

location. Small spills will be contained and collected immediately. Recovered fluids will be temporarily contained in drums or other sealed units. Materials used in spill response will be labelled as IDW and disposed of appropriately. Designated fuel handling/re-fuelling areas will be located away from surface drainage courses and containment provided. Site personnel will be made aware of spill response procedures and appropriate regulatory contacts. Spills will be immediately reported to a supervisor. NSE will be notified of any significant spills (>100 L or near a watercourse).

## 4.0 Monitoring

Monitoring is a key component of environmental management. The following samples will be collected as part of the pre-assessment to establish a baseline for comparison to both operational and post-operational conditions:

- Baseline surface soil samples will be obtained from each well site pad; and tested for metals and total organic carbon (TOC) concentrations.
- Where a surface watercourse is in the immediate vicinity of the well site, baseline upstream and downstream surface water sample will be collected. The samples will be analysed for general chemistry and metals and TSS. The results will be compared to the Canadian Council Ministers of the Environment (CCME) Fresh Water Aquatic Life (FWAL) Guidelines (**Appendix F**). If a surface watercourse is not in the immediate vicinity, a monitoring site will be established in the nearest downstream water body.

It is anticipated that surface water samples will be collected periodically during and subsequent to site activity. Samples will be analysed for general chemistry, metals, TSS and COD/BOD to identify changes in chemical character as a potential result of the SG exploration program. The results will be compared to baseline and the FWAL Guidelines and then submitted to NSE.

Other monitoring (as mentioned in Section 3.5.3 and 3.5.4) includes analysis of drill cutting/mud and water to confirm disposal requirements.

*It is noted that the level of effort (in consultation with NSE) with respect to both frequency, number of sample locations and analysis may be modified as the project proceeds. As additional information is collected and evaluated or processes are modified on approval by NSE, this monitoring framework may be updated.*

- Mobilization of drill rig and support equipment
- Monitoring
- Drilling Operations:
  - Drilling surface hole to approximately 400 m and cementing surface casing.
  - Installing casing bowl and blow out preventors
  - Drilling main hole to total depth (anticipated to be at 3000 m)
  - Wireline logging the hole with a shale gas logging suite
  - Running and cementing production casing and cementing in hole to surface.
- Demobilization of drill rig and support equipment

A conventional double drilling rig (contracted through Nabors Drilling) has been chosen to drill the O-61-C well. Drilling operations are a continual operation running 24 hours per day until completion of drilling operations.

Fracturing stimulation fluid (fresh water) will be temporarily stored on surface in frac tanks. The water will be drawn into a frac blender where chemicals will be added to gel the water and then sand mixed with the gelled water. The blender will pump sand laden fluid to the high pressure frac pumps which in turn pump the fluid down the wellbore at pressure up to 105 MPa to stimulate the zones.

**Abandonment/Rehabilitation**

It is noted that site abandonment and lease reclamation will occur if wells are determined not to be productive. Elmworth will consult with DOE, NSE and NSNR and utilize good oilfield practices to plan abandonment of the well bore and reclamation of the lease sites.

**Site Description**

Figure 1 and the site survey in Appendix C depict property boundaries, contours and nearby watercourses, wetland, dwellings (associated wells), roads and highways. The conceptual plan for rig and equipment layout is based on locating the wellhead in the center of a 120 m x 120 m pad with a graveled access road entering one side of the lease. A portion of the site will provide a turnaround location and storage for pipe and equipment.

The drill rig and support equipment will be mobile skid units transported to the site on tractor-trailers. Trailers for company representative(s), the site geologist and rig supervisor/crew will be located along one side of the lease in proximity to the lease entrance. A cement pit (approximately 3 x 3 x 3 m in size) for handling of returns during drilling will be constructed. Above ground mud tanks will be used, excluding the requirement for a drilling sump. Bags of drilling mud will be stored in a freight van on lease.

An emergency flare line will be located on one edge of the drill site a safe distance away from the rig and equipment. The flare line is intended for use in emergency well control situations only.

Portable holding tanks (plastic) for wastewater (grey and black) will be attached to trailers (excluding the need of an on-site septic approval).

**Treatment of Waste from Industrial Processes**

It is assumed that the fracture stage will involve 3 treatments requiring approximately 1000 m<sup>3</sup> (in total) of fresh water and 100 metric tons of proppant for stimulation. Using an average fluid recovery of 65% it is anticipated that there will be 1950 m<sup>3</sup> of waste water generated on each well bore. The waste water will be temporarily stored in the frac tanks on site and then transported to an approved waste disposal facility. Proponent flow back is not expected to be an issue, however, assuming a 5% flows back, 15 metric tons of proppant could be recovered on each site. This will again be stored in the frac tanks and then transported to an approved waste disposal facility.

*Water source*

*Waste Water - Ammonia*

**Waste Management (Liquid Effluents and Solid Wastes)**

Waste management includes miscellaneous garbage generated by field personal, investigative derived waste (IDW) generated from operations; septic/grey water and, drill cuttings and drilling fluids. Elmworth will follow the guidance provided in NSE's Environmental Best Management Practices for Drilling Wastes including reducing and reusing materials where possible.

Waste streams generated through the drilling will be hauled from site and disposed at approved facilities. There are no on-site treatment processes and therefore engineer stamped drawings are not applicable.

**Domestic Waste & IDW**

Domestic type waste will be taken to either the West Hants Landfill near Cogmagum or the East Hants Transfer Station (East Hants Waste Management Centre) near Georgefield. IDW will be properly contained and disposed of by a qualified contractor. Elmworth will retain the services of a private contractor to handle this material.

**Drill Cuttings**

It is estimated that conventional drilling of the well will generate approximately 75 to 125 m<sup>3</sup> of rock cuttings. Elmworth will retain the services a qualified contractor to remove cuttings and associated drill fluids for appropriate off-site disposal. The material will be sampled for parameters listed in NSE's *Guidelines for Disposal of Contaminated Solids in Landfills*. These guidelines provide acceptable levels for inorganic and organic parameters. If the concentrations of the specified parameters are exceeded, a leachate extraction analysis (Canadian General Standards Board CGSB 164-GP-IMP) is required. If the concentrations of the specified parameters in either of these analysis are less than or equal to the guidelines, the material is designated as hazardous waste and is not acceptable at a municipal solid waste landfill. Dewatering to reduce the volume of material and/or mixture with fly ash, sawdust, cement dust or some other substance to help solidify the material and/or reduce the leachability of earth metals may be warranted.

**Drill Fluids**

During the drilling phase all water will be disposed of at an appropriate offsite location (by a qualified contractor). Water quality samples will be collected and analysed at a minimum for general chemistry and metals parameter (particularly chlorides, iron, barium, ammonia and pH), Total Suspended Solids (TSS) and oxygen demand (COD and BOD). Depending on disposal method analysis may include toxicity testing.

**Septic Waste and Grey Water**

A holding tank (attached to site trailers) to contain septic waste and grey water will be utilized; therefore application for approval of an on-site system has not been made to NSE. A qualified hauler will be contracted to transfer this waste off-site for disposal at a provincially approved facility.

**Air Emissions**

Potential air quality issues include emissions from diesel combustion due to the running of engines (CO, CO<sub>2</sub>, SO<sub>x</sub>, NO<sub>x</sub>, particulates, etc.) and possible dust problems during periods of dry weather. Elmworth will comply with Air Quality Regulations - Environment Act. They will conduct regular equipment maintenance in order to manage/mitigate potential combustion issues.

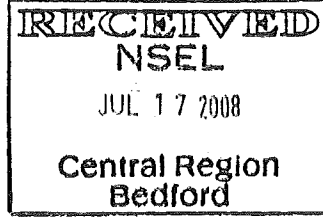
Water will be sprayed on the access road or construction site if needed during extensive periods of dry weather. The maximum acceptable dust concentration 120µm/m<sup>3</sup> over 24-hour period will be adhered to.

Gas flaring during drilling will only be conducted in an emergency situation, or, potentially, as part of drill stem testing. Drill stem testing involves controlled release of limited volumes over short time periods (i.e., 2 to 3 hours).

Water well  
Application proposed off-site

92100-30-Bed-2008-062744  
Vol #1

July 17, 2008



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ATTENTION: Mr. Bernie Matlock

**Industrial Application – Elmworth Energy Corporation Shale Gas Project, Hants County, Nova Scotia**

On behalf of Elmworth Energy Corporation's (Elmworth), Dillon Consulting Limited (Dillon) acknowledges receipt of your Department's comments regarding Elmworth's Industrial Approval Application (dated June 9, 2008).

In accordance to your letter (dated June 26, 2008), it is our understanding that Elmworth does not require approval from your Department to drill the well(s), but will require such approval should they proceed with further work to enhance gas recovery (i.e., well stimulation). At this time, Elmworth anticipates completing drilling of the first well by late July or early August. If positive results are obtained, they could be prepared to commence with testing by mid to late August. In this regard, they have requested Dillon to provide the following responses to your comments.

1. Please identify chemical agents and their composition which could possibly be used to enhance gas recovery. Include an MSDS for the chemicals.

Response: MSDS sheets for the proposed slick water system are provided in **Attachment 1.**

2. Please provide the anticipated volumes and characteristics of solid and liquid process waste generated by the project. It is the Department's current understanding that solid and liquid waste generated from the project will be removed from the site and transported for disposal at an approved facility. If temporary storage of process waste is planned for the site, please provide the details.

Response: It is assumed that the fracture stage will involve 3 treatments requiring approximately 1000 m<sup>3</sup> (in total) of fresh water and 100 metric tons of proppant for stimulation. Using an average fluid recovery of 65% it is anticipated that there will be 1950 m<sup>3</sup> of waste water generated on each well bore. The waste water will be temporarily stored in the frac tanks on site and then transported to

Handwritten notes in a vertical column:

- Left side: A bracket pointing to the response for item 2.
- Center: *Tested*
- Right side: *Completed*

What about

type of drill mud Ba?

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→ past practise

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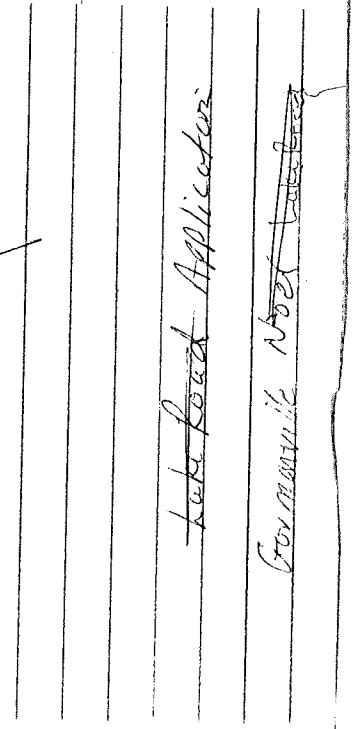
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noise

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Water will be sprayed on the access road or construction site if needed during extensive periods of dry weather. The maximum acceptable dust concentration 120µm/m<sup>3</sup> over 24-hour period will be adhered to.

Gas flaring during drilling will only be conducted in an emergency situation, or, potentially, as part of drill stem testing. Drill stem testing involves controlled release of limited volumes over short time periods (i.e., 2 to 3 hours). Qualified drilling engineers have designed a program and written procedures which use good engineering practices to minimize the chance of emergency well control situations. This information has been provided to DOE and will be approved as part of the "Authority to Drill" application. A gas sample (Appendix D) collected from wells constructed during the 2007 program indicated "sweet gas" (0.00 g/m<sup>3</sup> H<sub>2</sub>S).



- o Construction of ditching and berms to control surface water drainage (sedimentation control will be established in the ditch if necessary).
- o Graveling of access road and lease to enable secure and safe working conditions on access road and lease site.
- Mobilization of drill rig and support equipment
- Monitoring
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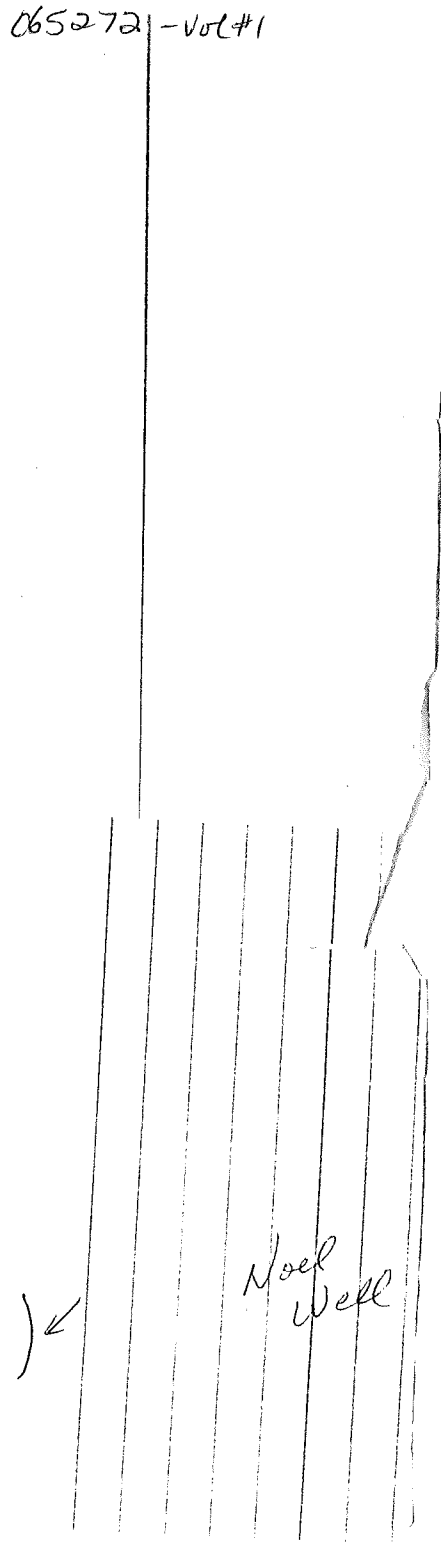
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