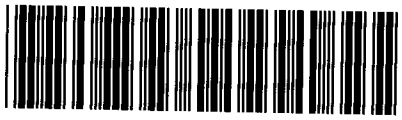

Control Number: 42867

Item Number: 110

Addendum StartPage: 0

SOAH DOCKET NO. 473-14-5138.WS
PUC DOCKET NO. 42857

2014 DEC -8 PM 1:41

PETITION OF NORTH AUSTIN MUNICIPAL UTILITY DISTRICT NO. 1, NORTHTOWN MUNICIPAL UTILITY DISTRICT, TRAVIS COUNTY WATER CONTROL AND IMPROVEMENT DISTRICT NO. 10 AND WELLS BRANCH MUNICIPAL UTILITY DISTRICT FROM THE RATEMAKING ACTIONS OF THE CITY OF AUSTIN AND REQUEST FOR INTERIM RATES IN WILLIAMSON AND TRAVIS COUNTIES	§	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

SOAH DOCKET NO. 473-14-5138.WS
PUC DOCKET NO. 42867

PETITION OF NORTH AUSTIN MUNICIPAL UTILITY DISTRICT NO. 1, NORTHTOWN MUNICIPAL UTILITY DISTRICT, AND WELLS BRANCH MUNICIPAL UTILITY DISTRICT FROM THE RATEMAKING ACTIONS OF THE CITY OF AUSTIN AND REQUEST FOR INTERIM RATES IN WILLIAMSON AND TRAVIS COUNTIES	§	BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS

TRAVIS COUNTY WATER CONTROL AND IMPROVEMENT DISTRICT NO. 10'S RESPONSE TO CITY OF AUSTIN'S FOURTH REQUEST FOR PRODUCTION OF DOCUMENTS

TO: City of Austin, by and through its attorneys of record, Stephen P. Webb and Gwendolyn Hill Webb, Webb & Webb, 712 Southwest Tower, 211 East 7th Street, Austin, Texas 78701.

COMES NOW, Travis County Water Control and Improvement District No. 10 ("Travis WCID," "Petitioner" or "District"), in the above-styled and numbered cause, and serves this, its Response to the City of Austin's Fourth Request for Production of Documents.

110

Respectfully submitted,

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John Carlton
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Telephone: (512) 614-0901
Fax: (512) 900-2855

By:_____
JOHN J. CARLTON

COUNSEL FOR PETITIONER

CERTIFICATE OF SERVICE

I certify that I served a true and correct copy of the foregoing document on all parties of record in this proceeding on this 8th day of December, 2014 via hand delivery, facsimile, electronic mail, overnight mail, U.S. mail and/or certified mail.

_____
JOHN J. CARLTON

PRODUCTION REQUESTS

The following requests pertain to the written prefiled testimony of Thomas C. Arndt for Travis County Water Control and Improvement District No. 10.

63. Please provide all documentation from the Texas Commission on Environmental Quality ("TCEQ") that authorizes WCID10 to operate the Red Bud Pump Station in-line booster pump station (in-line booster waiver, exception, etc.).

Objection: Travis WCID objects to this request on the grounds that it is unduly burdensome because the information is equally available to the City and the documents are obtainable by the City from an alternative source.

Response: Notwithstanding and without waiving the objections noted above, after a diligent search, no responsive documents were located.

64. Please provide a detailed drawing that identifies the location of the pressure gage referenced in Mr. Arndt's testimony used to base his opinion about the adequacy of the water supply provided by the City (October 17, 2014 Direct Testimony of Thomas C. Arndt, starting on page 6 row 25). Specifically, please provide a detailed drawing that identifies the location of that pressure gage relative to the master meter and to the District's pumping units and pump station suction piping.

Objection: Travis WCID objects to this request on the grounds that it is unduly burdensome because the information is equally available to the City and the documents are obtainable by the City from an alternative source.

Response: Notwithstanding and without waiving the objections noted above, Notwithstanding and without waiving the objections noted above, responsive and non-privileged documents will be produced.

65. Please provide all pressure recordings or engineering calculations that demonstrate the amount of water pressure loss in the WCID10 Red Bud Pump Station suction piping from the point of connection to the City of Austin system (master meter) to the WCID10 suction pressure gage referenced by Mr. Arndt in his testimony (October 17, 2014 Direct Testimony of Thomas C. Arndt, starting on page 6 row 25). Provide all relevant pipe lengths, pipe diameters, c-factors or roughness coefficients, water flow rates during the referenced periods in 2012 and 2014.

Response: Responsive and non-privileged documents will be produced. See also responsive documents to RFP No. 57 and 58.

66. Please provide all documentation demonstrating the suction and discharge hydraulic gradelines used in the design of the pump station including those used in the design of the WCID10 Red Bud Pump Station Improvements referenced on page 2 of Mr. Arndt's resume (Exhibit TCA-1 in October 17, 2014 Direct Testimony of Thomas C. Arndt).

Response: Responsive and non-privileged documents will be produced.

67. Please provide a copy of all reports and design plans associated with the WCID10 Red Bud Pump Station Improvements project referenced on page 2 of Mr. Arndt's resume (Exhibit TCA-1 in October 17, 2014 Direct Testimony of Thomas C. Arndt).

Objection: Travis WCID objects to this request on the grounds that it is unduly burdensome because the information is equally available to the City and the documents are obtainable by the City from an alternative source.

Response: Notwithstanding and without waiving the objections noted above, Notwithstanding and without waiving the objections noted above, responsive and non-privileged documents will be produced.

68. Please provide a copy of the WCID10 Water Master Plan referenced on page 2 of Mr. Arndt's resume (Exhibit TCA-1 in October 17, 2014 Direct Testimony of Thomas C. Arndt).

Response: Responsive and non-privileged documents will be produced.

69. Please provide all documentation to support Mr. Arndt's statement that "The City is only addressing water quantity issues for future customers with the Water Treatment Plant 4 project."

Response: After a diligent search, no items were identified that are responsive to this request.

RESPONSIVE TO REQUEST NOs. 64, 65, 66 & 67

TRAVIS COUNTY W.C.& I.D. NO. 10

Preliminary Engineering Report

For

Red Bud Trail Pump Station
Proposed Improvements

Prepared For
W.C.I.D. NO. 10
5450 Bee Caves Road, Suite 2-A
Austin, TX 78746

Prepared By:
Dannenbaum Engineering Corp.
3409 Executive Drive, Ste 129
Austin, TX 78731

December 2003

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INTRODUCTION

Pump Station No. 1 located on Red Bud Trail was originally constructed in the late 1950's and expanded in the 1970's. Currently, the pump station has three 2,450 gpm large capacity pumps and two 500 and one 800 gpm small capacity pumps that pump all of the water bought by the District from the City of Austin. The recently completed Master Plan for the District identified the need to increase the firm capacity of Pump Station No. 1 and implement other improvements to increase the reliability of this critical facility.

The increase in firm capacity and improvements to the station are required to provide the pump station with the firm pumping capacity required by the current number of connections being served by the District.

Pump Station No. 1 receives water from the City of Austin's Ullrich Water Treatment Plant and pumps the water into the 880 service area and into the McConnell tank which delivers water to the 990 and 1080 service areas. Pump Station No. 1 is the most critical facility the District owns and operates. Its capacity and reliability is essential to the District's ability to provide water to all of its customers.

SITE ISSUES

The pump station site (3618 ½ Red Bud Trail) is located with in Zone 1 habitat for the endangered golden-cheeked warbler and Karst. The City of Austin Balcones Canyonlands Preserve Program has approved the expansion of the pump station site with the requirement that clearing of vegetation in warbler habitat must be completed during the time that the warblers are not nesting (September 1 to February 28).

The site will be expanded by 25 feet to provide room for the improvements. This additional 25 feet wide by 67.33 feet deep has been leased from the City of Austin. This site extension has been declared eligible to participate in the City of Austin's Section 10(a) permit. (See Attachment A)

The improvements planned will add approximately 1,130 square feet of impervious cover to the site. This is a small enough area that a site plan exemption is acceptable to the City of Austin. The City has requested that the necessary evaluations be done to confirm that a Site Plan Exemption is appropriate. A Site Development Determination/exemption Form has been completed and the calculations and exhibit/sketches have been submitted to Watershed Protection and Development review Department of the City of Austin. The City of Austin has issued a Site Exemption. A building permit will be required for the electrical building.

The site plan for the expanded Pump Station No. 1 is shown on Exhibit No. 1.

PUMPS

The recently completed Master Plan for the District's water system identified the need to increase the firm pumping capacity from 7.1 mgd to 10.6 mgd. This plan recommends that a new, 2,450 gpm pump, similar to the three existing large pumps, be added along with the necessary piping to connect the new pump to the existing discharge-piping. Exhibit No. 1 depicts the proposed location for the new pump and piping. Exhibit No. 2 shows the proposed pump layout. Exhibit No. 2A shows the pump curve for Pump Station No. 1.

The Master Plan recommended that the three small pumps inside the equipment building be taken out of service. To provide lower flow conditions, it was recommended that two of the larger pumps be provided with variable speed motors to perform the function of the smaller pumps, allowing the smaller pumps to be removed. The building will be rehabilitated to serve as storage for the District's spare part inventory.

BUILDINGS

The existing building is in excess of 40 years old and in need of rehabilitation. The existing electrical switchgear is both obsolete and in poor condition and needs to be replaced.

The existing building does not have adequate room to install the new electrical equipment while the existing electrical equipment remains in service. In order to phase the construction of the new electrical equipment, a new building is required.

The phasing requirement can be met by constructing a new electrical building, installing the new electrical switchgear and reconnecting the pump motors. This is covered in detail in the electrical section of this report.

The proposed electrical building will be 12 feet wide by 39 feet long, constructed of concrete masonry units (CMU) with a stucco finish. The roof will be a standing seam metal roof with a 1:12 pitch. The building will have two doors, one will be a 6' wide double door, 8 feet tall, and the other a 3'-6" x 7' door to provide a second exit as required in the National Electric Code (NEC).

The building will have dual air conditioning units to provide a reliable environment for the electrical equipment. The air conditioning units will cool or heat the room to maintain a low humidity year round. The proposed building details are shown on Exhibit No. 3.

Once the new pump and the new electrical building have been placed in service, the pumps, piping and electrical equipment can be removed from the existing building. The existing building will be rehabilitated by filling in the pipe trenches, installing a new standing seam metal roof with a 1:12 pitch and stucco covering the brick exterior. The metal doors will also be replaced and a new lighting system will be installed. Other minor structural repairs may also be needed.

CONSTRUCTION ISSUES

The major construction constraints will be:

1. Maintain Pump Station No. 1 in continuous service with only short shutdowns to tie in pipes and electrical connections during low flow periods.
2. Clearing and grubbing of the site and all installation of pipes, buildings and pavement must occur between September 1 and February 28, the non-nesting season.

Phasing construction to satisfy these constraints will require the construction to begin in September, so the contractor can clear the site, pour the foundations, install underground pipes and electrical conduits and pave the driveway before the end of the following February.

The mechanical and electrical equipment to be installed will have long delivery times. This may required the construction to begin as early as July to allow adequate time to order the equipment,

get submittals reviewed and approved and the equipment delivered by January, 2005. This equipment can then be installed and connected into the existing piping and electrical systems during January and February when the water demands are the lowest.

Testing and startup can occur during March and April in order to have the Pump Station at full capacity as the water demands begin to increase toward the summer peaks. (See Attachment B)

RECOMMENDATIONS

Dannenbaum recommends that Pump Station No. 1 (Red Bud Trail) be improved by adding one new large pump, a new electrical building to properly house the Electrical and Controls systems, install Power Distribution System (Design Case No. 1) and controls as described in the attached electrical report (prepared by Harutunian Engineering) (See Attachment C), and rehabilitate the existing pump building to serve as storage for the District. These improvements will upgrade Pump Station No. 1 to meet the firm pumping requirements for the District and provide a higher level of reliability. The recommended schedule for this improvement is shown on the Project Schedule included in this report. To meet this schedule, the District needs to authorize the final design no later than December, 2003.

COST ESTIMATE

Install new 2450 gpm vertical turbine pump	$31,500
Pump Control Valve	8,100
Valve Vault	2,000
Transformer Pad	1,100
Piping	50,000
Electrical Bldg	58,500
Remove 6' Chain Link Fence	450
Install 6' Chain Link Fence	5,950
12' Double Leaf Chain Link Gate	1,200
Site Grading	2,700
Silt Fence	495
Stabilized Construction Entrance	1,300
Electrical	752,403
Subtotal	$915,698
Demolish Pump, Piping & Electrical in Existing Bldg	25,000
Rehabilitation in Existing Bldg	25,000
Subtotal	$50,000
Total	965,698
Survey/Engineer Fees	289,700
15% Contingencies	144,900
COA Inspection	96,600
TOTAL	$1,496,898

ATTACHMENT A

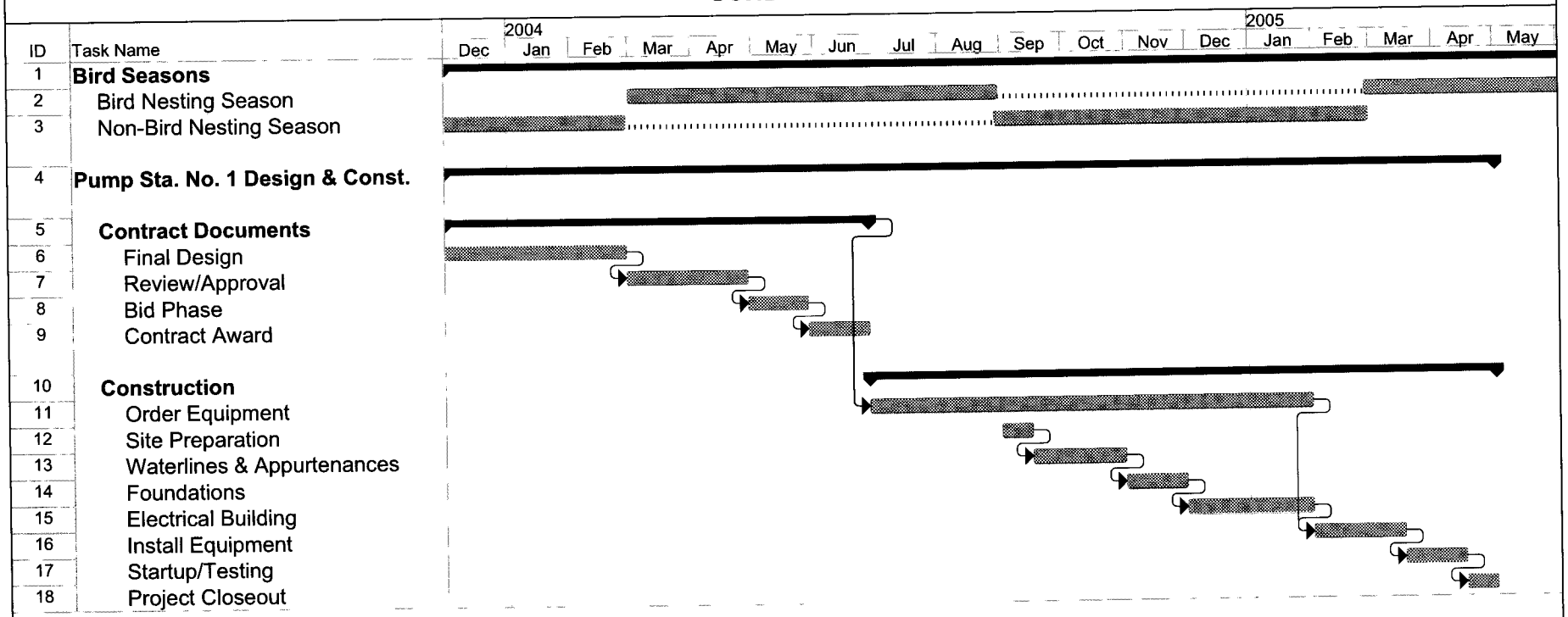
Supporting Documentation

ATTACHMENT B

Project Schedule

ATTACHMENT B

TRAVIS COUNTY WC & ID NO. 10
PUMP STATION NO. 1
SCHEDULE



Project: Schedule.mpp
Date: Thu 12/4/14

Task	External Milestone	Manual Summary Rollup
Split	Inactive Task	Manual Summary
Milestone	Inactive Milestone	Start-only
Summary	Inactive Summary	Finish-only
Project Summary	Manual Task	Progress
External Tasks	Duration-only	Deadline

Thu 12/4/14

DANNENBAUM ENGINEERING CORPORATION

ATTACHMENT C

Electrical Report

(Harutunian Engineering, Inc.)

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EXHIBITS AND TABLES

INTRODUCTION

Travis County Water Control and Improvements District #10 is in the process of increasing its water distribution capacity by upgrading the Red Bud Trail Pump Station. **HEI** was tasked to evaluate the existing Electrical, Instrumentation, and Controls systems and to provide recommendations for improvements.

The **HEI** project team developed the proposed facility's design based upon the following proposed Process/Mechanical improvements:

- Addition of a new 200 horsepower pump "P-7", which is required to have adjustable speed capabilities.
- The existing constant speed pump "P-5" is proposed to have adjustable speed capabilities.
- The existing constant speed pumps "P-4" and "P-6" will remain.
- The existing constant speed pumps "P-1", "P-2" and "P-3" will be demolished.
- The existing pump station building will remain and be reused for miscellaneous equipment storage at the discretion of the Water District.

Exhibit 4 provides an overview conceptual Process and Instrumentation diagram summarizing the proposed Process and Instrumentation system improvements to the Red Bud Trail Pump Station.

HEI also included the following results from the previous Feasibility Phase report into the preliminary engineering design effort:

- A new 25-ft wide easement has been acquired on the west of the existing pump station to facilitate the construction of a proposed Electrical Building.
- The existing Stand-Pipe Tone Telemetry System will not be modified during this phase.
- Consolidation of motor starters into motor control centers where applicable.
- Consolidation of pump station controls into a new centralized control panel.

After various meetings with the utility personnel, site investigations, and engineering analysis, **HEI** has developed the following to describe the existing conditions of the Red Bud Trail Pump Station facility and the recommended improvements.

DESCRIPTION OF EXISTING FACILITY

Evaluation of Existing Electrical Power Distribution System

The pump station currently has two electrical service connections from Austin Energy. The first service connection is provided by a single overhead 480Volt service feeder from three single phase electrical service pole mounted transformers. This feeder terminates in a 400 Amperc rated fused disconnect switch which then radially feeds the dedicated pump controllers for constant speed pumps "P-1" (rated 50 horsepower), "P-2" (rated 50 horsepower), and "P-3" (rated 75 horsepower). Each pump controller consists of a wall mounted full voltage combination starter with the pump controls located integral to each controller.

The second electrical service drop is provided by three 480V underground secondary service feeders to one Motor Control Center (MCC). These sets of underground feeders originate from the secondary side of one 750kVA pad mounted transformer. The secondary service feeders are intended to carry the entire electrical load of the MCC and consist of three sets of three #350kCMIL phase conductors and one #4/0 ground conductor with each set in 4" conduit. The MCC has a 480V, 3 phase, 1000A rated main bus and a 1000A main circuit breaker. The MCC also contains the reduced voltage auto-transformer type starters and pump controls for constant speed pumps "P-4" (ratcd 200 horsepower), "P-5" (rated 200 horsepower), and "P-6" (rated 200 horsepower). The auto-transformer motor starting technology utilizes power contactors switching an auto-transformer to abruptly vary the voltage on the motor windings in one discrete increment. This results in a lower initial inrush current by reducing the voltage on the motor for a number of seconds upon motor starting. After a set period of time, the motor then operates at full voltage. To obtain a motor shut down, the starter abruptly disconnects the motor from the power source.

The MCC also contains the control relays for the pump discharge control valves and supplies 480V power to a wall mounted combination dry-type distribution transformer (rated 15 kVA) and twelve circuit distribution panelboard. The distribution panelboard, with branch circuit breakers, distributes power to the various pump control valves, general control logic circuitry, the existing telemetry system, and other miscellaneous lighting and convenience receptacles within the existing pump station.

The existing MCC exhibits stages of advanced corrosion due to the lack of environmental controls inside the existing pump station. The continued use of the existing MCC under these conditions will lead to increased equipment failure, increased maintenance costs, and potential pump outages as the corrosion progresses.

The electrical service power meters for both services are located on the outside west wall of the pump station. The data these meters generate is not telemetered in any way, nor are the electrical service parameters monitored in any other way by other equipment on site.

In discussions with Water District personnel, power outages at the pump station have historically been the result of the entire distribution line being deenergized and not the result of one of the electrical service drops failing. Thus, the use of one service drop would not decrease the reliability of the pump station. Reducing the quantity of electrical services will also help to reduce electrical service costs.

Evaluation of Existing Instrumentation and Control System

The process variable monitoring of Red Bud Trail Pump station presently consists of one pressure switch located on the common pump suction header inside of the existing pump station building. This pressure switch, operating through a relay, serves as a low pump suction pressure cutoff for all of the pumps in the facility. There is presently no other continuous process variable monitoring (flow, pressure, chlorine residual, etc.,) of the process stream at the Red Bud Trail Pump Station.

Remote to the pump station, the level of the McConnell Elevated Storage Tank is monitored via six discrete pressure switches mounted in a stand pipe. The status of these switches are telemetered via a tone-telemetry type system over a telephone lease line to the Red Bud Trail Pump Station and converted at the pump station to six discrete output contacts inside of a tone-telemetry system control cabinet mounted on the west wall of the pump station. These contacts are then connected to multiple pump alternators located inside of the telemetry system cabinet and used in the pump motor starting control logic.

When the pumps are placed in the Automatic operating mode, their operation is controlled by one of the pump alternators located inside of the telemetry system cabinet.

The operating modes for Pumps "P-1", "P-2" and "P-3" are selected by a "HAND-STOP-AUTO" selector switch mounted on the side of each pumps' controller. There is also a "START" pushbutton located on the side of the pump controller. A "RUN" indicating light and an elapsed time meter are located on the front of the controller. There are no additional selector switches, pushbuttons (i.e., control operators), or indicating lights related to these pumps. Motor protection presently consists of an overload relay.

The operating modes for pumps "P-4", "P-5", and "P-6" are selected by a "HAND-OFF-AUTO" selector switch located on the face of the MCC. Each pump also has "START", "RESET", and "STOP" pushbuttons and 'OFF', "RUN", "EXCESSIVE VIBRATION", "OVER TEMP", "PHASE FAILURE", "OVERLOADS TRIPPED" indicating lights, and an elapsed time meter. There are no additional selector switches, pushbuttons (i.e., control operators), or indicating lights related to these pumps. Motor protection consists of a pump vibration switch, motor over-temperature switch, phase failure relay, and motor overload relays.

The pump discharge control valves for pumps "P-4", "P-5", and "P-6" are interlocked with their respective pump starters via control relays distributed inside multiple sections of the MCC. Each

valve has dedicated "OPEN" and "CLOSED" indicator lights and a "HAND-OFF-AUTO" selector switch. As presently connected, the indicator lights reflect the status of the solenoid valve operating coil rather than the actual position of the valve.

Each pump ("P-1" through "P-6") possesses a low pump suction header pressure cutoff as described earlier that is active in all pump operating modes.

Evaluation of Existing Remote Telemetry System

There is presently no remote monitoring of any process variable or pump condition associated with the Red Bud Trail Pump station at the Water District office.

Evaluation of Existing Lighting Systems

The interior lighting fixtures of the pump station are of the 120V ceiling mounted Flourescent type. The exterior building lighting is incandescent and is located over the personnel doors. There is generally minimal interior and exterior lighting. Local wall mounted switches are used to control the lighting. There is no dedicated task, walkway, or emergency egress lighting in the existing facility.

Evaluation of Existing Facility Auxiliary Power Distribution System

All duplex convenience receptacles located in the facility are 120V. There are no specialized receptacles in the facility.

Evaluation of Existing Personnel Communication System

Operations personnel presently employ the use of personal (hand held) two-way radios to facilitate communication. There is no dedicated personnel communication network connection to this facility.

Evaluation of Existing Security System

There is presently not a security system for the existing Red Bud Trail Pump Station.

RECOMMENDED PUMP STATION IMPROVEMENTS

Recommended Power Distribution System Improvements

The electrical design will conform to the National Electrical Code (NEC). It is proposed that industry standard products be used where possible. This will help the Water District in the maintenance of the pump station and help reduce maintenance costs by facilitating commonality among components in the Water District's facilities. Based on the power and operating requirements of the loads, all electrical loads are proposed to operate at 480VAC.

Table 1 illustrates the load requirements of the existing and proposed pumps (excluding system inrush) based upon the preliminary load data. Based on these loads, the entire Red Bud Trail Pump Station facility will require at least 986.6 kVA (excluding system inrush). The largest loads are the Distribution Pumps.

Table 1: Listing of Connected Loads, excluding system inrush.

Load Identification	**Preliminary Proposed Load (kVA)**
Constant Speed Distribution Pump "P-4"	199.3
Constant Speed Distribution Pump "P-6"	199.3
Adjustable Speed Distribution Pump "P-5"	229.9
Adjustable Speed Distribution Pump "P-7"	229.9
HVAC System (estimate)	53.15
Proposed 208/120V Auxiliary Load (estimate)	60.0
Existing 208/120V Auxiliary Load	15.0
Overall Pump Station Total	***986.6***

The rated electrical service capacity is generally 25% greater than the connected load in order to accommodate for inrush (due to motor starts) and improve equipment life expectancy. Excluding any future load growth, the minimum electrical service capacity would be 1233.3 kVA (986.6 x 1.25 = 1233.3 kVA). The available transformer rating closest to the minimum required electrical service capacity is 1500 kVA.

The existing pumps P-1, P-2 and P-3 are scheduled for demolition. Their existing dedicated electrical service, disconnect switch, and corresponding combination starters are of insufficient capacity for use with the proposed Process/Mechanical pump configuration. The other existing electrical service, its corresponding existing 750 kVA transformer and the existing 480V motor control center are of insufficient capacity for use with the proposed Process/Mechanical pump configuration. Therefore, a new electrical service is required to support the Process/Mechanical pump configuration. It is proposed to demolish both existing electrical services to the existing pump station.

Multiple power distribution system design cases have been developed for the proposed power distribution system improvements to the Red Bud Trail Pump Station and are described below. Each power distribution system design case has certain common characteristics as described in the "Common Features to all Power Distribution System Design Cases" section of this report.

Power Distribution System Design Case No. 1:

Under the first power distribution system design case, the proposed Electrical Building is proposed to accept dual feed power from Austin Energy. Each Austin Energy service feeder is proposed to serve an outdoor pad mounted 12470V:480V transformer, minimally rated at 1500kVA.

Each transformer will then feed a corresponding 480V switchboard with a main bus ampacity of 2000A, located in the Electrical Building. The proposed 480V switchboard would have the secondary selective configuration (main-tie-main) incorporating a single tie circuit breaker and be close coupled.

To help reduce construction costs, it is proposed that only one electrical service actually be established to the site at this time. Provisions will be made in the proposed raceway system for the second future electrical service from Austin Energy and future service transformer. It is proposed to interconnect the proposed switchboards such to facilitate maintenance or repair to one of the switchboard while still maintaining electrical service to the remaining pumps. In this way, maintenance can be safely performed to one of the switchboards while still maintaining operation of the pump station.

Each of the proposed 480V switchboards will then feed a corresponding 480V motor control center each containing a 480V reduced voltage solid state soft starter and variable frequency drive. This arrangement provides flexibility to the Water District to accommodate for changes in soft starter/variable frequency drive technology between manufacturers over time. Additionally, the separation among motor control centers adds operational flexibility such to maintain pump station operation during maintenance activities. This is the recommended power distribution system for the Red Bud Trail Pump Station.

Each of the proposed 480V switchboards will also feed a lighting and auxiliary power distribution system via an automatic transfer switch as described in the "Common Features for all Power Distribution System Design Alternatives" section below.

Exhibit 5 presents the conceptual overall power distribution for the pump station under this power distribution system design case. Exhibit 6 presents the proposed Electrical Building equipment arrangement for this power distribution system design case.

Power Distribution System Design Case No. 2

Under this case, the proposed Electrical Building is proposed to accept dual feed power from Austin Energy. Each Austin Energy service feeder is proposed to serve an outdoor pad mounted 12470V:480V transformer, minimally rated at 1500kVA.

Each transformer will then feed a corresponding 480V switchboard with a main bus ampacity of 2000A, located in the Electrical Building. The proposed 480V switchboard would have the secondary selective configuration (main-tie-main) incorporating a single tie circuit breaker and be close coupled.

To help reduce construction costs, it is proposed that, similar to Power Distribution System Design Case No. 1, only one electrical service actually be established to the site at this time. Provisions will be made in the proposed raceway system for the second future electrical service from Austin Energy and future service transformer. It is proposed to interconnect the proposed switchboards such to facilitate maintenance or repair to one of the switchboard while still maintaining electrical service to the remaining pumps. In this way, maintenance can be safely performed to one of the switchboards while still maintaining operation of the pump station.

Each of the proposed 480V switchboards will then feed an enclosed reduced voltage solid state soft starter and a separate enclosed variable frequency drive. While this arrangement provides additional flexibility to the Water District to accommodate for changes in soft starter/variable frequency drive technology between either soft starter manufacturers or variable speed manufacturers at an individual equipment level over time, this arrangement could lead to the use of varying manufacturers of soft starters and variable speed drives within the same facility. Where this to occur, equipment standardization would become difficult and maintenance costs would increase.

Each of the proposed 480V switchboards will also feed a lighting and auxiliary power distribution system via an automatic transfer switch as described in the "Common Features for all Power Distribution System Design Alternatives" section below.

Exhibit 7 presents the conceptual overall power distribution system for the pump station under this power distribution system design case. Exhibit 8 presents the proposed Electrical Building equipment arrangement for this power distribution system design case.

Power Distribution System Design Case No. 3

Under this case, the proposed Electrical Building is proposed to accept dual feed power from Austin Energy. Each Austin Energy service feeder is proposed to serve an outdoor pad mounted 12470V:480V transformer, minimally rated at 1500kVA.

Each transformer will then feed a corresponding 480V motor control center with a main bus ampacity of 2000A, located in the Electrical Building. The proposed 480V motor control centers

would have the secondary selective configuration (main-tie-main) incorporating a single tie circuit breaker.

To help reduce construction costs, it is proposed that, similar to Power Distribution System Design Case Nos. 1 and 2, only one electrical service actually be established to the site at this time. Provisions will be made in the proposed raceway system for the second future electrical service from Austin Energy and future service transformer. It is proposed to interconnect the proposed motor control centers such to facilitate maintenance or repair to one of the motor control centers while still maintaining electrical service to the remaining pumps. In this way, maintenance can be safely performed to one of the motor control centers while still maintaining operation of the pump station.

Each of the proposed 480V motor control centers will also contain a reduced voltage solid state soft starter and a variable frequency drive integral to the motor control center. This arrangement would help promote standardization upon manufacturers of soft starters and variable speed drives within the same facility. However, changes between manufacturers of soft starters and/or variable speed drives would be more constrained due to the physical close-coupling of the soft starters/variable speed drives with the main electrical power distribution system.

Each of the proposed 480V motor control centers will also feed a lighting and auxiliary power distribution system via an automatic transfer switch as described in the "Common Features for all Power Distribution System Design Alternatives" section below.

Exhibit 9 presents the conceptual overall power distribution system for the pump station under this power distribution system design case. Exhibit 10 presents the proposed Electrical Building equipment arrangement for this power distribution system design case.

Common Features for all Power Distribution System Design Cases

Common for all of the aforementioned power distribution system design cases, the Electrical Building will also consist of distribution and lighting panels and their applicable dry type transformers that will distribute power to all other equipment (transformers, loads, etc.) throughout the pump station. It is proposed that specific dry type transformers where shown on the Exhibits corresponding to the Power Distribution System Design Cases be of the isolation type to reduce the effect of the harmonic currents/voltages generated by the variable frequency drives.

As the existing pump "P-4", "P-5" and "P-6" motors will remain, it is proposed that line filters be added to the existing motors dedicated for variable speed operation in order to help filter the damaging harmonic voltages/currents resulting from the use of variable speed drives. It is proposed to incorporate power factor correction capacitors into the proposed power distribution system improvements in order to correct the power factor of the existing constant speed pumps to near 95%. These power factor correction capacitors will be located inside the proposed Electrical Building.

In order to help reduce construction costs, it is proposed to reuse the existing Austin Energy electrical service riser pole and primary service manhole. It is proposed to interconnect the proposed service transformer with the existing primary service manhole via a proposed duct bank system. A short outage would be required while Austin Energy disconnects the existing transformer and feeds the new transformer. Refer to the "Required Electrical Service Coordination Communications with Austin Energy" section of this report. The reuse of the existing electrical service also impacts the proposed timing of the construction sequencing for the facility. Refer to the "Recommended General Construction Sequencing" section of this report for additional information. As pumps "P-1", "P-2", and "P-3" are served from a separate electrical service drop and service transformer, the pump station would stay in service during the transfer of primary electrical service.

It is proposed to sub-feed the existing lighting and auxiliary power distribution system at the existing pump station from the proposed electrical building power distribution system. This will also help to reduce construction costs by leaving the existing pump station lighting and auxiliary systems intact when the two existing electrical services to the existing pump station are demolished.

The proposed variable speed drives, solid state soft starters, programmable logic controllers and related instrumentation and control equipment are environmentally sensitive devices. They are most reliable and their life expectancy is increased when they are operated in an environment that is not high in humidity nor extreme in temperature.

Required Electrical Service Coordination Communications with Austin Energy

The proposed Electrical Building electrical service is to be served from Austin Energy (AE). **HEI** contacted Austin Energy concerning the proposed and existing electrical services at the Red Bud Trail Pump Station.

It was learned that AE will furnish and install the service transformer and the 12470V (primary) service conductors at no charge to the Water District. The Water District will need to furnish and install the transformer pad per the requirements/drawings of Austin Energy, the 12470V (primary) raceway system, the 480V (secondary) service conductors, the secondary raceway system, and the metering equipment.

Austin Energy indicated that the disconnection of one existing electrical service and the connection of the proposed Electrical Building electrical service could occur in a 10-hour time frame.

Recommended Electrical System Concepts to Support the Process/Mechanical System

The following electrical system concepts are recommended in order to support the Process/Mechanical system improvements:

1. Motor Starters:

Each constant speed motor with a power requirement of 75 HP or above is proposed to be served by a reduced voltage starter. All other motors are proposed to be served by full voltage starters. The use of a reduced voltage starter will reduce the voltage dip effect which occurs due to the high inrush of magnetization current upon motor start-up. It is proposed to use the "Solid State" reduced voltage starter type. This device uses Silicon Controlled Rectifier (SCR) technology to allow the pump to ramp up to full speed over a set period of time. Since the initial torque on the pump is less, there would be less maintenance required on the pump. Less maintenance is required for the motor starters because there would be lesser quantity of power contactors and there would not be an auto-transformer. When the pumps slowly ramp up when starting and slowly ramp down when stopping, there is less of a potential for water hammer in the piping system, and thus the life of the piping system is prolonged. **HEI**'s discussions with Austin Energy indicate their preference for this technology.

2. High Efficiency Motors:

All process equipment, ventilation equipment, and air handling unit motors will be specified as high efficiency motors where possible. When it is not possible for said motor(s) to be high efficiency, the highest efficiency motor(s) possible will be employed. High efficiency motors shall be specified to minimize overall energy costs. If the motor is above 75 HP, then the motor will be of the high efficiency type. If the motor is above 25 HP and less than 75 HP, the designer shall use their engineering judgment in justifying the incurred cost of purchasing a high efficiency motor. The motor associated with pump "P-7" shall be specified as a high efficiency motor.

3. High Power Factor Motors:

All process equipment, ventilation equipment, and air handling unit motors will be specified as high power factor motors were possible. Such motors shall be specified to minimize overall energy costs yielding a minimum power factor of 90%. When it is not possible for said motor(s) to be high power factor, the highest power factor motor(s) possible will be employed. The proposed motor associated with pump "P-7" shall be specified as a high power factor motor and shall meet or exceed a power factor of 90%.

4. Motor Protection

The minimum protection provided for motors rated greater than or equal to 75 horsepower are ground fault, phase overcurrent, overcurrent (overload), over voltage, under voltage, under current, negative sequence over current. Note that all pumps (proposed and existing) fall into this category.

5. Power Metering:

Microprocessor based power monitoring equipment is proposed to be installed at the incoming power source (line side) in the motor control center(s), as applicable. The equipment is proposed to be a programmable device that measures and displays the following characteristics of incoming power: voltage, current, power factor, frequency, active power, apparent power, and reactive power.

For motors rated greater than or equal to 75 HP, a microprocessor based power monitoring unit will be installed on the Motor Control Center at the load side of the branch feeder/starters serving the load. At a minimum, the power monitoring unit shall monitor or meter the following parameters: voltage, current, power factor, frequency, active power, apparent power, reactive power, watt-hour, var-hour, torque, demand amperage, demand watts, demand var, demand volt-amps, and demand peak.

Each of these power monitoring units is proposed to have standard control interface ports, including RS-232C and RS-485 serial communication ports for peripheral programming and data transfer via the Modbus communication protocol along a Modbus communication network. This network is proposed to be interfaced to the DCS via serial communication. The minimum telemetered parameters from each power monitoring unit will be kW, kVA, power factor, kW demand, per phase current/voltage, and selected application specific power system trouble alarm(s). Each unit will also have a digital display of measured/telemetered parameters for local display.

6. Machine Monitoring:

The designer shall use their engineering judgment in justifying the incurred cost of machine monitoring. Such machine monitoring type and quantity will vary by application. Preliminarily, the Team is proposing to install two Vibration Indicating Transmitter on each pump. The final decision regarding the machine monitoring will be made during the design phase of the project.

7. Adjustable Speed Drives:

Due to the process/mechanical system configuration and pump selection, an adjustable speed application is required at the Red Bud Trail Pump Station. It is proposed to use the Variable Frequency Drive type of adjustable speed drive technology for this application due to the familiarity of maintenance personnel with the technology. Variable frequency drives (VFD's) consist of highly non-linear switching devices that instill harmonics in the frequency spectrum of the nominal power distribution of 60 Hz. Therefore, VFD's are proposed to be isolated from the remaining plant loads using L-C band-pass filters to diminish harmonics other than that of 60 Hz. In order to help reduce construction cost, it is proposed to install harmonic filters inside the proposed Electrical Building to help reduce the effects of the VFD generated harmonics upon the power distribution system. These filters will help to reduce the destructive effects of the harmonic currents/voltages generated by the VFDs upon the motors. It is proposed that the proposed pump "P-7" be an inverter duty rated motor. The existing pump motors are not inverter duty rated. Operating a non-inverter duty rated motor with a variable frequency drive may cause a non-inverter duty rated motor to operate at a higher temperature and decibel level.

This could potentially shorten the life of the existing motor. It is proposed that the properties of the existing motors be evaluated to determine their adaptability to a VFD application.

8. Distribution Buses:
It is proposed that all distribution buses will be made of copper, at minimum.

9. Emergency Generator:
Provisions for the connection of a mobile generator in the form of a circuit breaker mounted inside the proposed 480V main power distribution equipment and key interlocked with the respective 480V main power distribution equipment main and tie circuit breakers is proposed in order to enhance the reliability of the electrical service to the pump station.

10. Uninterruptible Power Supply:
An Uninterruptible Power Supply will be located inside of the proposed Instrumentation and Control System Main Control Panel. It is proposed to utilize the UPS to supply power to all of the PLCs and PLC related communication equipment.

Recommended Instrumentation and Control System Improvements

The Red Bud Trail Pump Station is designed for unattended automated operation using a Programmable Logic Controller (PLC) based control system. The majority of control functions shall be performed by PLCs in conjunction with a minimal quantity of hardwired (based upon electromagnetic relays) control functions. Hardwired control functions will be incorporated only for critical hydraulic functions, personnel safety/protection, machine protection, or where it provides the greatest cost effectiveness in the design. The pump station control philosophy is thereby one that is highly reliant upon a functioning PLC network for automatic control.

It is proposed to locate the PLC and most instrumentation and control equipment (except field control stations and field instruments) inside a centralized Main Control Panel (MCP) inside the proposed Electrical Buidling. A visible Operator Interface Unit (OIU) will be provided on the face of the MCP and will be the point of interface between the Operator and the PLC for control and indication of selected points within the station. Once telemetered to the PLC, data can be monitored, inhibited, or controlled as desired. Exhibit 11 provides the proposed conceptual overall control system architecture for the instrumentation and control system improvements for the Red Bud Trail Pump Station.

For additional operational reliability, it is proposed to install discrete control operators/indicators in the form of selector switches, pushbuttons, and indicating lights, as applicable, on the front of the MCP. Such an installation would enable manual operation of the pump station in case of a Telemetry system failure or PLC failure. The operators to be installed on the front of the MCP for each piece of process equipment will vary and are described hereinafter.

It is proposed that, depending on the application, most individual process equipment will have means to provide the Operator the ability to engage or disengage the equipment from operation. Such means, here called a Field Control Station (FCS), would be located near the equipment and generally would only be used should a particular PLC become nonfunctional or during maintenance activities for that process equipment. Operation at the FCS level of control will not include automatic coordination with the rest of the process and will require the Operator's complete attention in order to operate the facility. The operators to be installed on the FCS for each piece of process equipment will vary and are described hereinafter.

The team has the understanding that the Water District would ultimately like to monitor the Red Bud Trail Pump Station facility remotely via a supervisory computer system (Top-End) located at the Water District Office. It is proposed to interconnect the future Top-End and the Red Bud Trail Pump Station with a high speed type telephone lease-line connection. In order to help reduce construction costs, it is proposed to install the high speed lease line connection to the Red Bud Trail Pump Station in the future. It is proposed to install provisions in the proposed Electrical Building in the form of an empty raceway system in order to facilitate future telemetry system connection to the Red Bud Trail Pump Station PLC. Such provisions will also help to reduce future construction costs.

Until the future Top-End is installed, it is proposed to continue the use of the existing standpipe tone-telemetry system to control the operation of the Red Bud Trail Pump Station pumps. It is proposed to interconnect this existing system with the proposed distributed control system located inside the proposed Electrical Building. Once the future Top-End is installed, this existing tone-telemetry system will be demolished.

Recommended Instrumentation and Control System Concepts

A general control strategy of specified equipment has been described below including basic instrumentation requirements to implement the control and monitoring concepts required in order to support the Process/Mechanical system improvements. However, it is recommended that an I&C systems workshop be held during the design phase to revisit and finalize the control strategies, narratives, instrumentation and control equipment, field control station components, and distributed control system (DCS) system monitoring points described herein. The workshop would also help finalize the required operating practices and help develop an operator/maintenance friendly I&C system for each process/mechanical/electrical equipment in the project (equipment control logic, instruments, etc.).

1. Constant Speed Pumps:

The Process/Mechanical operation of the system provides for operation of one or more constant speed pumps once the flow demand exceeds the optimum operating point for the adjustable speed pumps. For optimal operation, it follows that the flow demand and status of other equipment in the pump station are considered as constraints before a constant speed pump is

started or stopped. Additionally, the Process/Mechanical operation of the system also provides for operational dependencies between the pump and its dedicated pump discharge control valve. It is also proposed to incorporate a pump alternation algorithm into the operating philosophy to stagger run-times among available equipment. Manual operation of the pump shall be provided for as well. Based on these requirements, it is proposed to provide three modes of operation for the constant speed Pumps:

1. DCS: This mode will incorporate the automatic pump selection and automatic pump alternation, and control interlock functionality between the pump and the valve.
2. HAND: This mode will provide for manual operation of the pump. No automatic pump selection, pump alternation, or pump/valve control interlock functionality will occur.
3. OFF: This mode will insure that the pump cannot be started. This mode will help to facilitate maintenance activities to the pump.

2. Adjustable Speed Pumps:

The Process/Mechanical operation of the system provides for operation of one or more adjustable speed pumps based upon the flow demand. Once the flow demand exceeds the optimum operating point for the adjustable speed pumps, then the speed of the adjustable speed pumps is adjusted (potentially minimized) to facilitate the operation of a constant speed pump. For optimal operation, it follows that the flow demand and status of other equipment in the pump station are considered as constraints before an adjustable speed pump is started or stopped. Additionally, the Process/Mechanical operation of the system also provides for operational dependencies between the pump and its dedicated pump discharge valve. It is also proposed to incorporate a pump alternation algorithm into the operating philosophy to stagger run-times among available equipment. Manual operation of the pump shall be provided for as well. Based on these requirements, it is proposed to provide three modes of operation for the adjustable speed pumps:

1. DCS: This mode will incorporate the automatic pump selection and automatic pump alternation, and control interlock functionality between the pump and the valve.
2. HAND: This mode will provide for manual operation and speed adjustment of the pump. No automatic pump selection, pump alternation, or pump/valve control interlock functionality will occur.
3. OFF: This mode will insure that the pump cannot be started. This mode will help to facilitate maintenance activities to the pump.

3. Pump Discharge Control Valves:

The Process/Mechanical operation of the pump discharge valve provides for operation of the valve contingent upon the operation of the pump during normal operation. To facilitate maintenance, it is proposed to include a mode by which maintenance upon the valve can be performed. Based on these requirements, it is proposed to provide three modes of operation for the Pump Discharge Control Valves:

1. REMOTE: This mode will incorporate the automatic pump and valve control interlock functionality.

2. LOCAL: This mode will provide for manual operation of the valve. No automatic pump/valve control interlock functionality will occur.
3. OFF: This mode will insure that the valve cannot be operated. This mode will help to facilitate maintenance activities to the valve.

Control Stations Arrangements

As discussed previously, it is proposed to install a dedicated control station to the front of the Main Control Panel for each pumping unit. The Field Control Station (FCS) provides local control of process equipment and is located adjacent to the equipment. All FCS enclosures will be NEMA 4X, Type 316 stainless steel. For the Red Bud Trail Pump Station, the proposed control station arrangements for the various process equipment will be finalized via an I&C workshop during the design phase of the project. The specific arrangement of the various control stations is summarized in Table 2 below.

Table 2: Proposed Control Station Arrangements

Process Equipment	Field Control Station Arrangement	Main Control Panel Control Station Arrangement
Distribution Pump (constant speed)	• Lockable Push to set, Pull to reset Emergency Stop Pushbutton	• DCS-Hand-Off Selector Switch • Start Pushbutton • Stop Pushbutton • Reset Pushbutton • On Indicating Light • Off Indicating Light • Common Failure Indicating Light
Distribution Pump (adjustable speed)	• Lockable Push to set, Pull to reset Emergency Stop Pushbutton	• DCS-Hand-Off Selector Switch • Start Pushbutton • Stop Pushbutton • Reset Pushbutton • On Indicating Light • Off Indicating Light • Common Failure Indicating Light • Speed Potentiometer
Pump Discharge Valve	• Open Pushbutton • Stop Pushbutton • Close Pushbutton • Local-Off-Remote Selector Switch	• Valve Fully Open Position • Valve Fully Closed Position • Control Station Status

Recommended Minimum Parameters/Functions Monitored by the Pump Station DCS System

The DCS will monitor the on/off and failure status of all equipment, process information, instruments, and field selector switch position status. The DCS will monitor run time for each piece of equipment and archive the information for maintenance purposes. The DCS will also monitor additional process variables as recommended by the Process/Mechanical design team.

Recommended DCS monitoring points for specific equipment has been identified in Table 3, but should be finalized via an I&C workshop during the design.

Table 3 Proposed Distributed Control System Monitoring Points

Process Equipment	Recommended DCS Monitoring Points per Unit
Distribution Pump (constant speed)	• Discharge Pressure • Pump Vibration • Motor Overload • Motor Starter Status • Motor Overtemperature • Control Station Status • Additional Process Variables as Recommended by the Process/Mechanical Design Team
Distribution Pump (adjustable speed)	• Discharge Pressure • Pump Vibration • Motor Overload • VFD Status • Motor Overtemperature • Control Station Status • Pump Speed • Additional Process Variables as Recommended by the Process/Mechanical Design Team
Pump Discharge Valve	• Valve Fully Open Position • Valve Fully Closed Position • Control Station Status
Pump Common Suction Header	• Flow • Pressure • Additional Process Variables as Recommended by the Process/Mechanical Design Team
Pump Common Discharge Header	• Additional Process Variables as Recommended by the Process/Mechanical Design Team
Proposed Electrical Building	• Building Temperature
Existing Pump Station Building	• Building Temperature

Instrumentation and Control Equipment Selection and Application

A general outline of equipment types and their application has been described in Table 4 below to implement the control and monitoring concepts previously described. It is proposed to standardize on these types of components where possible in order to help reduce maintenance costs for the Water District and promote reuse of common equipment in other Water District pump stations.

Table 4: Proposed Type of Various Instrumentation and Control System Equipment

Proposed Equipment	Type of Equipment
Flow Indicating Transmitter	Electro-magnetic flow indicating transmitter (Magmeter), and/or additional types as recommended by the Process/Mechanical design team
Pressure Indicating Transmitter	2-wire loop powered pressure indicating transmitter
Temperature Indicating Transmitter	2-wire loop powered temperature indicating transmitter
Speed Control Potentiometer Transmitter	High density (compact and DIN mounted) and will accept a 3-wire potentiometer. The transmitters output will be 2-wire loop and will provide a 4-20mA output signal proportional to the percent (%) travel of the potentiometer (input signal).
Process Variable Indicators/Transmitter/Controllers	LED display with minimum 0.56 inch characters. Units will be capable of receiving 4-20mA input. Unit will also provide multiple programmable set points, relay contact discrete outputs (form "C" contacts) and a 4-20mA variable output.
Control Relays	NEMA design, industrial type, with eight total field interchangeable contacts.
Terminal Blocks	DIN rail mounted terminal blocks of the normal density type, capable of 37 terminals per foot. Multiple layer (vertically stacked) terminal blocks will not be used.
Pilot Lights	30 millimeter diameter, NEMA-4X rated, push-to-test, transformer type light emitting diode (LED), lens color depends on application.
Selector Switches	30- millimeter diameter, NEMA 4X rated, action (momentary/maintained/etc.,) depends on application.
Pushbuttons	30- millimeter diameter, NEMA 4X rated, momentary action.
24Vdc Power Supply	Dual, Redundant, and Filtered
Programmable Logic Controller	"Modicon" as manufactured by Square D

It is proposed to utilize pressure transmitters in combination with Process Variable Indicators/Transmitters/Controllers in lieu of Pressure Switches in order to help reduce construction cost. Such a configuration also helps reduce maintenance costs. It is also proposed to use signal current isolators to provide total isolation between the signal from a non-isolated signal transmitter and a receiving device; therefore, eliminating faulty reading caused by ground loops and other electrical interference.

Recommended Convenience and Special Purpose Maintenance Receptacles

120Vac convenience receptacles will have a maximum spacing distance of 40-feet on centers. Additional receptacles will be provided to process equipment with an operating voltage of 120Vac. Process equipment with an operating voltage of 120Vac will be provided with Twist-Lock type assembly. No other types or voltages of convenience or special purpose receptacles will be installed.

Convenience and special purpose receptacles will be corrosion resistant and suitable for the application at hand, per the requirements of the NEC. All receptacles will be mounted at 3 feet above finished floor level.

Receptacles used inside the proposed Electrical Building shall be 120V, 20 ampere specification grade general purpose type receptacles. The accompanying receptacle mounting boxes will be of 99% copper free aluminum with the corresponding cover plates made of Type 304 Stainless Steel with a brushed finish.

Receptacles for all other areas of the Red Bud Trail Pump station (exterior or interior of the existing pump station) will be 120V, 20 ampere Ground Fault Interrupting type with weather proof, 99% copper free aluminum corrosion resistant boxes and weather proof coverplates.

Recommended Lighting System

Indoor Lighting

The design criteria selected for the development of the indoor lighting system consists of a working height of 2.5 feet, a ceiling and wall reflectance of no greater than 50%, and a floor reflectance equivalent to 20%. The foregoing criteria will be adopted for all areas within the structure. Lighting design levels will be 50 foot-candles (maintained) in the proposed Electrical Building. This criteria is in compliance with the requirements of the Illumination Engineering Standards of America (IES).

High power factor and high efficiency lighting fixtures will be utilized throughout the facility. Flourescent type lighting fixtures will be utilized in all areas and where the required fixture category and the available ceiling heights are compatible.

The lighting system's design goals will include the:

- even distribution of lighting, leading to higher efficiency and minimizing shadows
- minimization of glare, and
- providing visual comfort.

Since the main design constraint is easy and safe access to the fixtures for re-lamp purposes, the use of down-lighting fixtures will be maximized. Although the latter requirement does not assist in meeting the full intent of the aforementioned lighting design goals, it provides personnel safety and advocates preventative maintenance. Indirect lighting has the least glare and shadow characteristics in comparison to the wall-mount or down-lighting concepts; however, it is the least considered concept for use in the process mechanical areas mainly due to its inefficiency and higher wattage consumption.

It is proposed to provide interior lighting for the proposed Electrical Building. Although the interior lighting of the existing pump station does not provide coverage commensurate with the aforementioned goals of the proposed Electrical Building lighting system, modifications to the lighting system for the existing pump station will not be made at this time in order to help reduce construction cost.

Areas with more than one entrance or exit will have a corrosion resistant Light Switching Station at each entrance.

Outdoor Lighting

The existing Red Bud Trail Pump Station has limited exterior perimeter lighting around the existing pump station building and no outdoor task lighting. Operations personnel presently schedule outdoor maintenance activities during daylight hours and routinely provide portable lighting for any repair or maintenance activities required during the non-daylight period.

It is proposed to provide only perimeter lighting around the exterior of the proposed Electrical Building. Lighting design levels will be maintained at an average of 2-foot-candles for perimeter lighting. This criteria complies with the requirements of the Illumination Engineering Standards of America (IES). Preference will be given to lamp sizes/types in common use among other facilities in order to help reduce fixture re-lamping maintenance costs. Attention will also be given to the selection of fixtures to minimize light distribution to the surrounding neighborhood properties.

In consideration of the widespread use of portable lighting by facility maintenance personnel for outdoor nighttime maintenance activities, outdoor task, walkway, and perimeter lighting system modifications to the existing Red Bud Trail Pump Station facility will not be performed in order to help reduce construction cost.

Recommended Raceway System

The electrical wiring raceways will consist of a conduit system. Conduit routing methodology will be:

- above-ground and exposed,
- under the slab of the building structure and concealed, and/or
- underground in a duct bank system.

To the extent possible, the conduit system will be routed concealed and below the floor slab of the building structure in the area of the proposed Electrical Building. The conduit system will be routed exposed at or around process mechanical equipment, and also inside the extents of the existing Pump Stations.

Conduit bodies and systems concealed below slab or in a duct bank will be corrosion resistant, Schedule-40 PVC, per NEC requirements. Exposed conduit bodies and systems will be corrosion resistant, 99.0 percent copper-free aluminum, per NEC requirements. Conduits shall not be filled greater than the 40% maximum fill percentage as allowed by the NEC.

In recognition of the pump station life cycle, it is proposed to encase concealed (below finished grade) conduit systems in a reinforced concrete encased duct bank to prevent accidental contact by earth moving machinery. The design team has incorporated the cost of the duct bank employing reinforced concrete encasement into the preliminary conceptual construction cost opinion presented herein.

It is proposed to use pre-cast handholes and manholes, as applicable, to reduce construction cost. As the situation warrants, pull boxes mounted above grade will be employed. Such pull boxes will be constructed of #316 stainless steel when the size exceeds 12" square (12" high x 12" wide) and of aluminum when the size is 12" square or less in order to help reduce construction costs.

Conduit stub-outs out of the proposed Electrical Building dedicated for future equipment will be made as practicable to facilitate the connection of future equipment, thereby reducing future construction costs.

Recommended Electrical, Instrumentation, and Control Wiring

All 600 volt power wiring will be copper with 600 volt insulation when serving equipment rated 600 volts and below. All wiring will be copper. It is proposed to maintain separation between the power/control and instrumentation wiring such to facilitate safety and maintenance of the process equipment during operation. It is proposed to separate power and control wiring in separate raceway systems. It is proposed to utilize 600-volt rated multi-conductor control/power cable dedicated for process related equipment only when the cable is routed through handholes

and/or manholes. Otherwise, single conductor control/power cable will be used for process related equipment regardless of the raceway system configuration.

Recommended Grounding System

A single-point-grounding-network beneath the structure of the proposed Electrical Building will serve as a direct system ground for the Red Bud Trail Pump Station electrical system. The grounding system's design goal is to maintain a resistance to ground that is less than 2.0 ohms.

Recommended Inter-Facility Personnel Communication System

Due to the limited quantity of on-site operations staff and limited duration visits by facility operations personnel, it is proposed that the operations personnel continue to employ the use of the personal (hand held) two-way radios currently in use facilitate intra-plant communication, rather than purchasing additional communication equipment (telephones, voice grade telephone lines, etc.) dedicated for this facility. This will help reduce maintenance and capital costs by using existing equipment.

Recommended Security System Improvements

It is proposed to install an unauthorized entry system for the proposed Electrical Building. The proposed system will also contain audible alarms to annunciate a breach of security. It is proposed to ultimately install a security camera based system at the Red Bud Trail Pump Station to enable remote monitoring from the Water District office. In order to help reduce construction costs, it is proposed to defer the installation of the security cameras and related visual image processing hardware to occur commensurate with the installation of the Top-End host computer system and corresponding telemetry system communication network. It is proposed to install provisions in the form of an empty raceway system for security cameras strategically located around the existing pump station facility.

RECOMMENDATIONS CONCERNING REUSE OF EXISTING PUMP STATION EQUIPMENT

It is recommended that the existing wall mounted pump controllers and 480V motor control center, once demolished, be retained by the Water District for use as spare parts as needed for the repair of the Water District's other pump stations. A select inventory of spare parts can help facilitate equipment repair in the event of a maintenance emergency.

RECOMMENDED PROPOSED ELECTRICAL BUILDING HEATING, VENTILATION, AND AIR CONDITIONING SYSTEM

The recommended heating, ventilation, and air conditioning (HVAC) system for the proposed Electrical Building shall handle both the exterior wall/roof envelope load and the sensible load generated by equipment within the building. It is assumed outside air requirements shall be integral to the packaged air conditioning equipment and the system shall control heating and cooling setpoints with no humidity control. The system shall consist of two or more units to allow for both overall system reliability and staging of cooling and heating loads. The proposed units will be wall mounted and located on the exterior of the proposed Electrical Building for ease of maintenance. All system controls shall be local with no remote control capability. Controls shall be integral to the air conditioning equipment and the thermostat shall be accessible to the users for adjustment of setpoints and unit operation. Air particle filtration shall be integral to the packaged air conditioning equipment. Condensate shall be disposed directly onto grade. Remote alarms from the unit shall include at minimum a general unit alarm.

RECOMMENDED GENERAL CONSTRUCTION SEQUENCING

The recommended general construction sequence is intended to maximize the availability of the existing pumps to accommodate the continuous operation of the existing pump station. Only major items of work are listed here. It is recommended that the construction be timed such that the transfer of the electrical service (refer to the "Recommended Power Distribution System Improvements" section of this report) occur during a low water demand period in order to minimize the impact of construction upon the Water District's customers. The following general construction sequence is proposed:

1. Construct the necessary proposed field instrument and telemetry system interconnection raceway system.
2. Construct the majority of the interconnect raceway system between the electrical building and the existing pumps/valves.
3. Construct the primary raceway system between the proposed 12470V primary electrical service riser service pole and the proposed electrical service transformer.
4. Construct the proposed electrical building
5. Disconnect the existing service to the existing 480V motor control center. Establish electrical service to the proposed building using the same 12470V electrical service riser pole which was dedicated to the existing 480V motor control center. Establish the existing telemetry system interconnection with the proposed Electrical Building distributed control system.
6. Complete final connection to the proposed variable speed pump "P-7". Perform final checkout of the proposed pump and its operation with the proposed control system to insure reliable operation. The pump station continues to operate with the existing pumps "P-1", "P-2", and "P-3" fully operational due to their connection to a separate existing electrical service.

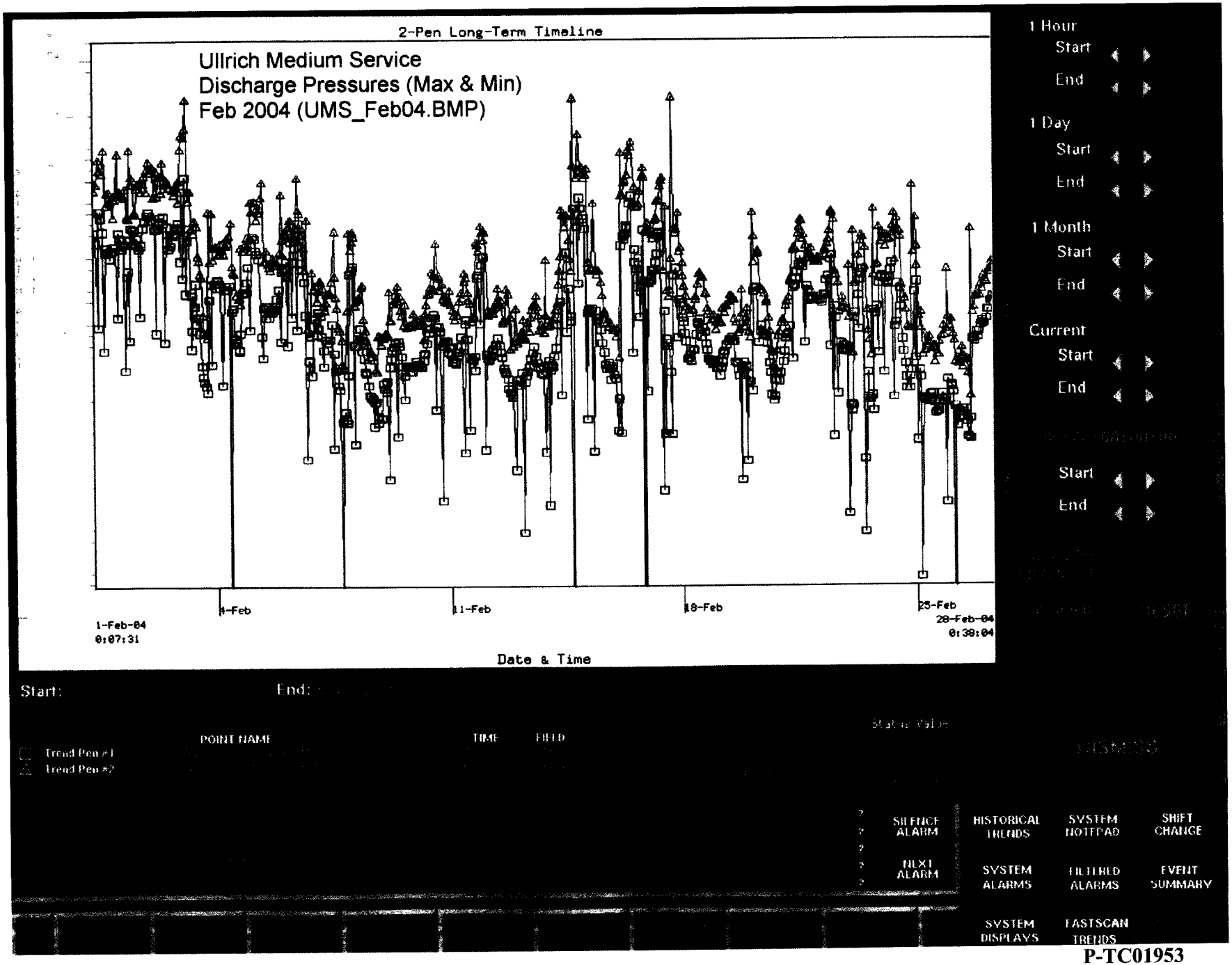
7. Disconnect one existing pump from the existing 480V motor control center and complete final connection to the proposed 480V power distribution system. Perform final checkout of the existing pump and its operation with the proposed control system to insure reliable operation. The pump station continues to operate with the existing pumps "P-1", "P-2", "P-3" and proposed variable speed pump "P-7".
8. Repeat step 6 until all existing pumps are connected to the proposed 480V power distribution system.
9. Connect the existing pump station lighting and auxiliary power distribution system to the proposed electrical building power distribution system.
10. Demolish the existing electrical connections to the existing pumps and the existing electrical services to the Red Bud Trail Pump Station in their entirety.

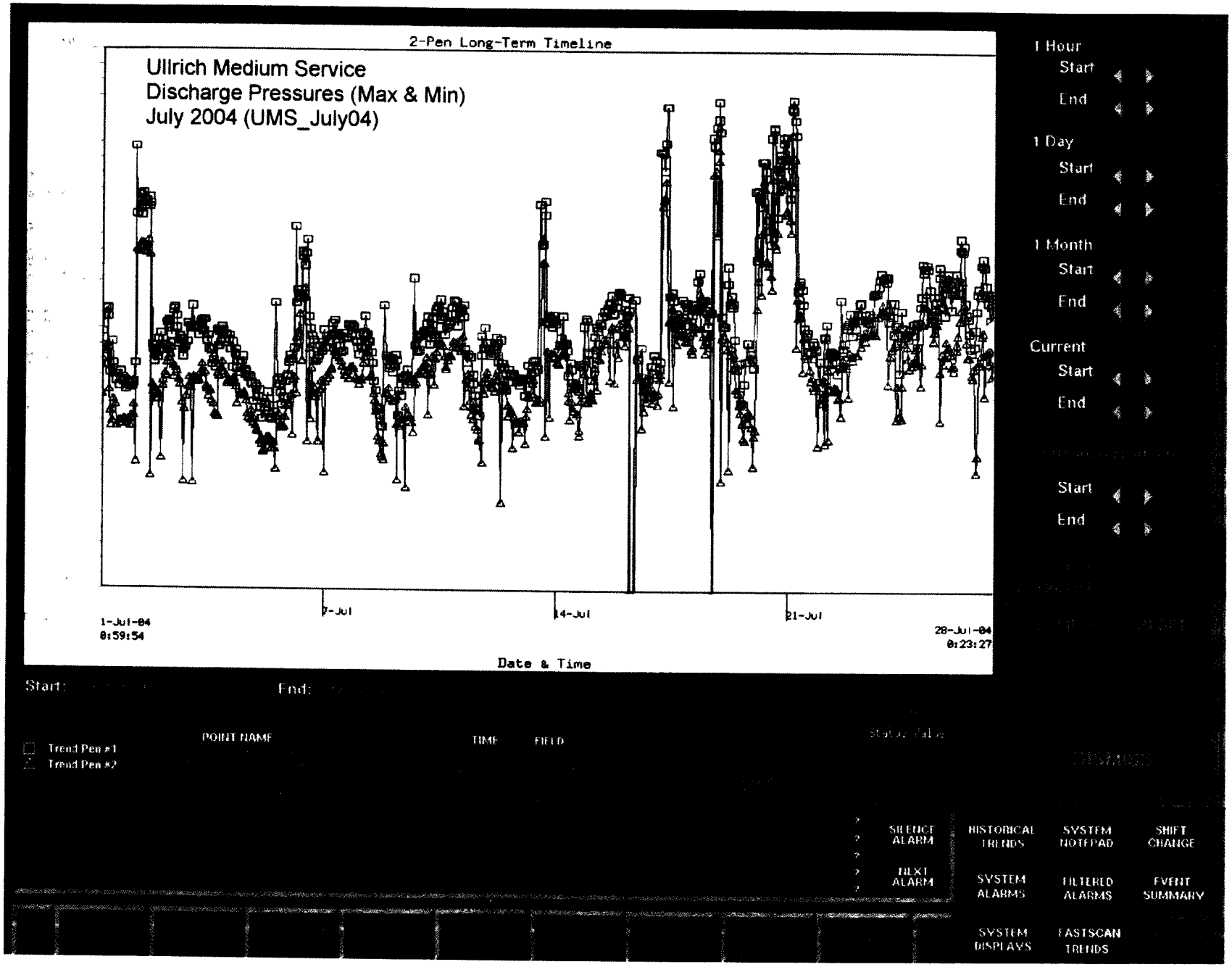
PRELIMINARY CONCEPTUAL CONSTRUCTION COST OPINION

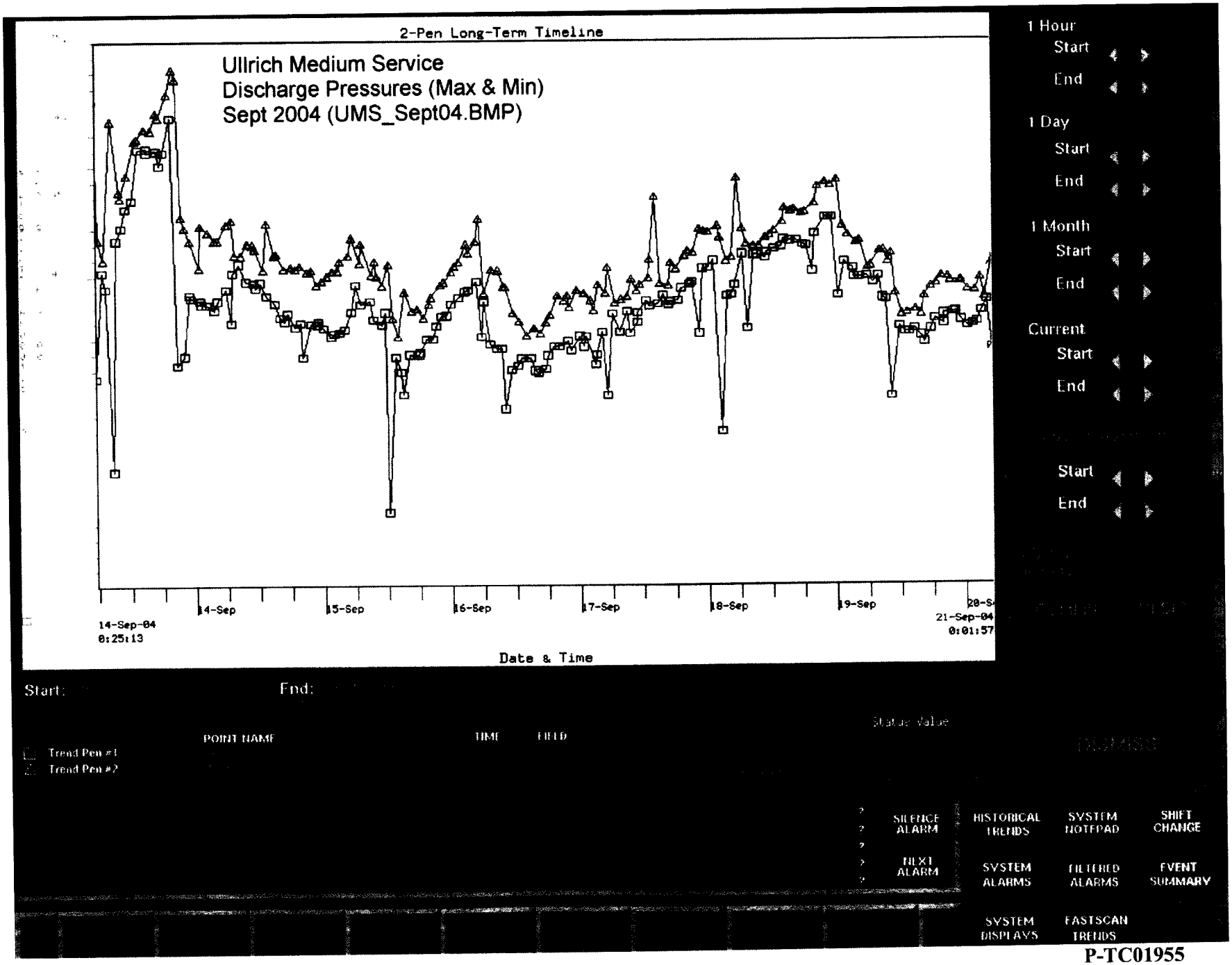
The Preliminary Conceptual Construction Cost Opinion for costs associated with the electrical and instrumentation control system upgrade described in this report were developed for the various Power Distribution System Design Cases previously described. The preliminary construction cost opinions for the different cases along with Exhibit references are presented in Table 5 below. For all cases, we also recommend adding a contingency of 15%. These Preliminary Conceptual Construction Cost Opinions do not include Electrical Building costs, engineering services, construction support, or control system programming. These Preliminary Conceptual Construction Cost Opinions do include Electrical, Instrumentation and Control, and HVAC.

Table 5. Preliminary Conceptual Construction Cost Opinion Summary Table

Power Distribution System Design Case	Preliminary Conceptual One-Line Exhibit	Preliminary Conceptual Electrical Building Floor Plan Exhibit	Preliminary Conceptual Construction Cost Opinion
Case No. 1	Exhibit 5	Exhibit 6	$ 752,403.00
Case No. 2	Exhibit 7	Exhibit 8	$ 742,962.00
Case No. 3	Exhibit 9	Exhibit 10	$ 747,093.00


2-Pen Long-Term Timeline
Ullrich Medium Service
Discharge Pressures (Max & Min)
Feb 2004 (UMS_Feb04.BMP)
1 Hour
Start
End
1 Day
Start
End
1 Month
Start
End
Current
Start
End
Start
End
4-Feb
11-Feb
18-Feb
25-Feb
1-Feb-04
0:07:31
28-Feb-04
0:38:04
Date & Time
Start:
End:
POINT NAME
TIME
FIELD
Trend Pen #1
Trend Pen #2
SILENCE ALARM
NEXT ALARM
HISTORICAL TRENDS
SYSTEM NOTEPAD
SHIFT CHANGE
SYSTEM ALARMS
FILTERED ALARMS
EVENT SUMMARY
SYSTEM DISPLAYS
FASTSCAN TRENDS


2-Pen Long-Term Timeline
Ullrich Medium Service
Discharge Pressures (Max & Min)
July 2004 (UMS_July04)
1 Hour
Start
End
1 Day
Start
End
1 Month
Start
End
Current
Start
End
Start
End
7-Jul
14-Jul
21-Jul
1-Jul-04
0:59:54
28-Jul-04
0:23:27
Date & Time
Start:
End:
Trend Pen #1
Trend Pen #2
POINT NAME
TIME
FIELD
SILENCE ALARM
NEXT ALARM
HISTORICAL TRENDS
SYSTEM NOTEPAD
SHIFT CHANGE
SYSTEM ALARMS
FILTERED ALARMS
EVENT SUMMARY
SYSTEM DISPLAYS
FASTSCAN TRENDS


2-Pen Long-Term Timeline
Ullrich Medium Service
Discharge Pressures (Max & Min)
Sept 2004 (UMS_Sept04.BMP)
1 Hour
Start
End
1 Day
Start
End
1 Month
Start
End
Current
Start
End
Start
End
14-Sep
15-Sep
16-Sep
17-Sep
18-Sep
19-Sep
14-Sep-04
0:25:13
21-Sep-04
0:01:57
Date & Time
Start:
End:
POINT NAME
TIME
Trend Pen #1
Trend Pen #2
SILENCE ALARM
NEXT ALARM
HISTORICAL TRENDS
SYSTEM NOTEPAD
SHIFT CHANGE
SYSTEM ALARMS
FILTERED ALARMS
EVENT SUMMARY
SYSTEM DISPLAYS
FASTSCAN TRENDS

```
* * * * * * * * * * * * K Y P I P E * * * * * * * * * * * *
*                                                           *
*  Pipe Network Modeling Software                           *
*                                                           *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)               *
*  Version: 6.020  07/25/2013                               *
*  Serial #:  6-3008647                                     *
*  Interface:  Classic                                      *
*  Licensed for Pipe2008                                    *
*                                                           *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

 Date & Time:  Thu Dec 04 12:54:17 2014

 Master File : g:\1410\7009-
21\design\calculations\newpumpstatest.KYP\newpumpstatest.P2K


 U N I T S   S P E C I F I E D

    FLOWRATE ............ = gallons/minute
    HEAD (HGL) .......... = feet
    PRESSURE ............ = psig
    METERED FLOW ........ = gallons
    POWER COST .......... = 0.050 $/kW-Hr



 O U T P U T   O P T I O N   D A T A

 OUTPUT SELECTION:  ALL RESULTS ARE INCLUDED IN THE TABULATED OUTPUT
        MAXIMUM AND MINIMUM PRESSURES       =   10


 E P S   D A T A

     TOTAL TIME FOR SIMULATION                  =   24.000
     NORMAL TIME PERIOD FOR CALCULATIONS        =    1.000
     NORMAL TIME PERIOD FOR TABULATED OUTPUT    =    1.000
     NORMAL TIME PERIOD FOR POSTPROCESSING FILE =    1.000


 EPS OUTPUT SELECTION:  THE ABOVE TABULATED OUTPUT OPTIONS ARE INCLUDED
                        WITH THE FOLLOWING EXTENDED PERIOD PRINT OPTIONS

    INTERMEDIATE REPORTS (tank status, flow meter, regulating valve,
etc.)
        SUPPRESSED FOR ALL INTERMEDIATE TIME PERIODS
```

SUPPRESSED FOR ALL STATUS CHANGES (tanks, pressure switches, etc.)

V A R I A B L E H E A D T A N K D A T A

TANK NAME	MAXIMUM ELEVATION (*) ft	MINIMUM ELEVATION ft	TANK CAPACITY gals	INITIAL VOLUME gals	EXTERNAL FLOW gpm
McConnell T(1)	880.00	860.00	160873.	72393.	0.00
Riske TK(1)	1080.00	1050.00	158641.	137489.	0.00
RobRoy(1)	1080.00	1050.00	1045089.	766399.	0.00

* TANK TYPE: (1) - CONSTANT DIAMETER (2) - VARIABLE AREA

P R E S S U R E S W I T C H D A T A

REFERENCE ELEMENT	REFERENCE NODE	SWITCHING GRADES (ft)
PUMP-7 McConnell Ta	865.00 &	879.50

S Y S T E M C O N F I G U R A T I O N

NUMBER OF PIPES .....(p) = 693
NUMBER OF END NODES .....(j) = 585
NUMBER OF PRIMARY LOOPS .....(l) = 104
NUMBER OF SUPPLY NODES .....(f) = 5
NUMBER OF SUPPLY ZONES .....(z) = 1

Time: 0.000

TIME FROM INITIATION OF EPS = 0.0000 HOURS (0.00AM, DAY: 1)

RESULTS OBTAINED AFTER 27 TRIALS: ACCURACY = 0.00019

S I M U L A T I O N D E S C R I P T I O N (L A B E L)

TRAVIS COUNTY WATER CONTROL AND
IMPROVEMENT DISTRICT NO. 10

RED BUD TRAIL PUMP STATION MODEL
09/15/2004

P I P E L I N E R E S U L T S

STATUS CODE: XX -CLOSED PIPE CV -CHECK VALVE

PIPE NAME	NODE NUMBERS #1	#2	FLOWRATE gpm	HEAD LOSS ft	MINOR LOSS ft	LINE VELO. ft/s	HL+ML/ 1000 ft/f	HL/ 1000 ft/f
1	1	2	2504.66	17.05	0.00	5.22	10.66	10.66
2	2	3	2903.80	9.66	0.00	8.24	27.61	27.61
3	3	4	387.92	15.37	0.00	4.40	20.49	20.49
4	4	5	385.92	12.89	0.00	4.38	20.29	20.29
5	5	525	2699.77	64.05	0.00	7.66	24.12	24.12
6	6	532	812.39	11.46	0.00	5.18	19.13	19.13
7	7	442	63.14	0.10	0.00	0.40	0.13	0.13
8	McConnell	526	-340.60	0.01	0.00	0.97	0.53	0.53
9	9	10	1891.78	0.97	0.00	3.02	3.13	3.13
10	10	11	2.00	0.00	0.00	0.01	0.00	0.00
11	10	12	1889.78	0.31	0.00	3.02	3.12	3.12
12	12	13	6.00	0.02	0.00	0.07	0.01	0.01
13	12	260	273.77	3.19	0.00	1.75	2.55	2.55
14	15	504	-1401.21	0.31	0.00	3.97	7.29	7.29
15	16	17	14.00	0.05	0.00	0.16	0.04	0.04
16	17	19	5.06	0.00	0.00	0.06	0.01	0.01
17	17	20	5.94	0.00	0.00	0.07	0.01	0.01
18	20	403	1.94	0.00	0.00	0.02	0.00	0.00

	19	20	21	1.00	0.00	0.00	0.01
0.00	0.00						
	20	301	499	186.80	0.35	0.00	2.12
5.29	5.29						
	21	23	24	4.00	0.00	0.00	0.05
0.00	0.00						
	22	20	422	0.00	0.00	0.00	0.00
0.00	0.00						
	23	25	26	-129.56	1.01	0.00	1.47
2.69	2.69						
	24	25	396	346.59	19.64	0.00	3.93
16.63	16.63						
	25	28	29	-56.50	0.51	0.00	0.64
0.58	0.58						
	26	29	30	4.95	0.00	0.00	0.06
0.01	0.01						
	27	30	31	298.56	0.16	0.00	0.85
0.43	0.43						
	28	31	32	131.56	0.28	0.00	1.49
2.77	2.77						
	29	31	806	118.00	0.00	0.00	0.33
0.08	0.08						
	30	302	34	176.80	4.78	0.00	2.01
4.78	4.78						
	31	34	35	164.80	2.94	0.00	1.87
4.20	4.20						
	32	35	391	1.00	0.00	0.00	0.01
0.00	0.00						
	33	29	37	-62.45	0.35	0.00	0.71
0.70	0.70						
	34	37	38	2.00	0.00	0.00	0.02
0.00	0.00						
	35	303	564	-268.50	0.21	0.00	0.76
0.35	0.35						
	36	39	40	22.99	0.07	0.00	0.26
0.08	0.08						
	37	40	41	18.99	0.07	0.00	0.22
0.06	0.06						
	38	41	42	10.36	0.01	0.00	0.12
0.02	0.02						
	39	42	43	7.09	0.00	0.00	0.08
0.01	0.01						
	40	43	44	3.00	0.00	0.00	0.03
0.00	0.00						
	41	43	45	-2.90	0.00	0.00	0.03
0.00	0.00						
	42	42	46	1.26	0.00	0.00	0.01
0.00	0.00						
	43	46	45	4.90	0.00	0.00	0.06
0.00	0.00						
	44	46	47	-5.64	0.00	0.00	0.06
0.01	0.01						
	45	41	47	6.64	0.01	0.00	0.08
0.01	0.01						

46	284	285	102.08	1.26	0.00	1.16	1.26
47	39	49	-329.73	0.51	0.00	0.94	0.52
48	49	466	-285.22	0.16	0.00	0.81	0.40
49	50	468	4.00	0.00	0.00	0.05	0.00
50	52	250	1.00	0.00	0.00	0.01	0.00
51	53	52	-44.04	0.17	0.00	0.50	0.36
52	53	49	73.51	0.54	0.00	0.83	0.94
53	54	53	30.46	0.06	0.00	0.35	0.18
54	54	55	-48.83	0.14	0.00	0.55	0.44
55	56	464	46.04	0.01	0.00	0.29	0.07
56	60	54	-17.37	0.04	0.00	0.20	0.07
57	59	55	27.26	0.02	0.00	0.17	0.04
58	55	56	-22.57	0.01	0.00	0.14	0.03
59	60	59	-58.11	0.20	0.00	0.66	0.61
60	60	61	46.85	0.14	0.00	0.53	0.41
61	399	61	-51.70	0.22	0.00	0.59	0.49
62	63	62	-55.89	0.18	0.00	0.63	0.57
63	39	63	-40.88	0.23	0.00	0.46	0.32
64	63	64	13.01	0.02	0.00	0.15	0.04
65	62	65	-6.19	0.01	0.00	0.07	0.01
66	61	66	-6.85	0.01	0.00	0.08	0.01
67	60	66	26.62	0.13	0.00	0.30	0.14
68	59	58	-86.37	0.08	0.00	0.55	0.30
69	57	56	71.61	0.13	0.00	0.46	0.16
70	57	69	-100.98	0.15	0.00	0.64	0.30
71	69	70	-101.98	0.85	0.00	1.16	1.25
72	68	58	60.01	0.14	0.00	0.38	0.16

	73	64	65	-63.44	0.21	0.00	0.72
0.72	0.72						
	74	67	68	-54.85	0.38	0.00	0.62
0.55	0.55						
	75	66	67	-52.85	0.17	0.00	0.60
0.51	0.51						
	76	65	66	-70.63	0.52	0.00	0.80
0.87	0.87						
	77	64	71	8.00	0.01	0.00	0.09
0.02	0.02						
	78	71	72	2.76	0.00	0.00	0.03
0.00	0.00						
	79	71	72	1.24	0.00	0.00	0.01
0.00	0.00						
	80	72	73	2.00	0.00	0.00	0.02
0.00	0.00						
	81	74	75	-168.54	0.89	0.00	1.08
1.08	1.08						
	82	75	407	-168.54	0.88	0.00	1.08
1.04	1.04						
	83	76	77	1.30	0.00	0.00	0.01
0.00	0.00						
	84	77	78	61.53	0.22	0.00	0.70
0.68	0.68						
	85	78	79	123.86	0.80	0.00	1.41
2.47	2.47						
	86	79	401	120.86	0.56	0.00	0.77
0.56	0.56						
	87	79	80	1.00	0.00	0.00	0.01
0.00	0.00						
	88	78	81	-65.33	0.55	0.00	0.74
0.76	0.76						
	89	77	81	-62.23	0.33	0.00	0.71
0.69	0.69						
	90	76	83	-172.84	0.90	0.00	1.10
1.13	1.13						
	91	83	82	-174.84	0.63	0.00	1.12
1.15	1.15						
	92	81	82	-129.56	1.21	0.00	1.47
2.69	2.69						
	93	1	462	807.60	2.06	0.00	2.29
2.58	2.58						
	94	429	8	-383.55	0.00	0.00	1.09
0.66	0.66						
	95	525	6	347.76	0.02	0.00	0.99
0.54	0.54						
	96	84	85	1.00	0.00	0.00	0.01
0.00	0.00						
	97	84	87	392.98	0.37	0.00	1.11
0.52	0.52						
	98	531	529	1890.07	1.03	0.00	3.02
3.13	3.13						
	99	89	88	-27.16	0.07	0.00	0.31
0.13	0.13						