East Grand Forks, MN  
Grand Forks, ND  
Local Flood Damage Reduction Project

Presentation for the  
2005 Infrastructure Conference  
HH&C CoP Sessions

by  
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Presentation Summary

✓ Project Location & Background
✓ Top-of-Levee Design
✓ Superiority Profile Complications
✓ Interior Flood Control Analysis
✓ Pump, Control & Generator Supply Contracts
✓ 15 Construction Contracts
✓ East Grand Forks “Removable” Floodwall
✓ Stepped Dam converted to Rock Rapids
✓ RR Closure Sill Installation
✓ Construction Using GPS
✓ Ice Bridge used to haul Borrow
✓ Design Team & Construction Office Issues
Project Location

- Canada
- Lake Michigan
- Lake Superior
- Grand Forks/East Grand Forks
- North Dakota
- Minnesota
- Mpls./St. Paul
- Wisconsin

One Corps Serving the Armed Forces and the Nation
Both Cities have Long History of Significant Flooding
Most Damaging was in April 1997 when Temporary Levees & Heroic Flood Fighting were not Successful
Plan consists of Levees, Floodwalls, Two Diversion Channels and Interior Flood Control Facilities
Current Working Estimate is $410 Million
Pre-Certification Package Submitted to FEMA in May 2005
East Grand Forks & Grand Forks Flood of 1997

Interstate 29
Red River
Demers Ave.
Hwy 7
Red Lake River
Flooded outline
Flooded outline
Project Overview
Top-of-Levee Design

Iterative Process based on Hydraulic Analysis & Geotechnical Slope Stability Analysis
Levee Overbuild for Settlement

Settlement Range:

- Minimum of 6 inches for a 5’ to 10’ high levee
- Maximum of 60 inches for a 35’ high levee

Superiority Profile for Overtopping at the Least Critical Location was Complicated by the Settlement Overbuild

Gravity Outlet Profiles were Adjusted to Accommodate the Settlement
Top-of-Levee with Overbuild

EGF & GF Top-of-Levee with Overbuild

Distance in Miles
Elevation in Feet-1929 NGVD

- Design WSP
- TOL without Superiority
- TOL with Superiority
- EGF TOL w/ Overbuild
- GF TOL w/ Overbuild
Gravity Outlets:

- Economic Optimization Analysis performed for Several Outlets
- Results were Inconclusive
- Outlets were Sized for the 4% (25-Year) Event with No Surcharge & No Damages for the 1% (100-Year) Event

Pump Stations:

- All were Sized based on Economic Optimization Analysis
- Included Analysis of Alternatives to Reduce the Number of Pump Stations via Interceptor Sewers.
Pump Stations

✓ Standard Pump Sizes of 3,000; 6,000 and 15,000 gpm were Selected based on Results of IFC Analyses

✓ Standard Pump Station Configurations were Developed & used throughout the Project

✓ Generators were included in All Pump Stations & were Sized to Power 1 of 2 or 2 of 3 Pumps

✓ Pumps, Pump Controls & Generators were Purchased under a Supply Contract

✓ Generators were also Sized to Power an Adjacent Sanitary Lift Station in two locations
Pump Stations

East Grand Forks – 11 Pump Stations
✓ Includes retrofit of an existing Station
✓ Smallest Station Capacity is 6,000 gpm
✓ Largest Station Capacity is 18,000 gpm

Grand Forks – 12 Pump Stations
✓ Includes one Station with a Capacity of 116,000 gpm that does not use the standard pumps and station configuration
✓ Smallest Station Capacity is 6,000 gpm
✓ Largest Station Capacity using standard pumps sizes is 60,000 gpm
Pump Stations
Pump Stations
Pump Stations
Pump Stations

2/11/2003 11:53am
Construction Contracts

Plans & Specs - EGF & GF
- Old Railroad (Pedestrian) Bridge Removal – In-house
- Riverside Dam – In-house
- Pedestrian Bridges – Ayres Associates

Plans & Specs – East Grand Forks
- Phase 1 - Short, Elliot, Hendrickson, Inc.
- Phase 2 - Short, Elliot, Hendrickson, Inc.
- Phase 3 - In-house
- Phase 4 – In-house
- Heartsville Coulee Diversion - Short, Elliot, Hendrickson, Inc.

Plans & Specs – Grand Forks
- English Coulee Diversion – HDR, Inc.
- English Coulee Pump Station – Ayres Associates
- Phase 1 – Stanley Consultants
- Phase 2 – Stanley Consultants
- Phase 3 – Stanley Consultants
- Phase 4 – Stanley Consultants
- 55th Street Pump Station – In-house
City of EGF received an Economic Development Administration grant that was used for “Removable” Floodwall

Removable Floodwall is a proprietary system from “Flood Control America”

Designed and Constructed before Corps FCP started Construction (with some Corps Input)

Floodwall is 880’ long including three full height road closures (two 80’ long and one 60’ long)

Floodwall begrudgingly accept by St. Paul District

Floodwall Portion has a 4’ high Parapet Wall at about the 1% (100-Year) Flood Elevation

Modifications required to include in FCP include changing pedestals to a grade beam and extending the footing ~6’ riverward
EGF “Removable” Floodwall
Parapet Wall with Intermediate Columns
EGF “Removable” Floodwall

Floodwall Portion with some Stop Logs Installed
EGF “Removable” Floodwall

Demers Avenue, 80’ Wide, 14’ High Closure
EGF “Removable” Floodwall

Flood Control America Stop Log
EGF “Removable” Floodwall

Footing Modifications to Include in FCP
EGF “Removable” Floodwall

Pedestal Modifications to Include in FCP
Riverside Dam
Riverside Dam

Section along Channel Centerline
Riverside Dam

Riverside Dam - Plan View of Rock Rapids Structure
Riverside Dam
Riverside Dam
Riverside Dam

Before

After
Railroad Closures

Three RR Closure Sills had to be completed in a single 24-hour track outage

24-hour outage included time for the RR to remove and replace the tracks

Contractor had 14 hours to excavate sites, drive sheetpile cutoffs, place rebar & forms, pour concrete, strip forms and backfill sites

Concrete mix included an accelerator additive, all test cylinders had strengths > 5,100 psi after 24 hours
Railroad Closures

Track & Tie Removal (by RR Crew)
Railroad Closures

Excavating Site
Railroad Closures

Driving Sheetpile Cutoff
Railroad Closures

Setting Rebar Mat

10/11/2004 4:01pm
Railroad Closures

Pouring Concrete
Railroad Closures

Fit Test of Stoplog
Railroad Closures

Installing & Setting Ties & Tracks (by RR Crew)
Construction using GPS

- Subcontractor requested Corps’ model files including the 3D models from Microstation InRoads.
- Subcontractor loaded Microstation files into their software.
- Computer in Bulldozer cab and GPS unit on each end of blade.
- Monitor in cab can display either plan view or cross-section view.
- In plan view, dozer is shown in respect to project centerline and footprint.
- In cross-section view, dozer is shown in elevation in respect to design.
- Cut or fill depths are indicated for each end of blade.
- When cut or fill depths are within a few inches, dozer may be switched to automatic mode to grade to design elevations.
Construction using GPS

GPS Units on Each End of Blade
Construction using GPS

GPS Base Station at the Subcontractor’s Shop
Construction using GPS

Monitor in Cab showing Plan View
Construction using GPS

Monitor in Cab showing Cross-Section View
Construction using GPS

Monitor in Cab showing Coordinates, Existing & Design Elevations, and GPS Status
Ice Bridge

- Subcontractor approached Corps regarding using an Ice Bridge to haul material across the Red Lake River.
- Ice bridge shortened haul route from 5 miles to ½ mile.
- Eliminated hauling through residential neighborhoods & by two schools.
- Eliminated Wear & Tear on Roads.
- Residents not Irritated by Traffic on Roads.
- MN DNR contacted for Permit Requirements.
- CRREL contacted for Technical Support.
- 22” of Clear, Sound Ice needed for 30-ton Trucks.
- To increase ice depth, subcontractor plowed snow from the area then flooded it & let it freeze.
Ice Bridge

✓ Ice was 18” thick at beginning of January.
✓ Ice was 40” thick on January 28th.
✓ Operators wore personal floatation devices and crampons and kept their truck windows open.
✓ Operators limited to 20 mph over the Ice Bridge.
✓ In just under a month, Subcontractor hauled & stockpiled more than 300,000 CY of Impervious Fill.
✓ Hauling would have taken three months without the Ice Bridge.
✓ Subcontractor kept detailed ice, weather and haul records that CRREL will use in studies re: Ice Bridges.
✓ Ice Bridge was deemed a success by Everyone.
Ice Bridge

Comparison of Routes
Ice Bridge

Plowing Snow from the Site
Ice Bridge

Flooding the Site to Increase Ice Thickness
Ice Bridge

Loading Borrow

1/29/2004 1:23pm
Ice Bridge

Truck Crossing Ice Bridge

2/6/2004 8:55am
Ice Bridge

Stockpiling Borrow

1/29/2004 1:02pm
Construction Office & Design Team Issues

Shop Drawings not Submitted according to Schedule

Numerous Design Changes made without Coordinating with Designers

Changes made to Interior Flood Control Facilities required Contract Modifications to Correct

- Street grades raised
- Curb Cuts to Drop Inlets Eliminated
- Drop Inlet Elevations Raised
- Toe Ditches Modified
EGF & GF
Local Flood Damage Reduction Project

Questions?

Comments?