

Harrison Park Detention Pond Failure – Lessons Learned

2022 IAFSM Conference – March 8, 2022

Concurrent Session 1D: Urban Flooding



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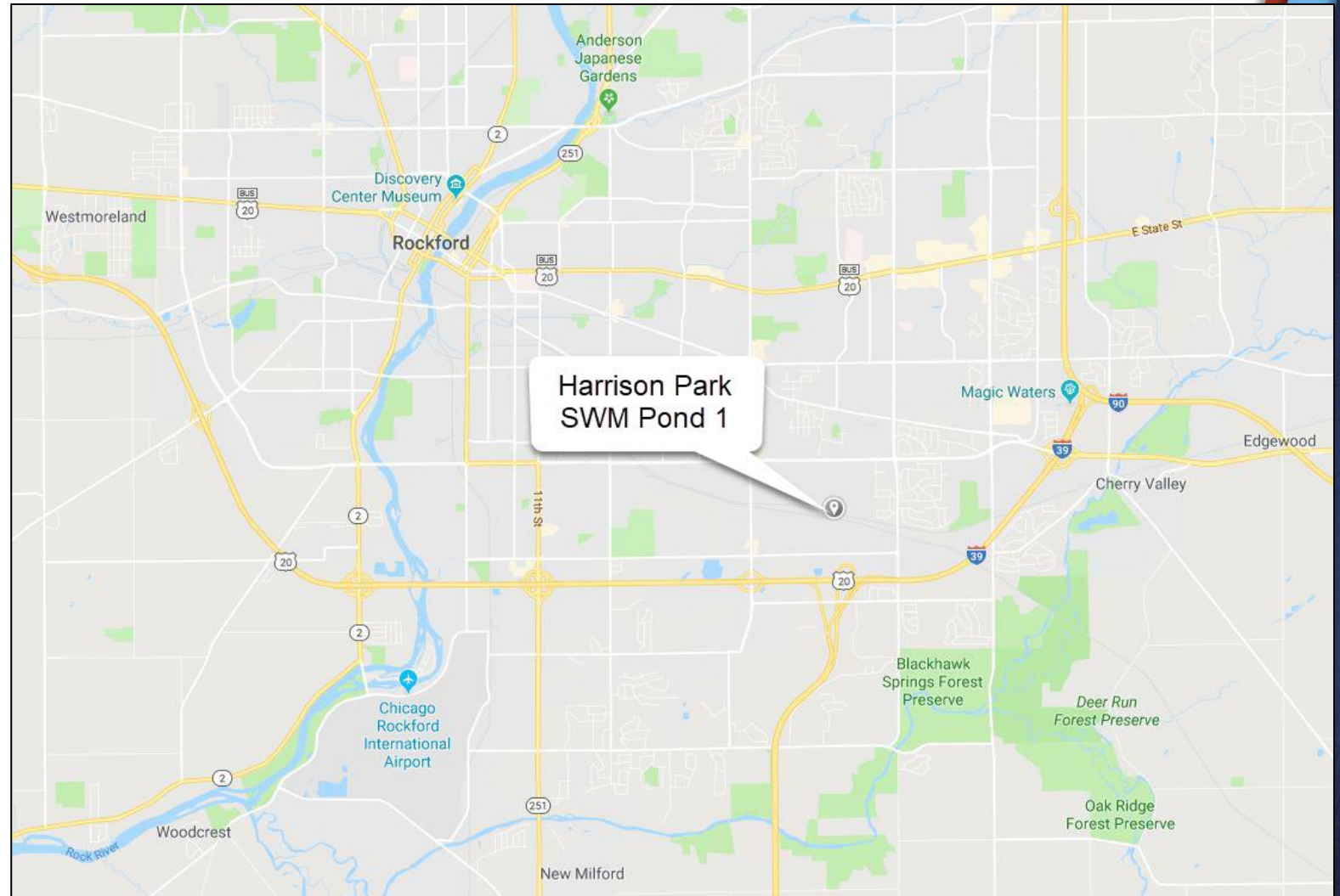
Environmental Practice Lead | Chief Water Resources Engineer

Harrison Park Detention Pond Failure

June 19, 2009

- Where again?

Source: Google Maps



Harrison Park Detention Pond

- Plans dated June 1997.
- 458-ft x 306-ft.
- 11.5 feet tall.
- Dry bottom detention.
- Reported 100-year design capacity.
- Primary outlet is 27-inch RCP.
- 40-foot wide emergency spillway with rock protection.
- Hazard Classification?



Post-breach Condition

- Breach measured 12-ft high 18-ft wide
- Local newspaper reported that investigators believed 80 percent of the pond drained in 14 minutes, between 7:01 and 7:15 p.m. (~9 ac-ft)
- Looking downstream.



Source: National Transportation Safety Board Report RAR-12/01

Figure 16. Postaccident photograph showing breach in SWM pond 1 as viewed from inside pond looking south.

Pre-breach Condition

- **Photo dated April 2008**
 - Looking upstream
- **Failure June 2009**



Source: National Transportation Safety Board Report RAR-12/01

Figure 17. View looking north from downstream end of outlet area of SWM detention pond 1 showing erosion over top of outlet culvert and erosion below outlet. (Photo taken in April 2008.)

***WHY*...**Are we talking about this?



Source: PBS News Hour

An aerial view of the June 19, 2009, Canadian National train derailment wreckage pileup at the grade crossing, after the fire was extinguished. – **Cherry Valley Fire Department**



▲ HIDE CAPTION

An aerial view of the June 19, 2009, Canadian National train derailment wreckage pileup at the grade crossing, after the fire was extinguished. - **CHERRY VALLEY FIRE DEPARTMENT**



An aerial view of South Mulford Road from the south side of the Canadian National tracks showing the aftermath of the June 19, 2009 train derailment, taken after the derailment. – **Cherry Valley Fire Department**

▲ HIDE CAPTION

An aerial view of South Mulford Road from the south side of the Canadian National tracks showing the aftermath of the June 19, 2009, train derailment, taken after the derailment. - **NATIONAL TRANSPORTATION SAFETY BOARD**

Emergency Response

35 separate fire departments

250 personnel

80 vehicles

- June 19 – 8:36 pm 911 reports of incident.
- 9:02 pm, the CVFPD chief contacted RFD Dispatch to implement a **mandatory evacuation within a radius of about 1/2 mile from the fire** perimeter. The evacuation was to be executed by the local law enforcement personnel.



Source: National Transportation Safety Board Report RAR-12/01

Figure 4. Looking north along Mulford Road toward burning tank cars at crossing.

Emergency Response

- 9:09 pm, Emergency responders were advised that the tank cars contained ethanol
- 10:30 pm, due to volume, topography, size of wreckage, availability of fire suppression foam and no immediate additional hazard to life or property, the **fire was allowed to burn itself out.**
- June 20 - 5pm, all fires burned off.
- June 21 - 5pm, on-scene operations were terminated.



Wreckage from the Canadian National train derailment June 19, 2009, is seen from the south side of the accident site the next day. – National Transportation Safety Board

▲ HIDE CAPTION

Wreckage from the Canadian National train derailment June 19, 2009, is seen from the south side of the accident site the next day. – NATIONAL TRANSPORTATION SAFETY BOARD

Casualties

- **1 fatality** (first vehicle stopped in the queue at the grade crossing)
- **3 seriously injured.**
- **6 people received minor injuries** (two emergency responders).

Injury Type ^a	Train crew	Citizens	Emergency Responders	Total
Fatal	0	1	0	1
Serious	0	3	0	3
Minor	0	4	2	6
Total	0	8	2	10
^a Title 49 <i>Code of Federal Regulations</i> 840.2 defines fatality as the death of a person either at the time an accident occurs or within 24 hours thereafter.				

Source: National Transportation Safety Board Report RAR-12/01

Hazardous Material Release

- Train had 75 tank cars loaded with a total of **2,158,724 gallons of denatured fuel ethanol**.
- 15 tank cars in pileup carrying total of **431,708 gallons**.
- **107,745 gallons (25%)**, was recovered.
- **323,963 gallons consumed by fire or released to water, soil, and air.**

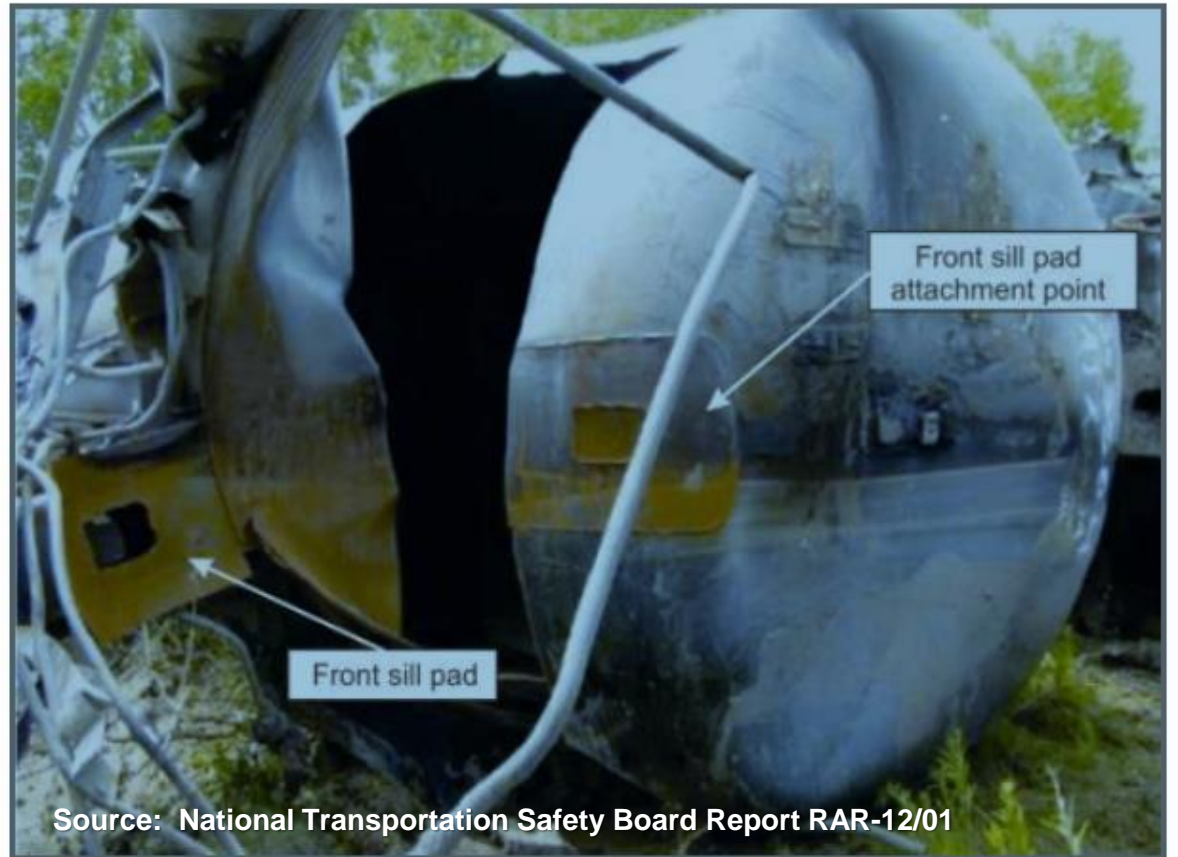


Source: Wikipedia

Hazardous Material Release – Fish Kill

- The EPA estimated that 60,000 gallons of ethanol were released into a tributary of the Rock and Kishwaukee Rivers, resulting in a significant fish kill.
- The Illinois Conservation Police began receiving reports at 8am June 21, 2009, regarding a fish kill in the Grand Detour area of the Rock River.

Source: National Transportation Safety Board Report RAR-12/01

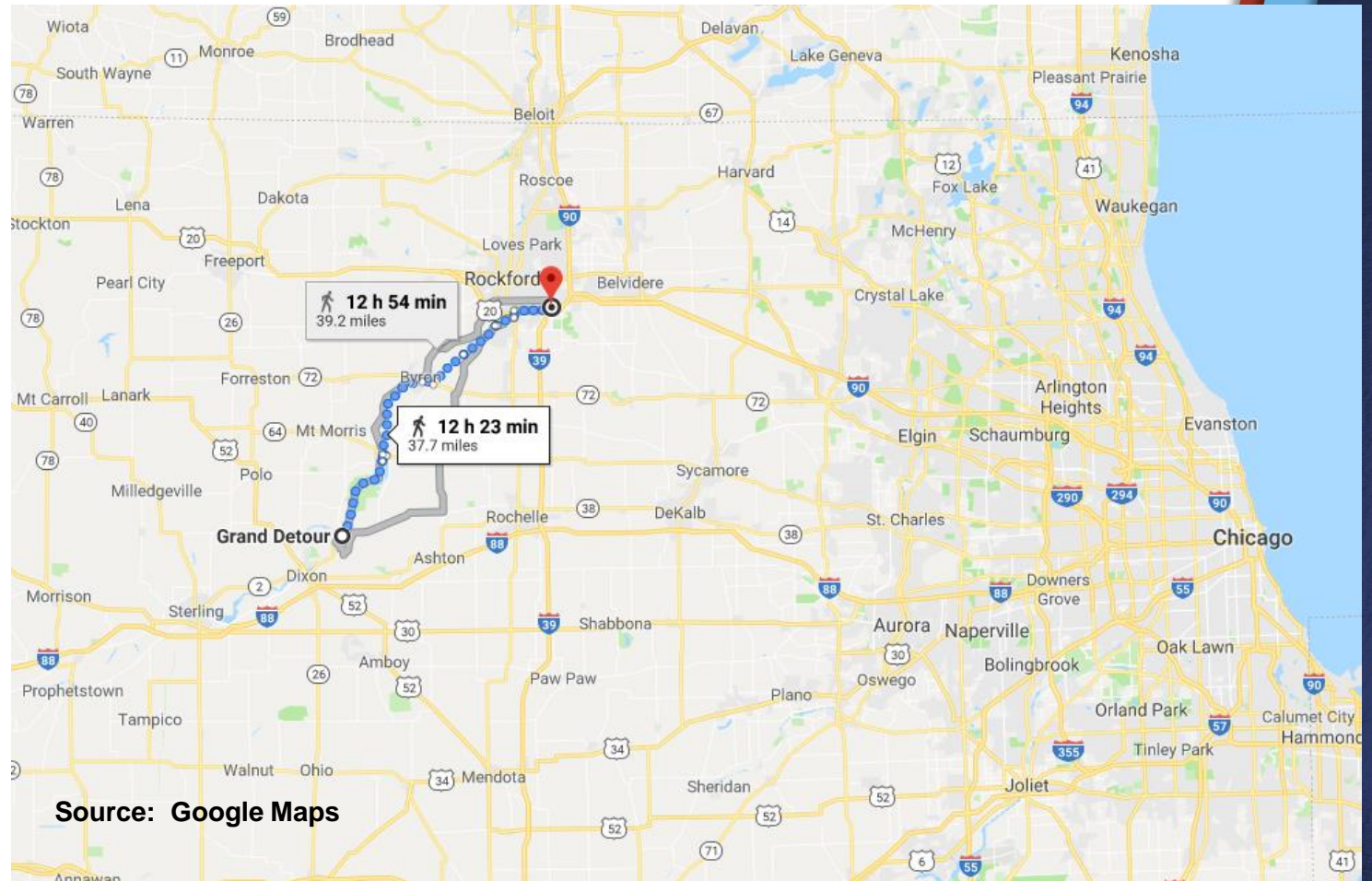


Source: National Transportation Safety Board Report RAR-12/01

Figure 20. B end of car NATX 303504.

Hazardous Material Release – Fish Kill

- Affected about 53.6 miles of the Rock River between Grand Detour and Erie, Illinois. For about 36 hours following the initial fish kill report.
- IDNR estimated that about **72,350 fish** were killed with an associated value of about \$272,300.

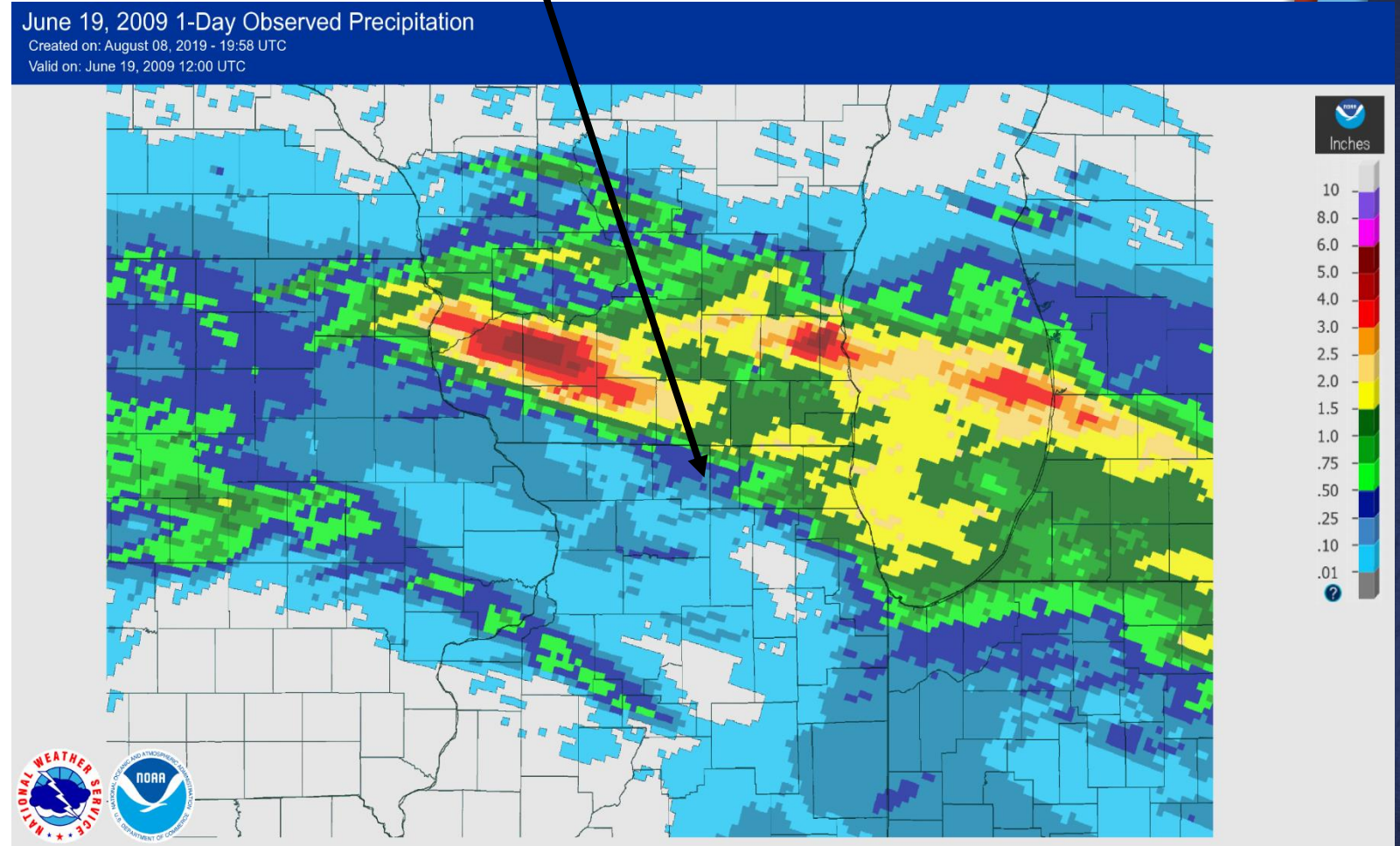


Source: National Transportation Safety Board Report RAR-12/01

Rainfall

- Local airport recorded 3.25 inches of rain. Airport is 5 miles from site.
- Doppler rainfall indicated much higher amounts ranging from 3.25 in/hour to 8.9 in/hour during a 50-minute period before the accident.

Pond 1 Location



Source: National Transportation Safety Board Report RAR-12/01

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
and Annette LaCross

6:54 p.m. It has rained nearly an hour, filling detention ponds in the Harrison Park subdivision and flooding the cul de sac on Stowmarket Avenue.

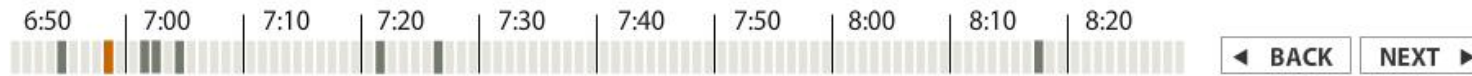


Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
and Annette LaCross

6:58 p.m. Water flows over the Union Pacific tracks at South Mulford Road.



Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
and Annette LaCross

7:01 p.m. Water flow increases along the west side of South Mulford and heads south toward tracks used by Canadian National Railroad.



Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
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7:01-7:02 p.m. Water breaches the southeast corner of a Harrison Park stormwater detention pond. The pond releases 2.9 million gallons of water — enough to cover each of seven football with a foot of water.



Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
and Annette LaCross

7:04 p.m. A flash flood washes out the Union Pacific tracks, and water flows southeast toward South Mulford.



Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
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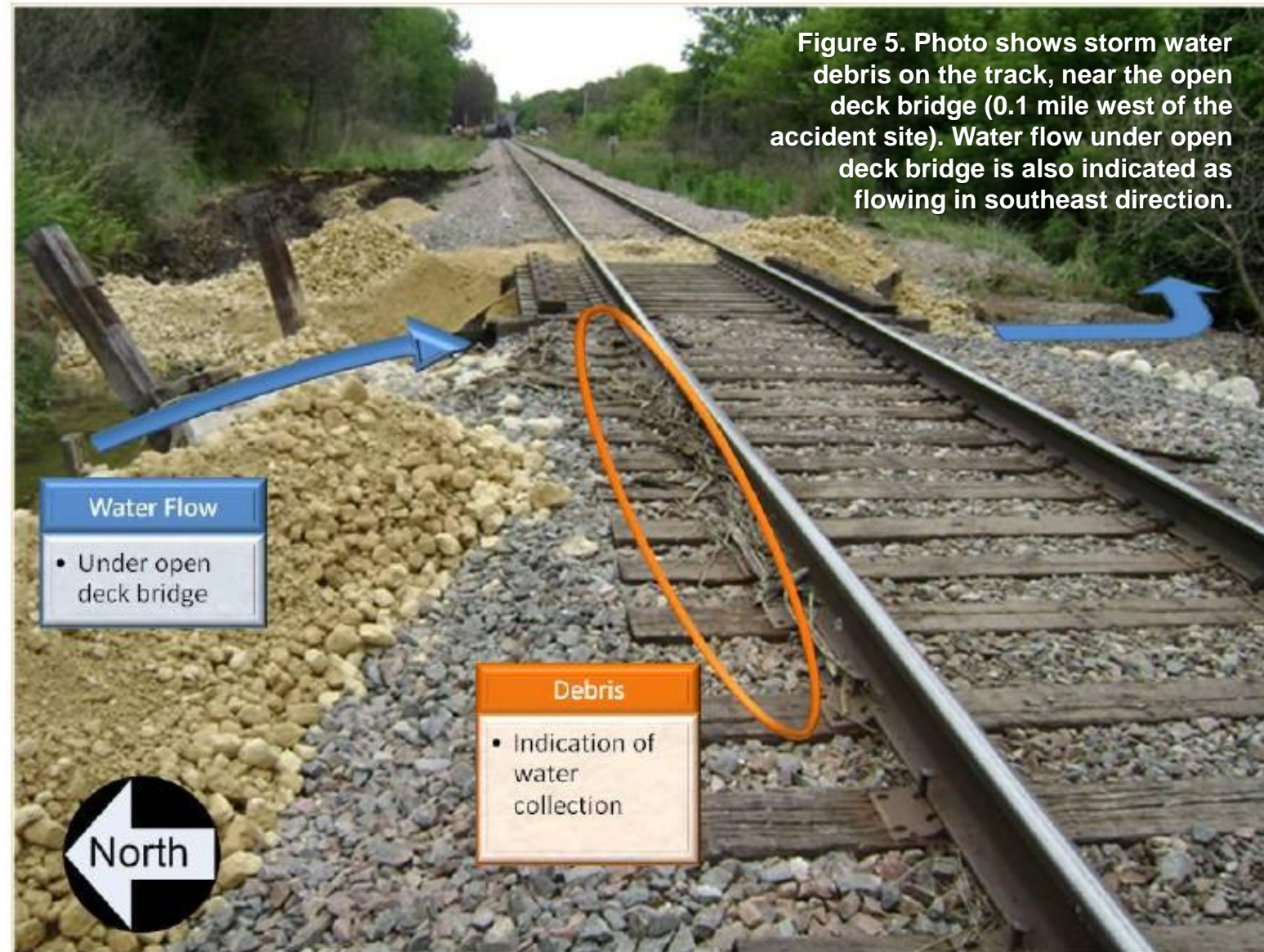
7:21 p.m. Water reaches its maximum height near a bridge west of South Mulford on tracks used by Canadian National.



Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
and Annette LaCross



Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
and Annette LaCross

7:26 p.m. Most of the water in the Harrison Park detention pond has drained. Water reaches its maximum depth at South Mulford, washing out tracks where the Canadian National train would derail 70 minutes later.



Source: www.e-rockford.com/special_sections/ethanolflooding

Chain of Events

Source: National Transportation
Safety Board documents
Graphics for rrstar.com by: Margo
Morgan, Brian Leaf, Chris Soprych
and Annette LaCross

8:17 p.m. Extent of flooding at time of sheriff's video.



Source: www.e-rockford.com/special_sections/ethanolflooding

Deputy Sheriff's Dashboard Video



Source: WAND-TV New I-TEAM – 2/4/2014

Deputy Sheriff's Dashboard Video



Figure 2. A still image produce from deputy sheriff's dashboard video recorder looking from a point on west berm of Mulford Road facing south.

Source: National Transportation Safety Board Report RAR-12/01

Harrison Park Detention Ponds

- **Pond 1**

- 458-ft x 306-ft
- Designed for 100-year event
- The recorded plat of the Harrison Park subdivision notes that "the maintenance of the drainage and storm water detention easement shall be the sole responsibility of the individual property owner."



Figure 15. Aerial view showing location of Harrison Park subdivision detention ponds in relation to accident site.

Source: National Transportation Safety Board Report RAR-12/01

Harrison Park Detention Pond - Factors

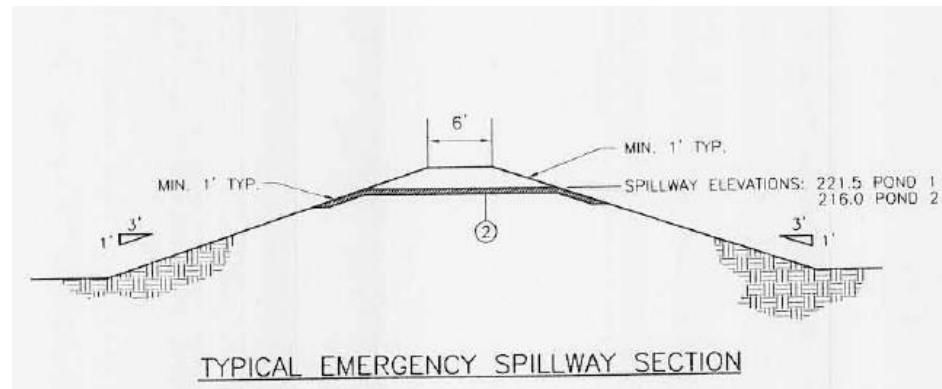
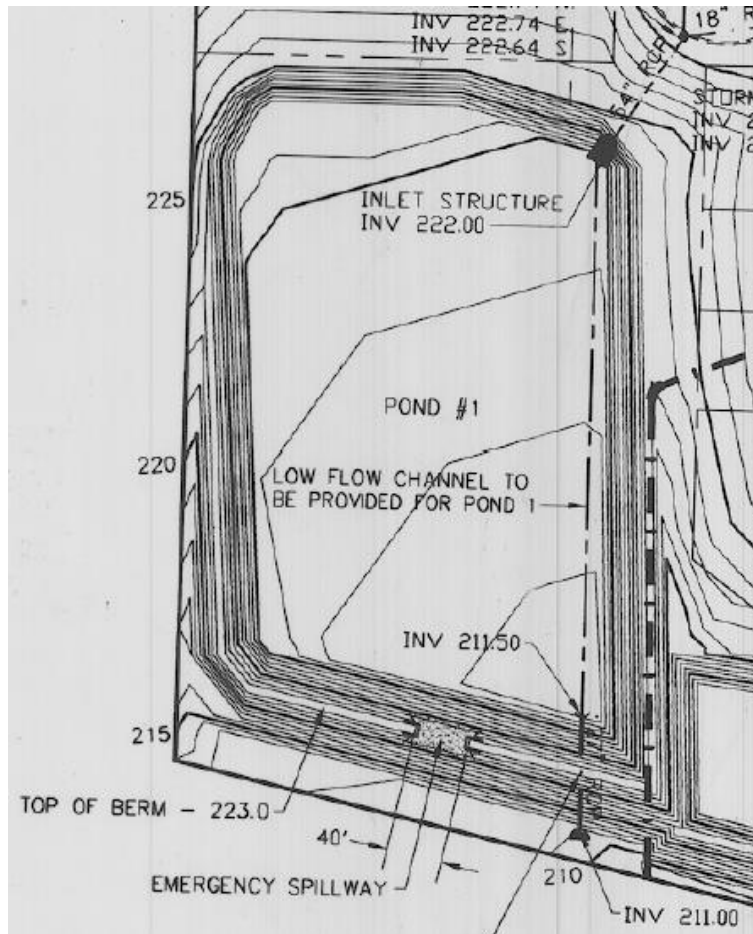
- April 2008, bid to repair the damage for **\$23,436**.
- 2009, the association agent began assessing Harrison Park landowners to pay for the repairs.
- June 2009 (failure), balance in the repair fund was **\$23,288.11**.
- September 3, 2009, breach was repaired at a cost of **\$23,500**.

Source: National Transportation Safety Board Report RAR-12/01



Figure 17. View looking north from downstream end of outlet area of SWM detention pond 1 showing erosion over top of outlet culvert and erosion below outlet. (Photo taken in April 2008.)

Record Drawings of Pond 1



KEY NOTES	
1	35 L.F. OF EMERGENCY SPILLWAY AT ELEVATION 216.
2	4"-6" LIMESTONE RIP-RAP OVER NON-BIODEGRADABLE GEOTEXTILE FABRIC.
3	12" RCP OUTLET PIPE WITH STANDARD FLARED ENDS AND ANTI-SEEP COLLAR.
4	27" RCP OUTLET PIPE WITH STANDARD FLARED ENDS AND ANTI-SEEP COLLAR.
5	12" CA1 RIP-RAP OVER NON-BIODEGRADABLE GEOTEXTILE FABRIC.
6	40 L.F. OF EMERGENCY SPILLWAY AT ELEVATION 221.5.

27" RCP W/ FLARED END SECTION
 MAXIMUM CFS - 57.3 CFS @ ELEVATION 220.7
 PROVIDE GEOTEXTILE UNDERLAYMENT AND RIP RAP MATERIAL AT OUTLET

POND # 1
 MAXIMUM STORAGE - 1,080,000 CUBIC YARDS
 MAXIMUM DISCHARGE - 57.3 CFS
 TRIBUTARY AREA - 67 ACRES
 OFF SITE FLOW - 55.8 CFS

- Date of Plans: June 1997
- Reported 100-year design capacity
- Invert: 211.5-ft
- Top of Berm: 223.0-ft (11.5-ft deep at outlet)
- Emergency Spillway: 221.5-ft 40-ft wide (1.5-ft freeboard)
- Rock protection at outlet and emergency spillway.

Record drawings provided by the City of Rockford



Figure 17. View looking north from downstream end of outlet area of SWM detention pond 1 showing erosion over top of outlet culvert and erosion below outlet. (Photo taken in April 2008.)

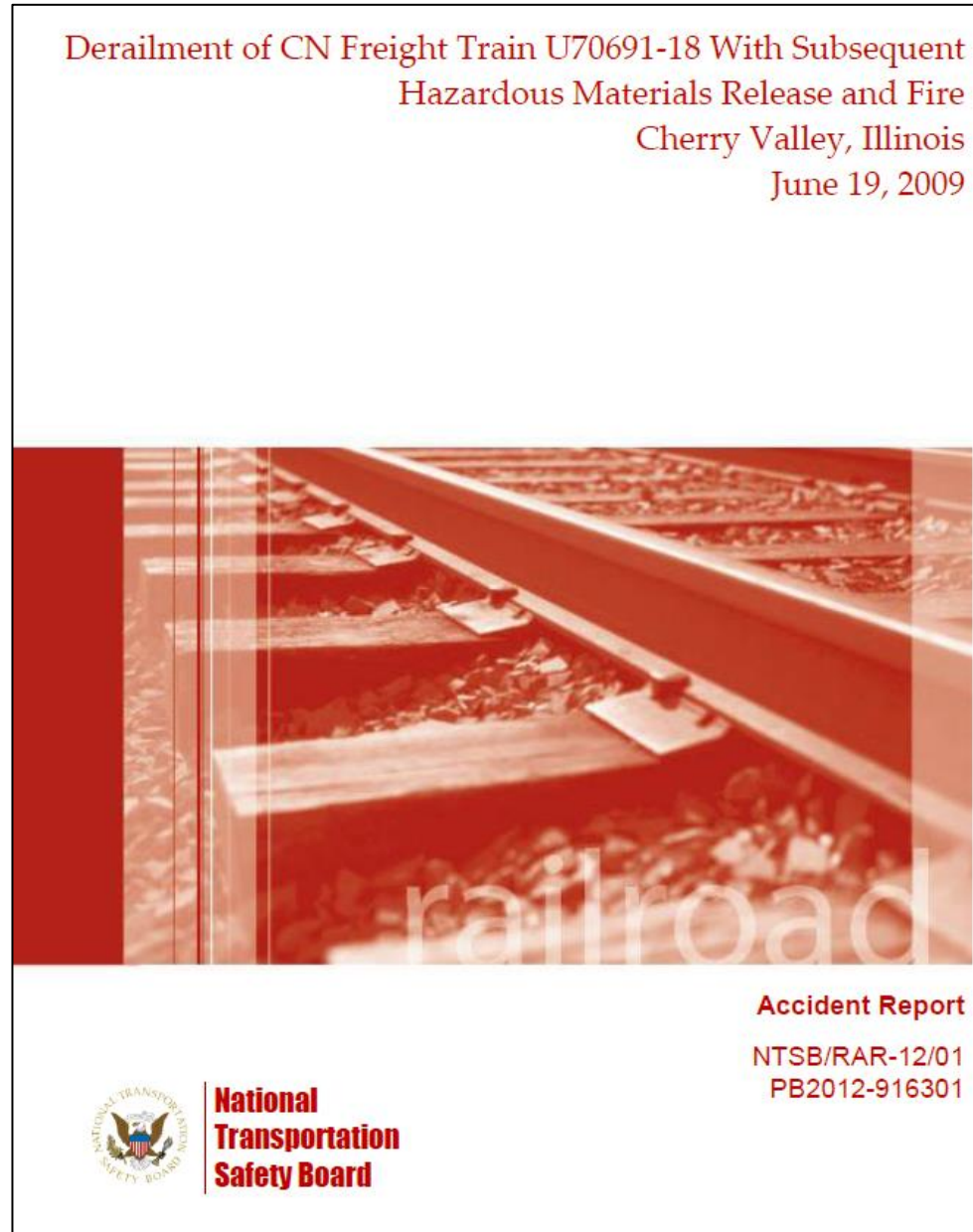


Figure 16. Postaccident photograph showing breach in SWM pond 1 as viewed from inside pond looking south.

Source: National Transportation Safety Board Report RAR-12/01

Report adopted Feb. 14, 2012

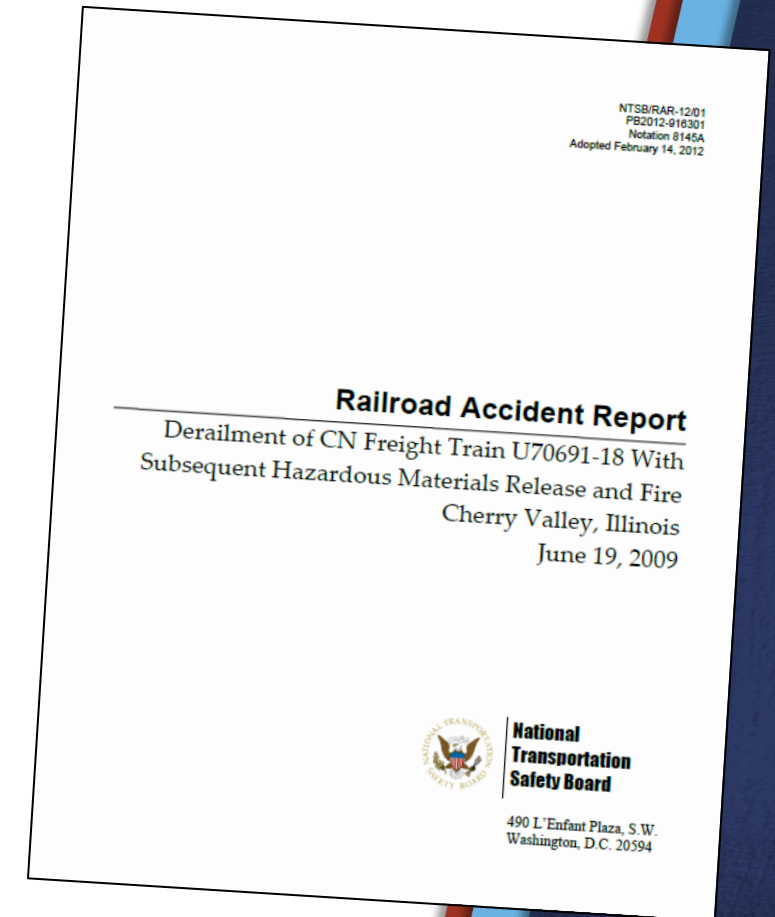
Report resulted in 15
specific recommendations



NTSB – Dam & Stormwater Related Recommendations

To the U.S. Department of Transportation:

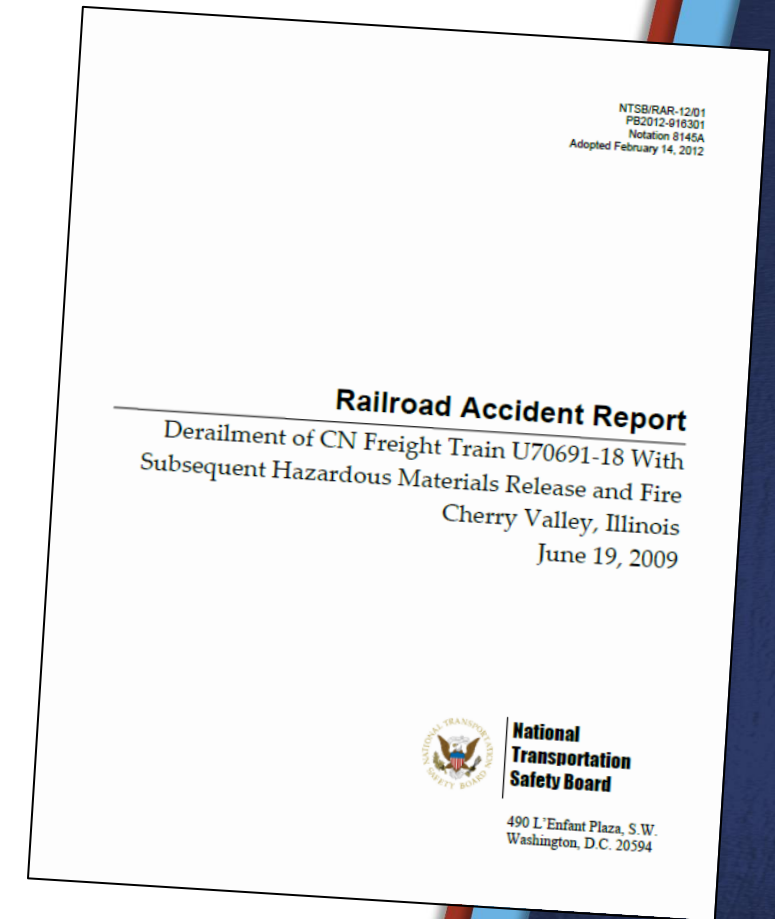
- Develop a comprehensive **storm water drainage assessment program** to be conducted **jointly by railroads and public entities** that ensures the adequate flow of water under both railroad and highway facilities, and require railroads and public entities to coordinate any changes to storm water drainage systems before their implementation. (R-12-1)
- Notify railroads and public entities about the circumstances of this accident and the importance of **exchanging information related to storm water drainage system design issues** that may adversely affect the adequate flow of water under both railroad and highway facilities. (R-12-2)



NTSB – Dam & Stormwater Related Recommendations

To the National League of Cities, the National Association of Counties, the **Association of State Dam Safety Officials**, the National Association of Towns and Townships, and the U.S. Conference of Mayors:

Inform your members about the circumstances of this accident and emphasize the importance of periodically inspecting storm water management detention ponds (both private and public) to ensure that no deterioration has occurred that would result in the failure of a pond to function as designed. (R-12-11)




Safety Recommendation R-12-011 (3/2/2012)

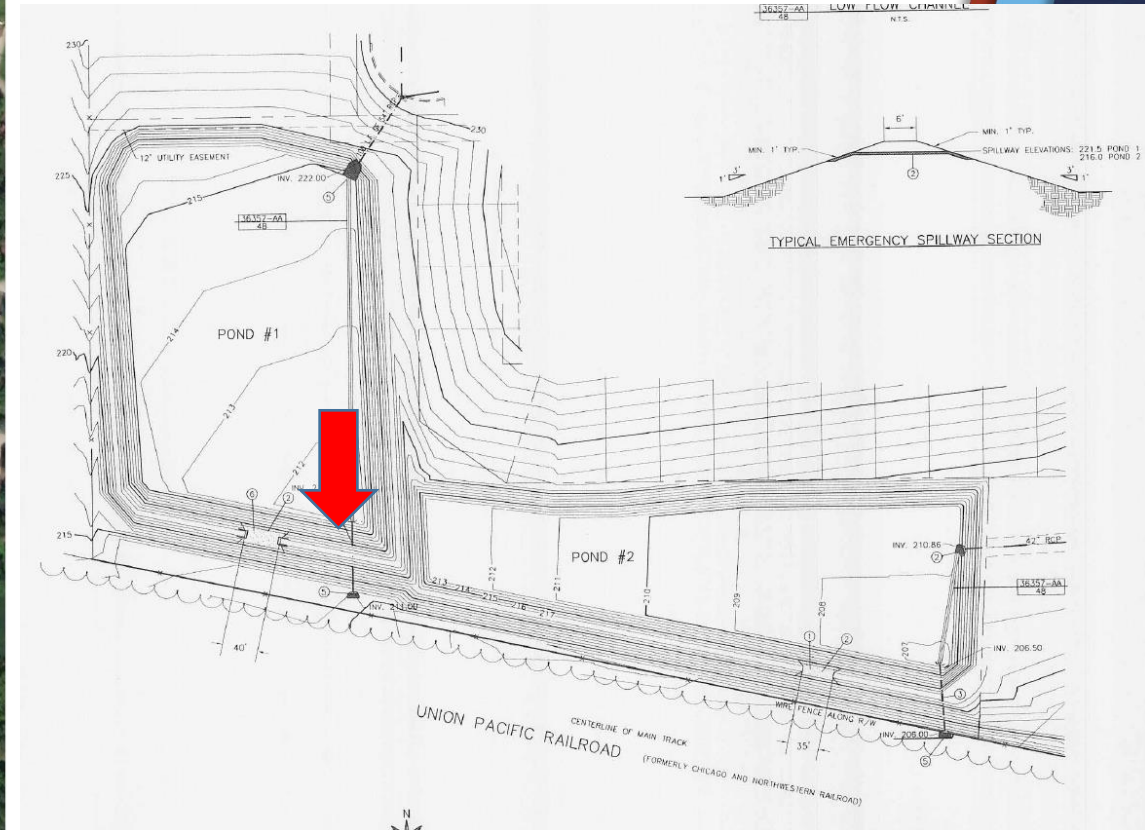
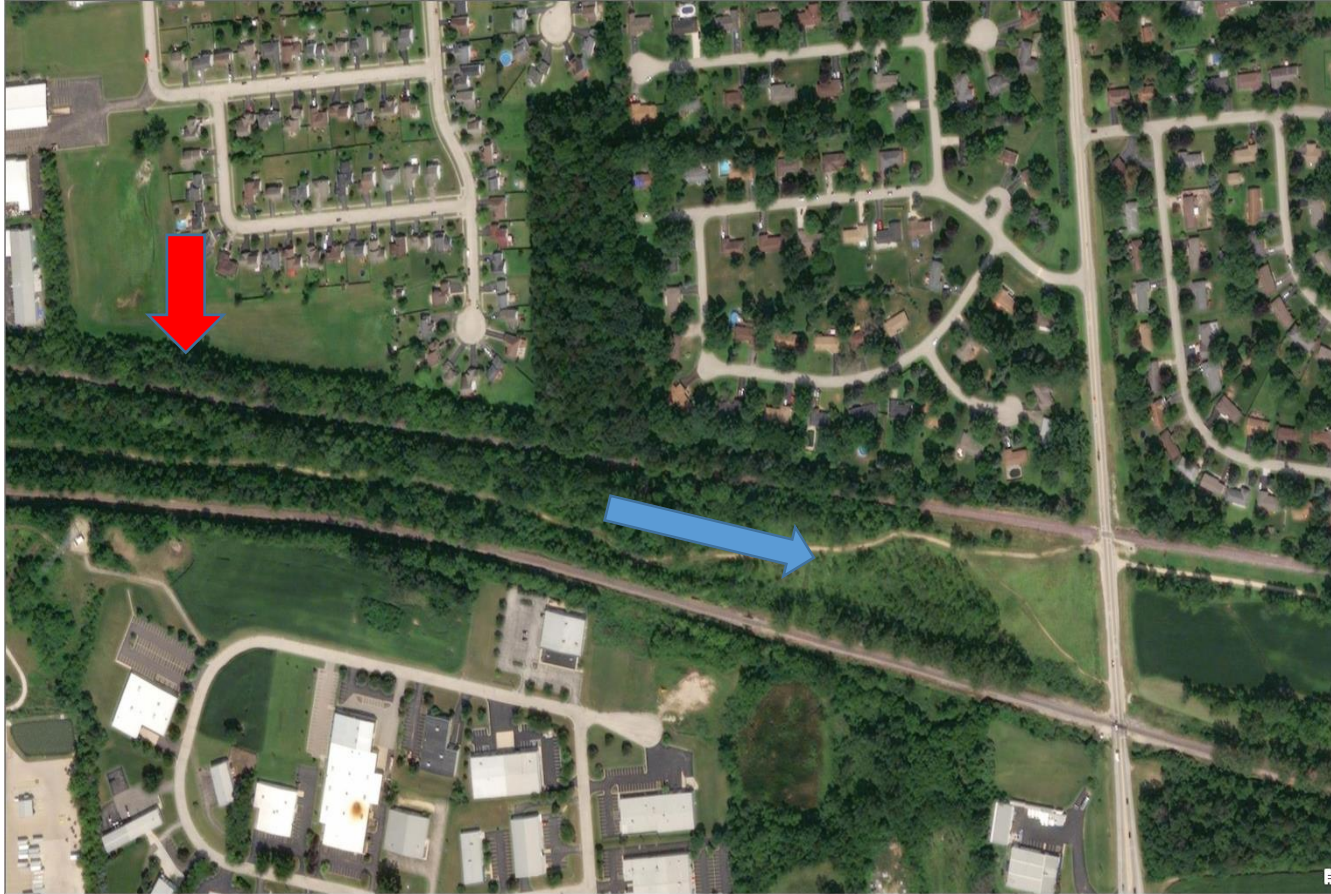
- ASDSO made members aware of NTSB findings via March 2012 eNews which included the following (emphasis added):

*While the impact of the detention pond failure on the washout of the rail line in this particular incident is not completely clear, the incident does provide a reminder that the washout of a rail line or a road due to **a dam failure can cause significant property damage and can result in loss of life. Please keep this situation in mind as you are evaluating hazard classification criteria for jurisdictional dams in your state.***

- This communication was reported as part of ASDSO's response to NTSB's Recommendation by the Executive Director on 4/12/2012

 National Transportation Safety Board Washington, D.C. 20594	
Safety Recommendation	
Date: March 2, 2012	
In reply refer to: R-12-11	
Mr. Don Borut Executive Director National League of Cities 1301 Pennsylvania Avenue, NW, Suite 550 Washington, D.C. 20004	Mr. Larry Naake Executive Director National Association of Counties 25 Massachusetts Avenue, NW, Suite 500 Washington, D.C. 20001
Ms. Lori Cannon Spragens Executive Director Association of State Dam Safety Officials 450 Old Vine Street Lexington, Kentucky 40507	Ms. Jennifer Imo Federal Director National Association of Towns and Townships 1130 Connecticut Avenue, NW, Suite 300 Washington, D.C. 20036
Mr. Tom Cochran Chief Executive Officer and Executive Director U.S. Conference of Mayors 1602 Eye Street, NW Washington, D.C. 20006	
<p>The National Transportation Safety Board (NTSB) is an independent Federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge you to take action on the safety recommendation in this letter. The NTSB is vitally interested in this recommendation because it is designed to prevent accidents and save lives.</p> <p>This recommendation addresses the inspection and maintenance of storm water detention ponds. The recommendation is derived from the NTSB's investigation of the June 19, 2009, derailment of a Canadian National Railroad Company (CN) freight train in Cherry Valley, Illinois, and is consistent with the evidence we found and the analysis we performed. As a result of this investigation, the NTSB has issued 15 safety recommendations, 1 of which is addressed to your organization. Information supporting this recommendation is discussed below. The NTSB would appreciate a response from you within 90 days addressing the actions you have taken or intend to take to implement our recommendation.</p>	
8145A	

What Hazard Classification is Appropriate?



Dam Hazard Classifications

- Class I – High Hazard Potential
- Class II – Significant/Moderate Hazard Potential
- Class III - Low Hazard Potential

With **Hazard Potential** defined as the probability (high, moderate or low) for causing loss of life or substantial economic loss in the event of a dam failure, *in excess of that which would naturally occur downstream of the dam if the dam had not failed.*

IL Part 3702 Rules for Construction of Dams

New Dams

- 1) Class I and II Dams
The owner of a proposed Class I or II dam shall obtain an OWR permit prior to the start of construction. The owner must do all construction and maintenance of the dam in accordance with this Part, as it applies to Class I or II dams.
- 2) Class III Dams
 - A) The owner of a proposed Class III dam shall obtain an OWR permit prior to the start of construction if the dam meets any of the following criteria:
 - i) the drainage area of the proposed dam is 6400 acres or more in a rural area or 640 acres or more in an urban area; or
 - ii) the dam is 25 feet or more in height, provided that the impounding capacity is greater than 15 acre-feet; or
 - iii) the dam has an impounding capacity of 50 acre-feet or more, provided that the dam height is greater than 6 feet
 - B) If a permit is required for the Class III dam under any of these criteria, then the owner must do all construction and maintenance of the dam in accordance with this Part, as it applies to Class III dams.

Lessons Learned

- Carefully evaluate the hazard classification **regardless of the dam size.**
- **Do not underestimate risk** even for small detention ponds.
- Consider **all failure modes**, downstream infrastructure, and **potential consequences.**
- **Regularly** inspect facilities.
- Repair damage to facilities in a **timely manner.**
- **Inspect facilities** after a large rainfall event.

Questions?

Thank You!

Tony Comerio, P.E., CFM
Environmental Practice Lead | Chief Water Resources Engineer
217-747-9425
tcomerio@hanson-inc.com



Please visit our booth

References

2) Hydrologic and Hydraulic Design Requirements

The basis for OWR review and approval of the hydrologic and hydraulic design requirements for Class I, II and III dams is the Corps Guidelines, subject to modifications as indicted herein. Technical publications other than the Corps Guidelines may be used to assure the use of current and applicable data for the hydrologic and hydraulic review of dam design.

A) Proposed Dams

The following minimum spillway design floods shall be used for proposed structures:

i) Principal Spillway Design Flood

<u>CLASSIFICATION</u>	<u>SIZE</u>	<u>PRINCIPAL SPILLWAY DESIGN FLOOD</u>
Class I	All	100-yr.
Class II	All	50-yr.
Class III	All	25-yr.

<u>CLASSIFICATION</u>	<u>SIZE</u>	<u>PRINCIPAL SPILLWAY DESIGN FLOOD</u>
Class I	Small	0.5 PMF
	Intermediate	1.0 PMF
	Large	1.0 PMF
Class II	Small	100-yr.
	Intermediate	0.5 PMF
	Large	1.0 PMF
Class III	Small	100-yr. *
	Intermediate	100-yr.
	Large	0.5PMF