Tempe Town Lake
Downstream Dam Replacement

NEW DAM ALTERNATIVES SELECTION

January 5, 2012

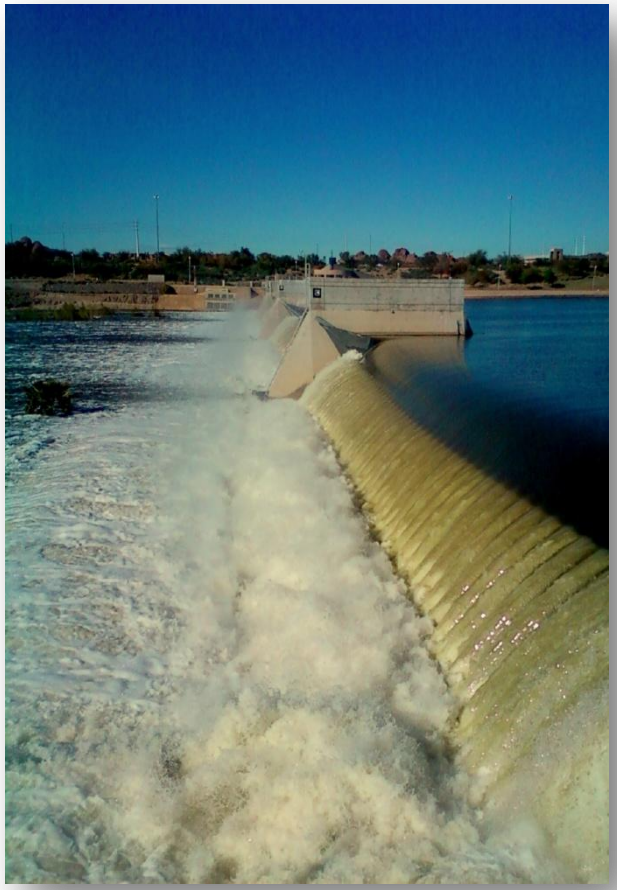
Gannett Fleming

Timeline *

- Alternatives Evaluation – June thru November
- Project Update with Council – September 22
- **Phase 1 Validate Concept & Select Dam Technology – November 2011**
- Phase 2 Design New Dam / Acquire Permits – complete by July 2013
- Bid and Procure Construction Contract by October 2013
- Start Construction by November 2013
- Construction Complete – December 28, 2015

* *Per current agreement with Bridgestone.*

Dam Must



- Maintain Waters of Town Lake
- Handle Flows from Storms, Regular Water Sources
- Return Lake to Normal After Floods
- Handle Water from Extreme Flood Events Smaller Than 210,000 cfs
- Meet Regulatory Requirements
- Be Safe and Reliable

Dam Design Criteria

1. Maintain or Improve Current Level of Flood Protection
2. Maintain Full Lake Quickly After Flood Event
3. Raise, Lower and Operate Reliably at Normal Lake Levels
4. Be Cost Efficient – Capital, Lifespan, O&M
5. Have Parts Easily Available
6. Be Compatible with Pedestrian Bridge, Existing Structures
7. Perform Well in this Climate
8. Meet Regulatory Requirements




Regulatory Conditions

US Army Corps of Engineers

Regulatory Agency	Concerns
U. S. Army Corps of Engineers	Water quality, channel conditions, 404 permitting
Flood Control District of Maricopa County	Flood control, levee maintenance
Federal Emergency Management Agency (FEMA)	Flood control, levees
Arizona Department of Water Resources	Dam Safety

FEMA

ARIZONA DEPARTMENT OF WATER RESOURCES

Flood Control Criteria

Flood Control District of Maricopa County:

- Use 200-Year Discharge for Design as it's Close to Capacity of Area Bridges (like Mill Ave, Rural Rd)
- West Dam 200-Year Discharge: 204,000 cfs
- East Dam 200-Year Discharge: 207,000 cfs
- Tempe Town Lake Capacity Discharge: 210,000 cfs

Alternatives Evaluation

About 20 Dam Options Studied:

- Radial (Tainter) Gates
- Bascule or Bottom-Hinged Leaf Gates
- Inflatable Rubber Dams(water and air-filled)
- Ogee Crest Weirs
- Labyrinth Weirs
- Many Styles of Fuse Plugs
- Several Styles of Pneumatically-Operated Hinged Crest Gates (Obermeyer)
- Hydraulic Hinged Crest Gates
- Dyrhoff Rubber Dams (Sumitomo)
- Vertical Lift Gates
- Swing Gates
- Fusegates (Hydroplus)
- Earth Embankment/Fuseplug
- Several Styles of Mixed-type Spans
- Cable-Operated Hinged Crest Gate
- Others

Alternatives Carried Forward

1

2

3

4

1. Obermeyer Crest Gates
2. Fusegates *(eliminated)*
3. Hinged Crest Gates
4. Inflatable Rubber Dams

Inflatable Rubber Dams

Pros	Cons
Lake could be maintained during construction	Condition of rubber is uncertain
Known operations	Long term cost may by high
Can catch end of flood to re-establish lake	Manufacturer support and warranty uncertain
Does not require additional piers	Vulnerable to vandalism
Simple	

Obermeyer Crest Gates

Pros	Cons
Does not require additional piers	Bladders have similar limitations as rubber dam
Simple and Reliable	Condition of rubber is uncertain
Can catch end of flood to re-establish lake	Relocation of SBI pipe (impact on multiuse path and TCA parking lot)
Lake can be maintained during construction	

Hinged Crest Gates

Pros	Cons
Simple	Would require additional piers and foundation
Reliable	Levee widening
Durable	Relocation of SBI pipe (impact on multi use path and TCA parking lot)
Can catch end of flood to re-establish lake	More maintenance required
Less vulnerable to vandalism than rubber dams	

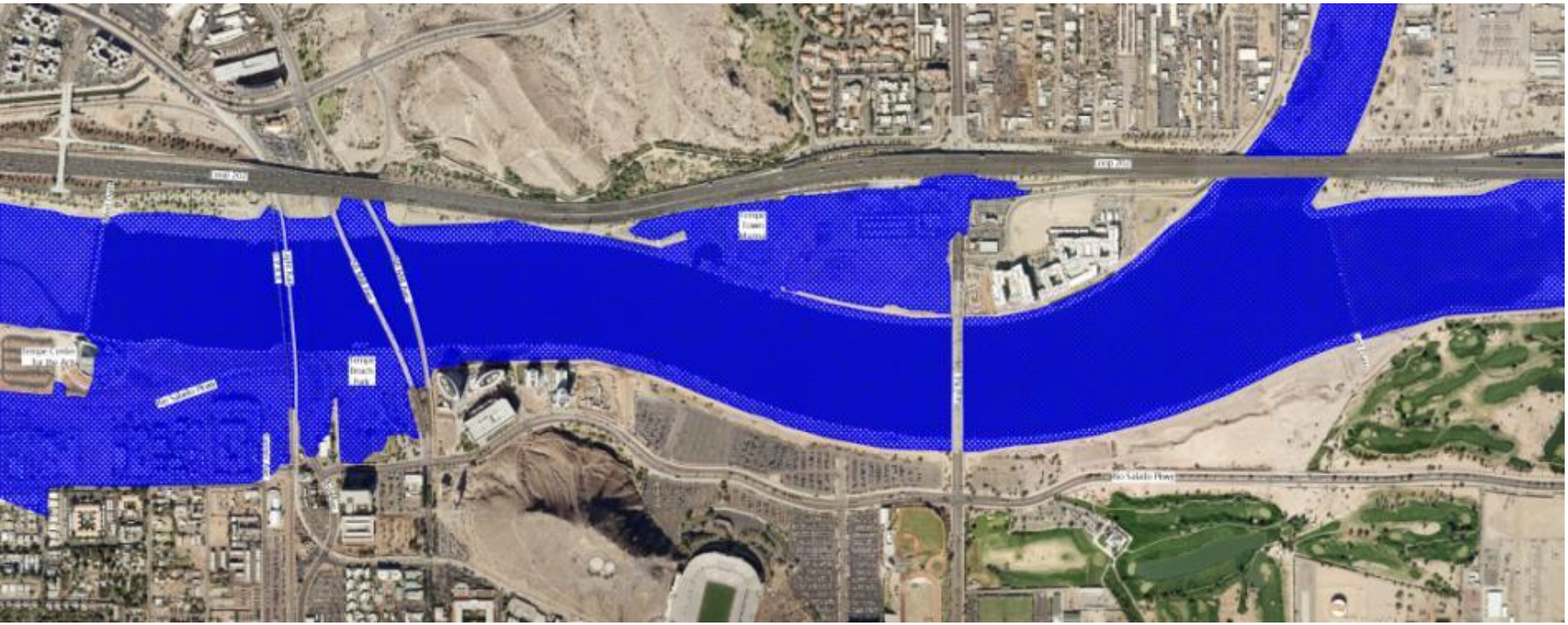
Current Level of Flood Protection

Designed to maintain or improve current levels of flood protection – 210,000 cubic feet per second (cfs.)

This is consistent with the rest of the river system.

Results of Restricted Flow

Results of Restricted Flow

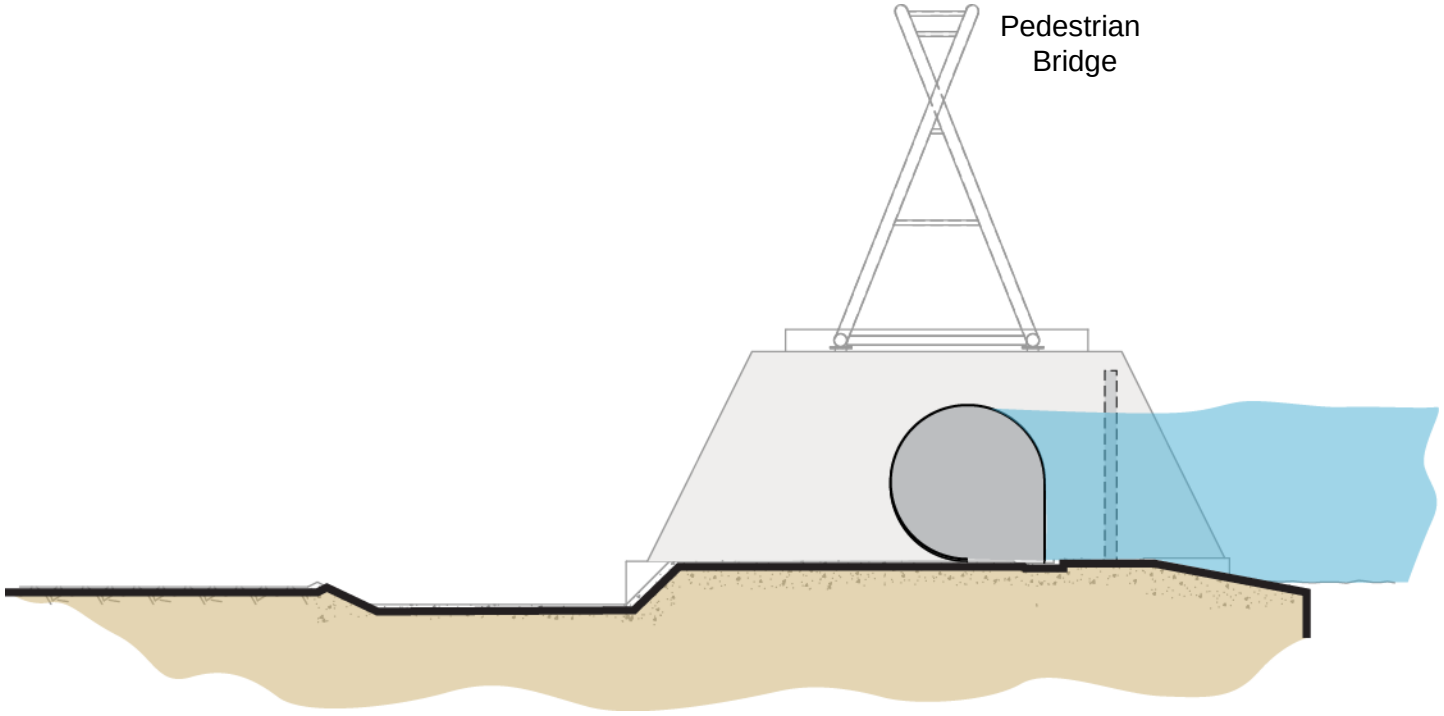


Three Viable Alternatives

- **Sumitomo Rubber Dam** (3-yr. warranty not extended)
- **Obermeyer Gate** (10-yr. warranty)
- **Hydraulic Hinged Crest Gate** (2-yr. warranty)

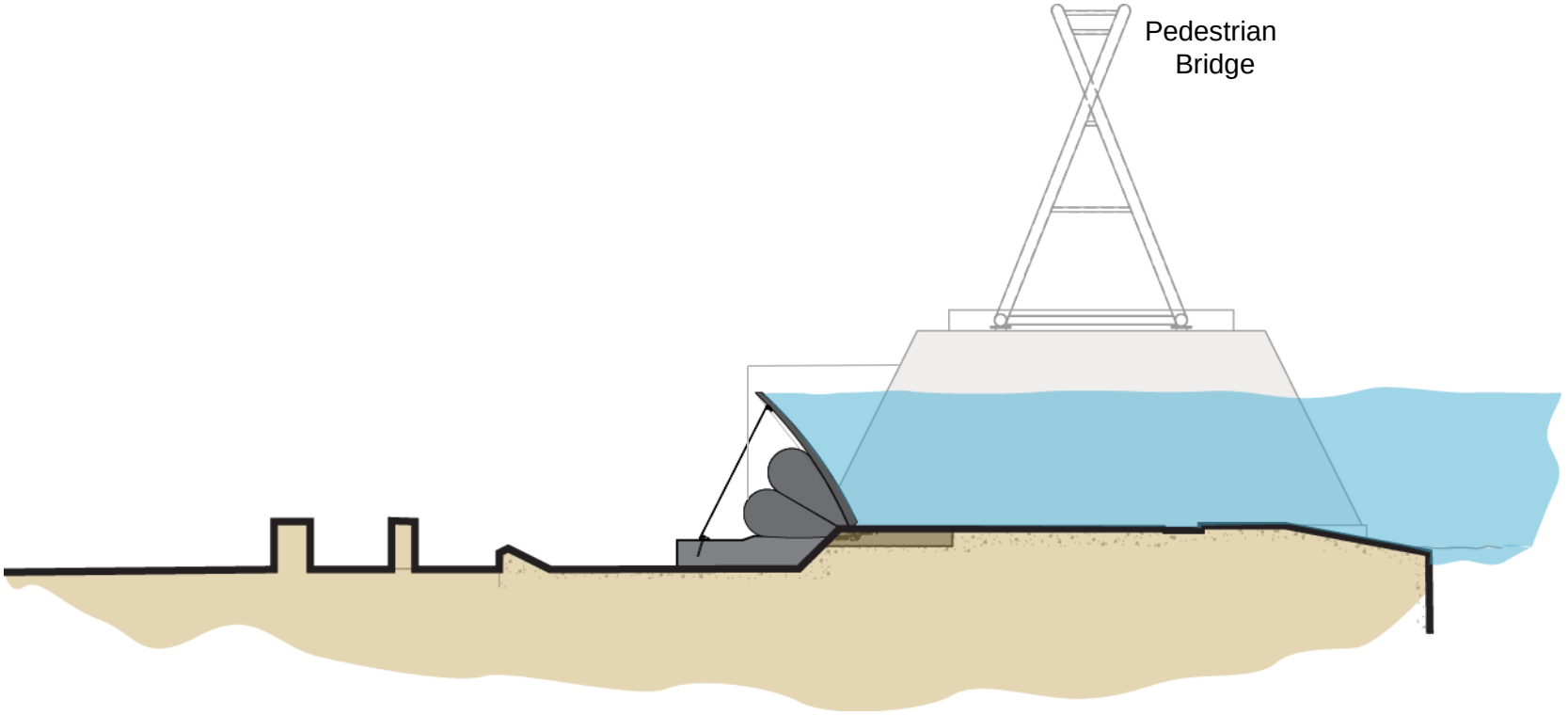
Proposed Alternative Locations

- Sumitomo – Replacing bladders, same location



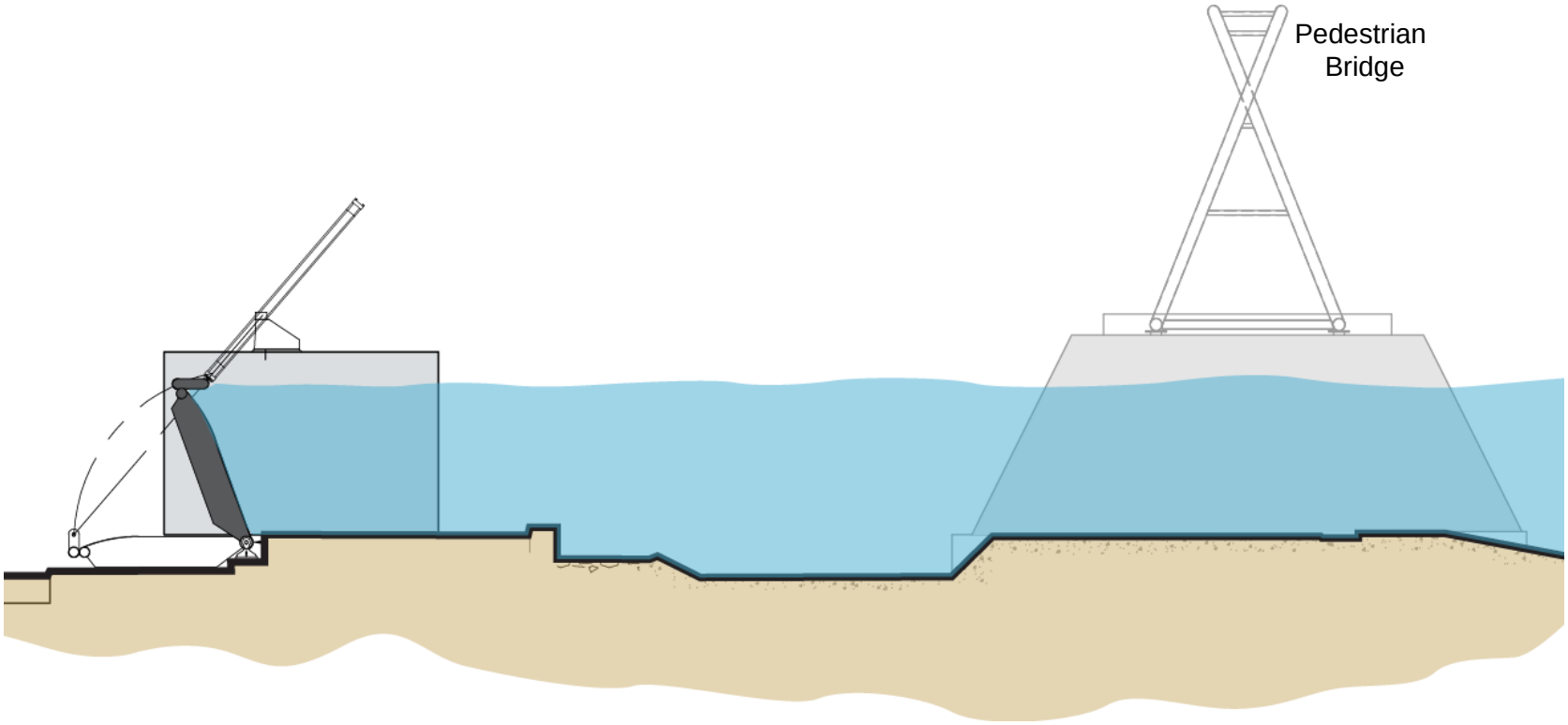
Proposed Alternative Locations

- Obermeyer – Adjacent to existing dam



Proposed Alternative Locations

- Hinged Crest Gate–100ft west of existing dam



Proposed Alternative Locations

Cost Estimate Approach

- Two cost estimates for each alternative
  - Construction costs
  - Life cycle costs
- Life cycle costs prepared for various rubber service life assumptions
- Construction costs reviewed/revised by an independent cost estimator

Construction Cost Assumptions

- Gate Procurement Costs from Vendors
- Mobilization
- Construction Contingency
- Engineering, Design, CM and Permitting
- Contractor Markups

Cost Assumptions

Sumitomo Rubber Dam

- **Construction Cost**
  - Requires cofferdam installation
  - No structural modifications required
  - Minimal controls/air supply modifications required

- **Life Cycle Cost**
  - 50 year project life
  - Rubber components replaced every 10 yrs.
  - Bladder replacement cost = full purchase price

Cost Assumptions

Obermeyer Gate

- **Construction Cost**
  - Minor structural modifications to existing piers
  - Moderate structural modifications to existing slab and stilling basin

- **Life Cycle Cost**
  - 50 year project life
  - Rubber components replaced every 10 yrs.
  - Steel gates replaced at 50 years

Cost Assumptions

Downstream Hinged Crest Gate

- **Construction Cost**
  - Requires construction of new foundation, abutments and piers
  - Requires channel widening

- **Life Cycle Cost**
  - 50 year project life
  - Hydraulic actuators refurbished at 20 and 40 years

Description	Sumitomo Rubber Bladders	Obermeyer Gate	Hydraulically Operated Hinged Crest Gate
Mobilization/Demobilization	$1,300,000	$1,000,000	$1,000,000
Structural concrete modifications	$0	$100,000	$0
Structural concrete modifications (New piers)	$0	$0	$1,000,000
Structural concrete modifications (Slab)	$0	$2,000,000	$0
New Foundation	$0	$0	$5,600,000
Dewatering	$0	$0	$200,000
SBI relocation	$0	$0	$250,000
Stilling basin modifications/new basin	$0	$1,500,000	$2,000,000
Channel widening	$0	$0	$650,000
Cofferdam installation	$800,000	$0	$0
Control system/air supply modifications/new hydraulically control system	$100,000	$1,000,000	$1,500,000
Purchase dam or gate system	$23,880,000	$11,985,500	$10,744,000
Install dam or gate system	$2,600,000	$600,000	$1,200,000
Purchase d/s panel	$0	$2,996,375	$0
Install d/s panel	$0	$1,000,000	$0
Subtotal	$28,680,000	$22,181,875	$24,144,000
Contingency (20%)	$5,736,000	$4,436,375	$4,828,800
Total Construction Cost	**$34,416,000**	**$26,618,250**	**$28,972,800**
Engineering, design, construction management	$2,868,000	$4,436,375	$4,828,800
Contractor markup on dam/gate procurement	$3,582,000	$1,797,825	$1,611,600
TOTAL INITIAL PROJECT COST	**$40,866,000**	**$32,852,450**	**$35,413,200**

Life Cycle Costs

Alternatives	Total Project Construction Cost	Total 50-Year Life Cycle Costs (Present Value)	Total Construction and Life Cycle Cost (Present Value)
Sumitomo Rubber Bladders - **10 Yr.** Rubber Life	$40,900,000	$138,300,000	**$179,200,000**
Obermeyer Gates - **10 Yr.** Rubber Life	$32,800,000	$41,600,000	**$74,400,000**
Hinged Crest Gates	$35,400,000	$32,700,000	**$68,100,000**

Life Cycle Costs

Alternatives	Total Project Construction Cost	Total 50-Year Life Cycle Costs (Present Value)	Total Construction and Life Cycle Cost (Present Value)
Sumitomo Rubber Bladders - **10 Yr.** Rubber Life	$40,900,000	$138,300,000	**$179,200,000**
Sumitomo Rubber Bladders - **20 Yr.** Rubber Life	$40,900,000	$56,000,000	**$96,900,000**
Obermeyer Gates - **10 Yr.** Rubber Life	$32,800,000	$41,600,000	**$74,400,000**
Obermeyer Gates - **20 Yr.** Rubber Life	$32,800,000	$23,800,000	**$56,600,000**
Hinged Crest Gates	$35,400,000	$32,700,000	**$68,100,000**

Dam Design Considerations

Criteria	Rubber Bladders	Obermeyer	Hinged Crest	Edge
Maintain or Improve Current Level of Flood Protection	Yes	Yes	Yes	**Even**
Maintain Full Lake Quickly After Flood Event	Yes	Yes	Yes	**Even**
Operate Reliably at Normal Lake Levels	Yes	Yes	Yes	**Even**
Be Cost Efficient – Capital, Lifespan, O&M	Most Expensive	Comparable To Hinged	Comparable to Obermeyer	**Obermeyer or Hinged**
Have Parts Easily Available	One source/ International	One Source/ Domestic	Multiple	**Hinged**
Compatible with Pedestrian Bridge, Existing Structures	Yes	Yes	New Structure	**Bladder/ Obermeyer**
Meet Regulatory Requirements	Yes	Yes	Yes	**Edge to Bladder and Obermeyer**
Perform Well in this Climate	Not Ideal	Not Ideal	Best	**Hinged**
Ability to inspect conditions	Difficult	Difficult	Simple	**Hinged**
Repairs on dam	Need cofferdam	Need cofferdam	Possibly No cofferdam	**Hinged**
Safe design, operations, use, performance	Our experience	SRP experience	Oklahoma experience	**Hinged**

Dam Recommendation

- Hydraulically Operated Hinged Crest Gate
  - Safety & Reliability
  - Durability
  - Value (cost competitive)
  - Engineering Requirements
  - Regulatory Requirements

Other Factors

- Public Perception
- Risk Management
- Funding

Dam Budget

Town Lake Downstream Dam Replacement

Project Description
This project will replace the existing Tempe Town Lake Dam. Newly proposed (pending City Council approval) hybrid technology will allow the use of the existing piers and foundation to replace approximately 840 lineal feet of dam, but may require changes to the mechanical systems. Construction drawings should begin no later than 2011 to allow enough time for permits and approvals of the new dam.

Estimated Project Costs	
Legal / Administration	$720,000
Land Acquisition	$0
Permit Fees	$1,317,380
Design and Engineering	$4,000,000
Survey / Staking	$300,000
Construction Management	$2,000,000
Furnishings / Equipment	$0
Construction / Improvement	$40,000,000
Geotech / Material Testing	$720,000
Utility Relocation Fees	$0
Utility Undergrounding	$0
ITD / Telecommunications	$0
Other Project Costs	$352,000
Total	$49,409,380
Project Number:	**6503069**
Estimated Start Date:	**07/01/11**
Estimated Completion Date:	**12/31/15**

2011-12 Source of Funds	
Rio Salado Fund Balance	$4,000,000

Minus $367,000 Gannett Fleming Contract for Dam Technology Analysis

New Appropriations by Fiscal Year

2011-12	2012-13	2013-14	2014-15	2015-16	Total 5 Year
$4,000,000	$1,379,780	$424,000	$43,605,600	$0	$49,409,380

Dam Financing

- Preliminary Capital Cost Estimates: $36 Million
- Includes Design, Materials, Construction
- Does Not Include East Dam or Pump System (New East Dam repl. $8M-$10M)
- Finance Options Include:
  - Use Remaining $3,633,000
  - Seek Voter Approval for Bond Authorization for Dam Replacement Capital Costs
  - Sale of City Properties
  - Lease / Purchase Agreement
  - Combinations

Next Steps

- Public Meeting, Jan. 11, 5:30 p.m.
  Tempe Center for the Arts
- Return to Council Jan. 19
- Review Financing Options
- Design, Permit, Build

Want more information?
Visit www.tempe.gov/lake
Click on Town Lake Dam Replacement in the Blue Box