ENVIRONMENTAL CONSERVATION PRACTICES FOR PIPELINES

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Keywords: environmental conservation, environmental planning, mitigation, pipeline, right-of-way, routing, reclamation, soil conservation, water crossings

Contents

Summary

Existing pipelines are present in almost every region of the world in a variety of landscapes. Environmental conservation practices associated with pipelines include: route selection; timing of construction; and construction techniques. Using a Western Canadian and North American perspective, the environmental conservation practices currently used in pipeline construction on agricultural lands are discussed for such areas of environmental interest as soils, aquatics, fish, wetlands, native vegetation, and wildlife as well as for heritage resources and traditional use sites. Environmental conservation during pipeline construction is commonly achieved through the implementation of mitigative measures documented in an environmental protection plan and under the supervision of an Environmental Inspector. During pipeline operations, post-construction monitoring programs are used to determine the success of environmental conservation practices. These programs can be a catalyst for improving construction techniques in order that the impacts of pipeline construction on the environment continue to be reduced during future projects.

1. Introduction

Pipelines are used around the world to gather and transport products used in everyday living (e.g. hydrocarbons) to markets. Pipelines range in size from small diameter gathering systems to large diameter transmission systems and vary in length from a few hundred meters to over 1,000 km.

A variety of landscapes are crossed by pipelines including forests, tundra, mountains, cultivated fields, pastures and urban areas, not to mention waterbodies such as wetlands, lakes, rivers and oceans. In Canada alone, there are over 580,000 km of pipeline rights-of-way which affect approximately 17,400 km^2, or an area slightly larger than the State of Connecticut.

Historically, pipelines were planned and constructed without regard for environmental considerations or protection measures. Typically, a ditch was dug and the pipe was laid inside and covered up. In some instances, no attempt was made to bury the pipe and so it was just left to rest on the ground. Regulatory requirements of the day did not consider environmental protection of affected resources during the planning, construction or operation phases of the pipeline nor was there any regulatory oversight in the form of inspections during pipeline construction.

The planning and construction of pipelines has come a long way since the early days of pipelines. In recent years, there has been a heightened awareness of the potential environmental impacts from pipeline projects. As a result, regulatory agencies have

incorporated environmental considerations into their regulatory processes, including providing on-site inspections during construction.
This chapter focuses on the environmental conservation practices currently used in the construction of terrestrial oil and gas pipelines on agricultural lands from a Western Canadian and North American perspective. These environmental conservation practices generally fall into one of three categories: routing; timing of construction; and construction techniques.

This chapter will explore how selecting a pipeline route can avoid or substantially minimize environmental impacts on the landscape and can influence the types of construction techniques used to protect various components of the environment.

The potential impacts, timing of construction and construction techniques presently used in the pipeline industry will be reviewed for such areas of environmental concern as soils, aquatics, wetlands, native vegetation, wildlife, heritage resources and Aboriginal traditional sites.

The use of environmental protection plans (EPP) and Environmental Inspectors during construction as a means to ensuring environmental mitigative measures are appropriately implemented during construction will be discussed. Finally, the use of post-construction monitoring of the pipeline as a tool to evaluate the success of environmental conservation practices will be addressed. A brief introduction to pipeline construction is provided.

1.1. Pipeline Construction in Brief

Pipelines are constructed within a construction right-of-way which consists of the easement (leased portion of land) plus temporary workspace necessary during construction. The construction right-of-way is divided into the spoil side which is generally used for topsoil and spoil storage, and the work side which is used by vehicle traffic.

For those unfamiliar with pipeline construction, Figure 1 by the Natural Resources Group, LLC (2008) shows a typical pipeline construction sequence commencing with surveying and staking of the boundaries of the construction right-of-way which usually ranges from 15 m to 40 m in width depending on the size of the pipe and land use.

The right-of-way is cleared of vegetation and then, using conventional equipment such as bulldozers or graders, topsoil is stripped off and grading, if necessary, is conducted. The pipe is strung, bent, welded and coated before the trench is excavated. The pipe is lowered into the trench and backfilled with spoil (subsoil) which is then compacted.

If necessary, the right-of-way is ripped to relieve compaction and the topsoil is spread back over the area that was stripped. Rocks and other debris are removed before cultivating the right-of-way. The right-of-way is then seeded and fertilized to landowner specifications. In some areas (e.g. wetlands, native prairie), natural regeneration is often encouraged.

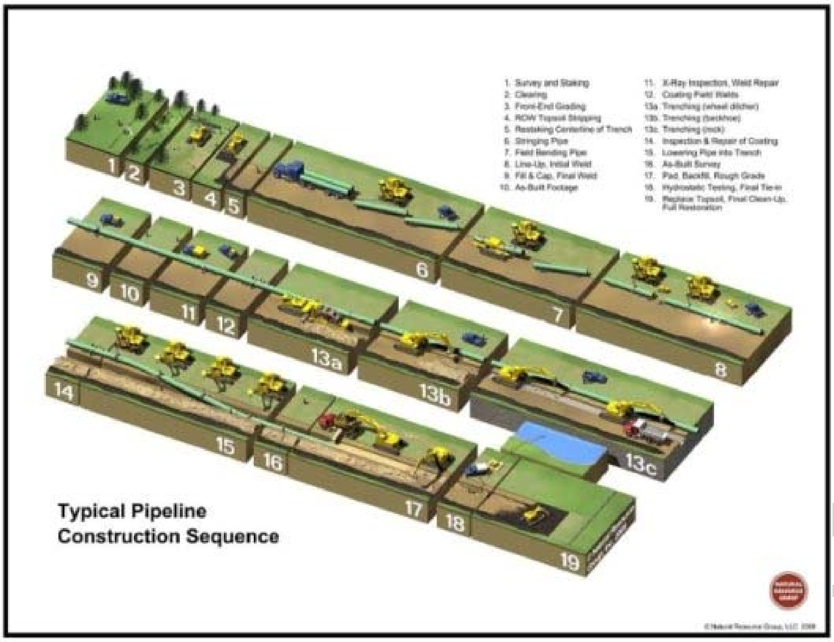

Figure 1. Typical Pipeline Construction Sequence

2. Environmental Conservation through Pipeline Route Selection

It can be argued that the single most effective method of environmental conservation practice in a pipeline project is the selection of the pipeline route. A properly selected route will generally result in potential environmental impacts associated with pipeline construction being avoided or greatly minimized in contrast to a poorly selected route which, despite adherence to timing constraints and use of state of the art construction techniques, will typically be less effective in conserving sensitive environments and resources.

The following factors are typically considered during the pipeline route selection process on agricultural lands to conserve soils, aquatics, wetlands, native vegetation, wildlife, heritage resources and Aboriginal traditional use sites:

- minimize pipeline length in order to minimize potential disturbance to soils, aquatics, wetlands, native vegetation, wildlife, heritage resources and Aboriginal traditional use sites;
- parallel existing linear developments (e.g. pipelines, roads, trails, cutlines, seismic lines, powerlines, rail lines) to minimize the overall area of disturbance to soils, aquatics, wetlands, native vegetation, wildlife, heritage resources and Aboriginal traditional use sites;
- minimize number of watercourse crossings and cross watercourses at right angles to conserve aquatic resources;
- avoid, where practical, or minimize crossings of marshes, swamps, bogs and sloughs to conserve wetlands, native vegetation, wildlife habitat and Aboriginal traditional use sites;
- avoid or minimize length on sensitive landscapes (*e.g.*, native prairie, sand dunes,

coulee complexes, steep slopes) to conserve native vegetation, wildlife habitat and Aboriginal traditional use sites;
- avoid or minimize length on isolated bush or wooded areas to conserve native vegetation, wildlife habitat and Aboriginal traditional use sites;
- adhere to setbacks distances from important natural features (e.g. mineral licks, wildlife features such as nest, leks, dens, staging areas, lambing areas, calving areas) to conserve wildlife values;
- avoid known archaeological or historical sites or areas of high archaeological or palaeontological potential, where practical, to conserve heritage resources; and
- avoid known ceremonial/spiritual sites, habitation sites and resource gathering sites to conserve traditional use sites of Aboriginal groups.

Other routing criteria which influence more the human environment but are equally important include:

- avoid, where practical, special land use areas (e.g. golf courses, research farms, certified Organic farms, flood irrigated lands, lands with drainage tiles);
- avoid non-compatible land uses (e.g. aggregate extraction, open pit mines, extensively developed oil or gas fields);
- avoid residences, urban areas, parks and designated natural areas; and
- adhere to regulatory setbacks and offsets given the product to be transported (e.g. sour gas, natural gas liquids, high vapor pipelines).

The importance of careful selection of a pipeline route cannot be over emphasized. A route chosen with the above routing factors and criteria is considered to be satisfactory in minimizing environmental impacts and the first environmental conservation practice used when planning new pipelines. Identified potential impacts of pipeline construction for each component of the environment can be further reduced or avoided through the implementation of the remaining two environmental conservation practices, namely timing of construction and construction techniques.

3. Soil Conservation

3.1. Potential Impacts

The potential effects of pipeline construction on soil and soil productivity are well known and understood within industry and regulatory agencies. Poor soil conservation results in lowering of soil capability for agricultural production through the mixing of topsoil (Ah or Ahe horizons) and subsoil (B and C horizons) and compaction of topsoil/subsoil. Topsoil/subsoil mixing causes a loss or dilution of organic material and nutrients in the topsoil, increased concentrations of salts left on or near the surface and increased stoniness caused by bringing rocks in the lower trench up to the surface. The width of soil conservation on a project is influenced by the diameter of the pipeline, season of construction, topography, land use and type of trenching / pipe installation equipment to be used. Inappropriate stripping widths can result in rutting and compaction. Compaction causes the formation of a hardpan layer which can be impenetrable by plant roots and serve as an impediment to water movement through the soil profile.

3.2. Timing of Construction

The timing of construction activities can influence the success of soil conservation efforts employed during pipeline construction. Based on thousands of pipeline projects through prime agricultural crop and forage lands in Western Canada, the preferred choice of industry is to conduct topsoil salvage activities under non-frozen soil conditions. Typically, this means such activities would be undertaken in late spring, summer and fall. If construction is scheduled to extend into frozen soil conditions, attempts are made to complete topsoil salvage activities along the length of the pipeline right-of-way prior to the onset of freeze-up. Recently, with the availability of specialized equipment capable of accurately stripping variable depths of topsoil, soil conservation can be successfully achieved during frozen soil conditions.

Other factors which influence timing of construction on agricultural lands are soil moisture conditions and land use. The amount of moisture in the soils along the pipeline right-of-way dictates not only when construction activities, particularly topsoil salvage, can commence (e.g. after spring thaw when soils are sufficiently dry) but also when construction activities may be suspended and resumed. Shut down of construction activities, especially topsoil salvage, occurs when there is: rutting of the topsoil to the extent that topsoil/subsoil mixing may occur; excessive wheelslip; excessive build-up on tires and cleats; formation of puddles; and/or tracking of mud as vehicles leave the right-of-way (Figure 2). Resumption of activities occurs when the soils have sufficiently dried in non-frozen conditions or re-frozen in frozen soil conditions. On cultivated and pasture lands, attempts are made to avoid peak agricultural activities (e.g. seeding, harvesting, grazing) as well as the irrigation season on irrigated lands.

Figure 2. Wet Weather Shutdown of Construction Activities along Right-of-Way

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Biographical Sketches

Tamara Petter is a Senior Environmental Planner and Principal with TERA Environmental Consultants in Calgary, Alberta, Canada. Ms. Petter has a Master of Environmental Studies from the University of Waterloo, Waterloo, Ontario (1994) and a Bachelor of Science (Honours) in physical geography (1992) from Queen's University in Kingston, Ontario. Since joining TERA in 1995, she has authored numerous environmental impact assessments for provincially and federally regulated pipelines throughout Western Canada. These pipelines cross a variety of diverse landscapes, including agricultural lands (cultivation and pasture), native prairie, forest, mountains, tundra, streams, wetlands, rivers and urban centers. Recently, she was the lead impact assessor for a pipeline looping project located within Jasper National Park in Alberta and Mount Robson Provincial Park in British Columbia, both of which form part of the UNESCO Canadian Rocky Mountains Park World Heritage Site. Ms. Petter has appeared before the National Energy Board as an expert witness on two occasions. Ms. Petter is Canadian Certified Environmental Practitioner.

Dean Mutrie has been an environmental consultant since 1973 and a Principal of TERA Environmental Consultants in Calgary, Alberta, Canada since 1986. Mr. Mutrie has Master of Arts (1980) and a Bachelor of Environmental Studies (Honours) (1973) in urban and regional planning from the University of Waterloo in Waterloo, Ontario. Mr. Mutrie has carried out over 300 powerline and pipeline projects totaling more than 30,000 km. Mr. Mutrie has acted as Project Director or Advisor for a number of high profile projects including Denali - The Alaska Gas Pipeline, TMX - Anchor Loop through Jasper National Park, the Mackenzie Gas Project, Georgia Strait Crossing and the Alliance Pipeline Project, as well as the Altamont Pipeline, Express Pipeline and Tuscarora Gas Transmission projects in the United States. He has led training courses on environmental protection planning for pipeline construction for several pipeline companies and regulators in Canada and the United States and co-edited the Proceedings of the Seventh International Symposium on Environmental Concerns in Rights-of-Way Management held in Calgary, Alberta in September 2000. Mr. Mutrie has appeared as an expert witness at regulatory hearings in Canada and the United States on nine occasions and has been a member of the Canadian Institute of Planners since 1977.