ORIGINAL

MILLER BROOKS
Environmental, Inc.

June 28, 2005

Mr. Marlin Scott
Engineering Section
Arizona Corporation Commission
1200 W. Washington St.
Phoenix, AZ 85007

W-03875A-03-0737
W-03875A-03-0870

Re: Docket Numbers W-03875A and W-03875A-0870
Procedural Order Amending Decision No. 67163
Arsenic Removal Treatment Plan for Mountain Glean Water Service, Linden, Arizona
Miller Brooks Environmental, Inc. Project Number 611-0001-02

Dear Mr. Scott:

Pursuant to the Arizona Corporation Commission's (Commission) Procedural Order Amending Decision Number 67163 requesting an arsenic removal treatment plan from Mountain Glen Water Service (MGWS) by June 30, 2006, Miller Brooks Environmental, Inc. (Miller Brooks) is submitting this arsenic treatment plan. Miller Brooks has been retained by MGWS as the site engineer to design and implement appropriate arsenic removal options.

Chronology of Events

- November 4, 2004: Miller Brooks submitted a proposal for dissolved arsenic removal alternatives and associated costs to MGWS. The proposal was forwarded to Arizona Department of Environmental Quality (ADEQ) Water Infrastructure and Finance Authority (WIFA) to secure Technical Assistance (TA) funding. A copy of this proposal is presented in Attachment A. The proposal included two options.

  - Option 1: An evaluation of different arsenic treatment technologies and associated costs. Different arsenic treatment technologies, construction requirements, advantages and disadvantages, and associated capital improvement and operation and maintenance costs were evaluated. Detailed evaluations of iron-oxide filtration, coagulation/filtration and hybrid iron media technologies were presented to ADEQ WIFA (Attachment A; Sections 3, 4 and 5).

  - Option 2: Replacement of arsenic-impacted wells with a new production well screened appropriately to replace and exceed the production capacity of arsenic-impacted wells. The new production well was proposed on land that was not owned by MGWS; however, with plans for MGWS to acquire the needed parcel. This option also included a capacity improvement/upgrade feature, which was a 120,000-gallon above ground storage tank (AST).

Upon review, ADEQ WIFA responded by requesting costs associated ONLY with the design of the new well (including drilling of a pilot hole to collect discreet interval water samples for arsenic analyses for proper well screening) as the TA funding did not cover costs associated with infrastructure improvements (including well completion, pump installation and tank installation

- On December 6, 2004, Miller Brooks submitted a revised cost estimate for design of arsenic mitigation that included costs associated with:

  - Design of a new production well and

  - Design of an arsenic treatment system (in the event the access to the proposed new well location was not granted)

  A copy of this correspondence/revised cost estimate is presented in Attachment B. A copy of the subsequent ADEQ WIFA funding approval is also presented in Attachment C.

- In January 2005, MGWS filed for an ADEQ WIFA Loan for funding of capital improvements. These funds would be slated for covering costs beyond the ADEQ WIFA TA which would include converting the pilot borehole to a production well, installing a pump, installing a new AST, connecting the water system back to the newly installed production well and associated permitting [Arizona Department of Water Resources (ADWR); Navajo County], construction, electrical and mechanical work related costs. The funds have been set aside by ADEQ WIFA; however, their approval and disbursement are subject to the Commission's approval of this document.

- Between January and April 2005, MGWS tried to negotiate the sale of the proposed new production well property as identified in the October 2004 proposal. However, the current property owner was reluctant to sell part of the property following several negotiations and submittal of the property usage maps, etc.

- After several failed negotiations to acquire the subject property for a new production well, in mid to late Aril 2005, MGWS decided to replace an existing well that had the overall best water quality, but did not have the production capacity due to lack of sufficient water column. This well, known as Linden West (Figure 1, Attachment A), lacks the water production capacity and adequate back-up storage capacity. The proposed method of approach for this location is as follows:

  - Abandon existing Linden West well;

  - Drill a new pilot borehole adjacent to the current well location and collect water quality data to design an appropriately screened new production well (per approved ADEQ WIFA TA funds);

  - Upon well design, convert the pilot borehole into a new 6-inch internal diameter production well;

- o Once the newly installed production well is completed, the existing storage tank will be removed and preparations for a new storage tank will begin. Miller Brooks is currently in the process of finding the most appropriately sized tank, which would provide the maximum storage capacity considering the limited lot size available for infrastructure improvements; and

- o Install well pump, connect new production well to storage tank and connect the tank to the water distribution system.

Developments Since May 2005

Once the final well location was selected (Linden West well location), in May 2005, Miller Brooks began the process of selecting the drilling contractor. On May 19, 2005, representatives from Miller Brooks and the drilling subcontractor (Drill Tech), along with Ms. Beatrice Parker of MGWS, met at the Linden West well site to evaluate drilling and construction logistics associated with the small lot size. Following the site reconnaissance visit and meeting, the following tasks have been completed, or are in the process of being completed:

- A well abandonment permit to abandon the Linden West well was prepared and submitted to ADWR. This permit was approved on June 1, 2005.
- A new well installation permit is being prepared for submittal during the week of June 13, 2005. Preliminary well construction details are presented in Attachment D.
- Miller Brooks is completing the evaluation of new storage tank size, dimensions and storage capacity for selection purposes.
- Miller Brooks has initiated permitting activities with Navajo County for well development water discharge and other construction-related activities.
- A tentative schedule for the start of project field activities is towards the end of July, with the disconnecting of the Linden West from the water system and decommissioning of the current on-site storage tank.
- Estimated project costs are as follows:
    - ADEQ WIFA Technical Assistance for new well design is $54,700.
    - ADEQ WIFA Loan amount is $176,000, which includes but is not limited to the following approximate cost breakdown:
        - Drilling services (existing well pump removal and well abandonment, new well drilling, depth specific water sampling, new well installation, pumping test and a 20 HP submersible pump installation) – $62,593.
        - Site infrastructure improvements (includes site boundary survey, new above-ground storage tank installation, removal of existing storage tank, site compound installation, grading work and connecting new well and tank to MGWS distribution main) – $75,440.
        - Engineering services [project planning, coordination and management, site supervision, permitting (Navajo County, ADWR, ADEQ etc.), geo-technical work, site preparation and project reporting] - $ 37,967.

Although, field activities are tentatively scheduled for July 2005, they are subject to the allocation/disbursement of ADEQ WIFA Loan funds to ensure that the project can be completed in a timely manner and transfer of funding from one source (TA) to another (Loan) is seamless and without any delays.

It is anticipated that the attached documents and the contents of this letter format will suffice as the Arsenic Treatment Removal Plan, which was requested by the Commission. If you have any questions or concerns, please do not hesitate to contact me at 602.728.0577 or via email at waseemkhan@millerbrooksenv.com.

Sincerely,
Miller Brooks Environmental, Inc.

Waseem A. Khan, PG, CEM
Vice President and Senior Geologist

Attachs:
- Attachment A Proposal for Arsenic Removal
- Attachment B Revised Cost Estimate for Design of Arsenic Mitigation
- Attachment C Notice to Proceed
- Attachment D Preliminary Well Construction Details

cc: Ms. Beatrice Parker, MGWS
Mr. Jon Bernreuter, ADEQ WIFA
Miller Brooks' Project File 611-0001-02

A

ATTACHMENT A

ADEQ WIFA
PROPOSAL FOR ARSENIC MITIGATION

NOVEMBER 4, 2004

PROPOSAL

FOR

ARSENIC REMOVAL

AT

LINDEN EAST #1 WELL
MOUNTAIN GLEN WATER SERVICE, INC.
LINDEN, ARIZONA

PRESENTED TO:
MOUNTAIN GLEN WATER SERVICE, INC.
P.O. BOX 868
CLAY SPRINGS, ARIZONA 85923

NOVEMBER 4, 2004

SUBMITTED BY:

MILLER BROOKS ENVIRONMENTAL
202 EAST EARLL DRIVE, SUITE 470
PHOENIX, ARIZONA 85012

MBE PROPOSAL No. [illegible]-04-11

TABLE OF CONTENTS

1.0 INTRODUCTION

Miller Brooks Environmental, Inc. (Miller Brooks) of Phoenix, Arizona is pleased to submit this proposal to Mountain Glen Water Service, Inc. (MGWS) for Arsenic. MGWS requested a proposal for the treatment and/or removal of dissolved Arsenic detected in their production well, "Linden East #1," located in Linden, Arizona (Figure 1). Miller Brooks understands that the project is partially funded by Arizona Water Infrastructure Finance Authority (WIFA). Miller Brooks is an approved WIFA contractor.

Miller Brooks will designate Mr. Waseem Khan to manage and coordinate the project, with additional support from other key staff members at Miller Brooks. The technical approach used to prepare this proposal is based on a review of the existing data provided by MGWS and information gathered from MGWS' Mr. Bill Parker and Ms. Beatrice Parker during a site reconnaissance visit and subsequent communications.

1.1 PROJECT BACKGROUND

The latest groundwater analytical results indicated that this well yielded total Arsenic concentration of 14 and 15 micrograms per liter (µg/L) (Mohave Environmental Laboratory, Bullhead City, Arizona and ATL, Tucson, Arizona, respectively) in water samples collected in September 2004. Beginning on January 1, 2006, the allowable Arsenic concentrations in drinking water are 10 µg/L. Consequently, MGWS will be required to reduce the influent total Arsenic concentrations in the water system generated at Linden East #1 Well. The analytical results do not present the nature of Arsenic (Arsenic +3 and/or Arsenic +5).

Other water wells incorporated in the MGWS include "Linden East #2 and Linden West" (Figure 1). Neither of these wells currently exceed the 10 µg/L limit for Arsenic. Details on the distribution system infrastructure are summarized in Section 2.0.

1.2 KEY PROJECT PERSONNEL

As mentioned above, Miller Brooks will designate Mr. Khan as the Project Manager and point of contact. Additionally, he will be assisted by a team of well-qualified and experienced technical personnel, including Mr. Raymond Craft and Ms. Susan Alvarez, who are both registered Chemical and Civil Engineers in Arizona, respectively. We have included their professional résumés in Appendix A.

2.0 WATER SYSTEM SPECIFICATIONS

The MGWS consists of the following engineering specifications:

2.1 WATER WELLS AND ASSOCIATED INFRASTRUCTURE

As mentioned earlier, the water distribution system consists of three exiting and operating wells. Based on a site reconnaissance visit conducted on September 17, 2004, personal interviews with MGWS personnel, and a review of the Arizona Department of Water Resources (ADWR) database, the following information is presented:

- Linden East #1:
  - ADWR Registration #: 55-629078
  - Legal Cadastral Coordinates: SW ¼, NW ¼, SE ¼, Section 34, Township 11 North, Range 21 East, Navajo County
  - Well Installation: 1965
  - Approximate Well Depth: 290 feet
  - Approximate Depth to Groundwater: 223 to 245 (1965) feet below ground surface (bgs)
  - Well Diameter: 10 inches
  - Casing Type: Steel
  - Approximate Daily Production: 58,000 gallons per day (gpd)
  - Storage Tank: 15,000-gallon galvanized steel above-ground storage tank (AST)
  - Submersible Pump Capacity: 20 horse power (HP)
  - Maximum Pump Capacity: 150 gallons per minute (gpm)
  - Booster Tanks: Three 85-gallon booster tanks
  - Booster Pump: Two 5-HP pumps

- Linden East #2:
  - ADWR Registration #: 55-629080;
  - Legal Cadastral Coordinates: NW ¼, NW ¼, SE ¼, Section 3, Township 10 North, Range 21 East, Navajo County
  - Well Installation: 1963
  - Approximate Well Depth: 265 feet
  - Approximate Depth to Groundwater: 230 (1965)
  - Well Diameter: 6 inches
  - Casing Type: Steel
  - Approximate Daily Production: 24,750 gpd
  - Storage Tank: 12,000-gallon galvanized steel AST
  - Submersible Pump Capacity: Unknown
  - Maximum Pump Capacity: 60 gpm
  - Booster Tanks: Four 85-gallon booster tanks
  - Booster Pump: One 7.5-HP pump

- Linden West:
  - ADWR Registration #: 55-629079;
  - Legal Cadastral Coordinates: SW ¼, SW ¼, SW ¼, Section 3, Township 10 North, Range 21 East, Navajo County
  - Well Installation: 1963

- Approximate Well Depth: 270 feet
- Approximate Depth to Groundwater: 223 to 230 (1963) feet bgs
- Well Diameter: 6-inch
- Casing Type: Steel
- Approximate Daily Production: 4,000 gpd
- Storage Tank: 12,000-gallon galvanized steel AST
- Submersible Pump Capacity: 7.5 HP
- Maximum Pump Capacity: 55 gpm
- Booster Tanks: Four 85-gallon booster tanks
- Booster Pump: One pump

The MGWS distribution system consists of the following infrastructure:

- Three production wells independently connected to the distribution network
- Number of Connections: Approximately 240
- Total System Yield: 50,000 to 90,000 gpd;
- Water Main Type and Diameter: Concrete and PVC; 6-inch internal diameter
- Fire Hydrants: None
- Pressure System: Varies across the distribution network due to elevation differences

3.0 ARSENIC REMOVAL

Based on the chemical and physical data provide by MGWS, Miller Brooks evaluated several options to address water quality generated at Linden East #1 Well. Upon data review, Miller Brooks evaluated the options as two categories which include an on-site water treatment at the Linden East #1 location OR installing a new production well to eliminate Linden East #1 from the existing distribution system. We have taken into account the existing site constraints and the existing infrastructure associated with the Linden East #1 well site and the MGWS distribution network, which limit treatment options. It should be noted that engineering design details on these alternatives are presented below:

3.1 OPTION #1: ARSENIC TREATMENT

As part of the treatment option, Miller Brooks evaluated several potential Arsenic removal alternatives. However, most were judged as impractical or not cost-effective for this scenario. Three Arsenic removal technologies were short-listed as practical and recognized Arsenic treatment technologies. These include treatment using granular iron oxide/Granular Ferric Hydroxide (GFH), coagulation/filtration, and hybrid iron media (ion exchange). Brief technology descriptions and associated impacts and operational features are presented below:

3.1.1 Iron-Oxide Filters

Granular iron oxide, also called GFH, is a method of removing dissolved Arsenic from drinking water. Although new to the United States, the method has been successfully utilized for years in Germany. There are two domestic equipment suppliers who receive their media from German sources. Both suppliers presumably provide similar media.

The technology appears to be simple and reliable. The City of Scottsdale, Arizona has contracted to have GFH systems installed for dissolved Arsenic treatment at three of their production well sites. Miller Brooks evaluated costs from two separate equipment suppliers (AdEdge and U.S. Filter).

3.1.1.1 Technology Description

Untreated water extracted from the well is passed through a bed of iron-oxide pellets, facilitating the adsorption of dissolved Arsenic onto the iron oxide. When the iron oxide becomes spent (unable to adsorb sufficient Arsenic to meet water-quality goals), it is discarded, and replaced with fresh iron oxide.

3.1.1.2 Design Criteria

The iron-oxide filtration equipment should have the following properties:

- Produce product water with concentrations of less than 10 μg/L Arsenic;
- Treat water at a maximum rate of 120 gpm;
- Operate reliably; and
- Operate with minimum maintenance

3.1.1.3 Environmental Impacts

An iron-oxide adsorption system would be installed near the well. The spent iron-oxide pellets can be disposed of as solid non-hazardous waste in a landfill. No adverse environmental effects are expected.

3.1.1.4 Land Requirements

No new land would be required by an iron oxide filter Arsenic treatment system. However, one12 feet by 12 feet building to house the treatment system and 10 feet by 10 feet concrete pad for a backwash tank will be needed for treatment system installation.

3.1.1.5 Potential Construction Problems

Iron-oxide filter systems use steel, or PVC pipe and valves, and steel pressure vessels common to other types of granular media filtration, such as carbon or resin. For this reason, the equipment is available off-the-shelf, and construction problems are minimal.

3.1.1.6 Advantages/Disadvantages

The advantages of using iron oxide filter systems are:

- The technology is simple and well understood;
- Equipment is easy to operate;
- Operations require no addition of chemicals;
- No requirement to chlorinate the water;
- There is only one point of maintenance;
- Additional taps require no additions to treatment equipment; and
- Operating costs are moderate due to the relatively low Arsenic concentration.

The disadvantage of iron-oxide filter systems is:

- The technology is not recognized by the U.S. Environmental Protection Agency (EPA) as a "best available technology" (BAT) for removing Arsenic from drinking water. However, the lack of recognition is probably because the technology is new to the United States, even though it has been successfully applied in Europe. The technology is now also being implemented throughout United States, including in Arizona.

3.1.1.7 Cost Estimates

Miller Brooks received cost estimates from AdEdge Technologies, Inc. (AdEdge), of Norcross, Georgia, which is the United States distributor for the iron-oxide filter systems manufactured by Severn-Trent Services and US Filter.

The following assumptions were made to arrive at estimated costs for the AdEdge system:

- Capital equipment cost of $70,300 (from AdEdge);
- Capital equipment cost of $61,000 (from US Filter)
- General labor costs of $20 per hour;
- AdEdge system includes a backwash recycle system.
- US Filter system requires a backwash tank, pump and controls;
- O&M general labor of 1 hour per week;
- Replacement media and disposal cost of $4,725 per year (from AdEdge); and $6,880 per year (from US Filter).
- The equipment lasts for 20 years.

3.1.2 Coagulation/Filtration

This Arsenic treatment technology has a proven track record and has been used at several locations throughout the United States. Miller Brooks evaluated this technology utilizing information and costs provided by Filtronics, Inc.

3.1.2.1 Technology Description

Iron oxide is added to the water. The iron oxide precipitates, and dissolved Arsenic co-precipitates along with the iron oxide. The precipitated iron oxide is then filtered out of the water stream. The system is designed to be backflushed periodically, to remove the precipitate and prevent it from clogging the filter media. The backflushed water could be either disposed of, or recycled. Both vendors offer equipment to pump the backflush into a settling tank, where the precipitant settles into a sludge at the bottom of the tank, and the water is recycled back into the system. The sludge is removed several times per year, and disposed of as solid non-hazardous waste.

3.1.2.2. Design Criteria

The coagulation/filtration equipment should have the following properties:

- Produce product water with concentrations of less than 10 µg/L Arsenic;
- Treat water at a maximum rate of up to 70 gpm. Flow is bypassed and blended during peak flow rates;
- Recovers backflushed water;
- Operate reliably;
- Operate with minimum maintenance;

3.1.2.2 Environmental Impacts

The filtration system would be installed on a concrete pad near the well. No adverse environmental effects are expected.

3.1.2.3 Land Requirements

No new land would be required by a coagulation/filtration Arsenic treatment system. However, system installation and infrastructure needs are similar to iron-oxide filtration technology.

3.1.2.4 Construction Problems

Coagulation/filtration equipment is available on a turnkey basis, and no construction problems are anticipated.

3.1.2.5 Advantages/Disadvantages

The advantages if coagulation/filtration are:

- Low operating cost
- There is only one point of maintenance; and
- Additional taps require no additions to treatment equipment.

The disadvantages of coagulation/filtration are:

- High capital cost;
- Need to chlorinate the water;
- Treatment system is more complex than the other centralized treatment system considered.

3.1.2.6 Cost Estimates

Miller Brooks obtained a cost estimate for the coagulation/filtration system from Filtronics, Inc. (Filtronics) of Anaheim, California. Filtronics strongly recommends that a pilot test be performed on site before the full-scale system is installed. The vendor would absorb most of the costs of the pilot study, if the full-scale system were purchased.

The following assumptions were made to arrive at estimated costs:

- Capital equipment cost of $99,800 (from Filtronics);
- Additional equipment costs for a tank for recycling backwash water;
- Non-reimbursable pilot study costs of $1,000, which represents travel, meals, and lodging for two Filtronics employees for 3 days (pilot study equipment rental costs are applied to the equipment purchase price);
- General labor costs of $20 per hour;
- O&M general labor of 1 hour per week;
- Chemical and electrical costs are $1,500 per year (from Filtronics); and
- The equipment lasts for 20 years.

3.1.3 Hybrid Iron Media

Hybrid iron media uses a nano-particle selective resin designed to remove Arsenic (arsenate and arsenite) from water. The hybrid media process involves passing untreated water through an iron-based material that adsorbs the Arsenic. Miller Brooks evaluated this technology using costs and system processes related information supplied by McPhee Environmental Supply and Conestoga-Rovers and Associates (CRA).

3.1.3.1 Technology Description

The untreated water passes through a bed of iron-oxide coated macroporous polystyrene beads and the dissolved Arsenic is adsorbed onto the iron oxide. When the media is exhausted, typically after a few months to more than a year, the spent media is removed from the lead vessel and taken off site for regeneration.

3.1.3.2 Design Criteria

The hybrid iron media equipment should have the following properties:

- Produce product water with concentrations of less than 10 ug/L Arsenic;
- Treat water at a maximum rate of at least 100 gpm;
- Operate reliably;
- Operate with minimum maintenance;

3.1.3.3 Environmental Impacts

A hybrid iron media system would be installed adjacent to the well. Spent hybrid iron media will be regenerated off site. The equipment supplier would remove spent media for regeneration in off-site facilities owned and operated by the supplier. Regenerated resin would be returned to the facility. There may be some potential environmental liability associated with off-site regeneration of spent Arsenic-laden media. The regeneration process may generate brines that require additional treatment. Treated wastewater from regeneration would require discharge to a City sewer under an industrial wastewater discharge permit (i.e., to a publicly-owned treatment works). Solid waste from media regeneration may be disposed of as solid non-hazardous waste in a landfill.

3.1.3.4 Land Requirements

No new land would be required by a hybrid iron media Arsenic treatment system. However, system installation and infrastructure needs are similar to the above-mentioned technologies.

3.1.3.5 Construction Problems

Hybrid iron media systems use steel, or PVC pipe and valves, and steel pressure vessels common to other types of granular media filtration, such as carbon or resin. As with the iron-oxide filtration system, the equipment is available off-the-shelf, and construction problems are minimal.

3.1.3.6 Advantages/Disadvantages

The advantages of hybrid iron media systems are:

- The technology is simple and well understood;
- The resin has received NSF 61 certification;
- Resins can be regenerated up to five times with minimal loss of capacity;
- Equipment is very easy to operate;
- Backwashing is not required.
- Operations require no addition of chemicals;
- No requirement to chlorinate the water;
- There is only one point of maintenance; and
- Additional taps require no additions to treatment equipment.

The disadvantage of hybrid iron media systems is:

- Media must be replaced every 10 years;
- Operating costs may escalate with increasing cost of media regeneration or replacement;
- As with iron oxide, the technology is not recognized by the EPA as a BAT for removing Arsenic from drinking water;
- Media must be regenerated off-site. Alternate regeneration facilities may not be available;
- Hybrid iron media is a relatively new technology; and
- No long-term performance data available. Systems using hybrid iron media have been pilot tested. Currently, no full-scale systems are in operation.

3.1.3.7 Cost Estimates

Miller Brooks received a cost estimate from CRA. The system proposed by CRA utilizes SolmeteX™ As:X^np resin. McPhee Environmental Supply (Appendix A) distributes Solmetex™ resins in Arizona.

The following assumptions were made to arrive at estimated costs:

- Capital equipment cost of $48,000 (from CRA);
- General labor costs of $20 per hour;
- O&M general labor of 1 hour per week;
- Media regeneration costs of $0.172/1000 gallons treated (from CRA);
- Media will require replacement every 10 years; and
- The equipment lasts for 20 years.

3.2 OPTION # 2: NEW PRODUCTION WELL

As an alternative to improving water quality within the MGWS distribution network, Miller Brooks has also evaluated a non-Arsenic treatment option. This option includes the drilling and installation of a new production well that could improve water quality, increase system capacity and upgrade the existing water distribution system. Figure 1 illustrates the proposed location of a new production well, should this option be selected instead of an active Arsenic treatment system at the Linden East #1 Well site.

3.2.1 Well Design

Prior to initiating well drilling activities, Miller Brooks will design the new production well. The well design will include, but not be limited to, the following:

- Perforation interval;
- Well casing diameter and type;
- Well construction details;
- Above-ground well completion details;
- Estimated depth to static water elevation;
- Installation of a 15- to 20-HP pump capable of producing 150 gpm;
- Annular space materials and depths; and
- A maximum total depth of 500 feet.

If needed, per the ADWR (unless agreed upon earlier by MGWS and the ADWR), the well design will be submitted by MGWS to the ADWR for approval before drilling activities commence. Miller Brooks can and is willing to submit the well design to the ADWR on behalf of MGWS. If needed, Miller Brooks will incorporate any changes and/or suggestions to the well design that may be requested by the ADEQ.

3.2.2 ADWR Permitting

Miller Brooks will prepare and submit Notice of Intent (NOI) to drill and install the proposed new well at the designated location (Figure 1). The process will include ADWR permit preparation, obtaining the MGWS designated board member or staff signature on the NOI forms, and submitting the permits to the ADWR for review and approval. The NOI form to the ADWR will be accompanied with well permitting fees, individual well design, and any applicable waiver request.

3.2.3 Well Drilling and Installation

Miller Brooks will provide project management and coordination with on-site supervision during essential drilling and well installation activities to ensure that the well is installed in accordance with specifications approved by ADWR, as well as any applicable MGWS requirements. We will utilize a qualified geologist to supervise the drilling program. He/she will ensure that a proper well drilling log is prepared and the well is installed according to the approved design specifications. This information can be submitted to the ADWR in a letter report format, if needed.

3.2.4 Production Well Drilling and Installation

For proposal purposes, Miller Brooks assumes that a 500-foot deep production well will be drilled and installed at the proposed location (Figure 1). It should be noted that upon project completion, Miller Brooks' invoice would be based on actual drilling footage, which may be less than the assumed 500 feet.

Based on anticipated drilling conditions at the proposed drilling location, Miller Brooks will utilize mud or foam rotary drilling technique. We assume that drill cuttings generated during drilling activities will be spread near the well location and would not be subject to containerization and later disposal. The cost estimate for the well installation option is based on the following assumptions:

- Total well depth is 500 feet;
- An 8-inch internal diameter steel surface casing will be installed;
- A 20-HP pump will be installed;
- Well will be perforated from approximately 400 to 500 feet bgs;
- A factor slotted screened interval will consist of ⅛ x 2¼ inch slots; and
- Well will be capable of producing approximately 150 gpm.

3.2.5 Well Development

Upon completion of well installation, the production well will undergo a 24-hour pumping test which will allow the connection between the well and the aquifer, as well as assist in the developing the well itself. Miller Brooks assumes that well water generated during the pumping test will not be containerized but will be allowed to discharge near the newly installed well.

3.2.6 Water Quality Analysis

Towards the end of the 24-hour pumping test, Miller Brooks will collect water samples for several water quality parameters, including chemical and physical parameters needed for a new public water system. The water samples will include Arsenic among other metals, organic compounds, inorganic compounds, hardness, pH and several other parameters.

3.2.7 Well Site Infrastructure

The corresponding costs also include for the installation of a 70,570-gallon AST connected to the new well and to the MGWS network at the nearby meter location. The tank specifications include the following:

- 26.154 feet diameter by 18.06 feet high;
- Factory coated steel;

- Tan colored;
- On-site construction and installation;
- Delivery to site approximately 6 to 8 weeks from project approval; and
- Constructed in accordance with standards, specifications and/or interpretations and recommendations of professionally recognized agencies and groups such as AWWA, API, ACI, ASTM, and AWS etc.

3.2.8 Electrical and Mechanical Work

The costs associated with the installation of a new well also include costs for on-site plumbing and electrical work. It should be noted that the well pump would require a 3-phase electric service. Based on site reconnaissance, it appears that single-phase power is available at the site. Costs associated with bringing a 3-phase electric service are NOT included in the cost estimate and can be provided later.

3.2.9 Project Completion Report

Upon completion of well installation, tank installation and connection to the MGWS distribution services, as an option, Miller Brooks has included costs associated with preparing and submitting a letter report documenting well installation and related activities upon completion of field tasks. This letter report, if needed, can be submitted to ADWR and other funding agencies by MGWS.

4.0 COST ESTIMATES

Based on the options presented in Section 3.0, Miller Brooks has prepared costs estimates for each of the three short-listed Arsenic treatment technologies presented in Option # 1 and also for a new public water system installation as presented in Option # 2. Breakdown of costs are presented in Tables 1 through 6. It should be noted that we have also provided estimated operation and maintenance costs associated with each of the Arsenic removal systems. In either case, the costs for implementing the most practical Arsenic removal system or the new water system are very similar.

Tables 1 through 4 present costs summaries associated with AdEdge, U.S. Filter, Filtronics and McPhee Environmental Supply/CRA equipment costs, respectively. Table 5 presents annual operation and maintenance costs associated with each of the technology. Finally Table 6 presents costs associated with the installation of a new water system. A summary of cost estimate breakdowns is as follows:

4.1 OPTION # 1: ARSENIC REMOVAL SYSTEMS

- Iron Oxide Filtration
  - AdEdge = capital costs are $114,926.18 and $5,725.00 annual O&M costs
  - U.S. Filter = capital costs are $143,998.43 and $7,880.00 annual O&M costs

- Coagulation/Filtration
  - Filtronics, Inc. = capital costs are $185,648.02 and $2,500.00 annual O&M costs

- Hybrid Iron Media
  - McPhee Environmental Supply, Inc./CRA = capital costs are $110,366.20 and $6,343.00 annual O&M costs

4.2 OPTION # 2: NEW WATER SUPPLY SYSTEM

- New water well, AST and supporting infrastructure = $114,957.50.

5.0 RECOMMENDATIONS

In the event MGWS elects to implement an Arsenic removal system at the Linden East #1 Well site, Miller Brooks recommends an Iron Oxide Filtration system manufactured by AdEdge. This recommendation is based on overall project costs, taking into account the capital costs, as well as long-term operation and maintenance costs. AdEdge system schematics and additional specifications are presented in Appendix B.

As illustrated in proposed costs, implementing either option will result in similar capital improvement costs. To assist MGWS in selecting the appropriate option, Miller Brooks has provided advantages and limitations of each option below.

5.1 ADVANTAGES /DISADVANTAGES OF ELECTING OPTION #1

The following are some of the advantages of implementing an AdEdge or any of the evaluated Arsenic treatment systems at the Linden East #1 Well site are as follows:

- Improve water quality and reduce dissolved Arsenic concentrations

The following are some of the disadvantages of installing a new well:

- Installing an Arsenic removal system will not increase system capacity;
- Capital costs for system implementation = ***$114,926.18;***
- Long-term operation and maintenance may not outweigh the benefits of water treatment;
- Although the current well site area configuration appears to permit the installation of system, it may restrict future vehicle traffic access to the wellhead for well maintenance or redevelopment, etc., resulting in accessing neighboring vacant lot; and
- Due to the lack of a central blending facility, the treated water produced at Linden East #1 Well may not overcome water-quality issues if water quality deteriorates in a separate well that is online.

5.2 ADVANTAGES /DISADVANTAGES OR ELECTING OPTION #2

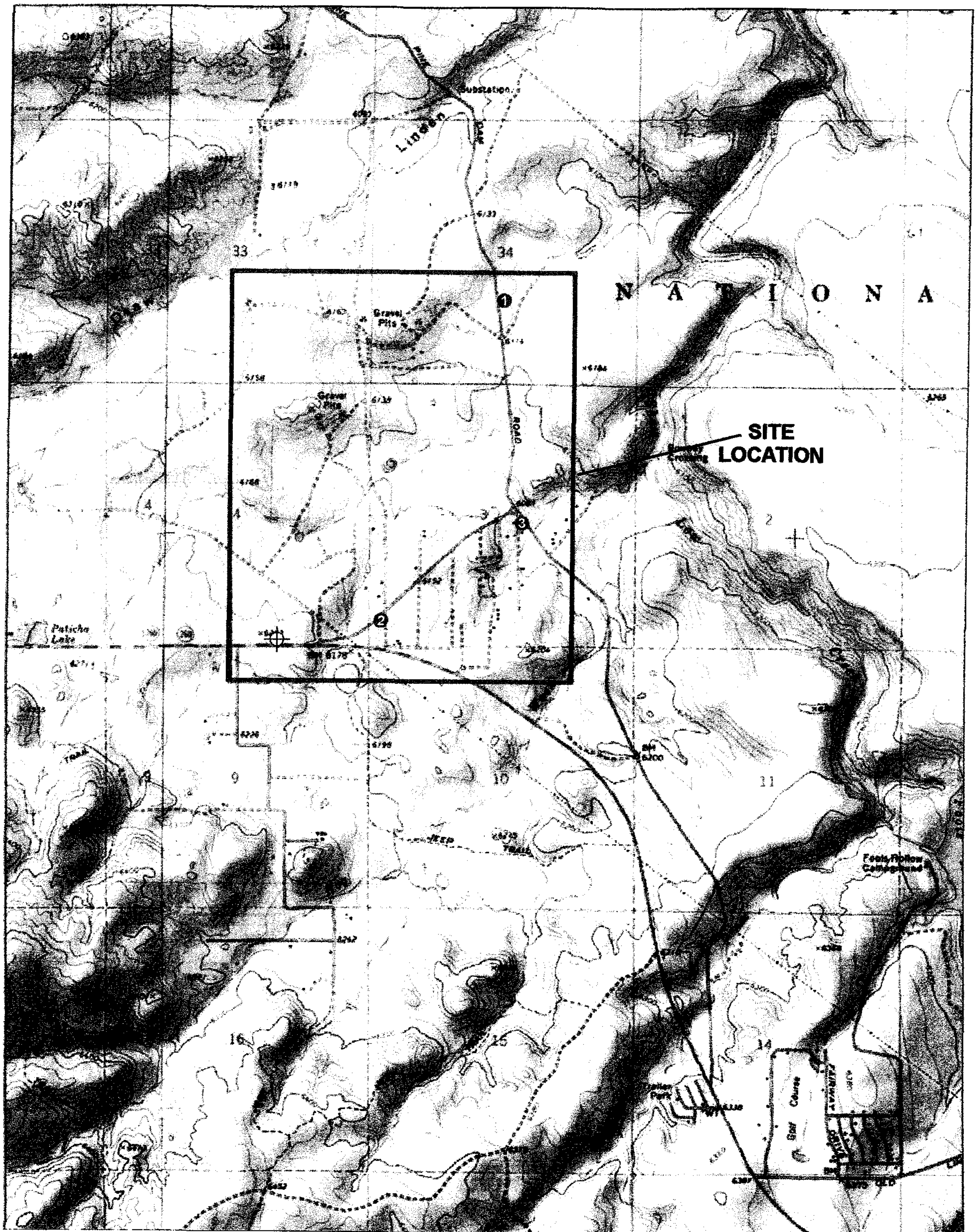
The following are some of the advantages of implementing Option #2:

- Improve water quality and reduce dissolved Arsenic concentrations. This is based on nearby wells screened in similar intervals;
- Increase system capacity;
- Allow for upgrading of the overall system;
- Reduce long-term operation and maintenance costs;
- Located near the highest point elevation of the MGWS distribution system; and
- Based on surface elevation, the new well and tank will allow for the overcoming of system pressure drops due to topographic changes within the water distribution main.

The following are some of the disadvantages of installing a new well:

- The land is not owned by MGWS and would either have to be purchased or leased;
- Capital costs for installing a new water supply system = ***$114,957.50;*** and
- Although nearby water-quality data indicates compliance with maximum allowable dissolved Arsenic concentrations, there are no guarantees that the new well will be in compliance until actual water samples are collected.

FIGURE



LEGEND

- ❶ Linden East #1
- ❷ Linden West
- ❸ Linden East #2
- ⌖ Proposed Alternate Production Well Location.

0 — 3000

Approximate Scale:
1 inch = 3000 feet

Source: US Geological Survey 7.5 min topographic map, Show Low, Arizona.

MILLER BROOKS Environmental, Inc.	MOUNTAIN GLEN WATER SERVICES, INC. LINDEN, ARIZONA			
SITE LOCATION MAP				FIGURE 1
PROPOSAL#: 09-04-11	FILE#: vmap1	DATE DRAWN: 11/03/04	DRAWN BY: J. HIGH	

TABLES

TABLE 1
Mountain Glen Water Service
Arsenic Removal System
Engineer's Opinion of Probable Cost

Iron Oxide Filtration - AdEdge

Arsenic Treatment System	$	92,926.18
Design	$	12,000.00
Construction Inspections and Testing	$	10,000.00
Total	**$**	**114,926.18**

Equipment	$	75,390.00
Concrete/Site Work/Building	$	6,664.14
Piping	$	6,882.04
Electrical	$	3,990.00

Arsenic Treatment System Cost Breakdown:	$	92,926.18

TABLE 2
Mountain Glen Water Service
System Improvements
Engineer's Opinion of Probable Cost

Iron Oxide Filtration - U.S. Filter

Arsenic Treatment System	$	103,595.43
Storage Tank and Piping	$	-
#REF!	$	-
Water Distrubution System	$	-
Subtotal	**$**	**103,595.43**
Design	$	15,539.00
Admin./Certifications	$	7,252.00
Survey, Construction Inspections and Testing	$	7,252.00
Contingencies	$	10,360.00
Total	**$**	**143,998.43**

TABLE 3

Mountain Glen Water Service System Improvements

Engineer's Opinion of Probable Cost

Coagulation/Filtration - Filtronics, Inc.

Arsenic Treatment System	$	143,913.02
Storage Tank and Piping	$	-
#REF!	$	-
Water Distrubution System	$	-
Subtotal	**$**	**143,913.02**
Design/Pilot Testing	$	14,391.00
Admin./Certifications	$	10,074.00
Survey, Construction Inspections and Testing	$	10,074.00
Contingencies	$	7,196.00
Total	**$**	**185,648.02**

TABLE 4
Mountain Glen Water Service
System Improvements
Engineer's Opinion of Probable Cost

Hybrid Iron Media - McPhee Environmental Supply/CRA

Arsenic Treatment System	$	76,643.20
Storage Tank and Piping	$	-
#REF!	$	-
Water Distrubution System	$	-
Subtotal	**$**	**76,643.20**
Design/Pilot Testing	$	15,329.00
Admin./Certifications	$	5,365.00
Survey, Construction Inspections and Testing	$	5,365.00
Contingencies	$	7,664.00
Total	**$**	**110,366.20**

TABLE 5

Estimated Capital and O&M Costs for Arsenic Treatment Systems
Mountain Glen Water Service, Linden, Arizona

Treatment Location	Arsenic Removal Technology	Equipment Supplier	Capital Cost*	Annual O&M Costs			Comment
				Chemicals /Media/Tests /Parts	O&M Labor	Total O&M Cost	
At Well	Granular Iron Oxide	AdEdge	$68,300	$4,725	$1,000	$5,725	Includes backwash recovery system.
	Coagulation/Filtration	Filtronics	$99,800	$1,500	$1,000	$2,500	May require additional water storage capacity.
	GFH Media	USFilter	$61,000	$6,880	$1,000	$7,880	Requires backwash recovery system.
	Hybrid Iron Media	McPhee/CRA	$48,000	$5,343	$1,000	$6,343	New technology. Doesn't require backwashing.

Assumed General Hourly Labor Cost: $20

* Does not include system infrastrucure design and installation

TABLE 6

Mountain Glen Water Services - New Water System Installation, Linden, Arizona
COST PROPOSAL WORKSHEET SUMMARY

Miller Brooks Proposal # 09-04-11

PROJECT OVERVIEW

Task Number	Description		Extended Price		Total
Task 1.0	**Project Planning and Support**				
Task 1.1	Project Management, Coordination and Site Inspections	$	10,014.80		
Task 1.2	Subcontractor Management Cost	$	4,794.70		
Task 1.3	Performance and Payment Bonds	$	-		
				$	14,809.50
Task 2.0	**HASP**	$	60.00		
				$	60.00
Task 3.0	**Well Installation**				
Task 3.1	Well Drilling and Installation, Tank Installation and Supporting Infrastructure	$	95,102.00		
Task 3.2	ADWR Permitting	$	900.00		
Task 3.3	Laboratory Analyses	$	1,250.00		
Task 3.4	Waste Disposal	$	-		
Task 3.5	Well Installation Report	$	1,986.00		
Task 3.6	Site Survey	$	850.00		
Task 3.7	Site Access	$	-		
				$	100,088.00
Task 4.0		$	-		
				$	-
			PROJECT TOTAL	***$***	***114,957.50***

APPENDICES

APPENDIX A

PROFESSIONAL RÉSUMÉS

WASEEM A. KHAN, R.G., P.G., C.E.M.
Senior Geologist/Vice President

EXPERIENCE SUMMARY

Mr. Khan has over 15 years of experience in applying environmental technologies to assist private and public sector clients. He has personally conducted or managed environmental projects and/or managed client accounts ranging in cost from a few thousand to over one million dollars a year accounts. Oriented and focused toward problem solving, Mr. Khan has been commended by his clients and the regulatory community for his thorough, comprehensive investigations, practical solutions, and clear and concise reports. He has an excellent record for obtaining agency cooperation and approval as well as fostering public understanding of complex and controversial projects.

His area of expertise includes managing multi-site portfolios with sites in various phases of environmental site assessments and/or remediation. His experience includes managing environmental site assessments, geologic data interpretation, performing remedial pilot tests, evaluating cost-effective remedial alternatives, regulatory liaison and/or negotiations, designing soil and groundwater remediation programs and implementing passive and/or active remediation.

PROJECT EXPERIENCE

- **Town of Why, Arizona**
  Mr. Khan is the current Project Director for a water infrastructure improvement project currently encumbering federal funding through USDA. Upon approval of funds, the project will include building an **Arsenic treatment facility, design and implementation of a new water main, installation of two above ground storage tanks and** installing several fire hydrants.

- **Meadowridge Estates, Oakland County, Michigan**
  A step draw down aquifer test and a pumping test were conducted to estimate the aquifer characteristics and determine the well loss coefficients for the pumping well. Mr. Khan coordinated and oversaw both tests. The hydro-geologic data collected was used to assess the feasibility of designing a high capacity domestic water production well capable of yielding 1,000 gpm to serve a 60-unit housing subdivision. Upon compiling of all pertinent data, the production well was designed and constructed.

REGISTRATIONS / CERTIFICATIONS

- Professional Geologist: Wisconsin
- Registered Geologist: Washington
- Certified Environmental Manager: Nevada

EDUCATION

- ***BS, Geology, University of Toledo, Toledo, Ohio***
- ***MS, Geology, Bowling Green State University, Bowling Green, Ohio***
- ***National Ground Water Association Courses:*** Capture Zone Analysis for Containment, Remediation and Wellhead Protection, Corrective Action for Containing and Controlling Ground Water Contamination, Risk Assessment for Environmental Professionals: Contaminant Fate and Transport using API Decision Support Software.
- ***Other Courses and Seminars:*** Risk Assessment: Characterizing, Quantifying and Communicating by Nicholas Associates, Inc., and Arizona and Federal Environmental Law by Arizona Chamber of Commerce

SPECIALIZED TRAINING

- OSHA Management and Supervisor Training
- 40-Hour OSHA Health and Safety Training

- **Cyprus Mining Corporation - Bagdad, Arizona**
  The Cyprus copper mine is located at approximately 4,000 feet above the National Geodetic Vertical Datum in a high desert environment. Because of arid environment, groundwater recharge is limited to infrequent heavy to moderate precipitation events. Groundwater recharge at the copper mine is via percolation process. Based on the surface geology at the site, water percolates through the unconsolidated basalt boulders and cobbles before reaching a weathered rhyolite tuff. This weathered rhyolitic tuff when saturated acts as a natural slip plane causing the overlying overburden to slide. Consequently several recent landslides have taken place near the edge of the mine into the adjoining canyon.

  Mr. Khan was a member of a multi-office team that performed a thorough site assessment to determine viable de-watering and land slide prevention alternatives at the above referenced copper mine in Yavapai County, Arizona. **Mr. Khan's duties included drilling and installing groundwater extraction wells, supervising aquifer pumping tests, installing de-watering submersible pumps, supervise groundwater recovery pipeline installation from various de-watering wells to recycling process station.** In addition, Mr. Khan was also involved with various former rafinate pond investigations that included drilling and soil sampling to delineate the vertical and lateral extent of low pH and heavy metals in former ponds.

  To mitigate frequent landslides at the site, a de-watering program was initiated. This program included the placement of a several pumping wells in a well field. This well field is currently in operation. In addition, groundwater entering the canyon floor via seeps next to the site is collected in a pond and pumped up hill approximately 700 feet in elevation from the canyon floor to the mine area. Groundwater pumped from the wells in the well field and the canyon floor is transported to a network of rafinate ponds where it is mixed and recycled with other low pH fluids from the leach fields. Some wells in the well field are serving dual purpose by not only de-watering the mesa, but also pumping low pH water containing high dissolved metals' concentrations.

WORK HISTORY

Miller Brooks Environmental, Inc. — 1995 – Present

Phoenix, Arizona. Mr. Khan began his career with Miller Brooks Environmental, Inc. in Phoenix as a Senior Project Geologist. Currently, he is a Senior Geologist and Vice President responsible for the day-to-day operations in Arizona and Clark County, Nevada. During his tenure with Miller Brooks Environmental, Inc., Mr. Khan was the project manager for ConocoPhillips' Alliance work in Arizona. He is also currently the project manager for Shell Oil Products US work in Clark County, Nevada and several special projects in Arizona.

Environmental Science & Engineering, Inc. — 1990-1995

Mr. Khan began his career with Environmental Science and Engineering, Inc. (ESE) as a Staff Geologist in the Williamston, Michigan office. Mr. Khan later transferred to the Phoenix, Arizona office. During his tenure with ESE, Mr. Khan was responsible for technical work including but not limited to planning and implementation of drilling programs involving soil boring, groundwater monitor well and remedial well installation, soil and groundwater sampling, remedial pilot testing, technical report preparation and project coordination and management. His work focused primarily for Mobil Oil Corporation, BP-Amoco, Chevron USA Products Company and various projects for the Arizona department of Environmental Quality – State Lead Unit.

Tooke Northeast, Inc. — 1989-1990

Mr. Khan began his career as a well site geologist in the oil and gas exploration in Michigan and Ohio Basins. His duties included subsurface lithological and hydrocarbon logging during drilling of oil and gas prospects.

RAYMOND S. CRAFT, P.E.

SENIOR ENGINEER

EXPERIENCE SUMMARY

Mr. Craft has 29 years of consulting engineering and management experience. His experience includes design and project management of projects for water and wastewater treatment, water reuse, plant expansion, facility upgrades, chemical and waste management systems, air pollution control, soil and groundwater remediation, and environmental compliance.

Mr. Craft's facilities/process engineering experience includes design and operation of water and wastewater treatment systems, groundwater remediation facilities, and point source permitting (Aquifer Protection, NPDES direct discharge and POTW pretreatment). His design experience includes both physical/chemical and biological treatment systems for industrial and municipal wastewater and air stripping, granular activated carbon adsorption, and chemical oxidation (ozone and UV/hydrogen peroxide) applications for groundwater, and advanced wastewater treatment processes for groundwater treatment, wastewater treatment, and water reclamation/wastewater reuse.

PROJECT EXPERIENCE

Why Utility Company Preliminary Engineering Report and Water Treatment System Upgrades, Town of Why, Arizona
Prepared Preliminary Engineering Report to address elevated concentration of dissolved arsenic in the Town's production wells and to upgrade the Town of Why's water distribution system. Work included **evaluation of arsenic removal technologies including point of use and central treatment alternatives**. Performed of cost/benefit analyses of the most feasible options, and recommended one option to the Why Utility Company for implementation. Also designed a major upgrade to the water distribution system to bring it into compliance with current state regulations. The revised Preliminary Engineering Report submitted to USDA Rural Development for approval and to obtain grant funding for the arsenic treatment and distribution system infrastructure.

Ground Water Treatment System Design and Installation, Arizona Department of Environmental Quality, Payson, Arizona
Project included development of the design basis, determination of equipment requirements, and preparation of plans, specifications, and installation requirements for treatment of over 100 gallons per minute (GPM) of groundwater contaminated with tetrachloroethylene at up to 10,000 micrograms per liter. Facility was designed to produce treated water suitable for reuse in potable drinking water system. Equipment included recovery pump, packed tower, dehumidifier, vapor carbon adsorption canisters, transfer pump, pre filtration and liquid phase carbon adsorption vessel. Project also included system start-up and operation and maintenance for one year following installation.

Town of Quartzsite Water Reuse Study, Quartzite, Arizona
Performed a feasibility study for reuse of treated effluent from the Quartzsite Waste Water Treatment Plant (WWTP). Study included flow evaluation, review of treatment and conveyance requirements, analysis of water reuse options. The report also included: preliminary sizing and cost analysis; evaluation of Arizona Department of Environmental Quality (ADEQ) water reuse permitting requirements; determination of emergency water supply and

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer, Arizona - No. 19384
- Professional Engineer, California - No. 3766
- Executive Board Member (past Chair), Arizona Section of the American Institute of Chemical Engineers

EDUCATION

- B.S., Chemical Engineering, University of Nevada, Reno
- Master of Science (candidate), Environmental Engineering, Arizona State University, Tempe, Arizona
- Graduate Studies in Business Management, University of Missouri, Kansas City and California State University at Sacramento

SPECIALIZED TRAINING/KEY SKILLS

- Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-Hour Training
- HAZWOPER Management and Supervisor Training
- Water/Wastewater Treatment
- Remedial Action Work Plans
- Air Pollution Control and Permitting
- NPDES, APP and POTW permitting
- Storm Water Pollution Prevention Plans
- Pollution Prevention & Waste Minimization
- Bench Scale and Pilot Testing
- Design Development
- RCRA/Hazardous Waste Management
- Water and Waste Recycling
- Surface and Groundwater Modeling (HEC-RAS, MODFLOW)
- Code Review and Safety Inspections
- Environmental Compliance/Audits
- Groundwater/Soil Remediation
- Construction Oversight
- SARA Title III reports (Tier II and Form R)

PROJECT EXPERIENCE - continued

discharge alternatives; and recommendations for public outreach and educational programs and changes to local ordinances to permit and regulate water reuse facilities.

Municipal Wastewater Treatment Facility Upgrade, U.S. Army National Training Center, Fort Irwin, California
Preparation of final engineering design, plans, and specifications for the repair, replacement, and upgrade of Fort Irwin's wastewater treatment facility.

Manenggon Hills Water/Wastewater Treatment Facilities, Guam, USA
Design of facilities for biological treatment of sanitary wastewater at the Manenggon Hills Water Reclamation Plant. Project Engineer for the design of a 1.55-MGD water softening plant using reverse osmosis. Responsibilities included conceptual design, material balances, photo ionization detection (PID), general/equipment arrangement and specifications.

Alternatives Analysis and Design, Confidential Client, Eagar, Arizona
Analysis included evaluation and design of facilities for remediation of gasoline and diesel in ground water from UST removal. Basis for system design was 140 gallon per minute (gpm) and included ground water pumping, equalization (250,000 gallons), and treatment with ozone and hydrogen peroxide/UV, air stripping, and both vapor and liquid-phase carbon adsorption.

Industrial Wastewater Treatment System, Michelin Tire Corporation, Clemson, South Carolina
Design of a 1.2-MGD facility for treatment of industrial wastewater from a major tire manufacturer. Fully automated system included biological treatment by sequenced batch reactor, heavy metals removal, dissolved air flotation, clarification, disinfection, and post-aeration prior to discharge under a NPDES permit.

Ground Water Treatment System Design, Motorola Corporation, Phoenix, Arizona
Provided design support for an 810-gpm ground water treatment system for the removal of halogenated and non-halogenated volatile organic compounds. System included bulk storage, air stripping and liquid and vapor carbon adsorption and steam regeneration of carbon.

Industrial Wastewater Treatment System Design, American Airlines, Tulsa Maintenance & Engineering Facility, Tulsa, Oklahoma
Performed analysis of discharge alternatives including deep well injection, NPDES direct discharge and industrial sewer and proposed process design of a 0.7-MGD wastewater recycling facility for a major airline maintenance facility including reverse osmosis, and treatment technologies for removal of suspended solids, oils, organic compounds, and metals. Developed a waste minimization program which included establishment of a tracking system, assessment of minimization options, determination of technical and economic feasibility, and recommendation of options for implementation for control and/or elimination of undesirable constituents (metals, solvents, toxic, etc.) in the facility's wastewater.

Wastewater Discharge Options/Design Review, Explosives Manufacturer, Salt Lake City, Utah
Evaluated discharge options (NPDES, direct discharge industrial sewer) and recycling/water reclamation alternatives (reverse osmosis, ion exchange, electrodialysis) for wastewater containing organic-nitrate explosives. Pilot tests were performed for both carbon adsorption and reverse osmosis to determine explosives removal capability prior to discharge to industrial sewer.

Arizona City Wastewater Treatment Facility, Arizona City, Arizona
Provided engineering oversight, design, and construction inspection services for all phases (site preparation through final construction) of an $8 Million, 1.5 MGD wastewater treatment facility. Highlights include: Expansion of existing 0.5 MGD facility; sequenced batch reactor with sand filtration, aerobic digestion, and sludge recovery (vacuum drying beds); and Aquifer Protection Permit for reuse and surface discharge.

SUSAN M. ALVAREZ, PE

SENIOR ENGINEER

EXPERIENCE SUMMARY

Ms. Alvarez has over 23 years of broad practical experience in civil and environmental planning, engineering and design for water resources, infrastructure, and community development projects. She has completed designs for the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, the U.S. Forest Service and Bureau of Land Management, the Los Alamos National Laboratory (LANL), Fort McDowell Yavapai Nation, Yavapai Prescott Tribe, and numerous small communities and private firms.

Ms. Alvarez has been involved in all aspects of a project's development: from the initial project planning and site evaluation, to the development of plans, specifications and cost estimates, to field observation and construction management. She is familiar with current computer models used for water and wastewater system analyses and design. She also has considerable experience in grants, public involvement, and other agency requirements that bring projects into fruition.

PROJECT EXPERIENCE

Santa Teresa Utility Investigation, Private Developer, Santa Teresa, NM.
Ms. Alvarez was the Project Manager and lead Civil Engineer for several projects at the U.S. /Mexico border crossing in Santa Teresa, NM. She performed a field utility investigation for a 220 acre industrial development. She performed design and cost estimating for a **1,500 gpm well**, **water distribution system**, 750,000 gallon elevated storage tank, 100,000 extended aeration wastewater treatment plant and adjacent evaporation ponds for disposal to serve the surrounding 550 acre area (including existing residential use). Ms. Alvarez wrote the preliminary engineering report summarizing the infrastructure needs and worked with New Mexico's U.S. Congressional delegation to secure a 1.4 million dollar appropriation to provide water and wastewater service.

Coeur d'Alene Tribe and USEPA, Region 10, Couer d'Alene, ID
As part of ongoing technical support for a CERCLA Feasibility Study, Ms. Alvarez prepared a "Technical White Paper" addressing current **water treatment** methods for removing **arsenic**, lead, zinc, and cadmium, for the 1,400 square mile Coeur d'Alene Coeur d'Alene River basin. Current and **innovative water treatment** technologies were evaluated with respect to effectiveness, implementability and relative costs. Ms. Alvarez also performed **life-cycle cost analyses** of these methods to assess cost impacts over time.

Nisqually Indian Tribe, Olympia, WA.
Ms. Alvarez was project manager for a **1,100-feet water supply**/distribution line, associated booster pump station, and hydropneumatic tank to serve an elder housing development for the community. She performed **water system analyses**, **pressure testing**, design, and construction management services

City of Albuquerque, South Valley Utility Upgrade, Santa Teresa, NM.
Ms. Alvarez was the project manager for an evaluation of existing septic systems and **private wells** in Albuquerque's South Valley, a former agricultural area of several square miles, that was rapidly developing into residential land uses. She developed a **water network model**, and **designed systems for water distribution**, **well replacement**, and several alternatives for **water and wastewater treatment**.

REGISTRATIONS

- Professional Engineer, Arizona - No. 34413
- Professional Engineer, Idaho- No. 8214
- Professional Engineer, New Mexico – No.11521
- Professional Engineer, Oregon - No. 18394
- Professional Engineer, Texas- No. 60372 (Inactive)
- Professional Engineer Washington - No. 32633

EDUCATION

- B.S., Civil Engineering, Rice University, Houston, Texas, 1981
- Graduate Studies in Water Resources, University of Washington, Seattle, Humboldt University, Arcata, California, and University of Houston, Texas

SPECIALIZED TRAINING

- Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-Hour Training
- Water wells, storage and distribution systems
- Water System Network Modeling
- Water/Wastewater Master Planning
- Water/Wastewater Treatment Design
- Onsite Sewage Treatment (Septic)
- Remedial Action Work Plans
- NPDES, Permitting
- Hydrologic, Hydraulic, Sediment Transport Modeling
- Storm Water Pollution Prevention Plans
- Pollution Prevention & Waste Minimization
- Waste Management
- Design Development
- RCRA/Hazardous Waste Management
- Water and Waste Recycling
- Construction Oversight
- Habitat assessment
- Habitat restoration
- Constructed Wetlands
- Mine Reclamation

PROJECT EXPERIENCE-continued

Metlakatla Indian Community, Annette Island, AK,
Ms. Alvarez developed the Annette Island Water System Concept Study for the Metlakatla Indian Community in Annette, AK in order to bring a World War II –era water supply and distribution system into compliance with **current USEPA drinking water regulations**. She performed **field reconnaissance** of the **existing water** system, designed and specified point-of-use treatment systems to bring safe water to 20 homes. She developed three alternatives replace a 10-mile long World War II-era waterline and surface water supply (including **advanced treatment** options to address **arsenic**). She also developed cost estimates for these each alternatives, along with an evaluation of advantages and disadvantages.

Greatwood and Twinwood Subdivisions, Private Developers, Sugarland, Texas
Ms. Alvarez was the Project Manager for a 1300-acre and the 450 acre mixed-use developments located near the Brazos River in Texas. She designed utilities, drainage and subdivision layouts for the initial 300 acre phase of each development. For each subdivision, she **designed**, **permitted**, and provided **construction management** for **two 1,500 gpm water wells**, ground water storage tanks, and **treatment** facilities, and extended aeration waste **water treatment plants**.

Lower Elwha Klallam Tribe, Port Angeles, WA
Susan worked with the Tribe and project stakeholders to identify alternatives for mitigating impacts of riverine dam removal on local water intake structures, **wells** and wastewater systems. She performed an inventory of on-Reservation septic facilities and **domestic wells**, and identified alternatives for water treatment to allow re-use. Alternatives carried forward for detailed evaluation included constructed wetlands, extended aeration treatment systems, **sequence batch reactor**, **filtration systems**, **membrane bioreactor**, and oxidation ponds. Ms. Alvarez also developed the design for constructed wetlands for wastewater polishing and disposal.

WORK HISTORY

Miller Brooks Environmental, Inc. 2004 – Present
Ms. Alvarez serves as a Senior Engineer responsible for the day-to-day project management in Arizona.

Ridolfi, Inc. – Seattle, WA and Scottsdale, AZ 1996 – 2004
Ms. Alvarez was the southwest regional manager and Senior Civil Engineer for a small women-owned and disadvantaged business enterprise that provides civil and environmental consulting engineering services.

Leedshill-Herkenhoff, Inc. - Albuquerque, NM 1991-1996
Ms. Alvarez served as Senior Project Manager and Civil Department Head for a mid-sized full-service architectural and engineering firm that provides consulting services to Tribes, Cities, State and Federal agencies.

Lockwood, Andrews & Newnam, Inc. - Houston, TX April 1989 – January 1991
Ms. Alvarez served as a Project Engineer V and provided design engineering, project management, scheduling and client interaction through a mid-sized full-service architectural-engineering consulting firm.

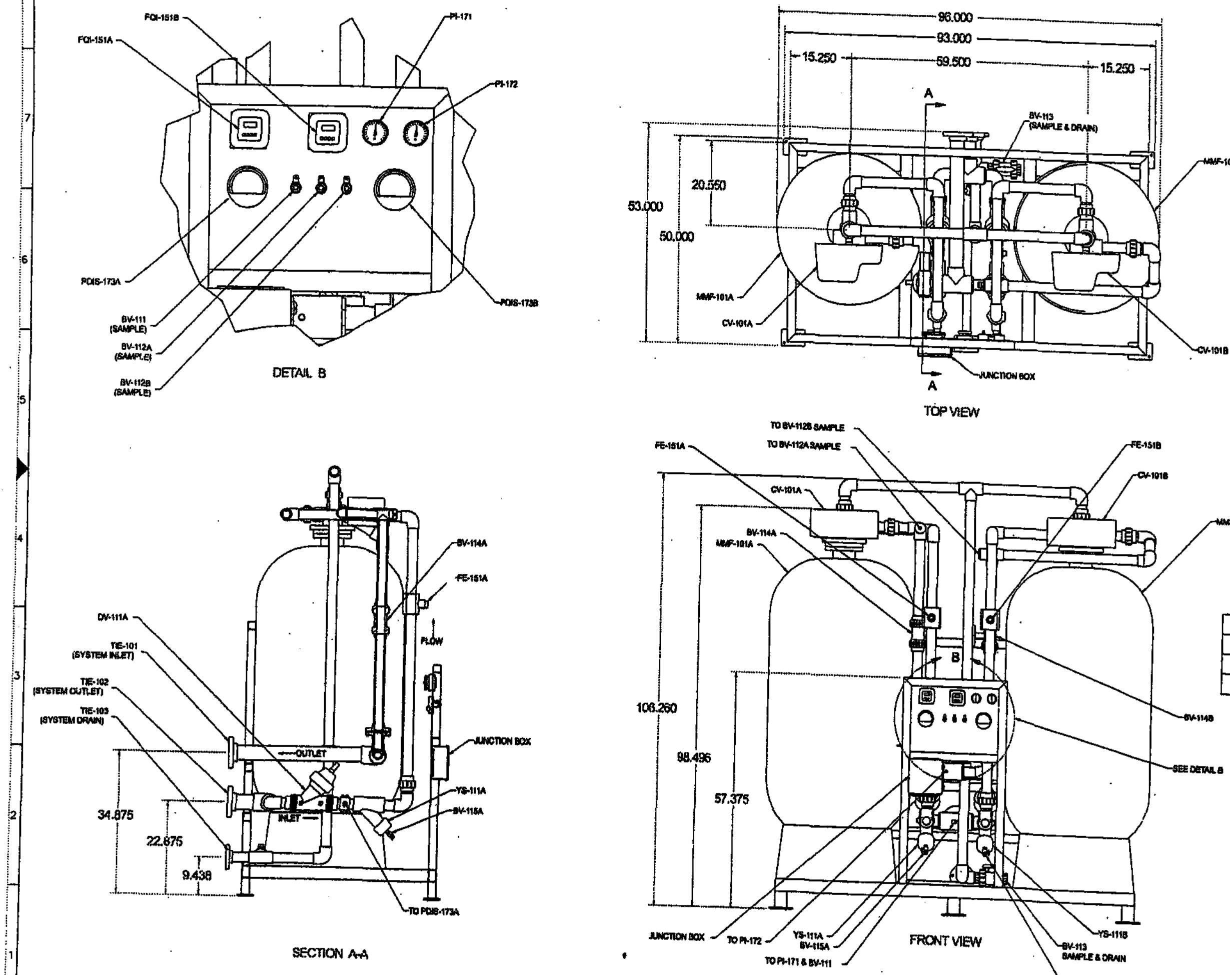
Espey Huston & Associates, Inc. - Houston, TX November 1985-April 1989
Ms. Alvarez worked as a Staff Engineer providing design engineering for a mid-sized full-service environmental and engineering consulting firm.

Bernard Johnson Incorporated - Houston, TX July 1982 – November 1985
Ms. Alvarez worked as an Engineer III providing Staff level design engineering, construction plan development and permit approval through a small full-service architectural-engineering consulting firm.

Lockwood, Andrews & Newnam, Inc. - Houston, TX June 1981 – July 1982
Ms. Alvarez worked as an Engineer I, providing field support and other entry level engineering.

APPENDIX B

IRON-OXIDE FILTRATION – ADEDGE SYSTEM SCHEMATICS AND SPECIFICATIONS



SERVICE CONNECTIONS:

TIE	DESCRIPTION	CONNECTION TYPE	MATERIAL
101	ADSORPTION SYSTEM INLET	3"~FLANGE, ANSI 150#	PVC, SCH.80
102	ADSORPTION SYSTEM OUTLET	3"~FLANGE, ANSI 150#	PVC, SCH.80
103	SYSTEM DRAIN	2"~FLANGE, ANSI 150#	PVC, SCH.80

LETTER	DATE	DESCRIPTION	DRAWN
	12-10-03		

REVISION BLOCK

adedge

DO NOT SCALE DRAWING

TITLE: GENERAL ARRANGEMENT

PROJECT: ARSENIC REMOVAL UNIT MODEL: SORB 33 APU-100

CUSTOMER: ROLLINSFORD, NEW HAMPSHIRE EPA DEMONSTRATION PROJECT

PREPARED BY: TAMM
CHECKED BY: EGC
APPROVED BY: GCO

REVISION: A

APU100-M-001-01

SHEET 1 OF 2

Sorb 33™ Arsenic Adsorption Treatment System
System Scope of Supply and Features

adedge

26-Oct-04

Mountain Glen Water - Clay Springs, AZ

Adsorption Vessels / Media

(1) Model APU-100 Adsorption systems rated for 100 gpm design flow
Pre-packaged, skid mounted system on steel tubular frame
2 Composite vertical adsorption (pressure) vessels in parallel
42-inch diameter adsorbers
Hub and lateral collection system, diffusers
52 cubic feet of Bayoxide E/AD33 Adsorption media, 10x35 mesh
Gravel/stone underbedding

Process Valves and Piping

Top mounted Automatic flow control package
Automatic backwashing and manual isolation
Electronic, programmable timer or pressure differential activated
Sch 80 PVC interconnecting piping, unions, flanged connections
Influent, effluent sample valves

Instrumentation & Controls

Programmable logic controller (optional)
Automatic controllers on each vessel
Instrument panel for mounted instruments / reading
Flow meter, flow totalizer
Pressure guages and differential pressure switches
Influent Y-strainers

Optional Pretreatment Equipment

None specified based on water profile provided

Optional Backwash Recycle System

5,000 gallon poly tank with bulkhead fittings, controls
Backwash recycle diaphram pump and controls
Bag Filter(s)
Check valve, backpressure valve, piping

Terms

Lead time is 5-6 weeks from contract / PO
Freight is FOB Mfg location: Atlanta or Los Angeles
Manufacturer's 1 year warranty
T&Cs to be refined in specific contract

Customer Provided Support

Single phase 120v, 20 amp electrical service
POTW or other discharge options for backwash
Concrete base for unit(s)
30 psig water supply or regulator if intermittant
Piping from backwash piping to discharge location
Permitting support; site layout drawings
Simple shade structure (minimum) for equipment

Field Services & Misc

System installation (TBD after site visit)
3-4 days of system startup and training
Operator training and O&M Manual

B

ATTACHMENT B

ADEQ WIFA
REVISED COST ESTIMATE FOR DESIGN OF ARSENIC MITIGATION

DECEMBER 6, 2004

MILLER BROOKS
Environmental, Inc.

December 6, 2004

Ms. Beatrice Parker
Mountain Glen Water System
P. O. Box 868
Clay Springs, Arizona 85923

RE: Revised Cost Estimate for Design of Arsenic Mitigation

Dear Ms. Parker:

Pursuant to our communications with you and Mr. Jon Bernreuter of WIFA of Arizona, the following is a revise cost breakdown of Arsenic Mitigation Design services.

Design of a New Production Well

The scope of work includes drilling of a pilot borehole using casing advancement to a maximum depth of 500 feet below ground surface (bgs). Discreet groundwater samples will be collected at approximately 20-foot intervals to analyze for total dissolved arsenic concentrations. Miller Brooks Environmental, Inc. (Miller Brooks) will utilize an onsite field arsenic testing kit to screen the samples. Additionally, the samples will also be submitted to an ADHS certified analytical laboratory for confirmatory analyses. A Miller Brooks' geologist will oversee the drilling operations to ensure that water samples are collected appropriately, record subsurface conditions and pertinent aquifer characteristics as well as create a geologic log of the borehole for submittal in the well design package to the ADEQ and ADWR. Prior to initiating any drilling activities, Miller Brooks will prepare and submit a Notice of Intent permit to the ADWR.

Upon completion of drilling activities, the analytical results will be utilized to design a new production well screened to minimize intake of arsenic rich waters. The well design will then be submitted to WIFA of Arizona as a deliverable. Should Mountain Glen Water Service (MGWS) elect to convert the pilot borehole into a production well, the well design will also be submitted to the ADEQ and ADWR to facilitate the permitting of a new Public Water System.

The cost estimate for the above-mentioned scope of work is as follows:

Well Permitting, and Design	$ 14,051.00
Pilot Borehole Drilling, Field Supervision and Discreet Water Sampling	$ 40,657.60
Total Costs for New Production Well Design	***$ 54,708.60***

Design of a Arsenic Treatment System

In the event the above option cannot be implemented, costs associated with the design of an arsenic removal system are as follows:

Arsenic Removal System Design	$ 13,800.00
Total Costs for a Arsenic Removal System Design	***$ 13,800.00***

202 East Earll Drive, Suite 470 • Phoenix, Arizona 85012 • Telephone: (602) 728-0577, Fax: (602) 728-0585

It should be noted that none of the costs above include the procurement and installation of infrastructure equipment and thus do not lead to the completion of a new well or the installation and start up of a new wellhead arsenic removal system. Costs associated for such infrastructure improvements are outside of the scope of a Technical Assistance grant provided by WIFA of Arizona.

If you have any questions or concerns, please do not hesitate to contact me at 602.728.0577. We look forward to assisting MGWS in implementing this project.

Sincerely:
Miller Brooks Environmental, Inc.

Waseem A. Khan, PG
Senior Geologist and Vice President

cc: Miller Brooks Proposal 09-04-11
Jon Bernreuter, WIFA of Arizona

C

ATTACHMENT C

ADEQ WIFA
NOTICE TO PROCEED

DECEMBER 13, 2004

WIFA

WIFA Technical Assistance Award
TA DW 009-2005

Water Infrastructure Finance Authority of Arizona

Janet Napolitano
Governor

Jay R. Spector
Executive Director

WIFA
1110 West Washington
Suite 200
Phoenix, AZ 85007
Telephone (602) 364-1310
Fax (602) 364-1327
1-877-298-0425

Arizona's Water and Wastewater Funding Source

December 13, 2004

Ms. Beatrice Parker
Mountain Glen Water Service, Inc.
P.O. Box 897
Clay Springs, Arizona 85923

Notice to Proceed
WIFA Technical Assistance Award TA DW 009-2005

Dear Ms. Parker,

The Water Infrastructure Finance Authority (WIFA) of Arizona has received the Agreement for Technical Assistance from Mountain Glen Water Service, Inc. (MGWS). WIFA has also received and reviewed the Proposal for Arsenic Removal at Linden East #1 Well, submitted by Miller Brooks Environmental.

WIFA is prepared to release monies from the Technical Assistance Award to MGWS upon completion of the milestones and deliverables outlined in the Scope of Work. To request a disbursement please fill out, and have the Project Manager sign one of the attached requisition forms. We have included a sufficient quantity of pre-numbered forms based on the deliverables schedule provided. When submitting a disbursement requisition you will need to include documentation of the expense in the form of an invoice or receipt. When task items are completed, please include the deliverable report or other documentation.

We look forward to working with you in developing the Arsenic Removal Technical Assistance project. If you have any questions, please contact our Environmental Program Specialist, Jon Bernreuter at (602) 364-1326.

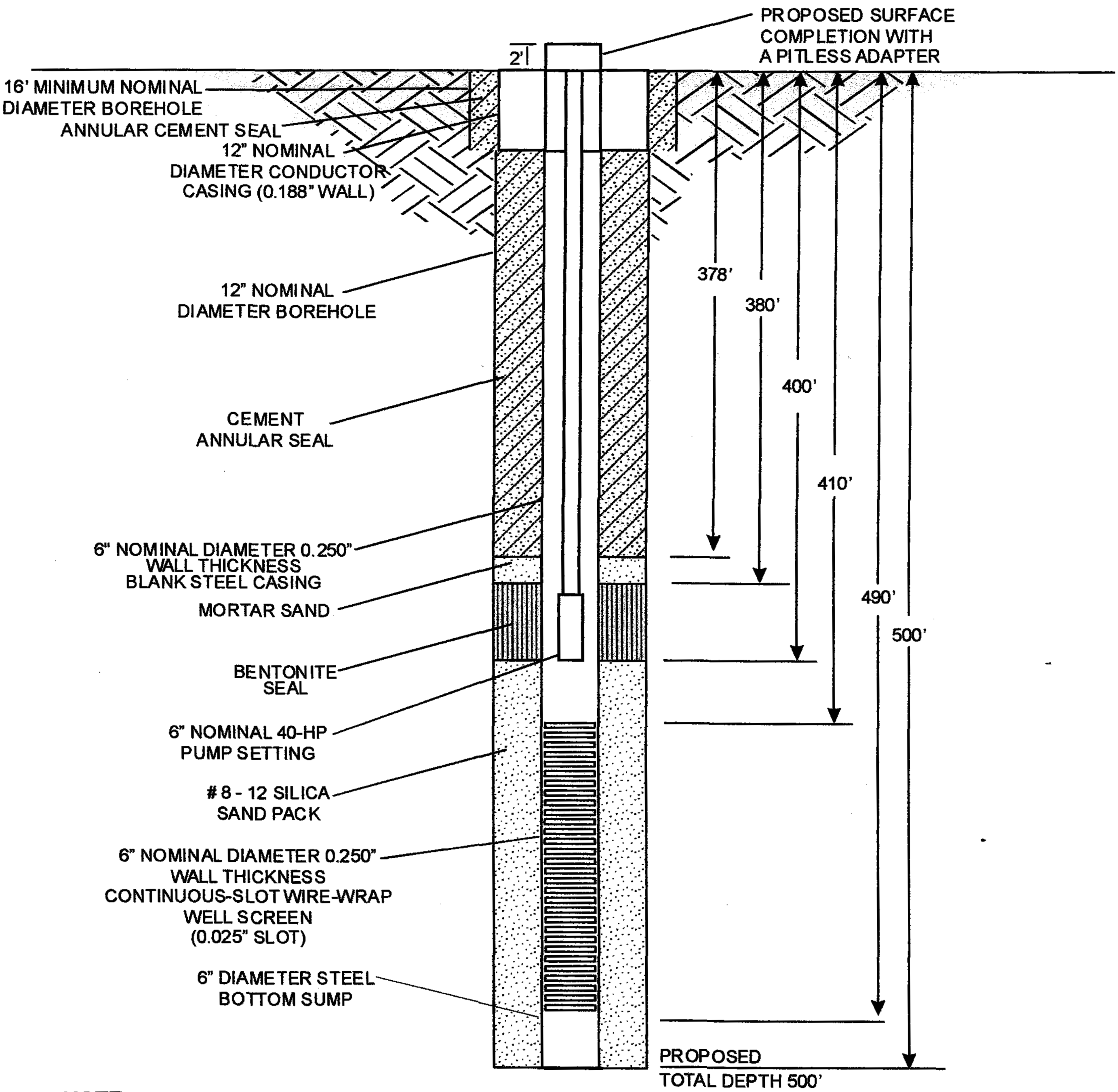
Sincerely,

Jay R. Spector
Executive Director

D

ATTACHMENT D

ADEQ WIFA
PRELIMINARY WELL CONSTRUCTION DETAILS



NOTE:
ESTIMATED DEPTH TO STATIC GROUNDWATER IS 260 FEET.

NOT TO SCALE

MILLER BROOKS Environmental, Inc.

MOUNTAIN GLEN WATER SERVICE, INC.
P.O. BOX 897
CLAY SPRINGS, ARIZONA 85923

PRELIMINARY WELL CONSTRUCTION DIAGRAM

FIGURE 2

PROJECT#:	FILE#:	DATE DRAWN:	DRAWN BY:
611-0001-01	mw1wcd	05/12/05	J. HIGH