**“The First and The Finest”**

U.S. NAVAL MOBILE CONSTRUCTION BATTALION ONE

# ALFA COMPANY
# WATER WELL
## AFTER ACTION REPORT

# TABLE OF CONTENTS

# EXECUTIVE SUMMARY

U.S. Naval Mobile Construction Battalion ONE, Water Well Team (WWT) put forth a tremendous effort in drilling three wells onboard Naval Support Activity (NSA) Souda Bay, Crete. The water well project was tasked in an effort to provide a backup water supply to NSA for force protection purposes.

The 13-person WWT departed Rota, Spain on 5 February 2000 via an Air Services Coordinator, Mediterranean (ASCOMED) flight and arrived in Souda Bay that same evening. All tools, material, equipment and required site approval were obtained prior to the WWT's arrival and staged in Detail Souda Bay's (DET SB) equipment yard. The WWT was tasked with completing one 1,000 ft well at NSA and to procure all required materials for an additional 600 ft well on Marathi Pier.

The 1,000 ft well site was located inland and was confined to a relatively small drilling area adjacent to an active taxiway. No archive files of well logs or local boring samples were available for review to ascertain pertinent geological information. The crew drilled three wells within the specified drilling area. However, none of those wells could be successfully developed. WWT personnel were sufficiently trained to perform all operations required to drill and develop water-wells, the causes for not establishing an operational well were geological and material problems.

The majority of the WWT returned to Rota Spain on 27 April 2000. The final two members of the WWT remained in Souda Bay to assist with repairing the well rig and coordinating the plans for a future well site at NSA Souda Bay.

# ADMINISTRATION

1. **General**: Detail, Souda Bay, provided administrative support for the WWT.

2. **Lessons Learned**:

   a. Problem/Item: **ADP Support**

   (1) Discussion: Due to onsite project tasking, the sharing of limited assets caused a delay in project planning for the Detail and made it difficult for the well team to complete their necessary administrative requirements. Additionally, typically the well team deploys to areas where a local Detail is not established to provide support. The team needs to be outfitted to be self-sustaining.

   (2) Recommendation: The water-well team should be self-sufficient, a laptop with accessories should be assigned to the WWT OIC for their use in completing the required reports.

   b. Problem/Item: **Records**

   (1) Discussion: Entries could not be made directly into the member's service record or DOR since records were maintained at main body. This caused delays in obtaining necessary administrative documentation for evaluations, mid-term counseling, etc. Additionally, the WWT was only scheduled to be on site for one month and did not deploy with their medical records.

   (2) Recommendation: Members service record and DOR should be checked out to the WWT OIC and turn over to either local medical department or PSD.

3. **SAFETY SUMMARY:**

| | |
|---|---|
| Fatalities | 0 |
| # Lost work days | 16 |
| # Lost day cases | 2 |
| # Light duty days | 45 |
| # Light duty cases | 3 |
| First Aid mishaps | 2 |
| Govt. vehicle mishaps | 2 |
| Govt. vehicle repairs cost | $5143.00 |
| Govt. vehicle miles driven | 112 |

# MEDICAL

1. **General:** NSA Souda bay, Crete, Medical Facility provided the medical services required in support of the WWT. The dental clinic provided only cleanings with other services handled out in town. Emergency airlift was obtainable and transportation conveniently provided by the fire and rescue or ambulance.

a. On 16 February 00, CM2 Qualls sustained serious injuries to both hands when the mud pump exploded. A command investigation concluded that the accident was caused by catastrophic failure of the flywheel as a result of hairline cracks formed after previous damage to the pump (years before). Additionally, it was determined that CM2 Qualls was performing in the line of duty and his injuries were not due to his misconduct.

b. On 25 March 00, UTCN Madewell broke two bones in his foot when a cable spool stand was dropped on it. The injury was not due to any negligence or misconduct and an accident report was filed.

# EMBARKATION

1. **General:** The WWT OIC along with 10 members of the water well team departed Rota Spain and arrived on 5 February 00 to join up with two other members already in Souda Bay, Crete.

During drilling operations two WWT members were injured on the job. One member received injuries to both hands on 16 February 00 when a pump flywheel blew apart. He was transported via ambulance to a local Greek hospital and then air lifted out by the Greek Air Force to a specialty unit in Athens. A follow-on U.S. Medical Evacuation (MEDEVAC) transported the member to Ramstein, Germany for further treatment and ultimately to the U.S. Naval Hospital in Bethesda, Maryland. On 25 March 00, a second WWT member was injured resulting in two broken bones in a foot. This member was MEDEVAC'd to Ramstein Germany for treatment, and ultimately back to Rota, Spain.

On 28 April 00, after completing all drilling operations, 7 of the 10 WWT members were flew back to Rota Spain via ASCOMED flight. The WWT OIC, NEC Driller, and Water Well Mechanic remained behind to assess repairs to the rig and obtain site approval for future well drilling operations. The DFT OIC returned to Rota, Spain on 7 May 00 and the NEC Driller returned to Rota, Spain on 30 May 00.

# OPERATIONS

1. **General:** The primary tasking for the WWT consisted of drilling a 1,000ft well and procure materials for a 600 ft well on the Marathi Pier once site approval was obtained. On 8 February 00 drilling operations began on NSA Souda Bay using the down hole hammer technique. The well site was located by the air terminal, and in close proximity to an operational chloride plant. A rough sketch of the drill site is shown in attachment (1).

On 9 February 2000, after reaching a depth of 276 ft, seven pieces of drill steel became lodged in the ground. After 12 hours of attempting to recover the steel with the well rig, the crew rented a 40-ton crane to attempt to pull the steel from the hole. The crane arrived on 10 February but was unsuccessful after three hours of pulling. After the crane departed, the crew began sending water and barafos through the center of the steel, which caused the blockage to dissolve allowing recovery of the drill steel on 11 February 00. The first well site was then abandoned with a hole plug and a 6' X 4' X 4" sanitary cap as shown in attachment (2). The crew theorized the blockage was caused by a cave-in from the backfill material that was used to construct the adjacent concrete slab.

On 12 February 00, the WWT started to drill for the surface casing at the second site. The actual well location was designated by Public Works to be 8 ft east and 10 ft north of the first well site. Well drilling operations were successful using foam vice the down hole hammer, until 20 February 00. After reaching 584 ft, the gear reduction box malfunctioned causing the rig to be deadlined. Since the part was not available in Automotive Repair Parts (ARP), it had to be purchased from the manufacturer, Ingersoll-Rand. The part arrived on 11 March 2000 and drilling operations began on 12 March 00. At a depth of 639 ft, a strong aquifer was uncovered and the crew continued to drill to a depth of 685 ft. After removing the drill steel, the well was cased and screened, gravel filter placed, air developing completed, and the pump/motor placed in the well with the draw down pipe. Typically, the draw down pipe is galvanized; however PVC was purchased for the specific well. During the 24 hour draw down test 57 GPM was achieved. On 18 March 00, only three hours into the draw down test, water stopped flowing from the well and the crew determined one the draw down pipe couplings had given way resulting in the draw down pipe falling 8-10 feet from the surface. The crew attempted to lift the pipe/pump combination with the attached safety cable; however the safety cable failed due to the crushing action from the rigs lifting hook and the weight being lifted. As a result, the pump fell to the bottom on the well.

For the next two weeks the WWT attempted every means possible to recover the pump and pipe. Several "fishing tools" were manufactured in the local Alfa Company shops and other fishing tools from Collateral were used to try to recover the pipe. A total of seven different attachments were created in the effort but the pump/pipe was unrecoverable. None of the attachments were able to get a solid grab on the top of the pipe. Finally, the blockage from mangled pipe was too great to penetrate or recover any

of the materials. After conferring with 2NCB and the main body, the well was abandoned.

A new BM was developed to account for lost material. The intent was to identify all material required to drill another well at NSA Souda Bay and the well at Marathi. An additional $28,000 was estimated to complete both wells. Once funding was obtained from CINCUSNAVEUR, a third well was started in the same vicinity of the first two wells. The new well was located 12 ft to the west of the second well, making it 10 ft north and 4 ft west of the first well (see attachment (1)). Drilling, using foam, began on 10 April 00. As each new piece of steel was added, the previous pieces were reamed out of the hole to ensure the well walls were smooth and to try to prevent any cave-ins. On 18 April 00, the crew found water and lost circulation at 687 ft. At that point, the crew started removing the drill steel. As each piece was removed, the force required to pull the steel increased. At 512 ft, the steel became lodged in the hole. The top head on the mast would not rotate and the steel could only move up and down 4-6 inches. The crew spent two days flushing the hole with water and barafos while simultaneously trying to pull the steel up and push it down. Despite flushing the hole with over 5,000 gallons of water, there was no water coming out of the hole. The water was escaping into an underground void.

Since the rig pressure was not powerful enough to move the steel, a 180-ton crane was rented to try to pull the steel. After applying about 50 tons of force to the steel over a three-hour period of time, the steel still would not move more than 6 inches. The next attempt was to have a larger civilian's water well rig attempt to pull the steel. On 22 April 00, the civilian rig arrived on site. The first piece of steel that was protruding from the ground was cut to allow the civilian's mast to line up over the hole. The civilian rig failed to pull the steel or dislodge the blockage by both pulling and drilling the same hole with a 6 inch drill bit. During the three drilling attempts, the civilian drill bit became lodged, clogged, or lost rotation, and was unable to drill past 320 ft. When air pressure was sent down the hole during drilling, the air was released through the second well excavation. Additionally, the bit became clogged with gravel filter, which resembled the gravel used on the second well. The crew theorized that the gravel filter used on the second well had also filled a continuous void underground as shown in attachment (3). This same void was encountered while drilling the third well.

After three failed attempts to drill, the crew attempted to break steel. The steel broke at the first coupling allowing one piece of steel to be recovered. Both sites two and three were then capped with hole plugs, concrete, and 4 ft X 4 ft X 6 inch sanitary caps as shown in attachment (2).

2. **Project Summary:**

a. **Description of Work:** Tasking consisted of drilling a 1,000 ft well and procuring materials for a 600 ft well on the Marathi Pier.

b. **Cumulative Labor Summary:**

| | |
|---|---|
| No. of Personnel | 13 |
| No. of Workdays | 66 |
| No. of Direct Labor | 12 |
| % of Direct Labor (actual) | 92% |
| Mandays Expended | 655 |

c. **Composition of WWT:**

BU-0
CE-2
SW-0
EO-7
CM-2
UT-2

d. **Status of Project:**

| | |
|---|---|
| Start Date: | 8 February 00 |
| WIP: | 0% |
| Completed: | 26 April 00 |

e. **Materials**: Materials became an issue and were the cause of losing the second well. With PVC being used in lieu of galvanized for drawdown pipe, the PVC could not sustain the weight or vibration of a 700 ft water well. Additionally, the PVC was connected with brass compression fittings that had only four treads. Galvanized pipe and couplings are stronger and are the recommended material to put in the well. This material was ordered and received for the third well. Finally, the electric wire used in the second well was 1" diameter wire. It was significantly heavier than the typical flat wire that is normally used. Also, it contained no ground wire. The additional weight of this wire contributed to the failure of the brass compression fittings.

The PVC well casing that was ordered was not a standard size. It therefore, did not fit the elevators in the well Table of Allowance. This caused delays due to adjusting the elevators and made them unserviceable for use. New elevators have since been ordered and received.

3. **OIC Discretionary projects completed:** N/A

4. **Lessons Learned:**

a. Problem/Item: **Drilling history of area**

(1) Discussion: No drilling logs from prior well sites were available to study the pertinent geological information necessary.

(2) Recommendation: An archive file should be kept by brigade personnel. It should include information concerning all civilian and military drilling operations in the area. Drilling logs should show at a minimum the follow information: different formations discovered with depth indicated, type of drilling operations used, and any kind of trouble that was encountered during drilling.

b. Problem/Item: **Drilling Site**

(1) Discussion: Site approval was not obtained in an expeditious manner. The location of the site was selected by PWD and had a poor history. Some of the problems with the site were: a nearby underground water tank, voids, and an abandoned sewage site only 200 ft away. The history of this area was not divulged until after drilling started.

(2) Recommendation: Do not send the drilling team out until site approval is in hand. A pre-construction meeting should be held with the customer, brigade, and the WWT OIC.

c. Problem/Item: **Point of Contact**

(1) Discussion: No central point of contact was established for drilling operations. Scheduled meetings were constantly being rescheduled and direction was given to the WWT by numerous personnel from the PW shop. This caused significant confusion and difficulty in obtaining the correct information.

(2) Recommendation: Establish one point of contact as early as possible or during pre- construction meeting. That person should be responsible for and have full authority in making decisions pertaining to all WW operations.

d. Problem/Item: **Well Material**

(1) Discussion: The material purchased, prior to WWT's arrival was substandard. These items were: the PVC draw down pipe, brass couplings with compression fittings and electric cable. This was brought to the attention of the PWD representatives, but no action was taken. Although the crew highly encouraged the purchase of the correct material, the customer did not want to spend additional money when material had already been purchased off the original BM.

(2) Recommendation: Each Battalion's well team operates in slightly different manner. The well team that orders the material should be the one drilling the well. Avoid turnover of material from one battalion to the next if possible.

e. Problem/Item: **Completions Kits**

(1) Discussion: The well completion kits are not currently part of the battalion's TOA. There is not enough time to order/reorder material to update the kits during drilling operations or when tasked with more than one well.

(2) Recommendation: The well completion kits need to be added to the battalion's TOA, this will save time in ordering the required material and will familiarize all well teams in using the same material in the completion kits throughout the NCF.

# SUPPLY, EQUIPMENT AND LOGISTICS

1. **General:** All Water Well project materials were procured from Italy or Greece. The Public Works Expediter transported all materials via airfreight for pick-up. Project funding was provided by Public Works in Souda Bay. A total of $97,000 was expended to procure the necessary materials and supplies for completion of two well sites. Repair parts for the water well rig and support equipment were ordered through NMCB ONE Main Body or open purchased from a stateside supplier.

The WWT berthed at barracks 52 for most of their stay while at NSA and received three meals per day from the local mess facility. DET SB made transportation available and laundry equipment was accessible at the barracks. All necessary tools were staged locally with the water well kit or checked out from the DET SB CTR.

2. **Lessons Learned**:

a. Problem/Item: **Cold Weather Gear**

(1) Discussion: Winter weather in Souda Bay includes temperatures in the 30's F and significant rainfall. The combination of wind, rain, and temperature make the wind chill factor quite low. Additionally, during drilling operations, the crew is constantly standing in water/foam which causes boots to become saturated and worn quickly.

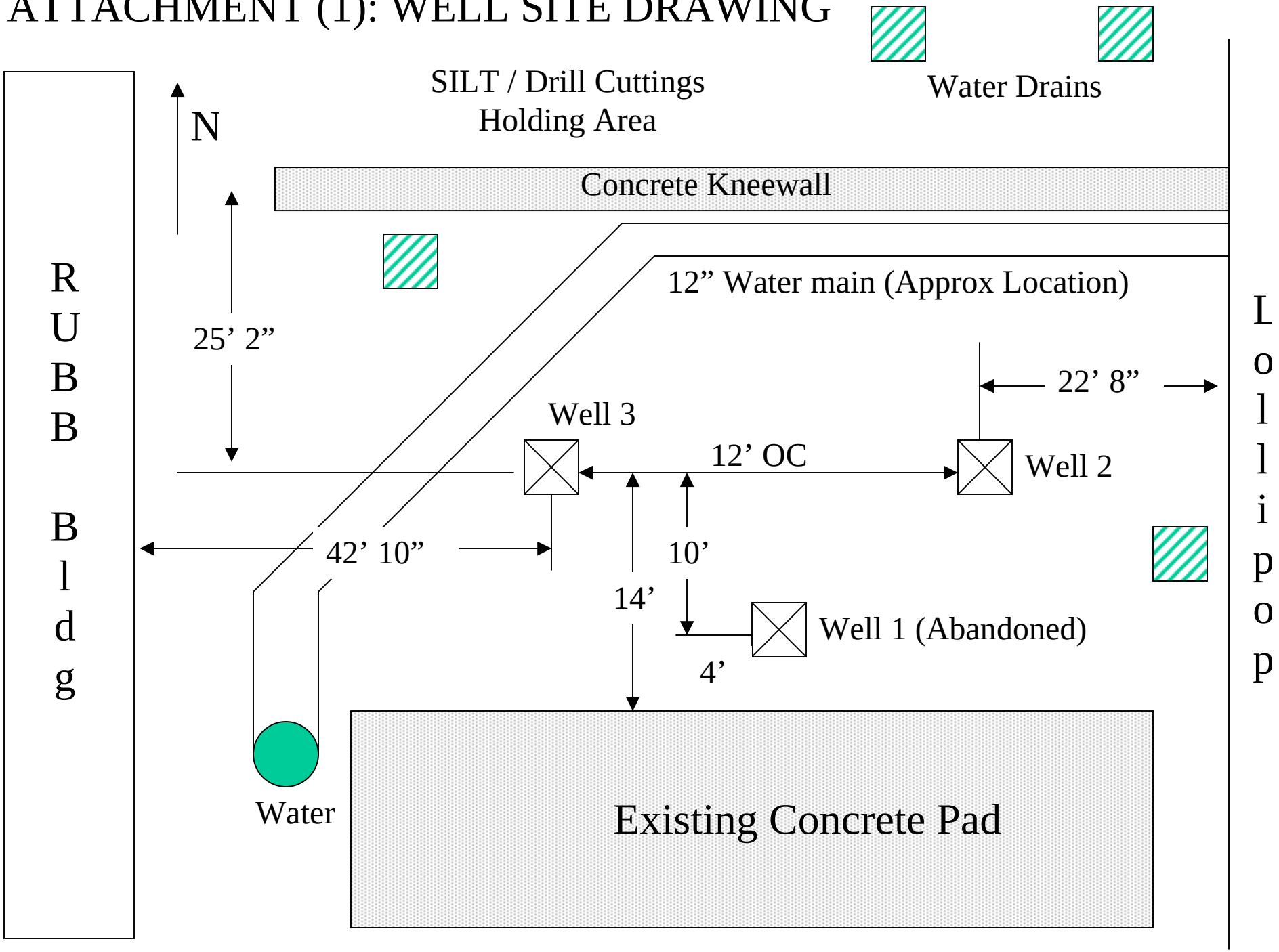
(2) Recommendation: The WWT should be outfitted with appropriate cold weather gear and spare boots as required to operate safely and complete the mission.

b. Problem/Item: **Repair parts**

(1) Discussion: During operations, there is not enough time to procure and deliver repair parts for the water well rig or support equipment using the normal supply system. Waiting for approval to purchase key items caused significant delays. In one case, 2 ½ weeks of down time occurred during drilling operations.

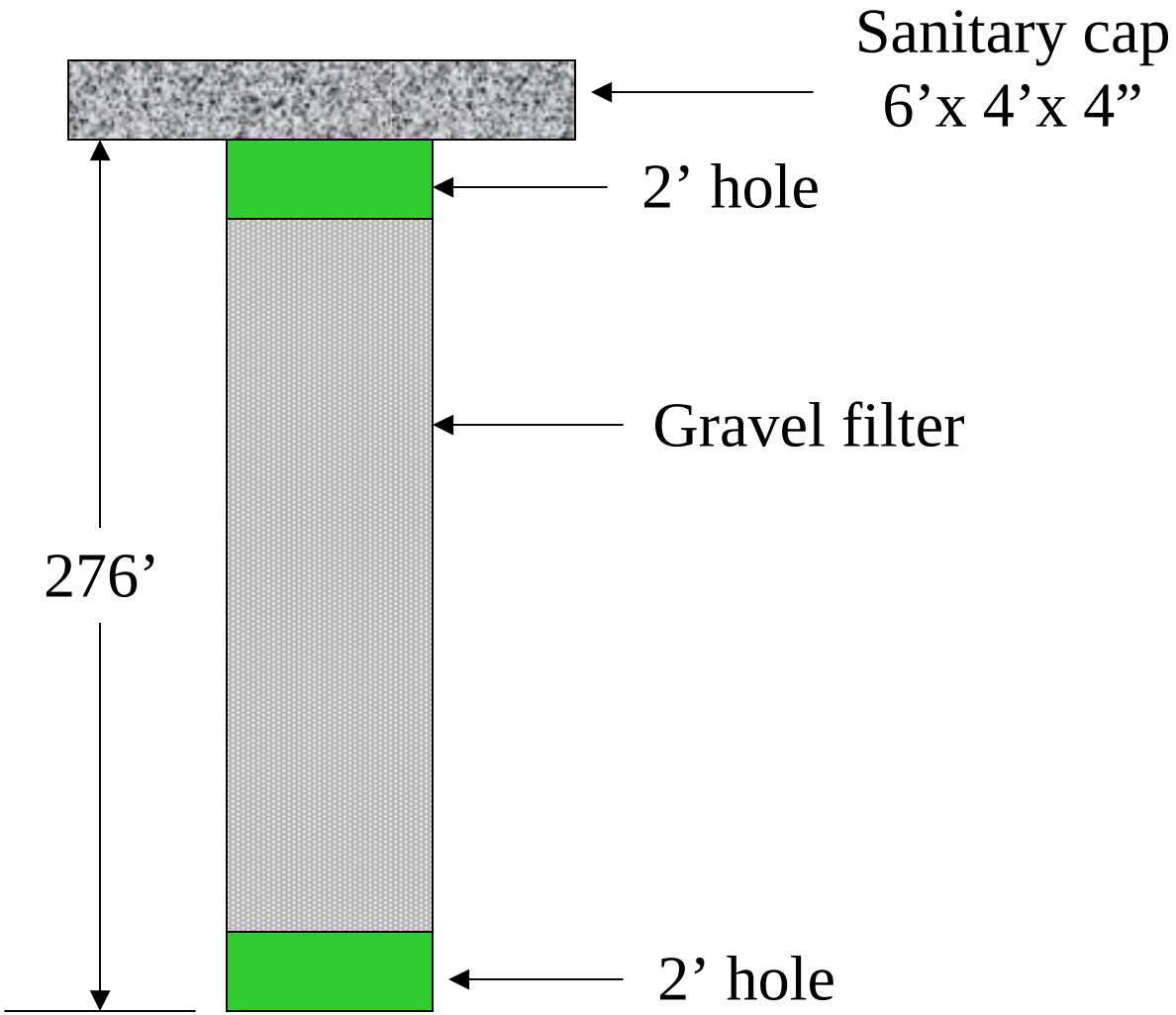
(2) Recommendation: Identify sources for water well drilling materials and water well drill rig repair parts, and purchase directly.

# ATTACHMENT (1): WELL SITE DRAWING



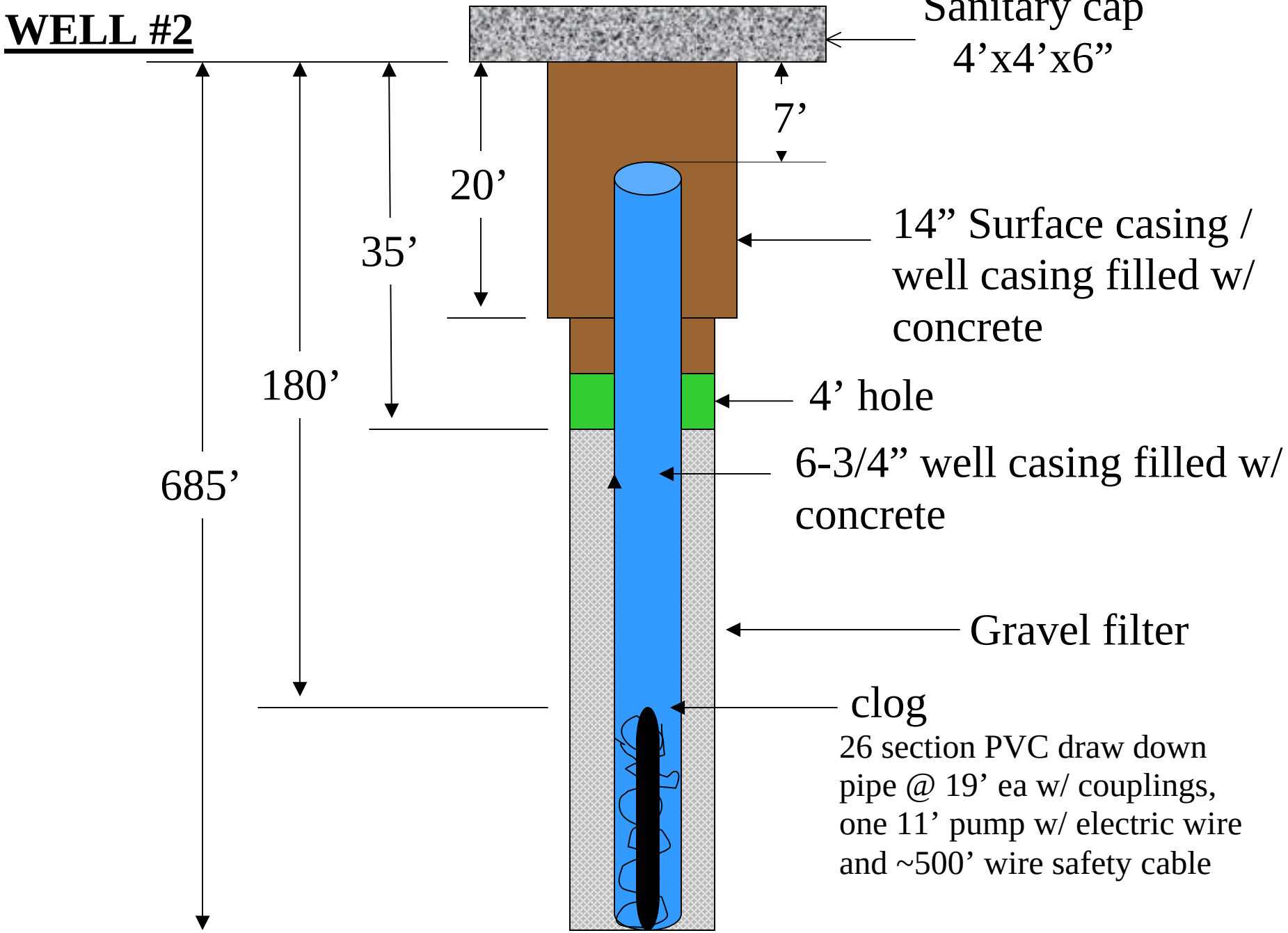
ATTACHMENT (2): SITE SKETCH

**WELL #1**

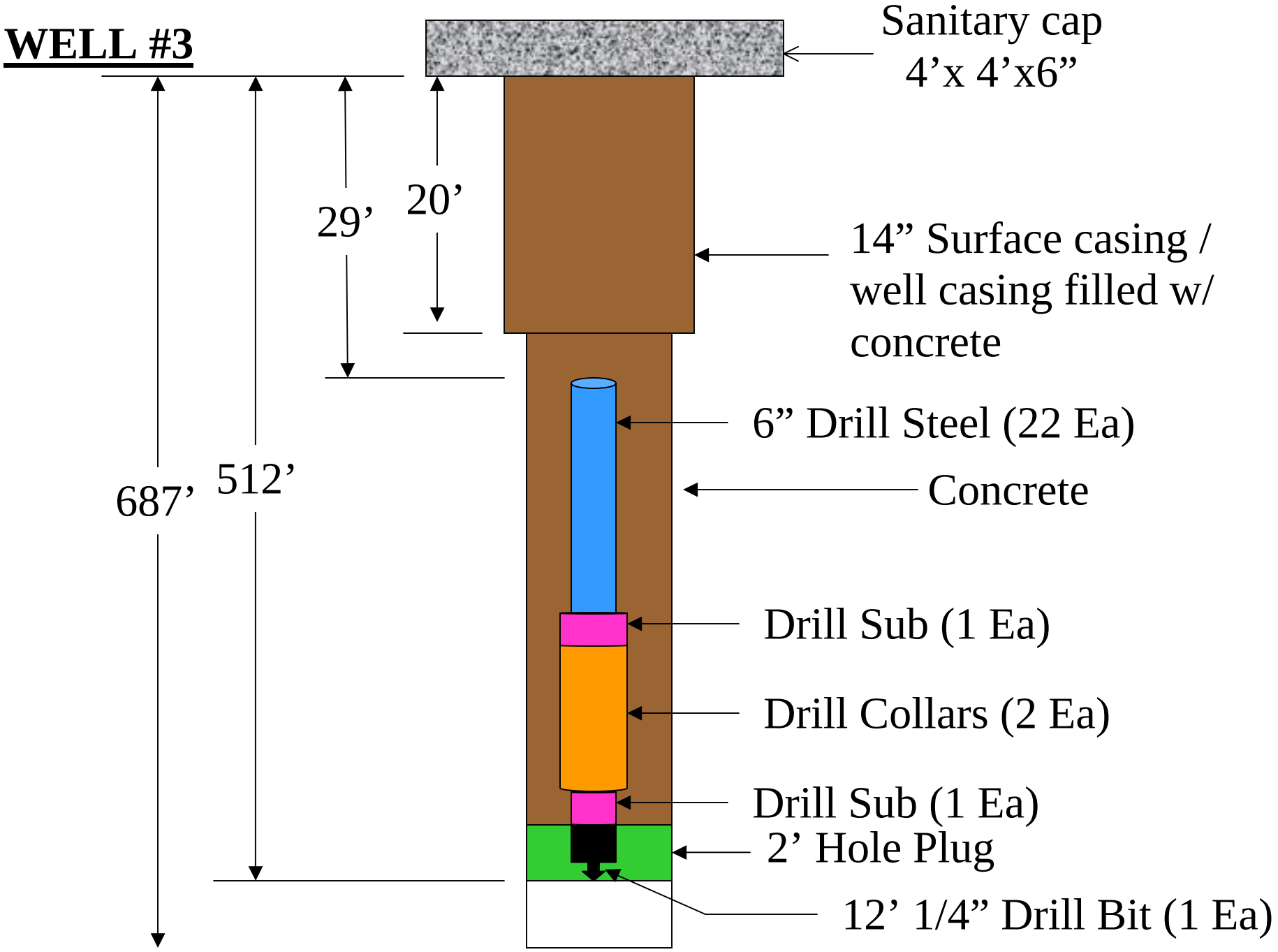


ATTACHMENT (2): SITE SKETCH

**WELL #2**



ATTACHMENT (2): SITE SKETCH



ATTACHMENT (3): CAVE-IN SKETCH

# THEORETICAL CAVE-IN PROBLEM WITH WELL#3