SILVER LAKE RESERVOIR COMPLEX
MASTER PLAN

TASK II: RESEARCH & ANALYSIS

GEOTECHNICAL RESEARCH REPORT

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SILVER LAKE RESERVOIR COMPLEX
MASTER PLAN PROJECT

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EXECUTIVE SUMMARY

Beyaz & Patel reviewed Geotechnical reports, construction and reconstruction reports provided by LADWP. The review of as-built Silver Lake Reservoir documents is to evaluate existing conditions and assist Hargreaves in achieving landscape improvements for Silver Lake Reservoir Complex Master Plan.

1 DOCUMENTS REVIEWED

Geotechnical Information

We researched geotechnical information provided by the City and reviewed documents. Following is excerpts.

Silver Lake Dam was constructed between 1904 and 1907 as part of developing water supply system of the City of Los Angeles. The dam was built with local alluvial soil hydraulically pumped in place. Prior to 1920, Silver Lake reservoir was used to impound irrigation water and not used for domestic purposes. The reservoir was improved in 1920 for potable water distribution. The improvement involved steepening of side slopes and five-foot increase in the crest elevation of the dam.

Final Engineering Report of the 1950-1951 Improvements
This report provided description of improvements carried out to the existing reservoir. The improvements consist of trimming existing slopes of reservoir on 2:1 slope for asphaltic paving placed at a later date. Rolled fill was placed on portions of reservoir bottom lying below elevation 423. Resulted toe of slope elevation was 425+ and crest 458. New 60-inch bypass line and screen wall were constructed during this improvement.

Final Report of 1953-1954 Improvement
The report describes second and final phase of improvement started in February 1953 and completed on August 1954. The work included placing of compacted fill for the main dam blanket and slopes. Paving of reservoir slopes with asphaltic concrete were completed. 72-inch bypass line, associated structures and appurtenances were constructed.

Silver Lake Dam Soil Test Data 1972 Report No AX-211-11, dated November 1972
Department of Water and Power initiated a program of exploration, testing and dynamic analysis to determine resistance of Silver Lake dam to earthquakes. Core holes, soil testing, data from 1953 reconstruction program and slope stability study in 1966-1967 were included in the report. However, no conclusions were put forth in this soil report. Geotechnical firm was preparing a report on expectable performance of dam and its foundation material under shaking of assumed design earthquakes.

Seismic Stability Evaluation July 1973, Report No. AX-211-14
Slope stability analysis of the dam performed in 1967 concluded the dam was safe to resist static and earthquake forces. However, Division of Safety of Dams requested DWP to investigate and report dynamic stability of dams containing hydraulically placed fill using newly developed dynamic method. The evaluation resulted in considerable liquification within the dam. DWP decide to replace the dam. Until construction of a new dam, the reservoir was restricted to operate with maximum water surface elevation of 443 feet (15 feet below crest of the dam.) The report provided construction recommendations for a new dam.

Final Construction Report of the Silver Lake Reservoir Reconstruction 1975-1976, AX-211-20
The existing reservoir was drained and placed out of service on January 8, 1974 for design and reconstruction of the new dam. See Appendix A for the Dam and Reservoir Data. A new dam was constructed using modern compaction methods and built on a bedrock foundation. The dam construction was completed on July 15, 1976. Reconstruction of Silver Lake dam utilized existing dam material removed down to bedrock and compacted to 95% into new embankment. The material excavated was sandy-silt to bedrock elevation 338 ft.

Outlet tower structure base was founded on bedrock at elevation 408 feet. Approximately 79 feet long bridge connects outlet tower from top of the west reservoir slope near the edge of west reservoir road. The abutment approach structure at west reservoir slope is supported on 2-foot-diameter caissons by 8-foot deep set into bedrock.

Paving on the reservoir slopes is asphaltic concrete. The tower access road, south ramp road, dam crest road and downstream weir vault access road subgrades were rolled prior to the placement of crushed aggregate base material followed by asphaltic concrete pavement.

See Appendix B for as-constructed dam and Silver Lake Reservoir. See Appendix C for the footbridge abutment caissons.

Bypass and Regulating Station Report December 2013 AX -559-S
This geotechnical report was prepared for design and construction of the Bypass and Regulating Station located on the north-west side of the Silver Lake Reservoir.

Artificial fill along the western perimeter slope of the Silver Lake Reservoir, where the new Bypass was installed, was approximately 2 to 3 feet thick underlain by alluvium soil. Bedrock was locally exposed in the road cuts bordering the west side of West Silver Lake Drive.

Soil design parameters for the Regulating Station and Flow Meter Vault are provided in the report. An allowable bearing of 3000 psf for mat foundations and 4000 psf for footings were recommended in the report. Site specific Seismic Design Criteria were also included in the report.

2 CHALLENGES & CONSTRAINTS

The attached sketch Appendix D of August 1951 depicts the 1953-1954 improvement to the slopes of the Silver Lake Reservoir. A compacted soil blanket was added to the slopes and to 20 feet of level surface outside slopes.

- It is important that the existing dams and their operations are not modified in any way.
- Any modifications to the existing slopes of the lake will require oversight of California Division of Safety of Dams (DSOD).
- Modification of slopes in the vicinity of dam should be avoided.
- The lake will likely need to be emptied for modification of slopes.
- A geotechnical report will be necessary for the final design. All design drawings shall be reviewed by a geotechnical consultant prior to submittal to DSOD.
- Existing slopes are paved with 3-inches of asphaltic concrete. Any modification of the lake slopes will require removal of the existing asphaltic concrete.

3 OPPORTUNITIES

Possible Strategies at Locations with room for cut:

Strategy 1: Ease slope for Habitat Enhancement
Achieving easing slopes by removing soil along slope and leveled areas will not be a major concern. Existing compacted blanket may need to be extended for easing slopes and

access road. A walkway in the sloped portion can be achieved by constructing concrete caissons. Further geotechnical investigation will be required.

Strategy 2: Terrace for Habitat Enhancement and Access

Removing soil from sloped area and leveled ground, to create terrace, is achievable. Providing a compacted blanket below terrace and access may be necessary. Further geotechnical investigation will be required.

Possible Strategies at Locations which might need fill

Strategy 1: Ease slope for Habitat Enhancement

Easing slope by imported engineered fill is achievable. Further geotechnical investigation will be required to evaluate any effect of addition of soil fill and provide recommendations of keying new fill on to existing slope.

Strategy 2: Terrace for Habitat Enhancement and Access

Filling slope and creating vertical face at Lake requires more work. A very high retaining wall will need to be constructed to retain fill behind. H piles or concrete caissons reaching to bedrock will make a stable retaining wall. A concrete parapet or guard rail will be necessary for fall protection. Further geotechnical investigation will be required.

5 JURISDICTIONAL REQUIREMENTS

Division of Safety of Dams Oversight

Silver Lake reservoir and dam comes under jurisdiction of Division of Safety of Dams (DSOD). See Appendix E. California Dam Breach Inundation maps include Silver Lake dam under dams without inundation map. It is rated high hazard dam and their critical appurtenant structure.

Any dam enlargements, repairs, alterations and removals shall be reviewed and approved by DSOD. The DSOD also needs to review/approve any work done to the slopes/embankments, spillways and the surrounding area, and the reservoir itself for possible changes in the depth or bottom of the reservoir.

DSOD will ensure dam safety by performing the following oversights:

- Reviewing and approving dam enlargements, repairs, alterations and removals to ensure that the dam appurtenant structures are designed to meet minimum requirements.

- Performing independent analysis to understand dam and appurtenant structures performance. These analyses include structural, hydrologic and geotechnical evaluations.

- Overseeing construction to ensure work is being done in accordance with the approved plans and specifications.