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	Engineering and Design ACQUISITION OF LANDS DOWNSTREAM FROM SPILLWAYS FOR HYDROLOGIC SAFETY PURPOSES	
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Regulation
No. 1110-2-1451

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Engineering and Design
ACQUISITION OF LANDS DOWNSTREAM FROM
SPILLWAYS FOR HYDROLOGIC SAFETY PURPOSES

1. Purpose. This regulation provides guidance on the acquisition of lands downstream from spillways for the purpose of protecting the public from hazards imposed by spillway discharges. Guidance contained herein is in addition to ER 405-2-150.
2. Applicability. This regulation is applicable to all Divisions and Districts having Civil Works responsibilities.
3. Reference. ER 405-2-150.
4. Discussion. A policy of public safety awareness will be adhered to in all phases of design and operation of dam and lake projects to assure adequate security for the general public in areas downstream from spillways. A real estate interest (paragraph 5) will be required in those areas downstream of a spillway where spillway discharge could create or significantly increase a hazardous condition. The real estate interest will extend downstream to where the spillway discharge would not significantly increase hazards. A real estate interest is not required in areas where flood conditions would clearly be non-hazardous.
5. Hydrologic Criteria. The construction and operation of a dam and spillway may create or aggravate a potential hazard in the spillway discharge area. Therefore, an appropriate solution should be developed in a systematic manner. All pertinent facts need to be considered to assure that the risk to non-Federal interests does not exceed conditions that would prevail without the project. General hydrologic engineering considerations are as follows:
 - a. Probability of spillway use. Pool elevation versus probability of filling relationships can change materially after initial construction. Spillway use may be more frequent than anticipated. The infrequent use of a spillway is not a basis for the lack of adequate downstream real estate interest.
 - b. Changes in project functions. Water resource needs within river basins change and pool levels may be adjusted to provide more conservation storage, particularly when high-level limited-service spillways are provided. Such changes normally increase spillway use and are to be considered.

c. Volume and velocity of spillway flow. The amount of flow and destructive force of the flow from a spillway during floods up to the spillway design flood can vary from insignificant to extremely hazardous magnitudes. The severity and area of hazard associated with spillway discharge will vary depending on specific project site conditions. Therefore, the hazard is to be analyzed on a project-by-project basis.

d. Development within floodway. If development within the floodway downstream from a spillway is not present at the time of project construction, the existence of the reservoir may encourage development. Adverse terrain conditions do not preclude development. Sparse present development is not a basis for lack of real estate acquisition.

e. Debris movement within floodway. The availability of erodible material in a spillway flow area intensifies the hazards of spillway flow. In fact, debris may be transported to downstream areas that otherwise would not be adversely affected. Extreme erosion may result from high velocities and turbulence. Both debris and erosion must be evaluated and considered.

f. Flood warning and response potential. Small projects generally have short time periods available to warn downstream inhabitants and may be unattended prior to spillway use. The ability to convince individuals to leave most of their worldly possessions to the ravages of spillway flow may be severely limited. In some cases flood warning systems may be necessary; however, this subject is beyond the scope of this regulation. Warning systems are not an adequate substitute for a real estate interest in lands downstream of spillways.

g. Location of spillways. Spillways should be located to minimize the hazards associated with their discharge and the total project cost (cost of spillway structure and downstream lands). Spillways, outlet works, stilling basins and outlet channels should be designed to minimize hazards to downstream interest insofar as is engineeringly and economically reasonable.

6. Real estate. The real estate interest required downstream of spillways will be adequate to assure carrying out project purposes and to protect non-Federal interest from hazards created by spillway flows. The interest may be either fee or permanent easement. A permanent easement must exclude all overnight and/or permanent habitation, structures subject to damage by spillway flows and activities that would increase the potential hazards. No real estate interest is required for:

a. Areas where the imposed or aggravated flood condition is non-hazardous. Affected interest should be informed of the nature of the imposed non-hazardous flood condition.

b. Areas where the construction and operation of a dam and spillway does not increase or create a hazardous condition.

7. Alternative Land Uses. In some cases lands acquired in fee downstream from spillways can be effectively used for purposes other than hydrologic safety. Therefore, the entire cost of the fee may not be an additional project cost. For example, the fee lands downstream of a spillway may be used for wildlife management essential to project purposes in lieu of other lands suitable for similar purposes at another location.

8. Procedural Guidance. Procedures regarding the application of the principles outlined in the above paragraphs are as follows:

a. For flood magnitudes up to the probable maximum flood determine the "with" and "without project" flood conditions downstream of a dam spillway for the following:

- (1) Flooded area
- (2) Flood depth
- (3) Flood duration
- (4) Velocities
- (5) Debris and erosion

b. Determine the combinations of flood magnitudes and the above flood conditions that could be the most hazardous and/or result in the greatest increase in hazard from "without" to "with project" flood conditions. Designate these combinations of flood magnitude and flood conditions as the critical conditions.

c. For the critical conditions selected above outline the areas where the project could increase and/or create (impose) one or more of the critical conditions. Areas where spillway flows do not create or increase flood conditions are excluded from further analysis.

d. Determine where the imposed critical conditions as outlined above would be hazardous and non-hazardous. Non-hazardous areas are defined as those areas where:

- (1) Flood depths are a maximum of 2 feet in urban and rural areas.
- (2) Flood depths are essentially non-damaging to urban property.
- (3) Flood durations are a maximum of 3 hours in urban areas and 24 hours in agricultural areas.
- (4) Velocities do not exceed 4 feet/per second.
- (5) Debris and erosion potentials are minimal.
- (6) Imposed flood conditions would be infrequent. That is, the exceedence frequency should be less than 1%.

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Hazardous areas are those where any of the above criteria are exceeded.

e. Based upon the information developed above and the principles outlined in paragraphs 3 through 6, decide on the extent of area and estate required for hydrologic safety purposes.

9. Reporting. Lands to be acquired downstream from spillways and intended purposes will be identified and the cost included in feasibility reports and real estate design memoranda. Additional specific information in support of land acquisition should be provided in Phase I or Phase II general design memoranda (GDM) and dam modernization reports. This information should include topographic maps, area flooded maps, velocities, erosion and debris areas "with" and "without" the project. Real estate boundaries and discussions of items in paragraph 4 are also essential in the GDM's and dam modernization reports.

FOR THE CHIEF OF ENGINEERS:



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