

## CHAPTER 7

## CONTRACT SPECIFICATIONS

7-1. General. Good specifications are essential to ensure adequate dewatering and groundwater control. Specifications must be clear, concise, and complete with respect to the desired results, special conditions, inspection and control, payment, and responsibility. The extent to which specifications should specify procedures and methods, is largely dependent upon the complexity and magnitude of the dewatering problem, criticality of the dewatering with respect to schedule and damage to the work, and the experience of the probable bidders. Regardless of the type of specification selected, the dewatering system(s) should be designed, installed, operated, and monitored in accordance with the principles and criteria set forth in this manual.

## 7-2. Types of specifications.

**a. Type A.** Where dewatering of an excavation does not involve unusual or complex features and failure or inadequacy of the system would not adversely affect the safety of personnel, the schedule, performance of the work, foundation for the structure, or the completed work, the specifications should be one of the following types:

(1) **Type A-1.** A brief specification that requires the Contractor to assume full responsibility for design, installation, operation, and maintenance of an adequate system. (This type should not be used unless the issuing agency has considerable confidence in the Contractor's dewatering qualifications and has the time and capability to check the Contractor's proposal and work.)

(2) **Type A-2.** A specification that is more detailed than type A-1 but still requires the Contractor to assume the responsibility for design, installation, operation, and maintenance. (This type conveys more information regarding requirements of design and construction than type A-1 while retaining the limitations described in (1) above.)

**b. Type B.** Where dewatering or relief of artesian pressure is complex and of a considerable magnitude and is critical with respect to schedule and damage to the work, the specifications should be of one of the following types:

(1) **Type B-1.** A specification that sets forth in detail the design and installation of a "minimum" system that will ensure a basically adequate degree of dewatering and pressure relief but still makes the Contractor

fully responsible for obtaining the required dewatering and pressure relief as proven by a full-scale pumping test(s) on the system prior to start of excavation, and for all maintenance, repairs, and operations.

(2) **Type B-2.** A specification that sets forth in detail the design and installation of a system that has been designed to achieve the desired control of groundwater wherein the Government or Owner assumes full responsibility for its initial performance, based on a full-scale pumping test(s), but makes the Contractor responsible for maintenance and operation except for major repairs required over and beyond those appropriate to normal maintenance. (This type of specification eliminates claims and contingencies commonly added to bid prices for dewatering and also ensures that the Government gets a dewatering system that it has paid for and a properly dewatered excavation if the system has been designed and its installation supervised by qualified and experienced personnel.)

(3) **Type B-3.** A specification that sets forth the desired results making the Contractor solely responsible for design, equipment, installation procedures, maintenance, and performance, but requires that the Contractor employ or subcontract the dewatering and groundwater control to a recognized company with at least 5 years, and preferably 10 years, of experience in the management, design, installation, and operation of dewatering systems of equal complexity. The specification should also state that the system(s) must be designed by a registered professional engineer recognized as an expert in dewatering with a minimum of 5 to 10 years of responsible experience in the design and installation of dewatering systems. This type of specification should further require submittal of a brief but comprehensive report for review and approval including:

(a) A description and profile of the geology, soil, and groundwater conditions and characteristics at the site.

(b) Design values, analyses, and calculations.

(c) Drawings of the complete dewatering system(s) including a plan drawing, appropriate sections, pump and pipe capacities and sizes, power system(s), standby power and pumps, grades, filter gradation, surface water control, valving, and disposal of water.

(d) A description of installation and operational procedures.

(e) A layout of piezometers and flow measuring

devices for monitoring performance of the system(s).

(f) A plan and schedule for monitoring performance of the system(s).

(g) A statement that the dewatering system(s) has been designed in accordance with the principles and criteria set forth in this manual.

(h) The seal of the designer.

(This type of specification should not be used unless the Government or Owner has or employs someone competent to evaluate the report and design submitted, and is prepared to insist on compliance with the above.)

7-3. Data to be included in specifications. All data obtained from field investigations relating to dewatering or control of groundwater made at the site of the project should be included with the specifications and drawings or appended thereto. These data should include logs of borings; soil profiles; results of laboratory tests including mechanical analyses, water content of silts and clays, and any chemical analyses of the groundwater; pumping tests; groundwater levels in each aquifer, if more than one, as measured by properly installed and tested piezometers, and its variation with the season or with river stages; and river stages and tides for previous years if available. Borings should not only be made in the immediate vicinity of the excavation, but some borings should be made on lines out to the source of groundwater flow or to the estimated "effective" radius of influence. Sufficient borings should be made to a depth that will delineate the full thickness of any substrata that would have a bearing on the control of groundwater or unbalanced uplift pressures. (Additional information on field investigations and the scope of such are given in chap 3.) It is essential that all field or laboratory test data be included with the specifications, or referenced, and that the data be accurate. The availability, adequacy, and reliability of electric power, if known, should be included in the contract documents. The same is true for the disposal of water to be pumped from the dewatering systems. The location and ownership of water wells off the project site that might be effected by lowering the groundwater level should be shown on one of the contract drawings.

7-4. Dewatering requirements and specifications. The section of the specifications relating to dewatering and the control of groundwater should be prepared by a geotechnical engineer experienced in dewatering and in the writing of specifications, in cooperation with the civil designer for the project. The dewatering specifications may be rather general or quite detailed depending upon the type of specification to be issued as described in paragraph 7-2.

CL. *Type A specifications.*

(1) If the specification is to be of Types A-1 and A-2 described in paragraph 7-2a(1) and (2), the desired results should explicitly specify the level to which the groundwater and/or piezometric surface should be lowered; give recommended factors of safety as set forth in paragraph 4-8; require that all permanent work be accomplished in the dry and on a stable subgrade; and advise the Contractor that he is responsible for designing, providing, installing, operating, monitoring, and removing the dewatering system by a plan approved by the Contracting Officer or the Engineer. This type of specification should note the limitations of groundwater information furnished since seepage conditions may exist that were not discovered during the field exploration program. It should be made clear that the Contractor is not relieved of responsibility of controlling and disposing of all water, even though the discharge of the dewatering system required to maintain satisfactory conditions in the excavation may be in excess of that indicated by tests or analyses performed by the Government. This type of specification should not only specify the desired results but also require that the Contractor provide adequate methods for obtaining them by means of pumping from wells, wellpoint systems, cutoffs, grouting, freezing, or any other measures necessary for particular site conditions. The method of payment should also be clearly specified.

(2) Prior to the start of excavation the Contractor should be required to submit for review a proposed method for dewatering the excavation, disposing of the water, and removing the system, as well as a list of the equipment to be used, including standby equipment for emergency use. (This plan should be detailed and adapted to site conditions and should provide for around-the-clock dewatering operation.)

(3) Perimeter and diversion ditches and dikes should be required and maintained as necessary to prevent surface water from entering any excavation. The specifications should also provide for controlling the surface water that falls or flows into the excavation by adequate pumps and sumps. Seepage of any water from excavated slopes should be controlled to prevent sloughing, and ponding of water in the excavation should be prevented during construction operations. Any water encountered in an excavation for a shaft or tunnel shall be controlled, before advancing the excavation, to prevent sloughing of the walls or "boils" in the bottom of the excavation or blow-in of the tunnel face. If the flow of water into an excavation becomes excessive and cannot be controlled by the dewatering system that the Contractor has installed, excavation should be halted until satisfactory remedial measures have been taken. Dewatering of excavations for shafts, tunnels, and lagged open excavations should continue for the duration of the work to be performed in the ex-

cavations unless the tunnel or shaft has been securely lined and is safe from hydrostatic pressure and seepage.

(3) The specifications should also require that the Contractor's plan provide for testing the adequacy of the system prior to start of excavation and for monitoring the performance of the system by installing piezometers and means for measuring the discharge from the system.

*b. Type B specifications.*

(1) Types B-1 and B-2 specifications (para 7-2b(1) and (2)) should set forth not only the required results for dewatering, pressure relief, and surface water control, but also a detailed list of the materials, equipment, and procedures that are to be used in achieving the desired system(s). The degree of responsibility of the Contractor for dewatering should be clearly set forth for specification types B-1 and B-2 as previously stated in paragraph 7-2. With either type of specification, the Contractor should be advised that he or she is responsible for operating and maintaining the system(s) in accordance with the manufacturer's recommendation relating to equipment and in accordance with good construction practice. The Contractor should also be advised that he or she is responsible for correcting any unanticipated seepage or pressure conditions and taking appropriate measures to control such, payment for which would depend upon the type of specification and terms of payment.

(2) Type B-3 specifications (para 7-2b) should include the basic requirements set forth above for types A-1 and A-2 specifications plus the additional re-

quirements set forth for type B-3 specifications in paragraph 7-2.

7-5. Measurement and payment.

a. Payment when using types A-1 and A-2 specifications is generally best handled by a "lump sum" payment.

b. Payment when using type B-1 specifications may be based on a lump sum type, or unit prices may be set up for specific items that have been predesigned and specified with lump sum payment for operational and maintenance costs,

c. Payment when using type B-2 specifications is generally on the basis of various unit prices of such items as wells, pumps, and piping, in keeping with normal payment practices for specified work. Operation for maintenance and repairs generally should be set up as a lump sum payment with partial payment in accordance with commonly accepted percentages of work completed,

d. Payment when using type B-3 specifications would generally be based on a lump sum type of payment.

e. Payment for monitoring piezometers and flow measuring devices is generally made in keeping with the method of payment for the various types of dewatering specifications described above,

**7-6.** Examples of dewatering specifications. Examples of various types of specifications described in paragraph 7-2, based on specifications actually issued and accomplished in practice, are included in appendix G.