CHAPTER 14
INSPECTION, MAINTENANCE, AND REHABILITATION OF SEEPAGE CONTROL MEASURES

14-1. Introduction. Proper functioning of seepage control features requires adequate maintenance, inspection, and, if necessary, rehabilitation. Some seepage control methods such as relief wells are in the best condition they will ever be the day they are installed and developed, while others such as soil-bentonite slurry trench cutoffs may increase in effectiveness with time. All seepage control features must function effectively for the life of the dam or be rehabilitated or, if necessary, replaced. The effectiveness of some seepage control methods, such as the toe trench drain, may be directly observed. For other seepage control methods, such as cutoffs, performance monitoring (see Chapter 13) is essentially the only means of determining the degree of effectiveness.

14-2. Inspection. The procedure for periodic inspection and continuing evaluation of dams is given in ER 1110-2-100. Procedures for reporting evidence of distress in dams are given in ER 1110-2-101. Procedures in these two ER's are often supplemented by Division Regulations as well. Details concerning the monitoring performance of seepage control measures are given in Chapter 13. The first general field inspection for new earth and rock-fill dams is carried out immediately after topping out the embankment. The initial inspection of concrete dams is accomplished prior to impoundment of reservoir water. The second inspection for earth and rock-fill and concrete dams is made at a reasonable stage of normal operating pool but no later than one year after initial impoundment has begun. Subsequent inspections will be made at one-year intervals for the next four years, at two-year intervals for the following four years, and then may be extended to every five years if warranted. The periodic inspections provide the opportunity for a group of specialists to critically examine a project for existing and/or potential problems, to recommend remedial action or changes in instrumentation, and to direct the attention of the operating personnel toward the significant and critical features of a project. However, the occasional inspection cannot take the place of daily observations required to detect potentially dangerous problems at an early and repairable stage. Table 14-1 outlines the inspection, instrumentation, maintenance, and rehabilitation of seepage control facilities. Some seepage control methods such as embankment zonation, cutoffs, and upstream impervious blankets are not amenable to visual inspection. Other methods such as flat slopes downstream of the dam and downstream seepage berms are most accessible and should be inspected daily during periods of full reservoir pool to ascertain that they are functioning properly in controlling seepage. Other seepage control facilities should be inspected on a regular schedule as shown in table 14-1.

14-3. Maintenance. Timely performance of maintenance on seepage control facilities is required for the facilities to perform satisfactorily. Some seepage control methods such as flat slopes downstream of the dam and downstream seepage berms are accessible and require maintenance. Other seepage control methods such as embankment zonation, cutoffs, and upstream impervious blankets do not require maintenance. However, maintenance is required on the instrumentation used to evaluate the degree of effectiveness of all seepage

Table 14-1. Inspection, Instrumentation, Maintenance, and Rehabilitation of Seepage Control Facilities

Seepage Control Facility	Visual Inspection		Instrumentation		Type of Maintenance	Method of Rehabilitation
	Frequency[a]	Type of Observation	Frequency[a]	Type of Measurement		
Control of Seepage Through Embankment						
Flat slopes without drains	Daily	Wet spots, sloughing, erosion	Monthly	Surface monuments	Fertilizing, mowing, filling	Extend slope thickness and length
Embankment zonation	--	--	Varies[b]	Piezometer	--[d]	--
Vertical and horizontal drains	Weekly	Turbidity and discharge rate	Varies[b]	Piezometer	--[d]	--
Control of Underseepage						
Horizontal drain	Weekly	Turbidity and discharge rate	Varies[b]	Piezometer	--[d]	--
Cutoff						
Compacted backfill trench	--	--	--	--	--[d]	--
Slurry trench						
Soil-bentonite	--	--	Varies[b]	Piezometer	--[d]	Install short parallel adjacent trench
Cement-bentonite	--	--	Varies[b]	Piezometer	--[d]	Install short parallel adjacent trench
Concrete wall	--	--	Varies[b]	Piezometer	--[d]	Grout adjacent to wall
Upstream impervious blanket	--	--	Varies[c]	Reservoir sedimentation	--	Filling by barge dumping or following reservoir drawdown
Downstream seepage berm	Daily	Seepage, boils, erosion	Monthly	Surface monuments	Fertilizing, mowing, filling	Extend berm thickness and length
Toe trench drain	Weekly	Turbidity and discharge rate	--	--	Check periodically[e]	--
Relief wells	Varies[b]	Flow rate and sand infiltration	Varies[b]	Piezometer	Check periodically[f]	Rehabilitate wells
Concrete galleries	Weekly	Turbidity and discharge rate	--	--	Check periodically[g]	--
Control of Seepage Through Abutment						
Upstream impervious blanket	--	--	Varies[b]	Reservoir sedimentation	--	Filling by barge dumping or following reservoir drawdown
Downstream filter layer	Weekly	Turbidity and discharge rate	--	--	--	--
Relief wells	Varies[b]	Flow rate and sand infiltration	Varies[b]	Piezometer	Check periodically[f]	Rehabilitate wells
Control of Seepage Beneath Spillways and Stilling Basins						
Drainage blanket	Weekly	Turbidity and discharge rate	Varies[b]	Piezometer	--[d]	--
Relief wells	Varies[b]	Flow rate and sand infiltration	Varies[b]	Piezometer	Check periodically[f]	Rehabilitate wells on unwatering of structure

[a] Schedule to be followed upon obtainment of full reservoir pool. The schedule during initial filling will be determined during the initial periodic inspection.

[b] Observations should be made one week after maximum reservoir level and at three subsequent falling reservoir stages.

[c] Varies depending upon potential sedimentation problems, impact on project performance, and impact on stream system (see EM 1110-2-4000).

[d] Rising or falling head test should be conducted on piezometers annually before the storage season (see EM 1110-2-1908, Part 1).

[e] Catch basins, manholes, ditches, drainage pipe, and weirs should be cleaned, as a minimum in the fall in preparation for the winter season, and again in the spring.

[f] Annually, before storage season, check valves, gaskets, well guards, cover plates, flap gates on the outlets and other appurtenances (see EM 1110-2-1908, Part 1).

[g] Should be examined for stress cracks, bulges, shifts of alignment, excessive leakage, and debris cleaned from gutters and weirs.

control methods. The type of maintenance to be conducted on seepage control facilities is given in table 14-1.

14-4. Rehabilitation. Inspection and maintenance of seepage control facilities may indicate the need for rehabilitation. The type of rehabilitation to be conducted on various seepage control facilities is shown in table 14-1. If the seepage control facility cannot be satisfactorily rehabilitated, remedial seepage control facilities should be installed (see Chapter 12). The majority of rehabilitation of seepage control facilities is in connection with relief wells. Often a relief well does not flow except during high reservoir levels. The water in the well becomes stagnant, various chemicals precipitate, algae grows, and the efficiency of the well deteriorates. This will be manifested by a fall in relief well discharge accompanied by a rise in piezometric levels. Rehabilitation of a relief well is in essence a redevelopment of the well. In addition to mechanical methods such as water jetting, surging, compressed air, and pumping, certain chemicals, detergents, and water softeners can be used in the rehabilitation process.. Chemical tests on water samples from the wells will indicate if and what chemicals are applicable. An examination of the well screen with a borehole TV camera is recommended, turbidity of the water permitting, to determine the degree of deterloration and/or clogging of the screen. For well screens constructed of metal (no wooden screens) that will not be damaged by acid, incrustation from calcium carbonate that has cemented gravel filter particles can be removed by treatment with hydrochloric acid. For well screens constructed of metal, treatment with chlorine can remove bacterial growths of slimes. Iron oxides may be removed by treatment with polyphosphate and surging the well. Calcium hypochlorite can be used with polyphosphates to kill iron bacteria (Johnson Division, Universal Oil Products Co. 1972).