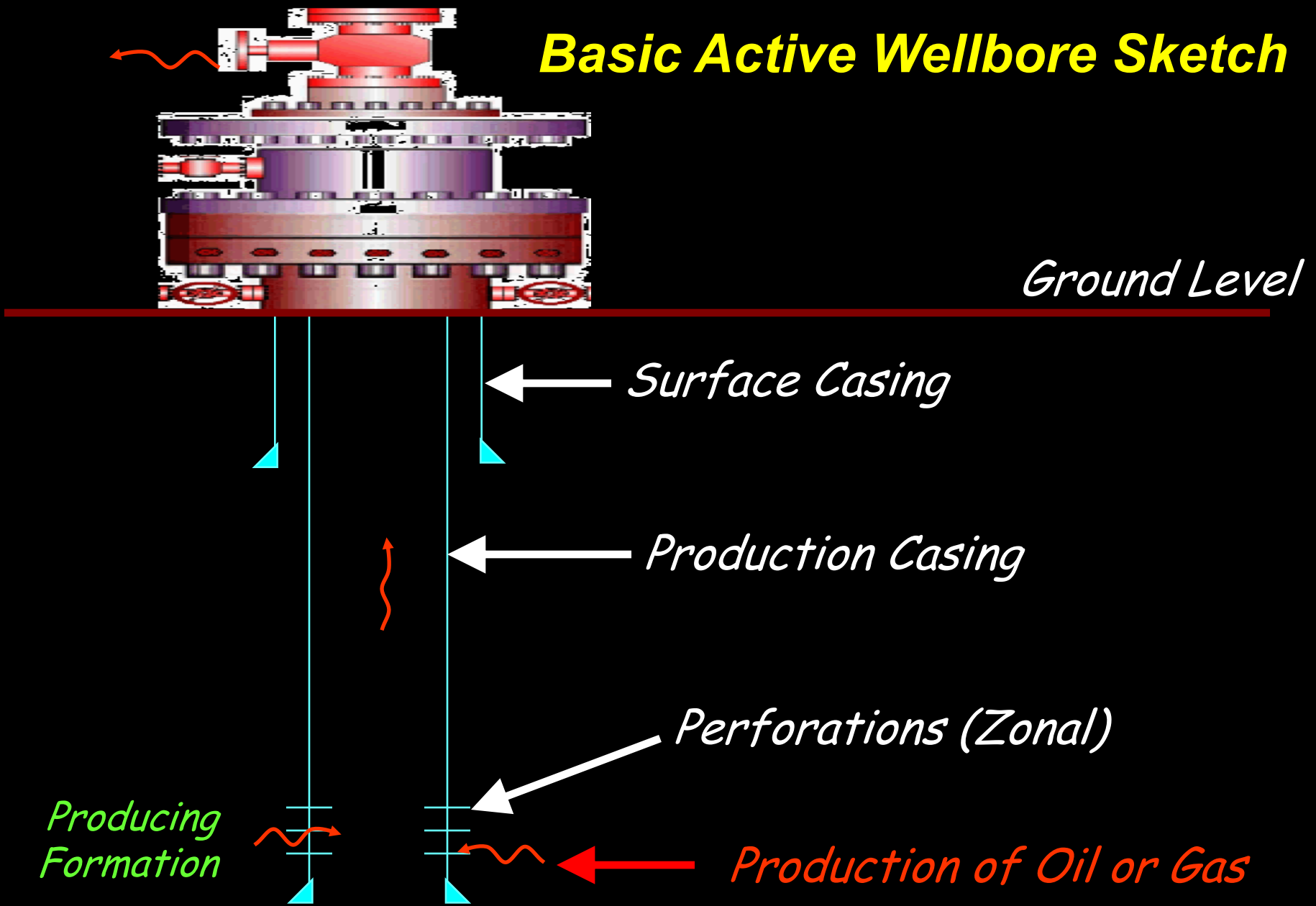


# Well Definitions

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|                       |   |
|-----------------------|---|
| <b>Active well</b>    | A well that has reported activity (oil, gas or water production, injection or disposal) in the last 12 months (6 months for critical sour and acid gas wells)                     |
| <b>Inactive well</b>  | A well that has not reported activity in the last 12 months.  |
| <b>Suspended well</b> | Inactive wells that meet AER Directive 13 suspension requirements.  |
| <b>Abandoned well</b> | A well which is left in a safe and stable condition (plugged down hole with wellhead removed and casing lowered and cut & capped) as per AER Directive 20 Well Abandonment Guide. |
| <b>Reclaimed well</b> | An abandoned well that has had its surface returned to equivalent land capability.  |
| <b>Orphan well</b>    | A well that has been investigated for responsible parties and specifically designated as an orphan following a determined process by AER.   |

# Basic Active Wellbore Sketch



# Well Abandonments

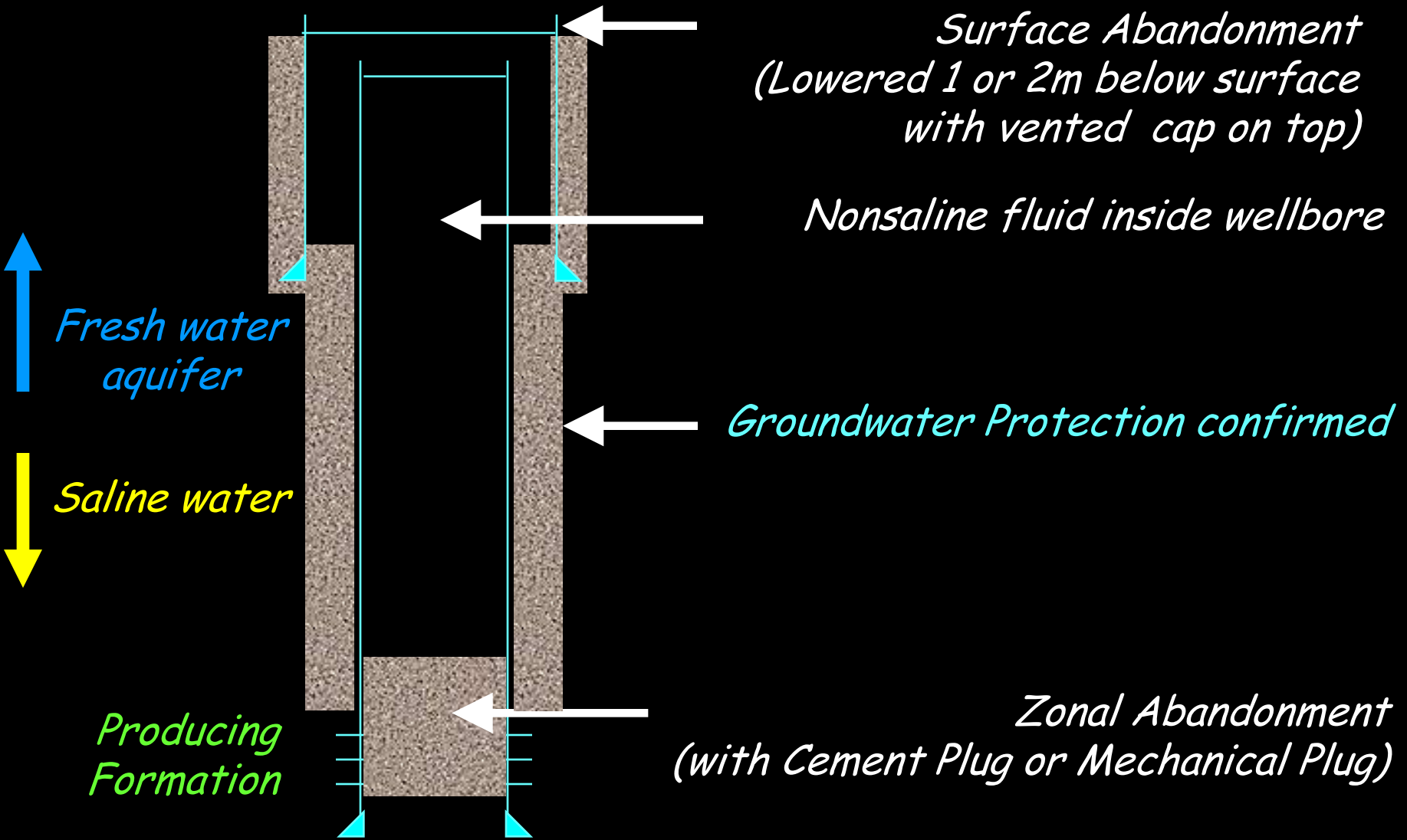
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AER Directive 20 Well Abandonment Guide requires all cased wells to have:

- (1) **Zonal Abandonment** – Well is plugged (with steel plug and and/or cement plug) where the production fluids (oil or gas) comes from the geological formation (zone) into the casing. Zonal abandoned wells become inactive or suspended wells.
- (2) **Groundwater Protection** –all non-saline aquifers that contact the outside of the wellbore are to be covered with cement so that saline water from below does not contaminate the fresh water aquifer.
- (3) **Surface Abandonment** – removing the wellhead and “cutting and capping” the casing. Casing is cut a minimum 1m below the ground surface and capped with a welded steel plate. Surface abandoned wells become abandoned wells.

# Properly Abandoned Well

Ground Level



Surface Abandonment  
(Lowered 1 or 2m below surface  
with vented cap on top)

Nonsaline fluid inside wellbore

Groundwater Protection confirmed

Zonal Abandonment  
(with Cement Plug or Mechanical Plug)

Fresh water  
aquifer

Saline water

Producing  
Formation





*Legal Oil and Gas 00/12-29-052-25W4/0*





*Banner Oils 00/06-34-017-03W5/0  
Wireline Operations*

*ML Cass  
00/14-02-028-  
01W4/0  
Downhole  
Abandonment  
with Service Rig*



**Orphan Well  
Association**

14-2-28-1w4

THIS SITE UNDER THE MANAGEMENT OF THE  
ORPHAN WELL ASSOCIATION. FOR INFORMATION  
PLEASE CALL (403)297-6416 DURING OFFICE HOURS





*Caron 00/06-11-047-07W4/2  
Cement Squeeze*





*Lea Park Syndicate 00/13-14-055-02W4/0  
Snubbing Operations*



*Camerina Petroleum  
00/10-09-061-27W4/0  
Removing Casing  
Stub in Pembina River*





*North Pacific Oil 00/10-11-085-21W5/0  
Removing Wellhead to Surface Abandon Well*

# Well Repairs

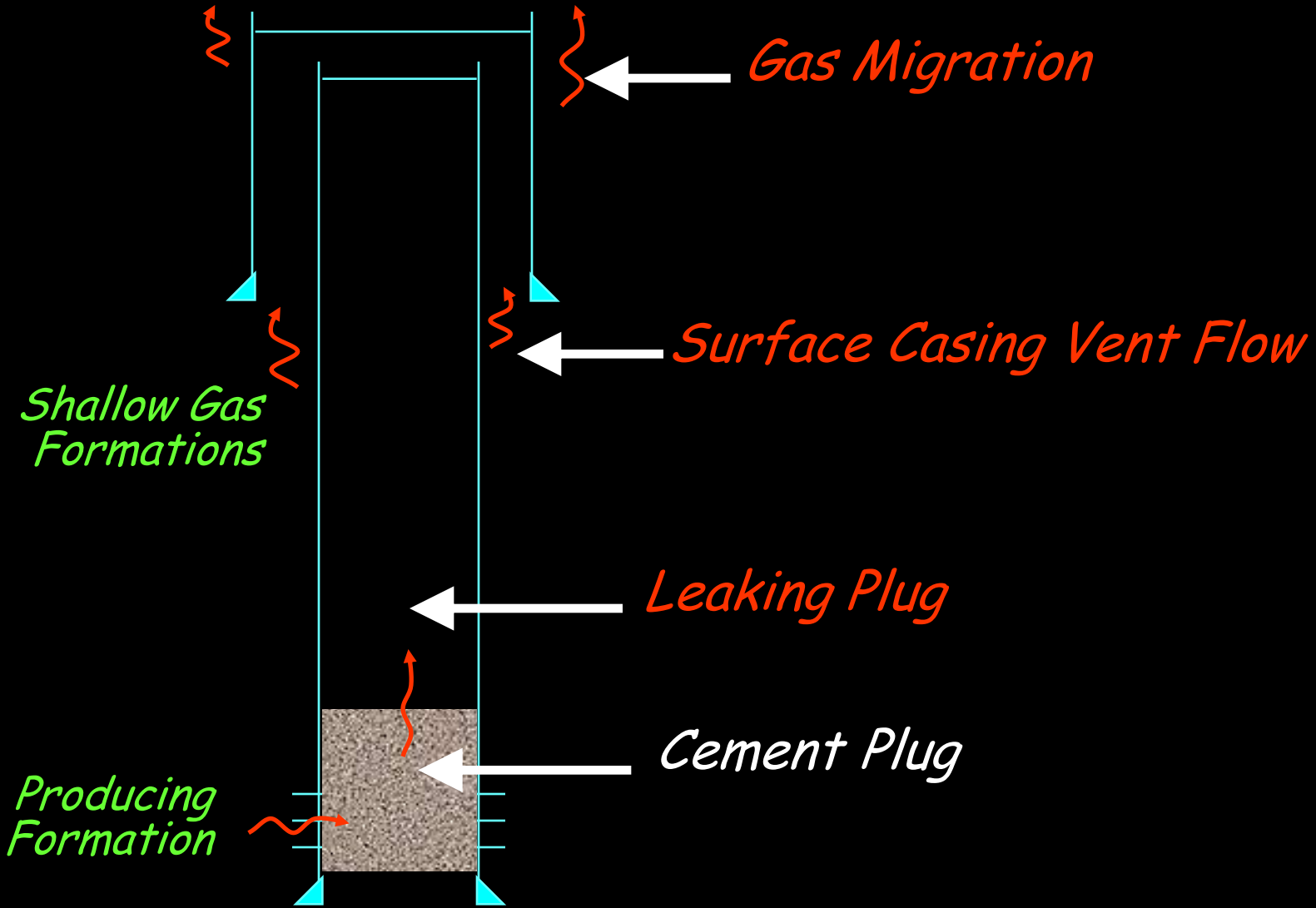
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Gas can leak typically from 3 places in a well:

- 1) From inside the well (inside the production casing) when the well is improperly abandoned (**Leaking Plug**)
- 2) Outside the production casing and inside the surface casing (called **Surface Casing Vent Flow** or **SCVF**).
- 3) Outside the production casing and outside the surface casing (called **Gas Migration** or **GM**).



# Abandoned Wellbore Sketch – Leak Pathways





**Alliance Oil Company Limited 00/14-11-006-02W5**





***55-02W4 well surveyed on fence line***



**55-02W4 Well Centre located**



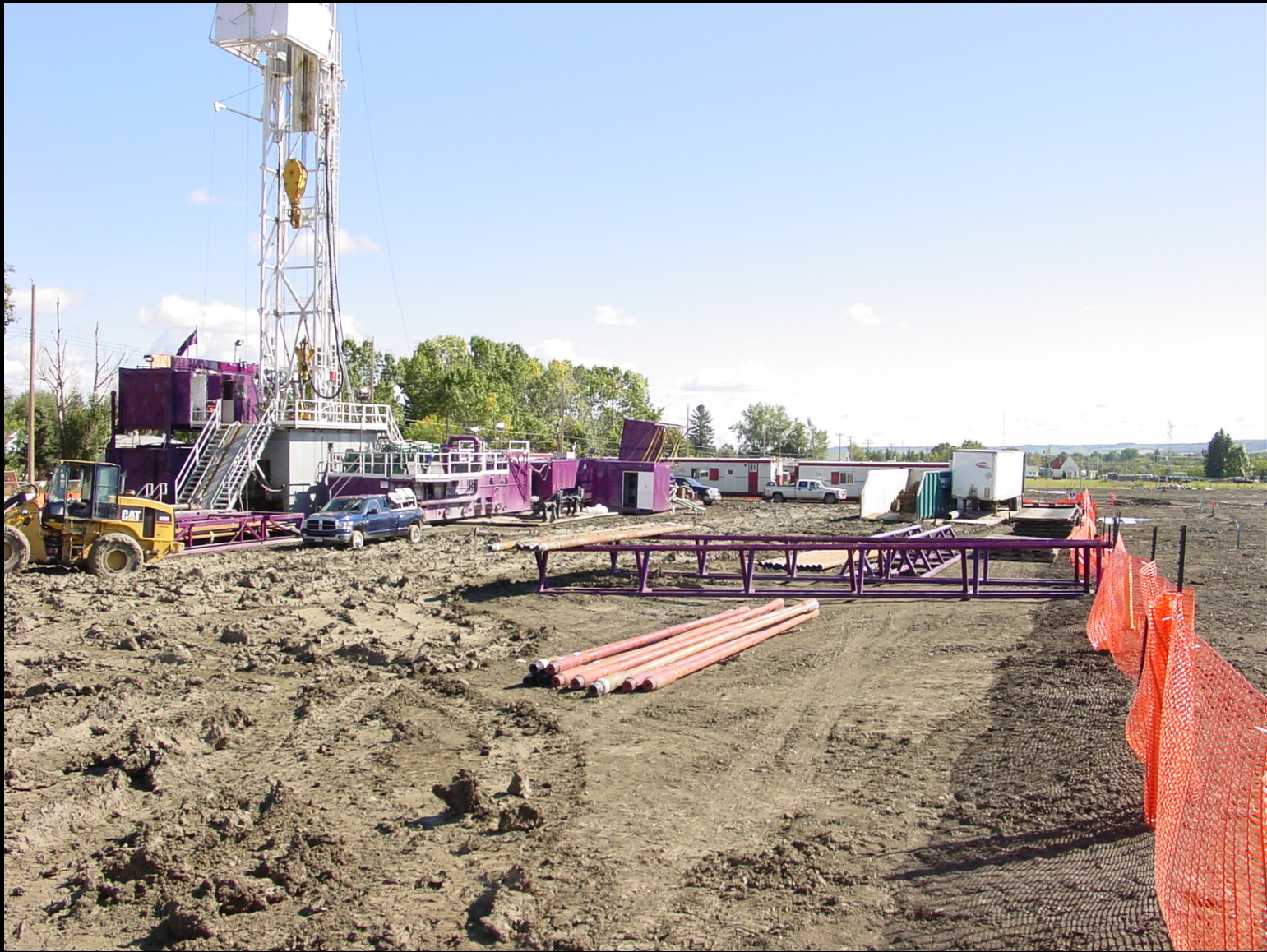


***55-02W4 Casing Stub Exposed***



***McLeod Oil Company Limited 00/15-03-020-03W5/0  
Gas migration detected by presence of bubbles***





**McLeod Oil Company Limited 00/15-03-020-03W5/0  
Gas migration detected by presence of bubbles**

# ***Basic Reclamation Definitions***

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## **Reclamation Certificate**

Operators are required to obtain a reclamation certificate from Alberta Environment and Sustainable Resource Development (ESRD) when their site has been successfully reclaimed. ESRD requires an analysis of contamination and a report detailing how contaminants and surface issues were addressed.

## **Reclamation Exempt**

Wells that has been surface abandoned (by AER records) and do not require reclamation certificates are considered Reclamation Exempt. These include wells that are

- within the White Area of the province that are abandoned prior to June 1, 1963
- within the Green Area of the province that are abandoned prior to August 15, 1978



# ***Basic Reclamation Definitions***

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## **Abandoned and Unreclaimed Well (Sites)**

An abandoned well without reclamation closure, i.e. a well that has been surface abandoned (by AER records) but

- is not in receipt of a reclamation certificate
- is not reclamation exempt, or
- is not in receipt of an overlapping exemption for the surface, i.e. surface responsibility has been taken over by another.

Companies are normally required to make surface lease payments to the landowner until a reclamation certificate is issued by AER.

# ***Reclamation Process***

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- Phase 1 – historical file review, landowner interview
- Phase 2 – intrusive site investigation
- Remediation – deal with contaminants, well centres, spills, flare pits, drilling sumps, requirements set by ESRD
- Reclamation – re-contour landscape, restore drainage, replace topsoil, re-vegetate
- Monitor re-establishment of vegetation
- Detailed Site Assessment of soils and vegetation
- Apply for Reclamation Certificate



# ***Phase 1 Environmental Site Assessment***

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- Identifies potential or existing environmental contamination liabilities
- Review of facilities and operations at the site, historical aerial photographs, well files, spills
- Identifies types of potential contaminants and locations (facilities, drilling waste disposal sumps, flare pits, spills, well head, pits)
- Interviews with operators when available, and landowners
- Site visit to assess site conditions
- Based on Phase 1 ESA is a Phase 2 ESA recommended

# ***Phase 2 Environmental Site Assessment***

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- An intrusive investigation that follows from the findings of a Phase 1 ESA
- Assessment of soil and groundwater quality
- EM survey completed to identify saline contamination
- Boreholes drilled and monitoring wells installed
- Soil and groundwater samples collected and analyzed by a laboratory for chemical concentrations
- Contaminant concentrations compared to regulatory guidelines
- If contaminant concentrations exceed regulatory guidelines remediation is recommended