Hazen

TRABUCO CANYON WATER DISTRICT

Proposal for

Master Plan and Condition Assessment Study

September 23, 2021 | Project No. 2122-012

Hazen and Sawyer
7700 Irvine Center Drive, Suite 200
Irvine, CA 92618 • 949.557.8549

September 23, 2021

Trabuco Canyon Water District (Administration Office)
Attn: Ms. Lorrie Lausten, P.E.
32003 Dove Canyon Dr.
Trabuco Canyon, CA 92679

Re: Master Plan and Condition Assessment Study (Project No. 2122-012)

Dear Ms. Lausten:

Thank you for the opportunity to propose on the Master Plan and Condition Assessment Study. It has been over 20 years since the previous Master Plan. A lot has changed – system facilities, water demands, home-building and development, as well as District staff. We understand the importance of an updated comprehensive Master Plan of the water, recycled water, and sewer systems to better operate your systems and manage your assets.

Much of the District's system facilities were built to meet the needs of the growing communities in the 1980's and 1990's. The pump stations, lift stations, critical transmission mains, and the Dimension Water Treatment Plant were built 30 to 40 years ago. Our team of experienced design engineers will conduct a thorough condition assessment of your facilities, just like we did for El Toro Lift Station to assist you in your negotiations with IRWD. We will develop a risk-based prioritization of the needed upgrades so your capital improvement budget is spent wisely, and focuses on the most urgent needs first.

Hydraulic modeling, and the development of master plans is a core service of our company, and an area of expertise for our Project Manager, Tori Yokoyama. Within the last year, Tori and our team have completed three major system-wide master plans for southern California agencies, which are included as representative projects.

It was a pleasure working with the District on Ridgeline Pump Station, and El Toro Lift Station. We got to know your system, your operations staff, and your expectations.

As this proposal will demonstrate, we bring the exceptional qualifications of our master planning, hydraulic modeling, and condition assessment team, all working together as one seamless unit. Moreover, we bring a proven history of delivering important projects for you - Ridgeline Pump Station, and El Toro Lift Station. For these reasons, we are the most qualified firm to successfully deliver this project for you. We would be honored to be selected for this important project and continue working with the District. Hazen confirms our proposal is valid for 90 days and that we can execute the contract with no exceptions.

Sincerely,

Cindy Miller, PE
Vice President

1014-143

Identification of Firm
Hazen and Sawyer
7700 Irvine Center Drive, Suite 200
Irvine, CA 92618
(949) 557-8549

Contact
Cindy Miller
Vice President
(714) 814-4909
cmiller@hazenandsawyer.com

We confirm that personal or organizational conflicts of interest prohibited by law do not exist.

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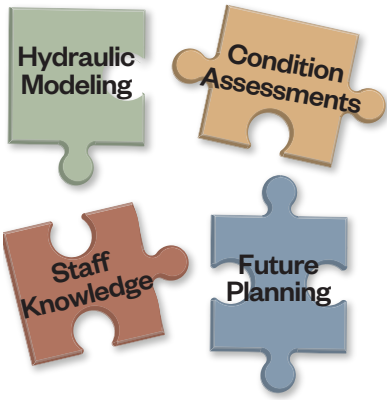
Executive Summary

The Master Plan and Condition Assessment Study is like completing a puzzle. You've done some planning, you've built some projects, you have an idea what should be focused on next along with some critical new pieces currently missing. Now it's time to bring those pieces together, and look at the big picture to make wise decisions about your future investments in your systems.



Scope of Work/Methodology

A primary benefit of a Master Plan is to provide an accurate accounting of what you have – all in one place. You have databases and production records and other documents where this information may reside, but it's not easy to obtain. The information isn't at your fingertips when you need it. A Master Plan will give you that comprehensive document that you need.

The District can't wait for things to break down to start replacing them. Rehabilitation, improvements, and replacements need to start now. But where? Where are we most vulnerable? What should be done first? What should be done next?

Our Project Approach centers on how we will answer the three primary questions:

Where are we at?

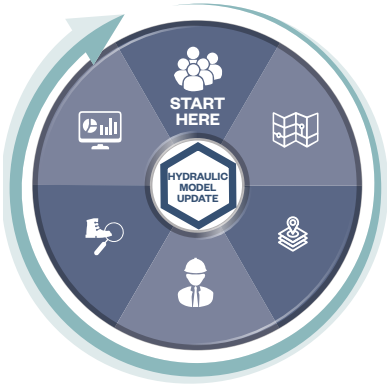
This includes accurate system descriptions, facility descriptions, calibrated hydraulic models, demands and sewer loads, condition assessments, CCTV data, surveyed data, hydrant data, and more.

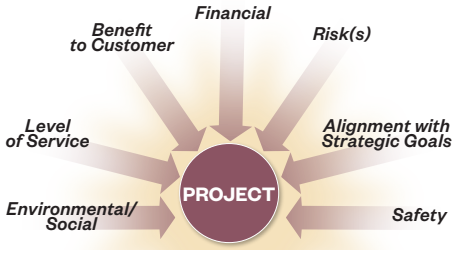
Where will we be?

This includes future modeling scenarios based on demand projections and the projected system performance and deficiencies, life expectancy for equipment and system facilities.

What do we need to do?

Based on where we are at today, and where expect to be in the future, development of a prioritized risk-based capital improvement program to ensure the long-term health of the water, sewer, and recycled water systems.





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A Team You Can Count On

Our team brings exceptional technical expertise, including master planning, modeling, asset management, condition assessment, demand projections, and financial analysis. **All technical and engineering staff are in-house Hazen team members, with all key personnel working from our Irvine office.**

Our team is led by professionals you know and trust. Cindy Miller, Tori Yokoyama, and Steve Conner delivered the critical Ridgeline Pump Station through preliminary design, final design, and support through construction. Along with our Asset Management and Condition Assessment Lead Sean Pour, we completed the study for El Toro Lift Station - a fast-tracked report needed to assess condition and confirm improvement costs. When the District has called, we've always offered timely assistance for other Southern California clients. Our team is ready to do the same for TCWD. This same team has successfully delivered a multitude of major master plan projects over the last 2-3 years.

Cindy Tori Sean Steve

Representative Projects

- City of Beverly Hills - Integrated Water Resources Master Plan (2021)
- City of Chino Hills - Water and Recycled Water Master Plan Update (2021)
- City of Chino - Water Master Plan Update and GIS Conversion Project (2021)
- Eastern Municipal Water District - Sewage Lift Station Condition and Risk Assessment (2019)
- Rancho California Water District - Pump Station Asset Management Program (2021)
- Bryon-Bethany Irrigation District - Mountain House Raw Water Pipeline – Hydraulic Evaluation and Condition Assessment Project (2020)
- Moulton Niguel Water District - Sewer Pipelines Rehabilitation and Replacement Prioritization (2017)

WHY HAZEN? We understand your needs for this project. We know how to get you there. But also, we care about the community. You can trust us to give you the Master Plan Update that exceeds your expectations, and makes the best recommendations for your system. This proposal demonstrates our exceptional qualifications and tailored approach to delivering a successful Master Plan.

Cindy Miller, PE
Principal in Charge

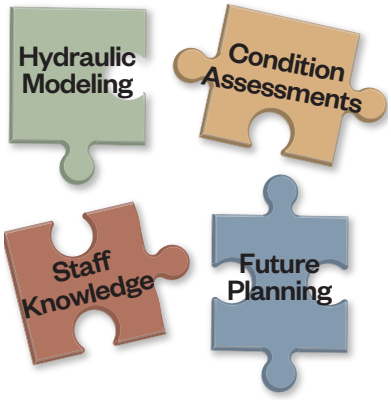
Section 2

Scope and Methodology

Section No. 2

Scope and Methodology

The Master Plan and Condition Assessment Study is like completing a puzzle. You've done hydraulic modeling, you've done some condition assessments, new facilities have been designed and constructed, and you have an idea of what parts of your system you should be addressing. Now it's time to bring those pieces together, and look at the big picture.



Project Understanding

A primary benefit of a Master Plan is to provide an accurate accounting of what you have – demands, services, pipelines, pump stations, reservoirs, pressure zones, supply points, flow meters, control valves, interconnections – all in one place. You have databases and production records and other documents where this information may reside, but it's not easy to obtain. The information isn't at your fingertips when you need it.

In the past 20+ years (since your previous Master Plan), it's safe to say that a lot has changed. Demands peaked in 2015 and then dropped considerably starting in 2016 due to drought restrictions. They've been bouncing around post-drought levels since. You've seen the home-building booms and busts and the slow return again. Facilities are always changing, from changing out pumps, to complete replacements.

The District's system isn't "old" by utility standards, but it was largely built around the same time. The District can't wait for things to break down to start replacing them. Rehabilitation, improvements, and replacements need to start now. But where? Where are we most vulnerable? What should be done first? What should be done next? Based on our understanding of the District, your systems, and our review of the RFP, the primary questions this Master Plan must answer are:

Where are we at?

This includes accurate system descriptions, facility descriptions, calibrated hydraulic models, demands and sewer loads, condition assessments, CCTV data, surveyed data, hydrant data, and more.

Where will we be?

This includes future modeling scenarios based on demand projections and the projected system performance and deficiencies, life expectancy for equipment and system facilities.

What do we need to do?

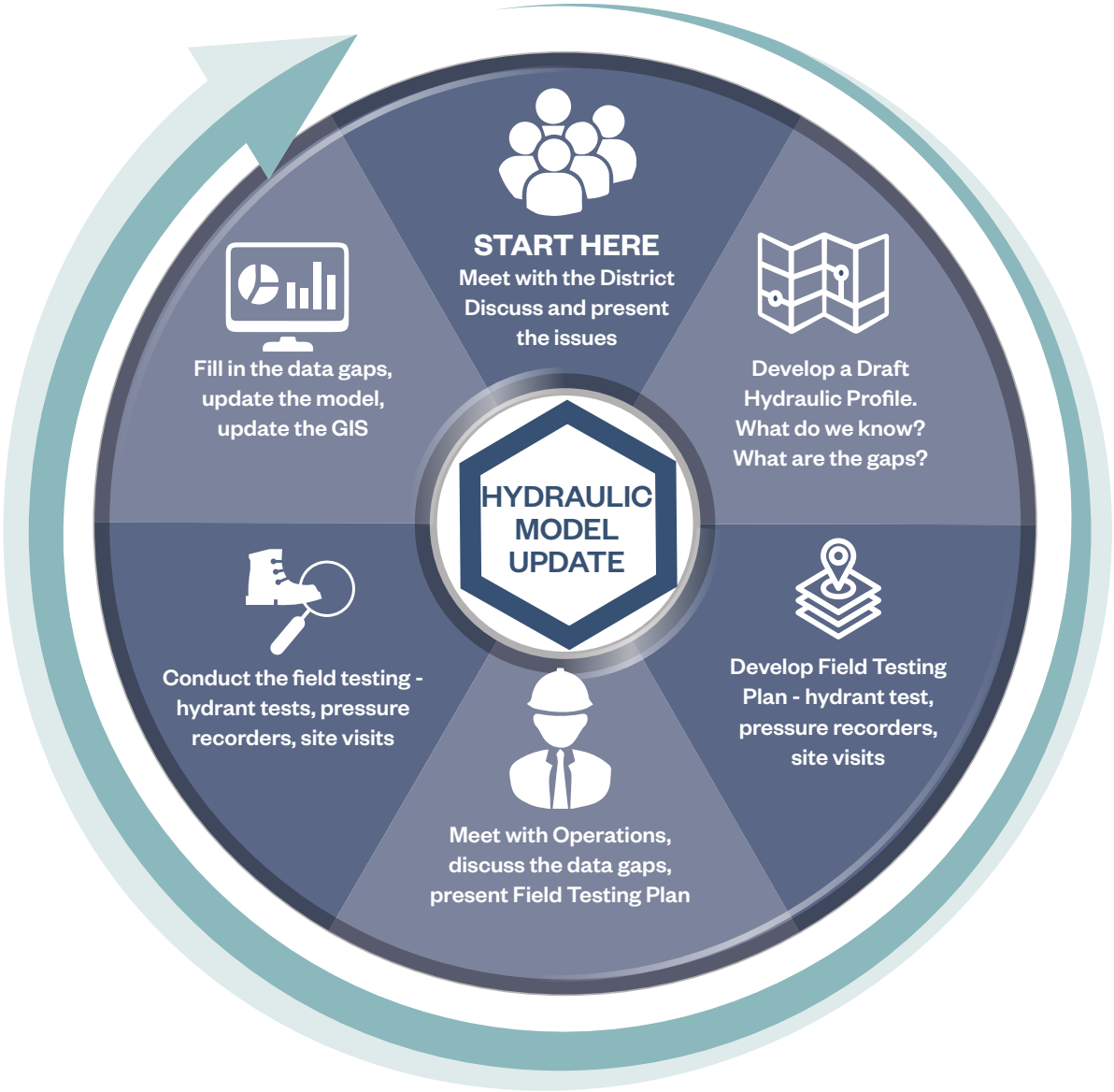
Based on where we are at today, and where expect to be in the future, development of a prioritized risk-based capital improvement program to ensure the long-term health of the water, sewer, and recycled water systems.

Project Approach

Our Project Approach centers on how we will answer the three primary questions: Where are we at? Where will we be? What do we need to do?

Where are we at?

The foundation of a Master Plan is a current and calibrated hydraulic model. Building a hydraulic model forces you to understand the details of how a system operates – how zones are divided, how a pump station operates, settings for control valves, tank level settings, or open and closed valves. We know the water and recycled water models are built, but they're not calibrated. They haven't been validated based on hydrant tests and SCADA data. We have a process for updating your water and recycled water hydraulic models, as illustrated in the graphic below, and expanded upon in the following page.



Water Model – Areas to Focus On

We know the District's hydraulic model well. We used it when designing the Ridgeline Pump Station to assist in developing system curves and conducting the surge analysis. From this knowledge, we also know the areas that we need to tackle first to ensure it is calibrated and accurately representing your system.

1. **Ridgeline Pump Station – Modeling the pump controls correctly**

Ridgeline has a unique control strategy due to being an in-line pump station between Dimension WTP and Harris Grade tanks. It is controlled based on the VFDs targeting a specific suction pressure range and matching flows coming from DWTP. This is atypical from most pump stations that are controlled by discharge pressure or a downstream tank level. Although we had a meeting with Psomas after construction to ensure they updated the model correctly, since we are both the engineer of record for the design of Ridgeline, and expert hydraulic modelers, we will ensure this control strategy is accurately set up in the model.

Steve Conner, Engineer of Record for Ridgeline Pump Station

2. **Modeling DWTP to Ridgeline Flow Discrepancy**

The flow from DWTP goes directly to the Ridgeline PS, where it is pumped to Harris Grade. However, the flow measured at DWTP is off from the Ridgeline PS flow by approximately 1 cfs. Both flow meters were independently calibrated and confirmed to be accurate. There are two connections served between DWTP and Ridgeline, but that should not account for the 1 cfs difference. If a leak were occurring in this quantity, it would not go unnoticed. But regardless of whether the reason for that flow discrepancy is discovered, it is important that the existing condition is modeled accurately.

Modeling team member Peace Maari setting up a pressure recorder for model calibration.

3. **Hydrant Tests and Pressure Recorders for Model Calibration**

The hydraulic model is built and substantially complete as far as the architecture, but it is not calibrated. We will develop a field testing plan and lead this process. Field testing will provide the validation needed for model calibration. Through the use of hydrant tests, pressure recorders (which we have and can provide to the District for this project), and tank level measurements, we will ensure the hydraulic model accurately represents the actual real world system conditions. We have done this for multiple local agencies within the last year including Moulton Niguel Water District, City of Chino, City of Chino Hills, and City of Beverly Hills.

Moulton Niguel Water District staff conducting hydrant test with Hazen team member

Another critical part of answering the question 'Where are we at?' is developing your asset inventory and conducting condition assessments of your facilities.

Asset Inventory

Understanding what assets the District owns, what condition they are in, when they need to be replaced or rehabilitated to ensure reliability of the water, recycled water and sewer systems and understanding how much it will cost is vital to understanding the long term funding needs of the District. Hazen's approach to achieve these objectives includes:

- Development of an asset inventory
- Condition Assessment
- Risk Assessment
- Asset Replacement Cost Estimates

Hazen electrical engineers discussing El Toro Lift Station with Jason Stroud.

Data Collection and Consolidation

First, Hazen will use the following type of information, to develop and populate an asset inventory with asset data for the District's assets.

- Drawings
- Electronic O&M Manuals
- Maintenance Records
- GIS geodatabase and shapefiles for water and sewer pipelines
- Hydraulic Models
- Bid Documents

Information gathered during the data collection or created during this project is summarized in the Table below.

Physical Attributes	Groupings	Remaining Useful Life	Valuation	Risk	Pump Specific Data
Asset ID	Discipline	Condition	Unit Cost	PoF	UNITID
Material	Assembly	Expected Useful Life	Original Cost	Asset-level CoF	PM Frequency
Size	Class	Customized Useful Life	Replacement Cost	Facility-level CoF	Pressure Zone (from)
Manufacturer	Type	Install Year	Rehabilitation Costs	Risk Score	Pressure Zone (to)
Serial No.	Sub-type	Age			Efficiency
Model		% Consumed			Elevation
		Rehab Year			Shutoff, Design, and Low Heads
		Rehab Description			Design and High Flows

The data will be assembled into a preliminary asset inventory and our Team will perform a data gap assessment to identify any gaps in the asset attribute data (e.g., install year, material, size). Data gap closure strategies will be presented to the District for consideration and the best strategies will be implemented to close the data gap. Once a strategy has been developed to close the data gaps, the field condition and performance assessment can commence.

Field Condition and Performance Assessment

The condition assessment includes two components, (1) a desktop condition and remaining useful life evaluation of all District above and below-ground assets, (2) hydraulic assessment and (3) visual condition assessment investigating the physical and functional condition of all structural, mechanical, electrical and instrumentation components of the following pump stations, lift stations and discharge pipeline identified in the RFP which included:

- Barneburg LS
- Golf Club LS
- Heritage LS
- Via Allegre LS
- Plano LS/PS
- Above ground visible segments of 3 miles of 16" CML&C discharge pipeline from Dimension Water Treatment Plant (DWTP) to Ridgeline/El toro Pump Station and DWTP

Prior to conducting the field condition assessment of pump/lift station facilities and discharge pipeline, Hazen will prepare and submit ESRI Survey 123 electronic forms that automates data collection to improve efficiency and consistency for the District review. The electronic forms will outline the specific condition assessment approach considering the distinctive characteristics of assets (e.g., site, structural, mechanical, and electrical) and will ensure consistency of field inventory and condition assessment processes and results.

The Hazen Team will leverage the knowledge gained during the documentation review and input from District staff to determine the level of condition assessment for each facility to prepare a Site Progression Plan prior to the field visits. The Site Progression Plan will establish a systematic approach to progressing through the field inventory and condition assessment. Once complete, a review meeting will be scheduled with the District to go over the process and clarify any final comments, questions, or concerns.

The field inventory and condition assessment of the pump/lift stations and above ground segments of the discharge pipeline will include experienced staff in each major discipline (civil, mechanical, structural, electrical, and I&C) who can assess the condition and identify critical issues quickly. Hazen will utilize a structured condition scoring system (score of 1 to 5) which is transparent, repeatable, and useful for later analysis by Hazen and District staff, with each score's definition which can be applied to all asset classes during the field condition assessment. The assessment of equipment will go beyond physical condition assessment to include performance assessment. The performance assessment involves interviews and discussions

Hazen will use iPads preloaded with initial data, developed in a collection form for efficiently gathering field data.

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 signifacant performance deterioration. Refurbishment of 20-40% of asset may be needed within next 2 years.

5 POOR

Asset is very near, or beyond, it's 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).

with O&M staff along with a review of available maintenance records and testing information with a goal of identifying opportunities to optimize operation and maintenance strategies and/or improve performance and possibly reduce costs. All data collected from the field condition assessment for each asset, including photographs of facility assets, the inspectors' notes, condition scores, inspection checklists, etc., are stored digitally and can be exported in a variety of formats.

Utilizing information in the District's geodata base (install year, material, diameter, etc.), any CCTV and break/leakage data, hydraulic models and current and future flow projections provided by the District, Hazen will perform a desktop condition assessment and hydraulic assessment of the domestic water, recycled water and sewer conveyance systems.

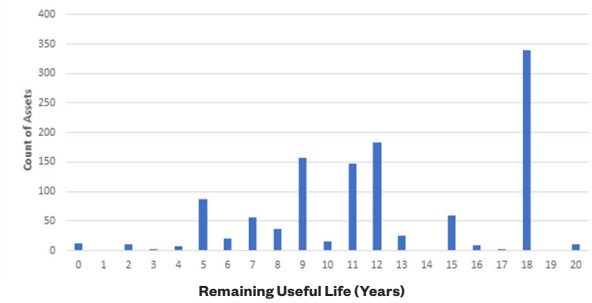
Updated and calibrated hydraulic models, along with a thorough condition assessment and asset inventory of your entire system are the two most important components in answering the question — 'Where are we at'?

Where will we be?

The next step in the master planning process is looking at where we will be in future years. Demand projections and hydraulic modeling will be used to assess the capacity and sizes of facilities, ensuring they can adequately meet the future demands of the system. The other component is looking at remaining useful life of your facilities and equipment.

Remaining Useful Life

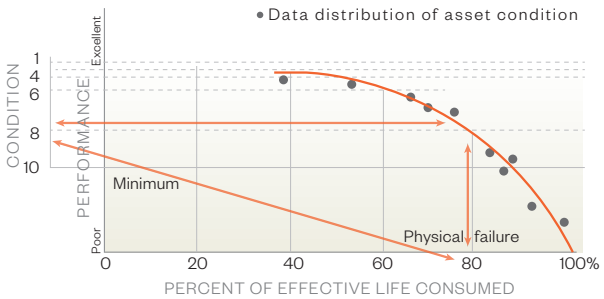
To confidently calculate the remaining useful life of assets, it is important to first determine the realistic and customized useful life of each asset. The estimated lifespans or useful lives will be based on industry best practices (e.g., WERF, AWWA, EPA), experience from local and similar projects, and on-site condition assessment. Useful lives are enhanced or diminished by factors such as operating environment, operational history, maintenance procedures, construction quality, material quality, and external stresses.



Hazen team examining existing pumps at Ridgeline prior to replacement

Hazen will use statistical analyses to determine the deterioration and survival patterns to determine the associated asset remaining life. Hazen will develop decay curves to assess the probability of failure versus the timing of failure. Asset-specific performance survival curves will be used to answer questions such as the proportion of each group of assets surviving past a certain time, and the rate they will fail afterwards. Utilizing the existing data, maintenance history, and the condition assessment scores, Hazen will determine the remaining useful life of each asset in the inventory. The remaining useful life and imminent failure mode will be used to determine the probability of failure.

Tying Condition Score to Asset Failure



Rehabilitation and replacement modeling that is based on the actual performance of the District's assets, as opposed to standard useful life numbers in the indus-

try, will provide more realistic budgetary requirements for future rehabilitation and replacement projects.

The methodologies and results of the desktop and field condition assessment will be summarized in a Technical Memorandum and a workshop will be conducted with the District to present the results and obtain feedback from District staff.

Determination of Replacement Cost

Accurate replacement valuation for individual assets can assist managers by effectively determining the appropriate management of that asset in terms of the present worth determination, appropriate condition monitoring required, optimal maintenance programs, and appropriate renewal strategies.

We understand the importance of providing accurate costs. You make decisions based on estimated costs. You set budgets based on estimated costs. You set rates and fees based on estimated costs.

The Hazen cost estimating staff is solely devoted to providing accurate costs for all Hazen projects, both for master plans and final design projects. **Chris Portner specializes in cost estimating for California construction projects.** He is in-tune of the latest bidding environment, material lead times, contractor profit mark ups, and AACE practices for cost estimating. Chris will provide accurate cost estimates that the District can rely on.

Risk Assessment

An understanding of the risk to the District's ability to provide the desired level of service if an asset fails can be of value to the District for prioritizing asset renewal, maintenance and inspection activities.

The risk assessment is comprised of three major components:

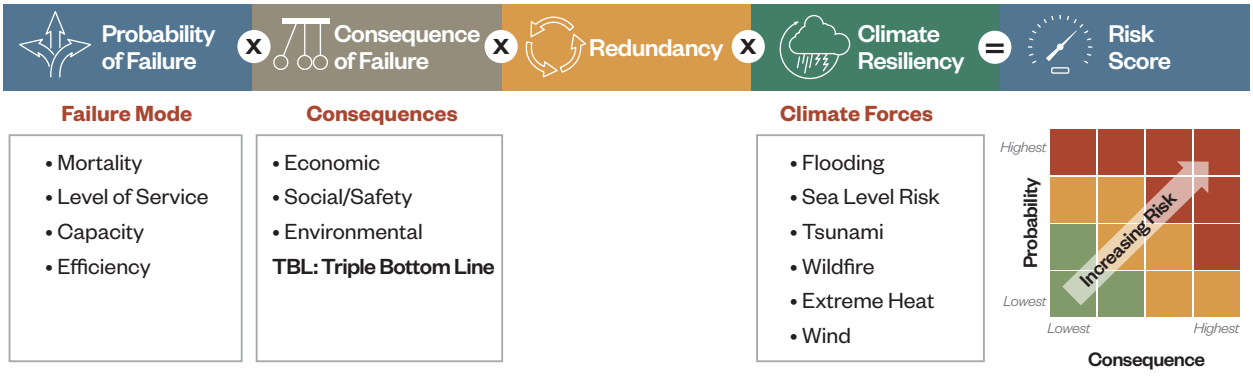
- Probability of failure (PoF) measures an asset's likelihood of or timing to failure.
- Consequence of failure (CoF) evaluates the direct and indirect impacts of a failure.
- Redundancy, the presence of backup asset, helps to decrease the overall business risk exposures.

The PoF will be based on the results of the condition assessment. Through workshops, Hazen will collaborate with District staff to establish environmental, social, and economic consequence of failure (CoF) criteria and criteria weighting for each asset. For pipelines, risk assessment can be done relatively quickly using available GIS data and Model Builder application. To establish a risk-based prioritization methodology, a set of criteria and weighting must be established for consequence of failure and probability of failure to score each pipe segment.

Flow	Land Use	Capital Cost	Public Impact	Proximity to Water Bodies	Accessibility
25%	20%	10%	20%	20%	5%

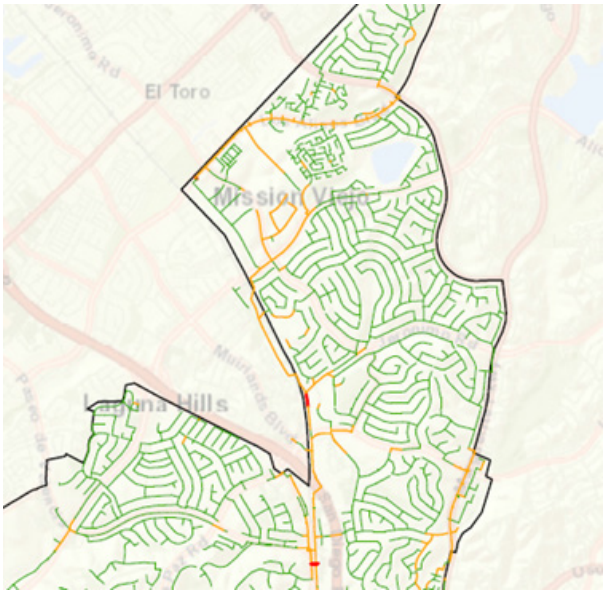
An Example of CoF Scoring Criteria and Weighting

As part of the Master Plan project, Hazen will use the results of the risk assessment to prioritize capital improvement projects and along with geographical region to develop a 5-year prioritized CCTV program for the District's sewer system.



Developing a 5-Year CCTV Program

To develop a 5-year prioritized CCTV program, a decision flow diagram will be developed that uses information such as previous CCTV data, risk scores, remaining useful lives and pipe material. The decision flow diagram will also be used to identify pipe segments that require immediate CCTV. If desired by the District, a CCTV of select pipelines will be performed. Our Team will develop a CCTV data grading logic to convert defect codes into structural and operational grades for each pipe segment. The grading logics will incorporate information such as type of defects as well as their severities and frequencies. The risk and remaining useful lives developed using these new condition data will increase the confidence level in identifying renewal needs.



The pipe segments will be grouped into high risk, medium risk, and low risk categories based on their overall risk score.

Final Asset Inventory

Hazen will provide the District a Microsoft-based Excel asset inventory updated with condition scores, estimated useful life for each asset class, remaining useful life, risk score and replacement cost for each asset. As an added value, the asset inventory will incorporate a Microsoft Power BI dashboard to facilitate the District's ability to easily navigate, filter, drill-down/roll-up and visualize asset data. This feature gives the District a valuable tool to use workshops, management presentations, and incorporating graphics into District staff reports.

What do we need to do?

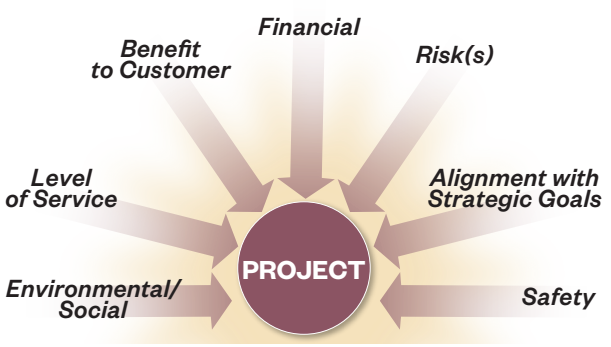
Based on where we are at today, and where we expect to be in the future, the next step is development of a prioritized Capital Improvement Program to ensure the long-term health of the water, recycled water, and sewer systems.

The Hazen team will develop a formal Business Case Evaluation process (BCE) to evaluate and prioritize Capital Improvement Projects (CIPs) based on minimizing the risk and life-cycle cost, while maintaining the levels of service and maximizing benefits. We want to ask ourselves, are we making the right decision, at the right time, at the right cost, for the right reason... **for the District?** We understand the importance of justifying capital expenditures to your Board. We will provide the backup that validates and justifies the investment decision.

Steve Conner observing construction at Ridgeline Pump Station

BCE is a best practice methodology for optimizing, justifying, and documenting investment decisions in a consistent and transparent manner. It provides a well-structured process that ensures transparent, consistent and justified decision-making that documents and highlights the following key decision-making elements.

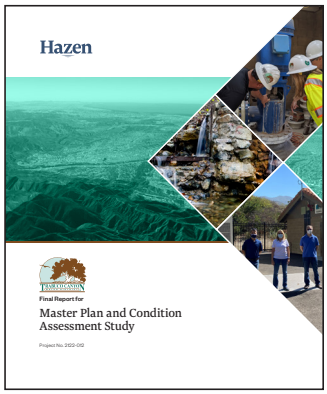
- Project information and requirements
- Business drivers
- Alternative options
- Capital cost
- Life-cycle cost
- Risks
- Benefits
- Benefit cost analysis
- Payback period / return on investment



Incorporating the concept of Benefit/Cost Ratio (B/C), each CIP will be carefully analyzed with respect to initial capital cost, on-going operation and maintenance costs, risk costs, and potential benefits. The solution providing the greatest benefit will formally be recommended for implementation. The results of the BCE will be used to develop the CIPs whose expenditures are focused on **addressing high risk assets first while maximizing benefit to the District.**

Master Plan Update Report

All information developed during the project such as CIP sheets, maps and exhibits and the process followed to develop the Master Plan Update will be compiled into a Master Plan Report. A Draft Report will be submitted for District staff review and comments. All comments gathered from District staff in writing and verbally in meetings will be addressed in the Final Master Plan Update Report.



Financial Analysis

We have developed a tailored approach to conducting the Financial Analysis task described in Task 14. Our in-house financial team led by Alan Karnovitz will assist you in setting future fees for developers.

The 2020 Water Capacity Charges Update recommended that the District increase the three water capacity charges assessed on new development and redevelopment projects involving higher water demand. Specifically, the Update recommended a 12.2% increase (based on the Engineering News Record Construction Cost Index) to reflect construction price increases that occurred since 2015, the last time the water capacity charges were increased. The 2020 Update did not address the methodology used to establish the baseline capacity charges.

Hazen proposes to revisit the method used to the calculate the initial water capacity charges and ascertain whether that methodology is consistent with the current best accepted practices and whether the assumptions originally used remain valid. For example, we will assess whether the capacity fees were developed in alignment with the methods described in the AWWA and WEF manuals for establishing capacity (i.e., development impact) fees. The manual present the three main commonly accepted approaches referred to as "System Buy-in", "Incremental" and "Hybrid". Although, it appears that the initial method used the "Buy In" approach, we recommend a review to determine if any modifications to that method of calculation would be warranted, such as new capital projects completed during the intervening period.

Hazen will also review the key assumptions used to develop the initial capacity fees. For example, the initial fees used the 1999 Master Plan average household demand of 459 gallons per day as one equivalent single family dwelling unit development (EDU). Per capita and per household water demand has substantially decreased in the last 22 years and using this assumption might well overestimate current water demand for new developments and result in potential overcharges. Noteworthy, is that in the 2020 Water and Wastewater Rate study conducted for the District, the Consultant assumed an average daily water demand of approximately 344 gallons demand for a typical household. We will also revisit capacity charges for the Supplemental Water Capacity Fee, which is reserved and allocated to pay the debt service for the COPs.

We want to emphasize that Hazen will only propose methodological changes if required. If the assumptions used to develop the current charges remain valid based on our initial review, we will end our study at that point. Otherwise, we will provide the District with a recommendation for a new method and applicable charges going forward. That method must be transparent, equitable, and legally defensible in accordance with California regulations.

Scope of Work

A detailed scope of work has been provided in the Appendix. The scope is summarized below.

1. **Project Management and Meetings**
    a. Hazen's Project Manager will provide pro-active project management throughout the duration of the project.
2. **Data Collection and Review**
    b. All available information pertinent to this project will be collected and reviewed. Known documents and information to be collected and reviewed include:
3. **Update Water Hydraulic Model**
    a. Model Software
    b. Model Infrastructure Update
    c. Model Controls Update
    d. Water Demands
    e. Future Developments/Customers
    f. Diurnal Curve, Peaking Factors
    g. Field Testing Plan
    h. Hydraulic Model Calibration
    i. Recycled Water
4. **Water System Analysis**
    a. Service and Design Criteria
    b. Demand Projections
    c. Water Supply Evaluation
    d. Existing Water System Evaluation
    e. Future Water System Evaluation
    f. Capital Improvement Program
5. **Recycled Water System Analysis**
    a. Recycled Water Demands
    b. Service and Design Criteria
    c. Existing Recycled Water System Evaluation
    d. Future Recycled Water System Evaluation
    e. Capital Improvement Program
6. **Sewer Model Development**
    a. Model Software
    b. Model Development
    c. Model Calibration / Verification
    d. Baseline / Future Capacity Analyses
7. **Flow Monitoring**
    a. A total of eight (8) monitors for three (3) weeks to capture dry-weather flow conditions.
8. **Asset Management / Condition Assessment**
    a. Data Collection and Consolidation
    b. Field Condition and Performance Assessment
    c. Replacement Cost Estimating
    d. Prioritized CCTV Program
    e. Condition Assessment CIP Development and Business Case Evaluation
9. **Financial Analysis**
    a. Review previous methodology.
    b. Review capacity fees, establish new fee structure if appropriate.
10. **Master Plan Update Report**
    a. Draft #1 Report (60% Completion Level)
    b. Draft #2 Report (90% Completion Level)
    c. Final Report
    d. Board Presentation
11. **Manhole Survey and Dips (OPTIONAL)**
    a. Field Survey 300 manholes and invert elevation.
12. **CCTV of Sewer System (OPTIONAL)**
    a. Please see pricing info below on the scope of services related to CCTV sewer inspection.
        - **Mobilization (one time): $2,500**
        - **6" Clean and CCTV = $2.10/LF**
        - **8"-10" Clean and CCTV = $1.80/LF**
        - **12" Clean and CCTV = $2.10/LF**

Section 3

Team

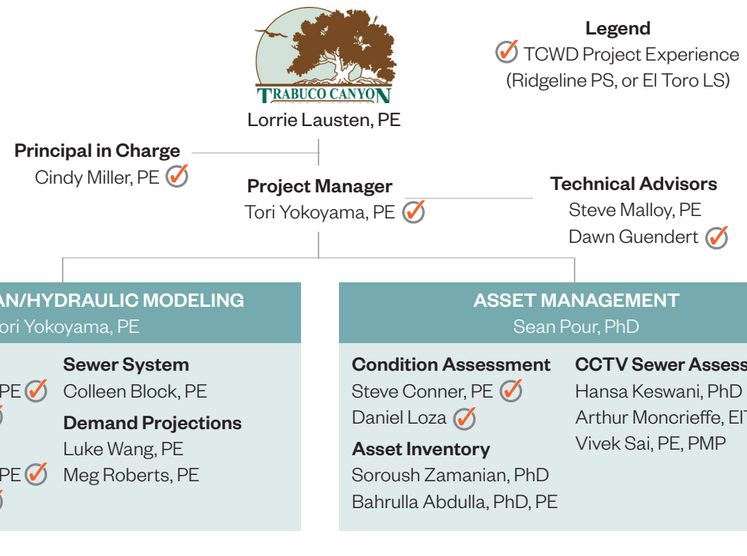
Section No. 3

Team

Our team brings exceptional technical expertise, including master planning, modeling, asset management, condition assessment, and financial analysis. All technical and engineering staff are in-house Hazen team members, with all key personnel working from our Irvine office.

Our team is led by professionals you know and trust. Cindy Miller, Tori Yokoyama, and Steve Conner delivered the critical Ridgeline Pump Station through preliminary design, final design, and support through construction. Along with our Asset Management and Condition Assessment Lead Sean Pour, we completed the study for El Toro Lift Station - a fast-tracked report needed to assess condition and confirm improvement costs. When the District has called, we've always offered timely assistance. This same team has delivered a multitude of major master plan projects over the last 2-3 years.

All of the people you will regularly interact with live locally in south Orange County and are based in our Irvine office. We are always available for a last minute site visit or meeting when needed. We are here to support you in any way you need us. Our team is also supported by specialty subconsultants for manhole dips, flow monitoring, and CCTV inspections.



Cindy Miller, PE

PRINCIPAL IN CHARGE

TCWD Benefits

- ✓ PIC for Ridgeline Pump Station, El Toro Lift Station
- ✓ PIC for three master plans over the last year
- ✓ Extensive experience advising local water agencies.

Cindy brings a wide range of experience, knowledge, and perspective to this incredibly important project for TCWD. Being both PIC, Project Manager, and Owner's Agent for a multitude of clients throughout Southern California, she will be able to guide Hazen's technical team, and advise TCWD leadership throughout this project. Cindy will be a valuable resource to TCWD, and looks forward to continuing to work together.

Tori Yokoyama, PE

PROJECT MANAGER

TCWD Benefits

- ✓ Project Manager for Ridgeline PS, El Toro LS
- ✓ Project Manager for 3 similar master plans within the last year
- ✓ Various roles on 20 system-wide master plans throughout career

Tori is a Technical Project Manager, and has proven his dedication to the District through responsiveness and assistance, regardless of whether we were working on an active project or not. Delivering the critical Ridgeline Pump Station from concept, to design, to construction, and operation proved his ability to bring a technical team of experts together to meet the District's high expectations. Delivering the fast-tracked El Toro Lift Station showed his ability to meet a tight schedule. Tori is a dedicated Project Manager, with personal expertise in hydraulic modeling and master planning. He is the right person for this project.

Sean Pour, PhD

ASSET MANAGEMENT

TCWD Benefits

- ✓ El Toro Lift Station team member
- ✓ Project Manager on multitude of asset management and condition assessment projects

Sean, along with Tori and Cindy work together in Hazen's Irvine office. Sean has grown Hazen's Asset Management group over the last 5 years from doing small single facility condition assessments to system-wide asset management projects. Sean has proven to be exceptional at presenting complex management of data and assessments into easy-to-comprehend and implementable solutions. Sean will work seamlessly with Tori in linking the hydraulic modeling work to the asset management work.

Steve Conner, PE

CONDITION ASSESSMENT

TCWD Benefits

- ✓ Design Lead for Ridgeline PS, El Toro LS
- ✓ Worked closely with TCWD Operations staff
- ✓ Technical "guru" on PS', LS's, and other system facilities
- ✓ Lead mechanical and civil expert on all Hazen's facility condition assessments

Steve led the design of Ridgeline Pump Station, and the technical condition assessment at El Toro Lift Station. Steve worked closely with TCWD Operations staff (Jason Stroud, Gary Kessler) from the very beginning - asking them their design and material preferences, and then working with them throughout our projects to ensure we were delivering facilities that were consistent with their expectations. Steve will be a valuable resource on this project - providing TCWD with the highest level of technical expertise.

Steve Malloy, PE

TECHNICAL ADVISOR

TCWD Benefits

- ✓ 30+ Years working for Irvine Ranch Water District - understanding from the Owner's perspective
- ✓ Oversight on three major system-wide master plans,

Steve understands your challenges as an Owner. Not only your challenges, but your expectations, your needs for Board presentations and staff reports, and unmovable deadlines. Steve's 30+ year career working at IRWD included oversight of final designs, construction, and a multitude of both system-wide master plans and subarea master plans. As a technical advisor on our team, Steve will not only provide valuable QC to our deliverables, he will also be a valuable resource to TCWD providing insight from another agency's perspective.

Crystal Broadbent, PE
Peace Maari, PE

WATER SYSTEMS I RW SYSTEMS

TCWD Benefits

- ✓ Performed hydraulic modeling and surge modeling for Ridgeline Pump Station
- ✓ Modeling and master planning expertise

Crystal and Peace know your hydraulic model very well. They used it for Ridgeline Pump Station to assist Steve Conner in developing system curves for the pump selection, and also to conduct the surge analysis. Hydraulic modeling is something they do day-in/day-out, every day. Beyond them, they regularly work with our modeling staff located throughout the country and AWWA recognized experts in hydraulic modeling Meg Roberts and Dr. Michael Wang (authors and contributors of AWWA manual for hydraulic modeling M32). Crystal and Peace will lead our effort to update and calibrate your water and recycled water model.

FUSCOE ENGINEERING — full circle thinking

SURVEY (MANHOLE DIPS)

Fuscoe's Survey & Mapping department utilizes state-of-the-art electronic survey equipment for accurate and efficient survey data collection even in the most remote or inaccessible locations. Fuscoe's field survey crews are each headed by a manager with over fifteen years of experience and are supported by an office staff, which includes fifteen licensed Professional Land Surveyors.

ADS ENVIRONMENTAL SERVICES

FLOW MONITORING

Founded in 1975, ADS Environmental Services is headquartered in Huntsville, AL. ADS currently maintains 21 offices throughout the Country with local offices in Huntington Beach and San Diego, CA. ADS is largest and longest serving flow services provider in the Country, we have as assisted thousands of municipalities around world providing critical flow and rainfall monitoring data. ADS is an organization with both a product and service offerings with internal functions ranging from product design and manufacturing, field services, data analysis and web based reporting. ADS is committed to continuous improvement in our project management and execution, we have developed and adhere to the strenuous internationally recognized ISO 9001 quality management program, this not only covers our manufacturing, but all of our procedures including field services, data analysis services, project management and R&D.

NATIONAL PLANT SERVICES — A Carylon Company

CCTV

Founded in 1949, the Carylon Corporation is one of the largest and oldest environmental services corporation in the United States, with 14 wholly owned subsidiary companies located throughout the country. National Plant Services, Inc. is one of those subsidiary companies, and has been serving the needs of our clients in California and the west since 1980. NPS has a valid and active "A" Contractors license in California #351503. We are experts in the inspection, Cleaning, maintenance, and trenchless rehabilitation of sewer and storm lines.

Section 4

Experience and References

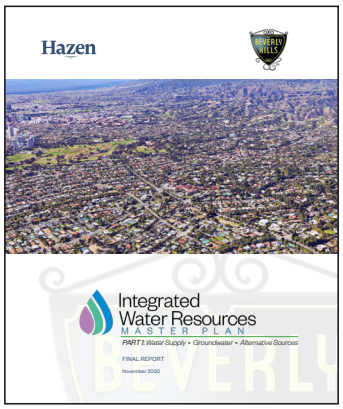
Section No. 4

Experience and References

Due to the page limit, we have provided brief project descriptions on the subsequent pages. For further detail or copies of the project reports, please let us know and we can provide those.

Beverly Hills Integrated Water Resources Master Plan (2021)

City of Beverly Hills, CA



The IWRMP is a comprehensive master plan of the potable water, sanitary sewer, stormwater, and SCADA system. The IWRMP achieved several important goals for the City, including:

- Developing a "Roadmap" for the water system
- Confirmation of future projects that need to be complete to address the needs of the City of Beverly Hills
- Addresses unique City challenges like serving customers beyond their City boundary
- Answers key technical questions

Relevance to this Project

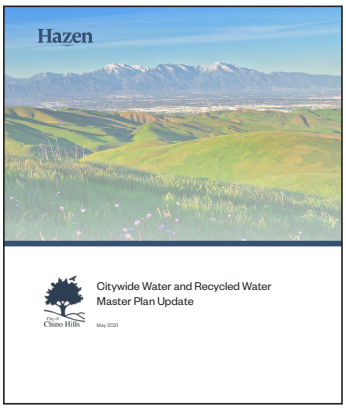
- Water, Recycled Water, Sewer Master Plan
- Hydraulic models developed for each respective system
- Condition Assessments
- Hydraulic model training
- Prioritized CIP using project criteria ranking
- Presentations and workshops conducted for Public Works Commission and City Council Meetings

Reference

Vince Damasse | Water Resources Manager
(310) 285-2491 | vdamasse@beverlyhills.org

Water and Recycled Water Master Plan Update (2021)

City of Chino Hills, Chino Hills, CA



Hazen delivered the City's Water and Recycled Water Master Plan Update. The City's goal was to create a comprehensive updated Citywide water and recycled water master plan complete with a new GIS-based hydraulic model and mapping tools. The document and the new modeling system is a guide for planning, operating, and maintaining the City's water and recycled water systems and infrastructure. The proposed CIP evaluated the City's water and recycled water system and identified recommended projects through year 2045.

Relevance to this Project

- Water and Recycled Water Master Plan
- Urban Water Management Plan
- Demand Projections
- Condition Assessments
- Hydraulic models developed and calibrated for each respective system
- Prioritized CIP

Reference

Fe M. Rama, PE | Senior Engineer
(909) 364-2776 | frama@chinohills.org

Water Master Plan Update and GIS Conversion Project (2021)

City of Chino, Chino, CA

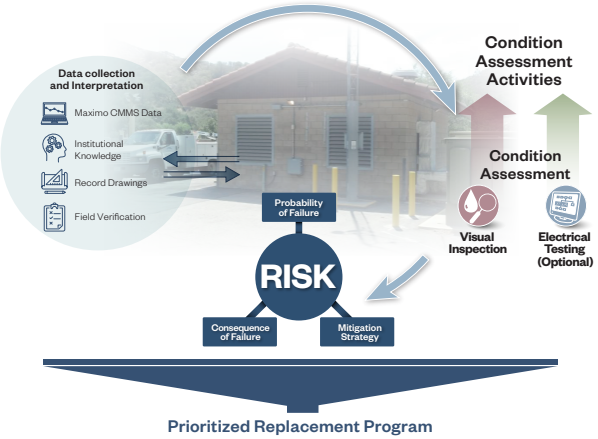
Key components of this project include the creation of a GIS geodatabase of the City's potable water distribution system, preparation of a Water Master Plan Report, and completion of a Risk and Resiliency Assessment. The Water Master Plan effort includes hydraulic model development and calibration; comprehensive hydraulic analysis of the City's conveyance, pumping, and storage facilities; and development of a prioritized Capital Improvement Program.

Relevance to this Project

- Water Master Plan
- Condition Assessments
- GIS Update
-
-

Reference

Amanda Coker | Engineering Manager
(909) 334-3508 | acoker@cityofchino.org



Sewage Lift Station Condition and Risk Assessment (2019)

Eastern Municipal Water District, Perris, CA

Hazen's performed a field condition assessment of 38 lift stations, desktop evaluation of 9 lift stations, risk assessment for assets at all 47 lift stations and determined appropriate rehabilitation or replacement alternatives with cost estimates for future CIP planning. EMWD was provided with the data and an interactive Dashboard to confidently make R&R decisions that will ensure the long-term functionality and reliability of each lift station to meet EMWD's future needs.

Relevance to this Project

- CMMS data gap closure
- Field condition assessment
- Risk assessment
- Replacement Costs
- Prioritized R&R

Reference

William Chen, PE | Civil Engineer, Wastewater CIP
(951) 928-3777 ext 6208 | Chenw@emwd.org

Pump Station Asset Management Program (2021)

Rancho California Water District, Temecula, CA

Hazen implemented an asset management methodology across all the assets of 38 Rancho Water's pump stations within its potable, recycled, and raw water network. Field condition assessment outcomes were used to quantify the remaining useful life and probability of failure. A risk methodology including consequence of failure was developed to prioritize the pump stations R&R and ensure that Rancho Water's CIP will align resources in a manner that will mitigate failure.

Reference

Jeff Kirshberg, PhD, PE
Water Resources Manager
(951) 296-6900
kirshbergj@ranchowater.org

Relevance to this Project

- CMMS data gap closure
- Field condition assessment
- Risk assessment
- Replacement Costs
- Prioritized Maintenance and R&R

Mountain House Raw Water Pipeline – Hydraulic Evaluation and Condition Assessment Project (2020)

Byron-Bethany Irrigation District (BBID), Byron, CA

An evaluation of commercially available, appropriate in-pipe inspection technologies was performed in collaboration with BBID staff. A comprehensive RFP for a short-list of vendors was developed by Hazen for BBID to solicit and select a vendor to complete a visual and structural inspection of the steel pipeline. Hazen managed all activities for the internal condition assessment of the pipeline, which was completed using a non-destructive tool which provided visual and electromagnetic data of the pipeline. Overall results indicated that the pipe is in good condition; only three locations showed measurable pipe wall loss, and minimal sediment buildup was observed.

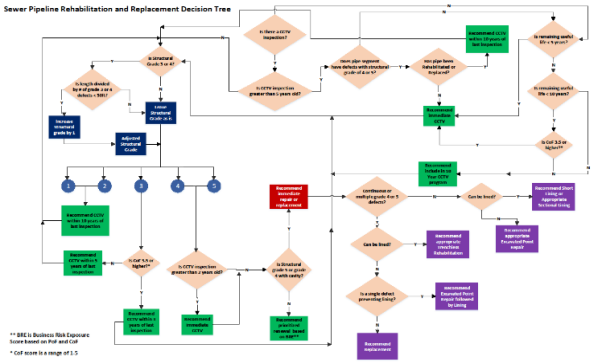
Hazen team members also completed a hydraulic investigation and evaluation of the existing MHRWP to document the real-time pipeline system pressures, establish a baseline condition of the current hydraulic grade line (HGL), and estimate the original design HGL for comparison with the real-time data. The objective of the investigation was to confirm whether the pipeline pressure was within normal operating parameters for the flow deliveries to the CSD WTP.

Relevance to this Project

- Hydraulic Evaluation
- Condition Assessment of Transmission Main
- Technical Report
- Cost Estimate

Reference

Rick Gilmore | General Manager
r.gilmore@bbid.org | (209) 835-0375



Sewer Pipelines Rehabilitation and Replacement Prioritization (2017)

Moulton Niguel Water District, Laguna Hills, CA

Hazen prioritized the collection system rehabilitation and replacement and CCTV activities for the District based on a risk-based approach considering desktop analysis of pipe condition, remaining useful life and consequence of failure. The results of the risk-based prioritization of the District's sewer system pipe segments were used to develop a Sewer Pipeline Prioritization Guidance Document. Hazen's scope included:

- Development of an asset inventory
- Developed risk model for performing probability and consequence of failure analysis
- Prioritized replacement of sewer system pipe segments based on risk model
- Developed a decision tree to identify the type of rehabilitation
- Reviewed CCTV data to assign condition score and determine remaining useful life.

Relevance to this Project

- GIS data gap closure
- Desktop condition assessment
- Prioritized CCTV Program
- Sewer Pipeline R&R Prioritization
- Pipeline R&R Solution Decision Logics

Reference

Todd Dmytryshyn | Senior Engineer
(949) 425-3549 | tdmytryshyn@mnwd.com

Section 5

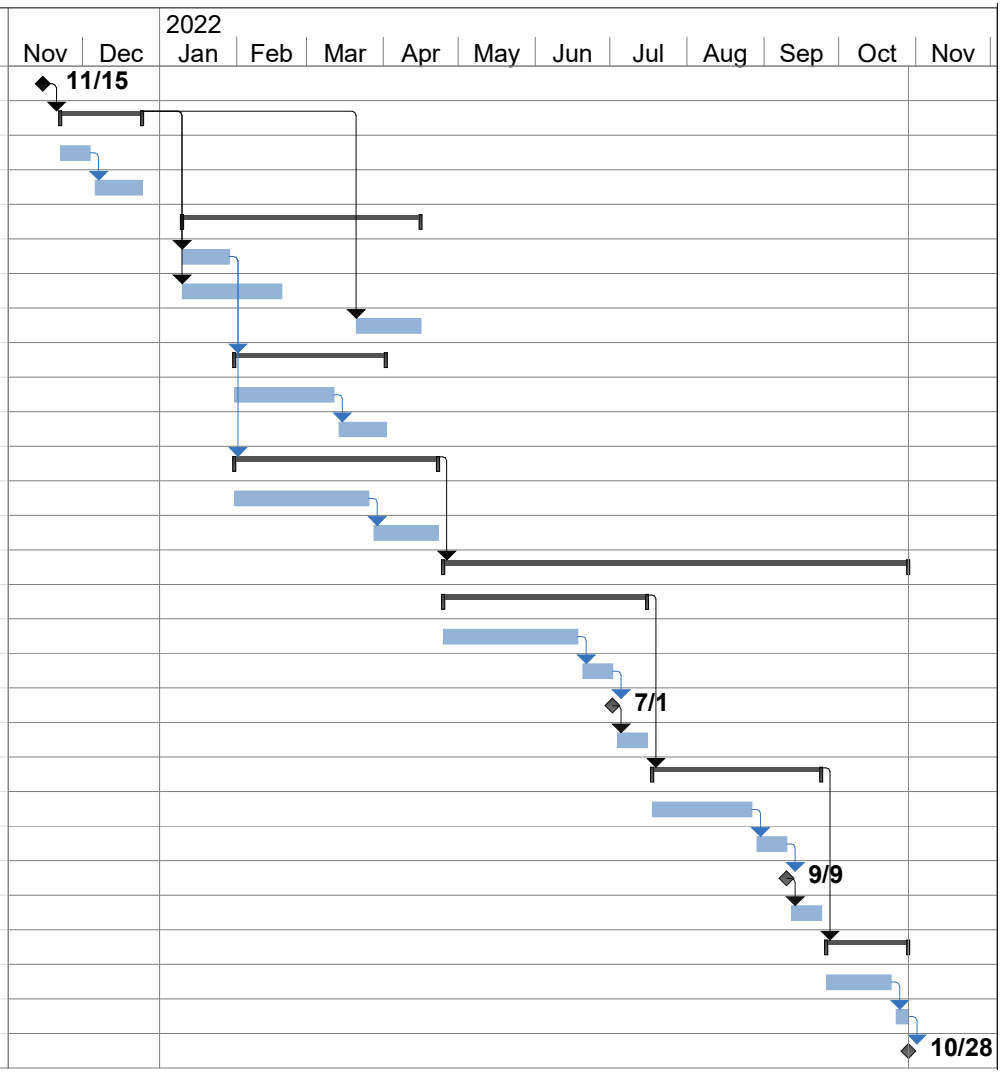
Schedule

Section No. 5

Schedule

Our team is structured to progress the project in the most efficient way. We have the major tasks being led by Tori Yokoyama and Sean Pour, and individual tasks being led by experts in distribution system modeling, collection system modeling, asset management tasks, and financial analysis tasks.

ID	Task Name	Duration	Start	Finish
1	**NOTICE TO PROCEED**	**0 days**	**11/15/21**	**11/15/21**
2	**DATA COLLECTION AND REVIEW**	**5 wks**	**11/22/21**	**12/24/21**
3	Data Collection	2 wks	11/22/21	12/3/21
4	Data Review	3 wks	12/6/21	12/24/21
5	**FIELD WORK**	**14 wks**	**1/10/22**	**4/15/22**
6	Hydrant Tests	3 wks	1/10/22	1/28/22
7	Survey Dips	6 wks	1/10/22	2/18/22
8	Flow Monitoring	4 wks	3/21/22	4/15/22
9	**Condition Assessments**	**9 wks**	**1/31/22**	**4/1/22**
10	Asset Register Update	6 wks	1/31/22	3/11/22
11	Condition Assessments	3 wks	3/14/22	4/1/22
12	**HYDRAULIC MODELS**	**12 wks**	**1/31/22**	**4/22/22**
13	Build/Update Models	8 wks	1/31/22	3/25/22
14	Model Calibration	4 wks	3/28/22	4/22/22
15	**MASTER PLAN UPDATE REPORT**	**27 wks**	**4/25/22**	**10/28/22**
16	**Draft #1 Final Report**	**12 wks**	**4/25/22**	**7/15/22**
17	Analysis/Report Preparation	8 wks	4/25/22	6/17/22
18	QC Report	2 wks	6/20/22	7/1/22
19	Deliverable to TCWD	0 days	7/1/22	7/1/22
20	TCWD Review	2 wks	7/4/22	7/15/22
21	**Draft #2 Final Report**	**10 wks**	**7/18/22**	**9/23/22**
22	Analysis/Report Preparation	6 wks	7/18/22	8/26/22
23	QC Report	2 wks	8/29/22	9/9/22
24	Deliverable to TCWD	0 days	9/9/22	9/9/22
25	TCWD Review	2 wks	9/12/22	9/23/22
26	**Final Report**	**5 wks**	**9/26/22**	**10/28/22**
27	Report Preparation	4 wks	9/26/22	10/21/22
28	QC Report	1 wk	10/24/22	10/28/22
29	Deliverable to TCWD	0 days	10/28/22	10/28/22



Section 6

Budget

Section No. 6

Budget

		Hazen and Sawyer							
Task No.	Description	Principal-in-Charge $300	Project Manager $250	Senior Associate $240	Associate $200	Principal Engineer $175	Assistant Engineer $145	QAQC $250	Subtotal Hours
Task 1	Project Management and Meetings	40	80	0	0	0	16	0	136
a	*Project Management*	*20*	*40*						60
b	*Progress Calls and Meetings*	*20*	*40*				*16*		76
Task 2	Data Collection and Review	0	8	0	8	0	24	0	40
a	*Data Collection and Review*		*8*		*8*		*24*		40
Task 3	Update Water Hydraulic Model	0	32	24	0	64	168	18	306
a	*Model Software Review*		*4*			*8*	*16*	*2*	30
b	*GIS Update*		*2*			*4*	*16*	*2*	24
c	*Model Controls Update*		*2*			*4*	*8*	*2*	16
d	*Water Demand Update*		*2*			*4*	*8*	*2*	16
e	*Future Scenarios*		*2*			*4*	*8*	*2*	16
f	*Diurnal Curve, Peaking Factor Update*		*2*			*4*	*8*	*2*	16
g	*Field Testing*		*2*			*4*	*24*	*2*	32
h	*Calibration*		*8*	*24*		*16*	*40*	*2*	90
i	*Recycled Water*		*8*			*16*	*40*	*2*	66
Task 4	Water System Analysis	0	64	0	0	32	116	10	222
a	*Service and Design Criteria*		*12*			*4*	*12*	*2*	30
b	*Demand Projections*		*4*			*4*	*8*	*2*	18
c	*Water Supply Evaluation*		*12*			*8*	*32*	*2*	54
d	*System Evaluation*		*12*			*8*	*32*	*2*	54
e	*Capital Improvement Program*		*24*			*8*	*32*	*2*	66
Task 5	Recycled Water System Analysis	0	44	0	0	0	92	10	146
a	*Recycled Water Demands*		*8*				*24*	*2*	34
b	*Service and Design Criteria*		*8*				*12*	*2*	22
c	*Existing Recycled Water System*		*12*				*16*	*2*	30
d	*Future Recycled Water System Evaluation*		*8*				*16*	*2*	26
e	*Capital Improvement Program*		*8*				*24*	*2*	34
Task 6	Sewer Model Development	0	28	44	188	0	256	0	516
a	*Model Software Review*		*4*	*4*	*8*		*16*		32
b	*Model Development*		*8*	*16*	*80*		*120*		224
c	*Model Calibration/Verification*		*8*	*16*	*60*		*60*		144
d	*Baseline/Future Capacity Analyses*		*8*	*8*	*40*		*60*		116
Task 7	Flow Monitoring	0	4	0	12	0	12	0	28
a	*Flow Monitoring*		*4*		*12*		*12*		28
Task 8	Asset Management / Condition Assessment	0	4	64	150	96	412	38	764
a	*Data Collection and Consolidation*	*0*	*2*	*2*	*8*	*2*	*158*	*4*	176
b	*Field Condition and Performance*	*0*	*2*	*26*	*54*	*44*	*126*	*16*	268
c	*Replacement Cost Estimating*	*0*	*0*	*4*	*40*	*0*	*24*	*2*	70
d	*Prioritized CCTV Program*	*0*	*0*	*14*	*20*	*26*	*72*	*12*	144
e	*Condition Assessment CIP Development*	*0*	*0*	*18*	*28*	*24*	*32*	*4*	106
Task 9	Financial Analysis	0	16	40	80	0	0	8	144
a	*Financial Analysis*		*16*	*40*	*80*			*8*	144
Task 10	Master Plan Update Report	4	112	0	360	0	416	28	920
a	*Draft #1 Report (60% Completion Level)*		*40*		*140*		*160*	*12*	352
b	*Draft #2 Report (90% Completion Level)*		*40*		*140*		*160*	*12*	352
c	*Final Report*		*24*		*80*		*80*	*4*	188
d	*Board Presentation*	*4*	*8*				*16*		28
	Person-Hours Subtotal	*44*	*392*	*172*	*798*	*192*	*1,512*	*112*	*3,222*

	OPTIONAL TASKS								
Task 11	Manhole Survey and Dips	0	12	0	0	0	24	0	36
a	*Manhole Survey and Dips*		*12*				*24*		36
Task 12	CCTV of Sewer System								
a	*CCTV of Sewer System*	***See pricing ($/LF) provided in proposal.***							

1008-950

Appendix A

Resumes

Cindy Miller, PE

Principal in Charge

Ms. Miller is an experienced Principal in Charge with a long resume of leading the most challenging projects to successful completion. Her experience extends from planning, design, construction, and owner's agent services.

Education

B.S., Civil Engineering, University of California, Irvine

Certification/License

Professional Engineer

Areas of Expertise

- Pipeline Planning and Design
- Project Management
- Program Management
- Project Delivery
- Groundwater Supply
- Well Equipping Planning and Design
- Pump Station Planning and Design
- Reservoir Storage Planning and Design
- Drinking Water

Professional Activities

AWWA, ASCE, AMTA

CA-NV AWWA

CA Water Reuse Association

Her assignments have included providing Program Management services for a $150 million groundwater supply project, which includes wells, pipelines, pump stations, and an advanced treatment system for R.O. concentrate reduction; Project Manager for preliminary and final design of a 28 MGD microfiltration treatment facility, and Project Manager for a 10 MGD R.O./Ion Exchange groundwater treatment plant. Ms. Miller has also led numerous water storage and conveyance infrastructure projects, including design of over 100 miles of pipeline Ductile Iron, CML&C steel, PVC, and HDPE pipeline), design of steel, pre-stressed concrete, and cast-in-place concrete storage reservoirs, up to 10 million gallons, and numerous pump station facilities. She has led feasibility/planning studies, developed treatment process evaluations and life-cycle cost evaluations, participated in value engineering studies and operations evaluations. She has developed detailed designs of many systems and provided construction and startup services. She has experience with different project delivery methods including: design-bid-build, design-build and design-build-operate-finance.

Beverly Hills Integrated Water Resources Master Plan (Water, Sewer, Storm, Recycled, and SCADA), City of Beverly Hills, CA
Principal in Charge for the City of Beverly Hills Integrated Water Resources Master Plan (IWRMP). This is a comprehensive $1.5 M master plan of the potable water, recycled water, sanitary sewer, stormwater, and SCADA system. The IWRMP – Part 1 addresses the City's major water resources strategy which includes imported water, groundwater, and other potential supply sources. Part 1 also addresses other topics including emergency storage for the water system, and stormwater compliance. The IWRMP – Part 2 is a master plan of the water, sewer, and storm drain systems. For each system, the document addresses the existing system and service area, evaluation and design criteria, system analysis, and capital improvements. The theme of the IWRMP is to focus on near-term practical solutions with an eye towards what could be done in the future. The near-term represents a focus on projects that should be implemented within the next five years – 2021 through 2025. An eye towards the future includes taking the necessary steps now to position for long-term resil-

Hazen

iency and reliability of the City's water, sewer, and storm drain systems. The IWRMP achieved several important goals for the City, including hydraulic model updates and calibration, long-range demand forecasting, and independent analysis of each of the systems.

Chino Hills Water and Recycled Water Master Plan, Chino Hills, CA
Principal in Charge. Hazen and Sawyer is currently delivering the City's Water and Recycled Water Master Plan Update. In July 2008, the City of Chino Hills approved and adopted the October 2005 Water, Recycled Water, and Sewer Master Plan. Since 2008, the City has evolved into a more fully developed and almost "built-out" community. Several of the CIP and recommended actions identified in the 2005 Master Plan have been implemented. The City recognizes the need to update the 2005 Water and Recycled Water Master Plan and develop the tools needed to assist in planning, operating, and maintaining the City's aging water and recycled water systems and infrastructure. The City's goal is to create a comprehensive updated Citywide water and recycled water master plan complete with a new GIS-based hydraulic model and mapping tools. The document and the new modeling system will be a guide for planning, operating, and maintaining the City's water and recycled water systems and infrastructure. The proposed CIP will evaluate the City's water and recycled water system and identify recommended projects through year 2045. Major scope elements include hydraulic model development and calibration (InfoWater), system analysis, condition assessment of high priority facilities, Urban Water Management Plan, Water Shortage Contingency Plan, Master Plan final report, and a prioritized Capital Improvement Program.

Water Master Plan Update and GIS Conversion Project, City of Chino, Chino, San Bernardino County, CA
Principal in Charge. The City of Chino serves over 12 million gallons per day of potable water to a population of approximately 74,000. Key components of this project include the creation of a GIS geodatabase of the City's potable water distribution system, preparation of a Water Master Plan Report, and completion of a Risk and Resiliency Assessment for compliance with America's Water Infrastructure Act requirements. The Water Master Plan effort includes hydraulic model development and calibration; comprehensive hydraulic analysis of the City's conveyance, pumping, and storage facilities; and development of a prioritized Capital Improvement Program for the planning horizon including preliminary cost estimates.

Water Master Plan & Hydraulic Model Update, Indio Water Authority
Principal in Charge of updating the previous master plan and hydraulic model. Hazen updated the Authority's 2012 Master Plan to reflect updates to the system and ongoing changes in the management of groundwater in the Coachella Valley.

Chino I Desalter VOC Treatment, Chino Basin Desalter Authority, CA
Project Manager. The project includes preliminary and final design of two (2) GAC treatment facilities (1.7 mgd and 3.4 mgd) at the Chino I Desalter Plant for the removal of TCE and 1,2,3-TCP, and evaluation of treatment requirements for 1,4-dioxanr, cis-1,2-DCE, 1,2-CDA, PFOA, and PFOS. The goal of this project is to provide groundwater treatment for all CDA bypass wells (CDA Wells I-1 through I-4), and several treated wells (CDA I-16 through 18), plus 10 new wells that will be installed by the County of San Bernardino as part of a Cleanup and Abatement Order issued by the Santa Ana Regional Water Quality Control Board (SARWQCB).

Chino Feasibility Study and Eastside Expansion for 1,2,3-TCP, Nitrate, and Perchlorate
Principal in charge for the City of Chino to identify a permanent solution to fully utilize all City groundwater wells by addressing water quality issues. Treatment and non-treatment options were evaluated for the City's twelve wells.

Tori Yokoyama, PE

Project Manager | Master Plan/Hydraulic Modeling

Mr. Yokoyama has extensive experience developing hydraulic models, performing hydraulic analyses, and preparing master plan reports for various public sector clients. He is proficient in all hydraulic modeling platforms commonly used by various agencies.

Education

B.S. Civil Engineering, Cal Poly San Luis Obispo

Certification/License

Professional Engineer

Areas of Expertise

- Master Plans
- Hydraulic Modeling
- Pipelines
- Pump Stations
- Reservoirs
- Civil Design

Professional Activities

CA-NV AWWA

OCWA

ASCE

He is a detailed and hands-on engineer that understands how to efficiently move a project forward from start to finish. His most recent master plan experience includes management of master plans for the Cities of Beverly Hills, Chino Hills, and Chino. Mr. Yokoyama is also an experienced engineer and Project Manager in the design and preparation of construction plans, specifications and cost estimates for large water and wastewater projects throughout Southern California.

Beverly Hills Integrated Water Resources Master Plan (Water, Sewer, Storm, Recycled, and SCADA), City of Beverly Hills, CA
Mr. Yokoyama is the Project Manager for the City of Beverly Hills Integrated Water Resources Master Plan (IWRMP). This is a comprehensive $1.5 M master plan of the potable water, recycled water, sanitary sewer, stormwater, and SCADA system. The IWRMP – Part 1 addresses the City's major water resources strategy which includes imported water, groundwater, and other potential supply sources. Part 1 also addresses other topics including emergency storage for the water system, and stormwater compliance. The IWRMP – Part 2 is a master plan of the water, sewer, and storm drain systems. For each system, the document addresses the existing system and service area, evaluation and design criteria, system analysis, and capital improvements. The theme of the IWRMP is to focus on near-term practical solutions with an eye towards what could be done in the future. The near-term represents a focus on projects that should be implemented within the next five years – 2021 through 2025. An eye towards the future includes taking the necessary steps now to position for long-term resiliency and reliability of the City's water, sewer, and storm drain systems. The IWRMP achieved several important goals for the City, including hydraulic model updates and calibration, long-range demand forecasting, and independent analysis of each of the systems.

Chino Hills Water and Recycled Water Master Plan, Chino Hills, CA
Project Manager. Hazen and Sawyer is currently delivering the City's Water and Recycled Water Master Plan Update. In July 2008, the City of Chino Hills approved and adopted the October 2005 Water, Recycled Water, and Sewer Master Plan. Since 2008, the City has evolved into a

Hazen

more fully developed and almost "built-out" community. Several of the CIP and recommended actions identified in the 2005 Master Plan have been implemented. The City recognizes the need to update the 2005 Water and Recycled Water Master Plan and develop the tools needed to assist in planning, operating, and maintaining the City's aging water and recycled water systems and infrastructure. The City's goal is to create a comprehensive updated Citywide water and recycled water master plan complete with a new GIS-based hydraulic model and mapping tools. The document and the new modeling system will be a guide for planning, operating, and maintaining the City's water and recycled water systems and infrastructure. The proposed CIP will evaluate the City's water and recycled water system and identify recommended projects through year 2045. Major scope elements include hydraulic model development and calibration (InfoWater), system analysis, condition assessment of high priority facilities, Urban Water Management Plan, Water Shortage Contingency Plan, Master Plan final report, and a prioritized Capital Improvement Program.

Water Master Plan Update and GIS Conversion Project, City of Chino, Chino, San Bernardino County, CA
Project Manager. The City of Chino serves over 12 million gallons per day of potable water to a population of approximately 74,000. Key components of this project include the creation of a GIS geodatabase of the City's potable water distribution system, preparation of a Water Master Plan Report, and completion of a Risk and Resiliency Assessment for compliance with America's Water Infrastructure Act requirements. The Water Master Plan effort includes hydraulic model development and calibration; comprehensive hydraulic analysis of the City's conveyance, pumping, and storage facilities; and development of a prioritized Capital Improvement Program for the planning horizon including preliminary cost estimates.

2019 Master Plan Update, Indio Water Authority, Indio, Riverside County, CA
Technical Advisor. The Indio Water Service Area includes approximately 38 square miles and supplied approximately 17,000 acre-feet of water to approximately 80,000 businesses and residents. Hazen provided professional engineering services for a Water Master Plan Update including development of existing and projected water demands, system capacity evaluation, operational program evaluation, hydraulic model calibration and analysis including water age analysis, and development of a 20-year Capital Improvement Program including project costs and prioritization with interactive dashboard.

Ridgeline Booster Pump Station, Trabuco Canyon Water District, Lake Forest, CA
Project Manager. The Ridgeline Booster Pump Station (RBPS) is a critical facility within Trabuco Canyon Water District's system. The RBPS is the primary means of delivering water from Dimension Water Treatment Plant (DWTP) to the Harris Grade pressure zone and tanks. The project includes preliminary design, final design, and construction support services for the RBPS Project. The project includes complete replacement of the pumps, piping, valving, pump station site improvements, security, and electrical and controls, and additionally, a building analysis and associated structural and architectural upgrades to accommodate the mechanical and electrical improvements at the site.

El Toro Sewer Lift Station Preliminary Study, Trabuco Canyon Water District, Lake Forest, CA
Project Manager. El Toro Sewer Lift Station (ETLS) is a critical facility within Trabuco Canyon Water District's sewer system. ETLS includes a dual wet well/dry pit configuration with two wet wells and two sets of pumps in series for each wet well. The pumps are two 100-hp pumps in series with both electrical motors, and engine driven backups. A planning study was performed that recommended complete replacement of piping, valving, site improvements, security, and electrical and controls. Additionally, a building analysis was conducted to identify associated structural and architectural upgrades needed to accommodate the mechanical and electrical improvements.

Steve Malloy, PE

Technical Advisor

Mr. Malloy is an experienced professional in sewage system planning and design. He brings a client's perspective to projects and applies his construction management experience in his QA/QC reviews.

Education

Engineering Management Certification, UC Irvine

M.S., Civil Engineering, Stanford University

B.S., Civil Engineering, Cal Poly, Pomona

Certification/License

Professional Engineer

Areas of Expertise

- Program Management
- Sewer Collection Systems
- Sewer Siphons and Air Jumpers
- Sewage Lift Stations and Force Mains
- Diversion Structures
- Metering
- Odor Assessment and Control

Professional Affiliations

Water Environment Federation

American Water Works Association

American Membrane Technology Association – Treasurer, 2010 - 2012

American Society of Civil Engineers – Life Member

Orange County Water Association – Life Member

Chino I Desalter VOC Treatment, Chino Basin Desalter Authority, CA
The project includes preliminary and final design of two (2) GAC treatment facilities (1.7 mgd and 3.4 mgd) at the Chino I Desalter Plant for the removal of TCE and 1,2,3-TCP, and evaluation of treatment requirements for 1,4-dioxanr, cis-1,2-DCE, 1,2-CDA, PFOA, and PFOS. The goal of this project is to provide groundwater treatment for all CDA bypass wells (CDA Wells I-1 through I-4), and several treated wells (CDA I-16 through 18), plus 10 new wells that will be installed by the County of San Bernardino as part of a Cleanup and Abatement Order issued by the Santa Ana Regional Water Quality Control Board (SARWQCB).

Michelson Water Recycling Plant Phase 2 Expansion Project, Irvine Ranch Water District, Irvine, CA
Project Manager on project to increase recycled water production capacity of existing plant from 18 mgd to 28 mgd. The project included new 48" to 60" influent sewers, headworks, primary sedimentation tanks, a 11 mgd membrane bioreactor, 22 mgd high rate clarifier, 15 mgd ultraviolet disinfection system, chemical systems, odor control, associated electrical and instrumentation systems, and a floodwall to provide 100-year flood protection. Duties included overseeing planning, design, construction management, permit compliance, and startup activities.

Irvine Desaler Project, Irvine Ranch Water District, Irvine, CA
Project Manager responsible for this potable and non-potable water project. The potable water portion included drilling 5 new brackish water wells, design and construction of pipelines, a 5 mgd drinking water low pressure reverse osmosis membrane treatment plant, and connection to an outfall for brine disposal. The non-potable portion of the project included implementing the Superfund Record of Decision for remediating the TCE plume emanating from the former El Toro Marine Corps Air Station, including rehabilitation of 3 wells, new pipelines, and 2 new air stripping/granular activated carbon treatment plants. Conducted extensive public outreach with the local community to acquire the well sites and treatment plant sites. Project included close coordination with the

Regional Water Quality Control Boards for NPDES permits, Dept. of the Navy, California Dept. of Toxic Substances Control, and Orange County Water District.

Deep Aquifer Treatment System, Irvine Ranch Water District, Irvine, CA
Project Manager for project to remove naturally occurring color from groundwater to produce a new drinking water supply. The project included drilling 2 new very deep wells, pipelines, an 8 mgd nanofitration treatment plant working at 92% recovery, and connection to Orange County Sanitation District sewers for concentrate disposal. The project was completed on time and within budget to meet an aggressive schedule to provide significant owner savings for a new water supply. Duties included overseeing the design, construction management of the design-build process, and coordination with Orange County Water District to ensure that the concentrate would not impact their Groundwater Replenishment System project.

Harvard Avenue Trunk Sewer, Irvine Ranch Water District, Irvine and Tustin, CA
Project Manager. 36" to 54" trunk sewer provided gravity connection to area formerly served by OCSD's Dow Street Lift Station. Includes two siphons under County flood control channel with air jumpers and a large diameter bore under railroad ROW.

Main Street Trunk Sewer and Sewer Diversion Structure, Irvine Ranch Water District, Irvine, CA
Project Manager. 60" sewer connects IRWD raw sewage flows to OCSD's collection system at Main Street and San Diego Creek. Project included a diversion structure, sewer siphon, air jumper, and flow meter.

Jeffrey Road Trunk Sewer, Irvine Ranch Water District, Irvine, CA
Project Manager. Design of new gravity sewer and triple-barrel siphon with air jumper pipe at San Diego Creek.

Michelson Pump Station No. 3 and Force Main, Irvine Ranch Water District, Irvine, CA
Project Manager. Pumps solids flows from MWRP to OCSD's collection system. Includes force main under I-405, a pig launching station, and chemical addition to reduce odors in the OCSD collection system.

University Drive Sewage Lift Station, Irvine Ranch Water District, Irvine, CA
Project Manager. Planning and design of lift station along University Drive that pumps to MWRP.

Bonita Canyon Road Sewage Lift Station, Irvine Ranch Water District, Irvine, CA
Project Manager. Design of lift station along Bonita Canyon Road that pumps to MWRP.

Sewage Lift Stations, Irvine Ranch Water District, Newport Beach, CA
Project Manager. Planning and design of lift station and force main along Newport Coast Drive that pump to OCSD's collection system.

Westpark Development, Irvine Ranch Water District, Irvine, CA
Project Manager. Planning and design of potable water, sewer, and recycled water pipelines in a new residential development area.

Newport Coast Development, Irvine Ranch Water District, Newport Beach, CA
Project Manager. Planning, design, and program management of potable water, sewer, and recycled water infrastructure including pump stations and reservoirs in a new luxury residential development area.

Foothill Ranch Development, Irvine Ranch Water District, County of Orange, CA
Project Manager. Planning, design, and program management of potable water, sewer, and recycled water infrastructure including pump stations and reservoirs in a new residential development area.

Dawn Guendert

Technical Advisor

Dawn Guendert uses her extensive experience with water and wastewater systems to lead Hazen's Asset Management team in the West Region. Dawn has served as the Project Manager and Project Director on a range of planning projects that applied asset management methodologies and tools to perform condition assessments and prioritize renewal activities.

Education

BA, Political Science, University of California, San Diego

Areas of Expertise

- Advanced Water Treatment
- Desalination
- Operational Efficiency
- Asset Management Strategic Plan

Professional Activities

American Water Works Association

American Membrane Technology Association

WateReuse Association

CalDesal, San Diego Coastkeepers

Board of Directors, Equinox Center

Publications

Greg Finlayson, David de Haas, Dawn Guendert, "Comparing Desalination and Recycling for Water Supply Augmentation", International Desalination and Water Reuse Quarterly, 2014.

Al Bazzi, Slavica Hammond, Kenneth Redd, Michael Sarullo, Roshanak Aflaki , Dawn Guendert; "Microfiltration and Reverse Osmosis Membrane Replacement Understanding Operating Process Data and Autopsy Data Projection of Useful Remaining Life"; presented at WEFTEC 2011

Robert Huehmer, Lisa Henthorne, Dawn Guendert, "Increasing MF/UF Reliability in Seawater Desalination Pretreatment Applications using Enhanced Pre-filtration", presented at IDA World Congress, Singapore 2005.

Sewage Lift Station Condition and Risk Assessment, Eastern Municipal Water District, Perris, CA
Project Director. This project included development of an asset inventory, field condition assessment that included a Tier 1 Seismic assessment, risk assessment, and prioritized rehabilitation and replacement projection.

Water Pipelines Condition Assessment and Renewal Prioritization, Rancho California Water District, Temecula, CA
Project Director. The objective of this project was to apply Asset Management practices to prioritize the field condition assessment of Rancho California Water District's (District) water pipelines based on business risk exposure.

Water Reclamation Plant Facilities Master Plan, San Bernardino Municipal Water Department, San Bernardino, CA
Project Director. Developed an inventory, conducted a field condition assessment and risk assessment to develop a prioritized list of rehabilitation and replacement projects to incorporate into a 20 year Facilities Master Plan.

Delta Diablo Sanitation District Water Reclamation Facility 20 Year Master Plan, Antioch, CA
Task Lead. Managed the development of a plant inventory, condition and risk assessment and prioritization of short-term capital improvement projects.

Socol Water Reclamation Facility Pipeline Condition and Risk Assessment, Napa Sanitation District, Napa, CA
The objective of this project was to apply Asset Management practices to prioritize field non-destructive condition assessment of pipelines at Napa Sanitation District's Socol Water Reclamation Facility based on business risk exposure.

Hazen

Rio Hondo Pump Station Condition and Risk Failure Analysis, Central Basin Municipal Water District, Commerce, CA
Project Manager. The project entails a condition assessment, risk of failure analysis, determination of remaining useful life and recommendations for rehabilitation or replacement of a critical recycled water pump station.

Treatment Facilities Yard Piping Condition Assessment Program, West Basin Municipal Water District, Carson, CA
Served as Technical Adviser to the development of a Condition Assessment Program for non-destructive testing of critical yard piping at the District's three water reclamation facilities.

Coastal Treatment Plant Upgrades, South Orange County Wastewater Authority, Dana Point, CA
Project Director. This project includes many improvements to ensure adequate treatment capacity, treatment process reliability and efficient operation through upgrades to the electrical system, aeration system, ferric chloride system and screenings system, along with complying with building and safety codes.

10 Year Capital Improvement Program, Goleta Sanitary District, Goleta, CA
Project Manager. Led a phased approach to the development of an asset management program for Goleta Sanitary District's wastewater treatment plant and collection system that served as the foundation for a 10-year year capital improvement program delivered as a digitized Story Map posted on the District's website.

Condition Assessment and Risk Analysis Rio Hondo Recycled Water Pump Station, Central Basin Municipal Water District, Commerce, CA
Project Manager. The project entails a condition assessment, risk of failure analysis, determination of remaining useful life and recommendations for rehabilitation or replacement of a critical recycled water pump station.

Water Reclamation Plant (WRP) Facilities Assessment and Master Plan, City of San Bernardino Municipal Water Department, CA
Project Director. Conducted an asset inventory and condition assessment of facilities, equipment and other assets for the City's 60-year-old, 33-mgd WRP. Work involved review of all WRP data including as-built drawings and com-puterized maintenance management system (CMMS) and preparation of a desktop inventory. The inventory was verified by field visits throughout the WRP including assessment of the condition of the assets. A risk-based condi-tion assessment was prepared including determination of remaining useful life estimated costs for rehabilitation and replacement for input into the capital improvement program for the WRP. Based on the condition assessment, a master plan was prepared to identify near-term (within 5 years) and longer-term (greater than 5 years) recom-mended improvements for both capital and operation & maintenance projects. The final deliverable included in-teractive asset management dashboards linked to the City's intranet.

Piedmont Creek Asset Management Plan, Santa Clara Valley Water District, Santa Clara, CA
Project Manager. Leading a team that is utilizing Santa Clara Valley Water District's (SCVWD) watershed assessment management plan as a foundation for developing an asset management plan (AMP) for Piedmont Creek by utilizing the USEPA 10-step asset management planning model (AMPM). The project includes updating the asset register, documenting the sta-tus of the assets, identifying the critical assets, developing strategies to manage the assets and projecting future investments required for Piedmont Creek to provide flood risk management within the watershed. GIS mapping (including photo links where possible) was used for ease of exhibit creation for decision-makers use and public review.

Crystal Broadbent, PE

Water System | RW System

Ms. Broadbent specializes in hydraulic design, water modeling, surge modeling, erosion control design, and environmental assessments.

Education

BS Civil Engineer, University of North Carolina at Charlotte

Certification/License

Professional Engineer

Areas of Expertise

- Water modeling
- Erosion control design
- Environmental assessment
- Geographical information systems (GIS)
- Hydrologic/hydraulic design and analysis
- Surge modeling
- Sewer modeling

Professional Activities

American Water Works Association

Water Environment Federation

Water For People, 2009 & 2010 Chair

North Carolina American Water Works Association-Water Environment Association

- 2012-2013 Secretary of Board
- 2014 Treasure of Board

Chino Hills Water and Recycled Water Master Plan, Chino Hills, CA
Hazen and Sawyer is currently delivering the City's Water and Recycled Water Master Plan Update. In July 2008, the City of Chino Hills approved and adopted the October 2005 Water, Recycled Water, and Sewer Master Plan. Since 2008, the City has evolved into a more fully developed and almost "built-out" community. Several of the CIP and recommended actions identified in the 2005 Master Plan have been implemented. The City recognizes the need to update the 2005 Water and Recycled Water Master Plan and develop the tools needed to assist in planning, operating, and maintaining the City's aging water and recycled water systems and infrastructure. The City's goal is to create a comprehensive updated Citywide water and recycled water master plan complete with a new GIS-based hydraulic model and mapping tools. The document and the new modeling system will be a guide for planning, operating, and maintaining the City's water and recycled water systems and infrastructure. The proposed CIP will evaluate the City's water and recycled water system and identify recommended projects through year 2045. Major scope elements include hydraulic model development and calibration (InfoWater), system analysis, condition assessment of high priority facilities, Urban Water Management Plan, Water Shortage Contingency Plan, Master Plan final report, and a prioritized Capital Improvement Program.

La Brea Subarea Groundwater Supply Project – Wells, Transmission Main, and Treatment Facilities, City of Beverly Hills, CA
Ms. Broadbent is performing Surge Analysis for the City of Beverly Hills La Brea Subarea Groundwater Supply Project. This is a $50 M project the City is implementing to expand their local water supply by developing groundwater in the La Brea Subarea of the Central Groundwater Basin. The project includes three (3) groundwater wells to be drilled and equipped, 4-miles of raw water transmission main through the City of Los Angeles and Beverly Hills, and upgrade of the City's existing reverse osmosis treatment plant. The first phase of the project which Hazen is leading is the drilling and equipping of the first groundwater well, and construction of the 4-mile transmission main.

Hazen

Concord Master Plan 2020, NC

Project Manager. Developed a master plan for the City. The City water system supplies more than 46,000 connections with an average day demand of 13.4 million gallons per day. The system includes 753 miles of water mains, 2 water treatment plants, 5 booster pump stations, and 6 elevated storage tanks. Task included updating the existing model with new GIS in InfoWater software, updating demands for 2019, performing hydraulic grade line test, fire flow test and calibrating model to the field work and SCADA tank levels. Project also included determining future service area, population, and demand projections out to 2050, water age analysis, available fire flow, identifying existing deficiencies and testing improvements. A final report with a CIP was delivered at the end of the master plan.

Prioritizing CIP Projects & Rehabilitation and Replacement of Water Mains, City of Hendersonville, NC

Project Manager. Ms. Broadbent completed the City's Master plan in 2017, resulting in over 60 CIP projects for the first 5 years. This project scored these CIP projects based on probably of deficiencies and the consequences resulting from not installing the CIP project. The City was provided with tables and graphs to assist them in their yearly CIP development. This project also prioritizes existing water mains for rehabilitation and replacement, based on installation date, pipe material, repair history, soil pH, proximity of critical users, DOT projects and hydraulic results from model. Projects were ranked and tabulated, including cost estimates.

Water and Wastewater Master Plan, City of Sunrise, Fl

Project Engineer. Ms. Broadbent assisted in the development of the potable hydraulic model and the analysis. The City's model is in Bentley WaterGems. Task included updating model to current GIS; developing updated diurnal pattern; updating water treatment plants, pumps curves and controls. Model was calibrated to field pressure measurements and used to analysis existing and future available fire flow and water age. Recommendations to improve conditions were described in the Capital Improvements Plan.

Cape Fear Public Utility Authority Water Master Plan, Wilmington, NC

As Project Engineer, she developed a master plan for the Authority. The Authority supplies more than 96,400 customers and includes 1,097 miles of water distribution system, two treatments plants, well water supply, three pressures zones, nine elevated storage tanks, and one booster pump station. The average day demand is 17.4 million gallons per day. Task included updating the demands in the Innovyze InfoWater model, calibrating to current SCADA and field test, identifying insufficient capacity, fire flow and water quality issues for current day, and providing solutions. Future day assessment included developing future water demands out to year 2040. Growth was determined in conjunction with the Authority and County. New pipes were added to serve areas where the Authority is expected to expand. Additional pipe improvements were then developed to hydraulically balance elevated storage tanks, ensure adequate AFF and peak hour pressures, and reduce water age. The 2040 improvements were phased over time and described in the Capital Improvements Plan.

Hendersonville Water System Master Plan, City of Hendersonville, NC

Project Engineer. Developed a master plan for the City. The City water system supplies more than 65,000 customers and includes 650 miles of water mains, 53 booster pump stations, and 24 water storage tanks. The water treatment currently treats up to 12 million gallons per day. The InfoWater model that Hazen had previously developed and calibrated was used for this project. Task included determining future service area, population and demand projections, water age analysis, identifying existing deficiencies and testing improvements. A subtask to the masterplan also included development of unidirectional flushing program, for areas identified with excessive old water age. A final report with a Capital Improvement Plan were delivered at the end of the master plan.

Peace Maari, EIT

Water System | RW System

Ms. Maari serves as an Assistant Engineer in the Irvine office. Her assignments have included climate change resilience studies, pump station design, updating collection system asset register, pipeline design, and surge modeling.

Education

BS, Environmental Engineering, University of Notre Dame

Certification/License

Engineer-in-Training

Areas of Expertise

- Hydrology and hydraulics
- Flood plain mapping
- Pipeline and manhole rehabilitation
- Sewer flow modeling
- Pump replacement design
- Surge modeling
- Wastewater

Professional Activities

- American Water Works Association
- American Society of Civil Engineers

Beverly Hills Integrated Water Resources Master Plan (Water, Sewer, Storm, Recycled, and SCADA), City of Beverly Hills, CA
This is a comprehensive $1.5 M master plan of the potable water, recycled water, sanitary sewer, stormwater, and SCADA system. The Integrated Water Resources Master Plan (IWRMP) – Part 1 addresses the City's major water resources strategy which includes imported water, groundwater, and other potential supply sources. Part 1 also addresses other topics including emergency storage for the water system, and stormwater compliance. The IWRMP – Part 2 is a master plan of the water, sewer, and storm drain systems. For each system, the document addresses the existing system and service area, evaluation and design criteria, system analysis, and capital improvements. The theme of the IWRMP is to focus on near-term practical solutions with an eye towards what could be done in the future. The near-term represents a focus on projects that should be implemented within the next five years – 2021 through 2025. An eye towards the future includes taking the necessary steps now to position for long-term resiliency and reliability of the City's water, sewer, and storm drain systems. The IWRMP achieved several important goals for the City, including hydraulic model updates and calibration, long-range demand forecasting, and independent analysis of each of the systems.

Chino Hills Water and Recycled Water Master Plan, Chino Hills, CA
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Hazen

based hydraulic model and mapping tools. The document and the new modeling system will be a guide for planning, operating, and maintaining the City's water and recycled water systems and infrastructure. The proposed CIP will evaluate the City's water and recycled water system and identify recommended projects through year 2045. Major scope elements include hydraulic model development and calibration (InfoWater), system analysis, condition assessment of high priority facilities, Urban Water Management Plan, Water Shortage Contingency Plan, Master Plan final report, and a prioritized Capital Improvement Program.

Water Master Plan Update and GIS Conversion Project, City of Chino, Chino, San Bernardino County, CA
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Water Reclamation Plant (WRP) Facilities Assessment and Master Plan, City of San Bernardino Municipal Water Department, CA
Project Scheduler. Conducted an asset inventory and condition assessment of facilities, equipment and other assets for the City's 60-year-old, 33-mgd WRP. Work involved review of all WRP data including as-built drawings and computerized maintenance management system (CMMS) and preparation of a desktop inventory. The inventory was verified by field visits throughout the WRP including assessment of the condition of the assets. A risk-based condition assessment was prepared including determination of remaining useful life estimated costs for rehabilitation and replacement for input into the capital improvement program for the WRP. Based on the condition assessment, a master plan was prepared to identify near-term (within 5 years) and longer-term (greater than 5 years) recommended improvements for both capital and operation & maintenance projects. The final deliverable included interactive asset management dashboards linked to the City's intranet.

Rio Hondo Recycled Water Pump Station Condition Assessment, Central Basin Municipal Water District, City of Pico Rivera, CA
The Condition Assessment included the pumps, pipes, valves, electrical equipment and the hydraulic performance of the pumps. The Condition Assessment used a matrix approach for each asset (86) to determine the remaining useful life and to prioritize the elements needing replacement immediately and over the next 5 years such as the large pump VFDs, one of the electrical transformers, some valves and a drain sump pump. CBMWD will use this Condition Assessment to evaluate their plans going forward to either update the pump station or replace it and add capacity for their future demands.

Buena Yard Improvements Facility Plan, Buena Sanitation District, Vista, CA
Ms. Maari created electronic field forms in Survey123 to help assess the condition of existing assets. This was later used to determine which assets would be kept or demolished at the plant.

Prioritization of Sewer Pipes and Rehabilitation Guidance Document, Moulton Niguel Water District, Laguna Hills, CA
Developed a risk methodology and prioritized the collection system replacement, rehabilitation and condition assessment activities considering both pipe condition and consequence of failure. Led the team in development of a decision tree model for prioritization of CCTV program and identification of next repair or replacement action.

Colleen Block, PE

Sewer System

Ms. Block specializes in wastewater conveyance studies and design in both the private and public sectors. She provides technical and management capabilities to work in collaborative settings involving complex projects and community interests. She has managed a wide variety of projects from initial planning, through design and construction.

Education

B.S., Environmental Engineering, University of Miami, Coral Gables, FL, Cum Laude

Certification/License

Professional Engineer

Areas of Expertise

- Pipeline Study/Design
- Sewage Pumping Station Design
- Sanitary Sewer System Evaluations
- Wastewater Collection System Rehabilitation Design
- Condition Assessment / Asset Management
- Construction Management
- Project Management
- GIS / Data Management

Professional Affiliations

American Water Works Association (AWWA)

Water Environment Federation (WEF)

Jones Falls Sewershed Collection System Improvements, Baltimore, MD

Gravity sewer replacement and rehabilitation design, GIS, data management. The goal of this design project was to implement the recommended improvements from the Jones Falls System Evaluation and Sewershed Plan, which aims to address sanitary sewer overflows. The Hazen work allocation included approximately 137,000 LF of CIPP lining, 14,000 LF of open cut point repair and CIPP lining, 57,428 LF of cleaning, 178 open cut point repairs, 500 LF of sewer replacement, and 273 manholes which are to be rehabilitated or replaced. Services included evaluation, assessment, and design of rehabilitation utilizing primarily trenchless technologies, preparation of cost estimates, local (traffic, erosion and sediment control) and state (MDE, SHA, etc.) permit applications, temporary construction easements, and coordinating subconsultant field investigations. Ms. Block reviewed the rehabilitation recommendations from the sewershed plan and performed GIS data management to support design. She also assisted with the development and implementation of a QAQC program to ensure that previous recommendations addressed existing conditions using appropriate rehabilitation methods. Hazen's work in the Jones Falls Sewershed was performed in multiple contracts with the City of Baltimore for additional pipeline design, including both trenchless (microtunneling) and open cut sewer construction methods.

Low Level Sewershed Collection System Improvements, Baltimore, MD

Gravity sewer replacement and rehabilitation design, GIS, data management. The goal of this design project was to implement recommended improvements to address sanitary sewer overflows. The improvements included approximately 6,266 LF of CIPP lining, 3,898 LF of open cut point repair and CIPP lining, 1,968 LF of heavy cleaning and CIPP lining, 2,181 LF of open cut pipe replacement, and 309 manhole rehabilitation

or replacements. Services in this project included review of field investigation data generated by previous studies, design for rehabilitation and replacement of gravity sanitary sewers, GIS and data management, geotechnical engineering, surveying, cost estimates, permit applications, easement acquisition, community meetings, and construction management services. Ms. Block reviewed and organized the recommendations from the sewershed plan in GIS so that the resulting layers could be used to develop figures, reports, and contract documents. She also assisted with the design and development and implementation of a QAQC program to ensure that previous recommendations addressed existing conditions using appropriate rehabilitation methods.

Experience at Fairfax County Wastewater Design and Construction Division

As a project manager and team leader in the Fairfax County Wastewater Design and Construction Division, Ms. Block planned and implemented design and construction of Capital Improvement projects for the County's wastewater collection system. She also performed and coordinated design and construction management services for emergency gravity sewer projects as needed. Ms. Block performed capital improvement planning and project management activities for several programs, including the Small Diameter Gravity Sewer Replacement (pipes with sags and defective slip-lined pipes), Large Diameter Condition Assessment, Pumping Station Rehabilitation, and Force Main Rehabilitation programs.

Little Pimmit Run Sanitary Sewer Realignment

Ms. Block conducted planning activities, bid advertisement, consultant selection, scoping, cost estimating, contract negotiation, and study-phase management for re-alignment of approximately 5,000 linear feet of the gravity sewer system in the Little Pimmit Run stream valley to reduce the number of high risk stream crossings and coordinate with concurrent stream restoration design activities. The study phase included an alignment alternative evaluation phase, several workshops to choose evaluation criteria and assign weights, and resulted in a preliminary engineering report summarizing results of the evaluation, land survey, geotechnical and site investigations, utility location, easement and permit identification, and a public outreach plan.

Small Diameter Sewer Replacement Package #1

Fairfax County Project Manager for design of open cut replacement of gravity sewers in various locations throughout the County, including reviewing and approving design submittals, permitting activities, and bid documents. Key issues were transportation permitting, bypass pumping and utility investigations.

Small Diameter Sewer Replacement Package #2

Fairfax County Project Manager for design of approximately 1,750 LF of gravity sewer open cut replacements in six locations throughout the County, primarily in roadways. Key issues were utility investigation, bypass pumping and easement acquisition.

Slip-lined Pipe Replacement #1 (Old Mill Road)

Design for replacement of approximately 1,100 feet of 10-inch slip-lined gravity main with new 16-inch gravity main in Old Mill Road. Key issues included a stream crossing and coordination with a private country club for construction access.

Slip-lined Pipe Replacement #3 (Celadon Lane)

Fairfax County Project Director for design of approximately 1,700 LF of defective slip-lined gravity sanitary sewer pipe replacements and relocation of approximately 900 LF of gravity sewer mains from residential back yards to the street, and re-routing associated service laterals. Key issues were community engagement and easement acquisition.

Luke C. Wang, PE

Demand Projections

Mr. Wang specializes in water supply planning, operations, and demand forecasting. He is Hazen's Water Resource Management Leader for the West Region.

Education

MS, Earth and Environmental Engineering, Columbia University

BS, Earth and Environmental Engineering, Columbia University

Certification/License

Professional Engineer

Areas of Expertise

- Water supply operations management
- Source water quality
- Big data management and visualization
- Hydrology

Professional Activities

American Water Works Association (AWWA)

AWWA Information Management & Technology Research Committee - Chair

American Geophysical Union

Publications

Arnold, Roger, Luke Wang, Talle Lopez, Sophie James, and Nicole Blute. "Updating Lead and Copper Rule Sample Site Selection: Best Practices from an Innovate Pilot Program." Journal of the American Water Works Association, April 2020: 22-31.

Gong, Gavin, Lucien Wang, Laura Condon, Alastair Shearman, and Upmanu Lall. "A Simple Framework for Incorporating Seasonal Streamflow Forecasts Into Existing Water Resource Management Practices." Journal of the American Water Resources Association 46.3 (2010): 574-585.

Beverly Hills Integrated Water Resources Master Plan (Water, Sewer, Storm, Recycled, and SCADA), City of Beverly Hills, CA
Provided technical guidance and supported development of the long-range demand forecast for Beverly Hills' Integrated Water Resources Master Plan (IWRMP). The forecasts supported hydraulic modeling of the City's potable water system and will be used to support the City's other long-range planing efforts. The forecasts incorporated both per-capita and land use elements.

Chino Hills Water and Recycled Water Master Plan, Chino Hills, CA
Hazen and Sawyer is currently delivering the City's Water and Recycled Water Master Plan Update. In July 2008, the City of Chino Hills approved and adopted the October 2005 Water, Recycled Water, and Sewer Master Plan. Since 2008, the City has evolved into a more fully developed and almost "built-out" community. Several of the CIP and recommended actions identified in the 2005 Master Plan have been implemented. The City recognizes the need to update the 2005 Water and Recycled Water Master Plan and develop the tools needed to assist in planning, operating, and maintaining the City's aging water and recycled water systems and infrastructure. The City's goal is to create a comprehensive updated Citywide water and recycled water master plan complete with a new GIS-based hydraulic model and mapping tools. The document and the new modeling system will be a guide for planning, operating, and maintaining the City's water and recycled water systems and infrastructure. The proposed CIP will evaluate the City's water and recycled water system and identify recommended projects through year 2045. Major scope elements include hydraulic model development and calibration (InfoWater), system analysis, condition assessment of high priority facilities, Urban Water Management Plan, Water Shortage Contingency Plan, Master Plan final report, and a prioritized Capital Improvement Program.

Water Master Plan Update and GIS Conversion Project, City of Chino, Chino, San Bernardino County, CA
The City of Chino serves over 12 million gallons per day of potable water to a population of approximately 74,000. Key components of this project include the creation of a GIS geodatabase of the City's potable water

Hazen

distribution system, preparation of a Water Master Plan Report, and completion of a Risk and Resiliency Assessment for compliance with America's Water Infrastructure Act requirements. The Water Master Plan effort includes hydraulic model development and calibration; comprehensive hydraulic analysis of the City's conveyance, pumping, and storage facilities; and development of a prioritized Capital Improvement Program for the planning horizon including preliminary cost estimates.

Santa Clara Valley Water District (Valley Water) Water Demand Model, San Jose, CA
Project Manager for developing Valley Water's new water demand model. Valley Water is in the process of developing a new water demand model for the purpose of developing long-term water demand projections. The model will be used to support several water supply planning and analysis efforts. As Project Manager, Mr. Wang is responsible for guiding the overall technical direction of the project, as well as maintaining the project budget and schedule.

East Bay Municipal Utility District (EBMUD) 2050 Demand Study, EBMUD, Oakland, CA
Deputy Project Manager for EBMUD's 2050 Demand Study. EBMUD is in the process of developing an econometric model for forecasting water demands in their service area out to the year 2050. The econometric model will explicitly account weather/climate conditions, anticipated land use changes, development trends, and socioeconomic factors (e.g. water rates, jobs, population growth, income) which have been shown to impact water use. The forecasted demands will be a critical component of EBMUD's 2020 Urban Water Management Plan.

Bay Area Water Supply & Conservation Agency Regional Water Supply Reliability Model Development and Analysis Services, San Mateo, CA
Project Manager and lead systems modeler for BAWSCA's Regional Water Supply Reliability Model project. Designed a water supply system model for the Bay Area incorporating regional supply sources (e.g. San Francisco Regional Water System) with locally utilized supplies and detailed estimations of municipal demands. BAWSCA is using the model for long-term water reliability planning and alternatives analysis.

Design Services for the Development of New York City's Operation Support Tool, NYCDEP, New York, NY
The Operations Support Tool (OST) is a state-of-the-art decision support system to provide computational and predictive operations and planning support for New York City's 1+ BGD water supply system. OST is an integrated model consisting of a water supply operations model, mechanistic reservoir water quality models, hydrologic forecasts, and a database containing near-real-time system data. Mr. Wang developed hydrologic forecasts, demand forecasts, dynamic reservoir operating rules, and customized dashboards for visualizing model output.

Tampa Bay Water Seasonal Source Water Allocation Decision Support Tool, Tampa Bay Water, Clearwater, FL
Developed a forecast-based decision support tool to set monthly source allocations, minimize anticipated costs, and avert financial and regulatory risks during TBW's annual budgeting process. The tool is a two-stage algorithm consisting of an inner system model and an outer optimization module. Mr. Wang designed and coded the inner system model which simulates TBW's monthly surface water and groundwater supply operations. He also designed and tested the outer optimization module (Genetic Algorithm) which seeks source allocations that minimize expected O&M costs and minimize probability of requiring groundwater permit violations. The tool is used to minimize probability of budget shortfall, budget surpluses, and need for utilizing rate stabilization funds or levying within-year rate increases.

Sean Pour, PhD

Asset Management Task Lead

Mr. Pour has made significant advancements towards developing and implementing new condition assessment and asset management methodologies.

Education

Ph.D.,Civil and Environmental Engineering, concentration in Const. Eng. and Mgmt., Oklahoma State University

MS, Civil and Environmental Engineering, concentration in Const. Eng. and Mgmt., Amirkabir University of Technology (Tehran Polytechnic)

BS, Civil and Environmental Engineering, concentration in Const. Eng. and Mgmt., Amirkabir University of Technology (Tehran Polytechnic)

Areas of Expertise

- Asset Inventory / Condition Assessment
- Asset Management
- Life Cycle Cost Analysis
- Risk Assessment
- Capital Improvement Project Validation

Professional Activities

American Society of Civil Engineers (ASCE)

American Water Works Association (AWWA)

Orange County Water Authority Association (OCWA)

Chi Epsilon (The civil engineering honor society)

He has over 13 years of asset management research and implementation experience. He started his asset management experience as a researcher, leading efforts in developing deterioration models that scientifically quantify the decay characteristics of infrastructure assets.

He specializes in analyzing condition data to improve the accuracy of the estimation of remaining effective life and risk. His areas of asset management specialization include assisting clients in performing remaining asset life calculation, risk assessment, life cycle cost projection, and project validation and prioritization.

Chino Hills Water and Recycled Water Master Plan, Chino Hills, CA
Hazen and Sawyer is currently delivering the City's Water and Recycled Water Master Plan Update. In July 2008, the City of Chino Hills approved and adopted the October 2005 Water, Recycled Water, and Sewer Master Plan. Since 2008, the City has evolved into a more fully developed and almost "built-out" community. Several of the CIP and recommended actions identified in the 2005 Master Plan have been implemented. The City recognizes the need to update the 2005 Water and Recycled Water Master Plan and develop the tools needed to assist in planning, operating, and maintaining the City's aging water and recycled water systems and infrastructure. The City's goal is to create a comprehensive updated Citywide water and recycled water master plan complete with a new GIS-based hydraulic model and mapping tools. The document and the new modeling system will be a guide for planning, operating, and maintaining the City's water and recycled water systems and infrastructure. The proposed CIP will evaluate the City's water and recycled water system and identify recommended projects through year 2045. Major scope elements include hydraulic model development and calibration (InfoWater), system analysis, condition assessment of high priority facilities, Urban Water Management Plan, Water Shortage Contingency Plan, Master Plan final report, and a prioritized Capital Improvement Program.

El Toro Sewer Lift Station Preliminary Study, Trabuco Canyon Water District, Lake Forest, CA
El Toro Sewer Lift Station (ETLS) is a critical facility within Trabuco Canyon Water District's sewer system. ETLS includes a dual wet well/dry

Select Publications

Pour, S. A., and Jeong, H. S. (2012). "Realistic Life-Cycle Cost Analysis Using Typical Sequential Patterns of Pavement Treatments via Association Analysis," Transportation Research Record: Journal of the Transportation Research Board, No. 2304, Transportation Research Board of the National Academies, Washington, D.C., 2012, pp. 104-111.

Pour, S. A., Jeong, H. S., Burman, R. R., and Gunsaulis, F. (2012). "Performance Assessment of On-Grade Horizontal Directional Drilling," ASCE Journal of Construction Engineering and Management, Vol. 138, No. 458, March, pp. 458-468.

pit configuration with two wet wells and two sets of pumps in series for each wet well. The pumps are two 100-hp pumps in series with both electrical motors, and engine driven backups. A planning study was performed that recommended complete replacement of piping, valving, site improvements, security, and electrical and controls. Additionally, a building analysis was conducted to identify associated structural and architectural upgrades needed to accommodate the mechanical and electrical improvements.

District-Wide Asset Management Plan, Goleta Sanitary District, Goleta, CA

Asset Management Specialist. Performed asset inventory, condition assessment, risk assessment and developed long-range investment projection for the wastewater treatment plant and sewer collection system. The project entailed inventory and condition assessment of three sewer lift stations. Sean developed an asset management plan for the District using a phased approach. First phase included field inventory, condition assessment, risk assessment and long-range funding needs projection for the wastewater treatment plant. The next phase comprised developing an asset management plan for the collections system including closing the gap in the GIS data, converting CCTV defect codes into condition scores, developing risk model for lift stations, gravity mains, force mains, manholes, and ocean outfall and developing a long-range rehabilitation and replacement plan.

Asset Management Specialist, Piedmont Creek Asset Management Plan, Santa Clara Valley Water District, Santa Clara, CA

The scope included assisting Santa Clara Valley Water District (SCVWD) to develop an asset management plan and improve the confidence in the planning results and lay the foundation to minimize the total investment of maintaining, operating, and renewing the Piedmont Creek assets. Worked with the team to update the asset register, document the status of the assets, identify the critical assets, develop strategies to manage the assets and project future investments required for Piedmont Creek to provide flood risk management within the watershed.

10-Year CIP Plan, Goleta Sanitary District, Goleta, CA

Asset Management Specialist. Assisted with development of 10-year CIP for the wastewater treatment plant, sewer collection system and lift stations based on the results of the asset management model. Worked with the District in business case evaluation to rank replacement and rehabilitation projects for the wastewater treatment plant and the collection system. Developed a Microsoft PowerBI dashboard to streamline CIP project validation and visualization of the 10-Year CIP.

Steven Conner, PE

Condition Assessment

Mr. Conner is a professional civil engineer with 27 years of experience in the planning and design of water infrastructure including pump stations and booster stations.

Education

BS, Civil Engineering/Water Resources, University of California, Irvine

Certification/License

Professional Civil Engineer

Transportation Worker Identification Credential (TWIC), California

Areas of Expertise

- Condition Assessment
- Pump Stations
- Well Equipping
- Pipeline Design
- Trenchless Pipeline Rehabilitation and Installation
- Steel Tanks
- Concrete Tanks

Professional Activities

American Society of Civil Engineers, Member

Mr. Conner has particular expertise in pump station design and has managed or served in a key technical role on projects ranging in size up to 600 mgd capacity. This includes in-depth evaluation of system requirements for proposed new facilities as well as rehabilitation, upgrade, or replacement of existing pumping systems. Steve serves as the pump station expert for the West Region.

Mr. Conner is highly skilled in project coordination and communication with public agencies at all levels of government, including federal state, county and municipalities, non-governmental organizations, and special interest groups. He has managed multi-disciplined project teams for large and complex projects throughout his career and has proven results through the collaborative relationships he has built with his clients and team.

District Wide Lift Station Condition Assessment and Diaz Lift Station Feasibility Study, Eastern Municipal Water District, CA

Mr. Conner was the project manager for preparing a districtwide lift station condition assessment of 36 lift stations that Hazen inspected, and determine the remaining useful life and cost of replacement for every asset at all 47 lift stations. A PowerBI dashboard was developed for the District so they can easily visualize, sort, and drill-down into the data as needed. In addition, the project included a feasibility study for converting the Diaz Lift Station from dry-pit to wet-pit operation by converting a portion of the existing dry-pit. Hazen developed a preliminary layout and detailed cost estimate as part of the report. The capacity of the Diaz Lift Station is 12 MGD.

El Toro Sewer Lift Station Preliminary Study, Trabuco Canyon Water District, Lake Forest, CA

Performed field assessment and provided recommended upgrades. El Toro Sewer Lift Station (ETLS) is a critical facility within Trabuco Canyon Water District's sewer system. ETLS includes a dual wet well/dry pit configuration with two wet wells and two sets of pumps in series for each wet well. The pumps are two 100-hp pumps in series with both electrical motors, and engine driven backups. A planning study was performed that recommended complete replacement of piping, valving, site improvements, security, and electrical and controls. Additionally, a building analysis was conducted to identify associated structural and architectural upgrades needed to accommodate the mechanical and electrical improvements.

Skyfarm 'A' and Hansford Court Lift Station Reconstruction, City of Santa Rosa, CA
Hazen was selected to provide a condition assessment, alternative analysis, detailed design and design services during construction for reconstruction of two of the City of Santa Rosa's wastewater lift stations. The lift stations were destroyed in the 2017 Tubbs fire. The reconstruction included replacement of existing lift station structures, pumps, electrical service, and associated electrical, mechanical and control components along with provisions for temporary pumping and power to ensure uninterrupted wastewater service to the surrounding residents. Since these lift stations were destroyed as part of a natural disaster, the design also required collaboration and coordination with the City and FEMA to comply with federal funding requirements.

Climate Resiliency Study SP-152, Orange County Sanitation District, Fountain Valley, CA
Performed field assessment of pump stations as part of a risk assessment of the district's infrastructure of two treatment plants and multiple pump stations based on climate variability and change and developed adaptation and mitigation recommendations to reduce vulnerabilities intensified by climate change. Sea level rise, flooding, wildfire and high heat were considered for impact to structures and systems. Adaptation strategies include emergency response procedures, setting new floor elevations for new CIP projects, retrofitting wall penetrations and pipe tunnel entrances.

Reservoirs 1 & 2, Pumps, Controls and Chemical System Assessment, Mesa Water District, Costa Mesa, CA
Completed an assessment of the condition and operation of the pumps and controls system at two domestic water reservoirs, developed a plan for removal and testing of pumps as well as completed an evaluation of the existing chemical dosing system. Prepared a preliminary design report and 30-percent design plans and specifications to replace the existing chemical feed systems and install new reservoir mixers. (2017-2018)

Storm Water Pump Station Improvements for NFPA 820 Compliance, San Diego, CA
Conducted facility assessments and prepared a list of improvements and concept level exhibits for bringing ten storm water pump stations into compliance with NFPA 820. The existing pump stations all lack physical separation to prevent combustible gasses from migrating from the wet wells to the dry wells, where the electrical equipment is located, and provided wet well access from the dry wells. Two options were developed for each pump station. The first option relocated all electrical panels outside of the existing electrical room, with the remaining pump motors, lighting, and ventilation equipment to be rated for Class 1, Division 2 environments. The second option physically sealed all floor hatch openings and penetrations and required a written documented procedure for de-energizing any non-compliant electrical equipment during maintenance operations that required wet well access. (2014-2015)

Van Vliet Pump Station, City of Chino, CA
Design of an 18 cfs (8,100 gpm) stormwater pumping station for the City of Chino. The pump station is designed to pump peak stormwater flows during rain events, and low flows from the detention pond water quality filter system. The pump station utilizes VFD driven duplex submersible non-clog pumps designed to maintain a constant liquid level in the wet well. VFD pumps were selected for this application to reduce the size of the wet well and number of pumps needed based on pump cycle time calculations.

Plant 30 Wellhead Treatment Design, Montclair, CA
Well pump analysis, QA/QC, and construction support for the planning, design, and construction of a 4,000 gpm wellhead treatment system for Monte Vista Water District. Treatment includes GAC for 1,2,3-TCP and regenerable ion exchange for nitrate and perchlorate. The design includes site civil design and treatment of three wells and off-site pipelines from two wells to the third well site.

Daniel Loza

Condition Assessment

Mr. Loza has over 14 years of experience in the petrochemical industry. He has demonstrated technical, design, and leadership capabilities to work in collaborative settings involving complex projects. He has been a lead electrical responsible for the execution, planning, managing of budget and schedule through design, construction and operation.

Education

BS, Electrical Engineering, California State Polytechnic University, Pomona, CA

Areas of Expertise

- Design of medium and low voltage electrical power distribution systems that includes switchgear, motor control centers, adjustable speed drives, and UPS systems
- Construction support and commissioning of electrical equipment

TEPS MCC Replacement, Eastern Municipal Water District, Moreno Valley Regional Water Reclamation Facility, CA
Electrical engineer supporting the lead electrical engineer for the replacement of existing low voltage power distribution systems. Responsibilities include contractor submittal reviews and engineering services during construction.

Ridgeline Booster Pump Station, Trabuco Canyon Water District, Lake Forest, CA
Electrical engineer supporting the lead electrical engineer for improvement of the pumps, piping, pump station site, security, and controls. The electrical improvements included installation of new electric utility service and installation of new low voltage distribution system. Responsibilities include contractor submittal reviews and engineering support during construction.

Blower Electrification, Eastern Municipal Water District, Riverside County, CA
Electrical engineer supporting the lead electrical engineer for the replacement of gas driven blowers with high speed turbo blowers at three different water reclamation facilities. The electrical improvements at Moreno Valley Regional Water Reclamation Facility include modification to the low voltage distribution system. The electrical improvements at Temecula Valley Regional Water Reclamation Facility include modification to the medium voltage distribution system, installation of new low voltage distribution system, and standby generator. The electrical improvements at San Jacinto Valley Regional Water Reclamation Facility include integration of a new standby generator to the medium voltage distribution system. Responsibilities include contractor submittal reviews and engineering support during construction.

Hazen

San Bernardino 1110.2 Resultant, San Bernardino Municipal Water District, San Bernardino, CA
Electrical engineer supporting the lead electrical engineer performing electrical improvements to the project. The electrical improvements included modification to the existing medium voltage distribution system, installation of new low voltage distribution system, and installation of new standby generator. Responsibilities include contractor submittal reviews and engineering support during construction.

Coastal Treatment Plant Facility Improvements, South Orange County Wastewater Authority, Dana Point, CA
Electrical engineer supporting the lead electrical engineer for replacement of ferric chloride chemical storage and feed system, replacement of the secondary clarifier, installing new drainage pump station. The electrical improvements included installation of new electric utility service and installation of new low voltage distribution system. Responsibilities include contractor submittal reviews and engineering support during construction.

Reservoir Replacement, City of Manhattan Beach, Manhattan Beach, CA
Electrical engineer supporting the lead electrical engineer for replacement of the existing reservoir and pumping station with new reservoir, separate pump station, separate chemical feed building, separate administration building. The electrical improvements included installation of new electric utility service and installation of new low voltage distribution system. Responsibilities include contractor submittal reviews and engineering support during construction.

Equipping of La Cienega Well No.1, Public Works Department City of Beverly Hills, Beverly Hills, CA
Lead electrical engineer responsible for the execution, planning, managing of budget and schedule of project. Responsibilities include installation of new electric utility service and installation of new low voltage distribution system.

Disinfection Improvements, Laguna Treatment Plant, City of Santa Rosa, CA
Lead electrical engineer for Hazen and Sawyer working with Carollo responsible for the execution, planning, managing of budget and schedule for portion of the project. Responsibilities include modification to the medium voltage distribution system and installation of new low voltage distribution system.

Soroush Zamanian, PhD

Asset Data Analyst

Dr. Zamanian is a mission-driven, collaborative, and highly motivated civil engineer with solid experience in machine learning, data science and infrastructure management.

Education

PhD, Strucutral Engineering, Ohio State University, Columbus, OH

MS, Strucutral Engineering w/ Data Analysis Minor, Ohio State University, Columbus, OH

BS, Civil Engineering, Qazvin University, Qazvin, Iran

Areas of Expertise

- Risk assessment & management
- Reliability analysis
- Resilience assessment
- Life cycle cost optimization
- Uncertainty quantification
- Machine learning
- Data mining
- Data imputation
- Data visualization
- Simulation-based model
- Meta-model
- Wastewater transmission and collection systems
- Rehabilitation & maintenance strategies
- Prestressed & post-tensioned structural design
- Building & Bridge design
- NDT material tests

Proven success executing risk assessment and management, data analysis, integrity reliability analysis, and structural analysis within different research projects. Expert at risk, reliability and resilience assessment of large networks, advanced machine learning techniques development, design formulation enhancement, data analysis, and predictive model development. Demonstrated strong leadership skills, passion for identification of problems, implementation of solution for broad range of complex problems, and execution of pioneer developed solution to structure and infrastructure systems.

Graduate Research Associate

The Ohio State University, RAMSIS

Infrastructure Risk Assessment and Management Analyst

- Developed active learning framework using machine learning techniques for reliability and risk assessment of high-dimensional networks against natural hazards.
- Developed surrogate-based time-dependent reliability and risk assessment framework for infrastructures exposed to aging and deterioration.
- Developed risk management and resilience assessment frameworks for wastewater collection systems subjected to extreme weather conditions.
- Developed validated computational models to predict and mitigate the performance of infrastructures against hazards, aging and deterioration.
- Generated reports and presented weekly to the RAMSIS Lab at The Ohio State University meetings to enhance the risk assessment and management strategies.

Data Analyst

- Identified, analyzed, and utilized key factors contributing to different types of systems by developing uncertainty quantification frameworks.
- Analyzed and converted data into actionable insight by predicting and modeling future outcomes.
- Calibrated key factors with high level of uncertainties to improve the predictive model performance.
- Developed predictive models for different infrastructures subjected to natural hazards such as earthquake, hurricane, and flood

Hazen

Publiciations

Zamanian, S., Hur, J., & Shafieezadeh, A. (2020). Significant variables for leakage and collapse of buried concrete sewer pipes: A global sensitivity analysis via Bayesian additive regression trees and Sobol'indices. Structure and infrastructure engineering, 1-13.

Zamanian, S., Hur, J., & Shafieezadeh, A. (2020). A high-fidelity computational investigation of buried concrete sewer pipes exposed to truckloads and corrosion deterioration. Engineering Structures, 221, 111043.

Zamanian, S., Rahimi, M., & Shafieezadeh, A. (2020). Resilience of Sewer Networks to Extreme Weather Hazards: Past Experiences and an Assessment Framework. In Pipelines 2020 (pp. 50-59). Reston, VA: American Society of Civil Engineers.

Zamanian, S., Terranova, B., & Shafieezadeh, A. (2020). Significant variables affecting the performance of concrete panels impacted by wind-borne projectiles: A global sensitivity analysis. International Journal of Impact Engineering, 144, 103650.

Zamanian, S. (2016). Probabilistic performance assessment of deteriorating buried concrete sewer pipes (Master thesis, The Ohio State University).

Zamanian, S., & Shafieezadeh, A. (2021). Age-dependent failure probabilities of corroding concrete sewer pipes under traffic loads. Tunnelling and Underground Space Technology incorporating Trenchless Technology Research (In press).

- Prepare reports to visualize and interpret the analyses for the different research groups.

Structural Design Experiences

- Performed basic structural design of simply supported bridges, buildings and parking garages using prestressed concrete, reinforced concrete and steel.
- Performed non-destructive tests for quality assessments of concrete.

Graduate Teaching Associate

The Ohio State University, Department of Civil, Environmental, and Geodetic Engineering, The Ohio State University

- Lectured and tutored Civil Engineering Material to 100 students.
- Lectured and tutored Geotechnical Engineering Lab to 100 students.
- Designed exams and assignments in addition to holding office hours for students.
- Developed curriculum for the Material in Civil Engineering course.
- Awarded a proposal by the College of Engineering for upgrading the Material Lab for $90,000 in Fall-2017.

Civil Engineer Intern

Construction Organization of Tehran Municipality, Tehran, Iran

- Assisted the lead structural team with the following projects:
  - Lashkarak Recreation & Commercial Complex
  - Rezvan Shopping Center in Tehran
- Designed sanitary and sewer pipes based on user requirements
- Performed basic structural design of Lashkarak Recreation & Commercial Complex in ETABS

Bahrulla Abdulla, PhD, PE

Asset Inventory

Dr. Abdulla has interdisciplinary project and research background, with over nine years of combined professional experience. During his Ph.D., his main area of research has been the application of simulation and (or) data analytics-based approaches to holistically assess critical infrastructure vulnerability, and he contributed to multiple infrastructure resilience or asset management themed projects funded by federal or state agencies.

Education

Ph.D. Civil Engineering, Texas A&M University College Station, TX

M.Sc. Engineering Systems & Management Khalifa University of Science and Technology, Abu Dhabi, UAE

B.Eng. Civil Engineering Southwest Jiaotong University, Sichuan, China

Certification/License

Professional Engineer

Areas of Expertise

- Infrastructure Risk Assessment, Asset Management, Data Analytics
- Transportation Systems Engineering, Supply Chain Management
- Conveyance System Engineering and Design

Professional Activities

Professional Member, ASCE, AGU

Technical Publications/ Papers/ Presentations

Abdulla, B., & Birgisson, B. (2020a). Characterization of Vulnerability of Road Networks to Random and Non-random Disruptions using Network Percolation Approach. Journal of Computing in Civil Engineering. https://doi.org/10.1061/(ASCE)CP.1943-5487.0000938

Abdulla, B., & Birgisson, B. (2020). Predicting Road Network Vulnerability to Fluvial Flooding Using Machine Learning Classifiers: Case Study of Houston during Hurricane Harvey. Construction Research Congress 2020, 38–47. https://doi.org/10.1061/9780784482865.005

Evaluate Potential Impacts, Benefits, Impediments, and Solutions of Automated Trucks and Truck Platooning on Texas Highway Infrastructure, TxDOT, College Station, TX

Responsible for systematically assessing impacts of truck platooning and automation on the pavement and bridges in Texas Freight Network using graph, Developed a mathematical tool that can quantify the systematic change in the TxDOT freight network assets (bridges and pavements). Results from my analysis informed TxDOT's policy on truck platooning and automation.

Assessment of Risks and Vulnerability in Coupled Human-Physical Networks of Houston's Flood Protection, Emergency Response, and Transportation Infrastructure in Harvey. And Anatomy of Coupled Human-Infrastructure Systems Resilience to Urban Flooding: Integrated Assessment of Social, Institutional, and Physical Networks, Houston, TX

Responsible for assessing the vulnerability of road network vulnerability and resilience under a wide range of simulated disruptive events. Road networks were modeled as graphs where nodes represent the intersections and edges represent the sections of the roads. Magnitude and impacts of disruptions (i.e., flood-induced, targeted or random) are simulated using Python programming language and vulnerability of road networks quantified using the giant connected component of the graph.

Hansa Keswani, PMP, EIT

CCTV Sewer Assessment

Mr. Keswani has over 8 years of experience in asset management, condition assessment, data analytics and database development in water, wastewater and stormwater projects.

Education

M.S., Johns Hopkins University

B.E., University of Mumbai

Certification/License

Professional Engineer

Project Management Professional

Areas of Expertise

- Asset Management Consulting
- Condition Assessment
- Database Development
- Data Analytics
- Geographic Information Systems

Professional Activities

- WEF
- AWWA

Ms. Keswani has an expertise in proposal development, cost-estimation, capital prioritization planning, risk assessment studies of various engineering and construction projects, database management and Geographic Information Systems (GIS) support. With a wide range of experience within the water industry, Ms. Keswani is a well-rounded consultant and is constantly implementing innovative tools and technologies to support her work.

WWTP Master Plan, Napa Sanitation District, Napa, CA

Ms. Keswani is responsible for performing focused condition assessment and risk assessment to determine near and long term CIP projects for the District which will be included with studies in other focus areas such as nutrient removal, wastewater process optimization, renewable energy production and optimization, residuals management and recycled water production, as a part of the master plan. Ms. Keswani is also conducting various workshops with the client at different milestones and will develop a near term and long term technical memorandum detailing the plant's renewable and rehabilitation needs as a part of the District's CIP plan.

Laguna Treatment Plant (LTP) Electrical Infrastructure Evaluation, City of Santa Rosa, Santa Rosa, CA

Ms. Keswani is an Asset Management Consultant responsible for Capital Improvement Program (CIP) Prioritization and updating the 2006 Power Master Plan for the City of Santa Rosa's LTP's electrical distribution system. The City would take a proactive approach to maintain reliability and improve redundancy of the electrical infrastructure and use the updated Power Master Plan to serve as a roadmap for electrical improvements at LTP.

Stormwater Master Plan Development, City of Stockton Municipal Utilities Department, Stockton, CA

Ms. Keswani is responsible for the development of a CIP cost estimation and prioritization for the current and future (2040) stormwater infrastructure improvements for City of Stockton's Municipal Utilities Department as a part of the stormwater master plan. The stormwater master plan will be the City's first plan to help the City understand their existing stormwater deficiencies, plan to address those deficiencies and the plan for future development via the CIP program. The CIP cost estimation will encompass both capital and O&M expenditures. A financial analysis to understand the City's current financial constraints will also be utilized to prioritize CIP projects comprising the Master Plan.

Hazen

12kV System Level 1 (Visual) Condition Assessment, Byron-Bethany Irrigation District (BBID), Byron, CA
Ms. Keswani is assisting in the electrical condition assessment effort which includes desktop inventory of electrical assets and field based visual condition assessment of the existing 12 kV distribution system, asset replacement valuation, risk assessment and renewal modeling. The 12 kV distribution system at BBID was built in 1960s. Due to the age of this system, the reliability of the system is one of the main concerns of the District which prompted the need for a proactive approach to managing the infrastructure assets. The condition and risk assessment and the renewal model will provide a 20-year rehabilitation & replacement(R&R) projection for the 12 kV assets.

The Clean Water Partnership Program, Prince George's County, Largo, MD
Ms. Keswani served as a Business Analyst and an Asset Management Consultant for Prince George's County's Clean Water Partnership Program. In March 2015, the County entered into the "first of its kind" innovative Community Based Public-Private Partnership (CBP3) Program committed to invest $100 million over the first three years of the partnership to meet the requirements of the Chesapeake Bay Total Maximum Daily Load (TMDL) and retrofit 2,000 acres of impervious surface. Ms. Keswani developed a centralized platform for stormwater assets supporting data aggregation across various disciples such as design, construction, program management, community outreach, mentor-protégé program and O&M services. She identified Key Performance Indicators (KPIs) in the program and developed dashboards for the clients and stakeholders. Ms. Keswani also developed an asset management framework for the program. She performed data gap assessment and risk assessment and made recommendations for changes to the existing CIP program at the County.

Performance Assessment of Patuxent Center Basin, Washington Suburban Sanitary Commission (WSSC), Laurel, MD
Ms. Keswani served as a Project Engineer and developed the scope of work for performance assessment of Patuxent Center Basin to be used as a pilot study for future performance assessment of other basins which are a part of WSSC's collection system. She analyzed previous records to identify Sanitary Sewer Overflows (SSOs) and Basement Backups (BBKs) that have occurred in the basin based on terms specified in the Sanitary Sewer Overflow Consent Decree signed in July 2005. She identified the causes of SSOs and BBKs in the basin and provided recommendations for future inspection and maintenance activities, to mitigate SSO and BBK occurrence in the basin.

Prestressed Cylinder Concrete Pipe (PCCP) Condition Assessment Basic Ordering Agreement (BOA), Washington Suburban Sanitary Commission (WSSC), Laurel, MD
Ms. Keswani served as a Condition Assessment Engineer for the PCCP Condition Assessment BOA for WSSC. She was responsible for field condition assessment of PCCP transmission mains in WSSC's collection system. WSSC's collection system consists of around 145 miles of PCCP pipelines, ranging from 36-in to 96-in in diameter. The results of the condition assessment and subsequent data analysis of selected pipelines facilitated the rehabilitation and repair of critical assets. Ms. Keswani also developed technical memorandums and condition assessment reports for the client.

Arthur Moncrieffe, Jr., EIT

CCTV Sewer Assessment

Mr. Moncrieffe has worked on numerous water and wastewater master plans and interactive CIP visualization tools

Education

MS, Environmental Engineering, University of Pittsburgh

Certification/License

Engineer-in-Training

NASSCO Certified: PACP, LACP, and MACP

Areas of Expertise

- Water/Wastewater Pipeline Design
- Sewer Rehabilitation/Asset Management
- AutoCAD
- GIS
- Primavera P6
- PowerBI

Professional Activities

American Society of Civil Engineers

Water Environment Federation

Water Master Plan Update and GIS Conversion Project, City of Chino, Chino, San Bernardino County, CA

Assistant Engineer. The City of Chino serves over 12 million gallons per day of potable water to a population of approximately 74,000. Key components of this project include the creation of a GIS geodatabase of the City's potable water distribution system, preparation of a Water Master Plan Report, and completion of a Risk and Resiliency Assessment for compliance with America's Water Infrastructure Act requirements. The Water Master Plan effort includes hydraulic model development and calibration; comprehensive hydraulic analysis of the City's conveyance, pumping, and storage facilities; and development of a prioritized Capital Improvement Program for the planning horizon including preliminary cost estimates.

Beverly Hills Integrated Water Resources Master Plan (Water, Sewer, Storm, Recycled, and SCADA), City of Beverly Hills, CA

Assistant Engineer. This is a comprehensive $1.5 M master plan of the potable water, recycled water, sanitary sewer, stormwater, and SCADA system. The IWRMP – Part 1 addresses the City's major water resources strategy which includes imported water, groundwater, and other potential supply sources. Part 1 also addresses other topics including emergency storage for the water system, and stormwater compliance. The IWRMP – Part 2 is a master plan of the water, sewer, and storm drain systems. For each system, the document addresses the existing system and service area, evaluation and design criteria, system analysis, and capital improvements. The theme of the IWRMP is to focus on near-term practical solutions with an eye towards what could be done in the future. The near-term represents a focus on projects that should be implemented within the next five years – 2021 through 2025. An eye towards the future includes taking the necessary steps now to position for long-term resiliency and reliability of the City's water, sewer, and storm drain systems. The IWRMP achieved several important goals for the City, including hydraulic model updates and calibration, long-range demand forecasting, and independent analysis of each of the systems.

Mountain House Raw Water Pipeline – Hydraulic Evaluation and Condition Assessment Project, Byron-Bethany Irrigation District, Bryon, CA
Assistant Engineer. The project involved a field investigation, hydraulic evaluation and condition assessment for 3.75 miles of a 30-inch diameter bar-wrapped welded-steel pipeline that delivered raw water to a local community WTP. Hazen team members completed the hydraulic investigation and evaluation of the existing pipeline to document the real-time system pressures, establish the baseline HGL condition and estimate the design HGL for comparison with the real-time data to confirm whether the pipeline pressure were within normal operating parameters for the flow deliveries to the WTP. After a market analysis of viable non-destructive condition assessment technologies, Hazen developed a comprehensive Request for Proposal for solicitation of bids and selection of a vendor to complete a visual (CCTV) and structural inspection of the pipeline to confirm and baseline the pipeline's current condition and identify any repairs that may be necessary including sediment removal. The next phase includes overseeing the field condition assessment and providing rehabilitation and/or replacement recommendations.

Storm water Asset Management, City of Carlsbad, Carlsbad, CA
Assistant Engineer. Tasks included parsing and organizing data from database for analysis.

Hyperion Force main assessment West Basin, El Segundo, CA
Assistant Engineer. Tasks included review of CCTV, research of current technologies, technical memorandum on findings and recommendation.

Yard Piping Asset Management, West Basin, El Segundo, CA
Assistant Engineer. Tasks include research of current technologies, class 4 cost estimation, metric analysis, dashboard creation and presentation of findings.

Storm and Sewer Asset Management, City of Goleta, Goleta, CA
Assistant Engineer. Assistance in creation of Dashboard and algorithm that assess projects in a CIP and allocates each in a given page for client use.

Asset Management, Otay Water District, Spring Valley, CA
Assistant Engineer. Tasks included parsing and organizing data from database for analysis.

SFPUD WWE Gap Analysis, San Francisco, CA
Assistant Engineer. Tasks include assisting in conducting interviews with stakeholders, data compilation, analysis toward assigning a score in the agency's asset management capability, and creating a road map toward gap closure.

Asset Management Milestone Monitoring, Multiple Projects, Jefferson County, AL
Mr. Moncrieffe has assisted in data analysis and data compilation used to monitor progress of over 50 projects in operation in Jefferson County, Al.

Program Management Services for Baltimore City's Water Utilities Program, City of Baltimore, MD:
Mr. Moncrieffe has assisted in data analysis, manipulation and entry to monitor the progress of over 100 projects and the replacement of over 237.57 miles of water mains in operation in the City of Baltimore.

Vivek Sai, PE, PMP

CCTV Sewer Assessment

Mr. Vivek Sai, PE has 18 years of experience in environmental engineering, asset management, GIS and Information Systems. Mr. Sai has provided professional engineering services for numerous municipal projects involving evaluation, modeling, and design of treatment facilities, pump stations and pipeline conveyance systems.

Education

MS Chemical Engineering, University of South Florida

BE Chemical Engineering,Shivaji University

Certification/License

Professional Engineer

Areas of Expertise

- Hydrology and Hydraulic Modeling
- Water and Wastewater Facility Design
- Geographic Information Systems (GIS) – ArcGIS
- Database Design and Development (SQL Server, Access)
- Data Collection and Processing
- Utilities Infrastructure Management

Professional Activities

American Water Works Association, AWWA

Water Environment Federation, WEF

American Institute of Chemical Engineers, AIChE

He has developed and updated numerous water and wastewater hydraulic models in a variety of software packages. He is a strategic member of Geographic Information System/Spatial Information Systems management (GIS/SIM) group in Hazen and Sawyer. His experience also includes a variety of projects related to GIS application development, utility infrastructure, conducting sewer evaluation studies, condition assessments and database management and construction related services. His asset management experience includes developing asset inventory list, analyzing condition data to improve accuracy of the estimation of remaining effective life and risk, advanced strategies for evaluation of asset conditions, and long-range rehabilitation and replacement needs projections for a variety of assets. Representative experience includes:

City of North Port Master Plan Update and US 41 Corridor Evaluation, FL

Project Engineer. Performed hydraulic modeling using Water CAD for both the master plan update and US 41 corridor study to evaluate the impact of proposed developments on the existing utilities. Based on additional developments that were being planned by the city he was able to input additional information into the model in order to advise them of necessary improvements that would be required for different scenarios.

Water, Wastewater, and Reclaimed Water Master Plan, DeSoto County, FL

Project Engineer. Involved in hydraulic modeling of the existing and future water and wastewater mains totaling over 114 miles of pipeline ranging from 4 to 20 inches. Mr. Sai was also involved in GIS mapping and building databases for the county's water and wastewater existing and potential customers. The Master plan identified both location and size of the various water and force mains which will be required to service the anticipated growth throughout the County. The project was completed in November 2005.

Opportunity Number

Hazen

Rock Run, Little Falls, and Watts Branch Sewer Basins Comprehensive Study, Washington Suburban Sanitary Commission

This project involved an Infiltration/Inflow (I/I) Analysis, Sewer System Evaluation, and an inventory, prioritization, and plan for addressing exposed sewer pipes in the Rock Run, Little Falls, and Watts Branch Basins in Montgomery County, MD. Mr. Sai was responsible for management of all flow monitoring data, GPS/GIS data, hydraulic modeling data, video data and synchronization of field data with central databases. Mr. Sai was also responsible for the QA/QC review of CCTV and manhole inspections of the sanitary sewer, making recommendations for rehabilitation and maintenance of manholes and pipe segments and, cost estimation.

Piscataway Creek Basin Comprehensive Sewer Study, WSSC, MD

The I/I and SSES program included a trunk sewer inspection program for sewer lines greater than 15 inches located near water bodies. As Project Engineer, he was responsible for management of all flow monitoring data, GPS/GIS data, video data and synchronization of field data with central databases. Mr. Sai was also responsible for the review of CCTV and Manhole inspections of the sanitary sewer and provided recommendations for rehabilitation and maintenance of manholes and sewer segments. The total cost of the project was $12 million.

South Mainland Regional Water Treatment Plant, Brevard County, FL

Project Engineer. Involved in the modeling of the water transmission and distribution system model to develop system improvements required to meet projected water demands. The scope also includes the task of developing a list of system improvements and the cost estimation of the improvements.

City of Reading, PA

This project was driven by Consent Decree to identify priority areas in the sanitary sewer system that require repair, replacement and or rehabilitation, and provide implementation schedule. The City's collection system is comprised of approx. 430 miles of sewers ranging from 6 to 66 inches in diameter. Mr. Sai was involved in managing inspections data done by sub-contractors and reviewing PACP and MACP data to identify deficiencies in the collection system, and develop rehabilitation plan and implementation schedule. He was also involved in updating the City's GIS.

Collection System Asset Management Program, Jefferson County, Alabama, Birmingham, AL

Project Engineer for development of collection system asset management program which will include the entire collection system consisting of approximately 3,200 miles of sanitary sewer, 80,200 manholes, and 174 pump stations and serving 144,000 customers. The program includes planning, evaluation, fow monitoring coordination, rehabilitation design, pipe upsizing, construction administration, construction management, capital improvement program (CIP) assistance, budgeting, scheduling, overfow reporting, and other tasks associated the collection system. Mr. Sai is assisting in development of automated tools to assist with sewer rehabilitation effort and to make staff more effcient. Tool and data developed include the following: asset management platforms, SSES data, capacity assurance programs, asset inventory and condition data, rehabilitation, replacement, cleaning and maintenance methods, system performance data sanitary sewer overfows (SSOs) and backups, television inspection (TVI), manhole inspections, and standardized condition evaluation and asset life estimation methods. He has developed several work flows to successfully implement program and construction management, developed power BI analytics to track several KPIs. This term of the contract is for three years, in the 3rd contract with a contract value of 21 million.

Alan Karnovitz, MPP

Financial Analysis

Mr. Karnovitz leads Hazen's Economic and Financial Services Group. He has 38 years of experience performing economic impact, regional economic, financial, and cost-benefit analyses and environmental assessments.

Education

MPP, Natural Resource Policy and Economics, Wharton School - University of Pennsylvania

BS, Biology and Natural Resources, University of California at Berkeley

Areas of Expertise

- Economic impact analyses
- Feasibility studies
- Regulatory impact studies
- Environmental assessments

Professional Activities

American Water Works Association

Stockton, California Stormwater Master Plan
Mr. Karnovitz is developing a financial plan to support the City's Stormwater Master Plan. He is using estimates being prepared for the Stormwater CIP to assist the City in optimizing their projected capital expenditures over the planning horizon of the Master Plan. This entails developing annualized costs, prioritizing projects, assessing potential affordability issues, and assisting the City in preparing a financing strategy that will include leveraging State and Federal grant and loan programs to the maximum extent possible.

Master Plan and Development Impact Fee Study, Durham, NC
Mr. Karnovitz evaluated alternative fee requirements and structure to obtain full cost recovery of expanded sewer infrastructure needed to accommodate planned residential development over a 20-year timeframe.

Master Planning for Broad Run Water Reclamation Facility, Loudoun Water, VA
Senior Economist. Evaluated alternative approaches to expanding the Broad Run Water Reclamation Facility. Supported the development of a financial model, assessing future regulatory scenarios, and will evaluate affordability aspects of technology options for shifting the facility into a fully sustainable production facility.

Methodology for a Comprehensive Analysis (Triple Bottom Line) of Alternative Water Supply Projects Compared to Direct Potable Reuse, WateReuse Foundation, DC
Senior Economist. Developed a new tool for assessing alternative water supply sources based on an extended Input-Output Analysis model that generated environmental and social impacts in addition to standard economic impacts. The project was supported by both the WateReuse and Water Research Foundation.

AMI Cost Benefit Analysis, Anne Arundel County, MD
Performing a cost benefit analysis of proposed program to install advanced metering infrastructure (AMI) for the County's Water Meter Services Department. Evaluating the alternative hardware and software systems being offered by the major AMI vendors and estimating life cycle costs and benefits of each alternative to support the County's decision on whether to proceed with the AMI program.

Hazen

Appomattox River Water Authority, VA
Performed the economic and financial evaluation of Authority's proposed 10-year Capital Program Plan (CPP) to estimate impacts on wholesale water prices and on distribution of the financial burden on the five jurisdictions comprising the Authority's service base. Evaluated alternative infrastructure configurations and financing and cost allocation options for optimizing CPP investments.

Series 2018 Water and Sewer Bond Issuance Engineering Report, City of Cartersville, GA
Recently led a project to conduct a 10-year forecast of revenues and expenses for the City of Cartersville, GA to evaluate future debt coverage sufficiency associated with the issuance of Series 2018 bonds. Evaluated historical data and used trend analysis to estimate future demand and revenue by customer class.

Financial Evaluation, Town of Nantucket, MA
Led a series of financial evaluations for the Town of Nantucket to help the Town optimize their capital investments. Tasks include performing a financial capability assessment, analyzing how capital investments are financed and recommending alternative approaches, using integrated planning to improve their CIP, and conducting a rate study.

Integrated Planning Framework, City of Lowell, MA
Using the EPA integrated planning framework (IPF) process to assist Lowell in preparing a Long Term Control Plan that will comply with the EPA's consent decree in an affordable manner and which will maximizes near term benefits based on the utility's most pressing needs. Also leading the Financial Capability Assessment in support of the IPF.

Proposed Statistical Threshold Value Water Quality Standards Affordability Analysis, DC Water
Led an affordability analysis of the proposed Statistical Threshold Value (STV) criteria for bacteria under consideration by the Department of Energy and Environment. Complying with the proposed STV would require significant new capital investments by DC Water. The study estimated and compared the rate impacts of the Status Quo CIP with the estimated rate impacts of the proposed STV Water Quality Standards. The study projected financial impacts to vulnerable households including low-income, minority, single-headed households.

Financial Impact of Proposed Enhanced Consumer Assistant Program, DC Water
Provided DC Water's CFO with rapid turnaround technical assistance to evaluate the financial costs of enhanced Consumer Assistance Programs (CAP) being proposed by the City's Mayor. Also helped the CFO in proposing alternative CAPs that would better focus on lower income households.

Feasibility Study of Alternative Water Supply, Charles County, MD
Applied triple bottom line analysis to evaluate alternative water supply sources that will be needed to meet the County's water requirements over the next 30 years. The analysis considered environmental, economic, financial, and social factors in comparing the merits and disadvantages of the competing alternatives.

Appomattox River Water Authority, VA
Mr. Karnovitz performed the economic and financial evaluation of Authority's proposed 10-year Capital Program Plan (CPP)to estimate impacts on wholesale water prices and on distribution of financial burden on the five jurisdictions comprising the Authority Service base. Evaluating alternative infrastructure configurations and financing and cost allocation options for optimizing CPP investments.

Newark and Marion Ohio Financial Capability Assessments (FCAs) and Rate Studies
Mr. Karnovitz has prepared FCAs and affordability studies in conjunction with development of Long-Term Control Plans for these two municipalities. Affordability studies and municipal financial constraints will be used to assist in prioritizing CIP Projects. He will assist in developing a schedule that is affordable to the ratepayers and financially sustainable to the municipalities. Also performed rate studies for these municipalities to assist them in establishing an affordable schedule and assisted in obtaining grants and low interest loans from the State of Ohio.

Christopher Portner, PE, CEP

Cost Estimating

Mr. Portner is a Civil Engineer with experience in pump station design, cost estimating and construction management. He is currently responsible for all of Hazen's Cost Estimating in California and has performed cost estimating from planning level through construction for all water projects, including conveyance and treatment facilities. Mr. Portner is a AACEi Certified Estimating Professional.

Education

MS ,Environmental Engineering, University of California, Berkeley

BS, Civil and Environmental Engineering, University of California, Berkeley

Certification/License

Professional Engineer

Certified Estimating Professional (CEP)

Areas of Expertise

- Cost Estimating
- Wastewater Treatment Plant Design
- Wastewater Process Engineering
- Construction Management
- Scheduling
- Change Order Preparation and Negotiation
- Design Services During Construction

Professional Activities

Water Environment Federation (WEF)

American Association of Cost Engineers (AACEi)

California Water Environment Association (CWEA)

Asset Management Data Inventory and Validation Pilot Project, Goleta Sanitation District, CA
Cost Engineer for development of long-term replacement costs for District assets located at its wastewater Treatment plant as part of a plant assessment.

Rio Hondo Recycled Water Pump Station Condition Assessment and Risk Failure Analysis, Central Basin Municipal Water District Commerce, CA
Cost Engineer for the project which entailed a condition assessment, risk of failure analysis, determination of remaining useful life and recommendations for rehabilitation or replacement of a critical recycled water pump station.

Plant 30 Wellhead Treatment Design, Montclair, CA
Cost Engineer for the planning and design of a 4,000 gpm treatment system for Monte Vista Water District. Treat-ment includes GAC for 1,2,3-TCP and regenerable ion exchange for nitrate and perchlorate. The design includes treatment of two out of three wells and pipelines from two wells to the third well site. Future expansion for treating all 3 wells is a design consideration.

Los Angeles Department of Water and Power, Treatment for San Fernando Groundwater Basin, Los Angeles, CA
Cost Engineer. The project is a large-scale groundwater remediation which may require advanced treatment. Role includes leading civil design for multiple water treatment plants. Civil design included trunkline piping, yard piping, off-site piping, grading, paving, drainage, and miscellaneous site improvements. Coordination with other disciplines including mechanical, electrical, instrumentation, architectural, and structural.

Eastside Water Treatment Facility Expansion Project, Chino, CA
Cost Engineer for design of a 3,500 gpm treatment expansion for the City of Chino at the Eastside Facility. Treatment includes GAC for 1,2,3-TCP and ion exchange for nitrate. The design includes treatment of three wells, with poten-tial for a forth, pipelines, buildings and control systems. This design requires careful integration of the new equip-ment with existing treatment on site.

Chino GAC and IX Design, Chino, CA
Cost Engineer for design of a 3,500 gpm treatment expansion for the City of Chino at the Eastside Facility. Treatment includes GAC for 1,2,3-TCP and ion exchange for nitrate. The design includes treatment of three wells, with poten-tial for a forth, pipelines, buildings and control systems. This design requires careful integration of the new equip-ment with existing treatment on site.

Water Quality Feasibility Study, City of Chino, Chino, CA
Mr. Portner was the Cost Engineer on a planning project for the City of Chino to identify a permanent solution to fully utilize all City groundwater wells by addressing water quality issues. Treatment and non-treatment options were evaluated for the City's twelve wells. The team evaluated groundwater quality considering current and poten-tial future regulated contaminants, determined compliance approaches, identified best value treatment technolo-gies, and prepared site plans for the leading options.

Plant 30 Wellhead Treatment Design, Monte Vista Water District, Montclair, CA
Cost Engineer. Mr. Portner is the Cost Engineer for the planning and design of a 4,000 gpm treatment system for Monte Vista Water District. Treatment includes GAC for 1,2,3-TCP and regenerable ion exchange for nitrate and perchlorate. The design includes treatment of two out of three wells and pipelines from two wells to the third well site. Future expansion for treating all 3 wells is a design consideration.

Chromium-6 Water Treatment Facilities Project, Coachella Water Authority, CA
Cost Engineer for detailed design for removal of chromium-6 from groundwater drinking wells. Project was bid as a Construction-Manager-at-Risk (CMAR), with the CMAR joining the design process at the 60% stage. Detailed design for this $200M+ project included a central regeneration facility, remote well treatment sites with both strong base and weak base ion exchange systems and transmission pipelines.

Reservoirs 1 & 2 Chemical Facilities, Mesa Water District, Costa Mesa, CA
Cost Engineer for design of upgrades at two reservoirs to address nitrification in the distribution system. Scope of work included addition of mixing to the reservoirs and chemical injection and monitoring systems and associated structures and appurtenances.

Chromium-6 Treatment and Compliance Study and Design, Coachella Water Authority, CA
Cost Engineer for compliance study alternatives and detailed design for removal of chromium-6 from groundwater drinking wells. Potential alternatives analyzed included ion exchange technology including onsite and offsite regeneration of resins. Detailed design for this $200M+ project included a central regeneration facility, remote well treatment sites with both strong base and weak base ion exchange systems and transmission pipelines.

Domestic Water System Source of Supply/Treatment Study, Coachella Valley Water District, Riverside, CA
Cost Estimator and Scheduler for an alternative analysis portion of a Consent Order Decree project to provide additional levels of treatment to groundwater and surface water. The scope of work included alternative analysis of ground water treatment systems at remote wellhead locations, traditional centralized surface water treatment plants and point-of-use systems.

Appendix B

Insurance

HAZE&SA-01 KSANCHEZ

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 9/8/2021

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER	CONTACT NAME:	
Ames & Gough 8300 Greensboro Drive Suite 980 McLean, VA 22102	PHONE (A/C, No, Ext): (703) 827-2277	FAX (A/C, No): (703) 827-2279
	E-MAIL ADDRESS: admin@amesgough.com	

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Hartford Fire Insurance Company A+ (XV)	19682
INSURER B : Twin City Fire Insurance Company A+ (XV)	29459
INSURER C : Continental Casualty Company (CNA) A, XV	20443
INSURER D :	
INSURER E :	
INSURER F :	

INSURED

Hazen and Sawyer
498 Seventh Avenue
New York, NY 10018

COVERAGES **CERTIFICATE NUMBER:** **REVISION NUMBER:**

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	X COMMERCIAL GENERAL LIABILITY			42UUNOL5499	3/29/2021	3/29/2022	EACH OCCURRENCE	$ 1,000,000
	CLAIMS-MADE X OCCUR						DAMAGE TO RENTED PREMISES (Ea occurrence)	$ 1,000,000
	X Contractual Liab.						MED EXP (Any one person)	$ 10,000
							PERSONAL & ADV INJURY	$ 1,000,000
	GEN'L AGGREGATE LIMIT APPLIES PER:						GENERAL AGGREGATE	$ 2,000,000
	POLICY X PRO-JECT LOC						PRODUCTS - COMP/OP AGG	$ 2,000,000
	OTHER:							$
A	AUTOMOBILE LIABILITY			42UENOL5501	3/29/2021	3/29/2022	COMBINED SINGLE LIMIT (Ea accident)	$ 2,000,000
	X ANY AUTO						BODILY INJURY (Per person)	$
	OWNED AUTOS ONLY / SCHEDULED AUTOS						BODILY INJURY (Per accident)	$
	HIRED AUTOS ONLY / NON-OWNED AUTOS ONLY						PROPERTY DAMAGE (Per accident)	$
							Comp./Coll. Ded	$ 1,000
	UMBRELLA LIAB OCCUR						EACH OCCURRENCE	$
	EXCESS LIAB CLAIMS-MADE						AGGREGATE	$
	DED RETENTION $							$
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) Y/N: N If yes, describe under DESCRIPTION OF OPERATIONS below	N / A		42WBOL6H6E	3/29/2021	3/29/2022	X PER STATUTE / OTH-ER	
							E.L. EACH ACCIDENT	$ 1,000,000
							E.L. DISEASE - EA EMPLOYEE	$ 1,000,000
							E.L. DISEASE - POLICY LIMIT	$ 1,000,000
C	Professional			AEH008231489	3/29/2021	3/29/2022	Per Claim	1,000,000
C	Liability			AEH008231489	3/29/2021	3/29/2022	Aggregate	2,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

RE: Master Plan and Condtion Assessemnt Study (Project #2122-012)

Trabuco Canyon Water District, its directors, officers, employees and authorized volunteers are included as additional insured with respect to General Liability and Automobile Liability when required by written contract. General Liability includes Additional Insured coverage for On-Going & Completed Operations as required by written contract. General Liability and Automobile Liability are primary and non-contributory over any existing insurance and limited to liability arising out of the operations of the named insured and when required by written contract. Workers Compensation policy includes a waiver of subrogation in favor of the additional insureds where permissible by state law and when required by written contract. 30-day Notice of Cancellation will be issued for the General Liability, Automobile Liability, Workers Compensation and Professional Liability policies in accordance with policy terms and conditions.

CERTIFICATE HOLDER

Trabuco Canyon Water District
32003 Dove Canyon Parkway
Trabuco Canyon, CA 92679

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Appendix C

Scope of Work

Appendix C

Scope of Work

1. **Project Management and Meetings**
    a. Hazen's Project Manager will provide proactive project management throughout the duration of the project (assumed 12-months), including email and phone correspondence as needed with the District, scheduling, coordination, and invoicing. This task also includes bi-weekly progress calls, and in-person meetings at key project milestones (assumed 4).
2. **Data Collection and Review**
    a. All available information pertinent to this project will be collected and reviewed. Known documents and information to be collected and reviewed include:
        - Previous Master Plan
        - Supply source/water production data
        - Water and recycled water demands
        - Reservoir, pump station, lift station data
        - Hydraulic models and related reports on model development
        - Sewer system data
        - All applicable system data, GIS files, as-built records, and operational information
3. **Update Water Hydraulic Model**
    a. **Model Software** – Hazen will procure quotes from up to three (3) software vendors for the water and recycled water models. The quotes will be presented to the District for review, and a recommendation will be made on the software to utilize.
    b. **Model Infrastructure Update** - Hazen shall use ESRI ArcGIS to review the latest geodatabase, provide a gap analysis report to the District, and work with the District on the best method of data gap closure. It is assumed up to 20 as-built sheets will be used for review and incorporation of new data into the hydraulic model. Linking of as-builts to the geodatabase is not included.
    c. **Model Controls Update** - Hazen shall establish valve control settings, pump control settings, reservoir dimensions, and water supply parameters – as needed for model calibration.
    d. **Water Demands** - Hazen shall use up to five years of meter billing data, AMI data and GIS land use data, analyzing use trends over groups and time, in order to determine existing water demands in the service area. Separate analyses will be reviewed for up to 5 large users within the service area. The model will be loaded with demands using geocoded meter billing data.
    e. **Future Developments/Customers** - Hazen will develop 5-year increment (up to 2045) of proposed demands based on development information and water demand factors.
    f. **Diurnal Curve, Peaking Factors** - Hazen shall use a combination of field data, industry standards and best practices to perform diurnal curve calculations, establishing a single diurnal curve for the entire distribution system in the water hydraulic model. Hazen shall develop maximum day and peak hour peaking factors from existing demand and production data. Peaking factors will be compared to the previous Master Plan.
    g. **Field Testing Plan** - It is recommended to conduct hydrant tests and install pressure recorders in the field over a 2-day period. Hazen staff will develop a testing plan and coordinate with District staff. Hazen staff will be in the field with District staff to implement the testing plan. Hazen and District staff will work together to implement the tests and collect the field readings. During the 2-day period, we anticipate collecting data at 15-20 locations.

h. **Hydraulic Model Calibration**

- Macrocalibration/Steady-state - Reviewing model for high level conformity, checking HGLs, pressure zone boundaries, and major facilities modeled correctly. This task will be performed on a steady-state scenario.
- Microcalibration/EPS – A 24-hour scenario will be developed for EPS calibration. The results from the field tests will be used for calibration. Iterative adjustments shall be made with the goal of +/- 10% accuracy to field measurements, or until adjustments no longer refine the accuracy of the model. The pipe roughness coefficients shall be the last variable adjusted, but will only be made within industry-accepted limits for certain pipe materials. The calibration results will be shown in tabular and graphical formats.

i. **Recycled Water** – The recycled water model update process will follow a similar scope as the water model, but the effort will be abbreviated based on the needs of the recycled water system and hydraulic model. The model will be updated based on current data, and field tests will be performed during the water system field tests. The model will be calibrated to the field test results and used for analysis and master planning.

4. **Water System Analysis**

a. **Service and Design Criteria** – Service criteria will be established for evaluating existing facilities. Design criteria will be established for designing new facilities.

b. **Demand Projections** – We will utilize demand projections from the 2020 UWMP.

c. **Water Supply Evaluation** – Analyze the adequacy and reliability of the District's water sources, identifying water quality issues, legal/institutional or contractual restraints, environmental documentation issues, and system issues as well as cost considerations. Develop a strategic plan to enhance the efficiency and reliability of the District's water supply.

d. **Existing Water System Evaluation** - Development of the hydraulic profile and system schematic along with an evaluation of the following parameters and recommendations for future improvements.

- Water supply facilities
- Storage facilities
- Booster stations
- Pressure reducing valves
- Fire flow availability
- Distribution system
- System performance and operations (should include a review of historical main breaks, water loss, energy use, and operational rotation/maintenance)

e. **Future Water System Evaluation** - Review of planned developments within the District and the needed system improvements to serve those developments. The same parameters as listed previously will be evaluated.

f. **Capital Improvement Program** - All recommended capital improvements will have an associated technical justification (based on analyses) description. All CIP descriptions will indicate relative priority and/or anticipated timing if needed for phasing. CIP projects will also include a cost estimate broken down by construction cost, contingency, engineering and admin, and construction management.

5. **Recycled Water System Analysis**

a. **Recycled Water Demands** - Perform an analysis of the existing recycled water users and identify potential future recycled water users, assuming a realistic expansion of the recycled water system.

b. **Service and Design Criteria** – Service criteria will be established for evaluating existing facilities. Design criteria will be established for designing new facilities.

c. **Existing Recycled Water System Evaluation** - Development of the hydraulic profile and system schematic along with an evaluation of the following parameters and recommendations for future improvements.

- Recycled Water supply facilities
- Storage facilities
- Booster stations
- Pressure reducing valves
- Distribution system
- System performance and operations

d. **Future Recycled Water System Evaluation** - Review of planned developments within the District and the needed system improvements to serve those developments. The same parameters as listed previously will be evaluated.

e. **Capital Improvement Program** - All recommended capital improvements will have an associated technical justification (based on analyses) description. All CIP descriptions will indicate relative priority and/or anticipated timing if needed for phasing. CIP projects will also include a cost estimate broken down by construction cost, contingency, engineering and admin, and construction management.

6. **Sewer Model Development**

a. **Model Software** – Hazen will procure quotes from up to three (3) software vendors for the sewer model. The quotes will be presented to the District for review, and a recommendation will be made on the software to utilize.

b. **Model Development** - Hazen will utilize the existing sewer geodatabase to develop a dynamic hydraulic model. The model is anticipated to include all facilities in the geodatabase including gravity mains, force mains, manholes, and lift stations. The WWTP will be modeled as an outfall point, is assumed the WWTP internal process piping will not be included in the system-wide hydraulic model.

Construction of the model will be performed by importing GIS data the software framework, and performing a QA/QC analysis on pipe/manhole connectivity and alignment. Data gaps will be populated using a combination of record drawings and surveyed invert data. If an excessive amount of interpolation and extrapolation of inverts and/or rim elevations is needed, we will discuss with the District. Lift station operational information will be defined in the model for explicitly-modeled pumps, and configuration of diversion structures will also be defined.

The model will be configured to represent both dry weather flow conditions as well as wet weather performance of the collection system. Dry weather flows will be developed based on a combination of flow metering data, water consumption data, and population data as appropriate. Wet weather flows will be developed using standard hydrologic parameters that represent the rainfall-dependent infiltration and inflow response of sewer systems.

c. **Model Calibration / Verification** - Hazen will utilize the flow monitoring data to perform dry weather calibration and verification of the hydraulic model. The model will be calibrated by adjusting hydraulic parameters until reasonable agreement is reached between observed and predicted flows, volumes and depths. Model calibration accuracy and quality will be judged by industry-standard guidelines, such as general acceptable ranges for model accuracy, as follows:

- Dry weather peak flows within +10% and -10%
- Dry weather flow volumes within +10% and -10%

d. **Baseline / Future Capacity Analyses** - Hazen will use the calibrated and verified model to simulate various scenarios and analyze the collection system under baseline and future conditions. Modeling evaluation will include impacts of any proposed system modifications, upgrades and expansions to the collection system. The simulations will be performed for two scenarios, baseline (based on the time period for which monitoring data is collected) and future (growth scenario based on UWMP projections)

The ability of the wastewater collection system to convey baseline and future flows will be evaluated. Locations of predicted SSOs, surcharging and hydraulic deficiencies will be identified. Tables and figures depicting the performance of the collection system for each scenario will be developed.

7. **Flow Monitoring**

a. **General** – this task will be carried out by our subconsultant ADS Environmental. Based on the size and layout of your system, we have determined that an appropriate sewer flow monitoring scope is a total of eight (8) monitors for three (3) weeks to capture dry-weather flow conditions, which includes installation, data collection, monitoring, maintenance, and demobilization of the flow monitors. The data will be summarized in a final report and provided to Hazen for use in sewer model development.

b. It is assumed the District can provide cleaning/jetting if needed, and if a permit is needed, the permit cost will be paid by the District.

8. **Asset Management / Condition Assessment**

a. **Data Collection and Consolidation** - Hazen will use information provided by the District including drawings, electronic O&M manuals, maintenance records, GIS geodatabase and shapefiles, hydraulic models and bid documents, if available, to develop and populate an asset inventory for the District's facilities including pump stations, reservoirs, lift stations, treatment facilities as well as distribution and collection system pipelines. Our Team will perform a data gap assessment to identify any gaps in the asset attribute data (e.g., install year, material, size) in the asset inventory. Data gap closure strategies will be presented to the District for consideration and the best strategies will be implemented to close the data gaps.

Deliverable:

- Preliminary Asset Inventory (Excel File)
- Data Gap Closure Workshop (2 hours)

b. **Field Condition and Performance Assessment** - The condition assessment includes two components, (1) a desktop condition and remaining useful life evaluation of all District above and below-ground assets, (2) visual condition assessment investigating the physical and functional condition of all structural, mechanical, electrical and instrumentation components of the following pump stations, lift stations and discharge pipeline identified in the RFP which included: Barneburg LS, Golf Club LS, Heritage LS, Via Allegre LS, Plano LS/PS and above ground visible segments of 3 miles of 16" CML&C discharge pipeline from Dimension Water Treatment Plant (DWTP) to Ridgeline/ El Toro Pump Station and DWTP. Hazen will utilize a structured condition assessment methodology which is transparent, repeatable, and useful for later analysis by Hazen and District staff, with each score's definition which can be applied to all asset classes during the field condition assessment.

Utilizing information in the District's geodatabase (install year, material, diameter, etc.), any CCTV and break/leakage data, hydraulic models and current and future flow projections provided by the District, Hazen will perform a desktop condition assessment and hydraulic assessment of the domestic water, non-domestic water and sewer conveyance systems. Utilizing the existing data, maintenance history, and the condition assessment scores, Hazen will determine the remaining useful life of each asset in the inventory.

Deliverables:

- Electronic Condition Assessment Forms
- Field Condition Assessment
- Preliminary Asset Register Updated with Condition Scores and Remaining Useful Lives (Excel File)
- Field Condition Assessment Photographs (Asset Photos)
- Condition Assessment Results Workshop (2 hours)
- Draft and Final Condition Assessment Results Document (PDF)

c. **Replacement Cost Estimating** - Hazen will estimate the replacement costs of each asset within the asset inventory. Various strategies are used including crew-based estimating, productivity-based estimating, general condition costs, and assessment of market conditions.

Deliverables:

- Asset Inventory Updated with Replacement Costs (Excel File)

d. **Prioritized CCTV Program** - Hazen will develop a risk assessment methodology for collection system pipelines. The CoF criteria, weighting factors, and scoring guide will be developed for determining the CoF scores and will be reviewed by District staff through a workshop. The PoF will be calculated based on the results of the desktop condition assessment. Hazen will develop risk scores by combining PoF and CoF scores and incorporating mitigation strategies and redundancies. Risk thresholds will be established to categorize the collection system pipelines into low, medium, and high risk levels.

Utilizing an asset management risk-based approach, Hazen will prioritize collection system pipe segments. To develop a 5-year prioritized CCTV program, a decision flow diagram will be developed that uses information such as previous CCTV data, risk scores, remaining useful lives, pipe material and geographical location. The decision flow diagram will also be used to identify pipe segments that require immediate CCTV.

Hazen will provide the District a Microsoft-based Excel asset inventory updated with condition scores, estimated useful life for each asset class, remaining useful life, risk score and replacement cost for each asset.

Deliverables:

- Risk Methodology Workshop (2 hours)
- Final Asset Inventory Updated with Risk Scores (Excel File)
- Risk Maps and Risk Matrices (PDF)
- Prioritized CCTV Program Workshop (2 hours)
- Draft and Final Prioritized CCTV Decision Flow Diagram (PDF)

e. **Condition Assessment CIP Development and Business Case Evaluation** - The Hazen team will facilitate a workshop to develop a formal Business Case Evaluation process (BCE) to evaluate and prioritize Capital Improvement Projects (CIPs) based on minimizing the risk, life-cycle cost, while maintaining the levels of service and maximizing benefits. Incorporating the concept of Benefit/Cost Ratio (B/C), each CIP will carefully be analyzed with respect to initial capital cost, on-going operation and maintenance costs, risk costs, and potential benefits. The solution providing the greatest benefit will formally be recommended for implementation. The results of the BCE will be

used to develop the CIPs whose expenditures are focused on addressing high risk assets first while maximizing benefit to the District.

Deliverables:

- Business Case Evaluation (BCE) Workshop (2 hours)
- Draft and Final BCE Model with Prioritized CIP Projects (Excel File)

9. **Financial Analysis**

   a. Hazen proposes to revisit the method used to the calculate the initial water capacity charges and ascertain whether that methodology is consistent with the current best accepted practices and whether the assumptions originally used remain valid. For example, we will assess whether the capacity fees were developed in alignment with the methods described in the AWWA and WEF manuals for establishing capacity (i.e., development impact) fees. The manual present the three main commonly accepted approaches referred to as "System Buy-in", "Incremental" and "Hybrid". Although, it appears that the initial method used the "Buy In" approach, we recommend a review to determine if any modifications of to that method of calculation would be warranted, such as new capital projects completed during the intervening period.

   b. Hazen will also review the key assumptions used to develop the initial capacity fees. For example, the initial fees used the 1999 Master Plan average household demand of 459 gallons per day as one equivalent single family dwelling unit development (EDU). Per capita and per household water demand has substantially decreased in the last 22 years and using this assumption might well overestimate current water demand for new developments and result in potential overcharges. Noteworthy, is that in the 2020 Water and Wastewater Rate study conducted for the District, the Consultant assumed an average daily water demand of approximately 344 gallons demand for a typical household. We will also revisit capacity charges for the Supplemental Water Capacity Fee, which is reserved and allocated to pay the debt service for the COPs.

   c. We want to emphasize that Hazen will only propose methodological changes if required. If the assumptions used to develop the current charges remain valid based on our initial review, we will end our study at that point. Otherwise, we will provide the District with a recommendation for a new method and applicable charges going forward. That method must be transparent, equitable, and legally defensible in accordance with California regulations.

10. **Master Plan Update Report**

   a. **Draft #1 Report (60% Completion Level)**

      - Draft #1 will be consistent with a 60% submittal. The major elements of the report will be complete including the various analyses, but not including recommended projects, or conclusions. Some levels of detail will be left for subsequent submittals to ensure concurrence from the District.
      - It is assumed four (4) bound double-sided copies will be provided to the District for review.

   b. **Draft #2 Report (90% Completion Level)**

      - Draft #2 will address all comments, plus incorporate all remaining aspects of the analysis and be a fully-completed report with all completed analyses, findings, recommendations, exhibits and graphics. The report completion level will be consistent with a 90% submittal. We consider this a complete document with no remaining work efforts to be completed except addressing changes and comments from District reviewers.
      - It is assumed four (4) bound double-sided copies will be provided to the District for review.

c. **Final Report**

- The Final Report will address any minor comments from Draft #2 and be signed and distributed for the District's final records.
- It is assumed four (4) bound double-sided copies will be provided to the District for review.

d. **Board Presentation**

- A presentation will be given to the District Board summarizing the Master Plan process, key findings, andrecommendations.

11. **Manhole Survey and Dips (OPTIONAL)**

a. Our subconsultant Fuscoe will deliver this task.

b. Field Survey locate 300 manholes and invert elevation. Horizontal and vertical location will be performed by RTK GPS field survey methods tied to Orange County Horizonal and Vertical CGPS control (CCS 83, VI 2017.5). Deliverables will include a comma delimited coordinate point file with rim and invert elevation and a georeferenced photo of each manhole. Manholes rims that are not locatable by GPS methods will be positioned based on the districts GIS coordinate position with a measured depth to the invert. Task Assumes that manholes are unlocked and surface accessible. No lane closures or traffic control permitting is included in this task.

12. **CCTV of Sewer System (OPTIONAL)**

a. Our subconsultant National Plant Services (NPS) will deliver this task.

b. Please see pricing info below on the scope of services related to CCTV sewer inspection.

Assuming the lines in scope are concurrent and relatively close to each other, NPS will perform 2-pass clean and CCTV at the following prices:

Mobilization (one time): $2,500
6" Clean and CCTV = $2.10/LF
8"-10" Clean and CCTV = $1.80/LF
12" Clean and CCTV = $2.10/LF

- Client to provide water for cleaning, and a place to dump sewer debris.
- Permits paid for by others.
- Traffic control reimbursed at cost plus 10% including TC plan preparation fees.

TRABUCO CANYON
WATER DISTRICT

Hazen

Hazen and Sawyer
7700 Irvine Center Drive • Suite 200 • Irvine, CA 92618

Hazen

Scope of Work

1. Project Management and Meetings

Hazen's Project Manager will provide proactive project management throughout the duration of the project (assumed 12-months), including email and phone correspondence as needed with the District, scheduling, coordination, and invoicing. This task also includes bi-weekly progress calls, and in-person meetings at key project milestones (assumed 4).

2. Data Collection and Review

All available information pertinent to this project will be collected and reviewed. Known documents and information to be collected and reviewed include:

- Previous Master Plan
- Supply source/water production data
- Water and recycled water demands
- Reservoir, pump station, lift station data
- Hydraulic models and related reports on model development
- Sewer system data
- All applicable system data, GIS files, as-built records, and operational information

3. Update Water Hydraulic Model

a. Model Software – Hazen will procure quotes from two (2) software vendors for the water and recycled water models. The quotes will be presented to the District for review, and a recommendation will be made on the software to utilize.

b. Model Infrastructure Update - Hazen shall use ESRI ArcGIS to review the latest geodatabase, provide a gap analysis report to the District, and work with the District on the best method of data gap closure. It is assumed up to 20 as-built sheets will be used for review and incorporation of new data into the hydraulic model. Linking of as-builts to the geodatabase is not included.

c. Model Controls Update - Hazen shall establish valve control settings, pump control settings, reservoir dimensions, and water supply parameters – as needed for model calibration.

d. Water Demands Update- Hazen shall use up to five years of meter billing data, AMI data and GIS land use data, analyzing use trends over groups and time, in order to determine existing water demands in the service area. Separate analyses will be reviewed for up to 5 large users within the service area. The model will be loaded with demands using geocoded meter billing data.

e. Future Developments/Customers - Hazen will develop 5-year increment (up to 2045) of proposed demands based on development information and water demand factors.

f. Diurnal Curve, Peaking Factors - Hazen shall use a combination of field data, industry standards and best practices to perform diurnal curve calculations, establishing a single diurnal curve for the entire distribution system in the water hydraulic model. Hazen shall develop maximum day and peak hour peaking factors from existing demand and production data. Peaking factors will be compared to the previous Master Plan.

g. Field Testing Plan - It is recommended to conduct hydrant tests and install pressure recorders in the field over a 2-day period. Hazen staff will develop a testing plan and coordinate with District staff. Hazen staff will be in the field with District staff to implement the testing plan. Hazen and District staff will work together to implement the tests and collect the field readings. During the 2-day period, we anticipate collecting data at 15-20 locations.

h. Hydraulic Model Calibration

- Marcrocalibration/Steady-State - Reviewing model for high level conformity, checking HGLs, pressure zone boundaries, and major facilities modeled correctly. This task will be performed on a steady-state scenario.
- Microcalibration/EPS – A 24-hour scenario will be developed for EPS calibration. The results from the field tests will be used for calibration. Iterative adjustments shall be made with the goal of +/- 10% accuracy to field measurements, or until adjustments no longer refine the accuracy of the model. The pipe roughness coefficients shall be the last variable adjusted but will only be made within industry-accepted limits for certain pipe materials. The calibration results will be shown in tabular and graphical formats.

i. Recycled Water – The recycled water model update process will follow a similar scope as the water model, but the effort will be abbreviated based on the needs of the recycled water system and hydraulic model. The model will be updated based on current data, and field tests will be performed during the water system field tests. The model will be calibrated to the field test results and used for analysis and master planning.

4. Water System Analysis

a. Service and Design Criteria – Service criteria will be established for evaluating existing facilities. Design criteria will be established for designing new facilities.

b. Demand Projections – We will utilize demand projections from the 2020 UWMP.

c. Existing Water System Evaluation - Development of the hydraulic profile and system schematic along with an evaluation of the following parameters and recommendations for future improvements.

- Water supply facilities
- Storage facilities
- Booster stations
- Pressure reducing valves
- Fire flow availability
- Distribution system

- System performance and operations (should include a review of historical main breaks, water loss, energy use, and operational rotation/maintenance)

d. Future Water System Evaluation - Review of planned developments within the District and the needed system improvements to serve those developments. The same parameters as listed previously will be evaluated.

e. Capital Improvement Program - All recommended capital improvements will have an associated technical justification (based on analyses) description. All CIP descriptions will indicate relative priority and/or anticipated timing if needed for phasing. CIP projects will also include a cost estimate broken down by construction cost, contingency, engineering and admin, and construction management.

5. Recycled Water System Analysis

a. Recycled Water Demands - Perform an analysis of the existing recycled water users and identify potential future recycled water users, assuming a realistic expansion of the recycled water system.

b. Service and Design Criteria – Service criteria will be established for evaluating existing facilities. Design criteria will be established for designing new facilities.

c. Existing Recycled Water System Evaluation - Development of the hydraulic profile and system schematic along with an evaluation of the following parameters and recommendations for future improvements.

- Recycled Water supply facilities
- Storage facilities
- Booster stations
- Pressure reducing valves
- Distribution system
- System performance and operations

Note, Future Recycled Water System Evaluation is not included. It is assumed the recycled water system is built-out, and no new significant customers will be added.

d. Capital Improvement Program - All recommended capital improvements will have an associated technical justification (based on analyses) description. All CIP descriptions will indicate relative priority and/or anticipated timing if needed for phasing. CIP projects will also include a cost estimate broken down by construction cost, contingency, engineering and admin, and construction management.

6. Sewer Model Development

a. Model Software – Hazen will procure quotes from two (2) software vendors for the sewer model. The quotes will be presented to the District for review, and a recommendation will be made on the software to utilize.

b. Model Development - Hazen will utilize the existing sewer geodatabase to develop a dynamic hydraulic model. The model is anticipated to include all facilities in the geodatabase including gravity mains, force mains, manholes, and lift stations. The WWTP will be modeled as an outfall point, is assumed the WWTP internal process piping will not be included in the system-wide hydraulic model.

   Construction of the model will be performed by importing GIS data the software framework and performing a QA/QC analysis on pipe/manhole connectivity and alignment. Data gaps will be populated using a combination of record drawings and surveyed invert data. If an excessive amount of interpolation and extrapolation of inverts and/or rim elevations is needed, we will discuss with the District. Lift station operational information will be defined in the model for explicitly-modeled pumps, and configuration of diversion structures will also be defined.

   The model will be configured to represent both dry weather flow conditions as well as wet weather performance of the collection system. Dry weather flows will be developed based on a combination of flow metering data, water consumption data, and population data as appropriate. Wet weather flows will be developed using standard hydrologic parameters that represent the rainfall-dependent infiltration and inflow response of sewer systems.

c. Model Calibration / Verification

   Hazen will utilize the flow monitoring data to perform dry weather calibration and verification of the hydraulic model. The model will be calibrated by adjusting hydraulic parameters until reasonable agreement is reached between observed and predicted flows, volumes, and depths. Model calibration accuracy and quality will be judged by industry-standard guidelines, such as general acceptable ranges for model accuracy, as follows:

   - Dry weather peak flows within +10% and -10%
   - Dry weather flow volumes within +10% and -10%

d. Baseline / Future Capacity Analyses

   Hazen will use the calibrated and verified model to simulate various scenarios and analyze the collection system under baseline and future conditions. Modeling evaluation will include impacts of any proposed system modifications, upgrades, and expansions to the collection system. The simulations will be performed for two scenarios, baseline (based on the time period for which monitoring data is collected) and future (growth scenario based on UWMP projections)

   The ability of the wastewater collection system to convey baseline and future flows will be evaluated. Locations of predicted SSOs, surcharging and hydraulic deficiencies will be identified. Tables and figures depicting the performance of the collection system for each scenario will be developed.

7. Flow Monitoring

a. General – this task will be carried out by our subconsultant ADS Environmental. Based on the size and layout of your system, we have determined that an appropriate sewer flow monitoring scope is

a total of eight (8) monitors for three (3) weeks to capture dry-weather flow conditions, which includes installation, data collection, monitoring, maintenance, and demobilization of the flow monitors. The data will be summarized in a final report and provided to Hazen for use in sewer model development.

b. It is assumed the District can provide cleaning/jetting if needed, and if a permit is needed, the permit cost will be paid by the District.

8. Asset Management / Condition Assessment

a. Data Collection and Consolidation

Hazen will use information provided by the District including drawings, electronic O&M manuals, maintenance records, GIS geodatabase and shapefiles, hydraulic models and bid documents, if available, to develop and populate an asset inventory for the District's facilities including pump stations, reservoirs, lift stations, treatment facilities as well as distribution and collection system pipelines. Our Team will perform a data gap assessment to identify any gaps in the asset attribute data (e.g., install year, material, size) in the asset inventory. Data gap closure strategies will be presented to the District for consideration and the best strategies will be implemented to close the data gaps.

- Deliverables:
  - Preliminary Asset Inventory (Excel File)
  - Data Gap Closure Workshop (2 hours)

b. Field Condition and Performance Assessment:

The condition assessment includes two components, (1) a desktop condition and remaining useful life evaluation of all District above and below-ground assets, (2) visual condition assessment investigating the physical and functional condition of all structural, mechanical, electrical and instrumentation components of the following pump stations, lift stations and discharge pipeline identified in the RFP which included: Barneburg LS, Golf Club LS, Heritage LS, Via Allegre LS, Plano LS/PS and above ground visible segments of 3 miles of 16" CML&C discharge pipeline from Dimension Water Treatment Plant (DWTP) to Ridgeline/El Toro Pump Station and DWTP. Hazen will utilize a structured condition assessment methodology which is transparent, repeatable, and useful for later analysis by Hazen and District staff, with each score's definition which can be applied to all asset classes during the field condition assessment.

Utilizing information in the District's geodatabase (install year, material, diameter, etc.), any CCTV and break/leakage data, hydraulic models and current and future flow projections provided by the District, Hazen will perform a desktop condition assessment and hydraulic assessment of the domestic water, non-domestic water, and sewer conveyance systems. Utilizing the existing data, maintenance history, and the condition assessment scores, Hazen will determine the remaining useful life of each asset in the inventory.

- Deliverables:

- Electronic Condition Assessment Forms
- Field Condition Assessment
- Preliminary Asset Register Updated with Condition Scores and Remaining Useful Lives (Excel File)
- Field Condition Assessment Photographs (Asset Photos)
- Condition Assessment Results Workshop (2 hours)
- Draft and Final Condition Assessment Results Document (PDF)

c. Replacement Cost Estimating:

Hazen will estimate the replacement costs of each asset within the asset inventory. Various strategies are used including crew-based estimating, productivity-based estimating, general condition costs, and assessment of market conditions.

- Deliverables:
  - Asset Inventory Updated with Replacement Costs (Excel File)

d. Condition Assessment CIP Development and Business Case Evaluation:

The Hazen team will facilitate a workshop to develop a formal Business Case Evaluation process (BCE) to evaluate and prioritize Capital Improvement Projects (CIPs) based on minimizing the risk, life-cycle cost, while maintaining the levels of service and maximizing benefits. Incorporating the concept of Benefit/Cost Ratio (B/C), each CIP will carefully be analyzed with respect to initial capital cost, on-going operation and maintenance costs, risk costs, and potential benefits. The solution providing the greatest benefit will formally be recommended for implementation. The results of the BCE will be used to develop the CIPs whose expenditures are focused on addressing high risk assets first while maximizing benefit to the District.

- Deliverables:
  - Business Case Evaluation (BCE) Workshop (2 hours)
  - Draft and Final BCE Model with Prioritized CIP Projects (Excel File)

9. Financial Analysis

a. Hazen proposes to revisit the method used to the calculate the initial water capacity charges and ascertain whether that methodology is consistent with the current best accepted practices and whether the assumptions originally used remain valid. For example, we will assess whether the capacity fees were developed in alignment with the methods described in the AWWA and WEF manuals for establishing capacity (i.e., development impact) fees. The manual present the three main commonly accepted approaches referred to as “System Buy-in”, “Incremental” and “Hybrid”. Although, it appears that the initial method used the “Buy In” approach, we recommend a review to

determine if any modifications of to that method of calculation would be warranted, such as new capital projects completed during the intervening period.

b. Hazen will also review the key assumptions used to develop the initial capacity fees. For example, the initial fees used the 1999 Master Plan average household demand of 459 gallons per day as one equivalent single family dwelling unit development (EDU). Per capita and per household water demand has substantially decreased in the last 22 years and using this assumption might well overestimate current water demand for new developments and result in potential overcharges. Noteworthy, is that in the 2020 Water and Wastewater Rate study conducted for the District, the Consultant assumed an average daily water demand of approximately 344 gallons demand for a typical household. We will also revisit capacity charges for the Supplemental Water Capacity Fee, which is reserved and allocated to pay the debt service for the COPs.

c. We want to emphasize that Hazen will only propose methodological changes if required. If the assumptions used to develop the current charges remain valid based on our initial review, we will end our study at that point. Otherwise, we will provide the District with a recommendation for a new method and applicable charges going forward. That method must be transparent, equitable, and legally defensible in accordance with California regulations.

10. Master Plan Update Report

a. Draft #1 Report (60% Completion Level)

- Draft #1 will be consistent with a 60% submittal. The major elements of the report will be complete including the various analyses, but not including recommended projects, or conclusions. Some levels of detail will be left for subsequent submittals to ensure concurrence from the District.
- It is assumed four (4) bound double-sided copies will be provided to the District for review.

b. Draft #2 Report (90% Completion Level)

- Draft #2 will address all comments, plus incorporate all remaining aspects of the analysis and be a fully-completed report with all completed analyses, findings, recommendations, exhibits and graphics. The report completion level will be consistent with a 90% submittal. We consider this a complete document with no remaining work efforts to be completed except addressing changes and comments from District reviewers.
- It is assumed four (4) bound double-sided copies will be provided to the District for review.

c. Final Report

- The Final Report will address any minor comments from Draft #2 and be signed and distributed for the District's final records.
- It is assumed four (4) bound double-sided copies will be provided to the District for review.

d. Board Presentation

- A presentation will be given to the District Board summarizing the Master Plan process, key findings, and recommendations.

11. Manhole Survey and Dips (OPTIONAL)

a. Our subconsultant Fuscoe will deliver this task.

b. Field Survey locate 300 manholes and invert elevation. Horizontal and vertical location will be performed by RTK GPS field survey methods tied to Orange County Horizonal and Vertical CGPS control (CCS 83, VI 2017.5). Deliverables will include a comma delimited coordinate point file with rim and invert elevation and a georeferenced photo of each manhole. Manholes rims that are not locatable by GPS methods will be positioned based on the districts GIS coordinate position with a measured depth to the invert. Task Assumes that manholes are unlocked and surface accessible. No lane closures or traffic control permitting is included in this task.

12. CCTV of Sewer System (OPTIONAL)

a. Our subconsultant National Plant Services (NPS) will deliver this task.

b. Please see pricing info below on the scope of services related to CCTV sewer inspection.

Assuming the lines in scope are concurrent and relatively close to each other, NPS will perform 2-pass clean and CCTV at the following prices:

- Mobilization (one time): $2,500
- 6” Clean and CCTV = $2.10/LF
- 8”-10” Clean and CCTV = $1.80/LF
- 12” Clean and CCTV = $2.10/LF

c. Client to provide water for cleaning, and a place to dump sewer debris.

d. Permits paid for by others.

e. Traffic control reimbursed at cost plus 10% including TC plan preparation fees.

13. Prioritized CCTV Program (OPTIONAL)

a. Prioritized CCTV Program:

Hazen will develop a risk assessment methodology for collection system pipelines. The CoF criteria, weighting factors, and scoring guide will be developed for determining the CoF scores and will be reviewed by District staff through a workshop. The PoF will be calculated based on the results of the desktop condition assessment. Hazen will develop risk scores by combining PoF and CoF scores and incorporating mitigation strategies and redundancies. Risk thresholds will be established to categorize the collection system pipelines into low, medium, and high risk levels.

Utilizing an asset management risk-based approach, Hazen will prioritize collection system pipe segments. To develop a 5-year prioritized CCTV program, a decision flow diagram will be developed that

uses information such as previous CCTV data, risk scores, remaining useful lives, pipe material and geographical location. The decision flow diagram will also be used to identify pipe segments that require immediate CCTV.

Hazen will provide the District a Microsoft-based Excel asset inventory updated with condition scores, estimated useful life for each asset class, remaining useful life, risk score and replacement cost for each asset.

- Deliverables:
  - Risk Methodology Workshop (2 hours)
  - Final Asset Inventory Updated with Risk Scores (Excel File)
  - Risk Maps and Risk Matrices (PDF)
  - Prioritized CCTV Program Workshop (2 hours)
  - Draft and Final Prioritized CCTV Decision Flow Diagram (PDF)

Hazen

Fee Proposal
Trabuco Canyon Water District
Master Plan and Condition Assessment Study
October 6, 2021

		Hazen and Sawyer											
Task No.	**Description**	**Principal-in-Charge** $300	**Project Manager** $250	**Senior Associate** $240	**Associate** $200	**Principal Engineer** $175	**Assistant Engineer** $145	**QAQC** $250	**Subtotal Hours**	**Direct Costs** LS	**Field Work (Subconsultants)**	**Sub-consultant Markup** 5%	**Total**
Task 1	Project Management and Meetings	32	80	0	0	0	16	0	128	$ 500	$ -	$ -	$ 32,420
a	*Project Management*	*16*	*40*						56	*$ 500*		*$ -*	*$ 15,300*
b	*Progress Calls and Meetings*	*16*	*40*				*16*		72			*$ -*	*$ 17,120*
Task 2	Data Collection and Review	0	8	0	8	0	24	0	40	$ 500	$ -	$ -	$ 7,580
a	*Data Collection and Review*		*8*		*8*		*24*		40	*$ 500*		*$ -*	*$ 7,580*
Task 3	Update Water Hydraulic Model	0	32	24	0	64	168	18	306	$ -	$ -	$ -	$ 53,820
a	*Model Software Review*		*4*			*8*	*16*	*2*	30			*$ -*	*$ 5,220*
b	*GIS Update*		*2*			*4*	*16*	*2*	24			*$ -*	*$ 4,020*
c	*Model Controls Update*		*2*			*4*	*8*	*2*	16			*$ -*	*$ 2,860*
d	*Water Demand Update*		*2*			*4*	*8*	*2*	16			*$ -*	*$ 2,860*
e	*Future Scenarios*		*2*			*4*	*8*	*2*	16			*$ -*	*$ 2,860*
f	*Diurnal Curve, Peaking Factor Update*		*2*			*4*	*8*	*2*	16			*$ -*	*$ 2,860*
g	*Field Testing*		*2*			*4*	*24*	*2*	32			*$ -*	*$ 5,180*
h	*Calibration*		*8*	*24*		*16*	*40*	*2*	90			*$ -*	*$ 16,860*
i	*Recycled Water*		*8*			*16*	*40*	*2*	66			*$ -*	*$ 11,100*
Task 4	Water System Analysis	0	52	0	0	32	92	8	184	$ -	$ -	$ -	$ 33,940
a	*Service and Design Criteria*		*8*			*4*	*12*	*2*	26			*$ -*	*$ 4,940*
b	*Demand Projections*		*4*			*4*	*8*	*2*	18			*$ -*	*$ 3,360*
c	*System Evaluation*		*16*			*16*	*40*	*2*	74			*$ -*	*$ 13,100*
d	*Capital Improvement Program*		*24*			*8*	*32*	*2*	66			*$ -*	*$ 12,540*
Task 5	Recycled Water System Analysis	0	36	0	0	0	76	8	120	$ -	$ -	$ -	$ 22,020
a	*Recycled Water Demands*		*8*				*24*	*2*	34			*$ -*	*$ 5,980*
b	*Service and Design Criteria*		*8*				*12*	*2*	22			*$ -*	*$ 4,240*
c	*Recycled Water System Evaluation*		*12*				*16*	*2*	30			*$ -*	*$ 5,820*
d	*Capital Improvement Program*		*8*				*24*	*2*	34			*$ -*	*$ 5,980*
Task 6	Sewer Model Development	0	28	44	188	0	256	0	516	$ -	$ -	$ -	$ 92,280
a	*Model Software Review*		*4*	*4*	*8*		*16*		32			*$ -*	*$ 5,880*
b	*Model Development*		*8*	*16*	*80*		*120*		224			*$ -*	*$ 39,240*
c	*Model Calibration/Verification*		*8*	*16*	*60*		*60*		144			*$ -*	*$ 26,540*
d	*Baseline/Future Capacity Analyses*		*8*	*8*	*40*		*60*		116			*$ -*	*$ 20,620*
Task 7	Flow Monitoring	0	4	0	12	0	12	0	28	$ -	$ 35,000	$ 1,750	$ 41,890
a	*Flow Monitoring*		*4*		*12*		*12*		28		*$ 35,000*	*$ 1,750*	*$ 41,890*

Hazen

Fee Proposal
Trabuco Canyon Water District
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Task No.	Description	Hazen and Sawyer: Principal-in-Charge $300	Project Manager $250	Senior Associate $240	Associate $200	Principal Engineer $175	Assistant Engineer $145	QAQC $250	Subtotal Hours	Direct Costs LS	Field Work (Subconsultants)	Sub-consultant Markup 5%	Total
Task 8	Asset Management / Condition Assessment	0	4	50	130	70	340	26	620	$ 1,000	$ -	$ -	$ 108,050
a	***Data Collection and Consolidation***	***0***	***2***	***2***	***8***	***2***	***158***	***4***	**176**	***$ -***	***$ -***	***$ -***	***$ 26,840***
	Data and Information Review			*2*	*2*	*2*	*2*		8			*$ -*	*$ 1,520*
	Preliminary Asset Inventory (Excel File)				*2*		*140*	*4*	146			*$ -*	*$ 21,700*
	Data Gap Closure Workshop (2 hours)		*2*		*4*		*16*		22			*$ -*	*$ 3,620*
b	***Field Condition and Performance Assessment***	***0***	***2***	***26***	***54***	***44***	***126***	***16***	**268**	***$ 1,000***	***$ -***	***$ -***	***$ 48,510***
	Electronic Condition Assessment Forms						*16*		16			*$ -*	*$ 2,320*
	Desktop Condition Assessment				*24*	*40*	*40*	*8*	112			*$ -*	*$ 19,600*
	Field Condition Assessment			*24*	*24*		*24*		72	*$ 1,000*		*$ -*	*$ 15,040*
	Preliminary Asset Register Updated with Condition Scores and						*24*		24			*$ -*	*$ 3,480*
	Field Condition Assessment Photographs (Asset Photos)						*2*		2			*$ -*	*$ 290*
	Condition Assessment Results Workshop (2 hours)		*2*	*2*	*4*	*4*	*16*		28			*$ -*	*$ 4,800*
	Draft and Final Condition Assessment Results Document (PDF)				*2*		*4*	*8*	14			*$ -*	*$ 2,980*
c	***Replacement Cost Estimating***	***0***	***0***	***4***	***40***	***0***	***24***	***2***	**70**	***$ -***	***$ -***	***$ -***	***$ 12,940***
	Asset Inventory Updated with Replacement Costs (Excel File)			*4*	*40*		*24*	*2*	70			*$ -*	*$ 12,940*
d	***Condition Assessment CIP Development and Business Case***	***0***	***0***	***18***	***28***	***24***	***32***	***4***	**106**	***$ -***	***$ -***	***$ -***	***$ 19,760***
	Business Case Evaluation (BCE) Workshop (2 hours)			*2*	*4*	*8*	*16*		30			*$ -*	*$ 5,000*
	Draft and Final BCE Model with Prioritized CIP Projects (Excel File)			*16*	*24*	*16*	*16*	*4*	76			*$ -*	*$ 14,760*
Task 9	Financial Analysis	0	16	40	80	0	0	8	144	$ -	$ -	$ -	$ 31,600
a	*Financial Analysis*		*16*	*40*	*80*			*8*	144			*$ -*	*$ 31,600*
Task 10	Master Plan Update Report	4	112	0	360	0	416	28	920	$ 6,000	$ -	$ -	$ 174,520
a	*Draft #1 Report (60% Completion Level)*		*40*		*140*		*160*	*12*	352	*$ 2,000*		*$ -*	*$ 66,200*
b	*Draft #2 Report (90% Completion Level)*		*40*		*140*		*160*	*12*	352	*$ 2,000*		*$ -*	*$ 66,200*
c	*Final Report*		*24*		*80*		*80*	*4*	188	*$ 2,000*		*$ -*	*$ 36,600*
d	*Board Presentation*	*4*	*8*				*16*		28			*$ -*	*$ 5,520*
										$ 8,000	$ 35,000	$ 1,750	$ 598,120
	Person-Hours Subtotal	*36*	*372*	*158*	*778*	*166*	*1,400*	*96*	*3,006*				
										TOTAL			**$598,120**
	OPTIONAL TASKS												
Task 11	Manhole Survey and Dips	0	12	0	0	0	24	0	36	$ -	$ 87,500	$ 4,375	$ 98,355
a	*Manhole Survey and Dips*		*12*				*24*		36		*$ 87,500*	*$ 4,375*	*$ 98,355*
Task 12	CCTV of Sewer System												
a	*CCTV of Sewer System*	***See pricing ($/LF) provided in proposal.***											
Task 13	Prioritized CCTV Program	0	0	14	20	26	72	12	144	$ -	$ -	$ -	$ 25,350
a	***Prioritized CCTV Program***	***0***	***0***	***14***	***20***	***26***	***72***	***12***	**144**	***$ -***	***$ -***	***$ -***	***$ 25,350***
	Develop Risk Model				*4*	*10*	*24*	*6*	44			*$ -*	*$ 7,530*
	Risk Methodology Workshop (2 hours)			*2*	*4*		*12*		18			*$ -*	*$ 3,020*
	Final Asset Inventory Updated with Risk Scores (Excel File)						*8*		8			*$ -*	*$ 1,160*
	Risk Maps and Risk Matrices (PDF)						*8*		8			*$ -*	*$ 1,160*
	Prioritized CCTV Program Workshop (2 hours)			*8*	*8*	*16*	*12*		44			*$ -*	*$ 8,060*
	Draft and Final Prioritized CCTV Decision Flow Diagram (PDF)			*4*	*4*		*8*	*6*	22			*$ -*	*$ 4,420*