Lake Perris Seepage Recovery Project Instrumentation and Data Collection for Groundwater Modeling

California Water and Environmental Modeling Forum
2022 Annual Meeting Program

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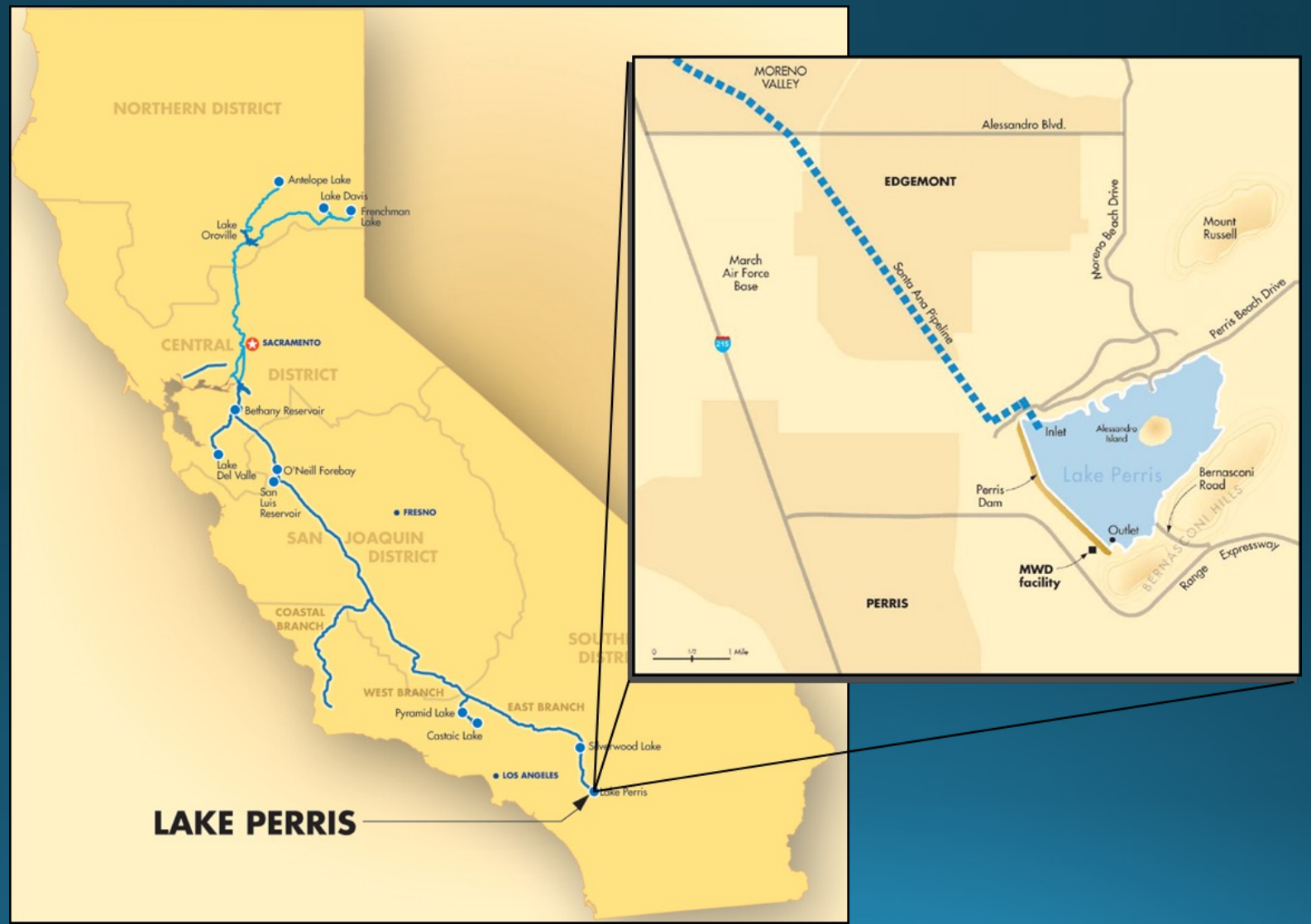
California Department of Water Resources

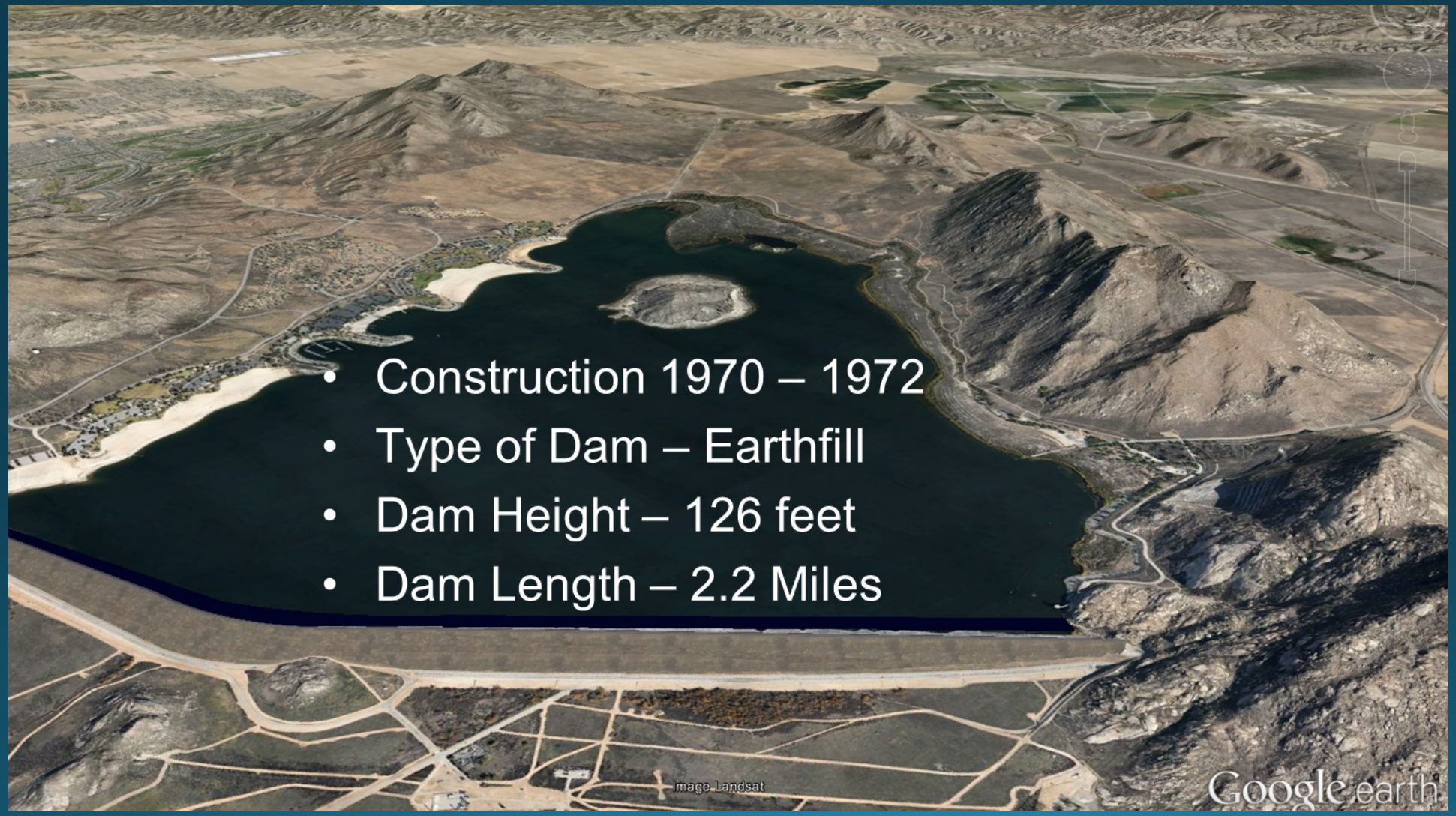
Outline of Presentation

- General site information
- Geologic setting
- Rationale for seepage recovery project
- Hydrogeologic Investigations
- Thermal Investigations
- Summary

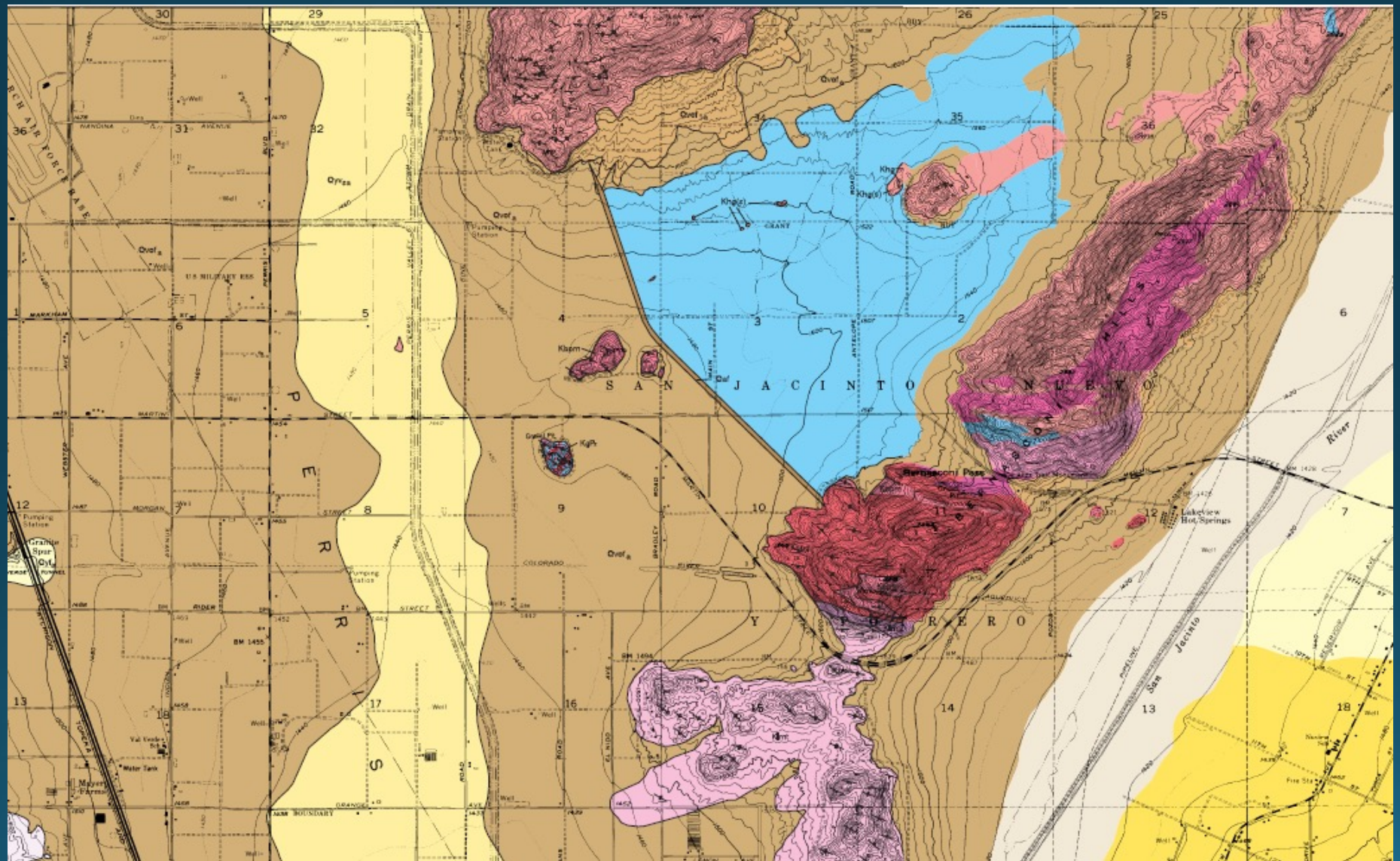
Site Location



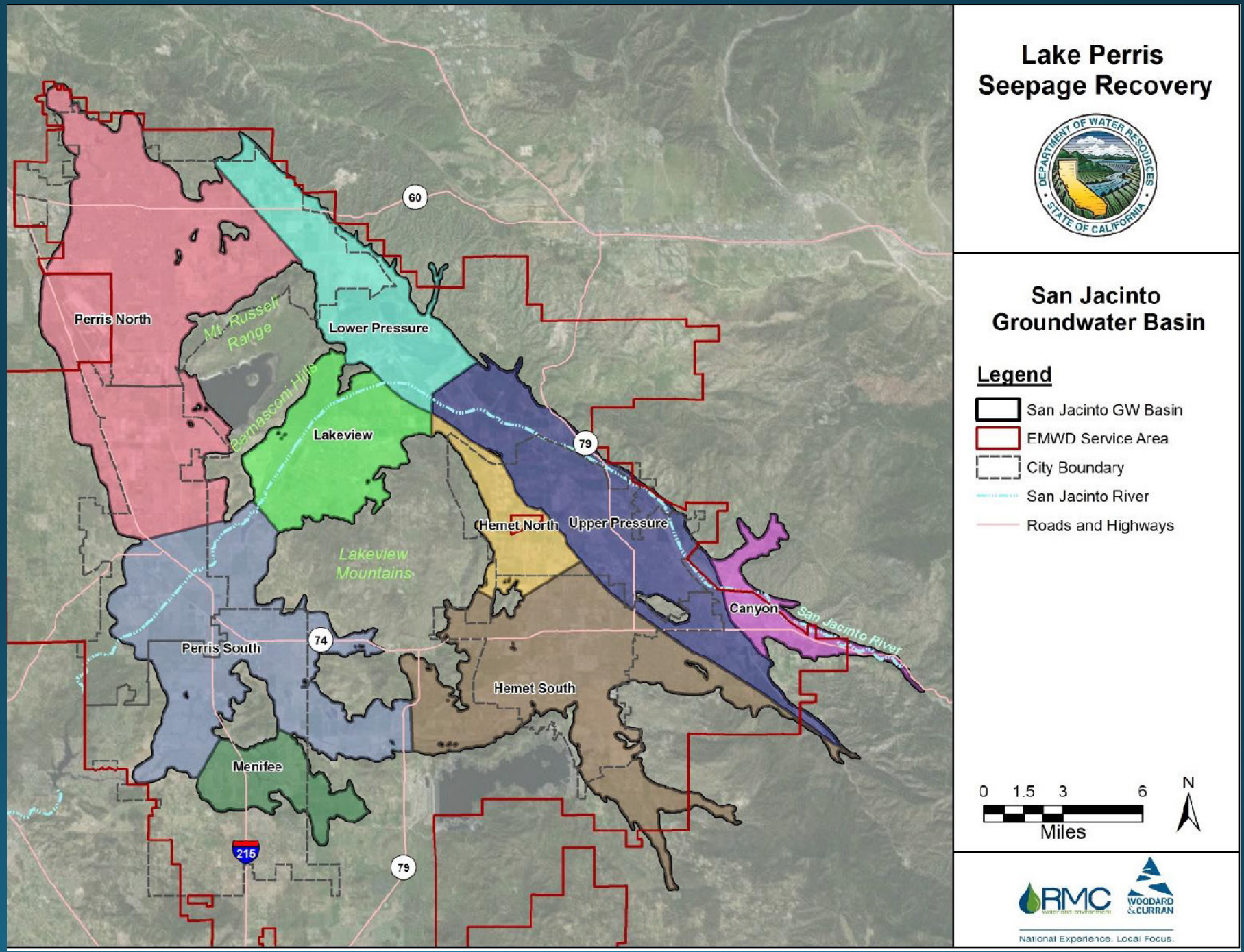
Perris Dam Features



Geologic Setting



Hydrogeologic Setting



Geologic Setting

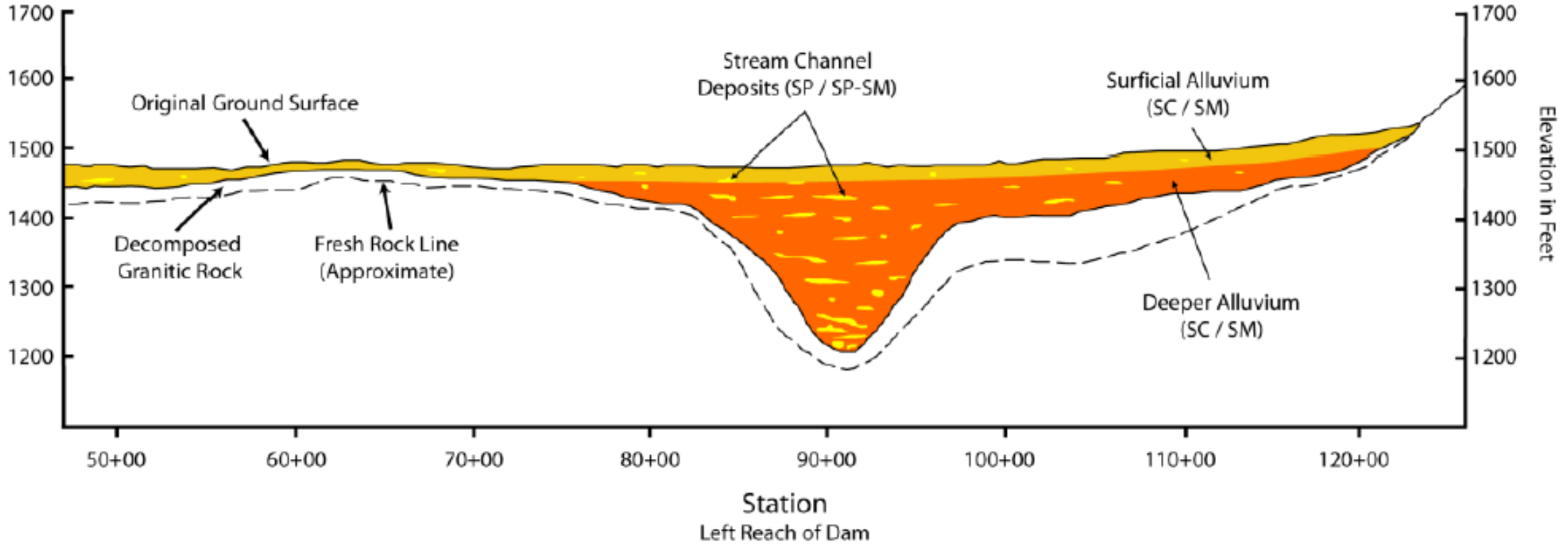
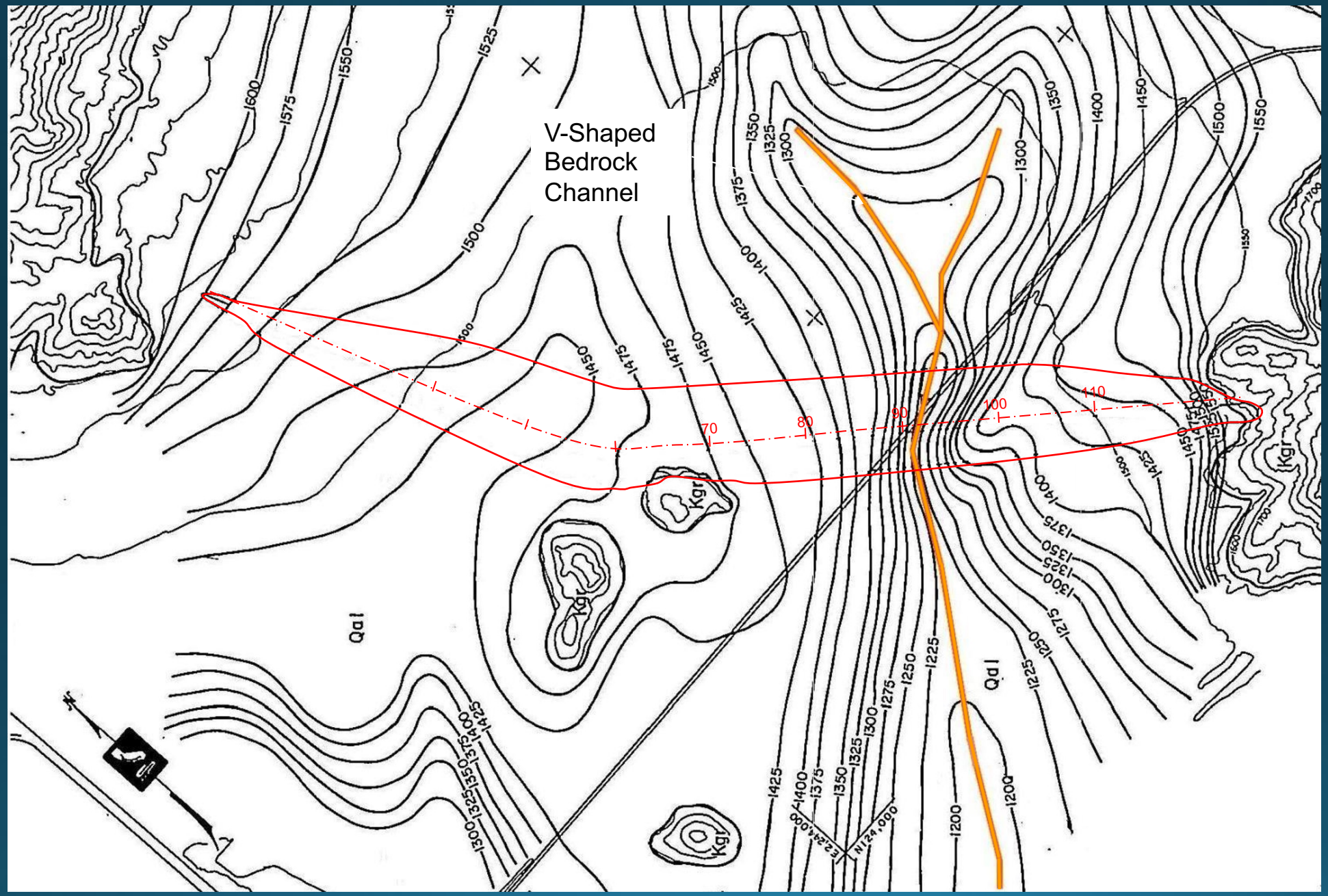
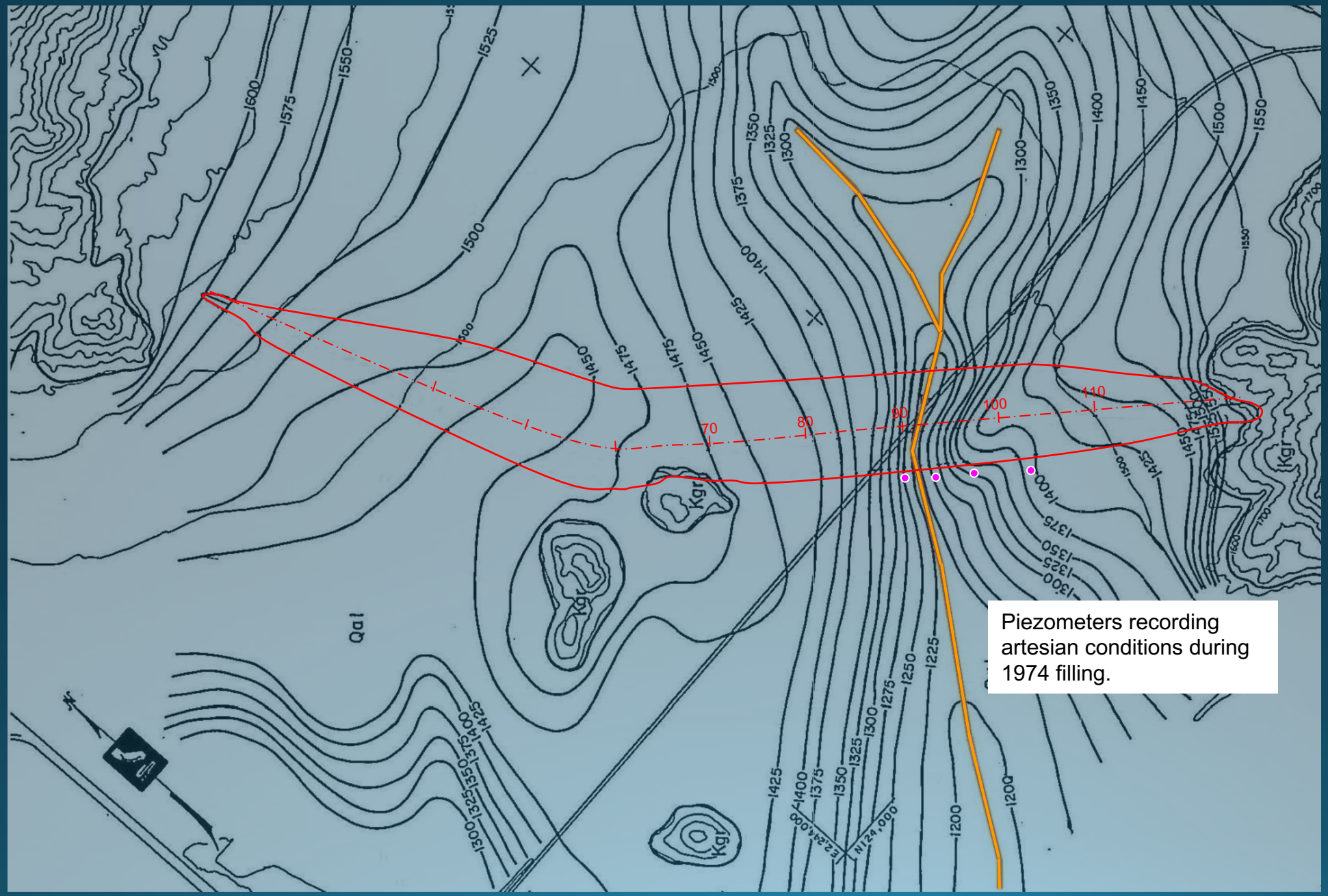
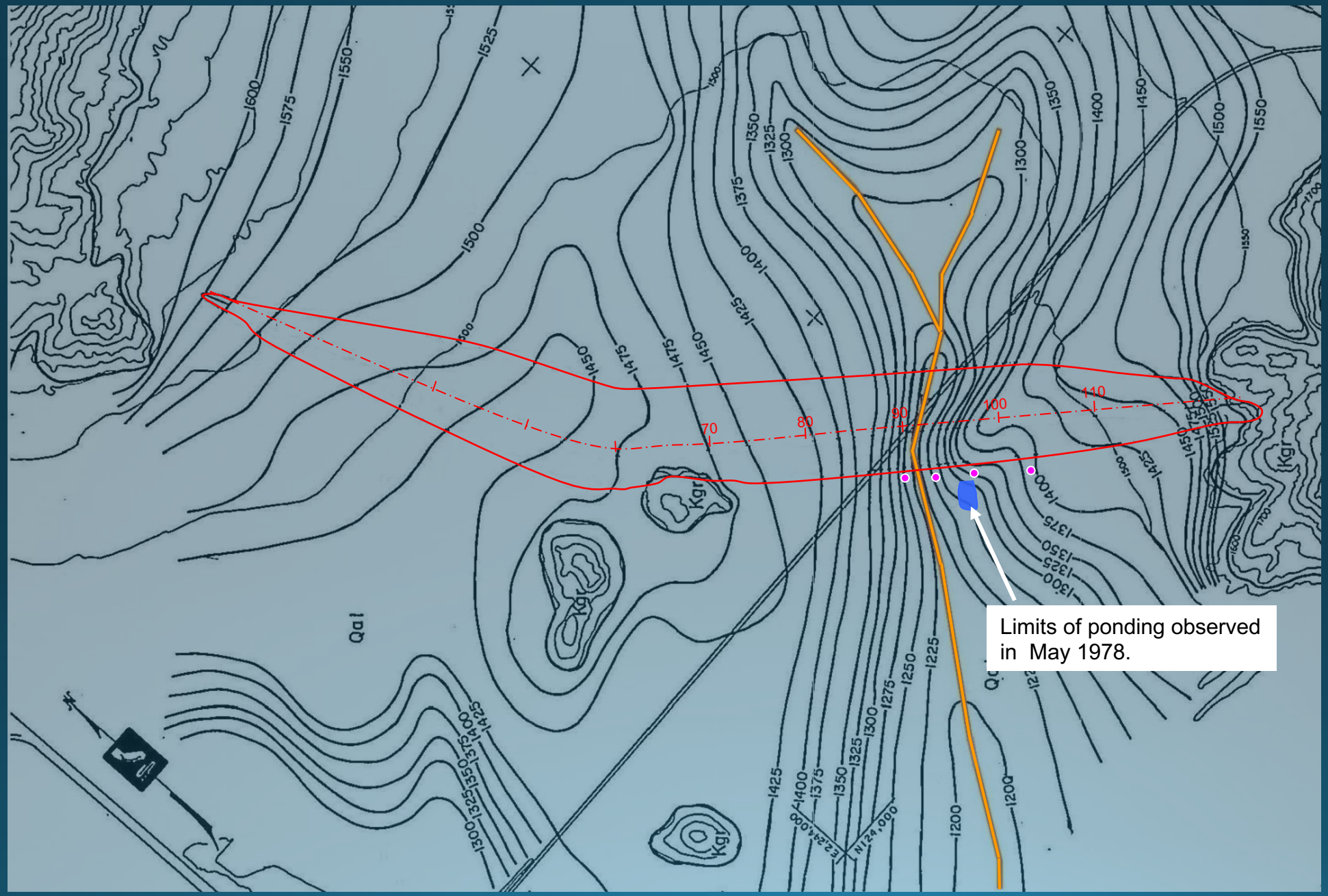
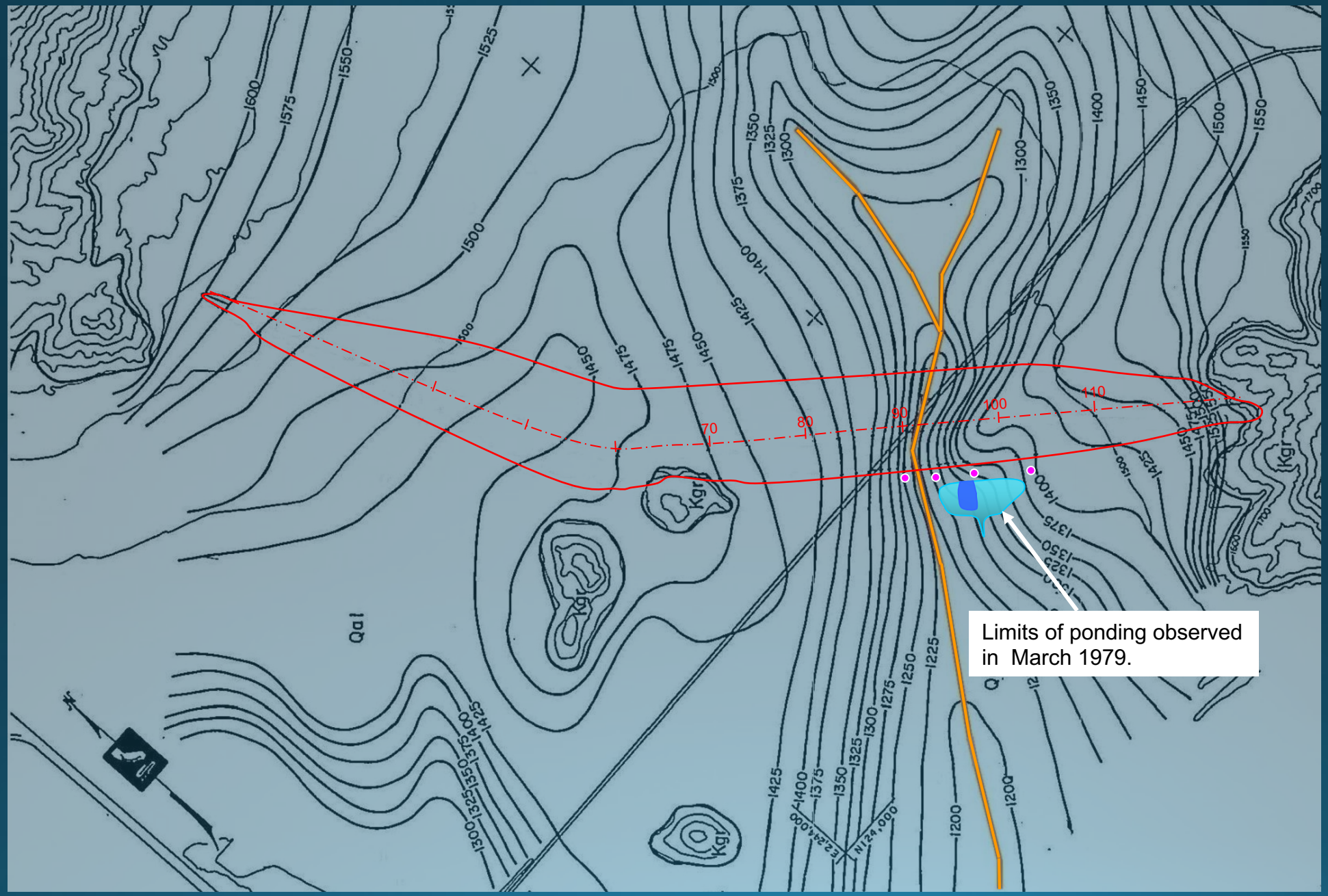


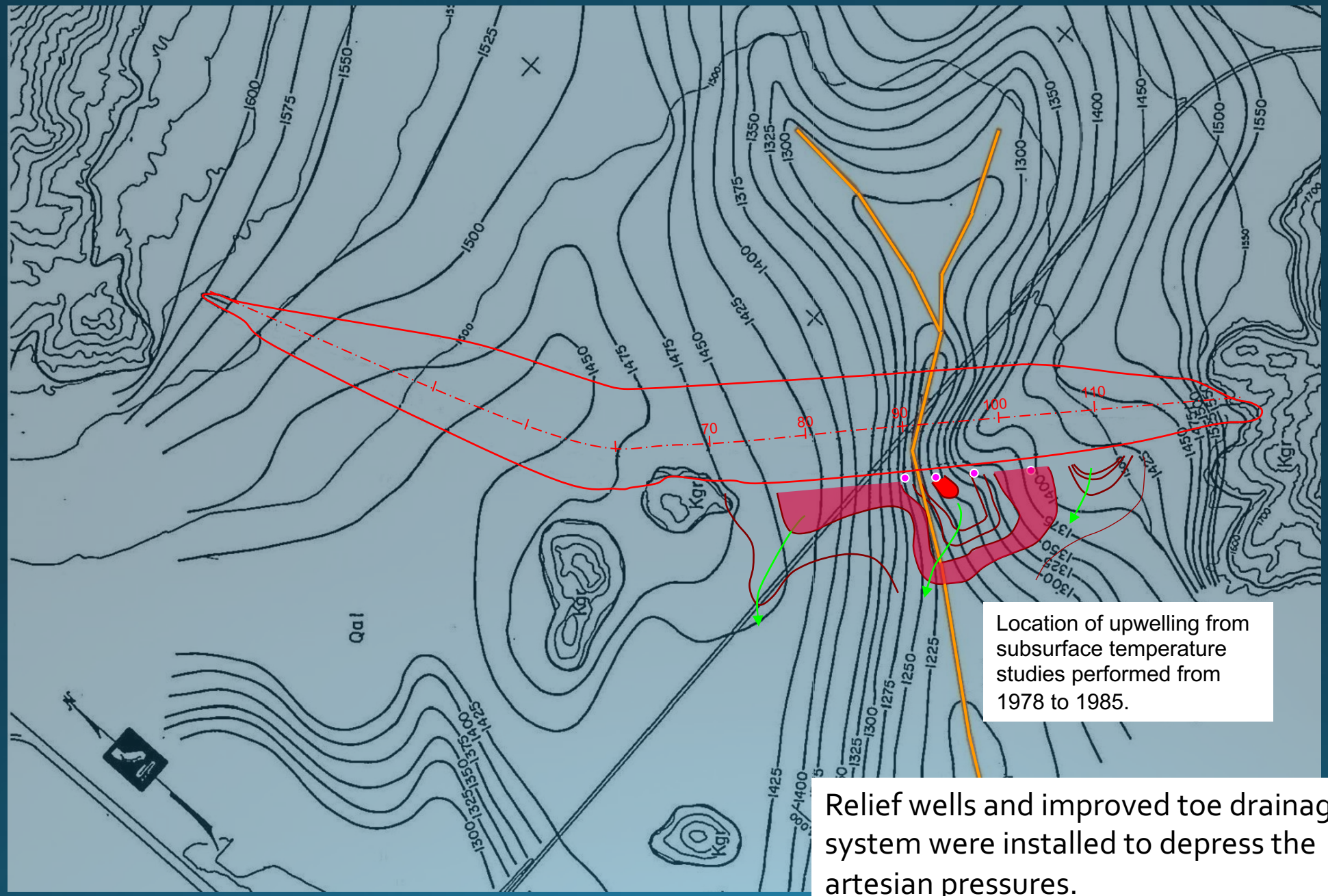
Figure 5: Profile of Left Reach Foundation


V-Shaped
Bedrock
Channel
Qal
Kgr
70
80
90
100
110


Piezometers recording artesian conditions during 1974 filling.
Qal
Kgr
70
80
90
100
110


Limits of ponding observed in May 1978.
Qal
Kgr
70
80
90
100
110


Limits of ponding observed in March 1979.
Qal
Kgr
70
80
90
100
110

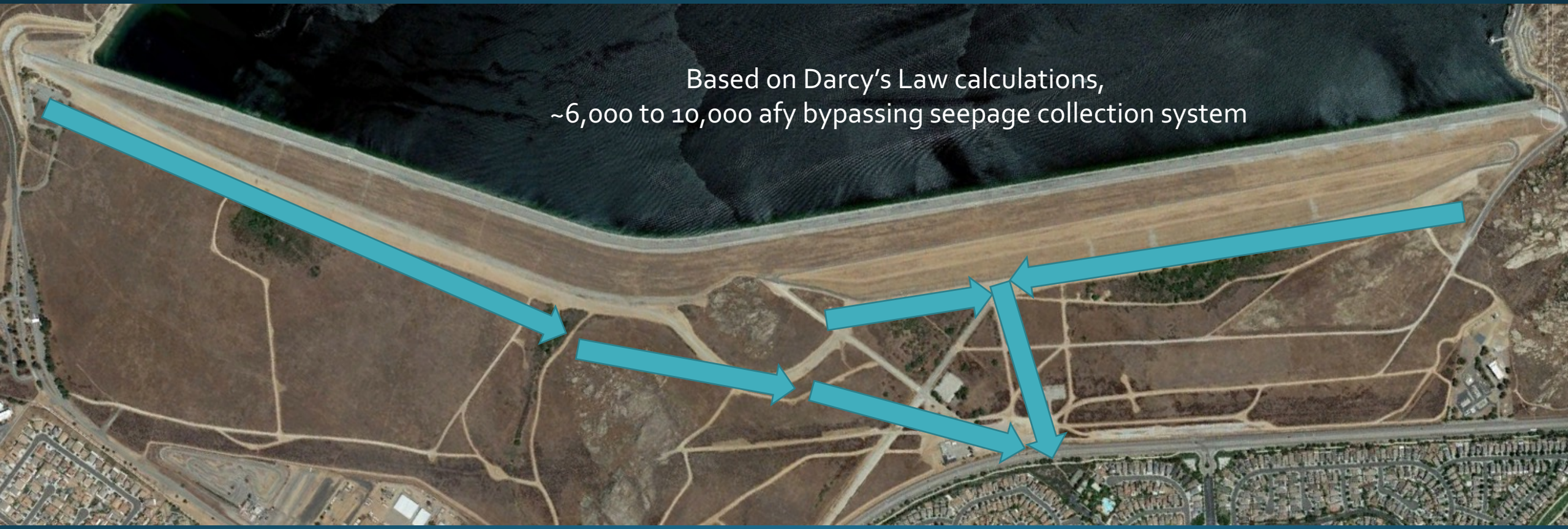


Relief wells and improved toe drainage system were installed to depress the artesian pressures.

Current Seepage Recovery System

~4,000 afy
Measured seepage

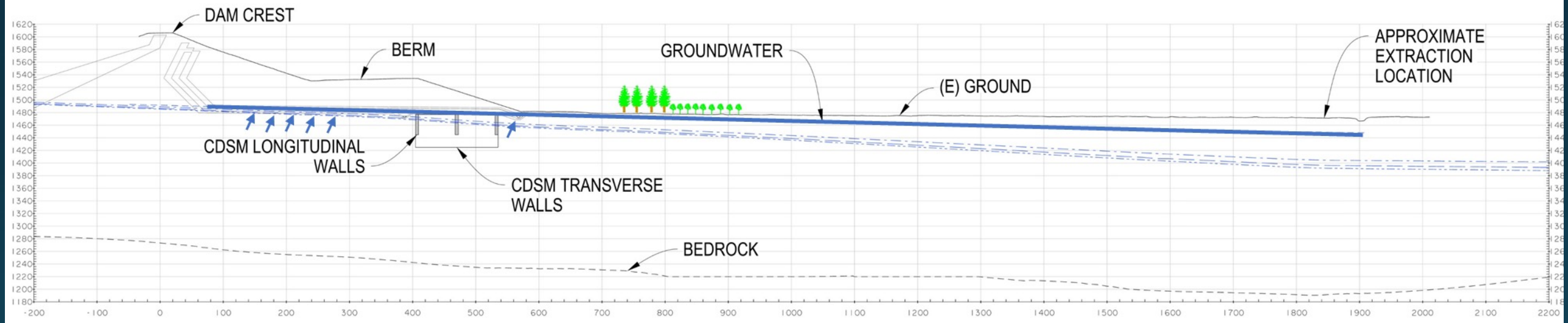
Rationale for Recovery System



Proposed Seepage Recovery System

Proposed Seepage Recovery System

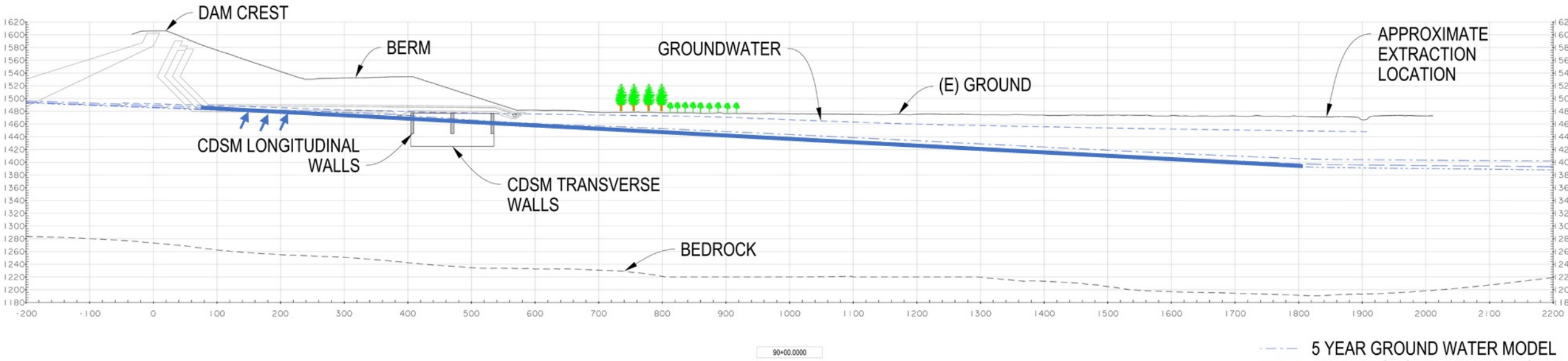
Current Conditions



Groundwater gradient ~ 0.0167 feet/foot (i.e., 10-foot drop over a distance of about 600 feet)

Proposed Seepage Recovery System

Conditions after 20 years of pumping



Groundwater gradient ~ 0.05 feet/foot (i.e., 10-foot drop over a distance of about 200 feet)

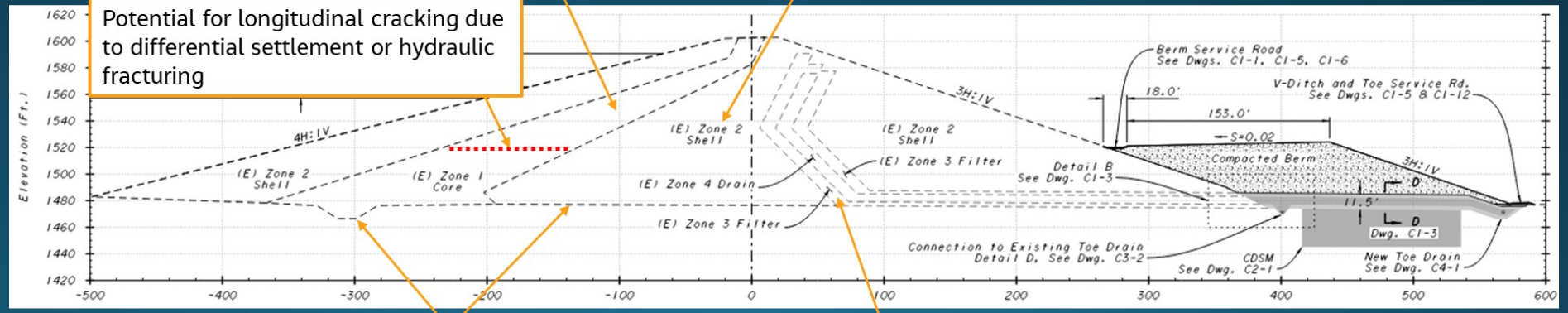
Potential Effects to the Dam

- Differential settlement
  - Embankment cracking
  - Hydraulic fracturing
  - Internal erosion

Hydraulic gradients across Zone 1, and Exit/Escape gradients

Suitability of Zone 2 for filter protection of Zone 1

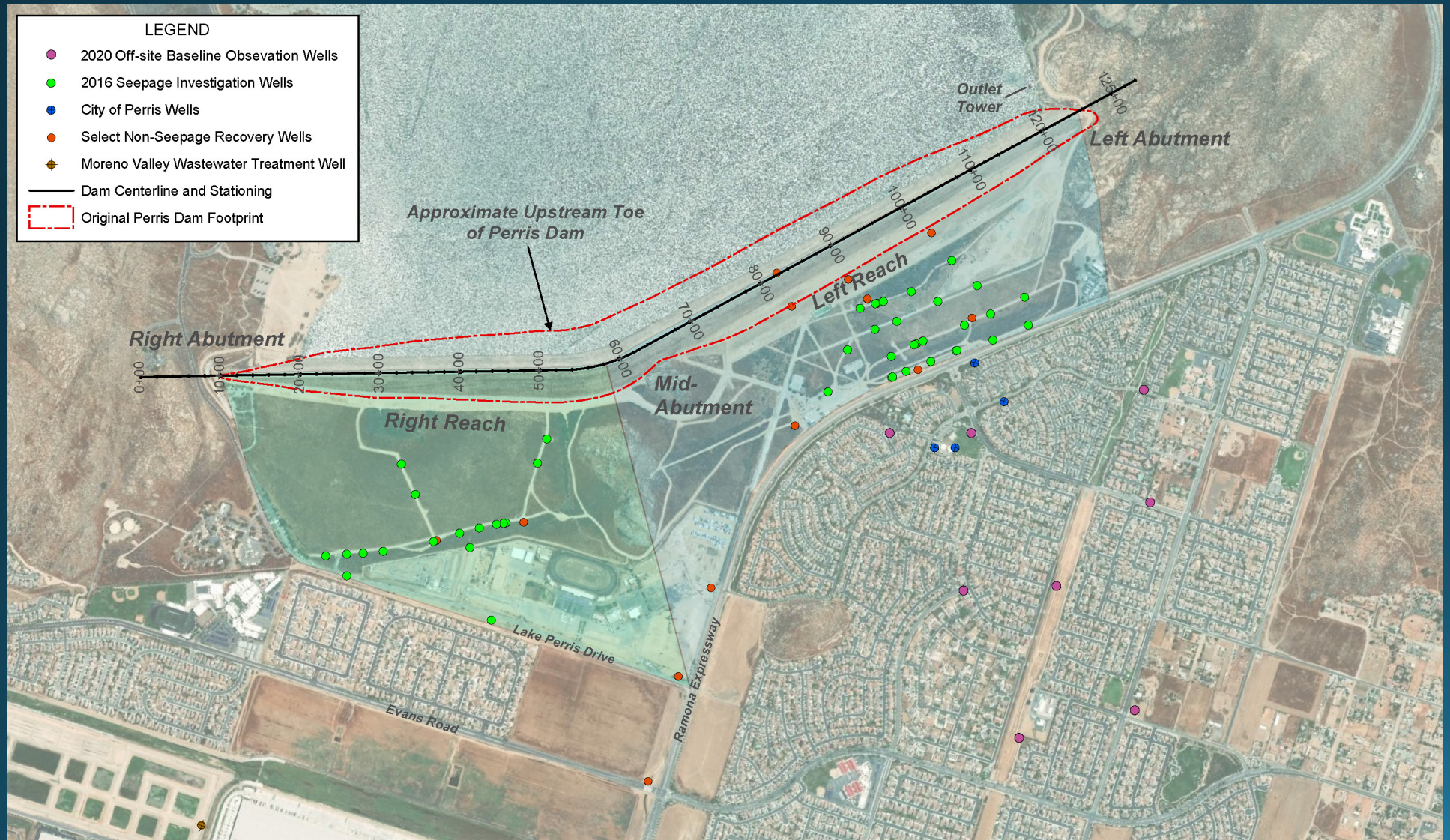
Potential for longitudinal cracking due to differential settlement or hydraulic fracturing



Extent of foundation contacts between Zone 1 or Zone 2 and foundation soils

Were cracks/fractures to penetrate Zone 2, would Zone 3 adequately filter Zone 1

Hydrogeologic Investigations



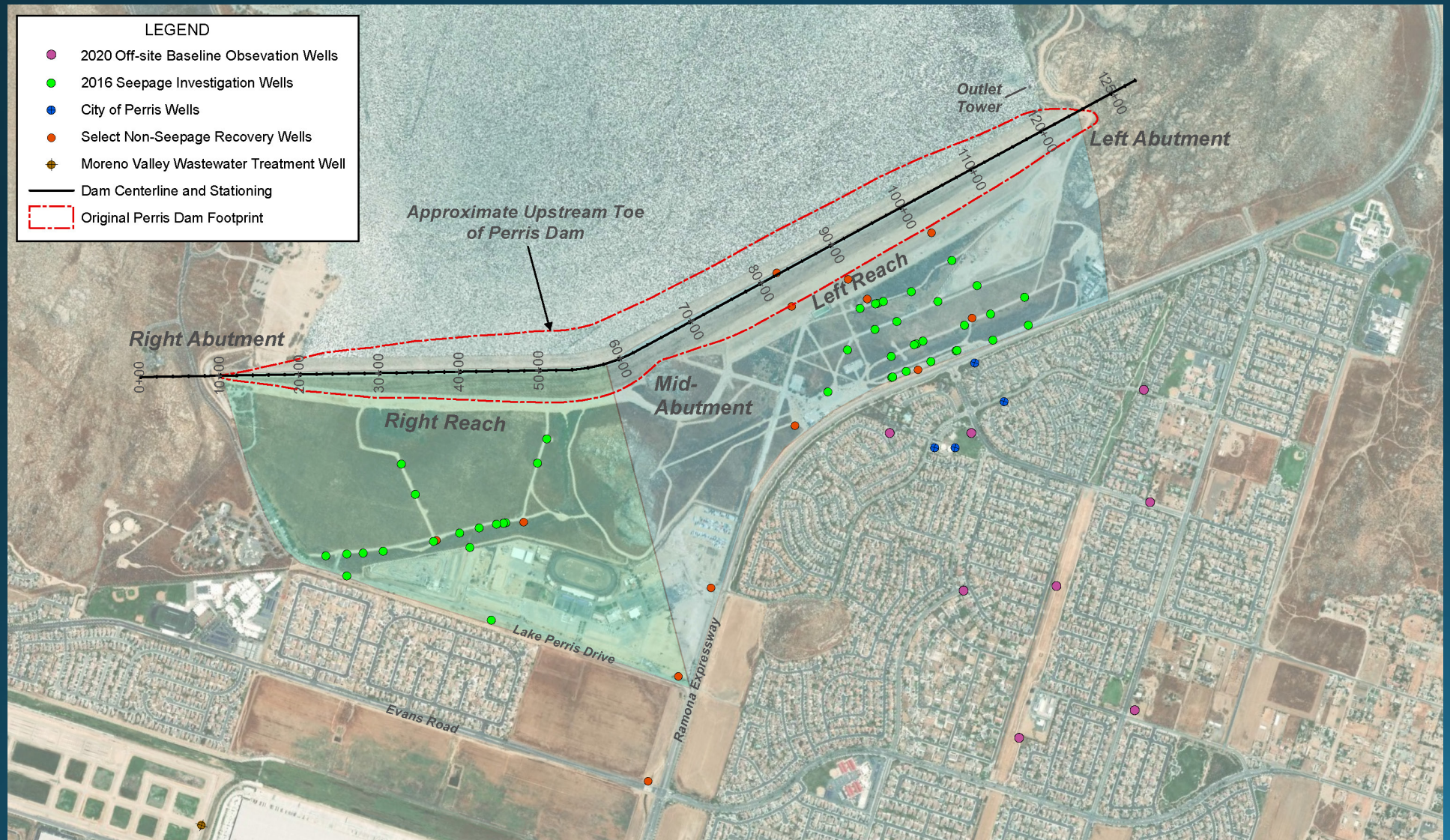
2020: 10 deep off-site observation wells installed

2016: 42 observation wells and 2 test wells

Various pre-existing DWR observation wells

Several off-site supply wells

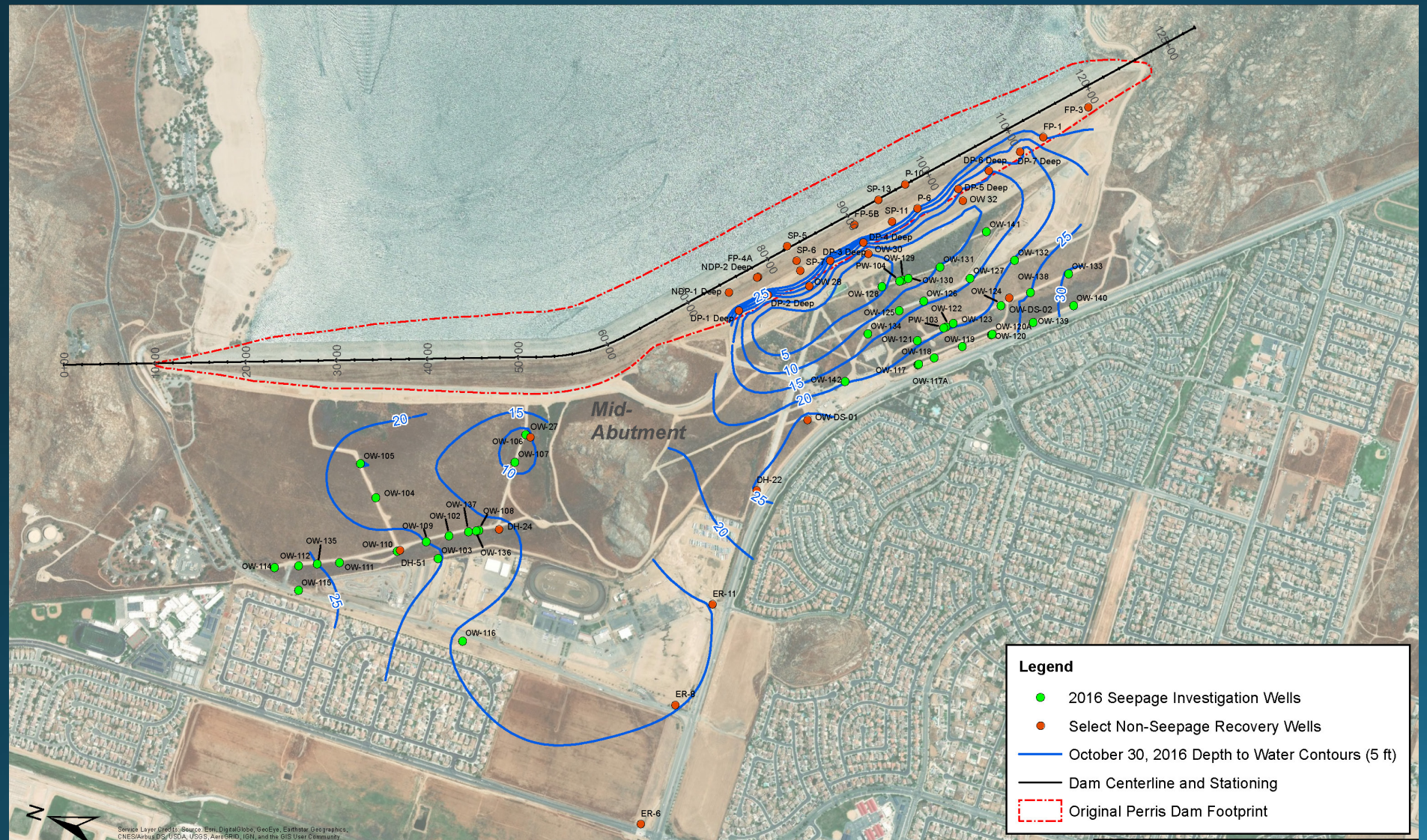
Hydrogeologic Investigations



All DWR observation wells are instrumented to collect groundwater elevations at defined intervals.

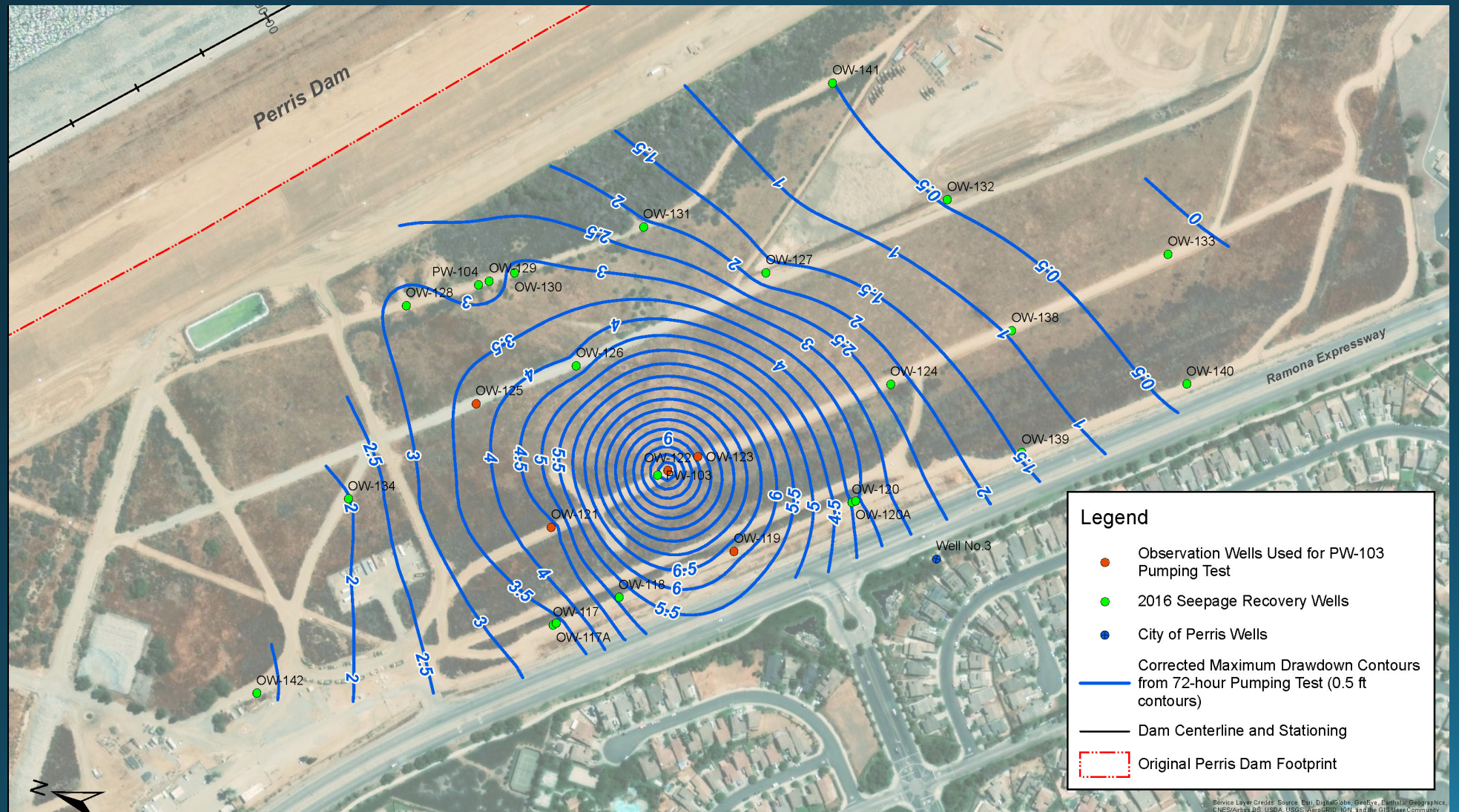
Many (but not all) observations are telemetered and available in real time via Sensemetrics online dashboard.

Hydrogeologic Investigations



Depth to water contours

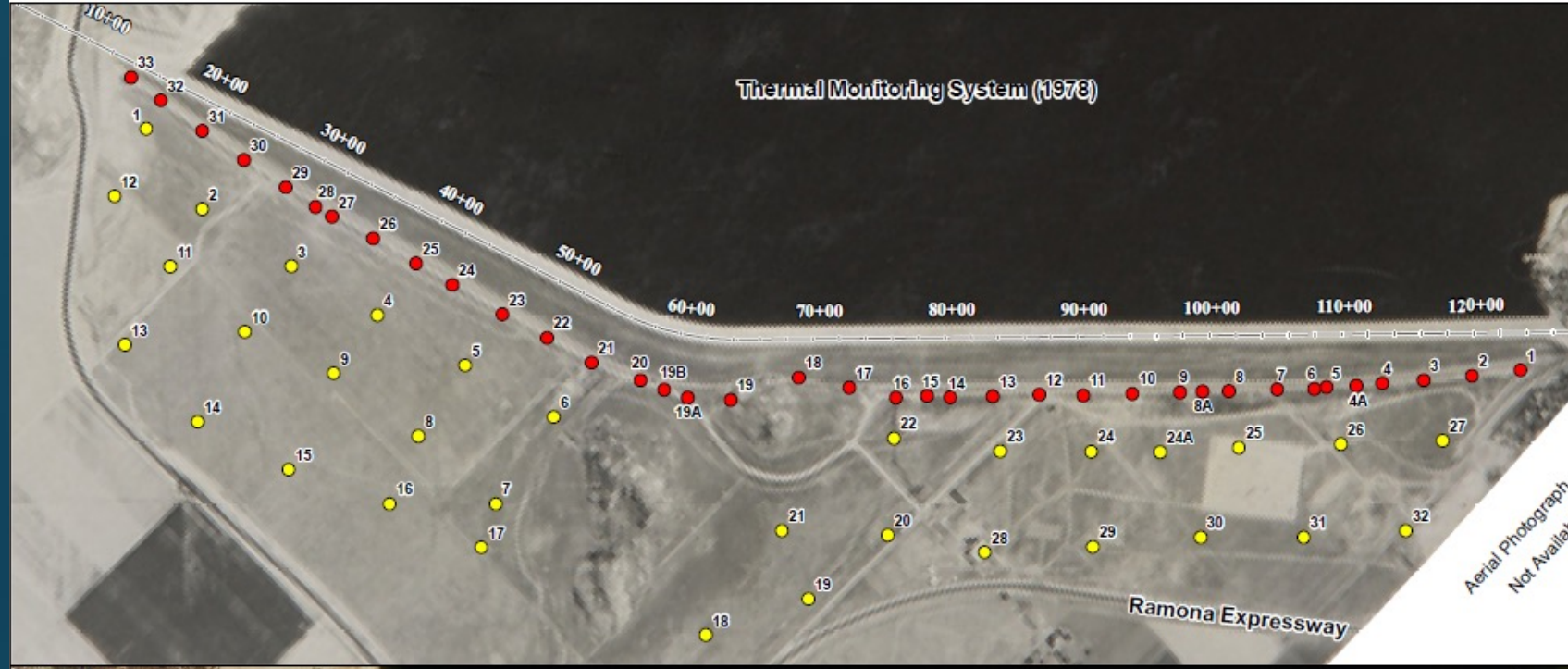
Hydrogeologic Investigations



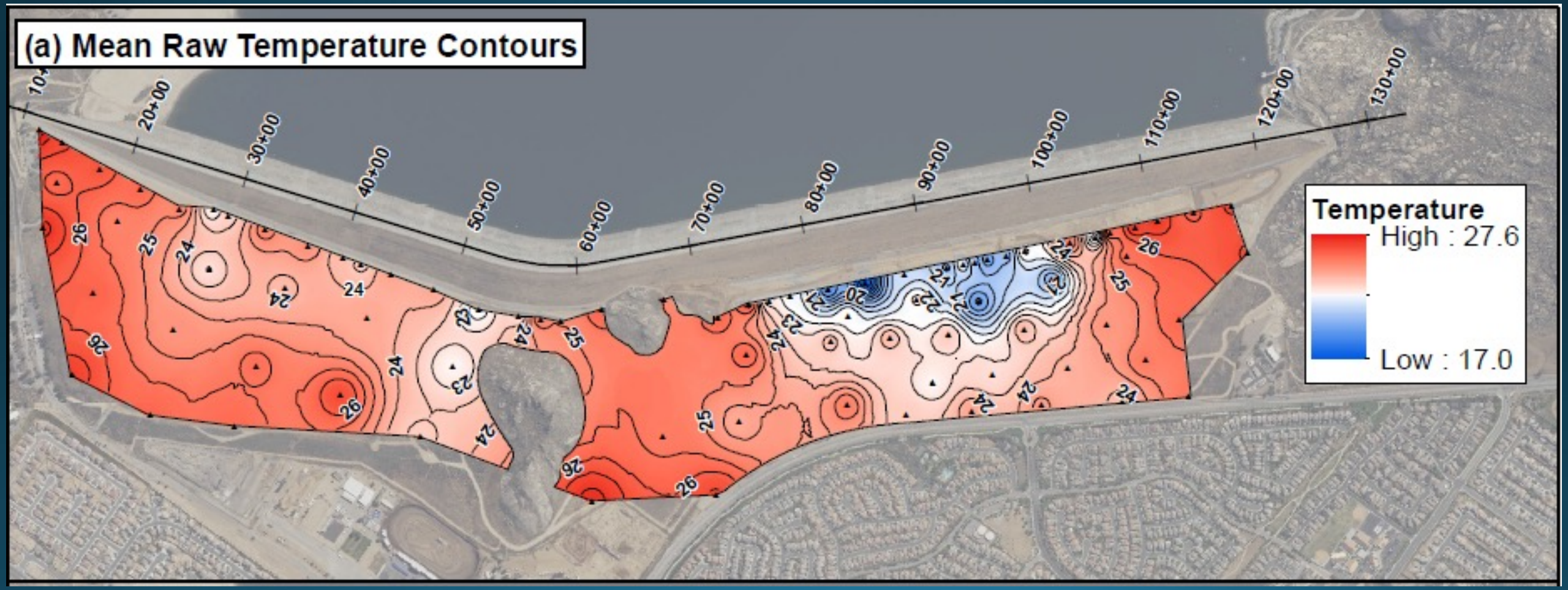
Drawdown during aquifer testing

Thermal Investigations

- Ground temperature probes were re-installed
- Measurements monthly since 2017



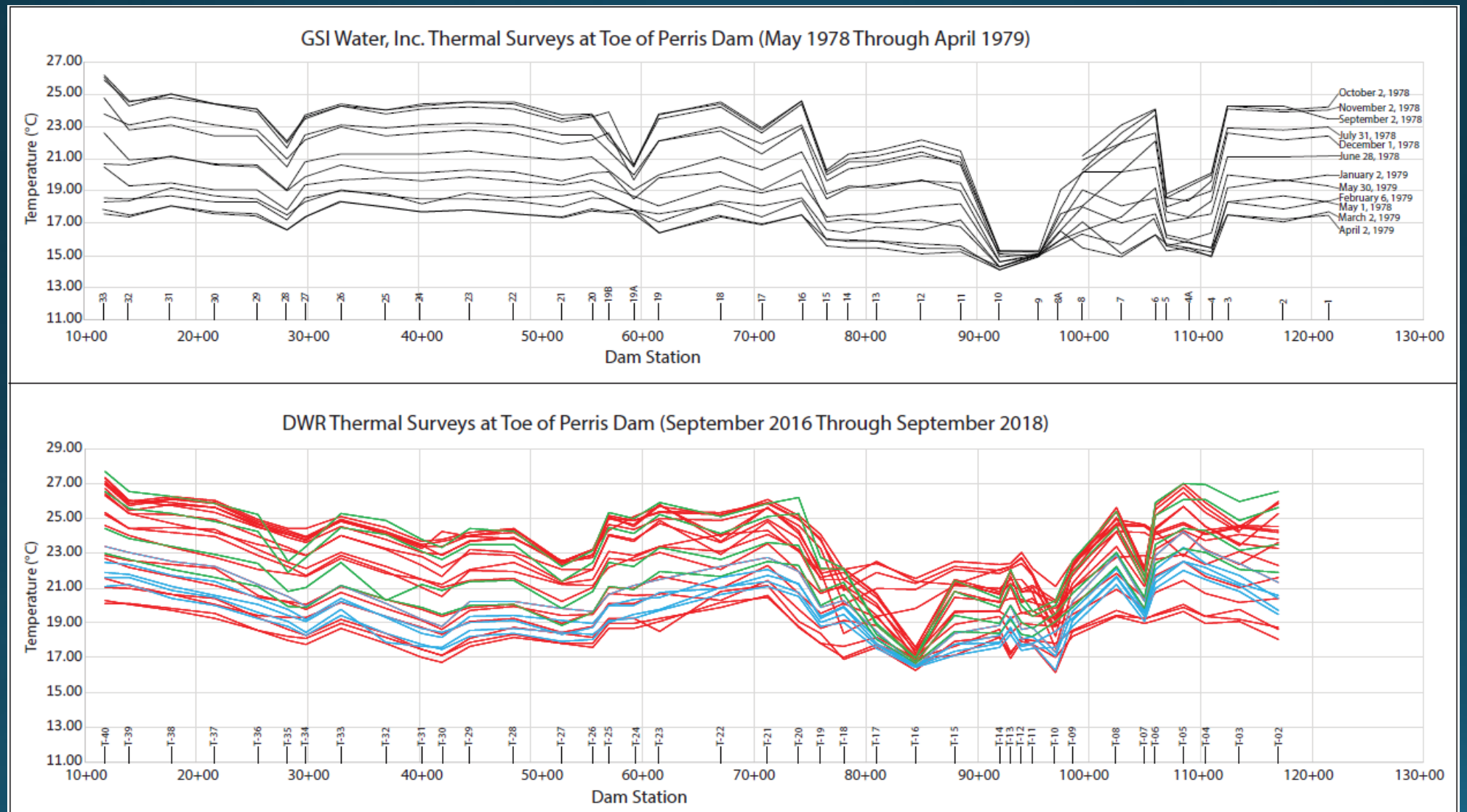
Thermal Investigations



Thermal Investigations

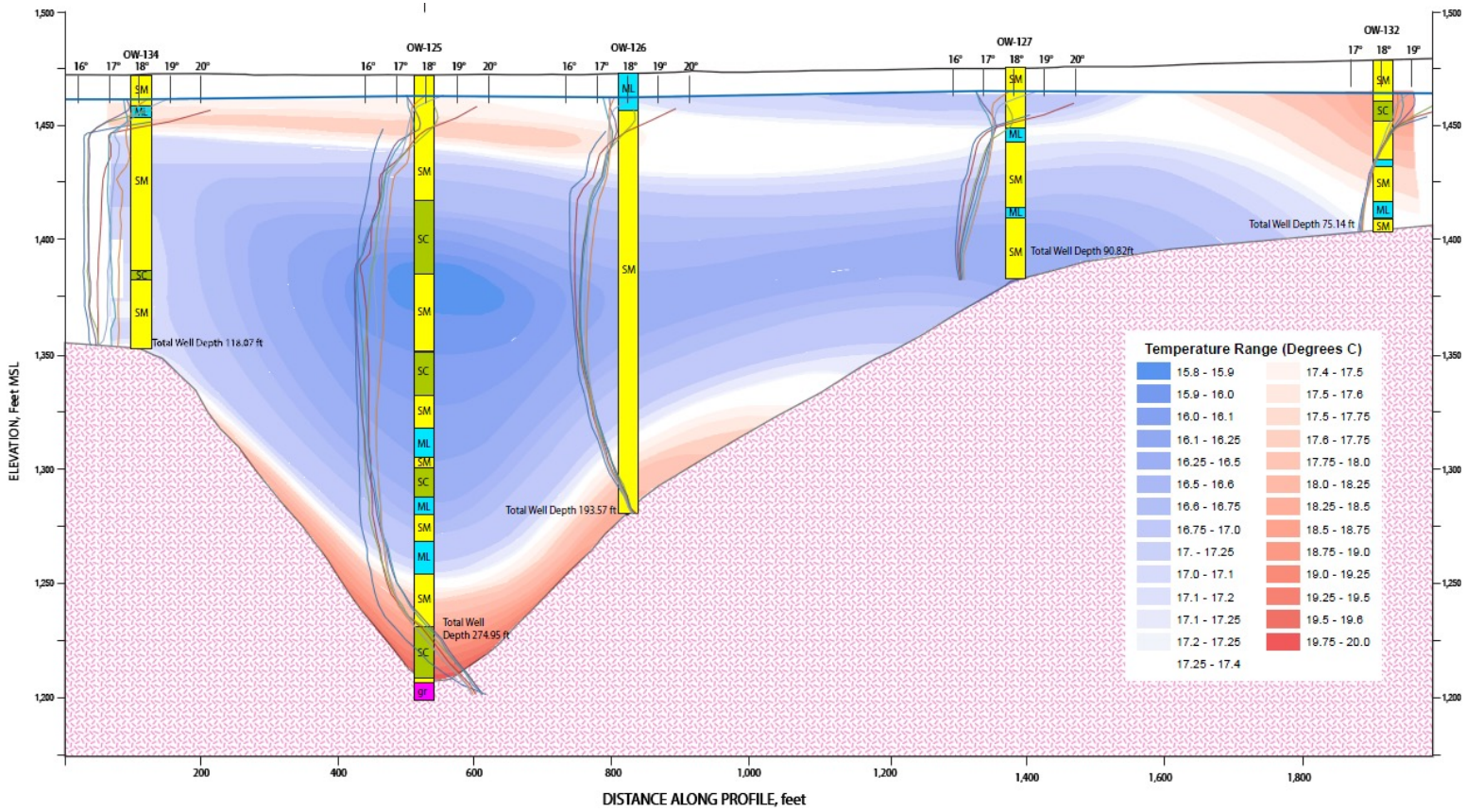
- Many more downhole temperature locations were measured
- Measurements collected monthly for a couple years, now periodically

Thermal Investigations



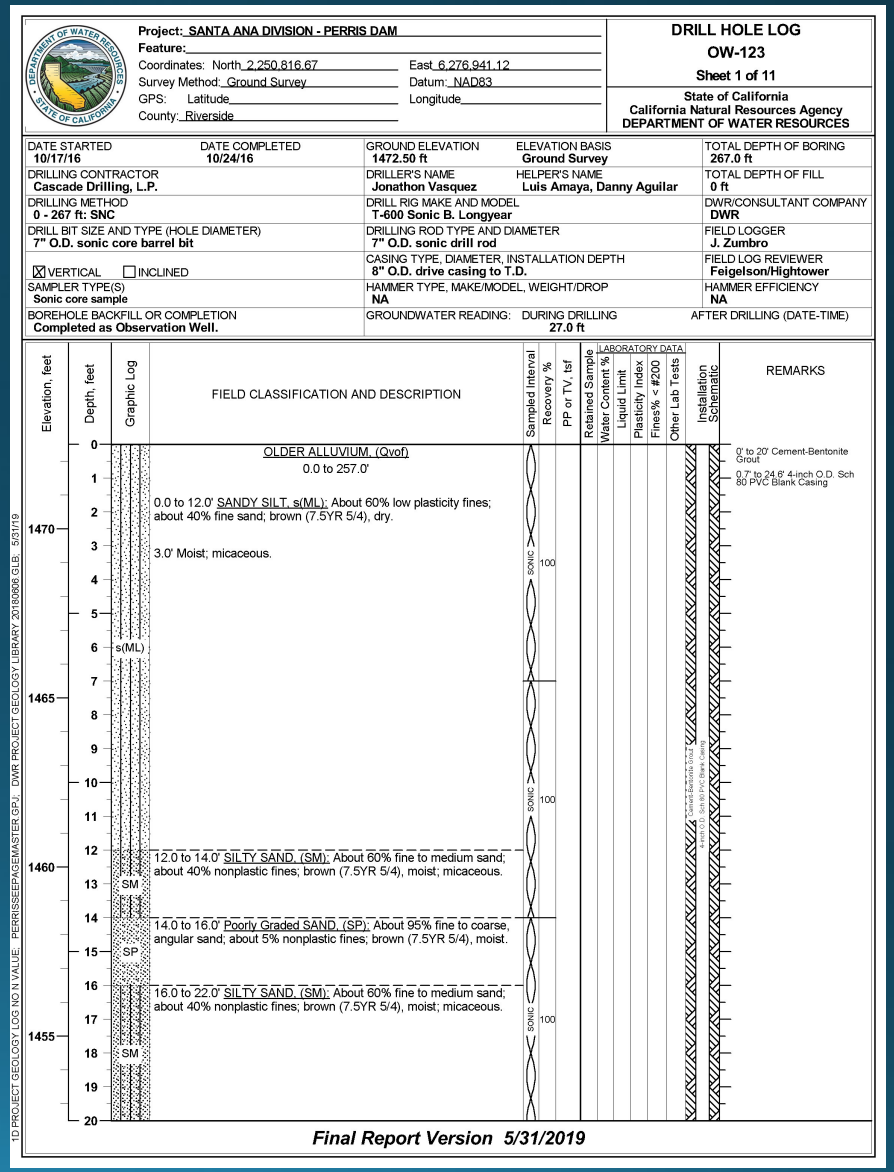
Thermal Investigations

- Temperature contouring reveals areas where increased water flow occurs



Summary of Data Incorporated into Groundwater Modeling

- Geologic borehole logs
- Top of bedrock surface
- Groundwater elevations
- Aquifer testing
- Ground temperature changes
- Water column temperature profiles



Project: SANTA ANA DIVISION - PERRIS DAM
Feature:
Coordinates: North 2,250,816.67 East 6,276,941.12
Survey Method: Ground Survey Datum: NAD83
GPS: Latitude Longitude
County: Riverside

DRILL HOLE LOG
OW-123
Sheet 1 of 11
State of California
California Natural Resources Agency
DEPARTMENT OF WATER RESOURCES

DATE STARTED 10/17/16 / DATE COMPLETED 10/24/16	GROUND ELEVATION 1472.50 ft / ELEVATION BASIS Ground Survey		TOTAL DEPTH OF BORING 267.0 ft
DRILLING CONTRACTOR Cascade Drilling, L.P.	DRILLER'S NAME Jonathon Vasquez / HELPER'S NAME Luis Amaya, Danny Aguilar		TOTAL DEPTH OF FILL 0 ft
DRILLING METHOD 0 - 267 ft: SNC	DRILL RIG MAKE AND MODEL T-600 Sonic B. Longyear		DWR/CONSULTANT COMPANY DWR
DRILL BIT SIZE AND TYPE (HOLE DIAMETER) 7" O.D. sonic core barrel bit	DRILLING ROD TYPE AND DIAMETER 7" O.D. sonic drill rod		FIELD LOGGER J. Zumbro
☒ VERTICAL ☐ INCLINED	CASING TYPE, DIAMETER, INSTALLATION DEPTH 8" O.D. drive casing to T.D.		FIELD LOG REVIEWER Feigelson/Hightower
SAMPLER TYPE(S) Sonic core sample	HAMMER TYPE, MAKE/MODEL, WEIGHT/DROP NA		HAMMER EFFICIENCY NA
BOREHOLE BACKFILL OR COMPLETION Completed as Observation Well.	GROUNDWATER READING: DURING DRILLING 27.0 ft	AFTER DRILLING (DATE-TIME)	

Elevation, feet | Depth, feet | Graphic Log | FIELD CLASSIFICATION AND DESCRIPTION | Sampled Interval | Recovery % | PP or TV, tsf | LABORATORY DATA: Retained Sample | Water Content % | Liquid Limit | Plasticity Index | Fines% < #200 | Other Lab Tests | Installation Schematic | REMARKS

OLDER ALLUVIUM, (Qvof)
0.0 to 257.0'

0.0 to 12.0' SANDY SILT, s(ML): About 60% low plasticity fines; about 40% fine sand; brown (7.5YR 5/4), dry.

3.0' Moist; micaceous.

12.0 to 14.0' SILTY SAND, (SM): About 60% fine to medium sand; about 40% nonplastic fines; brown (7.5YR 5/4), moist; micaceous.

14.0 to 16.0' Poorly Graded SAND, (SP): About 95% fine to coarse, angular sand; about 5% nonplastic fines; brown (7.5YR 5/4), moist.

16.0 to 22.0' SILTY SAND, (SM): About 60% fine to medium sand; about 40% nonplastic fines; brown (7.5YR 5/4), moist; micaceous.

0' to 20' Cement-Bentonite Grout
0.7' to 24.6' 4-inch O.D. Sch 80 PVC Blank Casing

Final Report Version 5/31/2019

10 PROJECT GEOLOGY LOG NO N VALUE PERRISSEEPA/GEMASTER.GPJ DWR PROJECT GEOLOGY LIBRARY 20180606.GLB 5/31/19

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Questions?