (sec)	14	\$.....	

note:

- in case if less than 14 second for the sweep length parameter approved , 3% will be deducted from the unite price of each point for each 2-second time.

- in case If two sweep per location are approved instead of four sweep per location at the same point, an amount of 7% will be deducted from the unite price for each point.

3- The price of the source point using dynamite in 3D seismic survey:  
 One hole is 12 meters deep and the charge weight is 3 kilograms

Item	12 meters depth/ 1 hole
Total charge size /SP .Kg	3
Charge size /hole . Kg	3
Unit price Shot Point	.....S
Total price for 1550 point	.....S

4- The cost of drilling and logging weathering layers in 3D survey (uphole) :

Depth /m	Price for each drilled meter Including logs and calculation- full package	Total price for each hole	Total price for 57 hole in the 3D project
50 m	S.....	S.....	S.....

The depth of the weathering layer hole is determined after testing. If a depth of less than 50 meters is approved, the cost of the hole is calculated according to the drilled depths.

**C- 2D seismic survey :**

1- The price of one working day to determine the recording parameters in the 2D seismic survey, it does not exceed three days as a maximum:

<b>One working day for 2D recording parameters testing</b>	<b>Price /day</b>	<b>Total price /3 days</b>
	.....S	.....S

**2- The price of the vibrator point using the vibrators in 2D seismic survey :**

Determine the price of one vibro point for sources that use four vibrators as energy sources and four sweeps at the same location , and the sweep length is 14 seconds.

<b>Source point used 4 vibrators</b>			
<b>Four (4) sweeps per VP /2D</b>			
		<b>Unit price for V.P</b>	<b>Total price for 27530 VP</b>
<b>Sweep length (sec)</b>	14	.....S	.....S

note:

- in case if less than 14 second for the sweep length parameter approved , 3% will be deducted from the unite price of each point for each 2-second time.

- in case If two sweep per location are approved instead of four sweep per location at the same point, an amount of 7% will be deducted from the unite price for each point.

**3- The price of the source point using dynamite in 2D seismic survey :**

One hole is 12 meters depth and the charge weight is 3 kilograms

<b>Item</b>	<b>12 meters depth/ 1 hole</b>
<b>Total charge size /SP .Kg</b>	3
<b>Charge size /hole . Kg</b>	3
<b>Unit price Shot Point</b>	.....S
<b>Total price for 27530 point</b>	.....S

4- Refraction survey of the low velocities layer in the weathering layer (weathering zone refraction survey LVL).

Refraction shallow survey WZ-LVL	Unit price / one location point S.....	Total price /688 point S.....
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D- Fees for demobilization the seismic crew outside the survey area:

	Description	Price
Demobilization	All seismic crew equipment will be moved out of the survey area after the completion of the two projects	S.....

C- Daily stand by fees:

According to the conditions stated in the technical conditions book, provided that the maximum permitted value does not exceed 1.5 % from the total amount of the bidder financial offer during the entire contract period.

Daily stand by rate	Unit price / day	Total Price/35 day
	.....S	.....S

H- The total value of the financial offer for both 2D & 3D projects , including stand by fees.

Total price for the 2D and 3D projects including the stand by rate
.....S