CITY OF ALBUQUERQUE, NEW MEXICO

PUMP STATION NO. 36 PRINCETON OPERATIONS MANUAL

Prepared for:

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The technical material and data contained in the Operations Manual were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer, licensed to practice in the State of New Mexico, is affixed below.

DISCLAIMER

All information pertaining to the stormwater pump station equipment and mode of operation is based on information relevant at the time this manual was prepared. Information will be subject to change as equipment is up graded and replaced in the future. We recommend the Owner update the information contained in this manual as improvements occur so this manual can continue to serve as a useful tool to the operations staff.

(SEAL)

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All questions about the meaning or intent of these documents shall be submitted only to the Engineer of Record, stated above, in writing.

OPERATIONS MANUAL
FOR THE
CITY OF ALBUQUERQUE STORMWATER PUMP STATION NO. 36 PRINCETON

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LIST OF ACRONYMS AND ABBREVIATIONS

3P	Three Phase
A	Ampere
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
AC	Alternating Current
AC/hr	Air Changes per hour
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AWG	American Wire Gauge
BSCP	Bar Screen Control Panel
CAS	Control and Status (pump relay)
CFM	Cubic feet per minute
CP	Control Panel
CT	Control Transformer
CV	Check Valve
DB	dry bulb
DC	Direct Current
FVNR	Full Voltage Non-Reversing (Motor Starter)
FVR	Full Voltage Reversing (Motor Starter)
GF	Ground Fault
GND	Ground
gpm	gallons per minute
HMI	Human-machine interface (screen and keyboard)
H-O-A	hand-off- automatic
HP	horsepower
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz (cycles per second)
ICP	Integrated control panel
IM	isolation means
IMP	Impedance
JB	junction box
kcmil	thousand circular mils (area of conductor)
kV	Kilovolt
kVA	Kilo volt-ampere
kW	kilowatt
kWH	Kilowatt Hour (meter)
LE	Level Element
LIT	Level Indicator Transmitter
LOA	Local-Off-Auto
LOR	Local-Off-Remote
LOTO	lock-out-tag-out
LPCP	Lift Pump Control Panel
LSCP	Lift Station Control Panel
LS	Level Switch

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

mA	Milliampere
MCB	Main Circuit Breaker
MCC	Motor Control Center
mg/L	milligrams per liter
MGD	million gallons per day
MLO	Main Lug Only
MV	Medium Voltage
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPSH	Net Positive Suction Head
O&M	Operation and Maintenance
OC	open-close
OCA	open-close-automatic
OIP	operator interface panel
OIS	operator interface station (screen and keyboard)
OL	Overload
OSE	Office of the State Engineer
P	Pump
P&ID	process and instrumentation diagram
PFCC	Power Factor Correction Capacitor
PLC	programmable logic controller
PMH-9	Model of Primary Voltage Switchgear Manufactured by S&C Electric
PNM	Public Service Company of New Mexico
PPE	personal protection equipment
PRV	pressure relief valve
psi	pounds per square inch
PT/CT	Potential (voltage) transformer/current transformer
PT	power transformer
RCP	reinforced concrete pipe
RMC	Rigid Metal Conduit
ROF	Reverse-Off-Forward
RPM	revolutions per minute
RTU	radio telemetry unit
RVPW	reduced voltage part winding
RVSS	reduced voltage solid state starter
SCADA	supervisory control and data acquisition
SLCP	Station Level Control Panel
SMP	Standard Maintenance Procedure
SOJP	Standard Operation Job Procedure
SPCP	Sump Pump Control Panel
sq.ft.	square feet
SS	stainless steel
SSCP	Stepped Speed Contactor Panel

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

SWRP	Southside Water Reclamation Plant
TDH	total dynamic head
UPS	Uninterruptible Power Supply
V	Volts
V	Valve
VDC	Volts Direct Current
VFD	variable frequency drive
WB	Wet Bulb
WC	Water column
WUA	Water Utility Authority
WUA-AMP	Water Utility Authority Asset Management Program
WWTP	Wastewater Treatment Plant
XFMR	Transformer

1.0 INTRODUCTION

This Operations Manual refers exclusively to the existing stormwater pump station facilities for Pump Station No. 36 Princeton. Refer to Section 1.3 for a description of existing facilities. The intent of this manual is to inform the operator of how each component operates and to serve as a reference for performing particular tasks. The intent of this manual is achieved by addressing three areas of operation: Operations & Maintenance (O&M); Overview, Standard Operating Job Procedure (SOJPs); and Standard Maintenance Procedures (SMPs). This manual is written with the assumption that the operator reading it has more than just a basic understanding of storm drainage systems and stormwater pump stations in general and is not intended to be used as an education publication.

1.1 Guide to the Manual

1.1.1 Section Organization

The information presented in this manual for the three (3) areas of operation is organized into nine (9) major sections. Each section includes specific information that pertains to the section title. Although each section contains valuable information necessary for efficient, orderly, and safe operations of the facilities, certain sections cover the technical operations of the facility and contain detailed instructions on how the pump station should be operated.

There is some variation, but most of the sections listed above are broken down into subsections under the following headings:

- Overview
- Equipment Description
- Design Criteria
- Instrumentation and Alarms
- Normal Operation
- Safety: Information Unique to the System or Process

1.1.2 Section Headings

The text of this manual is prepared using a sequence numbering system for all of the headings and components (figure numbers, table numbers, and page numbers). The first number denotes the start of a section. The second number denotes the start of a subsection. The third number denotes the headings or the component of each subsection. Some sections that appear in this manual may have a fourth division. For example, 4.1.4 refers to the normal operations for the mechanical barscreen in Section 4 – Pump Station System.

This section would be located under Section 4 – Pump Station System, Subsection 4.1 – Mechanical Bar Screen, Heading 4.1.4 – Normal Operation.

Tables, page numbers, and figures are presented using a similar numbering system. The first number indicates the section where the figure, table, or page can be found. The second number is separated from the first number by a dash and indicates the order of the figures, table, or page in the appropriate section.

To minimize repetition, many systems are cross-referenced throughout the text to show the interrelationship between the various units. Where possible, discussions concerning identical or similar equipment installed at different locations are kept as similar as possible to provide the personnel with a routine, which can be used at all of the involved locations.

1.2 City-Wide Stormwater Pumping System Description

The City of Albuquerque stormwater pump stations are located mostly in low areas of the Valley, with three (3) stations, Nos. 31, 35, and 36, designed to discharge into the North Diversion Channel, and are used to collect and pump stormwater runoff and prevent or mitigate the impact of flooding; three (3) stations, Nos. 30, 44, and 47, are located outside of the City limits in unincorporated Bernalillo County. A map of all fourteen (14) pump stations is presented in Figure 1-1. Please note station No. 42 Paseo Del Norte has been decommissioned, but is shown in Figure 1-1.

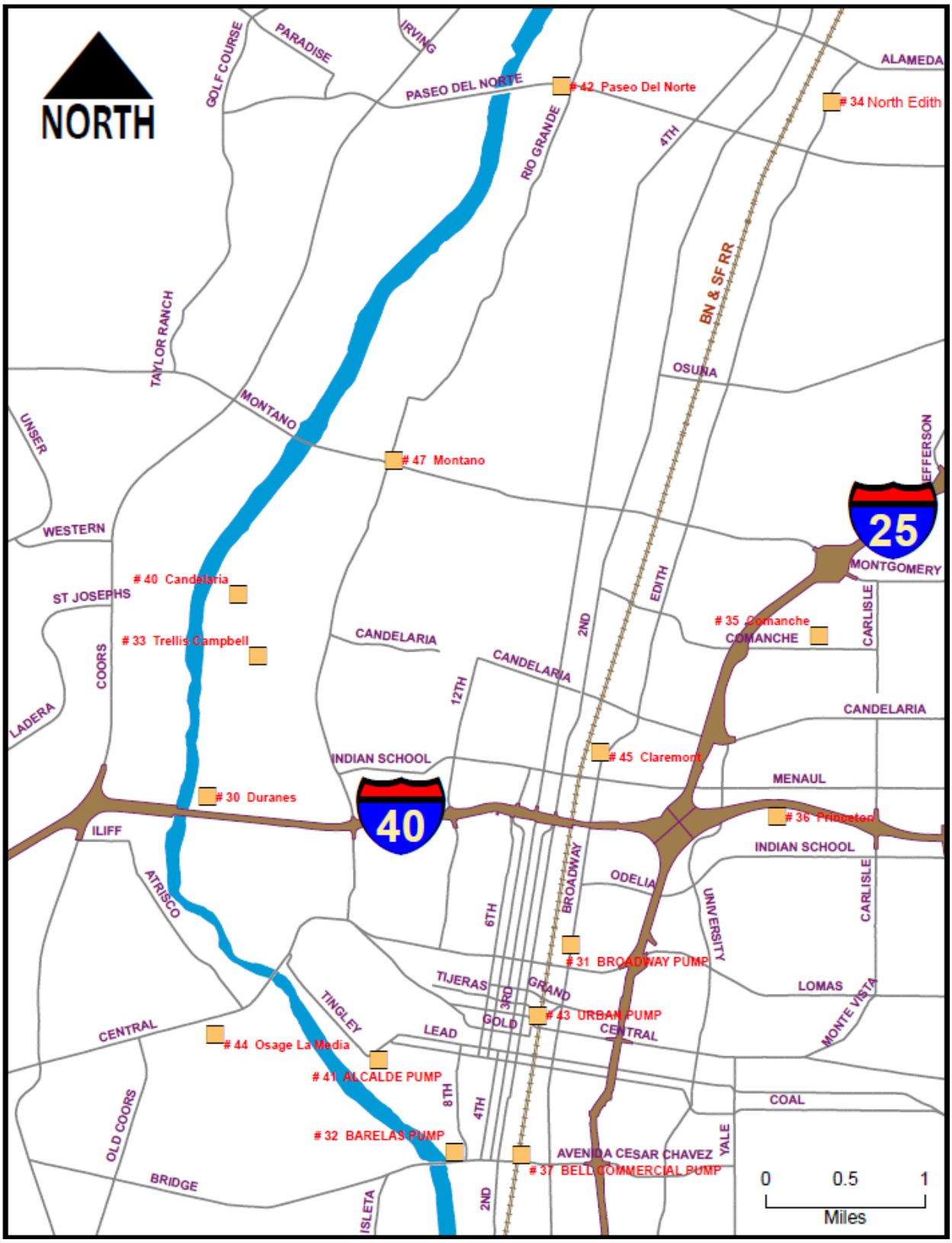


FIGURE 1-1
STORMWATER PUMP STATIONS MAP
Source: City of Albuquerque, DMD, SDD

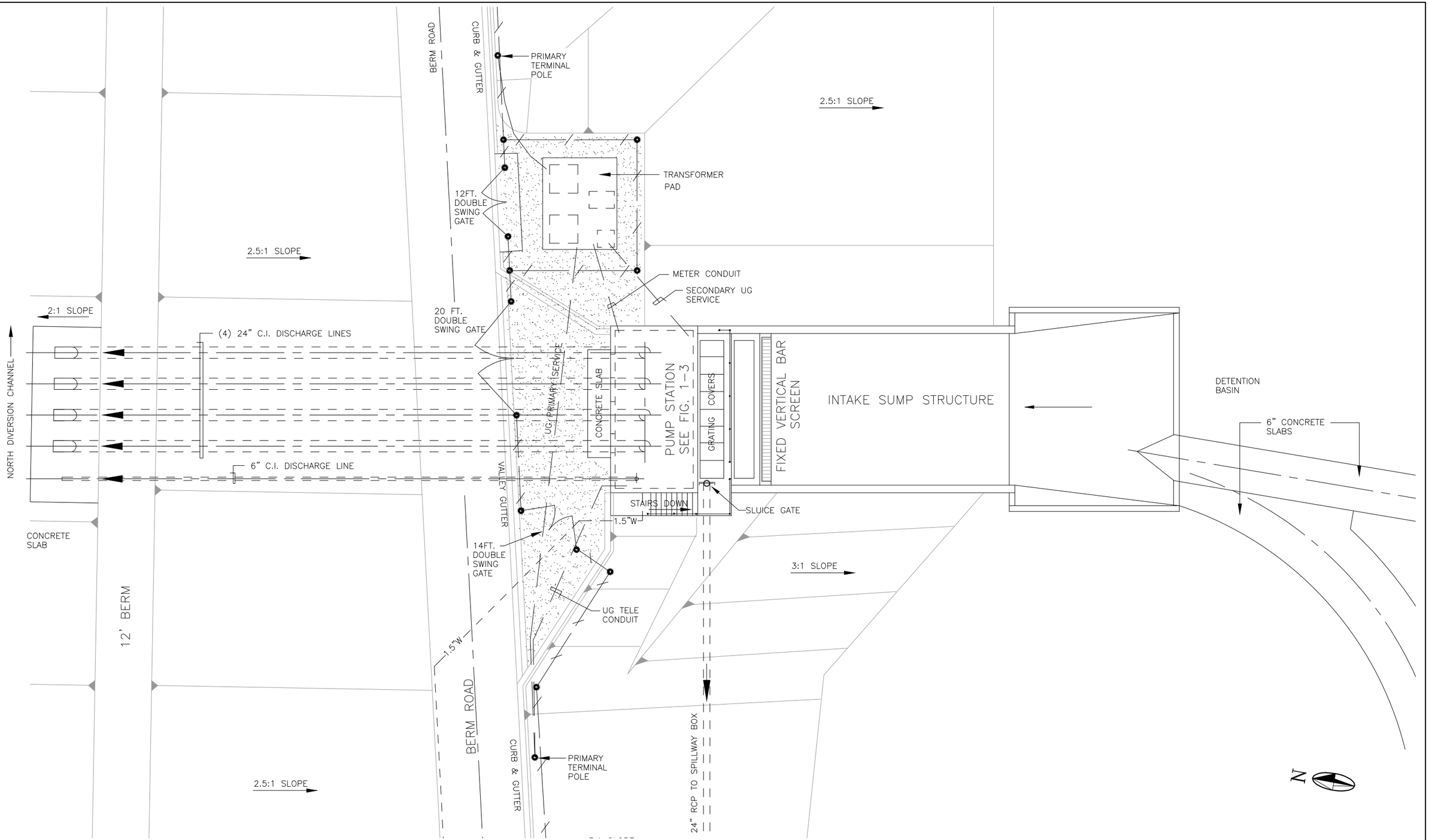
The stormwater pump stations are owned by the City of Albuquerque (COA) and are administered by the Albuquerque Department of Municipal Development (DMD), Engineering Division, Storm Drain Design (SDD). Through an agreement between the City and the Albuquerque Bernalillo County Water Utility Authority (ABCWUA), the ABCWUA Field Operations Department, Line Maintenance/ Lift Station Section operate and maintain the stormwater pump stations, along with their other duties to operate and maintain the wastewater vacuum and lift stations.

1.3 General Description of Stormwater Pump Station No. 36 Princeton

Pump Station No. 36 Princeton is located north of the intersection of Cutler Avenue NE and Princeton Drive NE, just south of the I-40 and the North Diversion Channel, shown in Figure 1-1. The address is 1920 Princeton Drive NE, and is located in zoning map grid H-16. It was constructed in 1969 to receive runoff from the surrounding neighborhood to the south. The pump station has been upgraded since its original construction, with the most recent upgrade occurring in 2004. The upgrade was part of the Stormwater Pumps Station Rehabilitation Phase III and included the installation of a sump pump and a jib crane. The upgrade also included electrical work, replacing equipment for instrumentation and controls.

The drainage area is roughly south of the North Diversion Channel to Constitution Avenue and east to Girard Boulevard. The area is bordered on the west by the University of New Mexico North Campus and Golf Course. The network of storm drains feeding the pump station can deliver between 79,000 and 91,000 gallons per minute (gpm) into the detention pond at maximum capacity, as discussed in Section 3.1.1, while the pump station is capable of discharging approximately 52,000 gpm. The remaining stormwater collects locally in the attached detention pond until the pump station can discharge the accumulated stormwater through force mains into the adjacent North Diversion Channel through its south embankment.

A site and base plan of the pump station is provided in Figure 1-2 and Figure 1-3, respectively. Additionally, a reference section drawing from a previous construction project at the Princeton Station is provided in Figure 1-4. Reference drawings are for information only and may not be representative of existing conditions.



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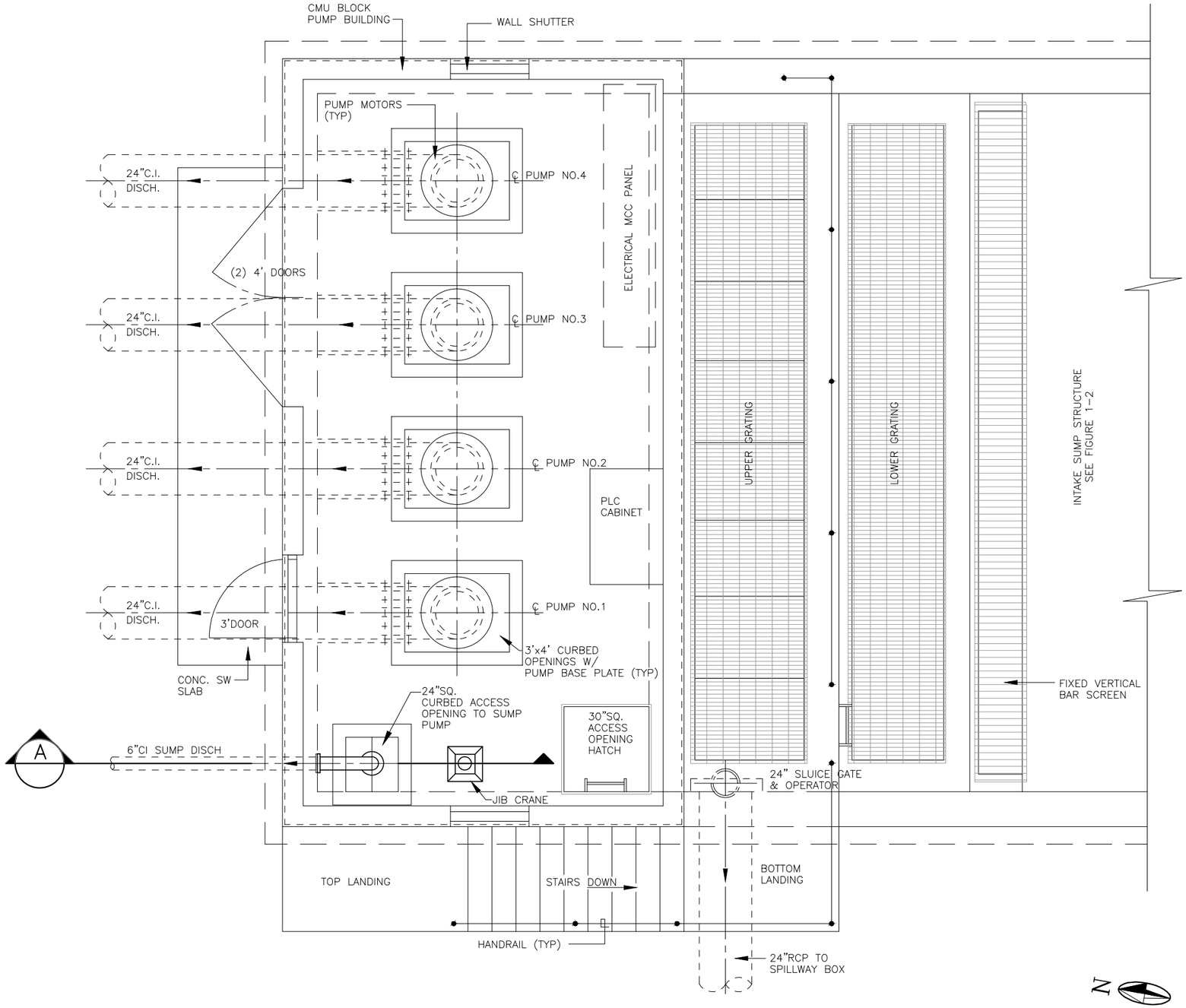
City Of Albuquerque Stormwater Pump Stations

Pump Station No. 36 Princeton Site Plan

Figure 1-2



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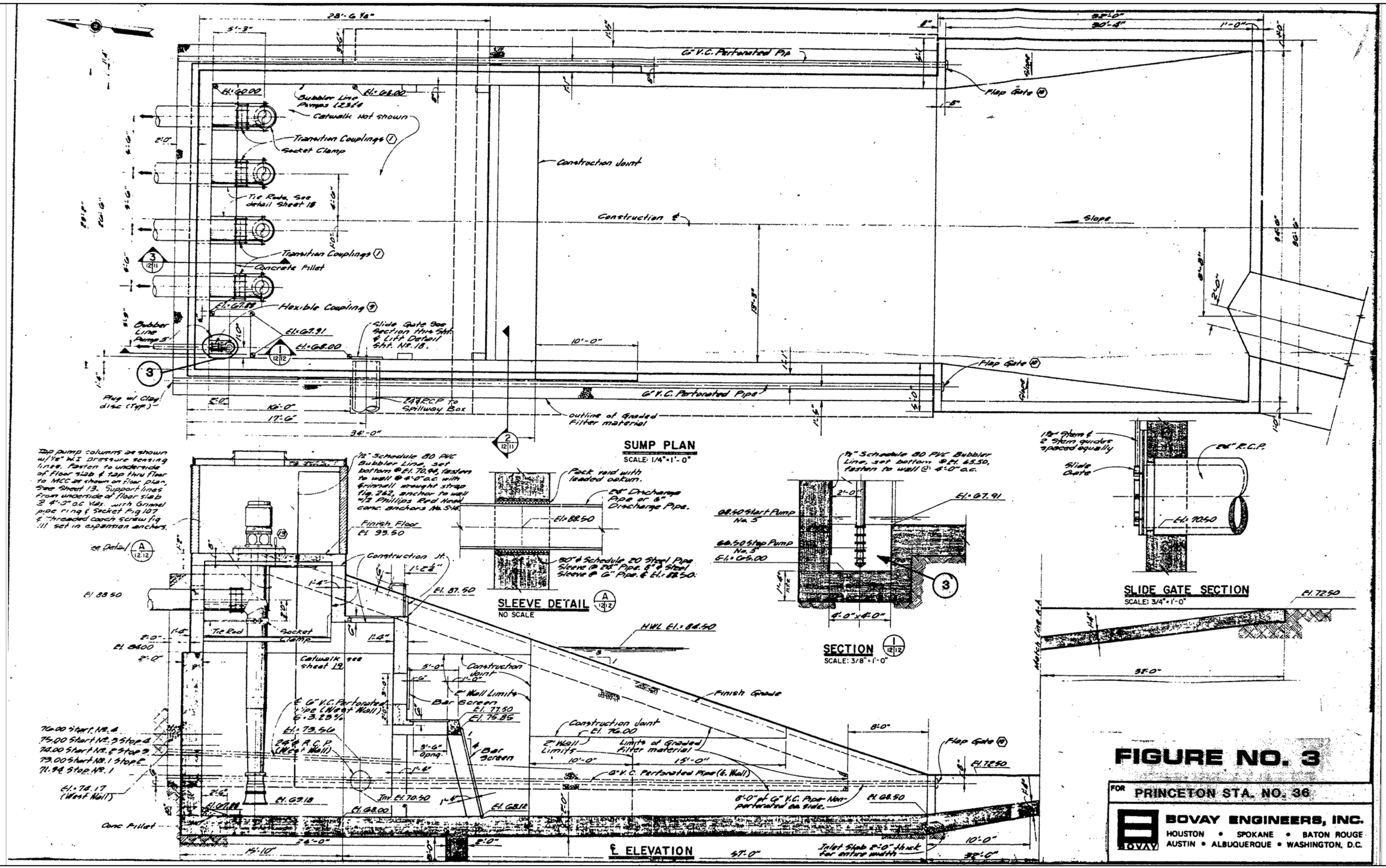
City Of Albuquerque Stormwater Pump Stations

Pump Station No. 36 Princeton Base Plan

Figure 1-3

LAST MODIFIED: Apr 16, 2015 - 10:08am BY USER: dbelka
DWG. LOCATION: I:\ALBUQUERQUE\ABQ13\1-1 Storm\PS Condition&Asset\O&M SOUP SMP\PS 36 Princeton\FIGURES\
DWG. NAME: Figure 1-4.dwg



2.0 STANDARDS

This section provides a brief description of the standards applicable to this pump station and identifies the governing regulations which dictate the level of standards recommended for design and installation.

2.1 Water Resource Standards

The stormwater pumps are recommended to be designed and installed to meet the following standards by the American National Standard Institute/ Hydraulic Institute (ANSI-HI):

- ANSI/HI 1.3 Rotodynamic (Centrifugal) Pumps for Design and Application
- ANSI/HI 2.3 Rotodynamic (Vertical) Pumps for Design and Application
- ANSI/HI 9.6.4 Rotodynamic Pumps for Vibration Measurement and Allowable Values
- ANSI/HI 9.8 Intake Design for Rotodynamic Pumps**.**
- ANSI/HI 14.6 Rotodynamic Pumps for Hydraulic Performance Acceptance Tests

2.2 Electrical Standards

The electrical systems are recommended to be designed and installed to meet the following standards: 2012 National Fire Protection Association (NFPA) – National Fire Code, NFPA 70 – National Electrical Code, NFPA 70B – Recommended Practices for Electrical Equipment Maintenance, NFPA 70E – Standard for Electrical Safety in the Workplace, NFPA 110 – Standard for Emergency and Standby Power Systems, and New Mexico Electrical Code (14.10.4.) Title 14 – Housing and Construction, Chapter 10.

Also, the electrical design is to comply with the recommended practices of the following organizations:

- NEMA – National Electrical Manufacturer's Association
- UL – Underwriters Laboratories
- IEEE – Institute of Electrical and Electronics Engineers

2.3 HVAC Standards

The HVAC systems are recommended to be designed and installed to meet the following standards: 2009 International Building Code, 2009 Uniform Mechanical Code, 2009 International Energy Conservation Code, and the National Fire Code. Special attention is focused on 2012 National Fire Protection Association (NFPA) 820, Recommended Practice for Fire Protection in Wastewater Treatment Plants.

Also, the HVAC design and installation is to comply with the recommended practices of the following organizations:

- ASHRAE Standard 62.1-2010 Ventilation for Acceptable Indoor Air Quality
- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- Air Moving and Conditioning Association (AMCA)
- Associated Air Balance Council (AABC)

2.3.1 HVAC Standard Description

2009 Uniform Mechanical Code – The Uniform Mechanical Code provides requirements for the installation and maintenance of heating, ventilating, cooling, and refrigeration systems.

2009 International Energy Conservation Code – The International Energy Conservation Code is a model code that regulates the minimum energy conservation requirements for all aspects of energy use in facilities heating and ventilating systems.

2012 National Fire Protection Association (NFPA) 820, Recommended Practice for Fire Protection in Wastewater Treatment Plants – This standard establishes the minimum requirements for protection against fire and explosion hazards in waste water treatment plants or collections systems such as storm sewers.

American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) – ASHRAE is the world's foremost technical society in the fields of heating, ventilation, air conditioning, and refrigeration.

Sheet Metal and Air Conditioning Contractors National Association (SMACNA) – SMACNA standards address all facets of the sheet metal industry, from duct construction and installation to air pollution control, and from energy recovery to roofing.

Air Moving and Conditioning Association (AMCA) – The Air Moving and Control Association is a non-profit association of air system equipment manufacturers – primarily fans, louvers, dampers, and air curtains used in commercial or industrial buildings.

Associated Air Balance Council (AABC) – The Associated Air Balance Council establishes industry standards for the field measurement and documentation of HVAC systems.

ASHRAE Standard 62.1-2010 Ventilation for Acceptable Indoor Air Quality – ASHRAE 62.1 standard specifies the minimum ventilation rates and measures intended to provide indoor air quality that is acceptable to human occupants.

3.0 DESIGN CRITERIA

This section provides a brief description of the criteria applicable to this pump station.

3.1 Water Resources Design Criteria

3.1.1 Inlet Pipe Capacity and Local Storage Volume

The station is fed directly from a small detention pond through a bar screen structure. The pond is fed by a 48-inch reinforced concrete pipe from the south along Princeton Drive at a slope of 0.015 feet per foot. Under full flow conditions, the inlet pipe capacity is approximately 79,000 gpm. If the pipe is surcharged with water to curb at the storm drain located on the corner of Princeton Drive and Schell Place and the detention pond flooded to the top of the inlet pipe, the inlet pipe capacity is approximately 91,000 gpm.

The station wet well and adjacent detention pond combine to provide a local equalization volume for larger flood events. If it is assumed that the station and pond are flooded to the design 100-year water surface elevation (5,084 feet above mean sea level), the local storage volume can be estimated to be 50.0 acre-feet (16.4 million gallons).

3.1.2 Lift Pumps

The lift pumps are Johnston Pump Company vertical, single-stage, mixed-flow pumps, Model 1 ST 20PS with underground-style discharge elbow. The bowl size is 20 inches in diameter, and the discharge pipe is 24 inches in diameter. The motors are 150 HP, 460V, 3-phase, 880 rpm full speed General Electric vertical induction motors. Refer to Appendix C for manufacturer's pump curve and data.

Each of the four lift pumps is designed to deliver 13,000 gpm at 36.7 feet of total dynamic head (TDH). Because of their independent discharge configuration, the station can operate at a combined capacity of approximately 52,000 gpm. Each discharge pipe is 104 linear feet of 24-

inch pipe and empties into the North Diversion Channel. A system hydraulic curve was not estimated for this station because of the independent discharge configuration.

The pumps require 4.2 feet of submergence over the bottom of the bell to prevent vortexes. Vortexes suck air into the pump from the water surface. Vortexes cause a reduction in capacity and can result in unbalanced operation that may damage the pumps. Stormwater pumping periods tend to be brief and some vortex pumping is tolerable over the life of the pumps.

The manufacturer's pump curve indicates the pump requires 28 feet of net positive suction head (NPSH) when running at the design flow. At the site elevation of the station, the pump would require 3.5 feet of water above the impeller (positive suction head) to prevent cavitation. When cavitation occurs, the pump runs noisy and sounds like it is pumping marbles. Prolonged cavitation will result in pitting of the impeller and intake bowl. Stormwater pumping periods tend to be brief, and some cavitation is tolerable over the life of the pumps.

3.1.3 Sump Pump

There is a single sump pump in the wet well designed to handle small, non-storm infiltration flows. The pump is a 10 HP Flygt submersible pump, model NP3127 with a 488-type impeller and 4-inch discharge pipe. The pump is rated for 540 gpm at 48 feet TDH. Refer to Appendix D for manufacturer's pump curve and data.

3.1.4 Fixed Bar Screen

The wet well inlet is cleaned by a fixed bar screen manufactured by Hastings Industries. It has 1.75-inch clear openings.

3.2 Electrical Design Criteria

3.2.1 Electrical Service

The pump station receives 480V, 3-phase power from a pad mounted transformer that is owned and maintained by PNM. Provision is made for a second primary source for the pump station power, but a transformer is not installed. A pullbox covers the primary conduit stub-up. Power from the installed transformer is connected to a 480V automatic transfer switch (ATS). The ATS output is routed through a pad mounted meter enclosure and is then connected to a 480V Motor Control Center (MCC).

3.2.2 Electrical Low Voltage

Low voltage is distributed from the MCC to the lift pumps, a sump pump, two (2) electric heaters, a supply fan, and a 120/240V panelboard via a 480V to 120/240V transformer.

3.2.3 Controls

The lift pumps are controlled by the Lift Station Control Panel (LSCP), a programmable logic-type controller (PLC). The LSCP receives level inputs from level transmitters in the wet well. The LSCP has an operator interface panel for displaying station status and alarm messages. The LSCP also has selector switches and pilot lights for control and monitoring station operations.

3.3 HVAC Design Criteria

3.3.1 Outdoor Design

Outdoor Design conditions as follows:

Outside Summer: 96 °F DB / 60 °F WB

Outside Winter: 16 °F DB

3.3.2 Indoor Design

Indoor design conditions vary, depending on the occupancies of the areas served. Table 3-1 lists the indoor design conditions as well as the code required ventilation rates. The ventilation rates for spaces are as required by NFPA 820 or ASHRAE 62.1. These rates are expressed in air changes per hour (AC/hr). This corresponds to the flow of fresh, outdoor air that is required to be supplied to the spaces.

TABLE 3-1
INDOOR HVAC DESIGN CRITERIA

Facility	Area	Min Indoor Design Temperature (°F)	Max Indoor Design Temperature (°F)	Ventilation Rate (Outdoor Air) (AC/hr)	Source/Reason for Ventilation Rate
Princeton – Pump Station No.36	Wet Well	Ambient	Ambient	Not Required	NFPA 820
	Control Room	55	90	Not Required	ASHRAE 62.1

4.0 PUMP STATION SYSTEM

This section provides a brief description of the different components of the stormwater pump station shown in Figure 1-2, including an overview of each process, equipment description, instrumentation and alarms, and safety information unique to the system or process. This section is supplemented with photos and diagrams of the processes at this pump station. The process and instrumentation diagram for the station is shown in Section 7.

4.1 Fixed Bar Screen

4.1.1 Overview

Stormwater enters the pump station wet well through a large concrete channel with a fixed bar screen by Hastings Industries (Figure 4-1). The concrete channel is connected to a detention pond adjacent to the pump station.

4.1.2 Equipment Description

The fixed bar screen has 1.75-inch clear openings. It also has a locked access door set into the screen for maintenance. The fixed bar screen at this station is not tagged with a Water Utility Authority's Asset Management Program (WUA-AMP) equipment tag. The missing tag number was prescribed to aid in identification and is shown on Figure 36-1 in Section 7 to provide clarity. The current tagging convention for the bar screen is listed below in Table 4-1.

TABLE 4-1
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
U53620	Station	Bar Screen	Unit

4.1.3 Instrumentation and Alarms

There is no instrumentation or alarm associated with the bar screen.

FIGURE 4-1
FIXED BAR SCREEN

4.1.4 Normal Operation

During normal operation, the bar screen is inaccessible because it is either completely or partially submerged in stormwater. It is a passive system, but requires maintenance to operate properly.

4.1.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines.

4.2 Lift Pumps

4.2.1 Overview

Stormwater enters the pump station wet well through a fixed bar screen by Hasting Industries (Figure 4-1). Stormwater level in the wet well is monitored by a Drexelbrook Universal III level transmitter with an additional sensor for redundancy. The high wet well level alarm is triggered

by a float switch. The four (4) lift pumps cycle on and off in lead/lag/alternate sequence according to the level in the wet well (Figure 4-2). The lift pumps can be run at variable speeds.

FIGURE 4-2
LIFT PUMP MOTORS AND INTAKES

In the event the pump station is out of service or the pumps cannot draw down the level in the detention pond fast enough, a concrete spillway box located part way up the northwest embankment of the detention pond collects high flow from the pond and sends it by gravity under the North Diversion Channel in a 72-inch inverted siphon pipe to discharge into Princeton Drive NE on the north side of the channel. The surface flow runs north in Princeton Drive where it is collected by storm drain inlet boxes at Menaul Boulevard. A 24-inch pipe allows direct bypass of stormwater from the pump station concrete inlet channel into the bottom of the spillway box. If the pump station is completely out of service, the sluice gate at the entrance to the 24-inch bypass pipe should be opened to place the direct bypass into service.

4.2.2 Equipment Description

Stormwater is pumped by any combination of the four (4) vertical, mixed-flow Johnston lift pumps, Model 1 ST 20PS, with 20-inch inlet bowls. The pumps are driven by 150 horsepower line-shaft, vertical induction motors that run at a full speed of 880 revolutions per minute (RPM) using 460V, 3-phase power. The Equipment Tags at this station follow an older tagging convention than is currently used by the Water Utility Authority's Asset Management Program. The current tagging convention for the lift pumps and motors, as well as the physical Equipment Tag numbers shown in parentheses, are listed below in Table 4-2.

TABLE 4-2
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
M53601 (536M01)	Station	Lift Pump No. 1	Motor
M53602 (536M02)	Station	Lift Pump No. 2	Motor
M53603 (536M03)	Station	Lift Pump No. 3	Motor
M53604 (536M04)	Station	Lift Pump No. 4	Motor
P53601 (536P01)	Station	Lift Pump No. 1	Pump
P53602 (536P02)	Station	Lift Pump No. 2	Pump
P53603 (536P03)	Station	Lift Pump No. 3	Pump
P53604 (536P04)	Station	Lift Pump No. 4	Pump

4.2.3 Instrumentation and Alarms

The wet well level signal is connected to the lift pump control panel.

Alarms connected to telemetry include:

- Lift Pump 1 Run
- Lift Pump 2 Run
- Lift Pump 3 Run
- Lift Pump 4 Run
- Lift Pump 1 Fail
- Lift Pump 2 Fail
- Lift Pump 3 Fail
- Lift Pump 4 Fail
- High Wet Well Level

4.2.4 Normal Operation

The lift pump start is initiated by an Ametek Drexelbrook Universal III level transmitter with fixed probe-type sensing element. The pumps lift water from the wet well to 24-inch discharge pipes that dead end into the North Diversion Channel. Once the wet well level drops below a specific depth, the pumps will cease to operate and excess water will be handled by the sump pump. The high wet well level alarm is triggered by a float switch.

4.2.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines.

4.3 Sump Pump

4.3.1 Overview

Stormwater below the lift pump intakes and small, non-storm infiltration flow is handled by the single wet well sump pump. The sump pump discharges through a separate pipe into the North Diversion Channel.

The sump pump is located inside a screened depression in the wet well (Figure 4-3) and has a 4-inch discharge pipe that expands to a 6-inch pipe before exiting into the AMAFCA Northern Diversion Channel.

4.3.2 Equipment Description

The sump pump is a Flygt Model NP3127 with a 488-type impeller. The pump is driven by an integral 10 HP 1,745 full speed RPM motor that runs on 460V, 3-phase power and has a rated capacity of 540 gpm at 48 feet of TDH. The sump pump is installed in Flygt's "P" configuration, which indicates that the pump has a vertical discharge riser, no suction piping, and is submerged under normal operating conditions.

The sump pump at this station is not tagged with a Water Utility Authority Asset Management Program Equipment Tag. A tag number was prescribed to aid in identification. The Equipment Tag number is listed below in Table 4-3 and shown on Figure 36-1 in Section 7 to provide clarity.

TABLE 4-3
EQUIPMENT INFORMATION

Equipment No.	Asset Info	Classification Type	Classification
P53603	Station	Sump Pump	Pump

4.3.3 Normal Operation

The sump pump is actuated by a Flygt ENM-10 float-level switch located within the same screened depression as the pump. The pump will discharge until the water level drops below the float-level sensor.

FIGURE 4-3
SUMP PUMP

4.3.4 Instrumentation and Alarms

The wet well and float level switch signals are connected to the sump pump control panel.

Alarms connected to telemetry include:

- Sump Pump Run
- Sump Pump Fail

4.3.5 Safety: Information Unique to the System or Process

Refer to Section 9 for general safety guidelines. Additional safety guidelines for performing work in confined spaces are detailed in Appendix F.

5.0 ELECTRICAL SYSTEM

This section provides a brief description of the electrical at this pump station. Refer to Figure 5-1 for Electrical One-Line Diagram and Figure 5-2 for Electrical Site Plan.

5.1 Electrical Service

5.1.1 Overview

The pump station receives 480V, 3-phase power from a pad mounted transformer that is owned and maintained by PNM. Power from the transformer is routed through a 480V automatic transfer switch then through a pad mounted meter before being connected to a 480V Motor Control Center (MCC).

5.1.2 Equipment Description

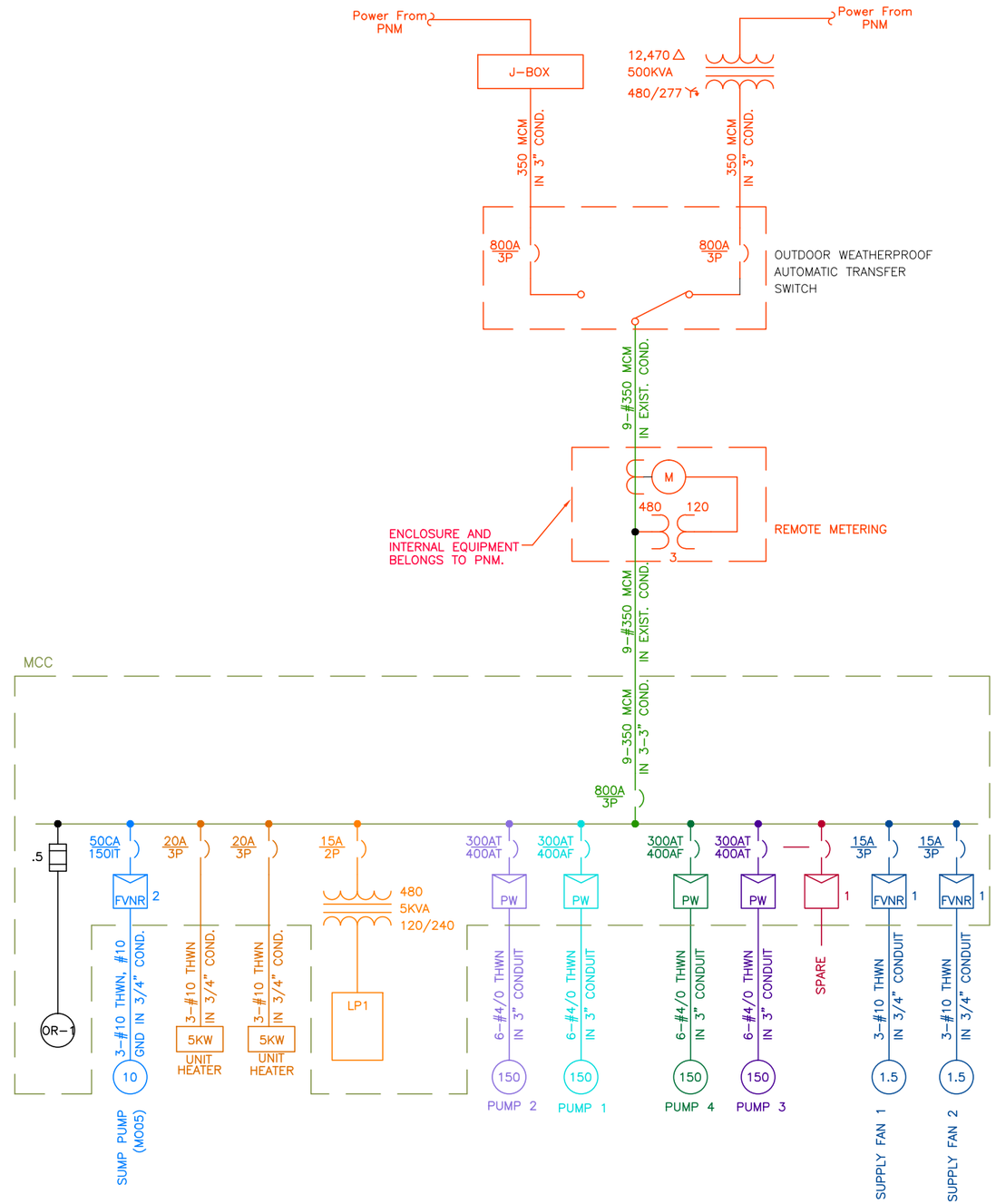
The service disconnect is the 800A main circuit breaker (MCB) of the station 480V MCC.

5.1.3 Controls

The Lift Station Control Panel (LSCP) is a programmable logic-type controller (PLC) manufactured by Industrial Electric Automation. Wet well level transmitters in the wet well are connected to the LSCP.

5.1.4 Normal Operation

The LSCP detects the wet well level from the level transmitters and operates pumps to control the level in the wet well.



PUMP STATION #36 ONE-LINE DIAGRAM

N.T.S.

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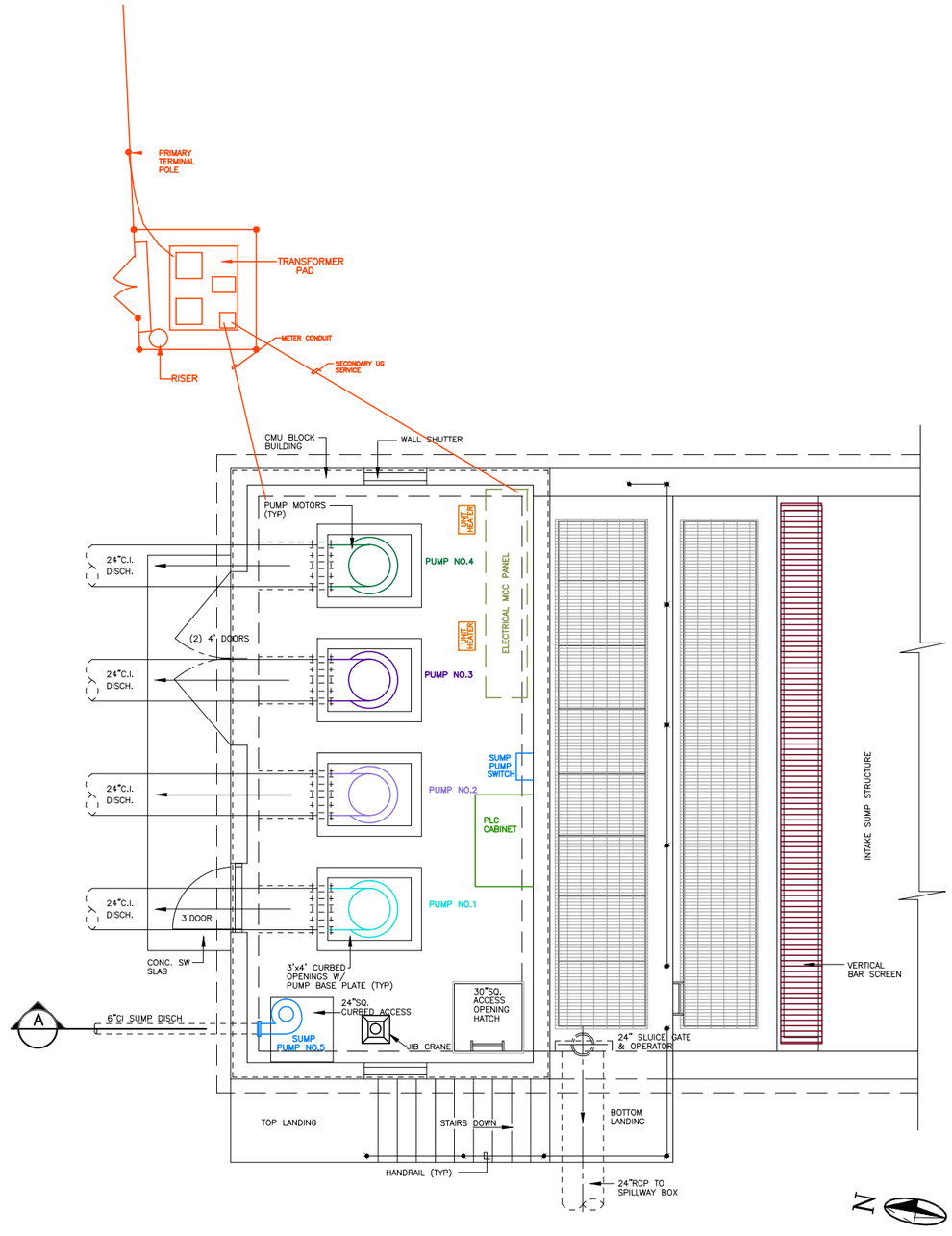
City Of Albuquerque Stormwater Pump Stations

Pump Station No. 36 Princeton Electrical One-Line Diagram

Figure 5-1



ELECTRICAL SITE PLAN

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City Of Albuquerque Stormwater Pump Stations

Pump Station No. 36 Princeton Electrical Site Plan

Figure 5-2

5.1.5 Safety: Information Unique to the System or Process

The electrical service is energized at 480V. Contact PNM to disconnect source, then lockout and tagout source before servicing.

5.2 480V Motor Control Center

5.2.1 Overview

The MCB in the 480V MCC serves as the station service disconnecting means. Additionally, the MCC contains starters and circuit breakers to connect station 480V loads to the electrical service.

5.2.2 Equipment Description

The 480V MCC contains the 800A MCB breaker that serves as the station service disconnecting means. The MCC also houses reduced voltage part winding starters for the four (4) lift pumps, two (2) full voltage non-reversing (FVNR) starters for two (2) supply fans, and a spare FVNR starter. The MCC also contains circuit breakers for the station sump pump, two (2) electric unit heaters, and the station 480V to 240/120V transformer. The station 120V to 240V panelboard is also mounted in the MCC.

5.2.3 Controls

Controls on the lift pump starters include the disconnect switch and reset pushbuttons for the overload in each winding. Controls on the starter for the ventilation fans include a hand-off-automatic (HOA) switch, a run pilot light, and an overload reset pushbutton.

5.2.4 Normal Operation

When the LSCP calls for a pump to run, it signals to the associated starter in the 480V MCC. The starter connects the pump motor start windings to the 480V source to start the pump. When a timer in the motor starter has expired, the start contactor opens and the run contactor closes.

5.2.5 Safety: Information Unique to the System or Process

The 480V MCC operates at 480V. Contact PNM to disconnect source, then lockout and tagout source before servicing. The disconnect switches shall be operated by trained personnel; the MCC shall be serviced and maintained by trained electricians.

5.3 Sump Pump Controller

5.3.1 Overview

The sump pump controller (SPC) is an enclosed FVNR starter.

5.3.2 Equipment Description

The SPC receives 480V power for a circuit breaker in the 480V MCC. Upon a high level signal from transmitters in the wet well, a contactor in the SPC closes connecting 480V power to the sump pump.

5.3.3 Controls

A reset pushbutton and a sump pump disconnect switch are mounted on the door of the SPC.

5.3.4 Normal Operation

The LSCP receives the wet well level from the level transmitters installed in the wet well sump area. When the level rises to a preprogrammed level, the LSCP calls for the sump pump to start. The SPC closes a contactor connecting 480V power to the sump pump. When the level falls sufficiently, the LSCP stops calling for the sump pump to run and the SPC opens the contactor stopping the sump pump.

5.3.5 Safety: Information Unique to the System or Process

The SPC operates at 480V. Disconnect and lockout and tagout source at the MCC before servicing the SPC. The SPC disconnect switch shall be operated by trained personnel; the MCC shall be serviced and maintained by trained electricians.

5.4 Sump Pump

5.4.1 Overview

The sump pump is a submersible pump installed in a sump area of the wet well. The sump pump operates to maintain the wet well level below the start level of the lift pumps. The pump is also used to empty the wet well for inspection and maintenance.

5.4.2 Equipment Description

The sump pump is a 10 HP submersible type pump that operates at 480V. The pump is controlled by the LSCP based on a 4 to 20 mA signal received from level transmitters installed in the wet well.

5.4.3 Controls

The pump has an internal temperature switch and a moisture detection switch. The internal switches are connected in the starter control circuit and a control relay connects a pump alarm signal to the LSCP.

5.4.4 Normal Operation

The LSCP receives the wet well level from the level transmitters installed in the wet well sump area. When the level rises to the start sump pump level, the LSCP starts the sump pump. When pumping has lowered the wet well level to the stop level, the LSCP stops the sump pump. While the sump pump is running, if the level continues to increase, the LSCP stops the sump pump and starts the lead lift pump at the predetermined level.

5.4.5 Safety: Information Unique to the System or Process

The sump pump is remotely controlled and could start unexpectedly. Disconnect; lockout and tagout the source at the SPC before servicing.

5.5 Lift Pumps

5.5.1 Overview

The lift pumps are vertical turbine pumps installed in the wet well. The pumps are driven by motors mounted on platforms in the pump station building.

5.5.2 Equipment Description

The lift pumps are 150 HP vertical turbine pumps that operate at 480V. The pumps are controlled by the LSCP based on level sensors installed in the wet well.

5.5.3 Controls

Each pump has a winding temperature switch. The internal switches are connected in the starter control circuit and a control relay connects a pump alarm.

5.5.4 Normal Operation

The LSCP receives the wet well level from the level sensors installed in the wet well. When the level rises to the start lead pump level, the LSCP starts the lead pump. If the level continues to rise, and reaches the start lag pump level, the LSCP starts additional pumps. The LSCP stops the last pump when pumping has lowered the wet well level sufficiently. The LSCP stops the lead pump then the wet well level falls into the sump pump range.

5.5.5 Safety: Information Unique to the System or Process

The lift pumps are remotely controlled and coulkd start unexpectedly. The pumps operate at 480V. Disconnect source, then lockout and tagout the source at the MCC before servicing.

5.6 Lift Station Control Panel

5.6.1 Overview

The LSCP receives the wet well level signals. The LSCP energizes relays to start the lift pumps in accordance to the wet well level and the lead selections made by the operator. The LSCP relay contacts are connected to the radio transmitter to broadcast alarms to the Southside Water Reclamation Plant.

5.6.2 Equipment Description

The LSCP is a PLC. The LSCP has front panel mounted indicators to indicate the station operations.

5.6.3 Controls

The LSCP contains lead pump selectors switches. The panel front has pilot lights for the sump pump and lift pumps to indicate the following: Call for, Call for Not Run, and Run. The panel front also has lift pumps and sump pump HOA switches. There is a door mounted PLC operator interface panel.

5.6.4 Normal Operation

In automatic, operation level signals are applied to the LSCP. When the level signal reaches a preprogrammed level, relays are operated to start the sump pump. As the wet well level rises, the lead pump is started. If the level continues to rise, the second and third lift pumps will be started. As the wet well level falls the lift pumps are stopped in sequence. When the level falls into the sump pump range, the lead pump is stopped and the sump pump starts to empty the wet well.

5.6.5 Safety: Information Unique to the System or Process

The control panel has voltage from more than one (1) source. Disconnect all sources before servicing.

6.0 HVAC SYSTEMS OPERATION

This section provides a brief description of the HVAC system at this pump station.

6.1 Exhaust Fan System (Typical of two at this pump station)

6.1.1 Overview

The exhaust fan system provides minimal ventilative cooling in the control room.

6.1.2 Equipment Description

The existing exhaust fan is roof-mounted, up-blast Skymaster EC30J-S. The capacity of the exhaust fan is estimated at 8,500 cubic feet per minute.

6.1.3 Controls

The exhaust fan is activated by a line voltage thermostat.

6.1.4 Normal Operation

The line voltage thermostat in the control room should be set to a maximum temperature of 90°F. A line voltage thermostat mounted in the control room will activate an exhaust fan whenever temperatures in the control room are equal to or above 90°F. When temperatures in the control room are below 90°F, the exhaust fan will be off.

6.1.5 Safety: Information Unique to the System or Process

Ventilation is required to maintain safe working temperatures of the electrical equipment. Overheating of the electrical equipment would likely result in costly replacement or possible down time on the pumping station.

6.2 Electric Heater (Typical of two at this pump station)

6.2.1 Overview

The electric heater provides minimal heating in the control room.

6.2.2 Equipment Description

The existing electric heater is a Chromalox LUH75 rated at 7.5 kW and uses 480V, 60Hz, 3-phase power.

6.2.3 Controls

The electric heater is activated by a line voltage thermostat.

6.2.4 Normal Operation

The line voltage thermostat in the control room should be set to a minimum temperature of 55°F. A line voltage thermostat mounted in the control room will activate an electric heater whenever temperatures in the control room are equal to or below 55°F. When temperatures in the control room are above 55°F, the electric heater will be off.

6.2.5 Safety: Information Unique to the System or Process

Heating is required to prevent freezing conditions.

7.0 STANDARD JOB OPERATING PROCEDURES

This section includes Standard Operating Job Procedures (SOJP) for the system and equipment for Pump Station No. 36 Princeton. The SOJPs provide the detailed instructions for testing each component necessary to ensure that during the summer storm season of July 1st through September 30th, the facilities will be prepared to operate. SOJPs are utility by the Albuquerque Bernalillo County Water Utility Authority (WUA) and are used as the primary means for testing the equipment within their system. If a facility appears to have an issue, the SOJP testing shall bring the issue to light and a means to promptly correctly address the issue.

7.1 List of SOJPs

Below is a list of the SOJPs developed for Pump Station No. 36 Princeton and are included in this section.

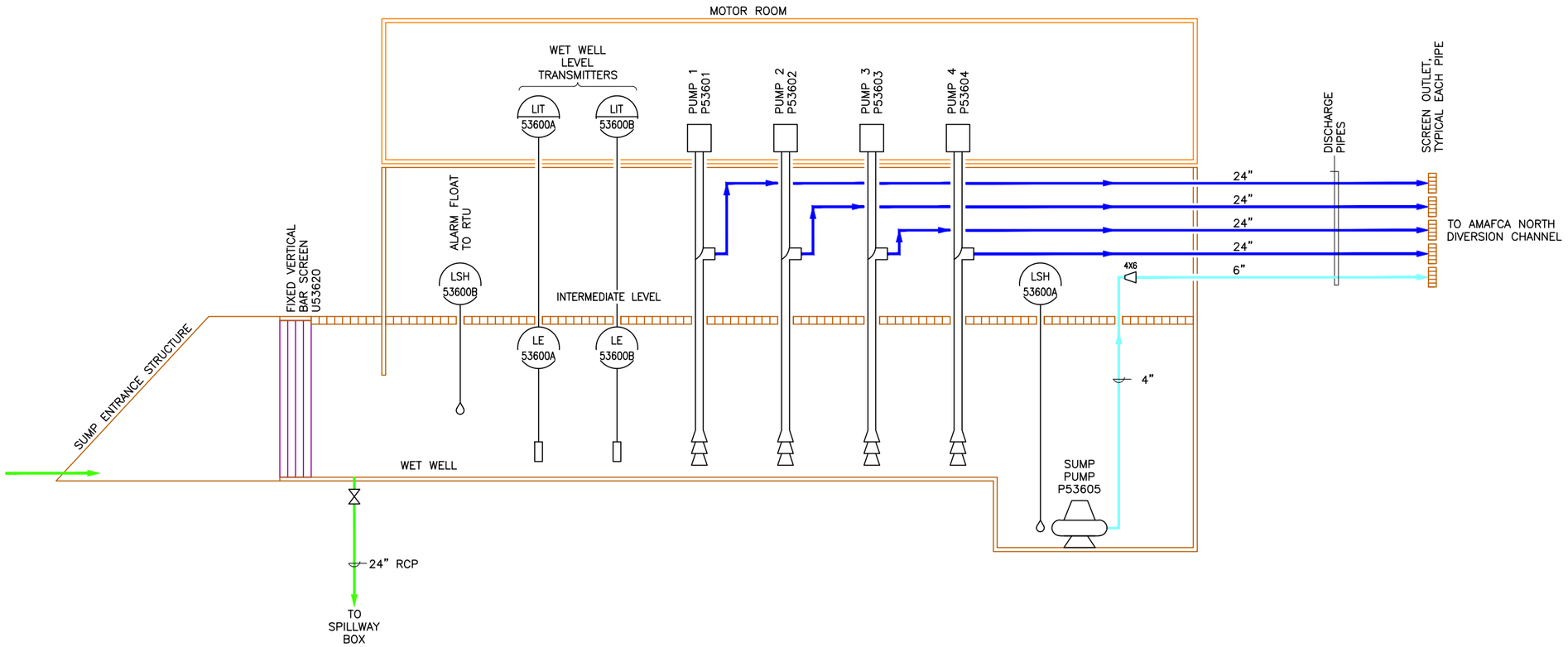
SOJP_3600_SU_Princeton Pump Station
SOJP_3600_N_ Princeton Pump Station
SOJP_3600_SD_ Princeton Pump Station

SOJP_3600_SU_ Princeton Exhaust Fan
SOJP_3600_N_ Princeton Exhaust Fan
SOJP_3600_SD_ Princeton Exhaust Fan

SOJP_3600_SU_ Princeton Electric Heater
SOJP_3600_N_ Princeton Electric Heater
SOJP_3600_SD_ Princeton Electric Heater

LEGEND

- VERTICAL MIXED-FLOW PUMP
- SUMP PUMP
- INSTRUMENT OPERATOR ACCESSIBLE
- FIELD MOUNTED INSTRUMENT
- FLOAT SWITCH
- LEVEL PROBE
- GATE VALVE



City Of Albuquerque Stormwater Pump Stations

Pump Station No. 36 Princeton P&ID

Figure 36-1

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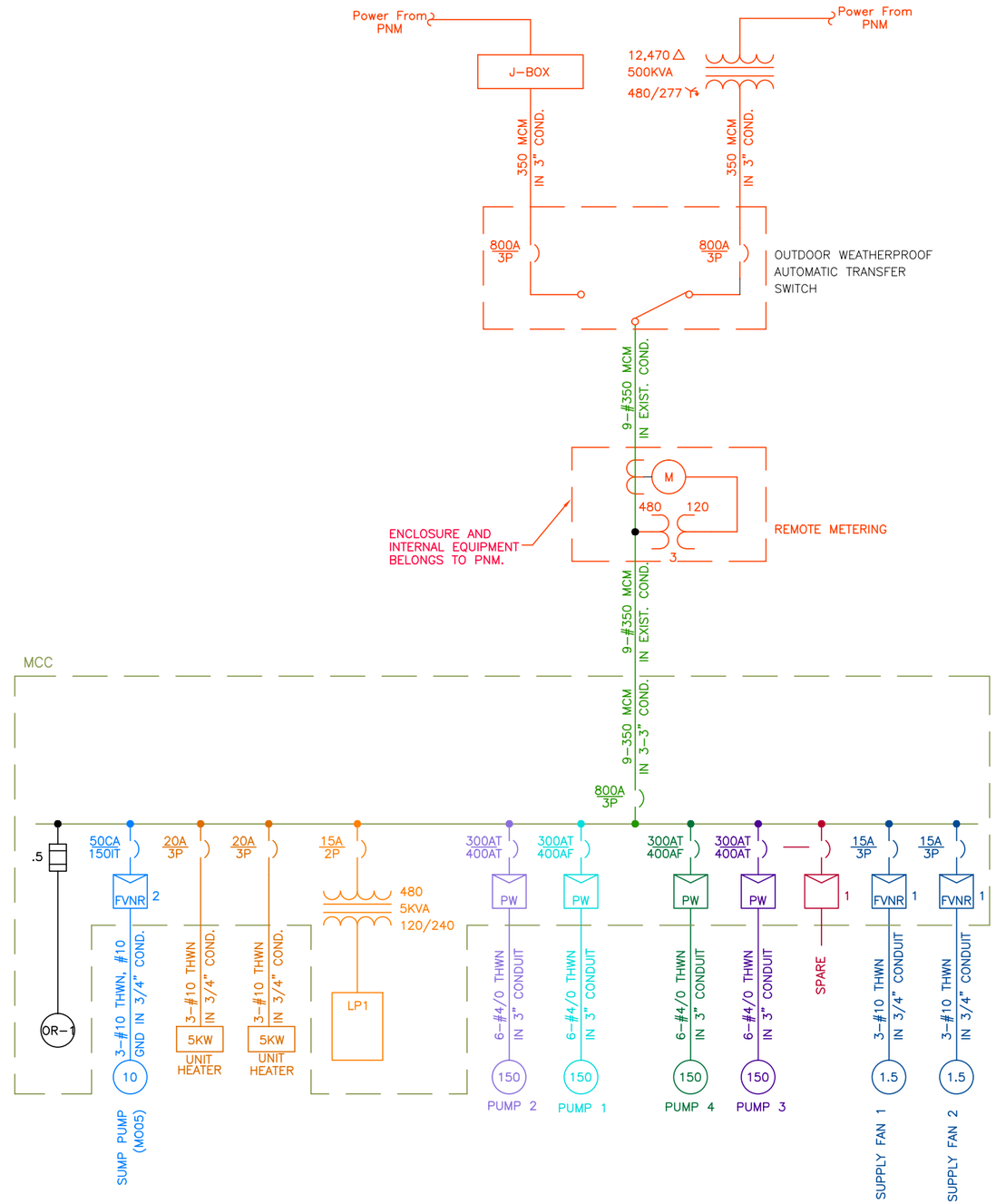

PUMP STATION #36 ONE-LINE DIAGRAM

N.T.S.

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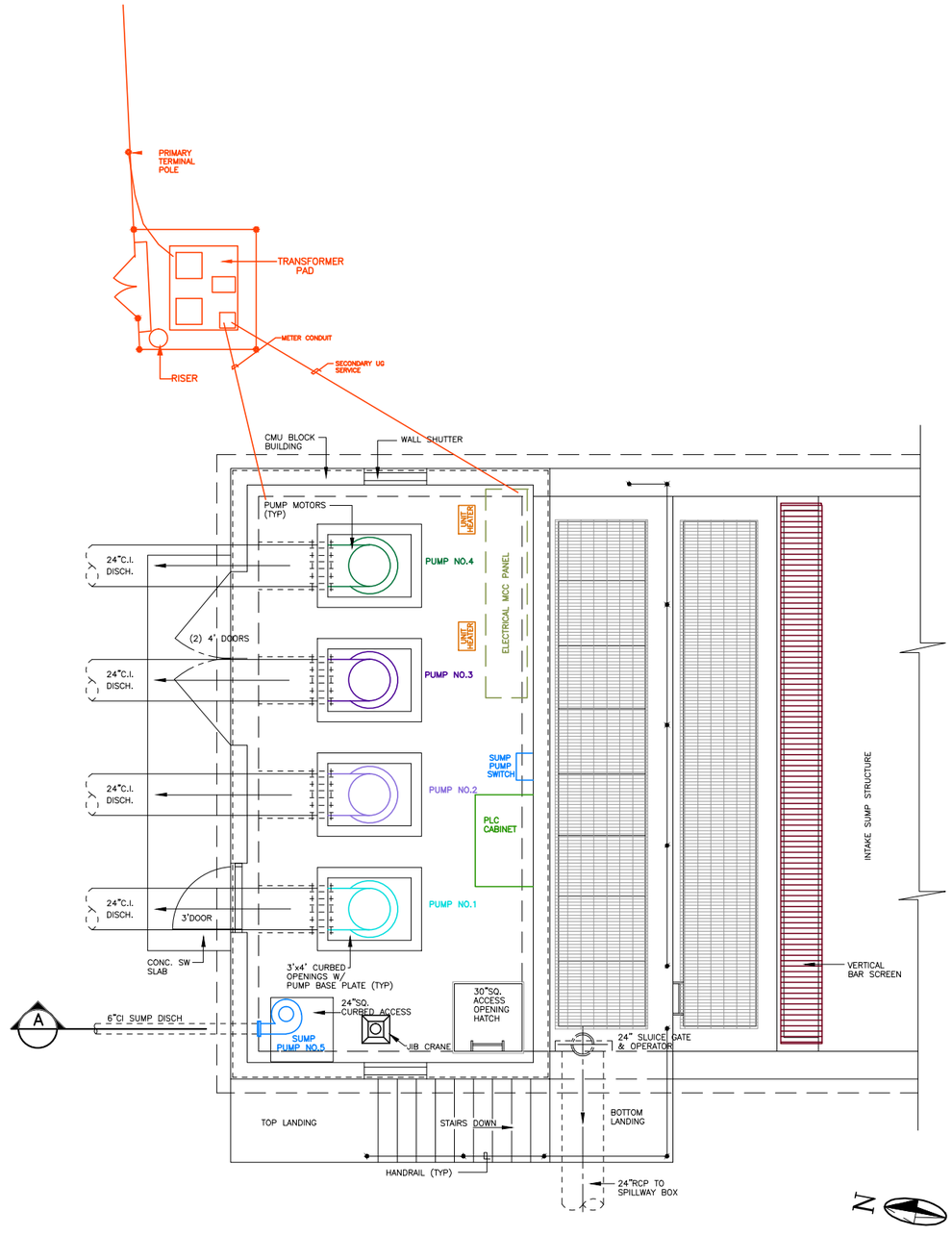
City Of Albuquerque Stormwater Pump Stations

Pump Station No. 36 Princeton Electrical One-Line Diagram

Figure 36-2



ELECTRICAL SITE PLAN

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City Of Albuquerque Stormwater Pump Stations

Pump Station No. 36 Princeton Electrical Site Plan

Figure 36-3

REF (Filename): SOJP_3600_SU_PRINCETON PUMP STATION.doc
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600-SU-PRINCETON PUMP STATION

TITLE: PRINCETON PUMP STATION – START-UP

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses.

Hazards: Slip and fall and electrical shock.

Caution: See Section 9 Safety of the Stormwater Pump Station No. 36 Princeton Operations Manual

SYSTEM SCHEMATICS

Figure 36-1 Pump Station No. 36 Princeton P&ID
Figure 36-2 Pump Station No. 36 Princeton Electrical One-Line Diagram
Figure 36-3 Pump Station No. 36 Princeton Electrical Site Plan

PRINCETON PUMP STATION

SYSTEM START-UP

PROCEDURE

Station Entry/Exit and Alarm Deactivation Procedure

Entry

1. Call Plant Control: Identify yourself with a Call Number: Example #202 and advise of your entry.
2. Entry: At the touchscreen, enter the code 5241 “Enter”. This code will disable the intrusion alarm. A banner on the bottom of the screen will appear and state “Entry Alarm”. Push the screen button “Acknowledge all alarms”. This will disable all alarms and PLC will be in operation.

Exit

1. Exit Station: At the touchscreen, select “Reset All” and “Clear All” and select the “Password Entry”. This will allow the operator to enter a two (2) number scramble code: Example 07. The operator at this time will need to select Enter Arrow “ ←-------“ . This will start the timer and allow the operator to exit the station within 120 seconds.
2. Call Plant control to verify all the alarms have been cleared and advise of your departure.

Before Normal Operation, the following is required:

1. Test the pumps starting with water in the wet well at a level at least 5 feet above the wet well floor. Water may be diverted into the storm drains from a nearby ditch or from a fire hydrant.
2. Check that the station medium voltage disconnect switch is closed **(ON)**.
   Test the Lift Pumps.
3. Check that the pump breaker switch(es) on the Motor Control Center (MCC) are closed (in the **ON** position).
   Note: if a breaker or disconnect switch (other than a 120V) for the equipment to be started is not in the **ON** position, notify the shift supervisor, enter the event in the operator log, and generate a work order for a maintenance repair dispatch to have the switch(es) placed in the **ON** position.
   Test the Lift Pumps in HAND.
4. Place the lift pump **HAND-OFF-AUTO** (HOA) switch(es) on the Lift Station Control Panel (LSCP) in **AUTO**.
5. Select a lead lift pump with the selector switch at the LSCP.
   Note: Verify there is sufficient wet well level before starting a lift pump.
6. Place the HOA selector in **HAND** position to start the lead pump. Record amperage and secondary voltage.
   Test the Lift Pumps in AUTO.
7. Place the HOA switches on the LPCP in the **AUTO** position.
8. Check and record the level at which the lead lift pump starts.
9. Check and record the level at which the lead lift pump stops.
10. Verify the HOA switches are in the **AUTO** position after start-up is complete.
    Test the Sump Pump in HAND.
11. Verify the station 480V disconnect circuit breaker (on the 480V MCC is closed **[ON]**).
    Note: Verify there is sufficient wet well level before starting the sump pump.
12. Select the **HAND** position with the HOA switch on the door of Sump Pump Control Panel (SPCP) and then press the start pushbutton.
13. Verify the run indicator on the door of SPCP illuminates.
    Note: Observe the wet well level. Stop the pump when the wet well level goes below the top of the pump housing.
    Test the Sump Pump in AUTO.
14. Place the HOA switch on the SPCP in the **AUTO** position.
15. Check and record the level at which the sump pump starts.
16. Check and record the level at which the sump pump stops.
17. Verify the HOA switch is in the **AUTO** position after start-up is complete.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_3600_N_ PRINCETON PUMP STATION .docx
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600-N-PRINCETON PUMP STATION

TITLE: PRINCETON PUMP STATION - NORMAL OPERATION

Tools: Personal Protection Equipment: Hard hat, safety boots, and safety glasses.

Hazards: Slip and fall and electrical shock

Caution: See Section 9 Safety of the Stormwater Pump Station No. 36 Princeton Operations Manual

SYSTEM SCHEMATICS

Figure 36-1 Pump Station No. 36 Princeton P&ID
Figure 36-2 Pump Station No. 36 Princeton Electrical One-Line Diagram
Figure 36-3 Pump Station No. 36 Princeton Electrical Site Plan

PRINCETON PUMP STATION

NORMAL OPERATION

GENERAL

Stormwater will be conveyed from the detention pond into the stormwater pump station wet well through a reinforced concrete channel. The stormwater passes through a fixed bar screen, that is manually raked. After passing through the bar screen, stormwater enters the pump station wet well and lift pumps. The pump station has a duty-standby configuration for the four (4) lift pumps and one (1) wet well sump pump. Stormwater is pumped by any combination of the four (4) 150 HP vertical mixed flow pumps, each capable of pumping 13,000 gpm. Since the lift pumps discharge independently into the North Diversion Channel, the combined duty of the pumps is additive, and the combined capacity is 52,000 gpm. The independent discharge pipes also eliminate the need for any pump check valves or isolation valves.

A spillway box located part way up the embankment of the detention pond collects high flows entering the pond and bypasses the pump station via a pipe that conveys stormwater by gravity under the North Diversion Channel to the storm collection system located north of the channel. A 24-inch bypass pipe with a sluice gate can bypass stormwater directly from the station inlet channel to the spillway box, in the event the station is completely out of service.

Capacity of the wet well sump pump is small, relative to that of the lift pumps. The intent of the sump pump is only to remove water in the wet well that remains once the water level has dropped below the inlet of the lift pumps, and to handle small, non-storm infiltration flows.

NORMAL OPERATION CONDITIONS

During normal operation, the HAND-OFF-AUTO (HOA) switches for the sump pump and lift pumps will be in **AUTO** and will start and stop automatically based on the level transmitters.

LEAD, LAG, STANDBY assignments:

The lead lift pump is selected manually with the selector at the Lift Station Control Panel.

The active level transmitter is selected automatically as the transmitter with the highest level indications or manually with a switch at the Station Level Control Panel.

NORMAL OPERATING PROCEDURES

Station Entry/Exit and Alarm Deactivation Procedure

Entry

1. Call Plant Control: Identify yourself with a Call Number: Example #202 and advise of your entry.
2. Entry: At the touchscreen, enter the code 5241 “Enter”. This code will disable the intrusion alarm. A banner on the bottom of the screen will appear and state “Entry Alarm”. Push the screen button “Acknowledge all alarms”. This will disable all alarms and PLC will be in operation.

Exit

1. Exit Station: At the touchscreen, select “Reset All” and “Clear All” and select the “Password Entry”. This will allow the operator to enter a two (2) number scramble code: Example 07. The operator at this time will need to select Enter Arrow “ ←-------“ . This will start the timer and allow the operator to exit the station within 120 seconds.
2. Call Plant control to verify all the alarms have been cleared and advise of your departure.

After initial Start-Up, Normal Operation is as follows:

1. Check for abnormal conditions when entering facility – flooding, broken equipment, electrical fires, etc.
2. Check the building thermostat for proper HVAC settings.
3. Check the pump station and equipment status at the control panel.
4. Check and record the AC voltage at the Motor Control Center.
5. During lift pump operation check and record the amperage and secondary voltage.
6. Check sump pump control panel indicators for faults.
7. Check and record wet well level at the level transmitters.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_3600_SD_ PRINCETON PUMP STATION.docx
Revision Date: 6/23/20151
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600-SD-PRINCETON PUMP STATION

TITLE: PRINCETON PUMP STATION-SHUTDOWN

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses.

Hazards: Slip and fall and electrical shock.

Caution: See Section 9 Safety of the Stormwater Pump Station No. 36 Princeton Operations Manual

SYSTEM SCHEMATICS

Figure 36-1 Pump Station No. 36 Princeton P&ID
Figure 36-2 Pump Station No. 36 Princeton Electrical One-Line Diagram
Figure 36-3 Pump Station No. 36 Princeton Electrical Site Plan

PRINCETON PUMP STATION

SYSTEM SHUTDOWN

PROCEDURE

Station Entry/Exit and Alarm Deactivation Procedure

Entry

1. Call Plant Control: Identify yourself with a Call Number: Example #202 and advise of your entry.
2. Entry: At the touchscreen, enter the code 5241 “Enter”. This code will disable the intrusion alarm. A banner on the bottom of the screen will appear and state “Entry Alarm”. Push the screen button “Acknowledge all alarms”. This will disable all alarms and PLC will be in operation.

Exit

1. Exit Station: At the touchscreen, select “Reset All” and “Clear All” and select the “Password Entry”. This will allow the operator to enter a two (2) number scramble code: Example 07. The operator at this time will need to select Enter Arrow “ ←-------“ . This will start the timer and allow the operator to exit the station within 120 seconds.
2. Call Plant control to verify all the alarms have been cleared and advise of your departure.

Lift Pump Shutdown

Shutdown is required for maintenance or for replacement. Shutdown of the selected lift pump is as follows:

1. Disconnect, lock and tag power source before servicing. Failure to disconnect power source can result in fire, shock or serious injury. Follow ABCWUA LOTO (lock out, tag out). Refer to Appendix E.
2. Select the **OFF** Position for the selected pump with the HAND-OFF-AUTO (HOA) switch on the door of the Lift Station Control Panel.
3. Verify the HOA for the remaining lift pumps are in the **AUTO** position.

Sump Pump Shutdown

Shutdown is required for maintenance or for replacement. Shutdown of the sump pump is as follows:

1. Disconnect, lock, and tag power source of the sump pump before servicing. Failure to disconnect power source can result in fire, shock, or serious injury. Follow ABCWUA LOTO (lock out, tag out). Refer to Appendix E.
2. Select the **OFF** position for the sump pump with the HOA switch on the door of the Sump Pump Control Panel (SPCP).
3. Open the 480V circuit breaker inside SPCP.

REF (Filename): SOJP_3600_SU_PRINCETON EXHAUST FAN.doc
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600-SU-PRINCETON EXHAUST FAN

TITLE: PRINCETON EXHAUST FAN SYSTEM – START-UP

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

PRINCETON EXHAUST FAN SYSTEM

SYSTEM START-UP

GENERAL

The exhaust fan system provides minimal ventilative cooling in the control room.

PROCEDURE

Before Normal Operation, the following is required:

1. Check all fasteners for tightness. In particular, check the setscrews in the wheel hub.
2. While in the off position or before connecting the fan to power, turn the fan wheel by hand to be sure it is not striking any obstacle.
3. Start the fan and shut if off immediately to check rotation of the wheel with directional arrow in the motor compartment.
4. When the fan is started, observe the operation and check for unusual noises.
5. With the system in full operation, measure the current input to the motor and compare with the nameplate rating to determine if the motor is operating under safe load conditions.
6. Inspection of the fan should be conducted at the first 30-minute and 24-hour intervals of satisfactory operation.
7. At the 30-minute interval, inspect bolts, setscrews and motor mounting bolts. Adjust and tighten as necessary.
8. At the 24-hour interval, check all internal components. On belt drives only, inspect belt alignment and tension. Adjust and tighten as necessary.
9. Set line voltage thermostat to 90°F for system serving control room.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_3600_N_PRINCETON EXHAUST FAN.doc
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600-N-PRINCETON EXHAUST FAN

TITLE: PRINCETON EXHAUST FAN SYSTEM – NORMAL OPERATION

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

PRINCETON EXHAUST FAN SYSTEM

NORMAL OPERATIONS

GENERAL

The exhaust fan system provides minimal ventilative cooling in the control room.

NORMAL OPERATION PROCEDURE

After initial Start-Up, Normal Operation is as follows:

1. The line voltage thermostat in the control room should be set to a maximum temperature of 90°F. A line voltage thermostat mounted in the control room will activate an exhaust fan whenever temperature in the control room is equal to or above 90°F. When temperature in the control room is below 90°F, the exhaust fan will be off.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_3600_SD_PRINCETON EXHAUST FAN.doc
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600–SD-PRINCETON EXHAUST FAN

TITLE: PRINCETON EXHAUST FAN-SHUTDOWN

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, tachometer, and screw driver for set crews.

Hazards: Improper installation can result in electric shock.

Caution: When servicing fan, motor may be hot enough to cause pain or injury.

SYSTEM SCHEMATICS

NA

PRINCETON EXHAUST FAN SYSTEM

SHUTDOWN OPERATIONS

PROCEDURE

Shutdown is required for maintenance or for replacement. Shutdown of the exhaust fans are as follows:

1. Disconnect, lock, and tag power source before servicing. Failure to disconnect power source can result in fire, shock, or serious injury.

REF (Filename): SOJP_3600_SU_PRINCETON ELECTRIC HEATER.doc
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600-SU-PRINCETON ELECTRIC HEATER

TITLE: PRINCETON ELECTRIC HEATER SYSTEM – START-UP

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, and screw driver.

Hazards: Improper installation can result in electric shock.

Caution: Heater must be mounted at least 7 feet above floor to prevent accidental contact with fan blade. To prevent possible overheating, keep at least a 5-foot clearance in front of the heater, 6 inches from ceiling, 6 inches from side wall and 13 inches from back wall.

SYSTEM SCHEMATICS

NA

PRINCETON ELECTRIC HEATER SYSTEM

SYSTEM START-UP

GENERAL

The electric heater system provides minimal heating in the control room.

PROCEDURE

Before Normal Operation, the following is required:

1. Check all fasteners for tightness.
2. Ensure wiring installed per National Electric Code and heater must be grounded against possible electrical shock. Inspect the control panel wiring to make certain insulation is intact and all connections are tight.
3. Verify the power supply voltage coming to heater matches the ratings printed on the heater nameplate before energizing.
4. The heater is hot when in use.
5. Do not insert or allow foreign objects to enter any ventilation or exhaust opening, as this may cause electric shock, fire, or damage to the heater.
6. To prevent a possible fire, do not block air intakes or exhaust in any manner. Keep combustible materials away from heater.
7. A heater has hot and arcing or sparking parts inside. Do not use it in areas where gasoline, paint or flammable liquids are used or stored.
8. Set line voltage thermostat to 55°F for system.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_3600_N_PRINCTON ELECTRIC HEATER.doc
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600-N-PRINCETON ELECTRIC HEATER

TITLE: PRINCETON ELECTRIC HEATER – NORMAL OPERATION

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, and screw driver.

Hazards: Improper installation can result in electric shock.

Caution: Heater must be mounted at least 7 feet above floor to prevent accidental contact with fan blade. To prevent possible overheating, keep at least a 5-foot clearance in front of the heater, 6 inches from ceiling, 6 inches from side wall and 13 inches from back wall.

SYSTEM SCHEMATICS

NA

PRINCETON ELECTRIC HEATER SYSTEM

NORMAL OPERATIONS

GENERAL

The electric heater system provides minimal heating in the control room.

NORMAL OPERATION PROCEDURE

After initial Start-Up, Normal Operation is as follows:

1. The line voltage thermostat in the control room should be set to a minimum temperature of 55°F. A line voltage thermostat mounted in the control room will activate an electric heater whenever temperature in the control room is equal to or below 55°F. When temperature in the control room is above 55°F, the electric heater will be off.

Albuquerque Bernalillo County
Water Utility Authority

REF (Filename): SOJP_3600_SD_PRINCETON ELECTRIC HEATER.doc
Revision Date: 6/23/2015
Revised By: Molzen Corbin
Approved by:

SOJP NO.: 3600–SD-PRINCETON ELECTRIC HEATER

TITLE: PRINCETON ELECTRIC HEATER - SHUTDOWN

Tools: Personal Protection Equipment: Hard hat, safety boots and safety glasses, and screw driver.

Hazards: Improper installation can result in electric shock.

Caution: Heater must be mounted at least 7 feet above floor to prevent accidental contact with fan blade. To prevent possible overheating, keep at least a 5-foot clearance in front of the heater, 6 inches from ceiling, 6 inches from side wall and 13 inches from back wall.

SYSTEM SCHEMATICS

NA

PRINCETON ELECTRIC HEATER SYSTEM

SHUTDOWN OPERATIONS

PROCEDURE

Shutdown is required for maintenance or for replacement. Shutdown of the electric heaters are as follows:

1. Disconnect, lock, and tag power source before servicing. Failure to disconnect power source can result in fire, shock, or serious injury.

8.0 STANDARD MAINTENANCE PROCEDURES

Standard Maintenance Procedures are developed to provide a list of tasks to be performed at a specified frequency to increase the overall life and performance of the lift station equipment. These procedures provide the recommended maintenance to be performed at the pump station with input from facilities staff and/or manufacturer's instructions.

8.1 Water Resource Equipment

8.1.1 Fixed Bar Screen

Inspect the screen visually after pumping events and manually remove and dispose of debris as needed.

8.1.2 Lift Pumps

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. The local sales and service representative for Johnston vertical mixed-flow pumps is Pumps and Service located in Albuquerque, NM. The station operator may check oil levels in the reservoir and fill with the manufacturer's specified oil as needed. For further instruction, refer to the manufacturer's O&M manual. Appendix C may also be referenced for manufacturer's general information and pump maintenance specifications.

Removal of the motors and/or pumps requires lifting the individual units with a hired crane through the roof hatches. The jib crane that resides in the motor room is rated to lift the sump pump only and should not be used for lifting the lift pumps and associated equipment.

8.1.3 Sump Pumps

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. The local sales and service representative for Flygt pumps is James, Cooke, and

Hobson (JCH) located in Albuquerque, NM. For further instruction, refer to the manufacturer's O&M manual. Appendix D may also be referenced for manufacturer's general information and pump maintenance specifications.

Removal of the sump pump unit is accomplished using the control building's jib crane. The sump pump portion of the wet well is equipped with guide rails to prevent swinging during removal and facilitate alignment during installation.

8.1.4 Storm Drain Outlet Gate

The 24-inch sluice gate located on the side of the wet well should be cycled annually to ensure proper operation.

8.2 Electrical Equipment

8.2.1 480V Motor Control Center (MCC)

The 480V MCC contains the main circuit breaker for the station 480V service, the 480V to 240/120V transformer, 120/240V panelboard, and a 480V panelboard with circuit breakers for the sump pump, the bar screen, the conveyor, and the 480V to 240/120V transformer.

Maintenance: Always disconnect, lock and tag power source before servicing.

Ongoing:

- Visual inspection
- Keep the surrounding area clean

Annual:

- Visual inspection
- Vacuum interior of the MCC
- Operate each circuit breaker
- Plug or cover all unused openings

5-Year:

Perform annual inspection

Check/tighten all connections

8.2.2 Sump Pump Control Panel (SPCP)

The SPCP operates the sump pump to maintain the level in the wet well below the point where the lift pump starts.

Maintenance: Always disconnect, lock and tag power source before servicing.

Ongoing:

Visual inspection

Keep the surrounding area clean

Annual:

Visual inspection

Vacuum interior of the control panel

Check/tighten all connections

Plug or cover all unused openings

5-Year:

Conduct annual maintenance

Infrared scan

8.2.3 Lift Station Control Panel (LSCP)

The LSCP operates the lift pumps to maintain the level in the wet well.

Maintenance: Always disconnect, lock and tag power source before servicing.

Ongoing:

Visual inspection

Keep the surrounding area clean

Annual:

Visual inspection

Vacuum interior of the control panel

Check/tighten all connections

Operate all switches

Test all pilot indicators

Plug or cover all unused openings

Connect variable 4 to 20 mA signal and check control relative to rising signal.

Verify transmission of alarm signals to SWRP

5-Year:

Conduct annual maintenance

Infrared scan

8.3 HVAC Equipment

8.3.1 Exhaust Fan

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. Maintenance is generally limited to cleaning, replacing belts, lubricating bearings and checking wheel alignment. Cleaning is limited to exterior surfaces only and removing dust build up on motor housing. Refer to the specific manufacturer's guidelines for further details. The following general guidelines should be followed every 12 months:

Always disconnect, lock and tag power source before servicing.

Greasing of motors is only intended when fittings are provided. Many fractional horsepower motors are permanently lubricated and should not be lubricated.

Motors supplied with grease fittings should be greased in accordance with manufacturer's recommendations. Where motor temperatures do not exceed 104°F, the grease should be replaced after 2,000 run hours.

Wheels and motor housing should be dusted off.

Shaft bearings that are non-lubricating require no further lubrication.

Cast pillow block bearings are factory lubricated and are provided with external grease fittings. Use only one (1) or two (2) shots of lubricant with a hand gun while rotting bearings.

Grease fittings should be wiped clean.

Grease should be pumped slowly until slight bead forms around the seal. A high grade lithium base grease should be used. Some Grease manufactures include the following:

US Electric Motors – Grease No. 83343

Chevron USA Inc - Chevron SRI Grease #2

Mobile oil Corporation – Mobilith or Mobil 532.

Fan RPM should not be readjusted. Only use pulleys of identical size and type when replacing pulleys. The adjustable motor pulley is factory set for the RPM specified. Speed is increased by closing or decreased by opening the adjustable pulley. Any increase in speed represents a substantial increase in horsepower and motor amperage should always be checked to avoid serious damage when speed is varied.

All fasteners should be checked for tightness each time maintenance checks are performed prior to restarting.

Wheel position is factory preset and realignment may be necessary if movement occurred. Reference vendor's maintenance manual for minimum overlap and gap dimensions.

Check wheel rotation by momentarily energizing the unit. Rotation should be clockwise when viewing from the shaft side. If wheel rotation is incorrect, reverse tow of the wiring leads or check motor wiring for single phase.

For units with two (2) groove pulleys, adjust so the tension is equal in both belts.

If adjustments are made, it is very important to check the pulleys for straight alignment.

Belt Drive Only

Worn belts should be replaced with new belts of the same type as supplied with unit.

To ensure belt tightness, check pulley set screws. Proper keys must be in keyways. Belt tension can be adjusted by loosening four (4) fasteners on the drive frame. Reference vendor's maintenance manual for Belt tension requirements.

Centering can be accomplished by loosening the bolts holding the drive frame to the shock mounts and repositioning the drive frame.

Wheel and inlet cone overlap can be adjusted by loosening the set screws in the wheel and moving the wheel to the desired position.

Direct Drive Only

Centering height alignment can be accomplished by loosening the set screws in the wheel and moving the wheel to the desired position.

Fan RPM should be checked and verified with a tachometer.

8.3.2 Electric Heater

Maintenance is to be performed only by qualified personnel who are familiar with this type of equipment. Maintenance is generally limited to cleaning and lubrication. Refer to the specific manufacturer's guidelines for further details. following general guidelines should be followed every 12 months:

Always disconnect, lock and tag power source before servicing.

Inspect the control panel wiring to make certain insulation is intact and all connections are tight.

Inspect all heaters and relay contacts. If the contacts appear badly pitted or burned, replace the contactor/relay.

For proper heater protection, ensure the correct size fuse is used.

Clean the unit casing, fan and motor once a year. Any rusty spots on the casing should be cleaned and repainted.

All units up to 20 kW have fan motors that are permanently lubricated so that only occasionally cleaning is required. Units above 20 kW have fan motors lubricated for 5 years of continuous duty or 10 years of intermittent operation. When required, remove the oil access plug on back of heater at motor intake grill, open oil cap, fill with S.A.E. No. 10 electric motor oil, and replace plugs and access plug.

9.0 SAFETY

This section presents general information on safety procedure to help prevent accidents. Consequently, to reduce the danger, anyone engaged in the operation of a stormwater pump station must be familiar with safety practices that pertain specifically to the profession. Once recognized, the inherent hazards can be readily corrected or at least guarded against by proper warnings and safety procedures. The overall dangers of accidents are much the same whether in valve vaults, pumping stations, or other facilities. These hazards can usually be classified under one (1) of the following categories:

- Physical injuries
- Body infections
- Dangers from explosive or noxious gases or vapors and oxygen deficiency

Safety regulations such as New Mexico Occupation Health & Safety Bureau (OHSB) and Occupational Safety & Health Administration (OSHA) should be followed. More information can be found at:

- https://www.osha.gov/law-regs.html and
- https://www.osha.gov/dcsp/osp/stateprogs/new_mexico.html.

9.1 General Safety Guidelines

1. Observe all written and verbal safety rules and be aware of the particular hazards surrounding your job.
2. Do not start a task until you have received and fully understand the instructions.
3. Immediately correct or report to your supervisor any hazardous conditions, unsafe equipment, or unsafe working practice.
4. Report all injuries or accidents to your supervisor.
5. Do not run. Watch for and avoid slippery or congested areas.
6. Do not ride on or operate any moving equipment unless it is part of your job and you have been instructed in its use.

7. When operating moving equipment, observe all traffic signs, speed limits, and parking regulations.
8. Do not wear loose clothing or carry rags in your pockets. Cloth may become caught in equipment and cause personal injury.
9. Use protective equipment (PPE) such as goggles, hard hats, gloves, and respirators, whenever warranted or required by the tasks.
10. Do not operate any equipment unless all safety guards and safety devices designed for that equipment are in place, except as permitted in written maintenance or emergency operation procedures.
11. Lock out equipment before cleaning debris from moving parts. Follow ABCWUA LOTO Procedures before working on any equipment. Refer to Appendix E.
12. If it is necessary to remove safety devices, handrails, manhole covers, or related items, warn fellow employees.
13. Keep all tools in good repair and ensure that you use tools appropriate to the work being performed.
14. Do not pass under or work beneath fellow employees unless a task requires doing so. Never enter a wet well, tank, or basin until all precautions have been taken to ensure safety.
15. Practice good housekeeping. Immediately clean up any grease, oil, or hydraulic fluid that may have spilled or leaked from the equipment. Do not use gasoline to clean up oil and grease. Keep all passageways, aisles, stairs, and exits clear of tools, equipment, and other materials.
16. Do not consider a job finished until you have made conditions as safe as possible for the next person.
17. Work in pairs when feasible, especially if the work being done has high risk of injury or requires assistance.

9.2 Electrical Hazards

1. Do not ground yourself in water or on pipes or drains. Avoid them when working near any electricity.
2. Allow only authorized people to work on electrical equipment and repairs.

3. Keep all electrical controls accessible and well marked.
4. Keep rubber mats on the floor in front of electrical panels; keep edges trimmed so they do not become a tripping hazard.
5. Keep wires from becoming a tripping hazard.
6. Work in pairs around electrical equipment.
7. Place "MAN ON LINE" signs on electrical disconnects, and lock the disconnects when working on electrical equipment which another person can turn on.
8. Never use metal ladders around electrical equipment.
9. Handle breaker wires as though they were "live" wires.
10. When there is a question about any electrical hazard, ask before you expose yourself to it.
11. Do not use any part of your body to test a circuit.
12. Ground all electrical tools.
13. When working around electrical equipment, as with any other hazardous work, always remain aware of the potential hazard.

9.3 Mechanical Equipment Hazards

The exposed moving parts of some pieces of equipment pose a safety hazard to personnel working around the equipment. Installing stationary guards where necessary can prevent accidental injury related to these parts. These guards, which would shield the moving part without interfering with its operation, should be considered for belts, wheels, chains, shafts, and any couplings between a piece of equipment and its drive motor or two (2) moving parts of a piece of equipment. Protective guards are sometimes furnished in the form of screens, plates, hollow shells, or tubes by the manufacturer and installed when the equipment is put into service. The designated personnel should inspect V-belts, drive chains, horizontal or vertical drive shafts, and all exposed moving parts.

Guards should be kept in good condition and replaced if necessary. Bent or improperly fitting guards could rub and interfere with the movement of a belt, shaft, wheel, etc. Before a guard is replaced, the related piece of equipment should be shut off and the power disconnected.

In addition, certain pieces of equipment may pose noise problems. High noise levels could cause serious injury to personnel coming into close contact with the equipment. Some form of ear protection, such as headsets, should be provided for personnel working near the unit. However, before any corrective measure is taken, the personnel should make certain the high noise level is not the result of a malfunction in the unit. At no time should unauthorized personnel be allowed to come near a piece of machinery that poses a safety threat. Whether guards are installed or not, this protective measure should always be observed.

9.4 Explosion and Fire Hazards

1. Install fire extinguishers where a fire hazard exists, and mark the location of the extinguishers with properly placed signs.
2. Post "NO SMOKING" signs where a potential fire hazard exists.
3. Instruct plant employees in fire prevention and what action to take in case of a fire.
4. Label all portable containers of flammable materials to indicate their contents.
5. Mark storage locations for flammable materials with signs reading "FLAMMABLE MATERIAL".
6. Store flammable combustible liquids in tanks or closed containers.
7. Clean up leaks or spills of flammable materials immediately and dispose of them promptly.
8. Inspect fire extinguishers monthly, keep them charged, and test them at least once every five (5) years.

9.5 Biological Hazards

1. All cuts, skin abrasions, scratches, and similar injuries should be treated promptly. It is recommended that all cuts and scratches, no matter how small, be treated immediately with a povidone-iodine solution and watched closely for any signs of redness, tenderness, swelling, or infection. If any of these signs appear, the individual should see a physician.
2. A doctor should be called for all but minor injuries.
3. Treatment facility personnel should be familiar with first aid treatment.
4. Avoid putting fingers in nose, mouth, or eyes while working.

5. Thoroughly clean hands when convenient and always before eating, smoking, or leaving work. Fingernails should be kept short to aid cleanliness.
6. Wear proper shoes and clothing on site, especially when working in the pump station wet well, to protect from injury (ex., needles, razors, broken glass, etc.).
7. Wear leather gloves to protect hands from nicks, scratches, etc.
8. Wear rubber gloves when direct contact with wastewater is a possibility.

9.6 Oxygen Deficiency and Noxious Gas Hazards

1. Test atmosphere before entering any confined space, in conformance with ABCWUA confined space entry procedures. Refer to Appendix F.
2. In closed spaces, allow no smoking or open flames, and guard against sparks.
3. Use only safety explosion-proof lighting equipment or mirrors.
4. Always ventilate all manholes, tanks, etc. (enclosed areas), before entering.
5. Test the atmosphere for explosive and toxic gases and oxygen deficiency, as required by the New Mexico Occupational and Health Safety Bureau. If the atmosphere is normal, a worker may enter with a safety harness attached and two (2) men available at the top. The atmosphere must be continually monitored.
6. If gas or oxygen deficiency is found, the atmosphere should be ventilated with pure air by natural or artificial means. Use of a portable blower is the most practical method of artificial ventilation. Gas tests should then be repeated and atmosphere cleared as normal before workers enter. Adequate ventilation must be maintained during work, and tests frequently repeated.
7. If gas or oxygen deficiency is present and it is not practical or possible to ventilate adequately before workers enter (such as in the saving of life), a hose mask or self-contained breathing apparatus should be worn and extreme care taken to avoid all sources of ignition if flammable gas is present. Use explosion-proof safety lights (not ordinary flashlights), wear rubber boots or non-sparking shoes, use non-sparking tools, etc.

Note: Work in a flammable gas atmosphere is extremely hazardous and should never be attempted except by those thoroughly familiar with the dangers and fully equipped with the proper protection safety equipment, and then only if it is impossible to provide a safe atmosphere within the time limitation of the emergency.

9.7 Safety Equipment

Safety helmets provide head protection from falling or flying objects and from limited electric shock.

Hearing protection (e.g. earplugs or earmuff) is required in areas of high noise levels.

Goggles prevent eye injury where there is a reasonable probability of injury.

Protective creams protect the skin from sunburn, oils, greases, paints, and dust.

Gloves of the appropriate material prevent injuries while handling pipe, tools, chemicals, solvents, and similar materials.

Safety boots protect toes from falling objects and when moving heavy items.

Oxygen, toxic gas, and explosive condition detectors are used to assure that the air in confined spaces or other work areas is not hazardous.

Portable air blowers are used for ventilating manholes and other confined spaces before entering.

Self-contained breathing apparatus or hose masks are used when atmospheres immediately hazardous to life or health must be entered.

Safety harness is required where individuals are exposed to hazardous atmospheres; the only type that should be used is that consisting of a body belt with a buckle and a shoulder harness.

1. Warning Signs or Tags: Required to be placed in strategic areas around dangerous or potentially dangerous areas; temporary tags should be attached to broken-down units to prevent start-up resulting in an injury.
2. Tools: Required by OSHA standards that the management makes sure that proper tools in good repair are available at all times (even those tools owned by employees); non-sparking tools should be available and used in required areas.
3. Fire Extinguishers: Required to place fire extinguishers approved by the Underwriter's Laboratories in areas of possible fire hazards.
4. Medical Aid: Required by OSHA standards that the employer must insure the availability of medical personnel; if there are no medical facilities in the nearby area, some employee trained in first aid should be available, as should a first aid kit.
5. Gas Detection Meter: Prevents injury by the detection of explosive and toxic gases before removal of manhole covers.

APPENDIX A

Pump Station List of Equipment

Pump Station No. 36 Princeton Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
CP53600	Station Control Panel	INDUSTRIAL ELECTRIC AUTOMATION	UL#D482811			Industrial Electric Automation; Albuquerque, NM
CP53605	Sump Pump Control Panel	CUTLER HAMMER				
E53600	Motor Control Center (MCC)	AUTOCON INDUSTRIES INC.				
E53610	Lighting	PRESCOLITE LIFE SAFETY PRODUCTS	N4XP14CVS	0302116033 & 030216031		
H53611A	Exhaust Fan	GREENHECK				
H53611B	Exhaust Fan	GREENHECK				
H53612A	Electric Heater	CHROMALOX	LUH75			
H53612B	Electric Heater	CHROMALOX	LUH75			
LE53600A	Wet well level element	DREXELBROOK	700-0005-054	7015		
LE53600B	Wet well level element	MILTRONIC	700-0005-054	7016		
LSH53600	Wet well float switch	FLYGT	ENM-10	P/N 582-88-30		James, Cooke, and Hobson; Albuquerque, NM
LT53600A	Wet well level transmitter	DREXELBROOK	409-1030-001	13645		
LT53600B	Wet well level transmitter	DREXELBROOK	409-1030-001	13652		
M53601	Lift Pump Motor 1	GENERAL ELECTRIC	5K6287XH58A	KEJ1003128	150 HP, 460V, 3 PHASE	
M53602	Lift Pump Motor 2	GENERAL ELECTRIC	5K6287XH58A	KEJ1003127	150 HP, 460V, 3 PHASE	
M53603	Lift Pump Motor 3	GENERAL ELECTRIC	5K6287XH58A	KEJ1003128	150 HP, 460V, 3 PHASE	
M53604	Lift Pump Motor 4	GENERAL ELECTRIC	5K6287XH58A	KEJ1003126	150 HP, 460V, 3 PHASE	
P53600						
P53601	Lift Pump 1	JOHNSTON PUMP	20 PS-F	GB-3288	880 RPM, 13000 GPM @ 36.7' TDH	Hennesy Equipment Sales; Phoenix, AZ
P53602	Lift Pump 2	JOHNSTON PUMP	20 PS-F	GB-3287	880 RPM, 13000 GPM @ 36.7' TDH	Hennesy Equipment Sales; Phoenix, AZ
P53603	Lift Pump 3	JOHNSTON PUMP	20 PS-F	GB-3286	880 RPM, 13000 GPM @ 36.7' TDH	Hennesy Equipment Sales; Phoenix, AZ

Pump Station No. 36 Princeton Equipment List

Equipment Number	Description	Manufacturer	Model Number	Serial Number	Size, Capacity	Local Source for Parts and Service
P53604	Lift Pump 4	JOHNSTON PUMP	20 PS-F	GB-3285	880 RPM, 13000 GPM @ 36.7' TDH	Hennesy Equipment Sales; Phoenix, AZ
P53605	Sump Pump	FLYGT	NP 3127		10 HP, 1750 RPM, 460V/3PH, 540 GPM @ 48' TDH	James, Cooke, and Hobson; Albuquerque, NM
T53600	Telemetry System	MOTOROLA	F7563A	085SNG042S		
U53620	Barscreen Unit	HASTINGS INDUSTRIES			1.75" Opening	
XA53625	Intrusion Alarm	ALLEN-BRADLEY	802R-AF			
YS53624	Smoke Detector Switch	EDWARDS	517TCB			
Z53600	Crane	SPANCO			0.5 TON	

APPENDIX B

(NOT USED)

APPENDIX C

Manufacturer's Lift Pump Curve and General Information

SPECIFICATIONS

CITY OF ALBUQUERQUE
NEW MEXICO

STORM DRAINAGE IMPROVEMENTS
AT NORTH DIVERSTON CHANNEL - SECTION II

PRINCETON PUMP STATION

GIRARD STORM SEWER

WILLIAM MAIOTAN & ASSOCIATES
ENGINEERS
230 Truman Street NE
Albuquerque, New Mexico

No. 21

SECTION 27

PUMPS

27-01. SCOPE: This section covers the furnishing, delivery, and installation of four mixed flow pumps and one sump pump for the Princeton Pump Station. Controls and all electrical work, including connections to motors, are covered in the Electrical section of these specifications.

27-02. MIXED FLOW PUMPS:

a. General: The pumping unit shall consist of a vertical shaft, single-stage impeller type pump direct-connected to a vertical hollow-shaft induction motor. The weight of the revolving parts of the pump, including the unbalanced hydraulic thrust of the impeller, shall be carried by a thrust bearing in the motor. The pump shall be supported from a base plate by means of a vertical column having horizontal below base discharge located as shown on the drawings. Pumps shall be capable of passing a 1-7/8 inch sphere.

b. Operating Conditions:

GPM	13,000
Total Pumping Head including Losses in Pump Column and Elbow	36.7'
Pump RPM	860
Power Characteristics	460-volt, 3-phase, 60-cycle
Motor Horsepower	150
Minimum Bowl Efficiency at Design Point	80%

The pumps shall be Johnston 20PS, Cascade #20, Layne Bowler 20LM, or Engineer-approved equal.

c. Pump Column and Discharge Elbow: The vertical pump supporting column and discharge elbow shall be of welded steel plate with 0.375 inch minimum wall thickness. The discharge opening shall be plain end. The discharge elbow shall be of the long sweep type. The column and discharge elbow shall be 24-inch inside dimension. The column sections shall be a maximum of 10 feet in length with flanged ends.

d. Base Plate: The pumping unit shall be suspended from a steel base plate 1-1/4" minimum thickness to support the weight and thrust of the complete unit. The base plate shall be constructed to the dimensions shown on the drawings. The oil tube nut shall be located above the base plate to provide for easy maintenance. The motor shall

be mounted above the base plate, level on a sturdy support stand having large openings to facilitate maintenance of the oil tube nut assembly.

e. Bowls: The suction bell and pump bowl shall be made of Class 35, close-grained cast iron and shall be designed for easy removal of impeller and bearings. The bowl bearings shall be SAE 40 bronze. The tube adapter shall be 83% copper, 5% zinc, 7% lead, and 5% tin, or SAE 40 bronze, unless otherwise approved by the Engineer in writing. The suction bell shall have a flared inlet designed to reduce entrance losses and a sufficient number of vanes to support the lower guide bearing as well as to sustain the weight of the impeller and pump shaft when dismantling the pump. The bearing below the impeller shall be grease packed.

f. Impellers: The pump impellers shall be made of the following alloy unless otherwise approved in writing by the Engineer: 83% copper, 5% zinc, 7% lead, and 5% tin, or SAE 40 bronze. The impeller shall be fastened to the shaft in such a manner as to be removed readily. The impellers shall be balanced dynamically and statically to reduce vibration and wear.

g. Shaft: The shaft of the pumping unit shall be of ample size to operate without objectionable distortion or vibration at maximum speed. It shall not be less than 1 and 15/16-inch diameter. The pump bowl shaft shall be made of 410-416 stainless steel and the line shaft shall be made of C-1045 turned, ground and polished steel. The ends shall be threaded and trued so that they will butt in the threaded couplings assuring a straight vibration-free shaft assembly.

h. Line Shaft Bearings: All oil-lubricated bearings shall be protected from water and foreign matter by the shaft-enclosing tube. A shaft seal shall be provided above the impeller. Bypass parts to drain excess oil from the shaft-enclosing tube shall be provided above the shaft seal. All bearings shall be easily replaceable and spaced not more than 5 feet apart. The line shaft bearings shall be made of SAE 40 bronze.

i. Lubrication: Each pump shall be equipped with a solenoid-operated lubrication system which shall supply lubricant to the line shaft bearings and shall have a metal oil reservoir with a capacity of not less than one gallon. The oiler shall be manually adjustable in the field and shall be so designed that it will operate when pump is running and will not waste oil when pump is idle.

j. Motor: The motor shall be 150 horsepower, 860 RPM, 460-volt, 3-phase, 60-cycle, vertical hollow-shaft type, with Class B insulation. Service factor shall be 1.15 with 60-degree centigrade rise above ambient. The motor shall be of the part-winding type suitable for operation with part-winding starters as specified. The thrust bearing shall be of proper design to carry the weight of all rotating parts and the unbalanced thrust of the impeller. Motors shall be equipped with thermal protectors imbedded in the motor windings with leads to the starters.

Motor conduit box shall be suitable for accommodating leads from the solenoid-operated oiler. The unit shall meet applicable requirements of the latest NEMA standards.

The motor horsepower rating shall be such that it shall not be overloaded at any condition that might be encountered in pump design required to meet the specified conditions of service.

The motor shall be equipped with a non-reverse ratchet to prevent reverse rotation of the rotating parts.

Provisions shall be made at the top of the motor shaft for adjusting the elevation of the impeller with reference to the pump bowl.

27-03. SUMP PUMP:

a. General: Sump pump shall consist of one vertical, turbine, oil-lubricated, 4-stage, below-base discharge, sump pump as shown on the drawings and as specified herein. Pump motor shall be vertical, hollow-shaft type. Impellers shall be closed type. Pump shall be capable of passing a 1/2-inch sphere.

The mixed-flow pump specifications, above, for materials, lubrication, and installation, and other applicable requirements, shall apply to the sump pump. Exceptions are as follows:

Column pipe: 4-inch standard-threaded, butt coupling.

Oil tube: 1-1/2" with 5 ft. bearing centers.

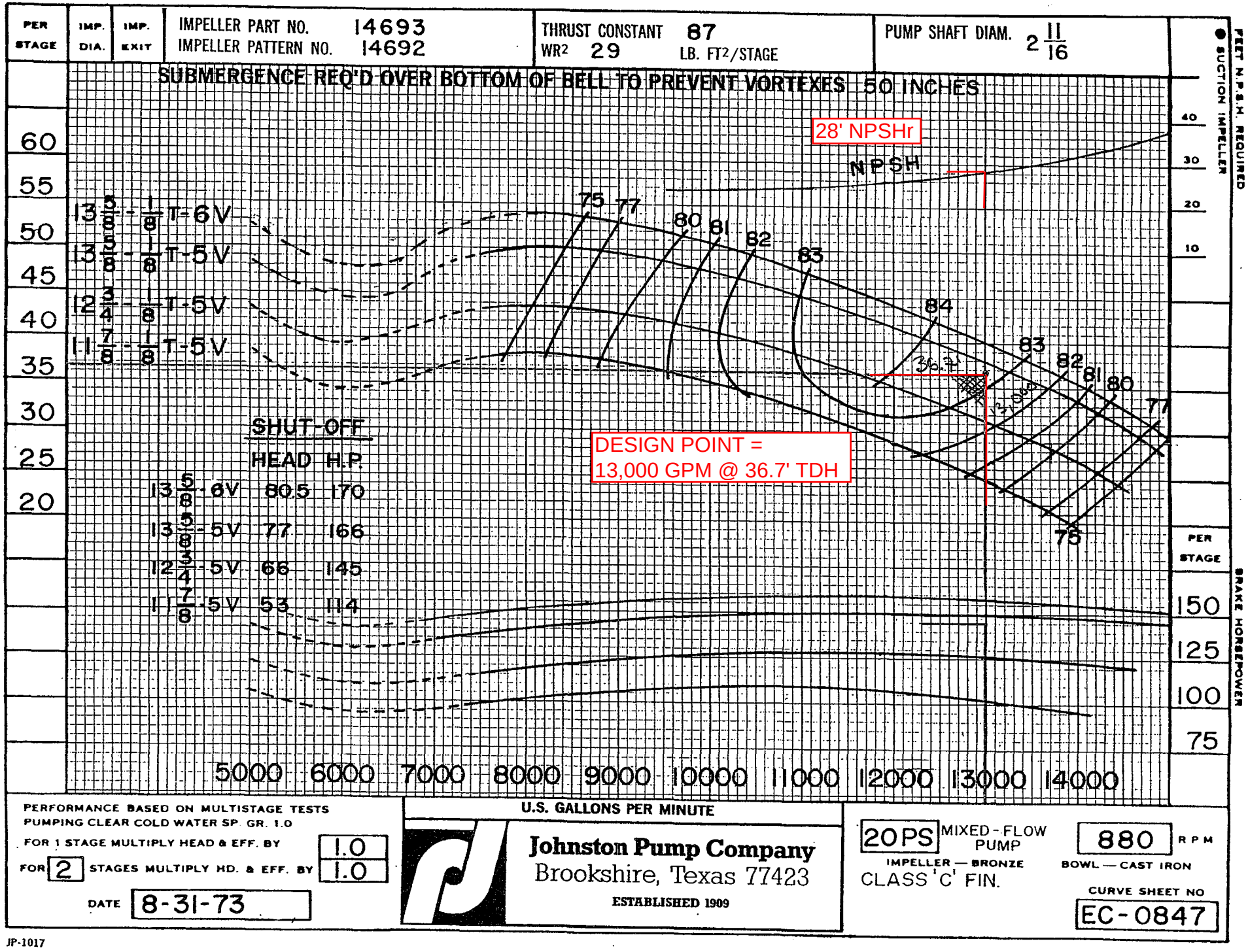
Shaft: 1" C-1045 turned, ground and polished steel, 10' maximum length.

Bowl Suction: Bell-mouth type.

SUPERSEDED AS PART OF PHASE II PUMP STATION REHAB

b. Operating Conditions:

GPM	175
Total Pumping Head including Losses in Pump Column and Elbow	43'
Pump RPM	1750
Power Characteristics	440-volt, 3-phase, 60-cycle
Motor Horsepower	3
Minimum efficiency at design point	78%


PER STAGE
IMP. DIA.
IMP. EXIT
IMPELLER PART NO. 14693
IMPELLER PATTERN NO. 14692
THRUST CONSTANT 87
WR² 29 LB. FT²/STAGE
PUMP SHAFT DIAM. 2 11/16
SUBMERGENCE REQ'D OVER BOTTOM OF BELL TO PREVENT VORTEXES 50 INCHES
28' NPSHr
NPSH
DESIGN POINT = 13,000 GPM @ 36.7' TDH
SHUT-OFF HEAD H.P.
13 5/8 - 6V 80.5 170
13 5/8 - 5V 77 166
12 3/4 - 5V 66 145
11 7/8 - 5V 53 114
FEET TOTAL BOWL HEAD
FEET N.P.S.H. REQUIRED
SUCTION IMPELLER
BRAKE HORSEPOWER
PER STAGE
U.S. GALLONS PER MINUTE
PERFORMANCE BASED ON MULTISTAGE TESTS
PUMPING CLEAR COLD WATER SP. GR. 1.0
FOR 1 STAGE MULTIPLY HEAD & EFF. BY 1.0
FOR 2 STAGES MULTIPLY HD. & EFF. BY 1.0
DATE 8-31-73
Johnston Pump Company
Brookshire, Texas 77423
ESTABLISHED 1909
20PS MIXED-FLOW PUMP
IMPELLER — BRONZE
CLASS 'C' FIN.
880 RPM
BOWL — CAST IRON
CURVE SHEET NO
EC-0847

JP-1017

Johnston Pump Company

MODEL JP AND JM PROPELLER AND MIXED FLOW PUMPS

GENERAL INFORMATION

The application of propeller and mixed flow pumps requires consideration of a number of factors as listed below.

I. OPERATING RANGE

A. Propeller pumps have a characteristic of high shut-off head and horsepower. Operation of propeller pump at a lower capacity or higher head than shown on the published performance curve may result in unstable operation, excessive noise, driver failure and shaft breakage.

B. Mixed flow pumps also have these characteristics but to a much lesser degree. A mixed flow pump, if required, can be engineered to operate at higher than normal head range as shown on the performance curves. The head and horsepower at shut-off condition are listed on the performance curves.

II. LUBRICATION OF BEARINGS

A. Oil lubricated lineshaft bearings are recommended for almost all applications. Two notable exceptions to this are applications with a positive suction pressure such as a flanged suction pump and those instances where traces of oil are objectionable because of contamination of the liquid.

B. Water lubricated open lineshaft construction can be furnished but lubrication of lineshaft bearings above the discharge elbow becomes a problem if the total pumping head is low and an underground discharge elbow is used. Air and vacuum valves are a necessity when a water lubricated pump is furnished with an underground discharge elbow. (See Section III-A below).

C. Grease lubricated bowl and lineshaft bearings can be furnished for special applications. The grease is supplied through special lines built into the pump. Grease pumps (manual or automatic) or a hand grease gun can be used to supply the grease.

D. Fresh water flushed bearings can be furnished to keep the bearings flushed clean of any sand or other abrasives present in the water being pumped. If a supply of fresh water is available, this flushing arrangement is highly recommended. The total quantity of flushing water required is usually quite small.

III. SPECIAL VALVES

A. The most common valve used with propeller and mixed flow pumps is an air and vacuum valve. This valve allows the air to escape from the column pipe as the pump is started. This is of special importance on a water lubricated pump with an underground discharge as it allows the water to rise into the upper section of column and lubricate the bearings. This will take place of course only if the bowl head is adequate to lift the water to the baseplate. These valves are also useful in helping to control special problems such as surging and water hammer.

B. By-pass valves are usually mounted in the column pipe directly above the bowl assembly. Their pupose is to prevent an excessively high head from being imposed on the pump which would cause trouble as described under I, Operating Range.

C. Siphon breaker valves are installed at the highest point in the discharge piping of a pump which is pumping over an embankment or levee and is using a siphoning action to reduce the total pumping head. When the pump is operating, the flow of water is away from the pump and the valve is closed. If the pump is stopped and, as is the normal case, the water level on the other side of the levee is higher than on the pump side, the water will start to flow backwards through the discharge pipe towards the pump. This reverse flow causes the siphon breaker valve to open, allowing air to enter the pipe and the siphoning action will be broken. This prevents accidental flooding of land on the pump side of the levee.

GENERAL INFORMATION (CONTINUED)

IV. VORTICES AND CAVITATION

These two terms are often thought to describe the same condition, whereas they are, in fact, separate and distinct.

A vortex is a "whirlpool" caused by a combination of factors such as sump design, inlet velocity and direction of flow, submergence and position of the bowl assembly in the sump. Air entering the pump through these vortices causes noise and vibration, but not cavitation. Various methods can be used to prevent vortices. These include the use of umbrellas or suction splitters, floats, lower inlet velocities, baffles in the sump and increased submergence.

Recommendations regarding the design of sumps are given in the "Standards of the Hydraulic Institute."

Cavitation is caused by inadequate NPSH at the entrance to the impeller or propeller. Use the NPSH curves to select a bowl assembly to suit the requirements of the installation. If limited NPSH is available, a large pump operating at a slow speed should be used.

V. MISCELLANEOUS

A. If the driver requires cooling water to cool the oil, check the minimum pumping head to make sure that water can be supplied to the driver at the corrct pressure. If the pumping head is too low, cooling water from some other source must be provided.

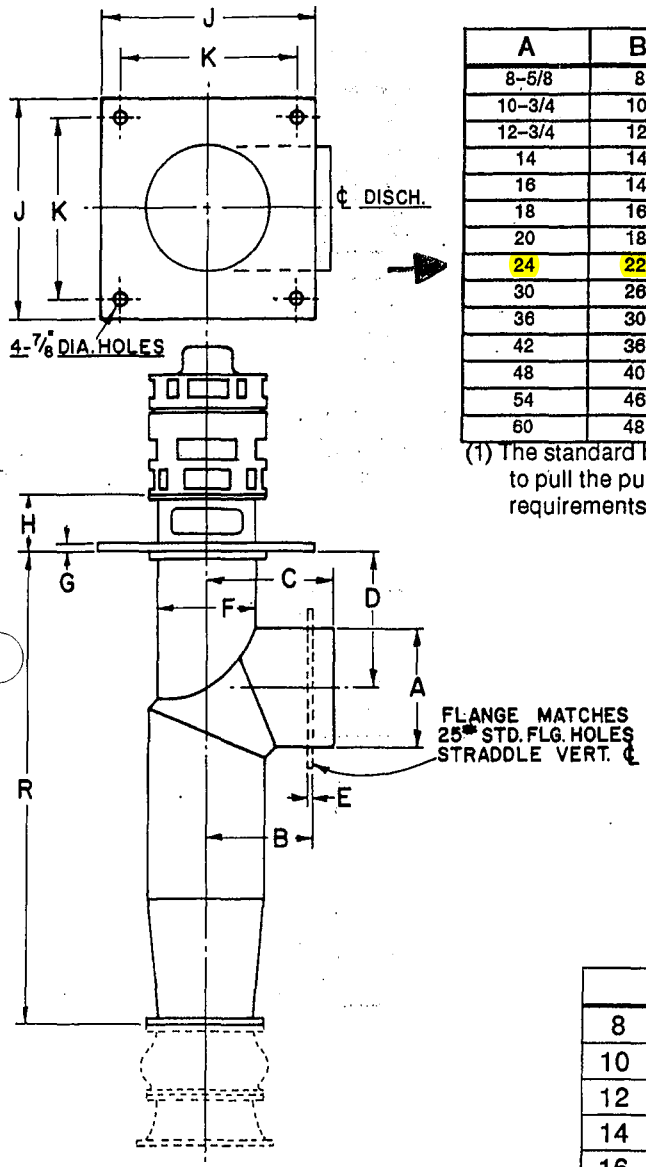
B. The diameter of the maximum sphere that can be passed through the pump is listed in the data pages. This does not mean that the pump will handle solids of this size. This listing is given only to give a relative indication of the sizes of the water passages in the various pumps.

C. Strainers are listed for all propeller and mixed flow pumps but their use is recommended only in those instances where installation of suitable trash racks is not possible. A strainer clogged with debris can cause driver overheating and failure, shaft breakage, cavitation and bearing failure.

D. Most pump drivers have a service factor which will permit operation at pumping conditions which require more horsepower than the nameplate rating of the driver. However, because the horsepower requirement of all propeller pumps and some mixed flow pumps rises sharply with an increase in the pumping head, it is not recommended practice to use this safety factor in selecting the driver size for these pumps.

MODEL JP AND JM PROPELLER AND MIXED FLOW PUMPS

UNDERGROUND DISCHARGE ELBOW DIMENSIONS



A	B	C	D	E	F	G	H	J(1)	K
8-5/8	8	12	18	3/4	8-5/8	1	16	18	15
10-3/4	10	14	18	3/4	8-5/8	1	16	18	15
12-3/4	12	16	18	3/4	8-5/8	1	16	18	15
14	14	18	24	3/4	12-3/4	1	16	24	21
16	14	22	24	3/4	12-3/4	1	16	24	21
18	16	24	24	3/4	14	1	16	24	21
20	18	26	24	3/4	18	1-1/4	21	30	27
24	22	28	30	3/4	18	1-1/4	21	30	27
30	26	34	30	3/4	24	1-1/4	21	36	33
36	30	38	36	1	30	1-1/4	21	42	39
42	36	46	42	1	36	1-1/4	21	42	39
48	40	52	42	1	36	1-1/4	21	48	45
54	46	58	48	1	42	1-1/2	22	56	53
60	48	60	54	1	48	1-1/2	22	64	61

(1) The standard base plate is not necessarily large enough to cover a dia. hole suitable to pull the pump. Check the customer's foundation for any oversize base plate requirements.

COLUMN SIZE	WALL THICKNESS
8-5/8	.277
10-3/4	.279
12-3/4	.330
14-30	.250
36-48	.375

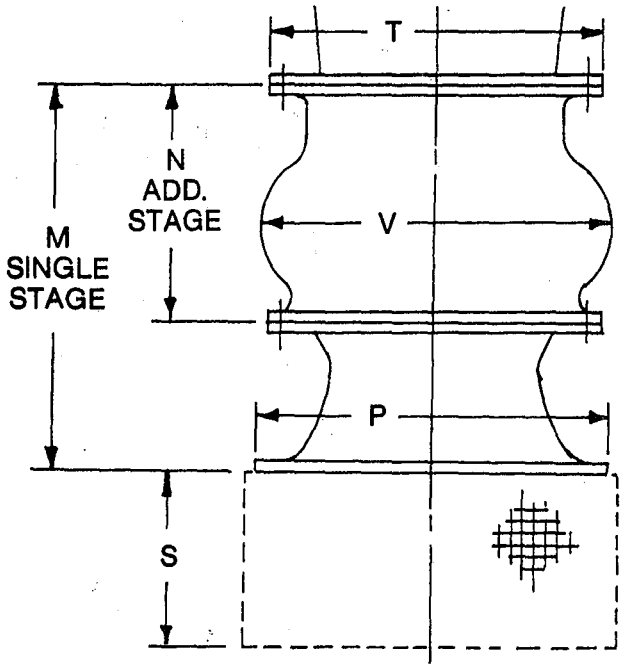
8", 10" and 12" column and elbow assemblies will be fabricated using pipe with outside diameters of 8-5/8", 10-3/4" and 12-3/4".

MIXED FLOW OR PROPELLER BOWL SIZE
MINIMUM "R" DIMENSIONS

	8	10	12	14	16	18	20	24	30	36	42	48
8	26											
10	39	27										
12	53	41	29									
14		60	48	36								
16		74	62	50	38							
18			76	64	52	40						
20				77	67	54	41					
24				110	98	86	74	50				
30							115	91	55			
36							162	138	102	66		
42									149	113	77	
48										157	121	88
54											166	130

Johnston Pump Company

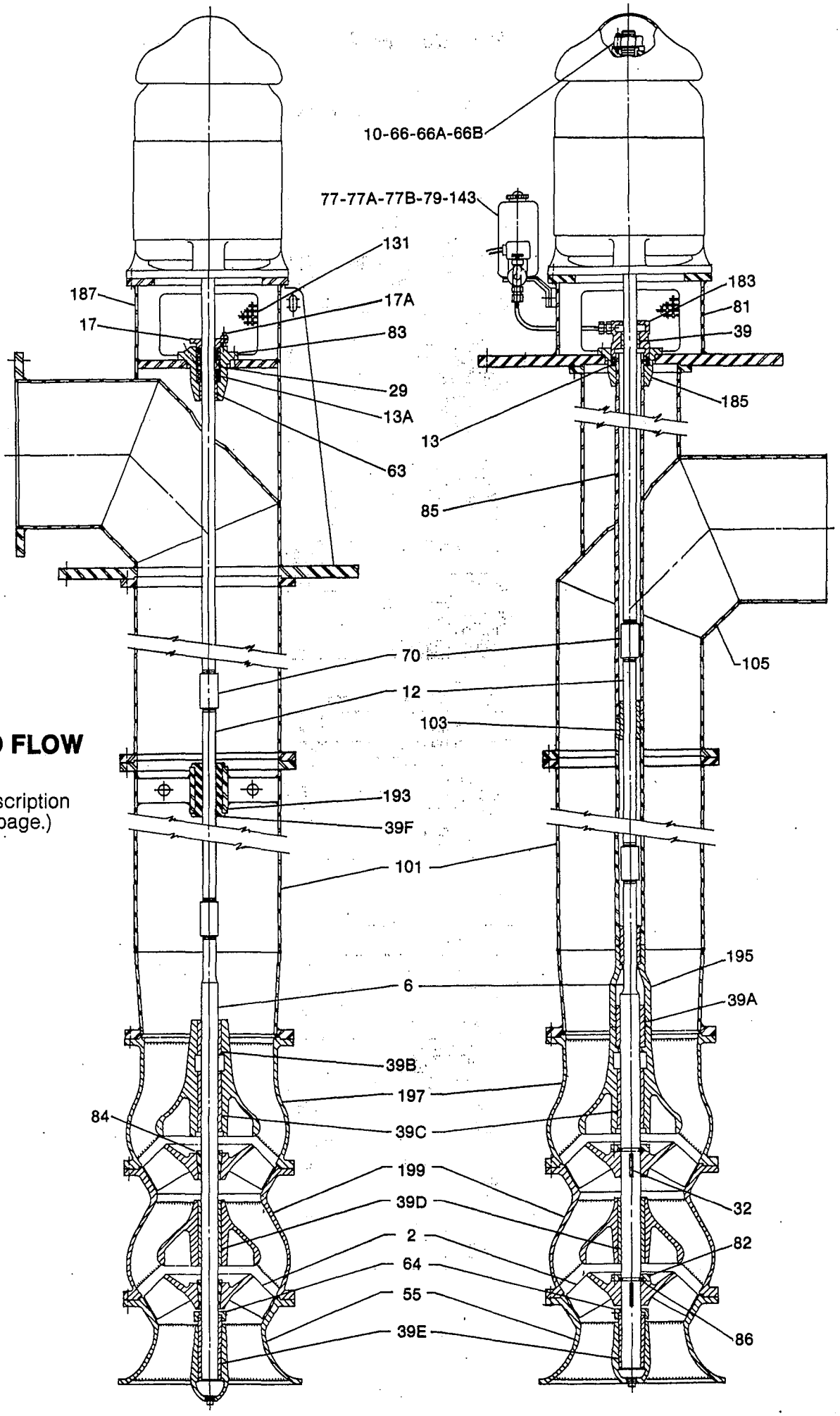
LS, MS, PS MIXED FLOW BOWL DATA



BOWL SIZE	M	N	P	S	T	V
8	13	8	12	6	11-1/2	10-1/8
10	16-1/2	10	14	7	13-3/8	12-5/8
12	19-3/4	12	17	8	16-3/8	15-1/16
14	23	14	19-7/8	9	18-5/8	17-9/16
16	26-1/2	16	22-1/2	10	20-3/4	20-1/16
18	29-3/4	18	25-1/2	11	23	22-1/2
20	33	20	28-1/2	12	25-3/8	25
24	39-1/2	24	33-1/2	12	30	29-7/8
30	49-1/2	30	42	14-1/2	36	37-1/8
36	59-1/2	36	50-1/2	16	42-5/8	44-1/2
42	69	42	59	18	49-1/4	51-3/4
50	82	50	70	20	58-1/2	62

BOWL SIZE	BOWL SHAFT DIA.	WGHT. OF ROTATIING PARTS/STG	THRUST CONSTANT "K"	WR^2 PER STAGE $LB.FT^2$ (2)	MAXIMUM (1) SPHERE SIZE		WEIGHTS FIRST STAGE	WEIGHTS ADD'L STAGE
					LS 5V PS 6V	MS 5V PS 5V		
8	1"	12	14	.32	7/8	1-1/4	114	64
10	1-1/2"	31	21	.96	1-1/4	1-5/8	195	124
12	1-11/16"	44	31	2.3	1-5/8	2	290	160
14	1-15/16"	70	42	4.8	1-7/8	2-3/8	415	255
16	2-7/16"	120	55	10.6	2-1/8	2-5/8	620	365
18	2-7/16"	135	70	17.0	2-3/8	3	775	465
20	2-11/16"	185	87	29.0	2-3/4	3-3/8	1030	640
24	2-11/16"	290	125	76.0	3-1/4	4	1780	1125
30	3-7/16"	550	194	222	4	5	2750	1810
36	4"	950	282	560	4-3/4	6	4500	2900
42	4-1/2"	1300	384	1060	5-5/8	7	6300	4050
50	5"	1800	542	2590	6-3/4	8-1/4	11600	7650

(1) Maximum sphere sizes listed are not a guarantee that pumps will handle liquid solids of these sizes.
(2) Based on bronze impellers.



MIXED FLOW PUMP

(See description on next page.)

Johnston Pump Company

MIXED FLOW PUMP

ELBOW ASSEMBLY				
ITEM No.	PART		MATERIAL	A.S.T.M. No.
10	SHAFT, HEAD	PRODUCT LUBE	ST. STEEL	A 582-416
		OIL LUBE	STEEL	A 108-GR1045
13	PACKING (2 RINGS OIL LUBE)			
13A	PACKING (6 RINGS PROD. LUBE)			
17	GLAND		BRONZE	B 584-836
17A	GLAND STUDS & NUTS		BRASS	
29	RING, LANTERN		BRONZE	B 584-836
39	BUSHING, BEARING		H. L. BRZ.	B 584-938
63	BUSHING, STUFFING BOX		H. L. BRZ.	B 584-938
66	NUT, SHAFT ADJUSTING		STEEL	A 108-GR1018
66A	NUT, LOCKING SCREWS		STEEL	
66B	GIB KEY		STEEL	A 108-GR1018
77A	SOLENOID VALVE, OILER			
77B	OIL LINE FITTINGS		COPPER	
77 & 79	OIL RESERVOIR & BRACKET		STEEL	
81	PEDESTAL, DRIVER		FAB. STL.	A 53 & A 36
83	STUFFING BOX		C. I.	A 48 CL-30
85	TUBE, SHAFT ENCLOSING		STEEL	A 120
105	ELBOW		FAB. STL.	A 53 & A 36
131	GUARD, COUPLING		GALV. STL.	A 526
143	GAUGE, SIGHT FEED OILER			
183	NUT, TUBE TENSION		C. I.	A 48 CL-30
185	PLATE, TUBE TENSION		C. I.	A 48 CL-30
187	HEAD, SURFACE DISCHARGE		FAB. STL.	A 53 & A 36

COLUMN ASSEMBLY				
ITEM No.	PART		MATERIAL	A.S.T.M. No.
12	LINE SHAFT	PRODUCT LUBE	ST. STEEL	A 582-416
		OIL LUBE	STEEL	A 108-GR1045
39 F	BUSHING, BEARING		RUBBER	C 425-65
70	COUPLING, SHAFT		STEEL	A 108-GR1137
101	COLUMN PIPE		STEEL	A 53 & A 36
103	BEARING, DRIVE SHAFT		BRONZE	B 584-836
193	BEARING, RETAINER*		FAB. STL.	A 36

*FAB. TYPE SHOWN

BOWL ASSEMBLY			
ITEM No.	PART	MATERIAL	A.S.T.M. No.
2	IMPELLER	BRONZE	B 584-836
6	PUMP SHAFT	ST. STEEL	A 582-416
32	KEY, IMPELLER	ST. STEEL	A 582-416
39A	BEARING, SCREW UPPER O. L.	BRONZE	B 584-836
39B	BEARING, UPPER DISCH. BOWL	H. L. BRZ.	B 584-938
39C	BEARING, LOWER DISCH. BOWL	H. L. BRZ.	B 584-938
39D	BEARING, INTER. BOWL	H. L. BRZ.	B 584-938
39E	BEARING, BELL	H. L. BRZ.	B 584-938
55	SUCTION BELL	C. I.	A 48 CL-30
64	COLLAR, PROTECTING	BRONZE	B 584-836
82	THRUST RING RETAINER	BRONZE	B 584-836
84	LOCK COLLET	STEEL	A 108-GR1213
86	THRUST RING	ST. STEEL	A 582-416
195	ADAPTER, TUBE	C. I.	A 48 CL-30
197	DISCHARGE BOWL	C. I.	A 48 CL-30
199	INTERMEDIATE BOWL	C. I.	A 48 CL-30

APPENDIX D

Manufacturer's Sump Pump Curve and General Information

LS #35 and #36 (Comanche & Princeton)

FLYGT

PERFORMANCE CURVE

PRODUCT	TYPE
NP3127.180	HT

DATE	PROJECT	CURVE NO	ISSUE
2003-02-18	ABQ Storm Water Retrofit Phase I	63-488-00-3755	1

	1/1-LOAD	3/4-LOAD	1/2-LOAD
POWER FACTOR	0.87	0.83	0.75
EFFICIENCY	84.5 %	85.0 %	83.5 %
MOTOR DATA	---	---	---

RATED POWER	10	hp
STARTING CURRENT ...	75	A
RATED CURRENT ...	13	A
RATED SPEED	1745	rpm
TOT.MOM.OF INERTIA ...	0.054	kgm2
NO. OF BLADES	2	

IMPELLER DIAMETER: 215 mm

MOTOR #	STATOR	REV
21-12-4AL	38D	10

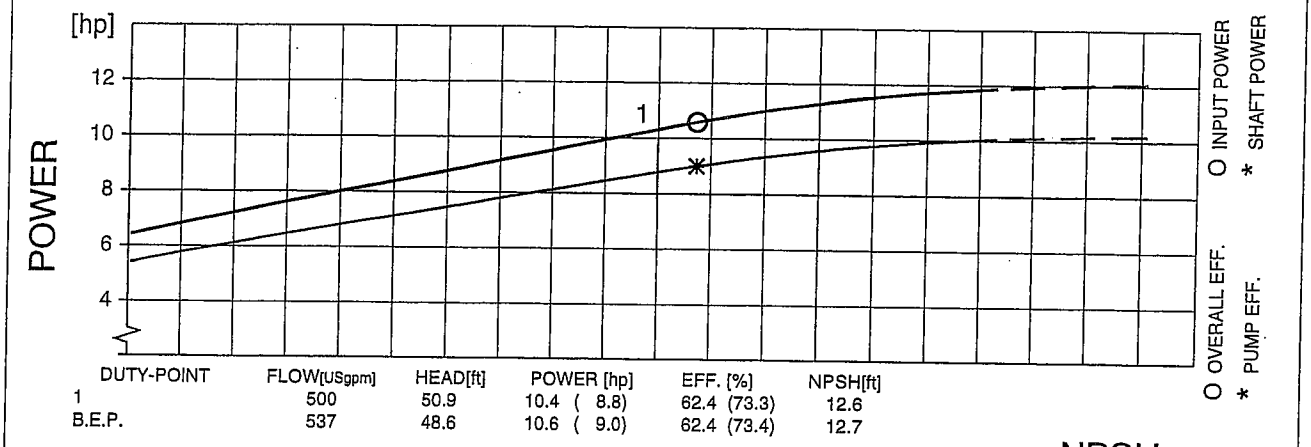
FREQ.	PHASES	VOLTAGE	POLES
60 Hz	3	460 V	4

GEARTYPE	RATIO
---	---

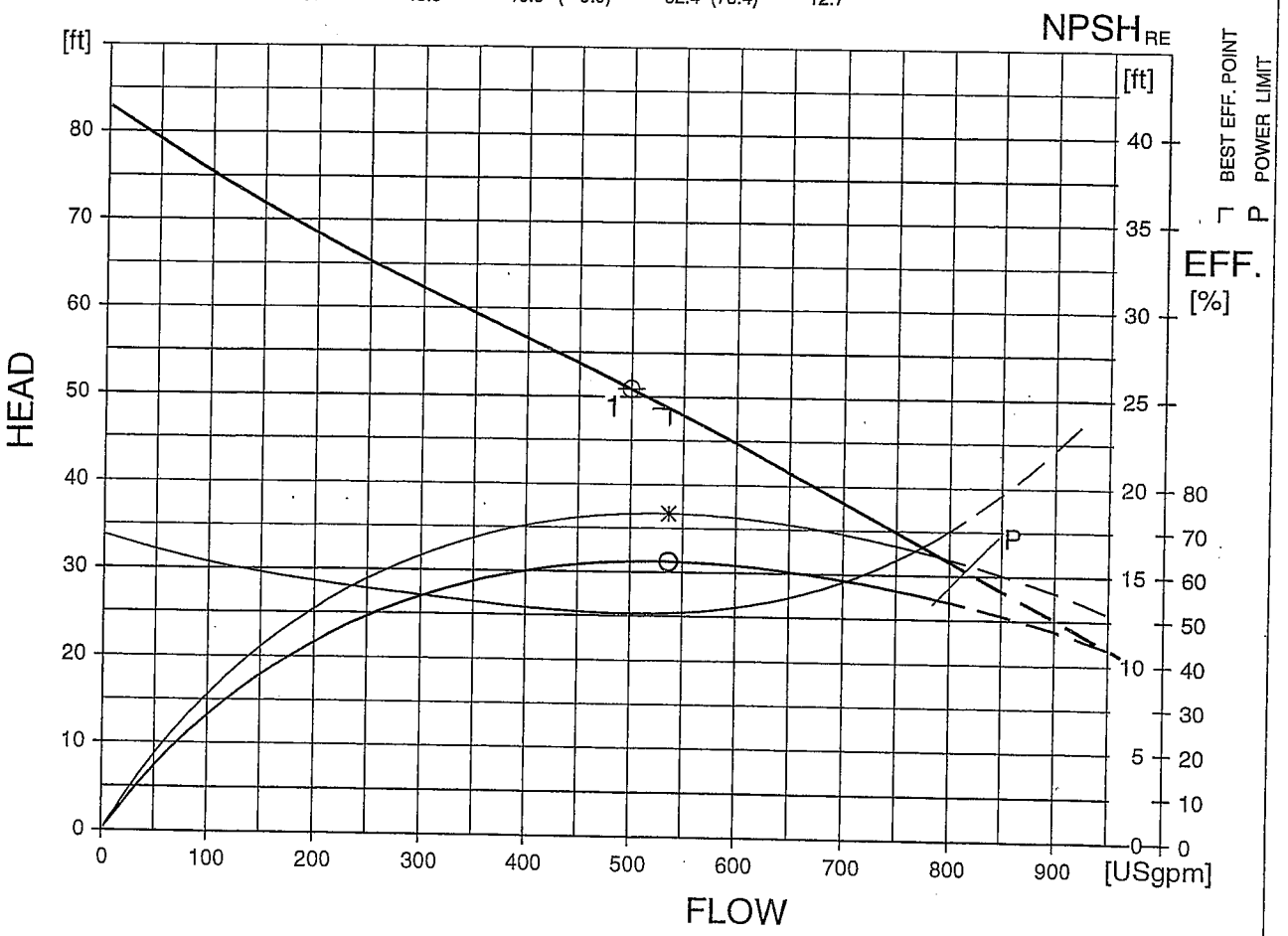
COMMENTS: 4" ϕ DISCHARGE

INLET/OUTLET: - /100 mm

IMP. THROUGHLET: ---



DUTY-POINT	FLOW[USgpm]	HEAD[ft]	POWER [hp]	EFF. [%]	NPSH[ft]
1	500	50.9	10.4 (8.8)	62.4 (73.3)	12.6
B.E.P.	537	48.6	10.6 (9.0)	62.4 (73.4)	12.7



FLYPS2.11 (20010918)

Performance with clear water and ambient temp 40 °C

FLYGT CURVE

Storm Water Pump Station Rehabilitation Phase III
Princeton Pump Station (Station 36) – New Pump Specifications
Flygt Model NP3127-488

REQUIREMENTS

Furnish and install 1 submersible non-clog nuisance water pump in each wet well. Each pump is equipped with a 10 HP submersible electric motor connected for operation on 460 volts, 3 phase, 60 hertz service.

One spare pump will be supplied to the owner for use in either Comanche Pump Station or Princeton Pump Station.

The pump is supplied with a mating cast iron 4" inch discharge connection. The pump is supplied with 40 feet of submersible cable (SUBCAB) suitable for submersible pump applications. The power cable is sized according to N.E.C. and ICEA standards, and also meets with P-MSHA Approval.

Each pump will deliver 537 GPM at 48 ft TDH.
An additional point on the same curve is 700 GPM at 38 feet total head.
Shut off head is 82 feet (minimum).
Pump hydraulic efficiency is 73% at specified duty point.
Overall efficiency is 62% with 9 shaft hp at specified duty point.
Pump output speed is 1745 rpm.

PUMP DESIGN

The pump automatically and firmly connects to the discharge connection, guided by two guide bars, extending from the top of the station to the discharge connection. There is no need for personnel to enter the wet-well.

Sealing of the pumping unit to the discharge connection is accomplished by a machined metal to metal watertight contact. Sealing of the discharge interface with a diaphragm, O-ring, or profile gasket is not acceptable, and is not used. No portion of the pump bears directly on the sump floor.

PUMP CONSTRUCTION

Major pump components are constructed of gray cast iron, ASTM A-48, Class 35B, with smooth surfaces devoid of blow holes or other irregularities. All exposed nuts or bolts are AISI type 304 stainless steel construction. All metal surfaces coming into contact with the pumpage, other than stainless steel or brass, are protected by a factory applied spray coating of acrylic dispersion zinc phosphate primer with a polyester resin paint finish on the exterior of the pump.

Sealing design incorporates **metal-to-metal contact** between machined surfaces. Critical mating surfaces where watertight sealing is required are machined and fitted with Nitrile rubber O-rings. Fittings are the result of controlled compression of rubber O-rings in two planes, and O-ring contact of four sides without the requirement of a specific torque limit.

Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered as adequate or equal. No secondary sealing compounds, elliptical O-rings, grease or other devices are allowed or used.

COOLING SYSTEM

Motors are sufficiently cooled by the surrounding environment or pumped media. A water jacket is not required.

CABLE ENTRY SEAL

The cable entry seal design precludes specific torque requirements to ensure a watertight and submersible seal. The cable entry consists of a single cylindrical elastomer grommet, flanked by washers,

all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly provides ease of changing the cable using the same entry seal. **The cable entry junction chamber and motor are separated by terminal board, isolating the interior from foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems are not considered acceptable, and are not used.**

MOTOR

The pump motor is a NEMA B design, induction type, with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. The stator windings are insulated with moisture resistant Class H insulation rated for 180°C (356°F). The stator is insulated by the trickle impregnation method using Class H monomer-free polyester resin, resulting in a winding fill factor of at least 95%.

The stator is heat-shrink fitted into the cast iron stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is not acceptable and is not used. The motor is designed for continuous duty handling pumped media of 40°C (104°F), and is **capable of up to 15 evenly spaced starts per hour**. The rotor bars and short circuit rings are made of cast aluminum.

Thermal switches set to open at 125°C (260°F) are embedded in the stator lead coils to monitor the temperature of each phase winding. These thermal switches are used in conjunction with and supplemental to external motor overload protection, and are to be connected to the control panel.

The junction chamber is sealed off from the stator housing, and contains a terminal board for connection of power and pilot sensor cables using threaded compression type terminals. The use of wire nuts or crimp-type connectors is not acceptable and is not used.

The motor service factor (combined effect of voltage, frequency and specific gravity) is 1.15. The motor shall has a voltage tolerance of +/- 10%. The motor is designed for continuous operation in up to a 40°C. ambient, and has a NEMA Class B maximum operating temperature rise of 80° C.

A motor performance chart shall be provided upon request exhibiting curves for motor torque, current, power factor, input/output kW and efficiency. The chart shall also include data on motor starting and no-load characteristics.

Motor horsepower is sufficient so that the pump is non-overloading throughout its entire performance curve, from shut-off to run-out.

POWER CABLE

The power cable is sized according to the NEC and ICEA standards. These pumps are supplied with 40 feet submersible cable to reach the junction box or control panel without the need of any splices. The outer jacket of the cable is of neoprene.

The pump cable end will be sealed with a high quality protective covering to make it impervious to moisture or water seepage prior to electrical installation.

The cable entry seal design precludes specific torque requirements to insure a water tight and submersible seal. The cable entry consists of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the body containing a strain relief function, separate from the function of sealing the cable. The assembly provides ease of changing the cable when necessary using the same entry seal.

The cable entry junction chamber and motor are separated by a terminal board, which shall isolate the interior form foreign material gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable, and are not used.

BEARINGS

The integral pump/motor shaft rotates on two bearings. The motor bearings are sealed and perrnanently grease lubricated with high temperature grease. The upper motor bearing is a single ball type bearing to handle radial loads. The lower bearing is a two row angular contact ball bearing to handle the thrust and radial forces. The minimum B_{10} bearing life shall exceed 50,000 hours at any usable portion of the pump curve.

MECHANICAL SEALS

Each pump will be provided with a positively driven dual, tandem mechanical shaft seal system consisting of two seal sets, each having an independent spring. The lower primary seal, located between the pump and seal chamber, contains one stationary and one positively driven rotating ring of solid corrosion resistant **tungsten-carbide**. The upper secondary seal, located between the seal chamber and the seal inspection chamber, contain one stationary and one positively driven rotating ring of solid corrosion resistant **tungsten-carbide**. All seal rings shall be individual solid sintered rings.

Each seal interface is held in place by its own spring system. The seals do not depend upon direction of rotation for sealing. Mounting of the lower seal on the impeller hub is not acceptable. Shaft seals without positively driven rotating members or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces are not acceptable. The seal springs are isolated from the pumped media to prevent materials from packing around them, limiting their performance.

Each pump is provided with a lubricant chamber for the shaft sealing system. The lubricant chamber is designed to prevent overfilling, and provides capacity for lubricant expansion. The seal lubricant chamber has one drain and one inspection plug, that are accessible from the exterior of the motor unit. The seal system does not rely upon the pumped media for lubrication.

The area about the exterior of the lower mechanical seal in the cast iron housing has a cast-in integral concentric spiral groove. This groove protects the seals by causing abrasive particulate entering the seal cavity to be forced out away from the seal (due to centrifugal action).

A separate seal leakage chamber is provided so that any leakage that may occur past the upper, secondary mechanical seal will be captured prior to entry into the motor stator housing. Such seal leakage will not contaminate the motor lower bearing. The leakage chamber wil be equipped with a float type switch (FLS) that will signal if the chamber should reach 50% capacity.

PUMP SHAFT

The pump and motor shaft are a single piece unit - the pump shaft is an extension of the motor shaft. Shafts using mechanical couplings are not acceptable. The shaft is AISI type 431stainless steel. Shaft sleeves are not acceptable and are not used.

"N" IMPELLER

The impeller is of gray cast iron, ASTM A-48 Class 35B, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges are mechanically self-cleaned upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped leading edges of the impeller are hardened to Rc 45, and are capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater.

The screw shape of the impeller inlet provides an inducing effect for the handling of up to 5% sludge and rag-laden wastewater. The impeller to volute clearance is readily adjustable by the means of a single trim screw. The impeller is locked to the shaft, held by an impeller bolt. The entire impeller is coated with alkyd resin primer.

"N" PUMP VOLUTE/ SUCTION COVER

The pump volute is a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified (8").

The volute has integral spiral-shaped, sharp-edged groove that is cast into the suction cover. The spiral groove provides the sharp edge across which each impeller vane leading edge shall cross during rotation to remain unobstructed. The internal volute bottom shall provide effective sealing between the multi-vane semi-open impeller and the volute.

PROTECTION

The motor stator incorporates thermal switches in series to monitor the temperature of each phase winding. At 260° F the thermal switches open, stop the motor, and activate an alarm.

PUMP WARRANTY

The pump manufacturer shall warrant the units being supplied to the owner against defects in workmanship and material for a period of five (5) years or 10,000 hours under the Municipal Wastewater-Permanent Installation Warranty Policy, under normal use, operation, and service. The warranty shall be in printed form and apply to all similar units and cover both parts and labor.

MANUFACTURER'S EXPERIENCE AND SERVICE

The pump manufacturer shall have a minimum of 1,000 units of similar type pumps, installed and operating for no less than five (5) years in the United States.

A factory authorized repair facility shall be located within 50 miles of the lift station, and shall have been appointed at least five years prior to bid date. Personnel of the repair facility shall have been trained, tested, and certified by the pump manufacturer in the proper repair of the pumps to be supplied.

Additionally, the local factory authorized repair facility shall maintain a stock of repair parts from the manufacturer of the pump of at least $50,000 and include all O-rings, bearings, mechanical seals, stator, power cable, grommets, and fittings of the pumps to be supplied under this job.

There will be provided for the pump station, the services of qualified personnel to inspect the completed installation, assist the Contractor with start up, and instruct operating personnel in the care and maintenance of the equipment.

BALL CHECK VALVES

Furnish and install Flygt HDL Ball Check Valves as listed on the plans. The ball check valve shall consist of just three components: body, cover, and ball--one moving part.

The design of the valve keeps solids, stringy material, grit, rags, etc., moving without the need for back flushing. Upon opening, the ball clears the waterway, providing "full flow" equal to the nominal size (non-clog operation).

There are no outside levers, weights, springs, dash pots or other accessories required. The ball is hollow steel with an exterior of nitrile rubber - resistant to grease, petroleum products, animal and vegetable fats, diluted concentrations of acids, alkalines (pH 4-10), tearing, and abrasion. The body and cover are of gray cast iron, Class 35. Flange drilling shall be according to ANSI B16.1, Class 125.

GUIDE BARS, UPPER BRACKET, LIFTING CHAIN, AND OTHER ACCESSORIES

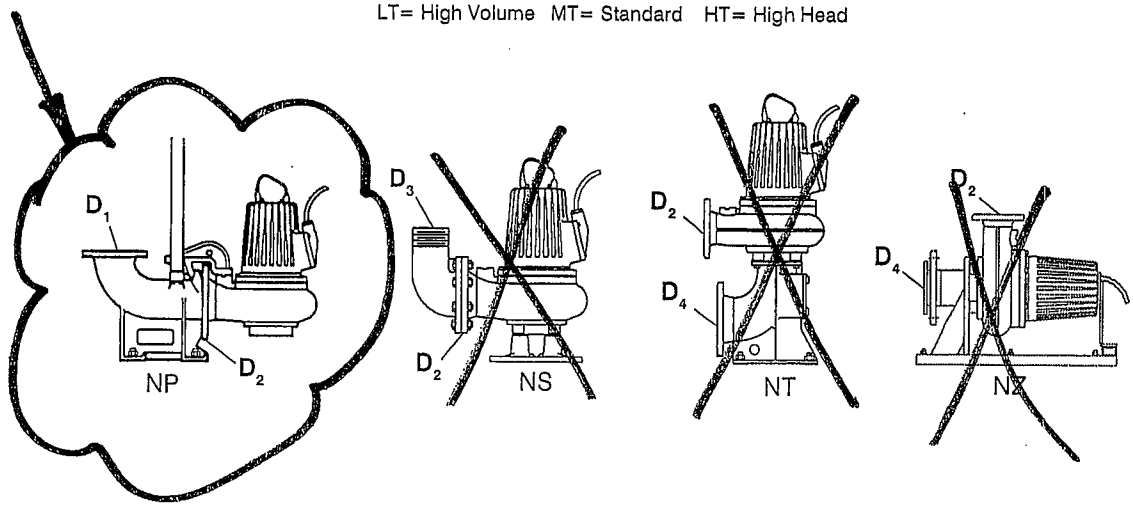
The lifting chain, shackles, guide bars, and upper guide bar brackets are constructed of 304 stainless steel metal. Guide bars shall be of 304 stainless steel pipe, size 2". The guide bars shall not support any portion of the weight of the pump.

N-3127

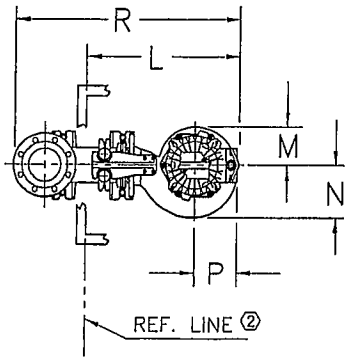
PUMP MODEL	IMPELLER CODE	HP RATING NP	NS	NT	NZ	VAC	D1	D2	D3	D4
3127 3Ø	[illegible] LT	10.0	10.0	--	--	[illegible]/460	[illegible]			
	[illegible] LT	7.5,10	7.5,10	7.4	7.4		[illegible]			
	[illegible] MT	10.0	10.0				[illegible]			
	489 MT	7.5,10	7.5,10	7.4	7.4		4,6,8	4,6"	4,6"	6"
	[illegible] HT	10	10				4"	4"	4"	
	488 HT	10					4"	4"		
	489 HT	7.5,10	7.5,10	7.4	7.4		4"	4"	4"	4"

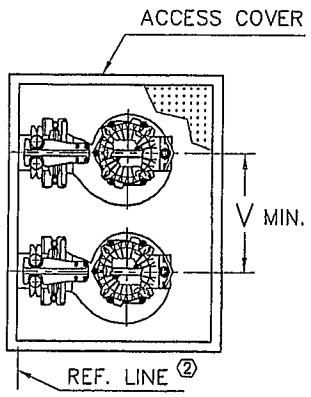
PUMP MODEL	IMPELLER CODE	HP RATING NP	NS	NT	NZ	VAC	D1	D2	D3	D4
3127 1Ø	422 LT	7.5	7.5	--	--	230	8"	6"	8"	--
	439 MT	7.5	7.5	--	--		4,6,8	4,6"	4,6"	--
	489 HT	7.5	7.5	--	--		4"	4"	4"	--

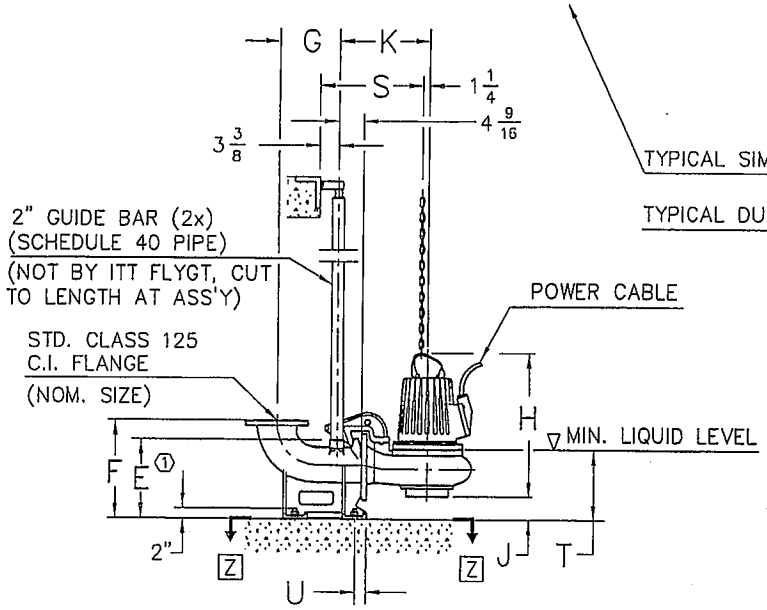
LT= High Volume MT= Standard HT= High Head



00235

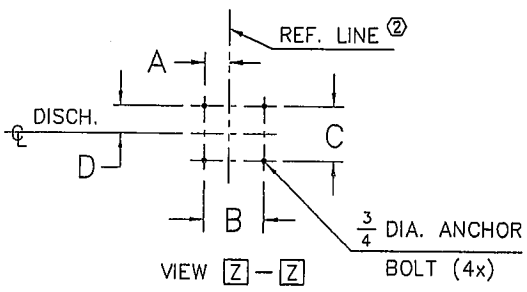






○ NOTES:

1. DIM. TO ENDS OF GUIDE BARS.
2. REPRESENTS CLEAR INSIDE EDGE OF ACCESS FRAME OR OPENING.
3. SEE STATION DWG. FOR COMPLETE INSTALLATION DIMENSIONS.



NOM. SIZE	TYPE	VERSION	WEIGHT (LBS) PUMP	DISCH
3"	CP	SH	325	80
4"	CP/NP	HT	325	80
4"	CP/NP	MT	340	80
* 6"	CP/NP	MT	340	120
** 6"	CP/NP	MT	340	120
8"	CP/NP	LT	325	145
8"	CP/NP	MT	340	145

* WITH 4" DIA. INLET
** WITH 6" DIA. INLET

ALL DIMENSIONS IN INCHES

TYPE	NOM. SIZE	VERSION	DIMENSIONAL CHART A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V
CP	3"	SH	2 1/2	10	8	4	10 3/4	15 3/4	10	25	3 1/4	16 3/4	28 1/2	7 3/4	9 1/4	8 1/4	39 1/4	19	11	2 3/4	20
CP/NP	4"	HT	2 3/4	10	8	4	10 1/4	15 3/4	10	25	3 1/4	16 3/4	28 1/2	7 3/4	9 1/4	8 1/4	39 1/4	19	11	2 3/4	20
CP/NP	4"	MT	2 3/4	10	8	4	10 1/4	15 3/4	10	25	3 1/4	16 3/4	28 1/2	7 3/4	9 1/4	8 1/4	39 1/4	19	11	2 3/4	20
* CP/NP	6"	MT	4 1/2	11	10	5	14 1/2	17 3/4	11	26	5 3/4	16 3/4	28 1/2	8 1/2	8 1/2	8	41 3/4	19	15	2 1/4	22
** CP/NP	6"	MT	4 1/2	11	10	5	14 1/2	17 3/4	11	26	4 1/4	16 3/4	28 1/2	7 1/4	9 1/2	8 1/4	41 3/4	19	15	2 1/4	22
CP/NP	8"	LT	5 1/2	11	10	5	15	17 3/4	12 1/4	26 3/4	4 1/4	18 1/4	30 1/2	7 1/4	10	8 1/2	46 3/4	20 1/2	14	2 1/4	22
CP/NP	8"	MT	5 1/2	11	10	5	15	17 3/4	12 1/4	26	4 1/4	18 1/4	28 1/2	7 1/4	9 1/2	8 1/4	41 3/4	19	15	2 1/4	22

Motor Data

RATED OUTPUT POWER HP	(kW)	Ø	VOLTS NOM.	FULL LOAD AMPS	LOCKED ROTOR AMPS	LOCKED ROTOR KVA	LOCKED ROTOR CODE LETTER KVA/HP	RATED INPUT POWER kW	POLES/RPM
10.0	(7.5)	3	460	13.0	75	60	G	8.9	4/1745
			200	30.0	258	89	K		
			230	26.0	192	76	H		
			460	13.0	96	76	H		
			575	11.0	85	85	J		

PUMP MOTOR HP	EFFICIENCY			POWER FACTOR		
	100% LOAD	75% LOAD	50% LOAD	100% LOAD	75% LOAD	50% LOAD
10.0	84.0	85.0	84.0	0.87	0.85	0.77

Cable Data

HP	VOLTS	MAX. LENGTH FT.	CABLE SIZE/ NOMINAL DIA.	CONDUCTORS (IN ONE CABLE)	PART NUMBER
10.0	460	535	10/3-2-1-GC 21.3mm (0.84")	(3) 10 AWG (PWR) (2) 12 AWG (CTRL) (1) 10 AWG (GND) (1) 12 AWG (GC)	94 21 06

APPENDIX E

Albuquerque Bernalillo County Water Utility Authority

Lockout/Tagout (LOTO)

Albuquerque Bernalillo County
Water Utility Authority

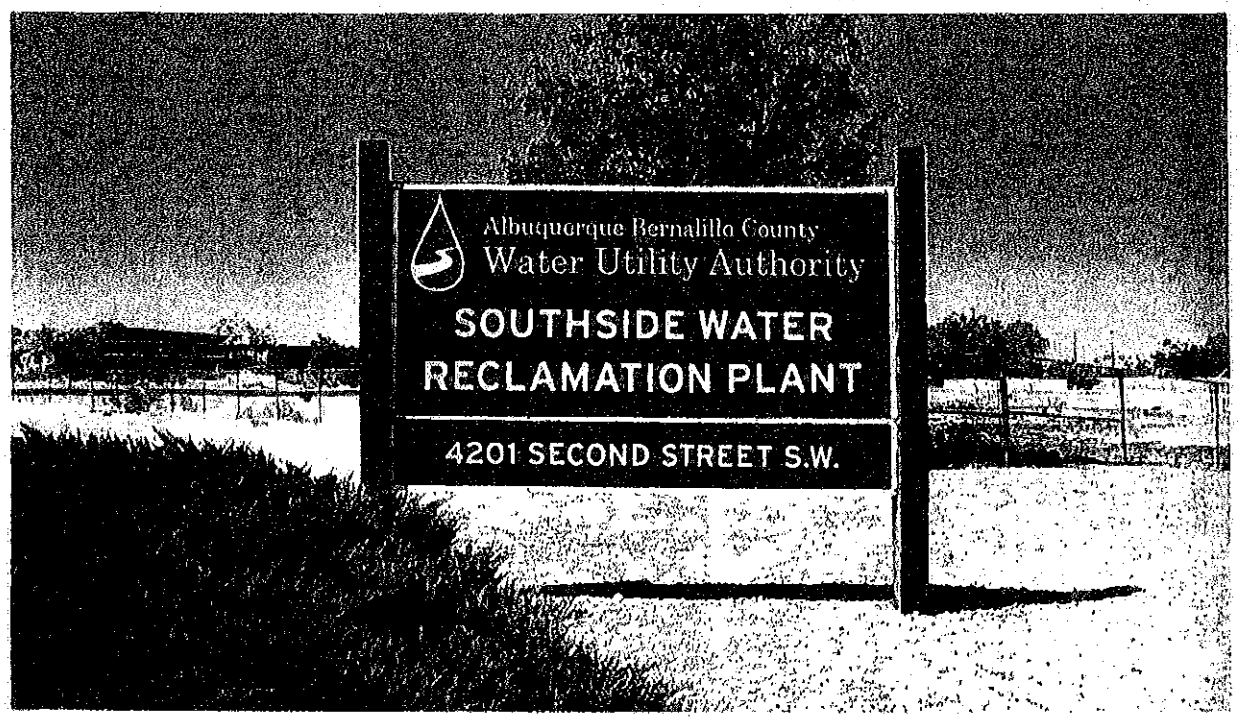
Southside Water Reclamation Plant

Program for the

Control of Hazardous Energy (Lockout/Tagout)

Based on

OSHA 29 CFR PART 1910.147



The Control of Hazardous Energy (Lockout/Tagout) Program

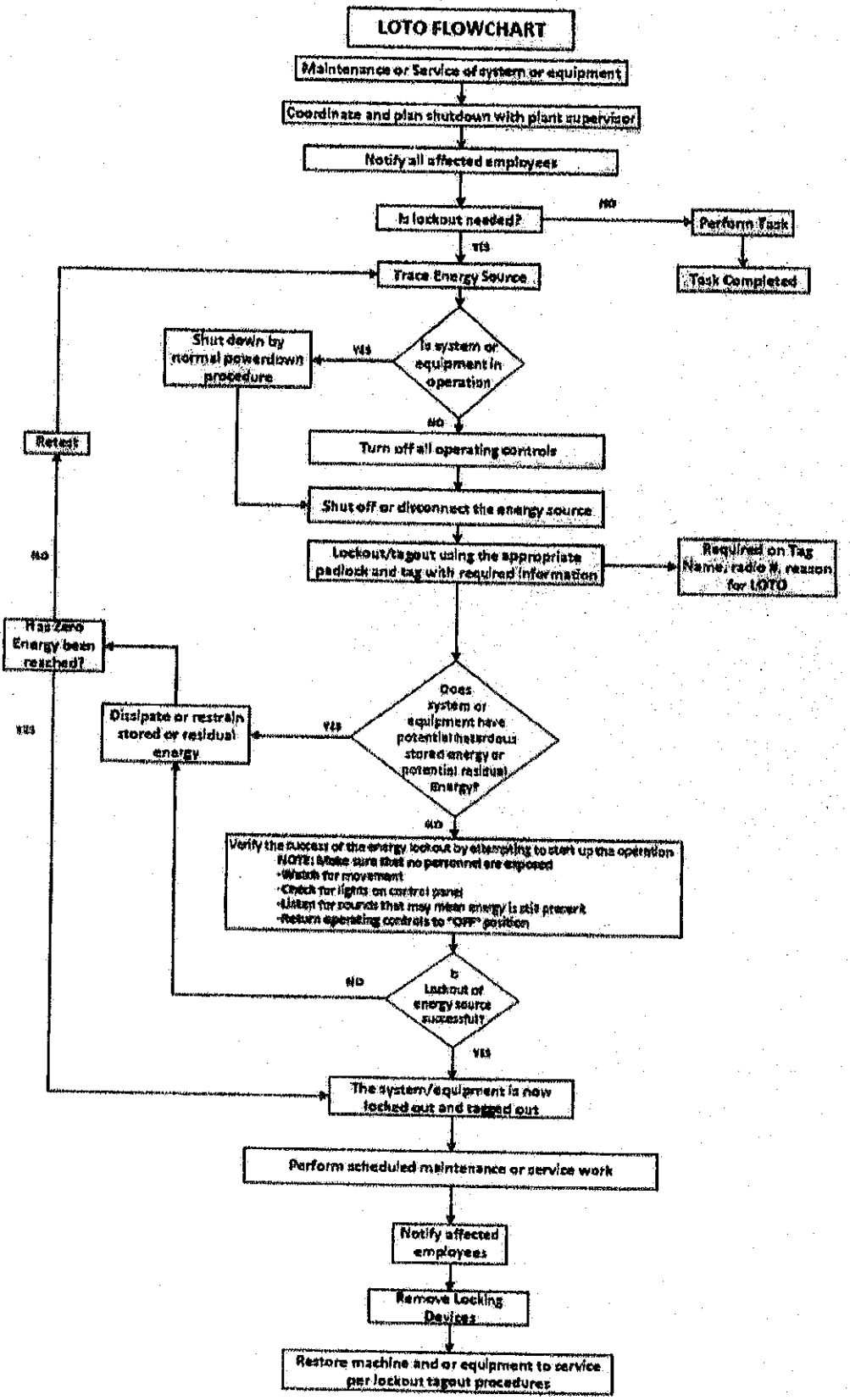
Table of Contents

Lockout/Tagout

Last Revised: March 2013

REVIEWED/APPROVED

Title/Name	Signature	DATE
Chief Engineer Jeff Romanowski		3-28-13
Operations Superintendent Joey Nogales		3-29-13
Maintenance Superintendent Jeff Romero		4-1-13
SAF J. Frank Bailey		4-1-13
Safety Manager Mike Cummings		4/4/13


LOTO FLOWCHART
Maintenance or Service of system or equipment
Coordinate and plan shutdown with plant supervisor
Notify all affected employees
Is lockout needed?
NO
Perform Task
Task Completed
YES
Trace Energy Source
Is system or equipment in operation
YES
Shut down by normal powerdown procedure
NO
Turn off all operating controls
Shut off or disconnect the energy source
Lockout/tagout using the appropriate padlock and tag with required information
Required on Tag Name, radio #, reason for LOTO
Does system or equipment have potential hazardous stored energy or potential residual energy?
YES
Dissipate or restrain stored or residual energy
Has Zero Energy been reached?
NO
YES
Retest
NO
Verify the success of the energy lockout by attempting to start up the operation
NOTE: Make sure that no personnel are exposed
-Watch for movement
-Check for lights on control panel
-Listen for sounds that may mean energy is still present
-Return operating controls to "OFF" position
Is Lockout of energy source successful?
NO
YES
The system/equipment is now locked out and tagged out
Perform scheduled maintenance or service work
Notify affected employees
Remove Locking Devices
Restore machine and or equipment to service per lockout tagout procedures

I. Introduction

The following "Lockout/Tagout" (LOTO) are the specific practices and procedures of the Albuquerque Bernalillo County Water Utility Authority (ABCWUA, hereafter referred to as Water Authority) Southside Water Reclamation Plant (SWRP) requirements to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of any stored hazardous energy during service or maintenance activities. This stored energy could be electrical, hydraulic, mechanical or any other source that may cause unexpected movement. This requires that a designated individual turns off, disconnects, disengages or blocks the machinery or equipment from its energy source(s) before performing service or maintenance.

All employees are required to follow the procedures outlined in this program.

II. Purpose

It is the policy of the SWRP for all employees working at this facility to follow all these established and effective lockout/tagout practices and procedures to ensure the safety of Water Authority employees.

III. Program Management Responsibilites

(A) Management (Chief Engineer):

(1) Responsible for providing the tools and resources necessary to implement this program and for ensuring that the provisions in this program are being followed by the Program Administrator.

(2) Developing specific lockout procedures for each individual piece of machinery/equipment at the facility. The Administrator will involve the maintenance staff, electricians, and employees operating the machinery/equipment in the development of the procedures to ensure all energy sources are identified.

(3) Identifying employee classifications – "Authorized" and Affected".

(B) Program Administrator (Safety Manager):

(1) Review program at least annually, or more frequently if changes are needed or new equipment is aquired.

(2) Identifying the proper personal protective equipment (PPE) needed, if any, during the LOTO procedures.

(3) Providing appropriate level of safety training to employees based on their classification.

(4) Providing outside contractors working at the SWRP with training and information on the SWRP Lockout/Tagout Program and procedures.

(C) Superintendents and Supervisors:

(1) Ensuring that only Authorized Employees who are qualified and trained apply and remove locks and tags.

(2) Ensuring that employees who are found to have insufficient skills or understanding of LOTO requirements do not perform LOTO and receive retraining before conducting any lockout/tagout procedures.

(3) Ensuring employees comply with all elements described in this program.

(4) Providing any information necessary for the continued functioning or updating of this program.
(5) Implement disciplinary procedures for employees deviating from the LOTO procedure.

(D) Employee Classification:

(1) "Authorized" Employees: Employees who are trained on the dangers of exposure to hazardous energy and are authorized (and trained) to perform de-energization of this hazardous energy. Employess are also trained to perform proper lock and tag out on a machine or piece of equipment in order to conduct servicing or maintenance on that machine, tool or piece of equipment under this program.

Duties of an "Authorized" employee include:

(a) Completing all training required to be authorized to perform lockout/tagout procedures on specific equipment, tool(s) or machinery under this program.
(b) Performing lockout/tagout activities which are in conformance with this program.
(c) Retaining control of the equipment, system or machinery while a lockout/tagout is in progress and works only under their own lock and tag.
(d) Maintaining lockout/tagout hardware and tags in good condition.
(e) Notifications of staff.

(2) "Affected" Employees. All employees whose job requires them to operate or use a machine or piece of equipment on which servicing or maintenance activities are being performed under LOTO, or whose job requires them to be in an area in which LOTO is being used, are considered "Affected" employees. They are not authorized to implement lockout/tagout procedures.

IV. Training and Communication

(A) Authorized Employees and their Supervisors

(1) The SWRP has developed and will provide LOTO training on the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, the methods and means available for energy isolation and control, and removal of energy-control devices. Equipment-specific training will be accomplished by presenting applicable written procedures to Authorized Employees, verifying that they understand the requirements of the procedure and observing correct performance of the lockout/tagout procedure(s). Reference SOJP's, SMJP's, and O&M manuals. Employees shall be trained on all individual lockout devices.

(B) Affected Employees

(1) Affected Employees working in areas where lockout/tagout may be used will be trained in the purpose of the lockout/tagout program, identification of locks and tags and restrictions these impose on equipment operation.
(2) Affected Employees must be retrained if a significant OSHA regulation or SWRP lockout/tagout guideline change has been made (i.e., new requirement, change in locks or tags).
(3) Affected Employee retraining can be delivered through awareness campaigns. Other Employees will be trained on the procedure and instructed never to attempt to restart or reenergize a machine that has been locked out or tagged out.

(C) Retraining of Authorized and Affected Employees

Retraining is required if:

(1) There is a change in task assignment that involves use of different LOTO procedures for which the Authorized Employee has not been previously trained.

(2) There is a change in the machine, equipment or processes that presents new hazards.

(3) There is a change in the energy-control procedures.

(4) The Supervisor has reason to believe, or determines through a periodic inspection or observation, that an Authorized or Affected Employee is performing the energy-control procedures inadequately or has deviated from or lacks sufficient knowledge of established procedures.

(D) Record retention

(1) All training records, including employee names and training dates, will be maintained in the employee's personnel files, or in plant administrative safety files.

(2) Training records will be maintained indefinitely.

(3) Training will be certified using Attachment A (Authorized Personnel) or Attachment B (Affected and Other personnel). The certifications will be retained in the employee personnel files.

V. Lockout/Tagout Control

LOTO devices are provided by the Water Authority. LOTO devices must be standardized as to color, size and shape. Each authorized person will have access to his/her individual lockout devices. Locks must be individually keyed. It shall be the responsibility of the employees performing the maintenance or repair to implement the lockout/tag out procedure before work begins. Supervisors are responsible for maintaining LOTO stations.

Note: LOTO procedures are the required method of isolating equipment. Tag out alone shall only be used when it is not possible to lock out the energy-isolating device and **shall not** be considered as an alternative method until all other options have been proven "Infeasible". When alternative methods are proven infeasible and only a tagout is used a safety watch, visual barriers, and danger or caution tape are required to be in place.

(A) Short-term locks are working-locks that are individually keyed in *red*, working locks are to be attached to energy isolation devices by each person in a work crew. Working locks are to be removed when maintenance is no longer being performed. Whenever a working lock is used, a "Danger - Do Not Operate" lock out tag shall be attached to the working lock. The lock out tag must also include the date that the lock is attached, a legible name and radio number of the person attaching the lock (see Appendix A).

(B) Long-term locks are color coded for operations and each maintenance group as shown in the table below:

DEPARTMENT	COLOR
Electrical	White
Instrumentation	Yellow
Mechanical	Blue
Operations	Green
Operations (* construction coordination)	Black

* Black padlocks are used by the Operations Superintendent or Assistant Operations Superintendent for new construction, contractor coordination and assistance requests.

VI. TAG OUT REQUIREMENTS

Tags used in the LOTO program (Appendix A) will be constructed of a laminated material (so that the following information can be recorded/written with a "grease pencil"); this information will contain but not be limited to:

(1) Full name
(2) Date, radio number, and phone number if applicable
(3) Reason for the LOTO / description

These Tags will be standardized as described below:
When a long-term lock is used, an identification tag shall be attached to a lock. The identification tag must also include the date that the lock was attached, a legible name and radio number of the person attaching the lock, and a brief description of work. Long-term locks are common keyed per work group and controlled by work group supervisors.

A tag may be used when it is infeasible to, or may create an unsafe condition to use a lockout/tagout device, and such no other means of isolation is possible. This tag will need approval from the Superintendent.

Tags shall be attached in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "neutral" or "off" position is prohibited. Tags shall be attached using all environment-tolerant nylon tie-wraps. Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

Note: Other (caution or work order) tags are not part of the LOTO program, but is used for informational purposes. They are not intended for employee protection. This process is referred to as an "administrative control" and is not a part of the LOTO procedure.

VII. ENERGY CONTROL PROCEDURE

(1) Coordinate and plan the shutdown of process equipment with the plant or field operations supervisor, as appropriate. Operations is primarily responsible for shut down, isolation, and lockout of plant process equipment. All personnel shall place their work group specific lock on the isolation device relevant to the equipment that they will be working on, along with a lock out tag.
Note: Planning and coordination must be done between the affected groups and all isolation points must be identified and addressed prior to the commencement of any work.
(2) Notify impacted employees that a lock out procedure is going to be utilized, and advise them of the machine or equipment that is involved.
(3) Isolate the equipment from all applicable energy sources using the isolation switches, breakers, valves or other energy isolating devices as appropriate.
Example: To change the drive belts on a HVAC system, isolate the voltage source. To perform maintenance on the heating cores, on a HVAC System, isolate the voltage source and the hot water supply and return lines. Bleed any stored thermal and hydraulic energy.

(4) Relieve stored energy associated with the equipment. Stored energy (such as that in springs, elevated machine members, hydraulic systems and air, gas, steam or water pressure, etc.) must be dissipated or restrained by methods such as repositioning, blocking, bleeding down pressure, etc. *Example:* To remove a hotsy after isolating all energy sources (voltage, gas and water supplies), allow the unit to cool, bleed off the water pressure, and after ensuring proper ventilation, vent off the gas pressure before proceeding to remove the equipment.
(5) LOTO the energy isolating device with an assigned padlock and attach a tag (Appendix A) to the lock.
(6) Verify that the equipment will not operate using normal operating controls.

VIII. REMOVING THE LOTO FOR START-UP

(1) After the servicing and/or maintenance are complete, and equipment is ready for normal operation, check the area around the machine or equipment that is locked out. Ensure that no one is exposed to danger if the machine or equipment is energized.
(2) Check the machine or equipment to ensure that all tools have been removed from the machine or equipment and that any guards that were removed have been reinstalled.

CAUTION: Insure controls are in "neutral" or "off" position prior to start-up and testing of equipment. Follow applicable SOJP's when starting or testing equipment.

(3) Notify operations supervisor that the equipment is ready for testing or start-up. Plant Operations is responsible for the start-up of plant equipment by removing operations locks from energy isolating devices. Operate the energy isolating devices to restore energy to the machine or equipment. Test the operation of the machine or equipment that was locked out for proper operation.
(4) Notify shift supervisor and the control room operator that the machine or equipment is no longer locked out and available for service or appropriate equipment status.

IX. DISCIPLINARY ACTION REQUIRED FOR VIOLATING LOTO PROCEDURES

The only person authorized to remove the LOTO devices is that person who installed the devices; therefore, unauthorized removal or by-passing the LOTO device procedure compromises the worker's safety. Any person who violates a LOTO procedure and energizes, starts or otherwise activates a machine or who removes a LOTO device without authorization shall be disciplined according to Water Authority policies and procedures. Disciplinary action shall be taken whether or not injury or damage occurs.

X. PROCEDURES INVOLVING MORE THAN ONE PERSON

If more than one person is involved in the service or repair of a machine or equipment, each individual will place his/her personal LOTO device on all energy isolating devices. When an energy isolating device cannot accept multiple locks or tags, a multiple lockout device (a hasp) may be used.

If LOTO is used, a single lock may be used to lockout the machine or equipment, but the key to that lock must be placed in a lockout box or cabinet which allows the use of multiple locks to secure it. Each employee will then use his/her own lock to secure the box or cabinet. As each person no longer needs to maintain his/her LOTO protection, that person will remove his/her own lock from the lockout device or from the lockout box.

XI. PROCEDURES INVOLVING MORE THAN ONE WORK GROUP

When a work group finishes its daily work, the work crew shall ensure that all tools are removed. Only that crews red lock out device and identification tag shall be removed from the energy isolating device associated with the machine or equipment. The technician/operator shall not remove his/her lock until all coworkers and affected personnel are notified and clear. If the equipment is ready for service, the last work crew to complete its work will assist operations in the complete procedure for removing the lock out devices and ensuring proper operation.

There may be occasions when a LOTO device must remain in place for more than one work shift or after other personnel changes. The procedure depends on whether or not employees on the incoming shift will be working on the locked out or tagged out equipment.

(A) Service or repair work will be continued by the new shift:
Employees leaving the work place will remove their locks and incoming employees will connect their locks under the direct observation of their supervisors. The supervisors for both shifts will be present for the transfer of the LOTO.

(B) Employees on other shifts will not be working on the machines:
The LOTO devices will remain in place and the incoming personnel will be notified that a LOTO is in affect. The supervisors of both shifts will be responsible for ensuring that the information is made available to the incoming personnel.

XII. NON-ROUTINE REMOVAL OF A LOTO DEVICE

When the employee who applied the LOTO device is not available to remove it, the LOTO may be removed under the direction of the supervisor of the employee who applied the lock out device, or under the direction of the responsible superintendent. The rules for LOTO removal still apply. Moreover, the supervisor must:

(1) Verify that any Authorized Employee who applied lock(s) and associated tag(s) is not on duty and that their work is no longer in progress. All reasonable efforts will be made to contact the Authorized Employee(s) to discuss the planned removal of their lock(s) and determine if the Authorized Employee(s) have any safety concerns with removal of their lock(s).
(2) An Authorized Employee/Supervisor returns the equipment to service and notifies the Affected Employees that service or maintenance is completed and the equipment is ready for use.
(3) When the Authorized Employee(s) whose lock(s) were removed return to work, their Supervisor(s) will again notify them that their lock(s) and tag(s) were removed.

XIII. HOT TAP OPERATIONS

Hot Tap Operations requires preapproval of the Chief Engineer. Work involving transmission and distribution systems for substances such as gas, steam, water or petroleum can be performed on pressurized pipeline systems if:
(A) The employer can demonstrate that the continuity of service is essential.
(B) Shutdown of the system is infeasible, and could lead to employees being exposed to other

hazards. In this case employees will need to follow established safe work procedures, developed for these operations.

(C) Special equipment is used that will provide effective protection for employees.

XIV. AUDIT/INSPECTION OF THE LOTO PROCEDURE

All LOTO procedures will be reviewed at least **annually**. The procedure will be reviewed for adequacy and completeness by an Authorized Employee who does not regularly use the machine/equipment-specific lockout procedure or by the Safety Manager or his/her designee. If any deviations or inadequacies are identified, the Program Administrator will take all necessary steps to update the procedure. The annual inspection will include a review, between the Reviewer and each Authorized Employee of that machine/equipment, to determine if they understand their responsibilities under that procedure. Annual inspections are documented with the information shown in **Attachment D**. This inspection record will be retained indefinitely.

XV. PROCEDURES FOR OUTSIDE PERSONNEL/ CONTRACTORS

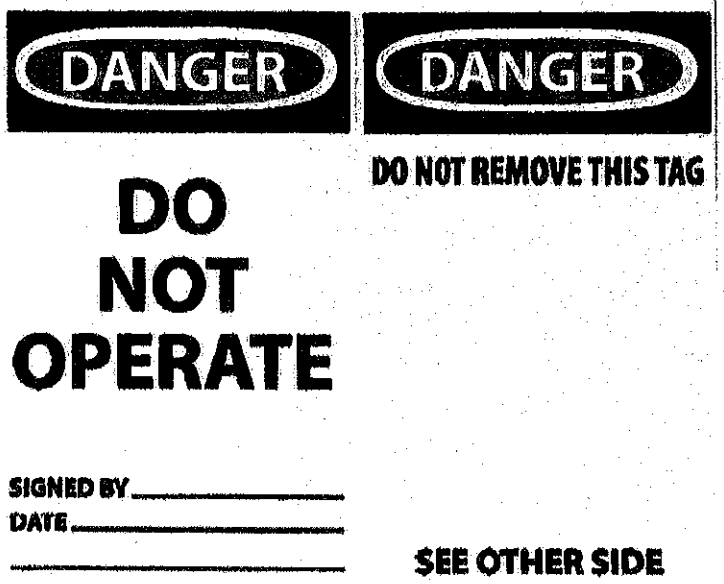
(A) Outside personnel/contractors shall be advised that the SWRP has and enforces the use of LOTO procedures. They will be informed of the use of locks and tags and notified about the prohibition of attempts to restart or re-energize machines or equipment that are locked out or tagged out.

(B) The company will obtain information from the outside personnel/contractor about their LOTO procedures and advise affected employees of this information.

(C) The outside personnel/contractor will be required to sign a certification form (see Attachment E). If outside personnel/contractor has previously signed a certification that is on file, additional signed certification is not necessary.

APPENDIX A

Lock Out Tag



ATTACHMENT A

Certification of Training
(Authorized Personnel)

I certify that I received training as an "Authorized Employee" under SWRP Lockout/Tagout program. I further certify that I understand the procedures and will abide by those procedures.

AUTHORIZED EMPLOYEE SIGNATURE

DATE

ATTACHMENT B

Certification of Training
(Affected Personnel)

I certify that I received training as an Affected Employee under SWRP Lockout/Tagout Program. I further certify and understand that I am prohibited from attempting to restart or re-energize machines or equipment that are locked out or tagged out.

AUTHORIZED EMPLOYEE SIGNATURE _____ DATE _____

ATTACHMENT C

Lockout/Tagout Equipment Inspection Certification

I certify that _____was inspected on this date utilizing lockout/tagout procedures. The inspection was performed while working on

_____.

_____ _____

AUTHORIZED EMPLOYEE SIGNATURE DATE

_____ _____

INSPECTOR SIGNATURE DATE

ATTACHMENT D

Annual Evaluation Report

Date(s) of Evaluation _____

Evaluation was made by _____.
(PRINT)

General policy has been reviewed: YES____NO____

Comments on general policy:

The following specific procedures have been reviewed (list below):

Does the procedure comply with the SWRP program?

If a specific lockout/tagout were inspected in the field placed by the employee evaluated:

Location: _____

Equipment No.: _____

Equipment Name: _____ Serial No.: _____

Department who apply the Lockout/Tagout in the machine/equipment: _____

Does the machine/equipment have properly the LOTO? Yes____ No____

If not explain what need to be addressed and fix it:_____

ATTACHMENT E

Outside Personnel/Contractor Certification

I certify that _____and _____ (outside personnel/contractor) have informed each other of our respective Lockout/Tagout procedures.

_____ _____

AUTHORIZED EMPLOYEE SIGNATURE DATE

_____ _____

INSPECTOR SIGNATURE DATE

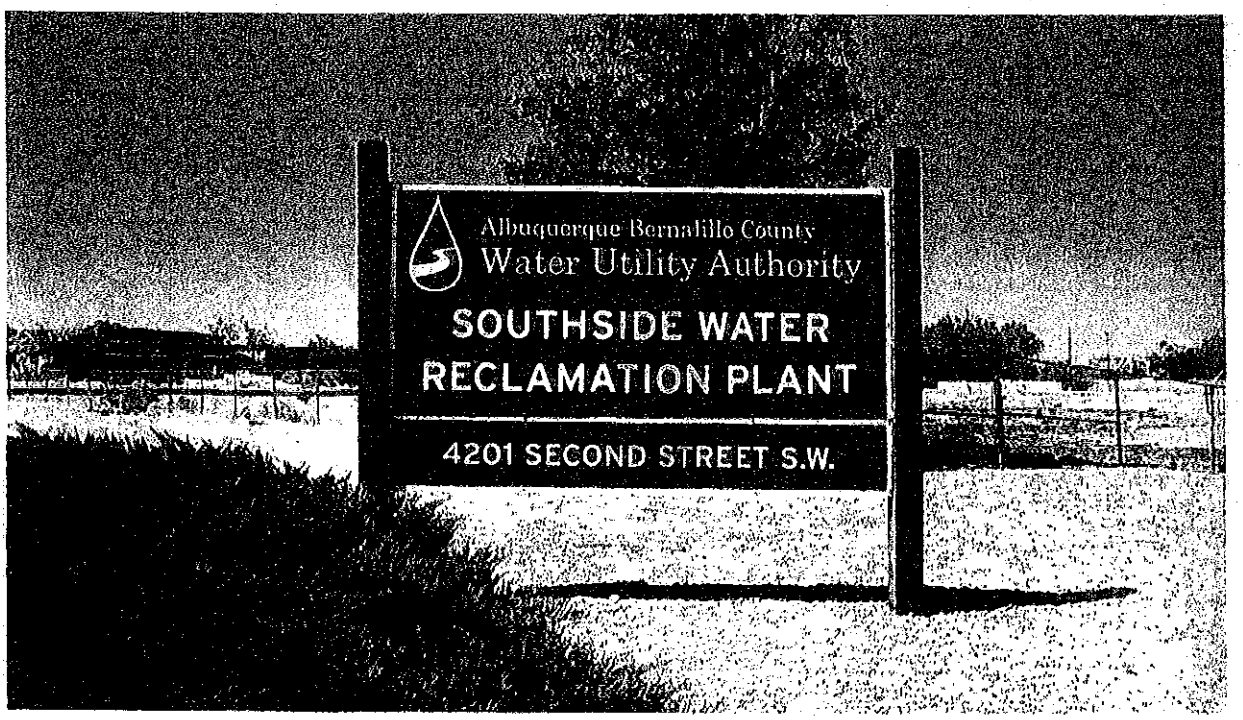
APPENDIX F

Albuquerque Bernalillo County Water Utility Authority

Confined Space Program

Albuquerque Bernalillo County
Water Utility Authority

Confined Space Program
For
Southside Water Reclamation Plant



Albuquerque Bernalillo County
Water Utility Authority

Southside Water Reclamation Plant

Confined Space Program

Last Revised: April 3, 2014

REVIEWED/APPROVED

SAFETY SUPERVISOR: _____

SWRP CHIEF ENGINEER: _____

SWRP OPERATIONS SUPERINTENDENT: _____

SWRP MAINTENANCE SUPERINTENDENT: _____

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CONFINED SPACE ENTRY PROCEDURES

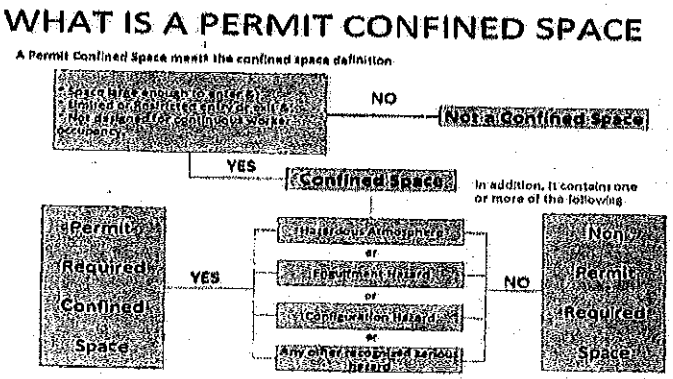
ALBUQUERQUE BERNALILLO COUNTY WATER UTILITY AUTHORITY
CONFINED SPACE ENTRY PROGRAM

I. Description of our Water Authority Program

The purpose of this program is to set forth the requirements for practices and procedures to protect Water Authority employees and contractors from exposure and injury from the hazards of entering and performing work in confined spaces. The policies and procedures in this document are elements that make up the Water Authority's Permit Space Program. This program is intended to meet and exceed the requirements of the U.S. Department of Labor, Occupational Safety and Health Administration's Confined Space Standard 29 CFR 1910.146.

II. Scope

This program applies to all confined spaces owned by the Water Authority. This program also applies to all confined spaces that may be entered by Water Authority employees. Included in this program are the Southside Water Reclamation Plant, Surface Water Treatment Plant, Sanitary Lift Stations, Storm Water Lift Stations, Well Stations, Water Pump Stations, and Chemical Feed Stations.



III. Requirements of the Water Authority

(1) In administering this Confined Space Entry Program the Chief Engineers and Safety Manager will:

(a) Monitor the effectiveness of the program;

(b) Provide training to affected employees and supervisors that is sufficient to impart necessary understanding, knowledge and skills;

(c) Certify that training has been accomplished. Certification must include employee's name, signature of trainer, dates of training;

(d) Provide atmospheric testing equipment as needed;

(e) Provide personal protective equipment as needed;

(f) Provide technical assistance as needed;

(g) Review and update the program on an annual basis or more often as needed.

(2) The Chief Engineers and Operation/Maintenance Superintendents are responsible for managing the Confined Space Entry Program in the Water Authority facilities and they will:

(a) Verify that all confined spaces at their facilities are properly labeled and maintained;
(b) Review all confined space entry permits for successful operation and perform "lessons learned" for any entry that experienced any problems or presented any condition that caused the permit to be canceled and the confined space to be evacuated;
(c) Maintain hard copies and electronic storage of all canceled/completed confined space entry permits. These canceled/completed permits will be kept for a minimum of 3 years;
(d) Require all employees who enter confined spaces to receive training which will make them both competent and qualified to perform confined space entry operations and establish employee proficiency in required duties;
(e) Verify that employees are provided all necessary confined space entry/rescue equipment, maintain that equipment properly, and ensure employees use that equipment properly;
(f) Perform monthly inspections of all related confined space entry equipment and verify all such equipment meets manufacturers' standards.

IV. Safety Policies and Regulations

It is the safety policy of the Water Authority that a confined space:
(1) Is large enough and so configured that an employee can bodily enter to perform assigned work; and
(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and
(3) Is not intended for continuous employee occupancy.

It is the safety policy of the Water Authority that a Permit-Required Confined Space means a confined space that has one or more of the following characteristics:
(1) Contains or has a potential to contain a hazardous atmosphere;
(2) Contains a material that has the potential for engulfing an entrant;
(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
(4) Contains any other recognized serious safety or health hazard.
Unauthorized entry into a permit-required confined space by Water Authority employees and contractors is forbidden and cause for disciplinary action.

Manpower and equipment shall be available during permit-required confined space entry to immediately and safely remove any disabled worker from the confined space. Assisted Self-Rescue is the approved procedure Water Authority employees will use to remove a disabled worker from a confined space.

Water Authority employees will perform Assisted Self-Rescue (ASR) vertical direct retrieval operations only. Horizontal confined space rescue is not allowed and will be contracted out to Rocco or some other confined space rescue service.

No Hot Work shall be conducted inside a confined space prior to completion of the appropriate Hot Work Permit.

Facial hair at the facepiece-to-face interface that may interfere with the operation of the full-face piece of the supplied air respirator shall not be permitted. This facial hair may include beards, sideburns, mustaches, long hair and or bangs.

Water Authority employees are required to consider all confined spaces as Permit-Required Confined

Spaces unless they can be reclassified as a Non-Permit Confined Space.

Multiple confined space entries are not to be monitored by a single attendant.

When the Water Authority arranges to have a contractor perform work that involves permit space entry, the Authority shall:
(1) Inform the contractor that the workplace contains permit-required confined spaces and that permit space entry is allowed only through compliance with the Water Authority permit space program;
(2) Apprise the contractor of the hazards identified and the Water Authority's experience to include but not limited to the presence of hydrogen sulfide (H_2S), carbon monoxide (CO), carbon dioxide (CO2), hydrogen chloride (HCL), and methane (CH4) gas in the space, that make the space in question a permit space;
(3) Apprise the contractor of any precautions or procedures that the Water Authority has implemented for the protection of employees in or near permit spaces where contractor personnel will be working;
(4) Coordinate entry operations with the contractor, when both Water Authority personnel and contractor personnel will be working in or near permit spaces;
(5) Meet and debrief the contractor at the conclusion of the entry operations regarding the Water Authority's permit space program regarding any hazards confronted or created in permit spaces during entry operations.

CONFINED SPACE IDENTIFICATION

V. Confined Space Identification

The Water Authority has implemented this written permit space program and it is available for inspection by employees and their authorized representatives. The Water Authority has evaluated the workplace and has determined that the workplace contains permit-required confined spaces. The permit spaces are posted with one or more of the following danger signs:

DANGER
PERMIT-REQUIRED CONFINED SPACE
AUTHORIZED ENTRY ONLY

DANGER
PERMIT-REQUIRED CONFINED SPACE
DO NOT ENTER

The Permit-Required Confined Spaces are also labeled with a number that identifies the confined space for identification and inventory purposes. The inventory label is PRCS followed by the confined space number, for example PRCS 365. This evaluation/inventory system will be used for annual review and to provide employees additional information about the confined space they will be working in. The Water Authority has evaluated the hazards of our permit spaces and the following procedures, practices, and acceptable entry conditions necessary for safe permit space entry operations are specified below.

VI. Permit-Required Confined Space Entry Permit

The Water Authority's confined space entry permit documents compliance with the Water Authority's Permit Space Program and authorizes entry to a permit space. The confined space entry permit is the most essential tool for assuring employee safety during entry operations in permit-required confined spaces with known hazards, or with unknown or potentially hazardous atmospheres. The entry permit process guides the entry supervisor, attendant, and entrants through a systematic evaluation of the permit space to be entered. The entry permit will be used to establish acceptable conditions before each entry and verify that conditions in the confined space are acceptable throughout the duration of an authorized entry.

VII. Permit-Required Confined Space Entry Procedures

(1) When entry into a permit-required confined space is necessary the Operations/Maintenance Superintendent from the appropriate section will select an entry supervisor, attendant, and entrant(s) to initiate the confined space entry procedures. An Operations/Maintenance Supervisor may also select the entry team.

(2) Prior to entry of the permit-required confined space, the entry supervisor, attendant, and entrant shall be responsible for the following:

(a) Completion of the confined space entry permit;
(b) Verify acceptable entry conditions in the confined space;
(c) Isolation of the permit space; establishing communication with the Control Room;
(d) Verifying the availability of the Assisted Self-Rescue service;
(e) Signature of the entry supervisor on the entry permit after its completion.

(3) Remove the entrance cover, hatch, or grating to the confined space to be entered. Any conditions making it unsafe to remove an entrance cover to the confined space shall be eliminated before the cover is removed. When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

(4) Before an employee enters the confined space, the internal atmosphere shall be tested, with a calibrated direct-reading gas detector, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Any entrant who enters the confined space shall be provided an opportunity to observe the pre-entry testing. The approved gas detectors for atmospheric testing are the RKI GX-2012, GX-2009 and GX-2001.

(5) Isolate the confined space from any potential hazards that may be encountered. This includes electrical hazards, mechanical hazards, Engulfment hazards, Entrapment hazards, and physical hazards. Make sure the proper isolation procedures are followed such as lock out/tag out, double block and bleed, blanked, blocked, chocked and disengaged. Document this isolation on the confined space entry permit. Employees are required to observe and assist with this isolating of the permit space.

(6) Ventilate the permit-required confined space with continuous forced air ventilation. The entry supervisor, attendant, and entrant shall be responsible for setting up the mechanical ventilation and it shall be used, as follows:

(a) An employee may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;
(b) The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space;
(c) The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.

(7) Test the confined space for a hazardous atmosphere. The entry supervisor, attendant, and entrant shall continuously monitor the atmosphere within the confined space. The pre-entry atmospheric check shall be documented on the entry permit. The entrant must have a calibrated gas detector on

his/her body at all times during entry operations. The entry supervisor, attendant, or designee shall monitor the atmosphere within the permit space from outside the confined space using a calibrated gas detector with a sample draw pump and tubing. This atmospheric testing will ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere. There may be no hazardous atmosphere within the space whenever any employee is inside the space.

(8) If a hazardous atmosphere is detected during entry;

(a) Each employee shall leave the space immediately;

(b) The space shall be evaluated to determine how the hazardous atmosphere developed;

(c) Measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

(9) The entry supervisor, attendant, and entrant shall establish the communication procedures to be used by the authorized entrants and attendants to maintain contact during entry operations. The preferred communication procedures are visual and voice contact at all times; every effort should be made to maintain this type of contact between the attendant and entrant. Visual contact at all times and the Authority radio system are also acceptable communication procedures. Any other communication procedures necessary must be preapproved by the entry supervisor.

(10) The attendant shall establish contact with the Control Room and inform the control room operator that a permit-required confined space entry is taking place. Give the control room operator the location of the confined space, authorized attendant, authorized entrant, and the purpose of the entry in case an emergency arises and emergency medical services needs to be contacted. A copy of the entry permit may also be posted in the Control Room if it is going to be a prolonged entry. The confined space entry permit must be located at the confined space during all entry operations.

(11) The entry supervisor shall select an Authority Assisted Self-Rescue Team required for the permit-required confined space entry. The entry supervisor will select an Assisted Self-Rescue team leader and team members. This Assisted Self-Rescue team will be responsible for rescue procedures associated with the confined space entry. Log this information down on the entry permit.

(12) The entry team (entry supervisor, attendant and entrant) shall procure all required personal protective equipment required for the permit entry. Don all equipment properly and set up the DBI-SALA confined space entry/retrieval system required for Assisted Self-Rescue.

(13) The entry supervisor shall certify that the confined space is safe for entry and that the pre-entry measures required by the confined space entry permit have been taken. The entry supervisor will then sign the permit-required confined space entry permit and allow work to commence.

(14) The entry supervisor shall assign a person to take periodic atmospheric tests of the atmosphere inside the confined space during entry operations. If an attendant is assigned this task it cannot interfere with his attendant duties. The interval between atmospheric readings shall be every 15 minutes unless specified otherwise by the entry supervisor. The names or initials of the person conducting these tests and an indication of when the tests were performed must be noted on the entry permit.

(15) When the confined space entry is completed the entry supervisor will make sure the permit is cancelled and closed out; all equipment is returned to its proper location and the entrance cover is replaced to the confined space.

Water Utility Authority

CONFINED SPACE ENTRY PERMIT

PERMIT VALID FOR 8 HOURS MAXIMUM ONLY. ALL COPIES OF PERMIT WILL REMAIN AT JOB SITE UNTIL JOB IS COMPLETED.
DATE: _____ PERMIT SPACE TO BE ENTERED: _____
PURPOSE OF ENTRY: _____
AUTHORIZED DURATION OF THE ENTRY PERMIT (Hours): _____
AUTHORIZED ENTRANTS (Full Name): _____, _____,
_____, _____,
AUTHORIZED ATTENDANTS (Full Name): _____, _____,
ENTRY SUPERVISOR (Full Name): _____

HAZARDS OF THE PERMIT SPACE TO BE ENTERED EMPLOYEES COULD BE EXPOSED TO THE FOLLOWING:	YES	NO	N/A	LIST
Engulfment/Entrapment	( )	( )	( )	_____
Presence of toxic gases	( )	( )	( )	_____
Presence of explosive/flammable gases	( )	( )	( )	_____
Oxygen deficiency	( )	( )	( )	_____
Bio-hazards	( )	( )	( )	_____
Wet conditions, slip, trip, and fall hazards	( )	( )	( )	_____

Mitigation: _____

ISOLATION OF THE PERMIT SPACE (Lock out/tag out devices specific to entry)	YES	NO	N/A	LIST & INITIAL ISOLATION
Electrical systems locked out and tagged out	( )	( )	( )	_____
Mechanical systems (blocked, chocked, disengaged)	( )	( )	( )	_____
Gas systems (blanked) locked out and tagged out	( )	( )	( )	_____
Liquid systems (double block, bleed) locked out	( )	( )	( )	_____
Secure area (Post, Flag, Barricade)	( )	( )	( )	_____

Mitigation _____

VENTILATION MODIFICATION	YES	NO	N/A	MODEL & FLOW RATE
Mechanical	( )	( )	( )	_____
Mechanical explosion proof	( )	( )	( )	_____
Natural ventilation only	( )	( )	( )	

ATMOSPHERIC CHECK AFTER ISOLATION AND VENTILATION
DATE: _____ TIME: _____ TESTER: _____ CALIBRATION DATE: _____ (Must be within 2 month period)
Percent Oxygen _____ % (Must be between 19.5% to 23.5%)
Explosive Gases _____ %LEL (Must be less than 10% LEL)
Toxic Gas (H2S) _____ PPM (Must be less than 5 PPM)
Toxic Gas (CO) _____ PPM (Must be less than 35 PPM)
Other (Specify) _____ PPM (Must be less than PEL)

COMMUNICATION PROCEDURES	YES	NO	N/A	LIST
Authority Radio System or Cellular Phone	( )	( )	( )	_____
Contact established with Control Room/Dispatch	( )	( )	( )	_____

RECLASSIFICATION (NON-PERMIT CONFINED SPACE)
If all hazards have been eliminated or mitigated, then this permit-required confined space can be reclassified as a non-permit confined space.

All hazards mitigated:	YES	NO
	( )	( )

Certification by: _____ Date: _____ Time: _____
(If "NO" continue with permit-required confined space procedures. If "YES" refer to WUA non-permit confined space procedures or OSHA 1910.146(C)(7) for further clarification on reclassifying a PRCS to non-permit confined space)

ASSISTED SELF-RESCUE & EMERGENCY SERVICES	YES	NO	N/A
Authority Assisted Self-Rescue on Site	( )	( )	( )
911 Emergency Medical Service Available	( )	( )	( )

Authority Assisted Self-Rescue Team (Full Name): _____, _____
Assisted Self-Rescue Team Leader: _____
All confined space, CPR, and first aid certifications current? YES ( ) If not do not proceed

PROTECTIVE CLOTHING AND EQUIPMENT IN ADDITION TO REGULAR HARD HAT, SAFETY SHOES AND SAFETY GLASSES

	YES	NO	N/A	LIST
Review MSDS, Post at Confined Space	( )	( )	( )	
Respiratory protection (Check one): ☐ SCBA ☐ Airline ☐ Cartridge type	( )	( )	( )	_____
Eye protection (Check one): ☐ Chemical goggles ☐ Face shield ☐ Dust goggles	( )	( )	( )	_____
Gloves (Check Type): ☐ Chemical ☐ Leather ☐ Other _____	( )	( )	( )	_____
Protective clothing (Check Type): ☐ Chemical suit ☐ Rubber apron ☐ Rubber boots	( )	( )	( )	_____
Electrical shock protection ☐ Flash suit ☐ Rescue hook ☐ Hot stick	( )	( )	( )	_____
Full body harness with lifeline, **(Mandatory)**	( )	( )	( )	_____
Rescue davit & retrieval winch **(Mandatory)**	( )	( )	( )	
Hearing protection _____	( )	( )	( )	
Fall protection _____	( )	( )	( )	
Lighting (Explosive Proof) _____	( )	( )	( )	
Hot work permit	( )	( )	( )	
Fire extinguishers _____	( )	( )	( )	
First Aid kit	( )	( )	( )	

I have reviewed the work authorized by this permit and the information contained here-in.
Permit Approved By:
ENTRY SUPERVISOR: _____
(Printed Name) (Signature)
Reviewed By: (Unit Superintendent) _____
(Printed Name) (Signature)
Reviewed By (Safety Manager) _____
(If Available #239-4122) (Printed Name) (Signature)

ATMOSPHERE TEST RESULTS, RECORD CONTINUOUS MONITORING RESULTS EVERY 15 MINUTES OR AS NECESSARY TO ENSURE PERMIT COMPLIANCE.
(Permissible safe limits for personnel are 19.5 - 23.5% Oxygen, less than TWA for toxics and less than 10% LEL.)
Instrument Model _____ Serial # _____ Date Calibration Performed? _____ Calibration Performed by Whom? _____

Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____
Tester_____ Time_____ Oxygen_____%, LEL._____%, H2S_____PPM, CO_____

VIII. Duties of Authorized Entrants

(1) Complete all required confined space training prior to entry operations.

(2) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure. Review the appropriate Material Safety Data Sheet (MSDS) for each chemical hazard that may be encountered;

(3) Properly use equipment as required by the Water Authority's permit-required confined space program. This equipment must be properly maintained and includes:

(a) Testing and monitoring equipment (RKI GX-2012, GX-2009 or GX-2001);
(b) Ventilating equipment needed to obtain acceptable entry conditions;
(c) Communications equipment;
(d) Personal protective equipment;
(e) Lighting equipment needed to work safely and to exit the space quickly in an emergency;
(f) Barriers and shields;
(g) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;
(h) Rescue and emergency equipment;
(i) Any other equipment necessary for safe entry into and rescue from permit spaces.

(4) Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by the permit-required confined space program.

(5) Alert the attendant whenever the entrant recognizes any warning sign or symptom of exposure to a dangerous situation or the entrant detects a prohibited condition.

(6) Exit from the permit space as quickly as possible whenever:

(a) An order to evacuate is given by the attendant or the entry supervisor;
(b) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
(c) The entrant detects a prohibited condition; or
(d) An evacuation alarm is activated.

IX. Duties of Attendants

(1) Complete all required confined space training prior to entry operations.

(2) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure. Review the appropriate MSDS for each chemical hazard that may be encountered;

(3) Is aware of possible behavioral effects of hazard exposure in authorized entrants;

(4) Continuously maintain an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants accurately identifies who is in the permit space;

(5) Remain outside the permit space during entry operations until relieved by another attendant;

(6) Communicate with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the confined space;

(7) Monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

(a) If the attendant detects a prohibited condition;
(b) If the attendant detects the behavioral effects of hazard exposure in an authorized entrant;
(c) If the attendant detects a situation outside the space that could endanger the authorized entrants; or
(d) If the attendant cannot effectively and safely perform all the duties required;

(8) Activate assisted Self-Rescue Procedures or summon emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

(9) Take the following actions when unauthorized persons approach or enter a permit space while entry is underway:

(a) Warn the unauthorized persons that they must stay away from the permit space;
(b) Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and
(c) Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;

(10) Perform non-entry rescue as specified by the Water Authority Assisted Self-Rescue procedures; and

(11) Perform no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

X. Duties of Entry Supervisors

(1) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure. Review the appropriate MSDS for each chemical hazard that may be encountered;

(2) Check that the appropriate entries have been made on the permit, all tests specified by the permit have been conducted and all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(3) Terminate the entry and cancel the permit when;

(a) The entry operations covered by the entry permit have been completed; or
(b) A condition that is not allowed under the entry permit arises in or near the permit space;

(4) Verify Authority Assisted Self-Rescue services are available and that the means for summoning them are operable;

(5) Remove unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

(6) Reevaluate the permit space in the presence of any authorized entrant who has reason to believe

that the evaluation of that permit space may not have been adequate;

(7) Determine, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

(8) The Entry Supervisor shall provide at least one authorized attendant outside the permit space into which entry is authorized for the duration of entry operations. Multiple spaces are not to be monitored by a single attendant according to the Water Authority's Permit Space Program.

NON-PERMIT CONFINED SPACE

XI. Non-Permit Confined Space

(1) A non-permit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm. The only hazard posed by the confined space is an actual or potential hazardous atmosphere.

(2) A space classified by the Authority as a permit-required confined space may be reclassified as a non-permit confined space under the following procedures:

(a) If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated.

(b) If it is necessary to enter the permit space to eliminate hazards, such entry shall be performed as a permit-required confined space entry. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated.

(c) The Authority shall document the basis for determining that all hazards in a permit space have been eliminated through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification shall be made available to each employee entering the space. This non-permit confined space certification shall be documented through the Confined Space Entry Permit.

(d) If hazards arise within a permit space that has been declassified to a non-permit required confined space, each employee in the space shall exit the space. The entry supervisor shall then reevaluate the space and determine whether it must be reclassified as a permit space.

(3) The Water Authority has determined that many of the permit-required confined spaces around its facilities may be declassified or reclassified to a non-permit required confined space if the proper reclassification procedures have been followed and documented. This reclassification procedure requires an entry supervisor, authorized attendant, or authorized entrant to perform an analysis of the hazards within the confined space and demonstrate and certify that these hazards have been eliminated.

(4) The certification that these confined space hazards have been eliminated will be accomplished through the first page of the Water Authority's Confined Space Entry Permit. The first page of the confined space entry permit will require an employee to document his or her basis for making a non-permit confined space reclassification and document the procedures followed. If the confined space cannot be reclassified as a non-permit confined space then it shall be treated as a permit-required confined space and the appropriate procedures shall be followed.

(5) All confined spaces shall be considered permit-required confined spaces until the pre-entry procedures completed on the Confined Space Entry Permit demonstrate that the space can be maintained in a safe condition for entry by natural ventilation or mechanical ventilation alone.

(6) When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, the Authority shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

XII. Non-Permit Confined Space Entry Procedures

(1) Prior to initiating the entry, the entry supervisor, attendant, and entrant shall:

(a) Obtain the Confined Space Entry Permit/Reclassification Form for the confined space to be entered. The Confined Space Entry Permits are on file in the SWRP Control Room or appropriate Maintenance/Operations shop.

(b) Assess whether or not recent changes due to construction, equipment failures, or other causes may have generated actual or potential hazards not anticipated in the Reclassification Permit.

(c) Designate authorized entrant(s).

(d) Designate authorized attendant(s).

(e) Designate Assisted Self-Rescue team members, minimum of two including the team leader.

(f) Establish contact with the Assisted Self-Rescue Team Leader and the Control Room. Advise them of all relevant details of the proposed entry, providing at least, the following information:

(1) Exact location of the confined space to be entered.

(2) Number of people who will be performing the entry.

(3) Estimated length of time the work will take.

(4) Radio call number of the authorized attendant.

(g) Verify that all required personal protective equipment, rescue equipment, and hazardous gas monitors are available for the entry to take place.

(h) The authorized attendant and authorized entrant shall check the calibration on the hazardous gas monitor and verify the operability of the gas detection equipment.

(2) Any conditions making it unsafe to remove an entrance cover to the confined space shall be eliminated before the cover is removed.

(3) When the entrance cover(s) are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening.

(4) Test atmospheric conditions in the confined space to determine if acceptable entry conditions exist before entry is authorized to begin and are being maintained during the course of entry operations;

(a) When testing for atmospheric hazards, test for oxygen first, test for combustible gases and vapors second, and then for toxic gases and vapors.

(5) Acceptable atmospheric conditions inside the confined space shall be 19.5% to 23.5% oxygen, less than 10% LEL, less than 5 ppm H_2S, and less than 35 ppm CO.

(6) The authorized attendant and authorized entrant shall continuously and independently monitor the atmosphere inside the non-permit confined space during entry operations. The entrant must have a calibrated gas detector on his/her body at all times during entry operations. The attendant shall monitor the atmosphere within the space from outside the confined space using a calibrated gas detector with a sample draw pump and tubing.

(7) The authorized attendant shall maintain contact with the Control room and the Assisted Self-Rescue team leader during entry operations.

(8) The authorized attendant shall notify the Control Room and the Assisted Self-Rescue team leader upon completion of the work inside the confined space.

(9) The confined space entrance shall be properly secured by entrant(s) before leaving the site.

(10) All equipment used during the entry operation shall be returned to proper storage.

ASSISTED SELF-RESCUE AND EMERGENCY SERVICES

XIII. Assisted Self-Rescue and Emergency Services

(1) The Water Authority will provide Assisted-Self Rescue Services to all employees required to enter permit-required confined spaces. Assisted Self-Rescue means trained, equipped rescuers standing by outside the confined space, prepared to perform vertical direct retrieval operations. Water Authority employees will not perform horizontal confined space rescue, an outside contractor like ROCCO will be contracted out to perform horizontal confined space rescue. Water Authority employees who have been designated to provide vertical permit space Assisted Self-Rescue shall be considered Assisted Self-Rescue Team members and shall take the following measures:

(a) Assisted Self-Rescue Team members shall be trained as permit space entrants and attendants at a minimum, including training in the potential hazards of all permit spaces from which rescue may be needed. Assisted Self-Rescue Team members shall demonstrate proficiency to perform assigned rescue duties;

(b) Assisted Self-Rescue Team members will be provided with and properly trained in the use and need for PPE, such as SCBA or fall arrest equipment, which may be required to perform permit space rescues. Every team member shall be properly trained to perform his or her functions and make rescues, and to use any rescue equipment, such as ropes and harnesses, that may be needed in a rescue attempt. Assisted Self-Rescue Team members shall demonstrate proficiency in the use of that PPE;

(c) Assisted Self-Rescue Team members shall be trained in the first aid and medical skills needed to treat victims overcome or injured by the types of hazards that may be encountered in the permit spaces until Emergency Medical Services arrive. At least one member of the rescue team must have current certifications in CPR, Basic First Aid, and Hazwoper 40; and

(4) Assisted Self-Rescue Team members shall practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces.

(2) Assisted Self-Rescue Team members shall focus on their own safety before considering the safety of the victim. Members shall be able to test the atmosphere to determine if it is IDLH. Members shall be able to identify information pertinent to the rescue from entry permits, hot work permits, and MSDSs.

(3) To facilitate non-entry rescue, employees will use the DBI-SALA confined space entry/retrieval systems whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of injury or would not contribute to the rescue of the entrant. The DBI SALA retrieval systems meet the following requirements:

(a) Each authorized entrant (includes rescue entrants) must use a full body or chest harness, with a

retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head.

(b) The other end of the retrieval line shall be attached to the DBI-SALA rescue davit retrieval system outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. The rescue davit retrieval system shall be available to retrieve personnel from vertical type permit spaces more than 5 feet deep.

(4) If an injured entrant is exposed to a substance for which a MSDS or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

(5) Assisted Self-Rescue Team members shall properly package and retrieve victims from a permit space that has a limited size opening (less than 24 inches in diameter), limited internal space, or internal obstacles or hazards. Airline respirators shall be used when required.

(6) The Chief Engineer, Safety Manager, Superintendents, and Assisted Self-Rescue Team members shall develop a plan for each of the kinds of permit space rescue operations at the facility that may be required. This rescue plan shall be developed in writing and shall be updated annually or as needed. Rescue operation plans of representative permit spaces with: Internal configuration, Elevation, Portal size and Space access.

XIV. Assisted Self-Rescue Procedures

Once an employee is assigned to an Assisted Self-Rescue Team or is selected to be an Assisted Self-Rescue team leader the following procedures shall be followed:

(1) Obtain all required personal protective equipment (PPE) as well as monitoring, communication, and rescue equipment to make a rescue feasible. SCBAs and mechanical ventilation are an example of PPE required to be on site at all times. Most of the required PPE will be housed in the Safety Equipment Building adjacent to the Operations and Maintenance Facility;

(2) Set up the required DBI-SALA rescue/retrieval equipment at the confined space to be entered before entry operations begin. This will ensure immediate Assisted Self-Rescue services are available at all times;

(3) Assisted Self-Rescue Team members will evaluate the confined space and scheduled work to be completed and assist with the isolation of the confined space and mitigation of all confined space hazards;

(4) Assisted Self-Rescue Team members will come up with a rescue plan that details how to rescue authorized entrants should an emergency situation arise. This rescue plan can be verbal among the rescue team members or it can be a written plan as long as all rescue team members understand how rescue procedures will be conducted and their roles;

(5) The Assisted Self-Rescue Team shall outfit every authorized entrant with a chest or full body harness equipped with fall protection, a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, and a retrieval hoist system. The confined space entry/rescue equipment authorized by the Water Authority is the DBI-SALA hoist systems;

(6) Continuously monitor the atmospheric conditions and potential hazards during entry operations. Two gas detectors are required during entry/rescue procedures, one detector on the entrant and the

other outside the confined space monitoring the internal atmosphere. Perform required duties until entry operations are completed. Assisted Self-Rescue Team members have the authority to stop permit space entry operations should a prohibited condition be detected;

(7) Once entry operations have been completed and the confined space entry permit has been cancelled, return all rescue equipment and personal protective equipment to its proper location. Please make sure the entrance cover to the confined space is properly secured.

DEFINITIONS

XV. Definitions

Acceptable entry conditions means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

Assisted Self-Rescue means Water Authority employees trained to provide vertical confined space rescue procedures.

Attendant means an individual stationed outside a permit space who monitors the authorized entrants and who performs all attendant's duties assigned in the Water Authority Permit Space Program.

Authorized entrant means an employee who is authorized by the Water Authority to enter a permit space.

Bio-Hazard or Biological Hazard refers to biological substances that pose a threat to the health of living organisms, primarily that of humans. This can include medical waste or samples of a microorganism, virus or toxin that can affect human health. It can also include substances harmful to animals.

Blanking or blinding means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (spectacle blind or skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

Confined space means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

Double block and bleed means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Emergency means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entrapment/engulfment means converging walls; to swallow up or overwhelm by or as if by overflowing and enclosing.

Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry permit means the written or printed document that is provided by the Water Authority to allow and control entry into a permit space and that contains the information required in **1910.146(f) Entry permit.**

Entry supervisor means the person (such as the operations/maintenance supervisor or superintendent) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by the Water Authority Permit Space Program.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, and impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this part and which could result in employee exposure in excess of its dose or permissible exposure limit;

(5) Any other atmospheric condition that is immediately dangerous to life or health.

Hot work permit means the Water Authority written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Immediately dangerous to life or health (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Inerting means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Isolation means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Line breaking means the intentional opening of a pipe, line, or duct that is or has been carrying

flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

Mitigate or Mitigation means to become less harsh or to eliminate the hazard.

Non-permit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Oxygen deficient atmosphere means an atmosphere containing less that 19.5 percent oxygen by volume.

Oxygen enriched atmosphere means an atmosphere containing more than 23.5 percent oxygen by volume.

Permit-required confined space means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;
(2) Contains a material that has the potential for engulfing an entrant;
(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
(4) Contains any other recognized serious safety or health hazard.

Permit-required confined space program means the Water Authority's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

Permit system means the Water Authority's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue service means the personnel designated to rescue employees from permit spaces. This rescue service could be provided by a contractor such as ROCCO.

Retrieval system means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

SWRP means the Southside Water Reclamation Plant.

TRAINING

XVI. Training

Training shall be provided by the Water Authority so that all employees whose work is regulated by the permit space program acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned.

(A) Training shall be provided to each affected employee:

(1) Before the employee is first assigned duties under the permit space program;

(2) Before there is a change in assigned duties;

(3) Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;

(4) Whenever the Water Authority has reason to believe either that there are deviations from the permit space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

(B) The training shall establish employee proficiency in the duties required by the permit space program and shall introduce new or revised procedures, as necessary, for compliance.

(C) The Water Authority shall certify that the training required of this program has been accomplished. The certification shall contain each employee's name, the signatures or initials of the trainers, and the dates of training. The certification shall be available for inspection by employees.

XVII. Respirator Fit Testing

Before a Water Authority employee may be required to use any respirator with a negative or positive pressure tight-fitting face-piece, the employee must be fit tested with the same make, model, style, and size of respirator that will be used. Water Authority employees will use the SCOTT AV-3000 full facepiece respirator or the SCOTT XCEL half facepiece respirator.

(A) The Water Authority shall ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT).

(B) Employees using a tight-fitting facepiece respirator are to be fit tested prior to initial use of the respirator and whenever a different respirator facepiece (size, style, model, or make) is used. Employees must pass a qualitative fit test at least annually thereafter.

(C) The Water Authority shall conduct an additional fit test whenever the employee reports, or the employer, PLHCP, supervisor, or program administrator makes visual observations of, changes in the employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.