measurements, slopes on most of the rolling terrain rangeland in northeast Montana crossed by Northern Border did not exceed 7 degrees, except for ravines such as in photo #40, and frequently were about 5 degrees.

Figures 2 and 3

The cross sections and vertical views show the different effects of clearing on the slopes shown in figure 1. The work space must be on the same side of the right-of-way because the ditch and pipe cannot be crossed by equipment, and is usually on the right side of the ditch when facing the direction of construction, because of convention. Equipment such as side-boom tractors and trenchers have thus been constructed with booms on the left. In other words, side-boom tractors cannot build a pipeline from east-to-west on the right-of-way depicted here. The main requirement is a level work space, with little deviation, on either side of the trench. This level space requirement allows a trench of uniform depth to be dug, safe and smooth operation of the very heavy equipiment required to move large pipe, easier construction, and lower stress on welded pipe moved into the trench.

Note that the south facing slope, "B", has a narrower r-o-w because spoil can be used as fill and thus less space is needed for soil and spoil storage. As shown in the pictures in the previous section, there is considerable variation from site-to-site, especially with spoil and soil storage.

Figure 4

Vertical view of a cleared and ditched r-o-w on level terrain. Commonly, sod remains on the work space on this terrain, if it is rangeland. "Grade debris" refers to small amounts of soil, sod bladed from high spots, and the above-surface portions of any woody plants that are present.

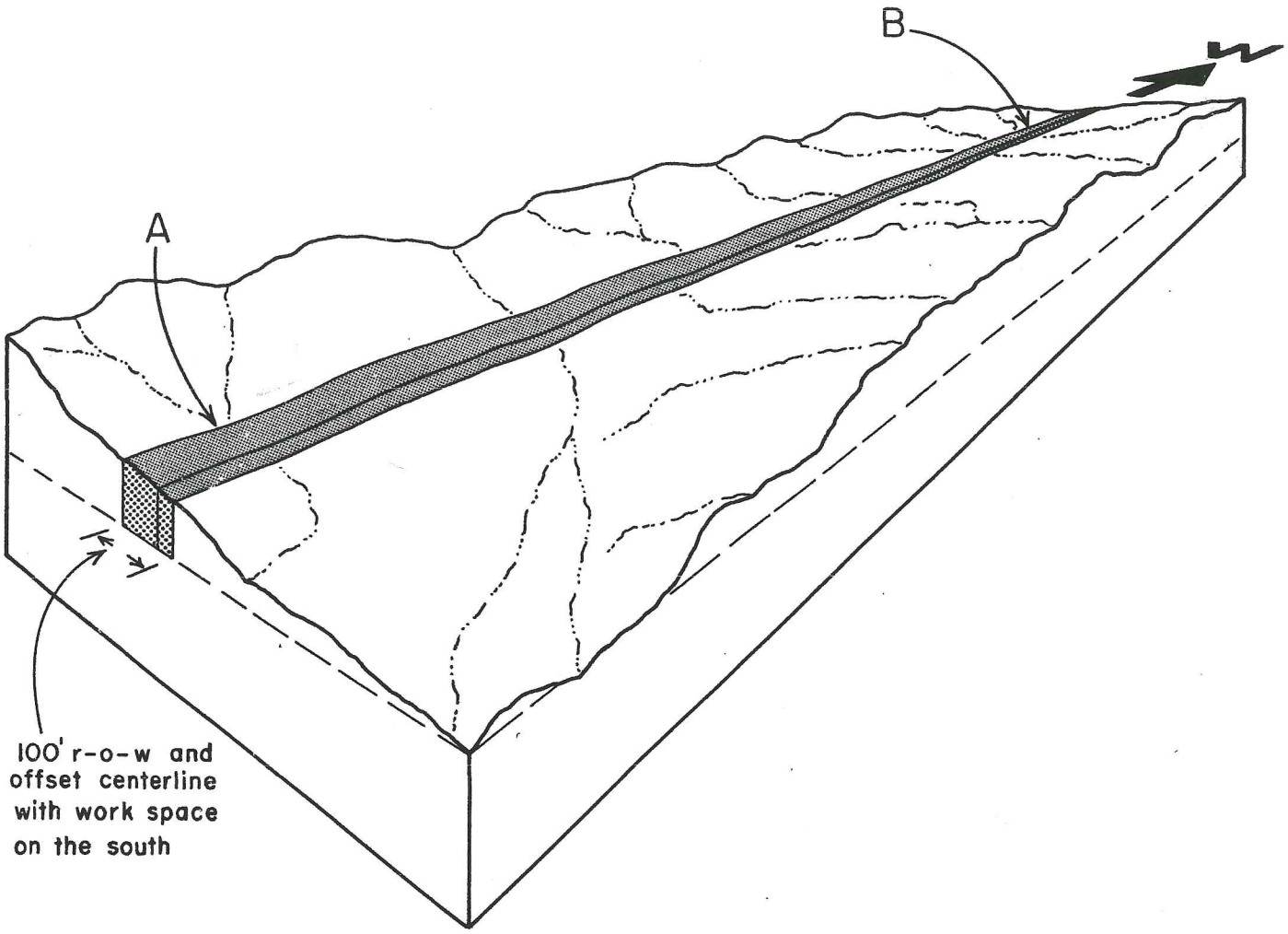


FIGURE 1

Generalized view of an east-west 100' pipeline Construction right-of-way as foreseen in Northern Border Pipeline Company's applications to cross Montana state lands. The terrain is typical of Montana state lands crossed in Phillips and Valley counties, where, aside from drainages, the steepest slopes are on the order of 5-7°, and rangeland is the primary land use.

December 1981

# DNRC

## Northern Border Pipeline

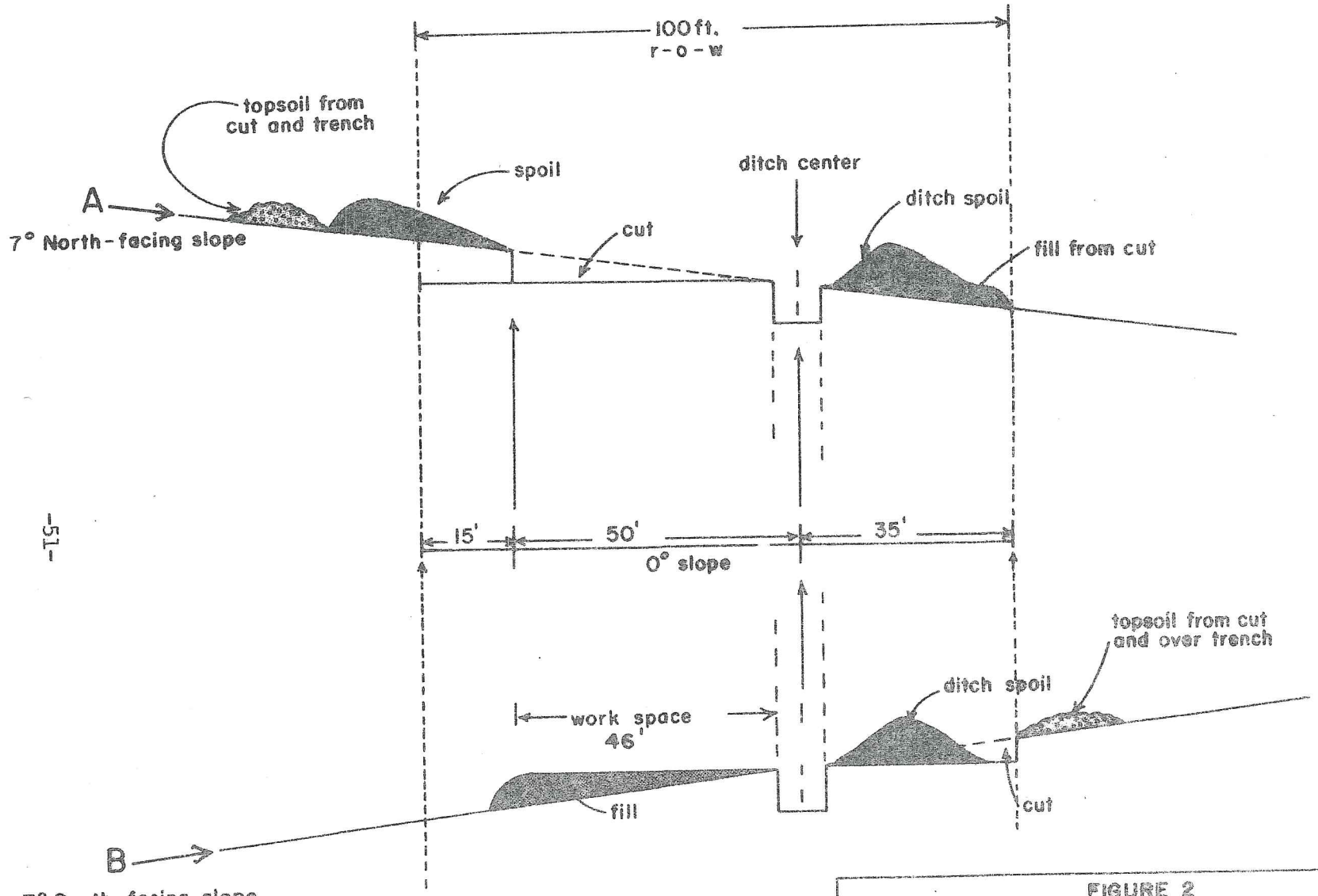




FIGURE 2

Cross sections of the cleared right-of-way at points A and B in Figure 1, as seen looking west.

Trench dimensions are depicted at 7' deep and 8' wide.

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FIGURE 3

Vertical view of cleared right-of-way at "A" and "B" locations of Figure 1. See figure 2 for additional measurements.

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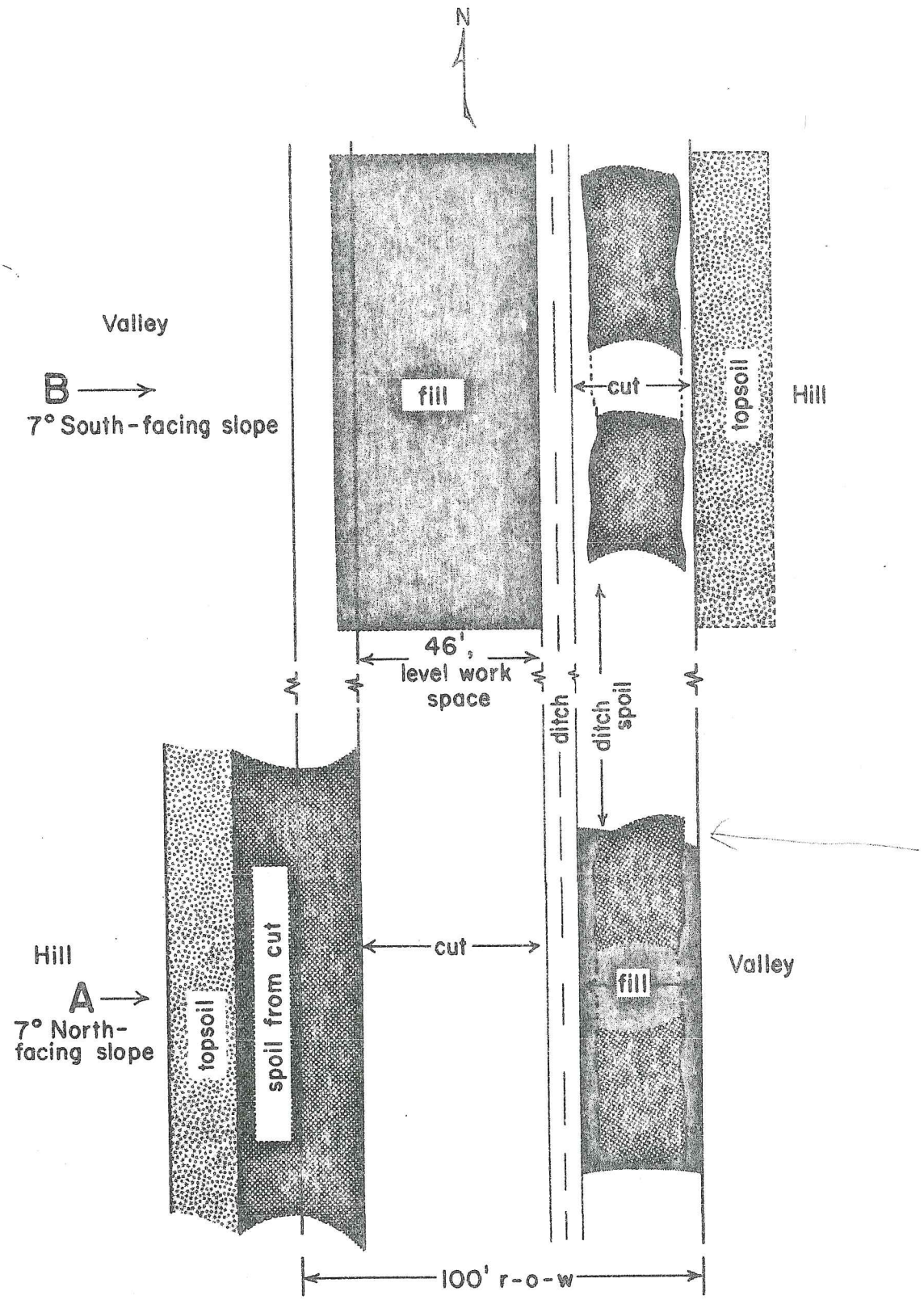
Northern Border Pipeline



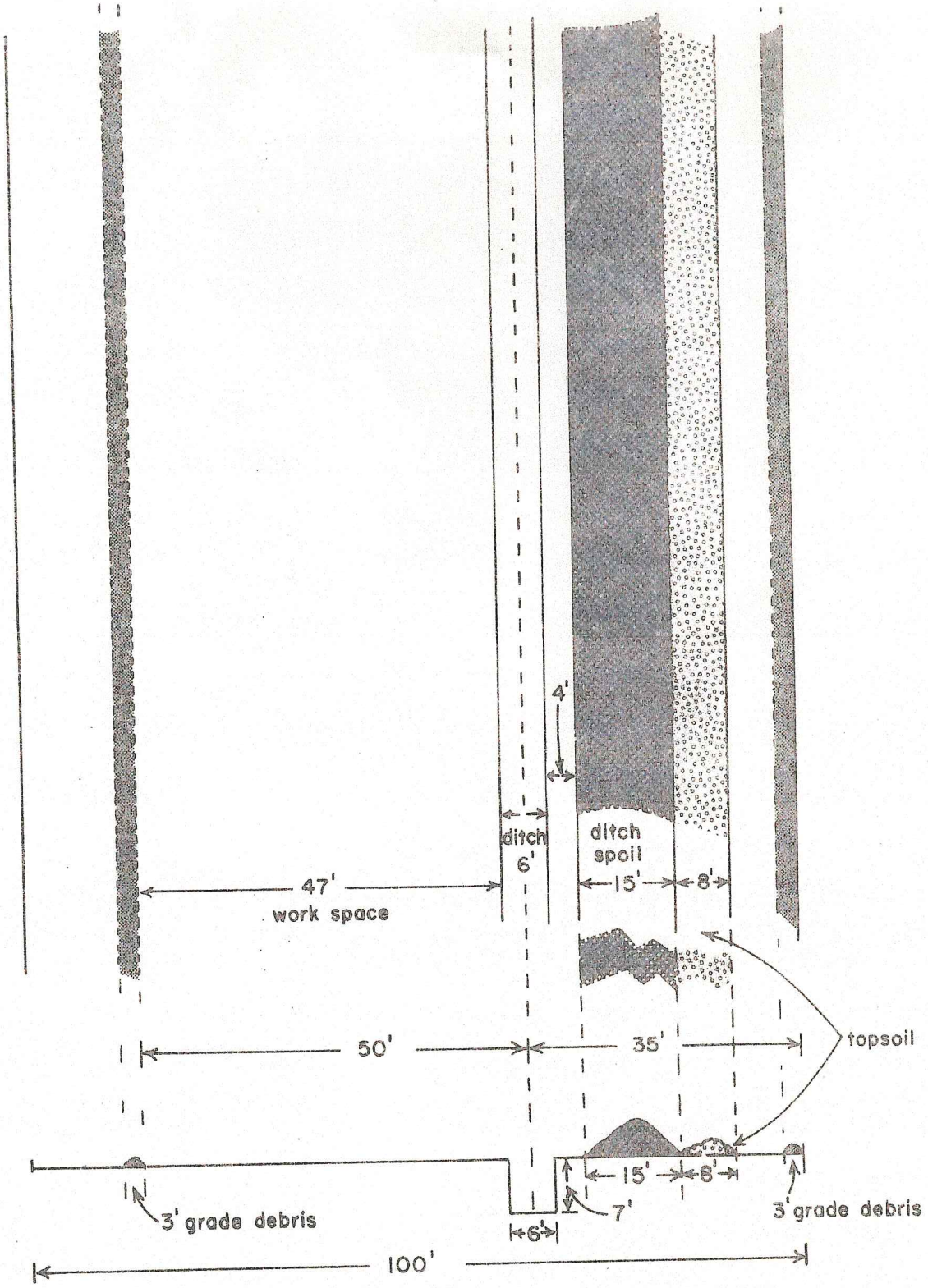



FIGURE 4

Construction across flat terrain. In this case a six-foot-wide ditch is depicted, which occurs when a trenching machine is used, and no backhoe work was necessary.

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Northern Border Pipeline

## Conclusions

The photographs and figures in this section indicate the following possible conclusions about r-o-w width requirements and topsoil stripping:

1) Any deviation from flat terrain (0 degree slope) causes a geometric increase in width requirements, primarily for soil and spoil storage.

2) There is often a progressive increase in r-o-w width after initial r-o-w clearing as the different stages of construction proceed.

3) There were numerous areas of extra r-o-w width needed beyond the 100 foot requested by DNRC.

4) There was a high potential for topsoil mixing in the numerous side-hill cuts.

5) There was an inconsistency in depths to which topsoil was stripped on state land parcels, and an inconsistency in keeping topsoil and substrate in separate piles.

6) Construction crews demonstrated an exceptional ability to re-contour the disturbed surface to the original configuration and replace topsoil when it had been correctly stripped.

7) A r-o-w narrower than 100 feet (apprxoimately 85 feet) is quite possible and reasonable on truly flat terrain (0 degree slope), but apears impractical on terrain with a slope greater than 5 degrees.

8) Separate topsoil storage piles on side-hills require a wide r-o-w. Recontouring without tearing up ground beyond the piles requires even greater widths.

These issues are discussed further in the next section on state lands, and in the conclusions section.

## CONSRUCTION ON MONTANA STATE LANDS

NBPC applied for an easement to cross lands managed by the Department of State Lands (DSL) in early January, 1981. At its April meeting the State Board of Land Commissioners refused them an easement, preferring a lease, effective May 2. Construction started two days later. The IPTF assisted DSL staff and NBPC in the necessary paperwork primarily because of time constraints, and because DNRC (and IPTF) was in the midst of negotiations with the Office of the Federal Inspector concerning federal and state roles during and after construction (see pages 64 and 74 below).

Federal legislation on the ANGTS required that NBPC build the pipeline according to general and site-specific environmental stipulations developed in part with federal and state agencies, and under the supervision of the OFI. The DNRC had examined drafts of these stipulations during the preparation of the EIS on the project. To keep federal and state

requirements as uniform as possible, the IPTF recommended that DSL adopt a modified version of NBPC's environmental plan and stipulations as a binding part of the lease. The modifications were minor, and mostly involved removal of ambiguity about whom would make decisions about reclamation. The DSL accepted this proposal, with some changes. The IPTF also helped develop the site specific stipulations. These stipulations are contained in Exhibit B of the lease.

The main features of the lease stipulations that later became problematic were: 1) insufficient topsoil removal and replacement from over the trench and on side-hill cuts, 2) substantial activity outside the approved r-o-w without prior permission from DSL or notification of the IPTF, 3) relief of soil compaction caused by heavy equipment, and 4) modification of the reseeding program specified in the lease. The significance of these problems is discussed below.

The extent to which additional space was needed beyond that originally requested can be seen in the photographs in this report. The amount of land that NBPC first applied for in its state land easement request (temporary and permanent combined) was about 152 acres. In December, 1981, the final platted calculation of additional space needs submitted by NBPC to DSL was about 43 acres more, or a 28 percent increase. As can be seen in the photos, this added space was largely for soil and spoil storage, indicating an underestimation of the amount of side-hill cutting needed.

The problem of inadequate topsoil handling is more serious, since it would result in some productivity loss. The problem is, of course, confined to those areas where side-hill cutting occurred, and over the trench. Problems on state parcels, however, could indicate problems on the whole route because there was no apparent difference between

construction on state lands and other lands. There is also no apparent reason for the inconsistencies in topsoil handling, although it might indicate an attempt to keep the r-o-w as narrow as possible.

Soil samples were taken in several locations to determine the extent to which topsoil was mixed with parent material. The results of a soil analysis on these samples are given in Appendix A, and it confirms the photographic evidence that there was inconsistent and insufficient topsoil removal and handling during r-o-w clearing and grading. Tests with 7 percent acid solution (HCL) on state parcels VA051, VA052, VA053.5, and VA057 indicated that the calcium carbonate layer on the trench sidewall ranged from 6 inches to 23 inches from the surface after blading and trenching (see photo #74). IPTF observers also saw substantial amounts of gypsum on the soil surface after clean-up on parcels PH018 and Ph019. These crystals were evidence that ditch spoil from several feet below the surface were mixed with top soil.

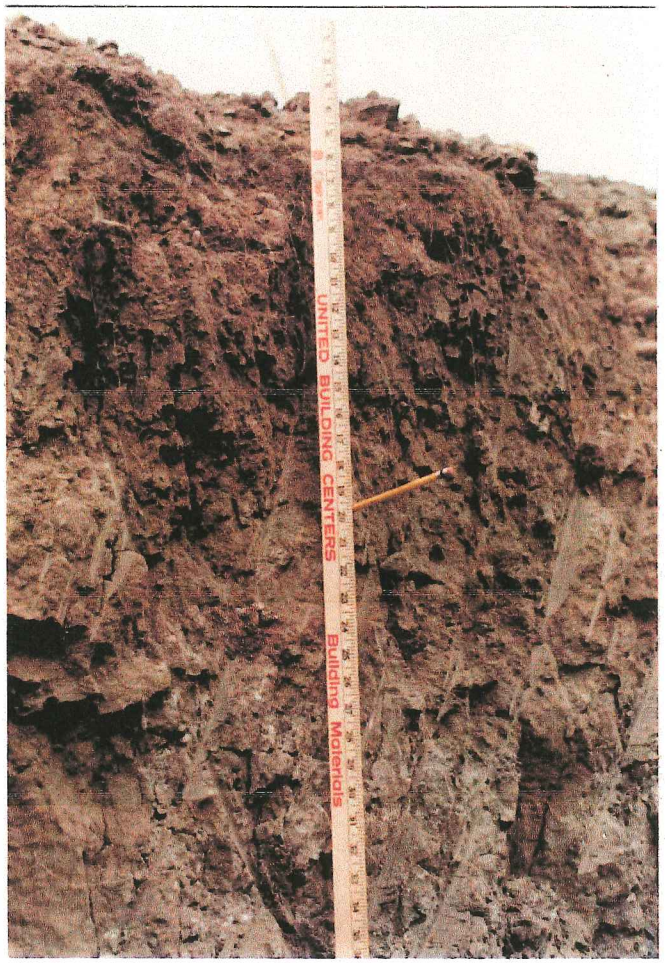
Soil compaction problems in traffic lanes were dealt with to some extent during clean-up by the Leonard Pipeline Company. NBPC's reclamation plan, however, and the DSL lease, required compaction relief in the fall as part of seedbed preparation. This reclamation work was covered by a separate reclamation contract that was not let until the fall. Even though Leonard Company personnel did have some compaction-reducing equipment, discussions with their field people gave the impression that their contract with NBPC did not require consistent treatment of compaction from a reclamation viewpoint.

The extent of the problem cannot now be readily determined because clean-up operations have replaced topsoil, spoil, and grade debris, and covered compacted areas to varying degress. Studies of soil compaction

have shown that heavy equipment can cause long-term soil damage (see DNRC's draft EIs on Northern Border). Soil in traffic lanes was severely compacted in certain areas, especially where there was a relatively high clay and gravel content, based on observations during construction. The r-o-w was used as a road, and received a high amount of traffic from heavy equipment, pipe-hauling trucks, other trucks, buses, pick-ups, and cars. Leonard Company field people said that heavy-duty, hydraulically-operated, chisel equipment would be necessary to break up the compacted areas.

If NBPC had attempted to relieve soil compaction in the fall, as part of seedbed preparation, there would have been problems with pulling up rocks and boulders which were plentiful in some areas. This would have required another round of removing rocks and boulders. The conclusion indicated by these observations is that compaction relief is best done at the time of r-o-w clean-up. R-o-w width problems led NBPC to request permission from DSL to wait until construction was completed before formally requesting modification of their state land lease. This was granted. Photos #74 through #81 cover some of the reasons for unpredictable increases in r-o-w width.

Difficulties with NBPC's reclamation contracts led to a program of aerial seeding rather than the on-the-ground program stipulated in the DSL lease (see photos #24, #26, and #27). It was felt that getting the seed on the ground in the fall was important. This method is usually used in steep terrain, and is considered to be not as reliable as ground-seeding where seed is drilled in with a seeder.




#74 Lack of sufficient topsoil removal as indicated on trench side wall on state parcel VA052. The top of the yard stick is at the surface after removal of 3-4 inches of topsoil. The pencil is at the level where an acid reaction began (see text). Note the dark and deep A & B horizon.

#75 Traffic off the r-o-w under muddy conditions on state parcel VA57. Photo taken July 15.

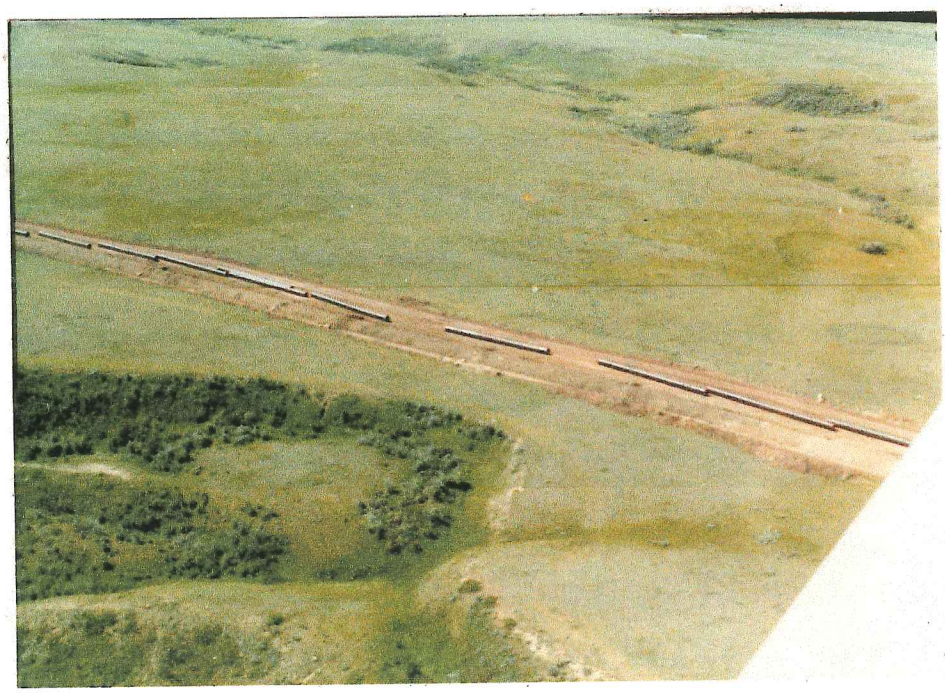
#76 Traffic off the r-o-w to avoid a mudhole on state parcel VA56. The praire in this area was poorly drained. Photo taken July 23.

#77 Traffic off the r-o-w on state parcel VA027.5 to avoid two gates near the northern part of parcel. Photo taken July 15.

#78 Typical clean-up in progress in wide r-o-w area in Phillips County. Dozers first push the soil back roughly to the original contour, then a road grader with chisels reduces soil compaction and finishes contouring. Note that there has been extensive traffic outside soil/spoil storage areas. This adds to r-o-w width requirements as noted earlier. Photo taken July 22.

#79 State parcel R0142. Only the area shown in the photo is crossed by the pipeline. Note that the r-o-w was fenced but backhoe widening of the trench added material to the spoil pile, covering the fence and topsoil. The view looks northwest on July 24 from the southern edge of the parcel.

#80 Lignite seam cut by trench on R0142. The seam is directly below the vantage point in #79.



#81 State parcel PH033, looking south on June 26. The route passes closely to a known buffalo jump at the lower left and crossed several archaeological sites.

## HYDROSTATIC TESTING

NBPC had difficulty obtaining water for hydrostatic testing in Phillips and Valley counties. Negotiations with the Frenchman Water Users Association fell through, and NBPC eventually constructed a 10-inch steel water pipeline along Highway 24 from Valley Industrial Park to the route, joining the pipeline next to the West Fork Porcupine Creek. Water from a well at VIP, and from the Missouri River via VIP's pipeline, was used.

IPTF and the Montana DHES visited water discharge points and found no water quality problems, and insignificant erosion. The problem that did occur, however, was a failure to give DHES two weeks prior notice of discharge. This was caused by a Leonard Pipeline Company employee telling the testing foreman that notice had been given.

## OFFICE OF THE FEDERAL INSPECTOR

The relationship of the OFI, landowners, and local and state agencies was not clearly stated in the federal legislation, and was not clarified by the time construction began, even though DNRC demonstrated a high degree of interest in coming to an agreement. It may be an understatement to say that the OFI dragged its feet. This probably was largely due to differences of opinion on federal/state jurisdictional issues. Appendix B presents a description and chronology of communications between the DNRC and the OFI regarding such an agreement. Some of these communications are contained in the EIS and the rest are in IPTF files.

At no time during the Northern Border project was there any formalized communication system established between the state and OFI. It was not clear as to how the OFI interpreted its responsibilities on state or private lands. This may have contributed to some of the r-o-w problems and the inconsistency in topsoil removal. For example, the OFI gave NRPC "Notice to Proceed" without having its field inspection system fully in place. Table 2 demonstrates that construction, once begun, proceeds very rapidly. With r-o-w grading proceeding at an average of 20 miles per week in May, there is little time for changing the clearing practice.

As indicated in the correspondence in Appendix B, the problem with the OFI reluctance to deal with state interests probably came from a failure by top-level OFI policy-makers to set up a system for interjecting state interests into the overall monitoring program of the OFI. The evidence indicates that the OFI interpreted the federal legislation to mean that complete authority to build the project resided in Washington. States are unlikely to concede to federal agencies this kind of authority, especially if it is ambiguously stated in the federal legislation. Rather than expediting construction, this may have contributed to delays and expense.

It should be noted that during construction, OFI field personnel indicated a willingness to cooperate and provide information and assistance. The Omaha office of the OFI, overseeing construction of the Eastern Leg, was also quite helpful.

## IPTF OPERATIONS

IPTF operations for Northern Border were funded voluntarily by NBPC through a negotiated contract with DNRC. Duties were described in the contract and were largely confined to assisting NBPC obtain permits, and responding to state agency requests for assistance with permits and monitoring of the project. Most of the IPTF work concerned the permit for crossing state lands (both DSL administered land and the DNRC land near Frenchman Creek), the hydrostatic test water discharge permit from DHES, the Conservation District 310 permits, and the DNRC water withdrawal permits. Efforts were made throughout the construction period to document the project in order to apply the knowledge to other large pipelines, especially the Northern Tier oil pipeline which looked as if it was soon to be built.

A description of the purpose and concept of the IPTF is contained in Montana's EIS's on the Northern Tier and Northern Border pipelines. Perhaps the major reason for the creation of the IPTF was that large pipelines are not regulated by the Major Facility Siting Act, although there have been proposals to place them under the act in the last two legislative sessions. The primary concern came from the Northern Tier proposal because the DNRC perceived a high level of public interest in environmental issues and because of the potential red tape for the company caused by the high number of separate governmental jurisdictions involved and the variety of landownerships.

All other states along the Northern Border route (North and South Dakota, Minnesota, and Iowa) regulate pipelines more closely than does Montana. The latter three passed

legislation in response to the ANGTS, and all four provide for county or state inspection during construction. Inspection is in most cases paid for by a per-mile assessment on the company.

Inspection must be carried out as a pipeline is built. On the Northern Border pipeline, there were NBPC inspectors for each of the operations listed in Table 2. OFI inspectors checked the overall operations of pipeline construction throughout the pipeline system in the five states affected.

As can be seen in Table 2, pipeline construction moves rapidly once begun. Problems with one operation can influence others and cause expensive delays. Rapid inspection and resolution of problems is important. It is also difficult to foresee exactly what will happen once construction begins and decisions may have to be made on the spot about environmental stipulations. The best example of this kind of difficulty on this project was the problems with topsoil salvage and r-o-w width. Thus, the inspection system should be compatible with construction operations. Experienced people with sufficient authority to make decisions at the construction site are essential to a functional inspection/construction system, especially during the beginning of construction. No inspection system was provided for in the IPTF agreement with NBPC. Any inspection carried out was to assist the DSL in monitoring the execution of the stipulations attached to the lease for crossing state lands.

## LANDOWNER ASSISTANCE

One of the IPTF functions was to respond to questions and complaints of landowners. There was, however, no provision for the IPTF initiating contacts with landowners. There were a few calls or comments to the IPTF from landowners or surface lessees of state lands concerning open fences and misunderstandings about how construction operations would block cattle movement. There was a general complimentary attitude on the part of the citizens toward MRPC during construction, and high interest in the project. Most contacts with MRPC occurred the year before construction began during the period when r-o-w agents were contacting landowners for easements. Most of these requests were for information on the project, and complaints about levels of reimbursement for damages. Although it is not envisioned that IPTF should interject itself into contract negotiations between the landowner and the company, an earlier role in providing general information to landowners could have eliminated some anxieties concerning easement negotiations and the condemnation process.

## CONCLUSIONS AND RECOMMENDATIONS

The conclusions that follow are my opinions gained from experience with preparing the EIS on the project, and on observations made while it was being built. I have made an attempt to base the conclusions on interpretations of the photographic evidence and other objective material presented in this report.