



WELL FACILITY DESIGN MANUAL



TOWN OF BUCKEYE

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May, 2007, Adopted November 20, 2007

**TOWN OF BUCKEYE
PUBLIC WORKS**

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TABLE OF CONTENTS

Section 1.0	General Information.....	- 1 -
Section 2.0	Service Life Expectancy	- 1 -
Section 3.0	Drinking Water Regulations.....	- 1 -
Section 4.0	Taste and Aesthetics	- 2 -
Section 5.0	Temperature Public Acceptance & Distribution Pressure Pipe De- Rating Limit	- 3 -
Section 6.0	Sand Production Pump Wear Limit	- 3 -
Section 7.0	Well Performance Requirements	- 3 -
7.1	LIMITS ON YIELD (GPM)	- 3 -
7.2	PUMPING LIFT	- 4 -
7.3	SPECIFIC CAPACITY.....	- 4 -
Section 8.0	Well Location and Pre-Construction Requirements:.....	- 4 -
8.1	WELL DRILLING PLAN AND APPROVAL.....	- 4 -
8.2	WELL COMPLETION PLAN	- 5 -
8.3	REGULATORY REQUIREMENTS OF STATE AND COUNTY AGENCIES; TOWN REQUIREMENTS	- 5 -
8.3.1	<i>Well Location Restrictions:</i>	- 6 -
Section 9.0	Well Drilling Specifications.....	- 6 -
Section 10.0	Geophysical Logging.....	- 7 -
Section 11.0	Well Drilling Examination for Sampling Protocol	- 7 -
Section 12.0	Well Design Parameters	- 8 -
12.1	CASING:	- 8 -
12.1.1	<i>Surface Casing</i>	- 8 -
12.1.2	<i>Blank Casing</i>	- 8 -
12.1.3	<i>Well Screen Casing</i>	- 9 -
12.2	WELL PUMP	- 9 -
12.3	WELL HOLE AND CASING CENTRALIZERS	- 10 -
12.4	FILTER PACKS	- 10 -
12.5	WELL DEVELOPMENT AFTER DRILLING	- 10 -
12.6	WELL HEAD PAD/INSTRUMENTATION	- 10 -
Section 13.0	Testing and Reporting	- 11 -
Section 14.0	Electric Power Service and Back-Up Emergency Power	- 11 -
Section 15.0	Well Site Plan	- 11 -
15.1	ON-SITE RETENTION BASIN.....	- 12 -
15.2	SITE GROUND COVER.....	- 12 -
Section 16.0	Site Security	- 12 -
Section 17.0	Communications and Control.....	- 13 -
Section 18.0	Approval of Well as a Drinking Water Source	- 13 -
Section 19.0	Post Construction.....	- 13 -
Section 20.0	Approval of Construction.....	- 14 -

Section 21.0	Conveyance of Well Site and Improvements to the Town	- 14 -
Section 22.0	Grandfathered Provisions	- 14 -
Section 23.0	Existing Wells of Unknown Construction or Previous Use.....	- 14 -

APPENDIX A

Well Location and Pre-Construction Checklist

APPENDIX B

Construction Details

B-300	Well Site Detail #1
B-300A	Well Site Detail #1A
B-301	Well Detail
B-302	Well Head Equipment Layout

Section 1.0 General Information

This manual provides requirements for the design, construction and approval of municipal wells to be conveyed to the Town of Buckeye (hereafter referred to as the Town) Public Works Department (PWD).

The goal of this manual is to:

(1) Optimize the water quality; (2) Ensure optimum reliability of the well and the well site for future service; and, (3) Minimize the cost of operation, maintenance, rehabilitation and replacement of the well by the Town's PWD.

Section 2.0 Service Life Expectancy

The well service life expectancy, which is the basis for the design of each well facility, is set by the Town at 50 years. This 50-year requirement is a reasonable expectation for the service life of a well facility. This manual includes well design and site layout requirements to ensure longevity for each well and each well site. These requirements extend the life of each well and ensure that should a well fail, that there are provisions for the Town to drill an additional well on each site, without impact to neighboring properties or the operation of the existing well.

Section 3.0 Drinking Water Regulations

Municipal wells shall be constructed to provide the optimum levels of water quality from each well. To provide a margin of safety and a goal for municipal water production, polishing shall be required when any contaminant in water is between 80% and 100% of the Maximum Contaminant Levels (MCL's) of Federal Primary Drinking Water Regulations that have been established pursuant to the Public Health Service Act, 42 U.S.C.A. §§ 300f to 300j-26 (PHSA). Treatment is required when any contaminant is greater than the MCL. The Arizona Department of Environmental Quality (ADEQ) has primary enforcement responsibility for enforcement of these regulations through Arizona Administrative Code R18-4-101 to R18-4-804.

The following are examples of 80% of the MCLs for contaminants of local concern:

Nitrates greater than 8 ppm (parts per million)
Arsenic greater than 8 ppb (parts per billion)
Fluoride greater than 3.2 ppm

The Town's PWD shall be notified in writing of fluoride concentrations which exceed the EPA Secondary MCL of 2.0 ppm, prior to the Town's acceptance of any well.

Wells shall be constructed to eliminate, to the extent practical, the need for treatment or polishing. Zonal groundwater sample results and the lithology for each site and nearby

wells shall be evaluated and the well shall be designed to reduce the concentration of one or more of any contaminant with a concentration greater than 80% of an MCL.

Treatment is defined as a process necessary to meet primary MCLs. Wells with water quality exceeding 100% of a Primary MCL must be addressed in a Water Treatment Plan that is submitted to the Town Engineer for approval.

Well water that requires treatment shall consider the well design and construction that provides for the use of blending as the preferred method of treatment. Polishing is defined as a process necessary to meet Town water quality requirements that are below the Primary MCL. Blending of water from multiple wells shall be considered as a type of treatment or polishing.

Variations may be considered for wells with water quality between 80% and 100% of a Primary MCL, if no single well brings the system average above 80% of the Primary MCL and no significant degradation of the water quality occurs in an existing system.

Requests for variances to the water quality requirements in this section shall be submitted for approval by the Town Engineer as part of a Water Treatment/Polishing Plan that achieves the goals in this section.

Section 4.0 Taste and Aesthetics

Total Dissolved Solids (also known as Total Dissolved Salts):

The EPA has established a Secondary MCL for Total Dissolved Solids (TDS) of 500 ppm and this is the Town's goal. However, the Town's upper limit for TDS shall be 700 ppm in any water system.

No well with TDS greater than 2,000 ppm shall be accepted by the Town due to the waste stream discharge/disposal limitations and the excessive costs associated with treatment of the water and the waste stream.

Variations may be considered for wells with TDS levels exceeding 700 ppm but less than or equal to 2,000 ppm, if polishing achieves a system average of 700 ppm or less with no significant degradation of the water quality in an existing system.

Requests for variances to the water quality requirements in this section shall be submitted for approval by the Town Engineer as part of a Water Treatment/Polishing Plan that achieves the goals in this section.

Section 5.0 Temperature Public Acceptance & Distribution Pressure Pipe De-Rating Limit

Well water with a temperature greater than 98 degrees Fahrenheit (°F) shall require treatment to reduce the temperature of the water delivered to the distribution system to 95 °F. Blending is the sole treatment option available to reduce water temperature. Requests for variances for wells with water temperature greater than 98 °F shall be submitted for approval by the Town Engineer as part of a Water Treatment/Polishing Plan that achieves a maximum blended water temperature of 95 °F.

Ambient heating in the distribution system (e.g. storage tanks) shall not be considered as contributory to exceeding the 95 °F maximum limit.

Well water with a temperature greater than 90 °F shall require consideration of the thermal de-rating factors for delivery piping and fittings in the design of the transmission piping from the well site. For PVC pressure pipe the de-rating of pressure ratings can be 25% at 90 °F, however the de-rating of the pipe manufacturer shall be used in all designs.

Section 6.0 Sand Production Pump Wear Limit

Excessive sand production in water pumped from a well can result in severe wear to the well pump and center shaft, and subsequent pumping and storage equipment. It can also have an adverse affect on treatment systems, particularly reverse osmosis systems.

Sand content shall be measured with the goal of an average of not more than 5 mg/L (ppm) produced for a complete pumping cycle of 2-hour duration when pumping at the design discharge capacity. No less than ten measurements shall be taken during post construction aquifer testing. The measurements shall be taken at equal intervals, to allow plotting of sand content as a function of time and production rate, to determine the average sand production for each cycle. A RossumTM Sand Tester or equivalent device which can measure sand content as low as 0.5 mg/L over a 10-minute interval should be used to measure sand production.

Wells shall be designed to restrict sand production to an average of 5 mg/L or less, or the well site shall include de-sanding equipment prior to the storage tank or prior to introduction of the water into the transmission or distribution system.

Section 7.0 Well Performance Requirements

7.1 Limits on Yield (GPM)

The operation and maintenance (O&M) of wells has a cost that should not vary significantly between well sites. The O&M of multiple wells with a low yield can have a disproportionate contribution to the rates charged by the Town for water. Therefore, the goal for yield for any well shall be 400 gallons per minute (gpm) or greater.

Wells producing between 150 gpm and 400 gpm shall require a variance. A variance request for a well producing between 150 gpm and 400 gpm shall be submitted for approval by the Town Engineer as part of a Water System Master Plan.

The Town shall not accept any wells producing less than 150 gpm for municipal uses except the Town may consider a variance to temporarily accept a well producing less than 150 gpm. A well that is temporary because it does not meet the minimum yield requirement may be considered for a variance to the well design parameters contained in Section 12.0. A variance request for a well producing less than 150 gpm shall be submitted for approval by the Town Engineer as part of a Water System Master Plan.

7.2 *Pumping Lift*

The cost of power required to lift water to the surface is affected by the static water level and the drawdown of the water level during pumping. Pumping lift calculations shall be submitted to the Town as a part of the Well Completion Report.

7.3 *Specific Capacity*

Specific capacity is the rate of discharge of a well per unit of drawdown, commonly expressed as gallons per minute (gpm) per foot of drawdown (gpm/foot of drawdown). Specific capacity is a useful indicator of well performance. Specific capacity calculations shall be submitted to the Town as a part of the Well Completion Report.

Section 8.0 Well Location and Pre-Construction Requirements:

8.1 *Well Drilling Plan and Approval*

A Well Drilling Plan shall be prepared and submitted to the Town for approval. At the minimum, the Well Drilling Plan shall include:

- Well Location and Pre-Construction Checklist
- Well Siting Study, including:
 - Local Hydrogeology
 - Anticipated Water Quality
 - Estimated Well Production
 - Preliminary Well Impact Evaluation
- Pilot Drilling Program
- Production Well Drilling Program

A pilot hole is required at any proposed well location unless information is available for review by the Town that provides water quality and aquifer performance information similar to the information available from a pilot hole. The information provided shall be from other wells or borings within reasonable proximity to the proposed well location.

The optimal location, design and construction of the well for water quality and production purposes shall be determined by drilling a test or pilot hole and conducting geophysical logging. The procedures for drilling the pilot hole (e.g. drilling method, depth, zonal sampling intervals) shall be submitted to the Town in writing for approval as a part of the Well Drilling Plan prior to drilling of the pilot hole.

An appropriate number of zonal samples shall be collected from the pilot hole and sent to an Arizona-certified (licensed) laboratory for analysis. The zonal samples shall be analyzed for contaminants of local concern including, at the minimum, the following: nitrates, arsenic, fluoride, and total dissolved solids.

8.2 Well Completion Plan

A Well Completion Plan shall be prepared and submitted to the Town for review prior to finalizing the design and construction of the well. At the minimum, the Well Completion Plan shall include:

- Drilling Logs
 - Lithologic Logs (including physical samples of the lithologic material, i.e. chip trays)
 - Geophysical Logs
- Zonal Water Quality
- Completion Recommendations

This Well Completion Plan shall be prepared by an Arizona State Board of Technical Registration registered professional engineer (PE) or geologist (RG) with appropriate experience from practice in Arizona. The evaluations and conclusions of the registrant shall be provided to the Town in writing for approval prior to finalizing the design and construction of the well. The Town acknowledges that the time frame for review and finalization of such plans can be as little as 24 to 48 hours when the reverse circulation drilling method has been employed in a comprehensive pilot and production well drilling effort.

8.3 Regulatory Requirements of State and County Agencies; Town Requirements

All State, County and Town requirements for well construction shall be met, including the following:

- (1) Town of Buckeye approval, Well Drilling Plan, and Well Completion Plan.
- (2) Arizona Department of Water Resources, Well Drilling Permit.
- (3) Maricopa County Department of Environmental Quality, Approval to Construct (as delegated by ADEQ).

- (4) Arizona Pollutant Discharge Elimination System General Permit for Wastewater Discharges that Pose a Limited or an Insignificant (De Minimus) Threat to Water Quality. A Notice of Intent (NOI) must be submitted to ADEQ five days prior to wastewater discharge; depending on the method well construction wastewater will be discharged. An NOI is required for all wastewater discharges to ephemeral or intermittent stream channels, effluent dependent water, sewers or canals.

8.3.1 Well Location Restrictions:

Wells shall be located greater than 50 feet from existing or proposed sewers.

Wells shall be located greater than 100 feet from any source of potential contamination (e.g. sewage disposal/pumping systems, gasoline stations, commercial chemical storage tanks, etc). Any new well proposed to be located within 100 to 300 feet of a potential source of contamination shall require review and prior approval of the well location by the Town.

Spacing of wells shall be in compliance with Arizona Administrative Code R12-15-1301 et seq., as may be amended from time to time.

Well sites shall not be located in designated floodways. Locations in designated floodplains require the well site to be constructed a minimum of two (2) feet above the 100-year floodplain level.

The site location, layout and size shall be designed to prevent adjacent structures or equipment from impairing the safety of the personnel and from impeding the operation of the equipment during the installation, operation, maintenance, repair, rehabilitation or replacement of the well or related equipment (e.g. proximity to overhead high voltage power lines).

Section 9.0 Well Drilling Specifications

The preferred drilling methods for the new well will be:

- (1) Dual Rotary Drilling (utilizing the pull-back method) – Preferred in areas with high levels of groundwater and unstable soils. This method is typically used by advancing exterior casing during drilling and then advancing a center drill shaft behind. For the dual rotary method, two casing sizes must be specified; one for the casing during drilling the hole, and the other for the casing in the production well zone of the well.

- (2) Reverse Circulation Rotary Drilling – Preferred in areas where the best water quality or availability is at depths greater than 1,000 feet.

Variances to the drilling methods specified in this section shall only be considered if the use of other drilling methods may be more favorable to the Town for a particular situation or location. A variance to this section shall be submitted to the Town under a separate application that includes justification for the variance from an Arizona registered geologist (RG).

Section 10.0 Geophysical Logging

Geophysical logging of the borehole shall be performed to determine the lithology, top and bottom of each distinct formation, differentiate between clean sand strata versus sand with silt or clay, provide an indication of water quality by measuring the apparent resistivity of materials surrounding the well bore, estimate the total porosity and relative porosity of various formations, and determine bedrock fracture patterns.

The following borehole geophysical logging methods are required:

- Electrical logs (e logs or electrical resistivity logs), combined with spontaneous potential (SP) logs
- Natural gamma logs
- Caliper logs
- Sonic logs

The following borehole geophysical logging methods are optional but also recommended:

- Guard resistivity logs
- Temperature logs
- Spinner flow meter or production logs
- Neutron logs

In order to penetrate the steel casing during dual rotary drilling, the required logging methods are neutron logs, and natural gamma logs, but sonic logs are optional.

During drilling for a new well all logging, pumping, development, sampling, testing and completion shall be directed by a registered engineer (PE) or geologist (RG).

Section 11.0 Well Drilling Examination for Sampling Protocol

During drilling, data for a lithographic/geophysical log shall be recorded by a qualified person.

Concurrent with drilling, the log shall be reviewed and evaluated by a registered professional engineer (PE) or geologist (RG) with appropriate experience from practice in Arizona depth- specific (zonal) groundwater sampling.

The evaluation by the registrant, with Town approval, shall be the basis to determine the sampling protocol for optimal design of the well for water quality and water production.

Section 12.0 Well Design Parameters

All materials in contact with water produced from the well, or additives shall be certified by the National Sanitation Foundation.

12.1 Casing:

A new well design shall be based on a minimum 50-year service requirement for the well site and the replacement well at this site. The well shall have a casing diameter that is large enough to allow at least 2 inches of clearance around the pump bowl diameter and well pump column pipe and allow for ease of redevelopment or future well rehabilitation. The well casing diameter shall be large enough to allow a liner to be installed. The liner shall consist of new casing and well screen installed inside the existing casing. The diameter of the liner shall be large enough to allow ease of installation and removal of a turbine pump and a sounding tube.

12.1.1 Surface Casing

A minimum surface casing (conductor casing) penetration depth of 38 feet is required to protect the well head from the infiltration of surface water contaminants. The surface casing shall stick up 2 feet above the finished grade. The surface casing shall be constructed of Low Carbon Steel (LCS) material minimum or better. Subject to specific circumstances or site-specific conditions, the Town reserves the right to require a change in surface casing material or to require deeper surface casing penetration.

Refer to Town of Buckeye detail #B-301 Well Detail

12.1.2 Blank Casing

The blank casing above the well screen shall be 18-inch minimum diameter. However, 16-inch diameter casing is acceptable if the well depth is less than or equal to 500 feet and the capacity is less than 1,000 gpm.

Blank Casing shall be constructed of High Strength Low Alloy (HSLA) steel or stainless steel.

Compression joints shall be installed if subsidence above the water table is suspected in the area or confirmed in the area by geophysical data.

12.1.3 Well Screen Casing

The louvered casing or well screen casing shall be 18-inch minimum diameter. However, 16-inch diameter casing is acceptable if the well depth is less than or equal to 500 feet and the capacity is less than 1,000 gpm.

Louvered well screen shall be constructed of HSLA steel or stainless steel.

Stainless steel wire wrap well screen or other types of well screen will only be allowed on a case by case basis as a part of Well Completion Plan that is approved by the Town.

No mills knife screen openings shall be allowed.

Well screen water open area guidelines:

<u>Type</u>	<u>% open area</u>
Stainless steel wire-wrap screen	19.6%
Full-Flo louvered screen	3.28%
Standard louvered	1.36%

Connections of well screen casing to blank casing shall have dielectric couplers or dissimilar metal adapters approved by the Town's PWD or Engineer when connecting two dissimilar metal casings (e.g. HSLA casings and stainless steel well screens).

12.2 Well Pump

Pumps shall be vertical impeller, line shaft with center shaft bearing column pipe.

A PVC sounding tube of minimum 1-inch inside diameter shall be strapped to the pump column unless the sounding tube is installed in the annulus.

The pump motor shall be 3-phase electrical power with different lift levels (gpm delivery).

Pump noise screening is required (attenuation) if the pump rating is above 300 horsepower (HP) or for any pump which is within 100 feet of residential or other noise sensitive areas. A noise level of 50 decibels shall not be exceeded at the property line.

The well head shall contain a screened vent pipe (Shephard's Hook).

12.3 Well Hole and Casing Centralizers

Casing centralizers in the 4-inch annular space between the blank casing and the bore hole may consist of the following material:

- Granular fill
- Bentonite grout
- Cement grout

Subject to subsurface hydro-geological data, annular casing centralizers may be full-depth cement grout or bentonite material for capping or sealing purposes. The annular casing centralizer design shall be made by an experienced RP.

12.4 Filter Packs

A minimum 4-inch wide annular filter pack shall be installed between the well screen casing and the well borehole. The filter pack shall consist of siliceous sand such as Colorado silica sand or a Town approved equivalent.

12.5 Well Development after Drilling

The well shall be initially swabbed and airlifted, followed by pumping and surging.

12.6 Well Head Pad/Instrumentation

The well head concrete pad shall be not less than 12 inches thick.

Aboveground piping shall be ductile iron pipe (DIP) with flanged and restrained joints. The DIP is to continue underground and shall be polyethylene bagged until connection to the off-site transmission piping.

All ports or openings shall be screened to prevent insect intrusion.

Pressure indicator and sensors units shall be located upstream of the check valve at the discharge of the pump for true indication of pump discharge pressure and identification of check valve position.

An electromagnetic flow meter shall be provided

Back flow prevention shall be provided on discharge or waste piping and/or other water services on the site.

Provide for air release valve at the well head, and or air vacuum valves at the pump discharge.

Automatic control valves shall control pump discharge.

Emergency chlorination connections including a corporation stop at the well head discharge pipe shall be provided.

Refer to Town of Buckeye detail #B-302 for the Well Head Equipment Layout.

Section 13.0 Testing and Reporting

Tests shall be performed and recorded under the supervision of the RP.

The tests conducted shall include, but are not limited to the following:

(1) Step-discharge pumping test (10-hour minimum)

Graphed as: Drawdown level versus (vs.) time, and
Specific drawdown vs. flow rate

(2) Constant rate aquifer test (24-hour minimum)

Graphed as: Drawdown versus time (Cooper-Jacob Plot)
Residual drawdown vs. the ratio t/t^* (Theis Recovery Plot)
Observed drawdown vs. time
Observed residual drawdown vs. the ratio t/t^*

A Well Completion Report shall be prepared by the RP that includes a narrative which describes the testing performed and a summary of the results, a diagram of the as-built well design, and the raw data and graphs specified for each test.

Section 14.0 Electric Power Service and Back-Up Emergency Power

A standby generator shall be provided that is sufficient to provide for continuous water service delivery during power outages.

The generator and fuel tank shall be sized to run continuously for 12 hours without load shedding. Double containment shall be provided and sized dependant on the size of the fuel tank.

Electric utility transformers, meters and other appurtenances shall be located on the well site but outside the block wall to enable meter reading and service to the utility equipment without the need for access to the well site.

Motor control cabinets must be located within a secured Town approved building.

Section 15.0 Well Site Plan

In addition to the Town's requirements set forth in a well construction agreement, a well site shall meet all minimum clear zone requirements as shown in Detail #B-300, and sufficient room shall be allowed for a drill rig to be placed over a replacement well site, assuming a 12-foot by 60-foot footprint for the rig. Sufficient room shall also be allowed for a pipe truck and support truck to be located near the drill rig. In addition, sufficient room shall be allowed for a Town maintenance vehicle to access the original well, while the replacement well is being drilled.

Refer to Town of Buckeye Detail #B-300 & #B300a Well Site Layout.

A variance request for the site specifications in the details shall be submitted and considered as part of the Town's approval of the Site Plan for the well site. Justification for the variance shall be included within the narrative submitted with the Site Plan. Justification for the variance must demonstrate that there is sufficient room for a drill rig, pipe truck and support vehicle to drill the replacement well, while allowing room for a Town maintenance vehicle to access the original well. Justification for the variance must also demonstrate that 50 feet of setback will be provided on any side of a site that borders residential properties.

No well site shall be located under electrical lines that would create an unsafe working environment for initial well drilling and construction, but also for the future safe removal/installation of well pumps or placement of drilling equipment.

Access to the site shall be by vehicle access off of Town or County public street right-of-way to property owned by the Town. No access shall be dependant upon easements across privately owned tracts or land, including homeowner association owned tracts (e.g. drainage areas, playgrounds, and retention basins) or private streets.

Site lighting shall be provided and shielded as necessary.

15.1 On-site Retention Basin

The grade of the site shall provide for drainage away from the well head to the on-site retention basin

A basin shall be constructed on the site that provides for on-site storm water retention of a 100-year, 2-hour event, or a 5-minute well start-up waste stream with drywells designed for drainage of the start-up volumes three times a day, whichever is the greater volume. Drywells shall conform to Town of Buckeye Standard Construction Detail B-502, which is found in Town of Buckeye Engineering Design Manual DM-500. The basin shall provide a method of energy dissipation of waste water flow to the retention area. The slope of the retention basin shall have a gradient of no more than 3 feet of length to 1 foot of depth.

15.2 Site Ground Cover

All ground cover shall be constructed to support maintenance vehicle movement during all weather conditions, and retard growth of vegetation within the site.

Section 16.0 Site Security

The site shall be secured by an 8-foot tall, grouted solid, block wall to match area architecture and color.

The site shall have provisions for securing all doors and gates.

The site shall have a sign fastened to the access gate or door that lists the name and phone number of responsible Town officials to call with questions or concerns. A sign shall also be provided that lists the well name, cadastral location, Arizona Department of Water Resources well registration number, and Public Water System number. The wording will be specified by the Town for each well site.

Section 17.0 Communications and Control

At the minimum, each well site shall have remote access, indication and control by radio telemetry and Supervisory Control & Data Acquisition System (SCADA) equipment that provides the following off-site functions:

- (1) Indication - flow rate, pressure, power failure, pump on/off status, pump fault/failure, generator on/off status, utility/standby power status, generator failure /common alarm, continuous pumping level monitoring, site pressure trending, waste and water totalization meters (i.e. meter all flows).
- (2) Control - remote manual functions for pumps.

Section 18.0 Approval of Well as a Drinking Water Source

After post construction well development and aquifer testing a water sample shall be collected in accordance with a sampling protocol that meets the requirements of the Maricopa County Environmental Services Department (MCESD) and ADEQ. Samples shall be tested by an Arizona-certified (licensed) laboratory for the full suite of contaminants (analytes) required by MCESD and ADEQ for approval of the well as a drinking water source.

A New Groundwater Source Approval for the well is required by the Town prior to approval and acceptance of the well by the Town.

Section 19.0 Post Construction

A full down-hole video survey of the completed well shall be recorded and provided to the Town as a part of the Well Completion Report.

A plumbness and alignment survey shall be performed and provided to the Town as a part of the Well Completion Report after the well has been installed, developed and tested.

Section 20.0 Approval of Construction

An Approval of Construction (AOC) shall be obtained from MCESD prior to delivering any water from the well site for any type of potable use.

The AOC application typically includes final as-built drawings, a signed certification by a registered engineer that the well was equipped and completed in accordance with the construction drawings approved by MCESD, and copies of the test results.

Section 21.0 Conveyance of Well Site and Improvements to the Town

The dedication to, and acceptance by the Town of any wells and well sites shall be pursuant to a well construction agreement required by the Town.

Section 22.0 Grandfathered Provisions

Well sites that have Site Plans previously approved by the Town shall not be subject to the well site requirements of Section 15.0 and Detail B-300A.

A Well Completion Report meeting the requirements of Section 8.2 must be submitted to the Town for approval before the Town will accept a municipal well which was installed prior to the adoption of this manual.

Section 23.0 Existing Wells of Unknown Construction or Previous Use.

Wells of unknown construction or previous non-municipal or non-domestic drinking water supply use, including agricultural use, shall only be considered for temporary use. Requests to temporarily use wells shall be submitted to the Town Engineer for approval as part of a Water System Master Plan.

APPENDIX A

WELL LOCATION AND PRE-CONSTRUCTION CHECKLIST

WELL CONSTRUCTION REQUIREMENTS:

Surface Casing Installed to Minimum Depth of 38 Feet, with 2 Feet of Stickup: ____ Yes ____ No
Surface Casing Compose of Low Carbon Steel with Minimum 38-Foot Cement Annular Seal: ____ Yes ____ No
Surface Casing Diameter (inches): _____

Diameter of Blank and Perforated Casing: ____ Inches. See Requirements Below:

- If Well Depth > 500 Feet and Capacity > 1,000 GPM, 18-Inch Casing and 28-Inch Borehole Diameter is Required
 - If Well Depth ≤ 500 Feet and Capacity ≤ 1,000 GPM, 16-Inch Casing and 26-Inch Borehole Diameter is Acceptable
- Blank Well Casing Constructed of HSLA Steel of Minimum 0.312-Inch Wall Thickness: ____ Yes ____ No
Perforated Casing of Ful Flo Louvered HSLA Steel of Minimum 0.312-Inch Wall Thickness: ____ Yes ____ No
Perforated 1-Inch Diameter Sounding Tube: ____ Yes ____ No
Filter Pack Material Composed of Minimum 95% Quartz Grains: ____ Yes ____ No
Minimum 2-Inch Wide Filter Pack Surrounding Perforated Casing (4-Inch Width Preferred): ____ Yes ____ No
Minimum 2-Inch Wide Cement or Bentonite Seal Between Blank Casing and Borehole Wall: ____ Yes ____ No
Minimum 20-Foot Blank Casing Sump Below Deepest Perforated Interval: ____ Yes ____ No
Bull Nose Casing Bottom: ____ Yes ____ No
12-Inch Thick, 10-Foot By 10-Foot Well Head Concrete Pad: ____ Yes ____ No

Well Owner/Applicant Contact Information:

Name: _____ Day Phone _____

Address: _____ City: _____ State: _____ Zip: _____

Email: _____

Drilling Company: _____

Hydrology Consultant: _____ Day Phone _____

Email: _____

APPENDIX B

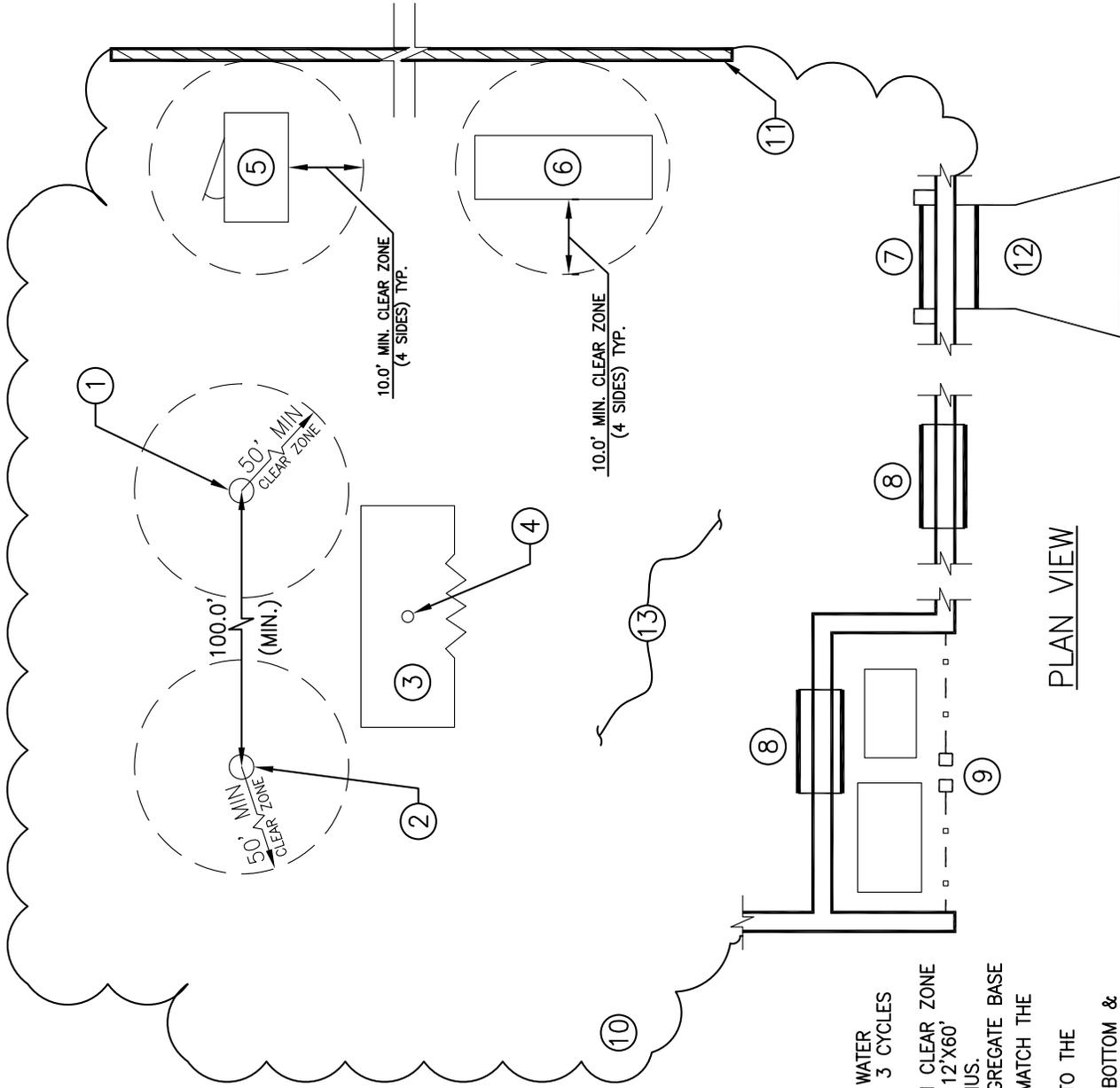
CONSTRUCTION DETAILS

B-300	Well Site Detail #1
B-300A	Well Site Detail #1A
B-301	Well Detail
B-302	Well Head Equipment Layout

- ① PROPOSED WELL HEAD – SEE WELL HEAD EQUIPMENT LAYOUT STANDARD DETAIL
- ② FUTURE REPLACEMENT WELL HEAD SITE
- ③ RETENTION BASIN—SEE NOTE #1
- ④ DRY WELL(S) – MUST BE A MINIMUM OF 50' FROM WELL HEADS
- ⑤ MOTOR CONTROL CENTER (MCC) W/ 3' DEEP CONCRETE PAD & SUNSHADE – SEE NOTE #6
- ⑥ 12 HOUR SERVICE CAPACITY GENERATOR SET W/FUEL AND 80 DECIBEL SOUND ATTENUATOR
- ⑦ 20' ROLLING SECURITY DRIVE GATE
- ⑧ SECURITY ACCESS DR
- ⑨ POWER TRANSFORMER AND SERVICE ENTRANCE SECTION (SES) FOR METERS & SWITCHES SHALL BE LOCATED OUTSIDE OF THE WELL SITE AREA
- ⑩ OVERALL SITE SIZE – SEE NOTE #2
- ⑪ 8"X8"X16" CMU BLOCK WALL TO MATCH THE STYLE, COLOR & FINISH OF ADJACENT DEVELOPMENT THEME WALLS
- ⑫ CONCRETE COMMERCIAL DRIVEWAY PER MAG STD DETAIL #250
- ⑬ PAVED AREA TO BE RESERVED FOR MAINTENANCE VEHICLE ACCESS & FOR FUTURE REPLACEMENT WELL HEAD SITE (MIN. 3" ASPHALT ON 8" COMPACTED ABC)

NOTES:

1. ON SITE RETENTION BASIN SHALL BE SIZED FOR ONSITE STORM WATER RETENTION & 5 MINUTES OF WELL STARTUP WASTE STREAM FOR 3 CYCLES DAY. DRYWELL(S) MAY BE REQUIRED.
2. THE OVERALL WELL SITE SHALL BE SIZED TO MEET ALL MINIMUM CLEAR ZONE REQUIREMENTS AND SHALL DEMONSTRATE THAT A DRILL RIG W/ 12'X60' DIMENSIONS HAS A CLEAR ACCESS W/ SUFFICIENT TURNING RADIUS.
3. INTERIOR AREA OF THE SITE SHALL HAVE 6" OF COMPACTED AGGREGATE BASE COURSE & 2" OF ¾" CLEAN-WASHED AGGREGATE W/ COLOR TO MATCH THE ADJACENT DEVELOPMENT AGGREGATES.
4. THE ROLLING SECURITY DRIVE GATE SHALL BE ANCHORED TO INTO THE GROUND & NOT THE CMU BLOCK WALLS.
5. RETENTION BASIN SHALL HAVE 4" MINIMUM OF RIVER ROCK ON BOTTOM & SIDE SLOPES.
6. THE MCC DOORS SHALL OPEN TO THE NORTH & SHALL HAVE LINE SITE TO THE WELL HEAD AND PUMP ASSEMBLY.



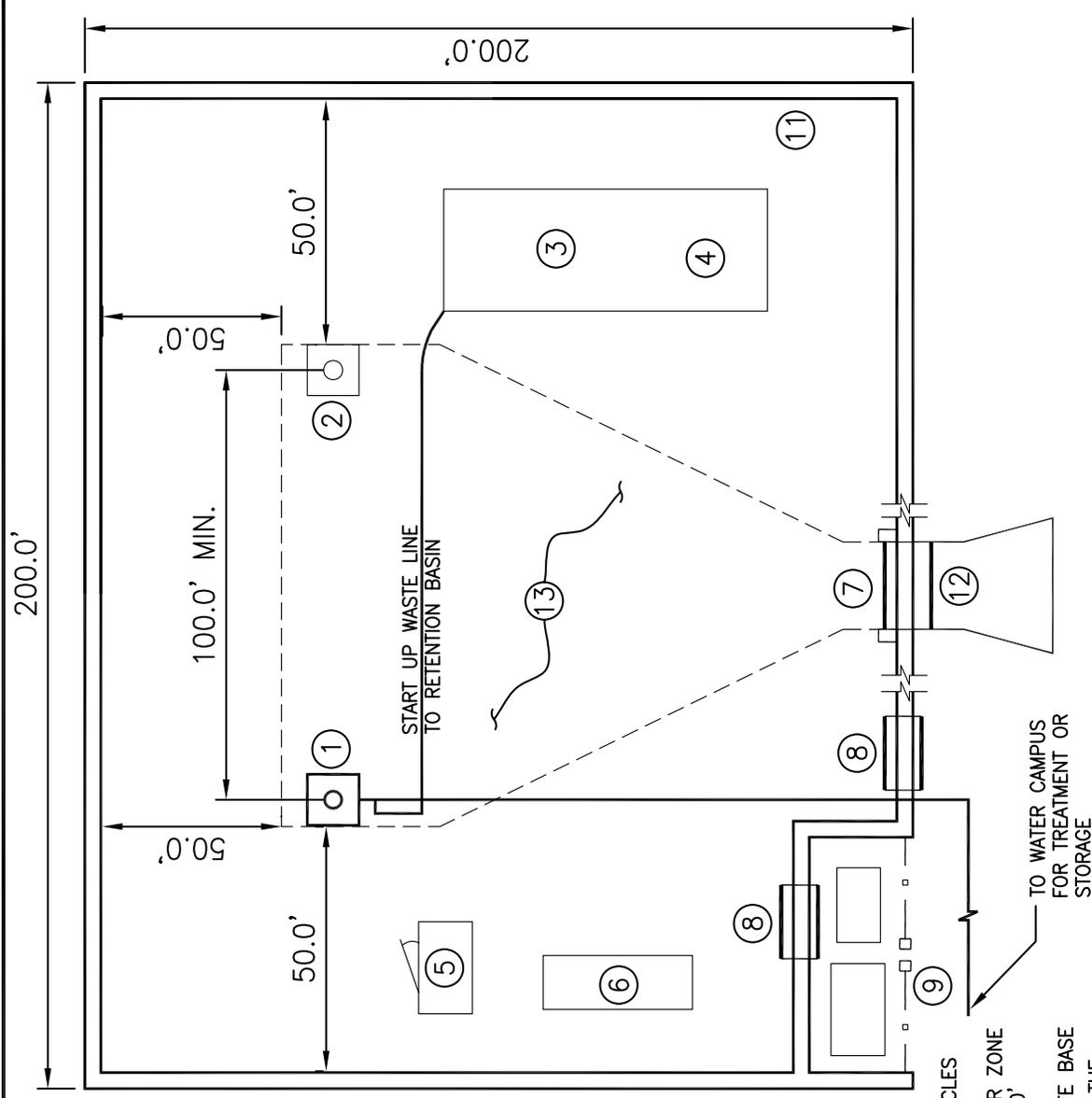
PLAN VIEW

DETAIL NO. B-300	TOWN OF BUCKEYE ARIZONA	STANDARD DETAIL ENGLISH	WELL SITE DETAIL 1 (CLEAR ZONE REQUIREMENTS)	SCALE NTS	DATE 12.28.06	REVISED	DETAIL NO. B-300
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- ① PROPOSED WELL HEAD - SEE WELL HEAD EQUIPMENT LAYOUT STANDARD DETAIL
- ② FUTURE REPLACEMENT WELL HEAD SITE
- ③ RETENTION BASIN-SEE NOTE #1
- ④ DRY WELL(S) - MUST BE A MINIMUM OF 50' FROM WELL HEADS
- ⑤ MOTOR CONTROL CENTER (MCC) W/ 3' DEEP CONCRETE PAD & SUNSHADE - SEE NOTE #6
- ⑥ 12 HOUR SERVICE CAPACITY GENERATOR SET W/FUEL AND 80 DECIBEL SOUND ATTENUATOR
- ⑦ 20' ROLLING SECURITY DRIVE GATE
- ⑧ SECURITY ACCESS DR
- ⑨ POWER TRANSFORMER AND SERVICE ENTRANCE SECTION (SES) FOR METERS & SWITCHES SHALL BE LOCATED OUTSIDE OF THE WELL SITE AREA
- ⑩ OVERALL SITE SIZE - SEE NOTE #2
- ⑪ 8"x8"x16" CMU BLOCK WALL TO MATCH THE STYLE, COLOR & FINISH OF ADJACENT DEVELOPMENT THEME WALLS
- ⑫ CONCRETE COMMERCIAL DRIVEWAY PER MAG STD DETAIL #250
- ⑬ PAVED AREA TO BE RESERVED FOR MAINTENANCE VEHICLE ACCESS & FOR FUTURE REPLACEMENT WELL HEAD SITE (MIN. 3" ASPHALT ON 8" COMPACTED ABC)

NOTES:

- 1. ON SITE RETENTION BASIN SHALL BE SIZED FOR ONSITE STORM WATER RETENTION & 5 MINUTES OF WELL STARTUP WASTE STREAM FOR 3 CYCLES DAY. DRYWELL(S) MAY BE REQUIRED.
- 2. THE OVERALL WELL SITE SHALL BE SIZED TO MEET ALL MINIMUM CLEAR ZONE REQUIREMENTS AND SHALL DEMONSTRATE THAT A DRILL RIG W/ 12'X60' DIMENSIONS HAS A CLEAR ACCESS W/ SUFFICIENT TURNING RADIUS.
- 3. INTERIOR AREA OF THE SITE SHALL HAVE 6" OF COMPACTED AGGREGATE BASE COURSE & 2" OF ¾" CLEAN-WASHED AGGREGATE W/ COLOR TO MATCH THE ADJACENT DEVELOPMENT AGGREGATES.
- 4. THE ROLLING SECURITY DRIVE GATE SHALL BE ANCHORED TO INTO THE GROUND & NOT THE CMU BLOCK WALLS.
- 5. RETENTION BASIN SHALL HAVE 4" MINIMUM OF RIVER ROCK ON BOTTOM & SIDE SLOPES.
- 6. THE MCC DOORS SHALL OPEN TO THE NORTH & SHALL HAVE LINE SITE TO THE WELL HEAD AND PUMP ASSEMBLY.



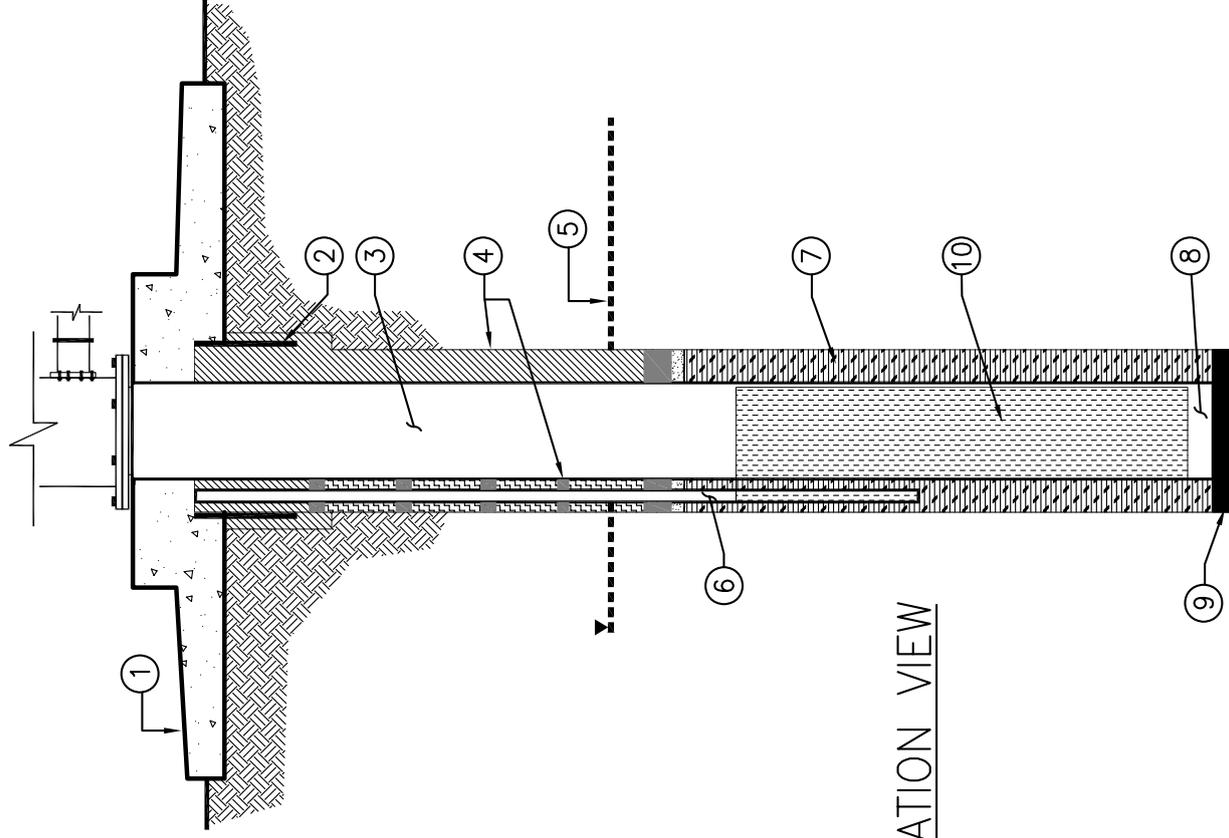
PLAN VIEW

DETAIL NO. B-300A	TOWN OF BUCKEYE ARIZONA	STANDARD DETAIL ENGLISH	WELL SITE DETAIL 1A (SAMPLE SITE LAYOUT)	SCALE NTS	DATE 12.28.06	REVISED	DETAIL NO. B-300A
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- ① 10'x10'x12" SANITARY SEAL/CONCRETE WELL HEAD PAD, 12" MINIMUM THICKNESS PITCHED AWAY FROM WELL HEAD FOR DRAINAGE
- ② 40' LOW CARBON STEEL SURFACE CASING--38' PENETRATION
- ③ 18" DIAMETER MINIMUM BLANK CASING - SEE NOTE #1
- ④ 20' BENTONITE ANNULAR SEAL, OR FULL GROUT SUBJECT TO SUB-SURFACE GEOLOGICAL DATA
- ⑤ HYDROSTATIC WATER LEVEL
- ⑥ SOUNDING TUBE, PERFORATED
- ⑦ 4" ANNULUS FILTER PACK
- ⑧ BULL NOSE CASING BOTTOM
- ⑨ GROUTED FOUNDATION/CASING BASE
- ⑩ 18" DIAMETER LOUVERED SECTION OR STAINLESS STEEL WIRE WRAPPED WELL SCREEN (SUBJECT TO TOWN APPROVAL) - SEE NOTE #1

NOTE:

- 1. 16" DIAMETER BLANK CASING AND LOUVERED CASING IS ACCEPTABLE IF THE WELL DEPTH IS < 500 FEET AND THE DISCHARGE RATE IS < 1000 GALLONS PER MINUTE (GPM)



ELEVATION VIEW

DETAIL NO. B-301	TOWN OF BUCKEYE ARIZONA	STANDARD DETAIL ENGLISH	WELL DETAIL (FOR GUIDELINE PURPOSES ONLY)		SCALE NTS	DATE 12.28.06	REVISED	DETAIL NO. B-301
								

① PUMP MOTOR AND DISCHARGE HEAD

② 6' DIAMETER WORKING ZONE

③ SOUNDING TUBE (W/ RECESSED THREADED PLUG)

④ GROUND ROD W/ BOND WIRE--TO DISCHARGE HEAD

⑤ BREATHER TUBE

⑥ POWER RISER PIPE

⑦ CENTER SHAFT OIL DRUM/RESERVOIR WITH ELECTRONIC OILER CONTROLS

⑧ DISCHARGE LINE

⑨ 10' X 10' X 12" CONCRETE PAD MINIMUM - SEE NOTE #3

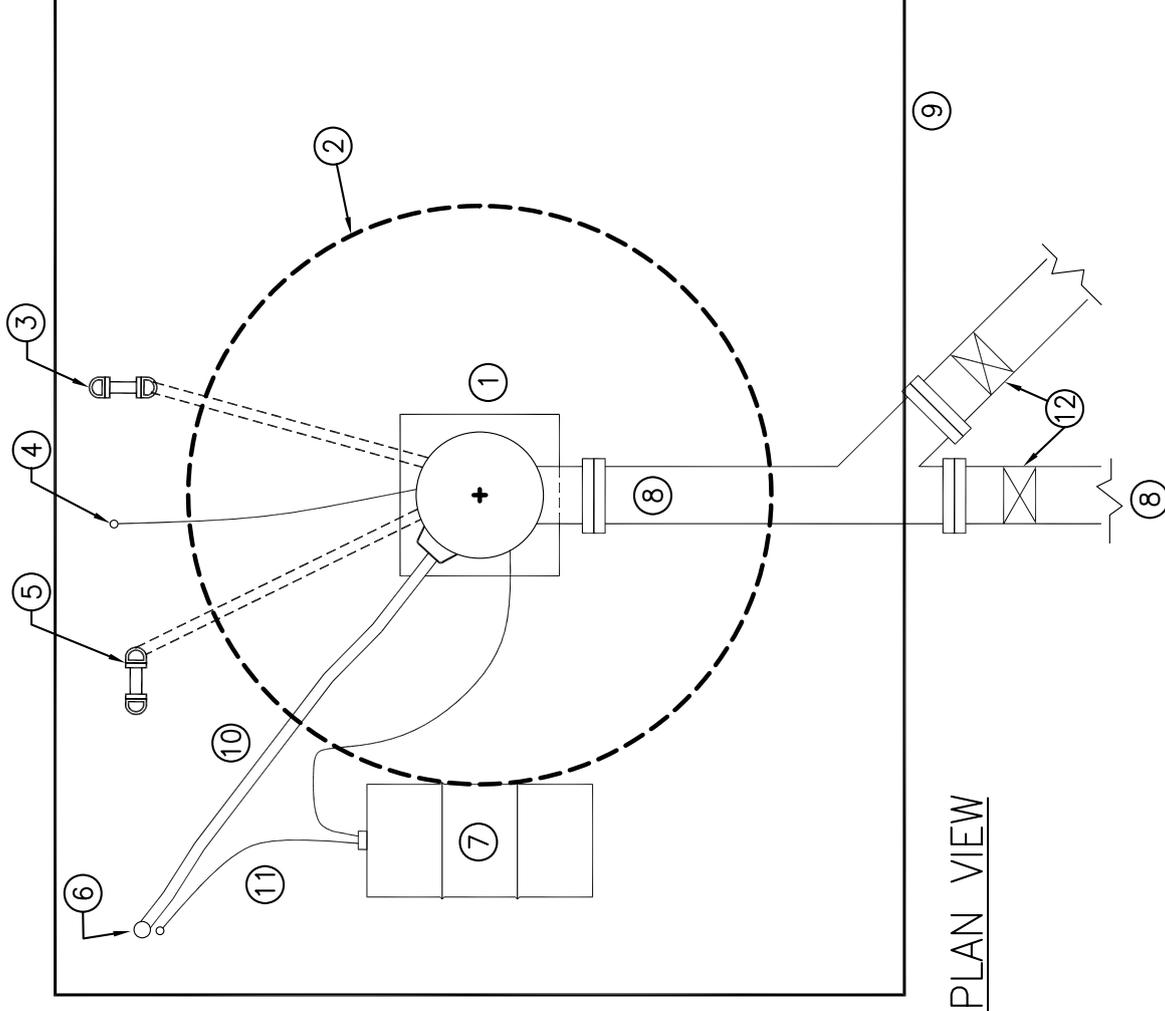
⑩ SEAL TIGHT FLEXIBLE CONDUIT WIRE WHIP FOR POWER TO WELL PUMP MOTOR

⑪ SINGLE PHASE WIRING IN SEAL TIGHT CONDUIT TO AUTOMATIC ELECTRONIC OILER CONTROL

⑫ VALVE & METER

NOTES:

1. NO EQUIPMENT, PIPING, RISERS, BREATHER TUBES SHALL PROTRUDE IN WORKING ZONE AREA OF WELL PAD.
2. EQUIPMENT SHALL BE PLACED SUCH THAT PUMP RIG HAS CLEAR ACCESS TO THE WELL HEAD AND CAN BE APPROACHED FROM DRIVE GATE OF WELL SITE.
3. WELL PAD SHALL BE SLOPED FOR POSITIVE DRAINAGE AWAY FROM WELL HEAD



PLAN VIEW

DETAIL NO.
B-302

 TOWN OF
BUCKEYE
ARIZONA

STANDARD DETAIL
ENGLISH
WELL HEAD EQUIPMENT LAYOUT
(FOR GUIDELINE PURPOSES ONLY--WORKING ZONE)

SCALE
NTS

DATE
12.28.06

REVISED

DETAIL NO.
B-302