

Propane System Master Plan

Kirkwood Meadows Public Utility District
25-year Propane System Master Plan

Prepared for:
Kirkwood Meadows Public Utility District

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Propane System Master Plan

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02	Propane System Master Plan	TZ, JR, HP	01/14/25	JR	01/14/25	TZ	01/14/25




Propane System Master Plan

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Prepared by



Signature

Joseph Rice, PE SE

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Signature

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Executive Summary

Kirkwood Meadows Public Utility District owns and operates a propane utility system that serves the Kirkwood community and Kirkwood Mountain Resort. Serving more than 400 customers, the propane system includes two large LPG storage tanks and vaporizers located on Loop Road along with an extensive underground propane distribution piping network.

Most of the residences and businesses in the valley depend on propane for heating and cooking so the propane delivery system is a critical utility. Due to limited propane storage capacity within Kirkwood and the related propane delivery risk and uncertainty, the KMPUD Board of Directors adopted Resolution 22-01, which determined that propane service would not be offered to new developments, or to lots in existing developments after January 8, 2025. Instead, the District will provide energy to new development solely through electric service and will encourage its current propane customers to convert their heating and cooking equipment to all electric.

KMPUD intends to continue to provide gas service to existing customers in the valley and will be investing in the system as needed to maintain its reliability and operability. There is no suitable area within Kirkwood that will allow for the expansion of storage capacity while maintaining compliance with laws and regulations. This master plan addresses the upgrades and changes recommended to meet KMPUDs goals, while ensuring safety for the operators as well as the customers over the 25-year period considered by the study.

The underground propane distribution system is in good condition and expected to last through the 25-year period covered in this masterplan. A planned project to replace the gas lateral piping that serves the valley residences will address the known service and safety issues with the existing piping.

The LPG storage tanks are in good condition and were recently inspected and their associate valves were replaced. The two water bath vaporizers have 4 and 8 years of projected remaining operating life, respectively, based on estimates provided by the manufacturer, but decreasing parts availability may shorten the functional operating life of the equipment. To maintain operations and to improve system standby capacity during peak demand times it is recommended that a new vaporizer be added and that the older of the two existing vaporizers be maintained in place as a backup during peak winter demand periods. When the second existing vaporizer reaches the end of its expected service life it is recommended that the oldest unit be replace with a new vaporizer and the current second unit be used as standby for the two replacement vaporizers.

The LPG tanks, valving, and vaporizers are all currently outdoors and subject to heavy snow loads. To gain access to the LPG valves and the vaporizers operations staff often manually digs snow tunnels from the road to access valves. This puts staff at risk of potential snow collapse and puts large loads on the LPG piping. This masterplan recommends installation of canopies over the LPG tanks and valve area as well as the vaporizer area. The tank area canopy can be expanded if desired to provide covered storage area on the west side of the tanks.

The canopies will improve operational safety as well as help to extend the operating life of the mechanical equipment.



1 System Description

The LPG system operated by the Kirkwood Meadows Public Utility District provides propane service to 443 customers, both commercial and residential, located in the Kirkwood Valley. As the primary source of fuel for heating and cooking purposes, the LPG system is a critical utility and its reliable operation is key to both the comfort and safety of the valley residents and guests.

The LPG system consists of a main storage and distribution yard and an extensive underground piping network that connects to customers throughout the valley. The central LPG storage yard is located on Loop Road. The central yard includes two large, above ground LPG storage tanks. One tank has 20,400 gallons of capacity and the adjacent tank has 30,000 gallons of capacity.

Just North of the two tanks, in a small shed, is the LPG delivery point where trucks are unloaded into the tanks. Above ground piping connects the two tanks together and to the delivery station. A truck-mounted pump is used to transfer LPG into the tanks. A small auxiliary transfer pump is located at the delivery station that can also be used to transfer LPG between the tanks and to draw off LPG to fuel portable District-owned containers through a connection in the shed.

A LPG liquid line that is fed from both tanks runs from the East side of the tank area underground to the two water bath vaporizers located adjacent to Loop Road. The vaporizers heat the LPG to make pressurized Propane vapor that is distributed through underground piping that runs throughout the service area. Service laterals from the distribution piping serve the individual customer's gas meters. A small enclosure located North of the water bath vaporizers contains 4 old direct fired vaporizers that have been abandoned in place.

To improve the safety and reliability of the system, KMPUD has performed a number of system upgrades and modifications. The piping and valving for the main LPG storage tanks was recently inspected and upgraded. The smaller tank was upgraded in 2018 and the larger tank was upgraded in 2020.

KMPUD is planning a project to replace lateral piping that serves the individual customers from the main distribution piping. This work will improve safety of the system by providing new piping and relocated isolation valving.

Figure 1 shows the layout of the LPG system and distribution piping throughout the valley. Figure 2 is a process flow diagram of the central LPG storage and vaporization equipment.



Propane System Master Plan

1 - System Description

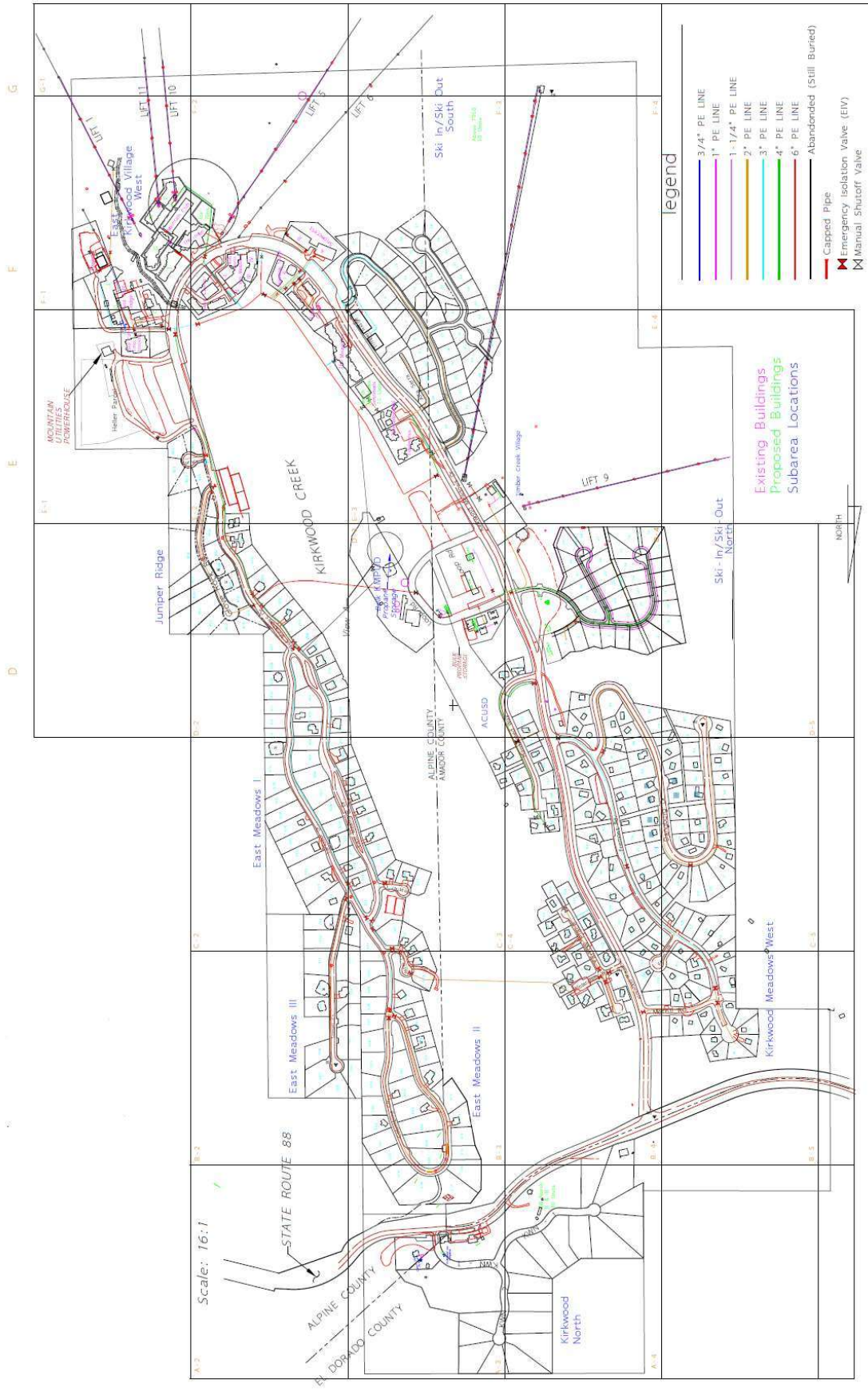


Figure 1 - Kirkwood Meadows Propane Distribution System

Propane System Master Plan
1 - System Description

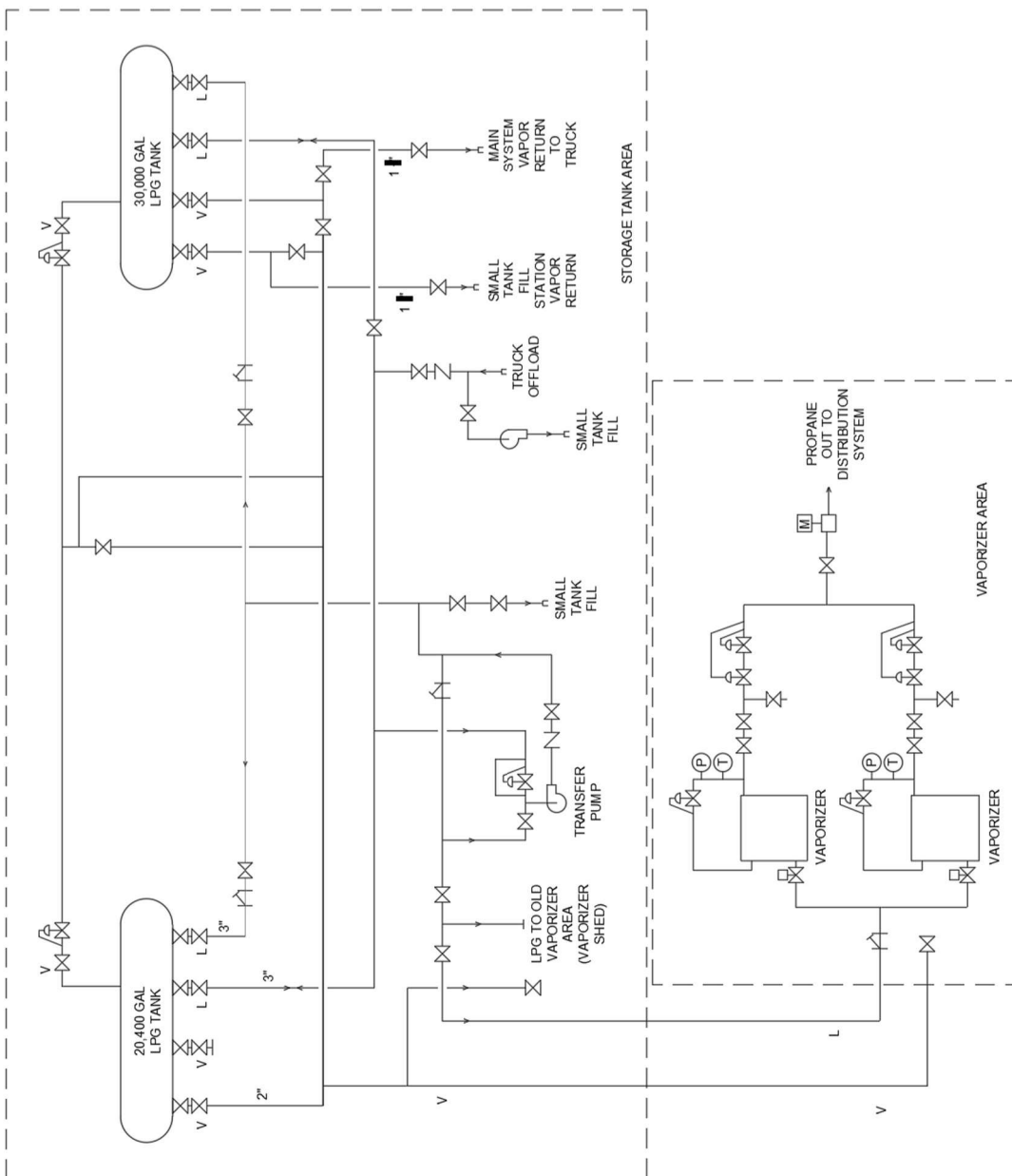


Figure 2 - Kirkwood LPG System Process Flow Diagram



2 Propane System Improvements

KMPUD anticipates operating the LPG and Propane system for at least 25 more years. Since no additional new propane customers will be added and existing customers may electrify, the expectation is that the demand on the system will slowly drop over time. Given the cost of converting to all-electric systems, it is expected that most customers will wait to convert until their existing heating or cooking equipment reaches end of life and requires replacement. This would lead to an increasing rate of conversion over time.

The LPG and Propane system serving the Kirkwood community is in good condition, particularly considering the age of the system and the harsh climate. As noted above, the main storage tanks were inspected and their associated piping and valves were recently replaced (2017-2020). The liquid transfer pump and piping inside the LPG fill and transfer equipment shed has not been updated but appears to be in fair and serviceable condition.

The two water bath vaporizers that are used to make the Propane gas for distribution are both manufactured by Algas SDI, model Q480V. Each of the vaporizers can vaporize up to 480 gallons/hour of LPG. Under operating conditions all of the Propane demand in the valley can be met with a single vaporizer. When the demand exceeds what a single unit can generate, for example on a holiday ski weekend, the second vaporizer can be operated in parallel to increase the total available system supply capacity. Under normal circumstances the two vaporizers provide backup for each other.

One of the vaporizers was installed in 2010 and the other in 2013. The units have reportedly been reliable and have required only typical maintenance and repairs, including the replacement of the burner blowers and other internal parts.

Algas SDI sets the expected baseline operational life of their water bath vaporizers at 10 years. That baseline value is adjusted depending on the vaporizer service conditions, level of maintenance, and environmental factors. Considering how the KMPUD vaporizers are operated and maintained. Algas SDI expects their actual service life to be between 14 and 16 years. Replacement parts for the two vaporizers have become increasingly difficult to source forcing the maintenance staff to have some components repaired locally. Parts availability issues will reduce the remaining viable operating life of the existing vaporizers.

Based on input from the equipment manufacturer, and the availability of spare parts, it is recommended that the existing vaporizers be replaced when they reach 16 years of operation, or earlier if regular inspections identify significant degradation in the glycol system or supporting piping. This would set the projected replacement dates at 2025 and 2029 for the two existing vaporizers.

As noted, except for infrequent peak heating demands, the propane demand can be met with a single vaporizer, with the second vaporizer providing redundancy in the event of a mechanical failure. During the peak demand times when both vaporizers are needed a vaporizer failure would result in a lack of propane



Propane System Master Plan

2 - Propane System Improvements

supply to KMPUD's customers. Adding a third vaporizer would help to ensure that a backup vaporizer is always available.

It is expected that the annual need to operate two vaporizers simultaneously will drop over time as customers shift away from propane heating. This dynamic will reduce the value of a third vaporizer over time.

The recommended alternative to minimize capital cost and increase reliability is to install a new vaporizer now and keep both existing vaporizers in service. That would provide supply redundancy now, when the system demand is at its highest level. The new vaporizer would be located adjacent to the existing water bath vaporizers. The older of the two existing vaporizers could be held in standby while the two newer units provide regular service. The older unit would be reactivated for use as redundant standby during the peak Winter demand months. In 2029 when the newer of the existing unit reaches its projected service life the 2010 unit would be replaced and the 2013 unit would be moved into the redundant standby service role.

By staggering the replacement schedule and keeping one of the existing vaporizers as a standby unit KMPUD would get a higher level of system redundancy with a minimum of additional cost.

To maintain reliability over the next couple of decades of system operation, the transfer and small tank fill pumps and equipment in the fill shed should be replaced in the next 5-7 years.



3 Site Improvements

The site was evaluated to determine feasible options for improving access to the vaporizer, storage tank, and ancillary equipment, especially during periods of heavy snow. Another key objective of these improvements was to protect the equipment from potential damage caused by vehicles and harsh weather conditions. The proposed solution is to construct canopy structures over the tanks and vaporizers to provide weather protection while ensuring continued access for KMPUD operations staff. Five canopy options were considered, with the final recommendations based on cost-effectiveness, constructability, and overall performance.

Steel-framed canopies emerged as the most practical option, given the significant snow loads and the site's remote location. Most of the fabrication can be completed off-site and delivered to KMPUD when conditions are favorable for construction. The proposed design includes steel-framed canopies supported by concrete piles and continuous footing foundations, with metal deck roofing and siding to enclose the structures.

Figure 3.1 below illustrates the locations of the storage tank and vaporizer at the KMPUD operations facility.



Figure 3.1: Equipment Locations



3.1 Existing Conditions of Equipment

Storage Tanks

Figures 3.2 and 3.3 below depict the current state of the storage tanks. Since these photos were taken, bollards have been added around the perimeter to serve as vehicle barriers. Several of these bollards will need to be removed during the construction of the new canopy.



Figure 3.2: Existing Storage Tanks (looking east)



Figure 3.3: Existing Storage Tanks (looking west)



Propane System Master Plan

3 - Site Improvements

Vaporizer

Figures 3.4 and 3.5 show the current conditions of the vaporizers. The vaporizers are installed on a slab-on-grade, with bollards positioned around the perimeter as vehicle barriers. The ground west of the equipment slopes upward as you move away from it (as shown in Figure 3.5). It is anticipated that the vaporizer canopy will need to retain several feet of soil, which is why masonry walls are used on the west side of the structure.



Figure 3.4: Existing Vaporizer (looking northwest)



Figure 3.5: Existing Vaporizer (looking north)



3.2 Propane Tank Canopy

Several framing options were developed for the propane tanks, based on the requirements of the KMPUD operations team, as shown in Figure 3.6. A steel truss option offered the largest clearance for the storage area and while maintaining enhanced snow removal capabilities. However, the higher construction costs and the need for additional field welding made this option less desirable. The steel joist option was also rejected due to the significant snow loads in this region, which would require heavy or custom joists. Steel beams, on the other hand, provide the necessary strength and simplify construction, as many connections can be bolted or welded off-site. Since the proximity of the columns to the existing tanks made spread footings impractical, piles were used for all the designs.

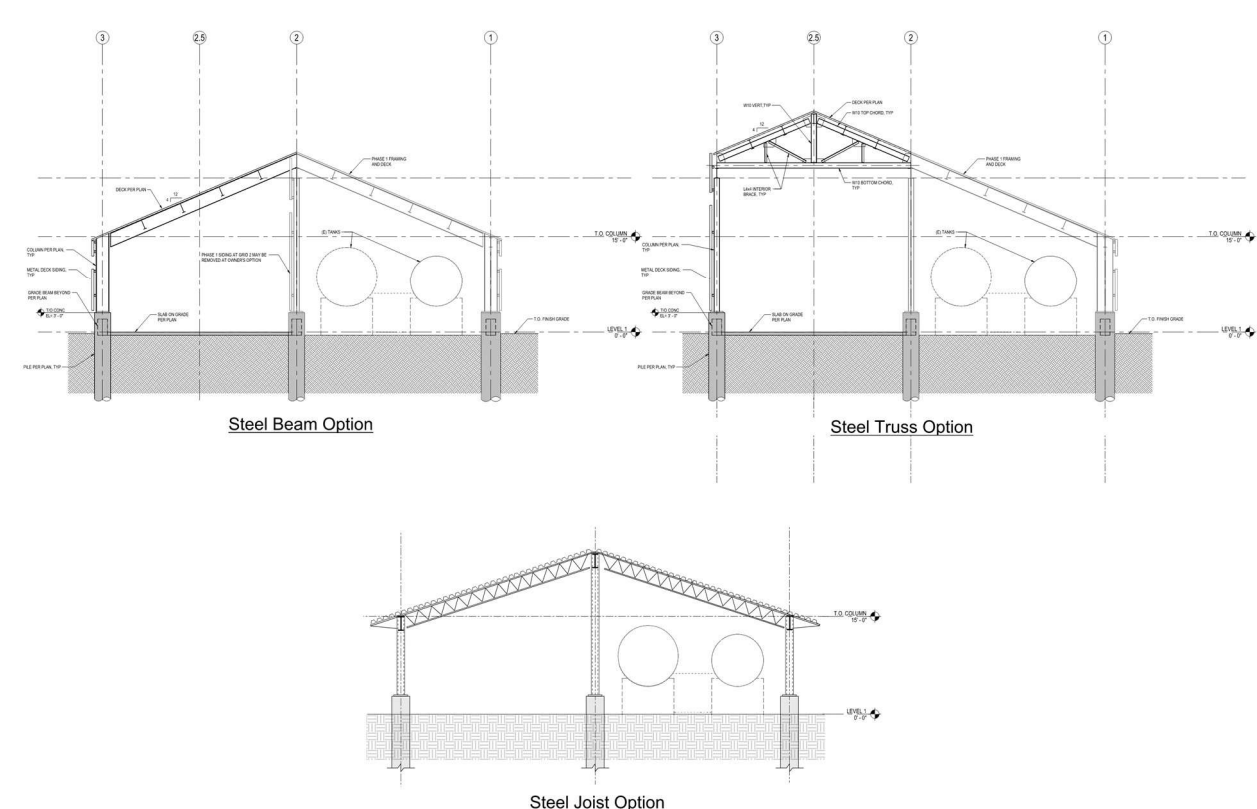


Figure 3.7: Storage Tank Canopy Framing Options

Several canopy coverage plans were also developed, offering varying levels of protection over the tanks and surrounding areas. Figure 3.7 illustrates the options, which range from full coverage over the tanks to designs focused solely on providing access to essential equipment. To balance these goals, a phased approach was selected for the final design. This plan divides the construction into two phases. Phase 1 consists of a partial canopy that covers the essential ancillary equipment and approximately one-quarter



Propane System Master Plan

3 - Site Improvements

of the tanks. This structure is independent and can serve as a permanent solution if Phase 2 is not pursued. Phase 2 would extend the Phase 1 structure, attaching to the existing columns and providing an additional 600 square feet of storage space for KMPUD staff.

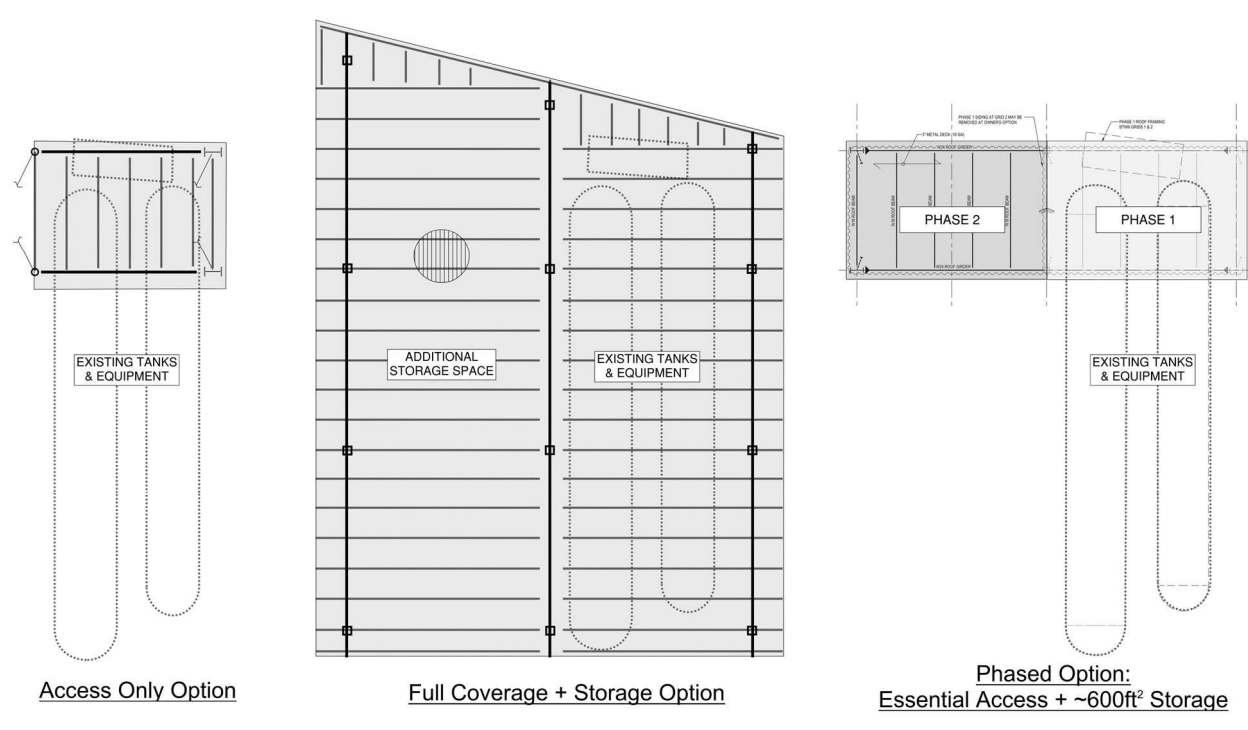


Figure 3.7: Storage Tank Canopy Coverage Area Options

The structural system for both Phase 1 and Phase 2 canopies consists of steel columns, beams, and girders supported by cast-in-place concrete piles. In the north-south direction, pile foundations are connected with concrete grade beams. The structure is enclosed with metal roof decking and siding on three sides, shielding the equipment and storage space from the elements, while the north side remains open. The lateral force-resisting system uses moment frames at the corners of the structure in the east-west direction and cable bracing between the columns in the north-south direction.

Concept drawings for the proposed tank canopy are provided in Appendix B.



3.3 Vaporizer Canopy

The vaporizer canopy will enclose the vaporizer and its ancillary piping. The structure consists of steel roof beams supported by steel columns and masonry walls. The initial design used columns supported by cast-in-place piles. However, after receiving feedback from KMPUD, the design was revised to eliminate piles by using offset columns and concrete grade beams. The foundation system for the final design includes concrete grade beams, footings below CMU walls, and a new slab-on-grade that will connect to the existing slab-on-grade supporting the vaporizer.

The lateral force-resisting system uses masonry shear walls in the east-west direction. In the north-south direction, lateral forces are resisted by both masonry shear walls and an ordinary steel moment frame. The structure will be enclosed with metal deck roofing and siding on three sides, with the east side remaining open for equipment access.

Concept drawings for the proposed vaporizer canopy are provided in Appendix B.

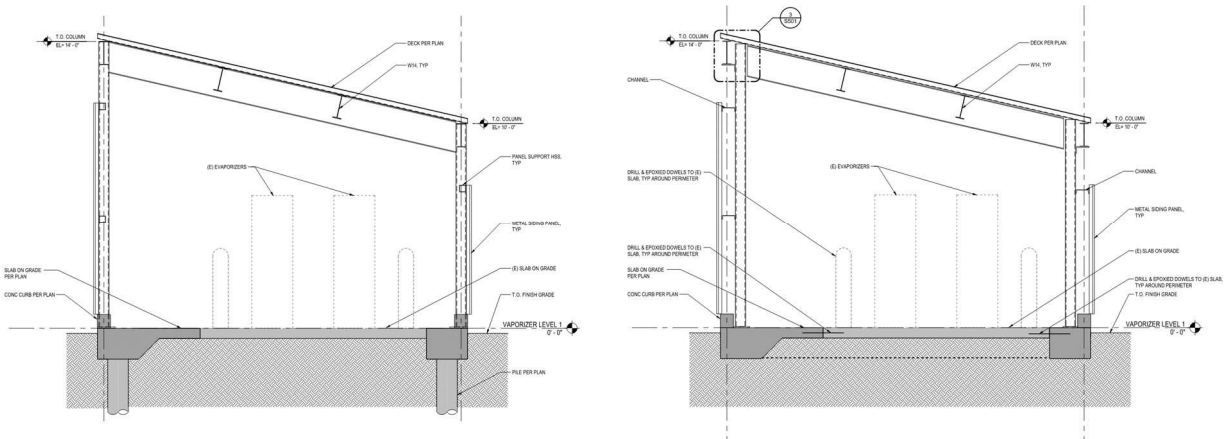


Figure 3.8: Vaporizer Canopy Foundation & Framing Options

3.4 Design Criteria

3.4.1 Loading

Live Loads

- Roof Live Load – 20psf

Snow Loads

- Ultimate Ground Snow Load – 811psf



Propane System Master Plan

3 - Site Improvements

- Ultimate Roof Snow Load – 647psf

Wind Loads

- Ultimate Wind Speed – 95mph

Seismic Loads

- Risk Category II
- Site Class – D (assumed)
- Seismic Design Category – D
- Sds – 1.01g
- Sd1 – 0.60g

Foundation Design Parameters (assumed)

- Active soil pressure – 35pcf
- Passive soil pressure – 300pcf
- Coefficient of friction – 0.30
- Soil weight – 110pcf
- Allowable soil bearing pressure – 2000psf
- Pile Design Parameters
 - Soil Type – Medium dense sand
 - Effective Unit Weight – 90pcf
 - Friction Angle – 30deg
- Groundwater – No groundwater

3.4.2 Design Codes

The project is designed to conform to the following applicable design codes:

- 2022 California Building Code
- ASCE/SEI 7-22, Minimum Design Loads for Buildings and Other structures
 - To be adopted by 2025 CBC based on the 2024 International Building Code and go into effect January, 2025.

3.4.3 Material Codes

The project is designed to conform to the following applicable codes as they apply to the structure.

- ACI 318-19: Building Code Requirements for Structural Concrete
- AISC 360-16: Specifications for Structural Steel Buildings
- AISC 341-16: Seismic Provisions for Structural Steel Buildings
- AWS D1.5: Structural Welding Code – Steel
- TMS 402-16: Building Code for Masonry Structures



3.4.4 Construction Material

Concrete (Normal Weight)

- Foundations and slab-on-grade , $f'_c = 4,000$ psi

Reinforcing Steel

- Deformed bars – ASTM A615, Grade 60, $F_y = 60$ ksi, $F_u = 75$ ksi

Structural Steel

- Wide flange shapes – ASTM A992
- Angles and channels – ASTM A36
- Base plates – ASTM A36
- Connection material and embedded plates – ASTM A572 (GR 50)
- Bolts – ASTM A325 or ASTM A490
- Anchor rods in concrete or masonry – ASTM F1554 (GR 36)
- Welding electrodes – ASTM E70xx



4 Capital Improvement Plan

4.1 Capital Improvement Plan

<u>Year</u>	<u>Item</u>	<u>Capital Expense</u>
2025	Phase 1 Canopy	\$237,000
	<i>Phase 2 Canopy (Add-alternate)</i>	<i>\$209,000</i>
	Vaporizer Area Canopy	\$167,000
	New (3 rd) Vaporizer	\$115,000
2026	Service Line Replacement	\$60,000
2027	Replace Transfer Pump	\$18,000
	Service Line Replacement	\$300,000
2028	Service Line Replacement	\$300,000
2029	New Vaporizer (Replace Oldest Unit)	\$105,000
2040	Replace Oldest Vaporizer	\$105,000
2044	Replace Oldest Vaporizer	\$105,000

4.2 Capital Improvement Costs

Capital expenses presented represent our Level 5 ROM cost estimate of improvements outlined in the master plan. These costs include material and installation labor based on typical regional unit prices and budgetary prices from equipment suppliers.

Equipment values quoted are in 2025 dollars based on vendor budgetary quotes.

Breakdown of Canopy structure cost estimates are provided in Appendix C.







Appendix A

Equipment Cutsheets







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The **SAFEST**,
most **RELIABLE**, and
most **EFFICIENT** gas-fired
LPG waterbath vaporizer
on the market.



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The **SAFEST**, most **RELIABLE**, and most **EFFICIENT** gas-fired LPG waterbath vaporizer on the market.

AQUAVAIRE® Specifications by Model



	Q320V	Q480V	Q640V	Q800V	Q960V	Q1120V	Q1375V	Q1650V
Rated Capacity								
Kg/Hr	614	921	1230	1535	1840	2150	2640	3332
Million BTU/Hr	29.1	43.7	58.2	72.8	87.4	102	125.1	150.2
Million Kcal/Hr	7.3	11	14.7	18.4	22	25.7	31.5	37.8
Nominal Capacity								
US Gallons/Hr	320	480	640	800	960	1,120	1,375	1,650
Heat Exchanger Surface Area								
Ft ²	30.5	40.6	58.6	90.5	90.5	99	99	140.7
m ²	2.83	3.77	5.45	8.41	8.41	9.2	9.2	13.07
Heat Exchanger Design Pressure								
PSIG	250	250	250	250	250	250	250	250
Bar	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
Heat Exchanger Test Pressure								
PSIG	375	375	375	375	375	375	375	375
Kg/cm ²	25.9	25.9	25.9	25.9	25.9	25.9	25.9	25.9
Waterbath								
US Gallons	116	136	237	294	294	505	505	505
Liters	431	511	893	1101	1101	1911	1911	1929
Waterbath Operating Temperature (Adjustable)								
°F	160	160	160	160	160	160	160	160
°C	71	71	71	71	71	71	71	71
Burner Fuel Input								
BTU/Hr	370,000	550,000	710,000	880,000	999,000	1,240,000	1,520,000	1,825,000
Kcal/Hr	93,240	138,600	178,920	221,760	251,748	312,480	383,040	459,890
Shipping Weight								
Lbs	1,821	2,076	2,784	2,994	2,994	3,387	3,387	3,587
Kg	826.0	941.0	1273.0	1358.0	1358.0	1536.0	1536.0	1627.0
Operating Weight (with 50/50 Glycol/Water)								
Lbs	2,801	3,236	4,804	5,484	5,484	7,717	7,717	7,957
Kg	1266	1,471	2,183	2,488	2,488	3,496	3,496	3,607
Electrical								
Specify 50Hz or optional voltage if required								
Voltage	120	120	120	120	120	120	120	120
Hz	60	60	60	60	60	60	60	60
Phase	1	1	1	1	1	1	1	1
Amperage	10.9	10.9	13.4	15.5	15.5	16.9	16.9	26.5



Propane System Master Plan

4 - Capital Improvement Plan

From the Algas SDI website:

What is the useable life of a vaporizer?

The question of vaporizer design life is a very popular and appropriate question which has been asked many times in the past by our customers. LP-Gas suppliers and end users alike need to know what they can expect as the typical life expectancy for a particular type of vaporizer placed on site under given conditions. This information is needed to both establish the front-end economics and to establish a safe and responsible maintenance and replacement program.

As the manufacturer, we can anticipate a variety of site and operating conditions and incorporate that information into our design basis. However, as the manufacturer it is not practical to calculate the life of the vaporizer under every possible set of field and site conditions. The most appropriate approach for permanent installations is to use the formula below to establish the expected physical lifespan:

Expected Physical Lifespan = Vaporizer Design Life x (1- (Environmental Factor + Maintenance Factor))

Vaporizer Design Life:

ZIMMER – 8 years
TORREXX – 8 years
TORREXX w/hermetic relay – 10 years
POWER P-Series – 10 years
Direct Fired – 8 years

Environmental Factor (0 = best to 0.3 = worst): Evaluated based on the severity of the physical atmosphere where the vaporizer is placed. Considerations – salt air, acid atmosphere, flooding, etc.

Maintenance Factor (-0.5 = best to 0.5 = worst): No maintenance over the life of the vaporizer results in the worst case and a regular maintenance program. appropriate for the type of vaporizer and one that effectively addresses and prevents problems including those related to LPG quality, results in the best case. For example, a vaporizer processing HD-5 propane beginning with a new (un-used) tank and a regular periodic preventive maintenance program would use a factor of -0.5.

Per the Algas SDI factory representative:

“Considering that the existing vaporizers are each operated only 50% of the time (one unit can meet the service demands) the expected life is”

Expected Life = 10 years * (1- (.2 + -.5)) * 1.15 = 15 years (Range 14-16 years)



Project: 224202855



Appendix B

Canopy Concept Drawings





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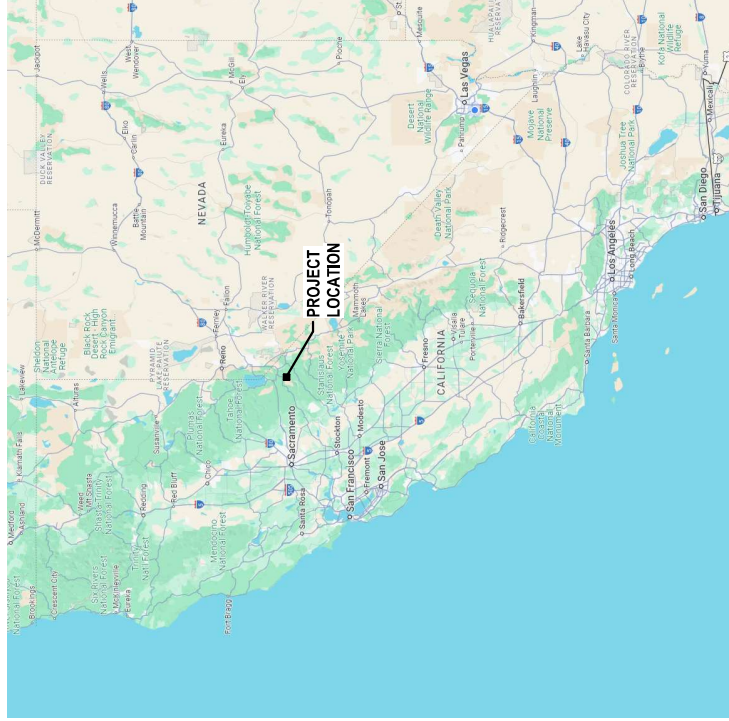
KMPUD LPG System Assessment

ATTACHMENT B: CANOPY 30% STRUCTURAL DRAWINGS

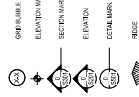
KIRKWOOD MEADOWS, CA

**MASTER PLAN
JANUARY 06, 2025**

Stantec Project Number: 224202855



SYMBOLS



ABBREVIATIONS

[illegible]



SITE: LOOKING NORTHWEST



SITE: LOOKING SOUTHWEST

EXHIBIT A: TANKS
1. SEE SHEET 1000 FOR FILE DETAILS

CONCEPT DRAWINGS FOR KPMUD PROPANE
SYSTEM MASTER PLAN ONLY
NOT FOR CONSTRUCTION
These drawings are for informational purposes only and are not to be used for construction. The drawings are subject to change without notice. The drawings are not to be used for any other purpose without the written consent of Stantec.

Client/Project Logo

Client/Project
KPMUD Meadows Public Utility District
KPMUD LPG System Assessment
KPMUD MEADOWS, CA

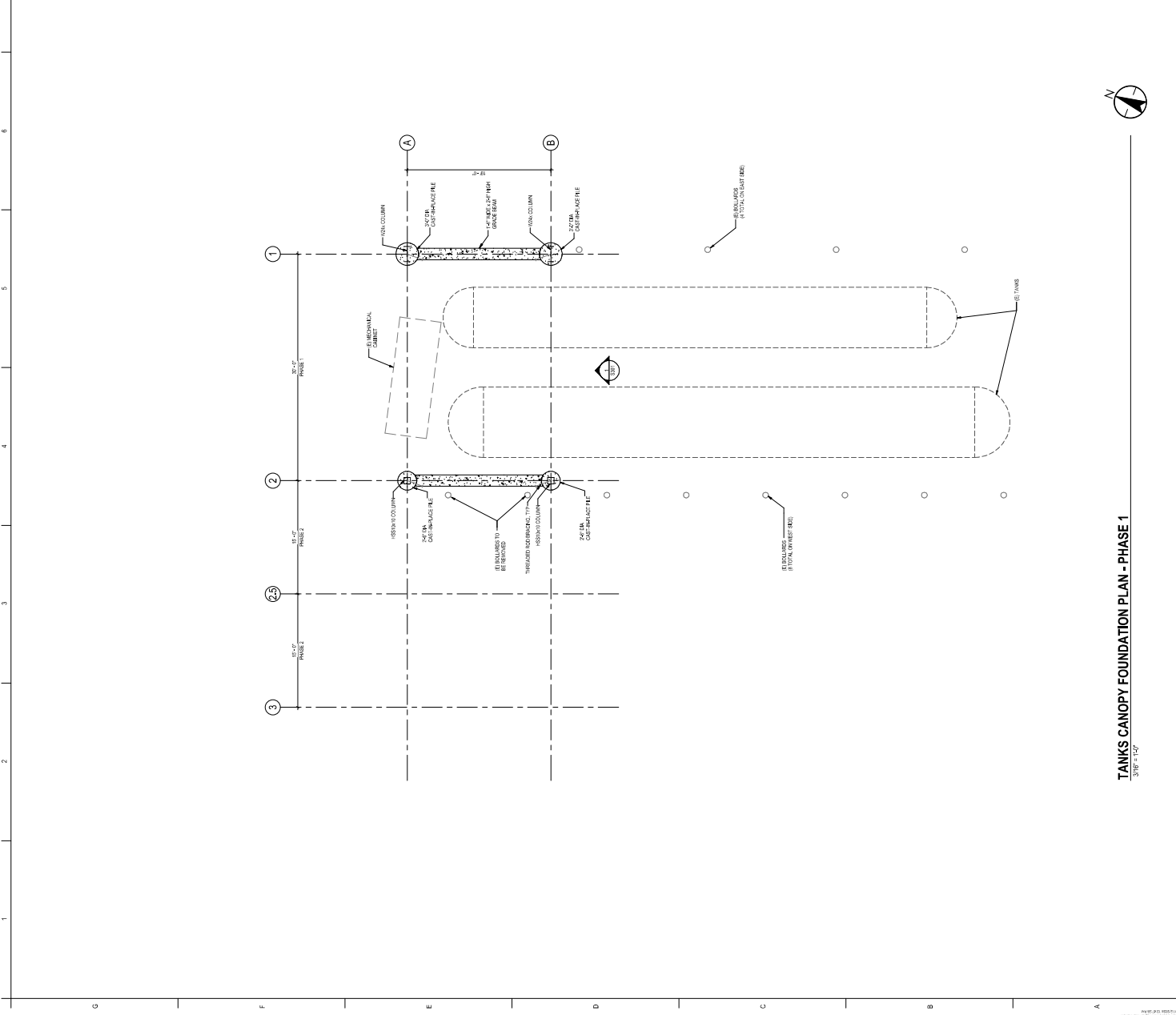
Title
TANKS CANOPY FOUNDATION PLAN -
PHASE 1

Project No.
2400000001

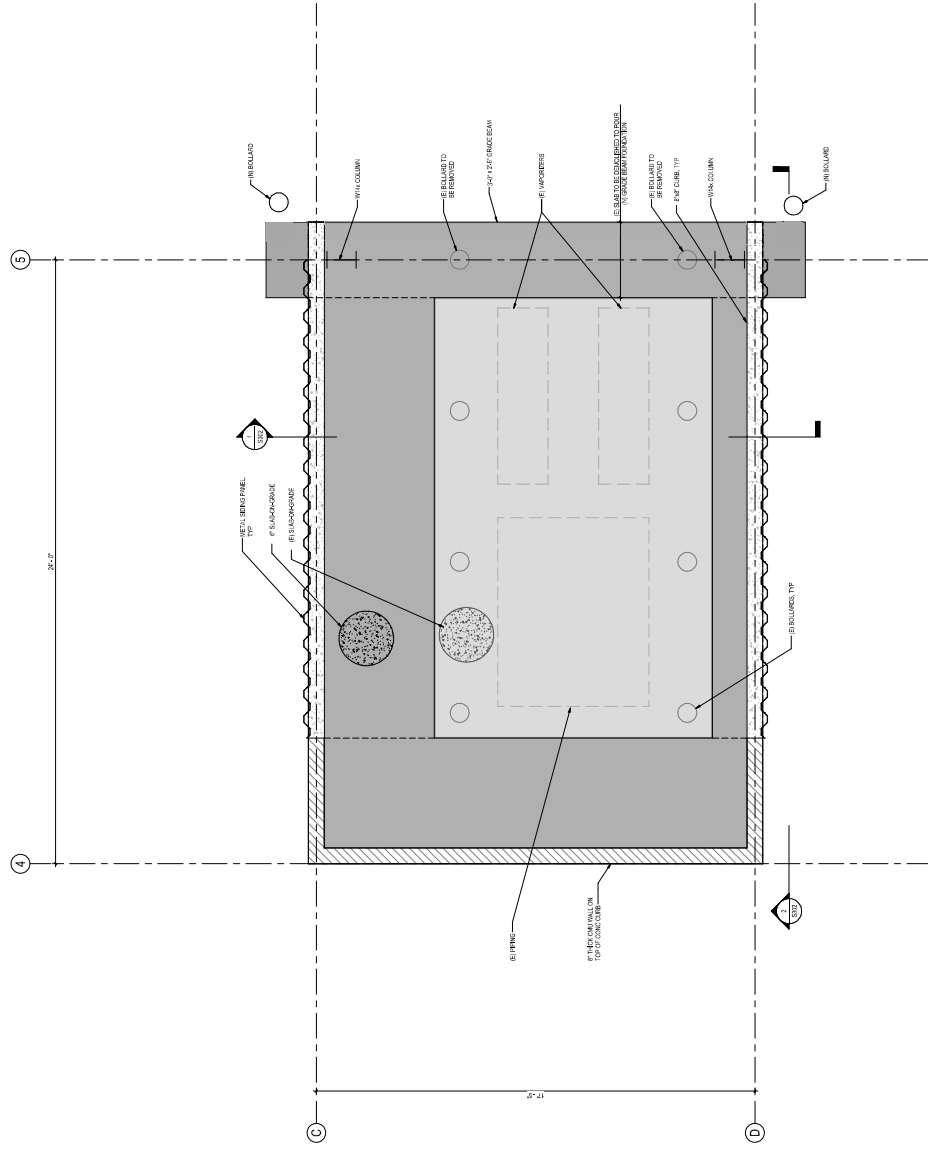
Scale
As Indicated

Revision
01

Sheet No.
S101



TANKS CANOPY FOUNDATION PLAN - PHASE 1
3/16" = 1'-0"

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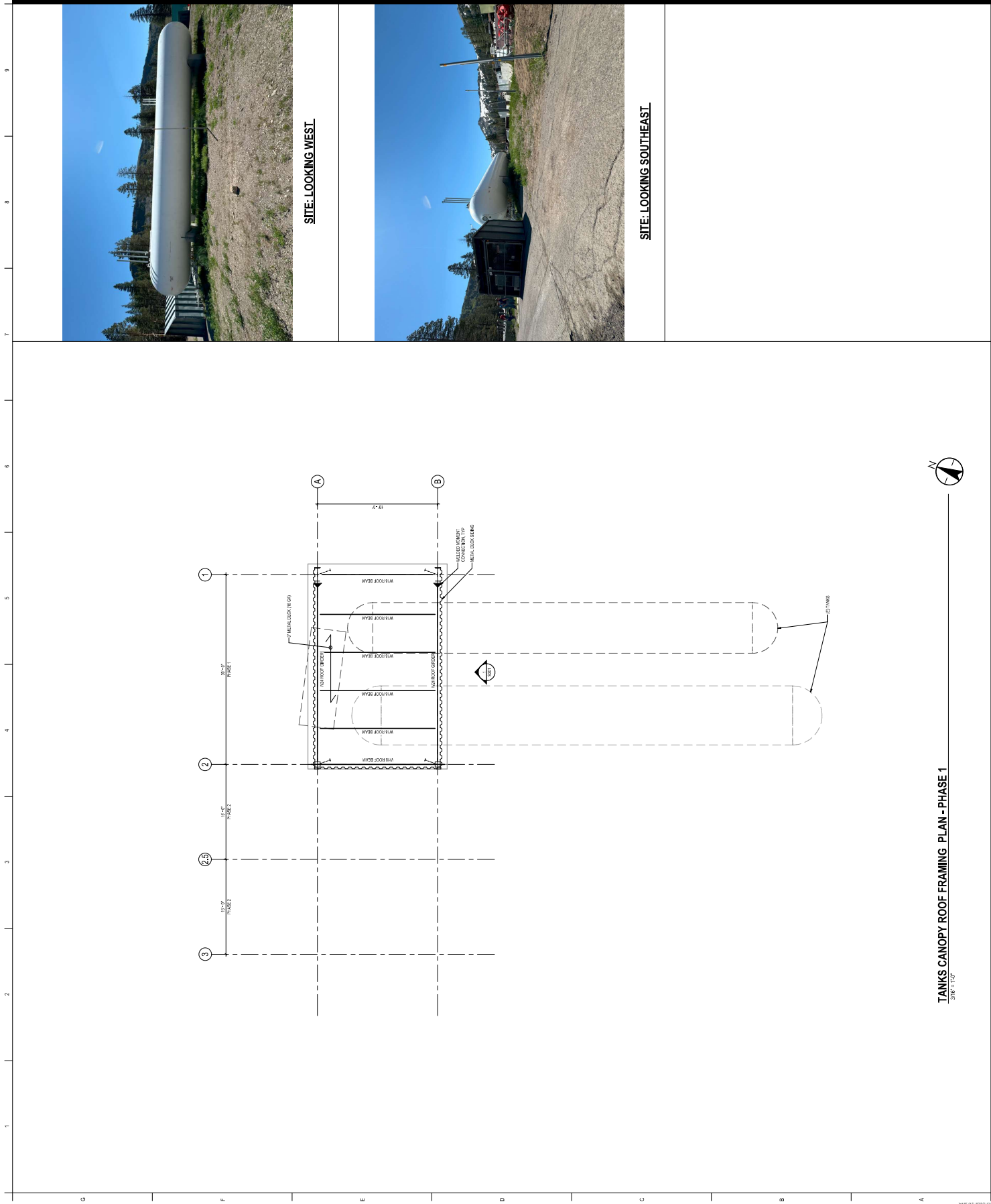
**CONCEPT DRAWINGS FOR KMPUD PROPANE
SYSTEM MASTER PLAN ONLY
NOT FOR CONSTRUCTION**

Client/Project Logo

Client/Project
Kirkwood Meadows Public Utility District
KM/PUD LPG System Assessment
KIRKWOOD MEADOWS, CA

Title _____
VAPORIZERS CANOPY FOUNDATION
PLAN

Project No. 224202855	Scale As indicated
Revision	Drawing No.



TANKS CANOPY ROOF FRAMING PLAN - PHASE 1

SITE 7142



Stantec
800 South Tower Road, Suite 300
Boulder, CO 80501
Tel: 303.440.5575

Client: KRMW
Project: KRMW Meadows Public Utility District
Title: KRMW LPG System Assessment
Revision: 1.0

Consultant: KRMW Meadows Public Utility District

Client: KRMW Meadows Public Utility District

Key Plan: KRMW Meadows Public Utility District

SITE: LOOKING WEST



SITE: LOOKING SOUTHEAST

Permit / Seal	Drawn	Rev.	Check	Tracked
Project / Title	Drawn	Rev.	Check	Tracked
Client / Project Logo	Drawn	Rev.	Check	Tracked
CONCEPT DRAWINGS FOR KRMW PROPRANE SYSTEM MASTER PLAN ONLY NOT FOR CONSTRUCTION	Drawn	Rev.	Check	Tracked
Notes: Please refer to the attached drawings for details. The drawings are for informational purposes only. Information is current as of 11/11/2020	Drawn	Rev.	Check	Tracked
Client / Project Logo	Drawn	Rev.	Check	Tracked
Client / Project	Drawn	Rev.	Check	Tracked
KRMW Meadows Public Utility District	Drawn	Rev.	Check	Tracked
KRMW LPG System Assessment	Drawn	Rev.	Check	Tracked
KRMW MEADOWS, CA	Drawn	Rev.	Check	Tracked
Title	Drawn	Rev.	Check	Tracked
TANKS CANOPY ROOF FRAMING PLAN - PHASE 1	Drawn	Rev.	Check	Tracked
Project No.	Drawn	Rev.	Check	Tracked
24002853	Drawn	Rev.	Check	Tracked
Revision	Drawn	Rev.	Check	Tracked
Scale	Drawn	Rev.	Check	Tracked
1" = 10'-0"	Drawn	Rev.	Check	Tracked
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S201	Drawn	Rev.	Check	Tracked



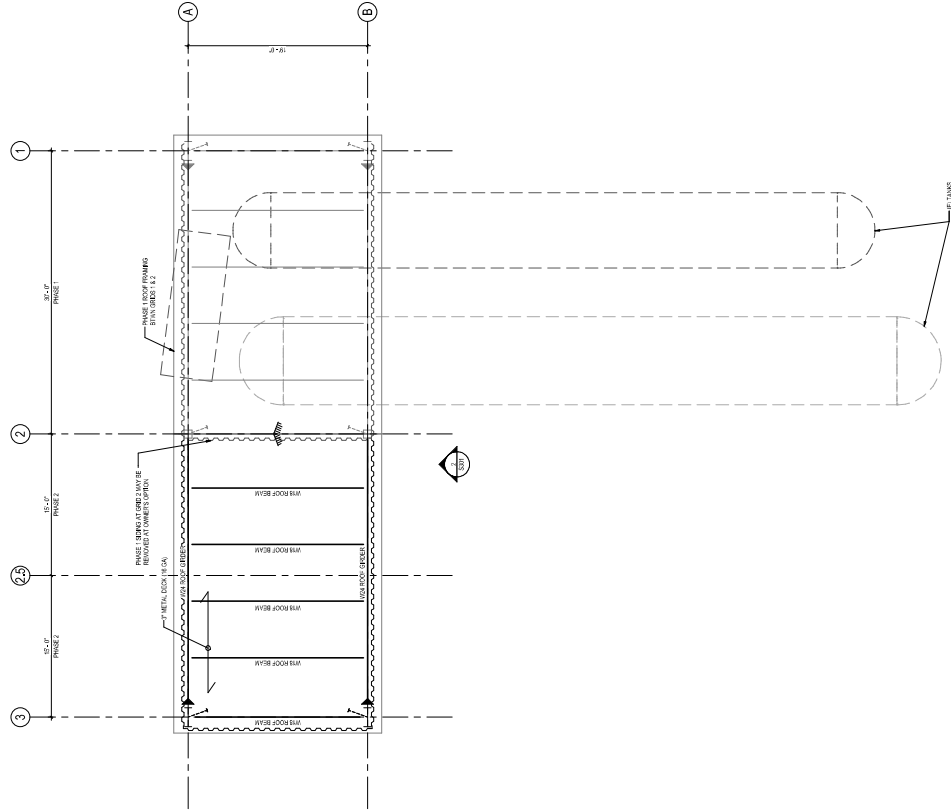
Slantec Consulting Services Inc.
801 South Figueroa Street Suite 300
Los Angeles, CA 90017-3007

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Consultant!

Client

Key Plan:



TANKS CANOPY ROOF FRAMING PLAN - PHASE 2
3/4"16" = 1'-0"

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Journal of Internal Medicine 255: 103–110

[illegible]

**CONCEPT DRAWINGS FOR KMPUD PROPANE
SYSTEM MASTER PLAN ONLY
NOT FOR CONSTRUCTION**

Client/Project Name

Client/Project
Kirkwood Meadows Public Utility District
KMPUD LPG System Assessment
KIRKWOOD MEADOWS, CA

Title
TANKS CANOPY ROOF FRAMING
PLAN - PHASE 2

Project No. 224202855	Scale As indicated
Revision	Drawing No.



Stantec
800 South Tower Street, Suite 300
San Francisco, CA 94107
Tel: 415.774.2577

Client: KMPUD
Project: KMPUD LPG System Assessment
Location: KIRKWOOD MEADOWS, CA

Consultant: KIRKWOOD MEADOWS, CA

Client:

Key Note:

1. FRAMING ELEVATION - PHASE 1
3/16" = 1'-0"

2. FRAMING ELEVATION - PHASE 2
3/16" = 1'-0"

Revision	By	Date	Description
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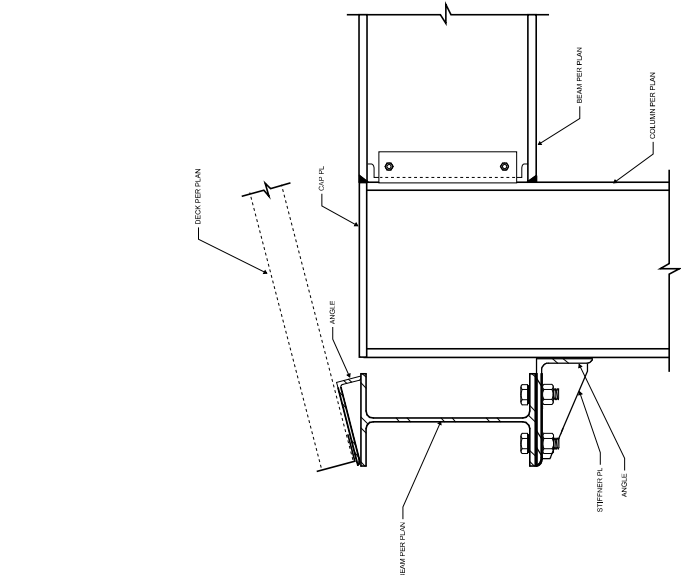
CONCEPT DRAWINGS FOR KMPUD PROPANE SYSTEM MASTER PLAN ONLY
NOT FOR CONSTRUCTION
These drawings are for informational purposes only and are not to be used for construction. All dimensions and details are subject to change without notice. The client is responsible for obtaining all necessary permits and approvals for construction.

Client/Project Logo

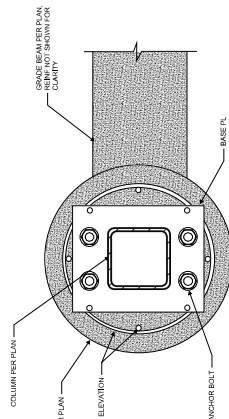
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Project: KMPUD LPG System Assessment
Location: KIRKWOOD MEADOWS, CA

Title: TANKS CANOPY BUILDING SECTIONS

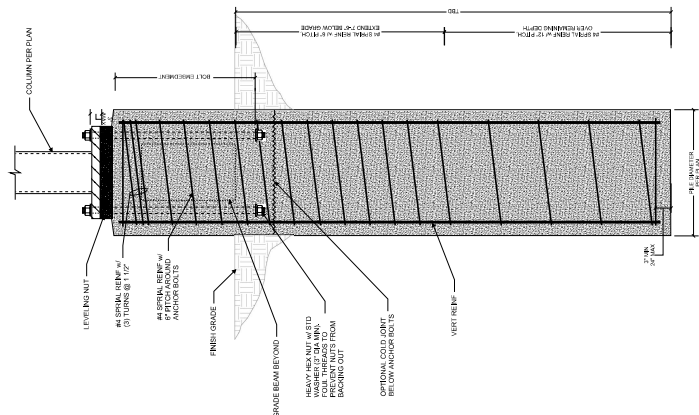
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Scale: 3/16" = 1'-0"
Revision: 10/10/2023



3 **OFFSET BEAM TO COLUMN CONNECTION**
S501 NOT TO SCALE



2 **BASE PL DETAIL**
S501 NOT TO SCALE



1 PILE & PEDESTAL DETAIL
S501 NOT TO SCALE

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532. Project Title	2541	533. Project Title	2542	534. Project Title	2543
535. Project Title	2544	536. Project Title	2545	537. Project Title	2546
538. Project Title	2547	539. Project Title	2548	540. Project Title	2549
541. Project Title	2550	542. Project Title	2551	543. Project Title	2552
544. Project Title	2553	545. Project Title	2554	546. Project Title	2555
547. Project Title	2556	548. Project Title	2557	549. Project Title	2558
550. Project Title	2559	551. Project Title	2560	552. Project Title	2561
553. Project Title	2562	554. Project Title	2563	555. Project Title	2564
556. Project Title	2565	557. Project Title	2566	558. Project Title	2567
559. Project Title	2568	560. Project Title	2569	561. Project Title	2570
562. Project Title	2571	563. Project Title	2572	564. Project Title	2573
565. Project Title	2574	566. Project Title	2575	567. Project Title	2576
568. Project Title	2577	569. Project Title	2578	570. Project Title	2579
571. Project Title	2580	572. Project Title	2581	573. Project Title	2582
574. Project Title	2583	575. Project Title	2584	576. Project Title	2585
577. Project Title	2586	578. Project Title	2587	579. Project Title	2588
580. Project Title	2589	581. Project Title	2590	582. Project Title	2591

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Client/Project Logo

Client/Project
Kirkwood Meadows Public Utility District
KMPUD LPG System Assessment
KIRKWOOD MEADOWS, CA

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DETAILS

DETAILS

Project No. 224202855	Scale As indicated
Revision	Drawing No.

Drawing No. S501



Appendix C

Cost Estimate Data



Propane System Master Plan
4 - Capital Improvement Plan

Phase 1 - Storage Tank Canopy				
CATEGORY	QTY	UNIT	UNIT COST	COST
Existing Conditions				
<i>Remove Ex Bollards</i>	2	Each	400	\$800
<i>Sawcut/Remove Ex Pavement at Foundations</i>	2	Each	600	\$1,200
<i>Protect in place existing equipment</i>				\$6,000
Earthwork				\$4,000
Exterior Improvements				\$8,000
Concrete				
<i>Concrete Caissons</i>	4	Each	5000	\$20,000
<i>Grade Beams</i>	38	LF	150	\$5,700
Metals				
<i>16 GA N-Type Metal Deck</i>	600	SF	15	\$9,000
<i>Structural Steel</i>	8	Ton	5000	\$40,000
<i>Rod Bracing</i>	100	LF	30	\$3,000
<i>Misc Metals</i>	0.8	Ton	5000	\$4,000
Thermal and Moisture Protection				
<i>Formed Metal Roof Panels</i>	600	SF	25	\$15,000
<i>Formed Metal Wall Panels</i>	1000	SF	25	\$25,000
Subtotal				\$141,700
General Conditions	15%			\$21,255
Design/Estimate Contingency	10%			\$14,170
Escalation	10%			\$14,170
Design Fees				\$20,000
Subtotal				\$211,295
Bonds	2%			\$4,226
Contractor's Fee	10.0%			\$21,130
Total				\$237,000
			Square Footage	600
			\$/SF	395



Propane System Master Plan
4 - Capital Improvement Plan

Phase 2 - Storage Tank Canopy				
CATEGORY	QTY	UNIT	UNIT COST	COST
Existing Conditions				
<i>Sawcut/Remove Ex Pavement at Foundations</i>	1	Each	1200	\$1,200
Earthwork				\$8,000
Exterior Improvements				\$8,000
Concrete				
<i>Slab on Grade</i>	600	SF	20	\$12,000
<i>Concrete Caissons</i>	2	Each	5000	\$10,000
<i>Grade Beams</i>	19	LF	150	\$2,850
Metals				
<i>16 GA N-Type Metal Deck</i>	600	SF	15	\$9,000
<i>Structural Steel</i>	7.2	Ton	5000	\$36,000
<i>Rod Bracing</i>	100	LF	30	\$3,000
<i>Misc Metals</i>	0.72	Ton	5000	\$3,600
Thermal and Moisture Protection				
<i>Formed Metal Roof Panels</i>	600	SF	25	\$15,000
<i>Formed Metal Wall Panels</i>	600	SF	25	\$15,000
Subtotal				\$123,650
General Conditions	15%			\$18,548
Design Contingency	10%			\$12,365
Escalation	10%			\$12,365
Design Fee				\$20,000
Subtotal				\$186,928
Bonds	2%			\$3,739
Contractor's Fee	10.0%			\$18,693
Total				\$209,000
			Square Footage	600
			\$/SF	348



Propane System Master Plan
4 - Capital Improvement Plan

Vaporizer Canopy				
CATEGORY	QTY	UNIT	UNIT COST	COST
Existing Conditions				
<i>Remove Ex Bollards and pad</i>	2	Each	800	\$1,600
<i>Sawcut/Remove Ex Pavement at Foundations</i>	2	Each	800	\$1,600
<i>Protect in place existing equipment</i>				\$3,800
Earthwork				\$8,000
Exterior Improvements				\$6,000
Concrete				
<i>Slab on Grade</i>	230	SF	20	\$4,600
<i>Concrete Foundations</i>	10	CY	800	\$8,000
<i>Grade Beams</i>	20	LF	300	\$6,000
Masonry				
<i>8" CMU Block Wall - Full Grout & Reinf</i>	350	SF	35	\$12,250
Metals				
<i>16 GA N-Type Metal Deck</i>	450	SF	15	\$6,750
<i>Structural Steel</i>	3.1	Ton	5000	\$15,500
<i>Misc Metals</i>	0.31	Ton	5000	\$1,550
Thermal and Moisture Protection				
<i>Formed Metal Roof Panels</i>	450	SF	25	\$11,250
<i>Formed Metal Wall Panels</i>	360	SF	25	\$9,000
Subtotal				\$95,900
<i>General Conditions</i>	15%			\$14,385
<i>Design Contingency</i>	10%			\$9,590
<i>Escalation</i>	10%			\$9,590
<i>Design Fees</i>				\$20,000
Subtotal				\$149,465
<i>Bonds</i>	2%			\$2,989
<i>Contractor's Fee</i>	10.0%			\$14,947
Total				\$167,000
			Square Footage	450
			\$/SF	371





Stantec is a global leader in sustainable architecture, engineering, and environmental consulting. The diverse perspectives of our partners and interested parties drive us to think beyond what's previously been done on critical issues like climate change, digital transformation, and future-proofing our cities and infrastructure. We innovate at the intersection of community, creativity, and client relationships to advance communities everywhere, so that together we can redefine what's possible.

