Burleigh County Water Resource District

P.O. Box 1255
Bismarck, North Dakota 58502-1255
(701) 354-1501
Website: www.bcwrd.org

Burleigh County, North Dakota

FOX ISLAND FLOOD CONTROL OPERATION & MAINTENANCE MANUAL

April 2021

OPERATION & MAINTENANCE MANUAL

Fox Island Flood Control Project

Burleigh County, North Dakota

April 2021

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

Michael H. Gunsch

North Dakota Reg. No. PE-3052

Houston Engineering, Inc.
3712 Lockport St.
Bismarck, ND 58503
Phone # 701-323-0200
HEI No. 6025-0006

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Registered Professional Engineer under the laws of the State of North Dakota.

Travis G. Johnson

North Dakota Reg. No. PE-5746

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

The Fox Island Flood Control Project (Project) was constructed starting in the fall of 2018 and competed in October 2020 to provide flood risk reduction to parts of southwest Bismarck, North Dakota. The Project includes an earthen levee, three gatewells, and a grade raise along Gallatin Loop, Gallatin Drive and Farwest Drive within the Fox Island Subdivision, tying into the existing the previously raised Tavis Road. The project was designed primarily to protect 105 rural residential properties within the Fox Island Area. Fifty-nine of these properties are included in the Construction Assessment District, while all 105 are part of the Operations and Maintenance District. The project was constructed according to City of Bismarck Construction Specifications for Municipal Public Works Improvements, which states that the Contractor shall guarantee all work and materials and performance of the finished project free from material defect or failure for a period of two years from the date of final payment. Final payment to Northern Improvement Company was approved on October 14, 2020. This Project was established by the Burleigh County Water Resource District (BCWRD). It was funded through a special state legislative appropriation, an allocation from Lincoln Township via the Burleigh County Commission, and the remaining funding was secured through a special assessment district under NDCC 61-16.1.

1.1 PURPOSE OF MANUAL

This operation and maintenance manual summarizes the procedures required for project maintenance during non-flood times and operations during flood events.

The manual has been organized with maps, drawings, and references to the pertinent components for project operations and maintenance. It begins with a project description, followed by standard maintenance procedures, and then concludes with operational procedures for impending flood situations, during flood operations, and post-flood operations.

1.2 AUTHORITY

The Burleigh County Water Resource District completed construction on the Fox Island Flood Control Project after initiating project evaluations after the 2009 ice jam event. The BCWRD is responsible for the operation and maintenance functions and all activities are coordinated under their authority with actual operations as noted below. The BCWRD has intentions to secure the services of the Burleigh County Highway Department to assist with O&M activities, however, any such agreement is outside the content of this manual.

1.3 RESPONSIBLE PARTY CONTACTS

Flood control regulations strongly recommend the BCWRD appoint a Project "Superintendent," who is responsible for the development and maintenance of, and directly in charge of, an organizational structure responsible for efficient facility operations during flood periods and for continuous inspection and Project maintenance works during periods of low water. The BCWRD has designated the Fox Island portfolio lead as Fox Island Flood Control Project Superintendent.

Parties that have been provided a copy of this O&M Manual for their use are listed in Appendix H.

1.3.1 NOTIFICATION

Additional contact information including entity and telephone numbers are provided below. The Superintendent should verify and update these contacts and phone numbers at least annually or as necessary.

Agency	Telephone Number
City of Bismarck – Engineering	(701) 355-1505
City of Bismarck – Public Works	(701) 355-1700
City of Bismarck – Police Department	(701) 223-1212
City of Bismarck Emergency Management	(701) 222-6727
Bismarck Rural Fire Department	(701) 258-5792
Burleigh County Highway Department	(701) 204-7748
Burleigh County Sheriff's Department	(701) 222-6651
Burleigh County Emergency Management	(701) 222-6727
Burleigh County Water Resource District – James Landenberger	(701) 426-6439
North Dakota Department of Emergency Services	(701) 328-8100
North Dakota Department of Transportation Bismarck District	(701) 328-6950
National Weather Service (Bismarck)	(701) 250-4224

1.4 PROJECT LOCATION

The Project is located primarily within dedicated public roadway right-of-way and on easements within private property in the Fox Island Subdivisions southwest of the City of Bismarck city limits, Burleigh County, North Dakota. The Project area is bound on the north by the Whispering Bay Subdivision, on the west by the Missouri River, on the east by Tavis Road, and on the south by the Lincoln Township Roadways north of the Missouri River oxbow channel. **Figure 1** shows the Project location with respect to the City of Bismarck.

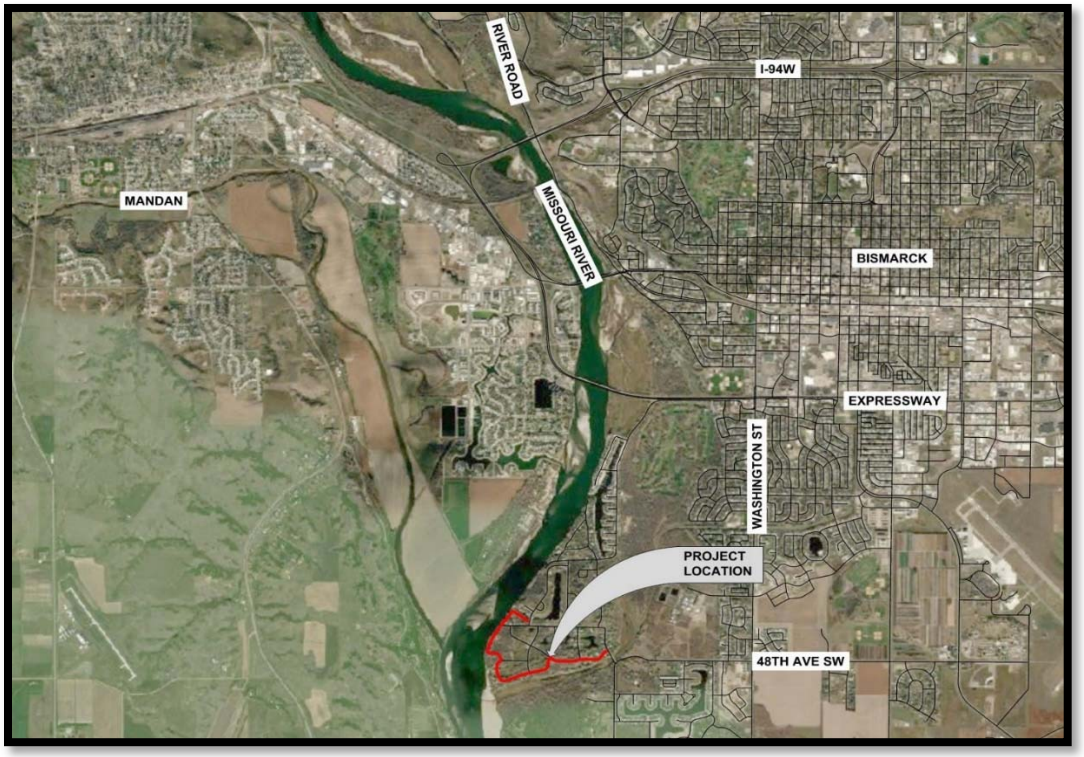

Figure 1: Project Location Map

1.5 PROJECT FEATURES

The Project utilizes an earthen levee, roadway grade raise, and three drainage structures to mitigate Missouri River flooding effects and reduce reliance on emergency measures for southwest Bismarck and Fox Island properties. The following sections describe the various project components. ***Appendix D*** includes the plan and profile drawings within the completed record drawings. The stationing begins at the west end on Gallatin Loop and extends in two runs, with the first heading approximately west then north and the second heading south then east. The north run is an earthen levee approximately 3,450 feet long and heads west to the Missouri River and then northeast paralleling the Missouri River and then east paralleling along the south side of the Whispering Bay access channel to Langer Lane. The southeast run, a township road grade raise, is approximately 5,656 feet long heading south on Gallatin Loop and then east on Gallatin Drive and Farwest Drive to the intersection with Tavis Road. An overview of the project features is illustrated in **Figure 2.** Note this project was designed to work in concert with flood control facilities previously constructed by the City of Bismarck, Burleigh County, and BCWRD under the *Burleigh County 20-Foot Flood Plan*. The Burleigh County Emergency Management Flood Annex document, dated February 2020, contains Action Plan sheets which indicate action levels and action plans for flood control structures for the City of Bismarck. The Control Structures contained in this Operations and Maintenance manual are shown on the Fox Island Action Plan sheet in Appendix 4 of the Flood Annex.

1.5.1 LEVEE

This Project consists of approximately 9,106 feet of grass covered earthen levee and raised paved roadway section. The north end of the earthen levee was constructed to with a top elevation set at 1637.24, and the proposed profile called for a 0.00% grade from Station 134+50 near Whisper Drive to the northwest until Station 125+84, where the grade changes to 0.02% and the levee turns southwest to Station 107+50 and then East until it reaches an elevation of 1637.02 at Station 100+00, where the north leg of the levee begins. At Station 0+62, the levee top elevation is set at 1636.84 and the levee continues south at a -0.02% grade to Station 10+00 and then east at a 0.00% grade to Station 55+78 where the levee top elevation is set at 1636.63. Up to two (2) inches of long term settlement is expected, resulting in slightly lower long term settled top of levee elevations. The side slopes on both the wet and dry sides are set at 4:1. The long-term settled elevations will provide the design minimum freeboard criteria of 0.7 feet based on the recorded water surface elevations experienced during the historic 2011 flood. This is based on the *Burleigh County 20 Foot Flood Plan*, adopted by the Burleigh County Commission and the City of Bismarck.

1.5.2 DRAINAGE STRUCTURES

As part of the project, an existing 24" RCP was removed, and a new culvert installed with a Gatewell Control Structure containing a 24"x24" sluice gate at Station 18+28 to allow surface waters to flow south out of the of Fox Island lake complex area (see **Figure 2**). Structure #1 ensures that during large summer rainfall events, or excessive groundwater elevations, like those occurring in the fall of 2019, water can be released south into the Missouri River. The invert elevation of this gated closure is approximately elevation 1627.76. The top of the Gatewell manhole is at elevation 1635.79. In addition, a pump discharge line was installed adjacent to and just west of this Gatewell structure for water removal from behind the levee when the gate is closed. The Gatewell system operational parameters are outlined in a *Pipeline Easement and Waiver* agreement contained in ***Appendix E***. This discharge line is equipped with a 6 inch camlock connection and conveys water to the Missouri River backchannel south of Fox Island.

An additional 18" RCP culvert and Gatewell Control Structure was installed near the east end of the roadway section to provide an additional drainage location near Sta. 41+59 (see **Figure 2**). The invert elevation for Structure #2 is approximately 1631.77. The top of the Gatewell manhole is at approximately elevation 1635.75. This location was not set up to accommodate a pump removal system and is simply a levee closure location.

Structure #3 is located along Whisper Drive on the east side of the Whispering Bay Marina, and with the street right-of-way as shown in the upper portion of **Figure 2**. The Whisper Drive roadway was elevated as part of the development. The invert elevation for Gatewell Control Structure #3 is at approximately elevation 1628.34. The top of the gatewell manhole is at approximately elevation 1638.50. This location was designed to accommodate a pump removal system to remove water from the inland side within the northern Fox Island development area. These surface waters are pumped west into the river side of this two-cell structure through access hatches in the cover when the gate is closed during a flood event.

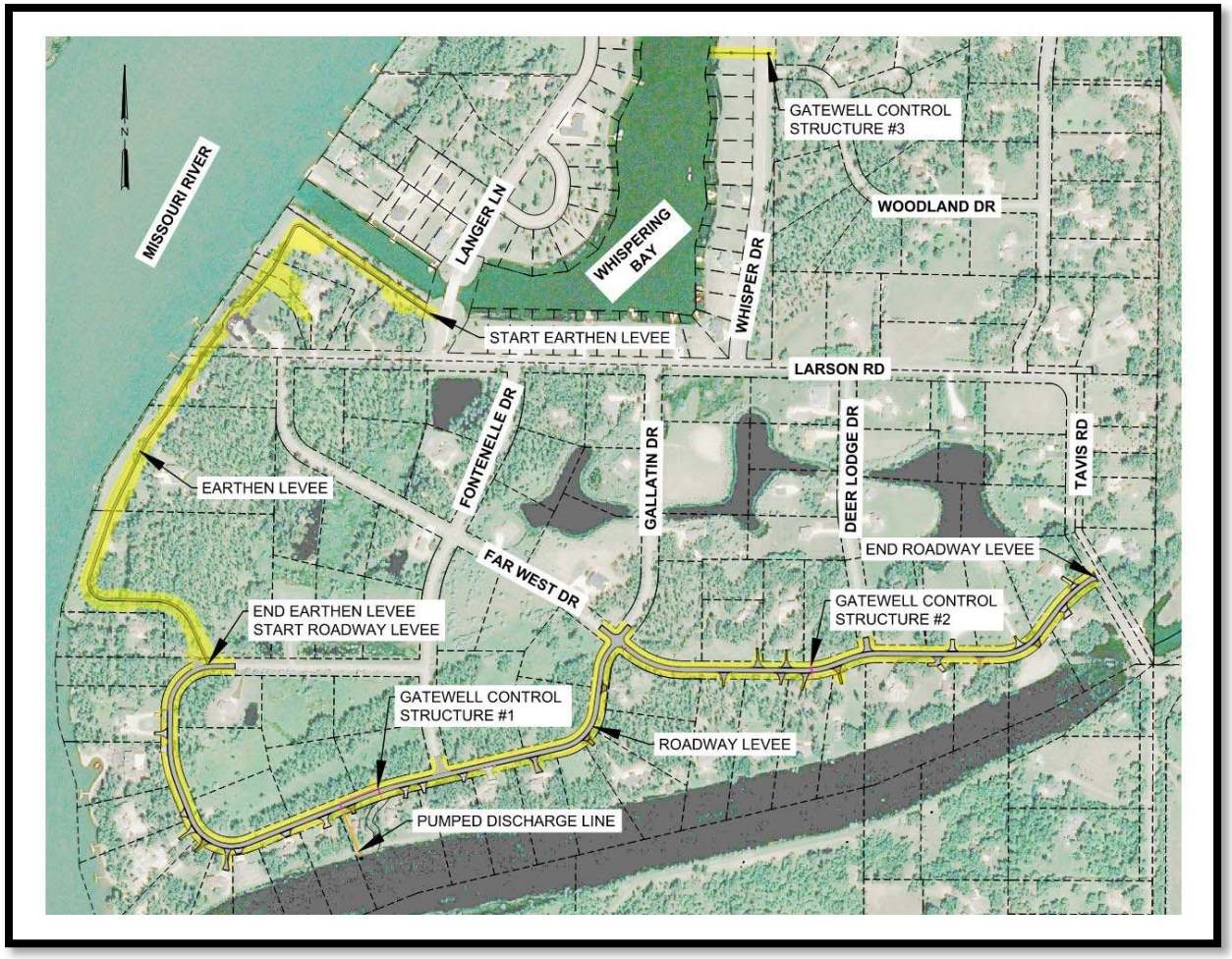

Figure 2: Fox Island Flood Control Project Features

Table 1: Storm Sewer Outfall Summary

Outfall		Gravity Outfall	Outfall Characteristics
Structure Number	Location		
1	West Gatewell (#1) (Sta 18+28)	24" RCP	Gatewell Manhole with Sluice Gate
2	East Gatewell (#2) (Sta 41+59)	18" RCP	Gatewell Manhole with Divider Wall and Sluice Gate
3	Whispering Bay Gatewell (#3)	24" RCP	Gatewell Manhole with Divider Wall and Sluice Gate {Note: The O&M on this facility is completed by the Burleigh County Highway Department}

Figure 3: Gatewell Structure #1

1.6 DATUM AND USGS GAGE

Elevations in this manual, unless otherwise noted, reference the North American Vertical Datum of 1988 (NAVD88), which is the same datum as the Burleigh County DFIRM's. River stages are referenced to the USGS Gage 06342500 (Bismarck Gage) located in Bismarck, North Dakota. Gage zero datum elevation is 1,618.28, National Geodetic Vertical Datum of 1929 (NGVD,29) which equates to an elevation 1619.62 (NAVD88).

1.7 FLOOD HISTORY

The Missouri River has a long history of flood risks along with frequent recent occurrences. Three of the top four recorded flood peaks have occurred in the last 24 years (including 1997, 2009, and 2011). **Table 2** shows the top 10 peak flood stages recorded at USGS Gage 06342500, Missouri River at Bismarck, ND (Bismarck Gage) during the post-Garrison Dam period from 1954 to 2020.

Table 2: Top Ten Recorded Peak Flood Stages (1954-2020)

USGS 06342500 Missouri River at Bismarck, ND			
Ranking	Year	Streamflow (cfs)	Stage (ft)
1	7/1/2011	155,000	19.25
100-year (BFE)			18.20
2	3/24/2009	30,000	16.11
3	6/13/1975	68,900	14.24
4	6/25/1997	59,500	13.98
5	2/25/1987	35,000	13.92
6	2/14/1988	34,000	13.33
7	3/27/1960	35,000	13.27
8	2/5/1989	26,500	13.12
9	3/25/2019	25,900	13.05
10	1/17/1992	24,000	12.70

1.8 PROJECT PERFORMANCE

The Project greatly enhances the County and City's flood fighting capabilities throughout the Fox Island, Whispering Bay, and SouthBay neighborhoods, as well as protection for the City of Bismarck Sanitary Sewer Treatment facilities. The top of levee elevation provides at least 0.7 feet of freeboard above the 2011 maximum recorded River Stage of 19.25, after all anticipated settlement has occurred. The Project will not provide FEMA accreditable protection to remove the flood insurance requirement, as that requires three feet of freeboard above the 100-year or base flood elevation (BFE), which was uneconomical under the ***Burleigh County 20-Foot Flood Plan***.

1.9 BURLEIGH COUNTY FLOOD INSURANCE STUDY

The BFEs in this manual reflect elevations documented in the Burleigh County Flood Insurance Study (FIS)[1] and the Burleigh County DFIRM, effective January 16, 2015. The DFIRM can be referenced on FEMA's Map Service Center website at the following link: https://msc.fema.gov/. As identified in ***Table 2***, the USGS gage height of the 100-year BFE at Bismarck is 18.2 feet. The DFIRM is currently under review by FEMA and the NDSWC, however it does not change the recorded 2011 flood elevations and the system design basis.

1.10 GENERAL REGULATIONS AND PROCEDURES

1.10.1 REGULATIONS

This manual is a guide for the operation and maintenance of the Fox Island Flood Control Project. Responsible officials should follow the flood control operation and maintenance requirements included in subsequent sections of this manual and are generally summarized as follows:

- Structures shall be continuously maintained and operated as necessary to obtain the maximum benefits.
- The responsible party for operation and maintenance shall appoint an official "Superintendent". This person is responsible for the efficient operation of all structures and facilities during flood periods and periodic inspections during periods of low water.
- A reserve supply of materials needed for a flood emergency shall be available at all times.
- No encroachment or trespass that will adversely affect efficient system operation shall be permitted.

- No improvements or construction shall be conducted on or near the Project features without prior determination that such activities will not adversely affect the functionality of the protective measures. Any improvements found to be desirable should be completed in accordance with standard engineering practice.
- Superintendent shall prepare an Annual Levee Inspection Report covering inspection, maintenance, and operation of the protective works. This annual report shall be kept on file with the BCWRD and be incorporated into this manual.
- Owner shall always have access to all portions of the protective works.
- Necessary maintenance measures shall be promptly taken or made.
- Appropriate measures shall be taken to ensure the activities of all private and public entities are coordinated with the activities of the Superintendent and to prevent adverse impacts to or obstruction of the levee (e.g., private adjacent sand bagging efforts, public works activities, wastewater and sanitary protection efforts, etc.).

1.10.2 IMPROVEMENTS AND PROJECT MODIFICATIONS

The BCWRD should consider the implications, if any, that may arise from project improvements or modifications as such changes may affect the operation, maintenance, or any other aspects of the levee and grade raise effectiveness. This operation and maintenance manual may need to be revised to reflect these changes.

1.10.3 ENCROACHMENT OR TRESPASS ON RIGHT OF WAY

No encroachment or trespass which may adversely affect the efficient operation or maintenance of the project works shall be permitted on the rights-of-way for the levee and roadway system. The Superintendent shall be vigilant for encroachments or potential encroachments and shall coordinate with landowners and public entities within the right-of-way to prevent encroachments or other adverse impacts to the levee. The Superintendent shall resolve encroachments and affect removal or other mitigating action to the extent deemed necessary under their authority, local ordinances, and easements (**Appendix E**) to prevent or remove the encroachment.

A Vegetation Free Zone (VFZ) shall be enforced which prevents trees and woody vegetation from existing within 15 feet of the levee/roadway toe. The VFZ shall only apply to woody plants. Grass and non-woody vegetative cover that will inhibit erosion is encouraged. The VFZ maintains the levee/roadway integrity and ensures access exists for inspection, maintenance, and emergency flood fighting efforts. The VFZ also helps prevent tree roots from penetrating the earthen levee/roadway or undermining the foundations of the flood protection measures. Existing trees within the 15-foot VFZ shall be reviewed on a case-by-case basis to evaluate their effects on the levee system. Additional vegetation management guidance should follow *USACE Engineering Technical Letter 1110-2-583* [2].

1.10.4 ANNUAL INSPECTION REPORT

The Superintendent must prepare a report documenting the annual inspection. This inspection is recommended to occur in early August each year to provide sufficient time for repair or maintenance needs before winter freeze-up. The levee system will then be prepared for spring runoff and potential flooding. The inspection should follow the last mowing or an annual mowing, as deemed necessary, to provide a cleaner landscape for locating cracks, animal burrow holes, and other concerning issues within the levee system.

A report format has been included in ***Appendix B.1*** that will be used to document the annual inspection. Each inspection shall include information with additional notations of issues or needed Project maintenance. Individual record drawing sheets from ***Appendix D*** should be attached to each inspection report to describe the locations for any required corrective measures. The inspection reporting should be revised as needed to document the levee system conditions to preserve their effectiveness. At a minimum, the report should include a summary of the following:

- Maintenance work identified during previous inspections
- Maintenance work completed since the last inspection report
- Noted deficiencies where corrective actions should be taken
- Items of potential concern that do not require immediate action, but should be monitored
- Maintenance work scheduled for the next year
- Any changes that need to be made to the operations and maintenance plan
- Changes in the Superintendent and in other normal or emergency contacts since the last inspection report.
- The manner in which the project functioned during any period of high river flow since the previous report
- Current condition of the Levee System and Storm Sewer Outfalls
- Any other information pertinent to operation and maintenance
- Include photographs of deficiencies with identified locations marked on the maps from ***Appendix D***.

1.10.5 FIVE-YEAR INSPECTION

In addition to the annual inspection, every five years a more in-depth project inspection should be conducted by the BCWRD. The five-year inspection report will include a review of design documents and an assessment of the project's structural integrity. Visual review of the inlet and outlet pipes and gate structures is required along with a survey to verify that appropriate levee height is still being maintained. A copy of the five-year inspection shall be maintained by the BCWRD and retained in this O&M Manual.

1.10.6 POST-FLOOD AFTER ACTION REPORT

It is advised that a Post-Flood After Action Report be created to document how the system operated after each declared flood event. The documentation provides an opportunity to improve upon future flood mitigation efforts. A generalized example of a Post-Flood After Action Report outline is provided in **Appendix B.2**. Additional detail pertaining to development of the Post-Flood After Action Report is summarized in *Section 6 – Post Flood After Action Report*.

1.10.7 REPORTING EVIDENCE OF STRUCTURAL DISTRESS

Any evidence of structural distress of flood control project features should be documented and considered for immediate or future repair. Typical conditions that would indicate distress or initiation of a potential failure include:

- Settlement, sliding, or excessive ground deformation within or near the levee system
- Evidence of internal erosion (piping) in the vicinity of the levee system
- Excessive seepage or an observed increase in seepage quantities through or under the levee system
- Unusual vertical or horizontal movements of the levee system
- Excessive deflection, displacement, or cracking of concrete structures such as gatewells or internal asphalt or concrete lining
- Vibration, binding, or unusual noises or movement associated with gate operation
- Any other indications of distress or potential failure that could inhibit project operation

2 ORDINARY INSPECTIONS, MAINTENANCE AND OPERATIONS

2.1 GENERAL

This part of the operation and maintenance manual describes the normal operation and maintenance procedures that must be followed when there is no threat of flooding to ensure the project will continue to provide protection in the event of a flood.

Prior to any inspection or maintenance activities on their property, notification shall be given and access to the levee shall be coordinated with the private landowners. Contact information is provided in **Appendix H**.

Ordinary project maintenance shall follow an established annual recurrence and shall include maintenance work found necessary in annual inspections. In addition, on intervals not to exceed every 5 years, the condition of all culverts/discharge pipes and other drainage structures should be reviewed using television video camera or visual inspection. A top of levee survey should be completed on 5-year intervals. The specific sections referenced are as follows:

- Levee, Drainage Structures, and Erosion Protection

2.2 LEVEE

The Superintendent shall provide maintenance as needed to ensure serviceability of the structures during flood events. The top, side slopes, and all areas within 15 feet of levee toe shall be kept free of brush, trees, and other undesirable vegetation. Should excessive vegetation grow within these areas, it shall be removed even with the ground surface and have treatment applied to kill the root system. The levee system shall also be kept free of animal burrows, which can affect performance during a flood. Additional repair may be required if burrowing animals or decaying root systems have caused voids in the levee system.

The same area shall be kept free of encroachments, such as unauthorized structures, tillage, excavation, pathways, or any other unauthorized use that is detrimental to the performance of the levee system.

Grass-covered slopes shall be mowed on a regular basis. At a minimum, mowing must be completed annually to ensure the serviceability and inspection of the system. Mowing promotes deeper establishment of the root system, which provides increased resistance to erosion due to precipitation and floodwaters. Regular mowing also discourages establishment of trees and brush. Any areas of the levee that become eroded due to natural forces or cracked due to settlement shall be repaired and replanted with an appropriate grass seed mix.

Any disturbance to the levee structure, including the placement of signs, utilities, pathways, etc. shall be coordinated with the Superintendent to ensure compatibility with the flood control features.

The levee height shall be monitored annually to note any differential settlement of the top of levee. At intervals not to exceed 5 years, levee top elevations should be surveyed to ensure design height is being maintained.

2.3 DRAINAGE STRUCTURES

Maintenance and inspection should follow the manufacturer manuals supplied in **Appendix C**. Manually operated sluice gates shall be examined, oiled, and trial operated annually. Operating wrenches for the sluice gates have been provided and are being stored at the Burleigh County Highway Department maintenance shop. Gatewell Manhole #2 has a handwheel operated sluice gate.

Pertaining to the flood control gates and structures, annual inspections and exercising of all gated outlets should be coordinated and conducted jointly with the Burleigh County Highway Department (701-204-7748) to ensure that personnel are adequately informed of the location and trained in the operation of drainage structures. Inspections shall also ensure that:

- Encroachments are not within 15 feet of the drainage structures
- Pipes, gates, and operating mechanisms are in good condition and operate as designed
- Precast concrete, end sections, trash racks, and headwalls as applicable are in good condition
- Inlet and outlet channels and gate manholes are open and free from debris
- Erosion is not occurring adjacent to structures which might endanger water tightness or stability

The exact interval at which specific operations take place shall be subject to the discretion of the Superintendent depending on the circumstance. Due to the frequency of flooding (major flooding is typically caused by spring runoff, major summer Garrison releases, and/or ice jams), it is advised that these inspections be required on an annual basis. Immediate steps should be taken to repair damage, replace missing or broken parts, or remedy adverse conditions disclosed by such inspections. Periodic video or visual inspections per Section 2.1 will also be required.

Normal gate operation involves keeping gates fully open allowing for the free flow of water through the structure.

2.4 EROSION PROTECTION

The levee embankment and foundation shall be protected by permanent grass cover. Areas where grass cover has been damaged or destroyed shall be restored or replaced so as not to compromise the integrity of the levee.

Areas with stone or precast concrete riprap shall be kept free of brush, trees, and undesirable vegetation that can hinder inspection. Any brush, trees, or undesirable vegetation within areas that have been protected with stone or precast concrete riprap shall be sprayed with an approved herbicide, and the large brush and trees cut off at grade. Stumps will be treated to kill the root system. Stone or precast concrete riprap displaced by natural events or human intervention will be replaced. Prompt replacement of stone or precast concrete riprap is necessary to prevent degradation of the underlying aggregate or geotextile filter and accelerated degradation of the erosion protection system.

Grass cover should be mowed prior to the fall inspection to provide a better opportunity to identify cracks, animal burrows and other issues with the embankment material.

3 IMPENDING FLOOD – INSPECTIONS, TESTS, AND OPERATIONS

3.1 GENERAL PREPARATION FOR FLOOD EMERGENCIES

The maintenance procedures in Section 2 allow the system to be ready for operation should it be needed. The procedures in this section will guide operations after a flood event has been forecasted. The procedures shall begin each spring before initial runoff and as necessary when the National Weather Service generates its flood forecasts.

When flood stages are imminent, the BCWRD shall arrange for mobilization of necessary personnel, equipment, and supplies depending on the forecasted crest. The mobilization shall ascertain that all personnel are familiar with the operating procedures, and that sufficient personnel are available to provide the required surveillance of all project components during the flood.

3.2 FLOOD WARNING AND PREDICTION

The National Weather Service (NWS) – Advanced Hydrologic Prediction Service provides flood warning and prediction forecasts and outlooks for the Missouri River. Critical flood events on the Missouri River that would cause project operation will predominantly occur during large summer releases from Garrison Dam and/or winter/spring ice jam events. The NWS provides probabilistic outlooks leading up to a flood event. As the Missouri River begins to rise, a 7-day and three week deterministic forecast is then produced by the USACE with estimated river stages and crest dates. This information typically provides sufficient lead time to complete closure of the Gatewell structures before floodwaters reach critical stages. The NWS references the Bismarck Gage previously mentioned in Section 1.

Web-link: http://www.weather.gov/mbrfc/

3.3 SUPERINTENDENT RESPONSIBILITIES

Floodwaters reach critical project components at different river stages. If flood forecasts show the Missouri River will reach or exceed 12 feet, which results in a Missouri River elevation of approximately 1628.0± at the project site, the Superintendent shall begin taking the necessary actions to prepare for an impending flood. Throughout the preparation process, the Superintendent shall use discretion as to the extent of action necessary based on the forecasted flood levels and coordinate with other activities included in the Burleigh County Flood Annex.

Actions may include the following:

- Review this operations and maintenance manual.
- Assemble and maintain sufficient personnel to provide patrolling of project features while the river remains above the critical elevations of components described in **Table 3**. These elevations generally reflect the ground elevation on the dry side of the system. The frequency of the surface patrol shall be at the discretion of the Superintendent based on the current river stage, flood forecast, and associated risk in cooperation with Burleigh County Emergency Management and the Burleigh County Flood Annex.
- Ensure responsible personnel are familiar with and assigned to implement the operating procedures and flood fight activities as indicated for the Fox Island Action Plan sheet included in Appendix 4 of the Burleigh County Flood Annex.
- Arrange for mobilization of all necessary personnel, equipment, and supplies.
- Perform a pre-flood inspection to ensure drainage gates will close and are not frozen or bound with debris and seats are clear of sediment.
- Perform maintenance necessary to ensure sufficient operation
- Monitor rainfall and stream flow forecasts when gates become closed

Table 3: Levee System Patrolling Stages

Name	Project Stationing			River Stage (ft)
	Upstream	Downstream	Elevation	
Reach 1 – Earthen Levee	100+00	134+50	1632.0	16
Reach 2 – Roadway	0+00	56+56	1630.0	14

3.4 PREPARATION OF LEVEE

Once a deterministic flood prediction has been made that has forecasted the Missouri River to reach or exceed a stage of 11 feet, the Superintendent shall conduct a pre-flood inspection to ensure that the levees are sufficient to provide the designed level of flood protection. At this time, inspection and maintenance records from the previous fall inspection should be reviewed to verify that there are no outstanding issues. Any critical maintenance or repairs should be completed before the start of the flood. Actual patrolling of the levees shall start when the flood waters reach the river stages defined in ***Table 3***. The levee should be patrolled, and all features monitored from this time until the floodwaters recede below the critical river stage. The inspection frequency shall be determined by event severity and forecasted water elevations to ensure adequate monitoring.

3.5 PREPARATION OF DRAINAGE STRUCTURES

If the Missouri River is forecasted to reach a river stage of 11 feet, the Superintendent shall conduct a pre-flood inspection to ensure that the drainage structures will operate and close properly once the floodwaters rise and gates need to be closed. Any trash, debris, ice, or other obstructions in drainage structures shall be removed. Inspection shall also involve checking, servicing, and trial closure. These procedures also apply to gates not ordinarily operated during floods to assure that they will operate in an emergency, if needed. The gate manuals in ***Appendix C*** should be consulted, as necessary. ***Table 4*** presents various gate information including the BFE at the gate location, the invert of the gate closure (and corresponding river stage), and the elevation and approximate river stage when the gate shall be closed (Gate Closure Trigger) in accordance with the critical drainage structure closure elevations listed in **Table 4**. At the option of the Superintendent, the gates may be closed when the river stage is at a lower elevation if the projected river stage is forecast to reach the Gate Closure Trigger elevation, or as a general precaution during periods of increased flood risk. Structure #3 at Whispering Bay is included for reference only due to proximity but is not part of the Fox Island Action Plan.

Table 4: Critical Drainage Structure Closure Elevations

Outfall Location	Gate Invert		Gate Closure Trigger	
	Elevation (ft)	River Stage (ft)	Closure Elevation (ft)	River Stage (ft)
West Gatewell (#1)[1]	1627.76	10.25	1628.51	11.00
East Gatewell (#2)	1631.77	14.26	1631.76	14.25
Whispering Bay (#3)	1628.34	10.83	1628.51	11.00
{1} See Appendix E – Landowner Agreement for Gatewell operation				

4 DURING FLOOD OPERATIONS

4.1 GENERAL

The following sections summarize operations and provide details for the operation of specific project features. These operations will be conducted according to the Burleigh County Emergency Management Burleigh County Flood Annex and associated Action Plan for Fox Island included in ***Appendix 4*** of the Flood Annex, and in coordination with Burleigh County Emergency Management.

4.2 LEVEE

Periodic patrolling of the levee system will begin when the river reaches a stage as defined in ***Table 3***. At a minimum, patrolling operations should occur daily, but may be more or less frequent under the Superintendent's discretion while considering the flood magnitude. Patrolling operations should detect locations that require prompt action and correcting any conditions that might jeopardize the levee integrity and the stability of the outlet structures. Significant seepage or identified boils should be monitored closely and repaired promptly.

Patrolling may require removal of private fences and closures normally in place to prevent unauthorized access to the levee. A private fence near the west end of Larson Road and another near Langer Lane may need to be removed to allow access down the top of the levee for inspection, maintenance, or possibly to allow the placement of fill or sandbags on top of the levee. When these actions are initiated, additional traffic control and signage may be required to prevent the public from trespassing on the levee. When these actions are taken, notification will be given to the agencies listed in Section 1.3.1, as appropriate. An email list will be assembled for any residents that have provided an email address and request to be kept informed. They will be provided an email update regarding changes in flood status and other activities conducted in response to the highwaters. These activities should be coordinated with others described within the Burleigh County Flood Annex.

4.3 DRAINAGE STRUCTURES

The Superintendent will coordinate periodic inspections of the drainage structures, perform maintenance as necessary, and ensure that the gated outlets are operating properly. Procedures may include removing trash, debris, ice, or other obstructions. Exterior ditches should be observed during flooding to ensure that they have not become blocked with sediment, debris, ice jamming, or any other obstruction. River flood stages should be continuously monitored, and conditions reported to the protected residents.

4.4 FLOOD EMERGENCY CONDITIONS

A flood emergency is defined when the flood waters are projected to approach the base level capacity of the system to protect from a predicted flood event. Floodwaters may threaten to overtop the levee, seepage through or under the levee may become severe, or a large rainfall event may result in interior runoff that exceeds the capacity of the lakes from the inside via excess surface waters and creates adverse impacts to septic systems. All these will be cause for emergency action and standard operations. Emergency actions could include raising the top of the levee with fill or sandbags, performing emergency repairs to the levee, or bringing in portable pumps. Continuous monitoring of the levee should be performed during flood emergency conditions.

In the event that portable pumps are deemed necessary to remove water from behind the levee, two pumping locations have been designated to protect the properties within the special assessment district.

West Gatewell (#1): Gatewell #1 located at 3367 Gallatin Drive is identified as a pumping location and a pumping easement has been secured for the purpose of dewatering the adjacent property behind the levee and removal of water from the interior lake system. A pipe has been installed with a 6 inch camlock coupler next to the gatewell for connection to a portable pump to remove water. The operation of this discharge line versus open surface removal is governed under a *Pipeline Easement and Waiver* as described in **Appendix E.16.**

Tavis Road Pumping Easement (#2): A pumping easement exists between the properties at 3152 Tavis Road and 3202 Tavis Road for the purpose of setting up a temporary pump to remove water from the internal lakes and discharge downstream from the Tavis Road gate structure to the south. The pump is to be located at the west end of the pumping easement with the discharge pipe placed east down the pumping easement to Tavis Road, and then south along and within the west side of Tavis Road right-of-way to the Missouri River Oxbow at the Tavis Road gate structure, discharging on the west side.

Based on 2019 high groundwater and surface water conditions, it was generally determined that when water levels exceed elevation 1629.0 (NAVD ’88) within the lake system, pumping is recommended. Then pumping to maintain a water level of 1627.0 or lower internal lake elevations should be the goal during the flood emergency.

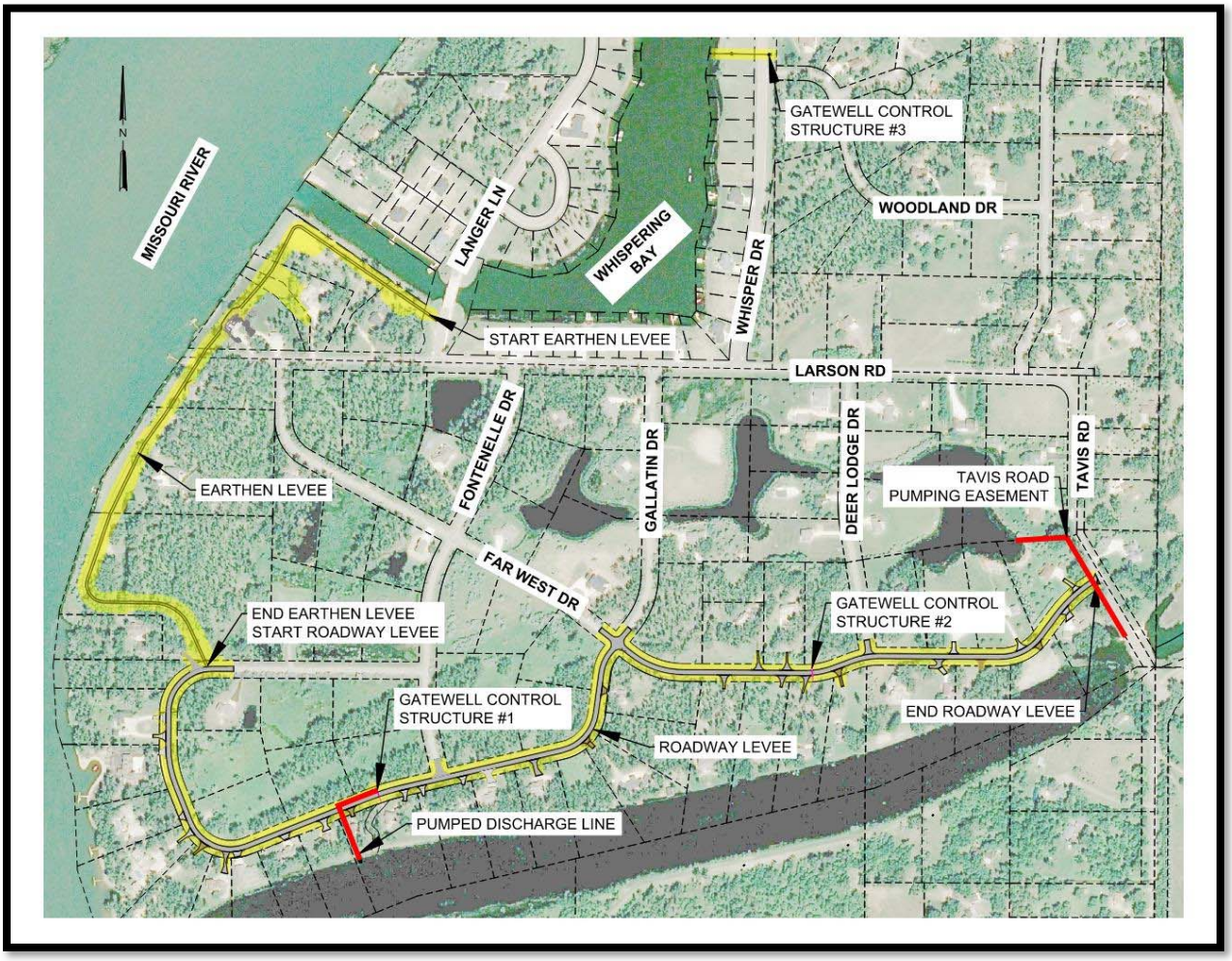

Figure 4: Fox Island Flood Pumping Locations

5 POST-FLOOD INSPECTIONS, TESTS, AND OPERATIONS

5.1 GENERAL

When a flood event is determined to have ended, or as soon as conditions permit, and in conjunction with other emergency agencies, the Superintendent shall coordinate cleanup of all flood control facilities, conduct an inspection and repair all damage to the levee system.

Demobilization of flood control activities should include the following:

- Release of emergency personnel
- Making an inventory of supplies and replenishing stockpiles as required
- Cleaning, storing, and replenishing equipment and parts
- Preparing a Post-Flood Report that includes flood activities, damages, and repairs (See Section 6)

When demobilization is complete, procedures should revert to normal operation and maintenance as described in *Section 2 – Ordinary Inspections, Maintenance, and Operations*.

5.2 LEVEE

All areas of levee damaged by high water should be repaired as soon as practicable following high-water events. Eroded areas should be brought up to the original levee cross section. Stone or precast concrete riprap that has been displaced, washed out, or removed will be replaced. Any areas in which the vegetative slope protection has been damaged should be repaired and seeded or sodded. Normal maintenance will then resume.

5.3 DRAINAGE STRUCTURES

Immediately following a flood, all drainage structures, including manholes, pipes, gates, drainage ditches, and headwalls should be examined for structural damage. Any defects should be corrected to ensure that the structures will function properly in the future. Necessary repairs should be completed as soon as possible.

Outlet channels and drainage ditches should be cleared of sediment and debris. Reshaping of the ditch and reestablishment of vegetative cover will be done, as necessary.

All missing or damaged rip-rap should be replaced along the flood protection embankments. Grass lining should also be restored where damaged in order to protect against future erosion.

6 POST-FLOOD AFTER ACTION REPORT

After each flood where operation of any component occurs, the Superintendent is encouraged to compile a post-flood after action report that covers all aspects of project activities. The report should document the complete flood history, including a log of operations and decisions based on the daily river stages, a discussion of pertinent factors in maintaining the project, and any other relevant information such as what worked and what should be changed prior to the next flood.

Operation and maintenance factors should include problems encountered (including the effects of ice on operation), damages incurred, repairs required, and any other significant occurrences during the flood. The record drawings within ***Appendix D*** can be used to reference locations for documented issues.

If possible, the report should include any other information about operation that may help make operations better during the next flood. Post-flood after action reports that are properly recorded, well documented, and readily available are valuable in planning to better respond to future flood events. A copy of the Post Flood After Action Report should be placed in this O&M manual for documentation and future reference. A sample Post-Flood After Action Report is provided in ***Appendix B***.

7 REFERENCES

1 Federal Emergency Management Agency (FEMA), Flood Insurance Study Number 38015CV000B, Burleigh County, North Dakota.

2 Department of the Army, Corps of Engineers, Engineering Technical Letter 583, “Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures”, 30 April 2014.

3 Houston Engineering, Inc., “Development Summary Report”, 2016.