

## SECTION 02405

### DEWATERING

*This section should be edited to reflect soil and groundwater conditions specific to the project site and the recommendations of a Geotechnical Engineer or hydrogeologist licensed in the State of Washington*

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

*Describe the dewatering work required for the project.*

This Section specifies dewatering requirements for installation of the new Hosmer Pumping Station. The City expects that temporary dewatering for pump station and wet well construction will be necessary unless a self contained, water proof, temporary shoring method is proposed. Dewatering shall consist of the furnishing, installation, testing, operation, maintenance, and removal of a dewatering system to achieve proper completion of all work performed under this Contract. The Contractor shall limit its dewatering efforts to localized areas for specific structures. The dewatering well systems shall meet the minimum standard for construction and maintenance of wells, Chapter 173-160 WAC, specified by the Department of Ecology, State of Washington.

The Contractor shall furnish, install, operate and remove any and all additional machinery, appliances and equipment necessary to keep excavations free from water during construction. The Contractor shall at all times have on hand sufficient pumping equipment and machinery in good working condition for all emergencies, including power outage and flooding. The Contractor shall be responsible for maintaining all electric power service connections to the dewatering system components. The Contractor shall have available at all times competent workers for the continuous and successful operation of the dewatering and monitoring systems. These systems shall not be shut down between shifts, on holidays, or weekends, or during work stoppage without written permission from the City.

The Contractor shall dewater and dispose of the water so as not to cause injury to public or private property, or to cause a nuisance or a menace to the public, and dispose of all water in a manner that is compliant with all pertinent permitting and regulatory requirements.

The Contractor shall control groundwater such that softening of the bottom of excavations, or formation of "quick" conditions or "boils" during excavation shall not occur. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils and to prevent damage to existing structures or interruption of site work. The Contractor shall maintain water levels a minimum of 2 feet below the bottom of all excavations at all times and under all conditions.

During excavating below the water table, construction of structures, installing of pipelines, placing working base, structure and trench backfill, the placing and setting of concrete, and prior to the acceptance of the work or any portion of the work, the Contractor shall

Work Order No. \_\_\_\_\_

4/22/2004 11:01 AM p:\21058\200\207\Final Draft\Specs\Common  
Last Revision Date: 12/18/03

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keep the excavation free of water. The Contractor shall control surface runoff so as to prevent entry or collection of water in excavations or in other isolated areas of the site.

Before dewatering is started, the Contractor shall submit the proposed method, installation procedures, and details of the dewatering system to the Engineer for review. Review by the Engineer of the method, installation and operation and maintenance details submitted by the Contractor shall not in any way be considered to relieve the Contractor from full responsibility for errors therein or from the entire responsibility for complete and adequate performance of the system in controlling the water level in the excavated areas. The Contractor shall be solely responsible for proper installation, operation, maintenance, and any failure of any component of the dewatering system for this Contract.

*Reference any groundwater information available to the City.*

**EXAMPLE:**

Pumping test data performed on this site is available in the Supplemental Geotechnical Report and Pumping Tests at 93rd & Hosmer Street Pump Station Upgrade, dated February 1999, and is provided with the project manual. Use of this information in no way relieves the Contractor from its responsibility for design, construction, and operation of a properly functioning dewatering system. Any additional testing or pumping the Contractor may wish to perform in order to assure itself of being able to provide a properly functioning dewatering system shall be at the Contractor's own cost.

**1.02 QUALITY ASSURANCE**

This section contains references to the documents listed below. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

| Reference           | Title   |
|---------------------|---|
| Chapter 173-160 WAC | Minimum Standards for Construction and Maintenance of Wells |

### 1.03 PERFORMANCE REQUIREMENTS

The Contractor shall drill and install monitoring wells and dewatering wells consistent with the requirements of this specification. The Contractor shall install additional wells as necessary to meet dewatering requirements with no additional cost to the Owner.

The Contractor shall provide sufficient number of pumps with adequate capacity at the site. Standby pumps and generators shall be on hand at all times. Provide appropriate sumps and ditches.

The Contractor shall provide backup power generation and minimum 20% Dewatering System components, including valves, flowmeters, pumps and piping, and devise emergency procedures for maintaining continuous uninterrupted groundwater control operations. The recovery of water levels in the soil may be rapid if pumping is interrupted. Stand-by equipment shall be installed and ready to operate to assure continuous pumping in the event that any or all of the Dewatering System becomes inadequate.

The Contractor is responsible for obtaining all necessary permits for installation and maintenance of the dewatering system, including permits necessary for disposal of water.

The Contractor shall maintain the Dewatering System during all phases of construction.

The Contractor shall provide adequate protection and warning signs where construction equipment crosses over, or is in the vicinity of discharge piping.

The Contractor shall provide separate flowmeters at each of the main line headers for the deep wells and seepage collection distribution piping so that flow rates can be monitored on a daily basis.

The Contractor shall be responsible for operating, maintaining, and monitoring the Dewatering System. System maintenance shall include, but not be limited to, at least daily supervision by some responsible person skilled in the operation, maintenance, and monitoring of flow rates from wells and sumps, replacement of system components, and any other work required to maintain the performance of the system. The system operation shall be continuous, and interruptions shall not be permitted.

Sufficient personnel skilled in the operation, maintenance, and replacement of the Dewatering System components shall be available 24 hours per day, seven days a week, including holidays, at all times when the system is in operation.

The Contractor shall maintain records of the Groundwater Control System installation and performance data. The records shall include well depths, elevations, dates of installation, approximate rates of flow, water levels at various times during construction, and sump and piping locations. Flow rates and the amount of settleable solids removed shall be recorded during operation of the Dewatering System.

## 1.04 DESIGN REQUIREMENTS

The Dewatering Plan shall be prepared, stamped and signed by an engineer or registered hydrogeologist licensed in the State of Washington. The professional shall be experienced in the design of dewatering systems for similar excavations.

### A. DISCHARGE POINTS:

*Describe acceptable locations available for disposal of groundwater.*

#### EXAMPLE:

Groundwater may be discharged to the existing storm drain manhole north of the intersection of South 92nd Street and Alaska Street, provided that it does not exceed the capacity of the existing facilities. The Contractor must meet all permit conditions and secure all required permits from the City and other applicable agencies prior to any discharge.

### B. ELECTRICAL SUPPLY FOR INSTALLATION OF DEWATERING SYSTEMS:

The electrical service used for dewatering shall be supplied by the Contractor and shall be separate from all other Contractor electrical requirements. The service shall be dedicated solely to the operation of the dewatering systems. If portable generators are utilized they shall be surrounded by noise reduction enclosures to minimize disturbance to neighbors. Generator noise shall not be more than 25 decibels at 40 feet from the generator.

### C. DEWATERING SYSTEM PROTECTION

The Contractor shall be responsible for taking all reasonable precautions necessary to insure continuous, successful operation of the dewatering system. This includes adequate marking of all well, pump and pipeline locations. Wherever dewatering wells, vacuum headers or discharge lines shall be crossed for access and egress, steel ramps shall be used to protect the system from vehicular and foot traffic. All ramps shall be capable of supporting the heaviest equipment on site and shall provide at least six-inches of clearance between the dewatering system element and the underside of the ramp. All vehicular access points across the dewatering system shall be clearly identified with brightly colored or flagged 8-foot high poles on each side of the access point. All ramped pipelines shall be valved on both sides of the ramp. Routings affecting regular vehicular traffic patterns in the vicinity of the project, must be approved by the City before installation.

### D. FILTER MATERIAL

*Reference any information on subsurface soil gradation.*

For well installations using an artificial gravel pack, the gravel pack filter material shall be clean, rounded, and washed, select gravel, free from silt, clay and other foreign material. The gravel pack sizes shall be determined by the Contractor and reviewed by the City, as part of the dewatering plan. The gravel pack shall be designed to maximize the flow of water into the wells and minimize the amount of fine grained material removed from the formation. The gradation of the filter material shall form a smooth and gradual grain size distribution curve when plotted. Utilize information from the (EXAMPLE: Supplemental Geotechnical Report and Pumping Tests

at 93rd & Hosmer Street Pump Station Upgrade, dated February 1999), to determine the grain size of the filter pack. However, the Contractor shall be prepared to provide (at no extra cost to the City) the required gravel pack material in accordance with the soils actually encountered during installation of the dewatering system. Re-submit documentation in support of the revised filter grain size determination.

Furnish sufficient gravel for initial gravel packing of each well and any additional gravel that may be necessary during well development.

The City's review of the Contractor's selection of gravel pack in no way relieves the Contractor of its responsibility for designing and installing wells or wellpoints that do not adequately protect foundation soils from fines removal.

## **E. FORMATION PROTECTION**

Design and construct the dewatering system such that foundation soils, natural or engineered, will not be subject to fines removal upon pumping. The Contractor shall perform sand content measurements in the presence of the Engineer. Provide the City with 24 hours notice prior to taking measurements. Monitoring for sand content shall be performed for each dewatering discharge on a daily basis until it meets the specified requirements and on a weekly basis thereafter.

### **1.05 SUBMITTALS**

Within 30 days after Notice to Proceed, submit drawings and complete design data showing methods and equipment proposed for use in dewatering and in maintaining the water level outside the excavation. All dewatering submittals will be subject to review by the Engineer. As a minimum, provide the following submittals in accordance with (Reference Submittal submission requirements.):

1. Drawings indicating the location and size of any berms, dikes, ditches, sumps, vacuum and discharge lines, flowmeters, silt tanks, and additional monitoring wells. All dewatering wells and monitoring well locations should be shown, these shall conform to the requirements of this specification.
2. Specifications for pumps including pump curves.
3. Submit calculation certification of flowmeters.
4. Certificate of filter material quality and gradation.
5. Detailed description of the dewatering schedule, operation, maintenance, and abandonment procedures.
6. Capacities of pumps, and standby equipment.
7. Design calculations demonstrating adequacy of system and selected equipment.

8. Detailed description of the dewatering schedule, installation methods, operation, maintenance, discharge rate and water level measurement procedures, and system abandonment procedures.
9. Filter pack design data and gradation.
10. Submit documentation in support of the filter pack grain size determination.
11. Furnish a certificate of gravel pack material quality and gradation prior to having gravel delivered to the site.
12. Permits for discharge of dewatering.

Review by the Engineer of the submitted drawings and data will not in any way relieve the Contractor from full responsibility for errors therein.

Submit well completion and boring logs to the Engineer within 14 days of installation.

Throughout the duration of construction, the Contractor shall submit weekly reports on daily dewatering and disposal operations. The reports shall present the following information.

1. Number of wells in operation for each system.
2. Average rate of water pumped from each pump and well.
3. Total volume of water disposed of from the date of the last report to the date of the current report.
4. Description of any problems with dewatering equipment or operations.
5. Sand content measurement.
6. Water level elevation in each monitoring well and each dewatering well.

Resubmit revised working drawings and calculations as necessary to reflect changes required by field conditions.

## **1.06 PERMITS**

The Contractor shall obtain all required permits from the City of Tacoma and/or Pierce County, State and Federal agencies as appropriate.

## **PART 2 PRODUCTS**

### **2.01 CONSTRUCTION MATERIALS**

#### **A. WELL CONSTRUCTION:**

The Subcontractor shall install dewatering wells, monitoring wells, and well points according to the requirements and schedule specified in Part 3. All well installations shall conform to WAC 173-160. Wells shall be constructed with the following materials.

1. Well Casing:
  - a. Dewatering well and monitoring well casings should be constructed of appropriate material. Appropriate materials include both polyvinyl chloride (PVC) and stainless steel.
2. Well Screen:
  - a. Each dewatering well shall have a well screen constructed of appropriate material. Appropriate materials include both polyvinyl chloride (PVC) and stainless steel. The well screen shall be engineered to allow an efficient flow of groundwater through the screen in order to meet dewatering requirements.
3. Centralizers:
  - a. Centralizers shall be placed both at the bottom of the screen section and 1 foot above the top of the screen section in each dewatering well and each monitoring well.
  - b. Centralizers shall be placed immediately above the top of the screen section for each well point.
4. Filter Material: The Contractor shall furnish gravel pack filter material for the dewatering wells and monitoring wells with the following requirements:
  - a. The filter material shall consist of clean, well rounded, washed select silica sand and gravel free from silt, clay, and other deleterious material.
  - b. The filter material shall consist of an engineered material to maximize groundwater flow to the well and minimize the loss of native soils.
  - c. The Contractor shall install sufficient filter material for initial gravel packing of each dewatering well, monitoring well, and well point. In addition, the Contractor shall furnish such additional filter material as the dewatering wells and well points may require during development.

- d. The Contractor shall furnish a certificate of filter material quality and gradation prior to having filter material delivered to the site.
5. Seal Material:
- a. The Contractor shall install a surface seal for each dewatering well, monitoring well, and well point in accordance with WAC 173-160.

In-line totalizing flowmeters shall clearly indicate flow rates in gallons per minute and the total flow from the dewatering system. All meters shall be installed in accordance with the manufacturers specifications and requirements. Particular attention shall be given to instrument location relative to the position of valves, elbows, joints, or other equipment which may impact the accuracy of the measurements.

The Contractor shall provide and size sumps and all piping to remove stormwater runoff and any groundwater seepage from the excavation. Sumps shall be designed and installed to prevent removal of native materials.

Rigid PVC, HDPE, or equivalent piping shall be used to carry water from the Dewatering System wells and well points to the discharge point. Flexible hose shall not be permitted. The piping shall be designed to minimize head loss and turbulent flow, and to be protected for all vehicular traffic loading when applicable.

The Contractor shall measure sand content and settleable solids content of the total system discharge water using and Imhoff Cone, a Centrifugal sand separating meter as described in Journal AWWA, 46:123 (February 1954), Rossum Sand Tester, or other approved method.

The Contractor shall furnish a baffled settling tank or tanks to make discharge water free of settleable solids.

**B. STANDBY EQUIPMENT:**

The Contractor shall maintain on site sufficient equipment and materials to insure continuous and successful operation of the dewatering, recharge and monitoring systems.

The Contractor shall provide one hundred percent standby electrical generating capacity for the dewatering system.

The Contractor shall maintain on site a minimum of 20 percent dewatering system components, including valves, flow-meters, pumps and piping, or other system hardware to insure immediate repair or modification of any part of the system as necessary.



## **PART 3 EXECUTION**

### **3.01 SYSTEM INSTALLATION REQUIREMENTS**

Drilling associated with the dewatering wells shall be performed using air rotary, bucket auger, cable-tool, or other acceptable drilling method. The use of mud-rotary drilling techniques is not permitted. The outside diameter of the temporary casing shall be a minimum of 4 inches larger than the dewatering well casing. While drilling, the Contractor shall collect samples of drill cuttings on a five-foot interval and will provide these to the Engineer.

The Contractor shall install dewatering wells according to the following specifications:

1. Dewatering wells shall be installed in the water bearing sand and/or gravel unit to a depth sufficient to maintain water levels a minimum of 2 feet below the bottom of all excavations.
2. Materials shall conform to the requirements of paragraph 2.01A of this specification.
3. Backfill material:
  - a. The boring shall be backfilled with seal material from the bottom of the boring to 1 foot below the bottom of the dewatering well screen.
  - b. Filter pack material shall extend from 1 foot below the bottom of the screen to 3 feet above the top of the screen.
  - c. The annular space above the filter pack can be filled with seal material or additional filter pack material.
  - d. A 2- to 4-foot thick surface seal shall be placed at the ground surface or subgrade elevation.
4. The Contractor shall develop each monitoring well consistent with the requirements of paragraph 3.03 of this section.
5. After installation of dewatering wells, the Contractor shall install all pumps, discharge piping, flow meters, valves, etc. necessary to operate the dewatering wells. A check valve shall be placed on each of the well headers just beyond the well riser pipe.
6. The Contractor shall complete a pumping test by pumping the installed dewatering wells continuously. The Contractor shall measure discharge rates from each dewatering well and collect water level measurements in each dewatering and monitoring well every 6 hours for a 7-day period and submit these measurements to the Engineer.

### **3.02 DISCHARGE POINTS**

*Describe known requirements and locations for discharge of groundwater from dewatering operations.*

#### **EXAMPLE:**

Groundwater may be discharged to the specified storm drain manhole north of the intersection of South 92nd Street and Alaska Street, provided that the discharge water is free of settleable solids. Groundwater from dewatering operations may be discharged to the storm drainage, provided that it does not exceed the capacity of the existing facilities and all permits are secured by the Contractor prior to any discharge and all permit conditions are met. The Contractor shall provide suitable storage or filtration devices to maintain a final settleable solid content.

### **3.03 WELL DEVELOPMENT**

The Contractor shall develop each dewatering well and monitoring well by a combination of pumping and surging. Development shall be considered complete when a volume not less than five times the volume inside the well casing has been removed and the sand content of the discharge water does not exceed 5 parts per million as determined by a Rossum Sand Tester, Imhoff Cone method, or other improved method.

Development discharge must be disposed into a settling tank and then may be disposed on site as permitted by the Engineer. The Contractor shall provide all equipment and fittings necessary for monitoring groundwater quality and sand content.

### **3.04 MONITORING SYSTEM**

Monitoring wells within excavations may be removed and replaced as the work requires; however, the Contractor shall be held responsible for the water level information provided by those wells and any consequences stemming from the lack of that information.

The Contractor shall be responsible for numbering and obtaining location coordinates and ground surface elevations for all dewatering wells and monitoring wells. Measuring points on wells shall be permanently marked and elevations surveyed. All monitoring information will be reported to the Engineer in a timely fashion.

### **3.05 DAMAGES**

The Contractor shall be responsible for and shall repair without cost to the Owner any damage to work in place, other contractors' equipment, the excavation, including damage to the trench bottom due to heave and including removal of material and pumping out of the excavated area, and adjacent structures as a result of dewatering induced settlements that may result from its negligence, inadequate or improper installation, maintenance and operation of the dewatering system, and any mechanical or electrical failure of the dewatering system.

### **3.06 AVAILABLE SOIL TEST DATA**

*Reference any materials that provide information on subsurface soil conditions.*

EXAMPLE:

Soils exploration data are available from the Geotechnical Report entitled *Supplemental Geotechnical Report and Pumping Tests at 93rd and Hosmer Street Pump Station Upgrade*, Shannon & Wilson, Inc., 1999. Use of this information in no way relieves the Contractor from its responsibility for design, construction, and operations of a properly functioning dewatering system. Any additional testing or pumping the Contractor may wish to perform in order to assure itself of being able to provide a properly functioning dewatering system shall be at the Contractor's own cost.

**3.07 SYSTEM REMOVAL**

Upon written authorization of the Engineer, the Contractor shall remove from the site all dewatering system elements with the exception of those monitoring wells so designated by the Engineer. Assume ownership and responsibility for the disposal of all dewatering pumps, pipes and other assorted system hardware. Remove and abandon all wells in accordance with Chapter 173-160 WAC. The Contractor shall employ the services of a licensed water well contractor for the well abandonment.

**3.08 PAYMENT**

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*Describe bidding and payment requirements for dewatering.*  
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No separate payment will be made for dewatering. All labor, materials, and equipment required to dewater shall be included in the lump sum contract price for Pumping Station Installation.

**\*\*END OF SECTION\*\***