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SPECIFICATIONS
Construction of A Drilling Pad and Waste Disposal Sump
Shell - U.S. Geothermal (CA-950) Site I

SHELL OIL COMPANY
PRODUCTION DEPARTMENT
WEST COAST OPERATIONS
WESTERN DIVISION

July 1977

UNIVERSITY OF UTAH
RESEARCH INSTITUTE
EARTH SCIENCE LAB.

I. Introduction

A. These specification pertain to the construction of a drilling pad and waste disposal sump for Shell's-U.S. Geothermal (CA-950) Site I.

B. All terms and provisions included in the construction plans, drawings, and these specifictions; and all conditions of the work order are considered parts of the contract and shall be binding to the Contractor.

C. Attached to these specifications is a copy of a 1" = 1000' scale U.S.G.S. topographical map showing the proposed drill site, access road, and water source location. Copies of the final construction plans and drawings will be available at the job walk.

D. All construction will be on land owned by the United States Governement under the administration of the Department of Interior, Bureau of Land Management and U.S. Geological Survey.

E. The worksite is located in Section 4, Township 10 North, Range 8 West, M.D.B.&M., in Sonoma County, California; approximately eight miles west of Middletown, California. The project area can be reached by two different routes. From Lake County one can travel Northwesterly out of Middletown along Highway 175 to the Socrates Mine Road, then Westerly along the Socrates Mine Road, across a private lease hold, to the intersection of the Socrates Mine Road and Pine Flat Road which marks the beginning of Shell's Lease. Access also can be obtained from Sonoma County by traveling Northerly out of Healdsburg, California to the Alexander Valley Road then Easterly to the Pine Flat Road, then Northeasterly along the Pine Flat Road to the end of pavement and the Socrates Mine marking the beginning of Shell's Lease. From Shell's Lease line one continues South along Pine Flat Road approximately three-forths of a mile where Site I will be located adjacent to the road way.

II. General Provisions

A. Inspection of Work

1. Shell shall have the right to inspect the progress of work at any time during construction.

2. A Shell authorized Construction Supervisor will be on site to perform inspections and coordinate other work.

3. The Shell Construction Supervisor must inspect and approve all work upon completion.

4. Authorized representatives from concerned Federal, State and County agencies shall have the right to inspect the worksite at any time.

5. Shell will provide a registered Soils Engineer or Soils Inspector for consultation, inspection and testing during the progress of the work to insure that all construction standards included in these specifications are adhered to. The Soils Engineer will report all results of inspections and tests and any recommendations directly to the Shell Project Engineer and Shell Construction Supervisor.

6. If, after inspections, Shell should deem it expedient to correct work injured or done not in accordance with given construction plans and/or these specifications, an equitable deduction from the payments made to the Contractor by Shell shall be made therefor, or the Contractor shall make the necessary repairs to correct the work in compliance with aforementioned guidelines at the Contractors cost.

7. Any alterations contrary to construction plans, drawings, or specifications can only be done with the ShellProject Engineer or Shell Construction Foreman approval.

B. Surveys, Permits, Laws and Regulations

1. Shell shall provide all initial grade and alignment staking for the construction. Checks on grade and alignment after the construction has started shall be the responsibility of the contractor.

2. All permits necessary for the prosecution of work shall be secured and paid for by Shell.

3. The contractor shall comply with all permits, that have been obtained by Shell and all laws, ordinances, rules and regulations of concerned Federal, State, and County agencies. If the Contractor performs any work knowing it to be contrary to such permits, laws, ordinances, rules and regulations; without Shell's approval of such work, he shall bear the costs arising therefrom.

4. The Contractor shall have a current County blasting permit in the event explosives are required during the construction.

C. Materials and Employees

1. Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, tools, equipment, power, transportation and other facilities necessary for the execution and completion of the work. Exceptions are noted in the Special Provisions; Section III, Item G of this document; where Shell reserves the right to furnish any or all materials.

2. Unless otherwise specified, all materials shall be new and of good quality. The Contractor shall, if required, furnish satisfactory evidence as to the quality and type of materials used.

3. Contractor shall have a qualified supervisor and/or foreman on the job site.

D. Schedules, Delays and Extensions

1. Contractor shall commence construction of the project covered under the contract on or about _____ assuming all final clearances and permits are approved at that time. Construction shall be completed not later than _____. In any case, the Contractor shall be allowed at least _____ _____ from the date on which construction began to complete the work.

2. If the Contractor is delayed at any time in the progress of the work by any act or neglect of Shell, or by any separate contractor employed by Shell, or by changes ordered in the work, or by strikes, unusual delays in transportation, or any causes beyond the Contractor's control, or by any cause which Shell shall decide to justify the delay, then the time of completion shall be extended for such reasonable time as Shell may decide.

E. Safety and Environmental Constraints

1. The Contractor shall, at all times, exercise reasonable precautions for the safety of employees in the performance of this contract and shall comply with all applicable provisions of Federal, State, and Municipal safety laws and building construction codes.

2. The Contractor shall, at all times, keep the worksite free from accumulations of waste materials and/or rubbish caused by his employees or work, and at the completion of the work, he shall remove all his rubbish, tools, unnecessary equipment, and surplus materials from the worksite unless more exactly specified by the Shell Construction Supervisor.

3. There shall be no unnecessary release of oil, grease, fuel, or any other biologically harmful material onto the ground in the area of the worksite. Such materials shall be collected, containerized and either retained by the Contractor or removed to a Class I disposal area. The Contractor shall notify the Shell Project Engineer of the intended disposal point prior to any such disposal.

4. There shall be no unnecessary clearing of native vegetation which has not been designated in the construction plans and drawings for the rights-of-way of the access road and/or drilling pad. Disturbed areas by new construction shall be kept to the minimum.

5. There shall be no turn-around, parking, and/or maintenance of equipment and vehicles or placement of materials along finished spoil areas, roadsides or any other area unless the site has been approved by the Shell Project Engineer or Construction Supervisor and clearly staked as such.

6. Construction will occur during the dry season therefore the Contractor shall be conscious of the potential fire hazards and shall have a fire prevention program including the following measures:

   a. Discourage all personnel from smoking except in designated areas (storage yards, turn-arounds, etc.) where vegetation has been cut back and the probability of fire spreading is low.

   b. Equip exhaust stacks on all engines in service with spark arresting mufflers or water-cooled exhaust systems to eliminate spark emissions.

   c. Allow absolutely no burning of any materials around the worksite unless approved of by the Shell Project Engineer or Shell Construction Supervisor.

   d. Necessary fire suppression equipment shall be maintained on the job at all times.

7. The Contractor shall maintain the access roadway and insure that dust from vehicular traffic along the county road and the access road be kept to a minimum by regular watering.

8. The Contractor will report to the Shell Construction Supervisor any accidents or injuries sustained on the job by telephone or in person within 4 hours of such accident or injury and on Shell's Public Accident Report Form EP 325 within 24 hours.

III. Special Provisions

A. Clearing of Construction Areas

1. Construction areas designated by the construction plans and drawings and if needed, additional areas authorized by the Shell Project Engineer or Shell Construction Supervisor, will be delineated by Shell with stakes and shall be stripped of trees, brush, and topsoil by the Contractor.

2. Trees and brush shall be placed in wind-rowed stockpiles along the side of the access road right-of-way and around the drilling pad location and track walked lengthwise to produce a compacted uniform height.

3. Topsoil shall be removed and stockpiled to be used later for the following purposes:

   a. Spreading over spoil areas and along roadsides to enhance revegetation.

   b. Providing an impervious compacted soil liner for the waste disposal sump at the drilling pad if found adequate by the Soil Engineer, otherwise soil containing the highest clay content in the area of construction will be designated by the Soils Engineer and shall be used by the Contractor for this purpose.

4. No trees outside the construction area will be removed and/or trimmed without the consent of the Shell Construction Supervisor.

B. Access Road (If required)

1. The access road shall be built according to the construction plans and drawings included with these specifications unless otherwise directed by the Shell Project Engineer or Shell Construction Supervisor.

2. Road subgrades shall be of competent native soil and crushed rock compacted to not less than 95 percent of maximum density achieved by ASTM D-1557 unless otherwise specified.

3. Along hillsides, the roadway shall be insloped two percent towards the cut bank.

4. Ditchs will be placed as specified in the Construction drawings and shall be four feet in width and one foot in depth.

5. Centerline road grades shall be a maximum of 15 percent unless otherwise specified in final construction plans.

6. All culverts installed shall be of good quality corrugated metal pipe. Culverts with diameters of 48 inches or less shall be 14 Ga. and diameters greater than 48 inches shall be 12 Ga. In installing culverts, surrounding fill shall be compacted in six inch lifts to 95 percent of maximum density. All culvert outlets shall be placed on original ground unless otherwise specified. Energy dissipaters will be installed at the downstream end of the culverts. These dissipaters shall be constructed with large stones placed where the culverts discharge to reduce erosion (see page one of construction drawings).

7. The traveled roadway (15 feet width) shall be surfaced with at least four inches of good quality, rolled, one inch minus crushed rock or onsite material if suitable, based material will be inspected and approved by Construction Supervisor prior to placement. The rock shall be spread evenly, watered as necessary and compacted to 95 percent of maximum density.

8. Road shoulders and side slope surfaces shall be compacted with a sheepsfoot roller.

C. Drill Site Location

1. The drilling pad location shall be built according to the construction plans and drawings included with these specifications unless otherwise directed by the Shell Project Engineer or Construction Supervisor.

2. The base of the pad shall be compacted to not less than 95 percent of maximum density and surfaced with a four inch layer of (one inch minus or onsite material if suitable) crushed stone compacted to 95 percent unless otherwise specified by the Construction Supervisor. Graveling procedures shall be the same as for the access road.

3. In order to control erosion, runoff water from the pad will be channeled to limit the flow only to original or cut ground before it enters natural drainage patterns. A compacted soil berm shall be constructed around the periphery of any slopes to insure this. Energy dissipaters constructed from rock piles shall be placed in areas where channeling of runoff water may cause potential erosion (see page one of construction drawings).

D. Waste Disposal Sump

1. The sump dimensions shall be as shown in the final construction plans and drawings. It shall be built in accordance with requirements of the State Water Resources Board for a Class II-I Waste Disposal Site.

2. A compacted soil berm, as shown in the final construction plans and drawings, shall be placed around the outer rim of the sump to serve as a freeboard and divert any surface drainage away from sump.

3. The inside sump walls shall be constructed on a slope of 2.5 horizontal to 1 vertical and shall be compacted to 95 percent of maximum density by ASTM D-1557.

4. A two foot clay-soil liner shall be applied to the sump walls and bottom. The soil should have a clay content of at least ten percent unless otherwise specified; this determination shall be made by the Soils Engineer. The clay lining shall be placed in six inch lifts, wetted to optimum moisture content and compacted with a sheepsfoot roller to at least 95 percent of maximum density by ASTM-D-1557.

5. The permeability of the sump lining as placed shall not exceed 1×10^{-6} cm/sec. This will be inspected and tested by the Soils Engineer.

E. Engineered Cuts

1. Cut slopes in normal soil areas shall not exceed 1.5 horizontal to 1 vertical (1.5:1). In areas where cuts are directly made on weathered serpentine rock, cut slopes of 2:1 may be required as specified by the Shell Construction Supervisor. In hard rocky areas, steeper slopes (0.5:1 to 1.5:1) may be used as specified by the Shell Construction Supervisor.

2. The crown portion of the cut shall be rounded through the soil zone to eliminate a sharp break and the face of the cut shall be roughened to enhance revegetation.

3. Interceptor ditches are to be constructed atop cut sections where large amounts of run-off water may cause erosion.

F. Engineered Fills and Spoil Areas

1. In preparing a site for an earth fill or spoil area, all trees, brush, logs, and other debris shall be removed from the area to be filled. The top soil shall also be removed and stockpiled for later use.

2. Fill areas shall be benched and keyed to achieve bond with the undisturbed ground. Vertical dimension of the required benches shall be determined on site by the Shell Construction Supervisor based upon location, degree, and condition of hillslope. The fill benches and keys shall be scarified to a depth of at least six inches.

3. Materials for the fill shall be free from vegetable matter and other deleterious substances and shall be approved by the Shell Construction Supervisor prior to placement.

4. Fill material shall be spread in uniform layers not exceeding six inches compacted thickness. Water shall be added to each layer of fill to obtain a moisture content at which compaction as specified can be achieved.

5. Each layer of fill shall be compacted to not less than 95 percent of maximum density achieved by ASTM D-1557 unless otherwise specified. Spoil areas not used for road subgrade or drilling pads shall be compacted to 90 percent. Compaction shall be by sheepsfoot rollers, multiple-wheeled pneumatic rollers or other acceptable rollers of such design that the fill can be compacted as specified.

6. Compacted outer fill slopes shall not exceed two horizontal to one vertical. In spoil areas, more gentle slopes of 3:1 to 4:1 shall be used. Slopes over 30 feet in height shall be benched with height between benches not to exceed 25 feet.

7. Fill slope banks shall be covered with topsoil or other soil materials designated by the Shell Construction Supervisor.

8. A three foot berm of compacted soil shall be constructed around the periphery of large fill slopes in order to direct water runoff away from the slope and into natural drainage patterns.

G. Furnished Services and Materials

1. Water Supply

   a. Shell will provide and pay for all water taken from its water source for use on this project.

   b. The Contractor shall supply a pump at the water source for loading his water trucks.

   c. The Contractor shall keep an accurate daily record of the quantity of water removed from the source and report this upon request to the Shell Construction Supervisor.

2. Base Rock

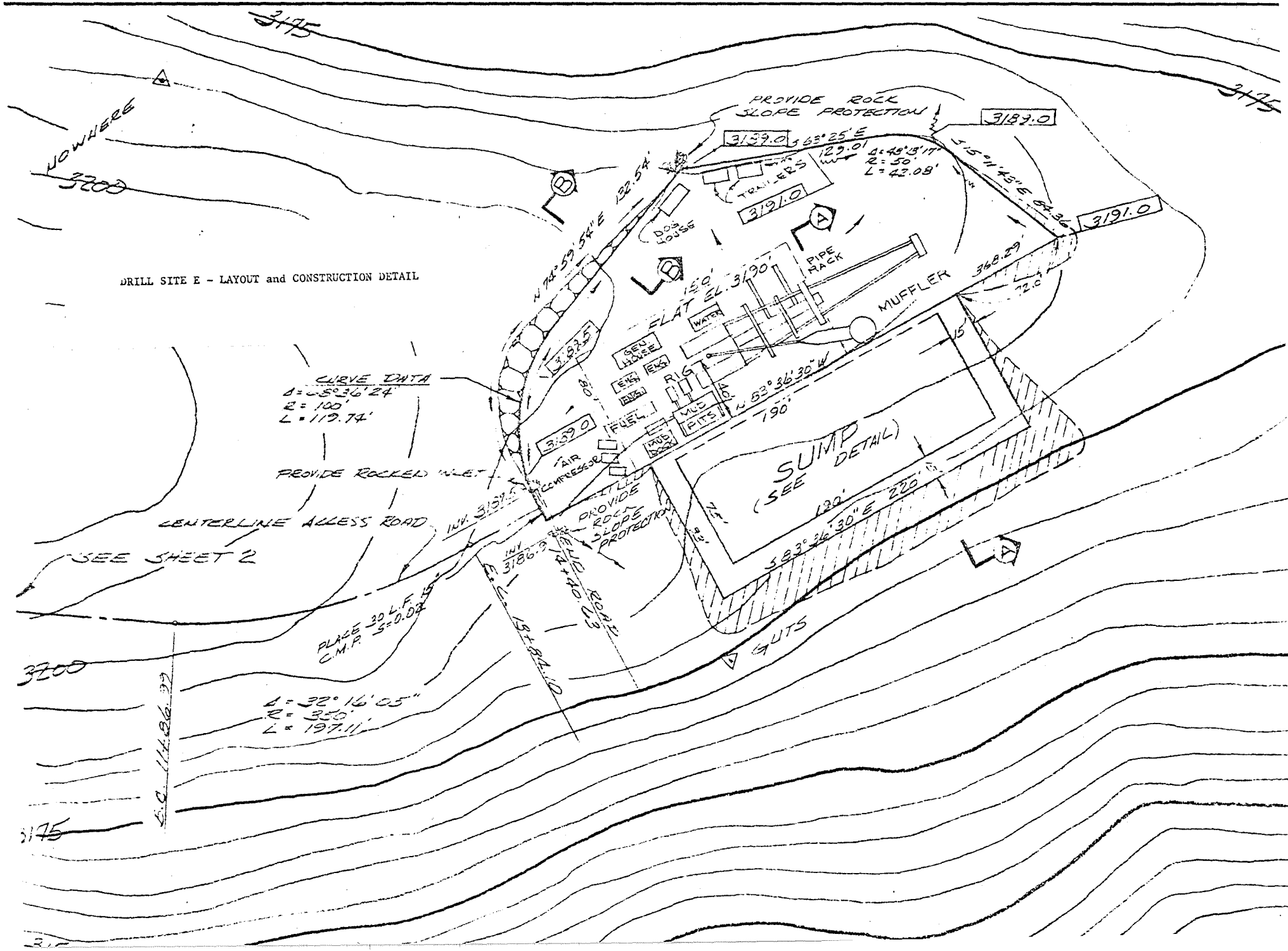
   a. Shell will locate and pay for all base rock used on this project.

   b. The Contractor shall supply a loading vechicle and trucks for hauling the base material to the construction site.

   c. The Contractor shall keep an accurate daily record of the quantity of rock removed from the source and report this upon request to the Shell Construction Supervisor.

H. Equipment Removal

1. All equipment, materials, etc., shall be removed from job site five (5) days after final approval unless otherwise approved by the Shell Construction Supervisor.


DRILL SITE E - LAYOUT and CONSTRUCTION DETAIL
NOWHERE
3200
3195
PROVIDE ROCK SLOPE PROTECTION
3189.0
3191.0
3159.0
S 65° 25' E
129.0'
Δ = 49° 13' 17"
R = 50'
L = 42.08'
S 15° 11' 43" E 64.36'
TRAILERS
DOG HOUSE
N 74° 59' 54" E 132.54'
PIPE RACK
368.29'
72.0'
MUFFLER
FLAT EL. 3190'
150'
WATER
SEW HOUSE
ENG'S
RIG
MUD PITS
FUEL
MUD BOOM
AIR COMPRESSOR
3187.5
3159.0
80'
N 53° 36' 30" W
190'
15'
SUMP (SEE DETAIL)
120'
220'
S 83° 36' 30" E
74'
83'
CURVE DATA
Δ = 65° 36' 24"
R = 100'
L = 119.74'
PROVIDE ROCKED WET
CENTERLINE ACCESS ROAD
INV. 3157.5
SEE SHEET 2
INV 3186.9
PROVIDE ROCK SLOPE PROTECTION
EQUIP BORE
R 4+40.03
E.L. 15+84.10
GUTS
PLACE 30 L.F. 15" C.M.P. S=0.07
Δ = 32° 16' 05"
R = 350'
L = 197.11'
E.C. 11+86.32
3175