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INFILTRATION GALLERY INSTALLATION WORK PLAN OPERABLE UNIT 4 (OU4) NTC ORLANDO FL

3/1/2012

TETRA TECH

INFILTRATION GALLERY INSTALLATION WORK PLAN

for

OPERABLE UNIT 4

Naval Training Center
Orlando, Florida

BRAC Program Management Office Southeast

Contract Number N62470-08-D-1001
Contract Task Order JM15

March 2012

031205/P

INFILTRATION GALLERY INSTALLATION WORK PLAN

OPERABLE UNIT 4

NAVAL TRAINING CENTER ORLANDO, FLORIDA

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Prepared for:
Department of the Navy
Base Realignment and Closure
Program Management Office Southeast
4130 Faber Place Drive
North Charleston, South Carolina 29405

Prepared by:
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661 Andersen Drive, Foster Plaza 7
Pittsburgh, PA

Prepared under:
CONTRACT NO. N62470-08-D-1001
CONTRACT TASK ORDER JM15

MARCH 2012

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FIGURES

ACRONYMS

amsl	above mean sea level
Cis-1,2-DCE	cis-1,2-dichloroethene
DRMO	Defense Reutilization and Marketing Office
EM	electromagnetic
FOL	Field Operations Leader
GPR	ground penetrating radar
GPS	Global Positioning System
HDPE	high density polyethylene
NAVFAC SE	Naval Facilities Engineering Comand Southeast
NTC	Naval Training Center
OU	Operable Unit
P&T	pump & treat
PCE	tetrachloroethene
PVC	polyvinyl chloride
SA	Study Area
SDR	Standard Dimension Ratio
SOW	scope of work
TCE	trichloroethylene
TOC	Total organic carbon
VC	vinyl chloride
VOC	Volatile Organic Compound
WBZ	Water Bearing Zone

1.0 INTRODUCTION

Tetra Tech has been contracted by the Department of the Navy, Naval Facilities Engineering Command Southeast (NAVFAC SE) to prepare a Work Plan to upgrade the existing groundwater extraction and treatment system for Operable Unit (OU) 4 at Naval Training Center (NTC) Orlando, Florida. The purpose of the existing extraction system is to create a hydraulic barrier to prevent the flow of impacted groundwater toward Lake Druid. This system upgrade consists of the installation of a subsurface infiltration system to discharge treated groundwater. Currently, treated groundwater is being discharged to the local sanitary system. OU 4 is located within Area C of the NTC, Orlando and includes Study Areas 12, 13, and 14. The location of NTC Area C in the Orlando area is shown in Figure 1-1. The site vicinity of Area C and the location of OU 4 within Area C are depicted in Figure 1-2.

1.1 SITE HISTORY AND BACKGROUND

OU 4 consists of a composite of Study Area (SA) 12 [Defense Reutilization and Marketing Office (DRMO) Warehouses and Salvage Yard], SA 13 (former base laundry and dry cleaning facility), and SA 14 (DRMO Storage Area). The eastern and southern portions of the site have been developed, include existing or legacy facilities formerly operated by the Navy, and are relatively flat lying with ground elevations ranging from 113 to 110 feet above mean sea level (amsl). Immediately west of former Building 1100, the site is mostly vegetated as the ground slopes gently downward to the shoreline of Lake Druid at an elevation of approximately 100 feet amsl (see Figure 1-2). Lake Druid consists of a roughly circular body of water approximately 16.5 acres in size with a maximum depth of approximately 14 feet near its center.

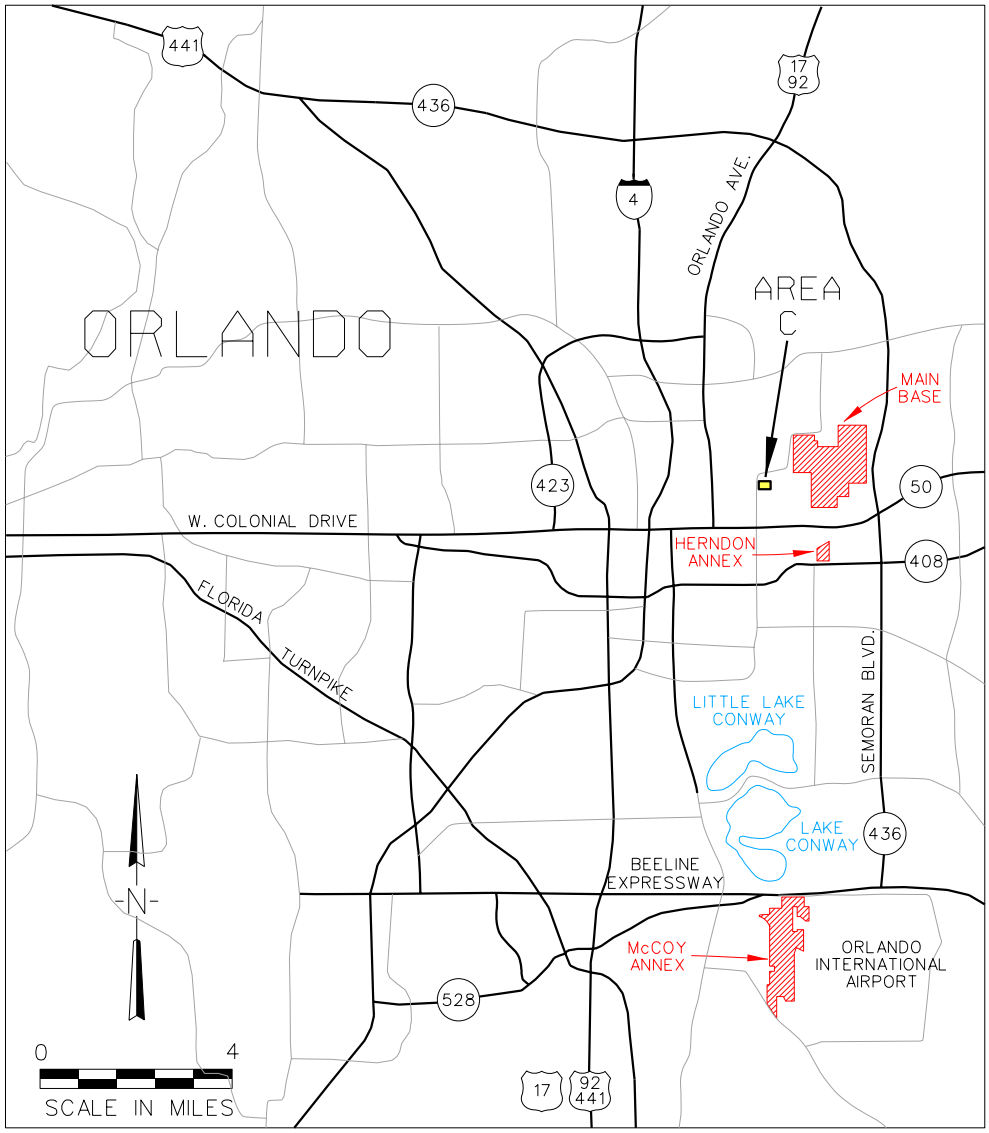
Former Building 1100 included the laundry and dry-cleaning facility and the building site is the primary focus for OU 4 and this Work Plan (see Figure 1-2). Building 1100 was constructed in 1943 and dry-cleaning operations began in 1958, or possibly earlier. Wastewater from the laundry machines was discharged to the sanitary sewer through floor trenches. The floor trenches discharged to a single pipe connected to a settling and surge tank. Due to the large volume of water generated from the laundry process, a 30,000-gallon surge tank was installed on the west side of the building in the mid-1960s. Waste filters from the dry-cleaning machines were also generated at the facility. Dry cleaning chemical tetrachloroethene (PCE) was separated from the water and filters by heating the assemblies in a pressure cooker known as the “Filter Cooker” located in the northern portion of the building. Operations ceased in the fall of 1994 and all laundry equipment (both conventional water-based and dry-cleaning) was subsequently removed from the building. The building was demolished in 2004.

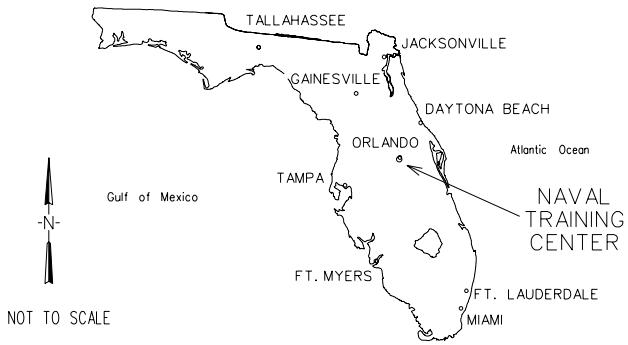
A series of environmental investigations conducted at OU 4 identified the presence of CVOC contamination in soil and groundwater originating from the laundry. The primary groundwater contaminants at OU 4 are PCE, trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC). The types of chemicals present and the location of highest levels of contamination indicate that the former dry cleaning operations, specifically floor drains in the building, were the primary source of the contamination release. Figure 1-3 shows the OU 4 site features and identifies the locations of wells installed at various depths in the surficial aquifer and the underlying Hawthorn Water Bearing Zone (WBZ).

1.2 EXISTING TREATMENT SYSTEM OVERVIEW

The current groundwater treatment system at OU 4 includes two recovery wells where groundwater is pumped from each well at approximately 6 gallons per minute (gpm). The combined flow of approximately 12 gpm is transferred to a low profile air stripper for treatment. The treated water is then transferred via a centrifugal discharge pump, under permit, to the local sanitary sewer system.

CAD FILE NO.: k:\dgn\navy\orlando\sites\AreaC\AC-106.dgn





DRAWN BY: ILG	DATE: 7-15-08		CONTRACT NO.: N62470-08-D-1001
CHECKED BY: TKG	DATE: 7-15-08	**SITE LOCATION MAP AREA C**	OWNER NO.: ----------
REVISED BY: ---	DATE: ---------	**NAVAL TRAINING CENTER ORLANDO, FLORIDA**	APPROVED BY: --- DATE: ---------
SCALE: AS NOTED			DRAWING NO.: FIGURE 1-1 REV.: 0

CAD FILE NO./DATE: K:\DGN\NAVY\ORLANDO\SITES\ou4\OU4_AERIAL-2004.dgn/12-15-2011

DRAWN BY: JAW	DATE: 12-15-2011	SITE VICINITY MAP OPERABLE UNIT 4 - AREA C NAVAL TRAINING CENTER ORLANDO, FLORIDA	CONTRACT NO.: N62470-08-D-1001
CHECKED BY: TKG	DATE: 12-15-2011		OWNER NO.: ----
REVISED BY: ---	DATE: --------		APPROVED BY: --- / DATE: --------
SCALE: AS NOTED			DRAWING NO.: FIGURE 1-2 / REV.: 0

NBRC-AV.dgn 5-14-08

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LOCATION COORDINATES		
LOC.	EASTING	NORTHING
A	544451	1536945
B	544803	1536948
C	545486	1536953
D	545492	1536283
E	545130	1536283
F	545130	1536472
G	544803	1536472
H	543793	1536472
I	543793	1536660
J	544455	1536670

-N-

0 120

SCALE IN FEET

PLAZA TERRACE DRIVE

AUDUBON PLACE CITY CONDOMINIUMS

AREA C NORTHWEST SITE BOUNDARY

AREA C NORTHEAST OU4 SITE BOUNDARY

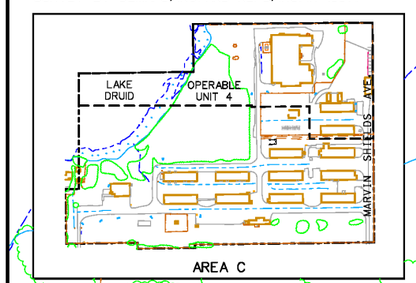
LAKE DRUID

TEMPORARY NO ACCESS ZONE

PHYTOREMEDIATION TREE FARM

LAND AND GROUNDWATER USE RESTRICTION ZONE

SOURCE:
ROADS, BUILDINGS, ETC. ARE FROM A PHOTOGRAMMETRIC SURVEY BY DEMAPS, INC. AND REPS, INC. IN 1997.



AREA C

LEGEND

- MONITORING WELL
- HAWTHORN MONITORING WELL
- MICROWELL
- EXTRACTION WELL
- DRIVE POINT
- TEMPORARY NO ACCESS ZONE
- LAND AND GROUNDWATER USE RESTRICTION ZONE
- FENCE
- WOODS BOUNDARY
- PROPERTY BOUNDARY
- DRAINAGE/EDGE OF WATER
- MARSH AREA

DRAWN BY: WRW	DATE: 2/07/2011
CHECKED BY: TKG	DATE: 9-1-2009
REVISED BY: ---	DATE: ---------
SCALE: AS NOTED	

SITE MAP
OPERABLE UNIT 4 - AREA C NORTHEAST AND AREA C NORTHWEST

NAVAL TRAINING CENTER ORLANDO, FLORIDA

CONTRACT NO.	N62470-08-D-1001
OWNER NO.	
APPROVED BY: ---	DATE: ---------
DRAWING NO.	FIGURE 1 - 3
REV.	0

2.0 DESIGN APPROACH

The proposed infiltration system will be used for discharge of treated groundwater as an alternative to discharging to the sanitary sewer system. A discharge rate of 20 gpm was used for design calculations. The infiltration gallery trenches will be installed in an open grassy area of OU 4. The conveyance line from the treatment system to the infiltration gallery trenches will be installed through a wooded area and across an existing asphalt access road. Further detail on the approach for designing the infiltration gallery is provided in the subsections below.

2.1 INFILTRATION GALLERY

The infiltration gallery was designed for discharge of treated groundwater to replace the previously utilized sanitary sewer system. Design calculations for the infiltration gallery are attached in Appendix A. The design calculations rely primarily on the site specific infiltration rate of the soil which was estimated from available sources. Since the site specific infiltration rate is not available percolation tests will be conducted to verify the calculations used for design.

2.2 PERCOLATION TESTS

The percolation tests will be conducted where the infiltration gallery is to be constructed. At least four locations shall be used to conduct percolation tests. At each location, a hole of 12 inches in diameter and 30 inches in depth will be dug. During the test, the starting water level should be 11 inches from the top of the hole and should not be drained lower than 17 inches from the top of the hole. The detailed procedure for performing the percolation tests is provided in Appendix B. Information from the tests will be evaluated and compared to the design calculations.

3.0 SUBSURFACE INFILTRATION SYSTEM DESIGN

3.1 CONNECTION PIPING AND FITTINGS

Within the treatment system the existing 2 inch polyvinyl chloride (PVC) discharge line to the sanitary sewer shall be tapped by installing one (1) PVC Tee, two (2) appropriate ball valves, and appropriate PVC reducing/expansion fittings and piping to connect to the newly installed conveyance line. Installation of the two ball valves shall allow for flow to be directed to either the newly constructed infiltration gallery or the existing sanitary sewer piping.

3.2 CONVEYANCE PIPING CONSTRUCTION

A 6-inch wide by 2.5-foot deep by approximately 500-foot long trench located as depicted on Figure 3-1 will be excavated from the pump & treat (P&T) system to the two main branches of the infiltration gallery. A few trees may be cut within the wooded area to provide access to the proposed conveyance line location. Prior to installation the exact path of this piping will be located to minimize disturbance of vegetation. A 3-inch I.D. Standard Dimension Ratio (SDR) 11 high density polyethylene (HDPE) discharge header will be installed within the trench for conveyance of P&T system discharges to the infiltration gallery. Connections of HDPE piping sections will be by fusion welds. A cross sectional diagram, which details the construction of the conveyance piping and infiltration gallery is provided as Figure 3-2.

During excavation of the conveyance trench, soil shall be stockpiled and placed back in the trench after piping installation. Within the backfilled native soil, metallic tape will be placed at 12 inches below grade to locate the piping once construction is complete. Compaction of the backfilled material shall be completed using 6” to 8” lifts and appropriate compaction equipment so that the filled material is of a similar compaction compared to that which existed prior to excavation.

3.3 ACCESS ROAD CONVEYANCE PIPING INSTALLATION

Approximately 12-feet of the conveyance line will cross an existing asphalt access road at the site. One of two options will be used to implement the conveyance piping and they are described below.

Option 1 - Horizontal Drilling

It is believed that horizontal drilling underneath the existing asphalt road may be the simplest method to install conveyance piping in these approximately 12 feet. The horizontal hole diameter should kept at a minimum so the conveyance pipe can be located within the hole while not requiring additional fill to be

needed to prevent subsidence. Conveyance pipe placement in this location shall be at approximately the same depth as shown in Figure 3-2 to match the conveyance pipe settings on either side of the access road.

Option 2 – Trenching, Construction and Resurfacing

A 6-inch wide by approximately 12-foot long section of asphalt shall be cut and broken up and removed from the site during excavation of the conveyance trench in this area. The bottom portion of the excavated trench material shall be stockpiled and reapplied after piping installation. Compaction of the backfilled material shall be completed using 6" to 8" lifts and appropriate compaction equipment so that the filled material is of a similar compaction compared to that which existed prior to excavation. Resurfacing of the top portion of the trench shall be completed using 6-inches of concrete followed by 2 inches of asphalt top coat to match the adjacent cut asphalt access road.

3.4 INFILTRATION GALLERY

An infiltration gallery will be installed approximately 300-feet southeast of the P&T system as shown on Figure 3-1. The infiltration gallery will be installed by excavating two parallel trenches spaced 88-feet apart with dimensions of 150-feet-long by 2.5-feet wide by 2.5-feet deep. The conveyance line from the P&T system will connect to the two parallel infiltration gallery trenches as shown in Figure 3-1. Connections from the header to the lateral infiltration gallery piping will be with HDPE to perforated pipe transitions.

A 6-inch bed of pea gravel will be placed at the bottom of the trench. Perforated 3-inch I.D. HDPE will be installed above the gravel bed and then a 9-inch lift of gravel will be placed above the bottom of the pipe. A separation geotextile will be placed on top of the gravel and the trench will be backfilled to grade with the native soil previously excavated. Any additional soil will be spread in the vicinity of the trenches. Within the backfilled native soil, metallic tape will be placed at 12 inches below grade to locate the piping once construction is complete. Compaction of the backfilled material shall be completed using 6" to 8" lifts and using appropriate compaction equipment so that the filled material is of a similar compaction compared to that which existed prior to excavation. A cross sectional diagram, which details the construction of the infiltration gallery is provided as Figure 3-2.

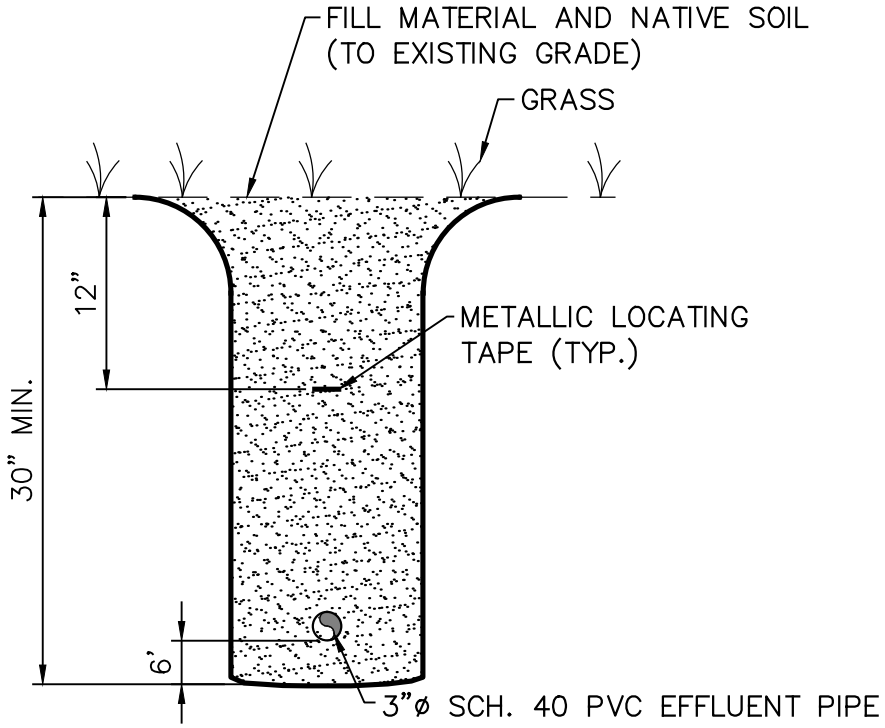
During the installation of the infiltration gallery, care must be taken to ensure that the gravel bed, and piping is installed below the root zone and where organic debris is evident.

PGH P:\GIS\ORLANDO_NTC\MXD\OU4_AREA-C_INFILTRATION.MXD 03/19/12 SP

DRAWN BY	DATE
K. MOORE	01/17/12
CHECKED BY	DATE
C. MILLER	03/19/12
REVISED BY	DATE
S. PAXTON	03/19/12
SCALE	
AS NOTED	

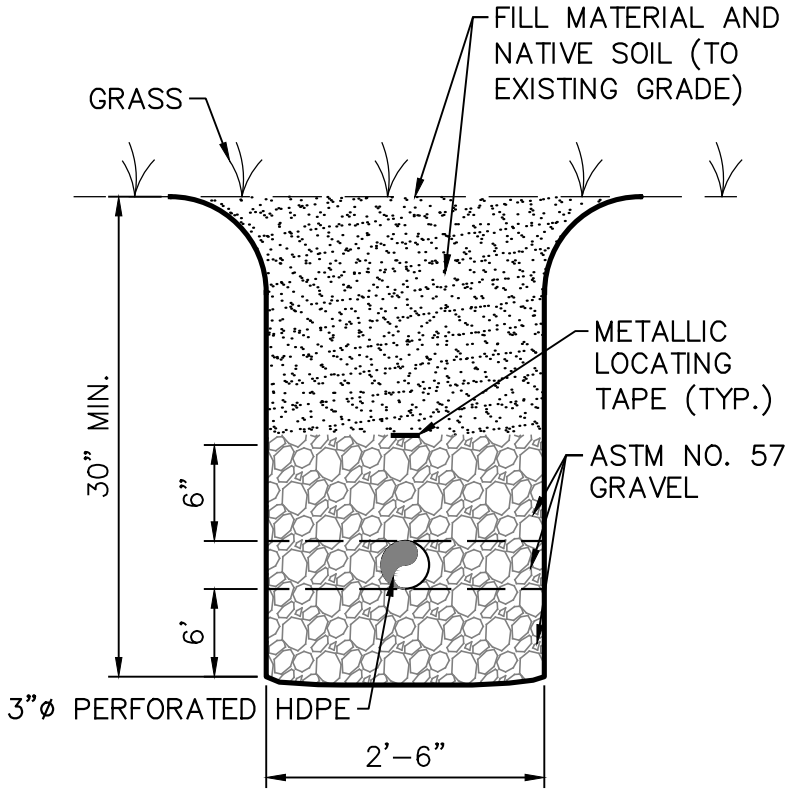
INFILTRATION GALLERY LOCATION
OPERABLE UNIT 4 - AREA C
NAVAL TRAINING CENTER
ORLANDO, FLORDIA

CONTRACT NUMBER	OWNER NO.
N62470-08-D-1001	00131
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO.	REV
3 - 1	0



SECTION A–A'
TYPICAL INFILTRATION GALLERY CONVEYANCE PIPING

NOT TO SCALE



SECTION B–B'
INFILTRATION GALLERY DETAIL

NOT TO SCALE

TETRA TECH
WWW.TETRATECH.COM
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921–7090 | F: (412) 921–4040

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

INFILTRATION GALLERY
OPERABLE UNIT 4 – AREA C
SCALE: NOT TO SCALE

DATE:	7/8/09
PROJECT NO.:	112G02581
DESIGNED BY:	PM
DRAWN BY:	BH
CHECKED BY:	PM
SHEET: 1 OF 1	
SIZE: A	FIGURE 3–2

4.0 CONSTRUCTION ACTIVITIES

This system upgrade described in Section 3 will be constructed by an appropriately selected subcontractor. See Appendix C for the scope of work (SOW) which will be used for solicitation and contracting a subcontractor for installation activities.

4.1 SEQUENCE OF CONSTRUCTION

Tetra Tech and its subcontractor(s) will execute the work according to the following basic construction sequence;

- Utility clearance activities shall be conducted.
- Percolation tests will be performed at the proposed location of the infiltration gallery.
- Percolation tests results will be evaluated and compared to design assumptions.
- A pre-construction meeting will be held prior to start of construction with Tetra Tech and Tetra Tech subcontractor(s). The purpose of this meeting will be to identify facility access procedures, safety issues, haul routes, material staging area and construction requirements.
- Tetra Tech will oversee all subcontractors to obtain and have delivered all needed construction materials to the approved material staging area prior to starting the excavation and placement of the infiltration gallery. In addition, all necessary equipment to perform the work will be mobilized.
- A Health and Safety Briefing Meeting will be held daily.
- A ditch witch and a small excavator will be utilized for excavating the conveyance and infiltration trench.
- Piping and materials will be constructed within the conveyance and infiltration trench.
- Following construction, trenches will be backfilled with the soil removed during excavation and resurfaced.

- All remaining materials will be removed from the Site.

- A survey of the horizontal coordinates on the final infiltration system will be performed using Global Positioning System (GPS).

4.2 UTILITY CLEARANCE SURVEY

The local public utility location service (One Call) will be contacted prior to intrusive activities; however, this service is not normally offered at the site. Considering the public utility service may not be available at the site a utility location survey will also be conducted to identify potential buried utilities that could be present in the construction alignments (work areas) to avoid damaging potentially active utilities during the infiltration gallery construction process.

Geophysical surveys using electromagnetic (EM), ground penetrating radar (GPR), and pipe and cable locator equipment shall be conducted to locate potential utilities within the intrusive work areas. Utilities identified from these surveys will be clearly marked in the field using spray paint and pin flags, and their locations will be determined and documented. Since planned construction is shallow, utilities within the top four feet in depth are most critical to identify to support this construction process; however, locations of deeper utilities (where detected) are also of interest and will also be marked and documented (identified). It is also possible that other buried structures, such as underground storage or settling tanks, may be present in the work areas, and the geophysical surveys performed in the utility location survey will also be used to target potential buried structures within the construction alignments as well.

4.3 PERSONNEL AND EQUIPMENT

Tetra Tech will provide a Field Operations Leader (FOL) to oversee the placement of the infiltration gallery and the accompanying work. The FOL will also be responsible for ensuring work is completed in accordance with this work plan and with the safety guidelines established in the Health and Safety Plan for the OU4 infiltration gallery installation. Because activities will not extend into impacted groundwater and soil is “clean”, site workers will not come into contact with contaminated material.

Anticipated equipment the subcontractor will require to perform the work includes a ditch witch (trencher), small excavator and hand tools. The excavator is expected to be used to move and place stone, excavate material from the infiltration gallery and assist the laborers in placement of the transfer piping. The hand tools are expected to be used by the laborer to perform miscellaneous work associated with placing the drainage pipe and packing in the pea gravel around the pipe. Additionally, the hand tools will allow for accurate removal of material without the risk of damaging the impermeable and drainage layers associated with the existing cap.

5.0 FINAL SYSTEM UPGRADE REPORT

At the end of the project, Tetra Tech will submit a Letter Report summarizing the project's history, including both routine and unusual events, an evaluation of subcontractor performance, materials used, and updated figures illustrating any changes to the proposed layout piping.

APPENDIX A

CALCULATIONS

Tetra Tech NUS

CALCULATION SHEET

CLIENT: NAVY	FILE No:	BY: CJM	PAGE: 1 OF 2
SUBJECT: Infiltration Trench	CHECKED BY: CJP	DATE: 1/10/12	

Objective: Determine length of infiltration trench needed

Approach: Estimate infiltration rate, set dimensions of trench then determine length of trench

Inputs:

Typical trench depth	2.5	feet	
Typical trench width	2.5	feet	
Depth to water	4	feet bgs	
Site Hydraulic conductivity	60	ft/day	assumed

Infiltration Trench

Depth of Trench, D_{trench}	Depth to Water Table, D_{wt}	Hydraulic Conductivity, K_{equiv}	Hydraulic Gradient, i	Infiltration Rate, f	$CF_{silt/bio}$	Adjusted Infiltration Rate, f_{corr}
Varies 1' to 6' (ft)	*Determined by Lab Tests* (ft)	*Determined by Lab Tests* (ft/day)	*Equation 1*	*Equation 2* (in/hr)	*See Table 1*	*Equation 3* (in/hr)
INPUT VALUES						
2	4	60	0.06	1.8805	0.8	1.5044
2	4	60	0.06	1.8805	0.8	1.5044

Calculation to detemine length of trench needed

Wetted length of proposed trench	=	5.5 ft	Top 1 ft on each side of trench is native material
Length of proposed trench	=	300 ft	Determine length of trench needed.
Surface area of trench	=	1650 ft2	
Maxium flow rate from trench	=	206.9 ft3/hr	Detemined using highlighted infiltration rate calculated above and total surface area of trench
	=	1547.3 gallons/hr	
		25.8 gpm	Slightly greater than 20 gpm as stated for design

Conclusion: **The estimated infiltration rate is highly dependant on the hydraulic conductivity of the site lithology. Approximately 300 ft of length is needed for the trench given the estimated site hydraulic conductivity value of 60 ft/day.**

Tetra Tech NUS

CALCULATION SHEET

CLIENT: NAVY	FILE No:	BY: CJM	PAGE: 1 OF 2
SUBJECT: Infiltration Trench	CHECKED BY: CJP	DATE: 1/10/12	

Equations:

Eq. 1

$$\text{gradient} = i \approx \frac{D_{wt} + D_{trench}}{78(K^{0.05})}$$

where:
K = saturated hydraulic conductivity, in feet/day
Dwt = depth from the base of the infiltration trench to the water table or to the first low-permeability layer, in feet
Dtrench = depth of water in the trench, in feet

Eq. 2

$$f = 0.5Ki$$

where:
f = specific discharge or infiltration rate of water through a unit cross-section of the infiltration fac
K = hydraulic conductivity
i =gradient for ponds and trenches at sites with shallow water tables, or a value of approximately for ponds and trenches at sites with deep water tables

Eq. 3

$$f_{corr} = (CF_{silt/bio})f$$

where:
CFsilt/bio = correction factor for siltation and biofouling
f = "uncorrected" infiltration rate

Table 1

Potential for biofouling	maintenance and performance	Infiltration rate reduction	
		Ponds	Trenches
Low	Average to high	0.9	0.9
Low	Low	0.6	0.8
High	Average to high	0.5	0.75
High	Low	0.2	0.6

APPENDIX B

PERCOLATION TEST PROCEDURE

PERCOLATION TEST PROCEDURE
INSTRUCTIONS

General Information - Complete the general information areas of sections 1., 2., and 3. at the top of the data sheet.

Location of Percolation Test Holes - The percolation(perc) test holes shall be spaced uniformly over the proposed soil absorption (leach field) site. **A minimum of three(3) test holes are required.** More than 3 can be used if desired.

Test Hole Preparation - Test holes that are 4 to 12 inches in diameter shall be dug or bored to the proposed depth of the leach field(typical depths are 30 to 42 inches). The side walls shall be vertical anda natural soil surface (one which is not smeared from digging) shall be exposed by scraping the sides and bottom of the test hole with a sharp pointed instrument. Any loose material shall be removed from the test hole and several inches of coarse sand or gravel placed in the bottom of the test hole in order to prevent scouring and sealing before the water is poured in.

Presoaking - **PRESOAKING IS ABSOLUTELY REQUIRED** in order to get valid percolation test results. The purpose of presoaking is to have the water conditions in the soil reach a stable condition similar to that which exists during continual wastewater application in a leach field. The minimum time of presoaking varies with soil type and soil conditions, but must be sufficiently long so that the water seeps away at a steady rate. The following presoaking instructions are usually sufficient to establish the proper soil moisture conditions.

a. Sandy or loose soils - Fill the test hole to within several inches of the top and allow it to seep away. Fill the hole a 2nd and 3rd time and let the water seep away. If the water continues to all seep away in ten(10) minutes or less, this indicates that the soil is excessively permeable and the site is unsuitable for a standard subsurface disposal system. In this case, the special requirements of Chapter 11, Section 36(d) shall be followed. If water remains after 10 minutes, then further presoaking is necessary before taking any measurements. Refer to the next section for further presoaking instructions.

b. Other suitable soils - If the soil is suitable for a standard subsurface leach field, then the test holes should be presoaked for at least 4 hours. Maintain at least 12 inches of water in the test holes for at least 4 hours, then allow the soil to swell for 12 hours (overnight is good) before starting the actual perc test measurements.

Perc Rate Measurements - Start the test by filling each test hole with approximately 12 to 18 inches of water. Let the soil rehydrate for about 15 minutes and then refill to 12 to 18 inches deep. Next, decide on a time interval for your test. Time intervals of 10 or 15 minutes are typical. Once decided, the **time interval must remain constant** throughout the test so that it can be determined when the water level drop rate has stabilized. Measure the initial water level (from a fixed reference point such as a flat board across the top of the hole) in each hole and record on the “Start” line in the test data table. To continue, record the actual water level in each hole at the end of each successive time interval. After each water level measurement, calculate the water level drop from the previous measurement and record in the test data table. Continue the test until the water level drop rate (right half of each column) has stabilized; ie. - 3 consecutive equal drop rates within 1/8 inch of each other. Please note that some test holes may take longer than others to stabilize. The test should be continued at each test hole until each drop rate stabilizes. Also please note, a minimum of 6 inches of water should be maintained in the test hole. If the level drops below 6 inches, some additional water should be added between time intervals. Before you use the test data sheet, **make several extra blank copies before you start** in case the tests take more than 10 intervals to stabilize or if you intend to use more than 3 test holes.

Perc Rate Calculation - After the water level drop rates have stabilized in all of the test holes, transfer the last water level drop measurement to the final drop row in the data table. To calculate the perc rate for each test hole, divide the time interval by the final drop. This is the perc rate in minutes per inch(mpi). Depending on how many test holes were used, determine the design percolation rate using either 3a or 3b at the bottom of the percolation test results data sheet.

An Example Test Data Sheet is provided on the back of these instructions to demonstrate how to record the data.

PERCOLATION TEST RESULTS

1. Performed by: Mike Plumber Test Date(s): 6-23 & 6-24, 99

   Credentials or Status of Tester: Contractor / installer

   (Owner, contractor, installer, engineer, geologist, sanitarian, soil scientist, or other)

2. The **time interval (ti)** between water level measurements was: 10 minutes.

3. **TEST DATA**: The test holes were **PRESOAKED** for: _____ hours, or X overnight

Test Hole # is:		1	2	3
Hole depth (inches) =		34 "	38 "	37 "
Interval Number	Elapsed Time	Water Level / Drop	Water Level / Drop	Water Level / Drop
Start =	0 min	17"		
		1 1/4		
1	10	18 1/4		
		1		
2	20	19 1/4		
		3/4		
3	30	20		
		5/8		
4	40	20 5/8		
		Refill		
5	50	15		
		1/2		
6	60	15 1/2		
	3/8			
7	70	15 7/8		
		1/2		
8	80	16 3/8		
Final Drop (**NOT Total**) =		1/2"	____	____
Perc rate(mpi) is: [**ti** / Final Drop] = 10 / ½ =		20.0 mpi	_____	_____

Water level drop between intervals

The actual water level below the top of the test hole

Refill hole if needed and Re-measure actual water level

Continue test until 3 consecutive "drops" are the same to within 1/8 inch total variation

a. If **6 or more holes** were tested, the **average perc rate** was: NA mpi, or

b. If **3 to 5 holes** were tested, the **slowest perc rate** (largest number) was: 20.0 mpi

PERCOLATION TEST RESULTS

1. Performed by: _____ Test Date(s): _____

   Credentials or Status of Tester: _____

   (Owner, contractor, installer, engineer, geologist, sanitarian, soil scientist, or other)

2. The **time interval (ti)** between water level measurements was: _____ minutes.

3. **TEST DATA**: The test holes were **PRESOAKED** for: _____ hours, or ___ overnight.

Test Hole # is:			
Hole depth (inches) =			
Interval Number	Elapsed Time	Water Level / Drop	Water Level / Drop	Water Level / Drop
Start =	0 min			
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Final Drop (**NOT Total**) =				
Perc rate(mpi) is: [**ti** / Final Drop] =				

a. If **6 or more holes** were tested, the **average perc rate** was: _____mpi, or

b. If **3 to 5 holes** were tested, the **slowest perc rate** (largest number) was: _____ mpi.

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CALCULATION SHEET

CLIENT: NAVY	FILE No:	BY: CJM	PAGE: 1 OF 2
SUBJECT: Percolation Test	CHECKED BY: CJP	DATE: 1/31/12	

Objective: Calculate infiltration rate based MPI found during percolation test

Approach: Provide table of calcuated infiltration rates based on possible MPI valuse determined in the Field

Inputs:

Hole depth	2	feet	
Hole width	1.0	feet	
Average wetted depth	16.0	inches	
MPI	5	feet bgs	Unknown
IPM	0.20		Unknown
Estimated Infiltration Rate	1.50	in/hr	Calculated in First Page

Calculation to detemine			**Notes**
Avegare Wetted depth of hole	=	16.0 inches	
Diameter of hole	=	1.0 ft	
Surface area in percolation test hole	=	16 in/12 in * 1 ft * Pi + Pi* 0.5 ft^2	
	=	5.0 ft2	
Flow Rate into percolation hole	=	IPM * 1/12 in/ft* SA ft2	
	=	0.0 ft3/min	
		0.0002 gpm	
Field Infiltration Rate	=	Flow / SA	
	=	0.0 ft/min	
	=	1.9 in/hr	

Tetra Tech NUS

CALCULATION SHEET

CLIENT: NAVY	FILE No:	BY: CJM	PAGE: 1 OF 2
SUBJECT: Percolation Test	CHECKED BY: CJM	DATE: 1/31/12	

MPI Conversion To Infiltration Rate.

MPI *Found in Field* min/in	IPM *Conversion* in/min	Flow Rate *Calc* (ft3/day)	Field Infiltration Rate *Calc* (ft/min)	Field Infiltration Rate *Calc* (in/hr)		
INPUT VALUES						
0.1	10.00	0.6542	0.13	94.2000		
0.2	5.00	0.3271	0.07	47.1000		
0.4	2.50	0.1635	0.03	23.5500		
1	1.00	0.0654	0.01	9.4200		
2	0.50	0.0327	0.01	4.7100		
3	0.33	0.0218	0.00	3.1400		
4	0.25	0.0164	0.00	2.3550		
5	0.20	0.0131	0.00	1.8840		
6	0.17	0.0109	0.00	1.5700		
7	0.14	0.0093	0.00	1.3457		
8	0.13	0.0082	0.00	1.1775		
9	0.11	0.0073	0.00	1.0467		
10	0.10	0.0065	0.00	0.9420		
20	0.05	0.0033	0.00	0.4710		
40	0.03	0.0016	0.00	0.2355		
80	0.01	0.0008	0.00	0.1178		
160	0.01	0.0004	0.00	0.0589		

Conclusion: **Determine average MPI from four percolation tests. Locate average MPI in table and find corresponding infiltration rate. Compare infiltration rate to assumed rate found in first calculation sheet.**

APPENDIX C

SCOPE OF WORK AND TECHNICAL SPECIFICATIONS
TRENCHING AND MATERIALS INSTALLATION

SCOPE OF WORK AND TECHNICAL SPECIFICATIONS
TRENCHING AND MATERIALS INSTALLATION
OPERABLE UNIT 4 – AREA C
NAVAL TRAINING CENTER
ORLANDO, FLORIDA

1.0 SCOPE OF WORK

1.1 Introduction

Tetra Tech, hereinafter referred to as the Engineer, under its Comprehensive Long-term Environmental Action Navy contract, is performing groundwater treatment system upgrades at the former Naval Training Center in Orlando. An infiltration gallery will be installed as a method of disposal of treated groundwater currently discharged to the City of Orlando sanitary sewer. The primary contaminants are tetrachloroethene (PCE), and trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC). All work is anticipated to be performed in uncontaminated areas.

Operable Unit (OU) 4 is located at Area C, one of four parts of the former Naval Training Center (NTC) in Orlando, Florida as depicted in Figure 1. NTC is located in Orange County, Florida, within the limits of the City of Orlando.

All technical questions related to the Scope of Work and Technical Specifications must be addressed to Ms. Sandy D'Alessandris, Subcontract Procurement Officer, at 412-921-8435.

1.2 Site Conditions

NTC is included under the Base Realignment and Closure (BRAC) program has been closed since 1999. Area C is fenced and accessed through a series of locked gates. The Engineer will provide site access.

The current groundwater treatment system includes two recovery wells where groundwater is pumped from each well at approximately 6 gallons per minute (gpm). The combined flow of approximately 12 gpm is transferred to a low profile air stripper for treatment. The treated water is then transferred via a centrifugal discharge pump, under permit, to the local sanitary sewer system.

The proposed infiltration gallery will be used for discharge of treated groundwater as an alternative to the sanitary sewer system. Figure 2 depicts the infiltration gallery trenching and construction extent. The infiltration gallery trenches will be installed in an open grassy area. The conveyance line from the treatment system to the infiltration gallery trenches will be installed through a wooded area and across an existing asphalt access road.

1.3 General Tasks

- Installation of conveyance piping and infiltration gallery.
- A ditch witch can be utilized for digging the conveyance pipe trench if desired. A small excavator is required for the infiltration trench.
- Piping and materials within the conveyance and infiltration trench are to be supplied and installed by the Subcontractor.
- Piping and fittings are to be supplied and installed by the Subcontractor to connect the newly installed conveyance line to the existing groundwater extraction and treatment system.
- The locations of the trenches will be marked by the Engineer.
- All Subcontractor workers must possess current certifications showing compliance with OSHA 29 CFR 1910.120.
- Following construction, trenches will be backfilled with the soil removed during excavation. Backfilled soil shall be compacted so that the filled material is of a similar compaction compared to that which existed prior to excavation. Soil that cannot be backfilled will be spread on the ground surface.
- All remaining materials will be removed from the Site.

1.4 Pre-Construction Meeting

A pre-construction meeting will be held with the Engineer and Subcontractor. The meeting is intended to identify and specify project workflow and logistics including the following:

- Proposed work scope, methodology, and schedule
- Work hours
- Site specific health and safety requirements and site security
- Equipment staging area(s)
- Materials staging area(s)
- Excavated material stock pile area(s)
- On-site utility location and identification services.

2.0 TECHNICAL REQUIREMENTS

2.1 Technical Proposal

The quality of work and project schedule are of prime importance on this subcontract. Any deviations, delays, or problems anticipated or encountered must be immediately directed to the Engineer. The

Subcontractor shall provide a Technical Proposal that includes an estimate of the time needed to accomplish the field efforts described in this Scope of Work. In addition, the Subcontractor is required to provide details on how they propose to complete the requested work, including availability, type and size of equipment proposed, number of personnel assigned, a summary of previous similar work performed in Orlando (if any), any recommendations for alternative methods proposed for this work.

Bidders are required to complete the attached Price Quotation Form for the work detailed in this Scope of Work. In order to be considered responsive, the Price Quotation Form must be completed in its entirety without modification. This provides a means for performing a consistent cost comparison of Bidders. Additional line items or alternate proposals may be submitted in addition to the Price Quotation Form. Bid packages will be evaluated based on proposed schedule, past performance and experience, equipment type and availability, appropriateness of any alternate proposals, proposal completeness, past health and safety performance and record, and cost.

3.0 TECHNICAL SPECIFICATIONS

The following is a technical description of the services required for this project. The Price Quotation Form presents the bid quantities for each corresponding line item for pricing purposes. Note that line item prices shall reflect performance in accordance with descriptions included in this section.

At the end of each day, the Subcontractor's representative and the Engineer's representative will complete a Daily Activity Form (provided by the Engineer) detailing the day's activities, including trenched footage, materials, etc. Both parties will sign the sheet and the quantities on the sheet will be the basis for invoicing. Any unresolved issues related to pay items between the Engineer's representative and the Contractor's representative will be brought to the attention of the Engineer Project Manager.

3.1 Mobilization/Demobilization

Mobilization/demobilization includes:

- mobilizing all required equipment and materials to the site
- obtaining any necessary State or Water Management District permits
- Attendance at an approximately 1/2-hour long site-specific health and safety review meeting for all Subcontractor personnel. This subtask also includes providing all documentation specified in Sections 4.1 and 4.2 to the Engineer's representative on site.
- Submission of any necessary documentation to the State of Florida in accordance with applicable regulations
- Construction of a soil staging area
- General site clean-up and removal of trash

- Incidental site clearing and site access, and restoration of site surface features
- Demobilizing all equipment and materials from the site

The Subcontractor will furnish all trenching and excavation equipment, support crew, all necessary tools, personal protective equipment (PPE) for the crew, and any miscellaneous equipment and materials required to complete the described activities. The Subcontractor will provide their own electricity and water. All down-hole equipment and tools must be steam cleaned prior to arrival onsite. All safety shut-off equipment must be in full working condition and will be tested by the Engineer prior to initiating daily activities. Other equipment checked prior to mobilization onto the site includes, back-up warning beeper, cables, clamps, winches, hydraulic leaks, electrical contacts, fire extinguisher, etc. All equipment must be in good condition with no oil or other fluid leaks. Any equipment that does not pass the initial safety and cleanliness inspection will not be allowed to enter the site, and will not be chargeable for the mobilization cost.

Mobilization includes attendance at the site-specific meetings described above during the initiation of onsite activities. All Subcontractor personnel must attend the initial training/badging/orientation meeting held on the first day.

All Subcontractor personnel will provide and use safety glasses, steel-toe work boots, hearing protection, work clothing and hard hats during work activities. In addition, due to safety concerns, the Subcontractor will provide and use cut resistant gloves during applicable work activities.

The Subcontractor will be responsible for obtaining all required local, State, and Federal permits necessary for performing the activities. The Subcontractor must be properly licensed to operate equipment used for trenching. Compliance and proof of this requirement must be provided in the Subcontractor's proposal.

The Subcontractor will keep the work site and adjacent areas as free of material, debris, and rubbish as is practicable and shall remove from any portion of the site such materials, which in the opinion of the Engineer, may interfere with the work or constitute a nuisance to onsite personnel. All efforts will be made to minimize dispersal of soil during trenching and excavation operations. All activities will be conducted in an efficient and professional manner, with the minimum practical damage to the site environment. The Subcontractor will be responsible for the security of their equipment and materials throughout the duration of the project.

This item includes travel time to and from the site. This item includes all labor, equipment, and materials for performing mobilization/demobilization. The measurement for payment will be by lump sum.

3.2 Trenching, Installation, and Backfilling

3.2.1 Connection Piping and Fittings

Within the treatment system the existing 2" pvc discharge line to sanitary sewer shall be tapped by installing one (1) PVC Tee, two (2) appropriate ball valves, and appropriate PVC reducing/expansion fittings and piping to connect to newly installed conveyance line. Installation of the two ball valves shall allow for flow to be directed to either the newly constructed infiltration gallery or the existing sanitary sewer piping.

3.2.2 Conveyance Piping Construction

A 6-inch wide by 2.5-foot deep by approximately 500-foot long trench located as depicted on Figure 2 will be excavated from the pump & treat (P&T)system to the two main stems of the infiltration gallery. A few trees may or may not need to be cut within the wooded area to provide access to the proposed conveyance line location. A 3-inch I.D. SDR 11 high density polyethylene (HDPE) discharge header will be installed within the trench for conveyance of P&T system discharges to the infiltration gallery. Connections of HDPE piping sections will be by fusion welds. A cross sectional diagram, which details the construction of the conveyance piping and infiltration gallery is provided as Figure 3.

During excavation of the conveyance trench soil shall be stockpiled and reapplied after piping installation. Within the backfilled native soil, metallic tape will be placed at 12 inches below grade to locate the piping once construction is complete. Compaction of the backfilled material shall be completed using 6" to 8" lifts and appropriate compaction equipment so that the filled material is of a similar compaction compared to that which existed prior to excavation.

3.2.3 Access Road Conveyance Piping Installation

Approximately 12-feet of the conveyance line will cross an existing asphalt access road at the site.

Option 1 - Horizontal Drilling

It is believed that horizontal drilling underneath the existing asphalt road may be the simplest method to install conveyance piping in these approximately 12 feet. The horizontal hole diameter should kept at a

minimum so the conveyance pipe can be located within the hole while not requiring additional fill to be needed to prevent subsidence. Conveyance pipe placement in this location shall be at approximately the same setting as shown in Figure 3 to match the conveyance pipe settings on either side of the access road.

Option 2 – Trenching, Construction and Resurfacing

A 6-inch wide by approximately 12-foot long section of asphalt shall be cut and broken up and removed from the site during excavation of the conveyance trench in this area. The bottom portion of the excavated trench material shall be stockpiled and reapplied after piping installation. Compaction of the backfilled material shall be completed using 6" to 8" lifts and appropriate compaction equipment so that the filled material is of a similar compaction compared to that which existed prior to excavation. Resurfacing of the top portion of the trench shall be completed using 6-inches of concrete followed by 2 inches of asphalt top coat to match the adjacent cut asphalt access road.

3.2.4 Infiltration gallery

An infiltration gallery will be installed approximately 300-feet southeast of the P&T system as shown on Figure 2. The infiltration gallery will be installed by excavating two parallel trenches spaced 88-feet apart with dimensions of 150-feet-long by 2.5-feet wide by 2.5-feet deep. The conveyance line from the P&T system will connect to the two parallel infiltration gallery trenches as shown in Figure 2. Connections to the header to the lateral infiltration gallery piping will be with HDPE to corrugated pipe transitions.

A 6-inch bed of Pea Gravel will be placed at the bottom of the trench. Corrugated 3-inch I.D. perforated HDPE will be installed above the gravel bed and then a 9-inch lift of gravel will be placed above the bottom of the pipe. A separation geotextile will be placed on top of the gravel and the trench will be backfilled to grade with the native soil previously excavated. Within the backfilled native soil, metallic tape will be placed at 12 inches below grade to locate the piping once construction is complete. Compaction of the backfilled material shall be completed using 6" to 8" lifts and using appropriate compaction equipment so that the filled material is of a similar compaction compared to that which existed prior to excavation. A cross sectional diagram, which details the construction of the infiltration gallery is provided as Figure 3.

During the installation of the infiltration gallery, care must be taken to ensure that the gravel bed, and piping is installed below the root zone and where organic debris is evident.

3.2.5 Infiltration Gallery Material Standards and Specifications

Drainage Pipe

- Corrugated Polyethylene pipe and fittings are to meet the requirements of AASHTO m252 standards.

Separation Geotextile

- Separation Geotextile is to meet the requirements of Florida DOT 985-1.2 – Drainage Fabric.

Metallic Tape

- Metallic tape used for utility locating procedures.

Crushed Stone

- Pea Gavel to be placed around the drainage.

4.0 ADDITIONAL REQUIREMENTS

4.1 Security and Access

Upon award, the Subcontractor will provide to the Engineer the names, social security numbers, birthdates and place of birth of all personnel expected to perform the fieldwork. All Subcontractor employees that will be onsite must have identification, such as a driver's license. Vehicles used by the Subcontractor should be clearly labeled with the company name and must have proof of current registration and insurance. The Engineer will act as a liaison between the Subcontractor and the Navy to gain access to the NTC property when required.

4.2 Health & Safety Requirements

This subcontract includes compliance with all of the Engineer's health & safety requirements, providing all health and safety equipment required for level D activities, and attendance at a site-specific health and safety meeting conducted during mobilization activities. Details of the health & safety requirements are provided on the Health & Safety Attachment.

4.3 Services Provided by the Engineer

In order to clarify the Engineer's obligations during this field effort, the services to be provided by the Engineer are summarized below.

- Select the locations of the trenches.
- Authorize the depths to which each trench shall be installed.
- Observe the Subcontractor's activities as required.

- Facilitate the Subcontractor's right-of-access to all necessary locations.
- Designate parking, equipment storage, and personnel and equipment decontamination areas.
- The Engineer has general responsibilities regarding Health and Safety activities as specified in the Health and Safety Plan. These responsibilities include controlling unauthorized access to the site and conducting environmental monitoring with an organic vapor analyzer for health and safety purposes.

4.4 Schedule

The Subcontractor shall provide an estimate of the time required to accomplish the field efforts described in these specifications and confirm in their proposal the availability of their proposed type of trenching and excavation equipment. Mobilization is tentatively scheduled for the week of March 19, 2012.

5.0 SUBMITTAL REQUIREMENTS

The following items are required for proposal:

1. Any deviations to the specification.
2. An estimate of the time needed to accomplish the efforts described in this Statement of Work.
3. The bidder shall complete the enclosed Price Proposal Form and sign in the spaces provided. Additional line items or alternate proposals may be submitted in addition to the Price Proposal Form.

PRICE FORM

TRENCHING, PIPING, AND MATERIALS INSTALLATION

Materials /Activity	Estimated Quantity	Unit	Unit Cost ($)	Extended Cost ($)
Mobilization/ Demobilization	1	LS		
Trenching & Backfilling	800	FT		
3-inch I.D. SDR 11 HDPE	500	FT		
3-inch I.D. perforated HDPE	300	FT		
6-inch bed of Pea Gravel	300	FT		
9-inch lift of Pea Gravel	300	FT		
Ancillary pipe fittings and connectors	1	LS		
Separation geotextile	300	FT		
Metallic Tape	800	FT		
Access Road Conveyance Piping Installation	1	LS		
Subtotal Estimated Cost:				

TOTAL ESTIMATED COST:	

Quantities shown on this Price Proposal Form are estimates only, and are included to establish a uniform basis for evaluating bids. Unit prices will be used to calculate actual prices. Tetra Tech does not guarantee that any or all task items listed will be required and reserves the right to vary quantities or delete items. All price quotations are fixed and are not subject to escalation of any kind. Price shall include all sales, use, and other taxes.

Company Name: _____

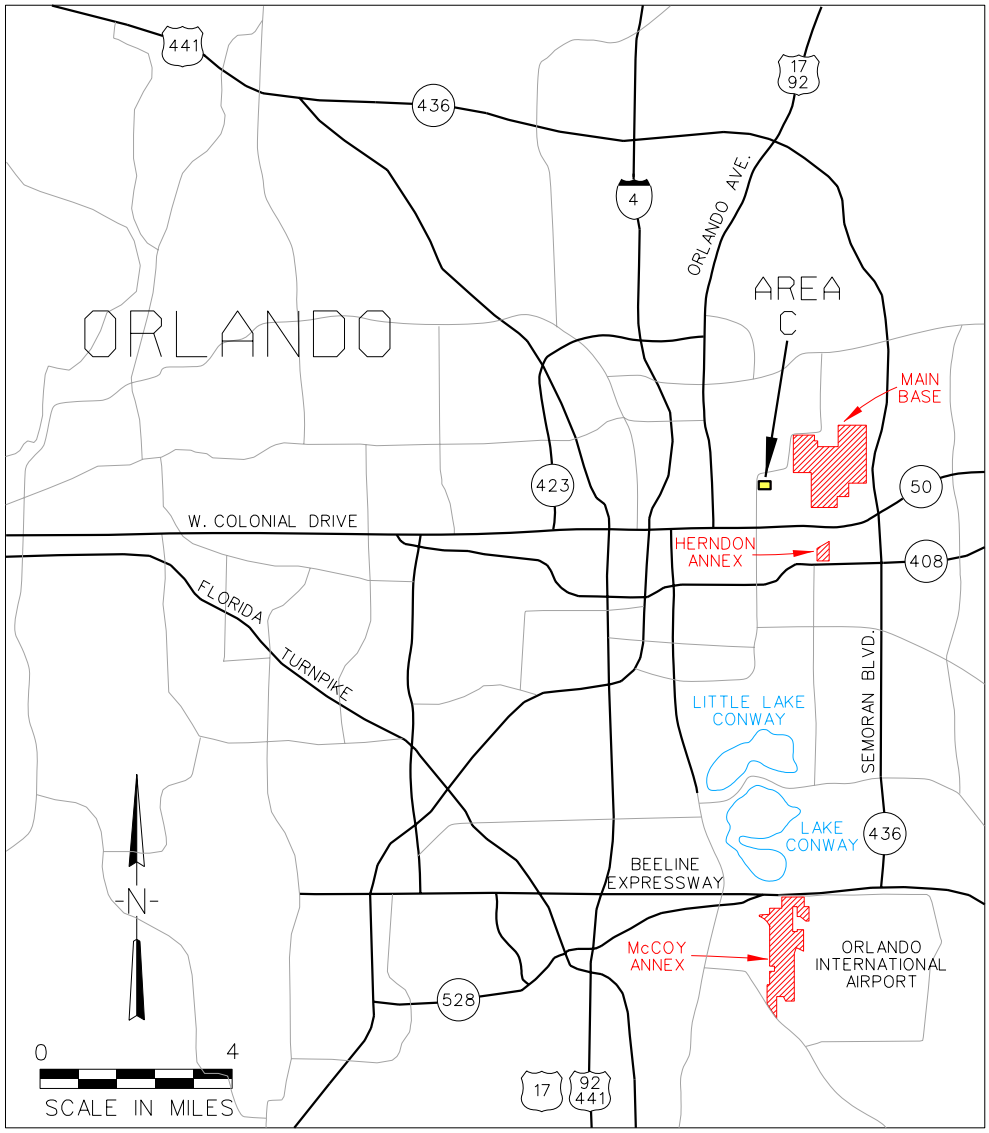
Signature: _____

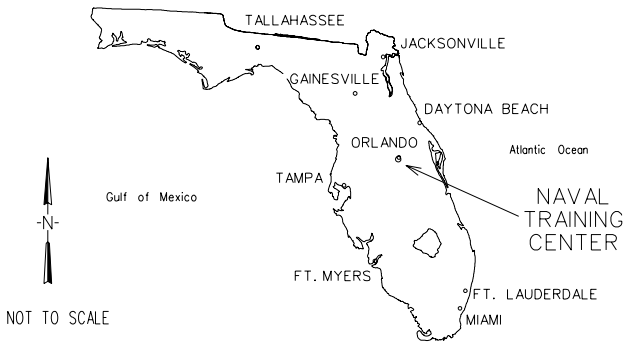
Printed Name: _____

Title: _____

Date: _____

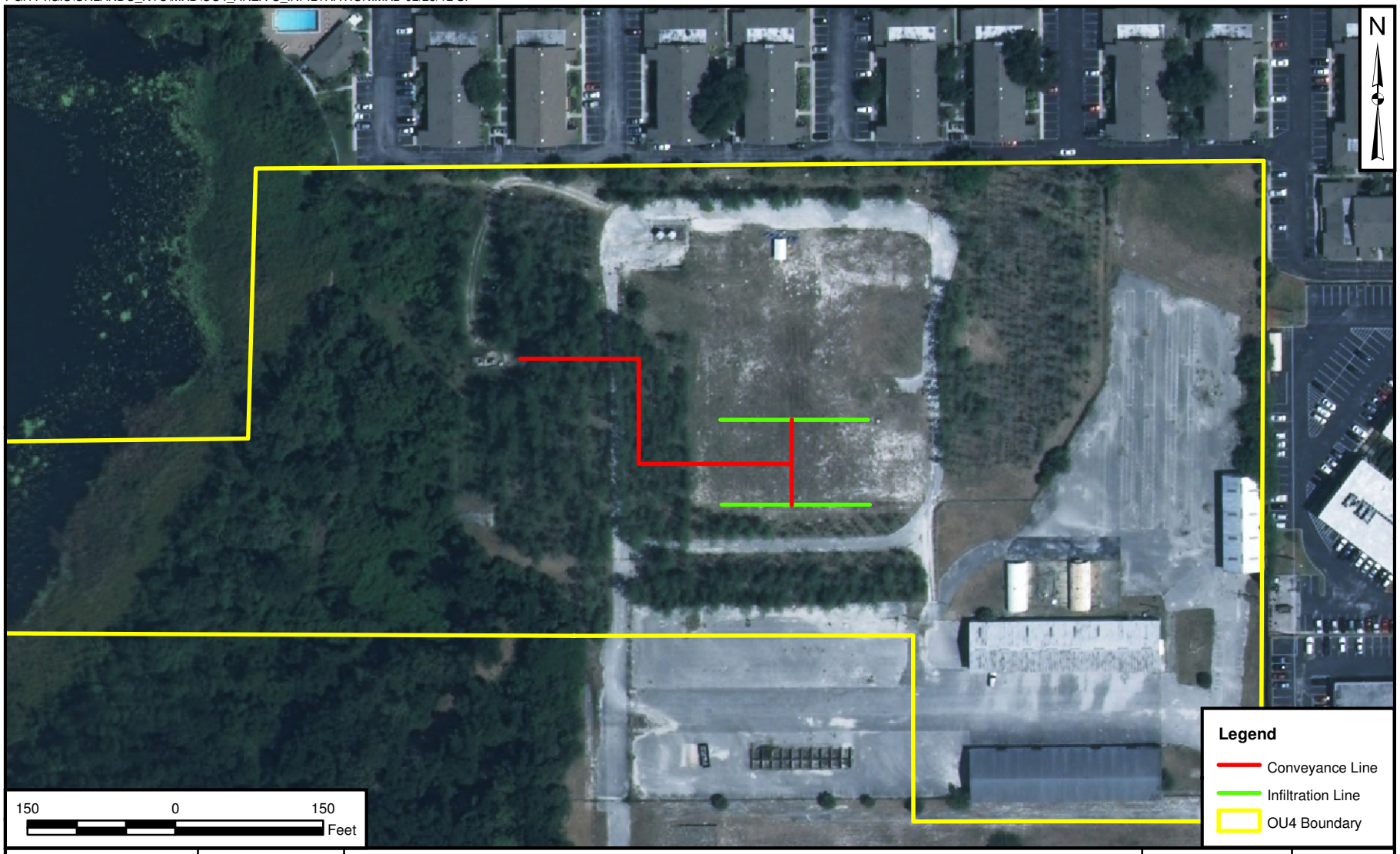
CAD FILE NO.: k:\dgn\navy\orlando\sites\AreaC\AC-106.dgn





DRAWN BY: ILG	DATE: 7-15-08	**SITE LOCATION MAP AREA C**	CONTRACT NO.: N62467-04-D-0055
CHECKED BY: TKG	DATE: 7-15-08	**NAVAL TRAINING CENTER ORLANDO, FLORIDA**	OWNER NO.: ----------
REVISED BY: ---	DATE: ---------		APPROVED BY: --- DATE: ---------
SCALE: AS NOTED			DRAWING NO.: FIGURE 1 REV.: 0

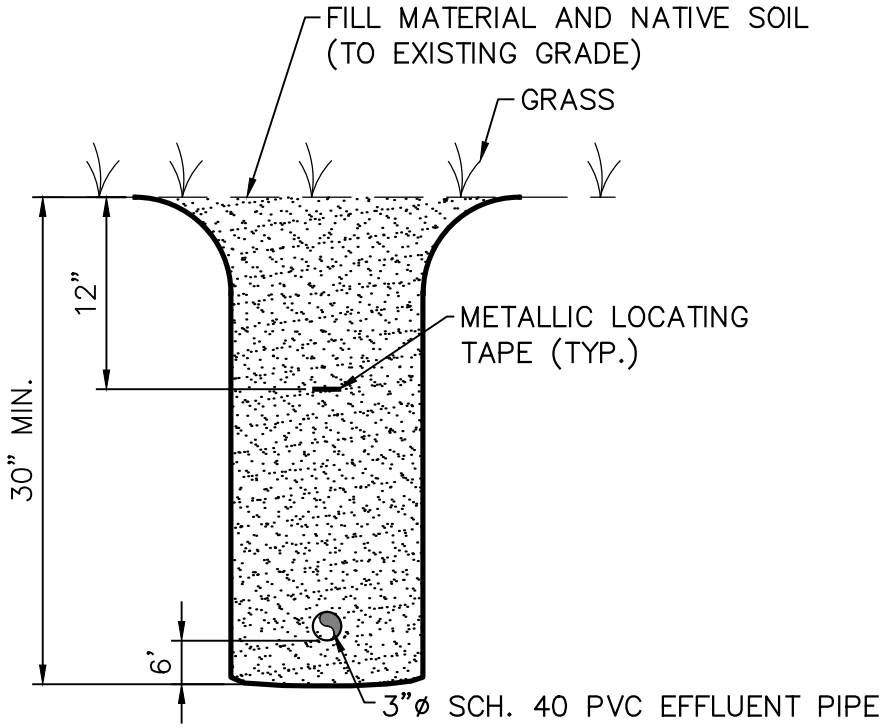
PGH P:\GIS\ORLANDO_NTC\MXD\OU4_AREA-C_INFILTRATION.MXD 02/28/12 SP



DRAWN BY	DATE
K. MOORE	01/17/12
CHECKED BY	DATE
C. MILLER	02/28/12
REVISED BY	DATE
S. PAXTON	02/28/12
SCALE	
AS NOTED	

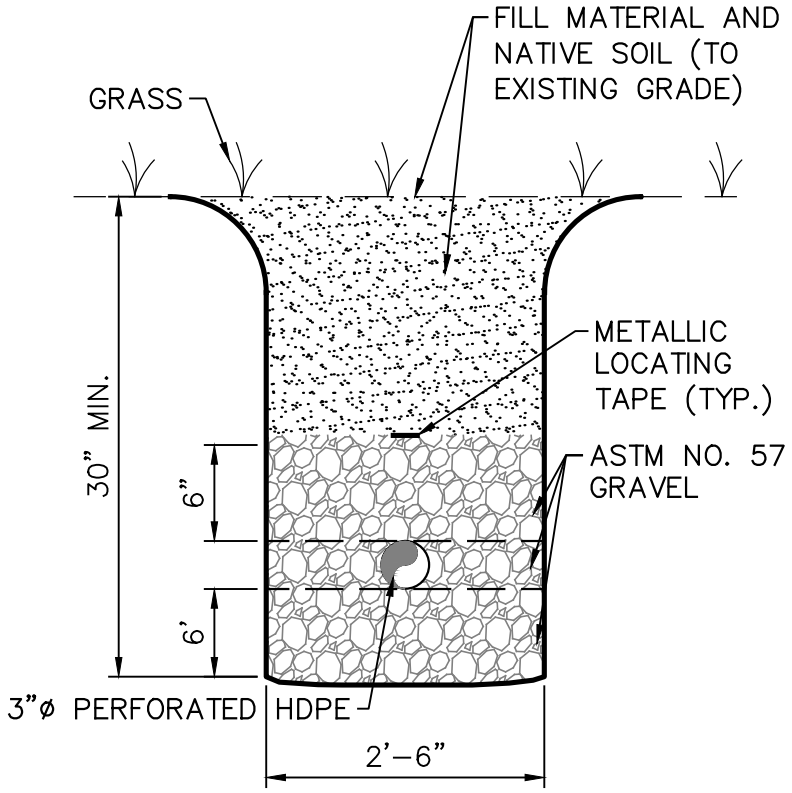
INFILTRATION GALLERY LOCATION
OPERABLE UNIT 4 - AREA C
NAVAL TRAINING CENTER
ORLANDO, FLORDIA

CONTRACT NUMBER	OWNER NO.
N62467-04-D-005	00131
APPROVED BY	DATE
___	___
APPROVED BY	DATE
___	___
FIGURE NO.	REV
2	0



SECTION A–A'
TYPICAL INFILTRATION GALLERY CONVEYANCE PIPING

NOT TO SCALE



SECTION B–B'
INFILTRATION GALLERY DETAIL

NOT TO SCALE

TETRA TECH
WWW.TETRATECH.COM
661 ANDERSEN DRIVE – FOSTER PLAZA 7
PITTSBURGH, PA 15220
T: (412) 921–7090 | F: (412) 921–4040

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

INFILTRATION GALLERY
OPERABLE UNIT 4 – AREA C
SCALE: NOT TO SCALE

DATE:	7/8/09
PROJECT NO.:	112G02581
DESIGNED BY:	PM
DRAWN BY:	BH
CHECKED BY:	PM
SHEET: 1 OF 1	
SIZE: A	COPYRIGHT TETRA TECH INC.

FIGURE 3