# PRELIMINARY WATER BASIS OF DESIGN REPORT
## FOR
# Gallery

A residential community located in the City of Scottsdale, Arizona

Accepted w/ Comments
City of Scottsdale
Water Resources Administration
9379 E. San Salvador
Scottsdale, AZ 85258

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August 31, 2015

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EXP. 9-30-16

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# 1.0 INTRODUCTION

## 1.1 Project Description

K Hovnanian Great Western Homes is planning the development of a 1.2-acre high density residential subdivision known as Gallery. Gallery is being developed in one phase.

The purpose of this report is to provide a preliminary basis of design of the potable water system for the proposed development. The analysis will determine if Gallery can be adequately serviced within the current pressure zone. The proposed site will be developed in one phase and include 18 single-family residential lots, a community pool, and open space. This report has been prepared to meet the requirements of the City of Scottsdale, the Maricopa County Environmental Services Department (MCESD), the Arizona Administrative Code (AAC), and the Arizona Department of Environmental Quality (ADEQ).

## 1.2 Project Location

Gallery is located at the southeast corner of 71st Street and Earll Drive in Scottsdale, Arizona. The site is bounded on the north by Earll Drive, on the east by an existing automotive repair service, on the west by a small apartment complex, and on the south by an accident repair shop

More specifically, the project is located within the southeast quarter of Section 27 of Township 2 North, Range 4 East, of the Gila and Salt River Meridian, within the City of Scottsdale, Arizona. The location of the property is depicted in *Exhibit 1- Location and Vicinity Map*.

### 1.3 Topographic Conditions and City of Scottsdale Pressure Zones

The existing topography for Gallery varies slightly. The site has a gradient fall of approximately 2 feet from the north to south, sloping at approximately 0.65%. The project site currently is undeveloped space. Onsite elevations range from approximately 1241 to 1243 feet above mean sea level (MSL).

There are several pressure zones throughout the City of Scottsdale. Gallery is within Pressure Zone 1 which is located between the elevations of 1,180 and 1,280 (Ref. 1). The lowest proposed ground elevation for Gallery is designed at an approximate elevation of 1,243feet. The highest proposed ground elevation for Gallery is 1,244.5 feet.

### 1.4 Existing Facilities

Gallery will be supplied from a 6-inch water line in Earll Drive that will connect to the proposed 8-inch line that will run through the site servicing all 18 lots.

## 2.0 WATER SYSTEM DESIGN PARAMETERS

### 2.1 Water System Requirements

The design criteria used in the analysis was based upon the criteria required by the City of Scottsdale Design Standards & Policies Manual (Ref. 1). The water system requirements that serve as the basis of the proposed water plan are listed below:

- For single-family residential developments, the unit demand is 248.2 gallons per household per day.
- The maximum day demand is 2.0 times the average day demand, and the peak hour demand is 1.75 times the maximum day demand.
- The minimum required pressure throughout the water distribution system for average day, maximum day, and peak hour flow demand is 50 pounds per square inch (psi). Maximum water pressure at all service locations is not to exceed 120 psi. The minimum allowable pressure for maximum day plus fire flow is 30 psi.

- The City of Scottsdale fire flow requirements are listed below in *Table 2.1.1 City of Peoria Fire Flow Criteria.*

**Table 2.1.1 City of Scottsdale Fire Flow Criteria**

| **Development Type** | **Flow (gpm)** |
|---|---|
| Single-family Residential (with sprinklers) | 500 |
| Multi-family Residential (with sprinklers) | 500 |
| Commercial (with sprinklers) | 1,500 |

- A Hazen-Williams Coefficient of 130 is to be used to model the proposed water distribution system.

- Maximum headloss is 8-feet of head per 1,000-feet of water line for transmission lines, and 10-feet of head per 1,000-feet of water line for distribution lines.

- Minimum water line sizes:
  - Section Lines: 16-inches
  - Mid-section Lines: 12-inches
  - Local Streets 8-inches

- Water quality sampling stations are required at a rate of one sampling station per 300 dwelling units or less. A water quality sampling station will not be installed on-site with the final construction documents unless specifically requested by the city.

## 3.0 PROPOSED WATER SYSTEM

### 3.1 Water Demand Calculations

Gallery projected potable water demands for the average day, maximum day, and peak hour are listed below in *Table 3.1.1 Water Demand Calculations*. Demands are calculated based on the criteria listed above in *Table 2.1.1 City of Scottsdale Unit Water Demands*. Detailed calculations for the site are included in the Appendix.

**Table 3.1.1 Water Demand Calculations**

| Average Day Demand (gpm) | Maximum Day Demand (gpm) | Peak Hour Demand (gpm) |
|---|---|---|
| 3.1 | 6.2 | 10.9 |

## 4.0 WATER SYSTEM MODELING

### 4.1 Water Distribution System

Gallery's water distribution system will consist of an 8-inch water distribution main in the local street. Water meters for residential and landscape use will be provided based on City of Scottsdale requirements. The water distribution system has been designed to meet the requirements outlined in Section 2.0 of this report. The water supply will be provided from an existing 6-inch line in Earll Drive. Onsite water line will be terminated with a fire hydrant or blow-off assembly. The water line and hydrant will be located within a 20 foot wide water easement.

Metering concept —
- each unit has own meter / fire line similar to SFR
- continuous fire wall between units.

## 4.2 Water Model Analysis

Gallery's proposed water system network was analyzed using Haestad Methods WaterCAD version 6.5. Demands for the individual lots were assigned to nodes based on their proximity to each node. The project was modeled for the Average Day, Max Day, Peak Hour, and Max Day plus Fire Flow. A pump was used to match the condition in the field by using a three point pump curve and the results of a fire hydrant test (Appendix E). The model output reports are located in the Appendix. Elevations of all junctions were set based on the existing topography of the site. A fire flow demand of 500 gpm was assigned to all single family unit nodes. A Hazen-Williams "C" value of 130 was used for all pipes within the system. Exhibit 2 shows the approximate location and size of the proposed distribution mains within Gallery.

## 4.3 Water Model Results

Based on the results of the water model, the system provides a minimum pressure of 82 psi within the site during the peak hour demand and a maximum pressure of 83 psi for the average day demand. These pressures are within the acceptable range from the City of Scottsdale *Design Standards & Policies Manual* (Ref. 1). The appropriate fire flow can be obtained at all junctions on site while maintaining a pressure greater than 30 psi. A detailed list of all junctions and pipes can be found in Appendices A, B, C, and D.

## 5.0 CONCLUSIONS

Based on the analysis presented in this Preliminary Water Basis of Design Report, the following conclusions are drawn:

1. This report was prepared in accordance with the recommendations and design parameters of the City of Scottsdale.

2. The proposed water distribution system pressures and velocities for Gallery are in accordance with the City of Scottsdale design criteria and are sufficient to meet the demand requirements for the development.

3. The calculations and the design of the water system within this report have been based on generally accepted engineering practices and in accordance with the City of Scottsdale requirements.

## 6.0 REFERENCES

1. *City of Scottsdale, Design Standards & Policies Manual*, January 2010.

# APPENDIX

# APPENDIX A

## WaterCAD Analysis – Average Day

# Scenario: Average Day
# Steady State Analysis
# Pipe Report

| Label | Length (ft) | Diameter (in) | Material | Hazen-Williams C | Check Valve? | Minor Loss Coefficient | Control Status | Discharge (gpm) | Pressure Pipe Headloss (ft) | Headloss Gradient (ft/1000ft) | Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | 83.00 | 6.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 3.10 | 0.00 | 0.00 | 0.04 |
| P-2 | 126.00 | 6.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 3.10 | 0.00 | 0.00 | 0.04 |
| P-3 | 330.00 | 8.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 3.10 | 0.00 | 0.00 | 0.02 |

# Scenario: Average Day
# Steady State Analysis
# Junction Report

| Label | Elevation (ft) | Type | Base Flow (gpm) | Pattern | Demand (Calculated) (gpm) | Calculated Hydraulic Grade (ft) | Pressure (psi) |
|---|---|---|---|---|---|---|---|
| J-1 | 1,243.00 | Demand | 0.00 | Fixed | 0.00 | 1,432.45 | 81.97 |
| J-2 | 1,241.00 | Demand | 3.10 | Fixed | 3.10 | 1,432.45 | 82.83 |

# APPENDIX B

## WaterCAD Analysis – Maximum Day

# Scenario: Maximum Day
# Steady State Analysis
# Junction Report

| Label | Elevation (ft) | Type | Base Flow (gpm) | Pattern | Demand (Calculated) (gpm) | Calculated Hydraulic Grade (ft) | Pressure (psi) |
|---|---|---|---|---|---|---|---|
| J-1 | 1,243.00 | Demand | 0.00 | Fixed | 0.00 | 1,432.45 | 81.97 |
| J-2 | 1,241.00 | Demand | 6.20 | Fixed | 6.20 | 1,432.45 | 82.83 |

# Scenario: Maximum Day
# Steady State Analysis
# Pipe Report

| Label | Length (ft) | Diameter (in) | Material | Hazen-Williams C | Check Valve? | Minor Loss Coefficient | Control Status | Discharge (gpm) | Pressure Pipe Headloss (ft) | Headloss Gradient (ft/1000ft) | Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | 83.00 | 6.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 6.20 | 0.00 | 0.01 | 0.07 |
| P-2 | 126.00 | 6.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 6.20 | 0.00 | 0.01 | 0.07 |
| P-3 | 330.00 | 8.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 6.20 | 0.00 | 0.00 | 0.04 |

# APPENDIX C

## WaterCAD Analysis – Peak Hour

# Scenario: Peak Hour
# Steady State Analysis
# Pipe Report

| Label | Length (ft) | Diameter (in) | Material | Hazen-Williams C | Check Valve? | Minor Loss Coefficient | Control Status | Discharge (gpm) | Pressure Pipe Headloss (ft) | Headloss Gradient (ft/1000ft) | Velocity (ft/s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| P-1 | 83.00 | 6.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 10.90 | 0.00 | 0.02 | 0.12 |
| P-2 | 126.00 | 6.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 10.90 | 0.00 | 0.02 | 0.12 |
| P-3 | 330.00 | 8.0 | Ductile Iron | 130.0 | true | 0.00 | Open | 10.90 | 0.00 | 0.00 | 0.07 |

# Scenario: Peak Hour
# Steady State Analysis
# Junction Report

| Label | Elevation (ft) | Type | Base Flow (gpm) | Pattern | Demand (Calculated) (gpm) | Calculated Hydraulic Grade (ft) | Pressure (psi) |
|---|---|---|---|---|---|---|---|
| J-1 | 1,243.00 | Demand | 0.00 | Fixed | 0.00 | 1,432.44 | 81.96 |
| J-2 | 1,241.00 | Demand | 10.90 | Fixed | 10.90 | 1,432.44 | 82.83 |

## APPENDIX D

## WaterCAD Analysis – Maximum Day + Fire Flow

# Scenario: Max Day + Fire Flow
# Fire Flow Analysis
# Fire Flow Report

| Label | Satisfies Fire Flow Constraints? | Needed Fire Flow (gpm) | Available Fire Flow (gpm) | Total Flow Needed (gpm) | Total Flow Available (gpm) | Calculated Residual Pressure (psi) | Minimum Zone Pressure (psi) | Calculated Minimum Zone Pressure (psi) | Minimum Zone Junction |
|---|---|---|---|---|---|---|---|---|---|
| J-1 | true | 1,000.00 | 1,200.00 | 1,000.00 | 1,200.00 | 67.10 | 20.00 | 67.97 | J-2 |
| J-2 | true | 1,000.00 | 1,200.00 | 1,006.20 | 1,206.20 | 64.28 | 20.00 | 67.10 | J-1 |

## APPENDIX E

## Fire Hydrant Flow Tests

# ALLIANCE FIRE PROTECTION CO.

Phone: (480) 966-9178 Fax: (480) 967-9191
2114 East Cedar Street • Tempe, Arizona 85281
E-mail Address: afpc@afpc.com

AZ Lic. C-16 58130
AZ Lic. L-16 74007
NV Lic. C-41a 30135


## FIRE HYDRANT FLOW TEST

Name: Hoskin-Ryan Consultants
The Gallery
71st And Earl
Scottsdale AZ

Date: 06/08/15
Time: 7:30 AM
Report #
Tech: R.Pfeiff

Static Hydrant: NWC of 71st & Earl
Flowing Hydrant: NEC of 71st & Earl

Elevation:
Elevation:

Dist. Between Hydrants: 100 yards
Type of Supply: City Main

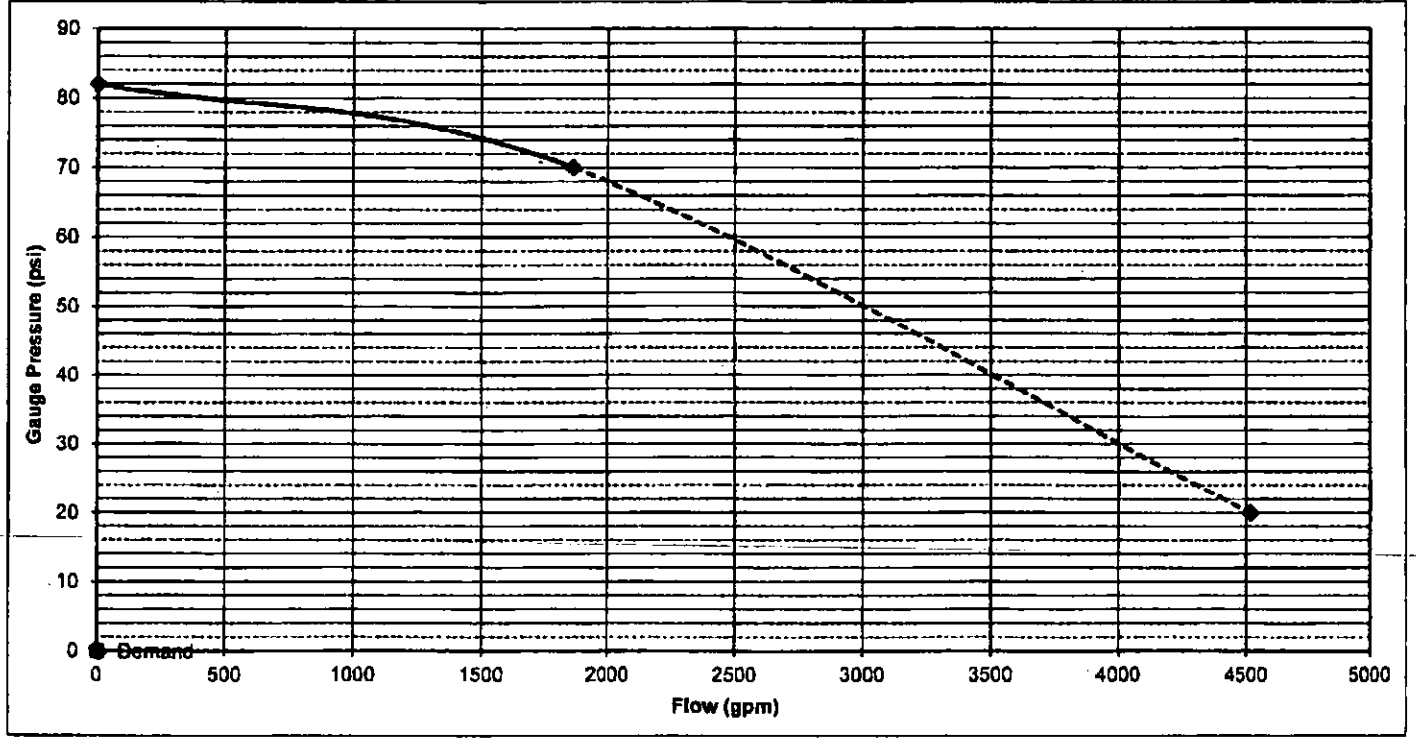
Diameter of Main: Unknown

| | | | | |
|---|---|---|---|---|
| Static Pressure: | A | 82.0 | B | |
| Residual Pressure: | A | 70.0 | B | |

Pump Present: NO
Tank Present: NO
Req. GPM: Req. PSI:

| Hydrant: | A | A | B | B |
|---|---|---|---|---|
| Outlet Diameter: | 3.5 | | | |
| Pitot Reading: | 32.0 | | | |
| Coeff: | 0.90 | | | |
| Discharge GPM: | 1860 | 0 | 0 | 0 |

| Flow A | | | | Flow B | | | |
|---|---|---|---|---|---|---|---|
| Static pressure of | 82 | psi @ | 0 gpm | Static pressure of | 0 | psi @ | 0 gpm |
| Residual pressure of | 70 | psi @ | 1860 gpm | Residual pressure of | 0 | psi @ | 0 gpm |
| Available flow @ | 20 | psi @ | 4516 gpm | Available flow @ | 20 | psi @ | gpm |

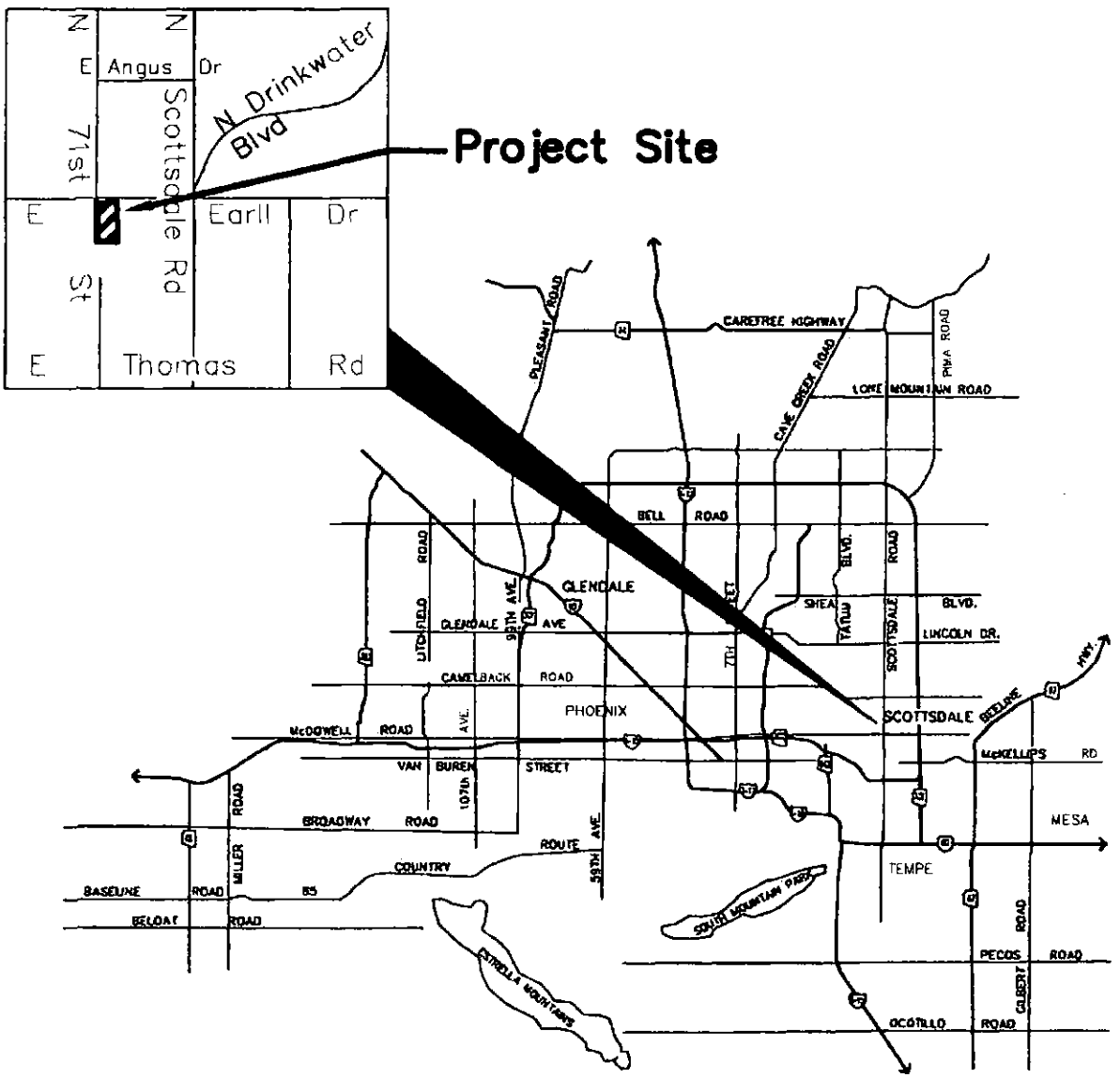



**Comments:**

NOTES:

1. Flowing hydrant is assumed to be on a circulating main or downstream of the pressure test hydrant on a dead-end system.
2. Flow analysis assumes a gravity flow system with no distribution pumps and having no demand, other than the test
3. The distance between hydrants, elevations & main diameters are for information only.

# EXHIBITS




NO SCALE

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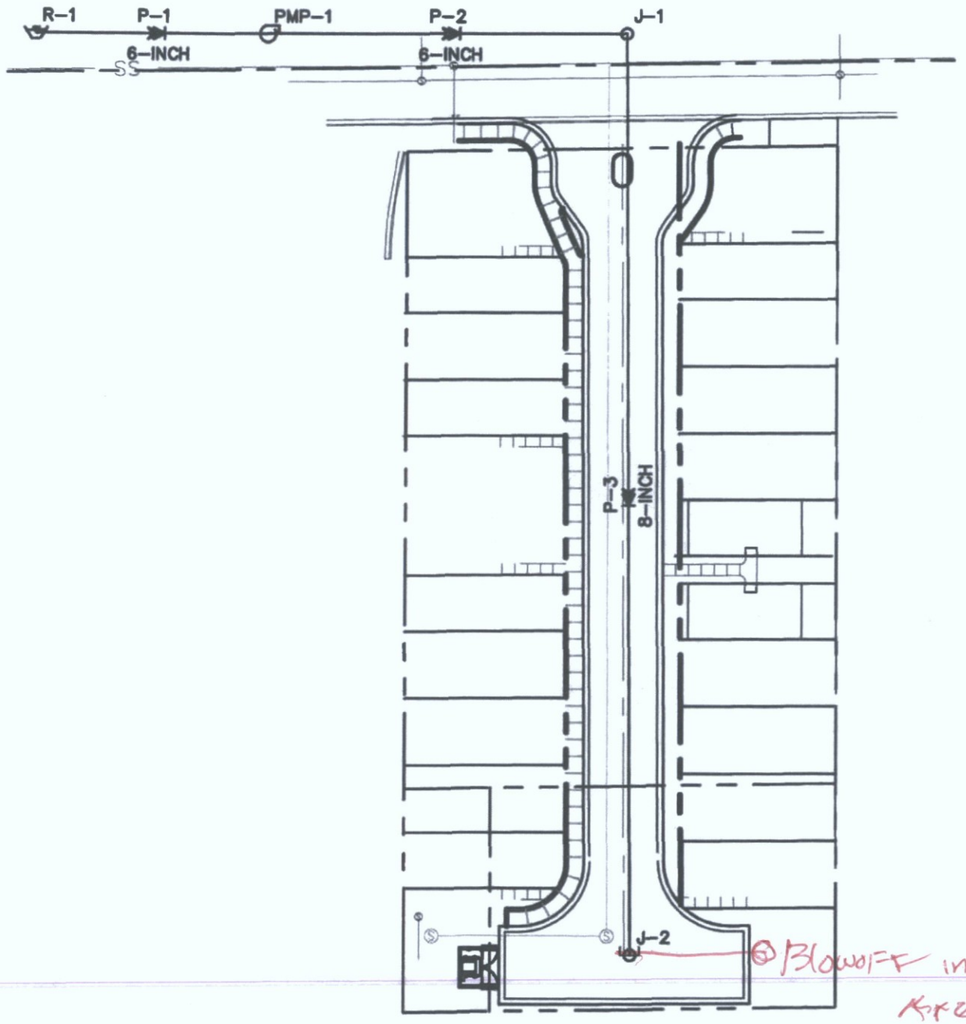
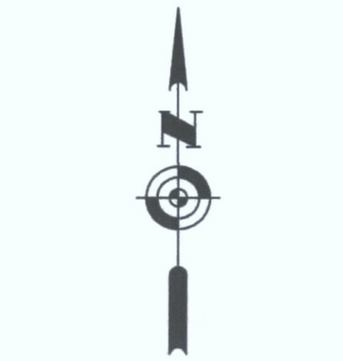
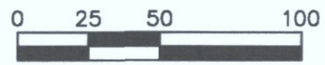
# The Gallery At 71st St & Earll Dr

## Location and Vicinity Map

FIGURE 1




LEGEND

- JUNCTION
- RESERVOIR
- PUMP
- PIPE

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LEGEND

# GALLERY
# WATER DISTRIBUTION MAP

EXHIBIT 2