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Open Stream Collection and Diversion: An Added Dimension In Providing Water For Grazing Animals

Technical Note 392



U.S. Department of the Interior
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Open Stream Collection and Diversion: An Added Dimension In Providing Water For Grazing Animals

by

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U.S. Department of the Interior
Bureau of Land Management

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Open Stream Collection and Diversion

Perhaps one of the greatest challenges in managing lands that produce forage for grazing animals is to strike a desirable balance between forage and water. The optimum situation would be one in which available drinking water was within a reasonable distance of all the available forage that could be properly utilized. However, on native grazing lands, this is rarely the case because of terrain characteristics and uneven water distribution.

The abundance and frequency of water are important when considering the optimum carrying capacity and proper management of the range. According to Stoddart, Smith, and Box, "Since livestock are as dependent upon water as upon food, lack of water may prevent proper utilization of forage. Cattle, and especially sheep, occasionally travel long distances to water and go for long periods without, particularly when snow is present. However, poor water distribution is probably the chief cause of poor distribution of livestock on the range."¹

In regard to wildlife, "The amount, availability, quality, and presence throughout the year of water can be improved for purposes of increasing wildlife numbers or expanding the use of habitat."² During the past several decades, significant efforts have been made by land managers to attain an increased water/forage balance for grazing animals. Natural springs have been developed, wells have been drilled and equipped with pumps, and, with the advent of plastic pipe, literally thousands of miles of pipeline have been installed to provide better water distribution for grazing allotments and habitat areas. Other means of providing water have included the construction of various types and sizes of earthen impoundments, i.e., reservoirs, and the installation of precipitation collectors, commonly referred to as "guzzlers" or water catchments, in recent years. In some areas, hauling water has proven effective where the hauling distance is practical and motor vehicle access routes are present.

All of these methods are commonly recognized by land managers across the country as being effective means of providing water sources for grazing animals. Other methods of an innovative nature may occasionally surface, and when they do, it is important to share the knowledge with others so as many as possible might benefit. One such method is referred to in this document as the "Open Stream Collection and Diversion System."

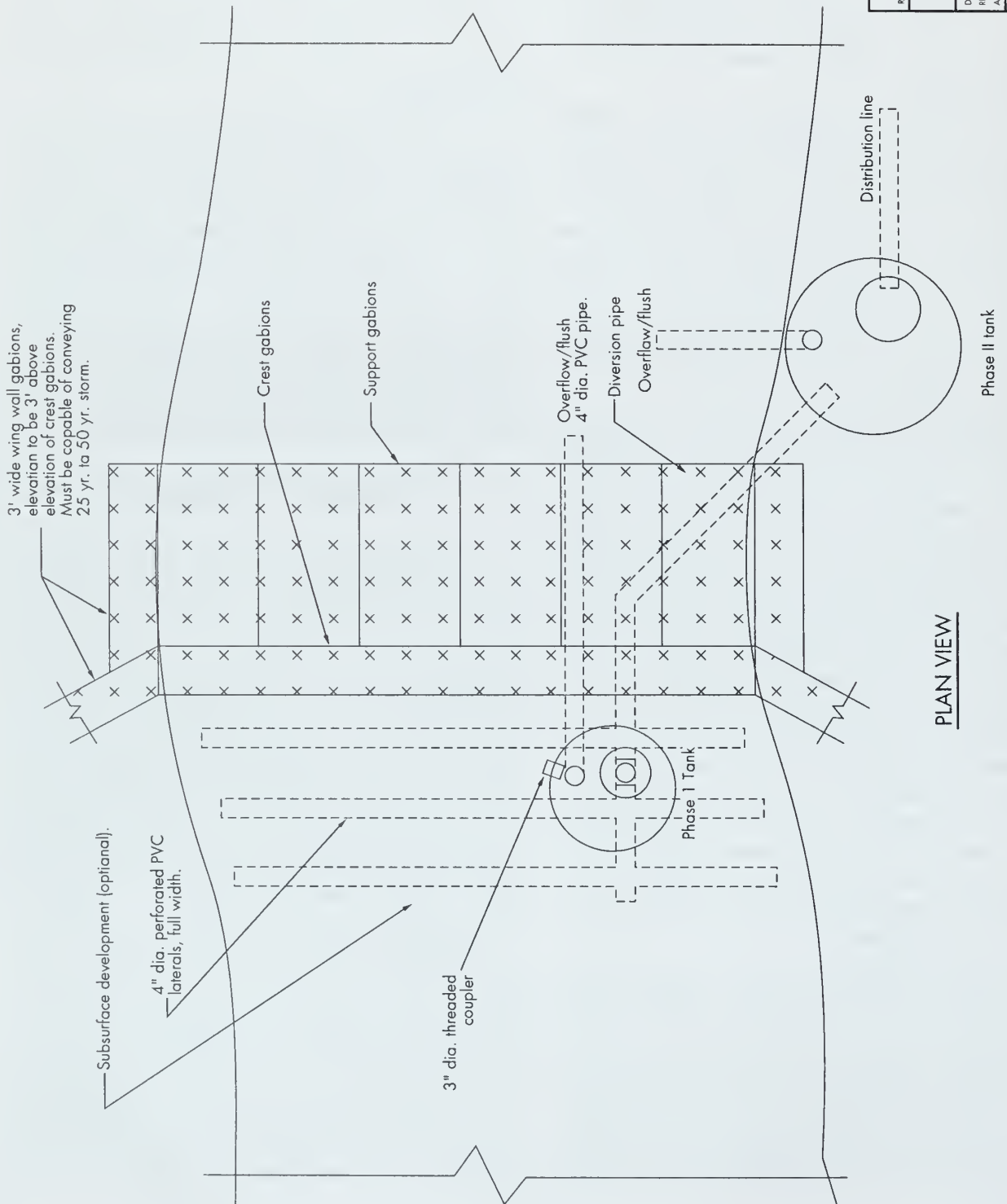
During the past 10 years, the Richfield District has developed an effective system for collecting water from open streams and conveying it several miles via pipeline systems to watering troughs at various locations. This has provided an additional means of making forage available that had been unusable because of a lack of water. This system thus provides yet another method to improve the distribution and expand the habitat of grazing animals.

The development of this system has evolved over the years from a simple system where the stream is generally clear and stable, with little or no threat of sedimentation, to a more sophisticated system where flooding occurs on a regular basis and sedimentation is severe. As expected, small, stable channels where the water is clear year-round require little maintenance; the primary problem here is the deposition or trapping of organic matter. Systems in larger, unstable channels, on the other hand, require more time and effort to maintain, depending on the frequency of storms that produce overland flow and increased sedimentation.

— Design Concept —

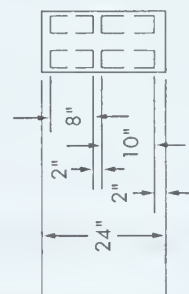
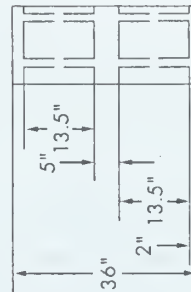
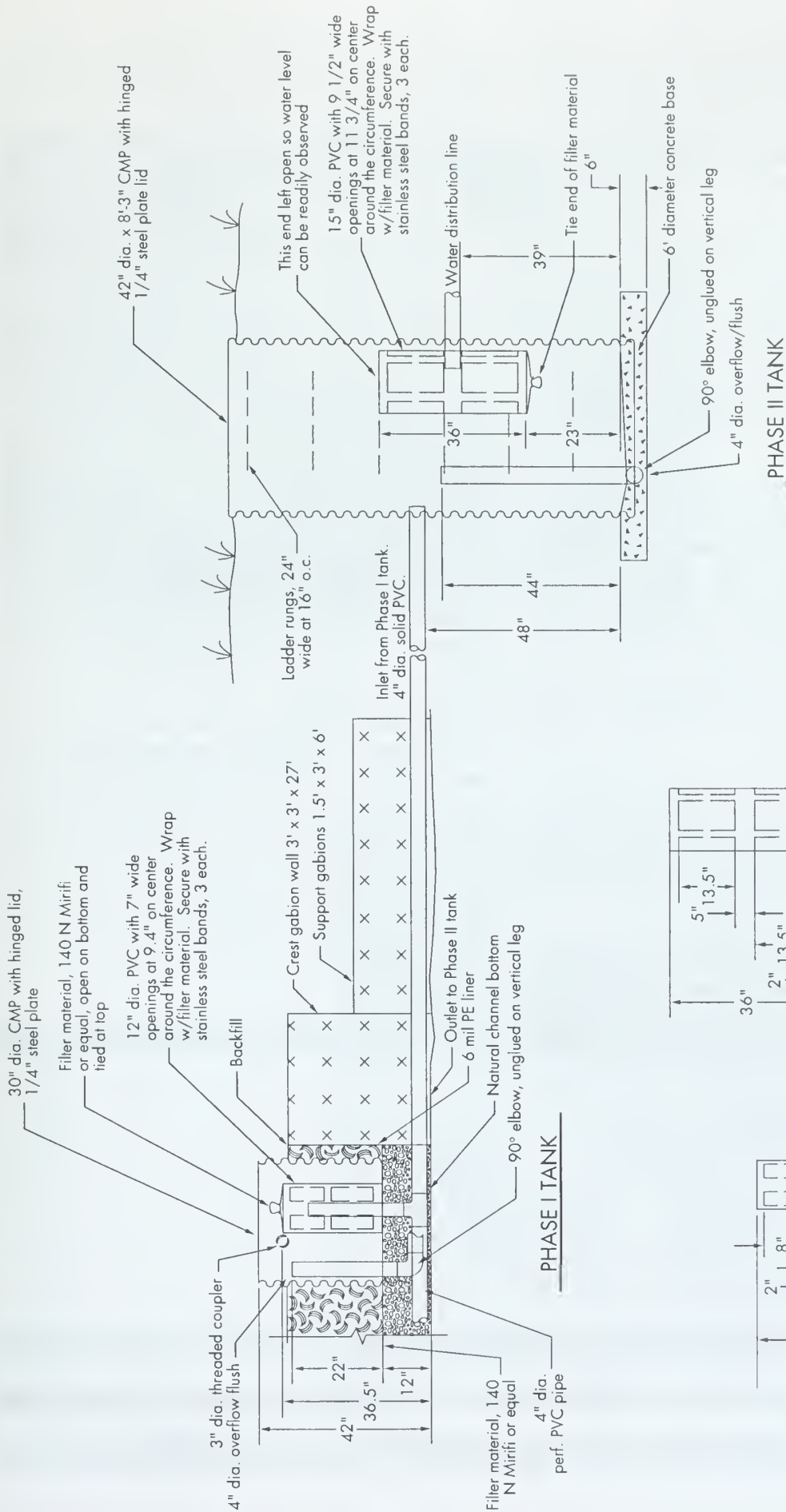
The design of the system is basically a two-phase filtering system. In phase one, the installation of a concrete or gabion structure across the stream channel reduces water velocity, allowing it to be collected from the stream into a small tank where it is filtered and diverted from the stream channel. Provision is made for excess water, sediments, and small debris to exit through an overflow/flush pipe. After the water is diverted from the stream channel, it enters phase two, which consists of a larger tank with a settling pool that allows any fine residual sediment to settle before the water is refiltered and conveyed into the main pipeline distribution system. This phase two tank also contains an overflow/flush provision. See the attached drawings for details.

This system is serviced as needed by flushing sediment from the two tanks and cleaning or changing the filter material. Experience has shown that when floodwaters laden with a heavy load of sediment hit the initial collection tank, the filter material will promptly seal off; any water that continues to enter the tank will exit via the overflow. Should any sediment escape into the inlet pipe, it will be trapped in the secondary tank, thereby protecting the distribution system.



PLAN VIEW

UNITED STATES DEPARTMENT OF THE INTERIOR	
BUREAU OF LAND MANAGEMENT	
RICHFIELD DISTRICT	
UTAH	
OPEN STREAM COLLECTION AND DIVERSION	
DESIGNED S.D. WOOD	
REVIEWED	
APPROVED	
DRAWN CM	SCALE NO SCALE
DATE AUGUST 1994	SHEET 1 OF 2
DRAWING NO	



PHASE II FILTER OPENING

PHASE I FILTER OPENING

UNITED STATES DEPARTMENT OF THE INTERIOR		BUREAU OF LAND MANAGEMENT		UTAH	
RICHFIELD DISTRICT		DESIGNED S.D. WOOD		SCALE NO SCALE	
		REVIEWED		DRAWN CM	
		APPROVED		DATE AUGUST 1994	
				SHEET 2 OF 2	
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Following a flood, the system can easily be re-activated by simply removing the overflow insert pipe and flushing the sediment out, and then rinsing or changing the filter material. The same procedure may be necessary in the secondary tank to get rid of the finer silt that may have accumulated after escaping the initial filtering process.

As an extra precaution, it is wise to install flush drains along the distribution pipeline, in addition to the two-phase filtering process. This is especially important where the pipeline traverses swales and small valleys where the velocity of water flowing through the pipe is not adequate to provide a self-flushing effect. Even in the worst case, however, there will probably be only minor amounts of fine silt that accumulate in these areas.

In addition to the surface collection system described above, a subsurface system can also be installed to convey a smaller amount of water into the system simultaneously. Experience has shown that the amount collected by the subsurface system will usually not exceed 2 gallons per minute (gpm). However, it will provide stability to the system, especially if waters laden with silt tend to close down the Phase I filter. This is accomplished by connecting the subsurface system directly to the phase II tank.

Note that a development of this type is subject to various appropriate laws and regulations. First, it is subject to State laws governing water rights. Second, it must be consistent with all laws and policies that direct the management and protection of riparian/wetland areas.

The actual design of the gabion or concrete wall will vary according to the soil conditions, channel geometry, and hydraulic conditions and should be done

by either a qualified engineer or a technician with in-depth experience. The efficiency of the filtering media will depend on sediment size and load and may improve with proper selection by the designer. However, if there is any question, designing for the finer sediments is recommended.

— Cost of Development —

Costs will vary with each individual situation, depending on site conditions, i.e., width of streambed, access problems, etc. For example, a wide streambed with a downstream gradient of 5 percent slope will require more time, effort, and materials than a narrow streambed with a gradient of only 1 or 2 percent.

If a gabion wall is used instead of concrete, the cost will depend on whether a supply of rip-rap material is available locally or whether it must be hauled in from an outside source. If concrete is used for the wall, it may be difficult to use "ready mix," given the fact that site access is usually partially restricted by terrain. In this case, the concrete components would have to be hauled to the site and a small portable mixer used to prepare the desired mix.

The following estimate is based on a stream channel that is 20 feet wide with a gradient of about 5 percent; the detention wall is constructed of gabions from a source of rip-rap that is available nearby. It is assumed that the work would be accomplished by a hired crew; if done by contract, it is assumed the total labor cost would be approximately the same.

Normally, the cost of developing stream channels narrower than 20 feet wide would be reduced accordingly.

Materials:

Gabion assortment	\$ 500
Perforated PVC pipe, 4" dia. - 80 ft.	60
Drain field rock - 25 cu. yds.	300
Solid PVC pipe, 4" dia. - 50 ft.	40
Pipe fittings, etc.	100
CMP tanks:	
30" dia. X 36" w/hinged lid, 2 or 3" coupling (inlet).	100
42" dia. X 96", hinged lid & drain, 3" outlet.	300
Cement, sand and gravel	50
Miscellaneous items	75
Filter material - 70 sq. yds.	75

Labor:

10 work days	1,500
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Equipment:

Backhoe - 20 hours	300
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Total	\$3,400
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This open stream collection system is located on the Colorado Plateau in northeastern Sevier County, Utah. Soils on the watershed are primarily derived from marine shales that produce very fine sediments. Operation provides drinking water for grazing animals during the winter months, hence the need for the solar reflector to help minimize ice buildup on the surface of the stream. The reflector is removed during the flood season.



The same system is piped approximately 6 miles and serves four troughs that provide water to livestock from December 1 to April 15. In addition, small herds of deer and elk take advantage of the water sources.



This system also provides water to a wetland area that evolved from an old reservoir constructed by the Civilian Conservation Corps in the 1930s. It is now permanently protected from livestock by the pole fence, which was constructed with volunteer labor.



Another collection system provides water to this 50,000-gallon collapsible tank, where it is conveyed by a booster pump to a permanent storage tank located 2 miles away and 600 feet higher in elevation. The water is then distributed by gravity flow through approximately 7 miles of pipeline to four sets of troughs.

Summary

Next in importance to an adequate supply of forage for grazing animals is the availability of drinking water. Frequently, on open range lands, problems with terrain and/or the lack of adequate water sources inhibit the optimal distribution of livestock to assure proper use of the range. Land managers have little control over terrain. However, since water is a fluid resource, it can be conveyed to various points within a grazing area so that proper utilization and management of forage can be realized.

The Open Stream Collection and Diversion System concept can provide an added dimension for distributing water to desired areas, if it is properly designed and constructed. The cost of such a project will vary according to individual site conditions. However, if a distribution system is feasible for providing water to multiple trough systems, it may be well worth the investment. Any developments must be subject to existing laws and regulations governing water rights and the management and protection of riparian/wetland areas.

References

1. Stoddard, L. A., A. D. Smith, and Thadis W. Box. 1975. Range Management (third edition), pp. 282-283, McGraw Hill Co., New York, New York.
2. Wildlife Society. 1969. Wildlife Management Techniques (third edition), p. 190, Edward Brothers, Inc., Ann Arbor, Michigan.

REPORT DOCUMENTATION PAGE

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