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FINAL PRELIMINARY SUBSURFACE INVESTIGATION REPORT AQUADRIVE FUEL SYSTEM NAVAL AUXILIARY LANDING FIELD CABANISS NAS CORPUS CHRISTI TX

3/1/2013

TETRA TECH

Comprehensive **L**ong-term **E**nvironmental **A**ction **N**avy

CONTRACT NUMBER N62467-04-D-0055

Rev. 0
March 2013

Final

Preliminary Subsurface Investigation Report

Aquadrive Fuel System

Naval Auxiliary Landing Field Cabaniss
Corpus Christi, Texas

Contract Task Order JM65

March 2013

NAVFAC
Naval Facilities Engineering Command
NAVFAC SOUTHEAST

NAS Jacksonville
Jacksonville, Florida 32212-0030

TETRA TECH

FINAL
PRELIMINARY SUBSURFACE INVESTIGATION REPORT
FOR
AQUADRIVE FUEL SYSTEM

NAVAL AUXILIARY LANDING FIELD CABANISS
CORPUS CHRISTI, TEXAS

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Southeast
NAS Jacksonville
Jacksonville, Florida 32212-0030

Submitted by:
Tetra Tech, Inc.
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King of Prussia, Pennsylvania 19046

CONTRACT NUMBER N62467-08-D-1001
CONTRACT TASK ORDER JM65

MARCH 2013

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CERTIFICATION PAGE
LICENSED TEXAS PROFESSIONAL GEOLOGIST
CERTIFICATION

By affixing my seal to this report, I certify that the data and interpretations represented in the *Preliminary Subsurface Investigation Report, Aquadrive Fuel System, Naval Auxiliary Landing Field Cabaniss, Corpus Christi, Texas* are true and accurate to the best of my knowledge. I further certify that I am licensed to practice geology in the State of Texas and that it is within my professional expertise to verify the correctness of this information.

Larry Basilio

Larry Basilio
Registration Number 506

3/22/13

Date

PRELIMINARY SUBSURFACE INVESTIGATION
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

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NALF Cabaniss, Corpus Christi, Texas

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PRELIMINARY SUBSURFACE INVESTIGATION
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

ABBREVIATIONS AND ACRONYMS

AFS	Aquadrive Fuel System
AICUZ	Air Installation Compatible use Zone
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CCISD	Corpus Christi Independent School District
CLEAN	Comprehensive Long-term Environmental Action Navy
COC	Contaminant of Concern
CSM	Conceptual Site Model
CTO	Contract Task Order
DoD	Department of Defense
DoT	Department of Transportation
ELAP	Environmental Laboratory Accreditation Program
Empirical	Empirical Laboratories
EPA	Environmental Protection Agency
°F	Degrees Fahrenheit
FM	Farm-to-Market
FP	Flashpoint
FUDS	Formerly Used Defense Site
GPS	Global Positioning System
GSA	General Services Administration
HSA	Hollow Stem Auger
ID	Inside Diameter
IDW	Investigation-Derived Waste
mg/kg	Milligram per Kilogram
mg/L	Milligrams per Liter
MSL	Mean Sea Level
NAAS	Naval Auxiliary Air Station
NAD	North American Datum
NALF	Naval Auxiliary Landing Field
NAS	Naval Air Station
NASCC	Naval Air Station Corpus Christi

NAVD88	North American Vertical Datum 1988
NAVFAC SE	Naval Facilities Engineering Command Southeast
NELAP	National Environmental Laboratory Accreditation Program
OD	Outside Diameter
OLF	Outlying Field
ORP	oxidation reduction potential
PAH	Polyaromatic Hydrocarbon
PCL	Protective Concentration Level
PID	Photoionization Detector
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
PSI	Preliminary Subsurface Investigation
PST	Petroleum Storage Tank
PVC	Polyvinyl Chloride
QA	Quality Assurance
QC	Quality Control
RCI	reactivity, corrosivity, and ignitability
SVOC	Semivolatile Organic Compound
TCEQ	Texas Commission on Environmental Quality
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TOX	Total Organic Halides
TPH	Total Petroleum Hydrocarbons
TRRP	Texas Risk Reduction Program
Tetra Tech	Tetra Tech, Inc.
UST	Underground Storage Tank
VOC	Volatile Organic Compound
WWII	World War II

1.0 INTRODUCTION AND PURPOSE

Tetra Tech, Inc. (Tetra Tech) was contracted by the Department of the Navy, Naval Facilities Engineering Command Southeast (NAVFAC SE) to perform a Preliminary Subsurface Investigation (PSI) and associated reporting for the former Aquadrive Fuel System (AFS) located at Naval Auxiliary Landing Field (NALF) Cabaniss, Corpus Christi, Texas. Figure 1-1 shows the general location of NALF Cabaniss. Figure 1-2 shows the location of the AFS at NALF Cabaniss. This work was performed under Contract Task Order (CTO) No. JM65 as part of the Comprehensive Long-term Environmental Action Navy (CLEAN) Contract No. N62467-08-D-1001.

This PSI Report presents the results of PSI investigative, sampling, and analytical activities.

1.1 PROJECT OVERVIEW

A PSI was conducted to determine if a release to the environment from the former AFS has occurred on Navy-owned property. The PSI consisted of the collection and laboratory analysis of subsurface soil and groundwater samples, land surveying of sample locations, and reporting of results. The PSI was conducted in accordance with the Tier II Sampling and Analysis Plan (Tetra Tech NUS, 2011).

1.2 INVESTIGATION OBJECTIVES

Data collected during the PSI were used to meet the following objectives:

- Determine the presence and nature of contaminants of concern (COCs) within soils at the AFS site.
- Determine the presence and nature of COCs within groundwater at the AFS site.
- Prepare a report summarizing field activities and information collected.

1.3 REPORT ORGANIZATION

The purpose of this PSI report is to present the results of the PSI activities that Tetra Tech conducted at the AFS site in September 2011 and November 2011. This PSI report contains the following sections:

1.0 – Introduction and Purpose
2.0 – Project Background and Physical Setting
3.0 – Preliminary Subsurface Investigation Activities
4.0 – Preliminary Subsurface Investigation Results
5.0 – Summary of Findings and Recommendations
6.0 – References

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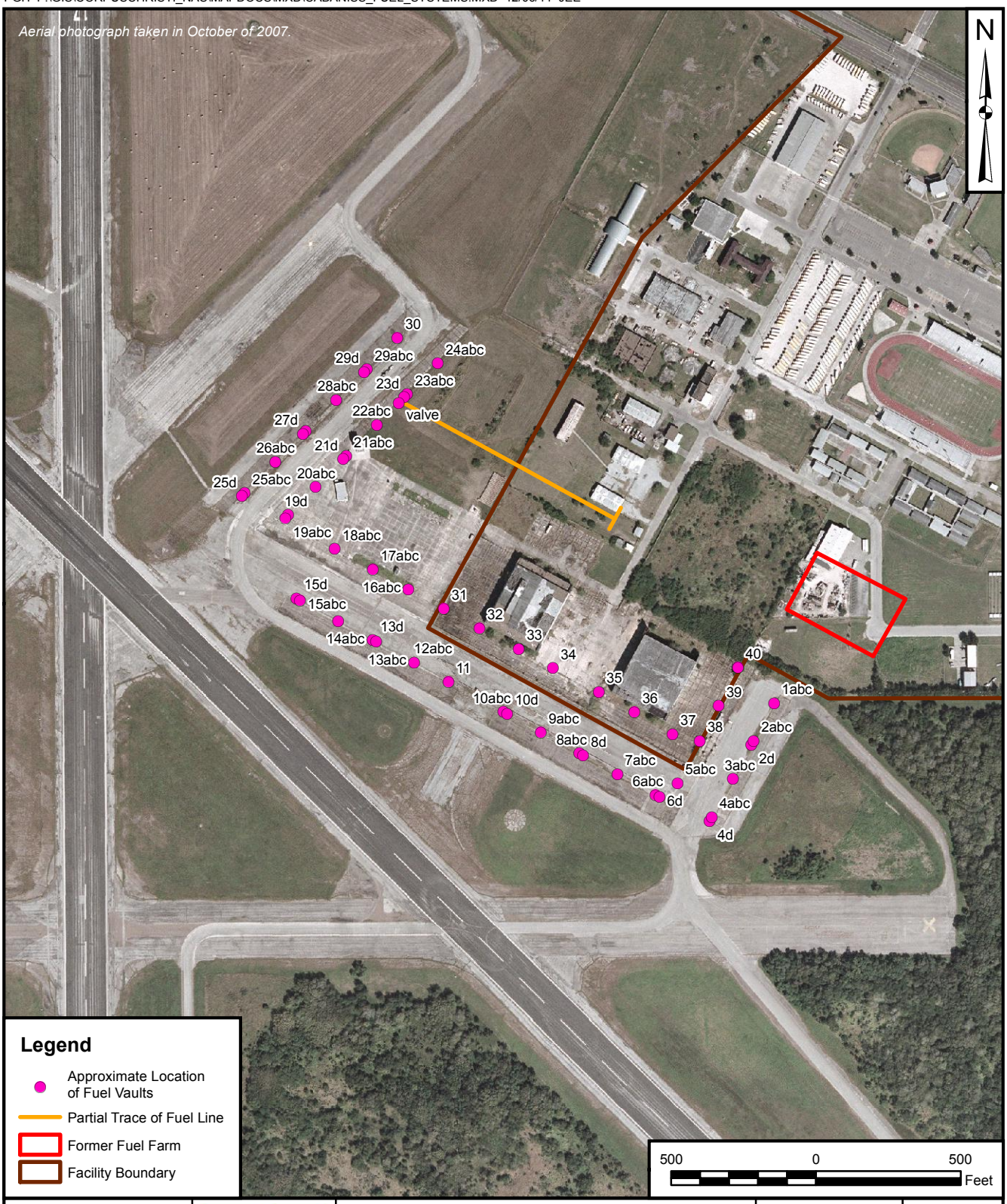

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2.0 PROJECT BACKGROUND AND PHYSICAL SETTING

This section provides a brief description of the project background and physical setting along with a summary of previous relevant investigations completed at the AFS site at NALF Cabaniss. Figure 1-1 shows the general location of NALF Cabaniss. Figure 1-2 shows the location of the AFS at NALF Cabaniss.

2.1 FACILITY LOCATION

NALF Cabaniss is located on the eastern side of Nueces County, Texas, and lies approximately 8 miles west of Naval Air Station Corpus Christi (NASCC). The installation is immediately bounded on the east by Brezina Road, on the west by Ayers Street and Farm-to-Market (FM) 286, to the north by Saratoga Road, and to the south by Oso Creek, a perennial water body that ultimately flows into Oso Bay. The installation boundary area includes Air Installation Compatible Use Zone (AICUZ) lands that extend northwest and southeast from the main acreage of the installation. These AICUZ lands are Navy property acquired to encompass noise zones and Accident Potential Zones in the event an accident were to occur on approach to or departing from the runways at NALF Cabaniss. The areas south of Oso Creek are agricultural and industrial properties. The areas east of the installation are mixed agricultural, industrial, and residential areas. North of the current boundary are former buildings and recreational areas that were once a part of the installation. These areas were transferred to the General Services Administration (GSA) for disposal in 1958, and are now the property of the Corpus Christi Independent School District (CCISD). Residential zones lie beyond these buildings to the north. A former landfill is located directly west of the installation.

2.2 FACILITY DESCRIPTION

NALF Cabaniss is an outlying field (OLF) with the current primary role of supporting Naval air training operations originating from NASCC. NASCC, home to the Chief of Naval Air Training, maintains and operates facilities and provides services and material to support the operations of the aviation facilities of the Naval Air Training Command and other tenant activities. The general command assignment is pilot training, focusing on primary and intermediate flight maneuvering and traffic pattern operations.

The installation was originally constructed with four 5,000-foot runways. Only two runways, oriented in north/south and northwest/southeast directions are presently active and maintained. Training Air Wing FOUR, based at NASCC, performs touch-and-go landing training between the main installation, NALF Cabaniss, and NALF Waldron, 3 miles south of NASCC. The airfield is lighted, to allow for night flight training, and daylight training.

NALF Cabaniss is covered with tall grasses, shrubs, trees, and other low-lying vegetation. Grasses and other vegetation near the operational runways are maintained through periodic mowing in support of flight training operations.

2.3 FACILITY HISTORY

In December 1938, the Navy recommended the Flour Bluff area south of Corpus Christi Bay as a potential site for the construction of a new aviation training station. Construction began June 30, 1940, and the installation was officially commissioned on March 12, 1941.

As an auxiliary station, Naval Auxiliary Air Station (NAAS) Cabaniss Field was outfitted with landing fields, runways, hangars, shops, barracks, a mess hall, and a recreational center. With the main installation and the six auxiliary fields, NASCC became the Navy's largest air training center during World War II (WWII). Following the conclusion of WWII, NASCC's mission was reduced to include only primary and instrument flight training. As a result, NAAS Cabaniss Field was temporarily decommissioned (1947), along with Naval Air Station (NAS) Kingsville, NAAS Rodd, and NAAS Waldron. The start of the Korean War in 1950 marked an increase in flight training at NASCC. NAS Kingsville, NAAS Cabaniss, and NAAS Chase Fields were also re-opened to support the increased training mission. In 1958, NAAS Cabaniss Field was converted from an auxiliary air station, which required personnel housing and support facilities, to an OLF, which required only the landing field property. As a result, approximately 346 acres in the northern section of the installation were determined to be excess and given over to the GSA for disposal. This portion of the property had mainly administrative and housing facilities. The installation was commissioned as a NALF in June 1969. NALF Cabaniss is currently in use as an OLF for primary flight training out of NASCC. Current flight training includes touch-and go, night training, and other student training operations.

2.4 PHYSICAL SETTING

2.4.1 Climate

The climate at NALF Cabaniss is a moderate to semi-tropical marine climate with hot, humid, breezy summers and mild winters. The wind direction is predominantly from the southeast during the warmer months, and from the northwest and north during periods of higher pressure and cold fronts during cooler months. Average low and high temperatures are 42 degrees Fahrenheit (°F) (January) and 86°F (July), respectively. The number of clear days averages 114 days per year. Annually, there are more than 100 days of high temperatures of 90°F or higher and fewer than 7 days of low temperatures at or below 32°F. Annual rainfall average is 34 inches.

2.4.2 Regional and Site Geology

Regional Geology

The coastal plain of the Corpus Christi area is underlain by Pleistocene river, delta, and shoreline sediments deposited during the interglacial periods. NALF Cabaniss is underlain by the Beaumont Formation, characterized by barrier islands and beach deposits composed of fine grained sands. Numerous pimple mounds and poorly defined relic beach ridges characterize the land surface. Locally active sand dunes are present in undisturbed areas. The barrier island and beach deposits of the Beaumont Formation are typically less than 60 feet thick. Other stratigraphic units, in order of increasing age, include the Montgomery Formation, Lissie Formation, Willis Formation, and the Goliad Sand. Figure 2-1 is a geologic map of the area.

Site Soil

NALF Cabaniss is underlain by Victorian Association soils. The Victoria series soils are dark, clayey sand, calcareous, crumbly soils that are referred to as blackland. These soils are deep, nearly level, and have developed over clayey materials of the coastal terrace. The soils exhibit very slow internal drainage when wet, and crack to depths of several feet when dry. Surface drainage from these soils flows into Oso Creek to the south of the installation.

Site Geology

The site-specific geologic setting was determined by the examination of drill cuttings and core samples from soil borings. Boring log data presented in Appendix A provide a detailed description of the lithologies encountered. Figure 2-2 depicts the trace of the cross section line. Figure 2-3 is a cross-section depicting the geology beneath the AFS site.

In general, the site-specific geologic section consisted of an upper fine-grained unit and a lower coarse-grained unit. This lower coarse-grained unit contained the first zone of saturated material. The upper fine-grained unit consisted of a brown to tan with depth, lean clay with a varying amount of admixed silt and some sand. The silt/sand content generally increased with depth. Caliche nodules were present in the upper portions of the section. The thickness of the unit was between 12 and 15 feet.

The lower coarse-grained unit was the first unit in which saturated sediments were encountered. The contact between the two units was generally well defined although the upper 2 feet was generally a mixture of sand and clay. This unit consisted of a brown very fine to fine grained silty to clayey sand. Because the borings were terminated in this lower unit, the true thickness of the lower zone was unable to be determined.

2.4.3 Topography and Surface Water Hydrology

Topography

The general topography of the mainland areas of Nueces County around Corpus Christi Bay can be described as a low-lying coastal area consisting of flat coastal prairies, chaparral pastures, and farmland. Elevations range between 15 and 30 feet above mean sea level (MSL). The topographic profile of NALF Cabaniss is generally flat with a mean elevation of 30 feet above MSL, with some steep downward slopes near Oso Creek.

Surface Water

Surface water resources at NALF Cabaniss include open drainage ditches, which drain south and southeast into Oso Creek. An unnamed pond associated with the former Sewage Disposal Plant is present 100 feet southeast of the NALF Cabaniss property.

Oso Creek forms the southern border of NALF Cabaniss. Oso creek is listed as Segment 2485A in the Texas Water Quality Inventory. It is an unclassified tidal stream with water body uses listed as aquatic life, contact recreation and fish consumption. Oso Creek empties into Oso Bay, Corpus Christi Bay and ultimately the Gulf of Mexico.

Freshwater and brackish water jurisdictional wetlands have been delineated at NALF Cabaniss, primarily concentrated at the southern end of the installation along Oso Creek. The wetlands at NALF Cabaniss cover a total area of 28.2 acres.

2.4.4 Groundwater Hydrogeology

The site is underlain by low permeability clays, which cause the majority of precipitation to run-off with only a small percentage recharging the groundwater. The regional aquifer, the Gulf Coast Aquifer, is predominantly sandy material overlying a clay zone with low permeability. Regional groundwater flow in the Corpus Christi area is generally to the northeast towards the ocean. Artesian aquifers located 250 to 2,800 feet below ground surface (bgs) in the Corpus Christi area are moderately to highly saline and so they have limited potential use. Therefore, potable water for the NALF Cabaniss and the City of Corpus Christi is supplied from Lake Corpus Christi, 38 miles to the northwest of the field.

As discussed in Section 2.4.2, the lower-coarse grained unit was the zone in which saturated materials were first encountered. Groundwater at the site appears to be under water table to slightly semi-confined conditions as water was measured in some wells at a higher level than was encountered during drilling.

Depth to static groundwater was measured at approximately 12 to 13 feet bgs in the three wells installed at the AFS. The actual water-bearing unit was encountered between 12 and 15 feet bgs.

Groundwater flow is generally to the southeast towards Oso Creek. Figure 2-4 is a groundwater contour map depicting flow across the site.

2.4.5 Ecology

Vegetation in the NALF Cabaniss area consists primarily of tall grasses and copses of shrubs, trees, and other low-lying vegetation. Original vegetation at the site likely consisted of mid- to tall grass in prairie grassland with minimal tree coverage. However, agricultural use and later development of the installation have left no native grasslands or natural vegetation; only disturbance-related species remain.

Fauna include; large mammals such as deer, small mammals such as rabbits, reptiles/amphibians, and bird species. No threatened or endangered species are known to occur on or near the site (Navy, 2006).

2.5 AQUADRIVE FUEL SYSTEM

2.5.1 Site Location

The AFS site is located in the central eastern portion the installation, along taxiways Bravo and Kilo. Figure 1-2 shows the location of the AFS site at NALF Cabaniss.

2.5.2 Site History

On July 30, 2008, NASCC Environmental received a report of oil coming out of the ground at NALF Cabaniss (Navy, 2008). The oil was determined to be coming from an underground vault (13-D) that was possibly part of an abandoned Aquadrive Fuel System. Initial inspection found oil seeping from one other vault (10-D). Both vaults were cleaned of excess surface oil and the vaults were covered with oil-absorbent booms and sandbags. The amount of oil that seeped out was unknown. Both vaults are surrounded by unsealed concrete with a thin asphalt top layer. The oil seeped out and traveled from vault 13-D across the pavement to an expansion joint where an undetermined amount of oil seeped through to the substrate.

NASCC Environmental conducted research by studying historical aerial photos and archived drawings which gave hints about the location and structure of the original fuel system. The most recent drawings of the site that have been located are dated 1950. All drawings are either incomplete or were drawn for other projects and only show the fuel system as a general feature. The only detailed drawings identified

during the records search were for similar fuel systems previously located at NASCC and NALF Waldron. The AFS at these other installations indicate that the systems were recorded as removed or filled in place. Appendix B contains copies of the available historical drawings for NALF Cabaniss.

The fuel system at NALF Cabaniss was apparently composed of approximately 40 vaults, 20 underground storage tanks (USTs), and interconnected fuel, water, and air lines. Figure 1-2 shows the locations of the components of the fuel system. Ten of the vaults and all the USTs were located on property that was transferred to GSA in 1958 when the base was converted to an OLF. The primary fuel used in the system is believed to be aviation gasoline (Avgas).

No information was found during a records search or interviews of base personnel related to the closure of the USTs. Therefore, it is not known if the USTs, valves, vaults, and lines currently located outside Navy-owned property were removed or abandoned in place.

A Formerly Used Defense Sites (FUDS) number has been assigned to NALF Cabaniss, K06TX0150. No site-specific information is available from the FUDS website detailing whether any environmental work has been conducted.

2.5.3 Previous Investigations

A Site Investigation (Navy, 2008) was conducted by NASCC environmental personnel in October 2008 in response to a report of oil coming out of the ground at NALF Cabaniss. Oil was found to be emanating from an underground vault believed to be part of an abandoned AFS. The initial assessment found a number of similar vaults, one of which was also seeping oil. NASCC Environmental staff responded and collected samples of the oil, water, and sediment/soil within eight of the vaults. Soil samples were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals and total petroleum hydrocarbons (TPH); water samples were analyzed for TCLP metals; and oil samples were analyzed for flashpoint (FP), total organic halides (TOX), TCLP metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs).

TOX concentration was measured at 20.3 milligrams per liter (mg/L) in one oil/water sample, but all samples were non-detect for VOCs and SVOCs. Detected metals concentrations in soil/sediment were less than the Texas-Specific Soil Background Concentration. All oil sample flashpoints were reported to be above 200°F. The concentrations of all other constituents were less than the practical quantitation limits (PQLs).

2.5.4 Remedial Actions

On October 16, 2008 a remedial operation was conducted by NASCC Environmental at the two vaults that were found to be seeping oil. A vacuum truck removed liquids and solids from the two vaults. A pressure washer was used to rinse residue from the vaults and agitate solids into a pumpable solution.

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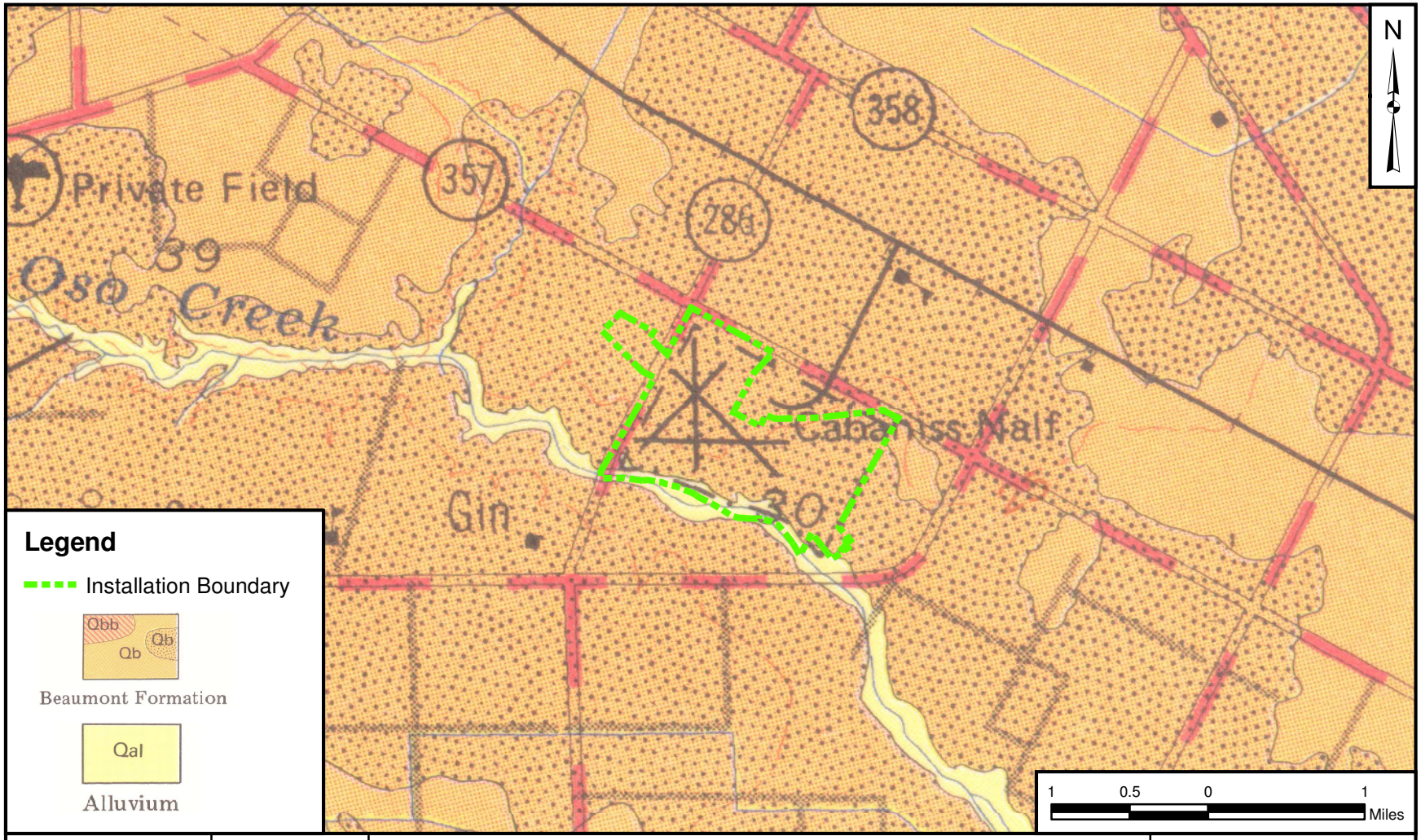

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GEOLOGIC MAP
NALF CABANISS
CORPUS CHRISTI, TEXAS

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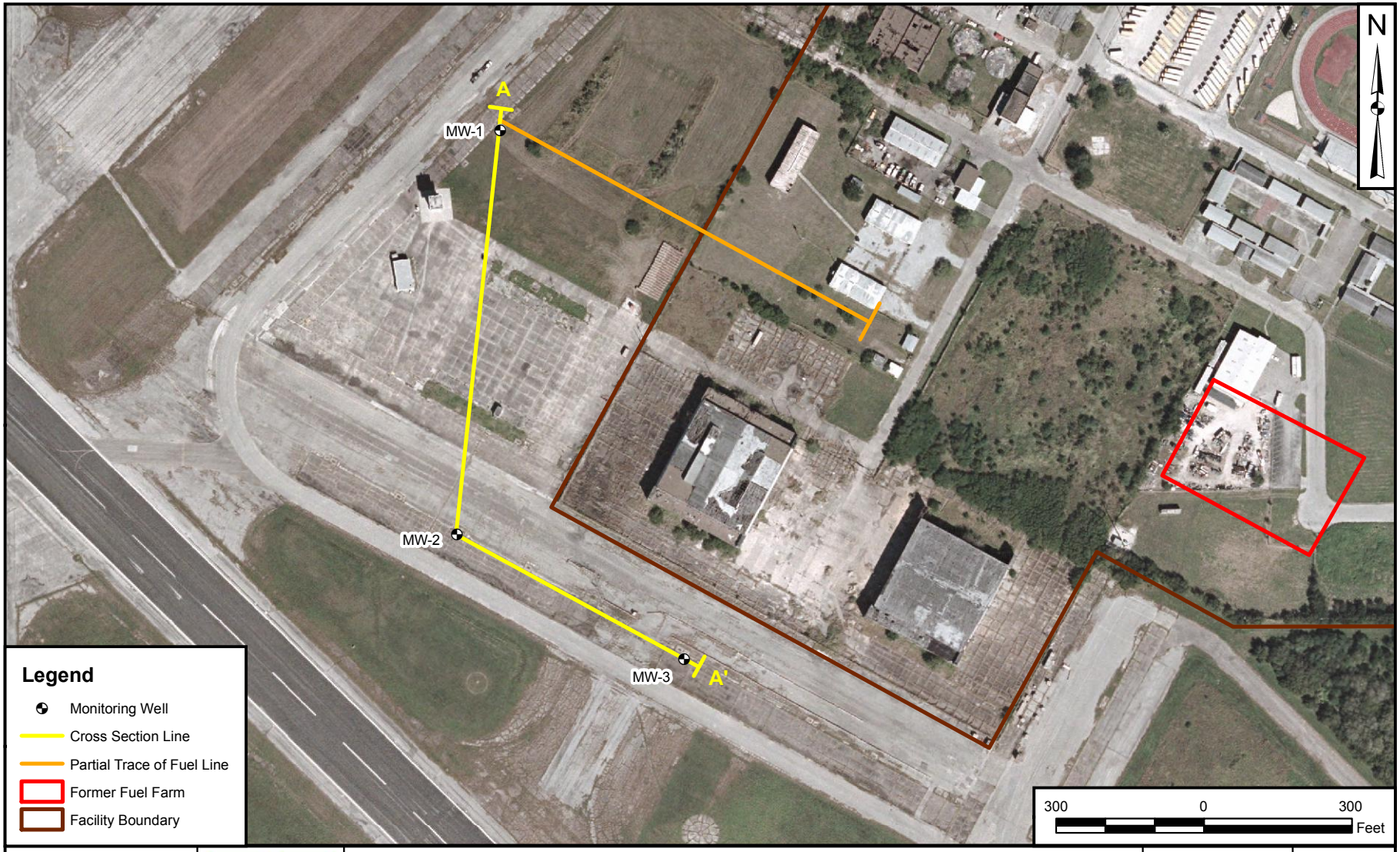

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CROSS SECTION LINE
AQUADRIVE FUEL SYSTEM
NALF CABANISS, TEXAS

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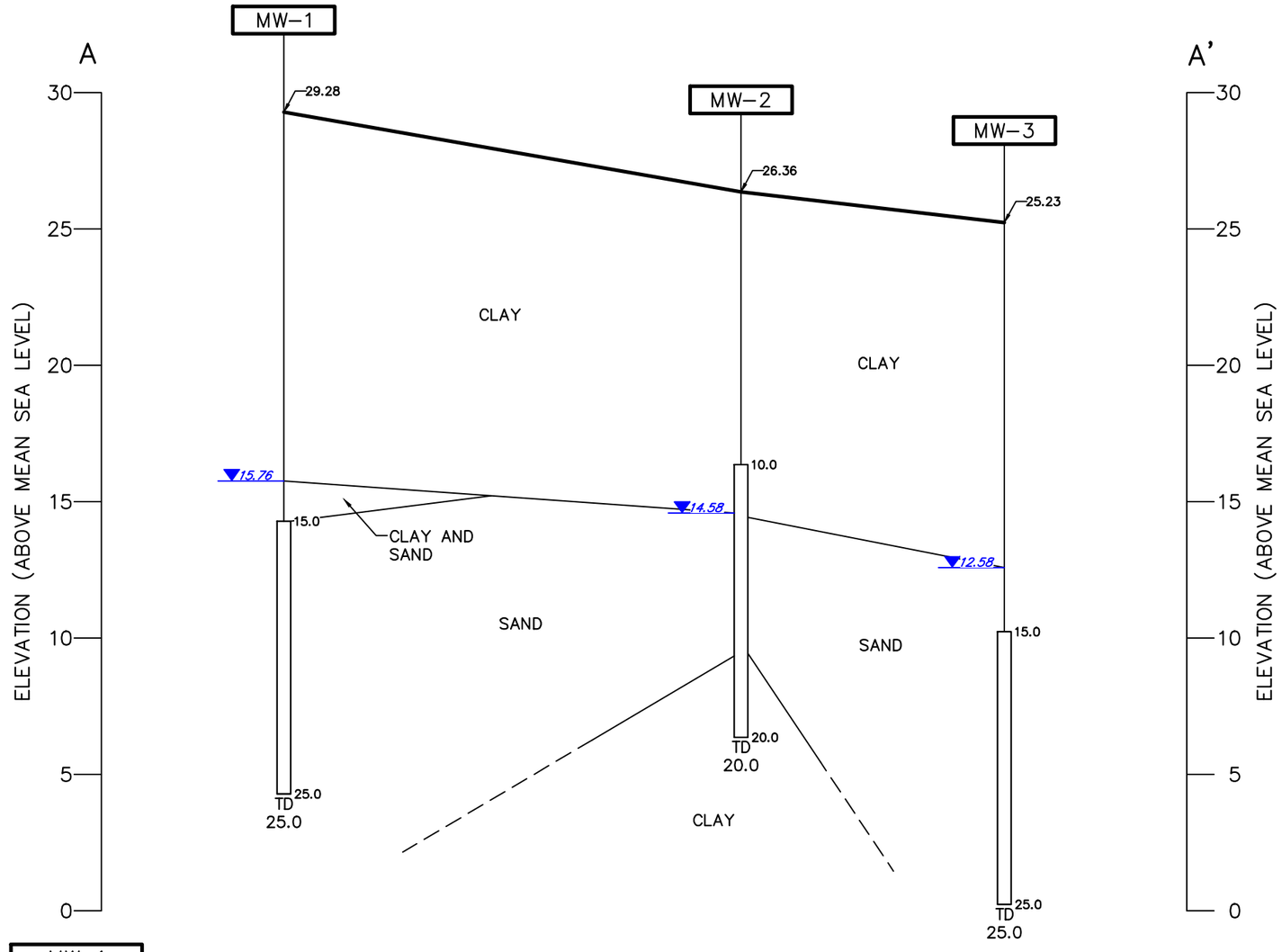

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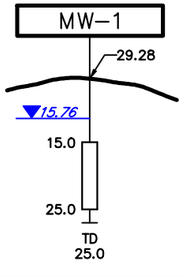

- MONITORING WELL OR BORING NUMBER
- GROUND SURFACE ELEVATION (MSL) GROUND SURFACE
- WATER LEVEL (MSL)
- TOP OF MONITORED INTERVAL (FT BGS)
- BOTTOM OF MONITORED INTERVAL (FT BGS)
- TOTAL DEPTH OF WELL OR BORING (FT BGS)

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GEOLOGICAL CROSS SECTION A–A'
AQUADRIVE FUEL SYSTEM
NALF CABANISS, TEXAS

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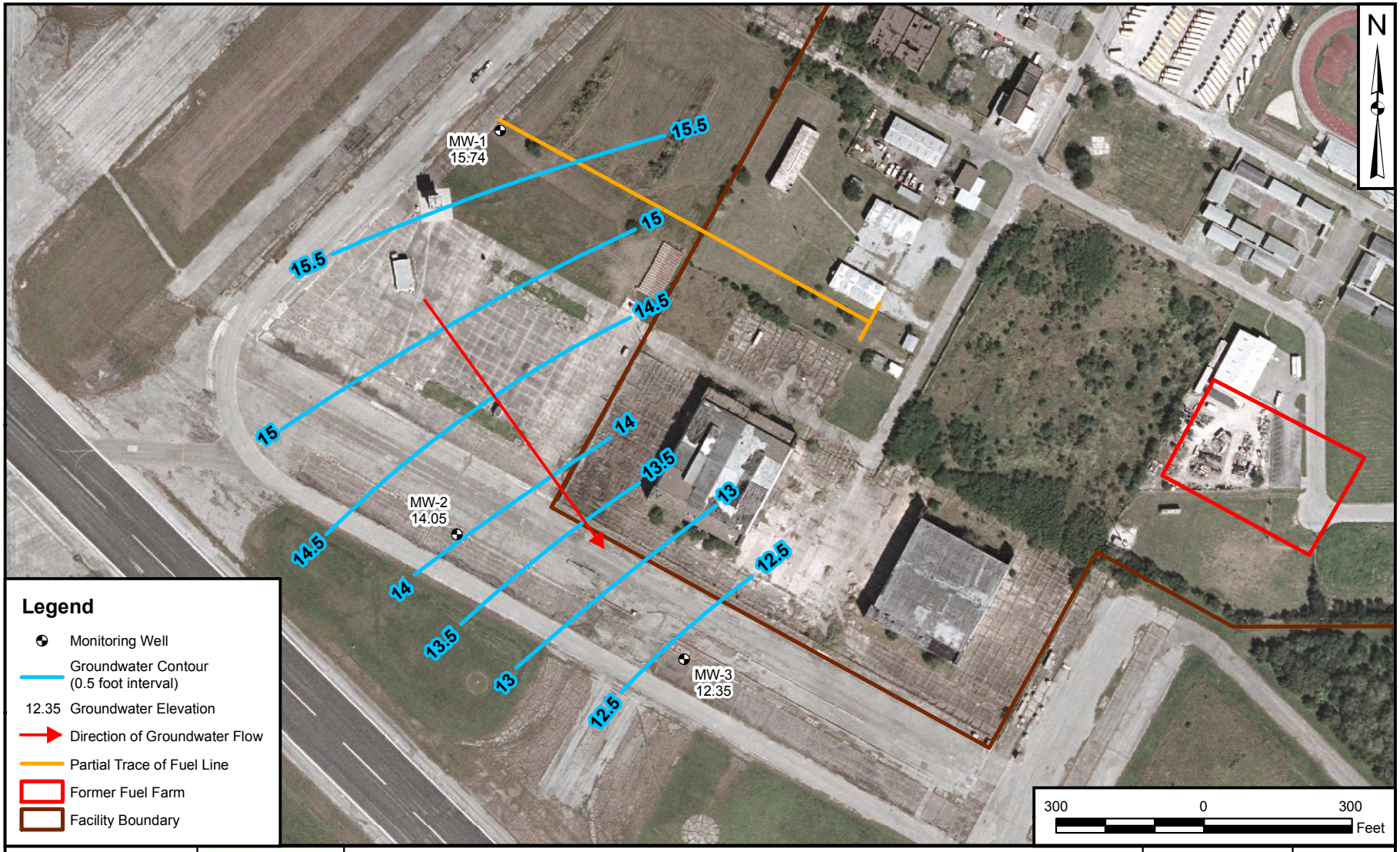

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GROUNDWATER CONTOUR MAP
AQUADRIVE FUEL SYSTEM
NALF CABANISS, TEXAS

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3.0 PRELIMINARY SUBSURFACE INVESTIGATION ACTIVITIES

The following subsections provide a detailed discussion of field and investigative operations that were conducted during the course of the PSI at the AFS site at NALF Cabaniss in September 2011 and November 2011. Figure 1-2 shows the general location of the AFS site at NALF Cabaniss.

3.1 GENERAL DESCRIPTION AND INFORMATION

This PSI was performed to determine the presence or absence and nature of COCs within subsurface soil and groundwater at the AFS site.

The PSI consisted of the drilling of soil borings, installation of groundwater monitoring wells, collection and laboratory analysis of soil and groundwater samples, a Global Positioning System (GPS) survey of sample locations, and reporting of results.

Tetra Tech obtained a Digging Permit from NASCC, identifying the area where the intrusive activities would occur, prior to sample collection.

3.2 SITE RECONNAISANCE

On September 7 and 8, 2011, Tetra Tech visited NALF Cabaniss to conduct a site reconnaissance. Tetra Tech was accompanied by a representative from NASCC Environmental. Each of the accessible vaults was opened and inspected. Because of their age or mechanical condition, several of the vaults were unable to be opened or could only be partially opened for observation.

An oil/water mixture was observed in vaults 10-D, 13-D and 23-D. A sheen was observed on the water in the concrete vault that contained a portion of the fuel line that was formerly connected to the fuel farm. Table 3-1 presents a summary of the site reconnaissance findings. A photographic log of the site reconnaissance is included as Appendix C.

A search for vaults on property currently owned by the CCISD was also conducted. Permission to access CCISD property was obtained by NASCC Environmental. According to records, 10 vaults (numbers 31 to 40) were located on the property. Four vault locations were found, but the vaults themselves appeared to have been removed and/or were filled with soil. Five vaults could not be found. The expected vault locations were covered by piles of dirt and/or heavy vegetation. One location was covered with concrete with no evidence of a vault. Mr. Buster Terry of CCISD, who provided access to the area, indicated that he was not aware of any oil seepage from the vaults on the property.

In addition to the on-site visit, an internet search of readily available information was conducted. The search was conducted to try and obtain information related to the AFS at NALF Cabaniss specifically, or general information concerning the construction and operation of an AFS.

As indicated by markings on equipment noted during the site visit, the AFS was either designed and/or installed by a company called Aqua System, Inc. An internet search of the company name revealed several companies by that name, none of which appeared to be involved with aircraft fuel delivery systems.

No internet information was found related to an AFS at NALF Cabaniss. However, three patents were found that had been issued to Aqua System Inc. for hydraulic storage and dispensing systems. Copies of the patents are included in Appendix D. Two of the patents relate to liquid storage and dispensing systems. One patent relates to a fuel handling pit box. The drawings for the fuel handling box appear to match the size and configuration of the fuel vaults seen at NALF Cabaniss.

3.3 SOIL BORING PROGRAM

At twenty locations, a drilling rig was used to advance a soil boring. At three locations, the soil borings were converted into permanent monitoring wells. The soil boring/monitoring wells were installed for the collection of soil and groundwater samples to determine if soil and groundwater have been impacted by COCs. In addition, water levels were measured so that groundwater gradient maps could be developed. The soil borings and monitoring wells were installed by a licensed Texas well driller.

3.3.1 Soil Boring Locations

Figure 3-1 shows the locations of the soil boring/monitoring wells. Soil boring locations were selected based on visual observations made during the site reconnaissance to represent areas that would most likely be impacted if a release had occurred. A secondary consideration was to provide a broad geographic distribution across the site. All drilling and sampling activities were conducted on NALF Cabaniss property. No drilling or sampling was conducted off-site.

3.3.2 Installation of Soil Borings

Twenty soil borings were drilled at the site. Soil borings were drilled using a Geoprobe 7720DT drilling rig with hollow stem auger (HSA) capability.

Sixteen of the soil borings were installed through the concrete tarmac. The four remaining soil borings were installed in natural ground. A concrete coring and sawing company was used to cut access holes

for the borings through the concrete. For soil boring locations, a 4-inch diameter core was cut through the concrete. For the monitoring well locations, an approximate 3-foot by 3-foot square was cut out of the concrete.

Boreholes were sampled for lithologic description and chemical analysis using Geoprobe Dual Tube sampling devices. The total depths of the soil borings ranged between 10 feet and 25 feet bgs. Each boring was logged by an on-site geologist as it was being drilled using the Field Log of Boring Form. Completed Boring Logs are included as Appendix A.

For the three monitoring well locations, once the total depth of the soil boring for sampling purposes had been reached, the drilling rig was converted for HSA drilling to install the monitoring well. HSA drilling was conducted using 8 1/4-inch outside diameter (OD) by 4 1/4-inches inside diameter (ID) auger flights.

Solid investigation derived waste (IDW) composed of soil cuttings generated during drilling activities was containerized in 55-gallon drums and stored on-site pending analysis for subsequent disposal.

Following completion of each of the soil borings in the concrete, the hole was filled with bentonite pellets, the concrete plug was reinserted, and the hole was patched with concrete. For soil borings installed in natural ground, the hole was filled with bentonite pellets, and the surface was topped off with concrete.

3.3.3 Soil Sampling and Preservation Methodology

Soil sampling was performed in conjunction with the soil boring program using a Dual Tube sampling system. A 1.375-inch diameter sample was obtained. One soil sample was collected from each soil boring for laboratory analysis. Soil cores were field screened with a photoionization detector (PID). Soil samples were collected at the total depth of the soil boring or from the interval exhibiting elevated PID readings. Soil samples were collected as discrete samples.

Samples were collected first for benzene, toluene, ethylbenzene, and xylene (BTEX) analysis, followed by samples designated for TPH analysis. Soil samples collected for volatile organics were obtained using TerraCore samplers per Method SW-5035. Each sample was collected by pushing the TerraCore sampler directly into the soil, ensuring that the sampler was packed tight with soil, and leaving zero headspace. The sample was then transferred to an appropriate sample container. Sample aliquots designated for polyaromatic hydrocarbons (PAHs) and lead were then collected. Sample containers were appropriately labeled, sealed in plastic "Ziploc" bags, and placed in an ice chest, filled with ice and prepared for shipping. Sample collection, preservation methods, holding times and containers were in accordance with US Environmental Protection Agency (EPA) Method SW-846.

Each member of the sampling crew donned a new pair of gloves at each sampling location. The person actually collecting the sample wore disposable latex gloves and changed them between each sample collected for chemical analysis. The samples were packaged for shipment at the conclusion of each day's sample collection activities.

3.4 GROUNDWATER SAMPLING PROGRAM

At three locations where soil borings were drilled, monitoring wells were installed so that groundwater samples could be collected to determine if groundwater has been impacted by COCs, and to classify the groundwater in accordance with the Texas Risk Reduction Program (TRRP) rule. In addition, water levels were measured so that groundwater gradient maps could be developed.

3.4.1 Groundwater Sampling Locations

Figure 3-1 shows the locations of the monitoring wells. Monitoring well locations were selected based on visual observations made during the site reconnaissance to represent areas that would most likely be impacted if a release had occurred. A secondary consideration was to provide a broad geographic distribution across the site and perceived upgradient and downgradient groundwater flow directions.

3.4.2 Monitoring Well Installation

The three soil borings were converted to monitoring wells, as described below.

For the three monitoring well locations, once the total depth of the soil boring for sampling purposes had been reached, the drilling rig was converted for HSA drilling to install the monitoring well. HSA drilling was conducted using 8 1/4-inch OD by 4 1/4-inch ID auger flights.

The wells consisted of new flush-threaded 2-inch ID, Schedule 40 polyvinyl chloride (PVC) riser pipe and factory slotted screen. The screen slot size was 0.01-inch and the screen length was 10 ft. The annular space surrounding each well screen was backfilled with a clean 20/40 silica sand filter pack. The sand filter pack extended from the bottom of the borehole to approximately 2 feet above the top of the screen. The annular space above the sand pack was backfilled to approximately 2 feet below the surface with dry granular bentonite and allowed to hydrate sufficiently to prevent migration into the sand pack. Well construction diagrams are included as Appendix A.

A flush mount surface completion was installed at each monitoring well. The surface completion consisted of a concrete pad constructed of high-quality structural-type concrete which was approximately 6 inches thick and approximately 3 feet square. The top of the pad slopes away from the well bore to the

edges to prevent ponding of water around the casing. A locking well cap was installed at the top of each monitoring well.

3.4.3 Monitoring Well Development

The three monitoring wells were developed by surging and pumping with an electric submersible pump. During the well development process at least three well volumes were evacuated from the monitoring wells. The turbidity of the formation water was recorded upon completion of development. Well development logs are included as Appendix A.

Water generated during monitoring well development was containerized in 55-gallon drums and stored on-site pending analysis for subsequent disposal.

3.4.4 Groundwater Sampling and Preservation Methodology

Once the wells were developed, the monitoring wells were allowed to stabilize and recharge overnight prior to commencement of groundwater sampling. Following recharge, the depth to groundwater was measured relative to the top of the PVC casing at each well location. Wells were then purged with a peristaltic pump for sampling using low-flow sampling methods. During purging activities, a water quality instrument measured water quality parameters including turbidity, dissolved oxygen, oxidation reduction potential, temperature, conductivity, and pH; and the data were recorded. After three water quality readings were obtained showing stabilized (within 10 percent) water quality parameters, groundwater was sampled from the monitoring wells. Copies of groundwater sample logs are included as Appendix A.

Water samples were collected directly from the discharge tube into laboratory-supplied containers. Groundwater samples were obtained for BTEX, TPH, PAHs, lead and total dissolved solids (TDS) analysis. Samples for VOC analysis were collected prior to collection of other aliquots. Sample aliquots designated for SVOC analysis were collected next, followed by the remaining sample aliquots. Sample collection, preservation methods, holding times and containers were in accordance with EPA Method SW-846.

Each member of the sampling crew donned a new pair of gloves at each sampling location. The person who actually collected the sample wore disposable latex gloves and changed them between each sample. Upon filling, sample containers were appropriately labeled, sealed in plastic "Ziplock" bags, and placed in an ice chest, filled with ice and prepared for shipping. The samples were packaged for shipment at the conclusion of each day.

3.5 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLE DESCRIPTION

The quality assurance/quality control (QA/QC) samples were collected during the investigation sampling activities to assess the variability introduced in sampling, handling, shipping, and laboratory analysis. Field QA/QC samples included equipment (rinsate) blanks, temperature blanks, trip blanks, and QC samples (field duplicates). The types and collection frequency of field QA/QC samples are described in the following subsections.

3.5.1 Equipment Blanks

Equipment (rinsate) blanks are samples that are prepared in the field to assess the effectiveness of decontamination procedures applicable to soil and groundwater sampling equipment. Equipment blanks were prepared by pouring analyte-free distilled water through the decontaminated sampling equipment and collecting the rinsate in appropriate clean laboratory-supplied sample containers.

Equipment blanks were collected at a rate of 5 percent, being defined as one equipment blank for every 20 or fewer samples per matrix for non-dedicated or non-disposable equipment. One equipment blank for soil was collected. The equipment blank was analyzed for BTEX, PAHs, TPH, and lead. Dedicated/disposable sampling equipment was used during groundwater sampling; therefore, no equipment blank was required.

3.5.2 Field Duplicates

Field duplicates are samples that are divided into two portions at the time of sampling. Field duplication provides precision information regarding homogeneity, handling, shipping, storing, preparation, and analysis. Field duplicates were collected at a frequency of one per every 10 or fewer samples per matrix (solid or liquid). A total of two soil and one groundwater duplicate samples were collected for fixed-base laboratory analysis. Duplicate samples were analyzed for the same parameters as the original sample as described in Sections 3.3 and 3.4.

3.5.3 Temperature Blanks

Temperature blanks, supplied by the analytical laboratory, were included in each cooler containing samples that were shipped to the laboratory. Temperature blanks are used by the laboratory to verify sample preservation.

3.5.4 Trip Blanks

Trip blanks were prepared at the analytical laboratory by pouring analyte-free reagent water into 40-ml Teflon-lined septum vials. The trip blanks accompanied the water sample containers into the field, but remained unopened until analyzed in the laboratory after being returned from the field. Trip blanks thus served to identify contamination of the water samples or sample containers that might have occurred during transport. One trip blank accompanied each sample shipping container in which soil and groundwater samples designated for BTEX analysis were contained. Five trip blanks were tested only for BTEX.

3.6 FIELD MEASUREMENTS

Field parameters measured during the course of the PSI were:

- Volatile organics screening of workers' breathing space and recovered soil samples.
- Water quality [pH, temperature, specific conductance, turbidity, dissolved oxygen, oxidation reduction potential (ORP)] of water samples.

Volatile organics screening was measured using a MiniRAE 3000. Water quality parameters were measured using a Horiba U-50.

Volatile organics screening data and water quality parameter data are presented on the soil borings logs and groundwater sampling log sheets located in Appendix A. Volatile organics screening of the workers' breathing space was at or below background readings.

Instruments used to collect field data were identified with a unique identification number so that the instrument calibration and maintenance history can be traced. Each instrument was calibrated prior to its delivery to the field, daily, or as needed, in accordance with the manufacturer's recommendations. The project field notebook or the calibration log sheet was used to document the calibration of field testing equipment.

3.7 DECONTAMINATION PROCEDURES

Proper decontamination of field equipment is an integral part of the overall QC process.

A decontamination pad was constructed for heavy equipment at the site. The decontamination pad was set up at a sufficient distance from the sample locations to prevent cross-contamination. The pad consisted of a high-density polyethylene membrane liner supported and secured on all sides by a one-

foot high berm constructed of landscape timbers. Wash racks were used at the decontamination pad to hold the equipment above ground to facilitate cleaning during decontamination activities. All decontamination liquids were pumped into Department of Transportation (DOT) approved 55-gallon drums which were stored in a secure designated area until analysis for final disposition, and clearly identified and labeled as "PENDING ANALYSIS."

Prior to and after the completion of all sampling events, sampling equipment was decontaminated through the following steps:

- Rinse with potable water.
- Wash in solution of potable water and Liquinox soap or equivalent.
- Rinse with potable water.
- Rinse with deionized water.
- Air dry, if feasible.

Potable water for decontamination was obtained from a faucet at the Fire Department building connected to the city public water supply.

3.8 FIELD DOCUMENTATION

Field documentation and tracking of sample custody are integral parts of the overall QA/QC process for the PSI. The field documentation system serves as a record of activities conducted in the field during sample collection and data generation, and provides the means to identify, track, and monitor each sample from the time of collection through final reporting of data.

3.8.1 Sample Identification

The sample identification scheme presented below was used to identify and label the field samples collected and the field QC blanks created during the PSI. The sample identification procedure was used for the sample labels and chain-of-custody documents in order to maintain consistency in the labeling process, and to allow efficient handling of a large number of samples from different sources.

The sampling numbers were assigned as follows:

AA	**AA**	**NN**	**NNNN (Soils only)**
Site Acronym	Matrix	Sample Location Number	Sequential depth interval from freshly exposed surface

Character Type:

A = Alpha

N = Numeric

Site Name (AA):

AF = Aquadrive Fuel System

Matrix Code (AA):

SS = Soil Sample (soil boring)

MW = Soil sample (monitoring well)

GW = Groundwater

Location Number (NN):

Sequential number beginning with “01” for each matrix.

Depth Interval:

This code section was used for soil samples only. The depth code was used to note the depth below ground surface at which a soil sample was collected. The first two numbers represent the top interval and the third and fourth numbers represent the bottom interval in feet bgs.

Field QA/QC samples are designated using a different coding system than the one used for regular field samples.

The QC code consisted of a three- to four-segment alpha-numeric code that identifies the sample QC type, the date the sample was collected, and the number of this type of QC sample collected on that date.

AA	NNNNNN	NN
QC Type	Date	Sequence Number (per day)

Character Type:

A = Alpha

N = Numeric

QC Types:

FD = Field Duplicate

TB = Trip Blank

RB = Rinsate Blank

3.8.2 Field Log Books/Sample Log Sheets

The sampling coordinator for the field team maintained a field notebook and field data sheets containing pertinent information regarding the samples. The field logs are intended to provide sufficient data and observations to enable the field team and other interested parties to reconstruct events that occurred during field activities. The field notebook was a bound book with consecutively numbered pages. Field documentation was completed in the field notebook or data sheets (e.g., boring log forms, sampling sheets, etc.) using indelible ink.

3.9 LAND SURVEYING

Land surveying was conducted to determine the horizontal (XY) location of each soil boring. Land surveying was conducted by Tetra Tech using a Trimble GeoXH GPS. Accuracy of locations is to approximately one-half meter in the horizontal axis. The points are referenced to the Texas State Plane Coordinate System, North American Datum 1983 (NAD 83).

Land surveying was conducted to determine the horizontal (XY) and vertical (Z) locations of the monitoring wells. Land surveying was conducted by Naismith Engineering, a Texas licensed surveying company. Horizontal points are referenced to the Texas State Plane Coordinate System, NAD 83. Elevations are measured in reference to North American Vertical Datum 1988 (NAVD 88). Table 3-2 summarizes the soil boring/monitoring well coordinates. Sample locations are shown on Figure 3-1.

3.10 SAMPLE MANAGEMENT

The following chain-of-custody procedures documented sample possession from the time of sample collection until its ultimate disposal. For the purposes of these procedures, a sample was considered to be in custody if it was:

- In one's actual possession.
- In view after being in one's possession.
- Secured (i.e., locked up) so that no one could tamper with it.
- In a secured area, available to authorized personnel only.

Strict chain-of-custody procedures were maintained throughout the duration of the investigation. These procedures included the following:

- A Chain-of-Custody record was completed in the field. The original accompanied the samples, and copies were maintained at intermediate steps.
- At the point where the responsibility for custody of the samples changed, the new custodian signed the Chain-of-Custody record and noted the date and time.

PSI samples were packed in an ice-filled cooler and sent by overnight carrier to the analytical laboratory, Empirical Laboratories, Inc. in Nashville, Tennessee, for chemical analyses.

3.11 INVESTIGATION-DERIVED WASTE MANAGEMENT

The types of wastes generated as a result of the PSI activities were disposable sampling equipment, personal protective equipment (PPE), soil, well development and purge water, and decontamination liquids. The liquid IDW was collected and placed into six 55-gallon drums. The solid IDW was collected and placed into seven 55-gallon drums. The waste containers were clearly identified and labeled "PENDING ANALYSIS." The generated IDW was temporarily stored at a location designated by NASCC personnel.

One composite liquid sample and one composite soil sample were collected from the drums containing liquid and soil IDW, and submitted to the laboratory for chemical analysis. The IDW samples were analyzed for TCLP VOCs, lead, TPH, and reactivity, corrosivity, and ignitability.

The liquid and solid IDW drums were classified as Class II waste and were transported to the Republic Tessman Landfill in San Antonio, Texas for disposal. A copy of the waste manifests associated with the transportation and disposal of these drums is included in Appendix E.

TABLE 3-1

**SUMMARY OF SITE RECONNAISANCE FINDINGS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS
PAGE 1 OF 3**

Vault Number	Water Observed?	Oil Observed?	PID Reading (ppm)	Comments
1-ABC	No	No	36.3	Vault is dry and filled with soil/sediment to 1 ft bgs. No odor noted.
2-ABCD	No	No	0	
3-ABC	No	No	0	
4-ABCD	No	No	0	
5-ABC	NA	No	NA	Vault filled in with concrete
6-ABC	NA	No	NA	Vault filled in with concrete
7-ABC	NA	No	NA	Vault filled in with concrete
8-ABD	NA	No	NA	Vault filled in with concrete
8-C	No	No	0	
9-ABC	No	No	0	
10-ABC	No	No	0	
10-D	Yes	Yes	0	Oil staining noted on concrete/asphalt ground surface
11	NA	No	NA	Vault filled in with concrete
12-ABC	No	No	0	
13-ABC	No	No	0	
13-D	Yes	Yes	0	Oil staining noted on concrete/asphalt ground surface
14-ABC	Yes	No	0	

TABLE 3-1

**SUMMARY OF SITE RECONNAISANCE FINDINGS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS
PAGE 2 OF 3**

Vault Number	Water Observed?	Oil Observed?	PID Reading (ppm)	Comments
15-ABCD	No	No	0	
16-ABC	No	No	0	
17-ABC	No	No	0	
18-ABC	Yes	No	0	
19-ABCD	No	No	0	
20-ABC	No	No	0	
21-ABCD	No	No	0	
22-ABC	Yes	No	0	
23-ABC	Yes	No	0	
23-D	Yes	Yes	0	
24-ABC	No	No	0	
25-ABC	No	No	0	
25-D	Yes	No	0	
26-ABC	No	No	0	
27-ABC	Yes	Yes	17	
27-D	Yes	Yes	0	Oil staining noted on concrete/asphalt ground surface
28-ABCD	No	No	0	
29-ABC	No	No	0	Oily water noted in valve box next to 29-D
30-ABC	No	No	3.5	
31	No	No	0	Vault covers missing and filled with soil

TABLE 3-1

**SUMMARY OF SITE RECONNAISANCE FINDINGS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS
PAGE 3 OF 3**

Vault Number	Water Observed?	Oil Observed?	PID Reading (ppm)	Comments
32	No	No	0	Vault covers missing, filled with soil
33	NA	NA	NA	Unable to access location due to heavy vegetation and/or debris piled on location
34	No	No	0	Vault covers missing, filled with soil
35	NA	NA	NA	No visible footprint of vault observed
36	NA	NA	NA	Unable to access location due to heavy vegetation and/or debris piled on location
37	No	No	0	Vault covers missing, filled with soil
38	NA	NA	NA	Unable to access location due to heavy vegetation and/or debris piled on location
39	NA	NA	NA	Unable to access location due to heavy vegetation and/or debris piled on location
40	NA	NA	NA	Unable to access location due to heavy vegetation and/or debris piled on location

NA = not applicable
ppm = parts per million
PID = photoionization detector

TABLE 3-2

SAMPLE LOCATION COORDINATES
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS
PAGE 1 OF 1

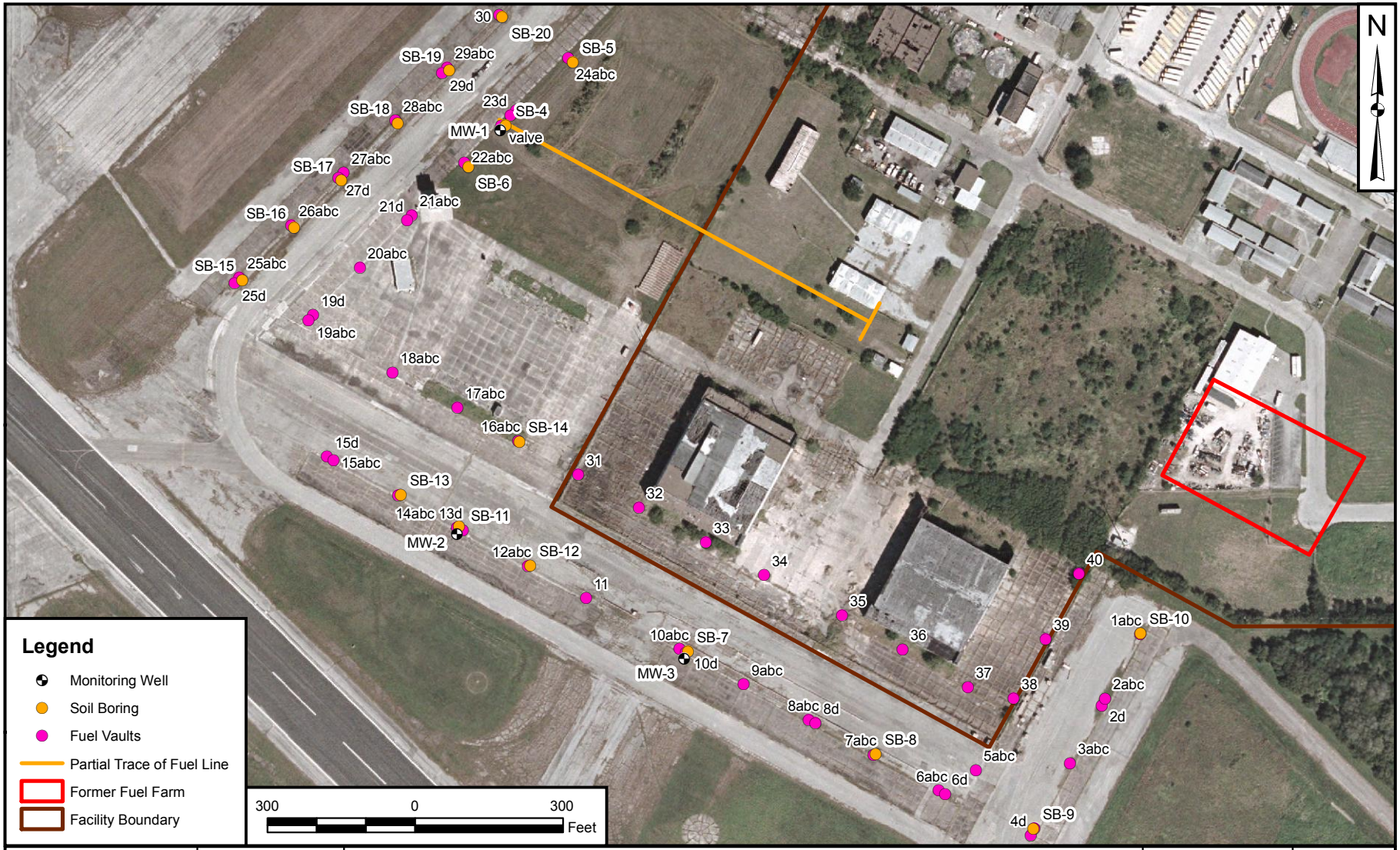
Location	Northing (feet)	Easting (feet)	Top of Casing Elevation (feet MSL)	Ground Elevation (feet MSL)
MW-1	17146792.65	1328164.69	29.26	29.28
MW-2	17145971.21	1328076.56	25.83	26.37
MW-3	17145719.47	1328537.57	25.00	25.23
SB-4	17146802.08	1328175.85	--	--
SB-5	17146930.05	1328311.52	--	--
SB-6	17146717.94	1328100.24	--	--
SB-7	17145733.25	1328545.65	--	--
SB-8	17145524.72	1328925.87	--	--
SB-9	17145372.75	1329246.14	--	--
SB-10	17145769.76	1329463.14	--	--
SB-11	17145986.51	1328080.63	--	--
SB-12	17145907.45	1328225.23	--	--
SB-13	17146051.38	1327962.46	--	--
SB-14	17146158.82	1328203.08	--	--
SB-15	17146486.97	1327641.00	--	--
SB-16	17146594.01	1327746.45	--	--
SB-17	17146690.46	1327841.75	--	--
SB-18	17146806.78	1327956.61	--	--
SB-19	17146913.93	1328061.39	--	--
SB-20	17147022.61	1328168.17	--	--

Note:

Coordinates are Texas State Plane, South Zone 4205, NAD83. Elevations are based on NAVD88.

MSL – mean sea level

PGH P:\GIS\CORPUSCHRISTI_NAS\MAPDOCS\MXD\CABANISS_FUEL_SYSTEMS_SAMPLOCS.MXD 12/13/11 JEE



DRAWN BY	DATE
J. ENGLISH	12/06/11
CHECKED BY	DATE
L. BASILIO	12/13/11
REVISED BY	DATE
SCALE	
AS NOTED	

NAVFAC

SAMPLE LOCATIONS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, TEXAS

CONTRACT NUMBER	CTO NUMBER
1001	JM65
APPROVED BY	DATE
APPROVED BY	DATE
FIGURE NO.	REV
3 - 1	0

4.0 PRELIMINARY SUBSURFACE INVESTIGATION RESULTS

The objective of the PSI was to determine the presence or absence and nature of COCs within subsurface soil and groundwater at the AFS site. The PSI consisted of the drilling of soil borings, installation of groundwater monitoring wells, collection and laboratory analysis of soil and groundwater samples, GPS survey of sample locations, and reporting of results. Field activities associated with the PSI were performed in 2011.

The PSI was conducted according to the Tier II Sampling and Analysis Plan (Tetra Tech NUS, 2011)and the Texas Petroleum Storage Tank (PST) Program rules (30 Texas Administrative Code Chapter 334). The PST Program rule specifies the assessment, monitoring, cleanup, reporting and other requirements for PST sites in Texas.

The analytical data presented in this PSI Report were subjected to a data validation process performed by Tetra Tech personnel to ensure the integrity and defensibility of the data. Samples collected for chemical analysis during the PSI were prepared and analyzed by Empirical Laboratories (Emperical) and PEL, a division of Spectrum Analytical, Inc. Empirical and PEL are Department of Defense (DoD) Environmental Laboratory Accreditation Program (ELAP) accredited, and National Environmental Laboratory Accreditation Program (NELAP) accredited.

For reporting purposes, detected concentrations of analyzed soil and groundwater samples are discussed in this section.

4.1 ANALYTICAL PARAMETERS AND METHODS

Soil and groundwater samples were collected at the AFS site and submitted to the laboratory for chemical analysis as described in the previous sections. Table 4-1 presents the analytical parameters and methods.

Soil samples collected during the PSI for chemical analysis were analyzed for BTEX, PAHs, TPH and lead using the methods as shown in Table 4-1

Groundwater samples collected during the PSI for chemical analysis were analyzed for BTEX, PAHs, TPH, lead, and TDS using the methods shown in Table 4-1.

IDW samples collected during the PSI for chemical analysis were analyzed for TCLP VOCs, lead, TPH, and reactivity, corrosivity, and ignitability (RCI) using the methods shown in Table 4-1.

4.2 REGULATORY CRITERIA

Analytical results of soil and groundwater samples were compared to Texas PST Program Action Levels (Table 1 of TCEQ publication RG-411, April 2010, Revised September 2011). The action level is the lowest applicable health-based or groundwater protective target concentration for the respective COC. Soil and groundwater analytical results for lead and TPH were compared to TRRP Tier 1 Protective Concentration Levels (PCLs).

4.3 SOIL ANALYTICAL RESULTS

Figure 3-1 shows the locations of the soil samples collected during the PSI. Table 4-2 presents the soil analytical results.

4.3.1 BTEX

BTEX was not detected at concentrations greater than the reporting limits in soil samples collected at the AFS during the PSI.

4.3.2 PAHs

Nine PAHs were detected at concentrations greater than the reporting limits in two soil samples collected at the AFS during the PSI. However, the concentrations detected are less than the respective PST Action Limits.

4.3.3 TPH

TPH was not detected at concentrations greater than the reporting limits in soil samples collected at the AFS during the PSI.

4.3.3 Lead

In soil samples collected at the AFS during the PSI, lead was detected at concentrations greater than the reporting limits, but less than the TRRP Tier 1 Residential PCL.

4.4 GROUNDWATER ANALYTICAL RESULTS

Figure 3-1 shows the locations of the groundwater samples collected during the PSI. Table 4-3 presents the groundwater analytical results.

4.4.1 BTEX

BTEX was not detected at concentrations greater than the reporting limits in groundwater samples collected at the AFS during the PSI.

4.4.2 PAHs

Two PAHs, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene, were detected at concentrations greater than the PST Action Limit in one groundwater sample collected at the AFS during the PSI.

Benzo(b)fluoranthene was detected in sample AF-GW03 at a concentration of 0.000121 "J" mg/L. This concentration exceeds the PST Action Limit of 0.000117 mg/L.

Indeno(1,2,3-cd)pyrene was detected in sample AF-GW03 at a concentration of 0.000124 "J" mg/L. This concentration exceeds the PST Action Limit of 0.000117 mg/L.

The remaining PAHs were either detected at concentrations greater than the reporting limits but less than the PST Action Limit, or were not detected at concentrations greater than the reporting limit.

Figure 4-1 is a tag map depicting the PAH exceedances.

4.4.3 TPH

TPH was not detected at concentrations greater than the reporting limits in groundwater samples collected at the AFS during the PSI.

4.4.4 Lead

Lead was not detected at concentrations greater than the reporting limits in groundwater samples collected at the AFS during the PSI.

4.4.5 TDS

TDS concentrations detected ranged from 1180 mg/L to 1320 mg/L in groundwater samples collected at the AFS during the PSI.

TABLE 4-1

ANALYTICAL PROGRAM
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS
PAGE 1 OF 1

Analysis	Method [1]
SOIL	
Benzene, Toluene, Ethylbenzene, Xylene	8260B
Polyaromatic Hydrocarbons	8270C
Total Petroleum Hydrocarbons	TX1005
Lead	6010C
GROUNDWATER	
Benzene, Toluene, Ethylbenzene, Xylene	8260B
Polyaromatic Hydrocarbons	8270C
Total Petroleum Hydrocarbons	TX1005
Lead	6010C
Total Dissolved Solids	SM2540C
IDW - SOIL	
TCLP Volatile Organics	1311/8260B
Lead	6010C
Total Petroleum Hydrocarbons	TX1005
Reactivity	SW-846 Chapter 7
Corrosivity	9040C
Ignitability	1020A
IDW – WATER	
TCLP Volatile Organics	1311/8260B
Lead	6010C
Total Petroleum Hydrocarbons	TX1005
Reactivity	SW-846 Chapter 7, 9012A
Corrosivity	9045B
Ignitability	1010A

Notes:
1. All methods from EPA SW-846 except as noted
TCLP = Toxicity Characteristic Leaching Procedure

TABLE 4-2

SOIL ANALYTICAL RESULTS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS

LOCATION		AF-SB01	AF-SB02	AF-SB03	AF-SB04	AF-SB05	
SAMPLE ID		AF-SS011315	AF-SS020103	AF-SS030507	AF-SS040810	AF-SS050810	AF-SS050810-D
SAMPLE DATE	PROJECT	20111101	20111102	20111102	20111101	20111101	20111101
SAMPLE CODE	ACTION	NORMAL	NORMAL	NORMAL	NORMAL	ORIG	DUP
MATRIX	LIMIT [1]	SO	SO	SO	SO	SO	SO
TOP DEPTH		13	1	5	8	8	8
BOTTOM DEPTH		15	3	7	10	10	10
METALS (MG/KG)							
LEAD	500	5.3	8.77	10.2	11.1	13.8	9.94
PETROLEUM HYDROCARBONS (MG/KG)							
TPH (C06-C12)	NC	28.9 U	29 U	27.4 U	29.7 U	28.5 U	28.8 U
TPH (C06-C35)	NC	28.9 U	29 U	27.4 U	29.7 U	28.5 U	28.8 U
TPH (C12-C28)	NC	28.9 U	29 U	27.4 U	29.7 U	28.5 U	28.8 U
TPH (C28-C35)	NC	28.9 U	29 U	27.4 U	29.7 U	28.5 U	28.8 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)							
ACENAPHTHENE	34.1	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
ACENAPHTHYLENE	54.7	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
ANTHRACENE	2.04	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
BENZO(A)ANTHRACENE	0.877	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
BENZO(A)PYRENE	0.0877	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
BENZO(B)FLUORANTHENE	0.877	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
BENZO(G,H,I)PERYLENE	0.824	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
BENZO(K)FLUORANTHENE	1.35	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
CHRYSENE	1.24	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
DIBENZO(A,H)ANTHRACENE	0.0877	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
DIBENZOFURAN	48.8	0.0222 U	0.026 U	0.0237 U	0.0285 U	0.0238 U	0.0242 U
FLUORANTHENE	25.5	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00267 J	0.00242 U
FLUORENE	30.2	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
INDENO(1,2,3-CD)PYRENE	0.877	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
NAPHTHALENE	99.7	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
PHENANTHRENE	28.2	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00366 J	0.00242 U
PYRENE	10.3	0.00222 U	0.0026 U	0.00237 U	0.00285 U	0.00238 U	0.00242 U
VOLATILES (MG/KG)							
BENZENE	0.12	0.00132 U	0.00154 U	0.00149 U	0.00166 U	0.00166 U	0.00148 U
ETHYLBENZENE	36.8	0.00132 U	0.00154 U	0.00149 U	0.00166 U	0.00166 UJ	0.00148 U
M+P-XYLENES	NC	0.00265 U	0.00309 U	0.00298 U	0.00333 U	0.00332 UJ	0.00296 U
O-XYLENE	NC	0.00132 U	0.00154 U	0.00149 U	0.00166 U	0.00166 UJ	0.00148 U
TOLUENE	39.1	0.00132 U	0.00154 U	0.00149 U	0.00166 U	0.00166 U	0.00148 U

Notes:
1. Table 1 TCEQ publication RG-411, April 2010, Revised September 2011
Lead is compared to TRRP Tier 1 PCLs, May 24, 2011
Highlight - exceedance of Project Action Limit
mg/kg - milligrams per kilogram
U - not detected
J - estimated
NC - no criteria

TABLE 4-2

SOIL ANALYTICAL RESULTS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS
PAGE 2 OF 4

LOCATION SAMPLE ID SAMPLE DATE SAMPLE CODE MATRIX TOP DEPTH BOTTOM DEPTH	PROJECT ACTION LIMIT [1]	AF-SB06 AF-SS060810 20111101 NORMAL SO 8 10	AF-SB07 AF-SS070810 20111102 NORMAL SO 8 10	AF-SB08 AF-SS080810 20111102 NORMAL SO 8 10	AF-SB09 AF-SS090810 20111102 NORMAL SO 8 10	AF-SB10 AF-SS100810 20111102 NORMAL SO 8 10	AF-SB11 AF-SS110810 20111102 NORMAL SO 8 10
METALS (MG/KG)							
LEAD	500	14.5	5.69	7.35	5.79	7.91	8.66
PETROLEUM HYDROCARBONS (MG/KG)							
TPH (C06-C12)	NC	31.1 U	28.3 U	28.4 U	27.3 U	29.3 U	28.3 U
TPH (C06-C35)	NC	31.1 U	28.3 U	28.4 U	27.3 U	29.3 U	28.3 U
TPH (C12-C28)	NC	31.1 U	28.3 U	28.4 U	27.3 U	29.3 U	28.3 U
TPH (C28-C35)	NC	31.1 U	28.3 U	28.4 U	27.3 U	29.3 U	28.3 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)							
ACENAPHTHENE	34.1	0.00252 U	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
ACENAPHTHYLENE	54.7	0.00252 U	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
ANTHRACENE	2.04	0.00252 U	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
BENZO(A)ANTHRACENE	0.877	0.00311 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
BENZO(A)PYRENE	0.0877	0.00252 U	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
BENZO(B)FLUORANTHENE	0.877	0.00336 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
BENZO(G,H,I)PERYLENE	0.824	0.00718 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
BENZO(K)FLUORANTHENE	1.35	0.00281 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
CHRYSENE	1.24	0.00303 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
DIBENZO(A,H)ANTHRACENE	0.0877	0.00252 U	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
DIBENZOFURAN	48.8	0.0252 U	0.022 U	0.0241 U	0.0232 U	0.0198 U	0.0253 U
FLUORANTHENE	25.5	0.0037 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
FLUORENE	30.2	0.00279 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
INDENO(1,2,3-CD)PYRENE	0.877	0.00252 U	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
NAPHTHALENE	99.7	0.00252 U	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
PHENANTHRENE	28.2	0.00399 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
PYRENE	10.3	0.00369 J	0.0022 U	0.00241 U	0.00232 U	0.00198 U	0.00253 U
VOLATILES (MG/KG)							
BENZENE	0.12	0.00163 U	0.00136 U	0.00154 U	0.00147 U	0.00117 U	0.00146 U
ETHYLBENZENE	36.8	0.00163 U	0.00136 U	0.00154 U	0.00147 U	0.00117 U	0.00146 U
M+P-XYLENES	NC	0.00327 U	0.00271 U	0.00308 U	0.00294 U	0.00234 U	0.00292 U
O-XYLENE	NC	0.00163 U	0.00136 U	0.00154 U	0.00147 U	0.00117 U	0.00146 U
TOLUENE	39.1	0.00163 U	0.00136 U	0.00154 U	0.00147 U	0.00117 U	0.00146 U

Notes:
1. Table 1 TCEQ publication RG-411, April 2010, Revised September 2011
Lead is compared to TRRP Tier 1 PCLs, May 24, 2011
Highlight - exceedance of Project Action Limit
mg/kg - milligrams per kilogram
U - not detected
J - estimated
NC - no criteria

TABLE 4-2

SOIL ANALYTICAL RESULTS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS

LOCATION		AF-SB12	AF-SB13	AF-SB14	AF-SB15	AF-SB16	AF-SB17
SAMPLE ID		AF-SS120810	AF-SS130810	AF-SS140810	AF-SS150810	AF-SS160810	AF-SS170810
SAMPLE DATE	PROJECT	20111102	20111102	20111103	20111103	20111103	20111103
SAMPLE CODE	ACTION	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL	NORMAL
MATRIX	LIMIT [1]	SO	SO	SO	SO	SO	SO
TOP DEPTH		8	8	8	8	8	8
BOTTOM DEPTH		10	10	10	10	10	10
METALS (MG/KG)							
LEAD	500	9	8.86	6.72	4.15	8.06	12.9
PETROLEUM HYDROCARBONS (MG/KG)							
TPH (C06-C12)	NC	29.4 U	29 U	29 U	28.5 U	28.2 U	30.1 U
TPH (C06-C35)	NC	29.4 U	29 U	29 U	28.5 U	28.2 U	30.1 U
TPH (C12-C28)	NC	29.4 U	29 U	29 U	28.5 U	28.2 U	30.1 U
TPH (C28-C35)	NC	29.4 U	29 U	29 U	28.5 U	28.2 U	30.1 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)							
ACENAPHTHENE	34.1	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
ACENAPHTHYLENE	54.7	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
ANTHRACENE	2.04	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
BENZO(A)ANTHRACENE	0.877	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
BENZO(A)PYRENE	0.0877	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
BENZO(B)FLUORANTHENE	0.877	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
BENZO(G,H,I)PERYLENE	0.824	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
BENZO(K)FLUORANTHENE	1.35	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
CHRYSENE	1.24	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
DIBENZO(A,H)ANTHRACENE	0.0877	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
DIBENZOFURAN	48.8	0.0226 U	0.0266 U	0.0194 U	0.0181 U	0.0201 U	0.0208 U
FLUORANTHENE	25.5	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
FLUORENE	30.2	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
INDENO(1,2,3-CD)PYRENE	0.877	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
NAPHTHALENE	99.7	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
PHENANTHRENE	28.2	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
PYRENE	10.3	0.00226 U	0.00266 U	0.00194 U	0.00181 U	0.00201 U	0.00208 U
VOLATILES (MG/KG)							
BENZENE	0.12	0.00132 U	0.00169 U	0.00122 U	0.00121 U	0.0013 U	0.00137 U
ETHYLBENZENE	36.8	0.00132 U	0.00169 U	0.00122 U	0.00121 U	0.0013 U	0.00137 U
M+P-XYLENES	NC	0.00264 U	0.00339 U	0.00245 U	0.00242 U	0.00259 U	0.00274 U
O-XYLENE	NC	0.00132 U	0.00169 U	0.00122 U	0.00121 U	0.0013 U	0.00137 U
TOLUENE	39.1	0.00132 U	0.00169 U	0.00122 U	0.00121 U	0.0013 U	0.00137 U

Notes:
1. Table 1 TCEQ publication RG-411, April 2010, Revised September 2011
Lead is compared to TRRP Tier 1 PCLs, May 24, 2011
Highlight - exceedance of Project Action Limit
mg/kg - milligrams per kilogram
U - not detected
J - estimated
NC - no criteria

TABLE 4-2

SOIL ANALYTICAL RESULTS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS

LOCATION		AF-SB18	AF-SB19	AF-SB20	
SAMPLE ID		AF-SS180810	AF-SS190810	AF-SS200810	AF-SS200810-D
SAMPLE DATE	PROJECT	20111103	20111103	20111103	20111103
SAMPLE CODE	ACTION	NORMAL	NORMAL	ORIG	DUP
MATRIX	LIMIT [1]	SO	SO	SO	SO
TOP DEPTH		8	8	8	8
BOTTOM DEPTH		10	10	10	10
METALS (MG/KG)					
LEAD	500	5.34	10.2	8.44	7
PETROLEUM HYDROCARBONS (MG/KG)					
TPH (C06-C12)	NC	27.5 U	29.1 U	30.7 U	28.8 U
TPH (C06-C35)	NC	27.5 U	29.1 U	30.7 U	28.8 U
TPH (C12-C28)	NC	27.5 U	29.1 U	30.7 U	28.8 U
TPH (C28-C35)	NC	27.5 U	29.1 U	30.7 U	28.8 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/KG)					
ACENAPHTHENE	34.1	0.0019 U	0.00195 U	0.00206 U	0.002 U
ACENAPHTHYLENE	54.7	0.0019 U	0.00195 U	0.00206 U	0.002 U
ANTHRACENE	2.04	0.0019 U	0.00195 U	0.00206 U	0.002 U
BENZO(A)ANTHRACENE	0.877	0.0019 U	0.00195 U	0.00206 U	0.002 U
BENZO(A)PYRENE	0.0877	0.0019 U	0.00195 U	0.00206 U	0.002 U
BENZO(B)FLUORANTHENE	0.877	0.0019 U	0.00195 U	0.00206 U	0.002 U
BENZO(G,H,I)PERYLENE	0.824	0.0019 U	0.00195 U	0.00206 U	0.002 U
BENZO(K)FLUORANTHENE	1.35	0.0019 U	0.00195 U	0.00206 U	0.002 U
CHRYSENE	1.24	0.0019 U	0.00195 U	0.00206 U	0.002 U
DIBENZO(A,H)ANTHRACENE	0.0877	0.0019 U	0.00195 U	0.00206 U	0.002 U
DIBENZOFURAN	48.8	0.019 U	0.0195 U	0.0206 U	0.02 U
FLUORANTHENE	25.5	0.0019 U	0.00195 U	0.00206 U	0.002 U
FLUORENE	30.2	0.0019 U	0.00195 U	0.00206 U	0.002 U
INDENO(1,2,3-CD)PYRENE	0.877	0.0019 U	0.00195 U	0.00206 U	0.002 U
NAPHTHALENE	99.7	0.0019 U	0.00195 U	0.00206 U	0.002 U
PHENANTHRENE	28.2	0.0019 U	0.00195 U	0.00206 U	0.002 U
PYRENE	10.3	0.0019 U	0.00195 U	0.00206 U	0.002 U
VOLATILES (MG/KG)					
BENZENE	0.12	0.00117 UJ	0.0012 U	0.00132 U	0.00132 U
ETHYLBENZENE	36.8	0.00117 UJ	0.0012 U	0.00132 U	0.00132 U
M+P-XYLENES	NC	0.00235 UJ	0.0024 U	0.00265 U	0.00264 U
O-XYLENE	NC	0.00117 UJ	0.0012 U	0.00132 U	0.00132 U
TOLUENE	39.1	0.00117 UJ	0.0012 U	0.00132 U	0.00132 U

Notes:
1. Table 1 TCEQ publication RG-411, April 2010, Revised September 2011
Lead is compared to TRRP Tier 1 PCLs, May 24, 2011
Highlight - exceedance of Project Action Limit
mg/kg - milligrams per kilogram
U - not detected
J - estimated
NC - no criteria

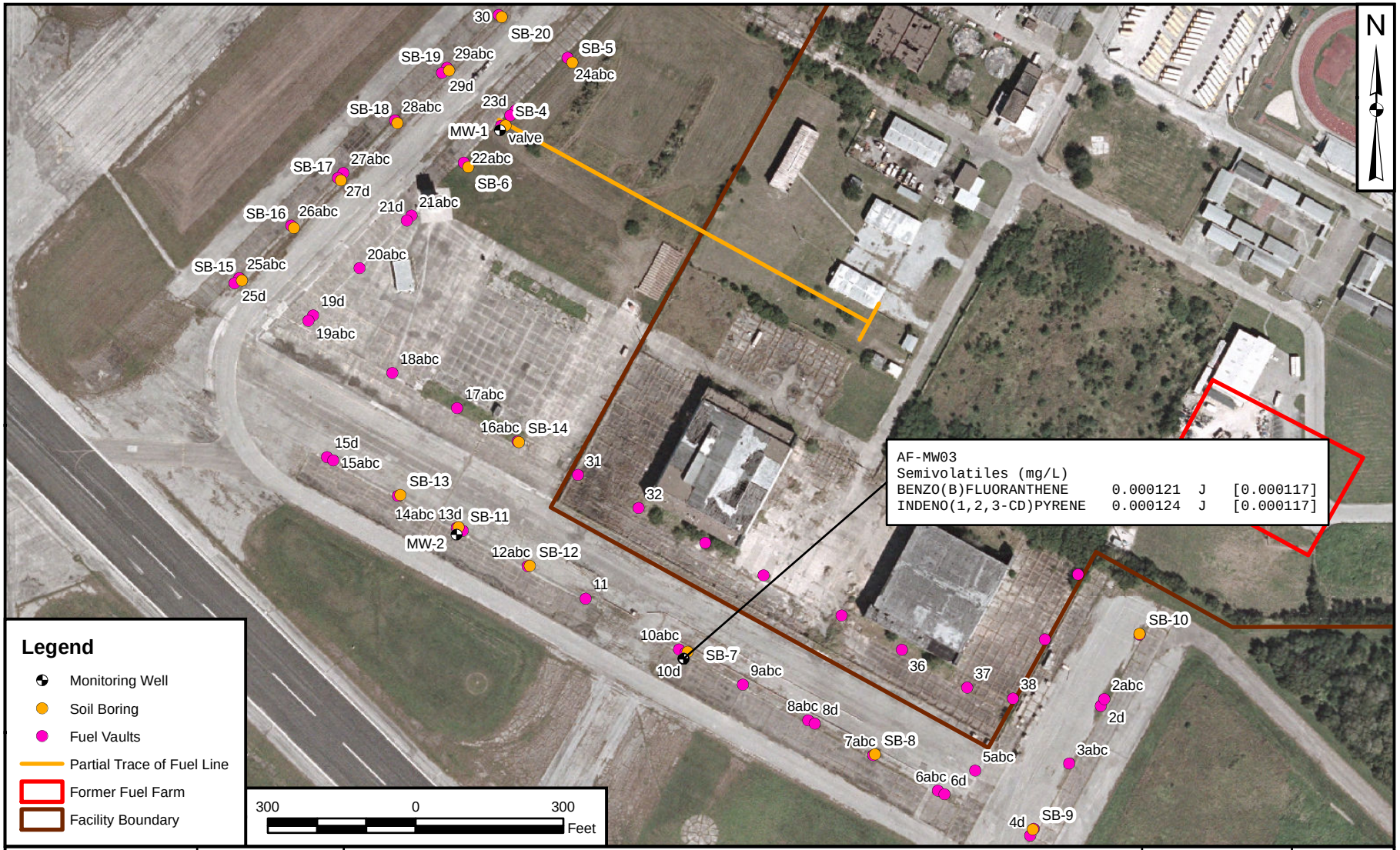
TABLE 4-3

GROUNDWATER ANALYTICAL RESULTS
AQUADRIVE FUEL SYSTEM
NALF CABANISS, CORPUS CHRISTI, TEXAS
PAGE 1 OF 1

LOCATION		AF-MW01		AF-MW02	AF-MW03
SAMPLE ID	PROJECT ACTION LIMIT (1)	AF-GW01	AF-GW01-D	AF-GW02	AF-GW03
SAMPLE DATE		20111104	20111104	20111104	20111104
SAMPLE CODE		ORIG	DUP	NORMAL	NORMAL
MATRIX		GW	GW	GW	GW
METALS (MG/L)					
LEAD	0.0015	0.0015 U	0.0015 U	0.0015 U	0.0015 U
MISCELLANEOUS PARAMETERS (MG/L)					
TOTAL DISSOLVED SOLIDS	NC	1180	--	1250	1320
PETROLEUM HYDROCARBONS (MG/L)					
TPH (C06-C12)	NC	2.4 U	2.4 U	2.5 U	2.4 U
TPH (C06-C35)	NC	2.4 U	2.4 U	2.5 U	2.4 U
TPH (C12-C28)	NC	2.4 U	2.4 U	2.5 U	2.4 U
TPH (C28-C35)	NC	2.4 U	2.4 U	2.5 U	2.4 U
POLYCYCLIC AROMATIC HYDROCARBONS (MG/L)					
ACENAPHTHENE	2.19	0.0000467 U	0.0000467 U	0.0000463 U	0.0000463 U
ACENAPHTHYLENE	11	0.0000467 U	0.0000467 U	0.0000463 U	0.0000463 U
ANTHRACENE	2.19	0.0000467 U	0.0000467 U	0.0000463 U	0.000069 J
BENZO(A)ANTHRACENE	0.000117	0.0000467 U	0.0000467 U	0.0000463 U	0.000102 J
BENZO(A)PYRENE	0.0002	0.0000467 U	0.0000467 U	0.0000463 U	0.0000844 J
BENZO(B)FLUORANTHENE	0.000117	0.0000506 J	0.0000467 U	0.0000463 U	**0.000121 J**
BENZO(G,H,I)PERYLENE	1.1	0.0000467 U	0.0000467 U	0.0000463 U	0.000128 J
BENZO(K)FLUORANTHENE	0.00117	0.0000467 U	0.0000467 U	0.0000463 U	0.000128 J
CHRYSENE	0.0117	0.0000467 U	0.0000467 U	0.0000463 U	0.0000994 J
DIBENZO(A,H)ANTHRACENE	0.0002	0.0000467 U	0.0000467 U	0.0000463 U	0.00015 J
DIBENZOFURAN	0.146	0.00000117 U	0.00000117 U	0.00000116 U	0.0000116 U
FLUORANTHENE	1.46	0.0000527 J	0.0000467 U	0.0000463 U	0.000117 J
FLUORENE	1.46	0.0000467 U	0.0000467 U	0.0000463 U	0.000063 J
INDENO(1,2,3-CD)PYRENE	0.000117	0.0000467 U	0.0000467 U	0.0000463 U	**0.000124 J**
NAPHTHALENE	0.73	0.0000467 U	0.0000467 U	0.0000463 U	0.0000463 U
PHENANTHRENE	1.1	0.0000935 U	0.0000935 U	0.0000996 J	0.00013 J
PYRENE	1.1	0.0000572 J	0.0000467 U	0.0000463 U	0.000112 J
VOLATILES (MG/L)					
BENZENE	0.005	0.00025 U	0.00025 U	0.00025 U	0.00025 U
ETHYLBENZENE	0.7	0.00025 U	0.00025 U	0.00025 U	0.00025 U
M+P-XYLENES	NC	0.00025 U	0.00025 U	0.00025 U	0.00025 U
O-XYLENE	NC	0.0005 U	0.0005 U	0.0005 U	0.0005 U
TOLUENE	1	0.00025 U	0.00025 U	0.00025 U	0.00025 U

Notes:
1. Table 1 of TCEQ publication RG-411, April 2010, Revised September 2011
Lead was compared to TRRP Tier 1 Protective Concentration Levels, May 24, 2011.
Highlight - exceedance of Project Action Limit
mg/L - milligrams per liter
U - not detected
J - estimated
NC - no criteria

PGH P:\GIS\CORPUSCHRISTI_NAS\MAPDOCS\MXD\CABANISS_GW_EXCEEDANCE_TAG.MXD 02/16/12 JN



DRAWN BY: J. NOVAK	DATE: 02/16/12
CHECKED BY: L. BASILIO	DATE: 02/16/12
REVISED BY	DATE
SCALE: AS NOTED	

NAVFAC

GROUNDWATER EXCEEDANCES
AQUADRIVE FUEL SYSTEM
NALF CABANISS, TEXAS

CONTRACT NUMBER: 1001	CTO NUMBER: JM65
APPROVED BY: ___	DATE: ___
APPROVED BY: ___	DATE: ___
FIGURE NO.: 4-1	REV: 0

5.0 SUMMARY OF FINDINGS AND RECOMMENDATIONS

The following section provides a discussion of the findings of the PSI and recommendations.

5.1 SUMMARY OF FINDINGS

Analytical results for soil and groundwater samples collected at the AFS are summarized in Tables 4-2 and 4-3, and Figure 4-1.

5.1.1 Summary of Findings - Soil

The analytical results for BTEX, PAHs, TPH, and lead are less than the PST Action Levels.

5.1.2 Summary of Findings - Groundwater

The analytical results for BTEX, TPH, and lead are less than the PST Action Levels.

The analytical results for two PAHs exceed the PST Action Levels in the groundwater sample collected from monitoring well MW-3.

An oil/water mixture was observed in vault 10-D at the location of monitor well MW-3.

TDS concentrations detected ranged from 1180 mg/L to 1320 mg/L in groundwater samples collected at the AFS during the PSI. Based on the TDS concentration, the groundwater at the site can be classified as a Class 2 groundwater resource (i.e., groundwater with a TDS less than 10,000 mg/L).

5.2 RECOMMENDATIONS

5.2.1 Recommendations - Soil

The analytical results for soil are less than the PST Action Limits; therefore, no further action for soil is required.

However, the source of the oil/water mixture seen in some of the fuel vaults is not known. It is possible that oil/water discharges from these or other vaults could impact the surrounding soil or groundwater.

Because of the known oil/water discharges and the uncertainty regarding the closure of the AFS, the following actions are recommended.

- Remove and dispose of oil stained soils and oil/water in the fuel vaults.

- Monitor the fuels vaults on a regular basis and take corrective action as needed.

- Excavate, remove and/or fill in the existing fuel vaults and associated piping.

5.2.2 Recommendations - Groundwater

The analytical results for groundwater are greater than the PST Action Limits; therefore, further action for groundwater is required.

- It is recommended that one additional round of groundwater sampling be conducted to verify COC concentrations.

- Conduct an investigation to delineate the extent of COC exceedances in groundwater.

5.3 CONCEPTUAL SITE MODEL (CSM)

The CSM summarizes available site information and identifies relationships between exposure pathways and associated receptors. Figure 5-1 presents the CSM.

The CSM is based on the information presented in the Site Investigation Report (Navy, 2008) and this PSI report. The site history and site characteristics are presented in Section 2.0.

The information was used to identify complete, or incomplete pathways (sources, receptors and the interactions between them), for current and future land uses for the site. The pathway must include a source, an exposure medium, an exposure route, and a receptor. The pathways may also include a release mechanism (e.g., volatilization) and a transport medium (e.g., air) if the point of exposure is not at the same location as the source.

Exposure media are those that contain the source or those media that become contaminated through migration of the contamination from the source area. The following are identified as exposure media:

- Surface and subsurface soils at the source area
- Groundwater (via leaching from surface and subsurface soils)

The following are not identified as exposure media:

- Surface water and sediments – the nearest surface water is over 3000 feet away.
- Food Chain via plant uptake from soils, contaminated fish and wildlife consumption, and domesticated animal consumption - the facility is fenced with restricted access and the site is covered with concrete making it undesirable for plant and animal communities.
- Air (via volatilization from surface soils) – the site is covered by a concrete and asphalt surface and nature of the COCs and concentrations are not supportive of volatilization.

5.3.1 Soil Exposure Pathway

Source of COCs

The source of the COCs is the former AFS, specifically the subsurface fueling pits and the subsurface lines connecting them. The COCs associated with aviation gasoline include volatile and semivolatile compounds and lead.

Exposure Pathway

Based on the results of this PSI, soil is one of the medium affected by releases from the AFS activity. COCs released from the AFS could migrate along the concrete to joints and impact the soil or be released from the susbsurface piping and vaults directly into the soil.

Current Site Conditions, Future Land Use and Access

The current and future land use for NALF Cabaniss is as an OLF with the primary role of supporting Naval air training operations originating from NASCC. It is anticipated that land use in the future will remain the same. NALF Cabaniss is a limited-access fenced installation with a locked gate. Military or appropriate civilian or contractor identification is required to access the installation. The AFS site is covered by concrete and asphalt.

Human Receptors

Potential human receptors include maintenance and construction crews, and contractor personnel. Construction workers and maintenance personnel may be exposed to soil by digging activities such as drilling, trenching or construction. The potential human routes of exposure are inhalation, ingestion, and direct contact.

The installation is typically not manned on weekends or at night. Trespassers are not considered a receptor due to the fencing and security gate. Exposure of facility personnel (i.e., Navy personnel manning the aircraft tower and fire station) to soil is not anticipated as the AFS area is covered by a concrete or asphalt cap.

Human Health Risk Assessment

Soil samples were collected from 20 locations during the PSI. Soil analytical results indicated COCs are present in the soil but did not exceed regulatory criteria. The future potential point of contact for human exposure for the soil pathway may be complete if digging, trenching, or construction activities remove the concrete or asphalt cap and expose the underlying soil.

5.3.2 Groundwater Exposure Pathway

Source of COCs

The source of the COCs is the former AFS, specifically the subsurface fueling pits and the subsurface lines connecting them. The COCs associated with aviation gasoline include volatile and semivolatile compounds and lead.

Exposure Pathway

Based on the results of this PSI, groundwater is one of the medium affected by releases from the AFS activity. COCs released from the AFS could migrate through the soil and impact the groundwater.

Current Site Conditions, Future Land Use and Access

The current and future land use for NALF Cabaniss is as an OLF with the primary role of supporting Naval air training operations originating from NASCC. It is anticipated that land use in the future will remain the same. NALF Cabaniss is a limited-access fenced installation with a locked gate. Military or appropriate civilian or contractor identification is required to access the installation. The AFS site is covered by concrete and asphalt.

Migration Pathway

Depth to groundwater is approximately 12 to 15 feet bgs. The direction of groundwater flow is to the southeast.

Groundwater Use and Access

Groundwater at the AFS site is not currently accessible. There are no water wells on NALF Cabaniss. NALF Cabaniss obtains it water from the local municipal water supply system. A water well receptor survey was not conducted during the PSI. However, the first encountered groundwater in this area eventually discharges downgradient into Oso Creek located over 3000 feet to the south of the AFS. The Navy owns all the property between the AFS and Oso Creek, so it is unlikely that any wells will be installed downgradient of the AFS.

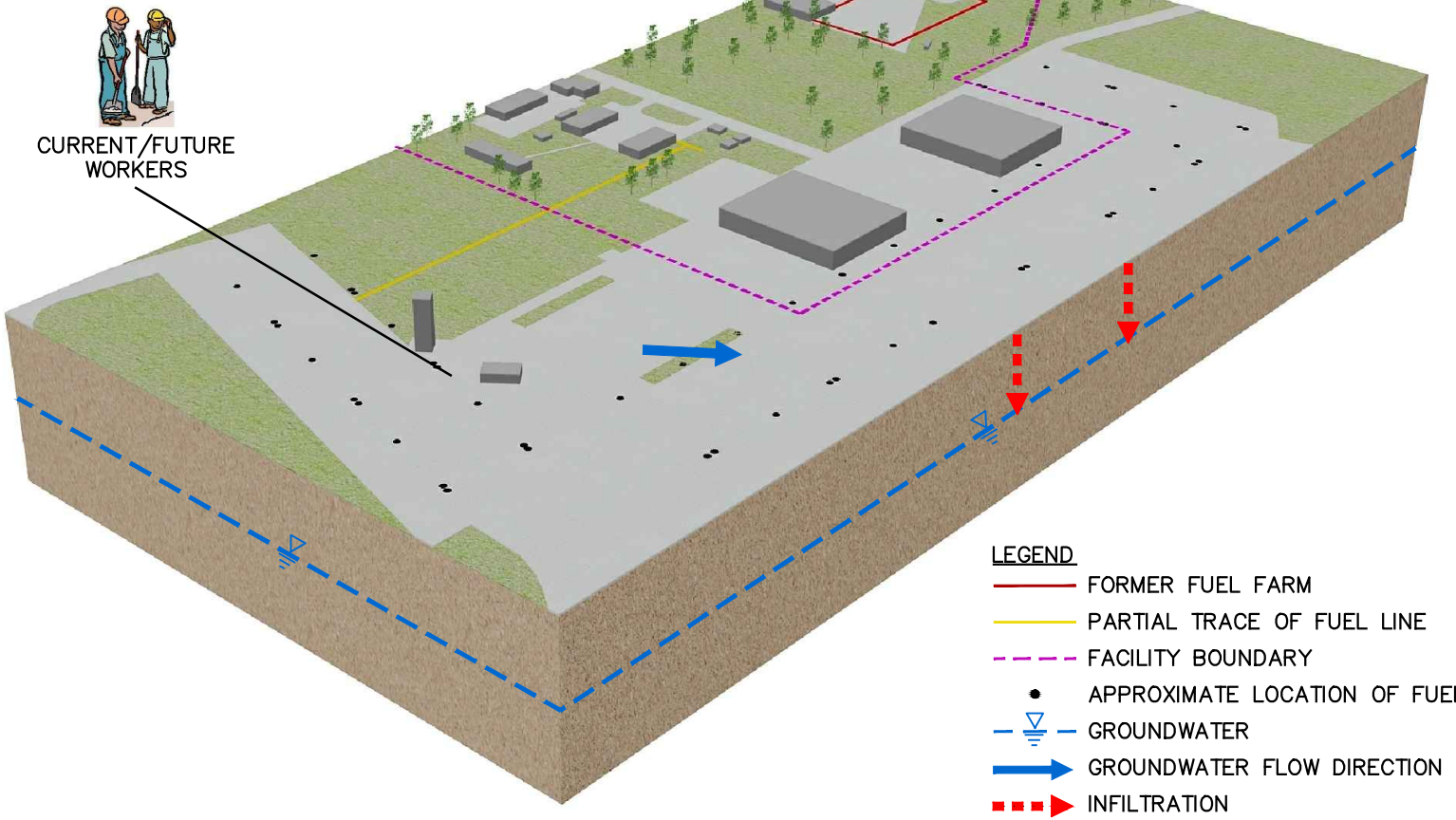
Human Receptors

Potential human receptors include maintenance and construction crews, and contractor personnel. The potential human routes of exposure are ingestion and direct contact.

The installation is typically not manned on weekends or at night. Trespassers are not considered a receptor due to the fencing and security gate. Exposure of facility personnel (i.e., Navy personnel manning the aircraft tower and fire station) to groundwater is not anticipated as there are no water wells present.

Human Health Risk Assessment

Groundwater samples were collected from 3 groundwater monitoring wells installed during the PSI. Because the groundwater at NALF Cabaniss is not used or accessible, the current potential point of contact for human exposure groundwater pathway is incomplete. However the future potential point of contact for human exposure for the groundwater pathway may be complete if water wells are installed or if digging, trenching, or construction activities encounter the groundwater bearing unit.



LEGEND

- FORMER FUEL FARM
- PARTIAL TRACE OF FUEL LINE
- FACILITY BOUNDARY
- APPROXIMATE LOCATION OF FUEL VAULTS
- GROUNDWATER
- GROUNDWATER FLOW DIRECTION
- INFILTRATION

NOTE: INFILTRATION MAY HAVE CARRIED CONTAMINATION INTO THE SOIL AND GROUNDWATER.

DRAWN BY CK	DATE 9/2/11	CONCEPTUAL SITE MODEL AQUADRIVE FUEL SYSTEM NALF CABANISS, TEXAS	CONTRACT NO. 3604
CHECKED BY	DATE		OWNER NO.
REVISED BY	DATE		APPROVED BY DATE
SCALE NOT TO SCALE			DRAWING NO. FIGURE 5-1 / REV. 0

NAVFAC

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6.0 REFERENCES

Navy, 2006. Naval Air Station Corpus Christi, Integrated Natural Resources Management Plan 2006, Five Year Update.

Navy, 2008. Cabaniss Site Investigation Report, Naval Air Station Corpus Christi, October 2008.

TCEQ, 2010. RG-411, Investigating and Reporting Releases from Petroleum Storage Tanks (PSTs). April 2010.

Tetra Tech NUS, Inc., 2011. Tier II Sampling and Analysis Plan, Preliminary Subsurface Investigation, Aquadrive Fuel System, Naval Auxiliary Landing Field Cabaniss, Texas. October.

APPENDIX A

FIELD LOGS

BORING LOGS AND STATE OF TEXAS WELL REPORTS

Tetra Tech NUS, Inc.
Houston, Texas

BOREHOLE No.: SB01/MW01

NORTHING: **17146792.65**

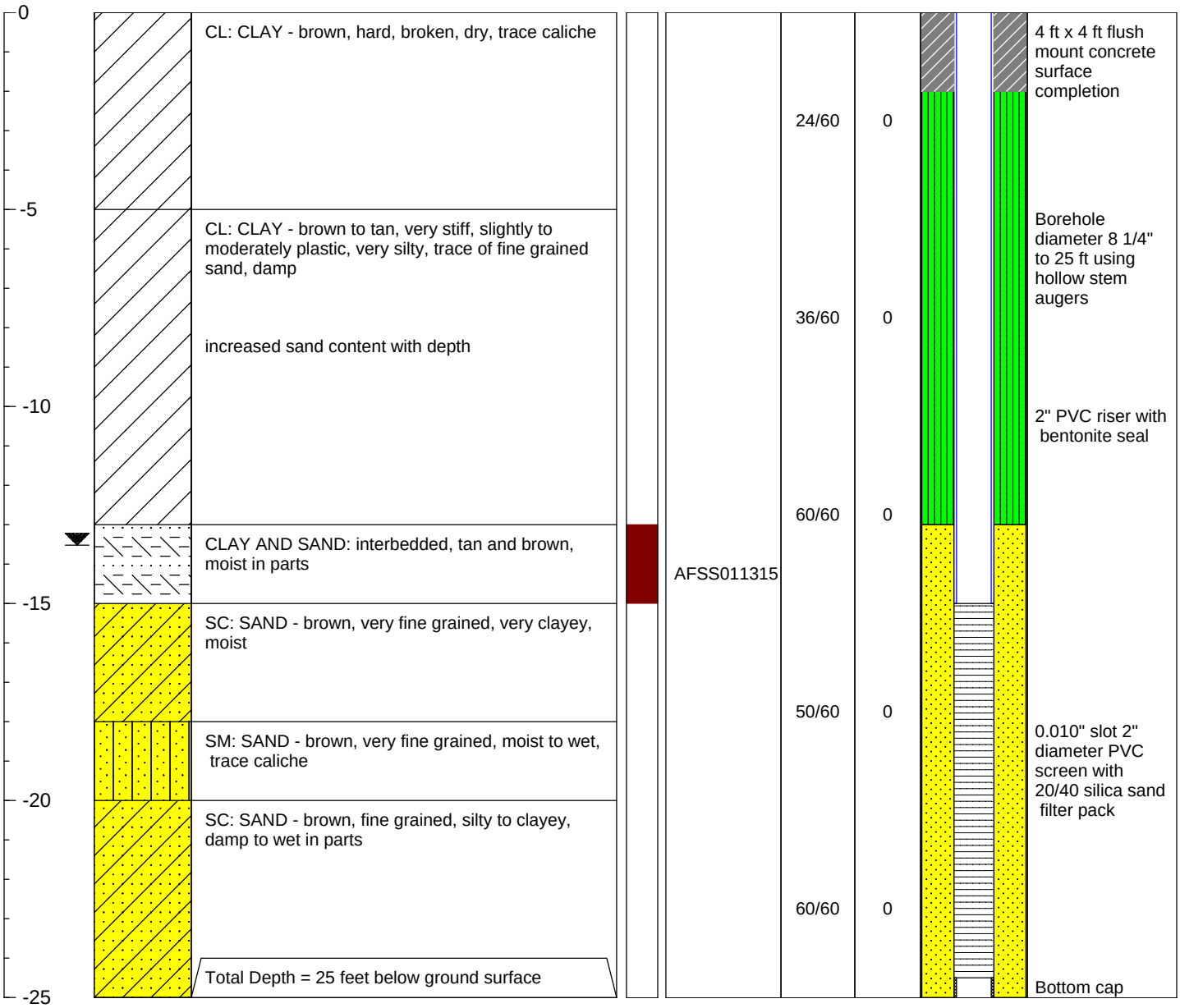
EASTING: **1328164.69** GROUND ELEVATION: **29.28 MSL**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe/HollowStem Auger**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATE DRILLED:	**11/01/11**	TOTAL DEPTH:	**25 feet BGS**

NOTES: Monitor well installed in natural ground

▽ Initial Water Level ▼ Static Water Level

Static water level measured 11/4/11 at 1509 hrs



Tetra Tech NUS, Inc.
Houston, Texas

BOREHOLE No.: SB02/MW02

NORTHING: **17145971.21**

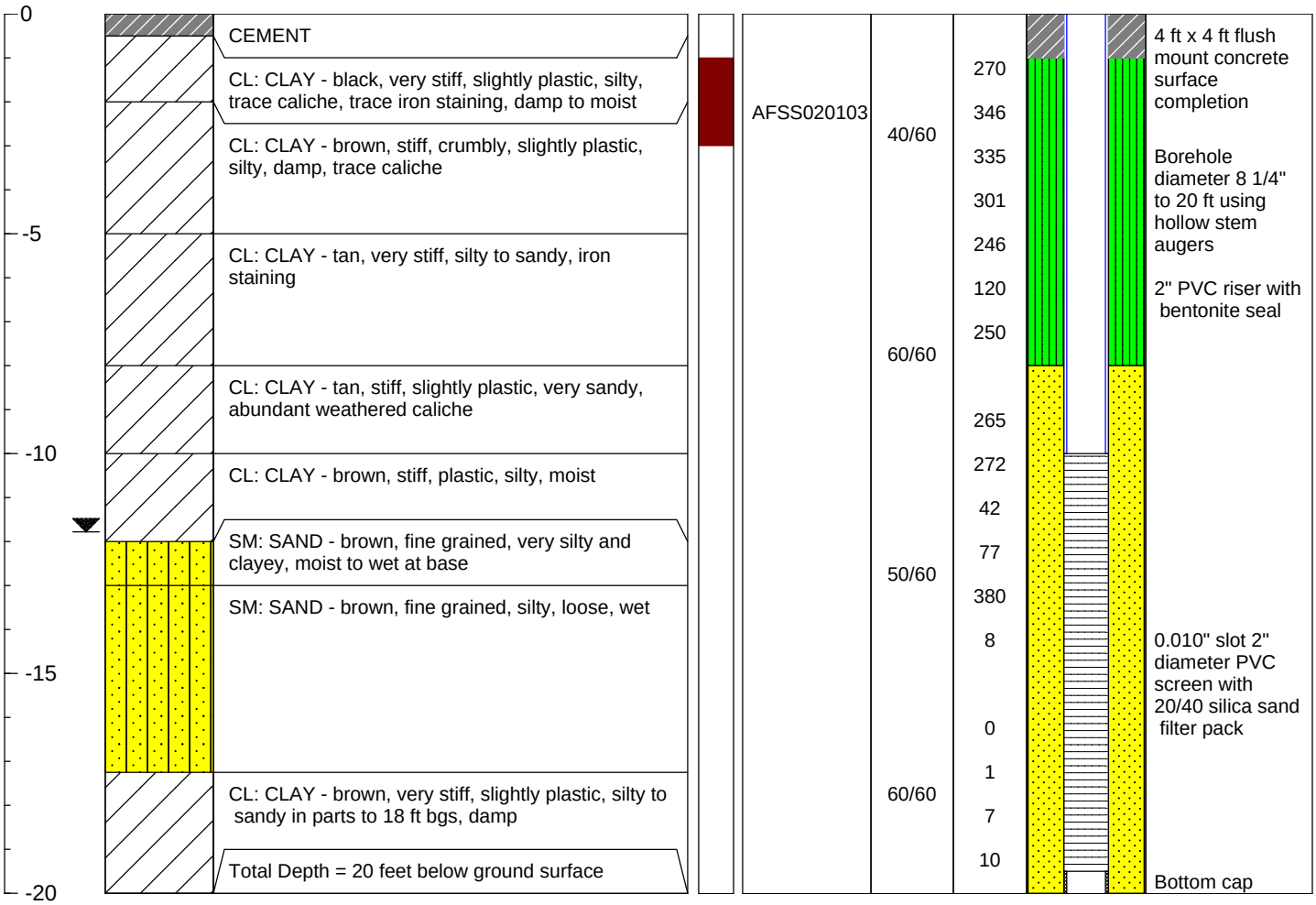
EASTING: **1328076.56** GROUND ELEVATION: **25.83 MSL**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe/HollowStem Auger**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATE DRILLED:	**11/02/11**	TOTAL DEPTH:	**20 feet BGS**

NOTES: Monitor well installed in concrete tarmac.
Oil staining visible on ground surface.

▽ Initial Water Level ▼ Static Water Level

Static water level measured 11/4/11 at 0940 hrs



Tetra Tech NUS, Inc.
Houston, Texas

BOREHOLE No.: SB03/MW03

NORTHING: **17145719.47**

EASTING: **1328537.57** GROUND ELEVATION: **25.00 MSL**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe/HollowStem Auger**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATE DRILLED:	**11/02/11**	TOTAL DEPTH:	**25 feet BGS**

NOTES: Monitor well installed in concrete tarmac.
Oil staining visible on ground surface.

▽ Initial Water Level ▼ Static Water Level

Static water level measured 11/4/11 at 0930 hrs

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)	WELL DETAIL	WELL DESCRIPTION
0		CEMENT					4 ft x 4 ft flush mount concrete surface completion
		CL: CLAY - black, grades to brown, very stiff, slightly plastic, damp		60/60	8 8		
		CL: CLAY - tan and brown, very stiff, silty to sandy, caliche			34 8		
-5		CL: CLAY - brown, very stiff, slightly plastic, silty, damp to mosit abundant weathered caliche from 5 to 8 ft bgs increased silt and sand content with depth	AFSS030507	60/60	0 283 99 37		Borehole diameter 8 1/4" to 20 ft using hollow stem augers
-10		CL: CLAY - brown, very stiff, slightly plastic, silty, damp			40 12 9		2" PVC riser with bentonite seal
		SC: SAND - tan and brown, fine grained, clayey to very clayey in parts, moist to wet		60/60	0		
-15		SM: SAND - dark brown to brown, fine grained, silty, clayey in parts, moist to wet		60/60	0 0 0		0.010" slot 2" diameter PVC screen with 20/40 silica sand filter pack
-20		SM: SAND - brown, fine to medium grained towards base, clayey in parts, wet		60/60	0 0 0		
-25		Total Depth = 25 feet below ground surface			0		Bottom cap

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB04

NORTHING: **17146792.65**
EASTING: **1328164.69** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/01/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in natural ground.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CL: CLAY - dark brown, hard, dry, trace caliche		48/60	0
-5		CL: CLAY - brown and tan, slightly plastic, silty, damp		48/60	0
		CL: CLAY - tan, moderately plastic, silty, damp	AFSS040810		0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB05

NORTHING: **17146930.05**
EASTING: **1328311.52** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/01/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in natural ground.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CL: CLAY - black, hard, dry, trace caliche		36/60	0
-5		CL: CLAY - brown, very stiff, slightly plastic, silty, damp, trace caliche			0
		more plastic and weathered caliche present at depth	AFSS050810	60/60	0
-10		Total Depth = 10 feet below ground surface			0

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB06

NORTHING: **17146717.94**
EASTING: **1328100.24** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/01/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in natural ground.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CL: CLAY - black, hard, dry		30/60	0
-5		CL: CLAY - tan, very stiff, slightly to moderately plastic, silty to sandy, damp	AFSS060810	40/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB07

NORTHING: **17145733.25**
EASTING: **1328545.65** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/01/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - black, very stiff, moderately plastic, silty, damp		54/60	0
-5		CL: CLAY - brown, very stiff, slightly plastic, damp, trace caliche			0
		CL: CLAY - brown to tan, very stiff to hard, slightly plastic, silty, damp, trace to abundant caliche	AFSS070810	60/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB08

NORTHING: **17145524.72**
EASTING: **1328925.87** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/02/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - black, very stiff, slightly plastic, moist			
		SM: SAND - black, fine grained, very silty, moist		48/60	0
		CL: CLAY - dark brown to light brown with depth, very stiff, softer with depth, slightly plastic			0
-5					0
		CL: CLAY - tan, stiff, moderately plastic, silty, damp to moist, caliche	AFSS080810	55/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB09

NORTHING: **17145372.75**
EASTING: **1329246.14** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/02/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - gray black, stiff, moderately plastic, silty to sandy in parts, damp		36/60	0
-5		CL: CLAY - gray, very stiff, crumbly, silty, damp, caliche			0
		CL: CLAY - tan, very stiff, slightly plastic, silty to sandy in parts, damp	AFSS090810	60/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB10

NORTHING: **17145769.76**
EASTING: **1329463.14** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/02/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - gray black, very stiff, moderately to very plastic, sandy in parts, moist		44/60	0
-5		CL: CLAY - gray black to brown, more tan with depth, very stiff, slightly plastic, moist		60/60	0
		CL: CLAY - tan, very stiff, moderately plastic, silty to sandy, damp, trace caliche	AFSS100810		0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB11

NORTHING: **17145986.51**
EASTING: **1328080.63** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/02/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - black, very stiff, moderately plastic, silty		54/60	0
		CL: CLAY - tan and black, stiff, plastic, silty, trace caliche			0
-5		CL: CLAY - tan, very stiff, slightly plastic, crumbly in parts, silty, trace sandy, trace caliche		60/60	0
			AFSS110810		0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB12

NORTHING: **17145907.45**
EASTING: **1328225.23** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/02/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - black at top grading to brown, stiff to very stiff, moderately plastic, silty to sandy, moist to damp with depth		54/60	0 0
-5		CL: CLAY - brown, very stiff, slightly plastic, silty, scattered caliche, damp	AFSS120810	60/60	0 0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB13

NORTHING: **17146051.38**
EASTING: **1327962.46** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/02/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - black, very stiff, moderately plastic, silty			
		CL: CLAY - brown, stiff, plastic, silty, slightly sandy, moist		50/60	0
-5		CL: CLAY - brown, very stiff, slightly plastic, silty to sandy in parts			0
		increased sand and moisture content with depth		60/60	0
			AFSS130810		0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB14

NORTHING: **17146158.82**
EASTING: **1328203.08** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/03/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - black, very stiff, moderately plastic, silty, moist			0
		CL: CLAY - gray brown grading to tan with depth, very stiff, moderately plastic, silty, trace sand, trace caliche, damp		48/60	
-5					0
		CL: CLAY - tan, very stiff, slightly plastic, silty to slightly sandy, weathered caliche from 8 to 10 ft bgs			0
				60/60	
			AFSS140810		0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB15

NORTHING: **17146486.97**
EASTING: **1327641.00** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/03/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - gray brown, very stiff, moderately plastic, damp		54/60	0
					0
-5		CL: CLAY - tan brown, very stiff, slightly plastic, silty to sandy in parts, caliche from 8 to 10 ft bgs			0
			AFSS150810	60/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB16

NORTHING: **17146594.01**
EASTING: **1327746.45** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/03/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - gray black grading to brown tan, very stiff, moderately plastic, silty, moist, trace caliche from 4 to 5 ft bgs		54/60	0
-5		CL: CLAY - tan, very stiff, slightly to moderately plastic, silty to sandy in parts, damp, trace caliche			0
			AFSS160810	60/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB17

NORTHING: **17146690.46**
EASTING: **1327841.75** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/03/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - gray black grading to tan, very stiff, plastic, silty, moist, trace sand		54/60	0
-5		CL: CLAY - tan, very stiff, slightly to moderately plastic, silty, trace sandy, damp, trace caliche			0
			AFSS170810	60/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB18

NORTHING: **17146806.78**
EASTING: **1327956.61** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/03/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - tan gray, very stiff, moderately plastic, silty, damp, trace caliche		54/60	0
-5		CL: CLAY - tan, very stiff, moderately plastic, silty, damp, trace caliche			0
				60/60	0
-10		Total Depth = 10 feet below ground surface	AFSS180810		0

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB19

NORTHING: **17146913.93**
EASTING: **1328061.39** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/03/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - gray black, tan with depth, very stiff, moderately plastic		54/60	0
					0
-5		CL: CLAY - brown, very stiff, slightly plastic, silty to sandy, damp, trace caliche			0
			AFSS190810	60/60	0
-10		Total Depth = 10 feet below ground surface			

Tetra Tech, Inc.
Houston, Texas

BOREHOLE No.: SB20

NORTHING: **17147022.61**
EASTING: **1328168.17** ELEVATION/DATUM: **NA**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	**Aquadrive Fuel System**	DRILLING CO.:	**Gainco, Inc.**
SITE LOCATION:	**NALF Cabaniss**	DRILLER:	**Stas Grover**
JOB NO.:	**112G03604**	RIG TYPE:	**Geoprobe 7720DT**
LOGGED BY:	**Larry Basilio**	METHOD OF DRILLING:	**Geoprobe**
PROJECT MANAGER:	**Larry Basilio**	SAMPLING METHODS:	**Duel Tube Sampler**
DATES DRILLED:	**11/03/11**	TOTAL DEPTH:	**10 feet BGS**

NOTES: Soil boring installed in concrete.
Soil boring plugged and abandoned.

▽ Initial Water Level ▼ Static Water Level

Water not encountered.

DEPTH (FEET)	SOIL SYMBOL	USCS: SOIL DESCRIPTION	SAMPLE NUMBER/ INTERVAL	RECOVER/ ADVANCE (inches)	PID (ppm)
0		CEMENT			
		CL: CLAY - brown gray, very stiff, moderately plastic, moist, trace caliche		54/60	0
-5		CL: CLAY - tan, very stiff, moderately plastic, silty, trace sandy, damp, trace caliche	AFSS200810	60/60	0
-10		Total Depth = 10 feet below ground surface			

STATE OF TEXAS WELL REPORT for Tracking #273509

Owner:	**Commanding Officer US Naval Air Station**	Owner Well #:	**MW01**
Address:	**11001 D St., Suite 143** **Corpus Christi , TX 78419**	Grid #:	**83-21-5**
Well Location:	**2601 Saratoga Blvd.** **Corpus Christi , TX 78413**	Latitude:	**27° 42' 20" N**
Well County:	**Nueces**	Longitude:	**097° 26' 14" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date: Started: **11/1/2011**
Completed: **11/1/2011**

Diameter of Hole: Diameter: **8.25 in From Surface To 25 ft**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: Gravel Packed From: **13 ft to 25 ft**
Gravel Pack Size: **20/40**

Annular Seal Data: 1st Interval: **From 13 ft to 2 ft with 2 bentonite (#sacks and material)**
2nd Interval: **From 2 ft to 0 ft with 1, cement (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand poured**
Cemented By: **Stanley J. Grover, Jr.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **No Data**

Plugging Info: Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality: Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information: **Gainco, Inc.**
P.O. Box 309
Portland , TX 78374

Driller License Number: **54247**

Licensed Well **Stanley J. Grover, Jr.**

Driller Signature:

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking **#273509**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0-13 ft, Clay (CL), blk to brown, v. stiff, damp to moist.
13-15 ft, Clay and sand interbedded, tan to brown, damp to moist.
15-18 ft, Sand (SC), v. fine grained, v. clayey, moist.
18-20 ft, Sand (SM), v. fine grained, trace caliche, brown, moist to wet.
20-25 ft, Sand (SC), fine grained, silty to clayey, brown, damp to wet.

CASING, BLANK PIPE & WELL SCREEN DATA

Dia. New/Used Type Setting From/To
2" New, Schd 40 PVC blank 0-15 ft bgs
2" New, Schd 40 PVC screen, 15-25 ft bgs, 0.010"

STATE OF TEXAS WELL REPORT for Tracking #273511

Owner:	**Commanding Officer US Naval Air Station**	Owner Well #:	**MW02**
Address:	**11001 D St., Suite 143** **Corpus Christi , TX 78419**	Grid #:	**83-21-5**
Well Location:	**2601 Saratoga Blvd.** **Corpus Christi , TX 78413**	Latitude:	**27° 42' 12" N**
Well County:	**Nueces**	Longitude:	**097° 26' 15" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date: Started: **11/2/2011**
Completed: **11/2/2011**

Diameter of Hole: Diameter: **8.25 in From Surface To 20 ft**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: Gravel Packed From: **8 ft to 20 ft**
Gravel Pack Size: **20/40**

Annular Seal Data: 1st Interval: **From 8 ft to 2 ft with 1 bentonite (#sacks and material)**
2nd Interval: **From 2 ft to 0 ft with 1 cement (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand poured**
Cemented By: **Stanley J. Grover, Jr.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **No Data**

Plugging Info: Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality: Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information: **Gainco, Inc.**
P.O. Box 309
Portland , TX 78374

Driller License Number: **54247**

Licensed Well **Stanley J. Grover, Jr.**

Driller Signature:

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking **#273511**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0-4", cement.
4"-13 ft, Clay (CL), blk to brown, v. stiff, damp to moist.

13-18 ft, Sand (SM), v. fine grained, trace caliche, brown, moist to wet.
18-20 ft, Clay (CL), silty to sandy, v. stiff, brown, damp.

CASING, BLANK PIPE & WELL SCREEN DATA

Dia. New/Used Type Setting From/To
2" New, Schd 40 PVC blank 0-10 ft bgs
2" New, Schd 40 PVC screen,10-20 ft bgs, 0.010"

STATE OF TEXAS WELL REPORT for Tracking #273513

Owner:	**Commanding Officer US Naval Air Station**	Owner Well #:	**MW03**
Address:	**11001 D St., Suite 143** **Corpus Christi , TX 78419**	Grid #:	**83-21-5**
Well Location:	**2601 Saratoga Blvd.** **Corpus Christi , TX 78413**	Latitude:	**27° 42' 10" N**
Well County:	**Nueces**	Longitude:	**097° 26' 10" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Monitor**

Drilling Date: Started: **11/2/2011**
Completed: **11/2/2011**

Diameter of Hole: Diameter: **8.25 in From Surface To 25 ft**

Drilling Method: **Hollow Stem Auger**

Borehole Completion: Gravel Packed From: **13 ft to 25 ft**
Gravel Pack Size: **20/40**

Annular Seal Data: 1st Interval: **From 13 ft to 2 ft with 2 bentonite (#sacks and material)**
2nd Interval: **From 2 ft to 0 ft with 1 cement (#sacks and material)**
3rd Interval: **No Data**
Method Used: **Hand poured**
Cemented By: **Stanley J. Grover, Jr.**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **Surface Sleeve Installed**

Water Level: Static level: **No Data**
Artesian flow: **No Data**

Packers: **No Data**

Plugging Info: Casing or Cement/Bentonite left in well: **No Data**

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality: Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information: **Gainco, Inc.**
P.O. Box 309
Portland , TX 78374

Driller License Number: **54247**

Licensed Well **Stanley J. Grover, Jr.**

Driller Signature:

Registered Driller Apprentice Signature: **No Data**

Apprentice Registration Number: **No Data**

Comments: **No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

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Please include the report's Tracking number (Tracking **#273513**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL

From (ft) To (ft) Description
0-4", cement.
4"-12.5 ft, Clay (CL), black to brown, v. stiff, damp to moist.
12.5-14 ft, Sand (SC), fine grained, silty, clayey, moist to wet.
14-25 ft, Sand (SM), fine to med grained, clayey, dk brown to brown, moist to wet.

CASING, BLANK PIPE & WELL SCREEN DATA

Dia. New/Used Type Setting From/To
2" New, Schd 40 PVC blank 0-15 ft bgs
2" New, Schd 40 PVC screen,15-25 ft bgs, 0.010"

STATE OF TEXAS WELL REPORT for Tracking #273515

Owner:	**Commanding Officer US Naval Air Station**	Owner Well #:	**sb04 thru sb20**
Address:	**11001 D St., Suite 143** **Corpus Christi , TX 78419**	Grid #:	**83-21-5**
Well Location:	**2601 Saratoga Blvd.** **Corpus Christi , TX 78413**	Latitude:	**27° 42' 20" N**
Well County:	**Nueces**	Longitude:	**097° 26' 14" W**
Elevation:	**No Data**	GPS Brand Used:	**No Data**
Type of Work:	**New Well**	Proposed Use:	**Environmental Soil Boring**

Drilling Date: Started: **11/1/2011**
Completed: **11/3/2011**

Diameter of Hole: Diameter: **2.5 in From Surface To 10 ft**

Drilling Method: **Driven**

Borehole Completion: Other: **plugged**

Annular Seal Data:
1st Interval: **No Data**
2nd Interval: **From (No Data) ft to 0 ft with (No Data) (#sacks and material)**
3rd Interval: **No Data**
Method Used: **No Data**
Cemented By: **No Data**
Distance to Septic Field or other Concentrated Contamination: **No Data**
Distance to Property Line: **No Data**
Method of Verification: **No Data**
Approved by Variance: **No Data**

Surface Completion: **No Data**

Water Level:
Static level: **No Data**
Artesian flow: **No Data**

Packers: **No Data**

Plugging Info:
The well **was** plugged within 48 hours.
Casing left in well: Cement/Bentonite left in well:
From (ft) To (ft) From (ft) To (ft) Cem/Bent Sacks Used
Soil borings were plugged from 0-10 ft bgs with bentonite, 2 sacks.

Type Of Pump: **No Data**

Well Tests: **No Data**

Water Quality:
Type of Water: **No Data**
Depth of Strata: **No Data**
Chemical Analysis Made: **No Data**
Did the driller knowingly penetrate any strata which contained undesirable constituents: **No Data**

Certification Data: The driller certified that the driller drilled this well (or the well was drilled under the driller's direct supervision) and that each and all of the statements herein are true and correct. The driller understood that failure to complete the required items will result in the log(s) being returned for completion and resubmittal.

Company Information:
Gainco, Inc.
P.O. Box 309
Portland , TX 78374

Driller License Number:	**54247**
Licensed Well Driller Signature:	**Stanley J. Grover, Jr.**
Registered Driller Apprentice Signature:	**No Data**
Apprentice Registration Number:	**No Data**
Comments:	**No Data**

IMPORTANT NOTICE FOR PERSONS HAVING WELLS DRILLED CONCERNING CONFIDENTIALITY

TEX. OCC. CODE Title 12, Chapter 1901.251, authorizes the owner (owner or the person for whom the well was drilled) to keep information in Well Reports confidential. The Department shall hold the contents of the well log confidential and not a matter of public record if it receives, by certified mail, a written request to do so from the owner.

Please include the report's Tracking number (Tracking **#273515**) on your written request.

Texas Department of Licensing & Regulation
P.O. Box 12157
Austin, TX 78711
(512) 463-7880

DESC. & COLOR OF FORMATION MATERIAL	CASING, BLANK PIPE & WELL SCREEN DATA
From (ft) To (ft) Description **0-10 ft, Clay (CL), brown to tan to gray, silty to sandy in parts, damp to moist.**	**No Data**

MONITORING WELL DEVELOPMENT SHEETS

2:37 2:39 45 2:43 2:45 50

1 vol = 1.788
5 vol = 8.94

Tetra Tech NUS, Inc.
Houston, Texas

MONITORING WELL DEVELOPMENT RECORD

Page 1 of ____

Well: MW01
Site: Aqua Field-NALF Cabaniss
Date Installed: 11-1-11
Date Developed: 11-2-11
Dev. Method: Pumping
Pump Type: ____

Depth to Bottom (ft.): 25.10
Static Water Level Before (ft.): 14.13
Static Water Level After (ft.): 19.95
Screen Length (ft.): 10'
Specific Capacity: ____
Casing ID (in.): 2" PVC

Responsible Personnel: Bridget Twigg
Drilling Co.: Gainco
Project Name: Aqua Field-NALF Cabaniss
Project Number: 112G03604

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks
1428	—	5	17.00	27.13	6.88	1.65	0.0	Flow Rate: 5gal / 2min 45sec (165sec)
1438	—	5	18.00	26.88	6.89	1.97	800.00	
1443	—	5	18.39	26.93	6.77	2.02	143	5gal / 2min 50sec (170sec)
1450	—	5	19.10	26.90	6.80	2.10	124	5gal / 2min 50sec (170sec)
1454	—	5	19.25	26.89	6.81	2.05	47.4	5gal / 2min 49sec (169sec)
1457	—	5	19.60	26.86	6.83	2.08	38.2	5gal / 170sec
1502	—	5	19.95	26.84	6.84	2.10	35.4	5gal / 170sec

0845
0851 5 Dec

7.53

Tetra Tech NUS, Inc.
Houston, Texas

MONITORING WELL DEVELOPMENT RECORD

Well: MW02
Site: Aqua Field
Date Installed: 11·2·11
Date Developed: 11·3·11
Dev. Method: pumping
Pump Type: _____

Depth to Bottom (ft.): 21.08
Static Water Level Before (ft.): 11.84
Static Water Level After (ft.): 14.01
Screen Length (ft.): 10'
Specific Capacity: _____
Casing ID (in.): 2" PVC

Responsible Personnel: Bridget Twigg
Drilling Co.: Gainco
Project Name: AgueField NALF Cabaniss
Project Number: 112G03604

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks
0819	—	5	12.92	26.41	6.82	2.80	0.0	5gal / 170 sec
0829	—	5	13.04	27.37	6.84	2.92	199	
0835	—	5	13.05	27.70	6.84	2.95	102	
0841	—	5	13.10	27.79	6.86	2.96	43.3	
0846	—	5	13.31	27.85	6.87	2.94	32.1	
0856	—	5	13.98	27.79	6.86	2.97	30.4	
0903	—	5	14.01	27.74	6.86	2.97	29.7	

Tetra Tech NUS, Inc.
Houston, Texas

MONITORING WELL DEVELOPMENT RECORD

Page ___ of ___

Well: MW03
Site: Aqua Field
Date Installed: 11-7-11
Date Developed: 11-3-11
Dev. Method: pumping
Pump Type: ___

Depth to Bottom (ft.): 25.10
Static Water Level Before (ft.): 13.30
Static Water Level After (ft.): 16.10
Screen Length (ft.): 10'
Specific Capacity: ___
Casing ID (in.): 2"

Responsible Personnel: Bridget Twigg
Drilling Co.: Gainco
Project Name: Aqua Field NALF Cabaniss
Project Number: 112G03604

Time	Estimated Sediment Thickness (Ft.)	Cumulative Water Volume (Gal.)	Water Level Readings (Ft. below TOC)	Temperature (Degrees C)	pH	Specific Conductance (Units mS/cm)	Turbidity (NTU)	Remarks
0950	–	5	13.45	26.14	7.25	2.08	0.0	5gal / 170 sec
1011	–	5	16.05	27.36	7.32	2.05	0.0	*had to change
1014	–	5	16.06	27.69	7.31	2.08	258	water level meter
1017	–	5	16.05	27.70	7.28	2.10	88.2	
1020	–	5	16.07	27.81	7.29	2.11	47.7	
1025	–	5	16.10	27.85	7.29	2.10	30.1	

LOW FLOW PURGE SHEETS AND GROUNDWATER SAMPLE LOGS

Tetra Tech NUS, Inc.
Houston, Texas

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NALF Cabaniss
Project No.: 112G03604

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: AF-GW01
Sample Location: SB01
Sampled By: BT
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 11-4-11	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP	TBD
Time: 1509								
Method: Low flow	clear	7.00	1.46	26.77	0.06	0.00	191	

PURGE DATA:

Date: 11-4-11	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	TBD	TBD
Method: Low flow								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 25.10								
Static Water Level (WL): 13.52								
One Casing Volume(gal/L): 1.89								
Start Purge (hrs): 1349								
End Purge (hrs):								
Total Purge Time (min):								
Total Vol. Purged (gal/L): 3.80								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX	HCL, <6 C	3 x 40 ml vials	-
PAHs	< 6 C	2 x 1 liter amber	-
Lead	HNO3, < 6 C	1 x 500 ml plastic	-
TDS	< 6 C	1 x 250 ml plastic	-

OBSERVATIONS / NOTES:

25.10
- 13.52
11.58
x0.163
1.887
x2.000
3.774

Circle if Applicable:

MS/MSD	Duplicate ID No.:
✓ ✓	FD-110411

Signature(s):

TBD: To Be Determined

Tetra Tech NUS, Inc
Houston, Texas

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NALF Cabaniss
PROJECT NUMBER: 112G03604
WELL ID.: AF-GW01
DATE: 11-4-11

			+/- 0.1	<9%	<10	10%	10%			
Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
1349	13.61	145	6.47	2.02	7.44	4.97	28.49	165	—	
1354	13.61	130	7.00	1.76	7.98	0.00	26.31	300	—	
1359	13.61	125	6.99	1.72	6.53	0.00	26.45	300	—	
1404	13.62	125	6.99	1.63	5.17	0.00	26.53	298	—	
1409	13.62	125	6.99	1.51	4.56	0.00	26.62	287	—	
1414	13.63	125	6.98	1.44	2.82	0.00	26.68	263	—	
1419	13.64	125	6.98	1.39	1.72	0.00	26.73	234	—	
1424	13.64	130	6.98	1.38	1.20	0.00	26.73	218	—	
1429	13.64	125	6.98	1.37	1.12	0.00	26.75	218	—	
1434	13.64	125	6.98	1.37	0.78	0.00	26.76	209	—	
1439	13.64	125	6.98	1.37	0.69	0.00	26.78	206	—	
1444	13.64	125	6.98	1.38	0.40	0.00	26.76	201	—	
1449	13.64	125	6.98	1.40	0.39	0.00	26.75	196	—	
1454	13.64	125	6.98	1.41	0.31	0.00	26.76	194	—	
1459	13.65	125	6.99	1.42	0.16	0.00	26.77	193	—	
1504	13.65	125	6.99	1.44	0.13	0.00	26.76	192	—	
1509	13.65									Sample

SIGNATURE(S):

Tetra Tech NUS, Inc.
Houston, Texas

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NALF Cabaniss
Project No.:

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: AF-GW02
Sample Location: SB02
Sampled By: LB
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 11-4-11	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP	TBD
Time: 1105								
Method: Low Flow	Clear	6.47	2.02	28.49	2	4.97	165	

PURGE DATA:

Date: 11-4-11	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	TBD	TBD
Method: Low Flow								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 21.08								
Static Water Level (WL): 11.78								
One Casing Volume(gal/L): 1.65								
Start Purge (hrs): 940								
End Purge (hrs): 1105								
Total Purge Time (min): 85								
Total Vol. Purged (gal/L): 4.5 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX	HCL, <6 C	3 x 40 ml vials	
PAHs	< 6 C	2 x 1 liter amber	
Lead	HNO3, < 6 C	1 x 500 ml plastic	
TDS	< 6 C	1 x 250 ml plastic	

OBSERVATIONS / NOTES:

21.08
- 11.78

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

TBD: To Be Determined

Tetra Tech NUS, Inc
Houston, Texas

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NALF Cabaniss
PROJECT NUMBER: 112G03604
WELL ID.: MW-2
DATE: 11/4/11

	±0.1	5%	<10	10%	10%				
Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
940 ~~940~~	11.78									TD - 21.08
945	11.90	300	6.66	3.16	116	7.54	27.58	270		1 V = 1.6 gal
955	11.88	200	6.70	3.12	~~64~~	6.35	27.73	271		
1003	11.88	180	6.70	2.95	19	6.74	27.86	267		
1013	11.88	150	6.58	2.63	9	6.49	27.93	221		
1022	11.86	150	6.51	2.39	5	6.27	27.93	181		
1035	11.89	130	6.45	2.06	3	5.81	28.04	166		
1042	11.90	200	6.45	2.04	2	5.59	28.38	163		Battery died, switch batteries
1049	11.88	150	6.44	2.00	2	5.34	28.49	161		
1055	11.88	150	6.45	2.01	2	5.25	28.41	164		
1100	11.88	150	6.46	2.01	2	5.14	28.49	163		
1105	11.88	150	6.47	2.02	2	4.97	28.49	165		Stop Purge collect samples

SIGNATURE(S): _____

PAGE___OF___

Tetra Tech NUS, Inc.
Houston, Texas

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: NALF Cabaniss
Project No.: 112G03604

[] Domestic Well Data
[X] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: AF-GW03
Sample Location: SB03
Sampled By: BT
C.O.C. No.:
Type of Sample:
[X] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 11-4-11	Color Visual	pH Standard	S.C. mS/cm	Temp. °C	Turbidity NTU	DO mg/l	ORP	TBD
Time: 1035								
Method: Low Flow	clear	7.34	2.12	26.17	4.86	0.00	-229	

PURGE DATA:

Date: 11-4-11	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	TBD	TBD
Method: Low Flow								
Monitor Reading (ppm): 0.0								
Well Casing Diameter & Material Type: 2" PVC								
Total Well Depth (TD): 25.01								
Static Water Level (WL): 12.65								
One Casing Volume(gal/L): 2.01								
Start Purge (hrs): 0930								
End Purge (hrs): 1035								
Total Purge Time (min): 65								
Total Vol. Purged (gal/L): 4.02								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
BTEX	HCL, <6 C	3 x 40 ml vials	✓
PAHs	< 6 C	2 x 1 liter amber	✓
Lead	HNO3, < 6 C	1 x 500 ml plastic	✓
TDS	< 6 C	1 x 250 ml plastic	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

TBD: To Be Determined

Tetra Tech NUS, Inc
Houston, Texas

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: NALF Cabaniss
PROJECT NUMBER: 112G03604
WELL ID.: AF-GW03
DATE: 11-4-11

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	pH (S.U.)	S. Cond. (mS/cm)	Turb. (NTU)	DO (mg/L)	Temp. (Celcius)	ORP mV	Salinity % or ppt	Comments
			+/- 0.1	5%	<10	10%	10%			
0930	12.68	150	7.48	2.17	~~29.0~~ 15.0	1.47	24.12	113	—	
0935		140	7.44	2.15	12.4	0.62	25.29	45	—	
0940		140	7.41	2.15	11.41	0.26	25.62	-27		
0945	12.70	140	7.37	2.16	8.82	0.03	25.94	-88	—	
0950		140	7.37	2.17	7.62	0.00	25.96	-99	—	
0955	~~12.70~~	140	7.37	2.17	8.01	0.00	26.03	-116	—	
1000	12.70	140	7.37	2.18	6.59	0.00	26.04	-125	—	
1005	12.71	140	7.36	2.16	6.02	0.00	26.06	-162	—	
1010		140	7.36	2.14	5.09	0.00	26.08	-173	—	
1015	12.71	140	7.36	2.13	5.03	0.00	26.10	-182	—	
1020		140	7.36	2.13	5.09	0.00	26.09	-206	—	
1025	12.71	140	7.35	2.13	4.72	0.00	26.12	-213	—	~~Sample~~ MS
1030		140	7.35	2.12	4.93	0.00	26.15	-219	—	
1035	12.72								—	Sample
1040										~~Sample~~ MS
1045										

SIGNATURE(S):

APPENDIX B

HISTORICAL DRAWINGS

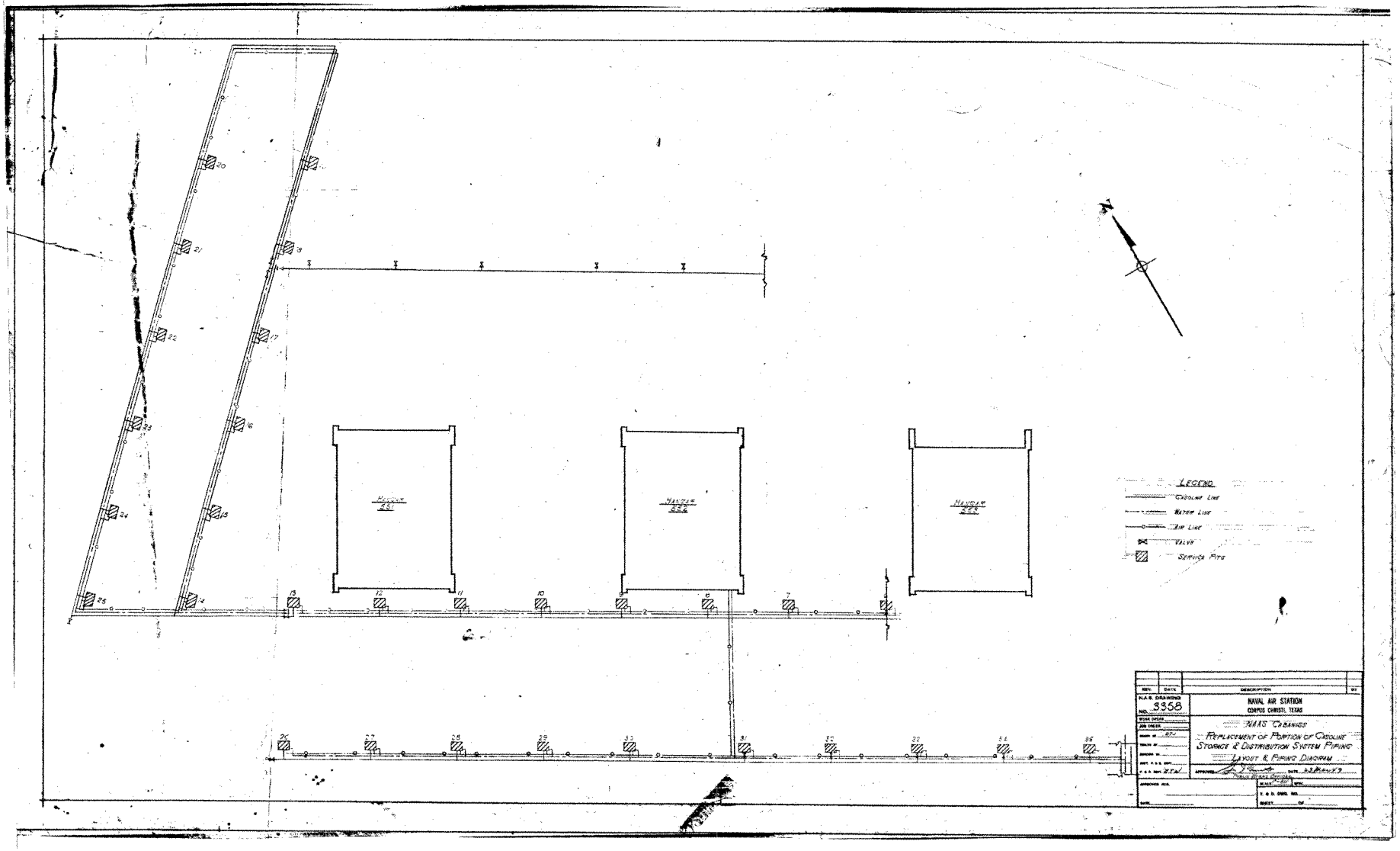
ARCHIVED DRAWINGS

SECTION: **ARCHIVED DRAWINGS**

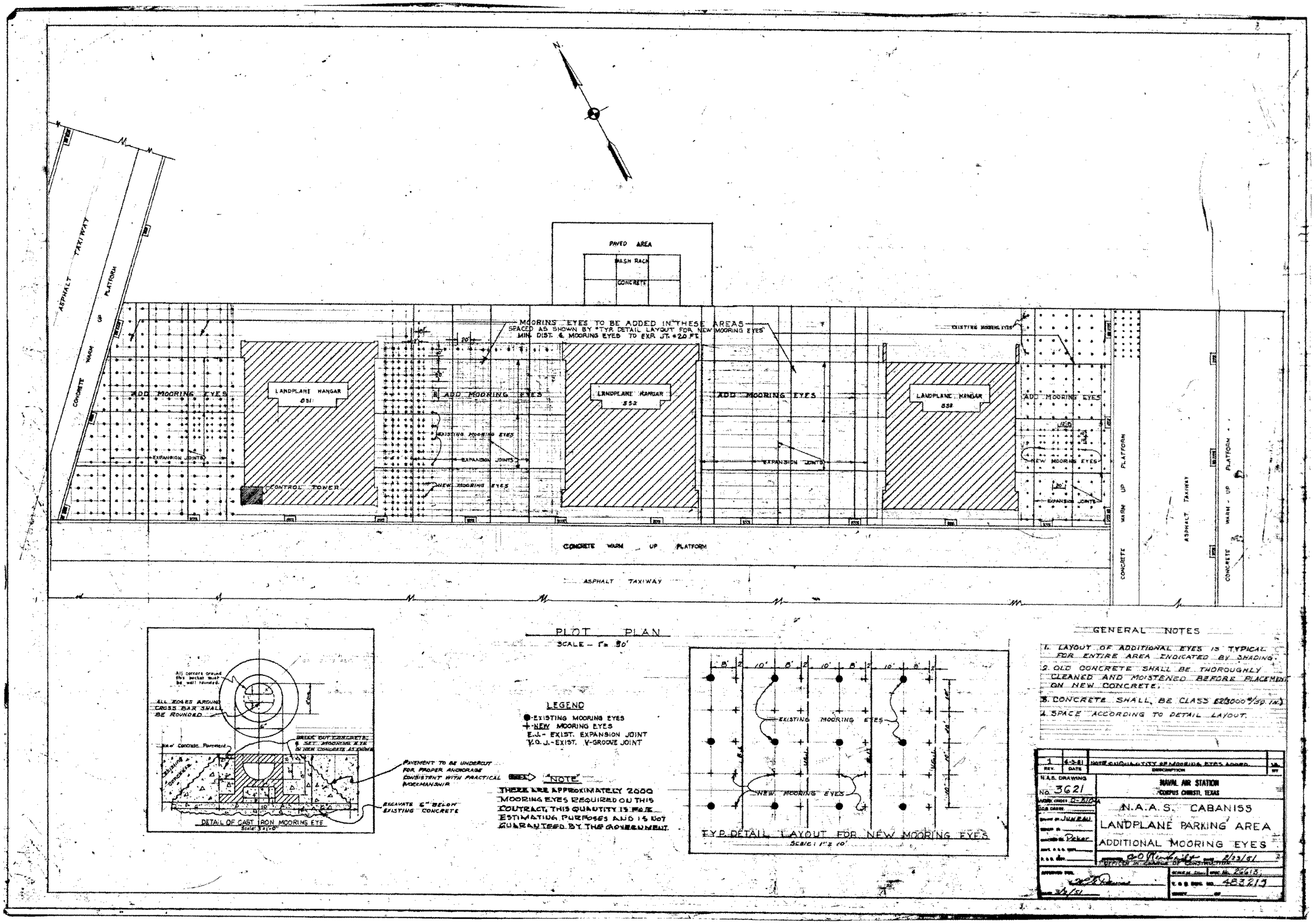
	Drawing Title	Significance
1	Replacement of Portion…	Detailed layout of portion of fuel system at. (Cabaniss)
2	Landplane Parking…	Layout of portion of service pits (Vaults). (Cabaniss)
3	Proposed Layout…	Location and identification of 300K Gal gasoline storage tanks. Shows a total of 12 tanks. (Cabaniss)
4	Patching & Sealing…	Location of gasoline storage tanks, fencing, additional building, facility number "576". (Cabaniss)
5	Site Plan…	Displays a total of 20 tanks. (Cabaniss)
6	Landplane Runways…	Describes Concrete Warming-up platforms. (Cabaniss)
7	Plan or runways…	Provides pavement composition. (Cabaniss)
8	Extensions to…	Provides detailed information on similar fuel system at NALF Waldron.

Drawing

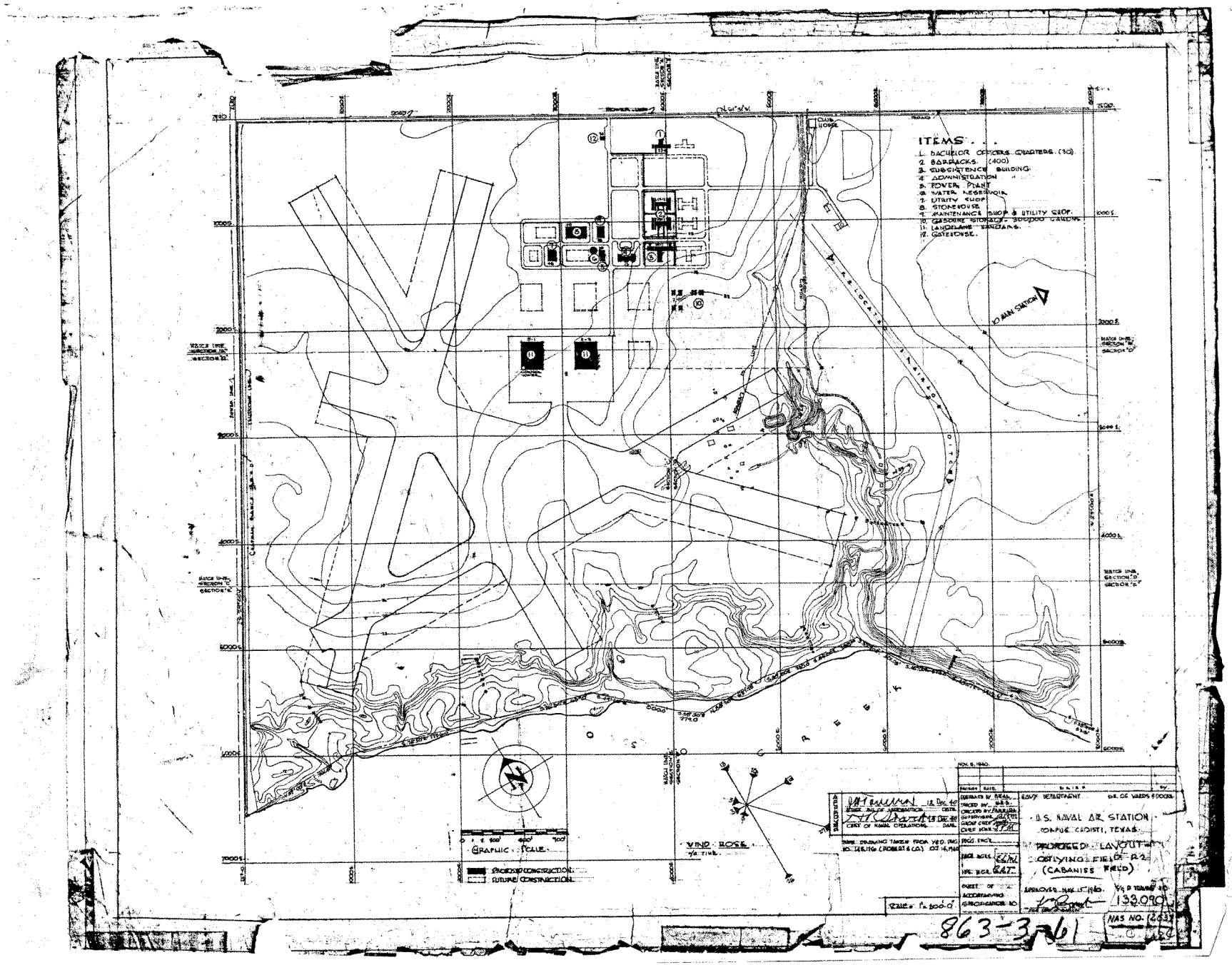
1

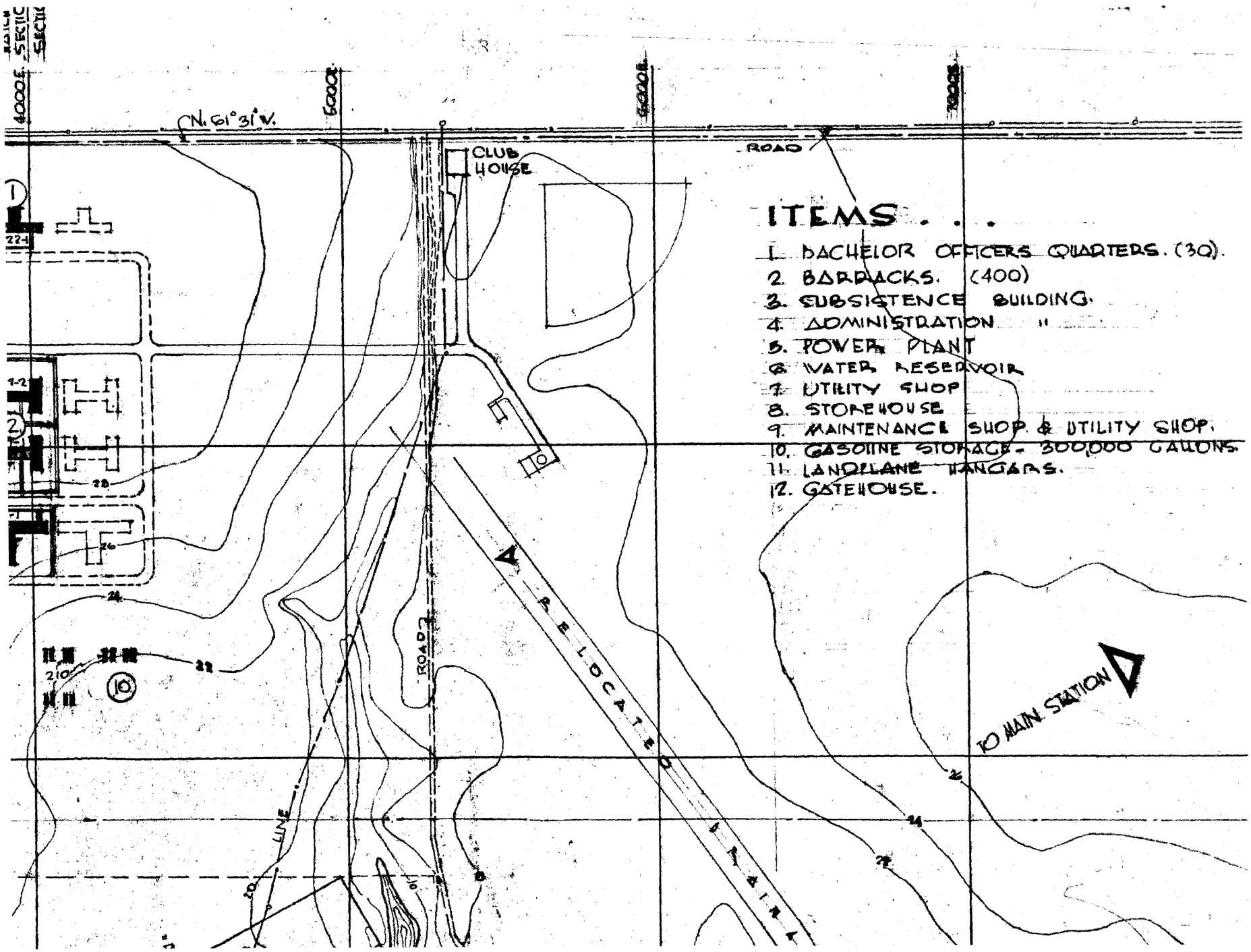

N
LEGEND
GASOLINE LINE
WATER LINE
AIR LINE
VALVE
SERVICE PITS
NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
NAS DRAWING
3358
REPLACEMENT OF PORTION OF GASOLINE
STORAGE & DISTRIBUTION SYSTEM PIPING
LAYOUT & PIPING DIAGRAM

Drawing


PAVED AREA
WASH RACK
CONCRETE
ASPHALT TAXIWAY
CONCRETE WARM UP PLATFORM
MOORING EYES TO BE ADDED IN THESE AREAS
SPACED AS SHOWN BY "TYP. DETAIL LAYOUT FOR NEW MOORING EYES"
MIN. DIST. & MOORING EYES TO EXP. JT. = 20 FT.
EXISTING MOORING EYES
ADD MOORING EYES
LANDPLANE HANGAR 851
LANDPLANE HANGAR 852
LANDPLANE HANGAR 853
EXPANSION JOINTS
CONTROL TOWER
NEW MOORING EYES
CONCRETE WARM UP PLATFORM
ASPHALT TAXIWAY
PLOT PLAN
SCALE - 1" = 30'
LEGEND
● - EXISTING MOORING EYES
+ - NEW MOORING EYES
E.J. - EXIST. EXPANSION JOINT
V.G.J. - EXIST. V-GROOVE JOINT
PAVEMENT TO BE UNDERCUT FOR PROPER ANCHORAGE CONSISTENT WITH PRACTICAL WORKMANSHIP
EXCAVATE 6" BELOW EXISTING CONCRETE
ALL EDGES AROUND CROSS BAR SHALL BE ROUNDED
BREAK OUT CONCRETE & SET MOORING EYE IN NEW CONCRETE AS SHOWN
DETAIL OF CAST IRON MOORING EYE
"NOTE"
THERE ARE APPROXIMATELY 2000 MOORING EYES REQUIRED ON THIS CONTRACT. THIS QUANTITY IS FOR ESTIMATING PURPOSES AND IS NOT GUARANTEED BY THE GOVERNMENT.
EXISTING MOORING EYES
NEW MOORING EYES
TYP. DETAIL LAYOUT FOR NEW MOORING EYES
SCALE: 1" = 10'
GENERAL NOTES
1. LAYOUT OF ADDITIONAL EYES IS TYPICAL FOR ENTIRE AREA INDICATED BY SHADING.
2. OLD CONCRETE SHALL BE THOROUGHLY CLEANED AND MOISTENED BEFORE PLACEMENT ON NEW CONCRETE.
3. CONCRETE SHALL BE CLASS E2(3000#/SQ. IN.)
4. SPACE ACCORDING TO DETAIL LAYOUT.
N.A.S. DRAWING NO. 3621
NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
N.A.A.S. CABANISS
LANDPLANE PARKING AREA
ADDITIONAL MOORING EYES
OFFICER IN CHARGE OF CONSTRUCTION
483213

Drawing

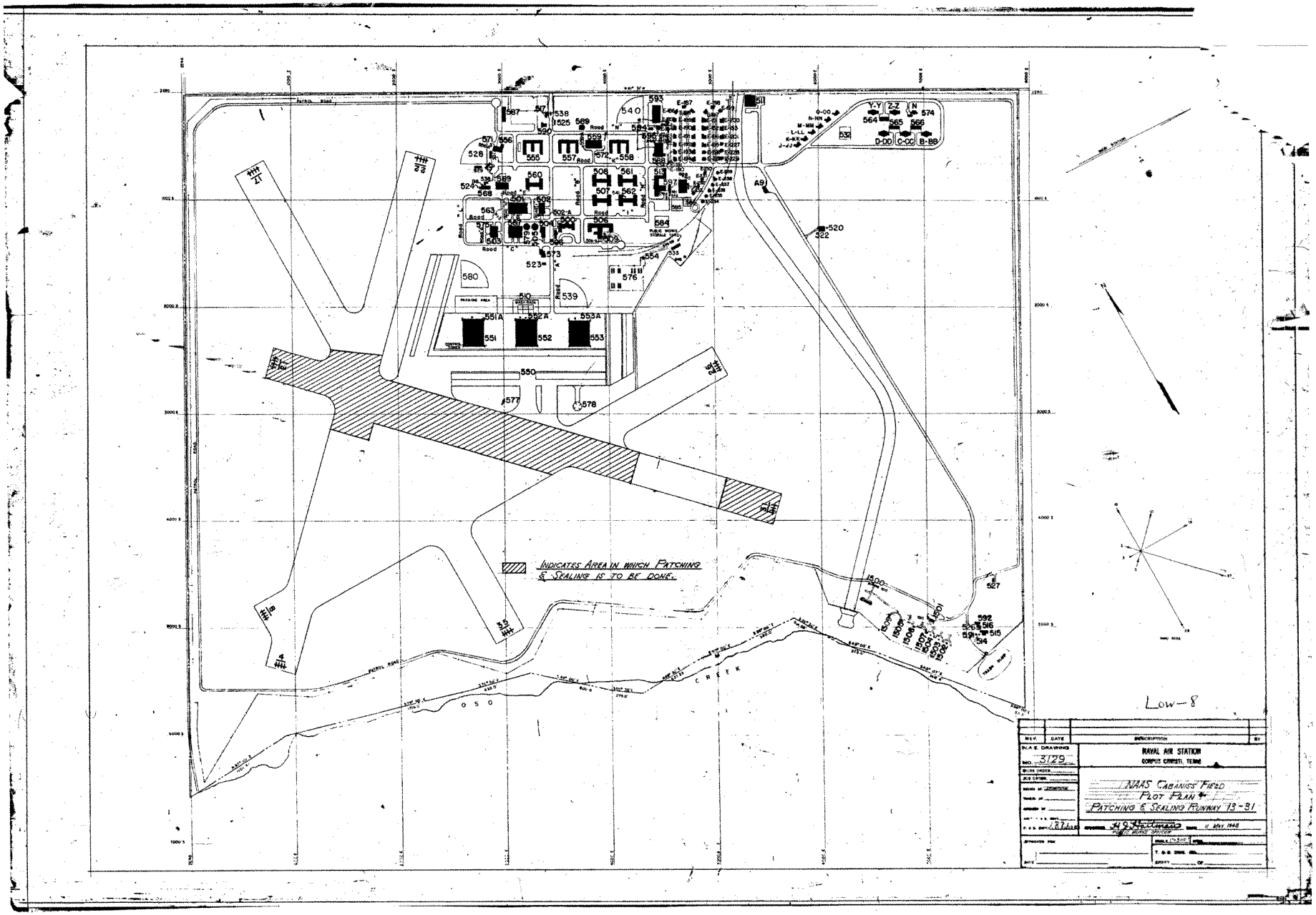

ITEMS . .
1. BACHELOR OFFICERS QUARTERS. (30)
2. BARRACKS. (400)
3. SUBSISTENCE BUILDING.
4. ADMINISTRATION
5. POWER PLANT
6. WATER RESERVOIR.
7. UTILITY SHOP.
8. STOREHOUSE.
9. MAINTENANCE SHOP & UTILITY SHOP.
10. GASOLINE STORAGE - 500,000 GALLONS.
11. LANDSCAPE SANITARY.
12. GATEHOUSE.
TO MAIN STATION
GRAPHIC SCALE
PROPOSED CONSTRUCTION.
FUTURE CONSTRUCTION.
WIND ROSE.
U.S. NAVAL AIR STATION
CORPUS CHRISTI, TEXAS.
PROPOSED LAYOUT
OUTLYING FIELD #2
(CABANISS FIELD)
SCALE: 1" = 500'-0"
NAS NO. (2033)
863-3-61

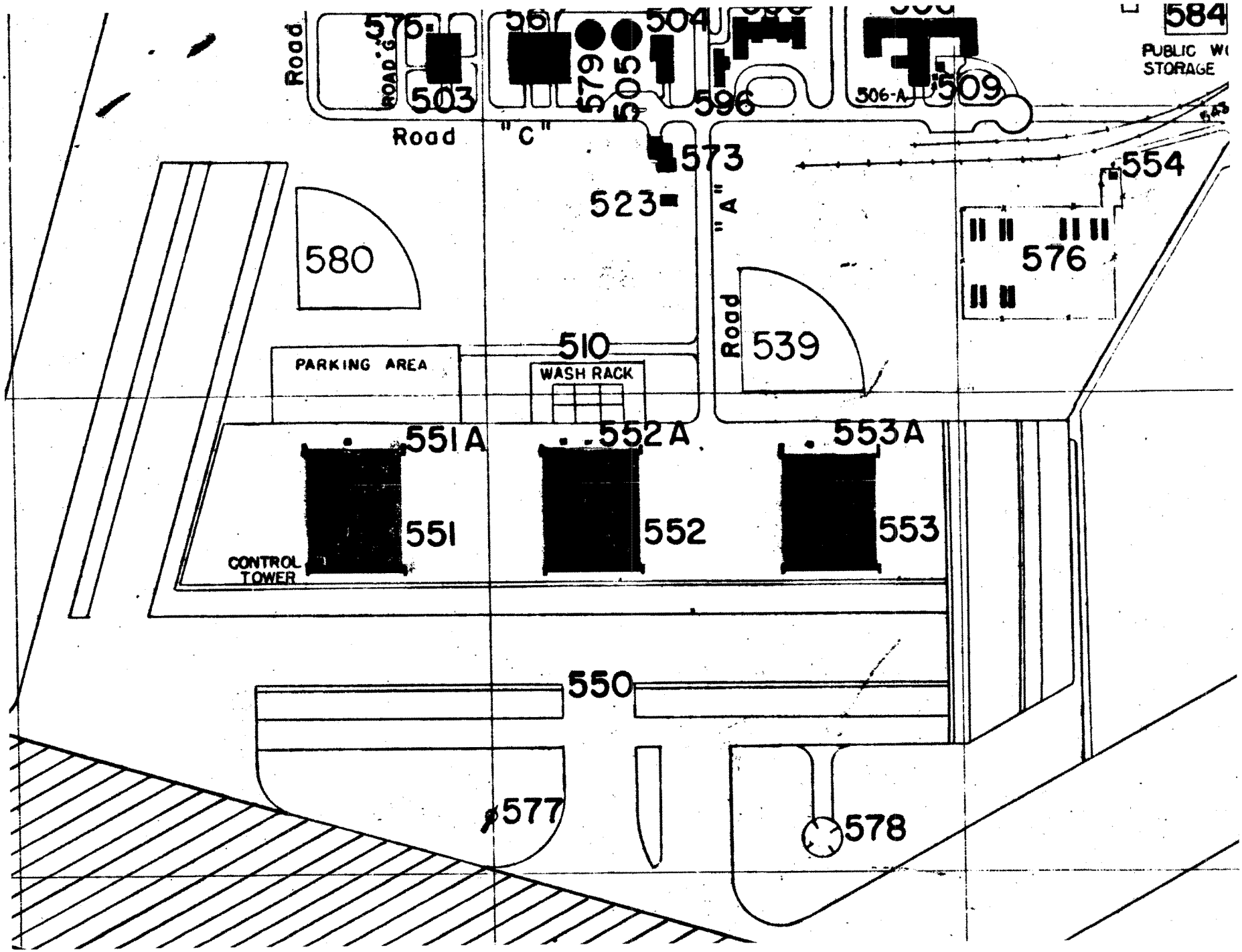

4000 E.
5000 E.
6000 E.
7000 E.
N. 61° 31' W.
ROAD
CLUB HOUSE
ITEMS . . .
1. BACHELOR OFFICERS QUARTERS. (30).
2. BARRACKS. (400)
3. SUBSISTENCE BUILDING.
4. ADMINISTRATION "
5. POWER PLANT
6. WATER RESERVOIR
7. UTILITY SHOP
8. STOREHOUSE
9. MAINTENANCE SHOP & UTILITY SHOP.
10. GASOLINE STORAGE - 300,000 GALLONS.
11. LANDPLANE HANGARS.
12. GATEHOUSE.
ROAD
RELOCATED
TO MAIN STATION
LINE

Drawing

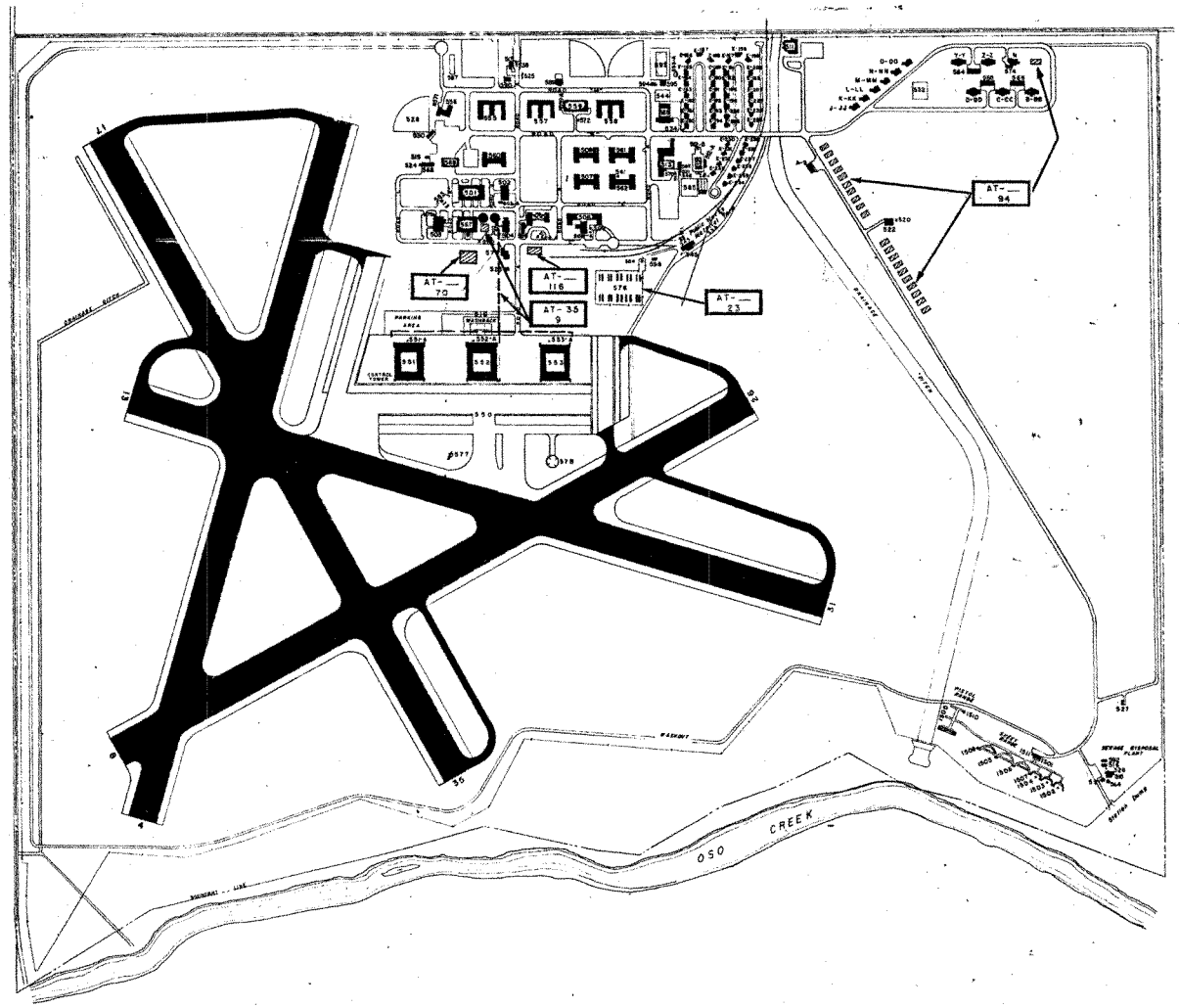
4

4


INDICATES AREA IN WHICH PATCHING & SEALING IS TO BE DONE.
CREEK
OSO
Low-8
NAVAL AIR STATION
CORPUS CHRISTI, TEXAS
NAAS CABANISS FIELD
PLOT PLAN
PATCHING & SEALING RUNWAY 13-31
U.S.N. DRAWING NO. 3129


Road "G"
575
503
Road "C"
579
505
504
596
506-A
509
584
PUBLIC W
STORAGE
573
523
554
580
"A"
576
Road
539
510
PARKING AREA
WASH RACK
551A
552A
553A
551
552
553
CONTROL TOWER
550
577
578

Drawing



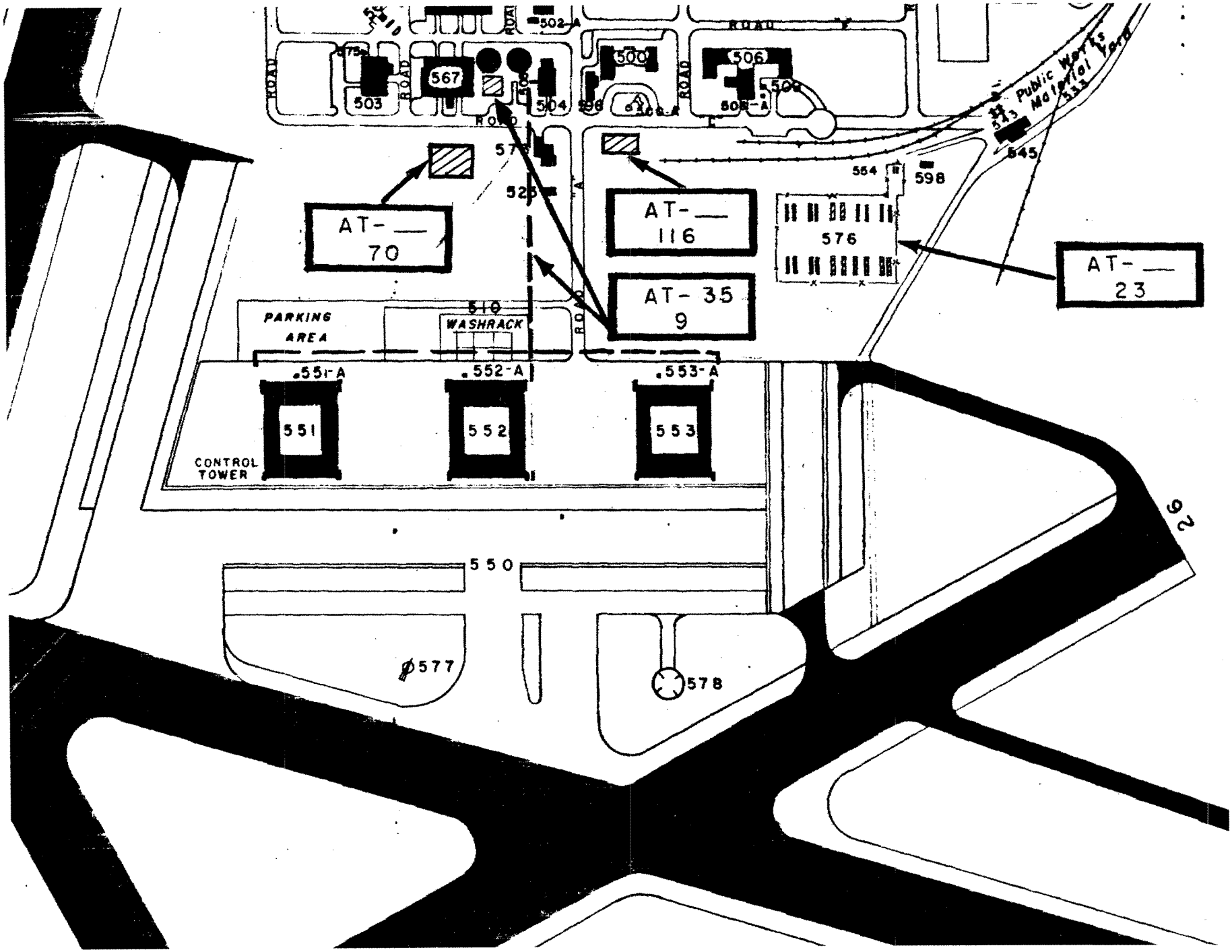
DRAWN BY: PAUL H. SIMPSON, SEPT., 1950

NOTE:
This dwg. supersedes Y&D Dwg. no. 189,075

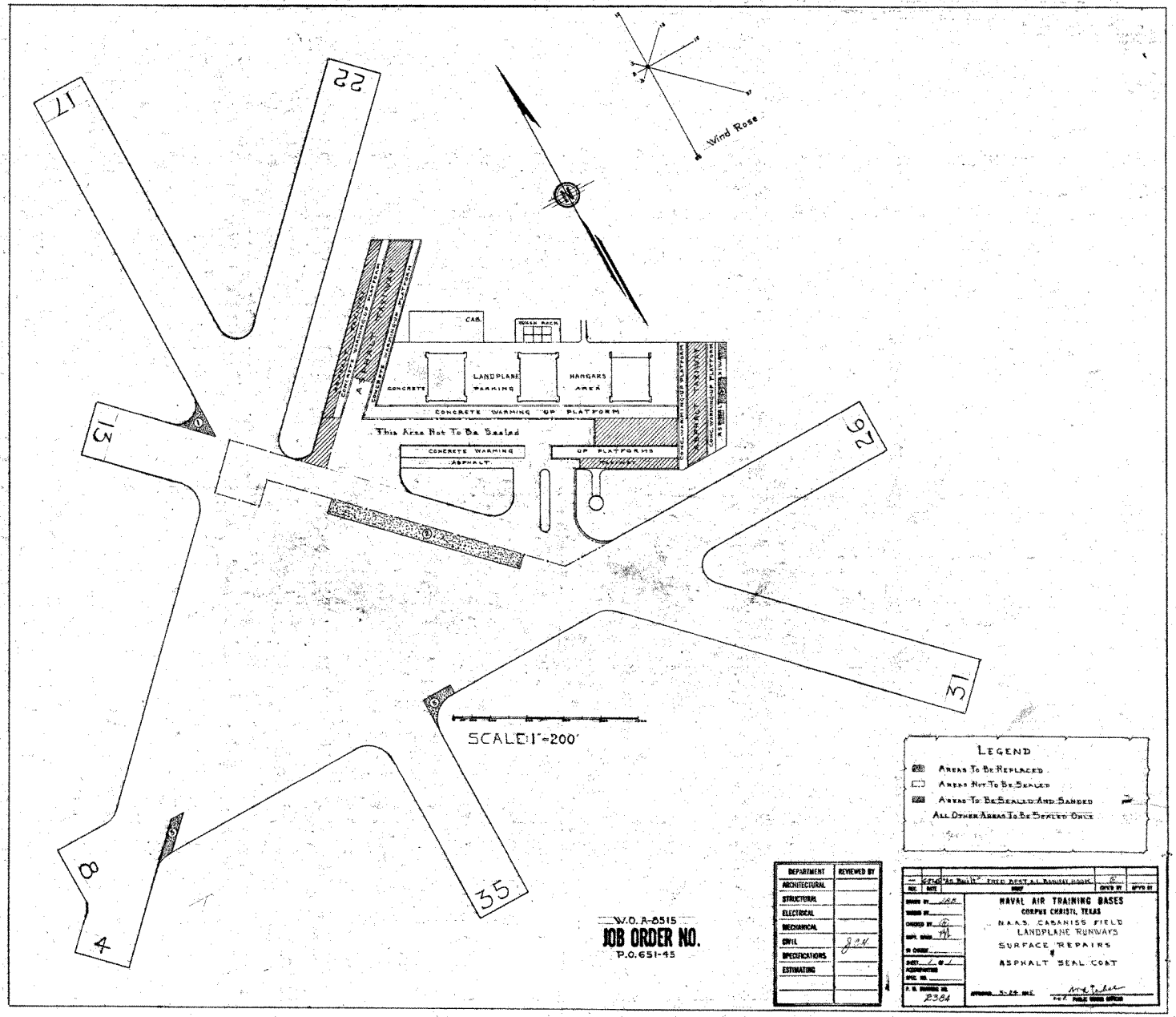
REV.	DATE	DESCRIPTION	BY

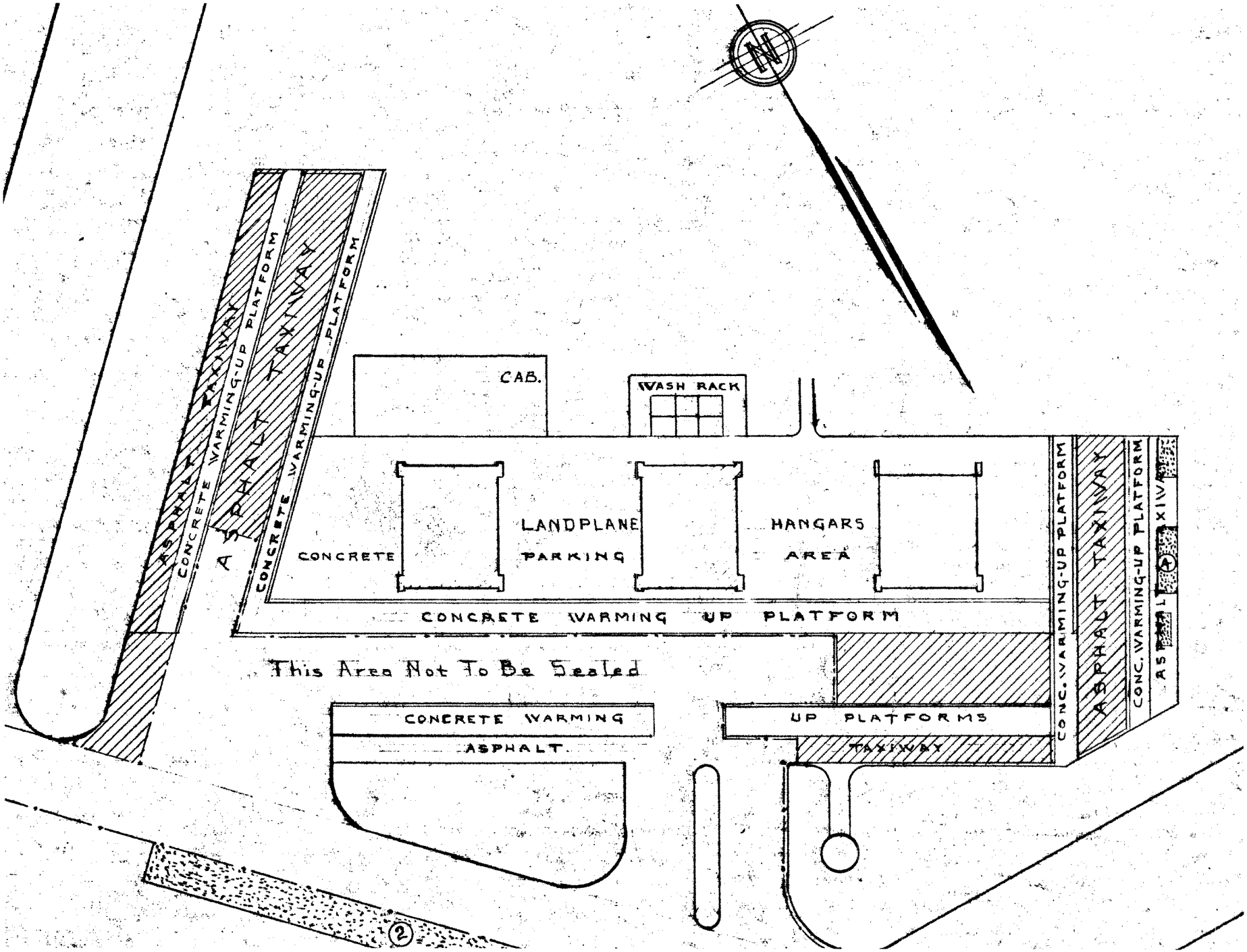
N.A.S. DRAWING NO. 7627	NAVAL AIR STATION CORPUS CHRISTI, TEXAS
WORK SHEETS	NAAS CABANISS FIELD SITE PLAN ACCOMPANYING THE NAVAL AIR TRAINING COMMAND DEVELOPMENT BOARD REPORT SUBMITTED TO THE NAVY DEPARTMENT IN OCTOBER 1951
JOB CHECK	
DRAWN BY: P.H. Simpson	
TRACED BY	
CHECKED BY	
ASST. P. & M. DIRECTOR	
P. & M. DIRECTOR	APPROVED: W. B. Stevens DATE: 10/4/50 Capt. U.S.N. Public Works Officer
APPROVED FOR	SCALE: SPEC.
DATE	Y. & D. DWG. NO.
	SHEET: OF

ENCL. E-2


ROAD
502-A
567
503
504
500
506
506-A
AT-__
70
AT-__
116
AT-35
9
AT-__
23
576
554
598
545
PARKING
AREA
510
WASHRACK
551-A
552-A
553-A
551
552
553
CONTROL
TOWER
550
577
578
26

Drawing

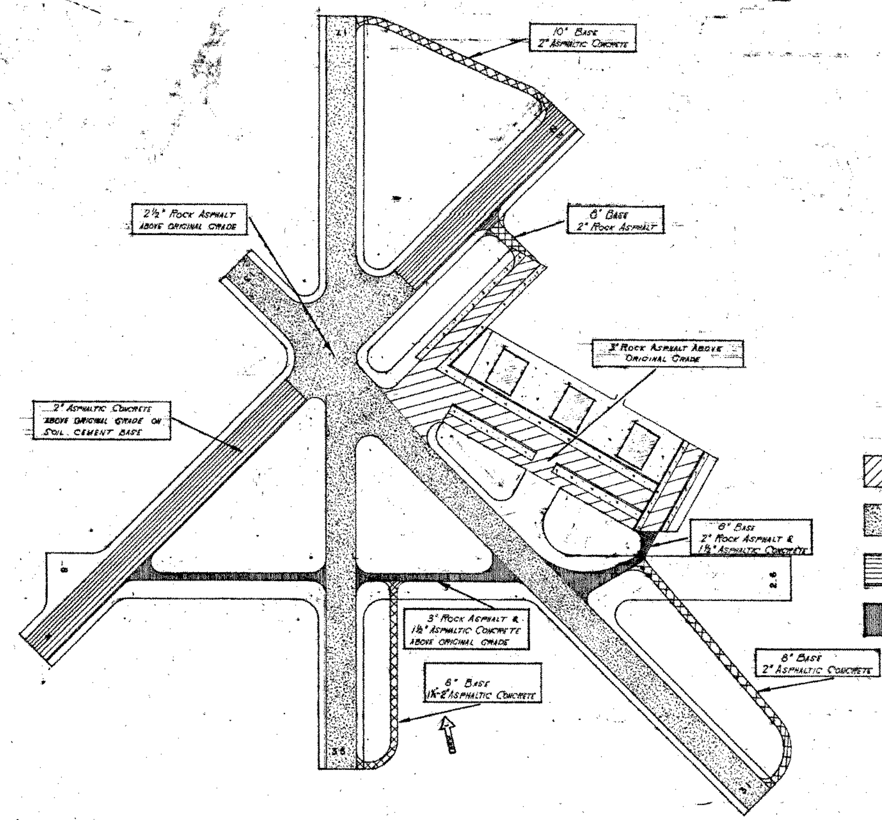

17
22
13
9
27
31
8
35
4
Wind Rose
CAB.
WASH RACK
CONCRETE
LANDPLANE PARKING
HANGARS AREA
CONCRETE WARMING UP PLATFORM
This Area Not To Be Sealed
CONCRETE WARMING UP PLATFORMS
ASPHALT
SCALE: 1"=200'
LEGEND
AREAS TO BE REPLACED
AREAS NOT TO BE SEALED
AREAS TO BE SEALED AND SANDED
ALL OTHER AREAS TO BE SEALED ONLY
DEPARTMENT
REVIEWED BY
ARCHITECTURAL
STRUCTURAL
ELECTRICAL
MECHANICAL
CIVIL
SPECIFICATIONS
ESTIMATING
W.O. A-8515
JOB ORDER NO.
P.O. 651-45
NAVAL AIR TRAINING BASES
CORPUS CHRISTI, TEXAS
N.A.S. CABANISS FIELD
LANDPLANE RUNWAYS
SURFACE REPAIRS
ASPHALT SEAL COAT
2364


N
CAB.
WASH RACK
ASPHALT TAXIWAY
CONCRETE WARMING-UP PLATFORM
CONCRETE WARMING-UP PLATFORM
ASPHALT TAXIWAY
CONCRETE
LANDPLANE PARKING
HANGARS AREA
CONCRETE WARMING UP PLATFORM
This Area Not To Be Sealed
CONCRETE WARMING
ASPHALT
UP PLATFORMS
TAXIWAY
CONC. WARMING-UP PLATFORM
ASPHALT TAXIWAY
CONC. WARMING-UP PLATFORM
2

Drawing

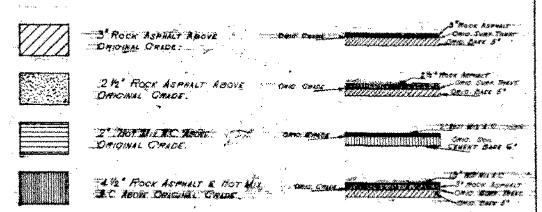
7

7



PLOT PLAN
SCALE 1" = 500'

LEGEND



New Taxiways Constructed as noted on Plan.

NOTE
ALL ORIGINAL BASES (WITH THE EXCEPTION OF THE SOIL CEMENT BASE AS INDICATED IN THE LEGEND) WERE CONSTRUCTED OF A 5" COLD MIX OF EMULSIFIED ASPHALT, SHELL, SAND & LIME IN THE FOLLOWING PROPORTIONS: SHELL 55%; COARSE SAND 15%; FINE SAND 21.5%; HYDRATED LIME 0.5% & EMULSIFIED ASPHALT 8%.
SOIL CEMENT RUNWAY CONSTRUCTED OF 6" SUB BASE OF SANDY LOAM, THE 6" BASE COMPOSED OF SAND CLAY WITH 1 TO 10 MIXTURE OF CEMENT. WELL WATERED & ROLLED WITH PNEUMATIC ROLLERS. WEARING COURSE & SEAL ARE SAME AS OTHER RUNWAYS WITH EXCEPTION THAT ASPHALT PRIME COAT WAS USED INSTEAD OF EMULSIFIED ASPHALT.

REV.	DATE	DESCRIPTION	BY
1	[illegible]	Revised Surface T.W. 25-26 as built	[illegible]

N.A.S. DRAWING NO. 3450

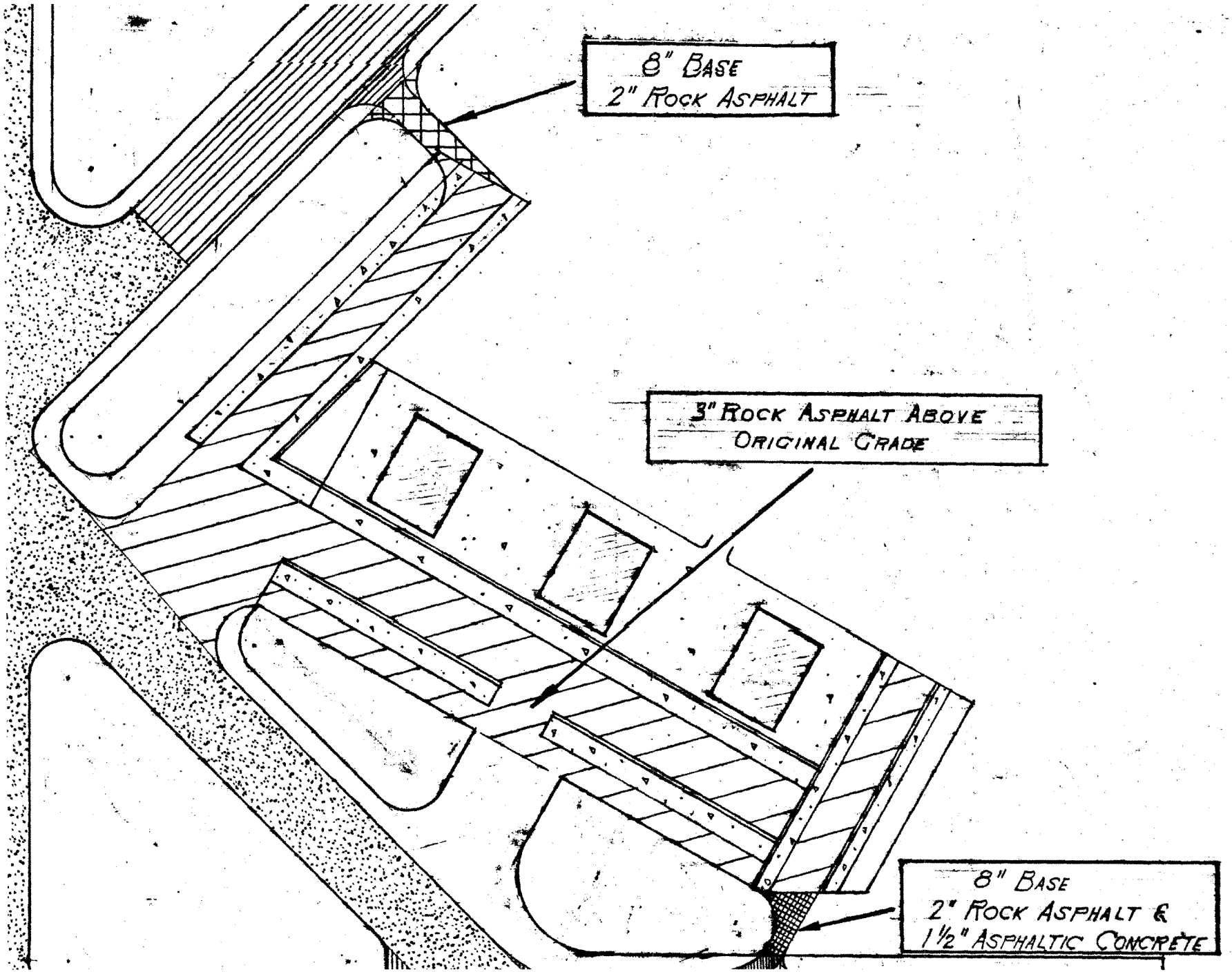
NAVAL AIR STATION
CORPUS CHRISTI, TEXAS

NAAS CABANISS
PLAN OF RUNWAYS & TAXIWAYS
SHOWING AS-BUILT & AUTHORIZED
FUTURE PAVEMENT CONSTRUCTION

WORK ORDER
JOB ORDER
DRAWN BY: GT JACOBS
TRACED BY:
CHECKED BY: PEKOR
ASST. P. & D. SUPT.
P. & D. SUPT.: [illegible]

APPROVED: [signature] DATE 20 DEC. 1949
CHIEF STAFF PUBLIC WORKS OFFICER

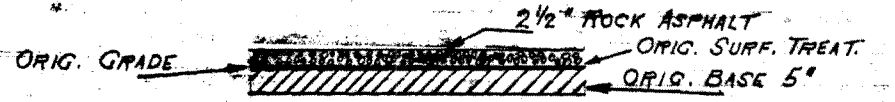
APPROVED BUR.
DATE
SCALE 1"=500' SPEC.
Y. & D. DWG. NO.
SHEET ___ OF ___


8" BASE
2" ROCK ASPHALT
3" ROCK ASPHALT ABOVE
ORIGINAL GRADE
8" BASE
2" ROCK ASPHALT &
1½" ASPHALTIC CONCRETE

LEGEND

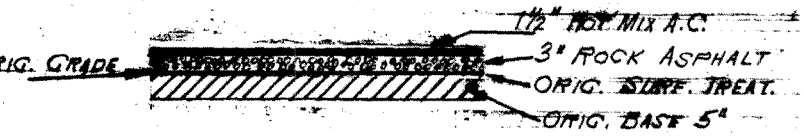
3" ROCK ASPHALT ABOVE ORIGINAL GRADE.

2 ½" ROCK ASPHALT ABOVE ORIGINAL GRADE.



2" HOT MIX A.C. ABOVE ORIGINAL GRADE.

4 ½" ROCK ASPHALT & HOT MIX A.C. ABOVE ORIGINAL GRADE.



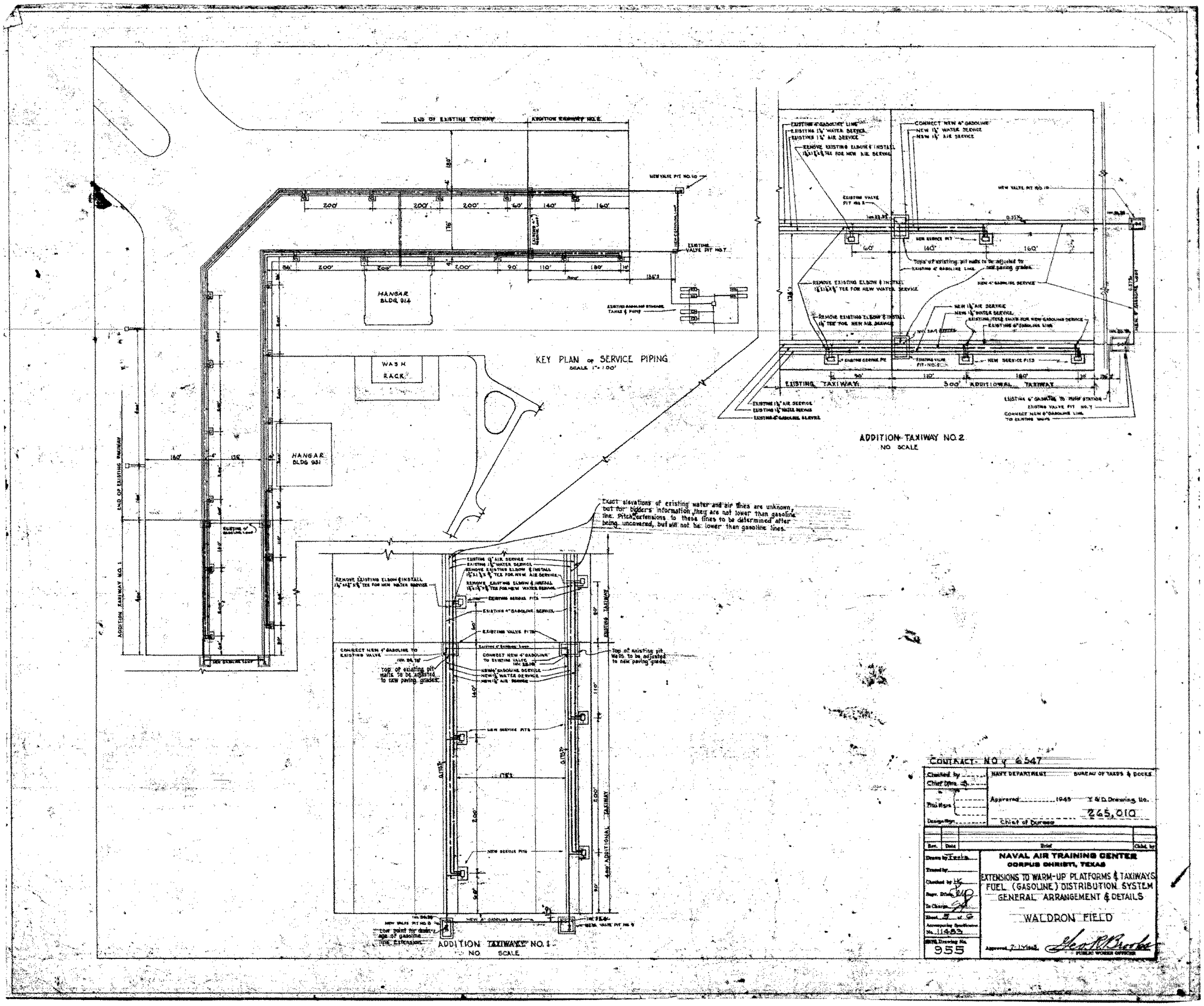
PETE

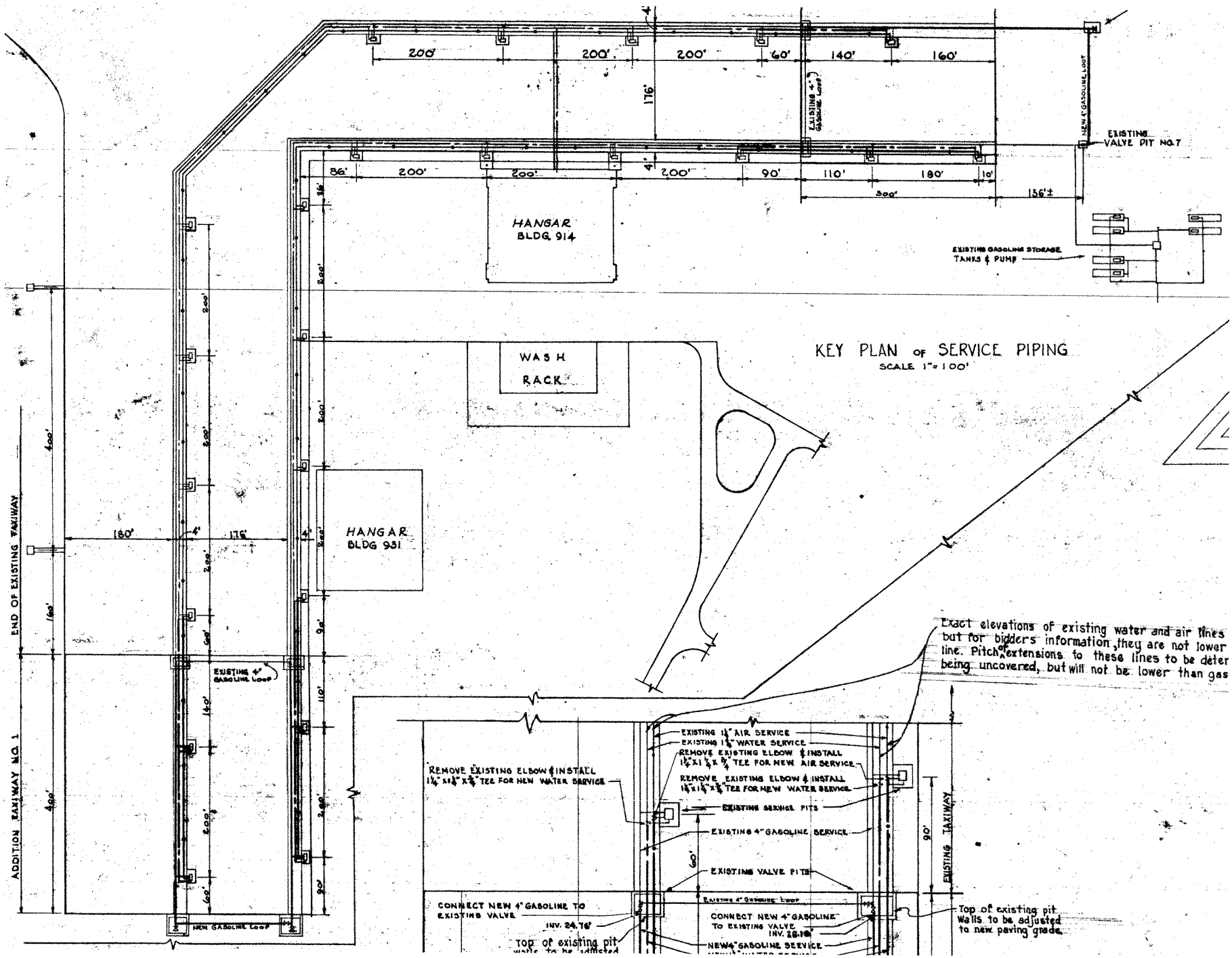
NEW TAXIWAYS CONSTRUCTED AS NOTED ON PLAN.

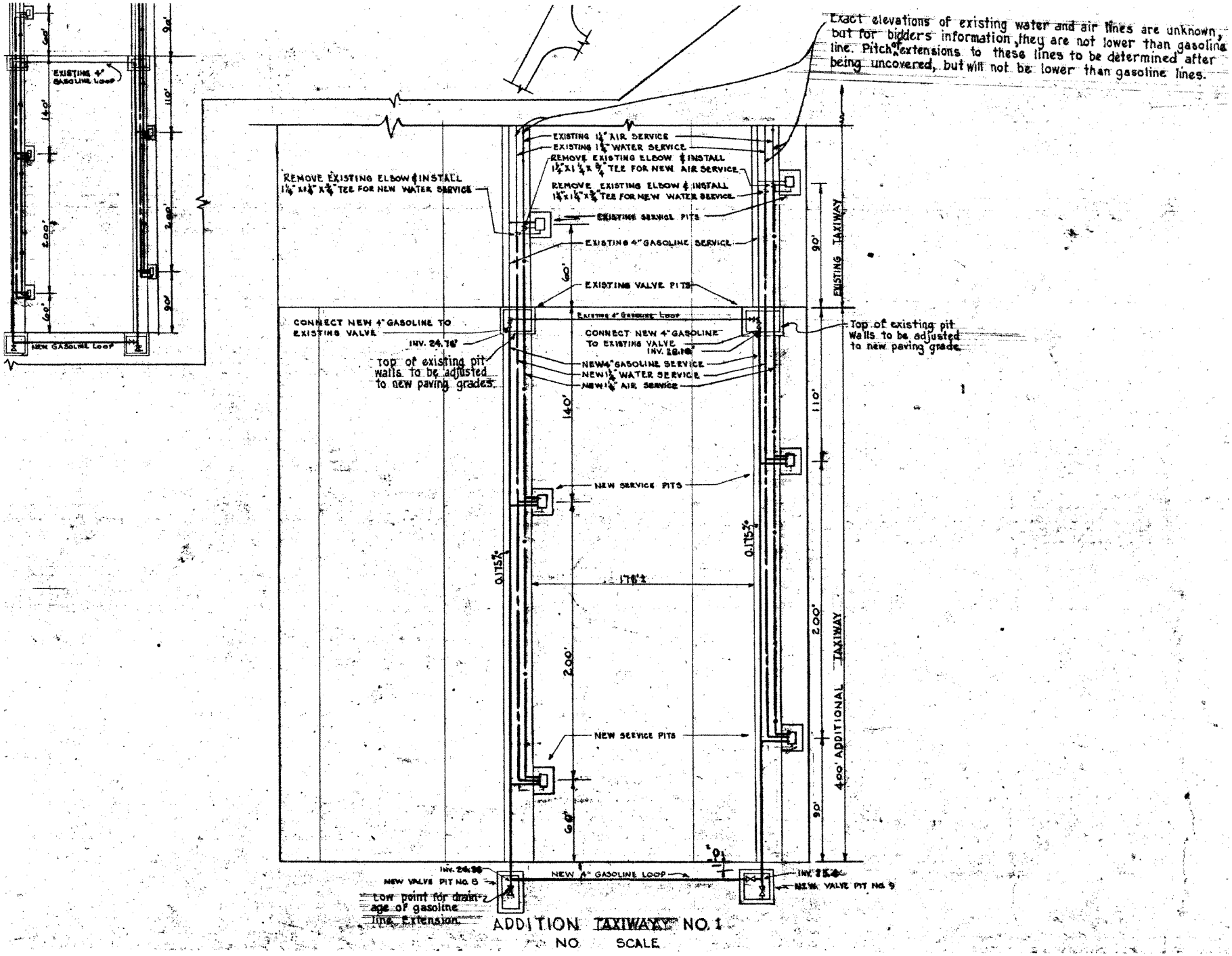
Drawing

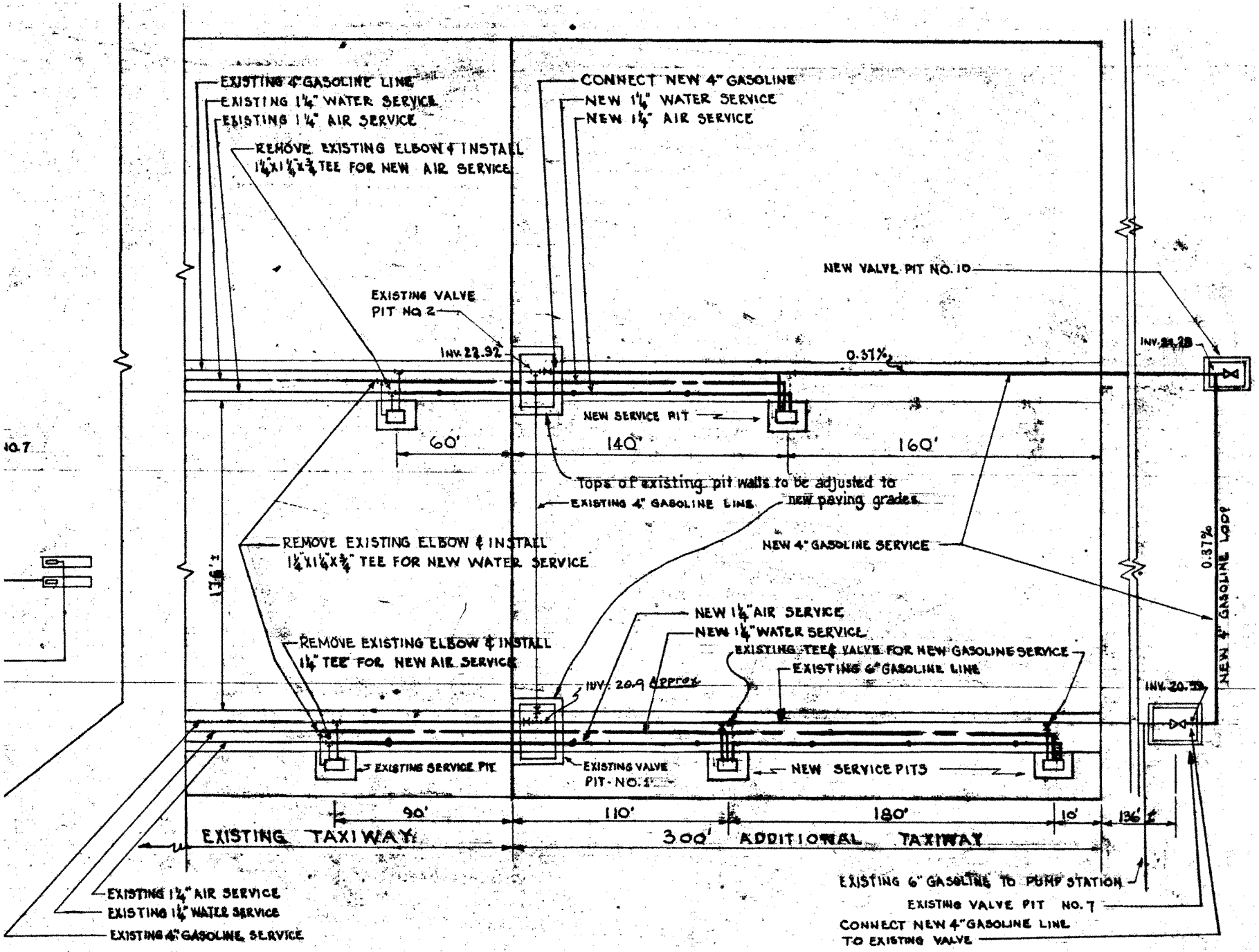
8

8


KEY PLAN of SERVICE PIPING
SCALE 1"=100'
HANGAR BLDG. 914
HANGAR BLDG. 931
WASH RACK
ADDITION TAXIWAY NO. 2
NO SCALE
EXISTING TAXIWAY
300' ADDITIONAL TAXIWAY
ADDITION TAXIWAY NO. 1
NO SCALE
500' ADDITIONAL TAXIWAY
NEW SERVICE PITS
EXISTING SERVICE PITS
EXISTING VALVE PITS
Exact elevations of existing water and air lines are unknown but for bidders information they are not lower than gasoline line. Pitch extensions to these lines to be determined after being uncovered, but will not be lower than gasoline lines.
Top of existing pit walls to be adjusted to new paving grades.
CONTRACT NOy 6547
NAVY DEPARTMENT
BUREAU OF YARDS & DOCKS
Approved 1945
Y & D Drawing No.
265,010
Chief of Bureau
Rev.
Date
Brief
Chkd. by
NAVAL AIR TRAINING CENTER
CORPUS CHRISTI, TEXAS
EXTENSIONS TO WARM-UP PLATFORMS & TAXIWAYS
FUEL (GASOLINE) DISTRIBUTION SYSTEM
GENERAL ARRANGEMENT & DETAILS
WALDRON FIELD
Sheet 5 of 6
Accompanying Specification No. 11483
Drawing No.
955
PUBLIC WORKS OFFICER


KEY PLAN of SERVICE PIPING
SCALE 1"=100'
HANGAR BLDG. 914
HANGAR BLDG 931
WASH RACK
EXISTING VALVE PIT NO.7
EXISTING GASOLINE STORAGE TANKS & PUMP
NEW 4" GASOLINE LOOP
EXISTING 4" GASOLINE LOOP
END OF EXISTING TAXIWAY
ADDITION TAXIWAY NO. 1
200'
200'
200'
60'
140'
160'
176'
86'
200'
200'
200'
90'
110'
180'
10'
500'
156'±
180'
176'
400'
160'
400'
200'
200'
200'
200'
200'
200'
200'
140'
110'
90'
60'
90'
EXISTING 4" GASOLINE LOOP
NEW GASOLINE LOOP
EXISTING 1½" AIR SERVICE
EXISTING 1½" WATER SERVICE
REMOVE EXISTING ELBOW & INSTALL 1½"x1¼"x¾" TEE FOR NEW AIR SERVICE
REMOVE EXISTING ELBOW & INSTALL 1½"x1¼"x¾" TEE FOR NEW WATER SERVICE
REMOVE EXISTING ELBOW & INSTALL 1½"x1¼"x¾" TEE FOR NEW WATER SERVICE
EXISTING SERVICE PITS
EXISTING 4" GASOLINE SERVICE
EXISTING VALVE PITS
EXISTING 4" GASOLINE LOOP
CONNECT NEW 4" GASOLINE TO EXISTING VALVE
INV. 24.76'
CONNECT NEW 4" GASOLINE TO EXISTING VALVE
INV. 26.16'
NEW 4" GASOLINE SERVICE
Top of existing pit walls to be adjusted to new paving grade.
Top of existing pit
60'
90'
EXISTING TAXIWAY
Exact elevations of existing water and air lines
but for bidders information, they are not lower
line. Pitch of extensions to these lines to be deter
being uncovered, but will not be lower than gas


EXISTING 4" GASOLINE Loop
NEW GASOLINE Loop
Exact elevations of existing water and air lines are unknown, but for bidders information, they are not lower than gasoline line. Pitch of extensions to these lines to be determined after being uncovered, but will not be lower than gasoline lines.
EXISTING 1½" AIR SERVICE
EXISTING 1½" WATER SERVICE
REMOVE EXISTING ELBOW & INSTALL 1½"x1¼"x¾" TEE FOR NEW AIR SERVICE
REMOVE EXISTING ELBOW & INSTALL 1½"x1¼"x¾" TEE FOR NEW WATER SERVICE
REMOVE EXISTING ELBOW & INSTALL 1½"x1¼"x¾" TEE FOR NEW WATER SERVICE
EXISTING SERVICE PITS
EXISTING 4" GASOLINE SERVICE
EXISTING VALVE PITS
EXISTING 4" GASOLINE Loop
CONNECT NEW 4" GASOLINE TO EXISTING VALVE
INV. 24.76'
Top of existing pit walls to be adjusted to new paving grades.
CONNECT NEW 4" GASOLINE TO EXISTING VALVE
INV. 28.18'
Top of existing pit walls to be adjusted to new paving grade.
NEW 4" GASOLINE SERVICE
NEW 1½" WATER SERVICE
NEW 1¼" AIR SERVICE
NEW SERVICE PITS
NEW SERVICE PITS
0.175%
0.175%
176'±
140'
110'
200'
90'
60'
EXISTING TAXIWAY
400' ADDITIONAL TAXIWAY
INV. 24.36
NEW VALVE PIT NO. 8
Low point for drainage of gasoline line extension.
NEW 4" GASOLINE LOOP
INV. 25.6±
NEW VALVE PIT NO. 9
ADDITION TAXIWAY NO. 1
NO SCALE


EXISTING 4" GASOLINE LINE
EXISTING 1¼" WATER SERVICE
EXISTING 1¼" AIR SERVICE
REMOVE EXISTING ELBOW & INSTALL 1¼"X1¼"X¾" TEE FOR NEW AIR SERVICE
CONNECT NEW 4" GASOLINE
NEW 1¼" WATER SERVICE
NEW 1¼" AIR SERVICE
NEW VALVE PIT NO. 10
EXISTING VALVE PIT NO 2
INV. 23.92
0.37½
INV. 24.28
NEW SERVICE PIT
60'
140'
160'
Tops of existing pit walls to be adjusted to new paving grades.
EXISTING 4" GASOLINE LINE
REMOVE EXISTING ELBOW & INSTALL 1¼"X1¼"X¾" TEE FOR NEW WATER SERVICE
NEW 4" GASOLINE SERVICE
0.37%
NEW 4" GASOLINE LOOP
NEW 1¼" AIR SERVICE
NEW 1¼" WATER SERVICE
EXISTING TEE & VALVE FOR NEW GASOLINE SERVICE
EXISTING 6" GASOLINE LINE
REMOVE EXISTING ELBOW & INSTALL 1¼" TEE FOR NEW AIR SERVICE
INV. 20.9 APPROX
INV. 20.78
EXISTING SERVICE PIT
EXISTING VALVE PIT - NO. 1
NEW SERVICE PITS
90'
110'
180'
10'
136'
EXISTING TAXIWAY
300' ADDITIONAL TAXIWAY
EXISTING 1¼" AIR SERVICE
EXISTING 1¼" WATER SERVICE
EXISTING 4" GASOLINE SERVICE
EXISTING 6" GASOLINE TO PUMP STATION
EXISTING VALVE PIT NO. 7
CONNECT NEW 4" GASOLINE LINE TO EXISTING VALVE

CONTRACT- NO y 6547

Checked by _____
Chief Dftsm. _____

Proj Mgrs _____

Design Mgr _____

NAVY DEPARTMENT BUREAU OF YARDS & DOCKS

Approved _____ 1943 Y. & D. Drawing No. 265,010

_____ Chief of Bureau

Rev.	Date	Brief	Chkd. by

Drawn by Foote

Traced by _____

Checked by HS

Supv. Dftsm. _____

In Charge _____

Sheet 5 of 6

Accompaning Specification No. 11483

BAYC Drawing No. 955

NAVAL AIR TRAINING CENTER
CORPUS CHRISTI, TEXAS

EXTENSIONS TO WARM-UP PLATFORMS & TAXIWAYS
FUEL (GASOLINE) DISTRIBUTION SYSTEM
GENERAL ARRANGEMENT & DETAILS

WALDRON FIELD

Approved 7-1-1943 Leo. R. Brooks
PUBLIC WORKS OFFICER

APPENDIX C

SITE RECONNAISANCE PHOTOGRAPHS

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 1 **DATE:** 9/7/11 **DIRECTION:** Southwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Vault covers for vault 1.	
PHOTO 2 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil 12” bgs, hose spool, no visible oil inside vault 1.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 3 **DATE:** 9/7/11 **DIRECTION:** Southwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Covers of vault 2.	
PHOTO 4 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Soil and grass flush with ground, inside vault 2. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 5 **DATE:** 9/7/11 **DIRECTION:** Southwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Covers of vault 3.	
PHOTO 6 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil 4” bgs inside vault 3. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 7 **DATE:** 9/7/11 **DIRECTION:** Southwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Covers of vault 4.	
PHOTO 8 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil 12” bgs, no visible oil in vault 4.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 9

DATE:
9/7/11

DIRECTION:
West northwest

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover vault 5. Dry soil to top of vault, flush with ground. No visible oil.

PHOTO 10

DATE:
9/7/11

DIRECTION:
West northwest

TAKEN BY:
Larry Basilio

DESCRIPTION:
Top of vault 6 location. Concrete filled.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 11 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Top of vault 6D location. Concrete filled. Aqua Systems Inc manway valve located immediately northwest of vault, concreted shut.	
PHOTO 12 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Top of vault 7 location. Concrete filled.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 13 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Top of vault 8A, B and C location. Concrete filled.	
PHOTO 14 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Top of vault 8D location. Concrete filled. Aqua System Inc manway valve cover.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 15 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** View inside manway valve. Dry soil ~ 8" bgs.	
PHOTO 16 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Covers of vault 9.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 17 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil and grass flush with ground within vault 9. No visible oil.	
PHOTO 18 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 10. Visible oil from vault 10D.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 19

DATE:
9/7/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Vault 10D and Aqua System Inc manway valve cover. Visible oil and water in vault. Sorbent pads deployed in vault. Oil and water flowing southwest from vault.

PHOTO 20

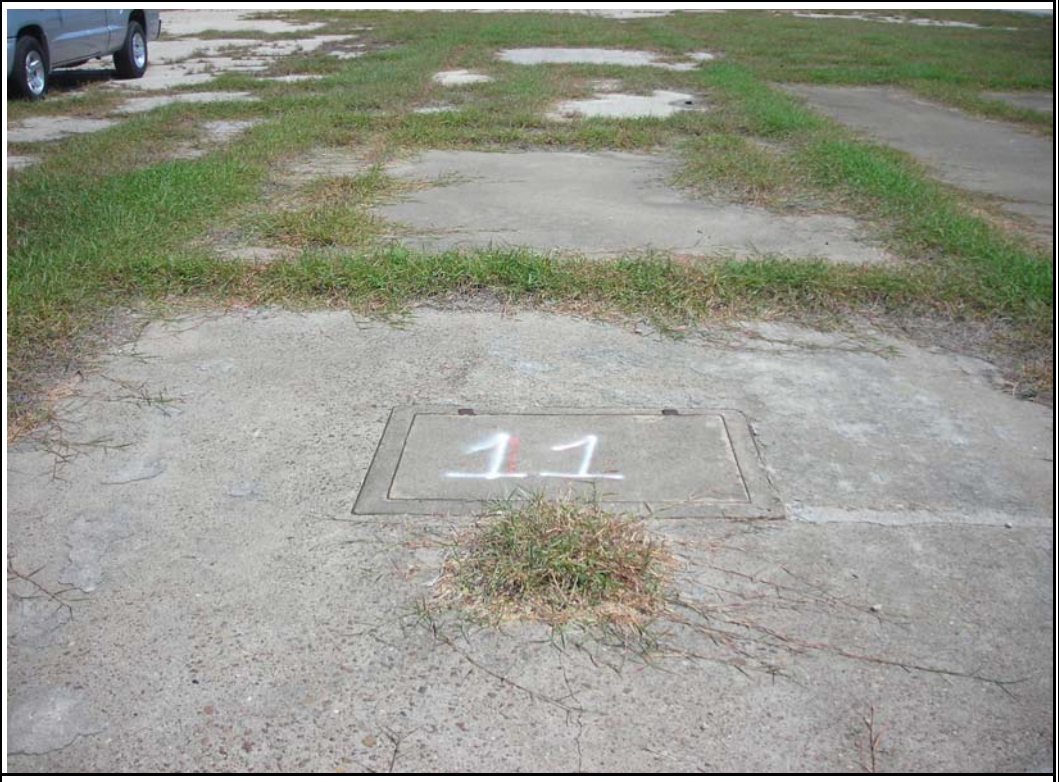
DATE:
9/7/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Aqua Systems Inc manway valve next to vault 10D has dry soil ~ 6" bgs. No visible oil or water.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 21 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Vault 11 is concrete filled.	
PHOTO 22 **DATE:** 9/7/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 12.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 23

DATE:
9/7/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Dry soil and gravel 4" bgs inside vault 12. No visible oil.

PHOTO 24

DATE:
9/7/11

DIRECTION:
West northwest

TAKEN BY:
Larry Basilio

DESCRIPTION:
Covers of vault 13. Visible oil flowing from vault 13 D.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 25 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Visible oil and water in vault 13D. Sorbent pads have been placed in vault to aid in absorption.	
PHOTO 26 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Aqua Systems Inc manway valve has dry soil ~ 8" bgs.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 27

DATE:
9/7/11

DIRECTION:
West northwest

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 14.

PHOTO 28

DATE:
9/7/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Soil is 6” bgs with 2” of clear water on top. No visible oil.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 29

DATE:
9/7/11

DIRECTION:
West northwest

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 15.

PHOTO 30

DATE:
9/7/11

DIRECTION:
West

TAKEN BY:
Larry Basilio

DESCRIPTION:
Dry soil and rebar. No visible oil.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 31 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Aqua System Inc manway valve alongside vault 15D. Dry soil ~ 6” to 8” bgs. No visible oil.	
PHOTO 32 **DATE:** 9/8/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 16.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 33

DATE:
9/8/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Dry soil 8” to 12” bgs and deteriorated hose spool inside vault. No visible oil.

PHOTO 34

DATE:
9/8/11

DIRECTION:
West northwest

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 17.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 35 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil 12” bgs and dead grass in vault 17. No visible oil.	
PHOTO 36 **DATE:** 9/8/11 **DIRECTION:** West northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 18.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 37 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Soil is ~ 6" bgs with 3" to 4" of clear water on top. No visible oil.	
PHOTO 38 **DATE:** 9/8/11 **DIRECTION:** Northeast **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 19.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 39 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil ~ 4" bgs. No visible oil.	
PHOTO 40 **DATE:** 9/8/11 **DIRECTION:** Northeast **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 20.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 41

DATE:
9/8/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Moist soil ~ 4" bgs. Hose spool located in vault. No visible oil.

PHOTO 42

DATE:
9/8/11

DIRECTION:
Northeast

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 21.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 43

DATE:
9/8/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Dry soil flush with ground in vault 21. No visible oil.

PHOTO 44

DATE:
9/8/11

DIRECTION:
Northeast

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 22.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 45

DATE:
9/8/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Soil is ~ 39" bgs (bottom of vault) with 34" of water on top. No visible oil.

PHOTO 46

DATE:
9/8/11

DIRECTION:
North east

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 23

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 47 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** In vault 23D soil is ~ 18" bgs with 3" of water on top. Oil visible with water. Associated valves and piping visible.	
PHOTO 48 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Vault 23A has soil 39" bgs with 5" of water on top. Water is clear in vault 23A with no visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 49 **DATE:** 9/8/11 **DIRECTION:** Northeast **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 24.	
PHOTO 50 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil 38” bgs, associated piping visible. No visible oi.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 51

DATE:
9/8/11

DIRECTION:
Northeast

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 25.

PHOTO 52

DATE:
9/8/11

DIRECTION:
West

TAKEN BY:
Larry Basilio

DESCRIPTION:
Dry soil 4" bgs. No visible oil. Vault 25D has 1" of clear water but no visible oil.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 53 **DATE:** 9/8/11 **DIRECTION:** Northeast **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 26.	
PHOTO 54 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil 2” to 3” bgs. No visible oil..	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 55 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Vault 27D and Aqua Systems Inc manway valve. Valve has dry soil ~ 9" bgs. No visible oil.	
PHOTO 56 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Soil is 39" bgs with 24" of water on top. Visible oil in vault 27B.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 57 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Cover of vault 28C.	
PHOTO 58 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** Dry soil 6” bgs. No visible oil in vault 28.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 59

DATE:
9/8/11

DIRECTION:
Northeast

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 29.

PHOTO 60

DATE:
9/8/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Dry soil 18” to 22” bgs. Associated piping and valves visible. No visible oil.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 61

DATE:
9/8/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
Aqua System Inc manway valve next to vault 29D. Soil is 8" bgs with 1" of oily water on top. Valve is broken off.

PHOTO 62

DATE:
9/8/11

DIRECTION:
Northeast

TAKEN BY:
Larry Basilio

DESCRIPTION:
Cover of vault 30. Cover for 30A has been displaced and vault area underneath had become filled with soil and overgrown with grass.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 63 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of vault 30C. Dry soil 6" bgs. No visible oil.	
PHOTO 64 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of buried hose spool, in 30C.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 65 **DATE:** 9/7/11 **DIRECTION:** Southeast **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of vault 31. No covers discovered in area. Vault filled with soil and overgrown with grasses.	
PHOTO 66 **DATE:** 9/7/11 **DIRECTION:** Northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of vault 31. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 67 **DATE:** 9/7/11 **DIRECTION:** Southeast **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of vault 32.	
PHOTO 68 **DATE:** 9/7/11 **DIRECTION:** Northwest **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of vault 32. No covers discovered in area. Vault filled with soil and grasses. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 69 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** Southeast view along former hangar, property now owned by CCISD. Overgrown with vegetation prohibiting access to vaults along building.	
PHOTO 70 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of vault 33 location. Area overgrown significantly, prohibiting access. No visible oil in area.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 71 **DATE:** 9/7/11 **DIRECTION:** Southeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** Southeast view along filled in trench between former hangars on CCISD property.	
PHOTO 72 **DATE:** 9/7/11 **DIRECTION:** Southeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of vault 34. No covers discovered in area. Vault filled with soil and grasses. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 73 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of former hangar, building 553.	
PHOTO 74 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of vault 35 location. No evidence of vault or covers in area.. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 75 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of former hangar, building 553 and vault 36 location.	
PHOTO 76 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of vault 36 location. Area covered with piles 6' to 8' of soil and fill. No evidence of vault or covers visible. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 77 **DATE:** 9/7/11 **DIRECTION:** Northwest **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of vault 37.	
PHOTO 78 **DATE:** 9/7/11 **DIRECTION:** N/A **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of vault 37 location. No evidence of vault covers in area. Vault filled with soil and grasses. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 79 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View along Southeast fence line of CCISD property. Area if overgrown with vegetation.	
PHOTO 80 **DATE:** 9/7/11 **DIRECTION:** Southeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of vault 38 location. No evidence of vault or covers in area. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 81 **DATE:** 9/7/11 **DIRECTION:** Northeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** Along Southeast fence line of CCISD property. Location of vault 39. No evidence of vault or covers in area. No visible oil.	
PHOTO 82 **DATE:** 9/7/11 **DIRECTION:** Southeast **TAKEN BY:** Bridget Twigg **DESCRIPTION:** View of vault 40 location. No evidence of vault or covers in area. No visible oil.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 83

DATE:
9/8/11

DIRECTION:
N/A

TAKEN BY:
Larry Basilio

DESCRIPTION:
View of P-1. Located southwest of vault 23. 53" bgs with 8" of water on top. 46" from top of pipeline to surface.

PHOTO 84

DATE:
9/8/11

DIRECTION:
N/A

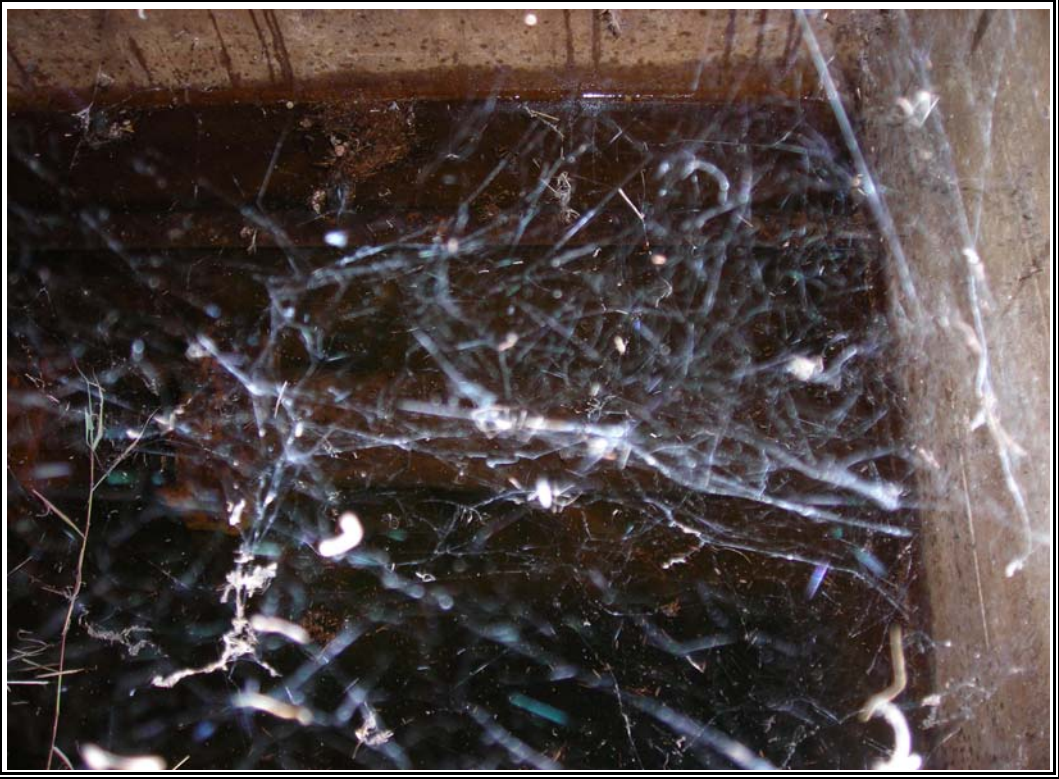
TAKEN BY:
Larry Basilio

DESCRIPTION:
View of P-1. Located southwest of vault 23. 53" bgs with 8" of water on top. 46" from top of pipeline to surface.

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 85 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of P-2. Located southwest of vault 23. 62” bgs with 37” of water on top.	
PHOTO 86 **DATE:** 9/8/11 **DIRECTION:** West **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of P-2. Located southwest of vault 23. Piping visible.	

Site Reconnaissance Photographic Documentation
Aquadrive Fuel System
NALF Cabaniss, Corpus Christi, Texas

PHOTO 87 **DATE:** 9/8/11 **DIRECTION:** N/A **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of P-3. Located southwest of vault 23. 48" bgs with 8" of water on top. Oily sheen visible on top of water	
PHOTO 88 **DATE:** 9/8/11 **DIRECTION:** West **TAKEN BY:** Larry Basilio **DESCRIPTION:** View of P-3. Located southwest of vault 23.	

APPENDIX D

PATENTS

May 20, 1930. W. J. PETER 1,759,708

SYSTEM FOR STORING AND DISPENSING OIL

Filed Jan. 31, 1929 3 Sheets-Sheet 1

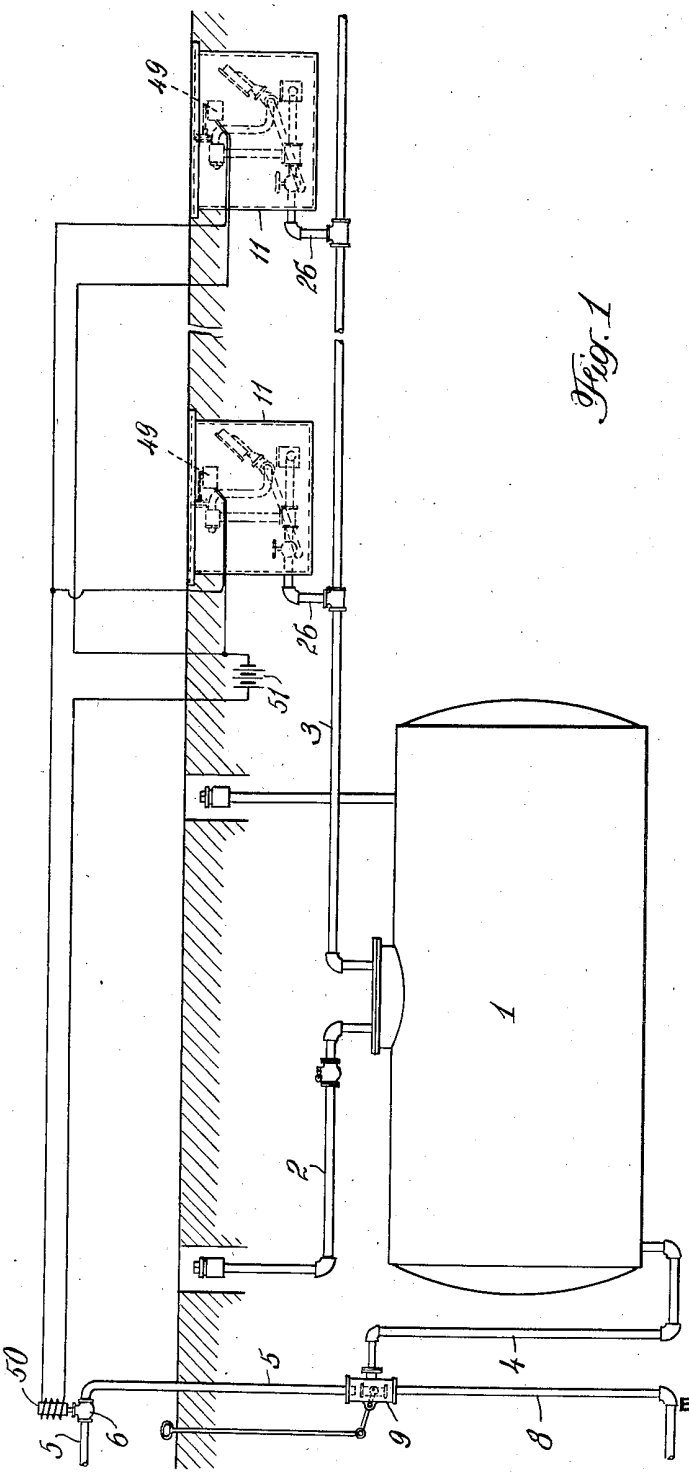


Fig. 1

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BY
Pennie, Davis, Marvin & Edmonds
his ATTORNEYS

May 20, 1930. W. J. PETER 1,759,708

SYSTEM FOR STORING AND DISPENSING OIL

Filed Jan. 31, 1929 3 Sheets-Sheet 2

Fig. 2.

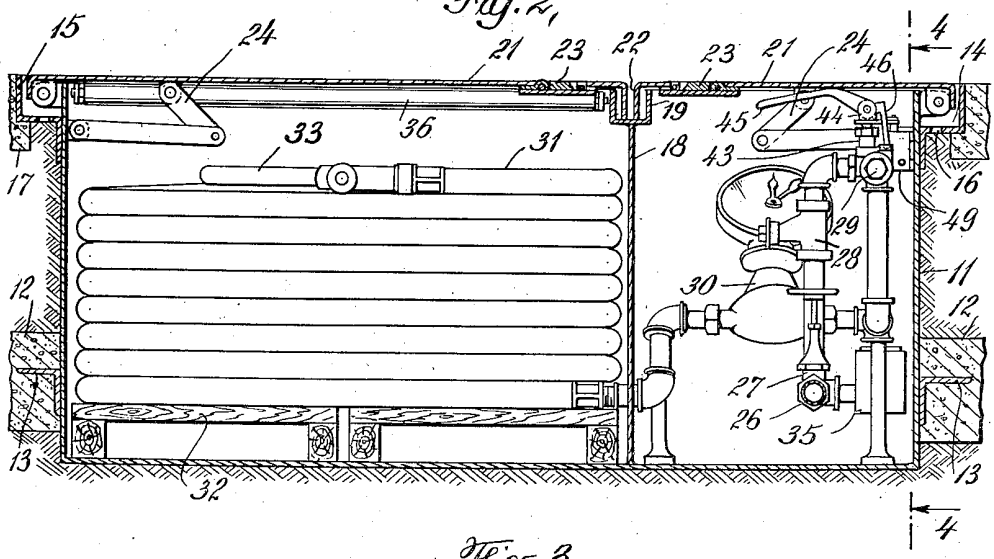
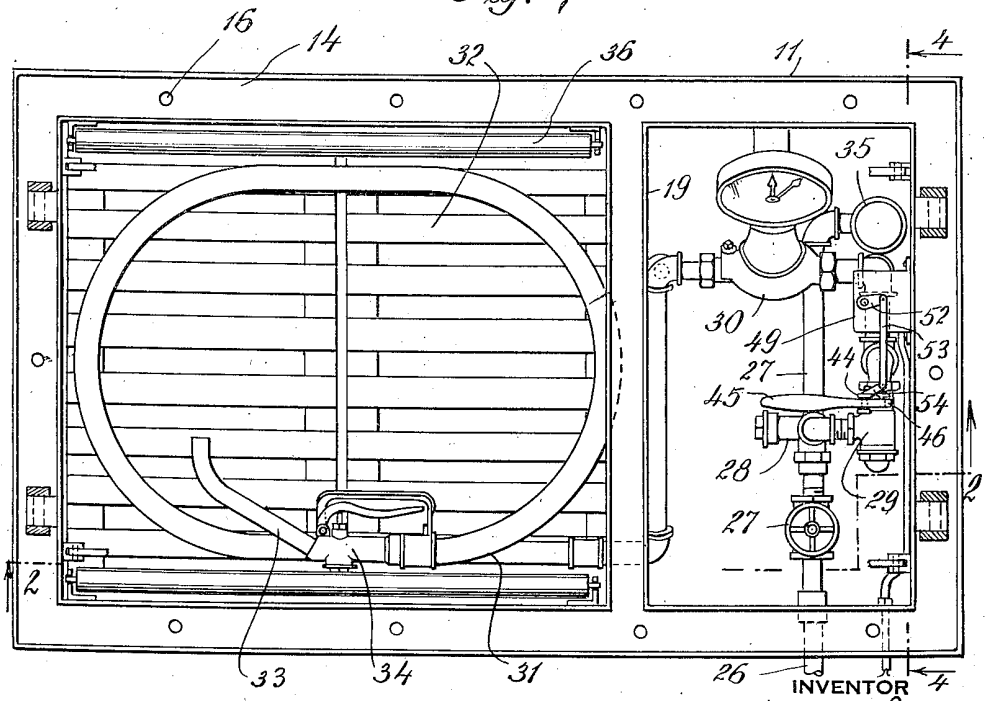


Fig. 3.



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May 20, 1930. W. J. PETER 1,759,708

SYSTEM FOR STORING AND DISPENSING OIL

Filed Jan. 31, 1929 3 Sheets-Sheet 3

Fig. 4.

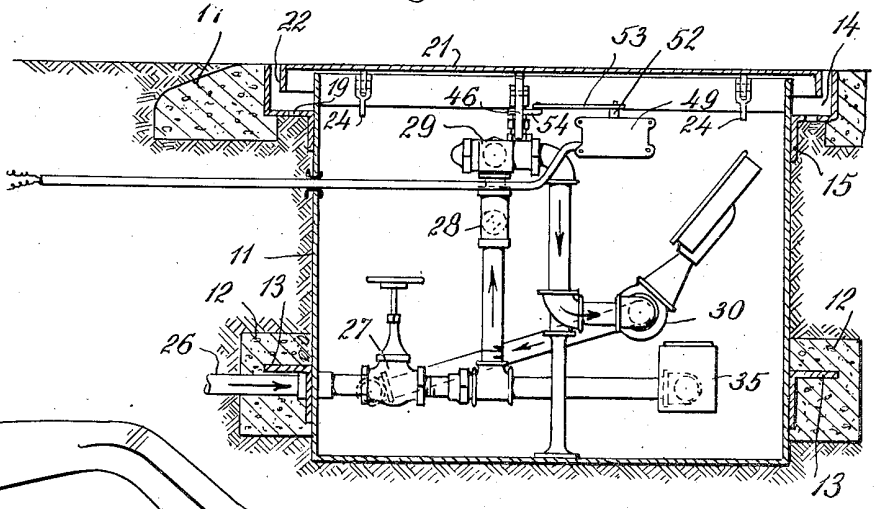
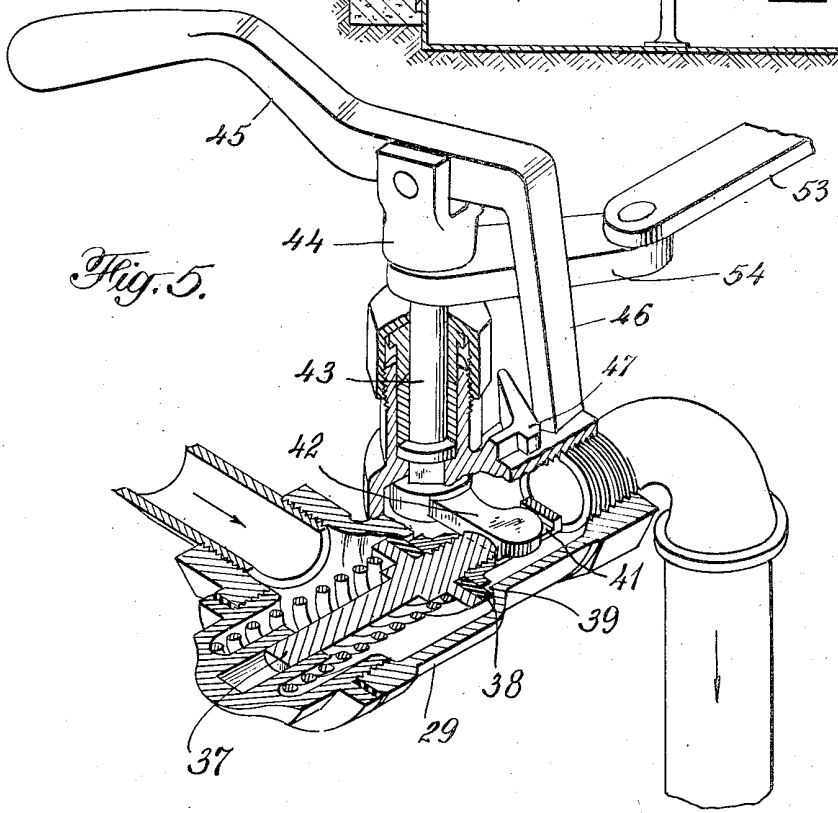


Fig. 5.



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Patented May 20, 1930 1,759,708

UNITED STATES PATENT OFFICE

WILLIAM J. PETER, OF NEW YORK, N. Y., ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO AQUA SYSTEMS INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

SYSTEM FOR STORING AND DISPENSING OIL

Application filed January 31, 1929. Serial No. 336,400.

This invention relates to oil storage and delivery systems and particularly to such systems adapted for use on flying fields in fueling airplanes, or in other locations where the fueling outlets must be submerged below ground level when not in use.

Airports are provided with wide level flying fields over which the planes taxi when taking off and when landing. These fields must be provided with fueling stations. The ordinary upstanding meter casings almost universally used in automobile filling stations for dispensing gasoline are objectionable when used on such fields because of the danger of their being struck by taxiing planes. It is therefore highly desirable to submerge the fueling outlets encasing them so that when not in use their covers shall be flush with the ground, and it is broadly the object of the present invention to provide an oil storage and delivery system for flying fields having such submerged fueling outlets.

In doing this I provide a plurality of metal boxes or casings sunk into the ground at convenient locations on the field, usually near the hangars, the tops of the boxes lying substantially flush with the ground. Each box is divided by a vertical partition into two compartments, one for the delivery hose and one for the meter and valves, and each compartment is provided with a flat cover. In order to protect the box and its contents from rain I provide a gutter having spaced drainage outlets. The covers have depending flanges which extend into this gutter so that when the covers are in place no water can run into the box. The boxes when closed are level with the field and hence present no obstruction to taxiing airplanes.

Gasoline is distributed to the various outlets from a centrally located tank by any suitable pressure means, either a pump or hydraulic means. In my copending application, Serial No. 140,006, filed October 7, 1926, I have disclosed means for automatically relieving the distributing line of pressure when no fuel is being dispensed. As disclosed in that application, when the operator opens the key valve in the meter casing, the tank is automatically placed under pressure, and when he replaces his hose upon its hook, the key valve is automatically closed and the pressure on the tank simultaneously cut off. In the system of the present invention the hose is not supported upon a hook but is coiled in the compartment of the box provided for that purpose. I have therefore, so placed my key valve that when the box cover is closed the key valve is necessarily closed and the pressure control valve automatically closed at the same time, provided no other hose is in use. As the box cover when open presents a distinctly visible and dangerous obstruction on the level field (it can be swung only through 90°) there is practically no danger that the operator will go away leaving it open. Thus at the conclusion of each filling operation, pressure on the tank is surely relieved and cannot be again applied until one of the box covers is opened.

Other improvements form part of the present invention and will be described in connection with the accompanying drawings which illustrate a preferred embodiment of my invention. In this embodiment I have illustrated a hydraulic system, that is, a system in which the operating pressure is obtained by forcing water into the fuel tank and thereby forcing the oil out. The present invention is, however, equally applicable to pump-operated systems. In these drawings, Figure 1 is a diagrammatic layout of an oil storage and delivery system constructed in accordance with the present invention and showing a plurality of outlet boxes; Figure 2 is a vertical, longitudinal section through one of the fueling outlet boxes taken along line 2—2 of Figure 3; Figure 3 is a plan view of the box illustrated in Figure 2 with the cover removed; Figure 4 is a transverse section through the box taken along line 4—4 of Figure 3; and Figure 5 is a detail view, partly in section, of the key valve.

Referring first to Figure 1, 1 represents the storage tank of the system which, as illustrated, is sunk well below the level of the ground, 2 the oil inlet pipe, 3 the oil discharge pipe and 4 the water delivery pipe. The hydraulic pressure under which the system operates may be obtained from any suit-

able source, but, in the embodiment illustrated here, I have contemplated the use of pressure of the city mains, water from these mains flowing to the tank through a pipe 5 controlled by a valve 6. The tank is conencted to the sewer by a waste pipe 8 through which water is forced when the tank is being filled with oil. The water pipe 5 and the sewer pipe 8 are selectively placed in communication with pipe 4, and hence with the tank by means of a manually controlled two-way valve 9. This main water valve is usually manipulated in the morning and night or when the tank is to be filled with oil through pipe 2 and its water discharged to the sewer. During normal operation of the system in dispensing oil the valve 9 is so positioned that the pipe 5 is in communication with the tank through the pipe 4, and communication with the sewer pipe 8 is cut off. The valve 6 which controls the flow of water to the pipe 5 is utilized to control the pressure on the tank, and hence the flow of oil. The specific method of operating this valve will be described in detail later.

The pipe 3 passes outward to outlet boxes 11 from which oil is dispensed. In the operation of a hydraulic system, such as here illustrated, valve 9 being set to permit communication between pipes 4 and 5, the valve 6 being open to permit flow through pipe 5, water flows into the tank forcing the lighter and immiscible oil out through the pipe 3 and to the dispensing point. Such a system is old, has already been patented by me and of itself forms no part of the present invention. I shall now describe the outlet box and its contents, with particular reference to the other figures of the drawings.

This sheet metal box 11 is sunk in the earth, as illustrated, with its top substantially flush with the surface of the ground. It is anchored in place by means of a concrete beam 12 cast around angle irons 13 secured to the vertical side walls of the box. Extending around the upper edges of the box, is a gutter 14 formed of Z-bars 15. The horizontal webs of these bars constitute the bottom of the gutter which is provided at suitable intervals with draining holes 16 which lead water falling into the gutter into the cinders or other loose material which immediately surround the box. A concrete coping 17 is built around the gutter and is provided with a downwardly sloping outer face, as illustrated. The box is provided with a vertical partition 18 dividing it into two compartments of unequal size. This partition carries at its upper edge a transverse U-beam 19, which communicates at its ends with the gutter 14 and forms a part thereof. The box is also provided with a pair of hinged covers 21 each provided with depending flanges 22 which extend within the gutter when the cover is closed. The covers are opened and closed by means of countersunk lifting rings 23. The covers can be swung open through only about 90°, the swing being limited by pivoted links 24. Thus, it is impossible to open the covers through 180° and leave them flat on the ground.

The box just described lies, when its covers are closed, flush with the surface of the ground and forms no obstruction whatever to the passage of the vehicles over it. Any water falling on the covers drains into the gutter and thence into the earth adjacent the box. It is thus practically impossible for water to enter the box when the covers are closed. I shall now describe the contents of the box.

The oil pipe 3 communicates with each box through a branch pipe 26 which enters the small compartment of the box near the bottom of one of its side walls. Within the box the oil passes through a manually controlled valve 27, thence upward through a strainer 28, and through the key valve 29, whence it passes through a meter 30 tilted back at an angle of 45° so as to be visible from above and to one side of the box and from the meter to the hose 31 which, as illustrated, is coiled within the larger compartment of the box and rests upon a removable wood grating 32. The hose terminates in a nozzle 33 provided with the usual nozzle control valve 34. Beyond the valve 27 the pipe 26 terminates in an air chamber 35 which serves as a cushion to absorb the momentum of the oil when the valve 34 is closed. The upper longitudinal edges of the larger compartment of the box 11 are provided with rollers 36 which facilitate the removal of the hose and minimize wear which might otherwise be occasioned by dragging the hose over the sharp edges of the box.

The key valve 28, which is illustrated in detail in Figure 5, comprises a spring-pressed plunger 37 provided with a washer 38 seated, when the valve is closed, upon the valve seat 39. Lying within a slot 41 in an extension of the plunger 37 is a cam arm 42 carried upon the lower end of a rotatable stem 43, provided at its upper end with a yoke 44, in which a handle 45 is pivotally mounted. The outer end of the handle is provided with a downwardly extending finger 46 designed to cooperate with a detent 47 integral with the valve housing. To open the valve the handle 45 is depressed and turned clockwise, thus swinging the cam arm and thereby forcing the valve back against its spring. To hold the valve in open position the finger 46 is swung down behind the detent 47 thus latching the handle in place. To close the key valve, it is only necessary to strike the handle 45 downward, thus freeing the finger 46, whereupon the spring assisted by the flow of the oil itself instantly closes the valve.

Mounted on the inner side of the box, ad-

jacent the key valve is a water-tight switch 49 preferably of the mercury momentary contact type. Referring again to Figure 1; the water valve 6 is operated by means of a solenoid 50, or its equivalent, such as a motor, in series with a source of electrical energy 51. Thus, when the switch 49 is closed the solenoid circuit is closed, the solenoid is energized and the valve 6 is opened permitting water to flow through the pipe 5 to the tank. When the switch 49 is open the circuit is broken, the solenoid is de-energized and the valve is closed, thus cutting off the pressure from the tank and stopping the flow of oil through the pipe 3. The valve 49 is operated by means of swinging arm 52 pivoted to a link 53 which, in turn, is pivoted to an arm 54 secured to the key valve stem 43. This linkwork is so arranged that when the handle 45 of the key valve is swung clockwise to open that valve the switch 49 is closed, thus energizing the solenoid circuit and opening the valve 6, and when the handle 45 is swung counterclockwise closing the key valve, the switch 49 is thereby opened, the solenoid de-energized and the valve 6 closed.

The system operates as follows: Assuming the tank 1 filled or partly filled with gasoline and the valve 9 opened to permit communication between the tank and the pipe 5, an airplane taxies up to one of the outlet boxes to be fueled. The operator opens the cover to the hose compartment and uncoils the hose. He then opens the cover of the valve compartment, both covers when open standing at substantially 90° to the ground, seizes the handle 45, swings it clockwise far enough for the finger 46 to clear the detent 47 and open the key valve 29, whereupon he swings the handle upward to latch the finger 46 behind the detent. This movement not only opens the key valve but through the linkwork 52, 53 and 54 closes the switch 49, which in turn energizes the solenoid 50 and opens the water control valve 6. The tank is thus placed under pressure and in order to deliver oil, it is only necessary for the operator to open the nozzle control valve 34. When the particular fueling job at hand is finished, the operator, of course, releases the nozzle control valve 34 which shuts off the flow of oil, but the hose and its associated connections are still under full tank pressure. Under no circumstances should the operator be permitted to coil the hose within its compartment while under pressure as any leak would result in loss of gasoline and involve a serious fire risk. The operator must, therefore, close the key valve 29 and at the same time open the switch 49, de-energize the solenoid 50 and close the water control valve 6. If the operator could be relied upon to do this, nothing further would be required but operators cannot be so relied upon. The operator, however, is not very likely to go away leaving the box covers up because they are distinctly visible in their upright position and constitute serious obstructions to the passage of planes. He can, therefore, be relied upon to close these covers, and in closing the cover on the valve compartment the upstanding handle 45 is struck, swinging the finger 46 free of the detent 47 whereupon the valve closing operations take place automatically and without the benefit of the operator's manipulations. Thus the water control valve 6 is open only when one or more of the discharge outlets is in use and pressure on the tank automatically shut off when not needed. In pump operated systems the operation is the same. There the pump is controlled by the circuit including the switch 49.

I claim:

1. In an oil storage and delivery system, the combination of a tank, a delivery outlet receiving oil from the tank, a source of pressure designed to be connected with and disconnected from the tank, a box, a cover on the box, and means within the box for connecting the source of pressure with the tank operable only when the cover is open and automatically operated to disconnect the source of pressure from the tank when the cover on the box is closed.

2. In an oil storage and delivery system, the combination of a tank, a delivery outlet receiving oil from the tank, a source of pressure designed to be connected with and disconnected from the tank, a box, a cover on the box, and manually controlled means within the box for connecting the source of pressure with the tank operable only when the cover is open, and automatically operated to disconnect the source of pressure from the tank when the cover is closed.

3. In an oil storage and delivery system, the combination of a tank, a delivery outlet receiving oil from the tank, a source of pressure designed to be connected with and disconnected from the tank, a box, a cover on the box, and a handle within the box for connecting the source of pressure with the tank operable only when the cover is open and when so operated extending beyond the plane of the cover when closed, the closing of the cover striking the handle and disconnecting the source of pressure from the tank.

4. In a hydraulic oil storage delivery system, the combination of a tank, a delivery outlet receiving oil from the tank, a source of hydraulic pressure designed to be connected with and disconnected from the tank, a box, a cover on the box, and manually controlled means within the box for connecting the source of pressure with the tank operable only when the cover is open, and automatically operated to disconnect the source of pressure from the tank when the cover is closed.

5. In a hydraulic oil storage and delivery system, the combination of a tank, a delivery

outlet receiving oil from the tank, a pipe for conducting water under pressure to the tank, a valve in the water pipe, a box, a cover on the box, and manually controlled means within the box for opening the valve operable only when the cover is open and automatically operated to close the valve when the cover is closed.

6. In a hydraulic oil storage and delivery system, the combination of a tank, a delivery outlet receiving oil from the tank, a pipe for conducting water under pressure to the tank, a valve in the water pipe, a box, a cover on the box, manually controlled means within the box for opening the valve operable when the cover is opened, a latch for holding the manually controlled means in valve opening position and means for automatically freeing the latch to close the valve when the cover is closed.

7. In a hydraulic oil storage and delivery system, the combination of a tank, a pipe for conducting water under pressure to the tank, a valve in the water pipe, a pipe for delivering oil from the tank, a valve in the oil pipe, a delivery outlet connected with the oil pipe, a box, a cover on the box, manually controlled means within the box for opening both valves when the cover is open and automatically operated to close both valves when the cover is closed.

8. In an oil storage and delivery system, the combination of a tank, an oil delivery pipe, a valve in the oil delivery pipe, a delivery outlet connected with the oil delivery pipe, a source of pressure designed to be connected with and disconnected from the tank, a box, a cover on the box and means within the box for automatically closing the valve in the oil delivery pipe and disconnecting the source of pressure from the tank when the cover is closed.

9. In a hydraulic oil storage and delivery system, the combination of a tank, a pipe for conducting water under pressure to the tank, a valve in the water pipe, a pipe for delivering oil from the tank, a plurality of branch pipes leading from the oil delivery pipe, a valve in each branch pipe, a delivery outlet connected with each branch pipe, a box in which each delivery outlet terminates, a cover on each box and means for automatically closing the valve in the branch pipe to a given outlet when the cover of that outlet box is closed and also the valve in the water pipe provided no other outlet is in use.

10. In an oil storage and delivery system, the combination of a tank, an oil delivery pipe terminating in a submerged box the cover of which when closed lies substantially flush with the surface of the ground, a source of pressure designed to be connected with and disconnected from the tank, a handle within the box operable when the cover is open to be moved above the plane of the cover when closed to connect the source of pressure with the tank, a latch for holding the handle in this position, a spring urging the handle into pressure disconnecting position, the relation of the parts being such that when the cover is closed the latch is tripped and the spring acts to disconnect the source of pressure from the tank.

11. In an oil storage and delivery system for flying fields, the combination of a tank, an oil delivery pipe, a valve in said pipe, a handle for operating the valve, a hose communicating with the oil delivery pipe, a submerged outlet box for the hose and the oil valves, the cover of which box lies substantially flush with the surface of the ground when closed, a source of pressure designed to be connected with and disconnected from the tank, a switch controlling the source of pressure, connections between the valve handle and the switch whereby when the handle is moved to open the oil valve the switch is closed and the source of pressure connected with the tank, a latch for holding the handle in open position, the handle then projecting above the plane of the cover when closed, and a spring urging the valve into closed position, the position of the parts being such that when the cover when closing strikes the handle and trips the latch, whereupon the spring closes the valve, opens the switch and disconnects the source of pressure from the tank.

12. In an oil storage and delivery system, the combination of a tank, an oil delivery pipe, a plurality of branch pipes leading from the oil delivery pipe, a valve in each branch pipe, a delivery outlet connected to each branch pipe, a source of pressure designed to be connected with and disconnected from the tank, a box in which each delivery outlet terminates and which houses the valve controlling that outlet, a cover on each box, and means within the box for automatically closing the valve in the oil delivery pipe and disconnecting the source of pressure from the tank when the cover is closed, provided no other outlet is in use.

In testimony whereof I affix my signature.

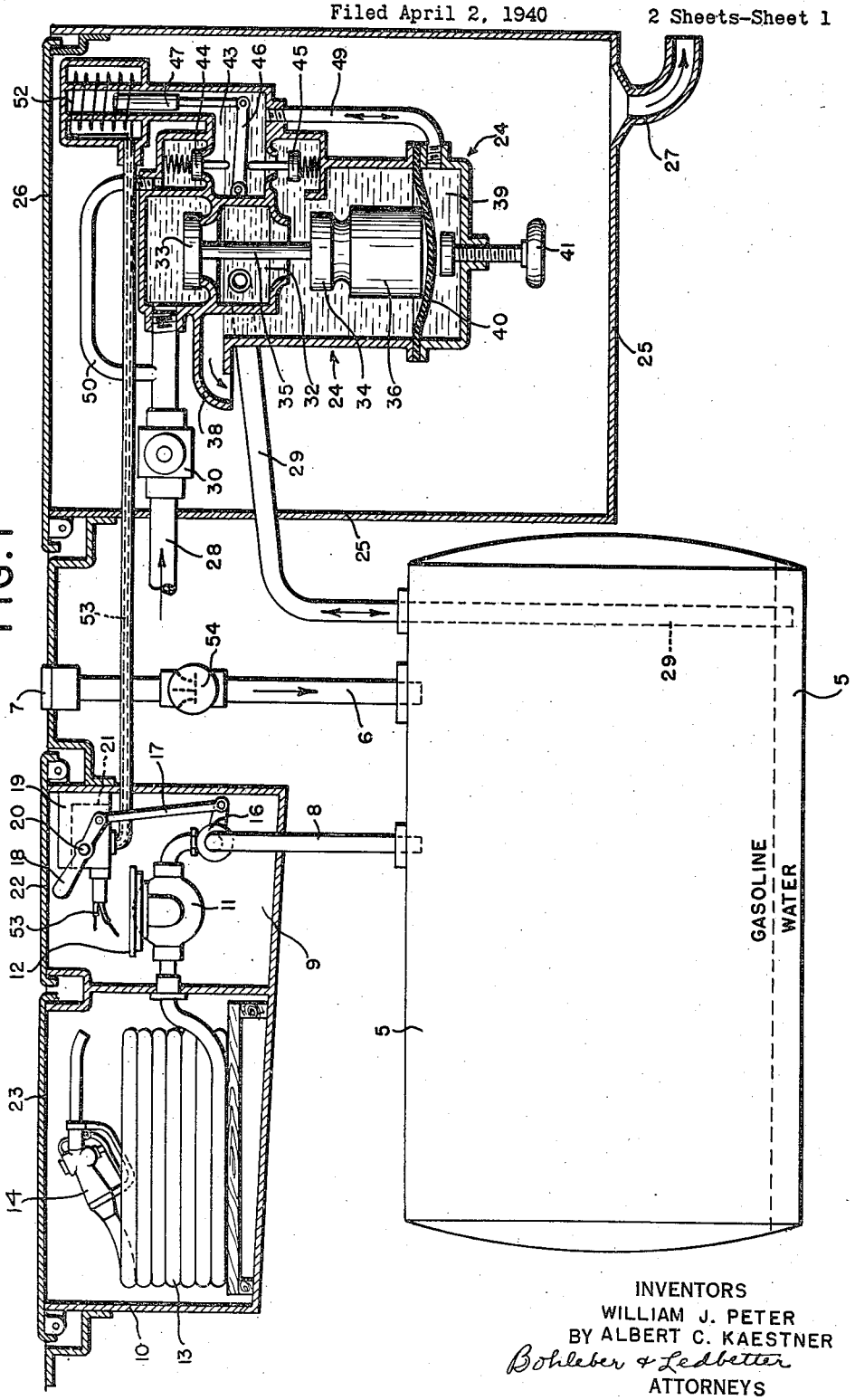
WILLIAM J. PETER.

April 27, 1943. W. J. PETER ET AL 2,317,800

HYDRAULIC STORAGE AND DISPENSING SYSTEM

Filed April 2, 1940 2 Sheets-Sheet 1

FIG. 1



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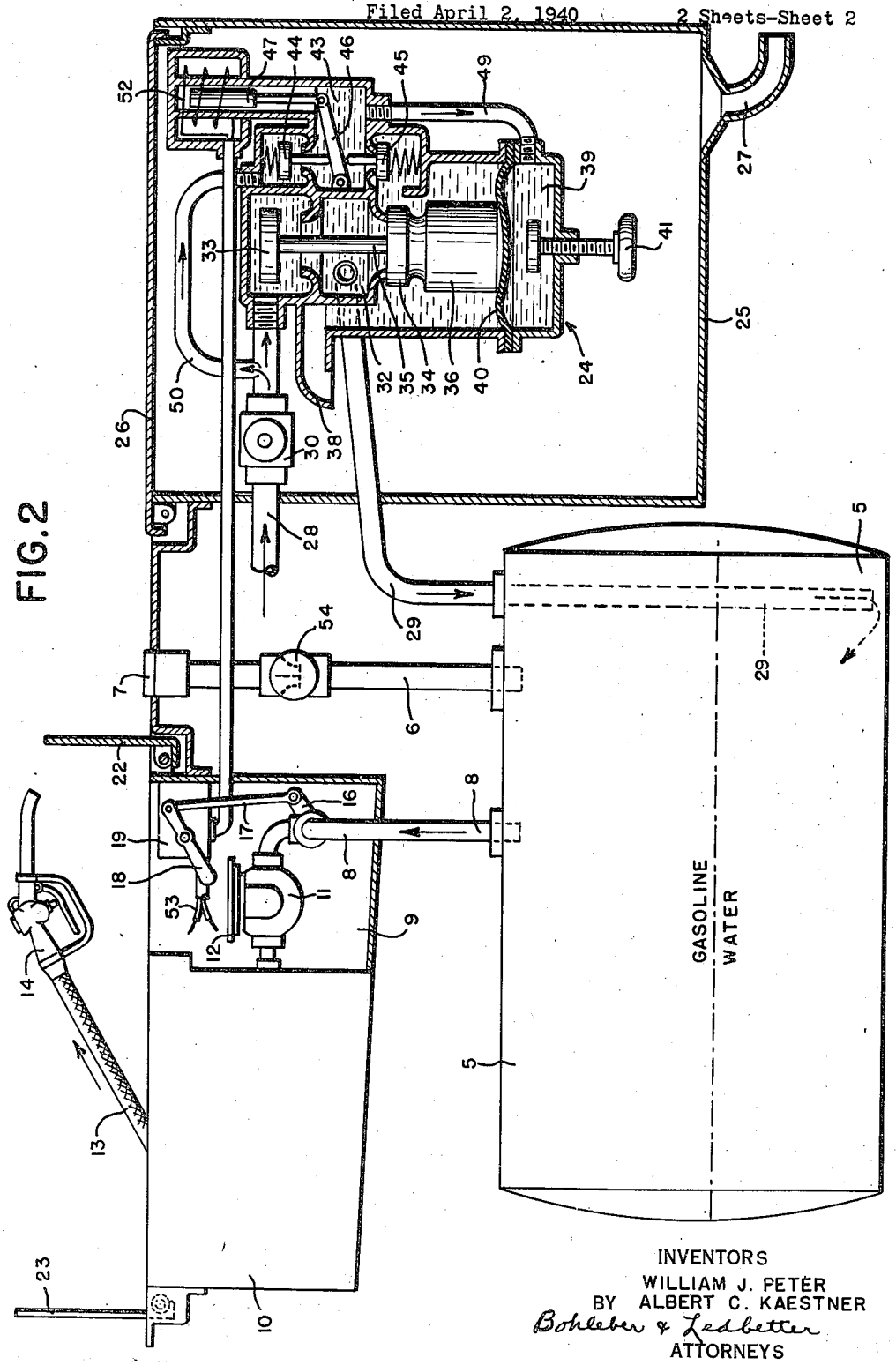
HYDRAULIC STORAGE AND DISPENSING SYSTEM

Filed April 2, 1940 2 Sheets-Sheet 2

FIG. 2



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Patented Apr. 27, 1943 2,317,800

UNITED STATES PATENT OFFICE

2,317,800

HYDRAULIC STORAGE AND DISPENSING SYSTEM

William J. Peter, New York, and Albert C. Kaestner, Crestwood, N. Y., assignors to Aqua Systems Incorporated, New York, N. Y., a corporation of New York

Application April 2, 1940, Serial No. 327,388

11 Claims. (Cl. 221—67)

This invention relates to liquid-handling systems for motor-fuel, gasoline, oil and other liquids lighter than water and immiscible therewith; and more particularly the invention relates to a new and improved hydraulic storage and dispensing system for storing and dispensing gasoline and the like.

Our combination storage-delivery system is useful in connection with fueling automotive vehicles, airplanes, and motor boats, etc., thus serving garages, parking buildings, service stations and airports; and the system is particularly efficient where the standards of service and quality of motor-fuels are high as regards the furnishing of pure gasoline unimpaired by reason of its period of storage or the addition of new gasoline from time to time to that previously left over in storage.

Consequently, this invention and the apparatus or system thereof is especially useful and recommended for airports and the like where it is desirable to store and preserve quantities of motor-fuel and quickly service the aircraft by dispensing pure gasoline to their fuel tanks. The invention especially lends itself to underground storage-dispensing systems and therefore is well suited to airports, as well as garage buildings, for storing a large amount of fuel or other liquid and dispensing it in metered quantities from a plurality of service stations distantly located from a storage tank.

The immiscibility of water and the lighter weight gasoline is availed of in practicing this invention, and we employ the water flotation principle not only for storing the gasoline free from contact with the atmospherc but for dispensing it, that is, displacing the gasoline by water power from the place of storage into the fuel tanks of the airplane or other vehicle being fueled.

An object of the invention is to produce improvements in a hydraulic storage and delivery system, comprising a new combination in a water-flotation or displacement means, for dispensing gasoline which is maintained or stored in a sealed condition entirely free from and against contact with the atmosphere, thus preventing evaporation of the stored gasoline or other volatile liquids. In this connection, the stored volatile liquid remains in storage floating on water and entirely free from contact with the atmosphere because all the air is not only expelled when the storage system receives gasoline but thereafter remains excluded, and the system is sealed from the outer atmosphere as well. Thus, the stored gasoline is neither in contact with the air inside the system nor the atmosphere outside thereof.

A further object is to produce improvements in a new combination hydraulic storage and delivery system which dispenses gasoline by the use of (*a*) water power or water pressure as the dispensing or propelling agent or force, together with (*b*) control means for utilizing the same water power in initially effecting the operation of a new master-control valve, which in turn controls the flow of said water employed for displacement of the gasoline and hence the dispensing thereof from a storage tank out through one or more remotely located meter dispensing stands or stations. Consequently, this invention renders it possible to employ the same source of water power for the control of the apparatus as is used for the actual dispensing force.

As regards the aforementioned master-control valve means per se, a further important object is to produce improvements in a water-operated hydraulic valve means for controlling the flow of water to and from a storage tank for effecting the sealed storage of gasoline and the dispensing thereof through a meter and hose line at one or more dispensing stations remotely located for fueling automotive vehicles and the like, the valve means being operated from the same water-power source as is used to perform the storage and dispensing operations, and being further characterized by freedom from by-passing and pressure-relieving devices.

A further important object is to produce a hydraulic storage and dispensing system having a storage tank for gasoline and the like, with one or more meter dispensing stations remotely located therefrom, together with remote manual-control means at said stations for not only applying and relieving the water pressure within the storage tank for starting and stopping the dispensing operations, but also for permitting the water within the tank to automatically discharge therefrom upon an increase of volume of the gasoline.

A further object is to produce a hydraulic dispensing system wherein the filling of the storage tank means with gasoline can be carried on conjointly with the dispensing of gasoline from said tank means. This is accomplished by employing the aforementioned master-control valve for performing the object in question by which, if the tank means is being filled by one attendant and some other attendant starts a dispensing operation, the said filling operation is automatically

suspended during said dispensing operation, and when the latter stops the former automatically resumes without any attention to the system from either of the attendants.

The accompanying drawings show the underlying principles of this new combination, and in particular show the new part or parts thereof including the water-actuated master-control valve which performs new functions in the combination. And certain other features and parts (ordinarily constituting a part of the commercial form of our hydraulic system but not actually required herein to disclose the fundamentals of the present invention) are omitted for clarity so as to simplify the description of the new features and their related functions.

With the foregoing and other objects in view, there is shown and explained one example of the invention (herein presented in its simpler form with a minimum number of parts for clarity), it being understood that changes may be made without departing from the principle of the invention which is susceptible of embodiment in forms of construction and operation other than here shown in a diagrammatic way in the accompanying drawings, wherein:

Figure 1 is a side view in longitudinal section of the combined hydraulic storage and dispensing system, showing its underground storage tank (in elevation) with the control and dispensing apparatus placed thereabove and also underground. The new hydraulically-operated master-control valve, as an element of and making a new combination, is enlarged somewhat beyond its natural size and comparative scale with other parts for the purpose of this description. This view shows the storage and dispensing system at rest, that is, not dispensing.

Figure 2 shows a view similar to Figure 1, except that the system is in a state of dispensing the stored liquid, such as gasoline, that is, the apparatus is under dispensing pressure; and it will be noted that the storage tank contains more water and less gasoline than in Figure 1, due to dispensing operations already performed by the apparatus, the dispensing hose of which is about to be returned to its underground storage compartment.

The stored "gasoline" or oil floats on top of the displacement "water," as indicated by these legends (Figures 1 and 2) printed on the storage tank means. The dotted horizontal liquid line between the legends designates the upper surface of the water and the lower surface of the lighter weight gasoline floating thereon. The system (its tank) is always full of the two liquids employed (gasoline and water) as a result of which no free or empty space occurs in the one or more storage tank or tanks employed in this system; consequently all air is excluded therefrom and evaporation is precluded.

Referring now to the drawings for a further description of the illustrated example of the invention, a conventional underground storage tank means 5 is shown; it is usually of large capacity and from it the gasoline or other liquid immiscible with water is adapted to be dispensed from time to time in small metered quantities. A fill pipe line 6 extends downwardly from the surface or ground line and into the top wall of the tank where it is sealed therein, that is, it has an air-tight screw connection with the tank, as in the case of all piping and other parts. A removable fill cap 7 closes the fill pipe 6 at the ground surface. This pipe 6 is used for the purpose of filling the storage tank 5 with gasoline or other liquid to be stored and thereafter dispensed to automotive vehicles, airplanes and the like. While one storage tank is shown in this example of the invention, several tanks are frequently employed in a large installation.

A dispensing pipe line 8 leads upwardly from the inside uppermost wall portion of the gasoline storage tank 5 and into a housing or fueling-pit box comprising a meter and switch compartment 9, together with an adjacent dispensing-hose compartment 10. The pipe 8 conveys the dispensed gasoline by leading it through a meter 11 having a dial or other visible indicator 12 and then connects with a flexible dispensing hose 13 protected in the pit box compartment 10 when not in use. A conventional dispensing-nozzle valve 14 is carried on the free end of the hose 13 in the usual way and remains normally closed by known spring loading means when not in use to seal the gasoline in the hose between dispensing operations. The dispensing valve 14 is opened manually by the operator, after its nozzle is inserted in the fuel tank to be filled, and gasoline is then automatically dispensed from the tank 5 through the hose.

A shut-off valve 16 is included in the dispensing pipe 8 on the inlet side of the meter 11 and has an operating link 17 extending upwardly therefrom. A manually-operable valve and switch control handle 18 is pivotally mounted on a switch box 19 having a switch-operating shaft 20 journalled therein. The handle 18 is fixed on the switch shaft 20 and is operatively connected with the upper end of the link 17. The box 19 encloses any suitable form of electric switch 21, shown in dotted lines Figure 1, and operated by the shaft 20 for controlling an electrical circuit for purposes later explained. The control handle 18, therefore, is interlocked with the switch 21 and the shut-off valve 16 so as to simultaneously control the opening and closing of the valve and switch. Consequently, when the valve 16 is open the switch 21 is closed and vice versa. This device comprising the switch-and-lever means 18, 21 is a remote control for the entire system, the importance of which will be more fully understood after presenting the entire description of the invention.

The meter and switch compartment 9 is covered by a lid 22, and the hose compartment 10 is similarly covered by a lid 23, both of which are preferably hinged to stand up, as shown in Figure 2. The two hinged lids provide a quickly accessible cover means for the hose and meter compartments of the fueling-pit box 9, 10 and are readily opened by tilting them upwardly when making ready for a dispensing operation. The fueling-pit box covers 22 and 23 form a flush surface with the ground line so as to be completely out of the way of vehicle wheels passing thereover.

The fueling-pit box 9, 10 constitutes a meter dispensing station and any number may be fed from the one or more storage tanks 5 of the system. In the case of garage buildings and the like, other than for air ports, a different form of metered dispensing station is employed, say a curb-pump stand or a wall panel, as will be understood by those conversant with the art. The pit-box dispensing station 9, 10 shown herein is by way of example as being similar to the type which is generally used at airports.

We now come to a description of the improvements in the new hydraulically-operated master-

control valve, indicated generally at 24, which designates the housing or valve cage thereof. It is operated by water power, say the same water power as used for the power-dispensing operation; and thus our new valve means, for this and other reasons, modifies and coacts with the combination or system as a whole. This master-valve means 24 is enclosed within an underground box or compartment 25, covered by a hinged lid 26 flush with the ground line similar to the previously mentioned lids or covers 22 and 23, where this storage-dispensing system is installed underground as here shown. The master-valve compartment 25 has a water drain spillway discharge 27 adapted to be connected with a waste or sewer pipe (not shown) to convey water away from the apparatus to the city sewer main, or other waste disposal, after the water has been used in connection with storing the gasoline in the tank 5, dispensing it therefrom, and operating the master-valve means 24.

A water-power supply or feed pipe 28 leads from any suitable source (not shown) of water having a sufficient head or pressure to dispense the gasoline through the lines 8 and 13. This pipe connects with the upper end of the master-control valve means 24; and the water flows in one direction only through this pipe 28 as shown by its arrow, namely, into the master valve 24. Sometimes in making an installation of this system, the water-power pipe 28 is connected to a tower water-supply tank as the power source for dispensing gasoline, while at other times the pipe 28 may be connected with the city water main as the power source.

A combination water inlet and outlet or tank pipe 29 is pitched to lead and drain downwardly from the water-control master-valve 24 through the top of the tank 5 where it is sealed therein and terminates near the inside bottom of the tank; and the water flows in both directions through this pipe 29, as shown by its arrow in Figure 1. Water flows into the bottom of the tank 5 for dispensing gasoline through the hose 13 and flows out through pipe 29 when filling the tank with gasoline through the fill pipe 6.

The water inlet and outlet pipe 29 preferably extends downwardly through the top of the tank 5 so as to have a portion of its length disposed within the tank, or it may enter the bottom of the tank, depending upon procedure and requirements of the particular installation being made at the time. Briefly, water under pressure flows from the feed pipe 28 into the upper portion of the master-control valve 24 and thence downwardly through the tank pipe 29 to the bottom of the tank 5, and the water thus admitted under the gasoline constitutes the propelling force for displacing the gasoline upwardly through the dispensing pipe 8 heretofore explained.

In some installations, a water pressure-reducing valve 30 is included in the water-power pipe 28 and located within the master-valve compartment 25 for the purpose of appropriately regulating the input power or pressure of the water received from some water-pressure source (not shown) to which the outer end of the feed pipe 28 is connected, as heretofore explained. The pressure-reducing valve 30 is convenient for cutting down the force or pressure of the water before it reaches the master-control valve 24, so as to regulate the apparatus to an appropriate dispensing pressure and velocity flow of gasoline from the nozzle valve 14 for rapid dispensing operations. A water-power head or pressure of 35 to 45 pounds, more or less, is usually employed, and the reducing valve 30 is adjusted accordingly.

A master-valve chamber 32 is formed within the upper portion of the valve housing 24 and below the top-enclosing wall thereof, and the tank pipe 29 connects with and opens into this valve chamber. It is seen that the water-power pipe 28 connects with the master-valve housing 24 above the valve chamber 32 in order to directly communicate therewith. A master inlet-valve head 33 normally closes the upper ported end of the valve chamber 32 when the apparatus is not dispensing (Figure 1); and also an exhaust or outlet master-valve head 34 remains normally open from the lower ported end of the valve chamber 32 when not dispensing. The inlet port (upper) and the outlet port (lower) of the valve chamber 32 is alternately opened and closed by the valve heads 33 and 34, respectively.

The movable master-valve heads 33 and 34 are connected by a common valve stem 35. A weight 36 is attached to the lower end of the outlet-valve head 34 to maintain it open in downwardly-limited position, and to keep the inlet-valve head 33 normally closed against the upper ported end of the valve chamber 32. Thus, when the system is not dispensing (Figure 1), the weight 36 acts on this master-valve mechanism to shut off communication between the valve chamber 32 and the water feed pipe 28. However, when dispensing (Figure 2), the master-inlet valve 33 is open and the outlet valve 34 is closed, so as to thereby connect the feed pipe 28 through the master-valve chamber 32 with the tank pipe 29.

A water spillway or open discharge port 38 opens the master-valve housing 24 into its underground compartment 25, so as to spill the waste water from the system and tank 5 by draining the water out through the sewer-drain connection 27 when filling the tank with gasoline, as later described. The spill port 38 has its outlet located above the entry of the tank pipe 29 in order to leave the valve housing 24 full of water at all times up to the level of said pipe. Likewise the pipe 29, pitched downwardly toward the tank, also remains filled with water during normal use of the system, since the spill port 38 thereabove cannot drain the water from said pipe. The water-filled valve housing 24 and pipe 29 provide a hermetically sealed elastic or yieldable closure against atmospheric communication between the tank 5 and outer air.

A diaphragm chamber 39 is formed within the lower end of the master-valve housing 24 by a flexible diaphragm 40 which has its perimeter sealed within the housing 24 as shown, or by other suitable means. This flexible diaphragm 40 is appropriately made or vulcanized of fabric and rubber composition or of any other suitable material such as leather or the like so as to provide a yielding center portion. The diaphragm is capable of deflection upwardly and downwardly for reversing the position of the master-valve means 33, 34 to set same to dispense (Figure 2) or cut-off and not dispense (Figure 1).

The depending valve weight 36 stands close to or may engage the diaphragm 40, although the latter does not sustain the weight of the member 36 when in down position. The weight must positively close the valve 33, and this closing function is assisted by the water pressure on top of the valve head 33. The weight 36 is sufficiently heavy to maintain the diaphragm 40 in its

normally-down position (Figure 1) when said diaphragm is not energized. When energized by water pressure admitted into the lower chamber 39, the diaphragm 40 moves upwardly (Figure 2) and lifts the weight 36 and valve means 35. It will now be seen that the comhbination of the weight 36 and diaphragm 40 constitute power means for operating the main water-control valve 35.

A hand screw 41 is carried in the bottom of the valve housing 24 for occasional manual use by an operator or service man should it become necessary to run the valve stem 35 upwardly to shut the outlet valve 34 and open the inlet valve 33 in connection with examining or servicing the system or valve apparatus in the event water power is not available for doing so, or in the event of other need. The operator can reach the hand screw 41 from the upper open top of the compartment 25 and screw the diaphragm 40 upwardly should the automatic water control of the master-valve fail and adjustment thereof be required, when the water flow is shut-off in the feed pipe 28.

A relay or pilot-valve chamber 43 is formed within the housing of the master-control valve means 24 for the purpose of automatically controlling the operation of the diaphragm 40. A relay or pilot-inlet valve 44 normally closes an upper inlet port leading from the water-power pipe 28 down into the relay-valve chamber 43; and a relay or pilot-inlet valve 45 normally opens an outlet port in the bottom of the valve chamber 43. Each relay valve 44 and 45 is spring loaded with a suitable coil spring of about equal compression adapted to alternately open and close each valve.

The relay valve heads 44 and 45 have stems projecting into the valve chamber 43 in axial alignment and terminating with an operating space remaining therebetween. A relay-valve operating arm 46 has its inner end carried on a stationary pivot, as for example on the outer cylindrical wall of the master-valve chamber 32, and is disposed between the adjacently spaced ends of the two valve stems and in close operative engagement therewith. The outer free end of the lever arm 46 is pivotally connected with a solenoid plunger 47 for swinging the arm on its pivot and changing the setting of the relay-valve means 44, 45 from dispensing (Figure 2) to non-dispensing (Figure 1) position.

A small water inlet and outlet or diaphragm pipe 49 connects the relay-valve chamber 43 with the diaphragm chamber 39, and water under pressure runs through this pipe to and from the diaphragm chamber as indicated (Figure 1) by the arrow. A relay or small water-feed pipe 50 connects the main water-power pipe 28 with the relay-inlet valve 44 so as to flood the relay-valve chamber 43 with water under pressure when the valve 44 is opened and the outlet valve 45 is closed. This secondary water-feed pipe 50 is usually connected with the primary water-feed pipe 28 between the pressure-reducing valve 30 and the master valve 24, although this position is not essential. Water under pressure from the feed pipe 28 flows through the relay pipe 50, thence through the relay-valve chamber 43, downwardly through the pipe 49, and into the diaphragm chamber 39. This operation energizes the diaphragm 40 and deflects it upwardly (Figure 2), thereby lifting the weight-loaded master-valve means 35 by which to close the outlet 34 and open the inlet 33.

The aforementioned solenoid plunger 47 is actuated up and down in a suitable guide by an electro-magnet or solenoid coil 52. Electrical circuit wires 53 are connected with a source of electrical current in any known way, extended through the switch box 19 where the switch 21 is connected therein, and the wiring is connected with the solenoid 52. This control circuit 53, for the master-valve means 24, is carried in a conduit in the usual way extending from the fueling-pit box 9, 10 to the solenoid 52 in the compartment 25.

According to the foregoing, it is seen that the master valve means 24 comprises a main water-power control-valve means 33, 34 of large size for starting and stopping the oil or gasoline dispensing operations, in combination with a relay or pilot-valve means 44, 45 of smaller size for operating said main water-control valve; and water pressure constitutes the power means for this plural-valve arrangement. Double acting poppet valves 33 and 34 as well as 44 and 45 are shown, but other types of movable valve elements may be employed instead thereof. The same water-power source can be availed of for both functions, that is, for dispensing and for operating the water-control valve. This combination valve means is rugged and dependable in operation and its employment evolves a new combination hydraulic storage and dispensing system.

A description of the operation and use of this hydraulic storage and dispensing system will now be given. Reference is first made to the manner of filling the tank 5 with gasoline and dispensing it therefrom, together with an explanation of other facts and conditions characterizing this invention in general.

When a storage and dispensing system of this character is first installed, the gasoline-storage tank 5 is initially filled with water, and this water-filling operation usually takes place after the tank 5 is properly located in the ground. The tank being filled with water in any convenient manner, the master valve 25 and its connections are also completed, whereupon the diaphragm chamber 39 is initially filled with water under pressure and thereafter always remains filled.

Under water pressure, the diaphragm 40 bulges upwardly which reverses the setting of the master-valve means 33, 34 from non-dispensing (Figure 1) to dispensing (Figure 2) position. The water pipes 28 and 29 are now in direct communication, and the tank 5 can be completely filled with water which is an operation initially to be performed prior to the first filling of said tank with gasoline. All the air is now excluded from the tank 5 and storage system. Having first filled the tank with water, through the convenient expedient of the master-control valve, the fueling-pit box 9, 10 installation now may be completed. Then the control handle 18 and shut-off valve 16 are set to non-dispensing (Figure 1) position which shuts off the water-feed pipe 28 and opens the tank pipe 29 to the water spill port 38 and waste drain 27, although no water as yet runs from pipe 29.

The hose of a gasoline tank car or delivery truck (not shown) is now attached to the fill pipe 6 and the gasoline usually runs by gravity into the tank 5, thus driving or discharging the water outwardly through pipe 29, thence through the spill port 38, and out through the water drain 27 to the sewer. This gasoline filling and water discharge operation continues until the water level recedes to a predetermined low point (Fig-

ure 1) in the tank 5, thus completely filling it with stored gasoline. A little water always remains in the bottom of the tank to cover the lower extremity of the tank pipe 29 thereby acting as a water seal against the atmosphere which prevents all atmospheric contact with the gasoline.

To now dispense the gasoline, at any one or more dispensing stations 9, 10, the control handle 18 is pushed downwardly (Figure 2) to set the master-valve means 33, 34 for the dispensing operation and to open the gasoline shut-off valve 16 at the meter 11. Water under pressure from the feed pipe 28 is now applied to the bottom of the tank 5 under the gasoline thereby placing it under dispensing pressure through the meter 11 and into the hose 13. The hose is withdrawn from its compartment 10, as seen in Figure 2, and the nozzle 14 thereof is introduced into the vehicle tank to be fueled. The operator opens the nozzle valve 14 and dispenses gasoline into the fuel tank until the desired amount is indicated on the meter dial 12, whereupon he releases the handle of the dispensing nozzle and it snaps closed, thus stopping the dispensing flow.

When the operator completes a dispensing operation he returns the hose 13 to its compartment and pulls the remote-control handle 18 (Figure 1) upwardly. That manual operation acts to close the gasoline shut-off valve 16, de-energizes the solenoid 52, closes the relay inlet valve 44 and opens relay outlet valve 45, whereupon the master-valve weight 36 gravitates downwardly thereby forcing the water from the diaphragm chamber 39 out through pipe 49, through the outlet relay 45, and thence through drain or spill port 38 along with the volume flow of waste water coming from tank 5. This operation closes the master-inlet valve 33 and opens the outlet 44 which relieves the system of dispensing pressure. Consequently, the tank 5 is not under operating pressure when not dispensing, but the tank and system remain completely full of the two immiscible liquids (gasoline and water) irrespective of their relative proportions which prevents atmospheric contact with the stored gasoline and hence prevents evaporation.

The temperature variation of the two liquids (gasoline and water) in the tank 5 is not appreciable, except seasonably, due to the fact that the tank is buried in the ground. Such temperature variation as may occur causes some contraction and expansion of the liquids in the tank. For example, a rise in temperature may cause the two liquids, particularly the gasoline, to expand in the tank, in the event of which a corresponding volume of water is forced from the bottom of the tank out through pipe 29 and from the master-valve water drain 38 to the waste line 27. This compensation at normal atmospheric pressure takes place by reason of the master-valve outlet 34 remaining normally open when the system is not dispensing.

On the other hand, a drop in temperature causes a shrinkage or contraction of volume of the two liquids in the tank 5, particularly the gasoline. It then follows that an equal volume of water in the pipe 29 flows into the tank thereby maintaining it full. Inasmuch as the tank pipe 29 is comparatively long and usually from two and one-half to four inches or of greater diameter in larger capacity installations for effective operation of this hydraulic system, the volume of water therein is adequate to compensate for contraction of the liquids in the tank 5 and keep it full to the top. Should the water in pipe 29 partially or completely drain into the tank to compensate for contraction of the liquid or liquids therein, it follows that the next dispensing operation will again leave the pipe full of water.

The immediate foregoing description makes it clear that the body of gasoline floating on water in the tank 5 is maintained at all times against the roof of the tank, which is to say that no air space or void exists in the tank. Since no air pocket exists in the tank, the stored gasoline does not have contact with air inside the tank, nor is there any outside communication with the atmosphere. Therefore, the gasoline is stored indefinitely without loss of strength commonly caused by evaporation prevalent in non-hydraulic storage and dispensing systems.

With all the foregoing description of the construction and mode of operation of this storage-dispensing system in mind, particularly filling and dispensing, we revert to the fill pipe line 6 for special mention of another feature of this invention having to do with the utility and characteristics of the master-control valve 24. It is noted that said fill pipe is equipped with a check valve 54. This check valve 54 closes upwardly against an upward force or attempted back flow of gasoline in the pipe 6, but it opens downwardly when filling the tank 5 through the fill cap 7. The master-control valve 24, in combination with the check valve 54, possesses a new function which, among other things, renders the system as a whole new and advantageous over the prior art. The combination of the two valves 54 and 24 affords a new result by permitting conjoint filling of and dispensing from the tank means 5, that is, said dispensing and filling can be carried on without interference with each other, as will now be described.

It sometimes requires several hours to fill the large capacity tank or tanks 5 from a gasoline tank car on the railway siding. A hose line (not shown) is run from the tank car and connected with the fill pipe line 6 at fill cap 7, and the gasoline then flows by gravity from the tank car into the storage tank means 5. As the gasoline flows down past the check valve 54, the water under the gasoline is forced from the tank up through pipe 29 and out the lower end of valve chamber 32, thence through the spill port 38, and to the sewer through the water drain 27.

While the foregoing gasoline filling operation is in progress, dispensing may be initiated from any one or more of the fueling-pit stations 9, 10 without disconnecting the fill hose line at fill cap 7 from the tank car and without any attention whatsoever by the tank-car operator and also without attention from the dispensing operator working at the remotely located fueling station 9, 10. When the dispensing operator pushes the control lever 18 downwardly to start dispensing (Figure 2), it follows that the master-valve outlet 34 (previously open) automatically closes and its inlet 33 opens. Instantly, a greater head of water pressure from the water-power pipe 28 is applied within the bottom of the tank 5 than the head of gasoline filling pressure applied to the fill pipe 6 at the top of the tank. This differential pressure condition results in upwardly closing the fill-check valve 54 which automatically suspends the filling operation from the tank car hose attached at the fill cap 7.

Therefore, dispensing can now take place

through the dispensing hose 13 without any manual readjustment or change of any valve setting in the entire system. After the dispensing operator has completed the dispensing of gasoline (Figure 2) to an airplane or other vehicle he restores the remote-control lever 18 to its cut-off position (Figure 1), whereupon the filling of the tank 5 with gasoline through the check valve 54 is automatically resumed. This automatic resumption of filling is due to the fact that the water in the feed pipe 28 is again cut off and the master-valve outlet 34 is again open to the spillway 38, 27 so that the filling of gasoline through pipe 6 is resumed by forcing water from the tank 5, thereby making room for the gasoline coming from the tank car.

Now it is seen by reason of this invention that dispensing at a station 9, 10 (which at some airports or fields may be a mile or so from the storage tank) and filling at the fill cap 7 may automatically take place substantially simultaneously, that is, conjointly, without one operation interfering with the other. This automatic reverse-operating control is an advantage over prior systems and the operation thereof where it was necessary for the old system to have its valve controls manually set and reset by the operators to permit a gasoline dispensing operation from the storage tank during the necessary filling thereof. The gravity flow of gasoline or oil from a tank car on a railway siding to the tank 5 of this new dispensing system is expedited by reason of the coordinate action of the fill-check valve 54 and the new master-valve means 24.

The foregoing is accomplished by the remote-control means 18 which not only relieves the hydraulic pressure from the system but more particularly opens the master-outlet valve 34 so that the displacement water accumulated in the tank 5, due to oil or gasoline dispensing operations by water power or force, can at any time automatically discharge or spill to the sewer line 27 to either make room for additional stored gasoline entering the tank through the fill means 6, 54 or the expansion of the gasoline and/or water already in the tank.

Another important characteristic of this new system also relates to filling the tank or tanks 5 from barges and oil tankers at water level where filling can not be accomplished by gravity flow as in the above-described case of tank cars above the ground. It is sometimes necessary to run a hose line several thousand feet from a gasoline tanker in a harbor to the storage tanks at an air field. High pressure pumps on the tanker propel the gasoline through the hose line at considerable pressure, say upwardly of 100 pounds, which is much higher than the normal 30 or 40 pound water pressure from the water-feed pipe 28. Under this condition, with an inflow of gasoline through the check-fill pipe 6 at barge-pump pressure, it will be seen that the water temporarily and automatically stops flowing through the open water-control valve 33 (Figure 2) when the tank 5 is being filled from a barge. If a dispensing operator at a station or stations 9, 10 sets the remote control 18 to dispense (while the tank is being filled from a barge) it transpires that the dispensing operation ensues by reason of the pressure of gasoline flowing into the tank for storage purposes and not at all due to the water pressure from feed pipe 28.

Under the several foregoing conditions, the remote-dispensing station control manual 18, together with the fill check means 6, 54, and the master-control valve 24, operates in combination to produce a fool-proof oil-handling system of such improved character that filling of the underground storage tanks and dispensing therefrom are readily and conveniently accomplished.

The advantage of relieving the system of its dispensing pressure, at the end of every dispensing operation, is not to be overlooked. The open master-outlet valve 34, with the valve housing 24 full of water up to the spill port 38, leaves the tank 5 at normal-atmospheric pressure but nevertheless sealed against outside atmosphere entry to the tank 5. While a storage system for handling gasoline must not leak, nevertheless, should a leak develop somewhere in the piping or joints, it will be seen that this is not serious due to the fact that the system remains at ordinary atmospheric pressure at all times except during a dispensing operation. Where the water pressure is merely stopped (but not removed) as in former types of apparatus, a small leak may not only waste a large amount of gasoline but create a fire hazard. The invention aids in solving those problems by maintaining the tank 5 in balance with atmospheric pressure so as to avoid all tendency to breathe.

The capacity of the large valve housing 24 not only provides water-covered or immersed valve means 33, 34 constantly open to atmosphere through its water spill port 38 when not dispensing, but also provides a water-chamber means of sufficient volume always to form a yieldable hydraulic cushion-like seal between the gasoline tank 5 and the open spillways 38 and 27. Thus it is that air cannot enter through the open water spill port 38 and into the pipe 29 or tank 5. Also, since the water seal trapped in chamber 24, between the sealed tank and unsealed spill port 38, always remains in balance at atmospheric pressure, it follows that the two liquids in the tank (water and gasoline) are likewise at atmospheric pressure and the tank is completely full of liquids to its roof, thereby inhibiting air space or air pockets. This condition prevents the tank from tending to breathe, that is, prevents the drawing of air into the system in the event of a negative pressure developing therein and also prevents the forcing of liquid outwardly in the event of positive pressure developing therein.

Thus, the gasoline is stored at atmospheric pressure but without atmospheric contact irrespective of all variables such as the change in quantity of gasoline due to dispensing or filling operations, or due to liquid expansion or contraction arising from temperature variations, all coupled with the fact that the hydraulic elastic water seal chamber 24 instantly restores the system to atmospheric pressure at the end of each dispensed operation. This water chamber is always filled and remains full of water by reason of trapping water from the piping system each time water flows in either direction through the tank pipe 29 in connection with either dispensing the immiscible liquid or filling the tank with such liquid.

It will be seen that the master water-control valve 24 essentially comprises a pair of water-power valves 33 and 34 and a pair of water-relay valves 44 and 45. This quadruple water-valve means is adequate for all purposes in the system. In other words, we have designed and constructed a valve apparatus characterized by

the four valves in question (33, 34, 44 and 45) which performs all these functions without the necessity of including a fifth and sixth valve-and-port means for by-passing and pressure-relieving functions, the latter being inherent in the four valve means.

Incidentally, other inventive features useful in connection with our storage and dispensing system have been omitted as they are covered in certain of our other patents. For example, a hydraulic system of preferred commercial form, embodying the present invention, includes an interlock control between the lid means 22 of the fueling-pit box 9, 10 and the manual control 18 so as to merely require the fueling-pit box lid to be closed to automatically open the switch 21 and close the shut-off valve 16, thereby rendering the system entirely safe and less dependent upon the operator.

Also, our hydraulic system of preferred commercial form includes a further control operated by a differential-float means within the storage tank 5 for the purpose of automatically shutting off the gasoline-filling operation, hence the stopping of the out-flow of water through the tank pipe 29, when the gasoline filling operation approaches the end and the water level has receded to a predetermined low position in the tank (Figure 1). Likewise, the commercial form of the apparatus employs a float-control within the tank to automatically shut off the dispensing flow of gasoline through the pipe line 8, thereby preventing water from entering said dispensing line, when the water level rises upwardly to a position near the top of the tank due to the gasoline in storage reaching a minimum predetermined volume floating on a maximum volume of water. These and other features which are actually employed in our commercial hydraulic system are covered elsewhere, and hence are omitted from this disclosure for the purpose of clarity.

It will be seen that a hydraulic storage and dispensing system of this character is noiseless in operation because it is entirely free of motor-driven pumping apparatus and other like mechanical equipment. The dispensed gasoline is clear and clean; and it is entirely free of any metallic particles or sediment which may come from motor-driven dispensing pumps. Likewise the stored gasoline is free of air and is of original freshness and strength irrespective of the time period of storage. Note also that the dispensed gasoline is water-free because if there is any water in the gasoline when it is initially stored in the tank 5, the water content precipitates from the gasoline to the bottom of the tank and merely adds to the volume of displacement water on which the gasoline is stored.

This invention is presented to fill a need for improvements in a hydraulic storage and dispensing system. It is understood that various modifications in structure, as well as changes in mode of operation, assembly, and manner of use, may and often do occur to those skilled in the art, especially after benefiting from the teachings of an invention. Hence, it will be understood that this disclosure is illustrative of preferred means of embodying the invention in useful form by explaining the construction, operation and advantages thereof.

What is claimed is:

1. A valve for water control, comprising a housing having a pipe connection, a master-valve chamber in the housing also having a pipe connection but located below the first pipe connection, an inlet valve head arranged to normally close the first pipe connection, an outlet valve head arranged to normally open the second pipe connection; whereby water flow is permitted in one direction only through the first pipe connection namely into the valve housing, but in both directions in the second pipe connection; a drain port opening outwardly from the valve housing above the second pipe connection, diaphragm-and-weight means associated with the inlet and outlet valve heads to shift the positions of the latter, a relay-valve chamber in the housing and a water passage therefrom to a diaphragm chamber formed in the housing below the diaphragm-and-weight means, and valve means in the relay-valve chamber for controlling the flow of water through the passage.

2. A hydraulic storage and dispensing system for gasoline and the like comprising, in combination, a storage tank adapted to be filled with gasoline or the like floating on water, suitable meter dispensing station means connected with the tank for dispensing the stored gasoline therefrom, a water-feed pipe entering the tank to admit water to the bottom thereof under pressure to force gasoline to the dispensing station; master-valve means included in the water-feed pipe to start and stop the flow of water to the tank, and hence the gasoline to the dispensing station, also to discharge water from the tank when filling the latter with gasoline, as well as leaving the tank free of dispensing pressure when the system is at rest, and also capable of taking in or discharging an amount of water equal in volume to the natural contraction or expansion of the combined gasoline and water in the tank when the system is at rest; and water-operated means associated with the master-valve means for operating the latter by water power to start and stop the dispensing operation and also to discharge water from the tank, whereby water-power is employed not only to perform the gasoline dispensing operation but likewise to actuate the master-valve means to control said gasoline dispensing operation as well as control the discharge of water from the storage tank when filling the latter with gasoline.

3. Valve apparatus for use in connection with hydraulic storage and dispensing systems for handling gasoline and the like, wherein a water-feed pipe connects with a storage tank and also with the valve apparatus, so that water power is used for the purpose of the dispensing operation as well as the control of said valve apparatus; comprising a master-valve means adapted to be included in the water-feed pipe and having inlet and outlet ports for controlling the flow of the water to the storage tank for dispensing gasoline therefrom, a water discharge port included in the master-valve means and located at a level between the inlet and outlet ports aforesaid by which to trap water in the valve apparatus to seal the same against the intake of air, water-power means for actuating the master valve means, and relay-valve means having small inlet and outlet ports associated with the water-power means for controlling the operation of the latter.

4. Valve apparatus for use in connection with hydraulic storage and dispensing systems for handling gasoline and the like, wherein gasoline is stored on water within a tank, and wherein a water-feed pipe connects the tank with the valve apparatus, and wherein water power is used for the purpose of the dispensing operation as well

as the control of said valve apparatus; comprising, in combination, a master-valve means adapted to be included in the water-feed pipe with an inlet port for controlling the flow of the water to the storage tank for dispensing gasoline therefrom and an outlet port for controlling the flow of water from said tank while filling it with gasoline, an open spillway included in the master-valve means and located at a level between the inlet and outlet ports aforesaid by which to trap water in the valve apparatus to seal the same against the intake of air, water-power means for actuating the master-valve means, relay-valve means having small inlet and outlet ports associated with the water-power means for controlling the operation of the latter, and a water jacket surrounding the master-valve means up to and in open communication with the spillway, the trapped water aforesaid covering the outlet port and acting as a cushion-like hydraulic seal to maintain the gasoline and water in the tank under atmospheric balance.

5. Valve apparatus for use in connection with hydraulic storage and dispensing systems for handling gasoline and the like, wherein gasoline is stored on water within a tank, and wherein a water-feed pipe connects the tank with the valve apparatus, and wherein water power is used for the purpose of the dispensing operation as well as the control of said valve apparatus; comprising, in combination, a master-valve means adapted to be included in the water-feed pipe and having inlet and outlet ports for controlling the flow of the water to the storage tank for dispensing gasoline therefrom and for discharging water while filling said tank, an open spillway included in the master-valve means and located at a level above the outlet port, water-power means for actuating the master-valve means, relay-valve means having small inlet and outlet ports associated with the water-power means for controlling the operation of the latter, and a water jacket surrounding the outlet ports of both the master valve and the relay valve, said jacket being refilled with water at each gasoline dispensing and tank-filling operation, whereby the tank is sealed by a hydraulic cushion-like body of water which maintains the tank at atmospheric pressure.

6. Valve apparatus for use in connection with hydraulic storage and dispensing systems for handling gasoline and the like, in which gasoline is stored on water within a tank, and a water pipe connecting the tank with the valve apparatus, and wherein water power is used for the purpose of dispensing the gasoline by displacement as well as for the control of said valve apparatus; comprising, in combination, a master-valve means adapted to be included in the water pipe and having inlet and outlet ports for controlling the flow of the water to and from the storage tank, a water jacket surrounding the valve apparatus, an open spillway communicating the water jacket to atmosphere and being located at a level above the outlet port by which to trap water in the valve apparatus to seal the same against the intake of air, water-power means for actuating the master-valve means, and relay-valve means having inlet and outlet ports associated with the water-power means for controlling the operation of the latter.

7. Valve apparatus for use in connection with hydraulic storage and dispensing systems for handling gasoline and the like, in which gasoline is stored on water within a tank, and a water pipe connecting the tank with the valve apparatus, and wherein water power is used for the purpose of the gasoline dispensing operation as well as the control of said valve apparatus; comprising, in combination, a master-valve means adapted to be included in the water pipe and having inlet and outlet ports for controlling the flow of the water to and from the storage tank, diaphragm-actuated means for controlling the master-valve means, relay-valve means having inlet and outlet ports associated with the diaphragm-actuated means, a water jacket enclosing all valve ports aforesaid, a spillway in the water jacket opening to atmosphere at a level above both of the outlet ports aforesaid, and said jacket being maintained full of water received from the water pipe for maintaining an atmospheric balance of the water and gasoline in the tank.

8. A hydraulic storage and dispensing system for gasoline and the like comprising, in combination, a storage tank adapted to be filled with gasoline or the like floating on water, meter-dispensing station means connected with the tank for dispensing the stored gasoline therefrom, a water pipe entering the tank to admit water to the bottom thereof under pressure to force gasoline to the dispensing station; master-valve means included in the water pipe to start and stop the flow of water to the tank, and hence the gasoline to the dispensing station, also to discharge water from the tank while filling the latter with gasoline, and to leave the tank free of dispensing pressure when the system is at rest; water-operated means associated with the master-valve means for operating the latter by water power to start and stop the dispensing operation and also to discharge water from the tank, whereby water power is employed not only to perform the gasoline dispensing operation but likewise to actuate the master-valve means; and a water chamber surrounding the master-valve means and immersing the latter in water, the chamber being maintained full of water received from the water pipe, a spillway port located high in the water chamber and open to atmosphere, whereby water trapped in the chamber acts as a hydraulic cushion-like seal to exclude air from the storage tank while permitting water to move either to or from said tank after each dispensing operation by which to place the gasoline and water therein under atmospheric pressure.

9. Valve apparatus for use in connection with hydraulic storage and dispensing systems for handling gasoline and the like, wherein a water pipe connects with a storage tank and also with the valve apparatus, so that water power is used for the purpose of the dispensing operation as well as the control of said valve apparatus; comprising a master-valve means adapted to be included in the water pipe and having inlet and outlet ports for controlling the flow of the water to the storage tank for dispensing gasoline therefrom and also for discharging water from said tank while filling it with gasoline, an open water spill port included in the master valve means and located at a level above the valve outlet port by which to trap water in the valve apparatus to immerse said outlet port in water to seal it against the intake of air, water-power means for actuating the master-valve means, and relay-valve means having inlet and outlet ports associated with the water-power means for controlling its operation.

10. A hydraulic storage and dispensing sys-

tem comprising, in combination, a storage tank, dispensing-station means connected with the storage tank, a water-piping system connected with the bottom of the tank through which water under pressure flows thereinto and subsequently discharges therefrom to a water spillway; valve means included in the piping system, said valve means including an inlet port in communication with the piping leading to the tank which when opened directs the flow of water thereinto for dispensing a stored immiscible liquid therefrom, and also including a water-submerged outlet port in communication with the spillway which when opened discharges water from the tank while being filled with immiscible liquid and remaining open when not dispensing same, thus providing for a movement of water balanced by atmospheric pressure to and from the tank when not dispensing the immiscible liquid to compensate for a variation in the volume of the two liquids therein so as to maintain the tank completely full of said liquids irrespective of contraction and expansion thereof, and means for operating the valve means by which to close the outlet port when the inlet port is open and vice versa; and water-chamber means included in the piping system between the tank and the spillway and in communication with the valve means, said water-chamber means always being open to atmosphere through the spillway when not dispensing, and being maintained full of water received from said piping system to submerge the outlet port when the latter is open as aforesaid and to act as a cushion-like hydraulic seal for excluding the atmosphere from the aforesaid water-submerged outlet port, also for maintaining the liquids in the tank at atmospheric pressure when the outlet port is open, and for restoring the tank to atmospheric pressure after each dispensing operation.

11. A hydraulically operated master valve, adapted to be connected in a water pipe line leading to a gasoline storage tank for supplying water thereto and dispensing gasoline therefrom, comprising a valve housing having an inlet port and an outlet port with valve heads for alternately opening and closing said ports, a diaphragm chamber carried by the valve housing, a diaphragm mounted in the latter chamber and operatively connected with the valve heads to simultaneously open one port and close the other port, relay valve means as well as water passages connecting the pipe line with the diaphragm chamber and adapted to be manually controlled for controlling the operation of the diaphragm, in combination with water-chamber means also adapted to be connected in the water pipe line, a water passage leading from the diaphragm chamber to the water-chamber means, the water-chamber means being arranged in communication with the housing for supplying water to submerge the outlet port, and a spill port provided at the upper portion of the water-chamber means which is always open to atmosphere and said spill port being located above the outlet port of the valve, the water-chamber means being maintained full of water received from the water pipe line in which it and the valve housing are connected to submerge the open outlet port as aforesaid, also to act as a cushion-like hydraulic seal for excluding the atmosphere from the submerged outlet port, as well as to equalize the pressure on each side of the water-chamber means, and hence maintain an atmospheric-pressure balance on both sides of the submerged outlet port.

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FUEL HANDLING PIT BOX

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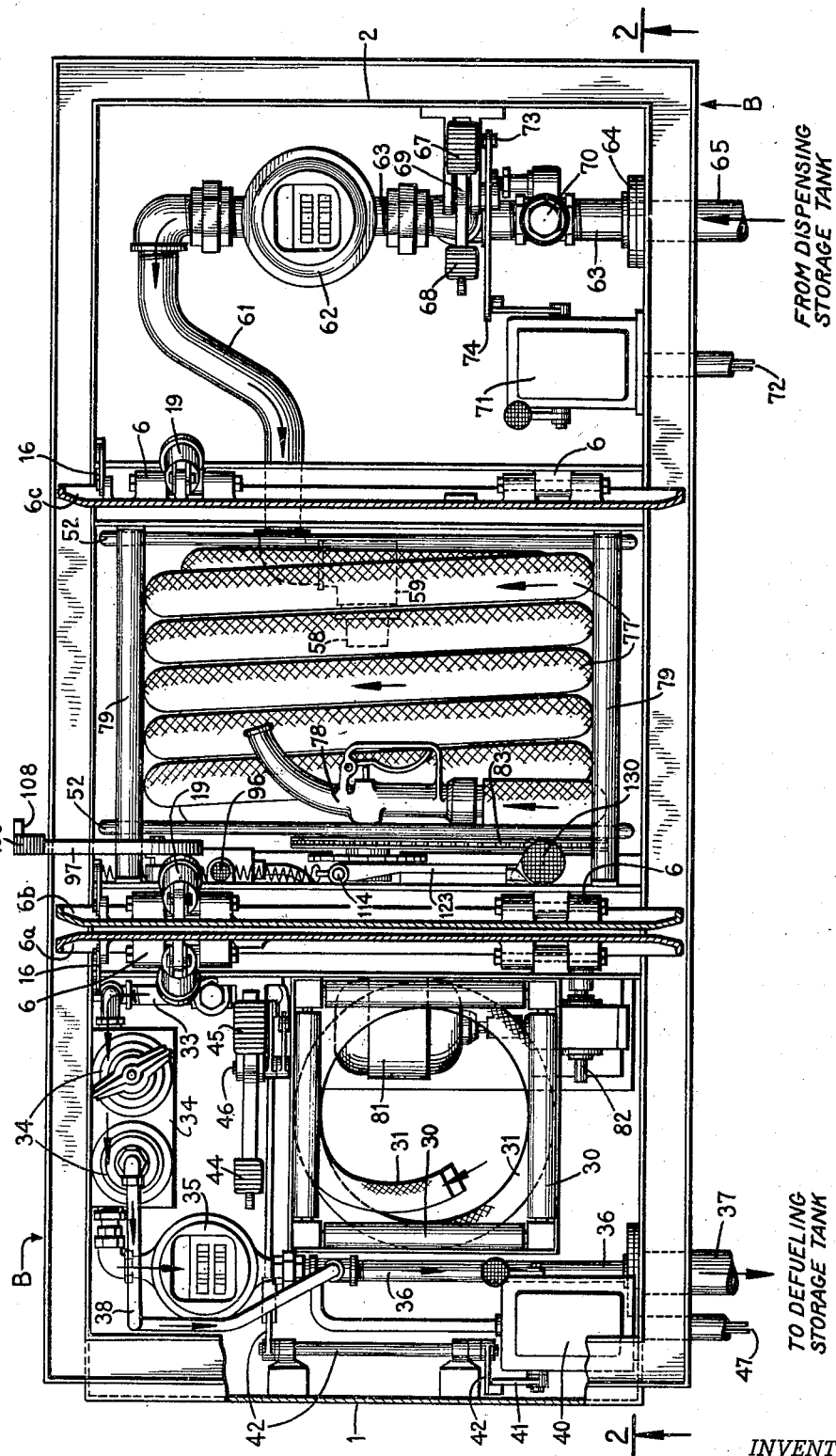
FIG. 1.



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FUEL HANDLING PIT BOX

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FIG.16.

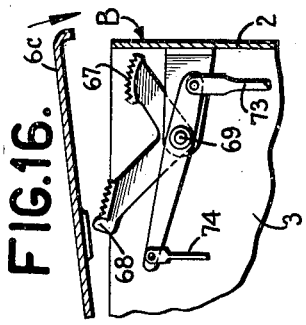

FIG.2.

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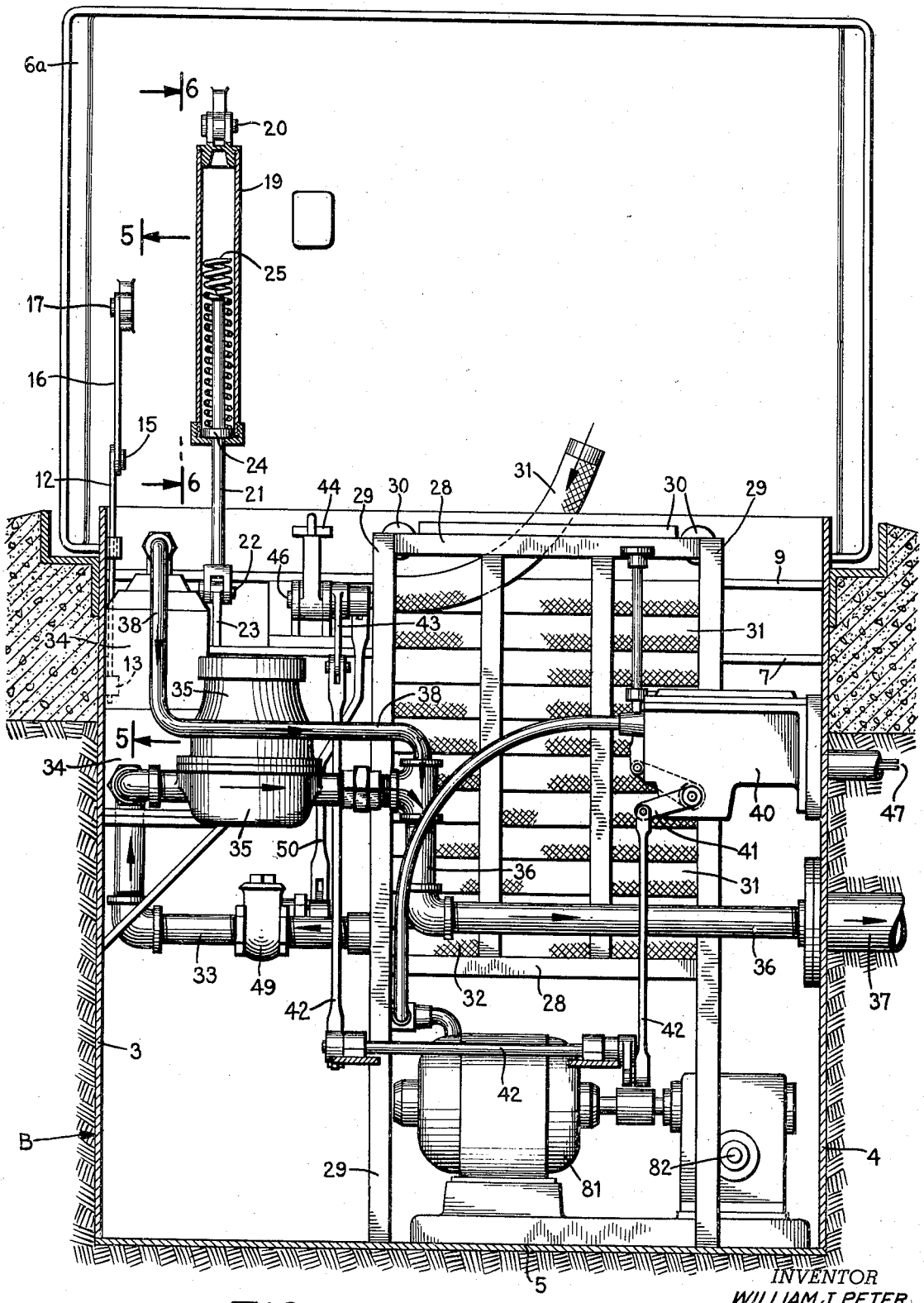

FIG. 3.

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FUEL HANDLING PIT BOX

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FIG. 4.

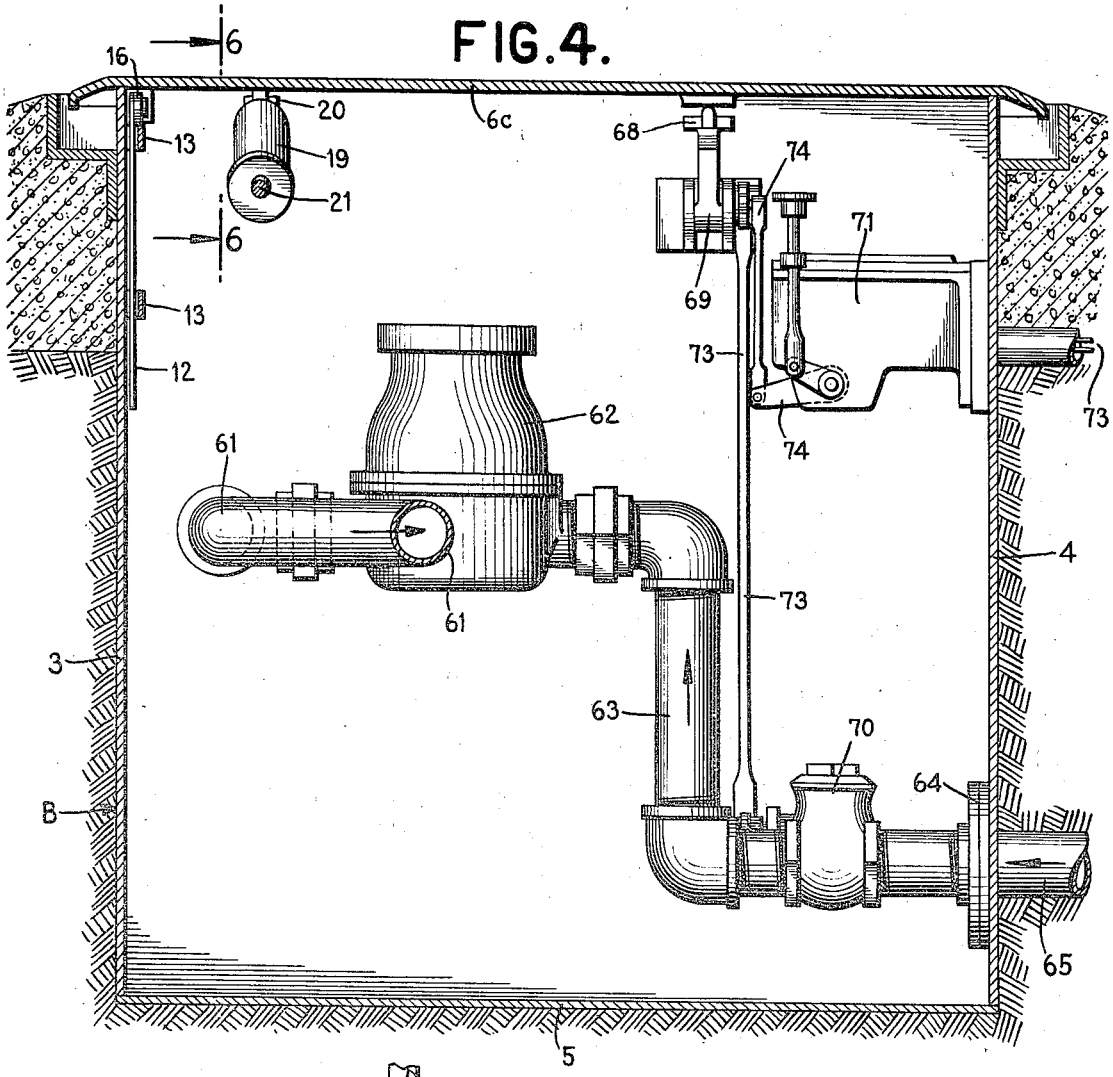

FIG. 5.

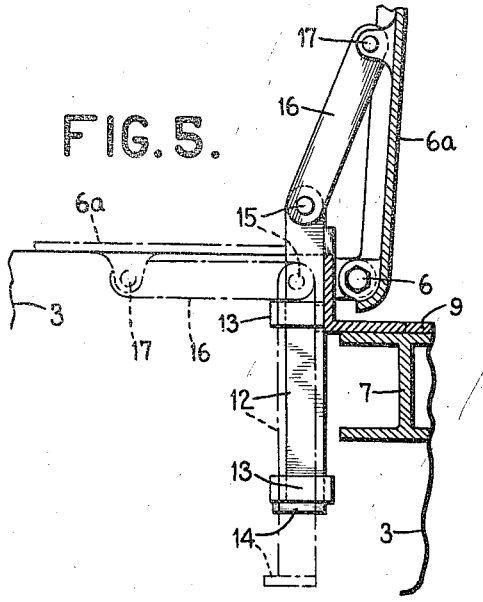

FIG. 6.

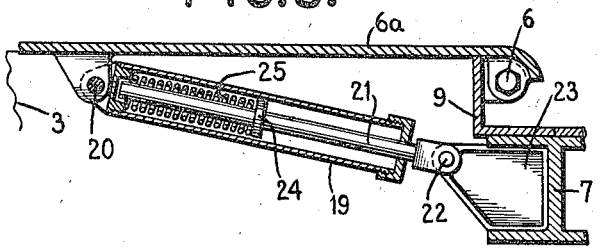

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FIG. 7.

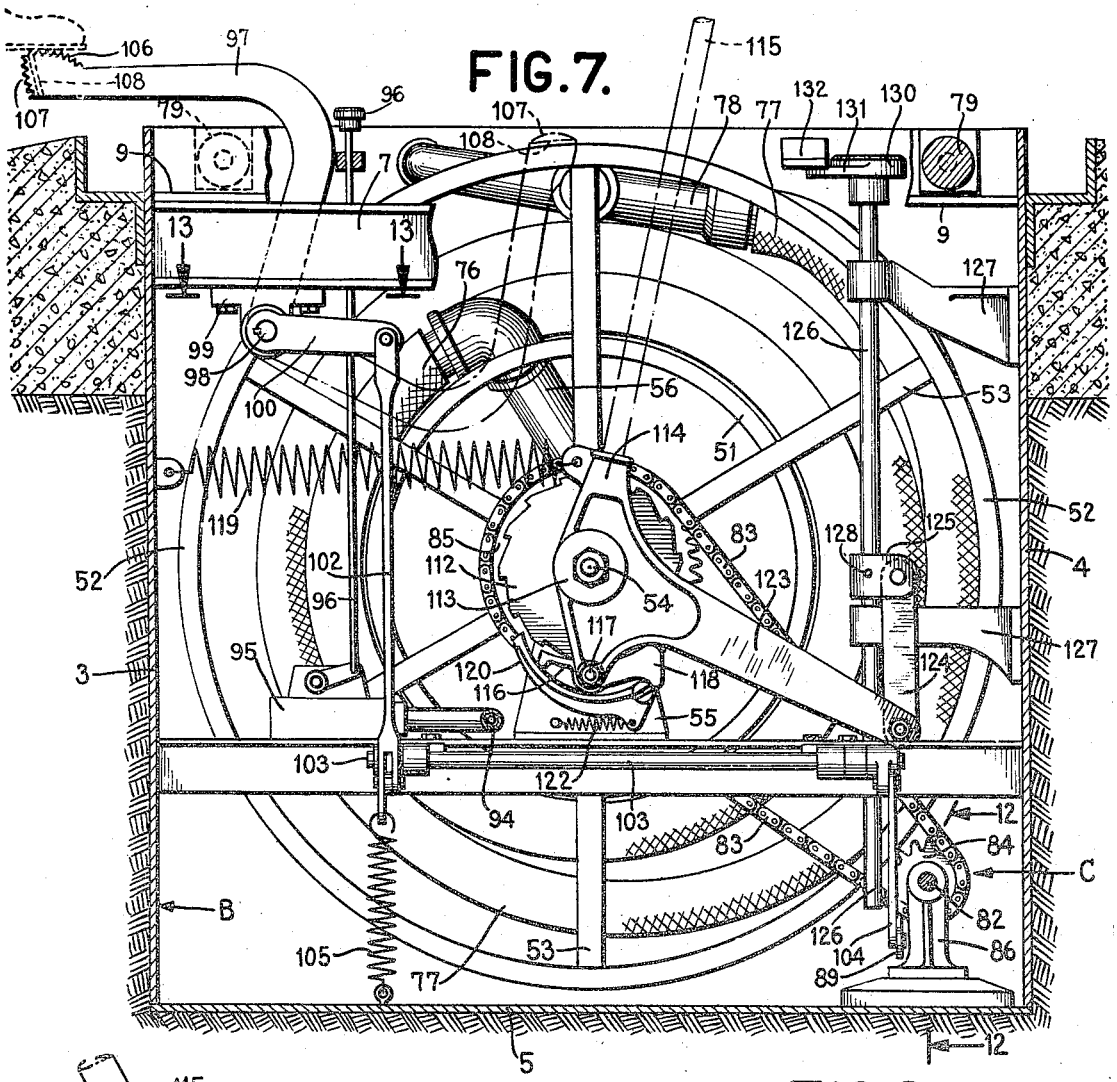

FIG. 8.

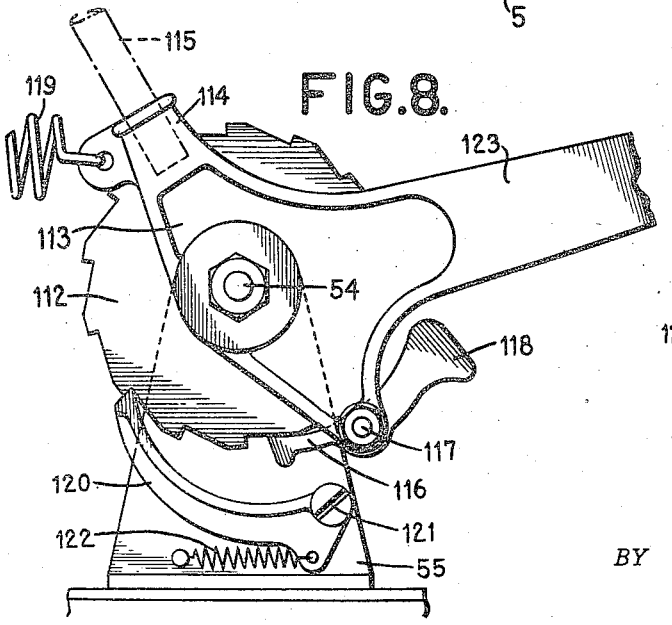

FIG. 9.

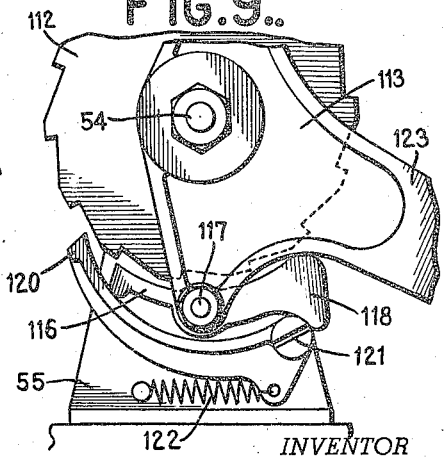

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FIG.10.

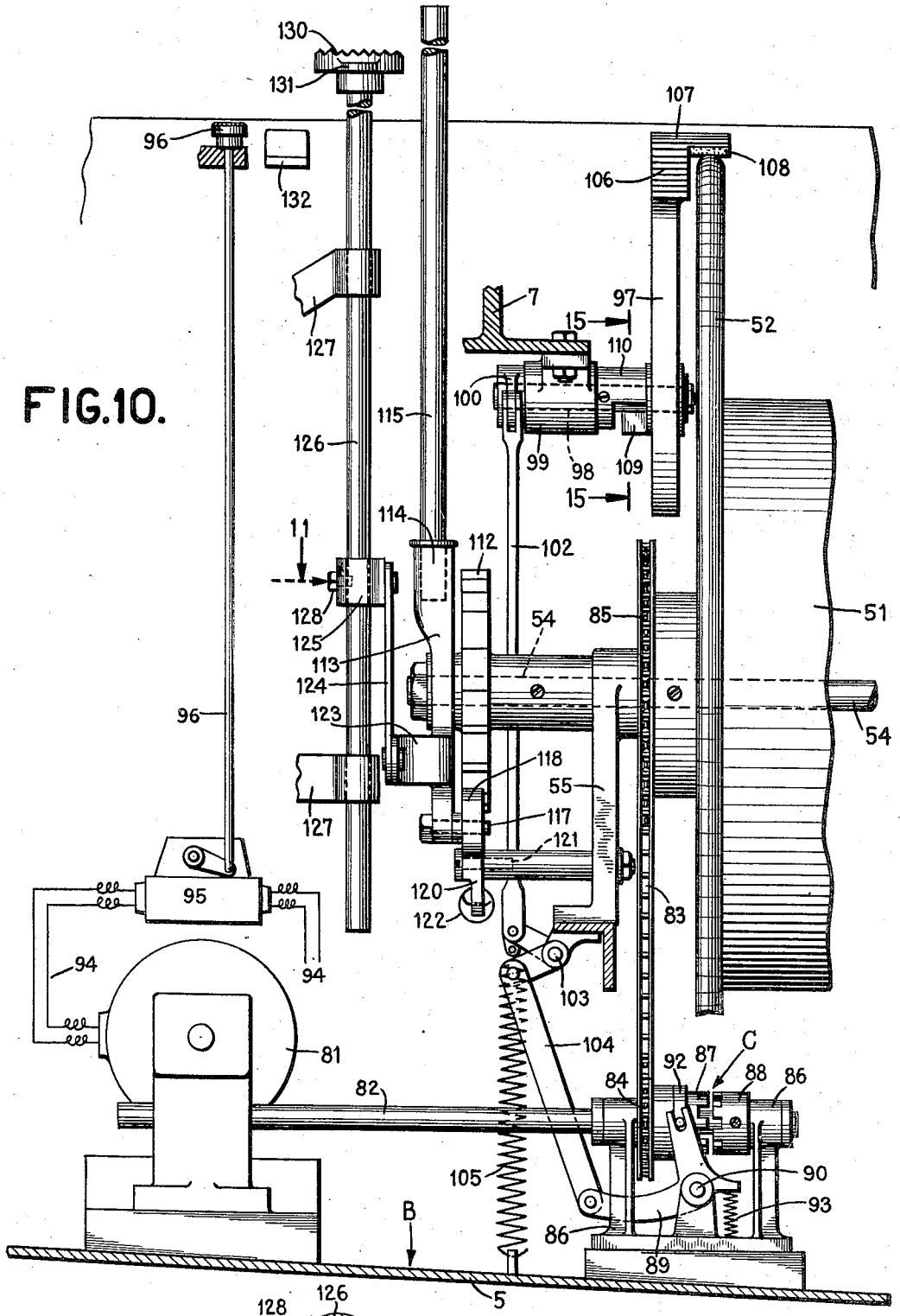
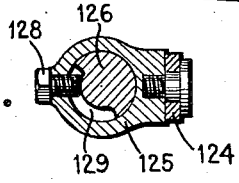


FIG.11.



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FUEL HANDLING PIT BOX

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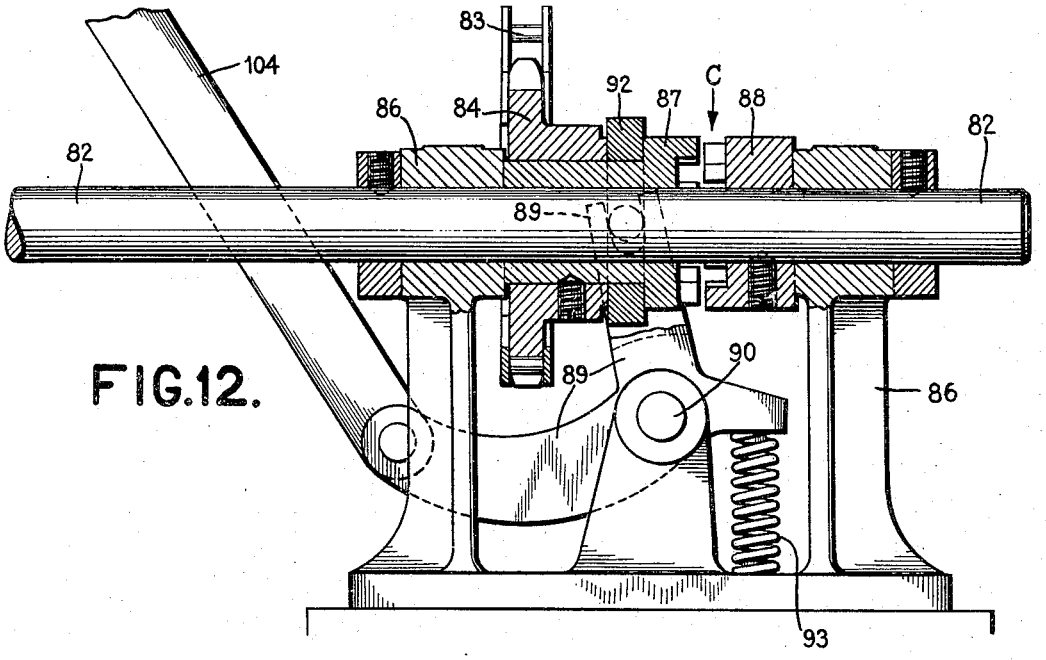


FIG.12.

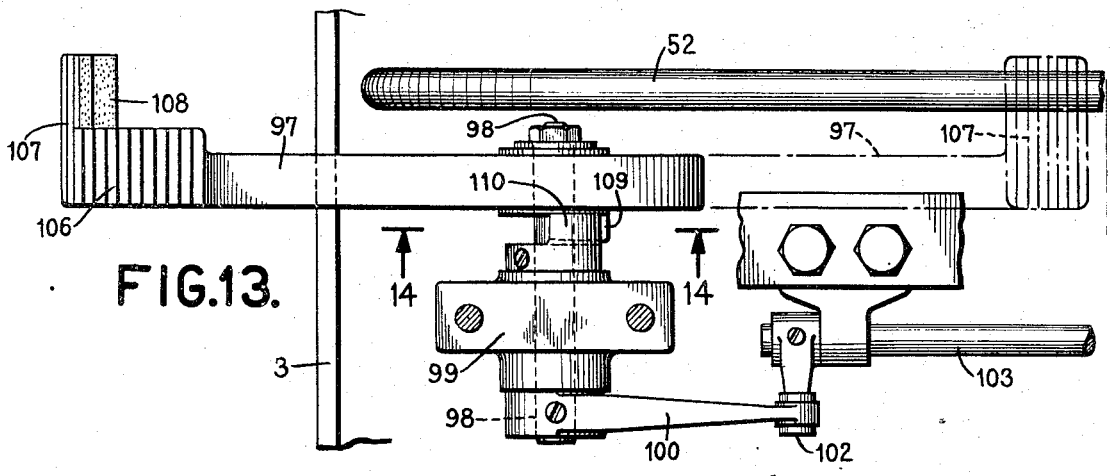
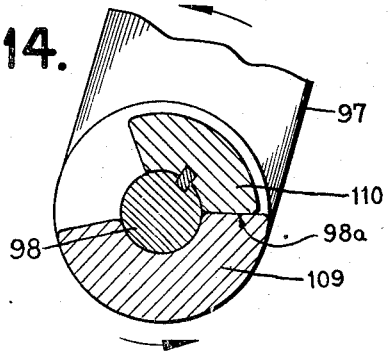


FIG.13.

FIG.14.



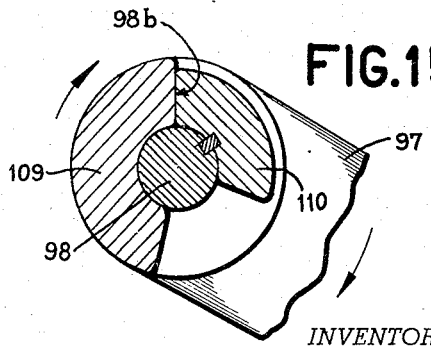


FIG.15.

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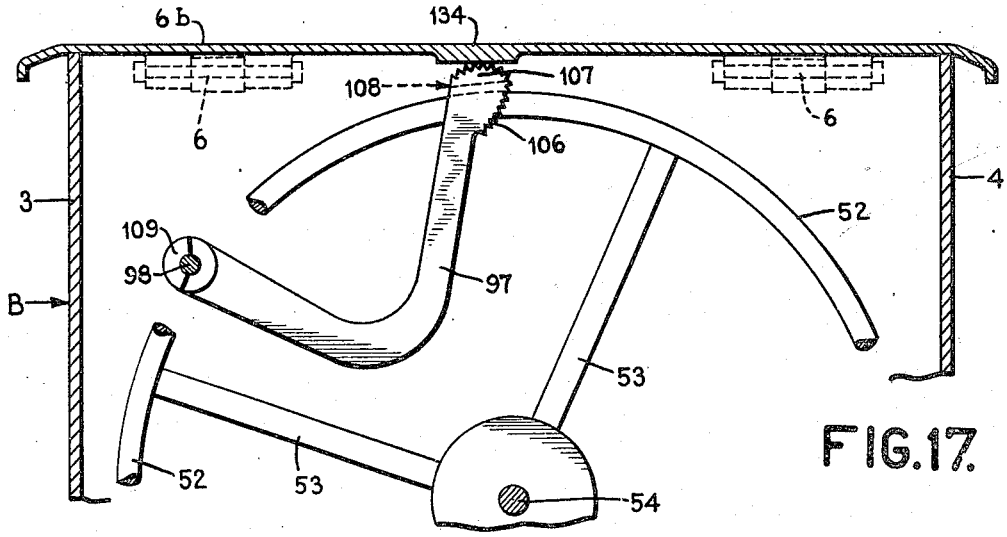

FIG.17.

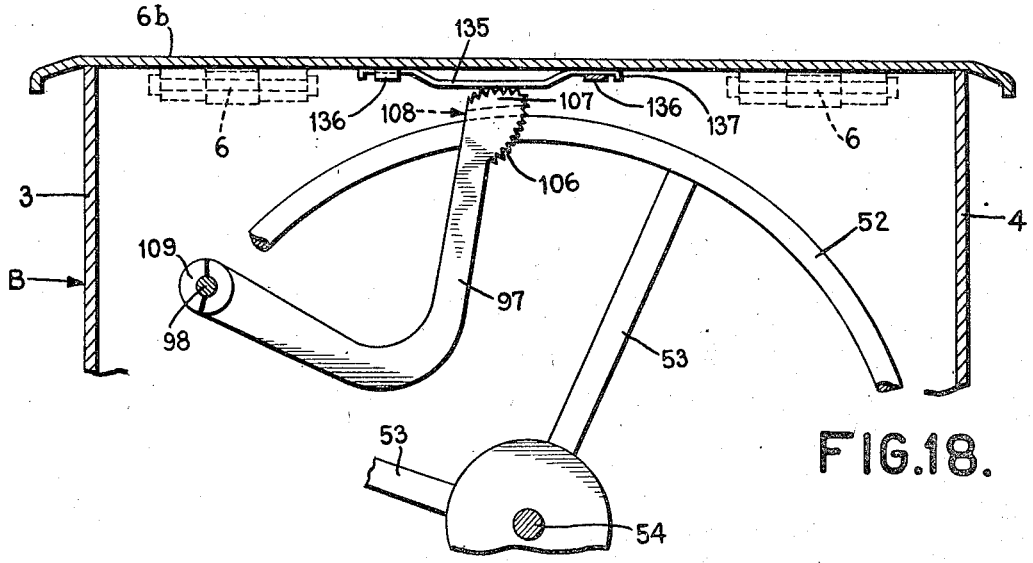

FIG.18.

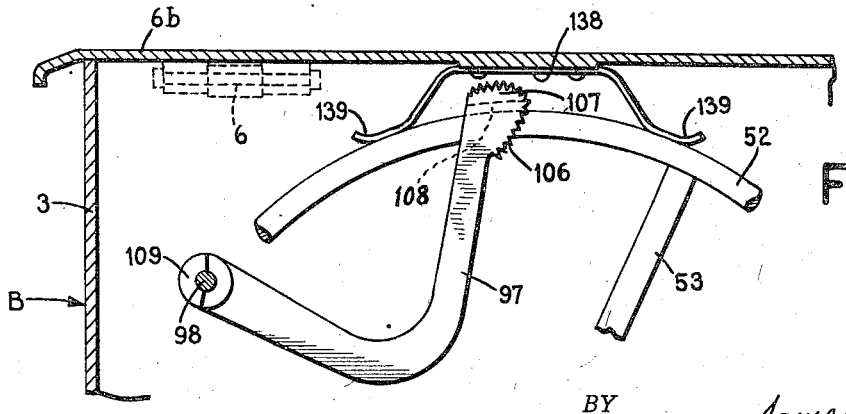

FIG.19.

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Patented Oct. 31, 1944 2,361,494

UNITED STATES PATENT OFFICE

2,361,494

FUEL HANDLING PIT BOX

William J. Peter, New York, N. Y., assignor to Aqua Systems Incorporated, New York, N. Y., a corporation of New York

Application April 20, 1942, Serial No. 439,653

40 Claims. (Cl. 242—86)

This invention relates to oil and gasoline fueling systems for servicing automotive vehicles and more particularly to a fuel handling pit box for use particularly at airports for filling the fuel tanks of airplanes and also for removing the fuel therefrom.

An object of the invention is to produce fuel dispensing and defueling apparatus, including hose equipment with coiling and rewinding apparatus for plural hose lines of considerable length as well as other features, of such character and form as to adopt the apparatus for underground installations, say in a pit box submerged level or buried flush with the ground surface in order that automobiles, trucks, airplanes and the like may readily pass or run over the pit box to facilitate the movement of traffic in and around an airport.

Another object is to produce a compact and dependable plural hose equipment for pit boxes, one hose being adapted as a fueling dispenser to fill airplane tanks with gasoline, while another hose may be used when necessary for defueling a plane, that is, withdrawing the gasoline preliminary to storing the plane or putting it in the hangar for servicing operations where it would be undesirable to leave fuel in the plane tanks.

A further object is to provide motor means, such as an electric motor for driving a reel on which the hose line is stored, accessible for quick service in handling engine fuel, particularly for filling airplane tanks, together with a clutch pedal and electrical control mechanism for operating the motor in order to rewind the long hose after fueling the tanks, all for the purpose of rendering the apparatus safe, convenient and efficient for use in connection with pit box installations at airports and the like.

Another object is to provide hand and foot operating means, for joint or separate use, to drive or operate a pit box dispensing and/or defueling hose reel for rewinding the long fuel hose by an operator or operators in the event the electric current or other power medium may be off or the motor means is otherwise not functioning.

Likewise, it is an object to provide a multi-use pedal means concealed within the pit box when closed but movable outwardly therefrom when the box is open for safe and convenient use in controlling on the one hand the motor driven hose reel by engaging its clutch, as well as other features in combination with the same pedal which also is used on the other hand not only for positively disengaging the clutch but likewise as a braking means to hold the reel in check when rewinding the hose by foot or hand power in the event the motor means, say an electric motor, is not functioning.

Also, an object is to produce a pit box fuel oil handling apparatus having ground-flush lid or cover means of adequate strength and weight to support heavy vehicles, such as large passenger and bombing planes, which may taxi or travel across the pit box, together with counterbalancing means acting on the heavy lid in aid of raising and lowering it, and means for securely holding the lid in its visibly open position, as well as causing the lid to either act as a brake, or to act on the pedal as a brake, for braking engagement with the reel to hold it against turning when the lid is closed.

It is a further object to produce a simple underground pit box defueling apparatus, with long hose means for withdrawing fuel oil from a plane, comprising a simple basket-like receptacle into which the hose may be coiled by hand, together with metering and air eliminating means for the gasoline, as well as an electrical and valve control means to stop and start the defueling operation, and a safety lid means to cover the defueling apparatus in the pit box.

Having the foregoing and other objects in view, the accompanying drawings illustrate the principles of the invention, as regards its several features, and show examples or embodiments thereof for practical use, wherein:

Figure 1 is a top view of a pit box in which, centrally and including the right hand end compartment thereof, is located a dispensing hose on a reel with its meter and other parts. This view also shows, in the left hand end of the box, a defueling hose coiled into a retainer basket, together with its meter and accessory parts, and the transmission for operating the dispensing hose reel in the central compartment, aforesaid. The lid means is shown raised to open position, there being three lids covering the pit box shown in the present example of the invention, thus tending to form the box into three compartments.

Figure 2 is a lengthwise sectional side view made on the line 2—2 of Figure 1 showing the dispensing hose on the reel in partial section but omitting for clarity the defueling hose basket and hose from the left-hand compartment. One lid is closed over the dispensing meter compartment, although shown open in dotted lines, and the other two lids are open over the dispensing hose reel and the defueler hose compartments. As a matter of fact, raising the left hand lid alone gives access to the defueling apparatus, while the

center lid and right hand lid are both opened when preparing to dispense gasoline.

Figure 3 is an enlarged end view made on the line 3—3 of Figure 2 showing the interior of the defueling compartment, including the hose coiled into its storage basket. The lid is in open position with its hold-open linkage of Figure 5 and counterbalance unit of Figure 6 fully extended. The motor means appearing in this defueling compartment is for operating the hose reel in the central compartment.

Figure 4 is a vertical cross-section on the line 4—4 of Figure 2 looking into the dispensing meter compartment with its lid closed down on the pit box.

Figure 5 is a detail view on the line 5—5 of Figure 3 showing one of the pivoted lid means in upright, open and rearwardly leaning position on the pit box, with a linkage means to hold the heavy lid in this up position against the pull of gravity.

Figure 6 is a detail view of the lid closed with its counterbalancing means under compression or spring-loaded to aid the manual raising and lowering thereof to open and close the pit box. Note line 6—6 of Figures 3 and 4.

The hold-open linkage (Figure 5) and the counterbalancing means (Figure 6) are both used on each lid means, but are shown separately in the last two views for clarity.

Figure 7 is a sectional view on the line 7—7 of Figure 2 showing an end view of the hose reel (adapted herein for the dispensing hose) with a motor driven transmission for rotating and controlling the reel to rapidly rewind the long hose after a dispensing operation has been completed. This view also shows the hand and pedal driving means for use also in rotating and controlling the reel in the event of emergency when the electric motor may not be in operating condition.

Figures 8 and 9 are two enlarged position views of the hand and pedal driving means for the hose reel, including a compound pawl and ratchet device by which to rewind the dispensing hose by hand and/or foot power.

Figure 10 is a diagrammatical side-view detail assembly of the hose reel with its optional driving means (motor, foot and/or hand power) as developed on a larger scale than shown in Figure 2 and with the parts somewhat separated for clarity.

Figure 11 is a section on the plane of line 11—— in Figure 10 showing one means by which a plunger pedal may be partially rotated or twisted by manually adjusting it for use in one instance and non-use in another instance.

Figure 12 is a longitudinal side sectional view made along the motor driven shaft (see line 12—12 in Figure 7), constituting part of the motor transmission drive, through and including a clutch as well as sprocket and chain for rotating the reel to wind in the hose.

Figure 13 is a top view of a universal or multi-use pedal specially devised for engaging, in one instance, the clutch of the motor driven reel and, in another instance, for applying a brake to the reel. The latter position is shown in dotted lines. The pivot means on which this combination clutch and brake pedal is carried is located by the section line 13—13 of Figure 7.

Figure 14 is a detail view on the line 14—14 of Figure 13 showing the pivot means feature of the foregoing universal pedal, including the shaft in section on which it is mounted, the position of the parts being that of clutch engagement for motor drive of the reel, the pedal being broken away.

Figure 15 likewise may be regarded as a section on the line 14—14, but showing the clutch pedal swung into the pit box, as occurs either at the end of a motor rewinding hose operation, or during foot and hand rewinding hose operations to be performed in the event the electric motor is not working. As to the position of the parts in Figure 15, the view is taken on the line 15—15 of Figure 10.

Figure 16 (sheet 2) is a side detail of a two-arm switch-and-valve control pedal, one each of which is used in the defueler and in the dispenser compartments for actuating the respective control means which starts and stops the fuel flow.

Figures 17, 18 and 19 are illustrations of another principle of the invention by which the pit box lid brakes the hose reel and holds it from turning when not in use to insure against loosening of the hose or snarling of same and to keep the hose nozzle at the top of the reel in easy reach.

Figure 17 shows the pit box lid engaging the inwardly retracted clutch control pedal and holding it against the reel.

Figure 18 shows the pit box lid performing the same function as in previous view, but employing a braking spring by which to permit the lid to more readily close onto the top edges of the pit box.

Figure 19 shows the pit box lid and its weight applied through a spring foot directly against the hose reel, without employing the clutch control pedal as a braking means.

The pit box and lid construction

Referring further to the drawings, the pit box or underground housing for the apparatus is indicated generally at B, and comprises end walls 1 and 2, side walls 3 and 4, and a bottom wall or floor 5. The open top of the box is provided, in this example of the invention, with one or more lid covers 6*a*, 6*b* and 6*c*. A hinge 6 pivotally attaches each lid to the box on an axis crosswise the length of the box. A pair of lids, say 6*a* and 6*b*, may have adjacent pivot mounts 6 and swing upwardly into open position toward each other, as shown in Figure 2.

Cross I-beams 7 and 8 provide a foundation or support for parts of the apparatus and the series of lids. Cross channel beams 9 and 10 may rest upon the beams 7 and 8, and the lids with their hinges are mounted on these latter members. These cross beams tie together the side walls of the pit box B at the upper portion thereof, reinforce the box, and sustain the weight of vehicles which may travel across it. The large pit box B is fabricated of steel plate and beam construction and is welded into an integral unit.

Each lid is equipped with a gravity prop-up or hold-open unit or means (Figure 5) to hold the lid in a lean-back position under the influence of gravity, in combination with a counterbalancing means (Figure 6) which aids the raising and lowering of each lid.

To first describe the hold-open linkage means, reference may start with Figure 5 as typical for all lids on the pit box. A vertical slide link 12 is confined in spaced guide loops 13 welded onto the inside of the box wall 3. A stop lug 14 is formed integral on the lower end of each link 12. The upper end of link 12 is pivotally connected at 15

with a swing link 16, of which the upper end also is pivotally connected at 17 to the lid 6a forwardly of its pivot or hinge 6. Figure 5 shows this hold-open linkage in dotted line position when the lid is closed, the slide link 12 having limited lateral freedom in the spaced guides 13 in order that pivot 15 may shift and adjust to the swing of the lid.

The prop-open linkage 12, 16 permits the lids 6a, etc., to stand open and lean rearwardly beyond the vertical plane of the hinge axis 6, and in this way gravity pulls laterally on link 16 and upwardly on the slide link 12, the latter holding its vertical position, with its lug 14 stopped against the lower stationary guide 13 to limit the rearward tilt of the lid to the leaning and braced position shown. This arrangement safely holds a heavy lid in open upright position where it is visible to truck drivers and plane pilots as an indication that the pit box is open.

Next, a description is given of the counterbalancing unit for each lid, and reference may start with Figure 6. A tube or cylinder 19 for each lid has its outer closed or headed end pivotally connected at 20 to the underneath surface of the lid 6a and others at a point toward the front free edge thereof, and a plunger rod 21 has its rear end pivotally connected at 22 on a bracket 23 welded into the cross beam 7 just below the hinge pivot 6. The plunger 21 reciprocates within the tube 19, and a shoulder 24 forms a part of the plunger. A compression spring 25 in the forward end of the tube 19 is confined on the outer free end of the plunger between its shoulder 24 and the outer head end of the tube 19.

Accordingly, the spring 25 is subjected to compression by the movable tube between its pivoted outer end 20 and the plunger shoulder 24. When the lid is fully open and leaning rearwardly, the compression spring 25 is free (see Figure 3) but after the lid moves downwardly a few degrees the spring 25 begins to compress and take up the heavy load of the lid and increasingly resists its downward movement under the pull of gravity. The swing of the lid in its upper range of movement is not acted on by gravity to an appreciable extent because the hinge 6 then carries most of the weight; hence the spring 25 may be made shorter than the tube 19 so that the spring compresses during the lower range of lid movement where gravity exerts a maximum pull.

A large lid cover for a pit box fueling system contemplated herein may weight upwardly of 150 pounds more or less in order to safely support heavy vehicles, and the compression spring 25 carries a portion of this dead weight, say about one-third thereof more or less, in order that an operator in raising and lowering the lid may only handle about two-thirds or say one-half of the lid weight.

The combination of the prop-up linkage unit 12, 16 with the counterbalancing unit 19, 25 provides a sturdy mechanism for handling each lid cover 6a, 6b and 6c for the pit box dispenser and defueler. This type of lid linkage is compact and hugs the side wall of the box thus taking up a minimum of space.

A pit box fuel handling apparatus of this character is installed or submerged in the ground with a concrete apron or emplacement surrounding same. A drain gutter is necessarily welded to the upper outer marginal edges of the pit box and the concrete apron brought up flush with the gutter. The outer down-turned edges of the lids overhang into the gutter. In this way, the upper rim or edge of the pit box is at ground level. The box is comparatively water tight and the apparatus inside thereof is protected from the weather. Provision, of course, is generally made at airports for occasionally pumping out any accumulation of water from the pit box installations.

The defueling apparatus

The long hose and accessory equipment for withdrawing gasoline from airplane tanks is shown in Figures 1, 2 and 3 at the left-hand end of the pit box B submerged to ground level. A hose receptacle comprising an open frame-like basket 28 is carried on legs 29. The bottom of the basket 28 may be supported above the floor 5 of the pit box by the legs.

In this instance, the basket is of square formation and has four rollers 30 at the inner top portion over which runs the hose in pulling it out and coiling it back into the basket. The upper edge and rollers 30 of the hose basket 28 are disposed near the upper edge of the pit box B at ground level in order that the hose next described may be handled at ground level.

A long defueling hose line 31 has its lower coiled end 32 connected through the bottom of the basket with a defueling pipe 33 which leads the gasoline through a combination strainer and air eliminator 34, and thence through a meter 35 to measure the gasoline withdrawn through the defueling hose 31. The gasoline then flows into a pipe 36 which connects through the pit box B with a large pipe line 37 serving to convey the gasoline withdrawn from the tanks of an airplane to a storage tank not shown. The direction arrows on the hose and piping show the direction of defueling flow of the gasoline.

An air pipe 38 has one end connected with the upper end of the air eliminator 34 and its other end connected into the defueling pipe 36 beyond the meter 35 in order that air and gas vapor separated from the gasoline in the strainer and air separator unit 34 may be returned to storage through the pipe 36, instead of being vented to the air and at the same time not pass through the meter 35.

An electric motor driven suction pump unit (not shown) is connected with the defueling pipe line 36, 37 at some convenient point remote from the pit box B, and a switch control for same is shown at 40 in the form of a switch box. Any suitable switch or electrical control is housed within the switch box 40 and is operated by an arm 41 pivotally connected through linkwork 42 with an arm 43 of a two-arm pedal 44, 45 pivotally mounted in the pit box B at 46 near the ground level and within reach of an operator's foot.

One arm 44 of the pedal is positively engaged by the lid 6a to tilt said pedal counterclockwise (Figure 2) when the lid is closed downwardly in order to positively operate the switch arm 41 through the linkwork 42 and hence open the switch in the box 40. This breaks the circuit of electrical wiring 47 leading from the switch box 40 to the previously mentioned electric motor driven defueling pump (not shown) used in connection with sucking gasoline through the defueling hose 31 and back through the meter 35 and hence to the defueling storage pipe line 36, 37 leading to a storage tank, not shown.

A defueling shut-off valve 49 is included in the defueling pipe line 33 and operated by additional linkwork 50 operatively connecting said valve

with the pedal 44, 45. Thus when the pedal 44 is pushed down by the operator's foot, or by the pit box lid 6a, the valve 49 is positively closed.

In the use and operation of the defueling apparatus (Figures 1, 2 and 3) the lid 6a is raised and the control pedal 44 is now free of the lid 6a. The upper free and open end of the hose 31 is uncoiled (see its end being started over roller 30) and withdrawn from the pit box basket 28 and inserted into a gasoline tank to be defueled. The operator then depresses the starting pedal 45 which actuates the linkwork 42 to close the switch in the electrical control box 40 and simultaneously opens the defueling valve 49. The defueling pump unit (not shown) at the end of the circuit 47 and storage pipe line 37 now start their operation and suck the gasoline from the plane tank through the hose. The direction arrows indicate the defueling flow.

Depressing the starting pedal 45 for defueling also tilts the safety pedal 44 upwardly beyond the plane or line of the lid 6a in order that when said lid is lowered again the safety pedal 44 will be engaged and tilted counterclockwise to positively open the switch in box 40 and break the current in the circuit 47 controlling the remotely located defueling pump motor. Likewise, the heavy lid 6a acting downwardly on the pedal 44 again closes the defueling valve 49.

The foregoing apparatus is simple and positive in use for defueling gasoline tanks and is conveniently mounted in the same pit box B with the dispensing apparatus next described for fueling the tanks.

Hose reel dispensing apparatus

A description will now be given of a hose reel and accessory dispensing means in the pit box B. This feature of the invention is shown in Figures 1, 2, 4 and 7 through 15 relating to the dispensing control and electric motor driven transmission for reverse rotation of the reel to rewind the hose thereon, as well as alternate or optional operator-actuated means in the form of hand lever and pedal means also used for driving the reel when the power transmission of the motor may not be in operation.

A hose reel is formed of a cylindrical body or hose receiving drum 51, with side flange or rim means 52 at each end thereof, and in between which the wound hose is confined. The two spaced rims 52 at each end of the drum 51 are shown attached to the reel drum 51 by spokes 53. A shaft 54 has one end journaled for free rotation in a bearing bracket 55, and this shaft end projects through the bearing bracket for use in connection with hand and foot operated parts later described for manual use by an operator. The shaft 54 has its other end fixed or pinned in a hub axially within the reel drum 51 and integrally made with a gasoline conduit elbow 56 which revolves with the hose reel.

The spokes 53 for the right-hand end of the hose reel (Figure 2) are directed axially into the reel drum 51 and are bolted or welded to a flange formed on the axial portion of the rotating elbow 56. A nipple 58 screws into the rotatable flanged elbow 56, forming a part thereof, and rotates with it and the hose reel. The inner smooth end of this nipple 58 constitutes a bearing which passes through an ordinary stuffing-box nut and rotates within a suitable packing gland in a stationary stuffing box 59 fixed on a frame bracket 60 (Figure 2) forming part of the inside bracing of the pit box B.

A gasoline delivery pipe 61 has one end connected with the stationary stuffing box 59 and its other end connected with the outlet side of a meter 62 for measuring the gasoline delivered through the stationary leak-proof stuffing box 59 to the rotatable elbow 56 of the reel and dispensing hose. The inlet side of the meter 62 connects with a pipe 63 which leads to the wall of the pit box (Figure 4) where it is screw fastened thereto by a flange connection 64.

After the pit box B is installed in the ground, a gasoline delivery pipe 65 outside the box is brought through the ground from a storage tank (not shown) and permanently screw connected at 64 with the pit box dispensing piping 63 leading through the meter 62 to the hose reel means.

A dispensing control two-arm pedal 67, 68 is pivoted at 69 in the pit box with the tread of each pedal close to the upper edge of the box and the ground level. A dispensing-off-and-on valve 70 is provided in the delivery inlet pipe 63 ahead of the meter 62, and switch mechanism in an electrical box 71 controls a power circuit 72 leading to an electrically operated dispensing means (not shown) which may be either a pump or hydraulic fuel propelling unit. Linkwork 73 interconnects the dispensing control pedal with the valve 70, and linkwork 74 interconnects the switch mechanism 71 with the pedal.

Depressing the pedal 67 opens the valve 70 and hence the delivery pipe 61, 63 leading to the dispensing reel and simultaneously closes the switch mechanism 71 to energize the power circuit 72 for starting the dispensing flow of gas through the pipe line 65 leading from a storage tank (not shown) to the pit box piping 63. This dispensing control pedal 67, 68 may be a duplicate of the defueling control pedal 44, 45 heretofore explained. It is seen (Figure 16) that the safety pedal 68 is pushed up above the plane of the box lid 6c, and above the ground-flush edge of the pit box B, when the starting pedal 67 is depressed. Consequently, the manual closing of the lid acts to tilt the safety pedal 68 back down into the pit box, thereby opening the power circuit 72 (Figure 2) for shutting off the dispensing flow from a storage tank, and at the same time the dispensing line 63 is positively closed by the valve 70.

Coming back to the conduit elbow 56 carried within the reel drum 51 and rotatable therewith, it will be noted that the inner end or coil 76 of a long dispensing hose line 77 is joined to the outer end of this conduit where it passes through the drum. This hose 77 in some installations is 100 to 150 feet long, more or less, in order to quickly reach the tanks of large planes, without taxiing them unduly close to a dispensing station pit box, or to reach the far side wing tank of a big plane. The outer free end of the dispensing hose 77 is fitted with a valve-closing dispensing nozzle 78. When ready to dispense fuel, the center pit box lid 6b is raised, and the hose is unwound by pulling out the nozzle 78. The hose is protected by running over rollers 79 located at the upper edge of each side wall of the pit box.

In the foregoing, the gasoline dispensing and features accessory thereto have been described, and now follows an explanation of the reel rewinding apparatus and its transmission wherein, preferably, motor means is used but likewise there is provided operator-actuated driving means for emergency use.

The motor drive for the reel

An electric motor 81 drives through a shaft 82 to a clutch C of known type (Figures 2, 7, 10 and 12), and thence through a transmission including a chain drive 83 or other means, to rotate the reel 52 in a clockwise direction (Figure 7) for rewinding the long dispensing hose 77 thereon. The motor 81 with its drive shaft 82 and gear reduction unit of known type, is shown here as installed on the pit box floor in the defueling compartment (left end of pit box B) where there is space for these parts used in connection with the reel dispensing unit in the center and right-hand end of the box. The chain 83 runs on a small driving sprocket wheel 84 driven by the shaft 82, and this chain reaches upwardly and around a large driven sprocket wheel 85 fixed on the reel shaft 54.

The low speed of the motor driven shaft 82 adapts this power transmission for use with a dog-type clutch C operable on the shaft 82 journaled in a bearing carried by a bracket 86. The driving sprocket 84 is free to stand still or idle on the motor driven shaft 82 and is also slidable axially thereon for clutching action. A toothed clutch sleeve 87 of the driving sprocket free on the shaft is shiftable into and out of engagement with a companion toothed sleeve 88 fixed on the shaft 82 by a set screw or other means making it permanent on the shaft to constantly rotate therewith when the motor 81 is running.

A clutch shifting fork 89, pivoted at 90 on the bearing bracket 86, is loosely connected with a clutch-shifting ring or collar 92 in a known way also free on the sprocket-clutch sleeve 87 for effecting clutching and declutching operation between the intermittently running free sprocket-clutch sleeve 87 and the constantly running fixed clutch sleeve 88. A spring 93 is under compression between the bracket 86 and the clutch shifting fork 89 urging the latter counterclockwise (Figure 12) by which to normally urge and hold the dog clutch C disengaged. Thus the motor and drive shaft 82 are first set in operation before engaging the clutch for rotating the hose reel 52.

A power circuit 94 (Figure 10) connects with the hose reel motor 81, and a switch box means 95 is included in this circuit for starting and stopping the electric motor. A switch button and its linkwork 96 operatively connects with a switch within the box in a known way to open and close the power circuit 94. This linkwork 94 enables an operator to start the motor 81 by pulling up on the button (note Figures 2 and 7) which, in order to start the motor, must be pulled upwardly above the plane or line of the pit box lid 6b. Thus if the operator does not push the switch-control button 94 back down to motor-off position (Figure 10), the lid 6c automatically does so when lowered to close the reel compartment of the pit box B.

The manual or operator's control of the clutch C in the electric motor transmission line is effected by a combination clutch and reel brake pedal 97 operatively mounted on a rock shaft 98 (Figures 7 and 10) journaled for free oscillation in a bearing 99 fixed on the lower face of the cross beam 7. Inasmuch as this clutch pedal 97 is located within the upper portion of the pit box near one side wall 3 thereof, while the clutch C is installed near the other side wall 4 and at the bottom, in the present form of commercial construction, a train of linkwork necessarily is provided as an operating connection between the pedal and clutch.

Accordingly, an arm 100 is keyed or otherwise anchored to the pedal pivot or rack shaft 98, with a link 102 operatively connecting said arm with a linkwork rock shaft 103 through a similar arm fixed on its left end, together with a like arm fixed on the right-hand end of said shaft 103, in order that a final link 104 may be operatively connected with the free end of the shifting fork 89 of the clutch C. A tension spring 105 pulls downwardly on the link 104 to normally maintain the clutch C disengaged and likewise the outer free end of the pedal 97 in its uppermost position. This is a conventional motion-transmitting linkwork from the pedal arm 100 to the clutch-shifting fork 89.

The operator depresses the outer free end of the pedal 97, thereby further tensioning the spring 105, and rocks the linkwork shaft 103 clockwise (Figures 2 and 10) to pull upwardly on link 104, thereby engaging the clutch C and starting the hose rewinding operation of the reel 52. The operator maintains foot pressure on the pedal 97 to hold the clutch C engaged, and upon removing this foot the spring 105 disengages the clutch and restores the outer end of the pedal 97 to its up and clutch-out position.

It will be noted that the clutch pedal 97 has a central bend of about 90° more or less and, together with other features, performs a number of independent functions. The mounting pivot 98 located in the pit box, as shown, below the ground level, enables the upper free end of the pedal, with a knurled tread 106 for foot control by an operator of the clutch C, to be tilted outwardly beyond the edge of the pit box into a position above the ground or concrete apron. In such position, an operator can conveniently depress the pedal end 106 for starting and stopping the motor driven reel 52. So long as the operator depresses the foot tread 106, the pedal grips the rock shaft 96 (as later explained) and pulls upwardly on the link 102 for the purpose of maintaining the clutch C engaged, against the pull of the spring 105 tending to disengage it, as heretofore explained.

However, the pedal 97 may be swung clockwise, over and back into the pit box below the lid line (Figures 10 and 13, also dotted-line position in Figure 7), not only to enable the lid 6b to be closed after each use of the apparatus, but more particularly in order that the pedal may rest against the reel 52 to control the latter when initially unwinding the long dispensing hose 77 by hand. One operator grasps the dispensing nozzle 78 and runs out with the hose 100 feet or so to a plane to be fueled, while another operator may apply light pressure on a second foot tread 107 to bear a brake pad lining 108 of the pedal against the reel rim 52. The operator applies light foot pressure on the pedal tread 107 so as to prevent the inertia or momentum of the rapidly rotating reel from running ahead of the hose-unwinding operation which otherwise would tend to snarl and kink the hose. The clutch-disengaging spring 105 holds the clutch C open when the pedal 97 is swung into the pit box; in fact this spring holds the clutch open at all times except when the pedal 97 is in its outermost position beyond the edge of the pit box and is being depressed by the operator's foot dotted in at Figures 2 and 7.

Initially, therefore, the multi-use pedal 97 acts as a brake on the reel 52 (Figure 10) when manually unwinding the hose preliminary to fueling a plane, and the pedal is thereafter tilted out-

wardly (Figures 1, 2, 7 and 13) for engaging the clutch C of the motor-driven transmission when rewinding the hose by the motor 81 after the fueling operation. Again, the second pedal tread 107 with its brake pad 108 is also used to control the rewind rotation and momentum of the reel 52 when turning it by hand or by foot (later described) for a hose rewinding operation. The angular relation of the dual purpose pedal treads 106 and 107, and the location of the brake pad 108, with a correct location of the pedal supporting rock-shaft pivot 98, provide a simple control pedal capable of several uses.

Now as to the two positions of the pedal 97 on its pivot shaft 98, by which its several functions are attained, it is seen (Figures 2, 10, 13, 14 and 15) that the pedal has an integral quadrant hub 109 free on the rock shaft 98, and that said shaft is likewise free in its bearing 99. A companion quadrant sleeve 110 is fixed on the shaft 98, pinned thereto by which it rocks the shaft and hence swings the fixed arm 100 of the linkwork from 102 through 104 to engage the clutch C. This quadrant sleeve 110 fixed on the rock shaft 98 and its companion pedal hub 109 free on said shaft have radial lugs which overlap into shouldering coaction (see Figure 2) by which the free pedal hub 109 abuts and forcibly oscillates the fixed hub 110 at 98a (Figure 14) and hence urges the rock shaft 98 counterclockwise (Figure 7) when the pedal 97 is positioned outside of and above the pit box in reach of an operator's foot (Figures 2 and 7) by which to depress the pedal tread 106 and thus engage the clutch C.

However, when this dual-purpose pedal 97 is tilted back into the pit box B to rest upon or close to the reel rim 52 (Figure 10, also dotted position Figures 7 and 13), it then follows that the quadrant hubs 109 and 110 become radially separated (Figure 15) from each other and function as lost-motion means, the pedal 97 now being free on its pivot shaft 98, and no coaction existing at 98a. The operator may now press his foot on the pedal tread 107 to either retard or permit increased speed of rotation of the hose reel, thus controlling and maintaining the long hose 77 in evenly coiled condition and avoiding injury thereto.

It is noted that the diameter of the reel rim 82 approaches the width and depth of the pit box B, and in particular that the high point of the rim is close to the line of the box lid, with clearance between the pedal end 107 and lid when said pedal is folded over into the box. Thus the pedal 97 is near the ground level and in convenient reach of the operator's foot in both adjusted positions of use. The axes of the reel 52 and pedal pivot 98 are parallel, the pivot being located below ground level and between the reel shaft 54 and pedal pivot. These relations afford the two pedal positions in question.

The foregoing covers the description of the structure and mode of operation of the motor drive transmission for the power operation of the reel when rewinding hose, and a description will now follow of the hand and foot apparatus for manually rotating the reel also for rewinding the hose in the event of an emergency and the electric motor 81 may not be in operation.

The operator's hand and foot drive for the reel

Optional hand and foot operating means are provided for driving the reel clockwise (Figure 7) to rewind the hose 77 in the event the motor 81 may not be in operation due to interruption of its power circuit. In this connection, an operator-actuated ratchet wheel 112 is fixed on the reel shaft 54 to turn it. A ratcheting dog 113 is free on the reel shaft adjacent the ratchet wheel.

A handle socket 114 is formed in the upper portion of the dog 113, and a removable handle 115 is mounted upright therein. When not in use, the handle may be kept in the pit box. The handle is shown in operative position in dot-and-dash lines (Figure 7), thus indicating its absence or presence in its retaining socket 114. A driving pawl 116 is pivoted at 117 on the lower portion of the dog and a weighted outer end 118 maintains this pawl in ratcheting and driving engagement with the ratchet wheel 112.

The removable handle 115 extends waist high above the pit box edge and ground level, and by swinging it back and forth on its axis 54 to oscillate the ratcheting dog 113 in a clockwise direction, it follows that the driving pawl 116 grips and advances the ratchet wheel 112, thereby rotating the hose reel 52. The motor driven chain 83 idles during this hand operation since the motor clutch C is held disengaged by the clutch spring 105.

A long-stretch coil tension spring 119 (Figures 7 and 8) is interconnected between the ratcheting dog 113 and the box wall, for one-way operation of the dog, to return it counterclockwise (Figure 7) and maintain it and the handle 115 in upright position. A locking pawl 120 is pivoted at 121 on the bearing bracket 55 rotatably supporting the reel 52. A spring 122 acts on the locking pawl 120 and constantly rides its latching free end against the tooth ratchet wheel 112 to hold it and the reel 52 at each step-by-step rotation imparted by the handle 115 and also to permit the handle and driving pawl 116 to reverse and pick up the ratchet wheel for another advance.

The design and construction of the ratcheting dog 113 lends itself also to foot operation as next described, and it will be seen that simplicity is attained by reason of a minimum number of parts in the combination of the hand and foot driving and controlling means for the hose reel 52.

The operator-actuated ratcheting dog 113 also includes, in addition to its handle socket 114, a laterally extending arm 123, on the outer end of which is pivotally connected the lower end of a vertically disposed thrust link 124. The upper end of this thrust link is pivotally connected with a collar 125 carried on and reciprocated by a plunger pedal 126. Spaced guides 127 anchored within the pit box B serve to slidably support the plunger pedal 126 in a vertical position to swing the arm 123 and oscillate the dog 113.

The collar 125, in this example of the invention, is shown as being attached to the plunger pedal 126 by a set screw 128 (see Figures 10 and 11) fixed in the collar with the inner end of said screw free in a radial groove 129 formed in the pedal. This arrangement permits a limited manually adjustable twisting motion of the pedal 126 within the collar 125, but serves to join together the pedal and thrust link 124 for up and down motion.

The upper end of the plunger pedal 126 is made with or fixed to a foot tread 130 having an integral latching toe 131 adapted to latch under a stationary angle plate in the form of a stop lug 132 anchored to the inside framing or cross beam 7 at the upper edge of the pit box just under the plane or line of the box lid 6b covering the hose reel 52. By a slight axial twist of the

plunger pedal 126, imparted by an operator's hand grasping the pedal tread 130, the latching toe 131 is snapped out from under the stop lug 132. Thereupon, the pedal 126 slides upwardly to its limit under the pull of the long-stretch spring 119 acting counterclockwise on the ratcheting dog 113.

The up-position of the plunger pedal 126, above ground level, now enables the operator to actuate it vertically with his foot, thereby imparting a clockwise step-by-step rotary motion to the ratcheting dog 113 through the drive of the pawl 116 riding the toothed ratchet wheel 112 fixed on the hose reel shaft 54. The pedal 126 and handle 115 drive the reel 52 through the same mechanism, a feature which characterizes this apparatus. The long-stretch spring 119 returns the pedal 126 to its up position after each leg stroke of the operator.

Figure 8 illustrates the mode of operation of the ratchet and pawl mechanism when driving the reel for rewinding the long dispensing hose 77 by use of the handle 115 or plunger pedal 123 or both. Incidentally, the brake pedal tread 107 may be used at this time to steady the rotation of the reel 52 by lightly applying foot pressure on the brake pad 108, in the event the hose should lap forward and tend to impart momentum and cause kinking thereof.

Figure 9 is important to next consider as showing the mode of operation of the ratchet and pawl mechanism, its inoperative or throw-out position, when the motor 81 is in use for rewinding the hose. At such time the clutch C is engaged by depressing the tread 106 of the clutch control pedal 97, as previously described. The ratcheting dog 113 must then be rendered inoperative, that is, set to a stationary position and disconnected from the ratchet wheel 112.

In Figures 7 and 9, the arm 123 has been pushed down to its lower limit and latched there by reason of the plunger pedal tread 130 having been adjustably twisted by an operator who reaches down and turns the pedal to the right until the latching toe 131 engages under the stationary stop 132. The operator does this by hand against the resistance of the spring 119 and the sping latches the pedal toe 131 under the retaining lug 132. Thus the plunger pedal 126 is now out of the way, below ground level, either for the purpose of closing the pit box lid 6b, or for using the motor 81 to perform a hose rewinding operation.

The foregoing latching down operation of the plunger pedal under the retaining lug 132 also displaces both ratcheting pawls 116 and 120 (Figure 9) to inoperative position. Thus they no longer ride the ratchet wheel 112 and the latter is now free to rotate with the reel shaft 54 being driven by the motor 81 through the chain 83 and other transmission means. As the arm 123 goes down to its limit, in order that the pedal 130 may latch under the retaining lug 132, it follows that the pivot 117 carrying the weighted pawl 116 is moving clockwise.

Accordingly, it is seen that such movement of the pivot 117 drags the lower edge of the pawl end 118 over the pivot 121 of the locking pawl 120. The camming end 118 rises as it tries to pass the pivot 121 and the other end of the pawl 116 (its ratcheting end) is depressed and knocked out of engagement with the ratchet wheel 112; not only that but it also knocks the locking pawl 120 out of engagement from the ratchet wheel 112. The two pawls simply kick each other away from the ratchet wheel, the rear end of the lower pawl 120 acting against the upper pawl 116 and, conversely, the latter against the former.

The weighted end 118 and spring 122 again restore both pawls to engagement with the ratchet wheel 112 for the hand and foot reel driving operation when the pedal 126 is released from under its retaining lug 132. The parts throughout constituting the combination are made to serve dual functions in the alternate or optional driving means for the hose winding reel.

The pedal 97 also acts to disengage the clutch C

An understanding of the construction and mode of operation of the foregoing reel handle 115 and the reel pedal 126, which comprise manual or operator-actuated means for rotating the hose reel 52 counterclockwise (Figures 7 and 10) for the purpose of rewinding the fuel hose 77, makes clear the importance of positively disengaging the clutch C when the clutch-control pedal 97 is tilted back into the pit box B in the position shown in dotted lines (Figure 7). The clutch must of course be positively disengaged in order to disconnect the reel shaft 54 from the motor-driven shaft 82 preliminary to the manual operation of the reel 52, and the pedal 97 acts to do so as will now be explained.

When the operator's foot (shown dotted in Figures 2 and 7) is lifted from the pedal tread 106, the pedal 97 can be tilted back into the pit box B by simply placing his toe under the outer end of the pedal and lifting it upwardly until the mass or weight of the pedal passes over its dead center beyond the rock shaft 98, and then the pedal drops back into the box under gravity and comes to rest on the reel rim 52.

One of the more usual ways to swing the pedal 97 back into the pit box B, without lifting it by hand or using your foot for throwing it back, is for the operator to press his foot downwardly on the pedal tread 106, thereby engaging the clutch C and fully tensioning the clutch-disengaging spring 105, the operator then suddenly slipping his toe off of the tread 106 and downwardly therefrom while the spring 105 is still stretched. The reaction of the tensioned spring 105 throws or flips the outer end of the pedal 97 upwardly and over toward its dead center position, whereupon gravity acts on the pedal causing it to rapidly drop into dotted line position (Figure 7) against the reel 52. In any event, the down swing and momentum of the pedal is utilized to positively disengage or kick open the clutch C, as will now be explained.

The dog clutch C is one of suitable type for use in connection with this apparatus, and sometimes a clutch may stick and not readily release under the pull of the spring 105. For example, the engaging teeth of the driven clutch sleeve 87 and driving sleeve 88 (Figure 10) may at times exert a tendency to hang together or stick due to the presence of grit in the teeth or other conditions. At any rate, it is not desirable to rely entirely upon the pull of the spring 105 to disengage the clutch C. It is for that reason that this invention employs as one of its features the momentum of the clutch and brake pedal 97, when its outer end is falling downwardly toward the reel 52, to give the clutch C a kick and thus knock it open by a jerk applied to the sleeve 87 slidably on the motor shaft 82.

The lost-motion coacting quadrant hubs 109 and 110 (Figures 2, 10, 13, 14 and 15), as here-

tofore described for engaging the clutch C by pressure of the operator's foot, are also employed to disengage the clutch, doing so by utilizing the momentum of the pedal 97 as striking power to kick the clutch C open. It has been explained how depressing the outer end of the pedal 97 acts to urge the rock shaft 98 counterclockwise (see arrows in Figure 14) by virtue of engagement at 98a of the radial faces of the two quadrant hubs. The bottom lug 109 is integral with the pedal 97 and acts against the upper lug 110 fixed to the rock shaft 98. In this way, the down motion of the pedal tread 106 urges the arm 100 (Figure 7) upwardly and, by acting through the pull link 102 and linkwork rock shaft 103, swings the clutch shifting fork 89 clockwise (Figure 10) to engage the clutch C. This linkwork, by reverse movement, acts to positively jerk or kick the clutch sleeve 87 out of the clutch sleeve 88, an important function in this apparatus.

The reverse or throw-back inwardly-tilting action of the clutch-control pedal 97, to positively kick open the clutch C, is explained by noting Figure 15 and observing that radial coacting faces 98b of the two quadrant hubs 109 and 110 are utilized to initiate the clutch disengaging function, aided of course by the pull of the spring 105. Figure 15 shows the pedal 97 tilted clockwise downwardly and toward the right, the same position as in dotted lines in Figure 7, and in said position it is this second pair of lug radial faces 98b which act reversely to rock the linkwork shaft 103 counterclockwise (Figure 10) to kick or jerk the clutch sleeve 87 out from the clutch sleeve 88.

The coacting lugs and their shouldering planes 98a (Figure 14) lift the arm 100 to engage the clutch C, while the opposite or second pair of shoulders 98b depress this arm to disengage the clutch. When the pedal 97 is tilted outwardly (counter-clockwise arrows, Figure 14) the lost-motion hub shoulders 98a engage to hold the pedal some six inches more or less above the ground. Reversely, when the pedal is tilted inwardly (clockwise arrows, Figure 15) the lost-motion quadrant hub 109 of the pedal strikes the other quadrant hub 110 before the pedal reaches the reel rim 52, and that action forcibly dislodges the clutch C by knocking the driven toothed sleeve 87 out from the driving sleeve 88. Thus dislodged, the clutch teeth are held open by the spring 105.

Accordingly, the clutch-disengaging spring 105 is not relied upon to dislodge the dog clutch C, but it is the falling weight or mass of the pedal 97 which does so. The weight of the pedal simply imparts its striking momentum through the lost-motion linkwork 98b and 102, etc., and gives the clutch a kick, thereby freeing it from any sticking tendency due to grit or other conditions, whereupon the spring 105 readily completes the clutch opening action and holds it open.

When using the clutch-control pedal 97 as a foot-operated reel-brake pedal (dotted line position, Figures 7 and 13), it follows that downward foot motion on the pedal tread 107 pushes in the same direction on the linkwork 102 and 103 as the spring 105 is pulling. This spring acts on the linkwork and clutch C to hold the latter open at all times after it has been forcibly disengaged by the inwardly tilting motion of the multi-purpose pedal. The clutch-disengaging function of the pedal 97 provides a more practical arrangement than that of employing a strong tension spring 105 to alone disengage the clutch C.

The clutch engaging-and-disengaging pedal 97 which also is a foot-operated brake pedal for the reel 52 has a fourth and further function in connection with the lid 6b when the latter is closed down over the reel compartment of the pit box B after the operator has wound in the long fuel hose 77 and placed its dispensing nozzle 78 at top or uppermost position thereon. This further combination of the clutch and brake pedal with the pit box lid is next described.

The pit box lid when closed brakes the hose reel

In Figures 17, 18 and 19, the parts and construction heretofore described are given the same reference numbers as before. The lid 6b swings on its hinge means 6 to close down on the ground-flush upper edge of the vertical wall 3 of the pit box B. Hence, new reference numbers are applied only to the new parts relating to this additional feature of the invention employing the weight of the pit box lid as a braking means to hold the reel 52 against rotation when the apparatus is not in use.

It is desirable to brake and hold the rotatable hose reel 52 against motion when the pit box is closed, and for this purpose the lid 6b when closed down over the apparatus acts as a brake on the reel. The movement of traffic across a closed pit box fueler B may set up vibration and cause the reel 52 to partially turn. This is particularly true when it is noted that the winding of the hose 77 on the reel may not result in a perfectly balanced condition of parts since the hose may possess more or less weight on one side of the reel axis 54 than on the other. Likewise, there is the weight of the dispensing nozzle 78 which throws the reel out of balance and tends to rotate it until the nozzle comes to rest on the bottom side. If that occurs, the nozzle may drop down into the box and become difficult for an operator to retrieve.

According to the foregoing, it is desirable to hold the reel 52 against rotation when the apparatus is not in use, and likewise it is not practical to provide any type of locking device operative through the cover lid by which to brake the reel and hold it after the pit box is closed. Therefore, this invention provides means by which the box lid automatically applies a braking effort to the reel for holding it against motion, thereby maintaining the hose nozzle 78 at the top of the reel in convenient reach (Figure 7) of the operators.

In Figure 17, the lid is made with a boss or pad 134 which swings down into engagement with the pedal braking tread 107 of the clutch control pedal 97, the latter having been tilted into the pit box B as shown. The weight, in whole or in part, of the lid 6b bears or rests against the pedal 97 and exerts braking pressure through the brake pad 108 engaging the reel rim 52. At the same time, the lid 6b also closes down against the top edge of the wall 3 of the pit box. The latter is accomplished by accurately locating the hinges 6 and properly fitting the lid to the box in order that the lid boss 134 may engage the pedal end 107 simultaneously with the underneath surface of the lid coming to rest upon the upper edges of the box B.

In Figure 18, the same function is accomplished in another manner and with a construction which may lend itself to rapid assembly and minimum fitting of lid parts. The pit box lid 6b

is provided on its under side with a pressure-compensating member in the form of a yieldable bowed leaf spring 135, the outer ends of which are carried in guide loops 136 welded to the inner surface of the lid. The extremities of the leaf spring 135 are formed at an angle to make locking toes 137 which maintain the bowed spring 135 in position. It will be noted, therefore, that when the lid swings down in closed position it readily engages the top edges of the box wall 3 and the yieldable leaf spring 135 simultaneously applies a yielding pressure to the uppermost tread end 107 of the pedal. In this way, the weight of the lid is applied to the brake pad 108 through the yielding spring 135 to hold the reel 52 against turning.

Referring now to Figure 19, there is shown a further construction coming within the principle of this phase of the invention. The pit box lid 6b carries a spring horn 138 welded or otherwise fixed to the inner surface of the lid. This spring member 138 may have two free ends comprising spaced pressure feet 139 which bear directly against the rim of the hose reel 52 when the lid is closed. Thus, the yieldable bow spring 138 applies a braking pressure directly to the reel without engaging the clutch pedal 97. Accordingly, the clutch pedal 97 need not form a part of the lid braking means for the reel when the apparatus is not in use. However, when the lid is up and the apparatus is in use, the pedal performs its normal function of acting as a brake against the rotating reel by applying foot pressure to the tread 107 in connection with reeling the hose out and rewinding the hose, as heretofore described.

This invention is presented to fill a need for a useful fuel handling pit box. It is understood that various modifications in construction, operation, use and method, may and often do occur to those skilled in the art, especially after benefiting from the teachings of an invention, and that this disclosure is exemplary of the principles but not limited to the present embodiment of the invention.

What is claimed is:

1. Apparatus for handling gasoline and the like comprising, in combination, a submerged pit box having its upper edge disposed at ground level, a ground flush lid by which to open and close the pit box, and a reel containing a hose line mounted within the pit box, the hose line being adapted for connection with a storage pipe line through which gasoline flows; a controlling device comprising a pedal cooperating with the reel by which to control the rotation of said reel when winding the hose thereupon, and means mounting the pedal within the pit box for movement out of said box into position for convenient use above ground level and also for movement back into said box below ground level after the hose is wound on the reel in order that the pit box lid may be closed.

2. Apparatus for handling gasoline and the like comprising, in combination, a submerged pit box having its upper edge disposed at ground level, a ground flush lid by which to open and close the pit box, and a reel containing a hose line mounted within the pit box, the hose line being adapted for connection with a storage pipe line through which gasoline flows; means for driving the reel, a controlling device cooperating with the driven reel by which to control its operation in winding the hose thereupon, and means movably mounting the controlling device within the pit box for movement out of said box into position for an operator's convenient use above ground level and also for movement back into said box below ground level after the hose is wound on the reel in order that the pit box lid may be closed.

3. Apparatus for handling gasoline and the like comprising, in combination, a submerged pit box having its upper edge disposed at ground level, a ground flush lid by which to open and close the pit box, and a rotatable reel containing a hose line mounted within the pit box, the hose line being adapted for connection with a storage pipe line through which gasoline flows; controlling means cooperating with the rotatable reel by which to wind the hose thereupon, and means mounting the controlling means within the pit box in operative relation with the reel for movement out of said box into position for convenient use above ground level and for movement back into said box below ground level after the hose is wound on the reel in order that the pit box lid may be closed.

4. Apparatus for handling gasoline and the like comprising, in combination, a submerged pit box having its upper edge disposed at ground level, a ground flush lid by which to open and close the pit box, and a reel containing a hose line mounted within the pit box, the hose line being adapted for connection with a storage pipe line through which gasoline flows; means for driving the reel by which to wind the hose thereupon, pedal means for controlling the rotation of the driven reel, and means movably supporting the pedal means within the pit box for use in two positions by an operator's foot, of which one position is outside the box above its ground edge level and the other is within the box for permitting the lid to be closed after a hose winding operation.

5. Apparatus for handling gasoline and the like comprising, in combination, a submerged pit box having its upper edge disposed at ground level, and a reel containing a hose line mounted within the pit box, the hose line being adapted for connection with a storage pipe line through which gasoline flows; means for rotating the reel by which to wind the hose thereupon; and a pedal pivotally mounted within the pit box, swingable to a position outside the box which automatically disposes it in control relation with the means for rotating the reel, and thereafter swingable back into the box out of said control relation and into braking position with the reel for operation under foot pressure to retard the rotation of said reel.

6. Fuel oil handling means employing a hose on a reel adapted to be manually unwound therefrom, with motor means for driving the reel to rewind the hose, and a control device for starting and stopping the reel rewinding operation by the motor means comprising, in combination therewith, operator-actuated means for driving the reel and rewinding the hose when the motor means is not in use therefor, means operatively mounting the control device in position for performing a dual function, first to apply and remove the power of the motor means for starting and stopping the reel when employing said motor means for rewinding the hose, and second to act as a brake on the reel to retard its rotation when manually unwinding the hose and also when rewinding the hose by the operator-actuated means.

7. Fuel oil handling means employing a hose on a reel adapted to be manually unwound therefrom, with motor means for driving the reel to

rewind the hose, and a control device for starting and stopping the reel rewinding operation by the motor means comprising, in combination therewith, operator-actuated means for driving the reel and rewinding the hose when the motor means is not in use therefor, the control device including pedal means, means operatively mounting the pedal means in position for performing a dual function, first to connect and disconnect the power of the motor means for starting and stopping the reel when employing said motor means for rewinding the hose, and second to act as a brake coacting with the reel to retard its rotation when manually unwinding the hose and also when rewinding the hose by the operator-actuated means.

8. Fuel oil handling means employing a hose on a reel adapted to be manually unwound therefrom, with motor means for driving the reel to rewind the hose, and a clutch for connecting and disconnecting the reel and motor means comprising, in combination therewith, operator-actuated means for also driving the reel and rewinding the hose when the motor means is not in use therefor, a pedal for controlling the clutch, pivot means operatively mounting the pedal for adjustment into two positions for performing independent functions, said pedal adapted to be swung on its pivot means into one position for controlling the clutch as aforesaid, and swung into another position to act as a brake on the reel to retard its rotation when manually unwinding the hose and also when rewinding the hose by the operator-actuated means.

9. Fuel oil handling means employing a hose on a reel adapted to be manually unwound therefrom, and motor means for driving the reel to rewind the hose, with a control device and clutch for starting and stopping the reel rewinding operation of the motor means comprising, in combination therewith, operated-actuated means for driving the reel and rewinding the hose when the motor means is not in use therefor, a pivot operatively mounting the control device in two positions for performing dual functions, quadrant hub means on the pivot including a pair of coacting lugs which engage to effect control of the clutch when the control device is in one position on the pivot, and which disengage to free the control device from its clutch control function and adapt it as a brake to coact with the reel when said control device is in another position on the pivot.

10. Fuel oil handling means employing a hose on a reel and motor means for driving the reel to rewind the hose thereon comprising, in combination therewith, operator-actuated means for driving the reel and rewinding the hose when the motor means is not in use therefor, a pedal mounted on a pivot and adapted to be swung thereon into one position away from the reel, and means operated by the pedal in this first position to apply and remove the power of the motor means for starting and stopping the reel when employing the motor means for rewinding the hose, said pedal also being adapted to swing into another position toward and into braking engagement with the reel to retard its rotation when the motor means is not in use.

11. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch for driving the reel comprising, in combination therewith, a rock shaft mounted within the pit box below its upper edge, parallel with the axis of the reel, and between the reel axis and wall of the box; and an angular pedal having a down turned portion operatively mounted on the rock shaft, an upper horizontal portion disposed above the box edge and extending outwardly thereacross, and an operating connection between the rock shaft and clutch.

12. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch for driving the reel comprising, in combination therewith, pivot means operatively mounted within the pit box below its upper edge, in substantially parallel relation with the axis of the reel; a control member having its upper end above the pit box convenient to an operator with its lower end operatively mounted on the pivot means, an operating connection between the control member and clutch to engage said clutch when said control member is moved in one direction on the pivot means, the control member adapted to be swung in the other direction into the pit box below its upper edge out of the way, and means actuated by said last motion of the control member for disengaging and holding the clutch open.

13. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch for driving the reel comprising, in combination therewith, a rock shaft mounted within the pit box below its upper edge, parallel with the axis of the reel, and between the reel axis and one wall of the box; a pedal mounted on the rock shaft with a foot portion swingable into position over the box edge, and an operating connection between the rock shaft and clutch operable to engage said clutch, the pedal being swingable on the rock shaft into the box toward the reel.

14. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch for driving the reel comprising, in combination therewith, a rock shaft mounted within the pit box below its upper edge, parallel with the axis of the reel, and between the reel axis and one wall of the box; an angular pedal having a down turned portion operatively mounted on the rock shaft, an upper horizontal portion disposed above the box edge and extending outwardly thereacross, an operating connection between the rock shaft and clutch and actuated by the pedal when in position extending across the box edge, the pedal being adapted to swing back into the box, and a brake engageable with the reel by the pedal in its last position.

15. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch for driving the reel comprising, in combination therewith, a rock shaft mounted within the pit box below its upper edge, parallel with the axis of the reel, and between the reel axis and one wall of the box; a pedal mounted free on the rock shaft and having a quadrant hub also free to turn on said shaft, a quadrant sleeve fixed on the rock shaft, the quadrant hub and sleeve being engageable by which to control the clutch from the pedal, the quadrant hub and sleeve being disengageable by which to render the pedal inoperative to control the clutch, and a brake applied

to the reel by the pedal when it is inoperative to control the clutch.

16. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch for driving the reel comprising, in combination therewith, a rock shaft mounted within the pit box below its upper edge, parallel with the axis of the reel, and between the reel axis and one wall of the box; a pedal of angular form having a down turned portion operatively mounted on the rock shaft, an upper horizontal portion disposed above the box edge and extending outwardly thereacross, and an operating connection between the rock shaft and clutch; two treads provided on the horizontal portion of the pedal, one tread for engagement by an operator's foot when the pedal is disposed above and across the box edge to actuate the rock shaft, the pedal adapted to be tilted on the rock shaft back into the box, and a brake means coacting with the reel and applied by the pedal when in its latter position, the other tread for engagement by the operator's foot when the pedal is in said latter position to actuate the brake.

17. A fuel handling pit box having a pivoted lid thereon flush with the ground level which encloses a reel with a hose thereon comprising, in combination therewith, a ratcheting mechanism operatively connected with the reel to drive same, a pedal operatively connected with the ratcheting mechanism, means mounting the pedal within the pit box adapting said pedal to be elevated above the level of the lid for foot operation and to be restored below said level in order that the lid may close, and means automatically connecting and disconnecting the pedal with and from the mechanism when the pedal assumes, respectively, its two positions.

18. A fuel handling pit box having a pivoted lid thereon flush with the ground level which encloses a reel with a hose thereon comprising, in combination therewith, a pedal within the pit box normally located below the level of the lid permitting the closing of said lid over the pedal, means for elevating the pedal above the level of the lid, and ratchet mechanism acting to automatically disconnect the pedal from the reel when displaced below the lid level as well as connecting it with said reel when elevated above said level.

19. A fuel handling pit box having a pivoted lid thereon flush with the ground level which encloses a reel with a hose thereon comprising, in combination therewith, a ratchet and pawl mechanism within the pit box below the lid line, a handle extending from the ratchet and pawl mechanism upwardly through the pit box above ground level for manually driving the reel, socket means adapting the handle to be detachably connected with said mechanism, and manually operable means for connecting and disconnecting the ratchet and pawl mechanism with the reel, and means including a driving connection between the manually operable means and said mechanism by which said manually operable means is adjusted to foot-operating position also for driving the reel.

20. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch for driving the reel comprising, in combination therewith, a pedal mounted within the pit box, an operating connection between the pedal and reel by which said reel may be driven by an operator's foot, spring actuated means for holding the clutch of the motor means disengaged while the reel is being driven by the pedal, and means for disconnecting the operating connection between the pedal and reel while said reel is being driven by the motor means.

21. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel having a hose line, and motor means with a clutch for driving the reel comprising, in combination therewith, a pedal mounted within the pit box, an operating connection between the pedal and reel by which the reel may be driven by an operator's foot, spring actuated means for holding the clutch of the motor means disengaged while the reel is being driven by the pedal, and means actuated by the pedal for disconnecting the operating connection between the pedal and reel while the reel is being driven by the motor means.

22. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel having a hose line, and motor means with a clutch for driving the reel comprising, in combination therewith, a pedal mounted within the pit box, an operating connection between the pedal and reel, mounting means supporting the pedal and so arranged that it stands above the pit box edge for operation by foot power, spring actuated means for holding the clutch of the motor means disengaged while the reel is being driven by the pedal, means cooperating with the pedal adapting it for displacement downwardly below the lid box edge when not in use, and means for disconnecting the operating connection when the pedal is displaced downwardly while the reel is being driven by the motor means.

23. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel having a hose line, and motor means with a clutch for driving the reel comprising, in combination therewith, a plunger pedal mounted within the pit box above the box edge, an operating connection between the plunger pedal and reel by which a reciprocating motion of said pedal drives the reel, spring actuated means for holding the clutch of the motor means disengaged while the reel is being driven by the pedal, the pedal being mounted and arranged to undergo a downward adjustable twisting displacement below the box edge, means to hold the pedal in this latter position, and means actuated by the pedal in said latter position for disconnecting the operating connection between the pedal and reel while said reel is being driven by the motor means.

24. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel carrying a hose line, and motor means with a clutch when engaged for driving the reel comprising, in combination therewith, a pedal mounted upright within the pit box, an operating connection including a ratchet and pawl between the pedal and reel by which the latter may be driven by an operator's foot which forces the pedal on its down stroke, means tensioning the operating connection to return the pedal on its up stroke, means for disconnecting the ratchet and pawl to render the pedal inoperative, the plunger pedal being disposed above the pit box ground level for reciprocation and adapted to be displaced downwardly below said level to actuate the means for dis-

connecting the ratchet and pawl, and means associated with the pit box and pedal for maintaining said pedal in its downwardly displaced position.

25. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel carrying a hose line, and motor means with a clutch for driving the reel comprising, in combination therewith, a plunger pedal mounted to reciprocate within the pit box above ground level, a ratchet wheel and dog mounted on the reel, an arm extending from the dog, a thrust link connecting the arm with the plunger pedal, a driving pawl pivoted on the dog and engaging the ratchet wheel to turn same, and a locking pawl latching against the ratchet wheel to prevent reverse turn thereof, the two pawls being operatively mounted adjacent each other and arranged for coaction by a downward thrust of the pedal below the box ground level to knock both pawls away from the ratchet wheel for disconnecting the dog from the reel.

26. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel and hose line, and motor means with a clutch for driving the reel comprising, in combination therewith, a clutch control pedal to engage said clutch for driving the reel by motor power, a reel driving pedal mounted within the pit box and having an operating connection with the reel for driving same by foot power, spring actuated means for holding the clutch of the motor means disengaged while the reel is being driven by the pedal, and means for disconnecting the operating connection between the pedal and reel while said reel is being driven by the motor means.

27. Fuel handling apparatus including a pit box with its walls and upper edge adapted to be submerged to ground level, enclosing a reel and hose line, and motor means with a clutch for driving the reel comprising, in combination therewith, a clutch control pedal to engage said clutch for driving the reel by motor power, a reel driving pedal mounted within the pit box and having an operating connection with the reel for driving same by foot power, spring actuated means for holding the clutch of the motor means disengaged while the reel is being driven by the pedal, means for disconnecting the operating connection between the pedal and reel while said reel is being driven by the motor means, pivot means mounting the clutch control pedal above and across the edge of the pit box, the clutch control pedal adapted to be swung on the pivot into and below said box edge, and a brake means acting against the reel and operated by the clutch control pedal inside the box when the reel is being driven by the reel driving pedal.

28. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch and driving transmission for operating the reel comprising, in combination therewith, a pedal mounted within the pit box having two independently operative positions in relation to said box, one within the box and the other outside thereof, and an operating connection between the clutch and pedal acting to engage the clutch when the pedal is depressed outside the box and to disengage the clutch when depressed inside the box.

29. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch and driving transmission for operating the reel comprising, in combination therewith, a pedal mounted within the pit box having two independently operative positions in relation to said box, one within the box and the other outside thereof, an operating connection between the clutch and pedal acting to engage the clutch when the pedal is depressed outside the box and to disengage the clutch when depressed inside the box, and a lost-motion means included in the operating connection rendering the latter inoperative for either action except when the clutch is either within the box or outside thereof.

30. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch and driving transmission for operating the reel comprising, in combination therewith, a pedal pivoted within the pit box adapted to swing outside and back into said box, with an operating connection between the clutch and pedal acting to engage the clutch when the pedal is depressed outside the box and to disengage the clutch when the pedal is pivoted into the box, and a spring cooperating with the pedal to tilt it over into the box when the operator depresses the pedal which tensions the spring and he slips his foot off said pedal.

31. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a clutch and driving transmission for operating the reel comprising, in combination therewith, a pedal mounted within the pit box, a rock shaft on which the pedal is pivoted, a pair of hubs carried on the rock shaft, with one hub fixed to said shaft and the other hub integrally formed with the pedal, the hubs having lost-motion engageable shoulders, and an operating connection between the rock-shaft and the clutch acting to engage said clutch when the pedal is depressed outside the box and to positively disengage the clutch when said pedal is pivotally displaced into said box.

32. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a toothed clutch and driving transmission for operating the reel comprising, in combination therewith, a pedal pivoted within the pit box having two independently operative positons in relation to said box, one within the box and the other outside thereof, each of which positions is attained by swinging the pedal in or out of the box, an operating connection between the toothed clutch and the pedal acting to engage the clutch when said pedal is depressed outside the box, and a lost-motion device included in the operating connection having a striking means actuated by the momentum of the pedal when swinging into the box for exerting a jerking action to dislodge the teeth of the clutch.

33. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, and motor means with a toothed clutch and driving transmission for operating the reel comprising, in combination therewith, a pedal within the pit box having two independently operative positions in relation to said box, one within the box and the other outside thereof,

means mounting the pedal movably within the box, whereby said pedal may be moved to either operative position, an operating connection between the clutch and pedal acting to engage the clutch when the pedal is depressed outside the box, and spring means acting on the clutch tending to disengage and hold said clutch open, and a striking means actuated by movement of the pedal into the box for forcibly separating the teeth of the clutch.

34. Fuel oil handling apparatus comprising, in combination, a box, a reel with a hose line rotatably mounted in the box, a lid on the box to close same, and means operated by the closed lid to hold the reel against rotation.

35. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose comprising, in combination therewith, a lid mounted on the box to swing closed thereon into ground-flush position, including means acted on by the lid to engage the reel and hold it against rotation.

36. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, in combination with a lid pivoted on the box to swing closed thereon into ground-flush position, and yieldable pressure means engageable with the reel under the influence of the weight of the lid when closed to hold said reel against rotation.

37. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, in combination with a braking device under the control of an operator to retard and control the rotation of the reel, and a lid mounted on the box to close thereon into ground-flush position and into engagement with the braking device.

38. Fuel oil handling apparatus comprising, in combination, a box, a reel with hose line rotatably carried in the box, a braking pedal pivotally mounted in the box engaging the reel, a lid to close the box, and means operated by the weight of the closed lid to hold the braking pedal against the reel.

39. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, a lid pivoted on the box to swing closed thereon into ground-flush position, in combination with means carried by the lid when closed to directly engage the reel and hold it against rotation.

40. Fuel oil handling apparatus including a pit box with its walls and upper edges adapted to be submerged to ground level, enclosing a reel containing a hose, a lid pivoted on the box to swing closed thereon into ground-flush position, in combination with yieldable pressure means carried on the under side of the lid adapted to engage the reel under the influence of the weight of the lid and hold said reel against turning when the lid is closed.

WILLIAM J. PETER

APPENDIX E

WASTE DISPOSAL MANIFEST

1/3020

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: ~~NAS~~ TX 7170022787
2. Page 1 of: 1
3. Emergency Response Phone: 800-322-5085
4. Manifest Tracking Number: 008813120 JJK

GENERATOR

5. Generator's Name and Mailing Address: ~~LT Commanding Officer NALF Cabaniss~~ NAS Corpus Christi
8851 Ocean Dr., Bldg 19
Corpus Christi, TX 78419
Generator's Phone: 361-961-5363

Generator's Site Address (if different than mailing address): NALF Cabaniss
2601 Saratoga Blvd.
Corpus Christi, TX 78413

6. Transporter 1 Company Name: Alamo1, 10843 Guilfdale, S.A. TX 78216
U.S. EPA ID Number: TXD987991868

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address: Texoma Landfill
7000 IH 10 East
San Antonio, TX 78219
Facility's Phone: 210-661-4104
U.S. EPA ID Number:

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. IDW Soil 5119120979 ~~#5119120995~~	7	DM	3500 lbs	P	008114892
	2. IDW Water 5119120995 ~~#5119120979~~	6	DM	2400 lbs	P	008122052
	3.					
	4.					

14. Special Handling Instructions and Additional Information

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Linda Riley-Lattimore
Signature: Linda Riley-Lattimore
Month: 01 Day: 20 Year: 12

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: CARL W. KASPER III
Signature: Carl W. Kasper III
Month: 1 Day: 20 Year: 12

Transporter 2 Printed/Typed Name:
Signature:
Month: Day: Year:

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator)
U.S. EPA ID Number:
Facility's Phone:

18c. Signature of Alternate Facility (or Generator)
Month: Day: Year:

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name: Kathryn Engelberg
Signature: Kathryn Engelberg
Month: 1 Day: 20 Year: 12

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATOR STATE (IF REQUIRED)