THE · CITY · OF

COPPELL

TEXAS · 1890

North Lake Raw Water System Evaluation

February 2018

PRELIMINARY SUBMITTAL

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1. Background and Purpose

The City of Coppell is evaluating options to maintain the level of North Lake to serve the Cypress Waters Development surrounding North Lake. The Cypress Waters development includes the lake as a key aesthetic feature as well as a source of irrigation water for the development. The City of Coppell plans to utilize the North Lake Raw Water Delivery system to maintain the pool elevation in North Lake.

Given the projected cost and time to refurbish the existing raw water pump station and pipeline, the City has requested Kimley-Horn and Associates (KHA) to develop a cost-effective approach to providing raw water to North Lake on a temporary, as-needed basis. The temporary solution desired should maximize existing infrastructure and minimize cost. This study presents our analysis and recommendation for a temporary solution other than relying on the potable water distribution system.

The main three components evaluated in this study are: the raw water pump station and intake at Elm Fork of the Trinity River, the existing 42-inch pre-stressed concrete cylinder pipe (PCCP), and the outfall structure at North Lake. See Exhibit 2 in Appendix 1.

2. Summary

The existing raw water system was designed to pump significantly larger volumes of water than are anticipated? to serve North Lake in the future. This makes restoring the existing pumps, motors, controls, and associated heavy electrical gear impractical regardless of their condition. The pump station was deenergized by ONCOR when it was turned over to the City and has not been maintained since. The electrical and mechanical systems (pumps and motors) are well past their service lives and appear to be in very poor or deteriorated condition.

The recommended long-range plan for the raw water system will depend largely on the condition and remaining service life of the existing 42-inch pipe between the river intake and North Lake. Reliably assessing the pipe's condition is infeasible at this time as there were no access points provided in its original design and construction. After stabilizing the existing pipeline and assessing its condition, the long-term plan for the system can be determined with greater confidence.

Kimley-Horn recommends targeted pipeline improvements to add access points, shore up known deficiencies, and remove components no longer needed. Adding an accessible pump connection point at the pump station will allow temporary pumping facilities to utilize the pipeline in the short term. Stabilizing the crossing at Grapevine Creek is needed to assure the pipeline is not structurally compromised by the eroding creek banks and undermining channel bottom. The existing outfall structure configuration adds unnecessary pumping head and may present an attractive nuisance for vandals and should be partially demolished. See Exhibit 7 for conceptual hydraulic profile.

To provide temporary, as-needed raw water to North Lake, Kimley-Horn recommends that the City of Coppell procure "on call (construction) pumping" contracts. This would be similar to contractor procurement of open cut dewatering subcontractors. There are at least three reputable, reliable construction dewatering service providers in the Dallas area that can provide competitive turnkey or simple equipment rental contracts for the City's needs. Some of the actions required to make this option viable involve minor site work to make the existing intake channel accessible and sufficiently functional for this purpose, as well as a new connection to the existing 42-inch PCCP line. See Exhibit 9. This approach provides value to the City of Coppell since water pumping cost is only accrued as raw water is needed to supply North Lake after the site has been made ready after the construction of the pump. Budgets to provide this service are presented in Appendix 7.

3. Background

The City of Coppell owns the North Lake Raw Water System that includes several discrete infrastructure elements. These elements include the raw water pump station, transmission pipeline, and North Lake outfall structure. See Exhibit 2 in Appendix 1. The pump station includes an intake structure on the Elm Fork of the Trinity River, several vertical turbine pumps and associated mechanical and electrical support systems, as well as a massive, high voltage transformer. An existing 42-inch concrete pressure pipe connects the pump station with North Lake and discharges into the lake near the left (northern) abutment of the dam via a previously-submerged outfall structure. This infrastructure was constructed in the mid-1950's as part of the former Dallas Power & Light Company (DP&L) North Lake Steam Electric Station.

4. Regional Water Supply Context

Surface water resources in Texas are scarce and their allocation has become highly regulated, and in some cases, litigious. The Elm Fork of the Trinity River, the source of raw water supply for North Lake, does not always have a reliable quantity of flow for all the adjudicated uses of the river's water. While water supply and availability analyses are beyond the scope of this present work, it is important to understand that the river system can become overused by other, "higher value" purposes (drinking water) leaving none for North Lake.

The City of Dallas holds several water rights in the Elm Fork that allow diversion of water from the River, which provides water to Dallas' Elm Fork and Bachman Water Treatment Plants (WTPs). The water in the Elm Fork consists of stored water released from Lakes Lewisville and Grapevine, and return flows from two wastewater treatment plants (WWTPs), as operated by the Cities of Lewisville and Flower Mound, as well as run-of-the-river water originating downstream of Lakes Lewisville and Grapevine. These lakes and WTPs are shown in Exhibit 1 in Appendix 1.

Lake Grapevine is owned and operated by the United States Army Corps of Engineers (USACE) and is located in Denton and Tarrant Counties on Denton Creek, a tributary to the Elm Fork. See Exhibit 1. Dallas has a water right to store 85,000 acft and rights to divert up to 75.9 MGD (85,000 acft/yr) for municipal, domestic, industrial, recreational, and manufacturing uses from the Lake.

Lake Lewisville is likewise owned and operated by the USACE and is located in Denton County on the Elm Fork downstream of Lake Ray Roberts. Prior to the construction of Lake Lewisville, Dallas operated Lake Dallas at a site 9.4 miles upstream of the Lake Lewisville dam site. Dallas has a water right to store 549,976 acft in Lake Lewisville and rights to divert up to 491.0 MGD (549,976 acft/yr) for municipal, domestic, industrial, irrigation, recreational, and hydroelectric power generation (non-consumptive) uses.

The City of Dallas also owns a run-of-river water right authorizing a combined 35.7 MGD (40,000 acft/yr) of diversions from the Elm Fork Trinity River at its Bachman and Elm Fork WTP diversion sites (Fraser and Carrollton Dams, respectively). This right is subject to a combined diversion rate of 640.73-cfs from the two diversion sites and includes special environmental flow conditions (which Dallas is required to honor) that periodically limit diversions.

The Dallas Long Range Water Supply Plan, as updated in October 2014, provides for a planned 4.5-MGD raw water demand on their system. It is listed in Tables ES-1 and 2-1 – Summary of Dallas Customers – Current and Projected

2070 Demands - as “Steam Electric Uses” with a footnote referring to a “Luminant Contract.” As paraphrased from Dallas’s Cost Study background information, the Plan serves to guide the City of Dallas to assure that its customer water supply obligations are always met if possible and reasonable.

5. Hydrologic Operational Design Basis

The City’s commitment to operate the lake within a specified “operating band” and Cypress Waters’ projected water usage informs the sizing of the pumps and pipelines associated with the North Lake Raw Water System. Of equal importance is the City’s preferred mode of operation. Essentially the decision to refill the lake very quickly after it has been drawn down versus lower rate, but more frequent pumping to avoid significant lake surface draw-down.

Allowing North Lake to operate on a cyclic fill-and-draw approach where the lake is re-filled at a comparatively high rate after being drawn down to its lower operating level would require greater pumping capacity, larger equipment, and a larger pipeline. Conversely, a lower-rate pumpage arrangement that seeks to maintain the lake surface much closer to its full level could achieve economies in equipment sizing.

The North Lake Dam O&M Manual suggests a 1-foot “operating pool depth.” A 1-foot “operating pool depth” would allow Cypress Waters to irrigate continuously for 2½ weeks at their proposed maximum flow (5.2-MGD). Realistic peak irrigation would only occur for about 10 hours at night during the summer watering season, extending the life of the full pool to a full six weeks. Similarly, the pool life could extend to nearly 3 months at continuous average day flows without being refilled.

The concept of operations (for the lake and the pump station) are further confounded by the uncertainty of water being available to the City in the Elm Fork. The City does not currently have a contract for raw water. A DRAFT version of a water supply contract with Dallas was reviewed, and that document indicates that Dallas is not promising a reliable raw water supply noting, “The sale of untreated water to meet the requirements of Purchaser is subject to and limited by the available system supply (as determined by the Dallas Director of Water Utilities).” The City of Dallas owns the vast majority of water rights in the local segment of the Elm Fork.

Planning for such highly constrained and uncertain water demands becomes quite complex with little certainty. To facilitate decision-making, a number of simplifying assumptions must be made. These include:

1. Providing capacity to match the Cypress Waters Peak Day Demand.
2. Operating the system conservatively (e.g. begin refilling the lake well ahead of forecasted needs, but at a reduced rate).
3. Assuming water will be available in the Elm Fork when needed without respect to Dallas and US Army Corps reservoir operating strategies.
4. Emergency lake filling can be accomplished by alternative means if necessary via the drinking water system (e.g. blowdown the southern sector to the storm drain system that feeds the lake).

These issues would form the basis of sizing and operating the system and are fundamentally tied to Water Rights commitments from the two upstream lakes: Grapevine and Lewisville. Being able to rely solely on the intake pump station on the Elm Fork is dependent in large part on water availability, presumably through Dallas’ water rights and reservoir release coordination schedule with the Corps of Engineers.

6. Hydraulic Design Basis

As noted in the previous section, there are a number of contractual and operational variables to consider when sizing the raw water transmission facilities. For simplicity, we have adopted 5-MGD (3,475-GPM) as the design basis for selecting pumps and equipment as well as sizing the pipeline.

Static head on the system is the difference between the outlet box bottom (assuming that the existing still well wall is demolished thereby removing 10-ft of unnecessary head) and the normal pool in the Elm Fork (e.g. 510.0-ft MSL-10-ft – 433-ft MSL; net 67.0-ft of static head).

Friction head is generally derived from an assumed 5-ft/sec pipe velocity. Assuming that a relatively light wall HDPE pipe will be installed as the transmission line inside the existing 42-inch concrete host pipe, we selected DR 17 (125-psi), the nearest pipe size that is a nominal 20-inch pipe with internal diameter of 17.5-inches. The design flow in the selected pipe size produces a velocity of 4.6-ft/sec, within the ideal range of economic pumping and scouring velocity to flush fines and sediment that settle in the pipe when not in operation. Minor losses are estimated to be about 2.0-ft of additional head loss.

These factors combine to arrive at a design duty point of 119.0-ft TDH at 3,475-gpm for the mid-range of expected pipe roughness coefficients: C=130. The head could range between 112-ft and 127-ft depending on pipe roughness. See Figure 6.1.

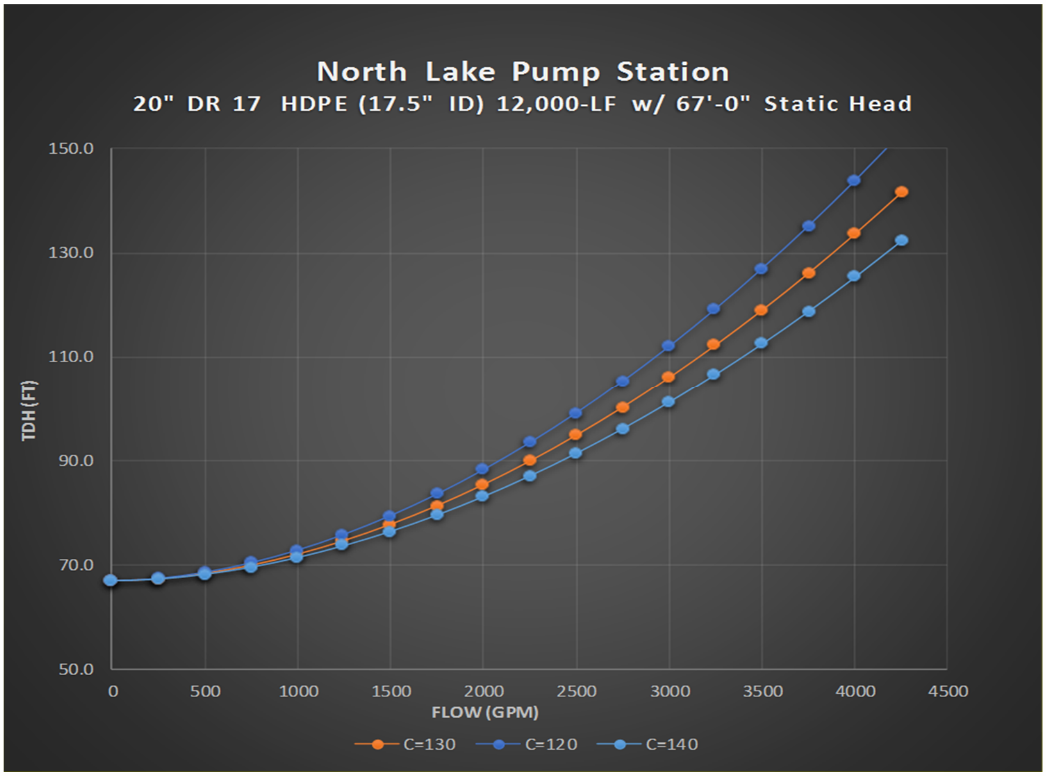


Figure 6.1: Flow vs Total Dynamic Head

7. Facility Condition Assessment

7.1 Intake

The existing river intake structure is an open-water concrete structure built on the west bank of the Elm Fork of the Trinity River. See Exhibit 3 in Appendix 1. The structure has three individual pump "bays" that can be isolated from the river with removable stop logs. To isolate any given pump bay, the stop logs would be placed in log guides (channels) cast into each pump bay's walls. The logs and guides would be accessed from removable hatches in the operating deck. No stop logs are known to exist for this facility.

It appears that the pumps in the two southernmost bays were installed as part of the original construction with a single 14'-0" wide bar screen protecting both bays. See Figure 7.1. The only construction plans available (DP&L Plan Sheet G-147465. See Appendix 3) seem to show the northern pump bay as an "open cell". Structural telltale signs observed during our site visit and the odd wooden "fore-structure" on the river side of the northern bar screen seem to indicate that the third (northern) pump was installed at some point later in the life of this pump station. The water level in the intake is controlled by the uncontrolled spillway at the Carrollton Dam some 300-LF downstream of the intake.

Figure 7.1: Pump Station Intake Looking North

The bar screens appear to be fabricated from 3/8-inch by 2-inch bar stock on 2-inch spacings. See Figure 7.2. The portion of the screens that are visible from the adjoining bank appear to be showing a fair amount of rust as would be expected for a structure of this age. The steel appears to be in generally good condition above the waterline. Removing and repairing or re-fabricating the rust-damaged sections of the screens should be considered while other heavy restoration work is ongoing at the pump station and heavy lift equipment is mobilized.

KHA staff performed sounding of the sediment accumulation immediately behind (pump station side) the bar screens. We used a 1/2-inch stainless steel rod to sound the level of mud and silt relative to the top of the working platform (assumed elevation of 442). Moving from north to south (north edge of the northern pump bay to the southern edge of the north pump bay to the middle of the southern pump bay), the sediment sounded 8'-4", 9'-2," and 12'-3" below the working platform. If the bottom of the pump bays is at elevation 426.0 as shown on the DP&L drawing, this translates to between 7'-8" and 3'-9" of sediment (at least at the points sounded). This may translate to roughly 100-200-CY of accumulated sediment. The bays and channel leading up to the intake structure should be dredged to return the pump station to its former intake capacity and avoid damage to the pump impellers and other equipment.

Figure 7.2: No. 3 Pump Bar Screen

7.2 Pump Station

As noted on the previous page, it appears that the pump station has been substantially expanded or rehabilitated in the past. A number of old floor penetrations have been removed and patched. The pad under the existing electrical transformer does not appear to be original to the pump station. There is a major spall on the bottom of the structural platform supporting the transformer near the mid-span of the concrete deck between the four adjoining columns. See Figures 7.3a and 7.3b. It is unknown if the new transformer pad was added as a corrective structural feature to redistribute the mass of the transformer between the piers and reduce the moment load between them.

(a) (b)

Figure 7.3: (a) Major spall below transformer and (b) Typical concrete repair on pump deck

The pump discharge heads and isolation butterfly valves are located in the pump bays below the pump operating deck. The pumps discharge through the back (west) wall of each pump bay. Pump motors and valve operators are attached to the pump operating deck. The age of the equipment and appurtenances appears to vary from unit to unit. For instance, the body of the valve operator and the spool piece on the No. 2 pump discharge shows considerable amounts of corrosion, whereas the flexible coupling adapter joining the spool to the discharge head appears to be relatively new. See Figure 7.4. Likewise, pump No. 3 appears to be of a newer make than the other two. See Figure 7.5.

Figure 7.4: Discharge Arrangement Pump No. 2 (Facing South)

Figure 7.5: Pump No. 3 Discharge Head (Facing West)

7.3 Pump Station Electrical and Control Systems

The North Lake Intake Pump Station was originally owned by Dallas Power and Light and later transferred to Luminant. It was deactivated in about 2012 and given to the City of Coppell. Because it is in a flood plain, the pump station mechanical gear was constructed as a platform with the pumps and electrical equipment on top, above the 100 year flood level. The facility has a 138-kV transmission feed to it with a 4160-volt transformer with a rated at 3750-kVA on the platform, see Exhibit 4 in Appendix 1. Adjacent to the platform is a 138-kV transmission tower where the 138-kV line dead-ends for the pump station. A 138-kV disconnect switch is mounted at the tower base at about the same level as the top mounted 138 kV bushings on the transformer.

The existing electrical load consists of three vertical pumps with motors on the platform deck and some miscellaneous auxiliary loads. The motors for the pumps are 450-hp, 900-hp, and 1000-hp. They are 4160-volt, three-phase induction motors. Each pumping unit has a motorized valve. There is also site lighting and power for instrumentation and controls.

The main switchgear is 4160-volts and is located in a weather protected enclosure. It was manufactured by General Electric in 1956. The switchgear is used as a main breaker and additional breakers are used as pump motor starters. The motors are started across-the-line.

The facility was deactivated and the equipment de-energized about the time that it was given to the City of Coppell. The 138-kV switch on the transmission tower is open. The equipment on the platform has been sitting de-energized for many years. On April 17, 2015, SHERMCO Industries did equipment testing and an evaluation of all the major electrical equipment on the platform. A copy of the report provide by SHERMCO is attached as Appendix 2.

The 138-kV to 4160-volt transformer has a manufacture date of 1966, and it appears, given the concrete deck under the transformer and the manufacture date, that this unit is not the original transformer. The SHERMCO report indicated that the transformer failed the winding insulation test and that several of the high voltage bushings were faulty. The SHERMCO report recommended that the transformer be replaced. Typically, a transformer repair facility would not accept a transformer with this amount of failed components. In addition, most 138-kV transformers are substation transformers with a 15-kV secondary and a much higher kVA rating. So the transformer is more of a one-off or custom transformer. It is basically scrap metal.

The SHERMCO report had an oil analysis done of the transformer oil, and the lab results indicated it was mineral oil. The manufacturer of the transformer is Westinghouse. EPA guidelines for determining if a transformer has had Polychlorinated Biphenyls (PCBs) state that Westinghouse transformers manufactured before 1979 are not certified to be PCB free. However, the lab results from the oil analysis states that the oil tested to have 37-ppm PCBs. Oil with 50-ppm or more PCBs are considered hazardous. The transformer most likely originally had PCBs, but at some point was remediated by Oncor before it was turned over to the City.

The SHERMCO report stated that they did not test the oil for PCBs in the three small oil filled transformers that step down from 4160-volts to 120/240-volts. These are located on the small tower next to the 4160-volt switchgear. It is recommended that the oil be tested before these transformers are removed.

SHERMCO also tested the 4160-volt switchgear and stated in the report that the overall condition is poor and recommended replacement. The report went into great detail about missing parts, only one would operate, and poor condition of the protective relays. Several manufacturers of re-manufactured obsolete electrical switchgear were contacted about salvage value, but none responded. Typically, the only value to this is, if they are interested, that they would come get it and remove it at no charge.

The pump motors were tested by SHERMCO as well. Two of the pumps failed the insulation test and one pump passed. The report did not state if the motors were repairable by rewinding and bearing replacement.

In summary, all of the existing electrical equipment is too deteriorated to be rebuilt or refurbished. It should be considered scrap metal with the possible exception of the motors. In addition, the new load is so much smaller than the existing load, that the equipment is either oversized or the wrong voltage.

7.4 42-inch Pipeline

The only design drawings of the existing "North Lake Supply Line" located to date refer to the pipeline as "42-IN CONCRETE PRESSURE PIPE". See Appendix 3. This pipe would appear to be a low pressure concrete pre-stressed embedded cylinder pipe manufactured by the former Gifford-Hill America (GHA) in Grand Prairie. A poor-quality scan of what is believed to be the original GHA laying plans was obtained by KHA through a third party is included as Appendix 4. The pressure ratings referred to on the laying plan comport with the DP&L Plan Sheet G-147465 shows the pipe pressure rating as 110-psi for the segment between the lake to about 300-ft north of MacArthur Blvd and 150-psi from there to the pump station.

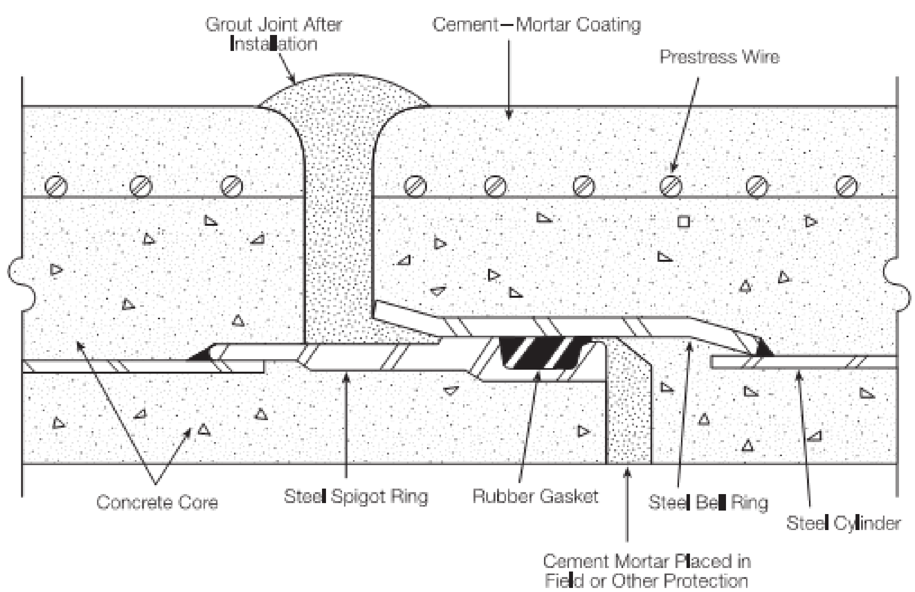


Figure 7.6: Pre-Stressed Concrete Embedded Cylinder Pipe

The design alignment of the pipeline has been reconstructed by KHA using a combination of City-provided GIS files and the GHA pipe laying plans as well as the DP&L original design plan sheet. The surface features (ARV pits) located in the field were correlated to the design plan sheet and GHA fabrication plans to harmonize the final alignment stationing in the field to comport with the GHA laying plans. The GHA laying plans and the ARV pits located in the field match very well. Exhibit 5 in Appendix 1 reflects our reconstruction of the alignment with the various data sources.

The pipeline was built in 1956 and generally followed the alignment of the former "Old Dallas Denton Road" from the river to the DP&L power transmission corridor. That road has since been renamed Sandy Lake Road when it was rebuilt, widened, and realigned/reconfigured. Where the pipeline is in relation to the road is uncertain as there were no surface features located that validate the alignment shown in the GIS data.

From Sandy Lake Road, the pipeline turns south and appears to parallel the high voltage transmission line as it runs roughly north-south to the south side of Belt Line Road. South of Belt Line Road, the alignment turns east-west and appears from field observation to run parallel to and roughly 15-ft inside the south edge of the easement. Where the power corridor meets North Lake Boulevard, the pipeline appears to turn southwest toward the lake outfall.

DP&L Plan Sheet G-147465 indicates that the pipeline was concrete encased where it was constructed within the old configuration of Sandy Lake Road (Old Denton Dallas Road) and placed on a concrete cradle where it crossed other then-existing roads. This plan sheet also indicates that the pipeline was installed in an open tunnel under the Fort Worth and Western Railroad embankment that parallels the north side of Belt Line Road (formerly known as Carrollton-Coppell Road) on sand bedding with bricked end plugs, but no annular fill. Construction plans for a number of crossing structures built after the pipeline was installed should be reviewed as part of any detailed design. These crossings include:

1. The widening and re-construction of Sandy Lake Road (formerly the Dallas-Denton Road, City of Coppell)
2. MacArthur Boulevard, (City of Coppell
3. Belt Line Road (formerly Carrollton-Coppell Road, City of Coppell)
4. The pedestrian bridge across the power transmission corridor that connects Starleaf Street with the cul-de-sac at the western end of Bradford Drive, City of Coppell
5. The concrete drive that connects Hidden Hollow Court with the retail/commercial development at the southwest corner of MacArthur Boulevard and Riverchase Drive, City of Coppell

Limited field investigations (walks) revealed what appear to be air release valve pits generally in the vicinity of where they are indicated on DP&L Plan Sheet G-147465. See Exhibit 5 in Appendix 1. The apparent construction of these facilities appears to conform in general with the details appearing on the DP&L Plan sheet. They appear to be approximately 36-inch round cast concrete covers set in what appears to be the bell of a 36-inch concrete pipe segment. Most are "marked" with a wooden fence post or bollard. See Figure 7.7. The manhole closest to and north of the railroad crossing is a larger structure, but of similar design, as shown in Figure 7.8.

Figure 7.7: Typical ARV Pit Facing Southwest at 500-LF North of Railroad

Figure 7.8: Large Access Manhole North of Belt Line Road

7.4.1 Condition

The condition of the existing pipeline is uncertain. Discussions with James Howe, a member of staff familiar with the line, indicate that until the time that it was effectively removed from service, there were no known issues with the line.

The pipe is exposed at the Grapevine Creek crossing/grade control structure as seen in Figure 7.9 below. The crossing is located at the southern (downstream) edge of the power corridor where the creek exists the corridor. The driven pile grade control structure installed as part of the pipeline appears to have been flanked on the east side by the creek. Some 12-ft to 15-ft of pipe are exposed where the creek has washed away its backfill, but appears to be intact.

Figure 7.9: Exposed Pipe at Grapevine Creek Crossing Facing West

7.4.2 Land Ownership

Pipeline: While substantial excavation is not contemplated, points of access and surface stringing of HDPE pipe along the alignment would be a consideration. Accordingly, coordination with surface ownership rights remains a major consideration. Exhibit 8 in Appendix 1 shows KHA's preliminary research based on Dallas County Appraisal District GIS data.

Grapevine Creek Crossing: As noted elsewhere, the crossing of Grapevine Creek has been compromised and some form of channel stabilization will be required. Grapevine Creek forms the boundary between Coppell and the City of Irving The west side of the crossing would be completed in the City of Irving. Because this section is within the power transmission corridor, land ownership is not believed to be a significant issue. However, design, construction, and maintenance of channel stabilization structures would need to be coordinated if not approved by the City of Irving.

Raw Water Pump Station: The pump station site is shown in Dallas County Appraisal District online GIS data to be the property of the City of Coppell as shown on Exhibit 8. The site includes the physical pump station itself, a small trapezoid generally conforming to the intake channel into the river, the parking area between the pump platform and the retaining wall that forms the west boundary of the main site, and a roughly boot-shaped extension that covers most of the north-south access road, but not the gate. The access from Sandy Lake Road to the gate crosses property owned by the Carrollton Farmers Branch ISD.

7.5 North Lake Raw Water Outfall Structure

The existing outfall structure is located near the left abutment of the dam. See Exhibit 6 in Appendix 1. The structure was designed to provide a flooded pipe discharge in a stilling basin that overflowed a weir wall that appears to have been set near the original lake's operating surface, approximate elevation 510-ft-msl. We infer that the outfall was designed this way to prevent draining the lake in the event of a pump station or control valve failure. The 42-inch raw water pipeline enters the structure via a normally submerged, trapezoidal flume-like structure. See Figure 7.10.

The weir wall is fitted with dual 12-inch butterfly valves near the bottom of the wall. See Figure 7.11. These appear to have been added after the original wall construction, but their purpose is unclear. Each outlet has two butterfly valves in series with the one closest to the wall operated from the outfall platform, the other with a standard AWWA square operating nut on the valve that would have normally been below the water's surface.

The existing outlet structure was effectively "stranded" by the lowering of the lake and consequential lateral movement of the "shoreline". Review of aerial photography during construction of the spillway improvements in 2014 shows that the "outfall" channel is now nearly 850-LF long from the original outfall structure to the apparent lake edge. See Figure 7.12.

Figure 7.10: Trapezoidal Flume-Like Structure at Outfall Structure

Figure 7.11: 12-Inch Butterfly Valves Near Bottom of Wall

Figure 7.12: Original Outfall Channel Location

The operation and maintenance of the outfall channel should be carefully considered in the final project configuration. As it exists today, the channel is normally dry. Because it was a manmade channel in uplands, it can be expected to be highly susceptible to erosion. If the land use around the channel is intended for public access or development, routine maintenance access as public safety (crossing) considerations should be accounted for. To minimize maintenance, soft armor revetment for the channel bottom and banks should be considered.

7.5.1 North Lake Dam

Construction of North Lake Dam was completed in August 1957 by Dallas Power and Light as a cooling pond for a steam electric generating plant. Luminant Power Company (formerly Dallas Power and Light) ceased operations at the station in 2010 and began decommissioning the power generation facilities. In 2012, Luminant transferred ownership of the dam to the City of Coppell ahead of the Cypress Waters development around the lake.

The development agreement associate with Cypress Waters included provisions to lower the normal pool elevation approximately 25 feet from 510 feet-msl to 485 feet-msl. These modifications included the construction of a new drop inlet spillway, lowering the crest elevation of both the main dam and saddle dam, and flattening the downstream slopes of both the main dam and saddle dam. See Figures 7.13 and 7.14. Construction of the new spillway and embankment modifications was completed in December 2014.

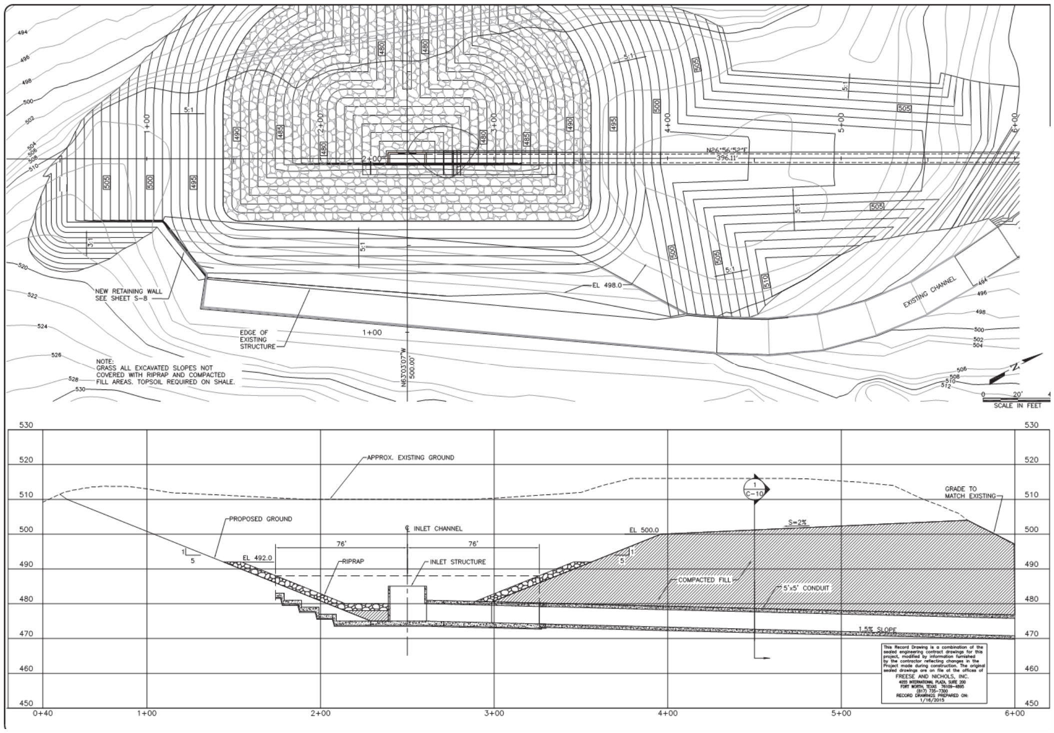


Figure 7.13: New Spillway Plan and Profile

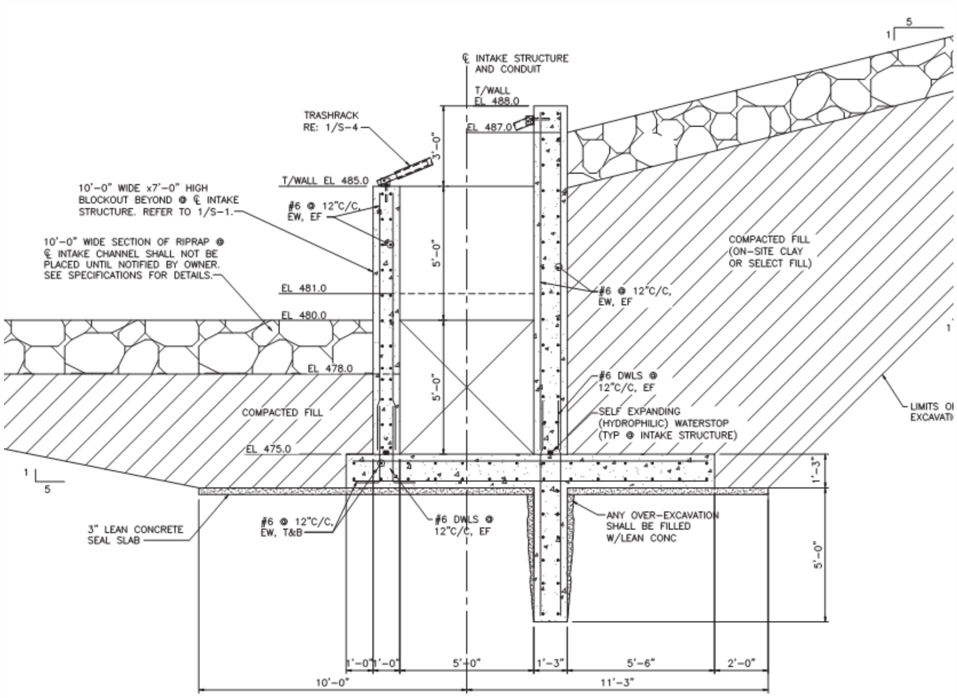


Figure 7.14: Spillway Weir (Intake) Section

7.5.2 Dam and Spillway Summary Data

Table 7.1: Spillway Data

Spillway	
Type:	Rectangular Concrete Drop Inlet and Conduit
Location:	Right Abutment
Crest Elevation:	485.0-feet-msl
Crest Length (Total):	30-feet
Inlet Dimensions:	5-feet by 20-feet (interior)
Conduit Dimensions:	5-feet by 5-feet

Table 7.2: Lake Data

Lake:	
Normal Pool Elevation:	485.0-feet-msl
Surface Area at Normal Pool:	289-acres
Capacity at Normal Pool:	3,199-acre-feet
Effective Top of Dam Elevation:	508.5-feet-msl
Surface Area at Top of Dam:	713-acres
Capacity at Top of Dam:	14,871-acre-feet

8. Raw Water System Improvements

The cost associated with full rehabilitation/replacement of the North Lake Raw Water System may not be a wise investment for the City at this time. Kimley-Horn recommends a progressive investment strategy to restoring pumping capability in the existing North Lake Raw Water System. The short-term plan would include on-call temporary contract pumping together with minor stabilization and rehabilitation work to allow the pipeline to be utilized for conveyance.

8.1 Interim Improvements

Kimley-Horn recommends targeted pipeline improvements to add access points, shore up known deficiencies, and remove components no longer needed. Adding an accessible pump connection point at the pump station will allow temporary pumping facilities to utilize the pipeline in the short term. Stabilizing the crossing at Grapevine Creek is needed to assure the pipeline is not structurally compromised by the eroding creek banks and undermining channel bottom. The existing outfall structure configuration adds unnecessary pumping head and may present an attractive nuisance for vandals and should be partially demolished. The recommended interim improvements are more fully described in Section 10.

8.2 Long Range Improvements

The recommended long-range plan for the raw water system will depend in large part on the condition and remaining service life of the existing 42-inch pipe between the river intake and North Lake. Reliably assessing the pipe’s condition is infeasible at this time as there were no access points provided in its original design and construction. After stabilizing the existing pipeline and assessing its condition, the long-term plan for the system can be determined with greater confidence.

As noted previously, the existing 42-inch line is far too large for the service contemplated, regardless of condition. While it may be possible to utilize it on a short-term basis, the very low velocities anticipated would not provide sufficient scouring velocity and the pipe sags (creek crossings and low points) tend to accumulate sediment and debris and eventually lead to plugging when scouring velocities are not achieved.

Large diameter concrete raw water pipes are susceptible to biogenic corrosion. This is caused by the very long retention times of nutrient rich raw water that develops a "slime" layer that is known to attack/corrode bare concrete. There a few examples of this phenomenon in North Texas. For these reasons, we would not recommend that approach as a long-term solution.

The existing 42-inch line could serve as a host pipe for smaller, more hydraulically-appropriate carrier pipe – effectively a 12,000-LF tunnel. The carrier pipe material selection and installation details would need to be carefully considered. While a detailed preliminary design of such a system is beyond the scope of this present work, the following logic could be applied to a possible "Slip lining" approach using high density polyethylene pipe as the carrier:

1. At existing high points (ARVs):
    a. Remove one or two sections of existing pipe
    b. Pull a length of pre-fused HDPE pipe into the 42-inch host pipe from the upstream direction
    c. Pull a length of pre-fused HDPE pipe into the 42-inch host pipe from the downstream direction
    d. Fusion weld on an upturned base tee branch saddle for setting a new ARV in a massive concrete base with thrust rings cast in to avoid thermal expansion forces from putting stress on the branch tee

2. At existing low points (blowoffs, sags between existing ARVs, intermediate pull points as needed to safely pull the designed length of carrier pipe):
    a. Fusion weld on a downturned base tee branch saddle for setting a blowoff valve and riser assembly in a massive concrete base with thrust rings cast in to avoid thermal expansion forces from putting stress on the branch tee

3. Seal the ends of the host pipe where the carrier enters and exists to minimize longitudinal water seepage.

4. Place a cement-stabilized sand or low-strength flowable around the host pipe entry point and the "exposed" carrier pipe (where the 42-inch pipe joints were removed) to provide long term, stable support of the pipe where it is not otherwise laying on the floor of the host pipe.

The condition of the exiting pump station and the hydraulic design of the existing raw water system to convey significantly larger volumes of water than are now planned to serve North Lake make significant investments in restoring the existing pumps and electrical gear an undesirable investment. Other than minor spall patching and crack injection work, the physical pump structure appears to be in serviceable condition. It could be re-purposed with new submersible pumps and discharge piping and controls. New, three phase power would need to be run into the site to make it operable as a stand-alone facility.

9. Design Criteria

The following tables include assumptions, dimensions, elevations and other important details taken into consideration during the system evaluation:

Table 8.1: Pump and Pipeline Hydraulics

Pump and Pipeline Hydraulics	
Flow	5-mgd *(per BGE Tech memo dated December 2017)*
Pipeline	42-in PCCP
Velocity	0.8-ft/s
Outfall	El 501.0 (assumed 12" BFV at Outfall Structure)
Intake	El 433.0 (Carrollton Dam Weir)
Static Head	68-ft (28.2 psi)
Friction Head	0.9-ft
TDH	69-ft (28.6 psi)
Connection	12" flanged connection added to existing 42" pipe above ground

Table 8.2: Proposed Pump Assumptions

Pump		
Condition	**Interim/Short Term (On Call Contracting)**	**Long Term**
Pump Class	End Suction Centrifugal (Self Priming)	Submersible Solids Handling
Size	12"	11" - 13" Impeller; 8" Discharge
Driver	Gas/Diesel Engine	130 - 150 HP Electrical
Fuel Demand	10-12 gal/hr at full load	3P 480v
Fuel Storage	300+ gal belly tank	N/A
Sound Attenuation	Sound Proofing	N/A

Table 8.3: Intake Channel Geometry

Intake Channel	
Geometry	Trapezoidal
Bottom Elevation	426.0
Bottom Width	28.0-ft
Top Width	70-ft
Length	30-ft

Table 8.4: Temporary Solution Assumptions

Temporary Pump Pad	
Width	20-ft
Surface Elevation	435.0
Access Ramp	
Width	20-ft
Grade	10%
Length	50-ft
Fill	Rock, rubble gravel
Surface	12-in flex-base
Armor	100-lb class dumped rock rip rap

10. Interim Improvements Implementation

10.1 Pump Station Site Improvements

10.1.1 Intake Channel Preparation

The formed trapezoidal intake channel from the Elm Fork river to the existing raw water pump station bar screens has been substantially plugged with flood-induced sediment and organic muck. The channel should be mechanically restored to its original general lines and grades and the resultant wet muck be staged on the site to dry prior to hauling and disposal at some other location or landfilled.

10.1.2 Channel Access Pad and Ramp

The intake channel is not currently accessible from the existing parking north and west of the raw water pump station and intake structure. A ramp should be constructed and a pad installed to allow staging of a temporary pump with its intake (suction line) placed in the intake channel to provide some protection from floating debris in the main river channel. To stabilize the ramp, large rock riprap should be placed on its slopes and edges. The ramp should be constructed of free-draining materials and surfaced with a nominal 12-inch thick road base driving course. Sediment and muck from the plugged intake channel should not be used for ramp fill materials.

10.2 Pipeline Preparation

While the pipeline is assumed to be serviceable for the limited purposes of this report, there are several items that the City of Coppell should consider undertaking prior to placing the line back into service. These include:

10.2.1 Air Release Valves

The existing air release valves should be located, inspected and replaced, if necessary. This would also afford the opportunity to remove the 10-inch flanges at those locations and possibly allow for limited internal inspection by CCTV. This would require draining the pipe.

10.2.2 Grapevine Creek Crossing

The channel grade stabilization structure and pipeline crossing at Grapevine creek has been flanked by the stream and several sections of the pipeline are exposed in the bottom of the channel. The crossing should be stabilized at least temporarily until a long-term permanent solution can be installed.

10.3 Outfall Preparation

10.3.1 Butterfly Valves

The serviceability of the existing butterfly valves should be evaluated and corrected if found inoperable.

10.3.2 Outfall Channel Stabilization

Filling the lake, that is now normally at 485-ft, via an outfall structure that has a flowline of about 500-ft will lead to substantial scour in the unlined and unvegetated channel that was formerly submerged in the lake bottom prior to it being lowered.

11. Permitting

11.1 US Army Corps of Engineers 404

The Maintenance portion of the Nationwide Permit 3 authorizes the removal of accumulated sediments and debris in the vicinity of existing structures, including water intake structures. The permit also authorizes the placement of new or additional riprap to protect existing structures. Therefore, no pre-constructions notice (PCN) is believed to be required. Kimley-Horn is pending validation by a qualified environmental professional.

11.2 Threatened and Endangered Mussels

Protected mussel species are known to be in this section of the Elm Fork of the Trinity River, but may not be present in the materials to be disturbed.

11.3 Corridor Development Certificate – North Central Texas Council of Governments

The proposed temporary ramp should be considered a temporary fill and a negligible impact on the hydraulics of the Elm Fork river just 300-ft upstream of the Sandy Lake Road bridge and Carrollton Dam bottleneck. However, preparing a Corridor Development Certificate (CDC) exemption should be considered, especially in light of other authorities having jurisdiction immediately adjacent to the project.

12. Assumptions and Limitations

12.1 Electrical Power

The existing pump station has been disconnected from the electrical grid and the cost to restore appropriate service is anticipated to be excessive. The time, permitting, and legal machinations (easements across properties owned by third parties) required to restore electrical service are equally prohibitive. Hence, any solution would require its own source(s) of power.

12.2 Existing 42-inch Pre-Stressed Concrete Cylinder Pipe's Condition

The physical condition of the existing 42-inch PCCP connecting the raw water pump station to North Lake is unknown. It has not been in service for over a decade. It was used several years ago to drain the lake back to the river as part of the lake lowering and new spillway project. The planned flow rate the pipe would see in the planned temporary pumping arrangement would be very low relative to its "normal" capacity, resulting in very little friction head. For practical design purposes, the friction head would be negligible (less than 1.0-psi) and pipe would see only the 67-ft (30-psi) of pressure.

The pipe's structural condition, given that it is over 60 years old and located in a high voltage power corridor without dedicated corrosion control devices or design features, is of greater concern than internal pressure. The cost to reliably assess the condition of the pipe in the ground is prohibitive (likely greater than $300,000).

The internal, hydraulic condition of the pipe may also be questionable. It is probable that sags and vertical bends in the pipe (especially at Grapevine creek) have accumulated substantial amounts of sediment and river muck. We have experience with low, raw water intakes in Texas and have seen a biological slime layer on the inside of concrete pies as much as 2-inches thick. While this would normally reduce the hydraulic capacity of the pipelines, this is not a concern in this application from a hydraulic capacity perspective. It is a concern from a structural integrity point of view. The attached biological slime layers are highly acidic and are known to aggressively consume the cementitious core of PCCP, reducing the sectional modulus considerably. This can serve to exacerbate a weakened pipe structure that may be compromised by galvanic corrosion of the pre-stressing wires.

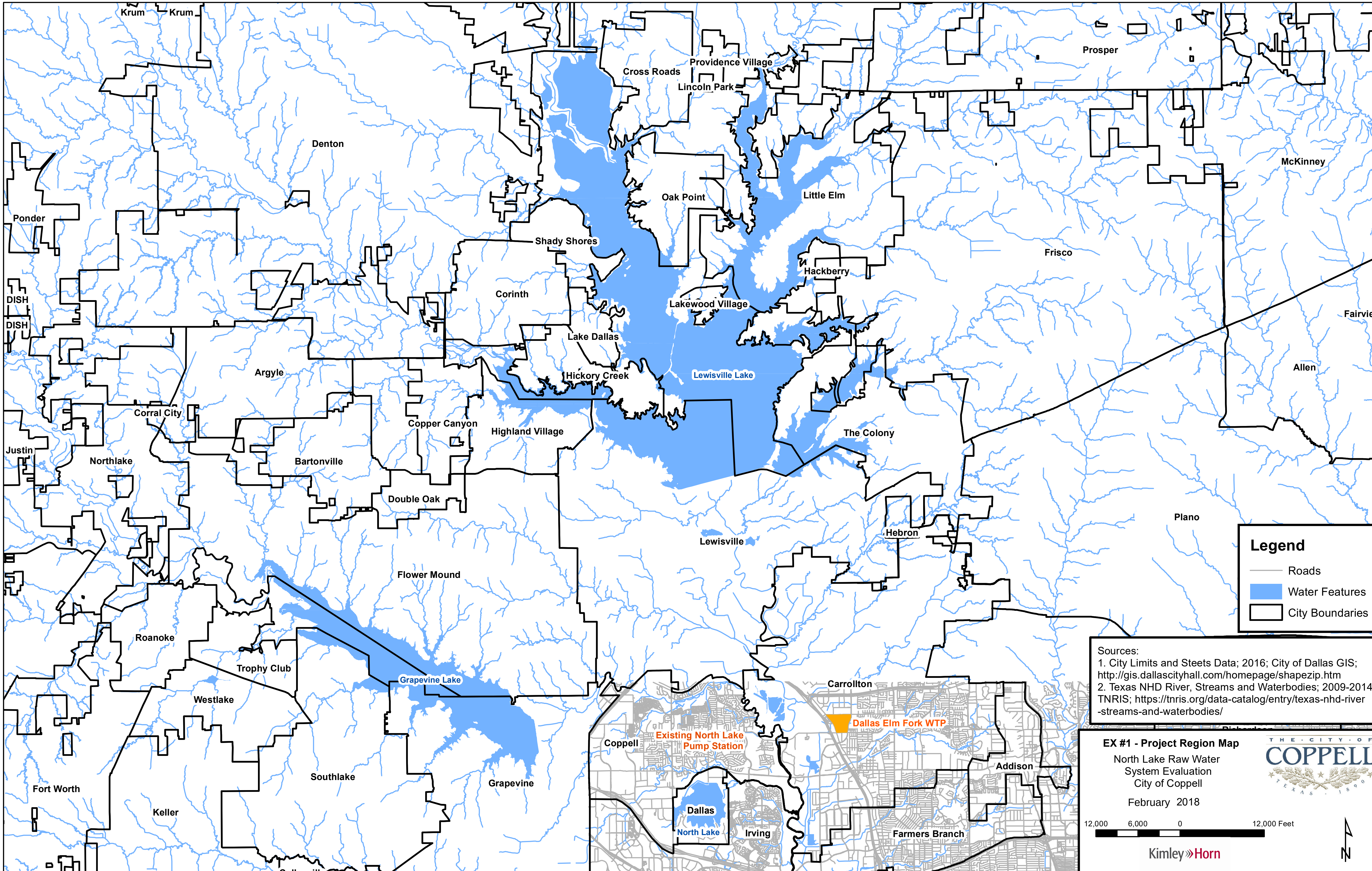
13. Opinion of Probable Construction Cost

Planning level Engineer's Opinions of Probable Construction Cost (OPCC) for both short and long term improvements are included in Appendices 5 and 6. These OPCC's reflect current construction pricing in the North Texas municipal market with planning level contingencies added as recommended by AACEI Best Practices. The short term OPCC's also include conceptual cost models for on-call pump contracting based on advice from the three major service providers in our region. A budget for on-call pumping services is presented in Appendix 7.

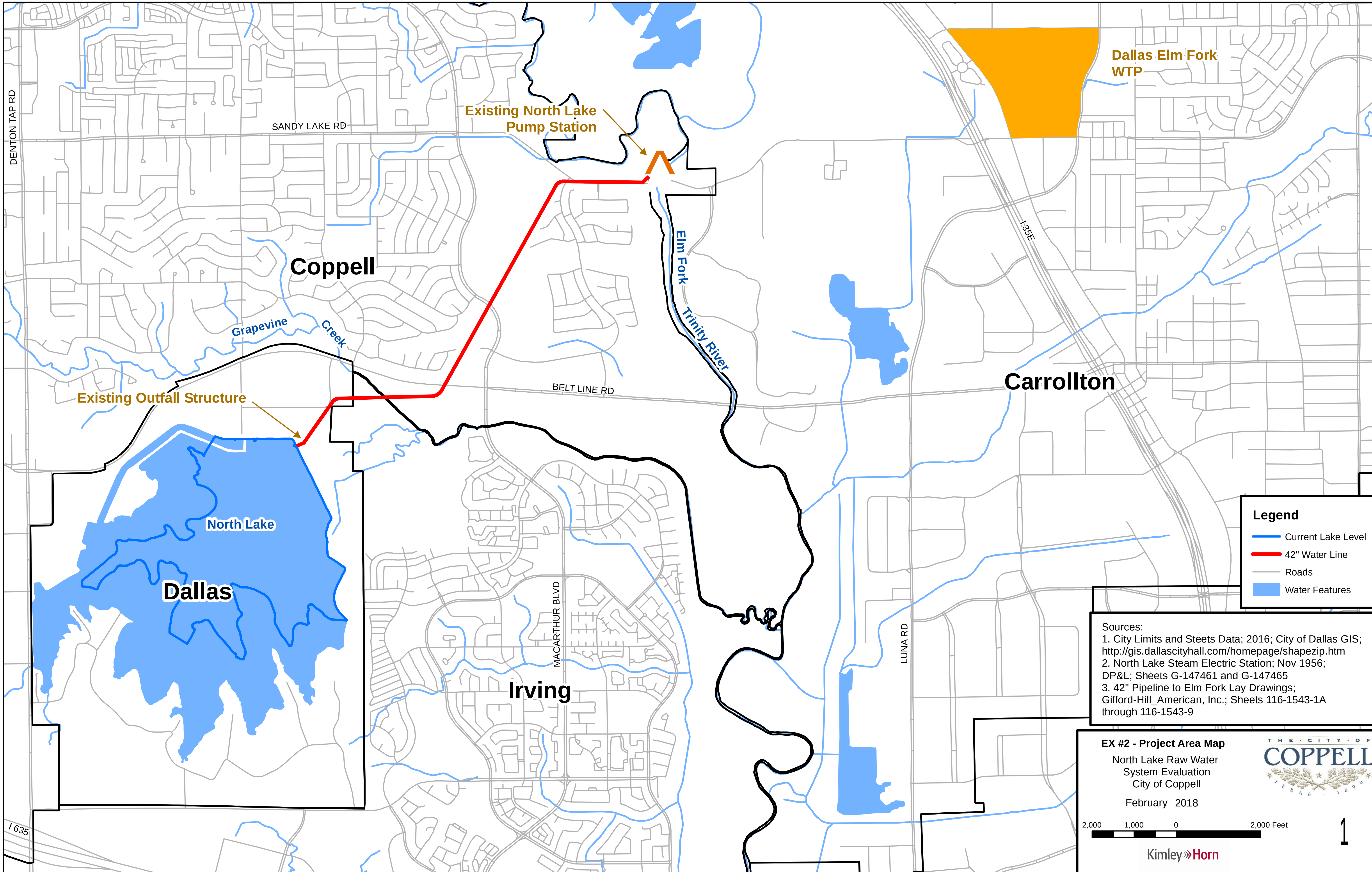
14. Appendices

1. Exhibits
2. SHERMCO Report
3. 42-inch Pipeline Plans
4. GHA Laying Plans
5. OPCC Short-Term
6. OPCC Long-Term
7. OPCC On-Call Pumping Services

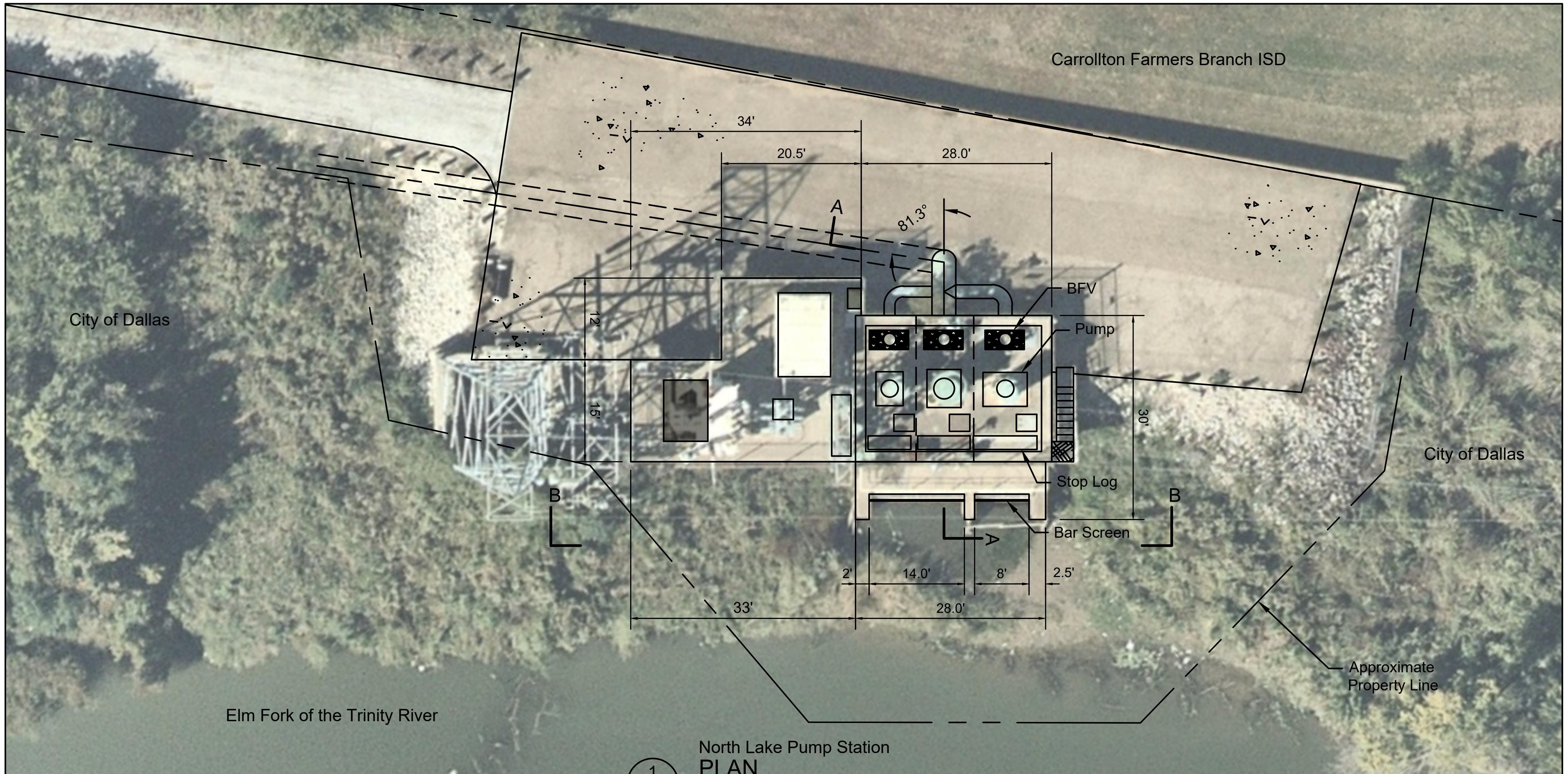
Appendix 1: Exhibits



Krum
Krum
Cross Roads
Providence Village
Lincoln Park
Prosper
Denton
McKinney
Oak Point
Little Elm
Ponder
Shady Shores
Frisco
Hackberry
Corinth
DISH
DISH
Lakewood Village
Fairview
Lake Dallas
Argyle
Hickory Creek
Lewisville Lake
Allen
Corral City
Copper Canyon
Highland Village
The Colony
Justin
Northlake
Bartonville
Double Oak
Plano
Hebron
Lewisville
Flower Mound
Roanoke
Trophy Club
Grapevine Lake
Carrollton
Westlake
Dallas Elm Fork WTP
Existing North Lake
Pump Station
Coppell
Addison
Southlake
Grapevine
Fort Worth
Keller
Dallas
North Lake
Irving
Farmers Branch
Colleyville
Legend
Roads
Water Features
City Boundaries
Sources:
1. City Limits and Steets Data; 2016; City of Dallas GIS;
http://gis.dallascityhall.com/homepage/shapezip.htm
2. Texas NHD River, Streams and Waterbodies; 2009-2014;
TNRIS; https://tnris.org/data-catalog/entry/texas-nhd-river
-streams-and-waterbodies/
EX #1 - Project Region Map
North Lake Raw Water
System Evaluation
City of Coppell
February 2018
12,000
6,000
0
12,000 Feet
N



Dallas Elm Fork
WTP
Existing North Lake
Pump Station
SANDY LAKE RD
DENTON TAP RD
Coppell
Grapevine
Creek
Elm Fork
Trinity River
I-35E
Carrollton
BELT LINE RD
Existing Outfall Structure
North Lake
Dallas
MACARTHUR BLVD
Irving
LUNA RD
I 635
Legend
Current Lake Level
42" Water Line
Roads
Water Features
Sources:
1. City Limits and Steets Data; 2016; City of Dallas GIS;
http://gis.dallascityhall.com/homepage/shapezip.htm
2. North Lake Steam Electric Station; Nov 1956;
DP&L; Sheets G-147461 and G-147465
3. 42" Pipeline to Elm Fork Lay Drawings;
Gifford-Hill_American, Inc.; Sheets 116-1543-1A
through 116-1543-9
EX #2 - Project Area Map
North Lake Raw Water
System Evaluation
City of Coppell
February 2018
2,000
1,000
0
2,000 Feet
THE CITY OF
COPPELL
TEXAS 1890
1
Kimley»Horn



North Lake Pump Station
PLAN
1 EX 3
SCALE: 1" = 20'

The information shown on this drawing is replicated from available record information and recent aerial; it is intended to indicate the configuration of the pump station and is not guaranteed to be accurate nor all inclusive.

Sources:
1. North Lake Steam Electric Station; Nov 1956; DP&L; Sheets G-147461 and G-147465
2. Aerial; Oct 2017; Nearmap
3. Property Owner Information; Retrieved on Dec 2017; Dallas Central Appraisal District

EX #3
Pump Station Plan and Section A-A

North Lake Raw Water
System Evaluation
City of Coppell

February 2018

Scale: As Shown

Kimley»Horn

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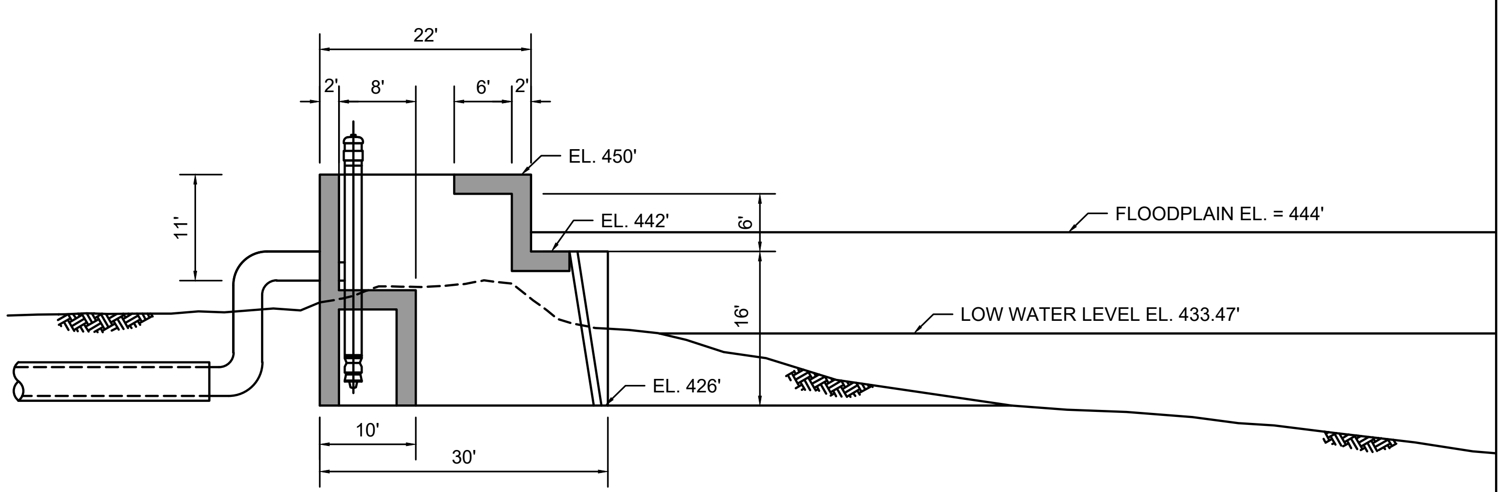
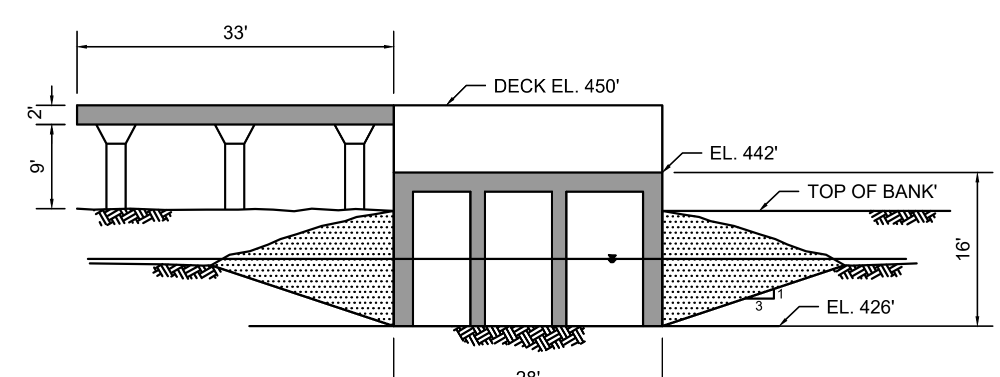


North Lake Pump Station
SECTION A-A
2 EX 3
SCALE: 1" = 20'



North Lake Pump Station
ELEVATION B-B
3 EX 3
SCALE: 1" = 20'

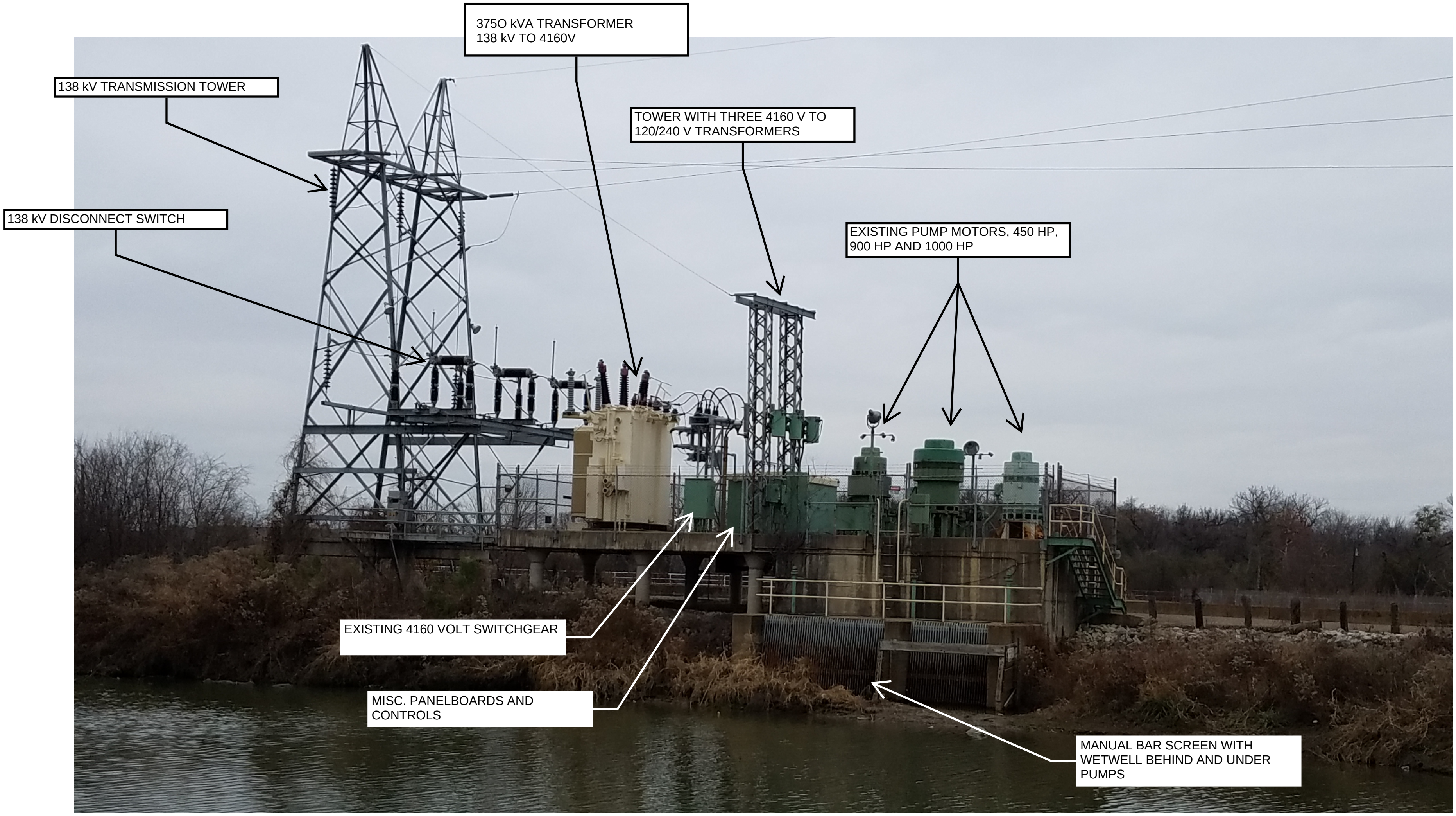


EXHIBIT E1

EX #4

North Lake Raw Water
System Evaluation
City of Coppell

February 2018

N.T.S.

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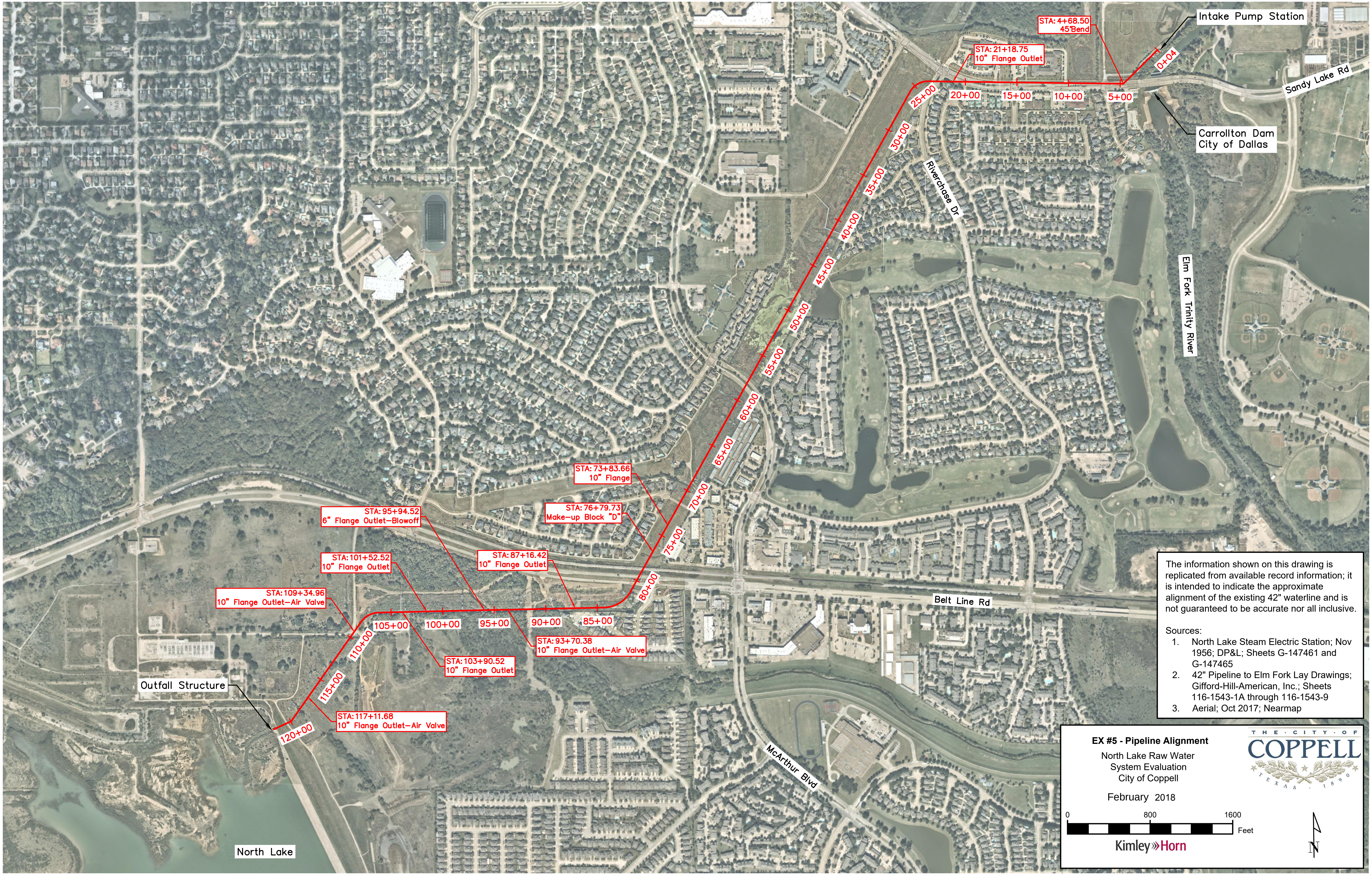
N



The information shown on this drawing is replicated from available record information; it is intended to indicate the approximate alignment of the existing 42" waterline and is not guaranteed to be accurate nor all inclusive.

Sources:

1. North Lake Steam Electric Station; Nov 1956; DP&L; Sheets G-147461 and G-147465
2. 42" Pipeline to Elm Fork Lay Drawings; Gifford-Hill-American, Inc.; Sheets 116-1543-1A through 116-1543-9
3. Aerial; Oct 2017; Nearmap

EX #5 - Pipeline Alignment

North Lake Raw Water
System Evaluation
City of Coppell

February 2018

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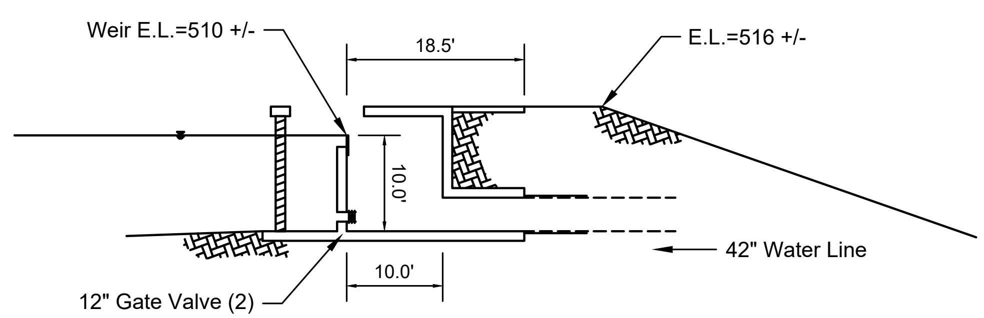
1 EX 6 North Lake Outfall Structure
PLAN
SCALE: 1" = 20'



2 EX 6 North Lake Outfall Structure
SECTION A-A
SCALE: 1" = 20'

The information shown on this drawing is replicated from available record information and recent aerial; it is intended to indicate the configuration of the pump station and is not guaranteed to be accurate nor all inclusive.

Sources:
1. North Lake Steam Electric Station; Nov 1956; DP&L; Sheets G-147461 and G-147465
2. Aerial; Oct 2017; Nearmap
3. Ground Elevation; Retrieved on Jan. 2018; NCTCOG

EX #6
Outfall Structure Plan and Section A-A

North Lake Raw Water
System Evaluation
City of Coppell

February 2018

Scale: As Shown

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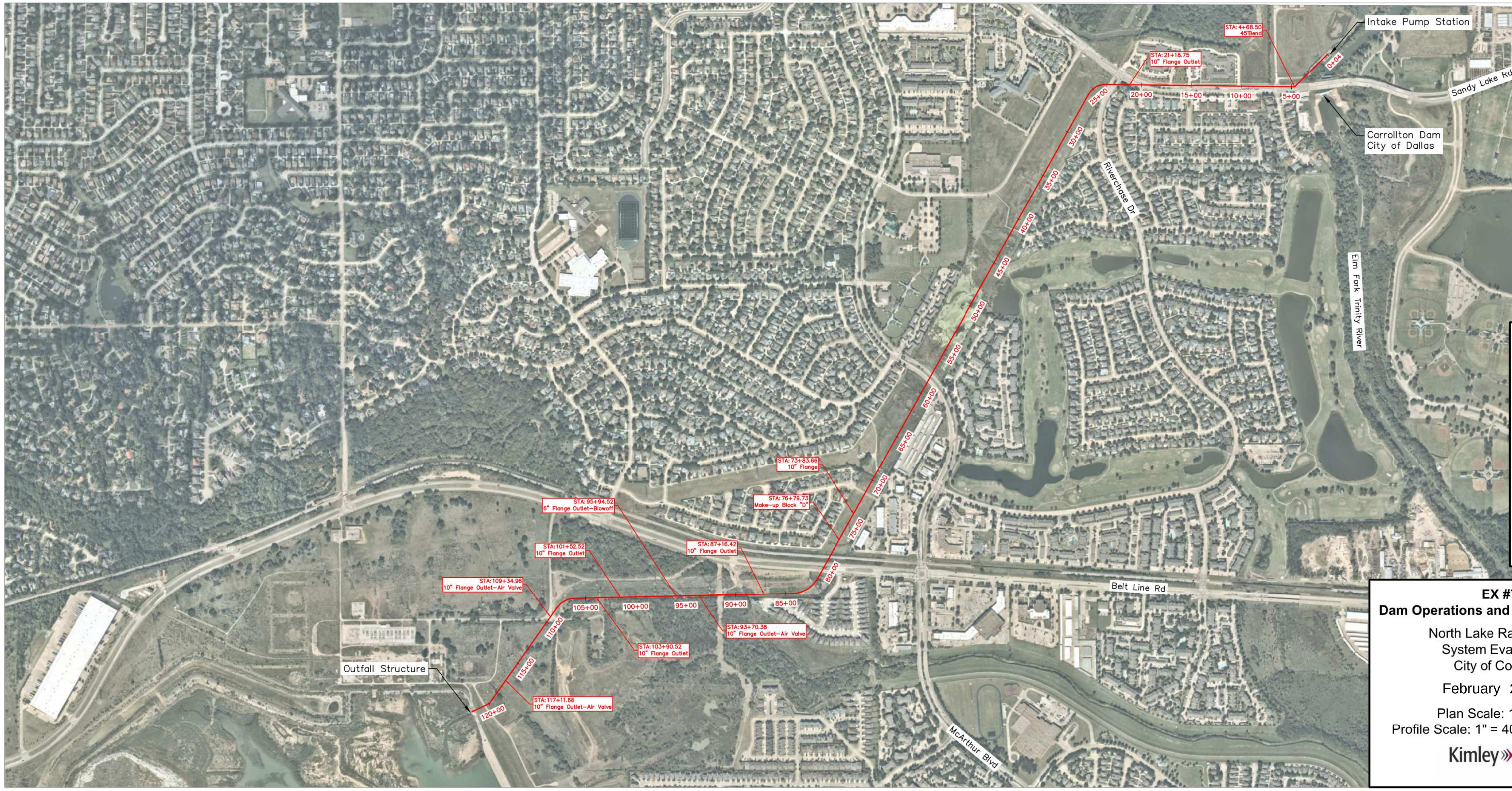

The information shown on this drawing is replicated from available record information; it is intended to indicate the approximate alignment of the existing 42" waterline and is not guaranteed to be accurate nor all inclusive.

Sources:

1. North Lake Steam Electric Station; Nov 1956; DP&L; Sheets G-147461 and G-147465
2. 42" Pipeline to Elm Fork Lay Drawings; Gifford-Hill-American, Inc.; Sheets 116-1543-1A through 116-1543-9
3. Aerial; Oct 2017; Nearmap

EX #7
Dam Operations and Hydraulic Profile

North Lake Raw Water
System Evaluation
City of Coppell

February 2018

Plan Scale: 1" = 600'
Profile Scale: 1" = 400' H, 1" = 40' V

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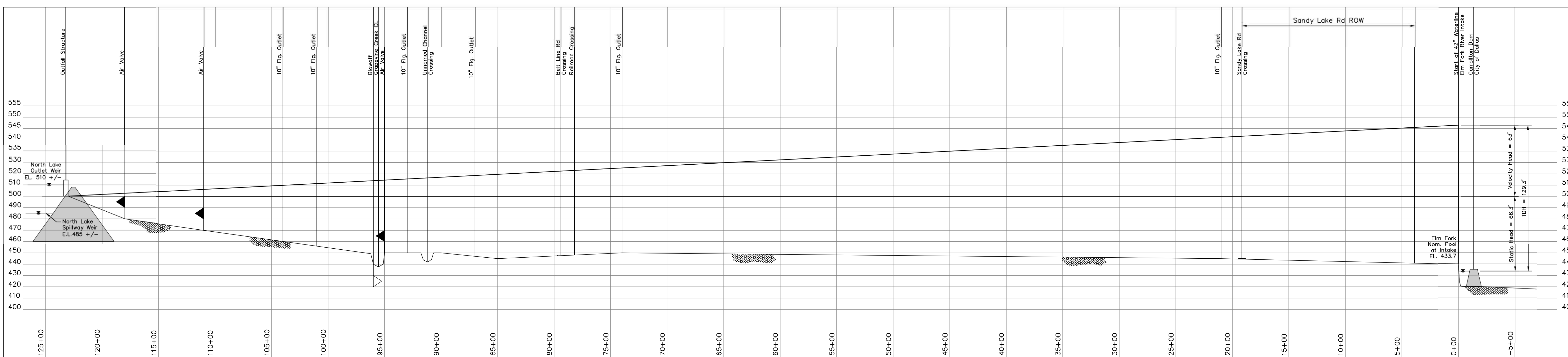
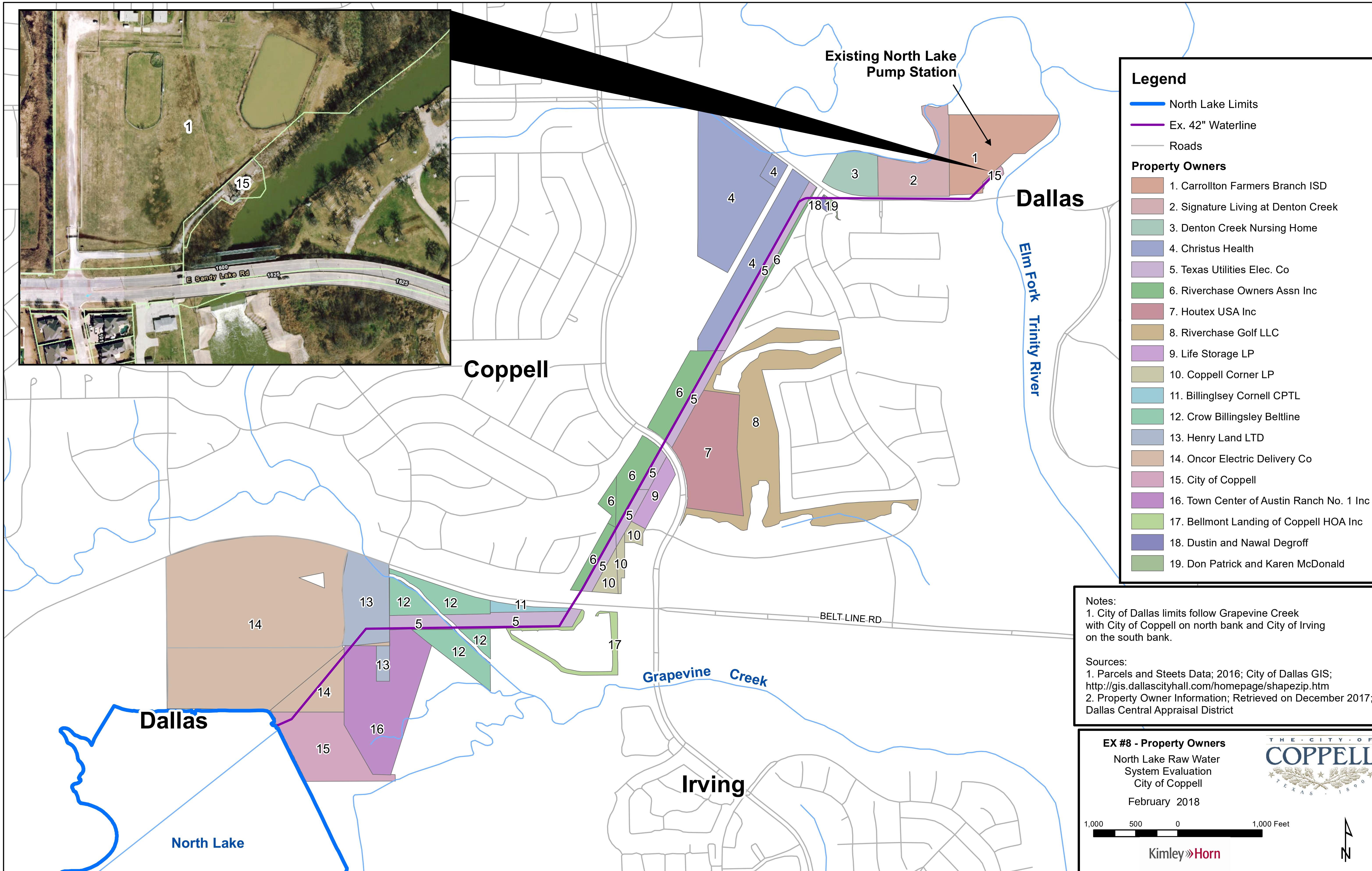
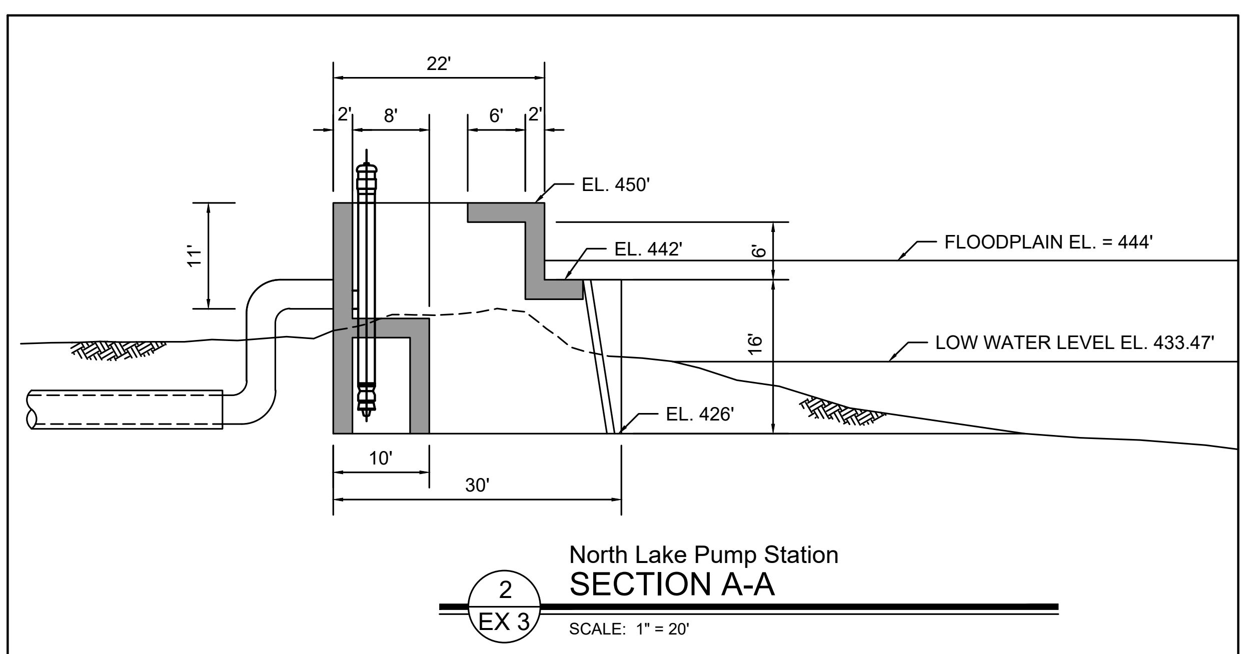


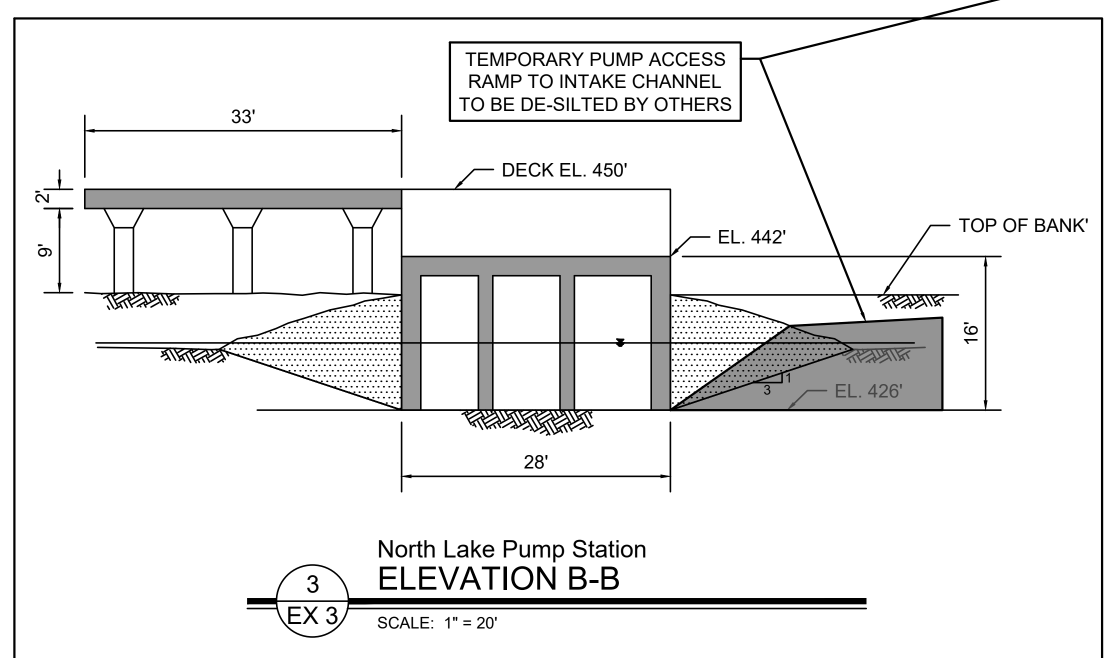


Existing North Lake Pump Station
Coppell
Dallas
Irving
North Lake
Elm Fork Trinity River
Grapevine Creek
BELT LINE RD
E Sandy Lake Rd
Legend
North Lake Limits
Ex. 42" Waterline
Roads
Property Owners
1. Carrollton Farmers Branch ISD
2. Signature Living at Denton Creek
3. Denton Creek Nursing Home
4. Christus Health
5. Texas Utilities Elec. Co
6. Riverchase Owners Assn Inc
7. Houtex USA Inc
8. Riverchase Golf LLC
9. Life Storage LP
10. Coppell Corner LP
11. Billinglsey Cornell CPTL
12. Crow Billingsley Beltline
13. Henry Land LTD
14. Oncor Electric Delivery Co
15. City of Coppell
16. Town Center of Austin Ranch No. 1 Inc
17. Bellmont Landing of Coppell HOA Inc
18. Dustin and Nawal Degroff
19. Don Patrick and Karen McDonald
Notes:
1. City of Dallas limits follow Grapevine Creek with City of Coppell on north bank and City of Irving on the south bank.
Sources:
1. Parcels and Steets Data; 2016; City of Dallas GIS; http://gis.dallascityhall.com/homepage/shapezip.htm
2. Property Owner Information; Retrieved on December 2017; Dallas Central Appraisal District
EX #8 - Property Owners
North Lake Raw Water System Evaluation
City of Coppell
February 2018
1,000 500 0 1,000 Feet
Kimley»Horn
THE CITY OF COPPELL TEXAS 1890
N

North Lake Pump Station
PLAN
1 EX 3
SCALE: 1" = 20'



North Lake Pump Station
SECTION A-A
2 EX 3
SCALE: 1" = 20'



North Lake Pump Station
ELEVATION B-B
3 EX 3
SCALE: 1" = 20'

The information shown on this drawing is replicated from available record information and recent aerial; it is intended to indicate the configuration of the pump station and is not guaranteed to be accurate nor all inclusive.

Sources:
1. North Lake Steam Electric Station; Nov 1956; DP&L; Sheets G-147461 and G-147465
2. Aerial; Oct 2017; Nearmap
3. Property Owner Information; Retrieved on Dec 2017; Dallas Central Appraisal District

EX #9
Temporary Pumping Option

North Lake Raw Water System Evaluation
City of Coppell

February 2018

Scale: As Shown

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TEXAS · 1890

Appendix 2: SHERMCO Report

Shermco industries®

One Line. One Company.®

Customer: FSG Electric

Location: North Lake Pump Station
Coppell, Texas

Shermco Project No.: 82000030

Description: Evaluate Switchgear

Date: April 17, 2015

Work Performed and Report Prepared By:
Shermco Industries
Corporate Headquarters | Dallas Service Center
2425 E. Pioneer Dr., Irving, TX 75061

June 11, 2015

Mr. Jerry Bevers
FSG Electric
2525 Walnut Hill Lane, Suite 100
Dallas, TX 75229

Subject: **Evaluate Switchgear**
Shermco Project No. 82000030

Location: **North Lake Pump Station**
Coppell, Texas

Dear Mr. Bevers:

On April 17, 2015, Shermco Industries performed an evaluation of the switchgear and transformers for FSG Electric at the North Lake Pump Station located in Coppell, Texas.

The following is the overall condition of the switchgear as found:

Transformer Issues: Overall power factor test was unsatisfactory. The winding to ground insulation has exceeded three times the maximum good rating limit. This condition may be related to the moisture in the winding insulation, contamination and/or deterioration of the bushing insulation and excessive surface leakage over the porcelain.

H1-bushing does not show any oil for the C2 tap and there was arcing when we tried to test it. The H2-bushing has a broken skirt and tested very high on power factor. The H3-bushing shows to be out or very low on oil. Shermco was unable to remove the cap for the C2 tap due to it being damaged from arcing of some sort.

The X3-lightning arrester is broken. Winding resistance is very high on high side winding. There are leaks on some of the bushings and radiators.

Shermco recommends replacing the transformer and low side arresters due to age and condition.

Circuit Breaker Issues: All three breaker cells are missing various cell side racking mechanism parts for racking motor. Shermco recommends replacing with vacuum retrofit breakers or have breakers remanufactured.

Pump #1 breaker is the only breaker that would close from the control switch. There seemed to be a standing trip on all of the breakers which we could not locate.

The closing plunger on Pump #2 sticks in the closed position and does not fall back into place which holds the breaker in the closed position.
The cell side bushing bottles on Pump #3 are leaking and recommend having them replaced. Also, the breaker after being closed and with the 48Vdc applied, would not trip immediately. The breaker would trip on its own after a minute or so. We were able to trip this breaker from the relays, operating them by hand due to the standing trip not affecting the breaker immediately.

All of the grease has hardened in the breaker mechanisms and the pivot points on the moving contacts of the breakers. The breakers would not operate without applying spray lubrication, which is only a temporary solution. A manual closing device was not available on site, so were unable to slow close the breakers. When opening or closing the breakers, the operation was very sluggish.

Switchgear Issues: Overall condition is very poor. Further investigation and troubleshooting would be necessary. The control wiring has random jumpers, cut wires and some of the wiring has insulation coming off. There are many areas where we had to remove the wire and clean the connections to allow voltage to pass through. There are defective wiring connections throughout the switchgear. There are signs of tracking in the switchgear and also areas that looked like it may have been wet at some point in time. The motor leads on Pump #2 and Pump #3 have the outer jacket over the insulation splitting in areas. Much of the gasket material has fallen off of the doors and deteriorated around the covers. This would also need to be replaced to help keep water and dirt out of the gear.

Relays: None of the relays would operate properly. The (27) UV relay coil was burnt and does not operate at all. Recommend to replace all relays and meters.

CPT's: The CPT's ratios were acceptable but the insulation resistance is low and does not pass NETA specifications. Recommend replacement.

Metering PT's: The metering PT's passed testing but had water in the secondary wiring connection compartment and the connections were corroded. Recommend to replace or repair.

Metering CT's, **Incoming PT's and CT's:** Passed all testing.

Batteries: No testing performed. Recommend to replace battery system.

Motors: Pump #1 insulation resistance test set would not reach test voltage (2500Vdc). It was only reaching 1050Vdc and the insulation resistance was 0.5 Megohms. We were able to verify that some of the heaters worked when we turned the heaters on.

Pump #2 insulation resistance test set reached the test voltage and the reading was 30 Megohms. The heaters do not appear to be wired nor could we verify that any heaters were working.

Pump 3 insulation resistance test set reached the voltage and the reading was 4.5 Megohms. This needs to be a minimum of 1000 Megohms per NETA specifications. We were able to verify that some of the heaters worked when we turned the heaters on.

Data sheets, oil sample test results and technical information are enclosed for your review.

Thank you for the opportunity to be of service. Should you have any questions or require additional information or services, please do not hesitate to contact us. We are available 24 hours a day, seven days a week.

Respectfully submitted,
Shermco Industries
Dallas Service Center

Butch Stark

Butch Stark
Field Service Technician
Engineering Services Division

Comment &
Deficiency Summaries

Shermco Industries, Inc
Corporate Headquarters
2425 E. Pioneer Drive
Irving, Texas 75061
1-888-SHERMCO
www.shermco.com

Deficiency Summary
Job #82000030

Customer FSG Electric
User North Lake Pump Station
Plant

Substation: Main Page: 3
CircuitID: Pump 1 Date: 2015 11:46:4
Equipment: 15015 - MVCB_R1 (Shermco)

DEFICIENCIES:

1. Mechanism does not have any lubrication. What lubrication was there had dried and is no longer good. The mech was sprayed with lube so it would operate.
2. The manual closing jack assembly is not on site. Unable to perform slow closing of breaker.
3. The racking mechanism is missing parts and also the racking motor is missing.
4. Unable to verify any control wiring due to bad connections, relays not working properly and possible interlocks not found on drawing. Heater wiring is bad also.
5. Contact resistance and Insulation resistance is out of NETA Specifications.

Substation: Main Page: 5
CircuitID: Pump 2 Date: 2015 11:45:2
Equipment: 15015 - MVCB_R1 (Shermco)

DEFICIENCIES:

1. Mechanism does not have any lubrication. What lubrication was there had dried and is no longer good. The mech was sprayed with lube so it would operate.
2. The manual closing jack assembly is not on site. Unable to perform slow closing of breaker.
3. The racking mechanism is missing parts and also the racking motor is missing.
4. Unable to verify any control wiring due to bad connections, relays not working properly and possible interlocks not found on drawing. Heater wiring is bad also.
5. Insulation resistance doe not pass NETA specifications on Line to Load testing.

Substation: Main Page: 7
CircuitID: Pump 3 Date: 2015 11:48:1
Equipment: 15015 - MVCB_R1 (Shermco)

DEFICIENCIES:

1. Mechanism does not have any lubrication. What lubrication was there had dried and is no longer good. The mech was sprayed with lube so it would operate.
2. The manual closing jack assembly is not on site. Unable to perform slow closing of breaker.
3. The racking mechanism is missing parts and also the racking motor is missing.
4. Unable to verify any control wiring due to bad connections, relays not working properly and possible interlocks not found on drawing. Heater wiring is bad also.
5. Cell side bottles leaking. Recommend to replace.
6. Contact resistance is higher than expected for amperage of breaker. Insulation resistance is out of NETA specifications.

Substation: Main Page: 9
CircuitID: Main Transformer Date: 2015 9:11:2
Equipment: 45001 - OVERCURRENT RELAY (Shermco) (2)

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

Substation: Main Page: 10
CircuitID: Main Transformer Date: 2015 9:12:2
Equipment: 45001 - OVERCURRENT RELAY (Shermco) (2) (2)

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

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Substation: Main — Page: 11
CircuitID: Pump 1 — Date: 2015 11:55:3
Equipment: 45001 - OVERCURRENT RELAY (Shermco) (2)

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

Substation: Main — Page: 12
CircuitID: Pump 2 — Date: 2015 11:56:2
Equipment: 45001 - OVERCURRENT RELAY (Shermco) (2)

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

Substation: Main — Page: 13
CircuitID: Pump 3 — Date: 2015 11:56:4
Equipment: 45001 - OVERCURRENT RELAY (Shermco)

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

Substation: Main Incoming — Page: 14
CircuitID: Undervoltage Relay — Date: 2015 12:41:0
Equipment: 46500 - PROTECTIVE RELAY (Shermco)

DEFICIENCIES: 1D. RELAY NOT TESTED DUE TO BURNT WIRE GOING TO SOLENOID FAILING AND DAMGING THE RELAY. RELAY HAS BEEN EXPOSED TO EXTREME MOISTURE AND WILL NOT SLIDE OUT OF THE CASE. RELAY RED TAGGED AND RECOMMEND REPLACING.

Substation: Main — Page: 15
CircuitID: Switchgear — Date: 2015 11:56:2
Equipment: 50950 - Distribution Switchgear (SI)

DEFICIENCIES:
1. Gasket material has degraded and does not keep water and dirt from getting into switchgear.
2. Kirk Lock for PT drawer had to be destroyed to be able to get into PT drawer.

Substation: Main — Page: 16
CircuitID: Main Transformer — Date: 015 12:34:4
Equipment: 56027 - TRANSFORMER - M4000 (Shermco)

TEST EQUIPMENT USED: ______ TESTED BY: ______

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Deficiency Summary
Job #82000030

DEFICIENCIES:
1. Winding resistance on High side is higher than normal.
2. Bushings tested do not meet NETA specifications.
3. The winding to ground insulation has exceeded three times the maximum Good Rating limit. This could be 1. Contamination and/or deterioration of the bushing insulation. 2. Excessive surface leakage over the porcelain. Due to the age and the unknown issues Shermco recommends to replace the transformer.

Substation: Main CPT's | Page: 18
CircuitID: Center CPT | Date: 2015 11:54:2
Equipment: 56040 - TRANSFORMER DATA SHEET (Si)

DEFICIENCIES:
1. Low side cables insulation is coming off.
2. Insulation resistance does not meet NETA specifications.

Substation: Main CPT's | Page: 19
CircuitID: East CPT | Date: 2015 11:54:4
Equipment: 56040 - TRANSFORMER DATA SHEET (Si)

DEFICIENCIES:
1. Low side cables insulation is coming off.
2. X1 bushing was found loose.
3. Insulation resistance does not meet NETA specifications.

Substation: Main CPT's | Page: 20
CircuitID: West CPT | Date: 2015 11:55:0
Equipment: 56040 - TRANSFORMER DATA SHEET (Si)

DEFICIENCIES:
1. Low side cables insulation is coming off.
2. Insulation resistance does not meet NETA specifications.

Substation: Metering PT's | Page: 22
CircuitID: Metering PT's | Date: 2015 11:55:4
Equipment: 56225 - INSTRUMENT TRANSFORMER (Si)

DEFICIENCIES:
1. Secondary wiring is very corroded. Wiring compartment is wet.

TEST EQUIPMENT USED: ______ TESTED BY: ______

Comment Summary
Job #82000030

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Customer: FSG Electric
User: North Lake Pump Station
Plant:

Substation: Main | Page: 1
CircuitID: Incoming CT's | Date: 4/15/2015
Equipment: 00200 - Comments (Shermco)

COMMENTS: 1. Model number may not be accurate due to name plate age and unable to make out all letters or numbers.

Substation: Main | Page: 3
CircuitID: Pump 1 | Date: 2015 11:46:4
Equipment: 15015 - MVCB_R1 (Shermco)

COMMENTS: 1. Counter does not operate.

Substation: Main | Page: 5
CircuitID: Pump 2 | Date: 2015 11:45:2
Equipment: 15015 - MVCB_R1 (Shermco)

COMMENTS: 1. Counter does not operate.

Substation: Main | Page: 7
CircuitID: Pump 3 | Date: 2015 11:48:1
Equipment: 15015 - MVCB_R1 (Shermco)

COMMENTS: 1. Counter does not operate properly.

Substation: Main | Page: 15
CircuitID: Switchgear | Date: 2015 11:56:2
Equipment: 50950 - Distribution Switchgear (SI)

COMMENTS: 1. Unable to verify control wiring due to added jumpers, cut wires and bad connections due to corrosion.

Substation: Main | Page: 16
CircuitID: Main Transformer | Date: 015 12:34:4
Equipment: 56027 - TRANSFORMER - M4000 (Shermco)

Comment Summary
Job #82000030

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COMMENTS: 1. Low side arresters not tested. X3 arrester is broken.

Substation: Main CPT's | Page: 18
CircuitID: Center CPT | Date: 2015 11:54:2
Equipment: 56040 - TRANSFORMER DATA SHEET (Si)

COMMENTS:
1. Cable from switchgear and all three transformers included on insulation resistance test H-L+G.
2. Fuse Info:GE, Type:EJ-1, CAT#6193404, Nom Volts: 4800, Amp:1.0E, Size C, INST:GE-10951, Max DES Volts:5500
3. Fuse Resistance 1.1,

Substation: Main CPT's | Page: 19
CircuitID: East CPT | Date: 2015 11:54:4
Equipment: 56040 - TRANSFORMER DATA SHEET (Si)

COMMENTS: 1. Cable from switchgear and all three transformers included on insulation resistance test H-L+G.

Substation: Main CPT's | Page: 20
CircuitID: West CPT | Date: 2015 11:55:0
Equipment: 56040 - TRANSFORMER DATA SHEET (Si)

COMMENTS: 1. Cable from switchgear and all three transformers included on insulation resistance test H-L+G.

Substation: Metering PT's | Page: 22
CircuitID: Metering PT's | Date: 2015 11:55:4
Equipment: 56225 - INSTRUMENT TRANSFORMER (Si)

COMMENTS: 1. Fuse Holder S&C SMU-20

TEST EQUIPMENT USED: | TESTED BY:

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Job #82000030

Shermco Industries, Inc
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Customer FSG Electric
User North Lake Pump Station
Plant

Test Data

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Corporate Headquarters
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Irving, Texas 75061
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Current Transformer Data

CUSTOMER	FSG Electric	PAGE	1
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE 4/15/2015 TEMPERATURE 75 °F HUMIDITY 50 % EQPT. LOCATION North Lake Pump Station

SUBSTATION Main CIRCUIT ID Incoming CT's

COMMENTS
Mfg: GE, Ratio:400:5, Cat #639X7, Model #91CS09AAZH. (See Note 1.)

COMMENTS:
DEFICIENCIES:

1. Model number may not be accurate due to name plate age and unable to make out all letters or numbers.

TEST EQUIPMENT USED: 14-011

TESTED BY: BStark / WCauthen

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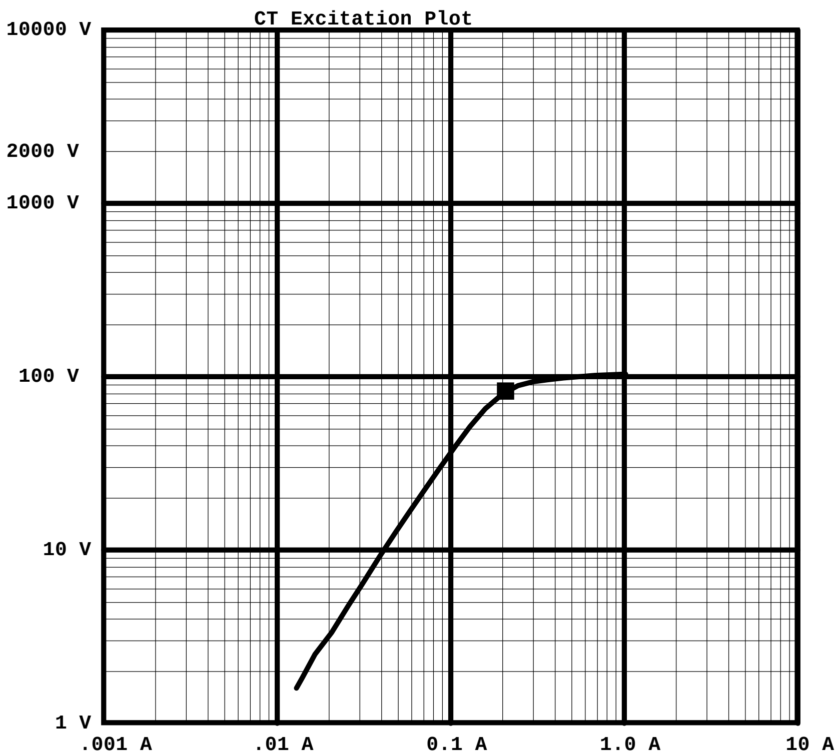
FILENAME: RunTest.test	MFR: GE	TEST # 1: X1-X2
DATE: 04/16/15 08:57:42	MODEL:	TEST NOTES:
COMPANY: FSG	SN:	KNEE TYPE: IEEE 30 Deg
STATION: North Lake PS	OPERATOR: BStark	FREQUENCY: 60 Hz
CIRCUIT: Incoming	COMMENTS:	

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 400/5.0	Ex V[Volts]: 55.100	Phase Angle:-0.04°
Vkp[Volts]: 82.92	Vkp[Volts]: 65.04	Vkp[Volts]: 87.52	M-RATIO: 80.053	Ex I[Amps]: 0.138	In Phase
Ikp[Amps]: 0.2088	Ikp[Amps]: 0.1572	Ikp[Amps]: 0.2390	% ERROR: 0.0665		



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0000	0.00		17	0.0482	12.76	264.73
2	0.0000	0.00		18	0.0576	16.52	286.81
3	0.0000	0.00		19	0.0698	21.80	312.32
4	0.0000	0.00		20	0.0860	29.52	343.26
5	0.0000	0.00		21	0.1062	39.84	375.14
6	0.0000	0.00		22	0.1298	51.88	399.69
7	0.0000	0.00		23	0.1590	65.92	414.59
8	0.0000	0.00		24	0.2002	79.96	399.40
9	0.0000	0.00		25	0.2458	88.84	361.43
10	0.0130	1.60	123.08	26	0.2974	93.48	314.32
11	0.0140	1.84	131.43	27	0.3592	96.48	268.60
12	0.0166	2.52	151.81	28	0.4468	98.80	221.13
13	0.0206	3.36	163.11	29	0.5546	100.60	181.39
14	0.0258	4.80	186.05	30	0.6792	101.96	150.12
15	0.0310	6.40	206.45	31	0.8370	103.16	123.25
16	0.0390	9.24	236.92	32	1.0220	104.12	101.88

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.10	100.00	12	0.2000	79.90	399.50
2	0.0020	0.20	100.00	13	0.4000	97.60	244.00
3	0.0040	0.50	125.00	14	0.5000	99.70	199.40
4	0.0050	0.60	120.00	15	0.8000	102.90	128.63
5	0.0080	1.00	125.00	16	1.0000	104.00	104.00
6	0.0100	1.20	120.00				
7	0.0200	3.20	160.00				
8	0.0400	9.60	240.00				
9	0.0500	13.50	270.00				
10	0.0800	26.70	333.75				
11	0.1000	36.70	367.00				

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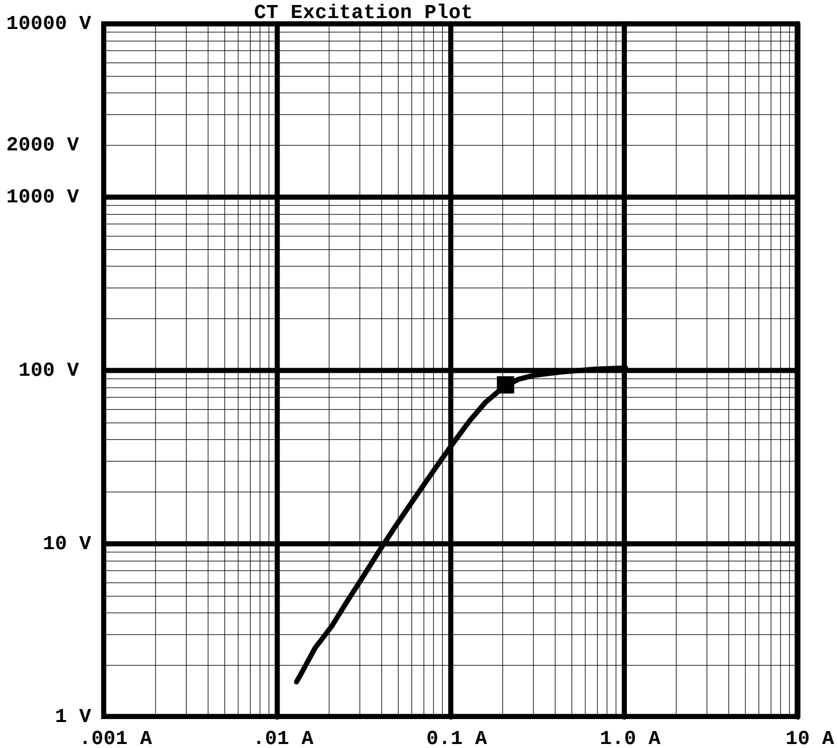
FILENAME: RunTest.test
DATE: 04/16/15 08:57:42
COMPANY: FSG
STATION: North Lake PS
CIRCUIT: Incoming

MFR: GE
MODEL:
SN:
OPERATOR: BStark
COMMENTS:

SUMMARY REPORT
KNEE TYPE: IEEE 30 Deg
FREQUENCY: 60 Hz

Test	Tap	IEEE30	IEEE45	IEC 10/50	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1 [redacted]	X1-X2	82.92	65.04	87.52	400/5.0	80.053	0.0665 %	-0.04°	N/A

CT Excitation Plot



Test Notepad

EZCT-2000 Software Version: 1.35
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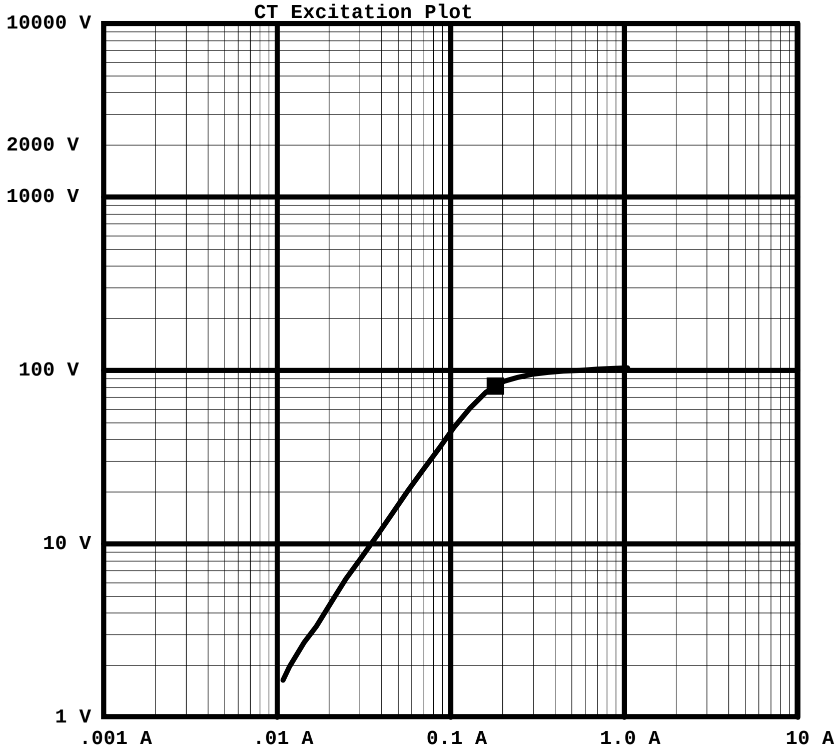
FILENAME: RunTest.test	MFR: GE	TEST # 1: X1-X2
DATE: 04/16/15 09:01:53	MODEL:	TEST NOTES:
COMPANY: FSG	SN:	KNEE TYPE: IEEE 30 Deg
STATION: North Lake PS	OPERATOR: BStark	FREQUENCY: 60 Hz
CIRCUIT: Incoming	COMMENTS:	

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 400/5.0	Ex V[Volts]: 54.900	Phase Angle:-0.02°
Vkp[Volts]: 81.24	Vkp[Volts]: 68.24	Vkp[Volts]: 87.24	M-RATIO: 80.032	Ex I[Amps]: 0.121	In Phase
Ikp[Amps]: 0.1828	Ikp[Amps]: 0.1452	Ikp[Amps]: 0.2072	% ERROR: 0.0395		

CT Excitation Plot



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0000	0.00		17	0.0462	15.12	327.27
2	0.0000	0.00		18	0.0568	20.28	357.04
3	0.0000	0.00		19	0.0698	27.00	386.82
4	0.0000	0.00		20	0.0866	36.36	419.86
5	0.0000	0.00		21	0.1052	47.08	447.53
6	0.0000	0.00		22	0.1298	60.88	469.03
7	0.0000	0.00		23	0.1600	75.20	470.00
8	0.0000	0.00		24	0.2038	86.80	425.91
9	0.0108	1.64	151.85	25	0.2426	91.84	378.57
10	0.0118	1.96	166.10	26	0.2966	95.24	321.11
11	0.0144	2.72	188.89	27	0.3656	97.56	266.85
12	0.0168	3.36	200.00	28	0.4476	99.36	221.98
13	0.0210	4.80	228.57	29	0.5578	100.84	180.78
14	0.0250	6.28	251.20	30	0.7004	102.20	145.92
15	0.0306	8.36	273.20	31	0.8518	103.16	121.11
16	0.0384	11.52	300.00	32	1.0488	104.28	99.43

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.20	200.00	12	0.2000	85.80	429.00
2	0.0020	0.30	150.00	13	0.4000	98.30	245.75
3	0.0040	0.60	150.00	14	0.5000	100.10	200.20
4	0.0050	0.80	160.00	15	0.8000	102.80	128.50
5	0.0080	1.20	150.00	16	1.0000	104.00	104.00
6	0.0100	1.50	150.00				
7	0.0200	4.40	220.00				
8	0.0400	12.20	305.00				
9	0.0500	17.00	340.00				
10	0.0800	32.70	408.75				
11	0.1000	44.10	441.00				

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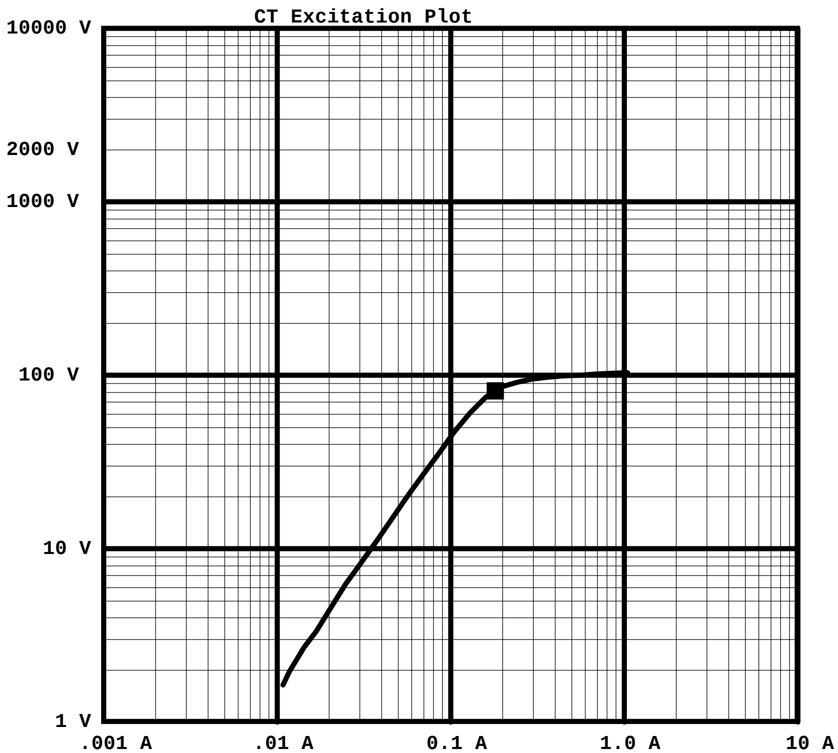
FILENAME:	RunTest.test	MFR:	GE		SUMMARY REPORT
DATE:	04/16/15 09:01:53	MODEL:		KNEE TYPE:	IEEE 30 Deg
COMPANY:	FSG	SN:		FREQUENCY:	60 Hz
STATION:	North Lake PS	OPERATOR:	BStark		
CIRCUIT:	Incoming	COMMENTS:			

Test	Tap	IEEE30	IEEE45	IEC 10/50	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1 [redacted]	X1-X2	81.24	68.24	87.24	400/5.0	80.032	0.0395 %	-0.02°	N/A



Test Notepad

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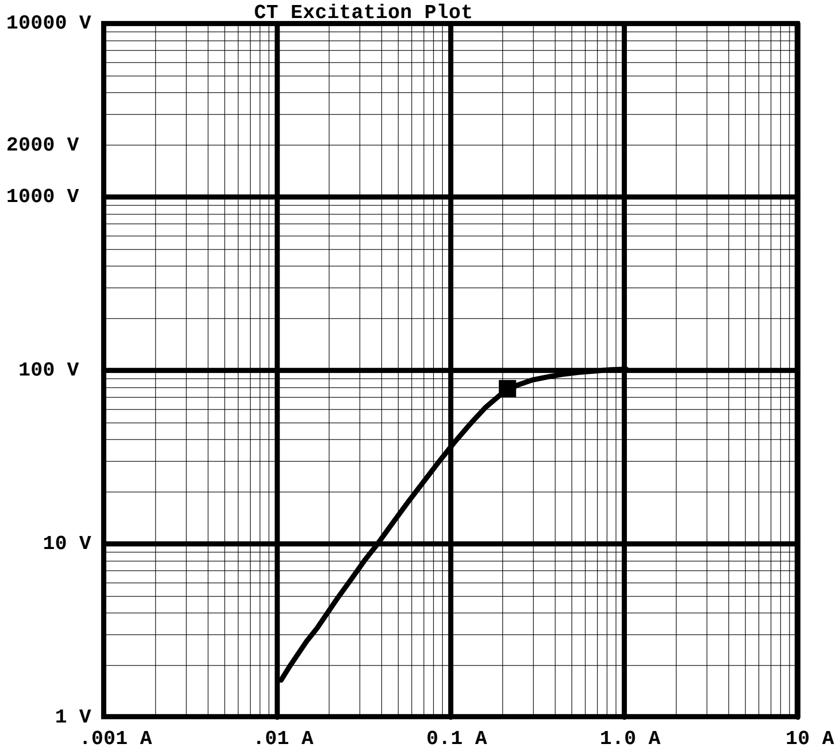
FILENAME: RunTest.test	MFR: GE	TEST # 1: X1-X2
DATE: 04/16/15 09:04:57	MODEL:	TEST NOTES:
COMPANY: FSG	SN:	KNEE TYPE: IEEE 30 Deg
STATION: North Lake PS	OPERATOR: BStark	FREQUENCY: 60 Hz
CIRCUIT: Incoming	COMMENTS:	

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 400/5.0	Ex V[Volts]: 54.000	Phase Angle:-0.04°
Vkp[Volts]: 78.20	Vkp[Volts]: 58.36	Vkp[Volts]: 84.72	M-RATIO: 80.049	Ex I[Amps]: 0.141	In Phase
Ikp[Amps]: 0.2132	Ikp[Amps]: 0.1508	Ikp[Amps]: 0.2638	% ERROR: 0.0607		

CT Excitation Plot



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0000	0.00		17	0.0472	13.56	287.29
2	0.0000	0.00		18	0.0570	17.48	306.67
3	0.0000	0.00		19	0.0710	23.32	328.45
4	0.0000	0.00		20	0.0862	30.00	348.03
5	0.0000	0.00		21	0.1056	38.68	366.29
6	0.0000	0.00		22	0.1292	49.32	381.73
7	0.0000	0.00		23	0.1584	61.60	388.89
8	0.0000	0.00		24	0.2006	74.36	370.69
9	0.0106	1.64	154.72	25	0.2430	82.44	339.26
10	0.0118	1.96	166.10	26	0.2958	88.28	298.44
11	0.0148	2.76	186.49	27	0.3664	92.52	252.51
12	0.0170	3.28	192.94	28	0.4424	95.24	215.28
13	0.0224	4.88	217.86	29	0.5478	97.56	178.09
14	0.0266	6.24	234.59	30	0.6796	99.64	146.62
15	0.0322	8.12	252.17	31	0.8270	101.28	122.47
16	0.0378	9.96	263.49	32	1.0264	102.48	99.84

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.20	200.00	12	0.2000	74.20	371.00
2	0.0020	0.30	150.00	13	0.4000	93.70	234.25
3	0.0040	0.60	150.00	14	0.5000	96.50	193.00
4	0.0050	0.80	160.00	15	0.8000	101.00	126.25
5	0.0080	1.20	150.00	16	1.0000	102.30	102.30
6	0.0100	1.60	160.00				
7	0.0200	4.20	210.00				
8	0.0400	10.80	270.00				
9	0.0500	14.70	294.00				
10	0.0800	27.30	341.25				
11	0.1000	36.20	362.00				

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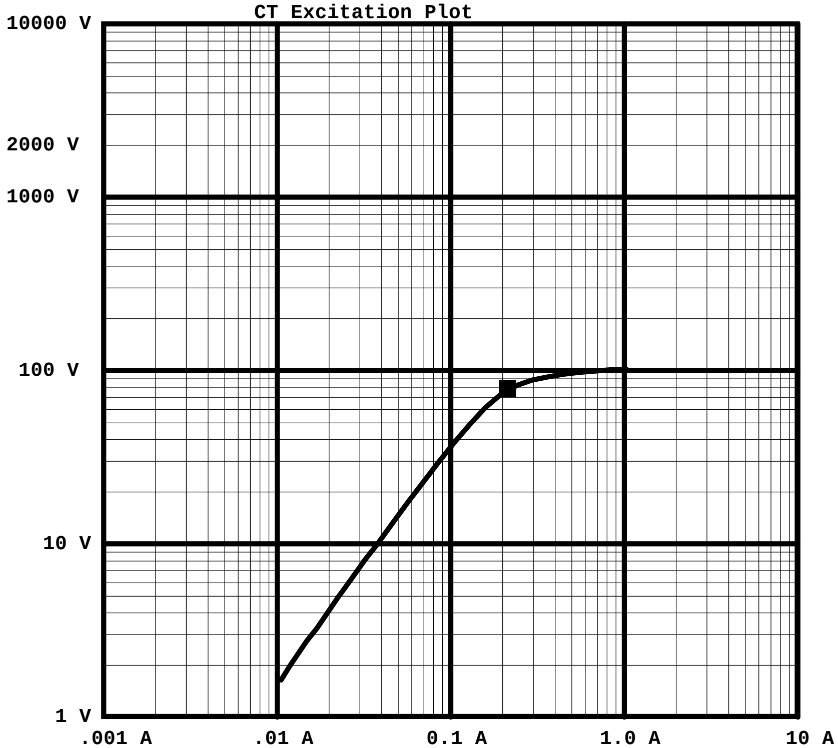
FILENAME: RunTest.test
DATE: 04/16/15 09:04:57
COMPANY: FSG
STATION: North Lake PS
CIRCUIT: Incoming

MFR: GE
MODEL:
SN:
OPERATOR: BStark
COMMENTS:

SUMMARY REPORT
KNEE TYPE: IEEE 30 Deg
FREQUENCY: 60 Hz

Test	Tap	IEEE30	IEEE45	IEC 10/50	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1 [redacted]	X1-X2	78.20	58.36	84.72	400/5.0	80.049	0.0607 %	-0.04°	N/A

CT Excitation Plot



Test Notepad

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Current Transformer Data

CUSTOMER	FSG Electric	PAGE	2
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE 4/15/2015 TEMPERATURE 75 °F HUMIDITY 50 % EQPT. LOCATION North Lake Pump Station

SUBSTATION Main CIRCUIT ID Metering CT's

COMMENTS
Mfg: ABB, Ratio:150:5, Rating Factor: 3.0, S#7524A25G10

COMMENTS:

DEFICIENCIES:

TEST EQUIPMENT USED: 14-011 TESTED BY: BStark / WCauthen

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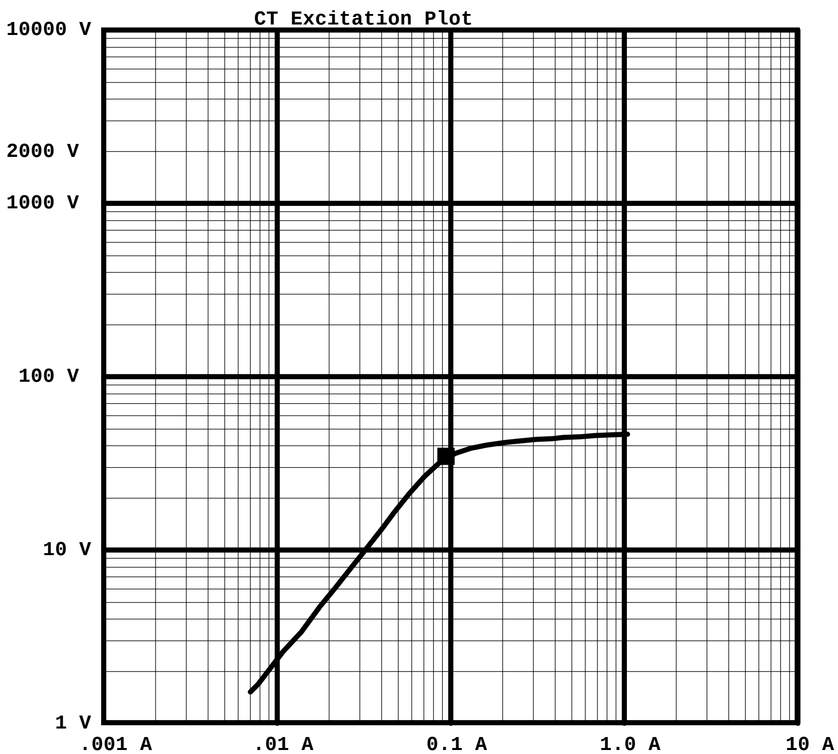
FILENAME: RunTest.test	MFR: ABB	TEST # 1: X1-X2
DATE: 04/15/15 14:06:47	MODEL:	TEST NOTES:
COMPANY: FSG	SN: 40143568	KNEE TYPE: IEEE 30 Deg
STATION: North Lake Pump Stat	OPERATOR: BStark	FREQUENCY: 60 Hz
CIRCUIT: X1	COMMENTS: Metering CT	

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 21.900	Phase Angle:0.04°
Vkp[Volts]: 34.72	Vkp[Volts]: 26.76	Vkp[Volts]: 36.72	M-RATIO: 29.949	Ex I[Amps]: 0.060	In Phase
Ikp[Amps]: 0.0944	Ikp[Amps]: 0.0708	Ikp[Amps]: 0.1118	% ERROR: 0.1690	Winding Res: 126.19 mill-ohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0000	0.00		17	0.0470	16.40	348.94
2	0.0000	0.00		18	0.0576	21.24	368.75
3	0.0000	0.00		19	0.0708	26.76	377.97
4	0.0000	0.00		20	0.0874	32.36	370.25
5	0.0000	0.00		21	0.1070	36.24	338.69
6	0.0000	0.00		22	0.1306	38.68	296.17
7	0.0070	1.52	217.14	23	0.1622	40.48	249.57
8	0.0078	1.68	215.38	24	0.2046	41.68	203.71
9	0.0108	2.60	240.74	25	0.2410	42.60	176.76
10	0.0134	3.28	244.78	26	0.3130	43.52	139.04
11	0.0138	3.36	243.48	27	0.3860	44.20	114.51
12	0.0178	4.76	267.42	28	0.4496	44.64	99.29
13	0.0216	6.04	279.63	29	0.5570	45.24	81.22
14	0.0270	8.00	296.30	30	0.6876	45.80	66.61
15	0.0308	9.44	306.49	31	0.8394	46.32	55.18
16	0.0408	13.56	332.35	32	1.0472	46.88	44.77

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.20	200.00	12	0.2000	41.60	208.00
2	0.0020	0.40	200.00	13	0.4000	44.30	110.75
3	0.0040	0.90	225.00	14	0.5000	44.90	89.80
4	0.0050	1.10	220.00	15	0.8000	46.20	57.75
5	0.0080	1.80	225.00	16	1.0000	46.80	46.80
6	0.0100	2.40	240.00				
7	0.0200	5.50	275.00				
8	0.0400	13.20	330.00				
9	0.0500	17.80	356.00				
10	0.0800	29.90	373.75				
11	0.1000	34.80	348.00				

EZCT-2000 Software Version: 1.35
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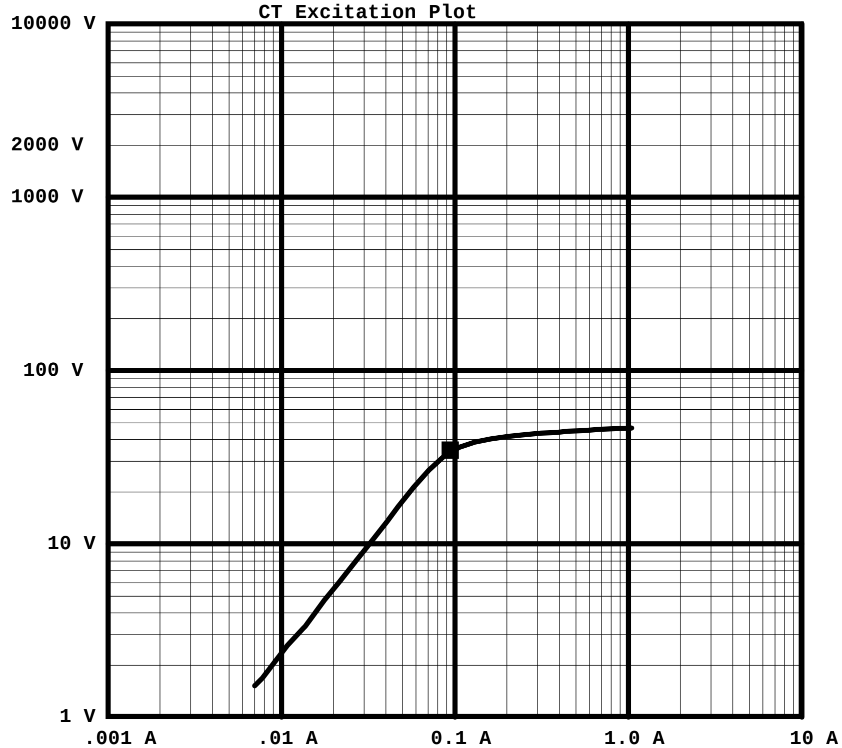
FILENAME: RunTest.test	MFR: ABB	SUMMARY REPORT
DATE: 04/15/15 14:06:47	MODEL:	KNEE TYPE: IEEE 30 Deg
COMPANY: FSG	SN: 40143568	FREQUENCY: 60 Hz
STATION: North Lake Pump Stat	OPERATOR: BStark	
CIRCUIT: X1	COMMENTS: Metering CT	

Test	Tap	IEEE30	IEEE45	IEC 10/50	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1 [redacted]	X1-X2	34.72	26.76	36.72	150/5.0	29.949	0.1690 %	0.04°	126.19 m-ohms

CT Excitation Plot



Test Notepad

EZCT-2000 Software Version: 1.35
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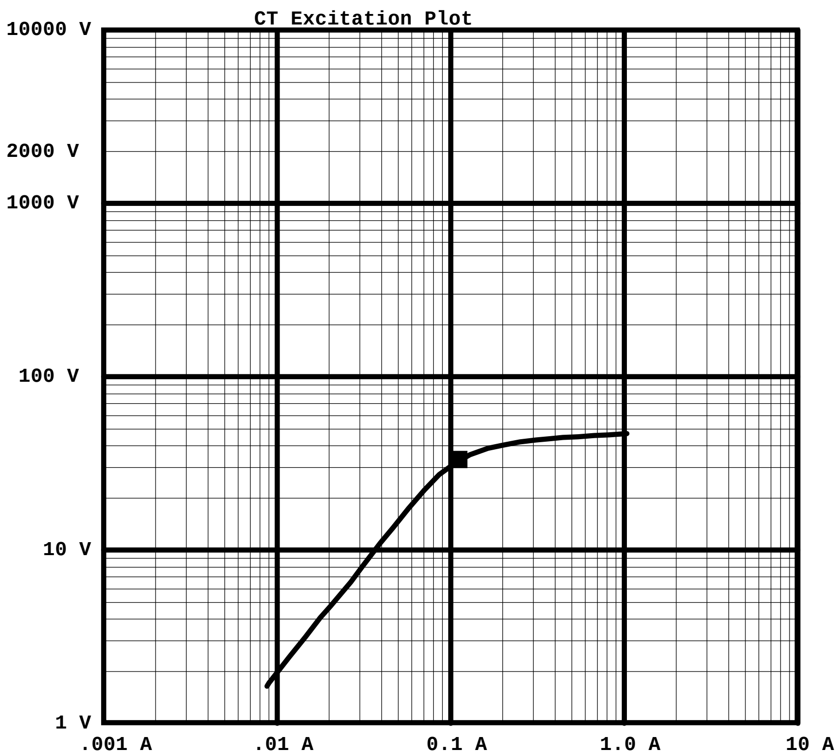
www.vanguard-instruments.com

FILENAME: RunTest.test	MFR: ABB	TEST # 1: X1-X2
DATE: 04/15/15 14:16:21	MODEL:	TEST NOTES:
COMPANY: FSG	SN: 40143567	KNEE TYPE: IEEE 30 Deg
STATION: North Lake Pump Stat	OPERATOR: BStark	FREQUENCY: 60 Hz
CIRCUIT: X1	COMMENTS: Metering CT	

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 22.100	Phase Angle:0.04°
Vkp[Volts]: 33.24	Vkp[Volts]: 24.96	Vkp[Volts]: 37.12	M-RATIO: 29.948	Ex I[Amps]: 0.072	In Phase
Ikp[Amps]: 0.1118	Ikp[Amps]: 0.0792	Ikp[Amps]: 0.1470	% ERROR: 0.1743	Winding Res: 89.83 mill-ohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0000	0.00		17	0.0466	13.48	289.27
2	0.0000	0.00		18	0.0574	17.40	303.14
3	0.0000	0.00		19	0.0710	22.36	314.93
4	0.0000	0.00		20	0.0864	27.28	315.74
5	0.0000	0.00		21	0.1064	31.96	300.38
6	0.0000	0.00		22	0.1292	35.48	274.61
7	0.0000	0.00		23	0.1638	38.68	236.14
8	0.0088	1.64	186.36	24	0.2022	40.60	200.79
9	0.0090	1.72	191.11	25	0.2522	42.16	167.17
10	0.0118	2.44	206.78	26	0.3110	43.32	139.29
11	0.0146	3.16	216.44	27	0.3744	44.08	117.74
12	0.0178	4.08	229.21	28	0.4444	44.64	100.45
13	0.0204	4.76	233.33	29	0.5446	45.24	83.07
14	0.0266	6.56	246.62	30	0.6764	45.84	67.77
15	0.0308	8.00	259.74	31	0.8190	46.32	56.56
16	0.0394	11.00	279.19	32	1.0428	46.96	45.03

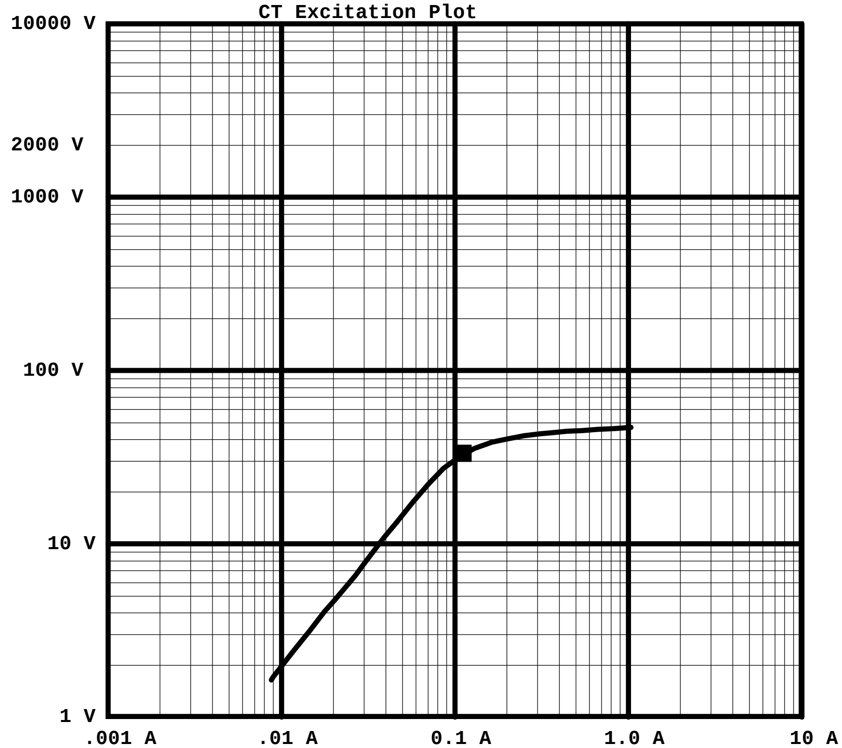
GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.20	200.00	12	0.2000	40.50	202.50
2	0.0020	0.40	200.00	13	0.4000	44.30	110.75
3	0.0040	0.80	200.00	14	0.5000	45.00	90.00
4	0.0050	0.90	180.00	15	0.8000	46.20	57.75
5	0.0080	1.50	187.50	16	1.0000	46.80	46.80
6	0.0100	2.00	200.00				
7	0.0200	4.60	230.00				
8	0.0400	11.20	280.00				
9	0.0500	14.70	294.00				
10	0.0800	25.20	315.00				
11	0.1000	30.50	305.00				

FILENAME:	RunTest.test	MFR:	ABB		SUMMARY REPORT
DATE:	04/15/15 14:16:21	MODEL:		KNEE TYPE:	IEEE 30 Deg
COMPANY:	FSG	SN:	40143567	FREQUENCY:	60 Hz
STATION:	North Lake Pump Stat	OPERATOR:	BStark		
CIRCUIT:	X1	COMMENTS:	Metering CT		

Test	Tap	IEEE30	IEEE45	IEC 10/50	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	33.24	24.96	37.12	150/5.0	29.948	0.1743 %	0.04°	89.83 m-ohms

CT Excitation Plot



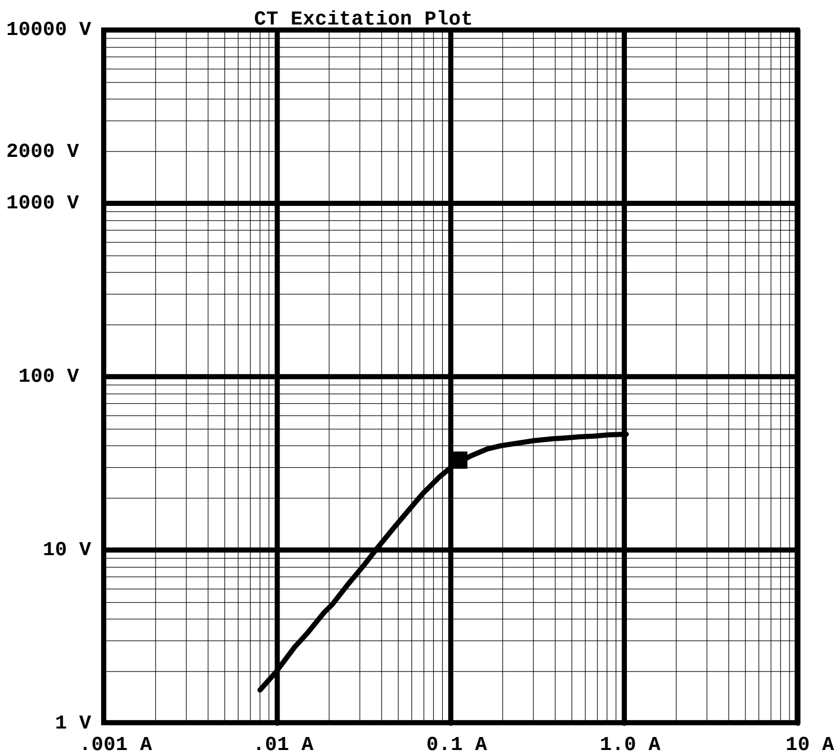
Test Notepad

FILENAME: RunTest.test
DATE: 04/15/15 14:23:53
COMPANY: FSG
STATION: North Lake Pump Stat
CIRCUIT: X3

MFR: ABB
MODEL:
SN: 401435
OPERATOR: BStark
COMMENTS: Metering CT

TEST # 1: X1-X2
TEST NOTES:
KNEE TYPE: IEEE 30 Deg
FREQUENCY: 60 Hz

IEEE 30	IEEE 45	IEC 10/50	NP-RATIO: 150/5.0	Ex V[Volts]: 21.700	Phase Angle:0.06°
Vkp[Volts]: 32.88	Vkp[Volts]: 24.16	Vkp[Volts]: 37.32	M-RATIO: 29.948	Ex I[Amps]: 0.072	In Phase
Ikp[Amps]: 0.1122	Ikp[Amps]: 0.0784	Ikp[Amps]: 0.1528	% ERROR: 0.1733	Winding Res: 87.98 mill-ohms	



CT DATA POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0000	0.00		17	0.0478	13.76	287.87
2	0.0000	0.00		18	0.0572	17.04	297.90
3	0.0000	0.00		19	0.0698	21.48	307.74
4	0.0000	0.00		20	0.0860	26.52	308.37
5	0.0000	0.00		21	0.1050	31.12	296.38
6	0.0000	0.00		22	0.1306	35.16	269.22
7	0.0000	0.00		23	0.1630	38.36	235.34
8	0.0080	1.56	195.00	24	0.1942	40.00	205.97
9	0.0098	1.96	200.00	25	0.2426	41.64	171.64
10	0.0126	2.76	219.05	26	0.3022	42.84	141.76
11	0.0150	3.32	221.33	27	0.3916	43.88	112.05
12	0.0186	4.36	234.41	28	0.4528	44.44	98.14
13	0.0208	4.88	234.62	29	0.5526	45.04	81.51
14	0.0258	6.40	248.06	30	0.6660	45.64	68.53
15	0.0320	8.28	258.75	31	0.8150	46.20	56.69
16	0.0380	10.36	272.63	32	1.0312	46.80	45.38

GRAPH POINTS

POINT	CUR(A)	VTG(V)	Z(OHM)	POINT	CUR(A)	VTG(V)	Z(OHM)
1	0.0010	0.20	200.00	12	0.2000	40.20	201.00
2	0.0020	0.40	200.00	13	0.4000	44.00	110.00
3	0.0040	0.80	200.00	14	0.5000	44.70	89.40
4	0.0050	1.00	200.00	15	0.8000	46.20	57.75
5	0.0080	1.60	200.00	16	1.0000	46.70	46.70
6	0.0100	2.00	200.00				
7	0.0200	4.70	235.00				
8	0.0400	11.00	275.00				
9	0.0500	14.50	290.00				
10	0.0800	24.60	307.50				
11	0.1000	29.90	299.00				

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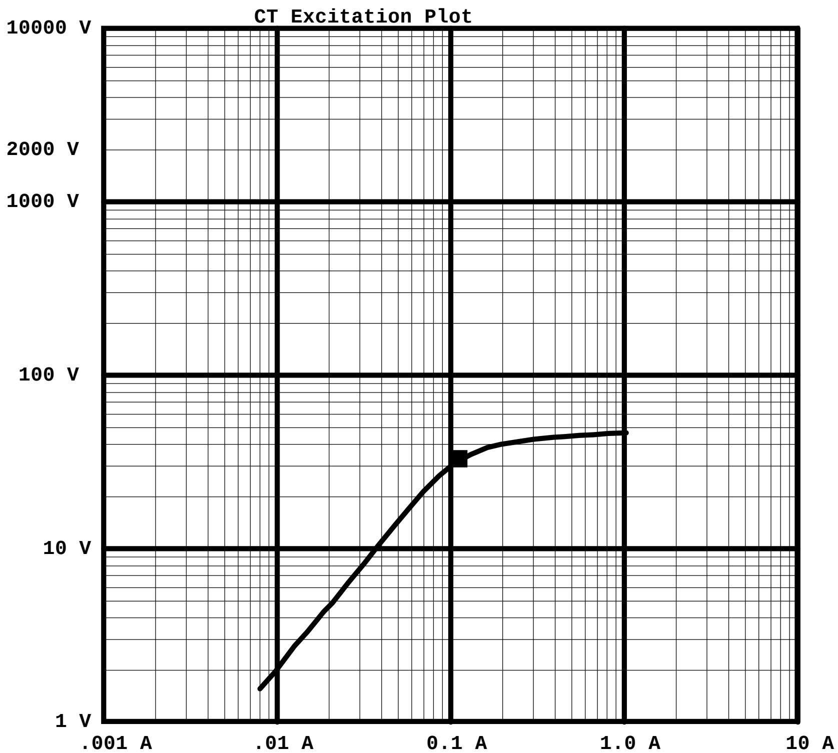
FILENAME:	RunTest.test	MFR:	ABB		SUMMARY REPORT
DATE:	04/15/15 14:23:53	MODEL:		KNEE TYPE:	IEEE 30 Deg
COMPANY:	FSG	SN:	401435	FREQUENCY:	60 Hz
STATION:	North Lake Pump Stat	OPERATOR:	BStark		
CIRCUIT:	X3	COMMENTS:	Metering CT		

Test	Tap	IEEE30	IEEE45	IEC 10/50	NP-Ratio	M-Ratio	% Error	Phase Angle	Winding Res
1	X1-X2	32.88	24.16	37.32	150/5.0	29.948	0.1733 %	0.06°	87.98 m-ohms



Test Notepad

EZCT-2000 Software Version: 1.35
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MEDIUM-VOLTAGE CIRCUIT BREAKER

Shermco Industries, Inc
Corporate Headquarters
2425 E. Pioneer Drive
Irving, Texas 75061
1-888-SHERMCO
www.shermco.com

CUSTOMER: FSG Electric | PAGE: 3
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 | JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 | CMMS #:

DATE: 4/14/2015 | TEMPERATURE: 62 °F | HUMIDITY: 75 % | EQPT. LOCATION: North Lake Pump Station
SUBSTATION: Main | CIRCUIT ID: Pump 1

MANUFACTURER: General Electric | CATALOG: AM-2.4/4.16-100/150-S | AGE: 12/56
BREAKER TYPE: Magneblast | SERIAL NO.: 433A953-52 | BIL LEVEL: 60
INTERRUPTING TIME: 8 Cycles | AMPACITY: 1200 | OPERATING VOLTAGE: 4.16 kV
INTERRUPT CAPACITY: 21 kA | MAX VOLTAGE: 4.76 kV | OPERATING MECHANISM: Solenoid
OTHER: IB-GEH-2000

VISUAL & MECHANICAL INSPECTION	Sat	Unsat	N/A	Note No.:
Compare nameplate data with drawings & specifications.**	○	○	●	
Inspect physical and mechanical condition.	○	●	○	Note D1
Verify**/Utilize** correct application of manufacturer's recommended lubricants.	○	●	○	Note D1
Inspect anchorage, alignment, grounding, arc chutes. Inspect moving and stationary contacts for condition, wear and alignment.	●	○	○	
Verify that all maintenance devices are available for servicing and operating the breaker.	○	●	○	Note D2
Perform all mechanical operator (inc. slow close) and contact alignment tests on both the breaker and its operating mechanism.	○	○	●	
Check cell fit and element alignment.	●	○	○	
Inspect puffer operation.	●	○	○	
Check racking mechanism.	○	●	○	Note D3
Clean unit prior to testing unless as-found and as-left tests are required.***	●	○	○	
Perform circuit breaker travel time test.	○	○	●	

Inspect all bolted electrical connections for high resistance using one of the following methods:

Low Resistance Ohmmeter ● | Torque Wrench ○ | Thermographic Survey ○

**Acceptance Testing Only ***Maintenance Testing Only

TEST RESULTS

RESISTANCE MEASUREMENTS		POLE 1 AS FOUND	POLE 1 AS LEFT	POLE 2 AS FOUND	POLE 2 AS LEFT	POLE 3 AS FOUND	POLE 3 AS LEFT
BOLTED CONNECTION RESISTANCE (Microhms)	Line	N/A	N/A	N/A	N/A	N/A	N/A
	Load	N/A	N/A	N/A	N/A	N/A	N/A
CONTACT RESISTANCE (Microhms)		63	63	65	65	39	39

OVERPOTENTIAL TEST (in microamps)		
POLE 1	POLE 2	POLE 3
54	23.5	20
Test kV	14DC	

INSULATION RESISTANCE in Megohm @ 2.5 kVdc	POLE 1 (P1-P2)	POLE 2 (P2-P3)	POLE 3 (P1-P3)
Pole to Pole	1030	1610	1330
Pole to Frame	382	750	1040
Line to Load	78	50.6	47.6

OPERATIONAL TESTS	Performed/ Verified	Note No.
Trip and close breaker with control switch.	☐	D4
Trip breaker by operating each protective device.	☐	D4
Verify trip-free and anitpump function.	☐	D4
Perform insulation resistance test on control wiring.	☐	D4
Verify operation of heaters.	☐	D4

PICK-UP VOLTAGE TEST	VOLTAGE	RANGE	PICK-UP VOLTAGE
Shunt Trip	48 DC	28-60	
Close Coil	125 DC	90-130	

TIMING TEST	POLE 1	POLE 2	POLE 3
Open Speed	N/A	N/A	N/A
Close Speed	N/A	N/A	N/A

COUNTER READING		
	AS FOUND	01629
	AS LEFT	01629

BLOWOUT COIL RESISTANCE (Ohms)	POLE 1	POLE 2	POLE 3	N/A
				☑

CONTACT MEASUREMENT (in inches)	POLE 1	POLE 2	POLE 3
Contact Gap	3.75	3.75	3.8125
Contact Erosion	.25	.25	.25

VACUUM BOTTLE INTEGRITY		POLE 1	POLE 2	POLE 3	N/A
Test kV					☑

COMMENTS: 1. Counter does not operate.

DEFICIENCIES:
1. Mechanism does not have any lubrication. What lubrication was there had dried and is no longer good. The mech was sprayed with lube so it would operate.
2. The manual closing jack assembly is not on site. Unable to perform slow closing of breaker.
3. The racking mechanism is missing parts and also the racking motor is missing.
4. Unable to verify any control wiring due to bad connections, relays not working properly and possible interlocks not found on drawing. Heater wiring is bad also.

TEST EQUIPMENT USED: 03-031 / 06-052 / 04-049 | TESTED BY: BStark / WCauthen

Shermco Industries, Inc
Corporate Headquarters
2425 E. Pioneer Drive
Irving, Texas 75061
1-888-SHERMCO
www.shermco.com

DEFICIENCIES: 5. Contact resistance and Insulation resistance is out of NETA Specifications.

MEDIUM-VOLTAGE CIRCUIT BREAKER

Shermco Industries, Inc
Corporate Headquarters
2425 E. Pioneer Drive
Irving, Texas 75061
1-888-SHERMCO
www.shermco.com

CUSTOMER: FSG Electric — PAGE: 5
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 — JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 — CMMS #:

DATE: 4/14/2015 — TEMPERATURE: 62 °F — HUMIDITY: 75 % — EQPT. LOCATION: North Lake Pump Station
SUBSTATION: Main — CIRCUIT ID: Pump 2

MANUFACTURER:	General Electric	CATALOG:	AM-2.4/4.16-100/150-S	AGE:	12/56
BREAKER TYPE:	Magneblast	SERIAL NO.:	433A953-52	BIL LEVEL:	60
INTERRUPTING TIME:	8 Cycles	AMPACITY:	1200	OPERATING VOLTAGE:	4.16 kV
INTERRUPT CAPACITY:	21 kA	MAX VOLTAGE:	4.76 kV	OPERATING MECHANISM:	Solenoid
OTHER:	IB-GEH-2000				

VISUAL & MECHANICAL INSPECTION	Sat	Unsat	N/A	Note No.:
Compare nameplate data with drawings & specifications.**	○	○	◉	
Inspect physical and mechanical condition.	○	◉	○	Note D1
Verify**/Utilize** correct application of manufacturer's recommended lubricants.	○	◉	○	Note D1
Inspect anchorage, alignment, grounding, arc chutes. Inspect moving and stationary contacts for condition, wear and alignment.	◉	○	○	
Verify that all maintenance devices are available for servicing and operating the breaker.	○	◉	○	Note D2
Perform all mechanical operator (inc. slow close) and contact alignment tests on both the breaker and its operating mechanism.	○	○	◉	

	Sat	Unsat	N/A	Note No.:
Check cell fit and element alignment.	◉	○	○	
Inspect puffer operation.	◉	○	○	
Check racking mechanism.	○	◉	○	Note D3
Clean unit prior to testing unless as-found and as-left tests are required.***	◉	○	○	
Perform circuit breaker travel time test.	○	○	◉	

Inspect all bolted electrical connections for high resistance using one of the following methods:

Low Resistance Ohmmeter	Torque Wrench	Thermographic Survey
◉	○	○

**Acceptance Testing Only — ***Maintenance Testing Only

TEST RESULTS

RESISTANCE MEASUREMENTS		POLE 1 AS FOUND	POLE 1 AS LEFT	POLE 2 AS FOUND	POLE 2 AS LEFT	POLE 3 AS FOUND	POLE 3 AS LEFT
BOLTED CONNECTION RESISTANCE (Microhms)	Line	N/A	N/A	N/A	N/A	N/A	N/A
	Load	N/A	N/A	N/A	N/A	N/A	N/A
CONTACT RESISTANCE (Microhms)							

OVERPOTENTIAL TEST (in microamps)		
POLE 1	POLE 2	POLE 3
54	23.5	20
Test kV	14DC	

INSULATION RESISTANCE in Megohm @ 2.5 kVdc	POLE 1 (P1-P2)	POLE 2 (P2-P3)	POLE 3 (P1-P3)
Pole to Pole	1030	1610	1330
Pole to Frame	382	750	1040
Line to Load	78	50.6	47.6

OPERATIONAL TESTS	Performed/ Verified	Note No.
Trip and close breaker with control switch.	☐	D4
Trip breaker by operating each protective device.	☐	D4
Verify trip-free and anitpump function.	☐	D4
Perform insulation resistance test on control wiring.	☐	D4
Verify operation of heaters.	☐	D4

PICK-UP VOLTAGE TEST	VOLTAGE	RANGE	PICK-UP VOLTAGE
Shunt Trip	48 DC	28-60	
Close Coil	125 DC	90-130	

TIMING TEST	POLE 1	POLE 2	POLE 3
Open Speed	N/A	N/A	N/A
Close Speed	N/A	N/A	N/A

COUNTER READING		
	AS FOUND	01629
	AS LEFT	00268

BLOWOUT COIL RESISTANCE (Ohms)	POLE 1	POLE 2	POLE 3	N/A
				☑

CONTACT MEASUREMENT (in inches)	POLE 1	POLE 2	POLE 3
Contact Gap	3.75	3.75	3.8125
Contact Erosion	.25	.25	.25

VACUUM BOTTLE INTEGRITY		POLE 1	POLE 2	POLE 3	N/A
Test kV					☑

COMMENTS: 1. Counter does not operate.

DEFICIENCIES:
1. Mechanism does not have any lubrication. What lubrication was there had dried and is no longer good. The mech was sprayed with lube so it would operate.
2. The manual closing jack assembly is not on site. Unable to perform slow closing of breaker.
3. The racking mechanism is missing parts and also the racking motor is missing.
4. Unable to verify any control wiring due to bad connections, relays not working properly and possible interlocks not found on drawing. Heater wiring is bad also.

TEST EQUIPMENT USED: 03-031 / 06-052 / 04-049 — TESTED BY: BStark / WCauthen

Shermco Industries, Inc
Corporate Headquarters
2425 E. Pioneer Drive
Irving, Texas 75061
1-888-SHERMCO
www.shermco.com

DEFICIENCIES: 5. Insulation resistance doe not pass NETA specifications on Line to Load testing.

MEDIUM-VOLTAGE CIRCUIT BREAKER

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Irving, Texas 75061
1-888-SHERMCO
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CUSTOMER	FSG Electric	PAGE	7
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE	4/15/2015	TEMPERATURE	59 °F	HUMIDITY	78 %	EQPT. LOCATION	North Lake Pump Station
SUBSTATION	Main					CIRCUIT ID	Pump 3

MANUFACTURER:	General Electric	CATALOG:	AM-4.16-150-4S	AGE:	02/66
BREAKER TYPE:	Magneblast	SERIAL NO.:	0179A4360-001	BIL LEVEL:	60
INTERRUPTING TIME:	8 Cycles	AMPACITY:	1200	OPERATING VOLTAGE:	4.16 kV
INTERRUPT CAPACITY:	25 kA	MAX VOLTAGE:	4.76 kV	OPERATING MECHANISM:	Solenoid
OTHER:	IB-GEH-2000				

VISUAL & MECHANICAL INSPECTION	Sat	Unsat	N/A	Note No.:
Compare nameplate data with drawings & specifications.**			●	
Inspect physical and mechanical condition.		●		Note D1
Verify**/Utilize** correct application of manufacturer's recommended lubricants.		●		Note D1
Inspect anchorage, alignment, grounding, arc chutes. Inspect moving and stationary contacts for condition, wear and alignment.	●			
Verify that all maintenance devices are available for servicing and operating the breaker.		●		Note D2
Perform all mechanical operator (inc. slow close) and contact alignment tests on both the breaker and its operating mechanism.			●	
Check cell fit and element alignment.	●			
Inspect puffer operation.	●			
Check racking mechanism.		●		Note D3
Clean unit prior to testing unless as-found and as-left tests are required.***	●			
Perform circuit breaker travel time test.			●	

Inspect all bolted electrical connections for high resistance using one of the following methods:

Low Resistance Ohmmeter	Torque Wrench	Thermographic Survey
●		

**Acceptance Testing Only ***Maintenance Testing Only

TEST RESULTS

RESISTANCE MEASUREMENTS		POLE 1 AS FOUND	POLE 1 AS LEFT	POLE 2 AS FOUND	POLE 2 AS LEFT	POLE 3 AS FOUND	POLE 3 AS LEFT
BOLTED CONNECTION RESISTANCE (Microhms)	Line	N/A	N/A	N/A	N/A	N/A	N/A
	Load	N/A	N/A	N/A	N/A	N/A	N/A
CONTACT RESISTANCE (Microhms)		96	96	113	113	131	131

OVERPOTENTIAL TEST (in microamps)		
POLE 1	POLE 2	POLE 3
21	36	26
Test kV	14DC	

INSULATION RESISTANCE in Megohm @ 2.5 kVdc	POLE 1 (P1-P2)	POLE 2 (P2-P3)	POLE 3 (P1-P3)
Pole to Pole	2490	1780	3390
Pole to Frame	1950	620	1240
Line to Load	58	130	69

OPERATIONAL TESTS	Performed/ Verified	Note No.
Trip and close breaker with control switch.	☑	D4
Trip breaker by operating each protective device.	☑	D4
Verify trip-free and anitpump function.	☐	D4
Perform insulation resistance test on control wiring.	☐	D4
Verify operation of heaters.	☑	D4

PICK-UP VOLTAGE TEST	VOLTAGE	RANGE	PICK-UP VOLTAGE
Shunt Trip	48 DC	28-60	
Close Coil	125 DC	90-130	

TIMING TEST	POLE 1	POLE 2	POLE 3
Open Speed	N/A	N/A	N/A
Close Speed	N/A	N/A	N/A

COUNTER READING		
	AS FOUND	00663
	AS LEFT	00664

BLOWOUT COIL RESISTANCE (Ohms)	POLE 1	POLE 2	POLE 3	N/A
				☑

CONTACT MEASUREMENT (in inches)	POLE 1	POLE 2	POLE 3
Contact Gap	3.8	3.8	3.8125
Contact Erosion	.25	.25	.25

VACUUM BOTTLE INTEGRITY		POLE 1	POLE 2	POLE 3	N/A
Test kV					☑

COMMENTS: 1. Counter does not operate properly.

DEFICIENCIES:
1. Mechanism does not have any lubrication. What lubrication was there had dried and is no longer good. The mech was sprayed with lube so it would operate.
2. The manual closing jack assembly is not on site. Unable to perform slow closing of breaker.
3. The racking mechanism is missing parts and also the racking motor is missing.
4. Unable to verify any control wiring due to bad connections, relays not working properly and possible interlocks not found on drawing. Heater wiring is bad also.

TEST EQUIPMENT USED: 03-031 / 06-052 / 04-049 TESTED BY: BStark / WCauthen

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DEFICIENCIES:

5. Cell side bottles leaking. Recommend to replace.
6. Contact resistance is higher than expected for amperage of breaker. Insulation resistance is out of NETA specifications.

OVERCURRENT RELAY

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CUSTOMER: FSG Electric — PAGE: 9
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 — JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 — CMMS #:

DATE: 4/16/2015 — TEMPERATURE: 65 °F — HUMIDITY: 83 % — EQPT. LOCATION: North Lake Pump Station
SUBSTATION: Main — CIRCUIT ID: Main Transformer

NAMEPLATE DATA (PHASE RELAY / NEUTRAL RELAY)

	Phase Relay	Neutral Relay
Manuf.	General Electric	N/A
Model:	121AC53A3A	N/A
Type/Style Number.:	IAC	N/A
Pickup Range:	.5-2	N/A
Seal-In Range:	0.2-2	N/A
Inst. Range:	N/A	N/A
TCC. No.:	N/A	N/A
Serial:	N/A	N/A
Instruction Booklet:	GEH-1788	N/A
Devices Operated:	N/A	N/A
CT Ratio:	/	:5

VISUAL AND MECHANICAL INSPECTION

	Sat	Unsat	N/A	Note No.:		Sat	Unsat	N/A	Note No.:
COVER GASKET	○	◉	○		GLASS CLEANED	○	○	◉	
GLASS CONDITION	◉	○	○		CASE CLEANED	○	○	◉	
NO FOREIGN MATERIAL	○	◉	○		RELAY CLEANED	○	○	◉	
NO MOISTURE PRESENT	○	◉	○		CONNECTION TIGHTENED	○	○	◉	
SPIRAL SPRING	○	◉	○		TAPS TIGHTENED	○	○	◉	
BEARING ENDPLAY	○	◉	○		CONTACTS CLEANED	○	○	◉	
BEARING CONDITION	○	◉	○		INSULATION RESISTANCE	○	○	◉	
DISC CLEARANCE	○	◉	○		CT SHORTING BAR REMOVED	○	○	◉	
CHECK LEDs	○	○	◉			○	○	○	

RELAY SETTINGS

	TAP / TIME DIAL		INSTANTANEOUS		SEAL - IN	
	AS FOUND	AS LEFT	AS FOUND	AS LEFT	AS FOUND	AS LEFT
PHASE RELAY	3.5	3.5	N/A	N/A	.2	.2
NEU/GND RELAY	N/A	N/A	N/A	N/A	N/A	N/A

PICKUP TESTS

TEST AMPS	CURVE SPECS	A PHASE		B PHASE		C PHASE		NEUTRAL/GROUND	
PHASE / (NEUT / GRND)	PHASE / (NEUT / GRND)	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
PICKUP AMPS		1D	1D	1D	1D	1D	1D	N/A	N/A
Test / Amps @	/ sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Test / Amps @	/ sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Test / Amps @	/ sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Instantaneous Pick-up Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Instantaneous Drop-out Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Seal-in Pick-up Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Seal-in Drop-out Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Time Dial Zero Check		1D	1D	1D	1D	1D	1D	N/A	N/A
Targets		1D	1D	1D	1D	1D	1D	N/A	N/A

COMMENTS:
DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

TEST EQUIPMENT USED: 08-024 — TESTED BY: B.Hasley

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2425 E. Pioneer Drive
Irving, Texas 75061
1-888-SHERMCO
www.shermco.com

OVERCURRENT RELAY

CUSTOMER	FSG Electric	PAGE	10
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE 4/16/2015 TEMPERATURE 65 ℉ HUMIDITY 83 % EQPT. LOCATION North Lake Pump Station

SUBSTATION Main CIRCUIT ID Main Transformer

NAMEPLATE DATA (PHASE RELAY / NEUTRAL RELAY)

	Phase Relay	Neutral Relay
Manuf.	General Electric	N/A
Model:	I2PJC3ID89A	N/A
Type/Style Number.:	IAC	N/A
Pickup Range:	40-160	N/A
Seal-In Range:	0.2-2	N/A
Inst. Range:	N/A	N/A
TCC. No.:	N/A	N/A
Serial:	N/A	N/A
Instruction Booklet:	GEI-83903	N/A
Devices Operated:	N/A	N/A
CT Ratio:		:5

VISUAL AND MECHANICAL INSPECTION

	Sat	Unsat	N/A	Note No.:		Sat	Unsat	N/A	Note No.:
COVER GASKET	○	◉	○		GLASS CLEANED	○	○	◉	
GLASS CONDITION	◉	○	○		CASE CLEANED	○	○	◉	
NO FOREIGN MATERIAL	○	◉	○		RELAY CLEANED	○	○	◉	
NO MOISTURE PRESENT	○	◉	○		CONNECTION TIGHTENED	○	○	◉	
SPIRAL SPRING	○	◉	○		TAPS TIGHTENED	○	○	◉	
BEARING ENDPLAY	○	◉	○		CONTACTS CLEANED	○	○	◉	
BEARING CONDITION	○	◉	○		INSULATION RESISTANCE	○	○	◉	
DISC CLEARANCE	○	◉	○		CT SHORTING BAR REMOVED	○	○	◉	
CHECK LEDs	○	○	◉			○	○	○	

RELAY SETTINGS

RELAY SETTINGS	TAP / TIME DIAL		INSTANTANEOUS		SEAL - IN	
	AS FOUND	AS LEFT	AS FOUND	AS LEFT	AS FOUND	AS LEFT
PHASE RELAY	N/A	N/A	40-64	40-64	.2	.2
NEU/GND RELAY	N/A	N/A	N/A	N/A	N/A	N/A

PICKUP TESTS

TEST AMPS	CURVE SPECS	A PHASE		B PHASE		C PHASE		NEUTRAL/GROUND	
PHASE / (NEUT / GRND)	PHASE / (NEUT / GRND)	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
PICKUP AMPS		1D	1D	1D	1D	1D	1D	N/A	N/A
Test / Amps @	/ sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Test / Amps @	/ sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Test / Amps @	/ sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Instantaneous Pick-up Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Instantaneous Drop-out Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Seal-in Pick-up Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Seal-in Drop-out Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Time Dial Zero Check		1D	1D	1D	1D	1D	1D	N/A	N/A
Targets		1D	1D	1D	1D	1D	1D	N/A	N/A
Other									

COMMENTS:

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

TEST EQUIPMENT USED: 08-024 TESTED BY: B.Hasley

OVERCURRENT RELAY

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www.shermco.com

CUSTOMER: FSG Electric — PAGE: 11
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 — JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 — CMMS #:

DATE: 3/19/15 — TEMPERATURE: 76 °F — HUMIDITY: 85 % — EQPT. LOCATION: North Lake Pump Station
SUBSTATION: Main — CIRCUIT ID: Pump 1

NAMEPLATE DATA (PHASE RELAY / NEUTRAL RELAY)

	Phase Relay	Neutral Relay		Phase Relay	Neutral Relay		Phase Relay	Neutral Relay
Manuf.	General Electric	N/A	Model:	121AC66C1A	N/A	Type/Style Number.:	IAC	N/A
Pickup Range:	2.5-5	N/A	Seal-In Range:	0.2-2	N/A	Inst. Range:	10-40	N/A
TCC. No.:	N/A	N/A	Serial:	N/A	N/A	Instruction Booklet:	GEI-28818	N/A
Devices Operated:	52A	N/A	CT Ratio:		:5			

VISUAL AND MECHANICAL INSPECTION

	Sat	Unsat	N/A	Note No.:		Sat	Unsat	N/A	Note No.:
COVER GASKET	●	○	○		GLASS CLEANED	●	○	○	
GLASS CONDITION	●	○	○		CASE CLEANED	●	○	○	
NO FOREIGN MATERIAL	○	●	○		RELAY CLEANED	●	○	○	
NO MOISTURE PRESENT	○	●	○		CONNECTION TIGHTENED	●	○	○	
SPIRAL SPRING	○	●	○		TAPS TIGHTENED	●	○	○	
BEARING ENDPLAY	○	●	○		CONTACTS CLEANED	●	○	○	
BEARING CONDITION	○	●	○		INSULATION RESISTANCE	●	○	○	
DISC CLEARANCE	○	●	○		CT SHORTING BAR REMOVED	●	○	○	
CHECK LEDs	○	○	●			○	○	○	

RELAY SETTINGS

	TAP / TIME DIAL		INSTANTANEOUS		SEAL - IN	
	AS FOUND	AS LEFT	AS FOUND	AS LEFT	AS FOUND	AS LEFT
PHASE RELAY	4.5/4	4.5/4	35	35	2	2
NEU/GND RELAY	N/A	N/A	N/A	N/A	N/A	N/A

PICKUP TESTS

TEST AMPS PHASE / (NEUT / GRND)	CURVE SPECS PHASE / (NEUT / GRND)	A PHASE INITIAL	A PHASE FINAL	B PHASE INITIAL	B PHASE FINAL	C PHASE INITIAL	C PHASE FINAL	NEUTRAL/GROUND INITIAL	NEUTRAL/GROUND FINAL
PICKUP AMPS		1D	1D	1D	1D	1D	1D	N/A	N/A
Test 11.25 / N/A Amps @	26 / N/A sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Test 13.5 / N/A Amps @	22 / N/A sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Test 18 / N/A Amps @	18 / N/A sec.	1D	1D	1D	1D	1D	1D	N/A	N/A
Instantaneous Pick-up Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Instantaneous Drop-out Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Seal-in Pick-up Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Seal-in Drop-out Amps		1D	1D	1D	1D	1D	1D	N/A	N/A
Time Dial Zero Check		UNSAT	UNSAT	UNSAT	UNSAT	UNSAT	UNSAT	N/A	N/A
Targets		SAT	SAT	SAT	SAT	SAT	SAT	N/A	N/A
Other									

COMMENTS:
DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

TEST EQUIPMENT USED: 08-024 — TESTED BY: B.Hasley

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OVERCURRENT RELAY

CUSTOMER	FSG Electric	PAGE	12
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE 3/19/15 TEMPERATURE 76 °F HUMIDITY 85 % EQPT. LOCATION North Lake Pump Station

SUBSTATION Main CIRCUIT ID Pump 2

NAMEPLATE DATA (PHASE RELAY / NEUTRAL RELAY)

	(PHASE RELAY / NEUTRAL RELAY)		(PHASE RELAY / NEUTRAL RELAY)		(PHASE RELAY / NEUTRAL RELAY)
Manuf.	General Electric / N/A	Model:	121AC66C1A / N/A	Type/Style Number.:	IAC / N/A
Pickup Range:	2.5-5 / N/A	Seal-In Range:	0.2-2 / N/A	Inst. Range:	10-40 / N/A
TCC. No.:	N/A / N/A	Serial:	N/A / N/A	Instruction Booklet:	GEI-28818 / N/A
Devices Operated:	52A / N/A	CT Ratio:	/ :5		

VISUAL AND MECHANICAL INSPECTION

	Sat	Unsat	N/A	Note No.:		Sat	Unsat	N/A	Note No.:
COVER GASKET	●	○	○		GLASS CLEANED	●	○	○	
GLASS CONDITION	●	○	○		CASE CLEANED	●	○	○	
NO FOREIGN MATERIAL	○	●	○		RELAY CLEANED	●	○	○	
NO MOISTURE PRESENT	○	●	○		CONNECTION TIGHTENED	●	○	○	
SPIRAL SPRING	○	●	○		TAPS TIGHTENED	●	○	○	
BEARING ENDPLAY	○	●	○		CONTACTS CLEANED	●	○	○	
BEARING CONDITION	○	●	○		INSULATION RESISTANCE	●	○	○	
DISC CLEARANCE	○	●	○		CT SHORTING BAR REMOVED	●	○	○	
CHECK LEDs	○	○	●			○	○	○	

RELAY SETTINGS	TAP / TIME DIAL		INSTANTANEOUS		SEAL - IN	
	AS FOUND	AS LEFT	AS FOUND	AS LEFT	AS FOUND	AS LEFT
PHASE RELAY	4.5/4	4.5/4	35	35	2	2
NEU/GND RELAY	N/A	N/A	N/A	N/A	N/A	N/A

PICKUP TESTS

TEST AMPS	CURVE SPECS	A PHASE		B PHASE		C PHASE		NEUTRAL/GROUND	
PHASE / (NEUT / GRND)	PHASE / (NEUT / GRND)	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL	INITIAL	FINAL
PICKUP AMPS		3.1	3.1	2.8	2.8	3.8	3.8	N/A	N/A
Test 11.25 / N/A Amps @	26 / N/A sec.	36.8	36.8	32.1	32.1	47.6	47.6	N/A	N/A
Test 13.5 / N/A Amps @	22 / N/A sec.	32.3	32.3	30.5	30.5	42.3	42.3	N/A	N/A
Test 18 / N/A Amps @	18 / N/A sec.	15.6	15.6	26.8	26.8	24.6	24.6	N/A	N/A
Instantaneous Pick-up Amps		39	39	38	38	37.6	37.6	N/A	N/A
Instantaneous Drop-out Amps		33	33	32	32	31.5	31.5	N/A	N/A
Seal-in Pick-up Amps		2.0	2.0	2.0	2.0	2.10	2.10	N/A	N/A
Seal-in Drop-out Amps		1.3	1.3	1.2	1.2	1.2	1.2	N/A	N/A
Time Dial Zero Check		UNSAT	UNSAT	UNSAT	UNSAT	UNSAT	UNSAT	N/A	N/A
Targets		SAT	SAT	SAT	SAT	SAT	SAT	N/A	N/A
Other									

COMMENTS:

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

TEST EQUIPMENT USED: 08-024 TESTED BY: B.Hasley

OVERCURRENT RELAY

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CUSTOMER: FSG Electric — PAGE: 13
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 — JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 — CMMS #:

DATE: 3/19/15 — TEMPERATURE: 76 °F — HUMIDITY: 85 % — EQPT. LOCATION: North Lake Pump Station
SUBSTATION: Main — CIRCUIT ID: Pump 3

NAMEPLATE DATA (PHASE RELAY / NEUTRAL RELAY)

Manuf.:	General Electric / N/A	Model:	121AC66C1A / N/A	Type/Style Number.:	IAC / N/A
Pickup Range:	2.5-5 / N/A	Seal-In Range:	0.2-2 / N/A	Inst. Range:	10-40 / N/A
TCC. No.:	N/A / N/A	Serial:	N/A / N/A	Instruction Booklet:	GEI-28818 / N/A
Devices Operated:	52A / N/A	CT Ratio:	/ :5		

VISUAL AND MECHANICAL INSPECTION

Item	Sat	Unsat	N/A	Note No.:	Item	Sat	Unsat	N/A	Note No.:
COVER GASKET	●	○	○		GLASS CLEANED	●	○	○	
GLASS CONDITION	●	○	○		CASE CLEANED	●	○	○	
NO FOREIGN MATERIAL	○	●	○		RELAY CLEANED	●	○	○	
NO MOISTURE PRESENT	○	●	○		CONNECTION TIGHTENED	●	○	○	
SPIRAL SPRING	○	●	○		TAPS TIGHTENED	●	○	○	
BEARING ENDPLAY	○	●	○		CONTACTS CLEANED	●	○	○	
BEARING CONDITION	○	●	○		INSULATION RESISTANCE	●	○	○	
DISC CLEARANCE	○	●	○		CT SHORTING BAR REMOVED	●	○	○	
CHECK LEDs	○	○	●			○	○	○	

RELAY SETTINGS

	TAP / TIME DIAL		INSTANTANEOUS		SEAL - IN	
	AS FOUND	AS LEFT	AS FOUND	AS LEFT	AS FOUND	AS LEFT
PHASE RELAY	4.5/4	4.5/4	35	35	2	2
NEU/GND RELAY	N/A	N/A	N/A	N/A	N/A	N/A

PICKUP TESTS

TEST AMPS PHASE / (NEUT / GRND)	CURVE SPECS PHASE / (NEUT / GRND)	A PHASE INITIAL	A PHASE FINAL	B PHASE INITIAL	B PHASE FINAL	C PHASE INITIAL	C PHASE FINAL	NEUTRAL/GROUND INITIAL	NEUTRAL/GROUND FINAL
PICKUP AMPS		3.2	3.2	2.8	2.8	3.8	3.8	N/A	N/A
Test 11.25 / N/A Amps @	26 / N/A sec.	20.04	20.04	14.52	14.52	10.86	10.86	N/A	N/A
Test 13.5 / N/A Amps @	22 / N/A sec.	17.52	17.52	17.92	17.92	12.56	12.56	N/A	N/A
Test 18 / N/A Amps @	18 / N/A sec.	14.47	14.47	14.63	14.63	13.21	13.21	N/A	N/A
Instantaneous Pick-up Amps		39	39	38	38	37.6	37.6	N/A	N/A
Instantaneous Drop-out Amps		33	33	32	32	31.5	31.5	N/A	N/A
Seal-in Pick-up Amps		2.0	2.0	2.0	2.0	2.10	2.10	N/A	N/A
Seal-in Drop-out Amps		1.6	1.6	1.6	1.6	1.5	1.5	N/A	N/A
Time Dial Zero Check		UNSAT	UNSAT	UNSAT	UNSAT	UNSAT	UNSAT	N/A	N/A
Targets		SAT	SAT	SAT	SAT	SAT	SAT	N/A	N/A
Other									

COMMENTS:

DEFICIENCIES: 1D. RELAY WILL NOT PRODUCE CONSISTANT RESULTS DUE TO CORROSION. RELAY RED TAGGED AND RECOMMEND REPLACING.

TEST EQUIPMENT USED: 08-024 — TESTED BY: B.Hasley

Shermco Industries, Inc
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PROTECTIVE RELAY

CUSTOMER: FSG Electric | PAGE: 14
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 | JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 | CMMS #:

DATE: 3/19/15 | TEMPERATURE: 76 °F | HUMIDITY: 85 % | EQPT. LOCATION:
SUBSTATION: Main Incoming | CIRCUIT ID: Undervoltage Relay

NAMEPLATE INFORMATION

MANUFACTURER: General Electric	INSTRUCTIONS: GEH-1755	
TYPE: HFA	PARTS BULLETIN: GEF-2757	SERIAL: N/A
MODEL: 12HFA11A44E	CURVE NO.:	
RANGE: 85-	OTHER:	

VISUAL & MECHANICAL INSPECTION	Sat	Unsat	N/A	Note No.:		Sat	Unsat	N/A	Note No.:
COVER GASKET OK	●	○	○		GLASS CLEANED	●	○	○	
GLASS CONDITION OK	●	○	○		CASE CLEANED	○	●	○	
NO FOREIGN MATERIAL	○	●	○		RELAY CLEANED	○	●	○	
NO MOISTURE PRESENT	○	●	○		CONNECTION TIGHTENED	●	○	○	
SPIRAL SPRING OK	○	○	●		TAPS TIGHTENED	●	○	○	
BEARING ENDPLAY OK	○	○	●		CONTACTS CLEANED	●	○	○	
BEARING CONDITION OK	○	○	●		INSULATION RESISTANCE	○	●	○	
DISC CLEARANCE OK	○	○	●		CT SHORTING BAR REMOVED	●	○	○	
CHECK LEDs	○	○	●			○	○	○	

SETTINGS

	Initial	Final
UNDERVOLTAGE PICKUP	1D	1D
UNDERVOLTAGE TIME DELAY	1D	1D

TEST RESULTS

	Initial	Final
UNDERVOLTAGE PICKUP	1D	1D
UNDERVOLTAGE TIME	1D	1D

COMMENTS:

DEFICIENCIES: 1D. RELAY NOT TESTED DUE TO BURNT WIRE GOING TO SOLENOID FAILING AND DAMGING THE RELAY. RELAY HAS BEEN EXPOSED TO EXTREME MOISTURE AND WILL NOT SLIDE OUT OF THE CASE. RELAY RED TAGGED AND RECOMMEND REPLACING.

TEST EQUIPMENT USED: 08-024 | TESTED BY: B.Hasley

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Irving, Texas 75061
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DISTRIBUTION SWITCHGEAR DATASHEET

CUSTOMER FSG Electric | PAGE 15

ADDRESS 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 | JOB # 82000030

USER North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 | CMMS #

DATE ______ TEMPERATURE ______ ℉ HUMIDITY ______ % EQPT. LOCATION ______

SUBSTATION Main | CIRCUIT ID Switchgear

GENERAL INFORMATION

MANUFACTURER ______ SERIAL NO. ______ DWGS. ______

VOLTAGE CLASS ______ TYPE ______

CONSISTING OF: ______ TOTAL BREAKERS ______ TOTAL INSTRUMENTS ______ TOTAL RELAYS

Visual and Mechanical Inspection	Sat	Unsat	N/A	Note No.:
COMPARE NAMEPLATE DATA WITH DRAWINGS AND SPECIFICATIONS				
INSPECT PHYSICAL AND MECHANICAL CONDITION				
INSPECT ANCHORAGE, ALIGNMENT, GROUNDING AND CLEARANCES				
UNIT IS CLEAN. NO LOOSE PARTS. SHIPPING BRACES AND DOCUMENTATION REMOVED				
VERIFY FUSE AND BREAKER SIZES CORRESPOND TO DRAWINGS AND COORDINATION STUDY				
VERIFY CURRENT AND VOLTAGE TRANSFORMER RATIOS CORRESPOND TO DRAWINGS				
INSPECT BOLTED CONNECTIONS BY DLRO, TORQUE WRENCH OR INFRARED SURVEY				
CONFIRM OPERATION AND SEQUENCE OF ELECTRICAL AND MECHANICAL INTERLOCKS				

Visual and Mechanical Inspection			
VERIFY APPROPRIATE LUBRICATION OF CURRENT-CARRYING AND MECHANICAL PARTS			
INSPECT INSULATORS FOR PHYSICAL DAMAGE AND CONTAMINATION			
VERIFY BARRIER AND SHUTTER INSTALLATION AND OPERATION			
EXERCISE ALL ACTIVE COMPONENTS			
INSPECT MECHANICAL INDICATING DEVICES FOR PROPER OPERATION			
VERIFY THAT FILTERS ARE IN PLACE AND VENTS ARE CLEAR			
VISUAL AND MECHANICAL INSPECTION OF INSTRUMENT TRANSFORMERS			
INSPECT CONTROL POWER TRANSFORMERS			

INSULATION RESISTANCE

BUS SECTION	RESISTANCE IN MEGOHMS @ ______ KVDC									
	A-B	B-C	C-A	A-NEU.	B-NEU.	C-NEU.	A-GND	B-GND	C-GND	N-GND
	11200	11100	10200				3450	5720	4570	

OVERPOTENTIAL TEST

BUS SECTION	READINGS IN MICROAMPS @ ______ KVAC									
	A-B	B-C	C-A	A-NEU.	B-NEU.	C-NEU.	A-GND	B-GND	C-GND	N-GND

BUS CONNECTIONS

BUS SECTION		RESISTANCE IN MICRO-OHMS				
FROM	TO	A	B	C	N	G

COMMENTS: 1. Unable to verify control wiring due to added jumpers, cut wires and bad connections due to corrosion.

DEFICIENCIES: 1. Gasket material has degraded and does not keep water and dirt from getting into switchgear.
2. Kirk Lock for PT drawer had to be destroyed to be able to get into PT drawer.

TEST EQUIPMENT USED: ______ TESTED BY: ______

TRANSFORMER
(M4000)

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CUSTOMER	FSG Electric	PAGE	16
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE	3/17/2015	TEMPERATURE	75 °F	HUMIDITY	40 %	EQPT. LOCATION	North Lake Pump Station
SUBSTATION	Main					CIRCUIT ID	Main Transformer

NAMEPLATE INFORMATION

Manufacturer: Westinghouse	Impedance (%): 7.1 — Indoor ◉ Outdoor ○
Xfmr. Type: SL	Top Oil Temperature (℃): 25
Serial No.: PCR-94421	Winding (℃): 22
High Voltage: 136800	Winding Configuration: Wye-Wye
Low Voltage: 4160	Class: OA
Rating (kVA): 3750 / 4200	Main Tank: ◉ Mineral Oil ○ N/A ○ Silicone ○ Other; Gallons 3,136 — LTC Tank: ○ Mineral Oil ◉ N/A ○ Silicone ○ Other; Gallons 0

INSULATION POWER FACTOR TEST RESULTS

Test No.	INSUL.	WINDING ENERGIZED	WINDING GROUND	WINDING GUARD	Test kV	Milliamps	Watts	% Power Factor Measured	Corr. 20°C (Correction Factor 0.99)	Insulation Rating	Capacitance (Picofarads)
1	CH + CHL	High	Low		10	17.327	0.532				4,596
2	CH	High		Low	10	8.877	0.347	0.39	0.39	B	2,354.5
3	CHL (UST)	CHL Direct		H - L	10	8.446	0.193	0.23	0.23	B	2,240.4
4	CHL	Calculated Results				8.450	0.185	0.22	0.22		2,241.5
5	CL + CHL	Low	High		2	28.471	0.898				7,552.1
6	CL	Low		High	2	20.023	0.711	0.36	0.35	B	5,311.1
7	CHL (UST)	CHL Direct		L - H	2	8.450	0.193	0.23	0.23	B	2,241.4
8	CHL	Calculated Results				8.448	0.187	0.22	0.22		2,241

EXCITATION RESULTS

DETC Position	LTC Position	kV	A Phase H1 – H0 (Milliamps)	B Phase H2 – H0 (Milliamps)	C Phase H3 – H0 (Milliamps)	Rating
2		10	8.768	6.480	9.322	G

VISUAL AND MECHANICAL INSPECTION

	Good	Fair	Poor	Explain
Fans	○	○	○	N/A
Paint	○	◉	○	
Connections	◉	○	○	
Grounds	◉	○	○	
Controls	○	○	○	
Control Voltage ____ Volts				

Leaks: ○ Gas ○ Air ◉ Liquid ○ None Detected — Describe: Bushings, Radiator

TEST EQUIPMENT USED: 17-002 / 04-049 / 18-014 / 22-006 — TESTED BY: BStark / WCauthen

Circuit ID: Main Transformer	Serial No: PCR-94421

BUSHING NAMEPLATE

	Manufacturer	Type	Class	Cat. No.	kV	Year
High Side	Westinghouse	O			115	1966
Low Side	Westinghouse	O			23	1966
Neutral	Westinghouse	O			23	1966

ARRESTER NAMEPLATE

	Manufacturer	Type	Class	Cat. No.	kV	Year
High Side						
Low Side						

TEST RESULTS

	Number	Bushing/ Arrester Serial No.	Test kV	Milliamps	Watts	% Power Factor Measured	% Power Factor Corr. 20°C (Correction Factor 1.00)	Nameplate Pwr Factor	Nameplate Picofarads	Measured Picofarads	Insulation
Bushings	H1	3	10	1.305	5.21	39.92	39.92	0.5	347	314.39	B
	H2	2	10	1.291	0.121	0.94	0.94	0.49	345	342.4	D
	H3	1	10				0	0.49	346		
	H0	0-1	10	1.008	0.048	0.48	0.48	0.5	244	267.44	D
	H0	C2 Tap	0.5	4.037	0.246	0.61	0.61			1,070.7	G
	X2						0				
	X3						0				
	X0						0				
Arresters	H1										
	H2										
	H3										
	X1										
	X2										
	X3										

RATIO TEST RESULTS

Tap No.	Found	Left	High / Low Voltage	Voltage Ratio	H1 – H0 X1 – X0	H2 – H0 X2 – X0	H3 – H0 X3 – X0
2	2	2	136800 / 4160	32.8846	32.99700	32.97600	32.99400

INSULATION RESISTANCE TEST RESULTS (IN MEGOHMS)

Test	kV	0.5 Min.	1 Min.	2 Min.	5 Min.	10 Min.	DAR	P.I.
H - L + G	5							
L - H + G	2.5							
T - L - G								

COIL TEST RESULTS (IN OHMS)

Winding Temp. (Degrees C)	Tap	H1 – H0	H2 – H0	H3 – H0	X1 – X0	X2 – X0	X3 – X0
22	2	15.588	15.613	15.591	.009791	.00973	.00970

Core Ground @ 500 VDC: N/A **Megohms**

Main Tank Ground Strap: Satisfactory ◉ Unsatisfactory ○

Remove a sample of insulating liquid:

Main Tank: DGA ◉ LQS ◉

LTC Tank: DGA ○ LQS ○

High Side Isolated ◉

Low Side Isolated ◉

X0 Isolated Only ○

COMMENTS: 1. Low side arresters not tested. X3 arrester is broken.

DEFICIENCIES:
1. Winding resistance on High side is higher than normal.
2. Bushings tested do not meet NETA specifications.
3. The winding to ground insulation has exceeded three times the maximum Good Rating limit. This could be 1. Contamination and/or deterioration of the bushing insulation. 2. Excessive surface leakage over the porcelain. Due to the age and the unknown issues Shermco recommends to replace the transformer.

TRANSFORMER DATA SHEET

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CUSTOMER	FSG Electric	PAGE	18
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE 4/15/2015 TEMPERATURE 70 ℉ HUMIDITY 63 % EQPT. LOCATION North Lake Pump Station

SUBSTATION Main CPT's CIRCUIT ID Center CPT

NAMEPLATE INFORMATION

Manufacturer:	Allis-Chalmers	Impedance (%):	2.4 (Indoor ○ / Outdoor ◉)
Xfmr. Type:	(PBSR) Pole Mount	Top Oil Temperature (℃):	15
Serial No.:	2088315	Winding (℃):	15
High Voltage:	4160	Winding Configuration:	Single Phase
Low Voltage:	120 / 240	Class:	OA (Distribution)
Rating (kVA):	15	Main Tank: ◉ Mineral Oil ○ N/A ○ Silicone ○ Other; Gallons 13	LTC Tank: ○ Mineral Oil ◉ N/A ○ Silicone ○ Other; Gallons

RATIO TEST RESULTS

Tap No.	Found	Left	High / Low Voltage	Voltage Ratio	H1 – H2 / X1 – X3	H1 – H2 / X2 – X3	H1 – H2 / X1 – X2
			2400 / 240	10 : 1	9.908		
			2400 / 120	20 : 1		19.925	19.922
				:			
				:			
				:			
				:			
				:			

INSULATION RESISTANCE TEST RESULTS (IN MEGOHMS)

Test	kV	0.5 Min.	1 Min.	2 Min.	5 Min.	10 Min.	DAR	P.I.
H - L + G	2.5		94.8					
L - H + G	0.5		315					

COIL TEST RESULTS (IN OHMS)

Winding Temp. (Degrees C)	Tap	H3 – H1	H1 – H2	H2 – H3	X0 – X1	X0 – X2	X0 – X3
N/A	N/A	0	0	0	0	0	0

VISUAL & MECHANICAL INSPECTION

	Good	Fair	Poor	Explain
Fans	○	○	○	N/A
Paint	○	◉	○	
Connections	◉	○	○	
Grounds	◉	○	○	
Controls	○	○	○	N/A
Control Voltage ______ Volts				N/A

Leaks: ○ Gas ○ Air ○ Liquid ◉ None Detected Describe:

Core Ground @ 500 VDC: ______ Megohms

High Side Isolated ○
Low Side Isolated ◉
X0 Isolated Only ○

Remove a sample of insulating liquid:
Main Tank: DGA ○ LQS ○
LTC Tank: DGA ○ LQS ○

Main Tank Ground Strap:
Satisfactory ◉
Unsatisfactory ○

COMMENTS:
1. Cable from switchgear and all three transformers included on insulation resistance test H-L+G.
2. Fuse Info:GE, Type:EJ-1, CAT#6193404, Nom Volts: 4800, Amp:1.0E, Size C, INST:GE-10951, Max DES Volts:5500
3. Fuse Resistance 1.1,

DEFICIENCIES:
1. Low side cables insulation is coming off.
2. Insulation resistance does not meet NETA specifications.

TEST EQUIPMENT USED: 04-049 / 18-014 TESTED BY: BStark / WCauthen

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TRANSFORMER DATA SHEET

CUSTOMER	FSG Electric	PAGE	19
ADDRESS	2525 Walnut Hill Lane; Suite 100; Dallas TX 75229	JOB #	82000030
USER	North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119	CMMS #	

DATE 4/15/2015 TEMPERATURE 70 °F HUMIDITY 63 % EQPT. LOCATION North Lake Pump Station

SUBSTATION Main CPT's CIRCUIT ID East CPT

NAMEPLATE INFORMATION

Manufacturer:	Allis-Chalmers	Impedance (%):	2.4 (Indoor ○ / Outdoor ◉)
Xfmr. Type:	(PBSR) Pole Mount	Top Oil Temperature (℃):	15
Serial No.:	2015626	Winding (℃):	15
High Voltage:	4160	Winding Configuration:	Single Phase
Low Voltage:	120 / 240	Class:	OA (Distribution)
Rating (kVA):	15	Main Tank: ◉ Mineral Oil ○ N/A ○ Silicone ○ Other ____ Gallons: 15	LTC Tank: ○ Mineral Oil ◉ N/A ○ Silicone ○ Other ____ Gallons:

RATIO TEST RESULTS

Tap No.	Found	Left	High / Low Voltage	Voltage Ratio	H1 – H2 X1 – X3	H1 – H2 X2 – X3	H1 – H2 X1 – X2
			2400 / 240	10 : 1	10.022		
			2400 / 120	20 : 1		20.049	20.05
				:			
				:			
				:			
				:			
				:			

INSULATION RESISTANCE TEST RESULTS (IN MEGOHMS)

Test	kV	0.5 Min.	1 Min.	2 Min.	5 Min.	10 Min.	DAR	P.I.
H - L + G	2.5		94.8					
L - H + G	0.5		95.8					

COIL TEST RESULTS (IN OHMS)

Winding Temp. (Degrees C)	Tap	H3 – H1	H1 – H2	H2 – H3	X0 – X1	X0 – X2	X0 – X3
N/A	N/A	0	0	0	0	0	0

VISUAL & MECHANICAL INSPECTION

	Good	Fair	Poor	Explain
Fans	○	○	○	N/A
Paint	○	◉	○	
Connections	◉	○	○	
Grounds	◉	○	○	
Controls	○	○	○	N/A
Control Voltage ____ Volts				N/A

Leaks: ○ Gas ○ Air ○ Liquid ◉ None Detected Describe:

Core Ground @ 500 VDC: ______ Megohms

High Side Isolated ○
Low Side Isolated ◉
X0 Isolated Only ○

Remove a sample of insulating liquid:
Main Tank: DGA ○ LQS ○
LTC Tank: DGA ○ LQS ○

Main Tank Ground Strap:
Satisfactory ◉
Unsatisfactory ○

COMMENTS: 1. Cable from switchgear and all three transformers included on insulation resistance test H-L+G.

DEFICIENCIES:
1. Low side cables insulation is coming off.
2. X1 bushing was found loose.
3. Insulation resistance does not meet NETA specifications.

TEST EQUIPMENT USED: 04-049 / 18-014 TESTED BY: BStark / WCauthen

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TRANSFORMER DATA SHEET

CUSTOMER: FSG Electric — PAGE: 20
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 — JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 — CMMS #:

DATE: 4/15/2015 — TEMPERATURE: 70 ℉ — HUMIDITY: 63 % — EQPT. LOCATION: North Lake Pump Station
SUBSTATION: Main CPT's — CIRCUIT ID: West CPT

NAMEPLATE INFORMATION

Manufacturer:	Allis-Chalmers	Impedance (%):	2.6 (Indoor ○ / Outdoor ◉)
Xfmr. Type:	(PBSR) Pole Mount	Top Oil Temperature (℃):	15
Serial No.:	1910124	Winding (℃):	15
High Voltage:	4160	Winding Configuration:	Single Phase
Low Voltage:	120 / 240	Class:	OA (Distribution)
Rating (kVA):	15	Main Tank: ◉ Mineral Oil ○ N/A ○ Silicone ○ Other; Gallons: 15	LTC Tank: ○ Mineral Oil ◉ N/A ○ Silicone ○ Other; Gallons:

RATIO TEST RESULTS

Tap No.	Found	Left	High / Low Voltage	Voltage Ratio	H1 – H2 / X1 – X3	H1 – H2 / X2 – X3	H1 – H2 / X1 – X2
			2400 / 240	10 : 1	10.027		
			2400 / 120	20 : 1		20.092	20.048
				:			
				:			
				:			
				:			
				:			

INSULATION RESISTANCE TEST RESULTS (IN MEGOHMS)

Test	kV	0.5 Min.	1 Min.	2 Min.	5 Min.	10 Min.	DAR	P.I.
H - L + G	2.5		94.8					
L - H + G	0.5		227					

COIL TEST RESULTS (IN OHMS)

Winding Temp. (Degrees C)	Tap	H3 – H1	H1 – H2	H2 – H3	X0 – X1	X0 – X2	X0 – X3
N/A	N/A	0	0	0	0	0	0

VISUAL & MECHANICAL INSPECTION

	Good	Fair	Poor	Explain
Fans	○	○	○	N/A
Paint	○	◉	○	
Connections	◉	○	○	
Grounds	◉	○	○	
Controls	○	○	○	N/A
Control Voltage ____ Volts				N/A

Leaks: ○ Gas ○ Air ○ Liquid ◉ None Detected Describe:

Core Ground @ 500 VDC: ______ Megohms

High Side Isolated ○
Low Side Isolated ◉
X0 Isolated Only ○

Remove a sample of insulating liquid:
Main Tank: DGA ○ LQS ○
LTC Tank: DGA ○ LQS ○

Main Tank Ground Strap:
Satisfactory ◉
Unsatisfactory ○

COMMENTS: 1. Cable from switchgear and all three transformers included on insulation resistance test H-L+G.

DEFICIENCIES:
1. Low side cables insulation is coming off.
2. Insulation resistance does not meet NETA specifications.

TEST EQUIPMENT USED: 04-049 / 18-014 — TESTED BY: BStark / WCauthen

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INSTRUMENT TRANSFORMERS
VOLTAGE TRANSFORMERS

CUSTOMER: FSG Electric — PAGE: 21
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 — JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 — CMMS #:

DATE: 4/16/2015 — TEMPERATURE: 65 °F — HUMIDITY: 84 % — EQPT. LOCATION:
SUBSTATION: Main — CIRCUIT ID: Incoming PT's

NAMEPLATE DATA

Manufacturer: General Electric — Type: E-22 — Class: Unknown
Style/Catalog No: 582X73 — B.I.L.: Unknown — Ratio: 35:1
Primary Voltage: 4200 — VA Rating: 200 — Accuracy Class: Unknown — Other Data: Model #3127404-134

PRIMARY FUSE DATA

Manufacturer: General Electric
Type: EJ-1 — Class:
Voltage: 4800 — Amps: .5 E
Inter. Rating:
Other Data: Cat #6293011G11

SECONDARY FUSE DATA

Manufacturer: N/A
Type: — Class:
Voltage: — Amps:
Inter. Rating:
Other Data:

VISUAL AND MECHANICAL INSPECTION

Item	Sat	Unsat	N/A	Note No.:
Compare nameplate data with drawings and specifications.**	○	○	◉	
Inspect physical and mechanical condition.	◉	○	○	
Verify correct connection of transformers with system requirements.**	○	○	◉	
Verify that adequate clearances exist between primary and secondary circuit wiring.**	○	○	◉	
Verify all required grounding.	◉	○	○	
Clean unit prior to testing unless as found and as left tests are required.***	◉	○	○	
Inspect all bolted electrical connections for high resistance using one of the following methods:	◉	○	○	

○ Low Resistance Ohmmeter — ◉ Torque Wrench — ○ Thermographic Survey

**Acceptance Testing Only — ***Maintenance Testing Only

ELECTRICAL TESTS

Fuse Resistance Measurements (microhms)	Primary H1	Primary H2	Secondary to Ground X1	Secondary to Ground X2
	2.79	2.77		

Circuit Burden Test (Optional)	Applied Voltage	Measured Amps	Calc. Impedance
	N/A	N/A	N/A

Ratio and Polarity	P.T. Identification	P.T. Secondary Taps	Nameplate Ratio	Measured Ratio	Polarity Primary	Polarity Secondary
	C813595	X1-X2	35:1	35.141	H1	X1

Insulation Resistance (Megohms)	@ KVDC	Prim. - Sec.	Prim. - Gnd.	@ KVDC Sec.	Sec. - Gnd.
	2.5	10700	10700	.5	176

ELECTRICAL TESTS

Fuse Resistance Measurements (microhms)	Primary H1	Primary H2	Secondary to Ground X1	Secondary to Ground X2
	2.75	2.79		

Circuit Burden Test (Optional)	Applied Voltage	Measured Amps	Calc. Impedance
	N/A	N/A	N/A

Ratio and Polarity	P.T. Identification	P.T. Secondary Taps	Nameplate Ratio	Measured Ratio	Polarity Primary	Polarity Secondary
	C808654	X1-X2	35:1	35.175	H1	X1

Insulation Resistance (Megohms)	@ KVDC	Prim. - Sec.	Prim. - Gnd.	@ KVDC Sec.	Sec. - Gnd.
	2.5	10700	10700	.5	176

COMMENTS:
DEFICIENCIES:

TEST EQUIPMENT USED: 04-049 / 18-014 — TESTED BY: BStark / WCauthen

INSTRUMENT TRANSFORMERS
VOLTAGE TRANSFORMERS

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CUSTOMER: FSG Electric — PAGE: 22
ADDRESS: 2525 Walnut Hill Lane; Suite 100; Dallas TX 75229 — JOB #: 82000030
USER: North Lake Pump Station; 14001 S Northlake Rd; Coppell TX 75119 — CMMS #:

DATE: 4/16/2015 — TEMPERATURE: 65 °F — HUMIDITY: 84 % — EQPT. LOCATION: North Lake Pump Station
SUBSTATION: Metering PT's — CIRCUIT ID: Metering PT's

NAMEPLATE DATA

Manufacturer: General Electric — Type: JVW-3 — Class: Unknown
Style/Catalog No: 763X30G1 — B.I.L.: 60 — Ratio: 20:1
Primary Voltage: 2400 — VA Rating: 750 — Accuracy Class: .3 — Other Data: GEH-230

PRIMARY FUSE DATA

Manufacturer:
Type: — Class:
Voltage: 4800 — Amps:
Inter. Rating:
Other Data:

SECONDARY FUSE DATA

Manufacturer:
Type: — Class:
Voltage: — Amps:
Inter. Rating:
Other Data:

VISUAL AND MECHANICAL INSPECTION

Item	Sat	Unsat	N/A	Note No.:
Compare nameplate data with drawings and specifications.**	○	○	◉	
Inspect physical and mechanical condition.	◉	○	○	
Verify correct connection of transformers with system requirements.**	○	○	◉	
Verify that adequate clearances exist between primary and secondary circuit wiring.**	○	○	◉	
Verify all required grounding.	◉	○	○	
Clean unit prior to testing unless as found and as left tests are required.***	◉	○	○	
Inspect all bolted electrical connections for high resistance using one of the following methods:	◉	○	○	

○ Low Resistance Ohmmeter ◉ Torque Wrench ○ Thermographic Survey

**Acceptance Testing Only ***Maintenance Testing Only

ELECTRICAL TESTS

Fuse Resistance Measurements (microhms)	Primary H1	Primary H2	Secondary to Ground X1	Secondary to Ground X2
	.30			

Circuit Burden Test (Optional)	Applied Voltage	Measured Amps	Calc. Impedance
	N/A	N/A	N/A

Ratio and Polarity	P.T. Identification	P.T. Secondary Taps	Nameplate Ratio	Measured Ratio	Polarity Primary	Polarity Secondary
	5483571	X1-X2	20:1	19.97	H1	X1

Insulation Resistance (Megohms)	@ KVDC	Prim. - Sec.	Prim. - Gnd.	@ KVDC Sec.	Sec. - Gnd.
	2.5			1	338

ELECTRICAL TESTS

Fuse Resistance Measurements (microhms)	Primary H1	Primary H2	Secondary to Ground X1	Secondary to Ground X2
	.30			

Circuit Burden Test (Optional)	Applied Voltage	Measured Amps	Calc. Impedance
	N/A	N/A	N/A

Ratio and Polarity	P.T. Identification	P.T. Secondary Taps	Nameplate Ratio	Measured Ratio	Polarity Primary	Polarity Secondary
	5483719	X1-X2	20:1	19.963	H1	X1

Insulation Resistance (Megohms)	@ KVDC	Prim. - Sec.	Prim. - Gnd.	@ KVDC Sec.	Sec. - Gnd.
	2.5			1	338

ELECTRICAL TESTS

Fuse Resistance Measurements (microhms)	Primary H1	Primary H2	Secondary to Ground X1	Secondary to Ground X2

Circuit Burden Test (Optional)	Applied Voltage	Measured Amps	Calc. Impedance
	N/A	N/A	N/A

Ratio and Polarity	P.T. Identification	P.T. Secondary Taps	Nameplate Ratio	Measured Ratio	Polarity Primary	Polarity Secondary
	5483576	X1-X2	20:1	19.965	H1	X1

Insulation Resistance (Megohms)	@ KVDC	Prim. - Sec.	Prim. - Gnd.	@ KVDC Sec.	Sec. - Gnd.
	2.5			1	338

COMMENTS: 1. Fuse Holder S&C SMU-20
DEFICIENCIES: 1. Secondary wiring is very corroded. Wiring compartment is wet.

TEST EQUIPMENT USED: 04-049 / 18-014 — TESTED BY: BStark / WCauthen

Oil Samples

Shermco industries

One Line. One Company.

Houston Service Center 33002 FM 2004 Angleton, Texas 77515 p. 979.848.1406 f. 979.848.0012 houston@shermco.com

OIL SAMPLE REPORT

CUSTOMER DATA

Customer:	FSG Electric	**Shop Order#:**	5-5357-05	**Equip ID**	Main XFMR
	2525 Walnut Hill Lane	**Customer PO#:**	30P 199008	**Location**	Northlake PS
	Suite 100	**Serial#**	PCR-94421	**Imp. (% Z)**	7.1
	Dallas	**Received Date:**	3/19/2015	**Gallons**	3136
	Tx 75229	**Reported Date:**	3/23/2015	**Primary Voltage kV**	136.8
Contact:	JERRY BEAVERS	**Phase**	3 Phase	**KVA:**	3750/4200
Phone:	(214) 357-5697 **EXT**	**Tank**	Transformer	**Mfg.**	Westinghouse
Cell:	(214) 837-1731	**Breathing**	Sealed	**Fluid**	Mineral Oil
FAX:	(214) 357-5794	**E-Mail:**	jerrtb@fsgi.com	**Voltage Class**	>69kV - <230kV

SAMPLE DATA

Date Sampled:	3/18/2015
Oil Temp (C):	22
Hydrogen (H2):	5
Methane (CH4):	1
Ethane (C2H6):	6
Ethylene (C2H4):	0
Acetylene (C2H2):	0
Carbon Monoxide (CO):	12
Carbon Dioxide (CO2):	543
Nitrogen (N2):	82412
Oxygen (O2):	15024
Tot Dissolved Gas:	98007
Tot Dissolved Combustible Gas:	24
Equivalent TCG %:	0.01
Moisture PPM:	11.2
Interfacial Tension (dynes/cm):	34.4
Acid Number (mg KH/g):	.01
Color Number (Relative):	1.0
Visual Exam (Relative):	Yellow
Sediment Exam (Relative):	ND
Dielectric Breakdown (kV):	
Dielectric Breakdown 1 mm (kV mm-C):	40.4
Dielectric Breakdown 2 mm (kV mm-C):	
Power Factor @ 25C (%):	.036
Power Factor @ 100C (%):	.811
Specific Gravity (Relative):	.880
Passivator (ppm):	
Oxidation Inhibitor (wt. %):	

Houston Service Center 33002 FM 2004 Angleton, Texas 77515 p. 979.848.1406 f. 979.848.0012 houston@shermco.com

Customer: FSG Electric **Shop Order#:** 5-5357-05 **Equip ID** Main XFMR

Customer PO#: 30P 199008 **Serial#** PCR-94421 **Location** Northlake PS

Results

O2 Diagnosis - Leak to atmosphere, air vented
N2 Diagnosis - Pad gas
Total Combustible Gas - OK, Continue routine operation
Relative Saturation - 7.46%

Recommendations

Sample data ok. Unit is in condition 1. No action required. Continue to monitor at normal sampling schedule. See attached particle count report.

Sample - PPM

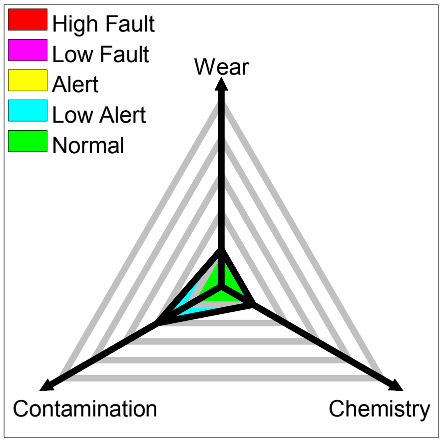
Database:	Shermco Database.rbm	Equipment:	E1 - Transformers
Area:	A192 - FSG Electric	Point:	P1 - Main Transformer

Sample Date	3/23/2015
Sample #	17293
Unit Usage - hrs	
Oil Usage - hrs	
Oil Added - gus	

Wear	0
Aluminum	
Chromium	
Copper	
Iron	
Lead	
Nickel	
Tin	
Ferrous Idx	0.0
LCont Ferrous	
LCont NonFe	

Contamination	5
Boron	
Silicon	
Sodium	
Contam Idx	
% Water	
LCont Droplet	
Cnts >4	855
Cnts >6	35
Cnts >14	1
Cnts >22	1
Cnts >38	1
Cnts >56	.7
Cnts >70	.6
ISO >4	17
ISO >6	12
ISO >14	7
NAS 1638	8
IR Water	
Water K.Fish	

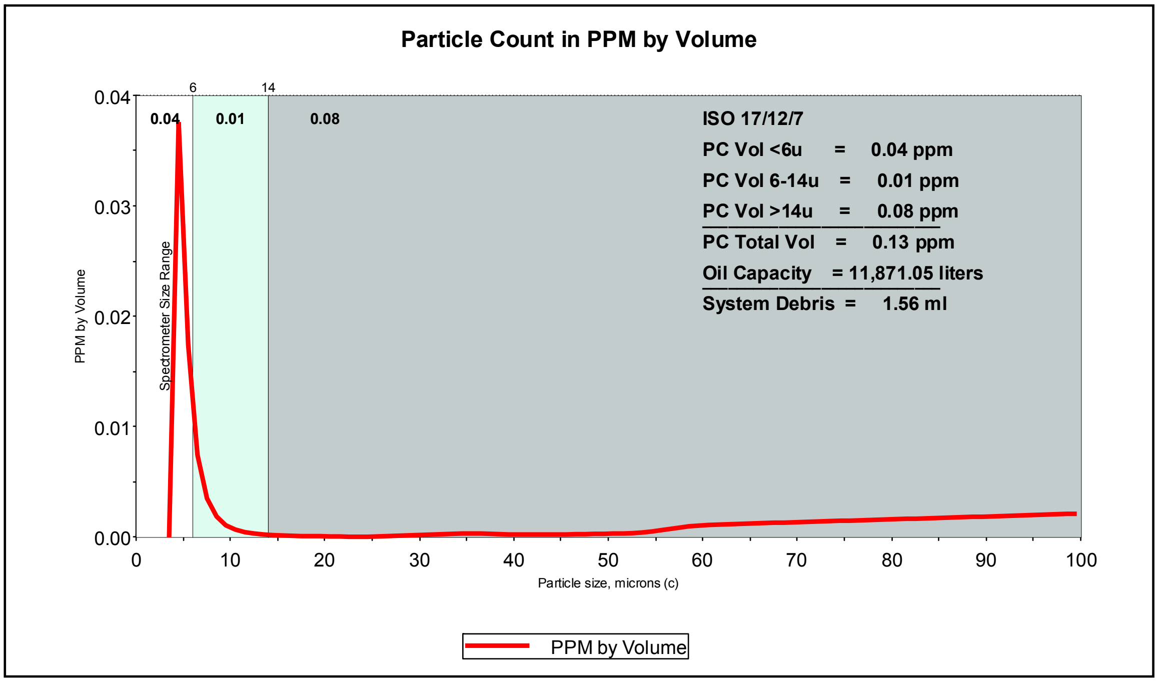
Chemistry	0
Barium	
Calcium	
Magnesium	
Molybdenum	
Phosphorus	
Zinc	
OilLife Idx	
Chemical Idx	0.0
Dielectric	
DV Visc 40C	
DV Visc %Chng	
IR Oxidation	
Visc 40C	
Visc 100C	
Visc Idx	
Total Acid	
Total Base	



Shermco Industries

Shermco Industries
33022 FM 2004
Angleton, Texas
(800)-219-9038
G.Sellers@Shermco.com

Ref Oil	No Reference Oil



Observations
Oil is in good condition
Oil is fit for further use

Actions
Continue normal sampling

Sample data ok. Particles within limits. No action required. Continue to monitor at normal sampling schedule.

Solomon Corporation Laboratory
302 W. 7th St.
Solomon, KS 67480
785-655-2191, Ext. 144

PCB Analytical Test Results

Shermco Industries
Attn: Accounts Payable
PO Box 540545
Dallas, TX 75354

Date Sampled: 03/18/2015
Analysis Date: 03/25/2015
Date Reported: 03/25/2015
Method: US EPA Method 8082
Reporting Limit: 2.0 ppm

KVA	Mfg.	Serial Number	Location	Company #	Unit Marking	Lab #	PCB Content (ppm)
3750.0	WH	PCR-94421	Angleton, TX	FSG Electric	Main Xfmr	553617	37

1 Units Reported

Sample Identification reported as submitted by client
I - Serial number or other unique identification not available
U - Date of collection unknown
E - Estimated concentration
M - Reporting limit higher than normal due to matrix interference
S - Surrogate recovery is greater than 130%

Kesa M. Ridee
Analyst

Descriptions of Tests

Test Decal Color Codes and Service Classifications

After a piece of electrical equipment or device is tested and/or calibrated by Shermco Industries, Inc. a Calibration/Test decal is attached to that particular device. An explanation of the decal color code and service classification is as follows:

White Decal

All Tests Satisfactory

When a device passes all tests satisfactorily and has met the requirements of the NETA testing specifications, then a white decal is attached to the device. This indicates that the device is electrically and mechanically sound and acceptable for return to service. There may be some minor deficiencies with the equipment, but none that effect the equipment electrically or mechanically to any large degree. Examples of deficiencies could be: evidence of slight corrosion, incorrect circuit ID, nameplate missing, etc.

Yellow Decal

Limited Service

If the device under test has a minor problem that is not detrimental to the protective operation or major design characteristics of that particular device, then a yellow “Limited Service” decal is attached to the device. Examples of limited service classifications could be: indicating trip targets that don’t function properly, slightly lower than acceptable insulation resistance readings, chipped arc chute, etc.

Red Decal

Non-Serviceable

If the device under test has a problem that is detrimental to the proper electrical or mechanical operation of that device, then a red “Non-Serviceable” decal is attached to the device. The non-serviceable decal would be attached to the device after attempts at field repair were made. Examples of non-serviceable classifications could be: no trip on one or more phases, low insulation resistance readings, mechanical trip problems, high contact resistance readings, etc.

Digital Low Resistance Ohmmeter Testing

The Digital Low Resistance Ohmmeter (DLRO or "Ducter") is an instrument that accurately measures very small values of resistance. The DLRO will normally give an indication in the micro-ohm range. The DLRO is used to determine the resistance of the load current path through a conductor, such as the contacts of a closed switch or circuit breaker.

The DLRO operates on the four-wire measurement principle, thus eliminating lead and contact resistances. With basic accuracies of ±0.25% and resolution down to 0.1 μΩ., they are designed to be rugged and portable for use at the job site.

The needs for accurate low resistance measurement are well known and very diverse. They range from receiving and inspection of components to ground bonding and welded joints. Applications include, but are not limited to, making dc resistance measurements for:

- Switch and breaker contact resistance
- Busbar and cable joints
- Integrity of welded joints
- Intercell strap connections on battery systems up to 600 V peak
- Transformer and motor winding resistance
- Graphite electrodes and other composites
- Wire and cable resistance

High resistance readings are an indication of a defective or problem current path on the device under test. This can be due to poor contact surface, insufficient contact spring tension, loose series trip unit, or other faulty devices in the current carrying portion of the device.

A high micro-ohm reading indicates the presence of a problem that, if not corrected, could lead to excessive heat. This heat in some cases can be sufficient to cause tripping of the breaker, which may contribute to unplanned shutdown of the equipment. The DLRO becomes very useful in identifying high resistance areas, which are difficult to find by any other means.

Doble Insulation Power-Factor Testing

The Doble test set is a device designed for testing electrical insulation in the field by measurements of dielectric-loss and current at a given applied voltage when connected to a commercial 120-volt 60-Hz source. The power factor of the test specimen in calculated from measurements of watts-loss and current. The test set has a maximum capacity of 200 milliamperes. It is suitable for testing bushings, potheads, insulators, circuit breakers, lightning arresters, insulating oils and askarels (PCB's), instrument transformers, power transformers of all sizes, and cables in lengths up to approximately 1000 feet. While the Doble test is loosely referred to as a *power-factor test*, it is implicit that all pertinent electrical parameters are taken into account in the analyses of the results. The AC parameters include: total current; dielectric-loss; power factor; capacitance; and resistance. The underlying principle of the Doble test is to measure these fundamental AC electrical characteristics of the insulation. The measurements are made at normal power-system frequency (as a result, the tests tend to simulate the manner in which voltage is normally distributed throughout complex non-homogeneous insulation systems of apparatus), applying test potentials that are low to moderate relative to the inherent voltage breakdown strength of the insulation system. The tests are then analyzed by various means, which include:

- Comparing the results against a manufacturer's factory data.
- Comparing the results against known data for other similar units.
- Observing changes in benchmark test results over time.

Degradation of insulation will produce, to varying degrees, changes in one or more of the measurable electrical parameters; measuring and analyzing these fundamental characteristics provide a convenient, searching, and effective means for *safely* detecting defective insulation of high-voltage equipment in the field. The AC dielectric-loss and power-factor test is a proven and effective *nondestructive* method, which can reveal the presence of faulty insulation, even when such faulty insulation is surrounded by good insulation.

Insulation Resistance Testing

In the insulation resistance test of insulation, an applied voltage from 100 to 10,000 volts, supplied from a source of constant potential, is applied to the device under test. The usual potential source is an insulation resistance test set (commonly referred to as a Megger), either hand or power operated, which indicates the insulation resistance directly on a scale calibrated in megohms. The quality of the insulation is evaluated based on the level of the insulation resistance.

The insulation resistance of many types of insulation is quite variable with temperature, so the data obtained should be corrected to the standard temperature for the class of equipment under test. Some published charts are available for this purpose.

The megohm value and insulation resistance obtained will be inversely proportional to the volume of insulation being tested. As an example, a cable 1000 feet long would be expected to have one-tenth the insulation resistance of a cable 100 feet long, if all other conditions are identical.

Insulation resistance tests are typically performed on motors, circuit breakers, transformers, low-voltage (unshielded) cables, switchboards, and panel boards to determine if degradation due to aging, environmental, or other factors has affected the integrity of the insulation. This test is normally conducted for 1 min, and the insulation resistance value is then recorded. The electrical properties of the insulation and the amount of surface area directly affect the capacitance between the conductor and ground, and therefore affect the charging time.

With larger motors, generators, and transformers, a common test is to measure the “Dielectric Absorption Ratio” (DAR) or the “Polarization Index” (PI) of the piece of equipment being tested. The dielectric absorption ratio is the 1-minute insulation resistance reading divided by the 30-second insulation resistance reading. The polarization index is the 10-minute (continuous) insulation resistance reading divided by the 1-minute reading.

Both of these provide additional information as to the quality of the insulation. Many types of insulation become dry and brittle as they age, thereby becoming less effective capacitors. Thus, a low polarization index (less than 2.0) may indicate poor insulation. Even though insulation may have a high insulation resistance reading, there could still be a problem, since the motor and transformer windings are subjected to strong mechanical stresses on starting. With the exception of electronic equipment (which can be damaged by testing), insulation resistance testing is normally done on most types of new equipment and is also part of a maintenance program. It is a good practice to perform insulation resistance testing on switchgear and panelboards after maintenance has been performed on them, just prior to re-energizing them. This prevents re-energizing the equipment with safety grounds still applied or with tools accidentally left inside.

(Above information is from IEEE Yellow Book; 902-1998)

Oil Tests and Their Significance

Physical Tests		ASTM Method Number
1.	Aniline Point	D611-82 (1998)
2.	Color	D1500-98
3.	Flash and Fire Points	D92-98a
4.	Interfacial Tension	D971-99 D2285-99
5.	Pour Point	D97-96a
6.	Relative Density (Specific Gravity)	D1298-85 (1990)
7.	Viscosity	D88-94 D445-97 D2161-93

Electrical Tests		ASTM Method Number
1.	Dielectric Breakdown Voltage	D877-87 (1995) D1816-97
2.	Dielectric Breakdown Impulse Voltage	D3300-94
3.	Dissipation Factor (Power Factor)	D924-92
4.	Gassing of Insulating Oils Under Electrical Stress and Ionization	D2300-98

Chemical Tests		ASTM Method Number
1.	Gas Content	D2945-90 (1998) D3284-99 D3612-96
2.	Polychlorinated Biphenyls	D4059-96
3.	Corrosive Sulfur	D1275-96a
4.	Neutralization Number (Acidity)	D664-95 D974-97
5.	Oxidation Inhibitor Content	D2668-96 D4768-96
6.	Oxidation Stability (Inhibited oil only, Oxidation Stability)	D2112-95 (BOMB) D2440-99
7.	Water in Insulating Liquids	D1533-96
8.	Furans in Insulating Liquids	D5837-95

Description Of Physical Tests

Aniline Point -ASTM D611-82- (1998)

The aniline point (temperature) of a mineral insulating oil indicates the solvency of the oil for some materials that are in contact with the oil. A high aniline point indicates a lower degree of aromaticity and a lower solvency for some material (rubber, for example).

Color - ASTM D1500-98

Insulating oil should have a light color and be optically clear so that it permits visual inspection of the assembled apparatus inside the equipment tank. Any change in the color of an oil over time is an indication of deterioration or contamination of the oil.

Flash and Fire Points - ASTM D92-98a

The flash point of an oil is the temperature to which the material must be heated (under prescribed conditions of test) in order to give off sufficient vapor to form a flammable mixture with air. The fire point is the temperature that provides sufficient oil vapors to ignite and sustain a fire for 3 seconds (under the same test conditions). A low flash point indicates the presence of volatile combustible contaminants in the insulating oil.

Interfacial Tension - ASTM D971-99a, ASTM D2285-99

This method covers the measurement, under nonequilibrium conditions, of the surface tension that an insulating fluid maintains against water. Interfacial tension is a measurement of the forces of attraction between molecules of the two fluids. It is expressed in millinewtons per meter (mN/m). The test is an excellent means of detecting oil-soluble polar contaminants and oxidation products in insulating oils.

Pour Point - ASTM D97-96a

The pour point is the temperature at which oil ceases to flow under prescribed testing conditions. The pour point has little significance as a test for contamination or deterioration of the oil. It may be useful for oil identification and determination of suitability for a particular climate.

Relative Density (Specific Gravity) - ASTM D1298-85

The relative density of an oil is the ratio of the weights of equal volumes of the oil and water, tested at 15 $^{\circ}$C. The relative density is significant in determining the suitability for use in certain applications, in cold climates, ice may form in equipment exposed to temperatures below freezing. When considered along with other oil properties, relative density can be an indicator of the quality of the oil.

Viscosity - ASTM D88-94, ASTM D445-97, ASTM D2161-93 (1999)

The viscosity of an insulating oil is measured by timing the flow of a known volume of oil through a calibrated tube. Viscosity is not significantly affected by oil contamination or deterioration, but may be useful for identifying certain types of service-aged insulating oils. Viscosity has an important influence on the heat transfer characteristics of an oil. High viscosity decreases the cooling efficiency of the oil. High viscosity will also affect the movement of parts in electrical equipment, such as circuit breakers, switchgear, tap changers, pumps, and regulators. Viscosity is a factor in determining the conditions for oil processing and cellulose impregnation time.

Visual Examination - ASTM D1524-94 (1999)

This test indicates the color and degree of turbidity of an oil, which may indicate the presence of free water or contaminating solid particles. The source of insoluble solid contaminants may be determined by filtrating the particles and examining them. This test may be used to suggest the need for additional laboratory tests, as it may permit a determination of whether the sample should be sent to a central laboratory for a full evaluation.

Description Of Electrical Tests

Dielectric Breakdown Voltage - ASTM D877-87 (1995), ASTM D1816-97

The dielectric breakdown voltage of insulating oil is a measure of its ability to withstand voltage stress without failure. It is the voltage at which breakdown occurs between two electrodes under prescribed test conditions. The test serves primarily to indicate the presence of electrically conductive contaminants in the oil, such as water, dirt, moist cellulosic fibers, or particulate matter. A high dielectric breakdown voltage does not indicate the absence of all contaminants, however.

The electrodes in D877 are thin flat disks, which are not representative of the electrodes in transformers. Although the rounded electrodes in D1816 do not duplicate the characteristics of insulated electrodes in transformers, they more closely approximate transformer applications. However, the D1816 electrodes are more responsive to particles and dissolved water in oil, both of which are detrimental to the electrical strength of oil in transformers. Therefore, D1816 test results furnish a better evaluation of changes that may occur in the oil from transformers.

Two methods are recognized for measuring the dielectric breakdown voltage of insulating oils:

1. ASTM D877-87 (1995) is recommended for the routine acceptance of new, unprocessed oil from a supplier for use in circuit breakers. This test method uses thin flat-faced cylindrical electrodes with a 2.5 mm gap. The sensitivity of this method, to the general population of contaminates present in a liquid sample, decreases as applied test voltages used in this method become greater than 25 kV rms.
2. ASTM D1816-97 is recommended for testing fluid that is being processed into transformers or contained in transformers and load tap changers. This method uses spherically shaped electrodes. The fluid sample is circulated continuously in the test cell throughout the test. The gap distance standard settings are 1 mm and 2 mm (alt. 0.04 in and 0.08 in).

Dielectric Breakdown Impulse Voltage - ASTM D3300-94

This test method is most commonly performed using a negative polarity point opposing a grounded sphere (NPS). The NPS breakdown voltage of fresh unused oils measured in the highly divergent field in this configuration depends on oil composition; decreasing with increasing concentration of aromatic, particularly polyaromatic, hydrocarbon molecules.

This test method may be used to evaluate the continuity of composition of oil from shipment to shipment. The NPS impulse breakdown voltage of oil can also be substantially lowered by contact with materials of construction, by service aging, and by other impurities. Test results lower than those expected for a given fresh oil may also indicate use or contamination of that oil.

Although polarity of the voltage wave has little or no effect on the breakdown strength of oil in uniform fields, polarity does have a marked effect on the breakdown voltage of oil in non-uniform electric fields.

Transient voltages may also vary over a wide range in both the time to reach crest value and the time to decay to half crest or to zero magnitude. The IEEE standard lightning impulse test specifies a 1.2 by 50-us negative polarity wave.

Dissipation Factor (Power Factor) - ASTM D924-92

The dissipation factor is a measure of the power lost when an electrical insulating liquid is subjected to an ac field. The power is dissipated as heat within the fluid. A low-value dissipation factor means that the fluid will cause little of the applied power to be lost. The test is used as a check on the deterioration and contamination of an insulating oil because of its sensitivity to ionic contaminants.

Gassing of Insulating Oils Under Electrical Stress and Ionization - ASTM D2300-98

This test measures whether insulating oils are gas absorbing or gas evolving when subjected to electrical voltage. For certain applications, when insulating oils are stressed at high voltage gradients, it is desirable to know the rate at which gas is absorbed or evolved from the oil. The absorption or evolution of gas by a liquid under electrical stress is a function of the aromatic character of the liquid molecules. Liquids that are significantly aromatic in character will absorb gas as they are electrically stressed. Liquids that have little or no aromatic character will evolve hydrogen gas upon application of an electrical voltage. At the present time, however, correlation of these test results with equipment performance is limited. Numerical results obtained in different laboratories or by using two different procedures may differ significantly in magnitude, and the results of this method should be considered qualitative in nature.

Description Of Chemical Tests

Gas Content ASTM D2945-90 (1998), ASTM D3284-99, ASTM D3612-96

The gas content of an insulating fluid may be defined as the volume of dissolved gas per 100 volumes of oil, at standard pressure and temperature. Some types of equipment require the use of electrical insulating liquids of low gas content. In filling electrical apparatus, a low gas content reduces foaming and also reduces the available oxygen, thereby increasing the service life of the insulating oil.

The amount and kind of gases dissolved in oil can be used as a tool to aid in detecting and diagnosing faults and abnormal operating conditions in equipment.

The test is not intended for use in purchase specifications because the oil is customarily degassed immediately prior to use. The test can be used, however, as a factory control test and is more useful in evaluating the health of the transformer equipment. Overheating or arcing within the transformer will generate combustible and noncombustible gasses that will be dissolved in the oil. For Dissolved Gas Analysis, reference IEEE C57.104-1991 for further recommendations.

Polychlorinated Biphenyls (PCBs) - ASTM D4059-96

United States regulations require that electrical apparatus and electrical insulating fluids containing PCBs be handled and disposed of through the use of specific procedures. The procedure to be used for a particular apparatus or quantity of insulating fluid is determined by the PCB content of the fluid. The results of this analytical technique can be useful in selecting the appropriate handling and disposal procedures, refer to Title 40 Code of Federal Regulations Part 761.

Corrosive Sulfur-ASTM D1275-96a

This test is designed to detect the presence of free sulfur and combined corrosive sulfur by how the liquid affects polished copper strips in prescribed conditions. The test indicates the possibility of corrosion inside of electrical equipment resulting from the presence of sulfur-containing compounds. The source of sulfur present in insulating oil is usually the crude oil from which it is refined. The sulfur may come from rubber hoses used for oil processing or from replacement gasket materials.

Neutralization Number (Acidity) - ASTM D664-95, ASTM D974-97

The neutralization number of an electrical insulating liquid is a measure of the acidic components of that material. In a new oil, any acid present is likely residual from the refining process. In a service-aged liquid, the neutralization number is a measure of the acidic byproducts of the oxidation of an oil. The neutralization number may be used as a general guide for determining when an oil should be reprocessed or replaced. ASTM D974-97 is the traditional color-change indicator method of titrating the acids with a mild (0.1 N) KOH solution. ASTM D664-95 is a potentiometric titration method. On some service-aged liquids, the color may be so dark as to impair the ability of the technician to determine the indicator color change in ASTM D974-97, so ASTM D664-95 is used instead. The correlation between these two methods, however, has not been established.

Oxidation Inhibitor Content - ASTM D2668-96 by infrared spectrophotometry, ASTM D4768-96 by gas chromatography

There are two synthetic oxidation inhibitors commonly used in dielectric fluids. They are 2-6 ditertiary-butyl phenol (DBP) and 2-6 ditertiary-butyl para-cresol (DBPC). Their use provides added resistance to oxidation in systems that are partially or wholly exposed to air. The effectiveness of the oxidation inhibitor depends a great deal on the type of crude oil from which the insulating oil came. Certain new oils may contain naturally occurring antioxidant substances that may yield a false-positive indication in this test.

Oxidation Stability, Inhibited only, (BOMB) - ASTM D2112-95, ASTM D2440-97

This method is a rapid test for evaluating the oxidation stability of a new mineral insulating oil that contains the synthetic oxidation inhibitor 2-6 DBPC or 2-6 DBP. The test measures the length of time required for the oil sample to react with a given volume of oxygen when a sample of oil is heated and oxidized under test conditions.

Oxidation Stability - ASTM D2440-99. This test method determines the resistance of mineral insulating oils to oxidation under prescribed accelerated aging conditions. Oxidation stability is measured by the propensity of oils to form sludge and acid products during oxidation. This test method is applicable to new oils, both inhibited and uninhibited.

Water in Insulating Liquids: Karl Fischer Method - ASTM D1533-96

Water may be present in insulating liquids in several forms. The presence of free water may be indicated by visual examination. The oil will appear cloudy or separated water drops will be seen, probably on the bottom surface. The presence of free water can be remedied by filtration or other means. Dissolved water cannot be detected visually and is normally quantified by physical or chemical means. Dissolved water may affect the dielectric breakdown of an insulating oil, however, its significance is determined by several factors including the percent of moisture saturation, and the amount and type of contaminates. The method cited is suitable for the determination of water in insulating oil, and, depending upon conditions of sample handling and methods of analysis, can be used to estimate total water as well as dissolved water in insulating oil. The units of measure of water are mg/Kg (parts per million) (ppm). New insulating oil received from the manufacturer normally contains less than 25mg/kg (ppm) moisture. New insulating oil should be tested for moisture content. If necessary, applicable measures should be taken to avoid introducing high moisture-content oil into electrical equipment.

Furans in Insulating Liquids - ASTM D5837-95

Furanic compounds are generated by the degradation of cellulosic materials used in the solid insulation systems of electrical equipment. Furanic compounds which are oil soluble to an appreciable degree will migrate into the insulating liquid. The presence of high concentrations of furanic compounds is significant in that this may be an indication of cellulose degradation from aging or incipient fault conditions. Testing for furanic compounds by High-Performance Liquid Chromatography (HPLC) may be used to complement dissolved gas in oil analysis as performed in accordance with ASTM D3612-90 test method.

PCB General Information

What are polychlorinated biphenyls?

For a century, PCBs were known mostly to engineers and chemists as the acronym for a variety of chemicals used in many manufacturing products. PCBs, or polychlorinated biphenyls, were considered chemically and thermally stable, meaning they did not break down easily. Nor did they easily catch fire. These physical properties made PCBs extremely desirable for a wide variety of industrial applications.

PCBs don't burn easily and are good insulating material. They have been used widely as coolants and lubricants in transformers, capacitors, and other electrical equipment. The manufacture of PCBs stopped in the United States in 1977.

What are They?

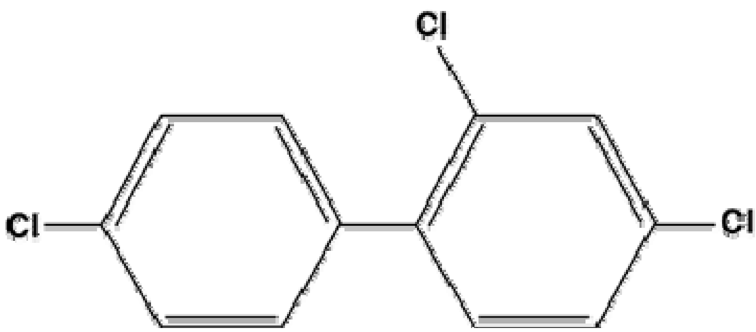
PCBs belong to a class of organic chemicals known as chlorinated hydrocarbons. For 50 years, the manufacture, sale, use and discharge of PCBs were legal in the United States. More than one billion pounds of PCBs were produced and sold.

PCBs were considered a “miracle” chemical because they would not burn and were widely used in electrical equipment installed in wooden factories and school buildings where fire was a constant threat. In fact, some city codes and some insurance companies required the use of PCB-type transformers and capacitors.

PCB Chemistry

PCBs are a family of compounds produced commercially by directly chlorinating biphenyl. Many different combinations are possible. In chemical terminology, "phenyl" denotes a ring structure of six carbon atoms attached to something else; "biphenyl" results when two such rings are attached to each other. And polychlorinated biphenyl (PCB) is any molecule having multiple chlorine atoms attached to the carbon atoms of a biphenyl nucleus. Chlorine atoms can be placed at any or all of ten available sites, with 209 PCB mixtures theoretically possible.

PCBs were manufactured and sold as complex mixtures differing in their average chlorination level. The 209 possible PCB compounds are referred to as "congeners." PCB congeners with the same number of chlorine atoms are known as "homologs" or "isomers" of each other. The materials now collectively referred to as PCBs are actually several dozen individual PCB congeners clustered around some average degree of chlorination.



Congeners may be grouped in terms of the number of chlorine atoms attached to the biphenyl molecule. For instance, one chlorine would produce a mono-chlorobiphenyl, two a di-chlorobiphenyl, ten a deca-chlorobiphenyl. Any biphenyl moecule with two or more chlorines is commonly referred to as a poly-chlorinated biphenyl.

Are There Risks?

PCBs have been regulated by the federal government as a "probable human carcinogen" based on studies of rats that were fed large doses of PCBs over their entire lives. But after nearly 20 years of research on human beings exposed to PCBs, there is no credible evidence that PCB exposure causes disease in people.

Their Physical Properties

The physical properties of PCBs vary among the different homologs. Lower-chlorinated PCBs (the mono-, di-, tri- and tetra-chlorinated PCBs) tend to be light, oily fluids. Penta-chlorobiphenyls are heavy, honey-like oils. The most highly chlorinated PCBs are greases and waxy substances.

In general, PCBs are non-flammable and water-insoluble. They have high boiling points and low electrical conductivity. They are chemically and thermally stable. These physical properties made PCBs extremely desirable for a wide variety of industrial applications, including dielectric heat transfer fluids, hydraulic fluids, solvent extenders, flame retardants, organic diluents, dielectric fluids, inks, dyes, paints and adhesives. For example, PCBs were found in carbonless copy paper, newsprint and caulking compounds.

Who Made and Used PCBs?

PCBs were manufactured in the United States by the Swann Chemical Co., beginning in 1929. Monsanto Industrial Chemicals Co. purchased Swann in 1935 and continued producing PCBs until the mid-1970s. More than one billion pounds of PCBs were produced and sold. Estimates for the cumulative total of U.S. industrial uses of PCBs from 1930 to 1975 are offered below:

Use	**Industrial PCB Purchases (in Millions of Pounds)**
Capacitors	630
Transformers	335
Plasticizers	115
Hydraulics and Lubricants	80
Carbonless copy paper	45
Misc. Industrial	28
Heat transfer	20

In 1970, reacting to concerns over PCB accumulations in the environment, Monsanto began voluntarily restricting its sale of PCBs to those customers that were manufacturers of sealed electrical equipment only. In 1976, Congress passed the Toxic Substances Control Act, to be implemented by 1979, that banned the manufacture of PCBs and PCB-containing products and established strict regulations regarding their future use and sale.

National PCB phase-outs similar to the U.S. ban took place in Japan, Canada and Sweden, but many other industrial nations, including the United Kingdom, Germany, France and Spain, continued to permit PCB production and the manufacture of PCB-filled capacitors and transformers into the 1980s.

The Kimbrough Study

In the largest-ever human study of its kind, researchers Renate D. Kimbrough, M.D., and Martha L. Doemland, PhD., have found no association between actual human exposure to

PCBs (polychlorinated biphenyls) and deaths from cancer or any other diseases.

For more than 20 years, the federal government has characterized PCBs as probable human carcinogens based in part on Dr. Kimbrough's 1975 study of PCBs in rats that were fed large quantities of PCBs in their diets.

"This new study provides strong evidence that even long-term human exposure to PCBs at higher levels than are found in the environment is not related to an increase in deaths from cancer or any other diseases," said Dr. Kimbrough, the study's principal investigator and a senior medical associate with the non-profit Institute for Evaluating Health Risks in Washington, D.C.

The findings of this study are consistent with those of four other studies of workers in the same factories conducted by other researchers over nearly 25 years, but the new study is the largest and most statistically powerful study ever conducted of humans exposed to PCBs.

The mortality study focused on the 7,075 men and women who worked between 1946 and 1977 in two Upstate New York factories that used PCBs in the manufacture of electrical capacitors. The study compared to national and regional averages the number and causes of death, adjusted for age and gender, for the 1,195 members of the study population who died.

The average follow-up time for the 7,075 workers was 31 years, providing a sufficiently long latency period in which to determine whether there was any increase in cancer mortality.

Some of the workers in the study had PCB levels in their blood as high as several thousand parts per billion. In the United States, the average PCB levels found in the blood of people who have been tested range from 4 to 8 parts per billion (ppb), according to the Agency for Toxic Substances and Disease Registry.

Federal and State Regulations That Apply to PCB Wastes

Federal Regulations: Toxic Substances Control Act (TSCA)

The EPA regulates PCBs through five statutes, the most comprehensive of which is the Toxic Substances Control Act (TSCA) of 1976. The regulations resulting from TSCA are codified in 40

Code of Federal Regulations (CFR) Part 761. These regulations govern the use, marking, storage, recording, and disposal of PCBs and PCB wastes.

These regulations: prohibit the manufacture of PCBs, unless the manufacture is specifically exempted by the EPA; prohibit the processing, distribution, and use of PCBs, except in a totally enclosed manner; and require that all wastes containing 50 parts per million (ppm) or greater PCB content must be disposed of at a TSCA-approved disposal facility.

State Regulations

In addition to the federal regulations governing PCB wastes, Texas also has regulations governing such wastes. Depending upon their source and their hazardous waste status, PCB wastes generated in Texas are subject to regulation by either the Railroad Commission of Texas (RRC) or the TNRCC.

Regulations Applying to PCB Wastes That Are Hazardous Wastes or Are Produced by Industrial Generators.

The TNRCC has jurisdiction over all hazardous wastes and wastes produced by generators of "industrial solid waste" (which is defined in 30 Texas Administrative Code (TAC) Section 335.1 (Definitions) as, ". . . waste resulting from or incidental to any process of industry or manufacturing, or mining or agricultural operation, which may include hazardous waste . . ."). TNRCC regulations that apply to both hazardous and industrial wastes are found in 30 TAC Chapter 335. At present, PCBs are not themselves defined as hazardous wastes. Wastes containing PCBs can be a hazardous waste only if they:

(1) Are mixed with a listed hazardous waste or are derived from a listed hazardous waste (in which case the resulting mixture is a listed hazardous waste); or
(2) Exhibit one or more characteristics of a hazardous waste.

Assigning Waste Codes to Hazardous Wastes and Industrial Wastes That Contain PCBs.

Before any hazardous waste or industrial waste containing PCBs can be disposed of, it must be assigned an eight-character waste code number that consists of

(1) a four-character sequence number,
(2) (2) a three-character form code, and
(3) (3) a one-character classification code.

Where can I get more information?

Contact Shermco at 972.793.5523 for regulatory support, outsourced guidance, and recommendiations.

Transformer Turns Ratio Testing

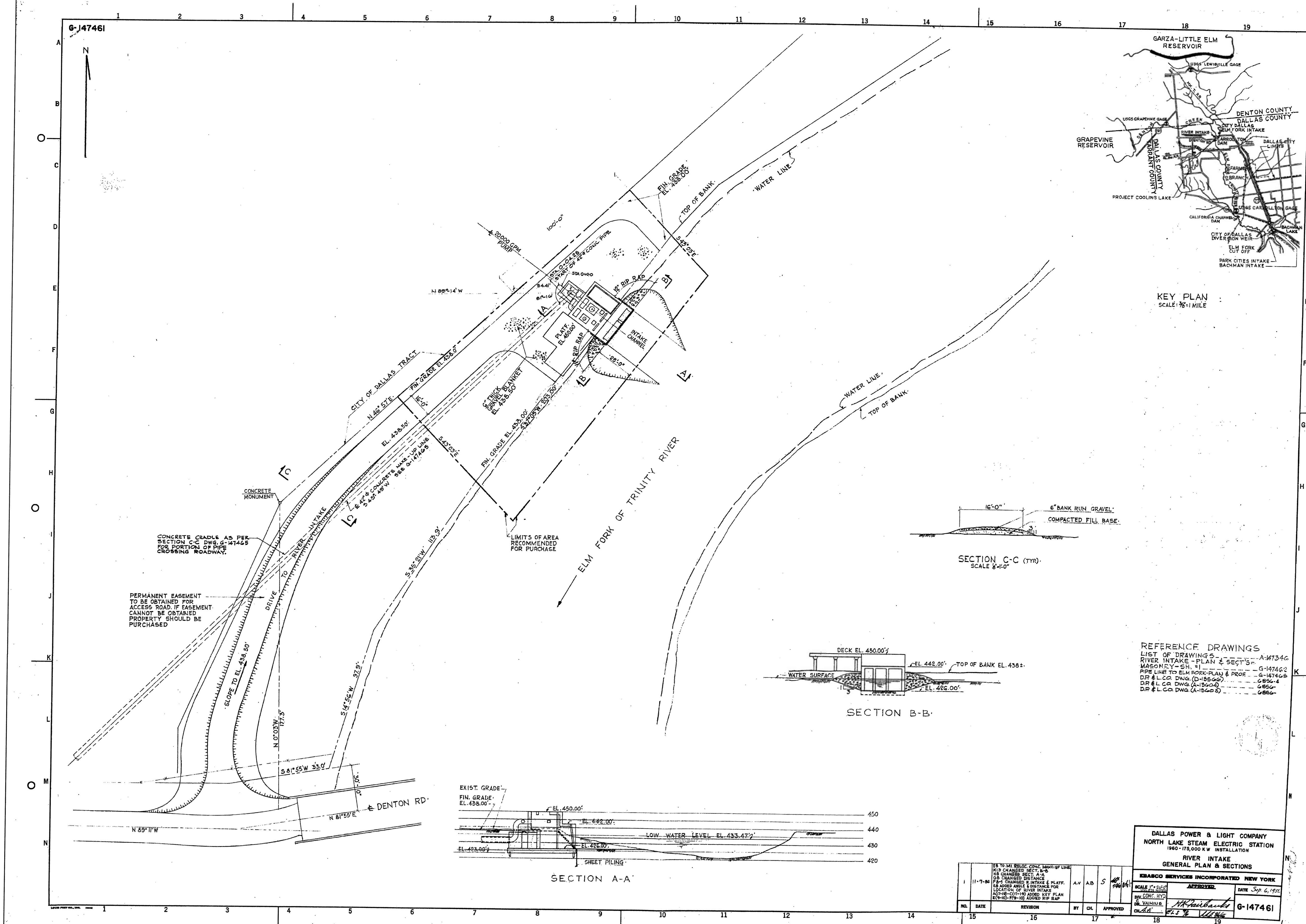
Transformer Turns Ratio (TTR) tests are used to determine the ratio of the transformer windings. The instrument is a null balance type of the portable hand crank equipment. Ten position switches will indicate the transformer ratio. The actual ratio value is normally indicated to three decimal places.

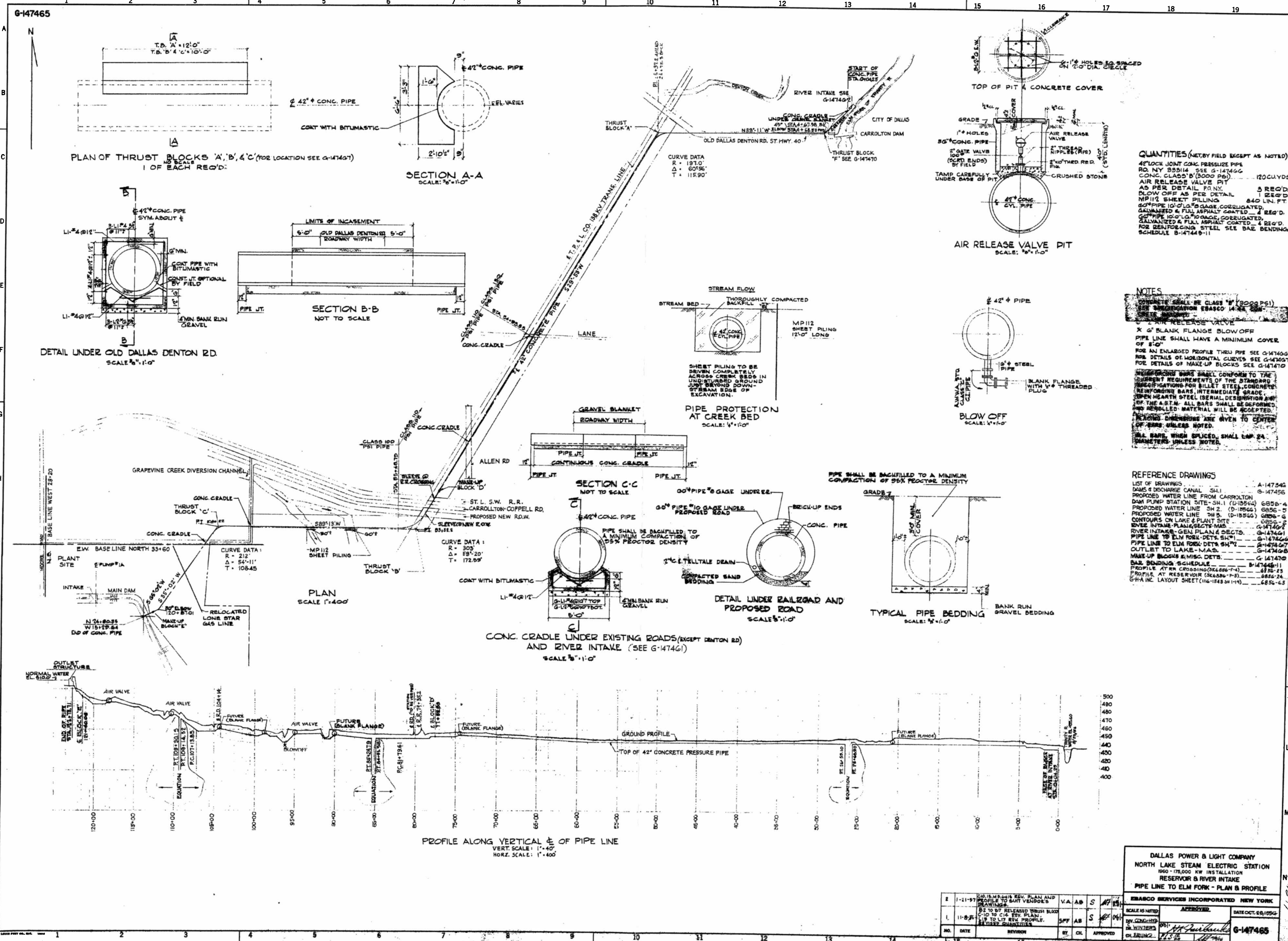
The voltage across the primary of a transformer is directly proportional to the voltage across the secondary, multiplied by the ratio of primary winding turns to secondary winding turns. In order to ensure that the transformer was wound properly when it was new, and to help locate subsequent turn-to-turn faults in the winding, it is common practice to perform a TTR test. The simplest method would be to energize one primary winding with a known voltage
(that is less than or equal to the winding's rating) and measure the voltage on the other winding. Since source test voltages can fluctuate, it is often more accurate to use a test set, designed for this purpose, that creates the test voltage internally, thus giving a direct read-out of the ratio measured.

This test is also used to locate faults in tap changer circuits or internal coil connections. It can also identify short circuited or bypassed turns.

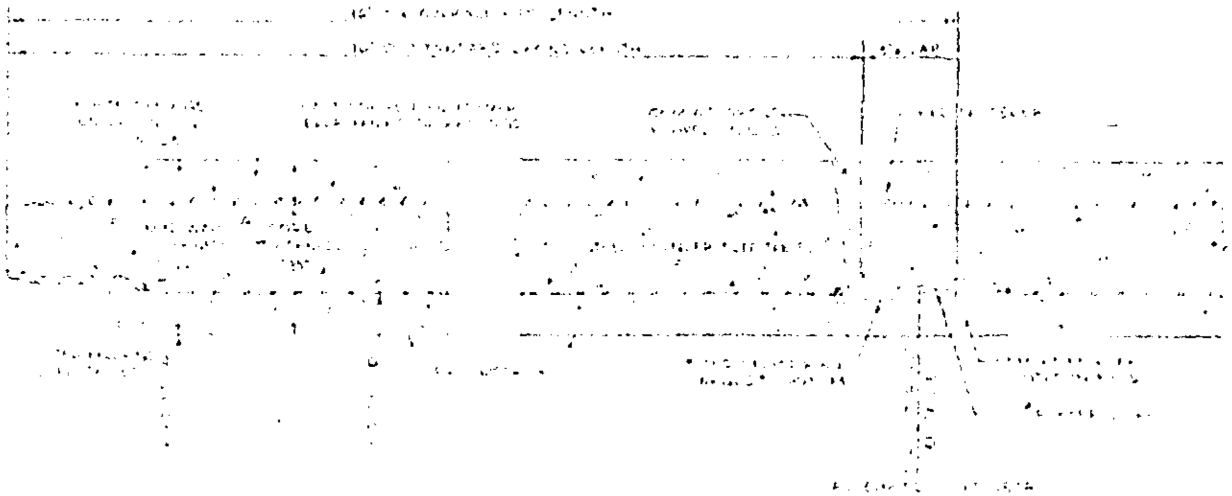
(Above information is from IEEE Yellow Book; 902-1998)

Appendix 3: 42-inch Pipeline Plans


G-147461
GARZA-LITTLE ELM RESERVOIR
DENTON COUNTY
DALLAS COUNTY
GRAPEVINE RESERVOIR
PROJECT COOLING LAKE
KEY PLAN
SCALE: 3/8"=1 MILE
CITY OF DALLAS TRACT
FIN. GRADE EL. 438.0'
N 46°57'E
10,000 GPM PUMP
RIP RAP
PLATF. EL. 450.00'
INTAKE CHANNEL
FIN. GRADE EL. 438.00
TOP OF BANK
WATER LINE
6" THICK GRAVEL BLANKET EL. 435.50
FIN. GRADE EL. 433.00
LIMITS OF AREA RECOMMENDED FOR PURCHASE
ELM FORK OF TRINITY RIVER
CONCRETE MONUMENT
CONCRETE CRADLE AS PER SECTION C-C DWG. G-147465 FOR PORTION OF PIPE CROSSING ROADWAY.
PERMANENT EASEMENT TO BE OBTAINED FOR ACCESS ROAD. IF EASEMENT CANNOT BE OBTAINED PROPERTY SHOULD BE PURCHASED
DRIVE TO RIVER INTAKE
SLOPE TO EL. 436.50'
DENTON RD.
SECTION C-C (TYP.)
SCALE 1/8"=1'-0"
6" BANK RUN GRAVEL
COMPACTED FILL BASE
DECK EL. 450.00'
EL. 442.00'
TOP OF BANK EL. 438±
WATER SURFACE
EL. 426.00'
SECTION B-B
EXIST. GRADE
FIN. GRADE EL. 438.00'
EL. 450.00'
EL. 442.00'
LOW WATER LEVEL EL. 433.47'
EL. 423.00'
EL. 426.00'
SHEET PILING
SECTION A-A
REFERENCE DRAWINGS
LIST OF DRAWINGS — A-147346
RIVER INTAKE - PLAN & SECT'S - MASONRY - SH. #1 — G-147462
PIPE LINE TO ELM FORK - PLAN & PROF. — G-147465
D.P. & L. CO. DWG. (D-13566) — 6856-4
D.P. & L. CO. DWG. (A-13604) — 6856-
D.P. & L. CO. DWG. (A-13605) — 6856-
1 | 11-7-56 | E8 TO M1 RELOC. CONC. MAKE-UP LINE; K13 CHANGED SECT. B-B; N8 CHANGED SECT. A-A; G8 CHANGED DISTANCE; F8-5 CHANGED R. INTAKE & PLATF.; E8 ADDED ANGLE & DISTANCE FOR LOCATION OF RIVER INTAKE; A(17-19)-C(17-19) ADDED KEY PLAN; E(9-10)-F(9-10) ADDED RIP RAP | A.V | AB
NO. | DATE | REVISION | BY | CH. | APPROVED
DALLAS POWER & LIGHT COMPANY
NORTH LAKE STEAM ELECTRIC STATION
1960 - 175,000 KW INSTALLATION
RIVER INTAKE
GENERAL PLAN & SECTIONS
EBASCO SERVICES INCORPORATED NEW YORK
SCALE 1"=20'-0" UNLESS NOTED
DIV. CONC. HYD.
DR. VAIHIUS
APPROVED
DATE Sep. 6, 1956
G-147461


G-147465
PLAN OF THRUST BLOCKS 'A', 'B', & 'C' (FOR LOCATION SEE G-147467)
NO SCALE
1 OF EACH REQ'D.
SECTION A-A
SCALE: 3/8" = 1'-0"
COAT WITH BITUMASTIC
DETAIL UNDER OLD DALLAS DENTON RD.
SECTION B-B
NOT TO SCALE
LIMITS OF INCASEMENT
OLD DALLAS DENTON RD. ROADWAY WIDTH
RIVER INTAKE SEE G-147462
CITY OF DALLAS
CARROLTON DAM
OLD DALLAS DENTON RD. ST. HWY. 40
THRUST BLOCK 'A'
THRUST BLOCK 'F' SEE G-147470
CURVE DATA
R = 193.0'
Δ = 60°56'
T = 113.90'
TOP OF PIT & CONCRETE COVER
AIR RELEASE VALVE PIT
SCALE: 3/8" = 1'-0"
QUANTITIES (NET, BY FIELD EXCEPT AS NOTED)
42" LOCK JOINT CONC. PRESSURE PIPE
P.O. NY 333114 SEE G-147466
CONC. CLASS 'B' (3000 PSI) ... 120 CU. YDS.
AIR RELEASE VALVE PIT
AS PER DETAIL P.O. N.Y. 3 REQ'D.
BLOW OFF AS PER DETAIL 1 REQ'D.
MP112 SHEET PILLING 840 LIN. FT.
60"φ PIPE 16'-0" LG. #8 GAGE, CORRUGATED, GALVANIZED & FULL ASPHALT COATED 4 REQ'D.
60"φ PIPE 10'-0" LG. #10 GAGE, CORRUGATED, GALVANIZED & FULL ASPHALT COATED 4 REQ'D.
FOR REINFORCING STEEL SEE BAR BENDING SCHEDULE B-147445-11
NOTES
CONCRETE SHALL BE CLASS "B" (3000 PSI) SEE SPECIFICATION EBASCO 14-44, CONCRETE MASONRY.
2" AIR RELEASE VALVE
* 6" BLANK FLANGE BLOW OFF
PIPE LINE SHALL HAVE A MINIMUM COVER OF 3'-0"
FOR AN ENLARGED PROFILE THRU PIPE SEE G-147466
FOR DETAILS OF HORIZONTAL CURVES SEE G-147467
FOR DETAILS OF MAKE-UP BLOCKS SEE G-147470
REINFORCING BARS SHALL CONFORM TO THE CURRENT REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR BILLET STEEL, CONCRETE REINFORCING BARS, INTERMEDIATE GRADE, OPEN HEARTH STEEL (SERIAL DESIGNATION A15) OF THE A.S.T.M. ALL BARS SHALL BE DEFORMED. NO REROLLED MATERIAL WILL BE ACCEPTED.
PLACING DIMENSIONS ARE GIVEN TO CENTER OF BARS UNLESS NOTED.
ALL BARS, WHEN SPLICED, SHALL LAP 24 DIAMETERS UNLESS NOTED.
STREAM FLOW
PIPE PROTECTION AT CREEK BED
SCALE: 1/4" = 1'-0"
BLOW OFF
SECTION C-C
NOT TO SCALE
GRAVEL BLANKET
ROADWAY WIDTH
CONTINUOUS CONC. CRADLE
REFERENCE DRAWINGS
LIST OF DRAWINGS ... A-147346
DAMS & DISCHARGE CANAL SH.1 ... G-147456
PROPOSED WATER LINE FROM CARROLTON DAM PUMP STATION SITE - SH.1 (D-13566) 6856-4
PROPOSED WATER LINE SH 2. (D-13566) 6856-5
PROPOSED WATER LINE SH 3. (D-13566) 6856-6
CONTOURS ON LAKE & PLANT SITE ... 6856-2
RIVER INTAKE - PLAN & SECTS - MAS. ... G-147462
RIVER INTAKE - GEN. PLAN & SECTS. ... G-147461
PIPE LINE TO ELM FORK - DETS. SH. #1 ... G-147466
PIPE LINE TO ELM FORK - DETS. SH. #2 ... G-147467
OUTLET TO LAKE - MAS. ... G-147468
MAKE-UP BLOCKS & MISC. DETS. ... G-147470
BAR BENDING SCHEDULE ... B-147445-11
PROFILE AT RR CROSSING (SK6856-F-4) ... 6856-23
PROFILE AT RESERVOIR (SK6856-F-5) ... 6856-24
G-H-A INC. LAYOUT SHEET (1116-1548 SH 1-19) ... 6856-63
GRAPEVINE CREEK DIVERSION CHANNEL
PLAN
SCALE 1" = 400'
CONC. CRADLE UNDER EXISTING ROADS (EXCEPT DENTON RD) AND RIVER INTAKE (SEE G-147461)
SCALE 3/8" = 1'-0"
DETAIL UNDER RAILROAD AND PROPOSED ROAD
TYPICAL PIPE BEDDING
PROFILE ALONG VERTICAL ℄ OF PIPE LINE
VERT. SCALE: 1" = 40'
HORZ. SCALE: 1" = 400'
GROUND PROFILE
TOP OF 42" CONCRETE PRESSURE PIPE
NO.	DATE	REVISION	BY	CH.	APPROVED
2	1-21-57	C10, 15, M5, 6416 REV. PLAN AND PROFILE TO SUIT VENDOR'S DRAWINGS.	V.A.	AB	S
1	11-8-56	B2 TO B7 RELEASED THRUST BLOCK C-10 TO C14 REV. PLAN. L13 TO L17 REV. PROFILE. REVISED QUANTITIES	SFF	AB	S
DALLAS POWER & LIGHT COMPANY
NORTH LAKE STEAM ELECTRIC STATION
1960 - 175,000 KW INSTALLATION
RESERVOIR & RIVER INTAKE
PIPE LINE TO ELM FORK - PLAN & PROFILE
EBASCO SERVICES INCORPORATED NEW YORK
SCALE AS NOTED
APPROVED
DATE OCT. 29, 1956
DIV. CONC-HYD.
DR. WINTERS
CH. BRUNO
G-147465

Appendix 4: GHA Laying Plans



CHECKED BY P.G.G. & H.L.M.

42"	150		3½"	1½"	5"	44½"	#16 GA.	0.072"	140,000	3789	#6 GA.	19.76	0.572	45"	¼"x5"	790#	59.5
42"	110		3½"	1½"	5"	44½"	#16 GA.	0.12"	140,000	3789	#6 GA.	14.51	0.420	45"	¼"x5"	790#	59.5
42"	100		3½"	1½"	5"	44½"	#16 GA.	.072"	140,000	3789	#6 GA.	13.17	0.381	45"	¼"x5"	790#	59.5

42"	45"	0°-57'	0.26'	0°-3 3/16"

(1) NOTE: PORTIONS OF THIS PIPE LINE IS TO BE PROVIDED WITH CONCRETE CRADLE. FOR LOCATIONS AND MANNER OF CRADLING SEE ENGR'S. DWG. #G1817465.

(1) GENERAL NOTES:

All steel plate, special pipe & fittings shall have ½" min. lining & 1" coating of cement mortar reinforced with 2" x 4" x #13 Ga. welded wire mesh, except that centrifugally spun lining shall not be reinforced.

Provide adequate block for thrust at bends, tees, wyes, dead ends, etc.

All flanges 12" I.D. and larger have standard 125# AM. Std. drillings & thickness according to A.W.W.A. Spec. C207-54T, Class "D", Table 1.

F.O. - #698
S.O. - #197

NORTH LAKE S.E.S. — DALLAS, TEXAS
42" PIPE LINE TO ELM FORK

DALLAS POWER & LIGHT — INQUIRY NO. - [illegible]

NOTES.

OCT. 22, 1956

1

(1) ADDED NOTES 11-14-56 N.M.

JOB TITLE Dallas, Texas
42" Pipe Line To Elm Fork
Inquiry No. DAL-602

GIFFORD-HILL-AMERICAN, INC.

LAYOUT SHEET

G. H. A. Dwg. No. 1116-1543-1A

This Sheet Added To Show Additional Piping 11-14-56 H.M.
① 11-26-56 Added Equation H.M.
② 12-20-56 Corrected Profile D.S.

DR. BY: H.M.
CHECKED: B.E.
DATE: Oct. 17, 1956
F.O. = 393
S.O. = 197

Pipe No	No. Req.	Class	Distance Slope	Distance Horizontal	Station	Slope	Tang	Turn or Pull	Elev.	Remarks
										Begin Laying @ 0+04.25 ~ Outside of Wall of Intake Structure
Pc.Mk. D43-WF1	1-Spec 42"	150#								42" Wall Fitting ~ Sheet #
					0+04.25					
#1 to #12	12-Std. 42"	"		192'		0°-00'	.00000			
					1+96.25			V-Turn = 4°28' Up	El. 431.75	
#13	1-Spec. 42"	"	15.85'	15.80'		+4°28'	.07820			4°28' Bevel
					2+12.05				El. 432.99	
#14 to #15	2-Std. 42"	"	32.00'	31.90'		+4°28'	.07820			
					2+43.95			V-Turn = 4°28' Dn	El. 435.48	
#16	1-Spec. 42"	"		15.85'		0°00'	.00000			4°28' Bevel
					2+59.80					
#17 to #26	10-Std. 42"	"		160'						
					4+19.80			V-Turn = 4°28' Up	El. 435.48	
#27	1-Spec. 42"	"	15.85'	15.80'		+4°28'	.07820			4°28' Bevel
					4+35.60			V-Turn = 4°28' Dn	El. 436.72	
#28	1-Spec. 42"	"		15.85'		0°00'	.00000			4°28' Bevel
					4+51.45					
#Ex-4	1-Spec. 42"	"		12.00'						Short Pipe
					4+63.45					
				4.13'	~Equation~	②				
					4+67.58 Bk.					
Pc.Mk. D43-B4	1-Spec. 42"	"			HPI = 4+69.50 Fwd.			Δ = 45°00' Rt.		42" ~ 45°00' Bend ~ Sheet #19
				5.47'						
					4+73.97					
#Ex-5	1-Spec. 42"	"		12.00'						Short Pipe
					4+85.97					
#29 to #126	98-Std. 42"	"		1568'						
					20+53.97					
#127	1-Spec. 42"	"		16'		0°00'	.00000			10" Flg. Outlet W/10" x 2" Red. Flg. @ 20+61.97 & 2" Plug Sheet #
					20+69.97			V-Turn = 1°04' Dn.	El. 436.72	
#128	1-Spec. 42"	"	15.96'	15.96'		-1°04'	.01862			1°04' Bevel
					20+85.93			V-Turn = 1°38' Dn	El. 436.42	
#129	1-Spec. 42"	"	15.95'	15.94'		-2°42'	.04716			1°38' Bevel
					21+01.87			V-Turn = 1°04' Up	El. 435.67	
#130	1-Spec. 42"	"	15.95'	15.94'		-1°38'	.02851			1°04' Bevel
					21+17.81			V-Turn = 1°38' Up	El. 435.22	
#131	1-Spec. 42"	"		15.95'		0°00'	.00000			1°38' Bevel
					21+33.76					
#132 to #145	14-Std. 42"	"		224'						
					23+57.76			H-Turn = 1°54' Lt.		
#146	1-Spec 42"	"		15.94'						1°54' Bevel
					23+73.70			H-Turn = [illegible] Lt.		

JOB TITLE DALLAS, TEXAS
42" PIPE LINE TO ELM FORK
INQUIRY #DAL-602

GIFFORD-HILL-AMERICAN, INC.

LAYOUT SHEET

G. H. A. Dwg. No. 1116-1543-2

① THIS SHEET REVISED TO SHOW ADDITIONAL PIPING. 11-14-56 HMM
② CORRECTED PROFILE D.S.-12-20-56

DR. BY: HMM
CHECKED: R.R.
DATE: OCT. 17, 1956
F.O. = 699
S.O. = 197

PIPE NO.	NO. REQ.	CLASS	DISTANCE SLOPE	DISTANCE HORIZONTAL	STATION	SLOPE	TANG	TURN OR PULL	ELEV.	REMARKS
								CURVE DATA: Δ: 60°-56' R: 197.00' T: 115.90' LC: 209.50		NOTE: THE EQUATION SHOWN AT THE P.I. OF HORIZ. CURVE No. 1 ON THE ENGR'S. DWGS. HAS BEEN COMBINED WITH THE EQUATION SHOWN HERE-ON.
					23+73.70			H-TURN: 4°36' LT.		
#147	1-SPEC. 42"	150#		15.85'						4°-36' BEVEL
					23+89.55			11-H-TURNS LT. @ 4°36' EA.		
#148 TO #158	11-SPEC. 42"	"		174.35'						11 - 4°36' BEVELS
					25+63.90			H-TURN = 3°34' LT.		
	(EQUATION ~ P.T. 25+68.90	BACK = 26+53.10 FWD.)								3°-34' BEVEL
#159	1-SPEC. 42"	"		15.89'						
					[illegible]3.99			H-PULL = 0°-16' LT.		
#160 TO #196	37-STD. 42"			592'		0°00'	00000			
					32+55.99			V-PULL 0°10' DN.	EL. 435.22	
#202 TO #233	32-STD. 42"	"		512'		-0°10'	00289			
					37+67.99			V-PULL [illegible]°10' UP	EL. 433.74	
#234 TO #341	108-STD. 42"	"		1729'		0°00'	00000			
					54+95.99					
	CHANGE	TO CLASS		110#						

NOTE: PIPE NO'S 197 THRU 201 DO NOT EXIST

JOB TITLE: DALLAS, TEXAS
42" PIPE LINE TO ELM FORK
INQUIRY NO. DAL. ~ 602

GIFFORD-HILL-AMERICAN, INC. ⓪ 12-20-56, CORRECTED PROFILE D.S.

LAYOUT SHEET

G. H. A. Dwg. No. 1116-1543-3

DR. BY:
CHECKED: D.S.
DATE: OCT 16 1956
F.O. =
S.O. =

PIPE NO.	NO. REQ.	CLASS	DISTANCE SLOPE	DISTANCE HORIZONTAL	STATION	SLOPE	TANG.	TURN or PULL	ELEV.	REMARKS
					54+95.99					
#342 to #364	23-Std. 42"	110#		368'		0°00'	.00000			
					58+63.99			V-Pull=0°19'(up)	El.=433.74	
#365 to #454	90-Std. 42"	"		1440'		-0°19'	.00550			
					73+03.99			V-Pull=0°19'(dn)	El.=441.66	
#455 to #463	9-Std. 42"	"		144'		0°-00'	.00000			
					74+47.99					
#464	1-Spec. 42"	"		16'		0°00'	.00000			10" Flg. Cut. 1/10 x 2" Reducer Flg ~ Sheet #10 & 2" Plug
					74+63.99			V-Turn=1°36'(dn)	El.=441.66	
#465	1-Spec. 42"	"		15.95'		-1°36'	.02793			1°36' Bevel
					74+79.94				El.=441.21	
#466 to #467	2-Std. 42"	"		32'		-1°36'	.02793			
					75+11.94			V-Turn=1°36'(up)	El.=440.32	
#468	1-Spec. 42"	"		15.95'		0°00'	.00000			1°36' Bevel
					75+27.89					
#469 to #481	13-Std. 42"	"		208'						
					77+35.89					
#EX-1	1-Spec. 42"	"		12.00'						Short Pipe.
					77+47.89					
R.Mk. D43-WF2	1-Spec. 42"	"		0.49'						42" Wall Fitting ~ Sheet #11
					77+48.38					
————	————	——	——	8.00'						Make-Up Block "D" ~ By Others
R.Mk. D43-WF3	1-Spec. 42"	"		~						42" Wall Fitting ~ Sheet #11
					77+56.38					
#482 to #484	3-Std. 42"	"		48'		0°00'	.00000			
					78+04.38			V-Turn=4°31'(dn)	El.=440.32	
#485	1-Spec. 42"	"	15.95	15.80'		-4°37'	.07899			4°-37' Bevel Pull joint to correct ℓ
					78+20.18				El.=439.07	
#486	1-Std. 42"	"	16.00	15.95'		-4°37'	.07899			
					78+36.13			V-Turn=4°37'(up)	El.=437.81	
#487	1-Spec. 42"	"		15.85'		0°00'	.00000			4°-37' Bevel
					78+51.98					
#488 to #507	20-Std. 42"	"		320'						NOTE: 64' of 60"ø Steel Liner Pipe is to be placed under railroad and 30' of 60"ø Steel Liner Pipe is to be placed under road. For exact location see [illegible] dwg.
					81+71.98					

GIFFORD-HILL-AMERICAN, INC. ① 12-20-56, Corrected Profile - D.S.

LAYOUT SHEET

JOB TITLE Dallas, Texas

42" Pipe Line To Elm Fork

Inquiry No. DAL ~ 602

G. H. A. Dwg. No. 1116 ~ 1543 - 4

DR. BY:

CHECKED: D.S.

DATE: Oct 26, 1956

F.O. = 698

S.O. = 197

Pipe No.	No. Req.	Class	Distance Slope	Distance Horizontal	Station	Slope	Tang	Turn or Pull	Elev.	Remarks
					81+71.98			H-Pull = 0°20' (RT)		
#508	1~Std.~42"	"		16.00'						
					81+87.98			H-Turn = 2°39' (RT)		
#509	1~Spec.~42"	"		15.92'						2°-39' Bevel
					82+03.90			18-H-Turns (RT) @ 3°-01' Ea.		
#510 to #527	18~Spec.~42"	"		286.20'						18~3°-01' Bevels
					84+90.10			H-Turn = 2°05' (RT)		
		Equation ~ Pt. = 84+93.38 BK = 85+24.79 FWD								
#528	1-Spec.~42"	"		15.93'						2°-05' Bevel
					85+37.44			H-Pull = 0°03' (RT)		
		Change to Class 100#								
#529 to #531	3-Std.~42"	100#		48.00'		0°-00'	.00000			
					85+65.44			V-Pull = 0°10' (UP)	El. = 437.81	
#532	1~Std.~42"	"		16.00'		+0°-10'	.00291			
					86+[illegible]1.44			V-Pull = 0°28' (UP)	El. = 437.87	
#533 to #554	22-Std.~42"	"		352.00'		+0°-38'	.01110			
					89+53.44			V-Pull = 0°10' (DN)	El. = 441.77	
#555	1~Std.~42"	"		16.00'		+0°-28'	.00814			
					89+69.44			V-Pull = 0°28' (DN)	El. = 441.90	
#556	1~Spec.~42"	"		16.00'		0°-00'	.00000			10" Flg. Out. W/10"x2" Reducer Flg.~Sheet #10 & 2" Plug
					89+85.44			V-Turn = 1°05' (DN)	El. = 441.90	
#557	1~Spec.~42"	"		15.96'		-1°-05'	.01891			1°05' Bevel
					90+01.44			V-Turn = 3°13' (DN)	El. = 441.60	
#558	1~Spec.~42"	"	15.96'	15.81'		-4°-18'	.07509			[illegible] Bevel
					90+17.21				El. = 440.41	
#559 to #560	2-Std.~42"	"	32.00'	31.90'		-4°-18'	.07523			
					90+49.11			V-Turn = 1°05' (UP)	El. = [illegible]	
#561	1~Spec.~42"	"	15.96'	15.93'		-3°-13'	.05635			1°05' Bevel
					90+65.0[illegible]			V-Turn [illegible]	El. = 437.11	
#562	1~Spec.~42"	"	15.82'	15.92'		0°-00'	.00000			5°-13' Bevel
					90+80.90					

JOB TITLE: Dallas, Texas
42" Pipe Line To Elm Fork
Inquiry #DAL-602

GIFFORD-HILL-AMERICAN, INC. ① 12-20-56, Corrected Profile - D.S.

LAYOUT SHEET

G. H. A. Dwg. No. 1116-1593-5

DR. BY:
CHECKED: D.S.
DATE: Oct. 25, 1956
F.O. = 698
S.O. = 197

PIPE No	No REQ	CLASS	DISTANCE SLOPE	DISTANCE HORIZONTAL	STATION	SLOPE	TANG	TURN or PULL	ELEV.	REMARKS
					90+80.90					
#563	1~Std.~42"	100		16.00'		0°-00'	.00000			
					90+96.90			V-Turn 1°17'(Up)	El.=437.11	
#564	1~Spec.~42"	"	15.96'	15.96'		+1°-17'	.02240			1°17' Bevel
					91+12.86			V-Turn 3°58'(Up)	El.=437.47	
#565	1~Spec.~42"	"	15.87'	15.80'		+5°-15'	.09190			3°58' Bevel
					91+28.66				El.=438.92	
#566 to #567	2~Std.~42"	"	32.00'	31.86'		+5°-15'	.09190			
					91+60.52			V-Turn 1°17'(Dn)	El.=441.85	
#568	1~Spec.~42"	"	15.96'	15.92'		+3°-58'	.06954			1°17' Bevel
					91+76.44			V-Turn 3°58'(Dn)	El.=442.96	
#569	1~Spec.~42"	"	15.81'	15.81'		0°-00'	.00000			3°58' Bevel
					91+92.31				El.=442.96	
#570 to #587	18~Std.~42"	"		288.00'		0°-00'	.00000			
					94+80.31				El.=442.96	
#588	1~Spec.~42"	"		16.00'		0°-00'	.00000			10" Flg Outlet w/10"x2" Reducer Flg-Sht.#10 & Bushing
					94+96.31			V-Turn 1°14'(Dn)	El.=442.96	
#589	1~Spec.~42"	"	15.96'	15.95'		-1°-14'	.02153			1°14' Bevel
					95+12.26			V-Turn 4°01'(Dn)	El.=442.61	
#590	1~Spec.~42"	"	15.87'	15.80'		-5°-15'	.09189			4°01' Bevel
					95+28.06				El.=441.16	
#591 to #594	4~Std.~42"	"	64.00'	63.72'		-5°-15'	.09189			
					95+91.78			V-Turn 1°14'(Up)	El.=435.31	
#595	1~Spec.~42"	"	15.96'	15.92'		-4°-01'	.07022			1°14' Bevel
					96+07.70			V-Turn 4°01'(Up)	El.=434.18	
#596	1~Spec.~42"	"	15.87'	15.87'		0°-00'	.00000			4°01' Bevel
					96+23.57				El.=434.18	
#597	1~Spec.~42"	"		16.00'		0°-00'	.00000			6" Flg. Out. For B.O. ~ Sheet #10
					96+39.57			V-Turn 1°01'(Up)	El.=434.18	
#598	1~Spec.~42"	"	15.96'	15.96'		+1°-01'	.01775			1°01' Bevel
					96+55.53			V-Turn 3°27'(Up)	El.=434.47	
#599	1~Spec.~42"	"	15.89'	15.84'		+4°-28'	.07812			3°27' Bevel
					96+71.37				El.=435.71	
#600 to #602	3~Std.~42"	"	48.00'	47.85'		+4°-28'	.07812			
					97+19.22			V-Turn 1°01'(Dn)	El.=439.44	
#603	1~Spec.~42"	"	15.96'	15.93'		+3°-27'	.06029			1°34' Bevel
					97+35.15			V-Turn 3°27'(Dn)	El.=440.40	
[illegible]	[illegible]	"	15.89'	15.89'		0°-00'	.00000			[illegible] Bevel
					97+51.04				El.=440.40	
#605 to #607	3~Std.~42"	"		48.00'		0°-00'	.00000			
					97+99.04			V-Turn 1°30'(Up)	El.=440.40	
#608	1~Spec.~42"	"	16.00'	15.99'		+1°-30'	.02618			1°30' Bevel
					[illegible]			V-Turn [illegible](Up)	El.=[illegible]	
#609	1~Spec.~42"		15.86'	15.79'		+5°-15'	.09189			3°45' Bevel
					98+30.8[illegible]				El.=44[illegible].27	

JOB TITLE Dallas, Texas
42" Pipe Line To Elm Fork
Inquiry # DAL-602

GIFFORD-HILL-AMERICAN, INC. (1) 12-20-56, Corrected Profile ~ D.S.

LAYOUT SHEET

G. H. A. Dwg. No. 1116-1543-6

DR. BY:
CHECKED: D.S.
DATE: Oct 30 1956
F.O. # 696
S.O. # 197

PIPE NO	NO REQ	CLASS	DISTANCE SLOPE	DISTANCE HORIZONTAL	STATION	SLOPE	TANG	TURN OR PULL	ELEV.	REMARKS
						+5°-15'	.09189			
					98+30.82			El.=442.27	V-Turn=1°29'(dn)	
#610	1~Spec.~42"	100#	15.96'	15.92'		+3°-46'	.06583			.°29' Bevel
					98+46.74			El.=443.32	V-Turn=3°46'(dn)	
#611	1~Spec.~42"	"	15.87'	15.87'		0°-00'	.00000			3°46' Bevel
					98+62.61			El.=443.32	V-Pull=0°23'(dn)	
#612	1~Spec.~42"	"		16.00'		-0°-23'	.00669			10" Flg. Out W/10"x2" Reducer Flg.-Sht. 10 #2" Plug
					98+78.61			El.=443.21	V-Turn=1°22'(dn)	
#613	1~Spec.~42"	"	15.96'	15.95'		-1°-45'	.03055			1°22' Bevel
					98+94.56			El.=442.72		
#614 to #617	4-Std.~42"	"	64.00'	63.96'		-1°-45'	.03055			
					99+58.52			El.=440.77	V-Pull=0°23'(up)	
#618	1~Std.~42"	"	16.00'	16.00'		-1°-22'	.02386			
					99+74.52			El.=440.39	V-Turn=1°22'(up)	
#619	1~Spec.~42"	"	15.96'	15.96'		0°-00'	.00000			1°[illegible] Bevel
					99+90.48			El.=440.39	V-Pull=0°20'(up)	
#620	1~Std.~42"	"		16.00'		+0°-20'	.00582			
					100+06.48			El.=440.48	V-Turn=1°[illegible](up)	
#621	1~Spec.~42"	"	15.96'	15.95'		+1°-35'	.02764			1°15' Bevel
					100+22.45			El.=440.92		
#622 to #623	2-Std.~42"	"	32.00'	31.98'		+1°-35'	.02764			
					100+54.41			El.=441.81	V-Pull=0°23'(dn)	
#624	1~Std.~42"	"		16.00'		+1°-12'	.02095			
					100+70.41			El.=442.14	V-Turn=1°07'(dn)	
#625	1~Spec.~42"	"	15.96'	15.96'		+0°-05'	.00145			1°07' Bevel
					100+86.37			El.=442.16	V-Pull=0°29'(up)	
#626	1~Std.~42"	"		16.00'		+0°-34'	.00989			
					101+02.37			El.=442.32	V-Pull=0°38'(dn)	
#627 to #645	19-Std.~42"	"		304.00'		+1°-12'	.02095			
					104+06.37			El.=448.69	V-Pull=0°05'(dn)	
#646	1~Std.~42"	"		16.00'		+1°-07'	.01949			
					104+22.37			El.=449.00	V-Pull=0°18'(dn)	
#647	1~Spec.~42"	"		16.00'		+0°-19'	.00562			10" Flg. Out. W/10"x2" Reducer Flg.-Sht. 10 #2" Plug
					104+38.37			El.=449.09	V-Turn=1°44'(dn)	
#648	1~Spec.~42"	"	15.95'	15.95'		-1°-06'	.01920			1°44' Bevel
					104+54.32			El.=448.78	V-Turn=4°09'(dn)	
#649	1-Spec.~42"	"	15.86'	15.73'		-5°-15'	.09189			4°09' Bevel
					104+70.11			El.=447.33	V-Turn=1°05'(dn)	
#650	1-Spec.~42"	"	15.96'	15.92'		-4°-10'	.07285			1°05' Bevel
					104+86.03			El.=446.17	V-Turn=4°10'(up)	
#651	1~Spec.~42"	"	15.86'	15.86'		0°-00'	.00000			4°10' Bevel
					105+01.89			El.=446.17		
#652 to #663	12-Std.~42"	"		192.00'						
					106+93.89					

GIFFORD-HILL-AMERICAN, INC.

LAYOUT SHEET

JOB TITLE: DALLAS, TEXAS
42" PIPE LINE TO ELM FORK
[illegible] #DAL-602

G. H. A. Dwg. No. 1116-1543-7

① CORRECTED STATIONING FROM 106+93.89 TO 109+79.12 & CHANGED LENGTH OF EX-2 ~ 12-6-56 HM
② 12-20-56, CORRECTED PROFILE ~ D.S.

DR. BY:
CHECKED: D.S.
DATE: NOV-6-56
F.O. = 393
S.O. = 137

PIPE NO.	NO. REQ.	CLASS	DISTANCE SLOPE	DISTANCE HORIZONTAL	STATION	SLOPE	TANG	TURN OR PULL	ELEV.	REMARKS
						0°00'	.00000			
					106+93.89			V-Turn 1°07' (up)	El. = 446.17	
#664	1-Spec.~42"	100#		15.96'		+1°07'	.1049			1°07' Bevel
					107+09.85			V-Turn 3°26' (up) H Turn 1°09' (Lt)	El. = 446.48	
#665	1-Spec.~42"	"	15.89'	15.84'		+4°33'	.07958			Comp. ∠ 3°52' 3°52' Bevel; Curve Data: [illegible]
					107+25.69			H. Turn 4°08' (up)	El. = 447.74	
#666	1-Spec.~42"	"	15.86'	15.81'		+4°33'	.07958			4°08' Bevel
					107+41.50			10-H. Turns (Lt) @ 4°17' ea.	El. = 449.00	
#667-#676	10-Spec.~42"	"	158.60'	158.15'		+4°33'	.07958			10-4°17' Bevels
					108+99.65			H. Turn 4°16' (Lt)	El. = 461.58	
		EQUATION ~ PT: 109+14.?? BK = 109+36.15 FWD.								
#677	1-Spec.~42"	"	15.86'	15.81'		+4°33'	.07958			4°16' Bevel
					109+31.29			H. Turn 1°48' (up)	El. = 462.84	
#678	1-Spec.~42"	"	15.94'	15.89'		+4°33'	.07958			1°48' Bevel
					109+47.18				El. = 464.11	
#679-#680	2-Std.~42"	"	32.00'	31.90'		+4°33'	.07958			
					109+79.08				El. = 466.65	
#EX-2	1-Spec.~42"	"	7.51'	7.48'		+4°33'	.07958			Short Pipe
					109+86.56			V-Turn 4°33' (dn)	El. = 467.24	
#681	1-Spec.~42"	"		15.86'		0°00'	.00000			4°33' Bevel
					110+02.42					
#682-#683	2-Std.~42"	"		32.00'		0°00'	.00000			
					110+34.42					
#684	1-Spec.~42"	"		16.00'		0°00'	.00000			10" Flg. Outlet w/10"x2" Reducer Flg.-Sch. [illegible] 2" Plug
					110+50.42			V-Turn 4°56' (dn)	El. = 467.24	
#685	1-Spec.~42"	"	15.84'	15.78'		-4°56'	.08652			4°56' Bevel
					110+66.20				El. = 465.88	
#686-#688	3-Std.~42"	"	48.00'	47.82'		-4°56'	.08652			
					111+14.02			V-Turn 4°56' (up)	El. = 461.74	
#689	1-Spec.~42"	"	15.84'	15.84'		0°00'	.00000			4°56' Bevel
					111+29.86			V-Turn 4°09' (up)		
#690	1-Spec.~42"	"	15.87'	15.83'		+4°09'	.07266			4°09' Bevel
					111+45.69				El. = 462.89	
#691-#693	3-Std.~42"	"	48.00'	47.88'		+4°09'	.07266			
					111+93.57			V-Turn 4°09' (dn)	El. = 466.37	
#694	1-Spec.~42"	"	15.86'	[illegible]		0°00'	.00000			4°09' Bevel
					112+09.43					
#695-#697	3-Std.~42"	"		[illegible]		0°00'	.00000			
					112+57.43			V-Turn 3°01' (up)		
#698	1-Spec.~42"	"	15.90'	15.88'		+3°01'	.0528			3°01' Bevel
					112+[illegible]				El. = 467.21	
#699-#701	3-Std.~42"	"	48.00'	[illegible]		[illegible]	[illegible]			
					113+[illegible]			V-Turn 3°01' (dn)	El. = 469.74	
#702	1-Spec.~42"	"	[illegible]	[illegible]		0°00'	[illegible]			3°01' Bevel
					113+77.15'				El. = [illegible]	

JOB TITLE Dallas, Texas

42" Pipe Line To Elm Fork

Inquiry # DAL-602

GIFFORD-HILL-AMERICAN, INC. ① 12-20-56, Corrected Profile D.S.

LAYOUT SHEET

G. H. A. Dwg. No. 116-1543~8

DR BY

CHECKED D.S.

DATE Jan-6 56

FO = 629

SO = 197

PIPE NO	NO REQ	CLASS	DISTANCE SLOPE	DISTANCE HORIZONTAL	STATION	SLOPE	TANG	TURN OR PULL	ELEV.	REMARKS
						0°-00'	.00000			
					113+37.15			V-Turn=4°18'(UP)	El=469.74	
#703	1-Spec.-42"	100#	15.86'	15.81'		+4°18'	.01519			4°18' Bevel
					113+52.96			V-Turn=4°18'(DN)	El.=470.93	
#704	1-Spec.-42"	"	15.86'	15.86'		0°-00'	.00000			4°18' Bevel
					113+68.82			V-Turn=3°40'(UP)		
#705	1-Spec.-42"	"	15.88'	15.85'		+3°40'	.06418			3°40' Bevel
					113+84.67				El.=471.95	
#706~#708	3-Std.-42"	"	48.00'	47.91'		+3°40'	.06418			
					114+32.58			V-Turn=3°40'(DN)	El=475.02	
#709	1-Spec.-42"	"		15.83'		0°-00'	.00000			3°40' Bevel
					114+48.66					
#710~#715	6-Std.-42"	"		96.00'		0°-00'	.00000			
					115+44.46			V-Turn=2°04'(UP)	El.=475.02	
#716	1-Spec.-42"	"	15.93'	15.92'		+2°-04'	.03612			2°04' Bevel
					115+60.38				El=475.60	
#717~#727	11-Std.-42"	"	176.00'	175.89'		+2°-04'	.03612			
					117+36.27			V-Turn=2°04'(DN)	El=481.95	
#728	1-Spec.-42"	"		15.93'		0°-00'	.00000			2°-04' Bevel
					117+52.20					
#729~#732	4-Std.-42"	"		64.00'		0°-00'	.00000			
					118+16.20					
#733	1-Spec.-42"	"		16.00'		0°-00'	.00000			10" Flg. Outlet/10"x2" Red. Flg. & 2" Plug 118+[illegible]
					118+32.20			V-Turn=3°40'(DN)	El=481.95	
#734	1-Spec.-42"	"	15.88'	15.85'		-3°40'	.06435			3°40' Bevel
					118+48.05			V-Pull=0°09'(UP)	El.=480.93	
#735	1-Std.-42"	"	16.00'	15.97'		-3°-31'	.06170			
					118+64.02			V-Turn=3°31'(UP)	El=479.94	
#736	1-Spec.-42"	"		15.88'		0°-00'	.00000			3°31' Bevel
					118+79.90					
#737~#743	7-Std.-42"	"		112.00'		0°-00'	.00000			
					119+91.90			V-Pull=0°31'(UP)	El.=479.94	
#744	1-Std.-42"	"		16.00'		+0°-31'	.00902			
					120+07.90			V-Turn=4°44'(UP)	El.=480.09	
#745	1-Spec.-42"	"	15.85'	15.78'		+5°-15'	.09180			4°44' Bevel
					120+23.68				El.=481.54	
#746~#748	3-Std.-42"	"	48.00'	47.79'		+5°15'	.09180			
					120+71.47				El.=485.92	
EX-3	1-Spec.-42"	"	12.00'	11.95'		+5°15'	.09180			Short Pipe
					120+83.42				El.=487.02	
			3.61'	3.59'		+5°15'	.09180			
Fr. Mk D73 [illegible]	1-Spec.-42"	"								42"-30°00' Bend - Sheet #13
					HM-120+87.01			Δ=30°00'(RT)	El=487.35	
			1.24'	1.23'		+5°15'	.09180			
					120+88.24				Fl=487.46	

JOB TITLE: Dallas, Texas
42" Pipe Line To Elm Fork
Inquiry # DAL-602

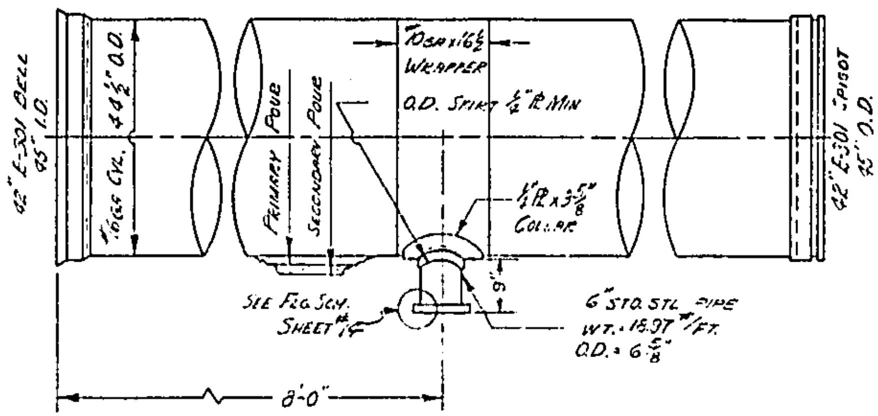
GIFFORD-HILL-AMERICAN, INC. ① 12-20-56 Corrected Profile D.S.

LAYOUT SHEET

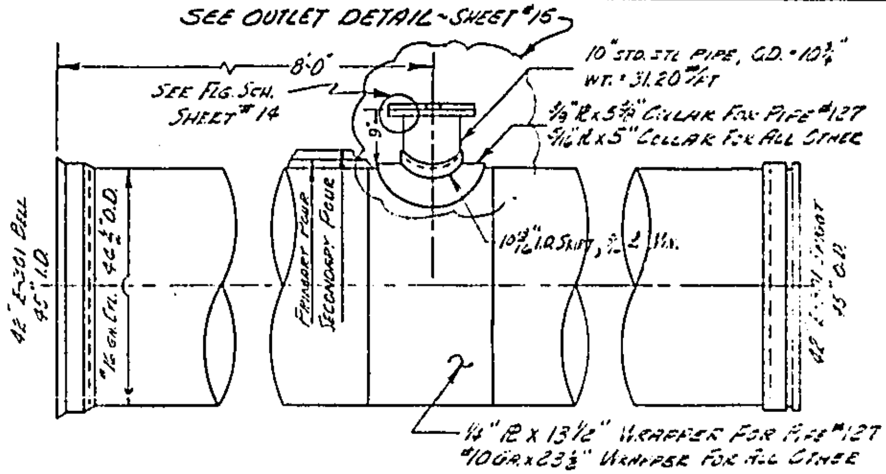
G. H. A. Dwg. No. 1116-1543-9

DR. BY:
CHECKED: D.S.
DATE: Nov. 6-56
F.O. #
S.O. #

PIPE NO	NO REQ	CLASS	DISTANCE SLOPE	DISTANCE HORIZONTAL	STATION	SLOPE	TANG	TURN OR PULL	ELEV.	REMARKS
					120+88.24				El. = 487.96	
#749	1-Std.~42"	100#	16.00'	15.93'		+5°-15'	.09160			
					121+04.17			V-Turn = 5°15'(DN)	El. = 488.92	
#750	1-Spec.~42"	"	15.84'	15.80'		0°-00'	.00000	V-Pull = 0°-15'(DN)		5°00' Bevel
					121+20.01			V-Turn = 5°03'(UP)		
#751	1-Spec.~42"	"	15.87'	15.88'		+5°-03'	.08837	V-Turn = 0°03'(UP)		5°00 Bevel
					121+35.89			V-Pull = 0°04'(UP)	El. = 490.33	
P.Mk. 043-WF4	1-Spec.~42"	"				+5°-07'	.08937			42" Wall Fitting, ~ Sheet #11
———	———	———	———	8.39'		+5°-07'	.08937			Make Up Block "E"
P.Mk. 043-WF5	1-Spec.~42"	"		~		+5°-07'	.08937			42" Wall Fitting ~ Sheet #11
					121+44.28				El. = 491.08	
#752~#754	3-Std.~42"	"	48.00'	47.82'		+5°-07'	.08937			
					121+92.10			V-Turn = 5°07'(DN)	El. = 495.35	
#755	1-Spec.~42"	"	15.84'	15.84'		0°-00'	.00000	V-Pull = 0°07'(DN)		5°00' Bevel
					122+07.94					
#756	1-Std.~42"	"		16.00'		0°-00'	.00000			
					122+23.94					
				0.62'		0°-00'	.00000			
									El. = 495.35	
P.Mk. 043-B2	1-Spec.~42"	"								42"~14°58' Bend ~ Sheet #12
					VPI = 122+24.56			Δ=14°58'(UP)		
			0.86'	0.83'		+14°-58'	.26763			
					122+25.39				El. = 495.57	
#757~#758	2-Std.~42"	"	32.00'	30.91		+14°-58'	.26763			
					122+56.30				El. = 503.85	
			0.57'	0.55'		+14°-58'	.26763			
									El. = 504.00	
P.Mk. 043-B3	1-Spec.~42"	"								42"~14°58' Bend ~ Sheet #12
					VPI = 122+56.85			Δ=14°58'(DN)		
				0.86'		0°-00'	.00000			
					122+57.71				El. = 504.00	
#759	1-Std.~42"	"		16.00'		0°-00'	.00000			
					122+73.71					
P.Mk. 043-WF6	1-Spec.~42"	"								Wall Fitting ~ Sheet #11
										~ END THIS CONTRACT ~



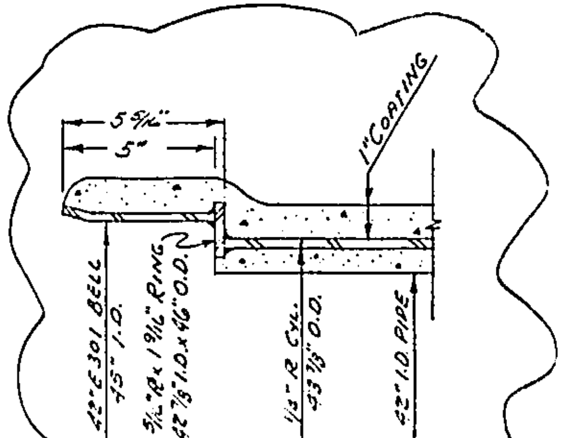
PIPE NO. 597
STA. ~ 96+31.57
6" Flg Outlet on 42" E-301
½" = 1'-0"
1 ~ Req.



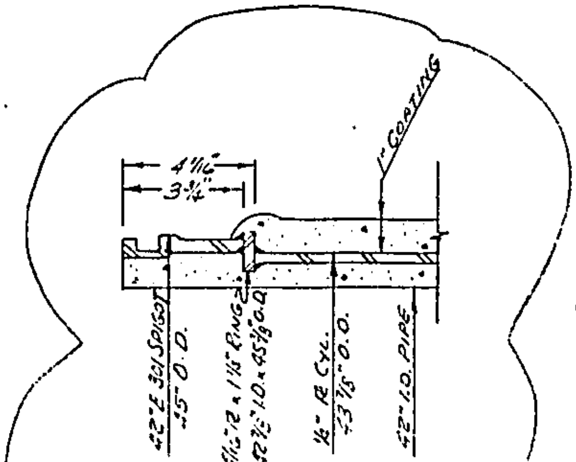
③ Added 2" Plug to 10" F.O. Detail - 11-27-56

10" Flg Outlet on 42" E-301
W/10" x 2" Red. Flg. (2" Plug ③)
½" = 1'-0" ~ 8 - Req.

②, Pipe #127 Added To Schedule RW 11-13-56



DETAIL "B42"
42" E-301 BELL
3" = 1'-0"



DETAIL "S42"
42" E-301 SPIGOT
3" = 1'-0"

PIPE NO.	STATION	CLASS
#464	74+55.90	110#
#556	89+77.44	100#
#588	94+88.31	100#
#612	98+70.61	100#
#647	103+30.37	100#
#685	110+42.42	100#
#734	118+24.20	100#
② #127	20+61.97	150#

F.O. - #698
S.O. - #197

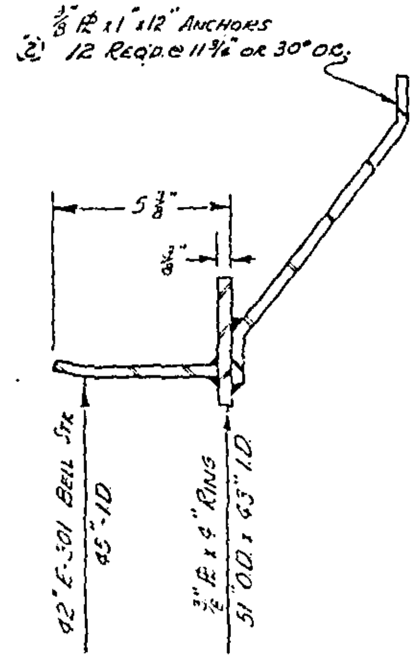
GIFFORD - HILL - AMERICAN, INC.
DALLAS, TEXAS

DALLAS, TEXAS

DR. BY D.J.
TR. BY
CHECKED
DATE

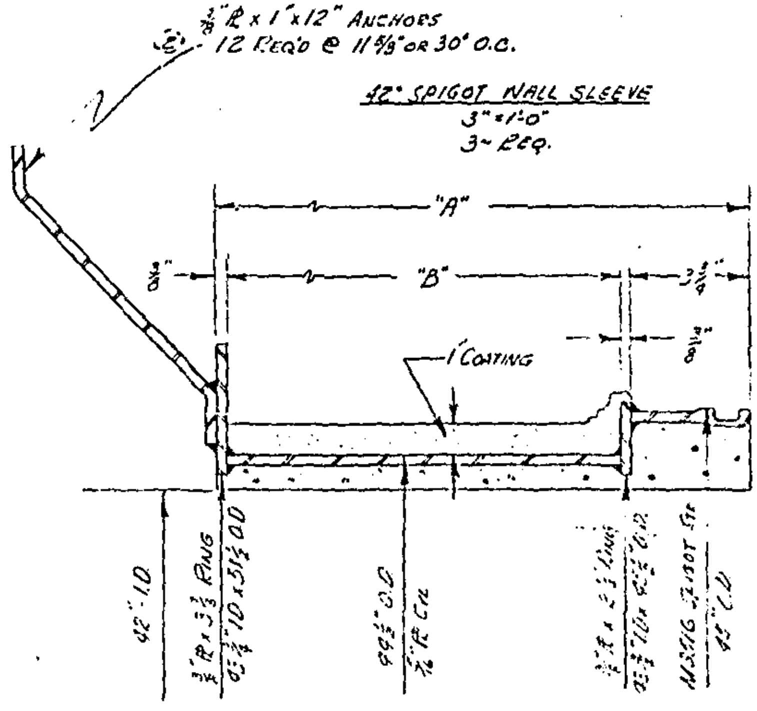
SCALE

SHEETS
SHEET NO.



42" BELL WALL SLEEVE
3~REQ'D
Pc. Mk. D43-WF1 ~ 0+04.25 (1)
Pc. Mk. D43-WF3 ~ 77+56.38
Pc. Mk. D43-WF5 ~ 121+44.28

42" SPIGOT WALL SLEEVE
3" = 1'-0"
3~REQ.



Pc. Mk.	Station	Dim. "A"	Dim. "B"
D43-WF2	77+48.38	15 1/8"	10 5/8"
D43-WF4	121+35.89	8 5/8"	4 1/8"
D43-WF6	122+73.71	8 5/8"	4 1/8"

FQ-#698
SO-#197

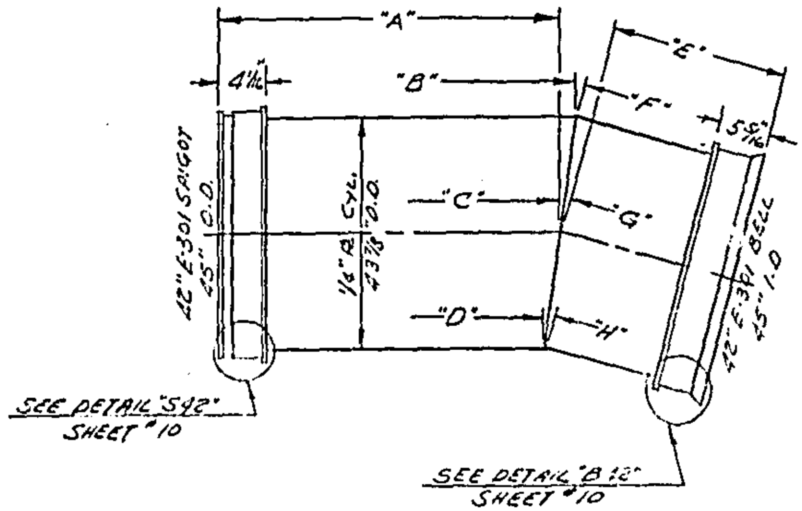
11-27-56 (2) CHANGED NO. OF ANCHORS REQ ON WALL SLEEVES
(1) ADDED STA. NO. TO WF1 11-14-56 JJM

GIFFORD - HILL - AMERICAN, INC.
DALLAS, TEXAS

DALLAS, TEXAS

DR. BY D.S.	SCALE	
TR. BY		
CHECKED		
DATE	SHEETS	SHEET NO. 11

Pc. Mk.	Station	Δ	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"
D43-B2	122+24.56	15°00'	10 3/4"	9 7/16"	6 11/16"	3 13/16"	10 5/16"	7 7/8"	5"	2 1/8"
D43-B3	122+56.85	15°00'	10 1/8"	8 15/16"	6 1/16"	3 3/16"	10 5/16"	7 7/8"	5"	2 1/8"



FACTORY ORDER No. 698
SHOP ORDER No. 197

GIFFORD - HILL - AMERICAN, INC.
DALLAS, TEXAS

DALLAS, TEXAS
42" PIPE LINE TO ELM FORK

DALLAS POWER & LIGHT | INQUIRY NO. DAL 602

DR. BY
TR. BY
CHECKED
DATE NOV. '56
SCALE NOTED
DR. NO. HC-1543-12
SHEETS
SHEET NO 12

SPIGOT LEG

PC. MK.	STATION	Δ	TANGENT	"A"	"B"	"C"	"D"
D93-B1	120+87.01	30°00'	9 9/16"	3'-10 1/2"	3'-4 7/16"	3'-1 9/16"	2'-10 11/16"

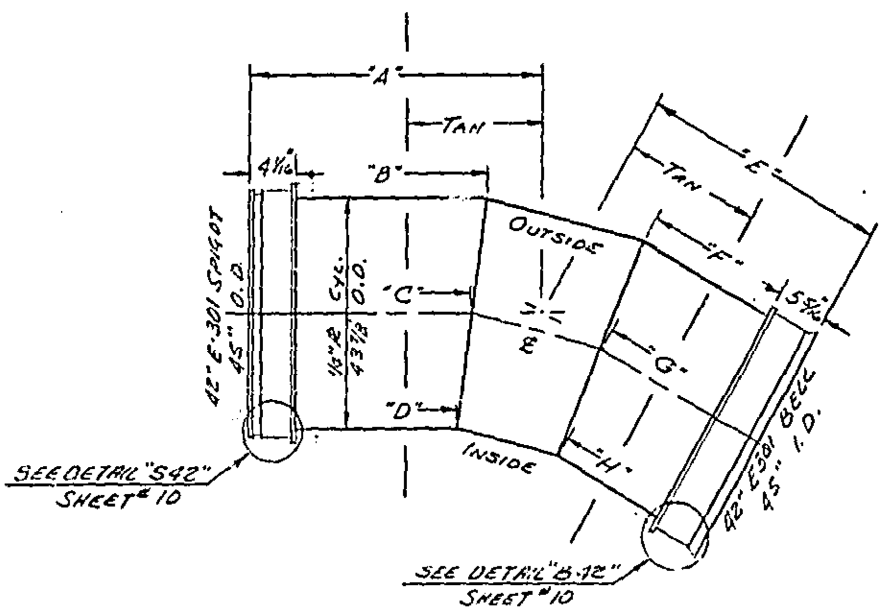
CENTER SECTIONS

1-SECTION REQ'D. PER BEND

OUTSIDE	℄	INSIDE
15 1/8"	9 3/8"	3 5/8"

BELL LEG

"E"	"F"	"G"	"H"
14 7/8"	7 9/16"	4 11/16"	1 13/16"



FACTORY ORDER NO. 698
SHOP ORDER NO. 197

GIFFORD - HILL - AMERICAN, INC. DALLAS, TEXAS	
DALLAS, TEXAS 42" PIPE LINE TO ELM FORK	
DALLAS POWER & LIGHT	INQUIRY NO. DAL. 662
DR. BY	SCALE NOTED
TR. BY	[illegible]
CHECKED	
DATE Nov '56	SHEETS / SHEET NO. 13

FLANGE SCHEDULE

	[illegible]	[illegible]	[illegible]								[illegible]	[illegible]	[illegible]	[illegible]
(1)	[illegible]	8	[illegible]								[illegible]	[illegible]	[illegible]	[illegible]
(2)	18"	1	19 25/32"	3/16"	5"	25"	22 3/4"	1 1/16"	1/4"	57/64"	16	1 1/8"	1 1/4"	SO#197

1-18" FLG. GASKET
(2) 16 - 1 1/8" x 4" BOLTS W/NUTS

(1)	* [illegible]	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
(2)	*18"	1	25"	1 1/16"	16 @ 1 1/4"	22 3/4"	S.O.#197

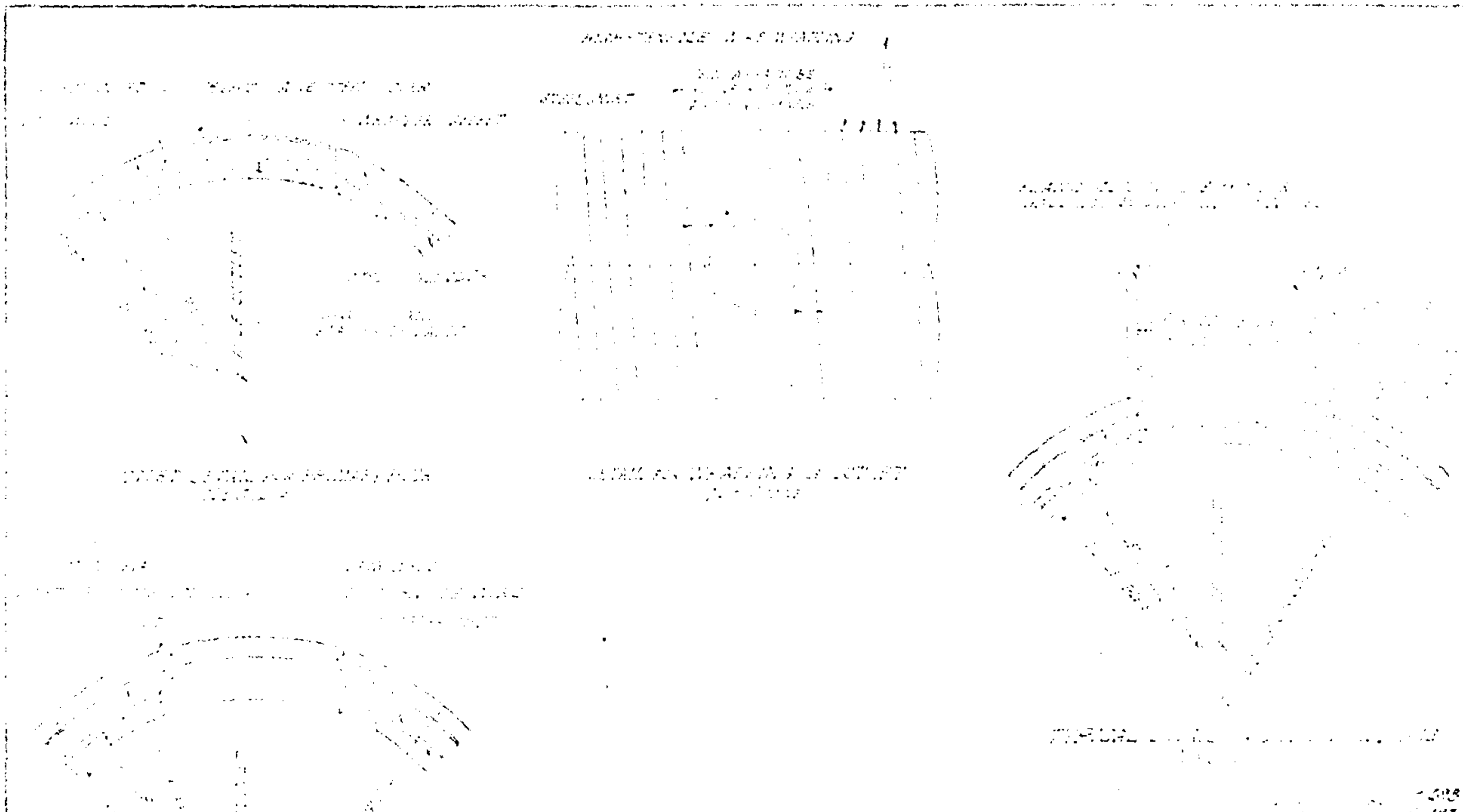
DALLAS, TEXAS ~ [illegible] PIPE LINE TO ELM FORK

NOV. 5, 1956

1116-1543-14

(1): ADDED 1-10" FLG & 1-10" x 2" RED. FLG. H711 11-15-56

(2): ADDED 1-18" FLG. & 18" x 2" RED. FLG.



DALLAS, TEXAS
42" PIPE LINE TO ELM FORK

DALLAS POWER & LIGHT

NONE DC NO. 1116-1543-15

NOTE: SEE SHEET #12 FOR DETAIL FOR BEVEL PIPE

42" E-301 Bevel Pipe

Pipe No.	Bevel	"A"	"B"	PL Thickness
557, 561, 598, 625, 650, 664 ①	5 - 1°05'	3"	3 13/16"	3/16"
564, 568, 589, 595, 613, 619, 621	7 - 1°17'	3"	4"	"
608 & 610	2 - 1°30'	3"	4 3/16"	"
465, 468 & 603	3 - 1°36'	3"	4¼"	"
648 & 678	2 - 1°44'	3"	4 3/8"	"
528, 716 & 728	3 - 2°05'	3"	4 5/8"	"
509	1 - 2°34'	3"	5"	"
604	1 - 2°54'	3"	5¼"	"
510 thru 527, 698 & 702	20 - 3°01'	3"	5 3/8"	"
558 & 562	2 - 3°13'	3"	5½"	"
599 & 736	2 - 3°27'	3"	5 11/16"	"
705, 709 & 734	3 - 3°40'	3"	5 7/8"	"
609 & 611	2 - 3°45'	3"	5 15/16"	"
665	1 - 3°52'	3"	6"	"
565, 569 590 & 596	4 - 3°58'	3 1/16"	6 1/16"	"
649, 651, 666, 690 & 694	5 - 4°09'	3¼"	6¼"	"
667 thru 676, 677, 703 & 704	13 - 4°17'	3 5/16"	6 5/8"	"
485, 487 & 681	3 - 4°37'	3 5/8"	7¼"	"
745	1 - 4°44'	3 11/16"	7 3/8"	"
685 & 689	2 - 4°56'	3 7/8"	7 5/8"	"
750, 751 & 755	3 - 5°00'	3 15/16"	7 7/8"	"

42" E-301 Short Pipe

Pipe No.	L. L.	O. L.
EX-1	12.00'	12'-3¼"
EX-2	② 7.51'	7'-9⅜"
EX-3	12.00'	12'-3¼"

① Added Bevel To Pipe #664
② Changed Length of EX-2 - 12-6-56 HAH.

F.O. #298
S.O. #197

GIFFORD - HILL - AMERICAN, INC.
DALLAS, TEXAS

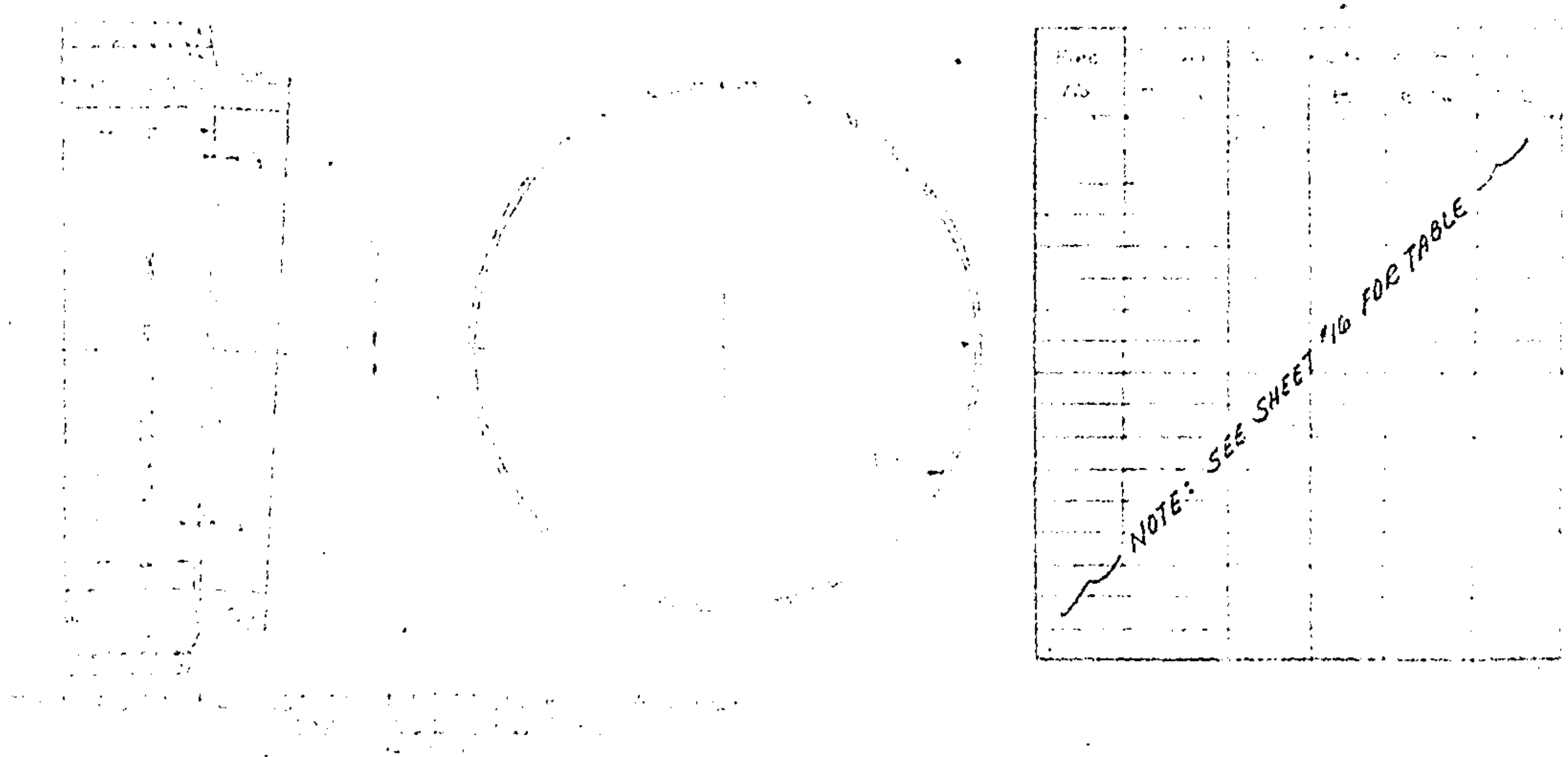
DALLAS, TEXAS
42" PIPE LINE TO ELM FORK

DALLAS POWER & LIGHT | INQUIRY NO. DAL-662

DR. BY JUB
TR. BY
CHECKED
DATE NOV '56

SCALE
NONE

SHEETS | SHEET NO



FACTORY ORDER # 698
SHOP ORDER # 197

DALLAS, TEXAS
42" PIPE LINE TO ELM [illegible]

DALLAS POWER & LIGHT INQUIRY NO. DPL [illegible]

NONE DC. NO. [illegible]-17

NOV. '56

NOTE: See Sheet #17 for detail of Bevel Pipe.

42" E-301 Bevel Pipe - Class 150# (cont'd)

Pipe No.	Angle	"A"	"B"	PL Thickness
13, 16, 27 & 28	4°20'	3½"	7"	½"
128	1°04'	3"	3 7/8"	"
129	1°38'	3"	4 1/4"	"
130	1°04'	3"	3 7/8"	"
131	1°38'	3"	4 1/4"	"
146	1°54'	3"	4½"	"
147 thru 158	4°36'	3 9/16"	7 1/8"	"
159	3°34'	3"	5 15/16"	½"

42" E-301 Short Pipe (cont'd)

Pipe No.	L. L.	O. L.
EX-4	12.00'	12'-3½"
EX-5	12.00'	12'-3½"

THIS SHEET REVISED 11-14-56 [illegible]

F.O. #698
S.O. #197

GIFFORD - HILL - AMERICAN, INC.
DALLAS, TEXAS

DALLAS, TEXAS
42" PIPE LINE TO [illegible] FORK

DALLAS POWER & LIGHT | INQUIRY # [illegible]

DR. BY [illegible] | SCALE NOTED | DR. NO. [illegible]
TR. BY
CHECKED
DA. [illegible]
SHEETS | SHEET NO. [illegible]

SPIGOT LEG

PC. MK.	STATION	Δ	TANGENT	"A"	"B"	"C"	"D"
D43-84	4+68.50	45°00'	43 1/2"	4'-4 13/16"	21 13/16	19 1/16"	16 3/16"

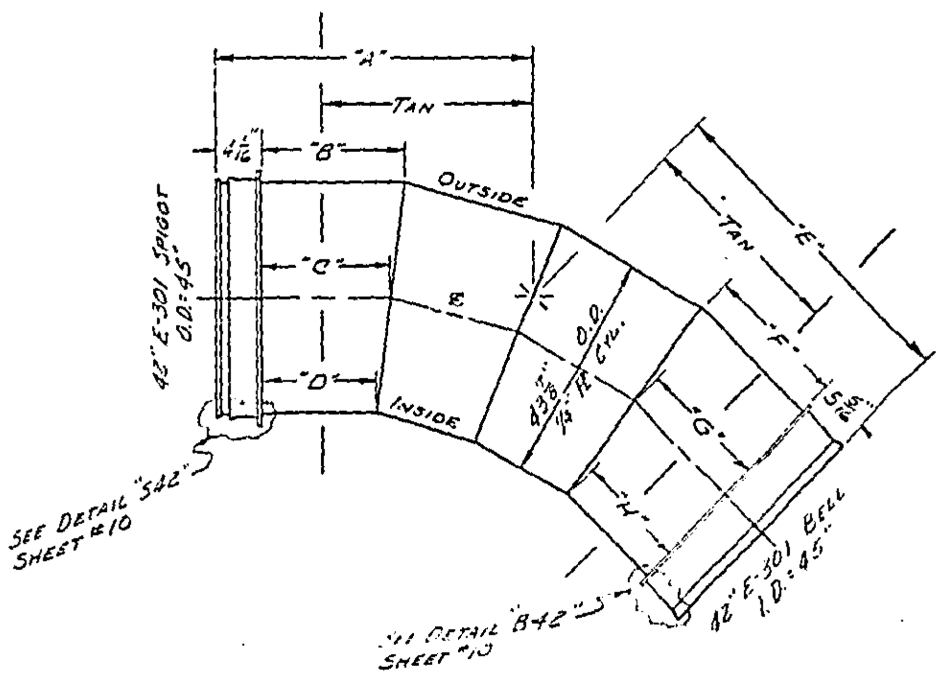
CENTER SECTIONS

2-SECTIONS REQ'D. PER BEND

OUTSIDE	℄	INSIDE
33 3/8"	27 5/8"	21 7/8"

BELL LEG

"E"	"F"	"G"	"H"
5'-5 5/8"	33 1/2"	30 5/8"	27 3/4"



FACTORY ORDER NO. 698
SHOP ORDER NO. 197

CHANGED LENGTH OF SPIGOT LEG. [illegible]

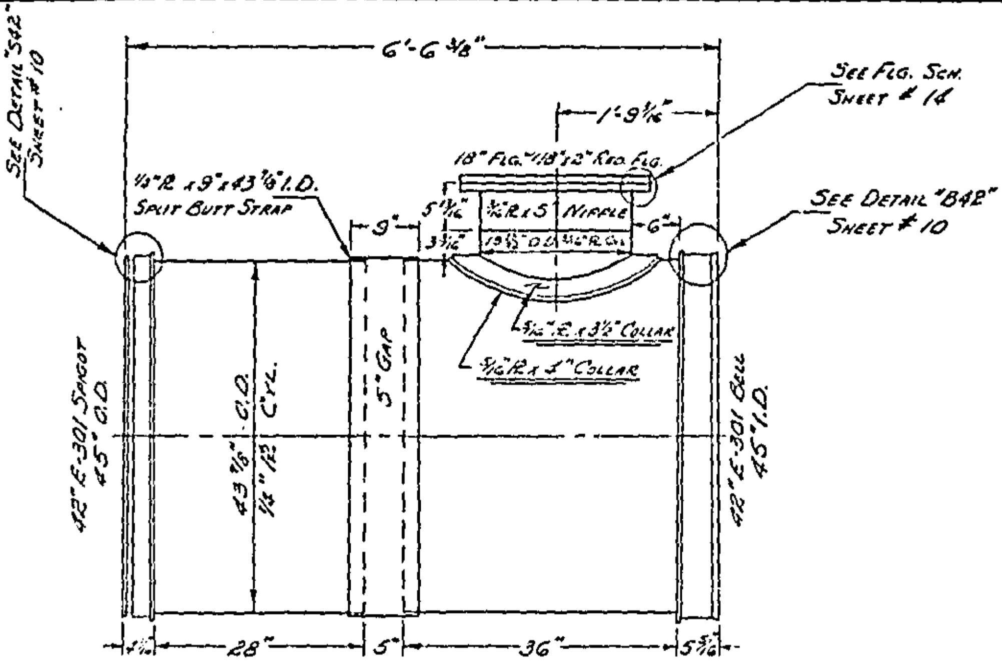
GIFFORD - HILL - AMERICAN, INC.
DALLAS, TEXAS

DALLAS, TEXAS
42" PIPE LINE TO ELM FORK

DALLAS POWER & LIGHT CO.
OWNER

INQUIRY NO. DAL-302

DR. BY H.M.	SCALE NONE	DR. NO. 15F2-19
TR. BY		
CHECKED		
DATE	SHEETS	SHEET NO.



Pc. Mk. D43-CS1

42" Grt. Closure Section w/ 18" MH

Sta. 77 + 52 ±

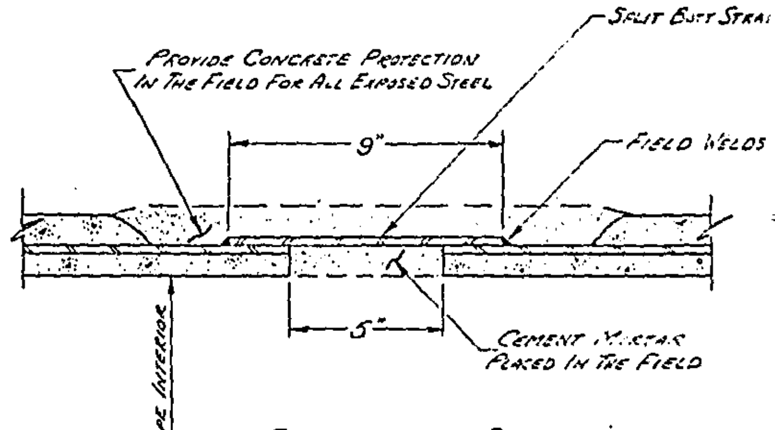
3/4" = 1'-0"

1 - Req'd.

THIS CLOSURE SECTION WILL REPLACE THE EXISTING MAKE-UP BLOCK "D" AND 42" WALL FITTINGS WF2 & WF3.

THIS FITTING WILL BE FABRICATED APPROX. 6" LONGER THAN FIELD MEASUREMENT TO INSURE SUFFICIENT LENGTH. THE EXCESS SHALL BE TRIMMED IN THE FIELD DURING INSTALLATION.

DELIVER FITTING DURING WEEK OF JUNE 17, 1957



CONSTRUCTION DETAIL

3" = 1'-0"

FACTORY ORDER NO. 593

SHOP ORDER NO. 797

MARK	BY	DATE	REVISION	MARK	BY	DATE	REVISION
[illegible]	BB	5-6-57	THIS SHEET ADDED				

SCALE: NOTED	DALLAS, TEXAS		GIFFORD-HILL - AMERICAN, INC. DALLAS, TEXAS
DR. BY: BB	42" PIPE LINE TO ELM FORK		
CHECKED:	DALLAS POWER & LIGHT CO. OWNER	P.O. # NY-333114	DR. NO. [illegible] SHEET [illegible] OF SHEETS
DATE: [illegible]-6-57			

Appendix 5: OPCC Short-Term

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Raw Water System INTERIM IMPROVEMENTS - ROM (0% Design)**	**Sheet:**	**1 of 4**
Item No.	Item Description		Item Cost
1	**Site Work**		**$300,000**
2	**Access Points**		**$340,000**
3	**Outfall Demo - Channel Armor**		**$280,000**
		Subtotal	**$920,000**

Contingency	25%	$230,000
GCs, Bonds, Ins., OH	15%	$138,000
		$1,288,000
Profit	12%	$155,000
		$1,443,000
Engineering, Surveying, Geotec	15%	$217,000
	TOTAL	**$1,660,000**

Basis for Cost Projection:

- ☑ No Design Completed
- ☐ Preliminary Design
- ☐ Final Design

This total does not reflect land acquisition, environmental nor permitting costs.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Site Work**			**Sheet:**	**2 of 4**
Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
1	PS Clean/Excavate Intake Channel and Adjoining Bank	1	LS	$20,000.00	$20,000
2	PS Rip Rock Intake Channel and Adjoining Bank	800	CY	$63.00	$50,400
3	Temp Access Ramp	1	LS	$40,000.00	$40,000
4	42" x 10" Tap	1	EA	$15,000.00	$15,000
5	Grapevine Cr Crossing Stabilization (Gabion wall and revetment)	2	LS	$85,000.00	$170,000
		Subtotal:			$295,400
		Conting. (%,+/-)		0%	
		Total:			**$300,000**

Basis for Cost Projection:

- [x] No Design
- [ ] Preliminary Design
- [ ] Final Design

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Access Points**			**Sheet:**	**3 of 4**
Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
1	20" HDPE DR17 - pipe matl	NIC	LF	$45.00	
2	20" HDPE DR17 - install	NIC	LF	$35.00	
3	Annular grout	NIC	CY	$125.00	
4	Access Point Site Prep	4	EA	$15,000.00	$60,000
	Remove single joint, replace with shop fab tee, butt straps	4	EA	$35,000.00	$140,000
5	CARV W/ MH	4	EA	$25,000.00	$100,000
6	LO POINT BLOWOFF W/MH	NIC	EA	$12,000.00	
7	Site Clear, Grub, and Preparation (60-FT WIDE CONSTR ESMNT)	4	EA	$5,000.00	$20,000
8	SEED/SOD RESTORATION	NIC	SY	$0.50	
9	Erosion Control	4	EA	$2,500.00	$10,000
10	SWPPP	1	LS	$5,000.00	$5,000
	Basis for Cost Projection:	Subtotal:			$335,000
	☑ No Design	Conting. (%,+/-)		0%	
	☐ Preliminary Design	**Total:**			**$340,000**
	☐ Final Design				

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Outfall Demo - Channel Armor**			**Sheet:**	**4 of 4**
Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
RAW WATER OUTFALL STRUCTURE					
1	Demo Ex. Outfall Sill Wall	1	EA	$15,000.00	$15,000
2	Demo Ex. Outfall Projecting Headwalls above rock line	2	EA	$15,000.00	$30,000
3	Demo Ex. Outfall Deck and Bridge Structure	1	EA	$25,000.00	$25,000
4	Soft Armor Outfall Channel (800-LF x 20-ft W 9" Gabion Mattress)	1,778	SY	$95.00	$168,889
5	8' CLF w/ Man Gate Access Control	200	LF	$50.00	$10,000
6	Landscape/Slope Armor Restoiration	1	LS	$20,000.00	$20,000
7	Erosion Control	1	LS	$5,000.00	$5,000
8	SWPPP	1	LS	$6,000.00	$6,000
		Subtotal:			$279,889
		Conting. (%,+/-)		0%	
		Total:			**$280,000**

Basis for Cost Projection:

- ☑ No Design
- ☐ Preliminary Design
- ☐ Final Design

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Appendix 6: OPCC Long-Term

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Raw Water Delivery System Conversion - ROM (0% Design)**	**Sheet:**	**1 of 7**

Item No.	Item Description		Item Cost
1	**Site Work**		**$590,000**
2	**Pump Station Piping and Equipment**		**$930,000**
3	**Force Main (installed in existing 42" host pipe)**		**$1,630,000**
4	**Electrical and Instrumentation (per J. Kotrla, PE)**		**$560,000**
5	**Structural**		**$270,000**
		Subtotal	**$3,980,000**

Contingency	25%	$995,000
GCs, Bonds, Ins., OH	15%	$597,000
		$5,572,000
Profit	12%	$669,000
		$6,241,000
Engineering, Surveying, Geotec	15%	$937,000
	TOTAL	**$7,178,000**

Basis for Cost Projection:

- ☑ No Design Completed
- ☐ Preliminary Design
- ☐ Final Design

This total does not reflect land acquisition, environmental nor permitting costs.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Site Work**	**Sheet:**	**2 of 7**

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
RAW WATER PUMP STATION					
1	Dredge (Mech) Intake	1	LS	$50,000.00	$50,000
2	Deveg, Clean and Rock Dress Intake Channel and Adjoinging Bank	1	LS	$100,000.00	$100,000
3	Bollards	16	EA	$600.00	$9,600
4	7" Concrete Pavement	1,000	SY	$96.00	$96,000
5	HMAC Pavement	1,067	SY	$65.00	$69,333
5	Site Clear, Grub, and Preparation	2	AC	$6,960.00	$13,920
6	Cut and Fill	500	CY	$10.00	$5,000
7	Fine Grading	1	LS	$30,000.00	$30,000
8	Export Spoils Off Site (Max 2 miles)	400	CY	$15.00	$6,000
RAW WATER OUTFALL STRUCTURE					
1	Soft Armor Outfall Channel (800-LF x 20-ft W 9" Gabion Mattress)	1,778	SY	$95.00	$168,889
2	8' CLF w/ Man Gate Access Control	200	LF	$50.00	$10,000
3	Landscape/Slope Armor Restoiration	1	LS	$20,000.00	$20,000
4	Erosion Control	1	LS	$5,000.00	$5,000
5	SWPPP	1	LS	$6,000.00	$6,000

Basis for Cost Projection:	Subtotal:		$589,742
☑ No Design	Conting. (%,+/-)	0%	
☐ Preliminary Design	**Total:**		**$590,000**
☐ Final Design			

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Kimley-Horn & Associates, Inc. **Opinion of Probable Construction Cost**

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Pump Station Mech Conversion**	**Sheet:**	**3 of 7**

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
A	3500-GPM, 150 HP VTP Pump (FOB Site)	2	EA	$85,000.00	$170,000
	Installation Mech	35%	%		$59,500
	Other Electrical & Instrumentation (20%)	25%	%		$42,500
					$272,000
	OR				
B	3500-GPM, 150 HP Submerisble Pump (w/ rails, base elbow, brackets)	2	EA	$55,000.00	$110,000
	Installation Mech	25%	%		$27,500
	Other Electrical & Instrumentation (20%)	25%	%		$27,500
					$165,000
C	Stop Logs (14 logs; 120" x 12")	14	EA	$3,200.00	$44,800
	Lifting Mechanism	1	EA	$3,500.00	$3,500
	Portabel Gantry Crane (10'-0" clr span, 8'-0" min hk ht)	1	EA	$10,000.00	$10,000
	2-ton Winch, 30-ft lift	2	EA	$12,000.00	$24,000
	Bar Screen Rebuild (pick screens, pressure wash, sand blast, replace heavily corroded bars)	2	EA	$25,000.00	$50,000
					$132,300
	SELECTIVE DEMO (incl salvage of ex. Equip value)	1	LS	$100,000.00	$100,000
1	Meter Vault (6 x 8)	1	LS	$25,000.00	$25,000
2	Grout	50	CY	$3.00	$150
3	1" Air Release/Vacuum Valve	3	EA	$1,000.00	$3,000
4	8" Ductile Iron Surge Relief Piping	50	LF	$250.00	$12,500
5	8" Flanged Coupling Adapter	2	EA	$1,200.00	$2,400
6	8" Gate Valve	2	EA	$4,000.00	$8,000
7	8" Surge Relief Valve	1	EA	$25,000.00	$25,000
9	8" Swing Check Valve	3	EA	$9,500.00	$28,500
11	8" Ductile Iron Discharge Piping	80	LF	$230.00	$18,400
12	8" Electromagnetic Flow Meter	1	EA	$25,000.00	$25,000
13	18" Gate Valve	1	EA	$12,500.00	$12,500
14	20" HDPE Discharge Piping	200	LF	$200.00	$40,000
16	Pipe Supports	1	LS	$10,000.00	$10,000
17	Link Seal Wall Penetrations	5	EA	$1,500.00	$7,500
21	48" x 48" Bilco SS Type JD-SS Hatch	4	EA	$10,000.00	$40,000
22	48" X 54" Bilco Aluminum Type JD-AL Hatch	0	EA	$5,000.00	$0
	Basis for Cost Projection:	Subtotal:			$927,250
	☑ No Design	Conting. (%,+/-)		0%	$0
	☐ Preliminary Design	**Total:**			**$930,000**
	☐ Final Design				

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Force Main (installed in existing 42" host pipe)**	**Sheet:**	**4 of 7**

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
1	20" HDPE DR17 - pipe matl	12,200	LF	$45.00	$549,000
2	20" HDPE DR17 - install	12,200	LF	$35.00	$427,000
3	Annular grout	3,362	CY	$125.00	$420,192
4	Pull Pits - Access Points	6	EA	$15,000.00	$90,000
5	CARV W/ MH	4	EA	$15,000.00	$60,000
6	LO POINT BLOWOFF W/MH	2	EA	$12,000.00	$24,000
7	Site Clear, Grub, and Preparation (60-FT WIDE CONSTR ESMNT)	2	AC	$5,000.00	$10,000
8	SEED/SOD RESTORATION	9,680	SY	$0.50	$4,840
9	Erosion Control	2	MI	$15,000.00	$30,000
10	SWPPP	1	LS	$10,000.00	$10,000
					$1,625,032

Basis for Cost Projection:

- ☑ No Design
- ☐ Preliminary Design
- ☐ Final Design

Subtotal:		$1,625,032
Conting. (%,+/-)	0%	
Total:		**$1,630,000**

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Architectural**	**Sheet:**	**5 of 7**

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
1	Stairs	0	LS	$35,000.00	$0
2	Wet Well/Dry Pit Waterproofing	0	LS	$20,000.00	$0
3	Metal Grating	0	SF	$30.00	$0
4	Electrical Building	0	LS	$60,000.00	$0
		Subtotal:			$0
		Conting. (%,+/-)		0	
		Total:			**$0**

Basis for Cost Projection:

- ☑ No Design
- ☐ Preliminary Design
- ☐ Final Design

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Electrical and Instrumentation** (per J. Kotrla, PE)	**Sheet:**	**6 of 7**

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
Elecrical					
1	MCC and Power House	1	LS	$57,500.00	$57,500
2	Conduit and Wire	1	LS	$50,000.00	$50,000
3	480 volt service from Sandy Lake Rd to Pump Station	1	LS	$25,000.00	$25,000
4	Grounding	1	LS	$7,500.00	$7,500
5	Lightning and surge Protection	1	LS	$7,500.00	$7,500
6	Lighting and misc.	1	LS	$10,000.00	$10,000
7	Instrumentation and controls	1	LS	$15,000.00	$15,000
SCADA					
	North Lake Intake Pump Station SCADA	1	LS	$50,000.00	$50,000
	Cypress Waters Raw Water Pump Staton SCADA	1	LS	$50,000.00	$50,000
ONCOR Allowance					
	Oncor Pad Mounted Switch	1	LS	$50,000.00	$50,000
	Oncor 3-Phase Extension (OHE from McInnish Park)	1	LS	$125,000.00	$125,000

Subtotal:		$447,500
Conting. (%,+/-)	25%	$111,875
Total:		**$560,000**

Basis for Cost Projection:

- ☑ No Design
- ☐ Preliminary Design
- ☐ Final Design

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Structural**	**Sheet:**	**7 of 7**

Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
RAW WATER PUMP STATION					
1	Demo Ex. Pump Pads; Pour New Hatch Opennings	2	EA	$15,000.00	$30,000
2	New 4x4 AL Hatches	2	EA	$12,000.00	$24,000
3	Demo Ex. Wall Penetrations - Pour new wall sleeves	2	EA	$7,500.00	$15,000
4	Valve Vault	1	LS	$45,000.00	$45,000
5	Selective Crack Injection	1	LS	$10,000.00	$10,000
6	Selective Patching	1	LS	$10,000.00	$10,000
RAW WATER OUTFALL STRUCTURE					
1	Demo Ex. Outfall Sill Wall	1	EA	$15,000.00	$15,000
2	Demo Ex. Outfall Projecting Headwalls above rock line	2	EA	$15,000.00	$30,000
3	Demo Ex. Outfall Deck and Bridge Structure	1	EA	$25,000.00	$25,000
4	Valve Vault	1	LS	$45,000.00	$45,000
5	Selective Crack Injection	1	LS	$10,000.00	$10,000
6	Selective Patching	1	LS	$10,000.00	$10,000

Basis for Cost Projection:

- ☑ No Design
- ☐ Preliminary Design
- ☐ Final Design

Subtotal:		$269,000
Conting. (%,+/-)	0%	
Total:		**$270,000**

This total does not reflect engineering, technical services, or land acquisition.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Appendix 7: On-Call Pumping Services

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Interim Improvements - ROM (0% Design)**	**Sheet:**	**1 of 3**
Item No.	Item Description		Item Cost
1	**Pump Station Intake/Pump Platform/Pipeline Connection Site Work**		**$160,000**
2	**On-Call Pumping** (Annual Services Contract Estimate)		**$90,000**
		Subtotal Construciton	**$160,000**

Contingency	25%	$40,000
GCs, Bonds, Ins., OH	15%	$24,000
		$224,000
Profit	12%	$27,000
		$251,000
Engineering, Surveying, Geotec	15%	$38,000
	TOTAL	**$289,000**

Basis for Cost Projection:

- ☑ No Design Completed
- ☐ Preliminary Design
- ☐ Final Design

This total does not reflect land acquisition, environmental nor permitting costs.

This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering (AACE). The capital costs within this project definition report are defined as order-of-magnitude-level (Class 4) estimate as defined in the AACE International Recommended Practice No. 18R-97, Cost Estimate Classification System. An estimate of this type is normally expected to be within +50 percent or –30 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report.

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**Pump Station Intake/Pump Platform/Pipeline Connection Site Work**			**Sheet:**	**2 of 3**
Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
1	Clean/Excavate Intake Channel and Adjoining Bank	1	LS	$20,000.00	$20,000
2	Rip Rock Intake Channel and Adjoinging Bank	800	CY	$63.00	$50,400
3	Temp Access Ramp	1	LS	$40,000.00	$40,000
4	42" x 10" Tap	1	EA	$40,000.00	$40,000
		Subtotal:			$150,400
		Conting. (%,+/-)		0%	
		Total:			**$160,000**

Basis for Cost Projection:

- [x] No Design
- [ ] Preliminary Design
- [ ] Final Design

This total does not reflect engineering, technical services, or land acquisition.
This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering

Kimley-Horn & Associates, Inc. | **Opinion of Probable Construction Cost**

Client:	**City of Coppell**	**Date:**	**2/14/2018**
Project:	**North Lake Raw Water Delivery System**	**Prepared By:**	**TRH**
KHA No.:	**64124028**	**Checked By:**	**MAS**

Title:	**On Call Pumping Services**			**Sheet:**	**3 of 3**
Item No.	Item Description	Quantity	Unit	Unit Price	Item Cost
1	Bypass Pumping Setup	1	LS	$5,000.00	$5,000
2	Maintenance	1	MO	$1,000.00	$1,000
3	Pump Rental/Control	3	MO	$7,500.00	$22,500
4	Fuel (1200-ACFT @ 5-mgd @ 8-gal_fuel/hr @ $4/gal_fuel)	15,014	GAL	$4.00	$60,057

Basis for Cost Projection:

- ☑ No Design
- ☐ Preliminary Design
- ☐ Final Design

Subtotal:		$88,557
Conting. (%,+/-)	0%	
Total:		**$90,000**

This total does not reflect engineering, technical services, or land acquisition.
This construction cost opinion adopts the classification of estimates as defined by the Association for the Advancement of Cost Engineering