CITY OF SCOTTSDALE

Water and Wastewater Study
Combined

City of Scottsdale

MULTI-USE SPORTS FIELDS

Bell Rd and 94th St

PRELIMINARY BASIS OF DESIGN REPORT - WASTEWATER

PRELIMINARY Basis of Design Report

- ☐ ACCEPTED
- ☑ ACCEPTED AS NOTED
- ☐ REVISE AND RESUBMIT

CITY OF SCOTTSDALE
SCOTTSDALE WATER
9379 E San Salvador Dr.
Scottsdale, AZ 85258

Disclaimer: If accepted; the preliminary approval is granted under the condition that a final basis of design report will also be submitted for city review and approval (typically during the DR or PP case). The final report shall incorporate further water or sewer design and analysis requirements as defined in the city design standards and policy manual and address those items noted in the preliminary review comments (both separate and included herein). The final report shall be submitted and approved prior to the plan review submission.
For questions or clarifications contact the Water Resources Planning and Engineering Department at 480-312-5685.

BY scan DATE 11/3/2020

Parks has accepted responsibility for maintenance of 6-inch sewer/service lateral. Therefore, the 6-inch service laterals are acceptable.

September 2020

Prepared For:

City of Scottsdale
Capital Project Management
7447 E Indian School Rd, Suite 205
Scottsdale, AZ 85251

Prepared By:

Gavan & Barker, Inc.
3030 North Central Avenue, Suite 700
Phoenix, Arizona 85012
Phone: (602) 200-0031

Job No. 2003

10-UP-2020
9/30/2020

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1.0 PROJECT DESCRIPTION

The purpose of this report is to provide a basis of design for the wastewater infrastructure associated with the new Multi-Use Sports Fields at the northwest corner of Bell Road and 94th Street. The proposed sports complex consists of six lighted multi-use fields, two parking lots, a restroom building, a staff office building, and a maintenance yard building. The maintenance yard also includes an outdoor wash pad with an sand/oil separator that will connect to the City sewer.

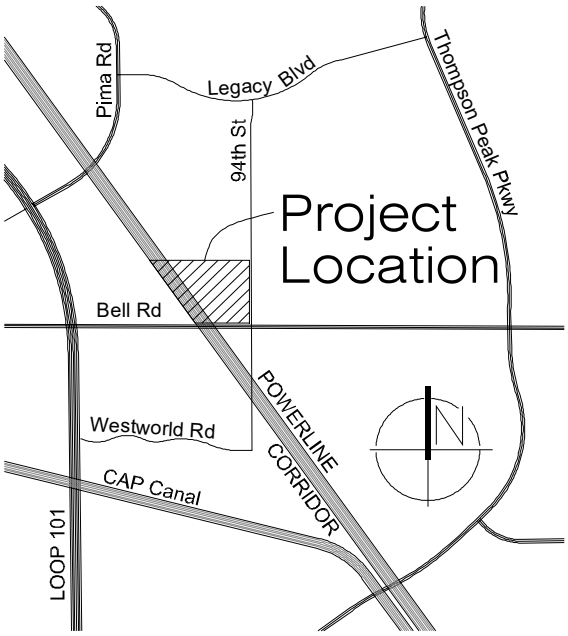


Figure-1: Vicinity Map

2.0 WASTEWATER DESIGN

2.1 EXISTING CONDITIONS

The site is currently undeveloped, natural desert land. There is an existing 18-inch PVC sewer in Bell Road along the south side of the site that has a 12-inch PVC stub-out located at the proposed driveway entrance to the sports complex. There is also an existing 18-inch sewer in a 20 foot wide easement along the north side of the site.

The 12-inch sewer stub-out on Bell Road was field surveyed at an invert elevation of 1551.39 which is 15.7 feet deep. The sewer invert of the existing 18-inch sewer on the north side of the site was also field surveyed at the exisitng manhole and found to have an invert elevation of 1575.5 which is 12.2 feet deep.

2.2 PROPOSED CONDITIONS

The proposed wastewater design includes a new 6-inch sewer service line that will run from the existing 12-inch sewer stub-out in Bell Road to the Public Restroom and Staff Office building location that lies about 500 feet north of Bell Road. In addition, a relatively short, 4-inch sewer service line will also be installed for the maintenance yard building. It will connect to the existing 18-inch PVC sewer that runs along the north side of the site. This connection will include a new manhole on the 18-inch sewer at the point of connection. Construct 8-inch sewer for pipe segments between manholes.

2.3 ESTIMATED WASTEWATER FLOWS

The wastewater flows include the flow generated in the restroom/office building area that will drain to the Bell Road sewer and the flow generated in maintenance yard that will drain to the sewer that runs along the north side of the site.

Maintenance Building Flows

Maintenance Yard Building (900 sf): Assume sewer demand is equivalent to office space. Per DSPM Figure 7-1.2, average day sewer demand for office is 0.4 gallon per day (gpd) per square foot. The maintenance yard will also include a wash pad with an estimated average daily flow of 0.5 gpm. Therefore, average daily sewer demand for the maintenance building is:

Avg. Daily Flow = 900 sf x 0.4 gpd/sf = 360 gpd = 0.25 gpm + 0.5 gpm (wash pad) = 0.75 gpm

Peak daily demand is based on a peaking factor of 3 in accordance with DSPM Figure 7.12.

Peak Daily Flow = 0.75 gpm (avg. daily flow) x 3 = 2.25 gpm

Combined Peak Daily Flow = 0.75 gpm (building) + 1.5 gpm (wash pad) = 2.25 gpm

Staff Office/Restroom Building Flows

Staff Office Building (3,220 sf): Per DSPM Figure 6-1.2, average daily sewer demand for office is 0.4 gallon per day (gpd) per square foot. Therefore, average day demand for the staff office building is:

Avg. Daily Flow = 3,220 sf x 0.4 gpd/sf = 1,288 gpd = 0.89 gpm

16-Stall Public Restroom Building (1,580 sf): Assumed 5 gallons per day (gpm) per person. The number of people at the sport complex is estimated to include 40 players per field plus 120 spectators, coaches and

referees for a total of 160 people per field. Therefore, for the six fields it is estimated that there are 960 people at the sports complex.:

960 people x 5 gpd = 4,800 gpd

Assume 12-hour day for field use, therefore the average daily sewer demand is:

4,800 gal/day / 12 hours / 60 min/hour = 6.67 gpm

Using a peaking factor of 3, the peak daily flow is:

6.67 gpm x 3 = 20 gpm

The combined peak daily flow from the restroom and office building is:

Combined peak daily flow = 0.89 gpm (Office) + 20 gpm (Restroom) = 20.89 gpm

2.4 CONVEYANCE CAPACITY OF PROPOSED SEWER SERVICE LINES

Hydraulic calculations were done for both proposed sewer service lines to demonstrate that will have adequate capacity to convey the estimated peak daily wastewater flows.

Maintenance Building Sewer

The peak daily flow from the maintenance yard is 2.25 gpm. The proposed 4-inch sewer service line will be installed with a minimum slope of 2% which has a flow capacity of 0.284 cfs which converts to 127 gpm (see HydraFlow calculation report in Appendix A). Therefore, the proposed 4-inch sewer service has 56 times the required capacity to safely drain the expected wastewater flows to the City sewer along the north property line.

Staff Office/Restroom Building Flows

The peak daily flow from the staff office and restroom buildings is 20.89 gpm. The proposed 6-inch sewer service line will be installed with a minimum slope of 2% which results in a flow capacity of 0.859 cfs which converts to 385 gpm (see HydraFlow calculation report in Appendix A). Therefore, the proposed 6-inch sewer service has 18 times the required flow capacity to safely drain the expected wastewater flows to the City sewer in Bell Road.

3.0 CONCLUSION

The staff office and public restroom buildings will contribute an average daily flow of 7.56 gpm and a peak daily flow of 20.89 gpm to the 18-inch public sewer in Bell Road. The proposed 6-inch sewer service line for these two buildings will be more than adequate with a conveyance capacity of 385 gpm.

The maintenance yard building and outdoor wash pad will contribute an average daily flow of 0.75 gpm and a peak daily flow of 2.25 gpm to the 18-inch public sewer along the north property line. The proposed 4-inch sewer service line will be more than adequate with a conveyance capacity of 127 gpm.

Appendix A: Sewer Capacity Calculations

Channel Report

Staff Office / Public Restroom Sewer Service Line (6" Diameter)

Circular

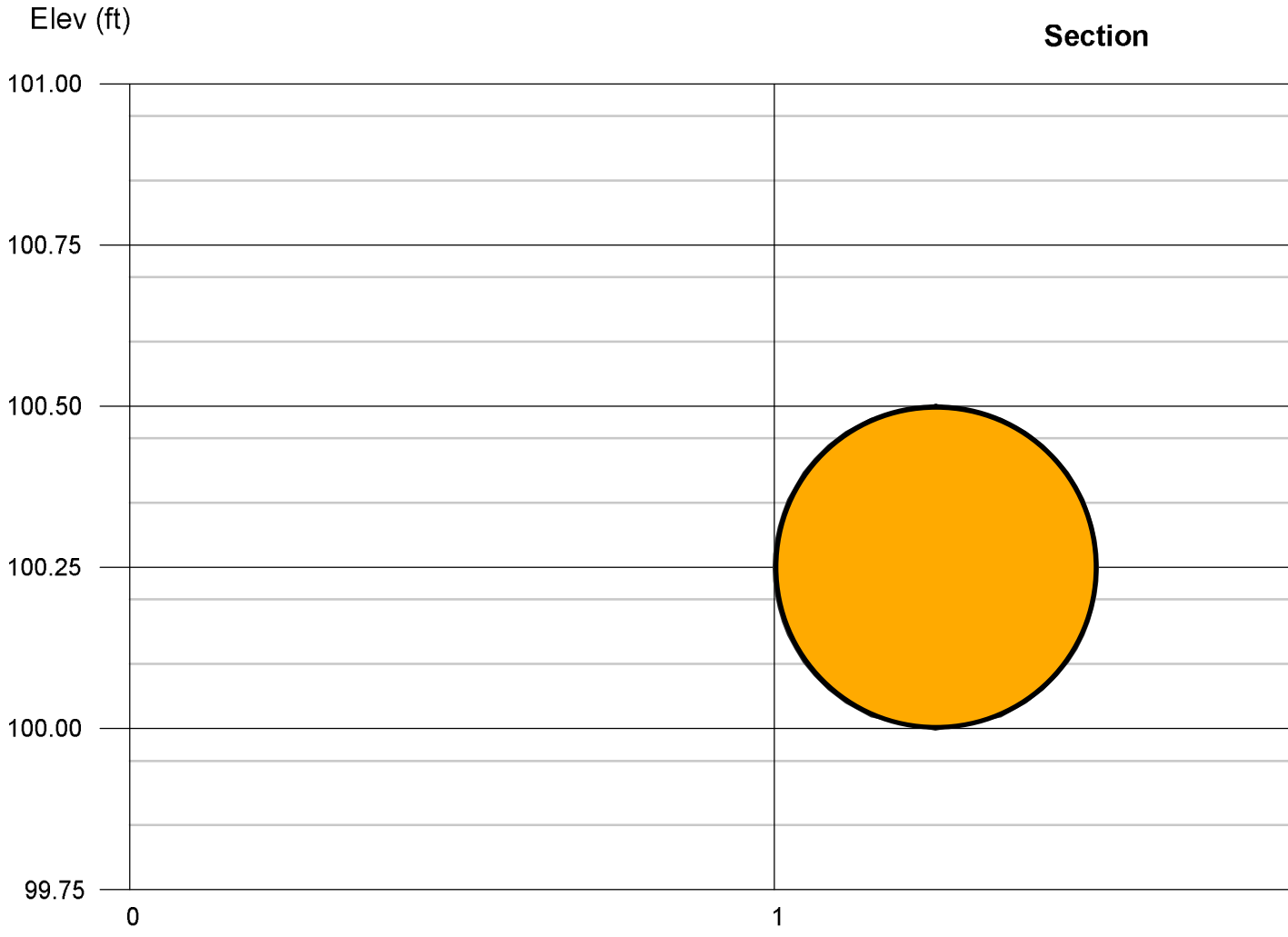
Diameter (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 2.00
N-Value	= 0.012

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 0.50

Highlighted

Depth (ft)	= 0.50
Q (cfs)	= 0.859
Area (sqft)	= 0.20
Velocity (ft/s)	= 4.38
Wetted Perim (ft)	= 1.57
Crit Depth, Yc (ft)	= 0.46
Top Width (ft)	= 0.00
EGL (ft)	= 0.80



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Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 10 2020

Maintenance Yard Sewer Service Line (4" Diameter)

Circular

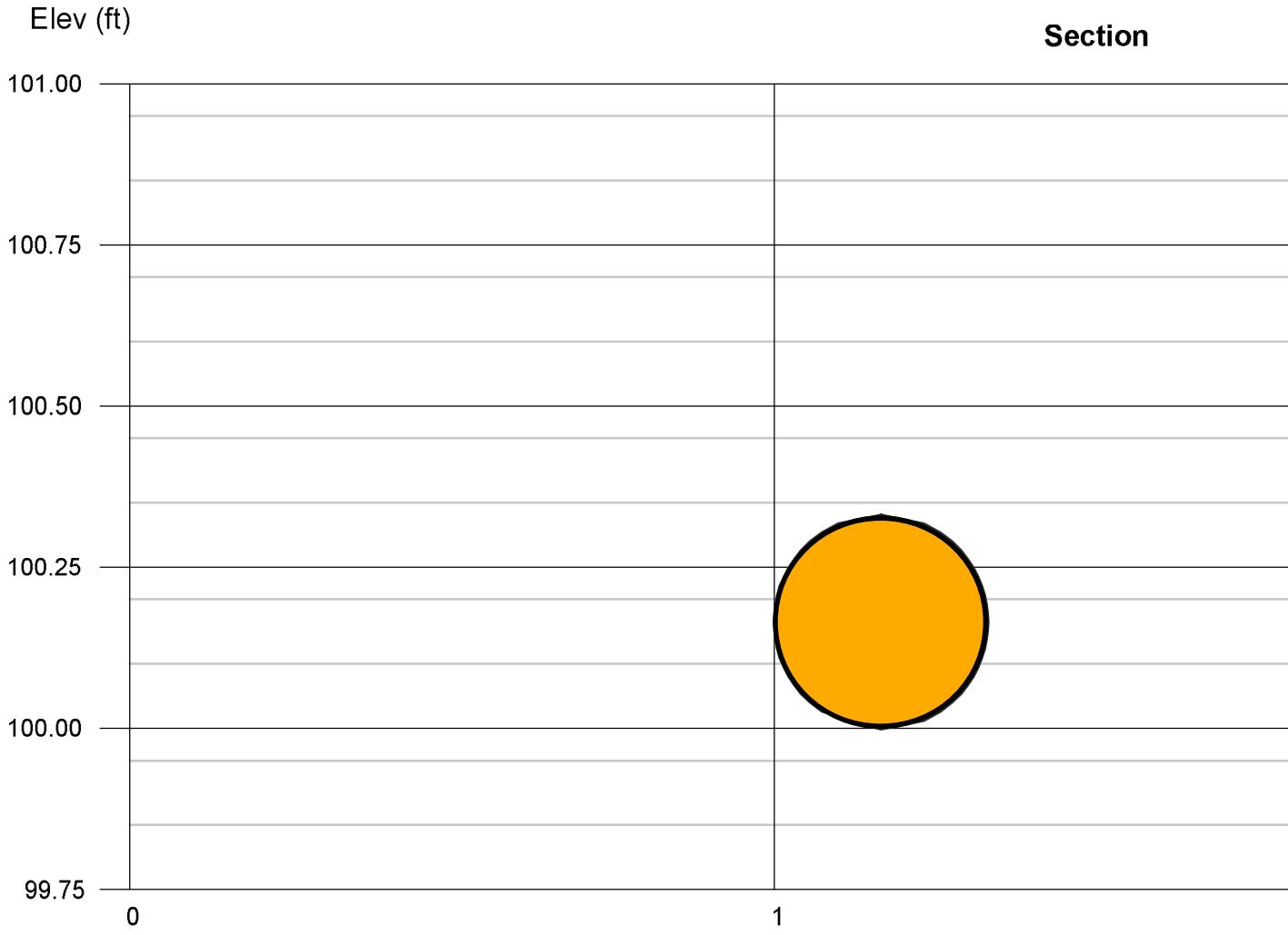
Diameter (ft)	= 0.33
Invert Elev (ft)	= 100.00
Slope (%)	= 2.00
N-Value	= 0.012

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 0.33

Highlighted

Depth (ft)	= 0.33
Q (cfs)	= 0.284
Area (sqft)	= 0.09
Velocity (ft/s)	= 3.32
Wetted Perim (ft)	= 1.04
Crit Depth, Yc (ft)	= 0.30
Top Width (ft)	= 0.00
EGL (ft)	= 0.50



Rea 10-UP-2020
9/30/2020

Appendix B: Sewer Plan

CITY OF SCOTTSDALE

MULTI-USE SPORTS FIELDS
BELL ROAD & 94TH STREET

SEWER PLAN

91st Street

CONNECT TO EXIST. 18" SEWER WITH NEW MANHOLE

NEW 4" SEWER SERVICE LINE

NEW MANHOLE

WASH PAD WITH SAND/OIL SEPARATOR

MAINTENANCE YARD BUILDING 900 S.F., FFE = 1587.10

STAFF OFFICE BUILDING 3,220 S.F., FFE = 1577.50

16-STALL RESTROOM BUILDING 1,580 S.F., FFE = 1577.50

NEW SEWER CLEANOUTS

NEW 6" SEWER SERVICE LINE

NEW MANHOLE

CONNECT TO EXIST. 12" PVC STUBOUT

NEW MANHOLE

94th Street

Bell Road

18" PVC S

8" DIP W

12" PVC S

8" PVC S

12" DIP W

24" RCP W

10" STL G

OHE

1"W

5"W

N

0 150

SCALE: 1" = 150'

Construct 8-inch sewer for pipe segments between manholes.

LEGEND

EXIST. PUBLIC SEWER

NEW SEWER SERVICE LINE

Gavan & Barker Inc.
Civil Engineering - Landscape Architecture
3030 North Central A
Arizona 85012 Ph: 60

10-UP-2020

9/30/2020

City of Scottsdale

MULTI-USE SPORTS FIELDS

Bell Rd and 94th St

PRELIMINARY BASIS OF DESIGN REPORT - WATER

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BY scan **DATE** 10/7/2020

September 2020

Prepared For:

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1.0 PROJECT DESCRIPTION

The purpose of this report is to provide a basis of design for the water infrastructure associated with the new Multi-Use Sports Fields at the northwest corner of Bell Road and 94th Street. The proposed sports complex consists of six lighted multi-use fields, two parking lots, a restroom building, a staff office building, and a maintenance yard building. The maintenance yard will also include an outdoor wash pad with a hose bibb. The sports fields and their surrounding landscaping will be irrigated with a separate, non-potable water supply.

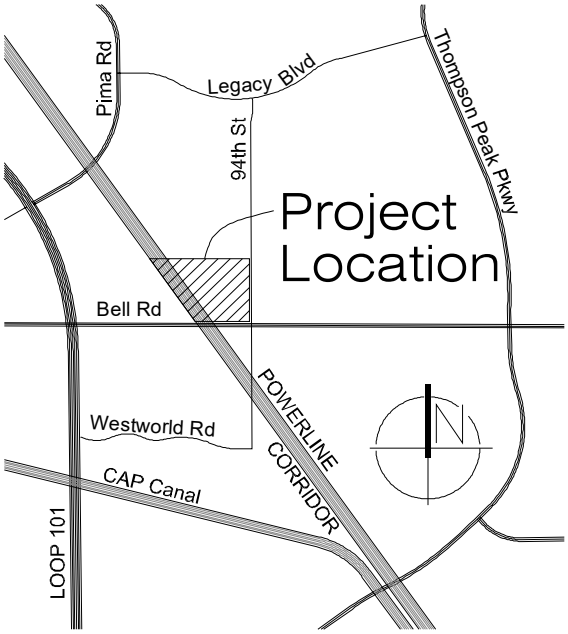

Figure-1: Vicinity Map

2.0 WATER DESIGN

2.1 EXISTING CONDITIONS

The site is currently undeveloped, natural desert land. There is an existing 24-inch waterline in Bell Road along the south side of the site, a 12-inch waterline in 94th Street along the east side and a 12-inch waterline on the north side that runs from the north in 91st Street and dead-ends at the northwest corner of the site.

2.2 PROPOSED CONDITIONS

The proposed water design includes a new 8-inch waterline that will run through the site providing a looped connection between the 24-inch waterline in Bell Road and the 12-inch dead-end waterline in 91st Street. The 8-inch waterline will be located within a new 20-foot wide waterline easement that runs diagonally

along the west boundary of the site through the new parking lot. There will be one water service line connected to the 8-inch waterline that will serve all three buildings, including the 16-stall public restroom, the 3,220 sf staff office building, and the 900 sf maintenance yard building. There will also be two fire lines; one that serves the restroom/office building and another that serves the maintenance yard building.

The new waterline will include two new fire hydrants, including one in the location of the restroom/office building and the other near the maintenance yard. A third new fire hydrant will also be installed on the east side of the site to serve the new parking lot. It will be connected directly to the existing 12-inch waterline in 94th Street.

2.3 ESTIMATED WATER DEMAND

The water demand includes the water usage at the three buildings plus the fire flow.

Building Water Usage

Maintenance Yard Building (900 sf): Assume water usage is equivalent to office space. Per DSPM Figure 6-1.2, average day water demand for office is 0.000834 gallon per minute (gpm) per square foot. The maintenance yard also has an outdoor wash pad with an estimated average day demand of 0.5 gpm. Therefore, average daily demand for the maintenance yard is:

900 sf x 0.000834 gpm/sf = 0.75 gpm (building) + 0.5 gpm (outdoor wash pad) = 1.25 gpm

Staff Office Building (3,220 sf): Per DSPM Figure 6-1.2, average daily water demand for office is 0.000834 gallon per minute (gpm) per square foot. Therefore, average day demand for the staff office building is:

3,220 sf x 0.000834 gpm/sf = 2.68 gpm

16-Stall Public Restroom Building (1,580 sf): Assumed 5 gallons per day (gpm) per person. The number of people at the sport complex is estimated to include 40 players per field plus 120 spectators, coaches and referees for a total of 160 people per field. Therefore, for the six fields it is estimated that there are 960 people at the sports complex.:

960 people x 5 gpd = 4,800 gpd

Assume 12-hour day for field use, therefore the average daily demand is:

4,800 gal/day / 12 hours / 60 min/hour = 6.67 gpm

Total Average Day Demand

Avg. Day = 1.25 gpm (Maint.) + 2.68 gpm (Office) +6.67 gpm (Restroom) = 10.6 gpm

Maximum Day Demand

Max. Day = 10.6 gpm (average day) x 2 = 21.2 gpm

Peak Hour Demand

Peak Hour = 10.6 gpm (average day) x 3.5 = 37.1 gpm

Fire Flow

The new buildings are Type IIB construction. Per Table B105.1 of the International Fire Code (IFC), the minimum required fire flow for all three buildings is 1,500 gpm. The IFC allows a reduction in the minimum fire flow since the buildings will have fire sprinkler systems, but it cannot be reduced below 1,500 gpm. Therefore, the minimum fire flow is 1,500 gpm.

Fire Flow

Minimum Required Fire Flow = 1,500 gpm

2.4 PRESSURE LOSS CALCULATIONS

For purposes of demonstrating that the proposed water system will adequately provide the needed water supply, all flow was assumed to come from the 24-inch waterline in Bell Road, ignoring the inflow from the 12-inch waterline in 91st Street. This is a very conservative, simplifying assumption to show that the proposed water design is more than adequate.

Design Flow:

The design flow is based on Model Scenario 3 (DSPM 6-1.202) which is maximum day demand at the buildings plus the required fire flow of 1,500 gpm. To simplify the calculations, this combined flow was all assumed to discharge at the northern fire hydrant, farthest from the Bell Road Waterline. That is a distance of 1,151 feet along the proposed 8-inch waterline.

Design Flow

Design Flow = 1,500 gpm (fire flow) + 21.2 gpm (max. day demand) = 1,521 gpm

Pressure in Existing Bell Road Waterline:

A fire hydrant flow test was performed to determine the residual pressure in the Bell Road 24-inch waterline with a fire hydrant opened on the 94th Street 12-inch waterline (See fire flow test report in

Appendix A). The results indicate that the static pressure in the Bell Road waterline is 80 psi with a residual pressure of 78 psi at a test flow of 2000 gpm at the 94th Street fire hydrant.

Available Pressure

Available Residual Pressure in the Existing 24-inch Waterline = 78 psi

NOTE – This test has not been completed yet, once it is this available pressure will be updated to reflect actual conditions Fire flow test is attached and looks ok.

Pressure Loss Calculation

As stated previously, the pressure loss calculations are based on the conservative assumption that all water supply is coming from the 24-inch waterline in Bell Road. Water supply was ignored from the 12-inch waterline in 91st Street.

The flow calculations were based on the pressure drop from the existing 24-inch waterline in Bell Road to the northernmost proposed fire hydrant in sports complex.

8" Pipe Length = 1,151 feet

6" Fire Hydrant Pipe Length = 33 feet

The Hazen-Williams Equation was used to calculate the pressure drop. The equations is:

$Q = 0.279\ (C)\ D^{2.63}\ S^{0.54}$, where

C = 120 (Ductile Iron Pipe),
Q = 2.19 mgd (1,521 gpm)
D = Diameter (ft), and
S = Friction Slope (ft/ft)

Headloss in 8" Pipe:
D = 8 in = 0.67 ft
S (8" pipe) = 0.045 ft/ft
Headloss = 0.045 x 1,151 ft = 51.8 ft = **22.4 psi**

Headloss in 6" Pipe:
D = 6 in = 0.5 ft
S (6" pipe) = 0.187 ft/ft
Headloss = 0.187 x 33 ft = 6.2 ft = **2.7 psi**

Total Headloss = 2.7+ 22.4 = 25.1 psi

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Minimum System Pressure

The minimum system pressure is at the northernmost fire hydrant with a pressure 52.9 psi. This is based on the residual pressure of 78 psi in the Bell Road waterline minus the headloss of 25.1 psi at the northernmost fire hydrant. The actual pressure will be significantly greater because the inflow from the 91st Street waterline was ignored in the pressure loss calculation.

Minimum Pressure

Min. Pressure = 78 psi (Bell Road waterline) – 25.1 psi (Headloss) = 52.9 psi

3.0 CONCLUSION

The proposed waterline design will meet the flow requirements for the worst case fire flow of 1,500 gpm plus the maximum day demand of 21.2 gpm. The minimum pressure at the fire hydrant for this case is 52.9 psi which is greater than the City's minimum requirement of 30 psi.

Because the water usage demands for the sports complex are vey small in comparison to the capacity of the proposed 8-inch waterline, pressure loss calculations were not considered necessary for other scenarios including the average day, maximum day and peak hour scenarios. For example, the peak hour demand of 37.1 gpm only results in a pressure drop of 0.2 psi per 100 feet in the 8-inch line. Therefore, pressure loss in the 8-inch can be considered negligible for purposes of providing water supply to the proposed sports complex buildings.

Appendix A: Fire Flow Test

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	Scottsdale Sports Fields
Project Address:	9390 East Bell Road, Scottsdale, Arizona 85260
Client Project No.:	Not Provided
Arizona Flow Testing Project No.:	20355
Flow Test Permit No.:	C63082
Date and time flow test conducted:	September 14, 2020 at 6:15 AM
Data is current and reliable until:	March 14, 2021
Conducted by:	Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Witnessed by:	Sonny Schreiner –City of Scottsdale-Inspector (602-819-7718)

Raw Test Data

Static Pressure: **80.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **73.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **25.0 PSI**
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One 4-inch Hose monster
(Measured in inches)

Coefficient of Diffuser: .7875

Flowing GPM: **1,880 GPM**
(Measured in gallons per minute)

GPM @ 20 PSI: **5,998 GPM**

Data with 10 % Safety Factor

Static Pressure: **72.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **65.0 PSI**
(Measured in pounds per square inch)

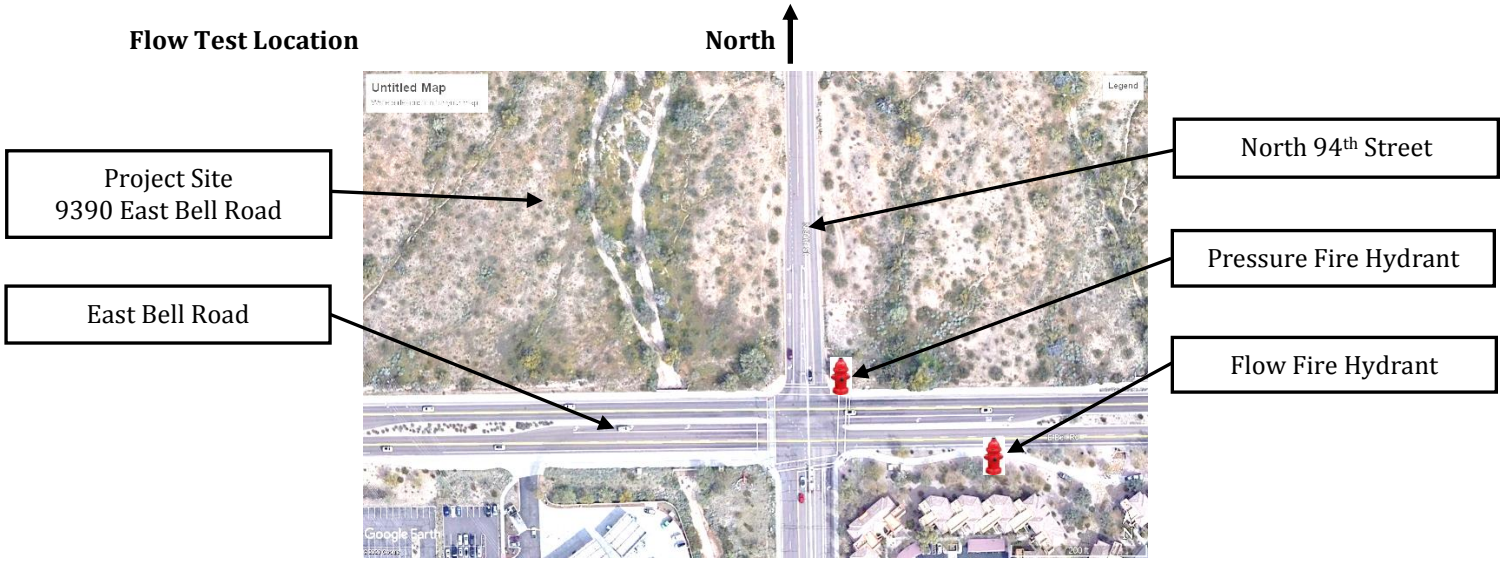
Distance between hydrants: Approx. 340 Feet

Main size: Not Provided

Flowing GPM: **1,800 GPM**

GPM @ 20 PSI**:** **5,552 GPM**

Flow Test Location **North**



10-UP-2020
9/30/2020

Appendix B: Water Plan

CITY OF SCOTTSDALE

MULTI-USE SPORTS FIELDS
BELL ROAD & 94TH STREET

WATER PLAN

CONNECT TO EXIST. 12" DIP WATERLINE

NEW 4" FIRELINE

WASH PAD WITH SAND/OIL SEPARATOR

MAINTENANCE YARD BUILDING 900 S.F., FFE = 1587.10

EXTEND EXIST. 12" WATERLINE

NEW FIRE HYDRANT

NEW FIRE HYDRANT

CONNECT TO EXIST. 12" DIP WATERLINE

STAFF OFFICE BUILDING 3,220 S.F., FFE = 1577.50

16-STALL RESTROOM BUILDING 1,580 S.F., FFE = 1577.50

NEW 8" WATERLINE

NEW 6" FIRELINE

NEW WATER METER

NEW FIRE HYDRANT

CONNECT TO EXIST. 24" RCP WATERLINE

91st Street

94th Street

Bell Road

N

0 150

SCALE: 1" = 150'

LEGEND

- EXIST. PUBLIC WATERLINE
- NEW PUBLIC WATERLINE
- NEW SERVICE LINE
- NEW BUILDING FIRELINE

Gavan & Barker Inc.
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