



UTILITIES DEPARTMENT

Stormwater and Wastewater Funds

Professional Services
Storm and Sanitary Sewer Study

Tittabawassee River Watershed

- Situated in an area where creeks, streams, and drains from throughout Midland County and beyond converge on the Tittabawassee River, the City of Midland is naturally susceptible to flooding.
- The Tittabawassee River has a history of flooding in the Midland area.

Tittabawasse River Watershed

Basin area: 2,471 sq miles



Historical River Crests

- Records from the National Weather Service going back to the year 1916 show (54) weather events that caused the river to surpass the 16 foot mark.

Tittabawassee River Flood Categories (in feet)

Major Flood Stage: 28

Moderate Flood Stage: 25

Flood Stage: 24

Action Stage: 20

Low Stage (in feet): 0

Tittabawassee River Historic Crests

Rank	Level	Date
1	33.89 ft	9/13/1986
2	32.15 ft	6/24/2017
3	29.70 ft	3/28/1916
4	29.50 ft	3/21/1948
5	28.80 ft	3/8/1946
6	28.37 ft	4/20/2013
7	28.26 ft	4/15/2014
8	28.00 ft	6/3/1945
9	27.82 ft	4/4/1959
10	27.75 ft	4/29/2011
26	25.00 ft	6/19/1996

Rain Events Recurrences and Probabilities

Recurrence interval, in years	Probability/Chance of occurrence in Any given year		24-HR Rain (in.)
100	1 in 100	1%	4.5
50	1 in 50	2%	4.2
25	1 in 25	4%	3.8
10	1 in 10	10%	3.5
5	1 in 5	20%	2.9
2	1 in 2	50%	2.3

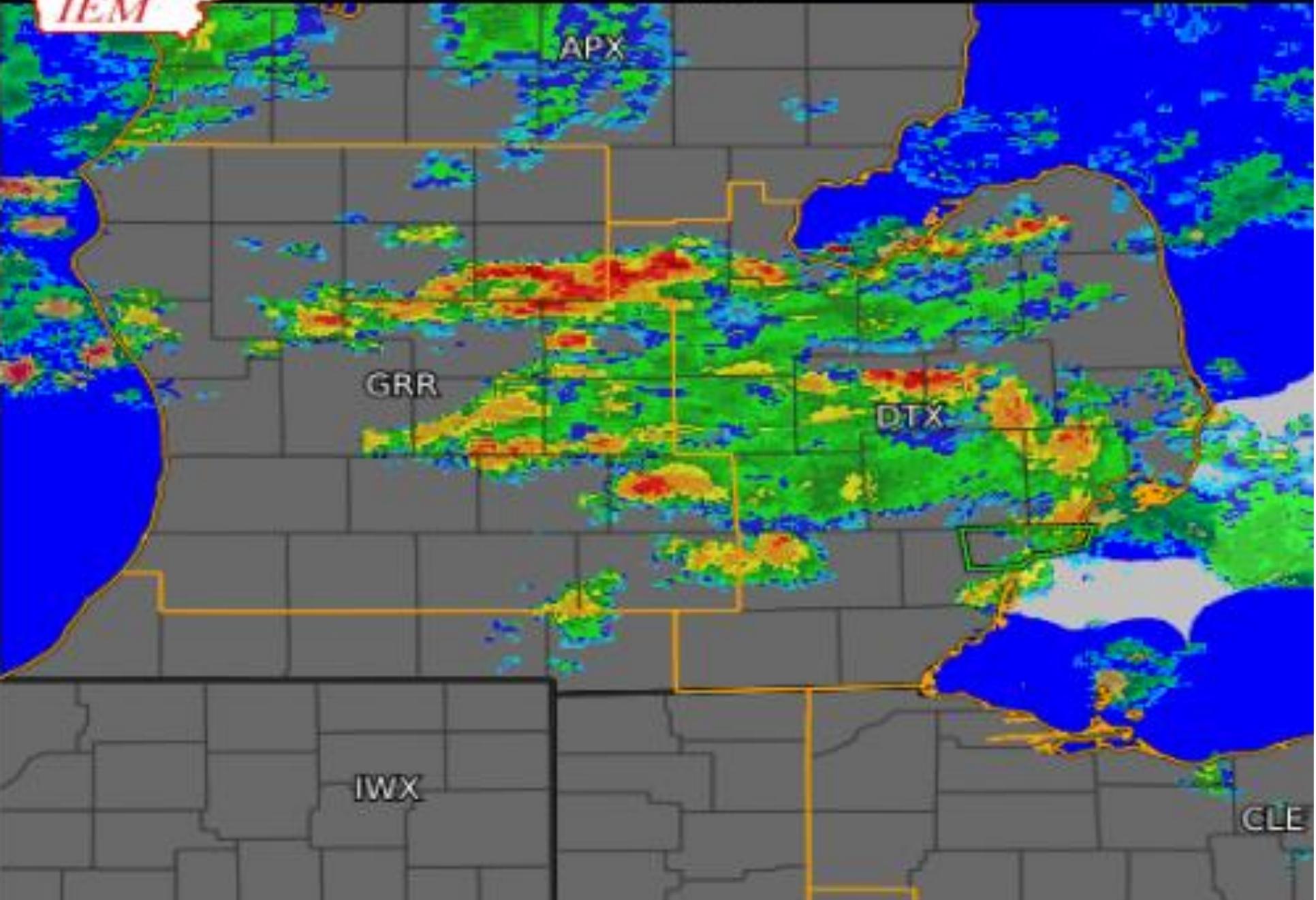
June 2017

Flood Overview

- Moist tropical air during the day on Thursday, June 22 helped to spark severe storms that began to develop during the late afternoon hours.
 - Intense rains began at 9:00 PM
- Heavy rains and winds continued through the night into Friday, June 23.
 - Heavy rains ended at 7:30 AM

NEXRAD Base Reflectivity

22 June 2017 9:40 PM EDT



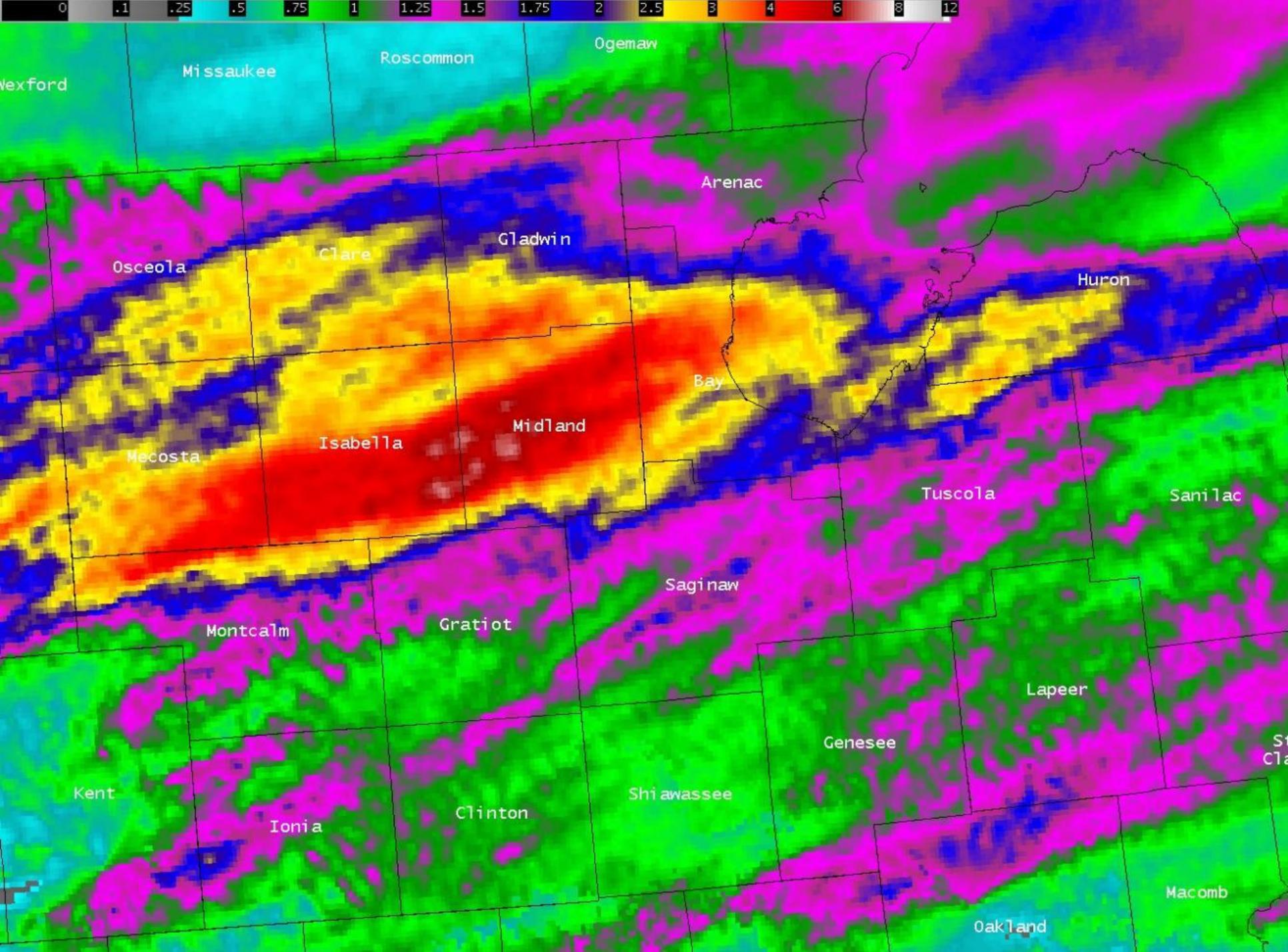
APX

GRR

DTX

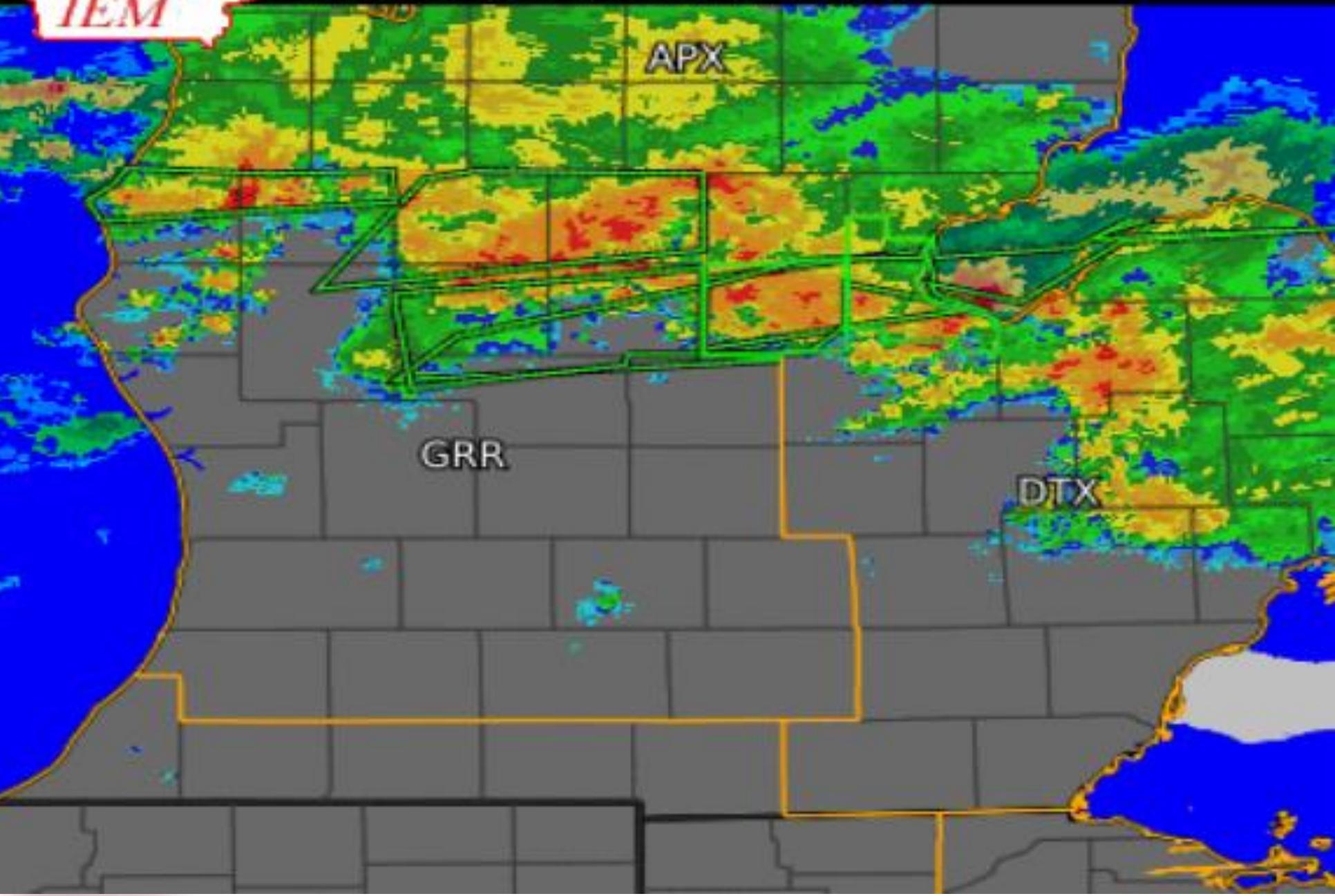
IWX

CLE



NEXRAD Base Reflectivity

23 June 2017 12:25 AM EDT



June 2017

Rain & Flood Overview

- The severe threat switched from rain to flooding Friday afternoon.
- The tributaries in and around the City were overcome by the rain waters and were held back by the rising Tittawbawasse River.
 - Crested 32.15 ft., Sat. June 24 6:00 PM
- Caused wide-spread damage to homes, businesses, and public infrastructure.

HAZE OFF

48 NM/h

VIDEO SPLIT MAP SAT



Towsley St

S McDonald St

S Ashman St

Ann St

Pere Marquette Rail Trl

128 yd

Golfside Drive

Isabella St

Isabella St

Golfside Dr

Isabella St

Golfside Dr / Currie Pkwy
Midland MI (Midland County, 56P911)



North View - Midland Mall Area



Currie Bridge



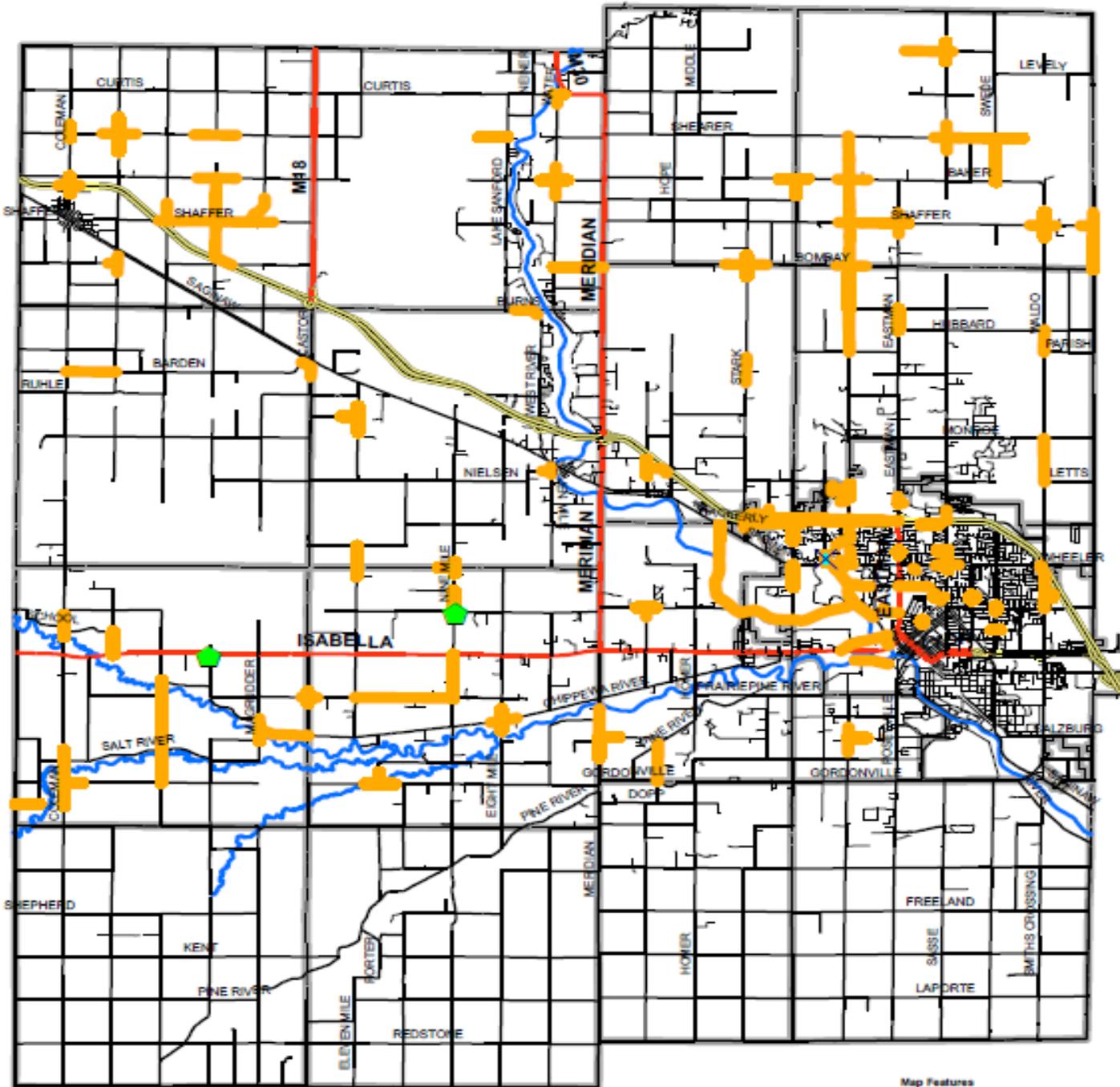
Alpine Mobile Home Village

Jack Barstow Airport
Airport Rd
Sturgeon Ave
US-10





Road/Bridge Closures



June 2017 Rain Event

Date	Date	Inches
Sun	6/18/2017	2.01
Mon	6/19/2017	0.48
Tue	6/20/2017	0.03
Wed	6/21/2017	0.00
Thu	6/22/2017	1.84
Fri	6/23/2017	2.77
Sat	6/24/2017	0.08
	Total 1 Week	7.21
	Month	9.72



June 2017

Rain & Flood Overview

- This specific event included a 100-year recurrence interval rainfall event – pouring $>4.6''$ in <24 hours.
- Followed by the Tittabawassee River reaching a level near the 100-year recurrence interval flood event
- The river level places this flood event second only to 33.89 feet that occurred in 1986.

June 2017

Rain & Flood Overview

- The June rain and flooding event marked the third major/historic event the City has experienced in the past 31 years.
 - 1986
 - 1996
 - 2013 and 2014 (honorable mention)
 - 2017

September 1986 Flood Overview

- The first historic weather event occurred in September 1986.
- The Tittabawassee River reached its peak historic level of 33.89 feet, well after the rains had stopped in Midland.
- As many as 9,500 homes experienced sewer backups or flooding.

September 1986

Flood Overview

- This event accelerated the separation of combined storm and sanitary sewers, which began in the 1950s, when the City began building separate systems.
- The last separation of the combined sewers was completed in 1995.

September 1986

Flood Overview

- In October 1987, a City ordinance was adopted that prohibited **new** installations of:
 - downspouts, weep tiles, footing drains, sump pump discharges or other conduit that allows or carries stormwater or groundwater into the sanitary sewer.

September 1986

Flood Overview

- In response to the 1986 flood event, the City completed sanitary sewer improvements totaling \$18 million.
- The projects included Wastewater Treatment Plant (WWTP) capacity improvements, as well as pump station and conveyance improvements to the WWTP.

June 1996

Rain Event Overview

- In June 1996, another historic weather event produced heavy rains on the City.
 - 3.96" in 3 hours
- Sanitary sewers became surcharged.
- Many homes experienced sewer backups and some experienced overland flooding.

June 1996

Rain Event Overview

- Although the rain reached a 200-year recurrence interval (0.5% chance of occurring in any given year) event, the Tittabawassee River during this event rose to only 25 feet (flood stage is 24 feet).

June 1996

Rain Event Overview

- One month later, the City Council appointed a Sewer Engineering Study Advisory Commission (SESAC) to work with staff and the City's consultant Hubbell, Roth and Clark (HRC) to develop alternatives for sanitary and storm sewer improvements.
- Members of the Community were appointed to the Commission.

June 1996

Rain Event Overview

- In September 1998, an ordinance was adopted that ordered all **existing** downspouts, roof drains, yard drains, truck docks and parking lot drains to be disconnected from the sanitary sewer.
- Existing footing drains were not part of the order to remove.
- That ordinance remains in effect.

June 1996

Rain Event Overview

- In early 1997, HRC began a phased study of the sanitary and storm sewer.
- Each phase aimed at identifying potential problems and developing alternatives for improvement.

June 1996

Rain Event Overview

- Phase 1 focused on identifying the cause(s) of flooding in both the sanitary and storm water systems.
- Phases 2 and 3 added detail to selected alternative improvement programs.

June 1996

Rain Event Overview

- Collectively, these studies were able to provide alternative improvement programs, including construction of relief storm sewers and/or storage facilities.
- We utilized HRC engineers for Phase 1, 2, and 3 at an aggregate cost of over \$330,000.

June 1996

Rain Event Overview

- The HRC studies identified a series of options that could be considered to enhance the capacity and capabilities of the storm and sanitary sewer systems.
- High level protection options were brought forward for community consideration on a November 1998 ballot.

June 1996

Rain Event Overview

- A Phase 4 Study was conducted to find a more cost-effective alternative storm sewer improvement than the one rejected by voters.
- That alternative increased the capacity level of the George Street Basin to a 50-year rainfall event.
- The completion in 2005 of that project provided a second large pipe outfall for the George Street Basin.

June 1996

Rain Event Overview

- Total cost of the sanitary sewer protective measures was \$48 million.
- Total cost of the storm sewer protective measures was \$15.2 million.
- The proposal to fund those improvements was not approved by voters.

June 1996

Rain Event Overview

- A Phase 4 Study was conducted to find a more cost-effective alternative storm sewer improvement than the one rejected by voters.
- That alternative increased the capacity level of the George Street Basin to a 50-year rainfall event.
- The completion in 2005 of that project provided a second large pipe outfall for the George Street Basin.

1999

Administrative Consent Order

- In September 1999, the City entered into an Administrative Consent Order (ACO) with the Michigan Department of Environmental Quality (MDEQ) due to a series of sanitary sewer overflows in violation of the WWTP's discharge permit.
- Three primary Requirements.

Administrative Consent Order Primary Requirement 1)

- 1) Construct a 43.5 MG storage basin to prevent bypasses from the WWTP during a 25-year recurrence interval rain event.
 - Completed 2003



**43.5 MG
Storage Basin**

Midland Wastewater
Treatment Plant

Genji Japanese
Steakhouse



Bay City Rd

Administrative Consent Order Primary Requirement 1)

- To assist with the Retention Basin Project, we utilized HRC for the Project Plan, Basis of Design, Construction Engineering Services, at cost of over \$330,000.

Administrative Consent Order Primary Requirement 2)

- 2) Implement an Offset-Mitigation Program – required that for each residential unit connected to the sanitary sewer system, a reduction of inflow & infiltration of groundwater must be removed from the sanitary sewer.
 - This requirement, along with the ACO, expired in 2005.

Administrative Consent Order Primary Requirement 3)

- 3) Implement a Flow Monitoring Study for sanitary sewer system
 - Objective was to identify areas with excessive inflow & infiltration, and to verify capacities of pumping districts.
 - The results indicated deficiencies that were subsequently corrected with the sewer improvements program, and re-districting of the pumping districts.

Administrative Consent Order Primary Requirement 3)

3) Continued...

- Subsequent flow monitoring of two pumping districts indicated that each had the capacity to meet a 25-year, 24-hour rain event, satisfying the ACO.
- We again utilized HRC for assistance on the Flow Monitoring Study - \$39,000

2001 Voters Approved Bond Sanitary Sewer Improvements

- In 2001, City of Midland voters approved a \$13.6 million bond proposal.
- To increase the design capacity of the sanitary sewer conveyance system to a 50-year recurrence interval rainfall event (2% chance of occurring in any given year).

2001 Voters Approved Bond Sanitary Sewer Improvements

Force Main	⇒	Saginaw Road
Force Main	⇒	Elizabeth Street
Force Main	⇒	East Ashman Street
Force Main	⇒	East Patrick Road
Gravity Sewer	⇒	Ashman Street
Gravity Sewer	⇒	Jefferson Avenue
Pump Station	⇒	Nelson Upgrade
Pump Station	⇒	Valley Upgrade
Pump Station	⇒	Ashman/Waldo Upgrade
Pump Station	⇒	Patrick Upgrade

Post-1996 Engineering Consulting Work

- Much of the post-1996 initiatives were undertaken with the help consulting engineers providing studies, reporting, and improvement design alternatives.

Removal of Inflow and Infiltration (I & I)

- The post-1996 sanitary and storm systems evaluations recommended that an on-going program be put in place to identify and correct inflow and infiltration of groundwater entering the sanitary sewer via cracked and leaking pipes and manholes, and illicit connections.

Removal of Inflow and Infiltration (I & I)

- Since the 1996 rain event, the City has:
 - Lined thousands of feet of sanitary sewer pipe.
 - Repaired and sealed hundreds of aged and deteriorating manholes.
 - Caused the separation of hundreds of downspouts, roof drains, yard drains, truck docks, and parking lot drains.

June 2017 Event

Sanitary and Storm Sewer Systems

- The City's sewer infrastructure is not designed or built to handle a storm event of the magnitude of a 100-year flood and 100-year rain event such as that experienced in June 2017.
- Pumping stations throughout the City ran at design capacities and conveyed flows never seen before to the WWTP over a one-week period.

June 2017 Event

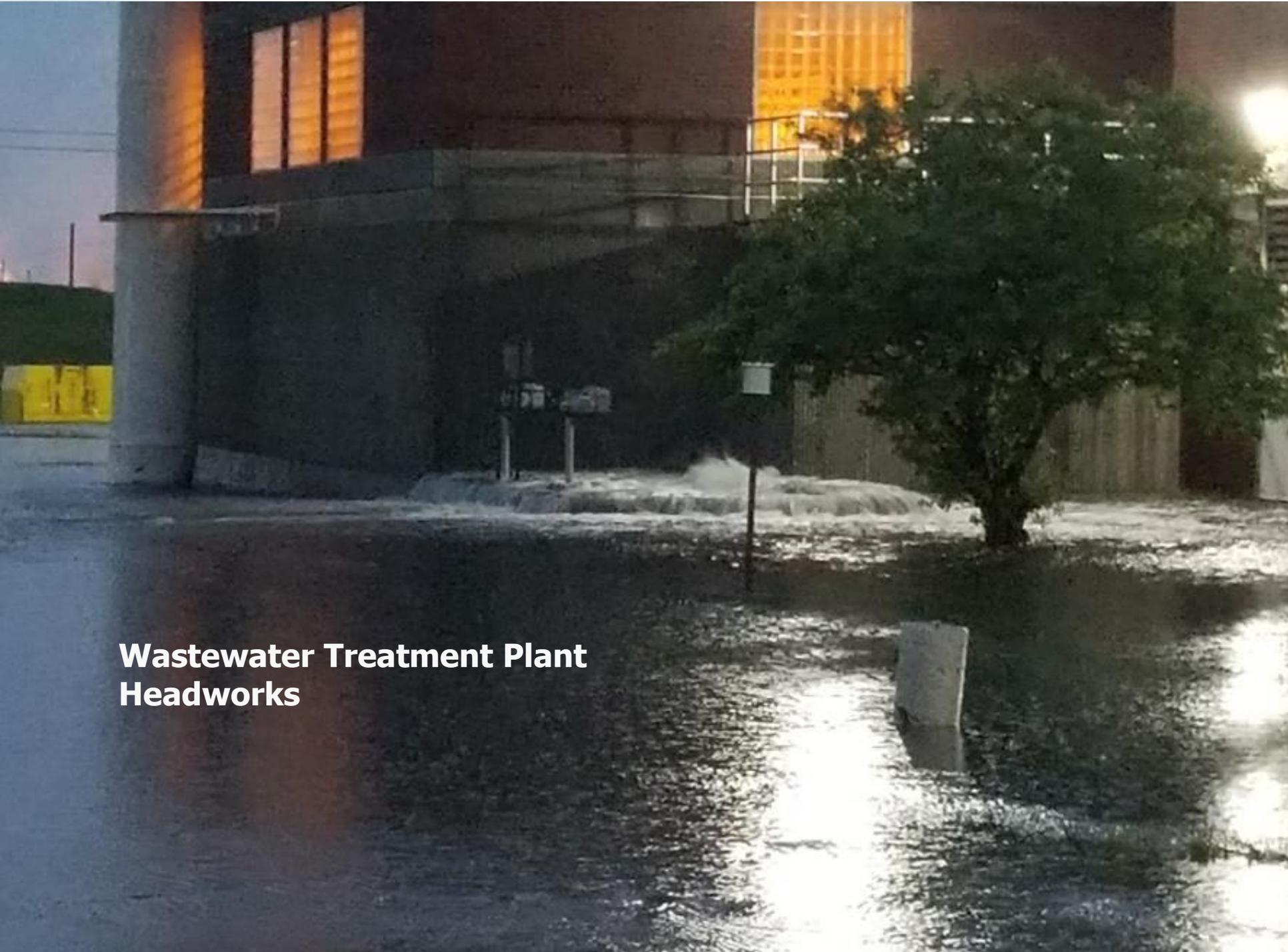
Sanitary and Storm Sewer Systems

- The vast amounts of water produced by the high-intensity storm exceeded the design capacities of the storm and sanitary sewer collection and conveyance systems.
- The WWTP overflowed more than 250 MG of diluted or partially treated sewage.
 - 6+ MG spilled onto the grounds of the WWTP campus.

June 2017 Event

Sanitary Sewer Systems

- The City violated its NPDES permit that is enforced by the MDEQ:
 - Overflows at the WWTP; partially treated
 - Collection system pump arounds; untreated
 - Whitewood
 - Lancaster
 - Mooreland, Sylvan, Perrine
 - Attempted, but creeks were too high



**Wastewater Treatment Plant
Headworks**

June 2017 Event

Sanitary Sewer Systems

- The June 2017 event confirmed that the sanitary sewer system improvements made and policies implemented over the past two decades:
 - Did increase conveyance and storage capacities.
 - Worked to the level to which they were designed and built.
 - WWTP was overburdened by the volume and rate of flows that it received.

June 2017 Event

The Way Forward

- During and after the event, Utilities staff were active in keeping the collection systems and WWTP operating at full capacity.
- City staff as a whole were assessing damages and speaking with and gathering information from the public.
- At review of that information, the need was identified to seek help defining and organizing an overview of the City's sanitary and storm sewer system capabilities.

June 2017 Event

The Way Forward

- Outside independent expertise was determined necessary for this purpose, as existing City staff do not have the expertise or previous experience necessary to fulfill this role.
- The hiring of professional services is permitted utilizing a qualification based selection process.

June 2017 Event

The Way Forward

- This approach is appropriate and recommended for this work as it is important that the City select consultants that are highly qualified and experienced in the analysis and design of sanitary and storm sewer systems.

June 2017 Event

The Way Forward

- Factors identified by staff as important in the selection of a consultant to analyze and recommend potential changes to our sanitary and storm sewer systems include:
 - Professional expertise
 - Broad experience
 - Direct project-related experience
 - Implementation experience
 - Familiarity with Midland systems is considered highly beneficial

June 2017 Event

Engineering Assistance

- It was a natural decision to recommend that engineering consultants Hubbell, Roth & Clark (HRC) of Bloomfield Hills be contracted to complete the analysis of our sanitary sewer system.

The Way Forward

Engineering Assistance - HRC

- HRC has over 100 years of experience in municipal infrastructure engineering.
- Has broad exposure to system analyses across the State of Michigan.
- Their staff are highly qualified in this field of work.
- In addition, HRC spearheaded the post-1996 sanitary and storm system activities and events for the City of Midland.

The Way Forward

Engineering Assistance - HRC

- HRC has a deep knowledge base of Midland and its sewer systems.
- HRC has a strong record of partnering well with City staff in implementing milestone improvements.
- In addition, it was determined that HRC has an on-going joint venture with another engineering firm that staff was considering separately for the storm sewer portion of the evaluation.

The Way Forward

Engineering Assistance - OHM

- Orchard, Hiltz & McCliment (OHM) has extensive experience in the area of footing drain separation, as well as global information systems (GIS), and storm sewer modeling.
- OHM has an important local presence in Midland, and is the engineering firm of record for the City in terms of road-related engineering services.

The Way Forward

Engineering Assistance - OHM

- OHM also has direct experience in other Michigan municipalities, such as Grand Rapids and Ann Arbor, where similar system concerns were identified and addressed, allowing them to bring that experience to bear in our own system review and analysis.

The Way Forward

Engineering Assistance – HRC & OHM

- The joint venture between HRC and OHM is appealing.
- It broadens the experience and knowledge depth of each of the individual firms.
- Provides value engineering to each of the sanitary sewer and stormwater directives.

The Way Forward

Engineering Assistance – HRC & OHM

- The combined team of HRC & OHM is considered by Staff to be the best available for the scope and nature of work needed here in Midland.

The Way Forward

Engineering Assistance – HRC & OHM

- Having identified the appropriate consulting firms, a scope of work was discussed and developed between Staff and the two consulting firms.
- The key deliverables for the work proposed by HRC/OHM joint venture are as follows:

The Way Forward

Key Deliverables

- ✓ Updated GIS Stormwater Geodatabase (including data from record drawing research and field survey)
- ✓ Hydrologic/hydraulic model input/output files for both wastewater and stormwater models

The Way Forward

Key Deliverables

- ✓ Technical Reports (wastewater and stormwater)
 - Data Collection / Public Engagement summary
 - Key findings from the hydrologic/hydraulic modeling efforts
 - Level of Service Findings and Options

The Way Forward

Key Deliverables

- Recent improvements to the wastewater collection system
- Maps of undersized system components (wastewater and stormwater)
- Capital Improvement Plan (Early Action Projects), including maps and illustrations of project locations
- Scoping Report for Phase 2

The Way Forward

Scope of Services

- The cost breakdown for the proposed scope of services:

Task	Description	Fee
I	Data Collection / Field Services	
	Storm	\$39,000
	Sanitary	10,000
II	Stormwater System Analysis	74,000
III	Wastewater System Analysis	116,000
IV	Outreach and Public Engagement	
	Storm	25,000
	Sanitary	25,000
Total Not-to-Exceed Cost		\$289,000

The Way Forward

Scope of Services

- Having previously worked with both firms, much of the base information and history of Midland's sanitary sewer and stormwater systems is already retained by JV HRC/OHM.
- Familiarity with the City and our systems will equate to fewer unknowns for both the City and JV HRC/OHM, and to a more refined scope of services.

The Way Forward

Scope of Services

- The combined cost of the work necessary is a not-to-exceed amount of \$289,000.
 - Wastewater Systems \$151,000
 - Stormwater Systems \$138,000

The Way Forward

Scope of Services

- The not-to-exceed cost approach will allow both the City and JV HRC/OHM to monitor the work and information identified through the analyses:
 - To adjust or eliminate work tasks as the study proceeds
 - Provides cost certainty to protect the interest of the City.

The Way Forward

Scope of Services

- The resolution will authorize a purchase order for professional services to the JV HRC/OHM in the amount of \$289,000.
- In accord Sec. 2-19 of the Code of Ordinances for the City of Midland.
- Provide the City Manager authorization to make changes not to exceed \$15,000, should the study process identify additional needs not able to be identified at this stage, but which might be critical to the final product.

Questions?