



FACILITIES CONDITION ASSESSMENT

15. Facilities Condition Assessment

15.1 Introduction

The District is taking a proactive approach in managing its water, non-domestic water, and sewer infrastructure needs by assessing the condition of critical facilities and identifying and documenting rehabilitation and replacement activities required to increase reliability of the operation. The objective of a condition assessment can be summarized as follows:

- Inventory the assets that can serve as a data source for the District-wide Computerized Maintenance Management System (CMMS),
- Determine the asset rate of deterioration based on condition scores, and
- Increase the level of confidence in projecting rehabilitation and replacement requirements.

Determination of the current state of the assets requires knowledge of the assets owned and managed by the District. The District owns/operates 43 major facilities including sewage lift stations, water pump stations, water and wastewater treatment plants, wells, reservoirs, etc. The first step, prior to condition assessment of the facilities, consisted of populating the asset register through desktop or field inventory. After inventorying the assets for all the facilities, for some facilities field condition assessment is performed which consists of visual inspection of assets on site. For the rest of the facilities desktop condition assessment is performed which is mainly based on the as-built record drawings. The desktop and field condition assessment process and methodology is presented in the following sections.

Table 15-1 lists the facilities assessed through desktop or field condition assessment. For three facilities: El Toro Lift Station (LS)³, Canyon Creek Pump Station (PS)⁴, and Dove Canyon-Robinson Ranch Recycled Water PS⁵, the results of previously performed assessments were used to assign condition scores to some of the assets without performing a field condition assessment. The condition assessment discussed here is performed by Hazen condition assessment team and includes investigating the physical and functional condition of all civil, structural, mechanical, HVAC, electrical and instrumentation components of the facilities.

³ 2020 El Toro Lift Station Technical Memorandum-Hazen and Sawyer

⁴ 2019 Canyon Creek Pump Station Evaluation-JIG Consultants

⁵ 2019 Dove Canyon and Robinson Ranch Recycled Water Pump Station Rehabilitation-JIG Consultants



Table 15-1: List of the Assessed District Facilities

#	System	Facility Type	Name	Condition Assessment
1	Sewer	Lift Station	Barneburg	Field
2	Sewer	Lift Station	Bell Canyon	Desktop
3	Domestic Water	Pump Station	Canyon Creek	Previous Assessment
4	Domestic Water	Reservoir	Cooks	Desktop
5	Sewer	Recycled Water Treatment Plant	Crystal Canyon	Desktop
6	Domestic Water	Water Treatment Plant	Dimension WTP	Field
7	Domestic Water	Reservoir	Dove Canyon	Desktop
8	Non-Domestic Water	Pump Station	Dove Canyon-Robinson Ranch Recycled Water	Previous Assessment
9	Non-Domestic Water	Creek	Dove Creek	Desktop
10	Non-Domestic Water	Pump Station	Dove Creek	Desktop
11	Non-Domestic Water	Reservoir	Dove Lake	Desktop
12	Non-Domestic Water	Dam	Dove Lake	Desktop
13	Non-Domestic Water	Pump Station	Dove Lake	Desktop
14	Domestic Water	Pump Station	El Toro	Desktop
15	Sewer	Lift Station	El Toro	Previous Assessment
16	Domestic Water	Pump Station	Falcon	Desktop
17	Sewer	Lift Station	Golf Club	Field
18	Domestic Water	Reservoir	Harris Grade	Desktop
19	Sewer	Lift Station	Heritage	Field
20	Domestic Water	Well	Lang Well	Desktop, Limited Field Visit on 1/27/2022
21	Domestic Water	Pump Station	Larchmont	Desktop
22	Sewer	Lift Station	O'Neill Regional Park	Desktop
23	Sewer	Lift Station	Plano Trabuco	Field
24	Domestic Water	Pump Station	Plano Trabuco	Field
25	Domestic Water	Pump Station	Ridgeline	Desktop
26	Domestic Water	Pump Station	Robinson Ranch	Desktop
27	Non-Domestic Water	Dam	Robinson Ranch	Field
28	Non-Domestic Water	Reservoir	Robinson Ranch	Field
29	Sewer	Wastewater Treatment Plant	Robinson Ranch WWTP	Field
30	Domestic Water	Pump Station	Rose Canyon	Desktop
31	Domestic Water	Reservoir	Rose Canyon	Desktop
32	Domestic Water	Well	Rose Well	Desktop, Desktop, Limited Field Visit on 1/27/2022
33	Domestic Water	Pump Station	Saddle Crest	Desktop
34	Domestic Water	Reservoir	Saddle Crest	Desktop
35	Sewer	Lift Station	Santiago	Desktop



#	System	Facility Type	Name	Condition Assessment
36	Non-Domestic Water	Detention Basin	Shadow Rock	Desktop
37	Non-Domestic Water	Pump Station	Shadow Rock	Desktop
38	Non-Domestic Water	Pump Station	Tick Creek	Desktop
39	Non-Domestic Water	Creek	Tick Creek	Desktop
40	Domestic Water	Pump Station	Topanga Canyon Rd	Desktop
41	Domestic Water	Water Treatment Plant	Trabuco Creek GWTP	Desktop
42	Domestic Water	Reservoir	Trabuco	Desktop
43	Sewer	Lift Station	Via Allegre	Field

15.2 Asset Inventory

The first step of the condition assessment was inventorying and identifying all assets associated with the facilities and placing the asset data into a consolidated database referred to as an asset register.

15.2.1 Asset Register Framework

An asset register is a systematic recording of all assets that the District owns or is responsible for their operation and maintenance. An asset hierarchy provides a structured framework for organizing assets in the asset register. A hierarchy enables the District staff to easily locate an asset and obtain data (e.g., valuation, risk, remaining useful life) required to support asset management decisions.

An asset register forms links between all asset-related applications or information systems and enables the assessment of the assets as individual components, composite assets, or groups of assets. Along with establishing the asset register hierarchy, developing an asset register includes the following components:

1. **Asset Definition:** Developing a definition for an asset that can be used across various facilities within the District.
2. **Asset Class:** An asset class can be defined as a group of assets with similar type, function, useful life, and pricing attributes (e.g., size, material, power).
3. **Data Standards:** Data standards identify data attributes required to support asset management decisions. There are common attributes (e.g., year of install, replacement cost, asset naming/numbering) and specific attributes (e.g., type, power, size, length, and material) for each asset class.

The asset register for the District was set up using the hierarchy as shown in

Figure 15-1 and Figure 15-2. There are five levels of hierarchy captured for the District in the asset register. The hierarchy divides into system, sub-system, facility type, and location which is further broken down into sub-location for some facilities. The developed asset register (provided in Appendix C) with the embedded hierarchy can be easily imported to the District's CMMS software. The Joplin reservoirs are owned by the

County of Orange (County) and as a result they are not included in the hierarchy. However, the District does own telemetry equipment at the site and has an agreement with the County to access the site when needed.

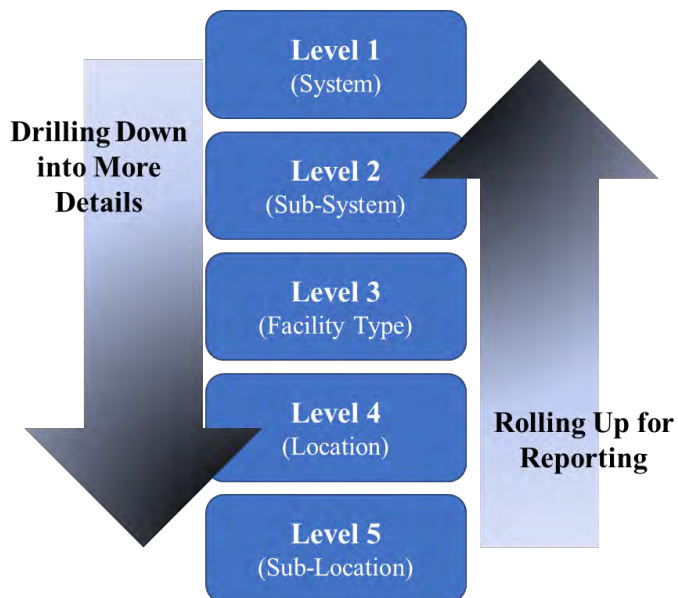


Figure 15-1: Five Levels of Hierarchy for Drilling Down and Rolling Up

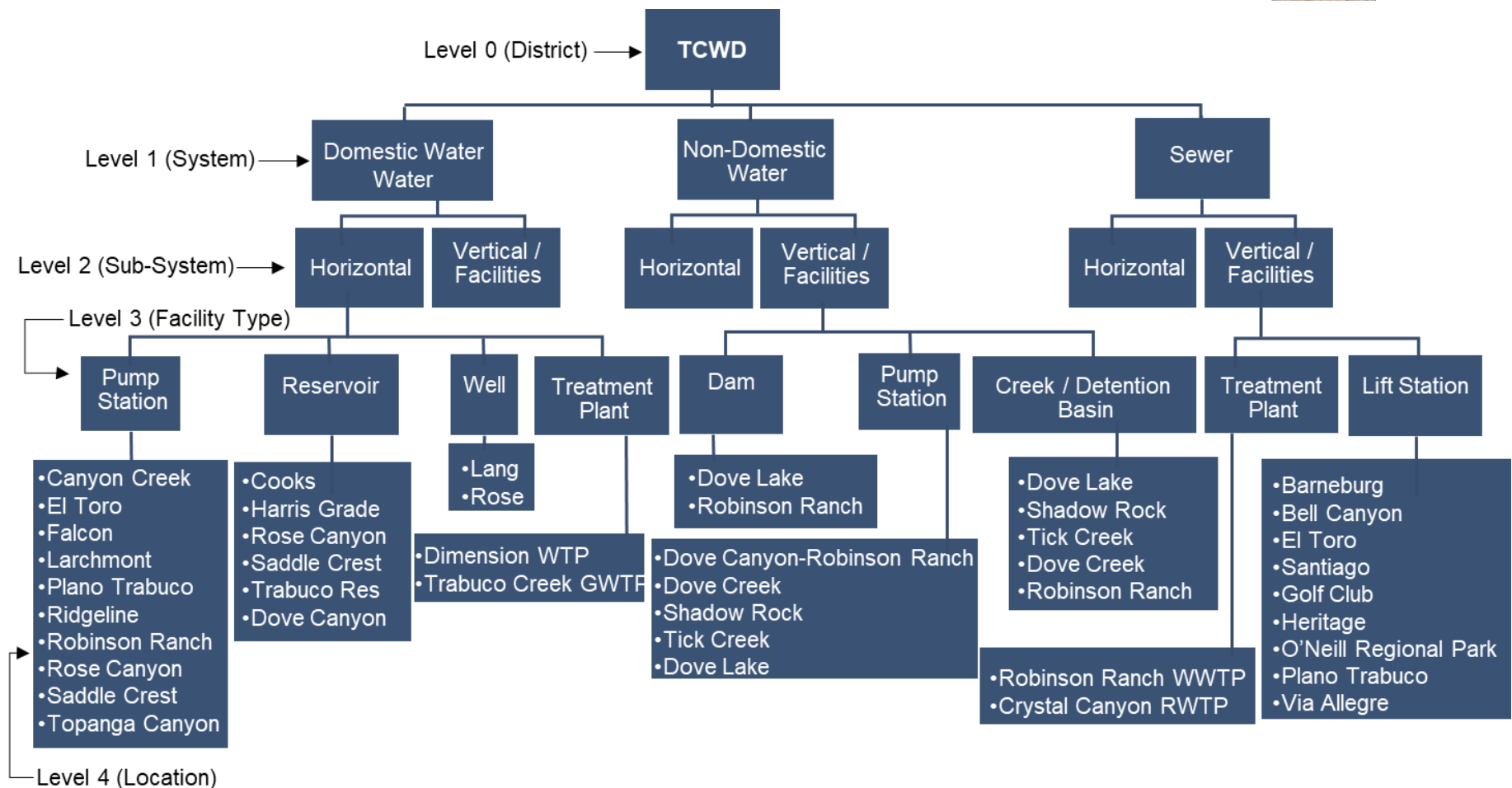


Figure 15-2: The District Assets Hierarchy



15.2.2 Desktop and Field Inventory Approach and Results

The facilities asset list includes assets within a building and/or the facility fence. Using obtained data from District’s existing sources such as existing asset list, available reports and record drawings, electronic O&M manuals, maintenance records, and staff institutional knowledge, a preliminary asset inventory of the District was developed.

The initial list of assets provided by the District included about 700 assets. As presented in Table 15-2, through the inventory of the 43 facilities, an asset inventory was developed with 1587 assets. This includes 833 assets for the 33 facilities that went through a desktop inventory and 754 assets for 10 facilities that went through a field verification.

Table 15-2: Summary of the Added Assets to the Existing Asset List

Inventory Method	Data Sources	Percentage of Total Asset Count	Count of Assets
Desktop	District existing asset list	58%	491
	Reports, Record Drawings, Electronic O&M Manuals, Staff	76%	647
	Removed/added	-38%	-305
	Total	100%	833
Field	District existing asset list	29%	220
	Reports, Record Drawings, Electronic O&M Manuals, Staff	48%	363
	Removed/added during field validation	23%	171
	Total	100%	754
Desktop & Field	Total		1587

Figure 15-3 presents the inventoried assets by facility through field and desktop inventory. It shows the highest number of listed assets are related to the Robinson Ranch Wastewater Treatment Plant (WWTP) and after that to the Dimension Water Treatment Plant (WTP).

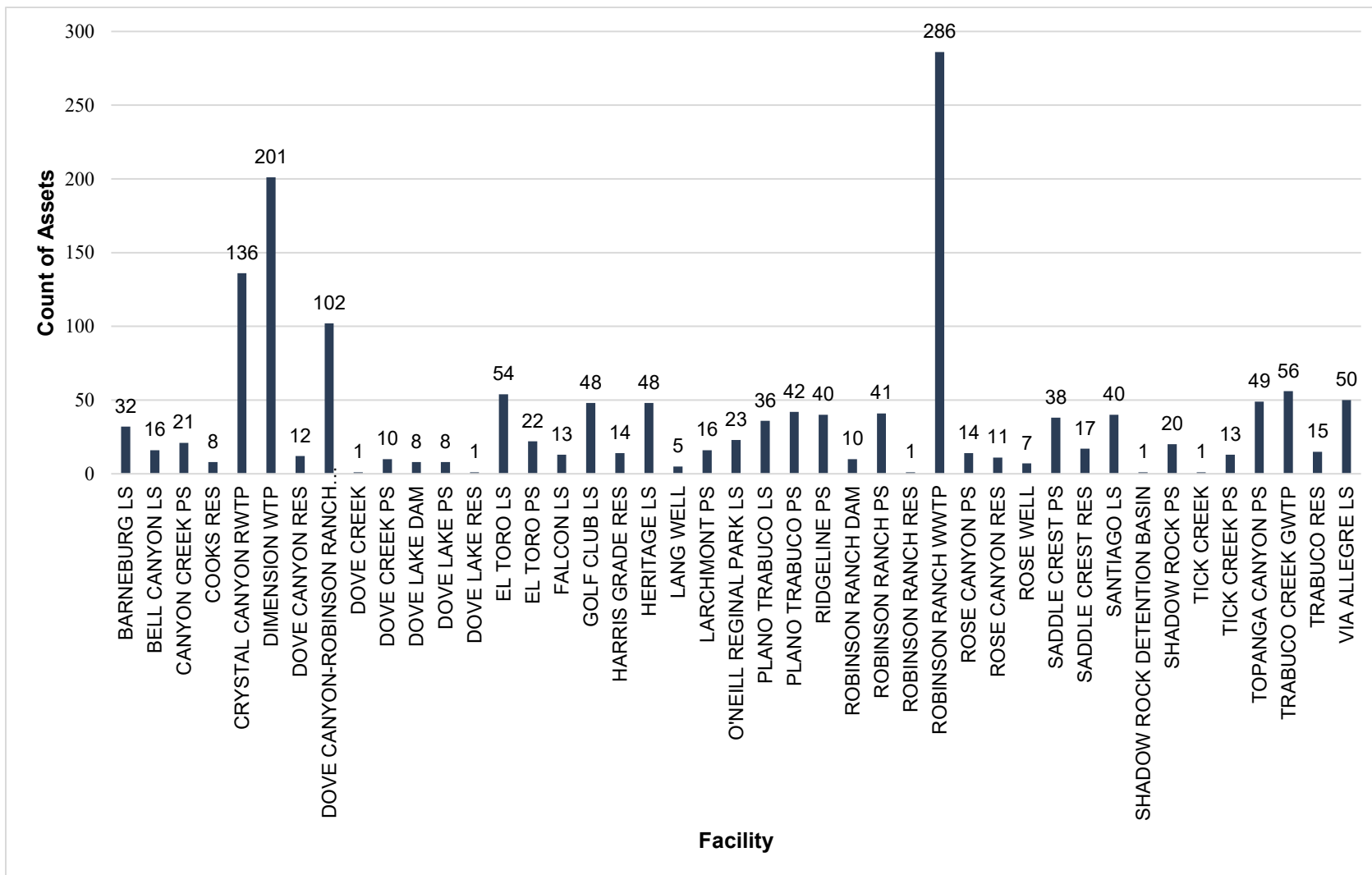


Figure 15-3: Summary of the District Inventoried Assets

The obtained desktop and field inventory results were provided through a dashboard developed in Microsoft Power BI (see Appendix D) and presented to the District staff for validation and additional feedback. A snapshot of the developed dashboard, providing an overview of the asset inventory result is presented in Figure 15-4.

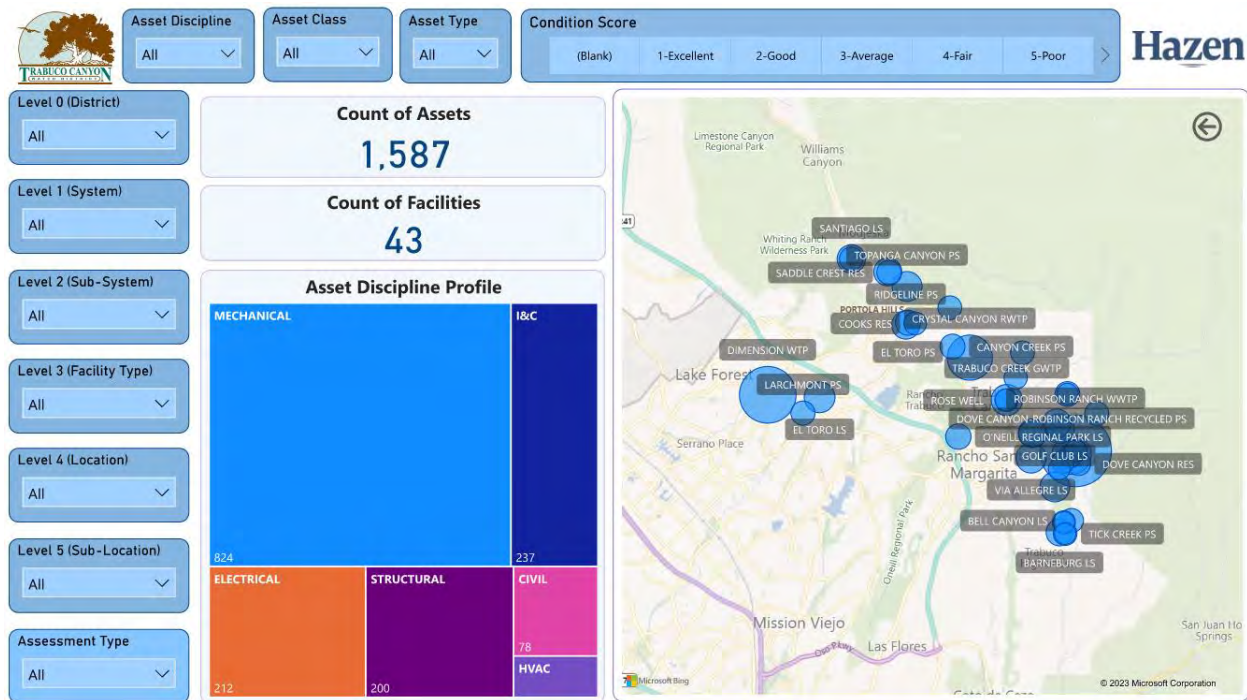


Figure 15-4: Summary of the District Asset Inventory Results in Power BI dashboard

15.3 Field Condition Assessment

The field condition assessment was performed for 10 facilities including Barneburg LS, Dimension WTP, Golf Club LS, Heritage LS, Via Allegre LS, Plano LS, Plano PS, and Robinson Ranch WWTP, Dam and Reservoir. These facilities were selected by the District for a field condition assessment due to their criticality, aging infrastructure, and potential needs for rehabilitation and replacement. The objective of the performed condition assessment is to estimate asset failure or the rate of deterioration of an asset to better plan for future rehabilitation and replacement needs. Other benefits of a condition assessment include adjusting remaining useful life (RUL), revising maintenance schedules, and updating total replacement costs and funding needs. The likelihood of an asset failing is most dependent upon the condition of the asset. As the condition of an asset deteriorates, the likelihood of failure increases. Ultimately, the goal of any condition assessment protocol is to acquire a more accurate knowledge of the timing to asset failure. Having more confidence in renewal needs will lead to more efficient and effective use of the District staff, resources, and funds.

In order to assess the current condition and the timing to asset failure, it is important to understand the ways an asset can fail. Collecting information and data about an asset will be meaningless unless it applies to the



known ways an asset will fail. The performance of an asset relates to the asset’s ability to meet the current and future demands placed on it. Assets can fail in four major ways (capacity, level of service, physical mortality, and financial efficiency) known as failure modes (shown in Table 15-3), which were used to assess the condition of each asset.

Table 15-3: Failure Modes

Failure Mode	Definition	Tactical Aspects
Capacity	Volume of demand exceeds design capacity	Growth, system expansion
Level of Service	Functional requirements exceed design capability	Codes and permits: NPDES, OSHA, noise, odor, life safety; service level, etc.
Mortality	Consumption of asset reduces performance below acceptable level	Physical deterioration due to age, usage (including operator error), acts of nature
Efficiency	Operations costs exceed that of feasible alternatives	Pay-back period

15.3.1 Field Condition Assessment Approach

Hazen performed a condition assessment of all the assets within ten facilities selected for field condition assessment. Level 1 (visual) condition assessment was conducted to assess the condition of mechanical, electrical, instrumentation and control (I&C), HVAC, civil, and structural assets within these facilities. Condition of assets, installation years, quantities, and O&M assessment/needs were identified during the on-site condition assessment. Additionally, we used input from District staff as to when the asset was last serviced to complete the condition assessment.

Field observations were recorded with mobile devices utilizing customized condition assessment forms. The condition scoring guide and the electronic condition assessment forms are presented in Figure 15-5. The condition assessment team assigned condition scores based on the International Infrastructure Management Manual with a rating range from 1 (Excellent condition) to 5 (Poor condition). Descriptions for each rating enabled the assessment team to assign ratings to assets in a consistent manner. All data collected for each asset, including photographs of the assets, the inspectors’ notes, condition scores, specific attributes, inspection checklists, etc., were digitally stored.

Figure 15-6 shows a portion of the inspection checklists for mechanical, electrical/I&C, structural, and civil assets, that were utilized during the condition assessments. The complete checklist for each discipline can be found in Appendix E. The team also captured 360-degree photos from each facility with an example shown in Figure 15-7.



Condition Scoring Guide

1 EXCELLENT	The physical condition of the asset is new or like-new, well maintained, fully operable, and performs at or above standards.
2 GOOD	Asset is sound, well maintained, delivers full efficiency with little or no performance deterioration, but may show signs of wear.
3 AVERAGE	Asset is functionally sound and may show normal signs of wear relative to age and use, but may have minor failures or performance deterioration. Minor or moderate refurbishment of 10-20% of asset may be needed within next 2 years.
4 FAIR	Asset functions but requires sustained high level of maintenance to remain operational. Substantial wear is visible and likely to cause significant performance deterioration. Refurbishment of 20-40% of asset may be needed within next 2 years.
5 POOR	Asset is very near, or beyond, its useful life. Incapable of performing to a satisfactory standard under normal operational conditions without on-going or corrective maintenance. Replacement needed in the near term (less than 2 years).

Figure 15-5: Condition Scoring Guide and Electronic Data Collection Tool

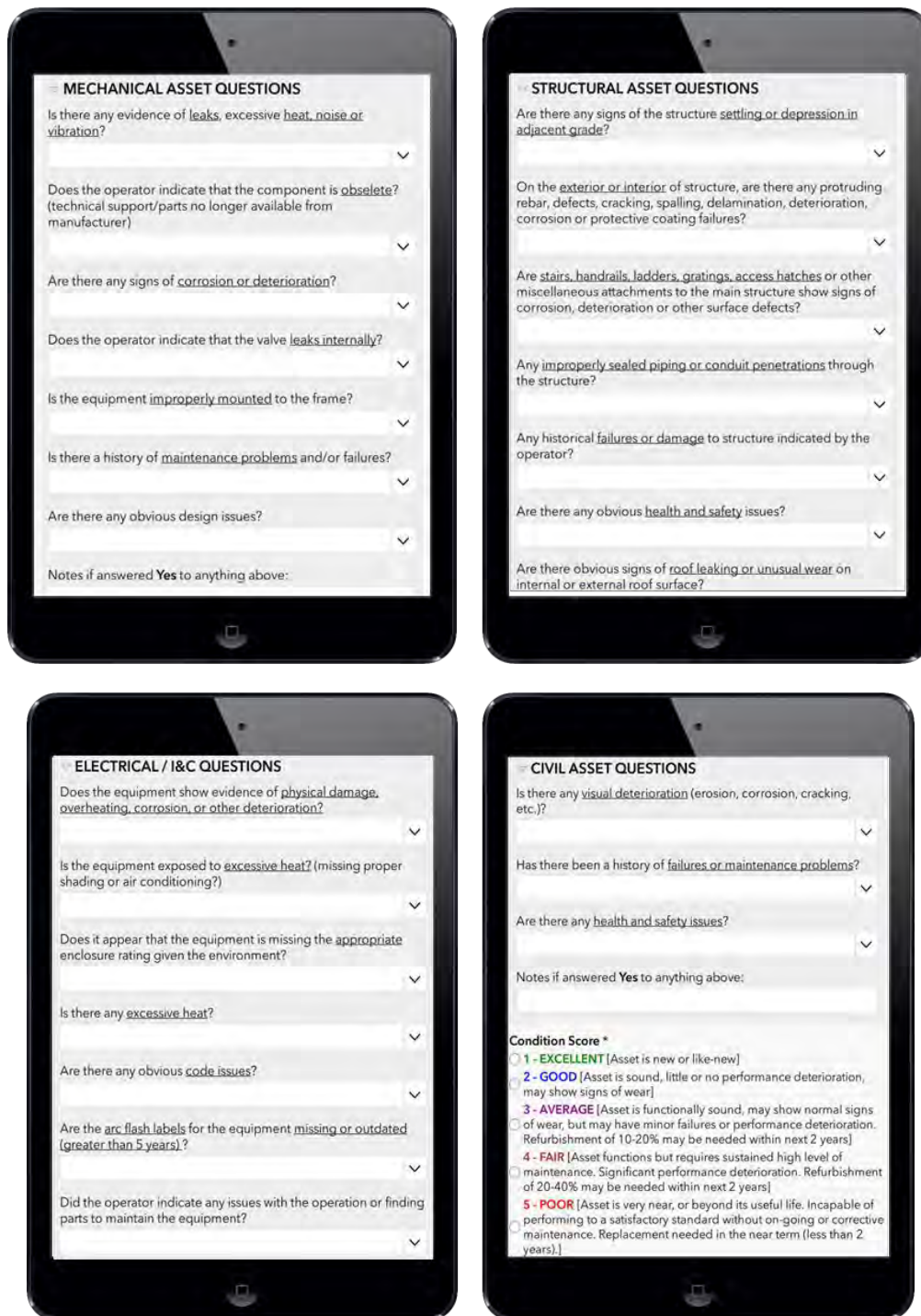


Figure 15-6: Inspection Checklists for Asset Disciplines



Figure 15-7: An Example 360-degree Photo Captured from Golf Club LS

15.3.2 Field Condition Assessment Results

A snapshot of the developed dashboard in Power BI, providing an overview of the asset inventory and condition assessment result is presented in Figure 15-8 (based on the 754 assets inspected during field visits).

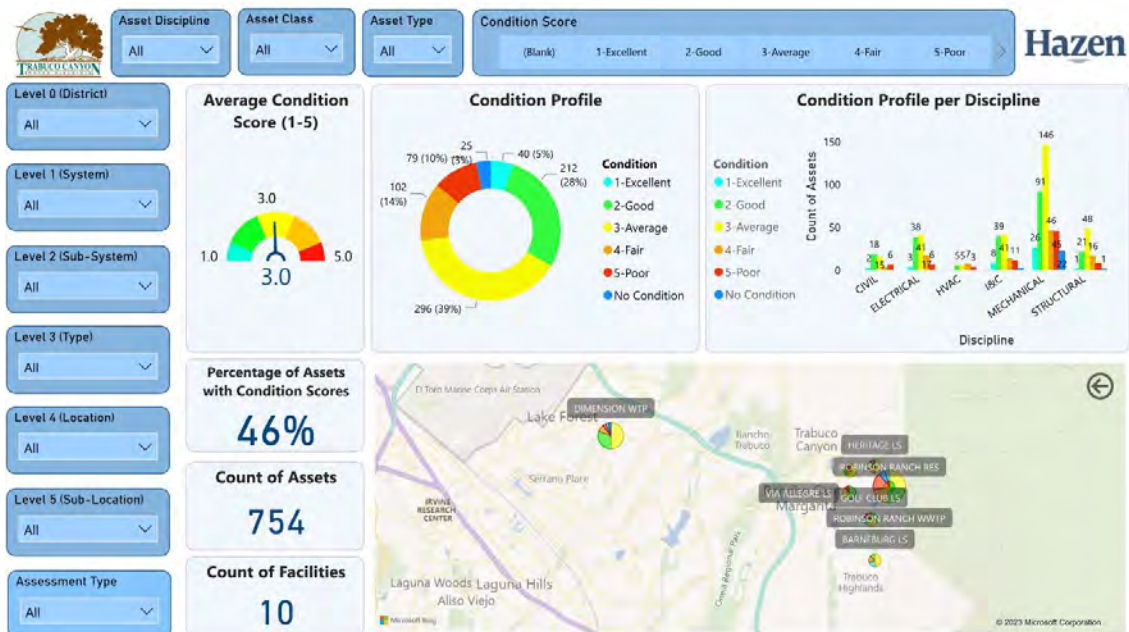


Figure 15-8: Summary of the District Condition Assessment Results in Power BI Dashboard

Figure 15-9 also provides a summary of the condition assessment results in ten facilities by condition score 1 through 5. As shown on Figure 15-9, out of the 754 assets inspected during field visits, 296 assets (39%) were in average; 212 assets (28%) were in good condition; 102 assets (14%) were deemed to be in fair condition; and 79 assets (10%) were found to be in poor condition. The District staff were aware of many of the assets that were determined to be in poor condition and have already initiated plans for rehabilitation or replacement. This result also shows that for 25 assets (3%), the inspection team were not able to visually inspect and assign a condition score to the asset. Therefore, an age-based approach, explained in the next section, was followed to determine the remaining useful life for assets with missing condition scores. These assets are listed in Appendix F.

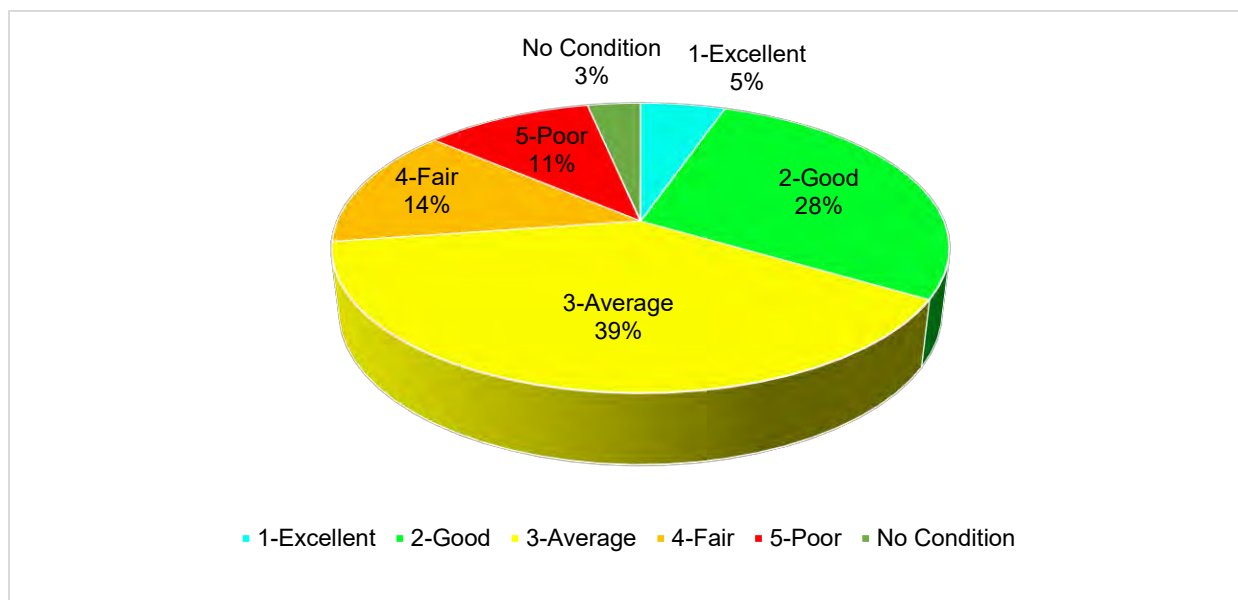


Figure 15-9: Summary of the Condition Assessment Results

Figure 15-10 presents a summary of condition assessment results that have been separated into six discipline categories of Mechanical, Electrical, Civil, Instrumentation and Control (I&C), Structural, and HVAC. As it is evident in this figure, the majority of the assets that were deemed to be in fair and poor condition belong to Mechanical discipline, followed by Structural, I&C, and Electrical discipline.

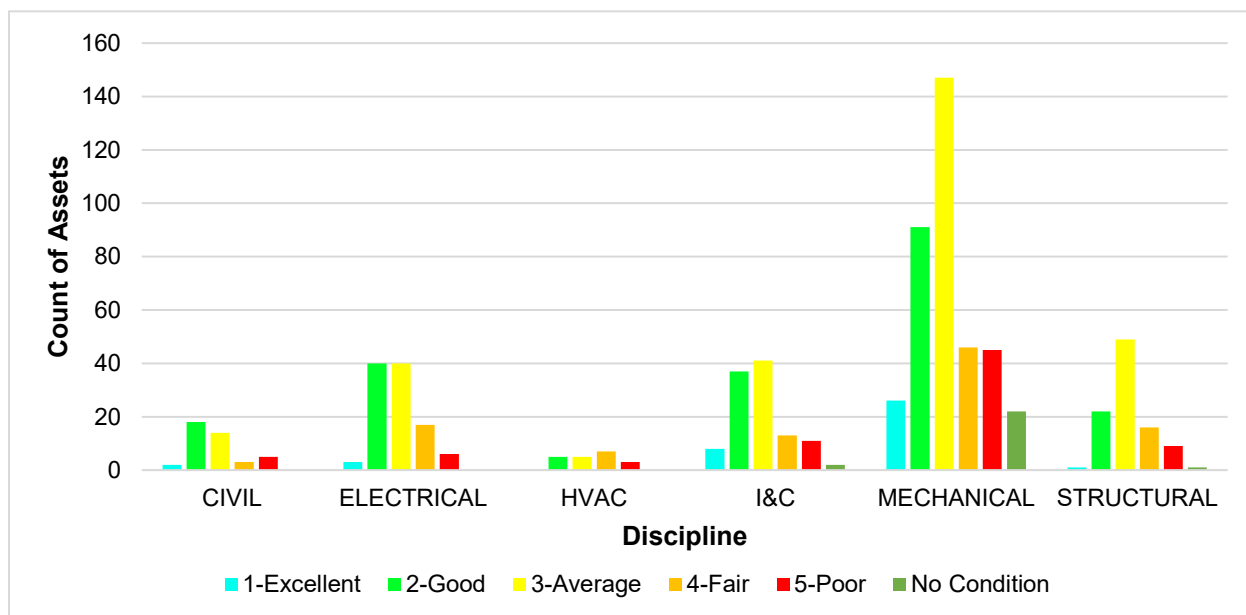


Figure 15-10: Condition Assessment Results by Discipline

The condition assessment results can also be presented by facility locations as shown in Figure 15-11. As it is evident in this figure, the Robinson Ranch WWTP has the most portion of the assets in poor condition (18%) while the assets in fair condition are also relatively high in this facility (18%). Other facilities with a relatively high number of poor assets are Golf Club LS (13%) and Plano Trabuco LS (11%). Further discussion on the condition of the assets in each facility is provided in the following subsections.

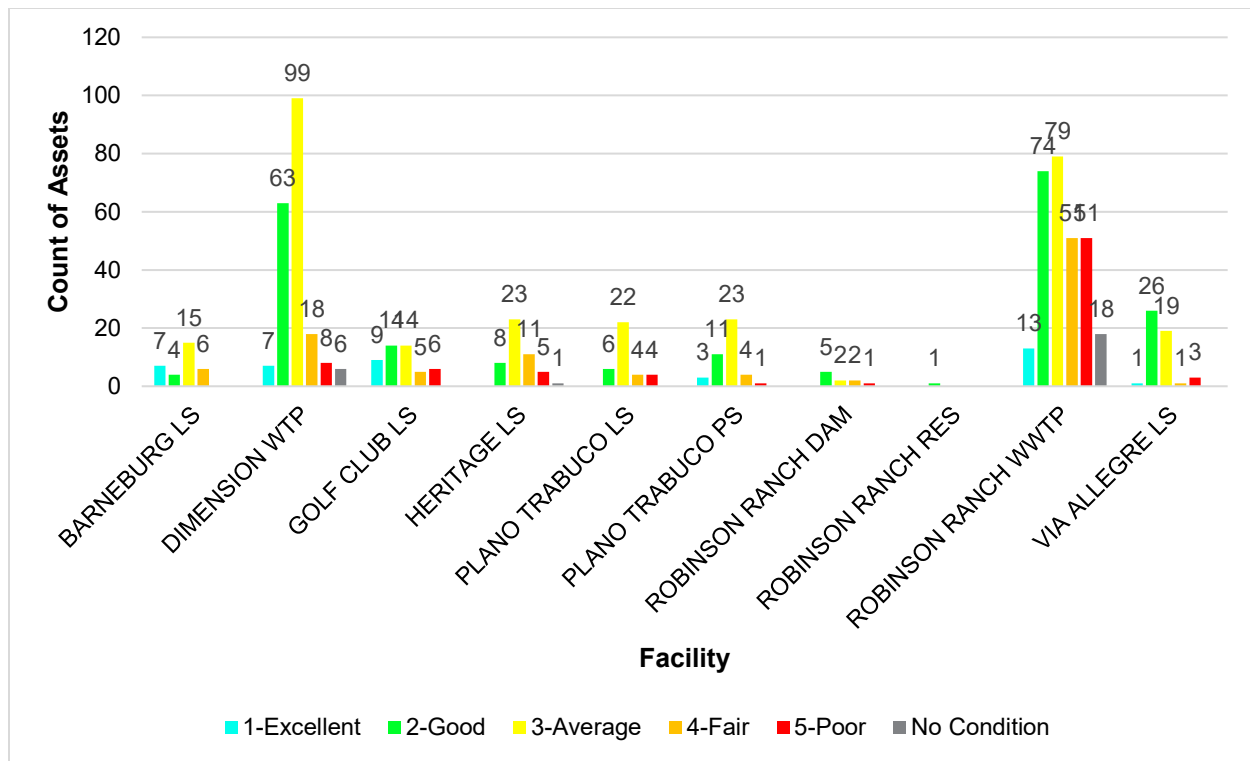


Figure 15-11: Summary of Asset Condition Scores by Facility Location

15.3.2.1 Barneburg LS

The Barneburg LS, installed in 1988, has a submersible configuration with two pumps, each with an average capacity of 215 gpm. The lift station is equipped with a surge protection system. The lift station has a diesel-driven electrical generator to provide standby power to the pumps in the event of a power failure or other interruption of electrical service. Based on the performed condition assessment on this facility (performed on January 26, 2022) and as Figure 15-11 shows, for 32 assets listed for this facility, the majority of the assets are in average condition group (15 out of 32 assets). However, 6 assets (19%) are in fair condition and no asset is in poor condition. Of primary interest is the understanding of which assets were found to be in fair or poor condition for planning and budgeting purposes. A list of the assets with a condition score of 4 (fair) for this facility is presented in Table 15-4.

Table 15-4: Barneburg LS Assets with Condition Score of 4 (fair)



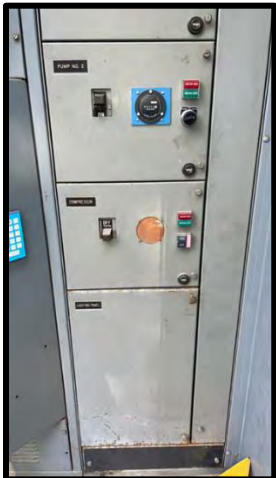



Photo	Sub-Location	Discipline	Asset Name	Comments
	SITE	Electrical	Emergency Generator	Generator works. Does not have proper filter for the smoke released by generator. Generator located next to residential housing. Aged generator but functional. Generator is US Motors, but the synchronous ac generator shows its own nameplate with a manufacturer name of Magnamax.
	SITE	Mechanical	Generator Diesel Engine	Generator works. However, the lack of filter for smoke outlet most likely doesn't comply with proper air regulations. Generator located next to residential housing.
	SITE	Electrical	MCC	No major issues communicated by the operator. Aged equipment. Lighting panel section is empty, lighting panel is in another section of the enclosure. Arc flash labels for the equipment are missing or outdated

Photo	Sub-Location	Discipline	Asset Name	Comments
	SITE	Civil	Entrance Gate	Aged and deteriorated
	VAULT	Structural	Bladder Surge Tank	Sign of corrosion on the tank. Some issues with surge tank, no level indicator.
	VAULT	Mechanical	Sump Pump	Pump is not under ideal operating condition and doesn't fully drain the vault.

15.3.2.2 Golf Club LS

The Golf Club LS, installed in 1988, has a wet pit/dry pit configuration. There are two pairs of pumps that work in series. Each set consists of a submersible pump in the wet well, which discharges to a centrifugal pump in the dry pit. The lift station is equipped with a surge protection system for the 8-inch diameter force main. It also has a diesel-driven electrical generator to provide standby power to the pumps in the event of a power failure or other interruption of electrical service. Based on the field visit (performed on January 27, 2022) and as Figure 15-11 shows, for 48 assets listed for this facility, the majority of the assets are in average and good condition group (28 out of 48 assets). However, 5 assets (10%) are in fair, and 6 assets (13%) are in poor condition. A list of the assets with a condition score of 4 (fair) and 5 (poor) for this facility is presented in Table 15-5

Table 15-5: Golf Club LS Assets with Condition Score of 4 (fair) and 5 (poor)



Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	WETWELL	Mechanical	Submersible Pump and Motor#1	5	Failed and out for service. Cannot be visually inspected.
	PUMP ROOM	Mechanical	Pump Room Sump Pump	5	Not reliable




Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	PUMP ROOM	HVAC	Pump Room Exhaust Fan	4	<p>The location of exhaust fan is ok. A supply fan needs to be installed to discharge air flow in dry well. The power is also low and cannot ventilate the air. Frame is heavily corroded. The extension cords on the outside of the building should be relocated internal to the building to avoid being vandalized</p>
	SITE	Electrical	Main Service Switchboard	5	<p>Evidence of physical damage, overheating, corrosion, or other deterioration - there is obvious code issues - arc flash labels for the equipment is missing or outdated</p>
	SITE	I&C	Telemetry Radio	4	<p>Evidence of physical damage, overheating, corrosion, or other deteriorations</p>





Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	SITE	Civil	Pavement	5	<p>Due to ongoing construction, pavement is failed. There are multiple longitudinal deep cracks on the concrete slab pavement too.</p>
	SITE	I&C	Submersible Pump #2 Disconnect Switch	5	<p>Evidence of physical damage, overheating, corrosion, or other deterioration - Operator indicates issues with the operation or finding parts to maintain the equipment</p>
	SITE	I&C	Submersible Pump #1 Disconnect Switch	4	<p>Evidence of physical damage, overheating, corrosion, or other deterioration - there is obvious code issues - Operator indicate issues with the operation or finding parts to maintain the equipment</p>

Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	WETWELL	Mechanical	Piping for Pump Room and Wetwell	4	Piping coating is failed in several spots and there is some internal corrosion - Piping and railing inside the wetwell is corroded and improperly sized
	WETWELL	Structural	Wetwell Structure and Access Hatch-Round Shape	4	Coating failed. Access hatches mechanism is not appropriate. Access hatches frame heavily corroded. No ladder
	PUMP ROOM	Structural	Surge Tank	5	Failed and leaked several times. Connections to the floor are heavily corroded.

15.3.2.3 Heritage LS

The Heritage LS, installed in 1983, is equipped with three pumps and emergency generator. Based on the field visit (performed on January 26, 2022) and as Figure 15-11 shows, for 48 assets listed for this facility, the majority of the assets are in average and good condition group (31 out of 48). However, 11 assets (23%) are in fair, and 5 assets (11%) are in poor condition. A list of the assets with a condition score of 4 (fair) and 5 (poor) for this facility is presented in Table 15-6.

Table 15-6: Heritage LS Assets with Condition Score of 4 (fair) and 5 (poor)




Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	AIR RELEASE VAULT	Structural	Air Release Vault	4	Cover failed. Cracks on the concrete wall. Base of the vault is not finished and is in poor condition.
	AIR RELEASE VAULT	Mechanical	Piping in Vault	4	Force main pipe cannot be visually inspected because of dirt around it and for assessment of confined-space entry is needed. The condition score is based on the adjacent assets.
	AIR RELEASE VAULT	Mechanical	Air Release Valve	5	Heavily corroded. Doesn't look functional.





Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	BUILDING	HVAC	Ventilation	5	Station is not constantly ventilated and has no indication to comply with NFPA 820, without ventilation this space is classified as class I div 2 spaces. Recommend installing go/no-go lights in compliance with NFPA 820
	CONTROL ROOM	I&C	Control Panel	5	Rust present on the enclosure - arc flash labels for the equipment missing or outdated - Operator indicate issues with the operation or finding parts to maintain the equipment
	CONTROL ROOM	Electrical	Main Breaker	4	Evidence of physical damage, overheating, corrosion, or other deterioration - there are obvious code issues - arc flash labels for the equipment is missing or outdated
	CONTROL ROOM	Structural	Control Room	4	The failure on the stairway caused the exposure of rebar. The handrail connection bolts corroded. Some tiles on the roof are broken.




Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	CONTROL ROOM	Electrical	Transformer Circuit Breaker	4	Appearance exhibits quite heavy amount of corrosion.
	PUMP ROOM	Mechanical	Pump #1	5	District has already purchased new pumps to replace existing pumps.
	PUMP ROOM	Mechanical	Pump #2	4	District has already purchased new pumps to replace existing pumps.





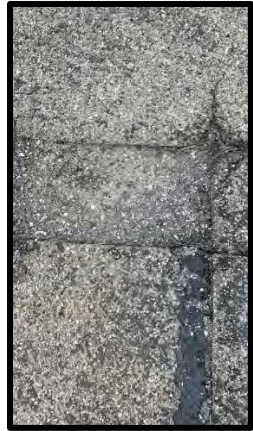

Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	PUMP ROOM	Mechanical	Pump #3	4	District has already purchased new pumps to replace existing pumps.
	PUMP ROOM	HVAC	Control Room and Pump Room Exhaust Fan	4	Heavily corroded and loud noise is produced when functioning
	SITE	Structural	Secondary Wetwell Manhole	5	This manhole allows secondary manhole for bypassing the wetwell. Based on the operator's comment, it has design issue and is already under rehabilitation. Confined-space entry is needed and can't be visually inspected.

Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	SITE	I&C	Telemetry Radio	4	A lot of corrosion present. Telemetry radio connected to SCADA.
	SITE	Civil	Pavement	4	Several cracks and the asphalt is peeled off in some spots.
	SITE	I&C	Wetwell Level Transmitter	4	Bubbler is functional; however, station lacks redundant level indicator of wet well. Operators would prefer redundant level instrument and high-level float

15.3.2.4 Via Allegre LS

The Via Allegre LS, installed in 1988, has a submersible pump configuration, with two pumps. The lift station is equipped with both a surge protection system for the 6-inch diameter force main and a diesel-driven electric generator to provide standby power in the event of a power failure or other interruption of electrical service. Based on the field visit (performed on January 27, 2022) and as Figure 15-11 shows, for 50 assets listed for this facility, the majority of the assets are in average and good condition group (45 out of 50 assets). However, one asset (2%) is in fair, and 3 assets (6%) are in poor condition. A list of the assets with a condition score of 4 (fair) and 5 (poor) for this facility is presented in Table 15-7.

Table 15-7: Via Allegre LS Assets with Condition Score of 4 (fair) and 5 (poor)

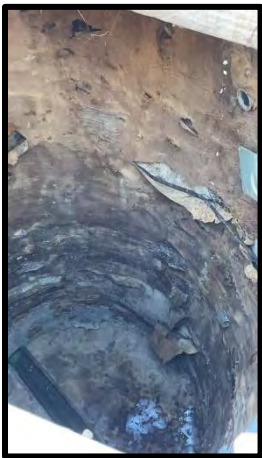



Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	OLD WETWELL	Structural	Old Wetwell Structure	4	Coating failed. It is being used as emergency storage. No ladder. Access hatch frame corroded
	SURGE TANK VAULT	Mechanical	Sump Pump for Surge Tank Vault	5	It seems to be failed and cannot discharge water.

Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	VALVE VAULT	Mechanical	Air Release Valve Pump #1	5	Valves are air-vac, cause slam and excessive noise during pump startup. Top of valve blew off and ball failed to seat, flooding vault. Currently closed. Operators want air release only, non-re-entry. Alternative is to use non-slam air-vac.
	VALVE VAULT	Mechanical	Air Release Valve Pump #2	5	Valves are air-vac, cause slam and excessive noise during pump startup. Top of valve blew off and ball failed to seat flooding vault. Currently closed. Operators want air release only, non-re-entry. Alternative is to use non-slam air-vac.

15.3.2.5 Plano Trabuco LS

Plano Trabuco LS, installed in 1982, is equipped with three pumps and a diesel-driven electric generator to provide standby power to the pumps in the event of a power failure or other interruption of electrical service. Based on the field visit (performed on January 26, 2022) and as Figure 15-11 shows, for 36 assets listed for this facility, the majority of assets are in average and good condition group (28 out of 36 assets). However, 4 assets (10%) are in fair, and 4 assets (11%) are in poor condition. A list of the assets with a condition score of 4 (fair) and 5 (poor) for this facility is presented in Table 15-8.

Table 15-8: Plano Trabuco LS Assets with Condition Score of 4 (fair) and 5 (poor)



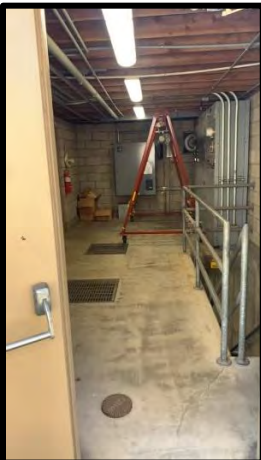
Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	CONTROL ROOM	I&C	Control Panel	4	Arc flash labels for the equipment are missing or outdated - Operator indicate issues with the operation or finding parts to maintain the equipment
	CONTROL ROOM	Electrical	Automatic Transfer Switch	5	Operator mentioned that ATS has issues when transferring between utility and generator power. Obsolete and discontinued parts - arc flash labels for the equipment are missing or outdated
	CONTROL ROOM	HVAC	Building Exhaust Ventilation	5	Lift station building likely considered as a hazardous/classified area due to lack of proper ventilation. Investigate NFPA 820 and recommend go/no-go light.






Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	PUMP ROOM LS	Mechanical	Sump Pump	4	Approaching the end of it's useful life due to age - corroded
	PUMP ROOM LS	Mechanical	Pump #1	5	Wall label does not match controls. Pump is not functional.
	SITE	Mechanical	Wetwell Level Transmitter	4	<p>Bubbler is functional, but there is no level instrument redundancy. If loose bubbler, no backup signal.</p> <p>Operations would like a redundant level instrument, such as ultrasonic or radar; and high float to turn pumps on if necessary / LIT info is not accessible/visible and may not be used, as would be another level indicator in LS control panel</p>

Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	SITE	Electrical	Diaphragm Switch	5	Operators indicate issues with the operation or finding parts to maintain the equipment
	SITE	Electrical	Emergency Generator	4	<p>There is some corrosion present. Grandfathered generator is rated Tier 1.</p> <p>Generator is nearby residential housing. Smoke coming out from generator could be a hazard.</p> <p>Generator replacement should be tier 4/have proper filter for smoke.</p>

15.3.2.6 Plano Trabuco PS

Plano Trabuco PS was installed in 1982 and based on the field visit (performed on January 26, 2022) and as Figure 15-11 shows, for 42 assets listed for this facility, the majority of the assets are in average and good condition group (34 out of 42). However, 4 assets (10%) are in fair, and one asset (2%) is in poor condition. A list of the assets with a condition score of 4 (fair) and 5 (poor) for this facility is presented in Table 15-9.

Table 15-9: Plano Trabuco PS Assets with Condition Score of 4 (fair) and 5 (poor)









Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	LOWER LEVEL	HVAC	AC Unit Exhaust Fan	4	Sign of corrosion on corresponding assets - motor produces noise
	SITE	Structural	Pump Room Building Structure-Sky hatch Lighting Source	4	Leakage from roof near skylight shades - Crack on the side seems to be foundation related issue
	SITE	Mechanical	Flow Control Valve #2 - 6	5	Removed from service at the moment but needs to be replaced. They currently use a butterfly valve. Paint chipped, bonnet bolts rusting




Photo	Sub-Location	Discipline	Asset Name	Condition Score	Comments
	SITE	Mechanical	Engine Exhaust Silencer	4	Heavily corroded. Produces black smoke
	CONTROL ROOM	Electrical	Main Switchboard	4	Building needs to be checked for compliance with NFPA 70E. Corrosion ok. Present SWBD only rated for 14ka short circuit, short circuit analysis should be performed to check if this exceeds available fault current. No arc flash labels on any electrical equipment on site - Motor starter within SWBD is by Digifire, this company is out of business as per maintenance staff - 3'4" clear from SWBD to ATS, likely NEC working space violation. Crane also located in front of switchboard currently




15.3.2.7 Dimension Water Treatment Plant




Dimension Water Treatment Plant (WTP), installed in 1968, is a surface water treatment facility with nominal design capacity of 6 cfs and consists of a pressure regulating valve (PRV), static mixer, microfloc trident clarifier/filter systems, low-head effluent pumps, a clear well, and pumps. The filtered water is disinfected with chlorine gas before entering the clearwell. In addition, there are air scour blowers and a backwash waste recovery system including sump pumps, settling tanks, and backwash recovery pump. Based on the field condition assessment of the Dimension WTP (performed on January 25, 2022) and as presented in Figure 15-11, 201 assets data were collected in this facility. These assets are mainly in average and good condition (162 out of 201 assets). However, 18 assets (9%) are in fair condition (score of 4) as listed in Table 15-10.




Table 15-10: Dimension WTP Assets with Condition Score of 4 (fair)




#	Photo	Sub-Location	Discipline	Asset Name	Comments
1		BACKWASH	Mechanical	Filter Plant Back Wash Sump Pump #1 (Large-40 hp)	Rehabbed in 2016, at the end of useful life, rusted and corroded.
2		CHLORINE BUILDING	HVAC	Exhaust Fan Chlorine Building	Heavily corroded. Exhaust needs to be more powerful for the area to meet fire code required air exchanges per hour.
3		CHLORINE BUILDING	Structural	Sodium Thiosulfate Tank	Connection to the floor does not exist

#	Photo	Sub-Location	Discipline	Asset Name	Comments
4		CHLORINE BUILDING	Structural	Chlorine Building Structure	Several defects on the roof. Back door severely corroded.
5		CLEARWELL	Mechanical	Effluent Pump#2 Near Clearwell	Rusted and corroded, In need of rehabilitation. Will be rehabbed after pump#1
6		ELECTRICAL ROOM	HVAC	Exhaust Fan for Electrical Room Structure	Ventilation system for the electrical room is not sufficient. Improvement is needed.

#	Photo	Sub-Location	Discipline	Asset Name	Comments
7		ELECTRICAL ROOM	Electrical	Main Service Switchboard	Evidence of physical damage, overheating, corrosion, or other deterioration - there are obvious code issues
8		FILTER BUILDING	Mechanical	Filter Plant Filter #4 Air Scour Valve	Approaching the end of its useful life due to age
9		FILTER BUILDING	Structural	Filter Plant Filter #4 - Structure	Heavily corroded. Requires coating.





#	Photo	Sub-Location	Discipline	Asset Name	Comments
10		FILTER BUILDING	Electrical	MCC-A	Evidence of physical damage, overheating, corrosion, or other deterioration - there are obvious code issues - arc flash labels for the equipment is missing or outdated - Operator indicate issues with the operation or finding parts to maintain the equipment
11		FILTER BUILDING	Electrical	Lightening Panel LP-A	Amperage of panel is based on main breaker size - Nameplate of panel is missing - arc flash labels for the equipment missing or outdated
12		FILTER BUILDING	I&C	Filter #4 Level Instrument	Evidence of physical damage, overheating, corrosion, or other deterioration

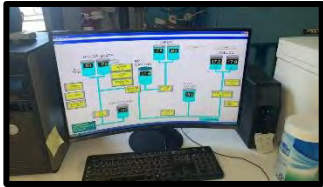



#	Photo	Sub-Location	Discipline	Asset Name	Comments
13		MCC ROOM	Electrical	Lighting For MCC B Building	The interior lighting needs improvement. Many of the fixtures are not in good condition.
14		MCC ROOM	HVAC	Exhaust Fan for MCC B Building	Ventilation system needs improvement given that MCCs are in this area.
15		SITE	I&C	Antenna Tower for SCADA	Tower legs heavily corroded.

#	Photo	Sub-Location	Discipline	Asset Name	Comments
16		SITE	Structural	Effluent Meter Vault	No sump pump in the vault. Some diagonal cracks near pump connection to the concrete. Access hatches need to be replaced. Require sump pump.
17		SITE	Mechanical	Waste Meter Vault Piping	The piping is heavily corroded
18		SITE	I&C	Plant Wastewater Flowmeter	Effluent wastewater meter

In this facility eight assets (4%) are also found in poor condition as listed in Table 15-11.

Table 15-11: Dimension WTP Assets with Condition Score of 5 (poor)

#	Photo	Sub-Location	Discipline	Asset Name	Comments
1		FILTER BUILDING	I&C	Filter Plant Filter #2 Flowmeter	Flow meter that calculates flow using differential pressure. They are not functioning now per operator.
2		FILTER BUILDING	I&C	Filter Plant Filter #1 Flow Meter	Filter differential pressure flow meters do not function properly and need replacement - Meter doesn't work anymore but they get a reading close to the accurate number (per operator)
3		FILTER BUILDING	I&C	Filter Plant Filter #3 Flowmeter	Flow meter that measures flow using differential pressure. Meter doesn't work anymore but they get a reading close to the accurate number (per operator)
4		FILTER BUILDING	I&C	Filter Plant Filter #4 Flow Meter	Likely DP2051 model similar to filter 1, but unable to confirm from nameplate - Operations stated these flowmeters do not provide accurate readings and need replacement

#	Photo	Sub-Location	Discipline	Asset Name	Comments
5		FILTER BUILDING	I&C	Old Scada System	Difficulties maintaining existing system and several issues with functionality
6		FILTER BUILDING	Civil	Rolling Motorized Gate for Filter Building	Motor needs to be replaced. It is in process of replacing with exactly the same motor.
7		FILTER BUILDING	Mechanical	16 In Piping for Filter #4	Heavily corroded. Leakage
8		FILTER BUILDING	I&C	Filter Plant PLC-Controller	Operators indicate issues with the operation or finding parts to maintain the equipment



15.3.2.8 *Robinson Ranch Wastewater Treatment Plant*




In this section, the assets related to Robinson Ranch three facilities of treatment plant, reservoir, and dam, are discussed. The Robinson Ranch Wastewater Treatment Plant (WWTP), with a digester installed as early as 1950, provides secondary and tertiary treatment, as well as stabilization and dewatering of sludge, for 0.85 MGD of wastewater. This plant includes a climber screen, influent equalization (EQ) tanks, sequence




batch reactors (SBRs), an aerobic digester, filtration, chlorine contact chambers, and the processed water is being stored in the nearby recycled water storage reservoir.



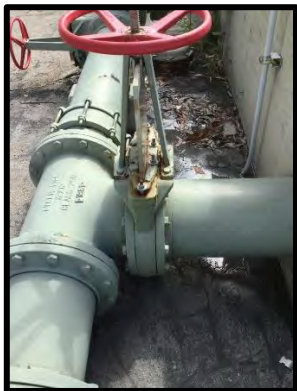
Hazen performed a field condition assessment and high-level process evaluation of the Robinson Ranch WWTP on April 26-28, 2022. The result of the preliminary process evaluation is provided through Appendix G. For the condition assessment results as Figure 15-11 shows, for 297 assets listed for Robinson Ranch WWTP, although the majority of the assets are in average and good condition (161 out of 297 assets), the number of assets in fair and poor condition are relatively high. 53 assets (18%) are found in fair, and 52 asset (18%) are found in poor condition. A list of the assets with a condition score of 5 (poor) for this facility is presented in Table 15-12.





Table 15-12: Robinson Ranch WWTP Assets with Condition Score of 5 (poor)


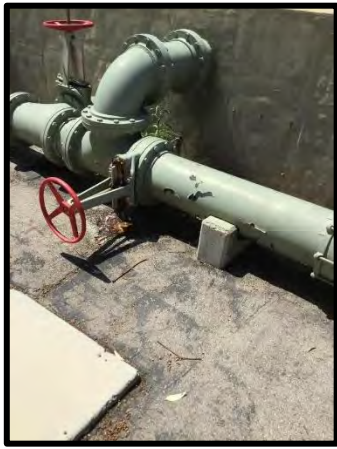

#	Photo	Sub-Location	Discipline	Asset Name	Comment
1		BELT PRESS BUILDING	Mechanical	Mid Floor Pump#1 (The Old One) and Motor - East - Wash Pump	Almost dead –leaks, excessive deterioration, corroded
2		BELT PRESS BUILDING	Mechanical	Isolation Valve Old Pump#1 - Mid Floor - West	Current functionality is unknown. Approaching the end of it's useful life due to age, corroded, and deteriorated.

#	Photo	Sub-Location	Discipline	Asset Name	Comment
3		BELT PRESS BUILDING	Mechanical	Piping - Upper & Lower Level	Leakage, vibration, corrosion, and deterioration were observed.
4		BELT PRESS BUILDING	Mechanical	Belt Press Plug Valve	Leakage, vibration, corrosion.
5		BLOWER ROOM	Mechanical	Pump#2 and Motor - Lower Floor	Shaft guard is missing (Safety Issue)




#	Photo	Sub-Location	Discipline	Asset Name	Comment
6		BLOWER ROOM	Mechanical	Pump#1 And Motor - Lower Floor	Shaft guard missing (Safety Issue). Leakage, excessive noise, heat, vibration was observed. Some corrosion to pump, moderate corrosion to pump base, and corrosion and deterioration to seals causing leaks
7		BLOWER ROOM	Mechanical	Blower Upper Level - West	No shaft cover (Safety Issue)
8		BLOWER ROOM	Mechanical	Blower LN - Lower Floor - Packaged Rotary - Motor - Silencers	Leaks, excessive noise, heat, and vibration were observed. Minor oil leak. Area caution taped / guard cover for belt is removed (Safety Issue)




#	Photo	Sub-Location	Discipline	Asset Name	Comment
9		BLOWER ROOM	Mechanical	Air Ventilation System - duct - Lower Level	<p>Inoperable. Without ventilation, this could be classified as a confined space. There could be a leak of WAS from the pumps and there is a chance of developing a hazardous atmosphere.</p> <p>Also, the blowers generate heat so the space should have some air circulation.</p>
10		BLOWER ROOM	Mechanical	Valve - With Handwheel Operator - Blower Room Outside	Record drawing states this is for foul air. Inoperable due to rust.
11		CHLORINE CONTACT CHAMBER	Mechanical	First Chamber Knife-Gate Valve - Handwheel Operated Urethane	Leakage, excessive noise, heat, and vibration were observed. Valve housing and packing are leaking. Operations reports valve does not work due to corrosion, deterioration.




#	Photo	Sub-Location	Discipline	Asset Name	Comment
12		CHLORINE CONTACT CHAMBER	Mechanical	Second Chamber Knife-Gate Valve - Handwheel Operated Urethane	Operations reports valve does not work due to corrosion, deterioration.
13		CHLORINE CONTACT CHAMBER	Mechanical	Third Chamber Knife-Gate Valve - Handwheel Operated Urethane	Operations reports valve does not work due to corrosion, deterioration.
14		CHLORINE CONTACT CHAMBER	Mechanical	Effluent Knife-Gate Valve - Handwheel Operated Urethane - Chamber 4th	Operations reports it does not work. History of failure and maintenance.
15		CHLORINE CONTACT CHAMBER	Mechanical	Effluent Knife-Gate Valve - Handwheel Operated Urethane - Chamber 3rd	Operations reports it does not work. History of failure and maintenance.





#	Photo	Sub-Location	Discipline	Asset Name	Comment
16		CHLORINE CONTACT CHAMBER	Mechanical	Fourth Chamber Knife-Gate Valve - Handwheel Operated Urethane - Downstream Bend	Operations report it does not work due to corrosion, deterioration.
17		CHLORINE CONTACT CHAMBER	Mechanical	Chamber 1 Bypass Valve	Leakage and vibration were observed. Severe corrosion. Inoperable due to corrosion and deterioration.
18		CHLORINE CONTACT CHAMBER	Mechanical	Chamber 2 Bypass Valve	Some corrosion observed. Operations reports valve does not work due to corrosion and deterioration.

#	Photo	Sub-Location	Discipline	Asset Name	Comment
19		CHLORINE CONTACT CHAMBER	Mechanical	Chamber 3 Bypass Valve	Some corrosion observed. Operations reports valve does not work due to corrosion and deterioration.
20		CHLORINE CONTACT CHAMBER	Mechanical	Chamber 4 Bypass Valve	Some corrosion observed. Valve cannot be opened without excavation of asphalt.
21		CHLORINE CONTACT CHAMBER	Mechanical	Dosing Point	Leakage and vibration were observed. Ground below is corroding and deteriorating due to hypochlorite leak (Safety Issue).


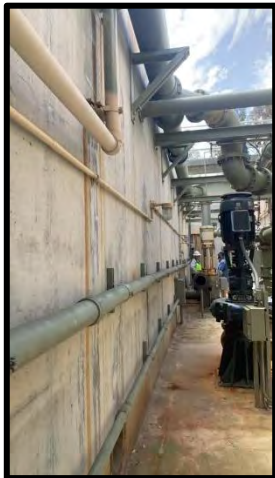

#	Photo	Sub-Location	Discipline	Asset Name	Comment
22		FILTERS	Mechanical	Filter#3 Drain Valve - Air Actuated	Installed in 1988 - at the end of service life. Corroded and deteriorated.
23		FILTERS	Mechanical	Filter#3 Effluent Valve	Original equipment - at the end of service life. Corroded/deteriorated.
24		FILTERS	Mechanical	Filter #3 Effluent Isolation Valve - Manual	Leaks/broken/corroded/deteriorated.




#	Photo	Sub-Location	Discipline	Asset Name	Comment
25		FILTERS	Mechanical	Filters Drain Line	Leakage and corrosion were observed, especially at the bottom. Only leaks when the filters are being drained.
26		FILTERS	Mechanical	Air Scour Blower	Inoperable and needs replacement. Filters are not air scoured.
27		FILTERS	Mechanical	First Filter System Inlet Valve	Valve is inoperable and is leaking internally.



#	Photo	Sub-Location	Discipline	Asset Name	Comment
28		FILTERS	Mechanical	Main Filter Inlet Valve	Valve is broken and is leaking internally.
29		FILTERS	Mechanical	Filter Bypass Valve	Slight corrosion/deterioration observed. Valve not in use.
30		FILTERS	Mechanical	Filter#2 Manual Isolation Valve	Valve stuck open. Leaking internally.

#	Photo	Sub-Location	Discipline	Asset Name	Comment
31		REACTOR DRYWELL	Mechanical	The Influent EQ Basin Piping to SBRs	Corroded and deteriorated
32		REACTOR DRYWELL	Mechanical	Chainwheel Valve - Eccentric	Valve only moves with excessive force. Corrosion/deterioration observed.
33		RESERVOIR	Mechanical	Reclaimed Reservoir Effluent Sluice Gate Valve Manual Actuator	Reservoir valve stuck open - Shaft mounting points broken - Operator concern over not being able to isolate reservoir in case of downstream failure, Corroded/Deteriorated.
34		SEQUENTIAL BATCH REACTORS	Mechanical	East/West Sequential Batch Reactor Aeration-Diffusers Assembly	The PVC pipe of the diffusers as it aerates fluctuates. When one small diffuser breaks it fills the line with sludge, and they must wash out the whole diffuser system. They would like to have the pipe up top and have sections of diffusers, so they don't lose the whole diffusers.

#	Photo	Sub-Location	Discipline	Asset Name	Comment
35		CLEARWELL	Electrical	Filter Backwash Pump-1 VFD	VFDs are obsolete and have exceeded useful life of equipment. Operations staff stated these VFDs do not work. Enclosure shows signs of deterioration, and spare parts are likely difficult to obtain. Missing pilot light cover for "motor online". No arc flash label installed (typical of facility)
36		CLEARWELL	Electrical	Filter Backwash Pump-2 VFD	VFDs are obsolete and have exceeded useful life of equipment. Operation staff stated these VFDs do not work. Enclosure shows signs of deterioration, and spare parts are likely difficult to obtain. Missing pilot light cover for "motor online". No arc flash label installed (typical of facility)
37		BLOWER ROOM	I&C	Blower Building PLC Panel – TSX Compact	Obsolete/older model Schneider PLC and I/O cards (pc-e984-285) I/O cards are obsolete and likely difficult to find/replace. Recommend upgrading PLC. (PLC and I/O cards appear original, white back panel, power supply and wiring appear to have been recently redone)

#	Photo	Sub-Location	Discipline	Asset Name	Comment
38		LAB - BUILDING C	I&C	Old Scada System	<p>Replacement parts unavailable/difficult to obtain. Control panel required troubleshooting in 2020. Pilot lights shows signs of sun degradation. Enclosure recently replaced but inside is original.</p>
39		REACTOR DRYWELL	Electrical	Dry Well Lighting	<p>Only 3 of 9 fixtures turn on when switched, other 6 appear not to be functional. The switches for the working lights not up in the on position. Recommend replacing with LEDs</p>
40		SITE	Electrical	Site Lighting	<p>15-20' high pole mounted fixtures are scattered across site. Some poles show signs of corrosion/deterioration. Fixtures are old and original – only about 50% work. Recommend replacement with LEDs. (Approx. 15 fixtures)</p>

#	Photo	Sub-Location	Discipline	Asset Name	Comment
41		BELT PRESS BUILDING	Structural	Floor Drain	<p>No longer drains. Leaking fluid from an old, nearby pump corrodes this and other nearby components. Floor also does not appear to slope toward drain. Standing water under belt press.</p>
42		DIGESTER	Structural	Digester Handrail and Catwalk	<p>Catwalk is not safe, and handrail is missing in some areas (Safety Issue).</p>
43		FILTERS	Civil	Filter#1,2,3,4,5,6 Tank	<p>The tank body is pitted and corroded. Drainage underneath tanks is not good. Air scouring of the tank does not work at all due to broken pump. Surface coating of the tank due to rain cascading impact is being damaged. Filter media replacement orifice is corroded and not sealed and causes issues. Backwash takes an hour/day as the valves have to be operated manually.</p>

#	Photo	Sub-Location	Discipline	Asset Name	Comment
44		INFLUENT EQUALIZATION BASIN	Structural	Structure - North/South Influent Equalization Basin and the Aluminum Cover	cleaning issue, minimal slope, hard access and bad drains, the cover is corroded and deteriorated and unsafe.
45		SITE	Civil	Stairway - Handrails - Catwalk (the Reactor Drywell, SBRs, Secondary Effluent Equalization Basin)	not sufficient handrails around the West-SBR and the secondary effluent equalization basin - safety issue

A list of the assets with a condition score of 4 (fair) for this facility is presented in Table 15-13 and as the number of assets with high condition score is high for this facility, no picture is provided for the assets in the table. The developed asset register for the District includes the collected picture for all the assets.



Table 15-13: Robinson Ranch WWTP Assets with Condition Score of 4 (fair)

#	Location	Discipline	Asset Name	Comment
1	BELT PRESS BUILDING	Mechanical	Mid Floor Pump#2 and Motor (West)	Leakage, excessive heat, noise, vibration was observed. Only serviced once for oil leak - otherwise original. Internal leak noted.
2	BELT PRESS BUILDING	HVAC	Air Ventilation System - Duct - Fresh Air	Some parts are badly corroded due to leaks in the building
3	BELT PRESS BUILDING	Structural	Belt Press Building	Drainage issues: clogged heavy drains and flooding. Roof needs major repair - rain enters and damages assets.
4	BELT PRESS BUILDING	I&C	Belt Press Control Panel	Evidence of deterioration - corrosion present on enclosure - due to NFPA 820 should be in NEMA 7x enclosure or ensure building is ventilated per standard of 820
5	BELT PRESS BUILDING	Mechanical	Air Compressor	Corrosion was observed. Slight oil leak noted.
6	BLOWER ROOM	Mechanical	Blower UN - Packaged Rotary - Motor - Silencer	Not suited for application, frequent failure, and difficulty in expediting repairs – leakage, corrosion, and deterioration signs, excessive heat, vibration, and noise
7	BLOWER ROOM	Mechanical	Blower UC - Packaged Rotary - Motor - Silencer	Not suited for application, frequent failure, and difficulty in expediting repairs – leakage, corrosion, and deterioration signs, excessive heat, vibration, and noise
8	BLOWER ROOM	Mechanical	Suction Isolation Valve Pump#3	Some corrosion. Missing handle.
9	BLOWER ROOM	Structural	Tank - Upper Floor	Adds additional capacity to the air compressor. Seems original.
10	BLOWER ROOM	Structural	Blower Room Building - Building D	Lower floor in poor condition. Water finds its way to the lower floor walls. Corrosion due to leakage
11	BLOWER ROOM	Civil	Crane	Not multidirectional, does not go over some equipment, very limited, due to some structural issue of the building they were not able to have multi direction crane a year ago, very limited use



#	Location	Discipline	Asset Name	Comment
12	BLOWER ROOM	Electrical	MCC Blower Building	No arc flash labels installed. Operators have had difficulty finding replacement parts. Excessive heat, sun exposure. Maintenance staff has had issues with electrical equipment in blower building due to excessive heat. Installed 1988.
13	BLOWER ROOM	Electrical	West Hoffman Blower Motor Starter - Stand Alone	Working space impeded by blower piping - piping is 26" from front of enclosure - code issue - motor starter components likely difficult to obtain
14	BLOWER ROOM	I&C	Blower Building South Wetwell Level Cp	Pilot devices are cracked- equipment appears to be past useful life
15	BLOWER ROOM	Electrical	MCC A - Upper Floor	No arc flash labels installed. Unable to determine useful size info as no nameplate was visible/legible. Maintenance staff has had difficulty finding replacement parts for this vintage mcc. Sump pump cp 16" in front of mcc violating NEC working space code- issue with maintenance - staff mentioned that due to heat in blower building, they have experienced failures of electrical equipment within building
16	BLOWER ROOM - SITE	I&C	Was Wetwell Bubbler Panel	Rust on enclosure panel - is mounted on exterior building, which has concrete pedestal extending 18" from in front of panel, impedes NEC working space, evidence of deterioration
17	CHEMICAL STORAGE - BUILDING A	Electrical	Lighting Panel LP-E	Rust present on enclosure, no arc flash label installed, evidence of deterioration
18	CHLORINE CONTACT CHAMBER	Mechanical	Influent Main BFV1 - Upstream	Leakage, corrosion - deteriorated, no maintenance since 2002 installation.
19	CHLORINE CONTACT CHAMBER	Mechanical	Influent Main Line BFV2 - Downstream	Corroded, deteriorated, no service since 2002 install.
20	CLEARWELL	Mechanical	Process Water Pump#1 (South)	Corroded/deteriorated - pump base corroded



#	Location	Discipline	Asset Name	Comment
21	CLEARWELL	Mechanical	Process Water Pump#1 (South) Discharge Check Valve	Valves are original and have never been serviced, corroded, deteriorated
22	CLEARWELL	Mechanical	Backwash Pump#1 (South) Discharge Check Valve	Valve has not been serviced since original install date, corroded, deteriorated
23	CLEARWELL	Mechanical	Backwash Pump#2 (North) Discharge Check Valve	Has not been serviced since original install date, Corroded, deteriorated
24	CLEARWELL	Mechanical	Process Water Pump#1 (South) Discharge Isolation Valve	Has not been serviced in 20+ years. Corroded, deteriorated
25	CLEARWELL	Mechanical	Backwash Pump#1 (South) Discharge Isolation Valve	Has not been serviced since original install date. corroded, deteriorated
26	CLEARWELL	Mechanical	Backwash Pump#2 (North) Discharge Isolation Valve	Has not been serviced since original install date. corroded, deteriorated
27	CLEARWELL	Mechanical	Backwash Pump#2 North	Approaching the end of it's useful life due to age, but functional. recommend refurbishment.
28	CLEARWELL	Mechanical	Backwash Pump#1 South	Approaching the end of it's useful life due to age, but Functional. recommend refurbishment.
29	CLIMBER SCREEN	I&C	Screen-Bioguard Control Panel	No arc flash label installed on 480v motor starter enclosure -unable to find replacement parts, have bought replacement parts on ebay missing/outdated label/operations staff mentioned panel was troubleshooted 2020 due to failures -pilot light shows signs of sun degradation.
30	CLIMBER SCREEN	Mechanical	Wastewater Treatment Plant Headworks Rotopress Compactor	Corroded, deteriorated
31	DIGESTER	Structural	Digester Basin	Issue with cleaning, less issue with cleaning after pump installation, no bypass option, improved aeration 6 years ago but not enough and is unreliable



#	Location	Discipline	Asset Name	Comment
32	FILTERS	I&C	Filters 1-3 Control Panel	Evidence of deterioration-pilot devices are worn-backwashing is local manual and consumes operator time, would be best if process could be automated -flex conduit to jbox is deteriorated
33	FILTERS	Mechanical	Filter#5 Influent Air Operated Butterfly Valve	Valve leaking internally.
34	FILTERS	Mechanical	Filter#6 Influent Air Operated Butterfly Valve	Valve leaking internally.
35	FILTERS	Mechanical	Filters#4-6 Effluent Valve - Air Actuated	Valve leaking internally.
36	FILTERS	Mechanical	Filters#4-6 Backwash Influent - Air Actuated	Valve leaking internally.
37	FILTERS	Mechanical	Filter#4 Influent - Air Actuated	Valve leaking internally.
38	FILTERS	Mechanical	Filter#4 Air Operated Backwash Effluent - Air Actuated	Valve leaking internally.
39	FILTERS	Mechanical	Filter#2 Effluent / Backwash Influent Valve - Air Actuated	Heavily corroded and deteriorated
40	FILTERS	Mechanical	Filter#2 Drain Valve - Air Actuated	Heavily corroded and deteriorated
41	FILTERS	Mechanical	Filters Instrument Air Distribution Lines	Some parts near distribution manifold moderately corroded/deteriorated
42	INFLUENT EQUALIZATION BASIN	Mechanical	Valve Between North and South Influent Equalization Tank	Not able to see, very hard to clean and have access, shared between two tanks
43	MAINTENANCE ROOM - BUILDING B	Electrical	MCC B	No arc flash labels installed; spare breakers can be difficult to obtain based on experience with similar mcc at other facilities - missing/outdated label
44	REACTOR DRYWELL	Mechanical	Submersible Non-Clog Pump West - Near SBR East	Heavily corroded and deteriorated



#	Location	Discipline	Asset Name	Comment
45	REACTOR DRYWELL	Mechanical	Submersible Non-Clog Pump East - Near SBR East	Heavily corroded and deteriorated
46	RESERVOIR	Mechanical	Piping - Contact Chamber Effluent to The Reservoir	Approaching the end of it's useful life due to age. No redundancy.
47	RESERVOIR	Mechanical	Valve - Primary Outflow Pipe	Corroded and deteriorated
48	SECONDARY EFFLUENT EQUALIZATION BASIN	I&C	Secondary Eq Bubbler Panel	Panel is obsolete and well past useful life
49	SEQUENTIAL BATCH REACTORS	Mechanical	East Sequential Batch Reactor Mud Valve - Middle of The Reactor - Under the Walkway	Very small for what it needs to drain
50	SEQUENTIAL BATCH REACTORS	Mechanical	West Sequential Batch Reactor Mud Valve - Middle of The Reactor - Under the Walkway	Very small for what it needs to drain
51	SEQUENTIAL BATCH REACTORS	Structural	Structure Of West Sequential Batch Reactor	Issue with cleaning the SBRs due to minimal slope.
52	SEQUENTIAL BATCH REACTORS	Structural	Structure of East Sequential Batch Reactor	Issue with cleaning the SBRs due to minimal slope.
53	SITE	Electrical	MCC C	No arc flash labels installed. Spare parts difficult to obtain for this vintage mcc. Evidence of deterioration. Recommend changing area to filters or site. Minor rust on enclosure

15.4 Remaining Useful Life

To project future rehabilitation and replacement needs, it is key to estimate the remaining useful life (RUL) of assets. While condition assessment provides important insight into the current state of the assets, it does not paint the entire picture without an understanding of the RUL of each asset. To confidently calculate the RUL of assets, it is important to first determine the nominal and customized useful life of each asset. Useful lives are enhanced or diminished by factors such as operating environment, operational history, maintenance procedures, construction quality, material quality, external stresses, among others. For



estimation of the RUL of the assets, Hazen started with the base useful life values obtained from the institutional knowledge and previous projects for individual asset class and asset type. These base useful life values for each asset class and type were then customized for TCWD’s facilities based on the condition assessment results and the actual performance of the assets over time to estimate expected useful life. Table 15-14 shows the customized total expected useful lives based on asset class and asset type applied for RUL estimation.

Table 15-14: Customized Expected Useful Life for the Asset Classes and Asset Types

#	Class	Type	Expected Useful Life (Year)
1	Ac Unit		15
2	Access Gate	Manual	35
3	Access Gate	Motorized	25
4	Access Gate	Rolling	30
5	Access Hatch		50
6	Aerator		15
7	Air Compressor		25
8	Air Compressor	Reciprocating	15
9	Air Compressor	Rotary Vane	25
10	Air Filter		35
11	Air Handling Unit		30
12	Air Ventilation System	Duct	40
13	Air Ventilation System	Exhaust Fan	30
14	Air Ventilation System	Louver	30
15	Air Ventilation System	Supply Fan	40
16	Alarm Dialer		15
17	Analytical Instrument	Chlorine Analyzer	15
18	Analytical Instrument	DO Analyzer	15
19	Analytical Instrument	Meter	15
20	Analytical Instrument	Pressure Gauge	15
21	Analytical Instrument	Residual Analyzer	15
22	Analytical Instrument	Turbidimeter	15
23	Antenna Tower		20
24	Bar Screen	Climber	50
25	Battery	Alarm Dialer	5
26	Battery	Generator Battery	5
27	Battery	Plc Battery	5
28	Belt Press Filter		35
29	Blower	Air Scour	25
30	Blower	Centrifugal	40
31	Blower	Positive Displacement	40
32	Bubbler		15
33	Building		75
34	Camera	Safety	20
35	Compacter		20
36	Condensing Unit		15
37	Control Panel		30
38	Controller	Level	15
39	Controller	PLC	20
40	Controller	RTU	20
41	Crane	Bridge	50
42	Crane	Monorail	40
43	Crane	Potable	40



#	Class	Type	Expected Useful Life (Year)
44	Creek		50
45	Dam		100
46	Detention Basin		50
47	Diffusers Assembly		10
48	Drain		30
49	Engine	Diesel	50
50	Fencing		50
51	Filter	Odor Control	10
52	Filter	Self Cleaning	20
53	Flowmeter		20
54	Flowmeter	Air	20
55	Flowmeter	Magnetic	30
56	Flowmeter	Propeller	20
57	Generator	Diesel	40
58	Hydrocyclone		20
59	Handrail And Catwalk		50
60	Ladder	Fixed	75
61	Level Indicator		15
62	Lighting		40
63	Lighting	Pole	40
64	Lighting	Wall-Mounted	30
65	Manhole Cover		60
66	MCC		30
67	Motor		30
68	Motor Disconnect		35
69	Motor Starter		35
70	Natural Reservoir		100
71	Non-Process Structure		60
72	Non-Process Structure	Canopy	50
73	Non-Process Structure	Concrete Pad	50
74	Non-Process Structure	Manhole	60
75	Non-Process Structure	Vault	75
76	Panel	Alarm Dialer	20
77	Panel	Circuit Breaker	30
78	Panel	Lighting	15
79	Panel	PLC	15
80	Pavement		50
81	Piping	Aboveground	50
82	Piping	Underground	40
83	Power Panel		20
84	Pressure Indicator		20
85	Pressure Transducer		25
86	Process Structure	Basin	50
87	Pump		35
88	Pump	Centrifugal	30
89	Pump	Chemical	15
90	Pump	Hydraulic	25
91	Pump	Jet Aeration	30
92	Pump	Submersible	20
93	Pump	Sump	20
94	Pump	Vertical Turbine	25
95	Radio	General	20
96	Safety Shower/Eyewash		45



#	Class	Type	Expected Useful Life (Year)
97	Sampling Station		15
98	SCADA		20
99	Screen Filter		5
100	Silencer		45
101	Slide Gate		30
102	Stairway And Catwalk		45
103	Static Mixer		10
104	Switch		35
105	Switch	Automatic Transfer	35
106	Switchboard		30
107	Switch	Disconnect	35
108	Switch	Flow	35
109	Switchgear		35
110	Switch	Pressure	10
111	Switch	Transfer	25
112	Tank	Chemical	25
113	Tank	Clearwell	30
114	Tank	Filter	30
115	Tank	Fuel	40
116	Tank	Hydropneumatic	50
117	Tank	Reservoir	60
118	Tank	Sludge	30
119	Tank	Storage	40
120	Tank	Surge	40
121	Tank	Wet well	50
122	Telemeter		25
123	Transformer		25
124	Transformer	Dry Type	25
125	Transmitter		15
126	Transmitter	Level	25
127	Transmitter	Pressure	20
128	UPS		3
129	Valve		30
130	Valve	Air Release	25
131	Valve	Air-Vac	25
132	Valve	Altitude	35
133	Valve	Automated	30
134	Valve	Automated Butterfly	30
135	Valve	Automated-Control	30
136	Valve	Ball	30
137	Valve	Butterfly	35
138	Valve	Check	35
139	Valve	Control	30
140	Valve	Gate	50
141	Valve	Knife Gate	50
142	Valve	Mud	30
143	Valve	Plug	40
144	Valve	Pressure Reducing	30
145	Valve	Pressure Relief	30
146	Valve	Sluice Gate	30
147	Valve	Swing Check	50
148	Variable Frequency Drive		25



For the assets with condition scores, the RUL was calculated using condition scores. The condition-based RUL is a function of percent consumed and expected useful life. The results of the condition-based RUL are recommended to be used for planning rehabilitation and replacement. For the assets with no condition scores, an age-based methodology was followed to calculate the RUL. Figure 15-12 summarizes the methodology for calculating RUL. The results of age-based RUL calculations can be used to prioritize future condition assessment as it is not recommended that the District replace or rehabilitate the assets just based on their age.

$$\text{Remaining Useful Life (years)} = (1 - \% \text{ Consumed}) * \text{Expected Useful Life (years)}$$

$$\% \text{ Consumed} = \exp\left(\frac{\ln\left(\ln\left(\frac{1}{0.582}\left(1 - \frac{\text{Worst Condition} - \text{Condition Score}}{\text{Worst Condition} - \text{Best Condition}}\right) + 1\right)\right)}{\text{Shape Factor}}\right)$$

Where: Worst Condition = 5, Best Condition = 1, and Shape Factor = 1.1

Age-Based:
 Remaining Useful Life (years) = Expected Useful Life (years) - Age (years)

Figure 15-12: Remaining Useful Life Calculation Methodology

Table 15-15 shows the conversion of condition scores into percent consumed.

Table 15-15: Conversion of Condition Scores to Percent Consumed

Condition Score	Percent Consumed
5	100%
4	84%
3	65%
2	39%
1	0%

For example, the submersible pumps located at Robinson Ranch WWTP have the condition score of 3, which corresponds to a percent consumed life of 65% (Shown in Table 15-15). The expected useful life for a pump class is 20 years, which results in RUL of 7 years (35% × 20 years) based on the condition-based approach (shown in Figure 15-12). Similarly, the centrifugal pumps located at lower floor of the blowing room of the Robinson Ranch WWTP, had a condition score of 5 and it was estimated to have zero RUL (consumed 100% of the 30-year useful life). In another example, there is no condition score assigned to the assets that had a desktop condition assessment performed. So, for instance, for the high and low flow pumps of the Shadow Rock Pump Station, following the age-based approach (shown in Figure 15-12), installation year of 2014 (age of 8 years) and expected useful life of 35 years, the RUL is calculated as 27 years (35–8=27). This means no matter what condition the assets are in (as no field condition assessment is performed), the remaining useful life will be estimated based on the install year and the useful life of the assets.



15.4.1 Condition-Based Remaining Useful Life Assessment Results

Figure 15-13 presents a summary of the condition-based RUL analysis results for the assets with condition scores assigned. This figure shows 124 assets, listed in poor condition for the facilities are at the end of their lives. In addition, some assets in fair, average, good, and excellent condition are in need of replacement in the next 20 coming years depending on their expected useful lives.

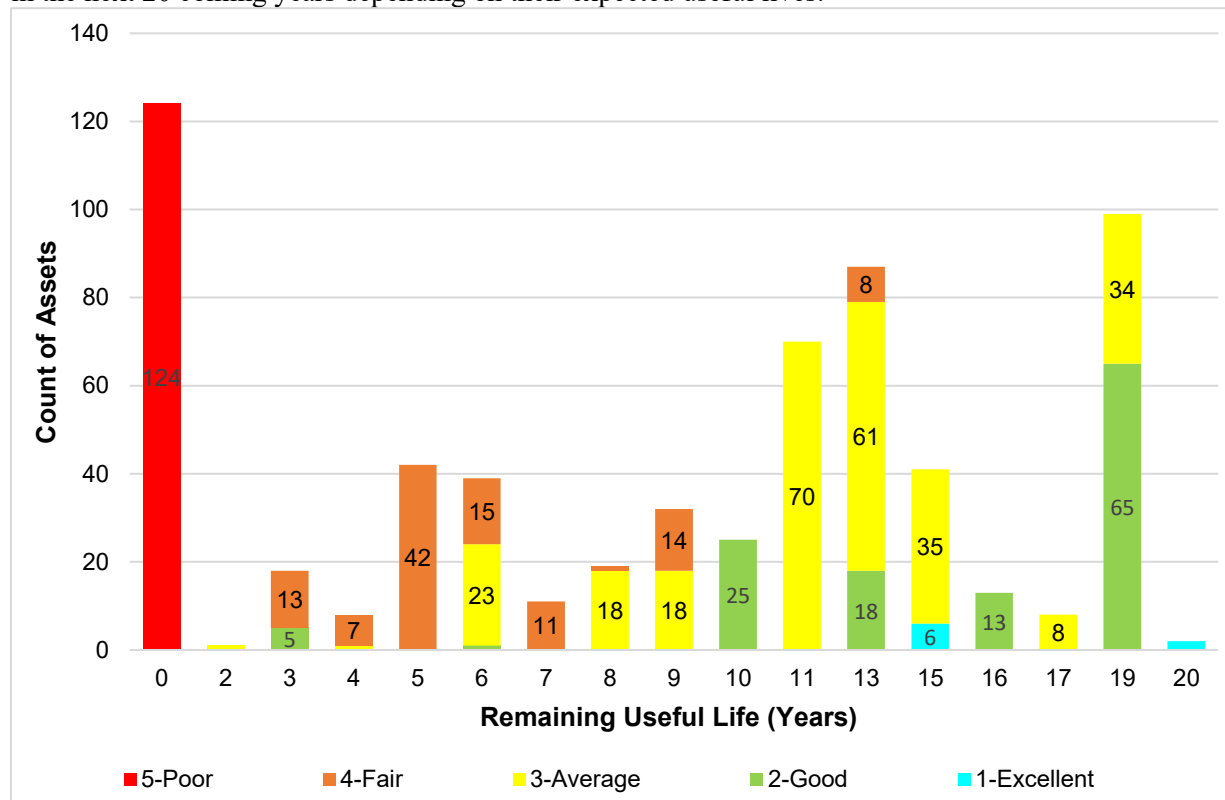


Figure 15-13: Summary of the Condition-based Remaining Useful Life Estimation

Figure 15-14 presents the number of assets in the visually inspected facilities coming up for replacement in the next 10 years based on condition scores.

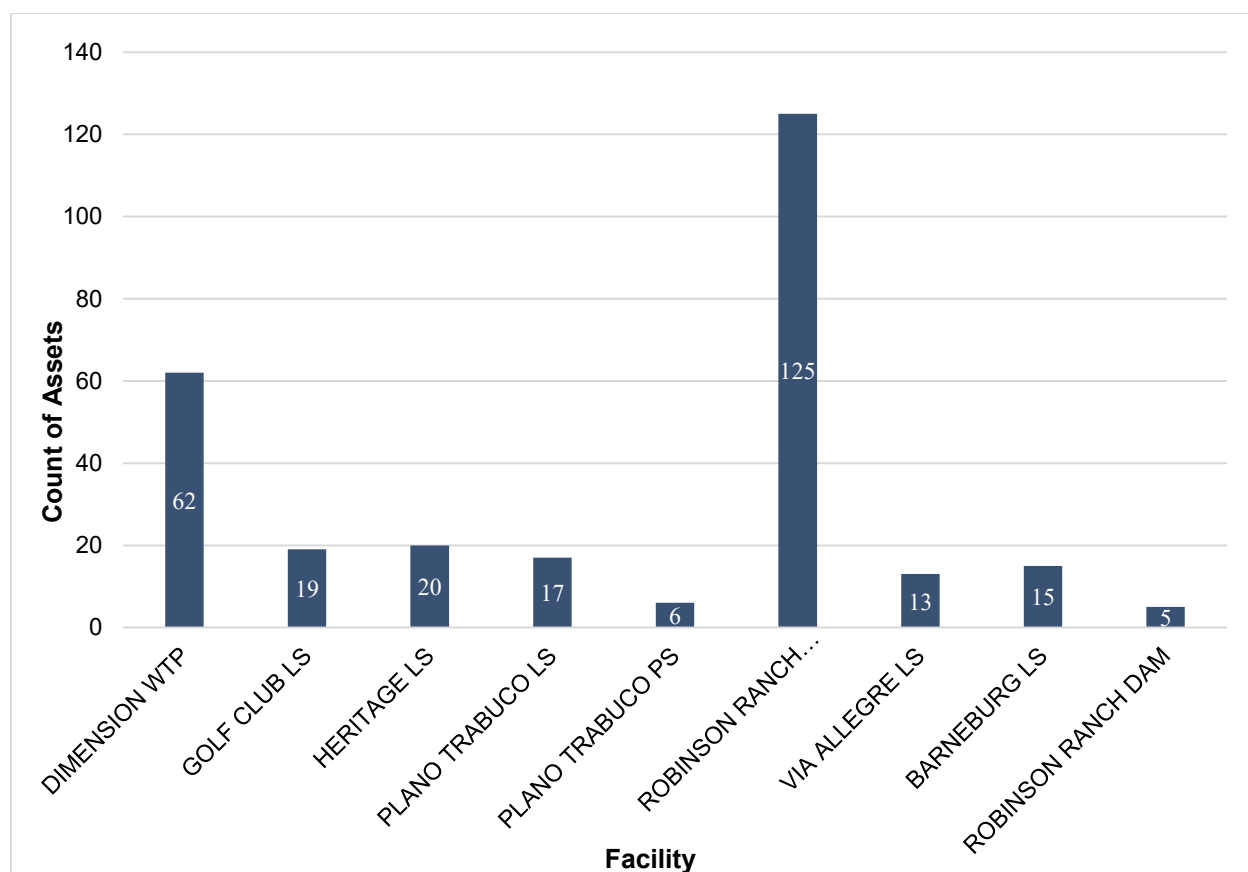


Figure 15-14: Assets Coming for Replacement in the Next 10 Years - Condition-based Approach

15.4.2 Age-Based Remaining Useful Life Assessment Results

Figure 15-15 presents a summary of the age-based RUL analysis results for the assets with no condition assigned. This figure shows the assets coming up for replacement in the next 20 years. As is evident from this figure, 254 assets are at the end of their useful life based on age-based method.

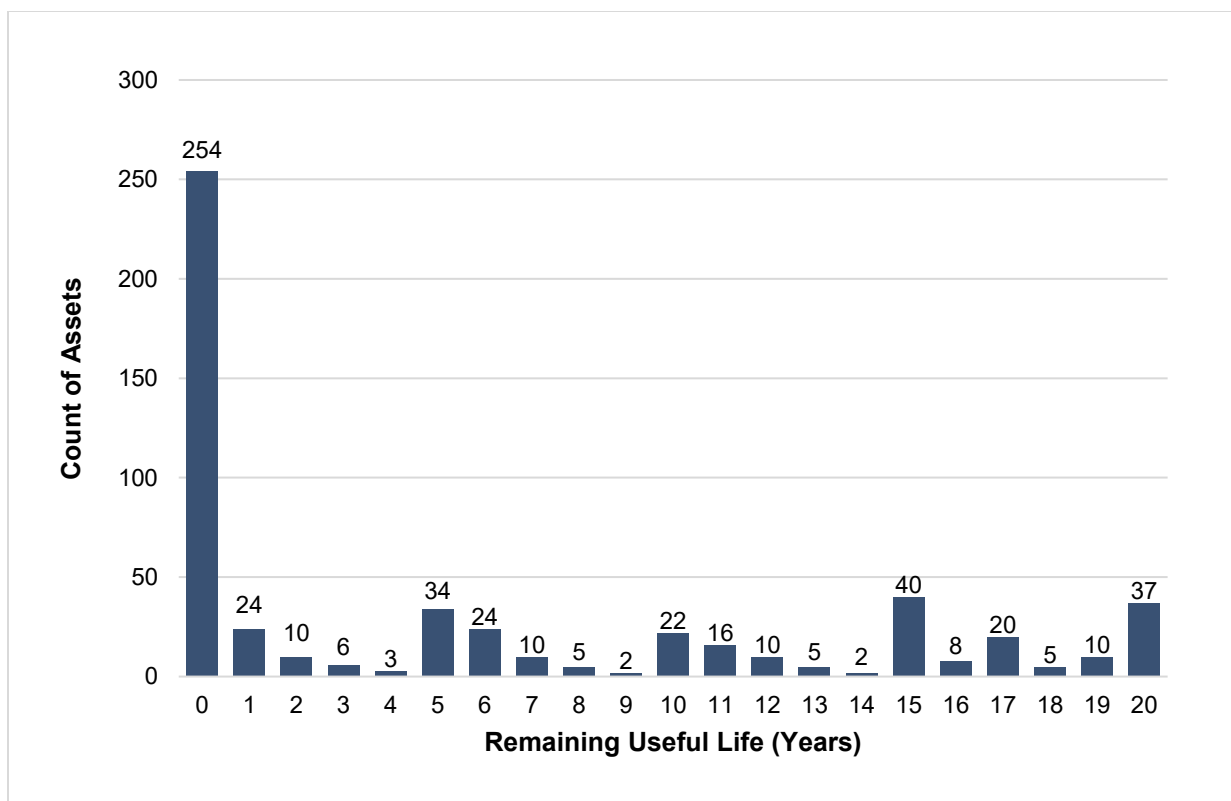


Figure 15-15: Summary of Remaining Useful Life Assessment Results - Assets without Condition Scores

15.5 Summary of Results and Findings

This chapter summarizes the results of the condition assessment for the District assets including the results of the desktop and field inventory, condition assessment, and remaining useful life estimation.

15.5.1 Desktop and Field Inventory

Hazen performed a desktop and field inventory of the District assets. The District existing asset list included only about 700 assets. However, Hazen conducted desktop and field inventory on 833 and 754 assets, respectively, for a total of 1,587 assets inventoried in 43 facilities.

15.5.2 Field Condition Assessment

The field condition assessment was performed in ten facilities including five lift stations, one pump station, one water and one wastewater treatment plant, one reservoir, and one dam facility. The obtained results show that out of the 754 assets inspected during field visits, 296 assets (39%) were in average, and 212 assets (28%) were in good condition. 102 assets (14%) were deemed to be in fair condition and 79 assets (10%) were found to be in poor condition. The Robinson Ranch WWTP, the facility with the highest number of assets, has the highest percentage of assets in poor condition (18%) while the assets in fair



condition are also relatively high in this facility (18%). Other facilities with a relatively high percentage of poor assets are the Golf Club LS (13%) and Plano Trabuco LS (11%).

15.5.3 Remaining Useful Life

Remaining useful life estimation was performed for the assets through condition-based and age-based method. Condition-based remaining useful life results show 124 assets in the facilities where field condition assessment was performed, are at the end of their useful life. Age-based remaining useful life results show 254 assets with no condition assigned that are at the end of their useful lives. While the results of the condition-based RUL can be used for planning rehabilitation and replacement, the age-based RUL calculations should only be used to prioritize the future condition assessments.