SAFCA
Natomas Levee Improvement Program
Contractor’s Informational Meeting

October 16, 2008
Meeting Agenda

• NLIP Overview
• Construction Phasing Schedule & Cost Estimates
• Construction Segments
  – Sacramento River, American River
  – Natomas Cross Canal, PGCC, NEMDC
  – Canal Relocations, Pumping Plant Modifications, Borrow Sites
• Environmental Constraints
• Discussion Topics
• Q & A
Identified Flood Risks

- Inadequate Levee Height
- Instability – Geometry, Underseepage, etc.
- Encroachments
- Channel Erosion
Program Objectives

• Provide 100-year flood protection as quickly as possible

• Provide 200-year flood protection over time

• Ensure that new development does not substantially increase the expected damage of an uncontrolled flood
**Levee Seepage Concerns**

**Levee Instability**
Saturated soil and sand layers may cause levee slopes to slump, or levee foundation to settle, risking levee failure at flood stage.

**Through-Seepage**
When the river is near flood-stage, high water pressure at some locations causes seepage through the levee.

**Under-Seepage**
High river levels lead to underseepage through sandy and gravelly soils. High water pressure beneath the surface can emerge at the land-side levee toe, causing sand boils, and can also appear at the surface up to several hundred feet land-side of the levee.
Waterside Levee Encroachments
Sacramento River Bank Erosion Sites
NLIP Construction Phasing
<table>
<thead>
<tr>
<th>Category</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>$421 M</td>
</tr>
<tr>
<td>ROW</td>
<td>$90 M</td>
</tr>
<tr>
<td>Mitigation &amp; Permit</td>
<td>$28 M</td>
</tr>
<tr>
<td>Engineering &amp; CM</td>
<td>$79 M</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$618 M</strong></td>
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</tbody>
</table>
Construction Cost Estimate

SREL $255 M
NCC $58 M
NEMDC/PGCC $95 M
ARNL $13 M
TOTAL $421 M
## Estimated Construction Cost

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Description</th>
<th>Cost (M)</th>
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<tbody>
<tr>
<td>2007</td>
<td>NCC S Levee Phase 1</td>
<td>$14M</td>
</tr>
<tr>
<td>2008</td>
<td>NCC S Levee Phase 1B</td>
<td>$4M</td>
</tr>
<tr>
<td>2009</td>
<td>SREL Phase 1</td>
<td>$49 M</td>
</tr>
<tr>
<td></td>
<td>NCC S L Phase 2</td>
<td>$40 M</td>
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<tr>
<td></td>
<td>SREL Phase 2</td>
<td>$104 M</td>
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<tr>
<td></td>
<td></td>
<td><strong>$193 M</strong></td>
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</table>
Estimated Construction Cost

2010
- SREL Phase 3 $82 M
- PGCC W L Phase 1 $19 M
$101 M

2011
- NEMDC W Levee $76 M
- ARNL $13 M
- SREL Phase 4 $20 M
$109 M
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October 16, 2008

Sacramento River East Levee &
American River North Levee Overview

Christopher Krivanec, PE, GE
Project Manager
HDR Engineering
SACRAMENTO RIVER EAST LEVEE SEGMENTS
(Construction Start Year)

SREL-1
Reach 1 to 4A
(2009)

SREL-2
Reach 4B to 9B
(2009)

SREL-3
Reach 10 to 15
(2010)

SREL-4
Reach 16 to 20
(2011)
Sacramento River East Levee
Adjacent Levee Design Concept
## Sacramento & American River Levees
### Construction Quantity Overview

<table>
<thead>
<tr>
<th>Phase</th>
<th>Total Fill (CY)</th>
<th>Cutoff Wall &lt; 80 ft (SF)</th>
<th>Cutoff Wall &gt; 80 ft (SF)</th>
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</thead>
<tbody>
<tr>
<td>SREL-1</td>
<td>1.53M</td>
<td>532,000</td>
<td>-</td>
</tr>
<tr>
<td>SREL-2</td>
<td>1.94M</td>
<td>1,334,000</td>
<td>654,000</td>
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<tr>
<td>SREL-3</td>
<td>2.01M</td>
<td>363,000</td>
<td>-</td>
</tr>
<tr>
<td>SREL-4</td>
<td>0.58M</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ARNL-1</td>
<td>-</td>
<td>626,000</td>
<td>-</td>
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</tbody>
</table>
SREL Preliminary Design Alternatives

• Adjacent Levee – Typical Cross Section
SREL Preliminary Design Alternatives

- Adjacent Levee with Seepage Berm
SREL Preliminary Design Alternatives

- Adjacent Levee with Cutoff Wall
## Preliminary Project Features

<table>
<thead>
<tr>
<th>Reach</th>
<th>Length (ft)</th>
<th>Average Levee Raise (ft)</th>
<th>Selected Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4,800</td>
<td>2.8</td>
<td>Adjacent Levee Raise (Entire Reach) 30’ SB Wall (Entire Reach)</td>
</tr>
<tr>
<td>2</td>
<td>5,200</td>
<td>2.9</td>
<td>Adjacent Levee Raise (Entire Reach) 60’ SB Wall (Entire Reach)</td>
</tr>
<tr>
<td>3</td>
<td>1,000</td>
<td>2.8</td>
<td>Adjacent Levee Raise (Entire Reach) 60’ SB Wall (Entire Reach)</td>
</tr>
<tr>
<td>4A</td>
<td>8,000</td>
<td>2.4</td>
<td>Adjacent Levee Raise (Entire Reach) 100’ Seepage Berm (Entire Reach)</td>
</tr>
</tbody>
</table>
SREL-1
Borrow Source

North of Sacramento International Airport
## SREL-2

### Preliminary Project Features

<table>
<thead>
<tr>
<th>Reach</th>
<th>Length (ft)</th>
<th>Average Levee Raise (ft)</th>
<th>Selected Mitigation Measures</th>
</tr>
</thead>
</table>
| 4B    | 3,800       | 2.6                      | Adjacent Levee Raise (Entire Reach)  
300' Seepage Berm with Relief Wells (Entire Reach)  
85' SB Cutoff wall at Pumping Plant #2 (Stations 209+50 to 224+50) |
| 5A    | 3,500       | 1.9                      | Adjacent Levee Raise (Entire Reach)  
75' SB Wall Stations (Entire Reach)  
100' Seepage Berm with Relief Wells (Stations 258+00 to 263+00) |
| 5B    | 1,700       | 1.7                      | Adjacent Levee Raise (Entire Reach)  
100' Seepage Berm with Relief Wells (Entire Reach) |
| 6A    | 2,300       | 2.1                      | Adjacent Levee Raise (Entire Reach)  
100' Seepage Berm with Relief Wells (Stations 280+00 to 293+50)  
115' SB Wall (Stations 293+50 to 302+00) |
| 6B    | 2,700       | 2.0                      | Adjacent Levee Raise (Entire Reach)  
115' SB Wall (Entire Reach) |
# SREL-2

## Preliminary Project Features

<table>
<thead>
<tr>
<th>Reach</th>
<th>Length (ft)</th>
<th>Average Levee Raise (ft)</th>
<th>Selected Mitigation Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>3,200</td>
<td>2.3</td>
<td>Adjacent Levee Raise (Entire Reach) 85' SB Wall (Stations 330+00 to 338+00) 85' SB Wall (Stations 338+00 to 362+00)</td>
</tr>
<tr>
<td>8</td>
<td>4,000</td>
<td>2.3</td>
<td>Adjacent Levee Raise (Entire Reach) 85' SB Wall (Entire Reach)</td>
</tr>
<tr>
<td>9A</td>
<td>500</td>
<td>1.9</td>
<td>Adjacent Levee Raise (Entire Reach) 85' SB Wall (Entire Reach)</td>
</tr>
<tr>
<td>9B</td>
<td>6,300</td>
<td>2.4</td>
<td>Adjacent Levee Raise (Entire Reach) 85' SB Wall (Stations 407+00 to 433+00) 80' SB Wall (Stations 433+00 to 455+00) 110' SB Wall (Stations 455+00 to 468+00)</td>
</tr>
</tbody>
</table>
ANTICIPATED CONSTRUCTION COSTS

SREL-1
Reach 1 to 4A
$49M

SREL-2
Reach 4B to 9B
$104M

SREL-3
Reach 10 to 15
$82M

SREL-4
Reach 16 to 20
$20M

ARNL-1
$13M
Natomas Levee Improvement Program

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Natomas Cross Canal
Pleasant Grove Creek Canal
Natomas East Main Main Drainage Canal
NCC South Levee – Phase 2
PGCC W Levee
NEMDC W Levee
Anticipated Award Schedule

- NCC Phase 2: Early 2009
- PGCC: Early 2010
- NEMDC Phase 1: Early 2011
- NEMDC Phase 2: Early 2011
NCC South Levee Phase 2
NCC Phase 2 – Scope of Work

- Construct soil bentonite cutoff wall
- Raise levee and flatten side slopes
- Raise existing pump plant discharge pipelines
- Demolish existing structures and utilities at selected parcels
NCC Phase 2 – Cutoff Wall Work Summary

• Soil bentonite cutoff wall
  – 1.3 million square feet (3.6 miles)
  – 67 to 77 feet deep
  – 36 inches wide
  – Permeability: $1 \times 10^{-6}$
  – $\frac{1}{2}$ levee degrade
  – 3 week wall settlement period
  – Conventional long reach excavator method
NCC Phase 2 – Levee Raise
Work Summary

- Raise levee and flatten side slopes
  - Levee Degrade: 265,000 CY
  - Total fill placement: 825,000 CY
  - Total import: 736,000 CY
  - Aggregate base: 22,000 tons
NCC Phase 2 – Outfall Pipe Modification Work Summary

• Raise existing pump plant pipelines
  – Odysseus Farms – (1) 18” WSP
  – RD 1000 Pump Plant No. 4 – (3) 48” WSP
  – Install Closure Devices, AR/AV Valves, Flap Gates
NCC Phase 2 – Demolition Work Summary

• Demolish existing structures and utilities at selected parcels
  – 2 to 3 houses
  – 1 large pole barn
  – 3 farm buildings
  – Abandon 2-3 domestic wells
  – Remove existing underground power and septic systems
NCC Phase 2 - Typical Water Side Raise Details

Levee Raise Section - Typical

Scale: 1"=10'

STA 215+00 TO 226+00
STA 229+00 TO 246+00
NCC Phase 2 - Typical Water Pipe Modification Details
NCC Phase 2 Demolition
NCC Phase 2 Schedule

- Anticipated Schedule:
  - Advertise: January 2009
  - Bid Opening: February 2009
  - Award: March 2009
  - NTP: April 15, 2009
  - Contract Completion: November 1, 2009
PGCC West Levee
PGCC West Levee

• **Scope of Work**
  – Levee widening/raising/slope flattening
    • 470,000 CY
  – Cutoff walls in select locations
    • 5,000 lineal feet
    • 60 feet deep
    • 300,000 SF
PGCC West Levee

Cutoff Walls

- Pierce-Roberts Drain
  3,000 LF

- Pleasant Grove Creek
  1,000 LF

- Curry Creek 1,000 LF
PGCC West Levee

Typical Section – Levee Widening
PGCC West Levee

Typical Section – Levee Widening with Cutoff Wall
NEMDC Phase 1

• Scope of Work
  – Cutoff Wall
    • 12,000-15,000 LF
    • 50-60 feet deep
    • 825,000 SF
    • Limited space available for levee degrading
    • Potentially by CB, DSM, or TRD method
  – Landside Slope Stability Modifications
Cutoff Walls

- Dry/Robla Creeks 3,900 LF
- Magpie Creek 4,000 LF
- Arcade Creek 5,400 LF
NEMDC Phase 2

NEMDC West Levee Phase 2
NEMDC Phase 2

• Scope of Work
  – Levee widening/slope flattening
    • 1,250,000 CY
  – Cutoff walls in select locations
    • 3 x 1,000 foot reaches
    • 180,000 SF
NEMDC Phase 2 - Closeup
NEMDC Phase 2
Typical Section – Levee Widening
NEMDC Phase 2

Typical Section – Levee Widening with Cutoff Wall
NLIP Borrow Sources
Major Borrow Sites

- Brookfield
- Airport North
- Fisherman's Lake Area
- Krumenacher
- Twin Rivers Stockpile
Natomas Cross Canal Borrow Source

Site Conditions
- Existing Rice Field
- Out of Production October 2008
- Suitable Material with Minimal Mixing
- Groundwater 10 feet Deep

Quantity Data
- Available Acreage: 204 acres
- Average Depth of Excavation: 4 to 5 feet
- Available Volume: 1,100,000 cy (800,000 cy levee in place)
- Average Haul Distance: 2.5 miles (one way)
Sacramento River North Borrow Sites

- Sites 4 & 1 for SREL-1
- Sites 2, 3 & 6 for SREL-2
- Haul overland to levee
- Haul route for construction will bridge several canals
Sacramento River North Borrow Source

Site Conditions

- Fallow agricultural fields
- Out of production for more than 2 years
- Some unsuitable material requiring mixing or waste
- Average groundwater depth: 5 to 6 feet
- Irrigation canals within work area
Sacramento River North Borrow Source

SREL-1 (North) Quantity Data

- Available Acreage: 229 acres
- Average Depth of Excavation: 4 to 5 feet
- Available Volume: 1.3 million cy (0.9 million cy levee-in-place)
- Average Haul Distance: 1 mile (one way)
Sacramento River North Borrow Source

SREL-2 (South) Quantity Data

– Available Acreage: 371 acres
– Average Depth of Excavation: 4 to 5 feet
– Available volume: 1.9 million cy (1.1 million cy levee-in-place)
– Average Haul Distance: 3 miles (one way)
Canal & Pump Station Redesign and Relocation
Irrigation and Drainage Facilities Overview

- Raise Irrigation and Drainage Pipes thru Levee (23 pipes north of I-5)
- Reconstruct RD1000 Pumping Plant No. 2
- Relocate Irrigation Canals
- New Drainage Canals
Typical Levee Pipe Crossing

Approximately 30 Pipe Penetrations - 12” to 48” diameter

NOTE:
(1) SLOPE OF PIPE TO BE DETERMINED BY SIPHON CALCULATIONS.
RD1000 Pumping Plant 2
RD1000 Pumping Plant 2
Sump and Outfall Pipe Section
Irrigation and Drainage Canals

- Relocated Elkhorn Canal -- SREL-2
- New GGS/Drainage Canal
  - North of I-5 – SREL-2
  - South of I-5 – SREL-3
- Relocated Riverside Canal - SREL-3
Elkhorn Canal System Construction Staging

- **Year 1 Outage** (August 15th)
  - North River Pumping Plant
  - Tie-in North River Pumping Plant
  - Tie-in South of Teal Bend Golf Course

- **Year 2 Outage** (September 1)
  - South River Pumping Plant
Elkhorn Canal Typical Cross Section
Elkhorn North

- 10,000 linear feet earthen canal
- 250,000 cubic yards embankment
- 2,000 linear feet of Welded Steel Pipe (pump discharge)
- 500 linear feet of twin 6’x6’ RCB
- 150 cubic yards Cast-In-Place Concrete
Elkhorn Irrigation System Construction

Elkhorn South

- 9,400 linear feet
  - 1,300 lf earthen canal
  - 4,100 lf concrete lined
  - 4,000 lf 42” RCP
- 50,000 cubic yards embankment
- 600 linear feet of Welded Steel Pipe (Pump Discharge)
- 1,300 linear feet of RCP (18” to 54”)
- 30 cubic yards Cast-In-Place Concrete
Excavated Soil Reused for Canal Embankment (or Levee) Construction

- 23,000 linear feet
- 250,000 cubic yards excavation
- 600 lf 8’x6’ Arch Culverts
- Dewatering
Environmental Constraints

- Swainson’s Hawk
- Giant Garter Snake
- Cultural Resources
NLIP Construction Phasing
Discussion Topics

• Contract packaging
• Availability of materials (bentonite)
• Availability of equipment and operators (long stick excavators)
• Slurry wall -- verification of acceptability
• Borrow sites -- variation in type of material
Questions?