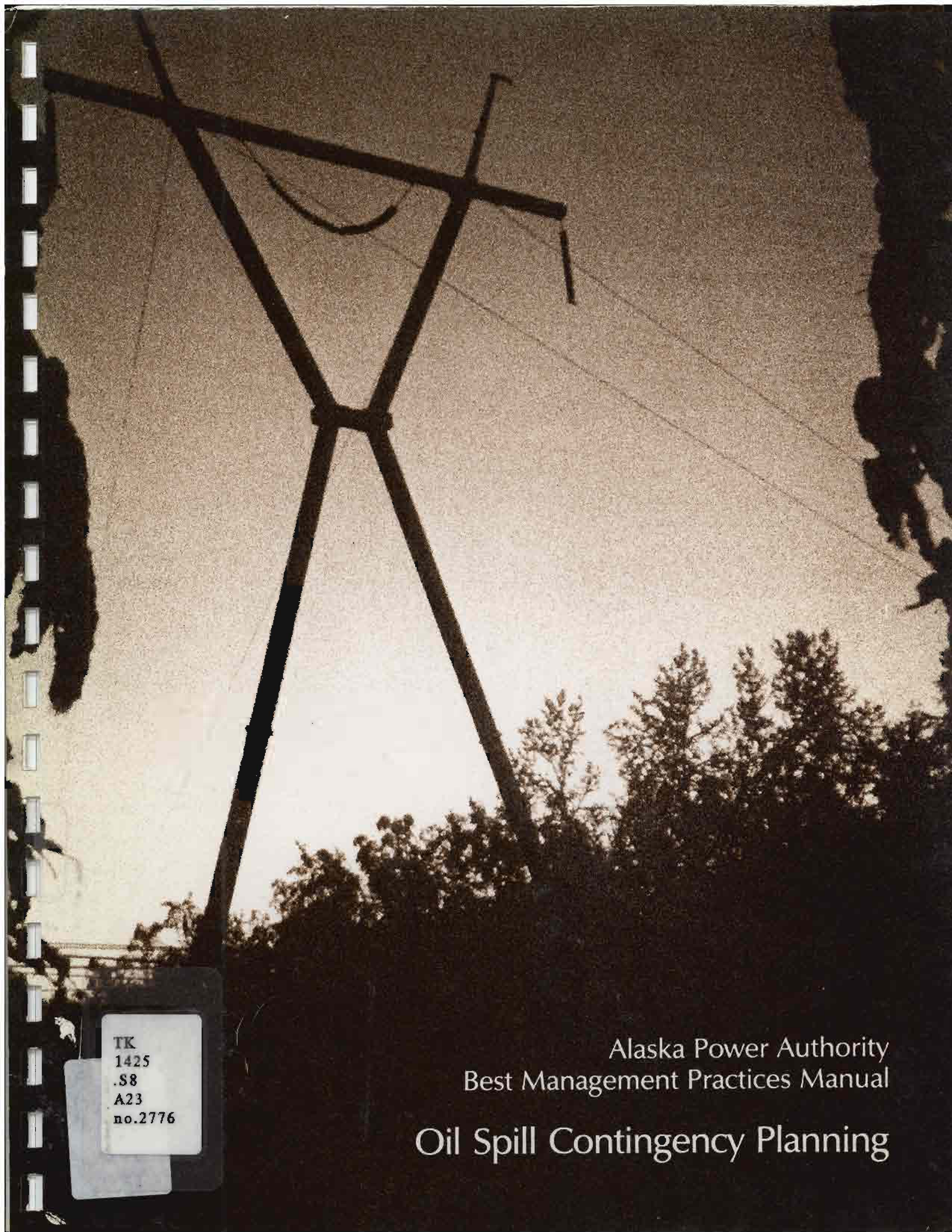

Alaska Power Authority
Best Management Practices Manual

Oil Spill Contingency Planning

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ALASKA POWER AUTHORITY

BEST MANAGEMENT PRACTICES MANUAL

OIL SPILL CONTINGENCY PLANNING

February 1985

Prepared by Frank Moolin & Associates, Inc.
under contract to Harza-Ebasco
Susitna Joint Venture

PREFACE

This manual is one of a series of "best management practices" manuals to be used in the design, construction, and maintenance of Alaska Power Authority projects. It represents a coordinated effort involving federal, state and local government agencies, and special interest groups.

The Alaska Power Authority intends that applicable guidelines and state-of-the-art techniques contained in the manuals will be incorporated where appropriate into the contractual documents for projects constructed, maintained, or operated by or under the direction of the Alaska Power Authority.

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CHAPTER 1 - INTRODUCTION

The Alaska Power Authority has prepared this best management practices (BMP) manual as one of a series of manuals to be used in design, construction, operation, and maintenance of Power Authority projects in Alaska. This BMP manual identifies the major elements that comprise an oil* spill contingency planning document and describes specific techniques for spill containment, cleanup, disposal and reclamation.

The U.S. Environmental Protection Agency (EPA) has regulatory jurisdiction over discharges into navigable waters of the United States and adjoining shorelines. EPA requires a Spill Prevention, Containment, and Countermeasure Plan (SPCC) for any above-ground petroleum storage greater than 660 gallons in a single tank or 1,320 gallons in more than one tank and for underground tanks greater than 42,000 gallons. The Alaska Department of Environmental Conservation (ADEC) requires a spill contingency plan for any facility with a storage capacity of 420,000 gallons or greater of petroleum products. The U.S. Coast Guard (USCG) requires an operations manual for facilities that transfer oil in bulk to or from any vessel. Each of the three documents must contain specific information as required by regulations and, for EPA and USCG documents, the information must be presented in a prescribed format.

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* For readability, this document uses the term "oil" spill. It is recognized, however, that other petroleum products, such as gasoline, will be used and stored at project sites. The guidelines and techniques discussed in this manual also apply to these other products.

The information presented in this manual, therefore, should be used only as a guide in preparing contingency or operations plans for specific projects. Not all the techniques discussed may be suitable for a particular project, some of them may not be acceptable from an environmental standpoint for a specific situation, and new techniques developed after publication of this manual may be more effective than those mentioned herein. Moreover, not all of the elements required by state and federal regulations to be included in a contingency or operations plan are discussed.

Following are the regulations governing oil spill contingency and operations plans:

<u>Code of Federal Regulations (CFR)</u>

40 CFR 110

40 CFR 112

33 CFR 153-156

<u>Alaska Administrative Code (AAC)</u>

18 AAC 75

CHAPTER 2 - POLICY GUIDELINES

It is the policy of the Power Authority to require every reasonable action to prevent spills of petroleum products and if they do occur, to minimize environmental damage and assure the safety of project workers and the public. The Power Authority and its contractors will comply with relevant pollution laws for the protection and conservation of environmental resources.

Prevention of spills associated with energy facilities is a prime objective of the Power Authority. (Many of the techniques and practices related to spill prevention are contained in a companion BMP manual on fuels and hazardous materials.) To assist in accomplishing this objective, the Power Authority and its contractors will:

- Incorporate state-of-the-art spill prevention measures in the design and construction of new facilities and improvements to existing facilities.

- Inspect facilities to determine potential sources of spills and remedial measures.

- Review construction, operation, and maintenance procedures with respect to prevention of spills.

- Establish formal training sessions for project personnel to ensure familiarity with facilities, equipment, procedures, and contingency response plans.

In the event of a spill, the Power Authority and its contractors will take all measures necessary to minimize damage to the environment and to protect project workers and the public. Priority will be given to safety considerations followed by a commitment to prevent spills from reaching environmentally sensitive areas. Project-specific contingency plans will be developed, as required by federal and state regulations, and will be ready for implementation before construction is initiated. These plans will specify procedures to:

- Ensure worker and public safety

- Rapidly and accurately detect and locate spills

- Minimize spill volume and spread

- Clean up, rehabilitate and restore affected areas

- Notify and cooperate with applicable regulatory agencies

CHAPTER 3 - ELEMENTS OF A CONTINGENCY PLAN

This chapter discusses the major elements of contingency planning and operations documents, as required by EPA, ADEC, and USCG regulations. Once again, the reader is cautioned that not all required elements are included and that the regulations listed in Chapter 1 of this manual should be used in preparation of plans for specific projects. Further, the techniques presented may not be applicable to specific projects or sites or may be superceded by new technology developed since publication of this manual.

3.1 PROJECT DESCRIPTION

Project contingency or operations plans should describe in detail those components involved with the storage, transfer and transport of petroleum products. Information should include:

- Physical and chemical characteristics of the material
- Location at facility
- Design, materials, and engineering features
- Volume
- Containment and drainage systems
- Inspection methods and procedures
- Security and fire fighting systems
- Leak detection and emergency shutdown systems

3.2 SPILL ASSESSMENT

Project contingency or operations plans must include an assessment of most likely discharges and the greatest possible discharge that could occur at the facility. This information is not only required by government regulation, but also is necessary in planning containment methods and structures, estimating response times, and determining cleanup equipment requirements. Factors that contribute to an assessment of potential discharges are:

- Physical and chemical characteristics of the substance
- Spill locations
- Spill volumes
- Amount of area covered by spill
- Rate of release
- Direction of movement
- Description of contaminated area
- Proximity to environmentally sensitive areas, and trails, roads, waterbodies
- Equipment, storage tanks or containers, vehicles involved
- Availability of personnel
- Weather and seasonal conditions

3.3 TRAINING PROGRAM

Training and advance preparation are integral factors in a spill contingency plan to insure that personnel respond rapidly and effectively, utilize material and equipment in an efficient manner, follow the actions specified in the plan, and are able to handle situations not foreseen in the plan. Both classroom and field training sessions must be provided to insure that all involved personnel will be prepared to react to a spill and that they are educated in the hazardous tasks to be performed as well as with the use of any personal safety equipment required for the spill response.

Classroom discussion sessions should include familiarization with all aspects of the contingency plan, the legal and environmental implications of spills, and the importance of successfully executing the plan in the event of a spill. Personnel should be assigned specific tasks and be provided with detailed instruction to insure that they are familiar with their task and associated spill control equipment, and how these tasks relate to the overall plan.

Field training sessions should be held to familiarize personnel with containment equipment and their deployment, use of sorbents, and recovery equipment. Actual field deployment of containment and cleanup equipment at a containment site should be included in these sessions. Full-scale drills to include all response actions involved in an actual spill should be conducted periodically.

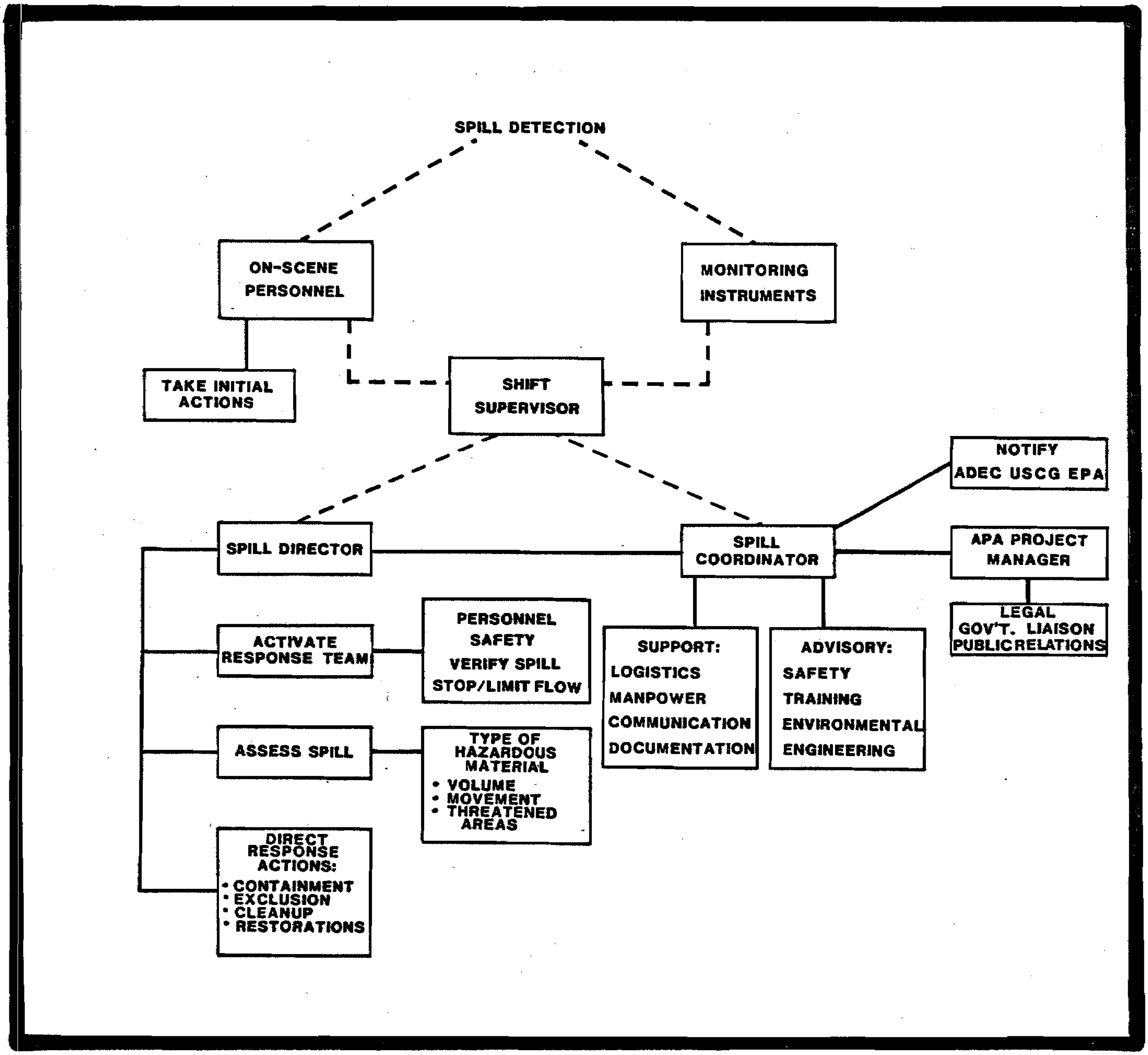
3.4 RESPONSE ORGANIZATION

Sequential actions and responsibilities in the event of a spill should be clearly defined to enable rapid and effective response. A project contingency or operations plan should specify immediate response action responsibilities to:

- Verify and locate leaks
- Alert supervisory personnel
- Provide initial assessment information
- Initiate control actions
- Initiate cleanup actions
- Notify applicable regulatory agencies

Figure 1 depicts a typical contingency response organization and action responsibilities for facilities operated by the Power Authority. As shown, actions to minimize a spill should be taken as soon as a spill is detected. If a spill can be stopped or brought under control without undue hazards to on-scene personnel, they should take prompt action to do so and notify their shift supervisor as soon as possible. If on-scene personnel are unable to completely handle a spill, the shift supervisor should notify both the spill director and the spill coordinator who will be responsible for initiating the subsequent actions indicated on Figure 1. All discharges should be reported to the spill coordinator who would be responsible for notifying applicable government agencies and the Power Authority.

Because spills are not routine occurrences, personnel assigned key roles in a response organization will normally have other full-time responsibilities. It is therefore important that job descriptions be developed for each position in the event of a spill. These job descriptions should specify the planning functions, emergency functions, and the primary and alternate operating positions assigned to each key role.



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CONTINGENCY RESPONSE ORGANIZATION AND RESPONSIBILITIES

FIGURE 1

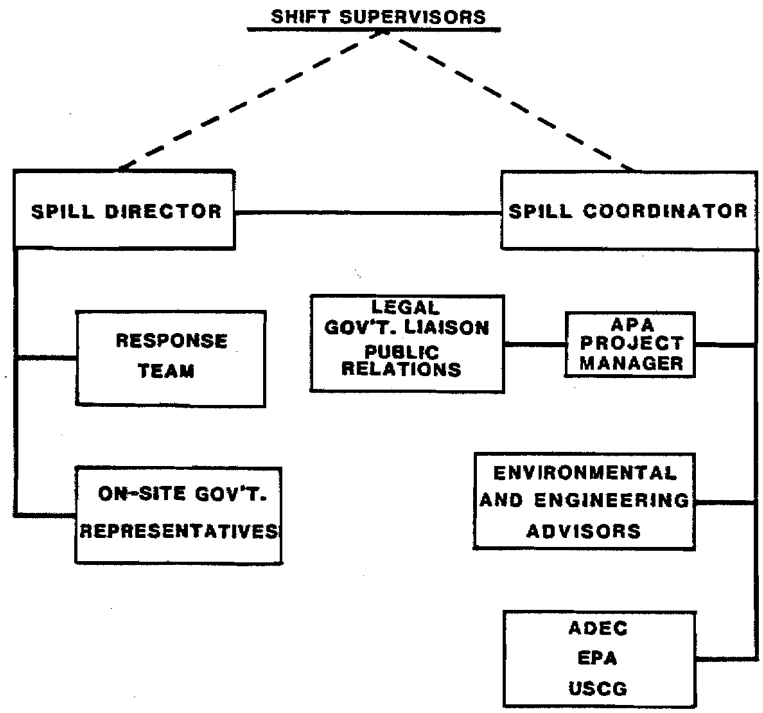
3.5 EMERGENCY NOTIFICATION AND COORDINATION

Emergency notification and coordination procedures stipulate who will be notified in the event of a spill, the sequence of notification, and communication methods. Using the spill response organization shown in Figure 1, and recognizing that primary and alternate personnel will be designated for key response positions, Figure 2 depicts a typical notification and coordination system.

It may also be appropriate to coordinate with other state and federal agencies in addition to EPA, ADEC, and USCG. For instance, the Alaska Department of Fish and Game may be able to provide advice regarding cleanup procedures in particularly environmentally sensitive areas. The Alaska Department of Transportation and Public Facilities may be able to support cleanup operations with equipment, traffic control, and snow removal.

Communication methods to be discussed in a contingency or operations plan include any telephone networks, voice dispatch circuits, VHF mobile radio systems, UHF radio systems, or marine radios.

Provisions should also be included in the contingency or operations plan to produce, update, and distribute notification lists that include names of personnel assigned to key roles, on and off-duty telephone numbers, and radio frequencies.



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SPILL NOTIFICATION AND COORDINATION SYSTEM

FIGURE 2

3.6 REPORTING PROCEDURES

Reporting procedures should be established in the contingency or operations plan to ensure documentation of discharges as required by EPA, ADEC, or USCG regulations. Documentation will also provide a means of measuring the success of the containment, exclusion and cleanup operations and thus suggest modifications or improvements to the plan. The following example of reporting procedures is based on the response organization depicted in Figure 1.

Documentation would commence when spills are reported to the shift supervisor. The shift supervisor would complete a written report to include the name and address of the person reporting the spill, approximate location of the spill, approximate quantity of spill, and type of substance. This report would be submitted to the spill coordinator who would be responsible for compiling all documentation of the incident from spill occurrence through cleanup actions to final post-spill assessment. Among the types of information required to provide documentation are:

- Cause of spill (equipment failure, persons causing spill, violation of safety or operational practices, vandalism)
- Spill characteristics (spill volume and direction of movement, type of substance, rate of release, proximity to waterbodies, effectiveness of containment)
- Photographs (identified per location, date, time, subject, direction)
- Weather conditions

- Equipment performance records
- Cost incurred
- Record of contacts with regulatory agencies
- Reports to government agencies

Information gathered for the documentation effort would be used to prepare the following formal reports required by the regulatory agencies:

<u>Oil discharges on land of less than 10 gallons.</u>

Spill coordinator will submit a completed report to ADEC within 7 days after the reported spill. Copy to Power Authority project manager.

<u>Oil discharges on land of 10 gallons or greater, any oil discharges on water, and all other hazardous substances discharges of any quantity on land or water.</u>

Spill coordinator will immediately notify ADEC, EPA and/or USCG by telephone (or other designated emergency contact system) followed by written notification as soon as possible. Spill coordinator will make a formal report to ADEC and EPA, and to the USCG (tidewater spills only) within 15 days of the discharge or completion of cleanup, after review by Power Authority legal advisors. Copy to Power Authority project manager.

The following information is required in reports to government agencies:

- Date and time spill occurred or was observed
- Location of spill
- Person responsible for discharge
- Estimate of amount spilled and type of substance
- Cause of discharge
- Environmental damage
- Cleanup actions undertaken
- Location and method of ultimate disposal of the substance and contaminated cleanup material, including date of disposal
- Action being taken to prevent recurrence of the discharge

3.7 SAFETY GUIDELINES

Human safety should always have first priority in a spill situation. This safety interest extends to public exposure as well as to the safety of project personnel. The following guidelines should be considered in formulating safety practices and procedures for spill activities.

- Prior to starting the job, personnel should be informed on-site of the potential hazards and trained in the use of spill cleanup equipment, safety measures, and fire suppression practices.

- Procedures should be developed for safety review and enforcement of practices.

- Potentially hazardous areas and conditions should be defined and restrictions placed upon personnel and operations to be allowed.

- Personnel should be specifically designated to provide safety and security actions with instructions to restrict unrequired people from access.

- Equipment to be employed will be checked to prohibit ignition of the residue product.

- No smoking areas should be designated.

- In addition to human safety, potential hazards and wildlife concerns should be noted and preventative safety measures initiated.

- Repair operations, particularly the use of cutting torches and welding equipment must be recognized as having an ignition potential.

- Equipment should be cleaned prior to storage.

- Measurements should be made to test for explosive conditions and hydrocarbon vapor concentrations whenever possible.

- Nighttime operations must be approached with extra care. The use of field lighting introduces a possible ignition hazard.

- Clean-up operations on rivers, in rugged terrain, and during adverse winter weather conditions requires special safety instructions and equipment such as life preservers and special clothing.

3.8 CONTROL ACTIONS

Efforts to minimize a spill and control its spread can be the most significant reactions in implementing a response plan. Design features such as containment dikes constructed around fuel storage tanks, automatic controls, monitoring procedures, and on-scene source control will limit losses and environmental contamination once a leak occurs. These are discussed in a companion BMP manual on fuels and hazardous materials. It is also crucial to anticipate and provide for emergency containment alternatives for spills occurring outside of designed storage areas.

3.8.1 Emergency Containment Sites

Criteria for selecting emergency containment sites include access and sensitive areas, waterbody characteristics, topography, man-made structures, potential spill volume, and response time, weather conditions, and spilled product characteristics.

Access and sensitive areas are probably the most critical factors in selecting a containment site. Wherever possible, access to containment sites should be via existing roads and pads. If off-road operation is required, adverse impacts can be lessened by using old survey trails, fire breaks and seismic trails. Particularly sensitive areas are those where removal of organic layers, ground covers, and shrubs expose the soil. Areas that should be avoided during summer activities are wetlands, slopes in excess of 10 percent, and riparian and alpine tundra communities. During winter, areas to avoid are slopes in excess of 10 percent and alpine tundra communities.

Site selection within waterbodies must consider seasonal characteristics as well as access, working space requirements, and environmental constraints. Potential containment sites during seasonal periods are shown on Table 1.

Natural terrain features, such as depressions or old moraine ridges, may be suitable for containment sites. Man-made barriers, such as work pads, roads, culverts, bridges, spur dikes, and low water crossings could provide excellent sites. Additional possibilities include old survey and seismic trails, fire breaks, material sites, and other cleared areas.

The potential volume of a spill is an obvious factor in selecting containment sites large enough to cope with containment, cleanup and disposal activities. Response times to reach a containment site, especially given any weather or transportation delays should also be considered.

3.8.2 Containment Methods and Implementation Guidelines

The following discussion describes various methods to limit the spread of a spill and guidelines for selecting appropriate techniques at potential spill locations.

TABLE 1

POTENTIAL CONTAINMENT SITES IN WATERBODIES

Season	Potential Site
Summer	
Low Flow Period	Man-made structures[1], natural pools, backwater areas, gravel and sand bars.
High Flow Period	Man-made structures, side channels, backwater areas, vegetated banks
Freezeup	
Before Ice Cover	Man-made structures, natural pools, ice jams, gravel and sand bars
After Ice Cover	Man-made structures, side channels, backwater areas
Winter	
Flow Beneath Ice	Man-made structures, side channels, backwater areas, upstream end of aufeis areas
Flow at Open Leads	Upstream entry
Intragravel Flow	Trenches in streambed, man-made structures, upstream end of aufeis areas
Breakup	
Before Ice Movement	Man-made structures, backwater areas, side channels
During/After Ice Movement	Man-made structures, backwater areas, side channels, vegetated backs

[1] Man-made structures include bridges, culverts, spur dikes, low water crossings.

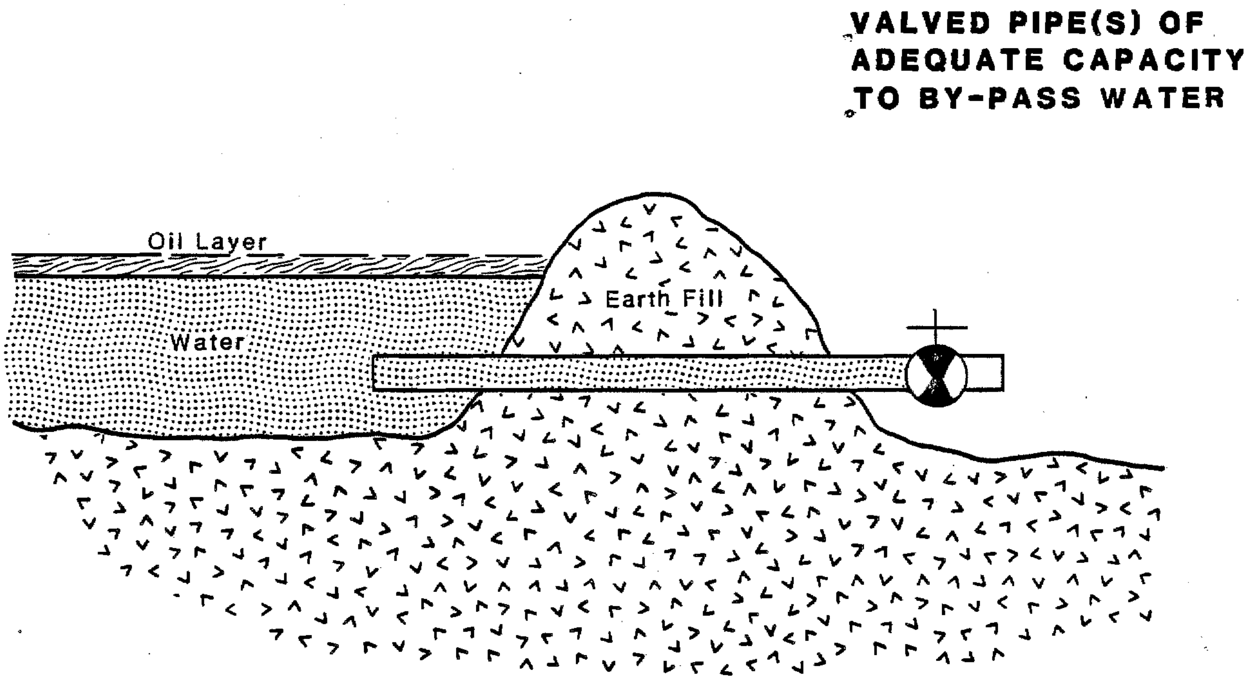
3.8.2.1 Techniques

DAMS - There are two types of dam construction appropriate for containing spills of petroleum products: complete blocking of an actual or potential drainage course (a blocking dam), and blocking of oil flow while letting water continue downslope (an underflow dam) or downstream (an underflow weir).

Blocking Dams - Blocking dams should be constructed only across drainage courses which have little or no water flow. The dam should be situated at an accessible point where there are high banks on the upstream side. It must be well keyed into the banks and buttressed to support the oil and water pressure. It can be constructed from several types of materials - earth, snow, sandbags, sheets of metal or wood, or any material that blocks flow.

The dam can be built across the drainage course to form a holding pond or reservoir to contain the oil and water. Water trapped behind the dam can be pumped out by placing the suction (intake) hose at the base of the dam on the upstream side, leaving oil trapped behind the dam for subsequent removal. The discharge (outlet) hose should be placed on the downstream side. Trapped water can also be moved across the dam with one or more siphons.

Underflow Dams and Weirs - For waterways with higher stream flow rates, an underflow dam or weir can be used (Figures 3, 4, and 5). If these techniques are to be effective, the surface of the oil must



Water flow of stream or surface water drainage is by-passed to maintain reservoir level. Oil is skimmed off or absorbed as conditions dictate.

Crest of dam should be of sufficient width to accommodate compaction vehicle. Height of fill is 2 to 3 feet above fluid level. Normal fall angle of fill will suffice for sloping.

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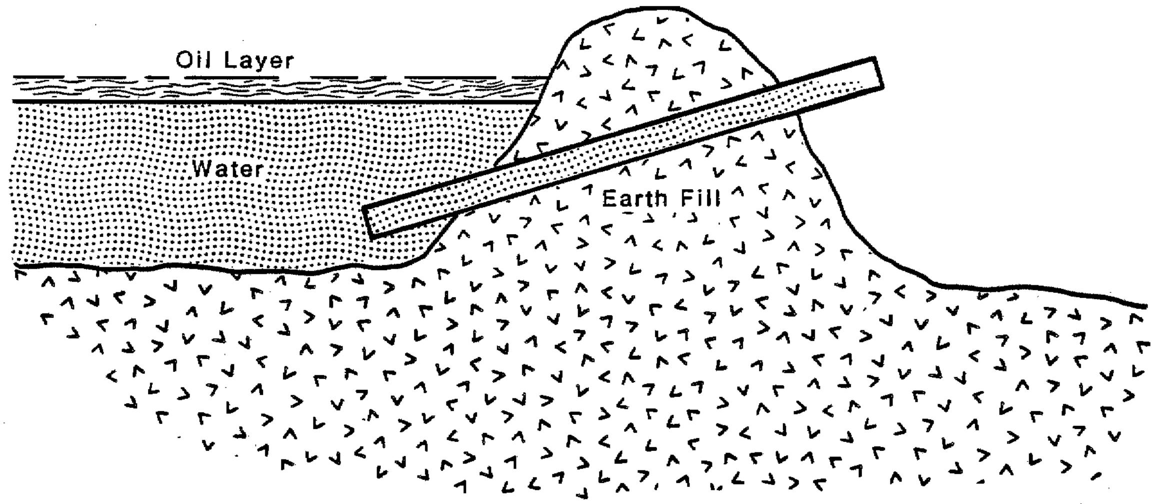
WATER BY-PASS DAM
(VALVED PIPE)

FIGURE 3



Water flow of stream is by-passed to maintain reservoir level. Elevate discharge end of tube(s) to desired reservoir level.

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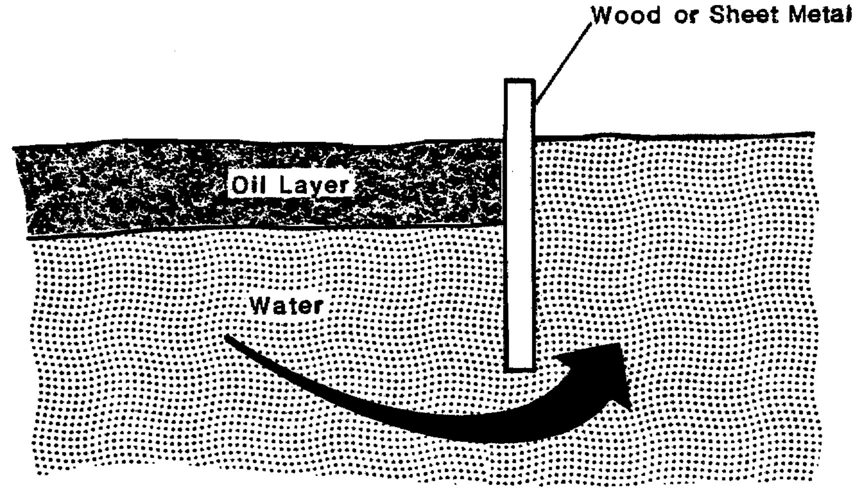
WATER BY-PASS DAM (INCLINED TUBE)

FIGURE 4



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UNDERFLOW WEIR

FIGURE 5

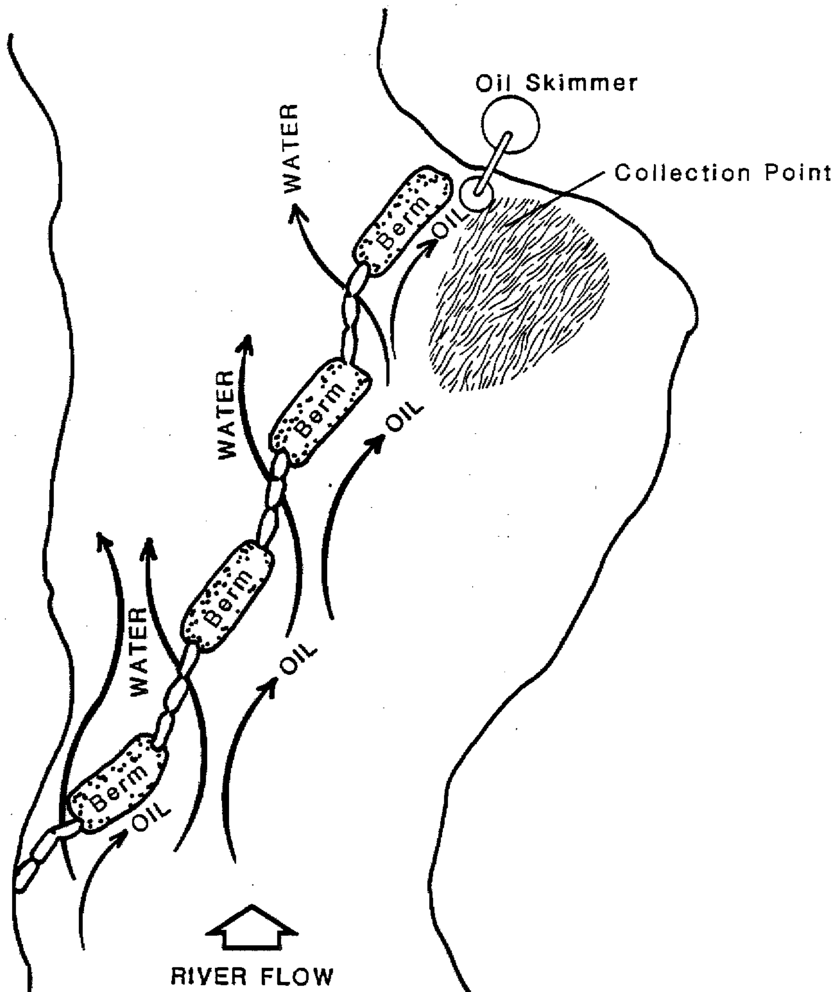
always be below the lip of the dam or weir, and the oil/water interface must be above the top of the underflow opening.

The underflow dam can be constructed by placing pipes of appropriate size on the streambed and building an earthen or sandbag dam over the pipe across the waterway. The diameter of the pipe will depend on the flow rate of the stream and the depth of the water behind the dam. For example, 24- to 30-inch diameter pipe will have sufficient capacity for a flow rate of up to 30 cubic feet per second. If time does not allow for pipe diameter calculations, a diameter larger than required will control flow if it is inclined at the proper angle or if a valve is used. A pair or series of dams may be required downstream if sufficient underflow cannot be maintained.

An underflow weir can be simple yet effective technique in small streams. A piece of wood or sheet metal placed across the stream and firmly anchored to the banks will stop the oil flow while allowing water to continue downstream.

<u>BERMS</u> - Berms are constructed to control flow by diversion or overflow. For creeks and rivers, overflow berms (weirs) or diversion berms can be constructed from materials in the floodplains; for terrestrial spills, earth berms can be built to divert or impede flow. In fast-moving streams, berms may have to be continually maintained.

<u>Diversion Berms</u> - Diversion berms would be constructed from floodplain materials on large rivers (Figure 6). In most situations, they should



This represents a series of diversion berms joined by booms. They are positioned so that a spill can be diverted to a location with adequate storage and accessability to removal equipment. If stream and spill conditions permit, one berm may be all that is required.

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DIVERSION BERMS

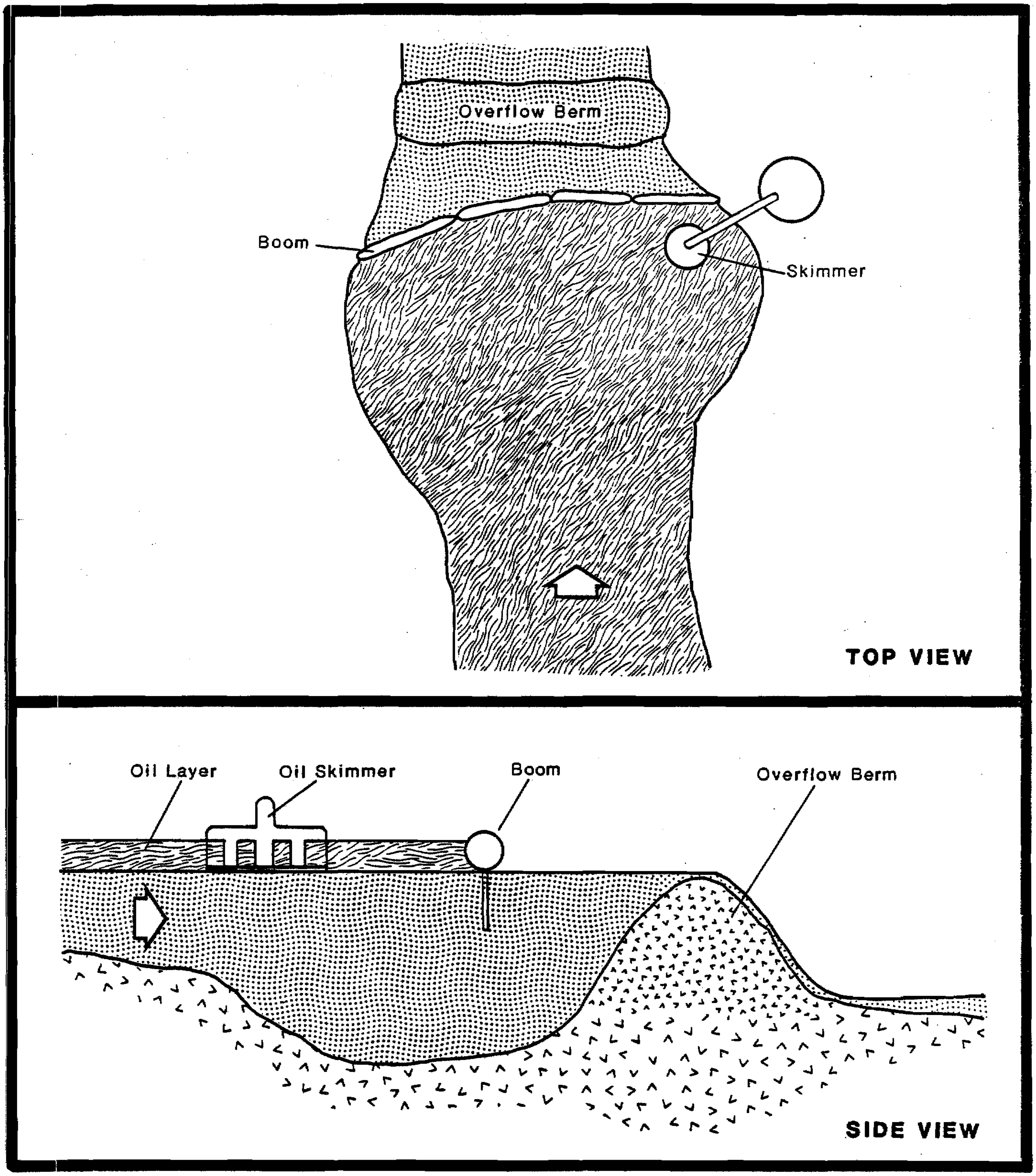
FIGURE 6

be constructed in a series, connected with short pieces of boom in a pattern that forces oil to flow into a containment pit, side channel, or similar feature for temporary storage. The spacing between each berm should allow water to flow under the connecting booms while forcing oil to the side. The size and angle of the berms will be dictated by stream velocity, channel size, and oil spill volume. As these factors increase, the required size of the berms will increase, and the angle between the upstream side of the berms and the stream bank will decrease.

Overflow Berms (weirs) - The purpose of overflow berms or weirs is to reduce water velocity by widening and deepening the stream. They can be constructed in smaller streams or in the side channels of larger rivers (Figure 7). Overflow berms must be constructed across the entire channel. Materials should be excavated from the upstream side of the berm, creating a pool where stream flow will be retarded, permitting boom deployment and oil removal upstream from the berm. The required height and width of the berm will increase with stream depth and water velocity.

Berms Built on Land - Land berms act as barriers to spill flow and may also be used to divert the flow to protect a sensitive area. Windrows along a road can prevent a spill from crossing the road or divert it into a storage area (Figure 8).

CULVERT BLOCKING - The most effective way to block culverts is to pile



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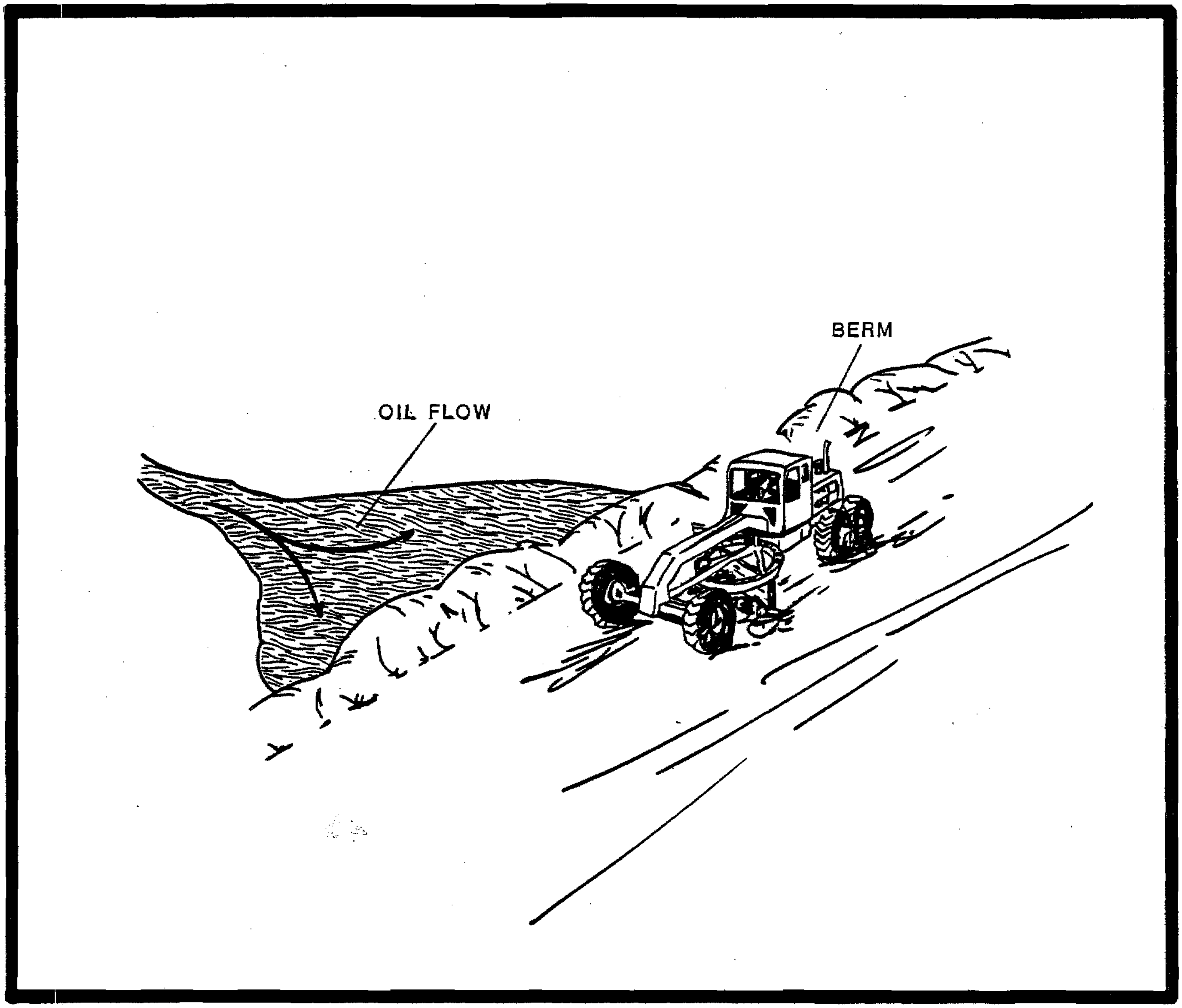
OVERFLOW BERM

FIGURE 7



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ON-LAND BERM

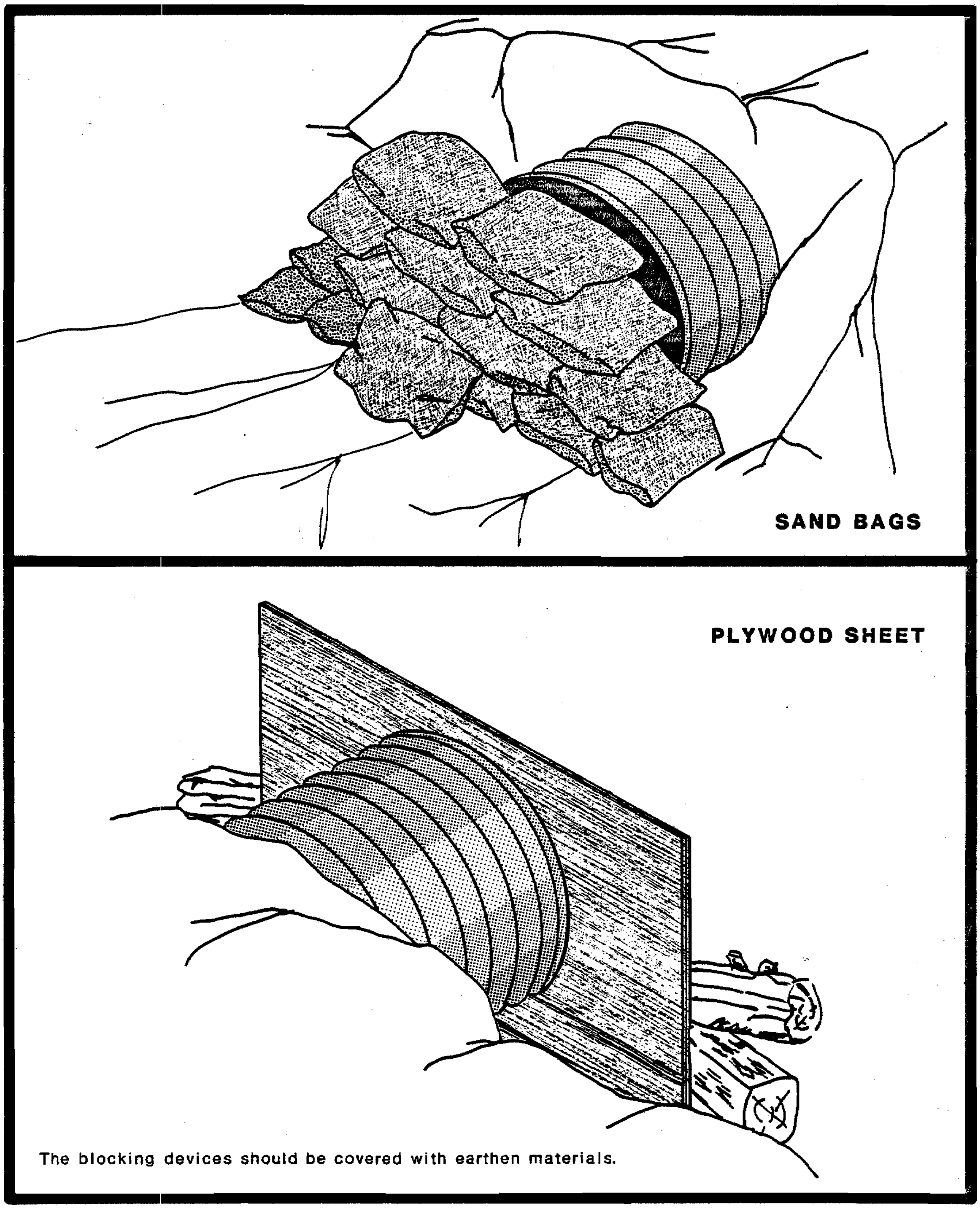
FIGURE 8

dirt, sand, or other earthen materials over the end of the culvert (Figure 9). A pump or siphon may be required to remove impounded water from the blocked culvert. Small volumes of water can be passed through a pipe covered with sandbags or dirt. Large culverts such as those that transport entire streams can be blocked with an underflow device (Figure 10). It may also be possible to install an inverted elbow on a culvert intake which will pass water below the oil layer.

INTERCEPTION BARRIERS - Interception barriers, such as trenches and sheet barriers (Figure 11), are used to intercept subsurface flow of spilled oil through a permeable layer that may or may not be transporting groundwater or between the vegetative mat and the ground surface. The actual direction of subsurface flow must be determined before a barrier is installed as the subsurface geology may permit oil to flow in directions that do not coincide with surface gradients.

TRENCHES - While a trench can be an effective technique for containing the flow of oil through a subsurface layer, excavating a trench in permanently frozen soils may cause more damage than the migration of the oil. The trench should be excavated at right angles to subsurface flow, extend about 18 inches below the oil level, and be wide enough to accommodate the anticipated method of removing the oily water. The downstream side and bottom of the trench should be covered with visqueen or a similar impermeable material.

SHEET BARRIERS - Sheet barriers constructed of metal or plywood driven into the ground can be used where the flow is near the surface. The overlapped



The blocking devices should be covered with earthen materials.

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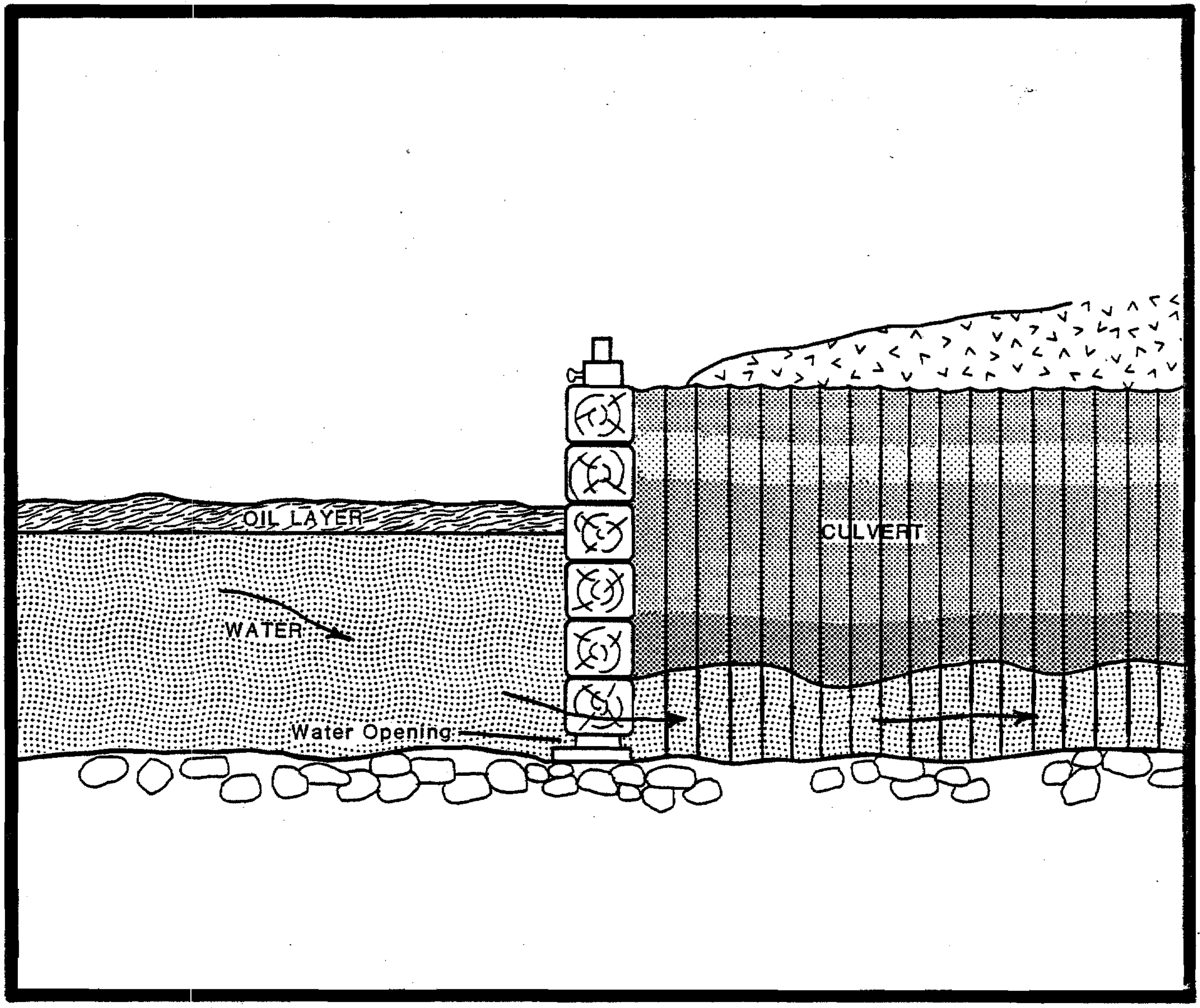
CULVERT BLOCKING

FIGURE 9



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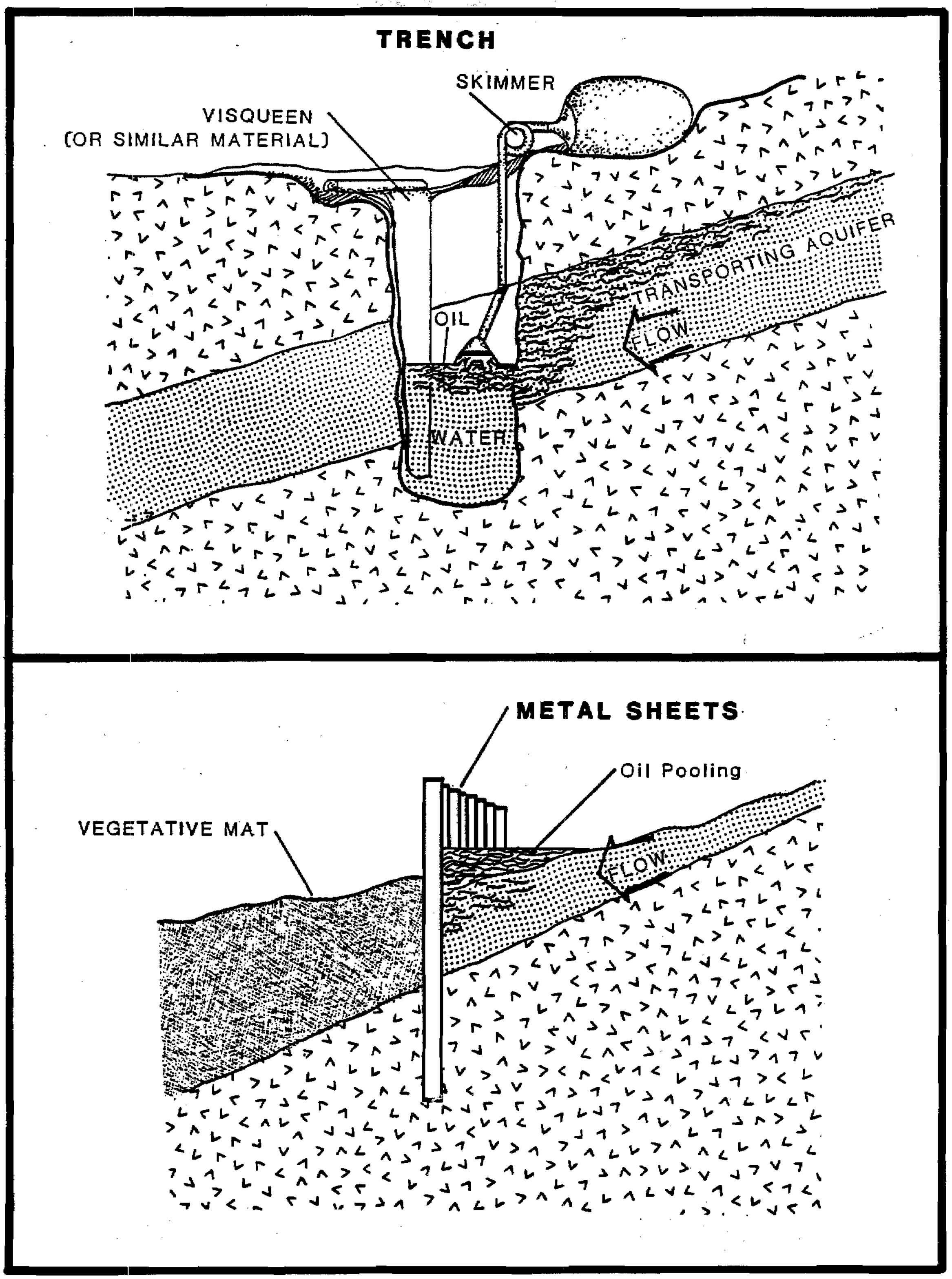
CULVERT UNDERFLOW DEVICE

FIGURE 10



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INTERCEPTION BARRIERS

FIGURE 11

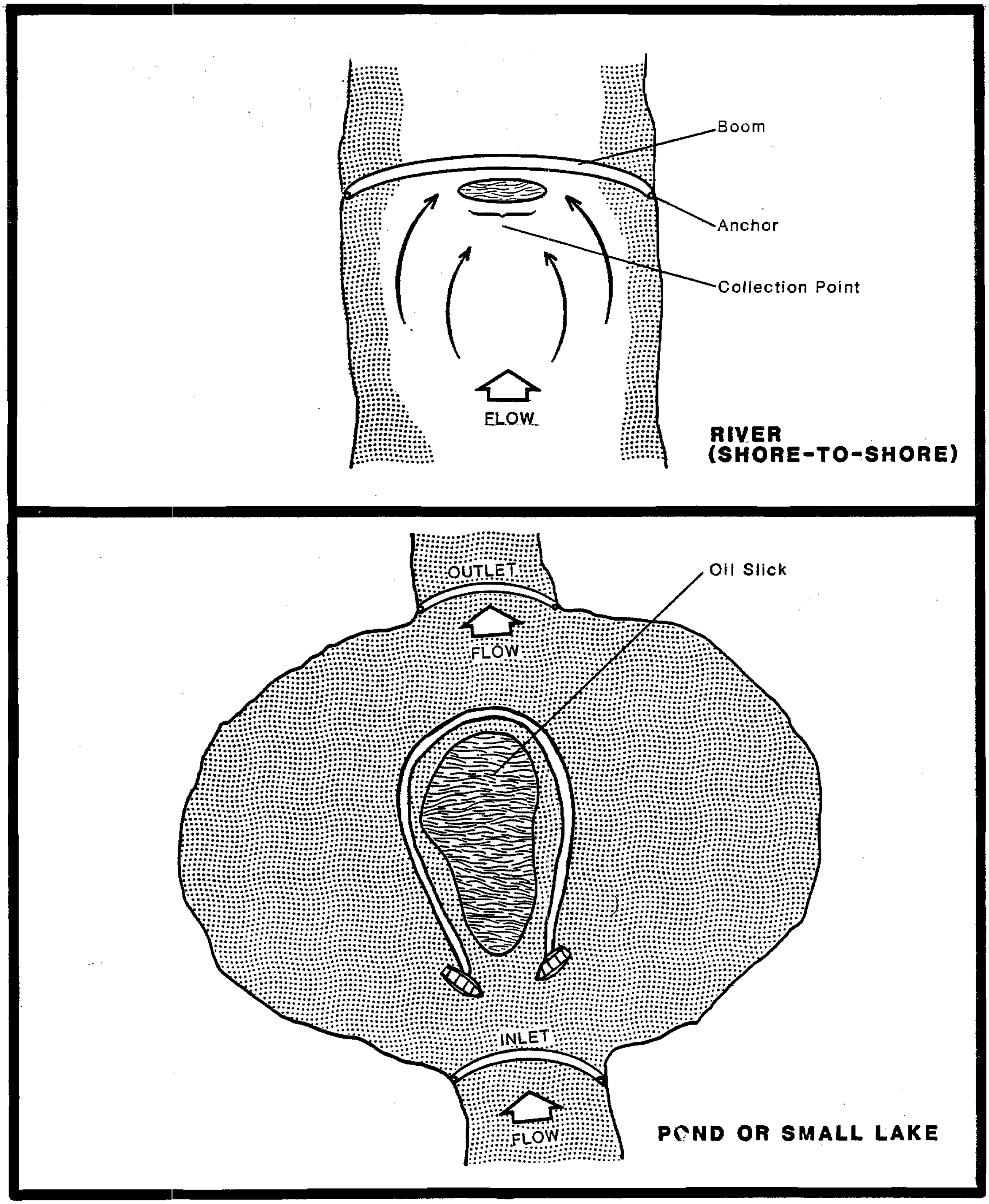
sheets should extend down to about 18 inches below the oil level, and up from the ground surface to create a ponding area for the oil. Sheet barriers should be installed at right angles to the subsurface flow and may bend upslope at the ends.

BOOMS - Booms are used to contain oil spills on water by either blocking the flow or diverting it to a collection point. Many different types of booms are commercially available or can be fabricated on site. All booms have a means of flotation, a barrier extending below (a skirt) and above the water surface, and a means of achieving longitudinal strength.

Containment Booms - Booms to contain the flow of oil are generally deployed from bank to bank or from shore to shore (Figure 12).

Booms deployed across the inlet stream to a lake may prevent oil from reaching the lake itself. Booming the outlet of a lake will create a large storage area where the decrease in current velocity will facilitate easier cleanup. Once it has reached a lake, two boats towing a long boom can encircle the slick and prevent it from spreading.

Booms deployed across a river or stream will usually contain the flow of oil if current velocity is less than about 1 knot (1.7 feet per second). Wind will affect surface water velocity by a factor of approximately 3 percent of the wind speed. This should be taken into consideration when wind is blowing downstream, upstream, or across a lake. If this technique is used, the oil will have to be removed rapidly from the upstream side of the boom. Containment booming is



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CONTAINMENT BOOMS

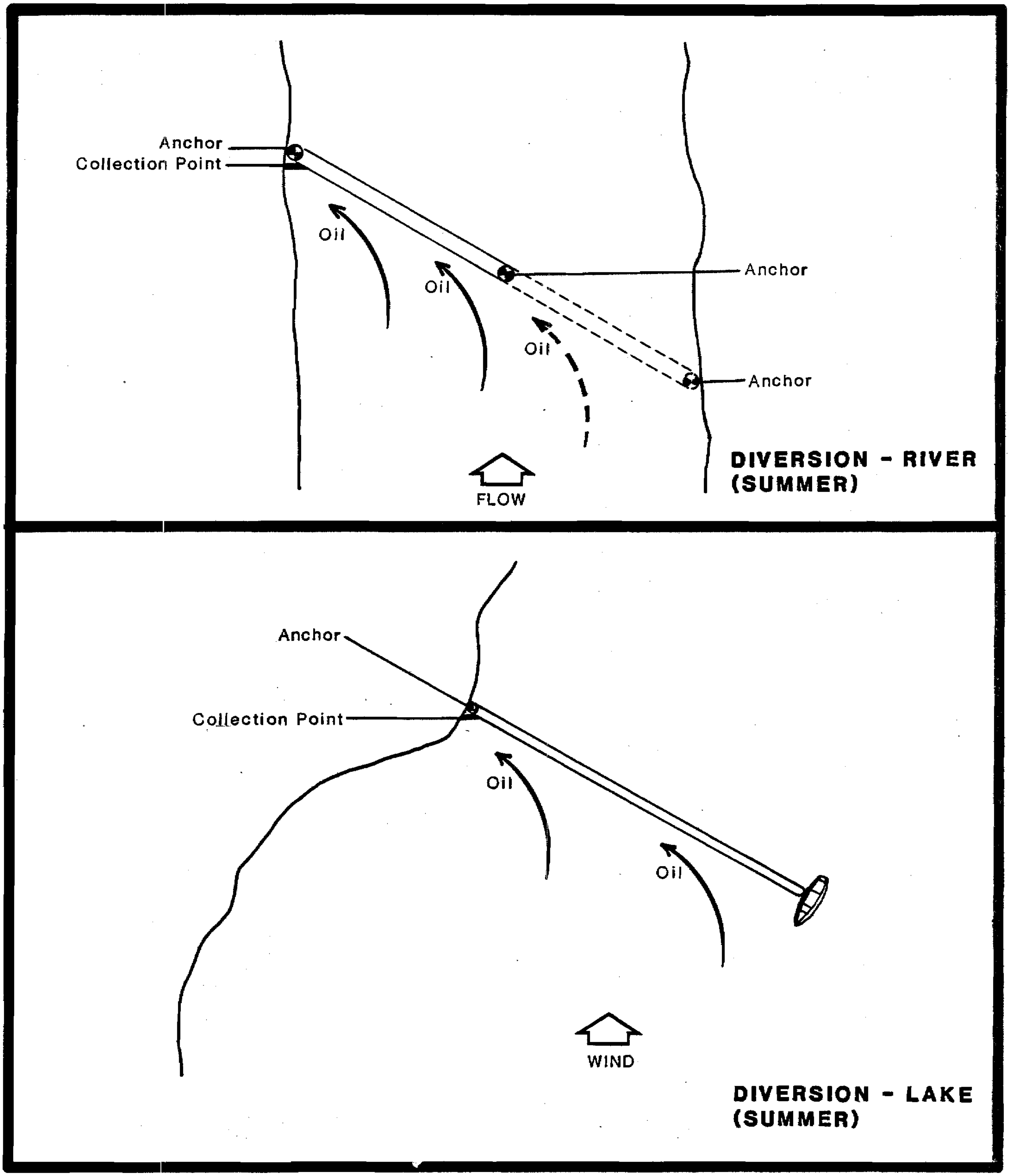
FIGURE 12

not likely to be useful on large rivers or whenever current velocities are over 1 knot; diversion booming will be necessary.

Where oil is flowing into a lake or stream over the bank or leaking from the ground into a water body, booms placed parallel to the bank can create a quiet surface area from which the oil may be skimmed. Booms can also be placed parallel to shorelines and banks to exclude oil from sensitive areas.

Diversion Booms - Diversion booms (Figure 13) are deployed to direct oil towards a containment pit/collection area, or to divert oil away from environmentally sensitive areas. Depending on river characteristics and size, diversion booms can be deployed as single or connected sections of booms, multiple booms staggered across main or side channels, or in conjunction with berms or river bars. When using diversion booms to divert oil towards a containment pit/collection area, the downstream end at the collection area is anchored by natural features, steel pipes, or tracked vehicles. The upstream end is fixed to a berm, boat, or tracked vehicle. Diversion booms deployed to protect environmentally sensitive areas will usually be fixed between boats, natural features, or berms.

COLLECTION AREAS AND DIVERSION PITS - Oil spills reaching moving bodies of water can be contained by diverting the spill with berms and booms to a collection area or containment pit adjacent to the affected water system. In incised river systems, oil may have to be diverted to high water channels, oxbow lakes, or areas of relatively quiet water. In braided



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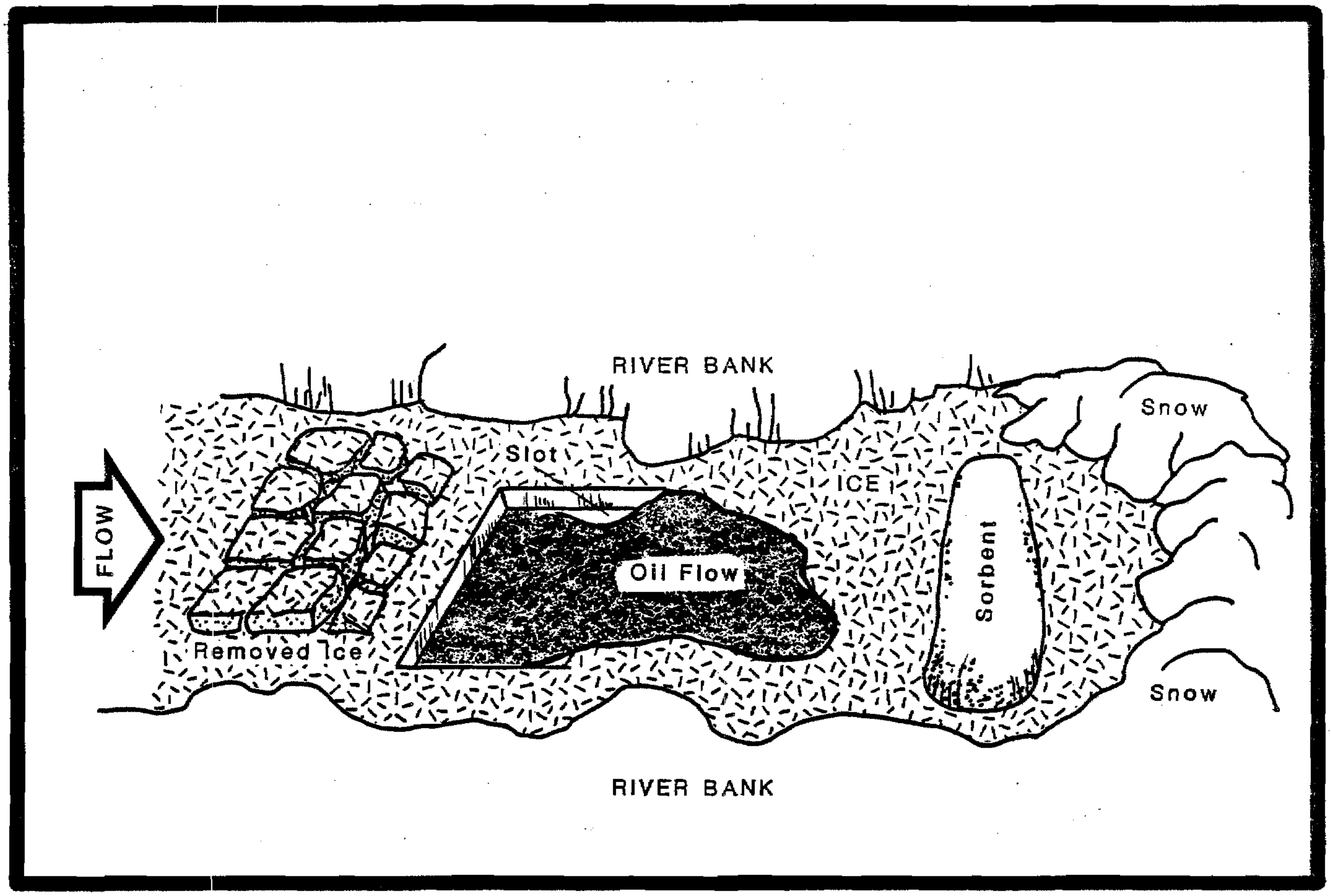
DIVERSION BOOMING

FIGURE 13

river systems, existing or abandoned material sites should be used wherever feasible. If conditions allow, containment pits should be excavated in the floodplain at approximately the same angle as the berms and booms have been constructed and deployed in the river channel. Containment pits excavated in floodplain materials will have to be made impermeable either by excavating the pit below the groundwater table or by covering the walls of the pit with plastic sheeting, clays, or similar materials. If the water level of the pit becomes too high, excess water can be discharged via underflow siphons or pumps. Also, if the water level cannot be maintained, additional water can be added to the pit with pumps or by adjusting the booms diverting oil into the pit, or the pit can be deepened moving the bottom closer to the water table.

CONTAINING OIL UNDER ICE - Two methods, a slot and a frozen barrier, can be used to divert oil from water flowing under ice to a location where it can be contained and cleaned up.

The Slot - This method requires a high velocity current and involves cutting a slot in river ice that will allow oil to flow "out and over" the surface of the ice (Figure 14). The slot should be rectangular and span the width of the highest current velocity. The longitudinal walls of the slot should be cut at right angles to the current and slope towards the center with the downstream wall dipping at least 45 degrees upstream. It is essential that any void between the surface of the stream and the bottom of the ice be minimal or that actual flowing water-ice contact is made. If possible, the slot should be cut above a natural highpoint in the streambed so that water flowing



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THE SLOT

FIGURE 14

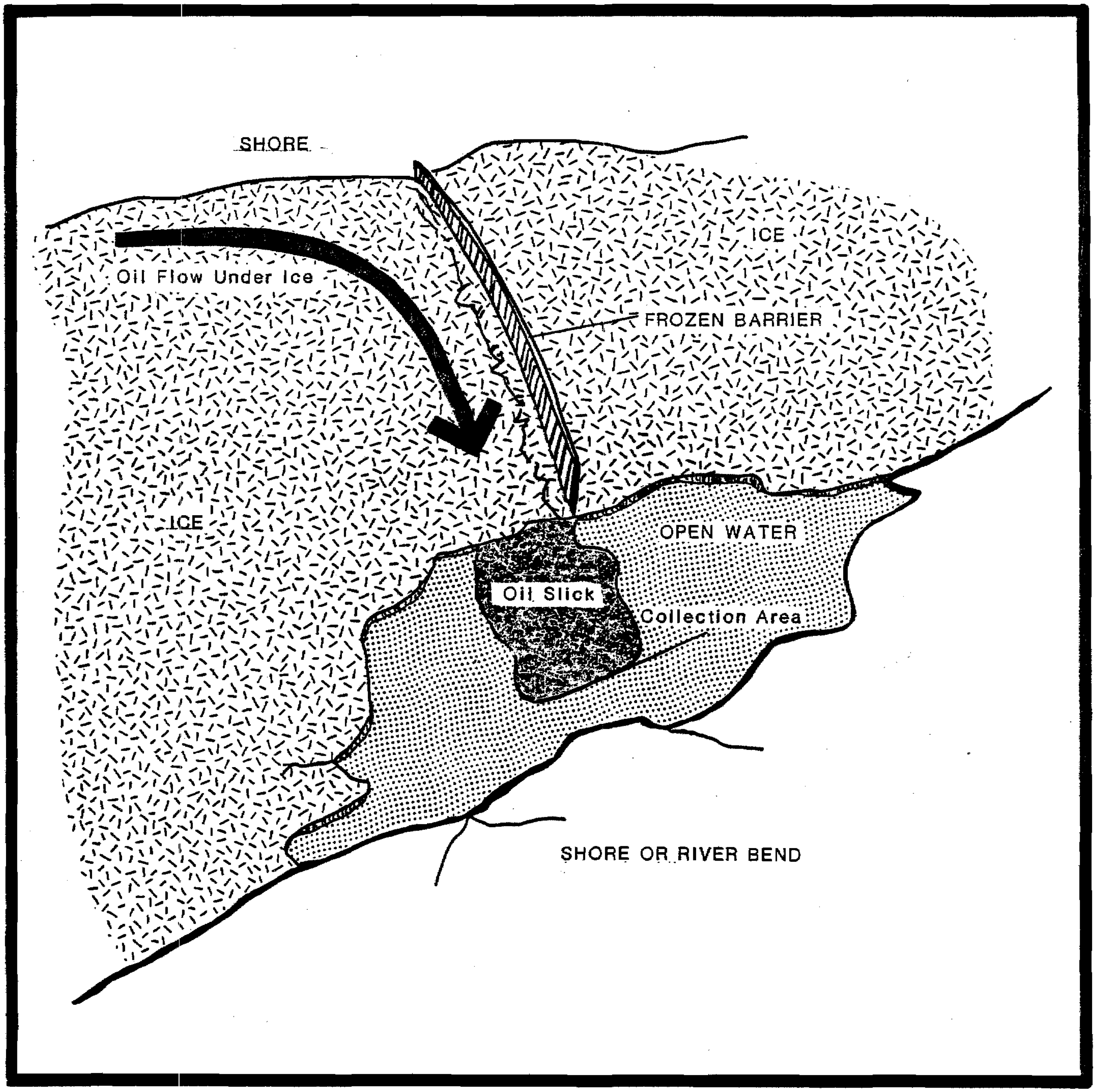
over the highpoint will force the floating oil "out and over" the ice. Alternatively, an artificial highpoint can be constructed by dropping heavy sandbags through the slot along the downstream wall so they come in contact with the flowing water.

Frozen Barrier - A conventional boom, plywood or steel sheeting, or wooden planks can be frozen in place on a lake or a river to divert oil to a collection point (Figure 15). A slot wide enough to accommodate the barrier is cut in the ice. The barrier is then placed in the slot so that it protrudes into the water for about 6 inches, and is allowed to freeze in place. Ice is removed along the shoreline to create an area to store and remove the diverted oil.

SORBENTS - A sorbent is any material which absorbs oil or to which oil adheres. While sorbents can be used as a protective barrier during containment activities to keep oil from uncontaminated areas, they should never be used on water unless there is a definite way to recover them. On small streams, fences constructed with stakes, wire mesh and sorbent material can be used effectively (Figure 16). The mesh will hold the sorbent material while allowing passage of water. The sorbents must be removed and replaced as they become saturated with oil.

3.8.2.2 Implementation Guidelines

Pads and Roads - Elevated pads and roads can serve as containment barriers for spills occurring upslope if drainage structures passing beneath them are blocked. Dams should be constructed across the ditches on the upslope



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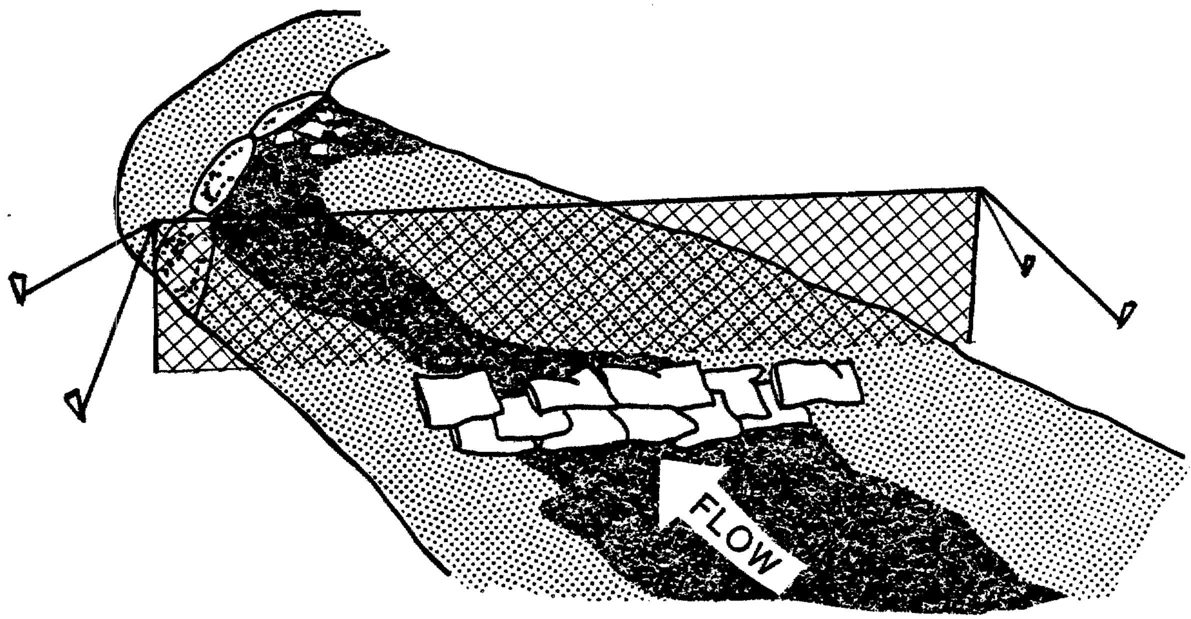
FROZEN BARRIER ON RIVER OR LAKE ICE

FIGURE 15



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SORBENT FENCE

FIGURE 16

side of the elevated pads or roads to provide containment. Spills occurring on pads or roads can be confined with berms or dams. Construction of a dam across a pad or road is especially important where it slopes toward a river, creek or low-water crossing.

Tundra and Forest - Natural features such as tussocks, deadfalls, vegetation, and snow will retard or stop surface flow of oil and retain it. Visqueen and/or sorbent materials should be placed on the uphill side of naturally occurring barriers except snow.

Interception trenches can be excavated in non-permafrost areas to divert or contain oil. Barriers can be placed in the vegetative mat to limit subsurface oil migration.

Small drainage courses and rivulets of meltwater can be blocked, using sandbags, earth, snow, sheets of plywood or metal, sorbents, or materials found on-site such as brush and logs. Drainage with flowing water will have to be dammed, either conventionally or with an underflow device. Oil flowing down a dry drainage course can be partially contained by placing a sorbent boom directly in the drainage course and/or by damming.

Small Creeks, Ponds, and Bogs - Containment of spills on small creeks generally requires an underflow dam, an overflow berm, or a dam in conjunction with a pump or siphon. These barriers should be located so that a pond will form upstream from the barrier. Containment can also be achieved in pools behind log debris or jams. On fast-flowing creeks, a series of containment barriers such as chicken wire (with sorbents) structures should be used. During periods of high flow, it may be necessary to install steel nets, chicken wire, or similar devices upstream of containment devices and areas in order to protect both equipment and personnel from floating debris.

Outlets of ponds should be boomed to collect the oil on the surface of the pond; additional booms should be deployed around the slick and around sensitive areas. Sorbent booms and conventional booms can be deployed in tandem across the pond outlet. The sorbent booms should be farther downstream where they will collect portions of the spill that may have passed beneath or around the conventional boom.

Containment in bogs will most likely be limited to interception with barriers and sorbent materials.

<u>Large Rivers and Floodplains</u> - Oil approaching the floodplain should be contained within the drainage course by constructing berms between the spill and the main river channel. Diversion berms can be built to direct the spill to a side channel, abandoned meander or channel, oxbow or oxbow lake or excavated diversion pit. Log jams on sand or gravel bars and side channels create pools where oil can be contained; berms should be constructed downstream from the debris to act as a backup containment barrier.

In some cases, aufeis can assist in blocking subsurface oil flow along river channels and force it to the surface where sorbents, sorbent booms, and manual methods could be used to contain the oil. If oil becomes trapped between layers of aufeis, especially when aufeis is formed by an aquifer discharging into a river from the bank, discoloration should be detectable and sorbents and barriers could be employed.

Intragravel flow may exist beneath the ice, even if flowing water is not detected, and could provide a route for oil. The streambed would have to be trenched deep enough to intercept the intragravel flow of oil, so it can then be ponded.

Spills on the main river channel will be difficult to contain, and can be treated several ways. During periods of high stream flow and velocity, a series of diversion berms and booms should be used to divert the spill to a containment pit or floodplain feature. Digging a pit across the main river channel will create eddies and pools of quieter water. This is practical only on smaller rivers where equipment can be used. This technique is more effective when used with an overflow dam directly downstream. The pit should be located where rapid removal of the oil is possible. While the usefulness of booms on fast-flowing large rivers is limited, they can be deployed in containment pits, upstream from natural or created pools, and near sandbars. Oil should be removed from behind the boom as rapidly as possible to prevent loss of oil and to keep the strain on the boom to a minimum. A spill entering the river can be partially controlled by deploying booms parallel to the riverbank downstream from the point of entry. Under some circumstances, side channels can be converted to containment ponds if the following procedures are used: 1) berm or dike the downstream end of the side channel; 2) blast or construct a suitable channel for a diversion skimmer in conjunction with an overflow berm so that the flowing oil is diverted into the mouth of the side channel, but the majority of water is allowed to flow down the main channel. Under most circumstances, containment barriers will have to be continually maintained. Their resistance to erosive forces can be increased if the upstream portion of earth barriers is covered with rip-rap.

Spill travel beneath ice can be diverted by inserting sheets of plywood or metal into slots cut in the ice and allowing them to freeze in place. When ice is to thin to support heavy equipment and there are leads of open water, summer containment and diversion techniques with ice diversion barriers can be used. Breakup poses the greatest hazard for personnel and least chance for containment. On some small rivers or channels of larger rivers, it might be possible to install steel nets upstream of a boom to protect it and personnel from debris and ice. While temporary ponding of water will exist behind log, debris, and ice jams, these jams may release at unpredictable times.

Large Lakes - Booms are the most useful means of containment on large lakes. The most effective technique is to encircle the spill with booms. If oil is flowing into the lake, a boom should be secured to the shore on one side of the point of entry and deployed around the periphery of the slick by boat until the spill is encircled. As in containing oil on small lakes, sorbent booms and conventional booms deployed in tandem may be effective. Both should be deployed across the lake outlet with the sorbent boom downstream. Sorbent pads can be distributed between the two booms. This technique will pick up some of the oil that passes the conventional boom.

3.9 CLEANUP ACTIONS

This section discusses the basic techniques to clean up a spill and guidelines for implementing appropriate techniques at potential spill locations.

In most instances, cleanup and removal of petroleum products should be initiated immediately following implementation of containment measures as changing weather conditions or containment equipment failures may expand a controlled spill unless the free substance can be removed. In some cases, however, the cleanup of spill residue may cause more environmental damage than either natural dissipation or some form of treatment in place. The spill director will determine the most appropriate cleanup alternative in these instances.

3.9.1 Techniques

The basic techniques used singly or in combination to clean up a spill include the use of heavy equipment, pressurized equipment, manual methods, skimmers, pumps, burning, sorbents, and pumping and flotation. To supplement these techniques, which are discussed below, provisions should be made for storing the recovered substance and contaminated materials before transporting them to disposal areas. Typical storage equipment would include 55-gallon drums, pillow tanks, and fuel trucks.

Heavy Equipment - Motorized graders and paddle-wheel scrapers can be used in combination to remove continuous contaminated sands from river deltas and floodplains. The graders cut and remove the contaminated layer and put it into windrows for pickup and transport to the disposal area by the paddle-wheel scrapers. While scrapers alone can remove and haul the material, they cannot control their depth of cut as well as graders and operate less efficiently than the motor grader-scraper combination. For spotty contamination of sands, front-end loaders and dump trucks would be the most efficient clean-up combination.

Bulldozers and front-end loaders can be used to remove contaminated <u>gravels</u> from floodplains and for cleaning up spills along roads. The bulldozers excavate the contaminated gravels, which are picked up by front-end loaders and loaded into dump trucks.

Backhoes, draglines, back-fillers, or grade-alls can be used in areas that are inaccessible to large pieces of equipment, but adjacent to a floodplain, road, or pad. Operating from these access points, the equipment can scoop out the contaminated material and place it into a dump truck.

Motorized graders, loaders, and dump trucks can be used to clean up contaminated snow and ice along a pad or road, or on lake or river ice thick enough to support heavy equipment. The technique is the same as used for contaminated sand: windrow the material, pick it up, and transport it. Contaminated snow overlaying vegetated areas should be removed with low ground pressure loaders to avoid damaging the vegetative mat or insulative layer underlying the snow. In areas adjacent to a roadway or graded surface, a dragline or a back-filler could be used.

<u>Pressurized Equipment</u> - Hydroblasting, air blasting, sand blasting, and

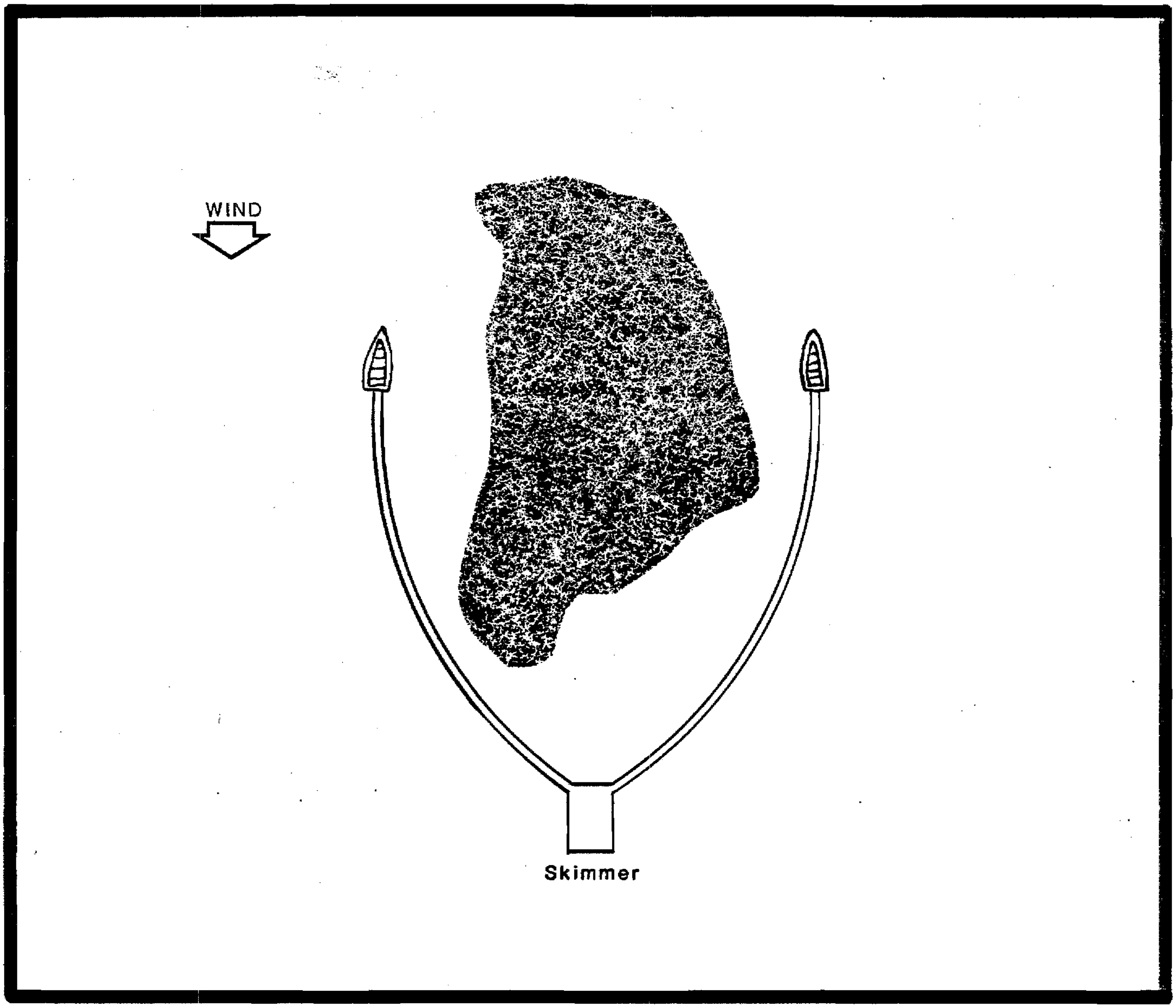
steam cleaning can be used with prior approval from state and federal agencies to remove oil from man-made structures and rocks. Care should be taken to ensure that the cleaning techniques do not do more harm to the surface than leaving the oil in place. Sorbents should always be used when hydroblasting and steam cleaning as these techniques will create pools of oil below the surface being cleaned.

Manual Methods - Areas that are inaccessible to equipment, or with only small amounts of surface to be cleaned should be cleaned by hand with hand scrapers, wire brushes, shovels, rakes and sorbents.

Removal of contaminated vegetation or snow overlying vegetative cover might also require manual methods.

Skimmers - Skimmers are normally used in conjunction with booms or ice diversion barriers to remove oil from the surface of the water and deposit it in a sump tank. (Explosion-proof skimmers are required for gasoline spills.) A spill which is fully contained by booms is best removed by a skimmer placed downwind from the highest concentration of oil (Figure 17) within the boomed area. If the slick is too wide for the boom, skimming should begin on the downwind side of the slick, move along the slick, and stay on the downwind side with each pass (Figure 18). The velocity of the boats and skimmer should not exceed 1 knot (1.7 feet per second).

Weir-type skimmers, which operate on the principle of gravity, work best in calm waters with thick oil slicks. The top of the weir is positioned as close as possible to the oil/water interface and the skimmer moves through



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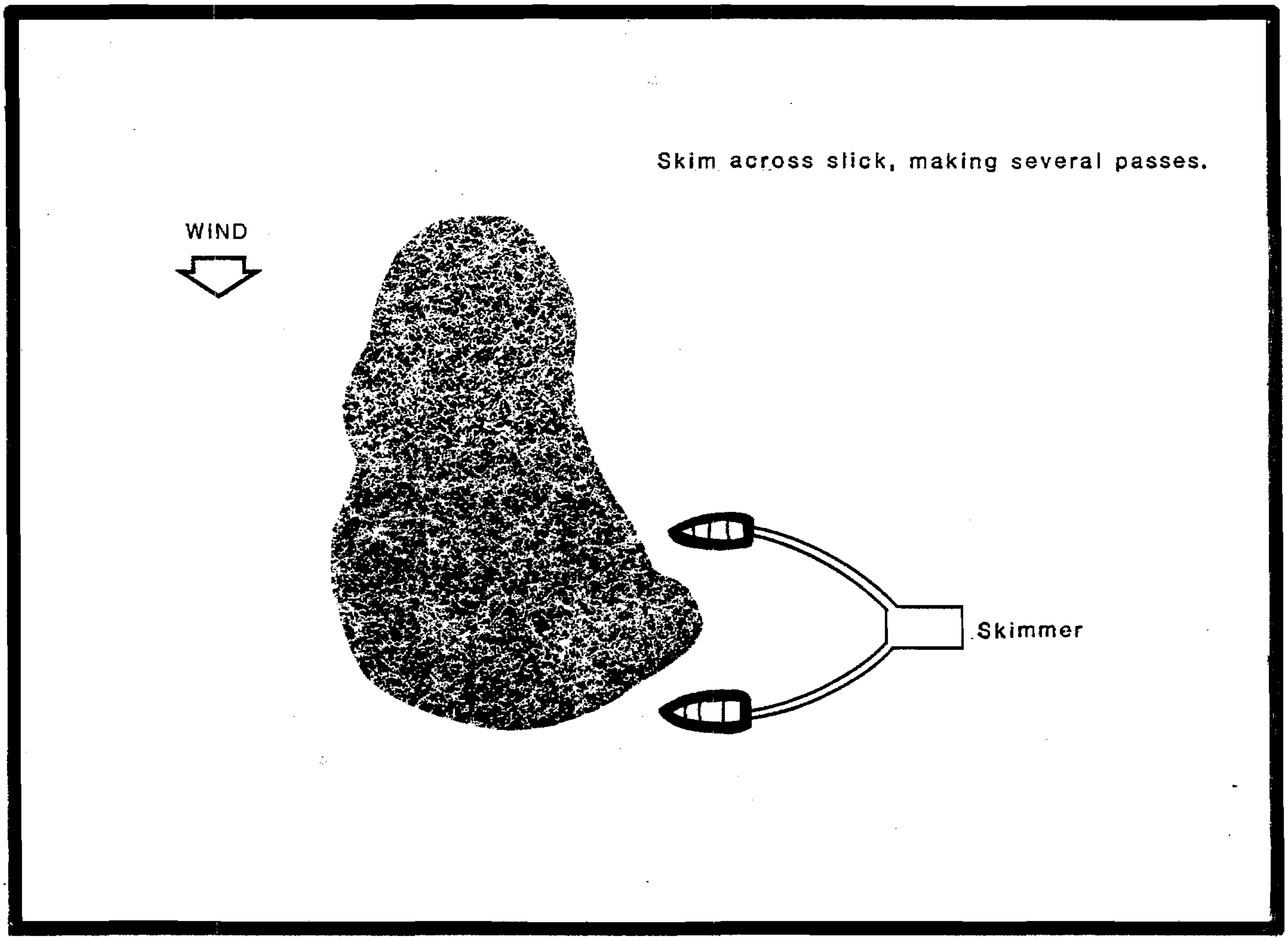
SKIMMING CONTAINED SPILLS

FIGURE 17



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SKIMMING UNCONTAINED SPILLS

FIGURE 18

the slick or is positioned in the current to intercept the oil. Oil and water flow across the weir into a sump or enclosed area. With careful adjustment of the weir, the maximum amount of oil and minimum amount of water can be skimmed.

Rotating disc or endless belt skimmers remove oil from the water surface by material oleophilic properties. Oil adhering to surface of the skimmer is subsequently removed and deposited in a sump or collection tank.

Pumps - Vacuum trucks can be used to remove oil from behind a boom and pump the oil into a containment pit, another truck, or into their own storage tanks. (Explosion-proof pumps are required for gasoline spills.) Diaphragm pumps are most efficient when the intake head is entirely submerged in the spill. The discharge nose can lead into a truck, containment pit, or bladder.

Burning - Burning as a cleanup technique should be limited to small pools of oil or gasoline that have collected on noncombustible surfaces such as floodplains, sand bars, and ice sheets. Burning should not be used to clean up spills on vegetative covering. Human safety should always be a major consideration.

Sorbents - Commercially available sorbents, packaged as rolls, pads, and booms, should be used immediately to be effective. They may be used to clean up residual slicks on waterbodies, shorelines, small pools of oil on land, and small seeps. Snow berms constructed to contain a spill will absorb the spill and can be removed when saturated.

Pumping and Flotation - In areas where a spill may migrate to significant depths (bogs, sand and gravel bars, elevated pads, etc.), some of the spill may be forced to the surface by waterflooding the area. Water pumped onto the area will raise the groundwater table and force the oil to the surface. Then the oil can be removed with booms, skimmers, and sorbents. In areas where the contaminated material is consolidated, the water may have to be pumped into the ground through one or more holes drilled into the groundwater table. Pumping will lower the groundwater table, forming a depression that will trap the spilled oil so that it can be pumped out. The discharge hose of the pump will be connected directly to at least two large storage containers. Cessation in pumping before all the oil is removed will cause the groundwater table to resume its former position and allow the once-pooled oil to migrate farther in the aquifer. Water used for the purposes of flooding and pumping should be properly treated before being discharged.

3.9.2 Implementation Guidelines

Cleanup activities at a given potential spill location may involve several of the techniques mentioned in the previous discussion. Except where noted, the procedures can be used throughout the year.

Pads and Roads - Contaminated material on the surface of gravel roads and pads can be windrowed by a motorized grader, picked up by loaders, and transported by dump trucks. Small pools on paved surfaces can be cleaned up with sorbents. Contaminated material along the edges of roads and pads can be pulled out with a backhoe or grade-all or by hand with rakes and shovels.

Tundra and Forest - Cleanup activities in tundra and forest regimes will normally require use of light equipment and hand cleaning techniques. Excessive vehicle traffic and trampling should be avoided.

A spill will likely kill low-lying shrubs and grasses, and any plant that absorbs oil through its roots. Large trees with oil on their trunks should be left alone. Pools of oil can be removed with sorbents, small hand-operated pumps with skimming heads, and rakes and shovels. During the winter, contaminated snow cover can be carefully removed with heavy equipment or manual methods.

If a spill flows beneath the vegetative mat, it may be feasible to flood the area with water, float some of the oil to the surface, and remove it with sorbents and small pumps and by hand.

Creeks, Ponds and Bogs - Clean-up operations in bogs and marshes will be limited, generally, to the use of sorbents, hand-operated pumps with skimming heads, and small tools. Waterflooding may be useful if large amounts of oil have reached a depression and lie beneath the vegetative cover. Contaminated vegetative cover can be removed by hand.

Shorelines of ponds can be cleaned by hand or with sorbents and hand-operated pumps with skimming heads. Contaminated grasses and debris will have to be removed by hand. The banks of creeks can be treated in much the same way. In addition, if the creek bed is wide enough, front-end loaders and draglines can remove large quantities of contaminated sand and gravel. Small slicks can be removed from the water surfaces with sorbents, small skimmers and booms, and hand-operated pumps with skimming heads.

Floodplains and Large Rivers - Spills on the surface of large rivers can be cleaned up by skimmers used with booms and berms. Rocks and boulders can be cleaned by hand scraping or pressurized equipment. Contaminated gravel bars can be removed with front-end loaders, draglines and backhoes. Contamination at depth in floodplain gravels can be treated by removing the gravel, flotation, or pumping. Sorbent booms and pads should be deployed around these work areas to prevent contamination of downstream areas. Breakup poses the greatest hazard to personnel and the least success for cleanup. Little can be done in the case of a spill directly into a major river during breakup, other than cleaning up any residue left on the floodplain as the river subsides.

Large Lakes - The primary means of cleaning up spills or large lakes is the use of booms, sorbents and skimmers. Contaminated vegetation along the shoreline can be clipped and removed. Sand and gravel can be removed and replaced.

3.10 DISPOSAL

Provisions for temporary and final disposal of oil and the debris associated with cleanup must be included in a project contingency plan. In most spill situations, recovered material is temporarily stored at a local site while arrangements are made for transport to a final disposal site. Also, recovered liquid wastes can undergo primary separation to reduce the amount of liquid requiring transport. All disposal plans must be reviewed and approved by ADEC prior to implementation.

3.10.1 Oil and Water Separation

Effective oil/water separators can be constructed under field conditions to recover oil from oil/water mixtures. Fifty-five gallon drums or sheet metal welded together into a 4 x 8 x 4-foot transportable container can be used as separators, after being fitted with a bottom draining pipe with valve. The oil/water mixture would enter the container from the top, be allowed to settle, and water then drained off the bottom through the drain pipe. The oil can be pumped to a storage tank or tank truck.

A second method can be used to remove oil from a natural or excavated sump pit. A 55-gallon drum fitted with a small pump and hose and a 4- x 18-inch slot cut from the top third is suspended upright into the sump pit, positioned such that the bottom of the slot remains just below the surface of the oil layer. Oil flowing into the drum is then pumped into a storage tank or tank truck.

A tank or any portable tank can also be used to provide oil/water separation. If water in oil emulsions is recovered, chemical de-emulsifiers can be added to the separator tanks to aid in breaking the emulsions and providing more effective water/oil separation.

3.10.2 Temporary Waste Storage

The purpose of a temporary storage site is to provide a location to accumulate debris removed during cleanup operations until arrangements are made for final disposal. Temporary storage sites should be located in an area with good access to the cleanup operation and to nearby roads.

Temporary storage sites should be selected and prepared to minimize contamination of surrounding areas. Storage sites should not be located on or adjacent to ravines, gullies, streams, or the sides of hills, but on flat areas with a minimum of slope. Once a location is selected, certain site preparation is usually necessary. An earth berm should be constructed around the perimeter of the storage site. Material can be excavated from the site itself and pushed to the perimeter, thereby forming a small basin. Entrance and exit gaps should be left in the berm to allow cleanup equipment access to the site. If the substrate or berm material is permeable, plastic liners should be spread over the berms and across the floor of the storage site.

3.10.3 Final Disposal

In some instances, contaminated debris can be incinerated on site, but only with prior approval from the Alaska Department of Environmental Conservation and other authorities. Otherwise, arrangements must be made with transporters and disposal site operators approved by EPA.

3.11 RECLAMATION

Initial reclamation of lands affected by spills and cleanup operations should be aimed at removing structures and equipment used in the cleanup and at preventing erosion. Techniques for preventing erosion include tilling or scarifying the surface, mulching, fertilizing, seeding and transplanting vegetation. These techniques and others are described in a companion best management practices manual on erosion and sedimentation control. Final reclamation efforts should be postponed until the next growing season when an evaluation can be conducted to determine whether or not natural recovery will be sufficient to prevent erosion and allow development of a satisfactory plant cover.

Restoration activities for affected waterbodies include removal of any structures and equipment used during cleanup operations. Excavations in streambeds shall be sloped to prevent fish entrapment.

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