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1 CONTROL OF WATER, CONSTRUCTION DRAINAGE AND DEWATERING


1.1 SCOPE OF WORK

- i) The Contractor shall provide all labour, material, and equipment necessary to design, build, operate, maintain, and remove the temporary dewatering facilities for protecting the Works under construction against flood flows in the rivers and creeks, and to design, build, install, operate, maintain and dismantle the temporary dewatering facilities required to remove service water and natural surface flow or groundwater seepage from the working areas on surface as well as from underground.
- ii) The Contractor shall be responsible for maintaining work sites free of water at all times. Contractor shall make good any damage whatsoever caused by flooding of the work sites due to failure of equipment, improper maintenance of protective works, and acts of negligence in his performance of the Work. The contractor shall indemnify OWNER against claims arising out of any such failure, lodged by other contractors, landholders or other persons.
- iii) The work shall be executed in accordance with the Contractor's design and specifications, and sequences as approved by the Project Manager.
- iv) Temporary dewatering facilities shall be removed upon Completion of Works.


1.2 SUBMITTALS

- i) Within 28 days after the date of issue of the Notice to Commence the work, the Contractor shall submit to the Project Manager the detail planning of all diversion, protection and dewatering systems and the necessary flow measurements.
- ii) This design shall be consistent with the outline description submitted by the Contractor with his Tender, and shall include the following:
 - a) Design assumptions and calculations,
 - b) Layout of diversion and drainage facilities,

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<p>construction sites. The Contractor shall supply, install, maintain, and operate all dewatering pumps, pipes, supports, channels, troughs, electrical installations, and necessary accessories, and other consumables required to maintain the different work sites free of water during construction.</p> <p>ii) The Contractor shall provide standby power supply unit commensurate with the capacity of the pumps as to cope with the water inflow construction sites during periods of breakdown and maintenance of his main power supply units.</p> <p>iii) Dewatering of the surface as well as the underground sites shall be undertaken by gravity as far as possible. Only where dewatering by gravity is not practical, pumping shall be resorted to after this mode has been approved by the Project Manager.</p> <p>iv) The Contractor shall propose the permanent sumps locations for approval of the Project Manager. The energy meters for the purpose of measuring energy consumed in dewatering for payment shall be installed at those locations.</p> <p>v) Where, in the opinion of the Project Manager existing or potential water inflows into excavations can be reduced or controlled by grouting, the Contractor shall perform grouting in accordance with Chapters “Drilling” and “Grouting”.</p> <p>vi) The pumped water carried in pipes or flumes shall be discharged at point sufficiently away from the edge of the excavation. Care shall be taken to ensure that there is no seepage or backflow to the working areas.</p> <p>vii) Water discharge from work areas shall not pollute or endanger the environment. Any polluted water coming from the working sites shall be treated prior to its discharge. Particular attention shall be paid to avoid possible pollution from oil or solvents coming into contact with the water prior to its discharge from the Site. Oil separators shall be provided within the drainage system as necessary.</p> <p>viii) The Contractor shall ensure that all drainage water will be disposed of without causing interference to his own or other contractors operations</p>		

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elsewhere at the Site and that no drainage water runs into adjacent Works. The dewatering systems shall not adversely affect any of other project activities and structures or works of other agencies. Where more than one agency are working in the same or adjacent area, the Contractor who has already provided the drainage facility, shall extend this facility to other agencies also. In case of any dispute in apportioning of such expenditure, it shall be decided by the Project Manager, whose decision shall be final. In no case, the Contractor shall stop the drainage activity.

- ix) In case the flow from one of the Contractor's site is passing through the site of other contractors or agencies, the Contractor in whose site the origin of the water is located shall attend the drainage.
- x) If at any time during construction stage, in the opinion of Project Manager, dewatering pumps in addition to the installed dewatering capacities are required in any working area, the Contractors shall provide and install such additional capacity of dewatering system.


1.5.2 DEWATERING OF SURFACE CONSTRUCTION SITES


- i) The Contractor shall perform all works necessary to drain the surface construction sites of rain, groundwater and service water. The work shall include, but not be limited to the following:
 - a) Design and construction of drainage, ditches, pits, pump sumps and settlement ponds with oil separators,
 - b) Design, furnishing, operation and maintenance of dewatering equipment,
 - c) Relocation of dewatering facilities required for the performance of other works,
 - d) All auxiliary works required for safe and continuous dewatering of the construction sites.
- ii) The Contractor shall design and install complete facilities at the surface construction sites. All the components of the dewatering systems shall be

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<div> <p>installed and operated in accordance with the agreed method and the construction time schedule, or approved modification thereof.</p> <p>iii) Dewatering near the river or stream shall be done to natural downstream water level by gravity. Suitable drainage shall be made joining the course downstream of the construction site to provide required gradient to facilitate proper and efficient dewatering. Below the natural water table, dewatering shall be done by pumping water collected in the sumps and discharging the same into the river course downstream of the construction site.</p> <p>iv) The Contractor shall provide, install, maintain, and operate adequate pumping and other equipment, including standby units, to drain all water entering into any of surface construction sites. In addition, he shall provide sumps and pumps and/or well points in the immediate vicinity of foundations of structure using such water conductors as are necessary to conduct the water away from the excavation and concrete placement operations in an approved manner.</p> <p>v) The Contractor shall provide the necessary power and energy for operating the pumps and wellpoints, if any, system. The standby power supply shall undergo weekly trial runs lasting at least 30 minutes.</p> <p>vi) The dewatering systems shall be designed and installed in such a way that modifications and extensions to the systems are possible while they are in full operation.</p> <p>vii) Upon completion of dewatering, temporary pipes and pump sumps beneath permanent structures shall be closed off and completely filled with grout, mortar or concrete as required by the Project Manager.</p> <p>1.5.3 <u>DEWATERING OF UNDERGROUND CONSTRUCTION SITES</u></p> <p>i) The Contractor shall perform all work necessary to collect and drain service and infiltrating groundwater, convey it to main conduits, and lead it out from underground Works such as tunnels, caverns, adits or shafts.</p> <p>ii) The work shall include, but not be limited to, the following:</p> <p>a) Design and construction of pits and trenches,</p> </div>		

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<div> <div> <div>b)</div> <div>Design, supply, operating, and maintenance of dewatering equipment,</div> </div> <div> <div>c)</div> <div>Relocation of dewatering facilities required for the performance of other tunnelling work,</div> </div> <div> <div>d)</div> <div>Design construction and operation of settlement ponds with oil separators at the portals,</div> </div> <div> <div>e)</div> <div>All auxiliary work required for the safe and continuous dewatering of the underground sites.</div> </div> </div> <div> <div>iii)</div> <div>Pilot holes will be drilled if required by the Project Manager, to provide information on the inflow of water into the tunnel or shaft as the excavation proceeds. Where the indications are such, that flows are likely to be large, grouting to seal off the water flows and drilling of drainage holes shall be undertaken with the approval of the Engineer in Charge.</div> </div> <div> <div>iv)</div> <div>The Contractor shall design and provide a complete dewatering system for both the descending and the ascending headings. Dewatering of the ascending heading shall be by gravity alone. The Contractor shall design and construct corresponding drainage trenches in the tunnel inverts with or without lining as appropriate and as instructed by the Engineer in Charge. Dewatering of descending headings shall be performed by an appropriate system of pump sumps and piping.</div> </div> <div> <div>v)</div> <div>After break-through in the tunnel and shaft, the drainage water from the descending heading shall be taken over by the upgrade drainage system of the ascending heading (dewatering by gravity).</div> </div> <div> <div>vi)</div> <div>All excavated areas shall be drained of all surface and ground water. In order to keep the construction areas free from water, the dewatering systems must be able to operate at any time during the whole construction period in any apart of the Works at the required capacity.</div> </div> <div> <div>vii)</div> <div>The Contractor shall provide adequate pumping capacity, including a sufficient number of standby pumping units, to handle all water entering into any portion of underground Works. These units shall be connected to the</div> </div> <div> <div>ISSUE P0</div> </div>		

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dewatering systems in such a way that proper and uninterrupted drainage will be guaranteed throughout the entire construction period.

- viii) The Contractor shall provide the necessary power and energy for operating the dewatering system. The standby power supply shall undergo weekly trial runs lasting at least 30 minutes.
- ix) All components of the systems shall always be maintained in ready-for-service condition and all access to pumps and other equipment shall be kept in good condition under the most adverse conditions.
- x) The dewatering systems shall be designed and installed in such a way that modifications and extensions to the systems are possible while they are in full operation.
- xi) All components of the dewatering system shall be installed and operated in accordance with the agreed method and the construction time schedule, or approved modifications thereof.
- xii) If required appropriate drainage holes shall be drilled either directly into the rock or through the concrete lining and/or consolidation-grouting measures shall be performed to seal the underground excavations from water ingress. The drilling and grouting measures shall be carried out in accordance with the chapter "Drilling" and "Grouting".
- xiii) After the excavated profile has been checked, the ground water which runs or drips into the excavated space shall be diverted into the drainage trench by means of water collectors, plastic foils, and pipes for collecting the seepage water from rock surfaces or steel lagging. Damp surfaces or seepage areas with low volume in flows can be sealed off with a quick-setting sealing compound.
- xiv) Particular care shall be exercised where excavation passes through material, which is liable to soften or swell when it comes into contact with water. In such locations the water entering the excavated space shall be collected as soon as possible and conveyed away in a pipe or other impervious channel in such a way that the water cannot come into contact with such material. Should the Contractor neglect to observe this

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requirement and a deterioration of the tunnel invert results from water being allowed to flow over or stand upon the sensitive or swelling material, the Project Manager may order the removal of the affected material and its replacement with concrete. The Project Manager may order installation of additional rock supports in connection with such remedial work.

- xv) If any water from another portion of the tunnel or shaft flows into a lower section where concreting is being done, either for the invert or for drainage trench or any other concreting likely to be affected by water, all such water shall be diverted past this area in such a way that no damage occur to the concrete. The length of the affected sections over which water has to be diverted shall be ordered by the Project Manager.
- xvi) The Contractor shall perform regular checking and cleaning of the drainage trench and all dewatering equipments and accessories during the whole construction period.
- xvii) The dewatering facilities shall be kept in operation according to the agreed schedule, which shall be related to the progress of the work. No pumps may be stopped, no pipes, ducts, trenches, etc., shall be taken out of service without the prior permission of the Project Manager in writing.
- xviii) Any openings such as pipes, boreholes, ducts, pumps, sumps etc., used for temporary drainage purposes in any part of the Works shall be completely sealed by filling with grout, mortar or concrete when no longer required, unless the contrary is directed by the Project Manager in writing. The Contractor shall notify the Project Manager in writing before any such openings are permanently closed.

1.6 **MEASUREMENT AND PAYMENT**

- i) The contractor shall be entitled to no claim for damages or additional compensation or payment for water leaking through under or around cofferdams/ temporary bunds.


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1.6.2 DEWATERING OF SURFACE CONSTRUCTION SITES

- i) Payment for the dewatering of surface construction sites shall be made on lump sum basis.
- ii) The quoted lump sum amount shall include but not limited to the entire cost of the following:
 - a) Supply, transportation, installation, operations, maintenance, testing, and removal of pumps, pipelines with all accessories, and other dewatering equipment for pumping water, regardless of the amount of water,
 - b) Design of all dewatering system,
 - c) All costs and labour for excavation, construction and protection of drainage ditches, wells, pits, pump sumps, and settlement ponds,
 - d) Multistage pumping,
 - e) Capturing and conveying the water into the drainage system,
 - f) Moving of the pumps and pipes as necessary between different locations,
 - g) All auxiliary work required.
- iii) The quoted lump sum amount will be payable to the Contractor on pro-rata basis of the cost of completed work for the particular Package at the time of billing. The lump sum amount shall hold good for any quantity of dewatering required to be done by Contractor without any variation/deviation limits.
- iv) The meters and other electrical connections shall be installed by the Contractor at his own expense. Meters shall be calibrated and tested before installation and the test reports shall be submitted to the Project Manager prior to installation.
- v) The Contractor shall not be entitled to any claim or compensation due to failure or interruptions in electric supply.
- vi) Payment for grouting and other seepage control and treatment work shall be paid as stipulated in the Chapters “Drilling” and “Grouting”.

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<div> <div> vii) Payment for drainage trench excavated along the top of excavated slopes will be deemed to be included in the appropriate Unit Prices for excavation, concrete, rock paving or others, as the case may be. Drain ditches on the berms will not be measured for payment and the cost thereof shall be included in the Unit Prices for surface excavation. </div> <div> viii) Any repair work or any indemnities which result from non-compliance by the Contractor with any requirements of this Chapter shall be at the Contractor's full responsibility and at his expense. </div> <div> 1.6.3 <u>DEWATERING OF UNDERGROUND CONSTRUCTION SITES</u> </div> <div> i) Measurement for payment for dewatering underground construction sites shall be made on lump sum basis. </div> <div> ii) See 1.6.2 ii) to 1.6.2 v) above, which applies also for Underground Construction Sites. </div> <div> End of Chapter </div> <div> ISSUE P0 </div> </div>		