

# 48 MG Terminal Reservoir Replacement Project: Replacing Aging Infrastructure while Maintaining Storage and Supply

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# Addressing Aging Infrastructure

## Common Challenges

- **Lack of Political Attention**
- **Who Pays for Rehabilitation or Replacement and How?**
- **Need for Uninterrupted Service**
- **Proximity to Development/Public Relations**
- **Lack of Planning/Funding**



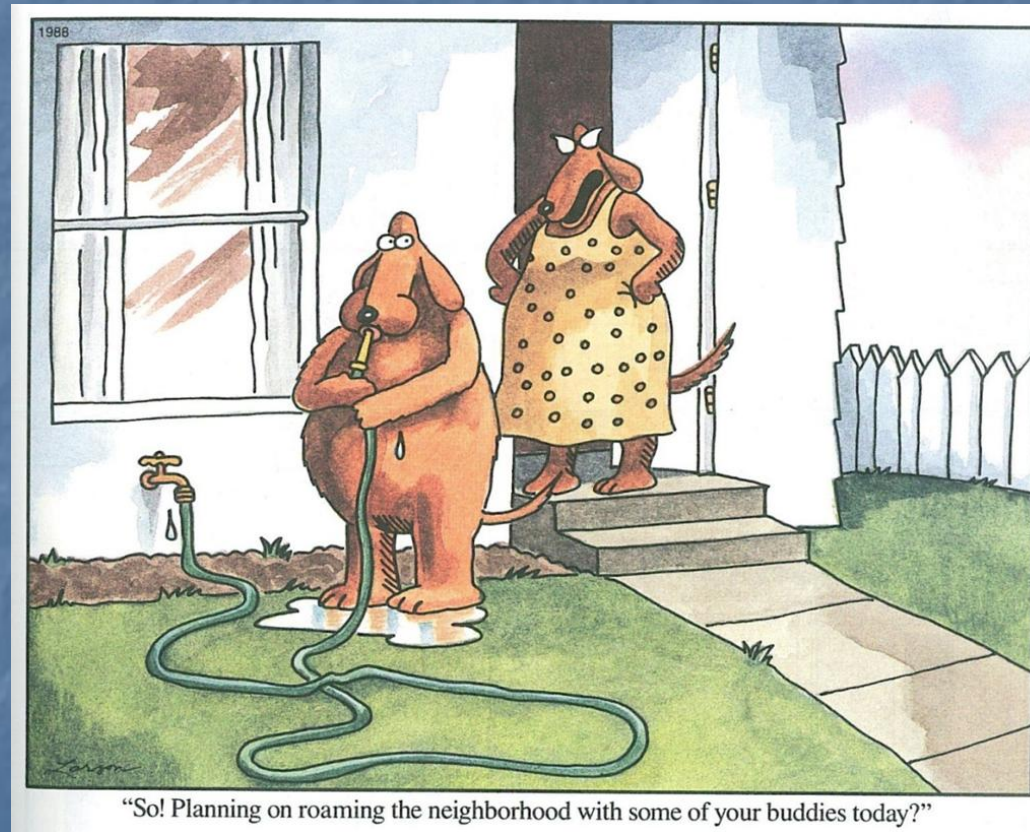
# Proactive Infrastructure (Asset) Management Steps

- Condition Assessments
- Master **Planning** (not just for new development)
- Setting Aside **Funds**
- Design
- Developing Project **Constraints**
- Public Relations
- Construction
- Maintenance



# Why Plan for Capital Improvements and Replacing Infrastructure?

- Based on BC&A historic averages:
  - Cost of adequately master planning facilities is approximately 0.3% of total capital costs
  - Savings of adequately master planning ranges from 5 to 30% of total capital costs





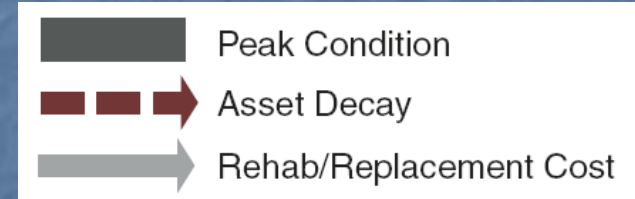
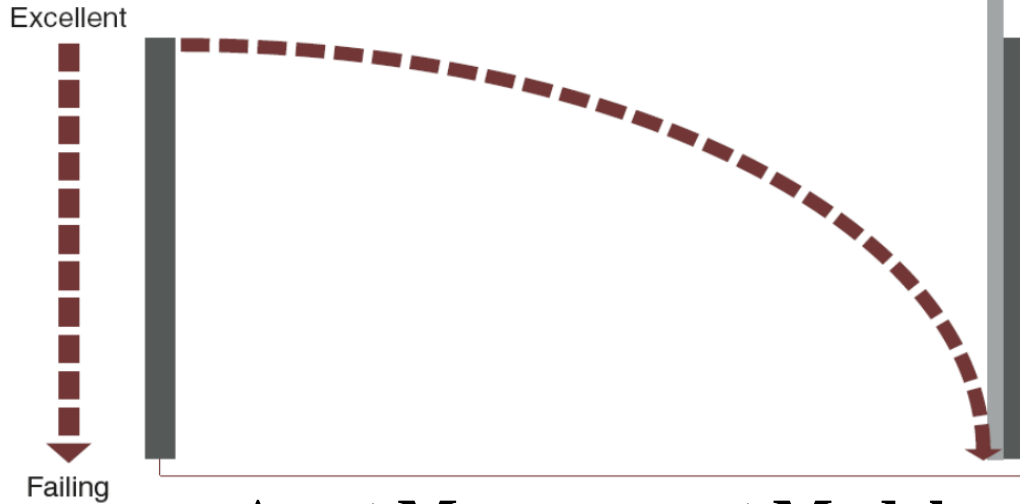
# Why Can't I Drive My Infrastructure Into the Ground?

- **Proactive Maintenance = 25 to 100% of new construction cost**
- **Reactive Replacement after Failure = 100 to 160% of new construction cost**



# Run to Failure vs. Asset Management Models

## Run to Failure Model



## Asset Management Model



20-Year Planning Cycles



# Project History – Salt Lake Aqueduct

- 1938 - 1950: Salt Lake Aqueduct constructed by US Bureau of Reclamation
- 42-mile, 69-inch diameter pipeline





# Project History – Salt Lake Aqueduct

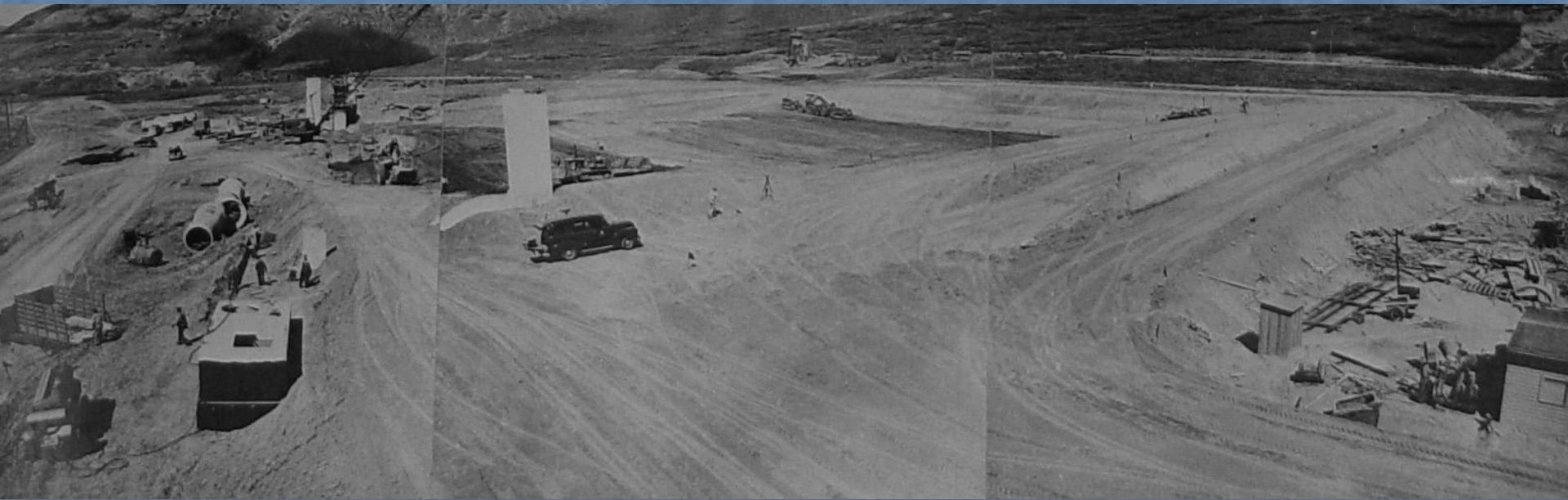
- Delivers raw water 33 miles from Deer Creek Reservoir to Little Cottonwood WTP
- Drinking water delivered 9 miles from Little Cottonwood WTP to Terminal Reservoir





# Project History – Terminal Reservoir

- 1950 - 1951: Terminal Reservoir constructed by US Bureau of Reclamation
- 40 million gallon concrete reservoir  
(two separate 20 million gallon cells)



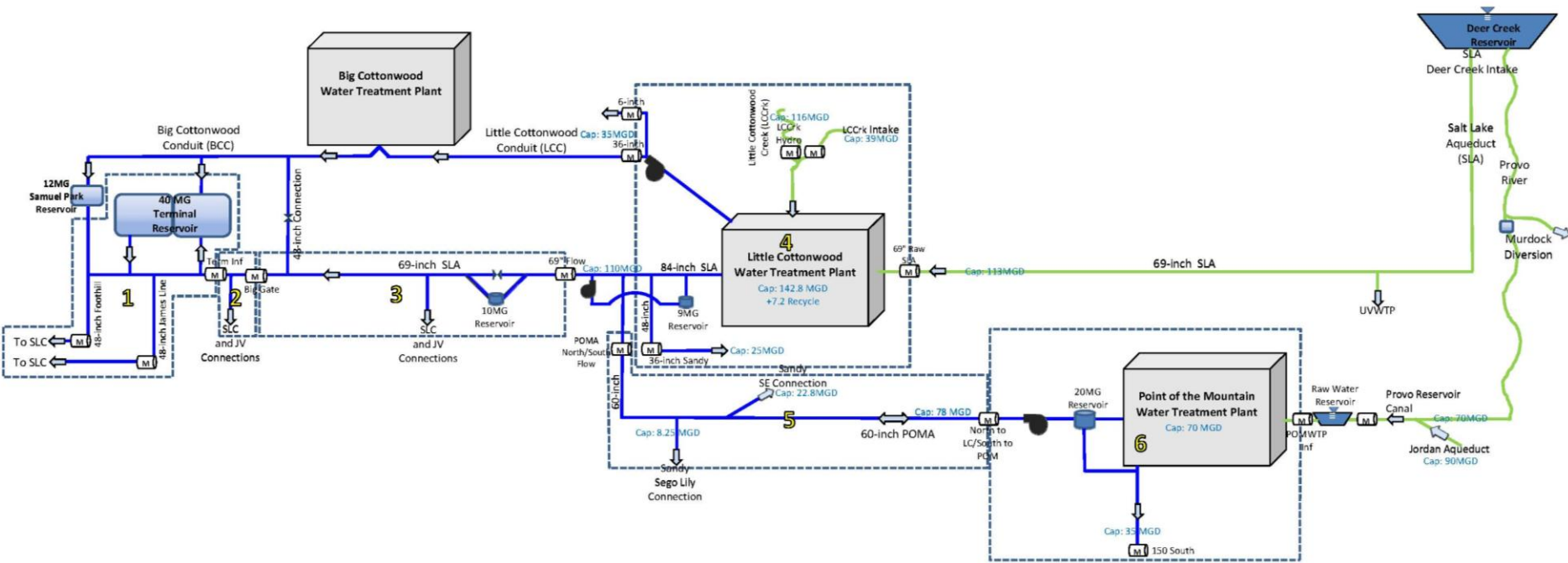
# Project History – Terminal Reservoir

- Terminal storage for Salt Lake Aqueduct
- Provides drinking water, equalization, and fire protection storage for Salt Lake City and unincorporated Salt Lake County





# Terminal Reservoir Operation



# Terminal Reservoir Site Today



**Existing Terminal Reservoir**

**Sam Park Reservoir**

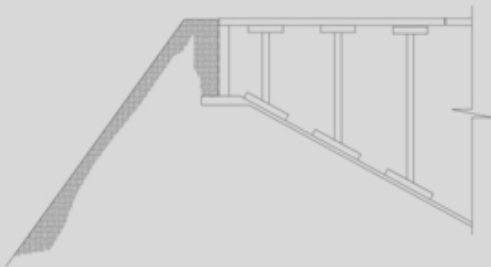
**3300 South**

**I-215**

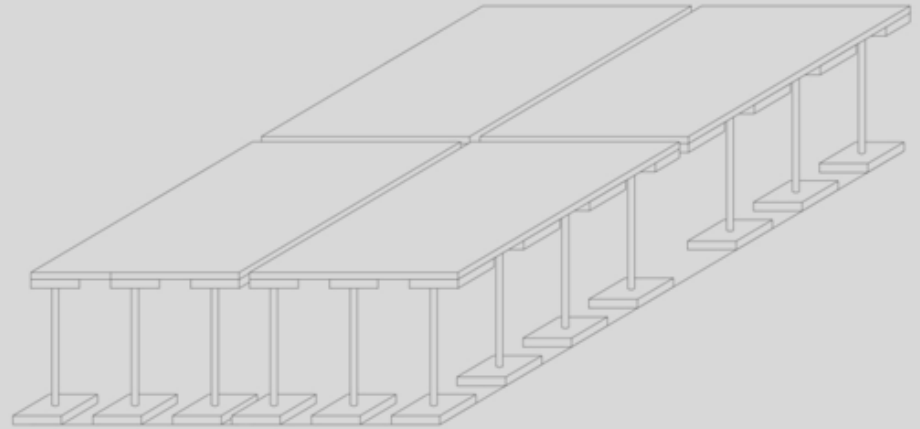


# Terminal Reservoir Risks

- **Seismic Response in an Earthquake**
  - **Roof panels are independent of each other**
  - **Embankment slopes are too steep**
- **Interim Improvements**
  - **Removed soil, exposed roof joints**



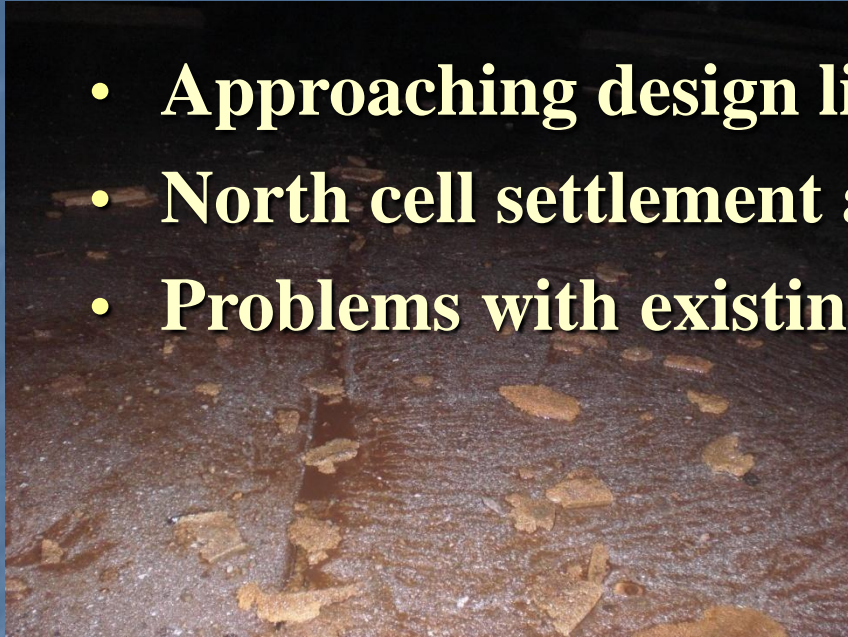
EMBANKMENT



ROOF

# Terminal Reservoir Condition

- Approaching design life, 60 years of use
- North cell settlement and leakage
- Problems with existing gates





# Project Timeline

- **1998: District Master Plan Update and Geologic Hazards Study**
- **1999: Terminal Reservoir Hazard Study**
- **2000: Interim Hazard Mitigation (Soil Removal)**
- **2009: Terminal Reservoir Replacement Project Preliminary Design**
- **2010 – 2011: Final Design**
- **2012 – 2018: Construction**

# Project Design Criteria

- Construct 48 MG with provisions for future expansion to 59 MG
- Limit supply pipeline shutdowns to winter months, with short shutdown durations
- Disinfection boosting to limit DBPs
- Pig retrieval improvements





# Project Storage Summary

## Existing Terminal Reservoir

2 Reservoirs @ 20 MG each

## New Terminal Reservoir

28 MG (2 Cells @ 14 MG each)

22 MG (1 Cell @ 11 MG and  
1 Future Cell @ 11 MG)

**Total: 39 MG (50 MG Future)**

## Existing Sam Park Reservoir

14 MG

## New Sam Park West Reservoir

9 MG



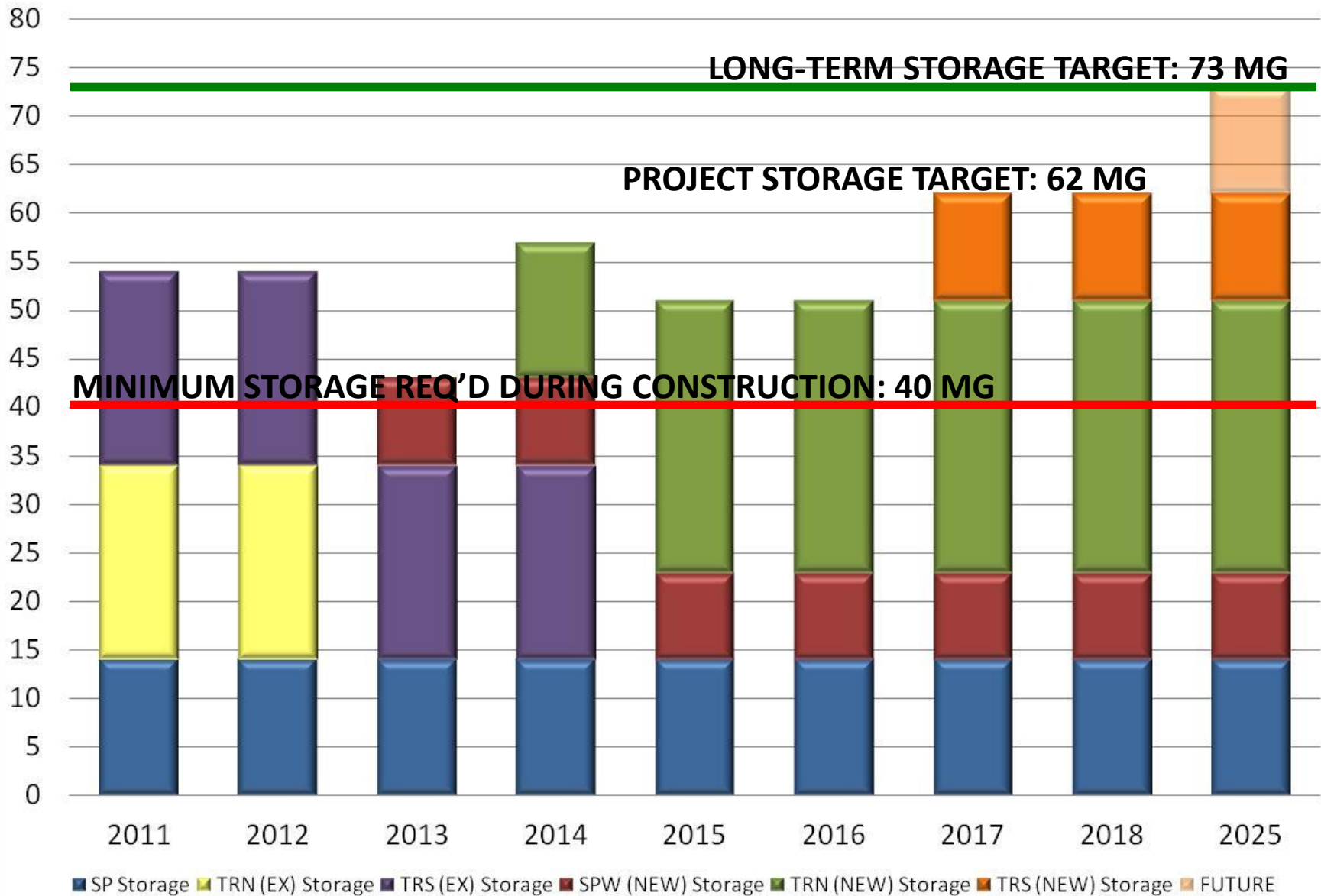
# Project Constraints and Challenges

- **Construct in phases to maintain storage. Maintain 40 MG minimum storage during construction (including Sam Park Reservoir)**
- **Limit supply pipeline shutdowns to winter months, with short shutdown durations**
- **Working in close proximity to residential area**
- **Preload new construction areas**



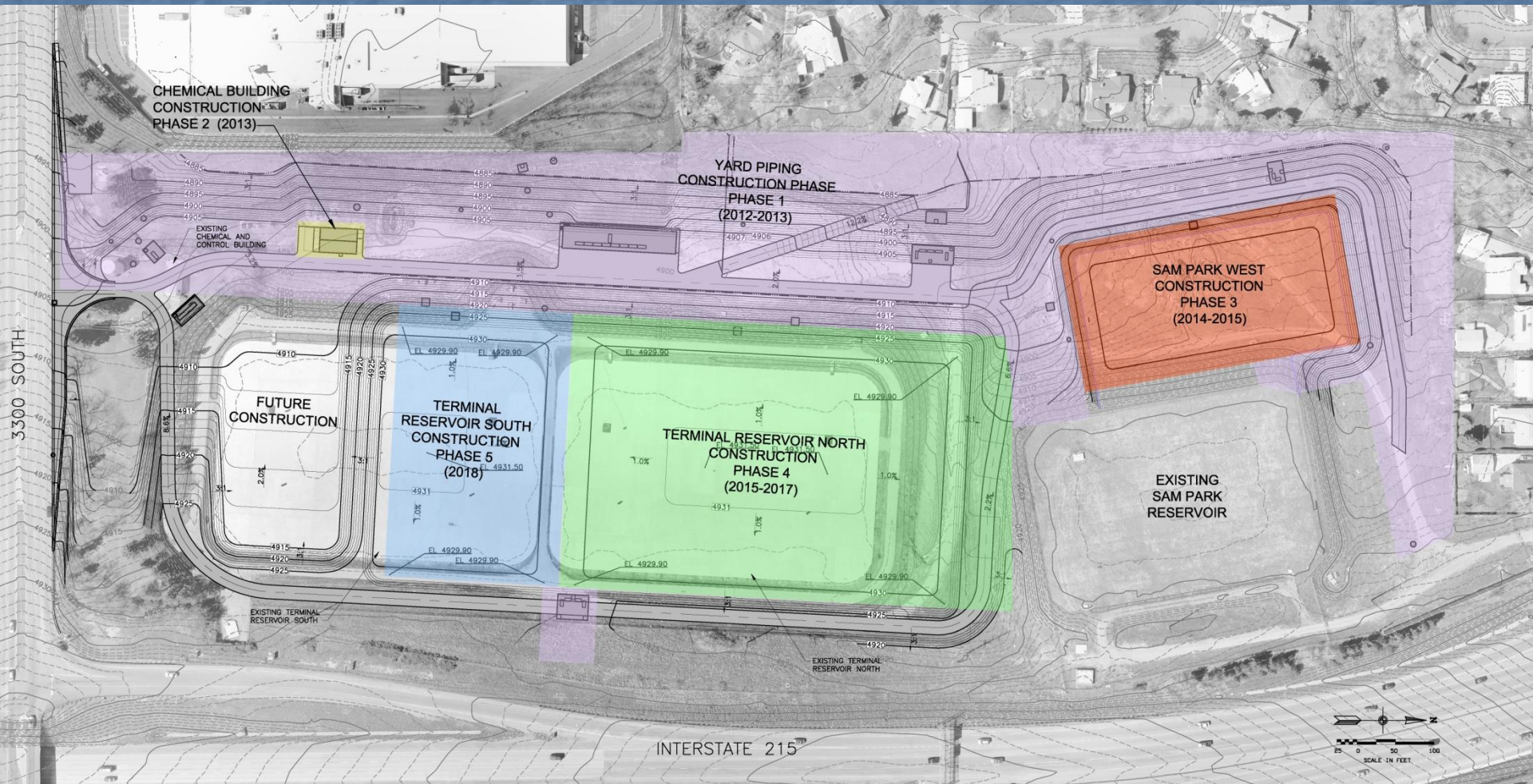
# Storage During Construction

## Terminal Reservoir Site Drinking Water Storage (MG)



# Construction Phasing

- Five phases over seven years (2012 – 2018)





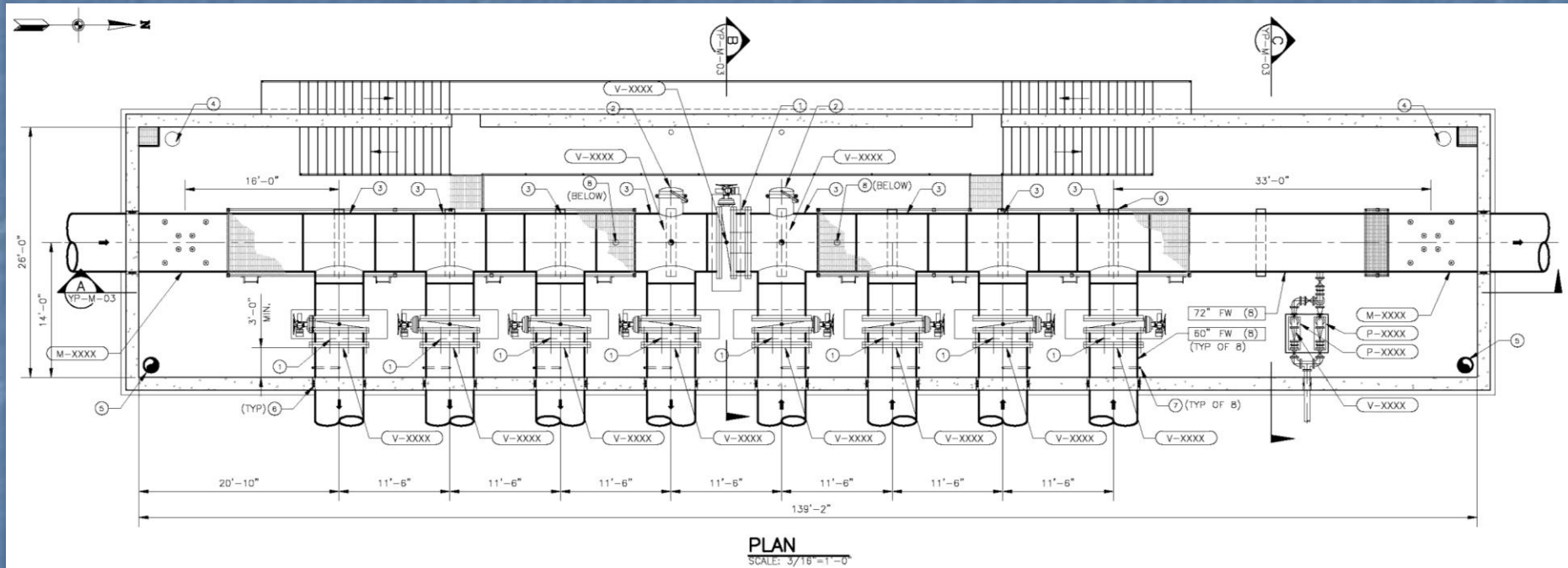
# Connections to Supply Pipelines

- Two supply pipelines into Terminal Reservoir (Salt Lake Aqueduct and Big Cottonwood Conduit), five pipelines out



# New Valve Vaults

- Valve manifolds and associated vaults designed to limit required shutdowns as new reservoirs are constructed and placed in service





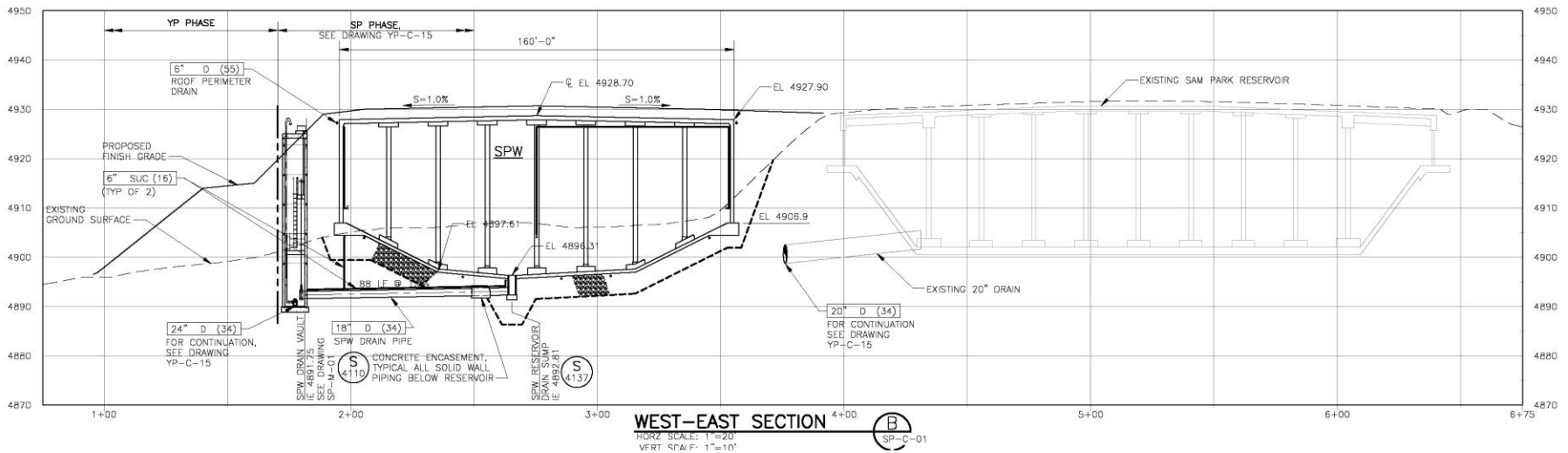
# Working Near Residential Area

- Public Relations Program
- Vibration Monitoring and Dust Control



# Preload in New Construction Areas

- Portions of existing north reservoir have settled as much as 1 foot in the past



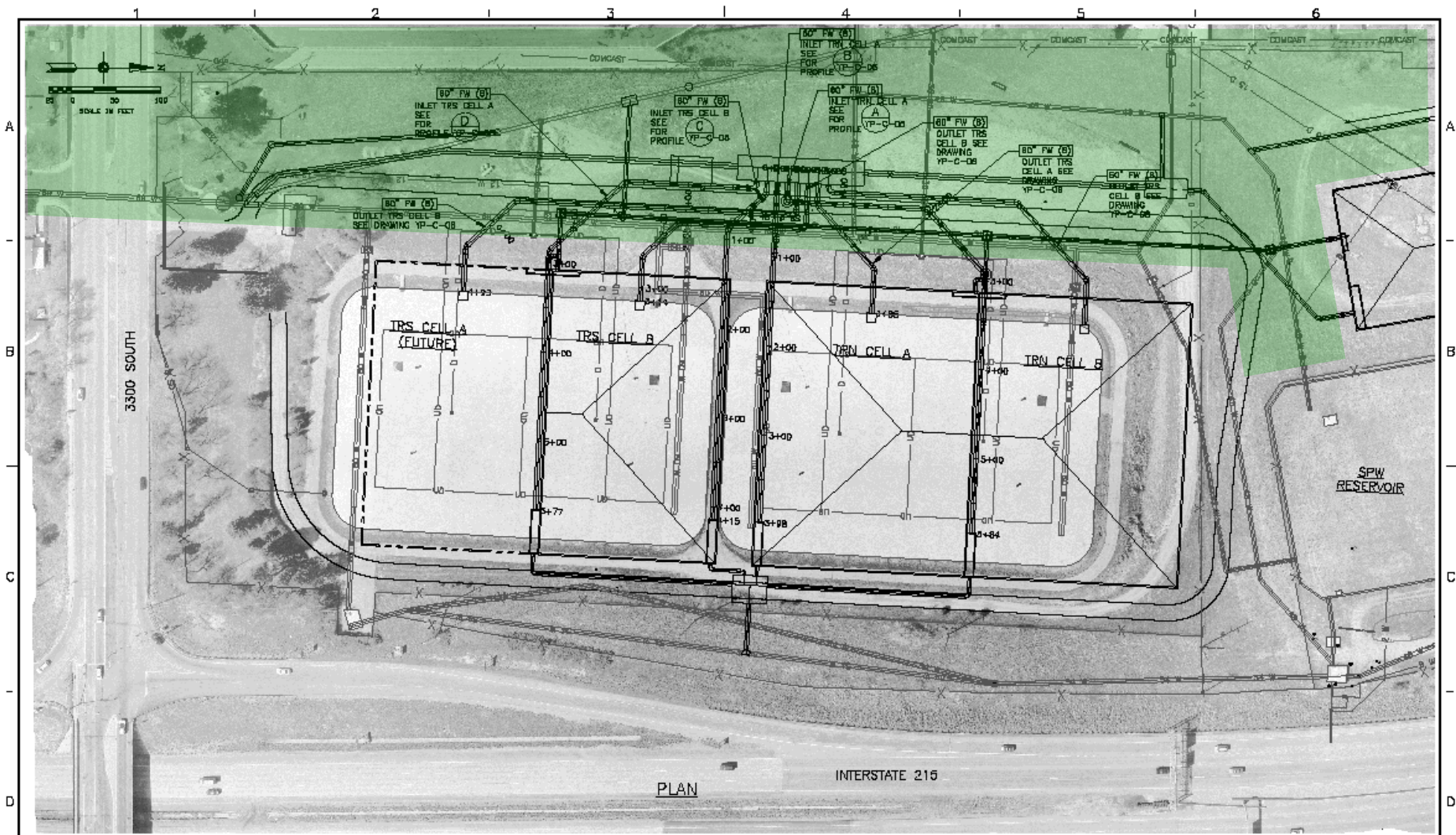


# Preload in New Construction Areas

- Placement of preload completed on April 30, 2012
- Three month duration



# Yard Piping Construction Phase

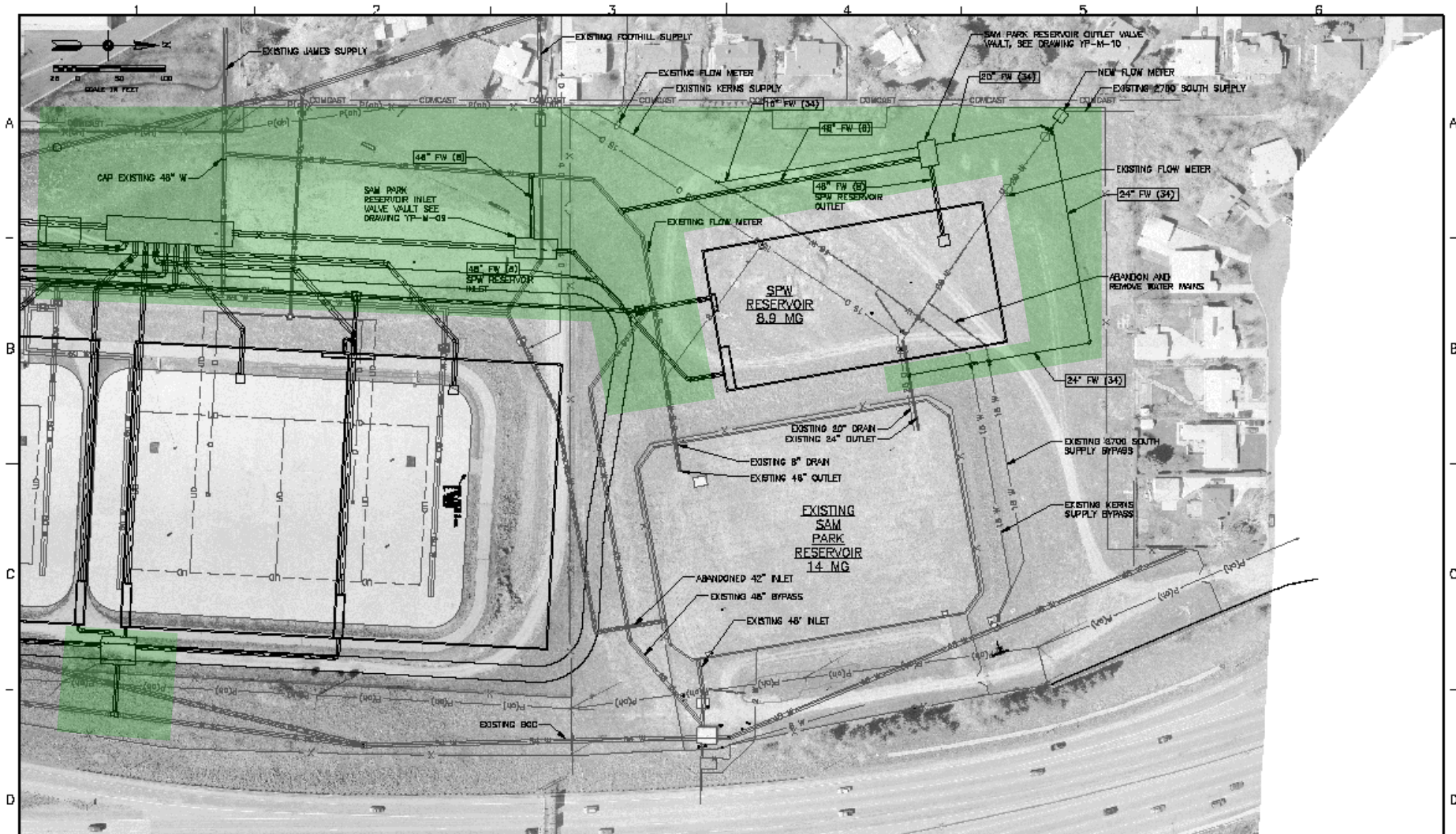


				PREPARED FOR <b>METROPOLITAN WATER DISTRICT                  OF SALT LAKE &amp; SANDY</b>		BOWEN, COLLINS & ASSOCIATES DESIGNED BY: G. LOSCHER CHECKED BY: R. GARCIA REVIEWED BY: X.KXXX APPROVED BY: X.KXXX VERIFY SCALE: 1"=30' DATE: NOV-2010 DRAWN BY: X.KXXX			TOWNHALL RESERVOIR REPLACEMENT PROJECT <b>SLA TERMINAL RESERVOIR                  INLET PLAN</b>		SCALE: 1"=30' DATE: NOV-2010 DRAWING NO.: YP-C-04 SHEET NO.: XXX
REV	DATE	BY	APP	DESCRIPTION							

P:\MetWater\Drawings\SLA\Terminal\Phase 1\04\Replacement of TOWNHALL RESERVOIR\PHASE 1\04\Design\Phase 1\04\Drawings\Yard\022.YP-TREN-D\BOWEN-C-YP-D4.dwg Mod:03/2010 1:13:37pm



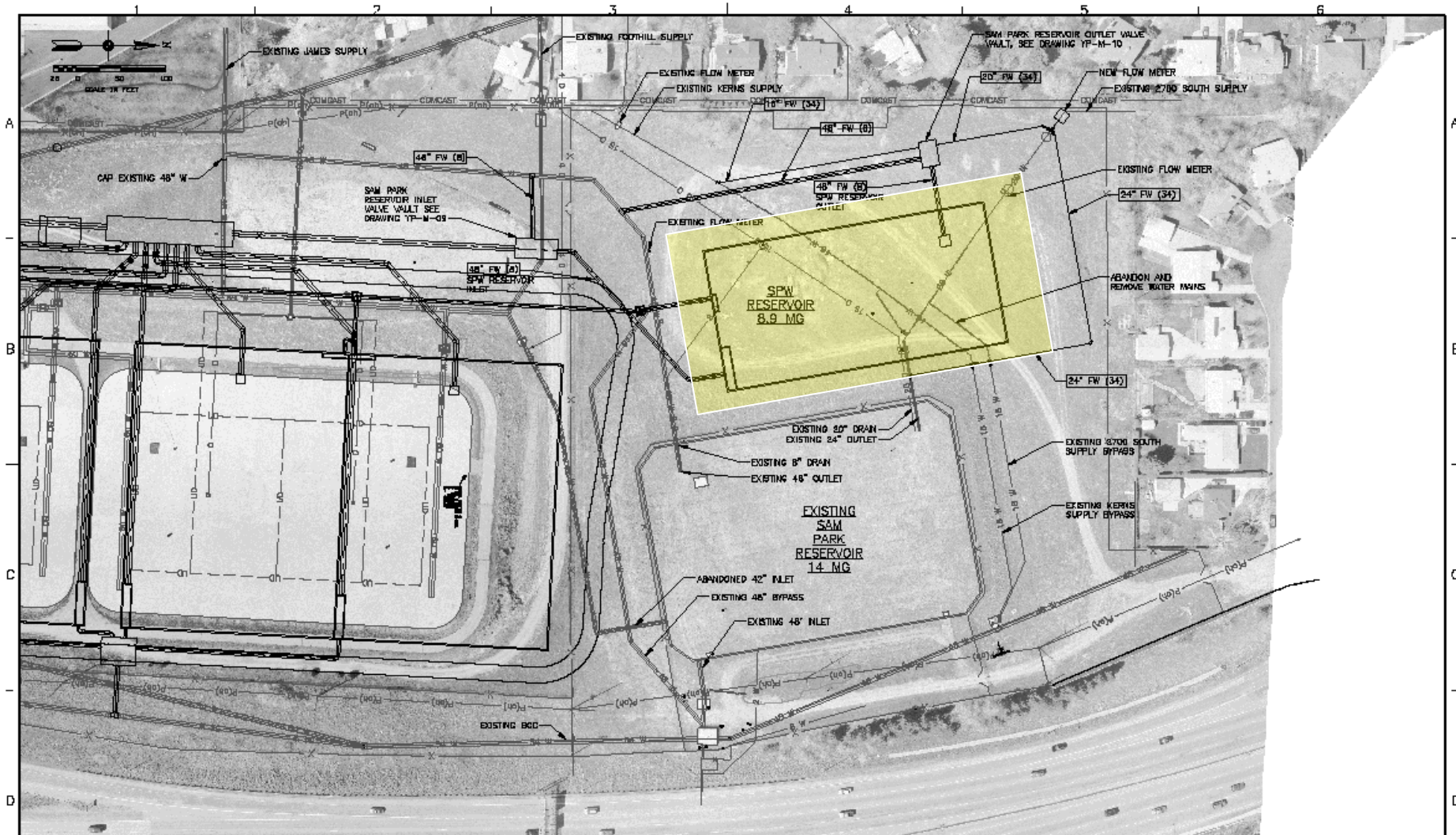
# Yard Piping Construction Phase



PREPARED FOR <b>METROPOLITAN WATER DISTRICT          OF SALT LAKE &amp; SANDY</b>				<b>BOWEN, COLLINS &amp; ASSOCIATES</b>				<b>TERMINAL RESERVOIR REPLACEMENT PROJECT</b>				SCALE: 1"=50'	
DESIGNED G. LOSCHER				CHECKED R. GARCIA				REVIEWED K. KOOXK				DATE NOV-2010	
DRAWING NO. 1P-C-13				SHEET NO. XX				PROJECT NO. 016-08-09				DISTRICT IDENTIFICATION TR003	



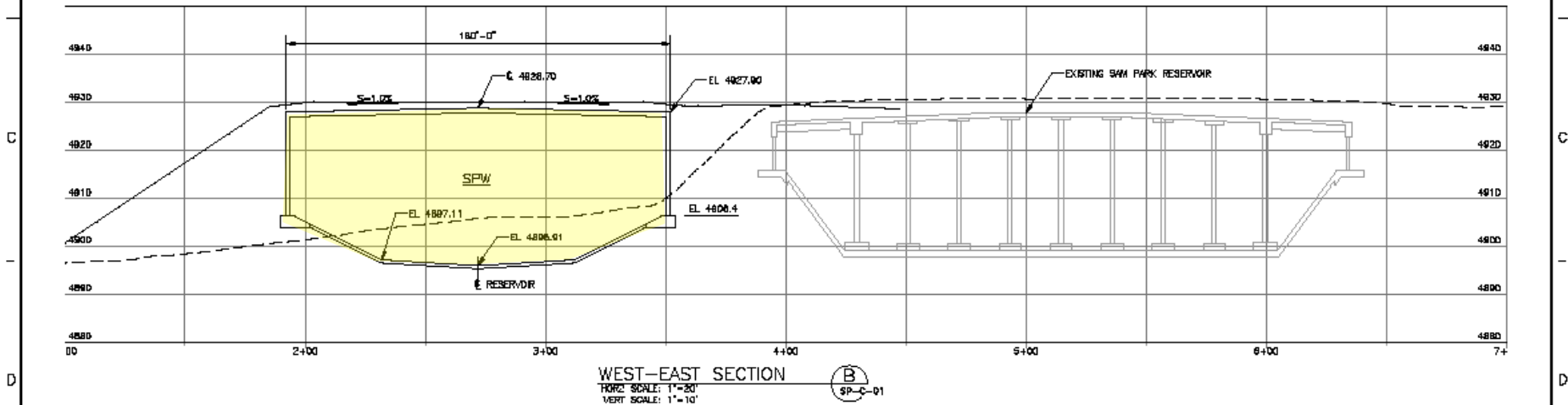
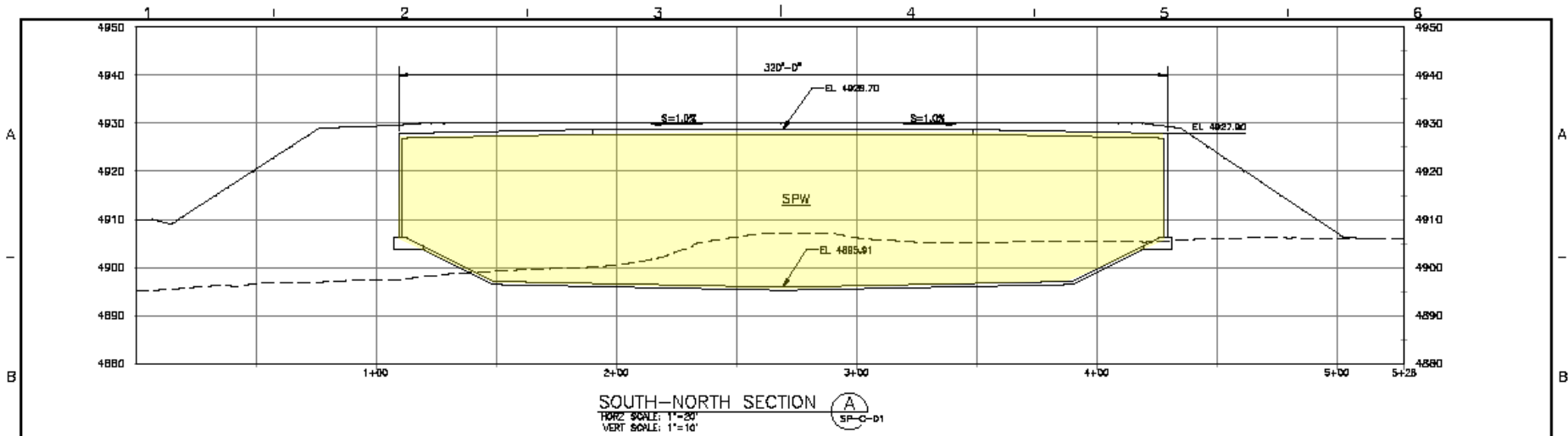
# Sam Park West Reservoir Construction Phase



PREPARED FOR				BOWEN, COLLINS & ASSOCIATES				TERMINAL RESERVOIR REPLACEMENT PROJECT				SCALE: 1"=50'	
METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY				DESIGNED G. LOSCHER				SAM PARK RESERVOIR YARD PIPING PLAN				DATE: NOV-2010	
CHECKED R. GARCIA				REVIEWED K. KOOXK				50% REVIEW				DRAWING NO. YP-C-13	
PROJECT NO. 016-08-09				DISTRICT IDENTIFICATION TR003				PROJECT NO. 016-08-09				SHEET NO. XX	

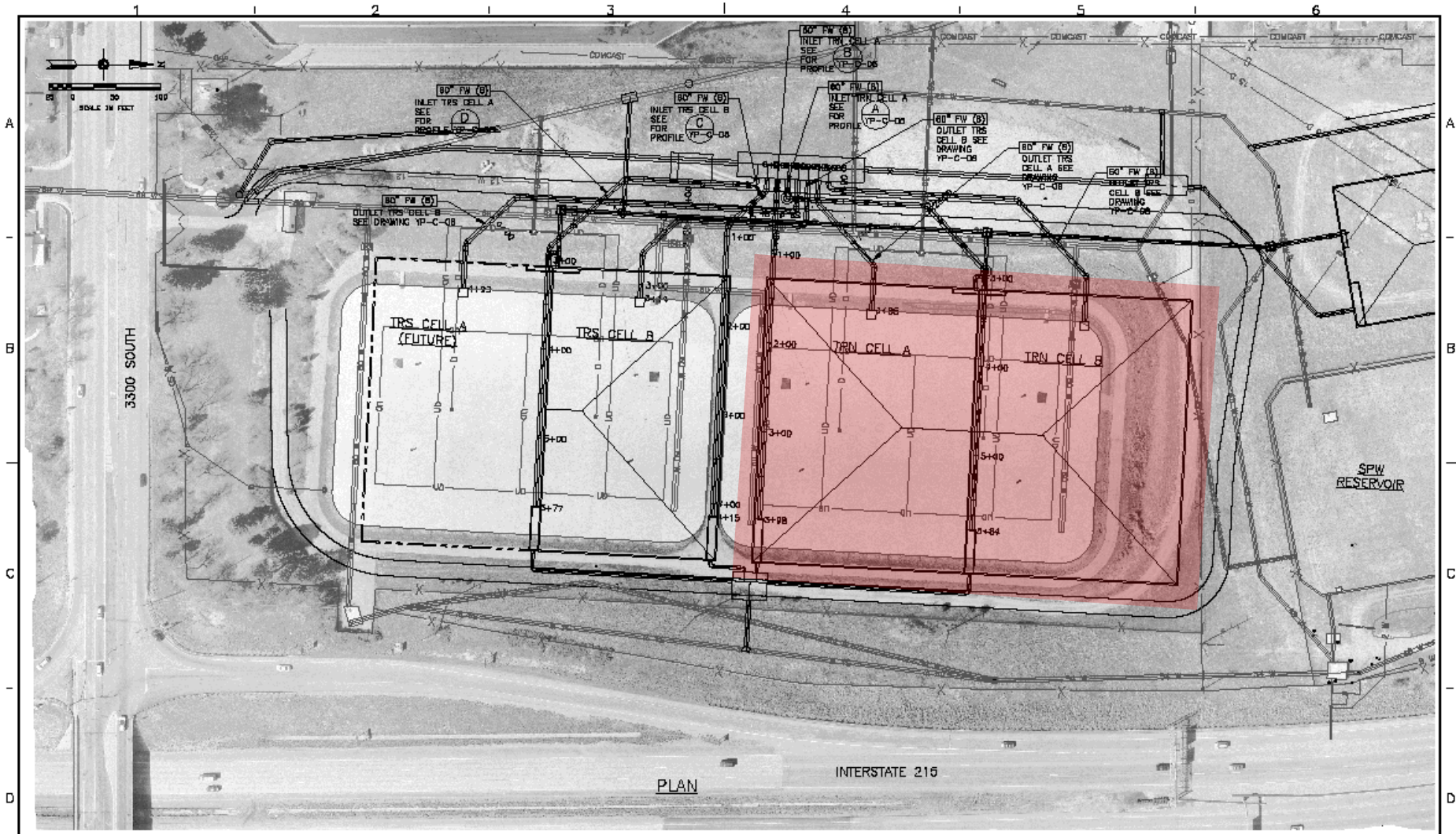


# Sam Park West Reservoir Construction Phase



PREPARED FOR <b>METROPOLITAN WATER DISTRICT                  OF SALT LAKE &amp; SANDY</b>				BOWEN, COLLINS & ASSOCIATES			TOWER RESERVOIR REPLACEMENT PROJECT <b>SAM PARK WEST                  RESERVOIR                  SECTIONS</b>		SCALE: 1"=20' DATE: NOV-2010		
DESIGNED B. LIESCHER DRAWN R. GARCIA				REVIEWED S. J. COOK APPROVED S. J. COOK		VERIFY SCALE OF SCALE SHEET SHEET # 12 OF 24		DISTRICT NUMBER TROB3		PROJECT NO. 918-08-14 SHEET NO. SP-C-02 XXX	

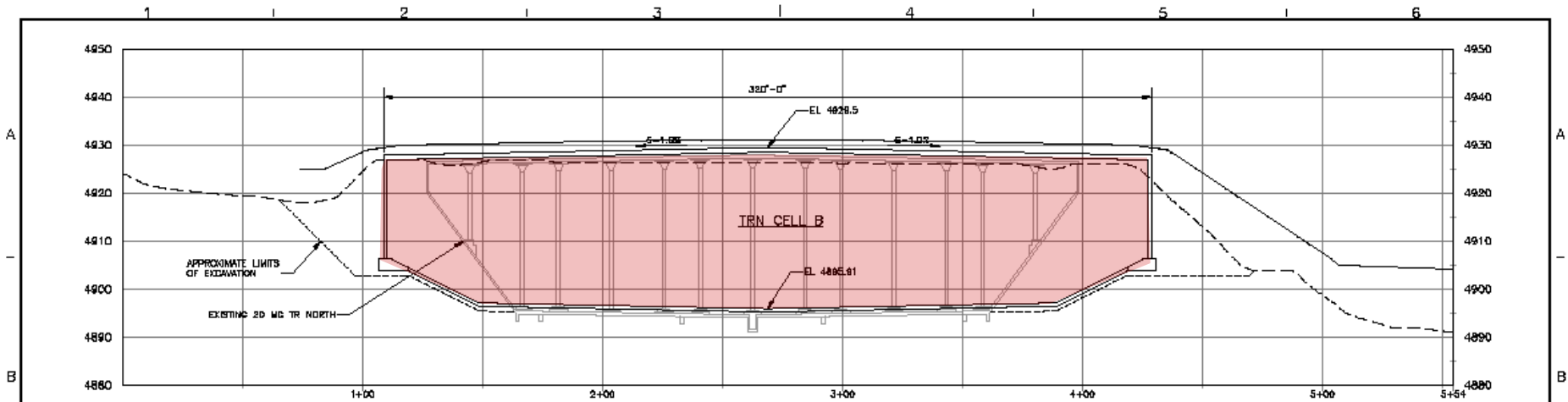
# Terminal Reservoir North Construction Phase



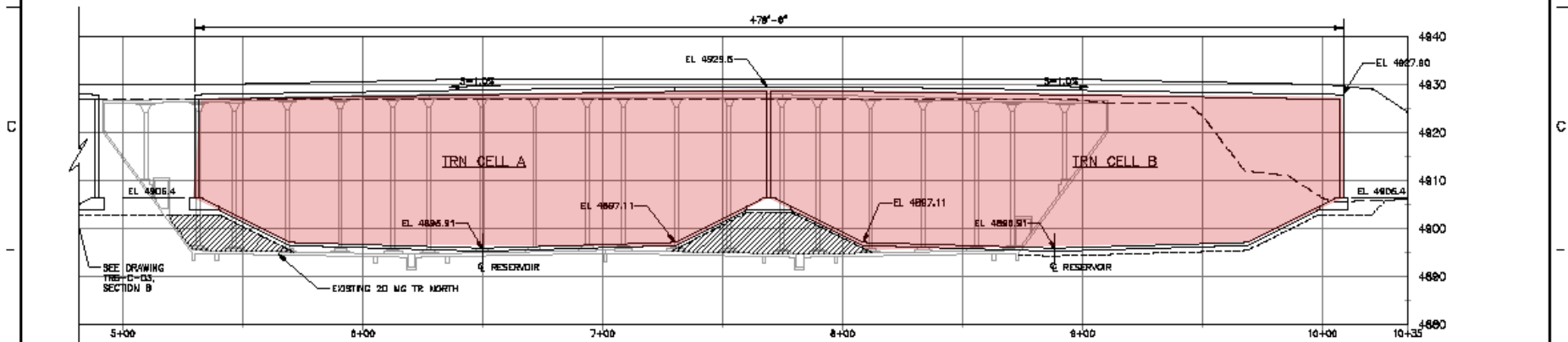
PREPARED FOR <b>METROPOLITAN WATER DISTRICT                  OF SALT LAKE &amp; SANDY</b>				BOWEN, COLLINS & ASSOCIATES DESIGNED BY: G. LOSCHER CHECKED BY: R. GARCIA REVIEWED BY: X.KXXX APPROVED BY: X.KXXX			<b>50% REVIEW</b>		TERMINAL RESERVOIR REPLACEMENT PROJECT <b>SLA TERMINAL RESERVOIR                  INLET PLAN</b>		SCALE: 1"=30' DATE: NOV-2010
DISTRICT NUMBER: TR003	IDENTIFICATION:	PROJECT NO.: 018-09-D4	DRAWING NO.: TP-C-04	SHEET NO.: XXX	PLAN INTERSTATE 215						



# Terminal Reservoir North Construction Phase



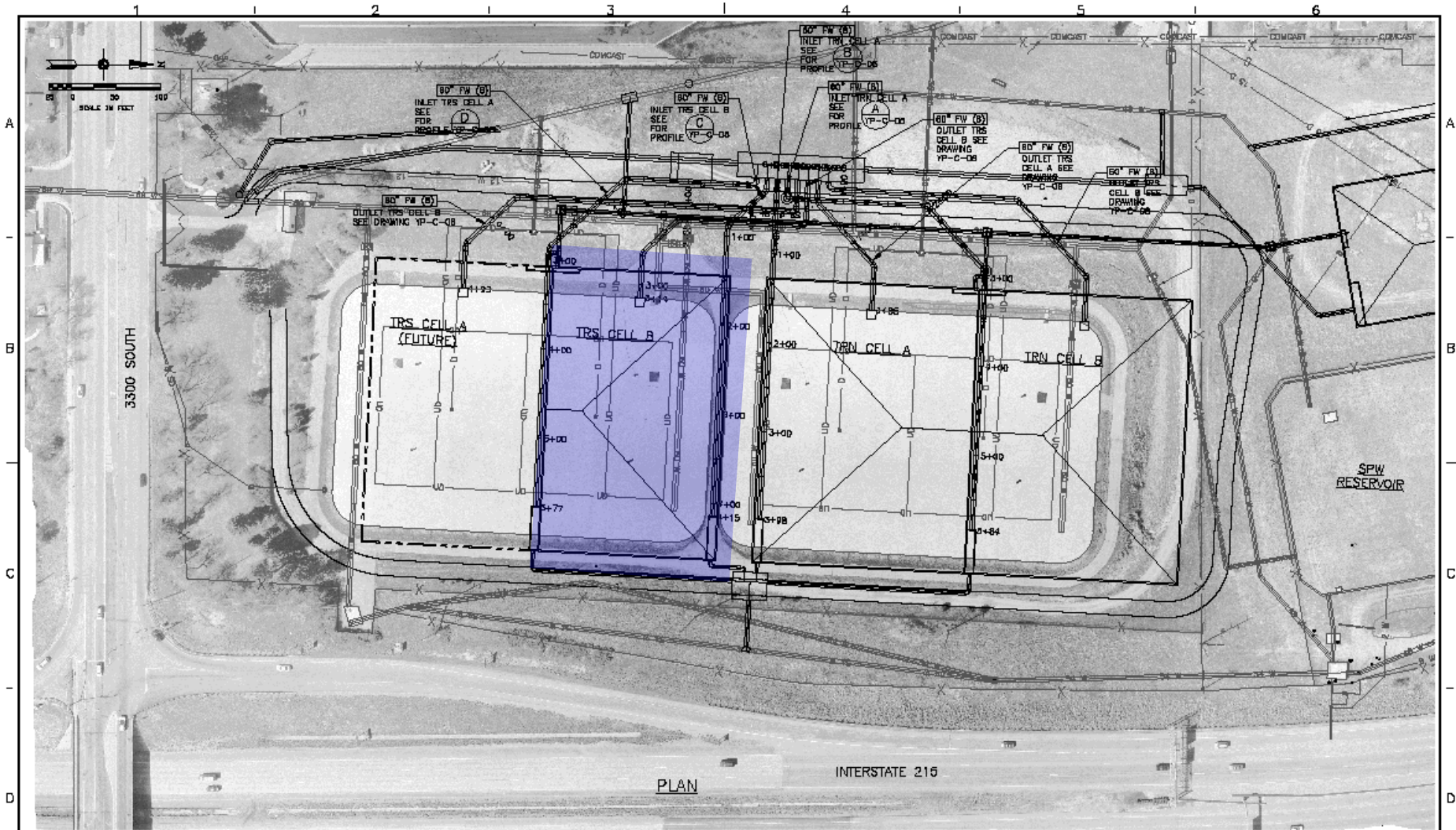
**EAST-WEST SECTION**  
 HORIZ SCALE: 1"=20'  
 VERT SCALE: 1"=10'  
 (A)  
 TRN-C-01



**SOUTH-NORTH SECTION**  
 HORIZ SCALE: 1"=20'  
 VERT SCALE: 1"=10'  
 (B)  
 TRN-C-01

PREPARED FOR <b>METROPOLITAN WATER DISTRICT                  OF SALT LAKE &amp; SANDY</b>				BOWEN, COLLINS & ASSOCIATES			TERMINAL RESERVOIR REPLACEMENT PROJECT			SCALE: 1"=20'
DESIGNED BY <b>R. GARCIA</b>				REVIEWED BY <b>K. J. COOK</b>			VERIFY SCALE OF ALL DIMENSIONS AGAINST THE FIELD			DATE: NOV-2010
APPROVED BY <b>R. GARCIA</b>				APPROVED BY <b>K. J. COOK</b>			50% REVIEW			SHEET NO. TRN-C-02
DISTRICT NUMBER TRN03				IDENTIFICATION NUMBER TRN03			PROJECT NO. 918-09-14			SHEET NO. XXX

# Terminal Reservoir South Construction Phase



REV	DATE	BY	APP	DESCRIPTION

PREPARED FOR <b>METROPOLITAN WATER DISTRICT                  OF SALT LAKE &amp; SANDY</b>
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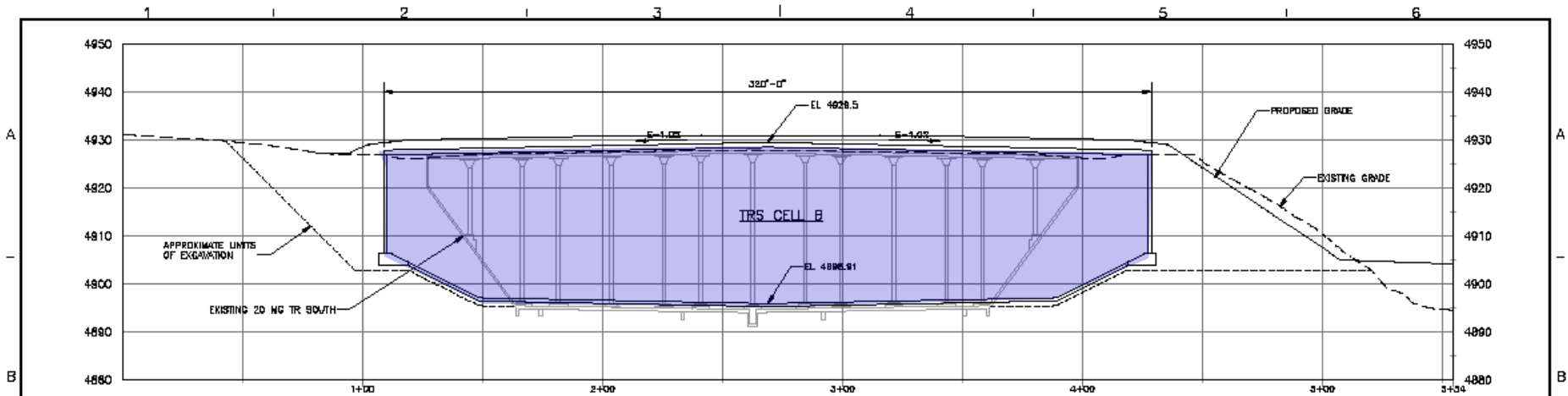
BOWEN, COLLINS & ASSOCIATES	
DESIGNED G. LINSCHER	CHECKED X. KXXX
DRAWN R. GARCIA	APPROVED X. KXXX

**50% REVIEW**

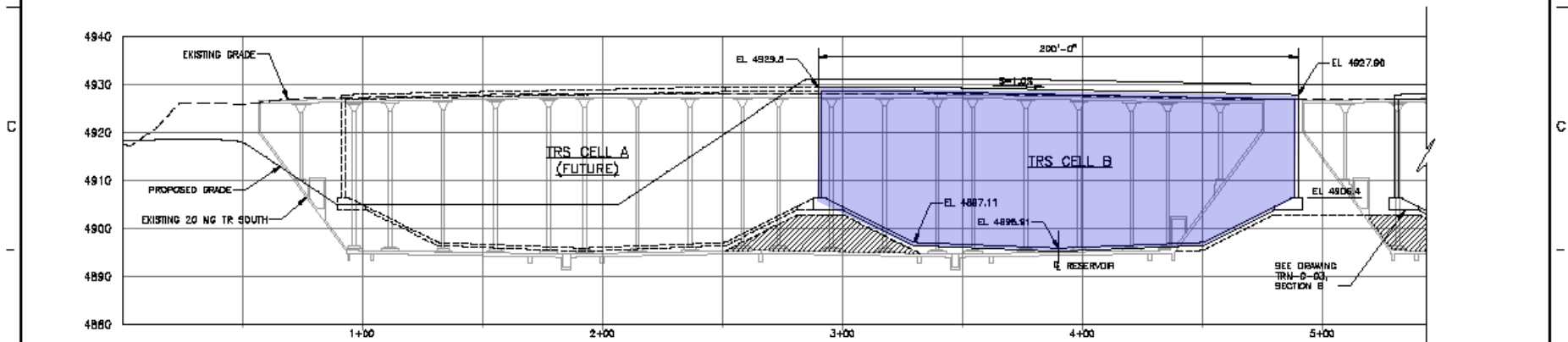
TERMINAL RESERVOIR REPLACEMENT PROJECT			
SLA TERMINAL RESERVOIR INLET PLAN		SCALE: 1"=30'	DATE: NOV-2010
DISTRICT NUMBER TR003	IDENTIFICATION PROJECT NO. 018-08-D4	DRAWING NO. TP-C-04	SHEET NO. XXX



# Terminal Reservoir South Construction Phase



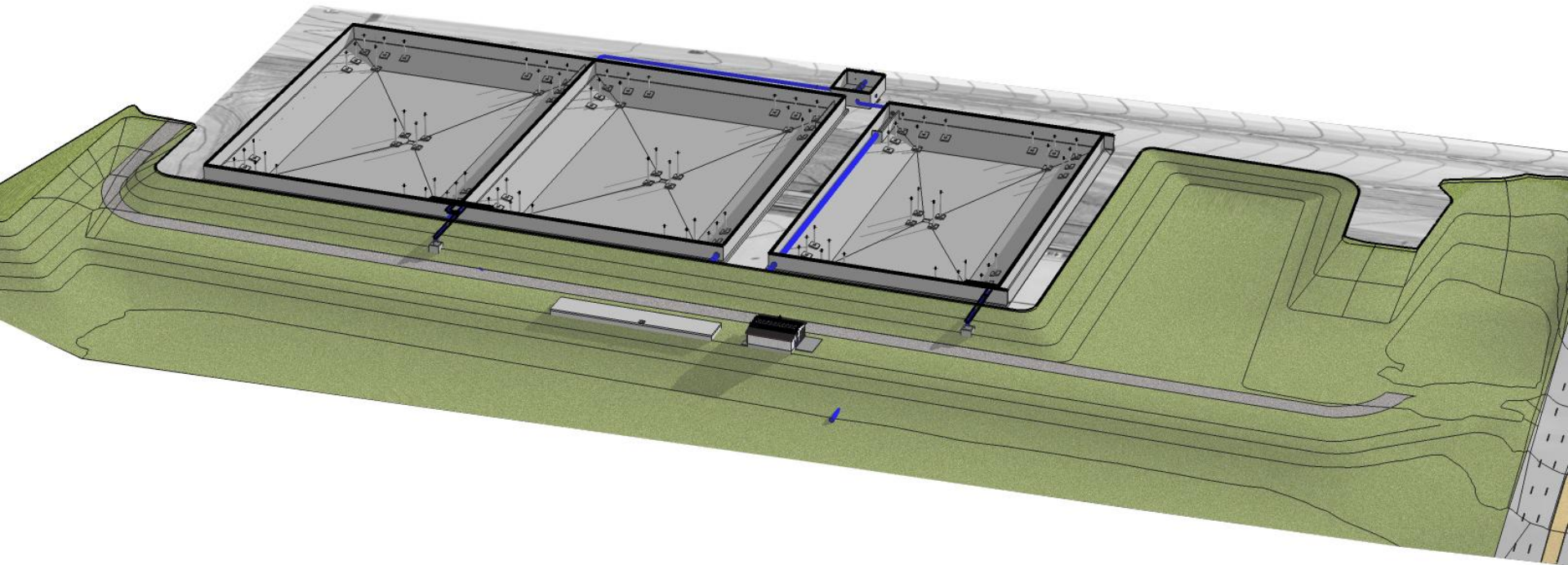
**EAST-WEST SECTION** (A)  
 TRS-C-01  
 HORIZ SCALE: 1"=20'  
 VERT SCALE: 1"=10'



**SOUTH-NORTH SECTION** (B)  
 TRS-C-01  
 HORIZ SCALE: 1"=20'  
 VERT SCALE: 1"=10'

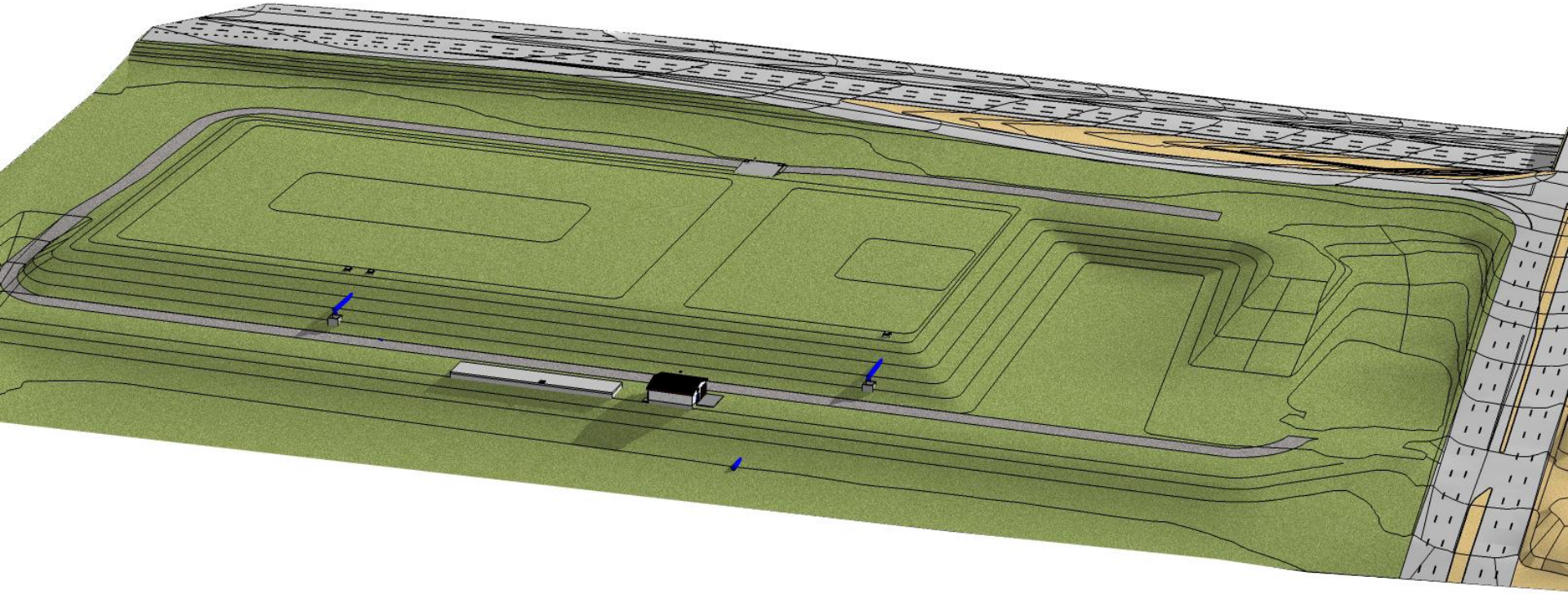
PREPARED FOR <b>METROPOLITAN WATER DISTRICT                  OF SALT LAKE &amp; SANDY</b>				BOWEN, COLLINS & ASSOCIATES				TERMINAL RESERVOIR REPLACEMENT PROJECT				SCALE: 1"=20'	
DESIGNED BY B. LIESCHER DRAWN BY R. GARCIA				REVIEWED BY K. KROCK APPROVED BY J. J. JONES				VERIFY SCALE OF EACH SHEET AGAINST THE PLAN				DATE: NOV-2010	
DISTRICT IDENTIFICATION NUMBER TR003				PROJECT NO. 918-08-141				SHEET NO. TRS-C-02				SHEET AM. XXX	

# Terminal Reservoir 3D Rendering





# Terminal Reservoir 3D Rendering



# Keys to Project Success

- **Proactive Planning**
- **Budgeting for Replacement (Original Reservoir (1950): \$ 1.26 M; New Reservoir (2011): \$ 36.7 M)**
- **Setting Realistic Construction Constraints**
- **Phased Approach**





**Questions?**