ctc technology & energy

engineering & business consulting

March 11, 2020

Mr. John Abaci
Assistant City Attorney
City of Sonoma
The Plaza
Sonoma, CA 95476

Re: Appeal of Verizon Wireless sites 6, 7, and 12

Dear Mr. Abaci:

This letter report has been prepared in response to your request for Columbia Telecommunications Corp. to review the technical points made in the February 3, 2020 letter from Paul B. Albritton to the City Council which accompanied the applicant's appeals ("Appeal Letter").

1. Technical infeasibility

The Appeal Letter states that it would not be "technically feasible" to place the radio in an underground vault due to "operational challenges" such as power outages, water intrusion, overheating and noise, in summary.

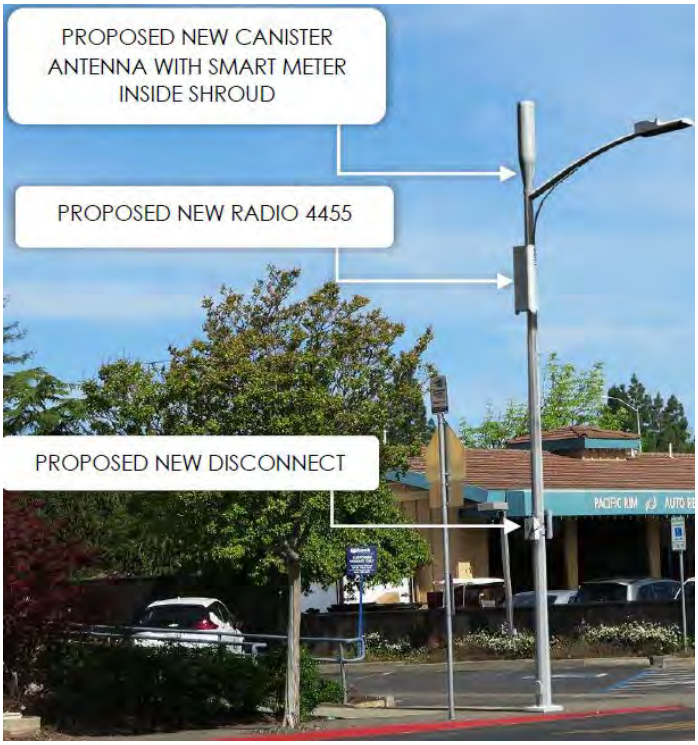
At issue is the pole-mounted radio enclosure proposed to be mounted below a lighting cross arm. This an air convection cooled housing with the dimensions of 30" H x10.4" W x 5.9" D. The approved permit is conditioned to require that the radio be mounted in an underground vault. The photo simulation for site 6 prepared by The CBR Group, Inc. (below) provides an illustration of the proposed streetlight pole, antenna, radio enclosure, and electrical cut-off switch required by PG&E to comply with the GO-95 safety code. We do not anticipate that placing the radio underground in a vault will result in any discernable impact in the coverage area of the site or in the level of radio frequency (RF) emissions produced by the site.

Previously we reviewed the CBR study prepared October 3, 2018 to address the feasibility of using vaults to house the radio equipment. For that specific design, Verizon was assuming the installation of two radios, not one radio as in the current design. Further, CBR assumed that more traditional, larger air-vented vaulting would be employed.

In March 2019 we contacted Syndèo, a firm that manufactures vaults targeted to the telecommunications market. They provided us with the description of a new product that they were prototyping in Austin, Texas that employs substantially smaller vaults that have watertight seals and employ a geothermal heat exchanger to cool the radio. Syndèo provided us with the

technical specifications for their vault, a cost estimate, and illustrative drawings. Attached are the drawings provided, as well as letters describing estimated costs and installation timelines.[1]

Ericsson 4455
30”x 10.4”x 5.9”



Site 6 Photo Simulation

All of the materials were provided by the City Planning Department to CBR for their and Verizon’s consideration. It is my understanding that that Verizon engineering staff performed a preliminary review[2] of the Syndèo vault without fully vetting the design as a viable option to address the undergrounding requirements included in the City Municipal Code.

Syndèo, in their preliminary price quote, estimated that a 49”x49”x30” vault will be required to house and cool the radio equipment. The estimated cost for the completed vault will be in excess of $30,000 per site. Syndèo estimates a construction time of 5 to 7 days. Since receiving the Appeal Letter, I have followed up with a representative of Syndèo regarding the vault design, pricing, and specifications that were previously provided and history of installations. Syndèo has confirmed that information that it had previously provided which is attached is still current. Syndèo has also represented to me verbally that it has built 2 underground vaults for small cell sites in Austin, Texas, and 3 underground vaults for small cell sites in Herndon, Virginia (located outside of Washington, D.C.). It has further represented that it is beginning construction on 5

[1] Syndèo Standard Product Specifications – Smart Vault; Syndèo Letters to Lee Afflerbach, March 18, 2019 – Sonoma Small Cell Installation and Sonoma Small Cell Installation Pricing

[2] I have reviewed a June 7, 2019 email from Jerry Bascom to a recipient whose name that has been redacted from the copy submitted by the applicant which includes a list of 5 “pro’s” and 19 “con’s” about the Syndèo vault design that was previously submitted by the City to CBR.

more underground vaults for small cell sites in Austin, Texas. Syndeo's representative has confirmed verbally that at least one of the vaults provides heat dissipation for a radio of 1,000 watts, which is significant as that is a higher wattage radio than the radio being proposed by the applicant, which has a wattage of 800. Finally, Syndėo has confirmed that its design consists of a sealed vault without outside vents or openings through which water intrusion could occur and would have 2 fans within the sealed vault. Thus, outside noise from fans within the sealed underground vault would appear to be limited. Cabling would extend from the interior of the vault to the inside of the pole—rather than being visible from the outside. Based on my understanding from this limited information, it would be my opinion that the Syndėo vault is a viable design to address the technical infeasibility concerns raised within the Appeal Letter, which the applicant may consider and appropriately vet as an available alternative to placement of the radio on the pole at each of the three sites.

2. Interruption of Service

The Appeal Letter also indicates that equipment failure resulting from the radio being placed within the underground vault would result in "disabl[ing] a small cell for an extended period of time, compromising network reliability."

Equipment failure is to be expected when utilizing either the applicant's design or a design in which the radio is placed within an underground vault. In either case, equipment failure may require replacement of the broken and no longer operational equipment. There is no reason given in the Appeal Letter as to why the period of time to replace a broken radio within a vault would be "extensive" as opposed to the time to replace a broken radio that is mounted on the pole. As such, I am aware of no support for the claim that failure of the vaulted radio would lead to an unreasonable interruption in operations when compared to the period of interruption anticipated for the applicant's radio mounted on the pole design. Regardless, however, as we have concluded from our tests measuring coverage within the 700 MHz band, each of the three sites currently receives 4G LTE service as confirmed by our field testing and each of these applications would only supplement the existing 4G coverage being provided. Since that is the case, in the event that coverage provided through any of these three sites were to be interrupted, under current site conditions 4G coverage would still exist at each site. Therefore, any temporary loss of coverage from equipment failure at any of three sites would not seem to impact receiving 4G LTE service.

Please note that our evaluation of these sites has been focused on radio technology. We do not generally address construction issues associated with civil and mechanical engineering expertise. Over the past three years we have reviewed several hundred small cell applications designed for Verizon, AT&T, and Sprint. Only one of the applications was designed with a vault housing of the radio equipment.

I trust this letter addresses your request. Please let me know if you need additional information or have any additional questions.

Regards,

Lee Afflerbach, P.E.

STANDARD PRODUCT SPECIFICATIONS

Smart Vault

Patented

COMPONENTS	SPECIFICATIONS
Tactile Surface Vault	**Options** • When used in an Americans with Disabilities Act compliant sidewalk curb ramp, a plastic composite detectable warning panel is utilized. • When used mid block in a sidewalk or terrace, a stainless steel or plastic composite diamond plate skid plate is utilized. The surface applied detectable warning tile is in compliance with the following standards (or most recent); • Americans with Disabilities Act (Title III Regulations, 28 CFR Part 36 ADA STANDARDS FOR ACCESSIBLE DESIGN, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES. • California Code of Regulations. The tactile surface panels are available in nine standard colors with Federal color identification. They can also be decorated with a patented high quality durable image. They are secured to the load-bearing subsurface panel using stainless steel screws.
Load-Bearing Subsurface Panel	The Smart Vault load-bearing subsurface panel meets the H-20 load rating standard of the American Association of State Highway Transportation Officials (AASHTO) Standard Specification M306. The H-20 load rating standard has a design criteria of a wheel loading of 16,000 lbs. with a 2.5 safety factor. Accordingly, the Smart Vault has been third-party tested to withstand a simulated 40,000 lb. wheel load. The load-bearing subsurface panel is secured to the aluminum frame, which is embedded in steel reinforced concrete, with four tamperproof stainless steel bolts.
Frame	A powder coated aluminum frame is imbedded into the surrounding concrete. A neoprene gasket is adhered to the frame providing water infiltration resistance between the load-bearing subsurface panel and the aluminum frame.
Smart Vault	The Smart Vault subsurface enclosure is comprised of two fiberglass reinforced plastic sections; • Top section • Base section Both the fiberglass reinforced plastic Smart Vault sections have a nominal wall thickness of 0.25”. The waterproof lid is secured to the base section with t-handle type screws. There are two standard Smart Vault sizes; • 49”x 30”x 21” – 17.8 CF • 49”x 49”x 21” – 29.5 CF
Smart Vault Entry	Physical entry into the Smart Vault is accomplished with a two-step process; • Remove the tamperproof bolts in the load-bearing subsurface panel. Lift the load-bearing subsurface panel off the aluminum frame using the supplied lifting handles. o Remove the t-handle screws attached to the top section of the Smart Vault. Then remove the waterproof top/lid section from the base section. The Smart Vault 49” x 30” x 21” SMART VAULT has an access opening of 11.4” x 32.4” o 49” x 49” x 21” SMART VAULT has an access opening of 32.4” x 32.4”
Smart Vault Conduit Entries	Conduit entries into the Smart Vault utilize a flexible double entry penetrations specifically designed for fiberglass wall enclosures. The two-piece flexible double entry penetrations doubles the sealing power of the entry system. Flexible entry boots create a reliable and safe seal for conduit pipe entries in subsurface enclosures. They are flexible enough to permit angled conduit pipe entries (on two axes) into the sidewall of the fiberglass Smart Vault. All flexible entry boots permit angled entries up to a 15-degree angle off the perpendicular center line in any direction without leaking or putting undo stress on the conduit pipe or conduit seal. The flexible entry boots come in 4”, 3” and 2” sizes. Flexible entry boots have been tested to withstand a minimum of 6’ of liquid head pressure. These seals provide a studded flange connection to create a positive and secure seal where the rubber contacts the Smart Vault wall and also around the conduit pipe. The securement process utilizes a torque-restricting wrench achieving a 60Nm tightening force in accordance with the manufacturers specifications. Tightening the series of stainless steel stud fasteners, corrosion-resistant nuts/washers along with a compression ring provides a high compression mechanical seal.

STANDARD PRODUCT SPECIFICATIONS

Smart Vault

Patented

Conduit Pipe	Conduit pipe is corrosion resistant Schedule 40/80 PVC pressure pipe and fittings, iron pipe size (IPS) sizes 4", 3" and 2", for use at temperatures up to and including 140°F. The material used in the manufacture of the pipe is rigid polyvinyl chloride (PVC) compound or high density polyethelene (HDPE). All sizes of PVC Schedule 40 and Schedule 80 pipe are manufactured in strict accordance to the requirements of ASTM D1785 for physical dimensions and tolerances. All pipe meets or exceeds the industry standards set forth by the American Society for Testing and Materials (ASTM) and the National Sanitation Foundation (NSF International). The conduit used will be as follows; • **Electrical and Fiber Conduit** – 3" or 2" Schedule 80 PVC pressure pipe, gray in color or HDPE. All fittings will be either long bends or long sweep bends. All pipe and fittings are cleaned with solvent and then cemented/glued for PVC or electrofused with HDPE pipe and fittings
Re-enterable Conduit Sealing System	The Smart Vault is connected to both electrical and telecommunication utilities and the subsurface enclosure of the Smart Vault is penetrated by these connections. These utilities enter via 2" or 3" conduits which contain one or more cable. The Smart Vault utilizes a re-enterable duct sealing system that blocks the entry of both gases and water up to 1 bar of atomospheric pressure. This duct sealing system provides strong support for all cabling contained inside conduits penetrating the Smart Vault, while also remaining re-enterable should conditions apply where additional cabling needs to be brought into, or removed from, the Smart Vault. This duct sealing system has the following resistant properties: fire, water, alkalines, chemicals, rodents, termites, hydrogen sulfide, methane and many other gases. Additionally, the sealing system is non-toxic, non-corrosive, shock absorbent and solvent free. For added assurance, SYNDÉO specifies that during field installation the re-enterable duct sealing system be installed on both the Smart Vault side of the conduit as well as the opposite conduit side to which feeder handhole/manhole is being fed.
Internal Thermal Dissipation	Standard Smart Vault configurations can handle internal equipment thermal loads up to *1.8kW. **Vented Solution -** This is accomplished via one (1) ambient air intake fan, and one (1) exhaust fan, both located inside the Smart Vault. The air intake and exhaust fan speeds are automatically controlled based upon the internal Smart Vault temperature. **Geothermal Solution –** This is accomplished via a heat exchanger housed within the Smart Vault connected to HDPE geothermal piping ground loops containing non-toxic antifreeze fluid or the like *Based upon corner case condition defined as: Maximum ambient air temperature of 117°F at an altitude of 6,000' above sea level.
Venting Fans (Vented Solution Only)	Two IP68 fans come standard with the Smart Vault. They are secured to an aluminum cone-shaped housing that in turn connects them onto the vent conduits. The blades are plastic and the fans have an operating temperature range of -4°F to 158°F. Expected service life is 70,000 hours (8 years). Finger guards are included on the exposed side of fan. Fan speed is adjusted automaticly on a real time basis depending on in the internal thermal load being realized. Maximum fan speed is 546 CFM and provides a minimum of 10 air changes per minute inside the Smart Vault. These fans utilize a 55-amp AC to DC conversion kit. When UPS and batteries are placed in the Smart Vault, venting fans are powered from the batteries' power supply so that they continue to run when outside sources of power have been interrupted.
Remote Water Monitoring	Every Smart Vault incorporates a OneEvent™ gateway and water puddle sensor as standard equipment. The provider for Smart Vault sensors and analytics is OneEvent. Their product, OnePrevent™, incorporates a multi-frequency gateway that receives communications from OneEvent sensors located in the Smart Vault. The OneEvent gateway supports cloud-based analysis and communications of sensor data via cellular data communications using redundant pathways. The OneEvent predictive analytic gateway operates on AC power with a four-hour battery backup. The OnePrevent sensor system focuses on stopping disasters before they happen by alarming on trend-line changes and not just thresholds. The OneEvent sytems has a mobile application based and web based monitoring dashboard that provides mobile monitoring with deployed sensors reporting out every three minutes.
Surface Venting Concealment (Vented Solution Only)	A variety of street furniture options can be configured to conceal the air intake and exhaust 4" Schedule 40 PVC conduits. Some available options are: trash cans, light pedestals and planters. SYNDÉO can design street furniture venting options to suit many customer requests.

STANDARD PRODUCT SPECIFICATIONS

Smart Vault

Patented

Rodent & Insect Protection – Vented Solution	Air intake and exhaust conduits utilize stainless steel screens ensuring a minimal number of small insects, dust and debris can be pulled into the Smart Vault via the air intake conduit and fans. The construction of the screening is of sufficient construction such that rodents cannot enter.
Power Distribution & Electrical Outlet(s)	The Smart Vault includes a custom designed power distribution panel. Depending on the application, the power distribution panel is designed and specifically built for the given Smart Vault deployment case (i.e. small cell, edge computing, uninterruptible power supply, traffic signal controller, etc.).
Optional Equipment	**Sump Pump -** Although the Smart Vault is designed not to leak, and a robust Waterproof Guarantee is provided, a sealed submersible sump pump is as an option for added protection from water penetration. An integrated unique float switch design assures reliability, and security, while providing access to the float for servicing. Permanently lubricated motor bearings require no maintenance during life of pump. ¼" discharge is suitable for ½" I.D. vinyl tubing. Any water that has infiltrated the Smart Vault is discharged through the exhaust air conduit to the ground surface. **OneEvent Additional Environmental Sensors Include –** • Humidity & Temperature Sensor • Photoelectric Smoke & Heat Sensor • Motion Sensor • CO & H_2 Sensor

March 18, 2019

Lee Afflerbach
Columbia Telecommunications Corp
Royal Oak, MD

RE: Sonoma Small Cell Installation Pricing

Dear Lee,

Enclosed is the budget pricing for this project. However, real costs could fluxuate depending on finalize site analysis design, as well as, the geothermal boring depth and the related required pipe and fluid network. The intent of this pricing is to simply provide a scale of the costs.

Materials Included:

- Geothermal heat exchanger
- Geothermal piping loop
- Smart Vault enclosure
- Slip resistant tactilce surface panel
- H20 load rated weight bearing panel (per AASHTO M306)
- (4) Conduit entry penetrations
- 70A electrical distribution panel with (2) quad receptacles
- Wireless gateway for environmental monitoring
- Water puddle sensor
- Unistrut racking assembly

Excluded:

- Small cell radio brackets/attachments
- Shipping
- Taxes
- Conduit material and placement to existing infrastructure connection points (fiber or power handholes and utility pole) as well as tapping into these items
- Permits

Pricing: 49”x49”30” Smart Vault Assembly = $13,010

Budget Construction Costs: $10,000 - $16,000
*This is a wide range, but since costs can very greatly depending on local labor rates and more site specific installation details, we’ve given a range accordingly.

Construction Duration: 5-7 working days

March 18, 2019

Lee Afflerbach
Columbia Telecommunications Corp
Royal Oak, MD

RE: Sonoma Small Cell Installation

Dear Lee,

SYNDÉO welcomes the opportunity to further advance and illustrate how our deployment solution can assist municipalities such as the City of Sonoma in the deployment of small cells, and other 'Smart City' infrastructure assets and doing so in a more aesthetically pleasing manner. Below is a project description of the Smart Vault and justifications to support the deployment application.

Location:
Smart Vaults have been designed to accommodate four distinct installation locations: grass terraces, bituminous pavement, concrete sidewalks and Americans with Disabilities Act (ADA) sidewalk curb ramps. These four installation applications enable Smart Vaults to be strategically located for 'Smart City' technologies in close proximity to the users of technologies such as; IoT, small cells, traffic signal equipment, UPS and battery backup, electric vehicle charging stations, citizens broadband radio service (CBRS) and public WiFi to name a few. For this specific project the installation application illustrated is in a concrete sidewalk.

Project Purpose:
The purpose of this project is to provide supporting validation that the deployment of small cells is viable utilizing underground vaults, if they are designed and specified as SYNDÉO's patented Smart Vaults.

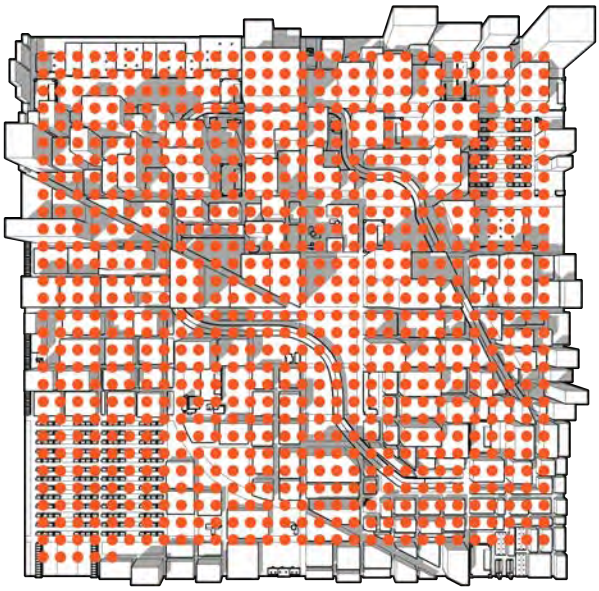
Scope of Work:
- Install (1) canister antenna on existing utility pole
- Install (1) 49"x49"x30" Smart Vault
- Install (2) Ericcson RRU-units inside the Smart Vault
- Install electrical distribution panel inside the Smart Vault
- Install (1) geothermal heat exchanger inside the Smart Vault connected to geothermal piping loop that will be drilled and grouted to a depth suitable to cool the RRU-units
- Install (1) utility disconnect switch mounted on the existing pole
- Install (1) electrical meter mounted on the existing pole
- Install (1) conduit from the Smart Vault to the existing pole for connection to the power equipment and canister antenna mounted on the pole
- Install sunshields on the existing pole to conceal electrical wiring
- Install, as further determined, conduits to connect into existing power and fiber handhole locations

Antenna:
The antenna design/type would be as per selected by the participating wireless carrier.

Radio Units:
The deployment illustrations contained herein have been modeled as RRU's to identically match those requested by Verizon per the "Sonoma 006" node installation.

The Problem:
As the growth of wireless usage has been expanding at exponential rates, and with 5G networks on the horizon, the wireless carriers need to significantly enhance their networks. Based off of the 2017 Small Cell Forum carrier study published in 2018, it is anticipated that between 250 and 875 small cells will be need, FOR EACH CARRIER, by 2020. This begs the question of where is all of this equipment going to go?

250 Small Cells



875 Small Cells

If it were strictly up to the carriers, this equipment would undoubtedly be direct mounted to existing infrastructure. While that sounds great for them, and economical, the result is a very unsightly urban landscape that is quickly overwhelmed with clutter on poles. See below for a small sampling;

The Solution – Small Cells:

At SYNDÉO we saw an opportunity for a cleaner deployment strategy, one that still accomplishes the wireless carrier's goal of small cell deployments while not compromising communal aesthetics. From our experience, communities aren't as bothered with the visual appearance of canister antennas on poles, rather, it's the unsightly appearance of power and fiber lines and bulky radios affixed to poles. Smart Vaults are the answer. Smart Vaults facilitate the placement of small cell radios out of sight and out of mind in underground vaults which are waterproof and environmentally controlled. Further, with the radios being in a climate-controlled environment, they should perform more reliantly as they will not experience the vast night time to day time temperature swings as they would being mounted on a pole in the open environment. In addition, the Smart Vault provides the opportunity for a wireless carrier to install battery backup in the same vault as the small cell radios. This cannot be accomplished in most

situations where the small cell is placed on an existing pole. Below in the following pages are a few installation illustrations specific to the "Sonoma 006" deployment.

The Solution – Smart City Technologies:

SYNDÉO's Smart Vault provides a city a complete smart city technology neutral host solution. This is more than just about small cells. A few examples of other smart city solutions that can be housed in the Smart Vault include - the Smart Vault can be used to make existing decorative light poles smart by placing the Smart Vault at the base of the pole to house electronic equipment, the Smart Vault can be a home for recharging equipment connecting cars and scooters with power and data right at curbside, the Smart Vault can be the home for intelligent traffic systems equipment including traffic controllers and the Smart Vault can provide edge computing very close to urban users.

Construction:

Once the permitting process is complete, a licensed local utility contractor would project manage the excavation, geothermal boring and the related pipe loop, Smart Vault installation, conduit installation, backfilling and concrete work necessary for the solutions installation in strict accordance with SYNDÉO's installation instructions and city specifications. Additionally, SYNDÉO would be able to provide on-site oversight of the installation. Start to finish the installation process takes around 5-7 full working days.

*Note – Without performing geothermal soil analysis specific to the determined site it is impossible to conclusively determine the soil type, and the related depth in which the geothermal cooling loop would need to be. However, for discussion purposes ONLY, one can figure the depth to be in the 180' depth range for the proposed heat dissipation load of 1.3kW for this project.

Maintenance and Monitoring:

Smart Vaults are virtually maintenance free once construction and equipment installations are completed. However, one of the key benefits of using Smart Vaults vs. pole mounted equipment is that in the event that maintenance is required, it does not necessitate the need of bucket trucks and the related vehicular traffic control measures. Rather, all equipment housed within the Smart Vault can easily be accessed off of the roadway on sidewalks with no heavy equipment needed to gain access.

SYDNÉO provides a waterproof warranty such that in the unlikely event, outside of an act of God, a Smart Vault leaks and equipment contained therein is damaged, SYNDÉO will replace said damaged equipment at no cost to the customer. Additionally, a wireless transmitting gateway, along with a water puddle sensor, is a standard component of Smart Vaults. Accordingly, should a water infiltration trip an alarm, SYNDÉO personnel will be notified and able to quickly dispatch local maintenance personnel to the site to diagnose the problem and take remedial actions if necessary. Additional monitoring equipment available are:

- Humidity & Temperature Sensor
- Photoelectric Smoke & Heat Sensor
- Montion Sensor
- Carbon Monoxide & Hydrogen Sensor

SYNDÉO Management Experience:

The father and son co-founding team at SYNDÉO has an extensive background in construction. Gary Henshue owned and operated an underground construction company whom employed in excess of 250 personnel installing water, sewer, gas and telecom infrastructure. Gary's company installed thousands of telecom handholes and thousands of miles of underground infrastructure.

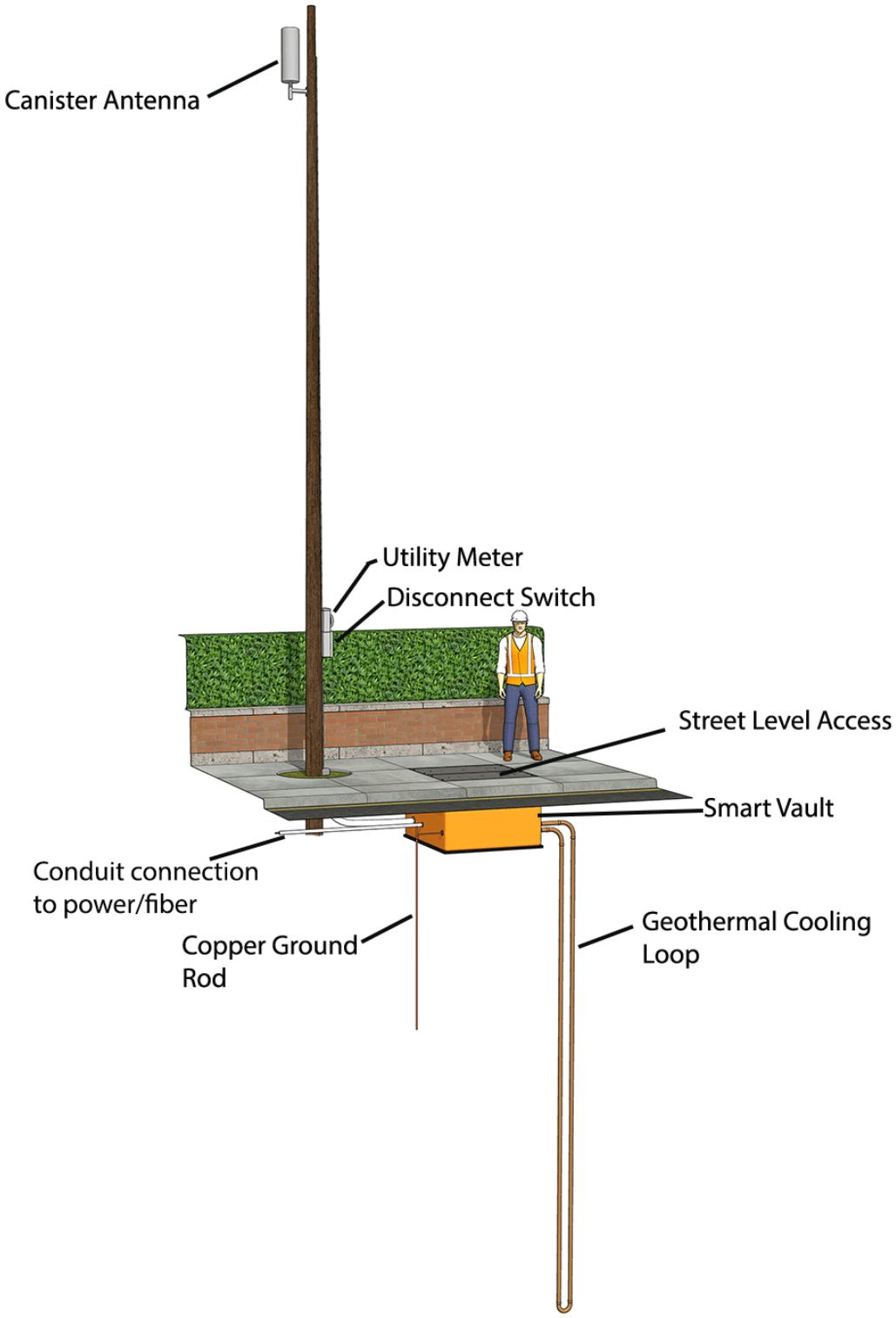
Chris Henshue is a 2004 graduate of the University of Wisconsin-Madison obtaining a degree in Civil Engineering with a certificate in Construction Management. With his engineering and construction background Chris was a project manager working for large general contractors building hospitals, clinics and surgery centers across the U.S.

The Henshue's have authored and have been issued over a dozen patents in the U.S., and internationally, for detectable warning panels to assist the visually impaired in safe wayfinding, and the 'Smart City' enabling product that has come to be known as the Smart Vault.

Smart Vault Illustrations:

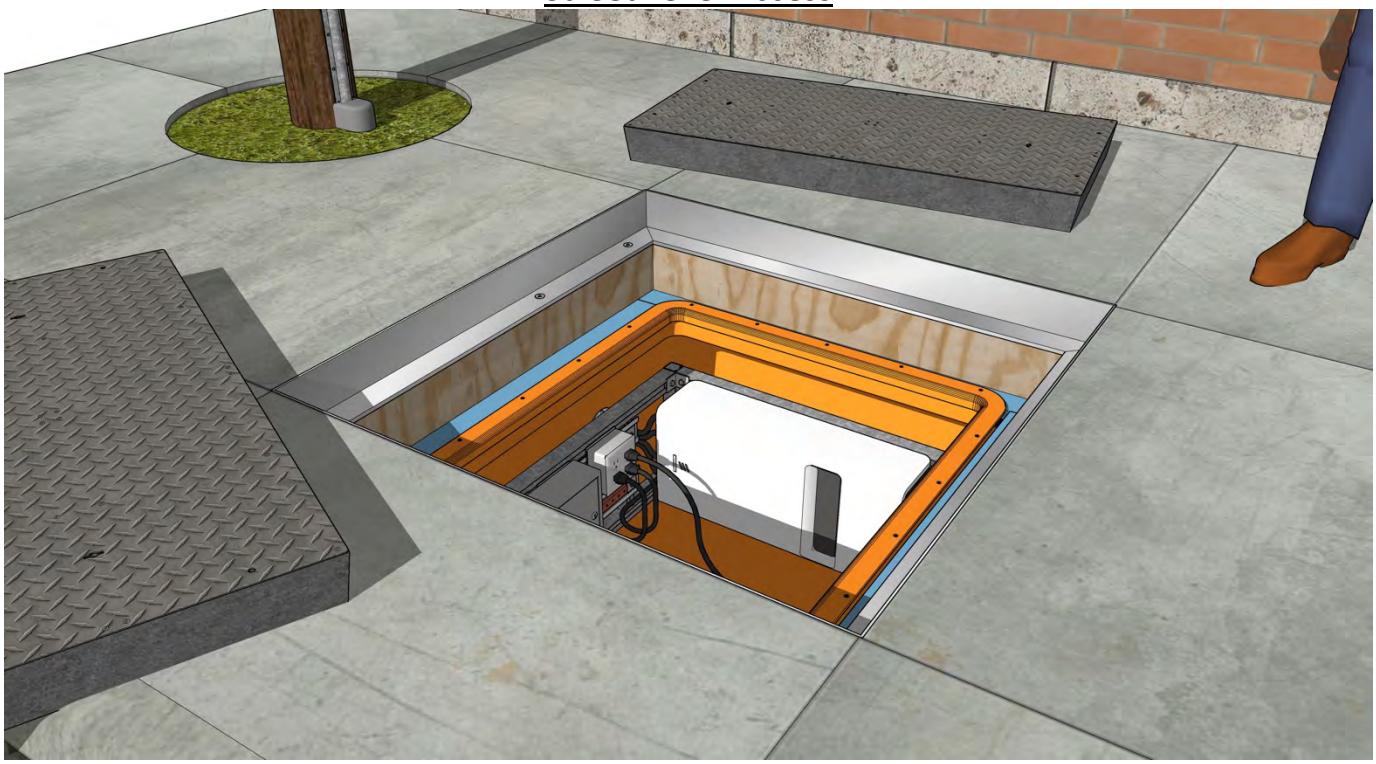
See below for detailed installation, and project specific illustrations for the "Sonoma 006" application. Additionally, a three dimensional model can be found by selecting here: **https://skfb.ly/6IDqy**

Deployment Components

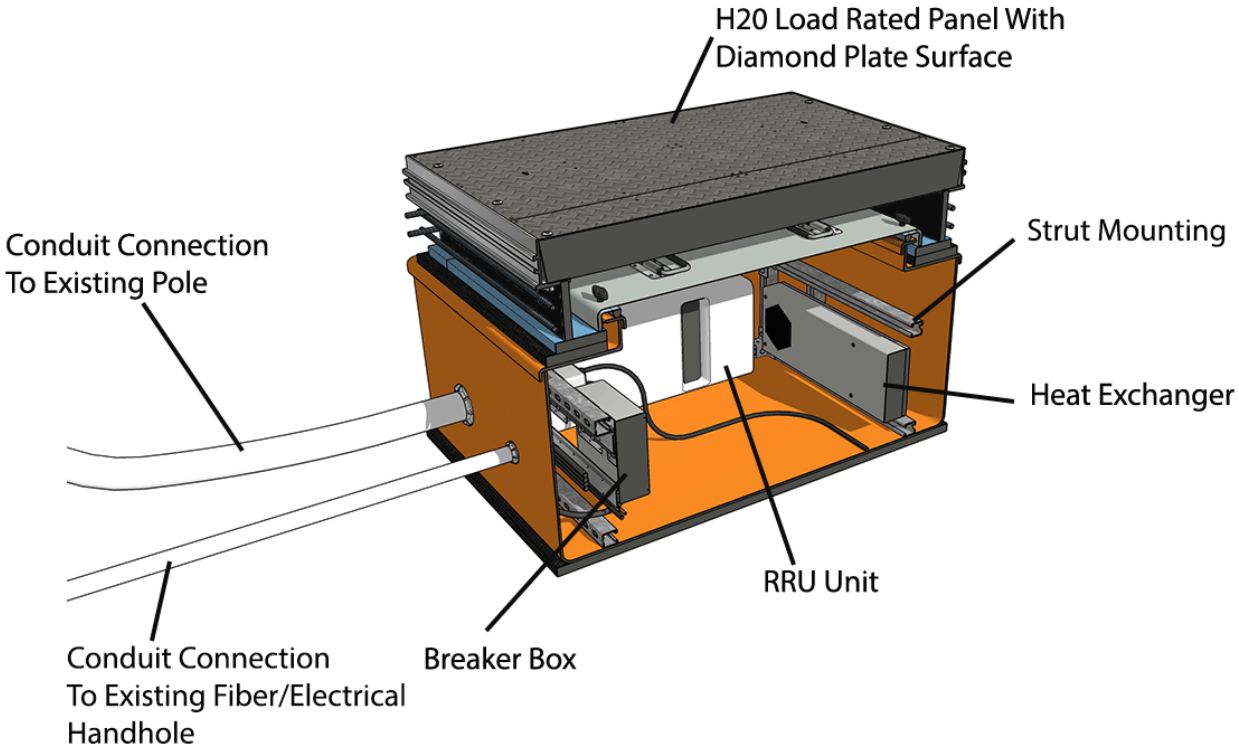


Street Level View

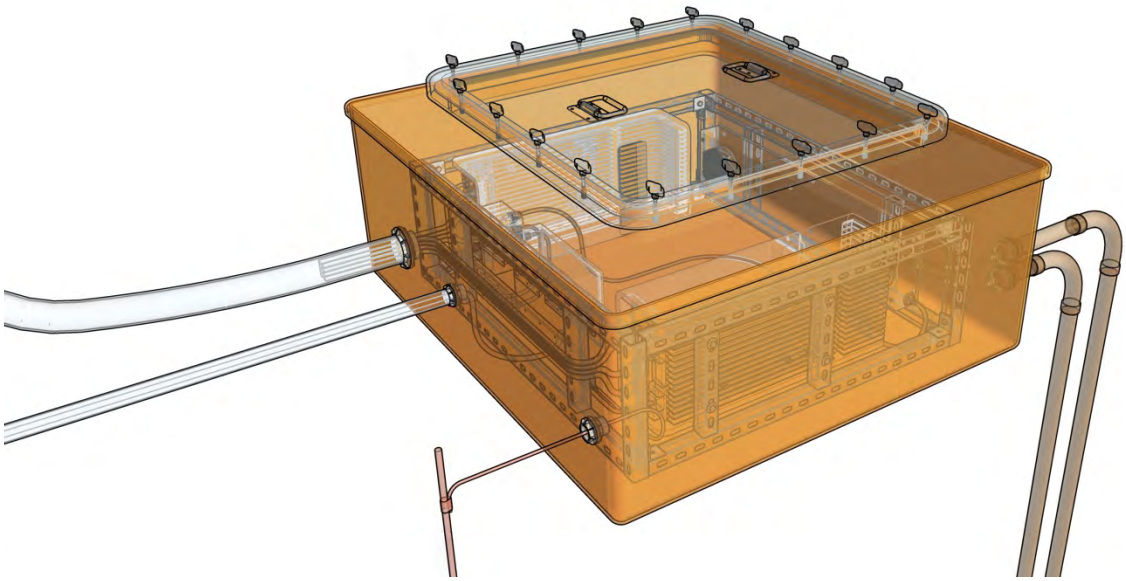
Street Level Access



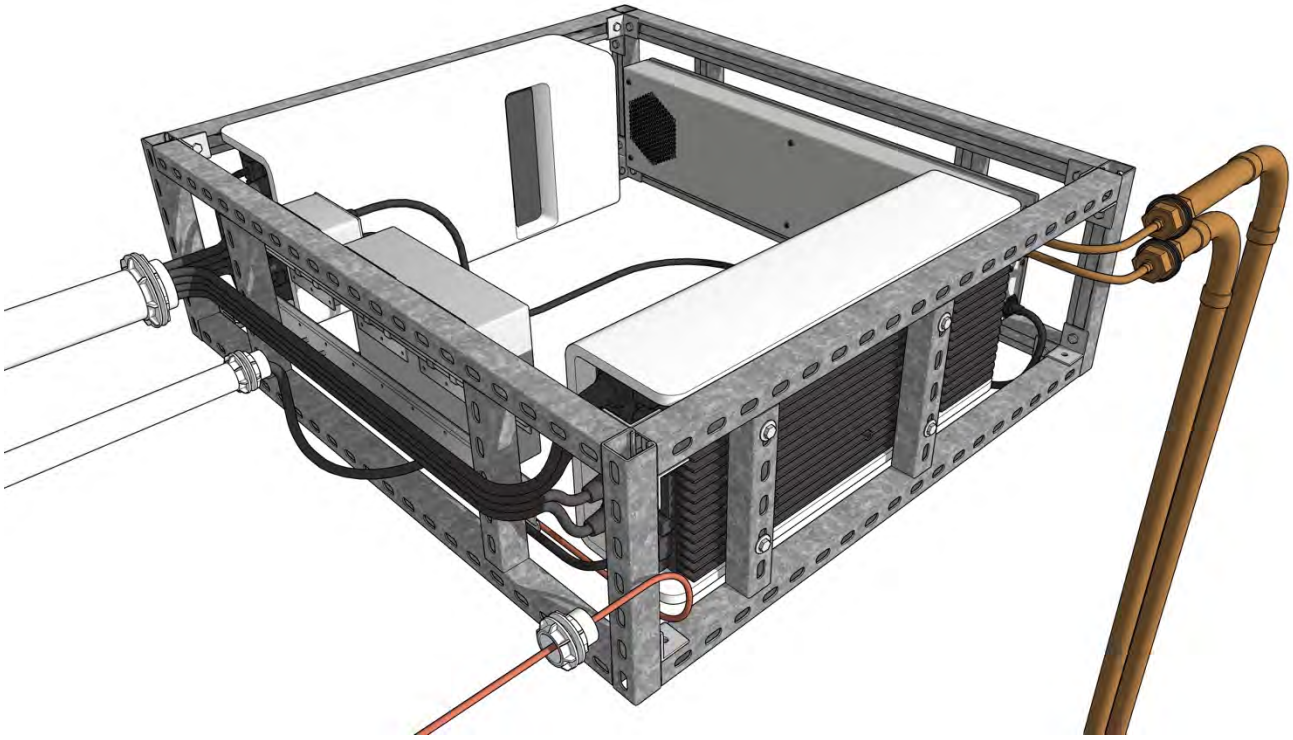
Smart Vault Section View



Smart Vault Unistrut Racking Detail 1



Smart Vault Unistrut Racking Detail 2



Equipment Layout Plan View