A FINGER IN THE DIKE AND A HOSE OVER IT

*How the **City of Omaha** Re-Engineered Its Collection System to Combat Record Levels of the Missouri River*

By: City of Omaha, Public Works

Background

- During May-September 2011, the Missouri River had risen to record levels.
- Among the many battles that the City of Omaha had to fight, was to keep the combined sewer system operating to prevent vast area flooding within the city.
- In many cases the only way to beat the river's high level was to pump the water over the levee.

Background - Continued

- **Where did it start?**
  - Our neighboring states, Montana and the Dakotas decided to keep huge amounts of snowpack on their plains and mountains. The snowmelt together with very stormy weather created unprecedented runoff.
- **And then what?**
  - Reservoirs upstream on the Missouri River were filled and water was released to control the flow.
  - 160,000 cfs. were released from Gavin's Point Dam (South Dakota and Nebraska border).

Mission: 11-1-5893 Sortie-a0025
Date: 07JUN11 TOT: 1624Z
Location: Gavin's Point Dam, NE
Latitude: N042 51.173 / Longitude: W097 28.282
Object: Spillway

Background - Continued

- **AND…….?**
- The Missouri River tried to deliver up to 216,000 cfs, ending at 7.3 feet above flood stage by Omaha Nebraska.

I-29 and I-680 Interchange

Labor Statue, Riverfront - Omaha, NE

Omaha - Getting Ready

- The City of Omaha had to protect her citizens, public and private properties by:
  - Operating, maintaining and extending13 miles of levee and floodwalls i.e. keep water out of the levee dry side, as much as possible.
  - Keep sewer system, sanitary and combined – operational.
- Public Works operated in 3 main areas:
  - Maintaining the existing levee
  - Extending the levee
  - Pumping, pumping, pumping


Filling sandbags
06/01/2011 15:24

Dike construction


End product
06/11/2011 10:44

Passive and active protection

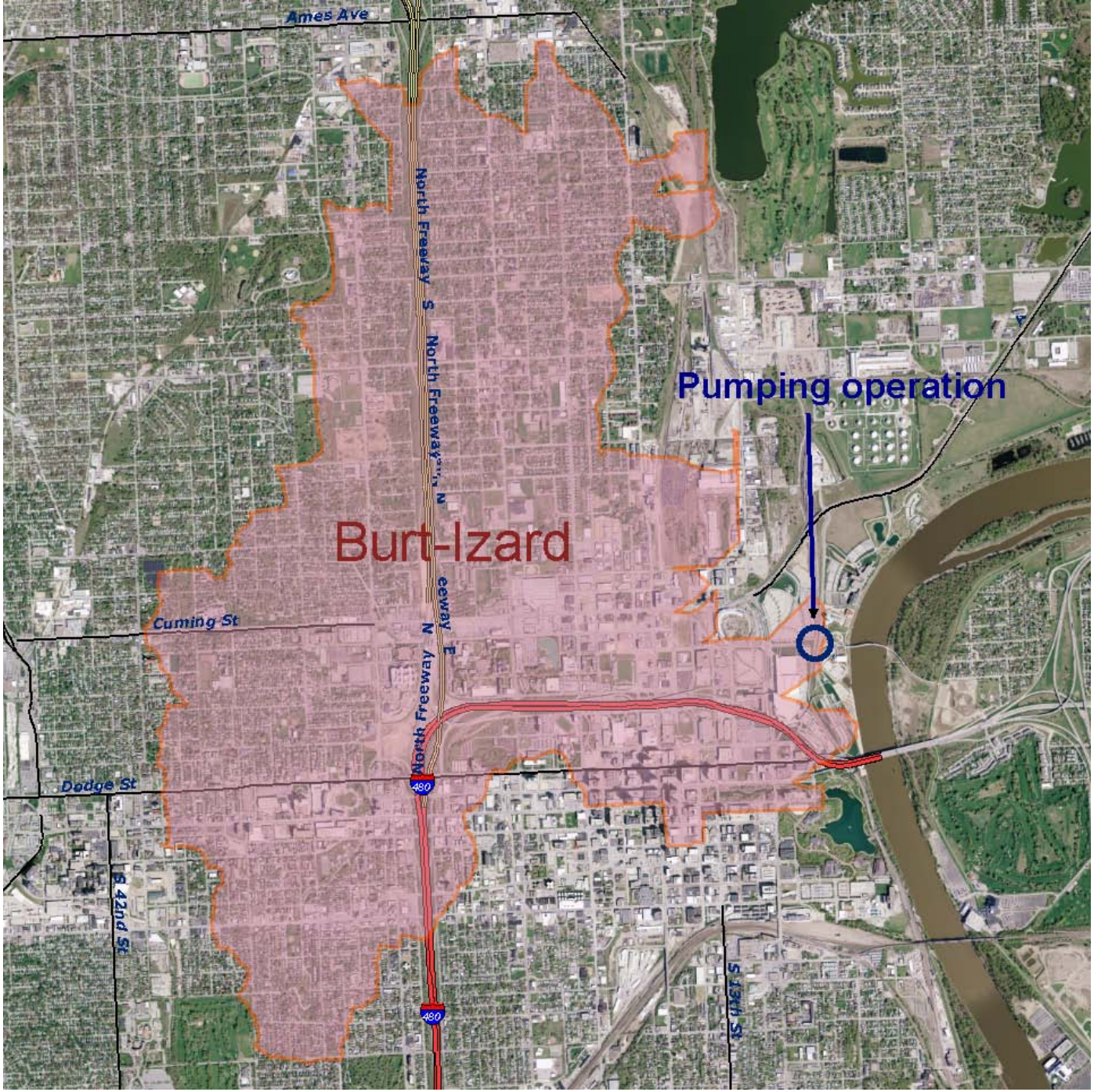

GLOBAL PUMP
GLOBAL PUMP

The Burt-Izard Temporary Pumping Station - Overview

- The temporary pumping operation in BI area was located in downtown Omaha within a highly visited tourist area:
  - CenturyLink (Convention) Center
  - TD Ameritrade Baseball Park, home field of the College World Series.
  - Riverfront walkway
  - Bob Kerrey Pedestrian Bridge over the Missouri River

Basin Description and Importance

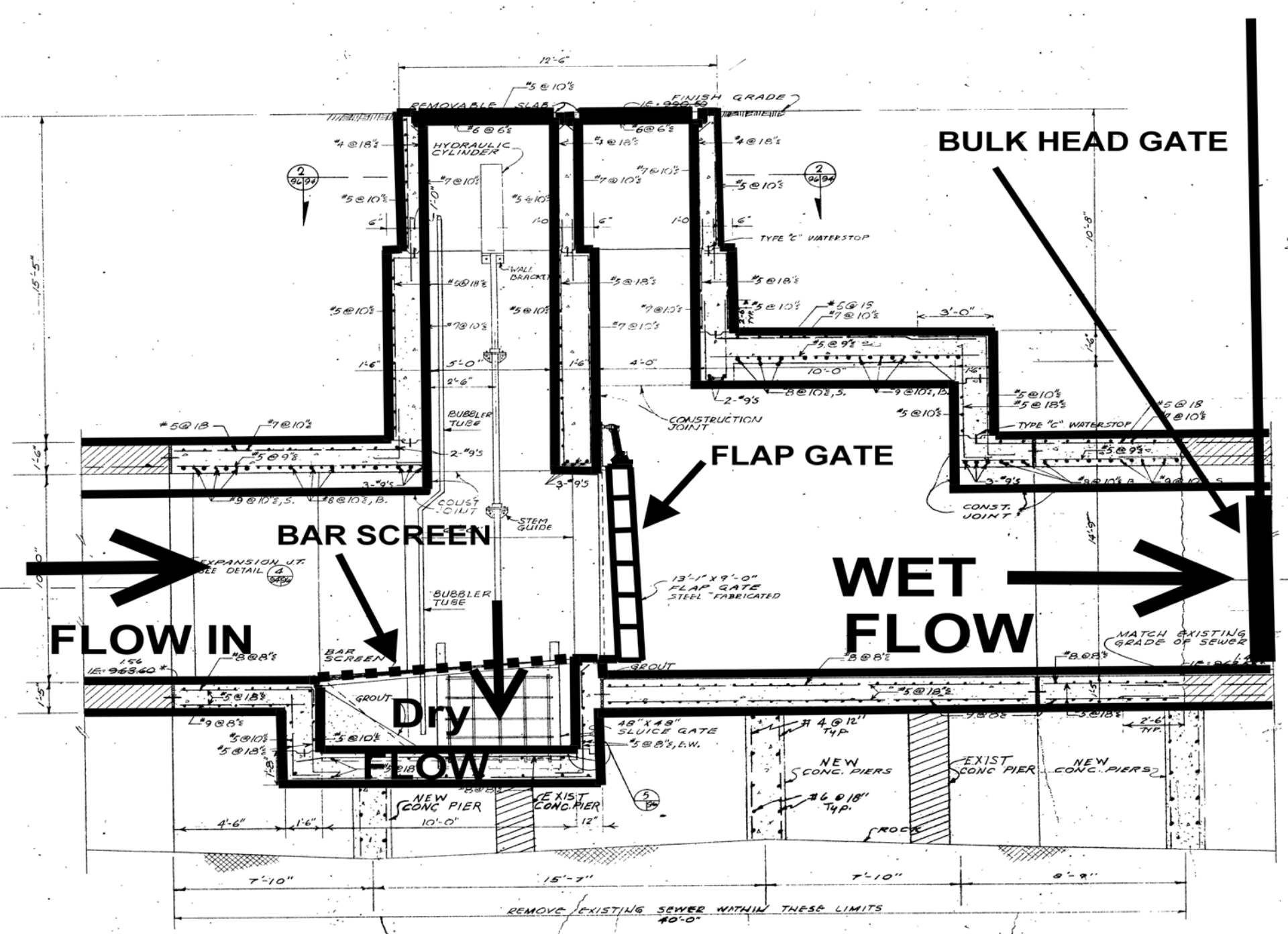
- BI basin area is about 5 square miles.
- Convention center and baseball stadium are located at the downstream BI basin in a depressed area protected by levee on it's east side.
- The basin consists of commercial residential and some industrial zoning. In upper basin majority is residential, in lower basin – commercial.

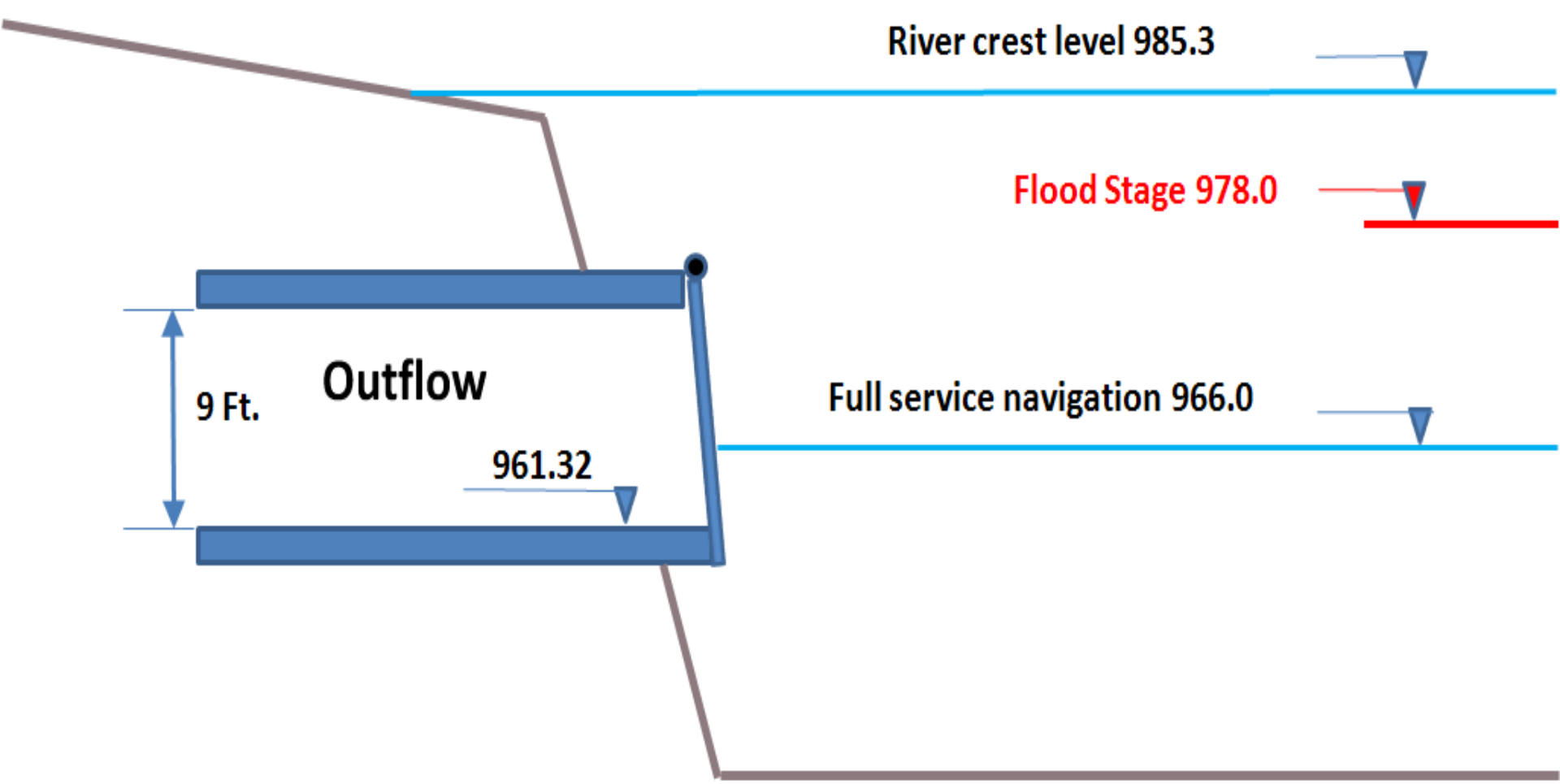

Ames Ave
North Freeway S
North Freeway N
Burt-Izard
Pumping operation
Cuming St
eeway E
N
North Freeway
Dodge St
480
480
S 42nd St
S 24th St


Bob Kerrey pedestrian bridge
Riverfront Marina
N
East side of CenturyLink Center

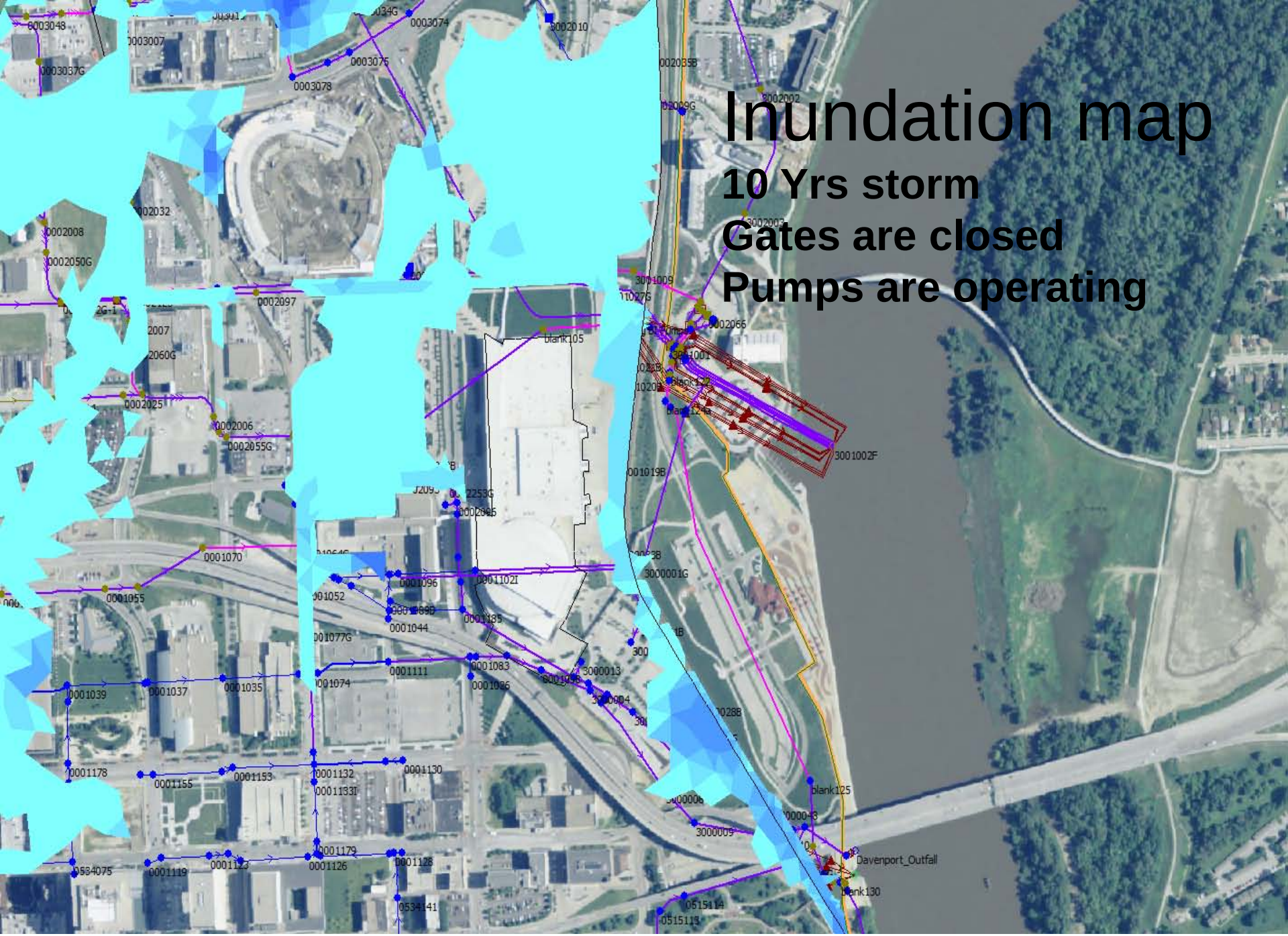
Sewer system in Burt-Izard

- A Combined sewer system in the BI basin.
- Three trunks in CenturyLink parking lot, conveying 1,000,000 GPM during 10 yr. storm event.
- Trunks end in a pumping/screening/overflow facility.
- Dry weather flow is pumped to the MoRiver Waste Water Treatment Plant (WWTP).
- Wet weather sewage overflows to the river.
- Gates are located on each interceptor protecting the system from intruding water while river level is elevated.


BULK HEAD GATE
FLAP GATE
BAR SCREEN
WET FLOW
FLOW IN
Dry FLOW
REMOVABLE SLAB
FINISH GRADE
HYDRAULIC CYLINDER
WALL BRACKET
TYPE "C" WATERSTOP
CONSTRUCTION JOINT
BUBBLER TUBE
STEM GUIDE
EXPANSION JT. SEE DETAIL
13'-1" X 9'-0" FLAP GATE STEEL FABRICATED
BAR SCREEN
GROUT
48"X48" SLUICE GATE
NEW CONC. PIERS
EXIST CONC PIER
NEW CONC PIER
MATCH EXISTING GRADE OF SEWER
ROCK
REMOVE EXISTING SEWER WATHIN THESE LIMITS
40'-0"



River levels in relation to outflow


Inundation map
10 Yrs storm
Gates are closed
Pumps are operating
blank105
blank125
Davenport_Outfall
blank130

Temporary Pumping Operation

- Avoiding pumping would cause vast flooding in the lower basin.
- More pumping capacity = shorter flooding time but costly operation.
- Challenge in pumping the wet weather flows:
  - Sewer system needed to be pumps-accessible.
  - Time limitations - the sooner the better.
  - 550 feet to the river = significant reduction in pumps efficiency.
  - Conflict w/utilities while excavating.
  - Challenges crossing railroad.

Temporary Pumping Operation

- Challenges in addition to common technical difficulties:
  - USACE Ban on excavating in the levee area.
  - Avoid interrupting:
    - Coal train traffic to OPPD.
    - College World Series games.
    - Activities at the National Parks building located by the river.
    - Scheduled conventions.
    - Tourism to high visited sites.

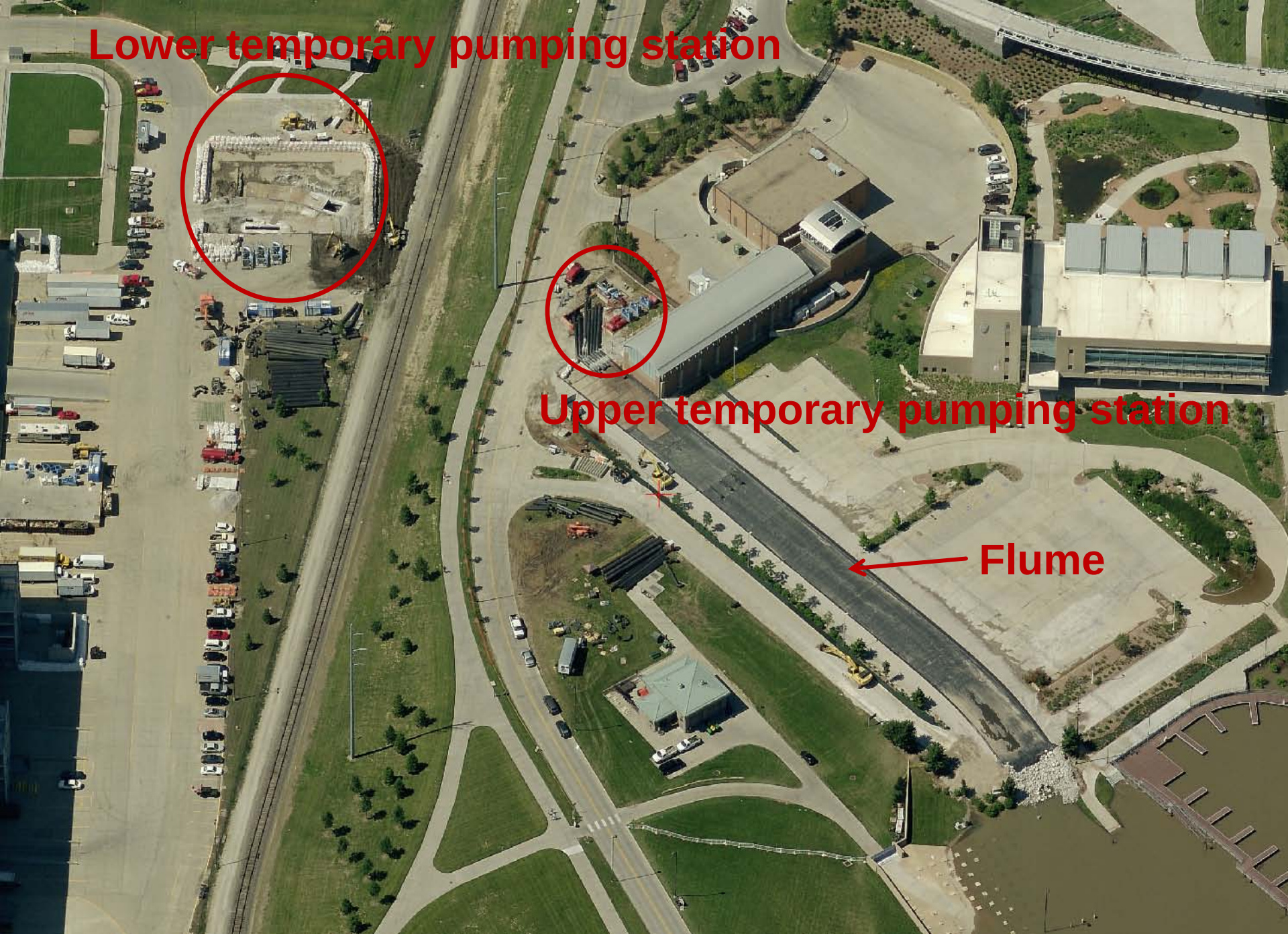
Implementation

- Required pumping capacity to evacuate flooding in reasonable time was 385,000 GPM.
- Upper pumping station – junction box next to the screening facility:
  - Required modifications to the junction box.
  - Limited area - only 7 pumps with total pumping capacity of 110,000 GPM.
- Lower pumping station – CenturyLink parking lot, required:
  - Pavement and top of box culverts removal
  - Construction of berm to contain the combined sewage.
  - Large floating pumps to operate from within the pit.
  - Crossing railroad.

Implementation - Continued

- Four floating pumps, three suction and one submersible pumps with 275,000 GPM capacity.
- The use of large floating pumps to operate from within the pit.
- Pipes crossing under railroad - installation within 48 hrs.

- Distance from river - flume solved the problem: 550 feet long, 40 feet wide, 0.7% slope. 5000 ton compacted crushed rock for bedding, 110 jersey barriers 10 feet long 32 inch high, 25,000 square feet of 45 mil EPDM liner and 530 tons of Type C riprap


Lower temporary pumping station
Upper temporary pumping station
Flume

Total pumping capacity
110,000 GPM

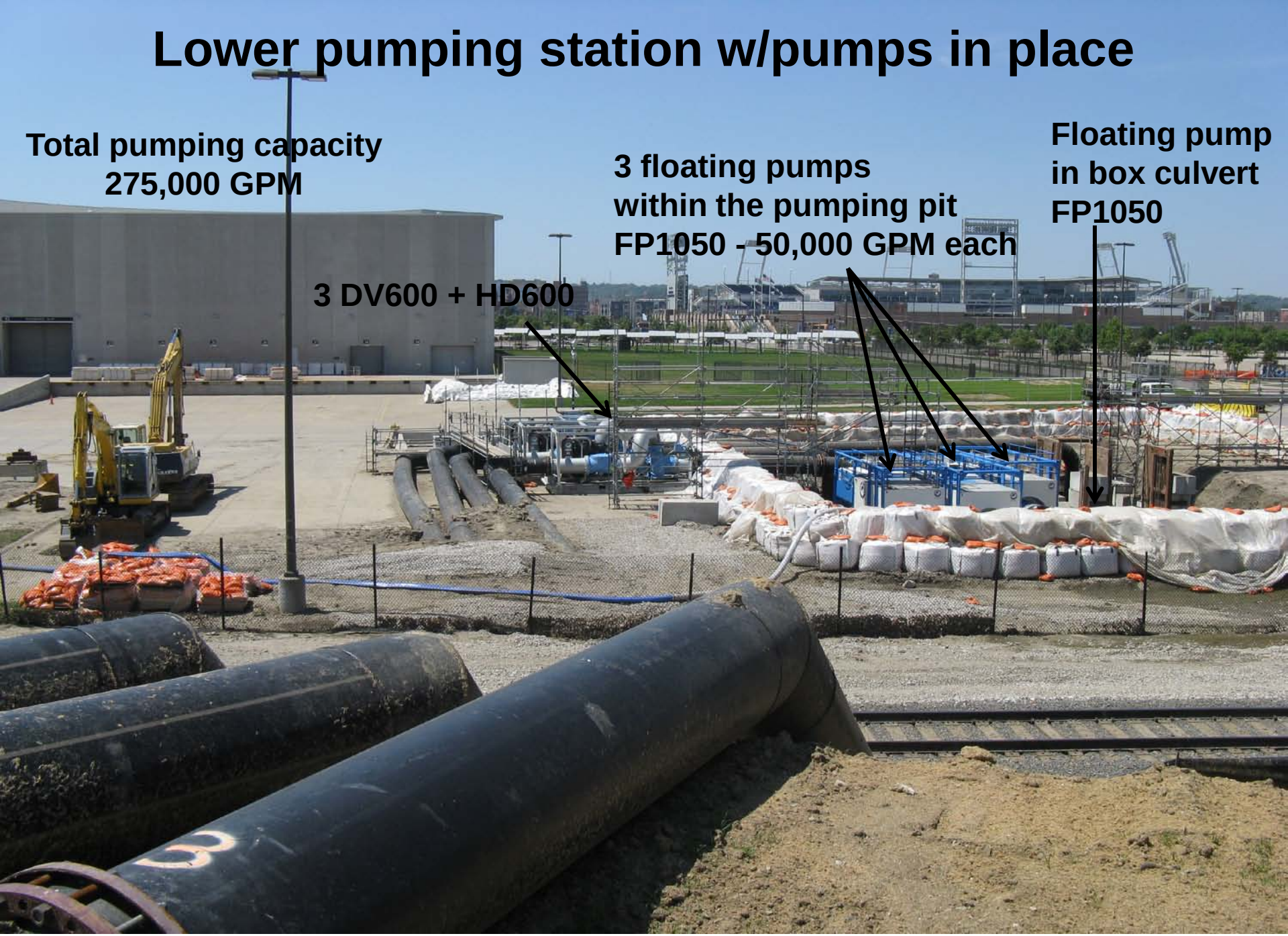
Upper pumping station

Flume


National Park Service
U.S. Department of the Interior
Carl T. Curtis Building
Midwest Regional Office
Lewis & Clark National
601 RIVERFRONT DRIVE

Pipe construction under railroad

Lower pumping station w/pumps in place

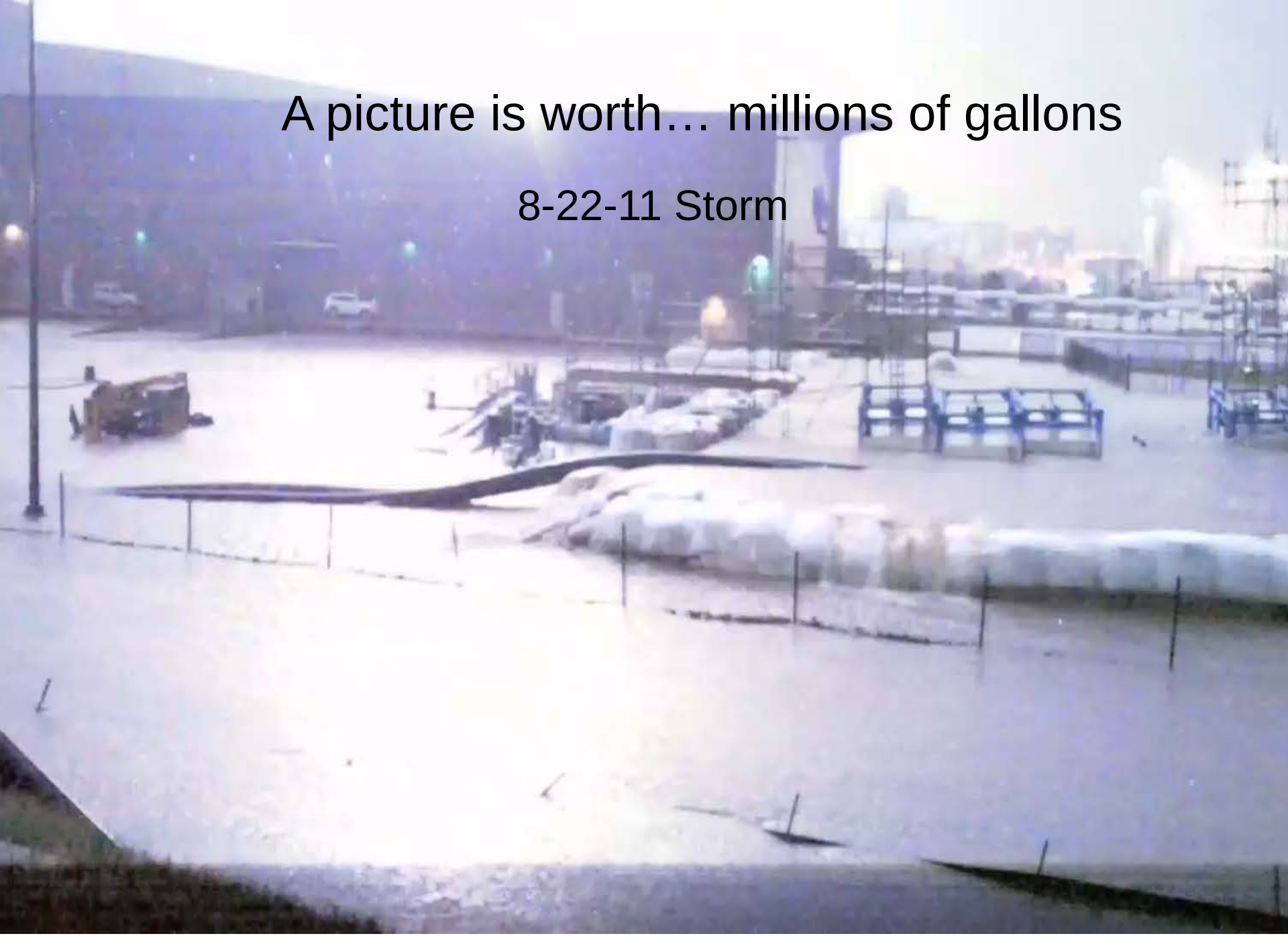


Challenges

- No contingency plans - designed ‘on the fly’.
- Tight schedule to protect life and avoid flooding damages.
- Need to adjust, reinforce or rebuild various components (trial and error):
  - Original pump layout plan was totally different than built.
  - Outfall was heavily reinforced after being damaged.
  - Second layer of EPDM was added in the flume and secured by heavy steel plates due to drag force.
  - Reconstruction of scaffolds to access pumps.
  - Addition of remote controls for floating pumps.
  - Berm reinforcement after breach.

A picture is worth… millions of gallons

8-22-11 Storm



Lessons Learned and Conclusions

- Emergency projects are different in nature, and require: Coordination, resources, Initiative, many hours in the field.
- Trial and error – live and learn, are major components in such projects
- Special attention to SAFETY.
- Such projects are extremely costly, business plans of emergency contractors are based on the notion of ‘crisis’ and that money is not a ‘factor’ (not that I blame them).

Lessons Learned and Conclusions -Continued

- **HARD WORKING TEAMS AND THEIR WILLINGNESS TO HELP THE COMMUNITY MADE FOR A SUCCESSFUL FLOOD MITIGATION PROJECT AND PROVIDED OMAHA'S RESIDENTS WITH RELATIVELY SAFE CONDITIONS AND NORMAL DAILY ROUTINE DURING THE FLOOD.**

Questions?