

**Environmental
Resources
Management**

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02 December 2008

Mr. Matt McClincy
Oregon Department of Environmental Quality
Northwest Region
2020 S.W. 4th Ave, Suite 400
Portland, Oregon 97201-4987



Subject: Former Arkema (previously ATOFINA) Portland Plant
Monitoring Well Installation Work Plan

Dear Mr. McClincy:

On behalf of Legacy Site Services, Inc. (LSS), ERM-West Inc. (ERM) has prepared this Work Plan to present the scope and schedule for installation of seven new monitoring wells at the former Arkema Chemicals facility located at 6400 N.W. Front Avenue, Portland, Oregon (the "Site") (Figure 1). The purpose of installing these wells is to establish a network of monitoring wells to assess upgradient groundwater conditions near NW Front Avenue. This work will be conducted in general accordance with the procedures described in *Elf Atochem Acid Plant Area Remedial Investigation and Feasibility Study Work Plan* (Exponent 1998) (RI/FS Work Plan).

SCOPE OF WORK

The scope of this project will include installation of seven monitoring wells. The proposed location of each well is provided in Figure 2. Six of the monitoring wells will be placed into two clusters, consisting of a well screened in each zone (Shallow, Intermediate, and Deep Groundwater Zone). A seventh monitoring well will be installed adjacent to an existing well pairing to create a third cluster. Specifically, the following monitoring well clusters will be installed:

- The first cluster will be installed near the northwest corner of Lot 3. Monitoring well MWA-71 will be installed in the Shallow Groundwater Zone, well MWA-74i will be installed in the

Intermediate Groundwater Zone, and well MWA-76d will be installed in the Deep Groundwater Zone.

- The second cluster will be installed in the southwest corner of Lot 3. Monitoring well MWA-72 will be installed in the Shallow Groundwater Zone, well MWA-75i will be installed in the Intermediate Groundwater Zone, and well MWA-77d will be installed in the Deep Groundwater Zone.
- In addition, monitoring well MWA-73 will be in the Shallow Groundwater Zone to the west of MWA-7i and MWA-12i(d).

Monitoring Well Drilling and Construction

The procedures used to install the proposed groundwater monitoring wells are described below. The procedures and specifications for installing these wells are based on the RI/FS Work Plan. All wells will be installed by an Oregon-licensed well driller in accordance with Oregon monitoring well construction requirements (Oregon Administrative Rule 690-240) and ODEQ guidance.

Utility Clearance

Prior to drilling, the monitoring well locations will be marked in the field for inspection and approval by a facility representative familiar with utilities at the site. The monitoring well locations will be cleared for underground utilities by facility personnel and by a private utility locator. In addition, the Oregon Utility Notification Center will be notified prior to any drilling activities. In the event that one of the planned locations interferes with subsurface utilities, the well will be relocated as close to the original location as possible. Relocated drilling locations will be approved by ERM's project/site manager and an LSS representative.

Monitoring Well Drilling Methods and Procedures

Under ERM direction, Cascade Drilling, Inc., an Oregon-licensed well driller, will install the proposed groundwater monitoring wells using a hollow-stem auger or a sonic drilling rig. The anticipated depths and

screen intervals are provided in Table 1. Monitoring wells will be installed within the Shallow, Intermediate, or Deep Groundwater Zone, as specified in Table 1. The final installation depths and well construction specifications will be approved by the ERM project manager. Soils will be collected continuously for field screening and stratigraphic logging purposes.

The three Shallow Zone wells will be installed using a hollow-stem auger drilling rig or sonic drilling rig to an anticipated depth of 14 to 22 feet below ground surface (bgs) (Table 1) with 10 feet of screen set at the bottom of the well (Figure 3). This target depth and screened interval has been selected based on known lithology in this specific area of the Site. The final construction depth of each well will be determined by the field geologist overseeing well installation based on lithologic information. The bottom of each boring will be targeted for the top of the silt layer between the shallow and intermediate aquifers. In the areas where this layer is not encountered, the bottom of the screen will be set at approximately 20 feet bgs. Soils will be collected continuously for field screening and stratigraphic logging purposes.

The two proposed Intermediate Zone monitoring wells will be installed using a hollow-stem auger rig or a sonic drilling rig. These wells will be installed to an anticipated depth of 32 to 55 feet bgs with 5 feet of screen (Table 1). This target depth is based on the anticipated depth of the silt zone at the base of the Intermediate Zone aquifer and will be dependent upon the observations of the field geologist overseeing the well installation. Borings in the Chlorate Plant Area in the northeast portion of Lot 4 (Figure 2) indicate that this layer is not continuous in all areas of the Site. If the silt zone between the shallow and Intermediate Zone is not encountered then the boring will proceed until the silt at the base of the Intermediate Zone is encountered.

The two proposed Deep Zone monitoring wells will be installed using a hollow-stem auger rig or a sonic drilling rig. These wells will be installed to an anticipated depth of 60 feet bgs with 5 feet of screen (Table 1). This target depth is estimated based on information from boring logs for other wells at the Site. The logs from the two wells installed in the Deep Zone on Lot 2 by Rhone Poulenc (RP-10-97 and RP-10-130) indicate that basalt was encountered at about 100 feet bgs. In the event that basalt is

encountered shallower than 60 feet bgs, the boring will be terminated and the well will be placed just above the Deep Zone silt/basalt interface.

Consistent with other monitoring wells installed at the site and located outside of the Acid Plant and Chlorate Plant areas, the new monitoring wells will not be cased off (that is, shallower aquifers will not be cased off from deeper aquifers).

Soil samples will be collected during drilling for lithologic logging. An experienced ERM field geologist will log the soil samples, monitor the drilling operations, record the well installation procedures, and prepare boring logs and well construction diagrams.

Well Construction

The new groundwater monitoring wells will be constructed in a manner that is consistent with previously installed wells at this site. Wells will be constructed of 2-inch type 304 stainless steel screen and casing to an elevation above the seasonal high groundwater table (approximately 10-feet below ground surface). The casing may be completed to ground surface with 2-inch schedule 40 PVC above the groundwater elevation or may be completed with 2-inch type 304 stainless steel casing. The screened interval will consist of 2-inch diameter 0.010-slot wire-wrap type 304 stainless steel screen. A schematic of the Shallow Zone, Intermediate Zone, and Deep Zone well designs are provided in Figures 3, 4, and 5, respectively. This well construction is chemically compatible with known site contaminants and will provide consistency between new and existing wells.

The well screens will include centralizers at the top and bottom of the screened interval. The wells will be packed to 2 feet above the screened interval with washed silica sand (Colorado Silica Sand 10-20 or equivalent). The sand filter pack will be surged repeatedly with a surge block to promote settling of the sand pack. After surging, the sands will be placed to 2 feet above the screen. The seal will be set using a 3-foot thick layer of bentonite pellets. The well will then be sealed to ground surface with a high solids bentonite grout (PureGold® Grout by Cetco or equivalent) pumped from the bottom up via tremie pipe. The wells will be completed with flush-mount traffic-rated well boxes.

All down-hole drilling equipment will be cleaned with Alconox and rinsed with steam before and after drilling. Decontamination will occur in a designated decontamination area away from the wells.

At the completion of the monitoring well installations, the horizontal and vertical coordinates of the monitoring wells will be surveyed by an Oregon-licensed surveyor.

Well Development

Following well completion, the wells will be developed using the following guidelines:

- Development will not be initiated for a minimum of 24 hours after well construction to allow sufficient time for the well seal to cure.
- Development will consist of gentle surging of the screened interval using a surge block or a close fitting bailer, and a submersible pump.
- Temperature, specific conductance, pH, redox potential, and turbidity readings will be collected and recorded after the removal of each well volume.
- Surging and pumping will continue until the turbidity has decreased to 5 Nephelometric Turbidity Units or less, and field parameters have stabilized (less than 10 percent variance in specific conductance and pH, and less than 1 degree Celsius in temperature), or until a minimum of 10 casing volumes have been removed.

Investigation-Derived Waste Management

Soil cuttings, decontamination fluids, and purge water will be contained in segregated 55-gallon drums. The drum contents will be characterized to determine the waste designation and appropriate method of disposal. The drums will be clearly marked with a description of the contents and the accumulation date.

HEALTH AND SAFETY

ERM anticipates that the field activities will be conducted using Level D personal protective equipment and will follow the Health and Safety Plan developed as part of the *Interim Remedial Action Measure Work Plan* for soil excavation (ERM, June 2000) and updated in November 2008. Although an exposure to volatile organic compound vapors is not anticipated, ERM will have a photo-ionization detector available to conduct periodic monitoring of the worker breathing zone near the drilling rig.

REPORTING

Following completion of the field work, ERM will complete a report summarizing the well installation activities in accordance with OAR 690-240-0395, *Monitoring Well Report Required (Monitoring Well Log)*. Three hard copies and one electronic copy of the report will be submitted to ODEQ.

If you have questions or comments regarding this work plan, please contact the undersigned at (503) 488-5282.

Sincerely,



Shira DeGrood
Project Geologist



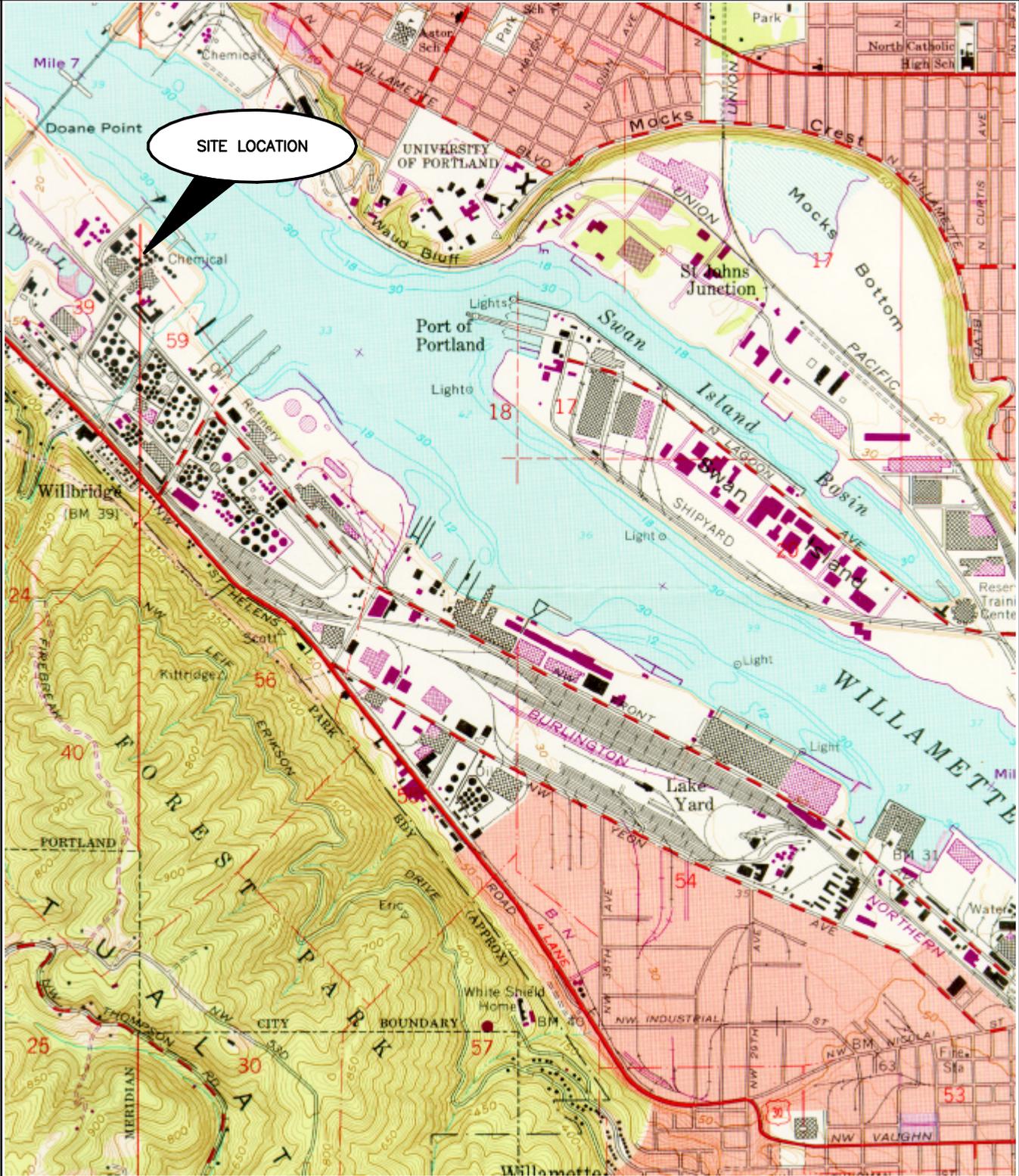
Erik C. Ipsen, P.E.
Partner

SHD/ECI/ssh/92890.01.01
Attachments

cc: Henning Larsen, ODEQ
Tom Gainer, ODEQ
Todd Slater, LSS
Larry Patterson
Steve Parkinson, Groff Murphy
David Livermore, Integral

Figures

CAD File: C:\4744\40\47444001.dwg
 Drawn By: R. Olson
 Date: 02/25/02
 Project No. 4744.40



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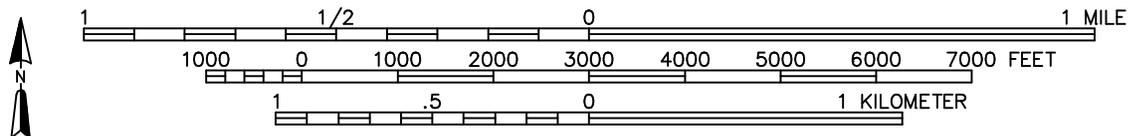
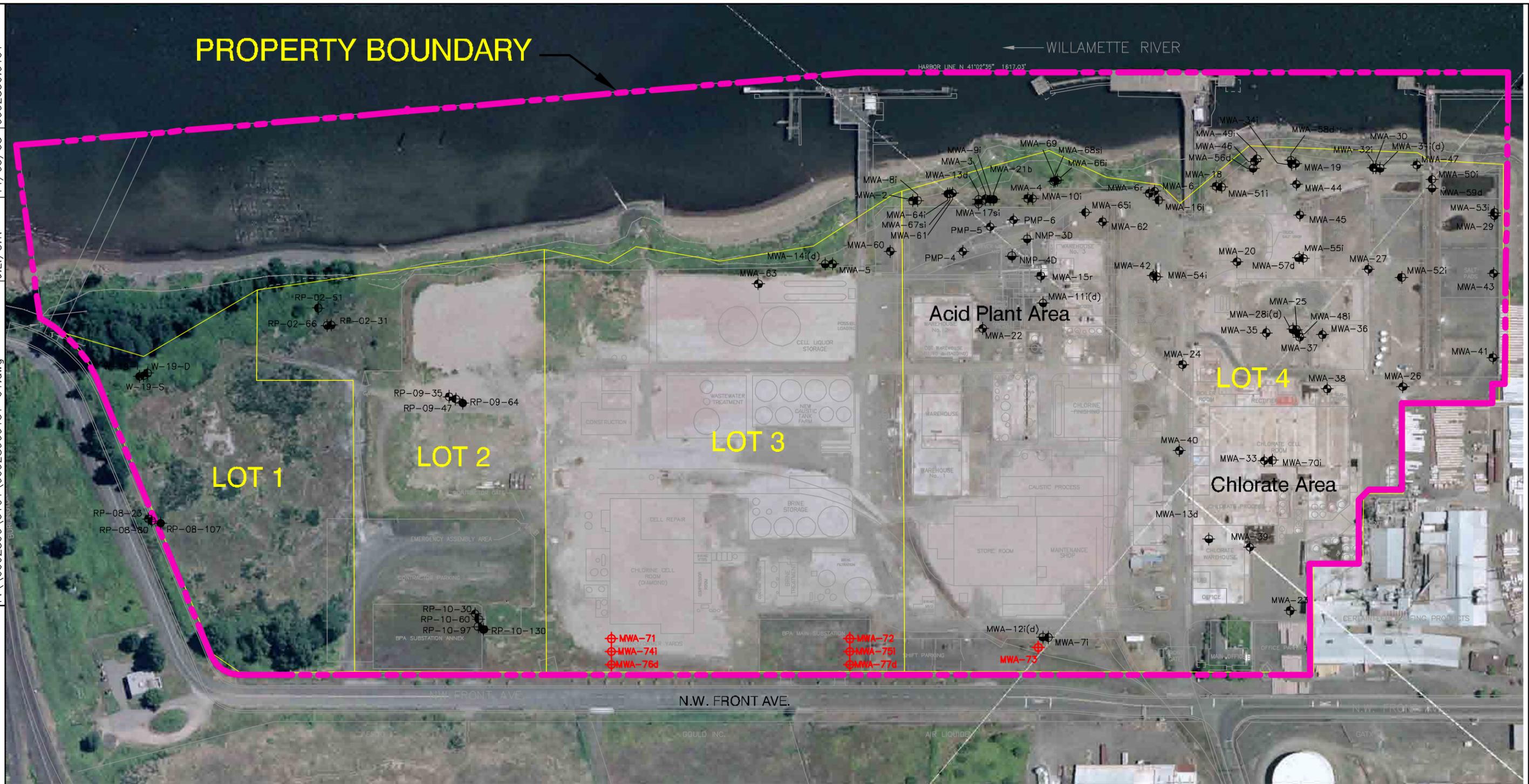


Figure 1
Site Location Map
ATOFINA Chemicals, Inc.
Portland, Oregon

References:
 U.S.G.S. 7.5 Minute Series (Topographic Portland, Oregon-Washington)
 Dated: 1961; Photorevised 1970 and 1977

PROPERTY BOUNDARY



LEGEND	
	Monitoring Well, Shallow Zone
	Monitoring Well, Shallow-Intermediate Zone
	Monitoring Well, Intermediate Zone
	Monitoring Well, Deep Zone
	Monitoring Well, Gravel Zone
	Monitoring Well, Basalt
	Proposed Monitoring Well

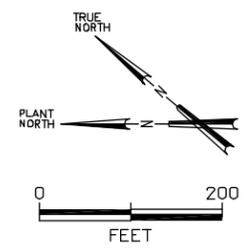
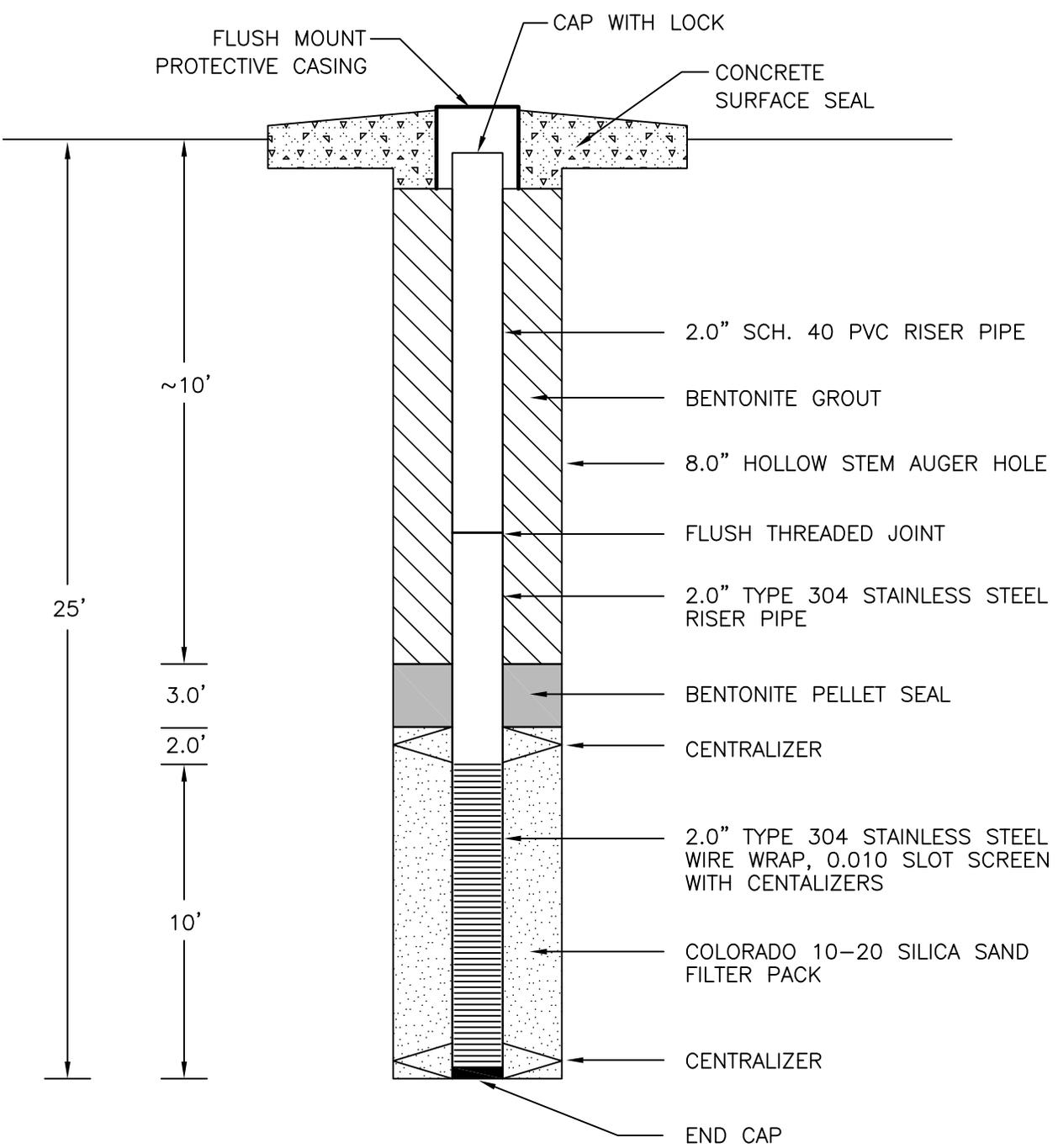


Figure 2
 Proposed Monitoring Well Installations Locations
 Arkema Inc.
 Portland, Oregon

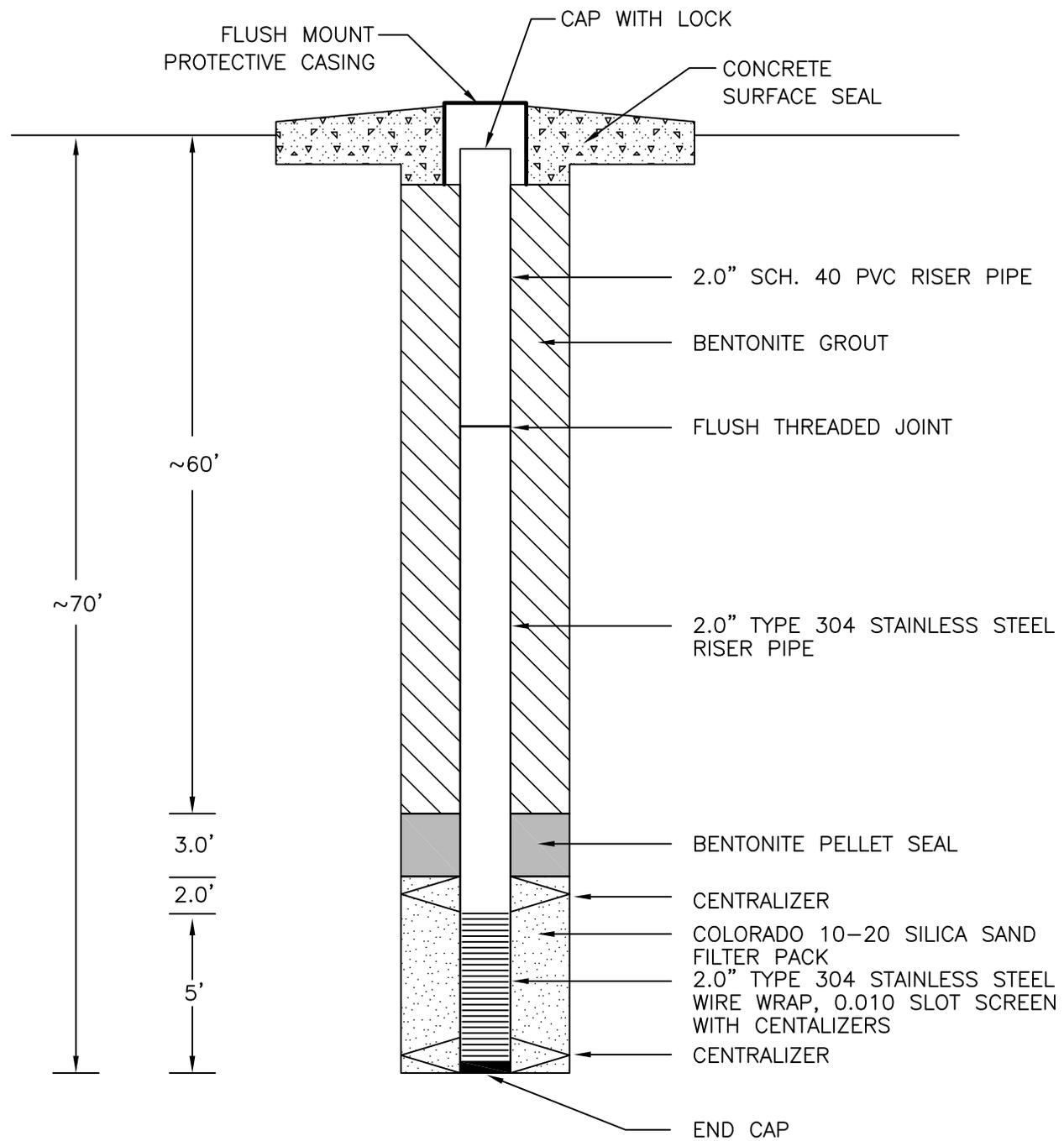
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NOT TO SCALE

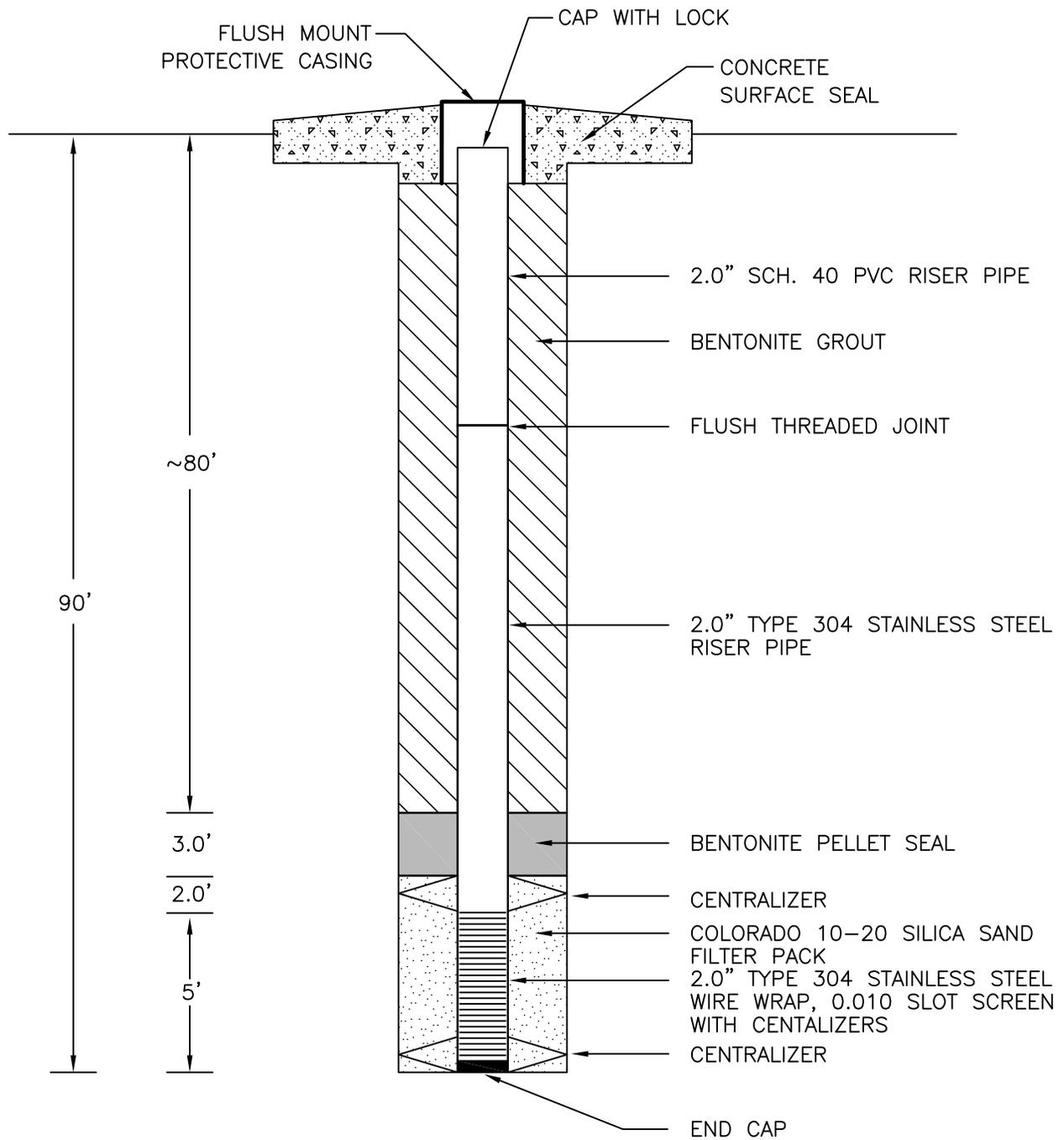
Figure 3
 Shallow Zone Monitoring Well Design
 ATOFINA Chemicals, Inc.
 Portland, Oregon

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 Drawn By: R.O./C.T.
 Date: 11/05/08
 Project No. 92890.0101



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Figure 4
Intermediate Zone Monitoring Well Design
ATOFINA Chemicals, Inc.
Portland, Oregon



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Figure 5
 Deep Zone Monitoring Well Design
 ATOFINA Chemicals, Inc.
 Portland, Oregon

Tables

Table 1
Monitoring Well Construction Details
Former Arkema Chemicals Facility
Portland, Oregon

Well Number	Depth Drilled (ft bgs)	Estimated Well Depth from Measuring Point (ft)	Screen Length (ft)	Screen Slot Size (in)	Screened Interval Depth Below Surface		Sandpack Interval Depth Below Surface		Sandpack Thickness (ft)
					Bottom (ft)	Top (ft)	Bottom (ft)	Top (ft)	
					<i>Shallow Zone</i>				
MWA-71	22	22	10.0	0.010	22	12	22	10	12.0
MWA-72	22	22	10.0	0.010	22	12	22	10	12.0
MWA-73	22	22	10.0	0.010	22	12	22	10	12.0
<i>Intermediate Zone</i>									
MWA-74i	50	50	5.0	0.010	50	45	50	43	7.0
MWA-75i	50	50	5.0	0.010	50	45	50	43	7.0
<i>Deep Zone</i>									
MWA-76d	60	60	5.0	0.010	60	55	60	53	7.0
MWA-77d	60	60	5.0	0.010	60	55	60	53	7.0

Notes

ft = Feet

ft bgs = Feet below ground surface