Pipeline Revegetation Techniques

ENVIRONMENTAL CONSIDERATIONS IN PLANNING AND ROUTING NATURAL GAS PIPELINES AND THEIR RELATIONSHIP TO OFF-ROAD VEHICLE USE

by G. F. Carpenter

Natural gas pipeline development impacts all aspects of the natural environment. This paper concerns natural gas pipeline routes in Michigan but its findings are applicable to other states and other types of rights-of-way such as electrical transmission corridors or roads. A search for right-of-way (ROW) locations must be concerned with land use and natural resources: land value, air quality, water quality, soils, wildlife, vegetation and aesthetics. The Michigan Public Service Commission (MPSC) has developed nineteen routing criteria to aid in the protection of these natural resources. Although the use of off-road vehicles (ORV) in pipeline rights-of-way presents special problems, with proper planning, they can be constructed and maintained in a manner compatible with both man and his environment.

Why all the Concern for the Environment?

Because of the enabling legislation, the Michigan Public Service Commission has a mandate to ensure the safe and cost efficient construction and operation of pipelines. In addition, the Anderson-Rockwell Environmental Protection Act (1980, P.A. 127) and the Governor's Executive Order 19074-4 imposes the duty on all state agencies to prevent or minimize environmental degradation. Similar legislative mandates exist in other states and federally for interstate projects. Finally, the public demands that aesthetics and human and natural resource protection be given equal consideration with economics in planning and authorizing development. Historically, safety and economic considerations, as controlled by the Michigan Gas Safety Code, have been paramount. In recent years, particularly in connection with development in northern Michigan, environmental considerations have held increasing importance.

Two events have had great impact on the increasing importance of the environment in natural gas pipeline development. These are the discovery and development of important hydrocarbon reserves in the northern lower peninsula of Michigan (known as the northern Niagaran Trend) and the "No Flare Order" issued by the Supervisor of Wells of the Michigan Department of Natural Resources (MDNR). The No Flare Order prevents waste of natural gas by flaring or venting, so wells which produce both crude oil and natural gas must provide for the collection of gas. The order results in the need for natural gas pipelines because, in contrast to crude oil production, it is safer and more efficient to transport gas by pipeline than by truck. The discovery of hydrocarbons in northern Michigan greatly increased the number of pipelines needed, resulting in a relatively large commitment of land. While this commitment may amount to only a small percentage of land in the Niagaran Trend, it is occurring in a popular recreation area affecting both private and state-owned property. The resulting public awareness and visibility have thrust environmental considerations into prominence in pipeline activities. The MPSC goal is to avoid pipeline disruption of sensitive environmental areas of habitats where feasible and prudent alternatives exist.

Sensitive areas are those which are least able to accommodate a pipeline without fundamental changes in their composition or structure. In Michigan,

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the habitats most sensitive to environmental disruption are streams and wetlands (Crabtree, et al, 1978). Stream impacts include destruction of banks, siltation from construction and erosion, destruction of fish cover, replacement of fish spawning beds, and heating because of pooling and removal of shading vegetation. Wetland impacts include dessication from sun and wind exposure; die back, sunscald and windthrow of shallow rooted trees along the right of way (ROW); little or no regrowth of slow-growing species; invasion by fast-growing opportunistic species; and loss of wildlife cover and breeding habitat. These and other habitats, such as uplands, can also

(see Habitats, pg. 30)

Habitats (cont. from pg. 29)

suffer from drainage pattern alterations which result in flooding on one side of a ROW and drying on the other because of damming or soils compaction.

Upland hardwood or conifer stands are less susceptible than wetlands and streams to damage, although clearing and the resulting "bowling alley" effect can be quite noticeable (Figure 1). It is here that aesthetic effects become more important. There is a danger that indiscriminantly placed right-of-way can subdivide or carve continguous forests into smaller parcels altering the forest habitat and opening it to invasion. This can place increasing pressure and reduce the range of wildlife species which prefer large or isolated areas. Carefully placed, however, a ROW can enhance habitat diversity by creating an edge effect in the vegetation and providing food and cover for a great variety of wildlife. Open fields, either wild or agriculture, are even less susceptible to environmental damage or aesthetic impact because vegetation clearing is minor and mitigation in the form of restoring the land grade and reseeding can quickly hide the land disturbance.

Habitat sensitivity rating based on this information can be a useful tool in planning the location for a new ROW. The MPSC has developed an impact rating system for use in natural gas pipeline routing in Michigan (Sicuranza and Carpenter, (1980)). The approach starts with a land use and vegetative cover classification system developed by the Michigan Department of Natural Resources (MDNR, 1976) and extends into a constraint map system. Other evaluation and rating systems such as Habitat Evaluation Procedures (U.S. Fish and Wildlife Service, 1980) or the NUROP (numerical rating of parameters) system (Stanford, 1980) are available for evaluating alternate routes or examining land use and wildlife habitat changes and their value.

Figure 1. The "bowling alley" effect of electrical transmission line corridors.

How can ROW Impact be Controlled?

Environmental guidelines have evolved out of the studies reported by Crabtree et al (1978) and Sicuranza and Carpenter (1980) as well as natural gas pipeline certification proceedings before the Michigan Public Service Commission (Table 1). These guidelines are intended for use by the utilities during the planning and construction of new pipelines but can be extended to any new ROW or facility siting project. A further intent is to acquaint the utility with the criteria that the MPSC staff will apply when reviewing a pipeline route application.

The guidlines are not exclusive and, in fact, can conflict with each other. The reason is that ROW routing is a dynamic exercise which requires balancing decisions based on safety, economics, and the environment. For example, the first three guidelines are intentionally conflicting. Commit the least amount of land possible means that a straight-line route is most economical, as long as physical barriers or environmentally sensitive areas which should be avoided (the second guideline) aren't present. The third guideline, utilize existing right-of-way, provides a less impactive means for crossing an environmentally sensitive area and also carries the warning that subdividing land units when nearby existing right-of-way can be used, is not desirable. Therefore, a more expensive deviation from the straight line route can be justified if significant environmental, aesthetic, or land use impact can be avoided.

The fourth guideline, minimize ROW clearing, exists because it is more expensive and aesthetically damaging to clear and then rehabilitate a wider ROW than that needed for construction purposes. A corollary to this guideline is to allow vegetation to regrow in part of the ROW, leaving only enough open area for inspection and emergency access purposes. Regrowth maximizes the benefit of habitat diversification in a

(see Guidelines, pg. 31)

Table 1. Planning and Mitigation Guidelines Developed by Michigan Public Service Commmission Staff

1) Commit the least amount of land possible to pipeline use.
2) Avoid environmentally sensitive areas whenever possible.
3) Utilize existing rights-of-way whenever environmentally and economically prudent.
4) Minimize clearing on the right-of-way.
5) Avoid crossing cold water streams if a feasible and reasonable alternative exists.
6) Control silt and sediment during aquatic construction by using the plow method or dewatering the trench.
7) Cross streams at right angles, at the narrowest point, and in areas of shallow stream banks.
8) Implement stream bank repair and protection immediately following construction.
9) Avoid wetlands whenever possible.
10) Cross wetlands at the narrowest point, following existing rights-of-way, and build during the period of minimum wildlife activity.
11) Begin construction during low water levels.
12) Protect and reestablish wetland drainage patterns using culverts or other aids.
13) Minimize the number of construction vehicles and their frequency of travel to control soil compaction in wetlands.
14) Avoid placing gravel or stone in streams and wetlands as a road bed for construction and inspection traffic.
15) Utilize periodic aesthetic bends when traversing forests and at road crossings to limit visibility along the right-of-way.
16) Avoid routes which require clearing crests of hills or ridges.
17) Replant or leave natural vegetation screens at road, major trail, stream, river, or wetland crossings.
18) Institute an active off-road vehicle program.

Guidelines (cont. from pg. 30)

forested area, aids in erosion control, and limits ORV use.

The fifth through eighth guidelines involve specific activities and benefits to streams. A cold water stream receives special consideration because of its value as a trout stream, but any stream should be avoided if possible. The plow construction method has proven to be less expensive than conventional trenching techniques and results in less downstream impact from sediment disruption (Figure 2). Large quantities of sediment of bank material dumped into a stream can bury spawning areas and pools, thereby disturbing habitat and fish carrying capacity. The plow method also reduces the amount of bank clearing and eliminates the need for placing road gravel in the stream bed to support construction vehicles. Narrow crossings and shallow banks can greatly reduce the substrate disruption and erosion so that the amount of material released into the stream can be minimized. Rapid bank repair can further reduce post construction erosion as well as the chances of later use by ORV traffic.

Figure 2. A tractor mounted plow used for burying gas pipelines.

Guidelines nine through fourteen apply to construction in wetlands although some of them apply to uplands or streams as well. Wetlands should be avoided whenever possible and existing rights-of-way should also be utilized. In addition to providing specialized habitats for many animals and plants, wetlands are seasonally utilized by many animal species for nesting and breeding. If construction can't be avoided, minimum wildlife activity and low water periods are preferred for construction activities in order to minimize interference with breeding seasons. A big danger in wetlands is alteration of drainage patterns caused by soil compaction from vehicle traffic or fill mounds in the pipeline trench. This alteration may result in a damming effect to surface and subsurface water movement and can often be avoided by using the plow method. Because of maintenance and inspection roads are common in larger rights-of-way, additional protection of natural drainage by installation of culverts may be necessary. Otherwise flooding can occur on the up-flow side of the ROW while drying-out can occur on the down-flow side. This problem can also occur in uplands and agricultural fields where interference with drainage, runoff, and drain tiles can result in altered land use or value.

The next three guidlines, fifteen through seventeen, involve aesthetics in upland situations as well as environmental impact. Long, straight right-of-way through forests are unattractive to many and an invitation to unauthorized ORV use (Figure 1). When oriented in the direction of prevailing winds, a "bowling alley" effect can funnel winds through a forest and result in tree blow down and soil drying. What might otherwise have been a useful creation of edge habitat in a deep forest can result in forest damage. Similarly, routes which require clearing hilltops or ridges increase these destructive tendencies and further open stabilized soils to possible erosion. Vegetation screens or offsets and bends (Figure 3) at road, trail, stream, or wetland crossings will reduce the negative aesthetic impact.

Finally, the eighteenth and nineteenth guidelines attempt to solve an increasing problem in ROW planning and maintenance. Erosion is a problem wherever it occurs, whether along stream banks or in an upland. Because many of the soils in Michigan are unstable sands, erosion control must be part of all construction plans. In addition, increased erosion is often associated with ORV use. ROW plans are necessary for rights-of-way where ORV use is anticipated so that traffic can be eliminated or routed in the least disruptive manner.

Figure 3. An aesthetic bend in a newly constructed pipeline ROW.

ORV's - A Special Case

Many of the problems experienced along rights-of-way in Michigan result from indiscriminant ORV use. Convenient long distance rights-of-way through areas with few roads can result in ORV highways through the woods (Figure 4). Stream access for fishing and steep hills provide purpose and excitement to some drivers (Figure 5).

Unstable soils contribute greatly to the problem; consequently, repeated use can result in definite scars on the landscape. This appearance contributes to negative public attitude and further pipeline development can encounter increasing delays. A case in point is a long battle which has waged in Michigan: exploration and develop-

(see ORV'S, pg. 32)

Figure 4. Use of major pipeline ROW by ORV's in northern Michigan.

Figure 5. Hill and stream damage from indiscriminate ORV use.

ment of hydrocarbon reserves in a state forest area perceived as pristine and sensitive, have been delayed for more than 10 years because of public resistance. Recent efforts in ORV management will help future developments proceed with reduced cost to the environment.

Several of the older rights-of-way need repair. One such case (Figure 6) in the northern lower peninsula required drastic measures before natural recovery could begin (Figure 7). These measures included closing the area to vehicles, installation of cement pipeline swamp weights as an unsightly but permanent barrier to traffic (Figure 8), construction of a log jam and a wing dam to repair the bank and stream bed (Figure 9), and extensive regrading before natural recovery could occur.

Even though ORV use is often destructive, it is a form of recreation which is growing in popularity. Many of our problems on older rights-of-way could have been avoided using the present routing criteria and including trails where ORV use was anticipated. Some areas which are level and have well established drainage are now used without major impact and, in the future, closing some areas, controlling trail use in others, and routing rights-of-way to avoid sensitive habitats will result in fewer problems.

Conclusion

Natural gas pipeline rights-of-way are major long-term commitments of natural resources to human need. Improper routing can result in substantial resource loss or degradation, loss of vegetation and wildlife, undesirable aesthetic impact, and limitation of future development. Through proper planning, routing, careful construction, and rehabilitation, many problems could have been avoided and will be avoided in the future. Utilization of planning criteria such as those developed by the MPSC can help minimize environmental impact. A ROW can create edge effect, diversity habitat for desired species and still be aesthetically pleasing (Figure 10). Special attention must be given to managing ORV impacts and still provide opportunities for this growing form of recreation. Pipeline construction and ROW management can be compatible with the quality environment the public demands and still help meet the energy needs of modern society.

References

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Figure 6. A heavily impacted ROW at a river crossing before repair.

Figure 7. The same river crossing one season after repair.

Figure 8. Pipeline swamp weights used as a permanent vehicle barrier

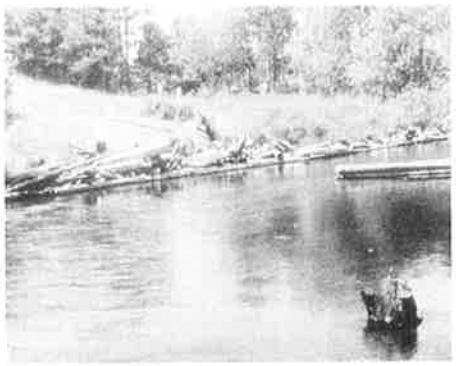

Figure 9. A log jam and wing jam installed to protect a river crossing.

Figure 10. Habitat diversification along a pipeline ROW.

CORRECTION

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The Virginia City tour Sunday, June 20 begins at 10:00 a.m., not 8:00 a.m. The MGM Grand Intro to Gaming class will be Sunday June 20 not Monday June 21, beginning at 2:30 p.m.