2020 BOND ELECTION

PRELIMINARY BOND ENGINEERING REPORT

PREPARED FOR:
UPPER BRUSHY CREEK WCID
460 TEXAS AVE
ROUND ROCK, TX 78664

PREPARED BY

K·FRIESE + ASSOCIATES
PUBLIC PROJECT ENGINEERING
FIRM NO. 6535

AUGUST 2020

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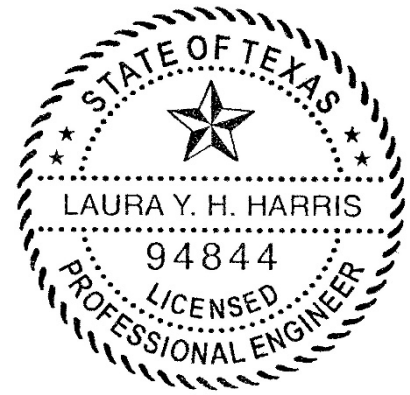

August 13, 2020

TABLE OF CONTENTS

APPENDICES

1 GLOSSARY OF TERMS AND ACRONYMS

Dam Assessment – Dam Portfolio Assessment & Prioritization Study

District – Upper Brushy Creek Water Control and Improvement District

FEMA – Federal Emergency Management Program

FPP – Upper Brushy Creek Watershed Flood Protection Plan

KFA – K Friese + Associates, Inc.

O&M – Operations & Maintenance

Original District – Brushy Creek Water Control and Improvement District No. 1 of Williamson and Milam Counties

PFM – Potential Failure Mode

PFMA – Potential Failure Mode Analysis

SQRA – Semi-Quantitative Risk Assessment

TCEQ – Texas Commission on Environmental Quality

WCID – Water Control and Improvement District

2 INTRODUCTION + PURPOSE

This report presents the preliminary engineering and economic information in support of the proposed November 2020 bond authorization election for the Upper Brushy Creek Water Control and Improvement District ("District"), as required by Section 49.106 of the Texas Water Code. It summarizes the flood safety projects proposed to reduce flood risk in the District. This report also addresses the land, improvements, and facilities to be studied, designed and constructed with their estimated costs. This report does not constitute a contract with the voters of, or residents and property owners in, the District. This report reflects estimated costs as well as proposed locations and project descriptions which are subject to change based on future economics, market and other conditions and, as a result, this report is subject to amendment as necessary to reflect the changing conditions of the District.

2.1 HISTORY

The original Brushy Creek Water Control and Improvement District (WCID) No. 1 of Williamson and Milam Counties (the "Original District") was established by the Texas Legislature in 1956 as the local sponsor of flood control structures to be constructed by the federal Soil Conservation Service. Earthen dams were identified as the most efficient and effective way to reduce flood damage through a series of disseminated dams along tributaries of local creeks. The dams were constructed between 1957 and 1966 and are subject to regulation by Texas Commission on Environmental Quality (TCEQ), under management by the Office of Water, Water Districts Division.

Since that time that the dams were constructed, rapid urbanization and increased dam safety regulations have resulted in the State designating all of the original WCID dams in the western half of the Original District as high hazard due to downstream risks. This designation prompted voters to divide the district into the Upper and Lower Brushy Creek WCIDs on November 6, 2001. On May 4, 2002, Upper Brushy Creek voters approved a two-cent tax rate to fund operations, dam maintenance, and the dam modernization program. Once funding was approved, the District focused on completing dam modernization projects to meet TCEQ's updated standards for high hazard dams to safely pass the Probable Maximum Flood (PMF). The final dam modernization project is scheduled to begin construction in 2020.

With the dam modernization program nearing completion, the District is continuing operational and maintenance efforts to address the aging dam and reservoir infrastructure and initiating new capital projects to ensure the dams continue to safely provide the much-needed flood protection for the next 50+ years. The District also continues to assess and collaborate on regional-scale solutions that would protect lives and minimize property damage from creek flooding. In 2011, the District began efforts to update area flood models for the first time in over 30 years with support from city and county floodplain Administrators. These models were submitted to FEMA and TWDB in 2016 and became effective in December 2019.

3 DESCRIPTION OF AREA

The District spans from Leander eastward to Hutto and is home to over 400,000 people. The District currently manages 23 dams throughout the Upper Brushy Creek Watershed, shown in Figure 1, with each dam's drainage area, and Figure 2, with the current municipal jurisdictions. Instead of constructing a large regional dam that would inundate a significant amount of lower-lying land, the Soil Conservation Service constructed this series of smaller watershed dams. Collectively, these dams protect the Upper Brushy Creek Watershed by controlling the release of runoff from the upper tributaries, reducing downstream flood risk.

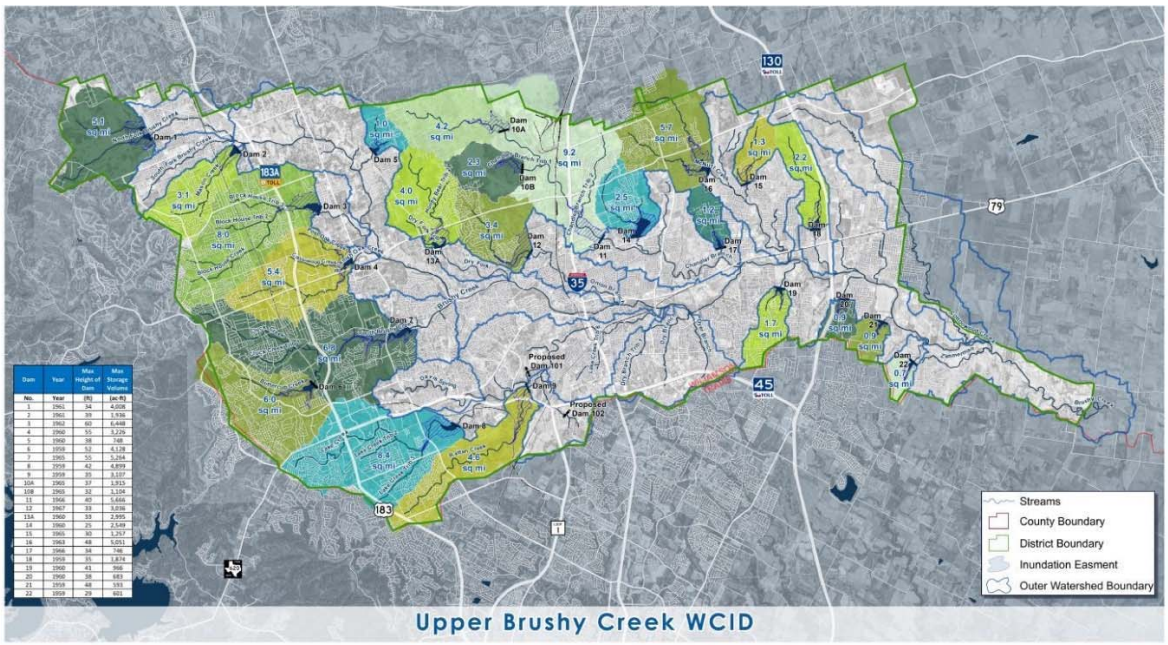

Figure 1. Upper Brushy Creek WCID Dam Drainage Area Map
(Source: https://www.upperbrushycreekwcid.org/35/Mapping)

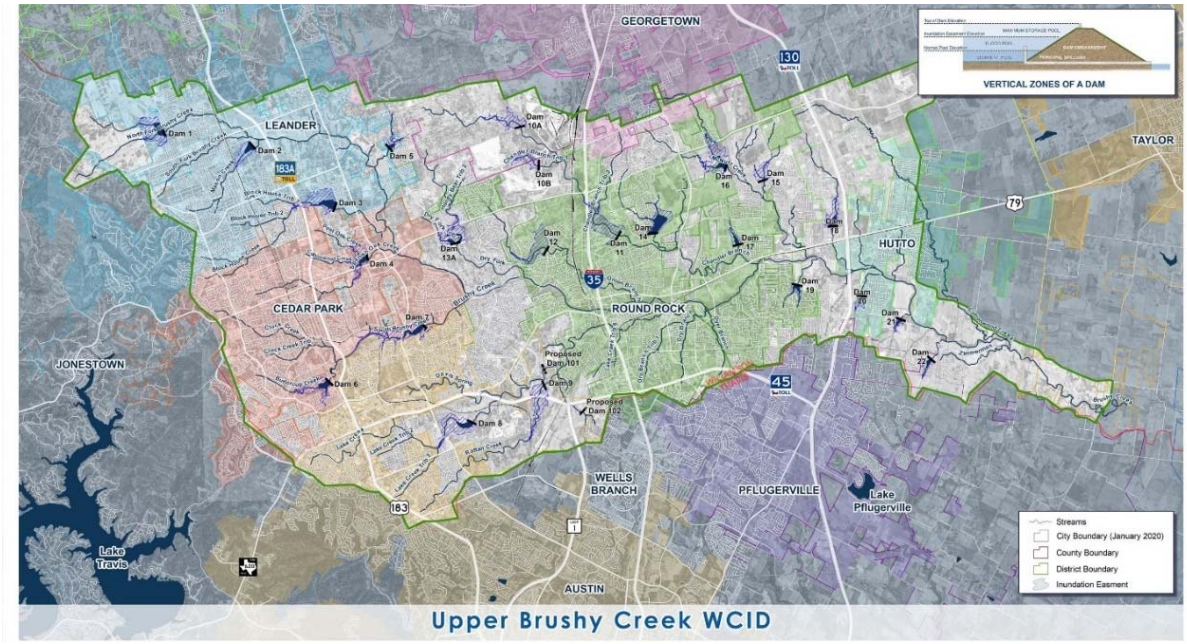

Figure 2. Upper Brushy Creek WCID Dam Jurisdiction Map
(Source: https://www.upperbrushycreekwcid.org/35/Mapping)

A summary of the District's dams is provided in Table 1. The table details the variety of jurisdictional areas of the dam locations across the District and the completion date for each dam.

Table 1. Upper Brushy Creek WCID Dams

UBC No.	Common Name	Jurisdictional Area	Year Built
Dam 1	Devine Lake	Leander	1961
Dam 2	Horizon Park	Leander	1961
Dam 3	Lakewood Lake	Leander/Cedar Park ETJ	1962
Dam 4	Spanish Oak	Cedar Park	1960
Dam 5	CR 176	Leander ETJ	1960
Dam 6	Lakeline Lake	Cedar Park	1959
Dam 7	Brushy Creek Lake Park	Cedar Park/Austin ETJ	1965
Dam 8	Ganzert Lake	LTD Austin ETJ	1959
Dam 9	Smith Lake	LTD Austin ETJ	1959
Dam 10A	North Texas Crushed Stone	Georgetown ETJ	1965
Dam 10B	South Texas Crushed Stone	Round Rock ETJ	1965
Dam 11	Luther Peterson	Round Rock	1966
Dam 12	Behrens Ranch	Round Rock	1966
Dam 13A	Mayfield Park	Round Rock	1960
Dam 14	Meadow Lake	Round Rock	1966
Dam 15	Paloma Lake	Round Rock	1965
Dam 16	CR 112	Round Rock ETJ	1963
Dam 17	Old Settlers Park	Round Rock	1966
Dam 18	Tradesman Park	Hutto ETJ	1959
Dam 19	Forest Creek Lake	Round Rock	1959
Dam 20	Hutto Lake	Hutto	1960
Dam 21	CR 137	Hutto ETJ	1959
Dam 22	CR 139	Pflugerville ETJ	1959

4 PREVIOUS PLANNING EFFORTS

The projects in this report have been identified by previous planning efforts conducted by the District, including the 2016 Upper Brushy Creek Watershed Flood Protection Plan[1] and 2020 Dam Portfolio Assessment & Prioritization Study. These plans identify and rank high priority flooding issues throughout the watershed, incorporating extensive input from local stakeholders. They also propose mitigation solutions to prolong dam life.

4.1 FLOOD PROTECTION PLAN

In September 2010, Tropical Storm Hermine dropped 11 inches of rain in 24 hours in parts of the Upper Brushy Creek watershed, which then equated to the 0.2% ACE (Annual Chance Event) (also known as a 500-year storm event) with auxiliary spillways engaging on four of the District's dams.. The event demonstrated that current dams do not adequately address hazards from major flood events. In response, the District initiated a watershed-wide study to identify regional opportunities for additional flood mitigation. The Upper Brushy Creek Watershed Flood Protection Plan (FPP) was initiated in 2011 and completed in 2016.

The purpose of the FPP was to identify creek flooding concerns throughout the watershed, prioritize them, and propose potential mitigation alternatives. The plan also provided high-level cost estimates and a cost-

[1] URS Corporation, *Upper Brushy Creek Watershed Flood Protection Plan* (Williamson County, Texas: Upper Brushy Creek Water Control and Improvement District, June 2016).

benefit analysis for selected alternatives. The report describes the methodology, analysis, and results of hydrologic and hydraulic modeling, as well as a flood hazard assessment and the mitigation alternatives for use and consideration by stakeholders in the development of capital improvement plans for local jurisdictions.

The hydrologic and hydraulic modeling methodology was vetted by a Technical Advisory Committee of stakeholders. The hydrologic methodology included decisions about how to quantify impervious cover given the rapid development in the watershed, how to calibrate the models to historic storms, and what data to use for rainfall and topography, given the differences in hydrologic analysis requirements among the jurisdictions within the watershed. The hydraulic modeling methodology, which most notably included calibrating to historic high-water marks to improve the hydraulic accuracy of the model.

The District developed a flood hazard assessment method to assign scores to habitable structures in areas of highest flood risk within the District. These structures were aggregated into Damage Centers (shown in Figure 3) and areas were prioritized by the Technical Advisory Committee based on their scores and qualitative factors.

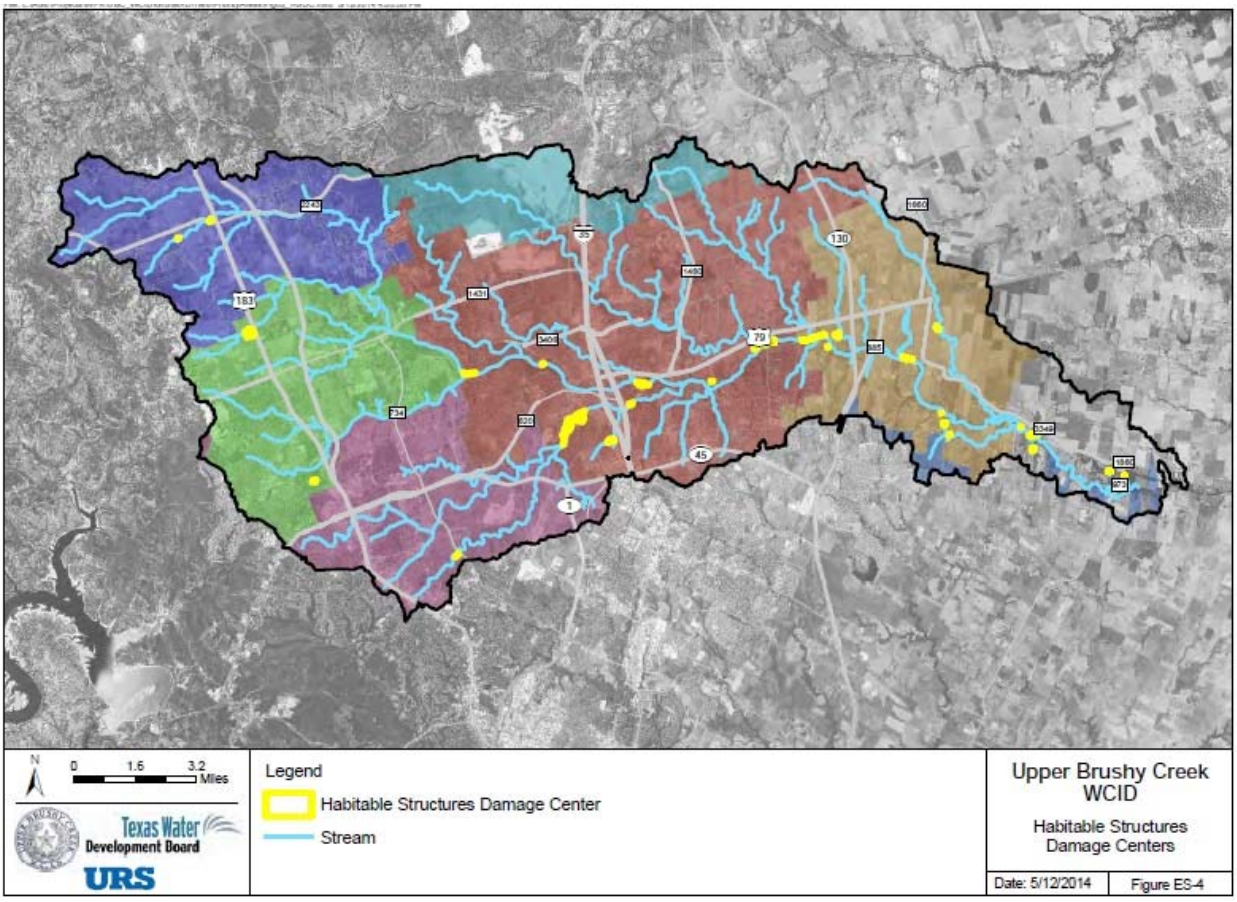

Figure 3. Habitable Structures Damage Centers[2]

Mitigation alternatives included concept designs and cost estimates for each Priority Area. The feasibility of the alternatives and the value of conducting further studies were assessed for each alternative during

[2] URS Corporation, *Upper Brushy Creek Watershed Flood Protection Plan* (Williamson County, Texas: Upper Brushy Creek Water Control and Improvement District, June 2016), 22.

meetings with local government stakeholders. Project benefits were estimated based on the changes in flooding depths at habitable structures when projects were incorporated into the hydrologic model. The mitigation alternatives focused on structural improvements such as dams, mitigation channels, and bridge crossings that could be included in stakeholder capital improvements plans. The alternatives were designed to add detention to the watershed, beginning with upstream projects and progressively moving downstream. The FPP does not include non-structural improvements such as public education, warning systems, and regulatory changes, but recommends these measures for further consideration by local jurisdictions.

4.2 DAM ASSESSMENT

The District completed a Dam Portfolio Assessment & Prioritization Study in March 2020. The purpose of the study was to perform a risk-informed dam safety assessment to inform long-term budgeting and prioritization of future dam rehabilitation efforts for the District to undertake.

This study resulted in two reports: the Dam Portfolio Screening Technical Report[3] and the Dam Portfolio Prioritization Summary Report[4], which are described in this section.

4.2.1 Dam Portfolio Screening Technical Report

The Dam Portfolio Screening Technical Report contains a detailed summary of the approach and methodology that guided the study. The study performed a Semi-Quantitative Risk Assessment (SQRA) and Potential Failure Mode Analysis (PFMA) for each dam to comprehensively and objectively assess risk across the District's portfolio of 23 dams.

SQRA/PFMA workshops were held to analyze each dam. Analysis incorporated existing data for each dam, potential failure modes, hydrologic loading, relative risk estimates, and resulting estimated life loss from a dam failure. Potential failure modes were identified based on an evaluation of the dams' vulnerabilities. The team identified 19 potential failure modes (PFMs) that were categorized into 16 normal and hydrologic loading conditions of potential failure (or damage) modes and 3 three hydrologic non-breach events.

The result of this analysis was a matrix of relative risk scores for breach and non-breach potential failure modes for each dam. The highest scoring Potential Failure Mode by Dam Matrix (shown graphically in Figure 4), provides a comparison of the risk of failure of all the District's dams. The report notes that the risk matrix will continue to change based on future studies, modifications, and events.

[3] HDR Engineering, Inc., *Dam Portfolio Screening Technical Report* (Williamson County, Texas: Upper Brushy Creek Water Control and Improvement District, March 2020).
[4] HDR Engineering, Inc., *Dam Portfolio Prioritization Summary Report* (Williamson County, Texas: Upper Brushy Creek Water Control and Improvement District, March 2020).

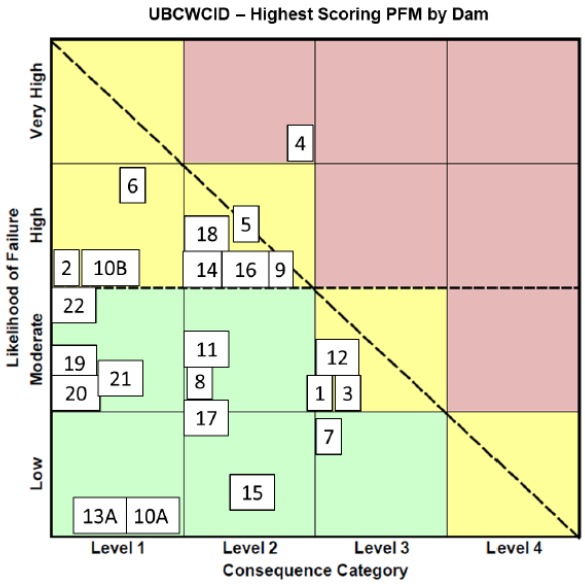

Figure 4. Highest Scoring PFM by Dam[5]

4.2.2 Dam Portfolio Prioritization Summary Report

The Dam Portfolio Prioritization Summary Report summarizes the risk evaluation performed for each dam and prioritizes recommended risk-reduction actions for the District's dam safety program. These actions include dam rehabilitation projects, engineering studies and analyses, non-structural risk management strategies, and critical operations and maintenance (O&M) activities. The report summarizes failure risk at each dam in a map of the watershed (provided in Figure 5), with green representing low risk, yellow representing moderate risk, and red representing high risk. The report also contains overviews of risk-reduction actions by project type; however, it does not contain cost estimates for these actions. This summary report acknowledges that actual implementation of these actions may vary based on availability of funding and resources.

[5] HDR Engineering, Inc., *Dam Portfolio Screening Technical Report* (Williamson County, Texas: Upper Brushy Creek Water Control and Improvement District, March 2020), 65.

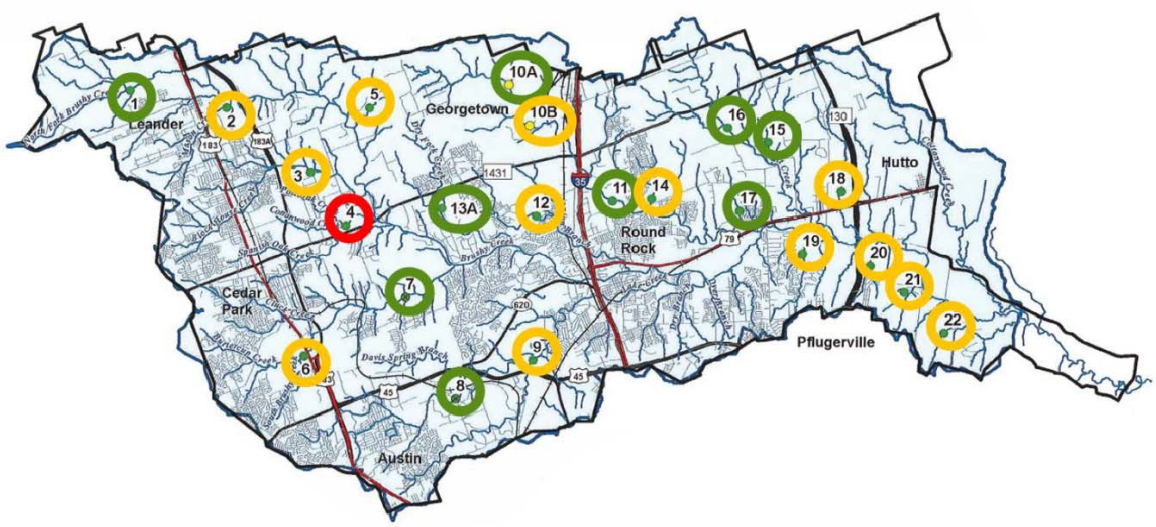

Figure 5. Map of Dam Failure Risk[6]

5 PROPOSED IMPROVEMENTS

The bond projects are derived from improvements that were identified in the District's Flood Protection Plan and the Dam Assessment. The proposed flood safety projects can be categorized into two types:

- **Dam Rehabilitation Projects:** The District's existing earthen dams were built over 50 years ago. Like all aging infrastructure, dams require rehabilitation to keep them working safely and effectively and to prevent against an unlikely but potential dam failure. Dam rehabilitation projects typically upgrade, replace, or reinforce parts of the dam. Projects can be categorized into the following types: embankment, principal spillway, and auxiliary spillway.
- **Flood Mitigation Projects:** The District's planning study identified numerous at-risk areas in the Upper Brushy Creek watershed. The bond is proposed to fund projects in the two most vulnerable areas in the watershed which were also identified as two of the most at-risk areas in the entire watershed.

5.1 DAM REHABILITATION PROJECTS

The District will draw on the findings of the Upper Brushy Creek Watershed Flood Protection Plan and the Dam Risk Assessments to prioritize new construction solutions and rehabilitation projects for the dams under its jurisdiction. The types of rehabilitation projects that are necessary to prevent dam failure and reduce flooding are described in Table 2. The rehabilitation projects will be designed and constructed in accordance with TCEQ Dam Safety and any other required State and Federal agencies.

[6] HDR Engineering, Inc., *Dam Portfolio Prioritization Summary Report* (Williamson County, Texas: Upper Brushy Creek Water Control and Improvement District, March 2020), 4.

Table 2. Dam Rehabilitation Project Types

Project	Description
Embankments	As earthen dams age, they are likely to experience two problems: (1) embankment slope stability issues due to the soil settling and weakening or as animal or people compromise the vegetation, and (2) underground seepage due to the natural flow of streams and groundwater. Embankment rehabilitation projects to prevent dam failure include reinforcing the surface of the dam and/or flattening slopes to solve stability issues, installing toe drains and/or reinforcing downstream slopes to solve seepage issues, and performing studies. To secure and protect the embankments, access control features, including fencing, gates, driveways, and warning signage, may be installed at dams whose surroundings have become increasingly developed and may require replacement or upgrade at dams where they already exist. Additional easements or property may be required for the improvements. Most of the District's dams also have a concrete parapet wall on top of the embankment, which may require rehabilitation or replacement due to structural or stability issues. Parapet walls can also allow flanking (where water escapes around the side of the wall), which can be prevented by either extending or replacing the wall with earth that extends to meet natural grade. Embankment rehabilitation projects will evaluate the most cost-effective ways to alleviate current issues and protect against future ones.
Principal Spillways	Principal spillways consist of multiple elements that can deteriorate with age, including the conduit, riser, trash rack, inlet and outlet structures, and stilling basins. Rehabilitation projects may include replacement or reinforcement of these elements, adding flood storage capacity through the installation of a secondary principal spillway, and performing studies. Additional easements or property may be required for the improvements. Rehabilitation projects will evaluate the most cost-effective way to remediate current issues and optimize the principal spillway capacity.
Auxiliary Spillways	Aging auxiliary spillways may experience erosion (particularly where the spillway meets the downstream waterway) and flanking (where water escapes from the spillway). Rehabilitation projects may include reinforcing the spillway to prevent erosion, raising the side of the spillway to prevent flanking, and performing studies. Additional easements or property may be required for the improvements. Rehabilitation projects will evaluate the most cost-effective way to strengthen the auxiliary spillways and protect against future issues.

5.2 FLOOD MITIGATION PROJECTS

In addition to identifying necessary rehabilitation projects for existing dams, the past studies performed by the District have analyzed and prioritized other damage centers based on risk. Accordingly, Table 3 describes the two highest priority projects that the District will undertake in partnership with local governments. As bond capacity allows, other flood mitigation projects identified by the studies described in Section 4 are also anticipated to be funded and implemented.

Table 3. Flood Mitigation Projects in High-Risk Damage Centers

Lake Creek (Dam 101)	The proposed multi-phase project, initiated in partnership with the City of Round Rock, includes the construction of a new dam – Dam 101 – to protect life and property for more than 380 residents. The project also protects infrastructure and improves emergency access to the area by reducing flood risk at multiple road crossings.
Block House Creek	The proposed multi-phase project, in partnership with the City of Cedar Park, plans for construction of channel and other improvements to protect life and property for more than 200 residents. The project also protects infrastructure and improves emergency access to the area by reducing flood risk at multiple road crossings.

6 SUMMARY OF COSTS

The following is a summary of costs for the Dam Rehabilitation and Flood Mitigation projects for the Upper District. Additional detail on the construction costs can be found in Appendix A.

Construction Costs

Dam Rehabilitation Projects, including Embankments, Principal Spillways, and Auxiliary Spillways*	$ 26,069,000
Flood Mitigation Projects, including Lake Creek (Dam 101) and Block House Creek*	$ 39,000,000
Land Acquisition/Easements	$ 9,230,000
Subtotal Construction Costs	$ 74,299,000

** includes Engineering and Contingency Costs*

Non-Construction Costs

Legal Fees (3%)	$ 2,229,000
Financial Fees (2%)	$ 1,486,000
Bond Discount (3%)	$ 2,229,000
Issuance Costs (1.5%)	$ 1,114,000
Inflation	$ 3,643,000
Subtotal Non-Construction Costs	$ 10,701,000
TOTAL BOND AUTHORIZATION	**$ 85,000,000**

7 FINANCIAL SUMMARY

The District utilizes the majority of its current maximum two-cent tax rate to slowly raise capital funds. Less than a third is required for ongoing operations and maintenance (O&M). The existing two-cent tax can support debt payments for over $100 Million of bond debt. Based on the current property development within the District, it is projected that the bond dept payments coupled with the O&&M costs will not require the full two-cent tax rate.

7.1 PROJECTED BOND REQUIREMENT

Based on the estimated costs for the drainage facilities and improvements necessary throughout the District for dam rehabilitation and flood mitigation, the projected total bond requirement is $85,000,000. The amount and timing of bonds actually issued will be subject to other factors, including the rules and permitting by TCEQ.

7.2 PROPOSED TAX PLAN

The proposed tax plan for the District is an annual ad valorem tax levied on the property within the District to support the debt service on the bonds.

Appendices

Appendix A: Project Cost Sheets

DAM REHABILITATION PROJECTS

Dam Rehabilitation Project Type	Quantity	Unit Costs	Total Costs
Embankment Projects			
Slope Instability Repairs	3	$ 1,500,000	$ 4,500,000
Flanking Flow Studies	4	$ 50,000	$ 200,000
Flanking Flow Repair	1	$ 300,000	$ 300,000
Slope Instability Studies	3	$ 100,000	$ 300,000
Slope Instability Repairs from New Studies	2	$ 1,000,000	$ 2,000,000
Embankment Crack Maintenance	6	$ 150,000	$ 900,000
Parapet Wall Maintenance	2	$ 500,000	$ 1,000,000
High Pool Seepage Monitoring	5	$ 50,000	$ 250,000
High Pool Seepage Fix	2	$ 750,000	$ 1,500,000
Crest Road Maintenance	1	$ 1,000,000	$ 1,000,000
		Embankments Subtotal	**$ 11,950,000**
Principal Spillway Projects			
Study Seepage at Principal Conduit	1	$ 50,000	$ 50,000
Slipline Principal Spillway	3	$ 85,000	$ 255,000
Install Secondary Principal Conduit	4	$ 1,150,000	$ 4,600,000
		Principal Spillways Subtotal	**$ 4,905,000**
Auxiliary Spillway Projects			
Flanking Flow Studies	4	$ 50,000	$ 200,000
Flanking Flows Repair	1	$ 300,000	$ 300,000
Auxiliary Spillway Erodibility Studies	5	$ 100,000	$ 500,000
Auxiliary Spillway Headcut Repairs	2	$ 500,000	$ 1,000,000
Repair Erosion on Aux Spillway Dike/Embankment	2	$ 1,000,000	$ 2,000,000
		Auxiliary Spillways Subtotal	**$ 4,000,000**
		Dam Rehabilitation Projects Subtotal	**$ 20,855,000**
		Contingencies (10%)	**$ 2,086,000**
		Engineering (15%)	**$ 3,128,000**
		Dam Rehabilitation Projects Total	**$ 26,069,000**

FLOOD MITIGATION PROJECTS

Lake Creek (Dam 101) Flood Mitigation **$ 31,500,000**

The Lake Creek (Dam 101) Flood Mitigation project is under design by AECOM and the Dam 101 portion is at 60% PS&E. The total cost estimate includes engineering, construction, and contingency costs for all phases of the project.

Block House Creek Flood Mitigation **$ 7,500,000**

The first phase of the Block House Creek Flood Mitigation project is under design by Scheibe Consulting and is at 30% PS&E. The total cost estimate includes engineering, construction, and contingency costs for all phases of the project.

Flood Mitigation Projects Total **$ 39,000,000**