

Horizontal Oil Well Requirements

Directive PNG006

November 2015

Revision 1.0

Governing Legislation:

Act: *The Oil and Gas Conservation Act*

Regulation: *The Oil and Gas Conservation Regulations, 2012*

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1. Introduction

This Directive sets out the policies and requirements of the Saskatchewan Ministry of the Economy (ECON) for regulating horizontal oil wells in Saskatchewan. It provides details on determining set-backs and drainage areas for horizontal wells.

Other requirements pertinent to this Directive include:

- *Directive PNG003: Well Survey Requirements* that provides details on the survey of horizontal wells;
- *Directive PNG010: Well Logging Requirements* that provides details on the well logging requirements for horizontal wells; and
- *Directive PNG012: Allowable Rates of Production: Oil Wells* that contains details on the allowable rates of production for horizontal wells.

Questions concerning the requirements set out in this document should be directed to the PNG support line at 1-855-219-9373.

1.1 Governing Legislation

The requirements outlined in this Directive are based on the provisions of *The Oil and Gas Conservation Act (OGCA)* and *The Oil and Gas Conservation Regulations, 2012 (OGCR)*.

Sections 17.1 of the *OGCA* provides the Minister with the authority to make orders approving plans for horizontal wells. Regulations specific to horizontal wells are contained in sections 37 to 39 of the *OGCR*. Licensees should consult these documents in conjunction with this Directive.

It is the responsibility of all operators, as specified in the legislation, to be aware of Ministry requirements and to ensure compliance with all requirements for horizontal wells prior to submitting any application.

1.2 Definitions

Commonly-owned lands: these are mineral lands where the mineral ownership, lessees and partners, well ownership and operator, farm-in agreements, etc., are identical.

Diversely-owned lands: these are mineral lands where the mineral ownership, lessees and partners, well ownership and operator, farm-in agreements, etc., are not identical.

Drainage area: includes all vertical well drainage units (see definition below) within the minimum lease boundary set-back of the productive interval of the horizontal well.

Horizontal well: means a well that has a productive interval of at least 100 m and that is 80 degrees from vertical, or is deemed by the minister to be horizontal.

Inter-well set-back: this is measured as the distance between productive intervals of adjacent wells producing or capable producing from the same pool.

Landing point: refers to the point where the well path has reached horizontal or near horizontal position within the target pool.

Lease boundary set-back distance: this is measured as the distance between the productive interval of a horizontal well and the inside edge of the lease boundary.

Monobore well: refers to a horizontal well with a single string of production casing, with uniform diameter, cemented from total depth of the horizontal well to surface.

Pooling agreement: means an agreement between multiple parties to allocate production across diversely-owned lands.

Productive interval: is the section of a horizontal well from the intermediate casing point to bottom hole. On a monobore well, the productive interval is defined as the landing point (LP) to bottom hole, where any perforation must be at a deeper measured depth than the LP, unless otherwise approved.

Set-back: refers to the distance from one defined entity to another defined entity.

Vertical drainage unit: refers to the spacing assigned to vertical wells. Requirements for these are set out in the *Guidelines for Determining Drainage Units and Target Areas*.

Ultimate drainage area: refers to an area calculated using a radius around the proposed well productive interval that is half of the minimum inter-well set-back distance.

2. Minimum Set-back Requirements

The productive interval(s) of horizontal wells must adhere to specific minimum inter-well and lease boundary set-backs. These set-backs are defined in *Pool Orders*, *Spacing Area Orders* and regulations in the *OGCR*, but brief descriptions of the minimum inter-well and lease boundary set-back requirements for horizontal wells are presented below.

2.1 Inter-well Set-backs

Unless defined by a *Pool Order* or *Spacing Area Order*, the productive interval of a horizontal well must have a minimum 150 m inter-well set-back, as set out in section 38(b) of the *OGCR*.

Wells drilled within the stratigraphic units and areas specified by Spacing Area E (see <http://www.economy.gov.sk.ca/spacing-area> for locations of spacing areas in Saskatchewan) must have a minimum 100 m inter-well set-back.

Proposed and 'as-drilled' survey plans must show that the minimum inter-well set-backs will be, or have been, met. (See Directive PNG003 for more details.)

2.2 Lease Boundary Set-backs

Unless defined by a *Pool Order* or *Spacing Area Order*, the productive interval of a horizontal well must have a minimum 100 m set-back to a diversely owned lease boundary, as set out in section 38(b) of the *OGCR*.

Proposed and ‘as-drilled’ survey plans must show that the minimum inter-well set-backs will be, or have been, met. (See Directive PNG003 for more details.)

3. Drainage Area Determination

All horizontal wells must have their drainage area identified when an application is submitted for a horizontal well licence. A drainage area is determined based on the productive interval of the well and the size of the vertical well drainage unit (e.g., 1 legal subdivision (LSD), 2 LSDs, etc.).

All vertical well drainage units within the lease boundary set-back of the productive interval of the horizontal well will make up the drainage area.

A company must have agreements in place with all mineral owners of lands that make up the drainage area of a horizontal well prior to submitting an application for a horizontal well licence.

Following are a few examples of how to determine the drainage area of a horizontal well given different sizes of vertical well drainage unit.

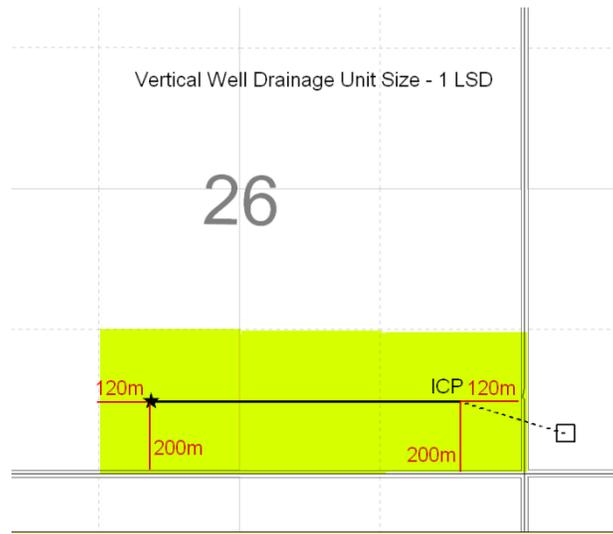


Figure 1. In this example, the size of the vertical well drainage unit is 1 legal subdivision (LSD). The intermediate casing point (ICP) of the proposed horizontal well is 120 m west of the east boundary of Section 26 and 200 m north of the south boundary. In this scenario, the drainage area for a horizontal well will include LSDs 1, 2 and 3 of Section 26.

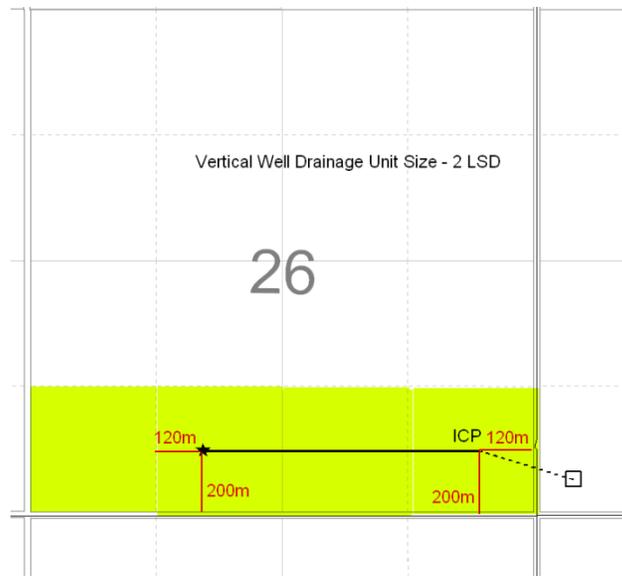


Figure 2. In this example, the vertical well drainage unit covers 2 legal subdivisions (LSDs). The intermediate casing point (ICP) of the proposed horizontal well is still 120 m west of the east boundary of Section 26 and 200 m north of the south boundary. For this scenario, the drainage area for a horizontal well will include LSDs 1, 2, 3 and 4 of Section 26.

4. Exceptions to the Set-back Requirements

4.1 Reduced Inter-well Set-backs

A reduced inter-well set-back is permitted if the offset well has 12 months of production where the average production is less than $1 \text{ m}^3/\text{day}$. This must be a true average, not artificially obtained, but calculated from natural decline and sustained production.

4.2 Reduced Diversely-Owned Land Boundary Set-backs

Reductions to the set-back for diversely-owned lands are permitted if certain conditions for approval are met. These conditions depend on the type of diversely-owned boundary.

- a) If a minimum lease boundary set-back is not met between diversely-owned disposed Crown minerals, an agreement must be in place between the Crown disposition holders.
- b) If a minimum lease boundary set-back is not met between diversely-owned freehold mineral lands, there must be a pooling agreement in place between the freehold mineral owners.
- c) Section 4.3 of this Directive sets out the requirements if a minimum set-back is not met between Crown and freehold land.

Example 1: The productive interval of a well is on FH mineral owner A's land and is less than 100 m from the boundaries of freehold mineral owner B's land. Freehold mineral owner A and freehold mineral owner B have formally agreed to a pooling of interests for the well, therefore the drainage area of the well will include freehold mineral owner B's affected land.

Example 2: The productive interval of a well is less than 100 m from the boundaries of freehold mineral owner A’s land. Freehold mineral owner A provides consent allowing for a set-back reduction from their lands. The drainage area of this well would not include any land owned by freehold mineral owner A and a pooling agreement is not required.

If a minimum set-back is not met and the offset party has consented to a reduced lease boundary set-back, those lands would not be included in the drainage area of that horizontal well.

Note: Consent will not be accepted to exclude an LSD that must be included due to sharing a vertical well drainage unit with the offset LSD.

4.3 Situations Involving Crown/Freehold Pooling

The following examples illustrate exceptions to the minimum inter-well set-back where the drainage area of a horizontal well covers both Crown and freehold tracts, and the Crown disposition holder and the freehold owners have a pooling agreement.

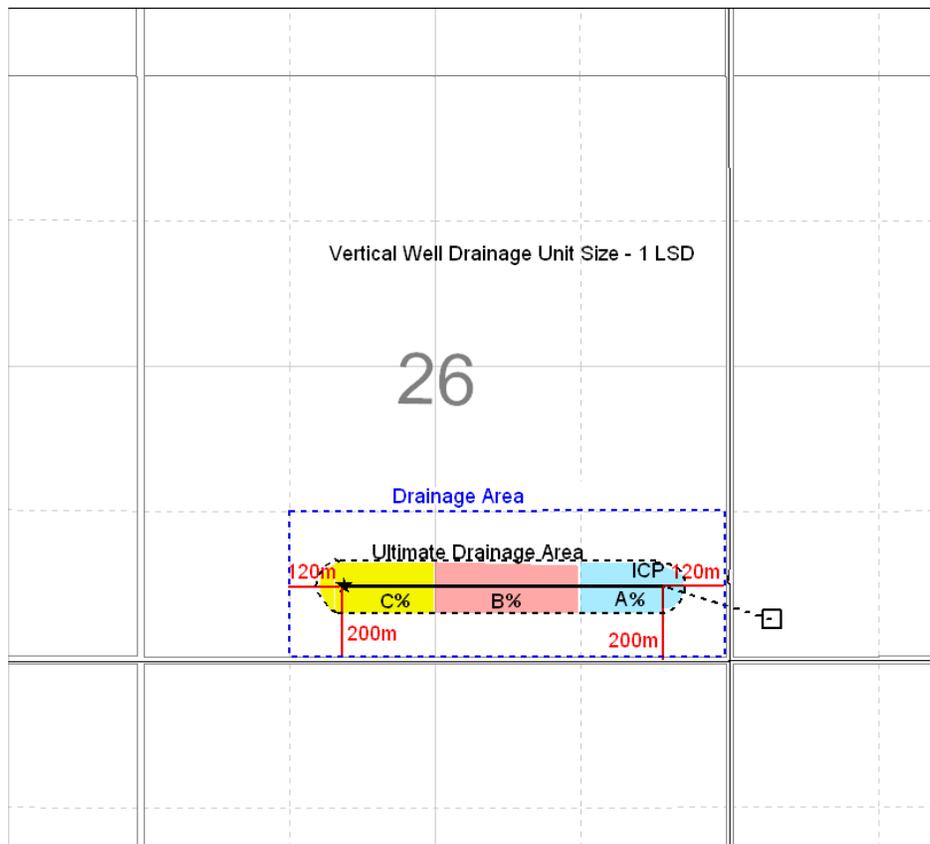


Figure 3. Determining the drainage area and ultimate drainage area of a horizontal well where the Crown/freehold pooling agreement covers a vertical drainage unit of 1 legal subdivision (LSD).

In the example in Figure 3, the minimum inter-well set-back is 150 m, so a 75 m drainage radius (half of the minimum set-back) is used when calculating the ultimate drainage area (UDA) of the productive interval of the well.

Each legal subdivision (LSD) within the drainage area is a 'tract'. The tract for each LSD is based on the percentage of the UDA within that LSD. As shown in Figure 3, LSD 1 would be allocated production in accordance with A% of the UDA, LSD 2 would be allocated B%, and LSD 3 would be allocated C% of the UDA.

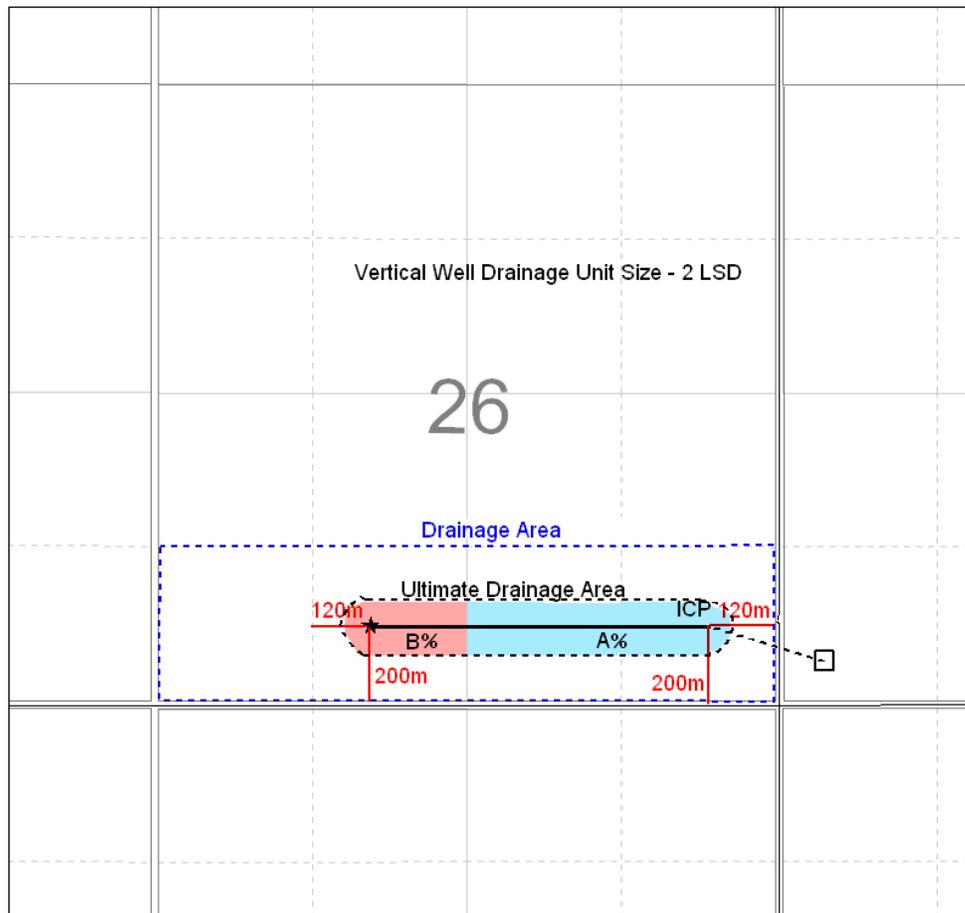


Figure 4. Determining the drainage area for a horizontal well with a Crown/freehold pooling agreement in place, where the vertical drainage unit area covers 2 legal subdivisions (LSDs).

In the example in Figure 4, the minimum inter-well set-back distance is 150 m, so a 75 m drainage radius (half the minimum set-back) is used for calculating the UDA. However, the vertical drainage unit size is 2 LSDs (80 acres), therefore LSD 4 of Section 26 is now included in the drainage area. Each LSD within the drainage area is still a tract, but the allocation of each tract is divided evenly within each vertical drainage unit.

For example, LSD 1 is allocated $A/2$ % of the UDA, LSD 2 is also allocated $A/2$ %, LSD 3 is allocated $B/2$ %, and LSD 4 is allocated $B/2$ %. The total allocated percent of production will add up to 100%.

All mineral owners within the drainage area must be a part of the agreements in place and the pooling declaration letter (see Appendix 1) must be attached to the horizontal well licence application.

4.4 Situations Involving Road Allowances

All road allowances are considered 100% Crown-owned land. However, when determining drainage areas, road allowances are only taken into account if the proposed well pools both Crown and freehold minerals. In these situations, the road allowance percentage is added to the UDA percentage of the nearest Crown tract within the drainage area, as shown in Figure 5.

If there is a Crown/freehold split on either side of the road allowance, the road allowance is divided evenly between the tracts on either side of the road allowance, as shown in Figure 6.

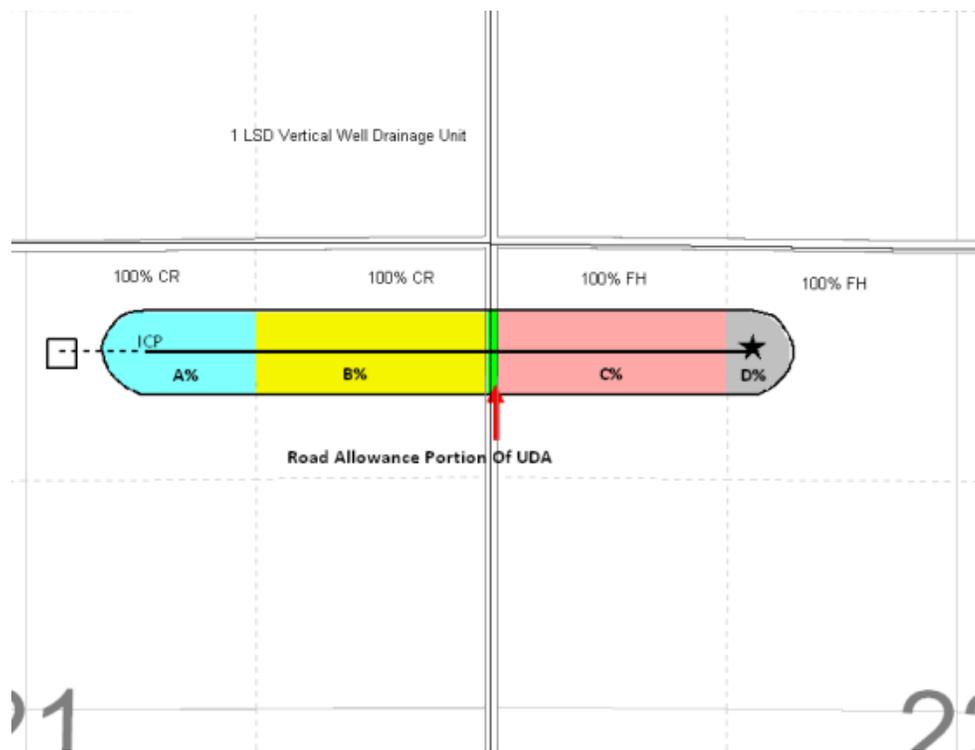


Figure 5. Example of a road allowance allocation for a pooling agreement involving Crown and freehold tracts. In this situation, the percentage of the drainage area allocated to the road allowance portion of the UDA would be added to tract B in LSD 16 of Section 21, since this is the nearest Crown tract in the drainage area.

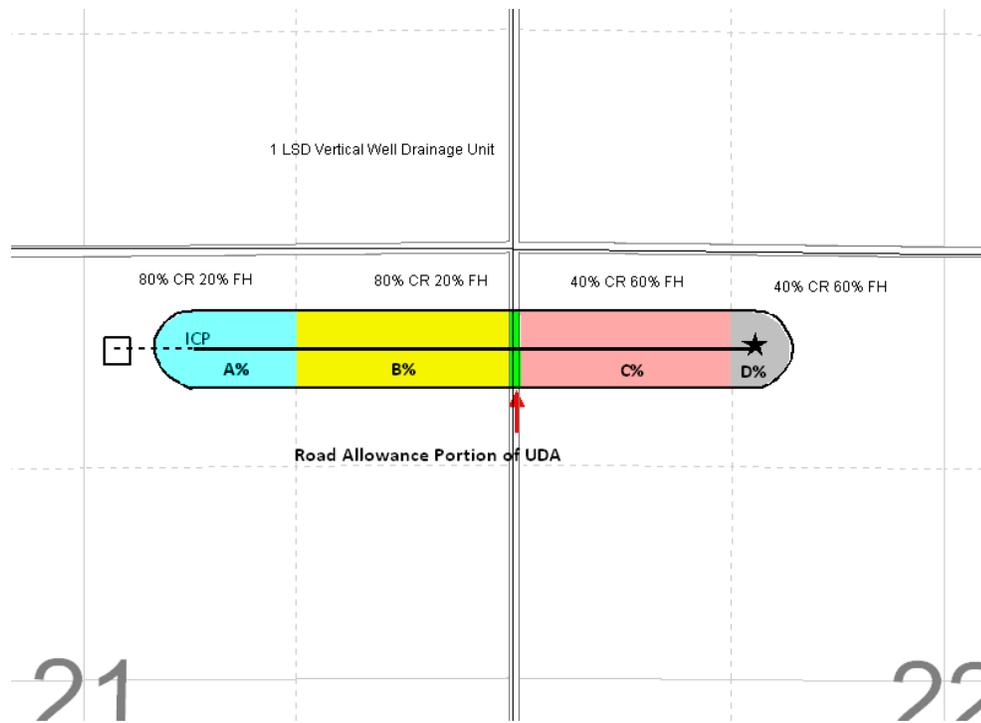


Figure 6. Example of a road allowance allocation where the Crown and freehold tracts in a pooling agreement are split between the road allowance. In this situation, the road allowance percentage of the drainage area would be divided evenly between tracts B and C. Tract B in LSD 16 of Section 21 would have 50% of the road allowance portion added, and tract C in LSD 13 of Section 22 would have 50% of the road allowance portion added.

If the well has any tract that is 100% Crown-owned, the road allowance percentage would be added to that LSD, even if it is not directly adjacent to the road allowance.

The same rules would apply if the vertical well drainage unit size was greater than 1 LSD. The road allowance portion would be added to the UDA percentage of the entire vertical drainage unit. Then this total percentage would be divided down to the LSD level.

