Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem Oregon 97301-1266
(503) 986-0900
www.wrd.state.or.us

Monitoring Well Constructor Exam Study Packet

Thank you for your interest in becoming a licensed Oregon Monitoring Well Constructor. This online Study Packet includes the following:

- Examination Schedule and Directions
- Monitoring Well Constructor Application Form
- Map Reading Fact Sheet
- Classification of Rocks
- High Voltage Lines Fact Sheet

The Monitoring Well Constructor examination is held the second Monday of January, April, July and October. To take the exam you must be at least 18 years old, submit a completed application and pay the $20 exam fee. It is recommended that you submit the application and exam fee prior to the exam to reserve a seat for the exam.

The exam tests the applicant's knowledge of:

- Oregon Revised Statute (ORS) Chapter 537, specifically 537.505 thru 537.795 and 537.992; and Oregon Administrative Rule (OAR) Chapters 690-240. These documents are available on the Department's website at http://www.wrd.state.or.us/OWRD/GW/well_constructors.shtml#Well_Licensing, be sure you also download the Monitor Well Rules Appendices, Tables and Figures;
- Hydrogeology, the occurrence and movement of ground water and the design, construction and development of monitoring wells;
- Types, uses, and maintenance of drilling tools and equipment, drilling problems and corrective procedures, repair of faulty monitor wells, sealing of monitor wells, and safety rules and practices;
- Correctly completing the start card and well log;
- Plotting the location of a well using ¼, ¼, township, range and section;
- Identification of different rock types (based on igneous, metamorphic and sedimentary).

If special physical, language or other accommodations are needed, please advise Laurie Norton, at 503 986-0856, as soon as possible but at least two (2) business days in advance of the exam.

WATER SUPPLY AND MONITORING WELL
DRILLER EXAM SCHEDULE & DIRECTIONS

2016 Exam Dates:

January 11, 2016

April 11, 2016

July 11, 2016

October 10, 2016

All examinations will be held in Conference Room 124 at the Salem Office of the Water Resources Department, 725 Summer St NE, Suite A, Salem, Oregon 97301-1266. Exams start promptly at 9:00 a.m. You are allowed four (4) hours to complete the exam. You may bring a calculator and a straight edge.

Directions: From Interstate 5, take Exit 253 (Highway 22/Mission Street) heading west. Follow signs to the 12th Street off-ramp (about 3 miles). Take 12th Street off-ramp and merge with northbound 12th Street traffic. Follow 12th Street to Union Street (12th turns into Union). Go 3 blocks to Winter Street. Turn right on Winter Street. The Water Resources Department is in the North Mall Building on the east side of Winter Street between the Employment Building and Division of State Lands.

Parking: Street parking (90 minute) is available on the west side of the building (Winter Street). Metered parking is available along Summer Street and Union Street. Hourly parking is available at Cliff's Automotive located on the corner of Court and Capitol Streets. Daily parking is available at the State yellow lot located at Marion and Summer Streets for $6/day (machine takes bills and coins; gives change and a receipt). A Park and Ride lot is located at the State Motor Pool (1100 Airport Road SE) with buses running approximately every 15-30 minutes.

Oregon Water Resources Department
725 Summer Street NE, Suite A
Salem Oregon 97301-1266
(503) 986-0900
www.wrd.state.or.us

Monitoring Well Constructor Application

(Please Print)

This Application will become part of your Monitoring Well Constructor's file. Please complete the entire application and return it to the above address with your $20 exam fee prior to the exam date.

Name: _____

Mailing Address: _____

City: _____ State: _____ Zip Code: _____

Phone: _____ County: _____ Date of Birth: _____

Email: _____
If you require a trainee card, please provide the name and license number of the Oregon bonded Monitoring Well Constructor who will endorse your trainee card:

Name: _____ License #: _____

If special physical, language or other accommodations are needed, please advise Laurie Norton at 503 986-0856, as soon as possible but at least two (2) business days in advance of the exam.

HISTORY OF MONITORING WELL DRILLING EXPERIENCE

List all periods of employment in the monitoring well construction industry. If you need more space you may attach additional pages.

PRESENT OR MOST RECENT EMPLOYER:

Company Name: _____

Mailing Address: _____

Telephone Number: _____

Supervisor's Name and Telephone Number: _____

Time Employed: from (month - year) _____ to (month - year) _____

Operator of Drilling Machine (type of drilling machine, number of wells and brief description): _____

_____

_____

_____

PREVIOUS EMPLOYER:

Company Name: _____

Mailing Address: _____

Telephone Number: _____

Supervisor's Name and Telephone Number: _____

Time Employed: from (month - year) _____ to (month - year) _____

Operator of Drilling Machine (type of drilling machine, number of wells and brief description): _____

_____

_____

_____

I, hereby **CERTIFY** that the information contained herein is true and complete to the best of my knowledge and contains no misrepresentations or falsifications. I understand any misstatement of material facts may disqualify me from receiving or be cause for revocation of an already issued Oregon Monitoring Well Constructor's License.

Signed _____ Date _____

Please print your name _____

Return with a $20 examination fee, to:
Oregon Water Resources Department
Attn: Laurie Norton
725 Summer St NE, Suite A
Salem OR 97301-1266
(503) 986-0856

MAP READING FACT SHEET

Township, Range and Section:

Oregon has adopted the official system ofland division which is based on measured distances from the Willamette Base Line and the Willamette Meridian. The Willamette Baseline runs east to the Idaho border and west to the Pacific Ocean. The Willamette Meridian runs north to Puget Sound and south to the California border. From these surveyed lines, Oregon is divided into townships six miles square (36 square miles) beginning at the Willamette Base Line numbering north or south and given a range beginning at The Willamette Meridian numbering east and west.

Each township is further subdivided into 36 sections, each containing about one square mile or 640 acres. Sections are always numbered consecutively starting with number one in the upper right hand comer and ending with number 36 in the lower right hand comer. See attached page.

A section is further subdivided by use of a quartering system. A section is divided into four equal parts, which are designated as the Northeast Quarter (NE 1/4), the Northwest Quarter (NW 1/4), the Southwest Quarter (SW 1/4), and the Southeast Quarter (SE 114). Each quarter is divided again into four equal parts and so on. Be aware that some counties use A, B, C, D designations for 1/4 1/4 rather than NE, NW, SW, and SE. The exam will text both methods of well locating. See attached page.

Topographic Maps:

Topographic (or "quadrangle") maps are an essential part of geologic and hydrologic research pertaining to the quantity and quality of groundwater. These maps aid in flood control, soil conservation, and reforestation studies. A good map will aid in describing the correct township, range, section, and quarter-quarter section. A topographic map also portrays the shape of the land surface by using of contour lines, roads, buildings, ridges, hills, valley, and river canyons which could be helpful in identifying the drill site.

As you review quadrangle maps it may be beneficial to note any change in the township and/or the range number designation along the margins of the map. Several areas in southern and eastern Oregon have halfrange and/or half township designations. For this reason, the range numbers at the top and bottom of a topographic map should be compared. The township numbers should also be checked on both the left and right side of the topographic map to be sure of the correct designation. Each township and range number is printed in red ink on the middle section lines of each township and range and are located along the margins of each topographic map.

In locating section lines there are several things that must be remembered. The first is donation land claim boundaries should not be confused with section lines. In most cases, the donation land claim boundaries are irregular lines that often make section boundaries difficult to distinguish. Section numbers can be distinguished from donation land claim numbers by the size of the numerical designation. Sections are numbered from 1to 36. Any number above 36, designates a donation land claim number.

ONLINE MAPPING AIDS

There are several online site that can be very useful in determining the well location. Following are some of them and what they can be used for.

- http://www.esg.montana.edu/gl/xy-data.html - this can be used to convert latitude longitude readings to township, range and section;

- http://www.ormap.org/ - this can be used to obtain tax lot information in Oregon;

- http://www.portlandmaps.com/ - useful for obtaining location information for properties in the Potiland metro area;

- http://terraserver.homeadvisor.msn.com/cmap.aspx?src=O&ppd=**1**&r=4&c=3&W=O&ClickAt=?O,O - can be used to convert a street address to a latitude longitude and/or to find a location on a topography map by using a street address, latitude longitude or township, range and section. Once you obtain the latitude longitude you can convert that to a township, range and section by going to the Montana website.

Each Oregon county also has a website. Many county websites have map functions that will give the location information. For example:

http://www.co.linn.or.us/assessor/newpropsearch.asp
http://www.rlid.org/laneat/siteadd_search.cfm

A section of land = 640 acres / 80 chains / 320 rods / 5280 feet

40 CHAINS

792 inches are 1 link
25 links are 1 rod
4 rods or 100 links are 1 chain
A rod is 16.5 feet
A pole is 16.5 feet
A chain is 66 feet or four rods
A mile is 320 rods, 80 chains or 5,280 feet
A square rod is 272.25 square feet
An acre contains 43,560 square feet
An acre contains 160 square rods
An acre is 208.7 [plus] feet square
Art acre is 8 rods wide by 20 rods long, or any two numbers [of rods] whose product *is* 160
25x125 feet equals 0717 of an acre

(160 ACRES)

40 chains equals 160 *rods* or 2640 feet

20 CHAINS

(80 ACRES)

80 Rods or 1320 Feet

10 CHAINS

(20 AC)

.C0 Aods *or 660* FL

50\Alru 5 Owiru
5 N::tes 5 Aaes
20 Aods Of 330 Ft. 20 Aods Of 1IO ft.

(10 AC)

'40 Rods *or 660* FL

(40 AC)

80 Rods or 1320 FL

36	31	32	33	34	35	36	31
1	6	5	4.	3	2	1	6
12	7	8	9	10	11	12	7
13'	18	17	16	15	14	13	18
24	19	20	21	22	23	24	19
25	30	29	28	27	26	25	30
36	31	32	33	34	35	36	31
1	6	5	4	3	2	1	6

NW NW B 40 Ac.	NE NW A 40 Ac.	NW NE B 40 Ac.	NE NE A *40* Ac.
SW NW C 40 Ac.	SE NW D 40 Ac.	SW NE (40 Ac.	SE NE D *40* Ac.
NW SW B 40 Ac.	NE SW A 40 Ac.	NW SE B *40* Ac.	NE SE A *40* Ac.
SW SW (40 Ac.	SE SW D 40 Ac.	SW SE t: *40* Ac.	SE SE D 40 Ac.

B A C D

NW	NE
SW	SE

D	C	B	A
E	F	G	H
M	L	K	J
N	r	Q	R

CLASSIFICATION OF ROCKS

Following is a description of the three main classes into which rocks are divided:

I. IGNEOUS: Rocks formed by the cooling of a molten mass, and therefore, are usually massive. They vary from a glassy to a coarsely-crystalline texture depending upon the rate of cooling of the magma.

EXAMPLES OF IGNEOUS ROCKS:

BASALT	A fine-grained volcanic rock dominated by dark-colored minerals, resulting in a dark gray to black appearance. Gas bubbles are present near the top and bottom of individual flows and contacts are generally marked by cinder beds, thin deposits of sediments, and reddish discoloration.
CINDERS	Glassy, vesicular ('holey'/bubbly) volcanic fragments ranging from 4 to 32 mm in diameter that fall to the ground in a solid condition. Generally black or red in color. In reporting cinders, describe the color and degree of coarseness, e.g. coarse red cinders, fine black cinders. (Can also be sedimentary in form)
GRANITE	Coarse-grained igneous rock dominated by light-colored minerals. Generally light to dark gray or pinkish in color. Mineral crystals are well developed and are generally even in size.
OBSIDIAN	A black or dark-colored volcanic glass, usually ofrhyolite composition, characterized by conchoidal (a type of rock or mineral fracture that gives a smoothly curved surface) fracture.
PUMICE	A light colored cellular glassy rock. Its color is generally light gray or white and is often so light that it will float on water.
RHYOLITE	Gray, white, red, or purplish in color. Often highly fractured, commonly exhibits flow texture. Contains grains of quartz, mica, and sometimes pumice fragments. Often associated with obsidian flows.
SCORIA	A vesicular cindery crust on the surface of lava flows, the cellular nature of which is due to the escape of volcanic gases before solidification; it is heavier, darker, and more crystalline than pumice.

II. METAMORPHIC: Rocks that have been derived from rocks which were originally in another rock grouping by application of heat, pressure or chemically active solutions. Pertaining to an alteration in composition, texture, or structure of rock masses caused by great heat and/or pressure.

EXAMPLES OF METAMORPHIC ROCKS:

GNEISS	Granitic appearing rocks with a banded appearance. Generally they are darker in color. Commonly feldspar and quartz rich.
QUARTZITE	A light colored, extremely hard sandstone consisting almost entirely of quartz. Formed by recrystallization of sandstone by regional or thermal metamorphism or cemented by secondary silica.

SLATE	A compact, fine-grained metamorphic rock possessing a very well developed cleavage (can be split into slabs and thin plates). Most slate was f01med by shale. Common in Southwestern Oregon.

III. SEDIMENTARY: Rock f01med by layers of material that has accumulated and hardened over time. Rocks formed from materials, including debris or organic origin, deposited as sediment by water, wind or ice and then compressed and cemented together by pressure. Sedimentary rocks have a layered appearance.

EXAMPLES OF SEDIMENTARY ROCKS:

CLAY	A detrital (meaning having been broken or eroded from a parent rock) mineral particle of any composition having a diameter less than 11256 mm. An earthy, extremely fine-grained sediment or soft rock composed primarily of clay-size or colloidal particles, having high plasticity and a considerable content of clay minerals.
COBBLE	A rock fragment between 64 and 256 mm in diameter, thus larger than a pebble and smaller than a boulder, rounded or otherwise abraded in the course of aqueous, eolian or glacial transport.
CLAYSTONE	A hardened clay having the texture and composition of shale, but lacking its fine layering or fissility.
CONGLOMERATE	A coarse-grained rock, composed of rounded to subangular fragments larger than 2 mm in diameter derived from pre-existing rock that has been transported and deposited and set in a fine-grained matrix of sand or silt, and cemented with other minerals. Color varies. Hardness varies widely with the degree of cementation.
DIATOMITE	A soft, white to gray, fine-grained rock composed of the tiny shells of diatoms. It has high surface area, absorptive capacity and is chemically stabile. Common throughout many parts of Eastern Oregon.
GRAVEL	An unconsolidated natural accumulation of rounded rock fragments, mostly of particles larger than sand such as boulders, cobbles, pebbles, granules, or any combination of these. The unconsolidated equivalent of conglomerate.
LIMESTONE	Compacted and cemented limy mud, calcareous sand, and/or shell fragments. Thin to thickly bedded. Generally light to dark gray in color. Rock will fizz when weak hydrochloric (Muriatic) acid is put on it.
LOESS	Wind deposited material composed chiefly of silt but may contain subordinate amounts of very fine sand and clay, buff colored. Loess can be found in Northeastern Oregon.
SAND	A detrital particle smaller than a granule and larger than a silt grain, having a diameter in the range of 1/16 to 2 mm. A loose aggregate of such particles, most commonly of quartz.
SANDSTONE	A elastic (a clast is a rock or mineral fragment) sedimentary rock composed of grains of sand set in a matrix of silt or clay and more or less

	firmly united by cementing materials (commonly silica, iron oxide or calcium carbonate); the consolidated equivalent of sand. Buff, yellow, brown, and gray in color.
SHALE	A fine-grained detrital sedimentary rock, formed by the compaction of clay, silt or mud. It has a finely laminated structure which gives it a fissility along which the rock splits readily, especially on weathered surfaces. It may be red, brown, black, or gray in color.
SILT	A detrital particle finer than fine sand and coarser than clay, commonly in the range of 1/16 mm to 1/256 mm. A loose aggregate of rock or mineral particles of silt size, commonly with a high content of clay minerals. Mud or fine earth in suspension in water
SILTSTONE	An indurated (rock or soil hardened or consolidated by pressure, cementation, or heat) sedimentary rock composed predominantly of silt size grains more or less firmly united by cementing materials (commonly silica, iron oxide, clay or calcium carbonate). Layered, generally gray in color. Having the texture and composition of shale but lacking its fine lamination or fissility.

Oregon Administrative Rules
Oregon Occupational Safety
and Health Division

GENERAL REQUIREMENTS S

§1910.303 GENERAL REQUIREMENTS.

(a) Approval. The conductors and equipment required or permitted by this subdivision shall be acceptable only if approved.

437-002-0321 General No employer shall require or permit any employee to enter or to petform anyfunction inproximity to high-voltage lines, unless dangerfrom accidental contact with said high-voltage lines has been effectively guarded against.

Stat. Auth.: ORS 654.025(2) and 656.726(3).
Hist: OR-OSHA Admin.Order 4-1990, .1123,go,el.1123/90.
OR-OSHA Admin.Order 2-1991, .214191, el.4/1/91.

437-002-0322 Clearance or Safeguards Required.

(1) The operation, erection, or transportation of any tools, equipment, or any part thereof capable of movement; the handling, transportation, or storage of any materials; or the moving of any building, near high-voltage lines, is prohibited, if at any time it ispossible to bring such object within 10feet of high-voltage lines.

(2) For equipment in transit, on smooth surfaces, the clearance shall be a minimum of 4feet for voltages less than 50 kV., 10feet for voltages over 50 kV., up to and including 345 kV., and 16feet for voltages up to and including 750 kV.

(3) A person shall be designated to observe clearance and give timely warning/or all operations where it is difficult for the operator to maintain the desired clearance by visual means.

(4) The 10-feet requirement shall not be reduced by movement due to any strains impressed upon the structures supporting the high-voltage line and upon any equipment,fixtures, or attachments thereon.

Stat. Auth.: ORS 654.025(2) and 656.726(3).
Hist: OR-OSHA Admin.Order 4-1990, .1123,go,ef.1123/90.
OR-OSHA Admin.Order 2-1991,f.214191,ef. 4/1191.

437-002-0323 Warning Signs Required. The employer shall post and maintain inplain view of the operator on each crane, derrick, power shovel, drilling rig, hay loader, hay stacker, pile driver, or similar apparatus, any part of which is capable of vertical, lateral, or swinging motion, a durable warning sign legible at 12feet reading "Unlawful to operate this equipment within 10feet of high-voltage lines."

Stat Auth.:ORS654.025(2) and656.726(3).
Hist: OR-OSHA Admin.Order 4-1990,f.1/23/90,ef.1/2390.
OR-OSHA Admin.Order 2-1991,f.214191,ef.4/1191.