

October 2, 2023

**EASTERN MUNICIPAL WATER DISTRICT
WATER STORAGE RESERVOIR AND RESERVOIR SITE
DESIGN AND SUBMITTAL GUIDELINES**



**EASTERN MUNICIPAL WATER DISTRICT
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UPDATE LOG		
Date	Item(s) Changed	Page #
10/02/23	Revised CDPH references to DDW throughout.	
	Added electronic submittal guidelines	4
	Updated siting analysis memorandum under Section II.D.10	3,4
	Added typical drawings under Section II.E.4	5
	Added Engineering Safety Pre-Use Analysis under Section II.J	6
	Expanded geotechnical requirements under Section III.A.3	8,9
	Expanded site selection criteria under Section III.C.	10,11
	Clarified reservoir overflow drain box design requirements under Section III.F.	11,12,13
	Revised altitude valve and seismic valve design requirements under Section III.F., III.K.2., and III.L.	17
	Added paragraphs d. and e. under Section III.F.	17,18,19,22
	Clarified the isolation valve requirements under Section III.F.	18
	Expanded sampling port requirements and instrumentation under Section III.I.5., III.I.8	20,21
Added tower requirements under Section III.L.	22	
Updated minimum security requirements under Section III.N.1	23	
12/14/21	Clarified design Risk Category.	8
03/01/10	Original	

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I. Introduction

These guidelines present the submittal process for plan review along with basic concepts and general design criteria for water storage reservoirs and water storage reservoir sites. The primary purpose of these guidelines is to promote uniformity of design concepts, design development, construction drawings, contract documents, types of equipment, and quality of work products delivered to Eastern Municipal Water District (EMWD or District) for development projects as well as capital improvement projects.

Each proposed water storage reservoir project shall be reviewed and approved by the District from concept through design, construction, and start-up. The District reserves the right to modify and supplement these guidelines and to require additional facilities, depending upon the specific project location, limitations, and changes in government regulations and standards.

The potable water system within the District service area shall be supplied by elevated storage tanks through a gravity system; the elevated storage shall be filled utilizing booster pumping stations or well pumping plants. Other methods of potable water distribution, such as hydropneumatic systems, will not be considered by the District unless elevated storage is infeasible as demonstrated through an engineering analysis. Only analyses prepared by civil engineers licensed in the State of California with experience in water system design will be considered for review.

II. Submittal Procedures

Procedures required for District approval of potable water storage reservoirs and reservoir sites are as follows (note: incomplete or unorganized submittals will be returned to the Developer/Consultant without review):

- A. The Developer and the Developer's Engineer (Engineer) shall acquire and review the latest revision of the Potable Water System Evaluation and Facilities Planning Criteria, as well as these guidelines.
- B. The Developer shall pay all District costs for the following:
 - Review and approval of the Plan of Service for the proposed development.

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- Plan checking of reservoir construction drawings and specifications, including all associated engineering submittals required herein.
- Inspection and construction management engineering costs associated with the construction of reservoirs.

Planning, plan checking, and inspection/construction management and engineering fees shall be determined by the District.

The Developer is advised to review these guidelines to understand the full scope of the submittal and review process for reservoirs. The Developer is also advised to consult with the District's Development Services Department to obtain an estimate of the planning, plan checking, and inspection/construction engineering and management deposits and fees for the proposed reservoirs. The Developer's actual fees for these services will be dependent upon the competence and diligence of the Developer's Engineer and Contractor.

The Developer will be required to deposit funds for Plan of Service review and approval prior to District Staff commencing any effort on the project. The Developer will be required to deposit funds for plan check services prior to District Staff, or District's representative, commencing review of any engineering or construction drawings submittals required herein. Prior to District approval of the reservoir construction drawings, Developer shall pay all remaining plan check fees. Likewise, the Developer will be required to deposit funds for inspection/construction management and engineering services prior to scheduling the preconstruction conference and initiating any construction activities. Prior to District acceptance of the completed reservoir, Developer shall pay all remaining inspection/construction management and engineering fees.

- C. The Engineer shall request a concept (pre-design) meeting with District staff to review requirements, guidelines, criteria, right-of-way, and location of specific project facilities. At this meeting, the Engineer shall submit all reference documentation such as tract maps, reference plans, and city approvals.
- D. Following the pre-design meeting and prior to commencing detailed design, the Engineer shall prepare and submit a Design Report for review by the District. The Design Report shall be prepared in accordance with District requirements; if the Design Report includes construction of new reservoir(s), the Design Report shall include the following:
 1. A statement indicating the proposed facilities are in conformance with the District's Master Plan, or if not, an explanation of the differences.

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2. Required usable volume of reservoir(s).
3. Reservoir Overflow Elevation/High Water Level (HWL).
4. Reservoir operational and seismic freeboard.
5. Reservoir High Operation Level Setting (HOLS).
5. Reservoir floor elevation.
6. Inlet/Outlet and Supply pipeline sizes.
7. Number, type, and elevation range of proposed service connections.
8. Service connection minimum and maximum static pressures.
9. Supporting calculations.
10. Siting analysis memorandum.

The purpose of the memorandum is to summarize the positive and negative attributes of each proposed tank site with recommendations for District review and approval. The analysis shall consider a minimum of two alternative sites. The following topics shall be analyzed and included in the memorandum:

- Proximity to critical facilities (hospitals, fire/police stations, schools, etc.)
- Proximity to natural drainage channels or existing or proposed storm drains
- Impacts of accidental tank overflow or failure and the proposed mitigation measures for potential community impacts.
- Visibility from existing and proposed homes including the proposed mitigation measures for potential visual community impacts.
- Length of required connecting pipeline.
- Site Access including a description of community impacts for the route to get to the access road or tank site.
- Geotechnical summary
- Master plan compliance and consideration of future facilities
- Safety considerations
- Defensible space requirements, as described in section III.C. –

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Site Selection

- All other considerations described in section III.C – Site Selection
- Statement confirming the proposed tank site will comply with all design requirements in section III of this guideline or provide a summary of deviations and justification.
- Initial environmental studies for CEQA/NEPA process (as appropriate) including biological, cultural/archaeological, etc.
- Space and access for potential future cell tower.

11. Impacts to existing facilities from proposed transmission facilities.
12. Coordination requirements to obtain Service from the Electric Utility Provider.
13. Environmental impacts and proposed mitigation.

In addition, a Preliminary Reservoir Site Plan shall be submitted that includes the following:

1. Proposed property to be deeded to the District.
2. Tank location including diameter and height.
3. Location of any future facilities.
4. Access road(s) and tank perimeter road.
5. Inlet and outlet manifold/structure location.
6. Site and tank drainage conveyance plan.
7. Supporting calculations.

Note: The Preliminary Reservoir Site Plan shall clearly demonstrate the intent and method to control/contain discharge of storm water runoff and tank discharge (drain and overflow) to eliminate or mitigate any downstream impacts to public or private property.

- E. Submit design calculations, drawings, and specifications for District approval as follows (also refer to the Design Guidelines in Section III):

All submittals required by these guidelines shall be provided to District electronically in conformance with the District's Electronic Submittal Requirements unless directed otherwise by the District.

1. Preliminary design (30% complete construction drawings) including (as a minimum) reservoir capacity calculations, system hydraulics, drainage hydrology and hydraulic calculations, foundation design calculations, geotechnical report, preliminary site layout, preliminary grading plan, preliminary piping plan, tank appurtenance plan, a list of selected equipment and materials, and all fee title/easement requirements necessary for the proposed facilities. Depending upon the site location, the 5District will determine whether the site will need special considerations and improvements such as masonry block perimeter walls in lieu of chain link fence, concrete paving in lieu of asphalt pavement, additional site lighting, additional access points, etc. District will provide specialty specifications to be utilized if necessary and available. The CEQA process should be completed at this phase to ensure site and detailed design can meet all CEQA requirements and/or mitigation.
2. Submit 60% complete construction drawings and specifications. Construction drawings shall incorporate District review comments from the 30% submittal. Submit legal descriptions and plats for all identified properties required including title reports and related title documents. In addition, submit plans for associated street improvements, water pipelines, storm drains, and access roads.
3. Submit 90% complete construction drawings and specifications, final engineering design calculations, and final Electric Utility Provider service plans. Construction drawings and specifications shall incorporate District review comments from the 60% submittal.
4. Submit final design calculations and 100% complete construction drawings and specifications. As a minimum, a typical construction drawing set should include the following drawings:
 - i. Title Sheet
 - ii. Legend and Abbreviations
 - iii. Construction Note Sheet
 - iv. Horizontal Control Plan
 - v. Grading and Drainage Plan
 - vi. Storm Drain Plan and Profiles
 - vii. Paving Plan
 - viii. Civil Details

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- ix. Offsite Access Road Plan and Profile
- x. Site Plan
- xi. Fuel Modification Zone Compliance Plan
- xii. Site Piping Plan and Profiles
- xiii. Offsite Pipeline Plan and Profiles (if applicable)
- xiv. Reservoir Sections and Appurtenance Plan
- xv. Reservoir Details
- xvi. Remote Inlet/Outlet Enclosure Plan
- xvii. Inlet/Outlet Piping and Valve Mechanical Plan
- xviii. Inlet/Outlet Sections and Details
- xix. Miscellaneous Site and Piping Details (multiple sheets)
- xx. Structural Notes
- xxi. Structural Sections and Details
- xxii. Foundation Plan and Details
- xxiii. Site Electrical Plan
- xxiv. Miscellaneous Electrical Details
- xxv. Electrical Utility Plan of Service
- xxvi. Cathodic Protection Site Plan
- xxvii. Cathodic Protection Sections and Details
- xxviii. Landscape Plans (if required)

The Title Sheet shall include a summary of project specific requirements and data, and references to all recorded easements and title changes. As a minimum, the construction plans shall show the following:

- a. Location of all proposed facilities (referenced to site property lines or easement boundary).
- b. Location of water pipelines. Provide bearings and distances along each pipeline segment shown on the Site Plan. Provide invert elevations. Pipelines shall be labeled with pipe size and material.
- c. Location of drainage facilities, including all inlet/discharge structures. Show bearing and lengths of all drainage piping. List piping sizes and materials as well as inlet/discharge structures materials and types.
- d. Location of remote inlet/outlet piping and enclosure, tank cleanout and sampling valves, stairs, guard posts, Electric Utility Provider service meter, and all other above grade facilities.
- e. Location of all site fencing and access gate(s). Provide bearing and distance or offset information.

- f. Finished grades for all proposed facilities and site improvements. As a minimum, grades (elevations) shall be provided for all concrete slabs, curb and gutter flow lines, cross gutter flow lines, and finish grading adjacent to site improvements.
 - g. Details for all site specific improvements
- F. Submit the Construction Drawings to appropriate District ERC staff to submit to the California State Water Board, Division of Drinking Water (DDW), after the District has approved the construction drawings.
- G. Submit Original Construction Drawings for Signature

After all plan checks are completed and the reservoir construction drawings and specifications are acceptable to the District, the original drawings shall be submitted to the District for electronic signature. Prior to the District approval of the reservoir construction drawings, final legal descriptions, plats, title reports, easements, and an Electric Utility Provider POS shall have been received, reviewed, and approved by the District for conformance with the approved plans, and Developer shall pay all remaining plan checking fees.

- H. Provide the District with Drawings

When the drawings have been fully approved by all agencies, the Developer shall provide the District with the final drawing files in AutoCAD/Microstation and pdf formats, and specifications files in Word and smart (searchable) pdf formats. All files shall be compatible with the District's latest software versions.

- I. Prepare and Present the Control Strategy

At the completion of the design phase and prior to facility commissioning during the construction phase, the Consultant shall prepare a presentation (PowerPoint) and review workshop to discuss the proposed operational strategy. At a minimum, the control strategy shall address the following key aspects:

- Purpose of Workshop and Presentation
- Facility and System overview.
- Project features and components.
- Anticipated operating conditions.
- Initial set point recommendations
- Other Items of Interest
- Programming and SCADA coordination during construction and start up.

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- Meeting and presentation at end of design and prior to start-up with District's Operations and Maintenance staff to review procedure and schedule.

Consultant shall summarize the results of the workshop into a technical manual (detailed PowerPoint) and submit electronically for District review. District comments on the Draft manual shall be incorporated into a Final manual for future reference. The Consultant shall submit an electronic copy (smart pdf) and original files of the Final manual to the District.

Upon approval and acceptance by the District, facilities will be owned by the District. Ownership will include the water storage reservoir site and right-of-way for access and pipelines. Water pipelines shall be constructed on District property, District right-of-way, or within public right-of-way whenever possible. Easements for water pipelines will only be considered under special circumstances. All right-of-way and easement documents shall be conveyed to the District and recorded prior to acceptance of facilities.

J. Engineering Safety Pre-Use Analysis

The safety pre-use analysis is a tool that is used to assist in identifying, analyzing, and mitigating hazards associated with capital, maintenance, and developer projects. The safety pre-use analysis consists of five (5) phases across various departments at the District. The five phases are as follows: (1) Preliminary Design, (2) Detailed Design (3) Pre-Bid, (4) Post Construction, and (5) Post 1-year Warranty. The Engineer shall complete the first two phases for preliminary and final design of the five phases of the complete safety analysis.

1. Preliminary Design: The initial pre-use analysis (Phase I) will be completed during the facilities planning or preliminary design phase to set safety expectations and design criteria. The first review will consider if applicable, among other things:
 - a. Alternative processes, chemicals, equipment, or technologies.
 - b. Provisions of safety controls, with appropriate redundancy.
 - c. Identify and consider potential confined spaces at this facility. A further analysis shall be conducted during the detailed design phase.
 - d. Provisions for site security and emergency access/egress roadways.

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2. Final Design: The next pre-use analysis will be completed as the most detailed phase in this process during the final design (90% submittal). Items considered in this phase of the process will include, if applicable:
 - a. A complete review of all items considered under Phase I.
 - b. Identification of specific hazards and mitigation measures implemented. This includes identifying specification sections used in the Contract Documents during the construction of the facility.
 - c. Detailed confined space evaluation. Refer to the latest version of the District's confined space procedure to complete this section.
 - d. Discuss the potential for hazardous atmosphere and ventilation system.
 - e. Discuss the facility controls and operation including safety equipment procedures and access to remote equipment.
 - f. New provisions for property protection, access for emergency personnel, and elaborate on site security discussed in Phase I.
 - g. Any other considerations that may come out of the team discussions.

III. Design Requirements

A. General

1. Reservoirs and reservoir sites shall be designed and constructed in accordance with the District guidelines contained herein and other District published standards (drawings and specifications). Where not specifically addressed or modified by the District guidelines and standards, the most current edition of the following codes and regulations shall be complied with: American Water Works Association (AWWA) D-100, Riverside County Health Services Department and California Department of Health Services, Standard Specifications for Public Works Construction, California Building Code, National Electric Code, Uniform Fire Code, International Building Code, American Petroleum Institute (API), and all other applicable government codes and regulations. Risk Category IV (CBC Table 1604.5 "essential facilities") shall be used for the design of buildings and other structures, including equipment and other structural and nonstructural components, and their supports and attachments.

2. Reservoir and reservoir site construction drawings shall be prepared by an engineer licensed in the State of California experienced in the design of similar facilities. Drawings shall be clear, concise, and meet all District standards contained herein.

Cathodic protection design and drawings shall be prepared by a California Licensed Engineer specializing in corrosion services

Drawings shall be drawn on D size sheets (24" x 36") with an Eastern Municipal Water District approved title block.

The Drawings shall be of professional quality specifically prepared as Reservoir Construction Drawings. Work shall be of standard engineering practice and shall be legible and present the proposed construction without confusion.

3. A Geotechnical Investigation shall be performed for the selected site and a geotechnical report prepared by a geotechnical engineer licensed in the State of California. As a minimum, the report shall contain recommendations for site preparation, site grading, allowable soil bearing loads, lateral soil loads, seismic design parameters, soil corrosion potential, trench backfill and shoring, and asphalt concrete pavement design. Seismic design parameters shall conform to Risk Category IV for "essential facilities" in accordance with paragraph 1 of this section. Geotechnical engineer of record shall review the draft preliminary design report and final plans and specifications (90%) and shall provide written concurrence certifying that the design is in accordance with geotechnical requirements and recommendations.
4. District's Detailed Provisions shall be utilized wherever applicable. District's Detailed Provisions do not cover all equipment and material required for reservoir construction. Engineer shall provide Detailed Provisions for all equipment and material not addressed by District's Detailed Provisions. As a minimum, the project construction specifications shall include the District's General Requirements, Welded Steel Tanks for Water Storage Specifications, Interior Coating, Disinfection, and Exterior Painting of a new Welded Steel Water Tank Specifications, and Standard Drawings.
5. When reservoir sites contain both potable and non-potable reservoirs, all facilities shall be designed to maintain separation requirements as set forth by DDW.

B. Reservoir Capacity

1. At a minimum, the required storage reservoir's usable volume shall be the sum of the storage required to supply 24 hours of flow at the maximum day flow rate, plus the storage required to supply the maximum zone fire flowrate and duration as stipulated by the local fire department or as required by the EMWD Water System Planning and Design Guidelines (whichever is greater).
2. The maximum day flow rate shall be based on the total demands at build-out for the intended service area of the reservoir. Any plan for multiple reservoirs shall be submitted to the District for approval.
3. The reservoir capacity shall conform to the Water Facilities Master Plan.

C. Site Selection

It is anticipated that the Developer and the District will work closely together to identify and select the optimum site for the new reservoir. Factors specific to each site must be identified in the siting analysis with proposed mitigation approved prior to commencing site design. Site selection shall conform to the District's latest Capital Improvement Program and/or Master Plans.

A number of factors shall be considered when selecting the reservoir site, including, but not limited to, providing the required high water level to match the District's corresponding pressure zone, minimizing the visual impact of the new reservoir (through use of earthen berms, landscaping, retaining walls, etc.), access from public roads, and proximity to existing drainage facilities that can accommodate site and tank discharge flows due to storm runoff and accidental tank overflow.

The reservoir site shall be located away from critical and sensitive facilities such as schools, hospitals, fire stations, police stations, etc. whenever possible; where not possible, a plan shall be submitted to the District outlining mitigation measures to be implemented to prevent damage or impact to these facilities in the event of a tank failure (tank failure being defined as a complete shearing of the inlet/outlet pipe and the instantaneous flows generated thereby). Mitigation may consist of constructing a containment berm around the site, constructing a retention basin between the site and the critical facility, or other developer proposed protection systems.

The reservoir site shall be located such that existing or proposed offsite drainage facilities are available whenever possible; however, should offsite drainage facilities not be available or construction of same be impracticable, a plan shall

be submitted to the District outlining the methods to control site drainage (tank overflow and/or 100 year storm runoff) and prevent or minimize impacts to downstream facilities. Drainage design shall meet all Regional Water Quality Control Board (RWQCB) requirements, and shall conform to the Riverside County Design Handbook for Low Impact Development Best Management Practices to the extent practicable.

Whenever possible, a reservoir site shall be selected that is tucked into a ravine and/or against a hillside, and not located against the skyline from any view point. The site shall have the necessary appurtenances and sufficient defensible space (100-ft minimum buffer zone) such that the facilities are protected and resilient. If a 100-ft buffer zone is not achievable, a site-specific defensible space plan evaluation shall be prepared and Engineer of Record acknowledgement provided.

Site selection shall consider needs for future booster pumping stations, pipelines, and/or additional tanks; and adequate property for future facilities shall be provided as required by the District. Site selection shall consider a two-tank site layout for operational flexibility. Future facilities for a single-tank site and/or single-tank pressure zone that may be required by the District include, but are not limited to temporary hydropneumatic booster pumping stations, temporary tanks, and related temporary controls. Temporary controls, including connection points and related appurtenances, may be required at the respective booster station (if part of proposed development) associated with the proposed tank.

The recommendation for the final selected site shall be accompanied by letter from the project Geotechnical Engineer stating that the site is suitable for construction of a reservoir of the diameter and height proposed.

D. Site Design

The following design criteria shall be utilized in preparing construction drawings for the proposed reservoir site.

1. General

The site shall be designed to accommodate one or more reservoirs as well as other facilities as directed by the District. In addition, the site shall be designed to accommodate the access road around the reservoir, earthen berms, and site landscaping.

The reservoir shall be concealed from public view to the maximum extent practicable through the use of landscaping, an earthen berm, and/or other District approved methods.

The reservoir site shall be designed to convey storm flows away from the reservoir and along concrete curb and gutter **to onsite catch basins or existing offsite drainage facilities**. Site piping shall be utilized to convey storm flows, tank drainage, and overflows from onsite catch basins to offsite storm drains or natural drainage courses. Energy dissipaters shall be constructed at the pipe termination points for flow conveyed to natural drainage courses or earthen retention basins. Hydrology and hydraulic calculations shall be submitted by the design engineer demonstrating the adequacy of the onsite facilities, the conveyance pipelines, and the existing or proposed offsite facilities.

2. Access Road to the Reservoir Site

Reservoir site shall be designed with a minimum 40-foot long paved approach with a turnaround area (hammerhead). Access road shall meet all requirements of Riverside County TLMA, the geotechnical report, and this guideline. The access road to the site shall adhere to the following design criteria:

- a. Minimum Width: 20 feet (curb face to curb face)
- b. Maximum Slope: 15%
- c. Minimum Cross Slope: 2%
- d. Maximum Cross Slope: 5%
- e. Minimum Radius: 100 feet (to centerline of road)
- f. The access road shall be paved with a minimum of 4 inches of asphalt concrete pavement (AC) over 6 inches of Class II base, or as recommended in the geotechnical report. A 6-inch high concrete curb with an 18-inch wide gutter (per Riverside County standard drawing) shall be constructed along side(s) of the access road which receives storm water runoff. An AC berm may be used elsewhere along the access road. AC pavement shall be furnished and installed in two lifts in accordance with District Standards and Detailed Provisions contained in the Construction Specifications.

If the adjacent ground surface slopes downward from the reservoir access road, the top of the slope shall be a minimum of 2 feet from the back of the curb. If the adjacent ground surface slopes upward from the reservoir access road, the toe of the slope shall be a minimum of 3 feet from the back of the curb and a concrete swale shall be constructed between the curb and the toe of the slope to prevent runoff from undermining the curb. The shoulder shall be sloped a minimum of 2% and a maximum of 10% away from the curb.

At approximately 200-foot intervals, openings shall be provided in the concrete curb to convey storm flows off of the access road. Concrete swales shall be constructed down the fill slopes to protect the slopes from erosion damage. Concrete swales shall terminate into flow energy dissipaters for flows conveyed to natural drainage courses or earthen retention basins.

At natural drainage course crossings, culverts with headwalls shall be constructed to convey storm flows under the access road.

3. Access Road around the Reservoir

The access road around the reservoir shall adhere to the following design criteria:

- a. Minimum Width: 18 feet clear from face of ringwall to face of curb, appurtenances, and encroachments
- b. Minimum Cross Slope: 1%
- c. Maximum Cross Slope: 8%
- d. The access road shall have a shoulder that extends a minimum of 2 feet from the back of curb to the top of the nearest down slope, and 3 feet to the toe of the nearest up slope. The shoulder shall be sloped 2% away from the roadway. If directed by the District or if excessive drainage is anticipated, a concrete drainage swale shall be provided between the curb and toe of slope.
- e. The access road shall be paved with a minimum of 4 inches of asphalt concrete pavement over 6 inches of Class II base, or as recommended in the geotechnical report, except under the manifold piping and valves, which shall be reinforced concrete. A 6-inch high concrete curb with an 18-inch concrete gutter (per

Riverside County standard drawing) shall be constructed along access road where storm water runoff is carried. An AC berm may be used elsewhere along the access road. AC pavement shall be furnished and installed in two lifts in accordance with District Standards and Detailed Provisions.

- f. The reinforced concrete ringwall for the reservoir shall project a minimum of 6 inches and a maximum of 15 inches above the asphalt concrete pavement.

4. Site Grading

- a. All site grading and surface preparation shall be performed in accordance with the geotechnical report.
- b. Maximum site slopes shall be 2:1; steeper slopes will be considered by the District only where special circumstances apply, and only if specifically addressed in the geotechnical report.
- c. Concrete drainage swales shall be provided at tops or toes of slopes to collect and convey storm flows and site runoff to natural drainage courses or storm drain facilities. Said swales shall have a minimum width of 3 feet, a minimum slope of 1%, a minimum thickness of 6 inches, and shall be reinforced with #4 bars at 24 inches on center each way, or welded wire fabric 4x4 W4.0/W4.0.
- d. Slopes with a vertical elevation change greater than 30 feet shall have 6-foot wide benches with 3-foot wide concrete drainage swales located at maximum 30-foot vertical intervals, or at mid-height where slopes are less than 60 feet high.

5. Site Fencing

- a. Reservoir site shall be completely enclosed and secured with a perimeter fence. Site fencing shall be 8-foot high chain link with three strands of barbed wire and spiral concertina wire in accordance with EMWD Standard Drawing D-672, except where special fencing (e.g., CMU, steel) is required to blend with surrounding development, in which case fencing or walls shall be as directed by the District.
- b. Site fencing shall be located 6 to 12 inches inside the site property lines or, if directed by the District, fencing shall be located behind access road curb, and shall extend around the tank and up the

access road to the top of berm at the site entrance. Where the fence is located near a toe of slope, fence shall be a minimum of 2 feet from said toe. If fence is not located along the property line, 2-foot high permanent markers shall be placed at property corners and along property lines at maximum 200-foot intervals. Marker type shall be approved by District prior to installation.

- c. Fence shall contain one 16-foot clear double swing gate located across the access road in accordance with EMWD Standard Drawing D-672, and one 4-foot clear man-gate. In addition, a second gate shall be installed at the beginning of the access road. Final location of access gates shall be determined by the District.

6. Landscaping

Sites shall be landscaped only when directed by EMWD or other jurisdictional agencies. When required, construction drawings shall be prepared by a Landscape Architect licensed by the State of California, and shall include planting and irrigation plans. Landscaping shall consist primarily of native trees encircling the new reservoir. Landscaping design shall be coordinated with the conservation department to ensure the use of native and drought tolerant vegetation, drip irrigation, etc. All cut and fill slopes shall be rolled with oat straw as directed by the District, except for solid rock slopes.

E. Site Piping

1. Site piping shall be designed and configured for normal operating conditions, emergency operating conditions, and future operating conditions. Piping to the site shall include an inlet/outlet pipeline connected to the zone being served by the reservoir, and a high pressure pipeline if there is a planned future booster plant at the site.
2. Reservoir site piping shall be sized the same as the transmission pipeline or 18-inch diameter, whichever is larger. (See Section F for additional discussion regarding inlet/outlet piping size.)
3. Reservoir overflow shall be designed to convey water at a rate equal to or greater than the maximum reservoir fill rate. Overflow line shall be minimum 18-inch diameter.
4. Reservoir drain line shall be minimum 8-inch diameter for reservoirs less than 5 million gallon (MG) capacity, and minimum 12-inch diameter for reservoirs 5 MG capacity and greater.

5. Reservoir drain and overflow piping shall discharge into an onsite concrete drain box. The top of the concrete drain box shall be flush with the surrounding grades to ensure no tripping hazards. Drain box grating shall be traffic rated for H-20 loading with sufficient open area to convey the maximum reservoir overflow flowrate.
6. All site transmission piping shall be cement mortar lined and coated welded steel with a minimum steel cylinder wall thickness of 0.25”.
7. All site storm drain piping shall be reinforced concrete pipe or corrugated high density polyethylene

F. Remote Inlet/Outlet (I/O) Piping Configuration and Enclosure

The onsite piping shall be a single transmission pipeline until it reaches the reservoir, where it shall then be split into separate inlet and outlet piping; the split shall be located inside a remote block enclosure as shown on the District's Standard Drawing. The inlet piping shall be constructed around the reservoir and be connected to a reservoir nozzle located approximately 180° opposite the outlet nozzle. Swing check valves shall be utilized to force the inlet flow around the tank. Inlet/Outlet piping/enclosure shall be located with respect to the reservoir to provide the minimum head necessary to unseat the disc at low level conditions. All materials shall be as noted herein and shall be selected from the District's current Approved Material Lists. The components shall generally include the following, however, the final configuration and components will be specifically determined for each reservoir site based on system operational needs and considerations:

1. Altitude Valve - Altitude valve shall be a globe valve with pilot system and manual shutoff located just prior to the split into separate inlet and outlet pipes. The pilot system shall include a return flow check valve. The altitude valve shall be equipped with limit switches that indicate valve open and closed position. The copper sensing line shall maintain a positive grade from the valve sensor port to a port on the tank. Altitude valve shall be sized to accommodate inlet and/or outlet flows, and may be smaller than the site piping. Calculations shall be provided indicating appropriate valve size. Altitude valve shall be by the manufacturer(s) listed in the District's Approved Materials List (Cla-Val Model 210-01 or equivalent).
2. Flexible expansion fittings shall be the force balanced type and installed on the inlet and outlet piping to allow for independent movement of the piping and reservoir during seismic events. Flexible expansion fittings

shall be by the manufacturer(s) listed in the District's Approved Materials List

3. The isolation valve located at the tank outlet nozzle shall be equipped with a seismic control system, which shall generally consist of the following, as described more particularly in EMWD Standard Detailed Provisions Section 15103.1:
 - a. The isolation valve shall be equipped with a pneumatic actuator by the manufacturer(s) listed in the District's Approved Materials List, unless otherwise stated by the District. The pneumatic actuator shall be operated via a compressed air system and shall include limit switches for remote position indication.
 - b. The compressed air system shall consist of District supplied compressed air bottles stainless steel tubing and related appurtenances. An enclosure shall be provided on an equipment pad near the tank outlet isolation valve to house the bottles
 - c. The compressed air supply to the pneumatic actuator shall be isolated via a seismically-actuated three-way valve by the manufacturer(s) listed in the District's Approved Materials List, unless otherwise specified by the District.

Refer to the Districts standard drawings for specific piping and enclosure requirements. Notwithstanding said drawings:

- d. The Engineer shall design any steps and/or platforms necessary to accommodate any difference in grade, for example, between the finished floor elevation of the remote inlet/outlet structure and the surrounding finished grades of the site in conformance with Cal/OSHA requirements.
- e. Brass couplings shall be utilized between dissimilar metals for the purposes of connecting instruments and appurtenances. No dielectric couplings shall be utilized.

G. Welded Steel Reservoir Requirements

Design and construction of the welded steel reservoir shall be performed in accordance with the Welded Steel Tanks for Water Storage Specifications (District Standard Detailed Provision Section 13311) with the following clarifications and/or modifications:

1. Diameter to height ratio shall not be less than 2 to 1.

2. Freeboard above the overflow level to the bottom of the rafters shall be as designed by the reservoir designer per the sloshing height calculation, as determined by calculating the impulsive and convective forces during a seismic event for the maximum acceleration at the site per the geotechnical report.
3. Nominal reservoir height shall be 32 feet or 40 feet from top of ringwall to bottom of knuckle.
4. Coating and painting of the welded steel reservoir shall be performed in accordance with the Interior Coating, Disinfection, and Exterior Painting of a New Welded Steel Water Tank Specifications (District Standard Detailed Provision Sections 09873 and 09873.1), with consideration of SCAQMD.
5. When practical, reservoir shall be designed to operate hydraulically compatible with existing reservoirs within the zone to promote turnover.

H. Reservoir Foundation

1. Reservoir foundation shall be Type I as defined in Section 12.6 of AWWA D100-05 (tank supported on ringwall footing). Preliminary ringwall dimensions and reinforcing shall be shown on the construction drawings. Design calculations shall be performed by the design engineer and submitted along with the geotechnical design parameters for review by the District during the design review phase. Final design shall be performed by the tank manufacturer and submitted during the construction submittal phase.
2. Anchors shall be installed on all steel reservoirs securing the tank to the ringwall when required by calculations. Tank shall be analyzed for the full and empty conditions. When anchorage is required, as a minimum, bolts with anchor chairs shall be installed at 8-foot maximum intervals, with special spacing at access manways and inlet/outlet piping structure and appurtenances. Chairs or rings shall be designed to transfer the full ultimate strength of the bolt, or 150 percent of the calculated load, whichever is less, to the tank shell.

I. Reservoir Appurtenances

Reservoir appurtenances and attachments shall be in accordance with the Welded Steel Tanks for Water Storage Specifications with the following clarifications and/or modifications:

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1. Flush-Cleanout. 48-inch x 48-inch, 180 degrees opposite shell manhole per District Standard Drawing B-599 and API. For reservoirs with a diameter greater than 100 feet, two flush-cleanouts shall be installed.
2. Overflow. The overflow weir and external piping shall be designed to accommodate the maximum inflow rate possible from the District's pumping system. The overflow pipe shall have an air gap above the ground surface complying with the California Department of Public Health requirements.
3. Stairway to Roof. Circumferential stairway to roof shall include a landing platform immediately in front of the stairway access gate (approximately 10 feet above the ringwall).
4. Roof Vents. In addition to the center vent, a minimum of four perimeter vents shall be included at 90 degrees apart located 5 feet from the connection to the knuckle plate. Perimeter roof vents shall be minimum 24-inch diameter.
5. Instrumentation and Sampling Ports. Reservoir shall include connections for sampling, instrumentation, and telemetry. District will furnish and install telemetry components. Connections shall include four 1-inch couplings at various elevations on the shell with locking gate valves, and two flanged roof openings for installation of level measuring equipment. Sampling ports shall comply with DDW guidelines and shall generally consist of PVC pipes extending 2 feet into the reservoir and non-threaded chrome plated brass spigots on the reservoir exterior. Security enclosures for sampling ports shall be provided in accordance with the District's standard detail; shall be sized to fit sampling bottles; and shall include a hinged lockable door (barrel type enclosure not acceptable).
6. Appurtenance orientation shall be selected by the District.
7. Recycled Water Reservoirs appurtenances only
 - i. Provide a tangential outlet to drain 100% of the reservoir into an adjacent sump. Provide a discharge line cam-lock connection to the outlet pipeline.
 - ii. Detention basins shall be designed in accordance with DDW rules and regulations.
8. Reservoir shall not include any inside-tank ladders.

J. Reservoir Mixing

As described in Section III.F. above, reservoir shall have separate inlet and outlet nozzles and related piping in accordance with California Department of Public Health Title 22 requirements. In certain zones (low tank turnover), reservoir design shall include a District approved internal mixing system. Engineer shall investigate the need for the mixing device which would be dependent on the system's operations control strategy. In some cases, an onsite disinfection system (ammonia and sodium hypochlorite) may be required. The mixing system shall utilize a low power consumption alternative and shall promote water movement horizontally and vertically within the tank. Where a mixing system is not installed with initial construction, roof ports shall be installed to accommodate a future mixing system.

K. Electrical and Controls

1. Construction Drawings shall include electrical plans indicating conductors, conduit, and meter requirements. An Electric Utility Provider 100A (minimum) 120V electrical power service shall be provided at all sites. The Electric Utility Provider shall have independent access for the utility. Three phase power service shall be provided when directed by the District. Construction documents shall require contractor to coordinate with Electric Utility Provider and provide all electrical power services. Site shall include a separately enclosed area for Electric Utility Provider service equipment with a separate access gate. Electrical design shall include spare conduits, junction boxes and pull boxes as necessary to support future electrical, telemetry, and security needs for the site.
2. Controls shall include the following control and monitoring appurtenances:
 - a. Pressure transducers and transmitter for level monitoring
 - b. Limit switches for altitude valve
 - c. Limit switches for tank outlet (seismic) isolation valve
 - d. Limit switches for gates and tank access ladder or stairway

L. Telemetry Equipment

District will furnish and install telemetry equipment system, including remote telemetry unit (RTU) to transmit alarm and status conditions to existing SCADA system. Contractor shall furnish and install the enclosure for the District's RTU.

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Plans shall include requirements for Contractor to terminate all alarm and status signals on a terminal strip in a Telemetry Termination Panel (TTP) adjacent to the RTU, including conduits for same. District will install connection between Contractor installed TTP terminal strips and RTU. The design shall include provisions for the following signals being sent to the District's RTU:

1. Tank level via pressure transmitter
2. Outlet (seismic) valve closed status
3. Outlet (seismic) valve open status
4. Altitude valve closed status¹
5. Altitude valve open status¹
6. Backup battery low charge status
7. Site access gate status
8. Tank access ladder or stairway gate status/intrusion alarms
9. Valve enclosure gate status

¹The District may, in the future, depending on operational needs, opt to equip the altitude valve pilotry with solenoid valves and associated controls to allow local/remote operation of the altitude valve. However provisions are not required in the design.

Contractor shall furnish and install any antenna towers required to support the telemetry equipment system. Antenna towers shall be by the manufacturer(s) listed in the District's Approved Materials List, and shall be equipped with 8-ft-0-inch tall anti-climbing panels. Antenna tower design shall include a line-of-sight survey by the District. Tank-mounted antennae are not acceptable.

M. Cathodic Protection

Tank shall include a direct connect galvanic cathodic protection system. A design shall be prepared by the design engineer and submitted to the District for approval during the review phase, with the specific design being prepared by an approved Corrosion engineer and submitted by the tank manufacturer during construction. Generally, the system shall consist of sacrificial anodes hanging from the tank roof accessed by roof handholes. The control box shall be located at the bottom of the tank for easy access. The anodes shall be disconnected from the system until after the coating anniversary inspection; upon approval of

any coating repairs at the anniversary inspection, in the presence of the District's Water Operations Corrosion Control Technician, the contractor shall connect the anodes, test the system, and engage the cathodic protection system. Engineer shall include in the specifications that anniversary inspection costs and engaging of cathodic protection system shall be paid for by contractor and handled via a deposit.

N. Security

As a minimum, the site shall be designed with the following security facilities:

1. Barbed wire or concertina wire on the top of chain link fencing and/or concrete under chain link fencing. These options shall be reviewed and approved by District staff on a case-by-case basis. Refer to Part III.D.5 "Site Fencing" for additional information.
2. Intrusion alarms to District RTU on all gates and tank access hatches. As a minimum, design shall specify that contractor shall furnish all conductors, conduit, and junction boxes for District security consultant to install security system. When required by District, complete systems shall be specified and installed.
3. Manual padlocks or smart keys at District's direction.
4. Motion sensitive security lighting at gates and I/O structures.
5. Photo sensitive security lights at entrance gate.
6. Video surveillance cameras at entrance gate, I/O structures, and tank stairs. As a minimum, conduit and junction boxes for future video system shall be specified. However, complete systems shall be specified at the District's request.