



**International Union for conservation of Nature
(IUCN)**

**ALMURUNAH- Building Climate Resilience Through Enhance Water
Security in MENA**

Tender of

“Rehabilitation of Wadi Seer Springs and Irrigation Canals”

Year of execution: 2024

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Natural Springs Rehabilitation

Rehabilitation of Al-Dalia Spring

A- Brief of Work

Rehabilitation work for Al Dalia spring, the work includes the following:

- 1- Rehabilitation Al Dalia Spring Yard including the following:
 - a. Removing and cleaning all obstacles (Rock, stone, rubbish, Roots, grass ... etc.)
 - b. Disassemble and shifting of existing Steel Pergolas (Tubes 4x8 cm) off site, available two Number of steel Pergola at the Upper and lower yards.
 - c. Remove and disassemble of existing Chain Link Fences which located in two locations the first at the lower area of spring yard and the second at the boundary stone wall.
 - d. Soil shoring system by Soil Nails Wall (Shoring Rock-Cut Which Surrounded the Spring), as well as preparation and excavation the rock-cut profile to be ready for shoring system.
 - e. Detection of Spring Source in the rock and do a shoring by special soil nails: contractor to Excavate Carefully in the spring source throw Mountain-cut to find the exact water flow location this will facilitate to assign the location of reinforcement collector water tank, which will have implemented to carry the spring water from the source (mountain-cut) Contractor to follow the directions by consultant supervisor/Engineer.
 - f. Carrying out of Steel Fences (Chain link Fence) (Baqlawa) above top of Rock-Cut (above shoring wall) at the high level, as per drawings, also carrying out of Steel Fence above the existing boundary stone wall, including steel gate 3mX2.65m.
 - g. Demolishing and removing the old concrete Channel (existing concrete channels) and rebuild a new reinforced concrete channel as per Specification & Drawings.
 - h. Carrying out of concrete collector tank with dimension 1.8X1.8m and height of 1.65m, for collection the spring water before the flow start on channels.
 - i. Carting out curbstone and interlock in the spring yard as per drawing, detail and specifications.
- 2- Stream which is neighbor to Al Dalia Spring:
 - a. Remove and cleaning all obstacles (Rock, stone, rubbish, Roots, grass ... etc.) from the path pf stream as per drawings.
 - b. Carrying out of Drainage line for storm water using Concrete Pipes to drainage of storm water, the works including Manholes, wing wall & Apron at Start and End of Concrete Pipes Line.

- c. Carrying out of Rock Bumpers (shock Absorber) in the path of stream before the beginning of cement pipes line
- 3- Al Dalia Channel (Outer side of Al Dalia Spring Yard):
- a. Demolishing and removing the old concrete Channel, and rebuild a new reinforced concrete channel as per Designed Drawings and Specifications, the demolishing will be for the walls only if the foundation is in good condition, the foundation shall be kept for fixing and supporting the new channels that planned to be implemented as per specifications and conditions.
 - b. Also, the location of no concrete channels (Damaged parts of channel) a new channel shall be implemented in this location and the level should be matching with the level of existing channels before and after a new section.
 - c. Supplying, installing and painting control gates (Slide Gates), containing from 4 mm thick sheet Plate, with dimensions as per existing or new channel dimensions (contractor shall follow the existing gates as a details for his fabrication and installation works), the works shall include all the necessary accessories, tools or any equipment, including also the frames that shall be embedded inside concrete or fixed with bolts with concrete, the gates including installing a chain for each gate that is tied to the gate plates and frames, the operation of open and close are manually.
 - d. Steel gate or control gate shall be installed at the required locations as per site conditions and consultant instructions.
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B- Work description

Rehabilitation work for Al-DALIA Spring area such as detection of Spring Source, Preparation & shoring for Rock-cut, remove the obstacles, demolishing existing channels and build a new channel and others, with consider the spring water shall be running and not stop the flow of water during implementation of all parts of rehabilitation works. The rehabilitation works include the following:

- 1- Cleaning and leveling the ground of spring: the contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
- 2- Disassemble & Remove of Steel Pergolas (Tubes 4x8 cm) two No. Upper and lower level, which erected by steel tubes (4x8 cm) with All Accessories: the contractor shall remove the existing Pergolas with all component and accessories by do an excavation around the Pergolas -columns and remove it from the origin (do not cut) then cut the Pergolas into vertical and horizontal tubes as per consultant instructions, then shift all steel materials and accessories to the location which assign by consultant supervisor, the works including steel gate.

- 3- contractor to Excavate Carefully in the spring source throw Mountain-cut to find the exact water flow location this will facilitate to assign the location of reinforcement collector water tank, which will have implemented to carry the spring water from the source (mountain-cut) Contractor to follow the directions by consultant supervisor/Engineer.
- 4- implement of shoring soil system for Mountain-cut which the water of spring is coming from, by using soil nails system & shotcrete with steel reinforcement including all accessories and materials which required to complete the work which consists of installing passive reinforcement in existing ground by installing closely spaced steel bars or nails, and placing a front face support. Soil nails are later grouted when they are installed in drilled holes.
- 5- Implemented of Soil Nails at the spring opening (water spring Source) in case of spring sources comes from the rock cut, the design of these nails shall be as per the drawings and specifications.
- 6- Reinforced concrete collector tank for Spring source : contractor to carrying out the collector tank (water tank) for spring water to be contact directly with the spring sources after indication and discovering the spring source, the dimensions of this tank equal (1.8mx1,8m) and height of 1.65m as per drawings, it is allowing to supply and install a precast water tank with all required dimensions and specifications and as per instruction by consultant supervisor/ engineer but the contractor should be fixing a 5 no. of soil nails in the foundation or wall of water tank with minimum length 4m, to be fixed with contacted soils.
- 7- Supply and apply interlock stone after prepare the spring area, it will be as per the drawings and specifications.
- 8- Demolishing and rebuild of spring inner channels (at spring yard) which the path of channel has to be from Spring sources to the connection with the outer channels as per the drawings, existing level have to be the design level for contractor, and the water flow should continue running throw all the duration of any work as proposed by contractor and approved by consultant, the work included the following:
 - a. Demolishing the existing inner channel in the spring yard for existing path of channels
 - b. Excavate of channel path and compaction the existing soil.
 - c. Install road base (150mm) thick with compaction degree (95%)
 - d. Casing blinding concrete (10 cm) with strength equal 200 kg/cm²
 - e. The channels inner and outer surfaces should be fair-face and smooth.
 - f. Backfilling and leveling around the channels outer section as per drawings and consultant approved.
- 9- Existing Stream: redirection and treatment of existing stream path by the following:
 - a. Clean and remove the rocks, big stones, rubbish and all abstract from the stream bath.
 - b. From existing rocks and boulders, a bumpers have been carrying out in the stream path and before the entrance of proposed drainage line, these Bumpers should be

executed as per attached drawings, the diameter or the smaller member of the rock shall not less than 1,0m, and the rock boulders shall be distributed as per drawings with embedded in the soil by 20cm.

- c. Drainage line for stream path shall be carrying out as per drawings including the manholes, wing wall and apron to carry the stream-water to the inlet of valley
 - d. Drainage line by Executing and installation of one row of concrete pipes with Diameter equal (1200mm) and connected between the stream path and the valley inlet.
 - e. Reinforcement Concrete with strength 250 kg/cm² and steel of one layer and two directions is (5Φ12/m) have to cast when the concrete pipes crossing the asphalt road, and located below asphalt layer.
 - f. The layers of drainage line it is as per the drawings.
- 10- Manholes for Spring-water: two manholes by inner dimension of (1.0mx1.0m) should be implemented as per tender drawings and specification and conditions
- a. Concrete pipes between manholes of spring-water: Execute and installation of one row of concrete pipe (600mm) between the Manholes for Spring-water these concrete pipes have to located Below the Road Asphalt as per the drawings and special specifications, a Reinforcement Concrete with strength 250 kg/cm² and steel of one layer and two directions is (5Φ12/m) have to cast above the concrete pipes and below of asphalt layer.
- 11- Demolishing and rebuild of outer channels of spring yard: which the path of channel has to be from second manhole to the end of existing channels. as per the drawings, existing level have to be the design level for contractor, and the water flow should continue running throw all the duration of any work as proposed by contractor and approved by consultant, the work included the following:
- a. Demolishing the existing channel in the (walls only) and keep the foundation to be base for new channels.
 - b. Excavate of channel parts that not available concrete channels (damaged parts) and base course with blinding shall provide for this section including all works related to accomplish the activities.
 - c. Install road base (150mm) thick with compaction degree (95%) in the parts that not available concrete channels (damaged parts).
 - d. Casing blinding concrete (10 cm) with strength equal 200 kg/cm², that not available concrete channels (damaged parts)
 - e. The channels inner and outer surfaces should be fair-face and smooth.
 - f. Backfilling and leveling around the channels outer section as per drawings and consultant approved.
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C- Soil Nails wall work / Soil shoring system for stabilize the rock-cut surfaces

Soil Nails wall work Includes the following items:

Special Condition for Soil nails Wall

- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor can provide a proposal for any works or activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the spring's water flow during all stages of the work.
- The dimension, numbers, lengths or any required specification for the soil nails wall it will be available tender drawings and details, this drawing designed for shoring the rock-cut surface.

Descriptions and specification of Soil Nails Wall Works

The sequence of construction for soil nail walls includes the following major steps:

1. Excavation (in case of required cutting soil to specified levels)
2. Drilling of nail holes
3. A) Nail installation and grouting
B) Installation of strip drain
4. Construction of initial shotcrete facing
5. Construction of subsequent levels (Repeat Steps 1-4)
6. Construction of final facing

1. Excavation:

- a. In the existing soil-cut, the rock profile is already excavated and exposed, the contractor is to find a suitable Idea to construction of soil nail walls with all stages, for example, the contractor can do Backfill for the rock surface as platforms level, after that construct of soil nail walls from upper level to lower level, then excavation again to carry out the subsequent levels, or the contractor shall provide special equipment (Machine) to do the works as per site condition. Contractor shall submit to consultant a Method statement for all works and for each activity.
- b. For excavation works, soil excavation is performed using earth-moving equipment from a platform, and final trimming of the excavation face can be carried out using a backhoe or excavator from this platform, also to cut and remove the loose materials from the

rock profile and reformation the surfaces to be ready for Shotcrete Work, The excavated face profile should be smooth and not too irregular to minimize excessive shotcrete quantities and provide Good View of face profile after complete the final facing.

2. Nails Hole:

- Soil Nail Inclination is 15 degrees from the horizontal.
- the contractor shall use the drill hole diameter as specified, with consider the minimum drill hole diameter shall be (4 to 8 in) to provide the bond resistance required for stability, to obtain the specified nominal pullout resistance and to possibly allow cleaning the drill hole, or accommodating a Grout pipe, Nails, and centralizers.
- soil nails shall place in a drilling hole that are drilled and grouted in a two-step operation:
 - o first step, drill holes shall have drilled at a shallow angle (15 degrees from horizontal) using cased or open-hole techniques.
 - o second step, the nails shall insert and grout in the drill holes.

3. Soil Nails Bar (Dia. Spacing, Length, Grade)

- Solid bar are the used soil nails. The dia. of soil nails is 25mm, soil nails must be threaded a minimum of (6 in.) on the cut face to allow proper attachment of the bearing plate and nut.
- Solid-Threaded Bars has a nominal tensile strength of 60 ksi (Grade 60), and has to conform to ASTM A615, also a special Epoxy paint should apply on full surface of solid steel for corrosion protection.
- The horizontal nail spacing, SH, equal to the vertical nail spacing, SV and equal to 5 ft.
- The first row of nails should be installed about 2 to 3 ft. from the top edge of the wall
- The lowermost row of nails should be installed about 2 to 3 ft. above the base of the excavation depend to the site condition.
- the soil nails are varying in lengths depend to excavation and other conditions depth (Wall height), therefore the lengths of the soil nails are calculated and indicating in the section drawing No. (Draw. No.).
- Soil Nails length is indicated in the attached drawings.

4. Components of Soil Nails Bar: the contractor shall provide the main components of soil nails wall which are depicted in the drawings.

- Bearing Plate: The bearing plate Grade 36 (AASHTO M183/ASTM A36), the Bearing Plate is square and flat with dimension should be (8- to 10 in.), with thicknesses of 0.75 to 1 in.
- Washers and nuts: must meet the requirements of AASHTO M291/ASTM A563 Grade B.
- headed studs: The connection to the final facing consists of four headed studs that are welded to the bearing plate and embedded into the final facing.

- Centralizers are made of polyvinyl chloride (PVC) or other synthetic materials not detrimental to the solid bar (Figure 3.8), Centralizers should have installed at various locations along the length of each solid bar to ensure that a minimum thickness of grout completely covers the solid bar, Centralizers should have installed at regular intervals, not exceeding 10 ft along the length of the nail and at a distance of about 1.5 ft from each end of the nail. Centralizers must be securely attached to the solid bar and must be sized to allow: (i) positioning the solid bar within 1 in. of the center of the drill-hole; (ii) inserting the grout-pipe to the bottom of the drill hole; and (iii) grout to freely flow up the drill hole.

5. Grout:

- When solid bars are installed, grout have to pumped shortly after the solid bar is placed in the drill hole to reduce the potential for squeezing or caving of the hole. For these applications, the grout is injected through a grout pipe inserted to the bottom of the drill hole until the grout fills the hole
- The grout can flow at inclinations of Nails Hole from the bottom of the drill hole to the head.
- The grout is Non-Shrinkage Cement Grout (sulfate resistance cement), the minimum compressive strength for the grout should be 1,500 pounds per square inch (psi) at 3 days, and 3,000 psi to 4,000 psi at 28 days, as tested in accordance with AASHTO T106/ASTM C109
- The water/cement ratio for grout used in soil nailing applications ranges from 0.4 to 0.5 in neat cement mixes, which is equivalent to a specific gravity of 1.8 to 1.9

6. Drain Strip and PVC Pipes

- The strip drains are fitted with drainage elements that allow exit of the water from the strips to the outside of the wall, as depicted in Figure 3.12. Strip drains are also fitted to discharge into a pipe drain running along the base of the wall and/or through weep-holes discharging through the facing and to the toe of the wall.
- Drain strips are equidistant from nails in the pattern, vertical geo-composite strip drains should be installed behind the (initial facing) and adjacent to the (excavation face) (Figure 3.12), to limit water pressure development behind the wall facing.
- Most drainage elements are made of PVC and consist of a Snap-On cap or grate, and an exit PVC pipe connected to the underdrain system. Generally, the underdrain system consists of a drainage pipe embedded in an aggregate-filled trench, which runs along the bottom of the excavation. The underdrain system pipe, as well as the pipe fittings, should meet the requirements of Schedule 40 PVC solid and perforated wall. The drainage pipe is slotted PVC or polyethylene (PE) surrounded by clean, coarse-gravel sized aggregate that is free of fine particles.
- Geo-composite strip drains consist of a drainage core and a filtration geotextile attached to or encapsulating the core. The drainage core is manufactured from synthetic polymers composed of polypropylene, polyester, polyamine, PVC, polyolefin,

or polystyrene. The core should have a minimum compressive strength of 40 psi when tested in accordance with ASTM D1621 Procedure A. In general, the drainage core with the geotextile fully encapsulating the core must have a minimum flow rate of 0.1 gallons per second per foot of strip width, when tested in accordance with ASTM D4716.

7. Wall Facing: Nails must be connected to a facing system at the excavation face or slope surface, the Facings consist of an initial facing of shotcrete and a final facing of shotcrete or cast-in-place concrete.

a. Construction of initial shotcrete facing:

- Contractor shall carry out the initial shotcrete facing, which consists of shotcrete and welded wire mesh, Shotcrete provides a continuous layer over the excavated face and fills irregularities.
- Initial shotcrete thickness shall be between 3 - 4 in.
- Contractor shall supply and apply Welded wire mesh (WWM) which is sold in panels or sheets, the opening between wires (2in.x2in.) and wire thickness (6-8mm), the overlapping should be at least one full mesh cell.
- Contractor should consider during construction of initial shotcrete to covers the exposed soil with the exception of a narrow band at the bottom of the lift, this band shall remain uncover to expose the lowest portion of the WWM and strip drains, and allows for the overlapping of these elements in the next excavation lift.
- contractor shall provide and install a short reinforcement bar which called waler bars and vertical bars around the nail heads.
- Contractor shall select a width of WWM panel to be consistent with the excavated lift height (equivalent to the vertical nail spacing plus an overlap of at least one full mesh cell).

b. Construction of final facing

- The total thickness of a reinforced final shotcrete facing is between 6 and 10 in.
- Contractor shall apply the final facing after the deepest lift of the initial facing is completed, and is advanced in phases from the bottom up, in order to achieve the required scenery which planning to carrying out in the final facing wall as per Drawings.
- The reinforcement of final facing is a rebar (5Φ14/m), this Reinforcing steel must meet the requirements of AASHTO M31/ASTM A615, Grade 420, deformed
- waler & vertical bars are not required to use in the Final facing, due to available a reinforced shotcrete by using rebar reinforcement.
- In this work the final view of soil nail walls has a special beauty view requirement. Therefore, contractor to be sure the even finish and color of final shotcrete facing to meet these requirements, Wood, steel, or rubber tools can be used on the as-shot surface to smooth the shotcrete, and to add grooves to create a more beauty view finish. Finished shotcrete surfaces can also be colored with pigmented sealers.

- The contractor shall provide all materials that required to execute the Planned scenery on the wall to be as final view which is consist of (like sculpted Palms trees) as per drawings, contractor shall provide shuttering, wood mold, much-up or any ideas that lead to achieve the works of Final facing as required, contractor shall submit method statement to consultant for approvals issue, shotcrete with reinforcement bars should have used for these final view works.

D- Chain link steel Fence and steel gate

supply and install Steel fence in two locations the first at spring yard including one steel gate, and the work contains the following article and the second on the top of soil nails wall (top of rock-cut):

- 1- supply and install Steel fence with a clear height of 2.0m and the vertical pipe shall has embedded 50 cm inside footing underground level as per drawings and details.
- 2- steel fence consisting of galvanized steel mesh (Baqlawa) dimension of 4cmX4cm and 4 mm thickness, its surrounded with galvanized steel-pipes of diameter (2"), and the vertical galvanized steel-pipes of diameter (3") shall erect every 4 m with a top cap.
- 3- The works including all accessories, plates and steel parts shown in the drawings and details.
- 4- the work including all tools, machines, parts and materials which required to implemented a double-leaf door with width 3.0m and height 2.65m for Spring yard entrance according to the drawings and details, the work include the all screws, bolts, welding or any type of elements required to complete the work.
- 5- All fence elements shall be full covered and painted by special layer to resist weather factors.
- 6- The Locations for installation the steel fences are: first location is above the existing stone wall and the other is above the shoring wall of spring
- 7- Part of vertical pipes shall be embedded amount (40cm) inside a reinforced footing, the dimensions of these footings are (40cmX40cm and depth of 50cm) and reinforcement steel is (Φ 12/12 cm).

E- Control steel gate, slide gate for Channels

- 1- Supply and install steel gates (control gates) inside the inner side of channels for controlling the flow of water inside the channels and towards the sub-channels.
- 2- All steel elements shall be painted by special layer to resist weather factors.
- 3- The channels components are steel frames and steel plate of 4mm thick. The frame shall be four sides bottom, top and two sides the half of upper side shall be free fix.
- 4- The dimension of channel shall be compatible with the inner width of existing or new channels.

- 5- Chains shall provide to tie the upper side of frame with the sliding gate.
 - 6- The contractor shall install the gates in a manner that prevents leakage around the gate and binding of the gates during normal operation.
 - 7- Surfaces of metal against which concrete will be placed shall be free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.
 - 8- Anchor bolts, thimbles, and spigot frames shall be secured in true position within the concrete forms and maintained in alignment during concrete placement.
 - 9- Concrete surfaces against which flat frames or plates are to be installed shall be finished to provide a smooth and uniform contact surface.
 - 10- When a flat frame is installed against concrete, a layer of concrete mortar shall be placed between the gate frame and the concrete.
 - 11- When a gate is attached to a wall thimble, a mastic or resilient gasket shall be applied between the gate
 - 12- frame and the thimble in accordance with the recommendations of the gate manufacturer.
 - 13- Wall plates, sills, and pin brackets for radial gates shall be adjusted and fastened by grouting and bolting after the gates have been completely assembled in place.
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F- Special Condition for Rehabilitation Springs & Channels:

- The contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and to keep the site clean for channels works.
- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor shall provide all necessary equipment, Manpower, Tools, shutter, ... etc., which will be required to complete the works
- The contractor can provide a proposal for any works or any activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the spring's water flow and channel's water flow during all stages of the work.
- The price for implementation a new channel is including the demolishing of the old channels, cleaning and removing all obstacle, excavation if required, backfilling, materials, tools, machine manpower and all the necessary that required to complete the works in the best quality, also contractor shall be keep running the flow of water fulltime during execution duration for all activities.

- The contractor shall Demolishing and Removing existing channels, and implement a new channel with location are the same existing Channels route, also using the current levels for existing channels as designed levels for the newly implemented channels route, also the contractor can use a new level for the new designed channels according to approval from the consultant engineer.
- Contractor shall supply and install a Steel gate (Control Gates) for the channels at many locations as per BOQ, the price will be included with the channels amount, and to be constructed according to be as per the existing gates, specifications and consultant instructions
- It must be taken into consideration that the thickness and steel reinforcement of the channel's walls that adjacent to the earthen-cut or the mountain-cut must be greater than the thickness of the other channel's walls as per drawings and details, but for channels that located in place of no earthen-cut or no required backfilling near the channel's walls the thickness of these walls will be equal on both sides.
- Channels, collector water tank or other concrete elements the concrete cover (Steel Cover) is (5 cm-7.5cm) if the element contact directly with the soil, and (3cm) if the structure element not contact directly with soils.
- The contractor shall Obtain Necessary authorization for start-up and execution of works and this includes (but not limited to) all permits and approvals related to the use of land, permission to build and access, as well as all relevant governmental bodies authorization depending on the proposed project requirements and on the national law.
- the contractor shall submit Method statement for any activity as per consultant instructions such as method statement for soil nails wall, storm water drainage line, channels, etc.
- channel removal work shall be includes removing all components of the channel, according to the current section of the site. In the case of concrete sections for channel, Riprap, or flow of water through regular soil channels, two cases shall be considered:
 - In the case of reinforced concrete walls, Blocks, and reinforced concrete foundations, all walls must be removed, but the foundations can be kept and adopted as a basis for the new channels that are required to be constructed.
 - In the case of non-reinforced channels (earth or Riprap), all their components must be removed, the backing must be compacted after removal, all foundation layers must be installed, including base course and Blinding Concrete, and the foundations and walls of the new channels must be constructed according to the required Drawings and specifications.
- When constructing new channels and indicating the instability of the old Foundation due to the location of the channel on the slope of the mountainous area, the contractor must stabilize the old foundation and the ground on which it is required to be established before the work of constructing the new channels, by using a stone wall below the foundation area with steel mesh and shotcrete or any idea from contractor and after approval by consultant.
- If the channels are located on flat ground, the channels must be constructed with all their layers, as per drawings and design, including a base course layer and blinding concrete with all necessary works related to these activities.

- Carrying out plastering work for the damaged areas for the retaining walls that a new channel will be constructed above these retaining walls, and rested above these walls, the work includes the following:
 - Clean and wash the retaining wall section from soil, dirt and stones before carrying out the plastering work and remove the cleaning waste away from the site.
 - Carrying out plastering work for the retaining wall section, two coats of plaster shall apply with a mixture of sand, cement, including sea sand and an adhesive. The ratio of sand to cement is 1:4. The first side is rough, the plastering works including the final coat of smooth finish, the works included supply and apply of all required materials, water, curing three days, tools and machine.
- The dimensions are according to the drawing and the supervisor instructions.
- For any case of reinforced concrete which will contact direct to soil, Base Coarse (min. thick 15cm and MDD 95%) and Blinding concrete (10 cm) should be applied at the below of reinforced concrete as layers, if this mentioned in drawings or not.
- The contractor shall provide any required type of shutter (Formwork), including fair-face timber in order to complete the required works and as per consultant instructions.
- The contractor shall implement a concrete collector tank which should be connected directly with the Spring sources to collect all water that Coming from spring before flowing throw the channels.
- The contractor shall supply and install a Water-stop rubber (thick. 20-25cm) for any size of Concrete-collector-tank at any spring, the location of this rubber shall be in the contact between foundation and vertical walls, first half width of this water-stop should embed in the foundation and the other half should have imbedded in the vertical walls.
- Dimension of Collector water tanks or channels for any springs shall as per drawings, and the compressive strength for theses tanks are 250 kg/cm³, concrete slump 10cm, the contractor shall provide concrete cubes for compressive strength test using 15cmX15cm cubes, the number of cubes for any test shall be 6 cubes, the first 3 cubes for doing the test and take the average, and the Additional 3 cubes for spare in case of failing the first cube test we can use it to do the test again.
- Steel specifications are ASTM designation A-615 or equivalent, stress =4200 kg/cm², grade 60
- For any reinforced concrete works, plastering works, ... etc. the concrete has to be cured with water for three days two times a day, vibrator shall provide and use during casting a reinforced concrete.
- In case of segregation, it must be treated with special filler-expansion materials and according to the consultant instructions and approvals, the consultant can decide for treatment or demolishing (removing) the concrete structure and the contractor have to follow the instructions by removing this structure and redo the work.
- Wall and roof shutters should not be removed before 3 and 14 days after casting respectively.

- ready mix concrete is the allowed concrete for any part of reinforced concrete structure, the contractor shall submit mix design for consultant approvals, in special cases and conditions it is allowed to use onsite-mixing and manual casting, with consider the percentage of mix components during onsite-mixing.
 - The prices for all required materials, tools, shuttering, fixing steel, casting concrete, ...etc. are included in the unit prices unless it mentioned otherwise.
 - The contractor shall provide a cover-block (Plastic or concrete) as required for channels, concrete water tank or other concrete elements, the concrete cover (Steel Cover) is (5 cm- 7.5cm) if the structure contact direct with the soil, and (3cm) if the structure not contact directly with soils.
 - The levels which indicated in the drawings of spring's underground water tank are from Surveying work results, therefore, if required to change any level from these levels for any reason during the work conditions, the other related levels should be change also, to keep the constructions depth or high as same as before changing the origin level.
 - The contractor shall implement a concrete collector tank with dimension 1.8X1.8m and height of 1.65m, the work shall include (but not limit to) all the necessary accessories, materials, tools equipment, etc. which required to accomplish all the activities.
 - The contractor shall Excavate in all types of soil and rock according to drawings levels and dimensions and to the technical specifications. The work starts by clearing, grubbing of top soil as specified.
 - For any concrete construction or sub-elements for any works in the tender such as collector tanks, manholes, Channels or etc., the contractor shall Excavate any type of soil or rock according to drawings dimensions and to the technical specifications.
 - The contractor also for any kind of activity and according to the drawings and specifications, shall do an Cleaning and Leveling, remove all debris, excavated materials, Rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
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G- PRECAST CONCRETE PAVERS, Curbs and Interlock

1- Interlock

- Contractor shall Provide and install an interlock measuring 10X20X6.5cm in different colors according to the owner's choice and the samples provided by the contractor.
- The work includes a layer of compacted sand with a thickness of 10cm with all the necessary slopes and everything necessary according to the specifications, drawings and instructions of the supervising engineer.

- Portland Cement: BS 12 or ASTM C 150, for ordinary Portland cement. Cement used shall be from the same mill and manufacturer to ensure uniform color for the entire paver units required for the project.
- Aggregates: The aggregates to be used in the manufacture of the paving must be provided from a single approved source to ensure uniformity of color, size and shape and shall be conforming to the requirements of BS EN 12620.
- Admixture: ASTM C260, air-entraining type.
- Water: Potable clean water clean and free from deleterious substances.
- Pigment to be used in manufacturing of precast concrete interlocking blocks shall be in the form of dry, soft powder and shall not contain chemical compounds that may affecting adversely the setting and development of strength of the cement and other properties of the product.

2- Curbs

- contractor shall Provide and build precast concrete stone (Curbs) of class (B) where necessary. The price includes a curb stone of 30 MPa grade concrete, with a length 50cm and height of 30cm and width of 10/15 cm, and the thickness of back-support concrete is 10cm with height of 20cm.
- The price includes the mortar and special paint according to the owner's choice, as well as excavation and backfilling from any soil types, and everything necessary to complete the work according to specifications, drawings and instructions of the supervising engineer
- Portland Cement: BS 12 or ASTM C 150, for ordinary Portland cement. Cement used shall be from the same mill and manufacturer to ensure uniform color for the entire paver units required for the project.
- Aggregates: The aggregates to be used in the manufacture of the paving must be provided from a single approved source to ensure uniformity of color, size and shape and shall be conforming to the requirements of BS EN 12620.
- Admixture: ASTM C260, air-entraining type.
- Water: Potable clean water clean and free from deleterious substances.
- Pigment to be used in manufacturing of precast concrete interlocking blocks shall be in the form of dry, soft powder and shall not contain chemical compounds that may affecting adversely the setting and development of strength of the cement and other properties of the product.
- Type: Precast concrete of 30 MPa, 28-day compressive strength.
- Nominal Size: L 500mm x H 300mm x W 10mm/150mm or as per drawings.
- Style: Precast edge with fair face finish, and Laser cut.
- Surfaces of all precast units shall be carefully cleaned on completion, taking care to avoid any damage.

- Adequate protection shall be given to all the completed work, to avoid damage from any subsequent activities.
 - Any damage caused to completed work shall be made good by the Contractor at his own expense.
 - Providing and supplying concrete curb stone for the springs area as assign in the drawings, with the addition of a corrosion- and moisture-preventing material, the curb stone dimensions is according to the following (10/15 cm x 50 cm x 30 cm). It shall laboratory-successful and delivered to the site according to the consultant instructions.
 - Building a concrete curb stone, making the necessary grout and back support concrete, and making the foundation that ensures the leveling of the stone according to the technical specifications, special conditions, and the engineer's instructions.
 - Dimensional tolerance does not exceed (+- 3 mm)
 - Transverse fracture load: According to the Jordanian standard, the transverse fracture load should not be less than (30 N), and the water absorption rate should not exceed (8%) of the weight, and the cement percentage should be appropriate to obtain the required specifications.
 - The contractor must remove and transport the Curb stone that does not conform to the specifications from the work site at his own expense, and bring the replacement that conforms to the specifications to the site.
 - The Curb stone is supplied to the site, which includes supplying it to the site, unloading the stone from the car, and distributing it in the locations specified by the engineer, all of which is at the contractor's expense.
 - The contractor will replace any broken stone as a result of the unloading at his own expense
 - The contractor is responsible for all excavation works to a depth of no less than 18 cm below the level of the asphalt and a width of 30 cm, according to the instructions of the supervising engineer.
 - The contractor must use a foundation of regular concrete (ready-mixed concrete) with a breaking strength of no less than 210 kg/cm², with a width of 30 cm and a thickness of 10 cm to ensure the levelness of the curb stone.
 - The concrete plate must be cured with sufficient water for three days under the supervision of the engineer to ensure the watering process is complete.
-

H- Drainage Line of storm water (Rain Water) for the Existing Stream:

- **The work contains the following article:**

- 1- Carrying out excavation work, providing and installing concrete pipes of different diameters, and constructing the necessary manholes and grills according to the engineering Drawings and according to the engineer's instructions.

- 2- The contractor must cut the layer of asphalt for the streets to be excavated according to the required width in order to prevent deformation and damage to the existing asphalt layer.
- 3- Carrying out excavation work of all types and everything necessary to complete the work.
- 4- The contractor must remove the rubble and excavation materials as soon as possible and not leave them on the site, and throw them outside the site in the yards designated for landfills which approved by consultant engineer and Authorized Departments.
- 5- Providing, supplying and spreading coarse sand (Single size), the result of laboratory-successful crushing of crushers, with a layer thickness of no less than (15) cm under the cement pipes.
- 6- Providing, supplying and spreading coarse (single size), the result of laboratory-successful crushing of crushers, on the sides of pipes with a thickness of (15) cm.
- 7- Providing, supplying and spreading coarse (single size) sand, the result of laboratory-successful crushing of crushers, on over of Cement pipes and below of Base coarse, (between top of Cement Pipes and Bottom of Base coarse)
- 8- Providing, supplying and spreading coarse sand (lenticular), the result of laboratory-successful crushing of crushers, below the level of 75 cm of the asphalt layer and above the lenticular layer (30 cm from the outer diameter of the culvert).
- 9- Providing, supplying and spreading graded aggregate (Base course) with a thickness of 20cm before Compaction according to the engineering Drawings over the Single Size layer that was spread over the Cement Pipes, so that the degree of compaction for the Base Course layers under the asphalt, is not less than 98% and to be consider to expand the excavation by a distance of 25% of the width of the excavation to increase the width of the base course layer (underneath the concrete layer) so that the total width under the concrete layer is covered according to Paragraph 13.
- 10-The contractor is committed to pouring concrete (fast-hardening) for the longitudinal sections with a thickness of no less than 20 cm and grade of 210 kg/cm². A sample of concrete cubes should be taken according to the instruction of the supervising engineer. As for the cross sections, the contractor is obligated to pour concrete with a thickness of 20 cm and a strength of 210 kg/cm², provided that the contractor places reinforcement steel for the cross sections consisting of one layer ($\Phi 12 / m5$) in both directions.
- 11-If the distance between top of cement pipes and top of asphalt layer become for any reason less than 75cm the concrete layer should change to reinforced concrete layer with steel mesh equal to ($\Phi 12 / m5$) in both directions at any section of works
- 12-Cut the Existing Asphalt Layer before starting the excavation process and before Providing, supplying and spreading the asphalt during asphalt work, the cutting should be in a straight line using a mechanical cutting machine, and unify it in the areas that are exposed to zig-zagging resulting from collapses or expansion during the excavation process, no matter how exposed it is to continuous expansion.
- 13-The contractor is obligated to provide, supply, spread and compact an asphalt mixture (according to the specifications of the Ministry of Public Works and Housing) for the excavation sections after complete the concrete pouring process. A sample of this

asphalt mixture can be taken / working day, and the thickness will be not less than 5 cm after compaction, and it will be matching with the existing Asphalt levels.

- 14-The contractor is prohibited to spreading the asphalt mixture manually, except with prior approval from the supervising engineer, depending on the case.
- 15-The ends and edges of the longitudinal and cross-section of the old asphalt layer should be cutting by using mechanical scissors, at a distance of 25% of the width of the section on each side. The asphalt process is carried out using a mechanical spreader (Finisher), and the section is sprayed with (MC) and the edges of the section of the old asphalt is sprayed with (RC). before compaction the asphalt, using a mechanical sprinkler to distribute it homogeneously over the sections. It is prohibited to use the manual method of spraying. If the excavation after cutting is smaller than the width of the (finisher), the excavation will be enlarged according to the (finisher) and according to the instruction of supervising engineer.
- 16-The contractor must return the road asphalt as it was previously, with cutting and removing the damaged parts of the existing asphalt layer, according to the general specifications of the roads, according to the engineering Drawings, and the instructions of the supervising engineer.
- 17-The contractor must verify the road levels before starting the excavation work and bear responsibility for any errors in the engineering drawings, contractor have to submit a Shop Drawing (longitudinal sections with levels) and profile drawings before starting the work and obtain approval from the supervising engineer for all lines, profile plan shall be including existing and designed levels, distances between manholes, excavation depth, inlet and outlet level, slopes cumulative distance ... etc.
- 18-The contractor has to submit proposals for how to connect the lines proposed in the bid with the old lines or with the culverts or the end of the lines, and written approval must be obtained from the supervising engineer before starting implementation work.
- 19-Constructing Inspection Points (manholes) according to the engineering Drawings and the consultant engineer's instructions, so that the contractor shall use (Fair Face) class (A) Formwork, reinforce and pour concrete with a strength grade of not less than (250 kg/cm²) cubes after 28 days for the walls, ceilings and bases, and pour Concrete with a breaking strength of not less than 150 kg/cm² for Blinding Concrete under the base, with consider to use the vibrator while pouring reinforced concrete, and the contractor must curing the reinforced concrete for three days according to the engineer's instructions.
- 20-Providing, supplying and installing manhole covers with Frames, such that they are made of heavy-duty cast iron, with a bearing strength of no less than (350 kN) and a diameter of (600) mm, a cover must be provided for each manhole with iron fingers.
- 21-contractor shall write on the manhole cover the followings, as per drawings:
 - a. for rainwater manholes (channels water):
(Greater Amman Municipality/ Rainwater Drainage / 2024)
 - b. for spring water manhole
(Ministry of Agriculture/ Al Dalya Spring Water / 2024)

- 22-The contractor must visit the various work sites and verify the nature of the soil and excavation levels. He is not entitled to modify prices during the implementation phase, regardless of the nature of the work.
- 23-The contractor must coordinate with public institutions (electricity, communications, water, MPWH, ...etc.) to avoid causing any damage to these services. In the event of causing any damage to public services or citizens' property, the contractor must restore them to their correct conditions, and the contractor shall bear the expenses of restoring conditions and everything related. With the value of the damages and fines inflicted on the lines of the public institutions mentioned previously, and the contractor bears responsibility for removing, moving, or changing the levels of the service lines that obstruct the drainage line.
- 24-The responsibility for removing obstacles, whatever their type, shall be on the contractor, as the contractor is obligated to review all relevant competent authorities, and the contractor is obligated not to claim any malfunction or damage resulting from these obstacles, no matter how great the damage.
- 25-The contractor is committed to submitting a survey study of all streets before starting implementation, and he must obtain written approval for this study. He is committed to conducting field surveys of the already existing lines to connect them with the lines proposed in the bid. The contractor is also committed not to demand any bonus in exchange for conducting studies. The contractor is also committed to conducting Evaluation and study of weather depressions and rainfall within the streets targeted for the tender, provided that the rain accumulations are monitored, documented and presented officially for approval and treatment of water problems.
- 26-The contractor is obligated to Excavate to any depth, no matter how great and according to what the study needs, and he is not entitled to any financial claim resulting from the depths.
- 27-The contractor is obligated to carry out reinforced concrete for Wing Wall & Apron at every beginning and end of any Storm Water drainage line. The wings wall and apron shall not measure for prices but it will have charged on linear meter of concrete pipes. According to the drawings and instructions of the supervising engineer.
- 28-Make side openings in the manholes where necessary and according to the engineer's instructions to connect branch lines in the future.
- 29-The contractor must coordinate with the traffic department in the district / governorate, if necessary, to close some streets, make the necessary diversions, and provide them with all means of guidance and public safety and everything necessary. The contractor bears responsibility for paying compensation for any accident resulting from negligence in ensuring traffic and public safety requirements.
- 30-The contractor must place barriers, reflectors, traffic signs, and traffic diversion signals to warn pedestrians and cars, establish pedestrian paths with a width of (1.5 m), and place protective barriers on both sides to ensure public safety. He must protect the works during implementation according to the engineer's instructions.

- 31-The consultant engineer has the right to increase or decrease the distances between manholes, or cancel any manhole without the contractor's objection, or to postpone or cancel some lines, as he deems appropriate, and the contractor is not entitled to claim for that.
- 32-The contractor must verify the street levels before starting the excavation work and bear responsibility for any errors in the engineering plans. He must submit an executive plan/ Shop Drawing (longitudinal sections with levels) and profile plans before starting the work and obtain approval from the supervising engineer for all lines. The sites mentioned in the tender, whether they have engineering Drawings (longitudinal sections or Profile) attached to the tender or without Attached Drawings, Contractor must submit proposals for how to connect the lines proposed in the bid with the old lines or with the culverts or the end of the lines, and written approval must be obtained from the supervising engineer before starting implementation work.
- 33-The passage of chain excavators on asphalt surfaces is prohibited unless there are rubber rollers or any alternatives approved in advance by the supervising engineer.
- 34-After the excavation process, the contractor is obligated to provide safe bridges for pedestrians to cross every entrance to a house or building, or a bridge for every 3 commercial stores, according to population pressure.
- 35-samples of Base Course layer, Concrete and Asphalt layers can be taken all at the contractor's expense, regardless of their frequency.

- **Technical specifications for concrete pipes**

1. The Jordanian standard specifications 289/1994 for cement pipes shall be adopted as general specifications for this tender, and what is stated in these specifications shall be applied to it, taking into consideration what is stated below.
2. Laboratory tests are conducted in a laboratory approved by the supervising engineer, so that the contractor shall obtain written approval for the laboratory or laboratories in which the tests are to be conducted.
3. Samples are taken after the pipes reach to the site and shall be taken from each diameter as follows to conduct tests: For all diameters, two pipes shall be test, the test shall be conduct on the first pipe and the second pipe is in order to compare the dimensions and according to the engineer's instructions.
4. The pipes shall be made of reinforced concrete with a separation connection and must meet the conditions and requirements of the Jordanian standard specifications (Article 1/289/1994) for Concrete pipes and are of the type of high-resistance pipes, Class I (A), a pipe with a separation connection, pipes shall success to appear the warranty load and the maximum load together upon inspection.
5. The required pipes and their parts (Rings & Conic) shall be made of reinforced concrete and of the high-resistance pipes type, class I.

6. The contractor is responsible for the age of the pipes when samples are taken for testing, as the age of the pipes when broken must not be less than (28) days from the date of casting these pipes.
7. The contractor must take into consideration the following matters from the General Technical Specifications for Buildings of 1996, Volume One for Civil and Architectural Works:
 - a. Excavations: Item numbers: (201, 202, 204/4, 204/6, 204/9, 204/10, 207/1, 207/2, 207/3, 207/4, 209/1)
 - b. Supporting and shoring the side of excavations: Item No. (211).
 - c. Scaffolding: Placing pedestrian passages in the places specified by the supervising engineer.
 - d. Site planning: Clause (106/1, 106/2, 106/4, 107/3).
 - e. Concrete works: Items Nos. (302/1, 302/2, 302/7, 304/8, 304/11, 305, 306, 307, 308, 309/2/b, 311, 317, 320)
 - f. Installing and connecting pipes: Clause (1504/3, 1504/1).
8. Installing a warning tape under the concrete layer, indicating the type and depth of the lines below the warning tape.
9. The dimensions of the manholes are from the inside.
10. When the height of the manhole's floor above the road surface exceeds 1.5 m, the manholes must be provided with a steel ladder fixed to the manhole, measuring every 20 cm, and the price is based on the linear meter of the pipes.
11. The level of the bottom of the incoming pipe must be higher than the level of the bottom of the outgoing pipe by at least 5 cm (between the inlet and outlet pipes).
12. The width of the excavation shall not be less than the outer diameter of the pipe + 30 cm (15 + 15 lenticulars), provided that consideration is given to the use of the appropriate excavator to view the section and to protect the edges of the asphalt after cutting from being disturbed by the excavator used, The contractor must choose the appropriate bucket for the width of the excavation
13. Spreading and rolling the asphalt is done using a mechanical spreader (finisher), These materials are sprayed using a mechanical sprinkler to distribute them homogeneously over the sections. It is prohibited to use the manual method of spraying according to the opinion of the supervising engineer.
14. The slope of the lines must not be less than 0.5% for the main lines, and the supervising engineer has the right to decide according to reality what he deems appropriate
15. 13- The supervisory body or the owner has the right to request quality control samples for any part of the work and examine them in public works laboratories, the University of Science and Technology, or the Royal Scientific Society, at the contractor's expense and at any stage of the work.

- **Technical specifications for constructing manholes and grills**

1. This work includes rainwater drains and manholes made of reinforced concrete with the necessary covers and clamps. It is implemented according to the locations and dimensions on the drawings and the consultant instructions.
2. Concrete: The concrete used shall be grade (25) with a strength of not less than (250) kg/cm².
3. Reinforcing steel: The reinforcing steel must be a deformed steel and have a yield stress of not less than 280 N/mm².
4. The contractor is obligated to implement a riser for the manholes (conic, rings) or pipes with a suitable diameter, regardless of the height level between manhole's ceiling and road surface, and these Risers will be included in the price of the manhole.
5. The inner side of floor and walls of the manholes and Grills shall have smooth faces (FIAR FACE), class (A).
6. The contractor is obligated to provide, supply and spread a graded aggregate (Base course) with a thickness of 20 cm at the bottom of the manholes and grills, according to the engineering drawings and at the bottom of the blinding concrete layer, so that the degree of compaction is not less than 95%.

- **Technical specifications for manhole & Grill cover**

1. Supply and install a grill's covers with frames from wrought steel for drainage of rainwater with clear dimension of 60cm width and 6m length and the clear depth shall be not less than 1.0m, the dimension and steel detail as per drawings and specifications, the work shall include steel cover with dimensions of 0.60mx1.0m as detailed, total number required for the works is 6 grills (0.6x1.0m), the grills consist of steel angle 8cmx8cm and 10mm thickness, and the inner steel members are 8.0cm with thick of 10mm the distances between these members are 3cm from edge to edge, and the price include the excavation work, reinforced concrete, grade 25, with a breaking strength of 25 kg/cm² with a period of 28 days, reinforcement steel as per detailed in the drawings. and including also everything necessary to complete the work according to technical standards and take into account general safety terms, the work must be completed according to Jordanian specifications and standards, as well as special and general specifications according to the attached drawings and according to the instructions of the supervising, a ring shall be provided for each cover, to facilitate cleaning the grill trench, also bituminous primer paint shall apply for all grill steel elements, on both sides, before installation and according to the consultant instructions.
2. The required manhole covers shall be made of heavy duty cast iron, with the necessary rings also made of cast iron, and shall have a regular and acceptable

external shape and be free of gaps and any other defects. One random sample shall be taken for test.

3. These steel covers shall be delivered to the site coated with a bituminous-based layer, provided that this layer is smooth and consistent and not susceptible to runny nose or peeling when exposed to temperatures ranging between 0 and 63 degrees Celsius.
 4. Loading test: One random sample shall be taken in order to test it according to Specification No. (BS-479). The covers must pass the loading test and all covers must be able to bear the specified load, which is (350) KN for a period of not Less than half a minute.
 5. The size of the grill will be (100*60) cm from the inside and according to the drawings.
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Rehabilitation of Al-Kursi Spring

A- Brief of Work

Rehabilitation work for Al Kursi spring, the work includes the following:

- 1- Removing and cleaning all obstacles (Rock, stone, rubbish, Roots, grass ... etc.).
- 2- Leveling the spring yard as per consultant instruction and approvals, the level will be varied depend to the location and depth of spring source and cave opening (if available cave).
- 3- Soil shoring system by Soil Nails Wall (Shoring of soil-Cut Which Surrounded the Spring).
- 4- excavation and offset 2m in the elevation 2 & 3 for soil cut around the spring source in order to implement a gabion wall at the excavation area to stabilize the soil cut there and to as per drawings and specifications.
- 5- Carrying out a gabion walls with length and height as per drawing, the location of these walls shall be on the elevation 2 and 3 after complete the excavation works by offset 2.0m away from spring source, the work shall comply with the specification and under consultant instructions.
- 6- Detection of Spring Source and do a shoring by soil nails system: contractor to Excavate Carefully in the spring source throw soil-cut to find the exact water flow location this will facilitate to assign the location of reinforcement collector water tank,

which will have implemented to carry the spring water from the source (soil-cut) Contractor to follow the instruction by consultant supervisor/Engineer.

- 7- Carrying out of Steel Fences (Chain link Fence) (Baqlawa) above top of soil-Cut (above shoring wall) at the high level and to reach the road boarder, as per drawings, also carrying out of steel gate 3mX2.65m.
 - 8- Carrying out steps using stones with cement mortar (stone steps) to be access for human to enter the spring yard.
 - 9- Carrying out of concrete collector tank with dimension 1.8X1.8m and height of 1.65m, for collection the spring water before the flow start on channels.
 - 10- Carrying out interlock tiles in the spring yard as per drawing, detail and specifications.
 - 11- Carrying out of Drainage line of concrete pipes 900mm for Spring water to carry the water from collector tank to the manhole which have to implement before crossing the road.
 - 12- Carrying out one manhole before crossing the existing road by the spring water concrete pipes.
 - 13- Implementation of guardrail (road rail) at the boarder of existing road with spring yard to protect the vehicles of fall down inside spring yard.
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B- Work description

Rehabilitation work for Al-KURSI Spring area such as detection of Spring Source, Preparation & shoring for soil-cut, remove the obstacles, with consider the spring water shall be running and not stop the flow of water during implementation of all parts of rehabilitation works. The rehabilitation works include the following:

- 1- Cleaning and leveling the ground of spring: the contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings and consultant instructions.
- 2- contractor to Excavate Carefully in the spring source throw soil-cut to find the exact water flow location this will facilitate to assign the location of reinforcement collector water tank, which will have implemented to carry the spring water from the source (soil-cut) Contractor to follow the directions by consultant supervisor/Engineer.
- 3- implement of shoring soil system for soil-cut which the water of spring is coming from, by using soil nails system & shotcrete with steel reinforcement including all accessories and materials which required to complete the work which consists of installing passive reinforcement in existing ground by installing closely spaced steel bars or nails, and

placing a front face support. Soil nails are later grouted when they are installed in drilled holes.

- 4- Implemented of Soil Nails at the spring opening (water spring Source) in case of spring sources comes from the soil cut, the design of these nails shall be as per the drawings and specifications.
 - 5- Reinforced concrete collector tank for Spring source : contractor to carrying out the collector tank (water tank) for spring water to be contact directly with the spring sources after indication and discovering the spring source, the dimensions of this tank equal (1.8mx1,8m) and height of 1.65m as per drawings, it is allowing to supply and install a precast water tank with all required dimensions and specifications and as per instruction by consultant supervisor/ engineer but the contractor should be fixing a 5 no. of soil nails in the foundation or wall of water tank with minimum length 4m, to be fixed with contacted soils.
 - 6- Supply and apply interlock stone after prepare the spring area, it will be as per the
 - a. Drainage line for spring water shall be carrying out as per drawings, to carry the Spring-water to the existing Pipes below asphalt road.
 - b. Drainage line by Executing and installation of one row of concrete pipes with Diameter equal (900mm) and connected between the spring source and existing concrete pipe below asphalt road.
 - 7- Carrying out Manholes for Spring-water: one manhole by inner dimension of (1.4mx1.4m) for 900mm diameter concrete pipe should be implemented as per tender drawings and specification and conditions.
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C- Soil Nails wall work / Soil shoring system for stabilize the rock-cut surfaces

Soil Nails wall work Includes the following items:

Special Condition for Soil nails Wall

- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor can provide a proposal for any works or activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the spring's water flow during all stages of the work.
- The dimension, numbers, lengths or any required specification for the soil nails wall it will be available tender drawings and details, this drawing designed for shoring the rock-cut surface.

Descriptions and specification of Soil Nails Wall Works

The sequence of construction for soil nail walls includes the following major steps:

1. Excavation (in case of required cutting soil to specified levels)
2. Drilling of nail holes
3. A) Nail installation and grouting
B) Installation of strip drain
4. Construction of initial shotcrete facing
5. Construction of subsequent levels (Repeat Steps 1-4)
6. Construction of final facing

1. Excavation:

- a. In the existing soil-cut, the rock profile is already excavated and exposed, the contractor is to find a suitable idea to construction of soil nail walls with all stages, for example, the contractor can do Backfill for the rock surface as platforms level, after that construct soil nail walls from upper level to lower level, then excavation again to carry out the subsequent levels, or the contractor shall provide special equipment (Machine) to do the works as per site condition. Contractor shall submit to consultant a Method statement for all works and for each activity.
- b. For excavation works, soil excavation is performed using earth-moving equipment from a platform, and final trimming of the excavation face can be carried out using a backhoe or excavator from this platform, also to cut and remove the loose materials from the rock profile and reformation the surfaces to be ready for Shotcrete Work, The excavated face profile should be smooth and not too irregular to minimize excessive shotcrete quantities and provide Good View of face profile after complete the final facing.

2. Nails Hole:

- Soil Nail Inclination is 15 degrees from the horizontal.
- the contractor shall use the drill hole diameter as specified, with consider the minimum drill hole diameter shall be (4 to 8 in) to provide the bond resistance required for stability, to obtain the specified nominal pullout resistance and to possibly allow cleaning the drill hole, or accommodating a Grout pipe, Nails, and centralizers.
- soil nails shall place in a drilling hole that are drilled and grouted in a two-step operation:
 - o first step, drill holes shall have drilled at a shallow angle (15 degrees from horizontal) using cased or open-hole techniques.
 - o second step, the nails shall insert and grout in the drill holes.

3. Soil Nails Bar (Dia. Spacing, Length, Grade)

- Solid bar are the used soil nails. The dia. of soil nails is 25mm, soil nails must be threaded a minimum of (6 in.) on the cut face to allow proper attachment of the bearing plate and nut.

- Solid-Threaded Bars has a nominal tensile strength of 60 ksi (Grade 60), and has to conform to ASTM A615, also a special Epoxy paint should apply on full surface of solid steel for corrosion protection.
- The horizontal nail spacing, SH, equal to the vertical nail spacing, SV and equal to 5 ft.
- The first row of nails should be installed about 2 to 3 ft. from the top edge of the wall
- The lowermost row of nails should be installed about 2 to 3 ft. above the base of the excavation depend to the site condition.
- the soil nails are varying in lengths depend to excavation and other conditions depth (Wall height), therefore the lengths of the soil nails are calculated and indicating in the section drawing No. (Draw. No.).
- Soil Nails length is indicated in the attached drawings.

4. Components of Soil Nails Bar: the contractor shall provide the main components of soil nails wall which are depicted in the drawings.

- Bearing Plate: The bearing plate Grade 36 (AASHTO M183/ASTM A36), the Bearing Plate is square and flat with dimension should be (8- to 10 in.), with thicknesses of 0.75 to 1 in.
- Washers and nuts: must meet the requirements of AASHTO M291/ASTM A563 Grade B.
- headed studs: The connection to the final facing consists of four headed studs that are welded to the bearing plate and embedded into the final facing.
- Centralizers are made of polyvinyl chloride (PVC) or other synthetic materials not detrimental to the solid bar (Figure 3.8), Centralizers should have installed at various locations along the length of each solid bar to ensure that a minimum thickness of grout completely covers the solid bar, Centralizers should have installed at regular intervals, not exceeding 10 ft along the length of the nail and at a distance of about 1.5 ft from each end of the nail. Centralizers must be securely attached to the solid bar and must be sized to allow: (i) positioning the solid bar within 1 in. of the center of the drill-hole; (ii) inserting the grout-pipe to the bottom of the drill hole; and (iii) grout to freely flow up the drill hole.

5. Grout:

- When solid bars are installed, grout have to pumped shortly after the solid bar is placed in the drill hole to reduce the potential for squeezing or caving of the hole. For these applications, the grout is injected through a grout pipe inserted to the bottom of the drill hole until the grout fills the hole
- The grout can flow at inclinations of Nails Hole from the bottom of the drill hole to the head.
- The grout is Non-Shrinkage Cement Grout (sulfate resistance cement), the minimum compressive strength for the grout should be 1,500 pounds per square inch (psi) at 3 days, and 3,000 psi to 4,000 psi at 28 days, as tested in accordance with AASHTO T106/ASTM C109

- The water/cement ratio for grout used in soil nailing applications ranges from 0.4 to 0.5 in neat cement mixes, which is equivalent to a specific gravity of 1.8 to 1.9

6. Drain Strip and PVC Pipes

- The strip drains are fitted with drainage elements that allow exit of the water from the strips to the outside of the wall, as depicted in Figure 3.12. Strip drains are also fitted to discharge into a pipe drain running along the base of the wall and/or through weep-holes discharging through the facing and to the toe of the wall.
- Drain strips are equidistant from nails in the pattern, vertical geo-composite strip drains should be installed behind the (initial facing) and adjacent to the (excavation face) (Figure 3.12), to limit water pressure development behind the wall facing.
- Most drainage elements are made of PVC and consist of a Snap-On cap or grate, and an exit PVC pipe connected to the underdrain system. Generally, the underdrain system consists of a drainage pipe embedded in an aggregate-filled trench, which runs along the bottom of the excavation. The underdrain system pipe, as well as the pipe fittings, should meet the requirements of Schedule 40 PVC solid and perforated wall. The drainage pipe is slotted PVC or polyethylene (PE) surrounded by clean, coarse-gravel sized aggregate that is free of fine particles.
- Geo-composite strip drains consist of a drainage core and a filtration geotextile attached to or encapsulating the core. The drainage core is manufactured from synthetic polymers composed of polypropylene, polyester, polyamine, PVC, polyolefin, or polystyrene. The core should have a minimum compressive strength of 40 psi when tested in accordance with ASTM D1621 Procedure A. In general, the drainage core with the geotextile fully encapsulating the core must have a minimum flow rate of 0.1 gallons per second per foot of strip width, when tested in accordance with ASTM D4716.

7. Wall Facing: Nails must be connected to a facing system at the excavation face or slope surface, the Facings consist of an initial facing of shotcrete and a final facing of shotcrete or cast-in-place concrete.

a. Construction of initial shotcrete facing:

- o Contractor shall carry out the initial shotcrete facing, which consists of shotcrete and welded wire mesh, Shotcrete provides a continuous layer over the excavated face and fills irregularities.
- o Initial shotcrete thickness shall be between 3 - 4 in.
- o Contractor shall supply and apply Welded wire mesh (WWM) which is sold in panels or sheets, the opening between wires (2in.x2in.) and wire thickness (6-8mm), the overlapping should be at least one full mesh cell.
- o Contractor should consider during construction of initial shotcrete to covers the exposed soil with the exception of a narrow band at the bottom of the lift, this band shall

remain uncover to expose the lowest portion of the WWM and strip drains, and allows for the overlapping of these elements in the next excavation lift.

- contractor shall provide and install a short reinforcement bar which called waler bars and vertical bars around the nail heads.
- Contractor shall select a width of WWM panel to be consistent with the excavated lift height (equivalent to the vertical nail spacing plus an overlap of at least one full mesh cell).

b. Construction of final facing

- The total thickness of a reinforced final shotcrete facing is between 6 and 10 in.
- Contractor shall apply the final facing after the deepest lift of the initial facing is completed, and is advanced in phases from the bottom up, in order to achieve the required scenery which planning to carrying out in the final facing wall as per Drawings.
- The reinforcement of final facing is a rebar (5Φ14/m), this Reinforcing steel must meet the requirements of AASHTO M31/ASTM A615, Grade 420, deformed
- waler & vertical bars are not required to use in the Final facing, due to available a reinforced shotcrete by using rebar reinforcement.
- In this work the final view of soil nail walls has a special beauty view requirement. Therefore, contractor to be sure the even finish and color of final shotcrete facing to meet these requirements, Wood, steel, or rubber tools can be used on the as-shot surface to smooth the shotcrete, and to add grooves to create a more beauty view finish. Finished shotcrete surfaces can also be colored with pigmented sealers.
- The contractor shall provide all materials that required to execute the Planned scenery on the wall to be as final view which is consist of (like sculpted Palms trees) as per drawings, contractor shall provide shuttering, wood mold, much-up or any ideas that lead to achieve the works of Final facing as required, contractor shall submit method statement to consultant for approvals issue, shotcrete with reinforcement bars should have used for these final view works.

D- Gabion Wall Specifications

The below shall be considered during implementation of gabion walls:

- 1- The size of available stone at the site shall be considered in order to assign the size of mesh opening.
- 2- The front or rear face shall be inclined by 10 degrees from the vertical axis, toward the backfilling face.
- 3- Width of foundation shall be 40% of height in case of rock foundation and 60% from height in case of dense sand, and less than 60% in case of loos sand.
- 4- The depth of foundation shall be not less than 30cm, with consider to avoid the loose soil or weak soil.

- 5- Place a gabion cage on top of each other (if required), at least 40 cm apart from the cage's dividers.
- 6- The binding shall do with wires of not less than 3 mm in diameter, and at least two turns per tie, at the recipient of the cross bars. It should also be taken into consideration that adjacent sections shall connect in the same manner.
- 7- The front face of the Gabion mat shall tie to the back face with 10 mm or 8 mm diameter steel bars (hooks) in order to prevent the cages from denting. The spacing between the hooks is approximately 80 cm and they are installed in a zigzag manner, taking into account that the outer bars of the face have to tie to prevent the loosening of the free bars.

c. properties of materiel:

- a. Rocks: The rocks used must be of a hard quality and resistant to erosion and fragmentation factors, with a specific gravity of not less than 2.4 and a water absorption of not more than 6%, a small size must be approximately 10 cm and large sizes must be approximately 30 cm, and the other sizes must be graduated between these two sizes.
- b. Mesh wires: The mesh wires must be made of galvanized steel with a diameter of not less than 3 mm (No. 11) with a tensile strength ranging between 6000-42000 kg/cm², and the amount of zinc coverage according to the test (ASTM A71-A641) should be 270 kg/m² of Uncovered mesh surface.

E- Chain link steel Fence and steel gate

supply and install Steel fence in two locations the first at spring yard including one steel gate, and the work contains the following article and the second on the top of soil nails wall (top of rock-cut):

- 1- supply and install Steel fence with a clear height of 2.0m and the vertical pipe shall has embedded 50 cm inside footing underground level as per drawings and details.
- 2- steel fence consisting of galvanized steel mesh (Baqlawa) dimension of 4cmX4cm and 4 mm thickness, its surrounded with galvanized steel-pipes of diameter (2"), and the vertical galvanized steel-pipes of diameter (3") shall erect every 4 m with a top cap.
- 3- The works including all accessories, plates and steel parts shown in the drawings and details.
- 4- the work including all tools, machines, parts and materials which required to implemented a double-leaf door with width 3.0m and height 2.65m for Spring yard entrance according to the drawings and details, the work include the all screws, bolts, welding or any type of elements required to complete the work.
- 5- All fence elements shall be full covered and painted by special layer to resist weather factors.
- 6- The Locations for installation the steel fences are: first location is above the existing stone wall and the other is above the shoring wall of spring
- 7- Part of vertical pipes shall be embedded amount (40cm) inside a reinforced footing, the dimensions of these footings are (40cmX40cm and depth of 50cm) and reinforcement steel is (Φ12/12 cm).

F- Special Condition for Rehabilitation Springs & Channels:

- The contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and to keep the site clean for channels works.
- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor shall provide all necessary equipment, Manpower, Tools, shutter, ... etc., which will be required to complete the works
- The contractor can provide a proposal for any works or any activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the spring's water flow and channel's water flow during all stages of the work.
- The price for implementation a new channel is including the demolishing of the old channels, cleaning and removing all obstacle, excavation if required, backfilling, materials, tools, machine manpower and all the necessary that required to complete the works in the best quality, also contractor shall be keep running the flow of water fulltime during execution duration for all activities.
- Channels, collector water tank or other concrete elements the concrete cover (Steel Cover) is (5 cm-7.5cm) if the element contact directly with the soil, and (3cm) if the structure element not contact directly with soils.
- The contractor shall Obtain Necessary authorization for start-up and execution of works and this includes (but not limited to) all permits and approvals related to the use of land, permission to build and access, as well as all relevant governmental bodies authorization depending on the proposed project requirements and on the national law.
- the contractor shall submit Method statement for any activity as per consultant instructions such as method statement for soil nails wall, storm water drainage line, channels, etc.
- The dimensions are according to the drawing and the supervisor instructions.
- For any case of reinforced concrete which will contact direct to soil, Base Coarse (min. thick 15cm and MDD 95%) and Blinding concrete (10 cm) should be applied at the below of reinforced concrete as layers, if this mentioned in drawings or not.
- The contractor shall provide any required type of shutter (Formwork), including fair-face timber in order to complete the required works and as per consultant instructions.

- The contractor shall implement a concrete collector tank which should be connected directly with the Spring sources to collect all water that Coming from spring before flowing throw the channels.
- The contractor shall supply and install a Water-stop rubber (thick. 20-25cm) for any size of Concrete-collector-tank at any spring, the location of this rubber shall be in the contact between foundation and vertical walls, first half width of this water-stop should embed in the foundation and the other half should have imbedded in the vertical walls.
- Dimension of Collector water tanks or channels for any springs shall as per drawings, and the compressive strength for theses tanks are 250 kg/cm³, concrete slump 10cm, the contractor shall provide concrete cubes for compressive strength test using 15cmX15cm cubes, the number of cubes for any test shall be 6 cubes, the first 3 cubes for doing the test and take the average, and the Additional 3 cubes for spare in case of failing the first cube test we can use it to do the test again.
- Steel specifications are ASTM designation A-615 or equivalent, stress =4200 kg/cm², grade 60
- For any reinforced concrete works, plastering works, ... etc. the concrete has to be cured with water for three days two times a day, vibrator shall provide and use during casting a reinforced concrete.
- In case of segregation, it must be treated with special filler-expansion materials and according to the consultant instructions and approvals, the consultant can decide for treatment or demolishing (removing) the concrete structure and the contractor have to follow the instructions by removing this structure and redo the work.
- Wall and roof shutters should not be removed before 3 and 14 days after casting respectively.
- ready mix concrete is the allowed concrete for any part of reinforced concrete structure, the contractor shall submit mix design for consultant approvals, in special cases and conditions it is allowed to use onsite-mixing and manual casting, with consider the percentage of mix components during onsite-mixing.
- The prices for all required materials, tools, shuttering, fixing steel, casting concrete, ...etc. are included in the unit prices unless it mentioned otherwise.
- The contractor shall provide a cover-block (Plastic or concrete) as required for channels, concrete water tank or other concrete elements, the concrete cover (Steel Cover) is (5 cm-7.5cm) if the structure contact direct with the soil, and (3cm) if the structure not contact directly with soils.
- The levels which indicated in the drawings of spring's underground water tank are from Surveying work results, therefore, if required to change any level from these levels for any reason during the work conditions, the other related levels should be change also, to keep the constructions depth or high as same as before changing the origin level.
- The contractor shall implement a concrete collector tank with dimension 1.8X1.8m and height of 1.65m, the work shall include (but not limit to) all the necessary accessories, materials, tools equipment, etc. which required to accomplish all the activities.

- The contractor shall Excavate in all types of soil and rock according to drawings levels and dimensions and to the technical specifications. The work starts by clearing, grubbing of top soil as specified.
 - For any concrete construction or sub-elements for any works in the tender such as collector tanks, manholes, Channels or etc., the contractor shall Excavate any type of soil or rock according to drawings dimensions and to the technical specifications.
 - The contractor also for any kind of activity and according to the drawings and specifications, shall do an Cleaning and Leveling, remove all debris, excavated materials, Rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
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G- PRECAST CONCRETE PAVERS, Curbs and Interlock

1- Interlock

- Contractor shall Provide and install an interlock measuring 10X20X6.5cm in different colors according to the owner's choice and the samples provided by the contractor.
- The work includes a layer of compacted sand with a thickness of 10cm with all the necessary slopes and everything necessary according to the specifications, drawings and instructions of the supervising engineer.
- Portland Cement: BS 12 or ASTM C 150, for ordinary Portland cement. Cement used shall be from the same mill and manufacturer to ensure uniform color for the entire paver units required for the project.
- Aggregates: The aggregates to be used in the manufacture of the paving must be provided from a single approved source to ensure uniformity of color, size and shape and shall be conforming to the requirements of BS EN 12620.
- Admixture: ASTM C260, air-entraining type.
- Water: Potable clean water clean and free from deleterious substances.
- Pigment to be used in manufacturing of precast concrete interlocking blocks shall be in the form of dry, soft powder and shall not contain chemical compounds that may affecting adversely the setting and development of strength of the cement and other properties of the product.

2- Curbs

- contractor shall Provide and build precast concrete stone (Curbs) of class (B) where necessary. The price includes a curb stone of 30 MPa grade concrete, with a length 50cm and height of 30cm and width of 10/15 cm, and the thickness of back-support concrete is 10cm with height of 20cm.
- The price includes the mortar and special paint according to the owner's choice, as well as excavation and backfilling from any soil types, and everything necessary to complete the work according to specifications, drawings and instructions of the supervising engineer
- Portland Cement: BS 12 or ASTM C 150, for ordinary Portland cement. Cement used shall be from the same mill and manufacturer to ensure uniform color for the entire paver units required for the project.
- Aggregates: The aggregates to be used in the manufacture of the paving must be provided from a single approved source to ensure uniformity of color, size and shape and shall be conforming to the requirements of BS EN 12620.
- Admixture: ASTM C260, air-entraining type.
- Water: Potable clean water clean and free from deleterious substances.
- Pigment to be used in manufacturing of precast concrete interlocking blocks shall be in the form of dry, soft powder and shall not contain chemical compounds that may affecting adversely the setting and development of strength of the cement and other properties of the product.
- Type: Precast concrete of 30 MPa, 28-day compressive strength.
- Nominal Size: L 500mm x H 300mm x W 10mm/150mm or as per drawings.
- Style: Precast edge with fair face finish, and Laser cut.
- Surfaces of all precast units shall be carefully cleaned on completion, taking care to avoid any damage.
- Adequate protection shall be given to all the completed work, to avoid damage from any subsequent activities.
- Any damage caused to completed work shall be made good by the Contractor at his own expense.
- Providing and supplying concrete curb stone for the springs area as assign in the drawings, with the addition of a corrosion- and moisture-preventing material, the curb stone dimensions is according to the following (10/15 cm x 50 cm x 30 cm). It shall laboratory-successful and delivered to the site according to the consultant instructions.
- Building a concrete curb stone, making the necessary grout and back support concrete, and making the foundation that ensures the leveling of the stone according to the technical specifications, special conditions, and the engineer's instructions.
- Dimensional tolerance does not exceed (+- 3 mm)
- Transverse fracture load: According to the Jordanian standard, the transverse fracture load should not be less than (30 N), and the water absorption rate should not exceed (8%) of the weight, and the cement percentage should be appropriate to obtain the required specifications.

- The contractor must remove and transport the Curb stone that does not conform to the specifications from the work site at his own expense, and bring the replacement that conforms to the specifications to the site.
 - The Curb stone is supplied to the site, which includes supplying it to the site, unloading the stone from the car, and distributing it in the locations specified by the engineer, all of which is at the contractor's expense.
 - The contractor will replace any broken stone as a result of the unloading at his own expense
 - The contractor is responsible for all excavation works to a depth of no less than 18 cm below the level of the asphalt and a width of 30 cm, according to the instructions of the supervising engineer.
 - The contractor must use a foundation of regular concrete (ready-mixed concrete) with a breaking strength of no less than 210 kg/cm², with a width of 30 cm and a thickness of 10 cm to ensure the levelness of the curb stone.
 - The concrete plate must be cured with sufficient water for three days under the supervision of the engineer to ensure the watering process is complete.
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H- Drainage Line of spring water at Al Kursi spring yard:

- **The work contains the following article:**

- 1- Carrying out excavation work, providing and installing concrete pipes of different diameters, and constructing the necessary manholes and grills according to the engineering Drawings and according to the engineer's instructions.
- 2- The contractor must cut the layer of asphalt for the streets to be excavated according to the required width in order to prevent deformation and damage to the existing asphalt layer.
- 3- Carrying out excavation work of all types and everything necessary to complete the work.
- 4- The contractor must remove the rubble and excavation materials as soon as possible and not leave them on the site, and throw them outside the site in the yards designated for landfills which approved by consultant engineer and Authorized Departments.
- 5- Providing, supplying and spreading coarse sand (Single size), the result of laboratory-successful crushing of crushers, with a layer thickness of no less than (15) cm under the cement pipes.
- 6- Providing, supplying and spreading coarse (single size), the result of laboratory-successful crushing of crushers, on the sides of pipes with a thickness of (15) cm.

- 7- Providing, supplying and spreading coarse (single size) sand, the result of laboratory-successful crushing of crushers, on over of Cement pipes and below of Base coarse, (between top of Cement Pipes and Bottom of Base coarse)
- 8- Providing, supplying and spreading coarse sand (lenticular), the result of laboratory-successful crushing of crushers, below the level of 75 cm of the asphalt layer and above the lenticular layer (30 cm from the outer diameter of the culvert).
- 9- Providing, supplying and spreading graded aggregate (Base course) with a thickness of 20cm before Compaction according to the engineering Drawings over the Single Size layer that was spread over the Cement Pipes, so that the degree of compaction for the Base Course layers under the asphalt, is not less than 98% and to be consider to expand the excavation by a distance of 25% of the width of the excavation to increase the width of the base course layer (underneath the concrete layer) so that the total width under the concrete layer is covered according to Paragraph 13.
- 10-The contractor is committed to pouring concrete (fast-hardening) for the longitudinal sections with a thickness of no less than 20 cm and grade of 210 kg/cm². A sample of concrete cubes should be taken according to the instruction of the supervising engineer. As for the cross sections, the contractor is obligated to pour concrete with a thickness of 20 cm and a strength of 210 kg/cm², provided that the contractor places reinforcement steel for the cross sections consisting of one layer ($\Phi 12 / m5$) in both directions.
- 11-If the distance between top of cement pipes and top of asphalt layer become for any reason less than 75cm the concrete layer should change to reinforced concrete layer with steel mesh equal to ($\Phi 12 / m5$) in both directions at any section of works
- 12-Cut the Existing Asphalt Layer before starting the excavation process and before Providing, supplying and spreading the asphalt during asphalt work, the cutting should be in a straight line using a mechanical cutting machine, and unify it in the areas that are exposed to zig-zagging resulting from collapses or expansion during the excavation process, no matter how exposed it is to continuous expansion.
- 13-The contractor is obligated to provide, supply, spread and compact an asphalt mixture (according to the specifications of the Ministry of Public Works and Housing) for the excavation sections after complete the concrete pouring process. A sample of this asphalt mixture can be taken / working day, and the thickness will be not less than 5 cm after compaction, and it will be matching with the existing Asphalt levels.
- 14-The contractor is prohibited to spreading the asphalt mixture manually, except with prior approval from the supervising engineer, depending on the case.
- 15-The ends and edges of the longitudinal and cross-section of the old asphalt layer should be cutting by using mechanical scissors, at a distance of 25% of the width of the section on each side. The asphalt process is carried out using a mechanical spreader (Finisher), and the section is sprayed with (MC) and the edges of the section of the old asphalt is sprayed with (RC). before compaction the asphalt, using a mechanical sprinkler to distribute it homogeneously over the sections. It is prohibited to use the manual method of spraying. If the excavation after cutting is smaller than the width of the (finisher), the

excavation will be enlarged according to the (finisher) and according to the instruction of supervising engineer.

- 16-The contractor must return the road asphalt as it was previously, with cutting and removing the damaged parts of the existing asphalt layer, according to the general specifications of the roads, according to the engineering Drawings, and the instructions of the supervising engineer.
- 17-The contractor must verify the road levels before starting the excavation work and bear responsibility for any errors in the engineering drawings, contractor have to submit a Shop Drawing (longitudinal sections with levels) and profile drawings before starting the work and obtain approval from the supervising engineer for all lines, profile plan shall be including existing and designed levels, distances between manholes, excavation depth, inlet and outlet level, slopes cumulative distance ... etc.
- 18-The contractor has to submit proposals for how to connect the lines proposed in the bid with the old lines or with the culverts or the end of the lines, and written approval must be obtained from the supervising engineer before starting implementation work.
- 19-Constructing Inspection Points (manholes) according to the engineering Drawings and the consultant engineer's instructions, so that the contractor shall use (Fair Face) class (A) Formwork, reinforce and pour concrete with a strength grade of not less than (250 kg/cm²) cubes after 28 days for the walls, ceilings and bases, and pour Concrete with a breaking strength of not less than 150 kg/cm² for Blinding Concrete under the base, with consider to use the vibrator while pouring reinforced concrete, and the contractor must curing the reinforced concrete for three days according to the engineer's instructions.
- 20-Providing, supplying and installing manhole covers with Frames, such that they are made of heavy-duty cast iron, with a bearing strength of no less than (350 kN) and a diameter of (600) mm, a cover must be provided for each manhole with iron fingers.
- 21-contractor shall write on the manhole cover the followings, as per drawings:
 - a. for rainwater manholes (channels water):
(Greater Amman Municipality/ Rainwater Drainage / 2024)
 - b. for spring water manhole
(Ministry of Agriculture/ Al Dalya Spring Water / 2024)
- 22-The contractor must visit the various work sites and verify the nature of the soil and excavation levels. He is not entitled to modify prices during the implementation phase, regardless of the nature of the work.
- 23-The contractor must coordinate with public institutions (electricity, communications, water, MPWH, ...etc.) to avoid causing any damage to these services. In the event of causing any damage to public services or citizens' property, the contractor must restore them to their correct conditions, and the contractor shall bear the expenses of restoring conditions and everything related. With the value of the damages and fines inflicted on the lines of the public institutions mentioned previously, and the contractor bears responsibility for removing, moving, or changing the levels of the service lines that obstruct the drainage line.

- 24-The responsibility for removing obstacles, whatever their type, shall be on the contractor, as the contractor is obligated to review all relevant competent authorities, and the contractor is obligated not to claim any malfunction or damage resulting from these obstacles, no matter how great the damage.
- 25-The contractor is committed to submitting a survey study of all streets before starting implementation, and he must obtain written approval for this study. He is committed to conducting field surveys of the already existing lines to connect them with the lines proposed in the bid. The contractor is also committed not to demand any bonus in exchange for conducting studies. The contractor is also committed to conducting Evaluation and study of weather depressions and rainfall within the streets targeted for the tender, provided that the rain accumulations are monitored, documented and presented officially for approval and treatment of water problems.
- 26-The contractor is obligated to Excavate to any depth, no matter how great and according to what the study needs, and he is not entitled to any financial claim resulting from the depths.
- 27-The contractor is obligated to carry out reinforced concrete for Wing Wall & Apron at every beginning and end of any Storm Water drainage line. The wings wall and apron shall not measure for prices but it will have charged on linear meter of concrete pipes. According to the drawings and instructions of the supervising engineer.
- 28-Make side openings in the manholes where necessary and according to the engineer's instructions to connect branch lines in the future.
- 29-The contractor must coordinate with the traffic department in the district / governorate, if necessary, to close some streets, make the necessary diversions, and provide them with all means of guidance and public safety and everything necessary. The contractor bears responsibility for paying compensation for any accident resulting from negligence in ensuring traffic and public safety requirements.
- 30-The contractor must place barriers, reflectors, traffic signs, and traffic diversion signals to warn pedestrians and cars, establish pedestrian paths with a width of (1.5 m), and place protective barriers on both sides to ensure public safety. He must protect the works during implementation according to the engineer's instructions.
- 31-The consultant engineer has the right to increase or decrease the distances between manholes, or cancel any manhole without the contractor's objection, or to postpone or cancel some lines, as he deems appropriate, and the contractor is not entitled to claim for that.
- 32-The contractor must verify the street levels before starting the excavation work and bear responsibility for any errors in the engineering plans. He must submit an executive plan/ Shop Drawing (longitudinal sections with levels) and profile plans before starting the work and obtain approval from the supervising engineer for all lines. The sites mentioned in the tender, whether they have engineering Drawings (longitudinal sections or Profile) attached to the tender or without Attached Drawings, Contractor must submit proposals for how to connect the lines proposed in the bid with the old lines or with the culverts or

the end of the lines, and written approval must be obtained from the supervising engineer before starting implementation work.

33-The passage of chain excavators on asphalt surfaces is prohibited unless there are rubber rollers or any alternatives approved in advance by the supervising engineer.

34-After the excavation process, the contractor is obligated to provide safe bridges for pedestrians to cross every entrance to a house or building, or a bridge for every 3 commercial stores, according to population pressure.

35-samples of Base Course layer, Concrete and Asphalt layers can be taken all at the contractor's expense, regardless of their frequency.

- **Technical specifications for concrete pipes**

1. The Jordanian standard specifications 289/1994 for cement pipes shall be adopted as general specifications for this tender, and what is stated in these specifications shall be applied to it, taking into consideration what is stated below.
2. Laboratory tests are conducted in a laboratory approved by the supervising engineer, so that the contractor shall obtain written approval for the laboratory or laboratories in which the tests are to be conducted.
3. Samples are taken after the pipes reach to the site and shall be taken from each diameter as follows to conduct tests: For all diameters, two pipes shall be tested, the test shall be conducted on the first pipe and the second pipe is in order to compare the dimensions and according to the engineer's instructions.
4. The pipes shall be made of reinforced concrete with a separation connection and must meet the conditions and requirements of the Jordanian standard specifications (Article 1/289/1994) for Concrete pipes and are of the type of high-resistance pipes, Class I (A), a pipe with a separation connection, pipes shall succeed to appear the warranty load and the maximum load together upon inspection.
5. The required pipes and their parts (Rings & Conic) shall be made of reinforced concrete and of the high-resistance pipes type, class I.
6. The contractor is responsible for the age of the pipes when samples are taken for testing, as the age of the pipes when broken must not be less than (28) days from the date of casting these pipes.
7. The contractor must take into consideration the following matters from the General Technical Specifications for Buildings of 1996, Volume One for Civil and Architectural Works:
 - a. Excavations: Item numbers:
(201, 202, 204/4, 204/6, 204/9, 204/10, 207/1, 207/2, 207/3, 207/4, 209/1)
 - b. Supporting and shoring the side of excavations: Item No. (211).
 - c. Scaffolding: Placing pedestrian passages in the places specified by the supervising engineer.
 - d. Site planning: Clause (106/1, 106/2, 106/4, 107/3).

- e. Concrete works: Items Nos. (302/1, 302/2, 302/7, 304/8, 304/11, 305, 306, 307, 308, 309/2/b, 311, 317, 320)
 - f. Installing and connecting pipes: Clause (1504/3, 1504/1).
8. Installing a warning tape under the concrete layer, indicating the type and depth of the lines below the warning tape.
 9. The dimensions of the manholes are from the inside.
 10. When the height of the manhole's floor above the road surface exceeds 1.5 m, the manholes must be provided with a steel ladder fixed to the manhole, measuring every 20 cm, and the price is based on the linear meter of the pipes.
 11. The level of the bottom of the incoming pipe must be higher than the level of the bottom of the outgoing pipe by at least 5 cm (between the inlet and outlet pipes).
 12. The width of the excavation shall not be less than the outer diameter of the pipe + 30 cm (15 + 15 lenticulars), provided that consideration is given to the use of the appropriate excavator to view the section and to protect the edges of the asphalt after cutting from being disturbed by the excavator used, The contractor must choose the appropriate bucket for the width of the excavation
 13. Spreading and rolling the asphalt is done using a mechanical spreader (finisher), These materials are sprayed using a mechanical sprinkler to distribute them homogeneously over the sections. It is prohibited to use the manual method of spraying according to the opinion of the supervising engineer.
 14. The slope of the lines must not be less than 0.5% for the main lines, and the supervising engineer has the right to decide according to reality what he deems appropriate
 15. 13- The supervisory body or the owner has the right to request quality control samples for any part of the work and examine them in public works laboratories, the University of Science and Technology, or the Royal Scientific Society, at the contractor's expense and at any stage of the work.

- **Technical specifications for constructing manholes and grills**

1. This work includes rainwater drains and manholes made of reinforced concrete with the necessary covers and clamps. It is implemented according to the locations and dimensions on the drawings and the consultant instructions.
2. Concrete: The concrete used shall be grade (25) with a strength of not less than (250) kg/cm².
3. Reinforcing steel: The reinforcing steel must be a deformed steel and have a yield stress of not less than 280 N/mm².
4. The contractor is obligated to implement a riser for the manholes (conic, rings) or pipes with a suitable diameter, regardless of the height level between manhole's ceiling and road surface, and these Risers will be included in the price of the manhole.

5. The inner side of floor and walls of the manholes and Grills shall have smooth faces (FIAR FACE), class (A).
6. The contractor is obligated to provide, supply and spread a graded aggregate (Base course) with a thickness of 20 cm at the bottom of the manholes and grills, according to the engineering drawings and at the bottom of the blinding concrete layer, so that the degree of compaction is not less than 95%.

- **Technical specifications for manhole & Grill cover**

1. Supply and install a grill's covers with frames from wrought steel for drainage of rainwater with clear dimension of 60cm width and 6m length and the clear depth shall be not less than 1.0m, the dimension and steel detail as per drawings and specifications, the work shall include steel cover with dimensions of 0.60mx1.0m as detailed, total number required for the works is 6 grills (0.6x1.0m), the grills consist of steel angle 8cmx8cm and 10mm thickness, and the inner steel members are 8.0cm with thick of 10mm the distances between these members are 3cm from edge to edge, and the price include the excavation work, reinforced concrete, grade 25, with a breaking strength of 25 kg/cm² with a period of 28 days, reinforcement steel as per detailed in the drawings. and including also everything necessary to complete the work according to technical standards and take into account general safety terms, the work must be completed according to Jordanian specifications and standards, as well as special and general specifications according to the attached drawings and according to the instructions of the supervising, a ring shall be provided for each cover, to facilitate cleaning the grill trench, also bituminous primer paint shall apply for all grill steel elements, on both sides, before installation and according to the consultant instructions.
2. The required manhole covers shall be made of heavy duty cast iron, with the necessary rings also made of cast iron, and shall have a regular and acceptable external shape and be free of gaps and any other defects. One random sample shall be taken for test.
3. These steel covers shall be delivered to the site coated with a bituminous-based layer, provided that this layer is smooth and consistent and not susceptible to runny nose or peeling when exposed to temperatures ranging between 0 and 63 degrees Celsius.
4. Loading test: One random sample shall be taken in order to test it according to Specification No. (BS-479). The covers must pass the loading test and all covers must be able to bear the specified load, which is (350) KN for a period of not Less than half a minute.
5. The size of the grill will be (100*60) cm from the inside and according to the drawings.

Rehabilitation of Al Deir Spring

I- Brief of Work

Rehabilitation work for Al-Deir Spring area like the Spring water tank (Manholes), and the outlet area which is available near the Asphalt Road, with consider the spring water shall be running and not stop the flow of water during all parts of rehabilitation works. The rehabilitation work includes the following:

- 1- Existing Manholes (two manholes): Carrying out and prepare the opening of existing manholes as followings:
 - a. Cut the existing ununiformed opening in the existing manholes (2 Manholes) with machine cutter (Grinder) by dimension equal to (75x75 cm)
 - b. Implemented a reinforced concrete squared upstand with clear opening of (75x75 cm) and height of (50 cm) and wall thick of 15cm, the works including installing a steel bar in the existing Manhole's slabs by using special material (such Epoxy) for bonding the steel bars with concrete slabs after drilling a hole (2 Rows) in staggered pattern and distance between bars equal 20cm in for each row
 - c. Supply and fix a heavy-duty steel cover
 - d. Supply and fix galvanized cat-ladder to facilitate the moving down inside the existing manholes, the steps and height as per specification and drawings.
- 2- Third location and opening near the Asphalt Road:
 - a. Up stand has to implemented with same as the above descriptions but the dimension shall be 90cmx140cm with height equal 50cm.
 - b. Supply and implemented grilles on the end of road slopes to carry the rainwater toward the stream path which located beside the road.

• Technical specifications for concrete pipes

16. The Jordanian standard specifications 289/1994 for cement pipes shall be adopted as general specifications for this tender, and what is stated in these specifications shall be applied to it, taking into consideration what is stated below.
17. Laboratory tests are conducted in a laboratory approved by the supervising engineer, so that the contractor shall obtains written approval for the laboratory or laboratories in which the tests are to be conducted.
18. Samples are taken after the pipes reach to the site and shall be taken from each diameter as follows to conduct tests: For all diameters, two pipes shall be test, the test shall be conduct on the first pipe and the second pipe is in order to compare the dimensions and according to the engineer's instructions.

19. The pipes shall be made of reinforced concrete with a separation connection and must meet the conditions and requirements of the Jordanian standard specifications (Article 1/289/1994) for Concrete pipes and are of the type of high-resistance pipes, Class I (A), a pipe with a separation connection, pipes shall success to appear the warranty load and the maximum load together upon inspection.
20. The required pipes and their parts (Rings & Conic) shall be made of reinforced concrete and of the high-resistance pipes type, class I.
21. The contractor is responsible for the age of the pipes when samples are taken for testing, as the age of the pipes when broken must not be less than (28) days from the date of casting these pipes.
22. The contractor must take into consideration the following matters from the General Technical Specifications for Buildings of 1996, Volume One for Civil and Architectural Works:
 - a. Excavations: Item numbers:
(201, 202, 204/4, 204/6, 204/9, 204/10, 207/1, 207/2, 207/3, 207/4, 209/1)
 - b. Supporting and shoring the side of excavations: Item No. (211).
 - c. Scaffolding: Placing pedestrian passages in the places specified by the supervising engineer.
 - d. Site planning: Clause (106/1, 106/2, 106/4, 107/3).
 - e. Concrete works: Items Nos. (302/1, 302/2, 302/7, 304/8, 304/11, 305, 306, 307, 308, 309/2/b, 311, 317, 320)
 - f. Installing and connecting pipes: Clause (1504/3, 1504/1).
23. Installing a warning tape under the concrete layer, indicating the type and depth of the lines below the warning tape.
24. The dimensions of the manholes are from the inside.
25. When the height of the manhole's floor above the road surface exceeds 1.5 m, the manholes must be provided with a steel ladder fixed to the manhole, measuring every 20 cm, and the price is based on the linear meter of the pipes.
26. The level of the bottom of the incoming pipe must be higher than the level of the bottom of the outgoing pipe by at least 5 cm (between the inlet and outlet pipes).
27. The width of the excavation shall not be less than the outer diameter of the pipe + 30 cm (15 + 15 lenticulars), provided that consideration is given to the use of the appropriate excavator to view the section and to protect the edges of the asphalt after cutting from being disturbed by the excavator used, the contractor must choose the appropriate bucket for the width of the excavation
28. Spreading and rolling the asphalt is done using a mechanical spreader (finisher), These materials are sprayed using a mechanical sprinkler to distribute them homogeneously over the sections. It is prohibited to use the manual method of spraying according to the opinion of the supervising engineer.
29. The slope of the lines must not be less than 0.5% for the main lines, and the supervising engineer has the right to decide according to reality what he deems appropriate

30.13- The supervisory body or the owner has the right to request quality control samples for any part of the work and examine them in public works laboratories, the University of Science and Technology, or the Royal Scientific Society, at the contractor's expense and at any stage of the work.

- **Technical specifications for constructing manholes and grills**

7. This work includes rainwater drains and manholes made of reinforced concrete with the necessary covers and clamps. It is implemented according to the locations and dimensions on the drawings and the consultant instructions.
8. Concrete: The concrete used shall be grade (25) with a strength of not less than (250) kg/cm².
9. Reinforcing steel: The reinforcing steel must be a deformed steel and have a yield stress of not less than 280 N/mm².
10. The contractor is obligated to implement a riser for the manholes (conic, rings) or pipes with a suitable diameter, regardless of the height level between manhole's ceiling and road surface, and these Risers will be included in the price of the manhole.
11. The inner side of floor and walls of the manholes and Grills shall have smooth faces (FIAR FACE), class (A).
12. The contractor is obligated to provide, supply and spread a graded aggregate (Base course) with a thickness of 20 cm at the bottom of the manholes and grills, according to the engineering drawings and at the bottom of the blinding concrete layer, so that the degree of compaction is not less than 95%.

- **Technical specifications for manhole & Grill cover**

6. Grill's covers and Frames shall be made of wrought steel, of plain sections (75x16mm) mm, and angles (80x80x8mm), according to the attached engineering drawings. A ring shall be provided for each cover, provided that the covers and rings shall be painted with bituminous primer paint, on both sides, before installation and according to the engineer's request.
7. The required manhole covers shall be made of heavy duty cast iron, with the necessary rings also made of cast iron, and shall have a regular and acceptable external shape and be free of gaps and any other defects. One random sample shall be taken for test.
8. These steel covers shall be delivered to the site coated with a bituminous-based layer, provided that this layer is smooth and consistent and not susceptible to runny nose or peeling when exposed to temperatures ranging between 0 and 63 degrees Celsius.
9. Loading test: One random sample shall be taken in order to test it according to Specification No. (BS-479). The covers must pass the loading test and all covers must be able to bear the specified load, which is (350) KN for a period of not Less than half a minute.

10. The size of the grill will be (100*60) cm from the inside and according to the drawings.

Rehabilitation of Tarabil Spring

J- Brief of Work.

Rehabilitation work for Tarabil Spring area like the Spring source, connection channels (after and before stream path), stream path, stream protect wall, channels below stream, with consider the spring water shall be running and not stop the flow of water during all parts of rehabilitation works. The rehabilitation work includes the following:

- 1- Clean all spring area: the contractor shall remove all debris, excavated materials, slurry, Stones, unnecessary roots, obstacles, rubbles and excavation output which are not reusable by other works, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval.
- 2- Demolishing and remove the concrete-channels which located after and before stream path as per drawing, Demolishing and removing the old concrete Channel, and rebuild a new reinforced concrete channel as per Designed Drawings and Specifications, the demolishing will be for the walls only if the foundation is in good condition, the foundation shall be keep for fixing and supporting the new channels that planned to implemented as per specifications and conditions.
- 3- New channels: new channels shall execute in the same path of old channels and same existing levels; the execution of the new channels have to consider tow cases:
 - a. First case: if the ground is retaining wall or concrete wall with good condition:
 - i. The new channel shall execute at the top of these walls by erection steel rebar using an epoxy material and complete the work of channels concrete from foundation up to precast cover.
 - b. Second case: if the ground is soil:
 - i. Excavation, Leveling, compaction, Base coarse and Blinding concrete shall be implemented before the channel's concrete works, with consideration of excavation levels up to design channels level.
- 4- The channels which are located at below of stream flow, special design (concrete culvert) available for this area to protect the spring water from mixing with Stream water, and to absorb the shock from stream water, during flowing the water toward the new channel.

- a. Chain link fence required to carrying out on the top of existing retaining wall as per the location on the plan, to protect the human from fall down on the stream flow path, carrying out of Steel Fences (Chain link Fence) (Baqlawa) above retaining wall as per drawings, including steel gate 3mX2.65m.
- 5- Upstands (2 numbers) are required to construction in order to redirect the stream flow toward the correct flow direction as per plan,
- 6- Retaining wall in front of stream flow: extended the retaining wall which is located at the front of Stream flow in order to prevent the water (during Flood) to leave the stream path toward the spring area and mixing with spring water.
- 7- Manhole (80cmX80cm) at the connection channels with the road shall be implemented.

K- Work description

- 8- Cleaning and leveling the ground of spring: the contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
- 9- Demolishing and rebuild of spring old channels (at spring yard) which the path of channel has to be from Spring sources to the connection with the road as per the drawings, existing level have to be the design level for contractor, and the water flow should continue running throw all the duration of any work as proposed by contractor and approved by consultant, the work included the following:
 - a. Demolishing the existing channel in the spring yard for existing path of channels
 - b. Excavate of channel path and compaction the existing soil.
 - c. Install road base (150mm) thick with compaction degree (95%)
 - d. Casing blinding concrete (10 cm) with strength equal 200 kg/cm²
 - e. The channels inner and outer surfaces should be fair-face and smooth.
 - f. Backfilling and leveling around the channels outer section as per drawings and consultant approved.
 - g. The layers of as per the drawings.
- 10- Manholes for Spring-water: one manhole by inner dimension of (0.8mx0.8m) should be implemented as per tender drawings and specification and conditions

L- Chain link steel Fence and steel gate

supply and install Steel fence in two locations the first at spring yard including one steel gate, and the work contains the following article and the second on the top of soil nails wall (top of rock-cut):

- 8- supply and install Steel fence with a clear height of 2.0m and the vertical pipe shall be embedded 50 cm inside footing underground level as per drawings and details.
 - 9- steel fence consisting of galvanized steel mesh (Baqlawa) dimension of 4cmX4cm and 4 mm thickness, its surrounded with galvanized steel-pipes of diameter (2"), and the vertical galvanized steel-pipes of diameter (3") shall erect every 4 m with a top cap.
 - 10- The works including all accessories, plates and steel parts shown in the drawings and details.
 - 11- the work including all tools, machines, parts and materials which required to implemented a double-leaf door with width 3.0m and height 2.65m for Spring yard entrance according to the drawings and details, the work include the all screws, bolts, welding or any type of elements required to complete the work.
 - 12- All fence elements shall be full covered and painted by special layer to resist weather factors.
 - 13- The Locations for installation the steel fences are: first location is above the existing stone wall and the other is above the shoring wall of spring
 - 14- Part of vertical pipes shall be embedded amount (40cm) inside a reinforced footing, the dimensions of these footings are (40cmX40cm and depth of 50cm) and reinforcement steel is (Φ 12/12 cm).
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M- Special Condition for Rehabilitation Springs & Channels:

- The contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and to keep the site clean for channels works.
- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor shall provide all necessary equipment, Manpower, Tools, shutter, ... etc., which will be required to complete the works
- The contractor can provide a proposal for any works or any activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the spring's water flow and channel's water flow during all stages of the work.
- The price for implementation a new channel is including the demolishing of the old channels, cleaning and removing all obstacle, excavation if required, backfilling, materials, tools, machine manpower and all the necessary that required to complete the works in the best

quality, also contractor shall be keep running the flow of water fulltime during execution duration for all activities.

- The contractor shall Demolishing and Removing existing channels, and implement a new channel with location are the same existing Channels route, also using the current levels for existing channels as designed levels for the newly implemented channels route, also the contractor can use a new level for the new designed channels according to approval from the consultant engineer.
- Contractor shall supply and install a Steel gate (Control Gates) for the channels at many locations as per BOQ, the price will be included with the channels amount, and to be constructed according to be as per the existing gates, specifications and consultant instructions
- It must be taken into consideration that the thickness and steel reinforcement of the channel's walls that adjacent to the earthen-cut or the mountain-cut must be greater than the thickness of the other channel's walls as per drawings and details, but for channels that located in place of no earthen-cut or no required backfilling near the channel's walls the thickness of these walls will be equal on both sides.
- Channels, collector water tank or other concrete elements the concrete cover (Steel Cover) is (5 cm-7.5cm) if the element contact directly with the soil, and (3cm) if the structure element not contact directly with soils.
- The contractor shall Obtain Necessary authorization for start-up and execution of works and this includes (but not limited to) all permits and approvals related to the use of land, permission to build and access, as well as all relevant governmental bodies authorization depending on the proposed project requirements and on the national law.
- the contractor shall submit Method statement for any activity as per consultant instructions such as method statement for soil nails wall, storm water drainage line, channels, etc.
- channel removal work shall be includes removing all components of the channel, according to the current section of the site. In the case of concrete sections for channel, Riprap, or flow of water through regular soil channels, two cases shall be considered:
 - In the case of reinforced concrete walls, Blocks, and reinforced concrete foundations, all walls must be removed, but the foundations can be kept and adopted as a basis for the new channels that are required to be constructed.
 - In the case of non-reinforced channels (earth or Riprap), all their components must be removed, the backing must be compacted after removal, all foundation layers must be installed, including base course and Blinding Concrete, and the foundations and walls of the new channels must be constructed according to the required Drawings and specifications.
- When constructing new channels and indicating the instability of the old Foundation due to the location of the channel on the slope of the mountainous area, the contractor must stabilize the old foundation and the ground on which it is required to be established before the work of constructing the new channels, by using a stone wall below the foundation area with steel mesh and shotcrete or any idea from contractor and after approval by consultant.

- If the channels are located on flat ground, the channels must be constructed with all their layers, as per drawings and design, including a base course layer and blinding concrete with all necessary works related to these activities.
- Carrying out plastering work for the damaged areas for the retaining walls that a new channel will be constructed above these retaining walls, and rested above these walls, the work includes the following:
 - Clean and wash the retaining wall section from soil, dirt and stones before carrying out the plastering work and remove the cleaning waste away from the site.
 - Carrying out plastering work for the retaining wall section, two coats of plaster shall apply with a mixture of sand, cement, including sea sand and an adhesive. The ratio of sand to cement is 1:4. The first side is rough, the plastering works including the final coat of smooth finish, the works included supply and apply of all required materials, water, curing three days, tools and machine.
- The dimensions are according to the drawing and the supervisor instructions.
- For any case of reinforced concrete which will contact direct to soil, Base Coarse (min. thick 15cm and MDD 95%) and Blinding concrete (10 cm) should be applied at the below of reinforced concrete as layers, if this mentioned in drawings or not.
- The contractor shall provide any required type of shutter (Formwork), including fair-face timber in order to complete the required works and as per consultant instructions.
- The contractor shall implement a concrete collector tank which should be connected directly with the Spring sources to collect all water that Coming from spring before flowing throw the channels.
- The contractor shall supply and install a Water-stop rubber (thick. 20-25cm) for any size of Concrete-collector-tank at any spring, the location of this rubber shall be in the contact between foundation and vertical walls, first half width of this water-stop should embed in the foundation and the other half should have imbedded in the vertical walls.
- Dimension of Collector water tanks or channels for any springs shall as per drawings, and the compressive strength for theses tanks are 250 kg/cm³, concrete slump 10cm, the contractor shall provide concrete cubes for compressive strength test using 15cmX15cm cubes, the number of cubes for any test shall be 6 cubes, the first 3 cubes for doing the test and take the average, and the Additional 3 cubes for spare in case of failing the first cube test we can use it to do the test again.
- Steel specifications are ASTM designation A-615 or equivalent, stress =4200 kg/cm², grade 60
- For any reinforced concrete works, plastering works, ... etc. the concrete has to be cured with water for three days two times a day, vibrator shall provide and use during casting a reinforced concrete.
- In case of segregation, it must be treated with special filler-expansion materials and according to the consultant instructions and approvals, the consultant can decide for treatment or demolishing (removing) the concrete structure and the contractor have to follow the instructions by removing this structure and redo the work.

- Wall and roof shutters should not be removed before 3 and 14 days after casting respectively.
 - ready mix concrete is the allowed concrete for any part of reinforced concrete structure, the contractor shall submit mix design for consultant approvals, in special cases and conditions it is allowed to use onsite-mixing and manual casting, with consider the percentage of mix components during onsite-mixing.
 - The prices for all required materials, tools, shuttering, fixing steel, casting concrete, ...etc. are included in the unit prices unless it mentioned otherwise.
 - The contractor shall provide a cover-block (Plastic or concrete) as required for channels, concrete water tank or other concrete elements, the concrete cover (Steel Cover) is (5 cm-7.5cm) if the structure contact direct with the soil, and (3cm) if the structure not contact directly with soils.
 - The levels which indicated in the drawings of spring's underground water tank are from Surveying work results, therefore, if required to change any level from these levels for any reason during the work conditions, the other related levels should be change also, to keep the constructions depth or high as same as before changing the origin level.
 - The contractor shall implement a concrete collector tank with dimension 1.8X1.8m and height of 1.65m, the work shall include (but not limit to) all the necessary accessories, materials, tools equipment, etc. which required to accomplish all the activities.
 - The contractor shall Excavate in all types of soil and rock according to drawings levels and dimensions and to the technical specifications. The work starts by clearing, grubbing of top soil as specified.
 - For any concrete construction or sub-elements for any works in the tender such as collector tanks, manholes, Channels or etc., the contractor shall Excavate any type of soil or rock according to drawings dimensions and to the technical specifications.
 - The contractor also for any kind of activity and according to the drawings and specifications, shall do an Cleaning and Leveling, remove all debris, excavated materials, Rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
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- **Technical specifications for constructing manholes and grills**

13. This work includes rainwater drains and manholes made of reinforced concrete with the necessary covers and clamps. It is implemented according to the locations and dimensions on the drawings and the consultant instructions.

14. Concrete: The concrete used shall be grade (25) with a strength of not less than (250) kg/cm².
15. Reinforcing steel: The reinforcing steel must be a deformed steel and have a yield stress of not less than 280 N/mm².
16. The contractor is obligated to implement a riser for the manholes (conic, rings) or pipes with a suitable diameter, regardless of the height level between manhole's ceiling and road surface, and these Risers will be included in the price of the manhole.
17. The inner side of floor and walls of the manholes and Grills shall have smooth faces (FIAR FACE), class (A).
18. The contractor is obligated to provide, supply and spread a graded aggregate (Base course) with a thickness of 20 cm at the bottom of the manholes and grills, according to the engineering drawings and at the bottom of the blinding concrete layer, so that the degree of compaction is not less than 95%.

- **Technical specifications for manhole & Grill cover**

11. Grill's covers and Frames shall be made of wrought steel, of plain sections (75x16mm) mm, and angles (80x80x8mm), according to the attached engineering drawings. A ring shall be provided for each cover, provided that the covers and rings shall be painted with bituminous primer paint, on both sides, before installation and according to the engineer's request.
12. The required manhole covers shall be made of heavy duty cast iron, with the necessary rings also made of cast iron, and shall have a regular and acceptable external shape and be free of gaps and any other defects. One random sample shall be taken for test.
13. These steel covers shall be delivered to the site coated with a bituminous-based layer, provided that this layer is smooth and consistent and not susceptible to runny nose or peeling when exposed to temperatures ranging between 0 and 63 degrees Celsius.
14. Loading test: One random sample shall be taken in order to test it according to Specification No. (BS-479). The covers must pass the loading test and all covers must be able to bear the specified load, which is (350) KN for a period of not Less than half a minute.
15. The size of the grill will be (100*60) cm from the inside and according to the drawings.

Irrigation Canals Rehabilitation

1. Rehabilitation of Abu Al-Batayeh Canal

N- Brief of Work

Rehabilitation work for Abu Al-Batayeh Canal, the work includes the following:

- 14- Rehabilitation Abu Al-Batayeh Canal Yard including the following:
 - a. Demolishing and removing old concrete Canal, and rebuild a new reinforced concrete canal as per Designed Drawings and Specifications, the demolishing will be for the walls only if the foundation is in good condition, the foundation shall be keep for fixing and supporting the new canals-foundations that planned to implemented as per specifications and conditions.
 - b. In case of implemented a new canal on soil base, the layers of base coarse 15cm and blinding concrete 10cm, with compaction for the base course and natural soil, the percentage of compaction shall be 95% for base course.
 - c. The designed level for the new canals shall be same as the existing canals, and contractor has to take reading for the levels before demolishing the old canals in order to use these readings for implementation the new canal levels
 - d. Supplying, installing and painting control gates (Slide Gates), containing from 4 mm thick sheet Plate, with dimensions as per existing or new canal dimensions (contractor shall follow the existing gates as a details for his fabrication and installation works), the works shall include all the necessary accessories, tools or any equipment, including also the frames that shall embedded inside concrete or fixing with bolts with concrete, the gates including installing a chain for each gate that is tied to the gate plates and frames, the operation of open and close are manually. These steel gates or control gate shall be installed at the required locations as per site conditions and consultant instructions.
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O- Work description

Rehabilitation work for Abu Al-Batayeh Canal area such as demolishing existing canals and build a new canal, with consider the water of canal shall be running and not stop the flow of water during implementation of all parts of rehabilitation works. The rehabilitation works include the following:

- 11- Contractor shall with consider the Canal water shall be running and not stop the flow of water during implementation of all parts of rehabilitation works
 - 12- Demolishing and rebuild of new canal and the work included the following:
 - a. If the new canal will be implemented on soil layer (nature layer):
 - Demolishing the existing canal for existing path.
 - Excavate of canal path and compaction the existing soil.
 - Install Base course (150mm) thick with compaction degree (95%)
 - Casing blinding concrete (10 cm) with strength equal 200 kg/cm²
 - The canals inner and outer surfaces should be fair-face and smooth.
 - Backfilling and leveling around the canals outer section as per drawings and consultant approved.
 - b. If the new canal will be implemented on the existing foundation in case of the old canal is concrete canal:
 - During demolishing the old canal, both side wall shall be demolishing completely and the foundation shall be keep to be as hard base for foundation of a new canal.
 - Cleaning and removing all the demolishing materials offsite directly.
 - Steel bars shall be installed in the old foundation throw drilling and bonding by special materials like Epoxy the bars have to installed in Zigzag pattern and the distances between them will be not more than 40cm in one direction as per drawing and specifications.
 - Formwork shall provide and installed as per consultant instructions and approvals.
 - 13- Concrete of Canal shall be not less than 250 kg/cm², and reinforcement steel grade 60 with yield strength 420N/mm² and with diameters as per drawings
 - 14- Backfilling and leveling around the canals outer section as per drawings and consultant approved.
-

P- Control steel gate, slide gate for Canals

- 14- Supply and install steel gates (control gates) inside the inner side of canals for controlling the flow of water inside the canals and towards the sub-canals.
- 15- All steel elements shall be painted by special layer to resist weather factors.

- 16- The canals components are steel frames and steel plate of 4mm thick. The frame shall be four sides bottom, top and two sides the half of upper side shall be free fix.
 - 17- The dimension of canal shall be compatible with the inner width of existing or new canals.
 - 18- Chains shall provide to tie the upper side of frame with the sliding gate.
 - 19- The contractor shall install the gates in a manner that prevents leakage around the gate and binding of the gates during normal operation.
 - 20- Surfaces of metal against which concrete will be placed shall be free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.
 - 21- Anchor bolts, thimbles, and spigot frames shall be secured in true position within the concrete forms and maintained in alignment during concrete placement.
 - 22- Concrete surfaces against which flat frames or plates are to be installed shall be finished to provide a smooth and uniform contact surface.
 - 23- When a flat frame is installed against concrete, a layer of concrete mortar shall be placed between the gate frame and the concrete.
 - 24- When a gate is attached to a wall thimble, a mastic or resilient gasket shall be applied between the gate frame and the thimble in accordance with the recommendations of the gate manufacturer.
 - 25- frame and the thimble in accordance with the recommendations of the gate manufacturer.
 - 26- Wall plates, sills, and pin brackets for radial gates shall be adjusted and fastened by grouting and bolting after the gates have been completely assembled in place.
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Q- Special Condition for Rehabilitation Springs & Canals:

- The contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and to keep the site clean for canals works.
- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor shall provide all necessary equipment, Manpower, Tools, shutter, ... etc., which will be required to complete the works
- The contractor can provide a proposal for any works or any activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the Canal's water flow and canal's water flow during all stages of the work.
- The price for implementation a new canal is including the demolishing of the old canals, cleaning and removing all obstacle, excavation if required, backfilling, materials, tools, machine manpower and all the necessary that required to complete the works in the best

quality, also contractor shall be keep running the flow of water fulltime during execution duration for all activities.

- The contractor shall Demolishing and Removing existing canals, and implement a new canal with location are the same existing Canals route, also using the current levels for existing canals as designed levels for the newly implemented canals route, also the contractor can use a new level for the new designed canals according to approval from the consultant engineer.
- Contractor shall supply and install a Steel gate (Control Gates) for the canals at many locations as per BOQ, the price will be included with the canals amount, and to be constructed according to be as per the existing gates, specifications and consultant instructions
- It must be taken into consideration that the thickness and steel reinforcement of the canal's walls that adjacent to the earthen-cut or the mountain-cut must be greater than the thickness of the other canal's walls as per drawings and details, but for canals that located in place of no earthen-cut or no required backfilling near the canal's walls the thickness of these walls will be equal on both sides.
- Canals, collector water tank or other concrete elements the concrete cover (Steel Cover) is (5 cm-7.5cm) if the element contact directly with the soil, and (3cm) if the structure element not contact directly with soils.
- The contractor shall Obtain Necessary authorization for start-up and execution of works and this includes (but not limited to) all permits and approvals related to the use of land, permission to build and access, as well as all relevant governmental bodies authorization depending on the proposed project requirements and on the national law.
- the contractor shall submit Method statement for any activity as per consultant instructions such as method statement for soil nails wall, storm water drainage line, canals, etc.
- canal removal work shall be includes removing all components of the canal, according to the current section of the site. In the case of concrete sections for canal, Riprap, or flow of water through regular soil canals, two cases shall be considered:
 - In the case of reinforced concrete walls, Blocks, and reinforced concrete foundations, all walls must be removed, but the foundations can be kept and adopted as a basis for the new canals that are required to be constructed.
 - In the case of non-reinforced canals (earth or Riprap), all their components must be removed, the backing must be compacted after removal, all foundation layers must be installed, including base course and Blinding Concrete, and the foundations and walls of the new canals must be constructed according to the required Drawings and specifications.
- When constructing new canals and indicating the instability of the old Foundation due to the location of the canal on the slope of the mountainous area, the contractor must stabilize the old foundation and the ground on which it is required to be established before the work of constructing the new canals, by using a stone wall below the foundation area with steel mesh and shotcrete or any idea from contractor and after approval by consultant.

- If the canals are located on flat ground, the canals must be constructed with all their layers, as per drawings and design, including a base course layer and blinding concrete with all necessary works related to these activities.
- Carrying out plastering work for the damaged areas for the retaining walls that a new canal will be constructed above these retaining walls, and rested above these walls, the work includes the following:
 - Clean and wash the retaining wall section from soil, dirt and stones before carrying out the plastering work and remove the cleaning waste away from the site.
 - Carrying out plastering work for the retaining wall section, two coats of plaster shall apply with a mixture of sand, cement, including sea sand and an adhesive. The ratio of sand to cement is 1:4. The first side is rough, the plastering works including the final coat of smooth finish, the works included supply and apply of all required materials, water, curing three days, tools and machine.
- The dimensions are according to the drawing and the supervisor instructions.
- For any case of reinforced concrete which will contact direct to soil, Base Coarse (min. thick 15cm and MDD 95%) and Blinding concrete (10 cm) should be applied at the below of reinforced concrete as layers, if this mentioned in drawings or not.
- The contractor shall provide any required type of shutter (Formwork), including fair-face timber in order to complete the required works and as per consultant instructions.
- The contractor shall implement a concrete collector tank which should be connected directly with the Canal sources to collect all water that Coming from Canal before flowing throw the canals.
- The contractor shall supply and install a Water-stop rubber (thick. 20-25cm) for any size of Concrete-collector-tank at any Canal, the location of this rubber shall be in the contact between foundation and vertical walls, first half width of this water-stop should embed in the foundation and the other half should have imbedded in the vertical walls.
- Dimension of Collector water tanks or canals for any Canals shall as per drawings, and the compressive strength for theses tanks are 250 kg/cm³, concrete slump 10cm, the contractor shall provide concrete cubes for compressive strength test using 15cmX15cm cubes, the number of cubes for any test shall be 6 cubes, the first 3 cubes for doing the test and take the average, and the Additional 3 cubes for spare in case of failing the first cube test we can use it to do the test again.
- Steel specifications are ASTM designation A-615 or equivalent, stress =4200 kg/cm², grade 60
- For any reinforced concrete works, plastering works, ... etc. the concrete has to be cured with water for three days two times a day, vibrator shall provide and use during casting a reinforced concrete.
- In case of segregation, it must be treated with special filler-expansion materials and according to the consultant instructions and approvals, the consultant can decide for treatment or demolishing (removing) the concrete structure and the contractor have to follow the instructions by removing this structure and redo the work.

- Wall and roof shutters should not be removed before 3 and 14 days after casting respectively.
 - ready mix concrete is the allowed concrete for any part of reinforced concrete structure, the contractor shall submit mix design for consultant approvals, in special cases and conditions it is allowed to use onsite-mixing and manual casting, with consider the percentage of mix components during onsite-mixing.
 - The prices for all required materials, tools, shuttering, fixing steel, casting concrete, ...etc. are included in the unit prices unless it mentioned otherwise.
 - The contractor shall provide a cover-block (Plastic or concrete) as required for canals, concrete water tank or other concrete elements, the concrete cover (Steel Cover) is (5 cm-7.5cm) if the structure contact direct with the soil, and (3cm) if the structure not contact directly with soils.
 - The levels which indicated in the drawings of Canal's underground water tank are from Surveying work results, therefore, if required to change any level from these levels for any reason during the work conditions, the other related levels should be change also, to keep the constructions depth or high as same as before changing the origin level.
 - The contractor shall implement a concrete collector tank with dimension 1.8X1.8m and height of 1.65m, the work shall include (but not limit to) all the necessary accessories, materials, tools equipment, etc. which required to accomplish all the activities.
 - The contractor shall Excavate in all types of soil and rock according to drawings levels and dimensions and to the technical specifications. The work starts by clearing, grubbing of top soil as specified.
 - For any concrete construction or sub-elements for any works in the tender such as collector tanks, manholes, Canals or etc., the contractor shall Excavate any type of soil or rock according to drawings dimensions and to the technical specifications.
 - The contractor also for any kind of activity and according to the drawings and specifications, shall do an Cleaning and Leveling, remove all debris, excavated materials, Rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
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2. Rehabilitation of Iraq Al Amir Canal

Rehabilitation of Iraq Al Amir Canal

R- Brief of Work

Rehabilitation work for Iraq Al Amir Canal, the work includes the following:

- 15- Rehabilitation Iraq Al Amir yard including the following:
 - a. Demolishing and removing old concrete Canal, and rebuild a new reinforced concrete canal as per Designed Drawings and Specifications, the demolishing will be for the walls only if the foundation is in good condition, the foundation shall be keep for fixing and supporting the new canals-foundations that planned to implemented as per specifications and conditions.
 - b. In case of implemented a new canal on soil base, the layers of base coarse 15cm and blinding concrete 10cm, with compaction for the base course and natural soil, the percentage of compaction shall be 95% for base course.
 - c. Execution Manholes with dimensions equal (80x80cm) and height 1.0m, to be use before and after crossing the canal with the existing road, as per Plan and as specifications, strength of concrete shall be not less than 250kg/cm² and steel of grade 60.
 - d. The designed level for the new canals shall be same as the existing canals, and contractor has to take reading for the levels before demolishing the old canals in order to use these readings for implementation the new canal levels
 - e. Supplying, installing and painting control gates (Slide Gates), containing from 4 mm thick sheet Plate, with dimensions as per existing or new canal dimensions (contractor shall follow the existing gates as a details for his fabrication and installation works), the works shall include all the necessary accessories, tools or any equipment, including also the frames that shall embedded inside concrete or fixing with bolts with concrete, the gates including installing a chain for each gate that is tied to the gate plates and frames, the operation of open and close are manually. These steel gates or control gate shall be installed at the required locations as per site conditions and consultant instructions.
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S- Work description

Rehabilitation work for Iraq Al Amir Canal area such as demolishing existing canals and build a new canal, with consider the water of canal shall be running and not stop the flow of water during implementation of all parts of rehabilitation works. The rehabilitation works include the following:

- 1- Contractor shall with consider the Canal water shall be running and not stop the flow of water during implementation of all parts of rehabilitation works
- 2- Demolishing and rebuild of new canal and the work included the following:
 - a. If the new canal will be implemented on soil layer (nature layer):

- Demolishing the existing canal for existing path.
 - Excavate of canal path and compaction the existing soil.
 - Install Base course (150mm) thick with compaction degree (95%)
 - Casing blinding concrete (10 cm) with strength equal 200 kg/cm²
 - The canals inner and outer surfaces should be fair-face and smooth.
 - Backfilling and leveling around the canals outer section as per drawings and consultant approved.
- b. If the new canal will be implemented on the existing foundation in case of the old canal is concrete canal:
- During demolishing the old canal, both side wall shall be demolishing completely and the foundation shall be keep to be as hard base for foundation of a new canal.
 - Cleaning and removing all the demolishing materials offsite directly.
 - Steel bars shall be installed in the old foundation throw drilling and bonding by special materials like Epoxy the bars have to installed in Zigzag pattern and the distances between them will be not more than 40cm in one direction as per drawing and specifications.
 - Formwork shall provide and installed as per consultant instructions and approvals.
- 3- Concrete of Canal shall be not less than 250 kg/cm², and reinforcement steel grade 60 with yield strength 420N/mm² and with diameters as per drawings
- 4- Backfilling and leveling around the canals outer section as per drawings and consultant approved.
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T- Control steel gate, slide gate for Canals

- 1- Supply and install steel gates (control gates) inside the inner side of canals for controlling the flow of water inside the canals and towards the sub-canals.
- 2- All steel elements shall be painted by special layer to resist weather factors.
- 3- The canals components are steel frames and steel plate of 4mm thick. The frame shall be four sides bottom, top and two sides the half of upper side shall be free fix.
- 4- The dimension of canal shall be compatible with the inner width of existing or new canals.

- 5- Chains shall provide to tie the upper side of frame with the sliding gate.
 - 6- The contractor shall install the gates in a manner that prevents leakage around the gate and binding of the gates during normal operation.
 - 7- Surfaces of metal against which concrete will be placed shall be free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.
 - 8- Anchor bolts, thimbles, and spigot frames shall be secured in true position within the concrete forms and maintained in alignment during concrete placement.
 - 9- Concrete surfaces against which flat frames or plates are to be installed shall be finished to provide a smooth and uniform contact surface.
 - 10- When a flat frame is installed against concrete, a layer of concrete mortar shall be placed between the gate frame and the concrete.
 - 11- When a gate is attached to a wall thimble, a mastic or resilient gasket shall be applied between the gate
 - 12- frame and the thimble in accordance with the recommendations of the gate manufacturer.
 - 13- Wall plates, sills, and pin brackets for radial gates shall be adjusted and fastened by grouting and bolting after the gates have been completely assembled in place.
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U- Special Condition for Rehabilitation Springs & Canals:

- The contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and to keep the site clean for canals works.
- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor shall provide all necessary equipment, Manpower, Tools, shutter, ... etc., which will be required to complete the works
- The contractor can provide a proposal for any works or any activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the Canal's water flow and canal's water flow during all stages of the work.
- The price for implementation a new canal is including the demolishing of the old canals, cleaning and removing all obstacle, excavation if required, backfilling, materials, tools, machine manpower and all the necessary that required to complete the works in the best quality, also contractor shall be keep running the flow of water fulltime during execution duration for all activities.

- The contractor shall Demolishing and Removing existing canals, and implement a new canal with location are the same existing Canals route, also using the current levels for existing canals as designed levels for the newly implemented canals route, also the contractor can use a new level for the new designed canals according to approval from the consultant engineer.
- Contractor shall supply and install a Steel gate (Control Gates) for the canals at many locations as per BOQ, the price will be included with the canals amount, and to be constructed according to be as per the existing gates, specifications and consultant instructions
- It must be taken into consideration that the thickness and steel reinforcement of the canal's walls that adjacent to the earthen-cut or the mountain-cut must be greater than the thickness of the other canal's walls as per drawings and details, but for canals that located in place of no earthen-cut or no required backfilling near the canal's walls the thickness of these walls will be equal on both sides.
- Canals, collector water tank or other concrete elements the concrete cover (Steel Cover) is (5 cm-7.5cm) if the element contact directly with the soil, and (3cm) if the structure element not contact directly with soils.
- The contractor shall Obtain Necessary authorization for start-up and execution of works and this includes (but not limited to) all permits and approvals related to the use of land, permission to build and access, as well as all relevant governmental bodies authorization depending on the proposed project requirements and on the national law.
- the contractor shall submit Method statement for any activity as per consultant instructions such as method statement for soil nails wall, storm water drainage line, canals, etc.
- canal removal work shall be includes removing all components of the canal, according to the current section of the site. In the case of concrete sections for canal, Riprap, or flow of water through regular soil canals, two cases shall be considered:
 - In the case of reinforced concrete walls, Blocks, and reinforced concrete foundations, all walls must be removed, but the foundations can be kept and adopted as a basis for the new canals that are required to be constructed.
 - In the case of non-reinforced canals (earth or Riprap), all their components must be removed, the backing must be compacted after removal, all foundation layers must be installed, including base course and Blinding Concrete, and the foundations and walls of the new canals must be constructed according to the required Drawings and specifications.
- When constructing new canals and indicating the instability of the old Foundation due to the location of the canal on the slope of the mountainous area, the contractor must stabilize the old foundation and the ground on which it is required to be established before the work of constructing the new canals, by using a stone wall below the foundation area with steel mesh and shotcrete or any idea from contractor and after approval by consultant.
- If the canals are located on flat ground, the canals must be constructed with all their layers, as per drawings and design, including a base course layer and blinding concrete with all necessary works related to these activities.

- Carrying out plastering work for the damaged areas for the retaining walls that a new canal will be constructed above these retaining walls, and rested above these walls, the work includes the following:
 - Clean and wash the retaining wall section from soil, dirt and stones before carrying out the plastering work and remove the cleaning waste away from the site.
 - Carrying out plastering work for the retaining wall section, two coats of plaster shall apply with a mixture of sand, cement, including sea sand and an adhesive. The ratio of sand to cement is 1:4. The first side is rough, the plastering works including the final coat of smooth finish, the works included supply and apply of all required materials, water, curing three days, tools and machine.
- The dimensions are according to the drawing and the supervisor instructions.
- For any case of reinforced concrete which will contact direct to soil, Base Coarse (min. thick 15cm and MDD 95%) and Blinding concrete (10 cm) should be applied at the below of reinforced concrete as layers, if this mentioned in drawings or not.
- The contractor shall provide any required type of shutter (Formwork), including fair-face timber in order to complete the required works and as per consultant instructions.
- The contractor shall implement a concrete collector tank which should be connected directly with the Canal sources to collect all water that Coming from Canal before flowing throw the canals.
- The contractor shall supply and install a Water-stop rubber (thick. 20-25cm) for any size of Concrete-collector-tank at any Canal, the location of this rubber shall be in the contact between foundation and vertical walls, first half width of this water-stop should embed in the foundation and the other half should have imbedded in the vertical walls.
- Dimension of Collector water tanks or canals for any Canals shall as per drawings, and the compressive strength for theses tanks are 250 kg/cm³, concrete slump 10cm, the contractor shall provide concrete cubes for compressive strength test using 15cmX15cm cubes, the number of cubes for any test shall be 6 cubes, the first 3 cubes for doing the test and take the average, and the Additional 3 cubes for spare in case of failing the first cube test we can use it to do the test again.
- Steel specifications are ASTM designation A-615 or equivalent, stress =4200 kg/cm², grade 60
- For any reinforced concrete works, plastering works, ... etc. the concrete has to be cured with water for three days two times a day, vibrator shall provide and use during casting a reinforced concrete.
- In case of segregation, it must be treated with special filler-expansion materials and according to the consultant instructions and approvals, the consultant can decide for treatment or demolishing (removing) the concrete structure and the contractor have to follow the instructions by removing this structure and redo the work.
- Wall and roof shutters should not be removed before 3 and 14 days after casting respectively.

- ready mix concrete is the allowed concrete for any part of reinforced concrete structure, the contractor shall submit mix design for consultant approvals, in special cases and conditions it is allowed to use onsite-mixing and manual casting, with consider the percentage of mix components during onsite-mixing.
 - The prices for all required materials, tools, shuttering, fixing steel, casting concrete, ...etc. are included in the unit prices unless it mentioned otherwise.
 - The contractor shall provide a cover-block (Plastic or concrete) as required for canals, concrete water tank or other concrete elements, the concrete cover (Steel Cover) is (5 cm- 7.5cm) if the structure contact direct with the soil, and (3cm) if the structure not contact directly with soils.
 - The levels which indicated in the drawings of Canal's underground water tank are from Surveying work results, therefore, if required to change any level from these levels for any reason during the work conditions, the other related levels should be change also, to keep the constructions depth or high as same as before changing the origin level.
 - The contractor shall implement a concrete collector tank with dimension 1.8X1.8m and height of 1.65m, the work shall include (but not limit to) all the necessary accessories, materials, tools equipment, etc. which required to accomplish all the activities.
 - The contractor shall Excavate in all types of soil and rock according to drawings levels and dimensions and to the technical specifications. The work starts by clearing, grubbing of top soil as specified.
 - For any concrete construction or sub-elements for any works in the tender such as collector tanks, manholes, Canals or etc., the contractor shall Excavate any type of soil or rock according to drawings dimensions and to the technical specifications.
 - The contractor also for any kind of activity and according to the drawings and specifications, shall do an Cleaning and Leveling, remove all debris, excavated materials, Rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
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V- **Manholes for Canal Water**

- **The work contains the following article:**

36-The contractor must verify the road levels before starting the excavation work and bear responsibility for any errors in the engineering drawings, contractor have to submit a Shop Drawing (longitudinal sections with levels) and profile drawings before starting the work and obtain approval from the supervising engineer for all lines, profile plan shall be including existing

and designed levels, distances between manholes, excavation depth, inlet and outlet level, slopes cumulative distance ... etc.

- 37-The contractor has to submit proposals for how to connect the lines proposed in the bid with the old lines or with the culverts or the end of the lines, and written approval must be obtained from the supervising engineer before starting implementation work.
- 38-Constructing Inspection Points (manholes) according to the engineering Drawings and the consultant engineer's instructions, so that the contractor shall use (Fair Face) class (A) Formwork, reinforce and pour concrete with a strength grade of not less than (250 kg/cm²) cubes after 28 days for the walls, ceilings and bases, and pour Concrete with a breaking strength of not less than 150 kg/cm² for Blinding Concrete under the base, with consider to use the vibrator while pouring reinforced concrete, and the contractor must curing the reinforced concrete for three days according to the engineer's instructions.
- 39-Providing, supplying and installing manhole covers with Frames, such that they are made of heavy-duty cast iron, with a bearing strength of no less than (350 kN) and a diameter of (600) mm, a cover must be provided for each manhole with iron fingers.
- 40-contractor shall write on the manhole cover the followings, as per drawings:
 - a. for rainwater manholes (canals water):
(Greater Amman Municipality/ Rainwater Drainage / 2024)
 - b. for Canal water manhole
(Ministry of Agriculture/ Iraq Al Amir Canal Water / 2024)
- 41-The contractor must visit the various work sites and verify the nature of the soil and excavation levels. He is not entitled to modify prices during the implementation phase, regardless of the nature of the work.
- 42-The contractor must coordinate with public institutions (electricity, communications, water, MPWH, ...etc.) to avoid causing any damage to these services. In the event of causing any damage to public services or citizens' property, the contractor must restore them to their correct conditions, and the contractor shall bear the expenses of restoring conditions and everything related. With the value of the damages and fines inflicted on the lines of the public institutions mentioned previously, and the contractor bears responsibility for removing, moving, or changing the levels of the service lines that obstruct the drainage line.
- 43-The responsibility for removing obstacles, whatever their type, shall be on the contractor, as the contractor is obligated to review all relevant competent authorities, and the contractor is obligated not to claim any malfunction or damage resulting from these obstacles, no matter how great the damage.
- 44-The contractor is obligated to Excavate to any depth, no matter how great and according to what the study needs, and he is not entitled to any financial claim resulting from the depths.
- 45-Make side openings in the manholes where necessary and according to the engineer's instructions to connect branch lines in the future.
- 46-The contractor must verify the street levels before starting the excavation work and bear responsibility for any errors in the engineering plans. He must submit an executive plan/

Shop Drawing (longitudinal sections with levels) and profile plans before starting the work and obtain approval from the supervising engineer for all lines. The sites mentioned in the tender, whether they have engineering Drawings (longitudinal sections or Profile) attached to the tender or without Attached Drawings, Contractor must submit proposals for how to connect the lines proposed in the bid with the old lines or with the culverts or the end of the lines, and written approval must be obtained from the supervising engineer before starting implementation work.

47-The passage of chain excavators on asphalt surfaces is prohibited unless there are rubber rollers or any alternatives approved in advance by the supervising engineer.

48-After the excavation process, the contractor is obligated to provide safe bridges for pedestrians to cross every entrance to a house or building, or a bridge for every 3 commercial stores, according to population pressure.

49-samples of Base Course layer, Concrete and Asphalt layers can be taken all at the contractor's expense, regardless of their frequency.

- **Technical specifications for constructing manholes and grills**

19. This work includes rainwater drains and manholes made of reinforced concrete with the necessary covers and clamps. It is implemented according to the locations and dimensions on the drawings and the consultant instructions.

20. Concrete: The concrete used shall be grade (25) with a strength of not less than (250) kg/cm².

21. Reinforcing steel: The reinforcing steel must be a deformed steel and have a yield stress of not less than 280 N/mm².

22. The contractor is obligated to implement a riser for the manholes (conic, rings) or pipes with a suitable diameter, regardless of the height level between manhole's ceiling and road surface, and these Risers will be included in the price of the manhole.

23. The inner side of floor and walls of the manholes and Grills shall have smooth faces (FIAR FACE), class (A).

24. The contractor is obligated to provide, supply and spread a graded aggregate (Base course) with a thickness of 20 cm at the bottom of the manholes and grills, according to the engineering drawings and at the bottom of the blinding concrete layer, so that the degree of compaction is not less than 95%.

- **Technical specifications for manhole cover**

16. The required manhole covers shall be made of heavy duty cast iron, with the necessary rings also made of cast iron, and shall have a regular and acceptable

external shape and be free of gaps and any other defects. One random sample shall be taken for test.

17. These steel covers shall be delivered to the site coated with a bituminous-based layer, provided that this layer is smooth and consistent and not susceptible to runny nose or peeling when exposed to temperatures ranging between 0 and 63 degrees Celsius.
18. Loading test: One random sample shall be taken in order to test it according to Specification No. (BS-479). The covers must pass the loading test and all covers must be able to bear the specified load, which is (350) KN for a period of not Less than half a minute.
19. The size of the grill will be (100*60) cm from the inside and according to the drawings.



3. Rehabilitation of Qasr Al-Amir Canal

W- Brief of Work

Rehabilitation work for Qasr Al-Amir Canal, the work includes the following:

4. Rehabilitation Qasr Al-Amir Canal Yard including the following:
 - a. Demolishing and removing old concrete Canal, and rebuild a new reinforced concrete canal as per Designed Drawings and Specifications, the demolishing will be for the walls only if the foundation is in good condition, the foundation shall be keep for fixing and supporting the new canals-foundations that planned to implemented as per specifications and conditions.
 - b. In case of implemented a new canal on soil base, the layers of base coarse 15cm and blinding concrete 10cm, with compaction for the base course and natural soil, the percentage of compaction shall be 95% for base course.

- c. The designed level for the new canals shall be same as the existing canals, and contractor has to take reading for the levels before demolishing the old canals in order to use these readings for implementation the new canal levels
 - d. Supplying, installing and painting control gates (Slide Gates), containing from 4 mm thick sheet Plate, with dimensions as per existing or new canal dimensions (contractor shall follow the existing gates as a details for his fabrication and installation works), the works shall include all the necessary accessories, tools or any equipment, including also the frames that shall embedded inside concrete or fixing with bolts with concrete, the gates including installing a chain for each gate that is tied to the gate plates and frames, the operation of open and close are manually. These steel gates or control gate shall be installed at the required locations as per site conditions and consultant instructions.
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X- Work description

Rehabilitation work for Qasr Al-Amir Canal area such as demolishing existing canals and build a new canal, with consider the water of canal shall be running and not stop the flow of water during implementation of all parts of rehabilitation works. The rehabilitation works include the following:

- 5- Contractor shall with consider the Canal water shall be running and not stop the flow of water during implementation of all parts of rehabilitation works
- 6- Demolishing and rebuild of new canal and the work included the following:
 - a. If the new canal will be implemented on soil layer (nature layer):
 - Demolishing the existing canal for existing path.
 - Excavate of canal path and compaction the existing soil.
 - Install Base course (150mm) thick with compaction degree (95%)
 - Casing blinding concrete (10 cm) with strength equal 200 kg/cm²
 - The canals inner and outer surfaces should be fair-face and smooth.
 - Backfilling and leveling around the canals outer section as per drawings and consultant approved.
 - b. If the new canal will be implemented on the existing foundation in case of the old canal is concrete canal:
 - During demolishing the old canal, both side wall shall be demolishing completely and the foundation shall be keep to be as hard base for foundation of a new canal.
 - Cleaning and removing all the demolishing materials offsite directly.
 - Steel bars shall be installed in the old foundation throw drilling and bonding by special materials like Epoxy the bars have to installed in Zigzag pattern and the distances between them will be not more than 40cm in one direction as per drawing and specifications.

- Formwork shall provide and installed as per consultant instructions and approvals.
 - 7- Concrete of Canal shall be not less than 250 kg/cm², and reinforcement steel grade 60 with yield strength 420N/mm² and with diameters as per drawings
 - 8- Backfilling and leveling around the canals outer section as per drawings and consultant approved.
-

Y- Control steel gate, slide gate for Canals

- 14- Supply and install steel gates (control gates) inside the inner side of canals for controlling the flow of water inside the canals and towards the sub-canals.
 - 15- All steel elements shall be painted by special layer to resist weather factors.
 - 16- The canals components are steel frames and steel plate of 4mm thick. The frame shall be four sides bottom, top and two sides the half of upper side shall be free fix.
 - 17- The dimension of canal shall be compatible with the inner width of existing or new canals.
 - 18- Chains shall provide to tie the upper side of frame with the sliding gate.
 - 19- The contractor shall install the gates in a manner that prevents leakage around the gate and binding of the gates during normal operation.
 - 20- Surfaces of metal against which concrete will be placed shall be free from oil, grease, loose mill scale, loose paint, surface rust, and other debris or objectionable coatings.
 - 21- Anchor bolts, thimbles, and spigot frames shall be secured in true position within the concrete forms and maintained in alignment during concrete placement.
 - 22- Concrete surfaces against which flat frames or plates are to be installed shall be finished to provide a smooth and uniform contact surface.
 - 23- When a flat frame is installed against concrete, a layer of concrete mortar shall be placed between the gate frame and the concrete.
 - 24- When a gate is attached to a wall thimble, a mastic or resilient gasket shall be applied between the gate
 - 25- frame and the thimble in accordance with the recommendations of the gate manufacturer.
 - 26- Wall plates, sills, and pin brackets for radial gates shall be adjusted and fastened by grouting and bolting after the gates have been completely assembled in place.
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Z- Special Condition for Rehabilitation Springs & Canals:

- The contractor is to remove all debris, excavated materials, rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and to keep the site clean for canals works.

- Contractor shall provide surveyor full time during soil nails works and during any activity, to insure and determined the levels, coordinate alignment of rock cut, also to assign and mark the location of soil nails before drilling works.
- The contractor shall provide all necessary equipment, Manpower, Tools, shutter, ... etc., which will be required to complete the works
- The contractor can provide a proposal for any works or any activities if he finds an alternative solution or alternative work procedures that will be easy and give the same Quality for the works with consider the specification terms, the approval for these proposals shall be for consultant Engineer.
- The contractor must maintain the continuity of the Canal's water flow and canal's water flow during all stages of the work.
- The price for implementation a new canal is including the demolishing of the old canals, cleaning and removing all obstacle, excavation if required, backfilling, materials, tools, machine manpower and all the necessary that required to complete the works in the best quality, also contractor shall be keep running the flow of water fulltime during execution duration for all activities.
- The contractor shall Demolishing and Removing existing canals, and implement a new canal with location are the same existing Canals route, also using the current levels for existing canals as designed levels for the newly implemented canals route, also the contractor can use a new level for the new designed canals according to approval from the consultant engineer.
- Contractor shall supply and install a Steel gate (Control Gates) for the canals at many locations as per BOQ, the price will be included with the canals amount, and to be constructed according to be as per the existing gates, specifications and consultant instructions
- It must be taken into consideration that the thickness and steel reinforcement of the canal's walls that adjacent to the earthen-cut or the mountain-cut must be greater than the thickness of the other canal's walls as per drawings and details, but for canals that located in place of no earthen-cut or no required backfilling near the canal's walls the thickness of these walls will be equal on both sides.
- Canals, collector water tank or other concrete elements the concrete cover (Steel Cover) is (5 cm-7.5cm) if the element contact directly with the soil, and (3cm) if the structure element not contact directly with soils.
- The contractor shall Obtain Necessary authorization for start-up and execution of works and this includes (but not limited to) all permits and approvals related to the use of land, permission to build and access, as well as all relevant governmental bodies authorization depending on the proposed project requirements and on the national law.
- the contractor shall submit Method statement for any activity as per consultant instructions such as method statement for soil nails wall, storm water drainage line, canals, etc.

- canal removal work shall be includes removing all components of the canal, according to the current section of the site. In the case of concrete sections for canal, Riprap, or flow of water through regular soil canals, two cases shall be considered:
 - In the case of reinforced concrete walls, Blocks, and reinforced concrete foundations, all walls must be removed, but the foundations can be kept and adopted as a basis for the new canals that are required to be constructed.
 - In the case of non-reinforced canals (earth or Riprap), all their components must be removed, the backing must be compacted after removal, all foundation layers must be installed, including base course and Blinding Concrete, and the foundations and walls of the new canals must be constructed according to the required Drawings and specifications.
- When constructing new canals and indicating the instability of the old Foundation due to the location of the canal on the slope of the mountainous area, the contractor must stabilize the old foundation and the ground on which it is required to be established before the work of constructing the new canals, by using a stone wall below the foundation area with steel mesh and shotcrete or any idea from contractor and after approval by consultant.
- If the canals are located on flat ground, the canals must be constructed with all their layers, as per drawings and design, including a base course layer and blinding concrete with all necessary works related to these activities.
- Carrying out plastering work for the damaged areas for the retaining walls that a new canal will be constructed above these retaining walls, and rested above these walls, the work includes the following:
 - Clean and wash the retaining wall section from soil, dirt and stones before carrying out the plastering work and remove the cleaning waste away from the site.
 - Carrying out plastering work for the retaining wall section, two coats of plaster shall apply with a mixture of sand, cement, including sea sand and an adhesive. The ratio of sand to cement is 1:4. The first side is rough, the plastering works including the final coat of smooth finish, the works included supply and apply of all required materials, water, curing three days, tools and machine.
- The dimensions are according to the drawing and the supervisor instructions.
- For any case of reinforced concrete which will contact direct to soil, Base Coarse (min. thick 15cm and MDD 95%) and Blinding concrete (10 cm) should be applied at the below of reinforced concrete as layers, if this mentioned in drawings or not.
- The contractor shall provide any required type of shutter (Formwork), including fair-face timber in order to complete the required works and as per consultant instructions.
- The contractor shall implement a concrete collector tank which should be connected directly with the Canal sources to collect all water that Coming from Canal before flowing throw the canals.
- The contractor shall supply and install a Water-stop rubber (thick. 20-25cm) for any size of Concrete-collector-tank at any Canal, the location of this rubber shall be in the contact between foundation and vertical walls, first half width of this water-stop should embed in the foundation and the other half should have imbedded in the vertical walls.

- Dimension of Collector water tanks or canals for any Canals shall as per drawings, and the compressive strength for these tanks are 250 kg/cm³, concrete slump 10cm, the contractor shall provide concrete cubes for compressive strength test using 15cmX15cm cubes, the number of cubes for any test shall be 6 cubes, the first 3 cubes for doing the test and take the average, and the Additional 3 cubes for spare in case of failing the first cube test we can use it to do the test again.
- Steel specifications are ASTM designation A-615 or equivalent, stress =4200 kg/cm², grade 60
- For any reinforced concrete works, plastering works, ... etc. the concrete has to be cured with water for three days two times a day, vibrator shall provide and use during casting a reinforced concrete.
- In case of segregation, it must be treated with special filler-expansion materials and according to the consultant instructions and approvals, the consultant can decide for treatment or demolishing (removing) the concrete structure and the contractor have to follow the instructions by removing this structure and redo the work.
- Wall and roof shutters should not be removed before 3 and 14 days after casting respectively.
- ready mix concrete is the allowed concrete for any part of reinforced concrete structure, the contractor shall submit mix design for consultant approvals, in special cases and conditions it is allowed to use onsite-mixing and manual casting, with consider the percentage of mix components during onsite-mixing.
- The prices for all required materials, tools, shuttering, fixing steel, casting concrete, ...etc. are included in the unit prices unless it mentioned otherwise.
- The contractor shall provide a cover-block (Plastic or concrete) as required for canals, concrete water tank or other concrete elements, the concrete cover (Steel Cover) is (5 cm-7.5cm) if the structure contact direct with the soil, and (3cm) if the structure not contact directly with soils.
- The levels which indicated in the drawings of Canal's underground water tank are from Surveying work results, therefore, if required to change any level from these levels for any reason during the work conditions, the other related levels should be change also, to keep the constructions depth or high as same as before changing the origin level.
- The contractor shall implement a concrete collector tank with dimension 1.8X1.8m and height of 1.65m, the work shall include (but not limit to) all the necessary accessories, materials, tools equipment, etc. which required to accomplish all the activities.
- The contractor shall Excavate in all types of soil and rock according to drawings levels and dimensions and to the technical specifications. The work starts by clearing, grubbing of top soil as specified.
- For any concrete construction or sub-elements for any works in the tender such as collector tanks, manholes, Canals or etc., the contractor shall Excavate any type of soil or rock according to drawings dimensions and to the technical specifications.

- The contractor also for any kind of activity and according to the drawings and specifications, shall do an Cleaning and Leveling, remove all debris, excavated materials, Rocks boulders, Stones, unnecessary roots, Grass, obstacles, rubbles, excavation output which are not reusable by other works and any obstacles listed or not listed in contract, off site to an approved location as per directions by consultant supervisor/Engineer and Authorities approval, and keep the site clean and Level as per Drawings.
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