

Upper Mississippi River Levee Elevations

ISSUE

Upper Mississippi River (UMR) mainstem levee system surveys found significant sections of 7 federal levee districts (10 levee systems) to be 2 to 4 feet above the levee systems' federally-authorized elevation (Figure 1). Two levee districts are in Illinois, three are in Missouri, and two are in Iowa, encompassing FEMA Regions 5 and 7. These alterations occurred largely in the last decade and were done without required Federal, state or public review or approval, creating unauthorized levee elevations. On several occasions, the Corps has formally advised these non-federal levee sponsors that increasing the height of their levees at local expense requires Corps permission according to legislation and regulations. Both 33 U.S.C. Section 408 and 33 C.F.R. Section 208 prohibit any modification of a flood control work built or improved by the United States without the approval of the Secretary of the Army. The resulting consequence is that the levee system(s) may not perform as designed, therefore resulting in increased or transference of flood risk.

LEVEE SURVEYS

In the winter of 2015-16, the Rock Island District conducted surveys on 28 UMR mainstem levee systems (205 miles) extending from Muscatine, Iowa to the District's southern jurisdictional boundary near Hamburg, IL. These surveys were plotted against authorized and historical levee elevations to discern nature and extent of deviations. The need for surveys was based on visual evidence from formal inspections, FEMA accreditation requests, complaints from neighboring levee districts, and concerns expressed by Congress, local communities, and private citizens.

LEVEE SYSTEMS

Levee and drainage districts have a very distinguished history, providing valuable contributions to the health, safety, security and prosperity of citizens, communities, and the Nation. They largely serve to protect lives, property, and infrastructure from recurrent and damaging flooding. No UMR systemic plan exists for managing floodplains or levee elevations as in the Mississippi Rivers & Tributaries (MR&T) system of the lower Mississippi River. The UMR levees consist of a combination of Federal and non-federal levees which were constructed at different times and designed for a variety of flood profiles. System performance is unpredictable as a result of a decentralized/locally-driven approach to flood risk management (FRM).

Eighty miles of the 205 mainstem miles surveyed in the winter of 2015-16 showed elevation increases >2 feet above authorized. The attached map highlights in red the 7 levee districts (10 levee systems) with significant portions (50-100%) of mainstem levees that have seen elevation increases >2 feet. Levee sponsors are likely modifying (raising) levees to seek 100-year FEMA accreditation through the National Flood Insurance Program (NFIP). In addition to NFIP incentive, the recent increased frequency and magnitude of flooding on the Mississippi River is encouraging levee sponsors to raise levees. Figures 2-3 show illustrative photos from 2008-09 levee pushup and incomplete push-down. Figure 4 illustrates and describes some performance issues with an altered Federal sand or sand/clay levee system.

Sny Island LDD, Illinois: Approximately 125,000 acres of primarily agricultural lands are currently authorized to be leveed for a flow equivalent to the 50-year reoccurrence period. The watershed drainage area is 150 square miles. Also protected are three major railroads, two federal highways and a state highway. The four Sny levee systems were federally constructed from Aug. 1959 to Sep. 1971 (1953 FCA). Population at risk of inundation in leveed area is 788 day/1349 night. Economic damages if inundated are \$82,560,000 (>99% of the leveed area is expected to have >2 feet of water if inundation). Three of the four primary Sny mainstem levee systems currently show 2 to 3 feet elevation increase above authorized on 37.5 of its 40.0 miles.

Fabius LDD, Missouri: Approximately 14,264 acres of primarily agricultural lands are currently authorized to be leveed for a flow equivalent of 50 year reoccurrence period. While most of the leveed area is cropland, about 400 acres are in industrial and commercial use and 200 acres are for other purposes. Two federal highways, several secondary roads, a class 1 airport, railroad yards and light

industries are in the leveed area. Early federal improvements were completed in 1941 (1936 FCA) and more recent federal improvements were completed in 1963 (1954 FCA). Population at risk of inundation in leveed area is 184 day/106 night. Economic damages if inundated are \$19,144,000 (>99% of the leveed area is expected to have >2 feet of water if inundation). Fabius mainstem levee is currently 2 to 4 feet elevation increase above authorized on 6 of its 8 miles.

AUTHORIZATION HISTORY

House Document No. 281, 83rd Congress, containing the plan authorized by the Flood Control Act of 1954 House, comprises nearly 100 pages of detailed explanation and analysis of flood control projects for the Upper Mississippi within the confines of the Rock Island District. Paragraph 159, pages 62-64, contains a detailed explanation of design profiles. Paragraph 159 also states: "In considering the levee districts bordering the river between Muscatine, Ia, and Hannibal, Mo., it appears that a uniform degree of flood protection should be afforded to all levee districts. That is, one agricultural area should not be provided with higher levees than the adjacent agricultural area. The most reasonable design grade is that which will provide protection against floods of 50-year frequency." The 50-year frequency was selected for several factors. The 50-year frequency was "the upper limit of economic justification," according to paragraph 159(a). Paragraph 159(b) stated that "a second consideration in the selection of a design grade for rural areas is the effect upon levees protecting urban areas...because of the greater potential danger inherent in the flooding of urban areas with their larger populations, it is considered advisable to provide an added factor of safety by constructing urban protection works higher than rural levees." Paragraph 203, page 80, of the House document outlines the local cooperation requirement, namely that the local interests would provide "without cost to the United States all lands, easements, and rights-of-way necessary for the construction of the projects; to hold and save the United States free from damages due to the construction work; and to maintain and operate all works after completion in accordance with regulations prescribed by the Secretary of the Army." The local interests in both urban and rural drainage and/or levee districts were informed of the requirements and "expressed willingness to comply with these requirements" in writing to the District Engineer.

Authorized Design Grade - the top of levee elevation as authorized by act of Congress: Federal levee projects are typically authorized by a Flood Control Act or Water Resources Development Act based on a Report of the Chief of Engineers that was developed as part of a Corps of Engineers feasibility study. The top of levee elevation identified in these authorizing documents is the authorized design grade used for development of the construction drawings and the plates in the Operations and Maintenance manuals. Non-federally constructed levees do not have an authorized design grade.

FEDERAL REGULATIONS

Any permanent modifications to the Federal Levee System is governed by 33 U.S.C. § 408, the Corps' implementing regulations for 33 C.F.R. § 208.10, and EC 1165-2-216. 33 U.S.C. § 408 is the statutory provision governing modifications to Federal navigation or flood control works. § 408 states that "[i]t shall not be lawful for any person or persons to take possession of or make use of for any purpose, or build upon, alter, deface, destroy, move, injure,...or in any manner whatever impair the usefulness of any...levee built by the United States,...in whole or in part,...to prevent floods...Provided, That the Secretary of the Army may, on the recommendation of the Chief of Engineers, grant permission for the temporary occupation or use of any of the aforementioned public works when in his judgment such occupation or use will not be injurious to the public interest...Provided further, That the Secretary may, on the recommendation of the Chief of Engineers, grant permission for the alteration or permanent occupation or use of any of the aforementioned public works when in the judgment of the Secretary such occupation or use will not be injurious to the public interest and will not impair the usefulness of such work."

The Corps' implementing regulations at 33 C.F.R. § 208.10 require that the non-Federal Sponsor "maintain and operate flood control works in accordance with regulations prescribed by the Secretary of the Army" and that the works "shall be continuously maintained in such a manner and operated at such times and for such periods as may be necessary to obtain the maximum benefits." "[N]o improvement shall be passed over, under, or through...levees..., nor shall any excavation or construction be permitted within the limits of the project right-of-way, nor shall any change be made in any feature of the works without prior determination by the District Engineer of the Department of the Army or his authorized

representative that such improvement, excavation, construction, or alteration will not adversely affect the functioning of the protective facilities.”

EC 1165-2-216 provides policy and procedural guidance for processing 408 requests, stating, “Proposed alterations must not be injurious to the public interest or affect the USACE project’s ability to meet its authorized purpose.” It defines “alteration” as “any action by any entity other than USACE that builds upon, alters, improves, moves, occupies, or otherwise affects the usefulness, or the structural or ecological integrity, of a USACE project.”

Alterations include occupation and use, as well as encroachments under 33 C.F.R. § 208.10. It requires that the non-Federal sponsor ensure that the project is operated in accordance with Corps requirements. The non-Federal sponsor must obtain 408 approval for “improvements, excavations, construction, or changes to local flood protection works referenced in 33 CFR 208.10(a)(4) and (5).” Non-Federal sponsors with operation and maintenance responsibilities “remain responsible for ensuring no unauthorized alterations are occurring within the project boundaries.”

IMPACTS

The Corps has not evaluated these unauthorized alterations in detail with respect to potential impacts to the integrity of the UMR system levees and is unaware if the levee districts have performed this analysis. There are known seepage issues and relief well deficiencies in some of these systems that could be exacerbated by raising the levee system and exposing them to higher differential pressures. These type of deficiencies may be the basis for designating the condition of the levees as unacceptable in the PL84-99 program. Beyond these concerns, this unauthorized alteration also potentially transfers and increases flood risk to other Federal projects, as well as state and local entities.

Federal, state and public review and comment of proposed alterations to a Federal levee are longstanding requirements from which to assess potential performance issues, risks and impacts. The non-federal levee sponsor is primarily responsible to follow all local, state and federal agreements, rules, regulation and laws in the operation, maintenance or proposed alterations of their levee system. The non-Federal sponsor seeking alteration of a Federal project is also required to conduct required testing and modeling to identify impacts or consequences of their proposed actions.

Since none of the aforementioned impact analysis steps were taken for these unauthorized levee elevations, the Rock Island District was directed to conduct a preliminary assessment of the potential hydraulics impacts of the Sny levee raises, which included a summary table that was used to communicate with the states and FEMA. For a modeled 400-yr event (527,000 CFS at Hannibal gage), the maximum impact of 2.35 feet occur near Hannibal, MO, and areas upstream to Keokuk, IA. The areas downstream from Hannibal, MO, to Grafton, IL may experience some increase in risk but not to the same magnitude as upstream areas (tenths of a foot). For comparison, the 1993 had peak discharge of 536,000 CFS at Hannibal gage. The Jacksonville District (CESAJ) conducted an independent review of the modeling completed by the Rock Island District to identify potential water surface impacts as a result of the existing Sny Levee elevation. The conclusion of the Jacksonville District independent review was *“CESAJ believes the hydraulic model is technically sufficient and meets its intended purpose of evaluating the Sny levee modifications and their upstream and downstream impacts. The model clearly demonstrates significant impacts from the proposed, or previous unauthorized levee modification”*

In fall 2016, Rock Island and St. Louis Districts received funding to initiate the development of a new FRM hydraulic model from Keokuk, IA through Thebes, IL. This model will be a valuable tool in evaluating alternatives & assessing potential individual/cumulative impacts of levee & floodplain modifications. Development and testing of this hydraulic model is being done in collaboration with technical experts from states and other Federal agencies. The model is currently scheduled to be completed in early fall 2017.

COLLABORATION/COMMUNICATION

Deliberate coordination & collaboration with multiple levee districts the 3 States, FEMA Regions 5 & 7, & multiple levee districts, each working within their own authorities, programs, and processes, will be required to identify effective FRM solutions. Collaboration and communication for the UMR levee survey data and systems elevation status must reflect an open and transparent climate.

Figure 1. Twenty-eight UMR mainstem levee districts surveyed in winter 2015-16. Red highlighted systems found to be 2 to 4 feet above the levee systems' federally-authorized elevation.

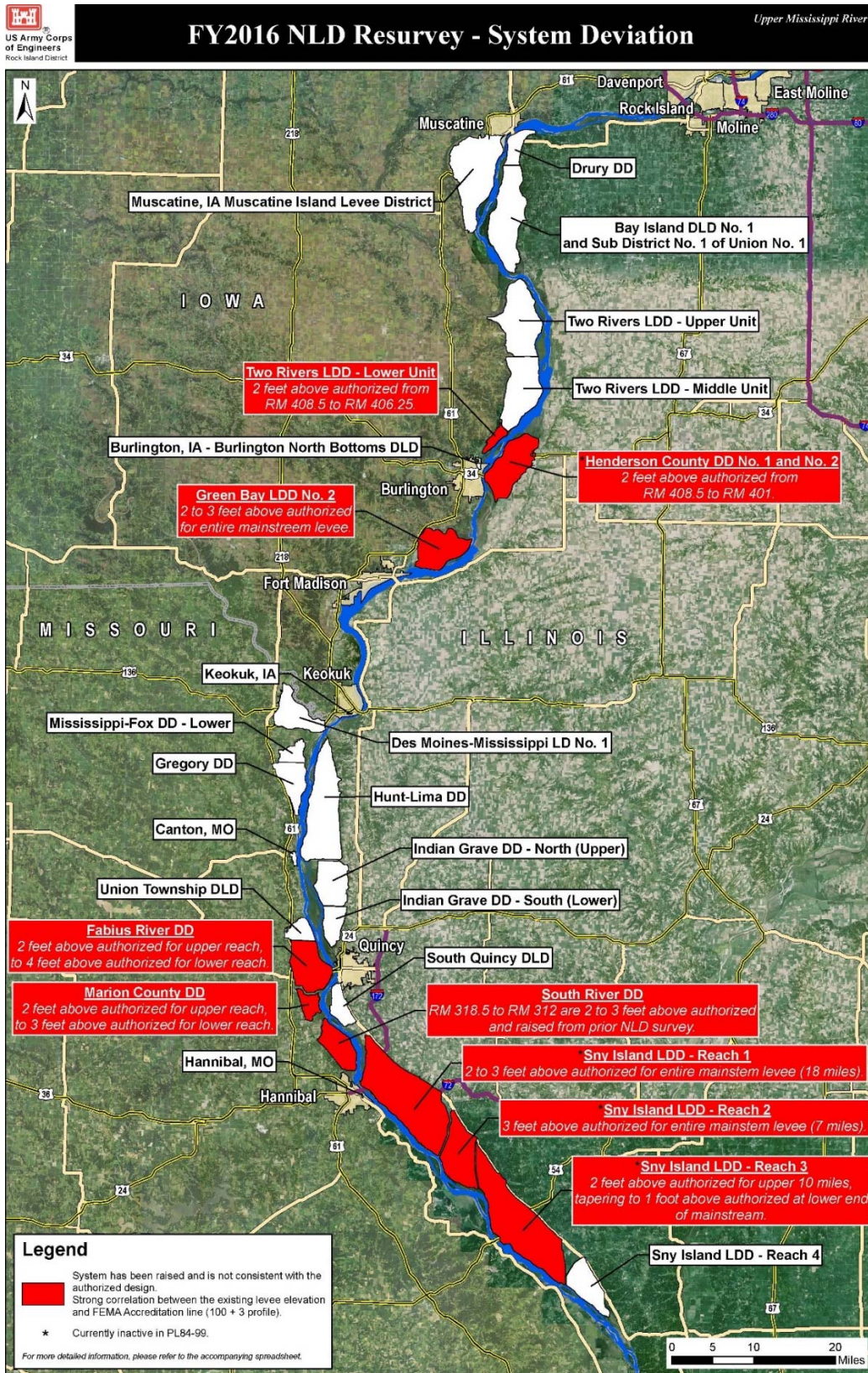


Figure 2. Illustrative picture of UMR sand levee push-up during 2008 flood fight.



Figure 3. Illustrative picture of UMR sand levee with incomplete push-down after 2008 flood fight.



Figure 4. Illustrative image depicting performance concerns with alterations to federal sand levee.

